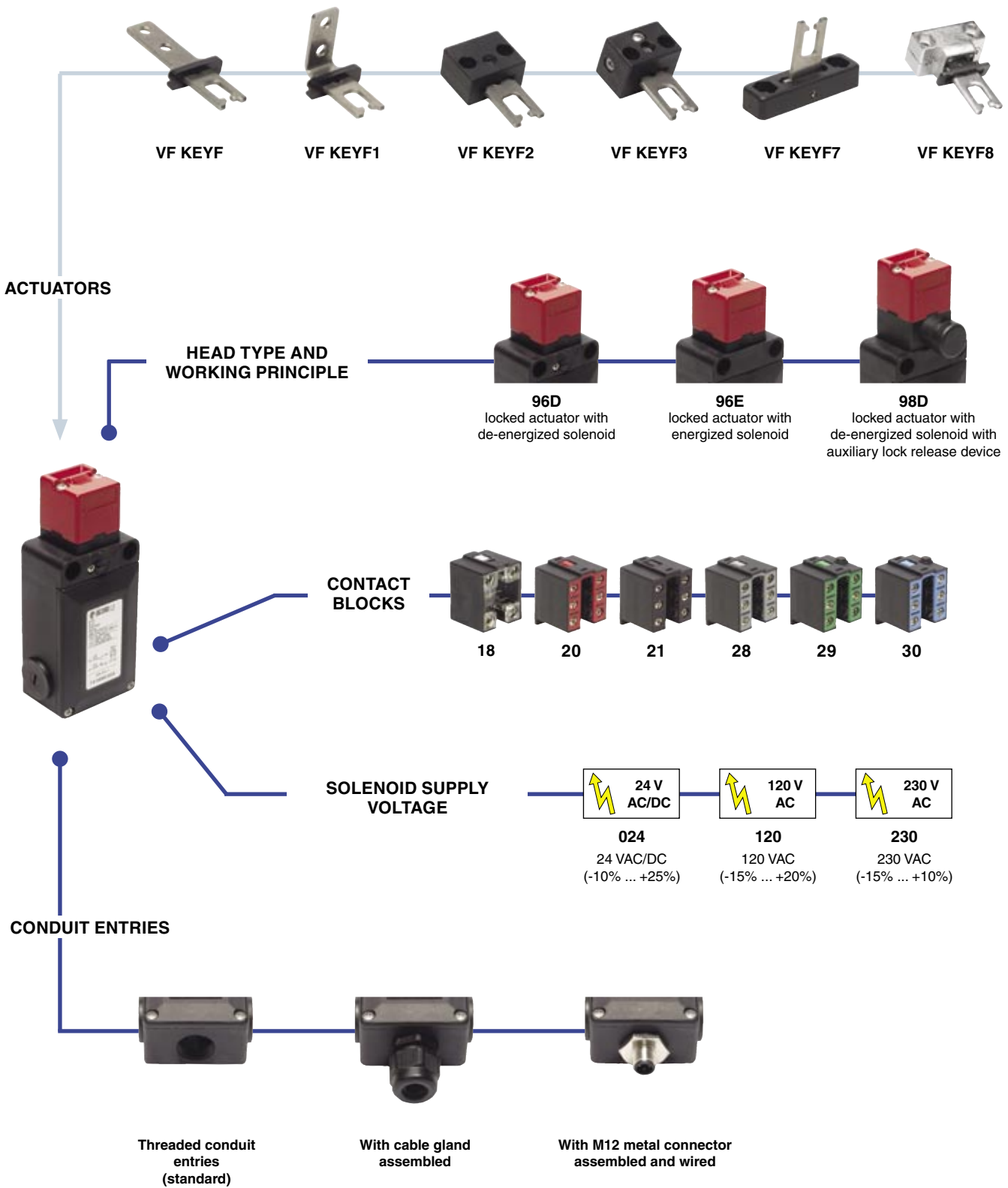


Selection diagram



—●— 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.

