pizzato

NORSTAT INC.

2017-2018

General Catalogue Safety

Index General Catalogue Safety

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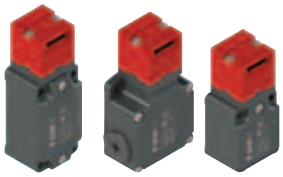

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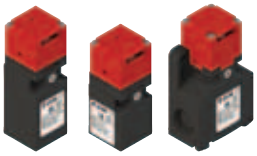

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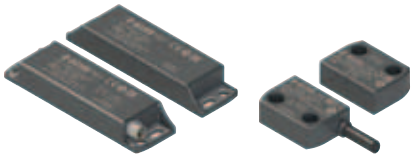

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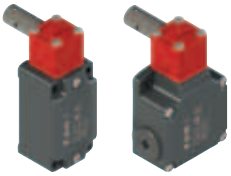

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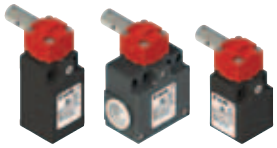

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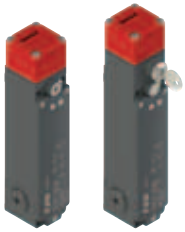

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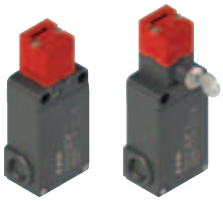

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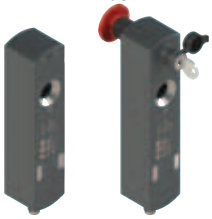

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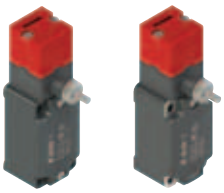

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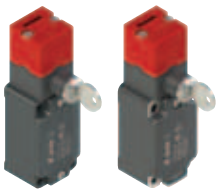

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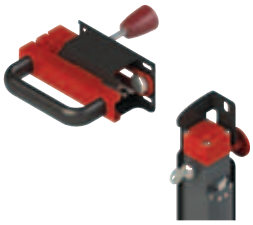

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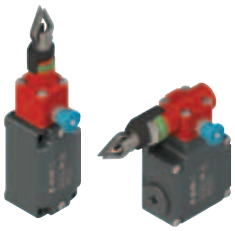

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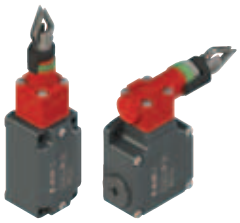

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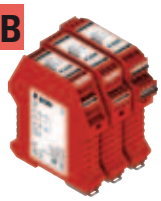

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MORE THAN 200 PROFESSIONALS WITH PASSION

It is people, with their professionalism and dedication that make a great company. This profound conviction has always guided Pizzato Elettrica in its choice of employees and partners. Today, Giuseppe and Marco Pizzato lead a tireless team providing the fastest and most efficient response to the demands of the market. This team has grown since the year 2000 and has achieved a considerable increase in business in all the countries where Pizzato Elettrica is present.

The various strategic sectors of the business are headed by professionals with significant experience and expertise. Many of these people have developed over years with the company. Others are experts in their specific field and have integrated personal experience with the Pizzato Elettrica ethos to extend the company's capability and knowledge.

From the design office to the technical assistance department, from managers to workers, every employee believes in the company and its future. Pizzato Elettrica employees all give the best of themselves secure in the knowledge they are the fundamental elements of a highly valuable enterprise.

100% MADE IN ITALY

Pizzato Elettrica is one of the leading European manufacturers of position switches, microswitches, safety devices, safety modules, foot switches, control and signalling devices, and devices for elevators.
An entrepreneurial company such as Pizzato Elettrica bases its foundations on a solid and widely shared value system. The pillars that form the basis of the company's work have remained constant, and constitute the fundamental guiding principles for all company activities.

PASSION FOR QUALITY

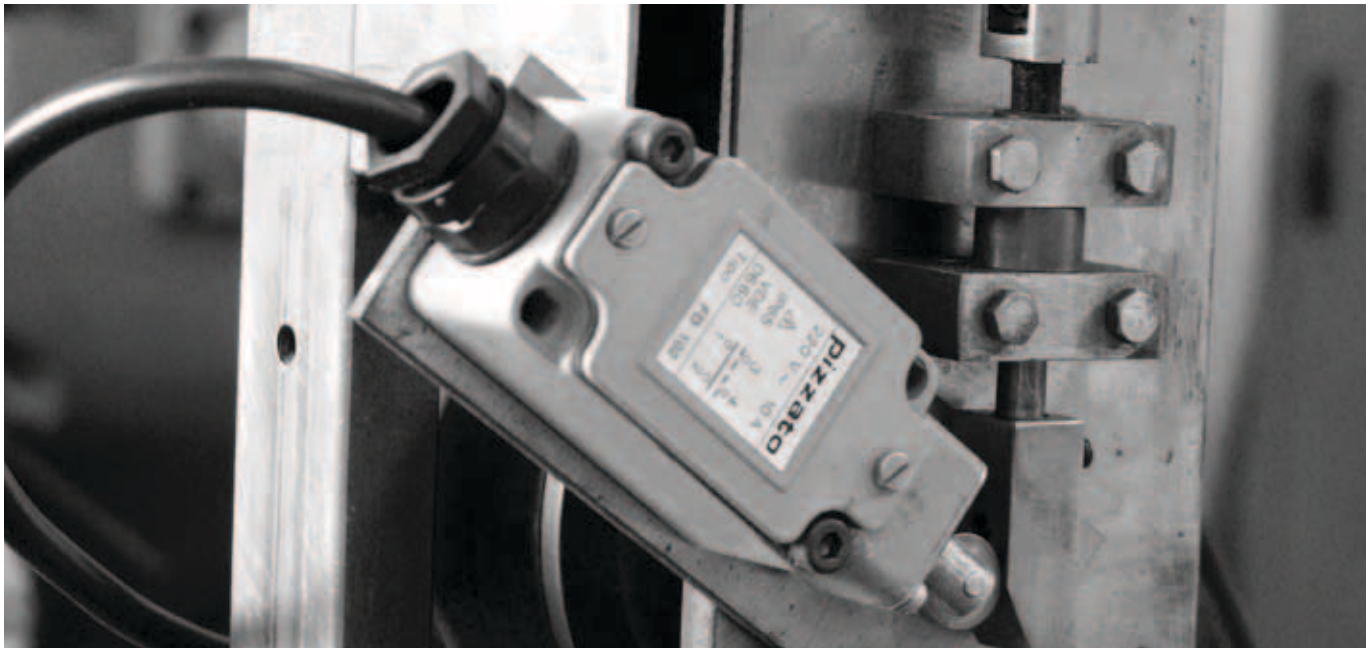
Passion for product quality, orientation towards excellence, innovation, and continuous development, represent the key principles of Pizzato Elettrica's everyday work.
Anyone using Pizzato Elettrica's products does so in the certainty that these devices are of certified quality, since they are the result of a process that is scrupulously controlled at every stage of the production.
The company's goal is to offer the market safe, reliable, and innovative solutions.

CARE FOR THE CUSTOMER

In order to be successful, a product must respond to the specific needs of those who will use it. Market developments must be carefully monitored in order to understand, in advance, which new applications will prove themselves truly useful. This is why Pizzato Elettrica has always cultivated close synergies with the companies that have chosen them as a supplier, using this continuous dialogue to identify the potential developments of the own product range in order to make it highly flexible, complete and capable to respond to the most diverse needs.

100% MADE IN ITALY

All Pizzato Elettrica products are designed, developed, and tested entirely at the 7 company plants in Marostica, in the province of Vicenza in Italy. The company is thus able to meet specific customer requirements at all times, by offering a comprehensive range of products and technologically advanced solutions.



1984: AN ENTREPRENEURIAL STORY BEGINS

1984
The company Pizzato di Pizzato B. & C. snc. manufacturer of position switches is founded.
1988
The company becomes a limited liability partnership, and is renamed Pizzato Elettrica, a brand shortly destined to become renowned and valued nationwide. Also in the year 1988, the first company-owned plant geared towards mechanical processing was built. By the end of the decade, thanks to the development of quality products and the experience built on the Italian market, Pizzato Elettrica turns to the international market.
1995
Building of the second plant geared towards the moulding of plastic materials. Development of the position switch range continues in parallel. Start of significant years in terms of safety devices planning. The safety sector becomes a key sector to the company.
1998
Construction of the third plant, housing the assembly department.
2002
New millennium starts with quality certifications: achievement of the ISO 9001:2000 certification. Launching of the first safety modules. Construction of the new headquarters and logistics site; currently the company head office. Continued expansion of the industrial safety and automation product range.
2007
Pizzato Elettrica faces their first generational change: Giuseppe and Marco Pizzato take over the company directorship.
2010
Extension of Pizzato Elettrica product portfolio, with the launch of the innovative EROUND line consisting of control and signalling devices. This product range accompanies position switches and safety devices, thus offering complete solutions to customers.
2012
Introduction of Gemnis Studio, the first software produced by Pizzato Elettrica. A graphic development environment for the creation, simulation, and debugging of programs that can be integrated in the Gemnis line modules.
2013
Foundation of first subsidiary of Pizzato Elettrica, Pizzato Deutschland GmbH, in Germany.
2014
A new production facility dedicated to switches and automatic machines is opened, spanning a surface area of 6000 m².
2016
Foundation of second subsidiary of Pizzato Elettrica, Pizzato France SARL, in France.
The new NS series of safety switches with electromagnets and RFID technology is introduced, fruit of the company's experience, spanning more than thirty years in the field of industrial safety. To date it is the state of the art in its industry.
2017
The company continues to expand and now includes an additional production facility, the new location of the offices in the sales network.
Today
Giuseppe and Marco Pizzato lead a company in constant growth in terms of new product launches, number of employees (more than 200 employees at present), turnover, and new markets. Pizzato Elettrica is continuing their new product internationalisation and development process.

70,000,000 PARTS SOLD WORLDWIDE

Pizzato Elettrica's product catalogue contains more than 7,000 articles, with more than 1,300 special codes developed for devices personalised according to clients' specific needs.
Pizzato Elettrica devices can be grouped, according to typology, into three main macro-categories:

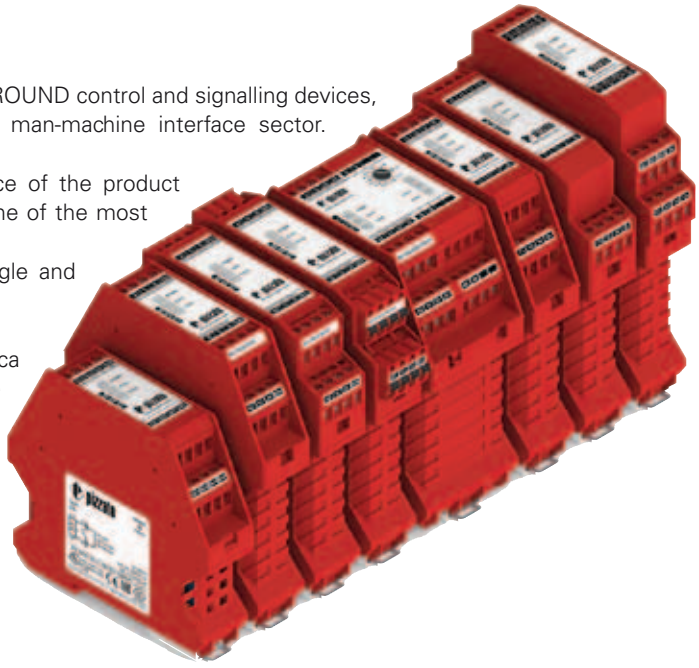
• POSITION SWITCHES. Pizzato Elettrica position switches are daily installed in every type of industrial machinery all over the world for applications in the sector of wood, metal, plastic, automotive, packaging, lifting, medicinal, naval, etc.
In order to be used in a such wide variety of sectors and countries, Pizzato Elettrica position switches are made to be assembled in a lot of configurations thanks to the various body shapes, dozens of contact blocks, hundreds of actuators and materials, forces, assembling versions.
Pizzato Elettrica can offer one of the widest product range of position switches in the world. Moreover, the use of high quality materials, high reliability technologies (e.g. twin bridge contact blocks) as well as the IP67 protection degree make this range of position switches one of the most technologically evolved.

• SAFETY DEVICES. The company Pizzato Elettrica has been one of the first Italian companies developing dedicated items for this sector, creating and patenting dozens of innovative products, thus becoming one of the main European manufacturers of safety devices. The wide range of specific products for machine safety completely designed and assembled in our company premises in Marostica (VI) - Italy, has been extended by the introduction of coded magnetic sensors, solenoid switches provided with emergency release devices, safety hinge switches and safety handles. Recent products include the safety sensors with RFID technology of the ST series, the stainless steel hinge safety switches of the HX series, the RFID safety switches with block of the NG series, the safety handle of the P-KUBE 2 line and the safety switches with electromagnets and RFID technology of the NS series.

• MAN-MACHINE INTERFACE. Thanks to the introduction of the EROUND control and signalling devices, Pizzato Elettrica has remarkably widened their offer within the man-machine interface sector.

Thanks to the new design, the care for details and the elegance of the product combined with its maximum safety and reliability, this series is one of the most complete and cutting-edge on the market.
Our company offers a wide range of products that includes single and modular foot switches with many patented joining kits.

In order to satisfy its customers' needs and requests, Pizzato Elettrica offers a lot of accessories purposely designed not only to complete their wide range of products, but also to help device installation on machineries.



12 MILLION CERTIFIED PRODUCT CODES

A simple brand isn't enough: the company is aiming for the Pizzato Elettrica brand to be widely recognised as a synonym for absolute quality and certainty.

A result that has been reached and consolidated over the years, updating and expanding the series of certifications obtained from the most important Italian and international control organisations. Product quality is assessed by five accredited external bodies: IMQ, UL, CCC, TÜV SÜD, EAC. These bodies lay out high technical and qualitative standards for the company to achieve and maintain, verified yearly with seven different inspections: these are performed, without prior notice, by qualified inspectors, who extract samples of products and materials destined for sale from plants, or from the market directly, to subject them to apposite tests.

• CE MARK. All Pizzato Elettrica products bear the CE marking in conformity with the European Directives in force.

• ISO 9001 CERTIFICATION. The company's production system complies with national UNI EN ISO 9001 and international ISO 9001 standards. The certification covers all of the company's plants and their production and managerial activities: entry checks, technical, purchasing and commercial department activities, manufacturing operations assessments, final pre-shipping product tests and checks, equipment reviews and the management of the metrological lab.

• CERTIFICATION OF COMPANY QUALITY SYSTEMS. Pizzato Elettrica has obtained the certificate of compliance with the UNI EN ISO 9000 regulations in force in Italy and abroad. It is issued by a recognised independent body that guarantees the quality and reliability of the service offered to clients worldwide.

• CSQ, CISQ AND IQNET. The CSQ system is part of the CISQ (Italian Certification of Quality Systems) federation, which consists of the primary certification bodies operating in Italy in the various product sectors. CISQ is the Italian representative body within IQNet, the biggest international Quality Systems and Company Management certification network, which is adhered to by 25 certification organs in as many countries.

TRADE FAIRS AND EVENTS

TRADE FAIRS

Pizzato Elettrica regularly participates to many trade fairs in Italy and abroad, presenting in this way to the market the products, the latest news, etc.

EVENTS

Besides offering qualified technical assistance, Pizzato Elettrica presents itself as a dynamic partner who is attentive to the needs of its customers. For this reason, the company organises several meetings and training courses with particular attention to the regulatory aspect of machinery safety.

MULTILINGUAL DOCUMENTATION

Pizzato Elettrica provides its customers with a wide range of technical documentation available in several languages: Italian, English, German, French, Spanish, etc.

From the general catalogue to the detailed brochures, from leaflets of new products to price lists and DVDs, Pizzato Elettrica customers can find in a quick and exact way all the information concerning products, the technical characteristics and functionality, the proper installation methods, application examples, etc.

NEW WEBSITE

To remain in line with its objectives and strategies, Pizzato Elettrica has also decided to renew their image online by designing and creating a new website.
The aim was therefore to create a more modern website: one that would be technologically competitive and feature eye-catching graphics but would also offer users detailed, up-to-date contents.
The main characteristics of version 2.0 of the website www.pizzato.com are therefore as follows:

SEARCH USING FILTERS
The product section has been extended and a decision was made to enhance it with several new aspects. Firstly, the use of filters, to aid customers as they search for products, and guide them in creating the item that best suits their requirements by enabling them to choose its characteristics.

RESPONSIVE DESIGN
Another significant characteristic is the compatibility of this new website with all kinds of devices. Indeed, it is a responsive site, capable of automatically adapting its graphic layout to suit the device with which it is viewed and so minimising the need for the user to resize and scroll the contents.

BROWSABLE, DOWNLOADABLE CATALOGUE
Users can also download our full catalogue or alternatively browse it directly online, an extremely handy solution for those wishing to consult our range of products simply and rapidly.

HIGH RESOLUTION IMAGES
The information provided for each one of our products is complete with high resolution images to offer visitors to the website a clear, accurate view of our items in close detail, also offering them the possibility to zoom in and out on the image.

LARGE VIDEO SECTION
The large video section of the website is capable of showcasing the main characteristics, functions and use of the various products.

TECHNICAL AND SALES ASSISTANCE

TECHNICAL DEPARTMENT

The Pizzato Elettrica technical department provides direct technical and qualified assistance in Italian and English, helping in this way the customers to choose the suitable product for their own application explaining the characteristics and the correct installation.

Spoken languages:

SALES DEPARTMENT

Among the strengths in the company relationship with the commercial network, the direct assistance guaranteed in five languages: Italian, English, French, German and Spanish. A service that confirms Pizzato Elettrica quality and attention to the needs of customers from around the world.

Spoken languages:

NS series
RFID safety switches with lock

- SIL 3/PL e/category 4 with a single device
- Actuator holding force: 2100 N
- Maximum PL e safety level can be maintained with series connection of up to 32 devices
- Protection degrees IP67 and IP69K
- 6 LEDs for immediate diagnosis
- TÜV SÜD approval

- Auxiliary release with lock or screwdriver and emergency release button, can be oriented in 4 directions
- Housing fastening on side or front, no adjustment necessary
- Connection options: integrated M12 connector, cable with M12 connector, cable
- Connection outputs, axial or laterally adjustable in four directions
- Function for protecting against recoil forces, prevents immediate blocking of the actuator

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NG series
RFID safety switches with lock

- New, integrated control devices
- Actuator holding force: 9750 N
- SIL 3/PL e/category 4 with a single device
- Maximum PL e safety level can be maintained with series connection of up to 32 devices
- Protection degrees IP67 and IP69K
- 6 LEDs for immediate diagnosis
- TÜV SÜD approval

▸ 113

P-KUBE 2
safety handles

- Compatible with NG series RFID safety switches with lock
- Easy to install and simple to operate
- System suitable for use with hinged and sliding doors, either with right or left closing
- Solid construction
- Intuitive LOCK OUT device
- LOCK-OUT with dual screening: RFID and actuator entry

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ST series
safety sensors with RFID technology

- SIL 3/PL e/category 4 with a single device
- Maximum PL e safety level can be maintained with series connection of up to 32 devices
- Protection degrees IP67 and IP69K
- Two actuation distances: 12mm and 20mm
- Version with EDM (External Device Monitoring)
- Version with extended 12 … 24 Vdc power supply range for the automotive sector
- TÜV SÜD approval

▸ 37

CS MP series
programmable multifunction modules

- New module configurations available
- New models with 8 safety outputs
- Gemnis Studio software updates:
  - Ability to manage projects of up to 4x4 sheets
  - Text search on desktop objects

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M23 female connectors with cable

- Error-proof simplified wiring
- Reduced installation times
- 12- or 19-pole versions with cable lengths of 10 or 20 m
- Protection degree IP67
- Ideal for NG and FG series

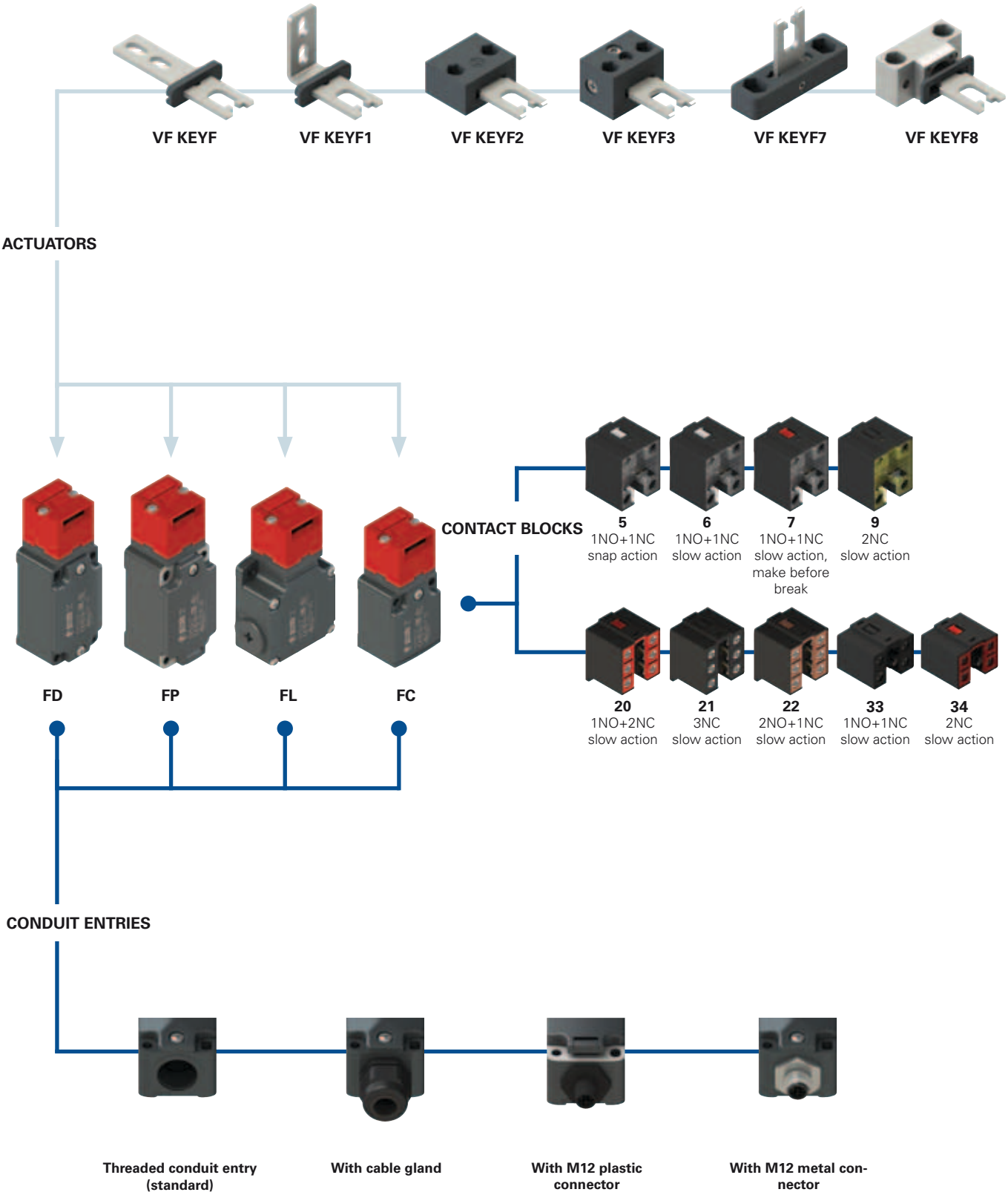
▸ 308

VF SL series
signalling lights

- High luminosity LED
- Protection degrees IP67 and IP69K
- PUSH-IN spring-operated connection
- Compact design

▸ 312

Selection diagram



Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options | options

FD 693-F1GM2K50T6

Housing	
FD	metal, one conduit entry
FL	metal, three conduit entries
FP	technopolymer, one conduit entry

Contact block	
5	1NO+1NC, snap action
6	1NO+1NC, slow action
7	1NO+1NC, slow action, make before break
9	2NC, slow action
20	1NO+2NC, slow action
21	3NC, slow action
22	2NO+1NC, slow action
33	1NO+1NC, slow action
34	2NC, slow action

Actuators	
	without actuator (standard)
F	straight actuator VF KEYF
F1	angled actuator VF KEYF1
F2	jointed actuator VF KEYF2
F3	jointed actuator adjustable in two directions VF KEYF3
F7	jointed actuator adjustable in one direction VF KEYF7
F8	universal actuator VF KEYF8

Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 22, 33, 34)

Threaded conduit entry	
M2	M20x1.5 (standard)
	PG13.5

Pre-installed cable glands or connectors	
	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
...	.....
K50	M12 metal connector, 5-pole
...	.....

For the complete list of possible combinations please contact our technical department.

Ambient temperature	
	-25°C … +80°C (standard)
T6	-40°C … +80°C

article | options | options

FC 3393-F1GM2K50T6

Housing	
FC	metal, one conduit entry

Contact block	
33	1NO+1NC, slow action
34	2NC, slow action

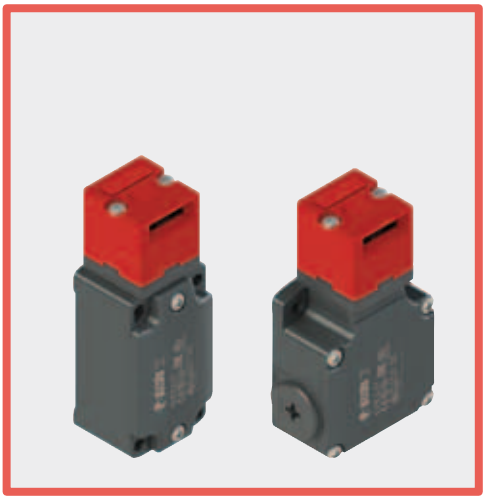
Actuators	
	without actuator (standard)
F	straight actuator VF KEYF
F1	angled actuator VF KEYF1
F2	jointed actuator VF KEYF2
F3	jointed actuator adjustable in two directions VF KEYF3
F7	jointed actuator adjustable in one direction VF KEYF7
F8	universal actuator VF KEYF8

Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating

Threaded conduit entry	
M2	M20x1.5 (standard)
	PG11

Pre-installed cable glands or connectors	
	no cable gland (standard)
K23	cable gland for cables Ø 6 … 12 mm
K50	M12 metal connector, 5-pole

Ambient temperature	
	-25°C … +80°C (standard)
T6	-40°C … +80°C



Main features

- Metal housing or technopolymer housing, from one to three conduit entries
- Protection degree IP67
- 9 contact blocks available
- 6 stainless steel actuators available
- Versions with M12 connector
- Versions with gold-plated silver contacts

Technical data

Housing

FP series housing made of glass fibre reinforced technopolymer, self-extinguishing, shock-proof and with double insulation: ⧈
FD, FL and FC series: metal housing, baked powder coating.
Metal head, baked powder coating.

FD, FP, FC series: one threaded conduit entry:	M20x1.5 (standard)
FL series: three threaded conduit entries:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Mechanical interlock, coded:	type 2 acc. to EN ISO 14119
Coding level:	low acc. to EN ISO 14119
Safety parameter B_{10D}:	2,000,000 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Max. actuation frequency:	3600 operating cycles/hour
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 22, 33, 34:	min.	1 x 0.34 mm²	(1 x AWG 22)
	max.	2 x 1.5 mm²	(2 x AWG 16)
Contact blocks 5, 6, 7, 9:	min.	1 x 0.5 mm²	(1 x AWG 20)
	max.	2 x 2.5 mm²	(2 x AWG 14)

Quality marks:

IMQ approval:	EG605
UL approval:	E131787
CCC approval:	2007010305230000 (FD-FL-FC series) 2007010305230014 (FP series)
EAC approval:	RU C-IT.АД35.В.00454

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, BG-GS-ET-15, UL 508, CSA 22.2 No.14.
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 No.14, GB14048.5-2001.

Compliance with the requirements of:
Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1

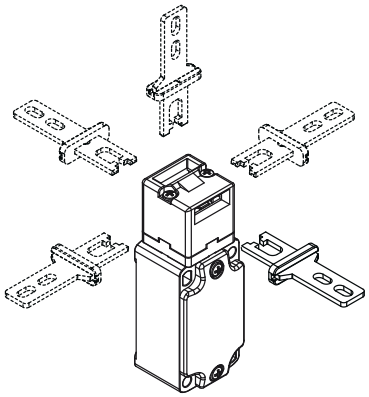
⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

Electrical data			Utilization category
without connector	Thermal current (I_{th}):	10 A	
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 22, 33, 34)	Alternating current: AC15 (50÷60 Hz) U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 22, 33, 34)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250
	Protection against short circuits:	type aM fuse 10 A 500 V	I_e (A) 6 1.1 0.4
	Pollution degree:	3	
with M12 connector, 4 or 5-pole	Thermal current (I_{th}):	4 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 120 250
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	Ie (A) 4 4 4
	Protection against short circuits:	type gG fuse 4 A 500 V	Direct current: DC13
	Pollution degree:	3	U_e (V) 24 125 250 I_e (A) 4 1.1 0.4
with M12 connector, 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	I_e (A) 2
	Protection against short circuits:	type gG fuse 2 A 500 V	Direct current: DC13
	Pollution degree:	3	U_e (V) 24 I_e (A) 2

Description

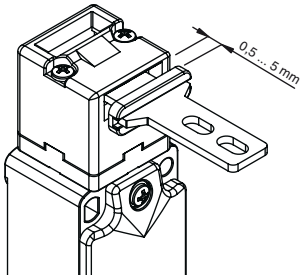
These safety switches are ideal for controlling gates, sliding doors and other guards which protect dangerous parts of machines without inertia.
The stainless steel actuator is fastened to the moving part of the guard in such a way that it is separated from the switch each time the guard is opened. A special mechanism ensures that removing the actuator forces the positive opening of the electrical contacts. Easy to install, these switches can be used with all types of guards (with hinge as well as sliding and removable types). The possibility to actuate the switch only with a specific actuator guarantees that the machine can be restarted only after the guard has been closed. These switches are made of robust materials with larger dimensions and are designed especially for heavy gates and harsh environments.

Head with variable orientation



For all switches, the head can be adjusted in 90° steps after removing the two fastening screws. In this way it is possible to actuate the switch from 5 different directions.

Wide-ranging actuator travel



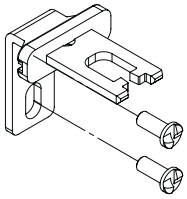
The actuation head of this switch features a wide range of travel. In this way the guard can oscillate along the direction of insertion (4.5 mm) without causing unwanted machine shutdowns. This wide range of travel is available in all actuators in order to ensure maximum device reliability.

Protection degree IP67

IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

Safety screws for actuators



As required by EN ISO 14119, the actuator must be fixed immovably to the door frame. Pan head safety screws with one-way fitting are available for this purpose. With this screw type, the actuators cannot be removed or tampered by using common tools. See accessories on page 310.

Extended temperature range

-40°C

These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C.
They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

Laser engraving

All devices are marked using a dedicated indelible laser system. These engravings are therefore suitable for extreme environments too. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Features approved by IMQ

Rated insulation voltage (U_i):	500 Vac 400 Vac (for contact blocks 20, 21, 22, 33, 34)
Conventional free air thermal current (I_{th}):	10 A
Protection against short circuits:	type aM fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (for contact blocks 20, 21, 22, 33, 34)
Protection degree of the housing:	IP67
MV terminals (screw terminals)	
Pollution degree:	3
Utilization category:	AC15
Operating voltage (U_e):	400 Vac (50 Hz)
Operating current (I_e):	3 A

Forms of the contact element: Zb, Y+Y, Y+Y+X, Y+Y+Y, Y+X+X
Positive opening contacts on contact blocks 5, 6, 7, 9, 20, 21, 22, 33, 34
In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories	Q300 (69 VA, 125-250 Vdc) A600 (720 VA, 120-600 Vac)

Housing features type 1, 4X "indoor use only", 12, 13
For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).

In compliance with standard: UL 508, CSA 22.2 No.14.

Please contact our technical department for the list of approved products.

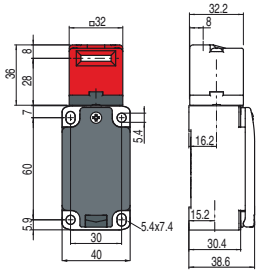
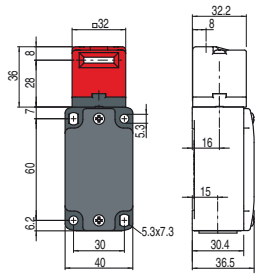
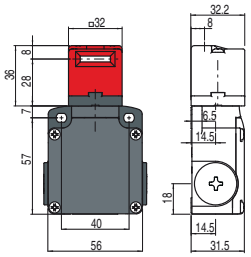
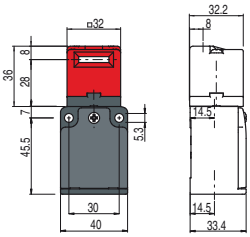
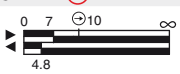
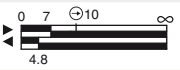
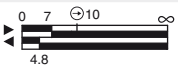
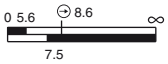
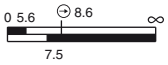
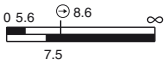
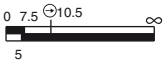
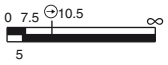
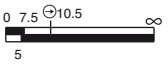
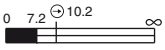
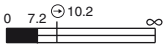
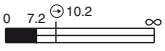
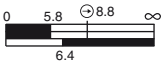
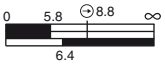
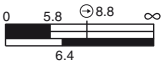
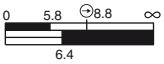
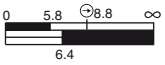
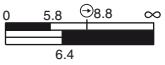
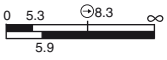
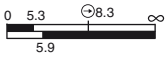
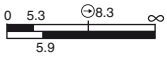
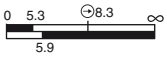
Dimensional drawings

All values in the drawings are in mm

Contact type:

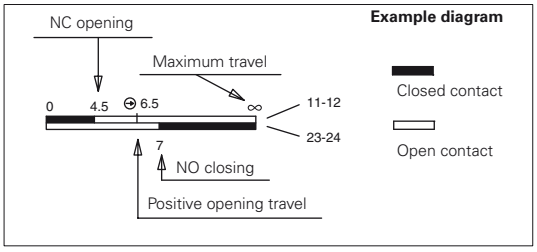
R = snap action
L = slow action
LO = slow action, make before break

Contact block

	Technopolymer housing	Metal housing	Metal housing	Metal housing
	Without actuator	Without actuator	Without actuator	Without actuator
				
5 R	FP 593-M2 → 1NO+1NC	FD 593-M2 → 1NO+1NC	FL 593-M2 → 1NO+1NC	
				
6 L	FP 693-M2 → 1NO+1NC	FD 693-M2 → 1NO+1NC	FL 693-M2 → 1NO+1NC	
				
7 LO	FP 793-M2 → 1NO+1NC	FD 793-M2 → 1NO+1NC	FL 793-M2 → 1NO+1NC	
				
9 L	FP 993-M2 → 2NC	FD 993-M2 → 2NC	FL 993-M2 → 2NC	
				
20 L	FP 2093-M2 → 1NO+2NC	FD 2093-M2 → 1NO+2NC	FL 2093-M2 → 1NO+2NC	
				
21 L	FP 2193-M2 → 3NC	FD 2193-M2 → 3NC	FL 2193-M2 → 3NC	
22 L	FP 2293-M2 → 2NO+1NC	FD 2293-M2 → 2NO+1NC	FL 2293-M2 → 2NO+1NC	
				
33 L	FP 3393-M2 → 1NO+1NC	FD 3393-M2 → 1NO+1NC	FL 3393-M2 → 1NO+1NC	FC 3393-M2 → 1NO+1NC
				
34 L	FP 3493-M2 → 2NC	FD 3493-M2 → 2NC	FL 3493-M2 → 2NC	FC 3493-M2 → 2NC
Actuating force	10 N (18 N →)	10 N (18 N →)	10 N (18 N →)	10 N (18 N →)

How to read travel diagrams

All values in the diagrams are in mm



IMPORTANT:
The state of the NC contact refers to the switch with inserted actuator. In **safety applications**, actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol →. Actuate the switch **at least with the positive opening force**, reported in brackets below each article, next to the actuating force value.

Limits of use

Do not use where dust and dirt may penetrate in any way into the head and deposit there. Especially not where powder, shavings, concrete or chemicals are sprayed. Adhere to the EN ISO 14119 requirements regarding low level of coding for interlocks. Do not use in environments with presence of explosive or flammable gas. In these case use ATEX products (see dedicated Pizzato catalogue).

Items with code on **green** background are stock items

Accessories See page 299

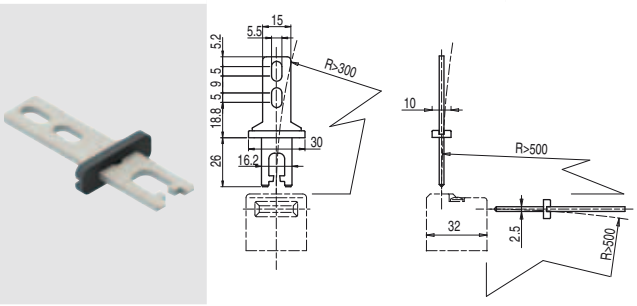
→ The 2D and 3D files are available at **www.pizzato.com**

Stainless steel actuators

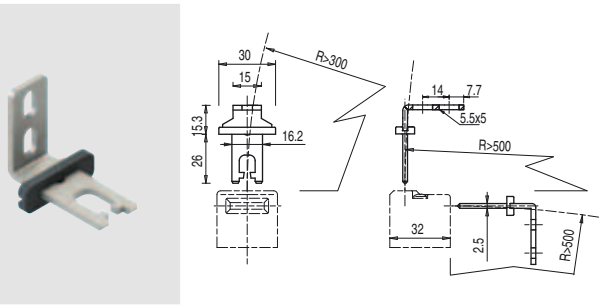
All values in the drawings are in mm

IMPORTANT: These actuators can be used only with items of the FD, FP, FL, FC and FS series (e.g. FD 693-M2).
Low level of coding acc. to EN ISO 14119.

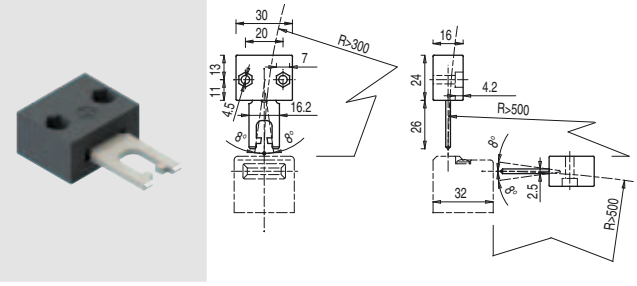
Article	Description
VF KEYF	Straight actuator



Article	Description
VF KEYF1	Angled actuator

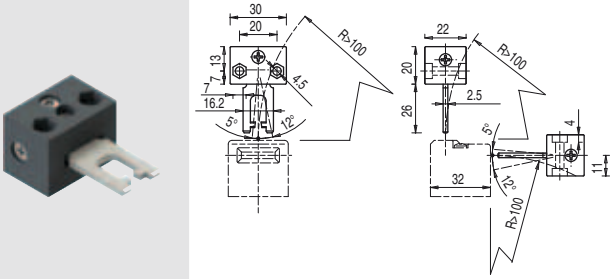


Article	Description
VF KEYF2	Jointed actuator



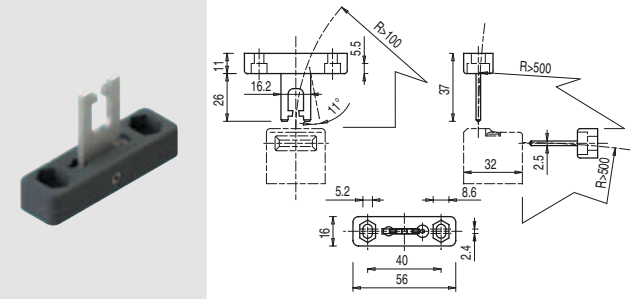
The actuator can flex in four directions for applications where the door alignment is not precise.

Article	Description
VF KEYF3	Actuator adjustable in two directions



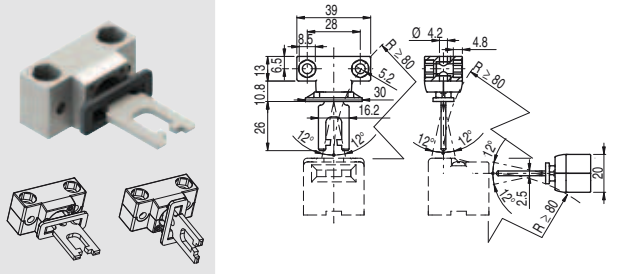
Actuator adjustable in two directions for doors with reduced dimensions.

Article	Description
VF KEYF7	Actuator adjustable in one direction



Actuator adjustable in one direction for doors with reduced dimensions.

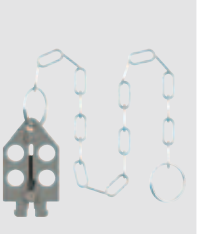
Article	Description
VF KEYF8	Universal actuator



Actuator adjustable in two dimensions for small doors; can be mounted in various positions.
The fixing block has two pairs of bore holes; it is provided for rotating the working plane of the actuator by 90°.
Body material: zinc alloy.

Accessories

Article	Description
VF KB1	Actuator entry locking device



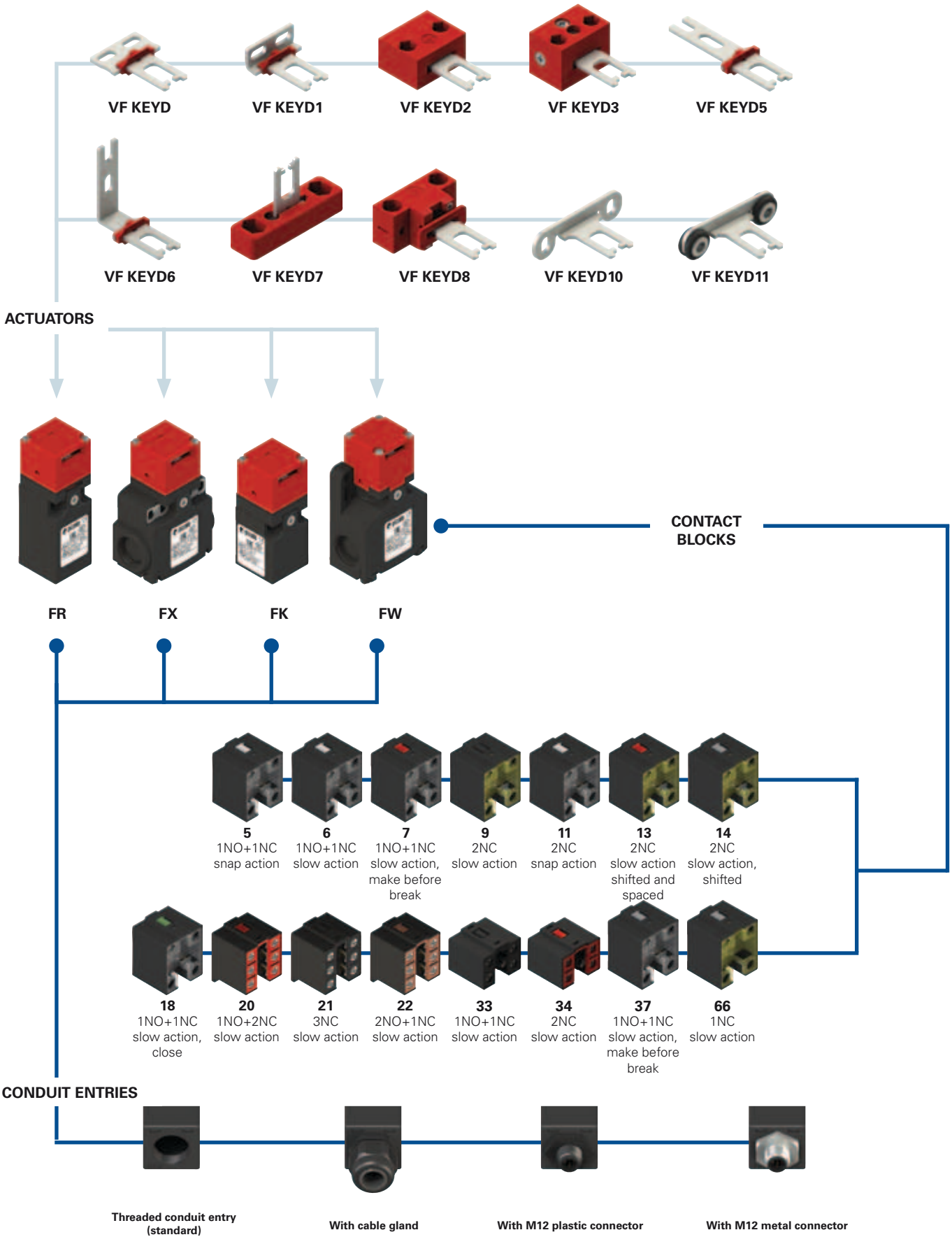
Padlockable device to lock the actuator entry in order to prevent the accidental closing of the door behind operators while they are in the danger area.

Items with code on **green** background are stock items

Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

Selection diagram



Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options | options

FR 693-E3D1XGM2K70T6

Housing

FR	technopolymer, one conduit entry
FX	technopolymer, two conduit entries
FW	technopolymer, three conduit entries

Ambient temperature

	-25°C … +80°C (standard)
T6	-40°C … +80°C

Pre-installed cable glands or connectors

	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
…	……
K70	M12 plastic connector, 4-pole
…	……

For the complete list of possible combinations please contact our technical department.

Contact block

5	1NO+1NC, snap action
6	1NO+1NC, slow action
7	1NO+1NC, slow action, make before break
9	2NC, slow action
11	2NC, snap action
13	2NC, slow action, shifted and spaced
14	2NC, slow action, shifted
18	1NO+1NC, slow action, close
20	1NO+2NC, slow action
21	3NC, slow action
22	2NO+1NC, slow action
33	1NO+1NC, slow action
34	2NC, slow action
37	1NO+1NC, slow action, make before break
66	1NC, slow action

Threaded conduit entry

M2	M20x1.5 (standard)
M1	M16x1.5
	PG 13.5 (FR-FX housing only)
A	PG 11 (FR-FX housing only)

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 22, 33, 34)

Head type

92	detachable head (FW housing only)
93	non-detachable head (FR, FX and FK housing only)

External metallic parts

	zinc-plated steel (standard)
X	stainless steel

Actuator extraction force

	10 N (standard)
E3	30 N

Actuators

	without actuator (standard)
D	straight actuator VF KEYD
D1	angled actuator VF KEYD1
D2	jointed actuator VF KEYD2
…	……

article | options | options

FK 3393-E3D1XGM1K24T6

Housing

FK	technopolymer, one conduit entry

Ambient temperature

	-25°C … +80°C (standard)
T6	-40°C … +80°C

Contact block

33	1NO+1NC, slow action
34	2NC, slow action

Pre-installed cable glands

	no cable gland (standard)
K24	cable gland for cables Ø 10 … 5 mm
K28	cable gland for cables Ø 3 … 7°mm

Actuator extraction force

	10 N (standard)
E3	30 N

Threaded conduit entry

M1	M16x1.5(standard)
	PG 11

Actuators

	without actuator (standard)
D	straight actuator VF KEYD
D1	angled actuator VF KEYD1
D2	jointed actuator VF KEYD2
…	……

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating

External metallic parts

	zinc-plated steel (standard)
X	stainless steel

Safety switches **with separate actuator**

Main features

- Technopolymer housing, from one to three conduit entries
- Protection degree IP67
- 15 contact blocks available
- 8 stainless steel actuators available
- Versions with M12 connector
- Versions with gold-plated silver contacts

Quality marks:

IMQ approval: EG610
UL approval: E131787
CCC approval: 2007010305230013 (FR-FX-FK-FW series)
EAC approval: RU C-IT.АД35.B.00454

Technical data

Housing

Housing made of glass fibre reinforced technopolymer, self-extinguishing, shock-proof and with double insulation: ⧈

FR series, one conduit entry:	M20x1.5 (standard)
FK series: one threaded conduit entry:	M16x1.5 (standard)
FX series: two knock-out threaded conduit entries:	M20x1.5 (standard)
FW series - three knock-out threaded conduit entries:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Mechanical interlock, coded:	type 2 acc. to EN ISO 14119
Coding level:	low acc. to EN ISO 14119
Safety parameter B_{10D}:	2,000,000 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Max. actuation frequency:	3600 operating cycles/hour
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Actuator extraction force	10 N (-E3 versions: 30 N)
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 22, 33, 34:	min.	1 x 0.34 mm²	(1 x AWG 22)
	max.	2 x 1.5 mm²	(2 x AWG 16)
Contact blocks 5, 6, 7, 9.11, 13, 14, 18, 37, 66:	min.	1 x 0.5 mm²	(1 x AWG 20)
	max.	2 x 2.5 mm²	(2 x AWG 14)

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, BG-GS-ET-15, UL 508, CSA 22.2 No.14
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 No.14 GB14048.5-2001.

Compliance with the requirements of:
Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

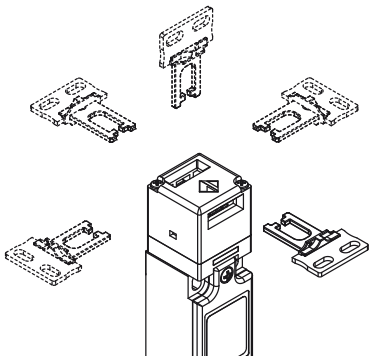
⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

	Electrical data		Utilization category
without connector	Thermal current (I_{th}):	10 A	
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 22, 33, 34)	Alternating current: AC15 (50÷60 Hz) U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 22, 33, 34)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250
	Protection against short circuits:	type aM fuse 10 A 500 V	I_e (A) 6 1.1 0.4
	Pollution degree:	3	
with M12 connector, 4-pole	Thermal current (I_{th}):	4 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 120 250 I_e (A) 4 4 4
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	Direct current: DC13
	Protection against short circuits:	type gG fuse 4 A 500 V	U_e (V) 24 125 250
	Pollution degree:	3	I_e (A) 4 1.1 0.4
with M12 connector, 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 I_e (A) 2
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	Direct current: DC13
	Protection against short circuits:	type gG fuse 2 A 500 V	U_e (V) 24
	Pollution degree:	3	I_e (A) 2

Description

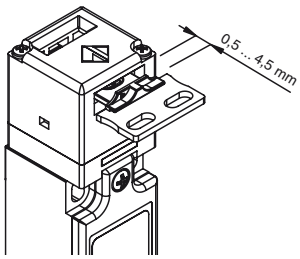
These safety switches are ideal for controlling gates, sliding doors and other guards which protect dangerous parts of machines without inertia. The stainless steel actuator is fastened to the moving part of the guard in such a way that it is separated from the switch each time the guard is opened. A special mechanism ensures that removing the actuator forces the positive opening of the electrical contacts. Easy to install, these switches can be used with all types of guards (with hinge as well as sliding and removable types). The possibility to actuate the switch only with a specific actuator guarantees that the machine can be restarted only after the guard has been closed.

Head with variable orientation



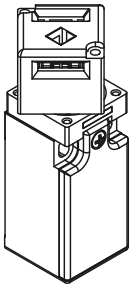
For all switches, the head can be adjusted in 90° steps after removing the two fastening screws. In this way it is possible to actuate the switch from 5 different directions.

Wide-ranging actuator travel



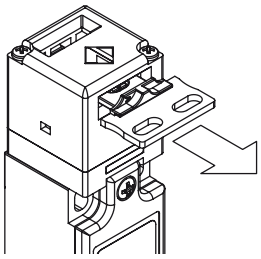
The actuation head of this switch features a wide range of travel. In this way the guard can oscillate along the direction of insertion (4 mm) without causing unwanted machine shutdowns. This wide range of travel is available in all actuators in order to ensure maximum device reliability.

Not detachable head



To make head adjustment safer and smoother, these switches are equipped with a special head to body coupling system. This system makes it impossible to remove the head from the device even during adjustment, thus rendering the use of one-way screws unnecessary for locking the head in position once adjustment is complete. This solution is available for the FR, FX and FK series.

Versions with 30 N actuator extraction force



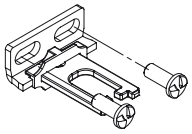
Versions with 30 N actuator holding force instead of the standard 10 N are available.

Protection degree IP67

IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

Safety screws for actuators



As required by EN ISO 14119, the actuator must be fixed immovably to the door frame. Pan head safety screws with one-way fitting are available for this purpose. With this screw type, the actuators cannot be removed or tampered by using common tools. See accessories on page 310.

Extended temperature range

-40°C

These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C.

They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

Features approved by IMQ

Rated insulation voltage (U_i):	500 Vac 400 Vac (for contact blocks 20, 21, 22, 33, 34)
Conventional free air thermal current (I_{th}):	10 A
Protection against short circuits:	type aM fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (for contact blocks 20, 21, 22, 33, 34)
Protection degree of the housing:	IP67
MV terminals (screw terminals)	
Pollution degree:	3
Utilization category:	AC15
Operating voltage (U_e):	400 Vac (50 Hz)
Operating current (I_e):	3 A

Forms of the contact element: Zb, Y+Y, Y+Y+X, Y+Y+Y, Y+X+X

Positive opening contacts on contact blocks 5, 6, 7, 9,11, 13, 14, 18, 20, 21, 22, 33, 34, 66

In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories	Q300 (69 VA, 125-250 Vdc) A600 (720 VA, 120-600 Vac)

Housing features type 1, 4X "indoor use only", 12, 13

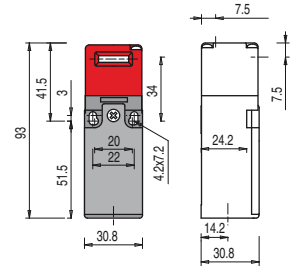
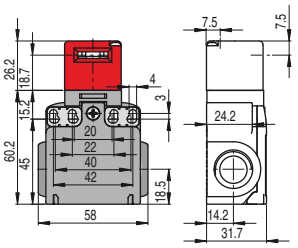
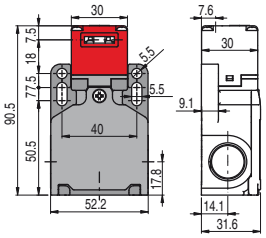
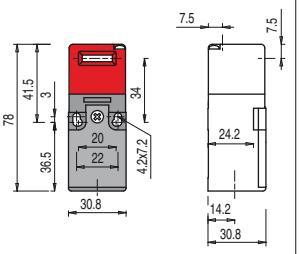
For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).

In compliance with standard: UL 508, CSA 22.2 No.14

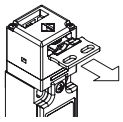
Please contact our technical department for the list of approved products.

Dimensional drawings

All values in the drawings are in mm

Contact type:		Technopolymer housing Without actuator	Technopolymer housing Without actuator	Technopolymer housing Without actuator	Technopolymer housing Without actuator
R = snap action L = slow action LO = slow action make before break LS = slow action shifted LV = slow action shifted and spaced LA = slow action close					
Contact block					
5	R	FR 593-M2 → 1NO+1NC	FX 593-M2 → 1NO+1NC	FW 592-M2 → 1NO+1NC	
6	L	FR 693-M2 → 1NO+1NC	FX 693-M2 → 1NO+1NC	FW 692-M2 → 1NO+1NC	
7	LO	FR 793-M2 → 1NO+1NC	FX 793-M2 → 1NO+1NC	FW 792-M2 → 1NO+1NC	
9	L	FR 993-M2 → 2NC	FX 993-M2 → 2NC	FW 992-M2 → 2NC	
11	R	FR 1193-M2 → 2NC	FX 1193-M2 → 2NC	FW 1192-M2 → 2NC	
13	LV	FR 1393-M2 → 2NC	FX 1393-M2 → 2NC	FW 1392-M2 → 2NC	
14	LS	FR 1493-M2 → 2NC	FX 1493-M2 → 2NC	FW 1492-M2 → 2NC	
18	LA	FR 1893-M2 → 1NO+1NC	FX 1893-M2 → 1NO+1NC	FW 1892-M2 → 1NO+1NC	
20	L	FR 2093-M2 → 1NO+2NC	FX 2093-M2 → 1NO+2NC	FW 2092-M2 → 1NO+2NC	
21	L	FR 2193-M2 → 3NC	FX 2193-M2 → 3NC	FW 2192-M2 → 3NC	
22	L	FR 2293-M2 → 2NO+1NC	FX 2293-M2 → 2NO+1NC	FW 2292-M2 → 2NO+1NC	
33	L	FR 3393-M2 → 1NO+1NC	FX 3393-M2 → 1NO+1NC	FW 3392-M2 → 1NO+1NC	FK 3393-M1 → 1NO+1NC
34	L	FR 3493-M2 → 2NC	FX 3493-M2 → 2NC	FW 3492-M2 → 2NC	FK 3493-M1 → 2NC
37	LO	FR 3793-M2 → 1NO+1NC	FX 3793-M2 → 1NO+1NC	FW 3792-M2 → 1NO+1NC	
66	L	FR 6693-M2 → 1NC	FX 6693-M2 → 1NC	FW 6692-M2 → 1NC	
Actuating force		10 N (18 N →)	10 N (18 N →)	10 N (18 N →)	10 N (18 N →)
Travel diagrams		page 318 - group 8	page 318 - group 8	page 318 - group 8	page 318 - group 8

All switches listed above are available in a version with 30 N actuator extraction force. To obtain these products, the order code must be changed by adding the extension "E3", for example FR 693-M2E3.



Actuator extraction force: 30 N	30 N (38 N →)	30 N (38 N →)	30 N (38 N →)	30 N (38 N →)

Limits of use

Do not use where dust and dirt may penetrate in any way into the head and deposit there. Especially not where powder, shavings, concrete or chemicals are sprayed. Adhere to the EN ISO 14119 requirements regarding low level of coding for interlocks. Do not use in environments with presence of explosive or flammable gas. In these case use ATEX products (see dedicated Pizzato catalogue).

Items with code on **green** background are stock items

Accessories See page 299

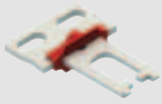
→ The 2D and 3D files are available at **www.pizzato.com**

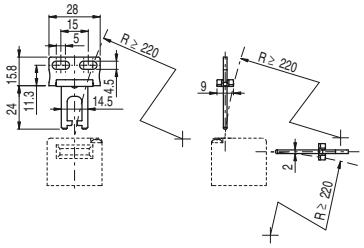
Stainless steel actuators

All values in the drawings are in mm

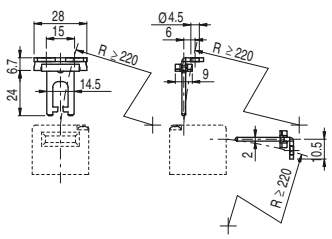
IMPORTANT: These actuators can only be used with items of the FR, FX, FK and FW series (e.g. FR 693-M2).
Low level of coding acc. to EN ISO 14119.

Article	Description
VF KEYD	Straight actuator

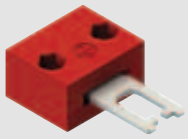


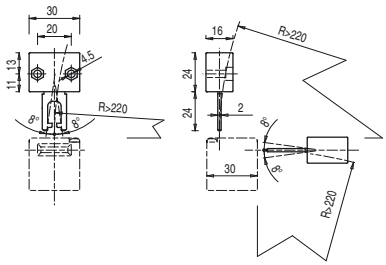


Article	Description
VF KEYD1	Angled actuator



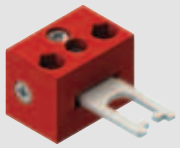
Article	Description
VF KEYD2	Jointed actuator

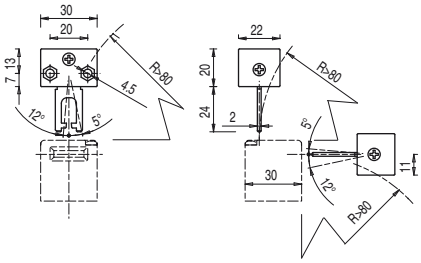




The actuator can flex in four directions for applications where the door alignment is not precise.

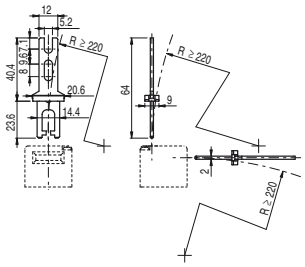
Article	Description
VF KEYD3	Actuator adjustable in two directions



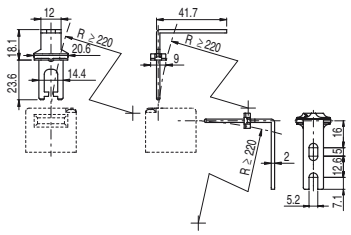


Actuator adjustable in two directions for doors with reduced dimensions.

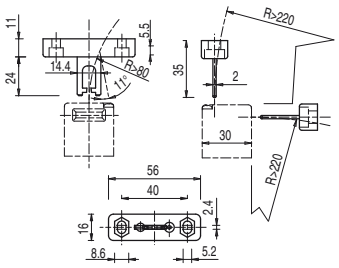
Article	Description
VF KEYD5	Extended actuator



Article	Description
VF KEYD6	Extended actuator, angled

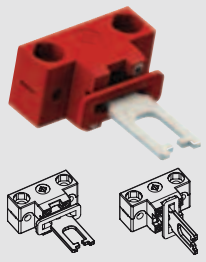


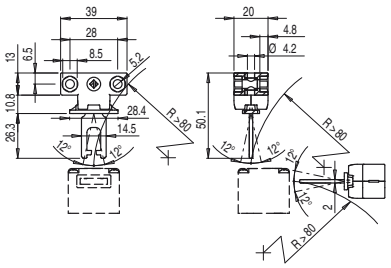
Article	Description
VF KEYD7	Actuator adjustable in one direction



Actuator adjustable in one direction for doors with reduced dimensions.

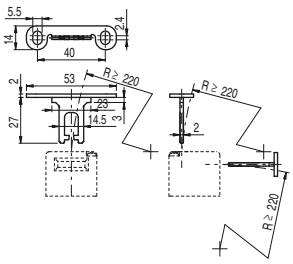
Article	Description
VF KEYD8	Universal actuator



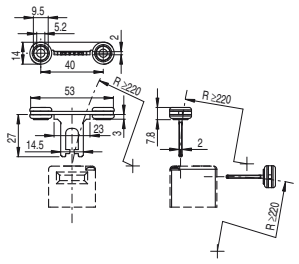


Actuator adjustable in two dimensions for small doors; can be mounted in various positions.
The fixing block has two pairs of bore holes; it is provided for rotating the working plane of the actuator by 90°.

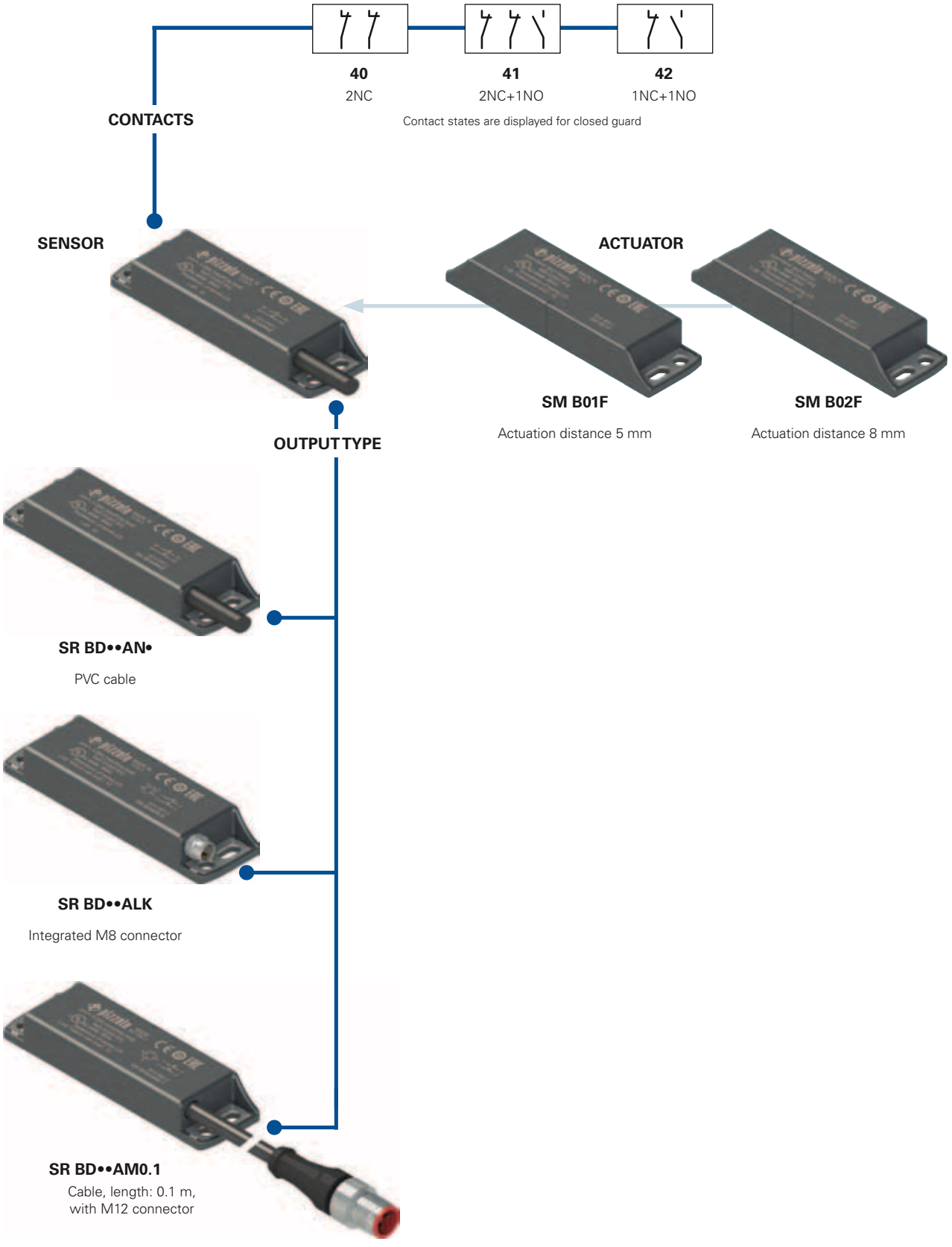
Article	Description
VF KEYD10	Profiled actuator



Article	Description
VF KEYD11	Profiled actuator



Selection diagram



product option
accessory sold separately

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

Code structure for sensor with actuator

article: **SR BD40AN2-B01F** options: **-X**

Sensor housing

SR	technopolymer

Contacts (with closed guard)

40	2NC (standard)
41	2NC+1NO (standard)
42	1NC+1NO

Cable or connector type

N1	PVC cable, length: 1 m
N2	PVC cable, length: 2 m (standard)
...	.....
N10	PVC cable, length: 10 m
M0.1	cable, length: 0.1 m, with M12 connector
LK	integrated M8 connector (available only with contacts 40 and 42)

Actuator

B01F	complete with actuator SM B01F, actuation distance 5 mm
B02F	complete with actuator SM B02F, actuation distance 8 mm

External metallic parts

	stainless steel fixing plates (standard)
X	fixing plates and connector body in stainless steel (LK connector available only)

Code structure for single sensor

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article: **SR BD40AN2** options: **-X**

Sensor housing

SR	technopolymer

Contacts (with closed guard)

40	2NC (standard)
41	2NC+1NO (standard)
42	1NC+1NO

Cable or connector type

N1	PVC cable, length: 1 m
N2	PVC cable, length: 2 m (standard)
...	.....
N10	PVC cable, length: 10 m
M0.1	cable, length: 0.1 m, with M12 connector
LK	integrated M8 connector (available only with contacts 40 and 42)

External metallic parts

	stainless steel fixing plates (standard)
X	fixing plates and connector body in stainless steel (LK connector available only)

Code structure for single actuator

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

SM B01F

Actuator

B01F	actuation distance 5 mm
B02F	actuation distance 8 mm

SR B series coded magnetic safety sensors

Main features
- Actuation without mechanical contact
- Stainless steel fixing plates
- Output contacts: 2NC, 1NO+2NC or 1NO+1NC
- Insensitive to dirt
- Protection degrees IP67 and IP69K
- Coded actuator
- Technopolymer housing
- Versions with M8 or M12 connector

Quality marks:

UL approval: E131787
TÜV SÜD approval: Z10 15 08 75157 008
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU
Machinery Directive 2006/42/EC
EMC Directive 2014/30/EU.

Technical data

Housing
Housing made of glass fibre reinforced technopolymer, self-extinguishing.
Versions with integrated cable 4 x 0.22 mm² or 6 x 0.25 mm², length 2 m, other lengths from 0.5 m … 10 m on request.
Versions with integrated M8 connector
Versions with 0.1 m cable length and M12 connector, other lengths from 0.1 … 3 m on request
Protection degree: IP67 acc. to EN 60529
IP69K acc. to ISO 20653
(Protect the cables from direct high-pressure and high-temperature jets)

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Interlock, no contact, coded:	type 4 acc. to EN ISO 14119
Coding level:	low acc. to EN ISO 14119
Safety parameter B_{10D}:	20,000,000 (with compatible Pizzato Elettrica safety modules) 400,000 (at max. load: DC12 24 V 250 mA)
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Ambient temp. with flexible installation cable:	-5°C … +80°C
Vibration resistance:	10 gn (10 … 150 Hz) acc. to IEC 60068-2-6
Shock resistance:	30 gn; 11 ms acc. to EN 60068-2-27
Pollution degree	3
Screw tightening torque:	0.8 … 2 Nm

In compliance with standards:
IEC 60947-1, EN 60947-1, IEC 60947-5-1, EN 60947-5-1, EN 60947-5-2, EN 60947-5-3 (in connection with safety module), EN ISO 14119, EN ISO 12100, EN ISO 13849-1, EN ISO 13849-2, IEC 60204-1, EN 60204-1, IEC 60529, EN 60529, ISO 20653, UL 508, CSA 22.2 No.14 .
Approvals:
UL 508, CSA 22.2 No.14 , EN ISO 13849-1, EN 60947-5-3, EN 50178, EN 61508-1, EN 61508-2, EN 61508-4, IEC 62061, EN 60947-1.

Actuation data

Assured operating distance Sao	5 mm with actuator SM B01F
Assured release distance Sar	15 mm with actuator SM B01F
Assured operating distance Sao	8 mm with actuator SM B02F
Assured release distance Sar	20 mm with actuator SM B02F
Repeat accuracy	≤ 10%
Switching frequency	up to 150 Hz
Distance between two sensors	min. 50 mm

Electrical data

Rated operating voltage U_e:	24 Vac/dc
Rated operating current I_e:	0.25 A (resistive load)
Rated insulation voltage U_i:	120 Vac (with cable) 60 Vac / 75 Vdc (with M8 connector) 120 Vac (with M12 connector, 4-pole) 30 Vac / 36 Vdc (with M12 connector, 8-pole)
Rated impulse withstand voltage (U_{imp}):	6 kV 1.5 kV (with connector)
Thermal current I_{th}:	0.25 A
Maximum switching load:	6 W (resistive load)
Protection fuse:	0.25 A type F
Electrical endurance:	1 million operating cycles

⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

Connection with safety modules for safety applications:
Connection with safety modules CS AR-01••••; CS AR-02••••; CS AR-04••••; CS AR-05••••; CS AR-06••••; CS AR-08••••; CS AR-46•024; CS AR-91••••; CS AT-0•••••; CS AT-1•••••; CS AT-3•••••; CS FS-5•••••; CS MF•••••-••; CS MP•••••-••.
When connected to the safety module, the sensor can be classified as a control circuit device up to PDF-M (EN 60947-5-3).
The system can be used in safety circuits up to PL e/SIL 3/category 4 in accordance with EN ISO 13849-1.

Features approved by UL

Utilization categories: 24 Vdc, 0.25 A (resistive load).

Housing features type 1, 4X "indoor use only", 12.

Accessory for CS series.

In compliance with standard: UL 508, CSA 22.2 No.14

Please contact our technical department for the list of approved products.

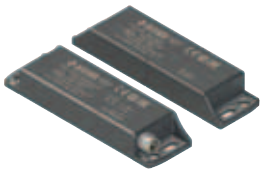
Features approved by TÜV SÜD

Supply voltage:	24 Vac/dc
Rated operating current (max.):	0.25 A
Ambient temperature:	-25 °C … + 80°C
Protection degree:	IP67
PL, category:	PL e, category 4 with CS AR-08

In compliance with standards: 2006/42/EEC Machine Directive, EN ISO 13849-1:2008, EN 60947-5-3/A1:2005, EN 50178:1997, EN 61508-1:1998 (SIL 1-3), EN 61508-2:2000 (SIL 1-3), EN 61508-4:1998 (SIL 1-3), IEC 62061:2005 (SIL CL 3), EN 60947-1

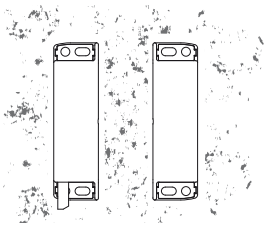
Please contact our technical department for the list of approved products.

Description



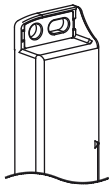
Coded magnetic sensors are devices suitable for monitoring protections and guards of machines without inertia which, when linked to a safety module, can create a system with safety category up to SIL 3 according to EN 62061, up to PL e according to EN ISO 13849-1 and up to category 4 according to EN ISO 13849-1. These products consist of a sensor that detects the magnetic field and which is connected to the machine structure and of a coded magnetic actuator, which is connected to the movable guard. When the sensor and actuator are approached (closed guard), the sensor detects the actuator and actuates the electrical contacts. The sensor is designed to be activated only by the correct coded actuator and not through a common magnet.

Insensitivity to dirt



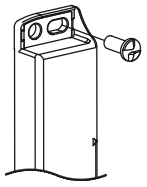
Magnetic sensors are totally sealed and retain their safety characteristics also where dirt and dust are present (not ferromagnetic material). This characteristic, combined with the design without recesses, makes them particularly suitable for use in the agricultural and food industries.

Stainless steel fixing plates



To prevent damage to the fixing slots when fastening on non-perfectly flat surfaces, coded magnetic sensors are equipped with stainless steel fixing plates. Even in the presence of suitable fixing surfaces, this solution makes the sensor more robust against mechanical stresses.

Safety screws for actuators



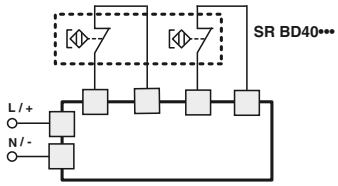
As required by EN ISO 14119, the actuator must be fixed immovably to the door frame. Pan head safety screws with one-way fitting are available for this purpose. With this screw type, the actuators cannot be removed or tampered by using common tools.

See accessories on page 310.

Laser engraving

All devices are marked using a dedicated indelible laser system. These engravings are therefore suitable for extreme environments too. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Compatible safety modules

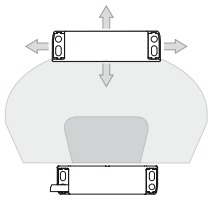


The magnetic sensors have been tested and approved for operation with suitable safety modules (see list). The use of complete and tested solutions guarantees the electrical compatibility between the sensor and safety module, as well as high reliability.

Sensors	Compatible safety modules	Safety module output contacts	
		Instantaneous contacts	Delayed contacts
SR BD40A•• SR BD41A•• SR BD42A••[a]	CS AR-01••••[b]	2NO+1NC	/
	CS AR-02••••[b]	3NO	/
	CS AR-04••••[b]	3NO+1NC	/
	CS AR-05••••	3NO+1NC	/
	CS AR-06••••	3NO+1NC	/
	CS AR-08••••	2NO	/
	CS AR-46•024	1NO	/
	CS AR-91••••	2NO+1PNP	/
	CS AT-0•••••	2NO+1NO	2NO
	CS AT-1•••••	3NO	2NO
	CS AT-3•••••	2NO	1NO
	CS FS-5•••••	1NO+1NC+1CO	/
	CS MP•••••-••	see page 253	see page 255
	CS MF•••••-••	see page 281	see page 283

[a] Compatible with CS MF202••-P4 and CS MP•••••-•• only.
[b] Compatible with modules with production batch later than 04/2014 only.
For features of the safety modules see page 191.

Wide actuation range

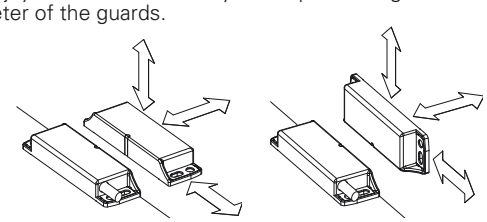


With their built-in features, magnetic sensors have a wide actuation range, making them very well suited for applications with large tolerances or where mechanical properties change over time.

In this type of sensor, the actuation distances may vary depending on the shift direction of the actuator in relation to the sensor.

Actuation from many directions

The coded magnetic sensors were designed to be activated by the respective actuator from various directions. The customer therefore enjoys maximum flexibility when positioning devices along the perimeter of the guards.



Protection degrees IP67 and IP69K

IP69K
IP67

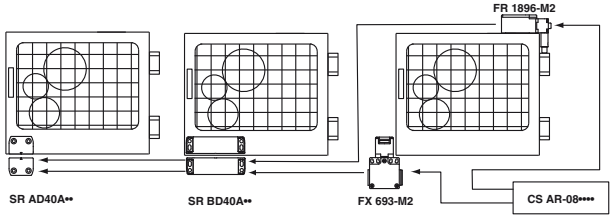
These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

Series connection of multiple sensors

The coded magnetic sensors can be connected in series with the only limitation that the overall resistance, of sensors and the related wiring, has to be not higher than the admitted max. value of the module, which typically is equal to 50 ohm (see module features). This is a very high value that, with normal wiring, allows the use of dozens of sensors without problems. It is also possible to realise mixed circuit solutions by connecting coded magnetic sensors in series to safety switches, with the only limitation being the above-mentioned maximum electrical resistance.

It should be noted that the series connection of two or more coded sensors reduces the self-monitoring capacity of the system, see ISO/TR 24119.

The use of Pizzato Elettrica safety modules is recommended.

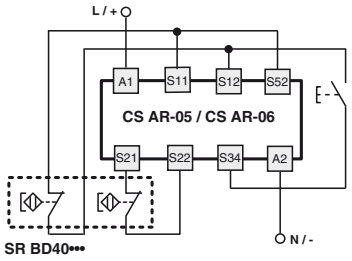


Connection with safety modules

Connection with safety modules CS AR-05 or CS AR-06

Input configuration with manual start (CS AR-05) and monitored start (CS AR-06)

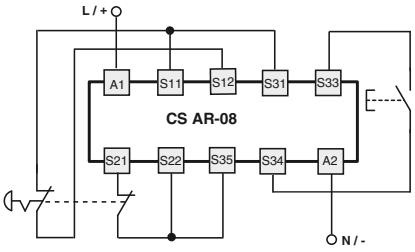
2 channels



Connection with safety module CS AR-08 or CS AT

Input configuration with manual start

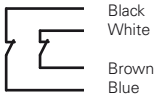
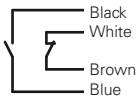
2 channels



For features of the safety modules see page 191.

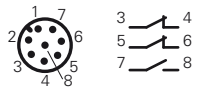
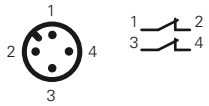
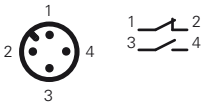
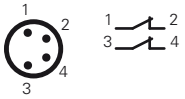
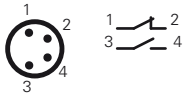
Internal connections with cable

Contact states are displayed for closed guard

With cable (2NC)	With cable (1NC+1NO)	With cable (2NC+1NO)
		

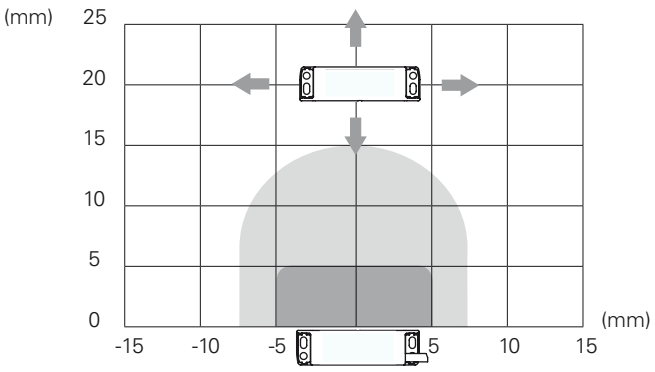
Internal connections with connector

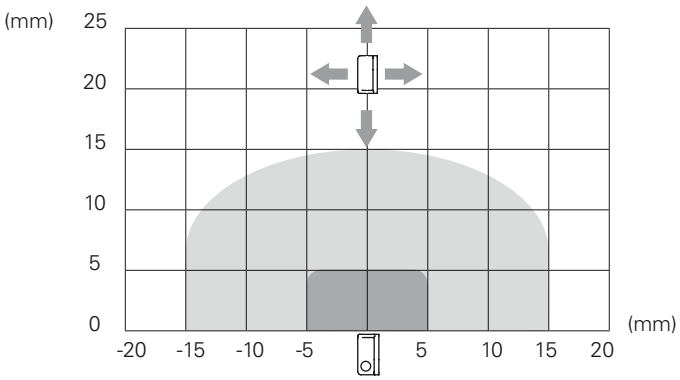
Contact states are displayed for closed guard

With M12 connector (2NC+1NO)	With M12 connector (2NC)	With M12 connector (1NC+1NO)	With M8 connector (2NC)	With M8 connector (1NC+1NO)
				

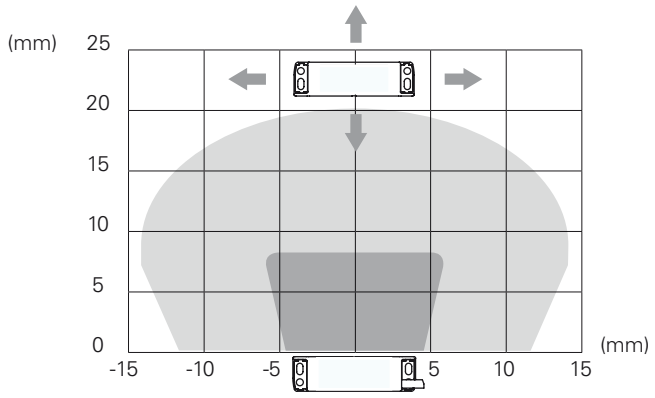
Female connectors see page 299

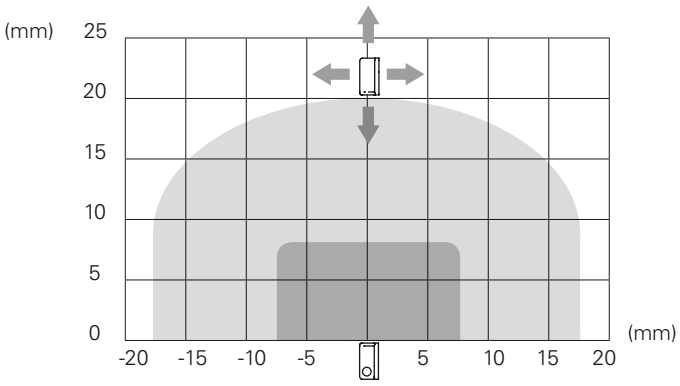
Operating distances SR BD•••••-B01F





Operating distances SR BD•••••-B02F





Legend:

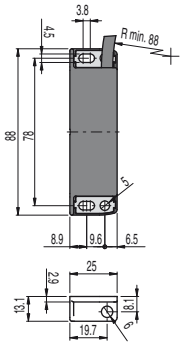
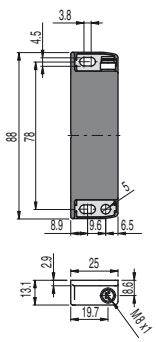
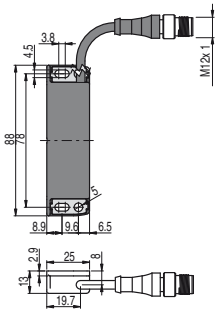
Assured operating distance S_{ao}

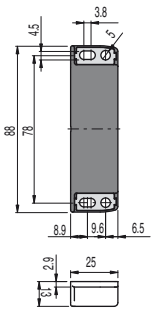
Assured release distance S_{ar}

Note: The progress of the activation areas is for reference only

Dimensional drawings

All values in the drawings are in mm

integrated cable, length: 2 m		M8 connector		cable, length: 0.1 m, with M12 connector	
					
SR BD40AN2	2NC	SR BD40ALK	2NC	SR BD40AM0.1	2NC
SR BD41AN2	1NO+2NC			SR BD41AM0.1	1NO+2NC
SR BD42AN2	1NO+1NC	SR BD42ALK	1NO+1NC	SR BD42AM0.1	1NO+1NC

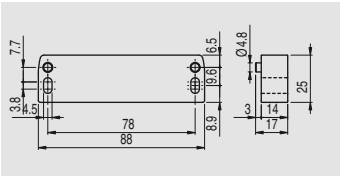
coded actuator Low level of coding acc. to EN ISO 14119	
	
SM B01F	Actuation distance 5 mm
SM B02F	Actuation distance 8 mm

Items with code on **green** background are stock items

Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

Spacer



This spacer is placed between the magnetic safety sensors and metal surfaces that can deflect the magnetic field: as a result, the activation and deactivation distances of the sensor remain the same.

Article	Description
VS SP1BA1	Spacer for SR B series sensors

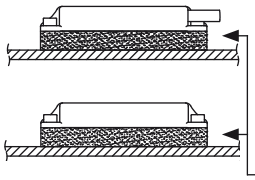
Use of coded magnetic sensors for safety applications

A coded magnetic sensor alone cannot be used for safety functions because its operating principles are not considered safe by the standards (such as the positive opening on mechanical switches). For this reason, a magnetic sensor coded for use in safety applications must always be connected to a safety module that monitors its proper operation through a circuit with at least two channels.

Limits of use

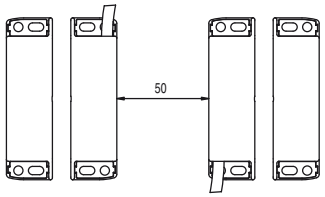
- Installation must be carried out by qualified staff only.
- Before commissioning and at regular intervals, the correct switching of the contacts and proper operation of the system, consisting of the sensor and the safety module, must be checked.
- Do not use a hammer for adjustment.
- Do not use the sensor as a mechanical stop.
- Observe the assured operating and release distances.
- Adhere to the EN ISO 14119 requirements regarding low level of coding for interlocks.
- Do not mount the sensor and actuator in strong magnetic fields.
- Keep away from iron filings.
- Avoid any impact with the sensor. Excessive shock and vibrations may affect the correct operation of the sensor.
- The actuator must not strike the sensor.
- In case of damages or wear, the entire device – including the actuator – must be replaced.
- Keep load under the value indicated in the electrical data.
- If the sensors are used without corresponding safety module, the protective fuse recommended in the electrical data must be connected in series to each sensor contact.
- Turn off the power supply before accessing the switch contacts, also during wiring.

Installation on ferromagnetic material



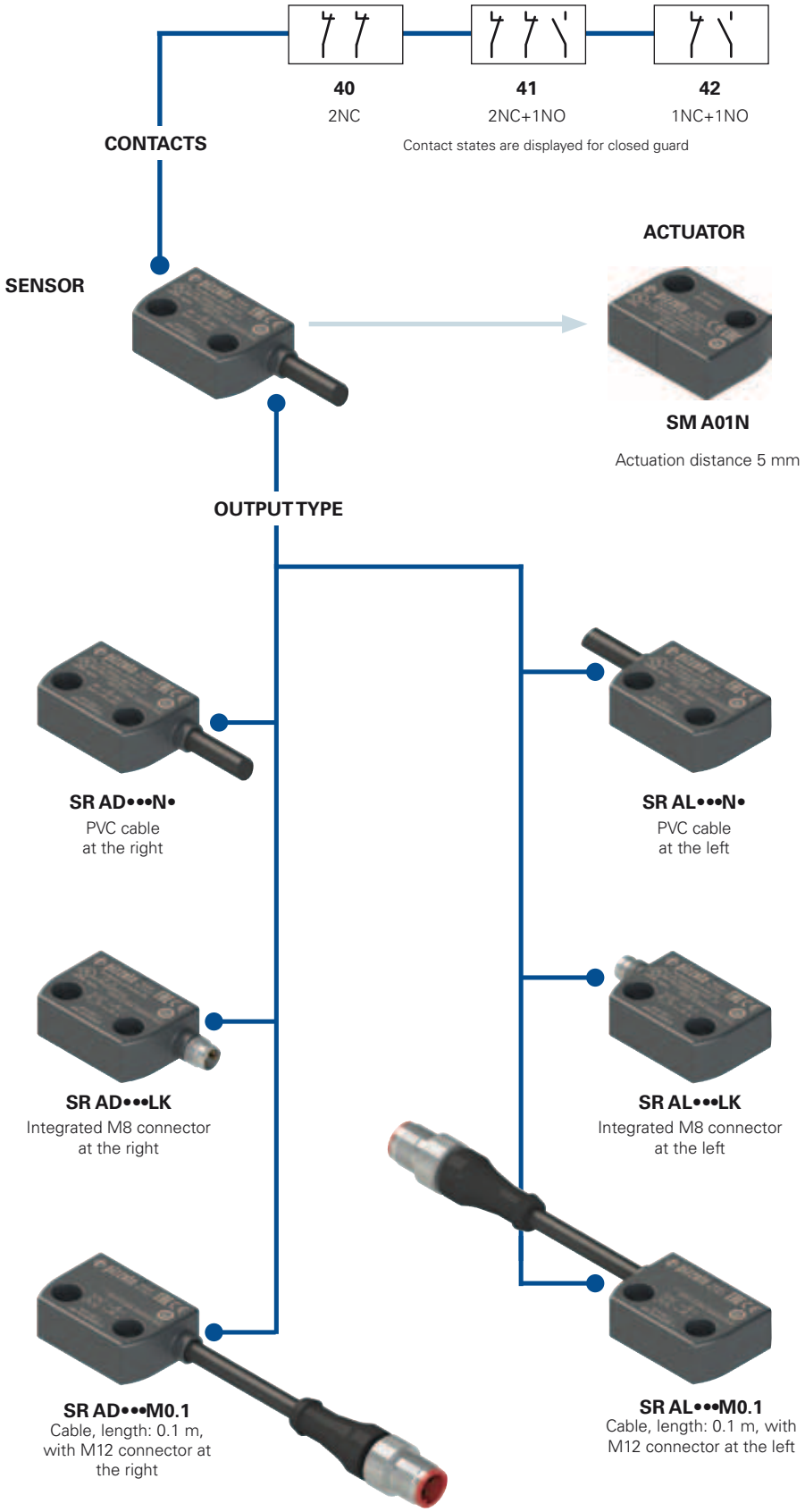
- If possible do not mount the sensor and the actuator on ferromagnetic materials.
- To avoid a reduction in the switching distances, use the special VS SP1BA1 spacer.

Assembly of multiple sensor-actuator systems



The minimum spacing between adjacent sensor-actuator systems must be at least 50 mm.

Selection diagram



product option
accessory sold separately

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

Code structure for sensor with actuator

article | options

SR AD40AN2-A01N-X

Sensor housing

SR	technopolymer

Output direction, connections

D	output at the right
L	output at the left

Contacts (with closed guard)

40	2NC (standard)
41	2NC+1NO (standard)
42	1NC+1NO

Actuator

A01N	complete with actuator SM A01N, actuation distance 5 mm

Cable or connector type

N1	PVC cable, length: 1 m
N2	PVC cable, length: 2 m (standard)
...	.....
N10	PVC cable, length: 10 m
M0.1	cable, length: 0.1 m, with M12 connector
LK	integrated M8 connector (available only with contacts 40 and 42)

External metallic parts

	brass, nickel-plated, where present (standard)
X	connector body in stainless steel (only LK connector available)

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

Code structure for single sensor

article | options

SR AD40AN2-X

Sensor housing

SR	technopolymer

Output direction, connections

D	output at the right
L	output at the left

Contacts (with closed guard)

40	2NC (standard)
41	2NC+1NO (standard)
42	1NC+1NO

Cable or connector type

N1	PVC cable, length: 1 m
N2	PVC cable, length: 2 m (standard)
...	.....
N10	PVC cable, length: 10 m
M0.1	cable, length: 0.1 m, with M12 connector
LK	integrated M8 connector (available only with contacts 40 and 42)

External metallic parts

	brass, nickel-plated, where present (standard)
X	connector body in stainless steel (only LK connector available)

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

Code structure for single actuator

SM A01N

Actuator

A01N	actuation distance 5 mm

SR A series coded magnetic safety sensor

Main features
- Actuation without mechanical contact
- Output contacts: 2NC, 1NO+2NC or 1NO+1NC
- Insensitive to dirt
- Protection degrees IP67 and IP69K
- Coded actuator
- Technopolymer housing
- Versions with M8 or M12 connector

Quality marks:

UL approval: E131787
TÜV SÜD approval: Z10 15 08 75157 008
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU
Machinery Directive 2006/42/EC
EMC Directive 2014/30/EU.

Technical data

Housing
Housing made of glass fibre reinforced technopolymer, self-extinguishing.
Versions with integrated cable 4 x 0.22 mm² or 6 x 0.25 mm², length 2 m, other lengths 0.5 m … 10 m on request
Versions with integrated M8 connector
Versions with 0.1 m cable length and M12 connector, other lengths from 0.1 … 3 m on request

Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Interlock, no contact, coded:	type 4 acc. to EN ISO 14119
Coding level:	low acc. to EN ISO 14119
Safety parameter B_{10d}:	20,000,000 (with compatible Pizzato Elettrica safety modules) 400,000 (at max. load: DC12 24 V 250 mA)
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Ambient temperature with flexible installation cable:	-5°C … +80°C
Vibration resistance:	10 gn (10 … 150 Hz) acc. to IEC 60068-2-6
Shock resistance:	30 gn; 11 ms acc. to EN 60068-2-27
Pollution degree	3
Screw tightening torque:	0.8 … 2 Nm

In compliance with standards:
IEC 60947-1, EN 60947-1, IEC 60947-5-1, EN 60947-5-1, EN 60947-5-2, EN 60947-5-3 (in connection with safety module), EN ISO 14119, EN ISO 12100, EN ISO 13849-1, EN ISO 13849-2, IEC 60204-1, EN 60204-1, IEC 60529, EN 60529, ISO 20653, UL 508, CSA 22.2 No.14 .
Approvals:
UL 508, CSA 22.2 No.14 , EN ISO 13849-1, EN 60947-5-3, EN 50178, EN 61508-1, EN 61508-2, EN 61508-4, IEC 62061, EN 60947-1.

Actuation data

Assured operating distance S_{ao}	5 mm with actuator SM A01N
Assured release distance S_{ar}	15 mm with actuator SM A01N
Repeat accuracy	≤ 10%
Switching frequency	up to 150 Hz
Distance between two sensors	Min. 50 mm

Electrical data

Rated operating voltage U_e:	24 Vac/dc
Rated operating current I_e:	0.25 A (resistive load)
Rated insulation voltage U_i:	120 Vac (with cable) 60 Vac / 75 Vdc (with M8 connector) 120 Vac (with M12 connector, 4-pole) 30 Vac / 36 Vdc (with M12 connector, 8-pole)
Rated impulse withstand voltage (U_{imp}):	6 kV 1.5 kV (with connector)
Thermal current I_{th}:	0.25 A
Maximum switching load:	6 W (resistive load)
Protection fuse:	0.25 A type F
Electrical endurance:	1 million operating cycles

⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

Connection with safety modules for safety applications:
Connection with safety modules CS AR-01••••; CS AR-02••••; CS AR-04••••; CS AR-05••••; CS AR-06••••; CS AR-08••••; CS AR-46•024; CS AR-91••••; CS AT-0•••••; CS AT-1•••••; CS AT-3•••••; CS FS-5•••••; CS MF•••••-••; CS MP•••••-••.
When connected to the safety module, the sensor can be classified as a control circuit device up to PDF-M (EN 60947-5-3).
The system can be used in safety circuits up to PL e/SIL 3/category 4 in accordance with EN ISO 13849-1.

Features approved by UL

Utilization categories: 24 Vdc, 0.25 A (resistive load).

Housing features type 1, 4X "indoor use only", 12.

Accessory for CS series.

In compliance with standard: UL 508, CSA 22.2 No.14

Please contact our technical department for the list of approved products.

Features approved by TÜV SÜD

Supply voltage: 24 Vac/dc
Rated operating current (max.): 0.25 A
Ambient temperature: -25°C … +80°C
Protection degree: IP67
PL, category: PL e, category 4 with CS AR-08

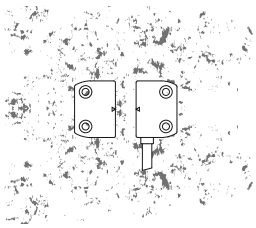
In compliance with standards: 2006/42/EEC Machine Directive, EN ISO 13849-1:2008, EN 60947-5-3/A1:2005, EN 50178:1997, EN 61508-1:1998 (SIL 1-3), EN 61508-2:2000 (SIL 1-3), EN 61508-4:1998 (SIL 1-3), IEC 62061:2005 (SIL CL 3), EN 60947-1

Please contact our technical department for the list of approved products.

Description

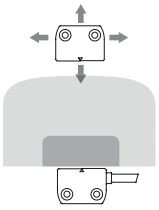
Coded magnetic sensors are devices suitable for monitoring protections and guards of machines without inertia which, when linked to a safety module, can create a system with safety category up to SIL 3 according to EN 62061, up to PL e according to EN ISO 13849-1 and up to category 4 according to EN ISO 13849-1. These products consist of a sensor that detects the magnetic field and which is connected to the machine structure and of a coded magnetic actuator, which is connected to the movable guard. When the sensor and actuator are approached (closed guard), the sensor detects the actuator and actuates the electrical contacts. The sensor is designed to be activated only by the correct coded actuator and not through a common magnet.

Insensitivity to dirt



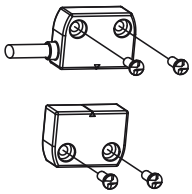
Magnetic sensors are totally sealed and retain their safety characteristics also where dirt and dust are present (not ferromagnetic material).
This characteristic, combined with the design without recesses, makes them particularly suitable for use in the agricultural and food industries.

Wide actuation range



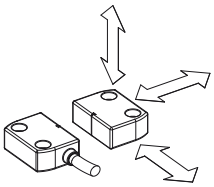
With their built-in features, magnetic sensors have a wide actuation range, making them very well suited for applications with large tolerances or where mechanical properties change over time.
In this type of sensor, the actuation distances may vary depending on the shift direction of the actuator in relation to the sensor.

Safety screws for actuators



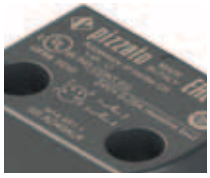
As required by EN ISO 14119, the actuator must be fixed immovably to the door frame. Pan head safety screws with one-way fitting are available for this purpose. With this screw type, the actuators cannot be removed or tampered by using common tools. See accessories on page 310.

Actuation from many directions



The coded magnetic sensors were designed to be activated by the respective actuator from various directions.
The customer therefore enjoys maximum flexibility when positioning devices along the perimeter of the guards.

Laser engraving



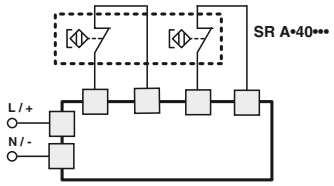
All devices are marked using a dedicated indelible laser system. These engravings are therefore suitable for extreme environments too. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Protection degrees IP67 and IP69K

IP69K
IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

Compatible safety modules



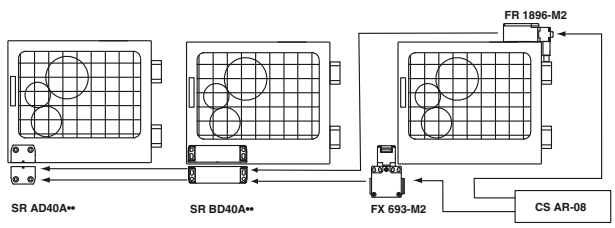
These magnetic sensors have been checked and tested for operation with suitable safety modules (see list). The use of complete and tested solutions guarantees the electrical compatibility between the sensor and safety module, as well as high reliability.

Sensors	Compatible safety modules	Safety module output contacts	
		Instantaneous contacts	Delayed contacts
SR AD40A•• SR AD41A•• SR AD42A••[a]	CS AR-01••••[b]	2NO+1NC	/
	CS AR-02••••[b]	3NO	/
	CS AR-04••••[b]	3NO+1NC	/
	CS AR-05••••	3NO+1NC	/
	CS AR-06••••	3NO+1NC	/
	CS AR-08••••	2NO	/
	CS AR-46•024	1NO	/
	CS AR-91••••	2NO+1PNP	/
	CS AT-0•••••	2NO+1NO	2NO
	CS AT-1•••••	3NO	2NO
	CS AT-3•••••	2NO	1NO
	CS FS-5•••••	1NO+1NC+1CO	/
	CS MP•••••-••	see page 253	see page 255
	CS MF•••••-••	see page 281	see page 283

[a] Compatible with CS MF202••-P4 and CS MP•••••-•• only.
[b] Compatible with modules with production batch later than 04/2014 only.
For features of the safety modules see page 191.

Series connection of multiple sensors

The coded magnetic sensors can be connected in series with the only limitation that the overall resistance, of sensors and the related wiring, has to be not higher than the admitted max. value of the module, which typically is equal to 50 ohm (see module features). This is a very high value that, with normal wiring, allows the use of dozens of sensors without problems. It is also possible to realise mixed circuit solutions by connecting coded magnetic sensors in series to safety switches, with the only limitation being the above-mentioned maximum electrical resistance.
It should be noted that the series connection of two or more coded sensors reduces the self-monitoring capacity of the system, see ISO/TR 24119. The use of Pizzato Elettrica safety modules is recommended.

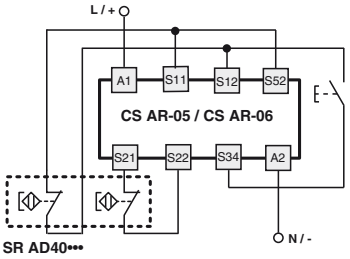


Connection with safety modules

Connection with safety modules CS AR-05 or CS AR-06

Input configuration with manual start (CS AR-05) and monitored start (CS AR-06)

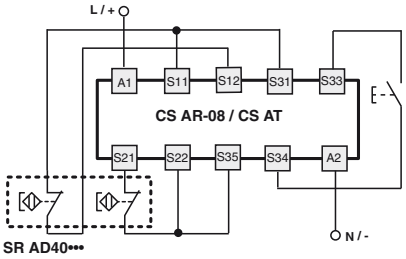
2 channels



Connection with safety module CS AR-08 or CS AT

Input configuration with manual start

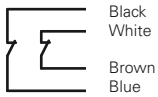
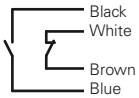
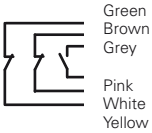
2 channels



For features of the safety modules see page 191.

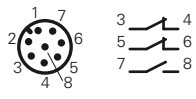
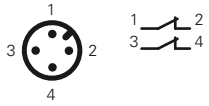
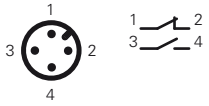
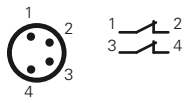
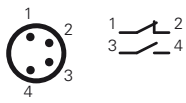
Internal connections with cable

Contact states are displayed for closed guard

With cable (2NC)	With cable (1NC+1NO)	With cable (2NC+1NO)
		
Black White Brown Blue	Black White Brown Blue	Green Brown Grey Pink White Yellow

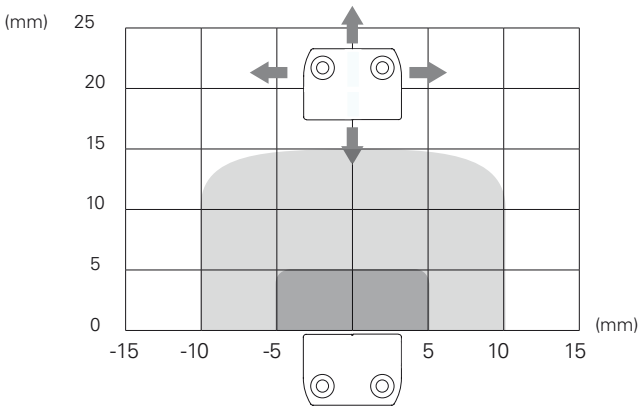
Internal connections with connector

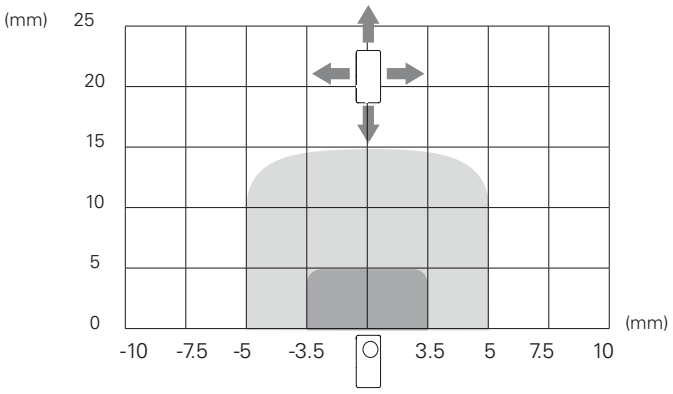
Contact states are displayed for closed guard

With M12 connector (2NC+1NO)	With M12 connector (2NC)	With M12 connector (1NC+1NO)	With M8 connector (2NC)	With M8 connector (1NC+1NO)
				

Female connectors see page 287

Operating distances SR AD•••••-A01N





Legend:

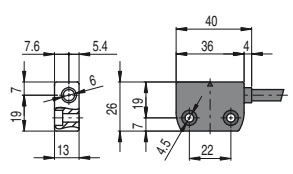
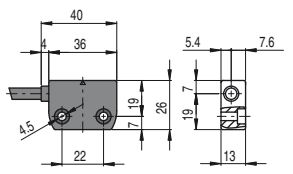
Assured operating distance S_{ao}

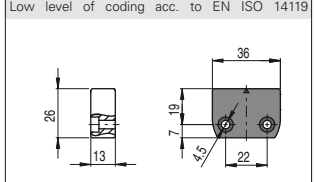
Assured release distance S_{ar}

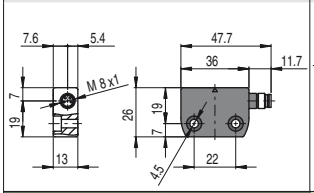
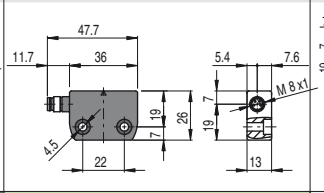
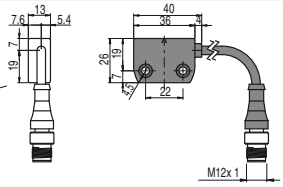
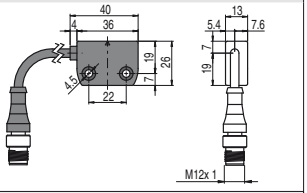
Note: The progress of the activation areas is for reference only

Dimensional drawings

All values in the drawings are in mm

integrated cable, length: 2 m, at the right		integrated cable, length: 2 m, at the left	
			
SR AD40AN2	2NC	SR AL40AN2	2NC
SR AD41AN2	1NO+2NC	SR AL41AN2	1NO+2NC
SR AD42AN2	1NO+1NC	SR AL42AN2	1NO+1NC

coded actuator Low level of coding acc. to EN ISO 14119	
	
SM A01N	Actuation distance 5 mm

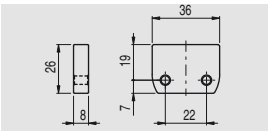
M8 connector, at the right		M8 connector, at the left		cable, length: 0.1 m, with M12 connector at the right		cable, length: 0.1 m, with M12 connector at the left	
							
SR AD40ALK	2NC	SR AL40ALK	2NC	SR AD40AM0.1	2NC	SR AL40AM0.1	2NC
				SR AD41AM0.1	1NO+2NC	SR AL41AM0.1	1NO+2NC
SR AD42ALK	1NO+1NC	SR AL42ALK	1NO+1NC	SR AD42AM0.1	1NO+1NC	SR AL42AM0.1	1NO+1NC

Items with code on **green** background are stock items

Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

Spacer



This spacer is placed between the magnetic safety sensors and metal surfaces that can deflect the magnetic field: as a result, the activation and deactivation distances of the sensor remain the same. Because it is made out of a single block of material, it is especially well suited for applications where a high level of cleanness is required, as any material present in the installation area cannot penetrate and accumulate.

Article	Description
VS SP1AA1	Spacer for SR A series sensors

Use of coded magnetic sensors for safety applications

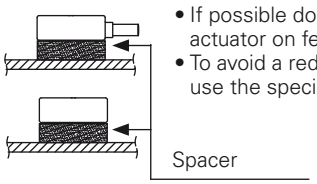
A coded magnetic sensor alone cannot be used for safety functions because its operating principles are not considered safe by the standards (such as the positive opening on mechanical switches).

For this reason, a magnetic sensor coded for use in safety applications must always be connected to a safety module with at least two channels that monitors the proper function.

Limits of use

- Installation must be carried out by qualified staff only.
- Before commissioning and at regular intervals, the correct switching of the contacts and proper operation of the system, consisting of the sensor and the safety module, must be checked.
- Do not use a hammer for adjustment.
- Do not use the sensor as a mechanical stop.
- Observe the assured operating and release distances.
- Adhere to the EN ISO 14119 requirements regarding low level of coding for interlocks.
- Do not mount the sensor and actuator in strong magnetic fields.
- Keep away from iron filings.
- Avoid any impact with the sensor. Excessive shock and vibrations may affect the correct operation of the sensor.
- The actuator must not strike the sensor.
- In case of damages or wear, the entire device – including the actuator – must be replaced.
- Keep load under the value indicated in the electrical data.
- If the sensors are used without corresponding safety module, the protective fuse recommended in the electrical data must be connected in series to each sensor contact.
- Turn off the power supply before accessing the switch contacts, also during wiring.

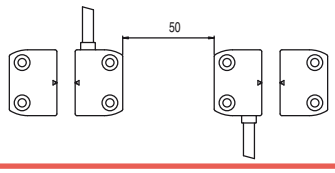
Installation on ferromagnetic material



- If possible do not mount the sensor and the actuator on ferromagnetic materials.
- To avoid a reduction in the switching distances, use the special VS SP1AA1 spacer.

Assembly of multiple sensor-actuator systems

The minimum spacing between adjacent sensor-actuator systems must be at least 50 mm.



ST series safety sensors with RFID technology

Introduction

In combination with the corresponding safety modules, the sensors of the ST series are suitable for the monitoring of protective devices on machines without inertia and allow the system in which they are used to reach a safety category up to SIL 3 acc. to EN 62061 as well as up to PL e and Category 4 acc. to EN ISO 13849-1.
These sensors use RFID (Radio Frequency IDentification) technology and provide high protection against possible manipulation thanks to the uniqueness of the codes transmitted by the actuator. Because they have no mechanical elements, they guarantee a long service life even in applications with frequent operating cycles and under harsh environmental conditions.

Maximum safety with a single device

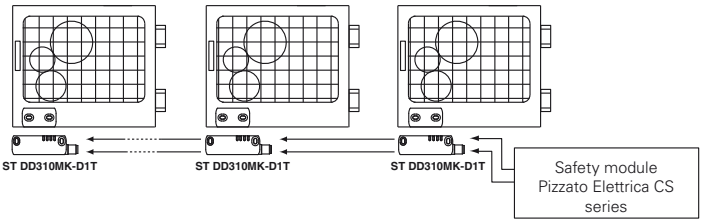
PL e + SIL 3

The sensors of the ST series are constructed with redundant electronics. As a result, the maximum PL e and SIL 3 safety levels can still be achieved through the use of a single device on a guard. This avoids expensive wiring in the field and allows faster installation. Inside the control cabinet, the two electronic safety outputs must be connected to a safety module with OSSD inputs or to a safety PLC.

Series connection of multiple sensors

PL e + SIL 3

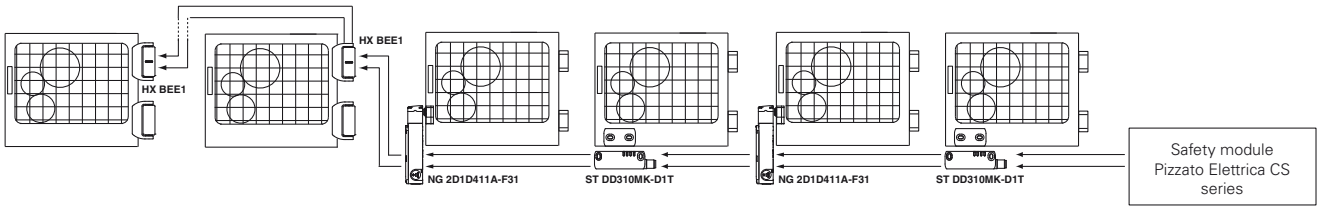
One of the most important features of the ST series from Pizzato Elettrica is the possibility of connecting up to 32 sensors in series, while still maintaining the maximum safety level (PL e) laid down in EN 13849-1.
This connection type is permissible in safety systems which have a safety module at the end of the chain that monitors the outputs of the last ST sensor.
The fact that the PL e safety level can be maintained even with 32 sensors connected in series demonstrates the extremely secure structure of each sensor of the ST series.



Series connection with other devices

PL e + SIL 3

The ST series features two safety inputs and two safety outputs, which can be connected in series with other Pizzato Elettrica safety devices. This option allows the creation of safety chains containing various devices. For example, stainless steel safety hinges (HX BEE1 series), transponder sensors (ST series) and door lock sensors (NG or NS series) can be connected in series while still maintaining the maximum PL e and SIL 3 safety levels.



High level coded actuators

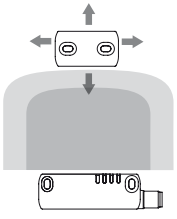
The ST series is provided with an electronic system based on RFID technology to detect the actuator. This allows to provide each actuator with different coding and makes it impossible to tamper with a device by using another actuator of the same series. Millions of different coding combinations are possible for the actuators. They are therefore classified as high level coded actuators, according to EN ISO 14119.

Protection degrees IP67 and IP69K

IP69K
IP67

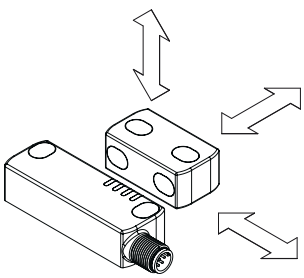
These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

Wide actuation range



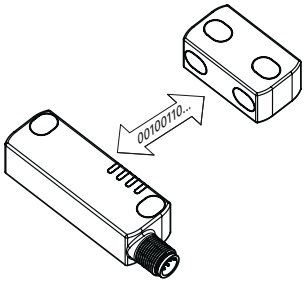
By utilising the properties of RFID technology, the sensors of the ST series have a wide actuation range, making them very well suited for applications with large tolerances or where mechanical properties change over time.

Actuation from many directions



The sensors of the ST series from Pizzato Elettrica were designed to be activated from various directions, thereby providing the customer with maximum flexibility when positioning the sensors on the guards. Furthermore, the SM D•T actuator can be secured in two mutually orthogonal directions.

Programmability



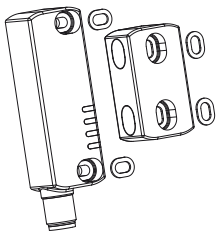
Pizzato Elettrica supplies a programmable version of the ST series sensors. With a simple and brief operation, the sensor can be programmed to recognise the code of a new actuator.

By activating a special input, the sensor is switched to a safe state, during which it waits for a new code to be accepted. As the actuator approaches, the ST sensor performs a number of checks on the code being received, whereby the code must adhere to certain parameters of RFID technology.

If the checks are successful, the sensor uses LEDs to signal the successful completion of the procedure.

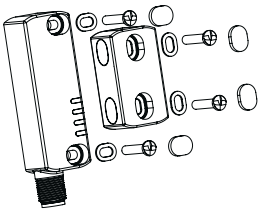
After programming has been completed, the sensor only recognises the code of the last programmed actuator, thereby preserving the safety level and the reliability of the system in which it is installed.

Stainless steel fixing plates



The stainless-steel fixing plates for the ST sensors not only protect the mounting eyes during installation on surfaces that are not perfectly flat, they also help the sensor better withstand mechanical loads. As a result, the system is safer and more reliable.

Double protection against tampering



The tamper protection offered by the protective caps can be increased further.

Pan head safety screws with one-way fitting are available for this purpose. Devices secured with this type of screw cannot be tampered with using common tools. See accessories on page 310.

Four LEDs for immediate diagnosis

As the LEDs have been designed for quick immediate diagnosis, the status of each input and output is highlighted by one specific LED. By knowing which device is active and which door is open, it is possible to quickly identify an interruption in the safety chain as well as any internal device errors. All of this at a glance, without needing to decode complex flashing sequences.

External device monitoring

EDM On request, the switch can be supplied with EDM function (External Device Monitoring). In this case, the switch itself checks the proper function of the devices connected to the safety outputs. These devices (usually relays or safety contactors) must send a feedback signal to the EDM input, which checks that the received signal is consistent with the state of the safety outputs.

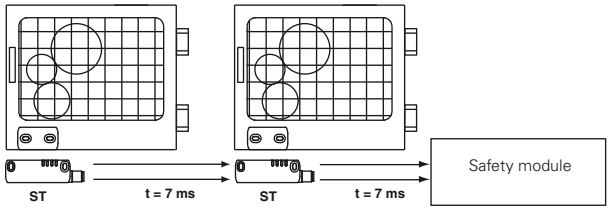
Laser engraving

All devices are marked using a dedicated indelible laser system. These engravings are therefore suitable for extreme environments too. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

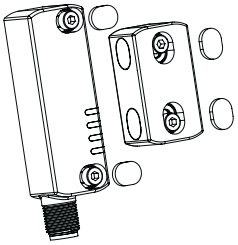
Short signal propagation delay

One of the main features of the ST sensors is the short signal propagation time of approx. 7 ms after deactivation of the inputs.

This short signal propagation time is particularly advantageous for sensors connected in series.

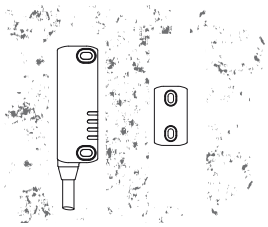


Protection against tampering



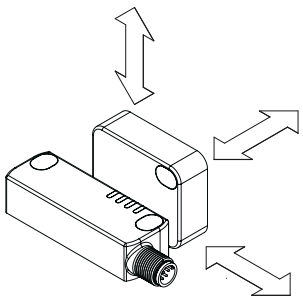
Each sensor and actuator of the ST series is supplied with protective caps. Not only do the caps prevent dirt from accumulating and simplify cleaning, they also block access to the fastening screws of the actuator. As a result, standard screws can be used instead of tamper-proof screws.

Insensitivity to dirt



The sensors are completely sealed and retain their safety characteristics even in the presence of dirt or deposits (not ferromagnetic material). This characteristic, combined with the design without recesses, makes them particularly suitable for use in the agricultural and food industries.

Versions with increased actuation distance

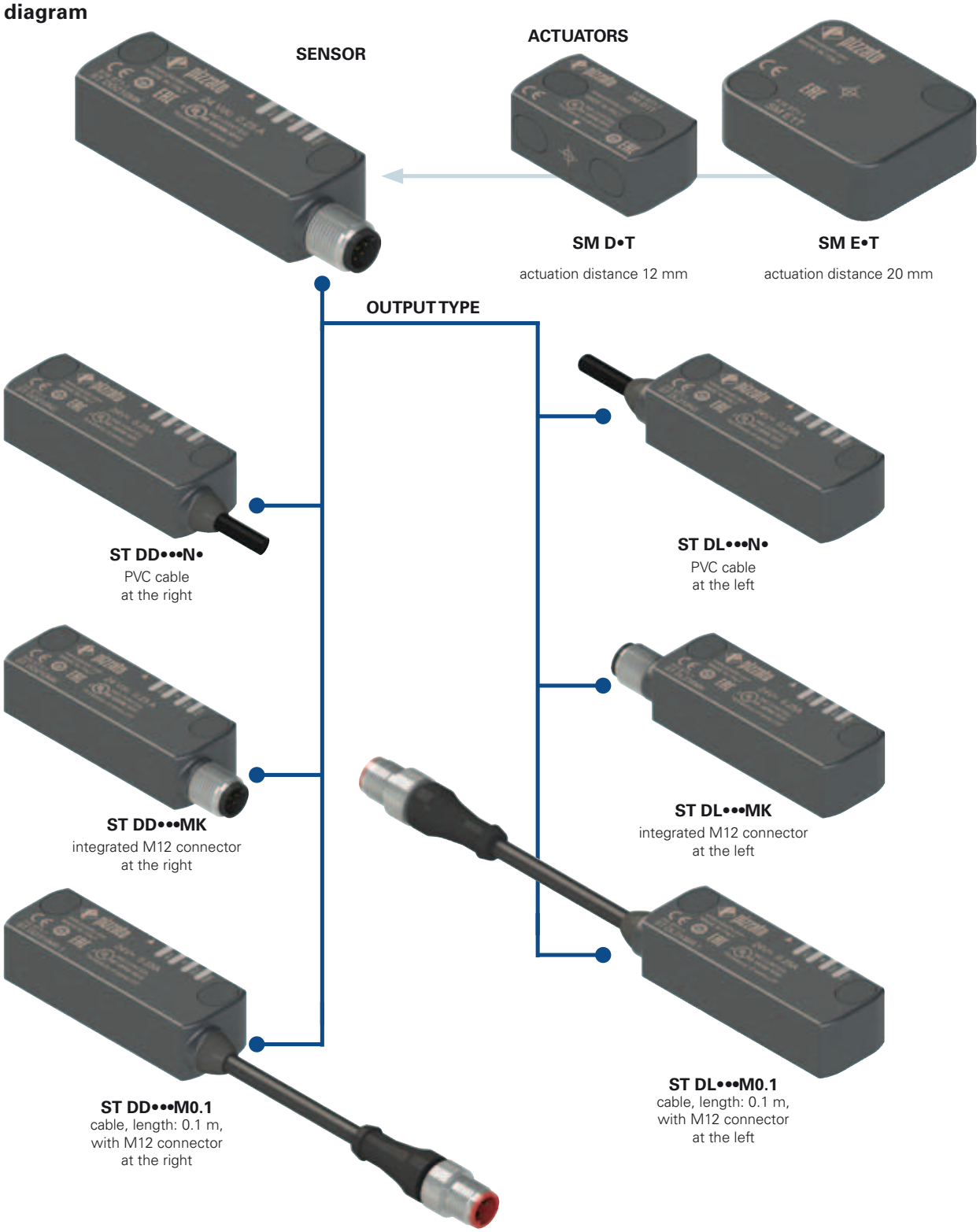


In addition to the standard actuation distance of 12 mm, sensors with an actuation distance of 20 mm are also available. The increased actuation distance of the sensors is ideal for installation situations in which it is not possible to ensure that the actuator approaches the sensor in a precise and stable manner.

Inverted signalling output

In addition to the standard version, a version with inverted function of signalling output O3 is available to help meet the various needs of the customers.

Selection diagram



product option
accessory sold separately

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

Code structure for sensor with actuator

ST DD420N2-D1T

Output direction, connections

D	output at the right
L	output at the left

Inputs and outputs

	OS safety outputs	O signalling outputs	IS safety inputs	I programming inputs	EDM inputs
21	2	1	-	-	-
31	2	1	2	-	-
42	2	1	2	1	-
51	2	1	2	-	1
61	2	1 (inverted)	-	-	-
71	2	1 (inverted)	2	-	-
82	2	1 (inverted)	2	1	-

Note: versions 21, 31, 51, 61, 71 are only supplied together with an actuator

Supply voltage

0	24 Vdc
1	12 … 24 Vdc

Actuator

D0T	low level coded actuator the sensor recognises any type D0T actuator
D1T	high level coded actuator the switch recognises one single type D1T actuator
E0T	low level coded actuator the sensor recognises any type E0T actuator
E1T	high level coded actuator the switch recognises one single type E1T actuator

Connection type

0.1	cable, length: 0.1 m, with M12 connector (not available with version ST D•2••••)
0.5	cable, length: 0.5 m
...	....
2	cable, length: 2 m (standard)
...	....
10	cable, length: 10 m
K	integrated M12 connector

Cable or connector type

N	PVC cable IEC60332-1 (standard)
H	PUR cable, halogen free (not available with version ST D•2••••)
M	M12 connector

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

Code structure for single sensor

ST DD420N2

Output direction, connections

D	output at the right
L	output at the left

Inputs and outputs

	OS safety outputs	O signalling outputs	IS safety inputs	I programming inputs
42	2	1	2	1
82	2	1 (inverted)	2	1

Supply voltage

0	24 Vdc
1	12 … 24 Vdc

Connection type

0.1	cable, length: 0.1 m, with M12 connector (not available with version ST D•2••••)
0.5	cable, length: 0.5 m
...	....
2	cable, length: 2 m (standard)
...	....
10	cable, length: 10 m
K	integrated M12 connector

Cable or connector type

N	PVC cable IEC60332-1 (standard)
H	PUR cable, halogen free (not available with version ST D•2••••)
M	M12 connector

Attention! Individual sensors are initially programmed with the code of the actuators with low coding level •0T.
Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

Code structure for actuator

SM D1T

Actuation distance

D	actuation distance 12 mm
E	actuation distance 20 mm

Actuator

0T	low level coded actuator the sensor recognises any type •0T actuator
1T	high level coded actuator the sensor recognises one single type •1T actuator

ST series safety sensors with RFID technology

Main features

- Actuation without contact, using RFID technology
- Digitally coded actuator
- Protection degrees IP67 and IP69K
- 4 LEDs for status display of the sensor
- Actuators with various actuation distances

Quality marks:

UL approval:	E131787
EC type examination certificate: M6A 161075157012	
TÜV SÜD approval:	Z10 12 11 75157 004
EAC approval:	RU C-IT.АД35.В.00454

In compliance with standards:
EN ISO 14119, IEC 61508-1, IEC 61508-2, IEC 61508-3, IEC 61508-4, EN ISO 13849-1, EN ISO 13849-2, EN ISO 14119, EN 62061, EN 60947-5-3,EN 60947-5-2, EN 60947-1, EN 61326-1, EN 61326-3-1, EN 61326-3-2, ETSI 301 489-1, ETSI 301 489-3, ETSI 300 330-2, UL 508, CSA 22.2 No.14

Compliance with the requirements of:
Machinery Directive 2006/42/EC
EMC Directive 2014/30/EC
Directive 2014/53/EU - RED
FCC Part 15

Connection with safety modules for safety applications:
Connection with safety modules CS AR-05••••; CS AR-06••••; CS AR-08••••; CS AT-0•••••; CS AT-1•••••; CS MP•••••.
When connected to the safety module, the sensor can be classified as a control circuit device up to PDDB (EN 60947-5-3).
The system can be used in safety circuits up to PL e/SIL 3/category 4 in accordance with EN ISO 13849-1.

Technical data

Housing

Housing made of glass fibre reinforced technopolymer, self-extinguishing.
Versions with integrated cable 6 x 0.5 mm² or 8 x 0.34 mm², length 2 m, other lengths 0.5 m … 10 m on request
Versions with M12 stainless steel connector
Versions with 0.1 m cable length and integrated M12 connector, other lengths 0.1 … 3 m on request

Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Interlock, no contact, coded:	type 4 acc. to EN ISO 14119
Level of coding acc. to EN ISO 14119:	high with D1T or E1T actuator low with D0T or E0T actuator
Safety parameters:	
$MTTF_D$:	4077 years
PFH_D:	1.20E-11
DC:	High
Service life:	20 years
Ambient temperature for sensors without cable:	-25 … +70°C
Ambient temperature for sensors with cable:	see table page 42
Storage and transport temperature:	-25 … +85°C
Vibration resistance:	10 gn (10 … 150 Hz) acc. to IEC 60068-2-6
Shock resistance:	30 gn; 11 ms acc. to EN 60068-2-27
Pollution degree	3
Screw tightening torque:	0.8 … 2 Nm

Electrical data of IS1/IS2/I3/EDM inputs

Rated operating voltage U_{e1}:	24 Vdc or 12 … 24 Vdc
Rated current consumption I_{e1}:	5 mA

Electrical data of OS1/OS2 safety outputs

Rated operating voltage U_{e2}:	24 Vdc or 12 … 24 Vdc
Output type:	PNP type OSSD
Maximum current per output I_{e2}:	0.25 A
Minimum current per output I_{m2}:	0.5 mA
Thermal current I_{th2}:	0.25 A
Utilization category:	DC13; U_{e2}=24 Vdc, I_{e2}=0.25 A
Short circuit detection:	Yes
Overcurrent protection:	Yes
Internal self-resettable protection fuse:	0.75 A
Duration of the deactivation impulses at the safety outputs:	< 300 µs
Permissible capacitance between outputs:	< 200 nF
Permissible capacitance between output and ground:	< 200 nF
Response time upon deactivation of IS1/IS2 inputs:	typically 7 ms, max. 12 ms
Response time upon actuator removal:	typically 80 ms, max. 150 ms

Electrical data of O3 signalling output

Rated operating voltage U_{e3}:	24 Vdc or 12 … 24 Vdc
Output type:	PNP
Maximum current per output I_{e3}:	0.1 A
Utilization category:	DC12; U_{e3}=24 Vdc; I_{e3}=0.1A
Short circuit detection:	No
Overcurrent protection:	Yes
Internal self-resettable protection fuse:	0.75 A

Actuation data	SM D•T actuator	SM E•T actuator
Assured operating distance S_{ao}:	10 mm	16 mm
Assured release distance S_{ar}:	16 mm	27 mm
Rated operating distance S_n:	12 mm	20 mm
Rated release distance S_{nr}:	14 mm	23 mm
Repeat accuracy:	≤ 10 % s_n	
Differential travel:	≤ 20 % s_n	
Max. switching frequency:	1 Hz	
Distance between two sensors:	min. 50 mm	

Power supply electrical data

Rated operating voltage U_e SELV:	24 Vdc -15% … +10% (24 Vdc versions) 12 … 24 Vdc -30% … +25% (12 … 24 Vdc versions)
Operating current at U_e voltage:	
- minimum:	40 mA
- with all outputs at maximum power:	0.7 A
Rated insulation voltage U_i:	32 Vdc
Rated impulse withstand voltage U_{imp}:	1.5 kV
External protection fuse:	1 A type F or equivalent device
Overvoltage category:	III

Features approved by UL

Utilization categories: 24 Vdc, 0.25 A (resistive load).

Inputs supplied by remote class 2 source or limited voltage and limited energy

Housing features type 1, 4X "indoor use only", 12.

Accessory for CS series.

In compliance with standard: UL 508, CSA 22.2 No.14

Please contact our technical department for the list of approved products.

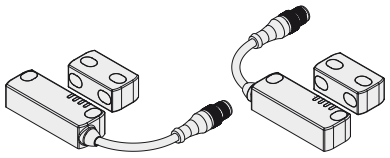
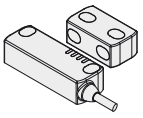
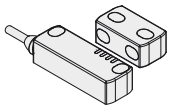
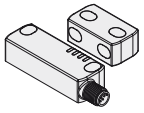
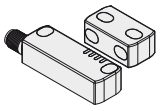
Features approved by TÜV SÜD

Supply voltage:	24 Vdc
Rated operating current (max.):	0.25 A
Ambient temperature:	-25 °C … + 70°C
Protection degree:	IP67
PL, category:	PL e, category 4

In compliance with standards:
2006/42/EEC Machinery Directive, EN ISO 13849-1:2008, EN 60947-5-3/A1:2005, EN 50178:1997, EN 61508-1:2010 (SIL 3), EN 61508-2:2010 (SIL 3), EN 61508-3:2010 (SIL 3),EN 61508-4:2010 (SIL 3), IEC 62061:2005 (SIL CL 3)

Please contact our technical department for the list of approved products.

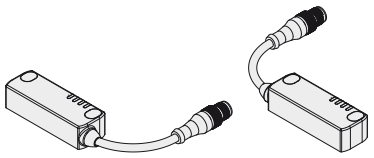
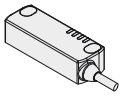
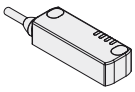
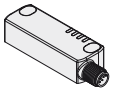
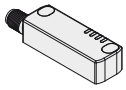
Selection table for sensors with high level coded actuators

OS safety outputs	O signalling outputs	IS safety inputs	I programming inputs	EDM inputs	Programmable	cable, length: 0.1 m, with M12 connector at the right	cable, length: 0.1 m, with M12 connector at the left	integrated cable, at the right	integrated cable, at the left	M12 connector, at the right	M12 connector, at the left
2	1	-	-	-	-			ST DD210N•-D1T	ST DL210N•-D1T	ST DD210MK-D1T	ST DL210MK-D1T
2	1	2	-	-	-	ST DD310M0.1-D1T	ST DL310M0.1-D1T	ST DD310N•-D1T	ST DL310N•-D1T	ST DD310MK-D1T	ST DL310MK-D1T
2	1	2	1	-	•	ST DD420M0.1-D1T	ST DL420M0.1-D1T	ST DD420N•-D1T	ST DL420N•-D1T	ST DD420MK-D1T	ST DL420MK-D1T
2	1	2	-	1	-	ST DD510M0.1-D1T	ST DL510M0.1-D1T	ST DD510N•-D1T	ST DL510N•-D1T	ST DD510MK-D1T	ST DL510MK-D1T

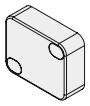
To order a product with E•T actuator replace D with E in the codes shown above. Example: ST DD310M0.1-D•T → ST DD310M0.1-E•T

Selection table for sensors

OS safety outputs	O signalling outputs	IS safety inputs	I programming inputs	EDM inputs	Programmable	cable, length: 0.1 m, with M12 connector at the right	cable, length: 0.1 m, with M12 connector at the left	integrated cable, at the right	integrated cable, at the left	M12 connector, at the right	M12 connector, at the left
2	1	2	1	-	•	ST DD420M0.1	ST DL420M0.1	ST DD420N•	ST DL420N•	ST DD420MK	ST DL420MK

Selection table for actuators



Level of coding acc. to ISO 14119	actuation distance 12 mm	actuation distance 20 mm
low	SM D0T	SM E0T
high	SM D1T	SM E1T

The use of RFID technology in ST series sensors makes them suitable for several applications. Pizzato Elettrica offers two different versions of actuators, in order to best suit customers' specific needs.

Type •0T actuators are all encoded with the same code. This implies that a sensor associated with an actuator type •0T can be activated by other actuators type •0T.

Type •1T actuators are always encoded with different codes. This implies that a sensor associated with an actuator type •1T can be activated only by a specific actuator. Another •1T type actuator will not be recognised by the sensor until a new association procedure is carried out (reprogramming). After reprogramming, the old actuator type •1T will no longer be recognized.

Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

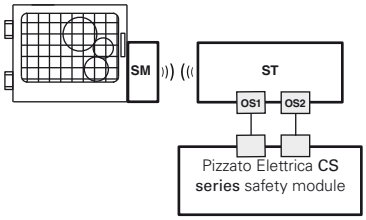
Items with code on **green** background are stock items

Ambient temperature for sensors with cable

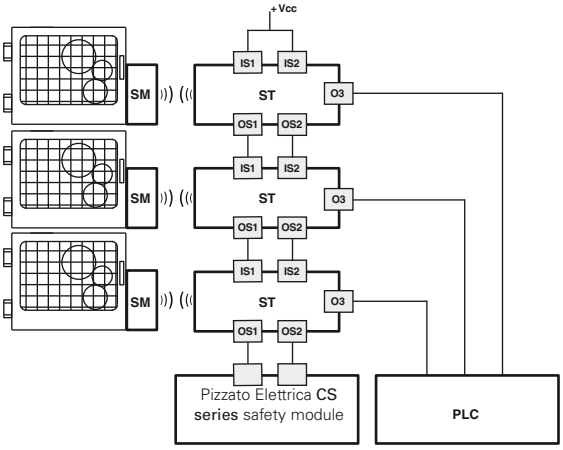
	Connection type	Output with cable		Output with cable and M12 connector
Cable features	Cable type	N	H	
	Conductors	8x0.34 mm²	8x0.34 mm²	8x0.25 mm²
	Application field	General	General, mobile installation	General
	In compliance with standards	03VV-F	03E7Q-H	03VV-H
	Sheath	PVC	PUR Halogen Free	PVC
	Self-extinguishing	IEC 60332-1-2 IEC 60332-1-3	IEC 60332-1-2 IEC 60332-1-3	IEC 60332-3 CEI 20-22 II
	Oil resistant	/	UL 758	ISO 6722-1
	Max. speed	/	300 m/min.	50 m/min
	Max. acceleration	/	30 m/s2	5 m/s2
	Minimum bending radius	94 mm	70 mm	90 mm
	Outer diameter	7 mm	7 mm	5 mm
	End stripped	80 mm	80 mm	/
	Copper conductors	Class 5 IEC 60228	Class 6 IEC 60228	Class 6 IEC 60228
Ambient temperature	Cable, fixed installation	-25°C +70°C	-25°C +70°C	-25°C +70°C
	Cable, flexible installation	-5°C +70°C	-25°C +70°C	-25°C +70°C
	Cable, mobile installation	/	-25°C +70°C	-15°C +70°C
	Approvals	CE cULusTUV EAC	CETUV EAC	CETUV EAC

Complete safety system

The use of complete and tested solutions guarantees the electrical compatibility between the sensors of the ST series and the safety modules from Pizzato Elettrica, as well as high reliability. The sensors have been tested with the modules listed in the adjacent table.



ST sensors can be used as individual devices provided that the outputs be evaluated by a Pizzato Elettrica safety module (see table for combinable safety modules).

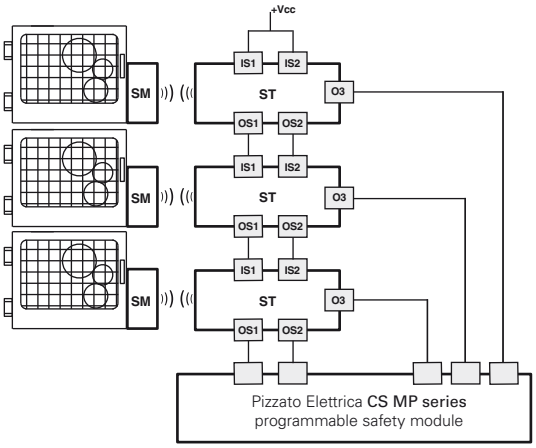


Possibility of series connection of multiple sensors for simplifying the wiring of the safety system, whereby only the outputs of the last sensor are evaluated by a Pizzato Elettrica safety module (see table with compatible safety modules). Each ST sensor is equipped with a signalling output, which – depending on the version – is activated or deactivated when the respective guard is closed. Depending on the specific requirements of the application, this information can be evaluated by a PLC.

Compatible safety modules

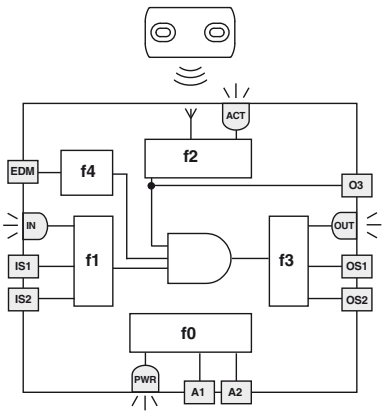
Sensors	Safety modules	Safety module output contacts		
		Instantaneous safety contacts	Delayed safety contacts	Signalling contacts
ST D••••••	CS AR-05••••	3NO	/	1NC
	CS AR-06••••	3NO	/	1NC
	CS AR-08••••	2NO	/	/
	CS AT-0•••••	2NO	2NO	1NC
	CS AT-1•••••	3NO	2NO	/
	CS MP••••••	see page 255		
	CS MF••••••	see page 283		

All ST series sensors can be connected, provided that compatibility is checked, to safety modules or safety PLCs with OSSD inputs.



Possibility of series connection of multiple sensors for simplifying the wiring of the safety system, whereby only the outputs of the last sensor are evaluated by a Pizzato Elettrica safety module of the CS MP series. Both the safety-relevant evaluation and the evaluation of the signalling outputs are performed by the CS MP series.

Internal block diagram (ST D•5••••)



The adjacent diagram illustrates five logical, linked sub-functions of the sensor.

Function f0 is a basic function and includes the monitoring of the power supply as well as internal, cyclical tests.

Function f1 monitors the status of the inputs, whereas function f2 monitors the position of the actuator in the detection area.

Function f3 is intended to activate or deactivate the safety outputs and check for any faults or short circuits in the outputs.

In the EDM versions, function f4 checks the EDM signal on state changes of the safety outputs.

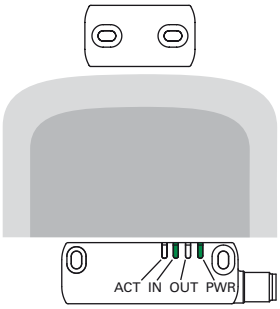
The safety-related function, which combines the sub-functions mentioned above, only activates the safety outputs if the input signals are correctly applied and the actuator is located within the safe zone.

The status of each sub-function is displayed by corresponding LEDs (PWR, IN, ACT, OUT), thereby providing a quick overview of the operating status of the sensor.

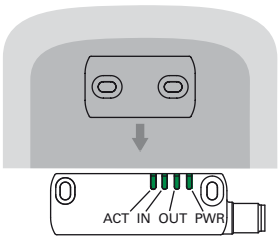
LED	Function
ACT	state of actuator / O3 output
IN	status of safety inputs
OUT	status of safety outputs
PWR	Power supply/self-diagnosis

Limit activation zone and safe activation zone (ST D•4••••)

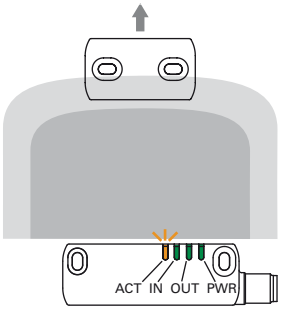
When aligning the sensor with the actuator, the status LEDs use various colours to indicate whether the actuator is in the limit activation zone or in the safe activation zone. The following figures use the ST DD420MK-D1T sensor as an example.



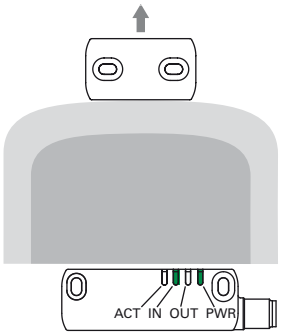
Operating voltage is applied to the sensor, (LED PWR on, green), the inputs are enabled (LED IN on, green), the outputs are deactivated (LED OUT off). The actuator is outside of the actuation zone (LED ACT off).



If the actuator is moved inside the safe activation zone (dark grey area), the ACT LED on the sensor illuminates (green) and it activates the outputs (LED OUT on, green).



When the actuator leaves the safe zone, the sensor keeps the safety outputs enabled. Entry into the limit activation zone (light grey area) is, however, indicated by the ACT LED (orange/green, flashing).



As soon as the actuator exits the limit activation zone, the sensor deactivates the outputs and switches off the OUT and ACT LEDs.

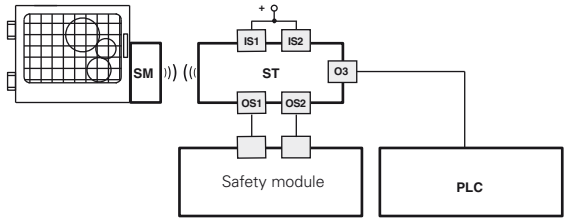
Operating states (ST D•4••••)

PWR LED	OUT LED	IN LED	ACT LED	Sensor state	Description
○	○	○	○	OFF	Sensor off.
●	○	○	○	POWER ON	Internal tests upon activation.
●	✳	○	✳	RUN	Sensor with inactive inputs.
●	✳	●	✳	RUN	Activation of the inputs.
●	✳	◔	✳	RUN	Input incoherence. Recommended action: check for presence and/or wiring of inputs.
●	✳	✳	●	RUN	Actuator in safe area. O3 signalling output active.
●	✳	✳	◔	RUN	Actuator in limit activation zone, O3 active. Recommended action: bring the sensor back to the safe area.
●	●	●	●	RUN	Activation of the inputs. Actuator in safe area and safety outputs active.
●	◔	✳	✳	ERROR	Error on outputs. Recommended action: check for any short circuits between the outputs, outputs and ground or outputs and power supply, then restart the sensor.
●	✳	✳	✳	ERROR	Internal error. Recommended action: restart the sensor. If the failure persists, replace the sensor.

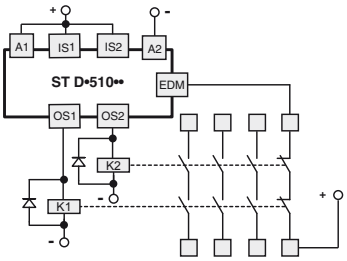
Legend: ○ = off ● = on ◔ = flashing ◐ = alternating colours
✳ = indifferent

O3 output inverted (ST D•6••••, ST D•7••••, ST D•8••••)

The version with inverted O3 signalling output allows checking of the actual electrical connection of the sensor by an external PLC. The O3 output will be activated when the actuator is removed and the OS safety outputs are switched off.

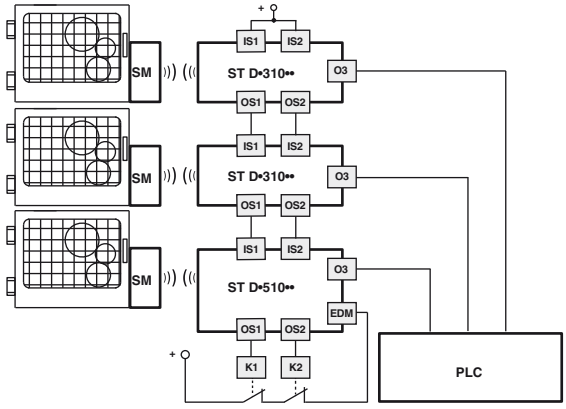


External device monitoring (EDM)



The ST D•51••• version, in addition to maintaining the operating and safety characteristics of the ST series, allows control of **forcibly guided NC contacts of contactors or relays** controlled by the safety outputs of the sensor itself. As an alternative to the relays or contactors you can use Pizzato Elettrica expansion modules CS ME-03. See page 245.

This check is carried out by monitoring the EDM input (External Device Monitoring as defined in EN 61496-1) of the sensor.



This version, with the IS safety inputs, **can be used at the end of a series** of ST sensors, **up to a maximum number of 32 devices**, while maintaining the maximum PL e safety level according to EN ISO 13849-1.

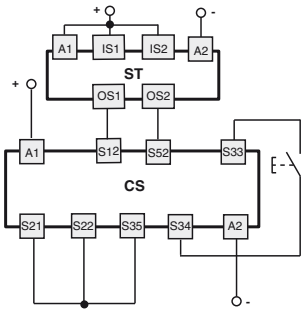
For specific applications, this solution allows you to dispense with the safety module connected to the last device in the chain.

Connection with safety modules

Connections with CS AR-08•••• safety modules

Input configuration with monitored start

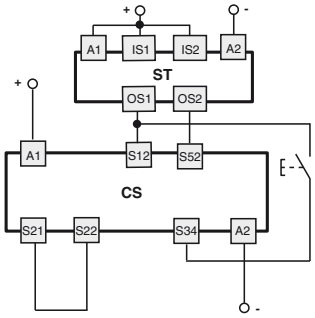
2 channels / Category 4 / up to SIL 3 / PL e



Connections with CS AR-05•••• / CS AR-06•••• safety modules

Input configuration per manual start (CS AR-05••••)
or monitored start (CS AR-06••••)

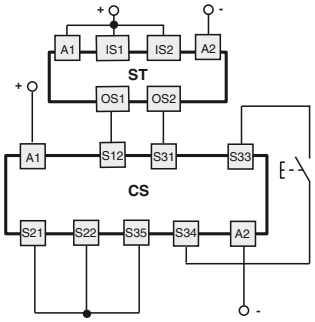
2 channels / Category 4 / up to SIL 3 / PL e



Connections with CS AT-0••••• / CS AT-1••••• safety modules

Input configuration with monitored start

2 channels / Category 4 / up to SIL 3 / PL e

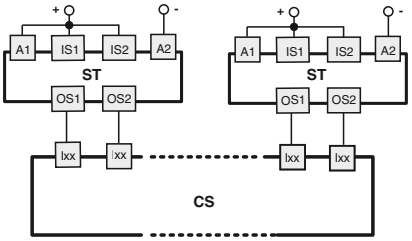


For features of the safety modules see page 191.

Connections with CS MP••••0 safety modules

The connections vary according to the program of the module

Category 4/ up to SIL 3 / PL e



Application example on page 254

Internal connections with cable

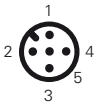
	ST D•2••N• ST D•6••N•
cable colour	connection
brown	A1(+)
red/white	OS1
blue	A2(-)
black/white	OS2
black	O3

	ST D•3••N• ST D•7••N•
cable colour	connection
brown	A1(+)
red	IS1
blue	A2(-)
red/white	OS1
black	O3
purple	IS2
black/white	OS2
purple/white	not connected

	ST D•4••N• ST D•8••N•
cable colour	connection
brown	A1(+)
red	IS1
blue	A2(-)
red/white	OS1
black	O3
purple	IS2
black/white	OS2
purple/white	I3

	ST D•5••N•
cable colour	connection
brown	A1(+)
red	IS1
blue	A2(-)
red/white	OS1
black	O3
purple	IS2
black/white	OS2
purple/white	EDM

Internal connections with connector



	ST D•2••M• ST D•6••M•
pin	connection
1	A1(+)
2	OS1
3	A2(-)
4	OS2
5	O3

	ST D•3••M• ST D•7••M•
pin	connection
1	A1(+)
2	IS1
3	A2(-)
4	OS1
5	O3
6	IS2
7	OS2
8	not connected

	ST D•4••M• ST D•8••M•
pin	connection
1	A1(+)
2	IS1
3	A2(-)
4	OS1
5	O3
6	IS2
7	OS2
8	I3

	ST D•5••M•
pin	connection
1	A1(+)
2	IS1
3	A2(-)
4	OS1
5	O3
6	IS2
7	OS2
8	EDM

Legend

A1-A2 supply
IS1-IS2 safety inputs
OS1-OS2 safety outputs
O3 signalling output
I3 programming input
EDM input for monitoring of NC contacts of the contactors

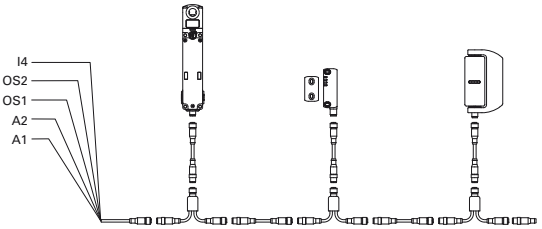
Female connectors see page 299

Series connection

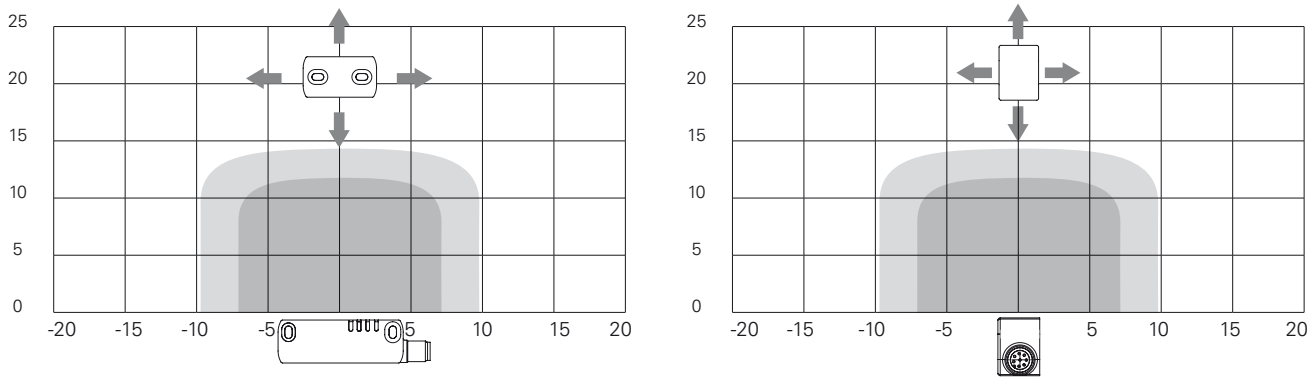
To simplify series connections of the devices, various M12 connectors are available that allow complete wiring.

This solution significantly reduces installation times while at the same time maintaining the maximum safety levels PL e and SIL 3.

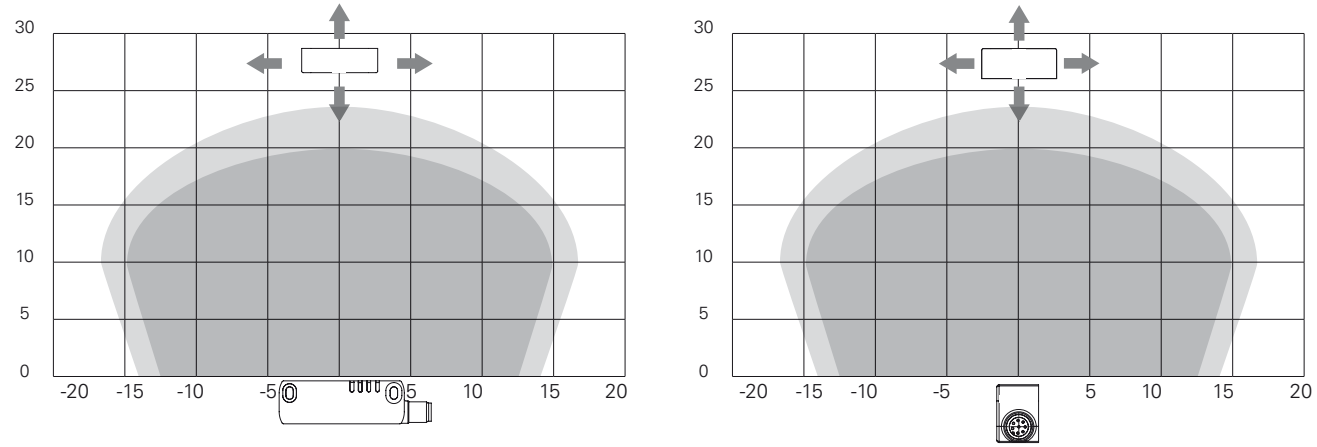
For further information see page 304.



Operating distances SM D•T actuator



Operating distances SM E•T actuator

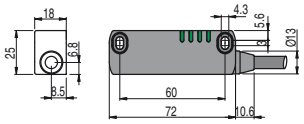


Legend:
Rated operating distance s_n (mm)
Rated release distance s_{nr} (mm)
Note: The progress of the activation areas is for reference only.

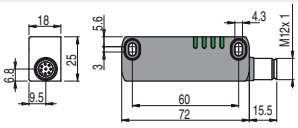
Dimensional drawings

All values in the drawings are in mm

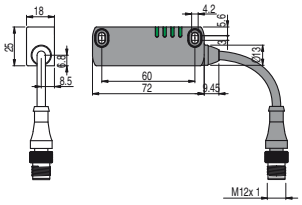
ST DD•••N• sensor with cable at the right



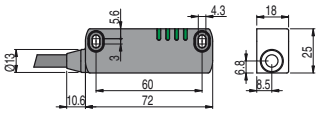
ST DD•••MK sensor with M12 connector at the right



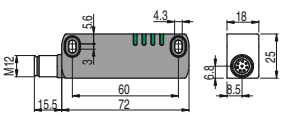
ST DD•••M0.1 sensor with cable and M12 connector at the right



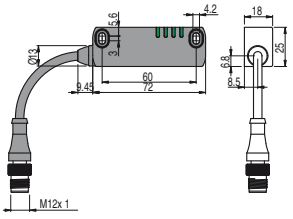
ST DL•••N• sensor with cable at the left



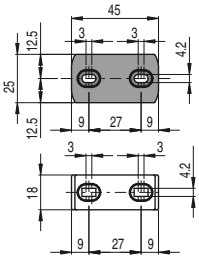
ST DL•••MK sensor with M12 connector at the left



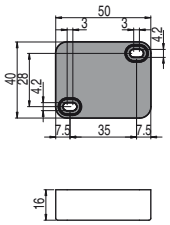
ST DL•••M0.1 sensor with cable and M12 connector at the left



SM D•T actuator



SM E•T actuator



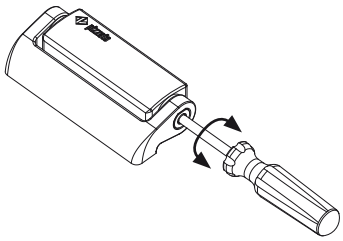
➔ The 2D and 3D files are available at **www.pizzato.com**

HP-HC series safety hinge switches

Description

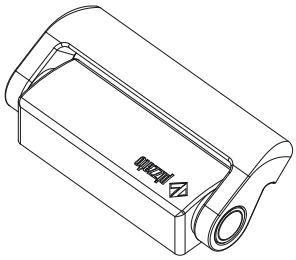
Pizzato Elettrica extends its range of products by creating the new HP-HC series safety hinge switches where safety and style blend into a single product.
The electric switch is fully integrated into the mechanical hinge so that it is virtually invisible to an inexpert eye. This, asides from being an aesthetic advantage, guarantees greater safety as a switch which is difficult to identify is consequently even more difficult to tamper with. The rear mounting without screws in sight and the very precise line mean the switch can be perfectly integrated even with guards of machinery with a very precise design. The offer is complemented by additional hinges with exclusively mechanical function.

Adjustment of the switching point



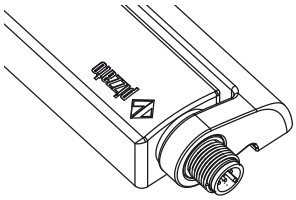
The switching point of the switches can be set with a Phillips head screwdriver.
Adjusting the switching point allows for any calibration for large size guards. After calibrating the switch, it is always necessary to close the hole using the safety cap supplied.

Basic activation angle variants



On request, versions with a switch activation angle of 15° multiples (e.g. 45° or 90°) are available.
The different activation angle does not exclude the possibility of adjustment of the switching point by means of the adjustment screw in the switch. Any change in the operating angle clearly does not alter the maximum mechanical switch travel.

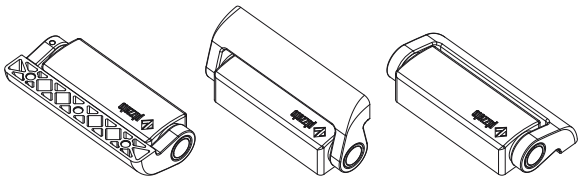
Integrated M12 connector



Versions with connection from the top or the bottom are available with integrated M12 connector.
The use of versions with connectors permits faster wiring if guards need to be moved from the test location to the installation site.

Opening angle up to 180°

The mechanical design of the switch also allows use on guards with an opening angle of up to 180°.



Protection degrees IP67 and IP69K

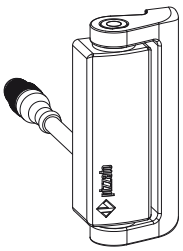
IP69K
IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

Versions for glass or polycarbonate doors

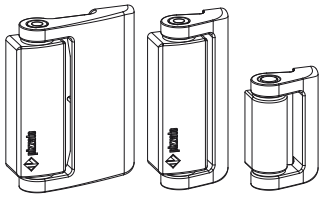
A version of the switch developed exclusively for glass and polycarbonate doors without frame is available.
Installation is facilitated by the larger supporting arm and the spaced fixing points; these also prevent the formation of cracks caused by holes located too close to the edge of the guard.
It is necessary to verify that the switch is not used as a mechanical stop for the door.

Cable with connector at the back



The version with a rear cable and M12 connector is the best combination between aesthetics and connection ease.
If machines need to assembled at the customer's site, this solution allows the wiring to be hidden. At the same time, it facilitates the connection and disconnection of the wiring from inside the machinery.

Additional hinges

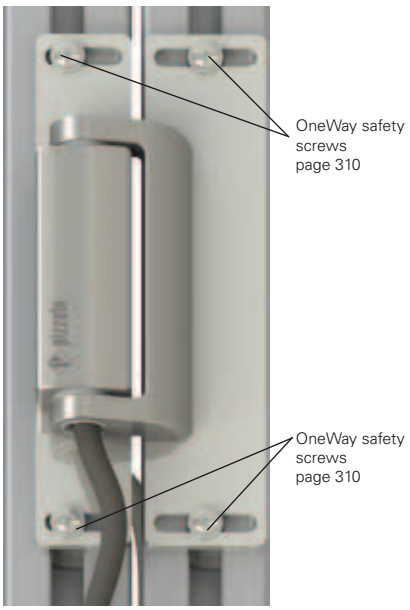


To complete the installation, various types of additional hinges are available to be used in a variable number depending on the weight of the guard.
These hinges have the same aesthetic but cost less as they contain no electrical parts.

Application examples

- Switch without mounting plate.
- Rear fixing.
- Cable output at the back.

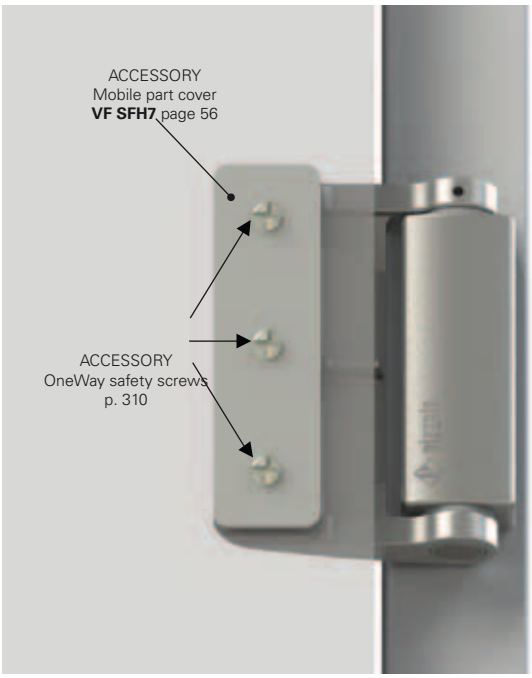
- Switch with angular mounting plate for slotted profile.
- Fastening with internal screws.
- Output with M12 connector at the bottom.



- Switch with straight mounting plate for front slotted profile.
- Fastening with screws at the back.
- Cable output at the bottom.

Closed door

Open door



- Direct fixing to the polycarbonate plate
- Switch without mounting plate
- Fastening with internal screws
- Output with connector at the back.

