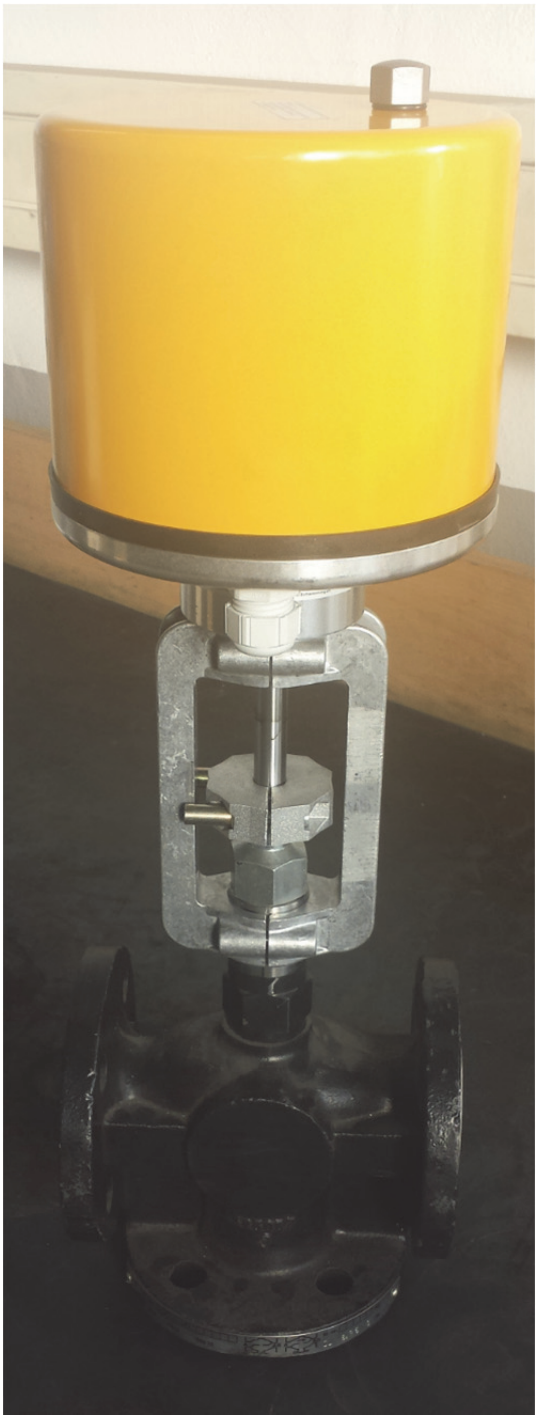
Operating Instructions **OI 373-E45**

Baelz-electrodyn
Actuator for modulating duty
Motorized linear actuator baelz 373-E45



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2. Safety

Carefully read the present Operating Instructions, especially the following safety precautions prior to installation and operation.

Caution
Potentially hazardous situation which could result in minor injury.
Also indicates a risk which may cause material damage.

Attention
Potentially harmful situation which can result in damage to the product or an object in its environment.

Danger
Imminently hazardous situation which will result in death or serious injury.

Warning
Potentially hazardous situation which may result in death or serious injury.

Tip: Instructions for use or other useful information.

2.1 Intended use

baelz 373-E45-40-15 motorized linear actuators are controlled by three-point control or constant control in combination with the PEL positioning electronics. The linear actuators of the series described in this document are intended for the stroke adjustment of valves.
To ensure their intended use, make sure that the above type identification complies with the identification label of the linear actuators before starting any activities. The actual technical data of the linear actuators and the power supply requirements are the specifications indicated on the identification label.
Any use other than the intended use mentioned above, different tasks, and operation with other power sources than those permitted, is considered to be improper use. In case of improper use, the operator shall be solely liable for the risk presented to persons and the device as well as other property!
The intended use also comprises compliance with the accident prevention regulations and the DIN VDE standards of the German Institute for Standardization and the Association for Electrical, Electronic & Information Technologies. It also implies working in accordance with the safety requirements when performing all activities described in the present Operating Instructions, under consideration of general technical rules and regulations.

2.2 For the operator

Make sure the Operating Instructions are kept permanently available and easily accessible at the site of operation of the linear actuators!
During set-up, operation and when performing maintenance procedures on the device, observe the applicable occupational safety regulations, accident prevention regulations and the DIN VDE standards of the German Institute for Standardization and the Association for Electrical, Electronic & Information Technologies. Observe compliance with any possibly applicable additional regional, local or in-house safety regulations.
Make sure that any person assigned by you to perform the activities described in the present Operating Instructions, has read and understood these instructions.

