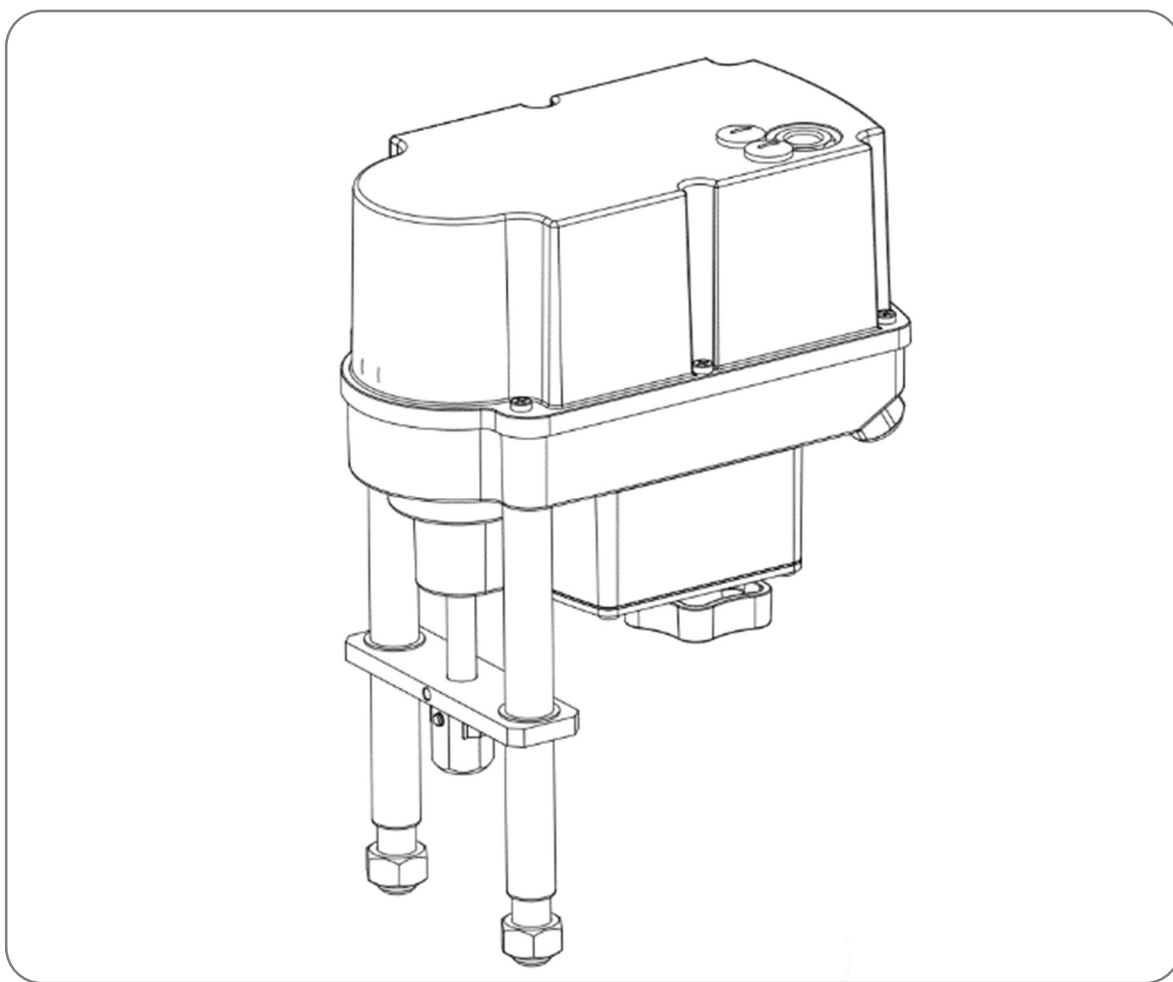


Operating Instructions



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1. Product description

The actuator PSF-M-EX is an industrial, multifunctional modulating actuator with fail-safe function for the operation of industrial valves of various types across a wide range of applications. The actuator is designed for assembly with valves and their motor operation.

It is used as an electric valve actuator in hazardous areas of

Ex zone 1, Ex d e, device protection level Gb or

Ex zone 21, device protection level Db installed in a fixed position using mounting columns.

An operating status (LED in Ex d motor assembly housing) can be displayed through an inspection glass in the hood. The actuator can be operated by 2 push buttons in the cover (the micro switches for this are likewise located in the Ex d housing).

Programming of the control (DIP switches) is possible in the **safe range** or in a voltage-free state. For this purpose, the hood is detached and the fastening screws in the Ex d housing are removed.

To protect against environmental influences, the cover and lower section are powder-coated.

Conduit entries are available in the lower section of the housing for inserting the electrical cables.

The construction, as well as the interaction of the individual components and the housing regarding their suitability for use in hazardous areas, are tested by PS Automation GmbH and confirmed by the identification with the type label.

The actuator PSF-M-EX essentially consists of:

- the two mounting columns
- the drive shaft and
- the housing section
- the mechanical section (multi-stage spur gear) is located in the lower section of the housing (mounting plate)
- the Ex e/t terminal compartment is located in the upper section of the housing (underneath the cover hood), this is formed by the hood and the upper side of the lower housing section (mounting plate)
- with conduit entries
- with connection panel for the electrical connections (electrical connection compartment)
- with Ex d motor control housing

2. Applicable standards

IEC 60079-0:2017/General requirements

IEC 60079-7:2015/Increased safety "e"

IEC 60079-31:2013/Protection by housing "t"