Selection diagram

DESIGNS

A

100x50 mm movable part, metal

B

100x75 mm movable part, metal

CABLES AND CONNECTORS

S

Cable output, bottom (standard)

A

Cable output, top

P

Cable output, back

KSM

M12 connector, bottom

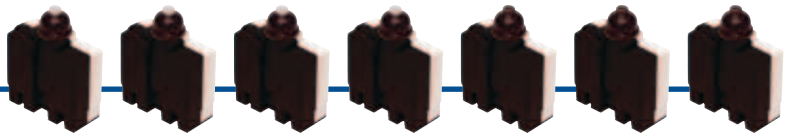
KAM

M12 connector, top

0.2PM

Cable, length: 0.2 m, with M12 connector, at back

CONTACT BLOCKS



52C

1NO+1NC slow action

52D

2NC slow action

52F

1NO+2NC slow action

52M

2NO+2NC slow action

53C

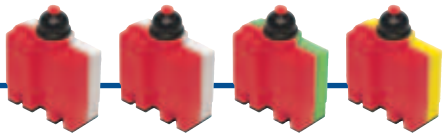
1NO+1NC slow action, make before break

53F

1NO+2NC slow action, make before break

53M

2NO+2NC slow action, make before break



50C

1NO+1NC snap action

50D

2NC snap action

50F

1NO+2NC snap action

50M

2NO+2NC snap action

ADDITIONAL HINGES

HC LL

HC AA

HC AB

product option

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article / options

HP AA052C-2SNGH15

Movable part	
A	100x50 mm movable part, metal
B	100x75 mm movable part, metal

Contact block	
52C	1NO+1NC, slow action
52D	2NC, slow action
52F	1NO+2NC, slow action
52M	2NO+2NC, slow action
53C	1NO+1NC, slow action, make before break
53F	1NO+2NC, slow action, make before break
53M	2NO+2NC, slow action, make before break
50C	1NO+1NC, snap action
50D	2NC, snap action
50F	1NO+2NC, snap action
50M	2NO+2NC, snap action

The versions with snap-action contact blocks are recommended for doors having a radius not greater than 600 mm.

Connection type	
0.2	cable, length: 0.2 m with M12 connector (available for 0.2 PM versions only)
0.5	cable, length: 0.5 m
...	.....
2	cable, length: 2 m (standard)
...	.....
10	cable, length: 10 m
K	integrated M12 connector

Cable or connector type	
N	PVC cable IEC 60332-1 (standard)
G	PVC cable CEI 20-22 II
H	PUR cable, halogen free
R	cable for railway applications (EN 50306-4)
M	M12 connector

Output direction, connections	
S	movable part at the right and bottom output
P	movable part at the right and output at the back
A	movable part at the right and output at top
Q	movable part at the left and output at the back

Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating

Activation angle	
	0° activation angle (standard)
H15	15° activation angle
H30	30° activation angle
H45	45° activation angle
H60	60° activation angle
H75	75° activation angle
H90	90° activation angle

Code structure for additional hinges

HC AA

Additional hinges (H x L)	
HC AA	100.6 x 49 mm
HC AB	100.6 x 79 mm
HC LL	65 x 44.5 mm

HP-HC series safety hinge switches

Main features

- Metal housing, cable output at top, bottom or back
- 4 types of integrated cable available
- Versions with M12 connector
- Protection degrees IP67 and IP69K
- 9 contact blocks with positive opening ⊕
- Additional hinges without contacts

Quality marks:

IMQ approval:	CA02.03746
UL approval:	E131787
CCC approval:	2013010305647255
EAC approval:	RU C-IT.АД35.B.00454

Technical data

Housing

Metal housing, powder-coated
Versions with integrated cable, length 2 m, other lengths from 0.5 … 10 m on request
Versions with integrated M12 connector
Versions with 0.2 m cable length and M12 connector, other lengths from 0.1 … 3 m on request

Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)
Corrosion resistance in saline mist:	≥ 300 hours in NSS acc. to ISO 9227

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Mechanical interlock, not coded:	type 1 acc. to EN ISO 14119
Safety parameters:	
B_{10D}:	5,000,000 for NC contacts
Service life:	20 years
Ambient temperature for hinges without cable:	-25C°…+80C° (standard) -40C°…+80C° (extended T6)
Ambient temperature for hinges with cable:	See table on page 52
Max. actuation frequency:	1200 operating cycles/hour
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	90°/s
Min. actuation speed:	2°/s
Mounting position:	any
Max. axial load:	1500 N (HP AA) / 750 N (HP AB)
Max. radial load:	1000 N (HP AA) / 500 N (HP AB)
Tightening torque, M5 screws:	3 … 5 Nm

Electrical data

Rated impulse withstand voltage Uimp:	4 kV
Conditional short circuit current:	1000 A acc. to EN 60947-5-1
Pollution degree:	3

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, ISO 20653, UL 508, CSA 22.2 No.14.
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 No.14.

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU, Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

⚠ If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.

⚠ Important: Switch off the circuit voltage before disconnecting the connector from the switch. The connector is not suitable for separation of electrical loads. According to EN 60204-1, versions with 8-pole M12 (2NO+2NC) connector can be used only in PELV circuits.

Features approved by IMQ

Rated insulation voltage (U_i):	250 Vac
Conventional free air thermal current (Ith):	10 A (1-2 contacts) / 6 A (2-3 contacts) / 4 A (4 contacts or 5-pole M12 connector)
Protection against short circuits (fuse):	10 A (1-2 contacts) / 6 A (2-3 contacts) / 4 A (4 contacts or 5-pole M12 connector) type gG
Rated impulse withstand voltage (U_{imp}):	4 kV
Protection degree of the housing:	IP67
MA terminals (crimped terminals)	
Pollution degree:	3
Utilization category:	AC15 / DC13 (with connector)
Operating voltage (U_e):	250 Vac (50 Hz) / 24 Vdc (with connector)
Operating current (I_e):	3 A / 2 A (with connector)

Forms of the contact element: X, Y, X+Y, X+X, Y+Y, Y+Y+X, X+X+Y, X+X+Y+Y
Positive opening contacts on contact blocks 50A, 50C, 50D, 50F, 50G, 50M, 51A, 51C, 51D, 51F, 51G, 51M, 52A, 52C, 52D, 52F, 52G, 52M, 53A, 53C, 53D, 53F, 53G, 53M

In compliance with standards: EN 60947-1, EN 60947-5-1 + A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories	R300 pilot duty (28 VA, 125-250 Vdc) B300 pilot duty (360 VA, 120-240 Vac) (1-2-3 cont.) C300 pilot duty (180 VA, 120-240 Vac) (4 cont.)

Housing features type 1, 4X "indoor use only", 12.
Housing features for the version with 1-2 contacts and type N cable Type 1, 4X "indoor use only"

In compliance with standard: UL 508, CSA 22.2 No.14

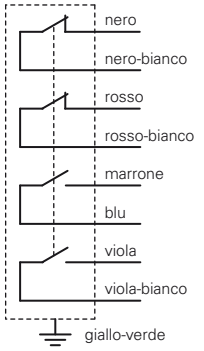
Please contact our technical department for the list of approved products.

Ambient temperatures for hinges with cable and electrical data

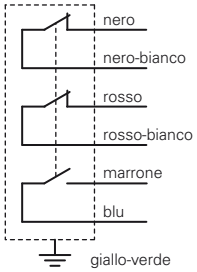
Connection type	Output with cable								Output with M12 connector	
Contact block	2 contacts				3 contacts		4 contacts		2 contacts	3 or 4 contacts
Cable type	N	G	H	R	N	H	N	R	M12 connector, 5-pole	M12 connector, 8-pole
Conductors	5x0.75 mm²	5x0.75 mm²	5x0.75 mm²	5x0.5mm²	7x0.5 mm²	7x0.5 mm²	9x0.34 mm²	9x0.5 mm²	5x0.25 mm2	8x0.25 mm2
Application field	General	General	General Mobile instal-lation	Rail	General	General Mobile instal-lation	General	Rail	General	General
In compliance with standards	05VV-F	05VV-F	05EQ-H	EN50306-4 1E-300V-5x0.5 mm² MM-90 EN 50306-4 EN 45545	03VV-F	03E7Q-H	03VV-F	EN50306-4 1P-300V-9x0.5 mm² MM-90 EN 50306-4 EN 45545	03VV-H	03VV-H
Sheath	PVC	PVC	PUR HALOGEN FREE	/	PVC	PUR HALOGEN FREE	PVC	/	PVC	PVC
Self-extinguishing	IEC 60332-1-2 IEC 60332-1-3	IEC 60332-1-2 IEC 60332-1-3 IEC 60332-3 CEI 20-22 II	IEC 60332-1-2 IEC 60332-1-3	IEC 60332-1 EN 50305 EN 50306-1	IEC 60332-1-2 IEC 60332-1-3	IEC 60332-1-2 IEC 60332-1-3	IEC 60332-1-2 IEC 60332-1-3	IEC 60332-1 EN 50305 EN 50306-1	IEC 60332-3 CEI 20-22 II	IEC 60332-3 CEI 20-22 II
Oil resistant	/	/	UL 758	/	/	UL 758	/	/	ISO 6722-1	ISO 6722-1
Max. speed	/	/	100 m/min	/	/	300 m/min	/	/	50 m/min	50 m/min
Max. acceleration	/	/	2 m/s²	/	/	25 m/s²	/	/	5 m/s²	5 m/s²
Minimum bending radius	80 mm	80 mm	80 mm	60 mm	108 mm	108 mm	94 mm	65 mm	75 mm	90 mm
Outer diameter	8 mm	8 mm	8 mm	6 mm	7 mm	7 mm	7 mm	6.5 mm	5 mm	6 mm
End stripped	80 mm	80 mm	80 mm	80 mm	80 mm	80 mm	80 mm	80 mm	/	/
Copper conductors IEC 60228	Class 5	Class 5	Class 6	Class 5	Class 5	Class 6	Class 5	Class 5	Class 6	Class 6
Ambient temperature with cable standard — Cable, fixed installation	-25°C +70°C	-25°C +70°C	-25°C +80°C	-25°C +80°C	-25°C +80°C	-25°C +80°C	-25°C +80°C	-25°C +80°C	-25°C +80°C	-25°C +80°C
Ambient temperature with cable standard — Cable, flexible installation	+5°C +70°C	+5°C +70°C	-25°C +80°C	-25°C +80°C	-5°C +80°C	-25°C +80°C	-5°C +80°C	-25°C +80°C	-25°C +80°C	-25°C +80°C
Ambient temperature with cable standard — Cable, mobile installation	/	/	-25°C +80°C	/	/	-25°C +80°C	/	/	-15°C +80°C	-15°C +80°C
Ambient temperature with cable extended (-T6) — Cable, fixed installation	/	/	-40°C +80°C	-40°C +80°C	/	-40°C +80°C	/	-40°C +80°C	/	/
Ambient temperature with cable extended (-T6) — Cable, flexible installation	/	/	-40°C +80°C	-40°C +80°C	/	-30°C +80°C	/	-40°C +80°C	/	/
Ambient temperature with cable extended (-T6) — Cable, mobile installation	/	/	-40°C +80°C	/	/	-30°C +80°C	/	/	/	/
Electrical data — Thermal current Ith	10 A	10 A	10 A	6 A	6 A	6 A	3 A	4 A	4 A	2 A
Electrical data — Rated insulation voltage Ui	250 Vac	250 Vac	250 Vac	250 Vac	250 Vac	250 Vac	250 Vac	250 Vac	250 Vac 300 Vdc	30 Vac 36 Vdc
Electrical data — Protection against short circuits (fuse)	10 A 500 V type gG	10 A 500 V type gG	10 A 500 V type gG	6 A 500 V type gG	6 A 500 V type gG	6 A 500 V type gG	3 A 500 V type gG	4 A 500 V type gG	4 A 500 V type gG	2 A 500V type gG
Utilization category DC13 — 24 V	2 A	2 A	2 A	2 A	2 A	2 A	2 A	2 A	2 A	2 A
Utilization category DC13 — 125 V	0.4 A	0.4 A	0.4 A	0.4 A	0.4 A	0.4 A	0.4 A	0.4 A	0.4 A	/
Utilization category DC13 — 250 V	0.3 A	0.3 A	0.3 A	0.3 A	0.3 A	0.3 A	0.3 A	0.3 A	0.3 A	/
Utilization category AC15 — 24 V	4 A	4 A	4 A	4 A	4 A	4 A	3 A	4 A	4 A	2 A
Utilization category AC15 — 120 V	4 A	4 A	4 A	4 A	4 A	4 A	3 A	4 A	4 A	/
Utilization category AC15 — 250 V	4 A	4 A	4 A	4 A	4 A	4 A	3 A	4 A	4 A	/
Approvals	CE cULus IMQ EAC CCC	CE EAC CCC	CE cULus IMQ EAC CCC	CE IMQ EAC CCC	CE cULus IMQ EAC CCC	CE cULus IMQ EAC CCC	CE cULus IMQ EAC CCC	CE IMQ EAC CCC	CE cULus IMQ EAC CCC	CE cULus EAC CCC

Internal cable wiring

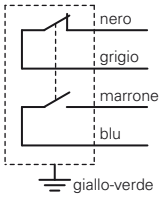
2NO+2NC



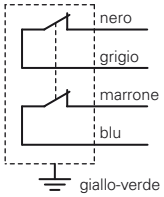
1NO+2NC



1NO+1NC



2NC



Connector pin assignment

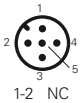
2NO+2NC

1-2 NC
3-4 NC
5-6 NO
7-8 NO

1NO+2NC

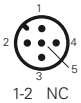
3-4 NC
5-6 NC
7-8 NO
1 ⏚

1NO+1NC



1-2 NC
3-4 NO
5 ⏚

2NC



1-2 NC
3-4 NC
5 ⏚

Female connectors see page 299

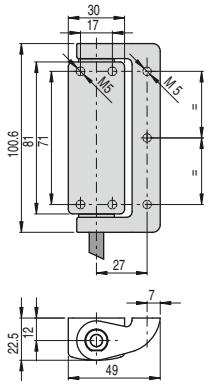
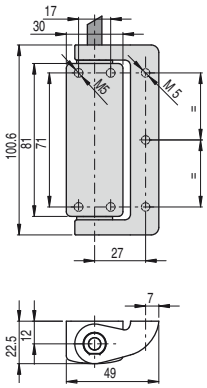
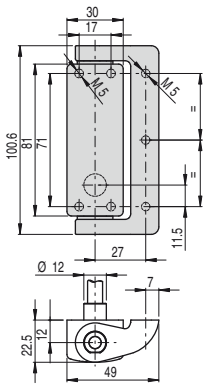
Dimensional drawings

All values in the drawings are in mm

Contact type:

L = slow action
LO = slow action make before break

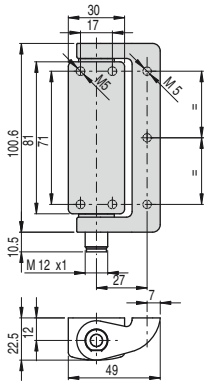
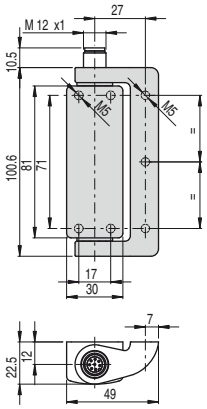
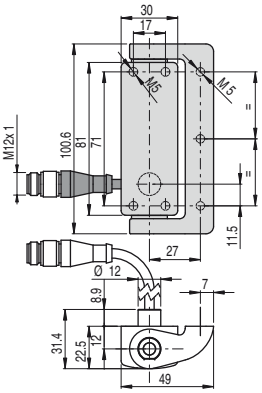
Contact block

		2 m cable, bottom		2 m cable, top		2 m cable, back	
							
52C	L	HP AA052C-2SN	1NO+1NC	HP AA052C-2AN	1NO+1NC	HP AA052C-2PN	1NO+1NC
52D	L	HP AA052D-2SN	2NC	HP AA052D-2AN	2NC	HP AA052D-2PN	2NC
52F	L	HP AA052F-2SN	1NO+2NC	HP AA052F-2AN	1NO+2NC	HP AA052F-2PN	1NO+2NC
52M	L	HP AA052M-2SN	2NO+2NC	HP AA052M-2AN	2NO+2NC	HP AA052M-2PN	2NO+2NC
53C	LO	HP AA053C-2SN	1NO+1NC	HP AA053C-2AN	1NO+1NC	HP AA053C-2PN	1NO+1NC
53F	LO	HP AA053F-2SN	1NO+2NC	HP AA053F-2AN	1NO+2NC	HP AA053F-2PN	1NO+2NC
53M	LO	HP AA053M-2SN	2NO+2NC	HP AA053M-2AN	2NO+2NC	HP AA053M-2PN	2NO+2NC
Actuating force		0.3 Nm (0.65 Nm)		0.3 Nm (0.65 Nm)		0.3 Nm (0.65 Nm)	
Travel diagrams		page 55 - group 1		page 55 - group 1		page 55 - group 1	

Contact type:

L = slow action
LO = slow action make before break

Contact block

		M12 connector, bottom		M12 connector, top		cable (0.2 m) with M12 connector, back	
							
52C	L	HP AA052C-KSM	1NO+1NC	HP AA052C-KAM	1NO+1NC	HP AA052C-0.2PM	1NO+1NC
52D	L	HP AA052D-KSM	2NC	HP AA052D-KAM	2NC	HP AA052D-0.2PM	2NC
52F	L	HP AA052F-KSM	1NO+2NC	HP AA052F-KAM	1NO+2NC	HP AA052F-0.2PM	1NO+2NC
52M	L	HP AA052M-KSM	2NO+2NC	HP AA052M-KAM	2NO+2NC	HP AA052M-0.2PM	2NO+2NC
53C	LO	HP AA053C-KSM	1NO+1NC	HP AA053C-KAM	1NO+1NC	HP AA053C-0.2PM	1NO+1NC
53F	LO	HP AA053F-KSM	1NO+2NC	HP AA053F-KAM	1NO+2NC	HP AA053F-0.2PM	1NO+2NC
53M	LO	HP AA053M-KSM	2NO+2NC	HP AA053M-KAM	2NO+2NC	HP AA053M-0.2PM	2NO+2NC
Actuating force		0.3 Nm (0.65 Nm)		0.3 Nm (0.65 Nm)		0.3 Nm (0.65 Nm)	
Travel diagrams		page 55 - group 1		page 55 - group 1		page 55 - group 1	

Attention! The safety hinge switch can be combined together exclusively with one or more Pizzato Elettrica hinges (HP or HC series). The use of whichever other hinge does not guarantee the correct operation of the safety device.

Items with code on **green** background are stock items

Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

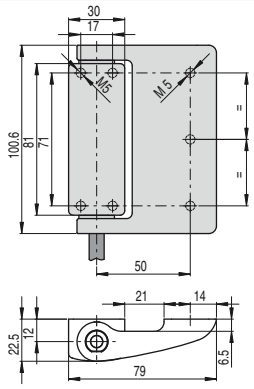
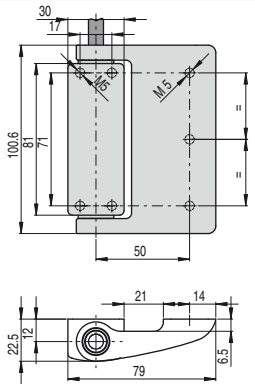
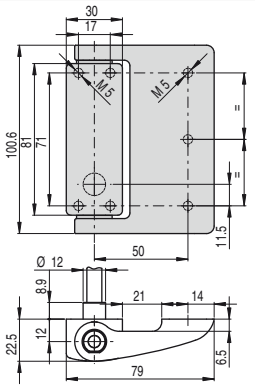
Versions for glass or polycarbonate doors - Dimensional drawings

All values in the drawings are in mm

Contact type:

L = slow action
LO = slow action make before break

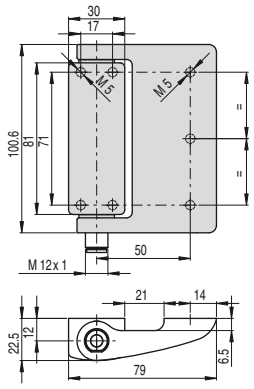
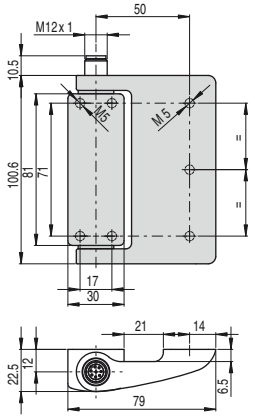
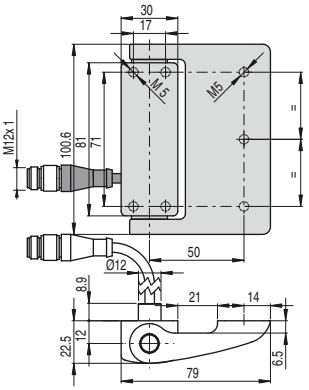
Contact block

		2 m cable, bottom		2 m cable, top		2 m cable, back	
							
52C	L	HP AB052C-2SN	1NO+1NC	HP AB052C-2AN	1NO+1NC	HP AB052C-2PN	1NO+1NC
52D	L	HP AB052D-2SN	2NC	HP AB052D-2AN	2NC	HP AB052D-2PN	2NC
52F	L	HP AB052F-2SN	1NO+2NC	HP AB052F-2AN	1NO+2NC	HP AB052F-2PN	1NO+2NC
52M	L	HP AB052M-2SN	2NO+2NC	HP AB052M-2AN	2NO+2NC	HP AB052M-2PN	2NO+2NC
53C	LO	HP AB053C-2SN	1NO+1NC	HP AB053C-2AN	1NO+1NC	HP AB053C-2PN	1NO+1NC
53F	LO	HP AB053F-2SN	1NO+2NC	HP AB053F-2AN	1NO+2NC	HP AB053F-2PN	1NO+2NC
53M	LO	HP AB053M-2SN	2NO+2NC	HP AB053M-2AN	2NO+2NC	HP AB053M-2PN	2NO+2NC
Actuating force		0.3 Nm (0.65 Nm)		0.3 Nm (0.65 Nm)		0.3 Nm (0.65 Nm)	
Travel diagrams		page 55 - group 1		page 55 - group 1		page 55 - group 1	

Contact type:

L = slow action
LO = slow action make before break

Contact block

		M12 connector, bottom		M12 connector, top		cable (0.2 m) with M12 connector, back	
							
52C	L	HP AB052C-KSM	1NO+1NC	HP AB052C-KAM	1NO+1NC	HP AB052C-0.2PM	1NO+1NC
52D	L	HP AB052D-KSM	2NC	HP AB052D-KAM	2NC	HP AB052D-0.2PM	2NC
52F	L	HP AB052F-KSM	1NO+2NC	HP AB052F-KAM	1NO+2NC	HP AB052F-0.2PM	1NO+2NC
52M	L	HP AB052M-KSM	2NO+2NC	HP AB052M-KAM	2NO+2NC	HP AB052M-0.2PM	2NO+2NC
53C	LO	HP AB053C-KSM	1NO+1NC	HP AB053C-KAM	1NO+1NC	HP AB053C-0.2PM	1NO+1NC
53F	LO	HP AB053F-KSM	1NO+2NC	HP AB053F-KAM	1NO+2NC	HP AB053F-0.2PM	1NO+2NC
53M	LO	HP AB053M-KSM	2NO+2NC	HP AB053M-KAM	2NO+2NC	HP AB053M-0.2PM	2NO+2NC
Actuating force		0.3 Nm (0.65 Nm)		0.3 Nm (0.65 Nm)		0.3 Nm (0.65 Nm)	
Travel diagrams		page 55 - group 1		page 55 - group 1		page 55 - group 1	

Attention! The safety hinge switch can be combined together exclusively with one or more Pizzato Elettrica hinges (HP or HC series). The use of whichever other hinge does not guarantee the correct operation of the safety device.

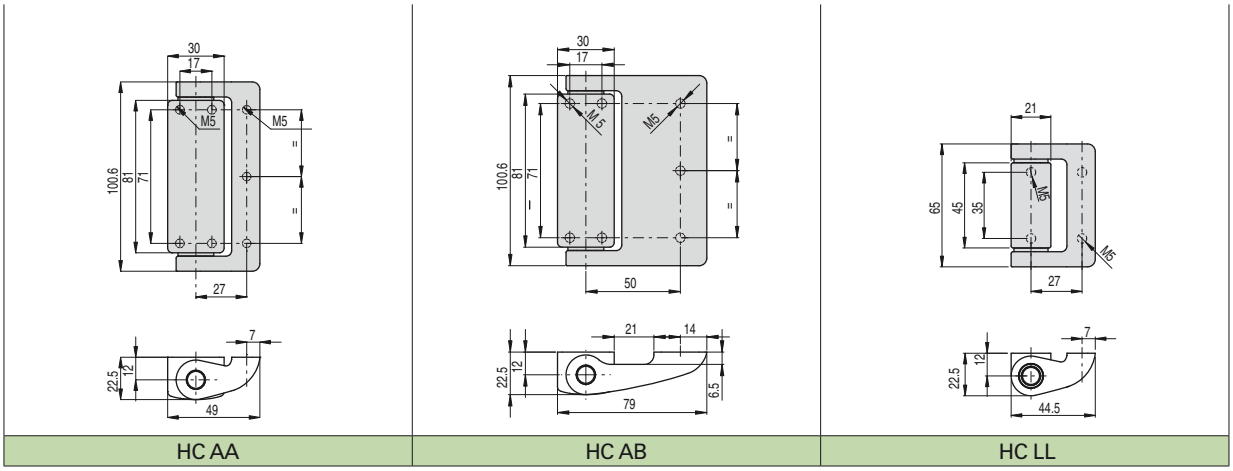
Accessories See page 299

The 2D and 3D files are available at **www.pizzato.com**

Items with code on **green** background are stock items

Additional hinges

All values in the drawings are in mm



HC AA	HC AB	HC LL

Travel diagrams

All values in the diagrams are in degrees

Contact block	Group 1
52C 1NO+1NC	0 3° 7° 180° 5°
52D 2NC	0 3° 7° 180°
52F 1NO+2NC	0 3° 7° 180° 5°
52M 2NO+2NC	0 3° 7° 180° 5°

Contact block	Group 1
53C 1NO+1NC	0 3° 7° 180° 1°
53F 1NO+2NC	0 3° 7° 180° 1°
53M 2NO+2NC	0 3° 7° 180° 1°

The switching point of the contacts can be adjusted from 0° to +4° compared to that indicated in the travel diagrams. The hinge is supplied without pre-adjustment.

Contact block	Group 1
50C 1NO+1NC	0 4° 8° 180° 1.5°
50D 2NC	0 4° 8° 180° 1.5°
50F 1NO+2NC	0 4° 8° 180° 1.5°
50M 2NO+2NC	0 4° 8° 180° 1.5°

Accessories

Article	Description
VF AC7032	Protection cap of adjustment screw

The cap is supplied with every hinge and must always be inserted after the adjustment of the switching point.
In case of loss or damage, the cap can be ordered separately.

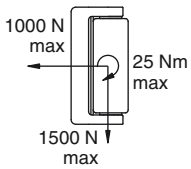
Legend

- Closed contact
- Open contact
- Positive opening travel
- Switch pressed / Switch released

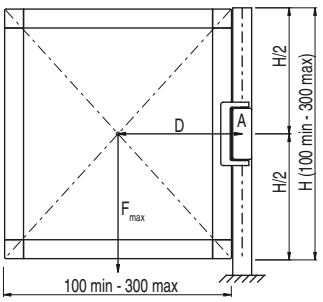
Max. forces and loads HP AA

All values in the drawings are in mm

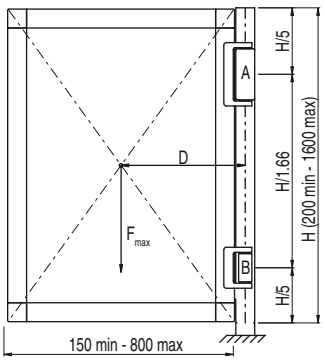
Admitted max. loads, independent of utilization conditions.



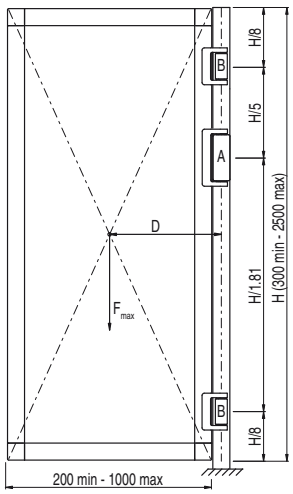
Doors with one safety hinge
F_{max} (N)=25,000/D (mm)



Doors with one safety hinge and one additional hinge
F_{max}(N)=200,000/D (mm)



Doors with one safety hinge and two additional hinges
F_{max} (N)=250,000/D (mm)



Legend

F_{max}	Force exerted by the weight of the door (N)
D (mm)	Distance from the centre of gravity of the door to the axis of the hinge
A	Safety hinge
B	Additional hinge

Items with code on **green** background are stock items

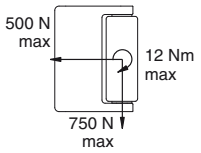
Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

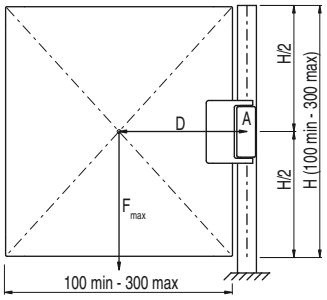
Max. forces and loads HP AB

All values in the drawings are in mm

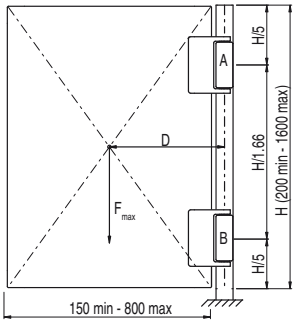
Admitted max. loads, independent of utilization conditions.



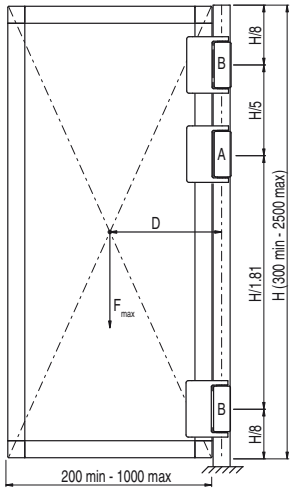
Doors with one safety hinge
F_{max} (N)=12,500/D (mm)



Doors with one safety hinge and one additional hinge
F_{max} (N)=100,000/D (mm)



Doors with one safety hinge and two additional hinges
F_{max} (N)=200,000/D (mm)



Legend

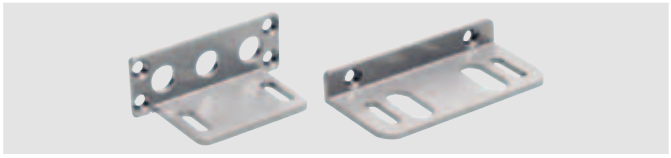
F_{max}	Force exerted by the weight of the door (N)
D (mm)	Distance from the centre of gravity of the door to the axis of the hinge
A	Safety hinge
B	Additional hinge

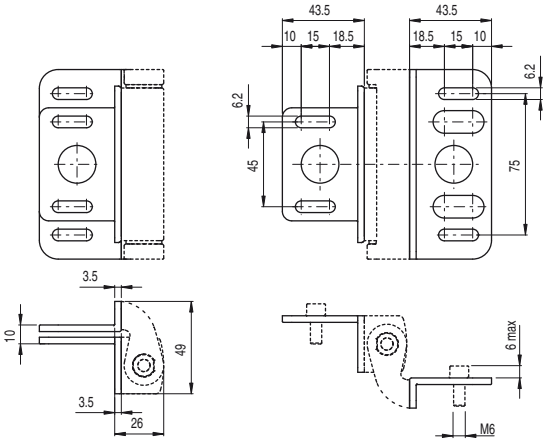
Fixing plates

All values in the drawings are in mm

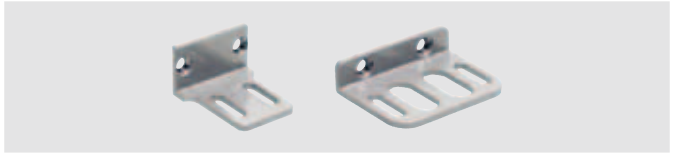
Fastening screws for profile not supplied.

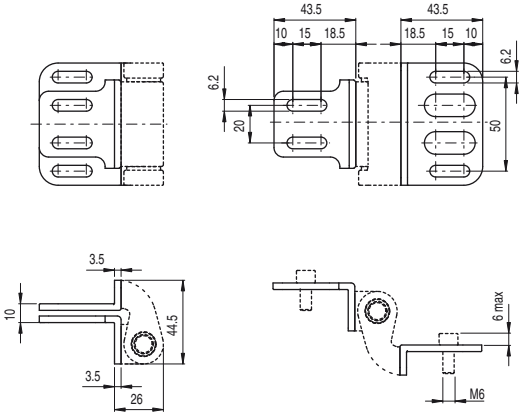
Article	Description
VF SFH1-C	Couple of angular plates for HP AA and HC AA supplied with fastening screws for attachment of the switch



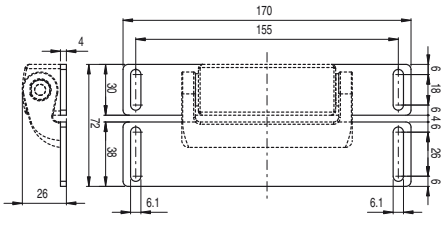


Article	Description
VF SFH2-C	Couple of angular plates for HC LL supplied with fastening screws for attachment of the switch

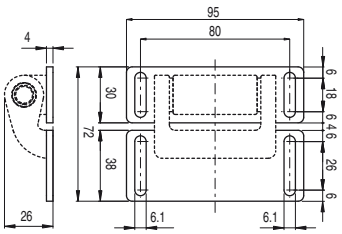




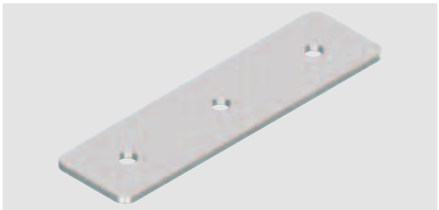
Article	Description
VF SFH3-C	Couple of plane plates for HP AA and HC AA supplied with fastening screws for attachment of the switch

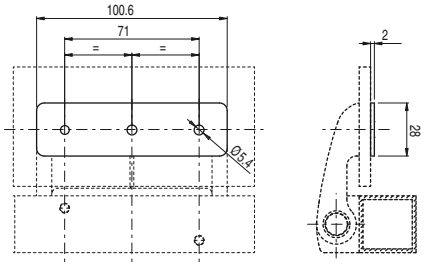


Article	Description
VF SFH4-C	Couple of plane plates for HC LL supplied with fastening screws for attachment of the switch



Article	Description
VF SFH7	HP AB series mobile part cover in stainless steel





Items with code on **green** background are stock items

Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

HX series safety hinge switches

Description

Pizzato Elettrica extends its range of products by creating the new HX series safety hinge switches where safety and style blend into a single product.

The electric switch is fully integrated into the mechanical hinge so that it is virtually invisible to an inexpert eye. This, asides from being an aesthetic advantage, guarantees greater safety as a switch which is difficult to identify is consequently even more difficult to tamper with. The rear mounting without screws in sight and the very precise line mean the switch can be perfectly integrated even with guards of machinery with a very precise design.

As the HX series safety hinge switches are in stainless steel, these devices can be used in environments where particular attention must be paid to hygiene making them suitable for a variety of applications, ranging from the food and pharmaceutical sectors to the chemical and marine sectors.

Maximum safety with a single device

PL e + SIL 3

The HX BEE1 series hinge switches are constructed with redundant electronics. As a result, the maximum PL e and SIL 3 safety levels can still be achieved through the use of a single device on a guard. This avoids expensive wiring in the field and allows faster installation. Inside the control cabinet, the two electronic safety outputs must be connected to a safety module with OSSD inputs or to a safety PLC.

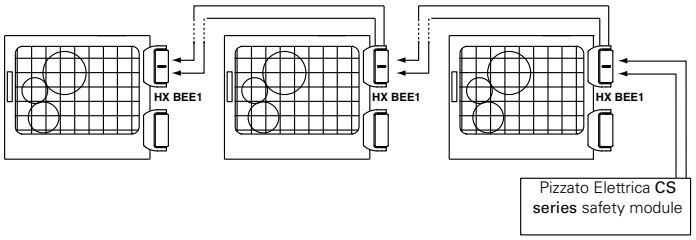
Series connection of several switches

PL e + SIL 3

One of the most important features of the HX series is the possibility of connecting up to 32 sensors in series, while still maintaining the maximum safety levels PL e laid down in EN 13849-1 and SIL 3 acc. to EN 62061.

This connection type is permissible in safety systems which have a safety module at the end of the chain that monitors the outputs of the last HX switch.

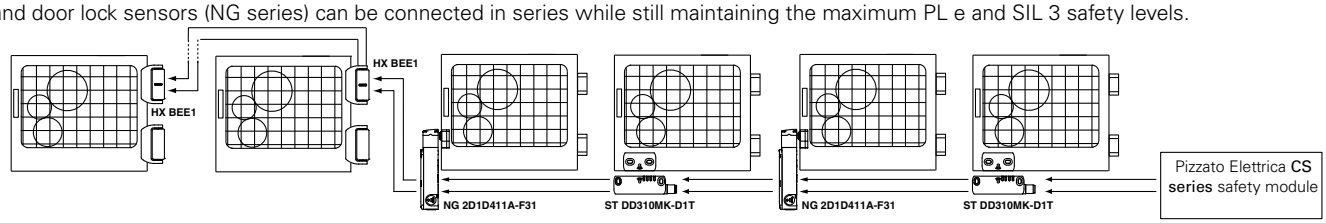
The fact that the PL e safety level can be maintained even with 32 sensors connected in series demonstrates the extremely secure structure of each single device.



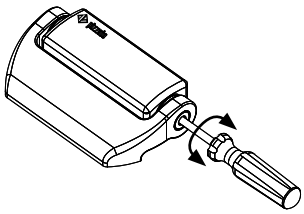
Series connection with other devices

PL e + SIL 3

The HX BEE1 series hinge switch features two safety inputs and two safety outputs, which can be connected in series with other Pizzato Elettrica safety devices. This option allows the creation of safety chains containing various devices. For example, stainless steel safety hinges (HX BEE1 series), transponder sensors (ST series) and door lock sensors (NG series) can be connected in series while still maintaining the maximum PL e and SIL 3 safety levels.



Adjustment of the switching point



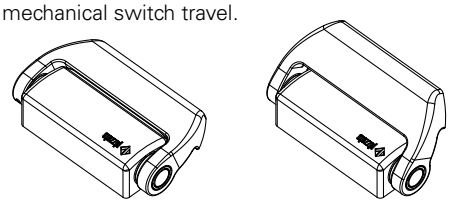
The switching point of the switches can be set with a flat-blade screwdriver.

Adjusting the switching point allows for any calibration for large size guards. After calibrating the switch, it is always necessary to close the hole using the safety cap supplied.

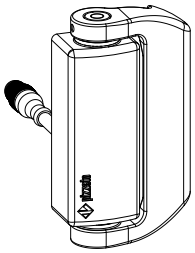
Basic activation angle variants

On request, versions with a switch base activation angle of 15° multiples (e.g. 45° or 90°) are available.

The different activation angle does not exclude the possibility of fine adjustment of the switching point by means of the adjustment screw in the switch. Any change in the base operating angle does not alter the maximum mechanical switch travel.



Cable with connector at the back

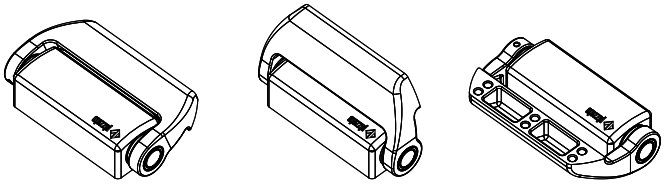


The version with a cable with M12 connector at the back offers the best combination of aesthetics and simple connection.

This solution allows the wiring to be hidden. At the same time, it facilitates the connection and disconnection of the wiring from inside the machinery.

Opening angle up to 180°

The mechanical design of the switch also allows use on guards with an opening angle of up to 180°.

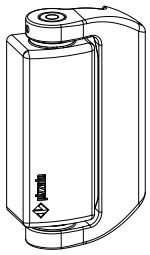


Protection degrees IP67 and IP69K

IP69K
IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

Additional hinges



To complete the installation, various types of additional hinges are available to be used in a variable number depending on the weight of the guard.
These hinges have the same aesthetic and mechanical structure but cost less as they contain no electrical parts.

Materials

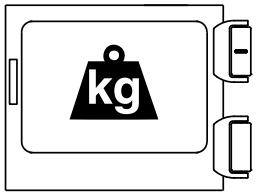
AISI
316L

With this new series in AISI316L stainless steel, Pizzato Elettrica offers an extensive range of devices suitable for environments where special attention must be paid to cleanliness and hygiene. The accurate surface finish allows these devices to be used for a variety of applications, ranging from the food and pharmaceutical sectors to the chemical and marine sectors.

Laser engraving

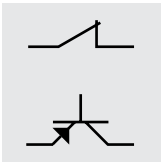
Pizzato Elettrica has introduced a new laser engraving system for stainless steel switches of the HX series.
Thanks to this new system, engravings on the products are indelible.

For heavy duty applications



Specially designed for heavy industrial applications, these hinges are made of high-thickness microfusion materials with high strength mechanical properties. The maximum loads indicated in the technical specifications are those that the hinge can withstand without any lubrication, for one million opening and closing cycles, while maintaining its features as a safety device in perfect efficiency.

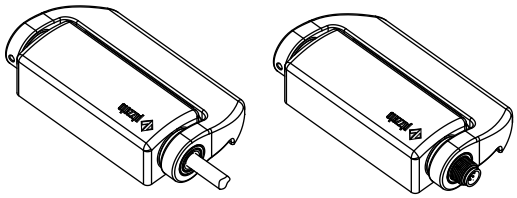
Mechanical or electronic contact blocks



Internally equipped with innovative concepts, the HX series safety switches can be supplied both with electromechanical safety contacts with positive opening, or with self monitoring redundant electronic safety outputs. This allows the customer to choose between the most cost-effective solution (mechanical contacts) or a maximum security solution (electronic outputs).

With cable or connector

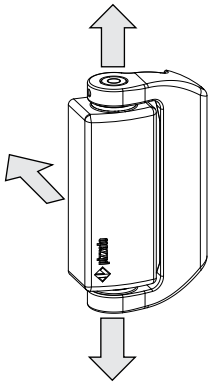
The electrical connection via integrated cable or M12 connector option makes the device suitable for the most diverse applications. The connector versions allow faster device replacement and installation, by making incorrect wiring connection impossible. The cable versions, on the other hand, offer the best value for money. Both the cable as well as the connector versions are available with mechanical or electronic contact blocks.



Four LEDs for immediate diagnosis

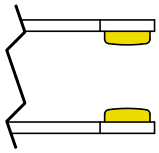
The versions with electronic contact block are equipped with four signalling LEDs. Each LED represents a specific hinge function, this greatly facilitates switching point adjustment via the immediate visual indication for the installer during the adjustment phase. There are also three separate LEDs available: one for input status, one for output status, and one for general device status. For serial applications, this independence enables identification of any interruptions in the safety chain and of any internal errors. All of this at a glance, without needing to decode complex flashing sequences.

Three different output directions



Designed for flexibility, the HX series safety hinges are equipped with three different output directions for the electrical conductors. Directions from below or from above allow the same exit direction of the conductor to be maintained, both for right and for left-hand doors. The direction from behind has the ultimate aesthetic, cleanliness and hygiene result. All three electrical output directions are available with output cables in various lengths or with M12 connector.

Gold-plated contacts



The contact blocks of these devices can be supplied gold-plated upon request. Ideal for applications with low voltages or currents; it ensures increased contact reliability. The high-thickness coating > 1 micron ensures the mechanical endurance of the coating over time.

Selection diagram

MECHANICAL CONTACT BLOCKS

L22
2NO+2NC slow action, close

H22
2NO+2NC slow action, make before break

CABLES AND CONNECTORS

•SN
Cable output, bottom (standard)

•AN
Cable output, top

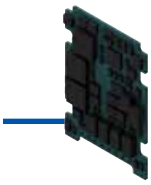
•PN
Cable output, back

KSM
M12 connector, bottom

KAM
M12 connector, top

0.2PM
Cable, length: 0.2 m, with M12 connector, at back

ELECTRONIC CONTACT BLOCK



EE1
Electronic contact block with LED

CABLES AND CONNECTORS

•SN
Cable output, bottom (standard)

•AN
Cable output, top

•PN
Cable output, back

KSM
M12 connector, bottom

KAM
M12 connector, top

0.2PM
Cable, length: 0.2 m, with M12 connector, at back

ADDITIONAL HINGES

HX CB **HX CD**

product option

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options

HX BL22-2PNGH15

Body and movable part dimensions	
B	126x76x31 mm

Contact block	
L22	2NO+2NC, slow action, close
H22	2NO+2NC, slow action, make before break
EE1	electronic contact block with LED 2 PNP safety outputs 1 PNP signalling output 2 PNP safety inputs

Connection type	
0.2	cable, length: 0.2 m (available for 0.2 PM versions only)
0.5	cable, length: 0.5 m
...	.....
2	cable, length: 2 m (standard)
...	.....
10	cable, length: 10 m
K	with integrated connector

Other cable lengths on request.

Activation angle	
	0° activation angle (standard)
H15	15° activation angle
H30	30° activation angle
H45	45° activation angle
H60	60° activation angle
H75	75° activation angle
H90	90° activation angle

Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating

Cable or connector type	
N	PVC cable IEC 60332-1
M	cable with M12 connector

Output direction, connections	
S	movable part at the right and bottom output
P	movable part at the right and output at the back
A	movable part at the right and output at top
Q	movable part at the left and output at the back (on request)

Code structure for additional hinges

HX CB

Additional hinges	
CB	126x76x31 mm, movable part at the right
CD	126x76x31 mm, movable part at the left

HX series safety hinge switches

Main features
- AISI 316L stainless steel housing
- Protection degrees IP67 and IP69K
- Electronic contact block with LED
- Versions with M12 connector
- Additional hinge without contacts

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU
Machinery Directive 2006/42/EC
EMC Directive 2014/30/EU
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, ISO 20653, IEC 61508-1, IEC 61508-2, IEC 61508-3, EN ISO 13849-1, EN ISO 13849-2, EN 62061 , EN 61326-1, EN 61326-3-1, EN 61326-3-2, UL 508, CSA 22.2 No.14

Quality marks:

UL approval:	E131787
TÜV SÜD approval:	Z10 14 03 75157 007
EAC approval:	RU C-IT.АД35.В.00454

Technical data

Housing
Metal housing, polished, AISI 316L stainless steel
Versions with integrated cable, length 2 m, other lengths from 0.5 … 10 m on request
Versions with integrated M12 connector
Versions with 0.2 m cable length and M12 connector, other lengths from 0.1 … 3 m on request

Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)
Corrosion resistance in saline mist:	≥ 1000 hours in NSS acc. to ISO 9227

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Mechanical interlock, not coded:	type 1 acc. to EN ISO 14119
Safety parameters HX B•22-•••	
B_{10D}:	5,000,000 for NC contacts
Safety parameters HX BEE1-•••	
$MTTF_D$:	2413 years
PFH_D:	1.24E-09
DC:	High
Service life:	20 years
Ambient temperature:	see table on page 62
Max. actuation frequency:	600 operating cycles/hour
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	90°/s
Min. actuation speed:	2°/s
Mounting position:	any
Tightening torque, M6 screws:	10 … 12 Nm

Electrical data (L22 - H22 mechanical contact blocks)

Rated impulse withstand voltage U_{imp}:	4 kV
Conditional short circuit current:	1000 A acc. to EN 60947-5-1
Pollution degree:	3

Electrical data (EE1 electronic contact block)

Rated operating voltage U_e:	24 Vdc -15%…+10% SELV
Consumption at voltage U_e:	< 1W
Rated impulse withstand voltage U_{imp}:	1.5 kV
Resettable internal protection fuse:	1.1 A
Overvoltage category:	III
IS1/IS2 inputs	
Rated operating voltage U_e:	24 Vdc
Rated current consumption:	5 mA
OS1/OS2 safety outputs	
Rated operating voltage U_e:	24 Vdc
Output type:	PNP type OSSD
Utilisation category:	DC12; U_e=24Vdc; I_e=0.25A
Short circuit detection:	Yes
Overcurrent protection:	Yes
Duration of the deactivation impulses at the safety outputs:	< 300 us
Permissible capacitance between outputs:	< 200 nF
Permissible capacitance between output and ground:	< 200 nF
O3 signalling output	
Rated operating voltage U_e:	24 Vdc
Output type:	PNP
Utilisation category:	DC12; U_e=24Vdc; I_e=0.1A
Short circuit detection:	No
Overcurrent protection:	Yes

⚠ If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.

⚠ Important: Switch off the circuit voltage before disconnecting the connector from the switch. The connector is not suitable for separation of electrical loads. According to EN 60204-1, versions with 8-pole M12 connector can be used only in PELV circuits.

Features approved by UL

Utilization categories	R300 pilot duty (28 VA, 125-250 Vdc) B300 pilot duty (360 VA, 120-240 Vac)

Housing features type 1, 4X "indoor use only", 12.
Housing features for the version with 2 contacts and type N cable Type 1, 4X "indoor use only"

In compliance with standard: UL 508, CSA 22.2 No.14

Please contact our technical department for the list of approved products.

Features approved by TÜV SÜD

Supply voltage: 24 Vdc
Rated operating current (max.): 0.25 A
Ambient temperature: -25°C … +70°C
Protection degree: IP67
PL, category: PL e, category 4

In compliance with standards: IEC 61508-1:2010 (SIL 3), IEC 61508-2:2010 (SIL 3), IEC 61508-3:2010 (SIL 3), IEC 61508-4:2010 (SIL 3), IEC 620611/A1:2012 (SIL CL 3), EN ISO 13849-1:2008 (PL e, Cat. 4), EN 60947-5-1/A1:2009, ISO 14119:2013

Please contact our technical department for the list of approved products.

Utilization temperatures and electrical data for L22/H22 mechanical contact blocks

			Cable type N 9x0,34 mm²	M12 connector, 8-pole
Ambient temperature	Cable, fixed installation		-25°C … +80°C	-25°C … +80°C
	Cable, flexible installation		-5°C … +80°C	-5°C … +80°C
	Cable, mobile installation		/	/
Electrical data	Thermal current I_{th}		3 A	2 A
	Rated insulation voltage U_i		250 Vac	30 Vac 36 Vdc
	Protection against short circuits (fuse)		3 A 500 V type gG	2 A 500V type gG
	Utilization category DC13	24 V	2 A	2 A
		125 V	0.4 A	/
		250 V	0.3 A	/
	Utilization category AC15	24 V	3 A	2 A
		120 V	3 A	/
		250 V	3 A	/

Utilization temperatures and electrical data for EE1 electronic contact block

			Cable type N 8x0,34 mm²	M12 connector, 8-pole
Ambient temperature	Cable, fixed installation		-25°C … +70°C	-25°C … +70°C
	Cable, flexible installation		-5°C … +70°C	-5°C … +70°C
	Cable, mobile installation		/	/
Electrical data	Thermal current I_{th}		0.25 A	0.25 A
	Rated insulation voltage U_i		32 Vdc	32 Vdc
	Protection against short circuits (fuse)		1 A	1 A
	Utilization category DC12	24 V	0.25 A	0.25 A

Internal connections with cable

L22/H22 mechanical contact blocks

cable colour	contacts
black	NC
black-white	
red	NC
red-white	
brown	NO
blue	
purple	NO
purple-white	
yellow/green	⏚

EE1 electronic contact block

cable colour	connection
brown	A1(+)
red	IS1
blue	A2(-)
red-white	OS1
black	O3
purple	IS2
black-white	OS2
purple-white	not connected

Internal connections with M12 connector

L22/H22 mechanical contact blocks

pin	contacts
1	NC
2	
3	NC
4	
5	NO
6	
7	NO
8	
/	⏚

EE1 electronic contact block

pin	connection
1	A1(+)
2	IS1
3	A2(-)
4	OS1
5	O3
6	IS2
7	OS2
8	not connected

Legend

A1-A2	supply
IS1-IS2	safety inputs
OS1-OS2	safety outputs
O3	signalling output
NC	normally closed contact
NO	normally open contact
⏚	ground connection

Dimensional drawings

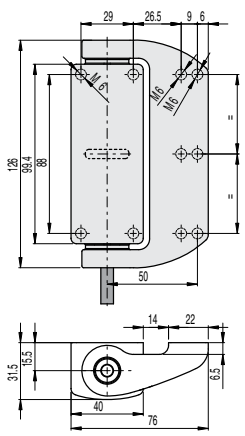
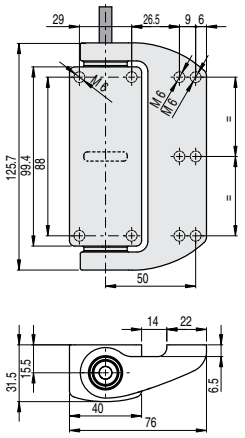
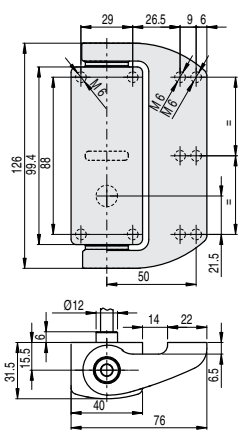
All values in the drawings are in mm

Contact type:

LA = slow action close

LO = slow action make before break

= electronic PNP

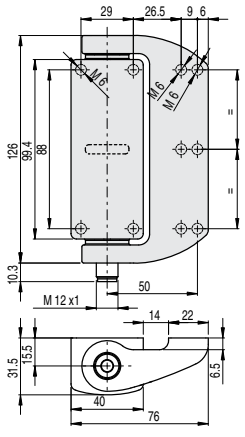
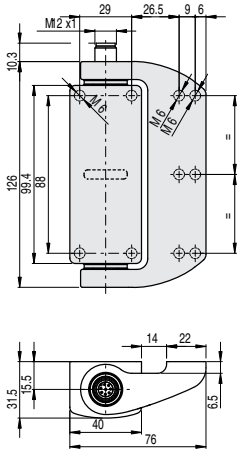
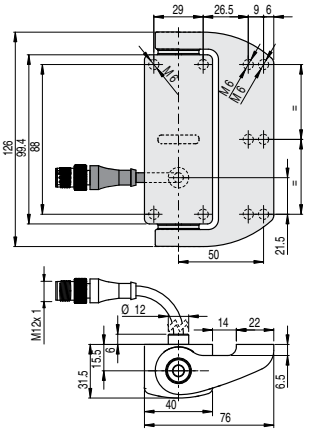
Contact block		2 m cable, bottom		2 m cable, top		2 m cable, back	
							
L22	LA	HX BL22-2SN	2NO+2NC	HX BL22-2AN	2NO+2NC	HX BL22-2PN	2NO+2NC
H22	LO	HX BH22-2SN	2NO+2NC	HX BH22-2AN	2NO+2NC	HX BH22-2PN	2NO+2NC
EE1		HX BEE1-2SN	PNP	HX BEE1-2AN	PNP	HX BEE1-2PN	PNP
Actuating force		0,3 Nm (0,65 Nm)		0,3 Nm (0,65 Nm)		0,3 Nm (0,65 Nm)	

Contact type:

LA = slow action close

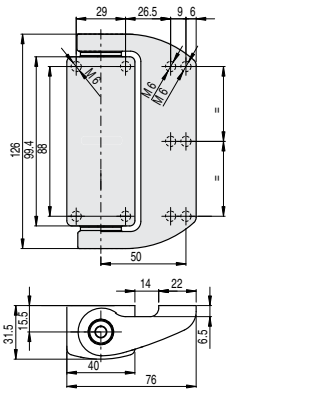
LO = slow action make before break

= electronic PNP

Contact block		M12 connector, bottom		M12 connector, top		cable (0.2 m) with M12 connector, back	
							
L22	LA	HX BL22-KSM	2NO+2NC	HX BL22-KAM	2NO+2NC	HX BL22-0.2PM	2NO+2NC
H22	LO	HX BH22-KSM	2NO+2NC	HX BH22-KAM	2NO+2NC	HX BH22-0.2PM	2NO+2NC
EE1		HX BEE1-KSM	PNP	HX BEE1-KAM	PNP	HX BEE1-0.2PM	PNP
Actuating force		0,3 Nm (0,65 Nm)		0,3 Nm (0,65 Nm)		0,3 Nm (0,65 Nm)	

To order a product with a movable part at the left replace P with Q in the codes shown above.
Example: HX BL22-2**P**N → HX BL22-2**Q**N

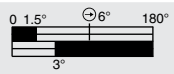
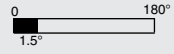
Additional hinges



HX CB

Travel diagrams

All values in the drawings are in degrees

Contact block	Group 1
L22 2NO+2NC	
H22 2NO+2NC	
EE1 PNP	

The switching point of the contacts can be adjusted ± 1° compared to that indicated in the travel diagrams.
The hinge is supplied without pre-adjustment.

Legend

Closed contact /Outputs OS1, OS2, O3 active

Open contact /Outputs OS1, OS2, O3 not active

Positive opening travel

Accessories See page 299

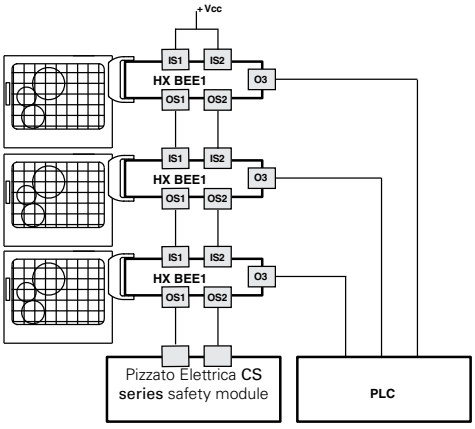
→ The 2D and 3D files are available at **www.pizzato.com**

Complete safety system

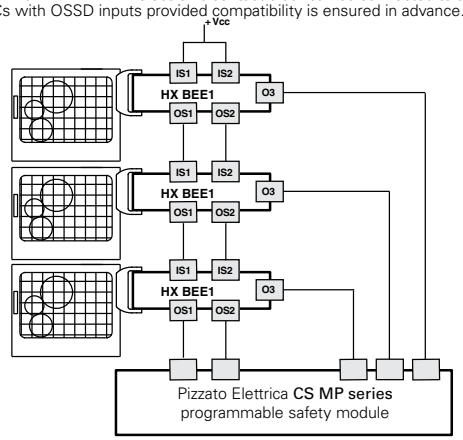
The use of complete and tested solutions guarantees the electrical compatibility between the hinge of the HX series and the safety modules from Pizzato Elettrica, as well as high reliability. The sensors have been tested with the modules listed in the adjacent table.

Switch	Compatible safety modules	Safety module output contacts		
		Instantaneous safety contacts	Delayed safety contacts	Signalling contacts
HX BEE1-•••	CS AR-05••••	3NO	/	1NC
	CS AR-06••••	3NO	/	1NC
	CS AR-08••••	2NO	/	/
	CS AT-0•••••	2NO	2NO	1NC
	CS AT-1•••••	3NO	2NO	/
	CS MP••••••	see page 255		
	CS MF••••••	see page 283		

The hinges with HX BEE1-••• electronic contact block can be connected to safety modules or safety PLCs with OSSD inputs provided compatibility is ensured in advance.

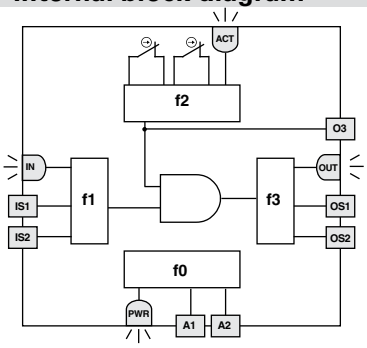


Possibility of series connection of multiple hinges for simplifying the wiring of the safety system, whereby only the outputs of the last hinge are evaluated by a Pizzato Elettrica safety module (see table with compatible safety modules). Each HX switch is provided with a signalling output, which is activated when the respective guard is closed. Depending on the specific requirements of the application, this information can be evaluated by a PLC.



Possibility of series connection of multiple hinges for simplifying the wiring of the safety system, whereby only the outputs of the last hinge are evaluated by a Pizzato Elettrica safety module of the CS MP series. Both the safety-relevant evaluation and the evaluation of the signalling outputs are performed by the CS MP series.

Internal block diagram

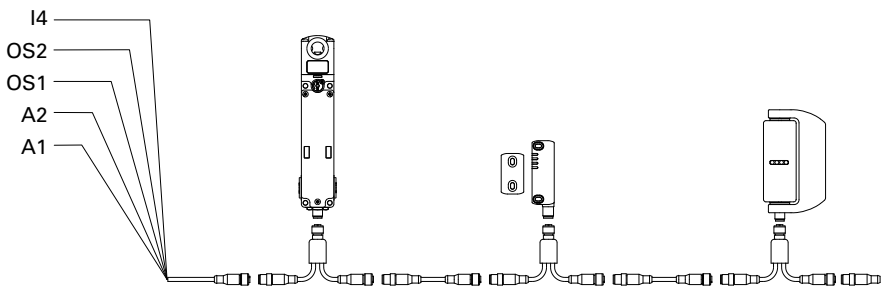


The adjacent diagram illustrates 4 logical, linked sub-functions of the hinge switch.
Function f0 is a basic function and includes the monitoring of the power supply as well as internal, cyclical tests.
The task of function f1 is to evaluate the status of the device inputs, whereas function f2 checks the opening of the guard. Function f3 is intended to activate or deactivate the safety outputs and check for any faults or short circuits in the outputs.
The safety-related function, which combines the sub-functions mentioned above, only activates the safety outputs if the input signals are correctly applied and the guard is in closed position.
The status of each function is displayed by the corresponding LED (PWR, IN, ACT, LOCK, OUT), in such a way that the general device status becomes immediately obvious to the operator.

LED	Function
ACT	state of actuator / O3 output
IN	status of safety inputs
OUT	status of safety outputs
PWR	Power supply / self-diagnosis

Series connection

To simplify series connections of the devices, various M12 connectors are available that allow complete wiring.
This solution significantly reduces installation times while at the same time maintaining the maximum safety levels PL e and SIL 3.
For further information see page 304.



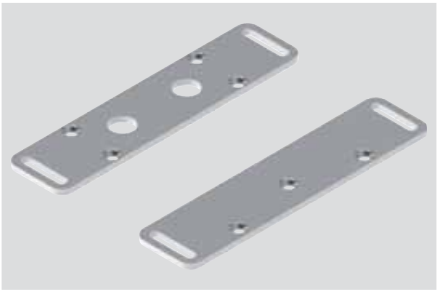
Accessories

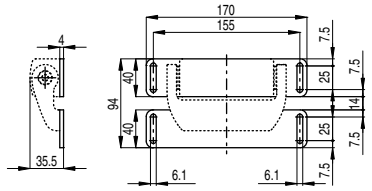
Article	Description
VF AC7032	Protection cap of adjustment screw

The cap is supplied with every hinge and must always be attached after the fine adjustment of the switching point.
In case of loss or damage, the cap can be ordered separately.

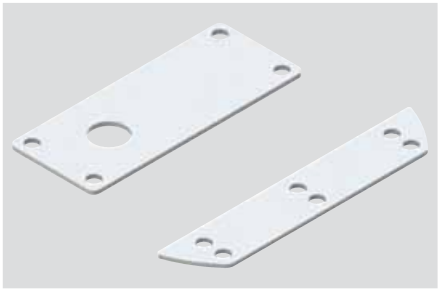
Fixing plates

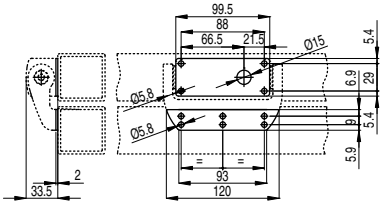
Article	Description
VF SFH10-TX	Couple of stainless steel plane plates supplied with fastening screws for attachment of the switch



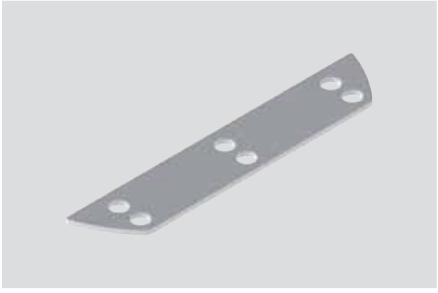


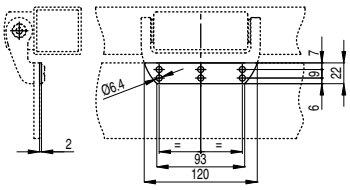
Article	Description
VF SFH9	Polyethylene gaskets for the food industry. Seals the contact surface between the hinge and the frame.





Article	Description
VF SFH8	Mobile part cover in stainless steel. Ideal for fixing the mobile part with polycarbonate guards.

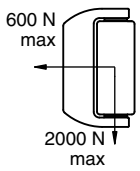




Max. forces and loads HX

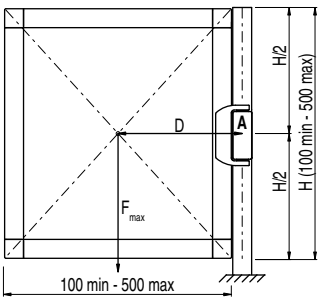
All values in the drawings are in mm

Admitted max. loads, independent of utilization conditions.

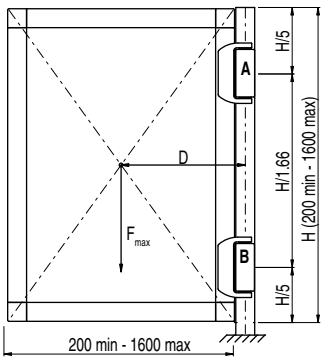


Attention: Never exceed the loads listed above under any circumstances.
The loads have been verified by a fatigue test of one million operating cycles with a 90° opening angle.

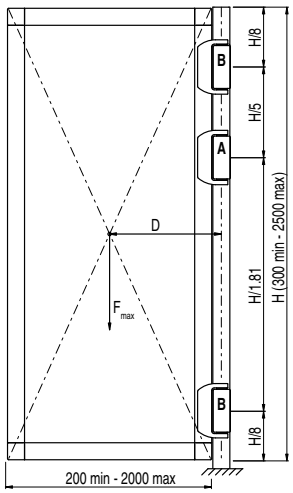
Doors with one safety hinge
F_{max} (N)=50,000/D (mm)



Doors with one safety hinge and one additional hinge
F_{max}(N)=400,000/D (mm)



Doors with one safety hinge and two additional hinges
F_{max} (N)=500,000/D (mm)



Legend

F_{max}	Force exerted by the weight of the door (N)
D	Distance from the centre of gravity of the door to the axis of the hinge (mm)
A	Safety hinge
B	Additional hinge

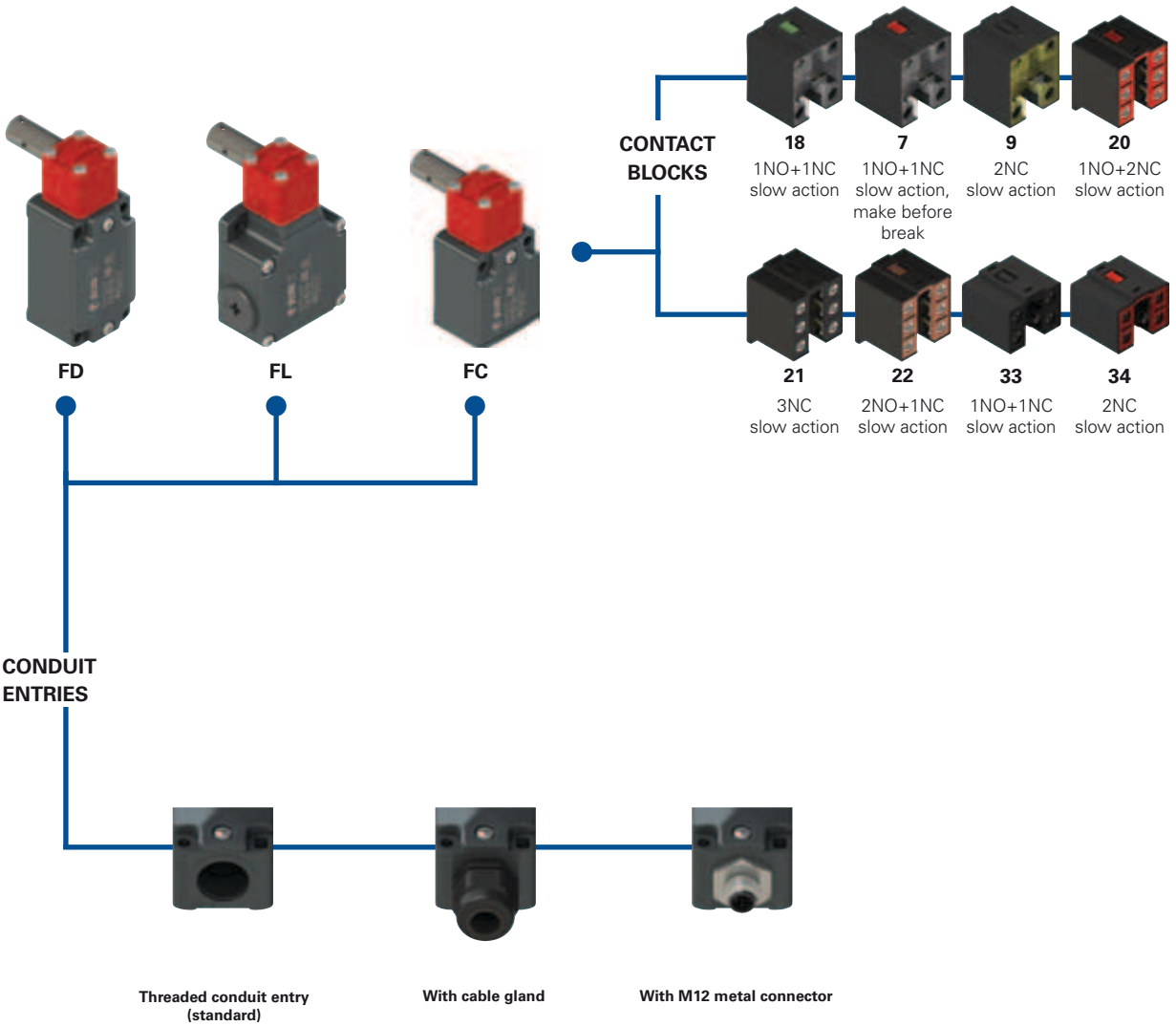
Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

Items with code on **green** background are stock items

Notes

Selection diagram



product option

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options | options

FD 1895-GM2K50T6

Housing	
FD	metal, one conduit entry
FL	metal, three conduit entries

Contact block	
18	1NO+1NC, slow action
7	1NO+1NC, slow action, make before break
9	2NC, slow action
20	1NO+2NC, slow action
21	3NC, slow action
22	2NO+1NC, slow action
33	1NO+1NC, slow action
34	2NC, slow action

Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 22, 33, 34)

Threaded conduit entry	
M2	M20x1.5 (standard)
	PG 13.5

Ambient temperature	
	-25°C … +80°C (standard)
T6	-40°C … +80°C

Pre-installed cable glands or connectors	
	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
…	.....
K50	M12 metal connector, 5-pole
…	.....

For the complete list of possible combinations please contact our technical department.

article | options | options

FC 3395-GM2K50T6

Housing	
FC	metal, one conduit entry

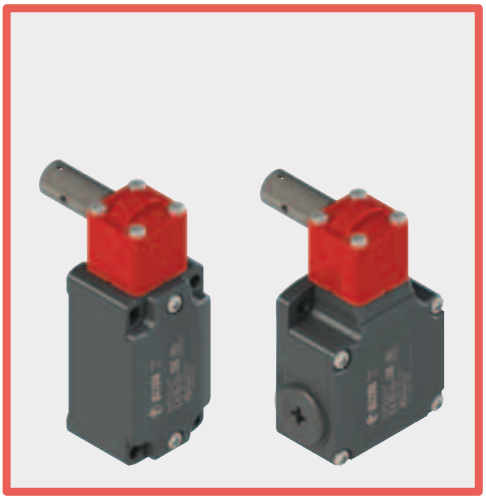
Contact block	
33	1NO+1NC, slow action
34	2NC, slow action

Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating

Threaded conduit entry	
M2	M20x1.5 (standard)
	PG 11

Ambient temperature	
	-25°C … +80°C (standard)
T6	-40°C … +80°C

Pre-installed cable glands or connectors	
	no cable gland (standard)
K23	cable gland for cables Ø 6 … 12 mm
K50	M12 metal connector, 5-pole



Main features
- Metal housing, from one to three conduit entries
- Protection degree IP67
- 8 contact blocks available
- Stainless steel actuator
- Versions with M12 connector
- Versions with gold-plated silver contacts

Technical data

Housing
FD, FL and FC series: metal housing, baked powder coating.
Stainless steel actuator.

FD, FC series: one threaded conduit entry:	M20x1.5 (standard)
FL series: three threaded conduit entries:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Mechanical interlock, not coded:	type 1 acc. to EN ISO 14119
Safety parameters:	
B_{10D}:	5,000,00 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Max. actuation frequency:	3600 operating cycles/hour
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	180°/s
Min. actuation speed:	2°/s
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 22, 33, 34:	min. 1 x 0.34 mm² (1 x AWG 22) max. 2 x 1.5 mm² (2 x AWG 16)
Contact blocks 7, 9, 18:	min. 1 x 0.5 mm² (1 x AWG 20) max. 2 x 2.5 mm² (2 x AWG 14)

Quality marks:

IMQ approval:	EG605
UL approval:	E131787
CCC approval:	2007010305230000
EAC approval:	RU C-IT.АД35.B.00454

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, UL 508, CSA 22.2 No.14.
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 No.14 , GB14048.5-2001.

Compliance with the requirements of:
Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

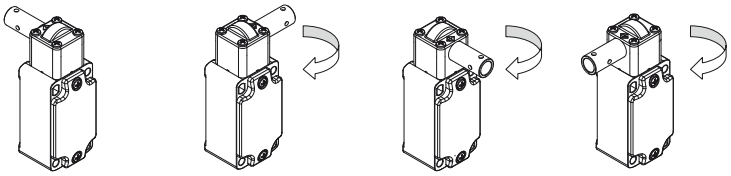
⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

Electrical data			Utilization category
without connector	Thermal current (I_{th}):	10 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 22, 33, 34)	U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 22, 33, 34)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250
	Protection against short circuits:	type aM fuse 10 A 500 V	I_e (A) 6 1.1 0.4
	Pollution degree:	3	
with M12 connector, 4 or 5-pole	Thermal current (I_{th}):	4 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	U_e (V) 24 120 250
	Protection against short circuits:	type gG fuse 4 A 500 V	I_e (A) 4 4 4
	Pollution degree:	3	Direct current: DC13
			U_e (V) 24 125 250
			I_e (A) 4 1.1 0.4
with M12 connector 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	U_e (V) 24
	Protection against short circuits:	type gG fuse 2 A 500 V	I_e (A) 2
	Pollution degree:	3	Direct current: DC13
			U_e (V) 24
			I_e (A) 2

Description

These safety switches are designed to monitor gates or doors that safeguard dangerous parts of machines without inertia. They are very sensitive, open the contacts after few degrees of rotation and immediately send the stop signal. The head, which can be turned in 90° steps, enables installation in multiple positions.
The metal housing and the stainless steel actuator enable use even under operating conditions in which dust and dirt could inhibit the operation of normal safety switches with separate actuator.

Head with variable orientation



For all switches, the head can be adjusted in 90° steps after removing the four fastening screws. This allows you to use the same switch on both right- and left-facing door fronts.

Protection degree IP67

IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

Extended temperature range

-40°C

These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C.
They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

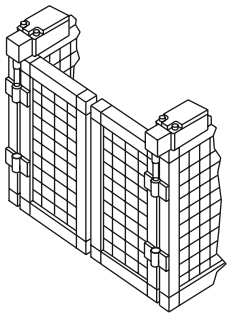
Laser engraving

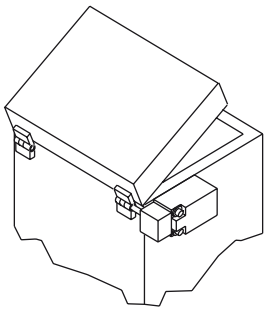
All devices are marked using a dedicated indelible laser system. These engravings are therefore suitable for extreme environments too. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Adjustable switching point

When installing the device, the contact switching point can be adjusted over the entire 360° range. By fixing the stud screw, it is possible to check the correct setting of the activation angle and quickly and easily adjust it if necessary. Once adjustment is complete, you can render the device tamper-proof against commonly used tools using the supplied lock pin.

Application examples





Features approved by IMQ

Rated insulation voltage (U_i):	500 Vac
	400 Vac (for contact blocks 20, 21, 22, 33, 34)
Conventional free air thermal current (I_{th}):	10 A
Protection against short circuits:	type aM fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}):	6 kV
	4 kV (for contact blocks 20, 21, 22, 33, 34)
Protection degree of the housing:	IP67
MV terminals (screw terminals)	
Pollution degree:	3
Utilization category:	AC15
Operating voltage (U_e):	400 Vac (50 Hz)
Operating current (I_e):	3 A

Forms of the contact element: Zb, Y+Y, Y+Y+X, Y+Y+Y, Y+X+X
Positive opening contacts on contact blocks 7, 9, 18, 20, 21, 22, 33, 34
In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories	Q300 (69 VA, 125-250 Vdc)
	A600 (720 VA, 120-600 Vac)

Housing features type 1, 4X "indoor use only", 12, 13
For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).
In compliance with standard: UL 508, CSA 22.2 No.14

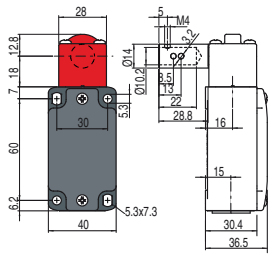
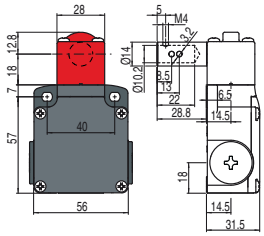
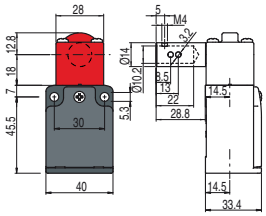
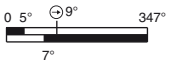
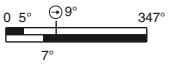
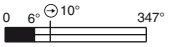
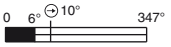
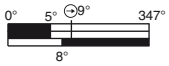
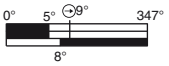
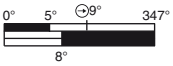
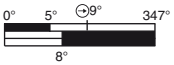
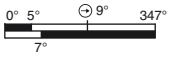
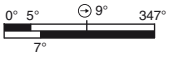
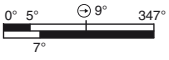
Please contact our technical department for the list of approved products.

Dimensional drawings

All values in the drawings are in mm

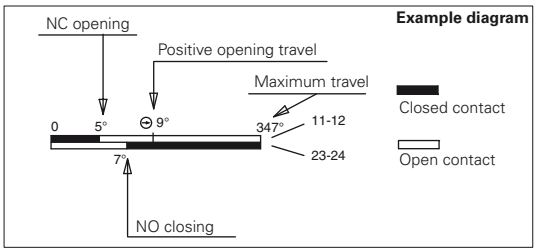
Contact type:

L = slow action
LO = slow action make before break

Contact block		Metal housing Stainless steel actuator	Metal housing Stainless steel actuator	Metal housing Stainless steel actuator
				
18	L	FD 1895-M2 → 1NO+1NC	FL 1895-M2 → 1NO+1NC	
				
7	LO	FD 795-M2 → 1NO+1NC	FL 795-M2 → 1NO+1NC	
9	L	FD 995-M2 → 2NC	FL 995-M2 → 2NC	
				
20	L	FD 2095-M2 → 1NO+2NC	FL 2095-M2 → 1NO+2NC	
				
21	L	FD 2195-M2 → 3NC	FL 2195-M2 → 3NC	
22	L	FD 2295-M2 → 2NO+1NC	FL 2295-M2 → 2NO+1NC	
				
33	L	FD 3395-M2 → 1NO+1NC	FL 3395-M2 → 1NO+1NC	FC 3395-M2 → 1NO+1NC
				
34	L	FD 3495-M2 → 2NC	FL 3495-M2 → 2NC	FC 3495-M2 → 2NC
Actuating force		0.15 Nm (0.4 Nm →)	0.15 Nm (0.4 Nm →)	0.15 Nm (0.4 Nm →)

How to read travel diagrams

All values in the diagrams are in degrees



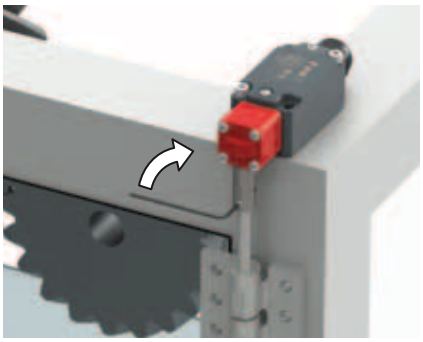
IMPORTANT:

In **safety applications**, actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol →. Actuate the switch **at least with the positive opening force**, reported in brackets below each article, next to the actuating force value.

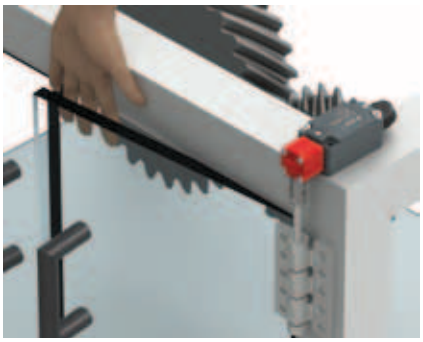
Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

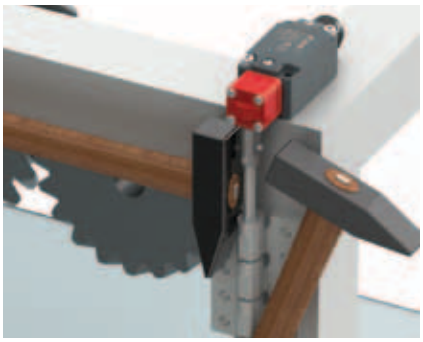
Adjustment of the switching point



Temporary locking of the actuator
(stud screw provided).

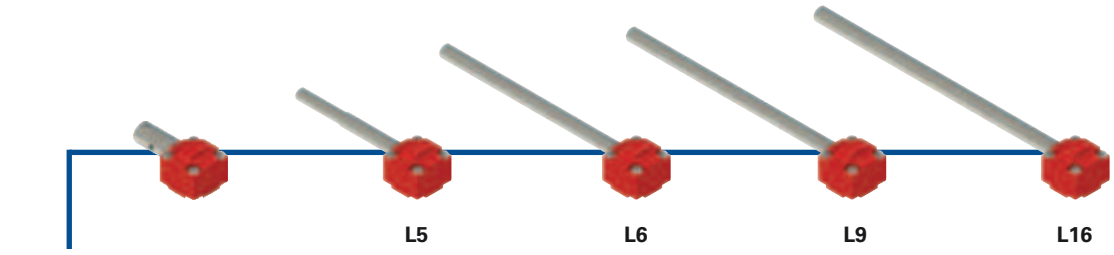


Verify the switching point according to
EN ISO 13857 and recalibrate if necessary.

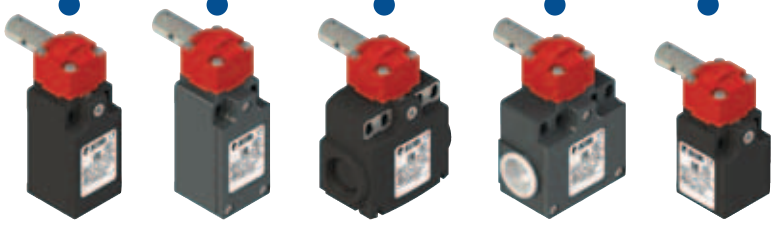


Pin the switch (pin is provided).

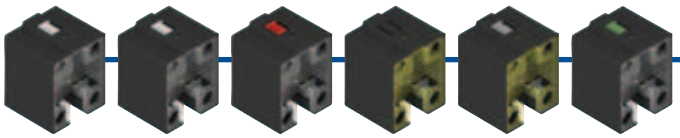
Selection diagram



ACTUATORS



CONTACT BLOCKS



5 1NO+1NC snap action

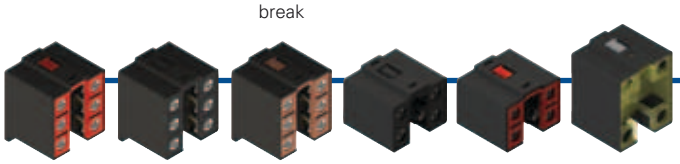
6 1NO+1NC slow action

7 1NO+1N slow action, make before break

9 2NC slow action

14 2NC slow action, shifted

18 1NO+1NC slow action, close



20 1NO+2NC slow action

21 3NC slow action

22 2NO+1NC slow action

33 1NO+1NC slow action

34 2NC slow action

66 1NC slow action

CONDUIT ENTRIES

Threaded conduit entry (standard)

With cable gland

With M12 plastic connector

With M12 metal connector

product option

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options | options

FR 1896-XGL16M2K70T6

Housing

FR	technopolymer, one conduit entry
FM	metal, one conduit entry
FX	technopolymer, two conduit entries
FZ	metal, two conduit entries

Contact block

5	1NO+1NC, snap action
6	1NO+1NC, slow action
7	1NO+1NC, slow action, make before break
9	2NC, slow action
14	2NC, slow action, shifted
18	1NO+1NC, slow action, close
20	1NO+2NC, slow action
21	3NC, slow action
22	2NO+1NC, slow action
33	1NO+1NC, slow action
34	2NC, slow action
66	1NC, slow action

External metallic parts

	zinc-plated steel (standard)
X	stainless steel

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 22, 33, 34)

Actuator design

	actuator with hole (standard)
L5	Ø8x69 mm, tapered Ø6.9
L6	Ø8x120 mm
L9	Ø8x140 mm
L16	Ø8.7x165 mm, stainless steel

Threaded conduit entry

M2	M20x1.5 (standard)
M1	M16x1.5 (FR-FX housing only)
	PG 13.5
A	PG 11 (FR-FX housing only)

Ambient temperature

	-25°C … +80°C (standard)
T6	-40°C … +80°C

Pre-installed cable glands or connectors

	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
...	.....
K70	M12 plastic connector, 4-pole
...	.....

For the complete list of possible combinations please contact our technical department.

article | options | options

FK 3396-XGL16M1K24T6

Housing

FK	technopolymer, one conduit entry

Contact block

33	1NO+1NC, slow action
34	2NC, slow action

External metallic parts

	zinc-plated steel (standard)
X	stainless steel

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating

Actuator design

	actuator with hole (standard)
L5	Ø8x69 mm, tapered Ø6.9
L6	Ø8x120 mm
L9	Ø8x140 mm
L16	Ø8.7x165 mm, stainless steel

Threaded conduit entry

M1	M16x1.5 (standard)
	PG11

Ambient temperature

	-25°C … +80°C (standard)
T6	-40°C … +80°C

Pre-installed cable glands

	no cable gland (standard)
K24	cable gland for cables Ø 5 … 10°mm
K28	cable gland for cables Ø 3 … 7°mm

Main features

- Metal housing or technopolymer housing, from one to two conduit entries
- Protection degree IP67
- 12 contact blocks available
- Versions with M12 connector
- Versions with gold-plated silver contacts
- Versions with stainless steel external metallic parts

Technical data

Housing

FR, FX and FK series housing made of glass fibre reinforced technopolymer, self-extinguishing, shock-proof and with double insulation: ⧈

FM and FZ series: metal housing, baked powder coating.

FR, FM series: one threaded conduit entry:	M20x1.5 (standard)
FK series: one threaded conduit entry:	M16x1.5 (standard)
FX series: two knock-out threaded conduit entries:	M20x1.5 (standard)
FZ series: two threaded conduit entries:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Mechanical interlock, not coded:	type 1 acc. to EN ISO 14119
Safety parameters:	
B_{10D}:	5,000,00 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Max. actuation frequency:	3600 operating cycles/hour
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	180°/s
Min. actuation speed:	2°/s
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 22, 33, 34:	min. 1 x 0.34 mm² (1 x AWG 22) max. 2 x 1.5 mm² (2 x AWG 16)
Contact blocks 5, 6, 7, 9, 14, 18, 66:	min. 1 x 0.5 mm² (1 x AWG 20) max. 2 x 2.5 mm² (2 x AWG 14)

Quality marks:

IMQ approval:	EG610 (FR-FX-FK series) EG609 (FM-FZ series)
UL approval:	E131787
CCC approval:	2007010305230013 (FR-FX-FK series) 2007010305229998 (FM-FZ series)
EAC approval:	RU C-IT.АД35.B.00454

In compliance with standards:

IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, UL 508, CSA 22.2 No.14.

Approvals:

IEC 60947-5-1, UL 508, CSA 22.2 No.14 , GB14048.5-2001.

Compliance with the requirements of:

Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.

Positive contact opening in conformity with standards:

IEC 60947-5-1, EN 60947-5-1.

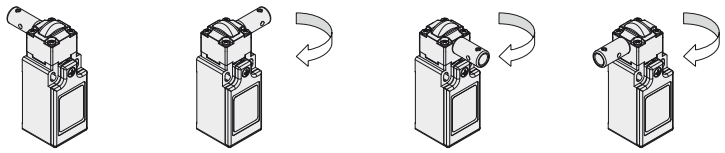
⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

	Electrical data		Utilization category
without connector	Thermal current (I_{th}):	10 A	
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 22, 33, 34)	Alternating current: AC15 (50÷60 Hz) U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 22, 33, 34)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250
	Protection against short circuits:	type aM fuse 10 A 500 V	I_e (A) 6 1.1 0.4
	Pollution degree:	3	
with M12 connector 4 and 5-pole	Thermal current (I_{th}):	4 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 120 250 I_e (A) 4 4 4
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	
	Protection against short circuits:	type gG fuse 4 A 500 V	Direct current: DC13
	Pollution degree:	3	U_e (V) 24 125 250 I_e (A) 4 1.1 0.4
with M12 connector 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 I_e (A) 2
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	
	Protection against short circuits:	type gG fuse 2 A 500 V	Direct current: DC13
	Pollution degree:	3	U_e (V) 24 I_e (A) 2

Description

These safety switches are designed to monitor gates or doors that safeguard dangerous parts of machines without inertia. They are very sensitive, open the contacts after few degrees of rotation and immediately send the stop signal. The head, which can be turned in 90° steps, enables installation in multiple positions. Available with technopolymer or metal housings, with protection degree IP67. The special design allows it to be used even under operating conditions in which dust and dirt could inhibit the operation of normal safety switches with separate actuator.

Head with variable orientation



For all switches, the head can be adjusted in 90° steps after removing the four fastening screws. This allows you to use the same switch on both right- and left-facing door fronts.

Protection degree IP67

IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

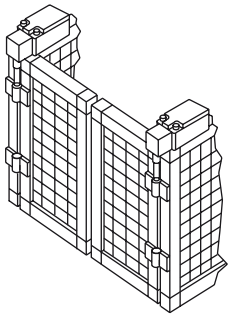
Extended temperature range

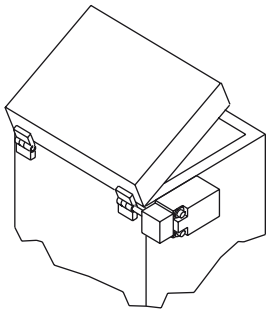
-40°C

These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C.

They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

Application examples





Adjustable switching point

When installing the device, the contact switching point can be adjusted over the entire 360° range. By fixing the stud screw, it is possible to check the correct setting of the activation angle and quickly and easily adjust it if necessary. Once adjustment is complete, you can render the device tamper-proof against commonly used tools using the supplied lock pin.

Features approved by IMQ

Rated insulation voltage (U_i):	500 Vac 400 Vac (for contact blocks 20, 21, 22, 33, 34)
Conventional free air thermal current (I_{th}):	10 A
Protection against short circuits:	type aM fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (for contact blocks 20, 21, 22, 33, 34)
Protection degree of the housing:	IP67
MV terminals (screw terminals)	
Pollution degree:	3
Utilization category:	AC15
Operating voltage (U_e):	400 Vac (50 Hz)
Operating current (I_e):	3 A

Forms of the contact element: Zb, Y+Y, Y+Y+X, Y+Y+Y, Y+X+X

Positive opening contacts on contact blocks 5, 6, 7, 9, 14, 18, 20, 21, 22, 33, 34, 66.

In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories	Q300 (69 VA, 125-250 Vdc) A600 (720 VA, 120-600 Vac)

Housing features type 1, 4X "indoor use only", 12, 13

For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).

In compliance with standard: UL 508, CSA 22.2 No.14

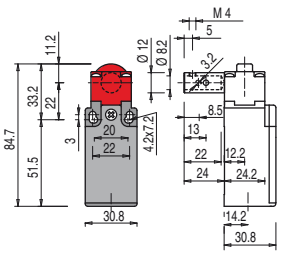
Please contact our technical department for the list of approved products.

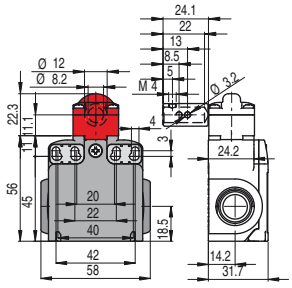
Dimensional drawings

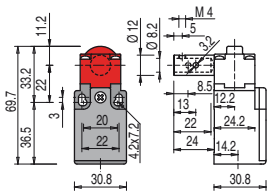
All values in the drawings are in mm

Contact type:

R = snap action
L = slow action
LO = slow action make before break
LS = slow action shifted



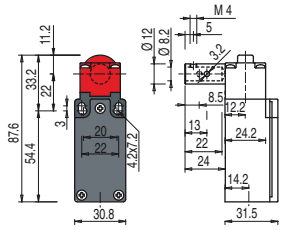


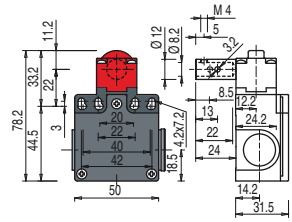


Contact block		Technopolymer housing	Technopolymer housing	Technopolymer housing
5	R	FR 596-M2 → 1NO+1NC	FX 596-M2 → 1NO+1NC	
6	L	FR 696-M2 → 1NO+1NC	FX 696-M2 → 1NO+1NC	
7	LO	FR 796-M2 → 1NO+1NC	FX 796-M2 → 1NO+1NC	
9	L	FR 996-M2 → 2NC	FX 996-M2 → 2NC	
14	LS	FR 1496-M2 → 2NC	FX 1496-M2 → 2NC	
18	L	FR 1896-M2 → 1NO+1NC	FX 1896-M2 → 1NO+1NC	
20	L	FR 2096-M2 → 1NO+2NC	FX 2096-M2 → 1NO+2NC	
21	L	FR 2196-M2 → 3NC	FX 2196-M2 → 3NC	
22	L	FR 2296-M2 → 2NO+1NC	FX 2296-M2 → 2NO+1NC	
33	L	FR 3396-M2 → 1NO+1NC	FX 3396-M2 → 1NO+1NC	FK 3396-M1 → 1NO+1NC
34	L	FR 3496-M2 → 2NC	FX 3496-M2 → 2NC	FK 3496-M1 → 2NC
66	L	FR 6696-M2 → 1NC	FX 6696-M2 → 1NC	
Actuating force		0.15 Nm (0.4 Nm →)	0.15 Nm (0.4 Nm →)	0.15 Nm (0.4 Nm →)
Travel diagrams		page 318 - group 9	page 318 - group 9	page 318 - group 9

Contact type:

R = snap action
L = slow action
LO = slow action make before break
LS = slow action shifted





Contact block		Metal housing	Metal housing
5	R	FM 596-M2 → 1NO+1NC	FZ 596-M2 → 1NO+1NC
6	L	FM 696-M2 → 1NO+1NC	FZ 696-M2 → 1NO+1NC
7	LO	FM 796-M2 → 1NO+1NC	FZ 796-M2 → 1NO+1NC
9	L	FM 996-M2 → 2NC	FZ 996-M2 → 2NC
14	LS	FM 1496-M2 → 2NC	FZ 1496-M2 → 2NC
18	L	FM 1896-M2 → 1NO+1NC	FZ 1896-M2 → 1NO+1NC
20	L	FM 2096-M2 → 1NO+2NC	FZ 2096-M2 → 1NO+2NC
21	L	FM 2196-M2 → 3NC	FZ 2196-M2 → 3NC
22	L	FM 2296-M2 → 2NO+1NC	FZ 2296-M2 → 2NO+1NC
33	L	FM 3396-M2 → 1NO+1NC	FZ 3396-M2 → 1NO+1NC
34	L	FM 3496-M2 → 2NC	FZ 3496-M2 → 2NC
66	L	FM 6696-M2 → 1NC	FZ 6696-M2 → 1NC
Actuating force		0.15 Nm (0.4 Nm →)	0.15 Nm (0.4 Nm →)
Travel diagrams		page 318 - group 9	page 318 - group 9

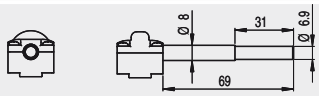
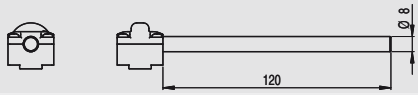
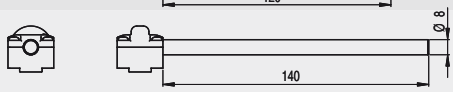
Items with code on **green** background are stock items

Accessories See page 299

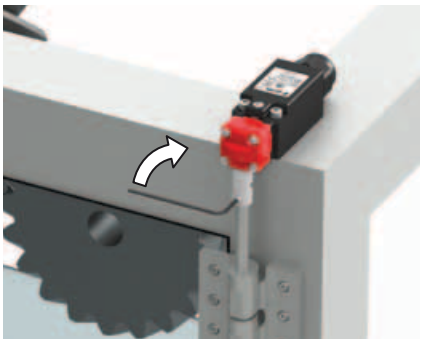
→ The 2D and 3D files are available at **www.pizzato.com**

Dimensional drawings for actuators

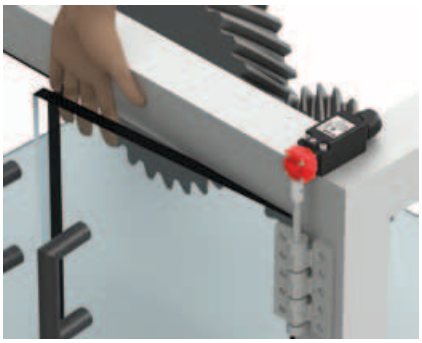
All values in the drawings are in mm

Option	Drawing
L5	
L6	
L9	
L16	

Adjustment of the switching point



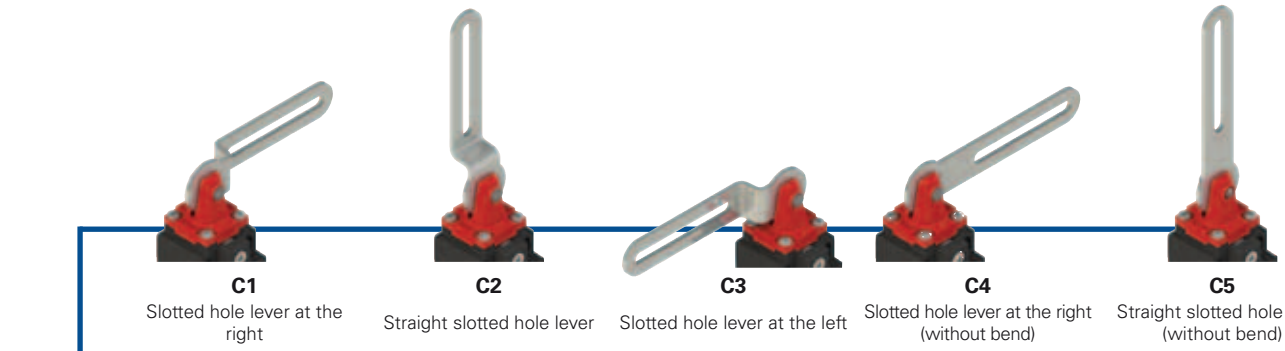
Temporary locking of the actuator (stud screw provided).



Verify the switching point according to EN ISO 13857 and recalibrate if necessary.

Pin the switch (pin is provided).

Selection diagram



C1
Slotted hole lever at the right

C2
Straight slotted hole lever

C3
Slotted hole lever at the left

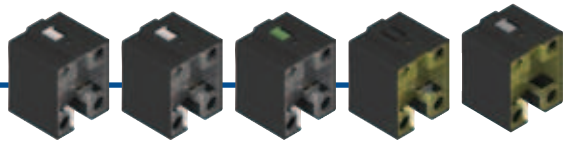
C4
Slotted hole lever at the right (without bend)

C5
Straight slotted hole lever (without bend)

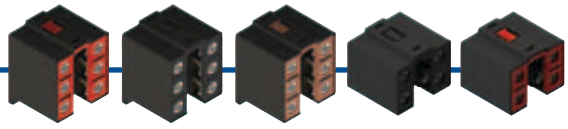
ACTUATORS

FR **FM** **FX** **FZ** **FK**

CONTACT BLOCKS



5 1NO+1NC snap action
6 1NO+1NC slow action
18 1NO+1NC slow action
9 2NC slow action
66 1NC slow action



20 1NO+2N slow action
21 3NC slow action
22 2NO+1NC slow action
33 1NO+1NC slow action
34 2NC slow action

CONDUIT ENTRIES

Threaded conduit entry (standard)
With cable gland
With M12 plastic connector
With M12 metal connector

product options

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options | options

FR 18C1-GM2K70T6

Housing	
FR	technopolymer, one conduit entry
FM	metal, one conduit entry
FX	technopolymer, two conduit entries
FZ	metal, two conduit entries

Contact block	
18	1NO+1NC, slow action
5	1NO+1NC, snap action
6	1NO+1NC, slow action
9	2NC, slow action
20	1NO+2NC, slow action
21	3NC, slow action
22	2NO+1NC, slow action
33	1NO+1NC, slow action
34	2NC, slow action
66	1NC, slow action

Actuators	
C1	slotted hole lever at the right
C2	straight slotted hole lever
C3	slotted hole lever at the left
C4	slotted hole lever at the right (without bend)
C5	straight slotted hole lever (without bend)

Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 22, 33, 34)

Threaded conduit entry	
M2	M20x1.5 (standard)
M1	M16x1.5 (FR-FX housing only)
	PG 13.5
A	PG 11 (FR-FX housing only)

Pre-installed cable glands or connectors	
	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
...	.....
K70	M12 plastic connector, 4-pole
...	.....

For the complete list of possible combinations please contact our technical department.

Ambient temperature	
	-25°C … +80°C (standard)
T6	-40°C … +80°C

article | options | options

FK 33C1-GM1K24T6

Housing	
FK	technopolymer, one conduit entry

Contact block	
33	1NO+1NC, slow action
34	2NC, slow action

Actuators	
C1	slotted hole lever at the right
C2	straight slotted hole lever
C3	slotted hole lever at the left
C4	slotted hole lever at the right (without bend)
C5	straight slotted hole lever (without bend)

Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating

Threaded conduit entry	
M1	M16x1.5 (standard)
	PG 11

Pre-installed cable glands	
	no cable gland (standard)
K24	cable gland for cables Ø 5 … 10°mm
K28	cable gland for cables Ø 3 … 7°mm

Ambient temperature	
	-25°C … +80°C (standard)
T6	-40°C … +80°C

Safety switches **with slotted hole lever**

Main features
- Metal housing or technopolymer housing, from one to two conduit entries
- Protection degree IP67
- 10 contact blocks available
- Versions with M12 connector
- Versions with gold-plated silver contacts

Technical data

Housing
FR, FX and FK series housing made of glass fibre reinforced technopolymer, self-extinguishing, shock-proof and with double insulation: ⧈
FM and FZ series: metal housing, baked powder coating.

FR, FM series: one threaded conduit entry:	M20x1.5 (standard)
FK series: one threaded conduit entry:	M16x1.5 (standard)
FX series: two knock-out threaded conduit entries:	M20x1.5 (standard)
FZ series: two threaded conduit entries:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Mechanical interlock, not coded:	type 1 acc. to EN ISO 14119
Safety parameters:	
B_{10D}:	2,000,000 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Max. actuation frequency:	3600 operating cycles/hour
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	180°/s
Min. actuation speed:	2°/s
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 22, 33, 34:	min. 1 x 0.34 mm² (1 x AWG 22) max. 2 x 1.5 mm² (2 x AWG 16)
Contact blocks 5, 7, 9, 18:	min. 1 x 0.5 mm² (1 x AWG 20) max. 2 x 2.5 mm² (2 x AWG 14)

Quality marks:

IMQ approval:	EG610 (FR-FX-FK series) EG609 (FM-FZ series)
UL approval:	E131787
CCC approval:	2007010305230013 (FR-FX-FK series) 2007010305229998 (FM-FZ series)
EAC approval:	RU C-IT.АД35.B.00454

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, UL 508, CSA 22.2 No.14
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 No.14 , GB14048.5-2001.

Compliance with the requirements of:
Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

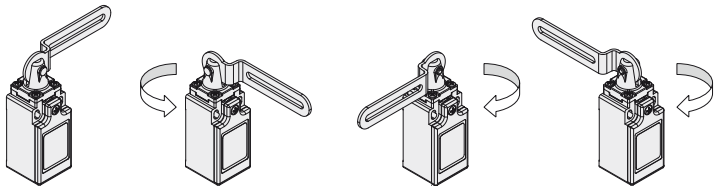
⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

	Electrical data		Utilization category
without connector	Thermal current (I_{th}):	10 A	
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 22, 33, 34)	Alternating current: AC15 (50÷60 Hz) U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 22, 33, 34)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250
	Protection against short circuits:	type aM fuse 10 A 500 V	I_e (A) 6 1.1 0.4
	Pollution degree:	3	
with M12 connector 4 and 5-pole	Thermal current (I_{th}):	4 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 120 250 I_e (A) 4 4 4
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	Direct current: DC13
	Protection against short circuits:	type gG fuse 4 A 500 V	U_e (V) 24 125 250
	Pollution degree:	3	I_e (A) 4 1.1 0.4
with M12 connector 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 I_e (A) 2
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	Direct current: DC13
	Protection against short circuits:	type gG fuse 2 A 500 V	U_e (V) 24
	Pollution degree:	3	I_e (A) 2

Description

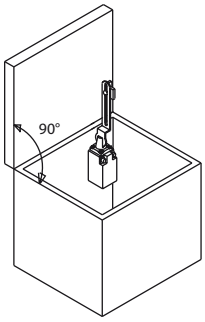
These safety switches are used to control gates or doors with hinges protecting dangerous parts of machines without inertia. Easy to install, they do not need the interaction with the hinge of the guard. They are very sensitive, open the contacts after few degrees of rotation and immediately send the stop signal.

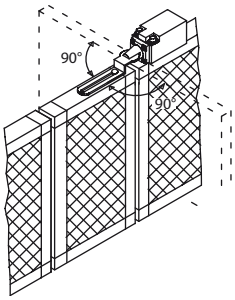
Head with variable orientation



For all switches, the head can be adjusted in 90° steps after removing the four fastening screws. This allows you to use the same switch on both right- and left-facing door fronts.

Application examples





Protection degree IP67

IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

Extended temperature range

-40°C

These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C.

They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

Features approved by IMQ

Rated insulation voltage (U_i):	500 Vac 400 Vac (for contact blocks 20, 21, 22, 33, 34)
Conventional free air thermal current (I_{th}):	10 A
Protection against short circuits:	type aM fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (for contact blocks 20, 21, 22, 33, 34)
Protection degree of the housing:	IP67

MV terminals (screw terminals)

Pollution degree:	3
Utilization category:	AC15
Operating voltage (U_e):	400 Vac (50 Hz)
Operating current (I_e):	3 A

Forms of the contact element: Zb, Y+Y, Y+Y+X, Y+Y+Y, Y+X+X

Positive opening contacts on contact blocks 5, 7, 9, 18, 20, 21, 22, 33, 34, 66
In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories	Q300 (69 VA, 125-250 Vdc) A600 (720 VA, 120-600 Vac)

Housing features type 1, 4X "indoor use only", 12, 13
For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).

In compliance with standard: UL 508, CSA 22.2 No.14

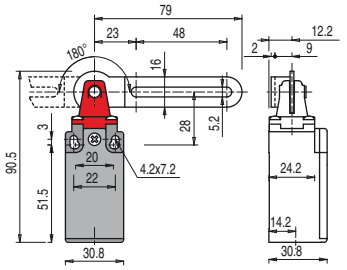
Please contact our technical department for the list of approved products.

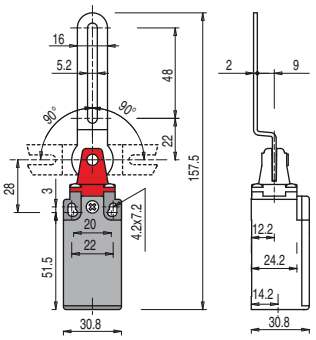
Dimensional drawings

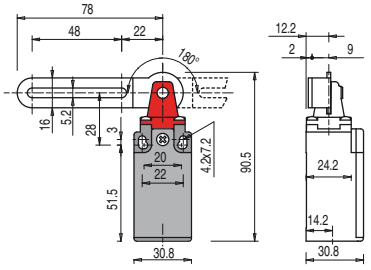
All values in the drawings are in mm

Contact type:

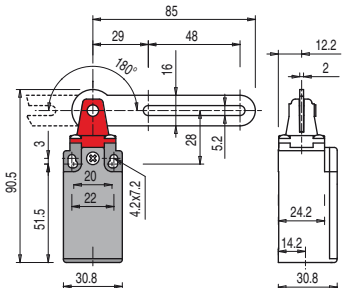
R = snap action
L = slow action
LA = slow action close

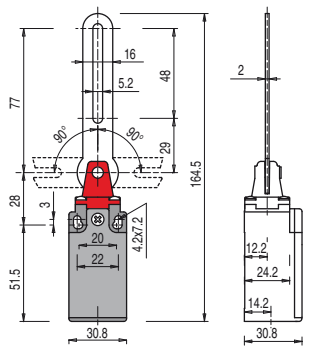






Contact block				
5	R	FR 5C1-M2 → 1NO+1NC	FR 5C2-M2 → 1NO+1NC	FR 5C3-M2 → 1NO+1NC
6	L	FR 6C1-M2 → 1NO+1NC	FR 6C2-M2 → 1NO+1NC	FR 6C3-M2 → 1NO+1NC
9	L	FR 9C1-M2 → 2NC	FR 9C2-M2 → 2NC	FR 9C3-M2 → 2NC
18	LA	FR 18C1-M2 → 1NO+1NC	FR 18C2-M2 → 1NO+1NC	FR 18C3-M2 → 1NO+1NC
20	L	FR 20C1-M2 → 1NO+2NC	FR 20C2-M2 → 1NO+2NC	FR 20C3-M2 → 1NO+2NC
21	L	FR 21C1-M2 → 3NC	FR 21C2-M2 → 3NC	FR 21C3-M2 → 3NC
22	L	FR 22C1-M2 → 2NO+1NC	FR 22C2-M2 → 2NO+1NC	FR 22C3-M2 → 2NO+1NC
33	L	FR 33C1-M2 → 1NO+1NC	FR 33C2-M2 → 1NO+1NC	FR 33C3-M2 → 1NO+1NC
34	L	FR 34C1-M2 → 2NC	FR 34C2-M2 → 2NC	FR 34C3-M2 → 2NC
66	L	FR 66C1-M2 → 1NC	FR 66C2-M2 → 1NC	FR 66C3-M2 → 1NC
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)
Travel diagrams		page 320 - group 10	page 320 - group 11	page 320 - group 10





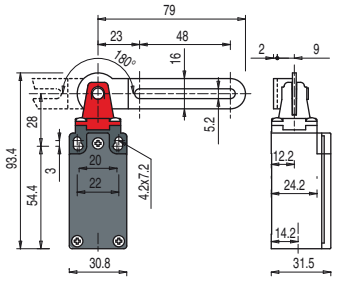
Contact block				
5	R	FR 5C4-M2 → 1NO+1NC	FR 5C5-M2 → 1NO+1NC	
6	L	FR 6C4-M2 → 1NO+1NC	FR 6C5-M2 → 1NO+1NC	
9	L	FR 9C4-M2 → 2NC	FR 9C5-M2 → 2NC	
18	LA	FR 18C4-M2 → 1NO+1NC	FR 18C5-M2 → 1NO+1NC	
20	L	FR 20C4-M2 → 1NO+2NC	FR 20C5-M2 → 1NO+2NC	
21	L	FR 21C4-M2 → 3NC	FR 21C5-M2 → 3NC	
22	L	FR 22C4-M2 → 2NO+1NC	FR 22C5-M2 → 2NO+1NC	
33	L	FR 33C4-M2 → 1NO+1NC	FR 33C5-M2 → 1NO+1NC	
34	L	FR 34C4-M2 → 2NC	FR 34C5-M2 → 2NC	
66	L	FR 66C4-M2 → 1NC	FR 66C5-M2 → 1NC	
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	
Travel diagrams		page 320 - group 10	page 320 - group 11	

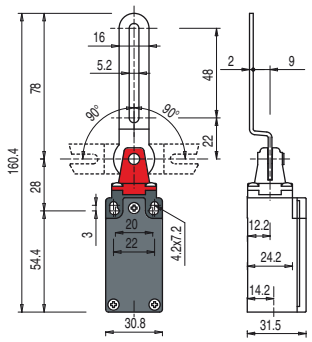
Accessories See page 299

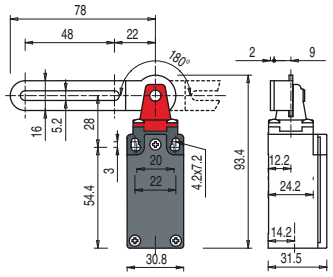
→ The 2D and 3D files are available at **www.pizzato.com**

Contact type:

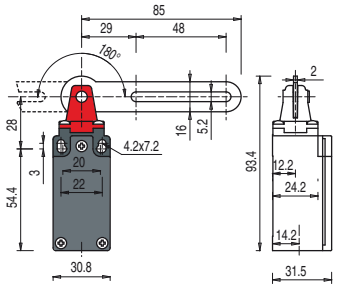
R = snap action
L = slow action
LA = slow action close

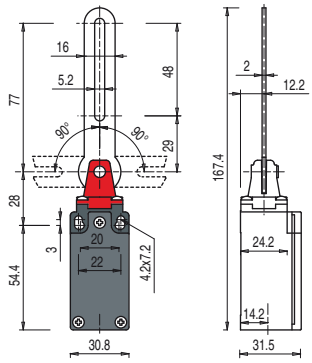






Contact block				
5	R	FM 5C1-M2 → 1NO+1NC	FM 5C2-M2 → 1NO+1NC	FM 5C3-M2 → 1NO+1NC
6	L	FM 6C1-M2 → 1NO+1NC	FM 6C2-M2 → 1NO+1NC	FM 6C3-M2 → 1NO+1NC
9	L	FM 9C1-M2 → 2NC	FM 9C2-M2 → 2NC	FM 9C3-M2 → 2NC
18	LA	FM 18C1-M2 → 1NO+1NC	FM 18C2-M2 → 1NO+1NC	FM 18C3-M2 → 1NO+1NC
20	L	FM 20C1-M2 → 1NO+2NC	FM 20C2-M2 → 1NO+2NC	FM 20C3-M2 → 1NO+2NC
21	L	FM 21C1-M2 → 3NC	FM 21C2-M2 → 3NC	FM 21C3-M2 → 3NC
22	L	FM 22C1-M2 → 2NO+1NC	FM 22C2-M2 → 2NO+1NC	FM 22C3-M2 → 2NO+1NC
33	L	FM 33C1-M2 → 1NO+1NC	FM 33C2-M2 → 1NO+1NC	FM 33C3-M2 → 1NO+1NC
34	L	FM 34C1-M2 → 2NC	FM 34C2-M2 → 2NC	FM 34C3-M2 → 2NC
66	L	FM 66C1-M2 → 1NC	FM 66C2-M2 → 1NC	FM 66C3-M2 → 1NC
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)
Travel diagrams		page 320 - group 10	page 320 - group 11	page 320 - group 10





Contact block				
5	R	FM 5C4-M2 → 1NO+1NC	FM 5C5-M2 → 1NO+1NC	
6	L	FM 6C4-M2 → 1NO+1NC	FM 6C5-M2 → 1NO+1NC	
9	L	FM 9C4-M2 → 2NC	FM 9C5-M2 → 2NC	
18	LA	FM 18C4-M2 → 1NO+1NC	FM 18C5-M2 → 1NO+1NC	
20	L	FM 20C4-M2 → 1NO+2NC	FM 20C5-M2 → 1NO+2NC	
21	L	FM 21C4-M2 → 3NC	FM 21C5-M2 → 3NC	
22	L	FM 22C4-M2 → 2NO+1NC	FM 22C5-M2 → 2NO+1NC	
33	L	FM 33C4-M2 → 1NO+1NC	FM 33C5-M2 → 1NO+1NC	
34	L	FM 34C4-M2 → 2NC	FM 34C5-M2 → 2NC	
66	L	FM 66C4-M2 → 1NC	FM 66C5-M2 → 1NC	
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	
Travel diagrams		page 320 - group 10	page 320 - group 11	

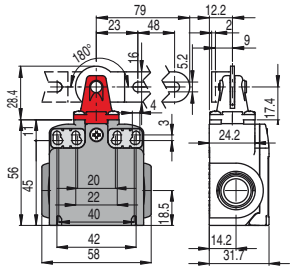
Accessories See page 299

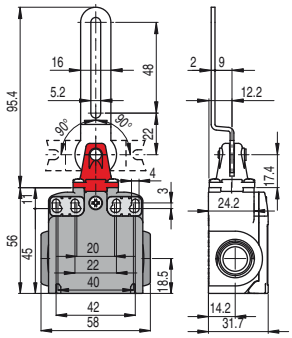
→ The 2D and 3D files are available at **www.pizzato.com**

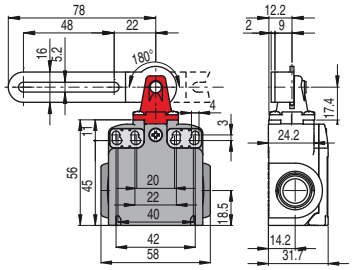
Safety switches **with slotted hole lever**

Contact type:

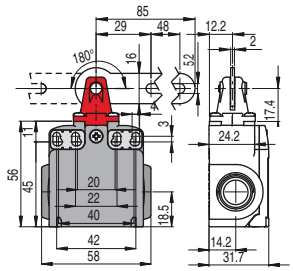
R = snap action
L = slow action
LA = slow action close

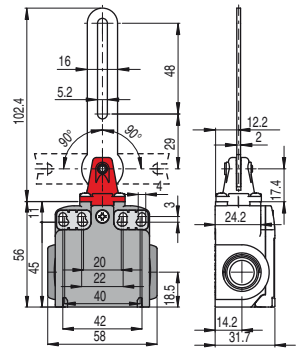






Contact block				
5	R	FX 5C1-M2 → 1NO+1NC	FX 5C2-M2 → 1NO+1NC	FX 5C3-M2 → 1NO+1NC
6	L	FX 6C1-M2 → 1NO+1NC	FX 6C2-M2 → 1NO+1NC	FX 6C3-M2 → 1NO+1NC
9	L	FX 9C1-M2 → 2NC	FX 9C2-M2 → 2NC	FX 9C3-M2 → 2NC
18	LA	FX 18C1-M2 → 1NO+1NC	FX 18C2-M2 → 1NO+1NC	FX 18C3-M2 → 1NO+1NC
20	L	FX 20C1-M2 → 1NO+2NC	FX 20C2-M2 → 1NO+2NC	FX 20C3-M2 → 1NO+2NC
21	L	FX 21C1-M2 → 3NC	FX 21C2-M2 → 3NC	FX 21C3-M2 → 3NC
22	L	FX 22C1-M2 → 2NO+1NC	FX 22C2-M2 → 2NO+1NC	FX 22C3-M2 → 2NO+1NC
33	L	FX 33C1-M2 → 1NO+1NC	FX 33C2-M2 → 1NO+1NC	FX 33C3-M2 → 1NO+1NC
34	L	FX 34C1-M2 → 2NC	FX 34C2-M2 → 2NC	FX 34C3-M2 → 2NC
66	L	FX 66C1-M2 → 1NC	FX 66C2-M2 → 1NC	FX 66C3-M2 → 1NC
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)
Travel diagrams		page 320 - group 10	page 320 - group 11	page 320 - group 10





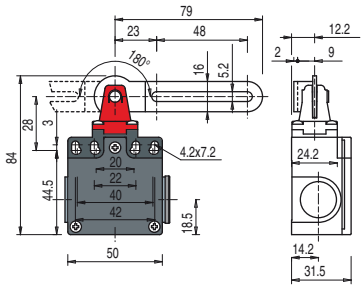
Contact block				
5	R	FX 5C4-M2 → 1NO+1NC	FX 5C5-M2 → 1NO+1NC	
6	L	FX 6C4-M2 → 1NO+1NC	FX 6C5-M2 → 1NO+1NC	
9	L	FX 9C4-M2 → 2NC	FX 9C5-M2 → 2NC	
18	LA	FX 18C4-M2 → 1NO+1NC	FX 18C5-M2 → 1NO+1NC	
20	L	FX 20C4-M2 → 1NO+2NC	FX 20C5-M2 → 1NO+2NC	
21	L	FX 21C4-M2 → 3NC	FX 21C5-M2 → 3NC	
22	L	FX 22C4-M2 → 2NO+1NC	FX 22C5-M2 → 2NO+1NC	
33	L	FX 33C4-M2 → 1NO+1NC	FX 33C5-M2 → 1NO+1NC	
34	L	FX 34C4-M2 → 2NC	FX 34C5-M2 → 2NC	
66	L	FX 66C4-M2 → 1NC	FX 66C5-M2 → 1NC	
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	
Travel diagrams		page 320 - group 10	page 320 - group 11	

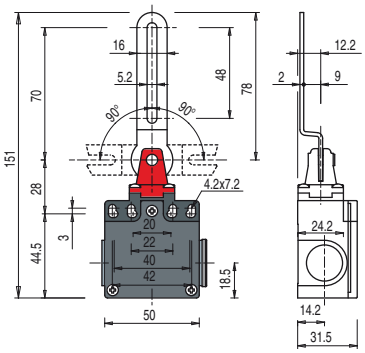
Accessories See page 299

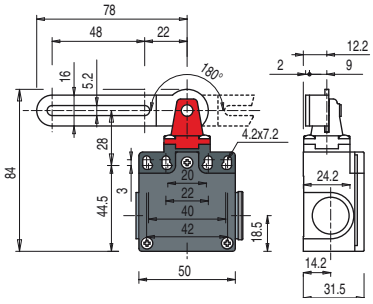
→ The 2D and 3D files are available at **www.pizzato.com**

Contact type:

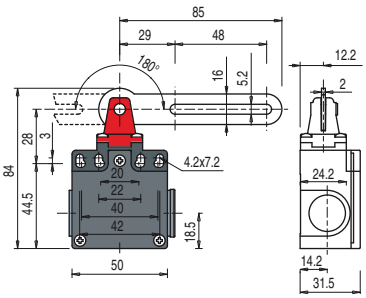
R = snap action
L = slow action
LA = slow action close

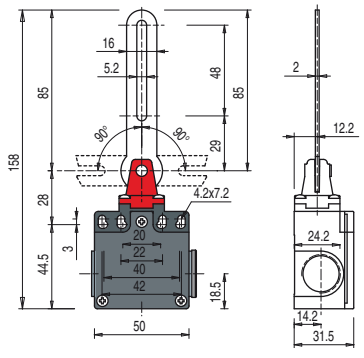






Contact block				
5	R	FZ 5C1-M2 → 1NO+1NC	FZ 5C2-M2 → 1NO+1NC	FZ 5C3-M2 → 1NO+1NC
6	L	FZ 6C1-M2 → 1NO+1NC	FZ 6C2-M2 → 1NO+1NC	FZ 6C3-M2 → 1NO+1NC
9	L	FZ 9C1-M2 → 2NC	FZ 9C2-M2 → 2NC	FZ 9C3-M2 → 2NC
18	LA	FZ 18C1-M2 → 1NO+1NC	FZ 18C2-M2 → 1NO+1NC	FZ 18C3-M2 → 1NO+1NC
20	L	FZ 20C1-M2 → 1NO+2NC	FZ 20C2-M2 → 1NO+2NC	FZ 20C3-M2 → 1NO+2NC
21	L	FZ 21C1-M2 → 3NC	FZ 21C2-M2 → 3NC	FZ 21C3-M2 → 3NC
22	L	FZ 22C1-M2 → 2NO+1NC	FZ 22C2-M2 → 2NO+1NC	FZ 22C3-M2 → 2NO+1NC
33	L	FZ 33C1-M2 → 1NO+1NC	FZ 33C2-M2 → 1NO+1NC	FZ 33C3-M2 → 1NO+1NC
34	L	FZ 34C1-M2 → 2NC	FZ 34C2-M2 → 2NC	FZ 34C3-M2 → 2NC
66	L	FZ 66C1-M2 → 1NC	FZ 66C2-M2 → 1NC	FZ 66C3-M2 → 1NC
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)
Travel diagrams		page 320 - group 10	page 320 - group 11	page 320 - group 10





Contact block				
5	R	FZ 5C4-M2 → 1NO+1NC	FZ 5C5-M2 → 1NO+1NC	
6	L	FZ 6C4-M2 → 1NO+1NC	FZ 6C5-M2 → 1NO+1NC	
9	L	FZ 9C4-M2 → 2NC	FZ 9C5-M2 → 2NC	
18	LA	FZ 18C4-M2 → 1NO+1NC	FZ 18C5-M2 → 1NO+1NC	
20	L	FZ 20C4-M2 → 1NO+2NC	FZ 20C5-M2 → 1NO+2NC	
21	L	FZ 21C4-M2 → 3NC	FZ 21C5-M2 → 3NC	
22	L	FZ 22C4-M2 → 2NO+1NC	FZ 22C5-M2 → 2NO+1NC	
33	L	FZ 33C4-M2 → 1NO+1NC	FZ 33C5-M2 → 1NO+1NC	
34	L	FZ 34C4-M2 → 2NC	FZ 34C5-M2 → 2NC	
66	L	FZ 66C4-M2 → 1NC	FZ 66C5-M2 → 1NC	
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	
Travel diagrams		page 320 - group 10	page 320 - group 11	

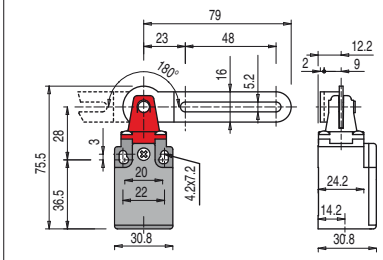
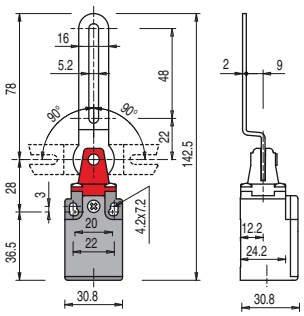
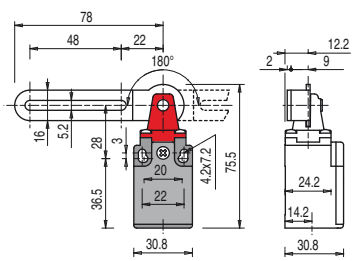
Accessories See page 299

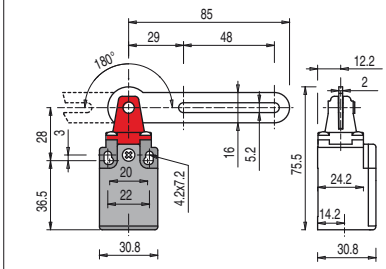
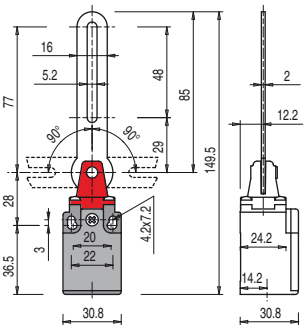
→ The 2D and 3D files are available at **www.pizzato.com**

Safety switches **with slotted hole lever**

Contact type:

L = slow action

Contact block				
				
33	L	FK 33C1-M1 → 1NO+1NC	FK 33C2-M1 → 1NO+1NC	FK 33C3-M1 → 1NO+1NC
34	L	FK 34C1-M1 → 2NC	FK 34C2-M1 → 2NC	FK 34C3-M1 → 2NC
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)
Travel diagrams		page 320 - group 10	page 320 - group 11	page 320 - group 10

Contact block				
				
33	L	FK 33C4-M1 → 1NO+1NC	FK 33C5-M1 → 1NO+1NC	
34	L	FK 34C4-M1 → 2NC	FK 34C5-M1 → 2NC	
Actuating force		0.11 Nm (0.15 Nm →)	0.11 Nm (0.15 Nm →)	
Travel diagrams		page 320 - group 10	page 320 - group 11	

Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

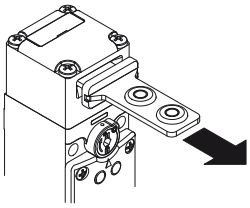
Notes

Safety switches **with solenoid and separate actuator**

Description

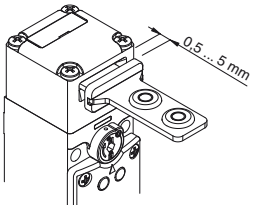
These switches are used on machines where the hazardous conditions remain for a while, even after the machines have been switched off, for example because of mechanical inertia of pulleys, saw disks, parts under pressure or with high temperatures. Thus, the switches can also be used if individual guards are only to be opened under certain conditions.
The versions with solenoid actuated NC contacts are considered interlocks with locking in accordance with ISO 14119, and the product's label is marked with the symbol shown.

Holding force of the locked actuator



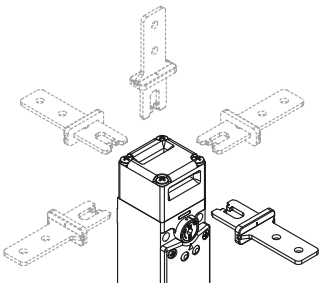
The strong interlocking system guarantees a maximum actuator holding force of F_{1max} = 2800 N.

Wide-ranging actuator travel



The actuation head of this switch features a wide range of travel. In this way the guard can oscillate along the direction of insertion (4.5 mm) without causing unwanted machine shutdowns. This wide range of travel is available in all actuators in order to ensure maximum device reliability.

Heads and devices with variable orientation

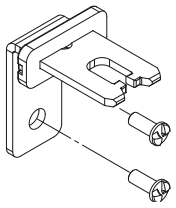


The system can be variably configured by loosening the 4 screws on the head.
The key release device and the release button can also be rotated and secured independently of one another in 4 steps of 90°. The device can thus assume 32 different configurations.

Contact blocks with 4 contacts

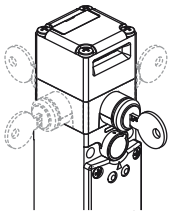
Innovative contact block with 4 contacts, available in various contact configurations for monitoring the actuator or the solenoid (patented). The unit is supplied with captive screws and self-lifting clamping plates. Removable finger protection for eyelet terminal.
High-reliability electrical contacts with 4 contact points and double interruption

Safety screws for actuators



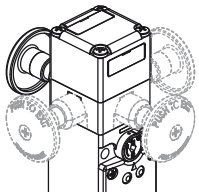
As required by EN ISO 14119, the actuator must be fixed immovably to the door frame. Pan head safety screws with one-way fitting are available for this purpose. With this screw type, the actuators cannot be removed or tampered by using common tools. See accessories on page 295.

Turnable key release with lock



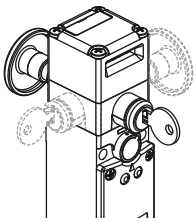
The auxiliary key release device is used to allow the maintenance or the entry into the machinery to authorized personnel only. Turning the key corresponds to actuating the solenoid: the actuator is released. The device can be turned, thereby enabling installation of the safety switch in the machine while the release device remains accessible on the outside of the guard. In this way, the switch is better protected against possible tampering and the external side/surface of the machinery remains smooth.

Emergency release button



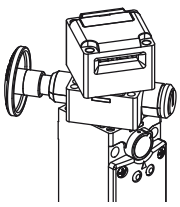
This device is used to safeguard a hazardous area that an operator may enter with his entire body. The release button, which is oriented towards the inside of the danger zone, allows the operator to escape even in the event of a power failure. Pushing the button results in the same function as the auxiliary release device. To reset the switch, simply return the button to its initial position. The emergency button can be rotated and is available with different lengths. It is fixed to the switch by means of a screw allowing the installation of the switch both inside and outside the guards.

Key release device and emergency release button



This device performs simultaneously the two functions mentioned above. The lock and button can be rotated in this case as well; the release button can be ordered with various lengths. The release button has priority over the lock, i.e., the emergency escape can be actuated to unlock the switch even if the lock is locked. To reset the switch, the lock and the button must be returned to their initial position.

Non-detachable heads and release devices



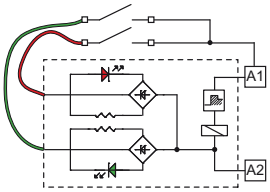
The head and the release device can be rotated but cannot be detached from each other. This makes the switch more secure since the problem of incorrect assembly by the installer cannot occur; in addition, the risk of damage is lower (loss of small parts, penetration of dirt, etc.).

LED display unit, type A

In the version with LED display unit of type A, two green LEDs are switched-on directly by the power supply of the solenoid. Wiring is not necessary.

LED display unit, types B and C

In the version with LED display unit of type B, connection wires from two LEDs are available, one green and one red. By means of suitable connections on the contact block, various operating states of the switch can be displayed externally.

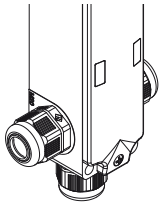


Protection degree IP67

IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

Three conduit entries



The switch is provided with three conduit entries in different directions. This allows its application in series connections or in narrow places.

Extended temperature range

-40°C

These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C.

They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

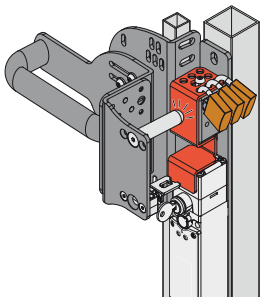
Sealable auxiliary release device

Switches with locked actuator with deactivated solenoid (function principle D) are equipped with an auxiliary release device for the solenoid to simplify installation of the switch and to facilitate entry into the danger zone in the event of a power failure. The auxiliary release device acts on the switch exactly as if the solenoid was energised. As a result, it also actuates the electrical contacts. Can only be actuated with the use of two tools; this ensures adequate protection against tampering. If necessary, it can be sealed using the appropriate hole.

Laser engraving

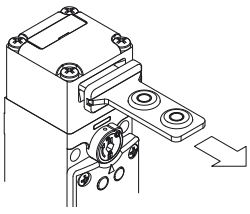
All FG series switches are permanently marked with a special laser system. As a result, the marking remains legible even under extreme operating conditions. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Access monitoring



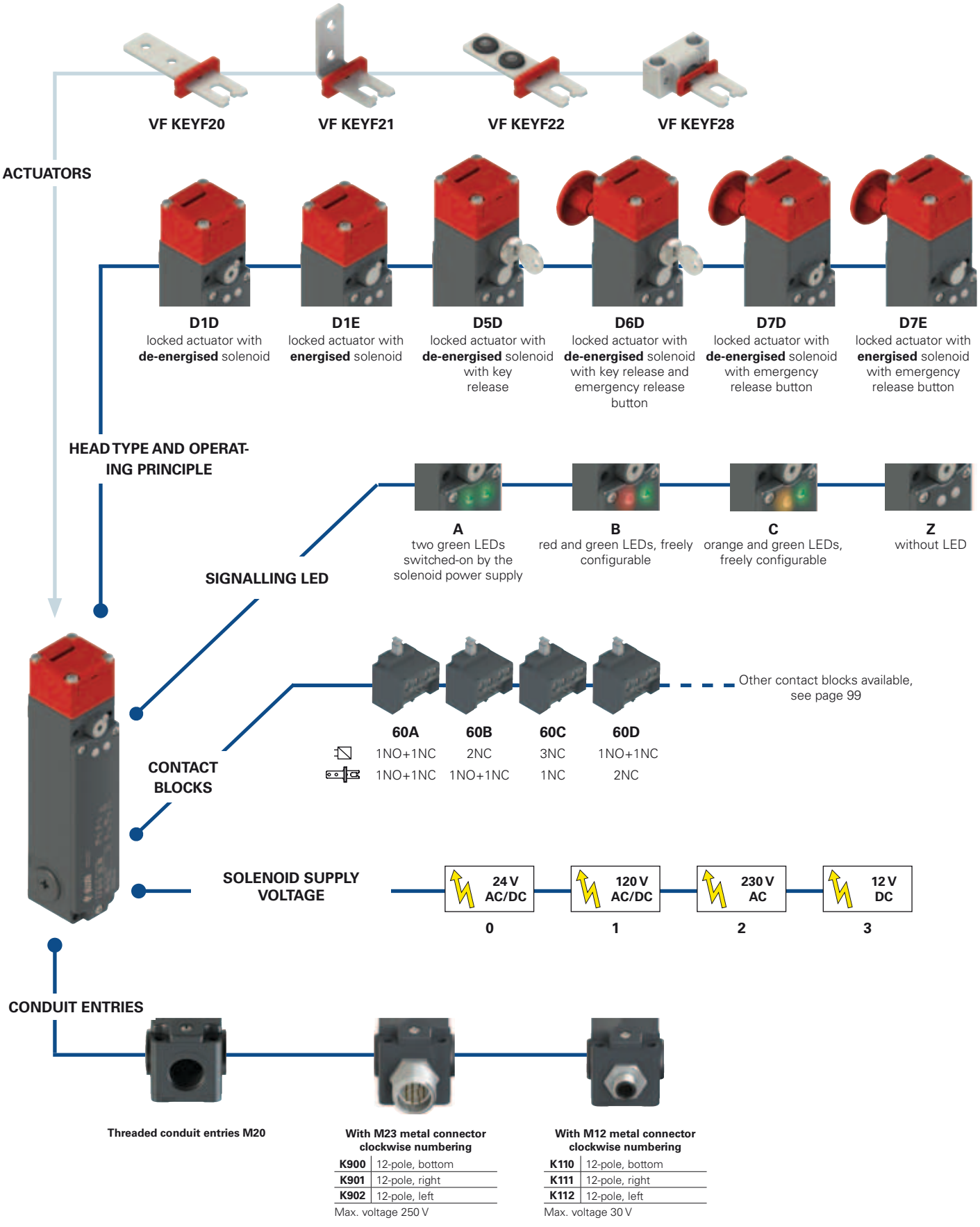
These safety switches alone do not provide sufficient personal protection to the operators or maintenance personnel in situations where they completely enter the danger zone, since unintentional closing of a door after entry could cause the machine to re-start. If the re-start release is completely dependent on these switches, a system for preventing this danger must be provided, e.g. a padlockable device for actuator entry VF KB2 (page 100) or a lockable safety handle, such as a VF AP-P11B-200P (page 153).

Holding force of the unlocked actuator



The inside of each switch features a device which holds the actuator in its closed position. Ideal for all those applications where several doors are unlocked simultaneously, but only one is actually opened. The device keeps all the unlocked doors in their position with a retaining force of 30 N~, stopping any vibrations or gusts of wind from opening them.

Selection diagram



product option

accessory sold separately

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options

FG 60AD1D0A-LP30F20GK900T6

Contact block

	Contacts activated by the solenoid	Contacts activated by the actuator
60A	1NO+1NC	1NO+1NC
60B	2NC	1NO+1NC
60C	3NC	1NC
60D	1NO+1NC	2NC
60E	1NO+2NC	1NC
60F	1NO+2NC	1NO
60G	2NC	2NC
60H	4NC	/
60I	3NC	1NO
60L	2NO+1NC	1NC
60M	2NO+1NC	1NO
60N	1NO+1NC	2NO
60P	1NC	3NC
60R	2NO+2NC	/
60S	1NC	2NO+1NC
60T	1NC	1NO+2NC
60U	/	4NC
60V	2NC	2NO
60X	1NO	3NC
60Y	1NO	1NO+2NC
61A	/	3NC+1NO
61B	/	2NC+2NO
61C	/	1NC+3NO
61D	1NC	3NO
61E	1NO	1NC+2NO
61G	2NO	1NC+1NO
61H	2NO	2NC
61M	3NO	1NC
61R	3NC+1NO	/
61S	1NC+3NO	/

Note: contact blocks 60U, 61A, 61B, 61C cannot be combined with operating principles D6D, D7D, D7E

Operating principle

D1D	locked actuator with de-energised solenoid
D1E	locked actuator with energised solenoid
D5D	locked actuator with de-energised solenoid. With key release
D6D	locked actuator with de-energised solenoid. With key release and emergency release button
D7D	locked actuator with de-energised solenoid. With emergency release button
D7E	locked actuator with energised solenoid. With emergency release button

Solenoid supply voltage

0	24 Vac/dc (-10% … +10%)
1	120 Vac/dc (-15% … +10%)
2	230 Vac (-15% … +10%)
3	12 Vdc (-15% … +20%)

Signalling LED

A	two green LEDs switched-on by the solenoid power supply
B	red and green LEDs, freely configurable
C	orange and green LEDs, freely configurable
Z	without LED

Release button length

	for max. 15 mm wall thickness (standard)
LP30	for max. 30 mm wall thickness
LP40	for max. 40 mm wall thickness
LP60	for max. 60 mm wall thickness
LPRG	adjustable, for wall thickness from 60 mm to 500 mm

Actuators

	without actuator (standard)
F20	straight actuator VF KEYF20
F21	angled actuator VF KEYF21
F22	actuator with rubber pads VF KEYF22
F28	universal actuator VF KEYF28

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating

Pre-installed connectors

	without connector (standard)
K900	M23 metal connector, 12-pole, bottom
...	...
K110	M12 metal connector, 12-pole, bottom
...	...

For the complete list of possible combinations please contact our technical department.

Ambient temperature

	-25°C … +80°C (standard)
T6	-40°C … +80°C

Safety switches **with solenoid and separate actuator**

Main features

- Actuator holding force F_{1max}: 2800 N
- 30 contact blocks with 4 contacts
- Metal housing, three M20 conduit entries
- Protection degree IP67
- Versions with key release and emergency release button
- 4 stainless steel actuators
- Head and release devices, individually turnable and non-detachable
- Signalling LED
- Operation with energised or de-energised solenoid

Quality marks:

IMQ approval:	CA02.03848
UL approval:	E131787
CCC approval:	2013010305602309
EAC approval:	RU C-IT.АД35.B.00454

Technical data

Housing

Metal head and housing, baked powder coating.	
Three threaded conduit entries:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Interlock with mechanical lock, coded:	type 2 acc. to EN ISO 14119
Coding level:	low acc. to EN ISO 14119
Safety parameters:	
B_{10D}:	5,000,000 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +60°C
Max. actuation frequency:	600 operating cycles/hour
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Maximum force before breakage F_{1max}:	2800 N acc. to EN ISO 14119
Max. holding force F_{Zh}:	2150 N acc. to EN ISO 14119
Maximum clearance of locked actuator:	4.5 mm
Released actuator extraction force:	30 N
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact block:	min. 1 x 0.34 mm² (1 x AWG 22) max. 2 x 1.5 mm² (2 x AWG 16)

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, EN 61000-6-2, EN 61000-6-3, BG-GS-ET-15, UL 508, CSA 22.2 N. 14.
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 N. 14.

Compliance with the requirements of:
Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

Solenoid

Duty cycle:	100% ED (continuous operation)
Solenoid protection 12 V:	type gG fuse 1 A
Solenoid protection 24 V:	type gG fuse 0.5 A
Solenoid protection 120 V:	fuse 315 mA, delayed
Solenoid protection 230 V:	fuse 315 mA, delayed
Solenoid consumption:	9 VA

⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

	Electrical data		Utilization category
without connector	Thermal current (I_{th}):	10 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 120 250 400 I_e (A) 6 5 3 Direct current: DC13 U_e (V) 24 125 250 I_e (A) 3 0.7 0.4
	Rated insulation voltage (U_i):	400 Vac 300 Vdc	
	Rated impulse withstand voltage (U_{imp}):	6 kV	
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	
	Protection against short circuits:	type gG fuse 10 A 500 V	
	Pollution degree:	3	
with M23 connector 12-pole	Thermal current (I_{th}):	8 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 120 250 I_e (A) 6 5 Direct current: DC13 U_e (V) 24 125 250 I_e (A) 3 0.7 0.4
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	
	Protection against short circuits:	type gG fuse 8 A 500 V	
	Pollution degree:	3	
with M12 connector 12-pole	Thermal current (I_{th}):	1.5 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 I_e (A) 1.5 Direct current: DC13 U_e (V) 24 I_e (A) 1.5
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	
	Protection against short circuits:	type gG fuse 1.5 A	
	Pollution degree:	3	

Features approved by IMQ

Rated insulation voltage (U_i):	400 Vac
Conventional free air thermal current (I_{th}):	10 A
Protection against short circuits:	type gG fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}):	6 kV
Protection degree of the housing:	IP67
MV terminals (screw terminals)	
Pollution degree:	3
Utilization category:	AC15
Operating voltage (U_e):	400 Vac (50 Hz)
Operating current (I_e):	3 A

Forms of the contact element: X+X+X+X, Y+Y+Y+Y, X+Y+Y+Y, X+X+Y+Y, X+X+X+Y

Positive opening of contacts on all contact blocks: 60A, 60B, 60C, 60D, 60E, 60F, 60G, 60H, 60I, 60L, 60M, 60N, 60P, 60R, 60S, 60T, 60U, 60V, 60X, 60Y, 61A, 61B, 61C, 61D, 61E, 61G, 61H, 61M, 61R, 61S

In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories: A300 (720 VA, 120-300 Vac)
Q300 (69 VA, 125-250 Vdc)

Housing features type 1, 4X "indoor use only", 12, 13

In compliance with standard: UL508, CSA 22.2 N. 14

Please contact our technical department for the list of approved products.

Operating principle

The operating principle of these safety switches allows three different operating states:

state A: with inserted and locked actuator

state B: with inserted but not locked actuator

state C: with extracted actuator

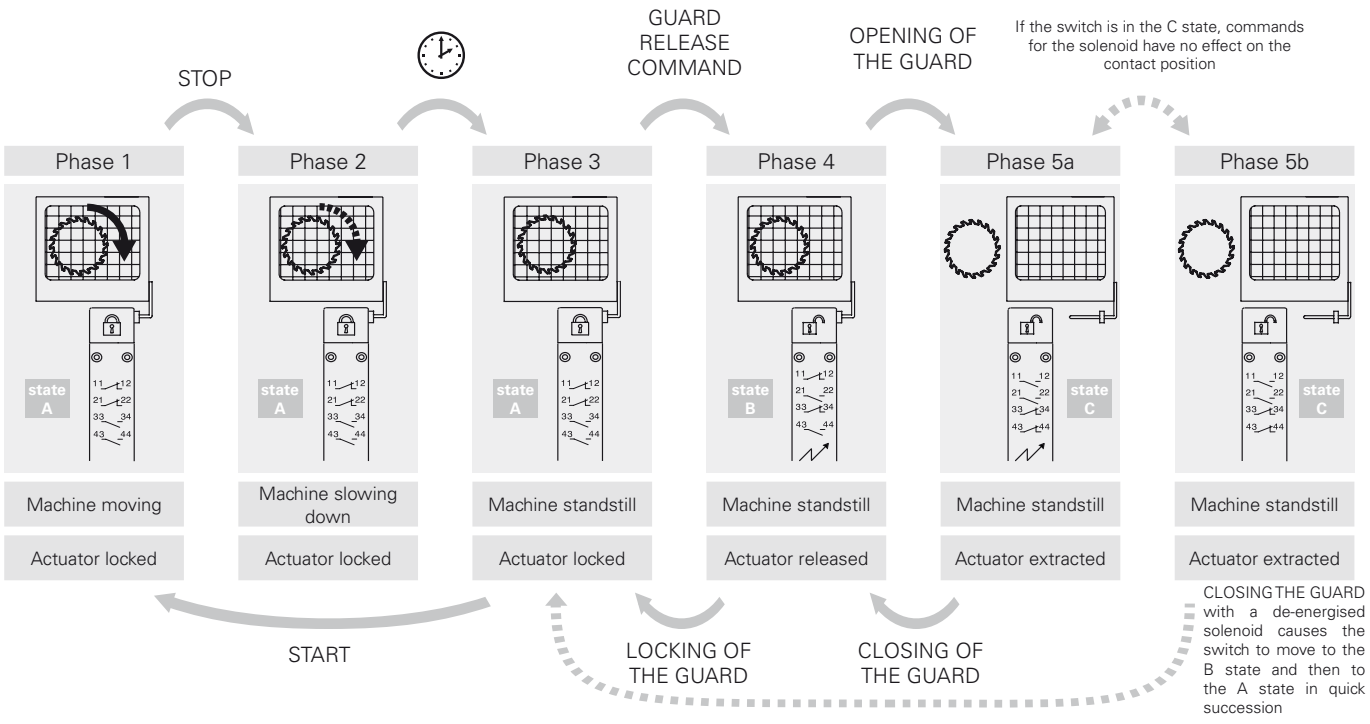
All or some of these states can be monitored by means of electrical NO contacts or NC contacts with positive opening by selecting the appropriate contact blocks. Contact blocks whose electrical contacts are marked with the solenoid symbol ( ) are actuated upon changing from state A to B, while contacts marked with the actuator symbol ( ) are actuated upon changing from state B to C.

Operating principle

Select from two operating principles for actuator locking:

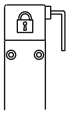
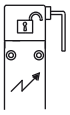
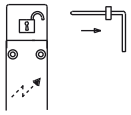
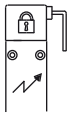
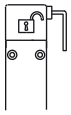
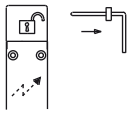
- **Operating principle D**: locked actuator with de-energised solenoid. The actuator is released by applying the power supply to the solenoid (see example of the operating phases).
- **Operating principle E**: locked actuator with energised solenoid. The actuator is released by switching off the power supply to the solenoid. This version should only be used under certain conditions, since a power failure at the system will result in the immediate opening of the guard.

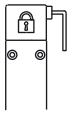
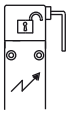
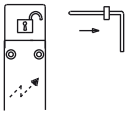
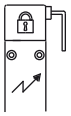
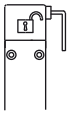
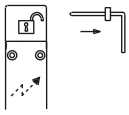
Example: operating phases with FG 60AD1D0A-F21 (switch with operating principle D)



Safety switches **with solenoid and separate actuator**

Contact positions related to switch states

Operating state	**Operating principle D** locked actuator with de-energised solenoid			**Operating principle E** locked actuator with energised solenoid		
	state A	state B	state C	state A	state B	state C
Actuator	Inserted and locked	Inserted and released	Extracted	Inserted and locked	Inserted and released	Extracted
Solenoid	De-energised	Energised	-	Energised	De-energised	-
						
FG 60A••••• 1NO+1NC controlled by the solenoid 1NO+1NC controlled by the actuator	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44
FG 60B••••• 2NC controlled by the solenoid 1NO+1NC controlled by the actuator	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44
FG 60C••••• 3NC controlled by the solenoid 1NC controlled by the actuator	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42
FG 60D••••• 1NO+1NC controlled by the solenoid 2NC controlled by the actuator	13-14 21-22 31-32 41-42	13-14 21-22 31-32 41-42	13-14 21-22 31-32 41-42	13-14 21-22 31-32 41-42	13-14 21-22 31-32 41-42	13-14 21-22 31-32 41-42
FG 60E••••• 1NO+2NC controlled by the solenoid 1NC controlled by the actuator	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44
FG 60F••••• 1NO+2NC controlled by the solenoid 1NO controlled by the actuator	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44
FG 60G••••• 2NC controlled by the solenoid 2NC controlled by the actuator	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42
FG 60H••••• 4NC controlled by the solenoid	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42
FG 60I••••• 3NC controlled by the solenoid 1NO controlled by the actuator	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44	11-12 21-22 31-32 43-44
FG 60L••••• 2NO+1NC controlled by the solenoid 1NC controlled by the actuator	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44
FG 60M••••• 2NO+1NC controlled by the solenoid 1NO controlled by the actuator	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44
FG 60N••••• 1NO+1NC controlled by the solenoid 2NO controlled by the actuator	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44	13-14 21-22 33-34 43-44
FG 60P••••• 1NC controlled by the solenoid 3NC controlled by the actuator	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42	11-12 21-22 31-32 41-42
FG 60R••••• 2NO+2NC controlled by the solenoid	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44
FG 60S••••• 1NC controlled by the solenoid 2NO+1NC controlled by the actuator	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44	11-12 21-22 33-34 43-44

Operating state	**Operating principle D** locked actuator with de-energised solenoid			**Operating principle E** locked actuator with energised solenoid		
	state A	state B	state C	state A	state B	state C
Actuator	Inserted and locked	Inserted and released	Extracted	Inserted and locked	Inserted and released	Extracted
Solenoid	De-energised	Energised	-	Energised	De-energised	-
						
FG 60T••••• 1NC controlled by the solenoid 1NO+2NC controlled by the actuator		11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44
FG 60U••••• 4NC controlled by the actuator		11-12, 21-22, 31-32, 41-42	11-12, 21-22, 31-32, 41-42	11-12, 21-22, 31-32, 41-42	11-12, 21-22, 31-32, 41-42	11-12, 21-22, 31-32, 41-42
FG 60V••••• 2NC controlled by the solenoid 2NO controlled by the actuator		11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44
FG 60X••••• 1NO controlled by the solenoid 3NC controlled by the actuator		13-14, 21-22, 31-32, 41-42	13-14, 21-22, 31-32, 41-42	13-14, 21-22, 31-32, 41-42	13-14, 21-22, 31-32, 41-42	13-14, 21-22, 31-32, 41-42
FG 60Y••••• 1NO controlled by the solenoid 1NO+2NC controlled by the actuator		11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44
FG 61A••••• 1NO+3NC controlled by the actuator		11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44
FG 61B••••• 2NO+2NC controlled by the actuator		11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44
FG 61C••••• 3NO+1NC controlled by the actuator		13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44
FG 61D••••• 1NC controlled by the solenoid 3NO controlled by the actuator		13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44
FG 61E••••• 1NO controlled by the solenoid 2NO+1NC controlled by the actuator		13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44
FG 61G••••• 2NO controlled by the solenoid 1NO+1NC controlled by the actuator		13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44
FG 61H••••• 2NO controlled by the solenoid 2NC controlled by the actuator		11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44	11-12, 21-22, 33-34, 43-44
FG 61M•••• 3NO controlled by the solenoid 1NC controlled by the actuator		13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44
FG 61R••••• 1NO+3NC controlled by the solenoid		11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44	11-12, 21-22, 31-32, 43-44
FG 61S••••• 3NO+1NC controlled by the solenoid		13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44	13-14, 21-22, 33-34, 43-44

Safety switches **with solenoid and separate actuator**

Dimensional drawings

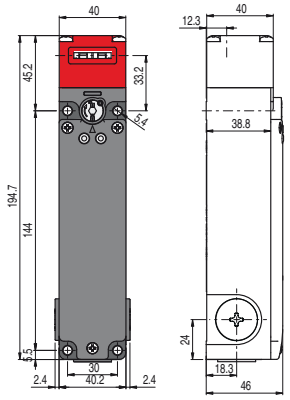
All values in the drawings are in mm

Contact type:

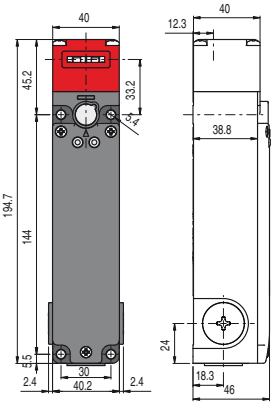
L = slow action

Contact block

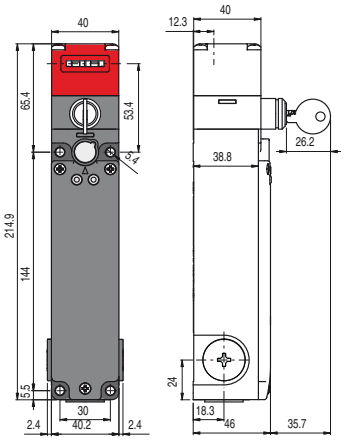
Operating principle D, with sealable auxiliary release device, without actuator



Operating principle E, without actuator



Operating principle D, with key release, without actuator



60A	L	FG 60AD1D0A		1NO+1NC	1NO+1NC	FG 60AD1E0A		1NO+1NC	1NO+1NC	FG 60AD5D0A		1NO+1NC	1NO+1NC
60B	L	FG 60BD1D0A		2NC	1NO+1NC	FG 60BD1E0A		2NC	1NO+1NC	FG 60BD5D0A		2NC	1NO+1NC
60C	L	FG 60CD1D0A		3NC	1NC	FG 60CD1E0A		3NC	1NC	FG 60CD5D0A		3NC	1NC
60D	L	FG 60DD1D0A		1NO+1NC	2NC	FG 60DD1E0A		1NO+1NC	2NC	FG 60DD5D0A		1NO+1NC	2NC
60E	L	FG 60ED1D0A		1NO+2NC	1NC	FG 60ED1E0A		1NO+2NC	1NC	FG 60ED5D0A		1NO+2NC	1NC
60F	L	FG 60FD1D0A		1NO+2NC	1NO	FG 60FD1E0A		1NO+2NC	1NO	FG 60FD5D0A		1NO+2NC	1NO
60G	L	FG 60GD1D0A		2NC	2NC	FG 60GD1E0A		2NC	2NC	FG 60GD5D0A		2NC	2NC
60H	L	FG 60HD1D0A		4NC	/	FG 60HD1E0A		4NC	/	FG 60HD5D0A		4NC	/
60I	L	FG 60ID1D0A		3NC	1NO	FG 60ID1E0A		3NC	1NO	FG 60ID5D0A		3NC	1NO
60L	L	FG 60LD1D0A		2NO+1NC	1NC	FG 60LD1E0A		2NO+1NC	1NC	FG 60LD5D0A		2NO+1NC	1NC
60M	L	FG 60MD1D0A		2NO+1NC	1NO	FG 60MD1E0A		2NO+1NC	1NO	FG 60MD5D0A		2NO+1NC	1NO
60N	L	FG 60ND1D0A		1NO+1NC	2NO	FG 60ND1E0A		1NO+1NC	2NO	FG 60ND5D0A		1NO+1NC	2NO
60P	L	FG 60PD1D0A		1NC	3NC	FG 60PD1E0A		1NC	3NC	FG 60PD5D0A		1NC	3NC
60R	L	FG 60RD1D0A		2NO+2NC	/	FG 60RD1E0A		2NO+2NC	/	FG 60RD5D0A		2NO+2NC	/
60S	L	FG 60SD1D0A		1NC	2NO+1NC	FG 60SD1E0A		1NC	2NO+1NC	FG 60SD5D0A		1NC	2NO+1NC
60T	L	FG 60TD1D0A		1NC	1NO+2NC	FG 60TD1E0A		1NC	1NO+2NC	FG 60TD5D0A		1NC	1NO+2NC
60U	L	FG 60UD1D0A			4NC	FG 60UD1E0A			4NC	FG 60UD5D0A			4NC
60V	L	FG 60VD1D0A		2NC	2NO	FG 60VD1E0A		2NC	2NO	FG 60VD5D0A		2NC	2NO
60X	L	FG 60XD1D0A		1NO	3NC	FG 60XD1E0A		1NO	3NC	FG 60XD5D0A		1NO	3NC
60Y	L	FG 60YD1D0A		1NO	1NO+2NC	FG 60YD1E0A		1NO	1NO+2NC	FG 60YD5D0A		1NO	1NO+2NC
61A	L	FG 61AD1D0A			3NC+1NO	FG 61AD1E0A			3NC+1NO	FG 61AD5D0A			3NC+1NO
61B	L	FG 61BD1D0A			2NC+2NO	FG 61BD1E0A			2NC+2NO	FG 61BD5D0A			2NC+2NO
61C	L	FG 61CD1D0A			1NC+3NO	FG 61CD1E0A			1NC+3NO	FG 61CD5D0A			1NC+3NO
61D	L	FG 61DD1D0A		1NC	3NO	FG 61DD1E0A		1NC	3NO	FG 61DD5D0A		1NC	3NO
61E	L	FG 61ED1D0A		1NO	1NC+2NO	FG 61ED1E0A		1NO	1NC+2NO	FG 61ED5D0A		1NO	1NC+2NO
61G	L	FG 61GD1D0A		2NO	1NC+1NO	FG 61GD1E0A		2NO	1NC+1NO	FG 61GD5D0A		2NO	1NC+1NO
61H	L	FG 61HD1D0A		2NO	2NC	FG 61HD1E0A		2NO	2NC	FG 61HD5D0A		2NO	2NC
61M	L	FG 61MD1D0A		3NO	1NC	FG 61MD1E0A		3NO	1NC	FG 61MD5D0A		3NO	1NC
61R	L	FG 61RD1D0A		3NC+1NO		FG 61RD1E0A		3NC+1NO		FG 61RD5D0A		3NC+1NO	
61S	L	FG 61SD1D0A		1NC+3NO		FG 61SD1E0A		1NC+3NO		FG 61SD5D0A		1NC+3NO	
Actuating force		30 N (60 N ⊖)				30 N (60 N ⊖)				30 N (60 N ⊖)			
Travel diagrams		page 99 - group 1				page 99 - group 1				page 99 - group 1			

Legend: ⊖ With positive opening according to EN 60947-5-1, interlock with lock monitoring acc. to EN ISO 14119

Items with code on **green** background are stock items

Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

Contact type:

L = slow action

Contact block

		Operating principle D, with key release, emergency release button, without actuator			Operating principle D, with emergency release button, without actuator			Operating principle E, with emergency release button, without actuator		
60A	L	FG 60AD6D0A	1NO+1NC	1NO+1NC	FG 60AD7D0A	1NO+1NC	1NO+1NC	FG 60AD7E0A	1NO+1NC	1NO+1NC
60B	L	FG 60BD6D0A	2NC	1NO+1NC	FG 60BD7D0A	2NC	1NO+1NC	FG 60BD7E0A	2NC	1NO+1NC
60C	L	FG 60CD6D0A	3NC	1NC	FG 60CD7D0A	3NC	1NC	FG 60CD7E0A	3NC	1NC
60D	L	FG 60DD6D0A	1NO+1NC	2NC	FG 60DD7D0A	1NO+1NC	2NC	FG 60DD7E0A	1NO+1NC	2NC
60E	L	FG 60ED6D0A	1NO+2NC	1NC	FG 60ED7D0A	1NO+2NC	1NC	FG 60ED7E0A	1NO+2NC	1NC
60F	L	FG 60FD6D0A	1NO+2NC	1NO	FG 60FD7D0A	1NO+2NC	1NO	FG 60FD7E0A	1NO+2NC	1NO
60G	L	FG 60GD6D0A	2NC	2NC	FG 60GD7D0A	2NC	2NC	FG 60GD7E0A	2NC	2NC
60H	L	FG 60HD6D0A	4NC	/	FG 60HD7D0A	4NC	/	FG 60HD7E0A	4NC	/
60I	L	FG 60ID6D0A	3NC	1NO	FG 60ID7D0A	3NC	1NO	FG 60ID7E0A	3NC	1NO
60L	L	FG 60LD6D0A	2NO+1NC	1NC	FG 60LD7D0A	2NO+1NC	1NC	FG 60LD7E0A	2NO+1NC	1NC
60M	L	FG 60MD6D0A	2NO+1NC	1NO	FG 60MD7D0A	2NO+1NC	1NO	FG 60MD7E0A	2NO+1NC	1NO
60N	L	FG 60ND6D0A	1NO+1NC	2NO	FG 60ND7D0A	1NO+1NC	2NO	FG 60ND7E0A	1NO+1NC	2NO
60P	L	FG 60PD6D0A	1NC	3NC	FG 60PD7D0A	1NC	3NC	FG 60PD7E0A	1NC	3NC
60R	L	FG 60RD6D0A	2NO+2NC	/	FG 60RD7D0A	2NO+2NC	/	FG 60RD7E0A	2NO+2NC	/
60S	L	FG 60SD6D0A	1NC	2NO+1NC	FG 60SD7D0A	1NC	2NO+1NC	FG 60SD7E0A	1NC	2NO+1NC
60T	L	FG 60TD6D0A	1NC	1NO+2NC	FG 60TD7D0A	1NC	1NO+2NC	FG 60TD7E0A	1NC	1NO+2NC
60V	L	FG 60VD6D0A	2NC	2NO	FG 60VD7D0A	2NC	2NO	FG 60VD7E0A	2NC	2NO
60X	L	FG 60XD6D0A	1NO	3NC	FG 60XD7D0A	1NO	3NC	FG 60XD7E0A	1NO	3NC
60Y	L	FG 60YD6D0A	1NO	1NO+2NC	FG 60YD7D0A	1NO	1NO+2NC	FG 60YD7E0A	1NO	1NO+2NC
61D	L	FG 61DD6D0A	1NC	3NO	FG 61DD7D0A	1NC	3NO	FG 61DD7E0A	1NC	3NO
61E	L	FG 61ED6D0A	1NO	1NC+2NO	FG 61ED7D0A	1NO	1NC+2NO	FG 61ED7E0A	1NO	1NC+2NO
61G	L	FG 61GD6D0A	2NO	1NC+1NO	FG 61GD7D0A	2NO	1NC+1NO	FG 61GD7E0A	2NO	1NC+1NO
61H	L	FG 61HD6D0A	2NO	2NC	FG 61HD7D0A	2NO	2NC	FG 61HD7E0A	2NO	2NC
61M	L	FG 61MD6D0A	3NO	1NC	FG 61MD7D0A	3NO	1NC	FG 61MD7E0A	3NO	1NC
61R	L	FG 61RD6D0A	3NC+1NO		FG 61RD7D0A	3NC+1NO		FG 61RD7E0A	3NC+1NO	
61S	L	FG 61SD6D0A	1NC+3NO		FG 61SD7D0A	1NC+3NO		FG 61SD7E0A	1NC+3NO	
Actuating force		30 N (60 N →)			30 N (60 N →)			30 N (60 N →)		
Travel diagrams		page 99 - group 1			page 99 - group 1			page 99 - group 1		

Items with code on **green** background are stock items

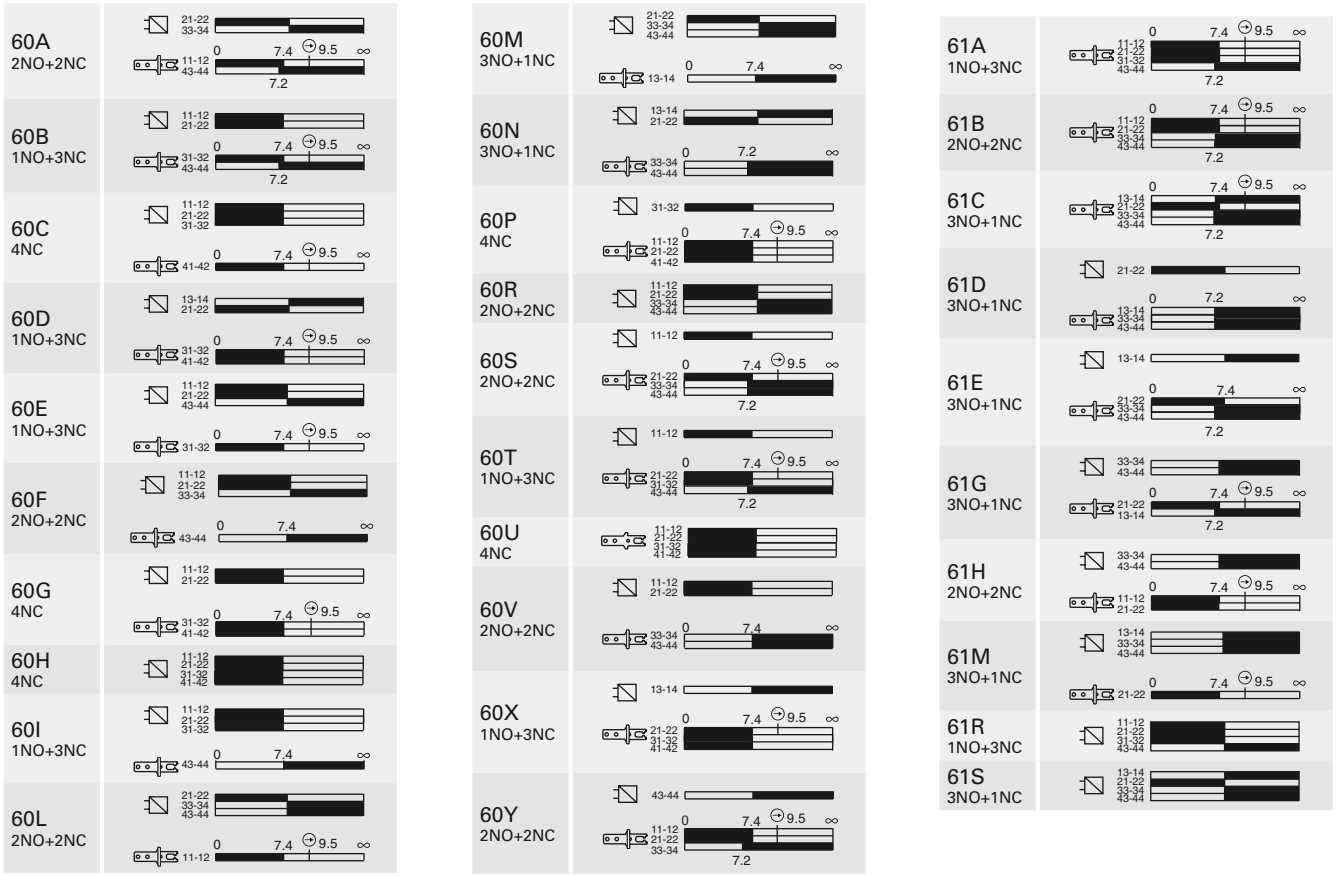
Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

Safety switches **with solenoid and separate actuator**

Travel diagrams table

All values in the drawings are in mm



Legend:

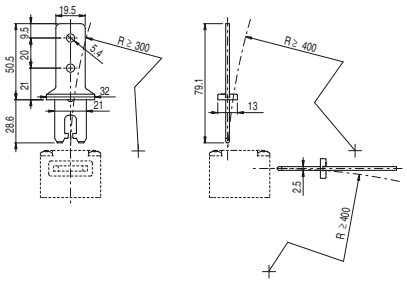
- Closed contact
- Open contact
- Contacts activated by the actuator
- Contacts activated by the solenoid
- Positive opening travel

Stainless steel actuators

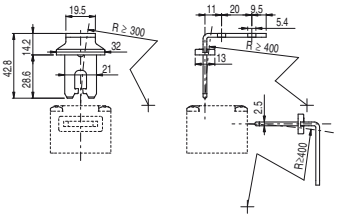
All values in the drawings are in mm

IMPORTANT: These actuators can be used only with items of the FG series (e.g. FG 60AD1D0A).
Low level of coding acc. to EN ISO 14119.