# FS 1896D024-F1GM2K40

### Contact blocks

	Solenoid operated	Actuator operated
<b>18</b>	1NO+1NC	
<b>20</b>	1NO+2NC	
<b>21</b>	3NC	
<b>28</b>	1NO+1NC	1NC
<b>29</b>	2NC	1NC
<b>30</b>	1NC	2NC

### Working principle

<b>96D</b>	locked actuator with de-energized solenoid
<b>96E</b>	locked actuator with energized solenoid
<b>98D</b>	locked actuator with energized solenoid with auxiliary lock release device

### Solenoid supply voltage

<b>024</b>	24 VAC/DC (-10% ... +25%).
<b>120</b>	120 VAC (-15% ... +20%)
<b>230</b>	230 VAC (-15% ... +10%)

### Preinstalled cable gland or connectors

	no cable gland or connector (standard)
<b>K21</b>	with assembled cable gland suitable for Ø 6 to Ø 12 mm cables range
<b>K40</b>	with M12 metal connector assembled and wired, 8 poles
...	.....

For the complete list of all combinations, please contact our technical office.

### Threaded conduit entry

	PG 13,5 (standard)
<b>M2</b>	M20x1,5

### Contacts type

	silver contacts (standard)
<b>G</b>	silver contacts gold plated 1 µm

### Actuators

	without actuator (standard)
<b>F</b>	with straight actuator
<b>F1</b>	with right-angled actuator
<b>F2</b>	with jointed actuator
<b>F3</b>	with jointed actuator adjustable in two directions
<b>F7</b>	with jointed actuator adjustable in one direction
<b>F8</b>	with universal actuator



### Main data

- Polymer housing, three conduit entries
- Protection degree IP66
- 6 contact blocks available
- 6 stainless steel actuators available
- Three supply voltages available
- Versions with auxiliary release device or auxiliary lock release device
- Versions with energized or de-energized solenoid

### Markings and quality marks:



Approval IMQ: CA02.00792  
 Approval UL: E131787  
 Approval EZU: 1010151

**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.

### Technical data

#### Housing

Housing made of glass-reinforced polymer, self-extinguishing, shock-proof thermoplastic resin and with double insulation □

Three conduit entries

Protection degree: IP66 (electrical contacts)

#### General data

Ambient temperature: from -25°C to +60°C  
 Max operating frequency: 600 operations cycles<sup>1</sup>/hour  
 Mechanical endurance: 800.000 operations cycles<sup>1</sup>  
 Max actuating speed: 0,5 m/s  
 Min. actuating speed: 1 mm/s  
 Max holding force: 1000 N  
 Max backlash of the actuator: 4,5 mm  
 Actuator extraction force: 30 N

(1) One operation cycle means two movements, one to close and one to open contacts, as foreseen by IEC 947-5-1 standard.

#### Cross section of the conductors (flexible copper wire)

Contact blocks 20, 21, 28, 29, 30:  
 min. 1 x 0,34 mm<sup>2</sup> (1 x AWG 22)  
 max. 2 x 1,5 mm<sup>2</sup> (2 x AWG 16)  
 Contact blocks 18:  
 min. 1 x 0,5 mm<sup>2</sup> (1 x AWG 20)  
 max. 2 x 2,5 mm<sup>2</sup> (2 x AWG 14)

#### In conformity with standards:

IEC 947-5-1, IEC 337-1, EN 60947-5-1, CEI EN 60947-5-1, CEI 17-45, IEC 204-1, EN 60204-1, CEI 44-5, EN 1088, EN ISO 12100-1, EN ISO 12100-2, IEC 529, EN 60529, CEI 70-1, EN 61000-6-2, EN 61000-6-3, EN 50081-1, EN 50082-2, CENELEC EN 50013, BG-GS-ET-15.

#### Approvals:

IEC 947-5-1, UL 508.

#### In conformity with requirements requested by:

Low Voltage Directive 73/23/EEC and subsequent modifications and completions.  
 Machinery Directive 98/37/EEC.  
 Electromagnetic Compatibility 89/336/EEC and subsequent modifications and completions.

