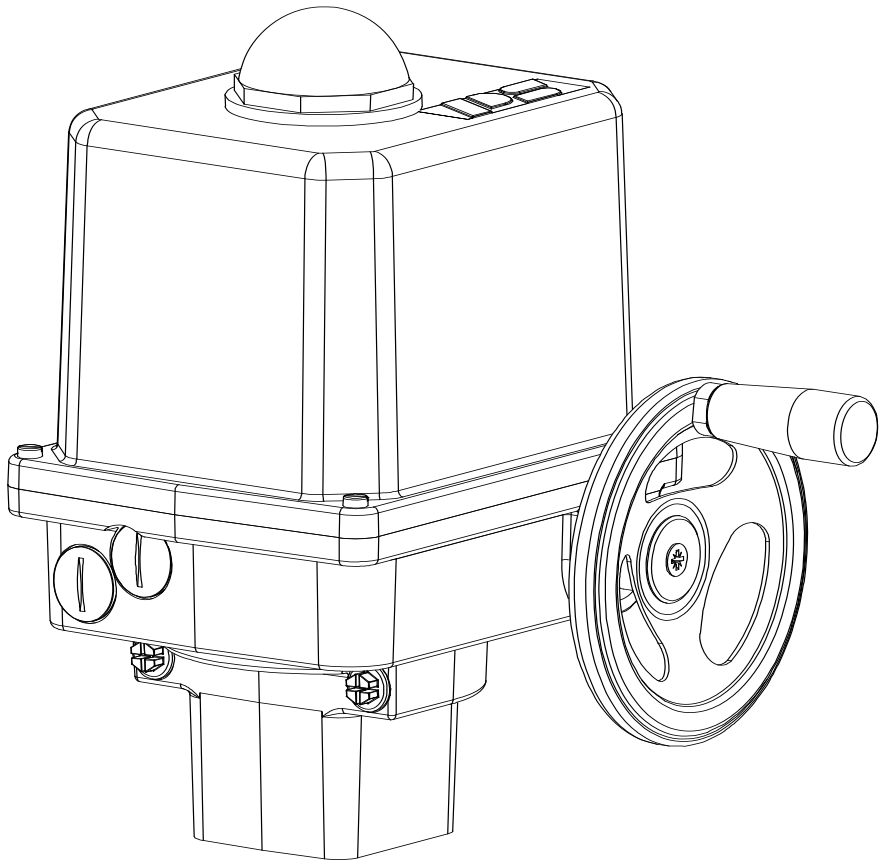
PS Automation
Gesellschaft für Antriebstechnik

We care for actuation.

Operating Instructions
PSQ



Subject to changes!

Contents

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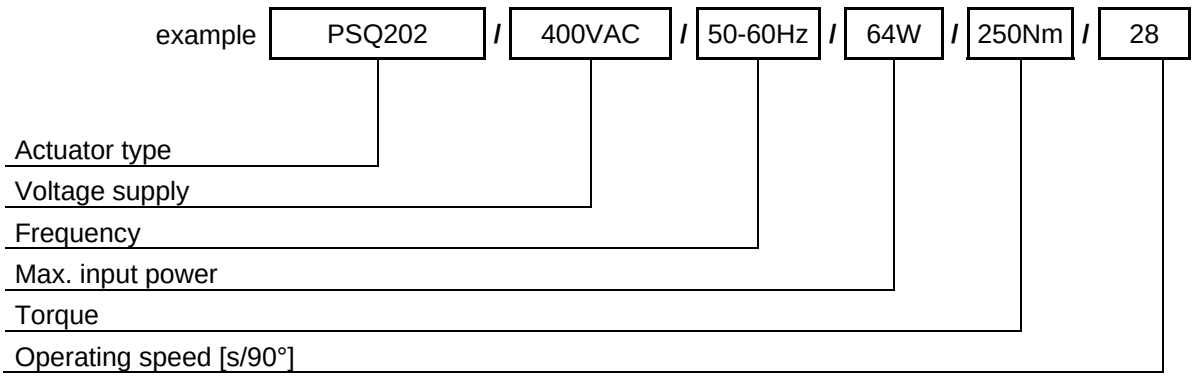


1. Symbols and Safety

Dangers of non-compliance with safety regulations

PSQ actuators are built to state-of-the-art technology and are safe to operate. Despite this, the actuators may be hazardous if operated by personnel that has not been sufficiently trained or at least instructed, and if the actuators are handled improperly, or not used as per specification.

This may

- cause danger to life and limb of the user or a third party,
- damage the actuator and other property belonging to the owner,
- reduce safety and function of the actuator,

To prevent such problems, please ensure that these Operating Instructions and the chapter on "1. Symbols and Safety" in particular have been read and understood by all personnel involved in the installation, commissioning, operation, maintenance and repair of the actuators.