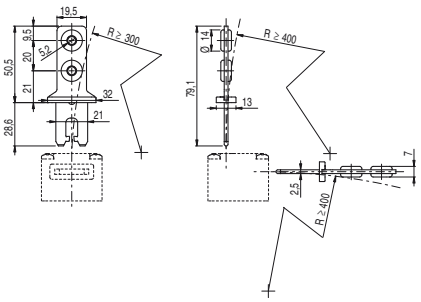
Article	Description
VF KEYF20	Straight actuator



Article	Description
VF KEYF21	Angled actuator



Article	Description
VF KEYF22	Actuator with rubber pads



Items with code on **green** background are stock items

Accessories See page 299

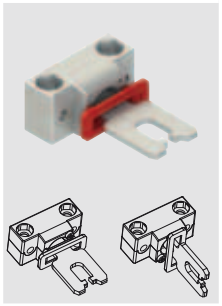
→ The 2D and 3D files are available at **www.pizzato.com**

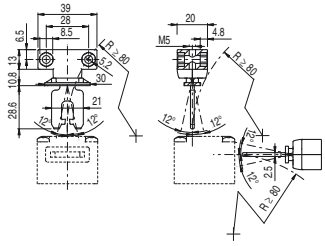
Universal actuator VF KEYF28

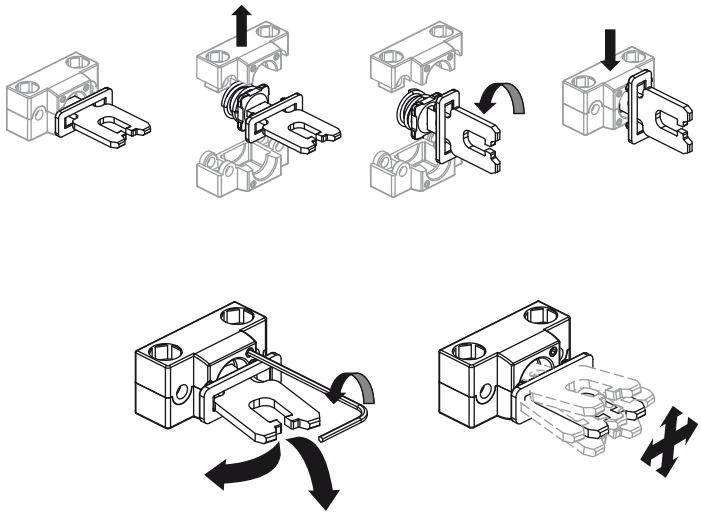
All values in the drawings are in mm

IMPORTANT: These actuators can be used only with items of the FG series (e.g. FG 60AD1D0A).
Low level of coding acc. to EN ISO 14119.

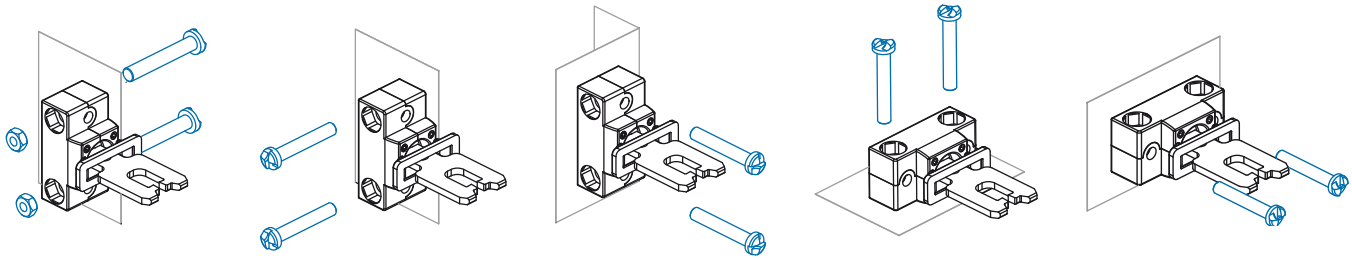
Article	Description
VF KEYF28	Universal actuator







Actuator adjustable in two dimensions for small doors; can be mounted in various positions.
The fixing block has two pairs of bore holes; it is provided for rotating the working plane of the actuator by 90°.



Accessories for sealing

Pliers, wire and lead seals are needed for applications in which it is required that the manual release devices be sealed (versions D1D and D7D only).

Article	Description
VF FSPB-200	Pack of 200 lead seals
VF FSPB-10	Pack of 10 lead seals

Article	Description
VF FSFI-400	400 metre wire roll
VF FSFI-10	10 metre wire roll

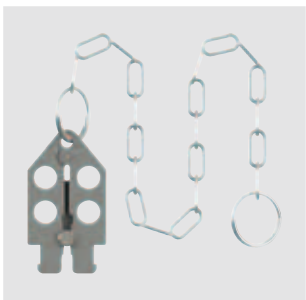
Article	Description
VF FSPZ	Pliers without logo

Limits of use

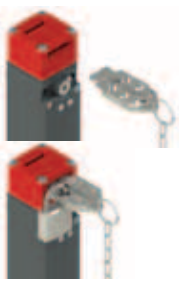
Do not use where dust and dirt may penetrate in any way into the head and deposit there. Especially not where powder, shavings, concrete or chemicals are sprayed. Adhere to the EN ISO 14119 requirements regarding low level of coding for interlocks. Do not use in environments with presence of explosive or flammable gas. In these case use ATEX products (see dedicated Pizzato catalogue).

Accessories

Article	Description
VF KB2	Actuator entry locking device



Padlockable device for locking the actuator entry (patented) to prevent the accidental closing of the door behind operators while they are in the danger area. To be used only with FG series switches (e.g. FG 60AD1D0A). Hole diameter for padlocks: 9 mm.



Article	Description
VF KLA371	Set of two locking keys

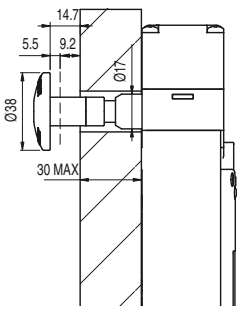
Extra copy of the locking keys to be purchased if further keys are needed (standard supply: 2 units).
The keys of all switches have the same code. Other codes on request.

Items with code on **green** background are stock items

Accessories See page 299

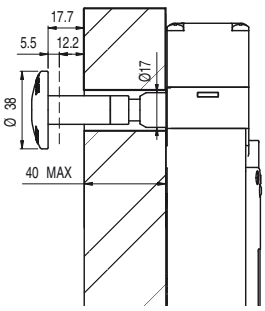
➔ The 2D and 3D files are available at **www.pizzato.com**

Other release button lengths



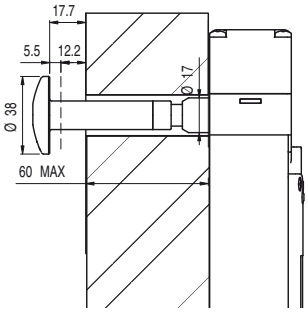
-LP30

For wall thickness
15 … 30 mm



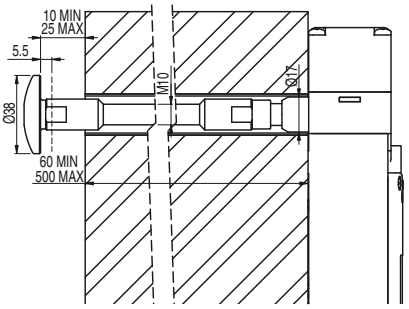
-LP40

For wall thickness
30 … 40 mm



-LP60

For wall thickness
40 … 60 mm



-LPRG

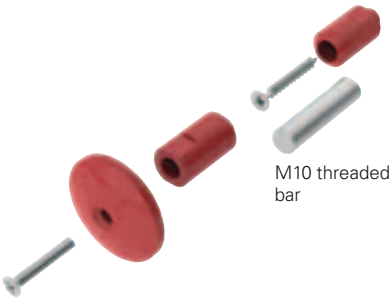
For wall thickness
60 … 500 mm

- Avoid bending and twisting the release button.
- To guarantee correct device operation, keep a distance of 10 … 25 mm between the wall and the release button.
- The actuation path of the release button must always be kept clean. Dirt or chemical products could compromise the device operation.
- Periodically check the device for proper function.

- Avoid bending and twisting the release button.
- On the inside of the wall, use a bushing or a tube with an inner diameter of 18±0.5 mm as a guide.
- Guide in the M10 threaded rod in such as way so as to prevent bending. The M10 threaded rod is not supplied with the device.
- Use medium-strength thread locker to secure the threaded rod.
- Do not exceed an overall length of 500 mm between the release button and the switch.
- To guarantee correct device operation, keep a distance of 10 … 25 mm between the wall and the release button.
- The actuation path of the release button must always be kept clean. Dirt or chemical products could compromise the device operation.
- Periodically check the device for proper function.

Release button

Article	Description
VF FG-LP15	Technopolymer release button for max. 15 mm wall thickness, supplied with screw
VF FG-LP30	Technopolymer release button for max. 30 mm wall thickness, supplied with screw
VF FG-LP40	Technopolymer release button for max. 40 mm wall thickness, supplied with screw
VF FG-LP60	Metal release button for max. 60 mm wall thickness, supplied with screw



M10 threaded bar

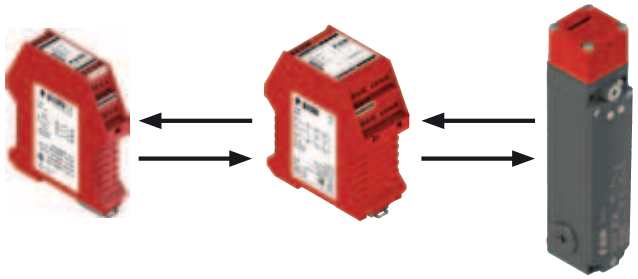
Article	Description
VF FG-LPRG	Metal release button for wall thickness from 60 to 500 mm, supplied with 2 supports and 2 screws, without M10 threaded bar

The M10 bar can be supplied in zinc-plated steel with 1 m length. Article: AC 8512.

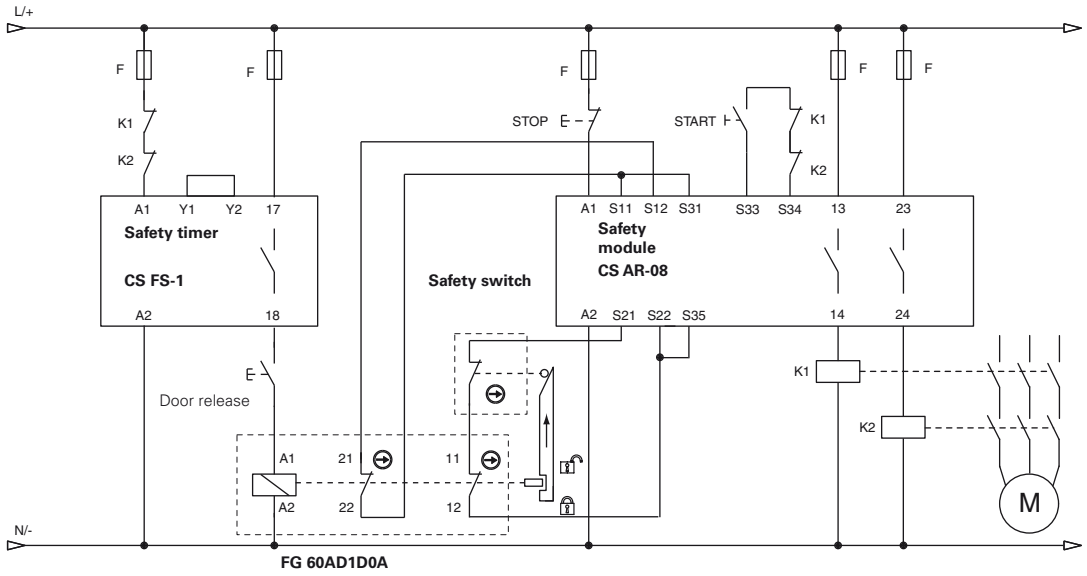
Safety modules

Pizzato Elettrica offers its customers a wide range of safety modules. These were developed taking into consideration typical problems encountered during the monitoring of safety switches under actual operating conditions. Safety modules with instantaneous or delayed contacts for emergency circuits of type 0 (immediate stop) or type 1 (controlled stop).

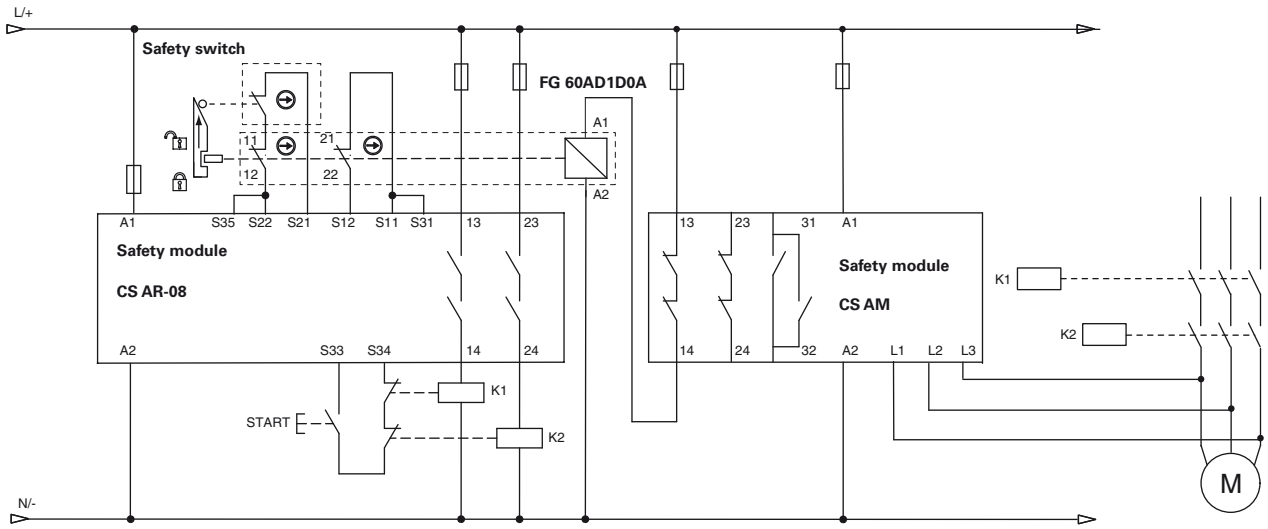
Safety switches with solenoid of the FG series can be connected to safety modules for the realization of safety circuits up to PL e acc. to EN ISO 13849. For technical information or wiring diagrams, please contact our technical office.



Application example with safety timer



Application example with safety module for standstill monitoring



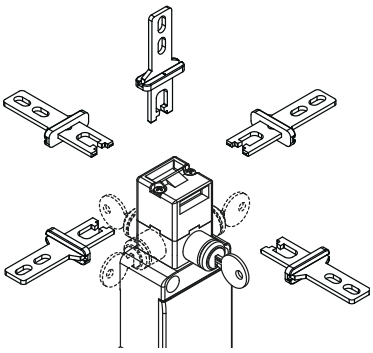
Safety switches **with solenoid and separate actuator**

Description

These switches are used on machines where the hazardous conditions remain for a while, even after the machines have been switched off, for example because of mechanical inertia of pulleys, saw disks, parts under pressure or with high temperatures. Thus, the switches can also be used if individual guards are only to be opened under certain conditions.

The versions with solenoid actuated NC contacts are considered interlocks with locking in accordance with ISO 14119, and the product's label is marked with the symbol shown.

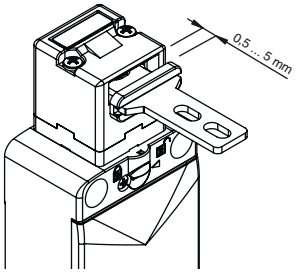
Head and release devices with variable orientation



The head can be quickly turned to each of the four sides of the switch by unfastening the two fastening screws.

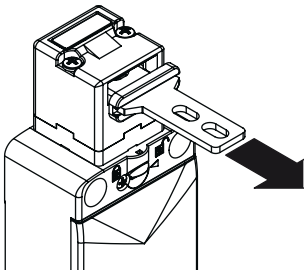
The auxiliary key release device can be rotated in 90° steps as well. This enables the switch to assume 32 different configurations.

Wide-ranging actuator travel



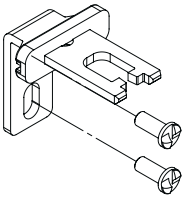
The actuation head of this switch features a wide range of travel. In this way the guard can oscillate along the direction of insertion (4.5 mm) without causing unwanted machine shutdowns. This wide range of travel is available in all actuators in order to ensure maximum device reliability.

Holding force of the locked actuator



The strong interlocking system guarantees a maximum actuator holding force of F_{1max} = 1100 N (head 96).

Safety screws for actuators



As required by EN ISO 14119, the actuator must be fixed immovably to the door frame. Pan head safety screws with one-way fitting are available for this purpose. With this screw type, the actuators cannot be removed or tampered by using common tools. See accessories on page 308.

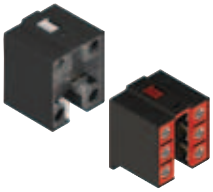
Protection degree IP67

IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529.

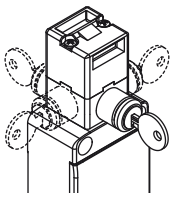
They can therefore be used in all environments where maximum protection degree of the housing is required.

Contact block



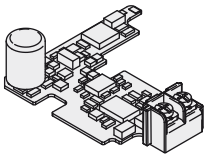
Contact blocks with captive screws, finger protection, twin bridge contacts and double interruption for higher contact reliability. Versions with gold-plated contacts available. Available in multiple variants with actuation by actuator or by solenoid.

Turnable key release with lock



The auxiliary key release device is used to allow the maintenance or the entry into the machinery to authorized personnel only. Turning the key corresponds to actuating the solenoid: the actuator is released. The device can be turned, thereby enabling installation of the safety switch in the machine while the release device remains accessible on the outside of the guard. In this way, the switch is better protected against possible tampering and the external side/surface of the machinery remains smooth.

Circuit board for monitoring the current consumption of the solenoid.

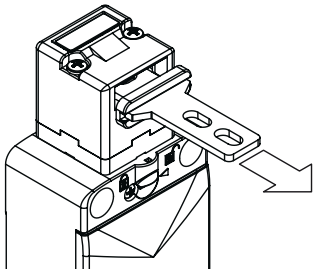


This technical solution resolves the problems that may derive from unstable power supply (machine distance from main transformers, voltage variation between night/day hours), allowing also a low solenoid power consumption and consequently enlarging the working temperature range of the switch.

Laser engraving

All FS series switches are permanently marked with a special laser system. As a result, the marking remains legible even under extreme operating conditions. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Holding force of the unlocked actuator



The inside of each switch features a device which holds the actuator in its closed position. Ideal for all those applications where several doors are unlocked simultaneously, but only one is actually opened. The device keeps all the unlocked doors in their position with a retaining force of 30 N~, stopping any vibrations or gusts of wind from opening them.

Two operating principles

D or E

The safety switches with solenoid offer two different operating principles for the actuator locking:

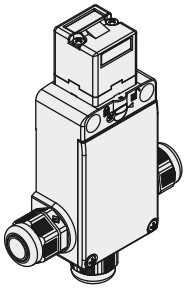
Operating principle D: locked actuator with de-energised solenoid. The actuator is released by applying the power supply to the solenoid.

Operating principle E: locked actuator with energised solenoid. The actuator is released by switching off the power supply to the solenoid. This version should only be used under certain conditions, since a power failure at the system will result in the immediate opening of the guard.

Sealable auxiliary release device

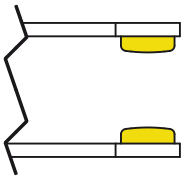
Switches with locked actuator with deactivated solenoid (function principle D) are equipped with an auxiliary release device for the solenoid to simplify installation of the switch and to facilitate entry into the danger zone in the event of a power failure. The auxiliary release device acts on the switch exactly as if the solenoid was energised. As a result, it also actuates the electrical contacts. Can only be actuated with a couple of tools, this ensures adequate resistance to tampering. If required it can be sealed by means of the hole provided.

Cable outputs



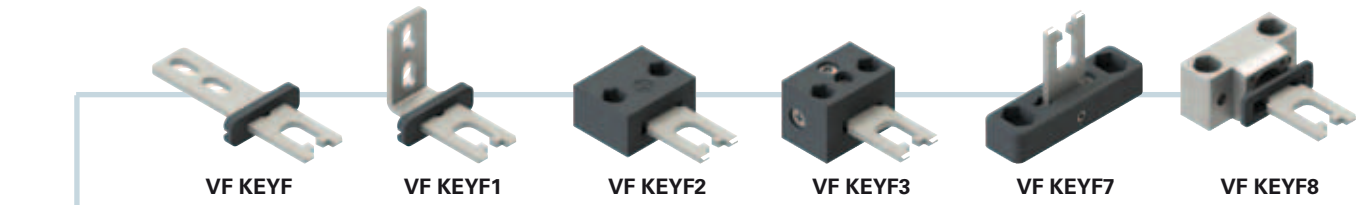
The switch is provided with three cable entries in different directions. This allows its application in series connections or in narrow places.

Gold-plated contacts



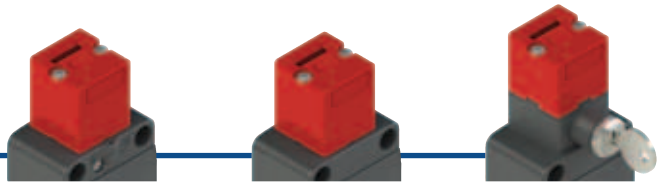
The contact blocks of these devices can be supplied gold-plated upon request. Ideal for applications with low voltages or currents; it ensures increased contact reliability. Available in two thicknesses (1 or 2.5 microns), it adapts perfectly to the various fields of application, ensuring a long endurance over time.

Selection diagram



ACTUATORS

HEAD TYPE AND OPERATING PRINCIPLE

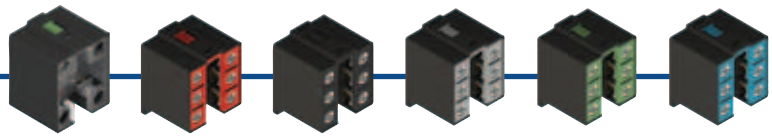


96D
Locked actuator with de-energised solenoid

96E
Locked actuator with energised solenoid

98D
Locked actuator with de-energised solenoid with auxiliary key release

CONTACT BLOCKS

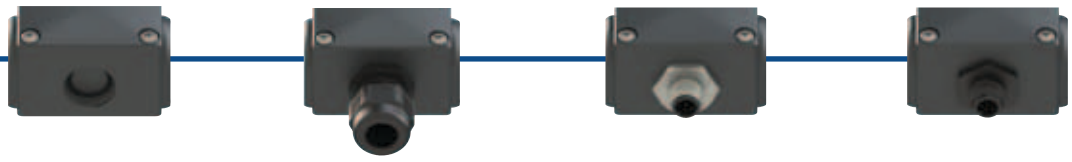


	18	20	21	28	29	30
	1NO+1NC	1NO+2NC	3NC	1NO+1NC	2NC	1NC
	/	/	/	1NC	1NC	2NC

SOLENOID SUPPLY VOLTAGE

024 **120** **230**

CONDUIT ENTRIES



Threaded conduit entry (standard)

With cable gland

With M12 metal connector	
K40	8-pole, bottom
K41	8-pole, right
K42	8-pole, left

Max. voltage 30 V

With M12 plastic connector	
K45	8-pole, bottom
K46	8-pole, right
K47	8-pole, left

Max. voltage 30 V

product option
accessory sold separately

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article / options / options

FS 1896D024-F1GM2K40

Contact block

	Contacts activated by the solenoid	Contacts activated by the actuator
18	1NO+1NC	/
20	1NO+2NC	/
21	3NC	/
28	1NO+1NC	1NC
29	2NC	1NC
30	1NC	2NC

Pre-installed cable glands or connectors

	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
...	.....
K40	M12 metal connector, 8-pole
...	.....
K45	M12 plastic connector, 8-pole
...	.....

For the complete list of possible combinations please contact our technical department.

Head type and operating principle

96D	locked actuator with de-energised solenoid
96E	locked actuator with energised solenoid
98D	locked actuator with de-energised solenoid with auxiliary key release

Threaded conduit entry

M2	M20x1.5 (standard)
	PG 13.5

Solenoid supply voltage

024	24 Vac/dc (-10% … +25%).
120	120 Vac/dc (-15% … +20%)
230	230 Vac (-15% … +10%)

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 28, 29, 30)

Actuators

	without actuator (standard)
F	straight actuator VF KEYF
F1	angled actuator VF KEYF1
F2	jointed actuator VF KEYF2
F3	jointed actuator adjustable in two directions VF KEYF3
F7	jointed actuator adjustable in one direction VF KEYF7
F8	universal actuator VF KEYF8

Safety switches **with solenoid and separate actuator**

Main features

- Technopolymer housing, three conduit entries
- Protection degree IP67
- 6 contact blocks available
- 6 stainless steel actuators available
- 3 solenoid supply voltages available
- Versions with auxiliary release device or turnable lock
- Operation with energised or de-energised solenoid

Quality marks:

IMQ approval:	CA02.00792
UL approval:	E131787
CCC approval:	2007010305230011
EAC approval:	RU C-IT.АД35.B.00454

Technical data

Housing

Housing made of glass fibre reinforced technopolymer, self-extinguishing, shock-proof and with double insulation:	⧈
Three knock-out threaded conduit entries:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Interlock with mechanical lock, coded:	type 2 acc. to EN ISO 14119
Coding level:	low acc. to EN ISO 14119
Safety parameters:	
B_{10D}:	4,000,000 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +60°C
Max. actuation frequency:	600 operating cycles/hour
Mechanical endurance:	800,000 operating cycles
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Maximum force before breakage F_{1max}:	1100 N (head 96), 900 N (head 98) acc. to EN ISO 14119
Max. holding force F_{Zh}:	846 N (head 96), 692 N (head 98) acc. to EN ISO 14119
Maximum clearance of locked actuator:	4.5 mm
Released actuator extraction force:	30 N
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 28, 29, 30:	min. 1 x 0.34 mm² (1 x AWG 22) max. 2 x 1.5 mm² (2 x AWG 16)
Contact block 18:	min. 1 x 0.5 mm² (1 x AWG 20) max. 2 x 2.5 mm² (2 x AWG 14)

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, EN 61000-6-2, EN 61000-6-3, BG-GS-ET-15, UL 508, CSA 22.2 N. 14.
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 N. 14, GB14048.5-2001.

Compliance with the requirements of:
Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

Solenoid

Duty cycle:	100% ED (continuous operation)
Solenoid inrush power:	20 VA 0.1 s (24 V) 18 VA 0,1 s (120 V) 18 VA 0,1 s (230 V)
Solenoid consumption:	4 VA
Average overall consumption:	10 VA
Solenoid protection 24 V:	fuse 500 mA, delayed
Solenoid protection 120 V:	fuse 315 mA, delayed
Solenoid protection 230 V:	fuse 160 mA, delayed

Notes: Calculate the power supply using the average overall consumption. Please consider the solenoid inrush power in order to avoid intervention of overload-protection in case of electronic power supply.

⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

Electrical data			Utilization category
without connector	Thermal current (I_{th}):	10 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 28, 29, 30)	U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 28, 29, 30)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250 I_e (A) 6 1.1 0.4
	Protection against short circuits:	type aM fuse 10 A 500 V	
	Pollution degree:	3	
with M12 connector 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	U_e (V) 24 I_e (A) 2
	Protection against short circuits:	type gG fuse 2 A 500 V	Direct current: DC13
	Pollution degree:	3	U_e (V) 24 I_e (A) 2

Features approved by IMQ

Rated insulation voltage (Ui): 500 Vac
400 Vac (for contact blocks 20, 21, 28, 29, 30)
Conventional free air thermal current (I_{th}): 10 A
Protection against short circuits: type aM fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}): 6 kV
4 kV (for contact blocks 20, 21, 28, 29, 30)
Protection degree of the housing: IP67
MV terminals (screw terminals)
Pollution degree: 3
Utilization category: AC15
Operating voltage (U_e): 400 Vac (50 Hz)
Operating current (I_e): 3 A

Forms of the contact element: Zb, Y+Y+X, Y+Y+Y, Y+X+X
Positive opening contacts on contact blocks 18, 20, 21, 28, 29, 30

In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories Q300 (69 VA, 125-250 Vdc)
A600 (720 VA, 120-600 Vac)

Housing features type 1, 4X "indoor use only", 12, 13
For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).

In compliance with standard: UL 508, CSA 22.2 N. 14

Please contact our technical department for the list of approved products.

Operating principle

The operating principle of these safety switches allows three different operating states:

state A: with inserted and locked actuator

state B: with inserted but not locked actuator

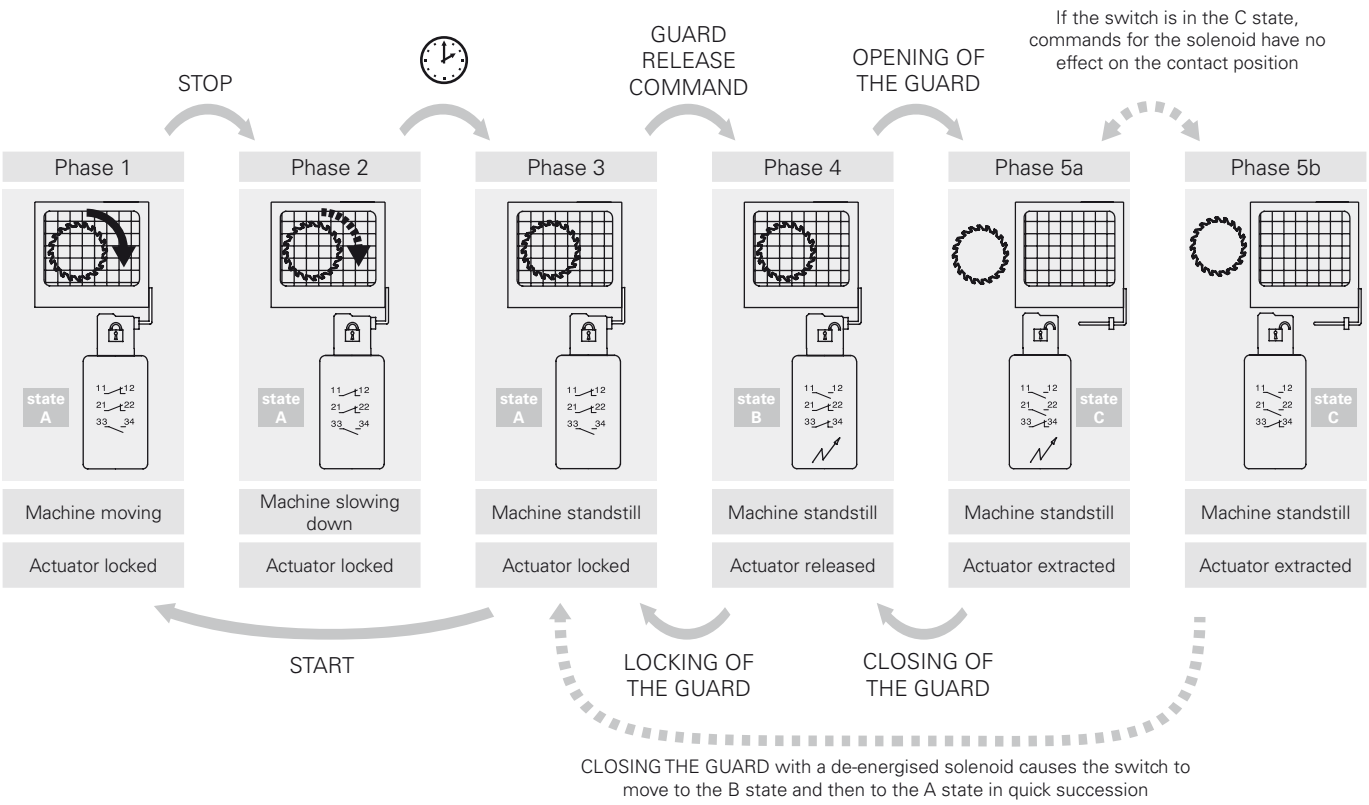
state C: with extracted actuator

All or some of these states can be monitored by means of electrical contacts with positive opening by selecting the appropriate contact blocks. In detail, contact blocks that have electric contacts marked with the symbol of the solenoid ( ) are switched in the transition between the state A and state B, while the electric contacts marked with the symbol of the actuator ( ) are switched between state B and state C.

It is also possible to choose between two operating principles for the actuator locking:

- **Operating principle D**: locked actuator with de-energised solenoid. The actuator is released by applying the power supply to the solenoid (see example of the operating phases).
- **Operating principle E**: locked actuator with energised solenoid. The actuator is released by switching off the power supply to the solenoid. This version should only be used under certain conditions, since a power failure at the system will result in the immediate opening of the guard.

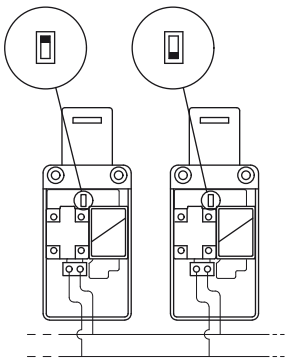
Example: operating phases with FS 2896D024-F1 (switch with operating principle D)



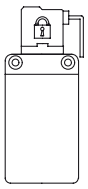
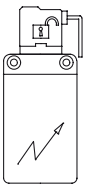
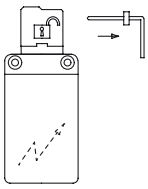
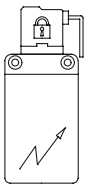
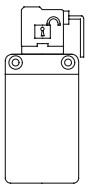
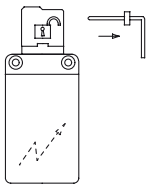
Installation of two or more switches connected to the same power supply

24 V AC/DC versions only

- This operation is intended to reduce the effects of the combined solenoid inrush currents on the power supply and should only be executed if necessary and with great care.
- Switch off the power supply.
- Open the switch cover.
- Loosen the two screws that secure the black plastic protective cover of the solenoid to the switch body and remove the plastic protective cover.
- Use a pin to set the selector switch so that each switch has a different combination (see figure at the side). If more than two switches are installed, repeat the combinations for any next set of two switches.
- Reposition the black plastic protective cover and tighten the two screws with a torque of 0.8 Nm.



Contact positions related to switch states

		Operating principle D locked actuator with de-energised solenoid			Operating principle E locked actuator with energised solenoid		
Operating state		state A	state B	state C	state A	state B	state C
Actuator		Inserted and locked	Inserted and released	Extracted	Inserted and locked	Inserted and released	Extracted
Solenoid		De-energised	Energised	-	Energised	De-energised	-
							
FS 18•••••• 1NC+1NO controlled by the solenoid		11 12 23 24	11 12 23 24	11 12 23 24	11 12 23 24	11 12 23 24	11 12 23 24
FS 20•••••• 2NC+1NO controlled by the solenoid		11 12 21 22 33 34	11 12 21 22 33 34	11 12 21 22 33 34	11 12 21 22 33 34	11 12 21 22 33 34	11 12 21 22 33 34
FS 21•••••• 3NC controlled by the solenoid		11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32
FS 28•••••• 1NO+1NC controlled by the solenoid 1NC controlled by the actuator		11 12 21 22 33 34	11 12 21 22 33 34	11 12 21 22 33 34	11 12 21 22 33 34	11 12 21 22 33 34	11 12 21 22 33 34
FS 29•••••• 2NC controlled by the solenoid 1NC controlled by the actuator		11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32
FS 30•••••• 1NC controlled by the solenoid 2NC controlled by the actuator		11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32	11 12 21 22 31 32

Limits of use

Do not use where dust and dirt may penetrate in any way into the head and deposit there. Especially not where powder, shavings, concrete or chemicals are sprayed. Adhere to the EN ISO 14119 requirements regarding low level of coding for interlocks. Do not use in environments with presence of explosive or flammable gas. In these case use ATEX products (see dedicated Pizzato catalogue).

Attention! These switches alone are not suitable for applications where operators may physically enter the dangerous area, because an eventual closing of the door behind them could restart the machine operation. In these cases the actuator entry locking device VF KB1 shown on page 111 must be used.

Safety switches **with solenoid and separate actuator**

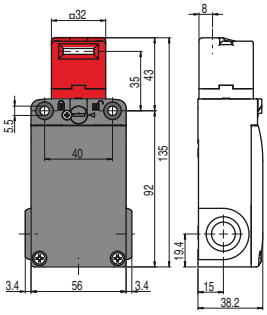
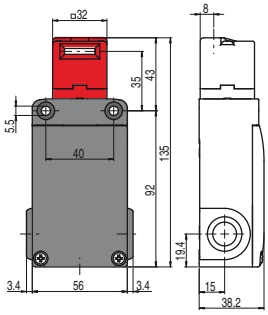
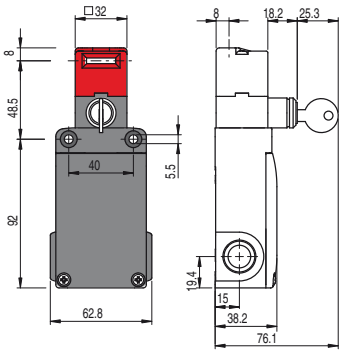
Dimensional drawings

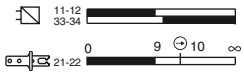
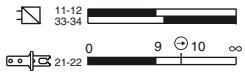
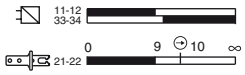
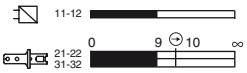
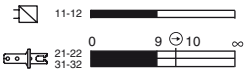
All values in the drawings are in mm

Contact type:

L = slow action

Contact block

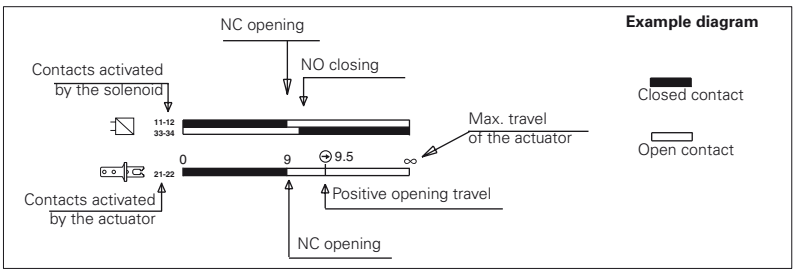
Operating principle D, with sealable auxiliary release device, without actuator	Operating principle E, without actuator	Operating principle D, with auxiliary key release, without actuator
		

Contact block				
18	L	FS 1896D024-M2 — 1NO+1NC	FS 1896E024-M2 — 1NO+1NC	FS 1898D024-M2 — 1NO+1NC
20	L	FS 2096D024-M2 — 1NO+2NC	FS 2096E024-M2 — 1NO+2NC	FS 2098D024-M2 — 1NO+2NC
21	L	FS 2196D024-M2 — 3NC	FS 2196E024-M2 — 3NC	FS 2198D024-M2 — 3NC
28	L	FS 2896D024-M2 — 1NO+2NC	FS 2896E024-M2 — 1NO+2NC	FS 2898D024-M2 — 1NO+2NC
				
29	L	FS 2996D024-M2 — 3NC	FS 2996E024-M2 — 3NC	FS 2998D024-M2 — 3NC
30	L	FS 3096D024-M2 — 3NC	FS 3096E024-M2 — 3NC	FS 3098D024-M2 — 3NC
				
Actuating force		30 N (40 N ⊖)	30 N (40 N ⊖)	30 N (40 N ⊖)

Legend: ⊖ With positive opening according to EN 60947-5-1, interlock with lock monitoring acc. to EN ISO 14119

How to read travel diagrams

All values in the diagrams are in mm

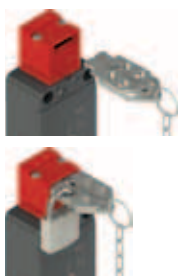


IMPORTANT:
The state of the NC contact refers to the switch with inserted actuator and locked lock. In **safety applications**, actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol ⊖. Actuate the switch **at least with the positive opening force**, reported in brackets below each article, next to the actuating force value.

Accessories

Article	Description
VF KB1	Actuator entry locking device

Padlockable device to lock the actuator entry in order to prevent the accidental closing of the door behind operators while they are in the danger area.
Hole diameter for padlocks: 9 mm.



Article	Description
VF KLA371	Set of two locking keys

Extra copy of the locking keys to be purchased if further keys are needed (standard supply: 2 units).
The keys of all switches have the same code. Other codes on request.

Items with code on **green** background are stock items

Accessories See page 299

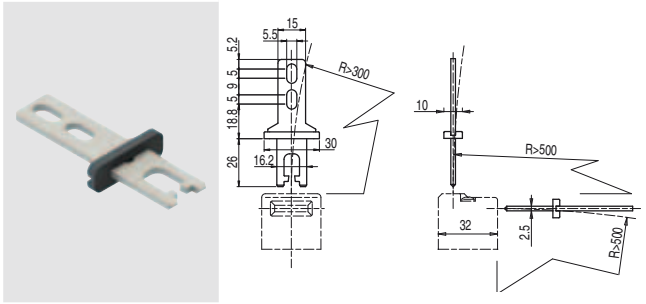
→ The 2D and 3D files are available at **www.pizzato.com**

Stainless steel actuators

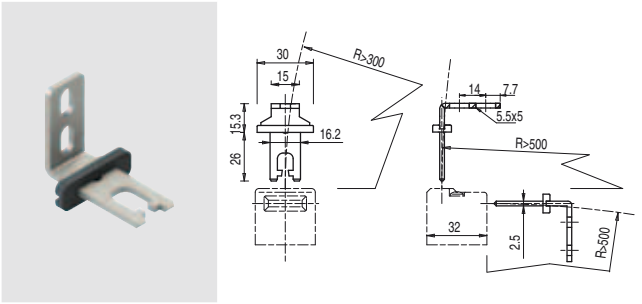
All values in the drawings are in mm

IMPORTANT: These actuators can be used only with items of the FD, FP, FL, FC, and FS series (e.g. FS 1896D024-M2).
Low level of coding acc. to EN ISO 14119.

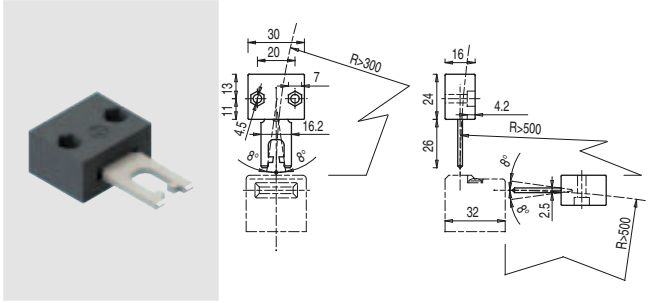
Article	Description
VF KEYF	Straight actuator



Article	Description
VF KEYF1	Angled actuator

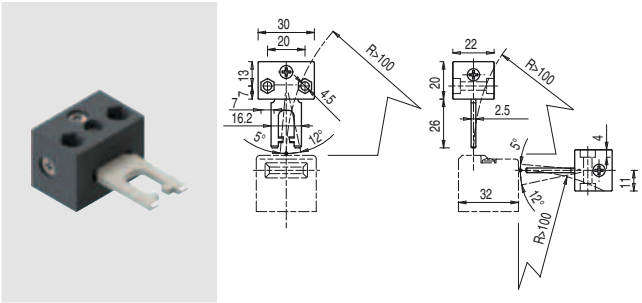


Article	Description
VF KEYF2	Jointed actuator



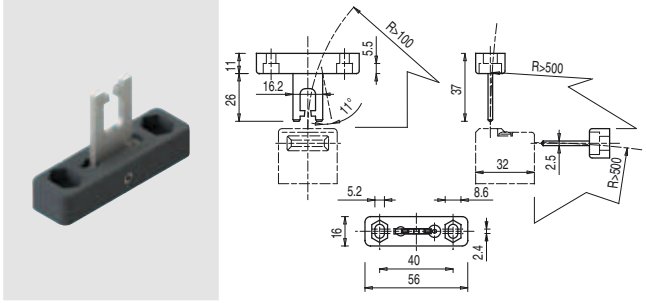
The actuator can flex in four directions for applications where the door alignment is not precise.

Article	Description
VF KEYF3	Actuator adjustable in two directions



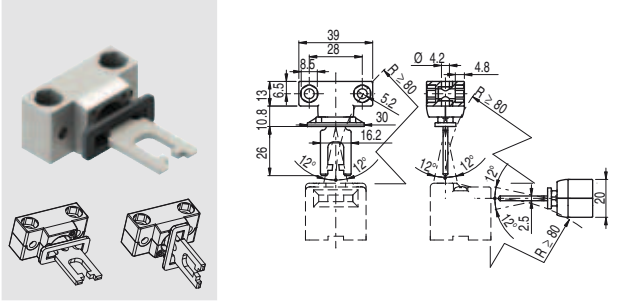
Actuator adjustable in two directions for doors with reduced dimensions.

Article	Description
VF KEYF7	Actuator adjustable in one direction



Actuator adjustable in one direction for doors with reduced dimensions.

Article	Description
VF KEYF8	Universal actuator



Actuator adjustable in two dimensions for small doors; can be mounted in various positions.
The fixing block has two pairs of bore holes; it is provided for rotating the working plane of the actuator by 90°.

Accessories for sealing

Article	Description
VF FSPB-200	Pack of 200 lead seals
VF FSPB-10	Pack of 10 lead seals

Article	Description
VF FSFI-400	400 metre wire roll
VF FSFI-10	10 metre wire roll

Pliers, wire and lead seals are needed to seal the manual release device (head 96D).

Article	Description
VF FSPZ	Pliers without logo

Items with code on **green** background are stock items

Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

NG series safety switches with solenoid and RFID technology

Description

These switches are used on machines where the hazardous conditions remain for a while, even after the machines have been switched off, for example because of mechanical inertia of pulleys, saw disks, parts under pressure or with high temperatures. Thus, the switches can also be used if individual guards are only to be opened under certain conditions.

Versions with mode 1 (safety outputs active when guard closed and locked) are interlocks with guard locking acc. to ISO 14119; the product is labelled with the symbol shown.

Maximum safety with a single device

PL e + SIL 3

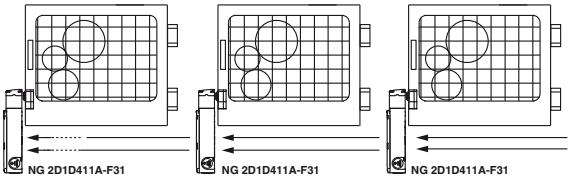
The NG series switches are constructed with redundant electronics. As a result, the maximum PL e and SIL 3 safety levels can still be achieved through the use of a single device on a guard. This avoids expensive wiring in the field and allows faster installation. Inside the control cabinet, the two electronic safety outputs must be connected to a safety module with OSSD inputs or to a safety PLC.

Series connection of several switches

PL e + SIL 3

One of the most important features of the NG series is the possibility of connecting up to 32 sensors in series, while still maintaining the maximum safety levels PL e laid down in EN 13849-1 and SIL 3 acc. to EN 62061.

This connection type is permissible in safety systems which have a safety module at the end of the chain that monitors the outputs of the last NG switch. The fact that the PL e safety level can be maintained even with 32 sensors connected in series demonstrates the extremely secure structure of each single device.

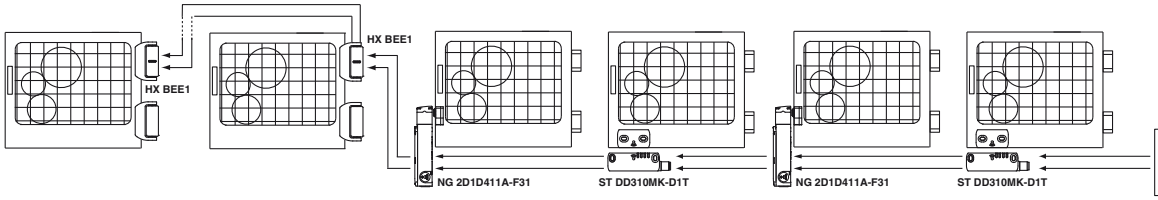


Pizzato Elettrica **CS series** safety module

Series connection with other devices

PL e + SIL 3

The NG series features two safety inputs and two safety outputs, which can be connected in series with other Pizzato Elettrica safety devices. This option allows the creation of safety chains containing various devices. For example, stainless steel safety hinges (HX BEE1 series), transponder sensors (ST series) and door lock sensors (NG series) can be connected in series while still maintaining the maximum PL e and SIL 3 safety levels.

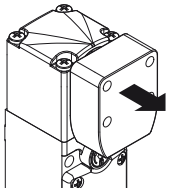


Pizzato Elettrica **CS series** safety module

RFID actuators with high coding level

The NG series is provided with an electronic system based on RFID technology to detect the actuator. This allows to provide each actuator with different coding and makes it impossible to tamper with a device by using another actuator of the same series. Millions of different coding combinations are possible for the actuators. They are therefore classified as high level coded actuators, according to EN ISO 14119.

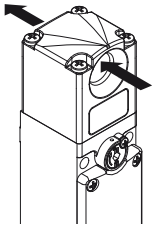
Holding force of the locked actuator



9750 N

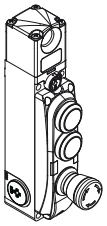
The strong interlocking system guarantees a maximum actuator holding force of F_{1max} = 9750 N. This is one of the highest values currently available on the market today, making this device suitable for heavy-duty applications.

Dustproof



The switch is provided with a through hole for inserting the actuator. Thanks to this unique feature, any dust that enters the actuator hole can always come out on the opposite side instead of remaining inside. Moreover, the lock pin is provided with a diaphragm seal, making the system suitable for critical environments with a high level of dust.

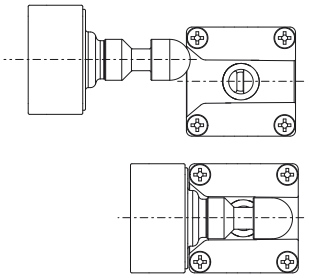
Integrated control devices



The switch is also available with elevated cover. Control devices such as buttons, emergency buttons, indicator lights or selectors can thereby be attached directly to the switch together with corresponding contact blocks.

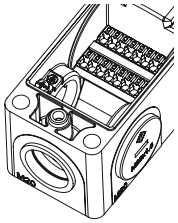
The result is a compact solution with direct access to control devices without needing to install them separately on the switch panel or in their own housing. The devices can be illuminated and, thanks to the PUSH-IN spring-operated connections, wiring is quick and intuitive.

Centring



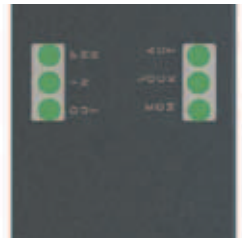
The switch is provided with a wide centring inlet for the actuator pin. This solution makes it easier to align the actuator and the opening hole on the head during installation. Moreover, this solution drastically reduces the probability of a collision between the switch and the actuator, making it possible to install the device even on inaccurately closing doors.

Push-in spring-operated connections



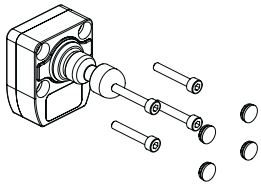
The switch is provided with a PUSH-IN type spring-operated connection system on the inside. This technology allows wiring to be performed quickly and easily, as the wire just needs to be inserted into the appropriate hole in order to establish the electrical connection and automatically secure the wire. This operation can be performed with rigid or flexible wires with a crimped wire-end sleeve and requires no tools. Release is obtained by pressing the appropriate wire-releasing button.

Six LEDs for immediate diagnosis



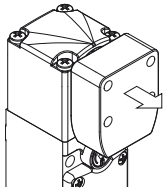
As the LEDs have been designed for quick immediate diagnosis, the status of each input and output is highlighted by one specific LED. This makes it possible to quickly identify the interruption points in the safety chain, which device is released, which door is opened and any errors inside the device. All of this at a glance, without needing to decode complex flashing sequences.

Protection against tampering



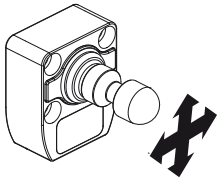
Each actuator of the NG series is supplied with four protective caps. Not only do the caps prevent dirt from accumulating and simplify cleaning, they also block access to the fastening screws of the actuator. As a result, standard screws can be used instead of tamper-proof screws.

Holding force of the unlocked actuator



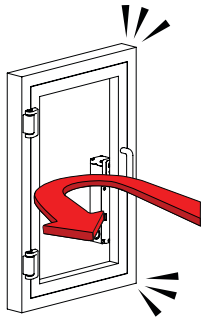
The inside of each switch features a device which holds the actuator in its closed position. Ideal for all those applications where several doors are unlocked simultaneously, but only one is actually opened. The device keeps all the unlocked doors in their position with a retaining force of 30 N~, stopping any vibrations or gusts of wind from opening them.

Articulated actuator for inaccurately closing doors



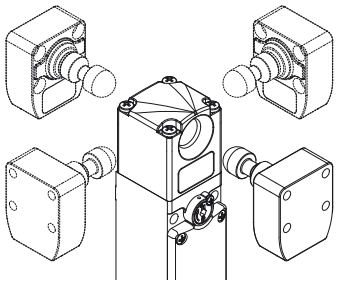
All NG series actuators are articulated, thereby allowing the actuator pin to be safely guided into the switch through the centring hole. As a result, the actuator and switch do not need to be precisely aligned during installation. In addition, the device can thereby be used on doors with a minimum actuation radius of 150 mm without the actuation pin needing to be angled.

Function for protecting against recoil forces



If a door is closed too quickly or with so much force that the recoil would cause it to open again, a special function in the NG switch prevents locking. This function prevents the immediate locking of the door if the lock signal is applied. This protects the switch against recoil forces that occur during instantaneous locking. This serves to protect the switch from damage and forces the operator to close the door more gently.

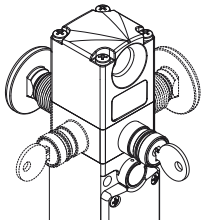
Head and devices with variable orientation



The system can be variably configured by loosening the 4 screws on the head.

The key release device and the emergency release button can also be rotated and secured independently of one another in steps of 90°. The device can thus assume 16 different configurations.

Key release device and emergency release button

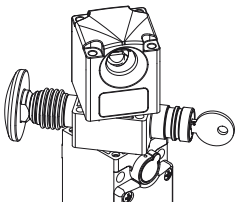


The key release device (auxiliary release) is used to permit unlocking of the actuator only by personnel in possession of the key. The device also functions with no power supply and, once actuated, prevents the guard from being locked.

The emergency release button (escape release) allows actuator release and immediate opening of the door. Generally used in machines within which an operator could inadvertently become trapped, it faces towards the machine interior, to allow the operator to exit even in the event of a power failure. The button has two stable states and can be freely extended in length with suitable extensions (see accessories).

Both devices can be positioned on the four sides of the switch. As a result, it can be installed both towards the interior and towards the exterior of the machine.

Non-detachable head and release devices



The head and the release device can be rotated but cannot be detached from each other. This makes the switch more secure since the problem of incorrect assembly by the installer cannot occur; in addition, the risk of damage is lower (loss of small parts, penetration of dirt, etc.).

High protection degree

IP69K
IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

Two safety output actuation modes

CLOSED
OR
CLOSED & LOCK

Two different activation modes are available for the switch: active safety outputs with guard closed and locked (mode 1) for machines with inertia or active safety outputs with guard closed (mode 2) for machines without inertia.

External device monitoring

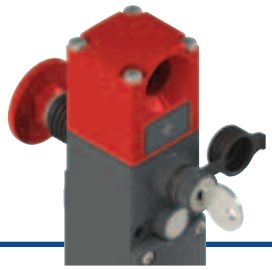
EDM

On request, the switch can be supplied with EDM function (External Device Monitoring). In this case, the switch itself checks the proper function of the devices connected to the safety outputs. These devices (usually relays or safety contactors) must send a feedback signal to the EDM input, which checks that the received signal is consistent with the state of the safety outputs.

Selection diagram

D5D

Locked actuator with **de-energised** solenoid with key release



D6D

Locked actuator with **de-energised** solenoid with key release and emergency release button

D7D

Locked actuator with **de-energised** solenoid with emergency release button

D7E

Locked actuator with **energised** solenoid with emergency release button

HEAD TYPE AND OPERATING PRINCIPLE

D1D

Locked actuator with **de-energised** solenoid

D1E

Locked actuator with **energised** solenoid

ACTUATORS

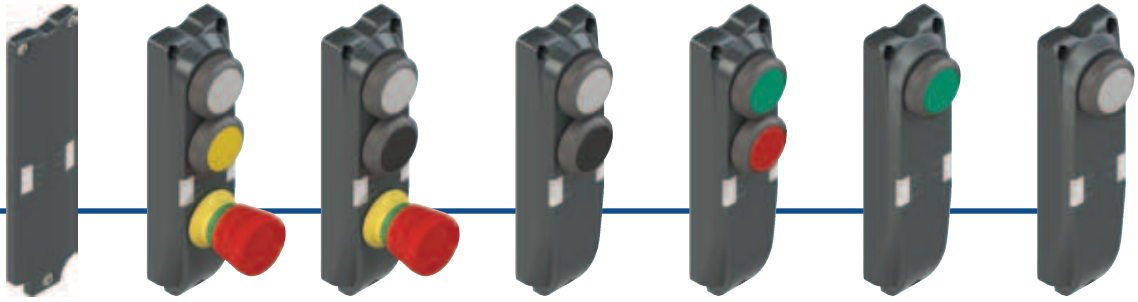
VN NG-F30

Low level coded actuator

VN NG-F31

High level coded actuator

COVER CONFIGURATIONS



1A **1C** **1D** **1E** **1F** **1G** **1H**

CONDUIT ENTRIES

Threaded conduit entries M20

With M12 metal male connector

K110	12-pole, bottom
K111	12-pole, right
K112	12-pole, left

With M12 metal male connector for stand-alone connection

K953	8-pole, bottom
K954	8-pole, right
K955	8-pole, left

With M12 metal male connector for series connection with "Y" connectors

K950	8-pole, bottom
K951	8-pole, right
K952	8-pole, left

With M23 metal male connector (clockwise numbering)

K900	12-pole, bottom
K901	12-pole, right
K902	12-pole, left

With M23 metal male connector (clockwise numbering)

K601	19-pole, bottom, configuration 1
K602	19-pole, bottom, configuration 2
•••	.....

product options

accessory sold separately

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article: **NG 2D1D411A** — options: **-F31E34K900LP30**

Operating principle	
D1D	locked actuator with de-energised solenoid
D1E	locked actuator with energised solenoid
D5D	locked actuator with de-energised solenoid. With key release
D6D	locked actuator with de-energised solenoid. With key release and emergency release button
D7D	locked actuator with de-energised solenoid. With emergency release button
D7E	locked actuator with energised solenoid. With emergency release button

Release button length	
	for max. 15 mm wall thickness (standard)
LP30	for max. 30 mm wall thickness
LP40	for max. 40 mm wall thickness
LP50	for max. 50 mm wall thickness
LP60	for max. 60 mm wall thickness
...	other wall thicknesses on request

Pre-installed connectors	
	without connector (standard)
K110	M12 metal connector, 12-pole, bottom
K601	M23 metal connector, 19-pole, bottom, configuration 1
K900	M23 metal connector, 12-pole, bottom
K950	M12 metal connector, 8-pole, bottom, for series connection
K953	M12 metal connector, 8-pole, bottom, for stand-alone connection
...	other connectors on request

For the complete list of possible combinations please contact our technical department.

Inputs and outputs	
3	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: closed guard 1 signalling output O4: locked guard 1 solenoid activation input I4 Note: Supplied only together with actuator
4	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: closed guard 1 signalling output O4: locked guard 1 solenoid activation input I4 1 programming input I3
5	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: closed guard 1 signalling output O4: locked guard 1 solenoid activation input I4 1 programming input I3 1 feedback input EDM I5
6	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: closed guard 1 signalling output FAULT O4 1 solenoid activation input I4 1 programming input I3

Actuator extraction force	
	actuator extraction force 30 N (standard)
E34	actuator freely removable

Actuator	
F30	low level coded actuator VN NG-F30 the switch recognises any type F30 actuator
F31	high level coded actuator VN NG-F31 the switch recognises one single type F31 actuator

Activation of OS outputs	
1	mode 1: OS safety outputs active with locked guard
2	mode 2: OS safety outputs active with closed guard

Cover configurations	
1A	standard cover
1C	cover with white button / yellow button / emergency button with rotary release
1D	cover with white button / black button / emergency button with rotary release
1E	cover with white button / black button
1F	cover with green button / red button
1G	cover with green button
1H	cover with white button
...	other configurations on request

Code structure for actuator

VN NG-F30

Actuator	
F30	low level coded actuator the switch recognises any type F30 actuator
F31	high level coded actuator the switch recognises one single type F31 actuator

Main features

- Actuation without contact, using RFID technology
- Digitally coded actuator
- Actuator holding force: 9750 N
- SIL 3 and PL e with a single device
- Optional integrated control devices
- Metal housing, three M20 conduit entries
- Protection degree up to IP67 and IP69K
- Versions with key release and emergency release button
- PL e also with series connection of up to 32 devices
- Signalling LED

Quality marks:

UL approval:	E131787
TÜV SÜD approval:	Z10 15 01 75157 005
EAC approval:	RU C-IT.АД35.B.00454

In compliance with standards:

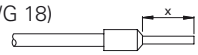
EN ISO 14119, EN 60947-5-3, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 12100, IEC 60529, EN 60529, EN 61000-6-2, EN 61000-6-3, BG-GS-ET-19, IEC 61508-1, IEC 61508-2, IEC 61508-3, IEC 61508-4, SN 29500, EN ISO 13849-1, EN ISO 13849-2, EN 62061, EN 61326-1, EN 61326-3-1, EN 61326-3-2, ETSI 301 489-1, ETSI 301 489-3, ETSI 300 330-2, UL 508, CSA 22.2 No.14

Compliance with the requirements of:

Machinery Directive 2006/42/EC
EMC Directive 2014/30/EU
Directive 2014/53/EU - RED
FCC Part 15

Connection terminals

Connection system: PUSH-IN spring type
Cross-section of rigid/flexible wires w. wire-end sleeve: min. 1 x 0.34 mm² (1 x AWG 22)
max. 1 x 1.5 mm² (1 x AWG 16)
Wire cross-section with pre-insulated wire-end sleeve: min. 1 x 0.34 mm² (1 x AWG 22)
max. 1 x 0.75 mm² (1 x AWG 18)
Cable stripping length (x):



min.: 8 mm
max.: 12 mm

Technical data

Housing

Metal head and housing, baked powder coating.

Three threaded conduit entries:	M20x1.5
Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653
Protection degree with control devices:	IP65 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

SIL level (SIL CL):	up to SIL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Interlock with lock, no contact, coded:	type 4 acc. to EN ISO 14119
Level of coding acc. to EN ISO 14119:	low with F30 actuator High with F31 actuator
Safety parameters:	
$MTTF_D$:	1883 years
PFH_D:	8.07 E-10
DC:	High
Service life:	20 years
Ambient temperature:	-20°C … +50°C
Max. actuation frequency with actuator lock and release:	600 operating cycles/hour
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Maximum force before breakage F_{1max}:	9750 N acc. to EN ISO 14119
Max. holding force F_{Zh}:	7500 N acc. to EN ISO 14119
Maximum clearance of locked actuator:	4 mm
Released actuator extraction force:	30 N
Tightening torques for installation: see page	see page 313-324

Electrical data of IS1/IS2/I3/I4/I5/EDM inputs

Rated operating voltage U_{e1}:	24 Vdc
Rated current consumption I_{e1}:	5 mA

Electrical data of OS1/OS2 safety outputs

Rated operating voltage U_{e2}:	24 Vdc
Output type:	PNP type OSSD
Maximum current per output I_{e2}:	0.25 A
Minimum current per output I_{m2}:	0.5 mA
Thermal current I_{th2}:	0.25 A
Utilization category:	DC13; U_{e2}=24 Vdc, I_{e2}=0.25 A
Short circuit detection:	Yes
Overcurrent protection:	Yes
Internal self-resettable protection fuse:	1.1 A
Duration of the deactivation impulses at the safety outputs:	< 300 µs
Permissible maximum capacitance between outputs:	< 200 nF
Permissible maximum capacitance between output and ground:	< 200 nF
Response time upon deactivation of IS1/IS2 inputs:	typically 7 ms, max. 15 ms
Response time upon actuator removal:	typically 120 ms, max. 200 ms

Electrical data of O3/O4 signalling output

Rated operating voltage U_{e3}:	24 Vdc
Output type:	PNP
Maximum current per output I_{e3}:	0.1 A
Utilization category:	DC12; U_{e3}=24 Vdc, I_{e3}=0.1 A
Short circuit detection:	No
Overcurrent protection:	Yes
Internal self-resettable protection fuse:	1.1 A

RFID sensor data

Assured operating distance S_{ao}:	2 mm
Assured release distance S_{ar}:	4 mm (actuator not locked) 10 mm (actuator locked)
Rated operating distance S_n:	2.5 mm
Repeat accuracy:	≤ 10 % s_n
Differential travel:	≤ 20 % s_n
Max. switching frequency:	1 Hz

Power supply electrical data:

Rated operating voltage U_e SELV:	24 Vdc ±10%
Operating current at U_e voltage:	
- minimum:	40 mA
- with activated solenoid:	0.4 A
- with activated solenoid and all outputs at maximum power:	1.2 A
Rated insulation voltage U_i:	32 Vdc
Rated impulse withstand voltage U_{imp}:	1.5 kV
External protection fuse:	1.5 A / 1.6 A type F or equivalent device
Overvoltage category:	III
Electrical endurance:	1 million operating cycles
Solenoid duty cycle:	100% ED (continuous operation)
Solenoid consumption:	9 W max.

Features approved by UL

Utilization categories: 24 Vdc, 0.25 A (resistive load).

Inputs supplied by remote class 2 source or limited voltage and limited energy

In compliance with standard: UL 508, CSA 22.2 No.14

Please contact our technical department for the list of approved products.

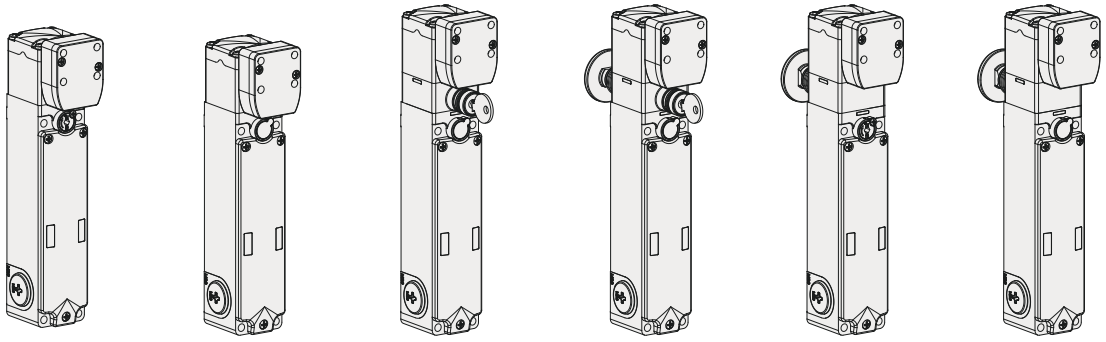
Features approved by TÜV SÜD

Protection degree:	IP67, IP69K
Ambient temperature:	-20°C…+50°C
Storage temperature:	-40°C…+75°C
PL, category:	PL e, cat. 4.
SIL:	SIL 3 / SIL CL 3

In compliance with standards: 2006/42/EC, EN 60947-1/A1:2011, EN 60947-5-2/A1:2012, EN 60947-5-3:2013, EN ISO 14119:2013, EN 61508-1:2010 (SIL 3), EN 61508-2:2010 (SIL 3), EN 61508-3:2010 (SIL 3), EN 61508-4:2010 (SIL 3), EN 62061/A1:2013 (SIL CL 3), EN ISO 13489-1: 2008 (PL e, cat. 4).

Please contact our technical department for the list of approved products.

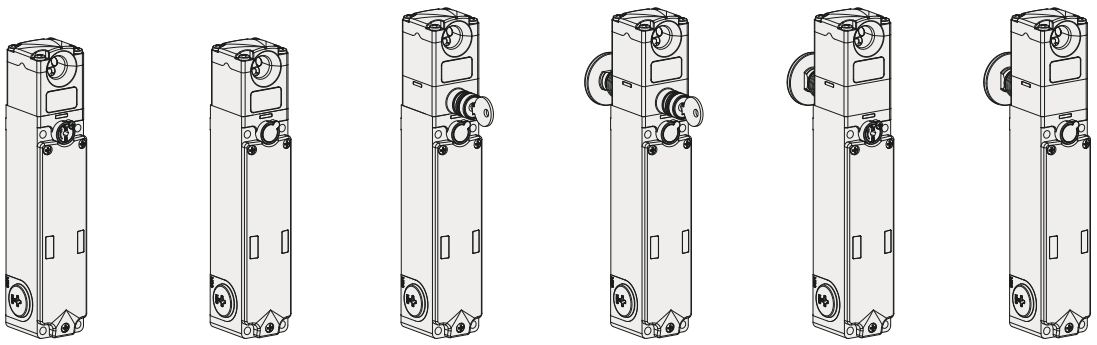
Selection table for switches with high level coded actuators



	Operating principle D, with sealable auxiliary release device	Operating principle E	Operating principle D, with key release	Operating principle D, with key release and emergency release button	Operating principle D, with emergency release button and sealable auxiliary release device	Operating principle E, with emergency release button
Mode 1 OS safety outputs active with locked and closed guard	NG 2D1D411A-F31	NG 2D1E411A-F31	NG 2D5D411A-F31	NG 2D6D411A-F31	NG 2D7D411A-F31	NG 2D7E411A-F31
Mode 2 OS safety outputs active with closed guard	NG 2D1D421A-F31	NG 2D1E421A-F31	NG 2D5D421A-F31	NG 2D6D421A-F31	NG 2D7D421A-F31	NG 2D7E421A-F31

To order a product with EDM input replace number 4 with number 5 in the codes shown above. Example: NG 2D1D**4**11A-F31 → NG 2D1D**5**11A-F31

Selection table for switches

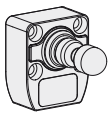


	Operating principle D, with sealable auxiliary release device	Operating principle E	Operating principle D, with key release	Operating principle D, with key release and emergency release button	Operating principle D, with emergency release button and sealable auxiliary release device	Operating principle E, with emergency release button
Mode 1 OS safety outputs active with locked and closed guard	NG 2D1D411A	NG 2D1E411A	NG 2D5D411A	NG 2D6D411A	NG 2D7D411A	NG 2D7E411A
Mode 2 OS safety outputs active with closed guard	NG 2D1D421A	NG 2D1E421A	NG 2D5D421A	NG 2D6D421A	NG 2D7D421A	NG 2D7E421A

To order a product with EDM input replace number 4 with number 5 in the codes shown above. Example: NG 2D1D**4**11A → NG 2D1D**5**11A

Legend: interlock with lock monitoring acc. to EN ISO 14119

Selection table for actuators



Level of coding acc. to EN ISO 14119	Article
low	VN NG-F30
high	VN NG-F31

The use of RFID technology in NG series devices makes them suitable for several applications. Pizzato Elettrica offers two different versions of actuators, in order to best suit customers' specific needs.

Type F30 actuators are all encoded with the same code. This implies that a device associated with an actuator type F30 can be activated by other actuators type F30.

Type F31 actuators are always encoded with different codes. This implies that a device associated with an actuator type F31 can be activated only by a specific actuator. Another F31 type actuator will not be recognised by the device until a new association procedure is carried out (reprogramming). After reprogramming, the old actuator F31 will no longer be recognized.

→ The 2D and 3D files are available at **www.pizzato.com**

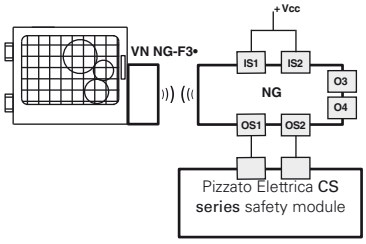
Items with code on **green** background are stock items

Complete safety system

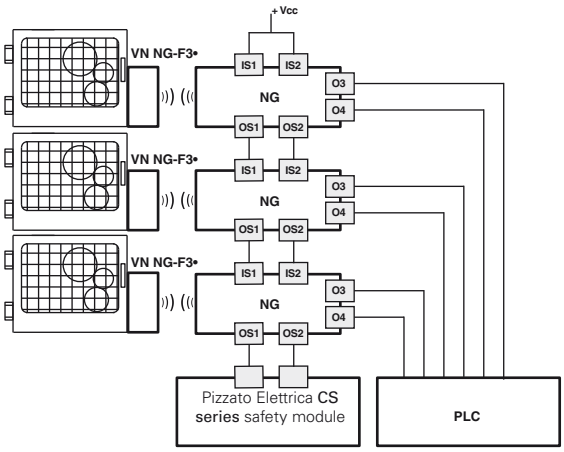
The use of complete and tested solutions guarantees the electrical compatibility between the NG series switches and the safety modules from Pizzato Elettrica, as well as high reliability. The switches have been tested with the modules listed in the adjacent table.

Switches	Compatible safety modules	Safety module output contacts		
		Instantaneous safety contacts	Delayed safety contacts	Signalling contacts
NG 2•••••••	CS AR-05••••	3NO	/	1NC
	CS AR-06••••	3NO	/	1NC
	CS AR-08••••	2NO	/	/
	CS AT-0•••••	2NO	2NO	1NC
	CS AT-1•••••	3NO	2NO	/
	CS MP••••••		page 255	
	CS MF••••••		page 283	

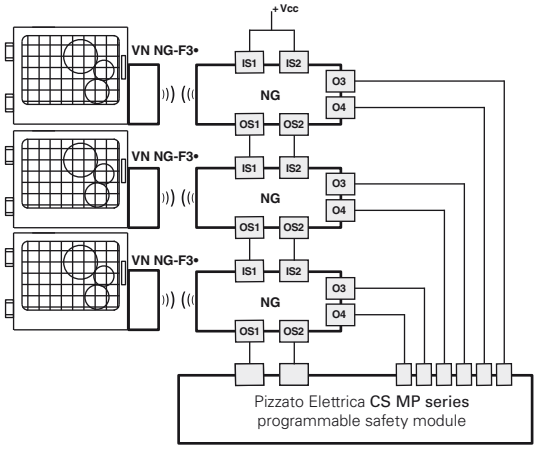
All NG series switches can be connected to safety modules or safety PLCs with OSSD inputs provided compatibility is ensured in advance.



NG series switches can be used as individual devices provided that the safety outputs be evaluated by a Pizzato Elettrica safety module (see table for combinable safety modules).

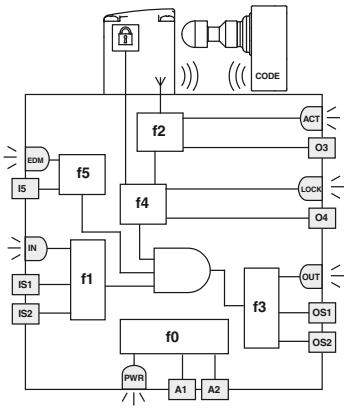


Possibility of series connection of multiple switches for simplifying the wiring of the safety system, whereby only the outputs of the last switch are evaluated by a Pizzato Elettrica safety module (see table with compatible safety modules). Each NG series switch is provided with two signalling outputs which are activated when the guard is closed (O3) or locked (O4). Depending on the specific requirements of the system that has been realised, the signals of the signalling outputs can be evaluated by a PLC.



Possibility of series connection of multiple switches for simplifying the wiring of the safety system, whereby only the outputs of the last switch are evaluated by a Pizzato Elettrica safety module of the CS MP series. Both the safety-relevant evaluation and the evaluation of the signalling outputs are performed by the CS MP series.
The examples listed above refer to applications with NG 2•••4•••

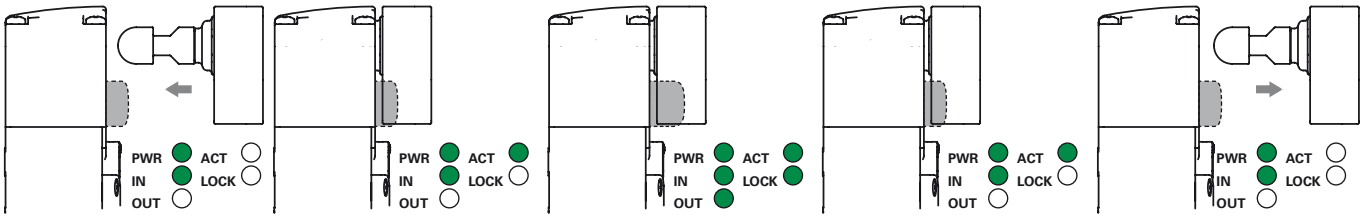
Internal block diagram



The diagram on the side represents the 6 logic functions which interact inside the device.
Function f0 is a basic function and includes the monitoring of the power supply as well as internal, cyclical tests. Function f1 monitors the status of the device inputs, whereas function f2 monitors the presence of the actuator within the detection areas of the switch.
Function f4 checks the actuator lock condition.
Function f3 is intended to activate or deactivate the safety outputs and check for any faults or short circuits in the outputs.
In the EDM versions, the f5 function verifies the consistency of the EDM signal during safety output state changes. The safety-related function, which combines the sub-functions mentioned above, only activates the safety outputs for the switches in mode 1 if the input signals are correctly applied and the actuator pin is in the safe actuation area in the head and locked. The safety outputs for switches in mode 2 are activated if the input signals are correctly applied and the actuator pin is in the safe actuation area in the head. The status of each function is displayed by the corresponding LED (PWR, IN, OUT, ACT, LOCK, EDM), in such a way that the general device status becomes immediately obvious to the operator.

LED	Function
PWR	Power supply/self-diagnosis
IN	status of safety inputs
OUT	status of safety outputs
ACT	actuator state
LOCK	actuator locked
EDM	state of EDM inputs (NG 2D••5•••)

Actuation sequence in mode 1



The switch is supplied with power (PWR LED on, green), the IS1 and IS2 inputs are enabled (IN LED on, green), the OS1 and OS2 safety outputs are disabled (OUT LED off). The actuator is outside of the actuation zone (LED ACT off).

When the actuator is brought inside the safe actuation area (dark grey area), the switch turns on the ACT LED (green). In this position, the O3 signalling output (door-closed) is activated. The actuator is not locked (LOCK LED off).

The I4 input can be used to lock the actuator (LOCK LED on, green). The OS1 and OS2 safety outputs are enabled (OUT LED on, green). The O4 signalling output is activated at the same time. The safe actuation area is extended in order to allow greater play for the actuator.

The I4 input can be used to unlock the actuator (LOCK LED off). The switch disables the OS1 and OS2 safety outputs and turns off the OUT LED. The O4 signalling output is deactivated at the same time. The safe actuation area returns to the initial values.

When the actuator leaves the actuation limit area, the device turns off the ACT LED and the O3 signalling output.

Actuation sequence in mode 2

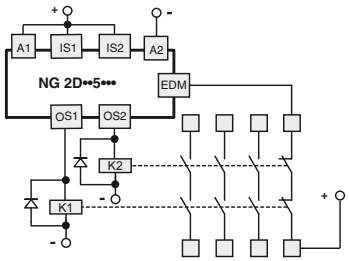
In contrast to the above mode 2 description, the safety outputs OS1 and OS2 enable when the actuator is detected, and disable when the actuator is no longer detectable.

Operating states

PWR LED	IN LED	OUT LED	ACT LED	LOCK LED	EDM LED (a)	Device state	Description
○	○	○	○	○	○	OFF	Device switched off.
◐	◐	◐	◐	◐	◐	POWER ON	Internal tests upon activation.
●	○	○	✳	✳	●	RUN	Safety inputs of the device not active.
●	●	✳	✳	✳	✳	RUN	Activation of safety inputs.
●	◐	○	✳	✳	✳	RUN	Safety inputs incoherence. Recommended action: check for presence and/or wiring of inputs.
●	✳	✳	●	✳	✳	RUN	Actuator in safe area. O3 signalling output active.
●	✳	✳	●	●	○	RUN	Actuator in safe area and locked; O3 and O4 outputs active.
●	●	●	●	●	○	RUN	**Mode 1** Activation of safety inputs IS1, IS2. Actuator in safe area and locked. O3, O4, OS1 and OS2 outputs active.
●	●	●	●	✳	○	RUN	**Mode 2** Activation of safety inputs IS1, IS2. Actuator in safe area. O3, OS1 and OS2 outputs active.
●	✳	((●))	✳	✳	✳	ERROR	Error on safety outputs. Recommended action: check for any short circuits between the outputs, outputs and ground or outputs and power supply, then restart the device.
●	○	○	((●))	○	○	ERROR	Actuator detection error. Check the physical integrity of the device and, in case of failure, please replace the entire device. If undamaged, realign the actuator with the switch and restart the device.
●	○	○	○	○	○	ERROR	Internal error. Recommended action: restart the device. If the failure persists, replace the device.
●	✳	○	✳	✳	●	RUN	EDM signal active (external relay off)[a]
●	●	●	●	●	○	RUN	EDM signal not active (external relay on)[a]
●	○	○	○	○	((●))	ERROR	Error in the EDM[a] function

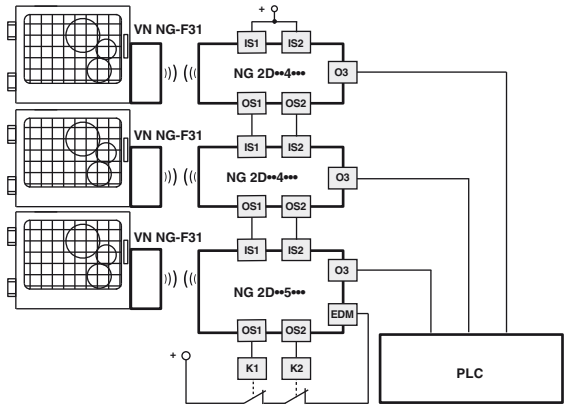
Legend: ○ = off ● = on ((●)) = flashing ◐ = alternating colours ✳ = indifferent (a) Available only in versions NG 2D••5•••

External device monitoring (EDM)



The NG 2D••5•••version, in addition to maintaining the operating and safety characteristics of the NG series, allows control of **forcibly guided NC contacts of contactors or relays** controlled by the safety outputs of the switch itself. As an alternative to the relays or contactors you can use Pizzato Elettrica expansion modules CS ME-03.

See page 245. This check is carried out via the EDM input (External Device Monitoring as defined in EN 61496-1) of the switch.



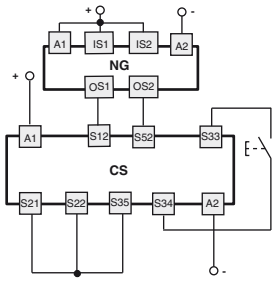
This version, with the IS safety inputs, **can be used at the end of a series** of NG switches, **up to a maximum number of 32 devices**, while maintaining the maximum PL e safety level and acc. to EN ISO 13849-1 and SIL 3 safety level acc. to EN 62061. This solution allows you to dispense with the safety module connected to the last device in the chain.

Connection with safety modules

Connections with CS AR-08•••• safety modules

Input configuration with monitored start

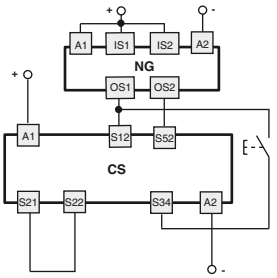
2 channels / Category 4 / up to SIL 3 / PL e



Connections with CS AR-05•••• / CS AR-06•••• safety modules

Input configuration per manual start (CS AR-05••••)
or monitored start (CS AR-06••••)

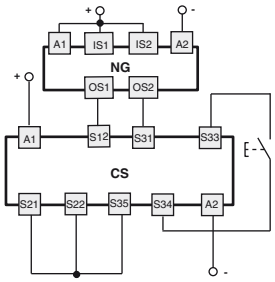
2 channels / Category 4 / up to SIL 3 / PL e



Connections with CS AT-0••••• / CS AT-1••••• safety modules

Input configuration with monitored start

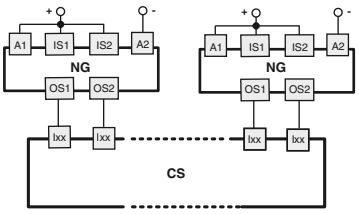
2 channels / Category 4 / up to SIL 3 / PL e



Connections with CS MF•••••, CS MP••••• safety modules

The connections vary according to the program of the module

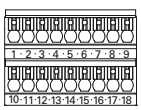
Category 4/ up to SIL 3 / PL e

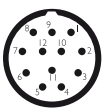


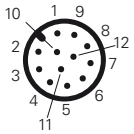
Application example on page 253.

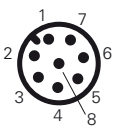
Pin assignments (version with standard cover NG 2D••••1A)

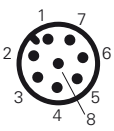
Internal terminal strip	M23 connector 12-pole	M12 connector, 12-pole	M12 connector, 8-pole stand-alone connection	M12 connector, 8-pole series connection with "Y" connectors	Connection	
A2 1	3	3	3	3	A2	Supply input 0 V
B2 2	3	3	3	3	B2	0 V auxiliary supply output
I4 3	10	10	8	8	I4	Solenoid activation input
O3 4	5	5	2	/	O3	Signalling output, actuator inserted
O4 5	9	9	5	5 (c)	O4	Signalling output, actuator inserted and locked (b)
I3 6	8	8	6	/	I3	Actuator programming input
A1 10	1	1	1	1	A1	Supply input +24 Vdc
B1 11	1	1	1	1	B1	Auxiliary supply output +24 Vdc, (I_{th} 8 A max.)
IS1 12	2	2	/	2	IS1	Safety input
IS2 13	6	6	/	6	IS2	Safety input
I5 14	11	11	/	/	I5	EDM input (a)
OS1 15	4	4	4	4	OS1	Safety output
OS2 16	7	7	7	7	OS2	Safety output











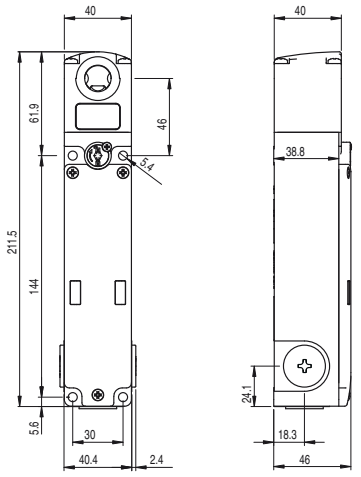
Important: terminals 7, 8, 9, 17, 18 of the internal terminal strip must not be used.
(a) Available in NG 2D••5••• version only.
(b) For NG 2D••6•••: the output signals the fault condition of the device.
(c) Available for 8-pole connector, not available for the end of a chain with Y connectors.

Female connectors see page 299

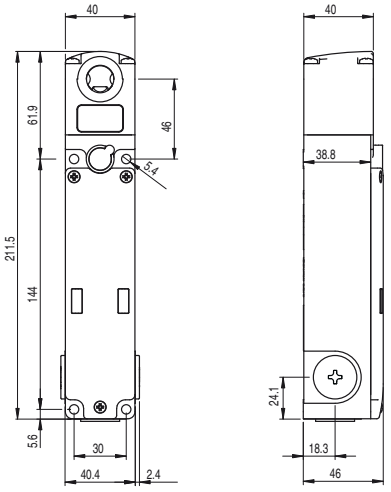
Dimensional drawings

All values in the drawings are in mm

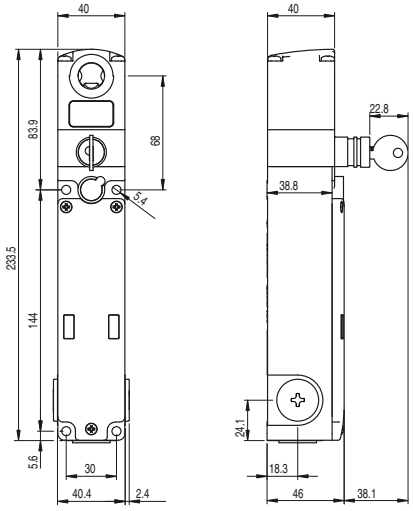
Switch NG 2D1D••1A
Operating principle D, with sealable auxiliary release device, without actuator



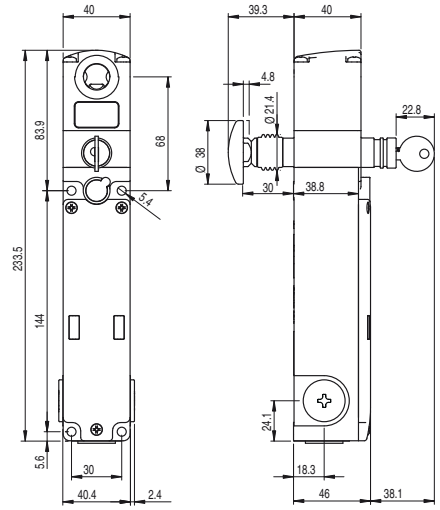
Switch NG 2D1E••1A
Operating principle E, without actuator



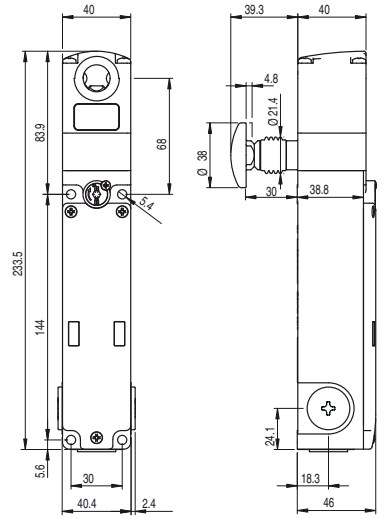
Switch NG 2D5D••1A
Operating principle D, with key release, without actuator



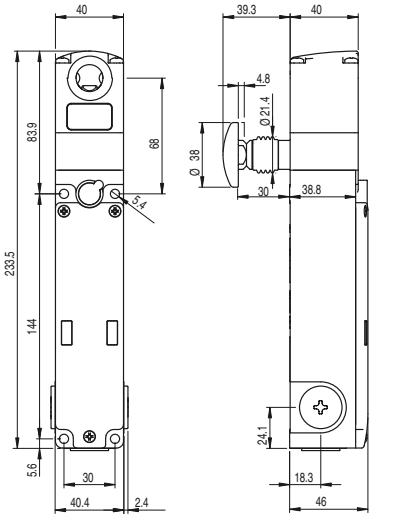
Switch NG 2D6D••1A
Operating principle D, with key release and emergency release button, without actuator



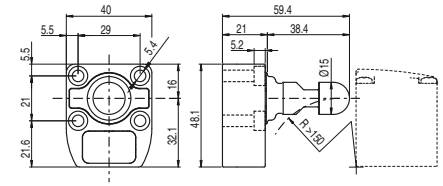
Switch NG 2D7D••1A
Operating principle D, with emergency release button, without actuator



Switch NG 2D7E••1A
Operating principle E, with emergency release button, without actuator



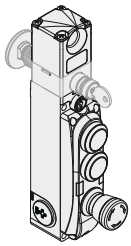
Actuator VN NG-F3•



➔ The 2D and 3D files are available at **www.pizzato.com**

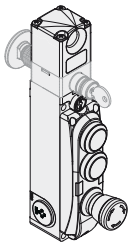
Switch with integrated field-wireable control devices

NG 2D••••1C



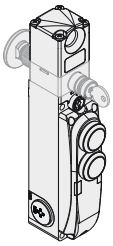
Description	Actuator colour	Terminals
illuminated button, spring-return 1NO+1NC	white	19 21 31 / 20 22 34 LED
illuminated button, spring-return 1NO+1NC	yellow	23 25 32 / 24 26 34 LED
emergency button, not illuminated, with rotary release 2NC	red	27 29 / 28 30

NG 2D••••1D



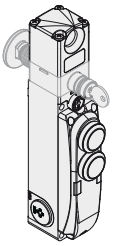
Description	Actuator colour	Terminals
illuminated button, spring-return 1NO+1NC	white	19 21 31 / 20 22 34 LED
button, not illuminated, spring-return 1NO+1NC	black	23 25 / 24 26
emergency button, not illuminated, with rotary release 2NC	red	27 29 / 28 30

NG 2D••••1E



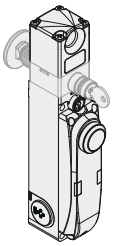
Description	Actuator colour	Terminals
illuminated button, spring-return 1NO+1NC	white	19 21 31 / 20 22 34 LED
button, not illuminated, spring-return 1NO+1NC	black	23 25 / 24 26

NG 2D••••1F



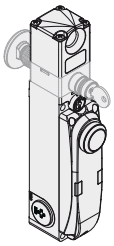
Description	Actuator colour	Terminals
illuminated button, spring-return 1NO+1NC	green	19 21 31 / 20 22 34 LED
illuminated button, spring-return 1NO+1NC	red	23 25 32 / 24 26 34 LED

NG 2D••••1G



Description	Actuator colour	Terminals
illuminated button, spring-return 1NO+1NC	green	19 21 31 / 20 22 34 LED

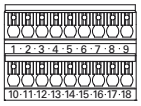
NG 2D••••1H



Description	Actuator colour	Terminals
illuminated button, spring-return 1NO+1NC	white	19 21 31 / 20 22 34 LED

Terminal assignments (version with integrated control devices)

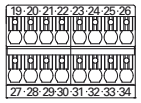
Internal terminal strip for switch



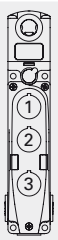
Terminal no.	Connection	
1	A2	Supply input 0 V
2	B2	0 V auxiliary supply output
3	I4	Solenoid activation input
4	O3	Signalling output, actuator inserted
5	O4	Signalling output, actuator inserted and locked (b)
6	I3	Actuator programming input
10	A1	Supply input +24 Vdc
11	B1	Auxiliary supply output +24 Vdc, (I_{th} 8 A max.)
12	IS1	Safety input
13	IS2	Safety input
14	I5	EDM input (a)
15	OS1	Safety output
16	OS2	Safety output

Important: terminals 7, 8, 9, 17, 18 of the internal terminal strip must not be used.
(a) Available in NG 2D••5••• version only.
(b) For NG 2D••6•••: the output signals the fault condition of the device.

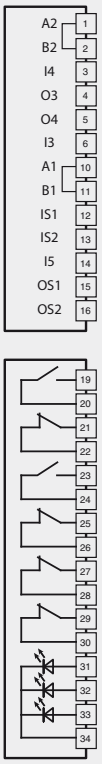
Internal terminal strip integrated control devices



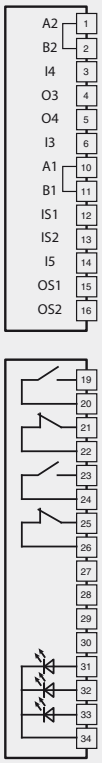
19	Contact 1	Device 1	
20			
21	Contact 2		
22			
23	Contact 1	Device 2	
24			
25	Contact 2		
26			
27	Contact 1	Device 3	
28			
29	Contact 2		
30			
31	Supply input +24 Vdc / LED device 1		
32	Supply input +24 Vdc / LED device 2		
33	Supply input +24 Vdc / LED device 3		
34	Supply input 0 V / LED		



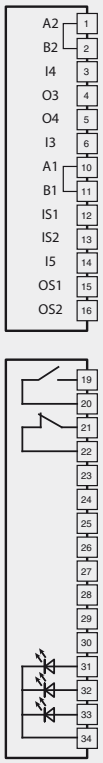
NG 2D••••1C
NG 2D••••1D



NG 2D••••1E
NG 2D••••1F

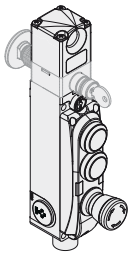


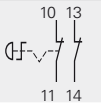
NG 2D••••1G
NG 2D••••1H



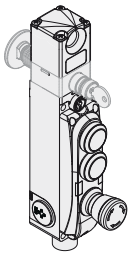
Switch with integrated control devices and M23 connector, 19-pole

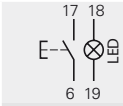
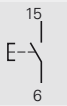
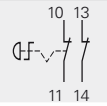
NG 2D••••1C-K603



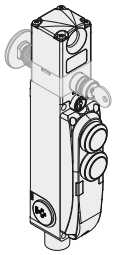
Description	Actuator colour	Pin no.
illuminated button, spring-return 1NO	white	
illuminated button, spring-return 1NO	yellow	
emergency button, not illuminated, with rotary release 2NC	red	

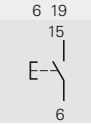
NG 2D••••1D-K603



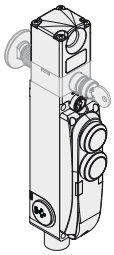
Description	Actuator colour	Pin no.
illuminated button, spring-return 1NO	white	
button, not illuminated, spring-return 1NO	black	
emergency button, not illuminated, with rotary release 2NC	red	

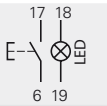
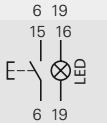
NG 2D••••1E-K602



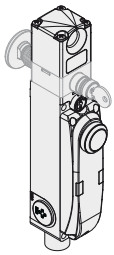
Description	Actuator colour	Pin no.
illuminated button, spring-return 1NO	white	
button, not illuminated, spring-return 1NO	black	

NG 2D••••1F-K602



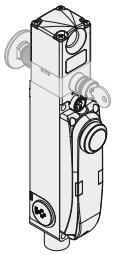
Description	Actuator colour	Pin no.
illuminated button, spring-return 1NO	green	
illuminated button, spring-return 1NO	red	

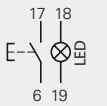
NG 2D••••1G-K601



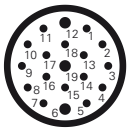
Description	Actuator colour	Pin no.
illuminated button, spring-return 1NO	green	

NG 2D••••1H-K601



Description	Actuator colour	Pin no.
illuminated button, spring-return 1NO	white	

Terminal assignments (version with integrated control devices)

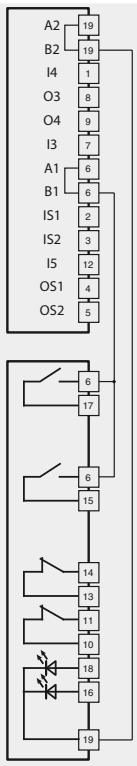


M23 connector, 19-pole		Connection
19	A2	Supply input 0 V
19	B2	0 V auxiliary supply output
1	I4	Solenoid activation input
8	O3	Signalling output, actuator inserted
9	O4	Signalling output, actuator inserted and locked (b)
7	I3	Actuator programming input
6	A1	Supply input +24 Vdc
6	B1	Auxiliary supply output +24 Vdc, (I_{th} 8 A max.)
2	IS1	Safety input
3	IS2	Safety input
12	I5	EDM input (a)
4	OS1	Safety output
5	OS2	Safety output

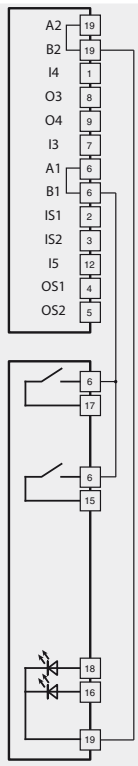
Important: terminals 7, 8, 9, 17, 18 of the internal terminal strip must not be used.
(a) Available in NG 2D••5••• version only
(b) For NG 2D••6•••: the output signals the fault condition of the device.

17	Contact 1	Device 1	
6	Contact 2		
/			
/			
15	Contact 1	Device 2	
6			
/	Contact 2		
/			
10	Contact 1	Device 3	
11			
13	Contact 2		
14			
18	Supply input +24 Vdc / LED device 1		
16	Supply input +24 Vdc / LED device 2		
/	Supply input +24 Vdc / LED device 3		
19	Supply input 0 V / LED		

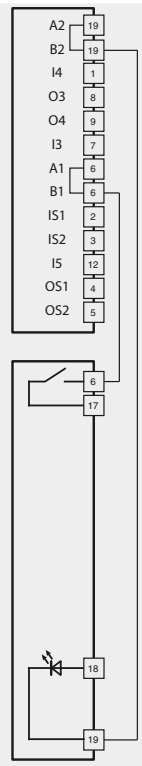
NG 2D••••1C-K603
NG 2D••••1D-K603



NG 2D••••1E-K602
NG 2D••••1F-K602



NG 2D••••1G-K601
NG 2D••••1H-K601

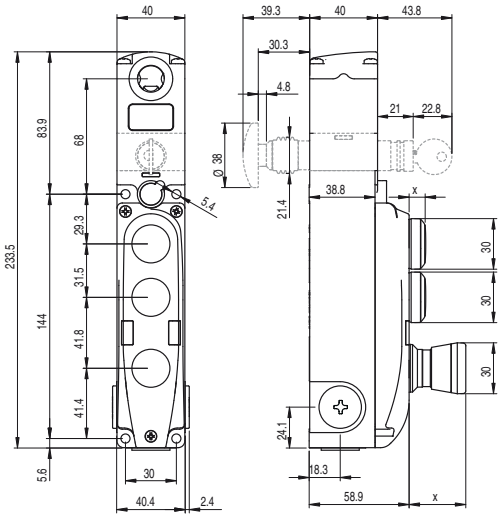


Female connectors see page 299

Dimensional drawings

values in the drawings are in mm

NG 2D •••••• switch with integrated control devices



Available integrated devices

	Description	Colours	Article	Combinable with contacts	Installation height (x) mm
	Illuminated button, spring-return	○ White ● Red ● Green ● Yellow ● Blue	VN NG-AC26005 VN NG-AC26001 VN NG-AC26003 VN NG-AC26002 VN NG-AC26004	1NO 2NO 1NO+1NC	10
	Button, not illuminated, spring-return	● Black	VN NG-AC26007	1NO 2NO 1NO+1NC	10
	Indicator light	○ White ● Red ● Green	VN NG-AC26064 VN NG-AC26060 VN NG-AC26062	/	9.7
	Emergency button acc. to. EN ISO 13850 Rotary release Push-pull release	 ● Red ● Red	 VN NG-AC26052 VN NG-AC26055	2NC	33.4
	Emergency release button, illuminated, acc. to. EN ISO 13850 Rotary release Push-pull release	 ● Red ● Red	 VN NG-AC26051 VN NG-AC26054	2NC	33.4
	Illuminated selector switch with handle, with transparent lens for LED	● Black ● Black	VN NG-AC26033 VN NG-AC26034	1NO 2NO 1NO+1NC	23.8
	Key selector switch, 2 positions	● Black ● Black	VN NG-AC26040 VN NG-AC26043	1NO 2NO 1NO+1NC	without key 21~ with key 46~
	Closing cap	● Black	VN NG-AC26090	/	4
	Fixing key	● Black	VN NG-AC26080	/	/

Legend: Maintained Spring-return Key extraction position

Other devices and contacts on request.
Please contact our technical office for the complete list of available products.

Technical data of the integrated control devices

General data

Protection degree:	IP65 acc. to EN 60529
Mechanical endurance:	
Spring-return button:	1 million operating cycles
Emergency button:	50,000 operating cycles
Selector switch:	300,000 operating cycles
Key selector switch:	50,000 operating cycles 30,000 operating cycles including removal of the key

Actuating force:

Spring-return button:	4 N min	100 N max.
Emergency button:	20 N min	100 N max.
Selector switch:	0.1 Nm min	1.5 Nm max.
Key selector switch:	0.1 Nm min	1.3 Nm max.

Contact blocks of the control devices

Material of the contacts: silver contacts

Contact type: Self-cleaning contacts with double interruption

Electrical data:

Thermal current I_{th}:	1 A
Rated insulation voltage U_i:	32 Vac/dc
Rated impulse withstand voltage U_{imp}:	1.5 kV
LED supply voltage:	24 Vdc ± 15%
LED supply current:	10 mA per LED

Utilization category of the contact block:

Direct current: DC13

U_e (V)	24
I_e (A)	0.55

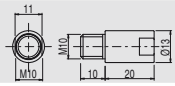
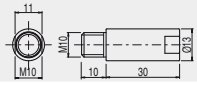
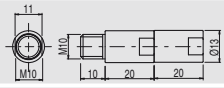
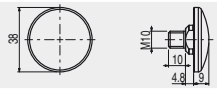
In compliance with standards:

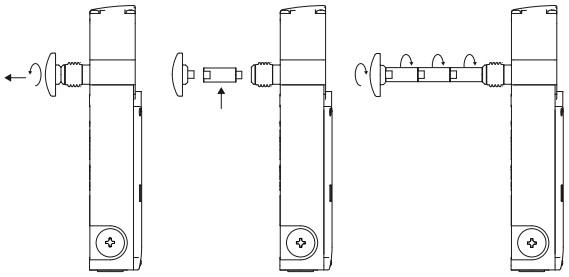
IEC 60947-5-1, IEC 60947-5-5, EN ISO 13850

⚠ Installation for safety applications:

Always connect the safety circuit to the **NC contacts** (normally closed contacts) as stated in standard EN 60947-5-1.

Extensions for release button

Article	Description	Drawing
VN NG-LP30	Metal extension for release button. For max. wall thickness of 30 mm	
VN NG-LP40	Metal extension for release button. For max. wall thickness of 40 mm	
VN NG-LP50	Metal extension for release button. For max. wall thickness of 50 mm	
VN NG-LP60	Metal extension for release button. For max. wall thickness of 60 mm	
VN NG-ERB	Red metal release button	



- Metal extensions can be combined with one another to achieve the desired length.
- Do not exceed an overall length of 500 mm between the release button and the switch.
- Use medium-strength thread locker to secure the extensions.

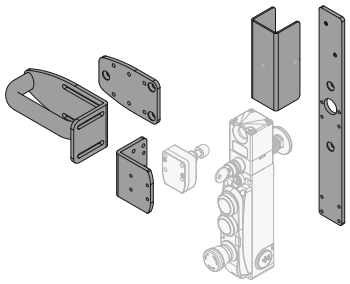
Compatibility with P-KUBE 2 safety handles

Anywhere it is necessary to monitor access to dangerous areas of machines or systems, the P-KUBE 2 safety handles can be used on doors or guards.

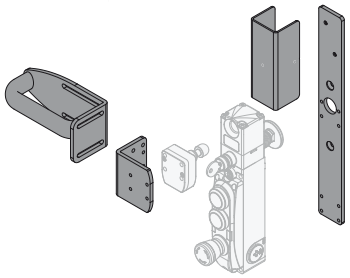
Together with the NG series RFID safety switches with guard locking, these door handles form an integrated locking system for guards that enables access control to dangerous areas. This combination allows a robust system to be created completely out of metal which is compact and configurable. It contains an RFID safety switch with centring pin for the door and optional emergency release button, an adjustable handle with LOCK OUT device and command devices.

The same article can be used on hinged doors with left and right stop as well as with sliding doors.

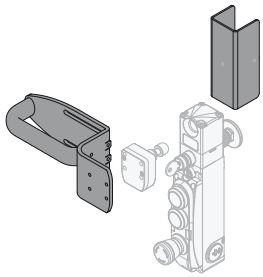
Article	Description
AP G1A-111P	Safety door handle with LOCK OUT device, with 3 plates with multiple fastening options



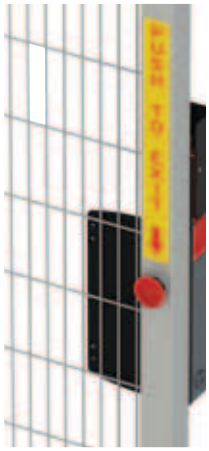
Article	Description
AP G1A-011P	Safety door handle with LOCK OUT device, with 2 plates with multiple fastening options



Article	Description
AP G1Z-200P	Safety door handle with LOCK OUT device, with 1 plate



Adhesive labels for emergency release button



Polycarbonate yellow adhesive, rectangular, 300x32 mm, red inscription. It has to be fixed on the internal part of the jamb and helps finding the emergency release button.

Article	Description
VF AP-A1AGR01	PREMERE PER USCIRE
VF AP-A1AGR02	PUSH TO EXIT
VF AP-A1AGR04	ZUM ÖFFNEN DRÜCKEN
VF AP-A1AGR05	POUSSER POUR SORTIR
VF AP-A1AGR06	PULSAR PARA SALIR
VF AP-A1AGR07	НАЖАТЬ ДЛЯ ВЫХОДА
VF AP-A1AGR08	NACISNĄĆ ABY WYJŚĆ
VF AP-A1AGR09	PRESSIONAR PARA SAIR

Accessories

Article	Description
VF KLB300	Set of two locking keys

Extra copy of the locking keys to be purchased if further keys are needed (standard supply: 2 units).

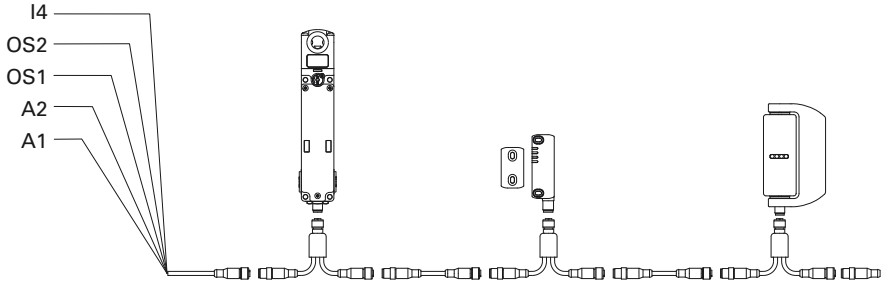
The keys of all switches have the same code. Other codes on request.

Series connection

To simplify series connections of the devices, various M12 connectors are available that allow complete wiring.

This solution significantly reduces installation times while at the same time maintaining the maximum safety levels PL e and SIL 3.

For further information see page 304.



Items with code on **green** background are stock items

NS series safety switches with solenoid and RFID technology

Description

These switches are used mainly on machines where the hazardous conditions persist even after the machine has been switched off. Mechanical parts such as pulleys, saw blades, etc., could continue to move after the machine is switched off or could still be hot or under pressure. Thus, the switches can also be used if individual guards are only to be opened under certain conditions.
Versions with mode 1 (safety outputs active when guard closed and locked) are interlocks with guard locking acc. to ISO 14119; the product is labelled with the symbol shown.

Maximum safety with a single device

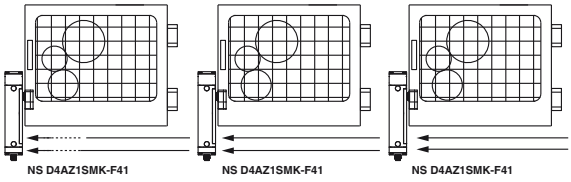
PL e + SIL 3

The NS series switches are constructed with redundant electronics. As a result, the maximum PL e and SIL 3 safety levels can still be achieved through the use of a single device on a guard. This avoids expensive wiring in the field and allows faster installation. Inside the control cabinet, the two electronic safety outputs must be connected to a safety module with OSSD inputs or to a safety PLC.

Series connection of several switches

PL e + SIL 3

One of the most important features of the NS series is the possibility of connecting up to 32 sensors in series, while still maintaining the maximum safety levels PL e laid down in EN 13849-1 and SIL 3 acc. to EN 62061.
This connection type is permissible in safety systems which have a safety module at the end of the chain that monitors the outputs of the last NS switch.
The fact that the PL e safety level can be maintained even with 32 sensors connected in series demonstrates the extremely secure structure of each single device.

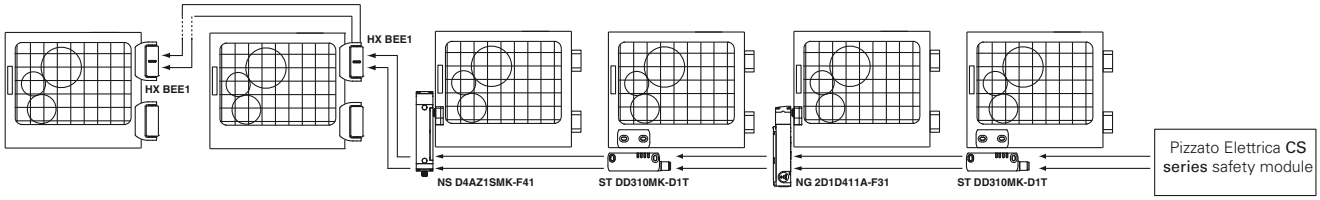


Pizzato Elettrica **CS series** safety module

Series connection with other devices

PL e + SIL 3

The NS series features two safety inputs and two safety outputs, which can be connected in series with other Pizzato Elettrica safety devices. This option allows the creation of safety chains containing various devices. For example, stainless steel safety hinges (HX BEE1 series), RFID sensors (ST series) and door lock sensors (NG series) can be connected in series while still maintaining the maximum PL e and SIL 3 safety levels.

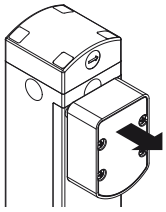


Pizzato Elettrica **CS series** safety module

RFID actuators with high coding level

The NS series is provided with an electronic system based on RFID technology to detect the actuator. This allows to provide each actuator with different coding and makes it impossible to tamper with a device by using another actuator of the same series. Millions of different coding combinations are possible for the actuators. They are therefore classified as high level coded actuators, according to EN ISO 14119.

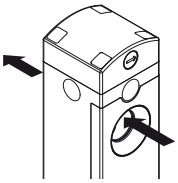
Holding force of the locked actuator



2100 N

The strong interlocking system guarantees a maximum actuator holding force of F_{1max} = 2100 N.

Dustproof

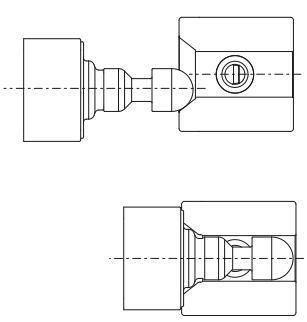


The switch is provided with a through hole for inserting the actuator. Thanks to this unique feature, any dust that enters the actuator hole can always come out on the opposite side instead of remaining inside. Moreover, the lock pin is provided with a diaphragm seal, making the system suitable for critical environments with a high level of dust.

Modularity

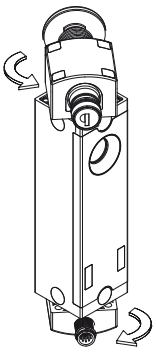
The innovative design of the auxiliary releases makes possible a wide range of combinations of auxiliary releases with lock, emergency release buttons or screwdriver releases with front and rear mounting.
The electrical connection is also highly flexible: outputs are available with cables as well as with connectors, which can be oriented axially or laterally.

Centring



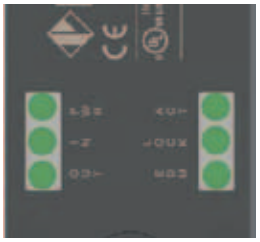
The switch is provided with a wide centring inlet for the actuator pin. This solution makes it easier to align the actuator and the opening hole on the head during installation. Moreover, this solution drastically reduces the probability of a collision between the switch and the actuator, making it possible to install the device even on inaccurately closing doors.

Head and release devices with variable orientation, not detachable



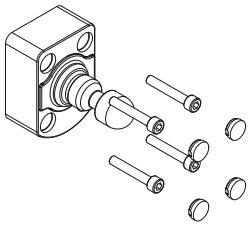
The upper part of the switch, which contains the release devices, can be rotated and is permanently connected to the lower part, which contains the outputs for the electrical connection. After loosening the fastening screws, the individual modules can be rotated in 90° steps. As a result, a single device can be used to realise various configurations without the installation technician needing to concern himself with the correct assembly of various parts.
The fastening screws are provided with protective caps to prevent dirt build-up and thereby simplify cleaning.

Six LEDs for immediate diagnosis



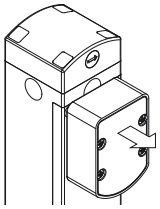
As the LEDs have been designed for quick immediate diagnosis, the status of each input and output is highlighted by one specific LED. This makes it possible to quickly identify the interruption points in the safety chain, which device is released, which door is opened and any errors inside the device. All of this at a glance, without needing to decode complex flashing sequences.

Protection against tampering



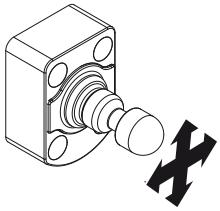
Each actuator of the NS series is supplied with four protective caps. Not only do the caps prevent dirt from accumulating and simplify cleaning, they also block access to the fastening screws of the actuator. As a result, standard screws can be used instead of tamper-proof screws.

Holding force of the unlocked actuator



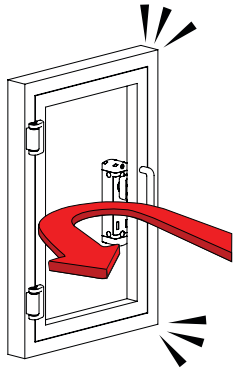
The inside of each switch features a device which holds the actuator in its closed position. Ideal for all those applications where several doors are unlocked simultaneously, but only one is actually opened. The device keeps all the unlocked doors in their position with a retaining force of 20 N~, stopping any vibrations or gusts of wind from opening them.

Articulated actuator for inaccurately closing doors



All NS series actuators are articulated, thereby allowing the actuator pin to be safely guided into the switch through the centring hole. As a result, the actuator and switch do not need to be precisely aligned during installation. In addition, the device can thereby be used on doors with a minimum actuation radius of 150 mm without the actuation pin needing to be angled.

Function for protecting against recoil forces

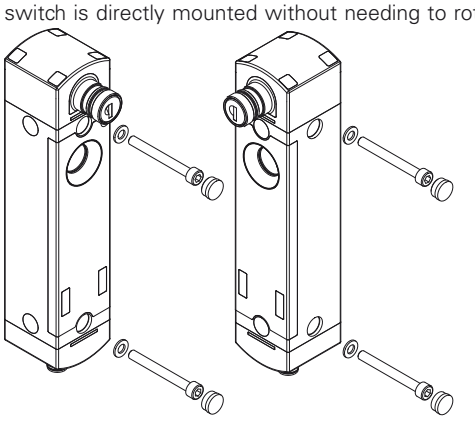


If a door is closed too quickly or with so much force that the recoil would cause it to open again, a special function in the NS switch prevents locking. This function prevents the immediate locking of the door if the lock signal is applied. This protects the switch against recoil forces that occur during instantaneous locking. This serves to protect the switch from damage and forces the operator to close the door more gently.

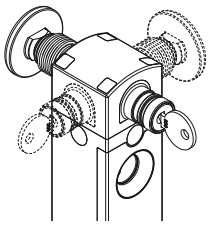
Front and side mounting

Integrated in the housing of the NS series is a hole for inserting the actuator pin. Fixing holes are also provided in the robust body for front and side mounting.

This makes it easier to mount the switch during lateral installation: the switch is directly mounted without needing to rotate the module that contains the hole for inserting the actuator pin. The fixing holes can be sealed with the protective caps provided for this purpose. Dirt deposits and tampering attempts are thereby prevented.



Key release device and emergency release button



The key release device (auxiliary release) is used to permit unlocking of the actuator only by personnel in possession of the key. The device also functions with no power supply and, once actuated, prevents the guard from being locked.

The emergency release button (escape release) allows actuator release and immediate opening of the door. Generally used in machines within which an operator could inadvertently become trapped, it faces towards the machine interior, to allow the operator to exit even in the event of a power failure. The button has two stable states and can be freely extended in length with suitable extensions (see accessories).

Both devices can be positioned on the four sides of the switch. As a result, it can be installed both towards the interior and towards the exterior of the machine.

High protection degree

IP69K
IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

Two safety output actuation modes

CLOSED
OR
CLOSED & LOCK

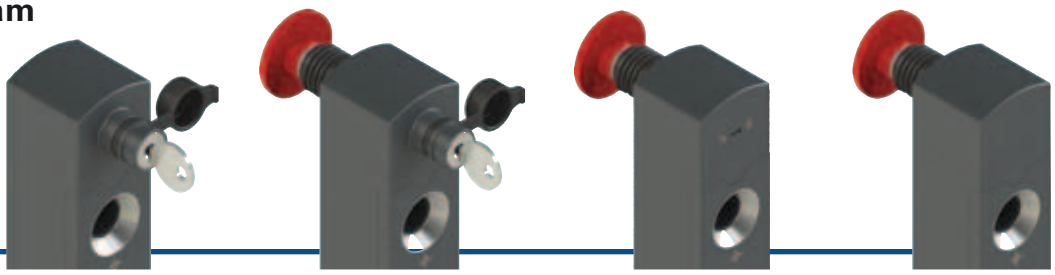
Two different activation modes are available for the switch: active safety outputs with guard closed and locked (mode 1) for machines with inertia or active safety outputs with guard closed (mode 2) for machines without inertia.

External device monitoring

EDM

On request, the switch can be supplied with EDM function (External Device Monitoring). In this case, the switch itself checks the proper function of the devices connected to the safety outputs. These devices (usually relays or safety contactors) must send a feedback signal to the EDM input, which checks that the received signal is consistent with the state of the safety outputs.

Selection diagram

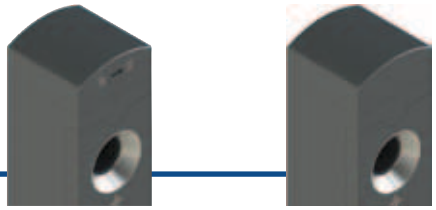


D•ST
Locked actuator with **de-energised** solenoid key release at front

D•SE
Locked actuator with **de-energised** solenoid key release at front and emergency release button at back

D•CE
Locked actuator with **de-energised** solenoid release by means of screwdriver at front and emergency release button at back

E•TE
Locked actuator with **energised** solenoid Without release at front and emergency release button at back

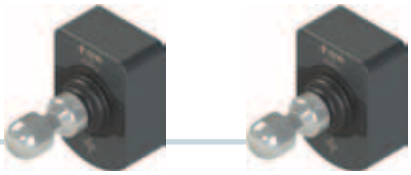


D•AZ
Locked actuator with **de-energised** solenoid release by means of screwdriver at front

E•ZZ
Locked actuator with **energised** solenoid

RELEASE AND OPERATING PRINCIPLE

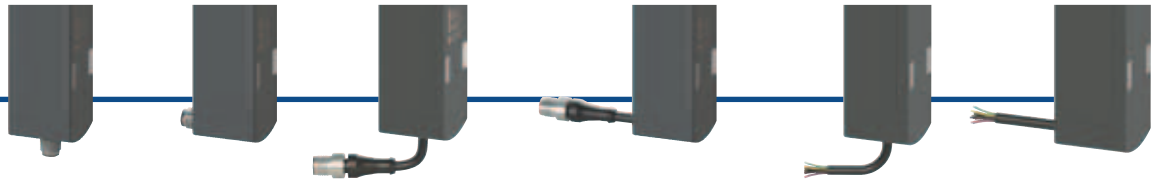
ACTUATORS



VN NS-F40
Low level coded actuator

VN NS-F41
High level coded actuator

CONNECTIONS



M12 connector, at bottom

SMK	12-pole
SPK	8-pole for stand-alone connection
SQK	8-pole, for series connection with Y connectors

M12 connector, lateral, orientable

DMK	12-pole
DPK	8-pole for stand-alone connection
DQK	8-pole, for series connection with Y connectors

Cable, length: 0.2 m, with M12 connector, at bottom

SM0.2	12-pole
SP0.2	8-pole for stand-alone connection
SQ0.2	8-pole, for series connection with Y connectors

Cable, length: 0.2 m, with M12 connector, lateral, orientable

DM0.2	12-pole
DP0.2	8-pole for stand-alone connection
DQ0.2	8-pole, for series connection with Y connectors

With PVC cable at bottom

SA2	12-pole, length: 2 m
SB2	8-pole, length: 2 m, for standalone connections

With PVC cable, lateral, orientable

DA2	12-pole, length: 2 m
DB2	8-pole, length: 2 m, for standalone connections

product options

Sold separately as accessory

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article: **NS D4AZ1SMK** — options: **-F41E36LP30**

Operating principle

D	locked actuator with de-energised solenoid. mode 1: OS safety outputs active with locked guard
E	locked actuator with energised solenoid. mode 1: OS safety outputs active with locked guard
G	locked actuator with de-energised solenoid. mode 2: OS safety outputs active with closed guard
H	locked actuator with energised solenoid. mode 2: OS safety outputs active with closed guard

Release button length

	for max. 15 mm wall thickness (standard)
LP30	for max. 30 mm wall thickness
LP40	for max. 40 mm wall thickness
LP50	for max. 50 mm wall thickness

Actuator extraction force

	actuator extraction force 20 N (standard)
E36	actuator freely removable

Actuator

F40	low level coded actuator VN NS-F40 the switch recognises any type F40 actuator
F41	high level coded actuator VN NS-F41 the switch recognises one single type F41 actuator

Inputs and outputs

3	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: closed guard 1 signalling output O4: locked guard 2 solenoid activation inputs IE1, IE2 1 reset input I3 Note: Supplied only together with actuator
4	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: closed guard 1 signalling output O4: locked guard 2 solenoid activation inputs IE1, IE2 1 programming / reset input I3
5	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: closed guard 1 signalling output O4: locked guard 2 solenoid activation inputs IE1, IE2 1 programming / reset input I3 1 feedback input EDM I5

Connection type

K	integrated M12 connector (standard)
0.2	cable, length: 0.2 m, with M12 connector
2	cable, length: 2 m (standard)
...	.....
10	cable, length: 10 m

Cable or connector type

A	PVC cable 12x0.14 mm² (standard)
B	PVC cable 8x0.34 mm² for stand-alone connection Note: without inputs IS1, IS2, I5 and without output O4
E	PUR cable, halogen-free, 8x0.34 mm² for stand-alone connection Note: without inputs IS1, IS2, I5 and without output O4
M	M12 connector, 12-pole (standard)
P	M12 connector, 8-pole, for stand-alone connections Note: without inputs IS1, IS2, I5 and without output O4
Q	M12 connector, 8-pole, for series connection with Y connectors Note: without inputs IE2, I3, I5 and without output O3

Auxiliary release at front and back

AZ	release by means of screwdriver at front only available for operating principle D or G
ST	key release at front only available for operating principle D or G
SE	key release at front and emergency release button at back only available for operating principle D or G
CE	release by means of screwdriver at front and emergency release button at back only available for operating principle D or G
ZZ	without release only available for operating principle E or H
TE	Without release at front and emergency release button at back only available for operating principle E or H

Output direction, connections

D	cable or connector, lateral
S	cable or connector, at bottom

Code structure for actuator

VN NS-F40

Actuator

F40	low level coded actuator the switch recognises any type F40 actuator
F41	high level coded actuator the switch recognises one single type F41 actuator

Main features

- Actuation without contact, using RFID technology
- Digitally coded actuator
- SIL 3 and PL e also with series connection of up to 32 devices
- Actuator holding force: 2100 N
- SIL 3 and PL e with a single device
- Protection degrees IP67 and IP69K
- Versions with key release and emergency release button
- 6 signalling LEDs

Quality marks:

0 1 2 3

EC type examination certificate: M6A170475157015
UL approval: E131787
TÜV SÜD approval: Z10170475157014
EAC approval: RU C-IT.АД35.В.00454

In compliance with standards:

EN ISO 14119, EN 60947-5-3, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 12100, IEC 60529, EN 60529, EN 61000-6-2, EN 61000-6-3, BG-GS-ET-19, IEC 61508-1, IEC 61508-2, IEC 61508-3, IEC 61508-4, SN 29500, EN ISO 13849-1, EN ISO 13849-2, EN 62061, EN 61326-1, EN 61326-3-1, EN 61326-3-2, ETSI 301 489-1, ETSI 301 489-3, ETSI 300 330-2, UL 508, CSA 22.2 No.14

Compliance with the requirements of:

Machinery Directive 2006/42/EC
EMC Directive 2014/30/EU
RED Directive 2014/53/EU
FCC Part 15

Technical data

Housing

Housing made of glass fibre reinforced technopolymer, self-extinguishing and shock-proof
Versions with integrated cable 12x0.14m² or 8x0.34m², standard length 2 m, other lengths from 0.5 … 10 m on request
Versions with integrated M12 stainless steel connector
Versions with 0.2 m cable and M12 connector, other lengths from 0.1 … 3 m on request
Protection degree: IP67 acc. to EN 60529
IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)

General data

SIL level (SIL CL): up to SIL 3 acc. to EN 62061
Performance Level (PL): up to PL e acc. to EN ISO 13849-1
Safety category: up to cat. 4 acc. to EN ISO 13849-1
Interlock, no contact, coded, with guard locking: type 4 acc. to EN ISO 14119
Level of coding acc. to EN ISO 14119: low with F40 actuator
High with F41 actuator

Safety parameters	PFH_D	$MTTF_D$	PL	SIL	Cat
System	1.24 E-09	1671 years	e	3	4
Lock (locked guard)	1.23 E-09	2657 years	e	3	4
Interlock (closed guard)	1.22 E-09	1840 years	e	3	4
Locking control	2.29 E-10	2243 years	e	3	4

DC: High
Service life: 20 years
Ambient temperature: -20°C … +50°C
Max. actuation frequency with actuator lock and release: 600 operating cycles/hour
Mechanical endurance: 1 million operating cycles
Max. actuation speed: 0.5 m/s
Min. actuation speed: 1 mm/s
Maximum force before breakage F_{1max}: 2100 N acc. to EN ISO 14119
Max. holding force F_{Zh}: 1615 N acc. to EN ISO 14119
Maximum clearance of locked actuator: 4 mm
Released actuator extraction force: ~ 20 N
Tightening torques for installation: see page 313-324

Electrical data of inputs IS1/IS2/I3/IE1/IE2/I5/EDM

Rated operating voltage U_{e1}: 24 Vdc
Rated current consumption I_{e1}: 5 mA

Electrical data of OS1/OS2 safety outputs

Rated operating voltage U_{e2}: 24 Vdc
Output type: PNP type OSSD
Maximum current per output I_{e2}: 0.25 A
Minimum current per output I_{m2}: 0.5 mA
Thermal current I_{th2}: 0.25 A
Utilization category: DC-13; U_{e2}=24 Vdc, I_{e2}=0.25 A
Short circuit detection: Yes
Overcurrent protection: Yes
Internal self-resettable protection fuse: 1.1 A
Duration of the deactivation impulses at the safety outputs: < 300 µs
Permissible maximum capacitance between outputs: < 200 nF
Permissible maximum capacitance between output and ground: < 200 nF
Response time upon deactivation of IS1/IS2 inputs: typically 7 ms, max. 15 ms
Response time upon actuator removal: typically 120 ms, max. 200 ms

Electrical data of O3/O4 signalling output

Rated operating voltage U_{e3}: 24 Vdc
Output type: PNP
Maximum current per output I_{e3}: 0.1 A
Utilization category: DC-13; U_{e3}=24 Vdc, I_{e3}=0.1 A
Short circuit detection: No
Overcurrent protection: Yes
Internal self-resettable protection fuse: 1.1 A

RFID sensor data

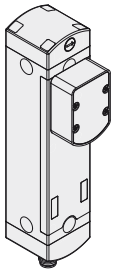
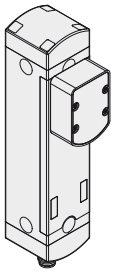
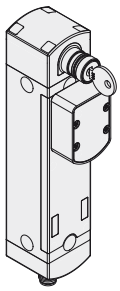
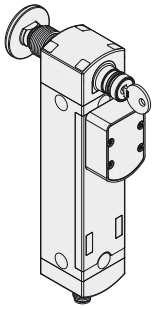
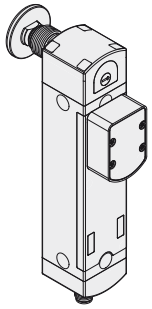
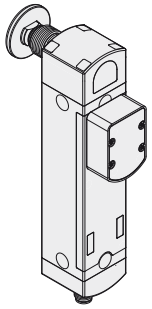
Assured operating distance S_{ao}: 2 mm
Assured release distance S_{ar}: 6 mm (actuator not locked)
10 mm (actuator locked)
Rated operating distance S_n: 3 mm
Repeat accuracy: ≤ 10 % s_n
Differential travel: ≤ 20 % s_n
Max. switching frequency: 1 Hz

Power supply electrical data

Rated operating voltage U_e SELV: 24 Vdc ±10%
Operating current at U_e voltage:
- minimum: 40 mA
- with activated solenoid: 0.4 A max.
- with activated solenoid and all outputs at maximum power: 1.2 A

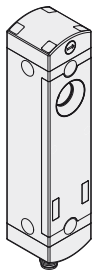
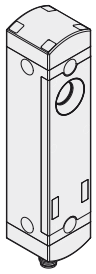
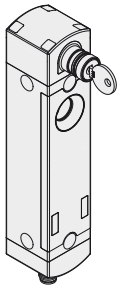
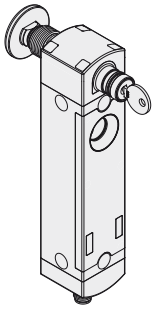
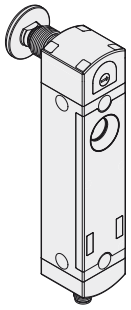
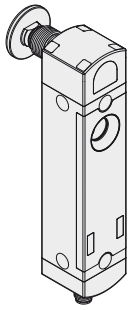
Rated insulation voltage U_i: 32 Vdc
Rated impulse withstand voltage U_{imp}: 1.5 kV
External protection fuse: type gG fuse 2 A or equivalent device
Overvoltage category: III
Electrical endurance: 1 million operating cycles
Solenoid duty cycle: 100% ED (continuous operation)
Solenoid consumption: 9 W max.

Selection table for switches with high level coded actuators

	Operating principle: locked actuator with de-energised solenoid. With screwdriver release	Operating principle: locked actuator with energised solenoid	Operating principle: locked actuator with de-energised solenoid. With key release	Operating principle: locked actuator with de-energised solenoid. With key release and emergency release button	Operating principle: locked actuator with de-energised solenoid. With screwdriver release and emergency release button	Operating principle: locked actuator with energised solenoid. With emergency release button
Mode 1 OS safety outputs active with locked and closed guard	NS D4AZ1SMK-F41	NS E4ZZ1SMK-F41	NS D4ST1SMK-F41	NS D4SE1SMK-F41	NS D4CE1SMK-F41	NS E4TE1SMK-F41
Mode 2 OS safety outputs active with closed guard	NS G4AZ1SMK-F41	NS H4ZZ1SMK-F41	NS G4ST1SMK-F41	NS G4SE1SMK-F41	NS G4CE1SMK-F41	NS H4TE1SMK-F41

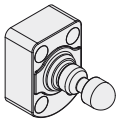
Selection table for switches

	Operating principle: locked actuator with de-energised solenoid. With screwdriver release	Operating principle: locked actuator with energised solenoid	Operating principle: locked actuator with de-energised solenoid. With key release	Operating principle: locked actuator with de-energised solenoid. With key release and emergency release button	Operating principle: locked actuator with de-energised solenoid. With screwdriver release and emergency release button	Operating principle: locked actuator with energised solenoid. With emergency release button
Mode 1 OS safety outputs active with locked and closed guard	NS D4AZ1SMK	NS E4ZZ1SMK	NS D4ST1SMK	NS D4SE1SMK	NS D4CE1SMK	NS E4TE1SMK
Mode 2 OS safety outputs active with closed guard	NS G4AZ1SMK	NS H4ZZ1SMK	NS G4ST1SMK	NS G4SE1SMK	NS G4CE1SMK	NS H4TE1SMK

To order a product with lateral connection replace character **S** with character **D** in the order codes shown above. Example: NS D4AZ1**S**MK → NS D4AZ1**D**MK
To order a product with EDM input replace number **4** with number **5** in the codes shown above. Example: NS D**4**AZ1SMK → NS D**5**AZ1SMK
Legend: interlock with lock monitoring acc. to EN ISO 14119

Selection table for actuators



Level of coding acc. to EN ISO 14119	Article
low	VN NS-F40
high	VN NS-F41

The use of RFID technology in NS series devices makes them suitable for several applications. Pizzato Elettrica offers two different versions of actuators, in order to best suit customers' specific needs.
Type F40 actuators are all encoded with the same code. This implies that a device associated with an actuator type F40 can be activated by other actuators type F40.
Type F41 actuators are always encoded with different codes. This implies that a device associated with an actuator type F41 can be activated only by a specific actuator. Another F41 type actuator will not be recognised by the device until a new association procedure is carried out (reprogramming). After reprogramming, the old actuator F41 will no longer be recognized.

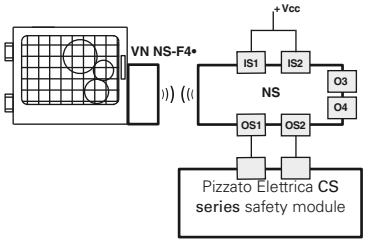
Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

Items with code on **green** background are stock items

Complete safety system

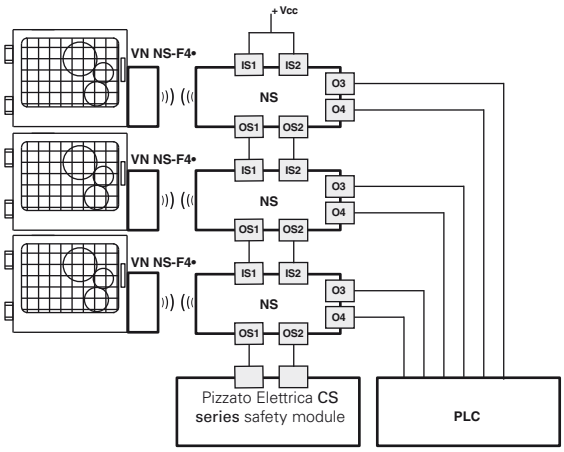
The use of complete and tested solutions guarantees the electrical compatibility between the NS series switches and the safety modules from Pizzato Elettrica, as well as high reliability. The switches have been tested with the modules listed in the adjacent table.



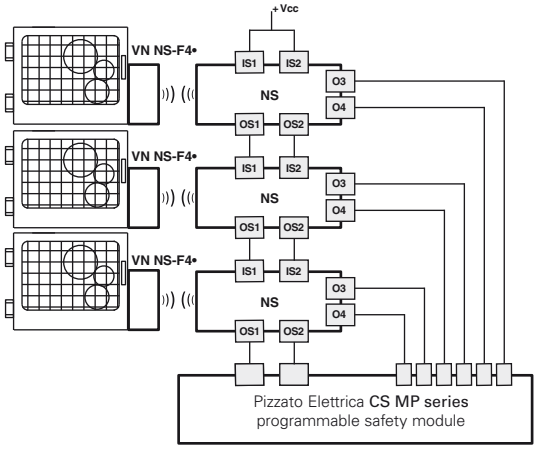
Switches	Compatible safety modules	Safety module output contacts		
		Instantaneous safety contacts	Delayed safety contacts	Signalling contacts
NS ••••1•••	CS AR-05••••	3NO	/	1NC
	CS AR-06••••	3NO	/	1NC
	CS AR-08••••	2NO	/	/
	CS AT-0•••••	2NO	2NO	1NC
	CS AT-1•••••	3NO	2NO	/
	CS MP••••••	page 255		
	CS MF••••••	page 283		

All NS series switches can be connected, provided that compatibility is checked, to safety modules or safety PLCs with OSSD inputs.

NS series switches can be used as individual devices provided that the safety outputs be evaluated by a Pizzato Elettrica safety module (see table for combinable safety modules).



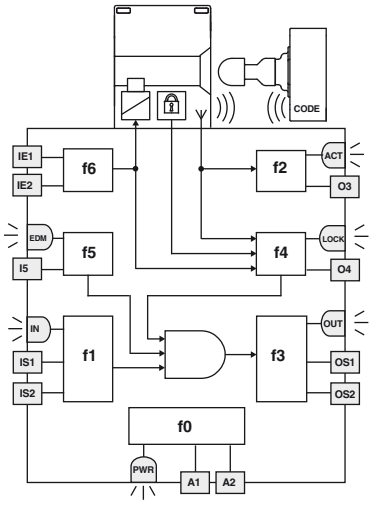
Possibility of series connection of multiple switches for simplifying the wiring of the safety system, whereby only the outputs of the last switch are evaluated by a Pizzato Elettrica safety module (see table with compatible safety modules). Each NS series switch is provided with two signalling outputs which are activated when the guard is closed (O3) or locked (O4). Depending on the specific requirements of the system that has been realised, the signals of the signalling outputs can be evaluated by a PLC.



Possibility of series connection of multiple switches for simplifying the wiring of the safety system, whereby only the outputs of the last switch are evaluated by a Pizzato Elettrica safety module of the CS MP series. Both the safety-relevant evaluation and the evaluation of the signalling outputs are performed by the CS MP series.
The examples listed above refer to applications with NS ••••1•••

Application example on page 253.

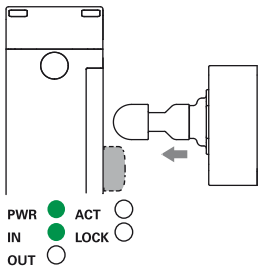
Internal block diagram



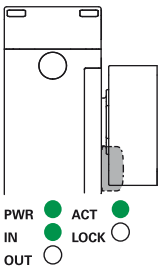
The diagram on the side represents the 7 logic functions which interact inside the device.
Function f0 is a basic function and includes the monitoring of the power supply as well as internal, cyclical tests. Function f1 monitors the status of the device inputs, whereas function f2 monitors the presence of the actuator within the detection areas of the switch.
Function f4 checks the actuator lock condition.
Function f3 is intended to activate or deactivate the safety outputs and check for any faults or short circuits in the outputs.
In the EDM versions, the f5 function verifies the consistency of the EDM signal during safety output state changes. The safety-related function, which combines the sub-functions mentioned above, only activates the safety outputs for the switches in mode 1 if the input signals are correctly applied and the actuator pin is in the safe actuation area in the head and locked. The safety outputs for switches in mode 2 are activated if the input signals are correctly applied and the actuator pin is in the safe actuation area in the head. The f6 function verifies the coherence of the enable/disable signals of the actuator lock command. The status of each function is displayed by the corresponding LED (PWR, IN, OUT, ACT, LOCK, EDM), in such a way that the general device status becomes immediately obvious to the operator.

LED	Function
PWR	Power supply/self-diagnosis
IN	status of safety inputs
OUT	status of safety outputs
ACT	actuator state
LOCK	actuator locked
EDM	state of EDM inputs (NS •5••1•••)

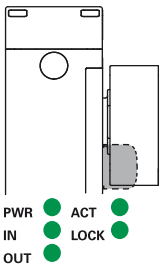
Actuation sequence in mode 1



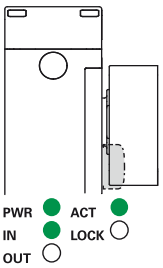
The switch is supplied with power (PWR LED on, green), the IS1 and IS2 inputs are enabled (IN LED on, green), the OS1 and OS2 safety outputs are disabled (OUT LED off). The actuator is outside of the actuation zone (LED ACT off).



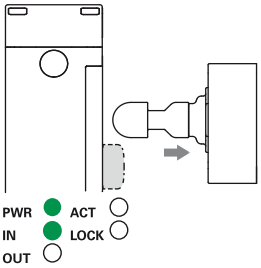
When the actuator is brought inside the safe actuation area (dark grey area), the switch turns on the ACT LED (green). In this position, the O3 signalling output (door-closed) is activated. The actuator is not locked (LOCK LED off).



The IE1, IE2 inputs can be used to lock the actuator (LOCK LED on, green). The OS1 and OS2 safety outputs are enabled (OUT LED on, green). The O4 signalling output is activated at the same time. The safe actuation area is extended in order to allow greater play for the actuator.



The IE1, IE2 inputs can be used to unlock the actuator (LOCK LED off). The switch disables the OS1 and OS2 safety outputs and turns off the OUT LED. The O4 signalling output is deactivated at the same time. The safe actuation area returns to the initial values.



When the actuator leaves the actuation limit area, the device turns off the ACT LED and the O3 signalling output.

Actuation sequence in mode 2

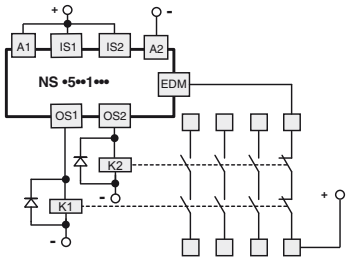
In contrast to the above mode 2 description, the safety outputs OS1 and OS2 enable when the actuator is detected, and disable when the actuator is no longer detectable.

Operating states

PWR LED	IN LED	OUT LED	ACT LED	LOCK LED	EDM LED (a)	Device state	Description
○	○	○	○	○	○	OFF	Device switched off.
◐	◐	◐	◐	◐	◐	POWER ON	Internal tests upon activation.
●	○	○	✳	✳	●	RUN	Safety inputs of the device not active.
●	●	✳	✳	✳	✳	RUN	Activation of safety inputs.
●	◐	○	✳	✳	✳	RUN	Safety inputs incoherence. Recommended action: check for presence and/or wiring of inputs.
●	✳	✳	✳	◐	✳	RUN	Incoherence of solenoid activation inputs IE1, IE2. Recommended action: check for presence and/or wiring of inputs.
●	✳	✳	✳	◐	✳	RUN	Auxiliary release activated. Deactivate the auxiliary release to lock the actuator
●	✳	✳	●	✳	✳	RUN	Actuator in safe area. O3 signalling output active.
●	✳	✳	●	●	○	RUN	Actuator in safe area and locked; O3 and O4 outputs active.
●	●	●	●	●	○	RUN	**Mode 1** Activation of safety inputs IS1, IS2. Actuator in safe area and locked. O3, O4, OS1 and OS2 outputs active.
●	●	●	●	✳	○	RUN	**Mode 2** Activation of safety inputs IS1, IS2. Actuator in safe area. O3, OS1 and OS2 outputs active.
◐	✳	✳	✳	✳	✳	RUN	Rapid flashing: supply voltage too high. Slow flashing: supply voltage within the tolerance limits
●	✳	◐	✳	✳	✳	ERROR	Error on safety outputs. Recommended action: check for any short circuits between the outputs, outputs and ground or outputs and power supply, then restart the device.
●	○	○	◐	○	○	ERROR	Actuator detection error. Check the physical integrity of the device and, in case of failure, please replace the entire device. If undamaged, realign the actuator with the switch and restart the device.
●	○	○	○	○	○	ERROR	Internal error. Recommended action: restart the device. If the failure persists, replace the device.
●	✳	○	✳	✳	●	RUN	EDM signal active (external relay off)[a]
●	●	●	●	●	○	RUN	EDM signal not active (external relay on)[a]
●	○	○	○	○	◐	ERROR	Error in the EDM[a] function

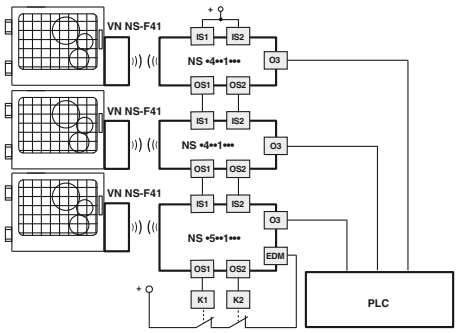
Legend: ○ = off ● = on ◐ = flashing ◑ = alternating colours ✳ = indifferent (a) Available only in versions NS •5••1•••

External device monitoring (EDM)



The NS •5••1••• version, in addition to maintaining the operating and safety characteristics of the NS series, allows control of **forcibly guided NC contacts of contactors or relays** controlled by the safety outputs of the switch itself. As an alternative to the relays or contactors you can use Pizzato Elettrica expansion modules CS ME-03.

See page 245. This check is carried out via the EDM input (External Device Monitoring as defined in EN 61496-1) of the switch.



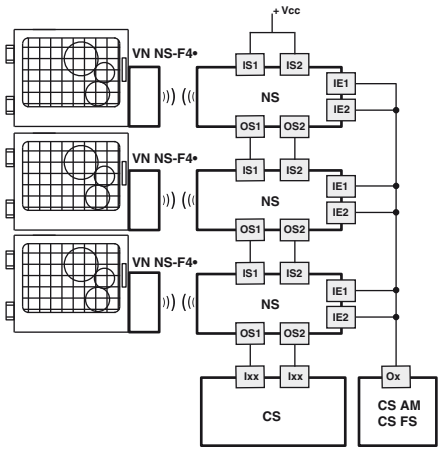
This version, with the IS safety inputs, **can be used at the end of a series** of NS switches, **up to a maximum number of 32 devices**, while maintaining the maximum PL e safety level and acc. to EN ISO 13849-1 and SIL 3 safety level acc. to EN 62061.

This solution allows you to dispense with the safety module connected to the last device in the chain. If present, the EDM function must be used.

Series connection of several switches

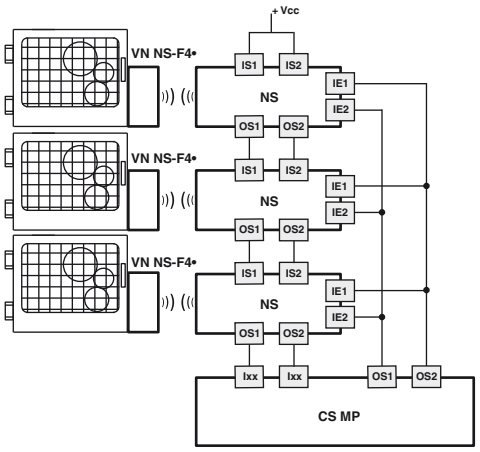
Lock detection function (guard locked)
2 channels / Category 4 / up to SIL 3 / PL e

Locking control function
1 channel / Category 2 / up to SIL 2 / PL d

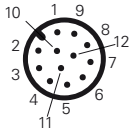


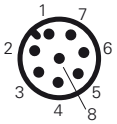
Lock detection function (guard locked)
2 channels / Category 4 / up to SIL 3 / PL e

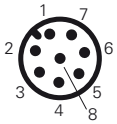
Locking control function
2 channels / Category 4 / up to SIL 3 / PL e



Connector pin assignment			Internal cable wiring			
M12 connector, 12-pole	M12 connector, 8-pole stand-alone connection	M12 connector, 8-pole series connection with "Y" connectors	Cable 12x0.14 mm² external Ø 6 mm	Cable 8x0.34 mm² external Ø 7 mm	Connection	
3	3	3	White	Blue	A2	Supply input 0 V
10	8	8	Purple	Red	IE1	Solenoid activation input
12	5	/	Red-Blue	Purple	IE2	Solenoid activation input
5	2	/	Pink	Black	O3	Signalling output, actuator inserted
9	/	5(b)	Red	/	O4	Signalling output, actuator inserted and locked
8	6	/	Grey	purple-white	I3	Actuator programming input / reset
1	1	1	Brown	Brown	A1	Supply input +24 Vdc
2	/	2	Blue	/	IS1	Safety input
6	/	6	Yellow	/	IS2	Safety input
11	/	/	Grey-Pink	/	I5	EDM input (a)
4	4	4	Green	Red-White	OS1	Safety output
7	7	7	Black	Black-White	OS2	Safety output







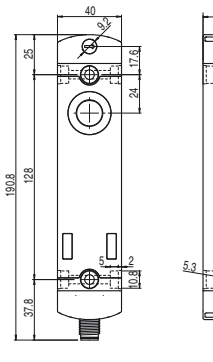
(a) Available for NS •5••1••• version only
(b) Available for 8-pole connector, not available for the end of a chain with Y connectors.

Female connectors see page 299

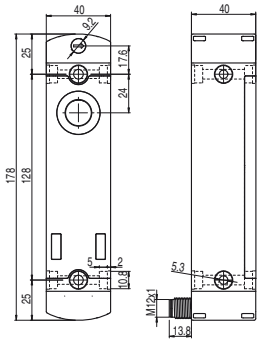
Dimensional drawings

All values in the drawings are in mm

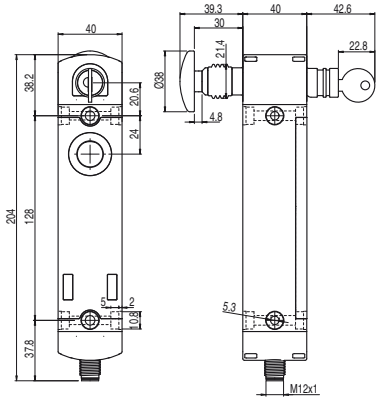
Switch
NS ••AZ1SMK
NS ••ZZ1SMK



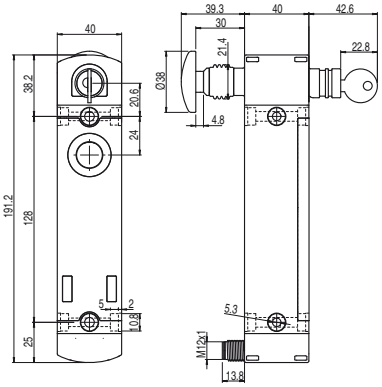
Switch
NS ••AZ1DMK
NS ••ZZ1DMK



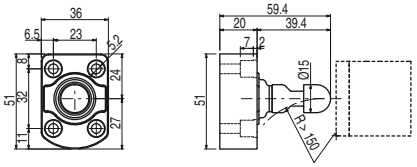
Switch
NS ••ST1SMK
NS ••SE1SMK
NS ••CE1SMK
NS ••TE1SMK



Switch
NS ••ST1DMK
NS ••SE1DMK
NS ••CE1DMK
NS ••TE1DMK

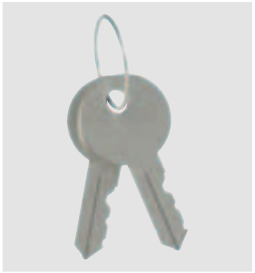


Actuator VN NS-F4•



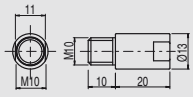
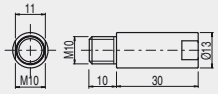
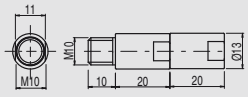
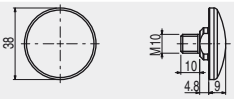
Accessories

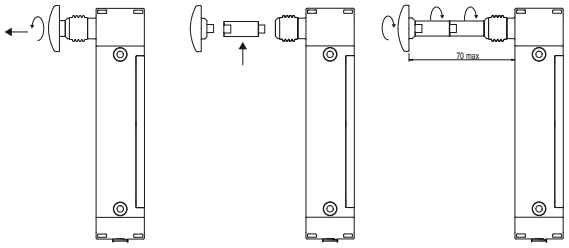
Article	Description
VF KLB300	Set of two locking keys



Extra copy of the locking keys to be purchased if further keys are needed (standard supply: 2 units).
The keys of all switches have the same code. Other codes on request.