#### Positive contact opening in conformity with standards:

IEC 947-5-1, EN 60947-5-1, CEI EN 60947-5-1, VDE 0660-206.

#### Solenoid

Solenoid duty cycle: 100% ED  
 Inrush solenoid power: 56 VA (0,1 s / 0,05 s for 230 V)  
 Steady-state solenoid power: 4 VA  
 Average solenoid power: 20 VA  
 Solenoid protection 24 V: fuse 1 A type aM  
 Solenoid protection 120 V: fuse 630 mA, delayed type  
 Solenoid protection 230 V: fuse 315 mA, delayed type

⚠ For the correct installation of all articles, please see "Utilization requirements" chapter, from page 6/1 to page 6/4.

### Electrical data

### Utilization categories

without connector  
 Thermal current (I<sub>th</sub>): 10 A  
 Rated insulation voltage (U<sub>i</sub>): 500 VAC 600 VDC  
 400 VAC for contact blocks 20, 21, 28, 29, 30  
 Protection against short circuits: fuse 10 A 500 V type aM  
 Pollution degree: 3

Alternate current: AC15 (50...60 Hz)  
 U<sub>e</sub> (V) 250 400 500  
 I<sub>e</sub> (A) 6 4 1  
 Direct current: DC13  
 U<sub>e</sub> (V) 24 125 250  
 I<sub>e</sub> (A) 6 1,1 0,4

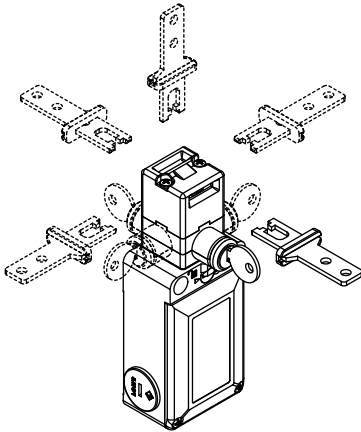
with 8 poles M12 connector  
 Thermal current (I<sub>th</sub>): 2 A  
 Rated insulation voltage (U<sub>i</sub>): 30 VAC 36 VDC  
 Protection against short circuits: fuse 2 A 500 V type gG  
 Pollution degree: 3

Alternate current: AC15 (50...60 Hz)  
 U<sub>e</sub> (V) 24  
 I<sub>e</sub> (A) 2  
 Direct current: DC13  
 U<sub>e</sub> (V) 24  
 I<sub>e</sub> (A) 2

## Description

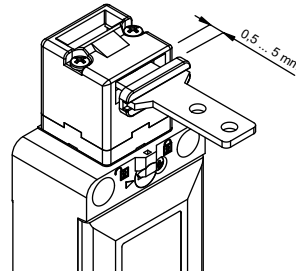
These switches are used on machines where the hazardous conditions remain for a while, even after the machine has been switched off, for example because of mechanical inertia of pulleys, saw disks, parts under pressure or with high temperatures. They can also be used when it is necessary to control machine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

## Rotating head and release device



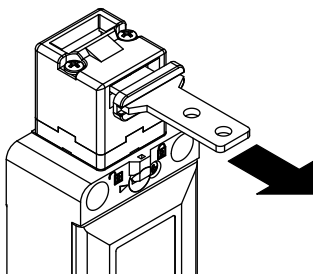
The head can be quickly rotated on each of the 4 sides of the switch by unfastening the two fixing screws. The mechanical lock release device can be rotated in 90° steps as well. This enables the switch to assume 32 different configurations.

## Actuator regulation zone



This switch has a wide backlash of the actuator into the head (4,5 mm) to avoid that door gaskets keep in traction the actuator on the solenoid. With closed door, check that the actuator doesn't knock straight against the head of the switch; it must be in the adjustment zone (0,5...5 mm)

## Actuator holding force



The strong interlocking system guarantees a maximum actuator holding force of 1000 N.