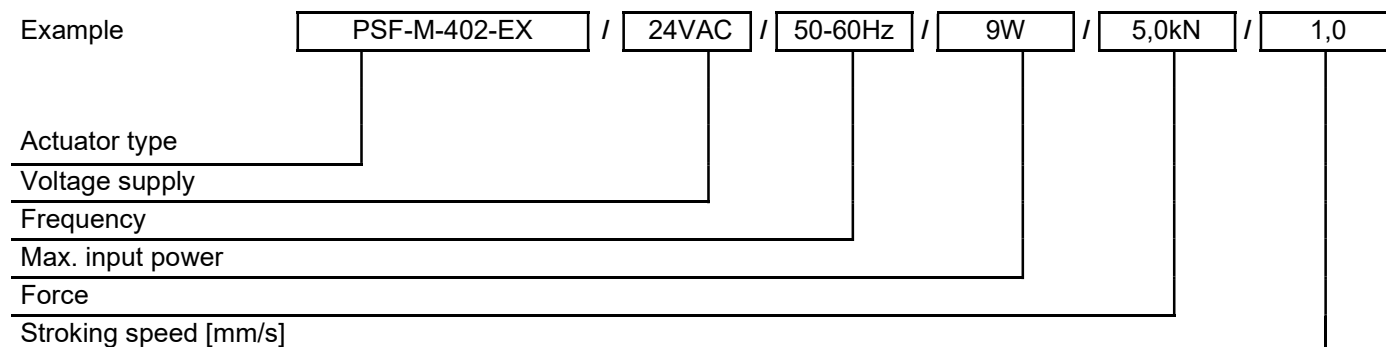
IEC 60079-1:2014/Flameproof enclosure "d"

3. Key figures

Certificate No.	IECEX TPS 22.0019X
Ex marking	Ex db eb IIC T6 Gb or Ex db eb IIC T4 Gb or rather Ex tb IIIC T80 °C Db or Ex tb IIIC T100 °C Db
Size (electrical section)	approx. 240 x 135 x 181 mm (WxLxH) (Ex e/Ex t housing)
Actuating power	Depending on variant
Operating time	0.5 - 1.0 mm/s
Stroke	40 mm-50 mm
Nominal voltage	24VAC/DC, 100-240VAC
Nominal current	maximum 1.8A AC / 1.1A DC
Backup fuse (only for 100 - 240VAC power supply unit, installed in power supply unit)	2AT 230VAC
External housing material	GD-ALSi9Cu3 (EX eb/tb housing) Die cast
Surface treatment	Powder-coated, permissible total coating thickness ≤ 500µm (incl. type label)
Ambient temperature range extended	-10 °C ≤ Ta ≤ +40 °C -10 °C ≤ Ta ≤ +60 °C
Temperature class	T6 (at Ta +40 °C) /T4 (at Ta +60 °C)
Max. surface temperature	80 °C (at Ta +40 °C) / 100 °C (at Ta +60 °C)
IP protection class	≥IP64

3.1 Type code

PSF-****.*-*-EX



4. Symbols used and safety

General dangers in case of non-observance of the safety instructions

The PSF-M-EX actuators are built according to the latest state of the art and are operationally safe. Nevertheless, hazards can arise from the actuators if they are not used by trained or at least instructed personnel and/or are used improperly or for purposes other than those for which they are intended.

This threatens, for example

- Danger to life and limb of the user or third parties,
- Dangers to the user's property,
- Impairment of safety and function of the actuator.

It must be ensured that every person in charge of the installation, commissioning, operation, maintenance and repair of the actuators has read and understood these operating instructions and this chapter in particular.

Safety-conscious work

- The actuators may only be operated by trained and authorised operating personnel.
- The safety instructions listed in this manual, the existing national regulations for accident prevention, as well as any internal working, operating and safety instructions of the operator must be observed.
- The isolating procedures specified in the operating instructions must be observed for all work such as installation, commissioning, set-up, operation, changes in operating conditions and operating methods as well as maintenance, inspection and repair.
- Before working on potentially live areas, ensure that they are free of voltage.
- Observe IEC 60079-14 when installing the actuators.
- It must be ensured that the actuators are always operated in perfect condition. Externally visible damage and defects, as well as changes in the operating behaviour which may affect safety, must be reported immediately.

Notice of hazards

The following hazard symbols are used in these instructions:



Attention! There are general hazards that can lead to property and/or personal injury.



Caution! Life threatening electrical voltages may be present!



Danger! This symbol warns of an imminent danger to the health of persons. Failure to follow these notices may result in injury.



Attention! Observe handling instructions. Electrostatic sensitive components.

Further instructions

- During maintenance, inspection and repair directly after operation, increased surface temperatures on the motor housing are to be expected. Danger of burns!
- Visible dust deposits must be removed immediately!
- The hood may only be opened in an explosion-free environment! When working in hazardous areas, the European standards IEC 60079-14 "Erection of electrical installations in potentially explosive atmospheres" and IEC 60079-17 "Testing and maintenance of electrical installations in potentially explosive atmospheres" must be observed.
- When upgrading and operating the actuator with PS accessories, the operating instructions available for them must be observed.
- Connections for the signal inputs and outputs are separated from the circuits that are dangerous to touch by double insulation.

5. Intended use

- The type PSF-M-EX actuator is a fixed installed device for use in Ex zone 1, 2, 21 or 22. The type PSF-M-EX actuator is not suitable for use in Zone 0 and Zone 20.
- The electrical data shown on the type plate as well as the device category for the place of use must be observed.
- The operator of an electrical system in a potentially explosive environment must keep the equipment in proper condition, operate it properly, monitor it and carry out maintenance and repair work.
See also IEC 60079-17/IEC 60079-19.
- The PSF-M-EX actuators are constructed exclusively for use as electronic valve actuators. They are designed for assembly with valves and their motorised operation.
- Any use other than this is considered unintended use. The manufacturer is not liable for damage resulting from this.
- The actuators shall not be used outside the limit values cited in the data sheet, catalogue and/or order documentation. Infringement negates all liability on the part of the manufacturer for any resultant damages.
- Proper intended use also includes compliance with the operating, maintenance and repair conditions from the manufacturer.
- Mounting and adjustment of the actuator as well as its maintenance are not considered as intended use. Enhanced safety precautions must be implemented in such situations!