Extensions for release button

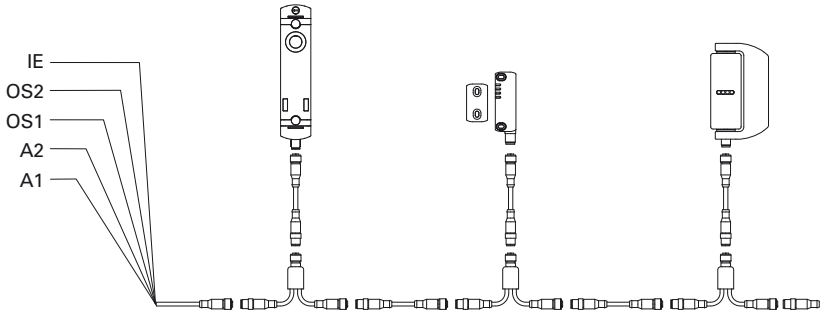
Article	Description	Drawing
VN NG-LP30	Metal extension for release button. For max. wall thickness of 30 mm	
VN NG-LP40	Metal extension for release button. For max. wall thickness of 40 mm	
VN NG-LP50	Metal extension for release button. For max. wall thickness of 50 mm	
VN NG-ERB	Red metal release button	



- Metal extensions can be combined with one another to achieve the desired length.
- Do not exceed an overall length of **70 mm** between the release button and the switch.
- Use medium-strength thread locker to secure the extensions

Series connection

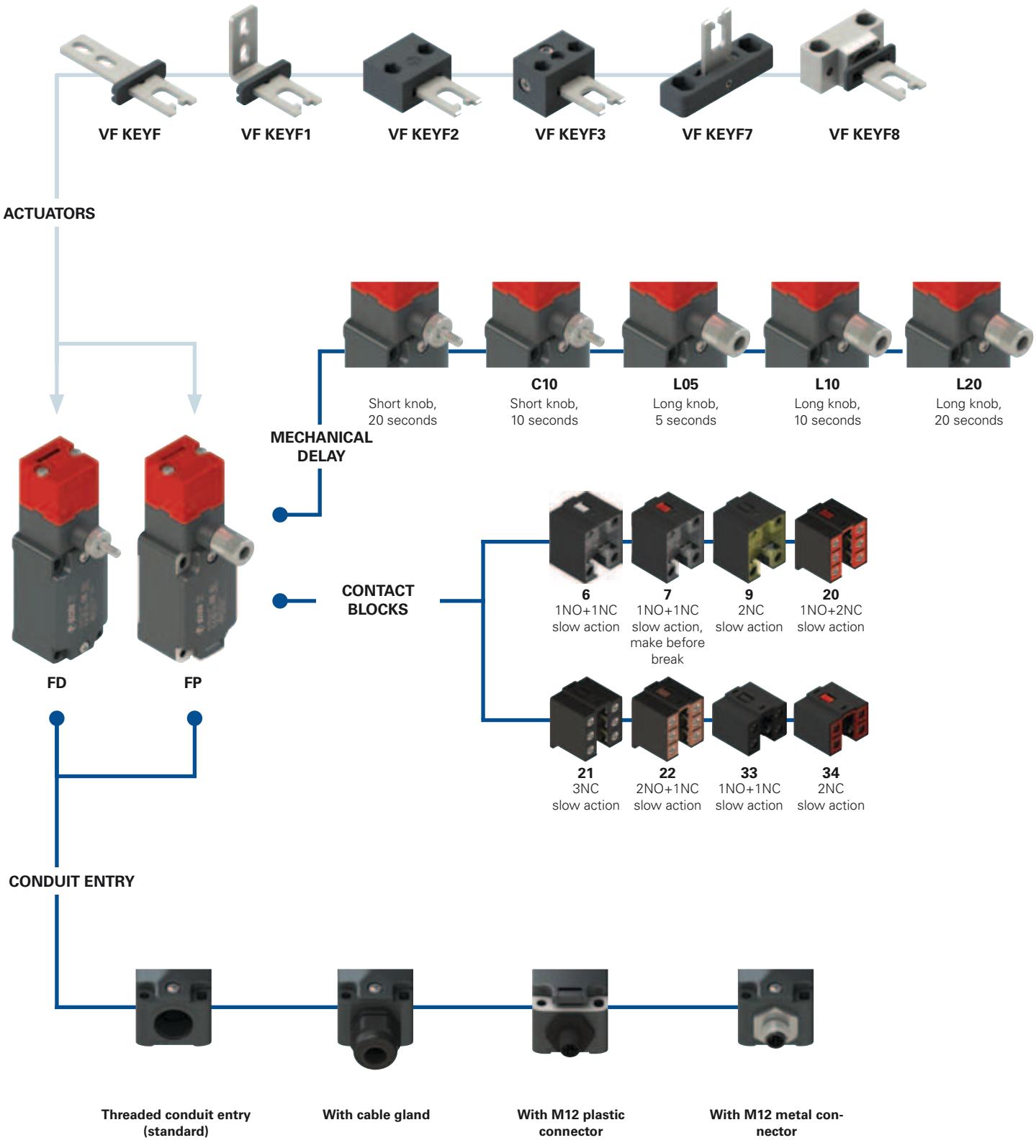
To simplify series connections of the devices, various M12 connectors are available that allow complete wiring.
This solution significantly reduces installation times while at the same time maintaining the maximum safety levels PL e and SIL 3 for the interlocking function.
For further information see page 304.



Items with code on **green** background are stock items

➔ The 2D and 3D files are available at **www.pizzato.com**

Selection diagram



product option
accessory sold separately

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options | options

FD 6R2-L10F1GM2K50T6

Housing	
FD	metal, one conduit entry
FP	technopolymer, one conduit entry

Contact block	
6	1NO+1NC, slow action
7	1NO+1NC, slow action, make before break
9	2NC, slow action
20	1NO+2NC, slow action
21	3NC, slow action
22	2NO+1NC, slow action
33	1NO+1NC, slow action
34	2NC, slow action

Mechanical delay	
	short knob, 20 s (standard)
C10	short knob, 10 s
L05	long knob, 5 s
L10	long knob, 10 s
L20	long knob, 20 s

Actuators	
	without actuator (standard)
F	straight actuator VF KEYF
F1	angled actuator VF KEYF1
F2	jointed actuator VF KEYF2
F3	jointed actuator adjustable in two directions VF KEYF3
F7	jointed actuator adjustable in one direction VF KEYF7
F8	universal actuator VF KEYF8

Threaded conduit entry	
M2	M20x1.5 (standard)
	PG 13.5

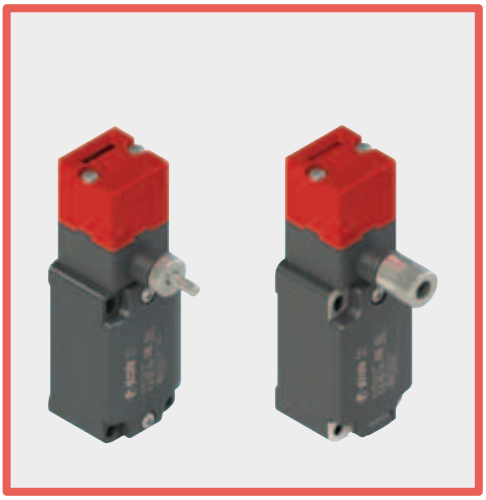
Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 22, 33, 34)

Ambient temperature	
	-25°C … +80°C (standard)
T6	-40°C … +80°C

Pre-installed cable glands or connectors	
	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
...	.....
K50	M12 metal connector, 5-pole
...	.....

For the complete list of possible combinations please contact our technical department.

Safety switches **with manual mechanical delay and separate actuator**



Main features

- Metal housing or technopolymer housing, one conduit entry
- Protection degree IP67
- 8 contact blocks available
- 6 stainless steel actuators available
- Versions with assembled M12 connector
- Versions with gold-plated silver contacts
- Strong actuator locking (1000 N)
- Manual actuator release
- Versions with different release delay times

Quality marks:

IMQ approval:	EG605
UL approval:	E131787
CCC approval:	2007010305230000 (FD series) 2007010305230014 (FP series)
EAC approval:	RU C-IT.АД35.B.00454

Technical data

Housing

FP series housing made of glass fibre reinforced technopolymer, self-extinguishing, shock-proof and with double insulation: ⧈
FD series: metal housing, baked powder coating.

One threaded conduit entry:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Interlock with mechanical lock, coded:	type 2 acc. to EN ISO 14119
Coding level:	low acc. to EN ISO 14119
Safety parameters:	
B_{10D}:	1,000,000 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Version for operation at ambient temperatures from -40°C … +80°C on request	
Max. actuation frequency:	360 operating cycles/hour
Mechanical endurance:	500,000 operating cycles
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Maximum force before breakage F_{1max}	1000 N acc. to EN ISO 14119
Max. holding force F_{Zh}	770 N acc. to EN ISO 14119
Max. clearance of the actuator:	4.5 mm
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 22, 33, 34:	min. 1 x 0.34 mm² (1 x AWG 22) max. 2 x 1.5 mm² (2 x AWG 16)
Contact blocks 6, 7, 9:	min. 1 x 0.5 mm² (1 x AWG 20) max. 2 x 2.5 mm² (2 x AWG 14)

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, BG-GS-ET-15, UL 508, CSA 22.2 No.14 .
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 No.14 , GB14048.5-2001.

Compliance with the requirements of:
Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

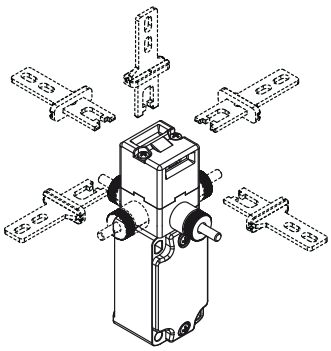
Electrical data			Utilization category
without connector	Thermal current (I_{th}):	10 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 22, 33, 34)	U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 22, 33, 34)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250 I_e (A) 6 1.1 0.4
	Protection against short circuits:	type aM fuse 10 A 500 V	
	Pollution degree:	3	
with M12 connector 4 and 5-pole	Thermal current (I_{th}):	4 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	U_e (V) 24 120 250 I_e (A) 4 4 4
	Protection against short circuits:	type gG fuse 4 A 500 V	Direct current: DC13
	Pollution degree:	3	U_e (V) 24 125 250 I_e (A) 4 1.1 0.4
with M12 connector 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	U_e (V) 24 I_e (A) 2
	Protection against short circuits:	type gG fuse 2 A 500 V	Direct current: DC13
	Pollution degree:	3	U_e (V) 24 I_e (A) 2

Description

These switches are used on machines where the hazardous conditions remain for a while, even after the machine has been switched off, for example because of mechanical inertia of the pulleys, saw disks, mills. This switch has its ideal application where the guard is not opened frequently and the installation of a switch with solenoid would be too expensive.

These switches are considered interlocks with guard locking in accordance with ISO 14119, and the product is marked on the side with the symbol shown.

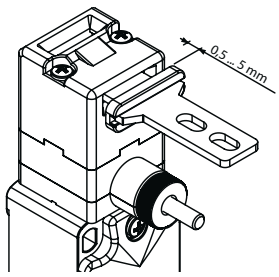
Head and knobs with variable orientation



The head can be quickly turned to each of the four sides of the switch by unfastening the two fastening screws.

The mechanical delay device can be rotated in 90° steps as well. This enables the switch to assume 32 different configurations.

Adjustment range



The actuation head of this switch features a wide range of travel. In this way the guard can oscillate along the direction of insertion (4.5 mm) without causing unwanted machine shutdowns. This wide range of travel is available in all actuators in order to ensure maximum device reliability.

Protection degree IP67

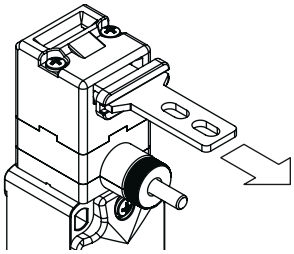
IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

Contact block

Contact blocks with captive screws, finger protection, twin bridge contacts and double interruption for higher contact reliability. Available in multiple versions with shifted, simultaneous or overlapping actuation paths. They are suitable for many different applications.

Holding force of the unlocked actuator



The inside of each switch features a device which holds the actuator in its closed position. Ideal for all those applications where several doors are unlocked simultaneously, but only one is actually opened. The device keeps all the unlocked doors in their position with a retaining force of 30 N~, stopping any vibrations or gusts of wind from opening them.

Extended temperature range

-40°C

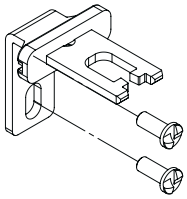
These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C.

They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

Laser engraving

All devices are marked using a dedicated indelible laser system. These engravings are therefore suitable for extreme environments too. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Safety screws for actuators



As required by EN ISO 14119, the actuator must be fixed immovably to the door frame. Pan head safety screws with one-way fitting are available for this purpose. With this screw type, the actuators cannot be removed or tampered by using common tools. See accessories on page 310.

Features approved by IMQ

Rated insulation voltage (U_i):	500 Vac 400 Vac (for contact blocks 20, 21, 22, 33, 34)
Conventional free air thermal current (I_{th}):	10 A
Protection against short circuits:	type aM fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (for contact blocks 20, 21, 22, 33, 34)
Protection degree of the housing:	IP67
MV terminals (screw terminals)	
Pollution degree:	3
Utilization category:	AC15
Operating voltage (U_e):	400 Vac (50 Hz)
Operating current (I_e):	3 A

Forms of the contact element: Zb, Y+Y, Y+Y+X, Y+Y+Y, Y+X+X

Positive opening contacts on contact blocks 6, 7, 9, 20, 21, 22, 33, 34

In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories	Q300 (69 VA, 125-250 Vdc) A600 (720 VA, 120-600 Vac)

Housing features type 1, 4X "indoor use only", 12, 13

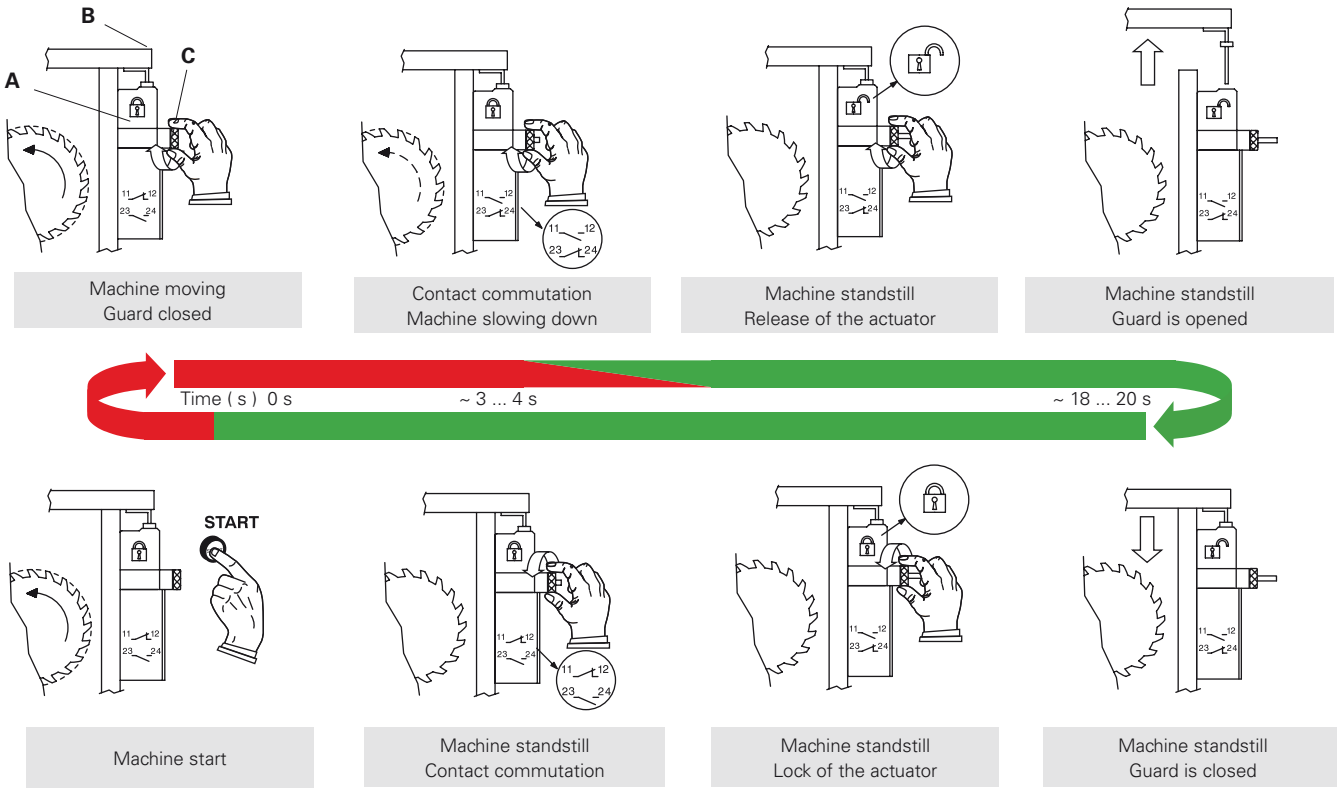
For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).

In compliance with standard: UL 508, CSA 22.2 No.14

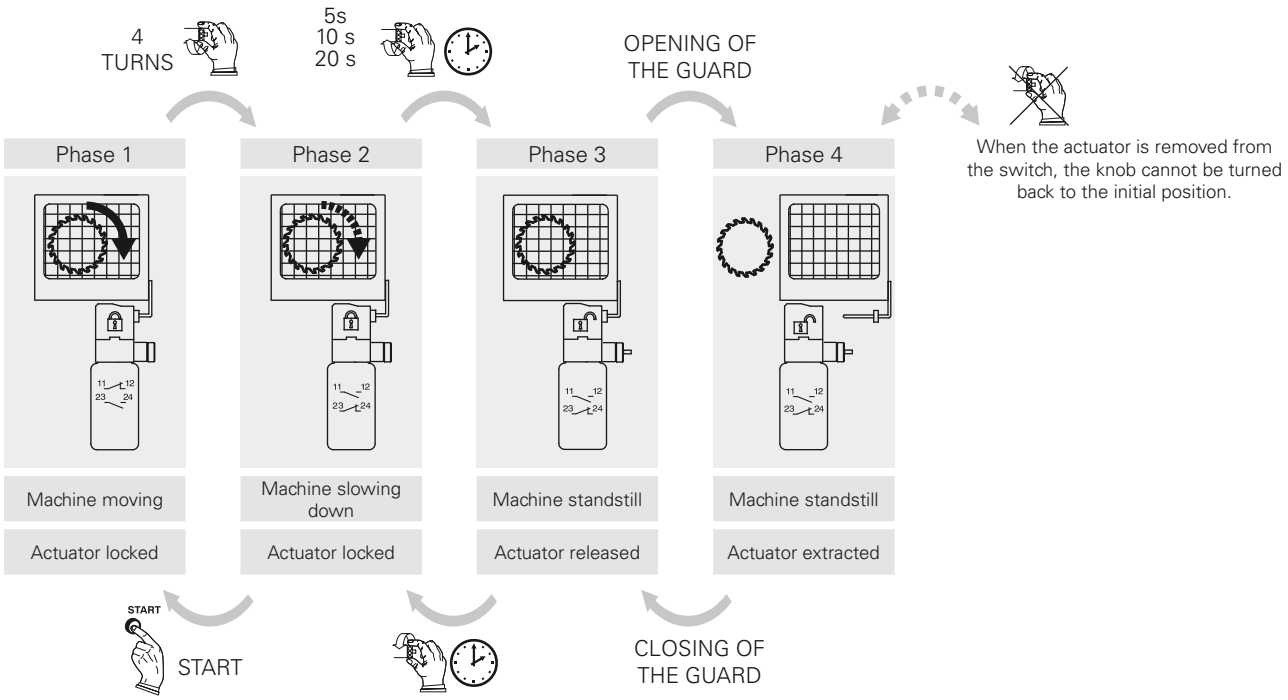
Please contact our technical department for the list of approved products.

Operation (FP 6R2-M2F1)

The switch is fastened to the machine body (A), while the stainless steel actuator is fastened to the guard (B). Once installed, the switch will firmly lock the actuator. In order to remove the actuator, the knob (C) has to be rotated. On the first turns the electrical contacts will positively open, then, after about 20 seconds (or 10 seconds depending on the version), the actuator will be released. In order to close the guard, the knob must be rotated in the opposite direction. This switch doesn't need power supply or timer and can be easily installed on old machines without important changes in their electrical circuit. The knob (C) may be supplied in a short (standard) or in a long version.



Operating phases (FD 6R2-M2F1)



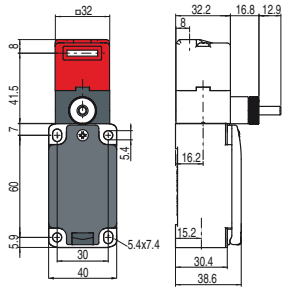
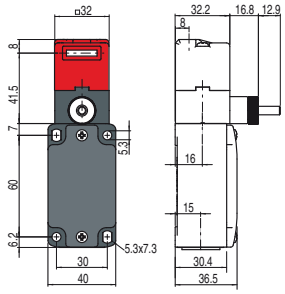
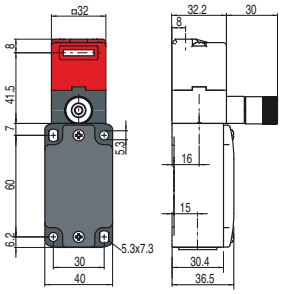
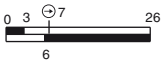
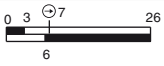
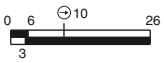
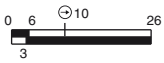
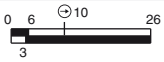
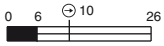
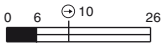
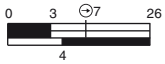
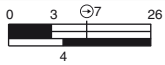
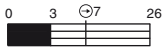
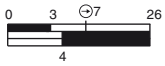
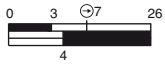
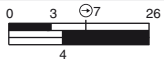
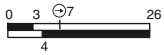
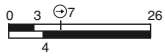
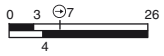
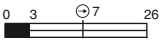
Dimensional drawings

All values in the drawings are in mm

Contact type:

L = slow action
LO = slow action, make before break

Contact block

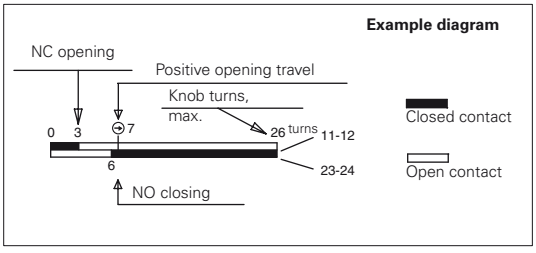
		Technopolymer housing Without actuator	Metal housing Without actuator	Metal housing Without actuator
				
6	L	FP 6R2-M2 1NO+1NC	FD 6R2-M2 1NO+1NC	FD 6R2-L10M2 1NO+1NC
				
7	LO	FP 7R2-M2 1NO+1NC	FD 7R2-M2 1NO+1NC	FD 7R2-L10M2 1NO+1NC
				
9	L	FP 9R2-M2 2NC	FD 9R2-M2 2NC	FD 9R2-L10M2 2NC
				
20	L	FP 20R2-M2 1NO+2NC	FD 20R2-M2 1NO+2NC	FD 20R2-L10M2 1NO+2NC
				
21	L	FP 21R2-M2 3NC	FD 21R2-M2 3NC	FD 21R2-L10M2 3NC
				
22	L	FP 22R2-M2 2NO+1NC	FD 22R2-M2 2NO+1NC	FD 22R2-L10M2 2NO+1NC
				
33	L	FP 33R2-M2 1NO+1NC	FD 33R2-M2 1NO+1NC	FD 33R2-L10M2 1NO+1NC
				
34	L	FP 34R2-M2 2NC	FD 34R2-M2 2NC	FD 34R2-L10M2 2NC
				
Actuating force		10 N (18 N ⊖)	10 N (18 N ⊖)	10 N (18 N ⊖)

All values in the diagrams are in turns of the knob

Legend: ⊖ With positive opening according to EN 60947-5-1, interlock with lock monitoring acc. to EN ISO 14119

How to read travel diagrams

All values in the diagrams are in turns of the knob



IMPORTANT:

The state of the NC contact refers to the switch with inserted actuator and with the knob turned anti-clockwise up to the end of the travel. For**installation in safety applications**, actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol ⊖. Actuate the switch **at least with the positive opening force**, reported in brackets below each article, next to the actuating force value.

Limits of use

Do not use where dust and dirt may penetrate in any way into the head and deposit there. Especially not where powder, shavings, concrete or chemicals are sprayed. Adhere to the EN ISO 14119 requirements regarding low level of coding for interlocks. Do not use in environments with presence of explosive or flammable gas. In these case use ATEX products (see dedicated Pizzato catalogue).

Attention! These switches alone are not suitable for applications where operators may physically enter the dangerous area, because an eventual closing of the door behind them could restart the machine operation. In these cases, the maintenance personnel must use the actuator entry locking device VF KB1 shown on page 144.

Items with code on **green** background are stock items

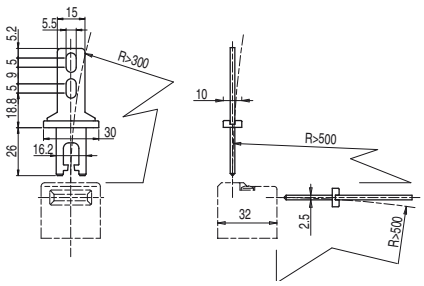
Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

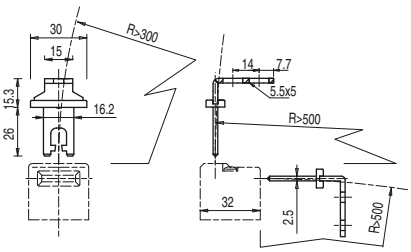
Stainless steel actuators

IMPORTANT: These actuators can be used only with items of the FD, FP, FL, FC and FS series (e.g. FD 6R2-M2).
Low level of coding acc. to EN ISO 14119.

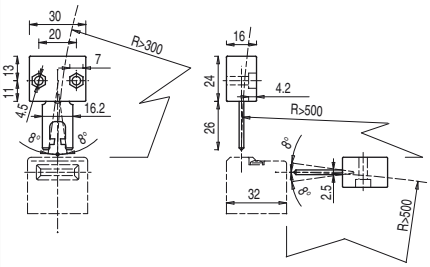
Article	Description
VF KEYF	Straight actuator



Article	Description
VF KEYF1	Angled actuator

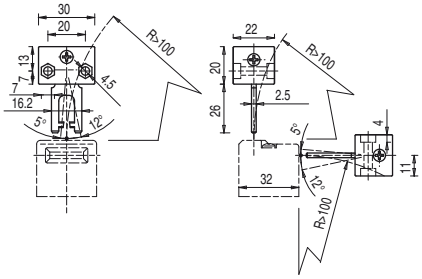


Article	Description
VF KEYF2	Jointed actuator



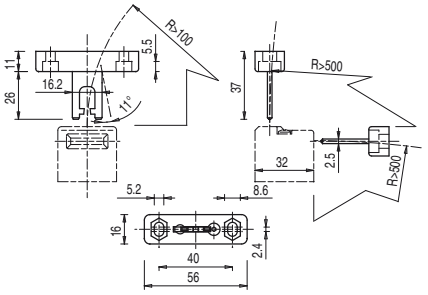
The actuator can flex in four directions for applications where the door alignment is not precise.

Article	Description
VF KEYF3	Actuator adjustable in two directions



Actuator adjustable in two directions for doors with reduced dimensions.

Article	Description
VF KEYF7	Actuator adjustable in one direction



Actuator adjustable in one direction for doors with reduced dimensions.

Items with code on **green** background are stock items

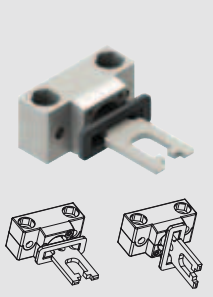
Accessories See page 299

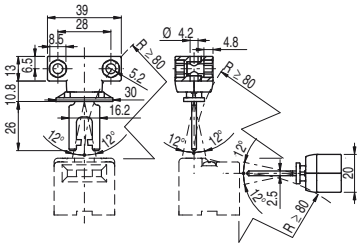
→ The 2D and 3D files are available at **www.pizzato.com**

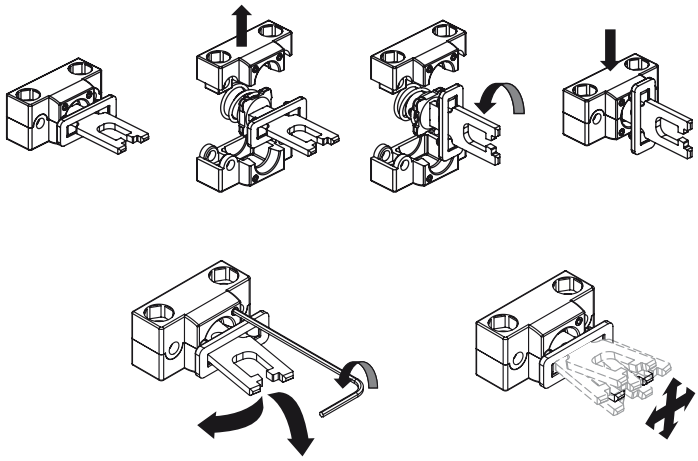
Universal actuator VF KEYF8

IMPORTANT: These actuators can be used only with items of the FD, FP, FL, FC and FS series (e.g. FD 6R2-M2).
Low level of coding acc. to EN ISO 14119.

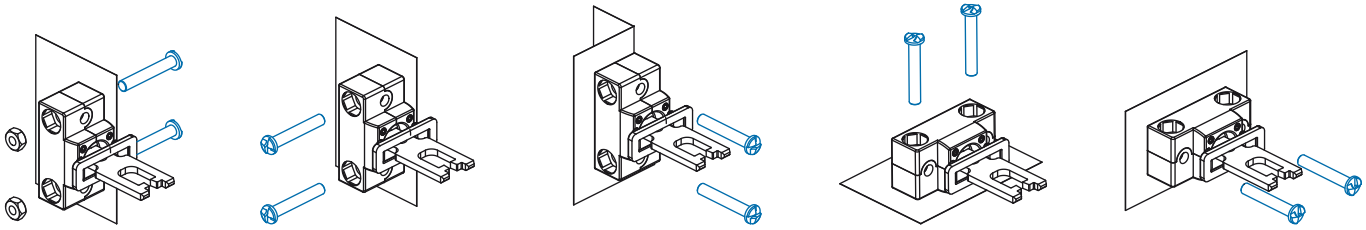
Article	Description
VF KEYF8	Universal actuator







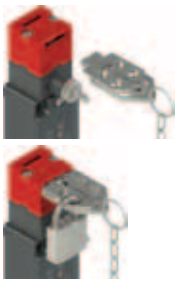
Actuator adjustable in two dimensions for small doors; can be mounted in various positions.
The fixing block has two pairs of bore holes; it is provided for rotating the working plane of the actuator by 90°.



Accessories

Article	Description
VF KB1	Actuator entry locking device

Padlockable device to lock the actuator entry in order to prevent the accidental closing of the door behind operators while they are in the danger area.
Hole diameter for padlocks: 9 mm.

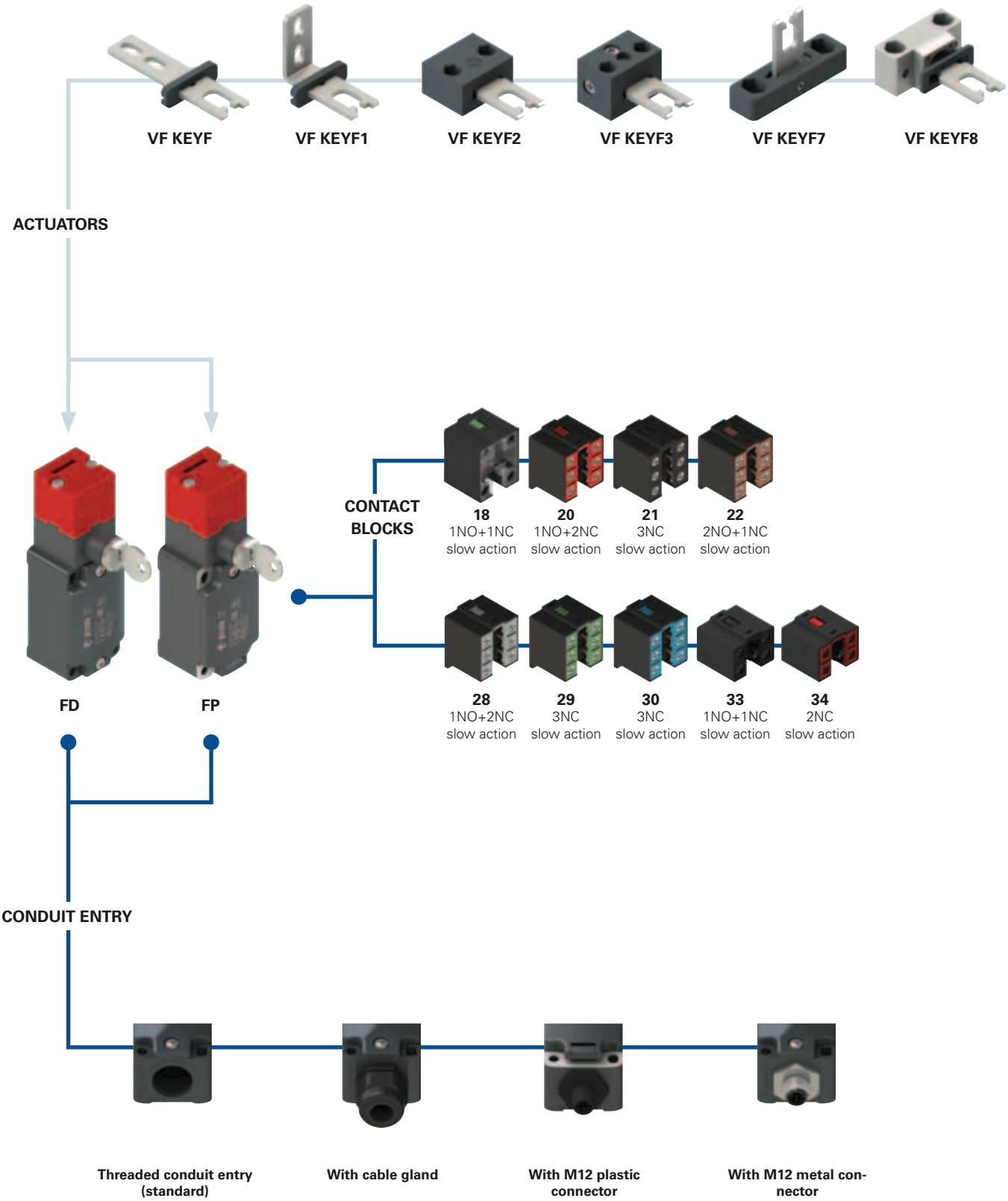


Items with code on **green** background are stock items

Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

Selection diagram



prodotto
accessorio venduto separatamente

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options | options

FD 1899-F1GM2K50T6V200

Housing

FD	metal, one conduit entry
FP	technopolymer, one conduit entry

Contact block

	Contacts activated by the lock	Contacts activated by actuator extraction
18	1NO+1NC	
20	1NO+2NC	
21	3NC	
22	2NO+1NC	
28	1NO+1NC	1NC
29	2NC	1NC
30	1NC	2NC
33	1NO+1NC	
34	2NC	

Actuators

	without actuator (standard)
F	straight actuator VF KEYF
F1	angled actuator VF KEYF1
F2	jointed actuator VF KEYF2
F3	jointed actuator adjustable in two directions VF KEYF3
F7	jointed actuator adjustable in one direction VF KEYF7
F8	universal actuator VF KEYF8

Threaded conduit entry

M2	M20x1.5 (standard)
	PG 13.5

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 22, 28, 29, 30, 33, 34)

Lock key coding

	one standard key coding (371)
V200	up to 50 different key codings

Ambient temperature

	-25°C … +80°C (standard)
T6	-40°C … +80°C

Pre-installed cable glands or connectors

	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
...	.....
K50	M12 metal connector, 5-pole
...	.....

For the complete list of possible combinations please contact our technical department.

Safety switches **with separate actuator** and key release

Main features

- Metal housing or technopolymer housing, one conduit entry
- Protection degree IP67
- 9 contact blocks available
- 6 stainless steel actuators available
- Versions with assembled M12 connector
- Versions with gold-plated silver contacts
- Strong actuator locking (1000 N)
- Release of the actuator by key

Quality marks:

IMQ approval:	EG605
UL approval:	E131787
CCC approval:	2007010305230000 (FD series)
	2007010305230014 (FP series)
EAC approval:	RU C-IT.АД35.B.00454

Technical data

Housing

FP series housing made of glass fibre reinforced technopolymer, self-extinguishing, shock-proof and with double insulation: ⧈
FD series: metal housing, baked powder coating.
Metal head, baked epoxy powder coating.

One threaded conduit entry:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Interlock with mechanical lock, coded:	type 2 acc. to EN ISO 14119
Coding level:	low acc. to EN ISO 14119
Safety parameters:	
B_{10D}:	1,000,000 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Max. actuation frequency:	3600 operating cycles/hour
Mechanical endurance:	500,000 operating cycles
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Maximum force before breakage $F_{1max:}$	1000 N acc. to EN ISO 14119
Max. holding force F_{Zh}:	770 N acc. to EN ISO 14119
Max. clearance of the actuator:	4.5 mm
Actuator extraction force:	30 N
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 22, 28, 29, 30, 33, 34:	min. 1 x 0.34 mm² (1 x AWG 22) max. 2 x 1.5 mm² (2 x AWG 16)
Contact block 18:	min. 1 x 0.5 mm² (1 x AWG 20) max. 2 x 2.5 mm² (2 x AWG 14)

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, BG-GS-ET-15, UL 508, CSA 22.2 No.14 .
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 No.14 , GB14048.5-2001.

Compliance with the requirements of:
Machinery Directive 2006/42/EC and EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

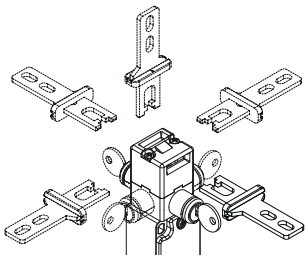
⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

Electrical data			Utilization category
without connector	Thermal current (I_{th}):	10 A	
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 22, 28, 29, 30, 33, 34)	Alternating current: AC15 (50÷60 Hz) U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 22, 28, 29, 30, 33, 34)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250
	Protection against short circuits:	type aM fuse 10 A 500 V	I_e (A) 6 1.1 0.4
	Pollution degree:	3	
with M12 connector 4 and 5-pole	Thermal current (I_{th}):	4 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 120 250
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	I_e (A) 4 4 4
	Protection against short circuits:	type gG fuse 4 A 500 V	Direct current: DC13
	Pollution degree:	3	U_e (V) 24 125 250 I_e (A) 4 1.1 0.4
with M12 connector 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	I_e (A) 2
	Protection against short circuits:	type gG fuse 2 A 500 V	Direct current: DC13
	Pollution degree:	3	U_e (V) 24 I_e (A) 2

Description

This type of switches **is applied on fences or guards where entrance is allowed to authorized personnel only. They have been designed to control large protected areas where operators may physically enter**. Supplied with a strong lock, the actuator can be removed from the head only after a complete rotation (180°) of the locking key. The electrical contacts are switched as the key is turned; the actuator is released only after the NC contacts have been positively opened. Contacts activated by the lock are reset to the initial position only with inserted actuator and with the key in the locking position. **It is impossible to rotate the key when the key locking device is unlocked and the actuator is removed (C state).** These switches are considered interlocks with guard locking in accordance with ISO 14119, and the product is marked on the side with the symbol shown.

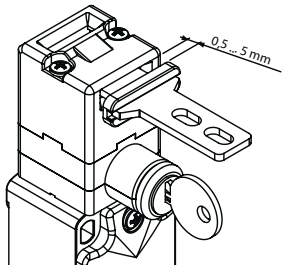
Head and release devices with variable orientation



The head can be quickly turned to each of the four sides of the switch by unfastening the two fastening screws.

The auxiliary key release device can be rotated in 90° steps as well. This enables the switch to assume 32 different configurations.

Adjustment range



The actuation head of this switch features a wide range of travel. In this way the guard can oscillate along the direction of insertion (4.5 mm) without causing unwanted machine shutdowns. This wide range of travel is available in all actuators in order to ensure maximum device reliability.

Protection degree IP67

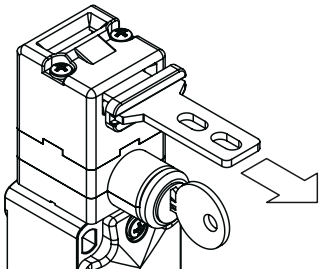
IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

Contact block

Contact blocks with captive screws, finger protection, twin bridge contacts and double interruption for higher contact reliability.

Holding force of the unlocked actuator



The inside of each switch features a device which holds the actuator in its closed position. Ideal for all those applications where several doors are unlocked simultaneously, but only one is actually opened. The device keeps all the unlocked doors in their position with a retaining force of 30 N~, stopping any vibrations or gusts of wind from opening them.

Extended temperature range

-40°C

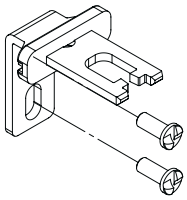
These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C.

They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

Laser engraving

All devices are marked using a dedicated indelible laser system. These engravings are therefore suitable for extreme environments too. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Safety screws for actuators



As required by ISO 14119, the actuator must be fastened immovably to the door frame. Pan head safety screws with one-way fitting are available for this purpose. With this screw type, the actuators cannot be removed or tampered by using common tools. See accessories on page 310.

Features approved by IMQ

Rated insulation voltage (U_i):	500 Vac
	400 Vac (for contact blocks 20, 21, 22, 33, 34)
Conventional free air thermal current (I_{th}):	10 A
Protection against short circuits:	type aM fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}):	6 kV
	4 kV (for contact blocks 20, 21, 22, 33, 34)
Protection degree of the housing:	IP67
MV terminals (screw terminals)	
Pollution degree:	3
Utilization category:	AC15
Operating voltage (U_e):	400 Vac (50 Hz)
Operating current (I_e):	3 A

Forms of the contact element: Zb, Y+Y, Y+Y+X, Y+Y+Y, Y+X+X
Positive opening contacts on contact blocks 18, 20, 21, 22, 28, 29, 30
In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

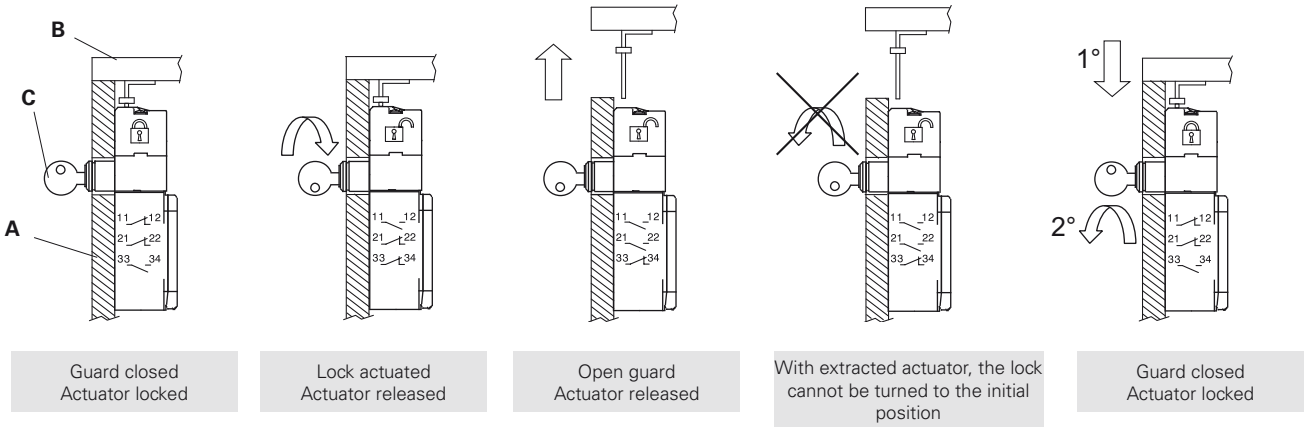
Utilization categories Q300 (69 VA, 125-250 Vdc)
A600 (720 VA, 120-600 Vac)
Housing features type 1, 4X "indoor use only", 12, 13
For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).

In compliance with standard: UL 508, CSA 22.2 No.14

Please contact our technical department for the list of approved products.

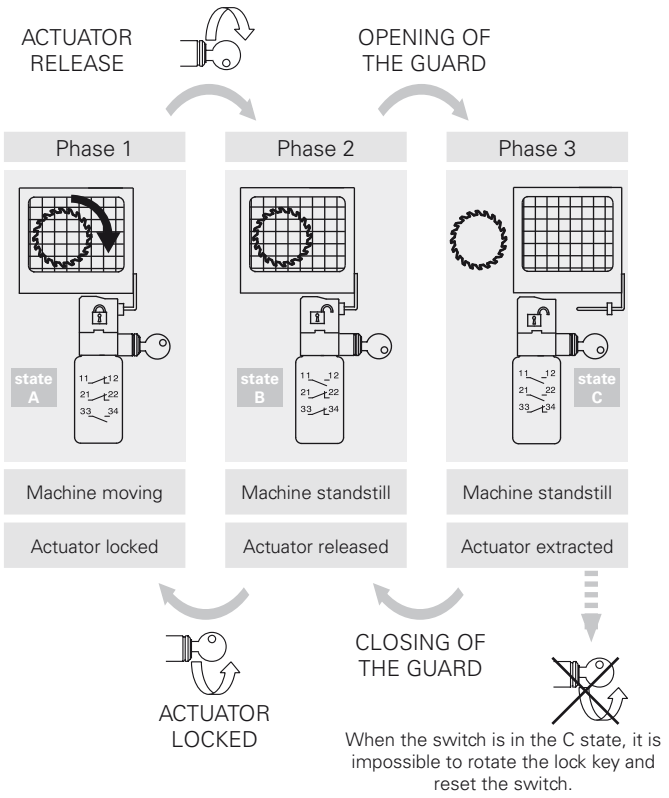
Operation

The switch is fastened to the machine body (A), while the stainless steel actuator is fastened to the guard (B). Once installed, the switch will firmly lock the actuator. To remove the actuator, the lock must be unlocked by turning the key (C). When the actuator is removed, the key cannot be put into the initial position anymore. The example shows how the contacts of the lock and actuator are switched and how the switch can be installed within the machine in such a way that only the release device is visible from the outside.



Guard closed Actuator locked	Lock actuated Actuator released	Open guard Actuator released	With extracted actuator, the lock cannot be turned to the initial position	Guard closed Actuator locked

Operating phases

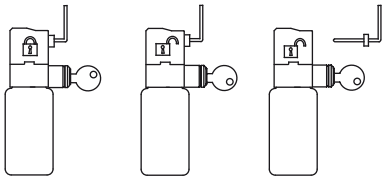


When the switch is in the C state, it is impossible to rotate the lock key and reset the switch.

Limits of use

Do not use where dust and dirt may penetrate in any way into the head and deposit there. Especially not where powder, shavings, concrete or chemicals are sprayed. Adhere to the ISO 14119 requirements regarding low level of coding for interlocks. Do not use in environments with presence of explosive or flammable gas. In these case use ATEX products (see dedicated Pizzato catalogue). Attention! These switches alone are not suitable for applications where operators may physically enter the dangerous area, because an eventual closing of the door behind them could restart the machine operation. In these cases the actuator entry locking device VF KB1 shown on page 152 must be used.

Contact positions related to switch states

Operating state		state A	state B	state C
Actuator		Inserted and locked	Inserted and released	Extracted
Lock		Closed	Open	Open
Contact block				
FD 1899 1NC+1NO controlled by the lock		11–12 23–24	11 12 23 24	11 12 23 24
FD 2099 2NC+1NO controlled by the lock		11–12 21–22 33–34	11 12 21 22 33 34	11 12 21 22 33 34
FD 2199 3NC controlled by the lock		11–12 21–22 31–32	11 12 21 22 31 32	11 12 21 22 31 32
FD 2299 1NC+2NO controlled by the lock		11–12 23–24 33–34	11 12 23 24 33 34	11 12 23 24 33 34
FD 2899 1NO+1NC controlled by the lock 1NC controlled by the actuator		11–12 21–22 33–34	11 12 21 22 33 34	11 12 21 22 33 34
FD 2999 2NC controlled by the lock 1NC controlled by the actuator		11–12 21–22 31–32	11 12 21 22 31 32	11 12 21 22 31 32
FD 3099 1NC controlled by the lock 2NC controlled by the actuator		11–12 21–22 31–32	11 12 21 22 31 32	11 12 21 22 31 32

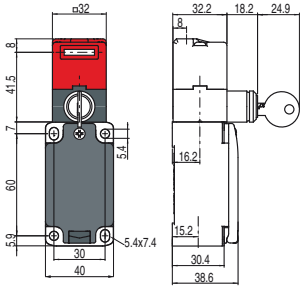
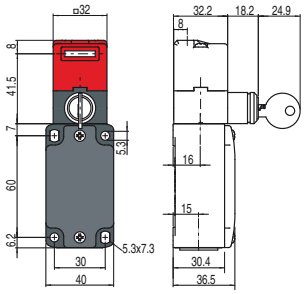
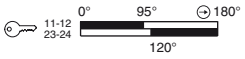
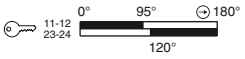
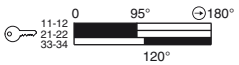
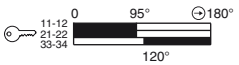
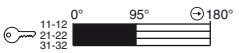
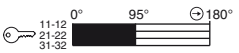
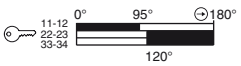
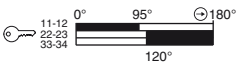
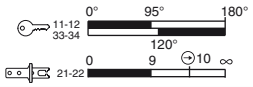
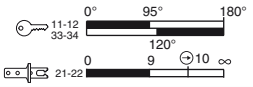
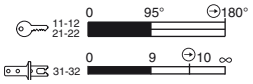
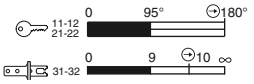
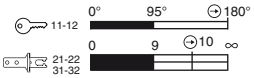
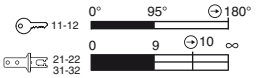
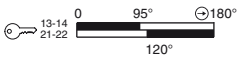
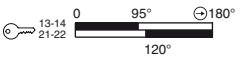
The key can be extracted from the lock with locked or released actuator.

Dimensional drawings

All values in the drawings are in mm

Contact type:

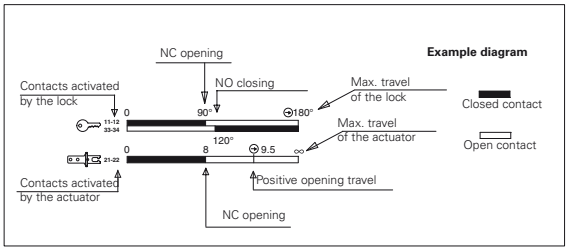
L = slow action

Contact block		Technopolymer housing Without actuator, supplied with two keys	Metal housing Without actuator, supplied with two keys
			
18	L	FP 1899-M2 1NO+1NC	FD 1899-M2 1NO+1NC
			
20	L	FP 2099-M2 1NO+2NC	FD 2099-M2 1NO+2NC
			
21	L	FP 2199-M2 3NC	FD 2199-M2 3NC
			
22	L	FP 2299-M2 2NO+1NC	FD 2299-M2 2NO+1NC
			
28	L	FP 2899-M2 1NO+2NC	FD 2899-M2 1NO+2NC
			
29	L	FP 2999-M2 3NC	FD 2999-M2 3NC
			
30	L	FP 3099-M2 3NC	FD 3099-M2 3NC
			
33	L	FP 3399-M2 1NO+1NC	FD 3399-M2 1NO+1NC
			
34	L	FP 3499-M2 2NC	FD 3499-M2 2NC
Actuating force		30 N (40 N ⊖)	30 N (40 N ⊖)

Legend: ⊖ With positive opening according to EN 60947-5-1, interlock with lock monitoring acc. to EN ISO 14119

How to read travel diagrams

All values in the diagrams are in mm or in degrees



IMPORTANT:
The state of the NC contact (⊂) refers to the switch with inserted actuator and locked lock. In **safety applications**, actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol ⊖. Actuate the switch **at least with the positive opening force**, reported in brackets below each article, next to the actuating force value.

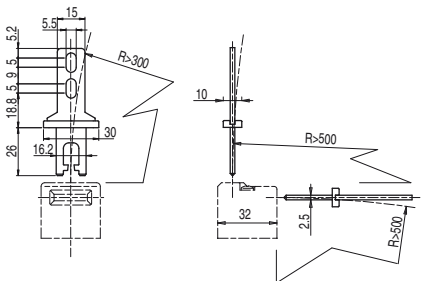
Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

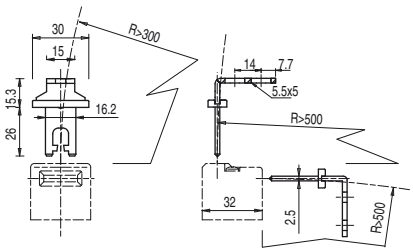
Stainless steel actuators

IMPORTANT: These actuators can be used only with items of the FD, FP, FL, FC, and FS series (e.g. FD 1899-M2).
Low level of coding acc. to EN ISO 14119.

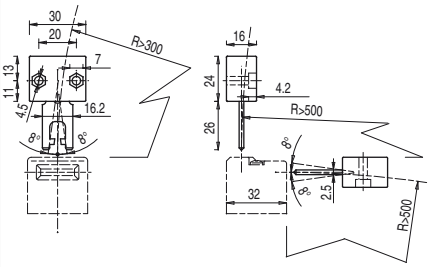
Article	Description
VF KEYF	Straight actuator



Article	Description
VF KEYF1	Angled actuator

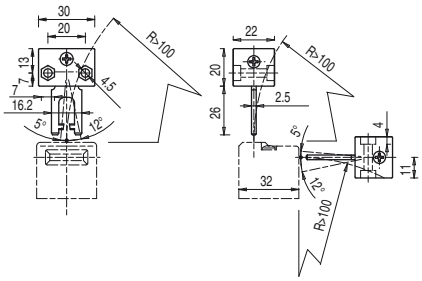


Article	Description
VF KEYF2	Jointed actuator



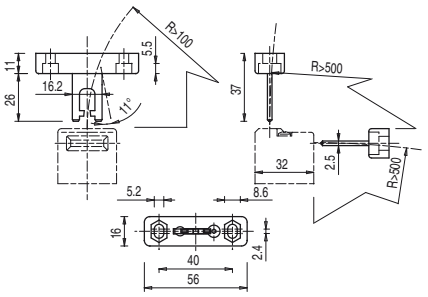
The actuator can flex in four directions for applications where the door alignment is not precise.

Article	Description
VF KEYF3	Actuator adjustable in two directions



Actuator adjustable in two directions for doors with reduced dimensions.

Article	Description
VF KEYF7	Actuator adjustable in one direction



Actuator adjustable in one direction for doors with reduced dimensions.

Items with code on **green** background are stock items

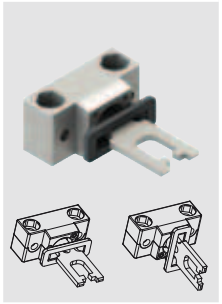
Accessories See page 299

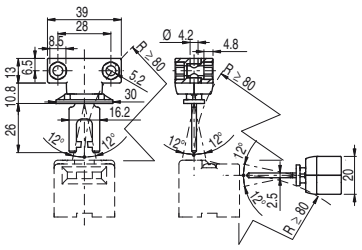
→ The 2D and 3D files are available at **www.pizzato.com**

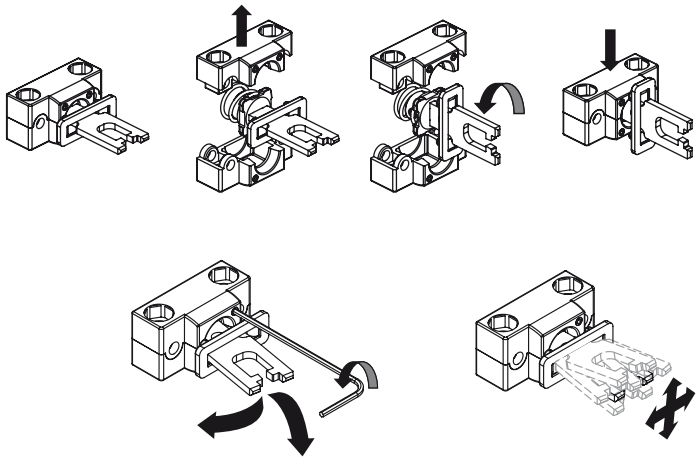
Universal actuator VF KEYF8

IMPORTANT: These actuators can be used only with items of the FD, FP, FL, FC, and FS series (e.g. FD 1899-M2).
Low level of coding acc. to EN ISO 14119.

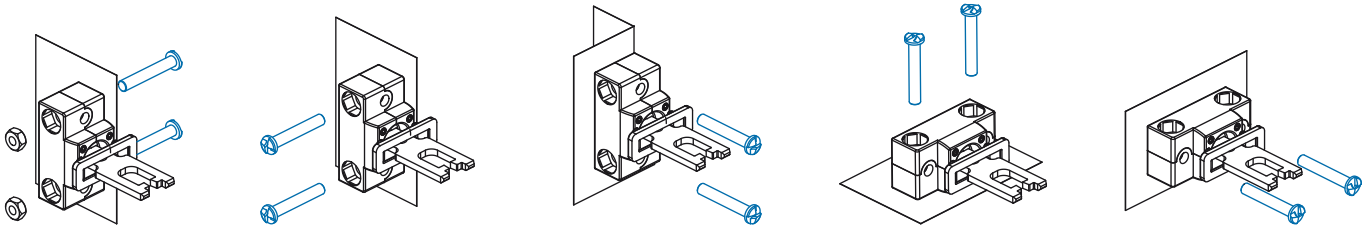
Article	Description
VF KEYF8	Universal actuator





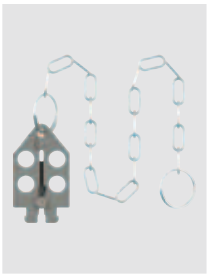


Actuator adjustable in two dimensions for small doors; can be mounted in various positions.
The fixing block has two pairs of bore holes; it is provided for rotating the working plane of the actuator by 90°.

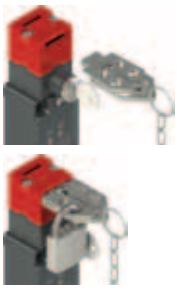


Accessories

Article	Description
VF KB1	Actuator entry locking device



Padlockable device to lock the actuator entry in order to prevent the accidental closing of the door behind operators while they are in the danger area.
Hole diameter for padlocks: 9 mm.



Article	Description
VF KLA371	Set of two locking keys

Extra copy of the locking keys to be purchased if further keys are needed (standard supply: 2 units).
The keys of all switches have the same code. Other codes on request.

Items with code on **green** background are stock items

Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

Description

The application of safety switches on machinery guards must deal with practical issues related to the ease of installation, the mechanical precision of the guard movements and the occurrence of critical environmental conditions. In addition, sometimes, guards are used by clumsy operators and, in some cases, by people who are not instructed or are unaware of the operating principles of the machines.

These problems become important when the guard is an access door to a protected area. The physical dimensions of this type of guards and their constructive tolerances create alignment problems with the resulting risk of damage to the security devices. The possibility that one or more operators physically access the protected area introduces further handling issues and the machine's risk analysis must include situations such as involuntary trapping of an operator within the hazardous area, sometimes even of unauthorised operators as in the case of cleaning personnel.

From its experience in this field, Pizzato Elettrica has created an innovative safety handle called P-KUBE with all the characteristics necessary to decrease the risks for the machinery manufacturers, make life simpler for the installers and make easier and more intuitive the operations for the operators getting in and out of the area.

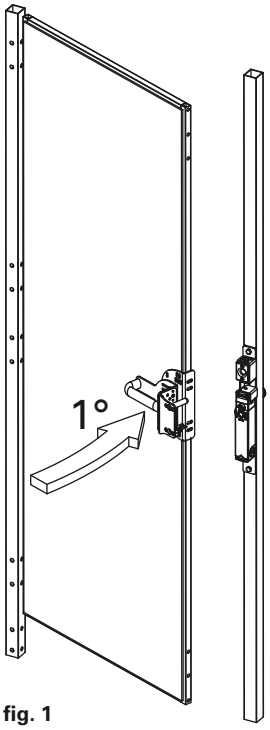


fig. 1

The basic principle of this series of products is a mechanical centring and stop system along the direction of movement of the door (Fig. 1).

This allows the operator to enter and exit the hazardous area with simple and natural movements. Especially in the case of trapped personnel, people in panic or uninstructed people, avoiding complex movements to escape the hazardous area greatly reduces the likelihood of accidents. The centring system is extremely robust and can also be used in heavy duty applications or in the presence of careless personnel.

These handles are designed to be used with switches of the same level of robustness suitable to support large axial loads, such as FG series electromagnet switches with retention forces up to 2800 N or FD series metal switches. Safety handles assembled in combination with an FG or FD series switch create an integrated locking system with related access control for hazardous areas, preventing the machine from restarting in case of open guard.

Some versions feature a "Lock-out" device to block the door in the open position and prevent an unexpected system restart when maintenance personnel access the system.

Thanks to their adjustable design these handles can be installed on different types of doors or barriers: hinged or sliding, right or left closing, as well as on various types of profiles.

The handle is supplied with all the components which have to be fixed at the appropriate mechanical distances by means of anti-tampering screws. The installer only has to assemble the components according to the application, fix the selected switch (supplied separately) and make centring adjustments.

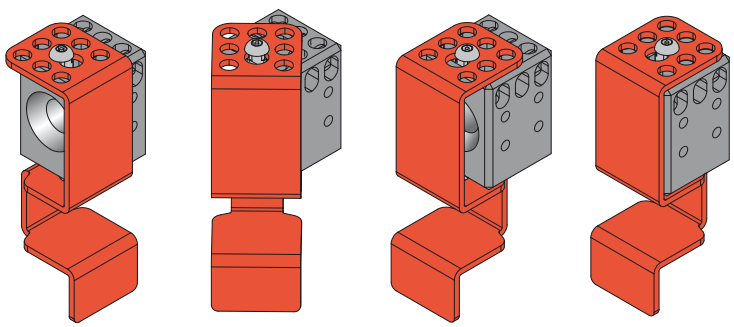
Main features

- Easy to use. No specific sequences required for door opening or closing, only intuitive actions
- Handle provided with a self-centring sturdy metal pin for the alignment between the jamb and the door. This device also serves as mechanical stop for the door.
- It can be installed both on hinged doors and sliding doors.
- Thanks to the slotted brackets the handle can be adjusted on 3 different axes.
- Easy to install.
- Optional Lock-out device that can be locked with padlocks avoiding that the actuator is inserted into the switch and therefore the accidental or unwanted closing of the guard.
- If the door interlock is carried out by means of FG series switches provided with a release push button, the door can be opened with a single movement even under stress (panic situations).
- Sturdy painted brackets (4 and 5 mm thick) and components in stainless steel.
- Compatible with FD series safety switches with separate actuator and with FG series safety switches with solenoid.

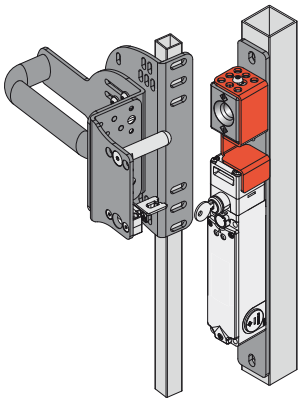
LOCK OUT (patent pending)

With a single operation, the "lock-out" device enables the closure of both the centring hole and the slot for the actuator present in the switch, thus making the mechanical closure of the door and the electrical commutation of the switch contacts impossible.

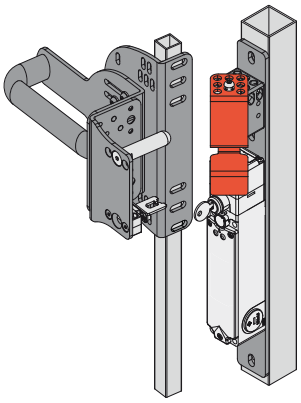
The "lock-out" device moves the red cover so that the holes in the cover do not coincide with the holes in the underlying metal block. This ensures that it is not possible to put a padlock on the device when it is open. Hole diameter for padlocks: 6.4 mm.



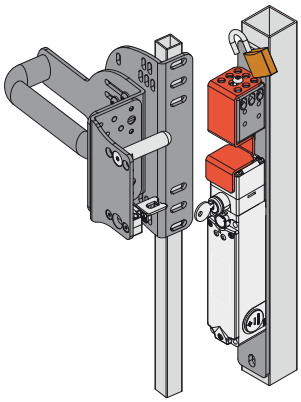
Operating principle of the LOCK OUT device



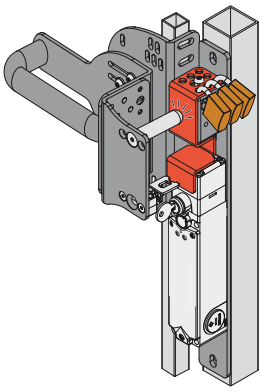
Lock-out device open
Safety switch is accessible



Closing of the lock-out device

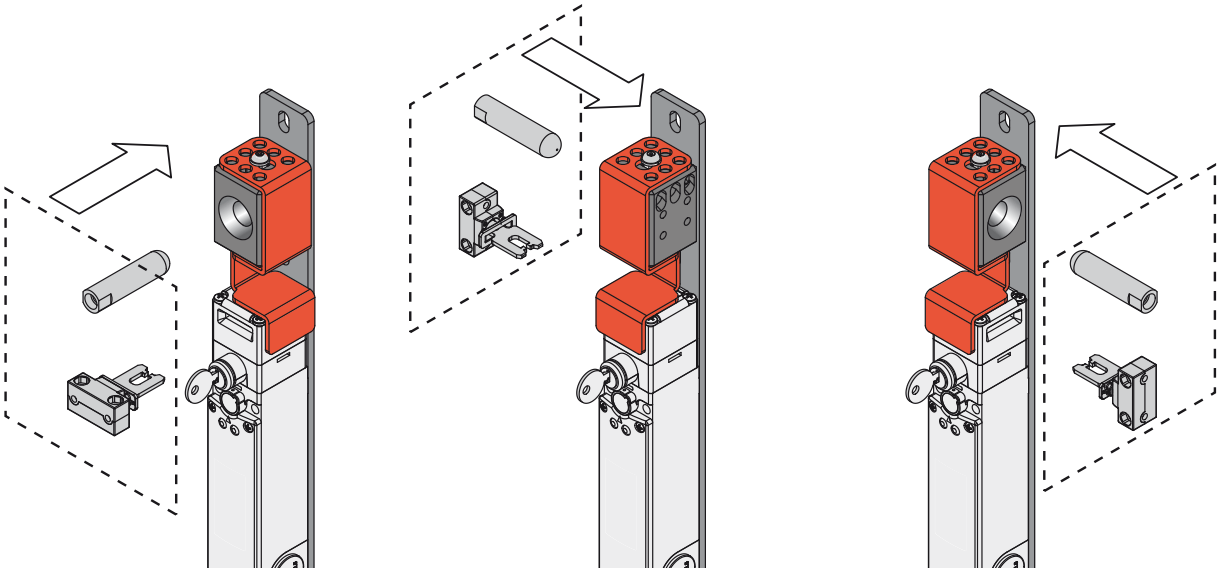


Lock-out device closed
Padlock insertion



Lock-out device locked
Padlock locked
Safety switch is not accessible

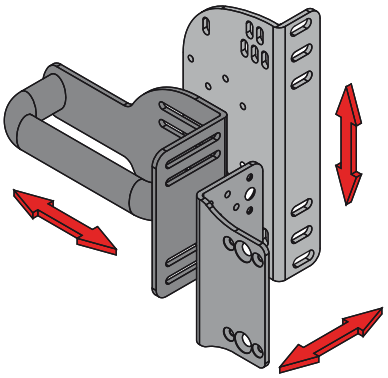
Turnable centring block

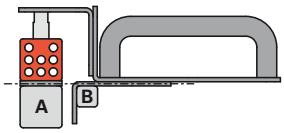


Thanks to its symmetrical design, the lock-out device can be installed on hinged and sliding doors, with both right and left closing, while still retaining its centring function and allowing for the attachment of multiple padlocks.

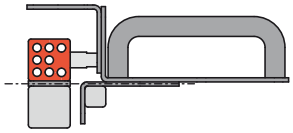
Flexibility and installation on different profiles

The slots of the three brackets applied on the door allow to carry out independent adjustments on 3 axes, providing an extremely easy installation and avoiding any modification of the existing protection structure. Thanks to these adjustments the handle can be installed on door profiles with different dimensions, from 40x40 mm to 60x60 mm **(A)** on the jamb and from 20x20 mm to 40x40 mm **(B)** on the door. The brackets are bolted together by means of anti-tampering screws.
Thanks to its vertical design, the bracket containing the safety switch and the lock-out device does not protrude beyond the jamb's profile.

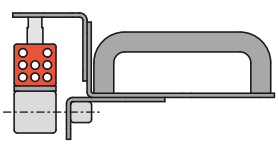




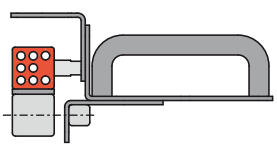
Hinged door and jamb frontally aligned



Sliding door and jamb frontally aligned



Hinged door and jamb axially aligned



Sliding door and jamb axially aligned

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

VF AP-P11A-200P

LOCK OUT device	
1	LOCK OUT device
0	Centering block only
2	LOCK OUT device with 100 N holding force

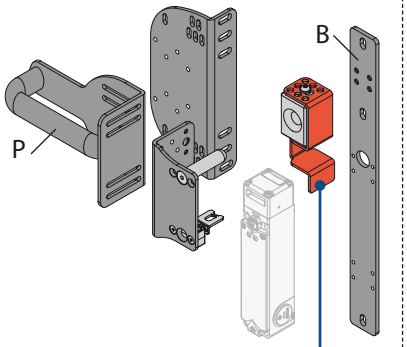
Handle	
P	Plastic handle
M	Metal handle
Z	Without handle

Mounting bracket supplied for installation	
A	FD ••••
B	FG ••••••••
Z	without plate (B) for FG brackets
Y	without plate (A) for FD brackets

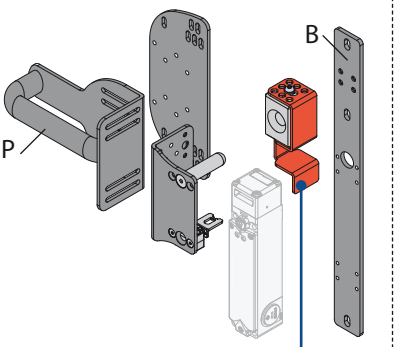
Plate configuration	
200	Configuration with adjustable "L" plate for door profiles
201	Configuration with adjustable plain plate for door profiles
202	Configuration without adjustable plate for door profiles

Note: the handle is supplied complete with switch actuator as well as fastening screws for the handle, the switch, the actuator, and between the plates.

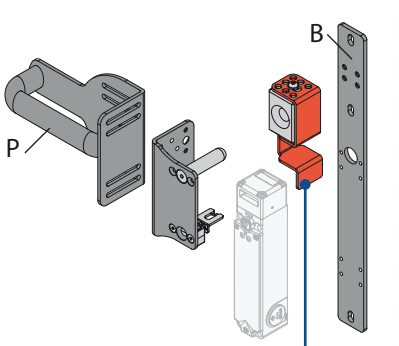
VF AP-P11B-200P

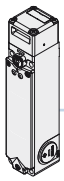


VF AP-P11B-201P

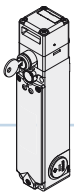


VF AP-P11B-202P

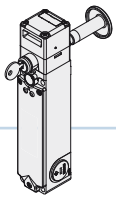




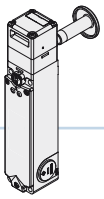
FG •••D1D••
Safety switch with solenoid and separate actuator.
Page 89



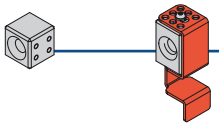
FG •••D5D••
Safety switch with solenoid and separate actuator.
With key release.
Page 89



FG •••D6D••
Safety switch with solenoid and separate actuator.
With key release and emergency release button.
Page 89



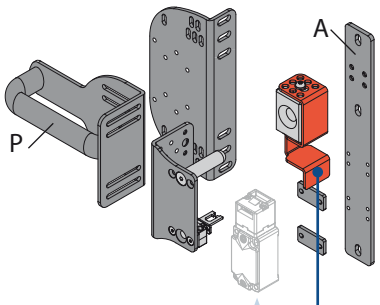
FG •••D7D••
Safety switch with solenoid and separate actuator.
With emergency release button.
Page 89



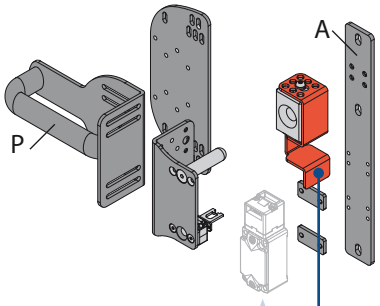
0
Centering block only

1
With LOCK OUT device

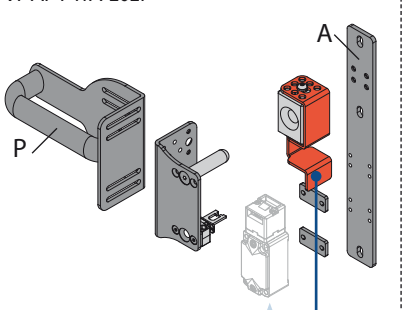
VF AP-P11A-200P

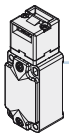


VF AP-P11A-201P

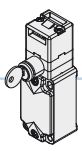


VF AP-P11A-202P

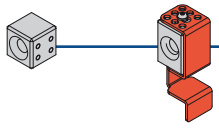




FD •93-M2
Safety switch with separate actuator.
Page 13



FD •99-M2
Safety switch with separate actuator and key release.
Page 145



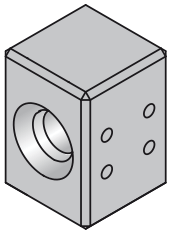
0
Centering block only

1
With LOCK OUT device

product options

Items with code on **green** background are stock items

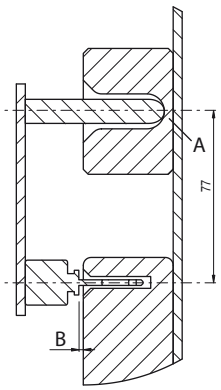
Robustness and simplicity



Thanks to its particular design and its special materials the safety handle can be used in heavy duty applications and with sturdy wide-ranging guards (min. 700 mm). In particular:

- Mounting system made up of robust painted brackets with thicknesses of 4 and 5 mm.
- Single-body centering block in stainless steel
- Large diameter centring pin in stainless steel
- Max. holding force of the actuator equal to 2800 N (versions with FG series switches).
- Stainless steel tamper proof bolts and screws and elastic washers (safety inserts excluded, see page 157).

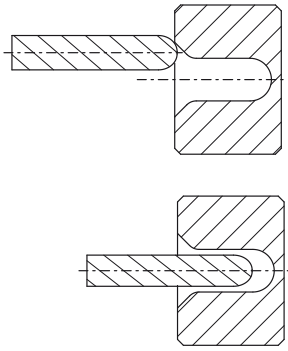
Mechanical stop



During door closing, the metal pin is flush to the bottom of the centring block (A) before the actuator can bump against the switch housing, leaving a safe distance (B), thus avoiding possible damage.

The metal pin is always flush on surfaces that transmit the impact to the frame and not to the switch, regardless of whether the lock-out device is open or closed.

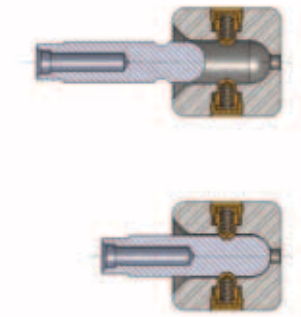
Centring



The centering of the pin on the block (both in stainless steel) forces the alignment between actuator and switch, ensuring a proper insertion preventing any risk of collisions.

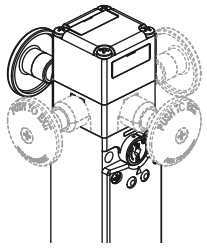
This also allows a safe re-alignment of the protection to the frame, even in case of big axial misalignments.

Holding force 100 N



A version of the lock-out device with 100 N holding force is available on request. With this new optional feature, the handle is kept in its limit-stop closed position; a moderately energetic pull is required to open the door. This device is ideal for all applications where multiple doors are unlocked simultaneously but only one is actually opened; all unlocked doors are held in position, thereby preventing vibrations or gusts of wind from opening them. As a result, the machine can be restarted very quickly, as it is no longer necessary to close doors that were unlocked and inadvertently opened.

Emergency release button (FG series)

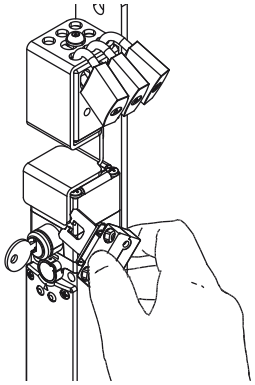


The FG series switches with actuator lock can be provided with an emergency release button that, if oriented towards the inside of the machinery, allows accidentally trapped personnel to escape even during a blackout.

Pushing the button results in the same function as the auxiliary release device. To reset the switch, just return the button to its initial position.

The emergency button can be rotated and is available with different lengths. It is fixed to the switch by means of a screw allowing the installation of the switch both inside and outside the guards.

Impossible to bypass with a separate actuator



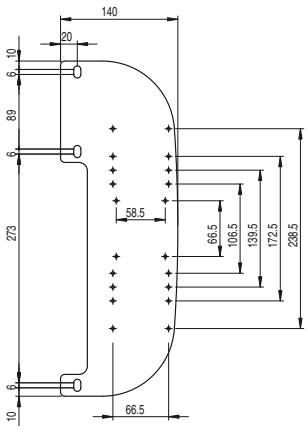
As soon as the lock-out device has been actuated and locked, the slot in the switch for the actuator is no longer accessible.

If an operator is in possession of a second, separate actuator, he is not able to bypass blocking of the device and actuate the switch.

Profiled plate

Article	Description
VF AP-C001	Profiled lateral plate

Profiled plate to be installed under the fixing plate of the switch. Suitable for both right and left mounting and provided with holes, this plate can be used for the installation of housings for the EROUND line button panels by Pizzato Elettrica (by means of common self-threading screws available on the market).



Safety inserts set

Set with 3 x 1/4" hexagonal safety inserts. Connection DIN 3126, C 6.35. Hex mount with hole.
The P-Kube safety handle is provided with tamper-proof screws. Therefore all 3 safety inserts of the set are required.

Article composition VF AP-K01:

Qty	Description	⊙	Length
1	Hexagonal insert 1/4" ⬡ for M5 screws	3 mm	25 mm
1	Hexagonal insert 1/4" ⬡ for M6 screws	4 mm	25 mm
1	Hexagonal insert 1/4" ⬡ for M8 screws	5 mm	25 mm

Adhesive labels for emergency release button

Polycarbonate yellow adhesive, rectangular, 300x32 mm, red inscription. It has to be fixed on the internal part of the jamb and helps finding the emergency release button.

Article	Description and language	
VF AP-A1AGR01	PREMERE PER USCIRE	ita
VF AP-A1AGR02	PUSH TO EXIT	eng
VF AP-A1AGR04	ZUM OFFNEN DRUCKEN	deu
VF AP-A1AGR05	POUSSER POUR SORTIR	fra
VF AP-A1AGR06	PULSAR PARA SALIR	spa
VF AP-A1AGR07	НАЖАТЬ ДЛЯ ВЫХОДА	rus
VF AP-A1AGR08	NACISNĄĆ ABY WYJŚĆ	pol
VF AP-A1AGR09	PRESSIONAR PARA SAIR	por

Complete housings for profiled plate

ES AC32010

Description	Features			Diagram
Button - 1NO E2 1PU2R421L35	flush, spring-return, green			
Contacts 1x E2 CF10G2V1	pos. 2 /	pos. 3 1NO	pos. 1 /	
Button - 1NC E2 1PU2S321L1	projecting, spring-return, red			
Contacts 1x E2 CF01G2V1	pos. 2 /	pos. 3 1NC ⊖	pos. 1 /	

ES AC32043

Description	Features			Diagram
Indicator light E2 1ILA210	white			
LED unit E2 LF1A2V1	White LED, 12 … 30 Vac/dc			
Button - 1NO E2 1PU2R4210	flush, spring-return, green			
Contacts 1x E2 CF10G2V1	pos. 2 /	pos. 3 1NO	pos. 1 /	

ES AC33076

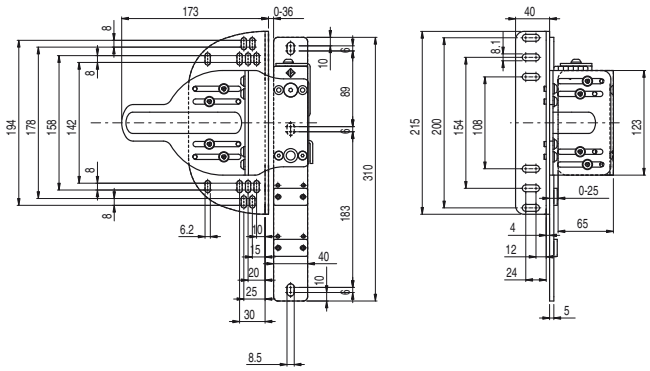
Description	Features			Diagram
Illuminated button - 1NO E2 1PL2R2210	flush, spring-return, white			
LED unit E2 LF1A2V1	White LED, 12 … 30 Vac/dc			
Contacts 1x E2 CP10G2V1	pos. 2 /	pos. 3 LED	pos. 1 1NO	
Illuminated button - 1NO E2 1PL2R5210	flush, spring-return, yellow			
LED unit E2 LF1A2V1	White LED, 12 … 30 Vac/dc			
Contacts 1x E2 CP10G2V1	pos. 2 /	pos. 3 LED	pos. 1 1NO	
Emergency button Ø 40 mm- 2NC E2 1PERZ4531	rotary release, Ø 40 mm, red			
Label with shaped hole VE TF32G5700	yellow, 30x60 mm rectangular, no engraving			
Contacts 2x E2 CF01G2V1	pos. 2 1NC ⊖	pos. 3 /	pos. 1 1NC ⊖	

Accessories See page 299

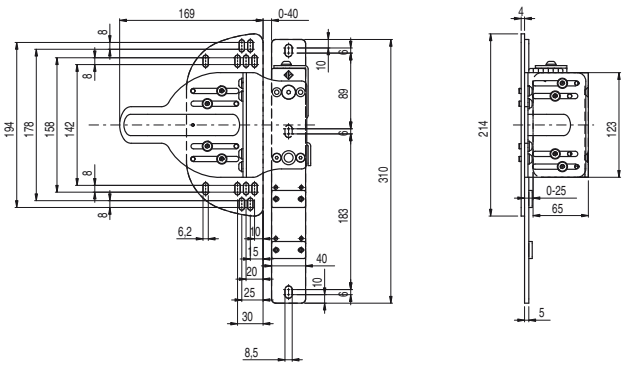
Dimensional drawings

All values in the drawings are in mm

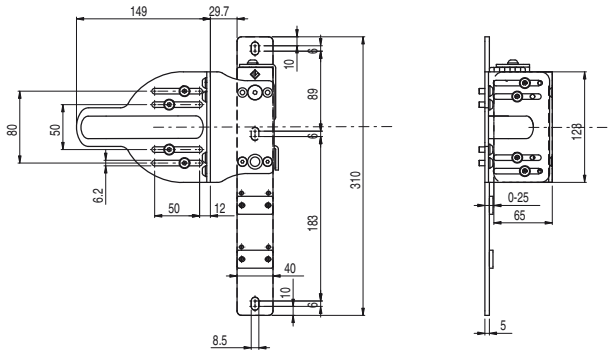
Safety handle VF AP-P1•A-200•



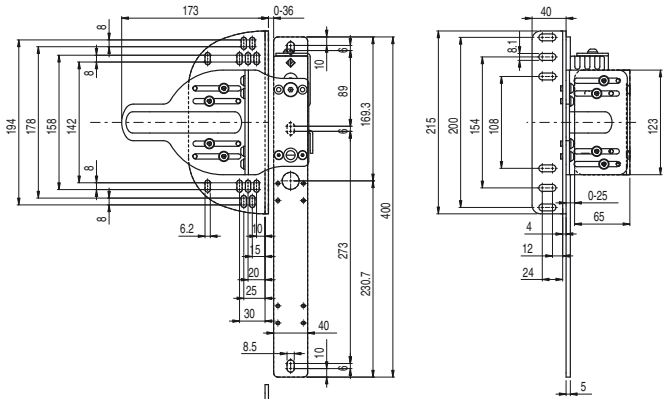
Safety handle VF AP-P1•A-201•



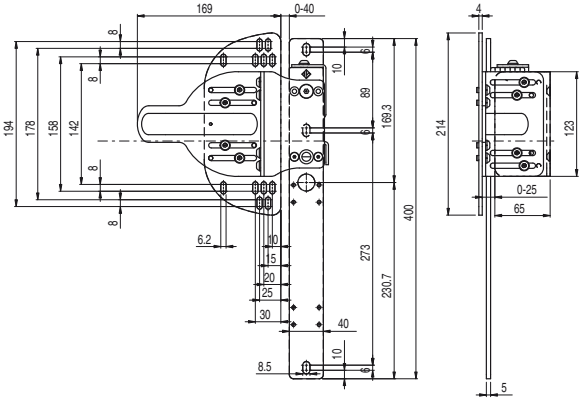
Safety handle VF AP-P1•A-202•



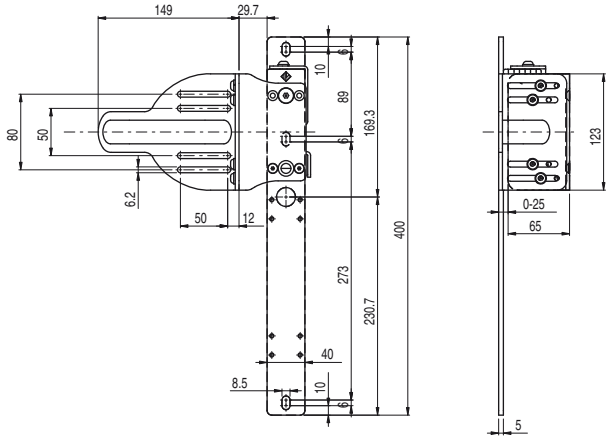
Safety handle VF AP-P1•B-200•



Safety handle VF AP-P1•B-201•



Safety handle VF AP-P1•B-202•



➔ The 2D and 3D files are available at **www.pizzato.com**

VF AP-S safety handles

Description

t o

The application of safety switches on machine guards must deal with issues related to ease of installation, mechanical precision of guard movements, the occurrence of critical environmental conditions and, in some cases, even with the presence of clumsy or inadequately informed operators.

These problems become important when the guard is an access door to a protected area: the physical dimensions of the guard and its constructive tolerances create alignment problems with the resulting risk of damage the safety devices.

This system with integrated closing mechanism is used on safety doors or safety enclosures where it is necessary to control access to dangerous areas of machines or systems.

The VF AP-S safety handle, unlike other products on the market, combines its compactness and lightness resulting from the sliding movement, with the robustness of the upper end models, which are distinguished by a higher weight, more bulky dimensions and greater constructive complexity.

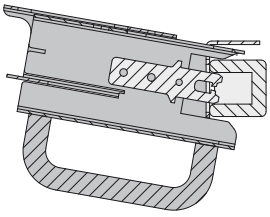
Structure

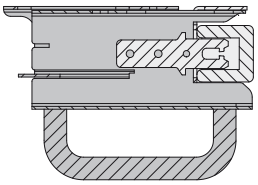
The VF AP-S handle is light and compact, has a galvanized and painted metal frame and an ergonomic plastic or aluminium grip for comfortable and easy use of the door handle itself.

The absence of screws and removable components prevents any tampering.

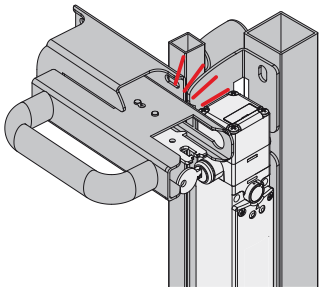
Centring

The "C"-shaped profile facilitates centring of the device when closing a guard that is not perfectly aligned with the frame. This enables an optimum alignment between actuator and switch, preventing any damage due to possible collisions.





Protection of actuator and switch

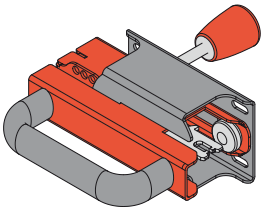


Thanks to the handle structure and the fixing bracket of the switch, both the switch and the actuator can be safely installed preventing any damage due to possible collisions. Any impacts resulting from incorrect actuation are completely absorbed on the handle frame.

Handle lock positions

There is a snap-on device that retains the handle in two positions: when it is pulled out, so as to contribute to the retaining force exerted by the actuator, and when retracted, to avoid undesirable movements caused by machine vibrations.

Internal lever for emergency escape



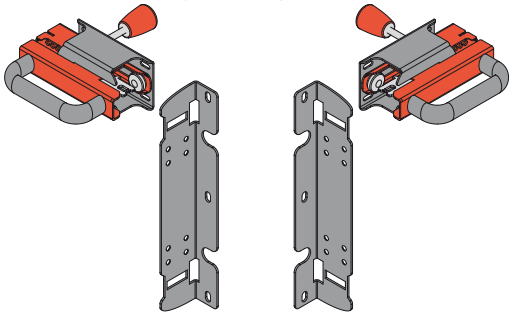
Optional lever for emergency opening from the inside: it ensures that operating personnel can exit the area should they accidentally become trapped within the dangerous area. It can be combined only with switches without lock (e.g. FD •93-M2) or switches with emergency release button (e.g. FG •••D6D••).

Accessories See page 299

Flexibility during installation

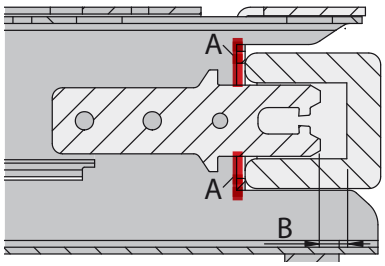
Thanks to its symmetrical design the device can be installed on hinged and sliding doors, either with right or left closing, without requiring any further adjustment.

The slotted brackets and the large actuator travel (60 mm) allow the device to be installed and adjusted on profiles of various sizes.



Mechanical stop

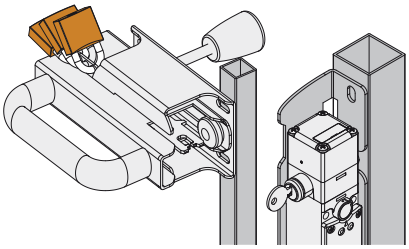
During door closing, a mechanical stop (A) prevents possible impacts between the actuator and the switch by constantly ensuring a safety distance (B) between these two components and the switch housing.



Padlocks

It is possible to fix up to 6 padlocks. Their function is to avoid the mechanical closing of the door and therefore accidental switching of the switch contacts.

Hole diameter for padlocks: 7 mm.



Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

VF AP-S13BP-200

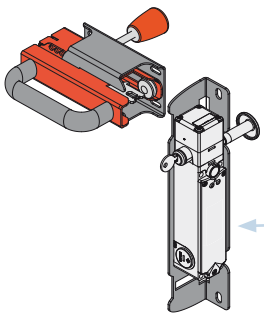
Mounting bracket supplied for installation	
A	FD ••••
B	FG ••••••••

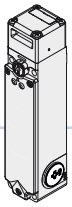
Internal lever for emergency escape	
P	internal lever for emergency escape
Z	without internal lever for emergency escape

Plate configuration	
001	without plate, with aluminium handle
002	without plate, with plastic handle
200	with plate for FG: with screwed-on aluminium handle
201	with plate for FD: with screwed-on aluminium handle
300	with plate for FG: with screwed-on plastic handle
301	with plate for FD: with screwed-on plastic handle

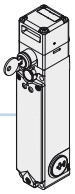
Note: the handle is supplied complete with switch actuator and fastening screws for fixing the switch to the plate.

VF AP-S13BP-300

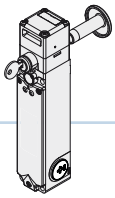




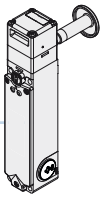
FG •••D1D••
Safety switch with solenoid and separate actuator.
Page 89



FG •••D5D••
Safety switch with solenoid and separate actuator.
With key release.
Page 89

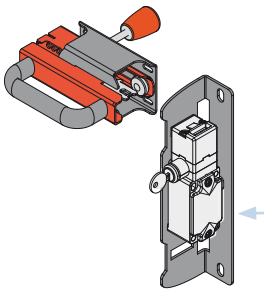


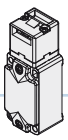
FG •••D6D••
Safety switch with solenoid and separate actuator.
With key release and emergency release button.
Page 89



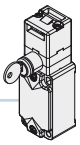
FG •••D7D••
Safety switch with solenoid and separate actuator.
With emergency release button.
Page 89

VF AP-S13AP-301



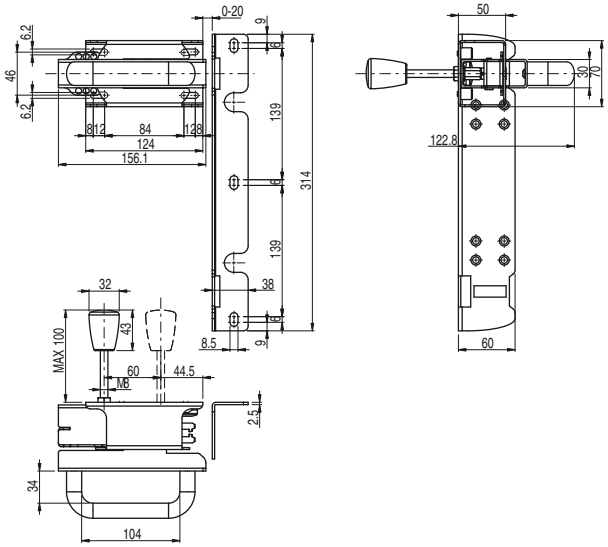


FD •93-M2
Safety switch with separate actuator.
Page 13

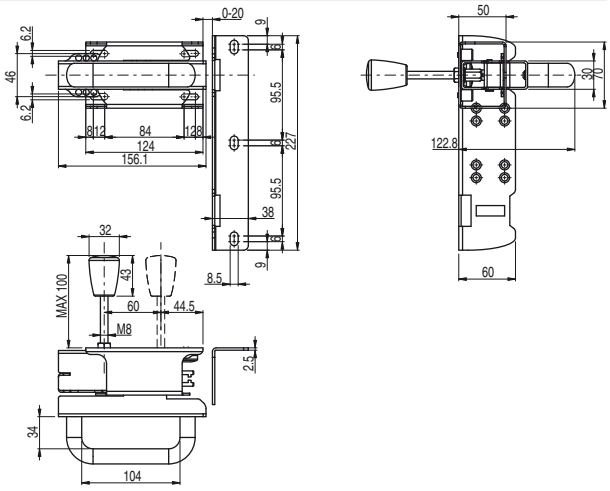


FD •99-M2
Safety switch with separate actuator and key release.
Page 145

Safety handle **VF AP-S13BP-300**



Safety handle **VF AP-S13AP-301**



FD and FG series safety switches

FD series safety switches with separate actuator

Main features
- Metal housing, one conduit entry
- Protection degree IP67
- 9 contact blocks available
- Versions with assembled M12 connector
- Versions with gold-plated silver contacts

FG series safety switches with solenoid and separate actuator

Main features
- Actuator holding force: 2800 N
- 30 contact blocks with 4 contacts
- Metal housing, three M20 conduit entries
- Protection degree IP67
- Versions with key release and emergency release button
- Signalling LED
- Operation with energised or de-energised solenoid

➔ The 2D and 3D files are available at **www.pizzato.com**

Items with code on **green** background are stock items

P-KUBE 2 safety handles

Description

This system with integrated closing mechanism is used on safety doors or safety enclosures as well as anywhere it is necessary to control access to dangerous areas of machines or systems.
The new safety handle P-KUBE 2, installed in combination with the NG series RFID safety switch with guard locking, provides an integrated locking system for the guards and access control to dangerous areas; this new combination makes it possible to obtain, with a single device, an access control function with the maximum PL e safety level according to EN 13849-1 or SIL 3 according to EN 62061.

Maximum safety with a single device

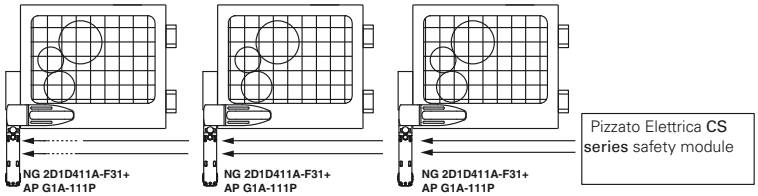
PL e + SIL 3

The the NG series switches combined with the P-KUBE 2 handle are constructed with redundant electronics. As a result, the maximum PL e and SIL 3 safety levels can still be achieved through the use of a single device on a guard. This avoids expensive wiring in the field and allows faster installation. Inside the control cabinet, the two electronic safety outputs must be connected to a safety module with OSSD inputs or to a safety PLC.

Series connection of several switches

PL e + SIL 3

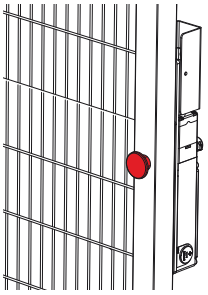
One of the most important features of the NG series combined with the P-KUBE 2 handle is the possibility of connecting up to 32 sensors in series, while still maintaining the maximum safety levels PL e laid down in EN 13849-1 and SIL 3 acc. to EN 62061.
This connection type is permissible in safety systems which have a safety module at the end of the chain that monitors the outputs of the last NG switch.
The fact that the PL e safety level can be maintained even with 32 sensors connected in series demonstrates the extremely secure structure of each single device.



RFID actuators with high coding level

The NG series is provided with an electronic system based on RFID technology to detect the actuator. This allows to provide each actuator with different coding and makes it impossible to tamper with a device by using another actuator of the same series. Millions of different coding combinations are possible for the actuators. They are therefore classified as high level coded actuators, according to EN ISO 14119.

Emergency release button



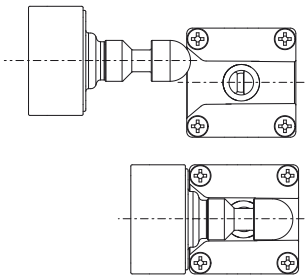
The release button oriented towards the inside of the machine allows accidentally trapped personnel to escape from the danger area even during a power failure. To reset the switch, simply return the button to its initial position.
The emergency release button can be freely extended using the appropriate extensions, allowing its installation also on very thick jambs (see accessories).

High protection degree

IP69K
IP67

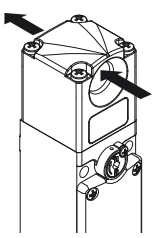
These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

Centring



The switch is provided with a wide centring inlet for the actuator pin. This solution makes it easier to align the actuator and the opening hole on the head during installation. Moreover, this solution drastically reduces the probability of a collision between the switch and the actuator, making it possible to install the device even on inaccurately closing doors.

Dustproof



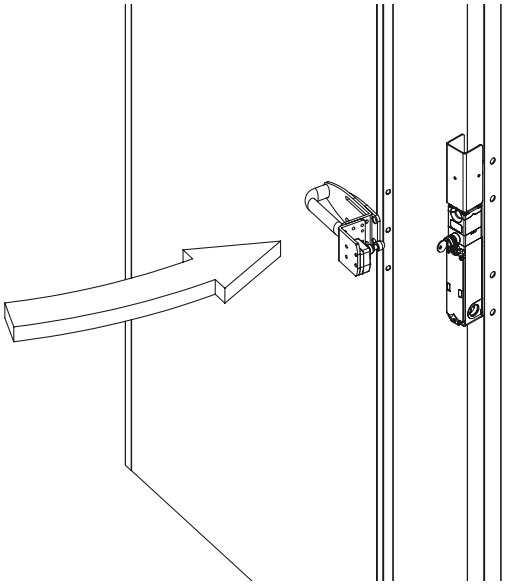
The switch is provided with a through hole for inserting the actuator. Thanks to this unique feature, any dust that enters the actuator hole can always come out on the opposite side instead of remaining inside. Moreover, the lock pin is provided with a diaphragm seal, making the system suitable for critical environments with a high level of dust.

Six LEDs for immediate diagnosis

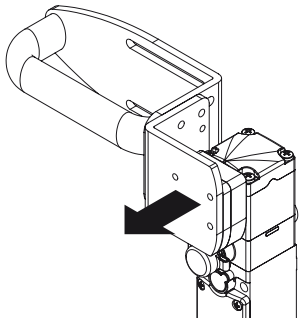
As the LEDs have been designed for quick immediate diagnosis, the status of each input and output is highlighted by one specific LED. This makes it possible to quickly identify the interruption points in the safety chain, which device is released, which door is opened and any errors inside the device. All of this at a glance, without needing to decode complex flashing sequences.

Easy to use

There are no specific sequences required for opening or closing the door, but only a single opening / closing movement.
If the door interlock is realised by means of a handle provided with a release push button, the door can be opened with a single movement even under stress (panic situations).

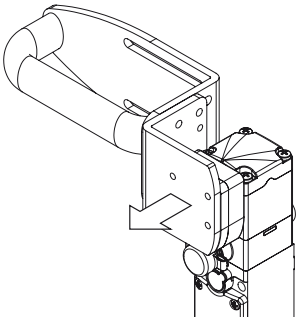


Holding force of the locked actuator



9750 N The robust interlocking system guarantees a maximum actuator holding force of F_{1max} = 9750 N. This is one of the highest values currently available on the market today, making this device suitable for heavy-duty applications.

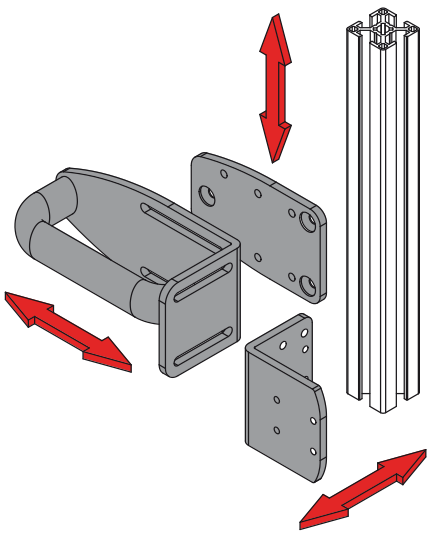
Holding force of the unlocked actuator

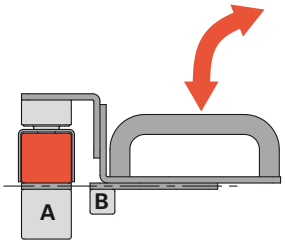


The inside of each switch features a device which holds the actuator in its closed position. Ideal for all those applications where several doors are unlocked simultaneously, but only one is actually opened. The device keeps all the unlocked doors in their position with a retaining force of 30 N~, stopping any vibrations or gusts of wind from opening them.

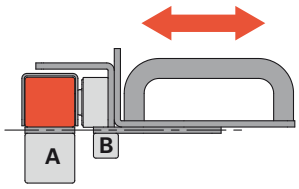
Sturdiness and easy installation

The handle is provided with 5 mm thick sturdy brackets in painted steel. The slots in the brackets allow independent adjustments to be performed. This ensures easy installation, eliminating the need to make changes to structure of the existing guard.
The adjustments make it possible to attach the handle to aluminium profiles or steel frames of various dimensions, from 40x40 mm to 80x80 mm for the frame jamb **(A)** and from 20x20 mm to 40x40 mm for the door **(B).**
It can be installed both on hinged doors and sliding doors, either with right or left closing.
The handle is supplied with all of the components necessary for fastening at the appropriate distances with tamper-proof screws. The installer only has to assemble the components according to the application, fix the selected switch (supplied separately) and make centring adjustments.

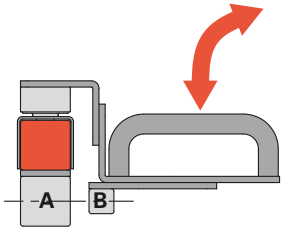




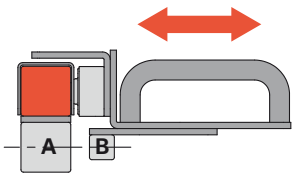
Hinged door and jamb frontally aligned



Hinged door and jamb frontally aligned



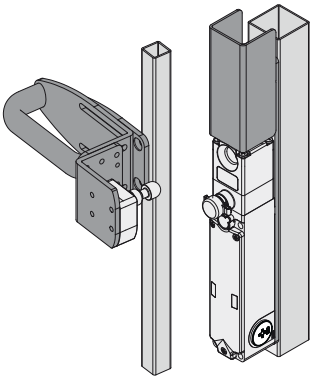
Hinged door and jamb axially aligned



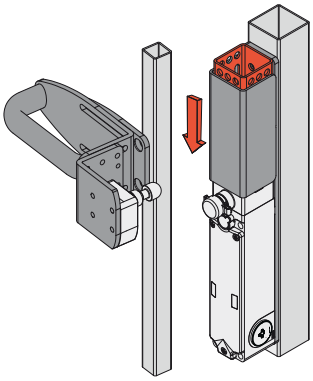
Sliding door and jamb axially aligned

Padlocking option for protecting against errors

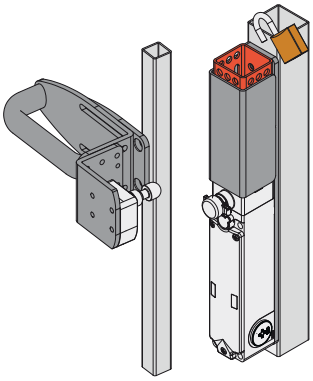
The lock-out device is simply pushed downward to expose the holes for mounting padlocks. As a result, padlocks can no longer be mounted incorrectly, since the holes are not exposed until the switch is fully locked. 9 holes for padlocks with a diameter of 7 mm are present. The head of the switch can be quickly rotated in four different directions after loosening the fixing screws, while the lock-out device reliably protects on 3 sides. The lock-out device can thus be used on hinged and sliding doors – with both right and left closing – without any modification.



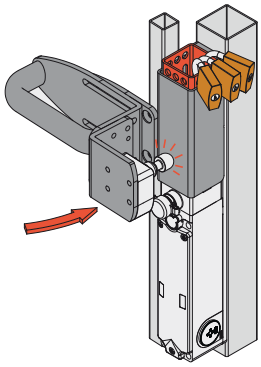
Lock-out device open.
Safety switch is accessible.



Closing of the lock-out device.



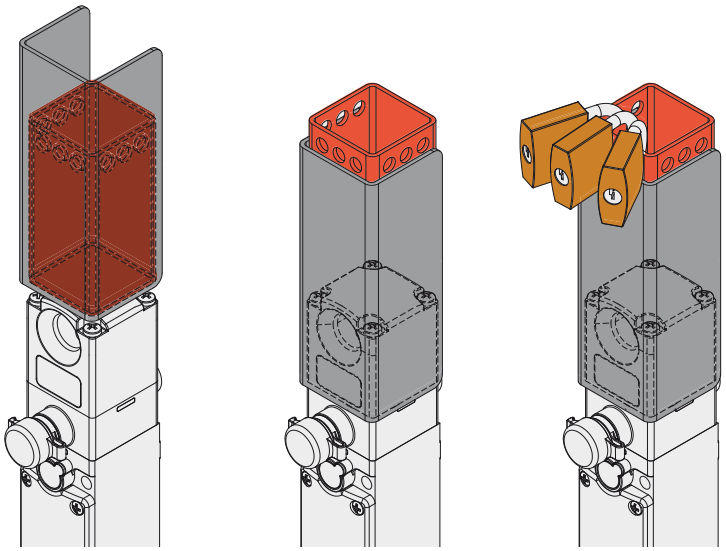
Lock-out device closed.
Padlock insertion.



Lock-out device locked.
Padlock locked.
Safety switch is not accessible.

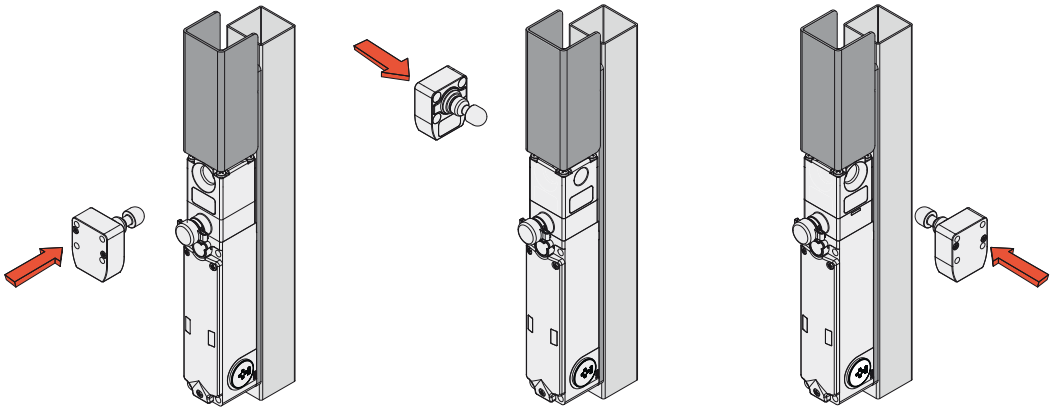
LOCK-OUT: maximum safety with just one movement

With a single operation, the lock-out device can close the centring hole in the NG switch as well as shield the RFID recognition system for detecting the actuator. Accidental closing of the guard is thereby prevented by inhibiting both the mechanical locking of the door and the electrical switching of the switch contacts.



Head rotation

Because the lock-out device covers the switch head in the 3 possible approach directions, it can be used on hinged and sliding doors – with both right and left closing – without any additional modification.



Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

AP G1A-111P

LOCK OUT device	
1	LOCK OUT device
0	Without LOCK OUT device

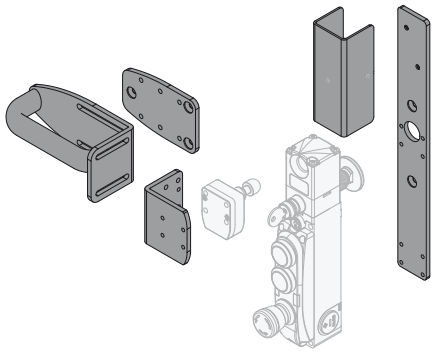
Handle	
P	Plastic handle
M	Metal handle
Z	Without handle

Fixing on frames	
A	Long plate
B	Short plate
Z	Without plate

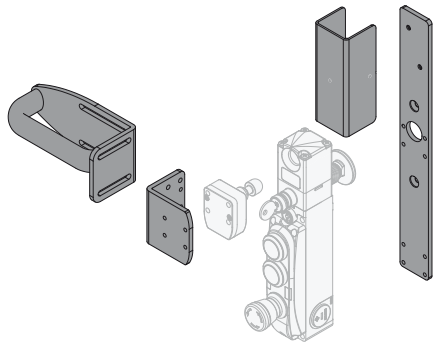
Plates for fastening the door handle	
000	Without door fastening plate
111	3 plates with multiple fastening options
011	2 plates with multiple fastening options
200	Configuration with 1 fixed plate

Note: the handle is supplied with fastening screws for the handle, for the switch, and for bolting the plates together.

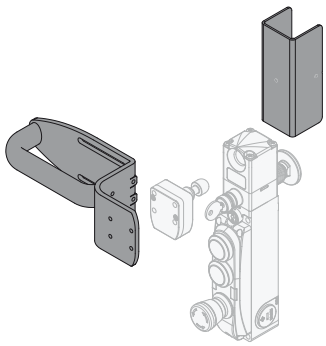
AP G1A-111P



AP G1A-011P



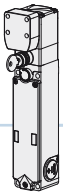
AP G1Z-200P



In case of special applications, the LOCK-OUT device can also be supplied as single device.

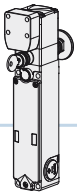
NG 2D1D411A-F31

Safety locking switch, complete with separate actuator.



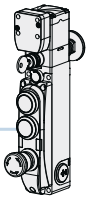
NG 2D5D411A-F31

Safety locking switch, complete with separate actuator.
With key release.



NG 2D6D411A-F31

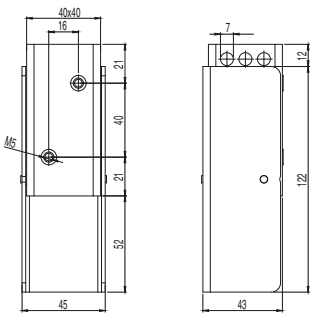
Safety locking switch, complete with separate actuator. With key release and emergency release button.



NG 2D7D411D-F31

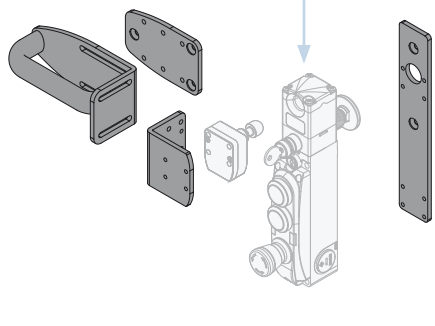
Safety locking switch, complete with separate actuator.
With emergency release button, lock and integrated control devices.

Article	Drawing
AP G1Z-000Z	

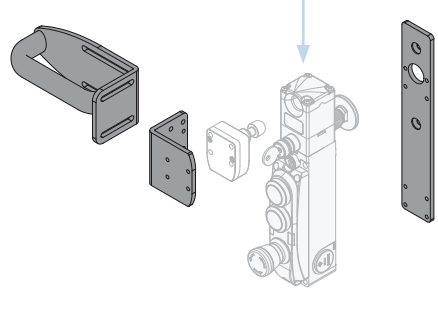


The NG series safety switch is also available in other versions. For further information see page 113.

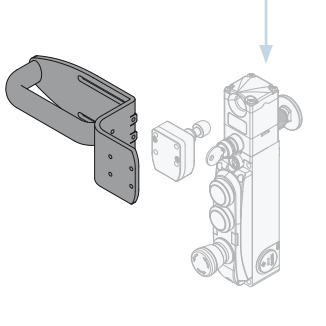
AP G0B-111P



AP G0B-011P



AP G0Z-200P



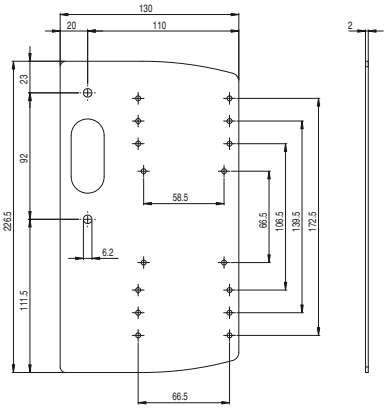
→ Sold separately as accessory

Items with code on **green** background are stock items

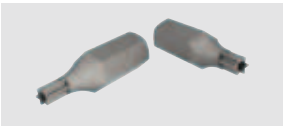
Profiled plate

Article	Description
AP A001	Profiled lateral plate

Profiled plate to be installed under the fixing plate of the switch. Suitable for both right and left mounting and provided with holes, this plate can be used for the installation of housings for the EROUND line button panels by Pizzato Elettrica (by means of common self-threading screws available on the market).



Bits for safety screws



Bits for safety screws with pin, with ¼" hexagonal connection.

Article	Description
VF VAIT1T25	Bits for M5 screws with Torx T25 fitting
VF VAIT1T30	Bits for M6 screws with Torx T30 fitting

Adhesive labels for emergency release button

Polycarbonate yellow adhesive, rectangular, 300x32 mm, red inscription. It has to be fixed on the internal part of the jamb and helps finding the emergency release button.

Article	Description and language	
VF AP-A1AGR01	PREMERE PER USCIRE	ita
VF AP-A1AGR02	PUSH TO EXIT	eng
VF AP-A1AGR04	ZUM OFFNEN DRUCKEN	deu
VF AP-A1AGR05	POUSSER POUR SORTIR	fra
VF AP-A1AGR06	PULSAR PARA SALIR	spa
VF AP-A1AGR07	НАЖАТЬ ДЛЯ ВЫХОДА	rus
VF AP-A1AGR08	NACISNĄĆ ABY WYJŚĆ	pol
VF AP-A1AGR09	PRESSIONAR PARA SAIR	por

Complete housings for profiled plate

ES AC32010

Description	Features			Diagram
Button - 1NO E2 1PU2R421L35	flush, spring-return, green			
Contacts 1x E2 CF10G2V1	pos. 2 /	pos. 3 1NO	pos. 1 /	
Button - 1NC E2 1PU2S321L1	projecting, spring-return, red			
Contacts 1x E2 CF01G2V1	pos. 2 /	pos. 3 1NC ⊕	pos. 1 /	

ES AC32043

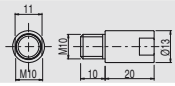
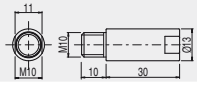
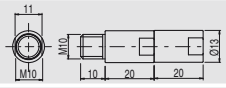
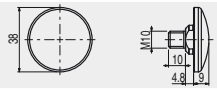
Description	Features			Diagram
Indicator light E2 1ILA210	white			
LED unit E2 LF1A2V1	White LED, 12 … 30 Vac/dc			
Button - 1NO E2 1PU2R4210	flush, spring-return, green			
Contacts 1x E2 CF10G2V1	pos. 2 /	pos. 3 1NO	pos. 1 /	

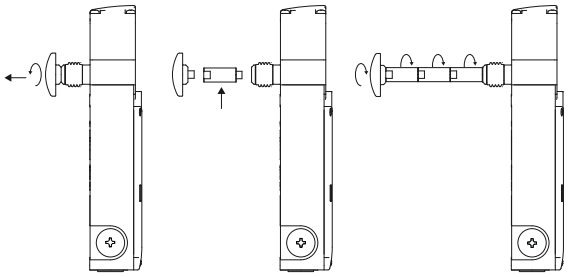
ES AC33076

Description	Features			Diagram
Illuminated button - 1NO E2 1PL2R2210	flush, spring-return, white			
LED unit E2 LF1A2V1	White LED, 12 … 30 Vac/dc			
Contacts 1x E2 CP10G2V1	pos. 2 /	pos. 3 LED	pos. 1 1NO	
Illuminated button - 1NO E2 1PL2R5210	flush, spring-return, yellow			
LED unit E2 LF1A2V1	White LED, 12 … 30 Vac/dc			
Contacts 1x E2 CP10G2V1	pos. 2 /	pos. 3 LED	pos. 1 1NO	
Emergency button Ø 40 mm- 2NC E2 1PERZ4531	rotary release, Ø 40 mm, red			
Label with shaped hole VE TF32G5700	yellow, 30x60 mm rectangular, no engraving			
Contacts 2x E2 CF01G2V1	pos. 2 1NC ⊕	pos. 3 /	pos. 1 1NC ⊕	

Accessories See page 299

Extensions for release button

Article	Description	Drawing
VN NG-LP30	Metal extension for release button. For max. wall thickness of 30 mm	
VN NG-LP40	Metal extension for release button. For max. wall thickness of 40 mm	
VN NG-LP50	Metal extension for release button. For max. wall thickness of 50 mm	
VN NG-LP60	Metal extension for release button. For max. wall thickness of 60 mm	
VN NG-ERB	Red metal release button	

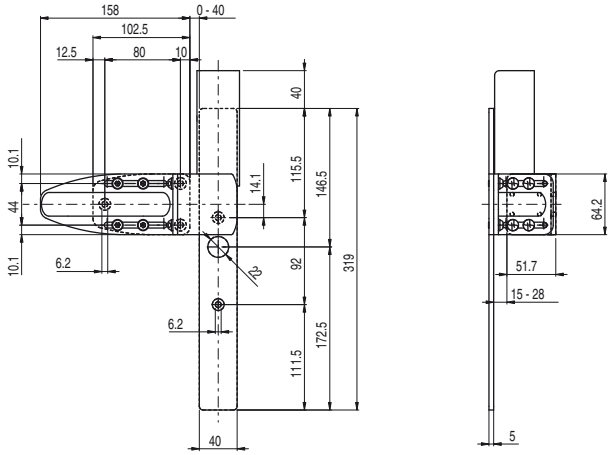


- Metal extensions can be combined with one another to achieve the desired length.
- Do not exceed an overall length of 500 mm between the release button and the switch.
- Use medium-strength thread locker to secure the extensions

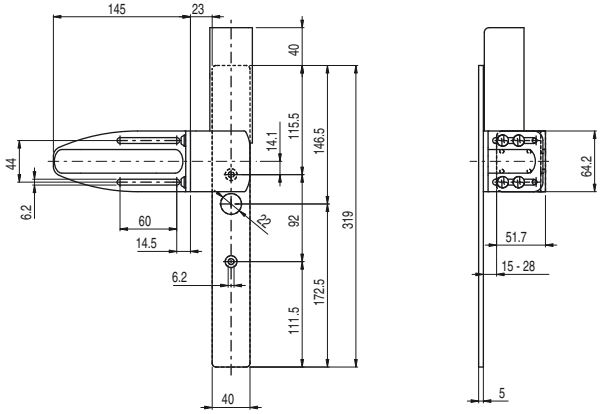
Dimensional drawings

All values in the drawings are in mm

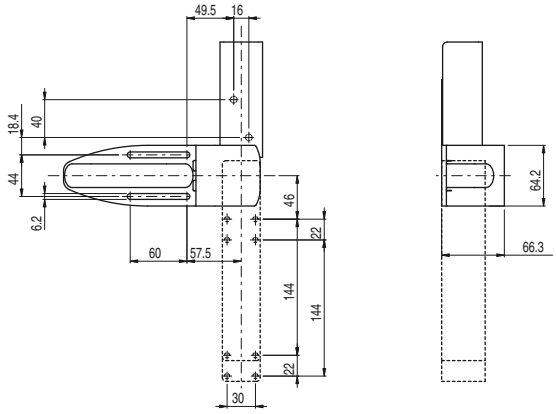
AP G1A-111• safety handles



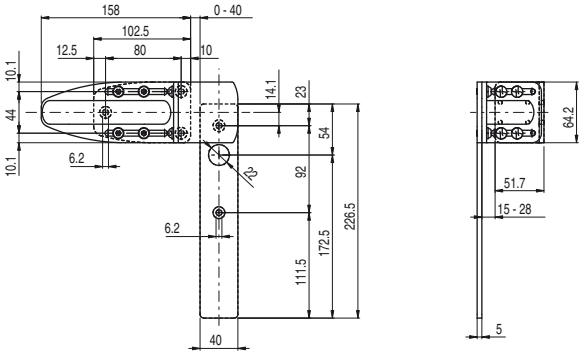
AP G1A-011• safety handles



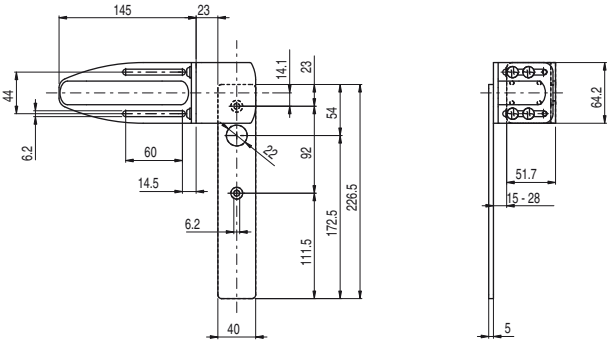
AP G1Z-200• safety handles



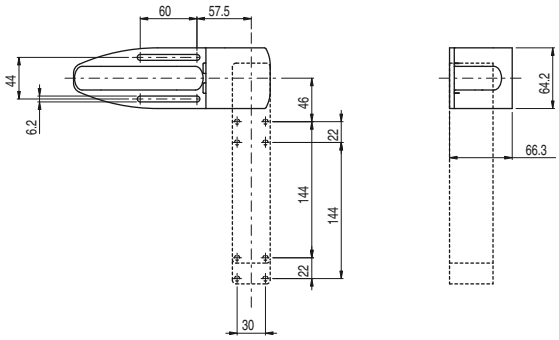
AP G0B-111• safety handles



AP G0B-011• safety handles



AP G0Z-200• safety handles



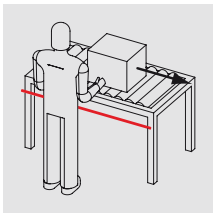
Items with code on **green** background are stock items

→ The 2D and 3D files are available at **www.pizzato.com**

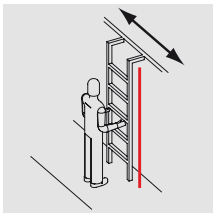
Introduction to **rope** safety switches

Description

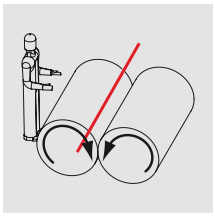
The rope switches from Pizzato Elettrica are the result of many years of experience and cooperation with major industrial machine manufacturers. The products can be used in nearly all industrial applications, including many niche solutions. The product range includes solutions for general start/stop applications as well as for emergency stop switches. The emergency-stop rope switches were the first on the market to satisfy the requirements of EN ISO 13850 with patented solutions in a small size. The range of products offered by Pizzato Elettrica is complemented with appropriate accessories for safe and long-term use, even under difficult environmental conditions. Among the latest product innovations, the fastening and tensioning systems of the "FAST" line are worth mentioning (patented). At the focus of this development was the fast installation and an attractive design that blends harmoniously into the flowing designs of current machine generations.



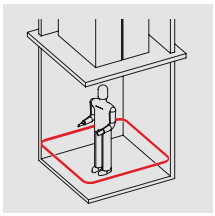
Conveyors



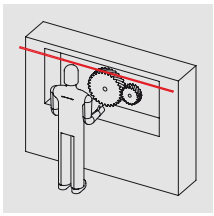
Sliding ladders



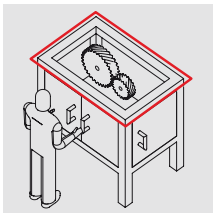
Rollers



Lift compartment



Long bay machinery



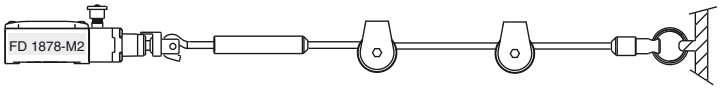
Complete perimeter protection

Rope switches are used to give different types of commands.

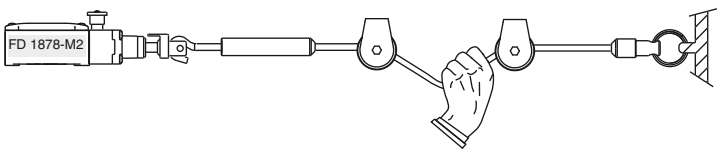
- **For stop commands,** rope switches with positive opening at medium rope tension are used; this also allows damage to the rope to be detected.
- **For emergency stop,** rope switches with positive opening in accordance with EN ISO 13850 are used. Here, the mechanical reset system opens the contact independent of the actuation speed of the rope, upon both actuation as well as breakage of the rope. With these switches, the reset system must be manually reset after each intervention.

	Requirements	Colours	How to install:
Stop commands example: FD 1879-M2	Positive opening is required ⊖	Black is the colour suggested by standards for stop operations.	 The rope should be tensioned so as to enable detection of any breaks or stretching of the rope
Emergency stops example: FD 1878-M2	Positive opening is required ⊖ Compliance with EN ISO 13850 is required	For emergency stops red rope is compulsory. A yellow background is recommended (see function indicator).	 The rope must be tensioned so as to enable detection of any breaks or stretching of the rope

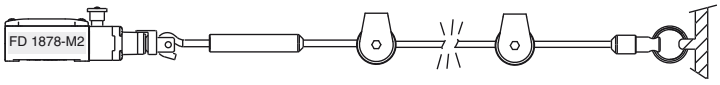
Detection of an actuated or cut rope



Rope correctly mounted and in resting position, electric contacts closed.



Rope pulled by operator, electric contacts open.



Rope cut, electric contacts open.

Accessories for rope locking and tightening, "FAST" system

Pizzato Elettrica has developed and patented special accessories for more quickly installing the ropes of safety switches and at the same time creating a more aesthetically pleasing system.

Compared to the traditional fixing method, the new accessories offer the following advantages:

- The installation is faster because only one screw is used for the fastening of every rope extremity, and the parts are designed to ease the installation. Practical tests have shown that the installation time is reduced by over half, hence the name: "FAST".
- The system is aesthetically pleasant, because thread parts (which sometimes tear operators' dresses) and the rope extremities, usually fixed by heat-shrinkable sheath or adhesive tape, have been hidden.
- The rope is fixed without kinking and, as a result, does not stretch over time; re-calibration of the rope tension is no longer necessary.

The system has been tested for correct function only if used with steel ropes of high quality like the ones Pizzato Elettrica supplies.

Rope function indicator

These function indicators help in the visualization of the rope and its emergency function highlighting its presence as recommended by the standard EN ISO 13850 chap. 4.5.1 and 4.4.5.

They are fixed on the rope through screws and thanks to their handle-shape make the operation easier. The indicators can be supplied with different texts in several languages.

LED signalling light

It is sometimes important to have an indicator that is visible on-site to indicate which rope switch has been actuated. The high luminosity LED signalling lights from Pizzato Elettrica were developed for this purpose and can be installed directly on the threaded cable glands of the switches. These signalling lights are robust and designed in protection degrees IP67 and IP69K. The inner part of the signalling light can rotate in such a way that it can be wired without any risk of kinking the wires. They are available for power supplies of 24 Vac/dc, 120 Vac and 230 Vac and can be delivered in red, green, yellow and white. Rope switches with three contacts facilitate the realisation of systems in which each switch has two NC contacts with positive opening for the safety chain and one NO contact for the signalling light.

For more details see page 312.

Safety springs

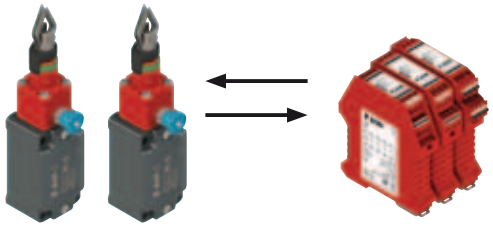
For some applications, ropes are needed for covering especially long spans. With day/night changes of temperature, the ropes are lengthened or shortened in proportion to the rope length, to the change of temperature and to the coefficient of expansion of the steel. The changes of the rope length do not have linear repercussions on the switch, because the very long ropes are regularly sustained by supports that modify the linearity of the system. With safety switches, the rope must be under tension within an operating tension range. As a result, an undesired actuation of the safety switch is possible with very long ropes or in the case of very high temperature differences. To reduce the effect of the changes of the temperature, it is possible to install a safety spring at the opposite extremity of the switch, so the rope elongation is equally divided between the two devices. The safety spring has been made to have an elastic coefficient equal to the spring inside the switch. In addition, the safety spring is equipped with a fixed ring that fully transfers the tensile force to the switch.

Stainless steel rope pulleys

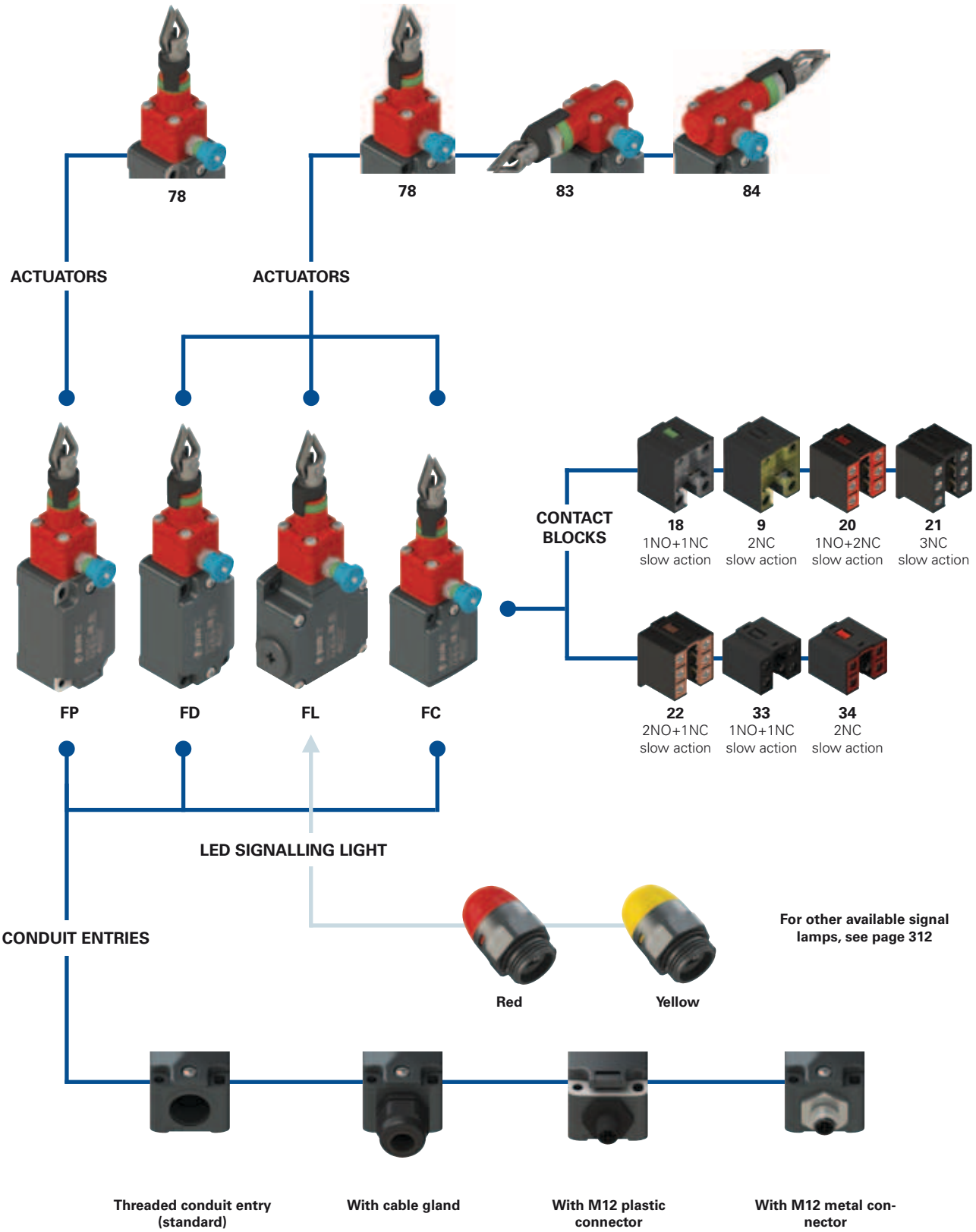
The pulleys in stainless steel are used in applications where the rope is rather long, to support its length or bend its route. The two available pulleys are robust and dimensioned so as not to deform and to securely hold the rope in the guide even if the rope is pulled energetically. The angular pulley is available in different designs with a slotted fixing hole. This simplifies installation and ensures that the rope retains the correct distance from guard edges.

Safety modules

The rope safety switches inserted in the emergency chains can be connected with the Pizzato Elettrica safety modules in order to obtain safety circuits up to PL e in accordance with EN ISO 13849. Safety modules with instantaneous and delayed contacts are available for the realization of emergency circuits type 0 (immediate stop) or type 1 (monitored stop).



Selection diagram



Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options | options

FD 1878-E7GM2K50T6

Housing	
FD	metal, one conduit entry
FL	metal, three conduit entries
FP	technopolymer, one conduit entry

Contact block	
18	1NO+1NC, slow action
9	2NC, slow action
20	1NO+2NC, slow action
21	3NC, slow action
22	2NO+1NC, slow action
33	1NO+1NC, slow action
34	2NC, slow action

Actuating head	
78	longitudinal head
83	left transversal head (FD-FL housing only)
84	right transversal head (FD-FL housing only)

Actuating force	
	standard
E7	initial 20 N...final 40 N (only head 78)
E9	initial 13 N...final 75 N (only head 83-84)

Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	Silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 22, 33, 34)

Threaded conduit entry	
M2	M20x1.5 (standard)
	PG 13.5

Pre-installed cable glands or connectors	
	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
...	.....
K50	M12 metal connector, 5-pole
...	.....

For the complete list of possible combinations please contact our technical department.

Ambient temperature	
	-25°C … +80°C (standard)
T6	-40°C … +80°C

article | options | options

FC 3378-E7GM2K50T6

Housing	
FC	metal, one conduit entry

Contact block	
33	1NO+1NC, slow action
34	2NC, slow action

Actuating head	
78	longitudinal head
83	left transversal head
84	right transversal head

Actuating force	
	standard
E7	initial 20 N...final 40 N (only head 78)
E9	initial 13 N...final 75 N (only head 83-84)

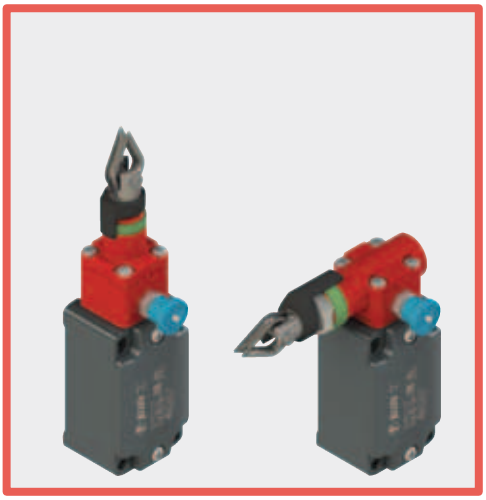
Contact type	
	silver contacts (standard)
G	silver contacts with 1 µm gold coating

Threaded conduit entry	
M2	M20x1.5 (standard)
	PG 11

Pre-installed cable glands or connectors	
	no cable gland (standard)
K23	cable gland for cables Ø 6 … 12 mm
K50	M12 metal connector, 5-pole

Ambient temperature	
	-25°C … +80°C (standard)
T6	-40°C … +80°C

Safety **rope switches with reset** for emergency stop



Main features
- Metal or plastic housing, from one to three conduit entries
- Protection degree IP67
- In compliance with EN ISO 13850
- 7 contact blocks available
- Versions with vertical or horizontal actuation
- Versions with assembled M12 connector
- Versions with gold-plated silver contacts

Quality marks:

IMQ approval:	EG605
UL approval:	E131787
CCC approval:	2007010305230000 (FD-FL-FC series) 2007010305230014 (FP series)
EAC approval:	RU C-IT.АД35.B.00454

Technical data

Housing

FP series housing made of glass fibre reinforced technopolymer, self-extinguishing, shock-proof and with double insulation: ⧈
FD, FL and FC series: metal housing, baked powder coating.

FD, FP, FC series: one threaded conduit entry:	M20x1.5 (standard)
FL series: three threaded conduit entries:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Safety parameters:	
B_{10D}:	2,000,000 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Max. actuation frequency:	1 cycle / 6 s
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Tightening torques for installation:	see page 313-324

Max. cable cross section (flexible copper strands)

Contact blocks 20, 21, 22, 33, 34:	min. 1 x 0.34 mm² (1 x AWG 22) max. 2 x 1.5 mm² (2 x AWG 16)
Contact blocks 18, 9:	min. 1 x 0.5 mm² (1 x AWG 20) max. 2 x 2.5 mm² (2 x AWG 14)

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, EN ISO 13850, EN 418, UL 508, CSA 22.2 No.14.
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 No.14 , GB14048.5-2001.

Compliance with the requirements of:
Machinery Directive 2006/42/EC and EMC Directive 2004/122/EC.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

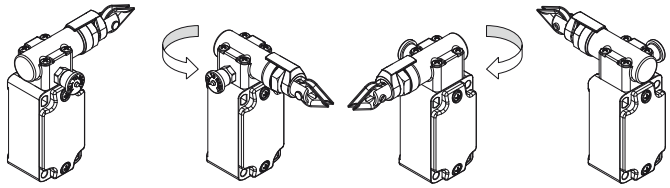
⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

	Electrical data		Utilization category
without connector	Thermal current (I_{th}):	10 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 22, 33, 34)	U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 22, 33, 34)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250
	Protection against short circuits:	type aM fuse 10 A 500 V	I_e (A) 6 1.1 0.4
	Pollution degree:	3	
with M12 connector 4 and 5-pole	Thermal current (I_{th}):	4 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	U_e (V) 24 120 250
	Protection against short circuits:	type gG fuse 4 A 500 V	I_e (A) 4 4 4
	Pollution degree:	3	Direct current: DC13
			U_e (V) 24 125 250
			I_e (A) 4 1.1 0.4
with M12 connector 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz)
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	U_e (V) 24
	Protection against short circuits:	type gG fuse 2 A 500 V	I_e (A) 2
	Pollution degree:	3	Direct current: DC13
			U_e (V) 24
			I_e (A) 2

Description

These rope-operated safety switches are installed on machines or conveyor belts and allow the machine to be brought to an emergency stop from any point and with any pull on the rope. This means significant cost savings for medium and large machines, since multiple emergency-stop buttons can be replaced with a single switch. They are equipped with a **self-control function** that constantly checks the correct function and signals a possible loosening or breaking of the rope through the opening of the contacts. These safety switches keep the contacts open after activation until the reset is performed, even if the rope is released.

Head with variable orientation



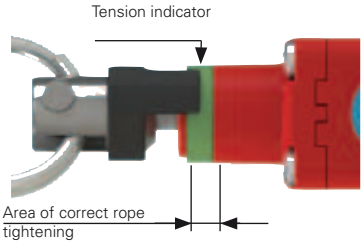
For all switches, the head can be adjusted in 90° steps after removing the four fastening screws.

Extended temperature range

-40°C

These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C. They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

Indicator for rope adjustment



All switches are provided with a green ring that shows the area of the correct tightening of the rope. The installer has only to tighten the rope until the black indicator will be in the middle of the green area. With this setting, the switch can be reset by pulling the blue knob to close the electrical safety contacts.
If the tension (or loosening) on the rope is so high that the black indicator exits the green area, the electrical safety contacts will open and the reset device will trigger.

Laser engraving

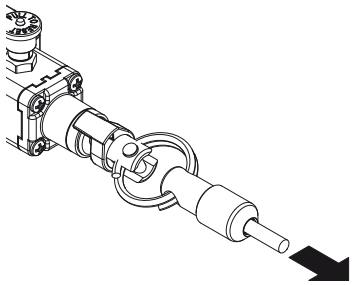
All devices are marked using a dedicated indelible laser system. These engravings are therefore suitable for extreme environments too. Thanks to this system that does not use labels, the loss of plate data is prevented and a greater resistance of the marking is achieved over time.

Protection degree IP67

IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

Reduced actuating force

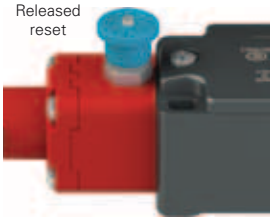


These switches can be supplied with reduced hardness internal springs on request. The force required to actuate the switch can thereby be reduced without changing the actuating path of the electrical contacts. This is particularly advantageous for smaller spans, but must, however, always make use of rope pulleys.

Indicator for the state of the reset

Armed reset

Released reset



If the tension indicator is in the green area, the electrical safety contacts can be closed by pulling the blue knob. The reset status can be identified quickly by the green ring under the blue knob.

Features approved by IMQ

Rated insulation voltage (Ui):	500 Vac 400 Vac (for contact blocks 20, 21, 22, 33, 34)
Conventional free air thermal current (Ith):	10 A
Protection against short circuits:	type aM fuse 10 A 500 V
Rated impulse withstand voltage (Uimp):	6 kV 4 kV (for contact blocks 20, 21, 22, 33, 34)
Protection degree of the housing:	IP67
MV terminals (screw terminals)	
Pollution degree:	3
Utilization category:	AC15
Operating voltage (Ue):	400 Vac (50 Hz)
Operating current (Ie):	3 A

Forms of the contact element: Zb, Y+Y, Y+Y+X, Y+Y+Y, Y+X+X
Positive opening contacts on contact blocks 18, 9, 20, 21, 22, 33, 34
In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories	Q300 (69 VA, 125-250 Vdc) A600 (720 VA, 120-600 Vac)

Housing features type 1, 4X "indoor use only", 12, 13
For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).

In compliance with standard: UL 508, CSA 22.2 No.14

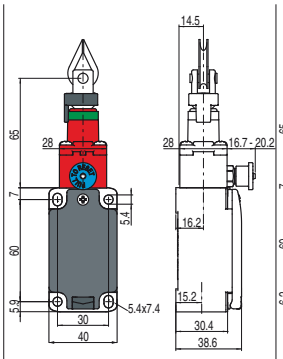
Please contact our technical department for the list of approved products.

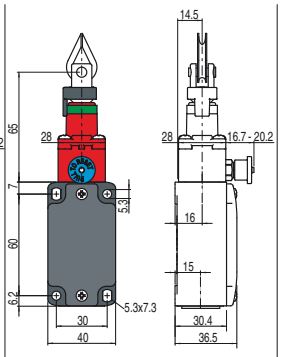
Dimensional drawings

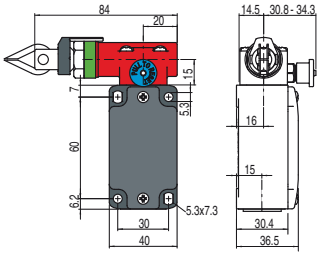
All values in the drawings are in mm

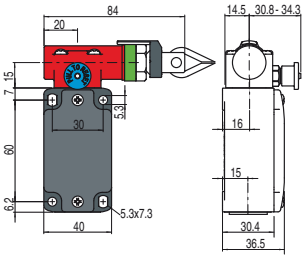
Contact type:

L = slow action



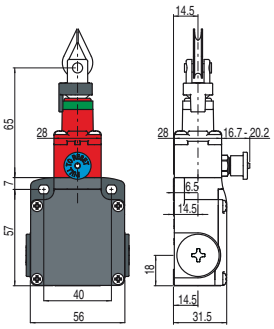


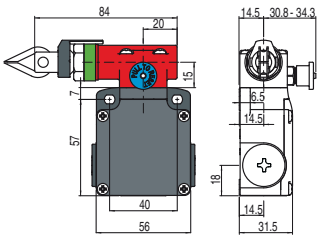


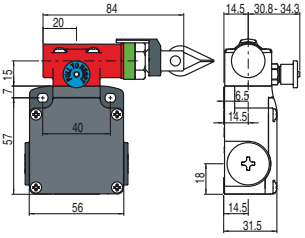


Contact block

18	L	FP 1878-M2	→	1NO+1NC	FD 1878-M2	→	1NO+1NC	FD 1883-M2	→	1NO+1NC	FD 1884-M2	→	1NO+1NC
9	L	FP 978-M2	→	2NC	FD 978-M2	→	2NC	FD 983-M2	→	2NC	FD 984-M2	→	2NC
20	L	FP 2078-M2	→	1NO+2NC	FD 2078-M2	→	1NO+2NC	FD 2083-M2	→	1NO+2NC	FD 2084-M2	→	1NO+2NC
21	L	FP 2178-M2	→	3NC	FD 2178-M2	→	3NC	FD 2183-M2	→	3NC	FD 2184-M2	→	3NC
22	L	FP 2278-M2	→	2NO+1NC	FD 2278-M2	→	2NO+1NC	FD 2283-M2	→	2NO+1NC	FD 2284-M2	→	2NO+1NC
33	L	FP 3378-M2	→	1NO+1NC	FD 3378-M2	→	1NO+1NC	FD 3383-M2	→	1NO+1NC	FD 3384-M2	→	1NO+1NC
34	L	FP 3478-M2	→	2NC	FD 3478-M2	→	2NC	FD 3483-M2	→	2NC	FD 3484-M2	→	2NC
Actuating force		Initial 63 N...final 83 N (90 N →)			Initial 63 N...final 83 N (90 N →)			Initial 147 N...final 235 N (250 N →)			Initial 147 N...final 235 N (250 N →)		
Travel diagrams		page 174 - group 1			page 174 - group 1			page 174 - group 2			page 174 - group 2		







Contact block

18	L	FL 1878-M2	→	1NO+1NC	FL 1883-M2	→	1NO+1NC	FL 1884-M2	→	1NO+1NC	
9	L	FL 978-M2	→	2NC	FL 983-M2	→	2NC	FL 984-M2	→	2NC	
20	L	FL 2078-M2	→	1NO+2NC	FL 2083-M2	→	1NO+2NC	FL 2084-M2	→	1NO+2NC	
21	L	FL 2178-M2	→	3NC	FL 2183-M2	→	3NC	FL 2184-M2	→	3NC	
22	L	FL 2278-M2	→	2NO+1NC	FL 2283-M2	→	2NO+1NC	FL 2284-M2	→	2NO+1NC	
33	L	FL 3378-M2	→	1NO+1NC	FL 3383-M2	→	1NO+1NC	FL 3384-M2	→	1NO+1NC	
34	L	FL 3478-M2	→	2NC	FL 3483-M2	→	2NC	FL 3484-M2	→	2NC	
Actuating force		Initial 63 N...final 83 N (90 N →)			Initial 147 N...final 235 N (250 N →)			Initial 147 N...final 235 N (250 N →)			
Travel diagrams		page 174 - group 1			page 174 - group 2			page 174 - group 2			

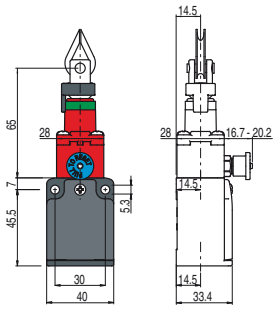
Items with code on **green** background are stock items

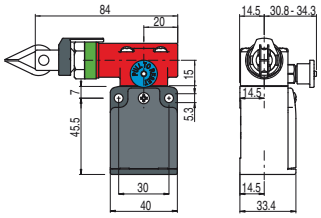
Accessories See page 299

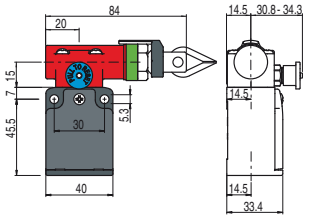
→ The 2D and 3D files are available at **www.pizzato.com**

Contact type:

L = slow action



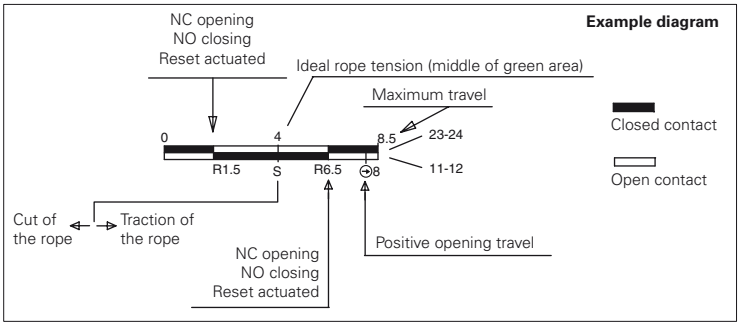




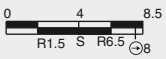
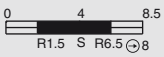
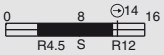
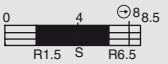
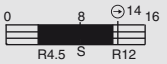
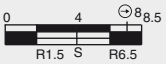
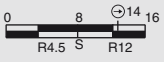
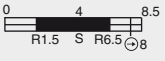
Contact block				
33 L	FC 3378-M2 ⊕ 1NO+1NC	FC 3383-M2 ⊕ 1NO+1NC	FC 3384-M2 ⊕ 1NO+1NC
34 L	FC 3478-M2 ⊕ 2NC	FC 3483-M2 ⊕ 2NC	FC 3484-M2 ⊕ 2NC
Actuating force	Initial 63 N…final 83 N (90 N ⊕)	Initial 147 N…final 235 N (250 N ⊕)	Initial 147 N…final 235 N (250 N ⊕)
Travel diagrams	page 174 - group 1	page 174 - group 2	page 174 - group 2

How to read travel diagrams

All values in the diagrams are in mm



Travel diagrams table

Contact block		Group 1	Group 2
18 1NO+1NC			
9 2NC			
20 1NO+2NC			
21 3NC			
22 2NO+1NC			
33 1NC+1NO			
34 2NC			

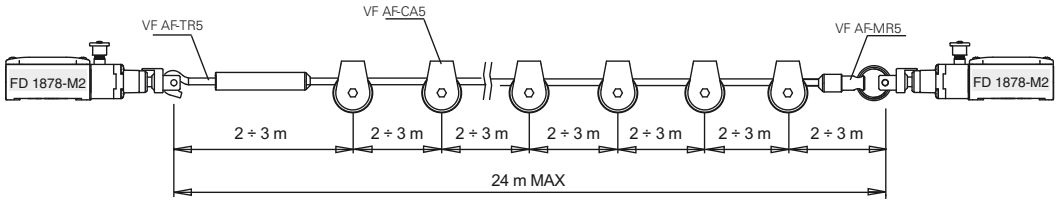
IMPORTANT:
In **safety applications**, actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol ⊕. Actuate the switch **at least with the positive opening force**, reported in brackets below each article, next to the actuating force value.

Accessories See page 299

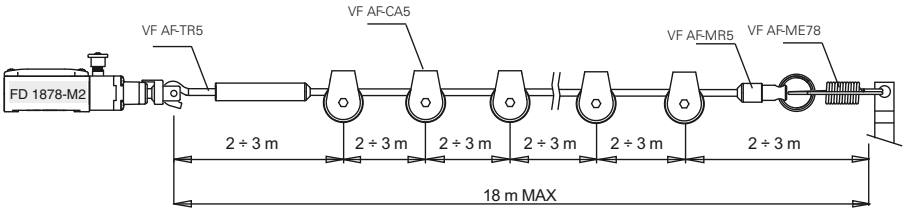
➔ The 2D and 3D files are available at **www.pizzato.com**

Application examples and max. rope length for switches with longitudinal head

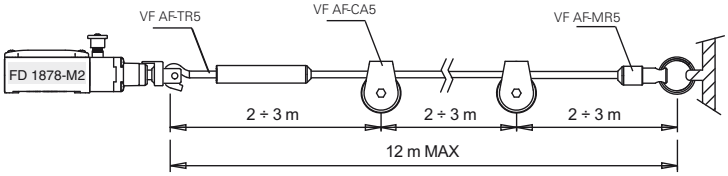
Example A



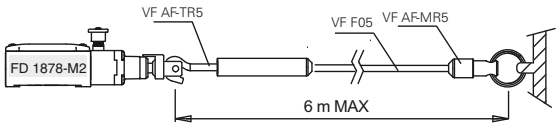
Example B



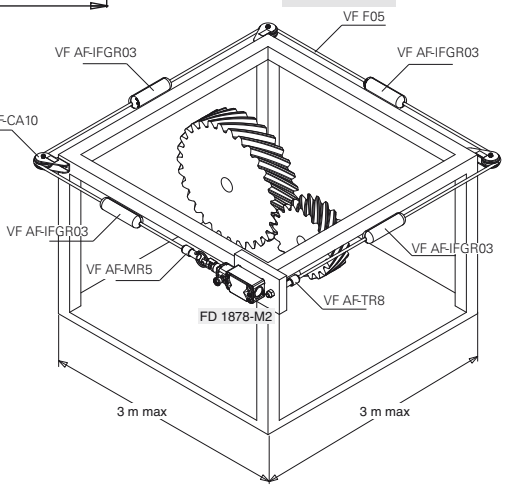
Example C



Example D

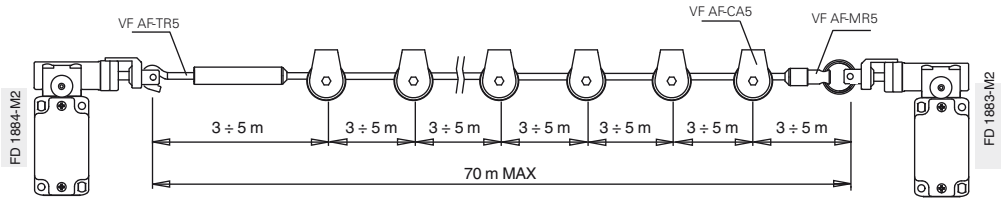


Example E

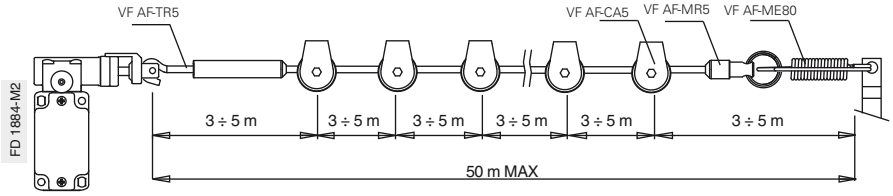


Application examples and max. rope length for switches with transversal head

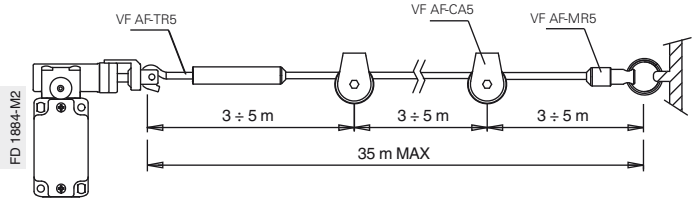
Example F



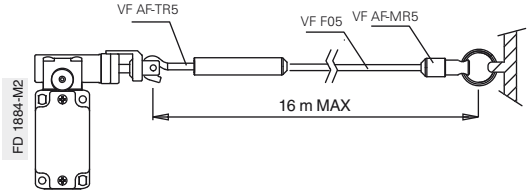
Example G



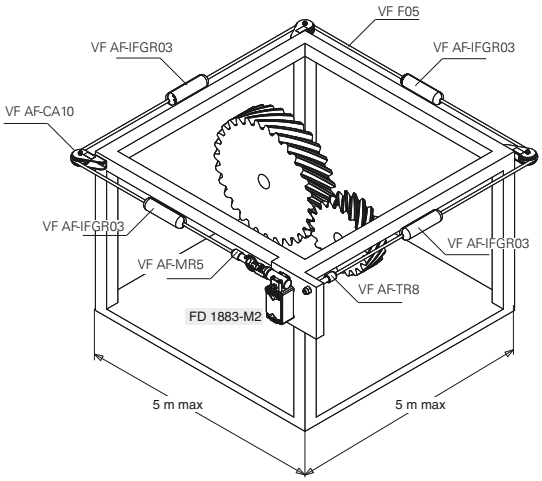
Example H



Example I

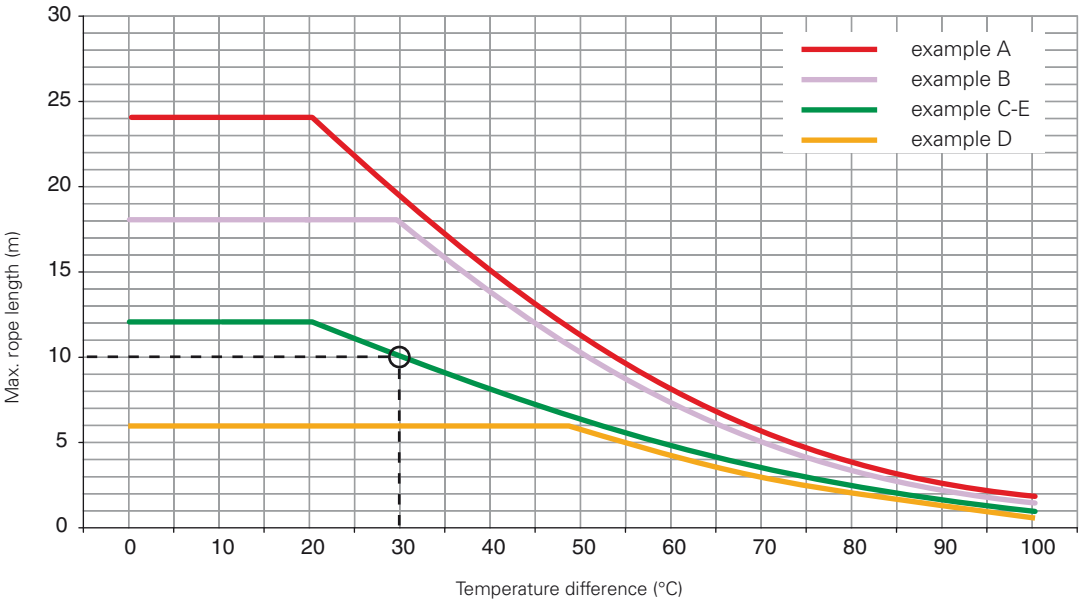


Example J



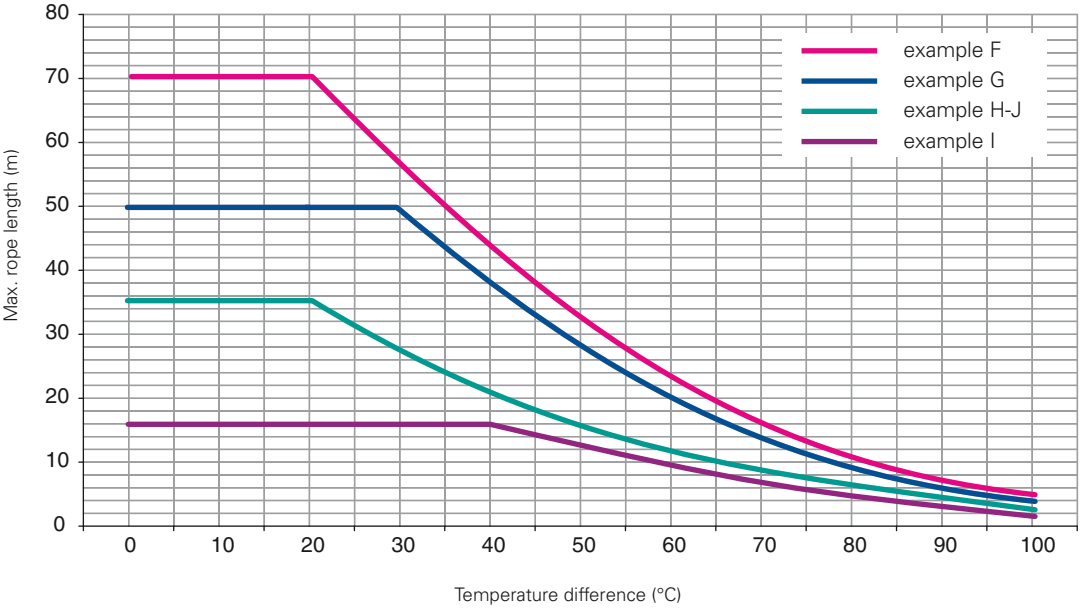
Maximum spans

Maximum spans for switches with longitudinal head



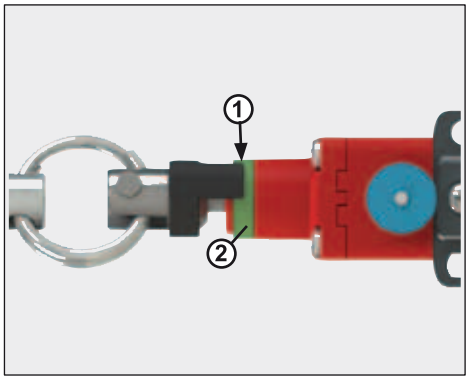
The max. recommended spans are indicated in the diagram as a function of the temperature fluctuations (temperature differences) to which the switch may be exposed at the point of use. For instance, with installation of type C and a temperature difference of 30°C, the max. recommended rope length is 10 metres.