Basic safety notes

- The actuators may only be operated by skilled and authorized operating personnel.
- Make sure to follow all security advices mentioned in this manual, any national rules for accident prevention, as well as the owner´s instructions for work, operation and safety.
- The isolating procedures specified in these operating instructions must be followed for all work pertaining to the installation, commissioning, operation, change of operating conditions and modes, maintenance, inspection, repair and installation of accessories.
- Before opening the actuator cover, ensure that mains supply is isolated and prevented from unintended re-connection.
- Areas that can be under voltage have to be isolated before working on them.
- Ensure that the actuators are always operated in faultless condition. Any damage or faults, and changes in the operational characteristics that may affect safety, must be reported at once.

Danger signs

The following warning symbols are used in this manual:

Caution! There is a general risk of damage to health and/or properties.

Danger! Electrical voltages may be present that are dangerous to life!
There is a risk of damage to health and/or properties with danger to lives.

With power supply 24 VAC the open motor phase can produce voltages up to 35 V due to motor generated induction voltage.

Other notes

- The motor surface may have elevated temperature when servicing, inspecting or repairing it immediately after operation. Danger of burning the skin!
- Always observe the relevant operating instructions when fitting PS accessories or operating the actuator with PS accessories.
- Connections for signal in- and output are double isolated from circuits that can be under dangerous voltage.

2. Usage as per Specification

- The PSQ quarter turn actuators are exclusively designed as electric valve actuators. They are meant to be mounted on valves for motor-operation.
- Any other use is considered to be not in accordance with standard specification, and the manufacturer cannot be held liable for any damage resulting from it.
- The actuators may not be used outside the limits laid out in data sheets, catalogues and order documentation. Otherwise the manufacturer cannot be held liable for any resulting damage.
- Usage as per specification includes the observance of the operating, service and maintenance conditions laid down by the manufacturer.
- Not to be regarded as usage as per specification are mounting and adjustment of the actuator, and servicing. Special precautions have to be taken while doing this!
- The actuators may only be used, serviced and repaired by personnel that are familiar with them and informed about potential hazards. The specific regulations for the prevention of accidents have to be observed.
- Damages caused by unauthorized modifications carried out on the actuators are excluded from the manufacturer's liability.
- Supply voltage may be switched on only after properly closing the main cover or terminal box.

3. Storage

The following must be observed with regards to proper storage:

- Only store the actuators in ventilated, dry rooms.
- Store the actuators on shelves, wooden boards etc. to protect them from floor moisture.
- Cover the actuators with plastic foil to protect them from dust and dirt.
- Protect the actuators against mechanical damage.

4. Operational Conditions

- The standard actuators can be operated at ambient temperatures from -20°C to +80°C
- Ambient temperature range for modulating duty is from -20°C to +60°C.
- The operating modes correspond to IEC 60034-1, 8: S2 for 3-point operation, and S4 for control duty (see data sheet for specific values for each actuator type).
- For protection against moisture and dust, the actuator enclosure rating is IP67 according to EN 60529. To ensure the protection rating, the cover must be fitted correctly and the holding screws tightened crosswise. The cable glands must be suitable for the cables and correctly fitted to the actuator.
- When installing the actuators, leave enough space to permit cover removal (figure 1).
- Any installation position is allowed except "cover pointing downwards" (figure 2).