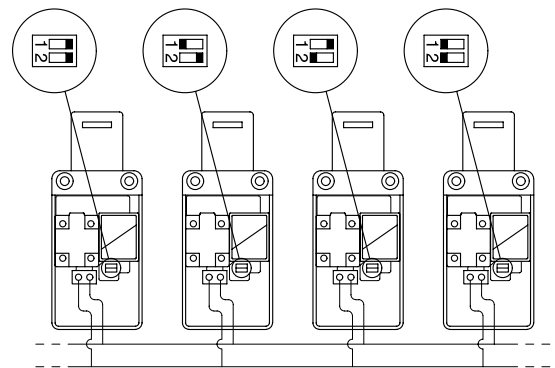
## Limits of utilization

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.  
Do not use where explosive or inflammable gas is present.

## Installation of two or more switches connected to the same power supply

### 24 VAC/DC version 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 body of the switch.
- Move the dip-switch with a tool so that each switch has a different combination (see figure beside). If more than four switches are installed, repeat the combinations for any next set of four switches.
- Reposition the black plastic protection and tighten the two screws with a torque of 0,8 Nm.



## Data type approved by IMQ and EZU

Rated insulation voltage (Ui): 500 VAC  
400 VAC for contact blocks 20, 21, 28, 29, 30

Thermal current (Ith): 10 A

Protection against short circuits: fuse 10 A 500 V type aM

Protection degree: IP66

MV terminals (screw clamps)

Pollution degree 3

Utilization category: AC15

Operation voltage (Ue): 400 VAC (50 Hz)

Operation current (Ie): 3 A

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

Positive opening of contacts on contact block 18, 20, 21, 28, 29, 30

In conformity with standards: EN60947-1, EN 60947-5-1 and subsequent modifications and completions, fundamental requirements of the Low Voltage Directive 73/23 EEC and subsequent modifications and completions.

## Data type approved by UL

Utilization categories Q300 (69 VA, 125-250 VDC)  
A600 (720 VA, 120-600 VAC)

Data of the housing type 1, 4X (indoor use only), 12, 13

In conformity with standard: UL 508

For all contact blocks use 60 or 75 °C copper (Cu) conductor and wire size No. 12-14 AWG. Terminal tightening torque of 7,1 Lb-In.

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

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



## Description

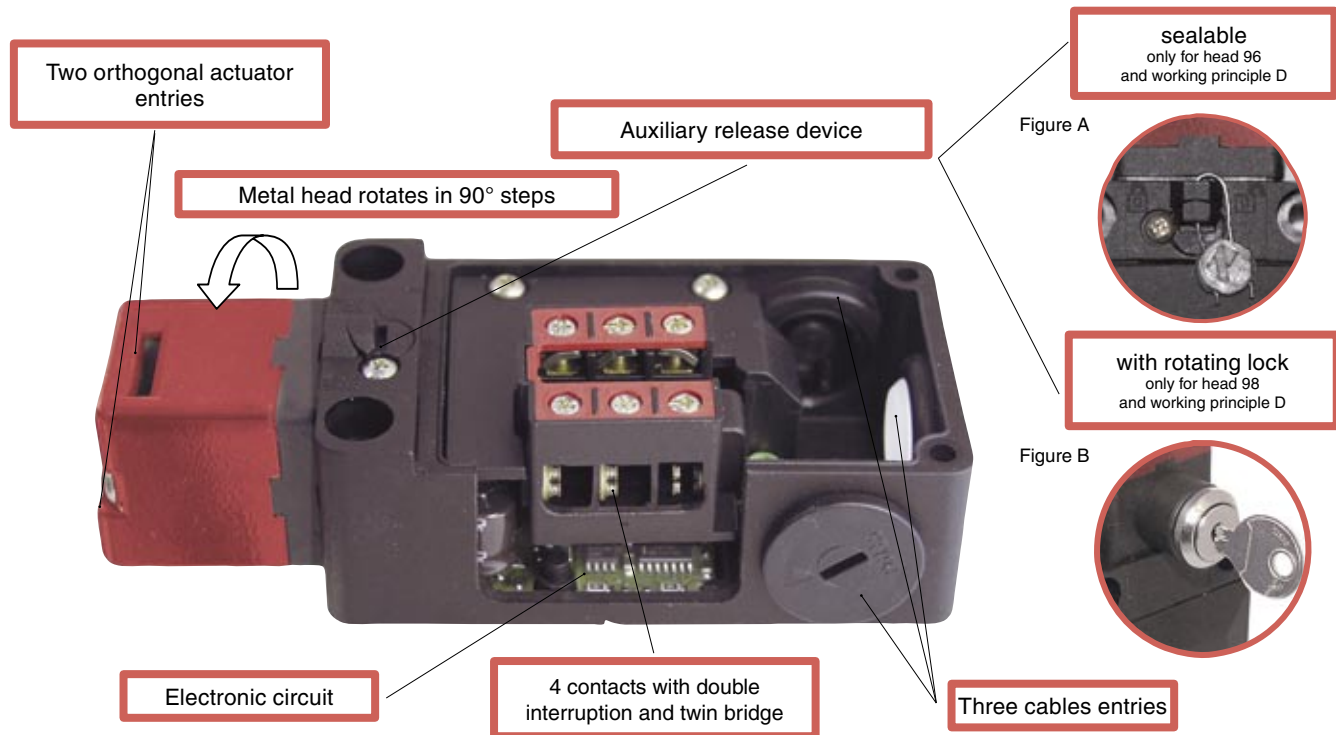
The working principle of these safety switches allows three different working states:

**state A**: with the actuator inserted and blocked by the solenoid

**state B**: with the actuator inserted but not blocked

**state C**: with the actuator extracted

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 blocked with de-energized solenoid. Actuator release is obtained by power supply to the solenoid (see example of working cycle steps).
- **Working principle E**: Actuator blocked with energized solenoid. The unlock 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.

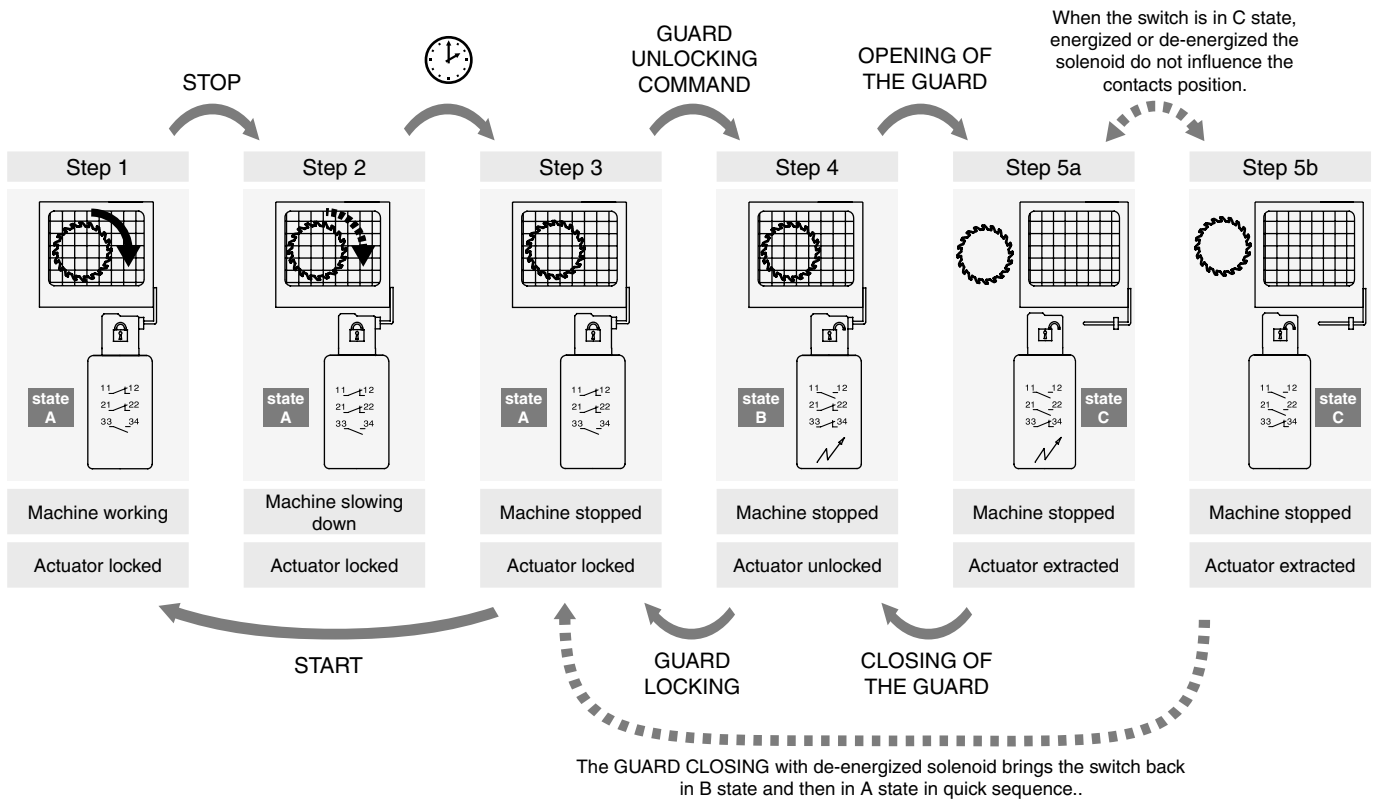
This series of products includes many technical solutions that result flexible on installation and easy working:

- Six different types of stainless steel actuator, suitable to be fixed in several positions and with insertion radius arc equal to or over 80 mm.
- Swinging head, in 90° steps, with two actuator entries for easy installation of the switch.
- To extract the inserted but not blocked actuator, a 30 N force is necessary, that avoids the guard opening because of vibrations or impacts.
- When actuator is locked, it can still move a little (4,5 mm), to avoid that door gaskets keep in traction the actuator on the solenoid.
- Housing with three conduit entries for an easier installation or connection in series.
- Electronic control of the power supply, which allow a wide tolerance on supply voltage. 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.
- No-loosening screws contact blocks, fingers protection, twin bridge contacts and double interruption for a higher contact reliability.

Versions with D working principle are supplied with a sealable auxiliary release device used by technicians during the installation or to access to inside the machine in case of black-out. The release device may be of sealable type (head 96, see figure A) or lock type (head 98, see figure B). In this last case the release device may also be used to allow authorized operators in possession of key to open small protections.

**Attention!** These switches alone are not suitable for applications where operators with key may physically enter the dangerous area, because an eventual closing of the door behind them could restart the machine working. In this case must be used the entry locking device VF KB1 that is visible on page 4/29.

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



## Contacts position in switch states

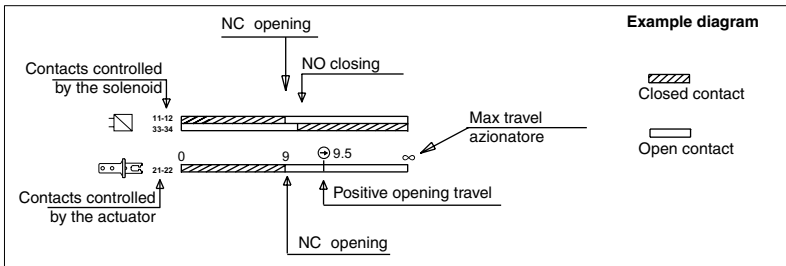
Operation state	Working principle D locked actuator with de-energized solenoid			Working principle E locked actuator with energized solenoid		
	state A	state B	state C	state A	state B	state C
Actuator	Inserted and locked	Inserted and unlocked	Extracted	Inserted and locked	Inserted and unlocked	Extracted
Solenoid	De-energized	Energized	-	Energized	De-energized	-
Contact blocks						
FS 18..... 1NC+1NO controlled by the solenoid						
FS 20..... 2NC+1NO controlled by the solenoid						
FS 21..... 3NC controlled by the solenoid						
FS 28..... 1NO+1NC controlled by the solenoid 1NC controlled by the actuator						
FS 29..... 2NC controlled by the solenoid 1NC controlled by the actuator						
FS 30..... 1NC controlled by the solenoid 2NC controlled by the actuator						