Maximum spans for switches with transversal head

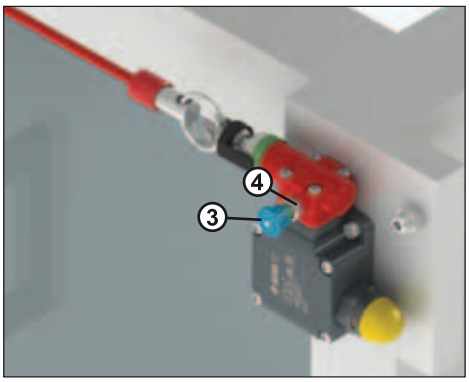


Important: The above data are guaranteed only using original rope and accessories. See page 185.

Adjustment of the switching point

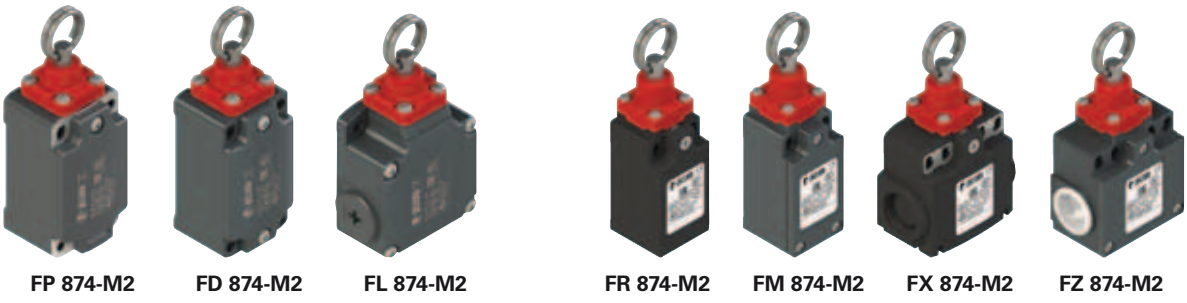


Tighten the rope connected to the switch, until the end of the indicator (1) reaches about the middle of the green ring (2).



Pull the knob (3) in order to close the safety contacts inside the switch. Below the knob a green ring (4) will be disclosed.

Selection diagram



FP 874-M2 | FD 874-M2 | FL 874-M2 | FR 874-M2 | FM 874-M2 | FX 874-M2 | FZ 874-M2

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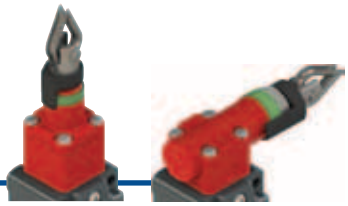
ACTUATORS

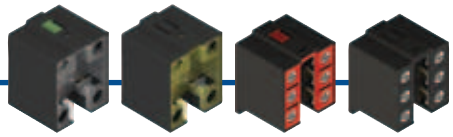


79 | 80

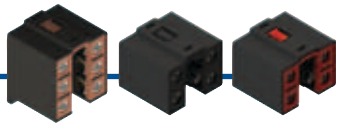
ACTUATORS

FP | FD | FL | FC

CONTACT BLOCKS



18 — 1NO+1NC slow action
9 — 2NC slow action
20 — 1NO+2NC slow action
21 — 3NC slow action



22 — 2NO+1NC slow action
33 — 1NO+1NC slow action
34 — 2NC slow action

CONDUIT ENTRIES

Threaded conduit entry (standard) | With cable gland | With M12 plastic connector | With M12 metal connector

product option

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options | options

FD 1879-E7GM2K50T6

Housing

FD	metal, one conduit entry
FL	metal, three conduit entries
FP	technopolymer, one conduit entry

Contact block

18	1NO+1NC, slow action
9	2NC, slow action
20	1NO+2NC, slow action
21	3NC, slow action
22	2NO+1NC, slow action
33	1NO+1NC, slow action
34	2NC, slow action

Actuating head

79	longitudinal head
80	transversal head (FD-FL housing only)

Actuating force

	standard
E7	initial 20 N...final 40 N (only head 79)
E9	initial 13 N...final 75 N (only head 80)

Ambient temperature

	-25°C … +80°C (standard)
T6	-40°C … +80°C

Pre-installed cable glands or connectors

	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
...	.....
K50	M12 metal connector, 5-pole
...	.....

For the complete list of possible combinations please contact our technical department.

Threaded conduit entry

M2	M20x1.5 (standard)
	PG 13.5

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	Silver contacts, 2.5 µm gold coating (not for contact blocks 20, 21, 22, 33, 34)

article | options | options

FC 3379-E7GM2K50T6

Housing

FC	metal, one conduit entry

Contact block

33	1NO+1NC, slow action
34	2NC, slow action

Actuating head

79	longitudinal head
80	transversal head

Actuating force

	standard
E7	initial 20 N...final 40 N (only head 79)
E9	initial 13 N...final 75 N (only head 80)

Pre-installed cable glands

	no cable gland (standard)
K23	cable gland for cables Ø 6 … 12 mm
K50	M12 metal connector, 5-pole

Threaded conduit entry

M2	M20x1.5 (standard)
	PG 11

Ambient temperature

	-25°C … +80°C (standard)
T6	-40°C … +80°C

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating

article | options | options

FD 874-E7GM2K50T6

Housing

FD	metal, one conduit entry
FL	metal, three conduit entries
FP	technopolymer, one conduit entry
FR	technopolymer, one conduit entry
FM	metal, one conduit entry
FX	technopolymer, two conduit entries
FZ	metal, two conduit entries

Actuating force

	standard
E7	initial 20 N...final 40 N

Contact type

	silver contacts (standard)
G	silver contacts with 1 µm gold coating
G1	silver contacts with 2.5 µm gold coating

Pre-installed cable glands or connectors

	no cable gland or connector (standard)
K23	cable gland for cables Ø 6 … 12 mm
...	.....
K50	M12 metal connector, 5-pole
...	.....

For the complete list of possible combinations please contact our technical department.

Threaded conduit entry

M2	M20x1.5 (standard)
M1	M16x1.5 (FR-FX housing only)
	PG 13.5
A	PG 11 (FR-FX housing only)

Ambient temperature

	-25°C … +80°C (standard)
T6	-40°C … +80°C

Safety **rope switch without reset** for simple stop

Main features
- Metal or plastic housing, from one to three conduit entries
- Protection degree IP67
- 7 contact blocks available
- Versions with vertical or horizontal actuation
- Versions with assembled M12 connector
- Versions with gold-plated silver contacts

Quality marks:

IMQ approval:	EG605 (FD-FL-FP-FC series) EG610 (FR-FX series) EG609 (FM-FZ series)
UL approval:	E131787
CCC approval:	2007010305230000 (FD-FL-FC series) 2007010305230014 (FP series) 2007010305230013 (FR-FX series) 2007010305229998 (FM-FZ series)
EAC approval:	RU C-IT.АД35.В.00454

Technical data

Housing

FP, FR, FX series housing made of glass fibre reinforced technopolymer, self-extinguishing, shock-proof and with double insulation: ⧈
FD, FL, FC, FM, FZ series: metal housing, baked powder coating.

FD, FP, FC, FR, FM series: one threaded conduit entry:	M20x1.5 (standard)
FX series: two knock-out threaded conduit entries:	M20x1.5 (standard)
FZ series: two threaded conduit entries:	M20x1.5 (standard)
FL series: three threaded conduit entries:	M20x1.5 (standard)
Protection degree:	IP67 acc. to EN 60529 with cable gland of equal or higher protection degree

General data

For safety applications up to:	SIL 3 acc. to EN 62061 PL e acc. to EN ISO 13849-1
Safety parameters:	
B_{10D}:	2,000,000 for NC contacts
Service life:	20 years
Ambient temperature:	-25°C … +80°C
Max. actuation frequency:	1 cycle / 6 s
Mechanical endurance:	1 million operating cycles
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Tightening torques for installation:	see page 313-324

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 22, 33, 34:	min. 1 x 0.34 mm² (1 x AWG 22) max. 2 x 1.5 mm² (2 x AWG 16)
Contact blocks 18, 8, 9:	min. 1 x 0.5 mm² (1 x AWG 20) max. 2 x 2.5 mm² (2 x AWG 14)

In compliance with standards:
IEC 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 14119, EN ISO 12100, IEC 60529, EN 60529, UL 508, CSA 22.2 No.14 .
Approvals:
IEC 60947-5-1, UL 508, CSA 22.2 No.14, GB14048.5-2001.

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU, EMC Directive 2014/30/EU.
Positive contact opening in conformity with standards:
IEC 60947-5-1, EN 60947-5-1.

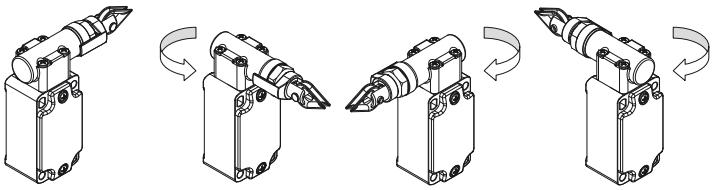
⚠ **If not expressly indicated in this chapter, for correct installation and utilization of all articles see chapter utilization requirements from page 313 to page 324.**

Electrical data			Utilization category
without connector	Thermal current (I_{th}):	10 A	
	Rated insulation voltage (U_i):	500 Vac 600 Vdc 400 Vac 500 Vdc (contact blocks 20, 21, 22, 33, 34)	Alternating current: AC15 (50÷60 Hz) U_e (V) 250 400 500 I_e (A) 6 4 1
	Rated impulse withstand voltage (U_{imp}):	6 kV 4 kV (contact blocks 20, 21, 22, 33, 34)	Direct current: DC13
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	U_e (V) 24 125 250
	Protection against short circuits:	type aM fuse 10 A 500 V	I_e (A) 6 1.1 0.4
	Pollution degree:	3	
with M12 connector 4 and 5-pole	Thermal current (I_{th}):	4 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 120 250 I_e (A) 4 4 4
	Rated insulation voltage (U_i):	250 Vac 300 Vdc	Direct current: DC13
	Protection against short circuits:	type gG fuse 4 A 500 V	U_e (V) 24 125 250
	Pollution degree:	3	I_e (A) 4 1.1 0.4
with M12 connector 8-pole	Thermal current (I_{th}):	2 A	Alternating current: AC15 (50÷60 Hz) U_e (V) 24 I_e (A) 2
	Rated insulation voltage (U_i):	30 Vac 36 Vdc	Direct current: DC13
	Protection against short circuits:	type gG fuse 2 A 500 V	U_e (V) 24
	Pollution degree:	3	I_e (A) 2

Description

These rope-operated safety switches are installed on machines or conveyor belts and facilitate the simple shut-down of the machine from any point and with any pull on the rope.
Provided with **self-control function**, they allow the constant monitoring of correct functioning, signalling with the opening of the contacts an eventual loosening or breaking of the rope.

Head with variable orientation



For all switches, the head can be adjusted in 90° steps after removing the four fastening screws.

Protection degree IP67

IP67

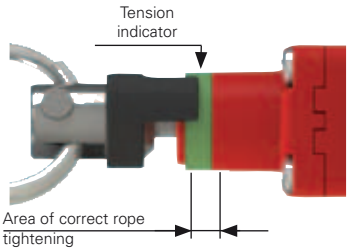
These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required.

Extended temperature range

-40°C

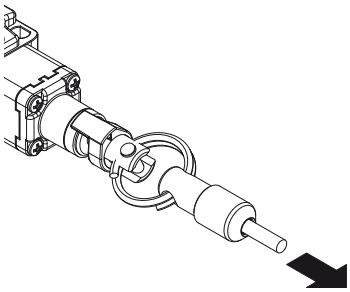
These devices are also available in a special version suitable for an ambient operating temperature range from -40°C up to +80°C.
They can therefore be used for applications in cold stores, sterilisers and other equipment with low temperature environments. The special materials used to produce these versions retain their characteristics even under these conditions, thereby expanding the installation possibilities.

Indicator for rope adjustment



The switches (head 79 and 80) are provided with a green ring that shows the area of the correct tightening of the rope. The installer has only to tighten the rope until the black indicator will be in the middle of the green area. If the tension (or loosening) on the rope is so high that the black indicator exits the green area, the electrical safety contacts will open.

Actuating forces



These switches can be supplied with reduced hardness internal springs on request. The force required to actuate the switch can thereby be reduced without changing the actuating path of the electrical contacts. This is particularly advantageous for smaller spans, but must, however, always make use of rope pulleys.

Features approved by IMQ

Rated insulation voltage (U_i):	500 Vac
	400 Vac (for contact blocks 20, 21, 22, 33, 34)
Conventional free air thermal current (I_{th}):	10 A
Protection against short circuits:	type aM fuse 10 A 500 V
Rated impulse withstand voltage (U_{imp}):	6 kV
	4 kV (for contact blocks 20, 21, 22, 33, 34)
Protection degree of the housing:	IP67
MV terminals (screw terminals)	
Pollution degree:	3
Utilization category:	AC15
Operating voltage (U_e):	400 Vac (50 Hz)
Operating current (I_e):	3 A

Forms of the contact element: Zb, Y+Y, Y+Y+X, Y+Y+Y, Y+X+X
Positive opening contacts on contact blocks 18, 8, 9, 20, 21, 22, 33, 34
In compliance with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2014/35/EU.

Please contact our technical department for the list of approved products.

Features approved by UL

Utilization categories	Q300 (69 VA, 125-250 Vdc)
	A600 (720 VA, 120-600 Vac)

Housing features type 1, 4X "indoor use only", 12, 13
For all contact blocks use 60 or 75 °C copper (Cu) conductor, rigid or flexible, wire size 12, 14 AWG. Tightening torque for terminal screws of 7.1 lb in (0.8 Nm).

In compliance with standard: UL 508, CSA 22.2 No.14

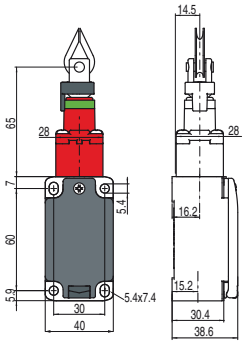
Please contact our technical department for the list of approved products.

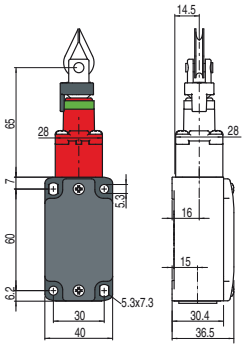
Dimensional drawings

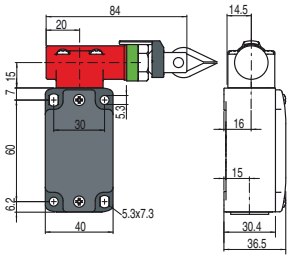
All values in the drawings are in mm

Contact type:

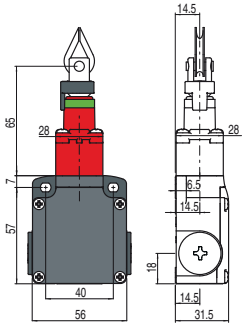
L = slow action

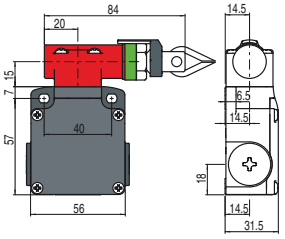


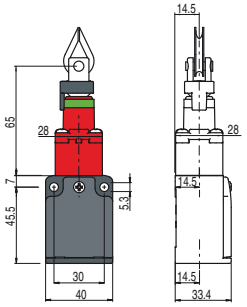


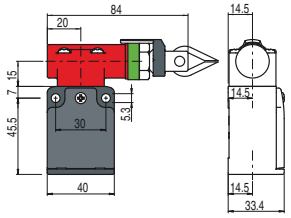


Contact block					
18	L	FP 1879-M2 → 1NO+1NC		FD 1879-M2 → 1NO+1NC	FD 1880-M2 → 1NO+1NC
9	L	FP 979-M2 → 2NC		FD 979-M2 → 2NC	FD 980-M2 → 2NC
20	L	FP 2079-M2 → 1NO+2NC		FD 2079-M2 → 1NO+2NC	FD 2080-M2 → 1NO+2NC
21	L	FP 2179-M2 → 3NC		FD 2179-M2 → 3NC	FD 2180-M2 → 3NC
22	L	FP 2279-M2 → 2NO+1NC		FD 2279-M2 → 2NO+1NC	FD 2280-M2 → 2NO+1NC
33	L	FP 3379-M2 → 1NO+1NC		FD 3379-M2 → 1NO+1NC	FD 3380-M2 → 1NO+1NC
34	L	FP 3479-M2 → 2NC		FD 3479-M2 → 2NC	FD 3480-M2 → 2NC
Actuating force		Initial 63 N…final 83 N (90 N →)		Initial 63 N…final 83 N (90 N →)	Initial 147 N…final 235 N (250 N →)
Travel diagrams		page 182 - group 1		page 182 - group 1	page 182 - group 2





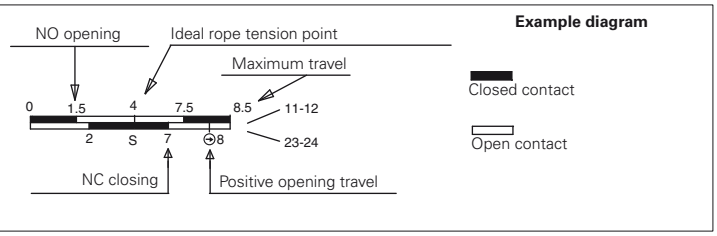




Contact block					
18	L	FL 1879-M2 → 1NO+1NC	FL 1880-M2 → 1NO+1NC		
9	L	FL 979-M2 → 2NC	FL 980-M2 → 2NC		
20	L	FL 2079-M2 → 1NO+2NC	FL 2080-M2 → 1NO+2NC		
21	L	FL 2179-M2 → 3NC	FL 2180-M2 → 3NC		
22	L	FL 2279-M2 → 2NO+1NC	FL 2280-M2 → 2NO+1NC		
33	L	FL 3379-M2 → 1NO+1NC	FL 3380-M2 → 1NO+1NC	FC 3379-M2 → 1NO+1NC	FC 3380-M2 → 1NO+1NC
34	L	FL 3479-M2 → 2NC	FL 3480-M2 → 2NC	FC 3479-M2 → 2NC	FC 3480-M2 → 2NC
Actuating force		Initial 63 N…final 83 N (90 N →)	Initial 147 N…final 235 N (250 N →)	Initial 63 N…final 83 N (90 N →)	Initial 147 N…final 235 N (250 N →)
Travel diagrams		page 182 - group 1	page 182 - group 2	page 182 - group 1	page 182 - group 2

How to read travel diagrams

All values in the diagrams are in mm



IMPORTANT:

In **safety applications**, actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol →. Actuate the switch **at least with the positive opening force**, reported in brackets below each article, next to the actuating force value.

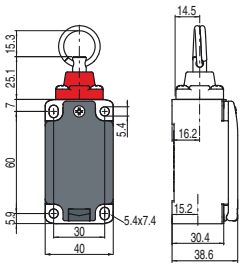
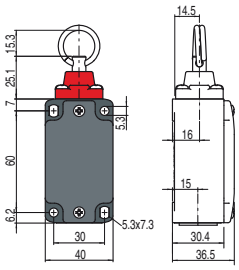
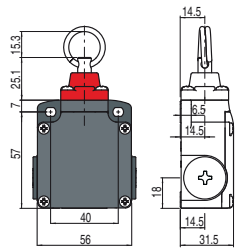
Items with code on **green** background are stock items

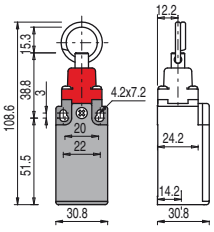
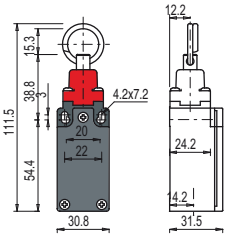
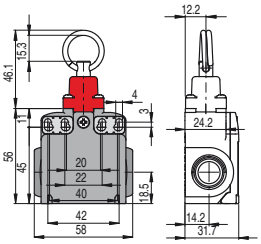
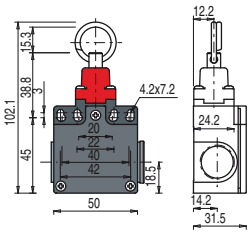
Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

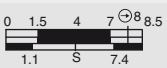
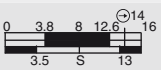
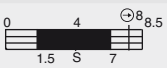
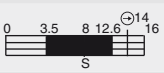
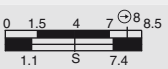
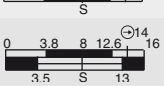
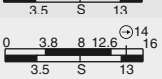
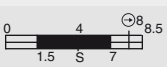
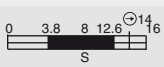
Contact type:

L = slow action

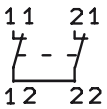
Contact block					
					
8 L	FP 874-M2 → 1NC	FD 874-M2 → 1NC	FL 874-M2 → 1NC		
Actuating force	Initial 63 N…final 83 N (90 N →)	Initial 63 N…final 83 N (90 N →)	Initial 63 N…final 83 N (90 N →)		
Travel diagrams	page 182 - group 3	page 182 - group 3	page 182 - group 3		

Contact block				
				
8 L	FR 874-M2 → 1NC	FM 874-M2 → 1NC	FX 874-M2 → 1NC	FZ 874-M2 → 1NC
Actuating force	Initial 63 N…final 83 N (90 N →)	Initial 63 N…final 83 N (90 N →)	Initial 63 N…final 83 N (90 N →)	Initial 63 N…final 83 N (90 N →)
Travel diagrams	page 182 - group 3	page 182 - group 3	page 182 - group 3	page 182 - group 3

Travel diagrams table

Contact block		Group 1	Group 2	Group 3
18 1NO+1NC				
8 1NC				
9 2NC				
20 1NO+2NC				
21 3NC				
22 2NO+1NC				
33 1NC+1NO				
34 2NC				

In the rest position (with rope correctly tightened) the two contacts of **contact block 8** are both closed and are activated respectively by tightening or loosening the rope. In order to use this contact block for safety applications it is necessary to connect the two contacts in series. For this reason, in the wiring diagrams the **contact block 8** is indicated as 1NC, whereas in travel diagrams both contacts are indicated.



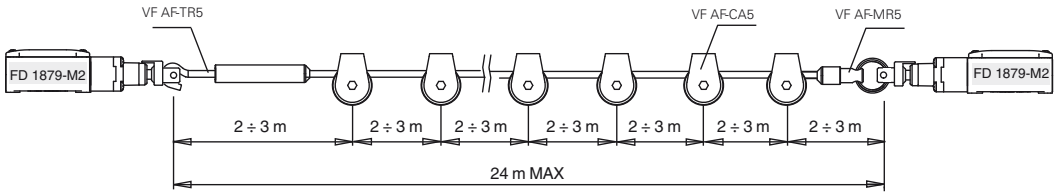
Accessories See page 299

→ The 2D and 3D files are available at **www.pizzato.com**

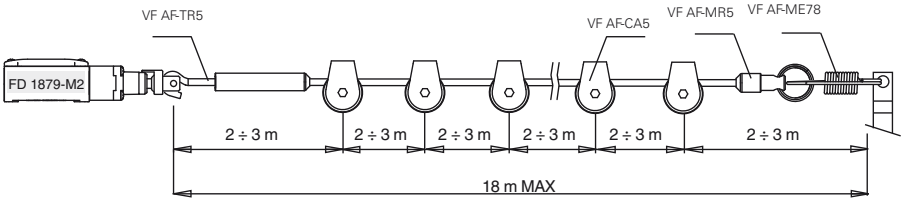
Safety **rope switch without reset** for simple stop

Application examples and max. rope length for switches with longitudinal head

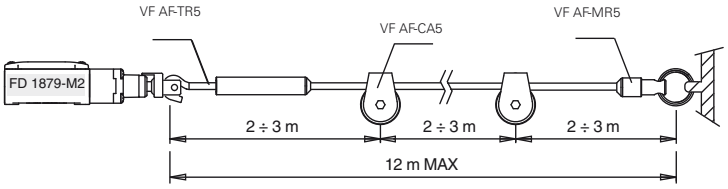
Example A



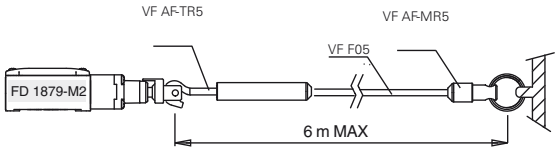
Example B



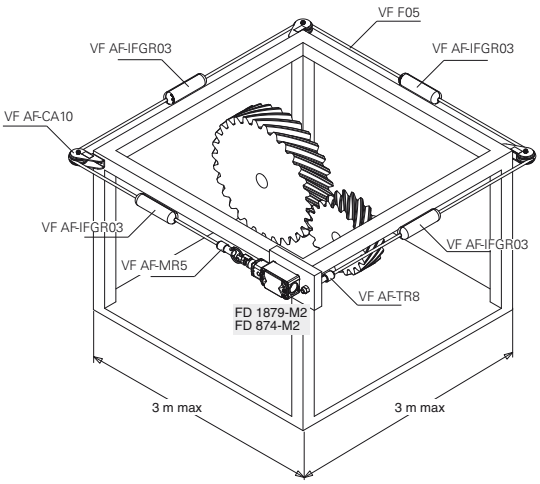
Example C



Example D

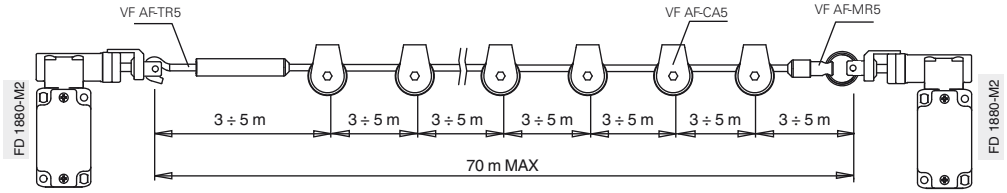


Example E

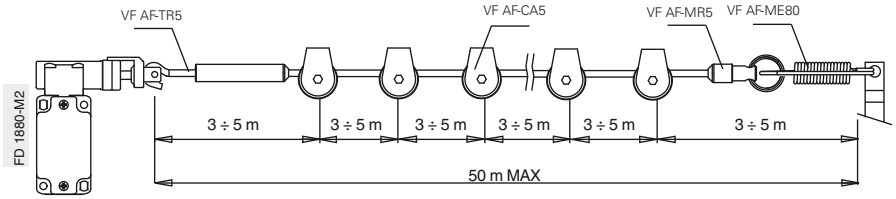


Application examples and max. rope length for switches with transversal head

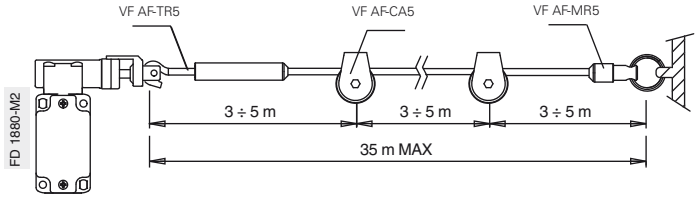
Example F



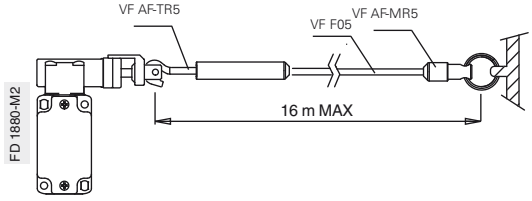
Example G



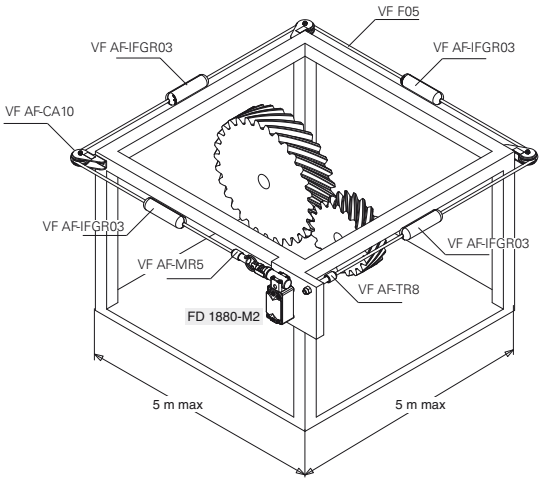
Example H



Example I

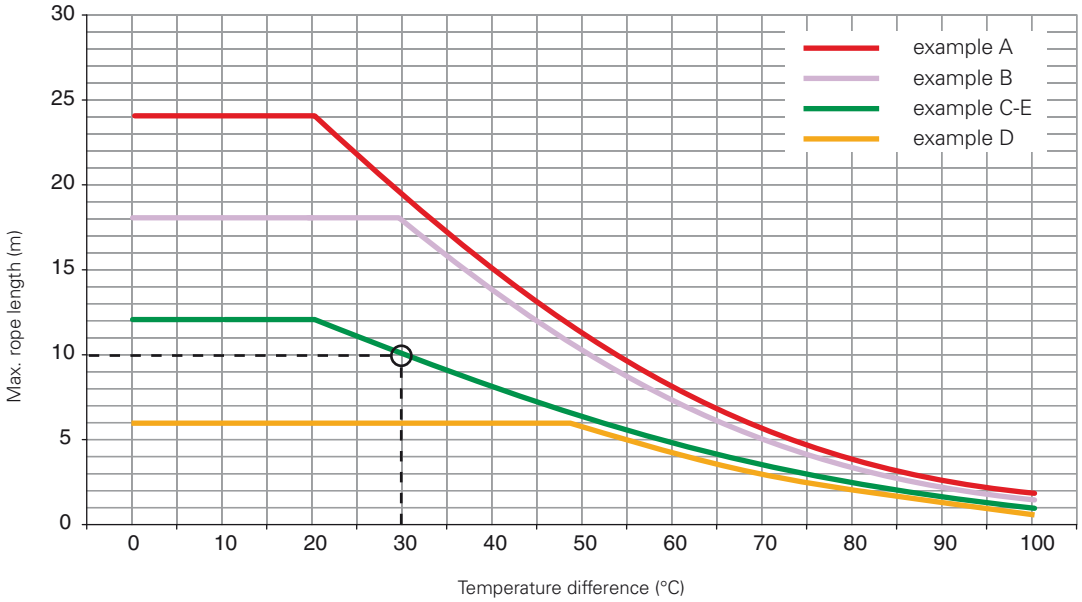


Example J



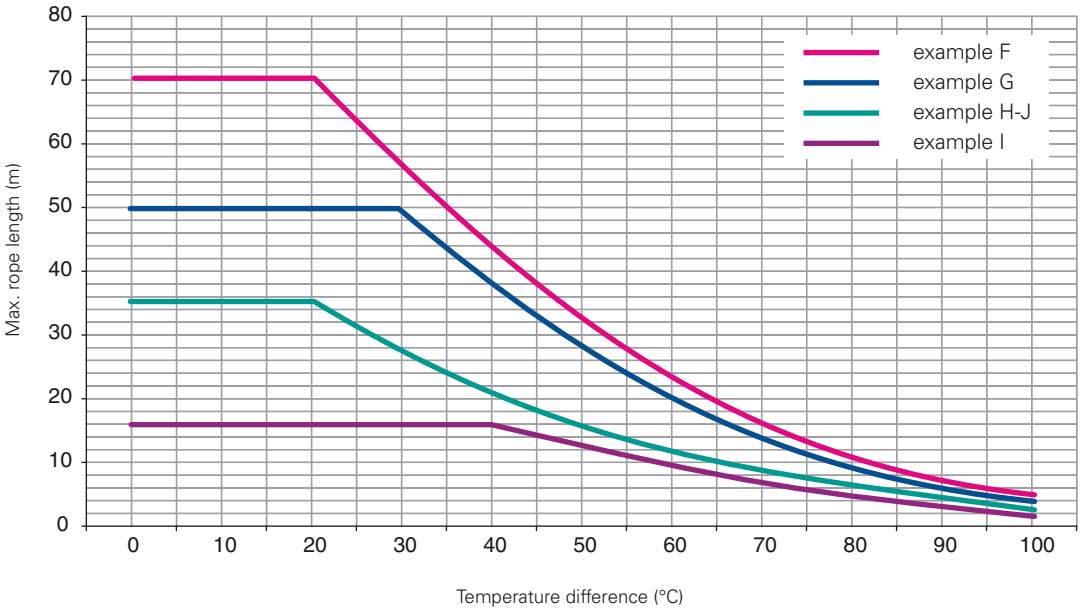
Maximum spans

Maximum spans for switches with longitudinal head



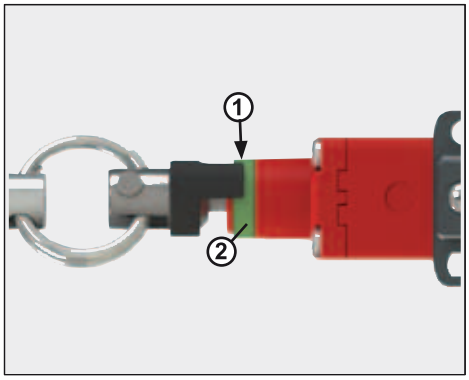
The max. recommended spans are indicated in the diagram as a function of the temperature fluctuations (temperature differences) to which the switch may be exposed at the point of use. For instance, with installation of type C and a temperature difference of 30°C, the max. recommended rope length is 10 metres.

Maximum spans for switches with transversal head

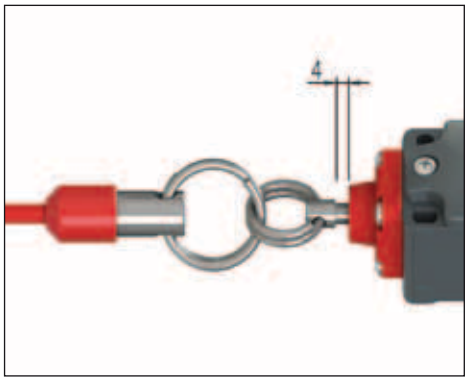


Important: The above data are guaranteed only using original rope and accessories. See page 185.

Adjustment of the switching point



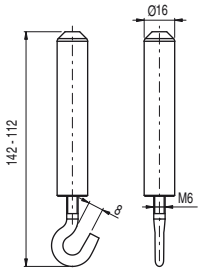
For switches with head 79 and 80: Tighten the rope connected to the switch, until the end of the indicator (1) reaches about the middle of the green ring (2).



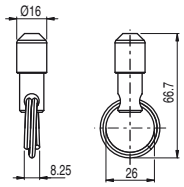
For switches with head 74: Tighten the rope connected to the switch until the thimble will be at about 4 mm from the head.

Accessories for rope installation - FAST line

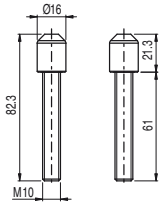
Article	Description
VF AF-TR5	Adjustable stay bolt



Article	Description
VF AF-MR5	End clamp

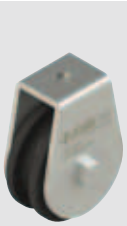


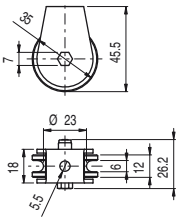
Article	Description
VF AF-TR8	Stay bolt



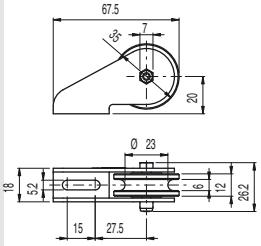
Pulleys

Article	Description
VF AF-CA5	Stainless steel pulley



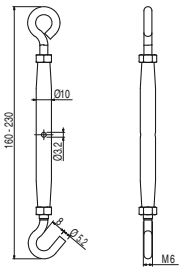


Article	Description
VF AF-CA10	Angular pulley, stainless steel



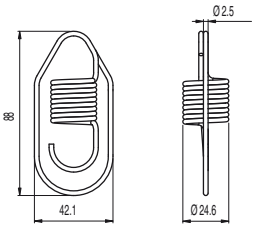
Accessories for rope installation

Article	Description
VF AF-TR2X	Adjustable stay bolt in stainless steel



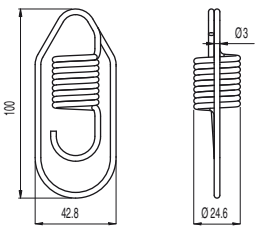
Safety springs

Article	Description
VF AF-ME78	Safety spring in stainless steel



For switches with longitudinal head.

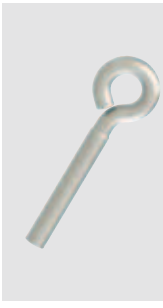
Article	Description
VF AF-ME80	Safety spring in stainless steel

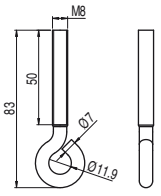


For switches with transversal head.

Accessories for rope installation

Article	Description
VF T870	Stay bolt





LED signalling lights

Article	Description
VF SL1A2PA1	White, 24 Vac/dc
VF SL1A3PA1	Red, 24 Vac/dc
VF SL1A4PA1	Green, 24 Vac/dc
VF SL1A5PA1	Yellow, 24 Vac/dc

These LED signalling lights are used for signalling that an electric contact has changed its state inside the switch. They can be installed on switches by screwing them on one of the conduit entries not used for electric cables. For details see page 312.

Function indicators

Article	Engraving	Language	Notes
VF AF-IF1GR01	STOP EMERGENZA	ita	
VF AF-IF1GR02	EMERGENCY STOP	eng	
VF AF-IF1GR03	STOP	eng	
VF AF-IF1GR04	NOT - AUS	deu	
VF AF-IF1GR05	ARRET D'URGENCE	fra	
VF AF-IF1GR06	PARADA DE EMERGENCIA	spa	
VF AF-IF1GR07	NODSTOP	dan	
VF AF-IF1GR08	ⓥ STOP ⓥ	eng	
VF AF-IF1GR11	ⓥ ⓥ		In compliance with EN ISO 13850

Rope function indicators in conformity with standard EN ISO 13850.

Items with code on **green** background are stock items

→ The 2D and 3D files are available at **www.pizzato.com**

Ropes and further accessories

Article	Description	Weight (Kg)
VF F05-100	100 m of rope on spool	5.1
VF F05-035	35 m of rope on spool	1.8
VF F05-020	20 m of rope, loose	1.0
VF F05-010	10 m of rope, loose	0.5

Zinc-plated steel rope coated with red plastic covering, 5 mm diameter.

Article	Description
VF F05-400	Rope

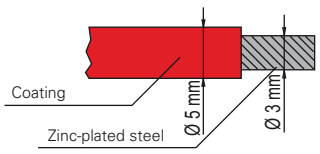
400 m spool of zinc-plated steel rope coated with red plastic covering, 5 mm diameter.

Weight 20.5 Kg.

Article	Description
VF F05-500B	Rope

500 m spool of zinc-plated steel rope coated with white plastic covering, 5 mm diameter.

Weight 25.6 Kg.

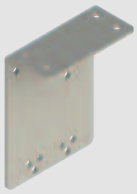


The rope is robust and has long-lasting protection against mechanical damage and corrosion.

Article	Description
VF SB400	Rope dispenser

Rope dispenser for 400 m and 500 m spools. This rope dispenser makes it easy to unroll the rope without tangles.

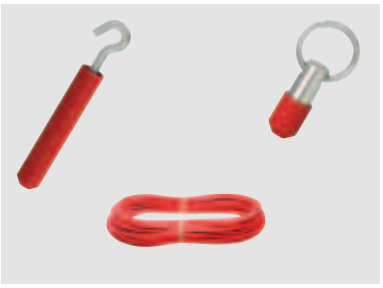
Article	Description
VF SFP2	Ceiling fixing plate



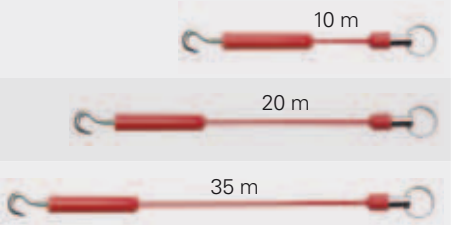
Metal fixing plate, for fixing rope switches on the ceiling.
The plate is provided with bore holes for fasting switches of the series. It is supplied without screws.

Accessory sets for rope installation - FAST line

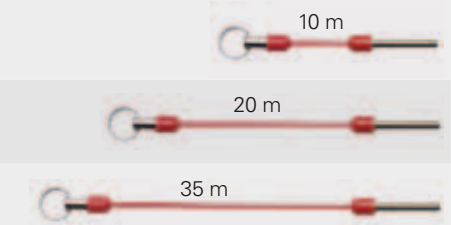
Practical installation set containing stay bolts and rope in the same package.



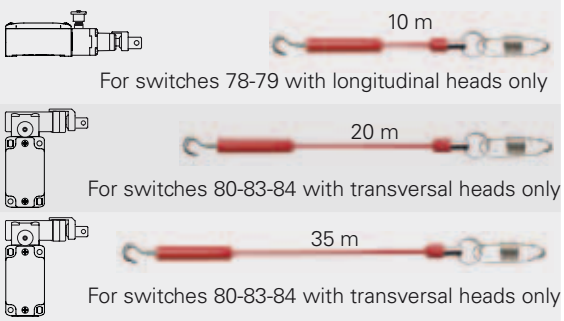
Article	Set content
VF AF-KT10M0	*1x* VF AF-TR5 *1x* VF AF-MR5 *1x* VF F05-010
VF AF-KT20M0	*1x* VF AF-TR5 *1x* VF AF-MR5 *1x* VF F05-020
VF AF-KT35M0	*1x* VF AF-TR5 *1x* VF AF-MR5 *1x* VF F05-035



Article	Set content
VF AF-KM10R0	*1x* VF AF-MR5 *1x* VF AF-TR8 *1x* VF F05-010
VF AF-KM20R0	*1x* VF AF-MR5 *1x* VF AF-TR8 *1x* VF F05-020
VF AF-KM35R0	*1x* VF AF-MR5 *1x* VF AF-TR8 *1x* VF F05-035



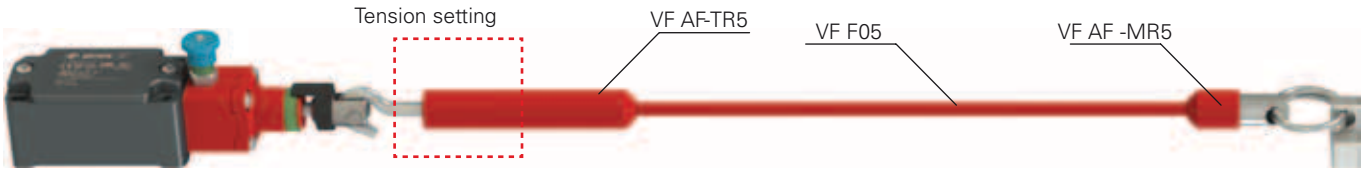
Article	Set content
VF AF-KT10M7	*1x* VF AF-TR5 *1x* VF AF-MR5 *1x* VF F05-010 *1x* VF AF-ME78
VF AF-KT20M8	*1x* VF AF-TR5 *1x* VF AF-MR5 *1x* VF F05-020 *1x* VF AF-ME80
VF AF-KT35M8	*1x* VF AF-TR5 *1x* VF AF-MR5 *1x* VF F05-035 *1x* VF AF-ME80



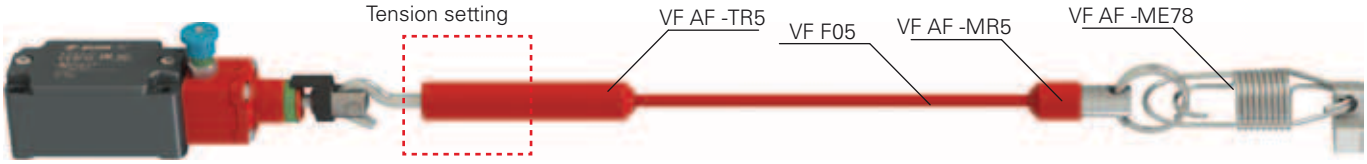
Items with code on **green** background are stock items

➔ The 2D and 3D files are available at **www.pizzato.com**

Combination examples



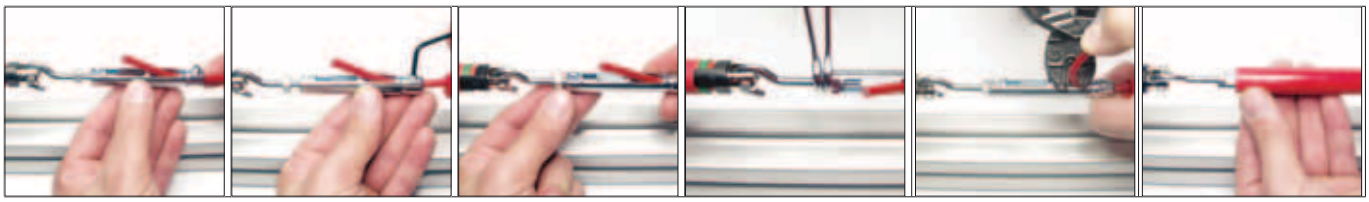
This combination of accessories is suitable for medium rope lengths, where the two rope ends are far away from each other.



This combination of accessories is suitable for medium-high rope lengths (thanks to VF AF-ME78 safety spring) and where the two rope ends are far away from each other.

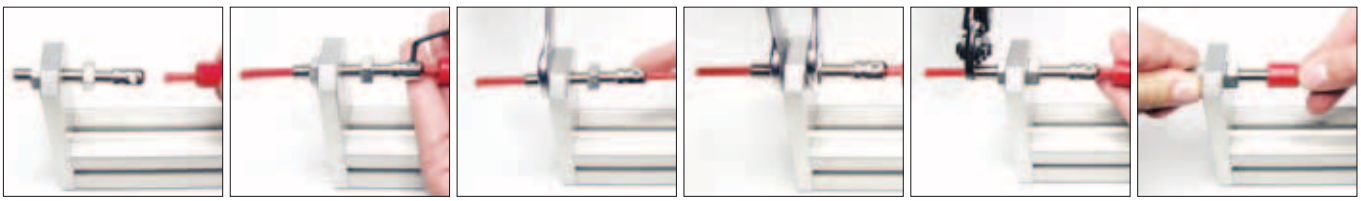
This combination of accessories is suitable for medium rope lengths or where the two rope ends are close to each other.

A Installation of adjustable stay bolt VF AF-TR5



Rope insertion | Rope fixing | Rope tightening | Stay bolt blocking | Cutting of the rope in excess | Stay bolt covering

B Installation of adjustable stay bolt VF AF-TR8

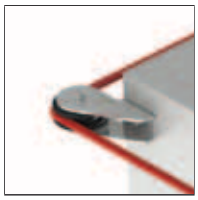


Rope insertion | Rope fixing | Rope tightening | Stay bolt blocking | Cutting of the rope in excess | Stay bolt covering

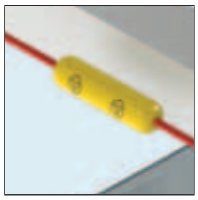
C Installation of end clamp VF AF-MR5

Rope insertion | Rope fixing | Clamp covering

Application example: possibility of emergency stop along the whole perimeter of the machine. Rope supported by angular pulleys



Angular pulley
Article: VF AF-CA10



Function indicator
Article: VF AF -IF1GR11

Safety module
Example: CS AR-20V024

End clamp
Article: VF AF-MR5

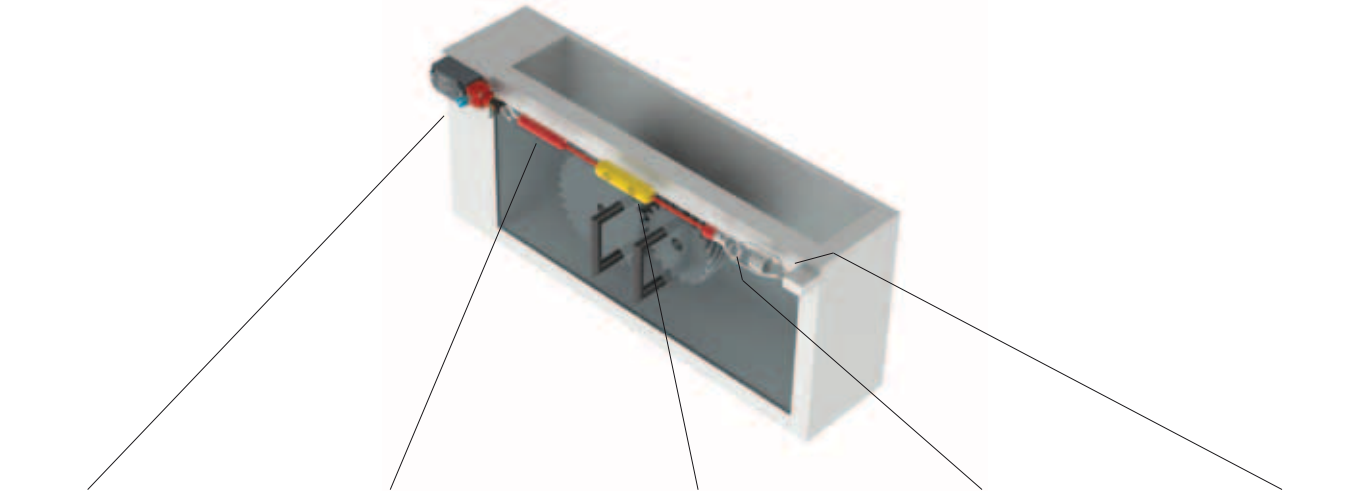
Safety rope switch

Article: FL 1883-M2

Stay bolt
Article: VF AF-TR8

Indicator light
Article: VF SL1A5PA1

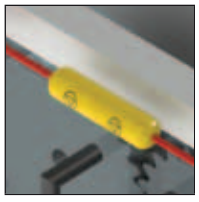
Application example: availability of emergency stop along the frontal section of the machine



Safety rope switch

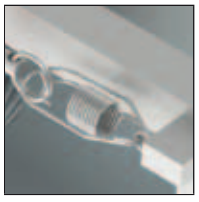
Article: FD 1878-M2

Adjustable stay bolt
Article: VF AF-TR5



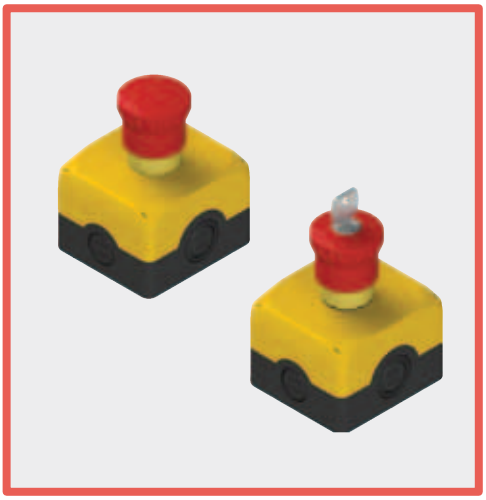
Function indicator
Article: VF AF
-IF1GR11

End clamp
Article: VF AF-MR5



Safety spring
Article: VF AF-ME78

Any information or application example, connection diagrams included, described in this document are to be intended as purely descriptive.
The choice and application of the products in conformity with the standards, in order to avoid damage to persons or goods, is the user's responsibility.



Main features
- Protection degrees IP67 and IP69K
- Stainless steel captive screws
- 4 side cable entries
- Screw caps included in the scope of supply

Quality marks:

EAC approval: RU C-IT.АД35.B.00454

Technical data

Housing

Material:	Self-extinguishing shock-proof polycarbonate with double insulation, UV-resistant and glass fibre reinforced, high shock resistance.
Material of the screws:	Stainless steel
Conduit entries:	4x knock-out side entries: N°2 M20 - 1/2 NPT, N°2 M20 - 1/2NPT - M25 2x M16 knock-out base entries
Emergency button	
Mechanical endurance:	300,000 operating cycles
Max. actuation frequency:	3600 operating cycles/hour
Actuation travel:	4 mm (NO contact), 4 mm (NC contact)
Actuating force:	25 N
Actuating force at limit of travel:	Push-pull 18.5 N (without contacts) Rotary release, 35 N (without contacts)
Maximum travel:	9 mm
Tightening torque of the fixing ring:	2 … 2.5 Nm

General data

Protection degree:	IP67 acc. to EN 60529, (with cable gland of equal or higher protection degree) IP69K acc. to ISO 20653 (only for versions without luminous disc)
Ambient temperature:	-25°C +80°C
Tightening torque of the cover screws:	1 … 1.4 Nm
Utilization requirements:	see page 139 of the General Catalogue HMI 2017-2018.

In compliance with standards:
IEC 60947-1, IEC 60947-5-1, IEC 60204-1, EN 60947-1, EN 60947-5-1, EN 60204-1, EN ISO 13850, UL 508, CSA 22-2 N°14.

Compliance with the requirements of:
Machinery Directive 2006/42/EC

General data

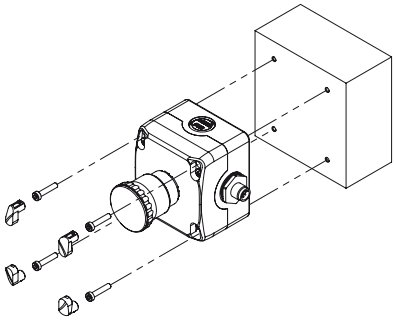
Protection degrees IP67 and IP69K

IP69K
IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

Fixing of EROUND housings

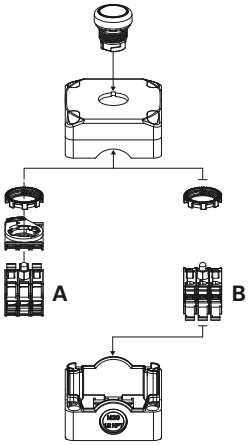
The new housings of the EROUND line by Pizzato Elettrica have 4 additional holes on the cover. The holes enable wall fixing from the outside by means of insertion of the screws, without the need to open the cover to access the holes.



The wall fixing screws and the ones for closing the housing cover can be sealed with 4 caps (supplied with the housing). The caps not only give the housing a more pleasant look, but they also prevent the accumulation of dirt inside the recesses of the screws besides making tampering more difficult.

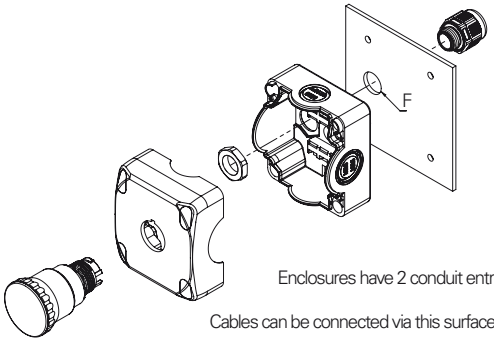
The external fixing of the housing is particularly valuable for already wired housings, since this simplifies the whole installation: you can simply fix the housing and connect the connector that, thanks to the presence of cable entries on the four sides of the housing, can be oriented in the preferred direction.

One housing, two solutions



The housing can fit up to 3 contact blocks/LED units (E2 CP, E2 LP) for panel mounting by means of a mounting adapter (A) or up to 3 contact blocks/LED units (E2 CF, E2 LF) for base mounting directly on the bottom of the housing (B).

Wiring through the lower surface



cable gland	F
M16	Ø 25
M20	Ø 28

Enclosures have 2 conduit entries on the lower surface.

Cables can be connected via this surface, hiding them from view.

Complete units with housing with emergency buttons

Housing cover colour	Actuator design and colour	Contacts pos. 2	Contacts pos. 3	Contacts pos. 1	Emergency button Push-Pull	Emergency button Rotary release	Emergency button key release
yellow RAL 1003	red	-	1NC	-	**ES AC31004** ES 31001 + E2 1PEPZ4531 + E2 CF01G2V1	**ES AC31003** ES 31001 + E2 1PERZ4531 + E2 CF01G2V1	**ES AC31022** ES 31001+ E2 1PEBZ4531 + E2 CF01G2V1
yellow RAL 1003	red	-	1NC SELF-MONITORED	-	**ES AC31081** ES 31001 + E2 1PEPZ4531 + E2 CF01S2V1	**ES AC31082** ES 31001 + E2 1PERZ4531 + E2 CF01S2V1	**ES AC31083** ES 31001+ E2 1PEBZ4531 + E2 CF01S2V1
yellow RAL 1003	red	1NC	-	1NC	**ES AC31009** ES 31001 + E2 1PEPZ4531 + E2 CF01G2V1 + E2 CF01G2V1	**ES AC31005** ES 31001 + E2 1PERZ4531 + E2 CF01G2V1 + E2 CF01G2V1	**ES AC31023** ES 31001+ E2 1PEBZ4531 + E2 CF01G2V1 + E2 CF01G2V1
yellow RAL 1003	red	1NC	-	1NO	**ES AC31010** ES 31001 + E2 1PEPZ4531 + E2 CF01G2V1 + E2 CF10G2V1	**ES AC31006** ES 31001 + E2 1PERZ4531 + E2 CF01G2V1 + E2 CF10G2V1	**ES AC31011** ES 31001+ E2 1PEBZ4531 + E2 CF01G2V1 + E2 CF10G2V1
yellow RAL 1003	red	1NC	1NC	1NO	**ES AC31146** ES 31001 + E2 1PEPZ4531 + E2 CF01G2V1 + E2 CF01G2V1 + E2 CF10G2V1	**ES AC31021** ES 31001 + E2 1PERZ4531 + E2 CF01G2V1 + E2 CF01G2V1 + E2 CF10G2V1	**ES AC31024** ES 31001+ E2 1PEBZ4531 + E2 CF01G2V1 + E2 CF01G2V1 + E2 CF10G2V1

Other combinations on request.
The standard colour of the base for the codes mentioned above is RAL 9005.
For properties of contact blocks, see the General Catalogue HMI

Housing cover colour	Actuator design and colour	Contacts pos. 2	Contacts pos. 3	Contacts pos. 1	Emergency button Push-Pull Yellow luminous disc, flashing Ø 60 mm, 24 Vac/dc	Emergency button rotary release Yellow luminous disc, flashing Ø 60 mm, 24 Vac/dc	Emergency button key release Yellow luminous disc, flashing Ø 60 mm, 24 Vac/dc
grey RAL 7035	red	1NO	1NC	CONNECTION BLOCK	**ES AC31430** ES 31000 + E2 1PEPZ4531 + VE DL1A5L13 + E2 CP10G2V1 + E2 CP01G2V1 + VE BC2PV1	**ES AC31433** ES 31000 + E2 1PERZ4531 + VE DL1A5L13 + E2 CP10G2V1 + E2 CP01G2V1 + VE BC2PV1	**ES AC31436** ES 31000 + E2 1PEBZ4531 + VE DL1A5L13 + E2 CP10G2V1 + E2 CP01G2V1 + VE BC2PV1
grey RAL 7035	red	1NO	1NC SELF-MONITORED	CONNECTION BLOCK	**ES AC31431** ES 31000 + E2 1PEPZ4531 + VE DL1A5L13 + E2 CP10G2V1 + E2 CP01S2V1 + VE BC2PV1	**ES AC31434** ES 31000 + E2 1PERZ4531 + VE DL1A5L13 + E2 CP10G2V1 + E2 CP01S2V1 + VE BC2PV1	**ES AC31437** ES 31000 + E2 1PEBZ4531 + VE DL1A5L13 + E2 CP10G2V1 + E2 CP01S2V1 + VE BC2PV1
grey RAL 7035	red	1NO	2NC	CONNECTION BLOCK	**ES AC31432** ES 31000 + E2 1PEPZ4531 + VE DL1A5L13 + E2 CP10G2V1 + E2 CP02G2V1 + VE BC2PV1	**ES AC31435** ES 31000 + E2 1PERZ4531 + VE DL1A5L13 + E2 CP10G2V1 + E2 CP02G2V1 + VE BC2PV1	**ES AC31438** ES 31000 + E2 1PEBZ4531 + VE DL1A5L13 + E2 CP10G2V1 + E2 CP02G2V1 + VE BC2PV1

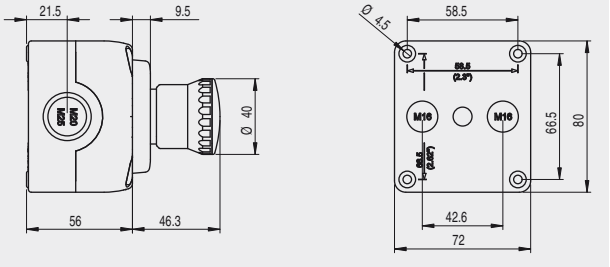
Other combinations on request.
The standard colour of the base for the codes mentioned above is RAL 9005.
➔ For the properties of contact blocks and luminous discs, please see the General Catalogue HMI.

Spare caps

Article		Description
	VE TS35RA1	4 spare caps for ES series housing cover. Colour: yellow
	VE TS39RA1	4 spare caps for ES series housing cover. Colour: grey

Dimensions

All values in the drawings are in mm



Items with code on **green** background are stock items

Accessories See page 299

➔ The 2D and 3D files are available at **www.pizzato.com**

Selection table for safety modules with single function

Product code	Supply voltage	For applications up to			Output contacts			Housing dimensions
		PL	SIL	Safety category	instantaneous	delayed	feedback	
Safety modules for emergency stops and end position monitoring for movable guards								
CS AR-01	24 Vac/dc; 120 Vac; 230 Vac: 10...30 Vdc	e	3	4	**2 NO + 1 NC**	-	-	22,5 x 114 mm
CS AR-02	24 Vac/dc; 120 Vac; 230 Vac: 10...30 Vdc	e	3	4	**3 NO**	-	-	22,5 x 114 mm
CS AR-04	24 Vac/dc; 120 Vac; 230 Vac	e	3	4	**3 NO + 1 NC**	-	-	22,5 x 114 mm
CS AR-05	24 Vac/dc; 120 Vac; 230 Vac	e	3	4	**3 NO + 1 NC**	-	-	22,5 x 114 mm
CS AR-06	24 Vac/dc; 120 Vac; 230 Vac	e	3	4	**3 NO + 1 NC**	-	-	22,5 x 114 mm
CS AR-07	24 Vac/dc	e	3	4	**4 NO + 1 NC**	-	-	22,5 x 129 mm
CS AR-08	12 Vdc, 24 Vac/dc; 120 Vac; 230 Vac	e	3	4	**2 NO**	-	-	22,5 x 114 mm
CS AR-20	24 Vac/dc; 120 Vac; 230 Vac	e	3	3	**2 NO**	-	-	22,5 x 114 mm
CS AR-21	24 Vac/dc; 120 Vac; 230 Vac	e	3	3	**2 NO**	-	-	22,5 x 114 mm
CS AR-22	24 Vac/dc; 120 Vac; 230 Vac	e	3	3	**3 NO + 1 NC**	-	-	22,5 x 114 mm
CS AR-23	24 Vac/dc; 120 Vac; 230 Vac	e	3	3	**3 NO + 1 NC**	-	-	22,5 x 114 mm
CS AR-24	24 Vac/dc	e	3	3	**4 NO + 1 NC**	-	-	22,5 x 114 mm
CS AR-25	24 Vac/dc	e	3	3	**4 NO + 1 NC**	-	-	22,5 x 114 mm
CS AR-40	24 Vac/dc	d	2	2	**2 NO**	-	-	22,5 x 91 mm
CS AR-41	24 Vac/dc	d	2	2	**2 NO**	-	-	22,5 x 91 mm
CS AR-46	24 Vac/dc	c	1	1	**1 NO**	-	-	22,5 x 91 mm
CS AR-91	24 Vac/dc	e	3	4	**2 NO+1 PNP**	-	-	22,5 x 114 mm
Module for emergency stops, end position monitoring for movable guards, safety mats and safety bumpers with 4-wire technology								
CS AR-51	24 Vac/dc	e	3	4	**2 NO**	-	-	22,5 x 114 mm
Safety modules for emergency stop and end position monitoring for movable guards with delayed contacts at the opening of the inputs								
CS AT-0③	24 Vac/dc; 120 Vac; 230 Vac	e	3	4 (②)	**2 NO + 1 NC**	**2 NO**	-	45 x 114 mm
CS AT-1③	24 Vac/dc; 120 Vac; 230 Vac	e	3	4 (②)	**3 NO**	**2 NO**	-	45 x 114 mm
CS AT-3③	24 Vac/dc	e	3	4 (②)	**2 NO**	**1 NO**	-	45 x 114 mm
Safety timer modules								
CS FS-1③	24 Vac/dc; 120 Vac; 230 Vac	①	①	①	-	**1 NO + 2 NC**	-	45 x 114 mm
CS FS-2③	24 Vdc; 120 Vac	d	2	3	-	**1 NO +1 NC +1 CO**	-	45 x 114 mm
CS FS-3③	24 Vdc; 120 Vac	d	2	3	-	**1 NO +1 NC +1 CO**	-	45 x 114 mm
CS FS-5③	24 Vdc; 120 Vac	d	2	3	-	**1 NO +1 NC +1 CO**	-	45 x 114 mm
Safety modules for two-hand controls or synchronism monitoring								
CS DM-01	24 Vac/dc; 120 Vac; 230 Vac	III C acc. to EN 574			**3 NO + 1 NC**	-	-	22,5 x 114 mm
CS DM-02	24 Vac/dc; 120 Vac; 230 Vac	III C acc. to EN 574			**2 NO**	-	-	22,5 x 114 mm
CS DM-20	24 Vac/dc; 120 Vac; 230 Vac	III A acc. to EN 574			**2 NO**	-	-	22,5 x 114 mm
Safety modules for motor standstill monitoring								
CS AM-0	24 ... 230 Vac/dc	d	2	3	**2 NO + 1 NC**	-	-	45 x 114 mm
Expansion modules with instantaneous contacts or delayed contacts at de-energizing								
CS ME-01	24 Vac/dc	①	①	①	**5 NO + 1 NC**	-	**1 NC**	22,5 x 114 mm
CS ME-02	24 Vdc	①	①	①	**4 NO + 2 NC**		**1 NC**	22,5 x 114 mm
CS ME-03	24 Vdc	①	①	①	**3 NO**	-	**1 NC**	22,5 x 91 mm
CS ME-20VU24-⑤	24 Vdc	①	①	①	-	**4 NO + 2 NC**	**1 NC**	22,5 x 114 mm
CS ME-30VU24-⑥	24 Vdc	①	①	①	-	**4 NO + 2 NC**	**1 NC**	45 x 114 mm
CS ME-31VU24-TS12	24 Vdc	①	①	①	-	**4 NO + 2 NC**	**1 NC**	45 x 114 mm

■ Available for this article
- Not available for this article
① Depending on the base module
② Category 4 for instantaneous contacts, category 3 for delayed contacts

③ Release times for delayed contacts
- 0 fixed time
- 1 adjustable, 0.3 … 3 s, 0.3 s steps
- 2 adjustable, 1 … 10 s, 1 s steps
- 3 adjustable, 3 … 30 s, 3 s steps
- 4 adjustable, 30 … 300 s, 30 s steps

④ Connection type
- V Screw terminals
- M Connector with screw terminals
- X Connector with spring terminals

⑤ Release time in absence of power supply
- TF0.5 0.5 s fixed time
- TF1 1 s fixed time
- TF2 2 s fixed time
- TF3 3 s fixed time

Product code	Autom. & manual start	Monitored start	Inputs of opposite potentials	Equipo-tential inputs	Parallel start (24 Vdc only)	Input type ⑦				Connection type ④			Page
										V	M	X	
CS AR-01	■	■	■	-	■	■	-	⑧	-	■	■	■	193
CS AR-02	■	■	■	-	■	■	-	⑧	-	■	■	■	195
CS AR-04	■	■	■	-	■	■	-	⑧	-	■	■	■	197
CS AR-05	■	-	■	■	■	■	■	■	-	■	■	■	199
CS AR-06	-	■	■	■	■	■	■	■	-	■	■	■	199
CS AR-07	■	■	■	-	■	■	-	-	-	-	■	■	201
CS AR-08	■	■	■	■	■	■	■	■	-	■	■	■	203
CS AR-20	■	-	-	-	-	■	-	-	-	■	■	■	205
CS AR-21	-	■	-	-	-	■	-	-	-	■	■	■	205
CS AR-22	■	-	-	-	-	■	-	-	-	■	■	■	207
CS AR-23	-	■	-	-	-	■	-	-	-	■	■	■	207
CS AR-24	■	-	-	-	-	■	-	-	-	■	■	■	209
CS AR-25	-	■	-	-	-	■	-	-	-	■	■	■	209
CS AR-40	■	-	-	-	-	■	-	-	-	■	■	■	211
CS AR-41	-	■	-	-	-	■	-	-	-	■	■	■	211
CS AR-46	■	-	■	-	-	■	-	■	-	■	■	■	213
CS AR-91	■	■	■	-	■	■	-	■	-	■	■	■	215
CS AR-51	■	■	■	-	--	■	-	-	■	■	■	■	217
CS AT-0③	■	■	■	■	■	■	■	■	-	■	■	■	219
CS AT-1③	■	■	■	■	■	■	■	■	-	■	■	■	221
CS AT-3③	■	■	■	-	-	■	-	■	-	■	■	■	223
CS FS-1③	-	-	-	-	-	■	-	-	-	■	■	■	225
CS FS-2③	-	-	-	-	-	■	-	-	-	■	■	■	227
CS FS-3③	-	-	-	-	-	■	-	-	-	■	■	■	229
CS FS-5③	■	■	-	■	-	■	-	■	-	■	■	■	231
CS DM-01	-	-	■	-	-	■	-	-	-	■	■	■	233
CS DM-02	-	-	■	-	-	■	-	-	-	■	■	■	235
CS DM-20	-	-	■	-	-	■	-	-	-	■	■	■	237
CS AM-01	-	-	-	-	-	■	-	-	-	■	■	■	239
CS ME-01	-	-	①	①	-	■	-	-	-	■	■	■	241
CS ME-02	-	-	①	①	-	■	-	-	-	■	■	■	243
CS ME-03	-	-	-	■	-	■	■	-	-	■	■	■	245
CS ME-20VU24-⑤	-	-	①	①	-	■	-	-	-	■	■	■	247
CS ME-30VU24-⑥	-	-	①	①	-	■	-	-	-	■	■	■	249
CS ME-31VU24-TS12	-	-	①	①	-	■	-	-	-	■	■	■	249

⑥ Release time in absence of power supply

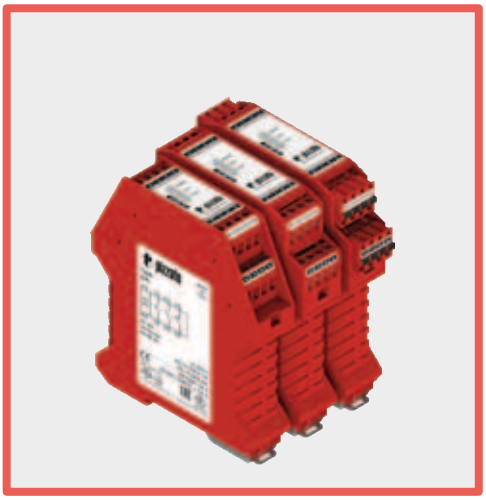
TF1 1 s fixed time
... .
TF12 12 s fixed time

⑦ Input type

electromechanical contacts
semiconductor outputs (e.g. light barriers)
magnetic safety sensors
4-wire safety mats and safety bumpers

⑧ Modules compatible with magnetic sensors from June 2014

Safety module **CS AR-01**



Module for emergency stops, end position monitoring for movable guards and magnetic safety sensors

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start or monitored start
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- Output contacts:
  2 NO safety contacts,
  1 NC auxiliary contact
- Supply voltage:
  10 … 30 Vdc, 24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	10 … 30 Vdc 24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	-10% … +15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	30 mA (typical)
Min. duration of start impulse t_{MIN}:	> 100 ms, > 50 ms (E02)
Response time t_A:	< 50 ms, < 150 ms (E02)
Release time t_{R1}:	< 20 ms
Release time in absence of power supply t_R:	< 70 ms, < 100 ms (E02)
Simultaneity time t_C:	unlimited

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 NO safety contacts, 1 NC auxiliary contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	72 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. See page 241-250.

Code structure

CS AR-01V024

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc
120	120 Vac
230	230 Vac
E02	10 … 30 Vdc

Stock items

- CS AR-01V024
- CS AR-01V120
- CS AR-01VE02

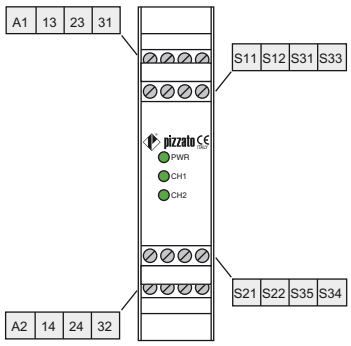
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

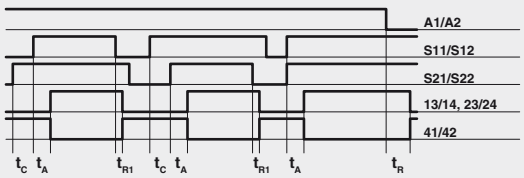
Safety module CS AR-01

Pin assignment

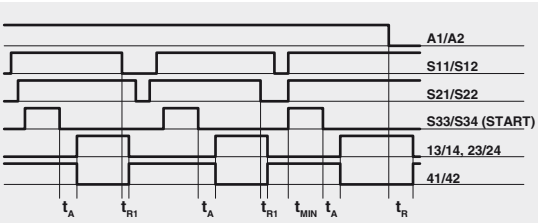


Function diagrams

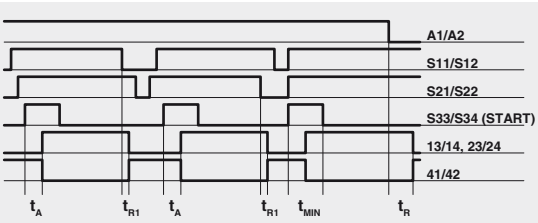
Configuration with automatic start



Configuration with monitored start



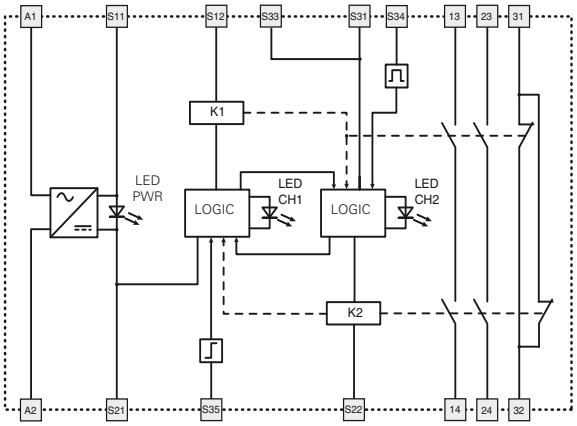
Configuration with manual start



Legend:
t_{MIN}: Min. duration of start impulse
t_C: simultaneity time
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply

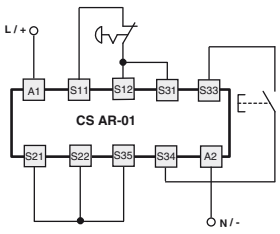
Notes:
The configurations with one channel are obtained taking into consideration the S11/S12 input only. In this case it is necessary to consider time t_{R1} referred to input S11/S12, time t_R referred to the supply, time t_A referred to input S11/S12 and to the start, and time t_{MIN} referred to the start.

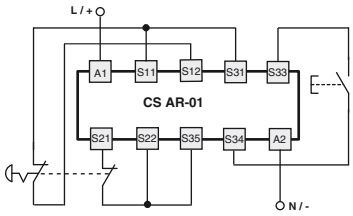
Internal block diagram



Input configuration

Emergency stop circuits	
Input configuration with manual start	
1 channel	2 channels

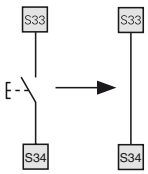




The diagram does not show the exact position of the terminals in the product

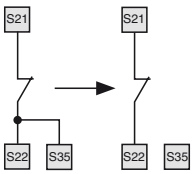
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



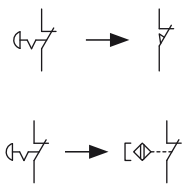
Monitored start

With regard to the indicated diagrams, remove the connection between S22 and S35 in order to activate the monitored start module.



Monitoring of movable guards and magnetic safety sensors

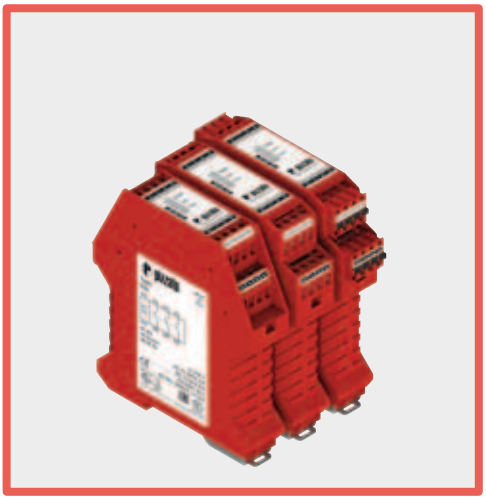
The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts.
The sensors can only be used in 2-channel configuration.



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AR-02**



Module for emergency stops, end position monitoring for movable guards and magnetic safety sensors

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start or monitored start
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- Output contacts: 3 NO safety contacts
- Supply voltage: 10 … 30 Vdc, 24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	10 … 30 Vdc 24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	< 30 mA
Min. duration of start impulse t_{MIN}:	> 100 ms
Response time t_A:	< 50 ms
Release time t_{R1}:	< 20 ms
Release time in absence of power supply t_R:	< 70 ms
Simultaneity time t_C:	unlimited

In compliance with standards:
EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	3 NO safety contacts,
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	72 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. See page 241-250.

Code structure

CS AR-02V024

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc
120	120 Vac
230	230 Vac
E02	10 … 30 Vdc

Stock items

CS AR-02V024

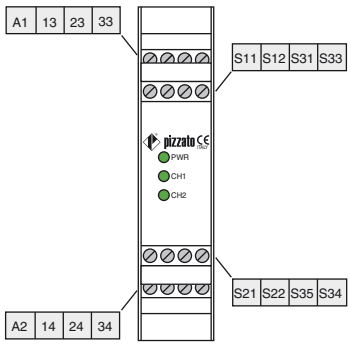
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

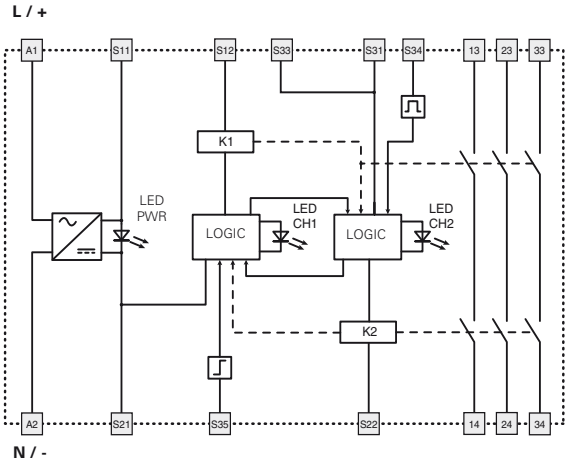
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS AR-02

Pin assignment

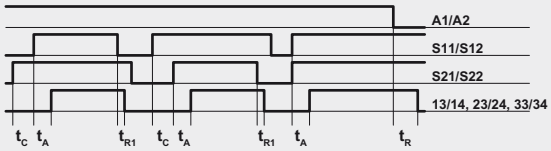


Internal block diagram

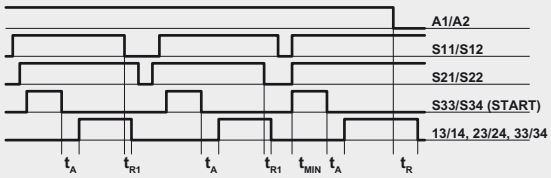


Function diagrams

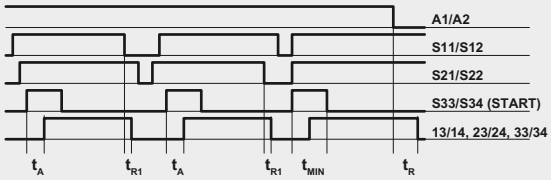
Configuration with automatic start



Configuration with monitored start



Configuration with manual start



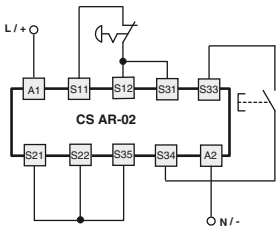
Legend:

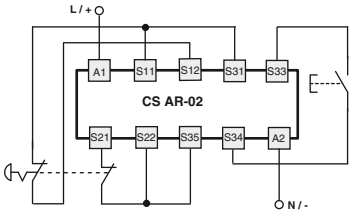
t_{MIN}:	Min. duration of start impulse	t_{R1}:	release time
t_C:	simultaneity time	t_R:	release time in absence of power supply
t_A:	response time		

Notes:
The configurations with one channel are obtained taking into consideration the S11/S12 input only. In this case it is necessary to consider time t_{R1} referred to input S11/S12, time t_R referred to the supply, time t_A referred to input S11/S12 and to the start, and time t_{MIN} referred to the start.

Input configuration

Emergency stop circuits	
Input configuration with manual start	
1 channel	2 channels

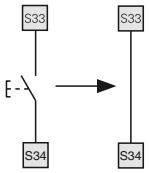




The diagram does not show the exact position of the terminals in the product

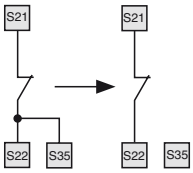
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



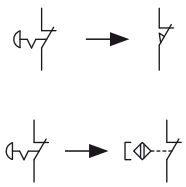
Monitored start

With regard to the indicated diagrams, remove the connection between S22 and S35 in order to activate the monitored start module.



Monitoring of movable guards and magnetic safety sensors

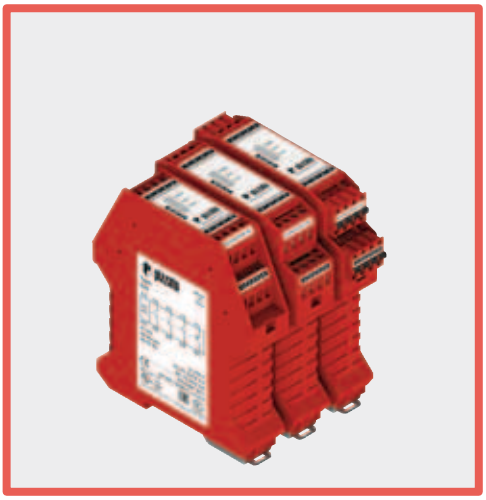
The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts.
The sensors can only be used in 2-channel configuration.



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AR-04**



Module for emergency stops, end position monitoring for movable guards and magnetic safety sensors

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start or monitored start
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- Output contacts:
  3 NO safety contacts,
  1 NC auxiliary contact
- Supply voltage:
  24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	30 mA (typical)
Min. duration of start impulse t_{MIN}:	> 100 ms
Response time t_A:	< 50 ms
Release time t_{R1}:	< 20 ms
Release time in absence of power supply t_R:	< 70 ms
Simultaneity time t_C:	unlimited

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	3 NO safety contacts 1 NC auxiliary contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	64 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AR-04V024

Connection type		Supply voltage	
V	Screw terminals	**024**	24 Vac/dc
M	Connector with screw terminals	**120**	120 Vac
X	Connector with spring terminals	**230**	230 Vac

Stock items

CS AR-04V024

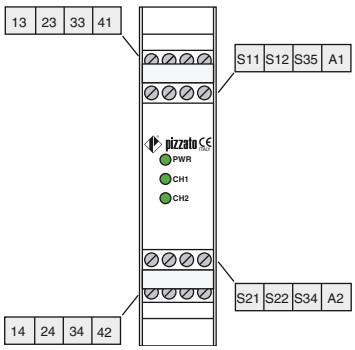
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

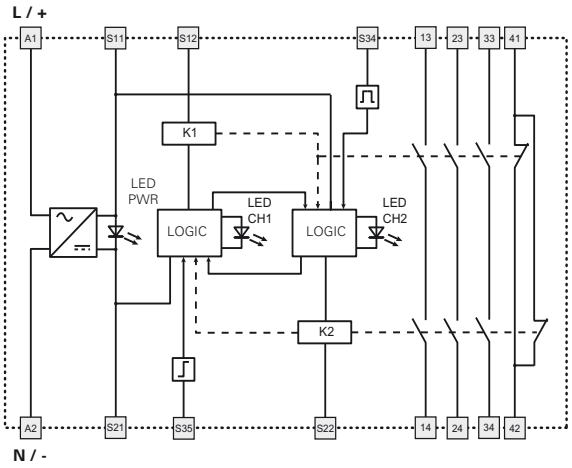
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS AR-04

Pin assignment

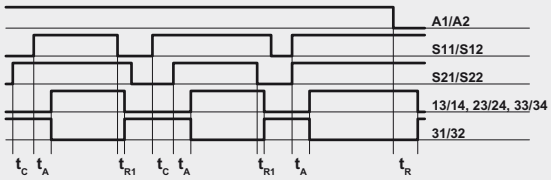


Internal block diagram

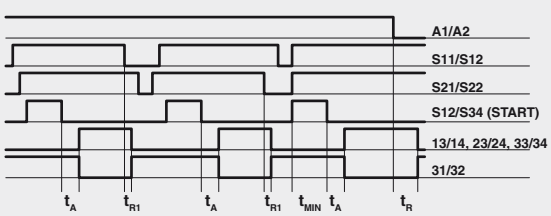


Function diagrams

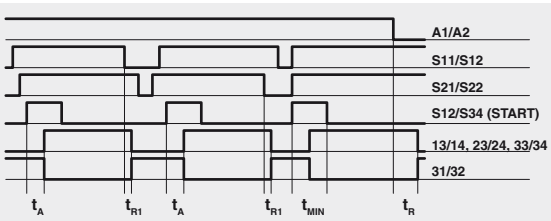
Configuration with automatic start



Configuration with monitored start



Configuration with manual start



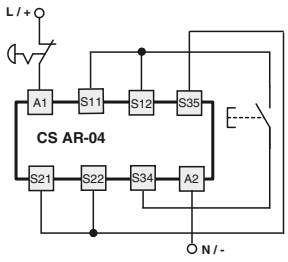
Legend:

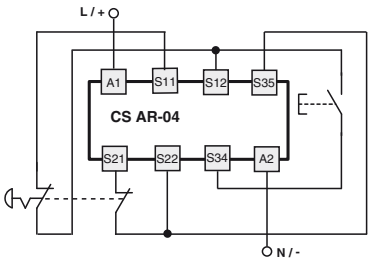
t_{MIN}:	Min. duration of start impulse	t_{R1}:	release time
t_C:	simultaneity time	t_R:	release time in absence of power supply
t_A:	response time		

Notes:
The configurations with one channel are obtained taking into consideration only the effect of the S11/S12 input on the supply. In this case it is necessary to consider time t_{R1} referred to input S11/S12, time t_R referred to the supply, time t_A referred to input S11/S12 and to the start, and time t_{MIN}.

Input configuration

Emergency stop circuits	
Input configuration with manual start	
1 channel	2 channels

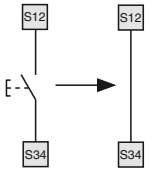




The diagram does not show the exact position of the terminals in the product

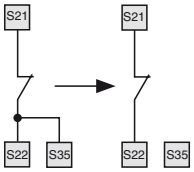
Automatic start

With regard to the indicated diagrams, bridge the start button between S12 and S34 in order to activate the automatic start module.



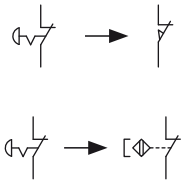
Monitored start

With regard to the indicated diagrams, remove the connection between S22 and S35 in order to activate the monitored start module.



Monitoring of movable guards and magnetic safety sensors

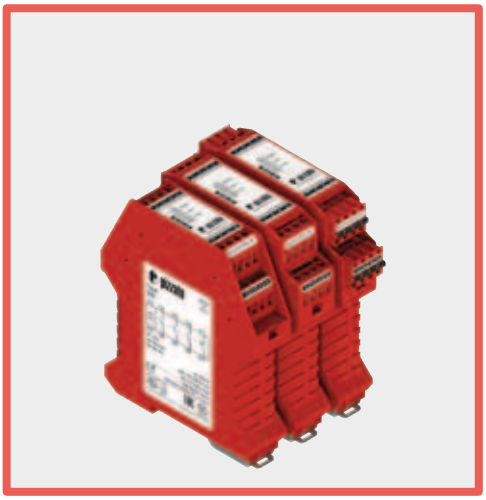
The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts.
The sensors can only be used in 2-channel configuration.



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AR-05 / CS AR-06**



Module for emergency stops, end position monitoring for movable guards, semiconductor outputs (e.g. light barriers) and magnetic safety sensors

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start (CS AR-05 only) or monitored start (CS AR-06 only)
- Can be connected to semiconductor outputs (e.g. light barriers), to electromechanical contacts or to magnetic safety sensors
- Output contacts:
  3 NO safety contacts,
  1 NC auxiliary contact
- Supply voltage:
  24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	< 30 mA
Min. duration of start impulse t_{MIN}:	> 250 ms
Response time t_A:	< 200 ms
Release time t_{R1}:	<20 ms
Release time in absence of power supply t_R:	< 70 ms
Simultaneity time t_C:	unlimited

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	3 NO safety contacts 1 NC auxiliary contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	64 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AR-05V024

Start mode	
05	manual or automatic start
06	monitored start

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc
120	120 Vac
230	230 Vac

Stock items

CS AR-05V024
CS AR-06V024

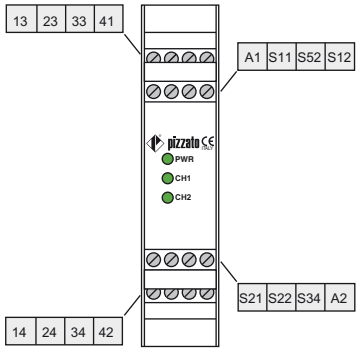
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

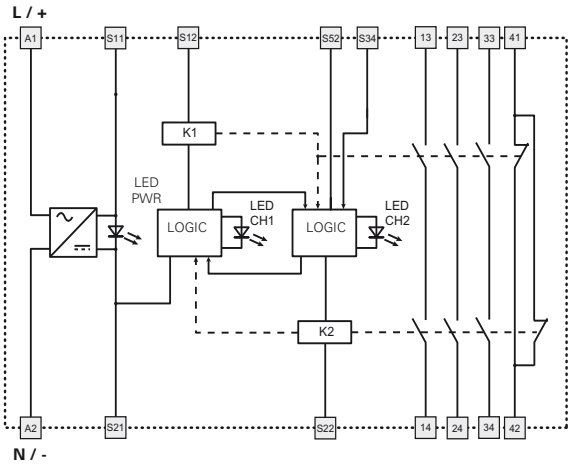
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS AR-05-06

Pin assignment

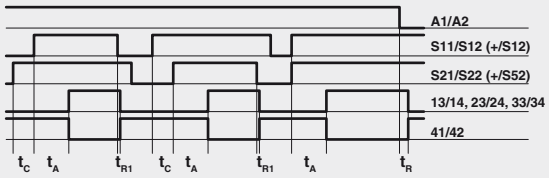


Internal block diagram

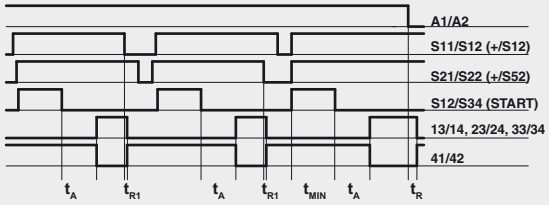


Function diagrams

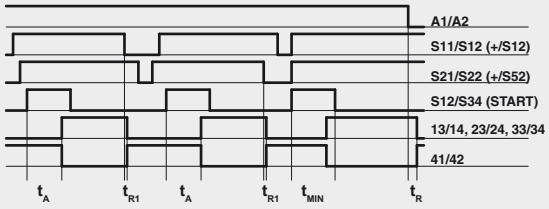
Configuration with automatic start (CS AR-05 only)



Configuration with monitored start (CS AR-06 only)



Configuration with manual start (CS AR-05 only)



Legend:

t_{MIN}:	Min. duration of start impulse	t_{R1}:	release time
t_C:	simultaneity time	t_R:	release time in absence of power supply
t_A:	response time		

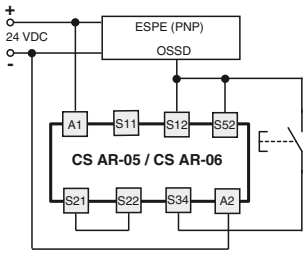
Notes:
The configurations with one channel are obtained taking into consideration the CH1 input only. In this case it is necessary to consider time t_{R1} referred to input CH1, time t_R referred to the supply, time t_A referred to input CH1 and to the start, and time t_{MIN} referred to the start.

Input configuration

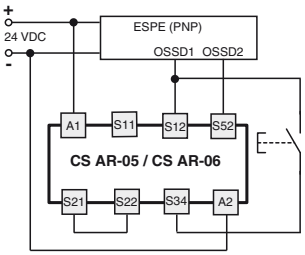
Semiconductor outputs (e.g. light barriers)

Input configuration with manual start (CS AR-05)

1 channel



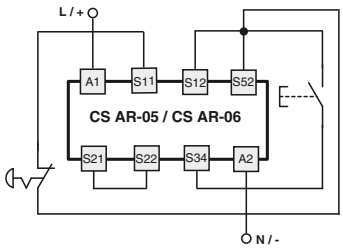
2 channels



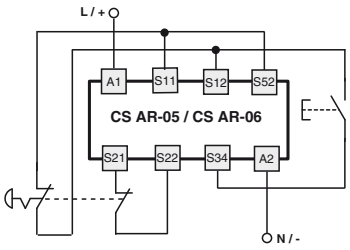
Emergency stop circuits

Input configuration with manual start (CS AR-05)

1 channel



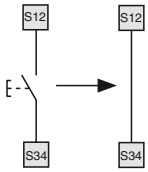
2 channels



The diagram does not show the exact position of the terminals in the product

Automatic start (CS AR-05 only)

Bridge the start button between S12 and S34 in order to activate the automatic start module.

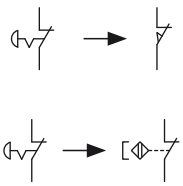


Monitored start

Use module CS AR-06 with the circuit diagrams for manual start.

Monitoring of movable guards and magnetic safety sensors

The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts. **The sensors can only be used in 2-channel configuration.**



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AR-07**

Module for emergency stops and end position monitoring for movable guards

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start or monitored start
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- Output contacts:
  4 NO safety contacts,
  1 NC auxiliary contact
- Supply voltage:
  24 Vac/dc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94	
Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design B

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	30 mA (typical)
Min. duration of start impulse t_{MIN}:	> 100 ms
Response time t_A:	< 70 ms
Release time t_{R1}:	< 40 ms
Release time in absence of power supply t_R:	< 80 ms
Simultaneity time t_C:	unlimited

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	4 NO safety contacts 1 NC auxiliary contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 220 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	72 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. See page 241-250.

Code structure

CS AR-07M024

Connection type		Supply voltage	
M	Connector with screw terminals	**024**	24 Vac/dc
X	Connector with spring terminals		

Stock items

CS AR-07M024

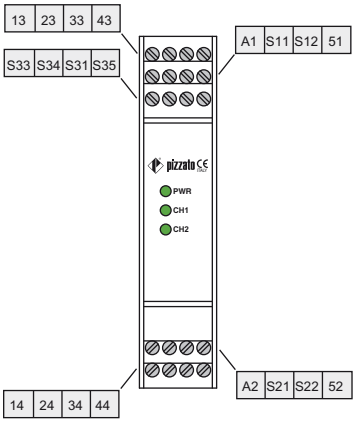
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

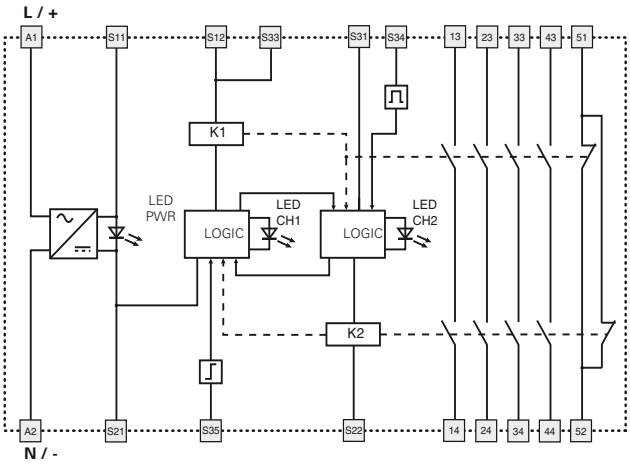
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS AR-07

Pin assignment

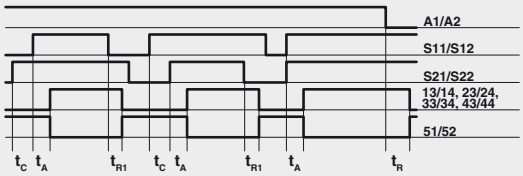


Internal block diagram

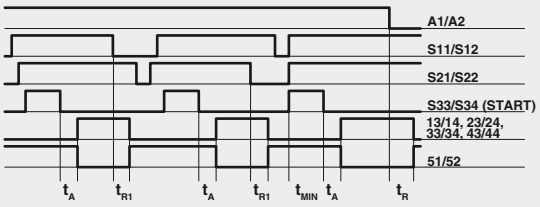


Function diagrams

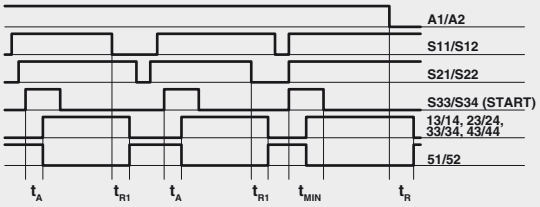
Configuration with automatic start



Configuration with monitored start



Configuration with manual start



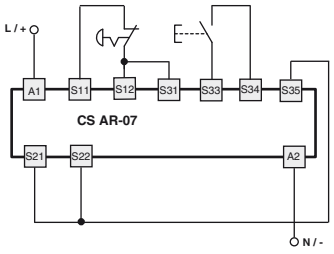
Legend:

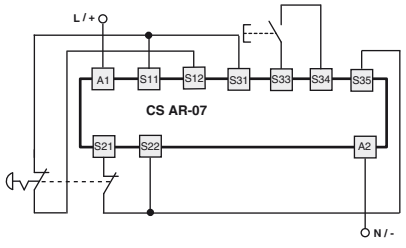
t_{MIN}:	Min. duration of start impulse	t_{R1}:	release time
t_c:	simultaneity time	t_R:	release time in absence of power supply
t_A:	response time		

Notes:
The configurations with one channel are obtained taking into consideration the S11/S12 input only. In this case it is necessary to consider time t_{R1} referred to input S11/S12, time t_R referred to the supply, time t_A referred to input S11/S12 and to the start, and time t_{MIN} referred to the start.

Input configuration

Emergency stop circuits	
Input configuration with manual start	
1 channel	2 channels

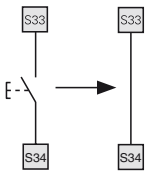




The diagram does not show the exact position of the terminals in the product

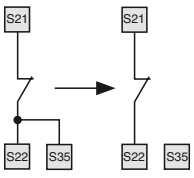
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



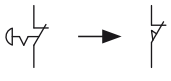
Monitored start

With regard to the indicated diagrams, remove the connection between S22 and S35 in order to activate the monitored start module.



Movable guard monitoring

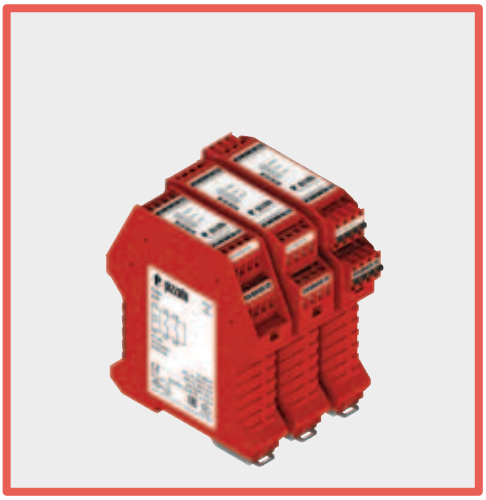
The safety module can monitor emergency stop circuits and control circuits for movable guards. Replace the emergency stop contacts with the switch contacts.



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AR-08**



Module for emergency stops, end position monitoring for movable guards, semiconductor outputs (e.g. light barriers) and magnetic safety sensors

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start or monitored start
- Can be connected to semiconductor outputs (e.g. light barriers), to electromechanical contacts or to magnetic safety sensors
- Output contacts: 2 NO safety contacts
- Supply voltage: 12 Vdc, 24 Vac/dc, 120 Vac, 230 Vac
- Possibility of parallel reset of several modules

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211 TÜV
SÜD approval: Z10 10 09 75157 002
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	12 Vdc 24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance 24 Vac/dc, 120 Vac, 230 Vac:	±15% of U_n
Supply voltage tolerance 12 Vdc:	-10% … +15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω (15 Ω)*
Current per input:	30 mA (70 mA)* (typical)
Min. duration of start impulse t_{MIN}:	> 200 ms (100 ms)*
Response time t_A:	< 150 ms (220 ms)*
Release time t_{R1}:	< 20 ms (15 ms)*
Release time in absence of power supply t_R:	< 150 ms (50 ms)*
Simultaneity time t_C:	unlimited

* Version CS AR-08•U12

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 NO safety contacts,
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Features approved by UL

Rated supply voltage (U_n): 24 Vac/dc, 50…60 Hz, 120 Vac; 50…60 Hz: 230 Vac; 50…60 Hz
Power consumption AC: < 5 VA
Power consumption DC: < 2 W
Maximum switching voltage: 230 Vac
Max. current per contact: 6 A
Utilization category: C300
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Features approved by TÜV SÜD

Rated supply voltage (U_n): 24 Vac/dc, ± 15%, 120 Vac ± 15%, 230 Vac ± 15%
Power consumption: 5 VA max AC, 2 W max DC
Rated operating current (max.): 4 A
Maximum switching load (max.): 1380 VA
Ambient temperature: -25°C … +55°C
Storage temperature: -25 °C … + 70°C
Protection degree: IP40 (housing), IP20 (terminal strip)
In compliance with standards: 2006/42/EEC Machinery Directive, EN ISO 13849-1 (up to cat. 4 PL e), EN 50178:1997, EN 60947-5-3/A1:2005, EN 61508-1:1998 (SIL CL 1-3), EN 61508-2:2000 (SIL CL 1-3), EN 61508-4:1998 (SIL CL 1-3), IEC 62061:2005 (SIL CL 3)

Code structure

CS AR-08V024

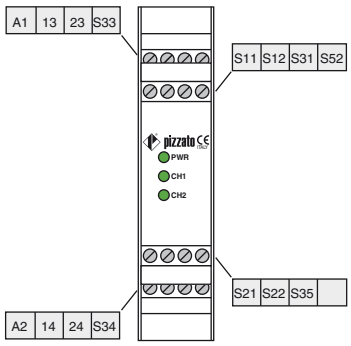
Connection type		Supply voltage	
V	Screw terminals	**U12**	12 Vdc
M	Connector with screw terminals	**024**	24 Vac/dc
X	Connector with spring terminals	**120**	120 Vac
		230	230 Vac

Stock items

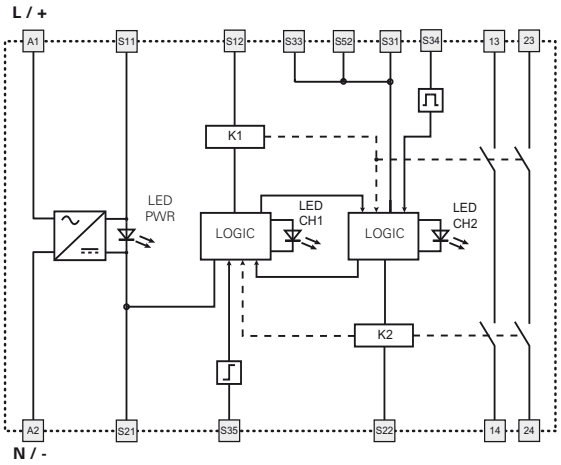
CS AR-08V024

Safety module CS AR-08

Pin assignment

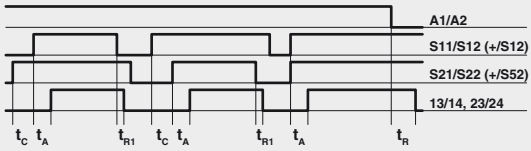


Internal block diagram

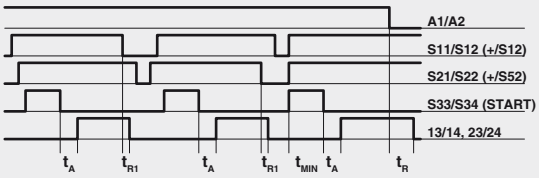


Function diagrams

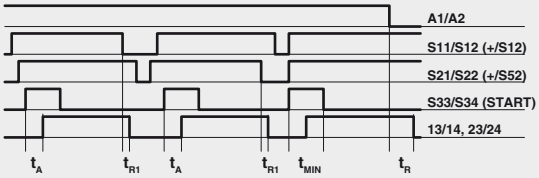
Configuration with automatic start



Configuration with monitored start



Configuration with manual start



Legend:

t_{MIN}:	Min. duration of start impulse	t_{R1}:	release time
t_C:	simultaneity time	t_R:	release time in absence of power supply
t_A:	response time		

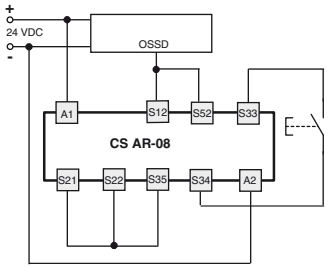
Notes:
The configurations with one channel are obtained taking into consideration the CH1 input only. In this case it is necessary to consider time t_{R1} referred to input CH1, time t_R referred to the supply, time t_A referred to input CH1 and to the start, and time t_{MIN} referred to the start.

Input configuration

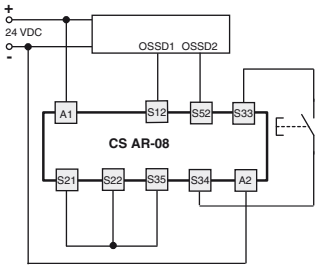
Semiconductor outputs (e.g. light barriers)

Input configuration with manual start

1 channel



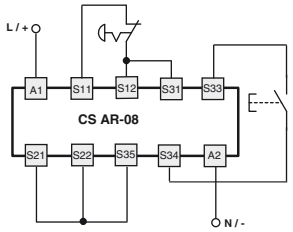
2 channels



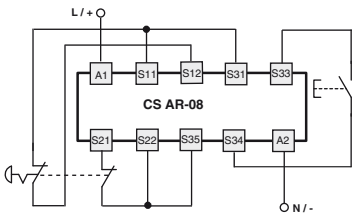
Emergency stop circuits

Input configuration with manual start

1 channel



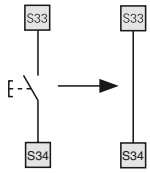
2 channels



The diagram does not show the exact position of the terminals in the product

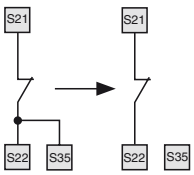
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



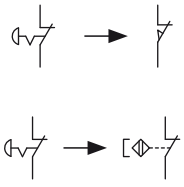
Monitored start

With regard to the indicated diagrams, remove the connection between S22 and S35 in order to activate the monitored start module.



Monitoringofmovableguardsandmagneticsafetysensors

The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts.
The sensors can only be used in 2-channel configuration.



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AR-20 / CS AR-21**

Module for emergency stops and end position monitoring for movable guards

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start (CS AR-20 only) or monitored start (CS AR-21 only)
- Reduced housing width of 22.5 mm
- 2 NO safety contacts
- Supply voltage: 24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 3 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	70 mA (typical)
Min. duration of start impulse t_{MIN}:	> 100 ms
Response time t_A:	< 50 ms
Release time in absence of power supply t_R:	< 100 ms
Simultaneity time t_C:	unlimited

In compliance with standards:
EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 NO safety contacts
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AR-20V024

Start mode	
20	manual or automatic start
21	monitored start

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc
120	120 Vac
230	230 Vac

Stock items

CS AR-20V024

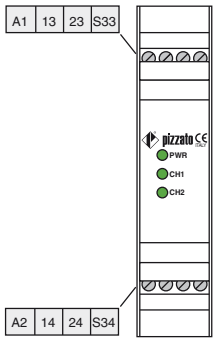
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

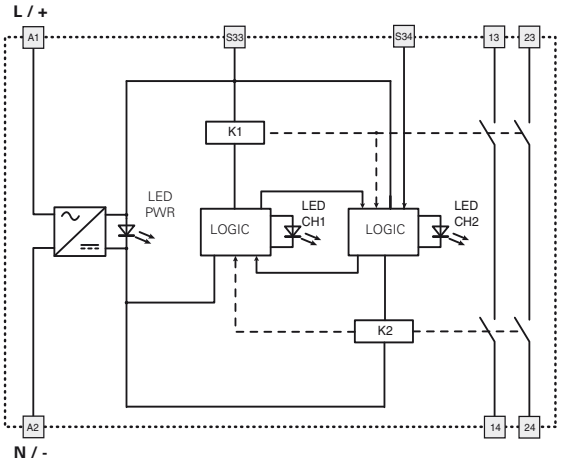
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS AR-20 / CS AR-21

Pin assignment

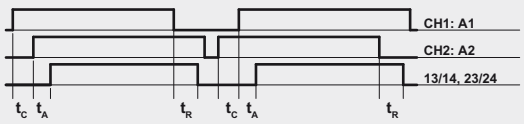


Internal block diagram

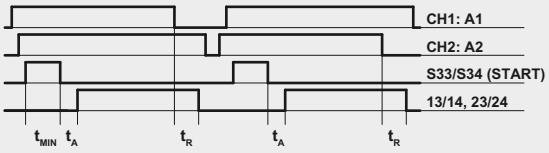


Function diagrams

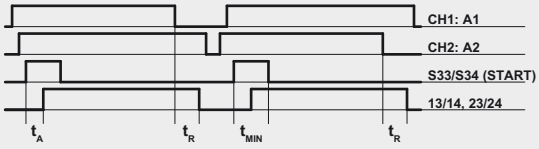
Configuration with automatic start (CS AR-20)



Configuration with monitored start (CS AR-21)



Configuration with manual start (CS AR-20)



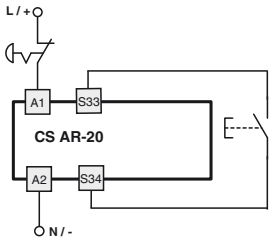
Legend:

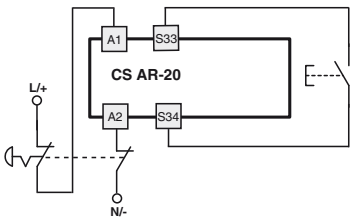
t_{MIN}: Min. duration of start impulse
t_C: simultaneity time
t_A: response time
t_R: release time in absence of power supply

Notes:
The configurations with one channel are obtained taking into consideration the CH1:A1 input only. In this case it is necessary to consider time t_R referred to input CH1:A1, time t_A referred to input CH1:A1 and to the start, and time t_{MIN} referred to the start.

Input configuration

Emergency stop circuits	
Input configuration with manual start	
1 channel	2 channels

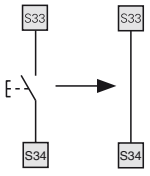




The diagram does not show the exact position of the terminals in the product

Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.

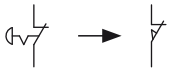


Monitored start

Use module CS AR-21 with the circuit diagrams for manual start.

Movable guard monitoring

The safety module can monitor emergency stop circuits and control circuits for movable guards. Replace the emergency stop contacts with the switch contacts.



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AR-22 / CS AR-23**

Module for emergency stops and end position monitoring for movable guards

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start (CS AR-22 only) or monitored start (CS AR-23 only)
- Reduced housing width of 22.5 mm
- 3 NO safety contacts, 1 NC auxiliary contact
- Supply voltage: 24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94	
Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 3 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	70 mA (typical)
Min. duration of start impulse t_{MIN}:	> 100 ms
Response time t_A:	< 50 ms
Release time in absence of power supply t_R:	< 75 ms
Simultaneity time t_C:	unlimited

In compliance with standards:
EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	3 NO safety contacts 1 NC auxiliary contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	80 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AR-22V024

Start mode	
22	manual or automatic start
23	monitored start

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc
120	120 Vac
230	230 Vac

Stock items

CS AR-22V024

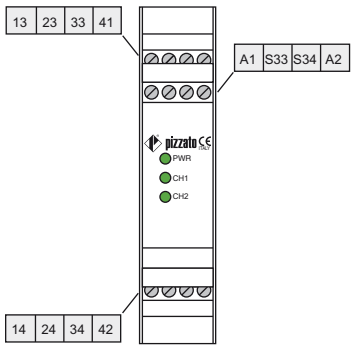
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

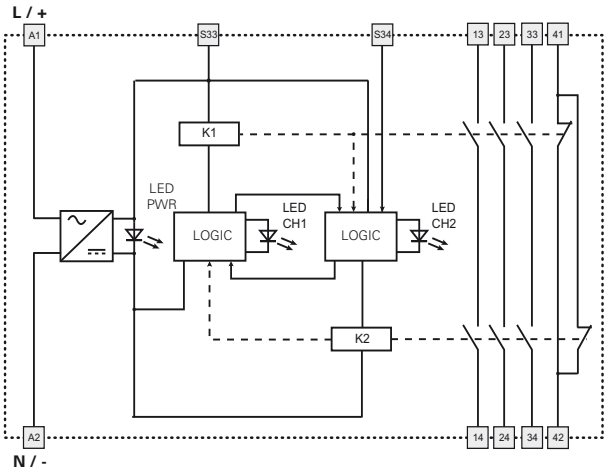
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS AR-22 / CS AR-23

Pin assignment

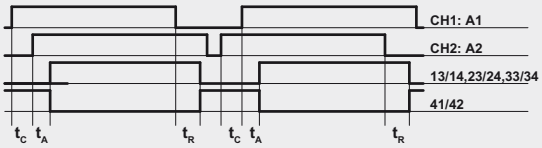


Internal block diagram

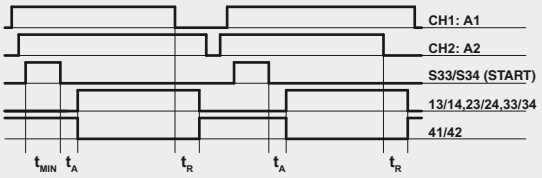


Function diagrams

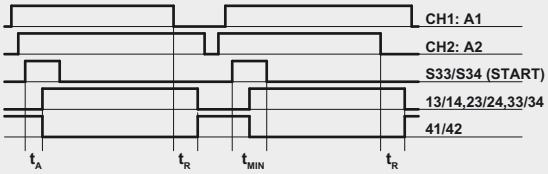
Configuration with automatic start (CS AR-22)



Configuration with monitored start (CS AR-23)



Configuration with manual start (CS AR-22)



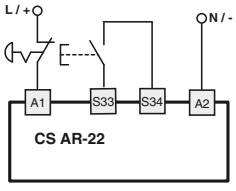
Legend:

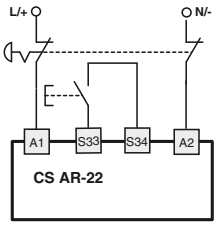
t_{MIN}:	Min. duration of start impulse	t_A:	response time
t_C:	simultaneity time	t_R:	release time in absence of power supply

Notes:
The configurations with one channel are obtained taking into consideration the CH1:A1 input only. In this case it is necessary to consider time t_R referred to input CH1:A1, time t_A referred to input CH1:A1 and to the start, and time t_{MIN} referred to the start.

Input configuration

Emergency stop circuits	
Input configuration with manual start	
1 channel	2 channels

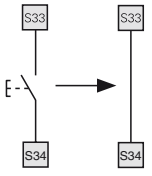




The diagram does not show the exact position of the terminals in the product

Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.

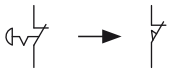


Monitored start

Use module CS AR-23 with the circuit diagrams for manual start.

Movable guard monitoring

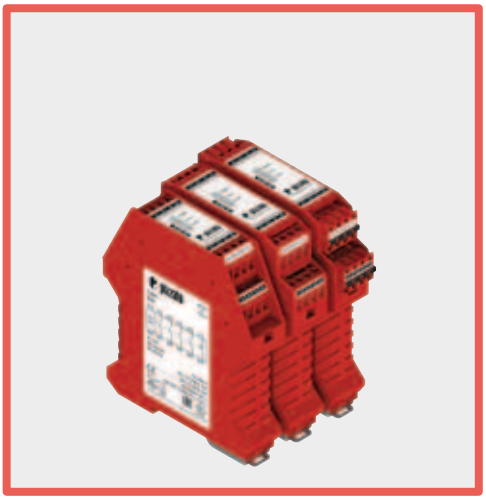
The safety module can monitor emergency stop circuits and control circuits for movable guards. Replace the emergency stop contacts with the switch contacts.



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AR-24 / CS AR-25**



Module for emergency stops and end position monitoring for movable guards

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start (CS AR-24 only) or monitored start (CS AR-25 only)
- Reduced housing width of 22.5 mm
- 4 NO safety contacts
- 1 NC auxiliary contact
- Supply voltage: 24 Vac/dc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 3 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	30 mA (typical)
Min. duration of start impulse t_{MIN}:	> 100 ms
Response time t_A:	< 100 ms
Release time t_{R1}:	< 40 ms
Release time in absence of power supply t_R:	< 170 ms
Simultaneity time t_C:	unlimited

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	4 NO safety contacts 1 NC auxiliary contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	72 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AR-24V024

Start mode	
24	manual or automatic start
25	monitored start

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc

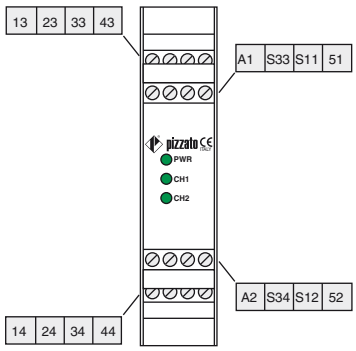
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

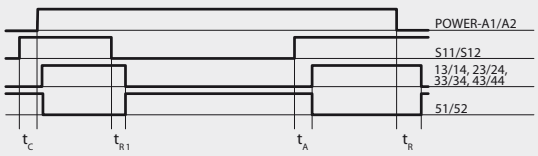
Safety module CS AR-24 / CS AR-25

Pin assignment

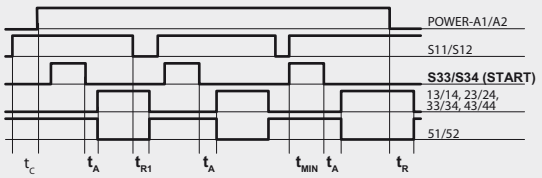


Function diagrams

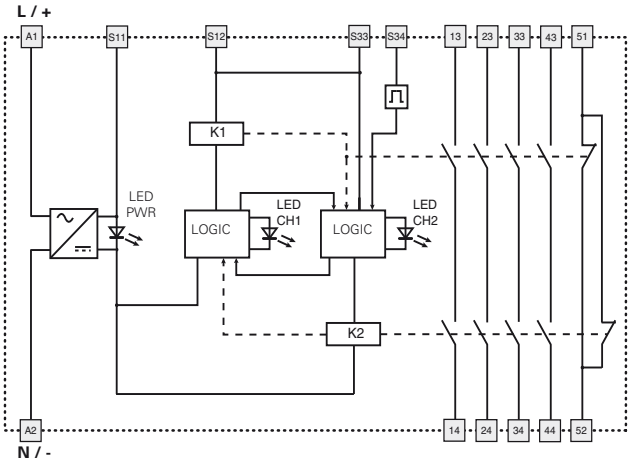
Configuration with automatic start (CS AR-24)



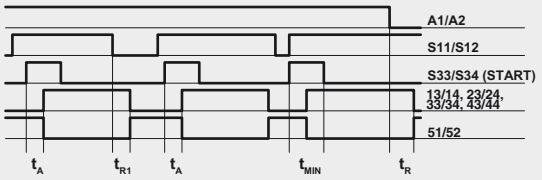
Configuration with monitored start (CS AR-25)



Internal block diagram



Configuration with manual start (CS AR-24)



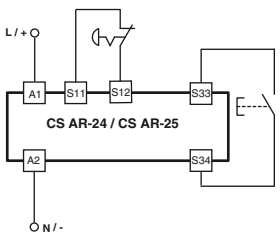
Legend:

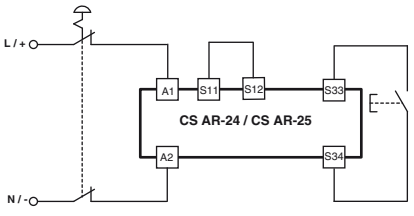
t_{MIN}:	Min. duration of start impulse	t_{R1}:	release time
t_C:	simultaneity time	t_R:	release time in absence of power supply
t_A:	response time		

Notes:
The configurations with one channel are obtained taking into consideration the S11/S12 input only. In this case it is necessary to consider time t_{R1} referred to input S11/S12, time t_R referred to the supply, time t_A referred to input S11/S12 and to the start, and time t_{MIN} referred to the start.

Input configuration

Emergency stop circuits	
Input configuration with manual start	
1 channel	2 channels

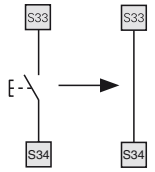




The diagram does not show the exact position of the terminals in the product

Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



Monitored start

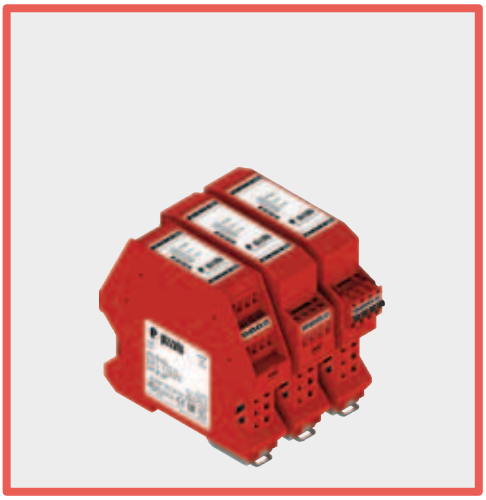
Use module CS AR-25 with the circuit diagrams for manual start.

Movable guard monitoring

The safety module can monitor emergency stop circuits and control circuits for movable guards. Replace the emergency stop contacts with the switch contacts.

Application examples See page 251

Safety module **CS AR-40 / CS AR-41**



Module for emergency stops and end position monitoring for movable guards

Main features

- For safety applications up to SIL CL 2/PL d
- Choice between automatic start, manual start (CS AR-40 only) or monitored start (CS AR-41 only)
- Reduced housing width of 22.5 mm
- 2 NO safety contacts
- Supply voltage: 24 Vac/dc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design D

General data

SIL CL:	up to SIL CL 2 acc. to EN 62061
Performance Level (PL):	up to PL d acc. to EN ISO 13849-1
Safety category:	up to cat. 2 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	70 mA (typical)
Min. duration of start impulse t_{MIN}:	> 100 ms
Response time t_A:	< 50 ms
Release time in absence of power supply t_R:	< 105 ms
Simultaneity time t_C:	unlimited

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 NO safety contacts
Contact type:	forcibly guided
Material of the contacts:	silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AR-40V024

Start mode	
40	manual or automatic start
41	monitored start

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc

Stock items

CS AR-40V024

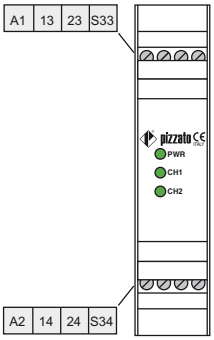
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

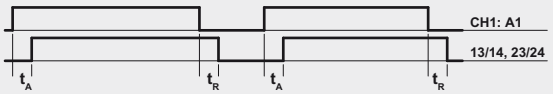
Safety module CS AR-40 / CS AR-41

Pin assignment

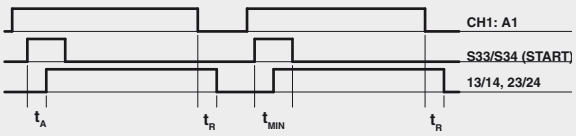


Function diagrams

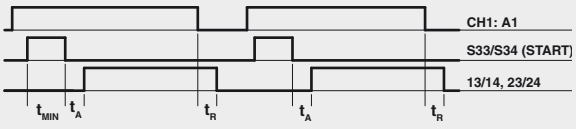
1-channel configuration with automatic start (CS AR-40)



1-channel configuration with manual start (CS AR-40)

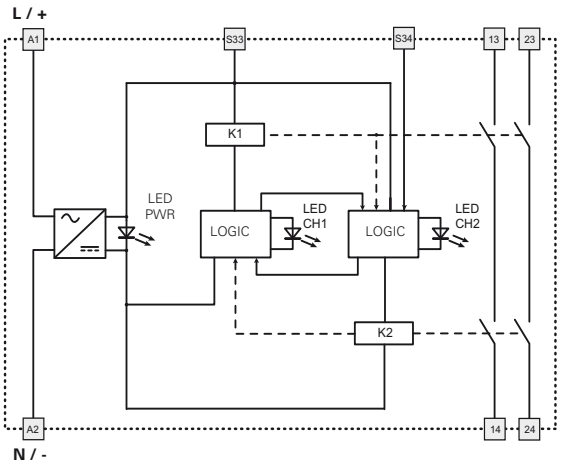


1-channel configuration with monitored start (CS AR-41)



Legend:
t_{MIN}: Min. duration of start impulse
t_A: response time
t_R: release time in absence of power supply

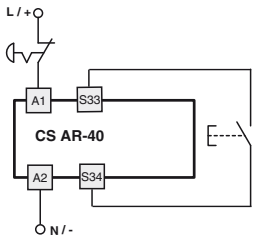
Internal block diagram



Input configuration

Emergency stop circuits

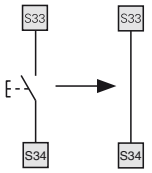
One channel input configuration with manual start



The diagram does not show the exact position of the terminals in the product

Automatic start

With regard to the indicated diagram, bridge the start button between S33 and S34 in order to activate the automatic start module.



Monitored start

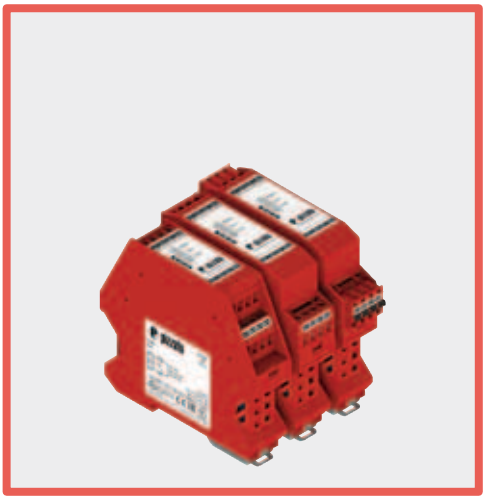
Use module CS AR-41 with the circuit diagrams for manual start.

Movable guard monitoring

The safety module can monitor emergency stop circuits and control circuits for movable guards. Replace the emergency stop contacts with the switch contacts.

Items with code on **green** background are stock items

Safety module **CS AR-46**



Module for emergency stop, end position monitoring for movable guards, and magnetic safety sensors and devices

Main features
- For safety applications up to SIL CL 1/PL c
- Reduced housing width of 22.5 mm
- 1 NO safety contact
- Supply voltage: 24 Vac/dc

Utilization categories
Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94	
Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design D

General data

SIL CL:	up to SIL CL 1 acc. to EN 62061
Performance Level (PL):	up to PL c acc. to EN ISO 13849-1
Safety category:	up to cat. 1 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	20 mA (typical)
Response time t_A:	< 15 ms
Release time t_{R1}:	< 20 ms
Release time in absence of power supply t_R:	< 100 ms
Simultaneity time t_C:	unlimited

In compliance with standards:
EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	1 NO safety contact
Material of the contacts:	silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AR-46V024

Connection type		Supply voltage	
V	Screw terminals	**024**	24 Vac/dc
M	Connector with screw terminals		
X	Connector with spring terminals		

Stock items

CS AR-46V024

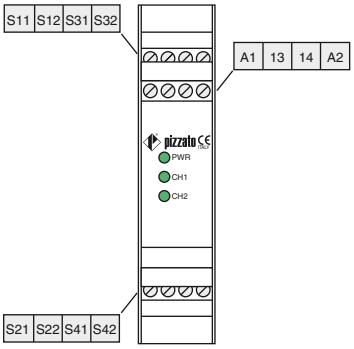
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

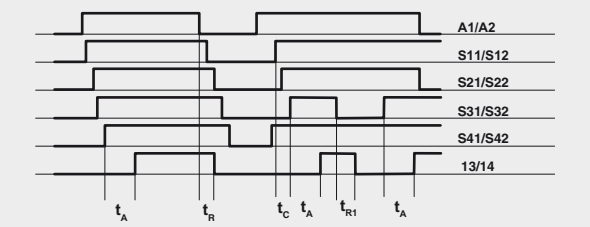
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS AR-46

Pin assignment

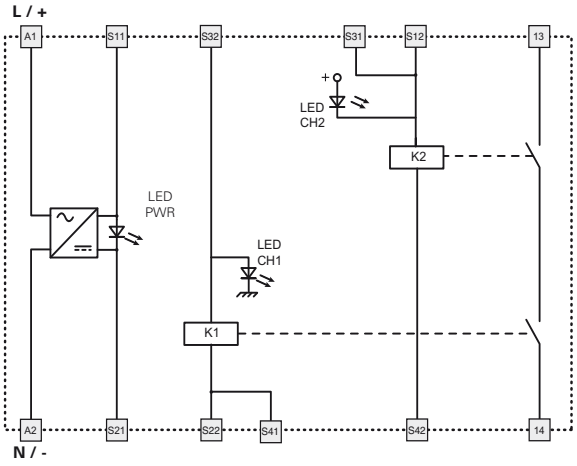


Function diagrams



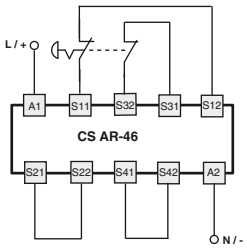
Legend:
t_C: simultaneity time
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply

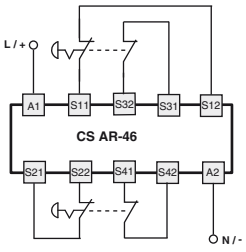
Internal block diagram

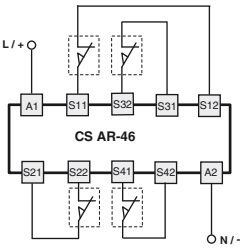


Input configuration

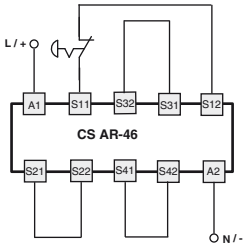
Emergency stop circuits		
Input configuration with automatic start		
2 channels and 1 emergency button	2 channels and 2 emergency buttons	2 channels and 4 switches





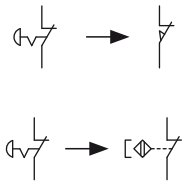


1 channel and 1 emergency button



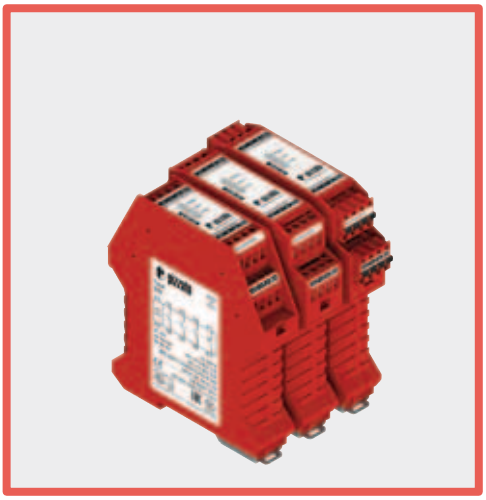
Monitoring of movable guards and magnetic safety sensors

The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts. **The sensors can only be used in 2-channel configuration.**



Items with code on **green** background are stock items

Safety module **CS AR-91**



Module for emergency stops, end position monitoring for movable guards and magnetic safety sensors

Main features

- For safety applications up to SIL 3/PL e
- Choice between automatic start, manual start or monitored start
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- Output contacts:
  2 NO safety contacts, 1 NO opto-decoupled auxiliary contact
- Supply voltage: 24 Vac/dc
- Insensitive to voltage dips

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

0051

IMQ certificate of conformity no. 340
(EN 81-20:2014; EN 81-50:2014; EN 81-1:1998+A3:2009; EN 81-2:1998+A3:2009)
EC type examination certificate: IMQ CP 432 DM
(Machinery Directive)
EC type examination certificate: IMQ 236
(Machinery Directive)
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; ±15%; 50…60 Hz
Max. DC residual ripple in DC:	10%
Power consumption AC:	< 5 VA
Power consumption DC:	< 2.5 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC response time:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	< 40 mA
Min. duration of start impulse t_{MIN}:	> 50 ms
Response time t_A:	< 120 ms
Release time t_{R1}:	< 15 ms
Release time in absence of power supply t_R:	< 65 ms
Simultaneity time t_C:	unlimited
Response time starting from application of the supply:	< 300 ms

Auxiliary signalling circuit

Auxiliary output (Y43-Y44):	1NO opto-decoupled
Rated operating voltage (U_e):	24 Vdc
Rated operating current (I_e):	25 mA
Rated impulse withstand voltage (U_{imp}):	4 kV
Release time t_{R2}:	< 1 ms

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 NO safety contacts,
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A type F

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. See page 241-250.

Code structure

CS AR-91V024

Connection type		Supply voltage	
V	Screw terminals	**024**	24 Vac/dc
M	Connector with screw terminals		
X	Connector with spring terminals		

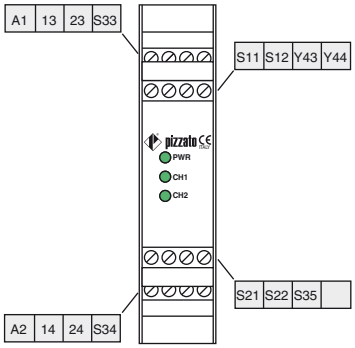
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2.5 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS AR-91

Pin assignment

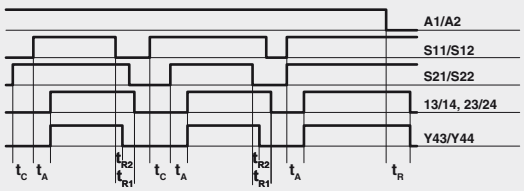


Voltage dips, short interruptions and voltage variations

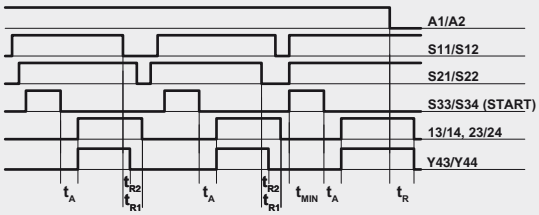
The CS AR-91 safety module has a built-in voltage drop sensor which serves to protect and safeguard the internal state of the safety relays, in the event of dips or short voltage interruptions. This is to prevent unwanted switching states in relation to the state of the inputs from occurring. When voltage is restored, the device continues to operate with a switching state that is consistent with the input signals. The safety module retains its normal function during voltage dips and brief interruptions; for longer voltage interruptions, the safety outputs open and reset themselves automatically during an automatic start if voltage is restored or – in the case of a manual or monitored start – require that the system be reset by the operator.

Function diagrams

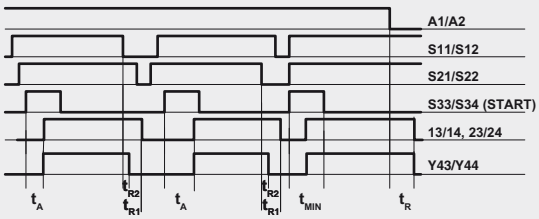
Configuration with automatic start



Configuration with monitored start



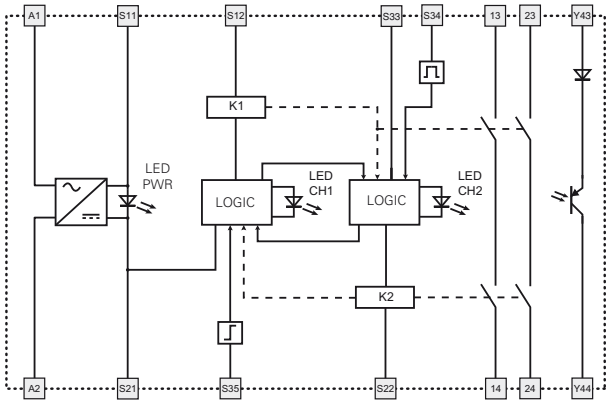
Configuration with manual start



Legend:
t_{MIN}: Min. duration of start impulse
t_c: simultaneity time
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply

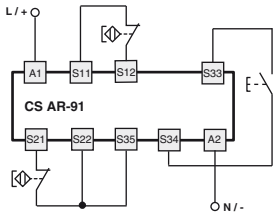
Notes:
The configurations with one channel are obtained taking into consideration the S11/S12 input only. In this case it is necessary to consider time t_{R1} referred to input S11/S12, time t_R referred to the supply, time t_A referred to input S11/S12 and to the start, and time t_{MIN} referred to the start.

Internal block diagram



Input configuration

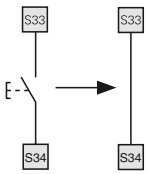
Input configuration with magnetic sensors
2 channels



The diagram does not show the exact position of the terminals in the product

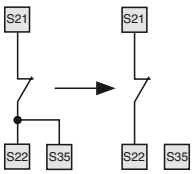
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



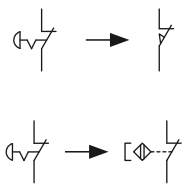
Monitored start

With regard to the indicated diagrams, remove the connection between S22 and S35 in order to activate the monitored start module.



Monitoring of movable guards and magnetic safety sensors

The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts.
The sensors can only be used in 2-channel configuration.



Application examples See page 251

Safety module **CS AR-51**

Module for emergency stops, end position monitoring for movable guards, safety mats and safety bumpers with 4-wire technology

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 2 channels
- Choice between automatic start, manual start or monitored start
- Connection of input channels of opposite potentials
- Can be connected to electromechanical contacts, safety mats or safety bumpers with 4-wire technology
- Output contacts:
  2 NO safety contacts,
- Supply voltage:
  24 Vac/dc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2.5 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 200 Ω
Current per input:	10 mA (typical)
Min. duration of start impulse t_{MIN}:	> 150 ms
Response time t_A:	< 120 ms
Release time t_{R1}:	< 15 ms
Release time in absence of power supply t_R:	< 100 ms
Simultaneity time t_C:	unlimited

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 NO safety contacts
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AR-51V024

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc

Stock items

CS AR-51V024

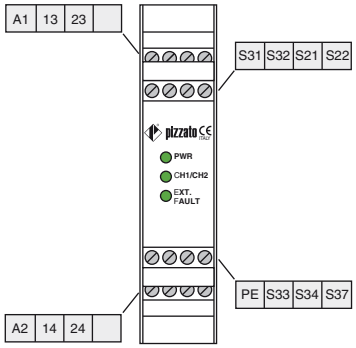
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS AR-51

Pin assignment

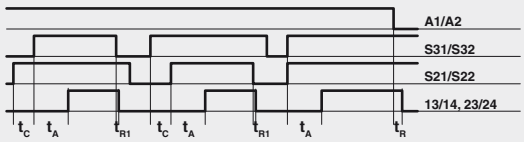


PE terminal connection
The PE terminal has to be connected to the equipotential circuit of machine protection if it is necessary.
This connection is made for functional reason, to reduce effects of an insulation fault on the machine operation.
In particular, ground faults in control circuits must not cause unwanted start-up or dangerous movements or prevent the machine from stopping.

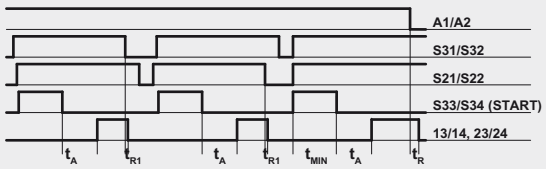
Function of "EXT. FAULT" LED
When a pressure is exerted on the surface of a safety bumper or safety mat, a short-circuit occurs between the two conductive elements, which constitute the apparatus and can be connected to the input channels of the safety module.
The signal thereby generated causes the EXT.FAULT LED to illuminate and signal the short-circuit and the opening of the output contacts, resulting in the blocking of the control circuit and causing the machine to switch to the safety setting. The EXT. FAULT LED does not switch on if the wires or internal connections of the safety mat or safety bumper are interrupted.

Function diagrams

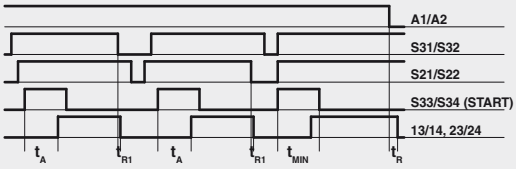
Configuration with automatic start



Configuration with monitored start

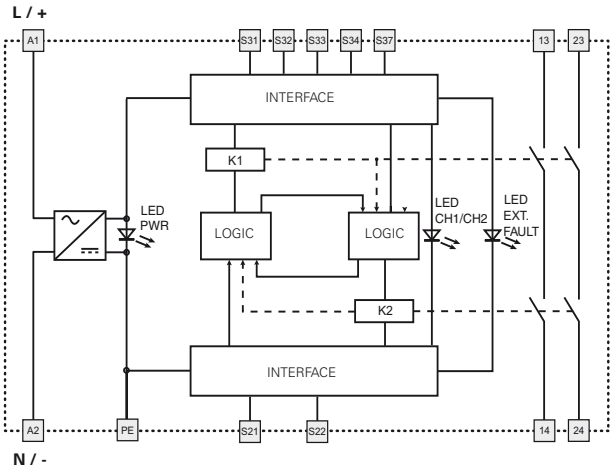


Configuration with manual start



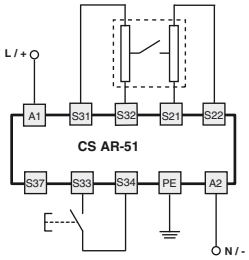
Legend:
t_{MIN}: Min. duration of start impulse
t_C: simultaneity time
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply

Internal block diagram

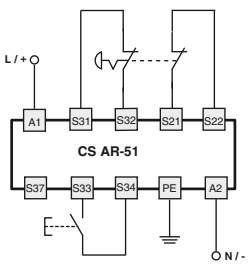


Input configuration

Safety mats and safety bumpers
Input configuration with manual start
2 channels



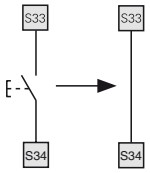
Emergency stop circuits
Input configuration with manual start
2 channels



The diagram does not show the exact position of the terminals in the product

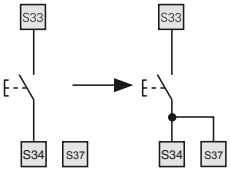
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



Monitored start

With regard to the indicated diagrams, establish the connection between S34 and S37 in order to activate the monitored start module.



Movable guard monitoring

The safety module can monitor emergency stop circuits and control circuits for movable guards. Replace the emergency stop contacts with the switch contacts.

Items with code on **green** background are stock items

Safety module **CS AT-0**

Module for emergency stops, end position monitoring for movable guards with delayed contacts at the opening of the input channels, semiconductor outputs (e.g. light barriers) and magnetic safety sensors

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start or monitored start
- Connection of input channels of opposite potentials
- Can be connected to semiconductor outputs (e.g. light barriers), to electromechanical contacts or to magnetic safety sensors
- Standard housing width of 45 mm
- 2 instantaneous NO safety contacts, 1 instantaneous NC auxiliary contact, 2 delayed NO safety contacts.
- Supply voltage: 24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design C

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to category 4 (instantaneous contacts), category 3 (delayed contacts) acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.5 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	-10% … +15% of U_n
Power consumption AC:	< 10 VA
Power consumption DC:	< 5 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	30 mA (typical)
Min. duration of start impulse t_{MIN}:	> 200 ms
Response time t_A:	< 150 ms
Release time t_{R1}:	< 20 ms
Release time in absence of power supply t_R:	< 150 ms
Release time, delayed contacts t_{R2}:	see "Code structure"
Simultaneity time t_C:	unlimited

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 instantaneous NO safety contacts, 1 instantaneous NC auxiliary contact, 2 delayed NO safety contacts.
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	72 (instant. contacts), 36 (del. contacts) A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AT-00V024-TF1

Release time, delayed contacts (t_{R2})	
0	Fixed time (see TF)
1	0,3 … 3 s, 0,3 s steps
2	1 … 10 s, 1 s steps
3	3 … 30 s, 3 s steps
4	30 … 300 s, 30 s steps

Release time, delayed contacts (t_{R2})	
TF0.5	0.5 s fixed time
TF1	1 s fixed time
TF3	3 s fixed time
...	.....

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc
120	120 Vac
230	230 Vac

Stock items

CS AT-01V024
CS AT-02V024
CS AT-03V024

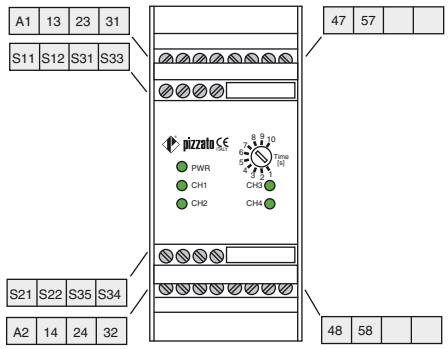
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 10 VA
Power consumption DC:	< 4 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).
-Surrounding air of 55°C.

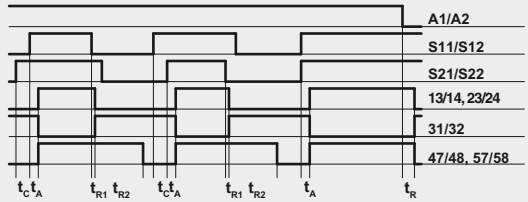
Safety module CS AT-0

Pin assignment

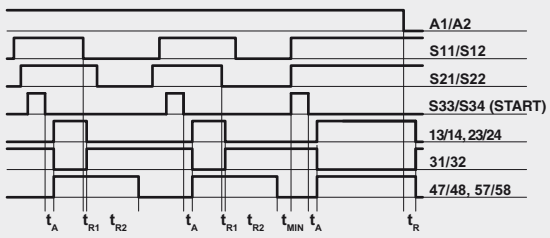


Function diagrams

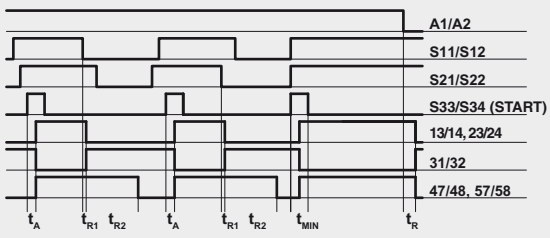
Configuration with automatic start



Configuration with monitored start



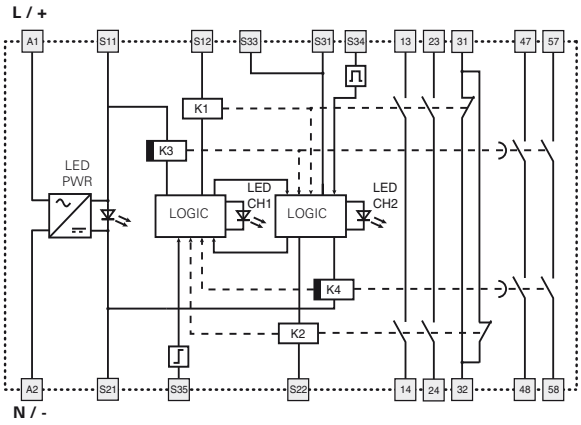
Configuration with manual start



Legend:
t_{MIN}: Min. duration of start impulse
t_c: simultaneity time
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply
t_{R2}: release time, delayed contacts adjustable (see "Code structure")

Notes:
The configurations with one channel are obtained taking into consideration the S11/S12 input only. In this case it is necessary to consider time t_{R1} and t_{R2} referred to input S11/S12, time t_R referred to the supply, time t_A referred to input S11/S12 and to the start, and time t_{MIN} referred to the start.

Internal block diagram

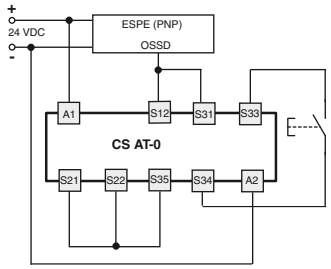


Input configuration

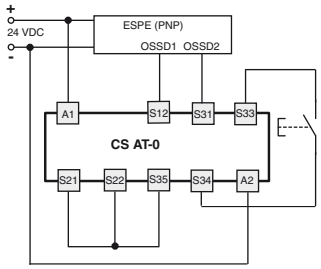
Semiconductor outputs (e.g. light barriers)

Input configuration with manual start

1 channel



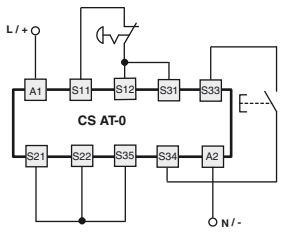
2 channels



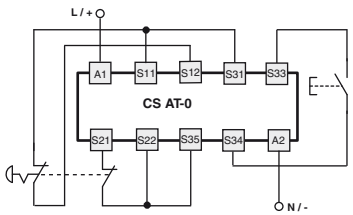
Emergency stop circuits

Input configuration with manual start

1 channel

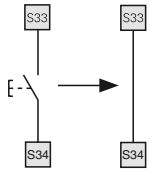


2 channels



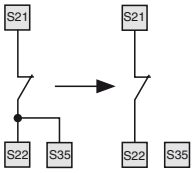
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



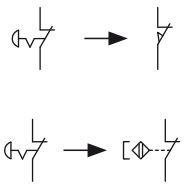
Monitored start

With regard to the indicated diagrams, remove the connection between S22 and S35 in order to activate the monitored start module.



Monitoring of movable guards and magnetic safety sensors

The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts.
The sensors can only be used in 2-channel configuration.



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AT-1**

Module for emergency stops, end position monitoring for movable guards with delayed contacts at the opening of the input channels, semiconductor outputs (e.g. light barriers) and magnetic safety sensors

Main features
- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start or monitored start
- Connection of input channels of opposite potentials
- Can be connected to semiconductor outputs (e.g. light barriers), to electromechanical contacts or to magnetic safety sensors
- Standard housing width of 45 mm
- 3 instantaneous NO safety contacts, 2 delayed NO safety contacts.
- Supply voltage: 24 Vac/dc, 120 Vac, 230 Vac

Utilization categories
Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing
Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design C

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to category 4 (instantaneous contacts), category 3 (delayed contacts) acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.5 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 10 VA
Power consumption DC:	< 5 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	30 mA (typical)
Min. duration of start impulse t_{MIN}:	> 200 ms
Response time t_A:	< 150 ms
Release time t_{R1}:	< 20 ms
Release time in absence of power supply t_R:	< 150 ms
Release time, delayed contacts t_{R2}:	see "Code structure"
Simultaneity time t_C:	unlimited

In compliance with standards:
EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	3 instantaneous NO safety contacts, 2 delayed NO safety contacts.
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	72 (instant. contacts), 36 (del. contacts) A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AT-10V024-TF1

Release time, delayed contacts (t_{R2})	
0	Fixed time (see TF)
1	0,3 … 3 s, 0,3 s steps
2	1 … 10 s, 1 s steps
3	3 … 30 s, 3 s steps
4	30 … 300 s, 30 s steps

Release time, delayed contacts (t_{R2})	
TF0.5	0.5 s fixed time
TF1	1 s fixed time
TF3	3 s fixed time
...	.....

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc
120	120 Vac
230	230 Vac

Stock items

CS AT-12V024

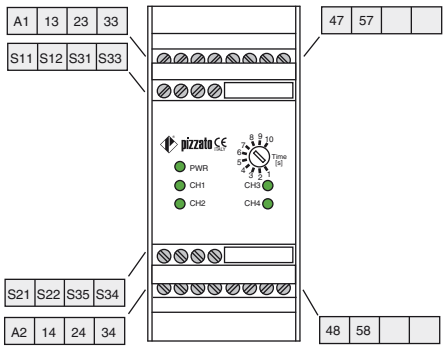
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 10 VA
Power consumption DC:	< 4 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).
- Surrounding air of 55°C.

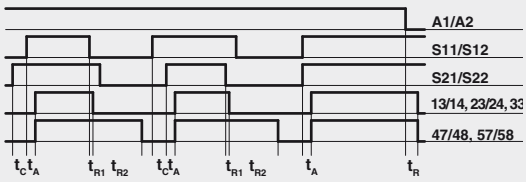
Safety module CS AT-1

Pin assignment

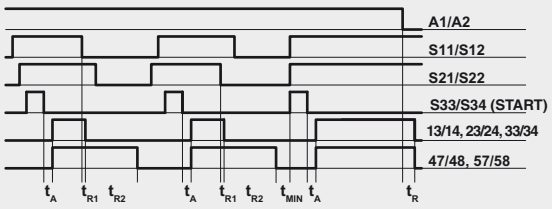


Function diagrams

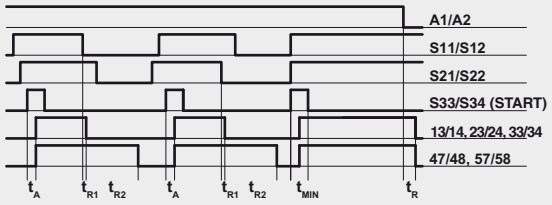
Configuration with automatic start



Configuration with monitored start



Configuration with manual start



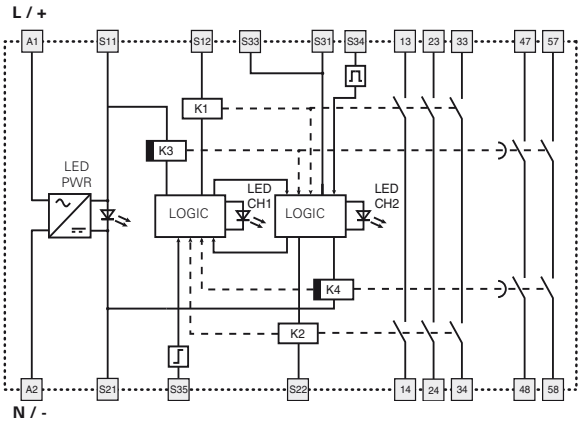
Legend:

t_{MIN}: Min. duration of start impulse
t_c: simultaneity time
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply
t_{R2}: release time, delayed contacts adjustable (see "Code structure")

Notes:

The configurations with one channel are obtained taking into consideration the S11/S12 input only. In this case it is necessary to consider time t_{R1} and t_{R2} referred to input S11/S12, time t_R referred to the supply, time t_A referred to input S11/S12 and to the start, and time t_{MIN} referred to the start.

Internal block diagram

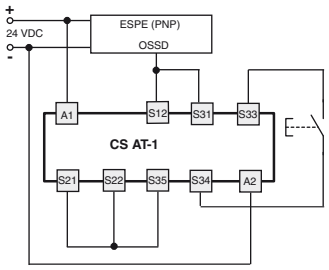


Input configuration

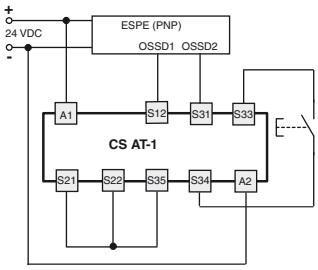
Semiconductor outputs (e.g. light barriers)

Input configuration with manual start

1 channel



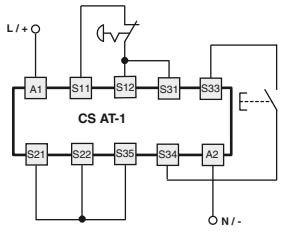
2 channels



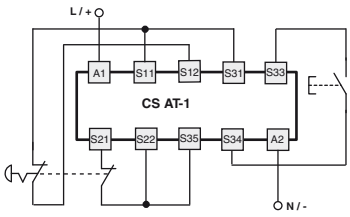
Emergency stop circuits

Input configuration with manual start

1 channel

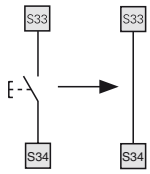


2 channels



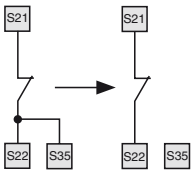
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



Monitored start

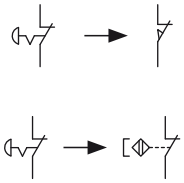
With regard to the indicated diagrams, remove the connection between S22 and S35 in order to activate the monitored start module.



Monitoring of movable guards and magnetic safety sensors

The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts.

The sensors can only be used in 2-channel configuration.



Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS AT-3**

Module for emergency stop and end position monitoring for movable guards with delayed contacts at the opening of the input channels and magnetic safety sensors

Main features

- For safety applications up to SIL CL 3/PL e
- Input with 1 or 2 channels
- Choice between automatic start, manual start or monitored start
- Can be connected to electromechanical contacts or to magnetic safety sensors
- 45 mm housing
- 2 instantaneous NO safety contacts, 1 delayed NO safety contact.
- Supply voltage: 24 Vac/dc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94	
Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design C

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to category 4 (instantaneous contacts) category 3 (delayed contacts) acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 10 VA
Power consumption DC:	< 5 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	30 mA (typical)
Min. duration of start impulse t_{MIN}:	> 100 ms
Response time t_A:	< 70 ms
Release time t_{R1}:	< 15 ms
Release time in absence of power supply t_R:	< 100 ms
Release time, delayed contacts t_{R2}:	see "Code structure"
Simultaneity time t_C:	unlimited

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 instantaneous NO safety contacts, 1 delayed NO safety contact.
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS AT-30V024-TF1

Release time, delayed contacts (t_{R2})	
0	Fixed time (see TF)
1	0,3 … 3 s, 0,3 s steps
2	1 … 10 s, 1 s steps
3	3 … 30 s, 3 s steps
4	30 … 300 s, 30 s steps

Release time, delayed contacts (t_{R2})	
TF0.5	0.5 s fixed time
TF1	1 s fixed time
TF3	3 s fixed time
...	.....

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc

Stock items

CS AT-31V024

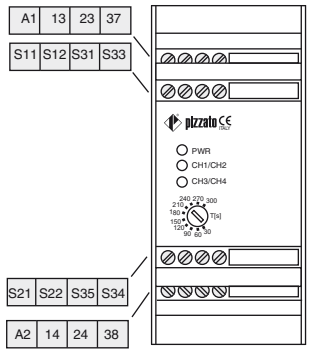
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Power consumption AC:	< 10 VA
Power consumption DC:	< 4 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).
- Surrounding air of 55°C.

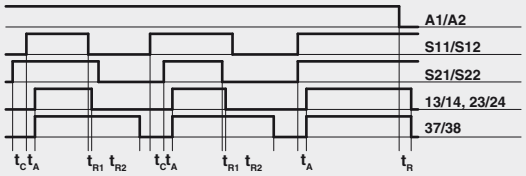
Safety module CS AT-3

Pin assignment

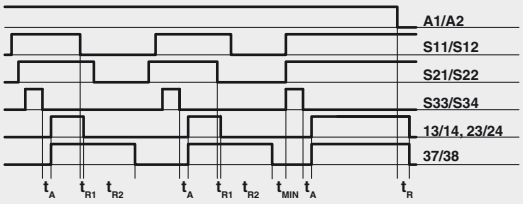


Function diagrams

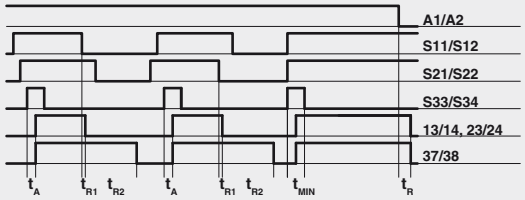
Configuration with automatic start



Configuration with monitored start



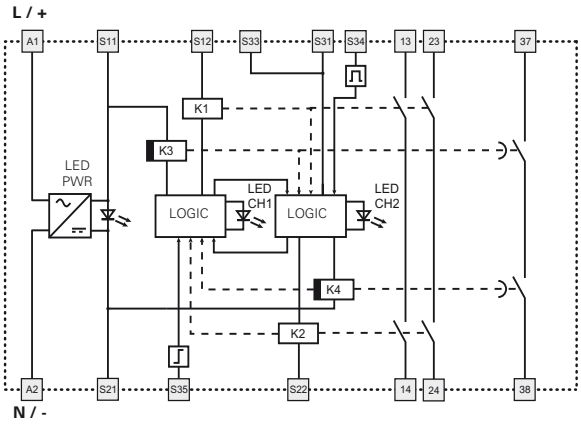
Configuration with manual start



Legend:
t_{MIN}: Min. duration of start impulse
t_C: simultaneity time
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply
t_{R2}: release time, delayed contacts adjustable (see "Code structure")

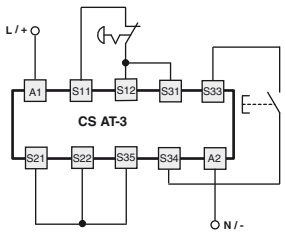
Notes:
The configurations with one channel are obtained taking into consideration the S11/S12 input only. In this case it is necessary to consider times t_{R1} and t_{R2} referred to input S11/S12, time t_R referred to the supply, time t_A referred to input S11/S12 and to the start, and time t_{MIN} referred to the start.

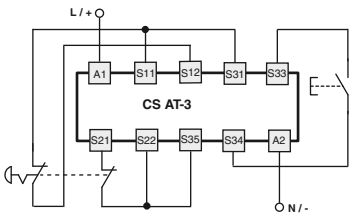
Internal block diagram



Input configuration

Emergency stop circuits	
Input configuration with manual start	
1 channel	2 channels

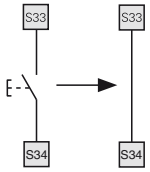




The diagram does not show the exact position of the terminals in the product

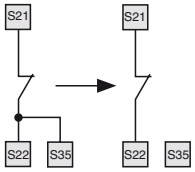
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.