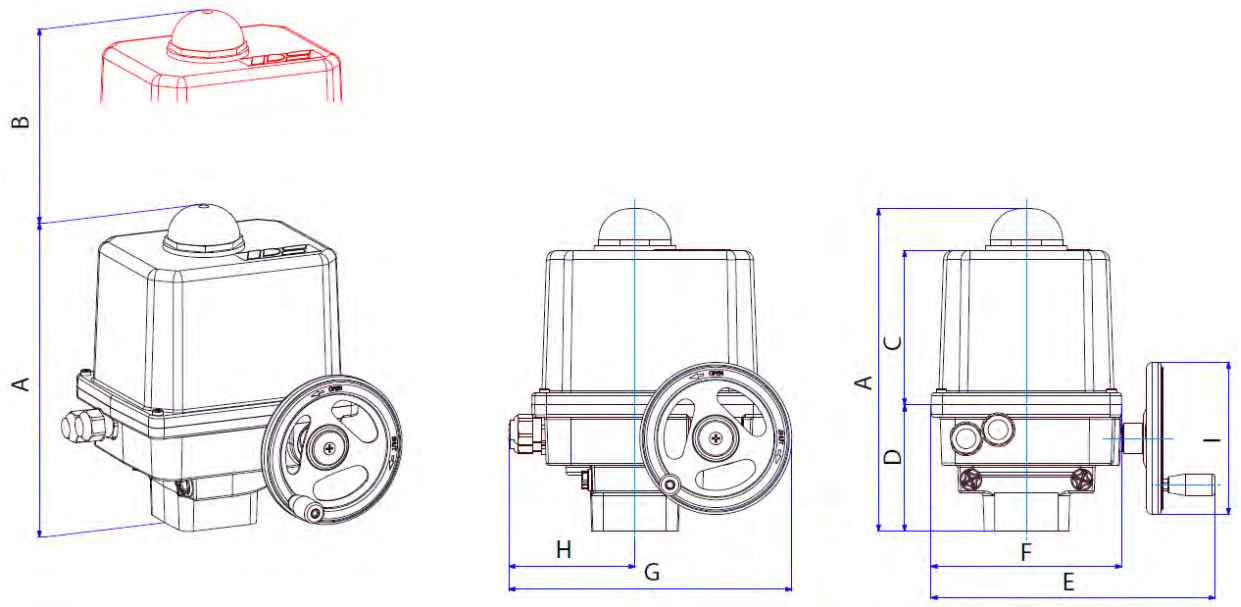


Figure 1: Installation dimensions

Dimensions	A	B	C	D	E	F	G	H	I
PSQ102	267	161	128	104.5	237	158	241	111	125
PSQ202	355	228	194	122.5	307	185	289	109	200
PSQ502/702	416	240	198	171.5	358	235	337	128	200
PSQ1002	416	240	198	171.5	289	235	362	128	250

4.1 Installation Position

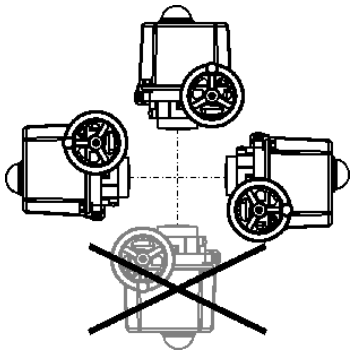


Figure 2: Installation position

Outdoor Usage

When using actuators in environments with high temperature fluctuations or high humidity, we suggest a heating resistor be fitted to prevent the build-up of condensation within the enclosure.

5. Function

The electric quarter-turn actuators Series PSQ are designed to operate valves with 90° motion. The PSQ actuators are provided with a mechanical interface according to ISO 5211 for valve mounting. The motor torque is transmitted via a spur gear onto the sun wheel of a „Wolfrom"-gear. The rotating output wheel of the „Wolfrom"-gear holds a removable drive bush to connect the actuator with the valve stem. Two adjustable position switches are limiting the electrical motion in both directions by interrupting the motor current or control circuit when reaching the adjusted position.

The 90° motion is mechanically adjustable by +/- 5° by means of two stop screws. Torque switches are installed for each direction (at PSQ102 and bigger).

The handwheel does allow comfortable manual operation in case of power failure or for commissioning. The handwheel is idle when the motor is operating the actuator, but engaged in any position without clutching or declutching.

Electrical wiring is done to a terminal block under the actuator cover.

6. Manual Operation

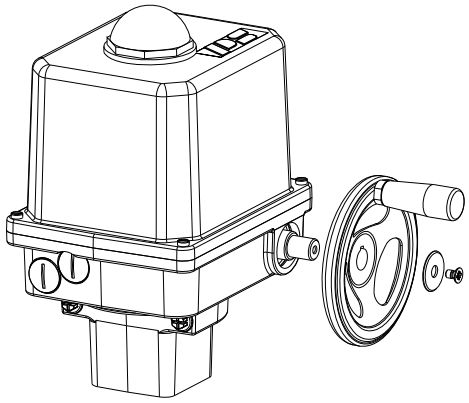


Figure 3: Hand wheel assembly

The actuators are supplied with loose enclosed handwheel. Mount the handwheel according to figure 3.

The handwheel does provide manual operation in case of power failure or commissioning. It is idle when the motor is operating and always ready for operation without clutching or declutching.

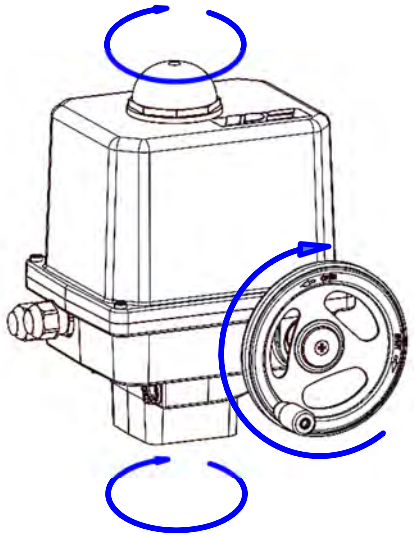


Figure 4: Manual Operation

Do not exceed the adjusted electrical stroke limits by handwheel.
The mechanical limits must be set accordingly.
Failure to observe this warning will change the electrical feedback setting!

7. Valve Mounting

The PSQ actuators are provided with a mechanical interface according to ISO 5211 for valve mounting. The „Wolfrom“ gear does contain a removable drive bush to connect the actuator to the valve stem.