- Assembly/disassembly, operating and maintenance work may only be carried out by suitable skilled personnel familiar with the work. All generally applicable legal regulations and other binding guidelines for work safety, accident prevention and environmental protection must be complied with.
- Unauthorised modifications to the actuators negate all liability on the part of the manufacturer for any resultant damages.

5.1 Special conditions

- To avoid critical electrostatic charges,
 - the devices must not be installed in the vicinity of highly charge-generating processes.
 - the devices are only cleaned with damp or antistatic fabric.
- The length of the flameproof joints is partly larger and the distances of the flameproof joints is partly smaller than the values of table 3 for IIC of IEC 60079-1:2014. Information regarding the dimensions of the flameproof joints can be obtained from the manufacturer.
- The fastening screws of flameproof enclosure parts must have a yield strength of at least 640 N/mm².

6. Storage

The following points must be observed for proper storage:

- Store only in well-ventilated, dry rooms.
- Store on a rack, on wooden pallet or similar to protect from ground moisture.
- Cover to protect from dust and dirt.
- Protect actuators from mechanical damage.

7. Operating conditions and installation

- When setting up and operating explosion-protected electrical equipment, care must be taken to ensure protection against harmful environmental influences that restrict the intended use of the equipment. These can be, for example, protection against aggressive liquids or climatic influences. During installation, observe IEC 60079-14 and other applicable national standards and regulations at the place of installation.
- The information on the type plate and the applicable documents must be taken into consideration. For cable entries with special installation conditions, (see "X" marking on the cable entry), the relevant instructions given by the manufacturer must be followed.
- The actuators can be operated in the IECEx version at ambient temperatures according to the data sheet.
- The duty cycles are according to IEC 60034-1, 8: S2 for short-time duty and S4 for modulating operation (for actuator-specific values, see actuator-specific data sheets).
- For protection against humidity and dust, the actuators are designed according to EN 60529 with protection class IP65.

Installation

- The conductor must be connected carefully at the terminal points so that the individual wires are not damaged. The maximum connection data on the type plate and the applicable documents must be taken into consideration.
- The device must be integrated into a suitable earthing or equipotential bonding system before commissioning, a connection part (4 mm²) is available for this purpose on the underside of the actuator. The effectiveness must be checked before initial commissioning.
- The actuators must be installed with sufficient clearance to remove the hood (Figure 1).
- The mounting position is arbitrary with the exception of “hood downwards” (Figure 2).

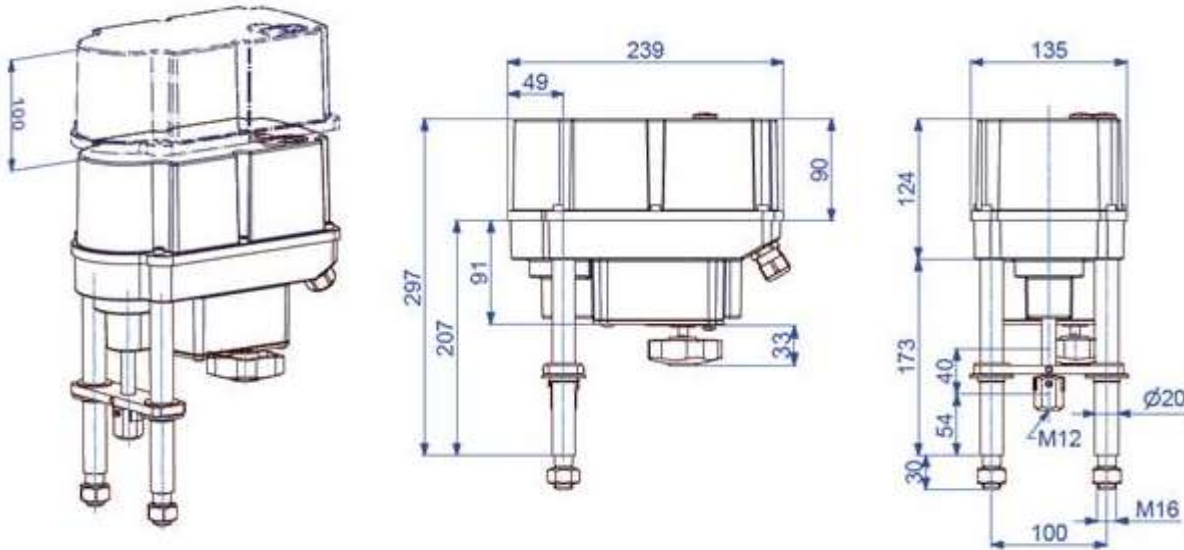


Figure 1: Installation dimensions

Mounting positions

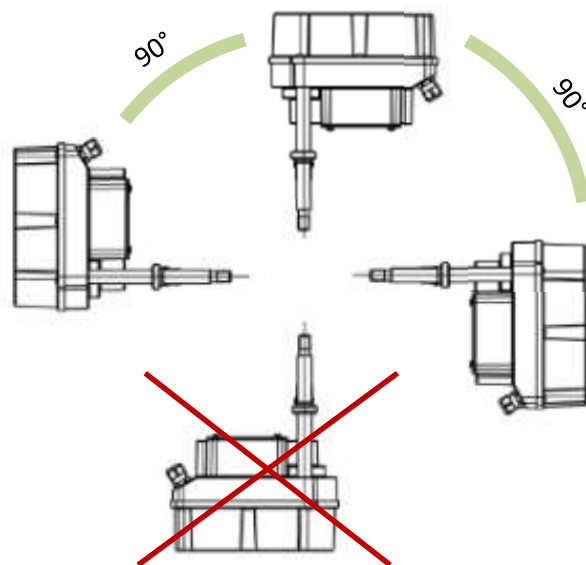


Figure 2: Mounting position

8. Manual override and setting of the DIP switches

8.1 Setting the actuators during commissioning (hood open)

When commissioning the actuators, the hood must be opened. The hood may only be opened in non-hazardous areas and only in a dry environment (see chapter 10 for instructions).

