

Description

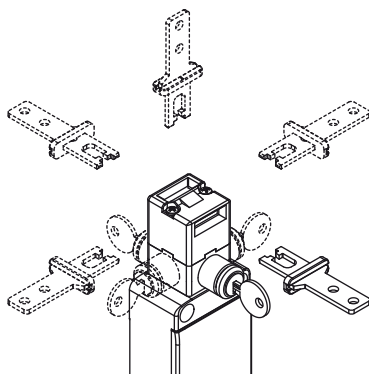


These switches are used on machines where the hazardous conditions remain for a while, even after the machines have been switched off, for example because of mechanical inertia of pulleys, saw disks, parts under pressure or with high temperatures. They can also be used when it is necessary to control machine guards allowing the opening of protections only under specific conditions.

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



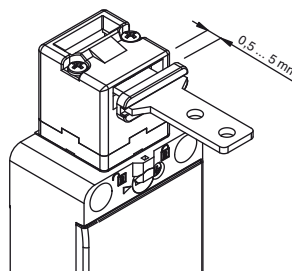
Orientable head and release device



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

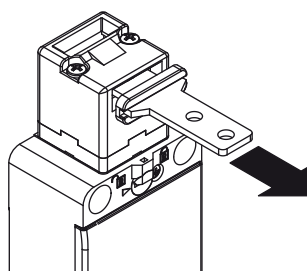
The auxiliary key release device can be rotated in 90° steps as well. This enables the switch to assume 32 different configurations.

Wide-ranging actuator travel



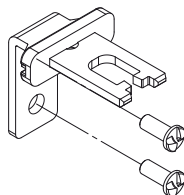
The head of this switch is equipped with an actuator with a wide range of travel. In this way the guard can oscillate along the direction of insertion (4.5mm) without causing unwanted machine shutdowns. This extensive travel is available in all actuators, in order to ensure maximum device reliability.

Holding force of the locked actuator



The strong interlocking system guarantees a maximum actuator holding force of $F_{1max} = 1100 \text{ N}$ (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 with using common tools. See accessories on page 295.

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 IEC 60529.

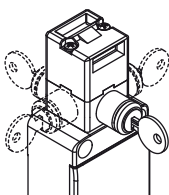
They can therefore be used in all environments where the maximum protection of the housing is required.

Contact blocks



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

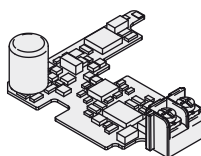
Key release device with orientable lock



The auxiliary key release device is used to allow the maintenance or the entry into the machinery to authorized personnel only. Rotating the key, will make the same action of the solenoid, that is move solenoid contacts and release the actuator. The device can be rotated allowing the installation of the safety switch inside the machinery and making the release device accessible outside

the protection. In this way, the switch is better protected against possible tampering and the external side/surface of the machinery remains smooth.

Electronic control board for solenoids power consumption



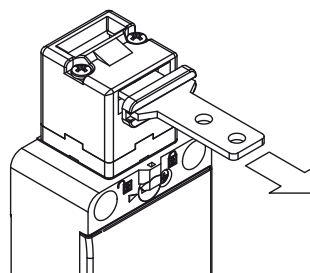
This technical solution resolves the problems that may derive from not stable power supply (machine distance from main transformers, tension variation between night/day hours), allowing also a low solenoid power consumption and consequently enlarging the working temperatures range of the switch.

Laser engraving



All the FG series switches are indelibly marked with a dedicated laser system that allows the marking to be also suitable for extreme environments. This system that does not use labels, prevents the loss of plate data and the marking is more resistant 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 working principles

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

Working principle D: locked actuator with de-energised solenoid. Actuator release is obtained by power supply to the solenoid.

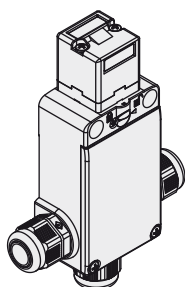
Working principle E: locked actuator with energised solenoid. The release of the actuator is obtained by power-off to the solenoid. It is advisable to use this version under special conditions because a blackout will allow the immediate opening of the protection.