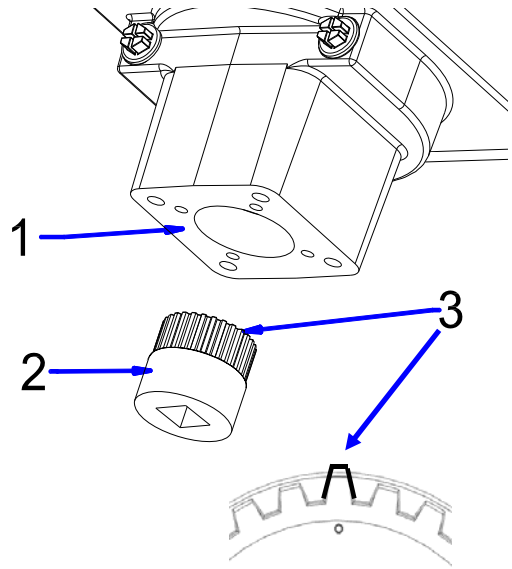


Figure 5: Actuator Flange

1 = actuator flange
2 = drive bushing
3 = indicator tooth

- Ensure that the actuator flange suits the valve flange.
- The bore of the drive bush (square, round bore with keyway, double-D) must correspond to the valve stem. The drive bushing (item 2) has one raised indicator tooth (item 3) to define the zero position of the bushing. This tooth may be filed off if other orientations are required.
- Clean all surfaces of the connection area, slightly lubricate drive bush and valve stem.
- Insert drive bush into the actuator first.
- Position the actuator on the valve. Tighten the screws in a diagonal sequence with the required torque.

8. Setting the Mechanical Stops

There are two adjustable screws installed for setting the mechanical limit of the 90° motion.

When setting the mechanical end positions, only the handwheel may be used. Do not operate the actuator electrically.

- Remove the protection cap (figure 6, item 3) from either stop screw.
- Unscrew both hexagon sockets anti-clockwise by approximately 5 turns.
- Move the actuator to the closed position by turning the handwheel clockwise.
  Turn stop screw for closed position (figure 6, item 1) to the stop.
- Move the actuator to the open position by turning the handwheel anti-clockwise.
  Turn stop screw for open position (figure 6, item 2) to the stop.

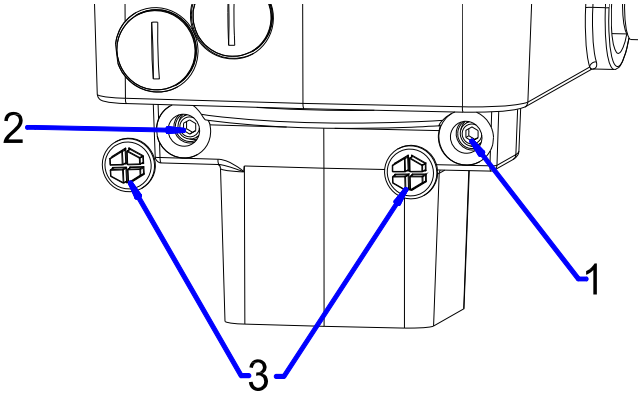


Figure 6: Mechanical stops

Item 1: Stop screw CLOSED position
Item 2: Stop screw OPEN position
Item 3: Protecting caps

8.1 Adjustment of the Position Indicator

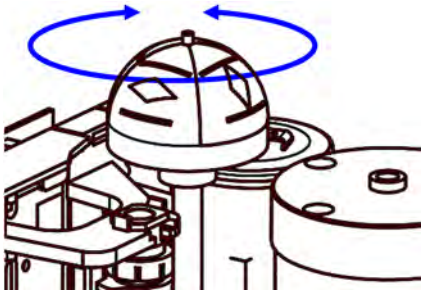


Figure 7: Adjustment of the position indicator

The position indicator is a two-coloured half ball turning under a transparent dome with blackened quarter segments.

Take off the cover and turn the half ball as appropriate to adjust the position indicator.