Dimensional drawings

Contacts type: L = slow action	Switch with D working principle, supplied with sealable auxiliary release device and without actuator	Switch with E working principle and without actuator	Switch with D working principle, supplied with lock auxiliary release device and without actuator
<b>18</b> L FS 1896D024 → 1NO+1NC 	<b>18</b> E FS 1896E024 → 1NO+1NC 	<b>18</b> D FS 1898D024 → 1NO+1NC 	
<b>20</b> L FS 2096D024 → 1NO+2NC 	<b>20</b> E FS 2096E024 → 1NO+2NC 	<b>20</b> D FS 2098D024 → 1NO+2NC 	
<b>21</b> L FS 2196D024 → 3NC 	<b>21</b> E FS 2196E024 → 3NC 	<b>21</b> D FS 2198D024 → 3NC 	
<b>28</b> L FS 2896D024 → 1NO+2NC 	<b>28</b> E FS 2896E024 → 1NO+2NC 	<b>28</b> D FS 2898D024 → 1NO+2NC 	
<b>29</b> L FS 2996D024 → 3NC 	<b>29</b> E FS 2996E024 → 3NC 	<b>29</b> D FS 2998D024 → 3NC 	
<b>30</b> L FS 3096D024 → 3NC 	<b>30</b> E FS 3096E024 → 3NC 	<b>30</b> D FS 3098D024 → 3NC 	
Min. force	30 N (40 N →)	30 N (40 N →)	30 N (40 N →)

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 by the lock. In safety applications it is necessary to activate the switch at least up to the positive opening point indicated in the diagrams with the symbol ⊕. Operate the switch at least with the positive opening force, indicated between brackets, below each article, next the value of minimum force.

Accessories

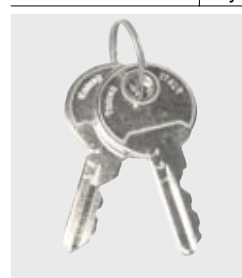
Article	Description	Pack
VF KB1	Actuator entry locking device	1 pc



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. To be used only with FD, FL, FC and FS series with metal heads.



Article	Description	Pack
VF KLA371	Set of 2 locking keys	1 pc

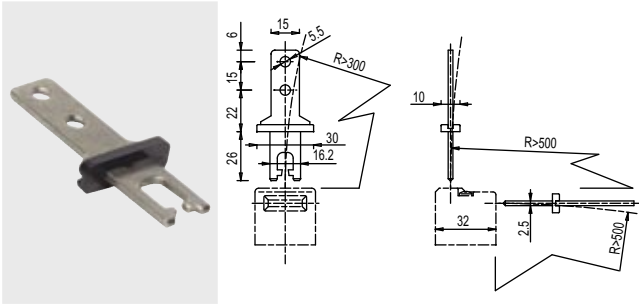


Extra copy of the locking keys, only to be purchased if further keys are needed (standard supply 2 units). All switches keys have the same code. Other codes on request.