2.3 Personnel

Only qualified personnel may operate these linear actuators or work in their vicinity. Qualified persons are persons who are familiar with the set-up, installation, commissioning, operation and maintenance of the linear actuators and possess the required qualification for their activity. The required or prescribed qualifications include amongst others:

- Training / instruction and the authorization to switch electric circuits and devices / systems on and off in accordance with EN 60204 (DIN VDE 0100 / 0113) and the technical safety standards.
- Training or instruction in accordance with the technical safety standards for the maintenance and use of appropriate safety equipment and personal protective equipment.
- First aid training.

Always work safely and never perform any work which might present a hazard to persons or damage the linear actuator or other property in any way.

2.4 Before starting work

Prior to starting any kind of work, check if the types specified here are identical with the specifications on the identification label on the linear actuator:
baelz 373-E45-40-15

2.5 During operation

Safe operation can only be ensured if transport, storage, assembly, operation and maintenance procedures are performed in compliance with the safety requirements, and are performed properly and competently.

2.5.1 Transport, installation and mounting

Observe the general installation and safety regulations for heating, ventilating, air conditioning and piping. Use tools properly and competently. Wear the required personal and other protective equipment.

2.5.2 Service and maintenance

Prior to maintenance or repair, make sure that the linear actuator is disconnected from power by qualified personnel in accordance with DIN VDE standards. The linear actuator requires little maintenance. We recommend lubrication of the gear with grease (Klüber Microlube GL 261) every 6 months and simultaneous removal of any deposits on the spindle. This requires removal of the actuator cover. Apart from this, the actuator does not require any other routine or periodic maintenance.

2.6 Work environment

Please observe the information regarding the work environment in the Specifications.

3. Product description

3.1 Identification

Each actuator has an identification label. This label includes specifications regarding the maximum operating conditions of the device and a unique, order-related serial number (F no.).

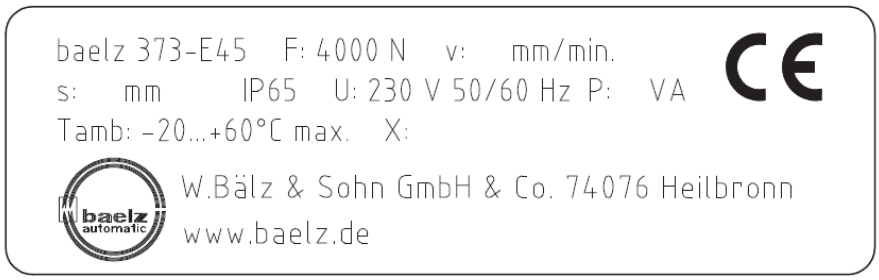

Figure 1: Baelz identification label for motorized actuators

3.2 Specifications

Type	Baelz 373-E45	
Positioning force kN	4.0	
Positioning speed [1] mm/min	15	40
Power consumption (230 V) VA	11	64
Nominal current: (230 V) VA	0.045	0.280
Type of motor [3]	syn	syn
Motor protection [4]	B	B
Max. stroke mm	40	
Supply voltage [2] [5]	24 V / 115 V / 230 V 50/60 Hz +-10%	
Type of duty acc. to IEC 34-1	S1 – 100% S3 – 30% cfd 1200 c/h	
Cable gland	3 x M20x1.5	
Electrical connection	Inside terminal board, terminal assignment according to electrical connection diagram	
Switch-off in end position	2 load-dependent switches, max. 250 V AC, rating for resistive load, max. 5 A, for inductive load, max 3 A	
Mounting position	as desired, but not in downward position	
Ambient temperature	-20 °C to +60 °C	
Lubricant for gearing	Klüber Microlube GL 261 grease	
Position indicator	by anti-rotation bar	
Manual adjustment	by means of hand crank	
Enclosure protection acc. to EN 60529	IP 65	
Trapezoidal thread	Tr 14 x 3	
Connection type	EN ISO 5210 F05 (also refer to options)	
Weight kg	8.0	

1) at 60 Hz, the positioning speeds and input power increase by 20%
2) other supply voltages on request
3) syn synchronous motor
4) B stallproof motor
5) see price list for possible combinations

Figure 2: Specifications table

3.4 Accessories and options

Options for actuators	
EZ	Additional limit switches for signalling end positions or intermediate positions, freely adjustable, max. 250 V AC, rating for resistive load max. 5 A, for inductive load max. 3 A, max. 2 switches for signalling end position, and max. 2 switches for intermediate position
FG	Potentiometer 100/130/200/500/1000/5000 ohms or 10 kOhms Linearity error ≤ 0.5%, max. 1.5 W, contact current 30 mA, max. 2 units
ESR	Electronic position transmitter, 2-wire system, output 0 (4)…20 mA, connection 24 V DC, requires 5000 ohm potentiometer.
PDB100	Profibus module for actuator control in separate housing IP 66 mounted at actuator with plug M12, 5 poles, 2 x M20 cable entries (potentiometer and 2 WE required)
PEL	Positioning electronics for actuator control, input 0…10 V, 0 (4)…20 mA, output 0…10 V, 0 (4)…20 mA, supply voltage 24, 115, 230 V 50/60 Hz, requires 1000 ohm potentiometer.
HZG	Heating resistor with thermoswitch against moisture with automatic temperature regulation, max. 15 Watts supply voltage 24, 115, 230 V 50/60 Hz