9. Setting the Position Switches

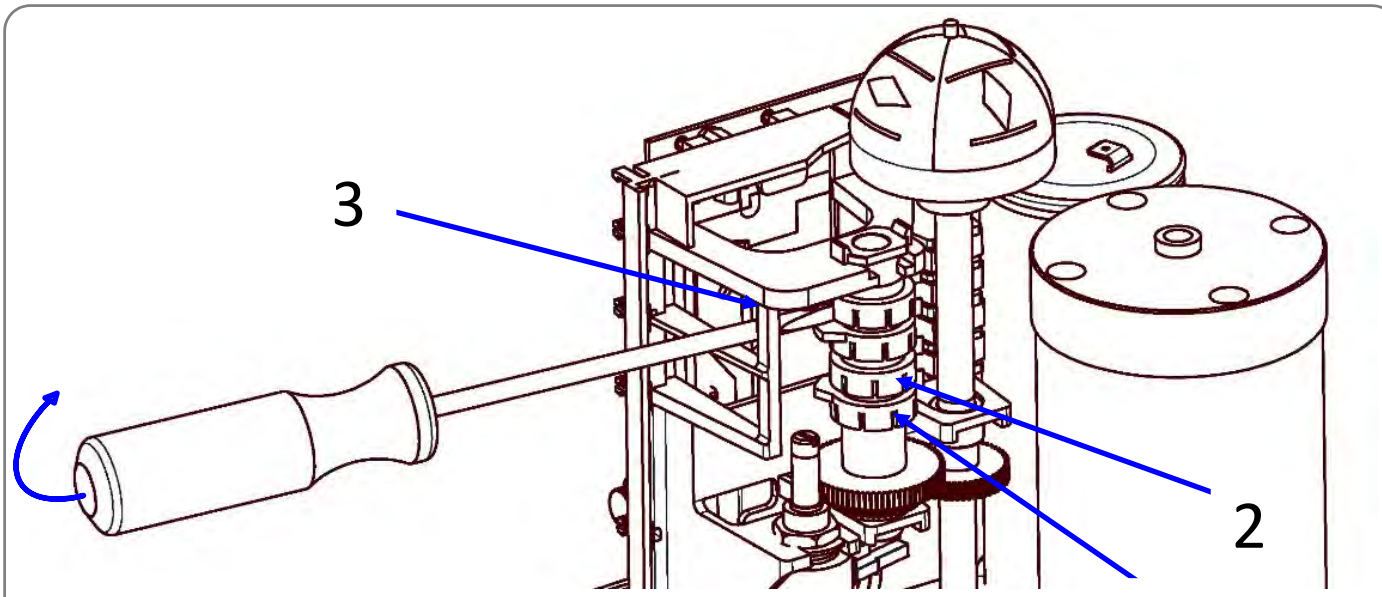


Figure 8: Setting the switching cams for position switches

The standard position switches serve to switch off the motor when the desired limits are reached.
Additional position switches are potential-free opeing/closing contacts and serve to indicate the valve position. These are available as accessories. The switches are activated by cams. These cams are stepless adjustable on their shaft by means of a friction coupling.

Item 1: Switching cam CLOSE position
Item 2: Switching cam OPEN position
Item 3: Bridge for screw driver support

NOTE:
Use the bridge (figure 8, item 3) as support for the screw driver when adjusting the cams.

Ensure that the mains supply is secured against accidental switching-on!

- Run the actuator electrically to the closed position until the valve is closed and the actuator is switched off by the torque switch.
- Turn the cam of the CLOSE position switch (figure 8, item 1) with an isolated srew driver (4 mm blade width) anti-clockwise until the micro switch is heard to click.
- Run the actuator electrically to the open position until the valve is fully open and the actuator is switched off by the torque switch.
- Turn the cam of the OPEN position switch (figure 8, item 2) with an isolated srew driver (4 mm blade width) clockwise until the micro switch is heard to click.
- Drive the actuator away from either end position to release the stop screws.
- Turn both stop screws counter-clockwise by one turn.
- Replace protection caps (figure 6, item 3) onto the stop screw holes after setting the position switches.

10. Setting the Torque Limit

There is one torque switch installed for each direction that cuts off the motor current when operated (single phase motors).

The quarter-turn actuator is set and checked by the manufacturer in order to limit the actuator to the nominal torque in both directions. The reduction of the maximum output torque is possible by setting the switch brackets, to suit the specific requirements of the valve.

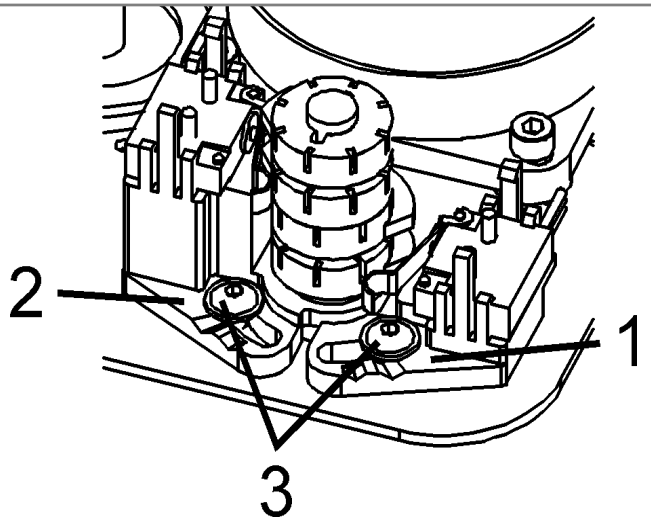


Figure 9: Brackets holding the switches

- Loosen the torque setting screws (fig. 9, item 3) and turn the switch brackets to the required position.
- Fix this positions by tightening the screws.