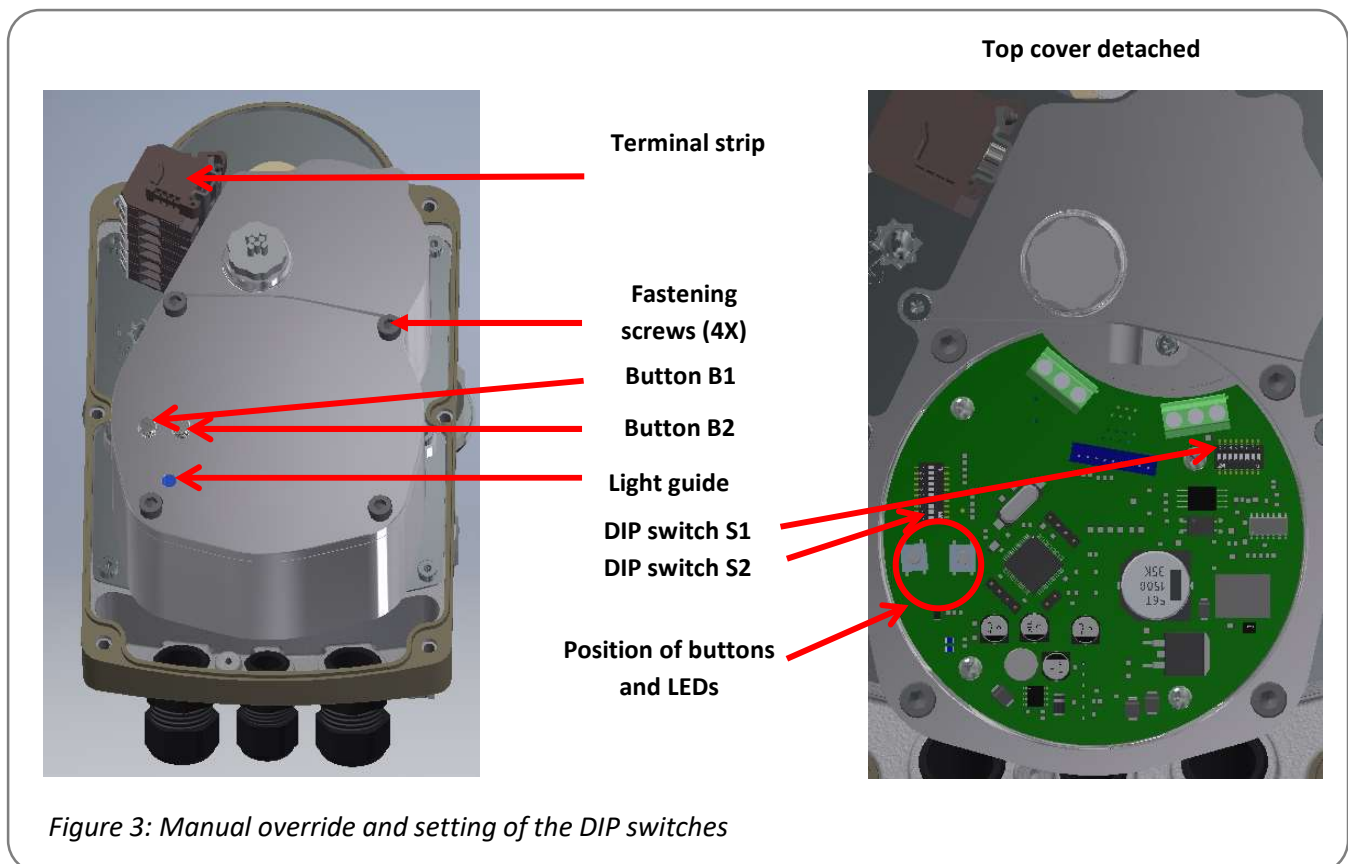
To actuate the actuator during setting work (valve assembly and end position setting), an electrical manual override by means of a push button is available (for operation, see chapter 12.2).

Programming of the control (DIP switch) is possible in voltage-free state (see chapter 12.1). To do this, first loosen 4 fastening screws of the upper cover of the Ex d control housing, then the upper cover can be removed from the Ex d control housing. The upper cover of the Ex d control housing must not be damaged in the area of the joint gap when removing it.

The top cover of the Ex d control housing must be installed considering the position of the push button and the light guide (see figure 3). The tightening torque for the Ex d cover screws is **6 Nm, minimum quality of the screws 8.8. (corrosion resistant)**.

The operating status (status display LED in the Ex d control housing) is indicated by a light guide in the Ex housing (see chapter 12.3).

The electrical connection of the actuators is made via the terminal strip. The wiring diagram must be observed (see chapter 11.2).



8.2 Setting the actuators during operation (hood closed)

To actuate the actuator during setting work in potentially explosive atmospheres (end position setting), an electrical manual override by means of a push button is provided in the hood (for conditions see chapter 12.2).

To reach the manual override, the screw plugs must be opened.