Figure 3: Accessories and options table

3.5 Type name

baelz 373 – E45 - 40 - 15 – S21

Motorized linear actuator	Thrust Yoke type
Actuator type	Positioning speed

3.6 Operating conditions

Attention

In case of extreme variations in ambient temperature and high humidity levels, installation of a heating resistor is recommended to minimise condensation in the actuator.
Actuator covers with suppression of thermal bridges (dual covers) are recommended.

- Connect the heater HZG as shown in the connection diagram.
- After installation, put the device immediately into operation.

The actuators are suitable for installation in industrial plants, in waterworks and power plants with a low pollutant concentration.
For use outdoors or in an environment with a high pollutant concentration, such as heavy traffic areas, industrial areas (chemical plants, sewage plants, etc.), coastal areas and the open sea, the actuators must have external parts made of non-corrosive material and must be provided with a special coating.
When used outdoors, the actuator must be protected with an additional cover against

- rain
- direct sunlight
- strong draught
- dust

4. Transport and storage

Caution **Risk of injury caused by failure to observe the safety regulations!**

- Wear the required personal and other protective equipment.
- Protect the linear actuator from impacts, shock, vibration and similar influences.
- Store the linear actuator (and, if necessary, the complete actuator/valve assembly) in a dry place.
- Observe the transport and storage temperature of -20 to +60°C.

5. Mounting

5.1 Mounting position

When mounted with the connecting rod in horizontal position, mount the linear actuator such that the two rods of the yoke are positioned on top of each other in the vertical plane.

Damage caused by missing valve!

Caution

- If the linear actuator is operated without a valve, the missing stop may cause damage to the actuator. The actuator must therefore **never** be operated **without a valve**.
- Allow for about 200 mm space above the cover at the site of installation.
- Check the work environment before mounting the actuator and before putting it into operation:
- Make sure that the valve is correctly installed. For detailed information, refer to the valve's installation instructions.
- Determine the mounting position of the linear actuator. **Do not** mount linear actuators in **downward** position.

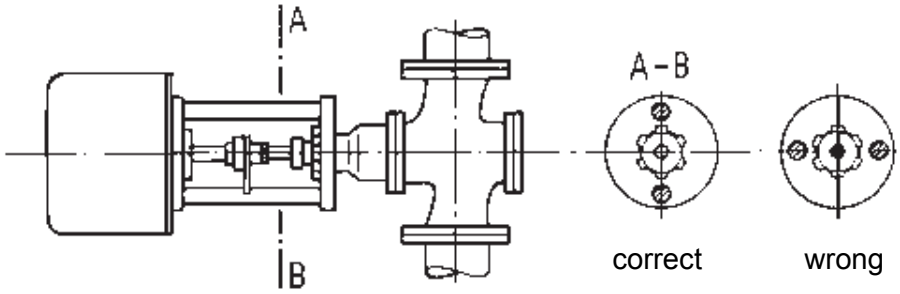

Figure 4: Mounting position

- The linear actuator is supplied extended (stroke 22 mm).
- A minor adjustment to mount the coupling can be made by turning the spindle.
- When mounting, the spindle must not protrude by more then 60mm +2mm from the housing. Otherwise the actuator will be damaged.
- When mounting, the spindle may protrude by a minimum of 40mm -2mm from the housing. Otherwise the actuator will be damaged.