Sealable auxiliary release device



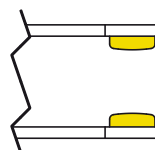
Versions with working principle D are supplied with a sealable auxiliary release device used by technicians during the installation or to access the machine in case of black-out. The auxiliary release device acts on the switch exactly as if the solenoid was energised, actuating therefore also the corresponding 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



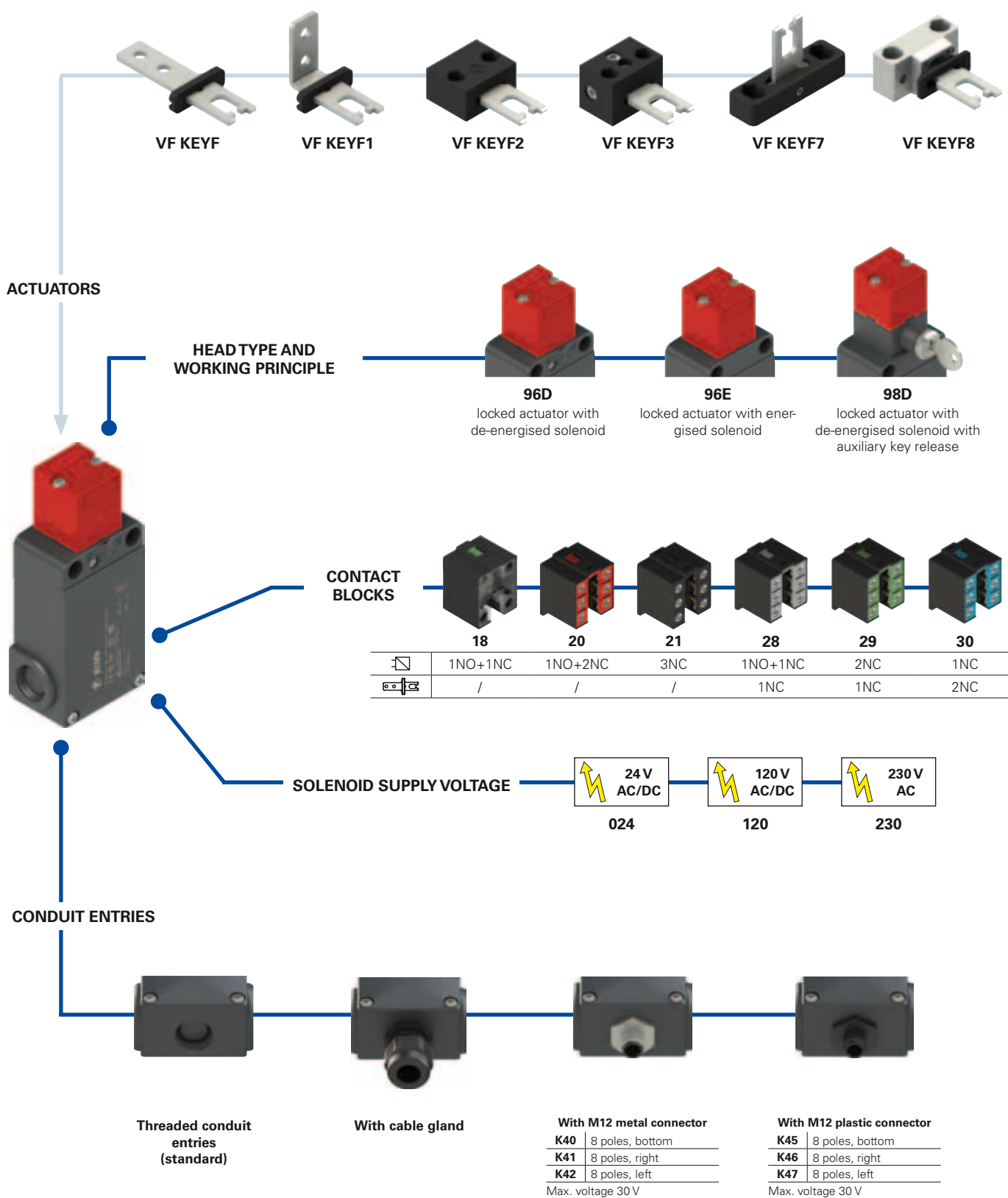
The switch is equipped with three cable entries in different directions. This allows its application in series connections or in narrow places.

