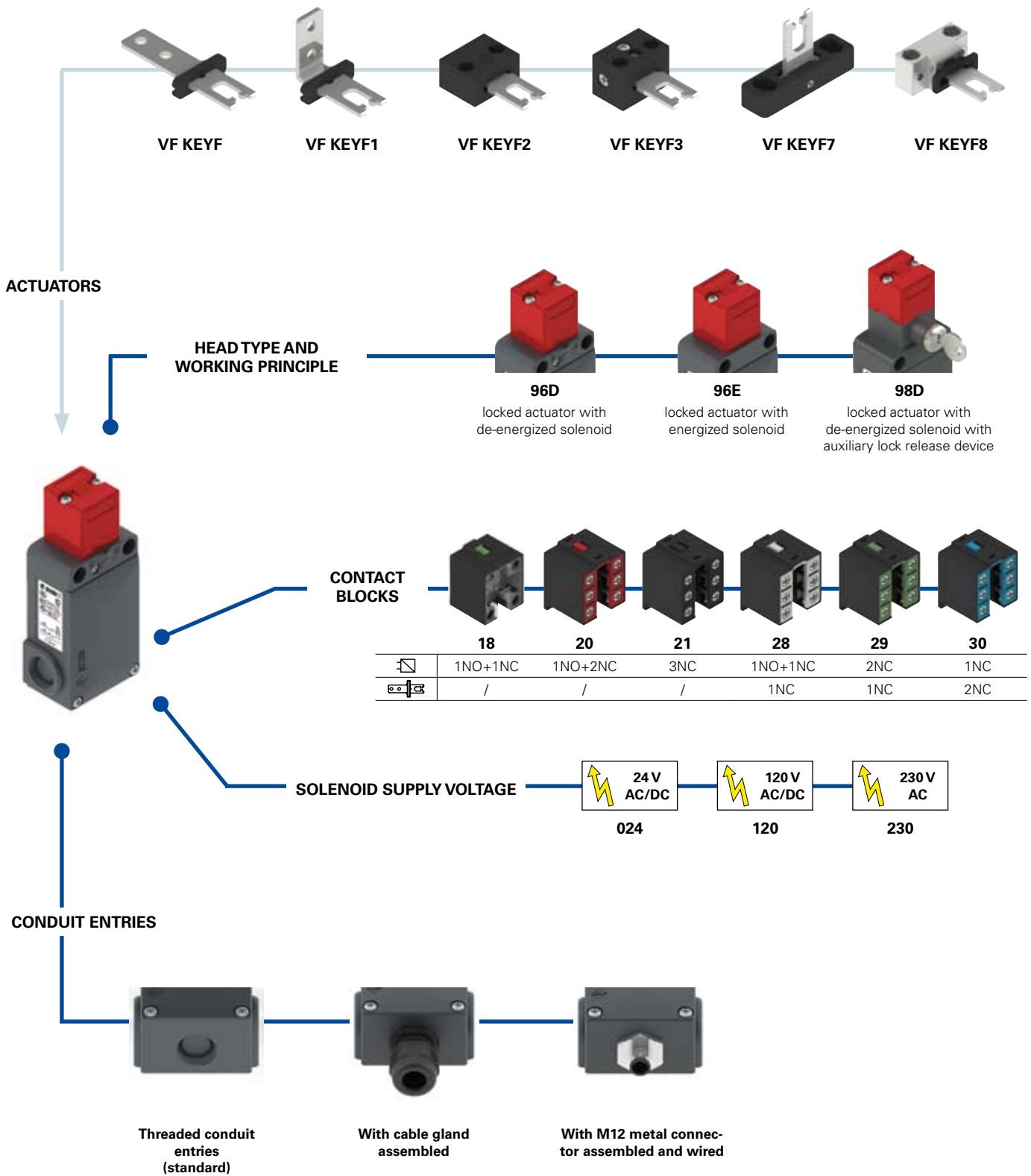


Selection diagram



● 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

**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               |

| 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 assembled 8 poles M12 metal connector                          |
| ...                                    | .....   |