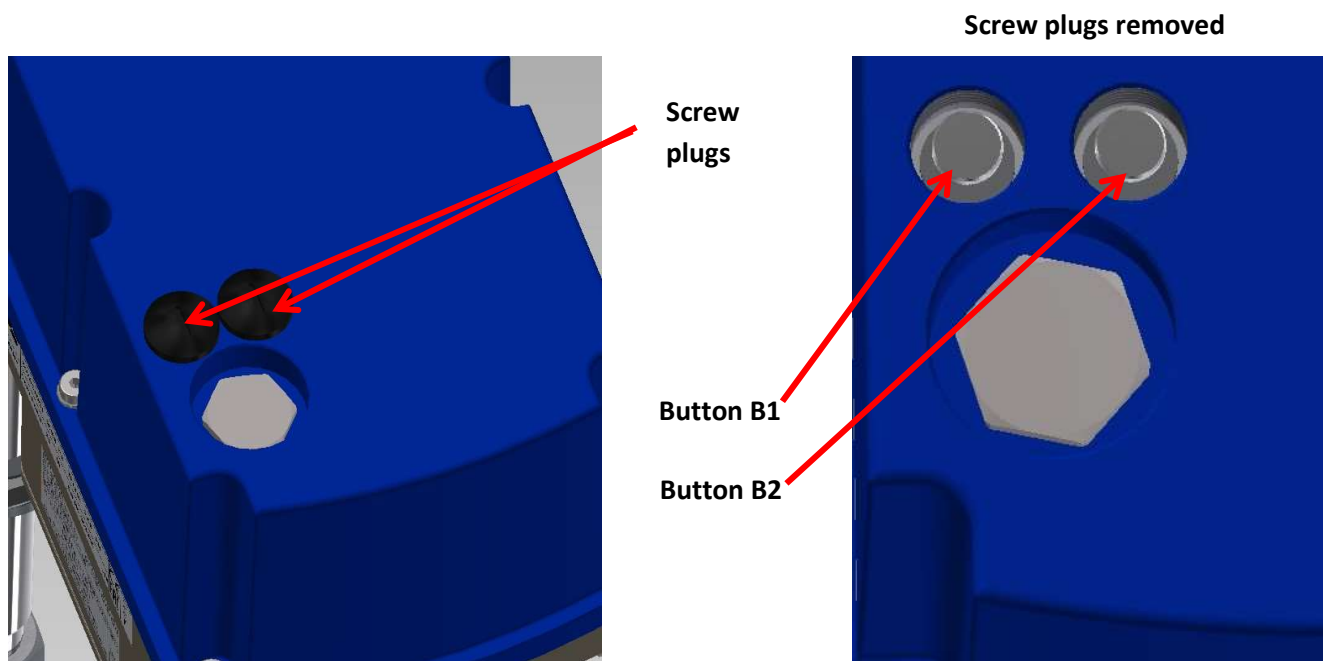


Figure 4: Manual override for setting work in potentially explosive atmospheres

9. Valve mounting

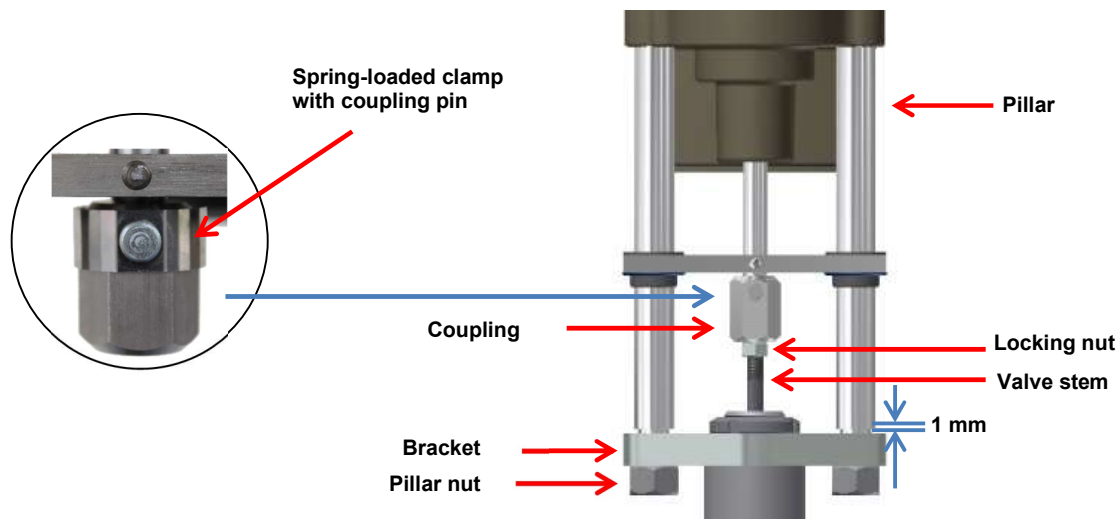


Figure 5: Valve mounting

9.1 Valve mounting for cut-off by force at extended actuator stem

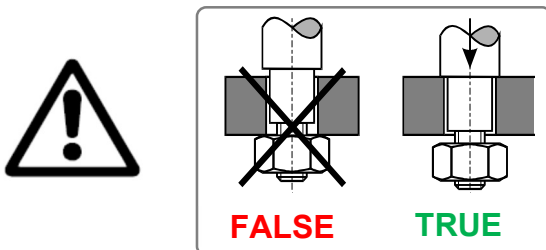
Initial position: Valve stem is retracted, actuator stem is extended

1. Put actuator onto the bracket.
2. Remove the coupling pin and screw the coupling 13 mm on the valve stem. There must be a 1 mm gap between the pillars and the bracket.
3. Insert the spring clamp with the coupling pin again and fix the locking nut.
4. Connect the actuator to electric supply.
5. Retract the actuator spindle manually until the edges of the pillars rest on the bracket.
6. Screw and tighten the pillar nuts.

9.2 Valve mounting for cut-off by force at retracted actuator stem

Initial position: Valve stem is extended, actuator stem is retracted

1. Put actuator onto the bracket, screw on the pillar nuts and tighten.
2. Remove the coupling pin and screw the coupling 13 mm on the valve stem. There must be a 1 mm gap between the pillars and the bracket.
3. Connect the actuator either by means of a handwheel or electrically (see chapter 11.) and retract the actuator by means of manual operation (see chapter 12.6) until the spring-loaded clamp with coupling pin can be re-inserted.



Before tightening the fastening nuts, the pillars must be seated on the valve bracket. If necessary, correct the position of the actuator via the manual override. In case of non-compliance: Damage to the actuator!