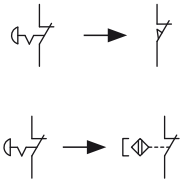
Monitored start

With regard to the indicated diagrams, remove the connection between S22 and S35 in order to activate the monitored start module.



Monitoring of movable guards and magnetic safety sensors

The safety module can monitor emergency stop circuits, control circuits for movable guards as well as magnetic safety sensors. Replace the emergency stop contacts with switch contacts or sensor contacts. **The sensors can only be used in 2-channel configuration.**



The diagram does not show the exact position of the terminals in the product

Items with code on **green** background are stock items

Application examples See page 251

Safety module **CS FS-1**

Safety timer module with delayed contacts at energizing

Main features

- For safety applications up to SIL CL 3/PL e
- Timing circuits by means of safety system with self-monitoring and redundancy
- Release command for interlocked safety devices
- 45 mm housing
- Output contacts:
  1 NO safety contact,
  2 NC auxiliary contacts
- Supply voltage:
  24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432
DM UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design C

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO13849-1 (depending on circuit structure)
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Response time t_A:	see "Code structure"
Release time in absence of power supply t_R:	< 60 ms

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	1 NO safety contact, 2 NC auxiliary contacts
Contact type:	forcibly guided
Material of the contacts:	silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS FS-11V024-TF1

Response time (t_A)	
0	Fixed time (see Tfx)
1	0,3 … 3 s, 0,3 s steps
2	1 … 10 s, 1 s steps
3	3 … 30 s, 3 s steps
4	30 … 300 s, 30 s steps

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc
120	120 Vac
230	230 Vac

Response time (t_A)	
TF0.5	0.5 s fixed time
TF1	1 s fixed time
TF3	3 s fixed time
TF10	10 s fixed time

Stock items

CS FS-14V024

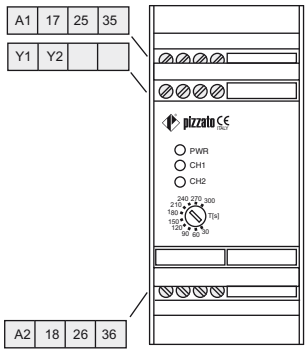
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

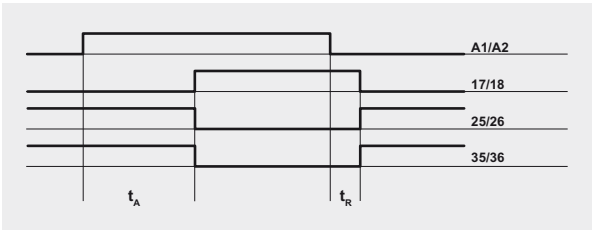
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS FS-1

Pin assignment

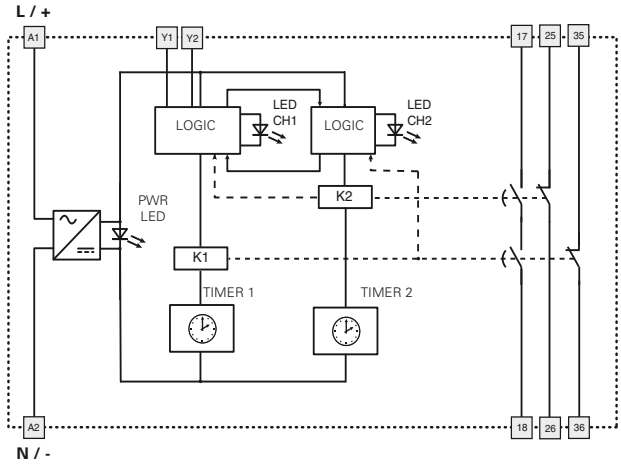


Function diagram



Legend:
t_A: adjustable response time (see "Code structure")
t_R: release time in absence of power supply

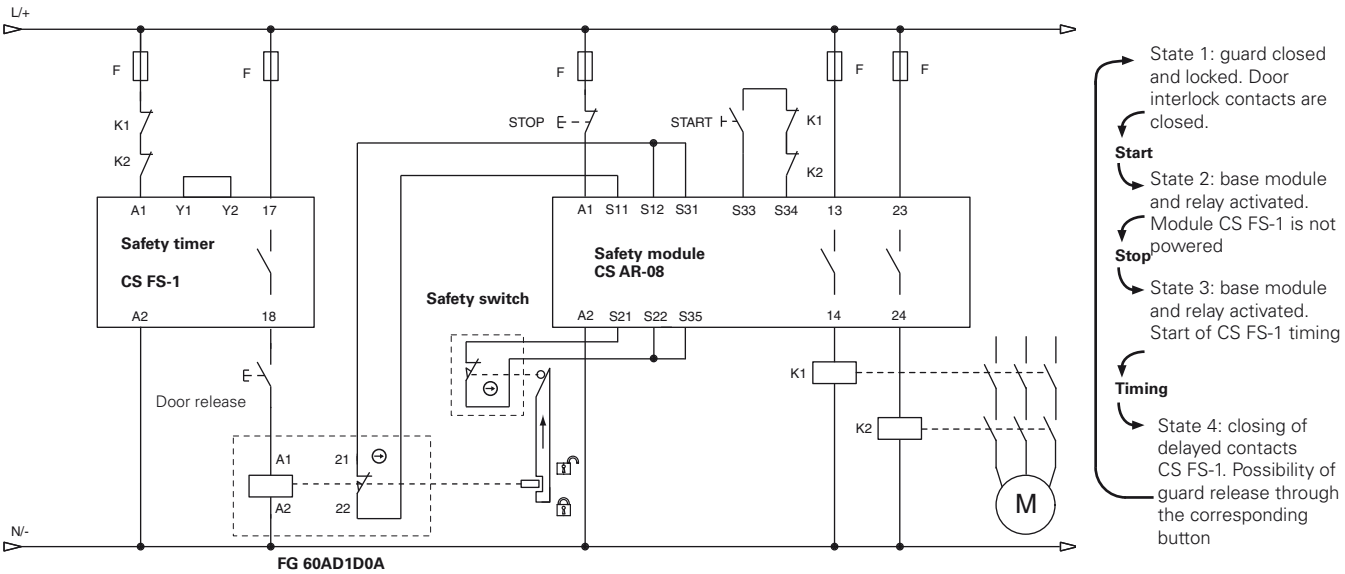
Internal block diagram



Y1-Y2: optional feedback inputs from any external contactors which are directly controlled by the module.

Circuit structure

Monitoring of a door-lock system with manual release



FG 60AD1D0A

The diagram illustrates the operating principle of a typical circuit for monitoring a door-lock system with interlock in the de-energised state and manual release of the individual doors.
For the complete electrical wiring diagrams with various types of electrical locking and release of the doors, please contact our technical office.

The diagram does not show the exact position of the terminals in the product

Items with code on **green** background are stock items

Safety module **CS FS-2**

Safety timer module with delayed contacts at energizing

Main features

- For safety applications up to SIL CL 2/PL d
- Timing circuits by means of safety system with self-monitoring and redundancy
- Release command for interlocked safety devices
- 45 mm housing
- Output contacts:
  1 NO safety contacts, 1 NC auxiliary contact,
  1 CO auxiliary contact
- Supply voltage:
  24 Vdc, 120 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks:

EC type examination certificate: M6A 161075157013
UL approval: E131787
CCC approval: 2013010305640211
TÜV SÜD approval: Z10 12 04 75157 003
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design C

General data

SIL CL:	up to SIL CL 2 acc. to EN 62061
Performance Level (PL):	up to PL d acc. to EN ISO 13849-1
Safety category:	up to cat. 3 acc. to EN ISO13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vdc (A1-A2) 120 Vac; 50…60 Hz (B1-B2)
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Response time t_A:	see "Code structure"
Release time in absence of power supply t_R:	< 100 ms

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	1 NO safety contact, 1 NC auxiliary contact, 1 CO auxiliary contact,
Contact type:	forcibly guided
Material of the contacts:	silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A
Error signal output (Y14):	Type: PNP
Rated operating voltage (U_e):	24 Vdc
Rated operating current (Ie):	10 mA

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. See page 241-250.

Code structure

CS FS-20VU24-TFxx

Response time (t_A)	
0	Fixed time (see Tfx)
1	0,3 … 3 s, 0,3 s steps
2	1 … 10 s, 1 s steps
3	3 … 30 s, 3 s steps
4	30 … 300 s, 30 s steps

Response time (t_A)	
TFxx	xx = s (fixed time)

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
U24	24 Vdc
120	24 Vdc (A1-A2) 120 Vac (B1-B2)

Features approved by UL

Rated supply voltage (U_n): 24 Vdc; 120 Vac; 50…60 Hz:
Power consumption AC: < 5 VA
Power consumption DC: < 2 W
Maximum switching voltage: 230 Vac
Max. current per contact: 6 A
Utilization category: C300
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

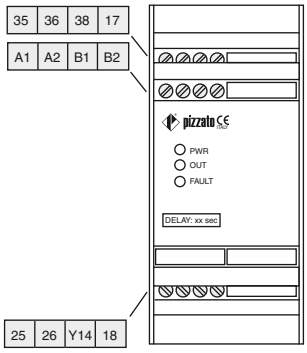
Features approved by TÜV SÜD

Rated supply voltage (U_n): 24 Vdc; ± 15%, 120 Vac ± 15%
Power consumption: 5 VA max AC, 2 W max DC
Rated operating current (max.): 4 A
Maximum switching load (max.): 1380 VA
Ambient temperature: -25°C … +55°C
Storage temperature: -25 °C … + 70°C
Protection degree: IP40 (housing), IP20 (terminal strip)
In compliance with standards: 2006/42/EEC Machinery Directive, EN ISO 13849-1 (up to cat. 4 PL e), EN 50178:1997, EN 60947-5-3/A1:2005, EN 61508-1:1998 (SIL CL 1-3), EN 61508-2:2000 (SIL CL 1-3), EN 61508-4:1998 (SIL CL 1-3), IEC 62061:2005 (SIL CL 3)

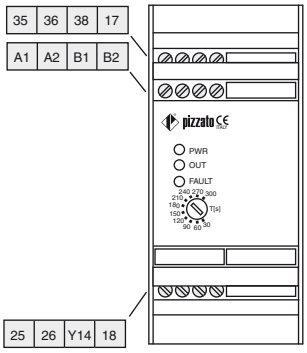
Safety module CS FS-2

Pin assignment

CS FS-20••••-TFxx

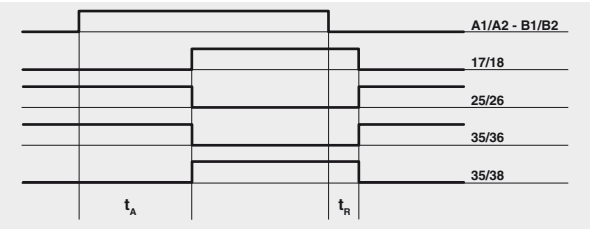


CS FS-2•••••



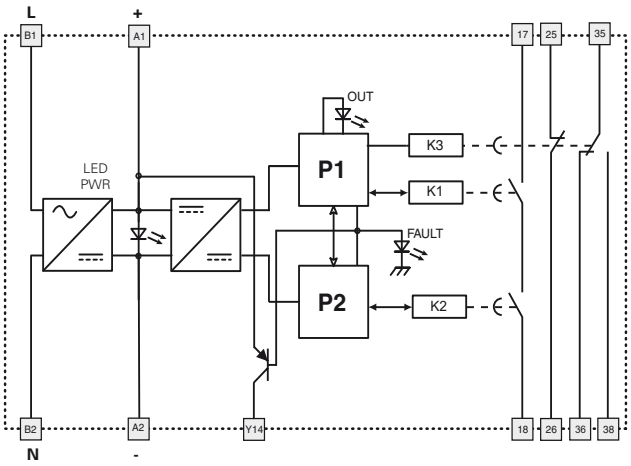
Function diagram

CS FS-2••••• Delay on
Normal operation without faults



Legend:
t_A: adjustable response time (see "Code structure")
t_R: release time in absence of power supply

Internal block diagram



A1-A2: 24 Vdc
B1-B2: 120 Vac

Y14: auxiliary output, activated when the module enters fault state.

Safety module **CS FS-3**

Safety timer modules with response delay

Main features

- For safety applications up to SIL CL 2/PL d
- Timing circuits by means of safety system with self-monitoring and redundancy
- Release command for interlocked safety devices
- 45 mm housing
- Output contacts:
  1 NO safety contacts, 1 NC auxiliary contact,
  1 CO auxiliary contact
- Supply voltage:
  24 Vdc, 120 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks:

EC type examination certificate: M6A 161075157013
UL approval: E131787
CCC approval: 2013010305640211 TÜV
SÜD approval: Z10 12 04 75157 003
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design C

General data

SIL CL:	up to SIL CL 2 acc. to EN 62061
Performance Level (PL):	up to PL d acc. to EN ISO 13849-1
Safety category:	up to cat. 3 acc. to EN ISO13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vdc (A1-A2) 120 Vac; 50…60 Hz (B1-B2)
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Release time t_A:	see "Code structure"
Release time in absence of power supply t_R:	< 100 ms
Start-up time t_S:	< 200 ms

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	1 NO safety contact, 1 NC auxiliary contact, 1 CO auxiliary contact,
Contact type:	forcibly guided
Material of the contacts:	silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A
Error signal output (Y14):	Type: PNP
Rated operating voltage (U_e):	24 Vdc
Rated operating current (I_e):	10 mA

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. See page 241-250.

Code structure

CS FS-30VU24-TFxx

Release time (t_A)	
0	Fixed time (see Tfx)
1	0,3 … 3 s, 0,3 s steps
2	1 … 10 s, 1 s steps
3	3 … 30 s, 3 s steps
4	30 … 300 s, 30 s steps

Release time (t_A)	
TFxx	xx = s (fixed time)

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
U24	24 Vdc
120	24 Vdc (A1-A2) 120 Vac (B1-B2)

Features approved by UL

Rated supply voltage (U_n): 24 Vdc; 120 Vac; 50…60 Hz:
Power consumption AC: < 5 VA
Power consumption DC: < 2 W
Maximum switching voltage: 230 Vac
Max. current per contact: 6 A
Utilization category: C300
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

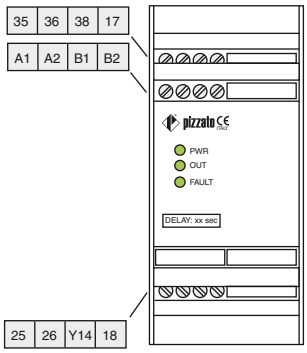
Features approved by TÜV SÜD

Rated supply voltage (U_n): 24 Vdc; ± 15%, 120 Vac ± 15%
Power consumption: 5 VA max AC, 2 W max DC
Rated operating current (max.): 4 A
Maximum switching load (max.): 1380 VA
Ambient temperature: -25°C … +55°C
Storage temperature: -25 °C … + 70°C
Protection degree: IP40 (housing), IP20 (terminal strip)
In compliance with standards: 2006/42/EEC Machinery Directive, EN ISO 13849-1 (up to cat. 4 PL e), EN 50178:1997, EN 60947-5-3/A1:2005, EN 61508-1:1998 (SIL CL 1-3), EN 61508-2:2000 (SIL CL 1-3), EN 61508-4:1998 (SIL CL 1-3), IEC 62061:2005 (SIL CL 3)

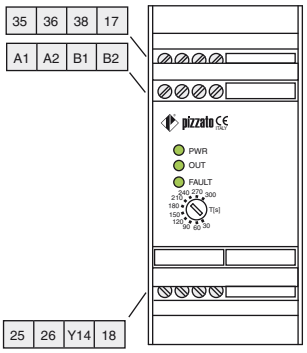
Safety module CS FS-3

Pin assignment

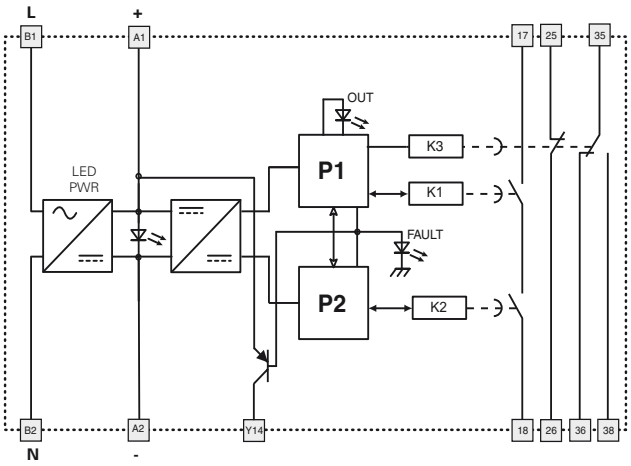
CS FS-30••••-TFxx



CS FS-3•••••



Internal block diagram

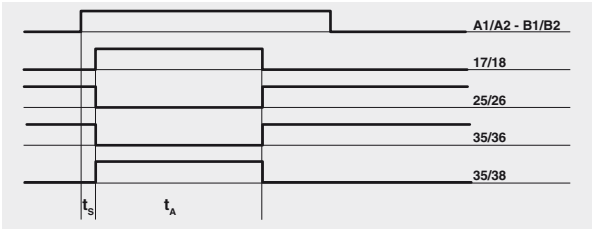


A1-A2: 24 Vdc
B1-B2: 120 Vac

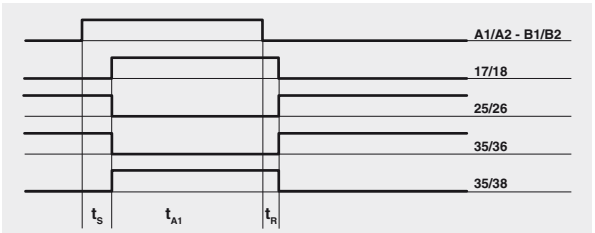
Y14: auxiliary output, activated when the module enters fault state.

Function diagram

CS FS-3••••• Delay off
Normal operation without faults



Operation without power supply



Legend:
t_A: release time (see "Code structure")
t_{A1}: release time if duration of power supply is less than t_A
t_R: release time in absence of power supply
t_S: start-up time

Safety module **CS FS-5**

Safety timer module with delayed contacts upon opening of the input

Main features

- For safety applications up to SIL CL 2/PL d
- Timing circuits by means of safety system with self-monitoring and redundancy
- Release command for interlocked safety devices
- 45 mm housing
- Output contacts:
  1 NO safety contact, 1 NC auxiliary contact, 1 CO auxiliary contact,
- Supply voltage:
  24 Vdc, 120 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks:

EC type examination certificate: M6A 161075157013
UL approval: E131787
CCC approval: 2013010305640211 TÜV
SÜD approval: Z10 12 04 75157 003
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94	
Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design C

General data

SIL CL:	up to SIL CL 2 acc. to EN 62061
Performance Level (PL):	up to PL d acc. to EN ISO 13849-1
Safety category:	up to cat. 3 acc. to EN ISO13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vdc (A1-A2) 120 Vac; 50…60 Hz (B1-B2)
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Release time t_A:	see "Code structure"
Release time in absence of power supply t_R:	< 100 ms

Input circuit

Maximum resistance per input:	≤ 50 Ω
Current per input:	< 8 mA
Response time t_S:	< 110 ms
Min. duration input signal t_{MIN}:	> 50 ms

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	1 NO safety contact, 1 NC auxiliary contact, 1 CO auxiliary contact,
Contact type:	forcibly guided
Material of the contacts:	silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A
Error signal output (Y14):	Type: PNP
Rated operating voltage (U_e):	24 Vdc
Rated operating current (I_e):	10 mA

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. See page 241-250.

Code structure

CS FS-50VU24-TFxx

Release time (t_A)	
0	Fixed time (see Tfx)
1	0,3 … 3 s, 0,3 s steps
2	1 … 10 s, 1 s steps
3	3 … 30 s, 3 s steps
4	30 … 300 s, 30 s steps

Release time (t_A)	
TFxx	xx = s (fixed time)

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
U24	24 Vdc
120	24 Vdc (A1-A2) 120 Vac (B1-B2)

Features approved by UL

Rated supply voltage (U_n): 24 Vdc; 120 Vac; 50…60 Hz:
Power consumption AC: < 5 VA
Power consumption DC: < 2 W
Maximum switching voltage: 230 Vac
Max. current per contact: 6 A
Utilization category: C300
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

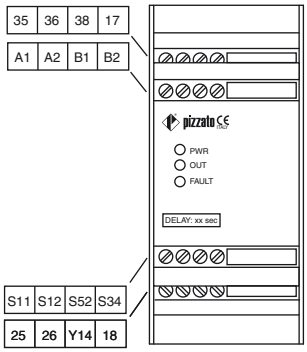
Features approved by TÜV SÜD

Rated supply voltage (U_n): 24 Vdc; ± 15%, 120 Vac ± 15%
Power consumption: 5 VA max AC, 2 W max DC
Rated operating current (max.): 4 A
Maximum switching load (max.): 1380 VA
Ambient temperature: -25°C … +55°C
Storage temperature: -25 °C … + 70°C
Protection degree: IP40 (housing), IP20 (terminal strip)
In compliance with standards: 2006/42/EEC Machinery Directive, EN ISO 13849-1 (up to cat. 4 PL e), EN 50178:1997, EN 60947-5-3/A1:2005, EN 61508-1:1998 (SIL CL 1-3), EN 61508-2:2000 (SIL CL 1-3), EN 61508-4:1998 (SIL CL 1-3), IEC 62061:2005 (SIL CL 3)

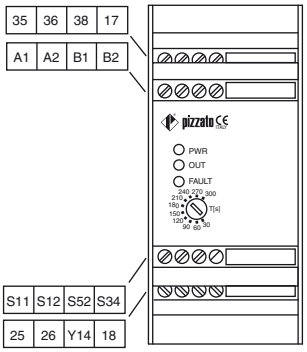
Safety module CS FS-5

Pin assignment

CS FS-50••••-TFxx

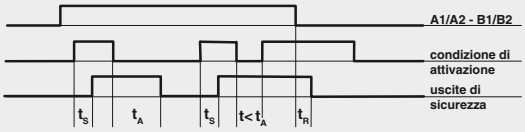


CS FS-5•••••

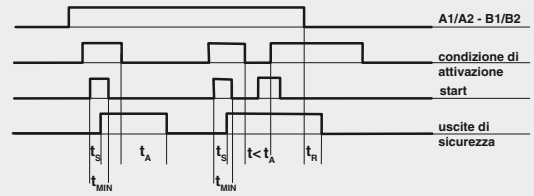


Function diagram

Configuration with automatic start

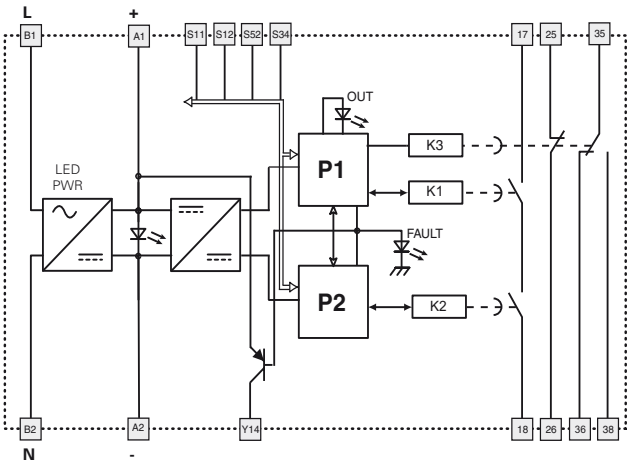


Configuration with manual start



Legend:
t_A: release time (see "Code structure")
t_R: release time in absence of power supply
t_S: response time
t_{MIN}: min. duration input signal

Internal block diagram

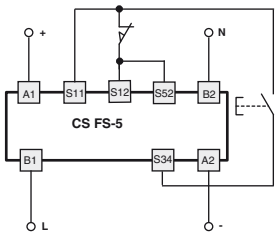


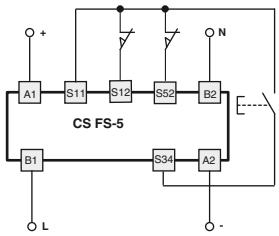
A1-A2: 24 Vdc
B1-B2: 120 Vac

Y14: auxiliary output, activated when the module enters fault state.

Input configuration

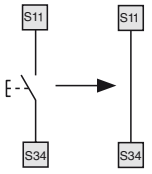
Movable guard monitoring	
Input configuration with manual start	
1 channel	2 channels





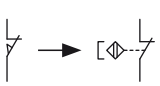
Automatic start

With regard to the indicated diagrams, bridge the start button between S33 and S34 in order to activate the automatic start module.

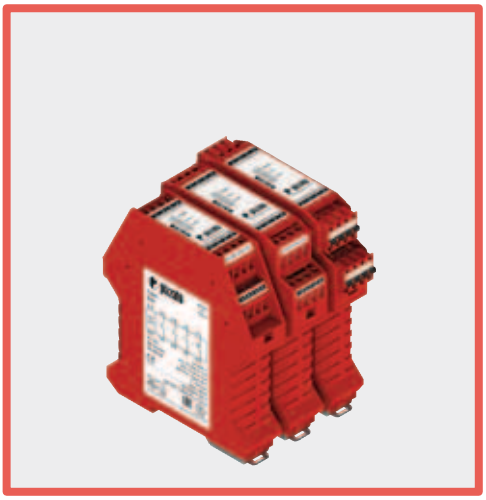


Monitoringofmovableguardsandmagneticsafetysensors

The safety module can monitor control circuits for movable guards as well as magnetic safety sensors. To do this, the switch contacts must be replaced with sensors.
The sensors can only be used in 2-channel configuration.



Safety module **CS DM-01**



Two-hand control device according to EN 574: type III C or safety module with synchronism control

Main features

- For safety applications up to SIL CL 3/PL e
- Two-channel inputs for two-hand control device or movable guards
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- 3 NO safety contacts, 1 NC auxiliary contact
- Supply voltage: 24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Type of two-hand control device:	EN 574: type III C
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	30 mA (typical)
Response time t_A:	< 50 ms
Release time t_{R1}:	< 20 ms
Release time in absence of power supply t_R:	< 70 ms
Time range for synchronised actuation t_{SN}:	< 0.5 s

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	3 NO safety contacts, 1 NC auxiliary contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	64 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS DM-01V024

Connection type		Supply voltage	
V	Screw terminals	**024**	24 Vac/dc
M	Connector with screw terminals	**120**	120 Vac
X	Connector with spring terminals	**230**	230 Vac

Stock items

CS DM-01V024

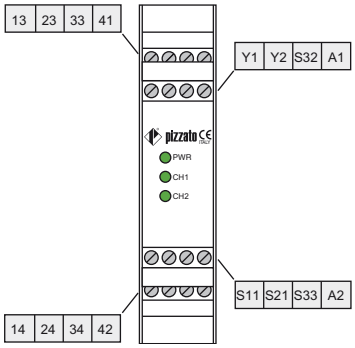
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

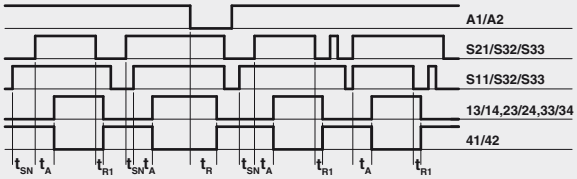
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS DM-01

Pin assignment

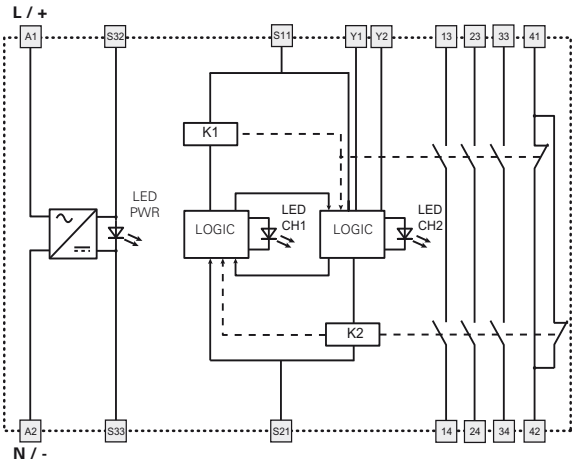


Function diagram



Legend:
t_{SN}: time range for synchronised actuation
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply

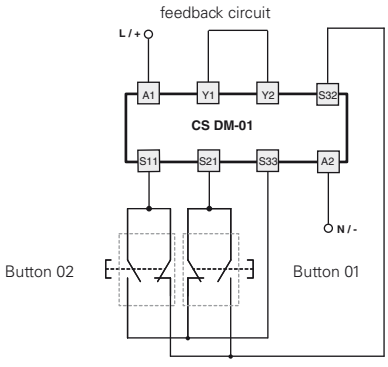
Internal block diagram



Application example on page 254.

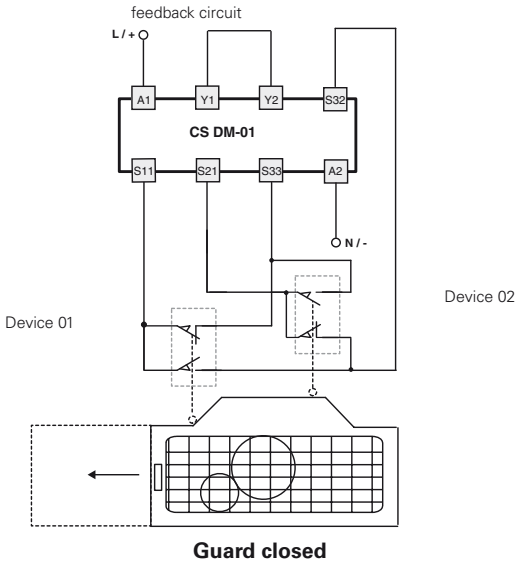
Input configuration

Circuit with two-hand control device type III C according to EN 574



The diagram does not show the exact position of the terminals in the product

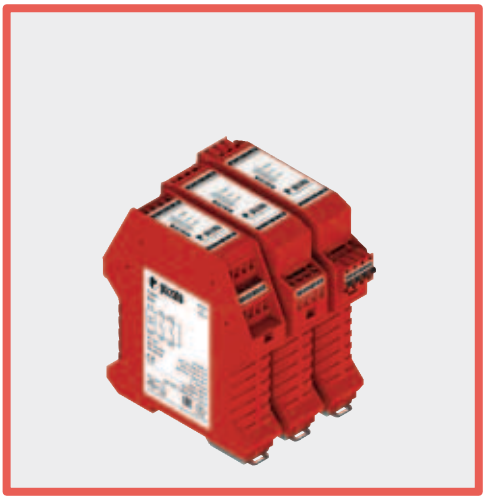
Movable guard monitoring with automatic start and simultaneity between channels < 0.5 s (safety category 4)



Guard closed

Items with code on **green** background are stock items

Safety module **CS DM-02**



Two-hand control device according to EN 574: type III C or safety module with synchronism control

Main features

- For safety applications up to SIL CL 3/PL e
- Two-channel inputs for two-hand control device or movable guards
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- 2 NO safety contacts
- Supply voltage: 24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1
Type of two-hand control device:	EN 574: type III C
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Current per input:	30 mA (typical)
Response time t_A:	< 30 ms
Release time t_{R1}:	< 25 ms
Release time in absence of power supply t_R:	< 90 ms
Time range for synchronised actuation t_{SN}:	< 0.5 s

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 NO safety contacts,
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS DM-02V024

Connection type		Supply voltage	
V	Screw terminals	**024**	24 Vac/dc
M	Connector with screw terminals	**120**	120 Vac
X	Connector with spring terminals	**230**	230 Vac

Stock items

CS DM-02V024

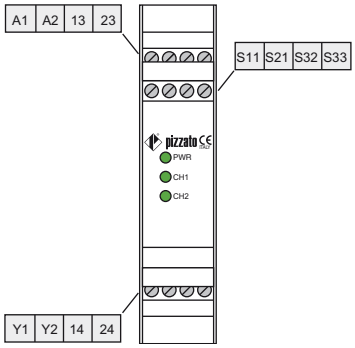
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

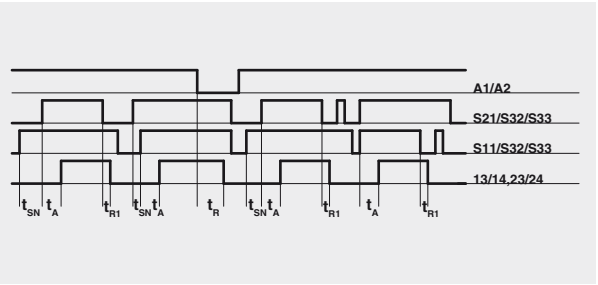
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS DM-02

Pin assignment

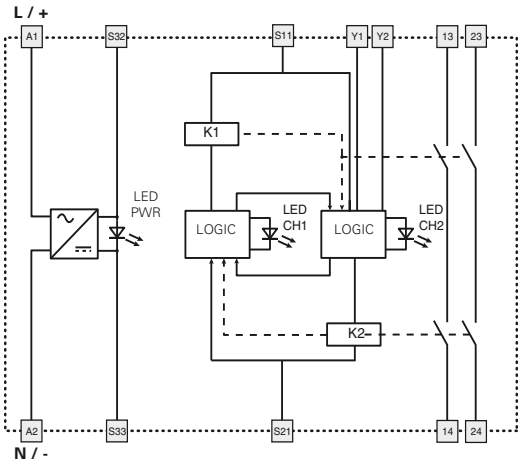


Function diagram



Legend:
t_{SN}: time range for synchronised actuation
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply

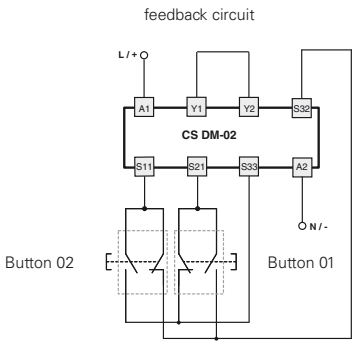
Internal block diagram



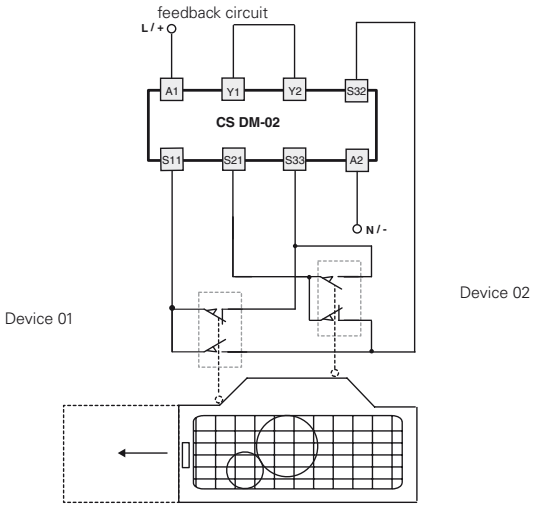
Application example on page 254.

Input configuration

Circuit with two-hand control device type III C according to EN 574



Movable guard monitoring with automatic start and simultaneity between channels < 0.5 s (safety category 4)

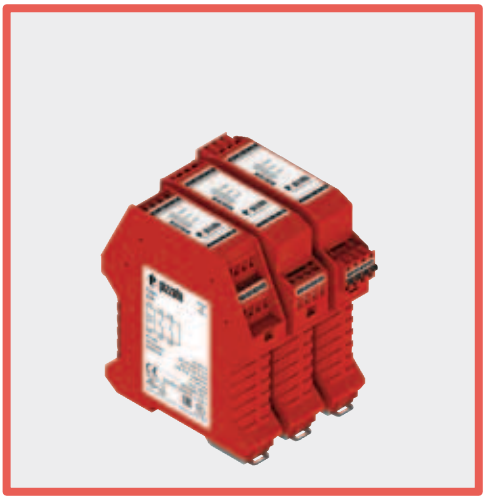


Guard closed

The diagram does not show the exact position of the terminals in the product

Items with code on **green** background are stock items

Safety module **CS DM-20**



Two-hand control device according to EN 574: type III A or safety module with synchronism control

Main features

- For safety applications up to SIL CL 1/PL c
- Two-channel inputs for two-hand control device or movable guards
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- 2 NO safety contacts,
- Supply voltage: 24 Vac/dc, 120 Vac, 230 Vac

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate :IMQ BP 210 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 1 acc. to EN 62061
Performance Level (PL):	up to PL c acc. to EN ISO 13849-1
Safety category:	up to cat. 1 acc. to EN ISO 13849-1
Type of two-hand control device:	EN 574: type III A
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 100 Ω
Current per input:	32 mA (typical)
Response time t_A:	< 12 ms
Release time t_{R1}:	< 10 ms
Release time in absence of power supply t_R:	< 200 ms
Time range for synchronised actuation t_{SN}:	< 0.5 s

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 NO safety contacts,
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. see page 241-250.

Code structure

CS DM-20V024

Connection type		Supply voltage	
V	Screw terminals	**024**	24 Vac/dc
M	Connector with screw terminals	**120**	120 Vac
X	Connector with spring terminals	**230**	230 Vac

Stock items

CS DM-20V024

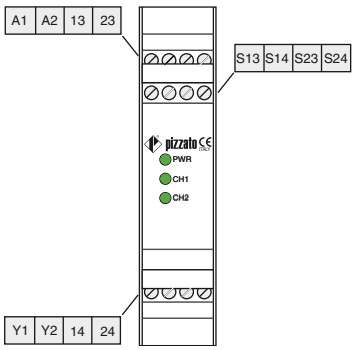
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz 120 Vac; 50…60 Hz 230 Vac; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

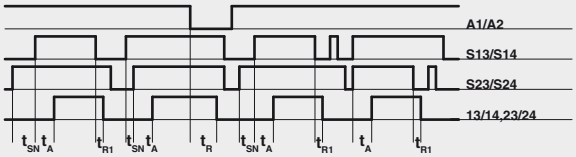
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

Safety module CS DM-20

Pin assignment

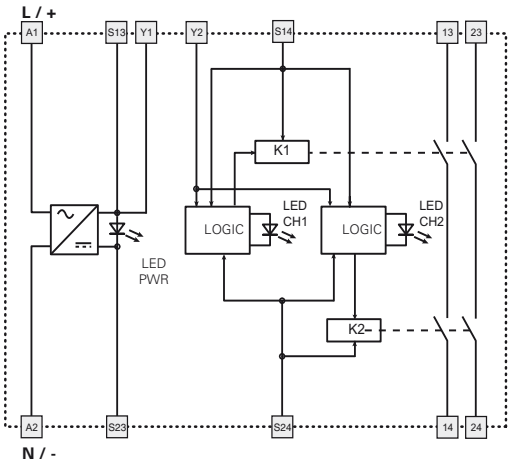


Function diagram



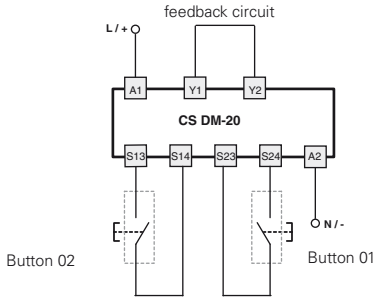
Legend:
t_{SN}: time range for synchronised actuation
t_A: response time
t_{R1}: release time
t_R: release time in absence of power supply

Internal block diagram



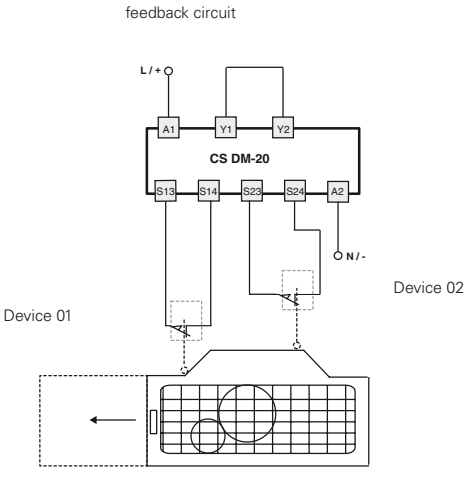
Input configuration

Circuit with two-hand control device type III A according to EN 574



The diagram does not show the exact position of the terminals in the product

Movable guard monitoring with automatic start and simultaneity between channels < 0.5 s



Guard closed

Items with code on **green** background are stock items

Safety module **CS AM-0**

Safety modules for motor standstill monitoring

Main features

- For safety applications up to SIL CL 2/PL d
- Select from 10 different residual voltages on motor standstill.
- Galvanic separation between control circuit and measurement circuit.
- 45 mm housing
- 2 NO safety contacts
  1 NC auxiliary contact
- 2 semiconductor outputs:
  - - 1 signalling output for failure state
  - - 1 signalling output for switching state of safety relays
- Possibility to connect single-phase or three-phase motors to measuring circuits.
- Supply voltages: 24 … 230 Vac/dc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate :IMQ CS 487 DM
EAC approval: RU C-IT.АД35.B.00454
UL approval: E131787
CCC approval: 2013010305640211

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design C

General data

SIL CL:	up to SIL CL 2 acc. to EN 62061
Performance Level (PL):	up to PL d acc. to EN ISO 13849-1
Safety category:	up to cat. 3 acc. to EN ISO 13849-1
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	< 0.3 kg

Supply

Rated supply voltage (U_n):	24 … 230 Vac/dc; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±±15% of U_n
Power consumption AC:	< 6 VA
Power consumption DC:	< 2 W

Input circuit

Voltage between terminals L1-L2-L3:	0 … 690 Vac
Frequency:	0 … 3 kHz
Input impedance:	>1 MΩ
Started motor threshold voltage:	from 20 mV to 500 mV adjustable in 10 increments
Stopped motor threshold voltage:	half the motor threshold voltage with motor in operation
Maximum input impedance Y1-Y2:	< 20 Ω
Current in START Y1-Y2 circuit:	70 mA (typical)
RESET input voltage:	24 Vdc ± 20%
RESET input current:	10 mA (typical)

Control circuit

Response time t_A:	< 3 s
Release time t_{R1}:	< 200 ms
Release time in absence of power supply t_R:	< 3 s
Simultaneity time t_{C1}, t_{C2}:	3 s
Test:	Self-test upon activation of the supply voltage and after activation of the RESET input.
Test duration:	2.5 s (During the test, the voltage in the measurement circuits must be less than the threshold voltage of the motor while at a standstill)

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	2 NO safety contacts, 1 NC auxiliary contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A
Semiconductor outputs:	PNP outputs galvanically separated, overvoltage and short-circuit protected
Switching voltage:	24 Vdc
Switching current:	50 mA
External supply voltage:	24 Vdc ±20%

The number and the load capacity of output contacts can be increased by using expansion modules or contactors. See page 241-250.

Code structure

article: **CS AM-01VE01** options: **-TC00UR1**

Adjustment range for the threshold voltage of the motor while at a standstill

01	from 20 to 500 mV, 53 mV step

Connection type

V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Simultaneity time (t_C)

	3s (standard)
TC00	infinite at standstill (t_C)
TA00	infinite on startup and standstill(t_C)
TD00	infinite on standstill and minimum activation time (t_A)

Threshold voltage for motor at standstill

	20-500 mV (standard)
UR1	45-750 mV

Features approved by UL

Rated supply voltage (U_n):	24 … 230 Vac/dc; 50…60 Hz
Power consumption AC:	< 9 VA
Power consumption DC:	< 2 W
Motor input:	up to 600 V
Output relay:	C300 pilot duty

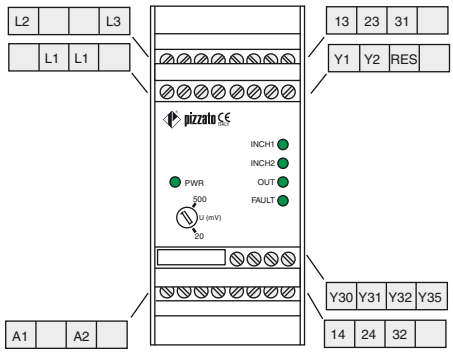
Notes:
- Suitable for use in environment with pollution degree 2
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.

Stock items

CS AM-01VE01

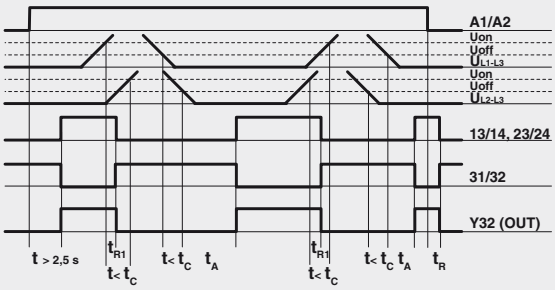
Safety module CS AM-0

Pin assignment

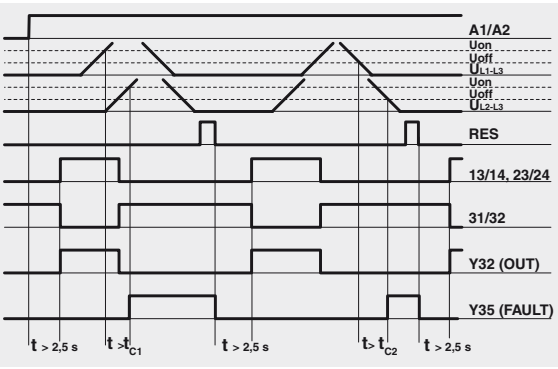


Function diagrams

Normal operation

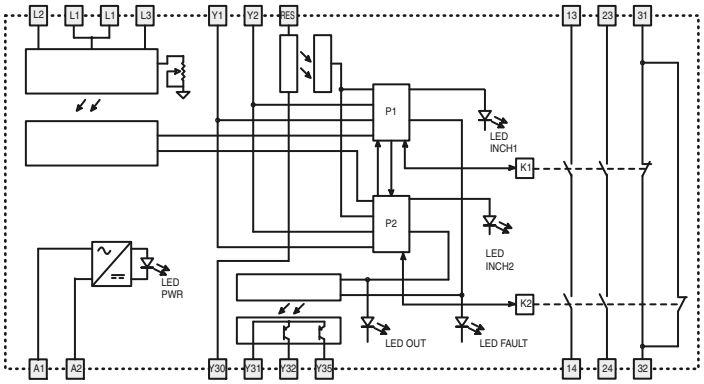


Reset (RES) operation



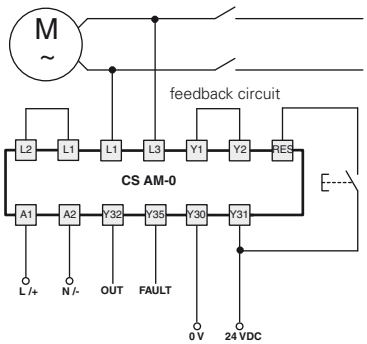
Legend:
- t_C: simultaneity time
- t_A: response time
- t_{R1}: release time
- t_R: release time in absence of power supply

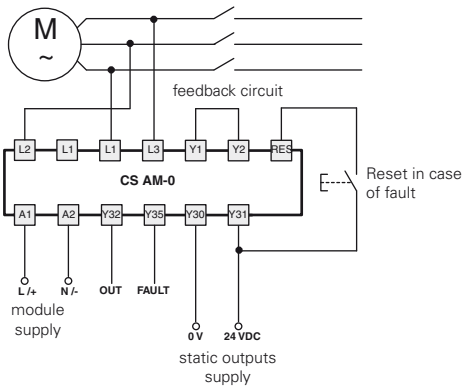
Internal block diagram



Input configuration

Single-phase motor	Three-phase motor





In case of star/delta starting, connect the module to the ends of a single winding

For dc motors connect + with L1 and - with L3.

The diagram does not show the exact position of the terminals in the product

Items with code on **green** background are stock items

CS ME-01 expansion module

Expansion module with output contacts

Main features

- For safety applications up to SIL CL 3/PL e
- Possibility of control with one or two channels
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- Output contacts:
  5 NO safety contacts,
  1 NC auxiliary contact,
  1 NC feedback contact
- Supply voltage: 24 Vac/dc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1 (see base module category)
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Response time t_A:	< 40 ms
Release time in absence of power supply t_R:	< 50 ms

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	5 NO safety contacts, 1 NC auxiliary contact, 1 NC feedback contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	72 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

Code structure

CS ME-01V024

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
024	24 Vac/dc

Stock items

CS ME-01V024

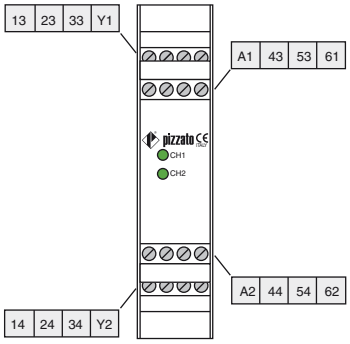
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Power consumption AC:	< 5 VA
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

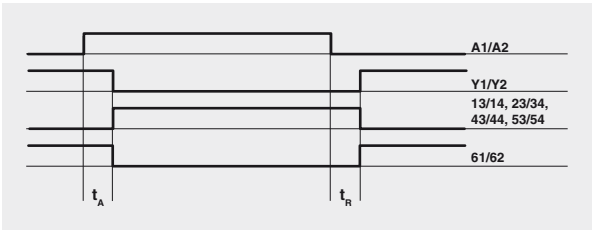
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

CS ME-01 expansion module

Pin assignment

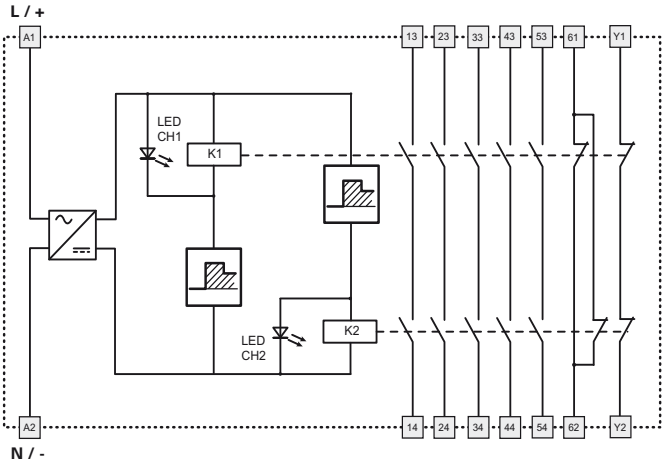


Function diagram



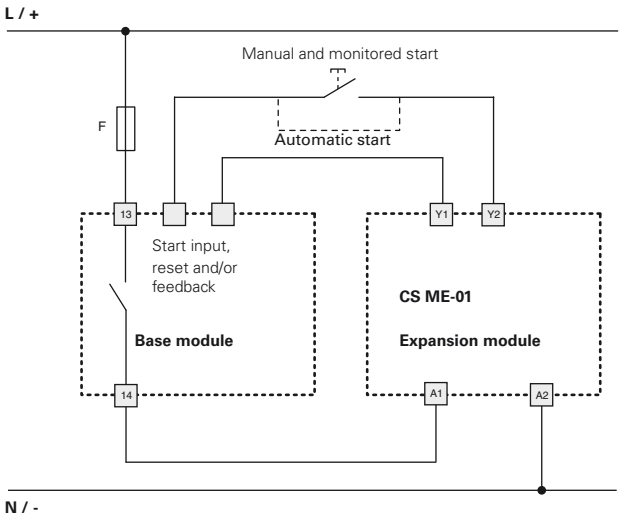
Legend:
t_A: response time
t_R: release time in absence of power supply

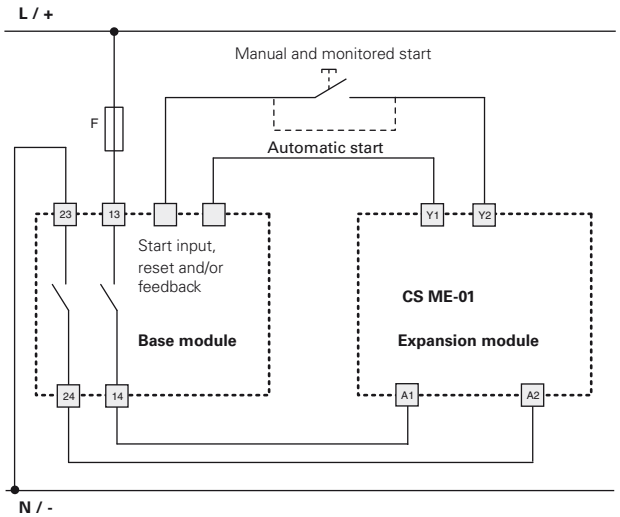
Internal block diagram



Input configuration

Single channel control	Double channel control

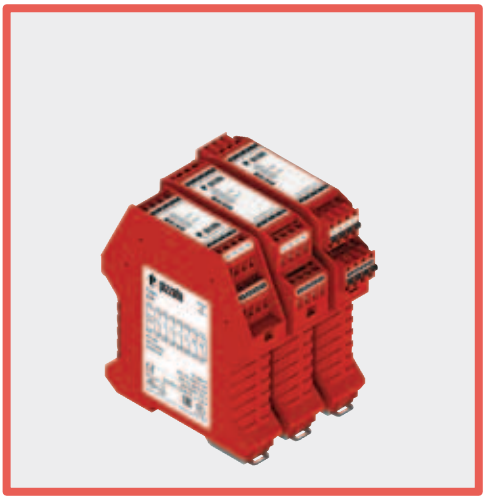




The diagram does not show the exact position of the terminals in the product

Items with code on **green** background are stock items

CS ME-02 expansion module



Expansion module with output contacts

Main features

- For safety applications up to SIL CL 3/PL e
- Possibility of control with one or two channels
- Connection of input channels of opposite potentials
- Reduced housing width of 22.5 mm
- Output contacts:
  4 NO safety contacts,
  2 NC auxiliary contacts,
  1 NC feedback contact
- Supply voltage: 24 Vdc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.B.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1 (see base module category)
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.3 kg

Supply

Rated supply voltage (U_n):	24 Vdc
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption DC:	< 2 W

Control circuit

Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC times:	Response time > 100 ms, release time > 3 s
Maximum resistance per input:	≤ 50 Ω
Response time t_A:	< 100 ms
Release time in absence of power supply t_R:	< 60 ms

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	4 NO safety contacts, 2 NC auxiliary contacts, 1 NC feedback contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	64 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

Code structure

CS ME-02VU24

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Supply voltage	
U24	24 Vdc

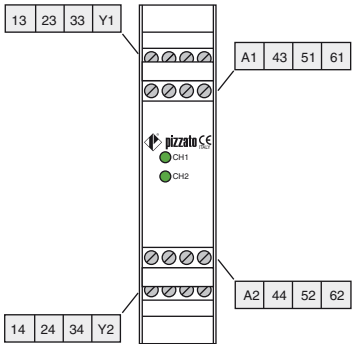
Features approved by UL

Rated supply voltage (U_n):	24 Vdc
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

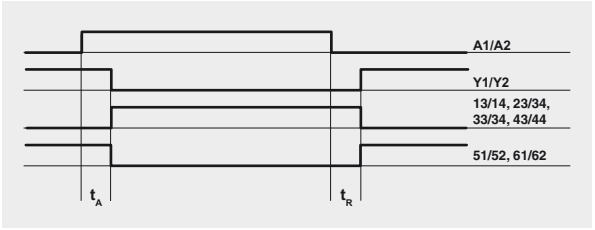
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

CS ME-02 expansion module

Pin assignment

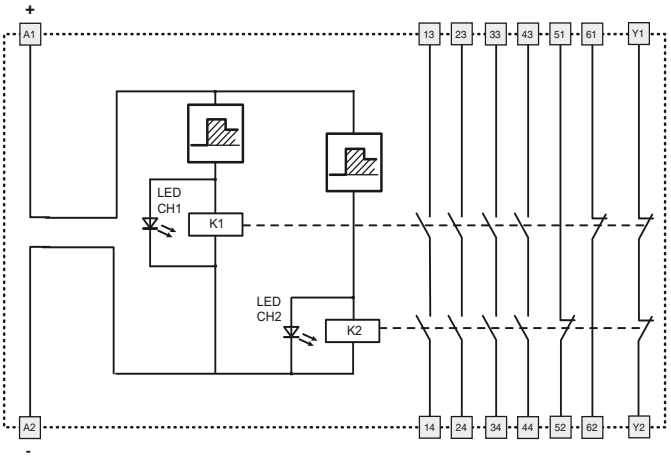


Function diagram



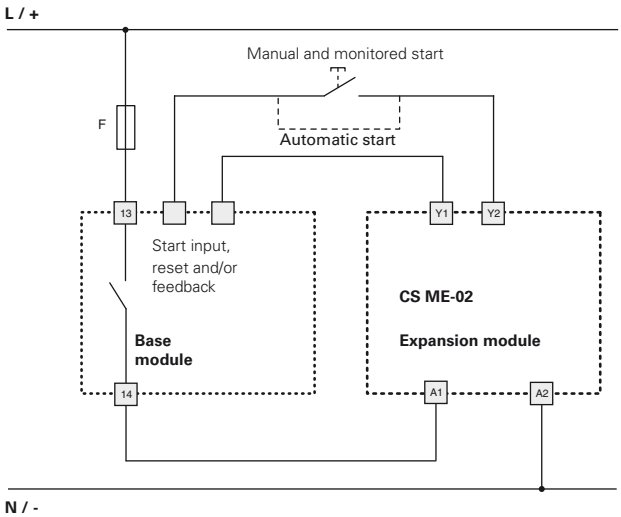
Legend:
t_A: response time
t_R: release time in absence of power supply

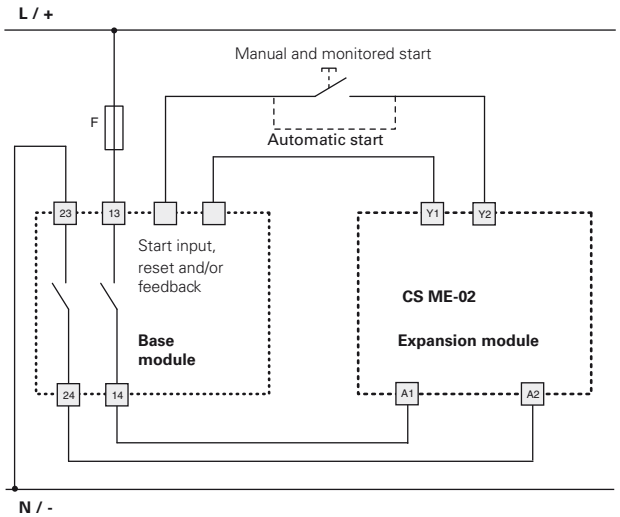
Internal block diagram



Input configuration

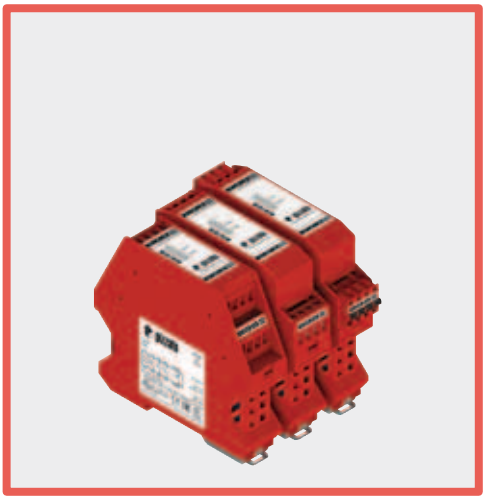
Single channel control	Double channel control





The diagram does not show the exact position of the terminals in the product

CS ME-03 expansion module



Expansion module with output contacts

Main features

- For safety applications up to SIL CL 3/PL e
- Module for semiconductor outputs (light barriers type 2 and 4)
- 2 OSSD inputs
- Reduced housing width of 22.5 mm
- Output contacts:
  3 NO safety contacts,
  1 NC feedback contact/EDM
- Supply voltage: 24 Vdc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design D

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1 (dependent on semiconductor outputs)
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vdc
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption DC:	< 2 W
Consumption at start:	< 3 W

Control circuit

Response time t_A:	< 40 ms
Release time t_{R1}:	< 15 ms

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	3 NO safety contacts, 1 NC feedback contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	36 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

Code structure

CS ME-03VU24

Connection type		Supply voltage	
V	Screw terminals	**U24**	24 Vdc
M	Connector with screw terminals		
X	Connector with spring terminals		

Stock items

CS ME-03VU24

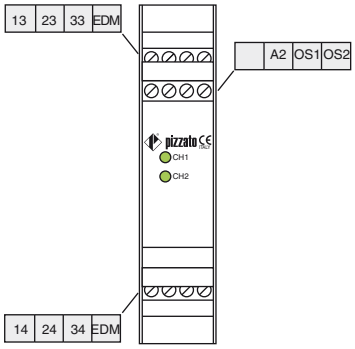
Features approved by UL

Rated supply voltage (U_n):	24 Vac/dc; 50…60 Hz
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

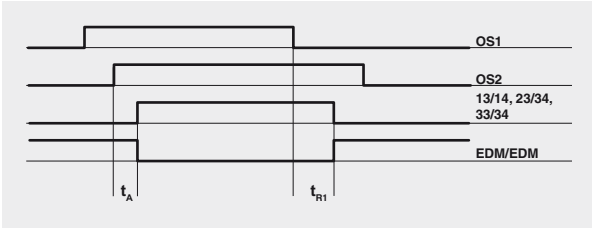
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

CS ME-03 expansion module

Pin assignment

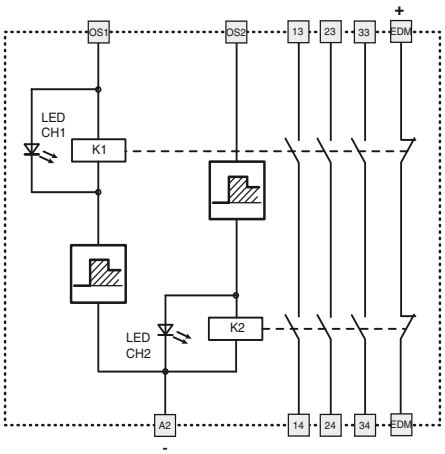


Function diagram



Legend:
t_A: response time
t_{R1}: release time

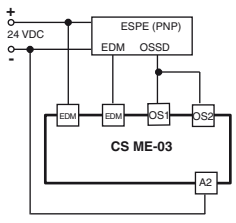
Internal block diagram

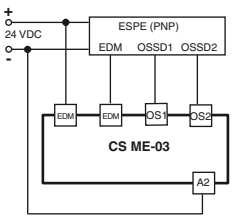


Application example on page 253.

Input configuration

Semiconductor outputs (e.g. light barriers)	
1 channel	2 channels

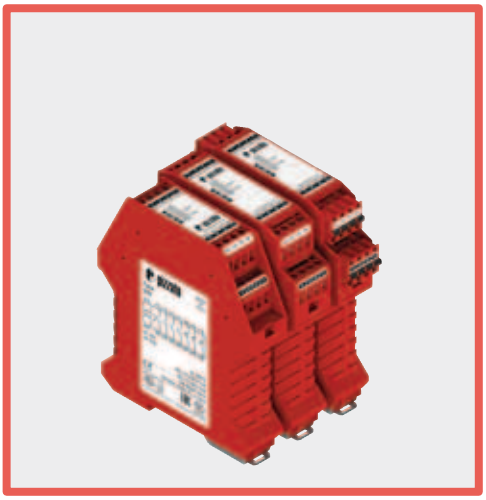




The diagram does not show the exact position of the terminals in the product

Items with code on **green** background are stock items

CS ME-20 expansion module



Expansion module with delayed output contacts at de-energizing

Main features

- For safety applications up to SIL CL 3/PL e
- Possibility of control with one or two channels
- 4 delay times 0.5 - 1 - 2 and 3 s
- Reduced housing width of 22.5 mm
- Output contacts:
  4 NO safety contacts,
  2 NC auxiliary contacts,
  1 NC feedback contact
- Supply voltage: 24 Vdc

Utilization categories

Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing

Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 295, design A

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1 (see base module category)
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.2 kg

Supply

Rated supply voltage (U_n):	24 Vdc
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption DC:	< 2 W

Control circuit

Maximum resistance per input:	≤ 50 Ω
Response time t_A:	< 120 ms
Release time in absence of power supply t_R:	see Code structure

In compliance with standards:

EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	4 NO safety contacts, 2 NC auxiliary contacts, 1 NC feedback contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	64 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

Code structure

CS ME-20VU24-TF1

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Release time in absence of power supply (t_R)	
TF0.5	0.5 s fixed time
TF1	1 s fixed time
TF2	2 s fixed time
TF3	3 s fixed time

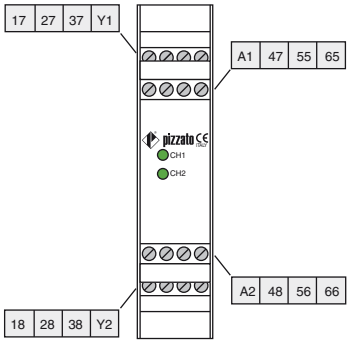
Features approved by UL

Rated supply voltage (U_n):	24 Vdc
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

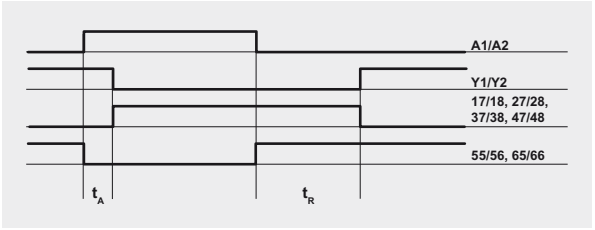
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

CS ME-20 expansion module

Pin assignment

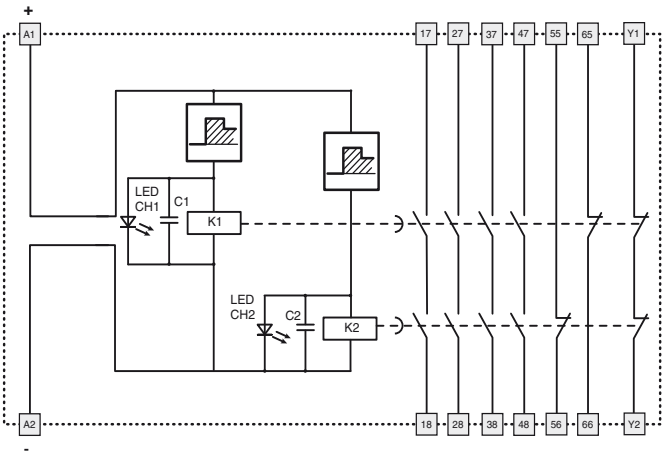


Function diagram



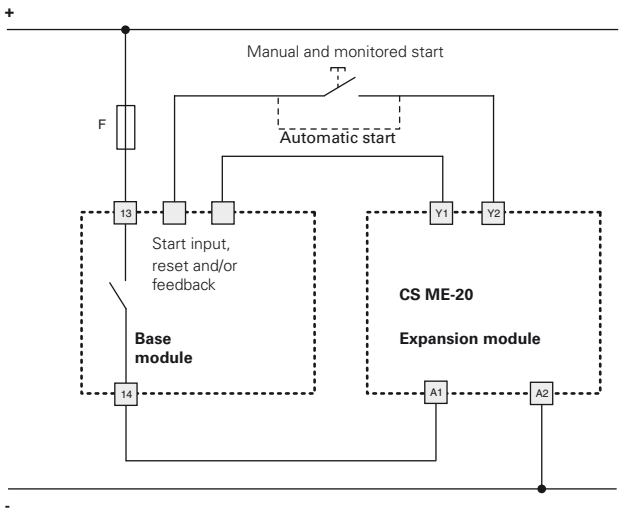
Legend:
t_A: response time
t_R: release time in absence of power supply (see "Code structure")

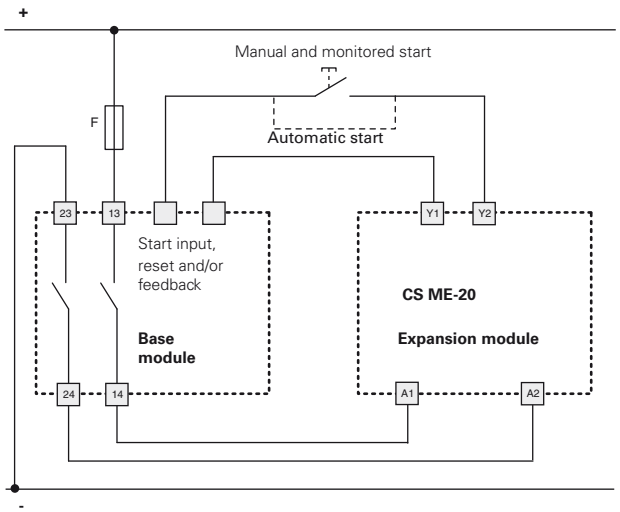
Internal block diagram



Input configuration

Single channel control	Double channel control





The diagram does not show the exact position of the terminals in the product

CS ME-30 / CS ME-31 expansion module

Expansion module with delayed output contacts at de-energizing

Main features
- For safety applications up to SIL CL 3/PL e
- Possibility of control with one or two channels
- Fixed or adjustable delay times
- 45 mm housing
- Output contacts:
  4 NO safety contacts,
  2 NC auxiliary contacts,
  1 NC feedback contact
- Supply voltage: 24 Vdc

Utilization categories
Alternating current: AC15 (50…60 Hz)
Ue (V) 230
Ie (A) 3
Direct current: DC13 (6 oper. cycles/min.)
Ue (V) 24
Ie (A) 4

Quality marks and certificates:

EC type examination certificate: IMQ CP 432 DM
UL approval: E131787
CCC approval: 2013010305640211
EAC approval: RU C-IT.АД35.В.00454

Compliance with the requirements of:
Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Technical data

Housing
Polyamide housing PA 66, self-extinguishing V0 acc. to UL 94

Protection degree:	IP40 (housing), IP20 (terminal strip)
Dimensions:	see page 296, design C

General data

SIL CL:	up to SIL CL 3 acc. to EN 62061
Performance Level (PL):	up to PL e acc. to EN ISO 13849-1
Safety category:	up to cat. 4 acc. to EN ISO 13849-1 (see base module category)
Safety parameters:	see page 349
Ambient temperature:	-25°C…+55°C
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Pollution degree:	external 3, internal 2
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	250 V
Overvoltage category:	II
Weight:	0.4 kg

Supply

Rated supply voltage (U_n):	24 Vdc
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Power consumption DC:	< 2 W

Control circuit

Maximum resistance per input:	≤ 50 Ω
Response time t_A:	< 200 ms
Release time in absence of power supply t_R:	see Code structure

In compliance with standards:
EN 60204-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 60664-1, EN 60947-1, EN ISO 13849-1, EN ISO 13849-2, EN 62061, UL 508, CSA C22.2 n° 14-95

Output circuit

Output contacts:	4 NO safety contacts, 2 NC auxiliary contacts, 1 NC feedback contact
Contact type:	forcibly guided
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230/240 Vac; 300 Vdc
Max. current per contact:	6 A
Conventional free air thermal current (Ith):	6 A
Max. total current Σ Ith^2:	64 A^2
Minimum current:	10 mA
Contact resistance:	≤ 100 mΩ
External protection fuse:	4 A

Code structure

CS ME-30VU24-TF1

Fixed or adjustable time	
0	fixed time
1	adjustable time

Connection type	
V	Screw terminals
M	Connector with screw terminals
X	Connector with spring terminals

Release time in absence of power supply (t_R)	
TF1	1 s fixed time (CS ME-30 only)
...	.....
TF12	12 s fixed time (CS ME-30 only)
TS12	Time adjustable from 1 to 12 s in increments of 1 s (CS ME-31 only)

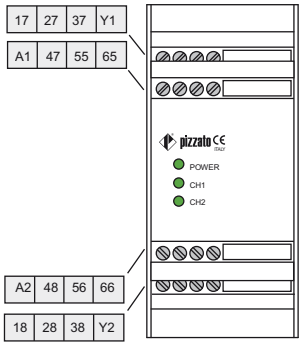
Features approved by UL

Rated supply voltage (U_n):	24 Vdc
Power consumption DC:	< 2 W
Maximum switching voltage:	230 Vac
Max. current per contact:	6 A
Utilization category	C300

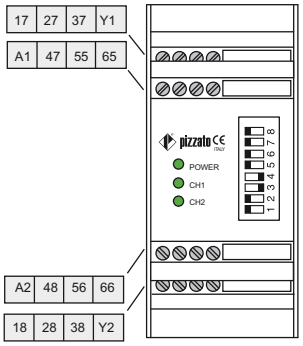
Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

CS ME-30 / CS ME-31 expansion module

Pin assignment

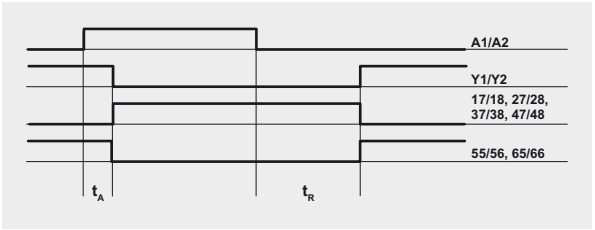


CS ME-30



CS ME-31

Function diagram

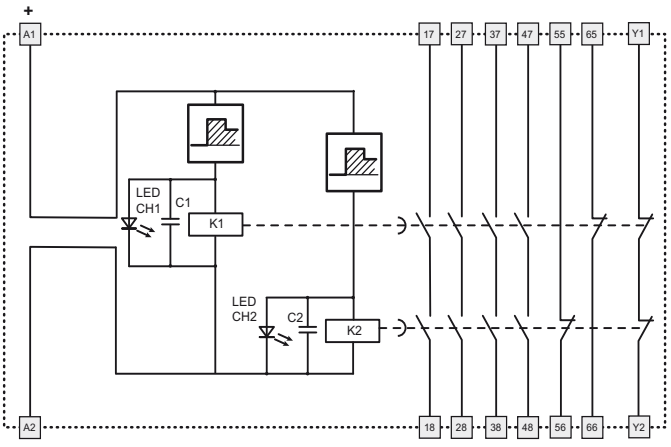


Legend:
t_A: response time
t_R: release time in absence of power supply (see "Code structure")

Release time selection t_R (CS ME-31 only)

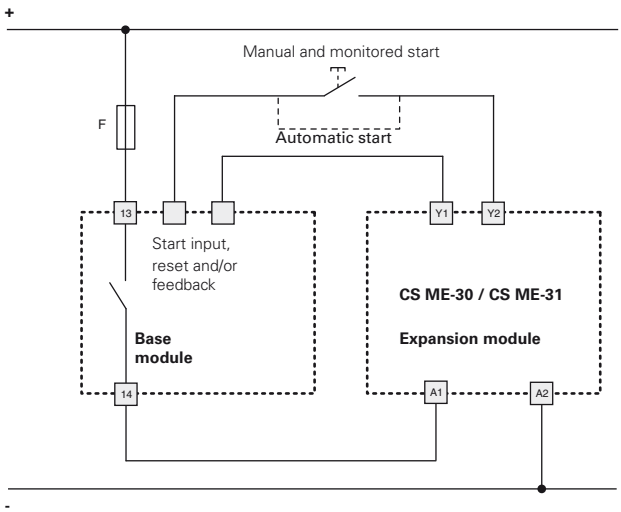
DIP SWITCH	t_R (s)
ON / OFF	1
ON / OFF	2
ON / OFF	3
ON / OFF	4
ON / OFF	5
ON / OFF	6
ON / OFF	7
ON / OFF	8
ON / OFF	9
ON / OFF	10
ON / OFF	11
ON / OFF	12

Internal block diagram

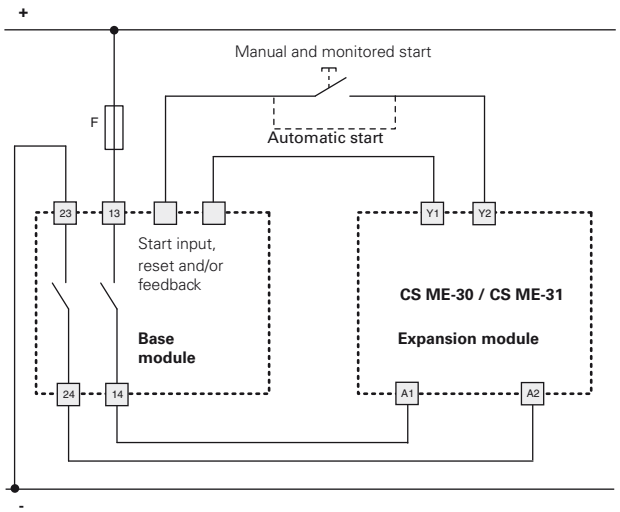


Input configuration

Single channel control

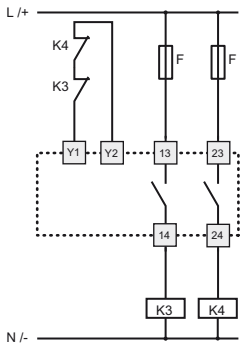


Double channel control



The diagram does not show the exact position of the terminals in the product

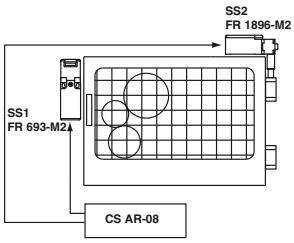
External contactors for increasing the number and the load capacity of the contacts

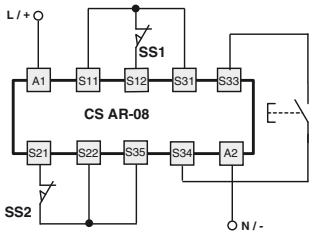


If necessary the number and the load capacity of output contacts can be increased by using expansion modules or contactors with forcibly guided contacts. For control of the external contactors, a NC contact of each relay is connected to the safety module feedback circuit between the start button terminals.

The following installation examples make use of the CS AR-08•••• module. For the use of other modules, see features, compatibility and internal block diagram of each single module.

Application examples: monitoring of movable guards, up to category 4 according to EN ISO 13849-1

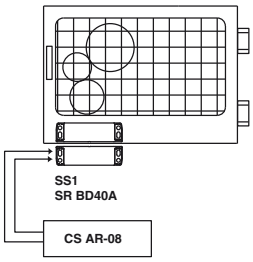


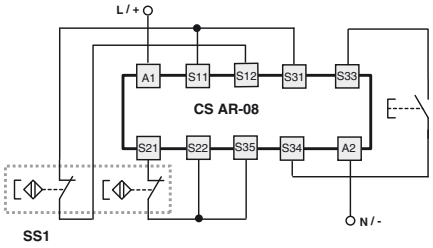


Compatible modules
CS AR-01•••• CS AR-02••••
CS AR-04•••• CS AR-05••••
CS AR-06•••• CS AR-07••••
CS AR-08•••• CS AT-0•••••
CS AT-1••••• CS AT-3•••••
CS AR-91•024

Monitoring of one movable guard through two switches with different technology. System in safety category 4.

Application examples: monitoring of safety magnetic sensors, up to category 4 according to EN ISO 13849-1

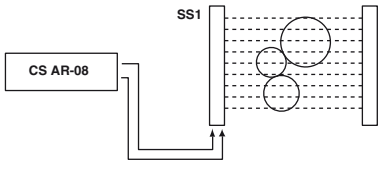


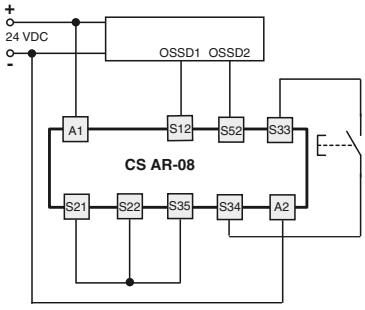


Compatible modules
CS AR-01•E02 CS AR-02•E02
CS AR-04•024 CS AR-05••••
CS AR-06•••• CS AR-08••••
CS AT-0••••• CS AT-1•••••
CS AT-3••••• CS AR-91•024

Monitoring of one movable guard through one coded magnetic sensor. System in safety category 4.

Application examples: light barrier monitoring, up to category 4 according to EN ISO 13849-1

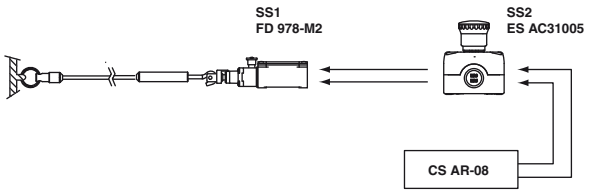


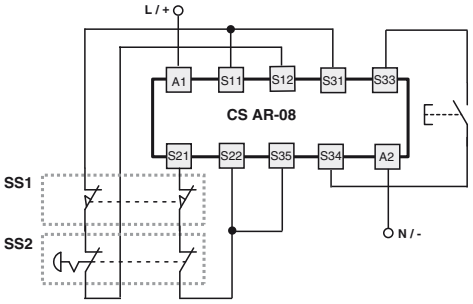


Compatible modules
CS AR-05•••• CS AR-06••••
CS AR-08•••• CS AT-0•••••
CS AT-1•••••

Semiconductor outputs (e.g. light barriers) with two OSSD outputs. System in safety category 2 or 4 according to the barrier.

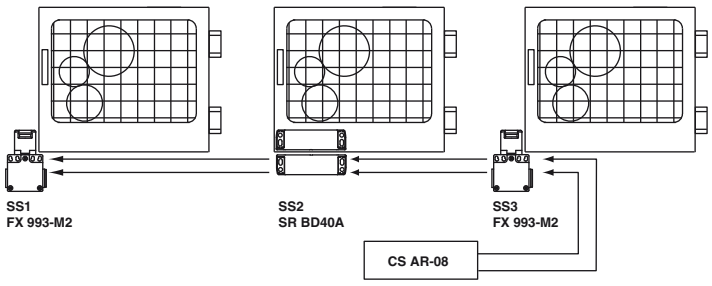
Application examples: monitoring of a switch and a button for emergency stop, up to cat. 3 according to EN ISO 13849-1

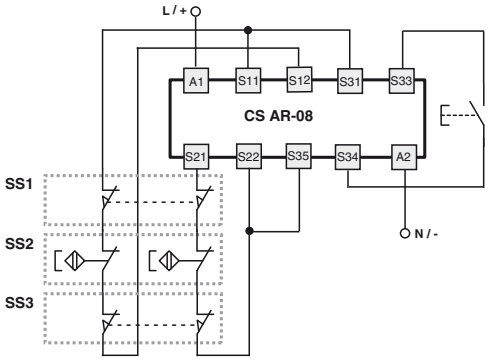




Compatible modules
CS AR-01•••• CS AR-02•••• CS AR-04•••• CS AR-05••••
CS AR-06•••• CS AR-07•••• CS AR-08•••• CS AR-20••••
CS AR-21•••• CS AR-22•••• CS AR-23•••• CS AR-24••••
CS AR-25•••• CS AT-0••••• CS AT-1••••• CS AT-3•••••
CS AR-91•024

Application examples: monitoring of a series of switches and magnetic sensors, up to cat. 3 according to EN ISO 13849-1



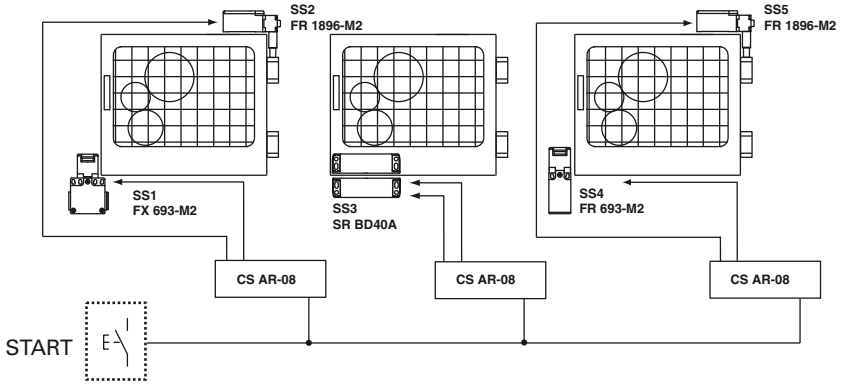


Compatible modules
CS AR-01•E02 CS AR-02•E02 CS AR-04•024 CS AR-05••••
CS AR-06•••• CS AR-08•••• CS AT-0••••• CS AT-1•••••
CS AT-3••••• CS AR-91•024

Monitoring of several guards through switches and magnetic sensors. System in category 3. For the calculation of the diagnostic coverage, see ISO TR24119.

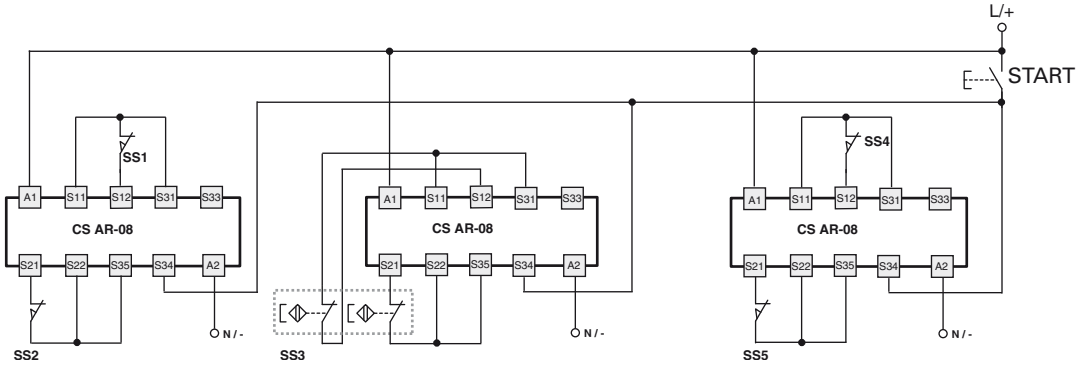
- The use of just one switch per guard requires that it be possible to exclude the possibility of mechanical breakage of the switch during the risk assessment.
- The sensor must have two channels and be coded.
- If available, verify the provisions of the Type C standard for your own machine.

Application examples: possibility of parallel module reset, up to category 4 according to EN ISO 13849-1

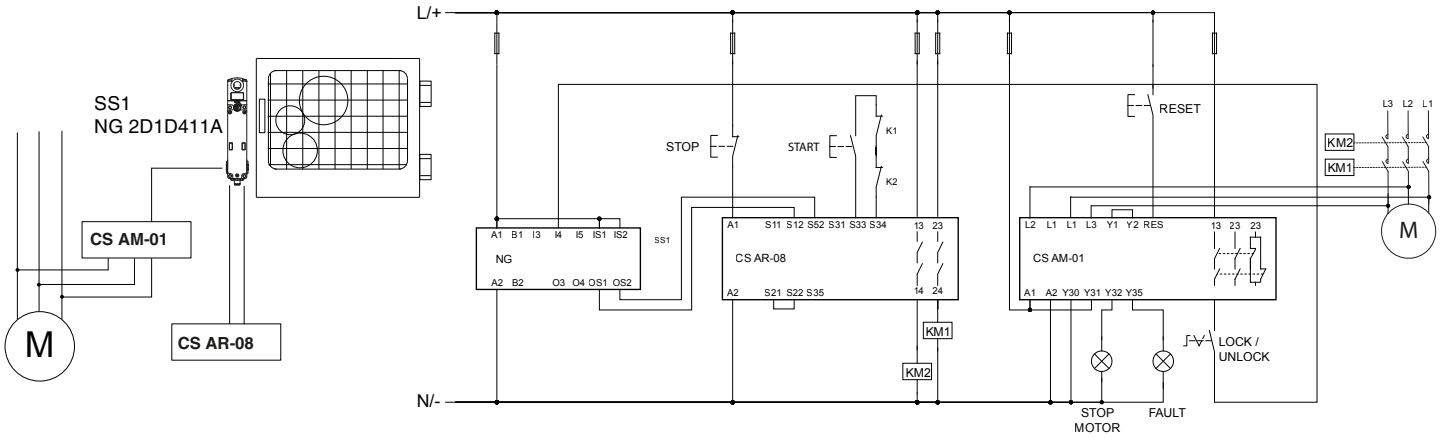


Monitoring of several guards through different technologies. System in safety category 4. The example shows the possibility of a contemporaneous reset of several modules via a single contact of a button.

Compatible modules
CS AR-04•024 CS AR-05•024 CS AR-06•024
CS AR-08•024 CS AR-91•024

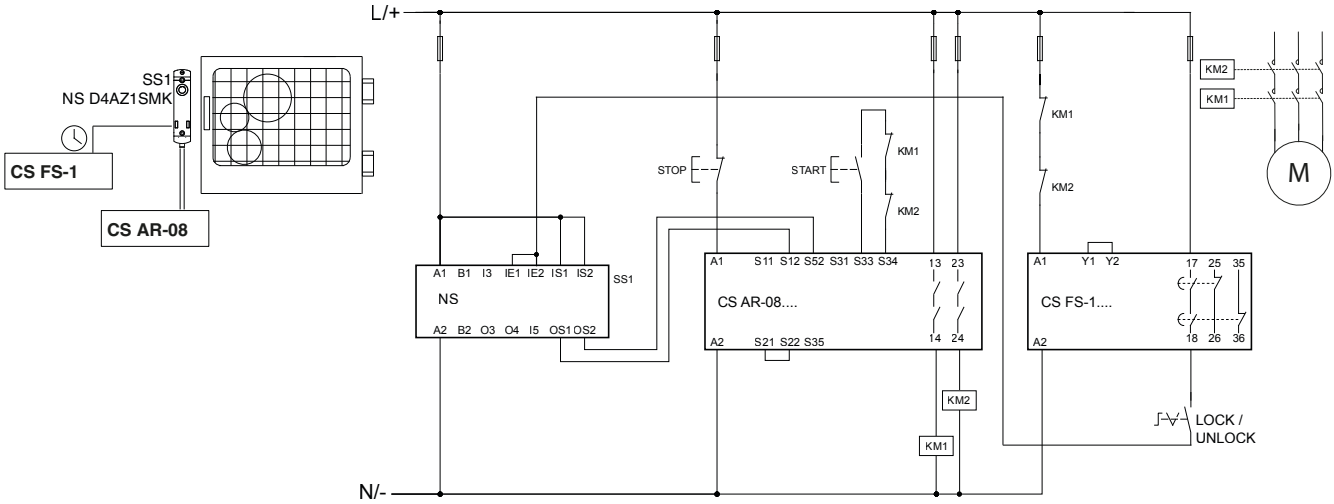


Movable guard monitoring in category 4 up to PL e acc. to EN ISO 13849-1
Guard interlock in category 2 up to PL d acc. to EN ISO 13849-1



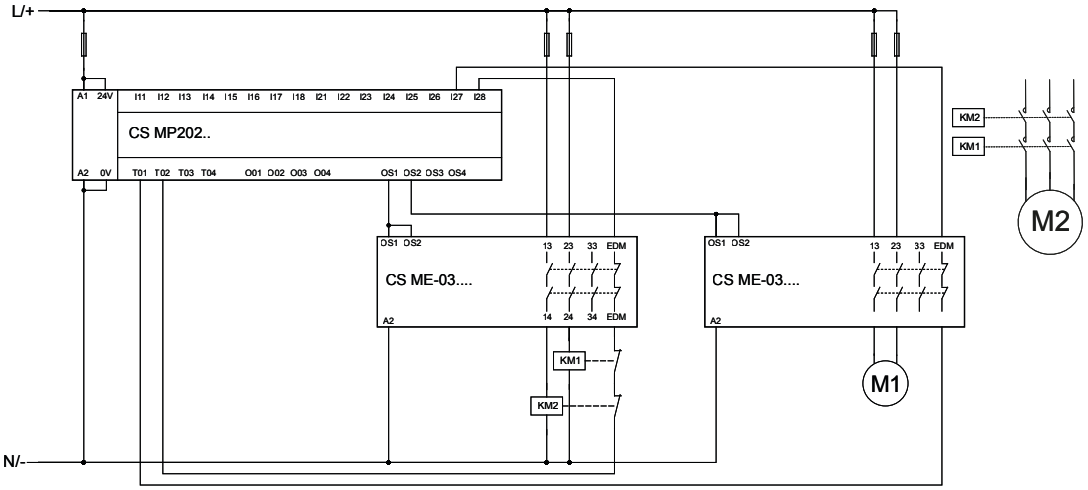
Guard monitoring and interlock by means of interlocking device with RFID technology in category 4, PL e SIL3.
Release command enabled by the safety module for standstill monitoring.

Movable guard monitoring in category 4 up to PL e acc. to EN ISO 13849-1
Guard interlock in category 2 up to PL d acc. to EN ISO 13849-1



Guard monitoring and interlock by means of interlocking device with RFID technology in category 4, PL e SIL3.
Release command enabled by the safety timer.

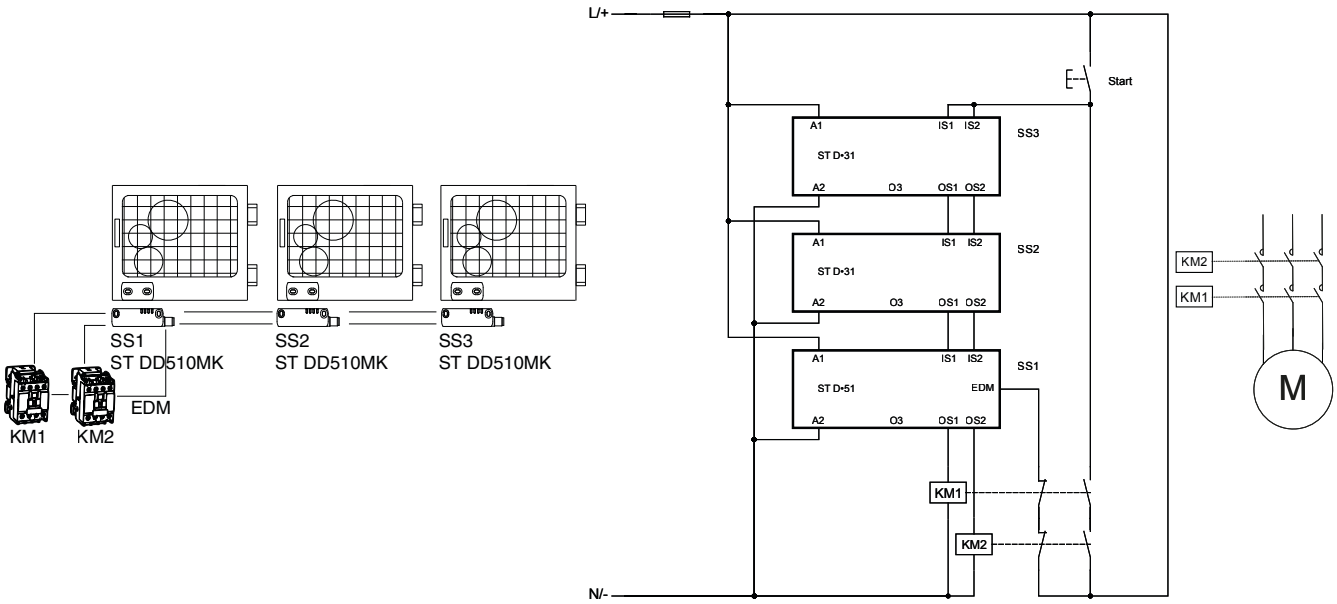
Connection of two expansion modules to the PNP safety outputs of a programmable module of the GEMNIS series



The circuit diagram only shows the connection of the expansion modules; the connection of inputs and other outputs was intentionally omitted.

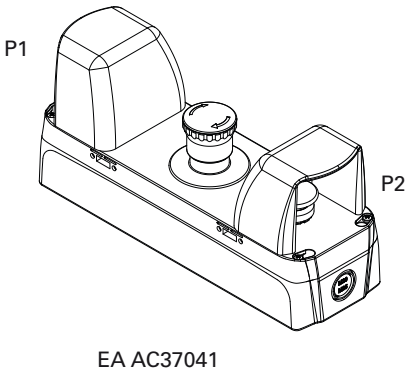
Note: Motor M1 with load according to the utilisation categories of the contacts of the CS ME-03 module.
Note: The connection between OS1 of module CS MP-202 and inputs OS1 and OS2 of module CS ME-03 can be regarded as fault-excluded since both are located in the same housing. See table D.4, item D.5.2 of EN ISO 13849-2.

Monitoring of guards by means of sensors with RFID technology in series connection

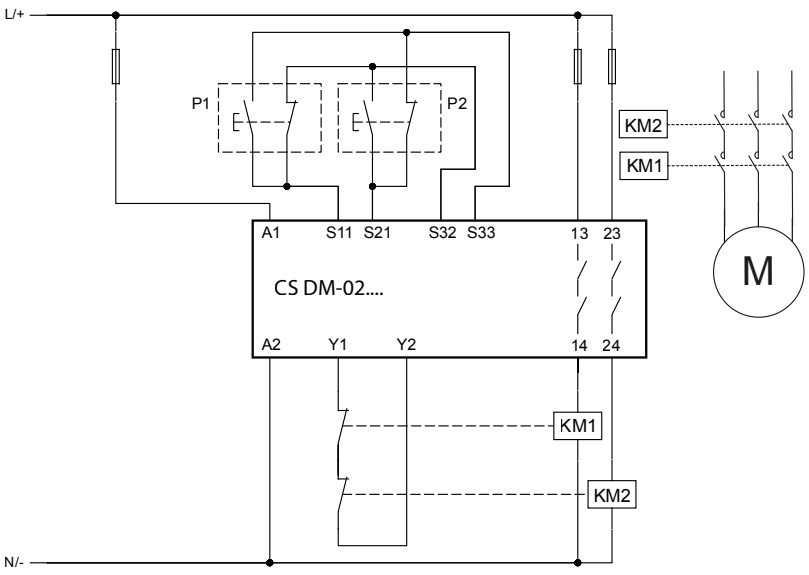


Direct monitoring of the status of the contactors via the EDM input of the last sensor in the series connection

Category IIIC two-hand control acc. to EN574



EA AC37041



CS MP programmable multifunction safety modules

Introduction

GEMNIS

A **Gemnis** series module is a programmable safety devices, which allows several safety functions to be carried out simultaneously. This product series has been developed specifically to meet the needs of machinery manufacturers for machines with a low to average number of safety functions. As an indication, these modules can manage small applications which are equivalent to the functions carried out by 3 to 4 traditional electromechanical safety modules, up to circuits with dozens of inputs.

Gemnis series safety modules can implement safety circuits with a safety category of up to SIL 3 acc. to EN 62061, PL e and category 4 acc. to EN ISO 13849-1.

The **Gemnis** series of safety modules has been updated to **version 11** which introduces new functions and improved hardware- and software-level performance.

This update considerably increases the application potential of these products.

The **Gemnis Studio** program is a graphic development environment for the creation, simulation and debugging of programs that are uploaded to the corresponding modules of the Gemnis family.

This software is licensed to users wishing to program these modules, subject to prior registration at **www.gemnis.com**.

You can download the new **Gemnis Studio** software version (**Gemnis Studio 11**) from the site, which will allow you to program both current, **Gemnis K11**-designated modules, as well as previous ones.

General features of safety modules

Gemnis series modules can manage all of the following safety device types:

- Mechanical safety switches
- Switches with solenoid for guard interlock
- Magnetic safety sensors
- Safety light barriers or optical safety sensors (category 4)
- Safety sensors
- Mushroom buttons for emergency stop
- Rope switches for emergency stop
- Safety mats or safety bumpers with 4-wire technology
- Category IIIA or IIIC two-hand controls
- Safety selector switches
- Enabling devices
- Analogue sensors 4-20 mA (Gemnis Studio 11)
- 0-4 kHz frequency signals (Gemnis Studio 11)
- Dual-beam muting systems (Gemnis Studio 11).

This modules are also equipped with functionality allowing you to also implement:

- Safety timers
- Detection of various types of faults in safety devices or their connections
- Verification of the module's internal temperature limit values
- Status communication via USB port.

Finally, Gemnis series modules can:

- Manage up to eight different electronic safety outputs or four relay outputs
- Manage various signalling outputs (not safety-related)
- Status information and data settings via the USB communication port.

Gemnis design safety modules can implement safety circuits with up to SIL CL3 acc. to EN ISO 62061, PL e and category 4 acc. to EN ISO 13849-1.

Website

This product line is supported online via the **www.gemnis.com** website, where you can:

- Download the gemnis studio installation package (following registration)
- Download support files
- Get the most up to date version of the instruction manual
- Get examples and other support information which will be added over time
- Watch videos illustrating Gemnis Studio 11 program operation.

Free Software DOWNLOAD

Hardware structure of the modules

Gemnis design modules are created with increased flexibility - even at the hardware level. These products are made up of various electronic circuit boards which are sold in various combinations, but which are always contained in a single housing and with one unique product code.
The Gemnis line modules have a general redundant and self monitoring type structure, they are controlled by a pair of processors which simultaneously run the application program and constantly monitor their operation and system integrity in parallel.

Each module is supplied in a single housing, of the minimum width required to house the boards which make up the module. 45 mm to 90 mm wide housings are available. The customer does not need to worry therefore about wiring the various parts.

The USB port integrated within the module is used for programming and debugging of the Gemnis Studio program module. Once a module is programmed, you can also use the USB port for communicating with a PC installed on the machine, and for the exchange of information relating to the module state.

The main hardware innovations introduced to version 11 by the safety module update are the following:

- Ability to manage programs up to 4 times larger
- The ability, with new dedicated modules, to manage analogue and/or speed inputs
- Models with 8 electronic safety outputs
- New module configurations available (see following table).

Module	Inputs type I	Inputs type J	Inputs type C	Inputs type F	Test signals T	OS safety outputs	O signalling outputs	Port	Width (mm)	Page
CS MP201M0	8	-	-	-	8	3NO	4	USB	45	261
CS MP202M0	16	-	-	-	4	4 PNP	4	USB	45	262
CS MP203M0	12	-	-	-	4	3NO + 1NO	4	USB	45	263
CS MP204M0	12	-	-	-	4	3NO	4	USB	45	264
CS MP205M0	4	4	-	4	4	4 PNP	4	USB	45	265
CS MP206M0	8	-	-	-	4	4 PNP	12	USB	45	266
CS MP207M0	4	-	2	-	4	4 PNP	4	USB	45	267
CS MP208M0	16	-	-	-	4	8 PNP	-	USB	45	268
CS MP301M0	24	-	-	-	8	3NO	4	USB	67.5	269
CS MP302M0	24	-	-	-	12	4 PNP	4	USB	67.5	270
CS MP303M0	32	-	-	-	4	4 PNP	4	USB	67.5	271
CS MP304M0	28	-	-	-	4	3NO + 1NO	4	USB	67.5	272
CS MP305M0	24	-	-	-	4	4 PNP	12	USB	67.5	273
CS MP306M0	20	-	-	-	4	3NO + 1NO	12	USB	67.5	274
CS MP307M0	8	4	2	4	4	4 PNP	4	USB	67.5	275
CS MP308M0	24	-	-	-	4	8 PNP	8	USB	67.5	276
CS MP309M0	32	-	-	-	4	8 PNP	-	USB	67.5	277
CS MP401M0	40	-	-	-	4	4 PNP	12	USB	90	278
CS MP402M0	32	-	-	-	12	8 PNP	8	USB	90	279
CS MP403M0	40	-	-	-	4	8 PNP	8	USB	90	280

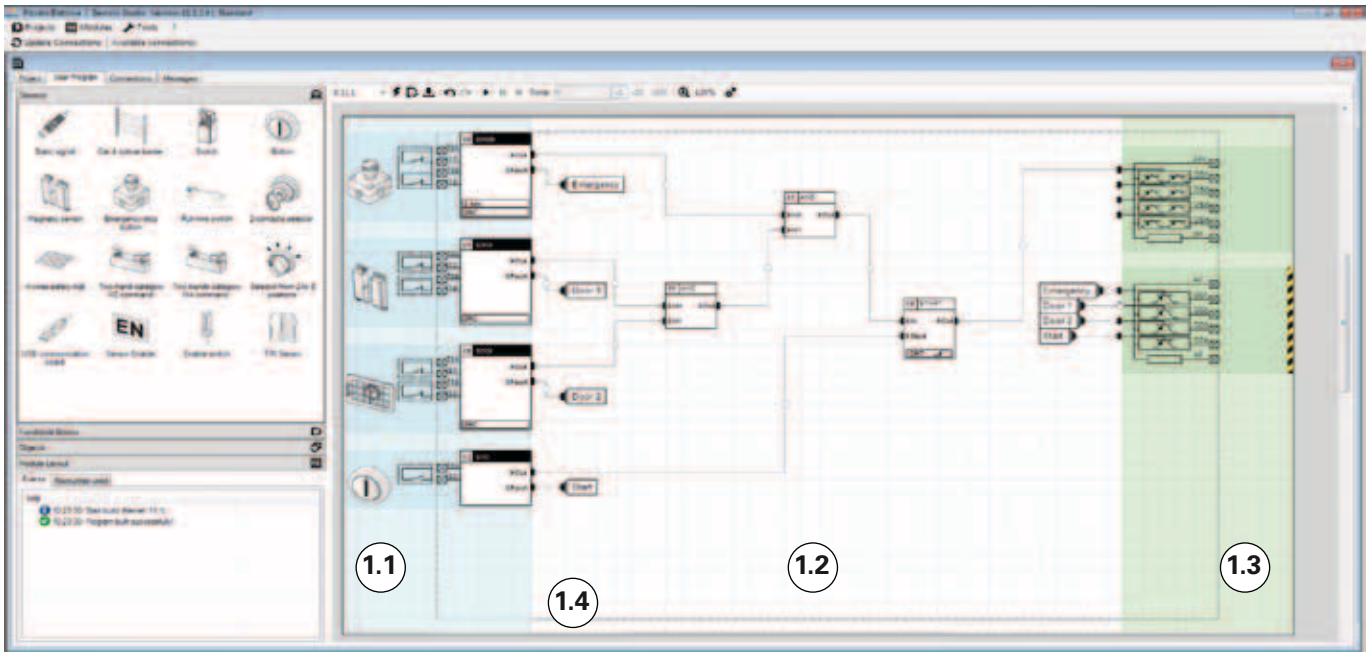
I = Digital inputs
J = Digital inputs, decoupled
C = Inputs for 4-20 mA analogue signals
F = Inputs for 0 … 4 kHz frequency signals

T = Test signals
OS = OSSD safety outputs (PNP)
nn = Relay safety outputs
O = signalling outputs (PNP)

Software Gemnis Studio

Gemnis Studio is software designed to allow the user to program a module belonging to the Gemnis line. This software has a graphical interface to visually display, in a natural and intuitive way, the assembly of operations that the application program will execute, once loaded to the module. Gemnis Studio allows you to attach supporting information and useful notes to the configuration information, for overall understanding of the program. Gemnis Studio also allows you to check correct application program operation prior to sending it to the module via the simulation.
Finally, Gemnis Studio allows you to carry out monitoring and detection operations, and to graphically represent the state of an active operational device in real time.

Desktop



The Gemnis Studio software has been designed with the objective of making Gemnis series module operation as immediate and visual as possible. With this aim, we decided to create a work environment – the Desktop – where, as far as possible, the user can amass all the information required to actually "view" and not just "imagine" the behaviour of the project under development. This is the reason we have made room for graphical object representations, of the physical characteristics of the module in use, and immediate interaction, by means of simulation, with the created program.
The desktop is the main user work area, the zone where the flow and processing to be applied to the data detected by the module are defined using the graphical program interface.

The desktop is divided into three parts:
1.1) the sensor zone
1.2) the functional block zone
1.3) the output zone

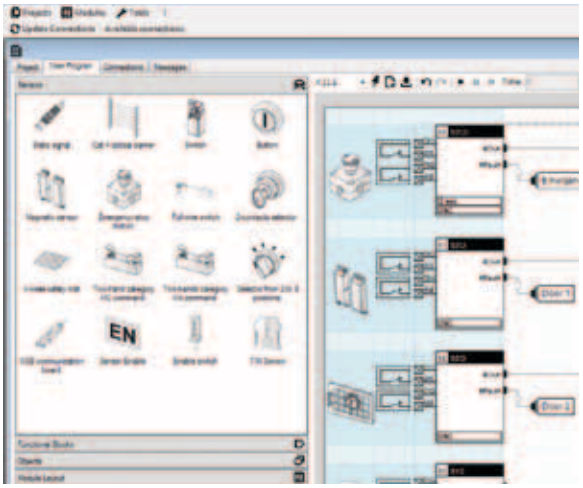
In the sensor zone (1.1) the user indicates the external device types connected to the module terminals, and all the parameters needed to define them.
In the output zone (1.3) all the output devices present in the selected module (relays, transistors etc.) are immediately shown.
In the function block zone (1.2) the user will enter all the logical functions needed to process the flow of data coming from the sensors, and will proceed to make the connections to transfer this data between the objects in the desktop and finally to the outputs.
The desktop includes a dotted box (1.4) which represents the area "occupied by the module", or, everything enclosed within the physical module, from terminals to code. The area outside this box, meanwhile, is occupied by images of the physical devices external to the module (switches, buttons, etc.), illustrating their expected internal structure and any description.
At the user's request, the desktop content is compiled and, provided there are no errors, it is translated into the application program. If a module is connected to the computer, you can immediately transfer the application program to it, and thereby check its effective operation in the field.
Otherwise it is possible to simulate application program operation directly on the desktop, by interacting with the sensors and evaluating their effects graphically.

Project
The collection of information required to configure a module and describe its activities is called a "Project". Using Gemnis Studio, the user can assemble the textual and graphical information required to elaborate and comment the functions which will be carried out by the program, once installed on a Gemnis line module.

Printing
Gemnis Studio can generate a Connection Report, which includes all connections to the module terminals, and a user Program Report, allowing you to print the Application Program.

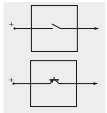
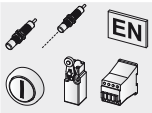
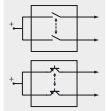
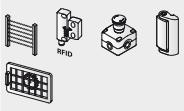
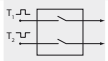
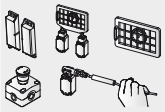
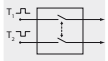
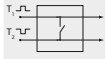
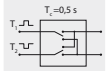
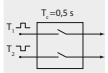
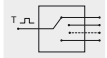
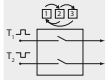
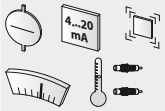
Password
The password gives the option of protecting a module's interaction capacity, and the ability to modify the project file.

Sensors

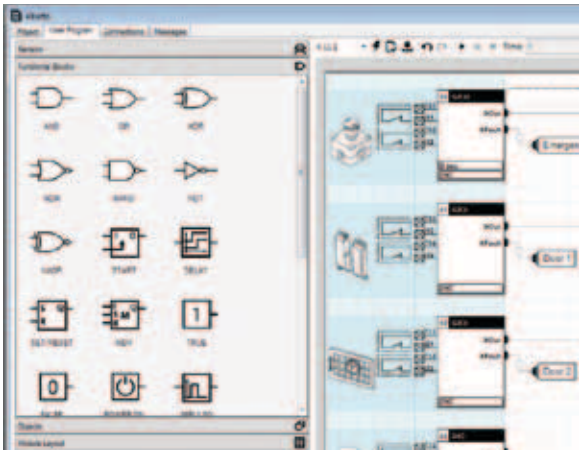


The sensor zone indicates the external device types which can be connected to the module terminals, and all the parameters needed to define them.
Each sensor created displays a view of the internal contact configuration and of how the contacts are connected to the module terminals, a box with the associated safety function, and the parameters selected for the function.
From the sensor panel, you can select a sensor using the mouse and drag it into the dedicated desktop area.
A full list of the available sensors follows.

Sensor list

Sensor type	Diagram	Examples
Sensor with 1 not testable channel		
Sensor with 2 not testable channels, with interdependent signals		
Sensor with 1 tested channel		
Sensor with 2 independent tested channels		
Sensor with 2 dependent tested channels		
Sensor with 2 always-closed tested channels, short circuit permitted between the channels		
Sensor with 2 tested channels which can be crossed		
Sensor with 2 tested channels which cannot be crossed		
Sensor with 2 to 8 tested channels which cannot be crossed and which may only be active one at a time		
Sensor with 2 tested channels which cannot be crossed and which must follow a very precise activation/deactivation sequence made up of three states: rest, work, stop		
Dual temperature sensor integrated in module		
Monitoring of a pair of analogue sensors with 4-20 mA output in both 2-wire and 3-wire versions		
Monitoring of a pair of signals with frequencies up to 4 KHz		

Function blocks

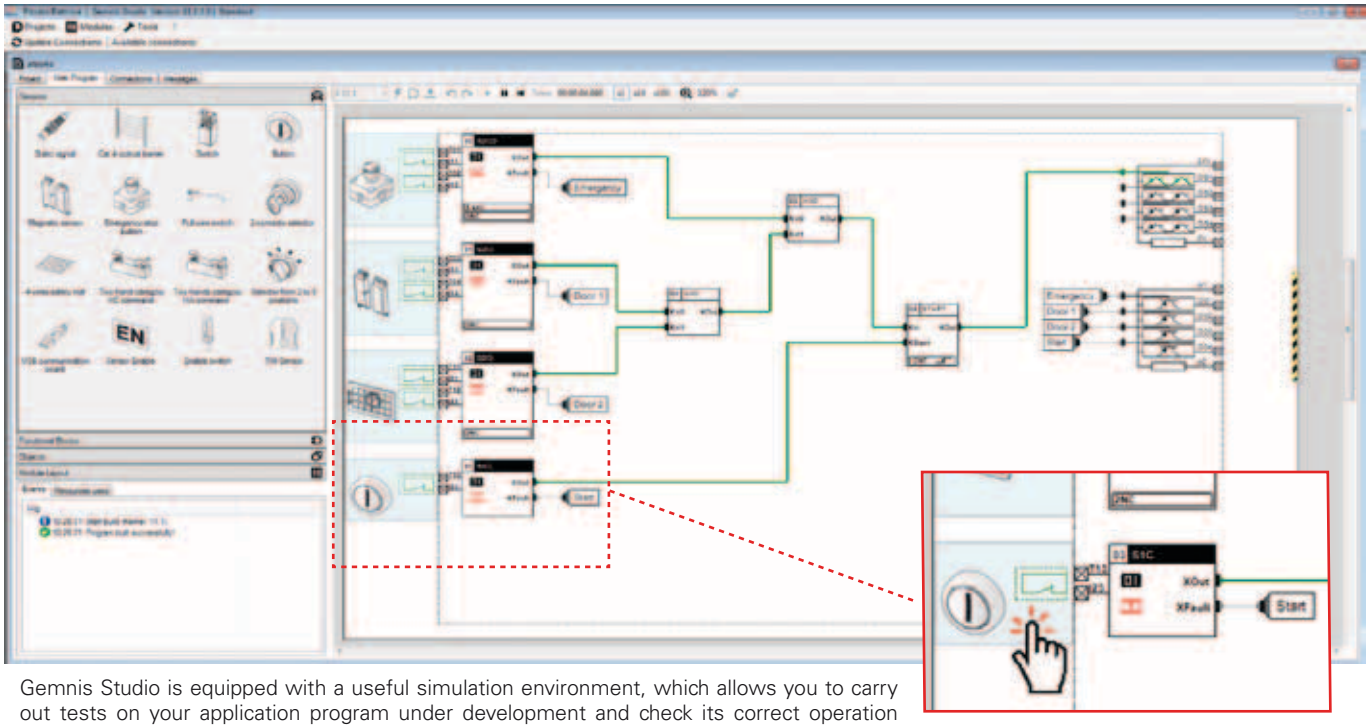


The function blocks represent all the logic functions required to process the data flow between sensors and outputs.
From the function block panel, a block can be selected using the mouse and dragged into the dedicated desktop area.
A full list of the available function blocks follows.

Function block list

- AND — Basic Boolean function
- OR — Basic Boolean function
- XOR — Basic Boolean function
- NOR — Basic Boolean function
- NAND — Basic Boolean function
- NOT — Basic Boolean function
- NXOR — Basic Boolean function
- START — Control function
- DELAY — Returns a signal of type Delay Off or Delay On
- SET/RESET — Basic logical memory function
- TRUE / FALSE — Basic Boolean function
- POWER ON — Active signal at first execution cycle
- PULSE — Returns a signal of type Delay Off on the preselected input edge
- CLOCK — Generates pulses at pre-established fixed intervals
- ERROR — Puts the module into Error State
- LKTBL — Conversion table between data of the same type
- GEQ/EQU/LEQ — Carries out a numerical comparison between two values of type B or W and displays the result in boolean format (X)
- MESSAGE — Transmits a message on the USB and COM ports
- COUNTER — Pulse counter
- TRIGGER — Detects the edge, either rising or falling, of an input signal
- FILTER — Filters a signal from interference for a duration lower than set time
- LDC — Upstream function block for monitoring of a door-locking system
- WAVE — Generates a waveform with variable period and ON time
- MUTE2 — Upstream function block for monitoring of a 2-beam muting system

Simulation



Gemnis Studio is equipped with a useful simulation environment, which allows you to carry out tests on your application program under development and check its correct operation before you install it in a module. To run an application program simulation during the development phase, simply press the Start button on the toolbar at the top of the desktop. If the application program cannot be compiled, the simulation will not run.

Upon start of the simulation phase, the desktop and the way you interact with it change. During this phase you can simulate module operation by interacting with the sensors and simulating real world conditions or operations. Clicking on the sensors will make them execute, in sequence, the standard events for each sensor. Each of these interactions modifies the state of the sensor output variables which, via the connectors, will become the input variables of the function blocks, which will evaluate them and so on, until the data arrives at the outputs that will or will not activate. This simulates exactly what will happen in the module.

Transmission of the information via the connectors is visible via colour change of the connectors.

Monitor

You can monitor operation of one or more Gemnis modules in real time using the Monitor function.

You can observe the overall operation state of the module and various data relating to the program being executed, including a list of most recently saved programs. The execution status of the program as well as the status of the module inputs and outputs can be viewed in real time. In Gemnis Studio 11 the video data update has been made faster and for the analysis of large projects, graphical pan & zoom functions are also available in the Monitor.

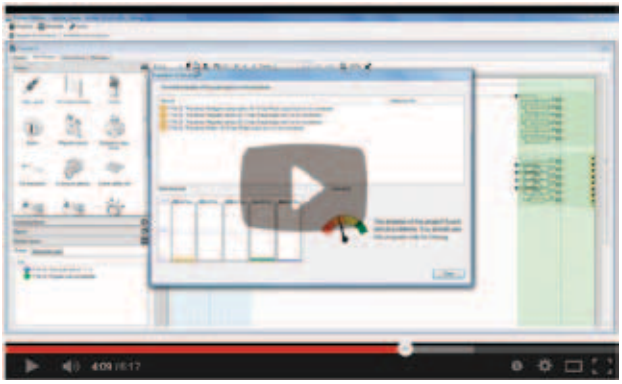
Technical support

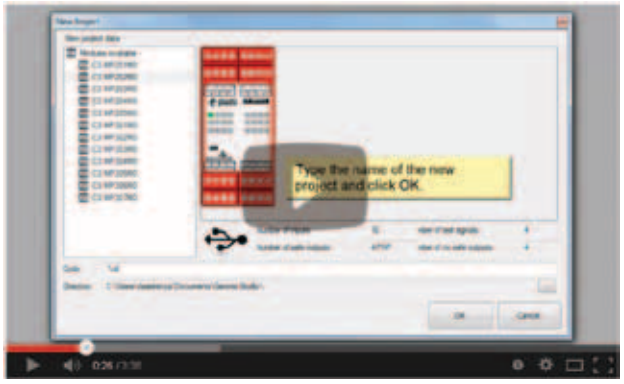
Complementary technical support is currently available to users who have registered on the website and downloaded Gemnis Studio.

The information requested must be relevant to the functionality of the module. We do not provide a consulting service based on the customer's application.

Online support

The site www.gemnis.com contains video tutorials illustrating Gemnis Studio 11 program operation.





CS MP201M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

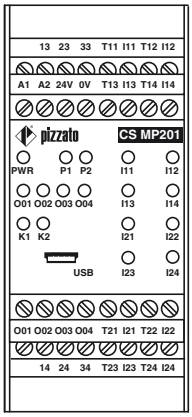
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

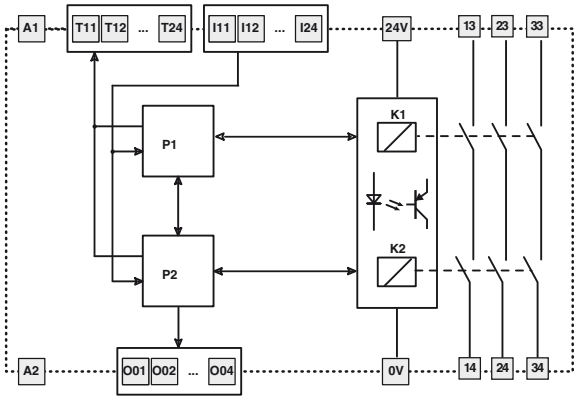
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	135	
PFH_D	1.44E-09	
Service life	20 years	
System response time	< 40 ms	
Dimensions (HxLxW)	111.5x45x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	8	281 part 6
Test outputs (Tx)	8	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Safety relay circuits	3NO	282 part 14
Weight	300 g	

Pin assignment



Internal block diagram



Code structure

CS MP201M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP202M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

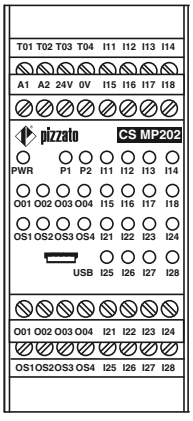
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	614	
PFH_D	1.32E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x45x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	16	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Semiconductor safety output circuits (OSx)	4 PNP	282 part 12
Weight	250 g	

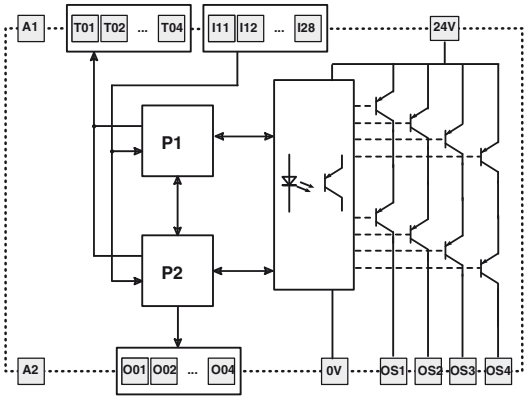
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.В.00454

Pin assignment



Internal block diagram



Code structure

CS MP202M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

Stock items

CS MP202M0

Items with code on **green** background are stock items

CS MP203M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

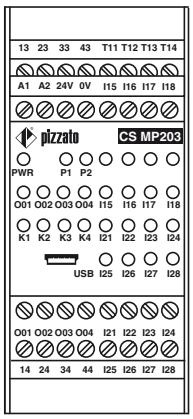
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

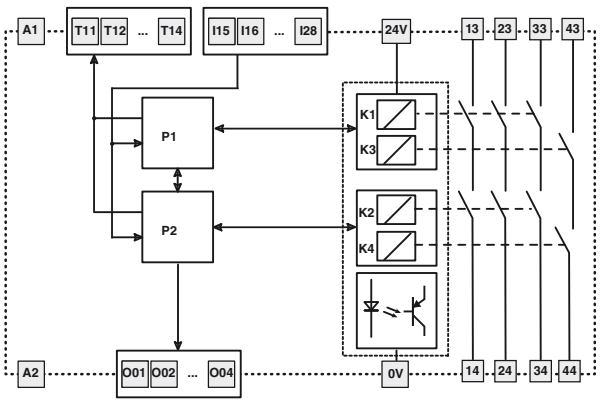
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	103	
PFH_D	1.61E-09	
Service life	20 years	
System response time	< 40 ms	
Dimensions (HxLxW)	111.5x45x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	12	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Safety relay circuits	3NO+1NO	282 part 14
Weight	300 g	

Pin assignment



Internal block diagram



Code structure

CS MP203M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP204M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

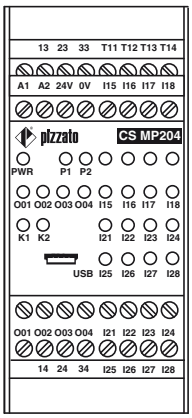
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	134	
PFH_D	1.52E-09	
Service life	20 years	
System response time	< 40 ms	
Dimensions (HxLxW)	111.5x45x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	12	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Safety relay circuits	3NO	282 part 14
Weight	300 g	

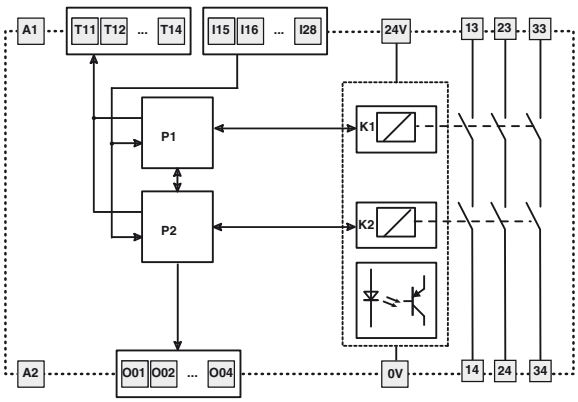
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

Pin assignment



Internal block diagram



Code structure

CS MP204M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP205M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

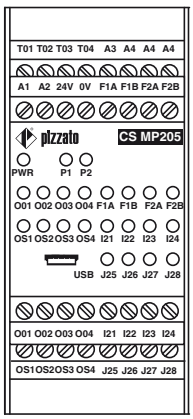
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

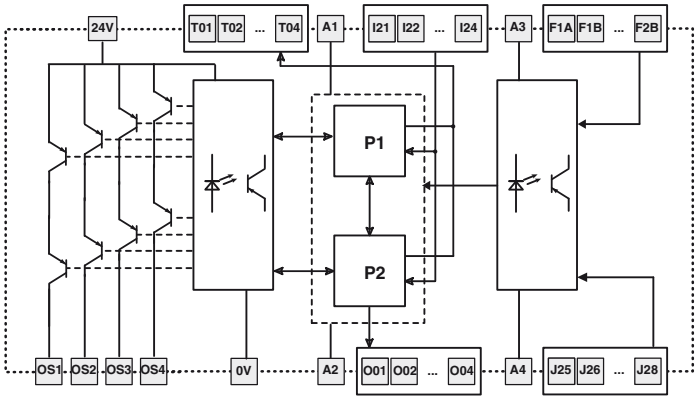
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	373	
PFH_D	2.19E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x45x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	4	281 part 6
Decoupled digital inputs (Jx)	4	281 part 7
Inputs for frequency signals from 0 to 4 kHz (Fx)	4	281 part 9
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Semiconductor safety output circuits (OSx)	4 PNP	282 part 12
Weight	250 g	

Pin assignment



Internal block diagram



Code structure

CS MP205M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP206M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

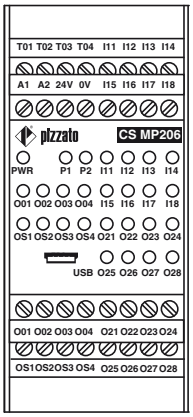
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.В.00454

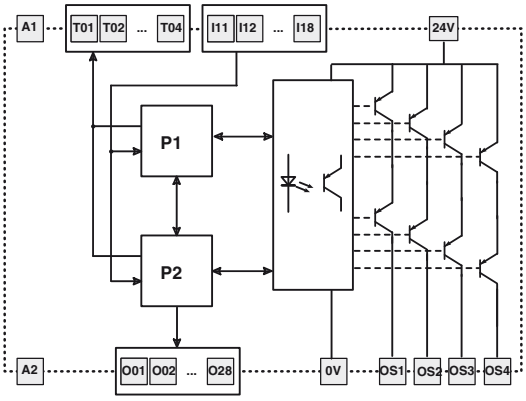
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	3314	
PFH_D	1.09E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x45x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	8	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	12	282 part 11
Semiconductor safety output circuits (OSx)	4 PNP	282 part 12
Weight	250 g	

Pin assignment



Internal block diagram



Code structure

CS MP206M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP207M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

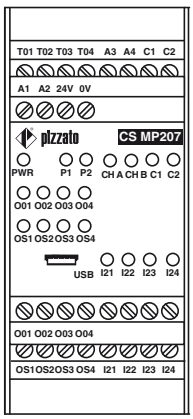
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

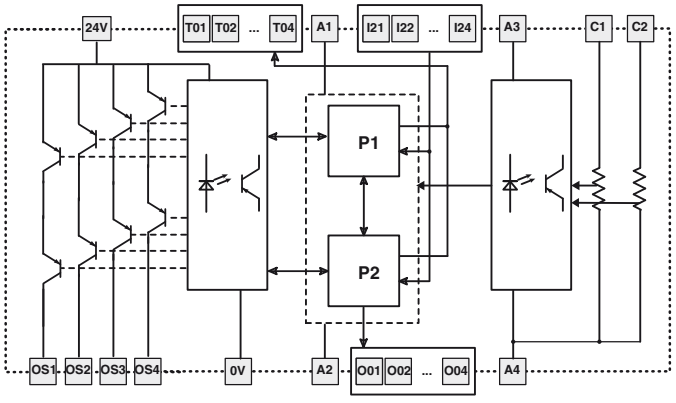
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	431	
PFH_D	7.08E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x45x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	4	281 part 6
Inputs for 4-20 mA analogue signals (Cx)	2	281 part 8
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Semiconductor safety output circuits (OSx)	4 PNP	282 part 12
Weight	250 g	

Pin assignment



Internal block diagram



Code structure

CS MP207M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP208M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

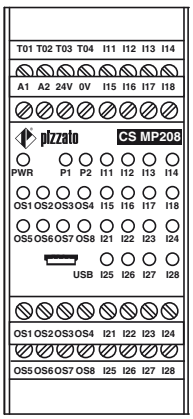
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	633	
PFH_D	7.02E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x45x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	16	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor safety output circuits (OSx)	8 PNP	282 part 13
Weight	250 g	

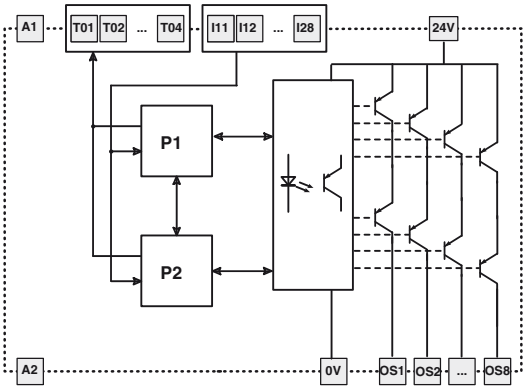
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

Pin assignment



Internal block diagram



Code structure

CS MP208M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP301M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

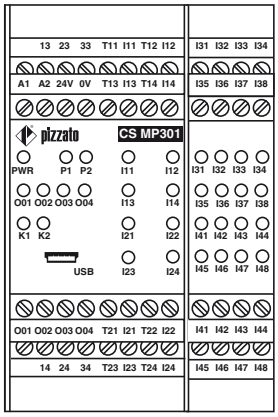
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

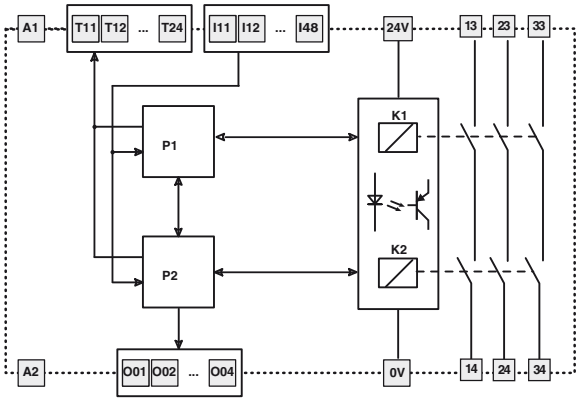
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	128	
PFH_D	1.88E-09	
Service life	20 years	
System response time	< 40 ms	
Dimensions (HxLxW)	111.5x67.5x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	24	281 part 6
Test outputs (Tx)	8	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Safety relay circuits	3NO	282 part 14
Weight	400 g	

Pin assignment



Internal block diagram



Code structure

CS MP301M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP302M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

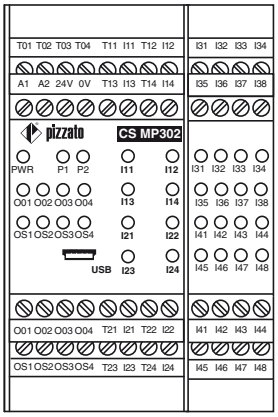
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	535	
PFH_D	1.57E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x67.5x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	24	281 part 6
Test outputs (Tx)	12	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Semiconductor safety output circuits (OSx)	4 PNP	282 part 12
Weight	350 g	

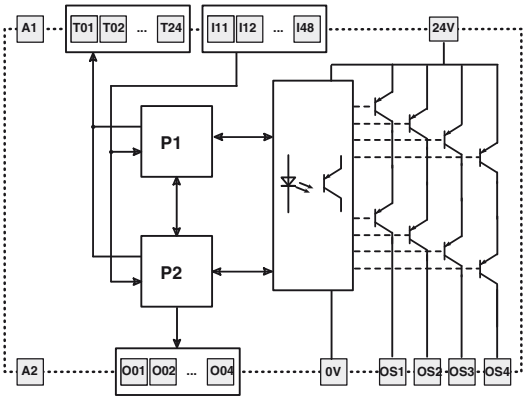
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

Pin assignment



Internal block diagram



Code structure

CS MP302M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

Stock items

CS MP302M0

Items with code on **green** background are stock items

CS MP303M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

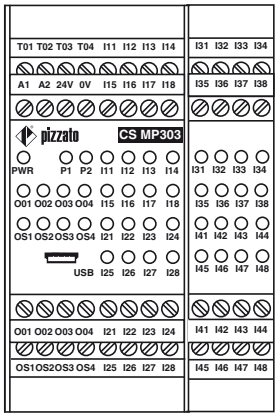
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

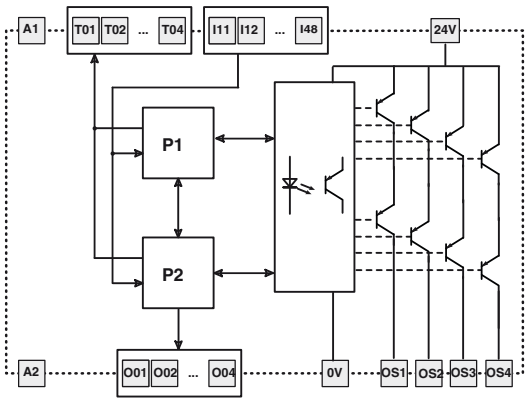
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	485	
PFH_D	1.76E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x67.5x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	32	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Semiconductor safety output circuits (OSx)	4 PNP	282 part 12
Weight	350 g	

Pin assignment



Internal block diagram



Code structure

CS MP303M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP304M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

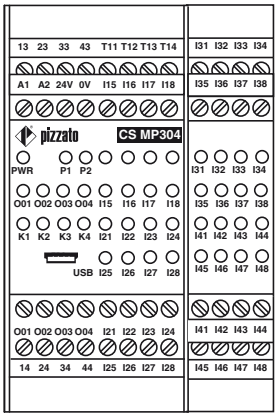
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	98	
PFH_D	2.05E-09	
Service life	20 years	
System response time	< 40 ms	
Dimensions (HxLxW)	111.5x67.5x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	28	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Safety relay circuits	3NO+1NO	282 part 14
Weight	400 g	

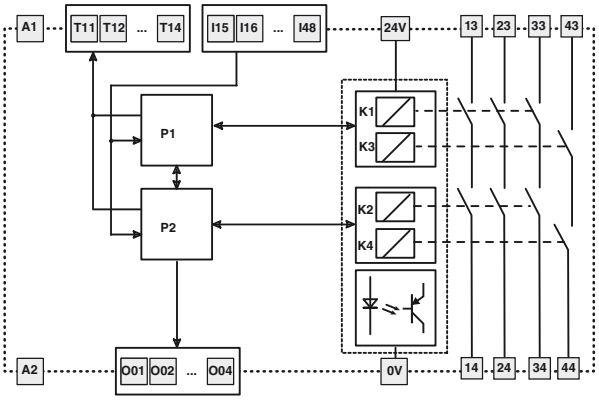
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.В.00454

Pin assignment



Internal block diagram



Code structure

CS MP304M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP305M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

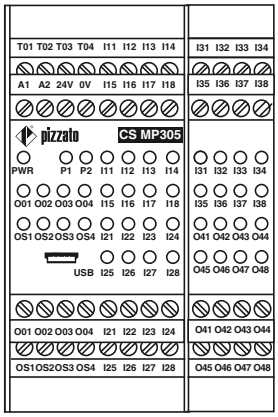
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

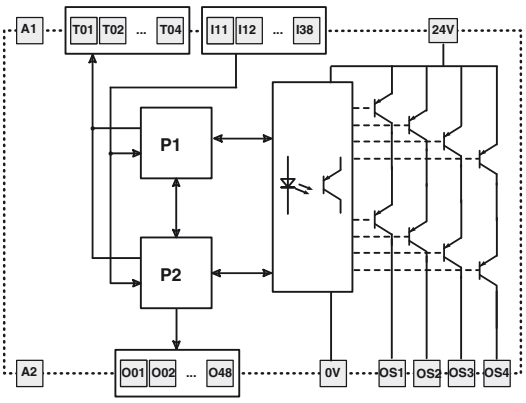
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	535	
PFH_D	1.57E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x67.5x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	24	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	12	282 part 11
Semiconductor safety output circuits (OSx)	4 PNP	282 part 12
Weight	350 g	

Pin assignment



Internal block diagram



Code structure

CS MP305M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP306M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

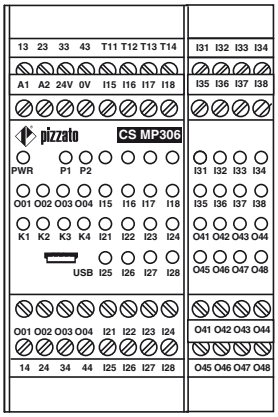
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	100	
PFH_D	1.86E-09	
Service life	20 years	
System response time	< 40 ms	
Dimensions (HxLxW)	111.5x67.5x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	20	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	12	282 part 11
Safety relay circuits	3NO+1NO	282 part 14
Weight	400 g	

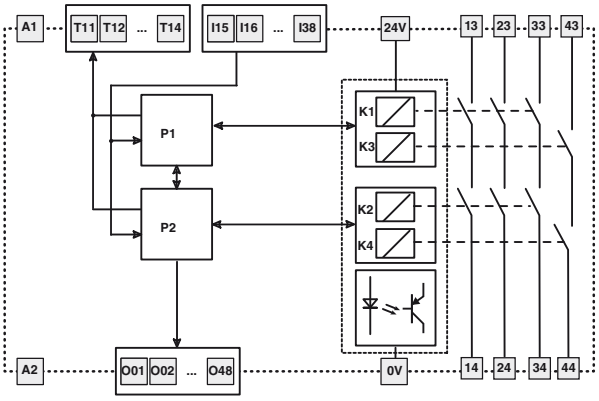
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.В.00454

Pin assignment



Internal block diagram



Code structure

CS MP306M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP307M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

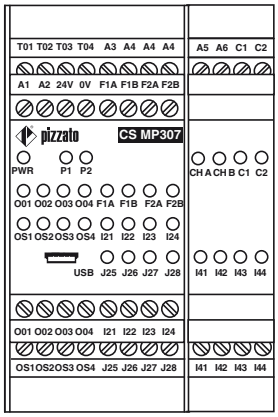
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

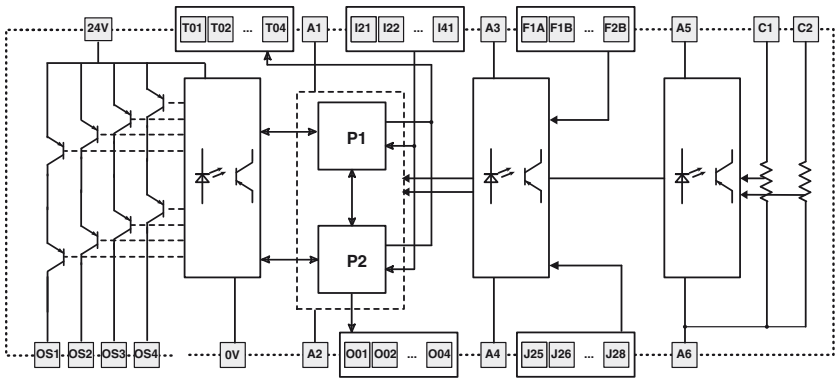
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	289	
PFH_D	8.38E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x67.5x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	8	281 part 6
Decoupled digital inputs (Jx)	4	281 part 7
Inputs for 4-20 mA analogue signals (Cx)	2	281 part 8
Inputs for frequency signals from 0 to 4 kHz (Fx)	4	281 part 9
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	4	282 part 11
Semiconductor safety output circuits (OSx)	4 PNP	282 part 12
Weight	350 g	

Pin assignment



Internal block diagram



Code structure

CS MP307M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP308M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

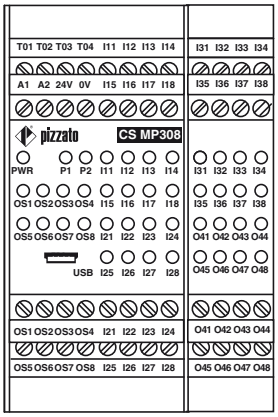
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	548	
PFH_D	7.27E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x67.5x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	24	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	8	282 part 11
Semiconductor safety output circuits (OSx)	8 PNP	282 part 13
Weight	350 g	

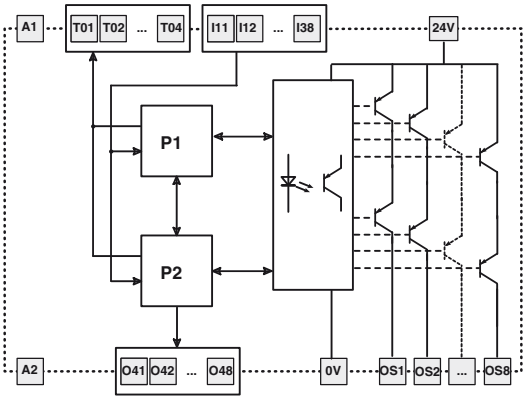
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

Pin assignment



Internal block diagram



Code structure

CS MP308M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP309M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

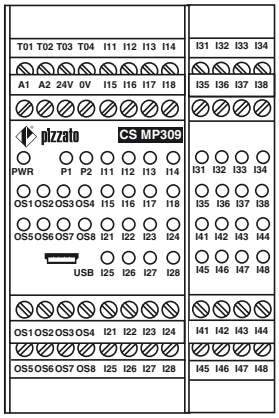
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

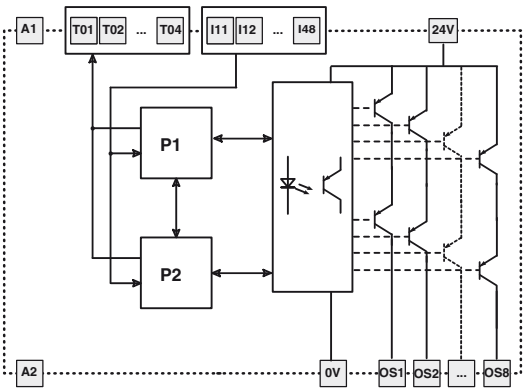
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	496	
PFH_D	7.46E-09	
Service life	20 years	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x67.5x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	32	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor safety output circuits (OSx)	8 PNP	282 part 13
Weight	350 g	

Pin assignment



Internal block diagram



Code structure

CS MP309M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP401M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

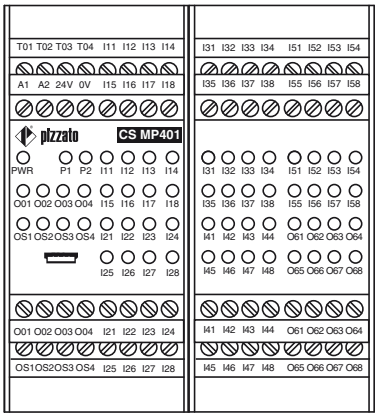
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	434	
PFH_D	1.73E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x90x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	40	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	12	282 part 11
Semiconductor safety output circuits (OSx)	4 PNP	282 part 12
Weight	500 g	

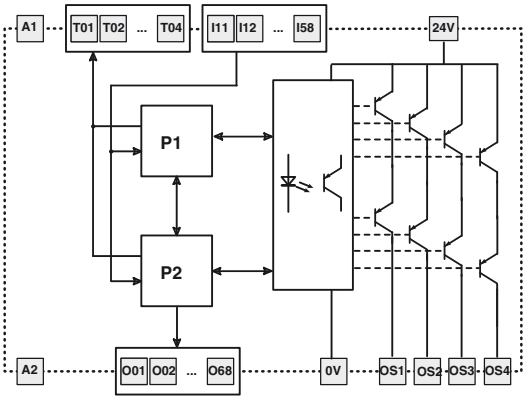
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.В.00454

Pin assignment



Internal block diagram



Code structure

CS MP401M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP402M0 programmable multifunction safety module

Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

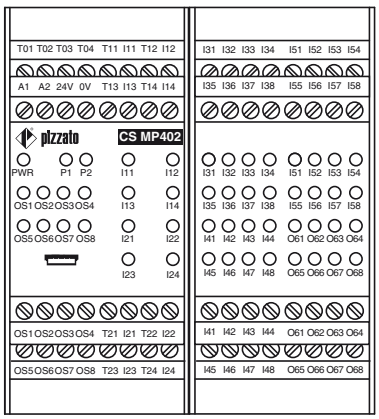
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

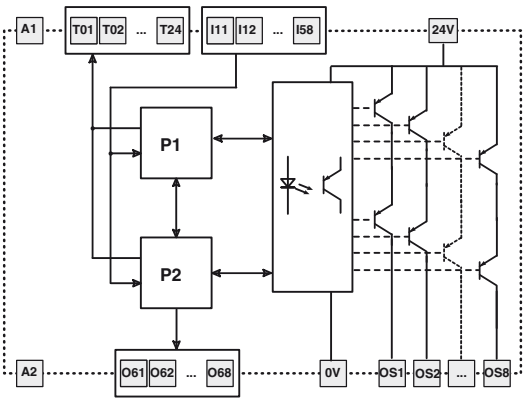
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	478	
PFH_D	7.24E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x90x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	32	281 part 6
Test outputs (Tx)	12	281 part 10
Semiconductor signalling output circuits (Ox)	8	282 part 11
Semiconductor safety output circuits (OSx)	8 PNP	282 part 13
Weight	500 g	

Pin assignment



Internal block diagram

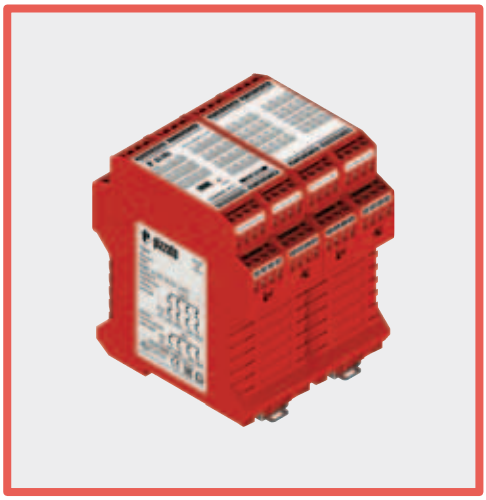


Code structure

CS MP402M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

CS MP403M0 programmable multifunction safety module



Main features

- For safety applications up to SIL CL 3/PL e
- Supply voltage: 24 Vdc
- Gemnis Studio for easy and intuitive programming and program simulation
- Large selection of logical blocks for the management of external devices and programs
- Custom configured versions available on request

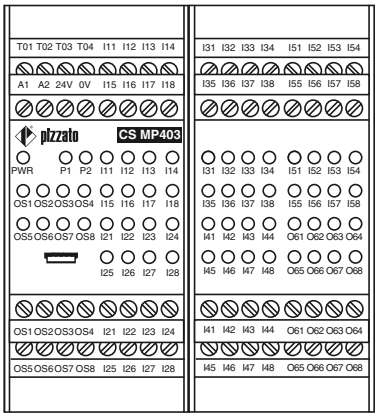
Main technical features

Parameter:	Value:	Page:
SIL CL acc. to EN IEC 62061	up to SIL CL 3	
Performance Level (PL) acc. to EN ISO 13849-1	up to PL e	
Safety category acc. to EN ISO 13849-1	up to cat. 4	
$MTTF_D$	438	
PFH_D	7.42E-09	
Service life	20 years	
System response time	< 30 ms	
Dimensions (HxLxW)	111.5x90x99 mm	
Housing data		281 part 1
Environmental data		281 part 2
Supply		281 part 3
In compliance with standards		281 part 4
Programming software	Gemnis Studio	281 part 5
USB port	Yes	
Safety inputs (Ix)	40	281 part 6
Test outputs (Tx)	4	281 part 10
Semiconductor signalling output circuits (Ox)	8	282 part 11
Semiconductor safety output circuits (OSx)	8 PNP	282 part 13
Weight	500 g	

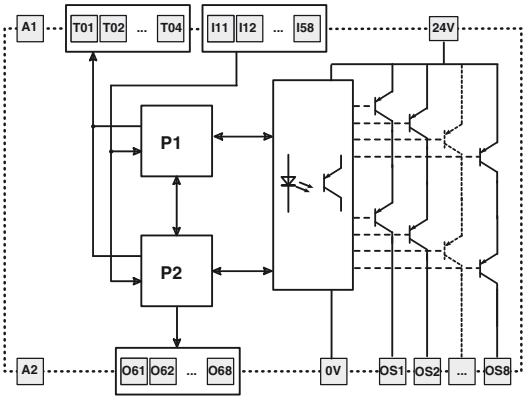
Quality marks:

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

Pin assignment



Internal block diagram



Code structure

CS MP403M0

Connection type	
M	Connector with screw terminals
X	Connector with spring terminals

Technical data

1) Housing

Housing:	polyamide PA 6.6, self-extinguishing V0 acc. to UL 94
Protection degree:	IP40 (housing) IP20 (terminal strip)
Dimensions, cable cross sections, terminal tightening torque:	page 296-297, design C / E

2) Environmental

Operating temperature:	0°C … +55°C
Storage temperature:	-20°C … +70°C
Pollution degree:	external 3, internal 2
Overvoltage category:	II

3) Power supply

Rated voltage A1-A2 (U_n):	24 Vdc
Max. DC residual ripple in DC:	10%
Supply voltage tolerance:	±15% of U_n
Rated consumption (w/o load):	< 3 W
Protection against short circuits:	PTC resistance, Ih=0.5 A
PTC response time:	Response time > 100 ms, release time > 3 s
Internal protection against short circuits on outputs (Tx, Ox):	Electronic
Maximum current output of the module as the total current of the Ox and Tx outputs:	0.5 A
Self-test duration on startup:	< 2 s

4) Compliance with standards

EN 60947-1, EN 60947-5-1, EN 60204-1, EN ISO 13849-1, EN ISO 13855, EN 1037, EN ISO 12100, EN ISO 13850, EN 60529, EN 61000-6-2, EN 61000-6-3, EN 61326-1, EN 61326-3-1, EN 60664-1, EN 62061, UL 508, CSA C22.2 n° 14-95.

Compliance with the requirements of:

Low Voltage Directive 2014/35/EU,
Machinery Directive 2006/42/EC,
EMC Directive 2014/30/EU

Features approved by UL

Rated supply voltage: 24 Vdc
Power consumption DC: < 3 W
Relay output:
- maximum switching voltage: 230/240 Vac,
- maximum current: 4 A
- utilization category: C300 pilot duty

Semiconductor outputs:
- maximum switching voltage: 24 V dc
- maximum current: 500 mA

Notes:
- Use 60 or 75 °C copper (Cu) conductors, rigid or flexible, wire size 30-12 AWG.
- Tightening torque for terminal screws of 5-7 lb in.
- Only for 24 Vac/dc versions: power supply only with class 2 sources or with limited voltage and energy. (Supply from Remote Class 2 Source or limited voltage limited energy).

5) Gemnis Studio

The **Gemnis Studio** software is the graphic development environment for the creation, simulation and debugging of programs designed for upload to Gemnis line modules.
This software is licensed to users wishing to program these modules, subject to prior registration at **www.gemnis.com**.
You can download the latest **Gemnis Studio** software version from the site, which will allow you to program Gemnis line safety modules.

Gemnis Studio software minimum download requirements

Computer and processor:	X86 with clock frequency of 1 GHz
Memory:	512 MB
Hard disk:	200 MB
Monitor:	Monitor with 1024x768 resolution or higher.
Operating system:	Microsoft Windows 7 or Microsoft Windows 10 Microsoft Framework .NET 3.5 or higher Microsoft Report Viewer Acrobat Reader

6) Input circuits (Ix)

Voltage and current in the input circuits:

	24 V, 5 mA
Input signals:	0-8 V (Off), 12-24 V (On)
Galvanic separation:	No
Minimum duration of input signal:	10 ms
Input signal filtering:	Yes, maximum interference period 0.4 ms
Maximum input resistance:	100 Ohm
Maximum input capacitance:	470 nF to ground 470 nF between two conductors

7) Decoupled input circuits (Jx)

Voltage and current in the input circuits:

	24 V, 5 mA
Input signals:	0-8 V (Off), 12-24 V (On)
Galvanic separation:	Yes
Insulation voltage (U_i):	500 V
Minimum duration of input signal:	10 ms
Input signal filtering:	Yes, maximum interference period 0.4 ms
Maximum input resistance:	100 Ohm
Maximum input capacitance:	470 nF to ground 470 nF between two conductors

NB: Voltage and current values indicated refer to the power supply terminals (Ax, see each module individually) of the board where the Jx type terminals are present

8) Analogue input circuits (Cx)

Rated supply voltage:	24 Vdc ± 15 %
Analogue input type:	4-20 mA current loop
Measurement range:	0 … 25 mA
Accuracy over entire measurement range:	1 % ± 1 digit
Resolution:	0.01 mA
Input resistance:	100 Ohm
Maximum applicable current:	30 mA
Managed sensors:	"source" type with 2/3 wires
Galvanic separation:	Yes
Insulation voltage (U_i):	500 V

NB: Voltage and current values indicated refer to the power supply terminals (Ax, see each module individually) of the board where the Cx type terminals are present

9) Frequency input circuits (Fx)

Rated supply voltage:	24 Vdc ± 15 %
Input circuit voltage and current:	24 Vdc, 7 mA
Check of the supply voltage of the connected proximity sensors:	24 Vdc ± 20 %
Maximum detectable frequency:	4 kHz
Minimum detectable frequency:	1 Hz
Frequency detection accuracy:	1 % ± 1 digit
Resolution:	0.1 Hz
Minimum time for standstill detection:	1 s
Galvanic separation:	Yes
Insulation voltage (U_i):	500 V

NB: Voltage and current values indicated refer to the power supply terminals (Ax, see each module individually) of the board where the Fx type terminals are present

10) Circuits with Test signals (Tx)

Signal type:	Pulsed 100 Hz 24V/0V, duty cycle 50%
Max. total current:	See Supply
Protected against short circuit:	Yes

11) Semiconductor signalling output circuits (Ox)

Output type:	PNP
Maximum current per output:	0.5 A
Max. total current:	see Supply
Impulse withstand voltage (U_{imp}):	0.8 kV
Rated insulation voltage (U_i):	32 V
Protected against short circuit:	Yes
Galvanic separation:	No

12) Semiconductor safety output circuits (OSx) with 4 safety outputs

Rated voltage 24V-0V:	24 Vdc
Number of outputs:	4
Output type:	PNP
Maximum current per output:	0.5 A
Max. total output current:	2 A
Minimum current:	10 mA
Maximum capacitive load to ground per output:	400 nF
Maximum inductive load per output:	500 mH
Protection fuse:	2 A type gG
Galvanic separation:	Yes
Impulse withstand voltage (U_{imp}):	0.8 kV
Rated insulation voltage (U_i):	32 V
Short circuit detection between outputs:	Yes
Duration of the deactivation impulses at the safety outputs:	< 300 µs

13) Semiconductor safety output circuits (OSx) with 8 safety outputs

Rated voltage 24V-0V:	24 Vdc
Number of outputs:	8
Output type:	PNP
Maximum current per output:	0.4 A
Max. total output current:	3 A
Minimum current:	10 mA
Maximum capacitive load to ground per output:	400 nF
Maximum inductive load per output:	500 mH
Protection fuse:	4 A type gG
Galvanic separation:	Yes
Impulse withstand voltage (U_{imp}):	0.8 kV
Rated insulation voltage (U_i):	32 V
Short circuit detection between outputs:	Yes
Duration of the deactivation impulses at the safety outputs:	< 300 µs

14) Safety relay circuits

Rated voltage 24V-0V:	24 Vdc
Contact type:	Forcibly guided contacts acc. to EN 50205
Material of the contacts:	gold-plated silver alloy
Maximum switching voltage:	230 Vac; 300 Vdc
Maximum current per contact:	6 A
Max. total current ΣI_{th2}:	36 A^2
Minimum current:	10 mA
Protection fuse:	4 A type gG
Maximum load:	1380 VA/W
Impulse withstand voltage (U_{imp}):	4 kV
Rated insulation voltage (U_i):	500 V
Utilization category (EN 60947-5-1):	AC15 (Ue=230V, Ie=3A); DC13 (Ue=24V, Ie=4A) (6 op. cycl./min.)
Utilization category (UL 508):	C300
Contact resistance:	< 100 mOhm
Mechanical endurance:	>10 million operating cycles
Electrical endurance:	>100,000 operating cycles
Galvanic separation:	Yes

The number and the load capacity of output contacts can be increased by using expansion modules or contactors.
See page 241-250.

CS MF pre-programmed multifunction safety module

Introduction

An increasing number of users requires products which carry out several safety functions without needing the complex management of a safety PLC or the complex wiring of many traditional safety modules. Such problems arise mainly when the safety functions are typically greater than 3 or 4, and/or when managing a safety PLC software (software purchase, training courses, programming of all modules, software management and filing, updates etc.) turns out to be too great an overhead in relation to problem complexity.

Pizzato Elettrica introduces Gemnis, a series of electronic modules which are pre-programmed for specific customer applications or for generic safety macro-functions commonly used in industrial contexts. The following pages list some of the pre-programmed products for generic macro-functions commonly used in the industrial sector. These products are also available for individual purchase. Any customer requiring a product pre-programmed to their particular specification can contact the Pizzato Elettrica technical department (minimum volumes are requested).

The resulting advantages for customers typically include simplified product management (purchase of finished components) and reduced general costs (no software to be installed and managed, products are immediately operational).

All Gemnis series products are able to provide circuit solutions at SIL 3 (EN 62061), PL e (EN ISO 13849-1) or category 4 (EN ISO 13849-1) levels.