Gold-plated contacts



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

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

FS 1896D024-F1GM2K40

Contact blocks		
	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

Head type and working 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

Solenoid supply voltage	
024	24 Vac/dc (-10% ... +25%).
120	120 Vac/dc (-15% ... +20%)
230	230 Vac (-15% ... +10%)

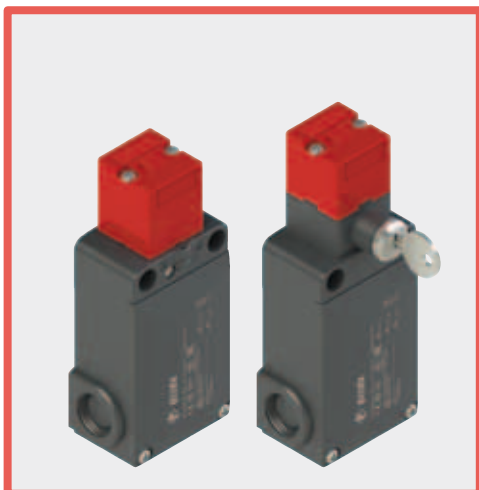
Actuators	
	without actuator (standard)
F	straight actuator VF KEYF
F1	angled actuator VF KEYF1
F2	jointed actuator VF KEYF2
F3	jointed actuator adjustable in two directions VF KEYF3
F7	jointed actuator adjustable in one direction VF KEYF7
F8	universal actuator VF KEYF8

Pre-installed cable glands or connectors	
	without cable gland or connector (standard)
K23	cable gland for cables Ø 6...Ø 12 mm
...
K40	M12 metal connector, 8 poles
...
K45	M12 plastic connector, 8 poles
...

Please contact our technical service for the complete list of possible combinations.

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

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



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 orientable auxiliary release device or key release
- Versions with energised or de-energised solenoid

Markings and quality marks:



IMQ approval:	CA02.00792
UL approval:	E131787
CCC approval:	2007010305230011
EAC approval:	RU C-IT DM94.B.01024

Technical data

Housing

Housing made of glass fiber 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 having 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 type 2 acc. to EN ISO 14119 Low acc. to EN ISO 14119
Interlock with mechanical lock, coded:	
Coding level:	
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 ¹ /hour
Mechanical endurance:	800,000 operating cycles ¹
Max. actuation speed:	0.5 m/s
Min. actuation speed:	1 mm/s
Maximum force before breakage F_{Tmax} :	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 play of locked actuator:	4.5 mm
Released actuator extraction force:	30 N
Tightening torques for installation:	see pages 297-308

(1) One operation cycle means two movements, one to close and one to open contacts, as defined in EN 60947-5-1.

Cable cross section (flexible copper strands)

Contact blocks 20, 21, 28, 29, 30:	min.	1 x 0.34 mm ²	(1 x AWG 22)
	max.	2 x 1.5 mm ²	(2 x AWG 16)
Contact block 18:	min.	1 x 0.5 mm ²	(1 x AWG 20)
	max.	2 x 2.5 mm ²	(2 x AWG 14)

In conformity 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.

In conformity with the requirements of:

Low Voltage Directive 2006/95/EC, Machinery Directive 2006/42/EC and EMC Directive 2004/108/EC.

Positive contact opening in conformity with standards:

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

Solenoid

Duty cycle:	100% ED
Solenoid inrush:	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
Medium total 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 solenoid power. Please consider the inrush solenoid 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 297 to page 308.

**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
	Rated impulse withstand voltage (U _{imp}):	6 kV 4 kV (contact blocks 20, 21, 28, 29, 30)	I _e (A)	6	4	1
	Conditional short circuit current:	1000 A acc. to EN 60947-5-1	Direct current: DC13			
	Protection against short circuits:	type aM fuse 10 A 500 V	U _e (V)	24	125	250
Pollution degree:	3	I _e (A)	6	1.1	0.4	

with M12 connector 8 poles	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		

Characteristics approved by IMQ

Rated insulation voltage (U_i): 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: IP66

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 of contacts on contact blocks 18, 20, 21, 28, 29, 30

In conformity with standards: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2006/95/EC.

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

Characteristics approved by UL

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

Data of housing 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 AWG 12-14. Terminal tightening torque of 7.1 lb in (0.8 Nm).