10. Opening and closing the hood

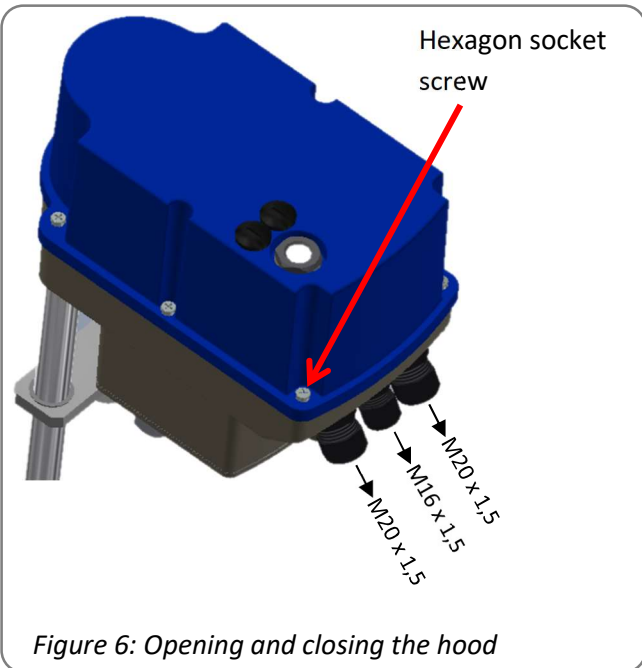


The hood may only be opened in non-hazardous areas and only in a dry environment.



Take appropriate ESD handling precautions before opening the housing:

- Earth the actuator.
- Touch earthed housing parts before opening the hood.



Opening:

First loosen all screws with a suitable screwdriver, then unscrew them completely from the gearbox housing. The screws are loss-proof. Remove the hood carefully so as not to damage the seal.

Closing:

Place the cover on the gearbox housing and press lightly. Lightly tighten all the screws, then tighten them crosswise. It must be ensured that all screws are firmly tightened to guarantee protection against ingress of water and dust in accordance with EN 60529 to IP65. **The tightening torque for the Ex e/t hood is 3 Nm.**

11. Electric supply

11.1 Safety instructions



During the connection of the mains voltage, this must be disconnected and secured against unintended reactivation.

The actuator hood must be opened for the electrical connection (see chapter 10).

The mains connection cables must be designed for the nominal current of the actuator.

Yellow-green coloured wiring shall be used **only** for connecting the protective earth connections.

The cable entry options (cable glands) on the actuator side are located on the lower part of the housing.

For this purpose,

- 2x M20 x 1.5

- 1x M16 x 1.5

are available for feeding through the cables from the outside to the inside (see chapter 10).

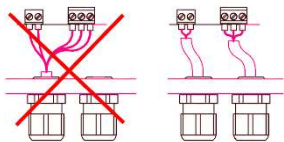
When guiding the cables through the cable glands, take the maximum bending radius of the cables into account.

Unused entries must be closed by suitable blanking elements.

As the PSF-M-EX electrical actuators do not have an internal electrical disconnect device available, a switch or circuit breaker must be provided in the building installation. This must be located in the vicinity of the device, easily accessible to the operator and must be identified as a disconnect device for the device.

The building installation must provide over-current protection devices according to DIN VDE 0100-430 / IEC 60364-4-43. Protective measures against electric shock must be implemented in accordance with DIN VDE 0100-410 / IEC 60364-4-41 for the connection of actuators of protection class I or protection class III at 24 VAC / 24 VDC.

The connection to the terminal block is specified by the manufacturer. The stripping length of the cables is 8 mm and the tightening torque on the terminal block must be min. 0.6 Nm and max. 0.8 Nm.



All mains connection lines and control lines must be mechanically secured ahead of the terminals with suitable measures to prevent unintentional loosening.

Mains connection lines and control lines shall not be routed together in one line but rather two separated lines shall be used in all situations!

11.2 Connection diagram

Figure 7 shows the electrical connection for standard drives. The wiring diagram in the actuator is binding for the connection. For the connection of optional accessories, please refer to the respective operating instructions.

24 VAC/DC

GND	Set Value	Feedback	L/+ OPEN	N/-	L/+ CLOSE	24VAC/DC Power Supply
8	7	6	5	4	3	N/- 2
						L/+ 1



100-240 VAC

GND	Set Value	Feedback	L/+ OPEN	N/-	L/+ CLOSE	100-240VAC Power Supply
8	7	6	5	4	3	N 2
						L 1



Figure 7: Electrical connection

Figure 8: Connection for potential equalisation



PE earth connection has to be connected to gear casing at  !

The connection for equipotential bonding is made at the external equipotential bonding connection of the actuator.

Ensure that all connecting cables are stripped to the correct length so that they are protected against electric shock.

12. Display and functions

12.1 DIP switches

S1 Function	1	2	3	4	5	6	7	8
Signal	Set value				Position feedback			
Voltage	On	On	Off	Off	Off	On	Off	On
Current	Off	Off	On	On	On	Off	On	Off

S2 function	1	2	3 ¹⁾	4 ¹⁾	5	6	7	8	9 ¹⁾	10
Control via set value						On				
Control via binary inputs						Off				
Extend valve stem with increasing set value					On					
Retract valve stem with increasing set value					Off					
Automatic commissioning	Closing with force / opening with force			On	On				Off	
	Closing with force / opening with stroke			On	On				On	
	Closing with force / opening with 20 mm stroke			On	Off				x	
	Closing with force / opening with 30 mm stroke			Off	On				x	
	Closing with force / opening with 40 mm or 50 mm stroke (PSF-M405-EX)			Off	Off				x	
Manual commissioning	Closing with force / opening with required stroke			On	On				On	
Set value range / feedback signal: 0-10 V / 0-20 mA			On				On	On		
Set value range / feedback signal: 2-10 V / 4-20 mA			Off				On	On		
Set value/split range 5-10 V/10-20 mA			On				On	Off		
Set value/split range 6-10 V/12-20 mA			Off				On	Off		
Set value/split range 0-5 V/0-10 mA			On				Off	On		
Set value/split range 2-6 V/4-12 mA			Off				Off	On		
Cut-off by force with valve stem extended		On								
Cut-off by force with valve stem retracted		Off								
LINEAR valve curve set value/position										Off
QUICK OPENING valve curve set value/position										On

¹⁾ When changing switches S2-3 and S2-4, a new calibration must be carried out so that this new operating mode becomes effective!