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

| Threaded conduit entry |                    |
|------------------------|--------------------|
|                        | PG 13,5 (standard) |
| <b>M2</b>              | M20x1,5            |

| 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 de-energized solenoid with auxiliary lock release device |

| Contacts type |                                  |
|---------------|----------------------------------|
|               | silver contacts (standard)       |
| <b>G</b>      | silver contacts gold plated 1 µm |

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

| 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 IP67
- 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 CCC:  | 2007010305230011    |
| Approval EZU:  | 1010151             |
| Approval GOST: | POCC IT.AB24.B04512 |

**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:

IP67 according to EN 60529  
with cable gland having equal or higher protection degree (electrical contacts)

#### General data

For safety applications up to SIL 3 / PL e

Safety parameters:

Ambient temperature:

Max actuation frequency:

Mechanical endurance:

Max actuating speed:

Min. actuating speed:

Max holding force:

Max backlash of the actuator:

Actuator extraction force:

Driving torque for installation:

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

see page 7/34

from -25°C to +60°C

600 operations cycles<sup>1</sup>/hour

800.000 operations cycles<sup>1</sup>

0,5 m/s

1 mm/s

1100 N (head 96), 900 N (head 98)

4,5 mm

30 N

see pages 7/1-7/12

#### 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 60947-5-1, EN 60947-5-1, EN 60947-1, IEC 60204-1, EN 60204-1, EN 1088, EN ISO 12100-1, EN ISO 12100-2, IEC 60529, EN 60529, EN 61000-6-2, EN 61000-6-3, NFC 63-140, VDE 0660-200, VDE 0113, BG-GS-ET-15.

#### Approvals:

IEC 60947-5-1, UL 508, GB14048.5-2001.

#### In conformity with requirements requested by:

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

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

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

#### Solenoid

Solenoid duty cycle:

Inrush solenoid power:

100% ED

20 VA 0,1 s (24 V)

18 VA 0,1 s (120 V)

18 VA 0,1 s (230 V)

Steady-state solenoid power:

Average solenoid power:

Solenoid protection 24 V:

Solenoid protection 120 V:

Solenoid protection 230 V:

4 VA

10 VA

fuse 500 mA delayed type,

fuse 315 mA, delayed type

fuse 160 mA, delayed type

**⚠ If not expressly indicated in this chapter, for the right installation and the correct utilization of all articles see requirements indicated from page 7/1 to page 7/12.**

#### Electrical data

#### Utilization categories

|                                    |  |   |                                      |                    |     |     |
|------------------------------------|--|---|--------------------------------------|--------------------|-----|-----|
| without connector                  | Thermal current (I <sub>th</sub> ):                  | 10 A  | Alternate current: AC15 (50...60 Hz) |                    |     |     |
|                                    | Rated insulation voltage (U <sub>i</sub> ):          | 500 Vac 600 Vdc                                     | U <sub>e</sub> (V)                   | 250                | 400 | 500 |
|                                    |  | 400 Vac 500 Vdc (contact blocks 20, 21, 28, 29, 30) | I <sub>e</sub> (A)                   | 6                  | 4   | 1   |
|                                    | Rated impulse withstand voltage (U <sub>imp</sub> ): | 6 kV  | Direct current: DC13                 |                    |     |     |
|                                    |  | 4 kV (contact blocks 20, 21, 28, 29, 30)            | U <sub>e</sub> (V)                   | 24                 | 125 | 250 |
| Conditional short circuit current: | 1000 A according to EN 60947-5-1                     | I <sub>e</sub> (A)                                  | 6                                    | 1,1                | 0,4 |     |
| Protection against short circuits: | fuse 10 A 500 V type aM                              |   |                                      |                    |     |     |
| Pollution degree:                  | 3  |   |                                      |                    |     |     |
| with 8 poles M12 connector         | Thermal current (I <sub>th</sub> ):                  | 2 A   | Alternate current: AC15 (50...60 Hz) |                    |     |     |
|                                    | Rated insulation voltage (U <sub>i</sub> ):          | 30 Vac 36 Vdc                                       | U <sub>e</sub> (V)                   | 24                 |     |     |
|                                    |  | Protection against short circuits:                  | fuse 2 A 500 V type gG               | I <sub>e</sub> (A) | 2   |     |
|                                    | Pollution degree:                                    | 3   | Direct current: DC13                 |                    |     |     |
|                                    |  |   | U <sub>e</sub> (V)                   | 24                 |     |     |
|                                    |  | I <sub>e</sub> (A)                                  | 2                                    |                    |     |     |