In conformity with standard: UL 508, CSA 22.2 N. 14

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



Working principle

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

state A: with inserted and locked actuator

state B: with inserted actuator, not locked

state C: with extracted actuator

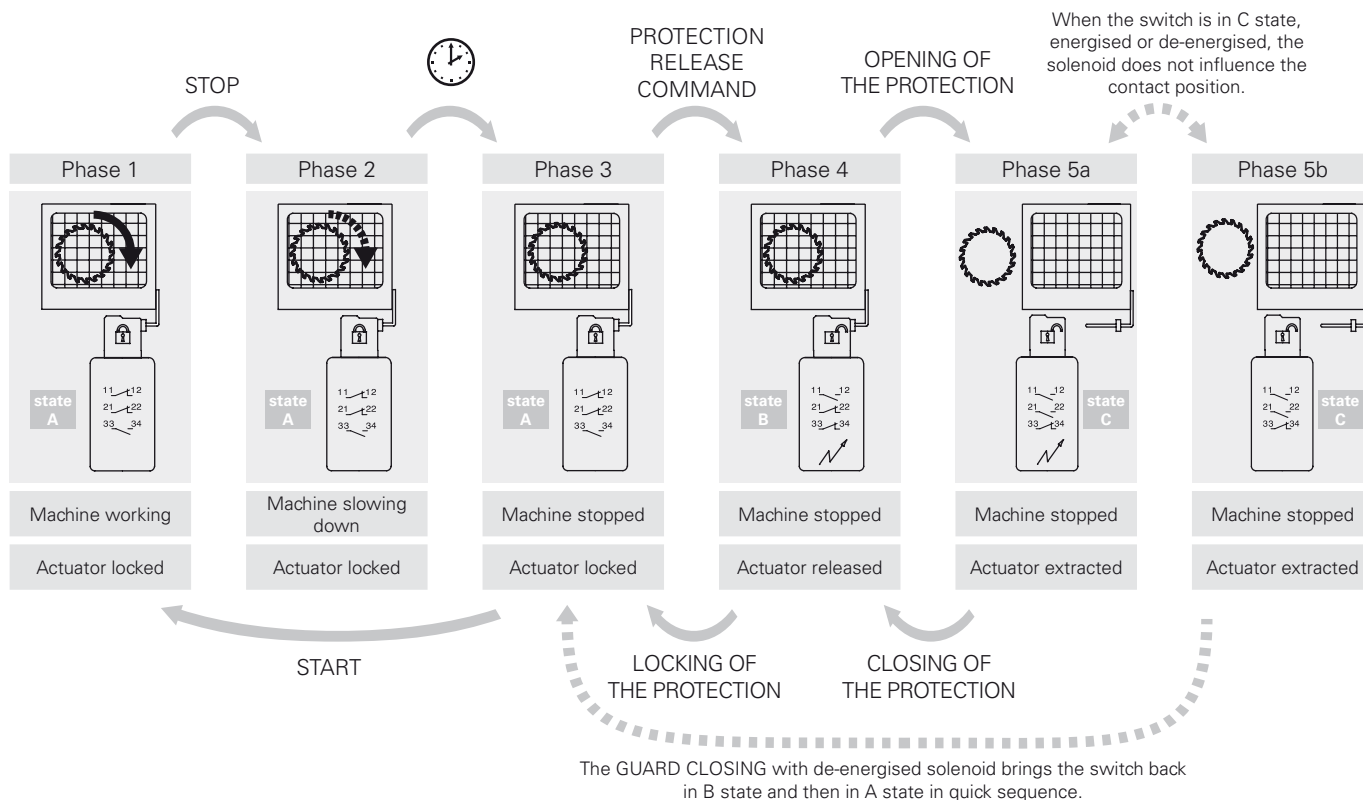
All or some of these states may be controlled through the positive opening contacts of the internal contact block. In detail, contact blocks that have electric contacts marked with the symbol of the solenoid () are switched in the transition between the state A and state B, while the electric contacts marked with the symbol of the actuator () are switched between state B and state C:

It is also possible to choose between two working principles for the actuator locking:

- **Working principle D:** Actuator locked with de-energised solenoid. Actuator release is obtained by power supply to the solenoid (see example of working cycle steps).

- **Working principle E:** Actuator locked with energised solenoid. The release of the actuator is obtained by power-off to the solenoid. It is advisable to use this version under special conditions because a blackout will allow the immediate opening of the protection.

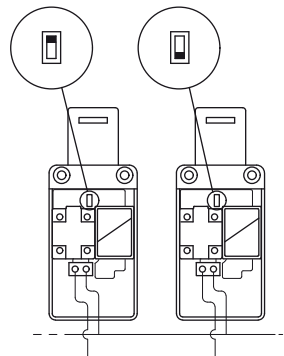
Example of working cycle steps with FS 2896D024-F1 (switch with working principle D)



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 results of the solenoid inrush current on the power supply and has to be executed only if necessary and with special care.
- Switch off the power supply.
- Open the switch cover.
- Remove the black plastic protection that covers the solenoid by unscrewing the two screws which fix the protection to the switch body.
- Move the dip-switch with a tool so that each switch has a different combination (see figure beside). If more than two switches are installed, repeat the combinations for any next set of two switches.
- Reposition the black plastic protection and tighten the two screws with a torque of 0.8 Nm.