12.2 Operating buttons

Function	Action	Button B1	Button B2	LED sequence
Manual operation	Activate	Press for > 3 sec.	Press for > 3 sec.	Both LEDs flash alternately
	Retract valve stem	Press		Green LED flashes
	Extend valve stem		Press	Red LED flashes
	Stop			Both LEDs flash alternately
	Exit	Press for > 3 sec.	Press for > 3 sec.	Red or green LED lights up
Automatic commissioning	Start		Press for > 7 sec.	Both LEDs light up
	Calibration ended			Green LED flashes 7x (when calibration is complete), Green LED flashes rapidly (if calibration fails)
	Exit	Press once		Red or green LED lights up
Manual commissioning	Activate	Press for > 7 sec.		Both LEDs flash alternately
	Retract valve stem	Press		Green LED flashes
	Extend valve stem		Press	Red LED flashes
	Start	Press for > 3 sec.	Press for > 3 sec.	Both LEDs light up
	Exit	Press once		Red or green LED lights up
Operating speed	Set up ¹⁾		Press for > 4 sec.	Red LED flashes, green LED lights up / 100% 3x 75% 2x 50% 1x
	Change		Press once to change a level	Red LED flashes, green LED lights up / 100% 3x 75% 2x 50% 1x
	Adopt	Press once		

¹⁾ If no further action is taken, the actuator automatically exits this setting function after 15 sec. and does not change the setting.

12.3 Status display

	Green LED	Red LED
Actuator not calibrated	Off	Flashes rapidly
Normal operation / actuator moves	On	Off
Normal operation / actuator stationary	Off	On
Manual mode active	Flashes alternately	Flashes alternately
Manual mode: Valve stem is extended	Off	Flashes
Manual mode: Valve stem is retracted	Flashes	Off
Automatic commissioning running	On	On
Automatic and manual commissioning successful	Flashes 7 x - 1.5 sec. off	On
Automatic commissioning failed	Flashes rapidly	On
Over-voltage	Flashes 1 x - 1.5 sec. off	On
Under-voltage	Flashes 2 x - 1.5 sec. off	On
Memory error	Flashes 3 x - 1.5 sec. off	On
Set value error (< 1 V, < 2 mA)	Flashes 4 x - 1.5 sec. off	On
Torque fault	Flashes 5 x - 1.5 sec. off	On
Under/over-temperature	Flashes 6 x - 1.5 sec. off	On

12.4 Automatic commissioning (see also chapter 12.2)

- Check secure connection between valve and actuator.
- To start automatic commissioning, press button B2 for at least 7 seconds.
 - Option 1: "Opening with force - Closing with force": The actuator moves to the open-end position by force and back again to the closed end position.
 - Option 2: "Open with calibrated stroke" (20/30/40 mm) or (20/30/50 mm for PSF-M405-EX): The closed end position is saved and the stroke is calculated based on the setting. If the possible travel path is less than the preset stroke, the stroke for operation is automatically reduced to the resulting maximum possible value.
- After successful commissioning, the green LED flashes seven times.
- Then press button B1 to return to normal operation.
- After successful commissioning, check the determined or adjusted stroke by setting the set value and the valve position.
- Unsuccessful commissioning is signalled by the green LED flashing rapidly. Check valve installation.
- For commissioning, it is necessary that a residual stroke of at least 1 mm is available in "Closing direction with force" before the actuator has reached its mechanical stop. Furthermore, the actuator must be able to perform a stroke of at least 5 mm.

12.5 Manual commissioning (see also chapter 12.2)

- Check that the gland between the valve and the actuator is secure.
- To activate the individual calibration, press button B1 > at least 7 seconds.
- The actuator can be moved manually with buttons B1 and B2 until the desired open-end position of the valve is reached.
- The calibration of the two end positions is started and saved by pressing B1 and B2 simultaneously for at least 3 seconds.

- After successful calibration, the green LED flashes seven times.
- Then press button B1 to return to normal operation.
- Check the adjusted stroke by setting the set value and measuring the actual value.
- Unsuccessful calibration is signalled by the green LED flashing rapidly.
- For commissioning, it is necessary that a residual stroke of at least 1 mm is available in "Closing direction with force" before the actuator has reached its mechanical stop. Furthermore, the actuator must be able to perform a stroke of at least 5 mm.

12.6 Manual operation (see also chapter 12.2)

- Press and hold buttons B1 and B2 simultaneously for at least 3 seconds to activate manual operation.
- Press button B1 to retract the valve stem.
- Press button B2 to extend the valve stem.
- Press and hold buttons B1 and B2 simultaneously for at least 3 seconds to exit manual operation.

12.7 Handwheel

- Press the handwheel towards the housing: the motor is deactivated.
- Keep the handwheel pressed and turn it:
 - to the left: the valve spindle moves downwards.
 - to the right: the valve spindle moves upwards.
- Release the handwheel: the handwheel is inoperative, after 5 seconds the motor is reactivated.