### Data type approved by IMQ, CCC 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

Rated impulse withstand voltage (U<sub>imp</sub>): 6 kV  
4 kV (for contact blocks 20, 21, 28, 29, 30)

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: EN 60947-1, EN 60947-5-1+ A1:2009, fundamental requirements of the Low Voltage Directive 2006/95/CE.

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

### 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

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 (0.8 Nm).

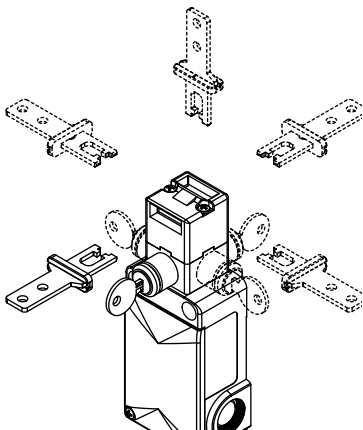
In conformity with standard: UL 508

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

### Description

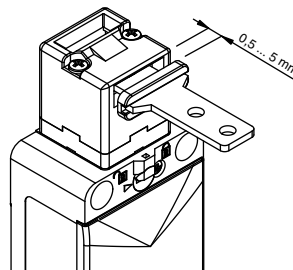
These switches are used on machines where the hazardous conditions remain for a while, even after the machine has been switched off, for example because of mechanical inertia of pulleys, saw disks, parts under pressure or with high temperatures. They can also be used when it is necessary to control machine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

### Rotating head and release device



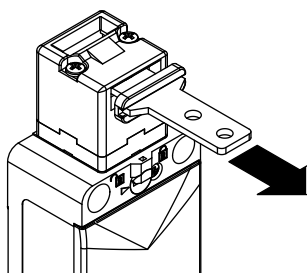
The head can be quickly rotated on each of the 4 sides of the switch by unfastening the two fixing screws. The mechanical lock release device can be rotated in 90° steps as well. This enables the switch to assume 32 different configurations.

### Actuator regulation zone



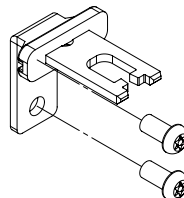
This switch has a wide backlash of the actuator into the head (4,5 mm) to avoid that door gaskets keep in traction the actuator on the solenoid. With closed door, check that the actuator doesn't knock straight against the head of the switch; it must be in the adjustment zone (0,5...5 mm)

### Actuator holding force



Thanks to recent mechanical improvement the strong interlocking system guarantees a maximum actuator holding force of 1100 N (head 96).

### Safety screws for actuators



These new screws have tamper-resistant Torx buttonheads. Devices fixed with this kind of screws cannot be removed or tampered by common tools. See accessories page 6/5.

### 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.

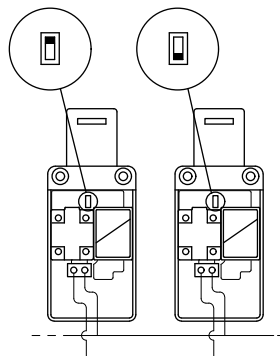
Do not use where explosive or inflammable gas is present.

Use Atex products in environments with explosion hazard (see page 2/137).

### 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 switch body.
- 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.