Item 1: Switch bracket „CLOSE“
Item 2: Switch bracket „OPEN“
Item 3: Fixing screws

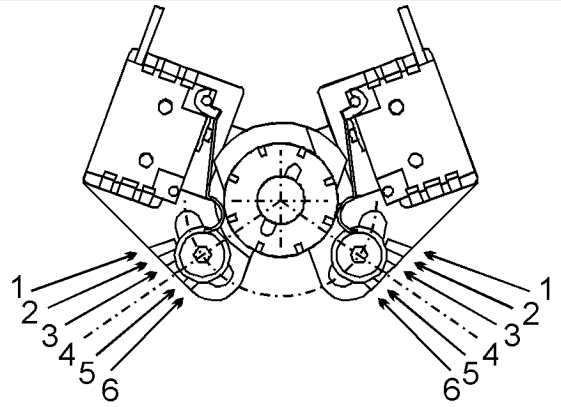


Figure 10: Torque setting (shown to mark 4)

There are marks on both switch brackets. When moving those marks against the center of the set srew, the following torque adjustments can be achieved (Figure 10).

PSQ102		PSQ202		PSQ502		PSQ702/1002	
Mark	**Torque**	**Mark**	**Torque**	**Mark**	**Torque**	**Mark**	**Torque**
End position	100%	End position	100%	End position	100%	End position	100%
Mark 1	90%	Mark 1	85%	Mark 1	90%	Mark 1	-
Mark 2	80%	Mark 2	70%	Mark 2	80%	Mark 2	85%
Mark 3	70%	Mark 3	55%	Mark 3	70%	Mark 3	-
Mark 4	60%	Mark 4	-	Mark 4	60%	Mark 4	-
Mark 5	50%	Mark 5	-	Mark 5	50%	Mark 5	50%
Mark 6		Mark 6		Mark 6		Mark 6	

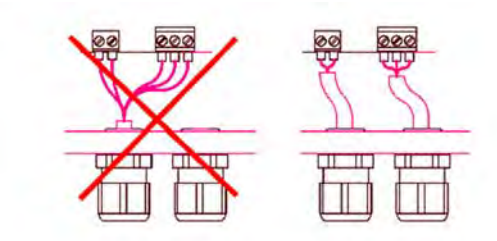
11. Electric Supply

Before connecting to mains, ensure that the mains supply is isolated and secured against an accidental switching-on.

The mains connecting cables must be suitably dimensioned to accept the maximum current requirement of the actuator, and correspond to IEC 227 and IEC 245. The yellow-green coloured cables may only be used for connecting to earth.
When inserting the cable through the cable connector, ensure that the maximum bending radius for the cable is observed.

The PSQ electric actuators do not have an internal electrical power switch. A power mains switch has therefore to be provided in the installation. This should be positioned close to the device and be easily accessible to the user and shall be labelled as the mains isolator switch for the actuator.
Electric installation as well as over-current and overvoltage protection devices must be conform to the standard DIN IEC 60364-4-41, protective class I resp. protection class 3 (24VAC/24VDC) and also to the standard DIN IEC 60364-4-44 according to the applied overvoltage category of the actuator.

Please protect all of the power supply and control cables in front of the terminals mechanically by using suitable measures against unintentional loosening. Never install the power supply and the control cables together in one line but instead please always use two different lines.



11.1 Wiring Diagram

Figure 11 indicates the electrical connections for standard actuators. However, the wiring diagram inside the actuator cover is relevant for the specific actuator. See the separate wiring diagram in the corresponding service instructions for any set of accessories.

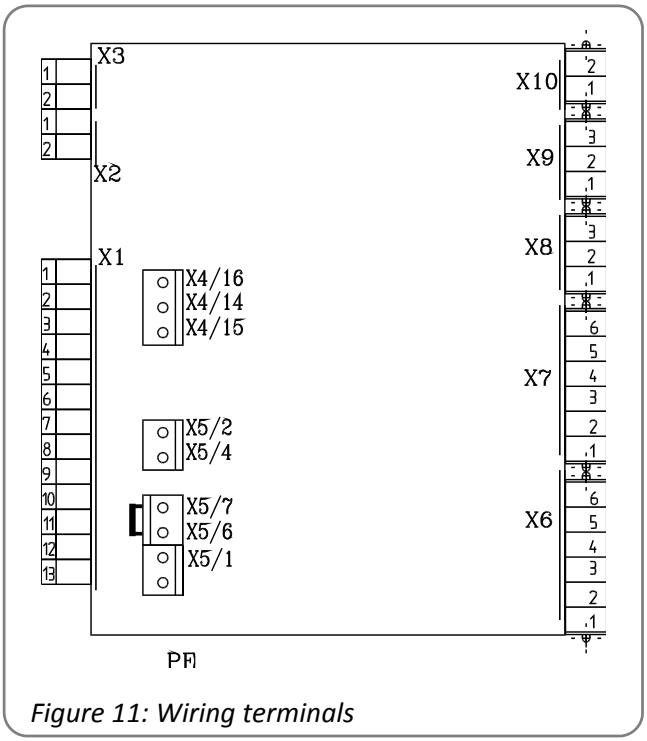


Figure 11: Wiring terminals

X1 =	Internal wiring
X2 =	Internal wiring
X3 =	Internal wiring
X4 =	Potentiometer connection for PSAP
X5/1 =	Neutral
X5/2 =	Motor phase to open
X5/4 =	Motor phase to close
X5/6 =	Thermo switch as potential-free contact
X5/7 =	Thermo switch as potential-free contact
X6 =	Additional position switches
X7 =	Additional torque switches
X8 =	Heating resistor
X9 =	Potentiometer 2
X10 =	Not used in the standard actuator
PE =	Earth connection on housing