Contact positions related to switch states

Operating state	Working principle D locked actuator with de-energised solenoid			Working principle E locked actuator with energised solenoid		
	state A	state B	state C	state A	state B	state C
	Inserted and locked	Inserted and released	Extracted	Inserted and locked	Inserted and released	Extracted
Actuator						
Solenoid	De-energised	Energised	-	Energised	De-energised	-

FS 18 1NC+1NO controlled by the solenoid		11	11	11	11	11	11
		23	23	23	23	23	23
FS 20 2NC+1NO controlled by the solenoid		11	11	11	11	11	11
		21	21	21	21	21	21
FS 21 3NC controlled by the solenoid		11	11	11	11	11	11
		21	21	21	21	21	21
		31	31	31	31	31	31
FS 28 1NO+1NC controlled by the solenoid 1NC controlled by the actuator		11	11	11	11	11	11
		21	21	21	21	21	21
		33	33	33	33	33	33
FS 29 2NC controlled by the solenoid 1NC controlled by the actuator		11	11	11	11	11	11
		21	21	21	21	21	21
		31	31	31	31	31	31
FS 30 1NC controlled by the solenoid 2NC controlled by the actuator		11	11	11	11	11	11
		21	21	21	21	21	21
		31	31	31	31	31	31

Utilization limits

Do not use where dust and dirt may penetrate in any way into the head and deposit there, in particular where metal dust, concrete or chemicals are spread. Adhere to the EN ISO 14119 requirements regarding low level of coding for interlocks. Do not use in environments with the presence of explosive or flammable gas. In these cases, use ATEX products (check the specific 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 this case the entry locking device VF KB1 shown on page 115 must be used.

Dimensional drawings

All measures in the drawings are in mm

Contact type:
L = slow action

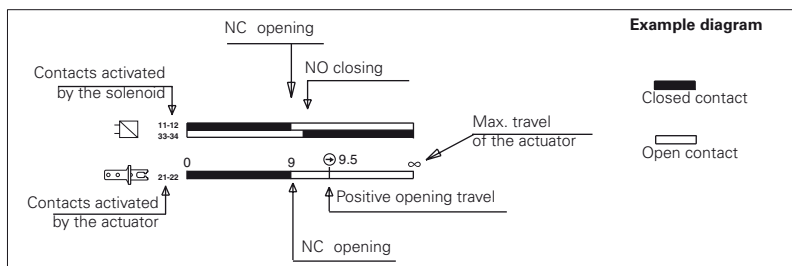
Contact blocks

	Working principle D, supplied with sealable auxiliary release device and without actuator	Working principle E, and without actuator	Working principle D, supplied with auxiliary key release and without actuator
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
Min. 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 in accordance with EN ISO 14119

How to read travel diagrams

All measures in the diagrams are in mm



IMPORTANT:

NC contact has to be considered with inserted actuator and lock. In **safety applications**, actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol . Operate the switch **at least with the positive opening force**, indicated between brackets below each article, aside the minimum force value.

Accessories

Article	Description
VF KB1	Actuator entry locking device
	Padlockable device to lock the actuator entry in order to prevent from the accidental closing of the door behind operators while they are inside the machine. 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