## Description

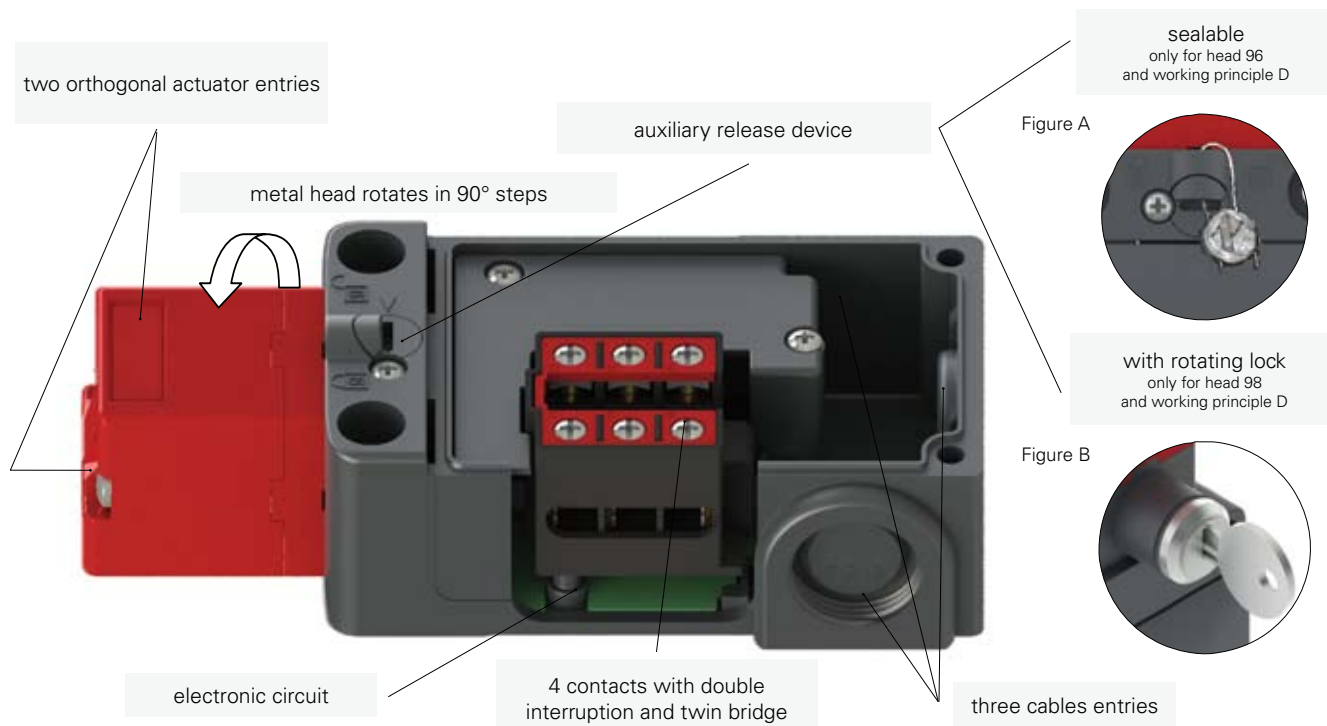
The working principle of these safety switches allows three different working states:

**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:

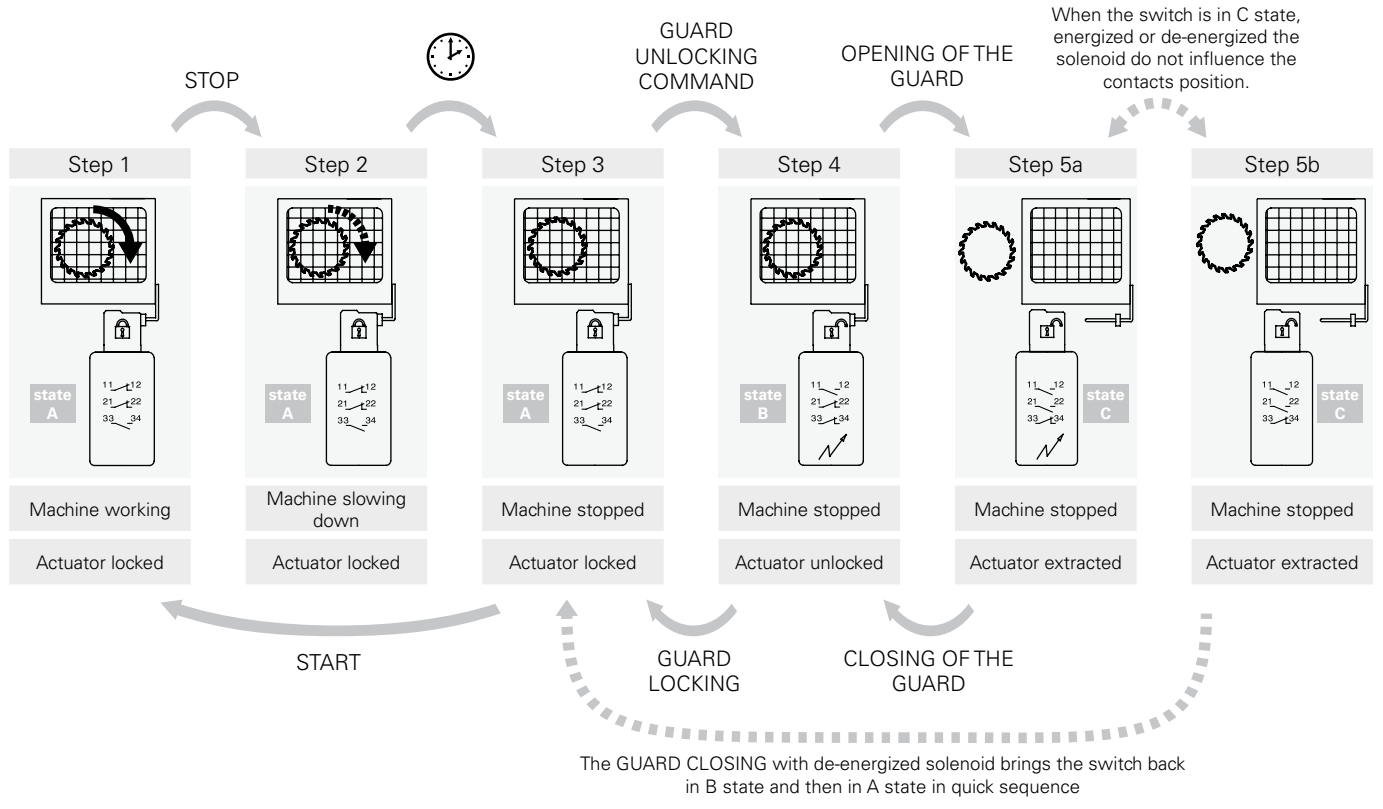
- Six different types of stainless steel actuator, suitable to be fixed in several positions and with insertion radius arc equal to or over 80 mm.
- Swinging head, in 90° steps, with two actuator entries for easy installation of the switch.
- To extract the inserted but not blocked actuator, a 30 N force 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-loosing 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 4/95.



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



**Contacts position in switch states**

| Operation state | Working principle D<br>locked actuator with de-energized solenoid |                       |           | Working principle E<br>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          | -         |