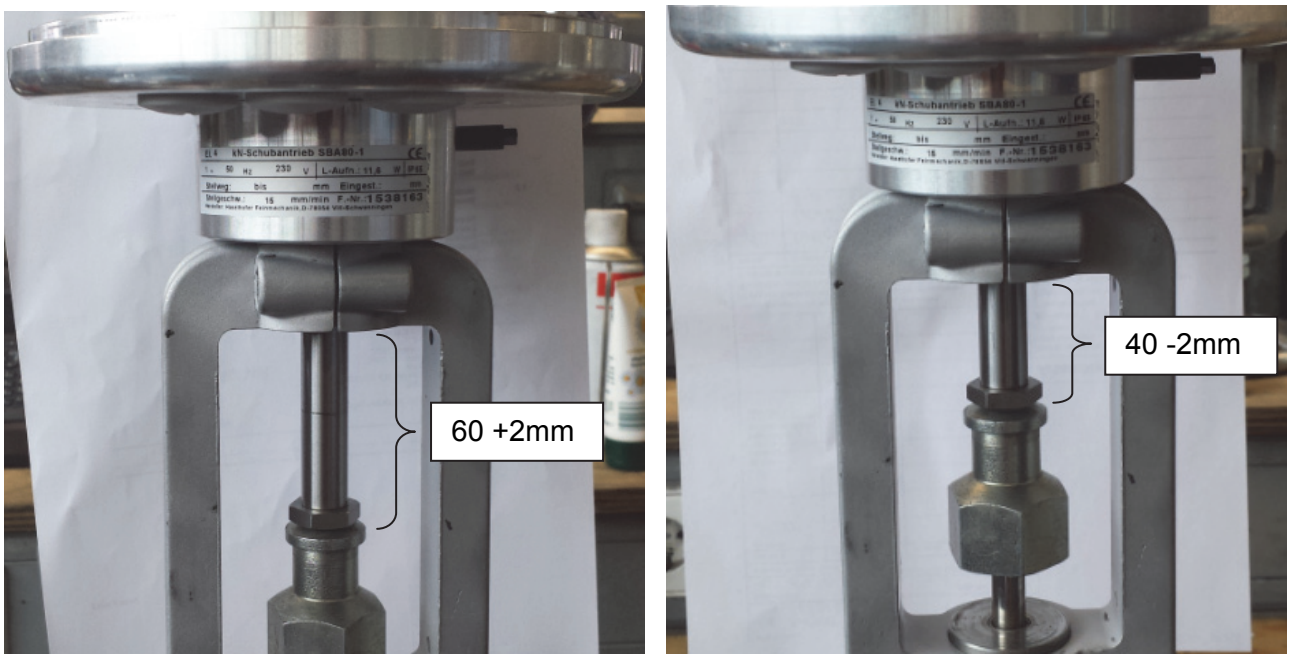

Figure 5: Mounting the actuator

5.2 Assembly with valve

Prior to assembly check that

- the specifications of the linear actuator comply with the operating conditions.
- the valve is complete (yoke on actuator or on valve).
- the connections on valve and actuator match.