Quality marks:

0123

EC type examination certificate: M6A 16 06 75157 010
UL approval: E131787
TÜV SÜD approval: Z10 16 05 75157 009
EAC approval: RU C-IT.АД35.B.00454

Code structure

CS MF201M0-P••

Hardware code	
•••	hardware code

Program code	
P••	program code

Connection type	
M	Connector with screw terminals

Supply voltage	
0	24 Vdc

Product list

Product code	Functions executed	Safety outputs	Signalling outputs	Page
CS MF201M0-P1	Monitoring of 2 guards in AND and 1 emergency stop with automatic start or manual monitored start.	3 NO	4 PNP	285
CS MF202M0-P2	Monitoring of 4 guards in AND, 1 bypass selector, 1 emergency stop, automatic start or manual monitored start, general enabling signal.	4 PNP	4 PNP	286
CS MF202M0-P3	Monitoring of 6 guards in AND (2NC contacts), 1 emergency stop, automatic start or manual monitored start.	4 PNP	4 PNP	287
CS MF202M0-P4	Monitoring of 6 guards in AND (1NC+1NO contacts), 1 emergency stop, automatic start or manual monitored start.	4 PNP	4 PNP	288
CS MF202M0-P5	Monitoring of 4 guards with independent outputs, 1 bypass selector, 1 emergency stop, automatic start or manual monitored start, general enabling signal.	4 PNP	4 PNP	289
CS MF202M0-P6	Monitoring of 2 guards, 1 bypass selector, 1 emergency stop, automatic start or manual monitored start, general enabling signal. Three instantaneous outputs and one delayed output with selector switch with 4 times. Selectable On/Off delay.	4 PNP	4 PNP	290
CS MF202M0-P7	Monitoring of 4 guards (AND linked) with switches with guard locking, operating principle "D", 1 emergency stop, monitored start. Two instantaneous outputs and two delayed outputs with selector switch with 4 times.	4 PNP	4 PNP	291
CS MF202M0-P8	Monitoring of 4 guards in AND with switches with guard locking, operating principle "E", 1 emergency stop, monitored start. Two instantaneous outputs and two delayed outputs with selector switch with 4 times.	4 PNP	4 PNP	292

Legend

- Movable guard monitoring
- Monitoring of a movable guard with lock
- Emergency stop
- Start function
- Bypass selector
- Time selector
- Enabling input

CS MF201M0-P1 pre-programmed module

Product code
CS MF201M0-P1

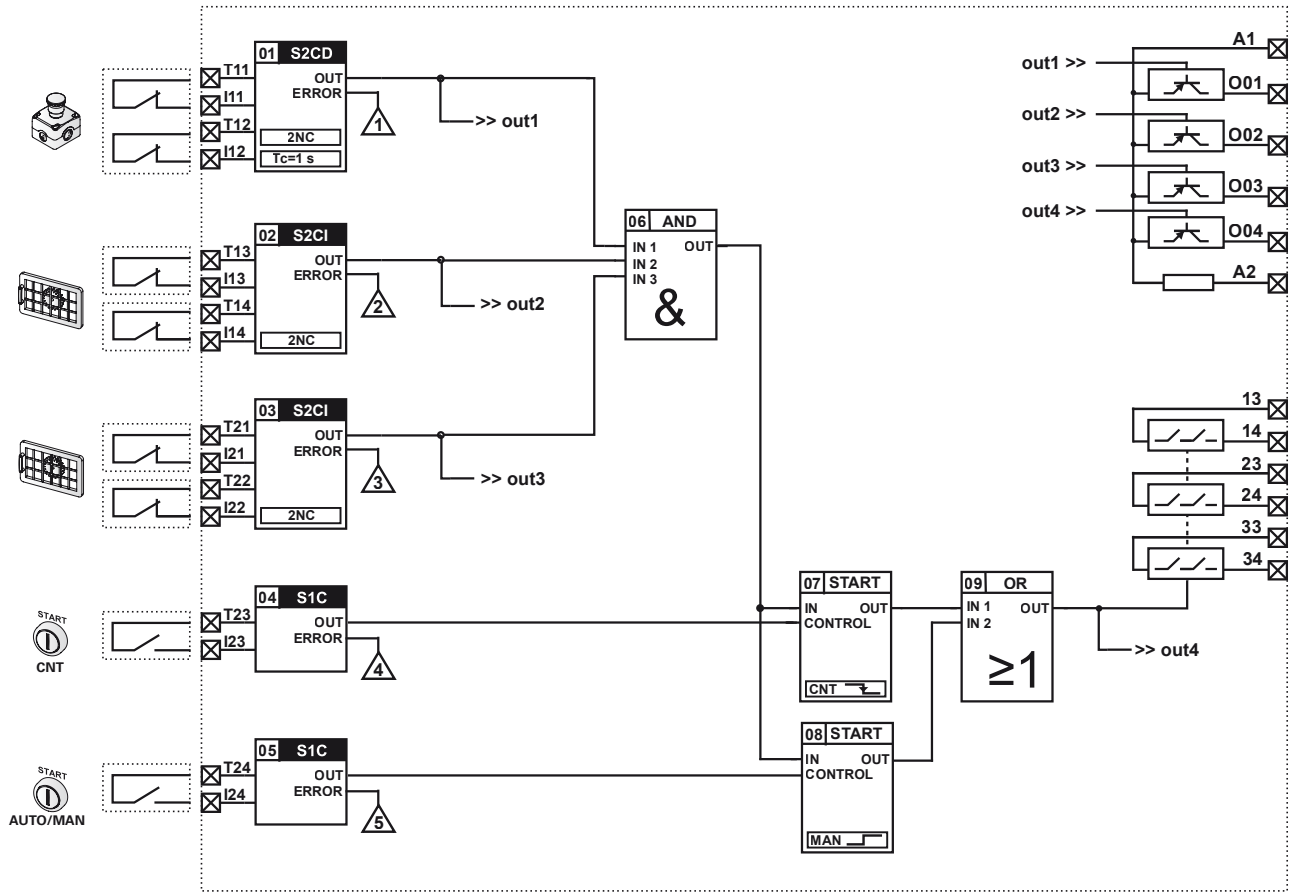
Main functions
- Monitoring of 2 guards
- Monitoring of 1 emergency stop
- Automatic start or monitored manual start

Outputs
- 3 NO safety outputs
- 4 PNP signalling outputs

Technical data: see CS MP201M0
Dimensions, cable cross sections, terminal tightening torque: page 296, design C
Internal block diagram: page 298
Terminal layout: page 298

Application program: P1

The application program stored in the module executes one or more safety functions, as shown in the following block diagram:



CS MF202M0-P2 pre-programmed module

Product code
CS MF202M0-P2

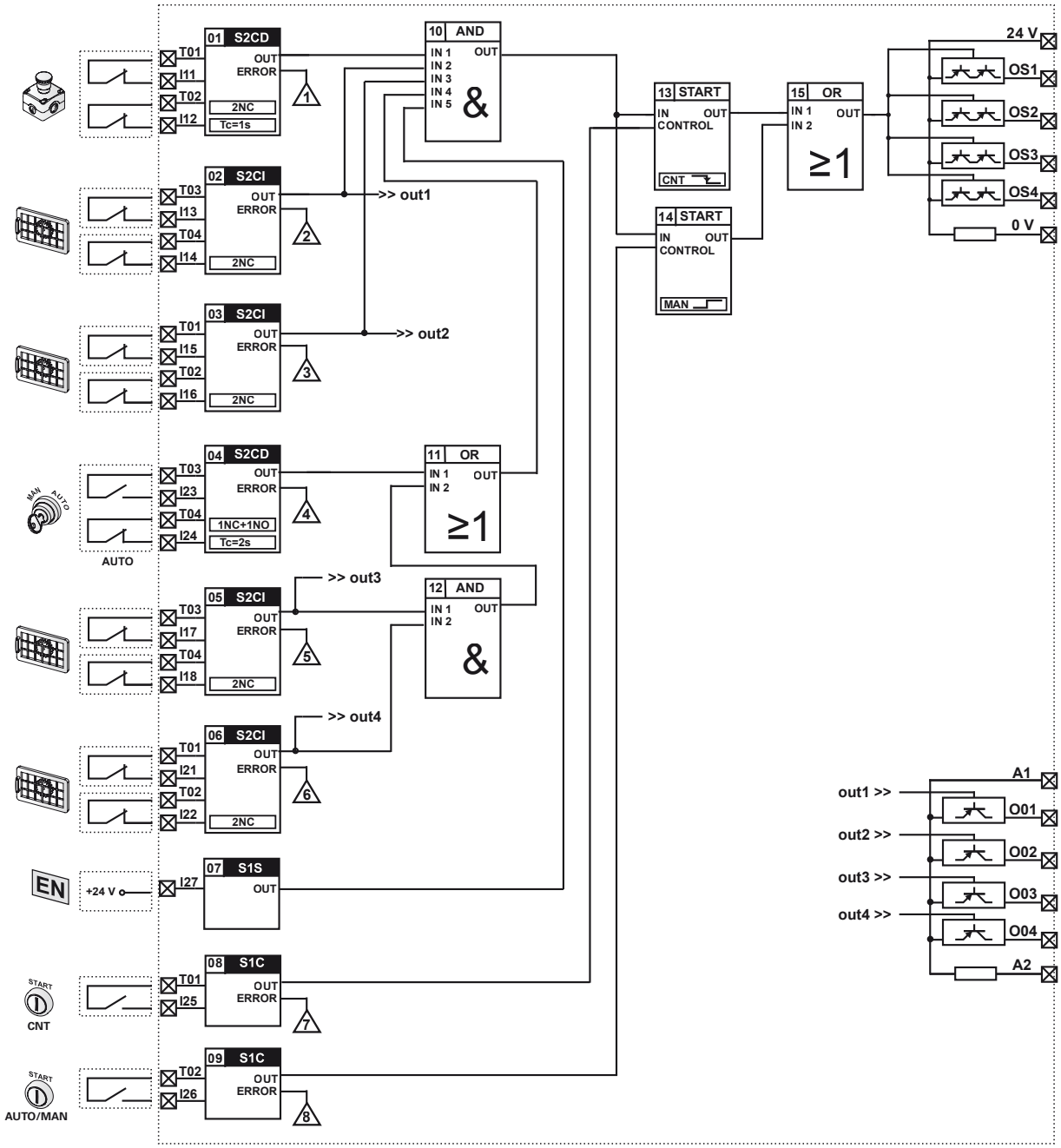
Main functions
- Monitoring of 4 guards
- 1 bypass selector
- 1 emergency stop
- Automatic start or monitored manual start
- General enabling signal

Outputs
- 4 PNP safety outputs
- 4 PNP signalling outputs

Technical data: see CS MP202M0
Dimensions, cable cross sections, terminal tightening torque: page 296, design C
Internal block diagram: page 298
Terminal layout: page 298

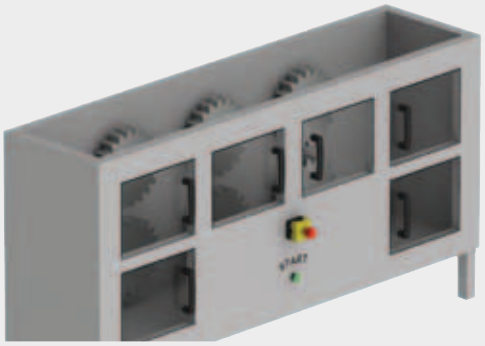
Application program: P2

The application program stored in the module executes one or more safety functions, as shown in the following block diagram:



CS MF202M0-P3 pre-programmed module

Product code
CS MF202M0-P3



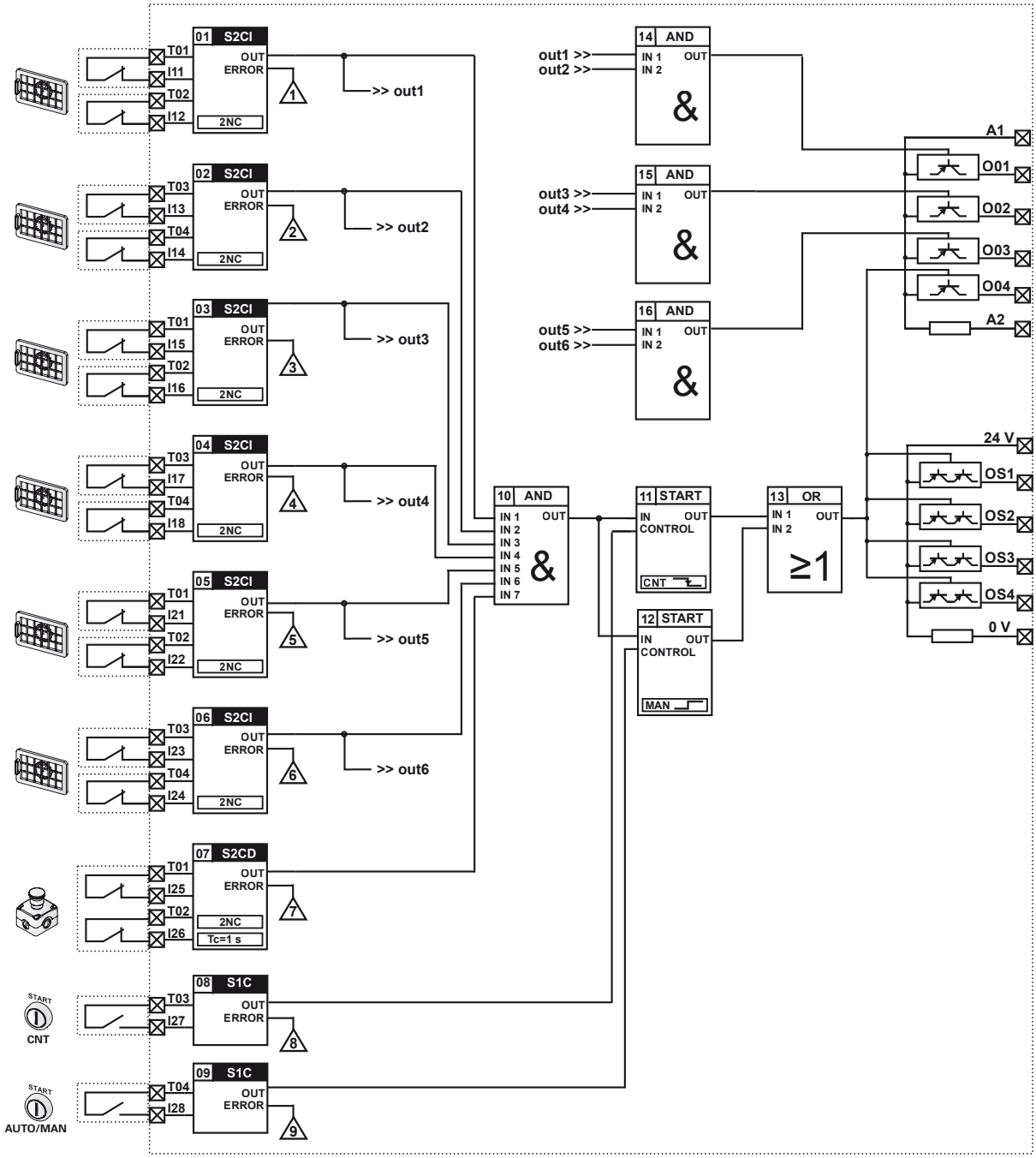
Main functions
- Monitoring of 6 guards (2NC contacts)
- 1 emergency stop
- Automatic start or monitored manual start

Outputs
- 4 PNP safety outputs
- 4 PNP signalling outputs

Technical data: see CS MP202M0
Dimensions, cable cross sections, terminal tightening torque: page 296, design C
Internal block diagram: page 298
Terminal layout: page 298

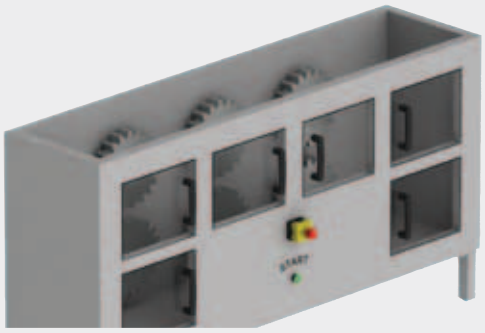
Application program: P3

The application program stored in the module executes one or more safety functions, as shown in the following block diagram:



CS MF202M0-P4 pre-programmed module

Product code
CS MF202M0-P4



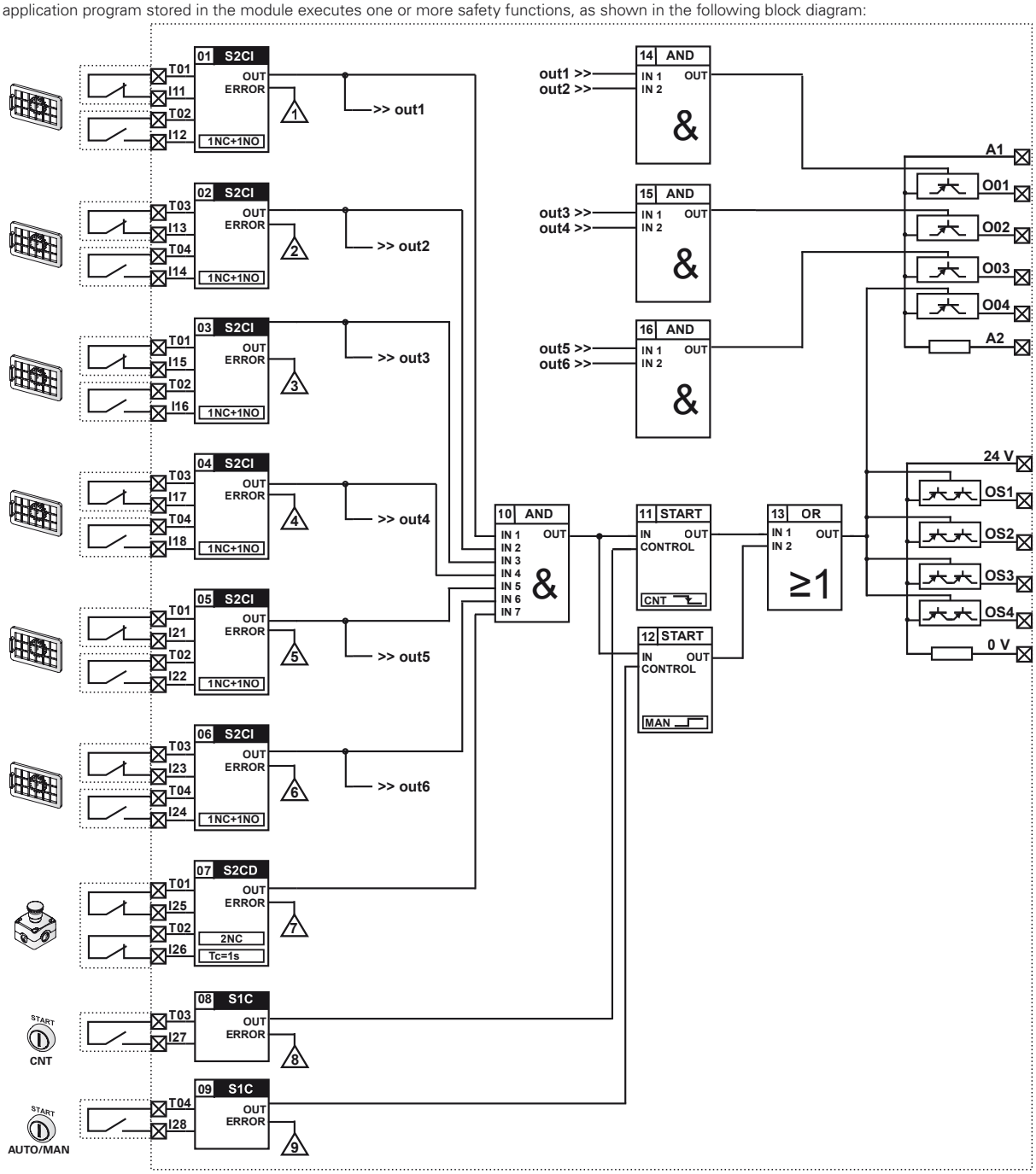
Main functions
- Monitoring of 6 guards (1NC+1NO contacts)
- 1 emergency stop
- Automatic start or monitored manual start

Outputs
- 4 PNP safety outputs
- 4 PNP signalling outputs

Technical data: see CS MP202M0
Dimensions, cable cross sections, terminal tightening torque: page 296, design C
Internal block diagram: page 298
Terminal layout: page 298

Application program: P4

The application program stored in the module executes one or more safety functions, as shown in the following block diagram:



CS MF202M0-P5 pre-programmed module

Product code
CS MF202M0-P5

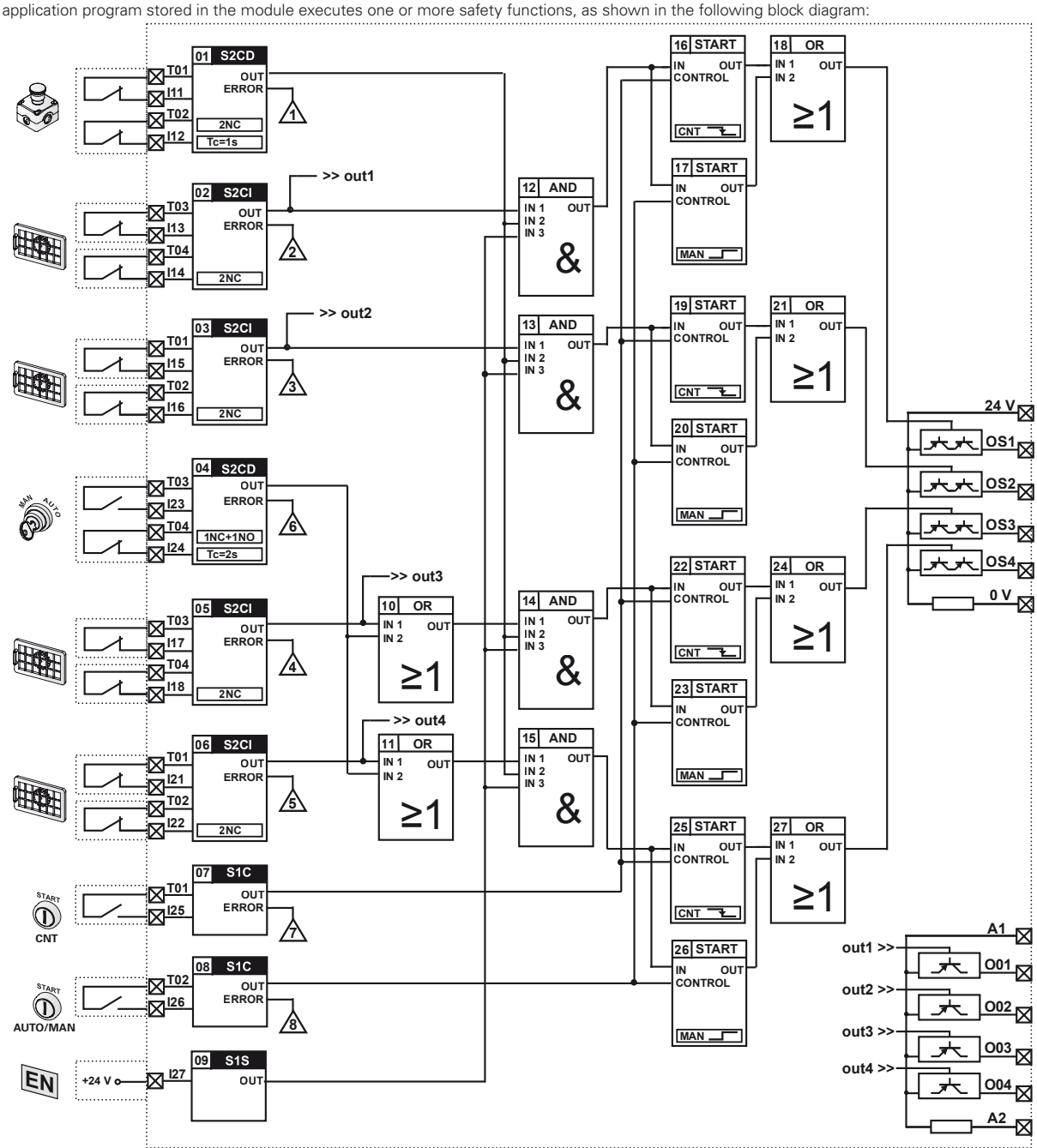
Main functions
- Monitoring of 4 guards with independent outputs
- 1 bypass selector
- 1 emergency stop
- Automatic start or monitored manual start
- General enabling signal

Outputs
- 4 PNP safety outputs
- 4 PNP signalling outputs

Technical data: see CS MP202M0
Dimensions, cable cross sections, terminal tightening torque: page 296, design C
Internal block diagram: page 298
Terminal layout: page 298

Application program: P5

The application program stored in the module executes one or more safety functions, as shown in the following block diagram:



CS MF202M0-P6 pre-programmed module

Product code
CS MF202M0-P6

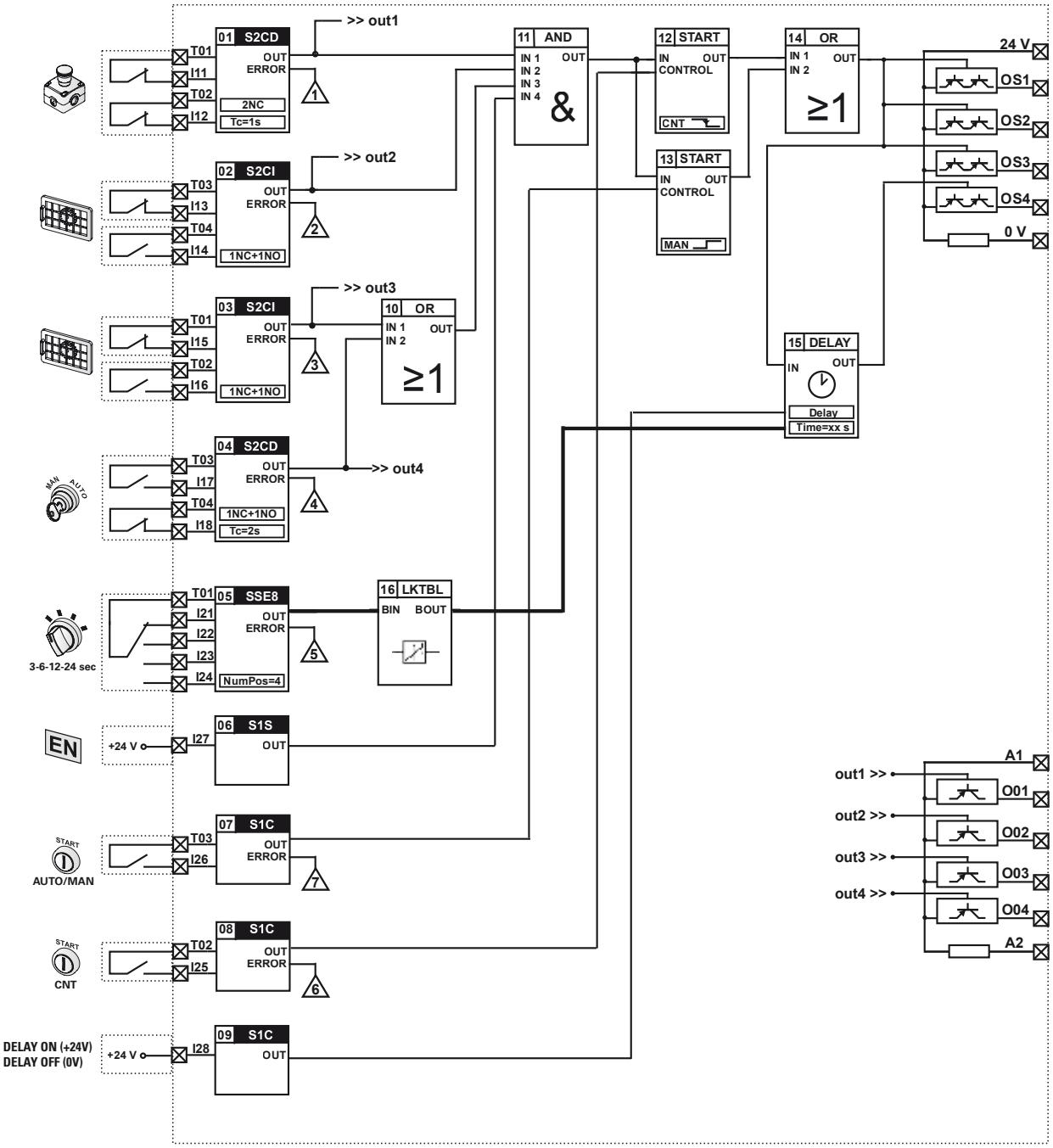
Main functions
- Monitoring of 2 guards
- 1 bypass
- 1 emergency stop
- Automatic start or monitored manual start
- General enabling signal
- Selectable On/Off delay
- Selector switch with 4 times

Outputs
- Three instantaneous outputs and one delayed PNP safety output
- 4 PNP signalling outputs

Technical data: see CS MP202M0
Dimensions, cable cross sections, terminal tightening torque: page 296, design C
Internal block diagram: page 298
Terminal layout: page 298

Application program: P6

The application program stored in the module executes one or more safety functions, as shown in the following block diagram:



CS MF202M0-P7 pre-programmed module

Product code
CS MF202M0-P7

Main functions

- Monitoring of 4 guards with switches with guard locking, operating principle "D" (guard locked if solenoid is de-energised)
- 1 emergency stop
- Monitored start

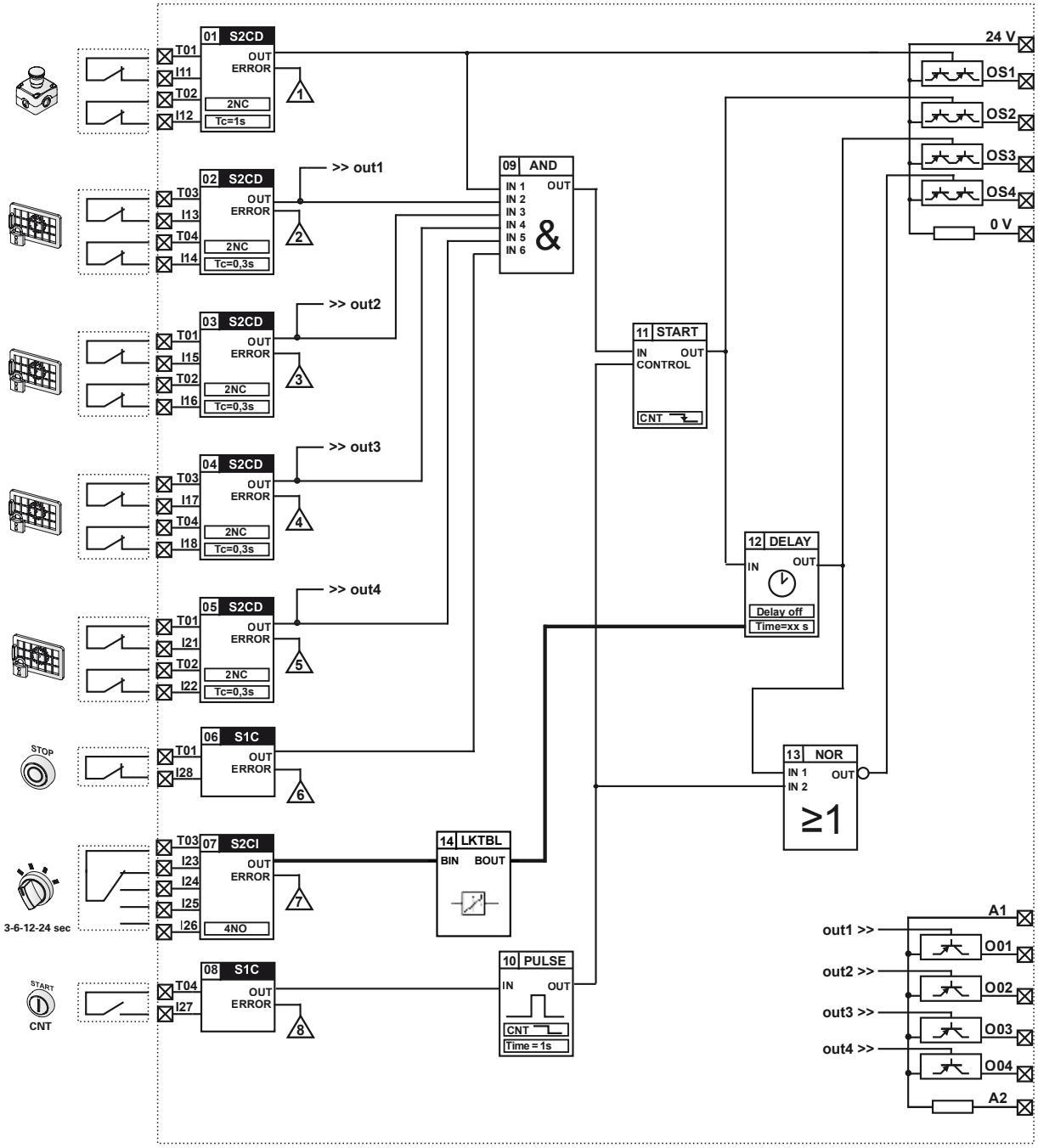
Outputs

- 2 instantaneous outputs and 2 delayed PNP safety outputs with selector switch with 4 times
- 4 PNP signalling outputs
- OS4 output for door locking control

Technical data: see CS MP202M0
Dimensions, cable cross sections, terminal tightening torque: page 296, design C
Internal block diagram: page 298
Terminal layout: page 298

Application program: P7

The application program stored in the module executes one or more safety functions, as shown in the following block diagram:



CS MF202M0-P8 pre-programmed module

Product code
CS MF202M0-P8

Main functions

- Monitoring of 4 guards with switches with guard locking, operating principle "E" (guard locked if solenoid is energised)
- 1 emergency stop
- Monitored start

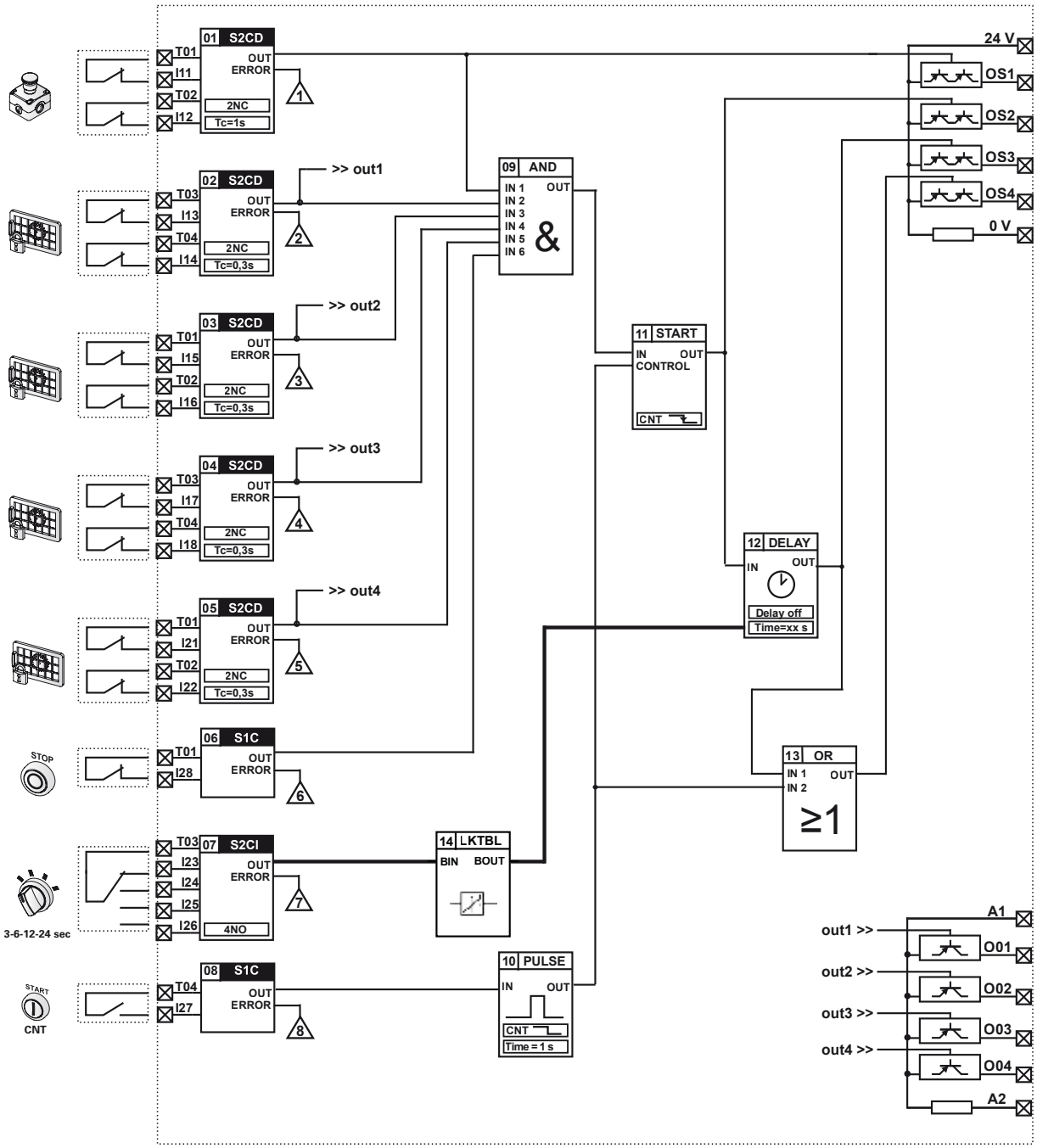
Outputs

- 2 instantaneous outputs and 2 delayed PNP safety outputs with selector switch with 4 times
- 4 PNP signalling outputs
- OS4 output for door locking control

Technical data: see CS MP202M0
Dimensions, cable cross sections, terminal tightening torque: page 296, design C
Internal block diagram: page 298
Terminal layout: page 298

Application program: P8

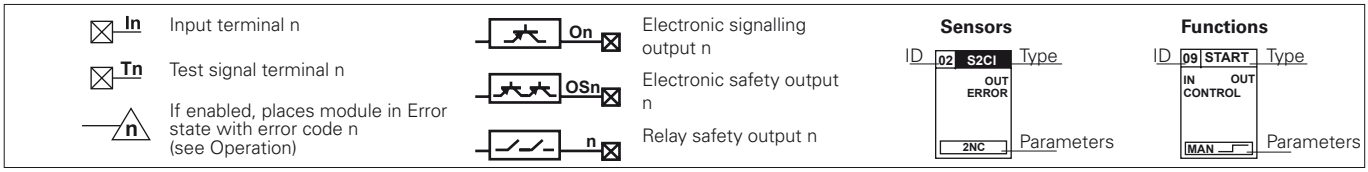
The application program stored in the module executes one or more safety functions, as shown in the following block diagram:



Utilization requirements

Notes: The positions of the contacts shown in the diagram are shown only as examples, and they refer to expected working conditions, with machinery in operation, guards closed, and safety devices not activated. For further explanations, please see documentation relating to each specific safety function (page 281).

Legend



Definitions

Application program: The internal software component of this module which is aimed at the application.

"Power On" state: The device state, which lasts from the time it is switched on until the end of the internal controls.

"Run" state: The device state on completion of the "Power-On" phase (if no errors have been detected) in which the Application program is run.

"Error" state: The device state when a fault is detected. In this state, the module switches to the safe state, i.e., all safety outputs are open.

Fault: A fault can be internal or external to the safety module. Internal faults are autonomously detected by the module thanks to its redundant and self-monitored structure. An external fault can be detected by the application program. It follows that the definition of external fault is strictly dependent on the application (see note A).

Operation

When supplied with power, the module enters the Power-On state and runs an internal self-diagnosis. In this phase, the two processor LEDs (P1, P2) remain illuminated red for about 1 second. If the internal tests are completed without malfunction, the two LEDs are switched off, the module enters the Run state, and runs the application program. If the start tests are not passed, the module enters the Error state and the malfunction is indicated by the processor LEDs remaining illuminated red.

The green LEDs relating to the power supply and the module inputs are not controlled by processors, and they immediately begin indicating the states of the respective inputs/outputs.

When the module is in the RUN state, and no faults are detected, the two LEDs (P1, P2) remain switched off.

In the Run state, the module can detect faults external to the module, for example caused by short circuits, or invalid input states (see note A). Depending on the fault type detected, the application program may place the module in error state, to indicate the malfunction. In this case, the application program can communicate an error code by making the LEDs (P1, P2) flash in sequence.

During the Run state, simultaneously with application program execution, the module constantly runs a series of internal tests to check for correct hardware operation. If a malfunction is detected, the module state changes to Error.

Once in Error state, the module is placed in a safe condition, that is with all the safety outputs open; the application program is no longer evaluated, and neither are the system inputs. Furthermore, the semiconductor signalling outputs are left unaltered (changes in inputs do not affect them) at the value imposed by the application program before entering the error state. To reset the module, just switch it off for the required duration (see technical data) and then switch it on again.

Note A: A short circuit is not always a fault. For example, in the case of an ordinary push button for emergency stops equipped with two NC contacts, contact opening is the signal to be evaluated and a short circuit between the two contacts is a fault. In contrast, in the case of a safety mat with 4-wire technology, the opposite is true, i.e. a short circuit between the wires is the signal to be evaluated whereas wire interruption is a fault.

Fault signalling

PWR LED		LEDs P1 and P2		Possible fault cause
Off	○	Off	○	No power supply, incorrect connections, power wires cut, external fuses broken. Module fault.
Green	●	Off	○	Normal operation.
Green	●	Red	●	Non-restorable fault. Recommended action: Send module for repair.
Green	●	Red x 1 Blue x 1	●))) 1 ●))) 1	Restorable fault: Overcurrent on Tx or Ox outputs. Recommended action: Disconnect the semiconductor signalling outputs (Ox) and the test outputs (Tx) to check whether an external short circuit is present.
Green	●	Red x 1 Blue x 2	●))) 1 ●))) 2	Restorable fault. Problem detected on OSx (short circuit towards earth or positive pole, or else short circuit between two OSx). Suggested action: Disconnect the safety outputs to check if there are any problems on the external connections of the OSx outputs.
Green	●	Red x 1 Blue x 3	●))) 1 ●))) 3	Restorable fault. Module temperature outside the limits. Recommended action: Restore module temperature to within permissible limits.
Green	●	Blue x N	●))) N	Module entered Error state at the request of the application program. Error code N. Typically due to incorrect input conditions (external short circuits, status not permitted). Recommended action: Disconnect the inputs to find any short circuits. Check the documentation supplied with the application program for further details.

Quick description of the main safety functions (CS MF•••••)

SENSORS

Sensor	S1C	Monitoring of one contact
Outputs	OUT	The OUT output is active when the input is closed and there is no error
	ERROR	The ERROR output is active in the case where an electrical malfunction is detected in the input signal
Parameters	None	
Examples		Start button. Stop button. Simple contact

Sensor	S1S	Monitoring of one static signal
Outputs	OUT	The OUT output is active if 24 Vdc is applied to the input
Parameters	None	
Examples		Generic sensors with PNP output. Enabling signals

Sensor	S2CD	Monitoring of two dependent contacts
Outputs	OUT	The OUT output is active when both inputs are in normal or safety state and there is no error
	ERROR	The ERROR output is active in the case where simultaneity times are not respected, or in the case where an electrical malfunction is detected at the input signals
Parameters	2NC / 1NO+1NC	Contact position in normal or safety state
	Tc	Max. time of simultaneity in seconds
Examples		Emergency stop button. Rope switch. Switch with two linked contacts. Mode selector with two settings, changeover. Two individual switches with a time dependency

Sensor	S2CI	Monitoring of two independent contacts
Outputs	OUT	The OUT output is active when both inputs are in normal or safety state and there is no error
	ERROR	The ERROR output is active in the case where an electrical malfunction is detected in the input signals
Parameters	2NC / 1NO+1NC	Contact position in normal or safety state
Examples		Two switches. Magnetic sensor

Sensor	SSE8	Mode selector with 2 to 8 positions
Outputs	OUT	The output gives a numerical value of 1 to 8 corresponding to the active input, 0 in case of error
	ERROR	The ERROR output is active if multiple inputs are active or if no input is active, or if an electrical failure is detected in the input signals
Parameters	NumPos	Number of input signals (2 to 8)
Examples		Mode selectors with a common contact and between 2 and 8 outputs

FUNCTIONS

Function	AND	AND logical function
Outputs	OUT	The OUT output is only active if all IN input signals are present

Function	DELAY	Delayed process activation/deactivation
Outputs	OUT	The OUT output is activated if a signal is present at the IN input with a delay of Td (parameter type Don) If the signal at the IN input drops out, the OUT output is deactivated with a delay of Td (parameter type Doff)
Parameters	Don / Doff	Delay type, Don (delay on) on activation or Doff (delay-off) on cut-off
	Td	Length of delay on activation or cut-off

Function	NOR	NOR logical function
Outputs	OUT	The OUT output is only active in the absence of all IN input signals

Function	OR	OR logical function
Outputs	OUT	The OUT output is only active if at least one IN input signal is present
Function	PULSE	Activation of a process for a short time
Outputs	OUT	The OUT output is activated on the IN signal falling edge and remains active for the time set by Tp
Parameters	Tp	Pulse duration

Function	START	Activation of a process
Outputs	OUT	The OUT output is activated by the edge (see parameters) of the CONTROL signal if the IN input signal is present. Thus, it remains active as long as the signal is present at IN
Parameters	MAN / CNT	MAN = activation on rising edge, CNT = activation on falling edge
Function	LKTBL	Lookup table; Conversion table between data of the same type
Outputs	BOUT	Converted data at output. Initial value = 0.
Parameters	Number of data	Number of data present in the table

Disclaimer:
Subject to modifications without prior notice and errors excepted. The data given in this sheet are accurately checked and refer to typical mass production values. The device descriptions and its applications, the fields of application, the external control details, as well as information on installation and operation, are provided to the best of our knowledge. This does not in any way mean that the characteristics described may entail legal liabilities extending beyond the "General Terms of Sale", as stated in the Pizzato Elettrica general catalogue. The customers/user is required to read our information and recommendations as well as the pertinent technical provisions before using the products for his own purposes.

Design A, housing thickness 22.5 mm

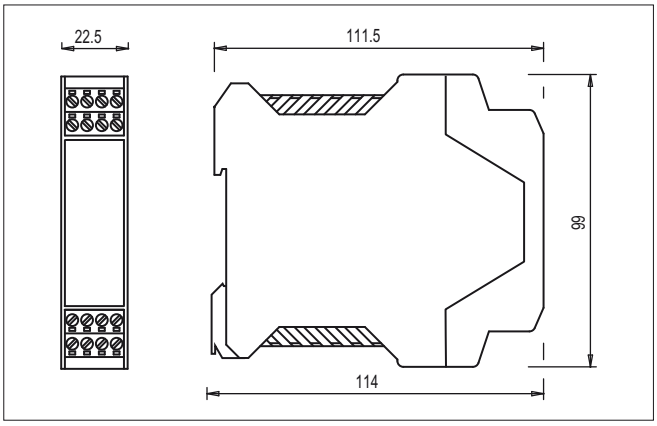
All values in the drawings are in mm

Connection data

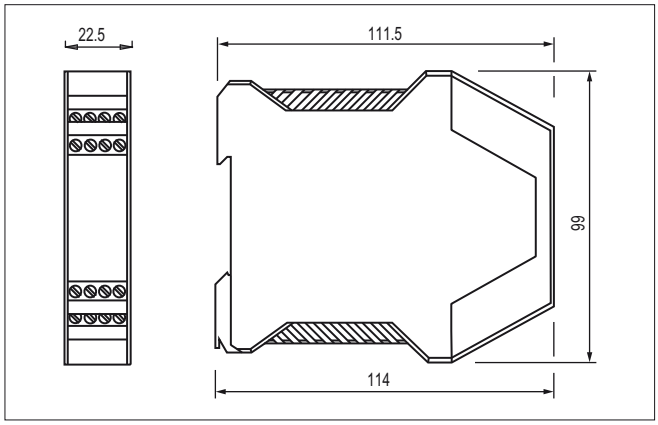
Terminal tightening torque:	0.5…0.6 Nm
Cable cross section:	0.2…2.5 mm²
	24…12 AWG

Installation

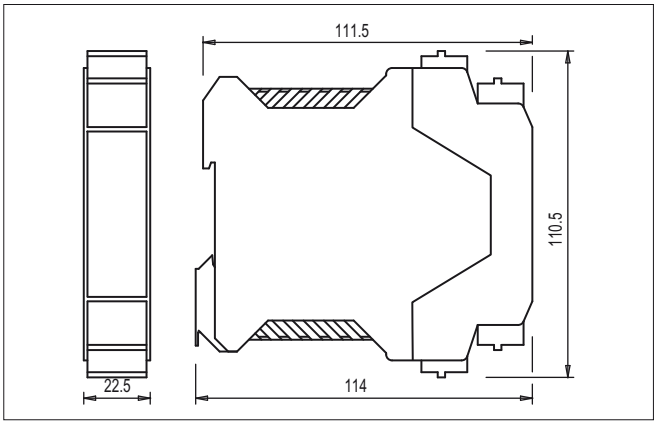
Snap-mounting on DIN rails



Connector with screw terminals



Screw terminals



Connector with spring terminals

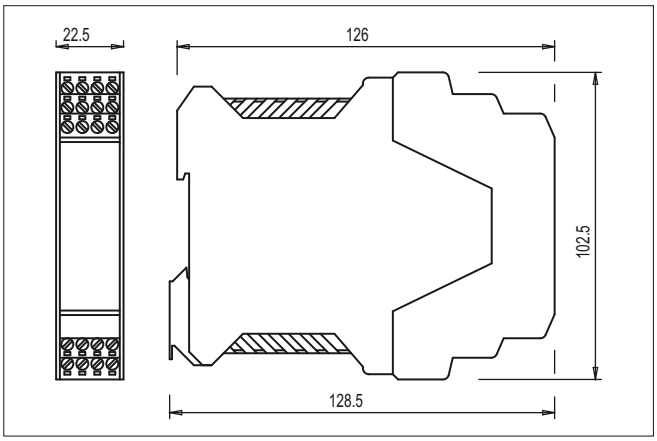
Design B, housing thickness 22.5 mm

Connection data

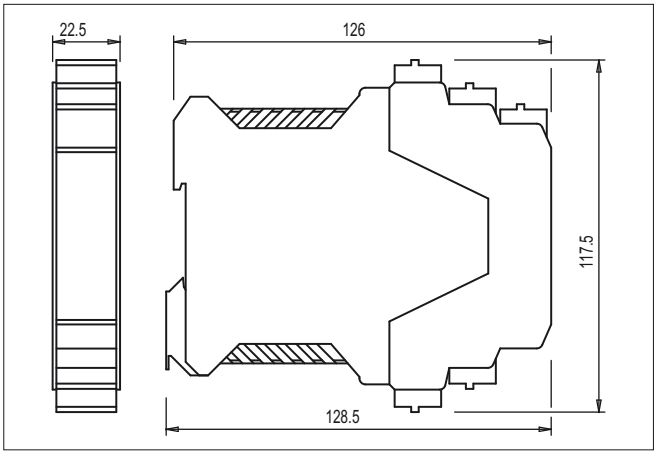
Terminal tightening torque:	0.5…0.6 Nm
Cable cross section:	0.2…2.5 mm²
	24…12 AWG

Installation

Snap-mounting on DIN rails



Connector with screw terminals

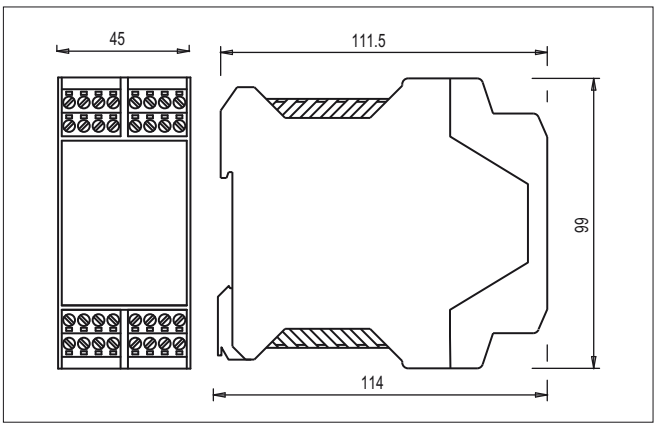


Connector with spring terminals

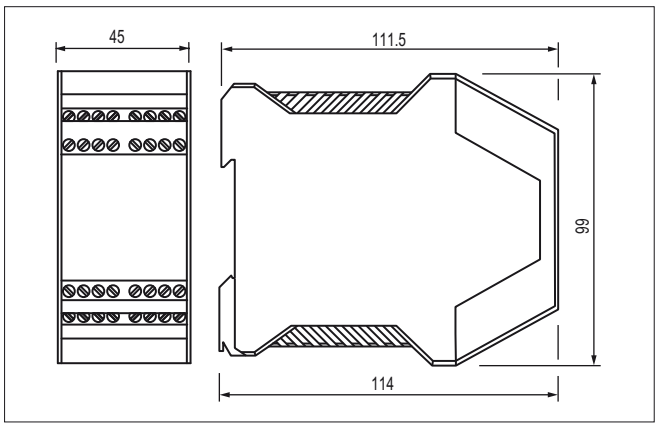
Design C, housing thickness 45 mm

Connection data
Terminal tightening torque: 0.5…0.6 Nm
Cable cross section: 0.2…2.5 mm²
24…12 AWG

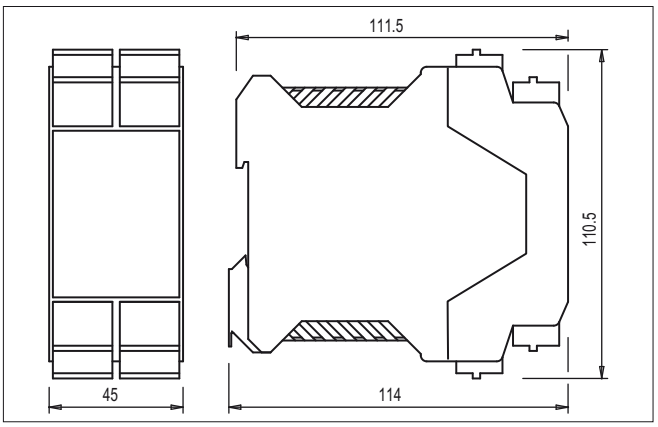
Installation
Snap-mounting on DIN rails



Connector with screw terminals



Screw terminals

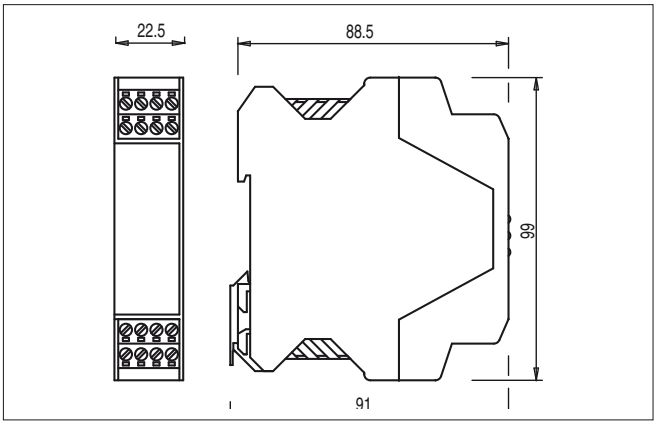


Connector with spring terminals

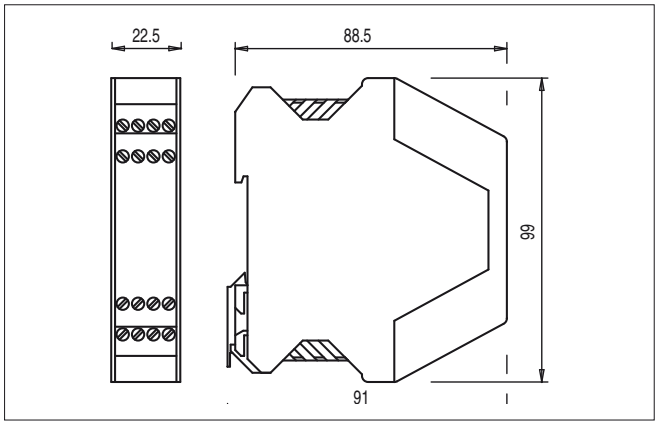
Design D, housing thickness 22.5 mm

Connection data
Terminal tightening torque: 0.5…0.6 Nm
Cable cross section: 0.2…2.5 mm²
24…12 AWG

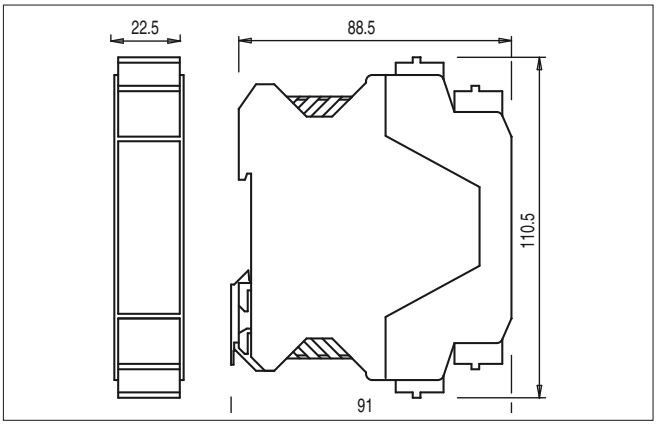
Installation
Snap-mounting on DIN rails



Connector with screw terminals



Screw terminals



Connector with spring terminals

Design E, housing thickness 67.5 mm

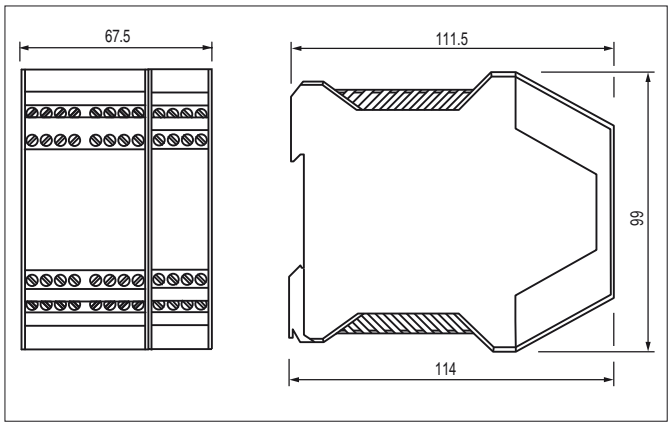
All values in the drawings are in mm

Connection data

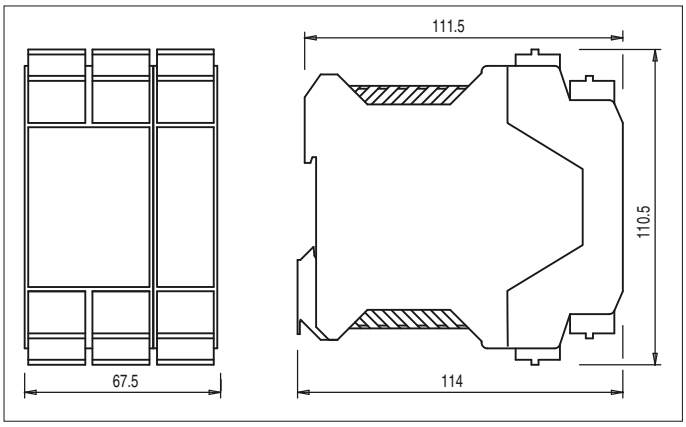
Terminal tightening torque:	0.5…0.6 Nm
Cable cross section:	0.2…2.5 mm²
	24…12 AWG

Installation

Snap-mounting on DIN rails



Screw terminals



Connector with spring terminals

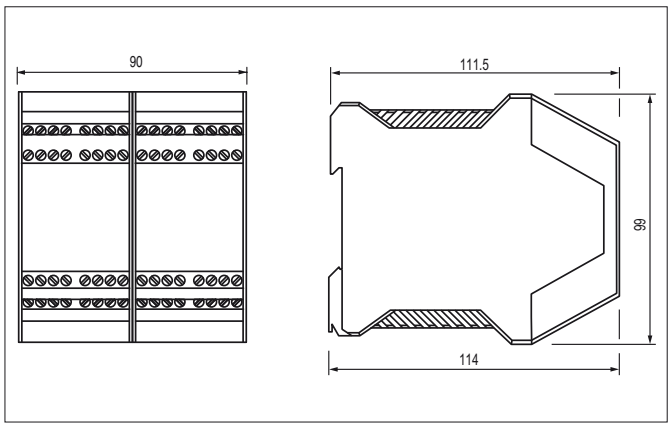
Design F, housing thickness 90 mm

Connection data

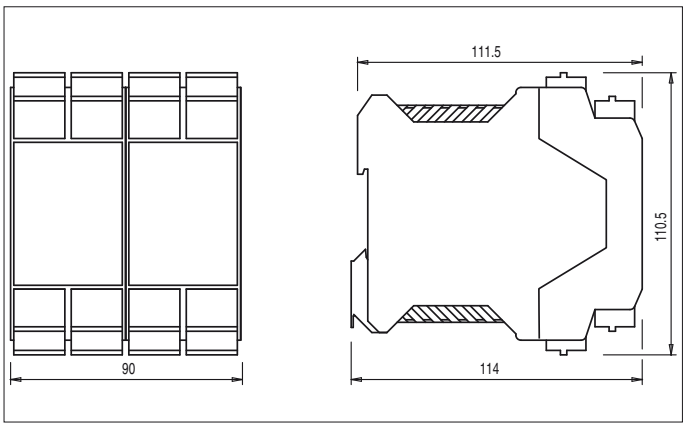
Terminal tightening torque:	0.5…0.6 Nm
Cable cross section:	0.2…2.5 mm²
	24…12 AWG

Installation

Snap-mounting on DIN rails

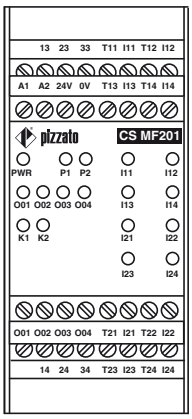


Screw terminals

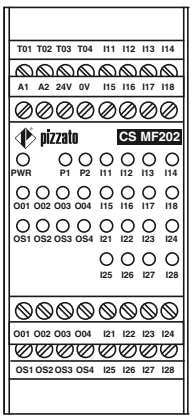


Connector with spring terminals

Pin assignment CS MF series

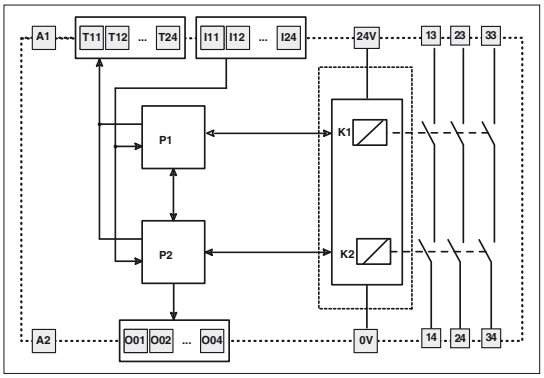


CS MF201

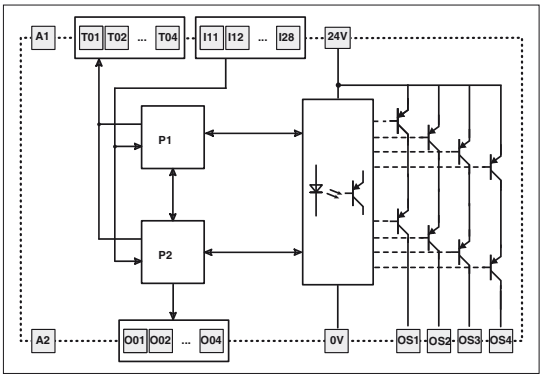


CS MF202

CS MF series internal block diagram



CS MF201



CS MF202

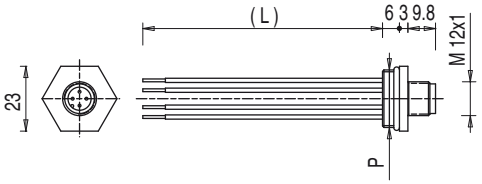
M12 male connectors

All values in the drawings are in mm

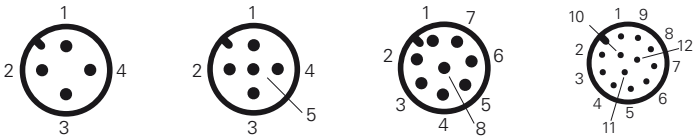
These standard M12 male connectors are ready for the installation on the switches.
Their wires have the right length for the connection to the contact blocks and are provided with wire-end sleeves. On request they can be delivered already wired to the switch. The connectors are used where a very short machine down time is required (e.g. in big plants). The connector-provided switch can be replaced very quickly with an identical one with no chance of incorrect wiring.

Technical data:

Max. operating voltage:	250 Vac / 300 Vdc (4/5-pole) 30 Vac / 36 Vdc (8/12-pole)
Max. operating current:	4 A (4/5-pole) 2 A (8-pole) 1.5 A (12-pole)
Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653
Ambient temperature:	-25°C … +80°C
Tightening torque:	1 … 1.5 Nm
Wire cross-section:	0.5 mm² (20 AWG) for 4/5-pole 0.25 mm² (23 AWG) for 8-pole 0.14 mm² (26 AWG) for 12-pole
Contact type:	gold-plated



Pin assignment



4 poles		5 poles		8 poles		12 poles	
Pin	Colour	Pin	Colour	Pin	Colour	Pin	Colour
1	Brown	1	Brown	1	White	1	Brown
2	White	2	White	2	Brown	2	Blue
3	Blue	3	Blue	3	Green	3	White
4	Black	4	Black	4	Yellow	4	Green
		5	Grey	5	Grey	5	Pink
				6	Pink	6	Yellow
				7	Blue	7	Black
				8	Red	8	Grey
						9	Red
						10	Purple
						11	Grey-Pink
						12	Red-Blue

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article — options

VF CNM5MM-L100

Body material	
M	metal
P	plastic

No. of poles	
4	4 poles
5	5 poles
8	8 poles
12	12 poles

Connection type	
M	M12x1

Connector thread (P)	
M	M20 x 1.5 (standard)
P	PG 13.5

Cable length (L)	
	8.5 cm (standard)
L16	16 cm
L100	100 cm
L200	200 cm

Stock items

- VF CNP4MM
- VF CNP4PM
- VF CNM5MM
- VF CNM5PM
- VF CNP8MM
- VF CNP5PM
- VF CNP5MM
- VF CNM4PM
- VF CNM8MM
- VF CNM8PM
- VF CNM12MM-L16
- VF CNM4MM

ATTENTION: always disconnect the power supply before removing the connector. The connector is not suitable for separation of electrical loads.
Note: the 12-pole connector is only available in metal with M20x1.5 thread and 16 cm cables.

Items with code on **green** background are stock items

→ The 2D and 3D files are available at **www.pizzato.com**

M12 female connectors with cable

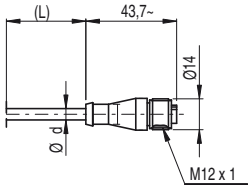
All values in the drawings are in mm

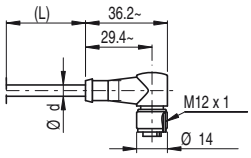
Technical data:

- Polyurethane connector body
- Class 6 copper conductors acc. to IEC 60228 - mobile installation
- Gold-plated contacts (resistance < 5 mΩ)
- Self-locking ring nut
- High flexibility cable with PVC sheath suitable to be used in drag chains, acc. to IEC 60332-3 and CEI 20-22II. With polyurethane sheath on request

Technical data:

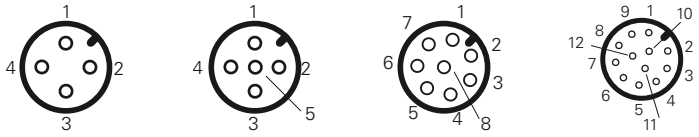
Max. operating voltage:	250 Vac / 300 Vdc (4/5-pole) 30 Vac / 36 Vdc (8/12-pole)
Max. operating current:	4 A (4-5-pole), 2 A (8-pole), 1.5 A (12-pole)
Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)
Ambient temperature:	-25°C … +80°C for fixed installation -15°C … +80°C for mobile installation
Wire cross-section:	0.34 mm² (22 AWG) for 4-pole 0.25 mm² (23 AWG) for 5/8-pole 0.14 mm² (26 AWG) for 12-pole
Minimum bending radius:	> cable diameter x 15





ø d: 5 mm for 4 and 5-pole
6 mm for 8 and 12 poles

Pin assignment



4 poles		5 poles		8 poles		12 poles	
Pin	Colour	Pin	Colour	Pin	Colour	Pin	Colour
1	Brown	1	Brown	1	White	1	Brown
2	White	2	White	2	Brown	2	Blue
3	Blue	3	Blue	3	Green	3	White
4	Black	4	Black	4	Yellow	4	Green
		5	Grey	5	Grey	5	Pink
				6	Pink	6	Yellow
				7	Blue	7	Black
				8	Red	8	Grey
						9	Red
						10	Purple
						11	Grey-Pink
						12	Red-Blue

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

VF CA4PD3M

No. of poles	
4	4 poles
5	5 poles
8	8 poles
12	12 poles

Cable sheath	
P	PVC (standard)
U	PUR

Connector type	
D	straight (standard)
G	angled

Connection type	
M	M12x1

Cable length (L)		No. of poles 4	5	8	12
1	1 metre				
2	2 metres				
3	3 metres (standard)	•	•		
4	4 metres				
5	5 metres (standard)	•	•	•	•
...					
0	10 metres (standard)	•	•	•	•

Other lengths on request

Stock items

VF CA4PD3M
VF CA4PD5M
VF CA4PD0M
VF CA5PD3M
VF CA5PD5M
VF CA5PD0M
VF CA8PD5M
VF CA8PD0M
VF CA12PD5M
VF CA12PD0M

Attention! No stock items, minimum order quantity 100 pcs.

ATTENTION: always disconnect the power supply before removing the connector. The connector is not suitable for separation of electrical loads.

Items with code on **green** background are stock items

➔ The 2D and 3D files are available at **www.pizzato.com**

M12 male connectors with cable

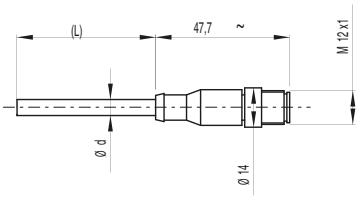
All values in the drawings are in mm

Technical data:

- Polyurethane connector body
- Class 6 copper conductors acc. to IEC 60228 - mobile installation
- Gold-plated contacts (resistance < 5 mΩ)
- Self-locking ring nut
- High flexibility cable with PVC sheath suitable to be used in drag chains, acc. to IEC 60332-3 and CEI 20-22II. With polyurethane sheath on request

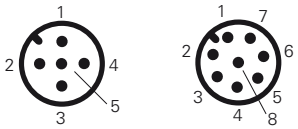
Technical data:

Max. operating voltage:	250 Vac / 300 Vdc (5-pole) 30 Vac / 36 Vdc (8-pole)
Max. operating current:	4 A (5-pole), 2 A (8-pole)
Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)
Ambient temperature:	-25°C … +80°C for fixed installation -15°C … +80°C for mobile installation
Wire cross-section:	0.25 mm2 (23 AWG)
Minimum bending radius:	> cable diameter x 15



ø d: 5 mm for 5-pole
6 mm for 8-pole

Pin assignment



5 poles		8 poles	
Pin	Colour	Pin	Colour
1	Brown	1	White
2	White	2	Brown
3	Blue	3	Green
4	Black	4	Yellow
5	Grey	5	Grey
		6	Pink
		7	Blue
		8	Red

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

VF CF5PD3M

No. of poles	
5	5 poles
8	8 poles

Connection type	
M	M12x1

Cable length (L)	
3	3 metres (standard)
5	5 metres
0	10 metres

Other lengths on request

Cable sheath	
P	PVC (standard)
U	PUR

Connector type	
D	straight

Articles

VF CF5PD3M
VF CF8PD3M

Attention! No stock items, minimum order quantity 100 pcs.

ATTENTION: always disconnect the power supply before removing the connector. The connector is not suitable for separation of electrical loads.

→ The 2D and 3D files are available at **www.pizzato.com**

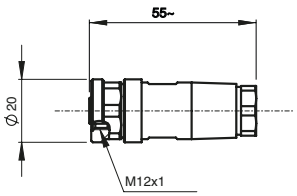
Field wireable M12 female connectors

All values in the drawings are in mm

General data

Technopolymer connector body
Gold-plated contacts
Screw terminals for cable screw fittings

Max. operating voltages	250 Vac/dc (4 and 5-pole) 30 Vac/dc (8-pole)
Maximum current	4 A (4 and 5-pole) 2 A (8-pole)
Protection degree	IP67 acc. to EN 60529
Ambient temperature	-25°C … +85°C
Wire cross-section	0.25 mm² (23 AWG) … 0.5 mm² (20 AWG)



Article	Description	no. of poles
VF CBMP4DM04	Field wireable M12 female connector, straight, for Ø 4 … Ø 6.5 mm multipolar cables	4
VF CBMP5DM04	Field wireable M12 female connector, straight, for Ø 4 … Ø 6.5 mm multipolar cables	5
VF CBMP8DM04	Field wireable M12 female connector, straight, for Ø 4 … Ø 7 mm multipolar cables	8

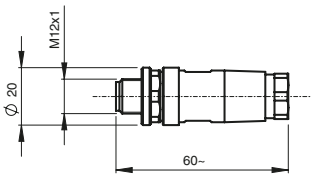
Field wireable M12 male connectors

All values in the drawings are in mm

General data

Technopolymer connector body
Gold-plated contacts
Screw terminals for cable screw fittings

Max. operating voltages	250 Vac/dc (5-pole) 30 Vac/dc (8-pole)
Maximum current	4 A (5-pole) 2 A (8-pole)
Protection degree	IP67 acc. to EN 60529
Ambient temperature	-25°C … +85°C
Wire cross-section	0.25 mm² (23 AWG) … 0.5 mm² (20 AWG)



Article	Description	no. of poles
VF CCMP5DM04	Field wireable M12 male connector, straight, for Ø 4 ... Ø 6.5 mm multipolar cables	5
VF CCMP8DM04	Field wireable M12 male connector, straight, for Ø 4 ... Ø 7 mm multipolar cables	8

ATTENTION: always disconnect the power supply before removing the connector. The connector is not suitable for separation of electrical loads.

Items with code on **green** background are stock items

➔ The 2D and 3D files are available at **www.pizzato.com**

Series connection with Y-shaped M12 connectors

To facilitate and simplify the series wiring of the safety devices, a variety of accessories designed specifically for this purpose are available. With the help of the proven M12 round connector and the connection of standard elements, safety equipment of Category 4, SIL3 and PL e with up to 32 elements connected in series is possible. All of which is possible without the risk of connection errors and with a high IP67 protection degree.
The safety circuits consist of a 24Vdc power supply unit, a number of extensions to the installed devices, Y connectors for branching out from the chain to each individual device and a terminating plug.
In addition to the power supply unit, a suitable safety module is used to assess the state of the safety outputs within the safety chain.

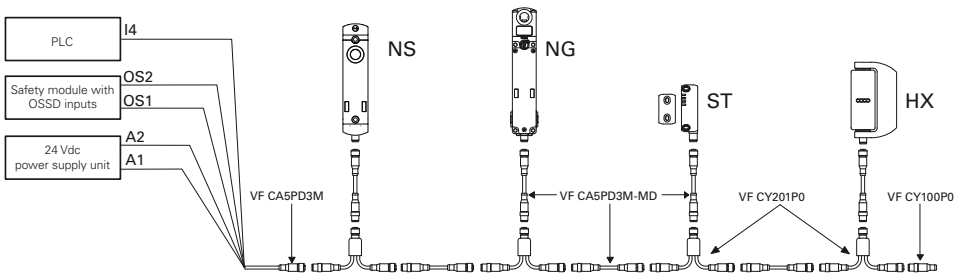
Devices suitable for series connection

The series may consist both of devices that are identical to one another (homogeneous series) or that belong to different series (mixed series).
Only the following Pizzato Elettrica devices may be connected in series using the Y connectors:
ST series safety sensors with RFID technology: ST D•31•M•, ST D•71•M•
NG series safety switches with solenoid and RFID technology: Any item with an M12 connector for series connection with a "Y" connector or with option: K950, K951, K952.
NS: Any item with an M12 connector for series connection with a "Y" connector or with the option "integrated cable or connector", letter "Q".
HX series safety hinge switches: HX BEE1-••M.

Electrical connection of the chain

Pin	Colour	Connection	
1	Brown	A1	Supply input +24 Vdc
2	White	OS1	Safety output
3	Blue	A2	Supply input 0 V
4	Black	OS2	Safety output
5	Grey	I4	Solenoid activation input

Note: By activating/deactivating input I4, all switches of the NG and NS series in the chain simultaneously block/open all guards. Activation and deactivation of input I4 has no effect on the ST sensors and HX hinges in the chain.



Attention! For proper operation of the devices connected in series via cables, Y connectors or junction boxes, it is necessary to pay particular attention to the voltage drop that occurs in the circuit. Pay particular attention to the flowing currents and cross-section/length of the used cables to ensure that the supply voltage of the components at the end of the series connection remains within the specified limit values during effective operation.

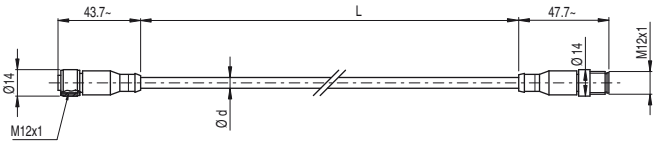
M12 extension cable

All values in the drawings are in mm

Technical data:
Polyurethane connector body
Class 6 copper conductors acc. to IEC 60228
Gold-plated contacts (resistance < 5 mΩ)
Self-locking ring nut
High flexibility cable with PVC sheath suitable to be used in drag chains, acc. to IEC 60332-3 and CEI 20-22II.

Technical data:

Max. operating voltage:	250 Vac / 300 Vdc (5-pole) 30 Vac / 36 Vdc (8-pole)
Max. operating current:	4 A (5-pole), 2 A (8-pole)
Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 2653 (Protect the cables from direct high-pressure and high-temperature jets)
Ambient temperature:	-25°C … +80°C for fixed installation -15°C … +80°C for mobile installation
Wire cross-section:	0.5 mm² (20 AWG) (5-pole) 0.25 mm² (23 AWG) (8-pole)
Minimum bending radius:	> cable diameter x 15



ø d: 6.4 mm for 5-pole
6 mm for 8-pole

Code structure

VF CA5PD3M-MD

No. of poles	
5	5 poles
8	8 poles

Cable sheath	
P	PVC

Connector type	
D	straight

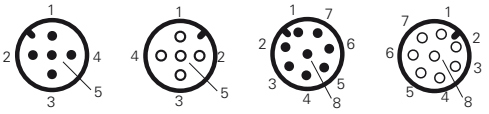
Connection type	
M	M12x1

Cable length (L)	No. of poles 5	8
3	3 metres (standard)	•	•
5	5 metres (standard)	•	•
0	10 metres (standard)	•	

Other lengths on request

Pin assignment

5 poles male	5 poles female	8 poles male	8 poles female



Stock items

VF CA5PD3M-MD
VF CA5PD5M-MD
VF CA5PD0M-MD
VF CA8PD3M-MD
VF CA8PD5M-MD

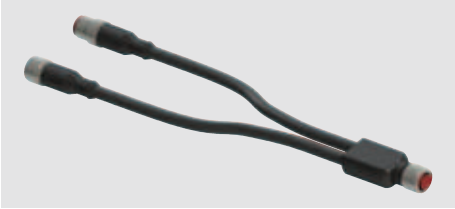
ATTENTION: always disconnect the power supply before removing the connector. The connector is not suitable for separation of electrical loads.

Items with code on **green** background are stock items

→ The 2D and 3D files are available at **www.pizzato.com**

M12 connectors, Y-shaped, for series connections

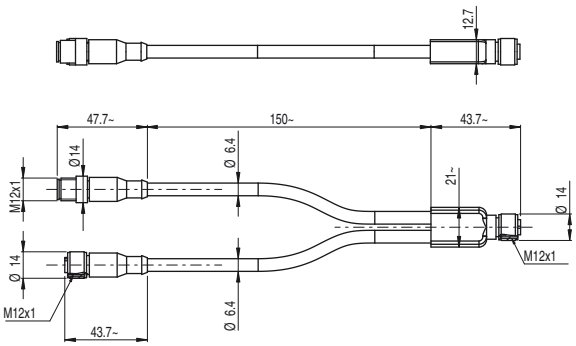
All values in the drawings are in mm



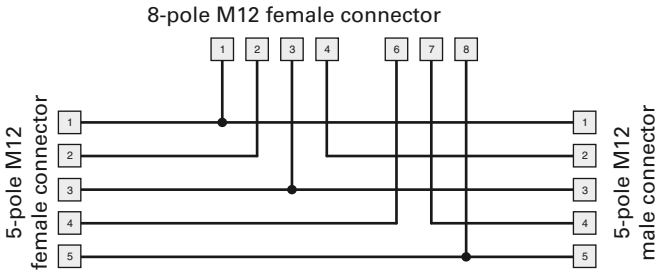
Technical data:
Polyurethane connector body
Class 6 copper conductors acc. to IEC 60228
Gold-plated contacts (resistance < 5 mΩ)
Self-locking ring nut
High flexibility cable with PVC sheath suitable to be used in drag chains, acc. to IEC 60332-3 and CEI 20-22II.

Technical data:

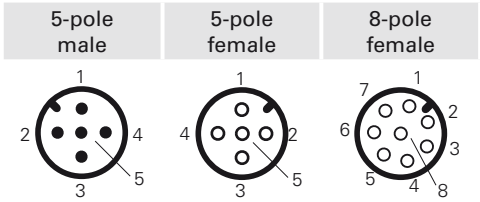
Max. operating voltage:	30 Vac / 36 Vdc
Max. operating current:	4 A (5-pole), 2 A (8-pole)
Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 2653 (Protect the cables from direct high-pressure and high-temperature jets)
Ambient temperature:	-25°C … +80°C for fixed installation -15°C … +80°C for mobile installation
Wire cross-section:	0.5 mm² (20 AWG)
Minimum bending radius:	> cable diameter x 15



Internal block diagram, Y-shaped connector



Pin assignment



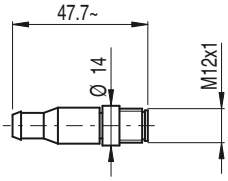
Article	Description
VF CY201P0	M12 connectors, Y-shaped, for series connections

M12 terminating plugs for series connections

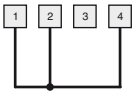
All values in the drawings are in mm

Technical data:
Polyurethane connector body
Gold-plated contacts (resistance < 5 mΩ)
Self-locking ring nut

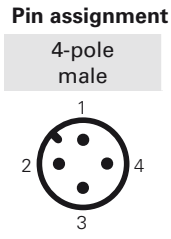
Protection degree:	IP67 acc. to EN 60529
Max. operating voltage:	250 Vac / 300 Vdc
Max. operating current:	4 A



Internal block diagram of the terminating plug



Pin assignment



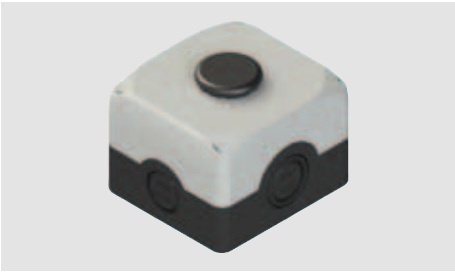
Article	Description
VF CY100P0	M12 terminating plugs for series connections, 4-pole

ATTENTION: always disconnect the power supply before removing the connector. The connector is not suitable for separation of electrical loads.

Items with code on **green** background are stock items

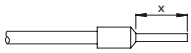
➔ The 2D and 3D files are available at **www.pizzato.com**

Junction box for series connection of up to 4 devices



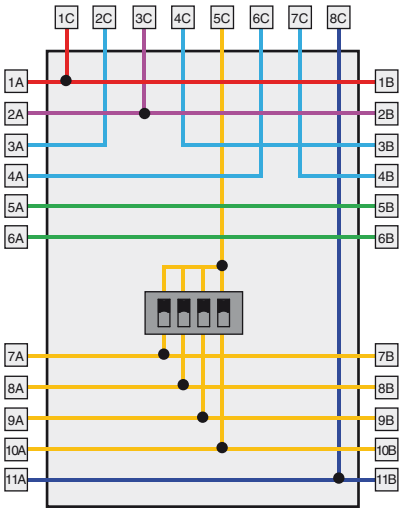
Technical data:

Material:	Self-extinguishing shock-proof polycarbonate with double insulation, UV-resistant and glass fibre reinforced, high shock resistance.
Material of the screws:	stainless steel
Protection degree:	IP67 acc. to EN 60529, IP69K acc. to ISO 20653, with cable gland of equal or higher protection degree
Conduit entries:	• 2x M20 - 1/2 NPT knock-out upper and lower entries • 2x M20 - 1/2 NPT - M25 knock-out side entries • 2x M16 knock-out base entries
Ambient temperature:	-40°C … +80°C
Tightening torque of the cover screws:	1 … 1.4 Nm
Connection system:	PUSH-IN spring type
Cross-section of rigid/flexible wires w. wire-end sleeve:	min. 1 x 0.34 mm² (1 x AWG 24) max. 1 x 1.5 mm² (1 x AWG 16)
Wire cross-section with pre-insulated wire-end sleeve:	min. 1 x 0.34 mm² (1 x AWG 24) max. 1 x 0.75 mm² (1 x AWG 18)
Cable stripping length (x):	min.: 8 mm max.: 12 mm



Article	Description
VF CY302P0	Junction box for series connection of up to 4 devices

Pin assignment



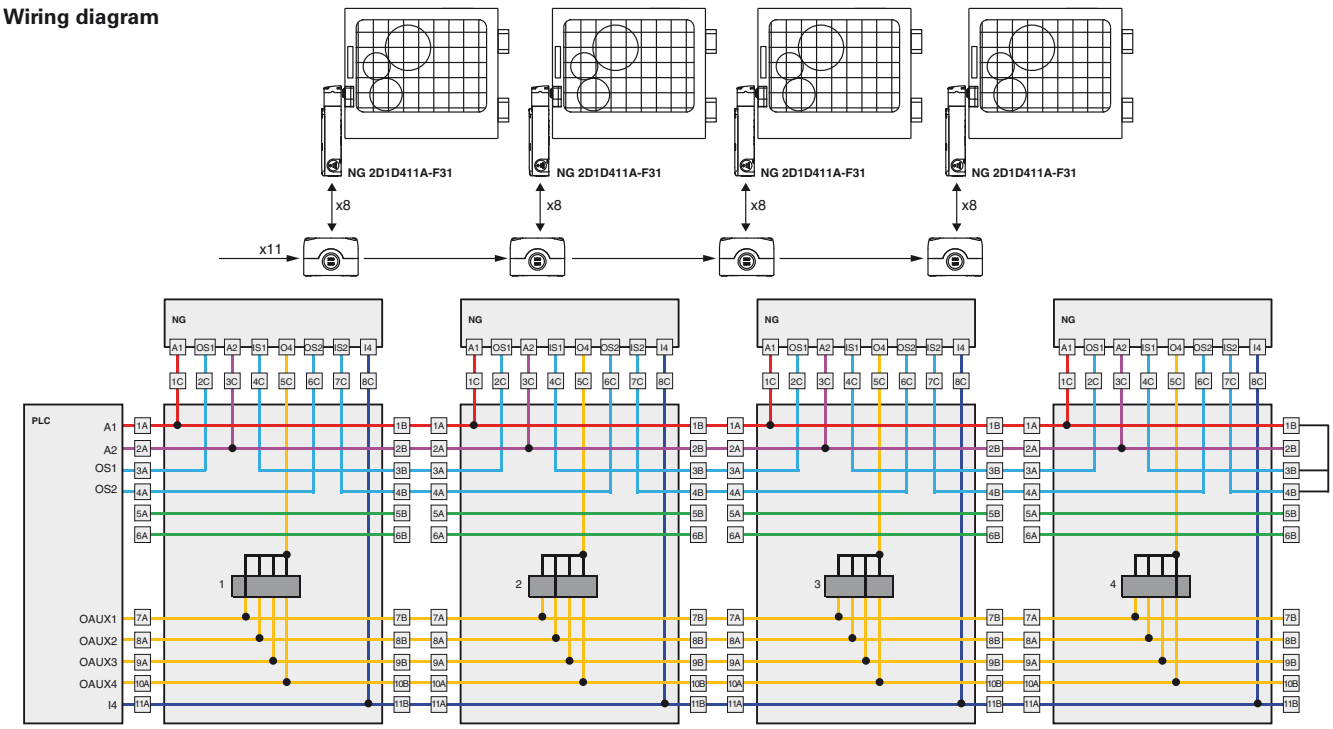
Example of series connection of 4 NG series switches

Terminal box	Connection	
1A	A1	Supply input +24 Vdc
2A	A2	Supply input 0 V
3A	OS1	Safety output
4A	OS2	Safety output
5A		Auxiliary connection
6A		Auxiliary connection
7A	OAUX1	Auxiliary output Oaux1
8A	OAUX2	Auxiliary output Oaux2
9A	OAUX3	Auxiliary output Oaux3
10A	OAUX4	Auxiliary output Oaux4
11A	I4	Solenoid activation input

Terminal box	Connection	
1B	A1	Supply input +24 Vdc
2B	A2	Supply input 0 V
3B	IS1	Safety input
4B	IS2	Safety input
5B		Auxiliary connection
6B		Auxiliary connection
7B	OAUX1	Auxiliary output Oaux1
8B	OAUX2	Auxiliary output Oaux2
9B	OAUX3	Auxiliary output Oaux3
10B	OAUX4	Auxiliary output Oaux4
11B	I4	Solenoid activation input

Terminal box	Connection	
1C	A1	Supply input +24 Vdc
2C	OS1	Safety output
3C	A2	Supply input 0 V
4C	IS1	Safety input
5C	O3	Signalling output, actuator inserted
	O4	Signalling output, actuator inserted and locked
6C	OS2	Safety output
7C	IS2	Safety input
8C	I4	Solenoid activation input

Wiring diagram

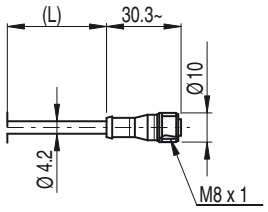


M8 female connectors with cable

All values in the drawings are in mm

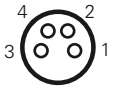
Technical data:
Polyurethane connector body
Class 6 copper conductors acc. to IEC 60228
Gold-plated contacts (resistance < 5 mΩ)
Self-locking ring nut
High flexibility cable with PVC sheath suitable to be used in drag chains, acc. to IEC 60332-3 and CEI 20-22II. With polyurethane sheath on request.

Max. operating voltage:	60 Vac / 75 Vdc
Max. operating current:	4 A
Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)
Ambient temperature:	-25°C … +80°C for fixed installation -15°C … +80°C for mobile installation
Wire cross-section:	0.25 mm2 (23 AWG)
Minimum bending radius:	> cable diameter x 15



Pin assignment

4 poles



Pin	Colour
1	Brown
2	White
3	Blue
4	Black

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

VF CA4PD3K

No. of poles	
4	4 poles

Cable sheath	
P	PVC (standard)
U	PUR

Connector type	
D	straight

Connection type	
K	M8x1

Cable length (L)	
1	1 metre
2	2 metres
3	3 metres (standard)
4	4 metres
5	5 metres (standard)
...	
0	10 metres

Other lengths on request

Stock items

VF CA4PD3K
VF CA4PD5K

Attention! No stock items, minimum order quantity 100 pcs.

Items with code on **green** background are stock items

➔ The 2D and 3D files are available at **www.pizzato.com**

Field wireable M23 female connectors

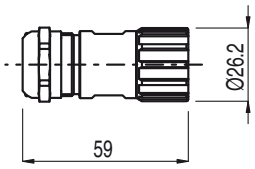
All values in the drawings are in mm

General data:

- Nickel-plated metal connector body
- Gold-plated contacts
- 12-pole or 19-pole versions

Technical data:

Max. operating voltage:	250 Vac (12-pole)
Max. operating voltage:	100 Vac (19-pole)
Max. operating current:	8 A
Protection degree:	IP67 / IP69K
Ambient temperature:	-40°C … +125°C
Tightening torque:	1 … 1.5 Nm
Contact type:	gold-plated (resistance < 3 mΩ)
Pollution degree:	3
Switching cycles:	> 1000



Pin configuration

12 poles

clockwise numbering

counterclockwise numbering

19-pole

clockwise numbering

Article	Description
VF AC2205	Mounting key. Necessary for opening and wiring the connector.

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

VF CBSM12TC07

Connection type	
S	M23x1

Body material	
M	metal

No. of poles	
12	12 poles
19	19-pole

Pin connection type	
C	crimp connection (standard) 0.34 … 1 mm²
S	solder connection 0.34 … 1 mm²

Cable diameter	
07	Ø 7 … Ø 12 mm

Connector type	
T	clockwise numbering (standard)
D	counterclockwise numbering

Stock items

VF CBSM12TC07
VF CBSM19TC07
VF CBSM12TS07

Note: For crimp connections, use, e.g., Knipex pliers, article number 97 52 63.

Items with code on **green** background are stock items

→ The 2D and 3D files are available at **www.pizzato.com**

M23 female connectors with cable

All values in the drawings are in mm

General data:

- Polyurethane connector body
- Class 5 copper conductors acc. to VDE 0295 (12-pole)
- Class 2 copper conductors acc. to VDE 0295 (19-pole)
- Gold-plated contacts (resistance < 5 mΩ)
- Self-locking ring nut
- Cable with PVC sheath acc. to IEC 60332-3, CEI 20-22 II e CEI 20-35/1-2 (flame retarding)

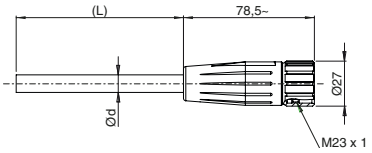
Technical data:

Max. operating voltage:	250 Vac (12-pole) 100 Vac (19-pole)
Max. operating current:	4 A
Protection degree:	IP67 acc. to EN 60529 IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)
Ambient temperature:	-5°C … +70°C
Wire cross-section:	0.5 mm² (20 AWG) (12-pole) 0.34 mm² (22 AWG) (19-pole)
Minimum bending radius:	> cable diameter x 15

Pin assignment

12-pole	19-pole

Pin	Colour	Pin	Colour
1	White	1	White
2	Brown	2	Brown
3	Green	3	Green
4	Yellow	4	Yellow
5	Grey	5	Grey
6	Pink	6	Pink
7	Blue	7	Blue
8	Red	8	Red
9	Black	9	Black
10	Purple	10	Purple
11	Grey-Pink	11	Grey-Pink
12	Red-Blue	12	Red-Blue
		13	White-Green
		14	Brown-Green
		15	White-Yellow
		16	Yellow-Brown
		17	White-Grey
		18	Grey-Brown
		19	White-Pink



ø d: 8.2 mm for 12-pole
8.6 mm for 19 poles

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

VF CA12PD20S

No. of poles	
12	12-pole
19	19-pole

Connection type	
S	M23x1

Cable sheath	
P	PVC (standard)

Cable length (L)	
0	10 metres
20	20 metres

Other lengths on request

Connector type	
D	straight (standard)

Articles

VF CA12PD0S
VF CA12PD20S
VF CA19PD0S
VF CA19PD20S

Attention! No stock items, minimum order quantity 50 pcs.

ATTENTION: always disconnect the power supply before removing the connector. The connector is not suitable for separation of electrical loads.

Items with code on **green** background are stock items

➔ The 2D and 3D files are available at **www.pizzato.com**

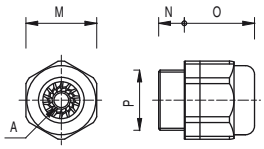
Strain relief cable glands

Packs of **10 pcs.**

This particular design ensures high resistance to traction of the cable glands. All cable glands are also suitable for a wide range of cable diameters.
Suitable for circular cross-section cables only.

Technical data:

Body and ring material:	technopolymer without halogen
Protection degree:	IP67 acc. to EN 60529
Tightening torque:	3 … 4 Nm (PG 13.5/M20) 2 … 2.5 Nm (PG 11/M16)



	Article	Description	A	⬡M	N	O	P
Metric threads	VF PAM25C7N	Cable gland M25x1.5 for a cable from Ø 10 to Ø 17 mm	○	30	10	28	M25x1.5
	VF PAM20C6N	M20x1.5 cable gland for one cable Ø 6 … 12 mm	○	24	9	24	M20x1.5
	VF PAM20C5N	M20x1.5 cable gland for one cable Ø 5 … 10 mm	○	24	9	24	M20x1.5
	VF PAM20C3N	M20x1.5 cable gland for one cable Ø 3 … 7 mm	○	24	9	24	M20x1.5
	VF PAM16C5N	M16x1.5 cable gland for one cable Ø 5 … 10 mm	○	22	7.5	23	M16x1.5
	VF PAM16C4N	M16x1.5 cable gland for one cable Ø 4 … 8 mm	○	22	7.5	23	M16x1.5
	VF PAM16C3N	M16x1.5 cable gland for one cable Ø 3 … 7 mm	○	22	7.5	23	M16x1.5
	VF PAM20CBN	M20x1.5 multi-hole cable gland for 2 cables Ø 3 … 5 mm	○	24	9	23	M20x1.5
	VF PAM20CDN	M20x1.5 multi-hole cable gland for 3 cables Ø 1 … 4 mm	○	24	9	23	M20x1.5
	VF PAM20CEN	M20x1.5 multi-hole cable gland for 3 cables Ø 3 … 5 mm	○	24	9	23	M20x1.5
	VF PAM20CFN	M20x1.5 multi-hole cable gland for 4 cables Ø 1 … 4 mm	○	22	9	23	M20x1.5
Threads PG	VF PAP13C6N	PG 13.5 cable gland for one cable from Ø 6 … 12 mm	○	24	9	24	PG 13.5
	VF PAP13C5N	PG 13.5 cable gland for one cable from Ø 5 … 10 mm	○	24	9	24	PG 13.5
	VF PAP13C3N	PG 13.5 cable gland for one cable from Ø 3 … 7 mm	○	24	9	24	PG 13.5
	VF PAP11C5N	PG 11 cable gland for one cable from Ø 5 … 10 mm	○	22	7.5	23	PG 11
	VF PAP11C4N	PG 11 cable gland for one cable from Ø 4 … 8 mm	○	22	7.5	23	PG 11
	VF PAP11C3N	PG 11 cable gland for one cable from Ø 3 … 7 mm	○	22	7.5	23	PG 11

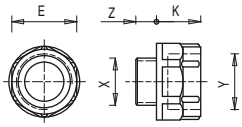
Thread adapters

Packs of **100 pcs.**

Thread adapters make it possible to fulfil requests for switches with a different thread to those generally found in stock. This means it is possible to offer customers a single product type with various threaded connections, while only having to stock the product itself and many kinds of adapters.

Technical data:

Body material:	glass fibre reinforced technopolymer
Tightening torque:	3 … 4 Nm



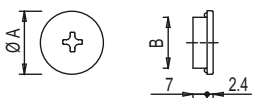
Article	Description	X	Y	Z	K	⬡E
VF ADPG13-PG11	Adapter from PG 13.5 to PG 11	PG 13.5	PG 11	9	12	22
VF ADPG13-M20	Adapter from PG 13.5 to M20x1.5	PG 13.5	M20x1.5	9	14	24
VF ADPG13-1/2NPT	Adapter from PG 13.5 to 1/2 NPT	PG 13.5	1/2 NPT	9	14	24
VF ADPG11-1/2NPT	Adapter from PG 11 to 1/2 NPT	PG 11	1/2 NPT	7	14	24
VF ADPG11-PG13	Adapter from PG 11 to PG 13.5	PG 11	PG 13.5	7	14	24
VF ADM20-1/2NPT	Adapter from M20 x 1.5 to 1/2 NPT	M20 x 1.5	1/2 NPT	9	14	24

Protection caps

Packs of **10 pcs.**

Technical data:

Body material:	technopolymer, self-extinguishing
Protection degree:	IP67 acc. to EN 60529 and IP69K acc. to ISO 20653
Tightening torque:	1.2 … 1.6 Nm
Cross-recessed screw:	PH3



Article	Description	A	B
VF PTM20	Protection cap M20x1.5	24	M20x1.5
VF PTG13.5	Protection cap PG13.5	24	PG 13.5

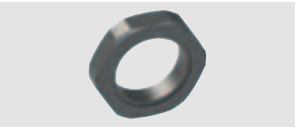
All values in the drawings are in mm

Items with code on **green** background are stock items

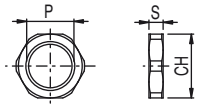
→ The 2D and 3D files are available at **www.pizzato.com**

Threaded nuts

Packs of **10 pcs.**



Technical data:
Body material: technopolymer
Tightening torque: 1.2 … 2 Nm



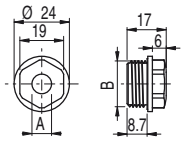
	Article	Description	S	CH	P
Plastic	VF DFPM25	Plastic nut, threaded, M25x1.5	6	32	M25x1.5
	VF DFPM20	Plastic nut, threaded, M20x1.5	6	27	M20x1.5
	VF DFPM16	Plastic nut, threaded, M16x1.5	5	22	M16x1.5
	VF DFPP13	Plastic nut, threaded, PG13.5	6	27	PG 13.5
Metal	VF DFMM20	M20x1.5 threaded nut in nickel-plated brass	3	23	M20x1.5

Chock plugs

Packs of **100 pcs.**

Technical data:
Body material: technopolymer
Protection degree: IP54 acc. to EN 60529
Tightening torque: 0.8 … 1 Nm

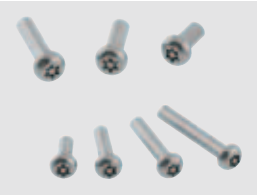
Notes: Use a socket wrench for tightening.



Article	Description	A	B
VF PFM20C8N	M20x1.5 chock plug for cables from Ø 8…Ø 12 mm	7.5	M20x1.5
VF PFM20C4N	M20x1.5 chock plug for cables from Ø 4…Ø 8 mm	3.5	M20x1.5

Torx safety screws

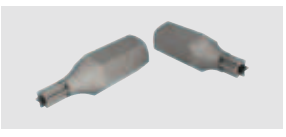
Packs of **10 pcs.**



Pan head screws with Torx fitting and pin, stainless steel.
Use a thread locker where required for applications acc. to. EN ISO 14119.

Article	Description
VF VAM4X10BX-X	M4x10 screw, with Torx T20 fitting, AISI 304
VF VAM4X15BX-X	M4x15 screw, with Torx T20 fitting, AISI 304
VF VAM4X20BX-X	M4x20 screw, with Torx T20 fitting, AISI 304
VF VAM4X25BX-X	M4x25 screw, with Torx T20 fitting, AISI 304
VF VAM4X30BX-X	M4x30 screw, with Torx T20 fitting, AISI 304
VF VAM5X10BX-X	M5x10 screw, with Torx T25 fitting, AISI 304
VF VAM5X15BX-X	M5x15 screw, with Torx T25 fitting, AISI 304
VF VAM5X20BX-X	M5x20 screw, with Torx T25 fitting, AISI 304
VF VAM5X25BX-X	M5x25 screw, with Torx T25 fitting, AISI 304
VF VAM5X35BX-X	M5x35 screw, with Torx T25 fitting, AISI 304
VF VAM5X45BX-X	M5x45 screw, with Torx T25 fitting, AISI 304

Bits for Torx safety screws



Bits for Torx safety screws with pin, with ¼" hexagonal connection.

Article	Description
VF VAIT1T20	Bits for M4 screws with Torx T20 fitting
VF VAIT1T25	Bits for M5 screws with Torx T25 fitting
VF VAIT1T30	Bits for M6 screws with Torx T30 fitting

One-Way safety screws

Packs of **10 pcs.**

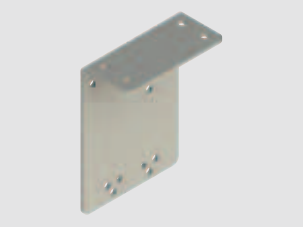
Pan head screws with OneWay fitting in stainless steel.
This screw type cannot be removed or tampered with using common tools. Ideal for fixing safety device actuators in accordance with EN ISO 14119.

Article	Description
VF VAM4X10BW-X	M4x10 screw, with OneWay fitting, AISI 304
VF VAM4X15BW-X	M4x15 screw, with OneWay fitting, AISI 304
VF VAM4X20BW-X	M4x20 screw, with OneWay fitting, AISI 304
VF VAM4X25BW-X	M4x25 screw, with OneWay fitting, AISI 304
VF VAM5X10BW-X	M5x10 screw, with OneWay fitting, AISI 304
VF VAM5X15BW-X	M5x15 screw, with OneWay fitting, AISI 304
VF VAM5X20BW-X	M5x20 screw, with OneWay fitting, AISI 304
VF VAM5X25BW-X	M5x25 screw, with OneWay fitting, AISI 304

Items with code on **green** background are stock items

➔ The 2D and 3D files are available at **www.pizzato.com**

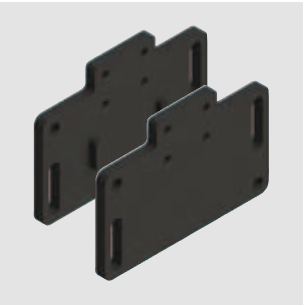
Fixing plates



Metal fixing plate, for fixing rope switches on the ceiling.
The plate is provided with bore holes for fasting switches of the FD, FL, FC, FP, FR, FM, FZ, FX, FK series. It is supplied without screws.

Article	Description
VF SFP2	Ceiling fixing plate

Fixing plates



Fixing plate (complete with fastening screws) provided with long slots for adjusting the operating point.
Each plate is provided with two pairs of fixing holes, one for standard switches and one for switches with reset device. The actuator thus always has the same actuating point.

Article	Description
VF SFP1	Fixing plate (FR series)
VF SFP3	Fixing plate (FX series)

Items with code on **green** background are stock items

→ The 2D and 3D files are available at **www.pizzato.com**

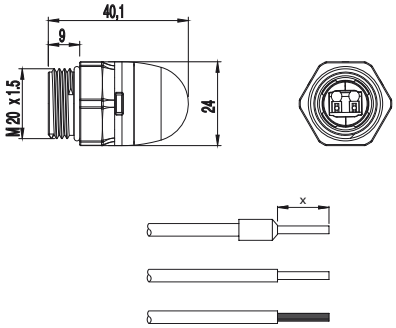
LED signalling lights

Packs of **5 pcs.**

These signalling lights with high luminosity LEDs are used for signalling that an electric contact has changed its state inside the switch. They can be installed only on switches of the FL, FX, FZ, FW, FG, NG or FS series by screwing them on one of the conduit entries not used for electric cables. They can be used for many different purposes: for example, in combination with a rope switch (e.g. FL 1878-M2) they can be used to signal (even from a distance) if the switch has been actuated.
In combination with safety switches with separate actuator (e.g. FL 693-M2), they can instead be used to signal whether or not the protection is closed correctly. In combination with solenoid safety switches (FS, FG or NG series), they can signal if the protection is locked or unlocked. If they are combined with any switch of the FL, FX, FW or FZ series they can be used to calibrate the actuator. The inner part can rotate in such a way that it can be wired and screwed on the switch without any risk of twisting the wires.

Technical data:

Protection degree:	IP67 acc. to EN 60529 and IP69K acc. to ISO 20653
Ambient temperature:	-25°C … +70°C
Operating voltage U_n:	24 Vac/dc 120 Vac 230 Vac
Tolerance on the supply voltages:	±15% of U_n
Operating current:	10 mA
Connection system:	PUSH-IN spring type
Cross-section of rigid/flexible wires w. wire-end sleeve:	min. 1 x 0.34 mm² (1 x AWG 24) max. 1 x 1.5 mm² (1 x AWG 16)
Wire cross-section with pre-insulated wire-end sleeve:	min. 1 x 0.34 mm² (1 x AWG 24) max. 1 x 0.75 mm² (1 x AWG 18)
Cable stripping length (x):	min.: 8 mm max.: 12 mm
Tightening torque.	1.2 … 2 Nm



Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

VF SL1A3PA1

Operating voltage	
1	24 Vac/dc
3	120 Vac
4	230 Vac

Type of light source	
A	standard LED with continuous light

Body design	
A	Total height 40 mm, spherical lens, threading M20x1.5mm

Connection type	
P	PUSH-IN terminal strip

Lens colour	
2	White
3	Red
4	Green
5	Yellow

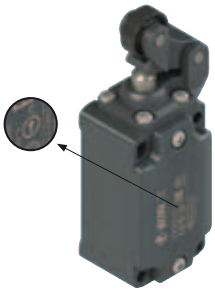
Stock items

VF SL1A3PA1
VF SL1A5PA1

Items with code on **green** background are stock items

→ The 2D and 3D files are available at **www.pizzato.com**

Installation of single switches with safety functions



- Use **only** switches with the symbol ⊖ (see figure on the side).
- Connect the safety circuit to **the NC normally closed contacts (11-12, 21-22 or 31-32).**
- **The NO normally open contacts (13-14, 23-24, 33-34)** should be used **only for signalling**; these contacts are not to be connected with the safety circuit. However, if two or more switches are used on the same guard, a connection can be established between the NO contacts and the safety circuit.
  In this case at least one of the two switches must have positive opening and a normally closed contact NC (11-12, 21-22 or 31-32) must be connected to the safety circuit.
- Actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol ⊖.
- The actuation system must be able to exert a force that is greater than the **positive opening force**, as specified in brackets below each article, next to the minimum force value.
- The device must be affixed in compliance with EN ISO 14119.

Whenever the machine guard is opened and during the whole opening travel, **the switch must be pressed directly** (fig. 1) **or through a rigid connection** (fig. 2)**.**
Only in this way the positive opening of the normally closed NC contacts (11-12, 21-22, 31-32) is guaranteed.

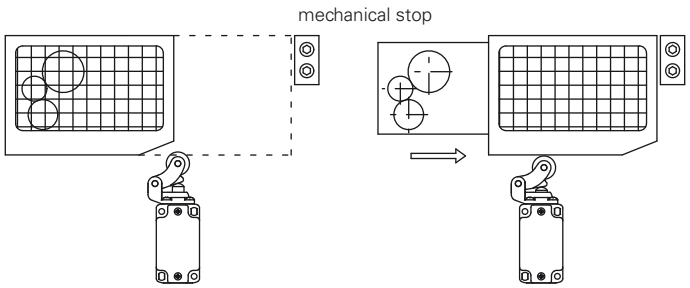


Fig.1

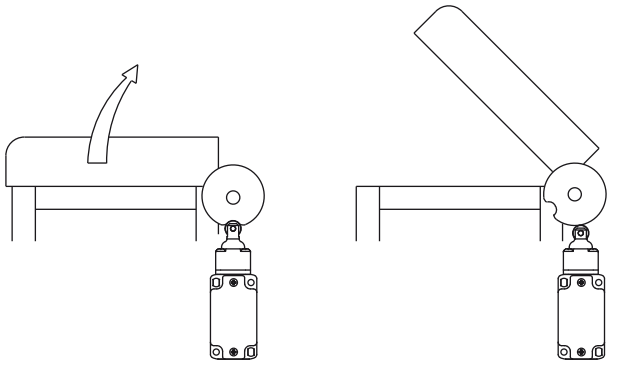


Fig.2

In safety applications with only one switch for each guard, the switches **must never be activated by a release** (fig. 3 and 4) **or through a non rigid connection** (i.e. by a spring).

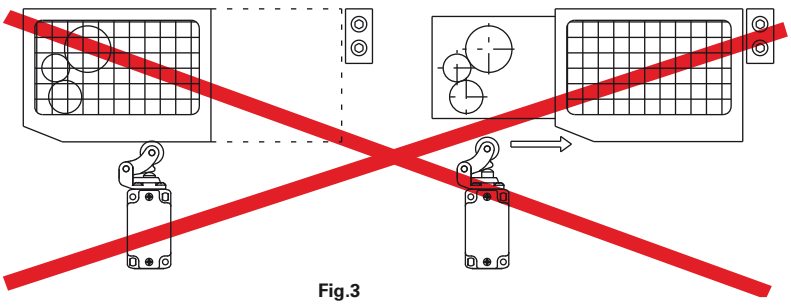


Fig.3

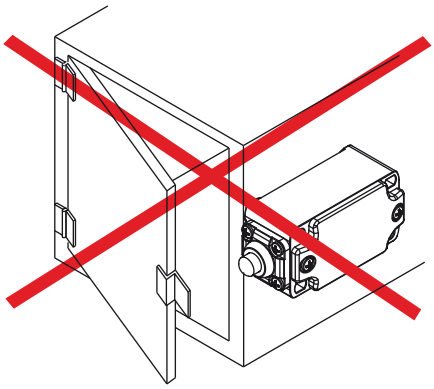
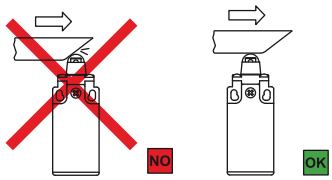


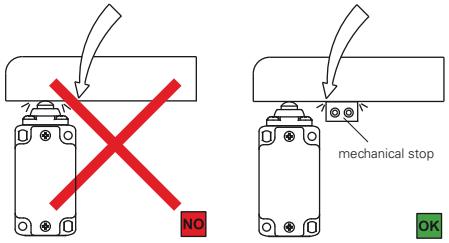
Fig.4

Mechanical stop

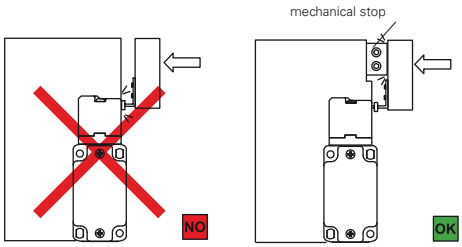
Acc. to EN ISO 14119 paragraph 5.2 letter h) "the position sensors must not be used as mechanical stop".



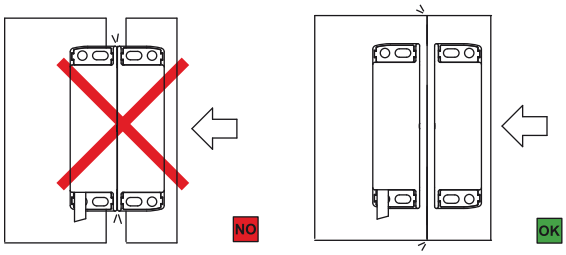
The actuator must not exceed the max. travel as indicated in the travel diagrams.



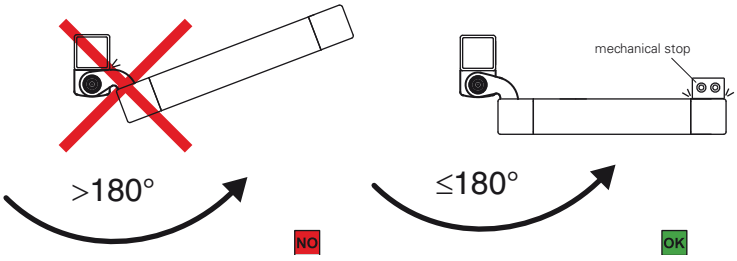
The guard must not use the switch head as a mechanical stop.



The actuator must not strike directly against the switch head.

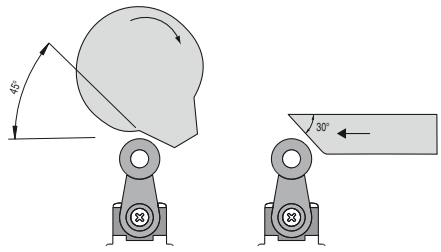
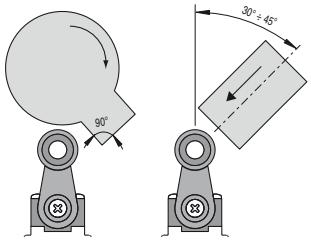
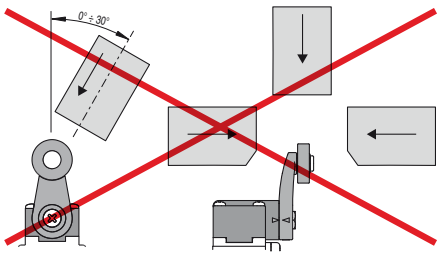
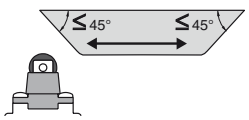
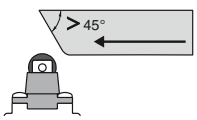
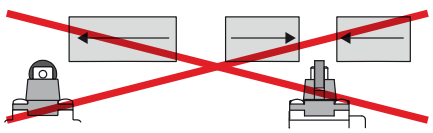
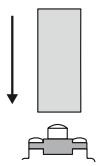
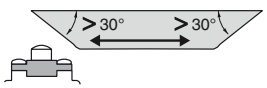
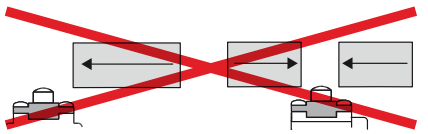


The actuator must not strike directly against the magnetic sensor.



The opening angle of safety hinge switch HP and HC series must not exceed 180°.

Actuation modes

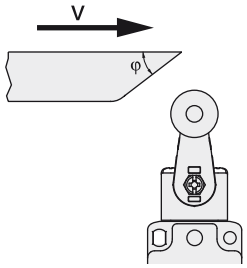
Recommended application	Application to avoid This application is possible, but increased mechanical stress may shorten the operating life of the switch	Forbidden application
		
		
		

Switches for heavy duty applications

Maximum and minimum actuation speed - FD-FL-FP-FC series

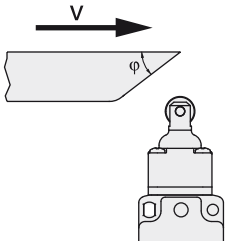
Roller lever - Type 1

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	2,5	9	0,07
30°	1,5	8	
45°	1	7	
60°	0,75	7	



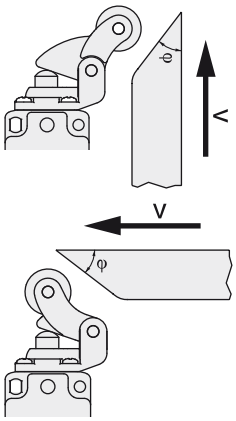
Roller plunger - Type 2

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	4	0,04
30°	0,5	2	0,02
45°	0,3	1	0,01



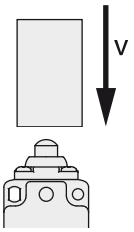
Roller lever - Type 3

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	5	0,05
30°	0,5	2,5	0,025
45°	0,3	1,5	0,015



Plunger - Type 4

Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
0,5	1	0,01

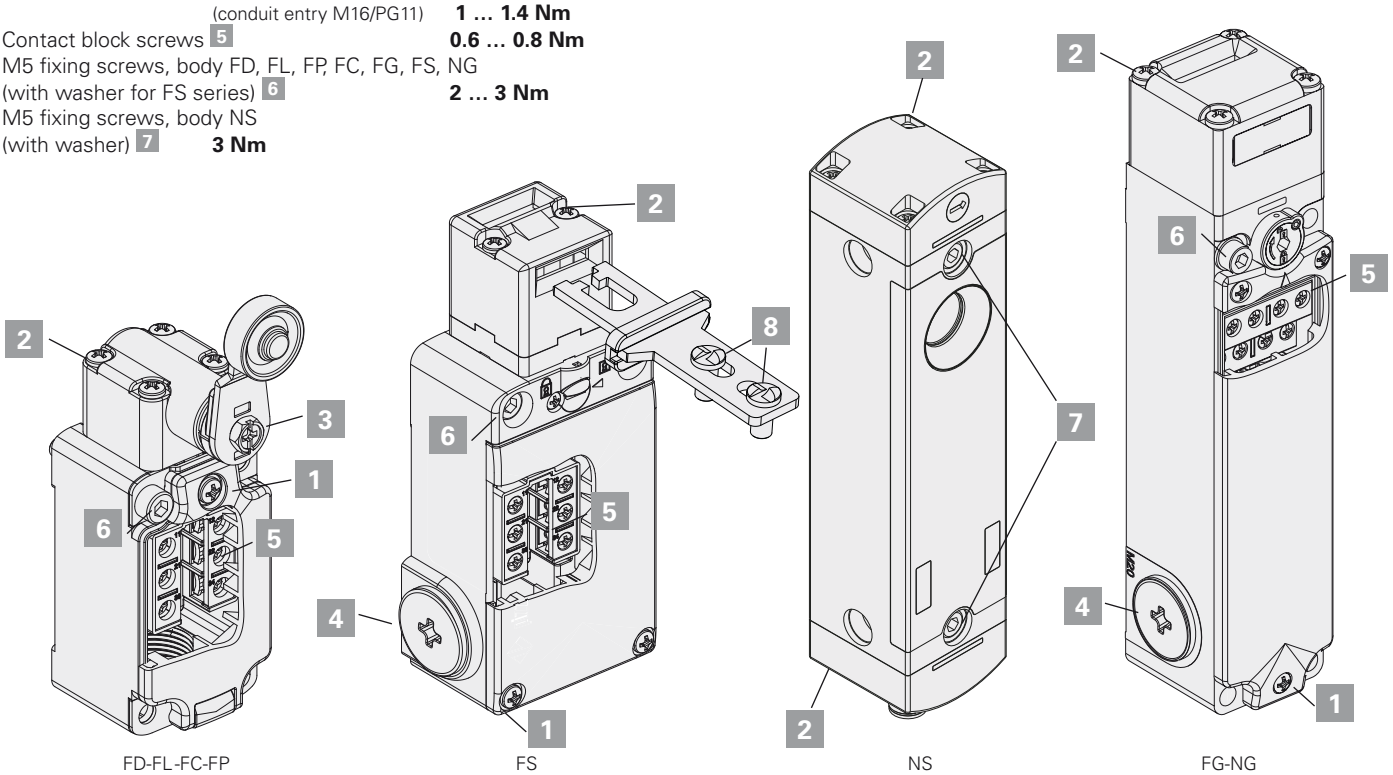


Contact type:

R = snap action
L = slow action

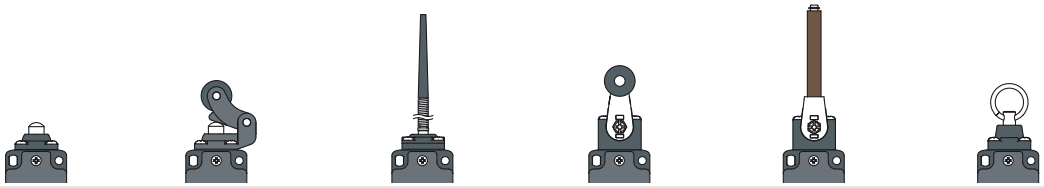
Tightening torques FD-FL-FP-FC-FG-FS-NG series

Cover screws 1	**0.8 ... 1.2 Nm**
Head screws 2	**0.8 ... 1.2 Nm**
Lever screw 3	**0.8 ... 1.2 Nm**
Protection caps 4 (conduit entry M20/PG13.5)	**1.2 ... 1.6 Nm**
(conduit entry M16/PG11)	**1 ... 1.4 Nm**
Contact block screws 5	**0.6 ... 0.8 Nm**
M5 fixing screws, body FD, FL, FP, FC, FG, FS, NG (with washer for FS series) 6	**2 ... 3 Nm**
M5 fixing screws, body NS (with washer) 7	**3 Nm**
Actuator screws VF KEY••• 8	**1.2 ... 1.6 Nm**



FD-FL-FP-FC series switches for heavy duty applications

Travel diagrams



Contact block	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6 inverted contacts
2 2x(1NO-1NC)	13 21 43 31 / 14 22 44 32	0 1.3 6 / 0.7	0 1.6 8 / 0.9	0 8° / 4°	0 20° 75° / 13°	0 20° 75° / 13°	0 3.3 8 / 2.5
3 1NO-1NC	13 21 / 14 22	0 1.3 6 / 0.8	0 1.7 8 / 1.1	0 10° / 5°	0 20° 75° / 13°	0 20° 75° / 13°	0 5.3 8 / 4.5
5 1NO+1NC	13 21 / 14 22	0 2.2 ⊖4 6 / 1.1	0 2.7 ⊖4.9 8 / 1.4	0 15° / 5°	0 30° ⊖60° 75° / 17°	0 22° ⊖52° 75° / 9°	0 2.9 8 / 1.7
6 1NO+1NC	11 23 / 12 24	0 1.5 ⊖3 6 / 3.4	0 1.8 ⊖3.7 8 / 4.2	/	0 22° ⊖42° 75° / 42°	0 14° ⊖34° 75° / 34°	0 2.3 8 / 0.8
7 1NO+1NC	11 23 / 12 24	0 3.1 ⊖4.6 6 / 1.6	0 3.8 ⊖5.7 8 / 2	/	0 40° 60° ⊖75° / 23°	0 32° ⊖52° 75° / 15°	0 1 8 / 2.2
9 2NC	11 21 / 12 22	0 2.9 ⊖4.4 6	0 3.6 ⊖5.4 8	/	0 40° 60° ⊖75°	0 32° ⊖52° 75°	0 1 8
10 2NO	13 23 / 14 24	0 1.4 6	0 1.7 8	0 9°	0 22° 75°	0 14° 75°	0 2.5 8
11 2NC	11 21 / 12 22	0 2 ⊖4 6 / 0.6	0 2.5 ⊖4.9 8 / 0.7	/	0° 27° ⊖57° 75° / 11°	/	0 3.5 8 / 2.1
12 2NO	13 23 / 14 24	0 2.9 6 / 1.5	0 3.6 8 / 1.8	/	0 38° 75° / 22°	0 30° 75° / 14°	0 2.6 8 / 1.1
13 2NC	11 21 / 12 22	0 0.8 ⊖2.3 6 / 3 ⊖4.5	0 1 ⊖2.8 8 / 3.7 ⊖5.5	/	0 14° ⊖34° 75° / 41° ⊖61°	0 6° ⊖26° 75° / 33° ⊖53°	0 1 8 / 3.2
14 2NC	11 21 / 12 22	0 1.4 ⊖2.9 6 / 3 ⊖4.5	0 1.7 ⊖3.6 8 / 3.7 ⊖5.5	/	0 22° ⊖42° 75° / 40° ⊖60°	0 14° ⊖34° 75° / 32° ⊖52°	0 0.9 8 / 2.5
15 2NO	13 23 / 14 24	0 1.4 6 / 3	0 1.7 8 / 3.7	/	0 22° 75° / 40°	0 14° 75° / 32°	0 1 8 / 2.6
16 2NC	11 21 / 12 22	/	/	/	66° 0 26° ⊖30° / ⊖37° 26° 66°	/	/
18 1NO+1NC	11 23 / 12 24	0 1.5 ⊖3 6 / 2	0 1.8 ⊖3.7 8 / 2.5	0 10° / 13°	0 23° ⊖43° 75° / 29°	0 15° ⊖35° 75° / 21°	0 2.4 8 / 1.9
20 1NO+2NC	11 21 33 / 12 22 34	0 1.5 ⊖3 6 / 2	0 1.8 ⊖3.7 8 / 2.5	0 10° / 13°	0 23° ⊖43° 75° / 29°	0 15° ⊖35° 75° / 21°	0 2.4 8 / 1.9
21 3NC	11 21 31 / 12 22 32	0 1.5 ⊖3 6	0 1.8 ⊖3.7 8	0 10°	0 23° ⊖43° 75°	0 15° ⊖35° 75°	0 2.4 8
22 2NO+1NC	11 23 33 / 12 24 34	0 1.5 ⊖3 6 / 2	0 1.8 ⊖3.7 8 / 2.5	0 10° / 13°	0 23° ⊖43° 75° / 29°	0 15° ⊖35° 75° / 21°	0 2.4 8 / 1.9
28 1NO+2NC	11 21 33 / 12 22 34	0 1.5 ⊖3 4.5 6 / 2 ⊖5.5	0 1.8 ⊖3.7 5.6 8 / 2.5 ⊖6.9	/	0 23° ⊖43° 60° 75° / 29° ⊖70°	0 15° ⊖35° 52° 75° / 21° ⊖62°	/
29 3NC	11 21 31 / 12 22 32	0 1.5 ⊖3 6 / 4.5 ⊖5.5	0 1.8 ⊖3.7 8 / 5.6 ⊖6.9	/	0 23° ⊖43° 75° / 60° ⊖70°	0 15° ⊖35° 75° / 52° ⊖62°	/
30 3NC	11 21 31 / 12 22 32	0 1.5 ⊖3 6 / 4.5 ⊖5.5	0 1.8 ⊖3.7 8 / 5.6 ⊖6.9	/	0 23° ⊖43° 75° / 60° ⊖70°	0 15° ⊖35° 75° / 52° ⊖62°	/
33 1NO+1NC	13 21 / 14 22	0 1.5 ⊖3 6 / 2	0 1.8 ⊖3.7 8 / 2.5	0 10° / 12°	0 23° ⊖43° 75° / 27°	0 15° ⊖35° 75° / 19°	0 2.4 8 / 2.1
34 2NC	11 21 / 12 22	0 1.5 ⊖3 6	0 1.8 ⊖3.7 8	0 10°	0 23° ⊖43° 75°	0 15° ⊖35° 75°	0 2.4 8
37 1NO+1NC	11 23 / 12 24	0 3.4 ⊖4.9 6 / 1.5	0 4.3 ⊖6.2 8 / 1.9	/	0 45° 65° ⊖75° / 18°	0 37° ⊖57° 75° / 10°	0 3 8 / 1.1
66 1NC	11 / 12	0 1.4 ⊖2.9 6	0 1.7 ⊖3.6 8	/	0 22° ⊖42° 75°	0 14° ⊖34° 75°	0 0.9 8
67 1NO	13 / 14	0 1.4 6	0 1.7 8	0 9°	0 22° 75°	0 14° 75°	0 2.5 8

Legend

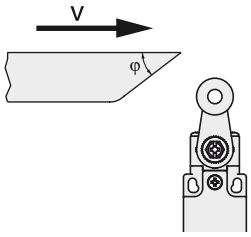
Closed contact | Open contact | ⊖ Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released

Switches for normal duty applications

Maximum and minimum actuation speed - FR-FM-FX-FZ-FK series

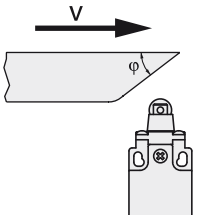
Roller lever - Type 1

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	2,5	9	0,07
30°	1,5	8	
45°	1	7	
60°	0,75	7	



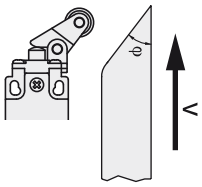
Roller plunger - Type 2

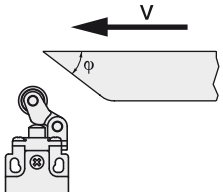
φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	4	0,04
30°	0,5	2	0,02
45°	0,3	1	0,01



Roller lever - Type 3

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	5	0,05
30°	0,5	2,5	0,025
45°	0,3	1,5	0,015



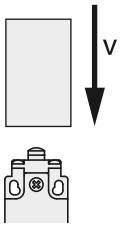


Contact type:

R = snap action
L = slow action

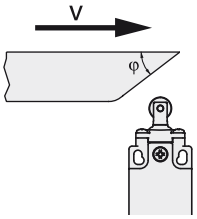
Plunger - Type 4

Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
0,5	1	0,01



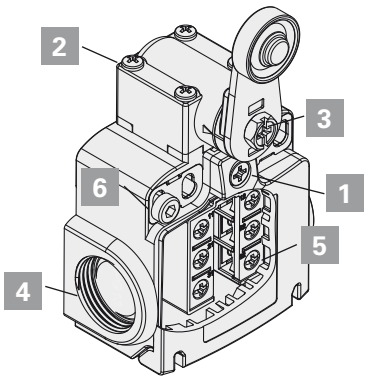
Roller plunger - Type 5

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	0,3	4	0,04
30°	0,2	2	0,02



Tightening torques - FR, FX, FK and FW series

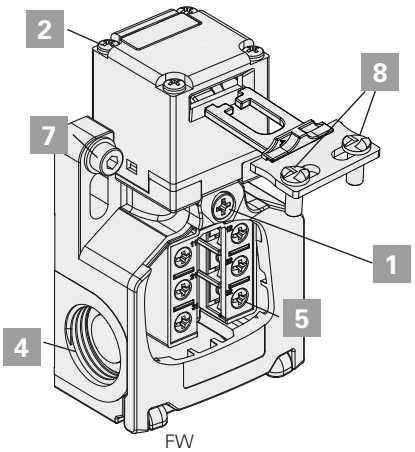
Cover screws 1	**0.7 ... 0.9 Nm**
Head screws 2	**0.5 ... 0.7 Nm**
Lever screw 3	**0.7 ... 0.9 Nm**
Protection caps 4	**1.2 ... 1.6 Nm**
Contact block screws 5	**0.6 ... 0.8 Nm**
M4 fixing screws, body (with washer for FR-FK series) 6	**2 ... 2.5 Nm**
M5 fixing screws, body (with washer for FW series) 7	**2 ... 2.5 Nm**
Actuator screws VF KEY••• 8	**1.2 ... 1.6 Nm**



FR-FX-FK-FM-FZ

Tightening torques - FM and FZ series

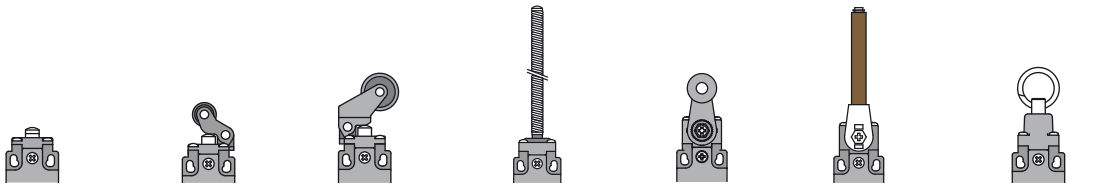
Cover screws 1	**0.5 ... 0.7 Nm**
Head screws 2	**0.5 ... 0.7 Nm**
Lever screw 3	**0.8 ... 1.2 Nm**
Protection caps 4	**1.2 ... 1.6 Nm**
Contact block screws 5	**0.6 ... 0.8 Nm**
M4 fixing screws, body 6	**2 ... 3 Nm**



FW

FR-FM-FX-FZ-FK series switches for normal duty applications

Travel diagrams



Contact block	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7 inverted contacts
2 2x(1NO-1NC)	0 1.3 6 / 0.7	0 2 8 / 1.1	0 3 13 / 1.6	0 9° / 4°	0 17° 75° / 10°	0 17° 75° / 10°	0 5.4 8 / 4.8
3 1NO-1NC	0 1.3 6 / 0.8	0 2 8 / 1.2	0 3 13 / 1.8	0 9° / 4°	0 17° 75° / 10°	0 17° 75° / 10°	0 3.4 8 / 2.9
5 1NO+1NC	0 2.2 ⊖4 6 / 1.1	0 3.3 ⊖6 8 / 1.7	0 5.1 ⊖9.2 13 / 2.5	0 17° / 6°	0 30° 60° ⊖ 75° / 15°	0 25° ⊖55° 75° / 10°	0 5 8 / 3.8
6 1NO+1NC	0 1.5 ⊖3 6 / 3.1	0 2.3 ⊖4.5 8 / 4.7	0 3.5 ⊖6.9 13 / 7.1	/	0 20° ⊖40° 75° / 42°	0 15° ⊖35° 75° / 35°	0 4.6 8 / 3
7 1NO+1NC	0 3.1 ⊖4.6 6 / 1.6	0 4.7 ⊖6.9 / 2.4 8	0 7.1 ⊖10.6 / 3.7 13	/	0 41° 61° ⊖ 75° / 22°	0 36° ⊖56° 75° / 17°	0 3 8 / 4.5
9 2NC	0 2.9 ⊖4.4 6	0 4.4 ⊖6.6	0 6.7 ⊖10.1	/	0 39° 75°	0 34° ⊖54° 75°	0 3.1 8
10 2NO	0 1.4 6	0 2.1 8	0 3.2 13	0 10°	0 20° 75°	0 15° 75°	0 4.6 8
11 2NC	0 2 ⊖4 6 / 0.6	0 3 ⊖6 8 / 0.9	0 4.6 ⊖9.2 13 / 1.4	/	0° 26° 56° ⊖ 75° / 7°	/	0 5.6 8 / 4
12 2NO	0 2.9 6 / 1.5	0 4.4 8 / 2.3	0 6.7 13 / 3.5	0 21° / 8°	0 37° 75° / 19°	0 32° 75° / 14°	0 4.7 8 / 3.3
13 2NC	0 0.8 ⊖2.3 6 / 3 ⊖4.5	0 1.2 ⊖3.5 8 / 4.5 ⊖6.8	0 1.8 ⊖5.3 13 / 6.9 ⊖10.4	/	0 11° ⊖31° 75° / 40° ⊖60°	6° ⊖26° 75° / 0 35° ⊖55°	0 3.1 8 / 5.3
14 2NC	0 1.4 ⊖2.9 6 / 3 ⊖4.5	0 2.1 ⊖4.4 8 / 4.5 ⊖6.8	0 3.2 ⊖6.7 13 / 6.9 ⊖10.4	/	0 19° ⊖39° 75° / 40° ⊖60°	0 14° ⊖34° 75° / 35° ⊖55°	0 3 8 / 4.7
15 2NO	0 1.4 6 / 3	0 2.1 8 / 4.5	0 3.2 13 / 6.9	/	0 19° 75° / 40°	0 14° 75° / 35°	0 4.7 8 / 3.1
16 2NC	/	/	/	/	75° 0 28° ⊖48° / 48° ⊖ 28° 75°	/	/
18 1NO+1NC	0 1.5 ⊖3 6 / 2	0 2.3 ⊖4.5 8 / 3	0 3.5 ⊖6.9 13 / 4.6	0 10° / 14°	0 20° ⊖40° 75° / 27°	0 15° ⊖35° 75° / 22°	0 4.6 8 / 4.1
20 1NO+2NC	0 1.5 ⊖3 6 / 2	0 2.3 ⊖4.5 8 / 3	0 3.5 ⊖6.9 13 / 4.6	0 10° / 14°	0 20° ⊖40° 75° / 27°	0 15° ⊖35° 75° / 22°	0 4.6 8 / 4
21 3NC	0 1.5 ⊖3 6	0 2.3 ⊖4.5 8	0 3.5 ⊖6.9 13	0 10°	0 20° ⊖40° 75°	0 15° ⊖35° 75°	0 4.6 8
22 2NO+1NC	0 1.5 ⊖3 6 / 2	0 2.3 ⊖4.5 8 / 3	0 3.5 ⊖6.9 13 / 4.6	0 10° / 14°	0 20° ⊖40° 75° / 27°	0 15° ⊖35° 75° / 22°	0 4.6 8 / 4.1
28 1NO+2NC	0 1.5 ⊖3 4.5 6 / 2 ⊖5.5	0 2.3 ⊖4.5 6.5 8 / 3 ⊖7.5	0 3.5 ⊖6.9 13 / 4.6 10.2 ⊖12.5	/	0 20° 40° ⊖ 58° 75° / 27° ⊖70°	0 15° ⊖35° 53° 75° / 22° ⊖65°	0 1.8 4.6 8 / 4
29 3NC	0 1.5 ⊖3 6 / 4.5 ⊖5.5	0 2.3 ⊖4.5 8 / 6.5 ⊖7.5	0 3.5 ⊖6.9 13 / 10.2 ⊖12.5	/	0 20° ⊖40° 75° / 58° ⊖70°	0 15° ⊖35° 75° / 53° ⊖65°	0 4.6 8 / 1.8
30 3NC	0 1.5 ⊖3 6 / 4.5 ⊖5.5	0 2.3 ⊖4.5 8 / 6.5 ⊖7.5	0 3.5 ⊖6.9 13 / 10.2 ⊖12.5	/	0 20° ⊖40° 75° / 58° ⊖70°	0 15° ⊖35° 75° / 53° ⊖65°	0 4.6 8 / 1.8
33 1NO+1NC	0 1.5 ⊖3 6 / 2	0 2.3 ⊖4.5 8 / 3	0 3.5 ⊖6.9 13 / 4.6	0 10° / 14°	0 20° ⊖40° 75° / 25°	0 15° ⊖35° 75° / 20°	0 4.6 8 / 4.3
34 2NC	0 1.5 ⊖3 6	0 2.3 ⊖4.5 8	0 3.5 ⊖6.9 13	0 10°	0 20° ⊖40° 75°	0 15° ⊖35° 75°	0 4.6 8
37 1NO+1NC	0 3.4 ⊖4.9 / 1.5 6	0 5.2 ⊖7.4 / 2.3 8	0 7.8 13 / 3.4 ⊖11.2	/	0 45° ⊖65° / 18° 75°	0 40° ⊖60° 75° / 13°	0 2.8 8 / 4.9
66 1NC	0 1.4 ⊖2.9 6	0 2.1 ⊖4.4 8	0 3.2 ⊖6.7 13	0 10°	0 19° ⊖39° 75°	0 14° ⊖34° 75°	0 3 8
67 1NO	0 1.4 6	0 2.1 8	0 3.2 13	0 10°	0 20° 75°	0 15° 75°	0 4.6 8

Legend

Closed contact | Open contact | ⊖ Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released

FR-FM-FX-FZ-FK series switches with W3 reset for normal duty applications

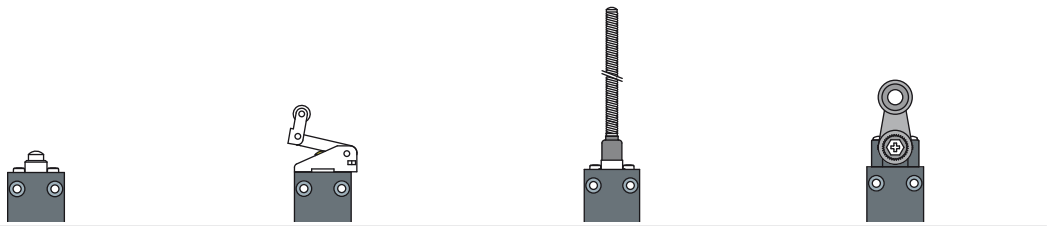
Travel diagrams

Contact block	Group 1	Group 2	Group 3	Group 4
6 1NO+1NC	0 1 ⊖3 6 R1	0 1.5 ⊖4.5 8 R1.5	0 2.3 ⊖6.9 13 R2.3	0 15° ⊖40° 75° R15°
9 2NC	0 1 ⊖4.4 6 R1	0 1.5 ⊖6.6 8 R1.5	0 2.3 ⊖10.1 13 R2.3	0 15° ⊖59° 75° R15°
10 2NO	0 1 6 R 1	0 1.5 8 R 1.5	0 2.3 13 R 2.3	0 15° 75° R 15°
20 1NO+2NC	0 1 ⊖3 6 R1	0 1.5 ⊖4.5 8 R1.5	0 2.3 ⊖6.9 13 R2.3	0 15° ⊖40° 75° R15°
21 3NC	0 1 ⊖3 6 R1	0 1.5 ⊖4.5 8 R1.5	0 2.3 ⊖6.9 13 R2.3	0 15° ⊖40° 75° R15°
22 2NO+1NC	0 1 ⊖3 6 R1	0 1.5 ⊖4.5 8 R1.5	0 2.3 ⊖6.9 13 R2.3	0 15° ⊖40° 75° R15°
33 1NO+1NC	0 1 ⊖3 6 R1	0 1.5 ⊖4.5 8 R1.5	0 2.3 ⊖6.9 13 R2.3	0 15° ⊖40° 75° R15°
34 2NC	0 1 ⊖3 6 R1	0 1.5 ⊖4.5 8 R1.5	0 2.3 ⊖6.9 13 R2.3	0 15° ⊖40° 75° R15°
2 2x(1NO-1NC)	0 1 6 R1	0 1.5 8 R1.5	0 2.3 13 R2.3	0 15° 75° R15°

Legend
Closed contact | Open contact | ⊖ Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released | R reset engagement travel

FA series pre-wired switches

Travel diagrams

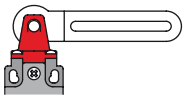


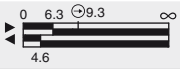
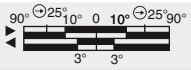
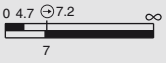
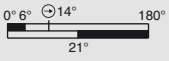
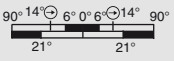
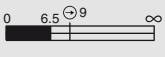
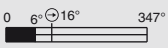
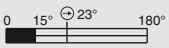
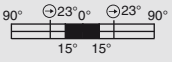
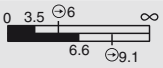
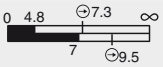
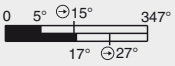
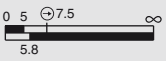
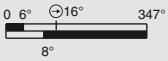
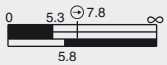
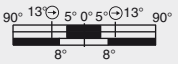
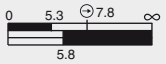
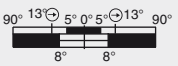
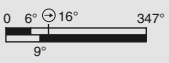
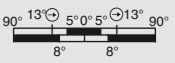
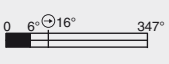
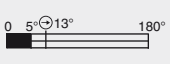
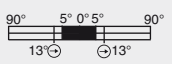
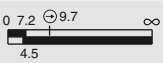
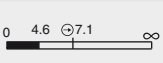
Contact block	Group 1	Group 2	Group 3	Group 4
41 1NO+1NC	0 1.8 5 1.1	0 4.2 9.9 2.3	0 12° 4°	0 22° 70° 8°
45 1NO+1NC	0 1.8 ⊖4 5 1	0 4.2 ⊖8 9.9 2	0 13° 3°	0 22° ⊖52° 70° 7°
46 1NO+1NC	0 1.3 ⊖2.8 5 3.2	0 2.7 ⊖5.6 9.9 6.8		0 13° ⊖33° 70° 43°
48 1NO+1NC	0 1.3 ⊖2.8 5 1.8	0 2.7 ⊖5.6 9.9 4	0° 7° 12°	0 14° ⊖34° 70° 22°

Legend
Closed contact | Open contact | ⊖ Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released

FR-FM-FX-FZ-FK-FW series switches for safety applications

Travel diagrams



Contact block	Group 8	Group 9	Group 10	Group 11
5 1NO+1NC				
6 1NO+1NC				
7 1NO+1NC			/	/
9 2NC				
11 2NC		/	/	/
13 2NC		/	/	/
14 2NC			/	/
18 1NO+1NC				
20 1NO+2NC				
21 3NC				
22 2NO+1NC				
33 1NO+1NC				
34 2NC				
37 1NO+1NC		/	/	/
66 1NC				

Legend

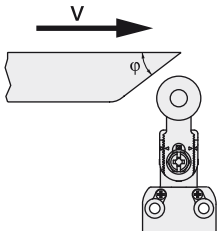
Closed contact | Open contact | Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released

NA-NB-NF series modular pre-wired switches

Maximum and minimum actuation speed

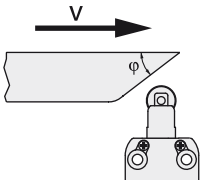
Roller lever - Type 1

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	2,5	9	0,07
30°	1,5	8	
45°	1	7	
60°	0,75	7	



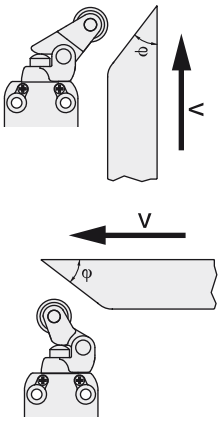
Roller plunger - Type 2

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	4	0,04
30°	0,5	2	0,02
45°	0,3	1	0,01



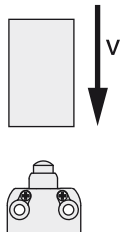
Roller lever - Type 3

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	5	0,05
30°	0,5	2,5	0,025
45°	0,3	1,5	0,015



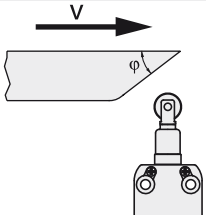
Plunger - Type 4

Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
0,5	1	0,01



Roller plunger - Type 5

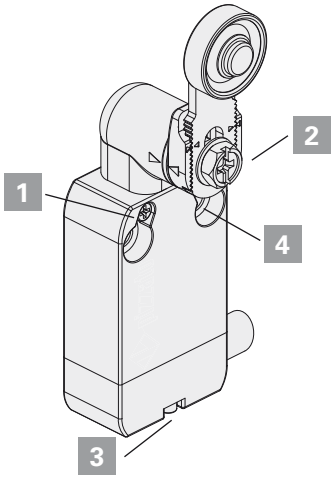
φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	0,3	4	0,04



Contact type:

R = snap action
L = slow action

Screw tightening torques



For NA and NB series:

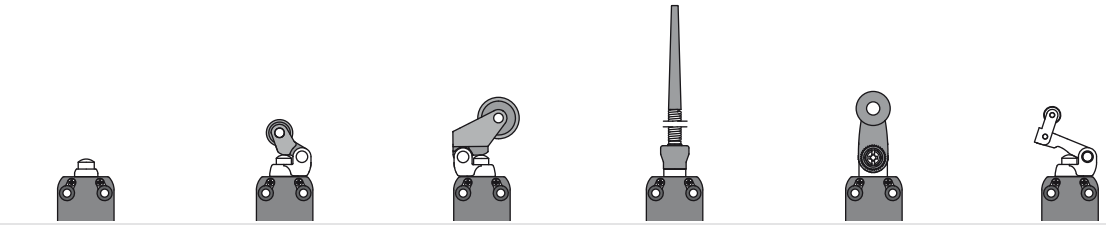
Head screws 1	**0.5 ... 0.7 Nm**
Lever screws 2	**0.8 ... 1.2 Nm**
Connector screw 3	**0.3 ... 0.6 Nm**
M4 fixing screws, body 4	**2 ... 3 Nm**

For NF series:

Head screws 1	**0.3 ... 0.4 Nm**
Lever screws 2	**0.8 ... 1.2 Nm**
Connector screw 3	**0.2 ... 0.3 Nm**
M4 fixing screws, body 4	**2 ... 3 Nm**

NA-NB-NF series modular pre-wired switches

Travel diagrams



Contact block	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
B11 1NO+1NC	0 1.5 ⊖4 5 / 0.9	0 2.1 5.6 ⊖7 / 1.5	0 3.5 9.6 ⊖11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2 ⊖14 / 3.1
B02 2NC	0 1.5 ⊖4 5 / 0.9	0 2.1 5.6 ⊖7 / 1.5	0 3.5 9.6 ⊖11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2 ⊖14 / 3.1
B12 1NO+2NC	0 1.5 ⊖4 5 / 0.9	0 2.1 5.6 ⊖7 / 1.5	0 3.5 9.6 ⊖11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2 ⊖14 / 3.1
B22 2NO+2NC	0 1.5 ⊖4 5 / 0.9	0 2.1 5.6 ⊖7 / 1.5	0 3.5 9.6 ⊖11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2 ⊖14 / 3.1
G11 1NO+1NC	0 1.4 ⊖2.9 5 / 3.1	0 2 ⊖4.1 7 / 4.5	0 3.3 ⊖7 11 / 7.3	/	0 18° ⊖38° 75° / 41°	0 4.1 ⊖8.1 14 / 9.5
G02 2NC	0 1.4 ⊖2.9 5	0 2 ⊖4.1 7	0 3.3 ⊖7 11	0 12°	0 18° ⊖38° 75°	0 4.1 ⊖8.1 14
G12 1NO+2NC	0 1.4 ⊖2.9 5 / 3.1	0 2 ⊖4.1 7 / 4.5	0 3.3 ⊖7 11 / 7.3	/	0 18° ⊖38° 75° / 41°	0 4.1 ⊖8.1 14 / 9.5
G22 2NO+2NC	0 1.4 ⊖2.9 5 / 3.1	0 2 ⊖4.1 7 / 4.5	0 3.3 ⊖7 11 / 7.3	/	0 18° ⊖38° 75° / 41°	0 4.1 ⊖8.1 14 / 9.5
H11 1NO+1NC	0 1.4 ⊖2.9 5 / 1	0 2 ⊖4.1 7 / 1.4	0 3.3 ⊖7 11 / 2.3	0 12° / 7°	0 18° ⊖38° 75° / 10°	0 4.4 ⊖8.1 14 / 2.8
H12 1NO+2NC	0 1.4 ⊖2.9 5 / 1	0 2 ⊖4.1 7 / 1.4	0 3.3 ⊖7 11 / 2.3	0 12° / 7°	0 18° ⊖38° 75° / 10°	0 4.4 ⊖8.1 14 / 2.8
H22 2NO+2NC	0 1.4 ⊖2.9 5 / 1	0 2 ⊖4.1 7 / 1.4	0 3.3 ⊖7 11 / 2.3	0 12° / 7°	0 18° ⊖38° 75° / 10°	0 4.4 ⊖8.1 14 / 2.8
L11 1NO+1NC	0 1.4 ⊖2.9 5 / 1.8	0 2 ⊖4.1 7 / 2.6	0 3.3 ⊖7 11 / 4.2	0 12° / 15°	0 18° ⊖38° 75° / 23°	0 3.8 ⊖8.1 14 / 5.2
L12 1NO+2NC	0 1.4 ⊖2.9 5 / 1.8	0 2 ⊖4.1 7 / 2.6	0 3.3 ⊖7 11 / 4.2	0 12° / 15°	0 18° ⊖38° 75° / 23°	0 3.8 ⊖8.1 14 / 5.2
L22 2NO+2NC	0 1.4 ⊖2.9 5 / 1.8	0 2 ⊖4.1 7 / 2.6	0 3.3 ⊖7 11 / 4.2	0 12° / 15°	0 18° ⊖38° 75° / 23°	0 3.8 ⊖8.1 14 / 5.2
BA1 1NO+1NC change-over	0 1.5 ⊖4 5 / 0.9	0 2.1 5.6 ⊖7 / 1.5	0 3.5 9.6 ⊖11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2 ⊖14 / 3.1

Legend

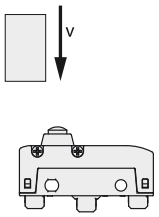
Closed contact | Open contact | ⊖ Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released

MK series microswitches

Maximum and minimum actuation speed

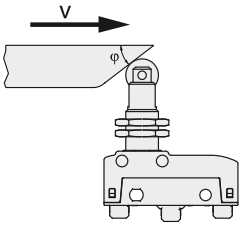
Plunger - Type 1

Vmax (m/s)	Vmin (mm/s)
0,5	0,05



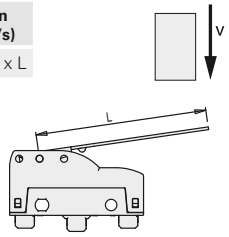
Roller plunger - Type 2

φ	Vmax (m/s)	Vmin (mm/s)
15°	0,6	0,2
30°	0,3	0,1
45°	0,1	0,05



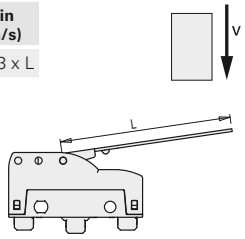
Lever with direct action (D) - Type 3

Vmax (m/s)	Vmin (mm/s)
0,03 x L	0,0166 x L



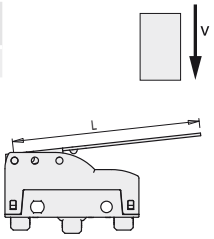
Lever with inverted action (R) - Type 4

Vmax (m/s)	Vmin (mm/s)
0,015 x L	0,0083 x L



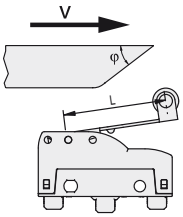
Lever with direct action, rear (F) - Type 5

Vmax (m/s)	Vmin (mm/s)
0,01 x L	0,0047 x L



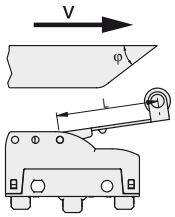
Roller lever with direct action (D) - Type 6

φ	Vmax (m/s)	Vmin (mm/s)
15°	0,1 x L	0,0664 x L
30°	0,05 x L	0,0332 x L
45°	0,03 x L	0,0166 x L



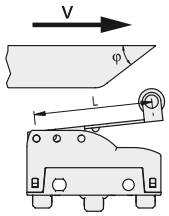
Roller lever with inverted action (R) - Type 7

φ	Vmax (m/s)	Vmin (mm/s)
15°	0,048 x L	0,0332 x L
30°	0,024 x L	0,0166 x L
45°	0,015 x L	0,0083 x L

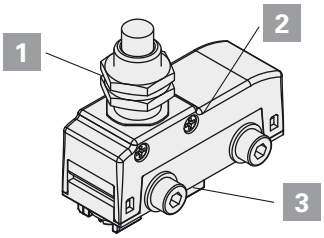


Roller lever with direct action, rear (F) - Type 8

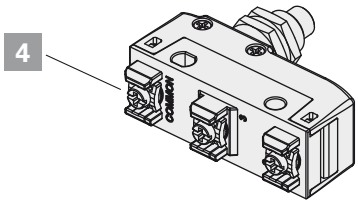
φ	Vmax (m/s)	Vmin (mm/s)
15°	0,032 x L	0,0188 x L
30°	0,016 x L	0,0094 x L
45°	0,01 x L	0,0047 x L



Tightening torques



Tighten the nuts 1 with a torque of **2** ... **3** Nm.
Tighten the head screws 2 with a torque of **0.3** ... **0.4** Nm.
Tighten the M4 screws 3 with a torque of **0.8** ... **1.2** Nm, insert washer.
Attention: A tightening torque higher than 1.2 Nm can cause the breaking of the microswitch.



Tighten the terminal screws 4 with a torque of **0.6** ... **0.8** Nm.

General requirements

The device is designed to be installed on industrial machineries.

The installation must be performed only by qualified staff aware of the regulations in force in the country of installation.

The device must be used exactly as supplied, properly fixed to the machine and wired.

It is not allowed to disassemble the product and use only parts of the same, the device is designed to be used in its assembly as supplied. It is prohibited to modify the device, even slightly e.g.: replace parts of it, drill it, lubricate it, clean it with gasoline or gas oil or any aggressive chemical agents.

The protection degree of the device refers to the electrical contacts only. Carefully evaluate all the polluting agents present in the application before installing the device, since the IP protection degree refers exclusively to agents such as dust and water according to EN 60529. Thus the device may not be suitable for installation in environments with dust in high quantity, condensation, humidity, steam, corrosive and chemical agents, flammable or explosive gas, flammable or explosive dust or other polluting agents.

Some devices are provided with a housing with openings for connecting the electrical cables. To guarantee an adequate protection degree of the device, the opening that the wiring passes through must be protected against the penetration of harmful materials by means of an appropriate seal. Proper wiring therefore requires the use of cable glands, connectors or other devices with IP protection degree that is equal to or greater than that of the device.

Store the products in their original packaging, in a dry place with temperature between -40° C and +70°C

Failure to comply with these requirements or incorrect use during operation can lead to the damage of the device and the loss of the function performed by the device itself. This will result in termination of the warranty on the item and will release the manufacturer from any liability.

Using the devices

- Before use, check if the national rules provide for further requirements in addition to those given here.
- Before installation, make sure the device is not damaged in any part.
- All devices are designed for actuation by moving parts of industrial machines.
- Do not use the device as mechanical stop of the actuator.
- Do not apply excessive force to the device once it has reached the end of its actuation travel.
- Do not exceed the maximum actuation travel.
- Avoid contact of the device with corrosive fluids.
- Do not stress the device with bending and torsion.
- Do not disassemble or try to repair the device, in case of defect or fault replace the entire device.
- In case the device is deformed or damaged it must be entirely replaced. Correct operation cannot be guaranteed when the device is deformed or damaged.
- Always attach the following instructions to the manual of the machine in which the device is installed.
- If specific operating instructions exist for a device (supplied or downloadable from www.pizzato.com), they must always be included with the machine manual and be available for the entire service life of the machine.
- These operating instructions must be kept available for consultation at any time and for the whole period of use of the device.

Wiring and installation

- Installation must be carried out by qualified staff only.
- Use of the device is limited to function as a control switch.
- Observe minimum distances between devices (if provided).
- Comply with the tightening torques indicated in this catalogue.
- Keep the electrical load below the value specified by the respective utilization category.
- Disconnect the power before to work on the contacts, also during the wiring.
- Do not paint or varnish the devices.
- Install the product on flat and clean surfaces only.
- Do not bend or deform the device during installation.
- Never use the device as support for other machine components (cable ducts, tubes, etc.)
- For installation on the machine, use the intended bore holes in the housing. The device must be fixed with screws of adequate length and resistance to the expected stress. At least two screws must be used to fix the housing to the machine.
- After and during installation, do not pull the electrical cables connected to the device. If excessive tension is applied to the cables (that is not supported by an appropriate cable gland), the contact block may be damaged.
- During wiring comply with the following requirements:
- For terminals (if present), comply with the minimum and maximum cross-sections of the conductors.
- Tighten the electrical terminals with the torque indicated in this catalogue (if present).
- Do not introduce polluting agents into the device as: talc, lubricants for cable sliding, powder separating agents for multipolar cables, small strands of copper and other pollutants that could affect the proper functioning of the device.
- Before closing the device cover (if present) verify the correct positioning of the gaskets.
- Verify that the electrical cables, wire-end sleeves, cable numbering systems and any other parts do not obstruct the cover from closing correctly or if pressed between them do not damage or compress the internal contact block.
- For devices with integrated cable, the free end of the cable must be properly connected inside a protected housing. The electrical cable must be properly protected from cuts, impacts, abrasion, etc.
- After installation and before commissioning of the machine, verify:
  - the correct operation of the device and all its parts;
  - the correct wiring and tightening of all screws;
  - the actuating travel of the actuator must be shorter than the maximum travel allowed by the device.
- After installation, periodically check for correct device operation.

Do not use in following environments:

- Environments where dust and dirt can cover the device and by sedimentation stop its correct working.
- Environment where sudden temperature changes cause condensation.
- Environments where coatings of ice may form on the device.
- Environments where the application causes knocks or vibrations that could damage the device.
- Environment with presence of explosive or flammable gas or dust.

Limits of use

- Use the devices following the instructions, complying with their operation limits and the standards in force.
- The devices have specific application limits (min. and max. ambient temperature, mechanical endurance, protection degree, utilisation category, etc.) These limits are met by the different devices only if considered individually and not if combined with each other. For further information contact our technical department.
- The utilization implies knowledge of and compliance with following standards: EN 60204-1, EN 60947-5-1, ISO 12100, EN ISO 14119.
- Please contact our technical department for information and assistance (phone +39.0424.470.930 / fax +39.0424.470.955 / e-mail tech@pizzato.com) in the following cases:
  - Cases not mentioned in the present utilization requirements.
  - In nuclear power stations, trains, airplanes, cars, incinerators, medical devices or any application where the safety of two or more persons depend on the correct operation of the device.

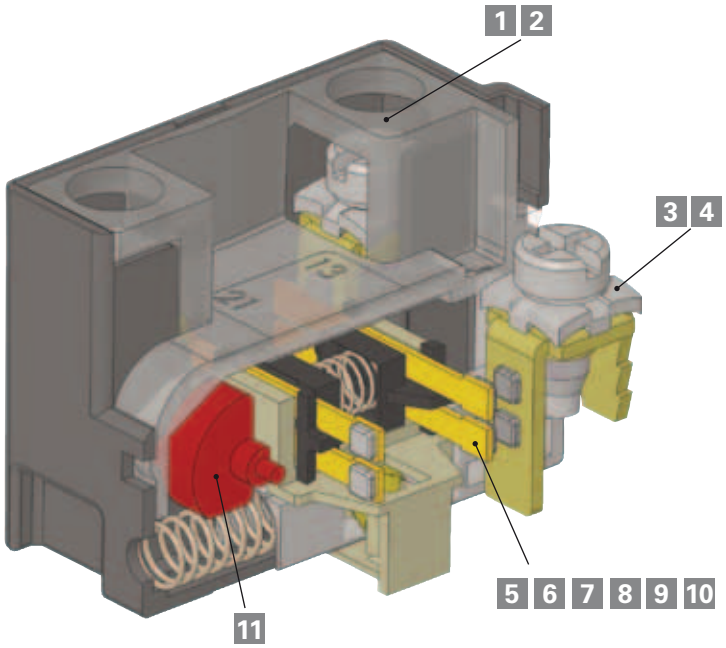
Additional requirements for safety applications

Provided that all previous requirements for the devices are fulfilled, for installations with operator protection function additional requirements must be observed:

- The utilization implies knowledge of and compliance with following standards: IEC 60204-1, IEC 60947-5-1, ISO 12100, EN ISO 14119, EN 62061, EN ISO 13849-1, EN ISO 13850.
- The protection fuse (or equivalent device) must be always connected in series with the NC contacts of the safety circuit.
- Periodically verify the correct working of the safety devices; the periodicity of this verification is settled by the machine manufacturer based on the machine danger degree and it does not have to be less than one a year.
- After installation and before commissioning of the machine, verify:
  - the correct operation of the device and all its parts;
  - the correct wiring and tightening of all screws;
  - the actuating travel of the actuator must be shorter than the maximum travel allowed by the device;
  - the actuating travel of the actuator must be greater than the positive opening travel;
  - the actuation system must be able to exert a force that is greater than the positive opening force.
- Devices with a safety function have a limited service life. Although still functioning, after 20 years from the date of manufacture the device must be replaced completely. The production date can be derived from the production batch on the item. Example: A10 FD7-411. The batch's first letter refers to the month of manufacture (A=January, B=February, etc.). The second and third letters refer to the year (10=2010, 11=2011, etc.).

Features

The contact blocks developed by Pizzato Elettrica are the result of 30 years of development experience and millions of sold switches. The range of contact blocks presented in this chapter is one of the most extensive in the world in the sector of position switches.
This chapter introduces to some features of Pizzato Elettrica contact blocks, in order to give the final user a better understanding of the technologies behind that element simply named "contact".
We underline that contact blocks are not available for sale (to the public) separately from switches, both because some of them are mechanically connected to the switch and because some technical features may change in accordance with the switch and its function. The following data is only intended to serve as an aid for the initial selection of the contact block. It is not to be used for determining the characteristics of the switch that uses this contact block. For example, the use of a contact block with positive opening with a switch with flexible actuator results in the combination of the two devices not having positive opening.
In this chapter, the properties of the E1 electronic contact block are explained in detail. It is used with position switches with multiple monitoring tasks that would require extensive effort to realize with electronic sensors. There is no other electronic sensor on the market that can match this contact unit with respect to precision and repeatability, adjustment of the switching point, operating temperature and price.



	Description
1	Captive screws
2	Finger protection
3	Clamping screw plates for cables with various diameters
4	Self-lifting clamping screw plates
5	Material of the contacts: Silver alloy or gold-plated silver alloy
6	Contact technology and reliability: Single bridge, double bridge
7	Operating voltages and currents for reliable switching

	Description
8	Classification of the contact design acc. to EN 60947-5-1: X, Y, C, Za, Zb
9	Contact type: Slow action / snap action / snap action with constant pressure
10	Force on contacts
11	Positive opening of contacts

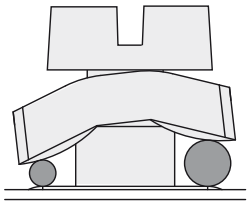
1 Captive screws

Switches with this characteristic have clamping screws that remain in place even if completely unscrewed. This feature reduces wiring time, since the operator does not have to be careful not to unscrew the screws completely and does not risk to lose them by mistake, which is very useful in case of wirings in uncomfortable position

2 Finger protection

All terminals in the contact blocks have protection degree IP20 in accordance with EN 60529, they are therefore protected against access to dangerous parts with a diameter greater than 12 mm.