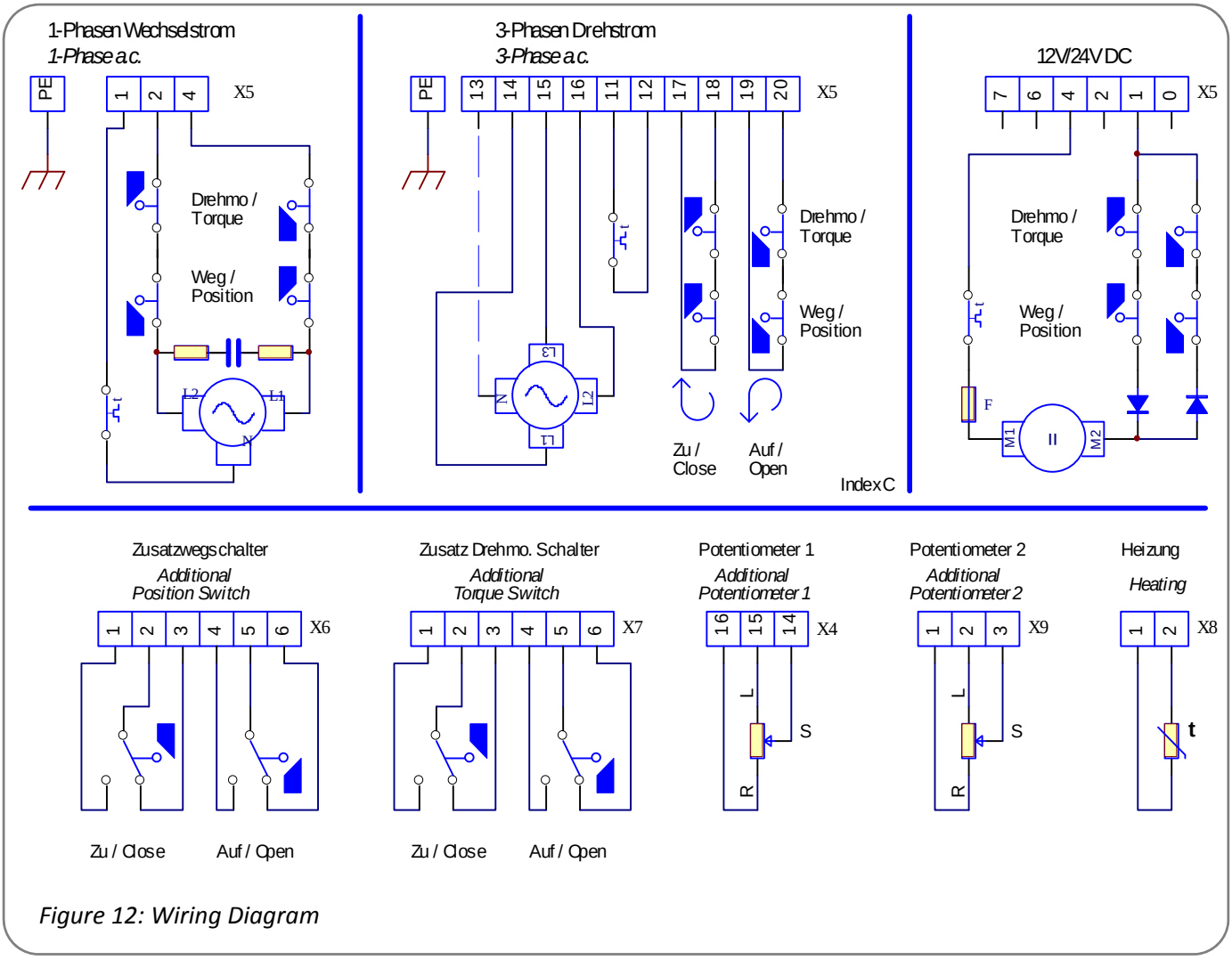


Figure 12: Wiring Diagram

PE earth connection on housing plate has to be connected!

Two adjustable position switches are installed to limit the stroke of the actuator, and cut-off the motor current in the relative direction.
Most motors have a thermal switch, depending on the actuator type, to cut off the current in both directions when a maximum temperature is reached (only at standard single phase power supply). The thermal switch loop is closed by the bridge between the X5/6 and X5/7 connections (see figure 11).

11.2 Thermo Switch as potential-free Contact

Bei einigen Antrieben ist der Motor durch einen Thermoschalter geschützt. Dieser ist in den Nullleiter des Motoranschluss eingeschleift (bei 1-Phasen Wechselspannung), kann aber falls erforderlich, als potentialfreier Kontakt nach außen geführt werden.