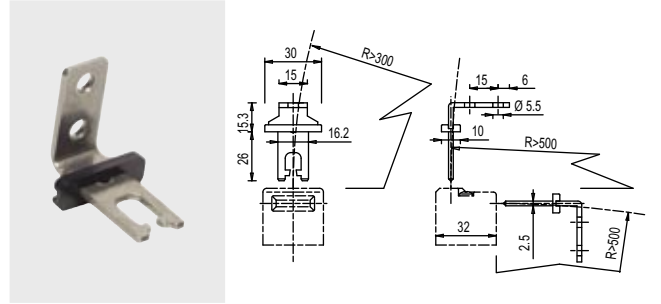
## Stainless steel actuators

**IMPORTANT:** These actuators must be used with FD, FP, FL, FC or FS series only (e.g. FS 1896D024)

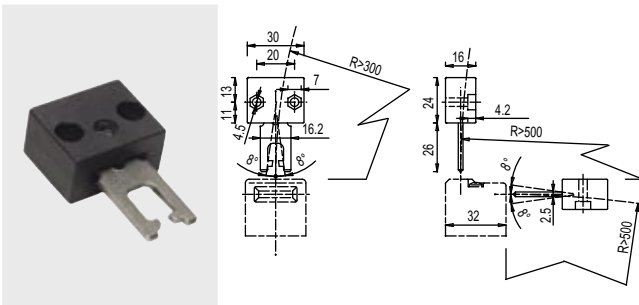
Article	Description	Pack
VF KEYF	Straight actuator	10 pcs



Article	Description	Pack
VF KEYF1	Right-angled actuator	10 pcs

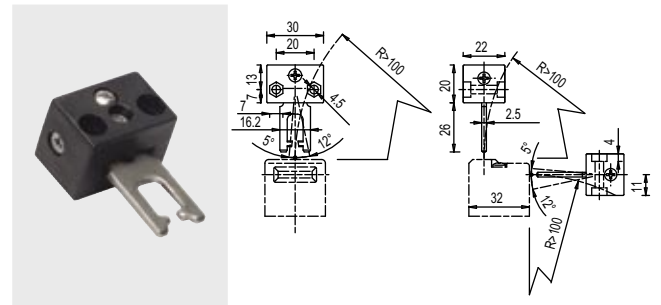


Article	Description	Pack
VF KEYF2	Jointed actuator	10 pcs



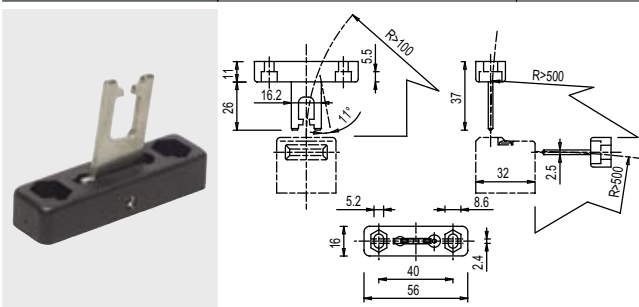
The actuator can flex in four directions for applications where the door alignment is not precise

Article	Description	Pack
VF KEYF3	Jointed actuator adjustable in two directions	10 pcs



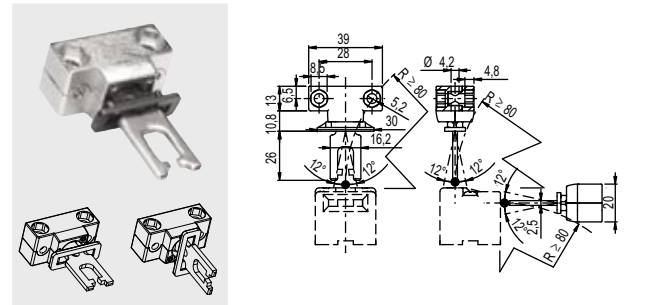
Actuator adjustable in two directions for doors with reduced dimensions.

Article	Description	Pack
VF KEYF7	Jointed actuator adjustable in one direction	10 pcs



Actuator adjustable in one direction for doors with reduced dimensions.

Article	Description	Pack
VF KEYF8	Universal actuator	1 pc



Actuator adjustable in two directions for doors with reduced dimensions. The actuator has two couples of fixing holes and it is possible to rotate the actuator-working plan (see picture).

**Accessories**  
See page 5/1

Items with code on the **green** background are available in stock

## Accessories for sealing



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

Article	Description	Pack
VF FSPB-200	Set of 200 lead seals	1 pc
VF FSPB-10	Set of 10 lead seals	1 pc
Article	Description	Pack
VF FSFI-400	400 m steel wire roll	1 pc
VF FSFI-10	10 m steel wire roll	1 pc
Article	Description	Pack
VF FSPZ	Plier without logo	1 pc