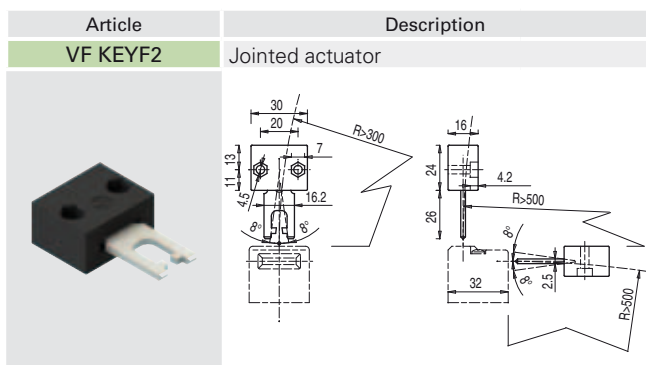
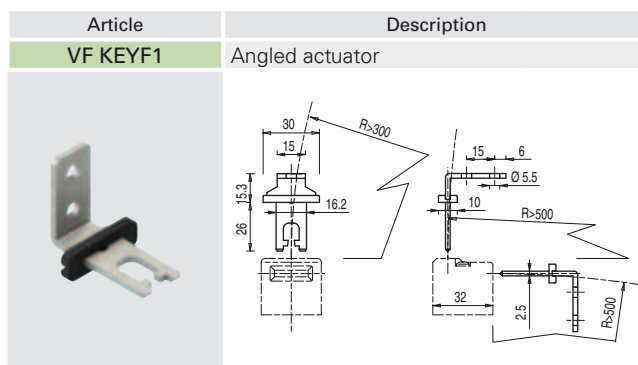
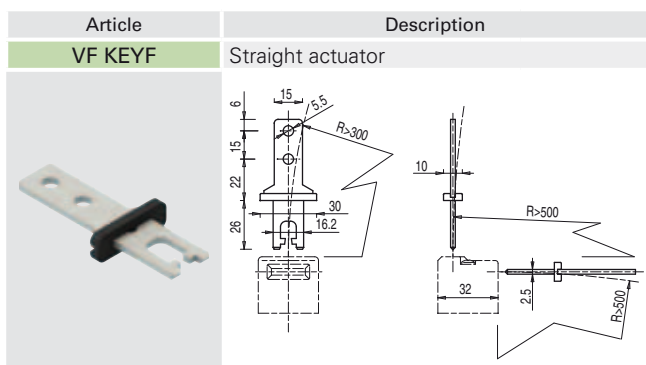
Accessories See page 287

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

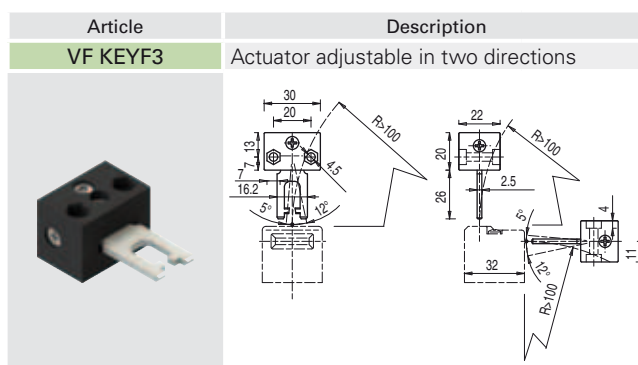


Stainless steel actuators

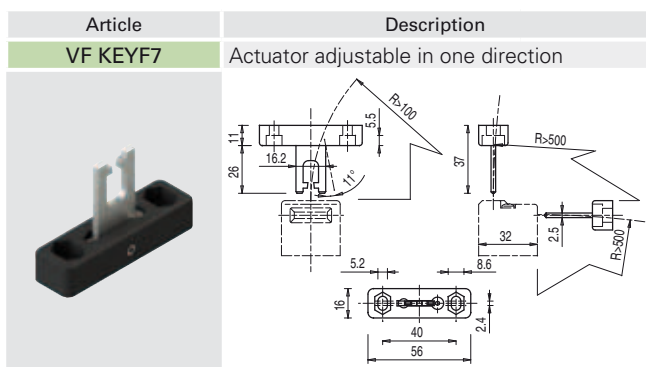
IMPORTANT: These actuators can be used with items of the FD, FP, FL, FC and FS series only (e.g. FS 1896D024-M2).
Low level of coding acc. to EN ISO 14119.



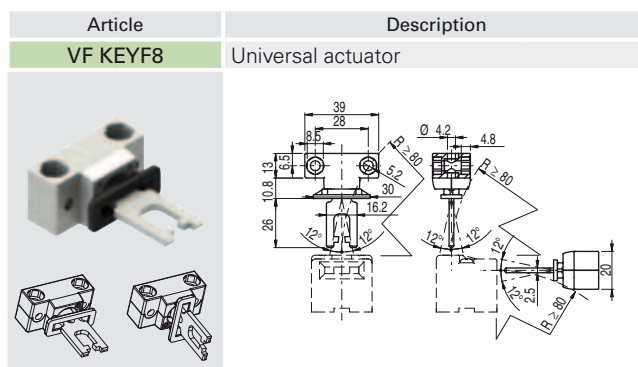
The actuator can flex in four directions for applications where the door alignment is not precise.



Actuator adjustable in two directions for doors with reduced dimensions.



Actuator adjustable in one direction for doors with reduced dimensions.



Joined and two directions adjustable actuator for doors with reduced dimensions.
The actuator has two couples of fixing holes and it is possible to rotate by 90° the actuator-working plan.

Accessories for sealing



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

Pliers, steel wire and lead seals used to seal the auxiliary release device (head 96D).

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

Article	Description
VF FSPZ	Pliers without logo