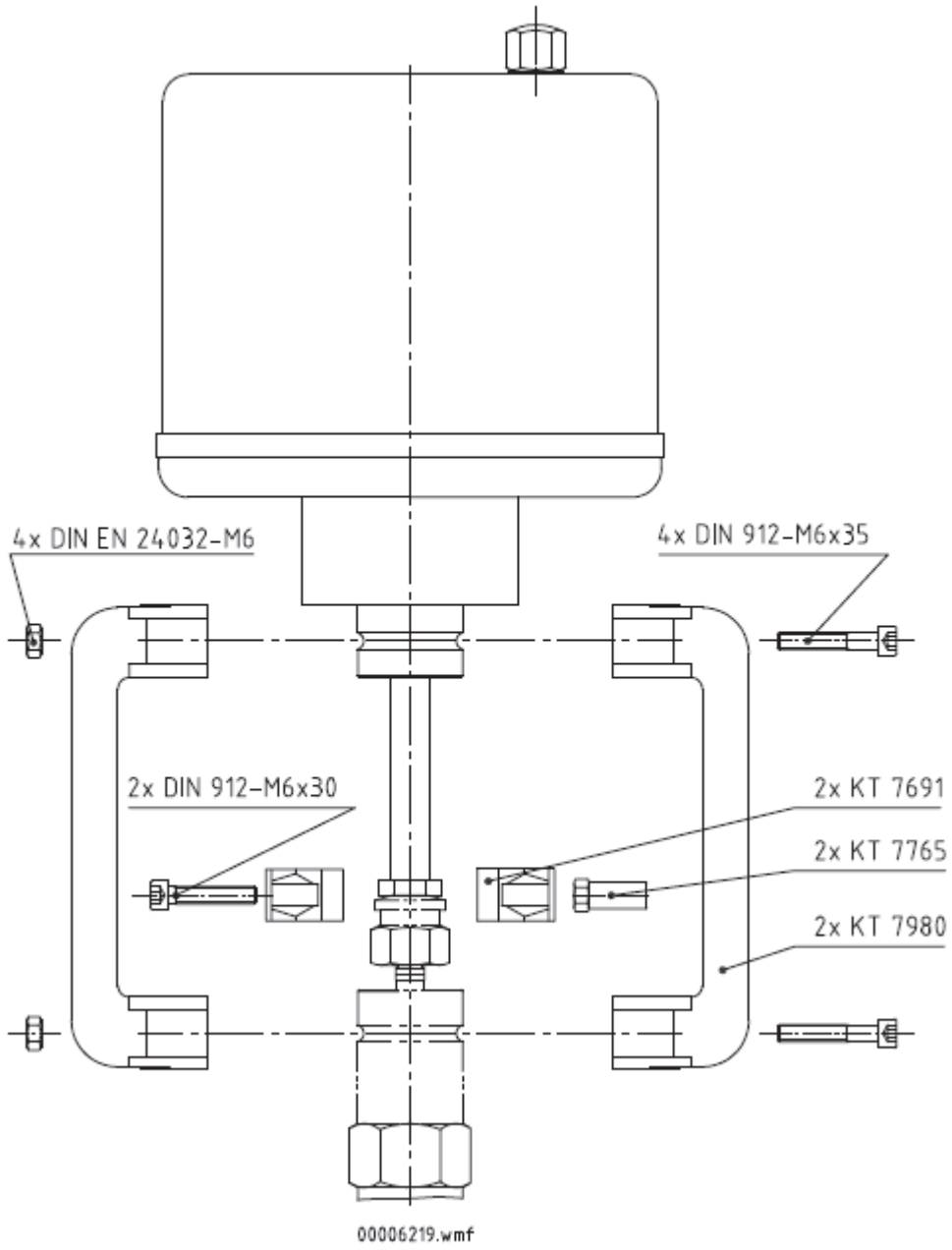

Figure 6: Assembly with valve

It must be ensured that the connecting rod of the actuator and the valve spindle are correctly aligned. A misalignment will lead to power loss or premature wear.
When supplied with integrated switching and signalling unit, the stroke may have to be adjusted.

5.3 Operating principle

Motorized linear actuators for modulating and open-close duty of control and process technology to operate control valves. The self-locking stem/stem nut is driven by an electric motor via a gearing. This converts the rotary movement into a linear movement. Load-dependent and travel-dependent switches define the stops for the end positions.

5.3.1 Manual adjustment

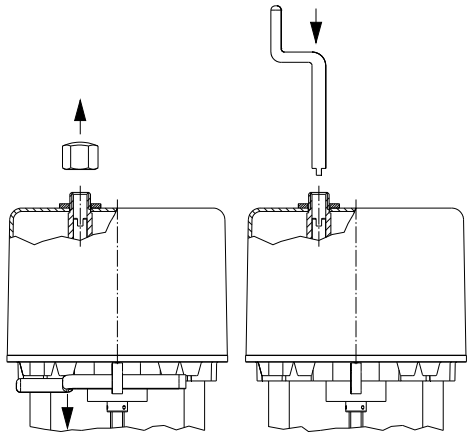

Figure 7: Manual adjustment

Manual adjustment may only be done when the motor is not in motion. For the adjustment, unscrew the cap nut, remove the hand crank from the bracket on the bottom of the actuator housing and insert it into the hole of the cover tube.
Turn the hand crank using light pressure.

5.4 Electrical connection

Risk of electric shock!

Danger

Make sure to use an appropriate power supply to ensure that no dangerous voltage will enter the device during normal operation or in the event of a system failure or failure of system components.
Failure to heed this warning may result in death, serious injury or substantial material damage.
For short-circuit protection and disconnection of the actuator from the power supply, fuses and switch disconnectors must be provided on site. The current values for the rating depend on the operating current of the motor (refer to the identification label).
The electrical connection may only be made by trained, qualified personnel.

- Prior to connection, observe the basic information provided in this chapter.
- After connection, but before applying voltage, observe the information in Chapter Commissioning and Test run.
- When making the electrical connection, be sure that the power supply is turned OFF! Ensure protection against unintentional reconnection to power!
- For wiring and connection, observe the regulations for the erection of electric power installations and the regulations of the local energy supplier!

- Check compliance of the line voltage and the line frequency with the specifications on the identification label of the actuator and on the identification label of the actuator motor.

- Always select the line cross section so as to match the actuator's power consumption and the required line length. Minimum cross section of the line for this type of linear actuator: 1 mm².

Under fault conditions: Dangerous voltage if protective earth conductor is NOT connected! Risk of electric shock.
→ Do not put the device into operation if the protective earth conductor is not connected.
Short-circuit due to jammed lines! Risk of electric shock and malfunction.

5.5 Making the electrical connection

Danger **Risk of electric shock!**

Dangerous voltage! Risk of electric shock.
→ Disconnect the device from power before removing the cover.
Always use the circuit diagram which is attached or adhered to the inside of the cover.
Replace the dummy plugs with cable glands
1. Strip the wires.
2. Remove the insulation from the conductors.
3. For flexible wires: Use wire end ferrules as specified in DIN 46228.
4. Connect the wires as specified in the customized circuit diagram.
The protection level IP ... shown on the identification label is only ensured if suitable cable glands are used.

6. Commissioning

Compare the thrust of the actuator and the set travel with the valve data. Overload can result in severe damage to the valve.
Pay attention to moving parts during mounting and adjustment. Risk of injury and or substantial material damage.