13. Operation

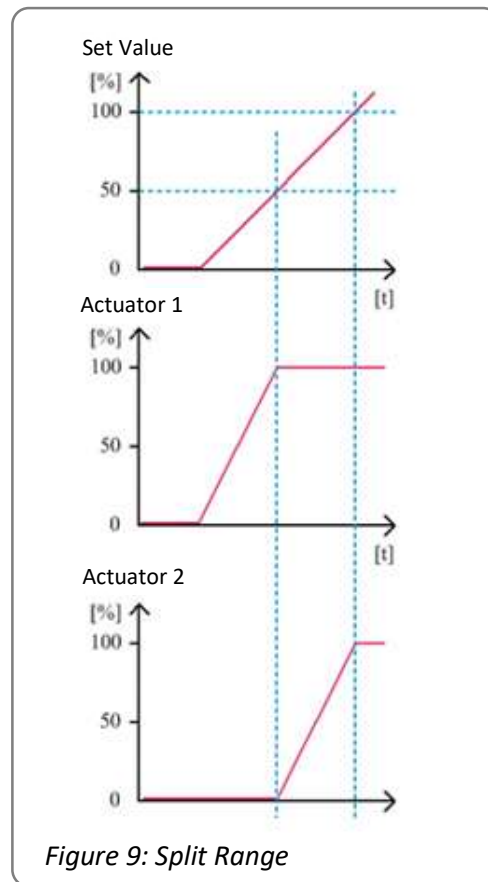
The operator of an electrical system in a potentially explosive environment must keep the equipment in proper condition, operate it properly, monitor it and carry out maintenance and repair work.

See also IEC 60079-17/IEC 60079-19.

During operation, all internal parameters, such as the required motor torque and the current position, as well as the operating states of the actuator are continuously monitored. This ensures that the actuator is positioned with optimal accuracy and that the valve is always closed correctly.

13.1 Split Range

With the setting "Set value signal/Split range" switch position S2-2/7/8, the set value is split into a lower or upper range. This means that several actuators can be controlled with only one set value signal.



13.2 Valve curve

Switch position S2-10 can be used to select the relationship between the set value and the actuator position. Two curves are available. With the linear valve curve, the actuator position in % corresponds to the set value in %. The "Quick Opening Curve" enables fast valve opening with a small set value.

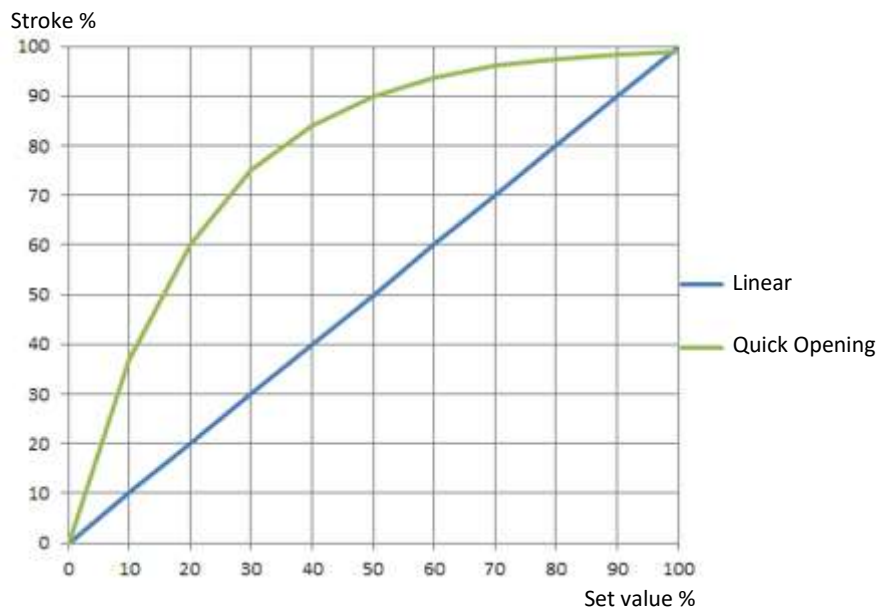


Figure 10: Valve curve

14. Commissioning



- Before the equipment is initially commissioned, it must be checked for its suitability in the relevant zone on the basis of its marking. The values specified on the type plate and in the applicable documents must not be exceeded.
- Commissioning and use may only take place when the operating equipment is correctly arranged within the system and is undamaged and clean.
- Opening the hood (see chapter 10), placing the actuator on the valve (see chapter 9), making the electrical connection (see chapter 11).
- Carry out automatic (see chapter 12.4) or manual commissioning (see chapter 12.5).
- Close the hood (see chapter 10).



The electrical connection and commissioning with mains voltage applied may only be carried out by trained specialist personnel!

Do not touch any connection lines during commissioning!

15. Maintenance and servicing

The actuators are maintenance-free under the operating conditions specified in the data sheet. The gearboxes are lubricated for life and do not require relubrication.



Attention!

During maintenance and servicing, the actuator must not be operated electrically.

Personnel carrying out work and maintenance and servicing must be skilled and familiar with the work.

15.1 Cleaning

Use a damp cloth for cleaning.

Please do not use any cleaning agents containing solvents, as these can make the inscription on the safety stickers and the type plate illegible. The actuator must not be moved during the cleaning process.

15.2 Servicing



The actuators are pre-tensioned by a return spring, the gearbox housing **must not** be opened.

Defective actuators must be returned to our main factory in Bad Dürkheim, Germany, for repair (see chapter 15.4).

15.3 Spare parts

Defective actuators can be returned to our main factory in Bad Dürkheim, Germany, to be investigated for damage and its possible causes (see chapter 15.4).

15.4 Service address:

PS-Automation GmbH
Phillip-Krämer-Ring 13
D-67098 Bad Dürkheim

Tel.: +49 (0) 6322/ 94980-0
E-mail: info@ps-automation.com
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16. Decommissioning and disposal

- Disconnect the mains connection and secure it against accidental reactivation.
- Open the hood.
- Remove external connections.
- Remove the actuator from the valve.

Disposal

The actuator is considered waste from electrical and electronic equipment and shall not be disposed of as household waste.



In accordance with 2012/19/EU on waste electrical and electronic equipment (WEEE), the devices described here may not be disposed of via municipal waste disposal companies.

If you are unable or unwilling to arrange for the equipment to be disposed of by a specialist company, you may return the equipment to the manufacturer, who will then ensure that the equipment is disposed of properly for a flat fee.

17. Annex

17.1 Accessories

Optional accessories are available for the actuators.

Technical data can be found in the corresponding data sheets.

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