If desired, the thermo switch can be wired to be monitored from the outside as follows:

- Remove the bridge between connections X5/6 and X5/7.
- Exchange the connections X1/11 and X1/13.
- Make a conductivity check between connections X5/6 and X5/7(resistance has to be zero)
- Connect the thermo switch as potential-free contact to the connections X5/6 and X5/7.

Maximum thermal switch loading:
The thermo switch can be loaded as a maximum to the nominal load of the motor (see motor nameplate).

When using the thermo switch as a potential-free contact, the switching signal must immediately stop the motor. Re-starting the motor is allowed only after the thermo switch has reset. Failure to observe this warning may result in damage to the actuator.

12. Commissioning

- Close the cover.
- Turning the handwheel, drive the valve to the middle position.
- Switch the setting signal briefly to OPEN and CLOSE and check that the actuator operates in the correct direction. If necessary, reverse the setting signal for OPEN/CLOSE.
- Drive the actuator in either direction, using the setting signal until the position switch cuts-off. Check that the position switch setting is correct. If necessary re-adjust the position switch (see chapter 9).

With power supply 24 VAC the open motor phase can produce voltages up to 35 VAC due to motor generated induction voltage.

13. Service / Maintenance

The actuators are maintenance-free if used under the operating conditions as established in the data sheet. The gearboxes are lubricated for lifetime and do not require further lubrication.

13.1 Cleaning

The actuators should be cleaned with dry cloth.

13.2 Spare Parts

PSQ actuators are very robust functional units. In case of malfunction or damage of any component, spare parts are available as per a separate spares price list. Please contact
PS Automation GmbH or the appropriate representative.

Rejected actuators can be returned to our works in Bad Dürkheim, Germany, or to our representatives, for evaluation of failures and repair.

14. Appendix

14.1 Accessories

Various accessories are available in order to adapt the actuator to the various installation conditions. The following shows a short selection.
Please see the actuator data sheets for technical data. Mounting and commissioning instructions are available separately for each accessory. We will be pleased to assist you with advice also by telephone.

Accessories/ Options	Power Supply		230 VAC 1~	115 VAC 1~	24 VAC 1~	400 V 3~	24 VDC
	Position Signal Switches	2WE	•	•	•	•	•
	Position Signal Switches Gold	2WE Gold	•	•	•	•	•
	Add'l Torque Switches	2DE	•	•	•	•	•
	Add'l Torque Switches Gold	2DE Gold	•	•	•	•	•
	Positioner	PSAP	•	•)[1]	•)[1]	•)[2]	
	Position Transmitter	PSPT	•	•	•	•	•
	Heating resistor	HR	•	•	•	•)[3]	•
	Potentiometer	PD	•	•	•	•	•
	Reversing Starter Contactor	WSM01				•	
	Corrosion protection	K2	Corrosion Protection K2 incl. Heating Resistor				
	Enclosure IP67	IP	IP68 incl. Heating Resistor and Corrosion Protection K2				

• = available

)[1] = PSAP with external relay required

)[2] = only to be used with reversing starter contactor

)[3]= supply voltage 24 V or 115-230 V

For additional position and torque switches:

Standard switches with silver contacts are suitable for currents 100 mA to 5 A at voltages in the range of 24 V to 230 V AC/DC. For lower power up to 0,12 VA (0,1 mA to 100 mA at 1 V to 24 V AC/DC) we recommend switches with gold contacts (2WE Gold and 2DE Gold).

With power supply 24 VAC the open motor phase can produce voltages up to 35 V due to motor generated induction voltage.

14.2 Declaration of Incorporation of Part Completed Machinery and EC Declaration of Conformity in compliance with the Directives on EMC and Low Voltage

We,

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

Declare under our sole responsibility that we manufacture electric actuator series

PSQ

according the requirements of the

EC Directive 2006/42/EC

as part completed machinery. These actuators are designed to be installed on industrial valves.
It is prohibited to take the actuator into service until it has been ensured that the complete machine conforms the applicable machinery directives.
The technical documentation described in Annex VII, part B has been prepared.

The above actuators further comply with the requirements of the following directives.

2014/30/EU	Electromagnetic Compatibility (EMC)
2006/95/EC	Low Voltage (LVD) *(valid until 05/19/2016)*
2014/35/EU	Low Voltage (LVD) *(valid from 05/20/2016)*

and have been successfully tested in accordance with the following harmonized standards

EN 61000-6-2: 2005	Electromagnetic compatibility (EMC), Generic standards-Immunity for industrial environments
EN 61000-6-3: 2007	Electromagnetic compatibility (EMC), Generic standards-Emission standard for **residential, commercial and light-industrial environments**
EN 61010-1: 2010	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use

Bad Dürkheim, 2015

Max Schmidhuber
(General Manager)

CAUTION!
To ensure comliance of these actuators with the above directives, it is the responsibility of the specifier, purchaser, installer and user to observe the relevant specifications and limitations when taking the product into service. Details are available on request, and are mentioned in the Installation and Maintenance Instructions.

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