3 Clamping screw plates for cables with various diameters



The clamping screw plates are provided with a particular "roofing tile" structure and are loosely coupled to the clamping screw. The design causes connection wires of different diameter to be pulled towards the screw when tightening the screw (see figure), preventing the wires from escaping towards the outside.

4 Self-lifting clamping screw plates

Switches with this feature are equipped with clamping screw plates that move up or down by turning the clamping screw; wiring is easier and faster as a result.

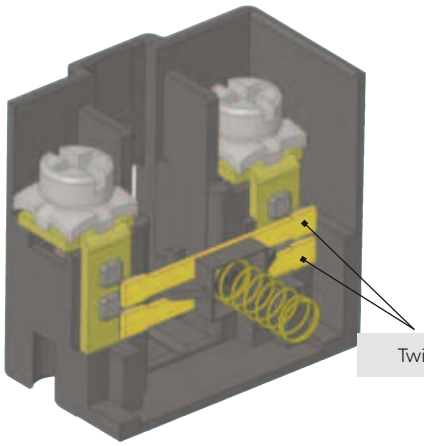
5 Contact material: gold-plated silver alloy

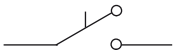
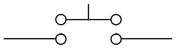
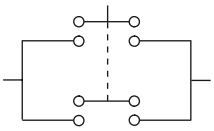
The contact blocks can be supplied with silver electric contacts with a special gold-plated surface, with total gold thickness of one micron. This type of treatment can be useful in environments which are aggressive against silver (very humid or sulphurous atmospheres) and in case of very small electric loads, usually with low voltages and supply currents. This thickness of the gold coating permits several million switching cycles.

6 Contact technology and reliability

Very rarely, an electric contact does not function. A failed switching operation is a typical consequence of an exceptionally high contact resistance caused by dust, a thin layer of oxidation or other impurities that could penetrate the switch during wiring. Thus, the repeated occurrence of faulty switching depends not only on the sensor type, but also on its environmental conditions and the load that the switch drives. These effects are more evident with low electrical loads if the electric voltage cannot penetrate the thin layers of oxide or small grains of dust.
This type of malfunction can normally be tolerated with hand-operated devices, because repeating the operation is enough to restore the function. This is not the case with position switches, as severe machine damage could result if the end position is not ascertained.
In the following table we refer to two typical contact structures (type A and B) normally used in the industry and the ones which have been used by Pizzato Elettrica for several years in most switches: movable contacts with double interruption and twin bridge (type C).
As you can see from the table below, the last structure (type C) has the same contact resistance **(R)** as the simple mobile contact (type A), but with a much lower probability of failure **(fe).**
With a failure probability of **x** for a single switching operation, the failure probability for type A is **fe=x**, for type B **fe** ≅ **2·x,** whereas for type C it is **fe** **4·x²**
This means that if the probability of a switching failure is x in a given situation, e.g., 1x10-4, (1 switching failure in 10,000), the result is as follows:

- for type A one failed commutation every 10,000.
- for type B one failed commutation every 5,000.
- for type C one failed commutation every 25,000,000.



Type	Diagram	Description	Contact resistance R	Probability of errors fe
A		simple mobile contact	R=Rc	fe=x
B		mobile contact with double interruption	R=2·Rc	$fe=2x-x^2$
C		mobile contact with double interruption and twin bridge	$R=\frac{2\cdot Rc}{2}=Rc$	$fe=4x^2-4x^3+x^4$

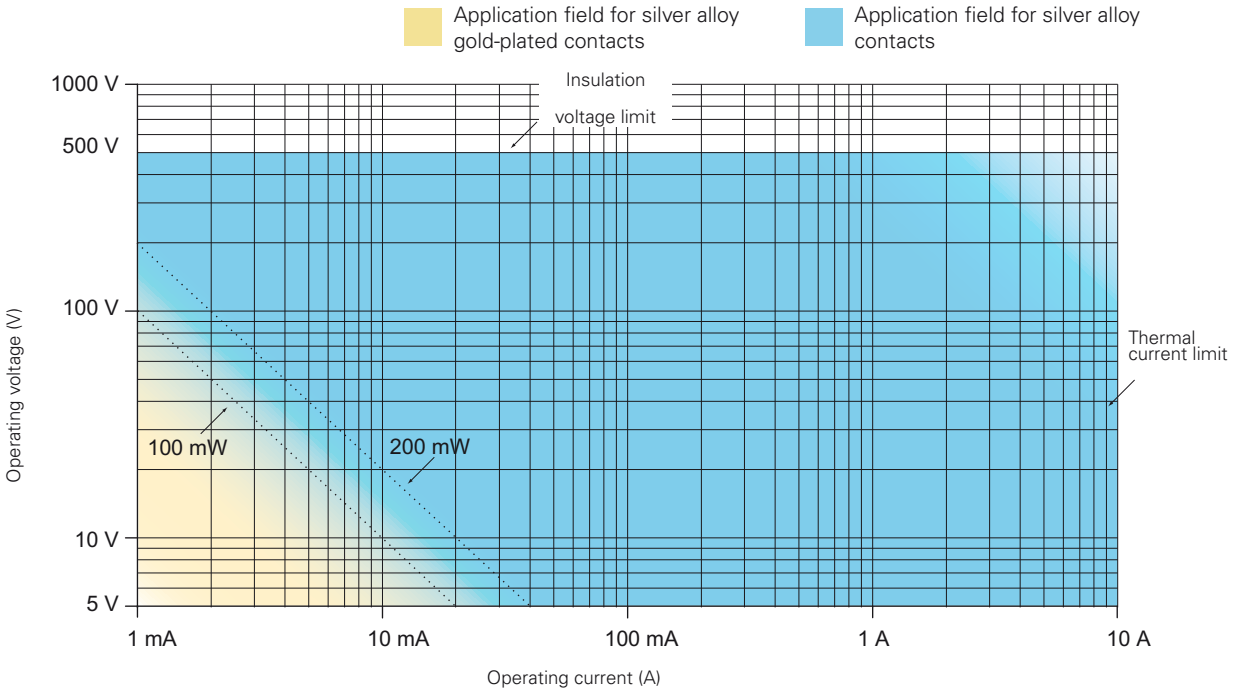
7 Minimum operating voltages and currents for reliable switching

The reliability of an electric contact depends on several factors, whose influence varies depending on the type of load. For high power loads is necessary for the contact to be able to dissipate the heat generated during switching. For low power loads, instead, it is important that it oxides and other impurities do not obstruct the passing of the electric signal. As a result, the material chosen for the electric contacts is a compromise among different and sometimes contrasting needs. In position switches contacts are usually made of a silver that has proved to be suitable for the switching of loads in the range of approximately 1 kW to 0.1 W. However, at lower loads, the effects of the oxide, which silver naturally develops upon contact with air, may occur; additionally to be taken into account are possible contaminations or impurities in the contact switching chamber (for example the talc powder in the cable sheaths that an installer could accidentally insert in the switch may have a similar effect).

It is impossible to define a fix threshold above which the "missing switching phenomenon" does not appear, because there are a lot of mechanical end electric parameters that influence this value. For example, in laboratory environment a good twin bridge electric contact is able to switch loads in the µW range for dozens of millions of handling operations, without losing signals. However, this does not mean that the same contact will have the same performance when the switch operates in environments with sudden changes of temperature (condensation) or where few switching occur (oxidation).

In order to avoid this kind of problem, gold plated contacts are used for very low loads profiting from the non-oxidability of this material. The gold-plating layer should be thick enough to be mechanically resistant to switching as well as electrically resistant to possible sparks that may vaporize it. For this reason Pizzato Elettrica uses micron thickness gold plating suitable for millions of working cycles. Thinner gold plating layers have often a purely aesthetic function and are only suitable to protect the product against oxidation during long time storage.

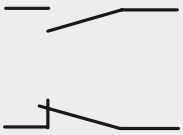
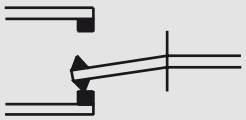
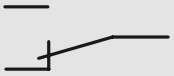
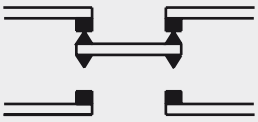
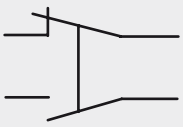
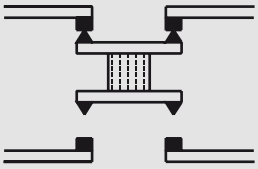
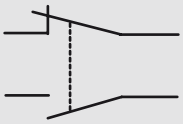
The minimum current and voltage values recommended by Pizzato Elettrica are shown in the diagram below, that is divided into two areas defined by a steady power limit. These values identify voltage and current combinations with high commutation reliability in most industrial fields. The lower voltage and current limits shown in the diagram are typical minimum values for industrial applications. They may also be reduced in non typical conditions. It is recommended, however, to always evaluate that the signal power to be switched is at least one magnitude order higher than the noise produced in the electric circuit, in particular when circuit cables are long and pass through areas with high electromagnetic fields and especially for powers lower than 10 mW.



100 mW Suggested limit for general applications with snap action contact blocks with silver alloy contacts.

200 mW Recommended limit for general applications with slow action contact blocks with silver alloy contacts.

8 Classification of the contact block acc. to the EN 60947-5-1

Design	Figure	Symbol	Description
X **Y**			Double interruption contact element with two terminals
C			Change-over contact element with single interruption and three terminals
Za			Change-over contact element with double interruption and four terminals. **The contacts have identical polarity**
Zb			Change-over contact element with double interruption and four terminals. **Mobile contacts are electrically separated**

Electrically separated contacts

The "**+**" symbol between two designs (e.g., X+X, Za+Za, X+X+Y, etc.) represents the combination of simple, **electrically separated** contact blocks.

The electrically separated contacts **allow** different voltages to be applied between the contacts and loads to be connected to different polarities (figure 1).

Requirements and restrictions for Za contacts

Electrical loads must be connected to the same phase or polarity. The contacts are not electrically separated. As a result, different voltages may not be applied to the NC and NO contacts (figures 2 and 3).

According to EN 60947-5-1 section K.7.1.4.6.1., the following restrictions apply for positive opening contacts of design Za when used for safety applications:

"If the control switch has changeover contact element of design C or Za, **only one contact element may be used** (closure or interruption). For changeover contact elements of design Zb, both contacts may be used..."

Contact design Zb

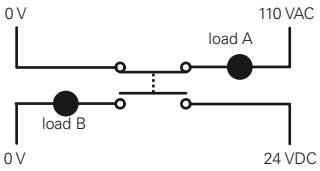


figure 1: **correct**

Contact design Za

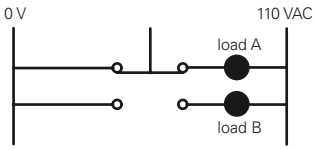


figure 2: **correct**

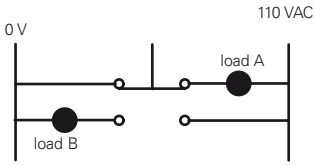
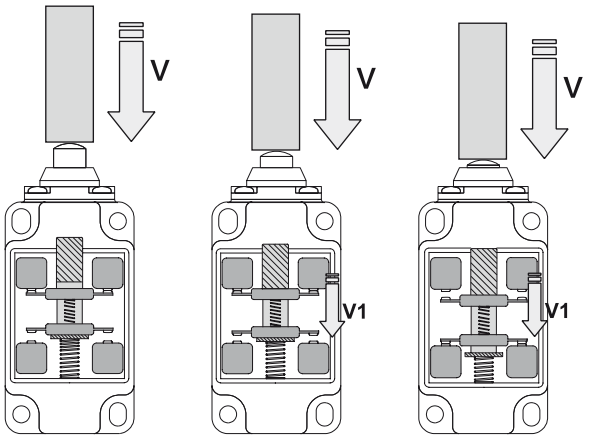


figure 3: **incorrect**

9 Contact blocks with different operating principle: slow action and snap action

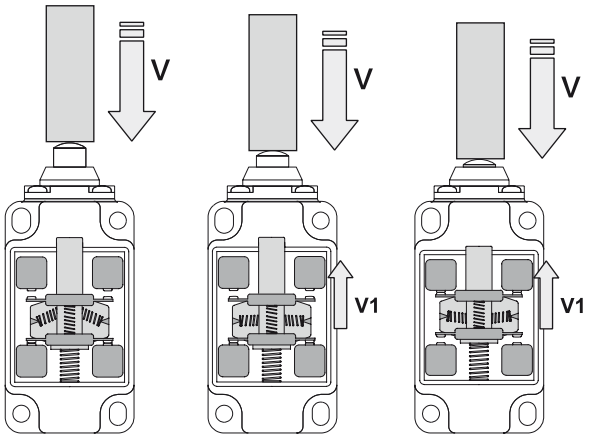
Contact blocks with slow action: component where the speed of the contact movement (V1) depends on the speed of the switch actuation (**V**). The contact carrier moves at a rate proportional to the actuation speed.
The slow action contact block is suitable for applications having low to medium currents and quick actuation movements. It has no differential travel.

$$V = V1$$



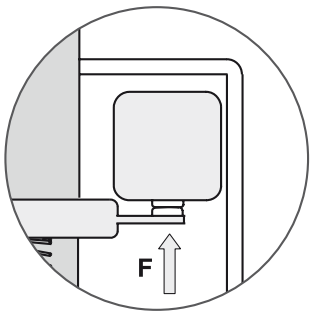
Contact block with snap action: component where the speed of the contact movement (**V1**) doesn't depend on the speed of the switch actuation (**V**). Upon reaching a predetermined point in the actuation travel, the contact carrier triggers and switches the contacts.
The snap action contact block is suitable for applications having high currents and/or slow actuation movements. This kind of contact block has a differential travel.

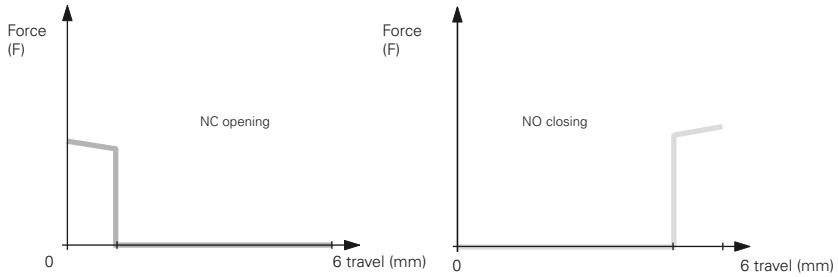
$$V \neq V1$$



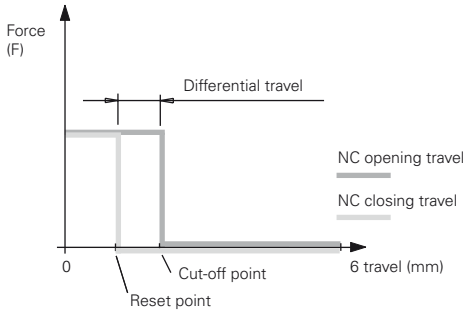
10 Contact blocks: diagrams of the force on the contacts

The following diagrams show the relationship between of the force exerted on the contacts (F) and the actuation travel to the end position.

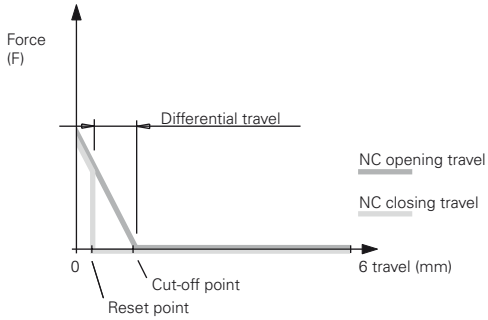




Contact block with slow action

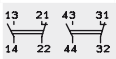
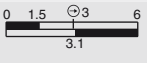
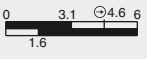
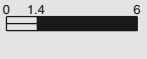
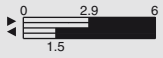
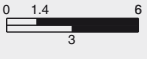
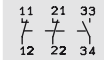
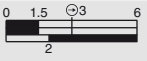
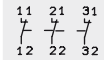
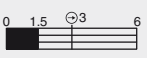
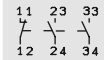
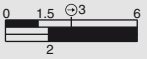
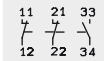
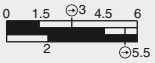
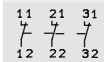
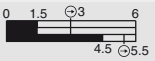
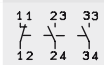
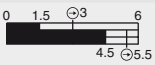
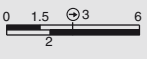
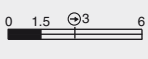
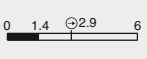


Contact block with snap action and constant pressure: 5, 11, 12.
The pressure on the contacts remains constant as the switching point is approached



Contact block with snap action: 2, 3, 17
The pressure on the contacts decreases as the switching point is approached

Contact blocks of the FD-FP-FL-FC-FR-FM-FX-FZ-FK-FW-FS series

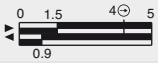
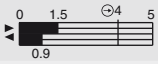
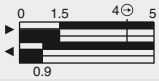
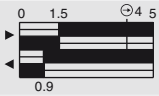
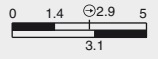
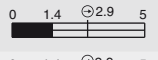
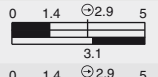
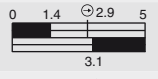
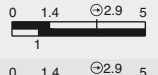
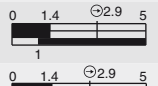
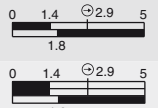
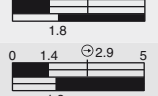
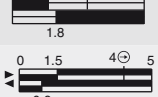
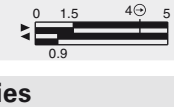
Contact block		Contact diagram	Linear travel diagram	Contact design	Operation type	Positive opening ⊕	Contact type	Captive screws	Terminals with finger protection	Gold-plated contacts
2	2x(1NO-1NC)			Za+Za	snap action	no	Double interruption	no	no	Not available
3	1NO-1NC			Za	snap action	no	Double interruption	no	no	Not available
5	1NO+1NC			Zb	snap action	yes	Double interruption, twin bridge	yes	yes	G / G1
6	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
7	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
8	1NC			Y	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
9	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
10	2NO			X+X	slow action	no	Double interruption, twin bridge	yes	yes	G / G1
11	2NC			Y+Y	snap action	yes	Double interruption, twin bridge	yes	yes	G / G1
12	2NO			X+X	snap action	no	Double interruption, twin bridge	yes	yes	G / G1
13	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
14	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
15	2NO			X+X	slow action	no	Double interruption, twin bridge	yes	yes	G / G1
16	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
18	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
20	1NO+2NC			Y+Y+X	slow action	yes	Double interruption, twin bridge	yes	yes	G
21	3NC			Y+Y+Y	slow action	yes	Double interruption, twin bridge	yes	yes	G
22	2NO+1NC			Y+X+X	slow action	yes	Double interruption, twin bridge	yes	yes	G
28	1NO+2NC			Y+Y+X	slow action	yes	Double interruption, twin bridge	yes	yes	G
29	3NC			Y+Y+Y	slow action	yes	Double interruption, twin bridge	yes	yes	G
30	3NC			Y+Y+Y	slow action	yes	Double interruption, twin bridge	yes	yes	G
33	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	yes	yes	G
34	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	yes	yes	G
37	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
66	1NC			Y	slow action	yes	Double interruption, twin bridge	yes	yes	G / G1
67	1NO			X	slow action	no	Double interruption, twin bridge	yes	yes	G / G1
E1	1NO-1NC			PNP	electronic	no	electronic	no	no	/

Legend: G= gold plated 1µm / G1= gold-plated 2.5µm

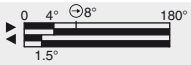
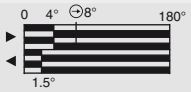
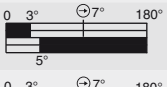
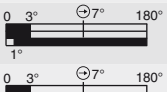
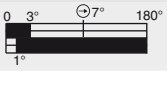
Contact blocks - FG series

Contact block		Contact diagram	Linear travel diagram	Contact design	Operation type	Positive opening ⊕	Contact type	Captive screws	Terminals with finger protection	Gold-plated contacts
60•	Contact block with 4 poles and multiple contact designs. See page 93, General Catalogue Safety 2017-2018.				slow action	yes	Double interruption, twin bridge and double contact point	yes	yes	G

Contact blocks - NA-NB-NF series

Contact block		Contact diagram	Linear travel diagram	Contact design	Operation type	Positive opening ⊖	Contact type	Captive screws	Terminals with finger protection	Gold-plated contacts
B11	1NO+1NC			Zb	snap action	yes	Double interruption	/	/	G
B02	2NC			Y+Y	snap action	yes	Double interruption	/	/	G
B12	1NO+2NC			X+Y+Y	snap action	yes	Double interruption	/	/	G
B22	2NO+2NC			X+X+Y+Y	snap action	yes	Double interruption	/	/	G
G11	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
G02	2NC			Y+Y	slow action	yes	Double interruption	/	/	G
G12	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
G22	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G
H11	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
H12	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
H22	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G
L11	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
L12	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
L22	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G
BA1	1NO+1NC change-over			C	snap action	yes	Double interruption	/	/	G

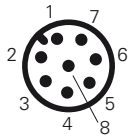
Contact blocks - HP series

Contact block		Contact diagram	Linear travel diagram	Contact design	Operation type	Positive opening ⊖	Contact type	Captive screws	Terminals with finger protection	Gold-plated contacts
50C	1NO+1NC			Zb	snap action	yes	Double interruption	/	/	G
50D	2NC			Y+Y	snap action	yes	Double interruption	/	/	G
50F	1NO+2NC			X+Y+Y	snap action	yes	Double interruption	/	/	G
50M	2NO+2NC			X+X+Y+Y	snap action	yes	Double interruption	/	/	G
52C	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
52D	2NC			Y+Y	slow action	yes	Double interruption	/	/	G
52F	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
52M	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G
53C	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
53F	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
53M	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G

Wiring diagram for assembled connectors

For FD - FL - FM - FZ - FC series with metal housing

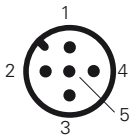
Contact block 2
1NO-1NC+1NO-1NC



M12 connector, 8-pole

Contacts	Pin no.
NO	3-4
NC	5-6
NC	7-8
NO	1-2

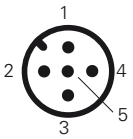
Contact block 5
1NO+1NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

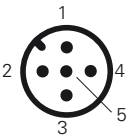
Contact block 6
1NO+1NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

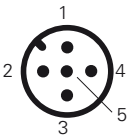
Contact block 7
1NO+1NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

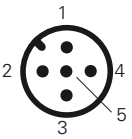
Contact block 9
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NC	3-4
ground	5

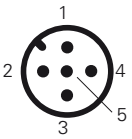
Contact block 10
2NO



M12 connector, 5-pole

Contacts	Pin no.
NO	1-2
NO	3-4
ground	5

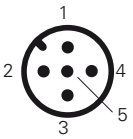
Contact block 11
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NC	3-4
ground	5

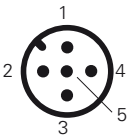
Contact block 12
2NO



M12 connector, 5-pole

Contacts	Pin no.
NO	1-2
NO	3-4
ground	5

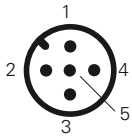
Contact block 13
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC (1°)	1-2
NC (2°)	3-4
ground	5

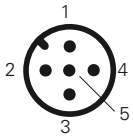
Contact block 14
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC (1°)	1-2
NC (2°)	3-4
ground	5

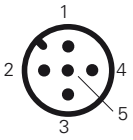
Contact block 15
2NO



M12 connector, 5-pole

Contacts	Pin no.
NO (1°)	1-2
NO (2°)	3-4
ground	5

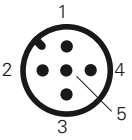
Contact block 16
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC, lever to the right	1-2
NC, lever to the left	3-4
ground	5

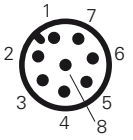
Contact block 18
1NO+1NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

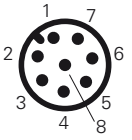
Contact block 20
2NC+1NO



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NO	7-8
ground	1

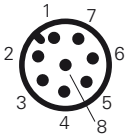
Contact block 21
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8
ground	1

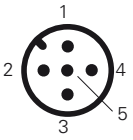
Contact block 22
1NC+2NO



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NO	5-6
NO	7-8
ground	1

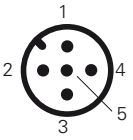
Contact block 33
1NC+1NO



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

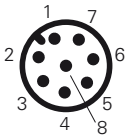
Contact block 34
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NC	3-4
ground	5

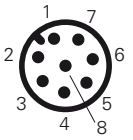
Contact block 28
2NC+1NO



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NO	7-8
ground	1

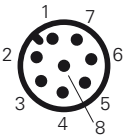
Contact block 29
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8
ground	1

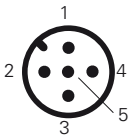
Contact block 30
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8
ground	1

Contact block E1
PNP

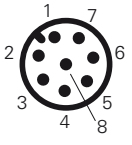


M12 connector, 5-pole

Contacts	Pin no.
+	1
-	3
NC	2
NO	4
ground	5

For FS series with technopolymer housing

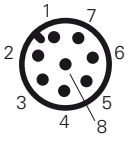
Contact block 18
1NO+1NC



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NO	5-6

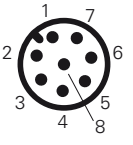
Contact block 20
2NC+1NO



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NO	7-8

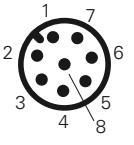
Contact block 21
3NC



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NC	7-8

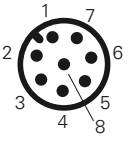
Contact block 28
2NC+1NO



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NO	7-8

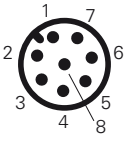
Contact block 29
3NC



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NC	7-8

Contact block 30
3NC



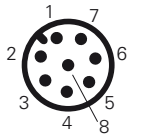
M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NC	7-8

Wiring diagram for assembled connectors

For FP - FR - FX - FW series with technopolymer housing

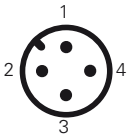
Contact block 2
1NO-1NC+1NO-1NC



M12 connector, 8-pole

Contacts	Pin no.
NO	3-4
NC	5-6
NC	7-8
NO	1-2

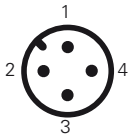
Contact block 5
1NO+1NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

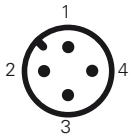
Contact block 6
1NO+1NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

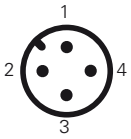
Contact block 7
1NO+1NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

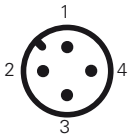
Contact block 9
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NC	3-4

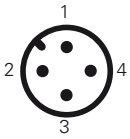
Contact block 10
2NO



M12 connector, 4-pole

Contacts	Pin no.
NO	1-2
NO	3-4

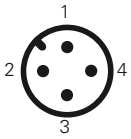
Contact block 11
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NC	3-4

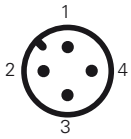
Contact block 12
2NO



M12 connector, 4-pole

Contacts	Pin no.
NO	1-2
NO	3-4

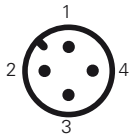
Contact block 13
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC (1°)	1-2
NC (2°)	3-4

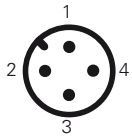
Contact block 14
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC (1°)	1-2
NC (2°)	3-4

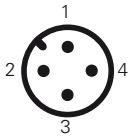
Contact block 15
2NO



M12 connector, 4-pole

Contacts	Pin no.
NO (1°)	1-2
NO (2°)	3-4

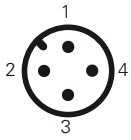
Contact block 16
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC, lever to the right 1-2	
NC, lever to the left 3-4	

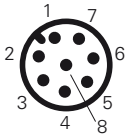
Contact block 18
1NO+1NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

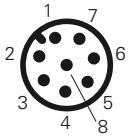
Contact block 20
2NC+1NO



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NO	7-8

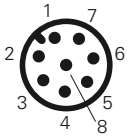
Contact block 21
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8

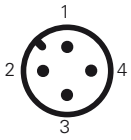
Contact block 22
1NC+2NO



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NO	5-6
NO	7-8

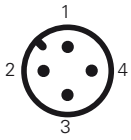
Contact block 33
1NC+1NO



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

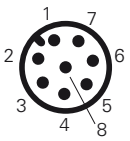
Contact block 34
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NC	3-4

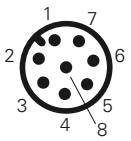
Contact block 28
2NC+1NO



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NO	7-8

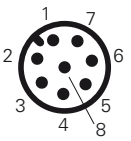
Contact block 29
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8

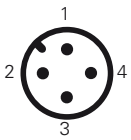
Contact block 30
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8

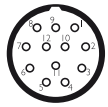
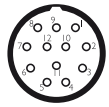
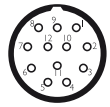
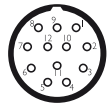
Contact block E1
PNP



M12 connector, 4-pole

Contacts	Pin no.
+	1
-	3
NC	2
NO	4

For FG series with metal housing and M23 connector

Contact block 60A 2NO+2NC	Contact block 60B 1NO+3NC	Contact block 60C 4NC	Contact block 60D 1NO+3NC	Contact block 60E 1NO+3NC	Contact block 60F 2NO+2NC	Contact block 60G 4NC	Contact block 60H 4NC	Contact block 60I 1NO+3NC	Contact block 60L 2NO+2NC
									
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Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.
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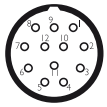
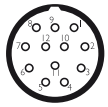
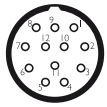
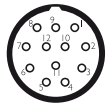
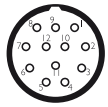
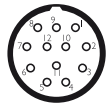
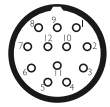
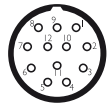
ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11

Contact block 60M 3NO+1NC	Contact block 60N 3NO+1NC	Contact block 60P 4NC	Contact block 60R 2NO+2NC	Contact block 60S 2NO+2NC	Contact block 60T 1NO+3NC	Contact block 60U 4NC	Contact block 60V 2NO+2NC	Contact block 60X 1NO+3NC	Contact block 60Y 2NO+2NC
									
M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole

Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.	Contacts	Pin no.
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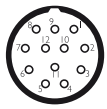
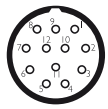
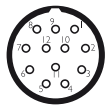
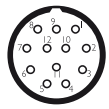
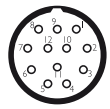
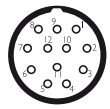
ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11

Contact block 61A 1NO+3NC	Contact block 61B 2NO+2NC	Contact block 61C 3NO+1NC	Contact block 61D 3NO+1NC	Contact block 61E 3NO+1NC	Contact block 61G 3NO+1NC	Contact block 61H 2NO+2NC	Contact block 61M 3NO+1NC	Contact block 61R 1NO+3NC	Contact block 61S 3NO+1NC
									
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NC	3-4	NC	3-4	NO	3-4	NO	3-4	NO	3-4	NO	3-4	NC	3-4	NO	3-4	NC	3-4	NO	3-4
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NC	7-8	NO	7-8	NO	7-8	NO	7-8	NO	7-8	NO	7-8	NO	7-8	NO	7-8	NO	7-8	NO	7-8
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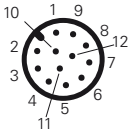
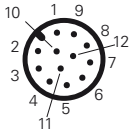
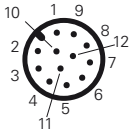
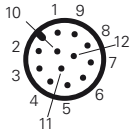
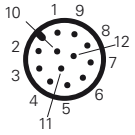
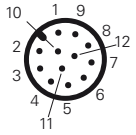
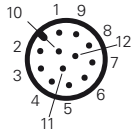
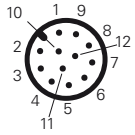
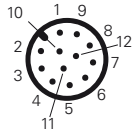
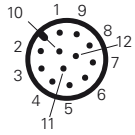
ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11	ground	11

For FG series with metal housing and M12 connector

Contact block 60A 2NO+2NC	Contact block 60B 1NO+3NC	Contact block 60C 4NC	Contact block 60D 1NO+3NC	Contact block 60E 1NO+3NC	Contact block 60F 2NO+2NC	Contact block 60G 4NC	Contact block 60H 4NC	Contact block 60I 1NO+3NC	Contact block 60L 2NO+2NC
									
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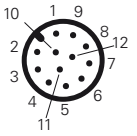
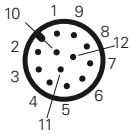
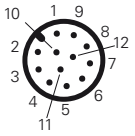
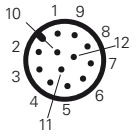
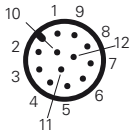
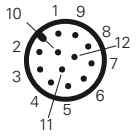
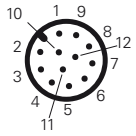
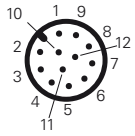
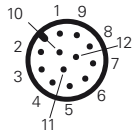
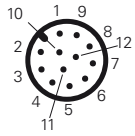
NO 7-8	NC 7-8	NC 7-8	NC 7-8	NC 7-8	NO 7-8	NC 7-8	NC 7-8	NC 7-8	NO 7-8
NO 9-10	NO 9-10	NC 9-10	NC 9-10	NO 9-10	NO 9-10	NC 9-10	NO 9-10	NO 9-10	NO 9-10

Contact block 60M 3NO+1NC	Contact block 60N 3NO+1NC	Contact block 60P 4NC	Contact block 60R 2NO+2NC	Contact block 60S 2NO+2NC	Contact block 60T 1NO+3NC	Contact block 60U 4NC	Contact block 60V 2NO+2NC	Contact block 60X 1NO+3NC	Contact block 60Y 2NO+2NC
									
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Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.
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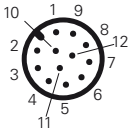
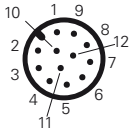
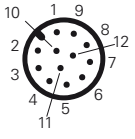
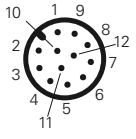
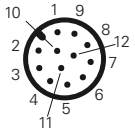
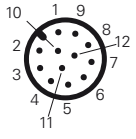
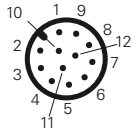
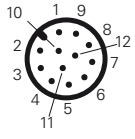
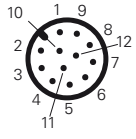
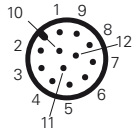
NO 3-4	NO 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NO 3-4	NC 3-4
NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6
NO 7-8	NO 7-8	NC 7-8	NO 7-8	NO 7-8	NC 7-8	NC 7-8	NO 7-8	NC 7-8	NO 7-8
NO 9-10	NO 9-10	NC 9-10	NO 9-10	NO 9-10	NO 9-10	NC 9-10	NO 9-10	NC 9-10	NO 9-10

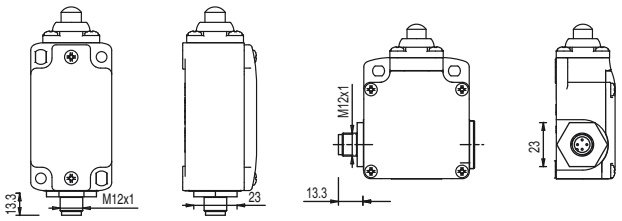
Contact block 61A 1NO+3NC	Contact block 61B 2NO+2NC	Contact block 61C 3NO+1NC	Contact block 61D 3NO+1NC	Contact block 61E 3NO+1NC	Contact block 61G 3NO+1NC	Contact block 61H 2NO+2NC	Contact block 61M 3NO+1NC	Contact block 61R 1NO+3NC	Contact block 61S 3NO+1NC
									
M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole
Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.	Contacts / Pin no.
A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2
NC 3-4	NC 3-4	NO 3-4	NO 3-4	NO 3-4	NO 3-4	NC 3-4	NO 3-4	NC 3-4	NO 3-4
NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6
NC 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NC 7-8	NO 7-8
NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10

Note: the wires connected to pins 11 and 12 of the M12 connector can be used to activate the LEDs in FG series configurations with freely connectable LEDs.

Dimensions with assembled connectors

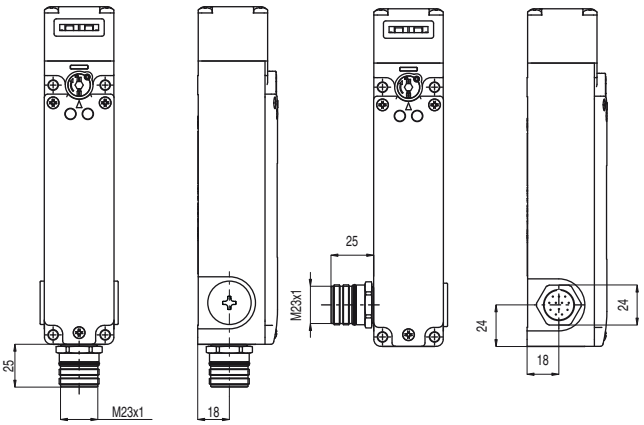
All values in the drawings are in mm

Switch with M12 connector, at bottom	Switch with M12 connector, at the right, at the left, or at bottom



FD - FP - FL - FC - FR - FM - FX - FZ - FW - FS - FG - NG series

Switch with M23 connector, at bottom	Switch with M23 connector, at the right or left

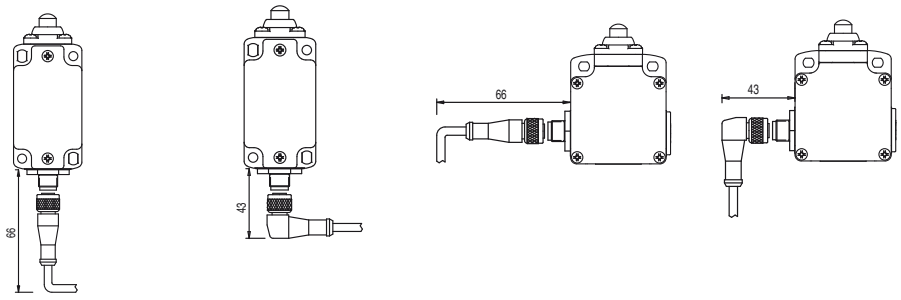


FG - NG series

Minimum distances required for insertion of the connectors

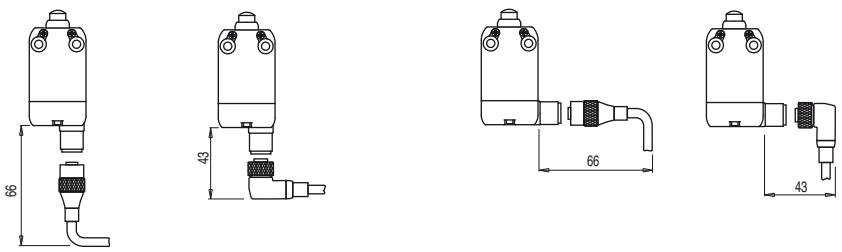
All values in the drawings are in mm

Switch with M12 connector, at bottom	Switch with M12 connector, at the right or left



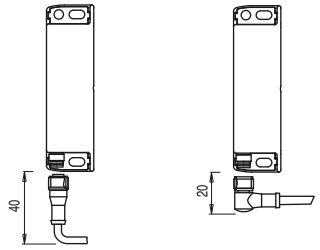
FD - FP - FL - FC - FR - FM - FX - FZ - FW - FS - FG - NG series

Switch with M12 connector, at bottom	Switch with M12 connector, at the right



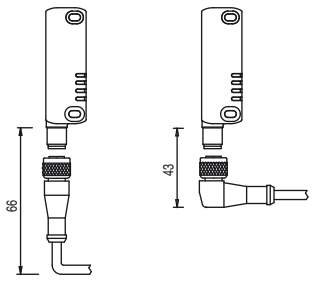
NA - NB - NF series

Sensor with M8 connector



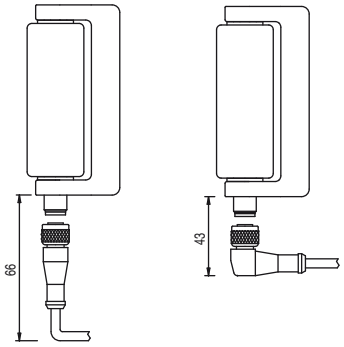
SR series

Sensor with M12 connector



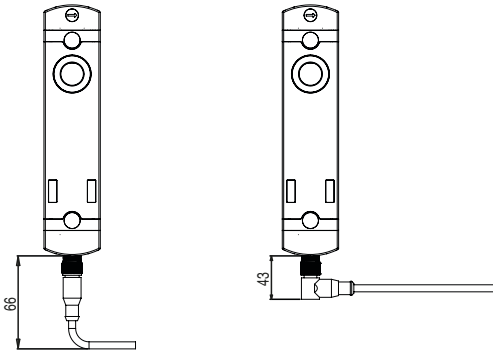
ST series

Hinge with M12 connector



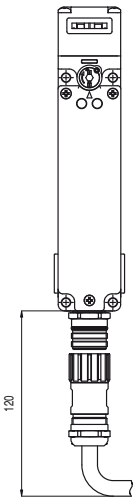
HP - HX series

Switch with M12 connector on bottom or swivel-mounted

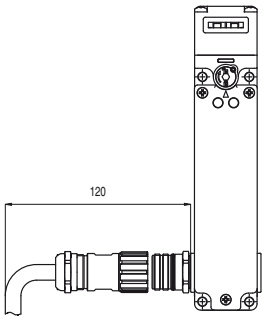


NS series

Switch with M23 connector
at bottom



Switch with M23 connector
at the right or left



FG - NG series

1- Introduction

The purpose of this section is to provide the machine manufacturer with a quick overview of a number of standards related to machine safety, to clarify some basic terms and to provide some application examples. This brief guide only covers aspects related to the functional safety of the machine, i.e., all measures that must be taken to protect the operating personnel from the hazards arising from the operation of the machine, as well as the project planning and selection of the appropriate interlocking devices for the given guard.
The machine designer himself must identify risks that are posed by other hazards, such as live parts, pressurised containers, explosive atmospheres, etc. These risks are not dealt with in this guideline.
Pizzato Elettrica prepared this document to the best of its knowledge, taking into consideration the standards, interpretations and existing technologies. The examples provided here must always be considered by the end customer with respect to the latest state of technology and standardisation. Pizzato Elettrica accepts no responsibility for the examples provided here and does not exclude the possibility of unintentional errors or inaccuracies.

2 -Design in safety. Structure of the European standards.

To freely market any type of device or machine in the countries of the European Community, they must comply with the provisions of the EU directives. They establish the general principles for ensuring that manufacturers place products on the market that are not hazardous to the operating personnel. The vast range of products pose many different hazards and, over time, has led to the release of various directives. As an example, consider the Low Voltage Directive 2014/35/EU, the Equipment for Explosive Atmospheres (ATEX) Directive 2014/34/EU, the Electromagnetic Compatibility Directive 2014/30/EU, etc. The hazards that arise from the operation of machinery are described in the Machinery Directive 2006/42/EC.
Conformity with the directives is certified by the Declaration of Conformity issued by the manufacturer and by the application of the CE marking on the machine.

For the assessment of risks posed by a machine and for the realisation of the safety systems for protecting the operating personnel from those risks, the European standardisation organisations CEN and CENELEC have issued a series of standards which translate the contents of the directives into technical requirements. The standards published in the Official Journal of the European Union are harmonised. The manufacturer is to verify conformity with the applied and listed standards.

The machine safety standards are divided into three types: A, B and C.
Type A standards: Standards that cover basic concepts and general principles for design in order to achieve safety in the design of machinery.
Type B standards: Standards that deal with one or more safety aspects and are divided into the following standards:
B1: Standards on particular safety aspects (e.g. safety distances, temperature, noise, etc.)
B2: Standards on safeguards (e.g. two-hand controls, interlocking devices, guards, etc.)
Type C standards: Standards that deal with detailed safety requirements for a particular group of machines (e.g. hydraulic presses, injection moulding machines, etc.)

The system or machine manufacturer must therefore determine whether the product is covered by a type C standard. If this is the case, this standard specifies the safety requirements; otherwise, the type B standards shall apply for any specific aspect or device of the product. In the absence of specifications, the manufacturer shall follow the general guidelines stated in the type A standards.

TYPE A STANDARDS
For example:

EN ISO 12100. Safety of machinery - General principles for design - Risk assessment and risk reduction.

TYPE B1 STANDARDS
For example:

EN 62061. Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
EN ISO 13849-1 e -2. Safety-related parts of control systems

TYPE B2 STANDARDS
For example:

EN 574. Two-hand control devices
EN ISO 13850. Emergency stop
EN ISO 14119. Interlocking devices associated with guards
EN 60204-1. Electrical equipment of machines
EN 60947-5-1. Electromechanical control circuit devices

TYPE C STANDARDS
For example:

EN 201. Plastics and rubber machines - Injection moulding machines
EN 415-1. Safety of packaging machines
EN 692. Mechanical presses
EN 693. Hydraulic presses
EN 848-1. Safety of wood-working machines – One side moulding machines with rotating tool – Part 1: Single spindle vertical moulding machines

3 - Designing safe machines. Risk analysis.

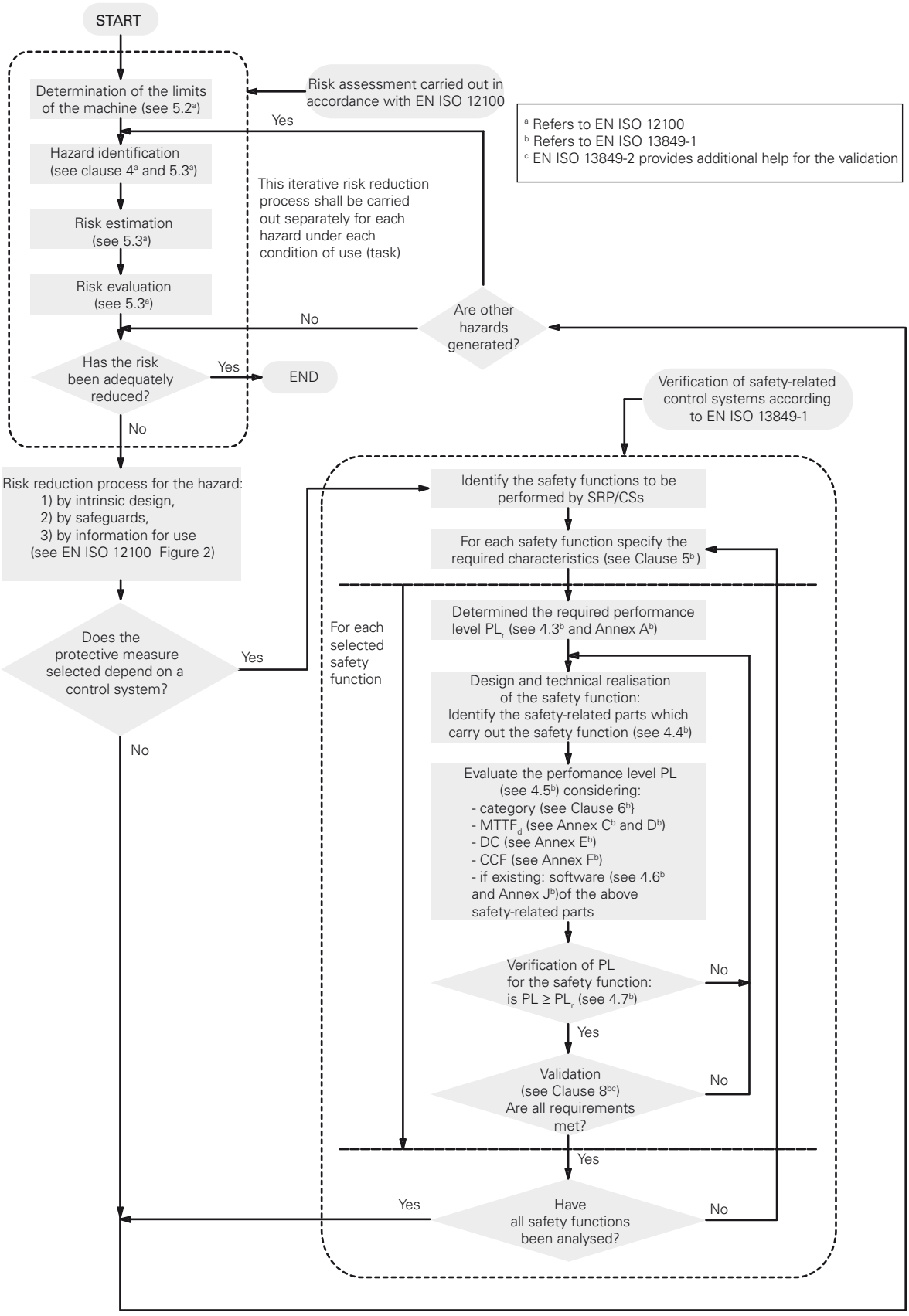
The first step in producing a safe machine is to identify the possible hazards to which the operators of a machine are exposed. The identification and classification of the hazards allows the risk for the operator or the combination of the probability of a hazard and the possible injury to be determined.

The methodology for risk analysis and evaluation and the procedure for the elimination/reduction of risks is defined by standard EN ISO 12100. This standard introduces a cyclic analysis model: starting with the initial objectives, the risk analysis and the various possibilities for reducing these risks are repeatedly evaluated until the initial objective is met.

The model introduced in this standard specifies that one proceed as follows after performing a risk analysis to reduce or eliminate risks:
1) Elimination of risks at their source through the use of intrinsically safe design principles and the structural set-up of the systems
2) Risk reduction through safeguarding and monitoring systems
3) Identification of residual risks though signalling and by informing the operating personnel.

Since every machine has hazards and because it is not possible to eliminate all possible risks, the objective is to reduce the residual risks to an acceptable level.

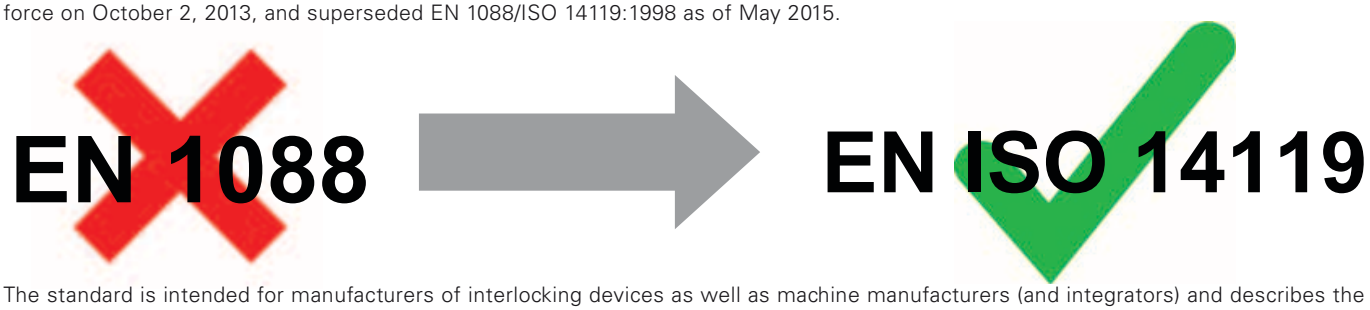
If a risk is reduced by means of a monitoring system, standard EN ISO 13849-1, which provides an evaluation model for the quality of this system, comes into play. If a given level is specified for a risk, it is possible to use a safety function of equal or higher level.



Note: This diagram was created by combining figures 1 and 3 of standard EN 13849-1. The texts in the diagram are not identical to those in the standard.

4- Design and selection of interlocking devices associated with guards (standard EN ISO 14119)

The new European standard EN ISO 14119 "Interlocking devices associated with guards – Principles for design and selection" came into force on October 2, 2013, and superseded EN 1088/ISO 14119:1998 as of May 2015.



The standard is intended for manufacturers of interlocking devices as well as machine manufacturers (and integrators) and describes the requirements on the devices and their correct installation.
The new standard provides clarification to a number of questions that are not always clear cut and considers the latest technologies used in the design of interlocking devices, defines a number of parameters (**actuator type and level of coding**) and describes the procedure for correct installation with the goal of minimizing the defeat possibilities of the interlocking devices.
The standard also considers other aspects related to interlocking devices (e.g. guard locking principles, electromagnetic guard locking, auxiliary release, escape and emergency release, etc.) which are not described here.

Coding level of the actuators

An important new addition to the standard is the definition of a coded actuator and the classification of the coding levels:

- **coded actuator** – actuator which was specially designed for use with a specific interlocking device;
- **low level coded actuator** – coded actuator for which 1 to 9 variations in code are available (e.g. the SR magnetic switch series or the safety switches with separate actuator and mechanical detection FS, FG, FR, FD…);
- **medium level coded actuator** – coded actuator for which 10 to 1000 variations in code are available;
- **high level coded actuator** – coded actuator for which more than 1000 variations are available. (e.g. the ST series sensors with RFID technology or the interlocking devices of the NG series with RFID technology and guard locking).

Types of interlocking devices

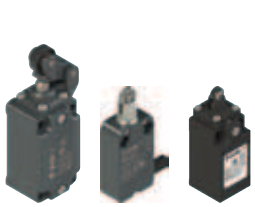
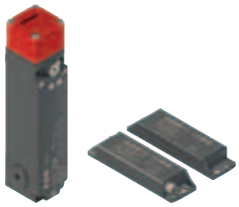
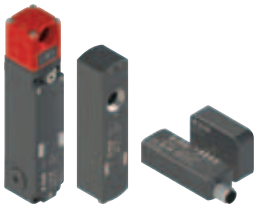
Standard EN ISO 14119 defines different types of interlocking devices:

- **Type 1 interlocking device** – interlocking device that is mechanically actuated by an uncoded actuator (e.g. HP series hinged interlocking devices)
- **Type 2 interlocking device** – interlocking device that is mechanically actuated by a coded actuator (e.g. safety switches with separate actuator of the FR, FS, FG, … series)
- **Type 3 interlocking device** – interlocking device that is contactlessly actuated by an uncoded actuator
- **Type 4 interlocking device** – interlocking device that is contactlessly actuated by a coded actuator (e.g. ST series safety sensors with RFID technology and NG and NS series safety switches with RFID technology)

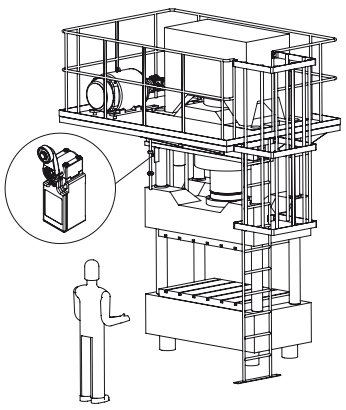
Examples of actuation principles		Actuator examples		Type
Mechanical	Direct contact/force	Uncoded	Rotary cam	Type 1
			Linear cam	
			Hinge	
		Coded	Key-actuated	Type 2
			Trapped key	
Non-contact	Inductive	Uncoded	Ferromagnetic material	Type 3
	Magnetic		Magnet, solenoid	
	Capacitive		Any suitable object	
	Ultrasonic		Any suitable object	
	Optic		Any suitable object	
	Magnetic	Coded	Coded magnet	Type 4
	RFID		Coded RFID tag	
	Optic		Optically coded tag	

Excerpt from EN ISO 14119 - Table 1

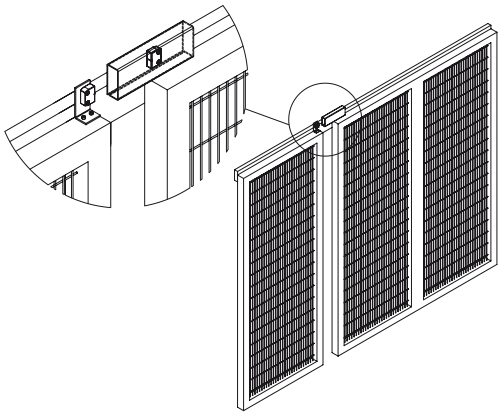
Requirements for the design and the installation of interlocking devices according to EN ISO 14119 to reduce defeating of guards.

Principles and measures against defeating	Type 1 devices		Type 2 and type 4 devices (low level coded actuators)	Type 2 and type 4 devices (high level coded actuators)
	Cam safety switches rotary or linear cam	Hinged safety switches		
				
Installation out of reach (1)	X		X	
Barriers or shielding (2)				
Installation in hidden position (3)				
Testing by means of control circuit (4)				
Non-detachable fixing of position switch and cam				
Non-detachable fixing of position switch		M		
Non-detachable fixing of the actuation element or cam		M	M	M
Additional position sensing and plausibility check	R		R	

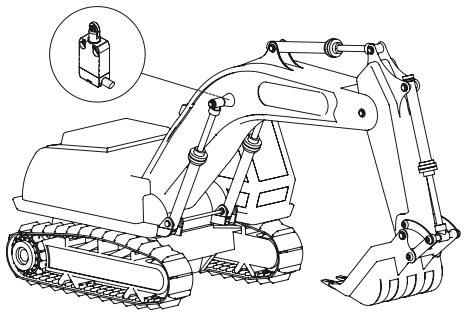
X: mandatory to apply at least one of the measures listed in the "Principles and measures" column Excerpt from EN ISO 14119 - Table 3
M: mandatory measure
R: recommended measure
It is clear that the use of devices with RFID technology, high coding level and hinged switches is the easiest way to meet the requirements of EN ISO 14119, as it is only necessary to fulfil a few requirements in order to prevent defeating of guards.
Devices with low or medium coding level require additional measures to ensure a tamperproof application.



(1) - Installation out of reach



(2) - Barriers or shielding



(3) - Installation in hidden position

(4) – Status monitoring or periodic testing can, for example, be performed on a machine with a simple operating cycle so as to verify that the guards are actually open at the end of or during specific operating phases (e.g. to remove the processed material or to perform quality controls). If status monitoring does not detect opening of the guard, an alarm is generated and the machine is stopped.

Guard locking devices and holding force

The manufacturer of the interlocking device with guard locking must ensure that the device can withstand at least the measured holding force FZh while the interlock is engaged. This holding force must not exceed the maximum holding force divided by a safety coefficient equal to 1.3.

$$F_{Zh} = \frac{F_{1max}}{1{,}3}$$

Example: A device with maximum holding force of FZh =2000 N must pass a test with a maximum holding force equal to F1max =2600 N.
An interlocking device with guard locking can both monitor the position of the guard (open/closed) as well as lock the guard (locked/unlocked). Each of the two functions may require a different PL safety level (acc. to EN ISO 13849-1). The guard locking function generally requires a lower PL than the position monitoring function. (See paragraph 8.4, note 2 of EN ISO 14119).
To identify whether an interlocking device also performs status monitoring, the standard specifies that the product label includes the symbol shown to the side here.

5 - Current status of the standards. Reason for changes, new standards and some overlapping

The "traditional" standards for functional safety, such as EN 954-1, played a large part in formalising some of the basic principles for the analysis of safety circuits on the basis of deterministic principles. On the other hand, they make no mention of the topic of programmable electronic control systems and are not generally in line with the current state of technology. To take programmable electronic control systems into account in the analysis of safety circuits, the approach taken by current standards is fundamentally probabilistic and introduces new statistical variables.

This approach is based on IEC 61508, which deals with the safety of complex programmable electronic systems and is very extensive (divided into 8 sections with nearly 500 pages). It is also used in a diverse range of application fields (chemical industry, machine construction, nuclear plants) and is therefore classified as a type A standard (not harmonised). This standard introduces the SIL concept (Safety Integrity Level), a probabilistic indication of a system's residual risk.

From IEC 61508 comes EN 62061, which covers the functional safety of the complex electronic or programmable control systems in industrial applications. The concepts introduced here permit general use for any safety-related electrical, electronic and programmable electronic control systems (systems with non-electrical technologies are not covered).

EN ISO 13849-1, developed by CEN under the aegis of ISO, is also based on this probabilistic approach. This standard, however, attempts to structure the transition to the concepts in a less problematic way for the manufacturer, who is accustomed to the concepts of EN 954-1. The standard covers electromechanical, hydraulic, "non-complex" electronic systems and some programmable electronic systems with predefined structures. EN ISO 13849-1 is a type B1 standard and introduces the PL concept (Performance Level); as with SIL, the concept provides a probabilistic indication of a machine's residual risk. This standard points out a correlation between SIL and PL; concepts borrowed by EN 61508 – such as DC and CCF – are used and a connection to the safety categories of EN 954-1 is established.

Important note
EN 13849-1 is a type B1 standard; if a type C standard is already applied for a machine, the type C standard is to be used. All type C standards previously developed are based on the concepts of EN 954-1. For manufacturers of machines that are covered by a type C standard, the introduction time of the new standards depends on how quickly the various technical committees update the C standards.

In the area of functional safety for the safety of control circuits, there are thus two standards presently in force:
EN ISO 13849-1. Standard type B1, which uses the PL concept.
EN 62061. Standard type B1, which uses the SIL concept.

There is clear overlapping of the two standards EN 62061 and EN ISO 13849-1 concerning their application field and many aspects are similar; there is also a link between the two symbol names (SIL and PL), which indicate the result of the analyses according to the two standards.

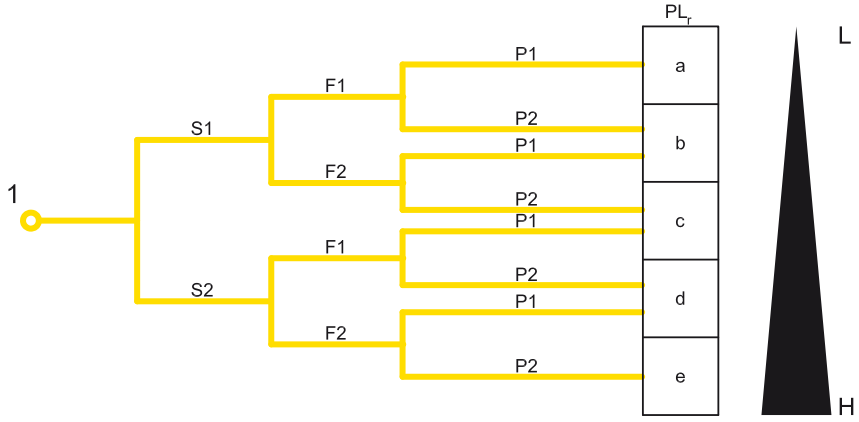
PL EN ISO 13849-1	**a**	**b**	**c**	**d**	**e**
SIL EN 62061 - IEC 61508	**-**	**1**	**1**	**2**	**3**
PFH_D	from 10^{-4} to 10^{-5}	from 10^{-5} to $3x10^{-6}$	from $3x10^{-6}$ to 10^{-6}	from 10^{-6} to 10^{-7}	from 10^{-7} to 10^{-8}
A hazardous failure every n years	from ~1 to ~10	from ~10 to ~40	from ~40 to ~100	from ~100 to ~1000	from ~1000 to ~10000

The choice of the standard to be applied is left to the manufacturer according to the technology that is used. We believe that standard EN ISO 13849-1 is easier to use thanks to its mediatory approach and the re-utilisation of the concepts already introduced on the market.

6- Standard EN ISO 13849-1 and the new parameters: PL, $MTTF_D$, DC, CCF

Standard EN ISO 13849-1 offers the manufacturer an iterative method for assessing whether the hazards posed by a machine can be reduced to an acceptable residual level through the use of appropriate safety functions. The applied method specifies a hypothesis-analysis-validation cycle for each risk. Once completed, it must be possible to demonstrate that every selected safety function is appropriate for the respective risk.
The first step involves the determination of the required performance level, which is required of each safety function. Like EN 954-1, EN ISO 13849-1 also uses a risk graph for the risk analysis of a machine function (figure A.1). Instead of a safety category, however, this graph is used to determine – as a function of the risk – a Required Performance Level or PLr for the safety function which protects the respective part of the machine.
Starting with point 1 of the graph, the machine manufacturer answers questions S, F and P and can then determine the PLr for the safety function being examined. He must then develop a system with a performance level PL that is equal to or greater than that which is required to protect the operating personnel.

Risk graph for determining the required PL_r for the safety function (excerpt from EN ISO 13849-1, figure A.1)



Key

1 Starting point for the evaluation of the safety function's contribution to risk reduction
L Low contribution to risk reduction
H High contribution to risk reduction
PL_r Required performance level

* F1 should be selected if the total duration of the exposure to the hazard does not exceed 1/20 of the total work time and the frequency of exposure to the hazard does not exceed once every 15 minutes
****** If there are no other reasons, F2 should be selected if the frequency of exposure to the hazard is greater than once every 15 minutes.

Risk parameters

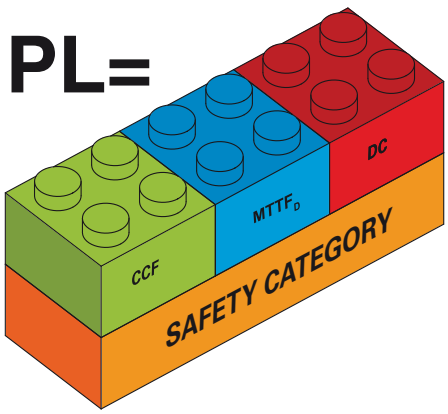
S Severity of injury
S1 Slight (normally reversible injury)
S2 Serious (normally irreversible injury or death)
F Frequency and/or exposure to hazard
***F1** Seldom-to-less-often and/or exposure time is short
****F2** Frequent-to-continuous and/or exposure time is long
P Possibility of avoiding hazard or limiting harm
P1 Possible under certain conditions
P2 Scarcely possible

Note: For a machine manufacturer, it may be of interest forego repeating the risk analysis of the machine and to instead to try and reuse the data already derived from the EN 954-1 risk analysis.
This is not generally possible, since the risk graph changed with the new standard (see previous figure) and, as a result, the required performance level of the safety function may have changed with identical risks. The German Institute for Occupational Safety and Health (BGIA), in its report 2008/2 on EN ISO 13849-1, recommends the following: assuming the "worst case", implementation can occur according to the following table. For further information, refer to the mentioned report.

Category required by EN 954-1		Required performance level (PLr) and category acc. to EN ISO 13849-1
B	→	b
1	→	c
2	→	d, Category 2
3	→	d, Category 3
4	→	e, Category 4

There are five performance levels, from PL a to PL e, with increasing risk; each represents a numerical range for the average probability of a dangerous failure per hour. For example, PL d specifies that the average probability of dangerous failures per hour is between 1x10-6 and 1x10-7, i.e., about 1 dangerous failure every 100-1000 years.

PL	Average probability of dangerous failures per hour PFHd (1/h)		
a	$\geq 10^{-5}$	e	$< 10^{-4}$
b	$\geq 3 \times 10^{-6}$	e	$<10^{-5}$
c	$\geq 10^{-6}$	e	$< 3 \times 10^{-6}$
d	$\geq 10^{-7}$	e	$< 10^{-6}$
e	$\geq 10^{-8}$	e	$<10^{-7}$

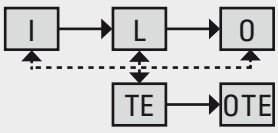
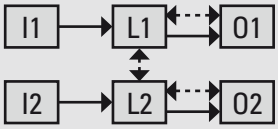
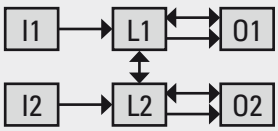


Several parameters are needed to determine the PL of a control system:
1. The safety category of the system, which is dependent on the architecture (structure) of the control system and its behaviour in the event of damage
2. $MTTF_d$ of the components
3. DC or Diagnostic Coverage of the system.
4. CCF or Common Cause Failures.

Safety category.
Most control circuits normally used can be represented with the following logic components:
- Input or signal input
- Logic or signal processing logic
- Output or output of the monitoring signal

These are connected to one another differently depending on the structure of the control circuit.

EN ISO 13849-1 allows for five different basic circuit structures, referred to as the designated architectures of the system. As shown in the following table, the architectures – combined with the requirements on the system behaviour in the event of failure and the minimum values of MTTFd, DC and CCF – give the safety category of the system control. Thus, the safety categories of EN ISO 13849-1 are not the equivalent, but rather extend the concept of the safety category introduced by the previous standard EN 954-1.

Category	Summary of the requirements	System behaviour	Safety principles	$MTTF_d$ of each channel	DC_{avg}	CCF
B	Safety-related parts of monitoring systems and/or their protective equipment, as well as their accessories, must be designed, constructed, selected, assembled and combined in accordance with the relevant standards so that they can withstand the expected influences. Fundamental safety principles must be used. Architecture:	The occurrence of a fault can lead to the loss of the safety function.	Mainly determined by the selection of components	Low to medium	None	Not relevant
1	In addition to the requirements of Category B, proven components and safety principles must be used. Architecture:	The occurrence of a fault can lead to the loss of the safety function; the probability of fault occurrence is, however, lower than for Category B.	Mainly determined by the selection of components	High	None	Not relevant
2	Requirements of Category B and proven safety principles must be used. The safety function must be checked at appropriate intervals by the control system. Architecture: 	The occurrence of a fault between two checks can lead to the loss of the safety function. The loss of the safety function is detected through the check.	Determined mainly by the structure	Low to high	Low to medium	See Annex F
3	Requirements of Category B and proven safety principles must be used. Important safety-related parts must be designed so that: - A single fault in any of these parts does not lead to the loss of the safety function. - Where reasonably practicable, the single fault is detected. Architecture: 	If a single fault occurs, the safety function is always performed. Some, but not all faults are detected. Accumulation of undetected faults can lead to the loss of the safety function.	Determined mainly by the structure	Low to high	Low to medium	See Annex F
4	Requirements of Category B and proven safety principles must be used. Important safety-related parts must be designed, so that: - a single fault in any of these parts does not lead to the loss of the safety function, and - a single fault during or before the next request for the safety function is detected. If this is not possible, the accumulation of undetected faults must not lead to the loss of the safety function. Architecture: 	If a single fault occurs, the safety function is always performed. The detection of accumulated faults reduces the probability of the loss of the safety function (high DC). The faults are detected in time to prevent the loss of the safety function.	Determined mainly by the structure	High	High (including accumulation of faults)	See Annex F

$MTTF_D$ ("Mean Time To Dangerous Failure").

This parameter is used to determine the functional system quality over the mean lifetime in years before a dangerous failure occurs (other failures are not considered). The calculation of the $MTTF_d$ is based on numerical values supplied by the manufacturers of the individual components of the system. In the absence of this data, the values can be taken from the tables with guide values included in the standard (EN ISO 13849-1 Annex C). The evaluation results in a numerical value, divided into three categories: High, Medium or Low.

Classification	Values
Not acceptable	$MTTF_D$< 3 years
Low	3 years ≤ $MTTF_D$< 10 years
Medium	10 years ≤ $MTTF_D$< 30 years
High	(30 years ≤ $MTTF_D$ ≤ 100 years

For components that are susceptible to high wear (typical for mechanical and hydraulic devices), the manufacturer supplies the value B_{10D} for the component, i.e., the number of component operations within which 10% of the samples failed dangerously, instead of the $MTTF_d$ of the component.

The B_{10D} value of the component must be converted to $MTTF_d$ by the machine manufacturer using the following formula:

$$MTTF_D = \frac{B_{10_D}}{0{,}1 \cdot n_{op}}$$

Where n_{op}= means number of annual operations for the component.
By assuming the daily operating frequency and the daily operating hours for the machine, n_{op} can be calculated as follows:

$$n_{op} = \frac{d_{op} \cdot h_{op} \cdot 3600s/h}{t_{ciclo}}$$

where
d_{op}= work days per year
h_{op}= operating hours per day
t_{cycle}= cycle time (s)

For components that are susceptible to wear, note that parameter $MTTF_d$ is dependent not only on the component itself but also on the application. An electromechanical device with low frequency of use, e.g. a remote switch that is only used for emergency stops, has a high $MTTF_d$; if the same device is used for normal processes in the operating cycle, the $MTTF_d$ of the same remote switch could drop dramatically.

All elements of the circuit contribute to the calculation of the $MTTF_d$ depending on their structure. In control systems with single-channel architecture (as is the case in categories B, 1 and 2), the contribution of each components is linear and the $MTTF_d$ of the channel is calculated as follows:

$$\frac{1}{MTTF_D} = \sum_{i=1}^{N} \frac{1}{MTTF_{D\,i}}$$

To avoid overly optimistic designs, the maximum value of the $MTTF_d$ of each channel is limited to 100 years (for categories B, 1, 2 and 3) or 2500 years (category 4). Channels with an $MTTF_d$ of less than 3 years are not allowed.

For two-channel systems (categories 3 and 4), the $MTTF_d$ of the circuit is calculated by averaging the $MTTF_d$ of the two channels using the following formula:

$$MTTF_D = \frac{2}{3}\left[MTTF_{DC1} + MTTF_{DC2} - \frac{1}{\frac{1}{MTTF_{DC1}} + \frac{1}{MTTF_{DC2}}}\right]$$

DC ("Diagnostic Coverage").

This parameter provides information on the effectiveness of a system's ability to self-detect any possible failures within the system. Using the percentage of the detectable dangerous failures, one obtains a diagnostic coverage of better or worse quality. The numerical DC parameter is a percentage value which is calculated using values taken from a table (EN ISO 13849-1 Annex E). Depending on the measures for failure detection taken by the manufacturer, example values are provided there. Because multiple measures are normally taken to rectify different anomalies in the same circuit, an average value or a DC_{avg} is calculated and can be assigned four levels:
High DC_{avg} ≥ 99%
Medium 90% ≤ DC_{avg} <99%
Low 60% ≤ DC_{avg} <90%
None DC_{avg} < 60%
A diagnostic coverage of none is only permissible for systems of category B or 1.

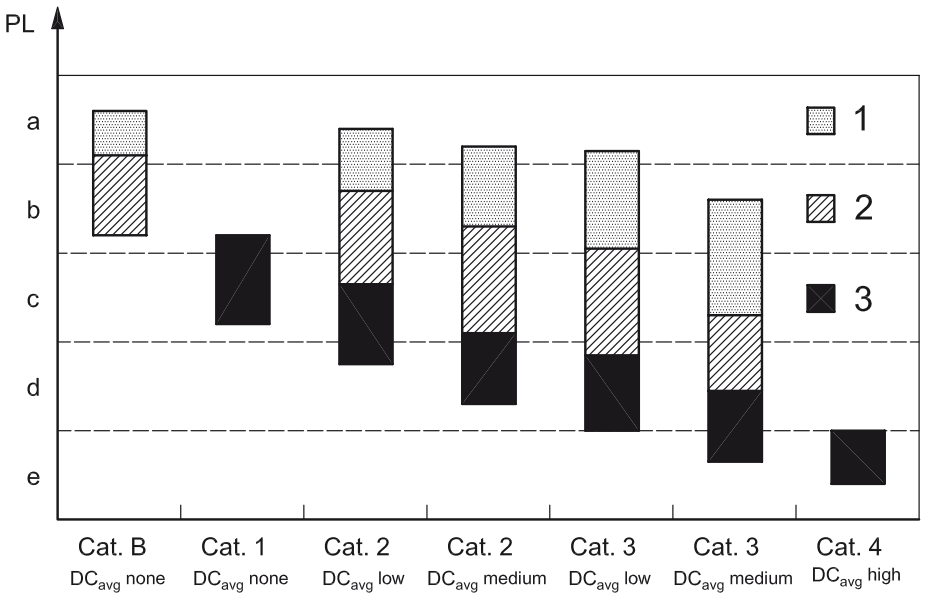
CCF ("Common Cause Failures")

For the calculation of the PL for systems of category 2, 3 or 4, it is also necessary to evaluate possible common cause failures or CCF, which may compromise the redundancy of the system. The evaluation is performed using a checklist (Annex F of EN ISO 13849-1); on the basis of the measures taken against common cause failures, points from 0 to 100 are assigned. The minimum permissible value for categories 2, 3 and 4 is 65 points.

PL ("Performance Level")

After determining this data, EN ISO 13849-1 gives the PL of the system using an assignment table (EN ISO 13849-1) or, alternatively, using a simplified graphic (EN ISO 13849-1, paragraph 4.5) as shown in the following.

Relationships between the categories, DC_{avg}, $MTTF_d$ of each channel and PL (acc. to EN ISO 13849-1, figure 5)



1 = $MTTF_{D\ of\ each\ channel\ =\ Low}$ (3 years ≤ $MTTF_D$ < 10 years)

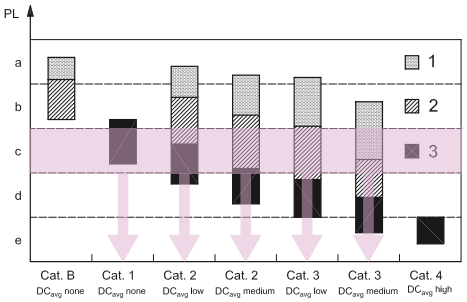
2 = $MTTF_D$ of each channel = Medium (10 years ≤ $MTTF_D$ < 30 years)

3 = $MTTF_D$ of each channel = High (30 years ≤ $MTTF_D$ ≤ 100 years)

This figure is very useful, as it can be read from multiple points of view. For a given PLr, it shows all possible solutions with which this PL can be achieved, i.e., the possible circuit structures that provide the same PL.

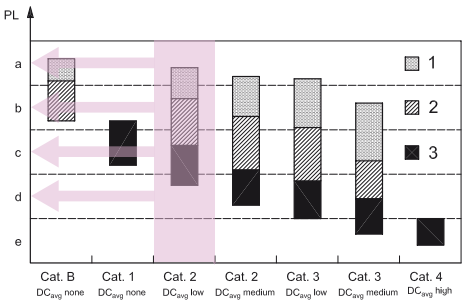
Considering the figure more closely, it is seen that the following possibilities exist for a system with PL equal to "c":

1. Category 3 system with less reliable components ($MTTF_D$=low) and medium DC.
2. Category 3 system with reliable components ($MTTF_D$=medium) and low DC.
3. Category 2 system with reliable components ($MTTF_D$=medium) and medium DC.
4. Category 2 system with reliable components ($MTTF_D$=medium) and low DC.
5. Category 1 system with very reliable components ($MTTF_D$=high).



Considering a given circuit structure, in this figure one can also identify the maximum PL that can be reached depending on the average diagnostic coverage and the $MTTF_D$ of the components.
Thus, the manufacturer can exclude a number of circuit structures in advance, as they do not meet the required PL_r.

However, the figure is not usually used to determine the PL of the system since the graphic areas overlap the boundaries of the different PL levels in many cases. Instead, the table in Annex K of standard EN ISO 13849-1 is used to precisely determine the PL of the circuit.



Notes

Table of safety parameters

The B_{10D} data in the table refers to the mechanical life of the device contacts under normal ambient conditions. The NO contacts may only be used in the safety circuits in combination with an NC contact and must be monitored (e.g. using a module or a safety PLC). The value of B_{10D} for NC and NO contacts refers to a maximum electrical load of 10% of the current value specified in the utilisation category. Mission time (for all articles listed below): 20 years.

Electromechanical control devices

Series	Article description	B_{10D} (NO)	B_{10D} (NC)	B_{10}/B_{10D}
F• ••••	Position switches	1,000,000	40,000,000	50%
F• ••93 F• ••92	Safety switches with separate actuator	1,000,000	2,000,000	50%
F• ••99 F• ••R2	Safety switches with separate actuator with lock	1,000,000	1,000,000	50%
FG	Safety switches with separate actuator with solenoid interlock	1,000,000	5,000,000	20%
FS	Safety switches with separate actuator with solenoid interlock	1,000,000	4,000,000	20%
F• ••96 F• ••95	Safety switch with hinge pin	1,000,000	5,000,000	20%
F• ••C•	Switches with slotted hole lever for hinged guards	1,000,000	2,000,000	50%
F• ••••	Rope switches for emergency stop	1,000,000	2,000,000	50%
HP - HX B•22-•••	Safety hinges	1,000,000	5,000,000	20%
SR	Magnetic safety sensors (with compatible Pizzato Elettrica safety modules)	20,000,000	20,000,000	50%
SR	Magnetic safety sensors (with max load: DC12 24V 250mA)	400,000	400,000	100%
PX, PA	Foot switches	1,000,000	20,000,000	50%
MK	Micro position switches	1,000,000	20,000,000	50%
NA, NB, NF	Modular pre-wired position switches	1,000,000	40,000,000	50%
E2 C•••••••	Contact blocks	1,000,000	40,000,000	50%

Series	Article description	B_{10D} (NC)	B_{10}/B_{10D}
E2 •PU1••••••, E2 •PL1••••••	Single buttons, maintained	2,000,000	50%
E2 •PU2••••••, E2 •PL2••••••	Single buttons, spring-return	30,000,000	50%
E2 •PD••••••, E2 •PT••••••	Double and triple buttons	2,000,000	50%
E2 •PE••••••	Emergency buttons	600,000	50%
E2 •SE••••••, E2 •SL••••••	Selector switches with and without illumination	2,000,000	50%
E2 •SC••••••	Key selector switches	600,000	50%
E2 •PQ••••••	Quadruple buttons	2,000,000	50%
E2 •MA••••••	Joystick	2,000,000	50%

ATEX series	Article description	B_{10D} (NO)	B_{10D} (NC)	B_{10}/B_{10D}
F• ••••-EX•	Position switches	500,000	20,000,000	50%
F• ••93-EX• F• ••92-EX•	Safety switches with separate actuator	500,000	1,000,000	50%
F• ••99-EX• F• ••R2-EX•	Safety switches with separate actuator with lock	500,000	500,000	50%
F• ••96-EX• F• ••95-EX•	Safety switch with hinge pin	500,000	2,500,000	20%
F• ••C•-EX•	Switches with slotted hole lever for hinged guards	500,000	1,000,000	50%
F• ••••-EX•	Rope switches for emergency stop	500,000	1,000,000	50%

Electronic devices

Code	Article description	$MTTF_D$	DC	PFH_D	SIL CL	PL	Cat
HX BEE1-•••	Safety hinge with electronic unit	2413	H	1.24E-09	3	e	4
ST	Safety sensors with RFID technology	4077	H	1.20E-11	3	e	4
NG	RFID safety switches with lock	1883	H	8.07E-10	3	e	4
NS	RFID safety switch with lock	1671	H	1.24E-09	3	e	4
CS AM-01	Safety module for standstill monitoring	218	M	8.70E-09	2	d	3
CS AR-01, CS AR-02	Safety module for monitoring guards and emergency stops	227	H	1.18E-10	3	e	4
CS AR-04	Safety module for monitoring guards and emergency stops	152	H	1.84E-10	3	e	4
CS AR-05, CS AR-06	Safety module for monitoring guards, emergency stops and light barriers	152	H	1.84E-10	3	e	4
CS AR-07	Safety module for monitoring guards and emergency stops	111	H	7.56E-10	3	e	4
CS AR-08	Safety module for monitoring guards, emergency stops and light barriers	1547	H	9.73E-11	3	e	4
CS AR-20, CS AR-21	Safety module for monitoring guards and emergency stops	225	H	4.18E-10	3	e	3
CS AR-22, CS AR-23	Safety module for monitoring guards and emergency stops	151	H	5.28E-10	3	e	3
CS AR-24, CS AR-25	Safety module for monitoring guards and emergency stops	113	H	6.62E-10	3	e	3
CS AR-40, CS AR-41	Safety module for monitoring guards and emergency stops	225	H	4.18E-10	2	d	2
CS AR-46	Safety module for monitoring guards and emergency stops	435	-	3.32E-08	1	c	1
CS AR-51	Safety module for monitoring safety mats and safety bumpers	212	H	3.65E-09	3	e	4

B_{10D}: Number of operations after which 10% of the components have failed dangerously
B_{10}: Number of operations after which 10% of the components have failed
B_{10}/B_{10D}: ratio of total failures to dangerous failures.
$MTTF_D$: Mean Time To Dangerous Failure
DC: Diagnostic Coverage
PFH_D: Probability of Dangerous Failure per hour

SIL CL: Safety Integrity Level Claim Limit. Maximum achievable SIL according to EN 62061
PL : Performance Level. PL acc. to EN ISO 13849-1

Electronic devices

Code	Article description	$MTTF_D$	DC	PFH_D	SIL CL	PL	Cat
CS AR-90	Safety module for monitoring floor leveling in lifts	382	H	5.03E-10	3	e	4
CS AR-91	Safety module for monitoring floor leveling in lifts	227	H	1.18E-10	3	e	4
CS AR-93	Safety module for monitoring floor leveling in lifts	227	H	1.34E-10	3	e	4
CS AR-94	Safety module for monitoring floor leveling in lifts	213	H	5.62E-09	3	e	4
CS AR-94•U12	Safety module for monitoring floor leveling in lifts	227	H	1.13E-10	3	e	4
CS AR-95	Safety module for monitoring floor leveling in lifts	213	H	5.42E-09	3	e	4
CS AT-0•, CS AT-1•	Safety module with timer for monitoring guards and emergency stops	88	H	1.23E-08	3	e	4
CS AT-3•	Safety module with timer for monitoring guards and emergency stops	135	H	1.95E-09	3	e	4
CS DM-01	Safety module for monitoring two-hand controls	142	H	2.99E-08	3	e	4
CS DM-02	Safety module for monitoring two-hand controls	206	H	2.98E-08	3	e	4
CS DM-20	Safety module for monitoring two-hand controls	42	-	1.32E-06	1	c	1
CS FS-1•	Safety timer module	404	H	5.06E-10	3	e	4
CS FS-2•, CS FS-3•	Safety timer module	205	H	1.10E-08	2	d	3
CS FS-5•	Safety timer module	379	M	1.31E-09	2	d	3
CS ME-01	Contact expansion module	91	H	5.26E-10	①	①	①
CS ME-02	Contact expansion module	114	H	4.17E-10	①	①	①
CS ME-03	Contact expansion module	152	H	3.09E-10	①	①	①
CS ME-20	Contact expansion module	114	H	6.14E-10	①	①	①
CS ME-3•	Contact expansion module	110	H	4.07E-09	①	①	①
CS M•201	Multifunction safety modules	135	H	1.44E-09	3	e	4
CS M•202	Multifunction safety modules	614	H	1.32E-09	3	e	4
CS M•203	Multifunction safety modules	103	H	1.61E-09	3	e	4
CS M•204	Multifunction safety modules	134	H	1.52E-09	3	e	4
CS M•205	Multifunction safety modules	373	H	2.19E-09	3	e	4
CS M•206	Multifunction safety modules	3314	H	1.09E-09	3	e	4
CS M•207	Multifunction safety modules	431	H	7.08E-09	3	e	4
CS M•208	Multifunction safety modules	633	H	7.02E-09	3	e	4
CS M•301	Multifunction safety modules	128	H	1.88E-09	3	e	4
CS M•302	Multifunction safety modules	535	H	1.57E-09	3	e	4
CS M•303	Multifunction safety modules	485	H	1.76E-09	3	e	4
CS M•304	Multifunction safety modules	98	H	2.05E-09	3	e	4
CS M•305	Multifunction safety modules	535	H	1.57E-09	3	e	4
CS M•306	Multifunction safety modules	100	H	1.86E-09	3	e	4
CS M•307	Multifunction safety modules	289	H	8.38E-09	3	e	4
CS M•308	Multifunction safety modules	548	H	7.27E-09	3	e	4
CS M•309	Multifunction safety modules	496	H	7.46E-09	3	e	4
CS M•401	Multifunction safety modules	434	H	1.73E-09	3	e	4
CS M•402	Multifunction safety modules	478	H	7.24E-09	3	e	4
CS M•403	Multifunction safety modules	438	H	7.42E-09	3	e	4

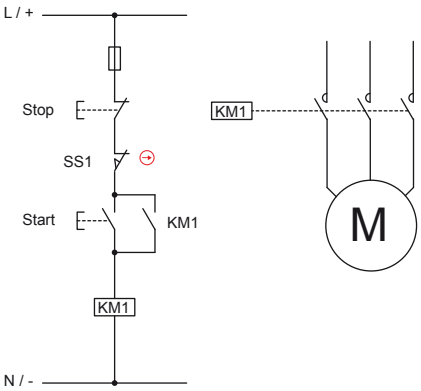
B_{10D}: Number of operations after which 10% of the components have failed dangerously
B_{10}: Number of operations after which 10% of the components have failed
B_{10}/B_{10D}: ratio of total failures to dangerous failures.
$MTTF_D$: Mean Time To Dangerous Failure
DC: Diagnostic Coverage
PFH_D: Probability of Dangerous Failure per hour

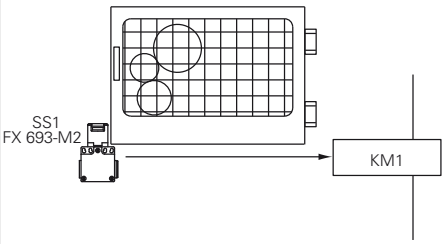
SIL CL: Safety Integrity Level Claim Limit. Maximum achievable SIL according to EN 62061
PL : Performance Level. PL acc. to EN ISO 13849-1

① Dependent on the base module

EXAMPLE 1
Application: Guard monitoring

Reference standard EN ISO 13849-1	
Safety category	**1**
Performance Level	**PL c**





Description of the safety function
The control circuit illustrated above has a guard monitoring function. If the guard is open the engine must not be able to start. The hazard analysis showed that the system has no inertia or rather that the engine, once the power has been switched off, stops at a much faster rate than the opening of the guard. The risk analysis has shown that the required PL_r target is PL c. This is necessary to verify if the intended control circuit with single channel structure is provided with a PL higher or equal to PL_r.
The guard position is detected by the switch with separate actuator SS1, which operates directly on the contactor KM1. The contactor KM1 monitoring the moving parts is usually activated by the Start and Stop buttons. Though, the analysis of the working cycle has shown that the guard is opening at every switching operation too. Therefore, the number of switch operations by the contactor and by the safety switch can be considered equal.
A circuit structure is defined as single-channel without supervision (category B or 1) if there are only an Input component (switch) and an Output (contactor) component.
In case a failure on one of the two devices the safety function is not guaranteed anymore.
No measures for fault detection have been applied.

Device data:
- SS1 (FX 693-M2) is a switch with positive opening (in accordance with EN 60947-5-1, Annex K). The switch is a well-tried component according to EN ISO 13849-2 table D.4. The B_{10D} value of the device supplied by the manufacturer is equal to 2,000,000 switching operations.
- KM1 is a contactor operated at nominal load and is a well-tried component in compliance with EN ISO 13849-2, table D.4. The B_{10D} value of this component is equal to 1,300,000 switching operations. This value results from the tables of the applicable standard (see EN ISO 13849-1, table C.1).

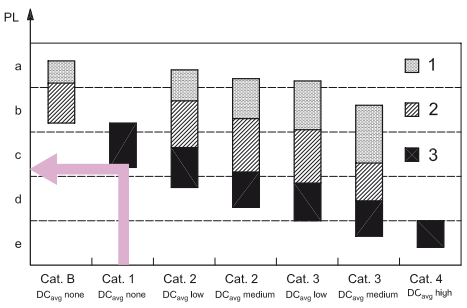
Assumption of the frequency of use
- It is assumed that the equipment is used for a maximum of 365 days per year, for three shifts of 8 hours and 600 s cycle time. For the switch, the number of switching operations per year is equal to maximum N_{op}=(365x24x3,600)/600=52,560.
- It is assumed that the start button is operated every 300 seconds. Therefore, the maximum number of switching operations per year is equal to n_{op}/year=105,120
- The contactor KM1 is actuated both for the normal start-stop of the machine as well as for the restart after a guard opening. n_{op}/year=52,560+105,120 = 157,680

$MTTF_D$ calculation
The$MTTF_D$ of the SS1 switch is equal to: $MTTF_D = B_{10D}/(0,1 \times n_{op})$ = 2,000,000/(0,1 x 52560) = 381 years
The$MTTF_D$ of the KM1 contactor is equal to: $MTTF_D = B_{10D}/(0.1 \times n_{op})$ = 1,300,000/(0.1 x 157680) = 82 years
Therefore, the $MTTF_D$ of the single-channel circuit is equal to: 1/(1/381+1/82) = 67 years

Diagnostic Coverage DC_{avg}
No measures for fault detection have been applied and there is therefore no diagnostic coverage, a permissible condition for the circuit in question that is in category 1.

CCF Common Cause Failures
The CCF calculation is not required for category 1 circuits.

PL determination
Using the graph or the figure no. 5 it can be verified that for a Category 1 circuit with $MTTF_D$=95 years the resulting PL of the control circuit is PL c. The PL_r target is therefore achieved.



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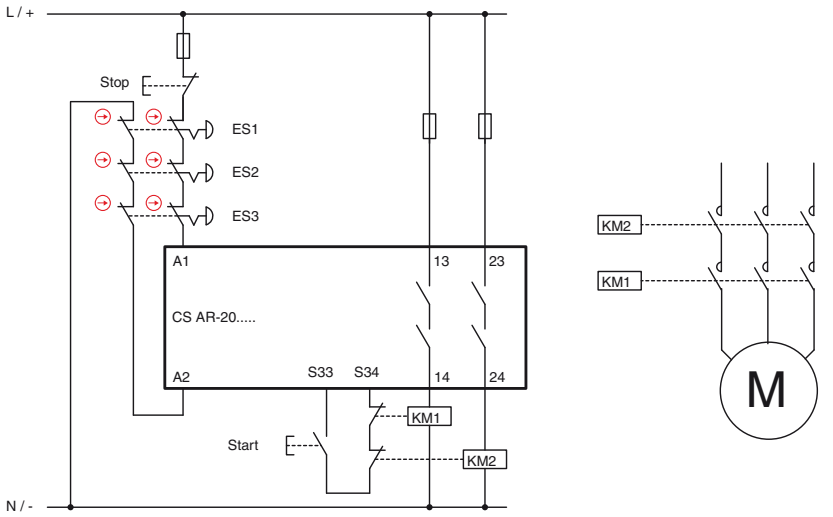
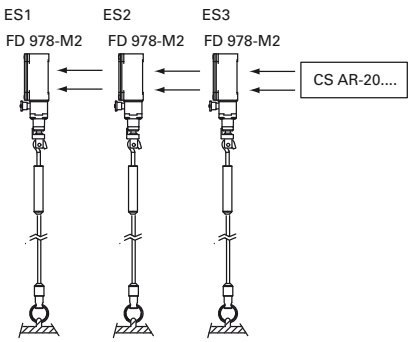
EXAMPLE 2
Application: Emergency stop control

Reference standard EN ISO 13849-1	
Safety category	**3**
Performance Level	**PL e**





Description of the safety function
The operation of one of the emergency devices causes the intervention of the safety module and the two contactors KM1 and KM2. The signal of the devices ES1, ES2, ES3 is redundantly read by the CS safety module. The contactors KM1 and KM2 (with forcibly guided contacts) are monitored by the CS via the feedback circuit too.

Device data:
- The devices ES1, ES2, ES3 (FD 978-M2) are rope switches for emergency stop with positive opening. The B_{10D} value is equal to 2,000,000 (see page 271)
- KM1 and KM2 are contactors operated at nominal load. The B_{10D} value is 1,300,000 (see EN ISO 13849-1 - Table C.1)
- CS is a safety module (CS AR-20) with $MTTF_D$=225 years and DC= High
- The circuit structure is two-channel in category 3

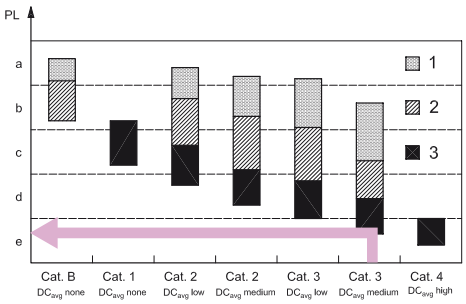
Assumption of the frequency of use
- Twice a month, n_{op}/year = 24
- Start button actuation: 4 times a day
- Assuming 365 working days, the contactors will take action 4 x 365 + 24 = 1484 times / year
- The switches will be operated with the same frequency.
- It is not expected that multiple buttons will be pressed simultaneously.

$MTTF_D$ calculation
- $MTTF_{D\ ES1,ES2,ES3}$ = 833,333 years
- $MTTF_{D\ KM1,KM2}$ = 8760 years
- $MTTF_{D\ CS}$ = 225 years
- $MTTF_{D\ CH1}$ =219 years. The value must be limited to 100 years. The channels are symmetric, therefore $MTTF_d$=100 years (High)

Diagnostic Coverage DC_{avg}
- The contacts of KM1 and KM2 are monitored by the CS module via the feedback circuit. DC=99% (High)
- The safety module CS AR-20 is provided with a "High" diagnostic coverage.
- Not all failures in the series of emergency devices can be detected. The diagnostic coverage is 90% (Medium)

CCF Common Cause Failures
We assume a score > 65 (acc. to EN ISO 13849-1 - Annex F).

PL determination
A circuit in category 3 with $MTTF_D$=High and DC_{avg}= High can reach a PL e.



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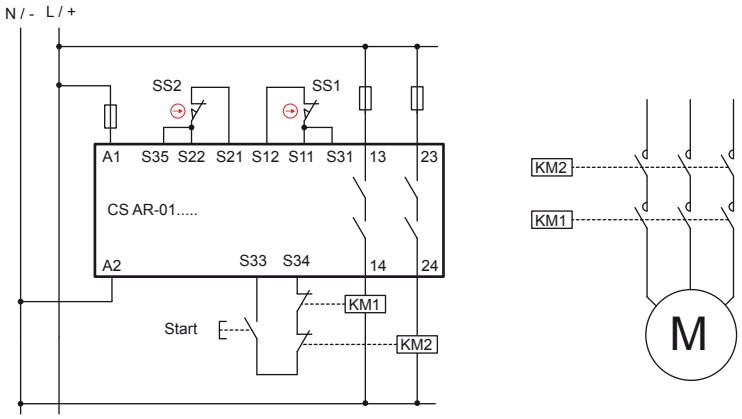
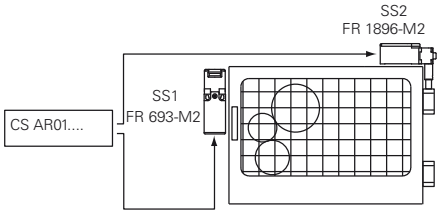
EXAMPLE 3
Application: Guard monitoring

Reference standard EN ISO 13849-1	
Safety category	**4**
Performance Level	**PL e**





Description of the safety function
The guard opening causes the intervention of the switches SS1 and SS2 and, by consequence, of the safety module and the KM1 and KM2 contactors too
The signal of the devices SS1, SS2 is redundantly monitored by the CS safety module.
The switches have different operating principles.
The contactors KM1 and KM2 (with forcibly guided contacts) are monitored by the CS via the feedback circuit too.

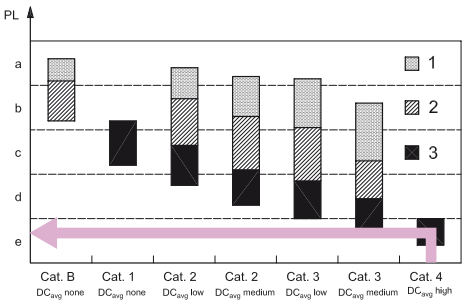
Device data:
- The switch SS1 (FR 693-M2) is a switch with positive opening. The B_{10D} value is 2,000,000
- The switch SS2 (FR 1896-M2) is a hinge switch with positive opening. B_{10D}= 5,000,000
- KM1 and KM2 are contactors operated at nominal load. B_{10D} = 1,300,000 (see EN ISO 13849-1 - Table C.1)
- The CS modules are safety modules (CS AR-01) with $MTTF_d$=227 years and DC= High

Assumption of the frequency of use
365 days/year, 16 h/day, 1 action every 4 minutes (240 s). n_{op}/year = 87,600.

$MTTF_D$ calculation
- $MTTF_{D\ SS1}$ = 228 years
- $MTTF_{D\ SS2}$ = 571 years
- $MTTF_{D\ KM1,KM2}$ = 148 years
- $MTTF_{D\ CS}$= 227 years
- $MTTF_{D\ CH1}$ = 64 years (SS1,CS,KM1)
- $MTTF_{D\ CH2}$ = 77 years (SS2,CS,KM2)
- $MTTF_D$: by calculating the average of the two channels $MTTF_D$ = 70.7 years (High) is achieved

Diagnostic Coverage DC_{avg}
- SS1, SS2 have DC = 99% since the SS1 and SS2 contacts are monitored by CS and have different operation principles.
- The contacts of KM1 and KM2 are monitored by the CS module via the feedback circuit. DC=99% (High)
- CS AR-01 is provided with an internal redundant and self-monitoring circuit. DC = High
- DC_{avg}= High

PL determination
A circuit in category 4 with $MTTF_D$=72.1 years and DC_{avg}=High corresponds to PL e.



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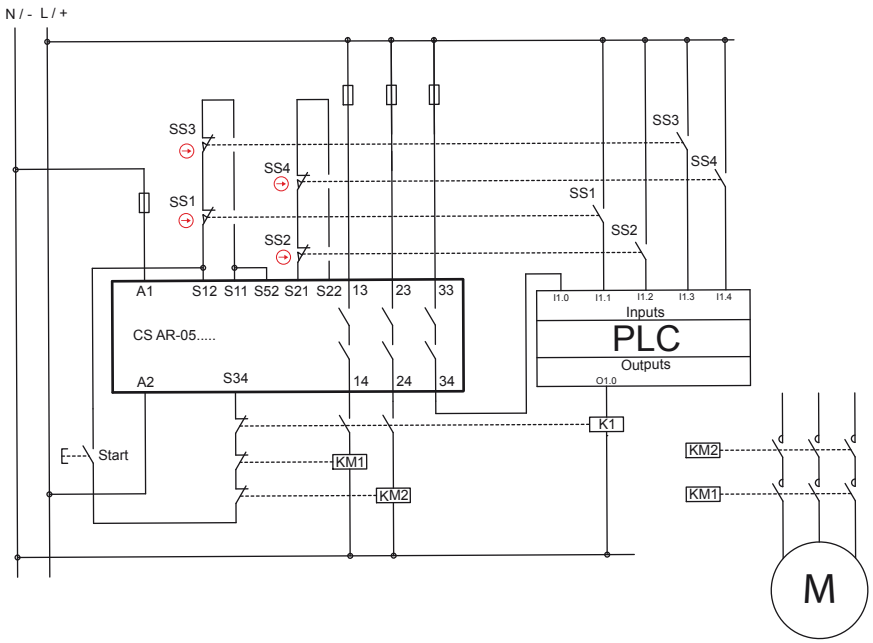
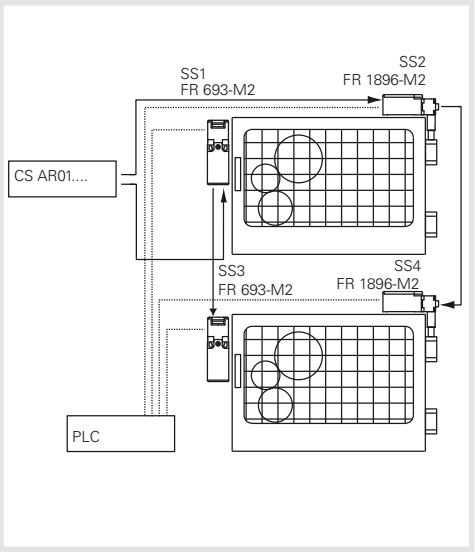
EXAMPLE 4
Application: Guard monitoring

Reference standard EN ISO 13849-1	
Safety category	**4**
Performance Level	**PL e**





Description of the safety function
The opening of a guard triggers the switches SS1 and SS2 on the first guard as well as SS3 and SS4 on the second. The switches trigger the safety module and the contactors KM1 and KM2 too.
The signal of the devices SS1, SS2 and SS3, SS4 is redundantly monitored by the CS safety module. Furthermore, an auxiliary contact of the switch is monitored by the PLC.
The switches have different operating principles.
The contactors KM1 and KM2 (with forcibly guided contacts) are monitored by the CS via the feedback circuit too.

Device data:
- The switches SS1, SS3 (FR 693-M2) are switches with positive opening. The B_{10D} value is 2,000,000
- The switches SS2, SS4 (FR 1896-M2) are hinge switches with positive opening. B_{10D}= 5,000,000
- KM1 and KM2 are contactors operated at nominal load. The B_{10D} value is 1,300,000 (see EN ISO 13849-1 - Table C.1)
- CS is a safety module (CS AR-05) with $MTTF_D$=152 years and DC= High

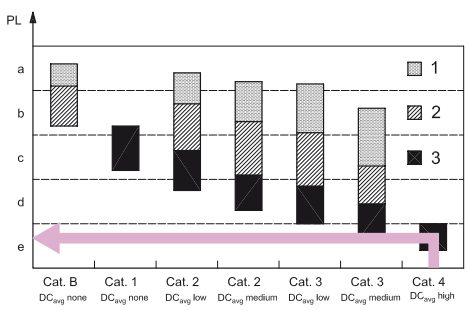
Assumption of the frequency of use
- 4 times per hour for 24 h/day for 365 days/year equal to n_{op}/year = 35,040
- The contactors will operate for twice the number of operations = 70,080

$MTTF_D$ calculation
- $MTTF_{D\ SS1,SS3}$ = 571 years; $MTTF_{D\ SS2,SS4}$ = 1,427 years
- $MTTF_{D\ KM1,KM2}$ = 185 years
- $MTTF_{D\ CS}$ = 152 years
- $MTTF_{D\ Ch1}$ = 73 years (SS1,CS,KM1) / (SS3,CS,KM1)
- $MTTF_{D\ Ch2}$ = 79 years (SS2,CS,KM2) / (SS4,CS,KM2)
- $MTTF_D$: by calculating the average of the two channels $MTTF_D$ = 76 years (High) is achieved

Diagnostic Coverage DC_{avg}
- The contacts of KM1, KM2 are monitored by the CS module via the feedback circuit. DC=99%
- All auxiliary contacts of the switches are monitored by the PLC. DC=99%
- The CS AR-05 module has a DC= High (see page 271)
- The diagnostic coverage for both channels is 99% (High)

CCF Common Cause Failures
- We assume a score > 65 (acc. to EN ISO 13849-1 - Annex F).

PL determination
- A circuit in category 4 with $MTTF_D$=88.6 years and DC_{avg}=High corresponds to PL e.



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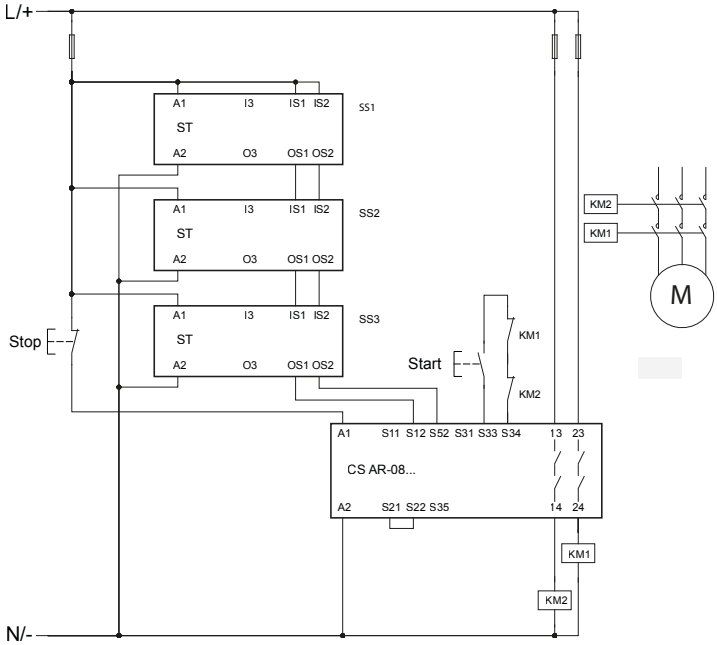
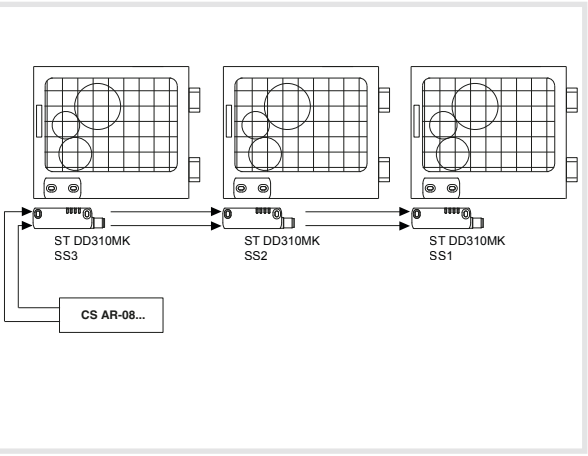
EXAMPLE 5
Application: Guard monitoring

Reference standard EN ISO 13849-1	
Safety category	**4**
Performance Level	**PL e**

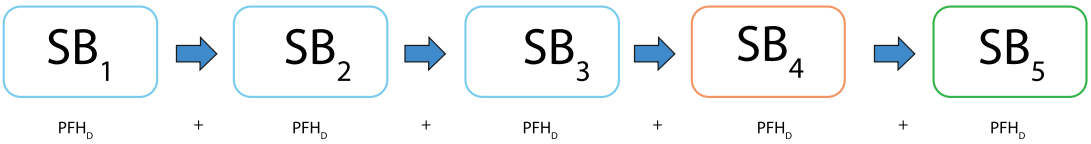




Description of the safety function
The opening of guards triggers the sensors SS1 on the first guard, SS2 on the second and SS3 on the third. The sensors trigger the safety module CS AR-08 and the contactors KM1 and KM2 too. The contactors KM1 and KM2 (with forcibly guided contacts) are monitored by the CS AR-08 via the feedback circuit.

Device data
SS1, SS2, SS3 are ST series coded sensors with RFID technology. PFH_D = 1.20E-11, PL ="e"
CS AR-08 is a safety module. PFH_D = 9.73E-11, PL = "e"
KM1 and KM2 are contactors operated at nominal load. B_{10D} = 1,300,000 (see EN ISO 13849-1 - Table C.1)

Assumption of the frequency of use
Each door is opened every 2 minutes, 16 hours a day, for 365 days a year, equal to nop = 175,200
Definition of the SRP/CS and subsystems
The SRP/CS consists of 5 subsystems (SB):
SB1,2,3 represent the three ST series RFID sensors
SB4 represents the safety module CS AR-08...
SB5 represents the two contactors KM1 and KM2 in redundant architecture (cat. 4)



PFH_D calculation for SB5
$MTTF_D$ KM1,KM2 = 74.2 years.
DC = 99%, the contacts of KM1 and KM2 are monitored by the CS safety module via the feedback circuit.
For the CCF parameter we assume a score higher than 65 (acc. to EN ISO 13849-1 - Annex F).
A category 4 circuit with $MTTF_D$ = 74.2 years (high) and high diagnostic coverage (DC = 99%) corresponds to a failure probability of PFH_D = 3.4E-08 and a PL "e".

Calculation of the total PFH_D of the SRP/CS
$PFH_{DTOT} = PFH_{DSB1} + PFH_{DSB2} + PFH_{DSB3} + PFH_{DSB4} + PFH_{DSB5}$ = 3.5E-08
It corresponds to PL "e".

Calculation example performed with SISTEMA software, downloadable free of charge at www.pizzato.com

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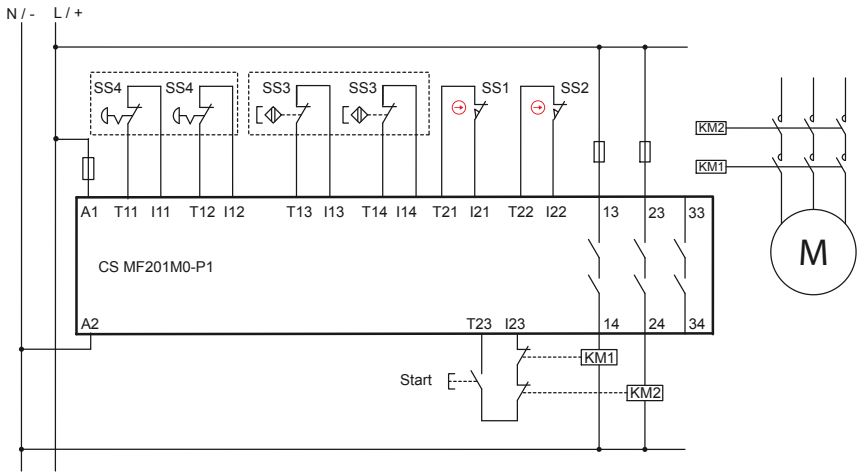
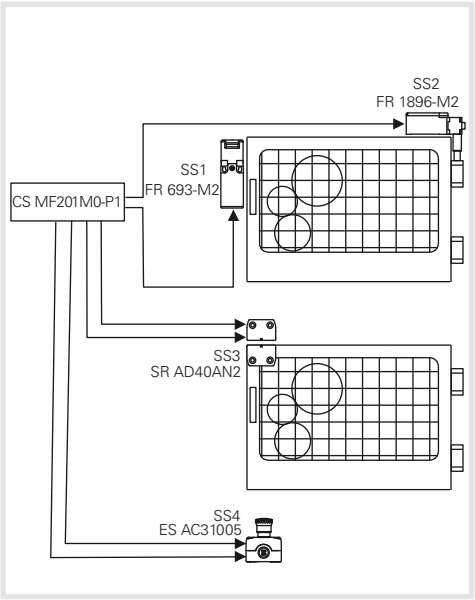
EXAMPLE 6
Application: Guard monitoring

Reference standard EN ISO 13849-1	
Safety category	4
Performance Level	PL e





Description of the safety function

The opening of a guard triggers switches SS1 and SS2 on the first guard and triggers sensor SS3 on the second; the switches trigger the safety module and both contactors KM1 and KM2.
The signals from the SS1, SS2 and SS3 devices are redundantly monitored by the CS MF safety module.
There is also an emergency button which has a two-channel connection with the safety module too.
The contactors KM1 and KM2 (with forcibly guided contacts) are monitored by the CS MF via the feedback circuit too.

Device data:

- The switch SS1 (FR 693-M2) is a switch with positive opening. B_{10D} = 2,000,000
- The switch SS3 (FR 1896-M2) is a hinge switch with positive opening. B_{10D}= 5,000,000
- SS3 (SR AD40AN2) is a magnetic safety sensor. B_{10D} = 20,000,000
- SS4 (ES AC31005) is a housing with emergency button (E2 1PERZ4531) provided with 2 NC contacts. B_{10D}= 600,000
- KM1 and KM2 are contactors operated at nominal load. B_{10D} = 1,300,000 (see EN ISO 13849-1 - Table C.1)
- CS MF201M0-P1 is a safety module with $MTTF_D$=842 years and DC=99%

Assumption of the frequency of use

- Each door is opened 2 times per hour for 16 h/day for 365 days/year equal to n_{op}/year = 11,680
- It is assumed that the emergency button is actuated at a maximum of once a day, n_{op}/year = 365
- The contactors will operate for twice the number of operations = 23,725

$MTTF_D$ calculation

Guard SS1/SS2

- $MTTF_{D\ SS1,SS3}$ = 1,712 years
- $MTTF_{D\ SS2,SS4}$ = 4,281 years
- $MTTF_{D\ KM1,KM2}$ = 548 years
- $MTTF_{D\ CS}$ = 842 years
- $MTTF_{D\ CH1}$ = 278 years (SS1,CS,KM1)
- $MTTF_{D\ CH2}$ = 308 years (SS2,CS,KM2)
- $MTTF_D$ = by calculating the average of the two channels $MTTF_D$ = 293 years is achieved

Guard SS3

- $MTTF_{D\ SS3}$ = 17,123 years
- $MTTF_{D\ KM1,KM2}$ = 548 years
- $MTTF_{D\ CS}$ = 842 years
- $MTTF_D$ = 325 years

Emergency button SS4

- $MTTF_{D\ SS4}$ = 16,438 years
- $MTTF_{D\ KM1,KM2}$ = 548 years
- $MTTF_{D\ CS}$ = 842 years
- $MTTF_D$ = 325 years

Diagnostic Coverage DC_{avg}

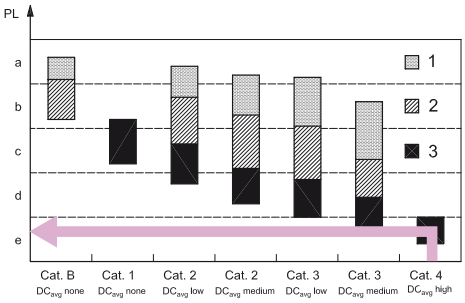
- The contacts of KM1, KM2 are monitored by the CS MF module via the feedback circuit. DC=99%
- For the devices SS1, SS2 and SS3 it is possible to detect all faults. DC=99%
- The CS MF201M0-P1 module has a DC=99%
- We assume a diagnostic coverage of 99% (High)

CCF Common Cause Failures

- We assume a score > 65 (acc. to EN ISO 13849-1 - Annex F).

PL determination

- A circuit in category 4 with $MTTF_D$=High and DC_{avg}= High corresponds to PL e.
- The safety functions associated to the guards SS1/SS2, SS3 and the emergency button present the level PL e.



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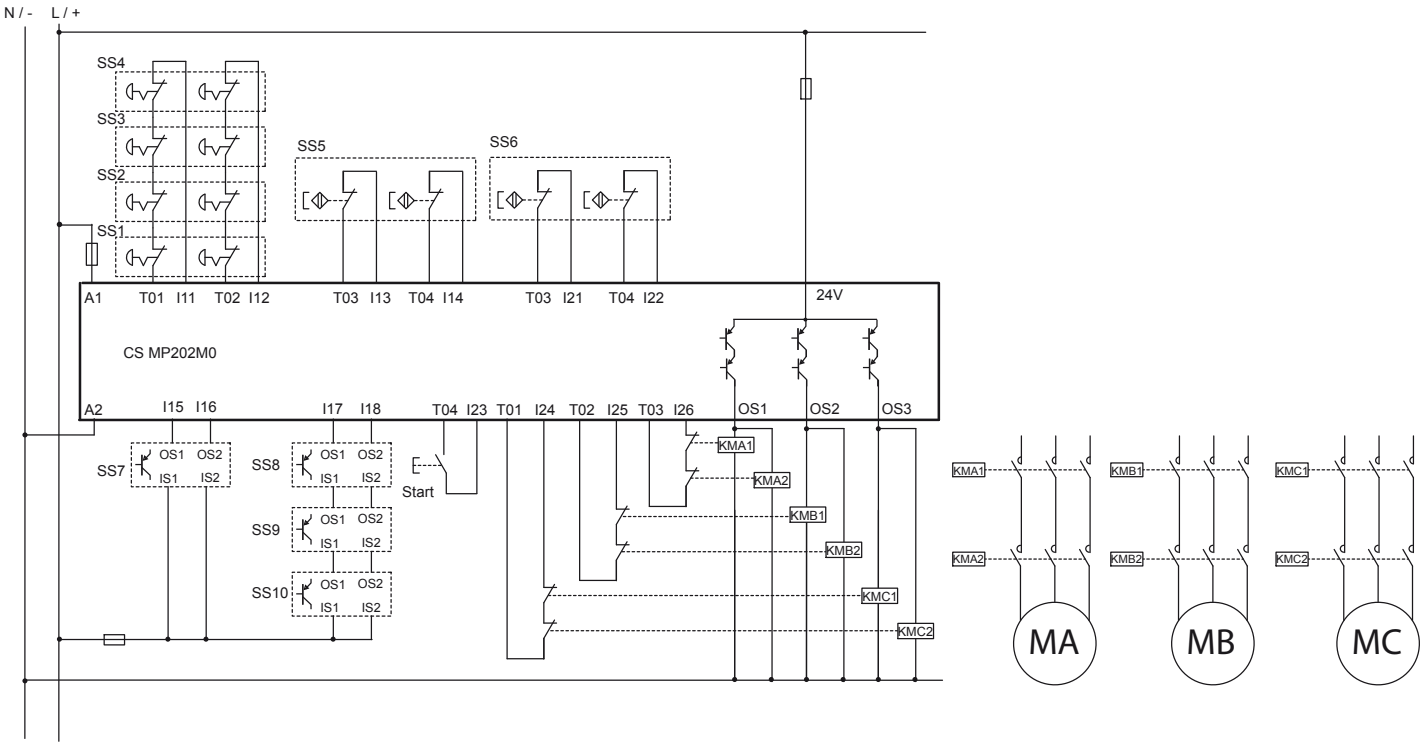
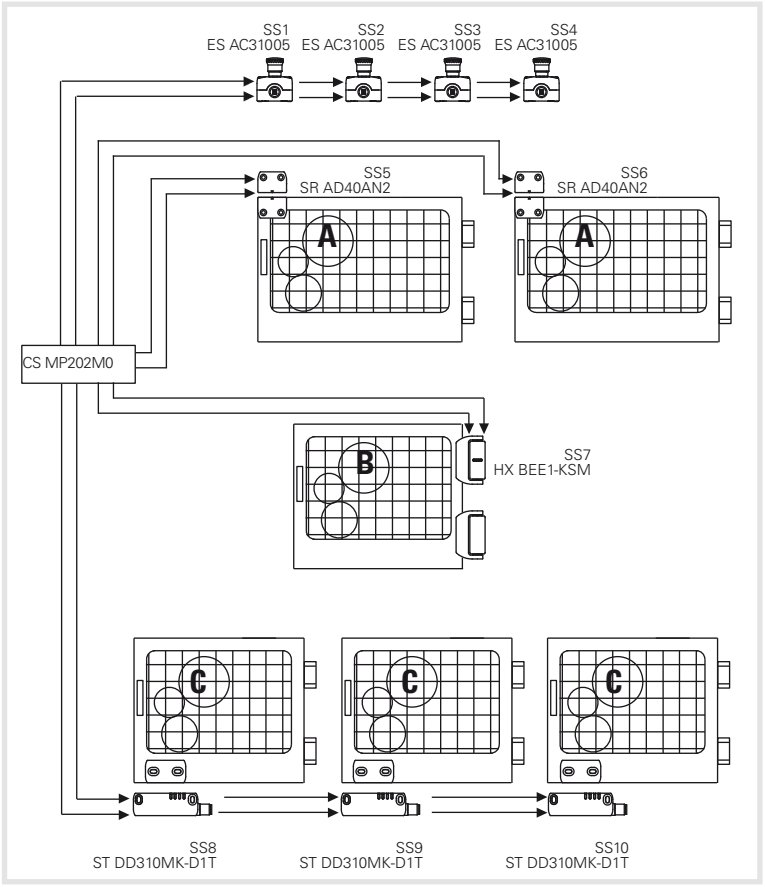
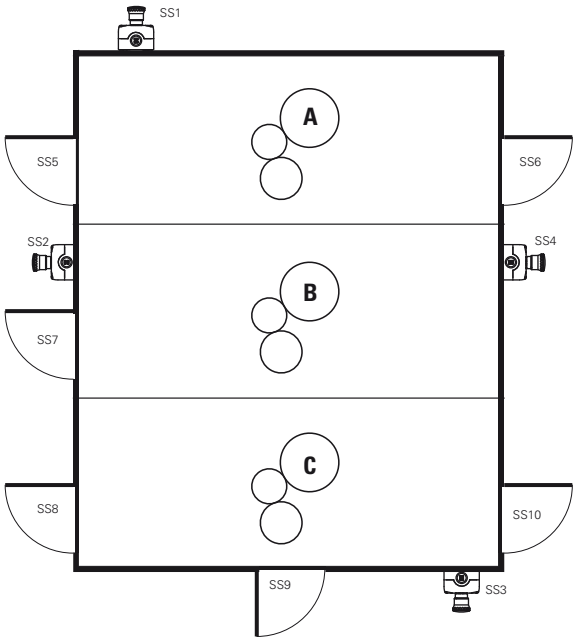
EXAMPLE 7
Application: Guard monitoring

Reference standard EN ISO 13849-1	
Safety category	**4**
Performance Level	**PL e**







Description of the safety function

Every machine is divided into 3 different zones. The access to each zone is monitored by the guards and 4 emergency buttons are present too.
The operation of an emergency button will trigger the CS MP safety module as well as the forcibly guided contactors KMA1/2, KMB1/2 and KMC1/2, and will therefore stop all motors.
The opening of a guard in zone A triggers the devices SS5 or SS6 and, as a consequence, the CS MP safety module as well as the contactors KMA1 and KMA2, and therefore also the stop of the MA motor. The devices SS5 and SS6 are connected to the CS MP safety module separately, with a two-channel connection.
The opening of the guard in zone B triggers the device SS7 and, as a consequence, the CS MP safety module as well as the contactors KMB1 and KMB2, and therefore also the stop of the MB motor. The SS7 hinge is provided with two OSSD outputs and is redundantly controlled by the CS MP safety module.
The opening of a guard in zone C triggers the devices SS8, SS9 or SS10 and, as a consequence, the safety module as well as the contactors KMC1 and KMC2, and therefore also the stop of the MC motor. The sensors SS8, SS9 and SS10 are interconnected via the OSSD outputs and are redundantly monitored by the CS MP safety module.

Device data

- SS1, SS2, SS3 and SS4 (ES AC31005) are emergency buttons (E2 1PERZ4531) provided with 2 NC contacts. B_{10D} = 600,000 (see page 333)
- SS5 and SS6 (SR AD40AN2) are magnetic safety sensors. B_{10D} = 20,000,000
- SS7 (HX BEE1-KSM) is a safety hinge with OSSD outputs. $MTTF_D$= 4,077 years / DC=99%
- SS8, SS9 and SS10 (ST DD310MK-D1T) are safety sensors with RFID technology and OSSD outputs. $MTTF_D$= 4,077 years / DC=99% (see page 333)
- KMA, KMB and KMC are contactors operated at nominal load. B_{10D} = 1,300,000 (see EN ISO 13849-1 - Table C.1)
- CS MP202M0 is a safety module with $MTTF_D$=2035 years / DC=99%

Assumption of the frequency of use

- Each door of zone A is opened 2 times per hour for 16 h/day for 365 days/year equal to n_{op}/year = 11,680. The contactors will operate for twice the number of operations = 23,360
- The door of zone B is opened 4 times per hour for 16 h/day for 365 days/year equal to n_{op}/year = 23,360. The contactors will operate for a given number of operations = 23,360
- Each door of zone C is opened 1 times per hour for 16 h/day for 365 days/year equal to n_{op}/year = 5,840. The contactors will operate for a given number of operations = 17,520
- It is assumed that the emergency button is actuated at a maximum of once a week, n_{op}/year = 52
- Fault Exclusion: since it is assumed that the pairs of contactors, connected in parallel to the respective safety outputs, are wired permanently within the switching cabinet, the possibility of short-circuit between +24V and the contactors is excluded (see Table D.4, item D.5.2 of EN ISO 13849-2).

$MTTF_D$ calculation

Emergency buttons

- $MTTF_D$ SS1/SS2/SS3/SS4 = 115,384 years
- $MTTF_D$ CS = 2035 years
- $MTTF_D$ KMC1,KMC2 = 742 years
- $MTTF_D$ e-stop = 541 years

Guards, zone A

- $MTTF_D$ SS5/SS6 = 17,123 years
- $MTTF_D$ CS = 2035 years
- $MTTF_D$ KMA1,KMA2 = 556 years
- $MTTF_D$ A = 425 years (SS5/SS6,CS,KMA)

Guards, zone B

- $MTTF_D$ SS7 = 4,077 years
- $MTTF_D$ CS = 2035 years
- $MTTF_D$ KMB1,KMB2 = 556 years
- $MTTF_D$ B = 394 years (SS7,CS,KMB)

Guards, zone C

- $MTTF_D$ SS8/SS9/SS10 = 4,077 years
- $MTTF_D$ CS = 2035 years
- $MTTF_D$ KMC1,KMC2 = 742 years
- $MTTF_D$ C = 479 years (SS8/SS9/SS10,CS,KMC)

Diagnostic Coverage DC_{avg}

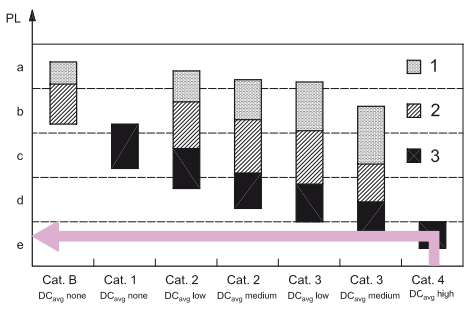
- The contacts of KMA, KMB and KMC are monitored by the CS MP module via the feedback circuit. DC=99%
- All faults in the various devices can be detected. DC=99%
- The CS MP202M0 module has a DC=99%
- The result is a diagnostic coverage of 99% for each function

CCF Common Cause Failures

- We assume a score > 65 for all safety functions (acc. to EN ISO 13849-1 - Annex F).

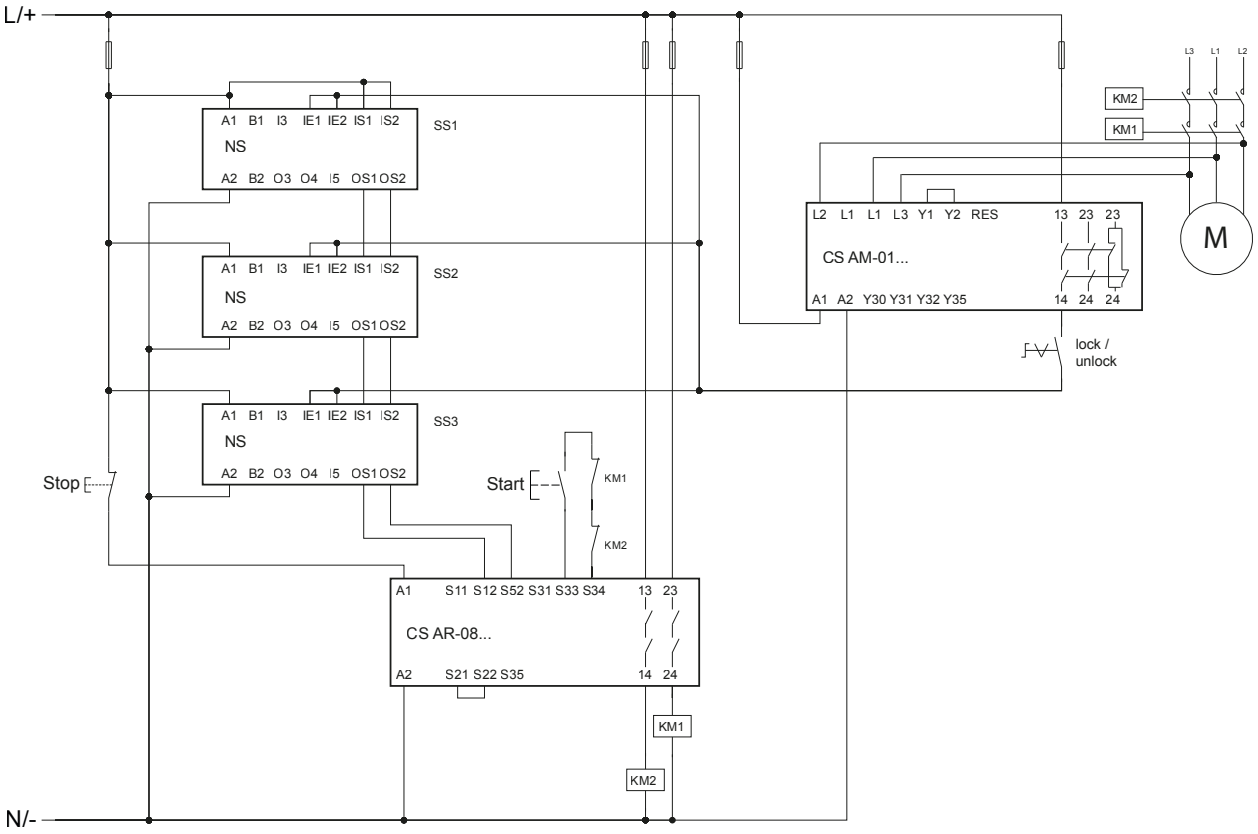
PL determination

- A circuit in category 4 with $MTTF_D$=High and DC_{avg}= High corresponds to PL e.
- All safety functions associated to the guards and the emergency buttons have PL e.

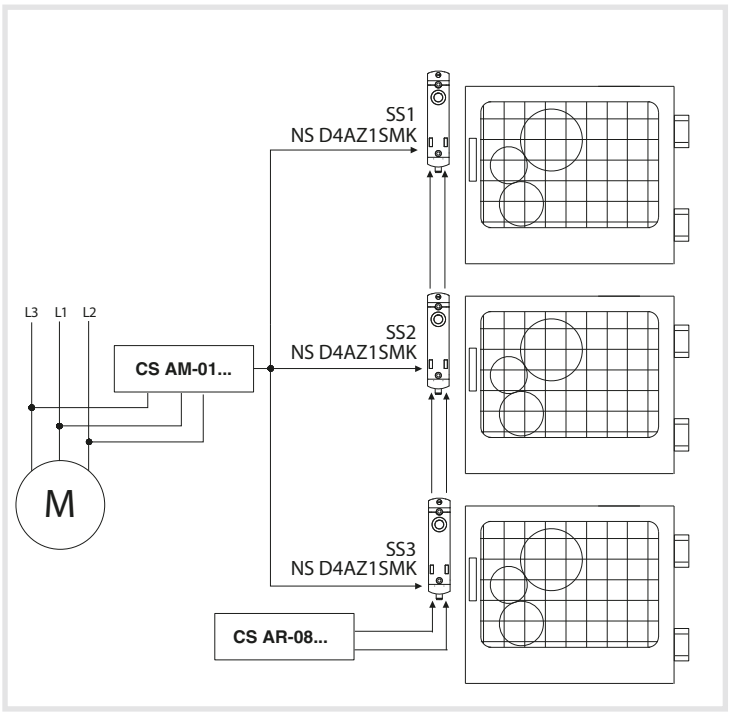


Any information or application example, connection diagrams included, described in this document are to be intended as purely descriptive.
The choice and application of the products in conformity with the standards, in order to avoid damage to persons or goods, is the user's responsibility.

EXAMPLE 8
Application: Guard monitoring



Reference standard EN ISO 13849-1	
Performance Level - Safety function 1	**PL e**
Performance Level - Safety function 2	**PL d**



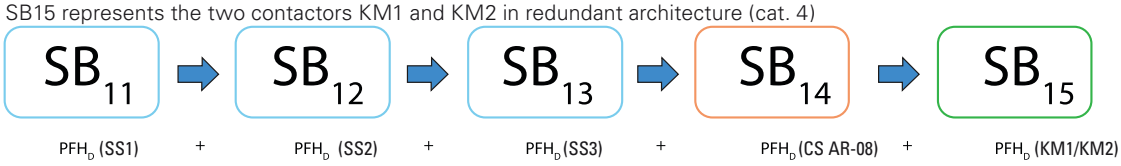
Description of the safety function
Interlocking devices SS1, SS2 and SS3 perform two safety functions: monitoring the locked state and locking the guard.
Once the guards have been released, the three sensors trigger the safety module and the contactors KM1 and KM2 too. The contactors KM1 and KM2 (with forcibly guided contacts) are monitored by the CS AR-08 via the feedback circuit.
The interlock command on the three devices SS1, SS2 and SS3 is maintained until the motor standstill monitoring module

CS AM-01 detects the actual stopping of movement.

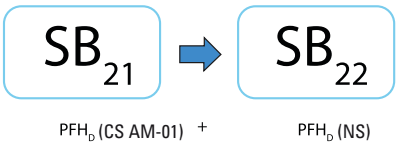
Device data
SS1, SS2, SS3 are NS series coded interlock devices with RFID technology, with guard locking device. Locked protection detection function PFH_D = 1.22E-09 PL = "e", operating of locking control PFH_D = 2.29E-10 PL = "e".
CS AR-08 is a safety module, PFH_D = 9.73 E-11, PL = "e".
CS AM-01 is a safety module for motor standstill monitoring, PFH_D = 8,70E-09, PL "d".
KM1 and KM2 are contactors operated at nominal load. $B10_D$ = 1,300,000 (see EN ISO 13849-1 - Table C.1)

Assumption of the frequency of use
Each door is opened every 10 minutes, 16 hours a day, for 365 days a year, equal to n_{op}/year = 35,040

Definition of the SRP/CS and subsystems
This application example presents two safety functions:
1. Safety-related stop function initiated by a protective measure
2. Maintaining the protection guard interlock with M motor in motion
The safety function 1 is performed by an SRP/CS consisting of 5 subsystems (SB):
- SB11,12,13 represent the three RFID interlock devices of the NS series: SS1, SS2 and SS3
- SB14 represents the safety module CS AR-08
- SB15 represents the two contactors KM1 and KM2 in redundant architecture (cat. 4)



The safety function 2 is performed by 2 subsystems (SB):
- SB21 represents the CS AM-01 safety module for motor standstill monitoring
- SB22 represents the three NS series RFID interlock devices



PFH_D calculation for SB15
$MTTF_D$ KM1,KM2 = 371 years.
DC = 99%, the contacts of KM1 and KM2 are monitored by the CS safety module via the feedback circuit.
For the CCF parameter we assume a score higher than 65 (acc. to EN ISO 13849-1 - Annex F).
A category 4 circuit with $MTTF_D$ = 371 and high diagnostic coverage (DC = 99%) corresponds to a failure probability of PFH_D = 6.3E-09 and a PL "e".

Calculation of the total PFH_D of the SRP/CS safety function 1
$PFH_{DTOT} = PFH_{DSB11} + PFH_{DSB12} + PFH_{DSB13} + PFH_{DSB14} + PFH_{DSB15}$ = 1E-08
It corresponds to PL "e".

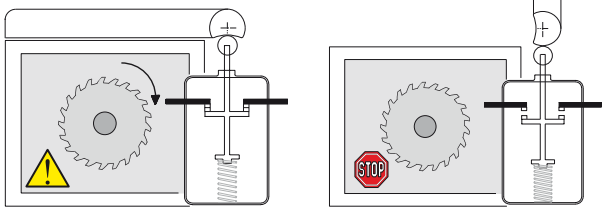
Calculation of the total PFH_D of the SRP/CS safety function 2
$PFH_{DTOT} = PFH_{DSB21} + PFH_{DSB22}$ = 8.9E-09
That would correspond to PL "e". However, considering that the motor standstill monitoring module is characterised by a PL "d", and that the unlock command takes place via a single-channel architecture, the entire SRP/CS is downgraded to this value, therefore PL "d".

Calculation example performed with SISTEMA software, downloadable free of charge at www.pizzato.com

7 - Positive opening, redundancy, diversification and self-monitoring

Positive mode and negative mode.
According to the standard EN ISO 12100, if a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements, these components are said to be connected in the **positive** mode. Instead, if the movement of a mechanical component simply allows another element to move freely, without using direct force (for example by gravity force, spring effect, etc.), that connection is said to be connected in the **negative** mode.

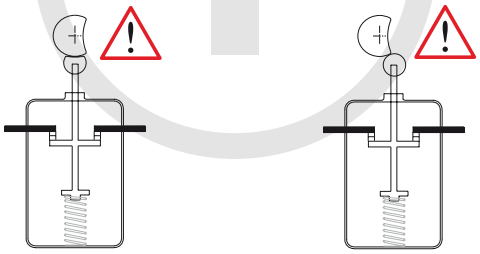
Positive mode



Machine in operation
Gate closed

Machine standstill
Gate open

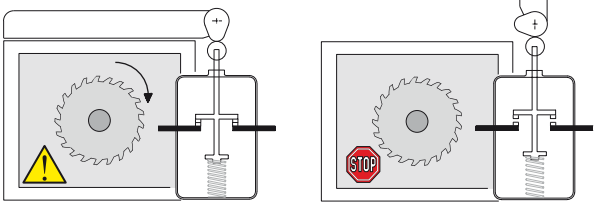
Dangerous failures: The machine continues operation.



Worn-out roller

Misaligned roller

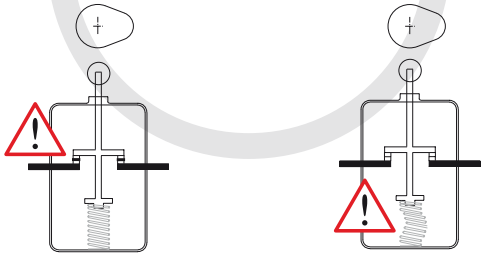
Negative mode



Machine in operation
Gate closed

Machine standstill
Gate open

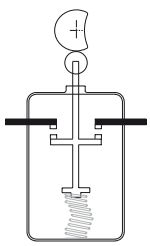
Dangerous failures: The machine continues operation.



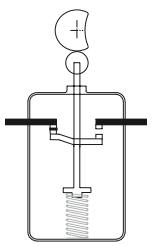
Welded contacts

Damaged spring

With positive mode, preventive maintenance can be performed, thereby avoiding the dangerous failures described above. With negative mode, on the other hand, failures can occur within the switch and are therefore difficult to detect.
In the event of an internal failure (welded contacts or a damaged spring), the contacts will still open in positive mode in spite of the damage and the machine will be stopped.

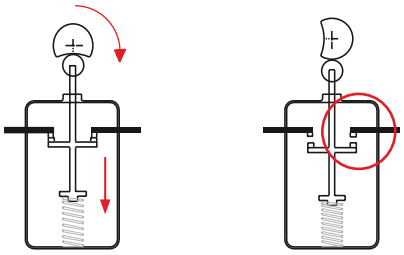


Damaged spring → Machine standstill



Welded contacts → Machine standstill

Use of switches in safety applications
If only one switch is used in a safety application, the switch must be actuated in positive mode. In order to be used for safety applications, the opening contact (normally closed) must be with "**positive opening**". All switches with the symbol ⊖ are provided with NC contacts with positive opening.



No flexible connection between the moving contacts and the actuator on which the actuating force is exerted.

In case of two or more switches, they should operate in opposite modes, for example:
- The first with an NC contact (normally closed contact), actuated by the guard in positive mode.
- The other with an NO contact (normally open contact), actuated by the guard in negative mode.

This is a common practice, though it does not exclude the possible use of two switches that are actuated in positive mode (see diversification).

Diversification
In redundant systems, safety is increased through **diversification**. This can be obtained by using two switches with different design and/or technology; failures with the same cause can thereby be prevented. Some examples of diversification are: the use of a switch working with positive switching mode combined with another working in negative switching mode; a switch with mechanical actuation combined with another with non-mechanical actuation (e.g. electronic sensor); two switches, both with mechanical actuator working in positive mode but with a different actuation principle (e.g. a key switch FR 693-M2 combined with a pin switch FR 1896-M2).

Redundancy
Redundancy implies the use of more than one device or system to make sure that, in case of a failure in one device, there is another one available to perform the required safety functions. If the first failure is not detected, an additional failure may lead to the loss of the safety function.

Self-monitoring
Self-monitoring consists in an automatic control performed to check the functioning of all devices involved in the machine working-cycle. This way the next working cycle can be either accepted or rejected.

Redundancy and self-monitoring
Combining **redundancy** and **self-monitoring** in the same system makes sure that a first failure in the safety circuit does not lead to the loss of safety functions. This first failure will be detected at the next re-start or, in any case, before a second failure which may lead to the loss of the safety function.

Definitions according to the EN 60947-1 and EN 60947-5-1 standards

Control switches
Devices or operating mechanism for controlling the operation of equipment, including signalling, interlocking, etc.

Utilization category
Combination of specified requirements related to the conditions in which the switching device fulfils its purpose.

Operating cycle
Sequence of two operations, one for opening and one for closing.

Rated current Ie
This current depends on the rated operating voltage, the rated frequency, the utilization category and the type of protective enclosure, if present.

Thermal current Ith
Maximum current for heating tests on equipment without enclosure, in free air. Its value shall be least to equal to the maximum value of the rated operational current Ie of the equipment without enclosure, in eight-hour duty.

Electrical endurance
Number of on-load operating cycles, under the conditions defined by the corresponding product standard, which can be carried out without repair or replacement.

Mechanical endurance
Number of no-load operating cycles (i.e. without current on the main contacts), under the conditions defined by the corresponding product standard, which can be carried out without repair or replacement of mechanical parts.

Contact elements
The parts, fixed or movable, conducting or insulating, of a control switch necessary to close and open one single conducting path of a circuit.

Single interruption contact elements
Contact element opening or closing the circuit's conducting path at one point only.

Double interruption contact elements
Contact element opening or closing the circuit's conducting path at two points in series.

Make-contact elements (normally open)
Contact element closing a circuit's conducting path when the control switch is actuated.

Break-contact elements (normally closed)
Contact element opening a circuit's conducting path when the control switch is actuated.

Change-over contact elements
Contact element combination including one make-contact element and one break-contact element.

Electrically separated contact elements
Contact elements of the same control switch which are well isolated from each other and therefore can be connected to electric circuits with different voltages.

Contact elements with independent action (snap action)
Contact element of a manual or automatic device for control circuits where the motion speed of the contact is substantially independent from the motion speed of the actuator.

Contact elements with dependent action (slow action)
Contact element of a manual or automatic device for control circuits where the motion speed of the contact depends on the motion speed of the actuator.

Minimum actuating force
Minimum force to be applied to the actuator that will cause all contacts to reach their switched position.

Position switch
Control switch whose controller is actuated by a moving part of the machine, when this part arrives to a set position.

Foot switch
Control switch whose actuator is actuated by exerting force with a foot on the pedal.

Pre-travel of the actuator
The maximum travel of the actuator which does not cause any travel of the contact elements.

Ambient temperature
The air temperature surrounding the complete switching device, under prescribed conditions.

Rated operating voltage Ue
Voltage which, combined with the rated operational current Ie, determinates the application of the equipment and the referred utilization categories.

Rated insulation voltage Ui
Reference voltage for the dielectric test voltage and the creepage distances along surfaces.

Rated impulse withstand voltage Uimp
The highest peak value of an impulse voltage, of a prescribed shape and polarity, which does not cause destructive discharge under the specified test conditions.

Contact block
Contact element or contact elements combination which can be combined with similar units, operated by a common actuating system

Markings and quality marks

CE marking

The CE marking is a mandatory declaration made by the manufacturer of a product in order to indicate that the product satisfies all requirements foreseen by the directives (regulated by the European Community) in terms of safety and quality. Therefore, it ensures National bodies of the EU countries about the fulfilment of obligations laid down in the agreements.

IMQ mark

The IMQ (Italian Institute of the Quality Mark) is an association in Italy (independent third body) whose task is to check and certify the compliance of materials and equipment with safety standards (CEI standards in the electric and electronic sector). This voluntary conformity certification is a guarantee of quality, safety and technical value.

UL mark

UL (Underwriters Laboratories Inc.) is an independent non-profit body that tests materials, devices, products, equipment, constructions, methods and systems with regard to their risk for human life and goods according to the standard in force in the United States and Canada. Decisions made by UL are often recognized by many governing authorities concerning the compliance with local safety regulations.

CCC mark

The CQC is the organization in the Chinese Popular Republic whose task is to check and certify the low voltage electrical material.
This organization issues the product mark CCC which certifies the passing of electrical/mechanical conformity tests by products and the compliance of the company quality system with required standards. To obtain the mark, the Chinese body makes preliminary company visits as well as periodical check inspections. Position switches cannot be sold in the Chinese territory without this mark.

TÜV SÜD mark

TÜV SÜD is an international authority claiming long-standing experience in the certification of operating safety for electrical, electromechanical and electronic products. In the course of type approval, TÜV SÜD closely inspects the quality throughout all the stages concerning product development, from software design and completion, to production and to the tests conducted according to ISO/IEC standards. The operating safety certification is obtained voluntarily and has a high technical value, since it not only certifies the electrical safety of the product, but also its specific operating suitability for use in safety applications according to the IEC 61508 standard.

EAC mark

The EAC certificate of conformity is a certificate issued by a Customs Union certification body formed by Russia, Belarus and Kazakhstan, with which the conformity of a product is certified with the essential safety requirements laid down by one or more Technical Regulations (Directives) of the Customs Union.

International and European Standards

EN 50041: Low voltage switchgear and controlgear for industrial use. Control switches. Position switches 42.5x80 mm. Dimensions and features
EN 50047: Low voltage switchgear and controlgear for industrial use. Control switches. Position switches 30x55 mm. Dimensions and features
EN ISO 14119: Safety of machinery. Interlocking devices associated with guards. Design and selection principles.
EN ISO 12100: Safety of machinery. General design principles. Risk assessment and risk reduction.
EN ISO 13849-1: Safety of machinery. Safety-related parts of control systems. Part 1: General principles for design.
EN ISO 13850: Safety of machinery. Emergency stop devices, functional aspects. Design principles.
EN 61000-6-3 (equivalent to IEC 61000-6-3): Electromagnetic compatibility. Generic emission standard. Part 1: residential, commercial and light-industrial environments.
EN 61000-6-2 (equivalent to IEC 61000-6-2): Electromagnetic compatibility. Generic immunity standard. Part 2: Industrial environments.
EN ISO 13855: Safety of machinery. Positioning of safeguards with respect to the approach speeds of parts of the human body.
EN 1037: Safety of machinery. Prevention of unexpected start-up.
EN 574: Safety of machinery. Two-hand control devices. Functional aspects. Principles for design.
EN 60947-1 (equivalent to IEC 60947-1): Low-voltage switchgear and controlgear. Part 1: General rules.
EN 60947-5-1 (equivalent to IEC 60947-5-1): Low-voltage switchgear and controlgear. Part 5: Devices for control and operation circuits. Section 1: Electromechanical control circuit devices.
EN 60947-5-2: Low-voltage switchgear and controlgear. Part 5-2: Control circuit devices and switching elements - Proximity switches
EN 60947-5-3: Low-voltage switchgear and controlgear. Part 5-3: Control circuit devices and switching elements - Requirements for proximity devices with defined behaviour under fault conditions (PDF)
EN 60204-1 (equivalent to IEC 60204-1): Safety of machinery. Electrical equipment of machines. Part 1: General rules.
EN 60529 (equivalent to IEC 60529): Protection degree of the housings (IP codes).
ISO 20653: Road vehicles-degrees of protection (IP CODE)
EN 62326-1 (equivalent to IEC 62326-1): Printed boards. Part 1: Generic specification
EN 60664-1 (equivalent to IEC 60664-1): Insulation coordination for equipment within low-voltage systems
Part 1: Principles, requirements and tests.
EN 61508 (equivalent to IEC 61508): Functional safety of electrical, electronic and programmable electronic systems for safety applications.
EN 62061 (equivalent to IEC 62061): Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems.
EN 60079-0 (equivalent to IEC 60079-0): Electrical devices for potentially explosive atmospheres. General rules
EN 60079-11 (equivalent to IEC 60079-11): Electrical apparatus for potentially explosive atmospheres. Intrinsic safety "i"
EN 60079-31 (equivalent to IEC 60079-31): Electrical apparatus for potentially explosive atmospheres. Type of protection: "n".
EN 60079-28 (equivalent to IEC 60079-28): Electrical apparatus for use in the presence of combustible dust. Part 1-1: Construction and testing
BG-GS-ET-15: Prescriptions about how to test switches with forced contact opening to be used in safety applications (German standard).
UL 508: Standards for industrial control equipment. (American standard).
CSA 22-2 No.14: Standards for industrial control equipment. (Canadian standard).

European directives

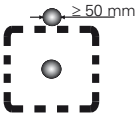
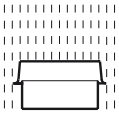
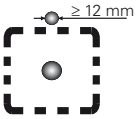
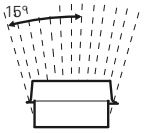
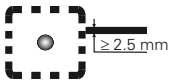
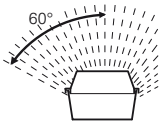
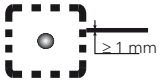
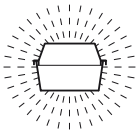
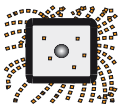
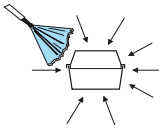
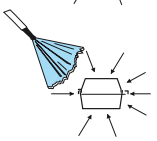
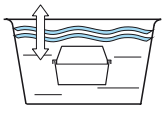
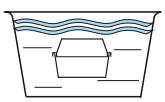
2014/35/EU	Directive on low-voltage switchgear and controlgear
2006/42/EC	Machinery Directive
2014/30/EU	Directive on electromagnetic compatibility
94/9/EC	ATEX Directive

Regulatory Organisations

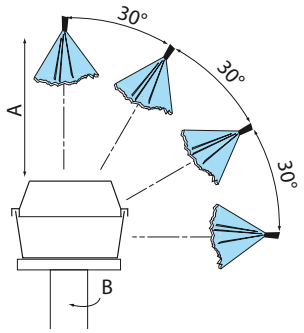
CEI	Comitato Elettrotecnico Italiano (IT)	**NF**	Normes Françaises (FR)
CSA	Canadian Standard Association (CAN)	**VDE**	Verband Deutscher Elektrotechniker (DE)
CENELEC	European Committee for Electrotechnical Standardisation	**UNI**	Ente Nazionale Italiano di Unificazione (IT)
CEN	European Committee for Standardisation	**UL**	Underwriter's Laboratories (USA)
IEC	International Electrotechnical Commission	**TÜV**	Technischer Überwachungs-Verein (DE)

Protection degree of housings for electrical material according to EN 60529

The table reports the required protection degrees according to the IEC 60529, EN 60529, CEI 70-1 standards.
The protection degrees are indicated by the abbreviation IP and 2 following digits. 2 additional letters can be reported indicating protection of persons or other features. The first digit shows the degree of protection against penetration of external solid materials. The second digit identifies instead the protection degree against liquid penetration.

1st digit	Description	Protection for the machine	Protection for persons	2nd digit	Description	Protection for the machine
0		Not protected	Not protected	**0**		Not protected
1		Protected against solid objects greater than 50 mm	Against access to hazardous parts with the back of a hand (Ø 50 mm)	**1**		Protected against vertically falling water drops
2		Protected against solid objects greater than 12 mm	Against access to hazardous parts with a finger (Ø 12 mm)	**2**		Protected against water drops falling at max. 15° angle
3		Protected against solid objects greater than 2.5 mm	Against access to hazardous parts with a tool (Ø 2.5 mm)	**3**		Protected against rain drops falling at max. 60° angle
4		Protected against solid objects greater than 1 mm	Against access to hazardous parts with a wire (Ø 1 mm)	**4**		Protected against splash water from any direction
5		Protected against dust	Against access to hazardous parts with a wire (Ø 1 mm)	**5**		Protected against water jets from any direction
6		Totally protected against dust	Against access to hazardous parts with a wire (Ø 1 mm)	**6**		Protected against powerful water jets from any direction (e.g. waves)
				7		Protected against temporary water immersion (30 minutes at one-meter depth)
				8		Protected against continuous immersion in water

Protection degree IP69K according to ISO 20653



ISO 20653 envisages a particularly strenuous test. This test simulates the conditions of pressure washing in industrial environments with water jets having pressure between 80 and 100 bar, flow rate between 14 and 16 l/min. and a temperature of 80°C.

Test specifications:

Rotation speed (B):	5 ± 1 rpm
Distance from water jet (A):	100 +50/-0 mm
Water flow rate:	15 ± 1 l/min
Water pressure:	9000 ± 1000 kPa
Water temperature:	80 ± 5 °C
Test duration:	30 s per position

Housing data in accordance with UL (UL 508) and CSA (C22-2 no.14) approvals

The features required for a housing are determined by a specific environmental designation and other features such as the kind of gasket or the use of solvent materials.

Type	Intended use and description
1	Mainly for indoor utilization, supplied with protection against contact with the internal mechanism and against a limited quantity of falling dirt.
4X	Suitable for both indoor and outdoor use, provided with protection degree against falling rain, water splashes and direct coming water from a pipe. No damage caused by ice formation on the hosing. Corrosion-resistant.
12	Indoor utilization, provided with a protection degree against dust, dirt, flying fibres, dripping water and outside condensation of non-corrosive fluids.
13	Indoor utilization, supplied with a protection degree against gauze, dust penetration, outside condensation and sprinkling of water, oil and non-corrosive fluids.

Pollution degree (of environmental conditions) according to EN 60947-1

According to the EN 60947-1 standard, the pollution degree is a conventional number based on the quantity of conducting hygroscopic dust, ionized gas or salt, and on the relative humidity and its frequency of occurrence resulting in hygroscopic absorption or condensation of moisture leading to reduction in dielectric strength and/or surface resistivity. In equipment to be used inside a housing or having an integral enclosure as part of the device, the pollution degree applies to the inner part of housing. With the purpose of evaluating the air and surface insulation distances, the following four pollution degrees are defined:

Degree	Description
1	No pollution or only dry and non-conductive pollution occurs.
2	Normally, only non-conductive pollution is present. Occasionally some temporary conductivity caused by condensation may occur.
3	Some conductive pollution is present, or some dry non-conductive pollution that becomes conductive because of condensation.
4	Pollution causes persistent conductivity, for instance due to conductive dust or rain or snow.

Where not otherwise specified by the applicable standards for the product, equipment for industrial applications are generally intended for their use in environment with pollution degree 3. Nevertheless, other degrees can be considered, depending on the micro-environment or on particular applications.

Use in alternating and direct current of auxiliary devices acc. to EN 60947-5-1

Alternating current use

Utilization category	Description
AC12	Control of resistive loads and solid state loads with insulation by optocouplers.
AC13	Control of solid state loads with transformer isolation
AC14	Control of electromagnetic loads, power ≤ 72 VA
AC15	Control of electromagnetic loads, power ≥ 72 VA

Direct current use

Utilization category	Intended use
DC12	Control of resistive loads and solid state loads with insulation by optocouplers.
DC13	Control of electromagnetic loads without economy resistors in circuit
DC14	Control of electromagnetic loads with economy resistors in circuit

Alphanumeric index of product codes

Legend:

CS AM-0••••• The dots indicate a generic alphanumeric character

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AC 8512	91
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AP G••-••••	161
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FD ••79-M2	177
FD ••80-M2	177
FD ••83-M2	169
FD ••84-M2	169
FD ••93-M2	13
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FL ••84-M2	169
FL ••93-M2	13
FL ••95-M2	67
FM ••74-M2	177
FM ••96-M2	73
FM ••C•-M2	79
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FP ••78-M2	169
FP ••79-M2	177
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Changed article codes

Legend:

CS AR-03•••• → CS AR-08•••• The codes in grey have been replaced by the code after the arrow

Old article	New article
CS AR-03•••• →	CS AR-08••••
CS AT-0A•••• →	CS AT-00••••-TF0.5
CS AT-0B•••• →	CS AT-00••••-TF1
CS AT-0C•••• →	CS AT-00••••-TF3
CS AT-0D•••• →	CS AT-00••••-TF10
CS AT-1A•••• →	CS AT-10••••-TF0.5
CS AT-1B•••• →	CS AT-10••••-TF1
CS AT-1C•••• →	CS AT-10••••-TF3
CS AT-1D•••• →	CS AT-10••••-TF10
CS AT-2••••• →	CS AT-3•••••
CS FS-0••••• →	CS FS-1•••••
CS FS-0A•••• →	CS FS-00••••-TF0.5
CS FS-0B•••• →	CS FS-00••••-TF1
CS FS-0C•••• →	CS FS-00••••-TF3
CS FS-0D•••• →	CS FS-00••••-TF10
CS ME-2AVU24 →	CS ME-20VU24-TF0.5
CS ME-2BVU24 →	CS ME-20VU24-TF1
CS ME-2EVU24 →	CS ME-20VU24-TF2
CS ME-2CVU24 →	CS ME-20VU24-TF3
VF IL•••••• →	VF SL••••••

General terms and conditions of sale

Order procedures:
Purchasing orders must always be sent in writing (fax, e-mail). We reserve the right to not accept e-mail orders in case of missing characteristics necessary to correctly identify the sender or to not process them in case of virus infected attachments or attachments of dubious origin.

Minimum order amount:
Unless specifically agreed, the minimum order amount for deliveries is EUR 200 net (VAT excluded). For orders of less than EUR 200, a EUR 10 fee will be deducted towards the costs if the delivery occurs in Italy and San Marino; for deliveries abroad, the fee will be EUR 30.

Prices:
The prices quoted in the price list do not include VAT, custom taxes or any other charges. Unless otherwise agreed, the prices quoted in the price list are not binding and may undergo changes without prior notice.

Order quantities:
Some products are shipped in packs. The ordered quantities of these items must be multiples of the quantities contained in the packages.

Order cancellation/changes:
Order changes might be accepted depending on the job order status. Changes or cancellation of special article orders will not be accepted.

Supply:
The supply includes only what is expressly stated in the order confirmation. As per article 1461 of the Italian Civil Code, we reserve the right to stop supply in case of changes in the customer's financial standing.

Delivery:
The delivery is indicated in the order confirmation and reports the period in which the goods can be available at the factories of Pizzato Elettrica and not the date of arrival at the customer's premises. This date is an approximate value and cannot be used as a reason of the order non-fulfilment.

Packaging:
Packaging is free. For more than six boxes pallets can be necessary for the transport.

Shipment:
Goods always travel at risk of the buyer, even if the goods are sold carriage paid. The customer must check that the forwarder delivers the number of boxes indicated in the delivery note, that the boxes are intact and that the weight corresponds to what is stated in the documents. In case of any inconsistencies, always accept the goods SUBJECT TO VERIFICATION, clearly specifying the type of damage. Any discrepancy or mistakes should be reported in writing within 8 days of receipt of the goods at info@pizzato.com.

Warranty:
The warranty has a validity of 12 months starting from the delivery date of the material. The warranty does not cover improper use of the material, negligence or wrong installation/assembling. The warranty does not cover parts subjected to wear or products used beyond the technological limits described in the catalogue, or items that have not received the right maintenance. Pizzato Elettrica engages itself to repair and/or replace parts or the complete product for those elements that present evident manufacturing defects, provided that they are still covered by warranty. Pizzato Elettrica is only responsible for the value of the product and requests for compensation due to machine downtime, repairs or costs for direct or indirect damages resulting from product malfunctions will not be accepted, even if these occur during the warranty period. It is the responsibility of the manufacturer to evaluate the importance of the products used and the possible damage caused by their malfunction and to adopt the necessary technical measures to minimize consequences on machines also for personal safety purposes (redundancy systems, self-controlled systems, etc). The warranty will be subject to the customer's compliance with the payment terms.
Any samples provided free of charge or bearing the phrase "SAMPLE" must be considered as purely demonstrative and are not covered by the guarantee.

Products:
Products can be subjected to technical improvements in any moment without prior notice.

Payment terms:
Payments should be settled within the terms agreed in the order confirmation. The payment method is always at the risk of the buyer, regardless of the means chosen. In case of delayed payment, Pizzato Elettrica reserves the right to stop the delivery of any current orders and charge interest at the rate envisaged by European Directive 2011/7/EU. Any technical or commercial complaints do not entitle the claimant to suspend the due payments.

Returns:
Any products returned for any reason will not be accepted unless they are previously APPROVED and AUTHORISED in writing.
Otherwise, Pizzato Elettrica reserves the right to reject the goods and return them "freight collect" at the expense of the buyer, in the same way by which they were forwarded. Returns have to be sent back within 3 months from the authorization date and no later. After this period, returns will not be accepted. The request to return goods will lead to their sales price being devalued and will be considered if relative to standard items and materials delivered no more than 12 months ago. The returned goods and the relative packaging must be intact and free from damage.

Ownership:
The delivered products remain property of Pizzato Elettrica until full settlement of the invoices.

Proper Law:
The Court of Vicenza shall have jurisdiction in any disputes.

For the updated terms of sale, please consult the website www.pizzato.com

Notes

Notes

Notes

Notes

Any information or application example, connection diagrams included, described in this document are to be intended as purely descriptive.
The choice and application of the products in conformity with the standards, in order to avoid damage to persons or goods, is the user's responsibility.
The drawings and data contained in this catalogue are not binding and we reserve the right, in order to improve the quality of our products, to modify them at any time without prior notice.
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