Attention

Attention, the linear actuator is factory-set to a stroke of 22 mm. Should it be necessary to adjust the stroke or if adjustment to a valve is required, set the stroke as describe in chapter "7.1 Installing the additional assembly (main board)".

6.1 Setting for switching off in end positions

By default, the actuator is switched off in the end positions by force using DE switches. These are factory-set to the force indicated on the identification label.

6.2 Test run

6.2.1 Checking the direction of rotation

- Move the actuator manually to its intermediate position or to a sufficient distance to the end position.
- In direction of travel CLOSE, switch the actuator on and watch the direction of rotation.
- If the direction of rotation is wrong, switch off immediately.
- Check wiring (jumpers). With 3-phase power supply, correct the phase sequence.
- Repeat the test run.

With wrong direction of rotation, damage to actuator and valve will occur, as switching off in end positions fails in case of wrong direction of rotation.

6.2.2 Switching off in end positions

Danger **Risk of electric shock!**

If the switches in the actuator are not factory-wired, check for proper switching off in end positions:
With the cover removed, the linear actuator may only be operated briefly for test runs or when performing absolutely essential adjustments on electrical components, such as potentiometer, limit switches or positioning electronics.
While performing this activity, there is unobstructed access to hazardous, live, exposed, moving and rotating parts. Adjustments performed incorrectly or without applying the necessary caution may result in death, serious injury or substantial material damage.
Any operation of the linear actuator with the cover removed for a purpose other than that described above is prohibited.

Use an insulated screwdriver to actuate the switching rolls of the DE switches and WE switches as shown in the connection diagram and check that the respective switches actually switch off the motor. If necessary, change the motor supply jumpers installed.

Danger **Risk of electric shock!**

7. Accessories

Attention **When mounting, always make sure that the connecting rod is extended.**

Danger **Disconnect the actuator from power before starting any work.**

Attention **Attention: limit switches can only be installed when mounted "with a potentiometer" (main board)!**

7.1 Installing the additional assembly (main board)

Screw nut [287] with toothed lock washer [290] onto the threaded insert of the connecting rod.
Use the marks on the adjusting lever to move slide [261] to the desired travel (for stroke 22 mm set to ~25). Install adjusting lever [260].
Screw toothed lock washer [290] and nut [287] onto the threaded insert.
Turn both hex nuts [287] to adjust the adjusting lever [260] on the threaded insert of the connecting rod such that adjusting lever [260] and driving lever [259] are exactly in parallel in their tilted position.
Use screws [275] to secure the board.