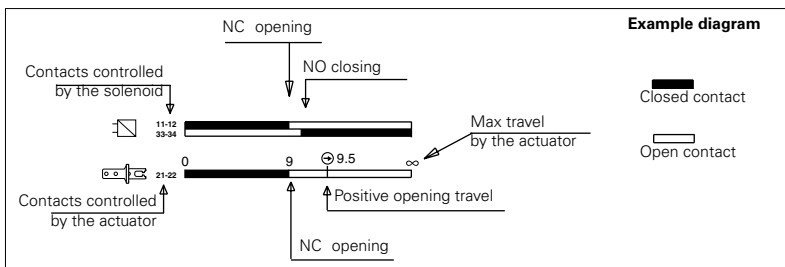
|  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|
| FS 18.....<br>1NC+1NO controlled by the solenoid                                   |  |  |  |  |  |  |
| FS 20.....<br>2NC+1NO controlled by the solenoid                                   |  |  |  |  |  |  |
| FS 21.....<br>3NC controlled by the solenoid                                       |  |  |  |  |  |  |
| FS 28.....<br>1NO+1NC controlled by the solenoid<br>1NC controlled by the actuator |  |  |  |  |  |  |
| FS 29.....<br>2NC controlled by the solenoid<br>1NC controlled by the actuator     |  |  |  |  |  |  |
| FS 30.....<br>1NC controlled by the solenoid<br>2NC controlled by the actuator     |  |  |  |  |  |  |

## Dimensional drawings

| Contacts type:    |     | D working principle, supplied with sealable auxiliary release device and without actuator | E working principle and without actuator | D working principle, supplied with lock auxiliary release device and without actuator |
|-------------------|-----|---|--|---|
| [L] = slow action |     |   |  |   |
| Contact blocks    |     |   |  |   |
| 18                | [L] | FS 1896D024 → 1NO+1NC   | FS 1896E024 → 1NO+1NC                    | FS 1898D024 → 1NO+1NC   |
|                   |     |   |  |   |
| 20                | [L] | FS 2096D024 → 1NO+2NC   | FS 2096E024 → 1NO+2NC                    | FS 2098D024 → 1NO+2NC   |
|                   |     |   |  |   |
| 21                | [L] | FS 2196D024 → 3NC   | FS 2196E024 → 3NC                        | FS 2198D024 → 3NC   |
|                   |     |   |  |   |
| 28                | [L] | FS 2896D024 → 1NO+2NC   | FS 2896E024 → 1NO+2NC                    | FS 2898D024 → 1NO+2NC   |
|                   |     |   |  |   |
| 29                | [L] | FS 2996D024 → 3NC   | FS 2996E024 → 3NC                        | FS 2998D024 → 3NC   |
|                   |     |   |  |   |
| 30                | [L] | FS 3096D024 → 3NC   | FS 3096E024 → 3NC                        | 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   |
|---------|---|
| 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. It cannot be used for switches with plastic heads. Padlocks diameter holes 9 mm |
|         |   |

| Article   | Description  |
|-----------|--|
| VF KLA371 | Set of 2 locking keys  |
|           | Extra copy of the locking keys to be purchased if further keys are needed (standard supply 2 units). All switches keys have the same code. Other codes on request. |

Accessories See page 6/1

All measures in the drawings are in mm



### Stainless steel actuators

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

| Article        | Description       |
|----------------|-------------------|
| <b>VF KEYF</b> | Straight actuator |

| Article         | Description           |
|-----------------|-----------------------|
| <b>VF KEYF1</b> | Right-angled actuator |

| Article         | Description      |
|-----------------|------------------|
| <b>VF KEYF2</b> | Jointed actuator |

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

| Article         | Description                                   |
|-----------------|---|
| <b>VF KEYF3</b> | Jointed actuator adjustable in two directions |

Actuator adjustable in two directions for doors with reduced dimensions.

| Article         | Description                                  |
|-----------------|--|
| <b>VF KEYF7</b> | Jointed actuator adjustable in one direction |

Actuator adjustable in one direction for doors with reduced dimensions.

| Article         | Description        |
|-----------------|--------------------|
| <b>VF KEYF8</b> | Universal actuator |

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 | Set of 200 lead seals |
| VF FSPB-10  | Set of 10 lead seals  |

| Article     | Description           |
|-------------|-----------------------|
| VF FSFI-400 | 400 m steel wire roll |
| VF FSFI-10  | 10 m steel wire roll  |

| Article | Description        |
|---------|--------------------|
| VF FSPZ | Plier without logo |

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

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