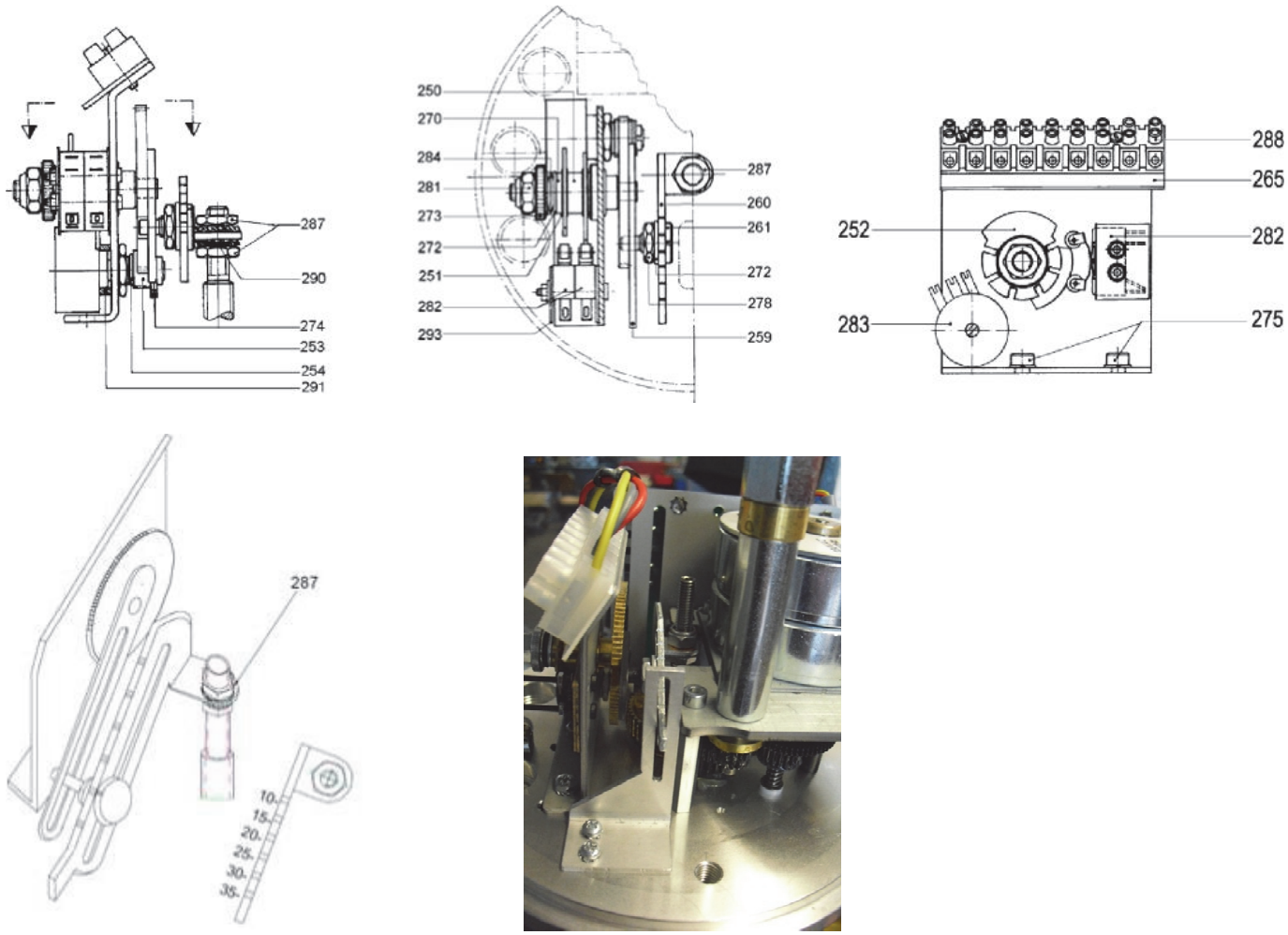

Figure 8: Installation of the additional assembly

8. Installing the potentiometer

Unscrew the mounting screws (275) for the switching and signalling unit and remove the switching and signalling unit.
Remove pinion (253) and circlips (274) from the potentiometer shaft, unscrew the nut from the potentiometer and remove it together with the serrated lock washer.
Slide potentiometer (283) with spacer ring (291) from the side of the tripping cam into the hole provided.
Slide the serrated lock washer onto the potentiometer shaft and screw the nut onto the potentiometer lug.
Assemble in reverse order. Connect wires according to wiring diagram on terminal block.
Make sure there is a minor backlash between the toothed wheel and the potentiometer pinion.
The electrical connection of the potentiometer must be at a sufficient distance from the cams.
The potentiometer can be set to the stroke range using the screw slot located on the rear of the potentiometer.

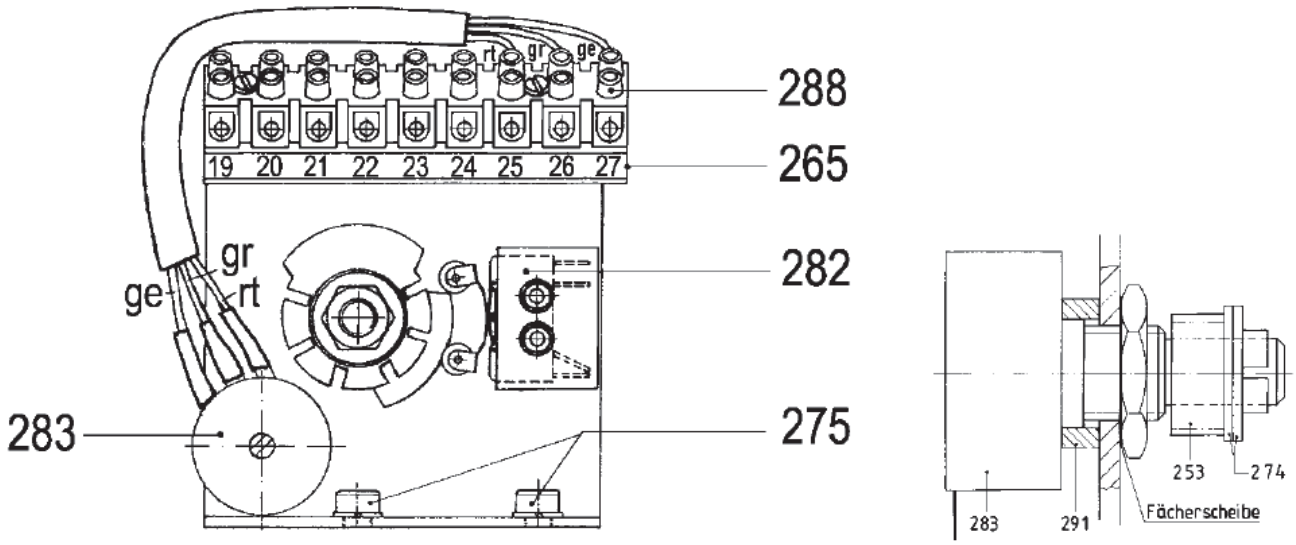

Figure 9: Potentiometer installation

9. Installing additional limit switches

Unscrew nuts (276) from stud bolt (295). Remove face plates (271) and insulating plate (293). Slide switch S4 with the longer wiring harness, followed by the switch with the shorter wiring harness onto stud bolt (295). Assemble in reverse order. Connect wires according to wiring diagram on terminal block.

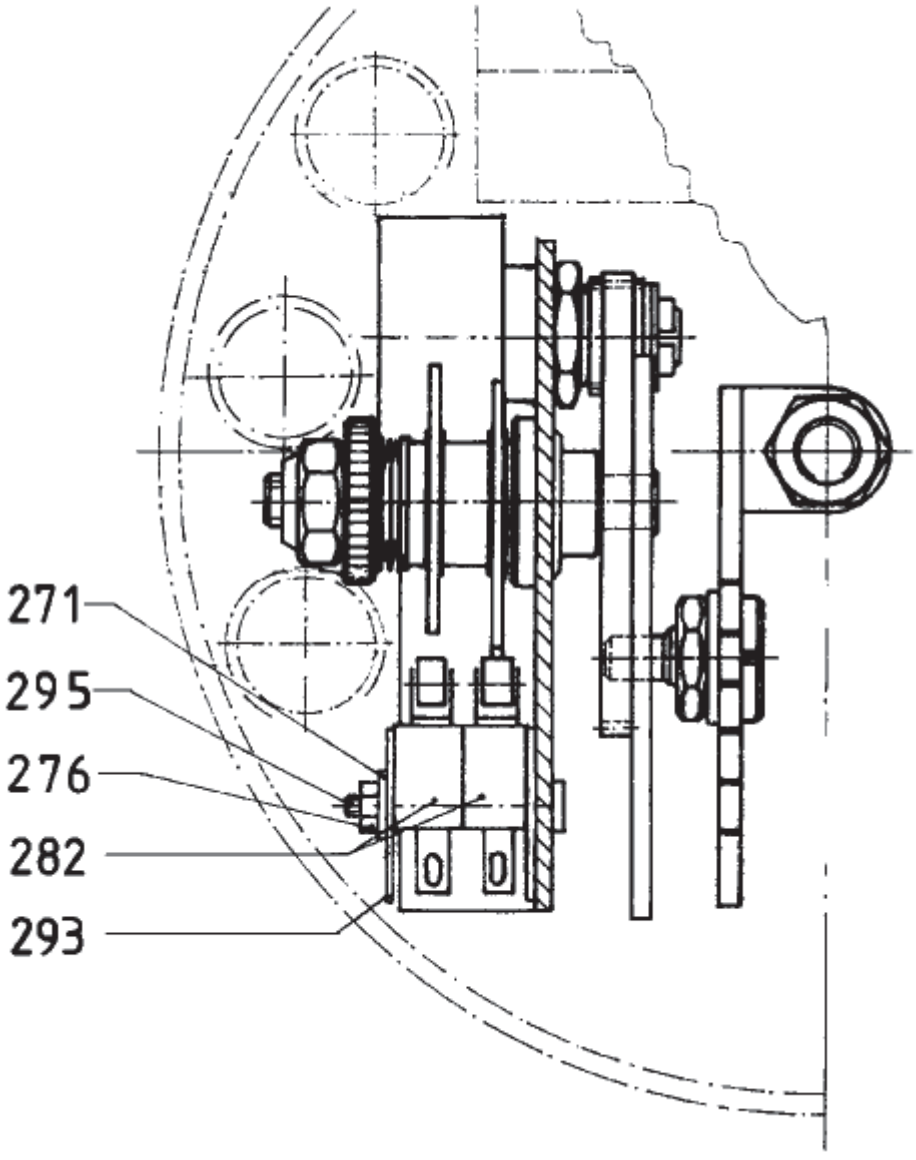

Figure 10: Installation of additional limit switches

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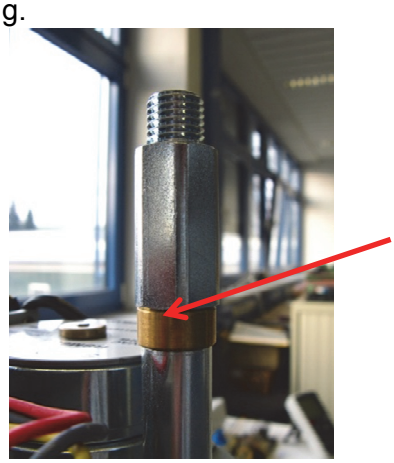
10. Installing the positioning electronics

- Remove the brass sleeve on the manual adjustment shaft by loosening the upper hexagon extension fitting.



- Install the components as shown in the drawing below, do not forget routing of cables.

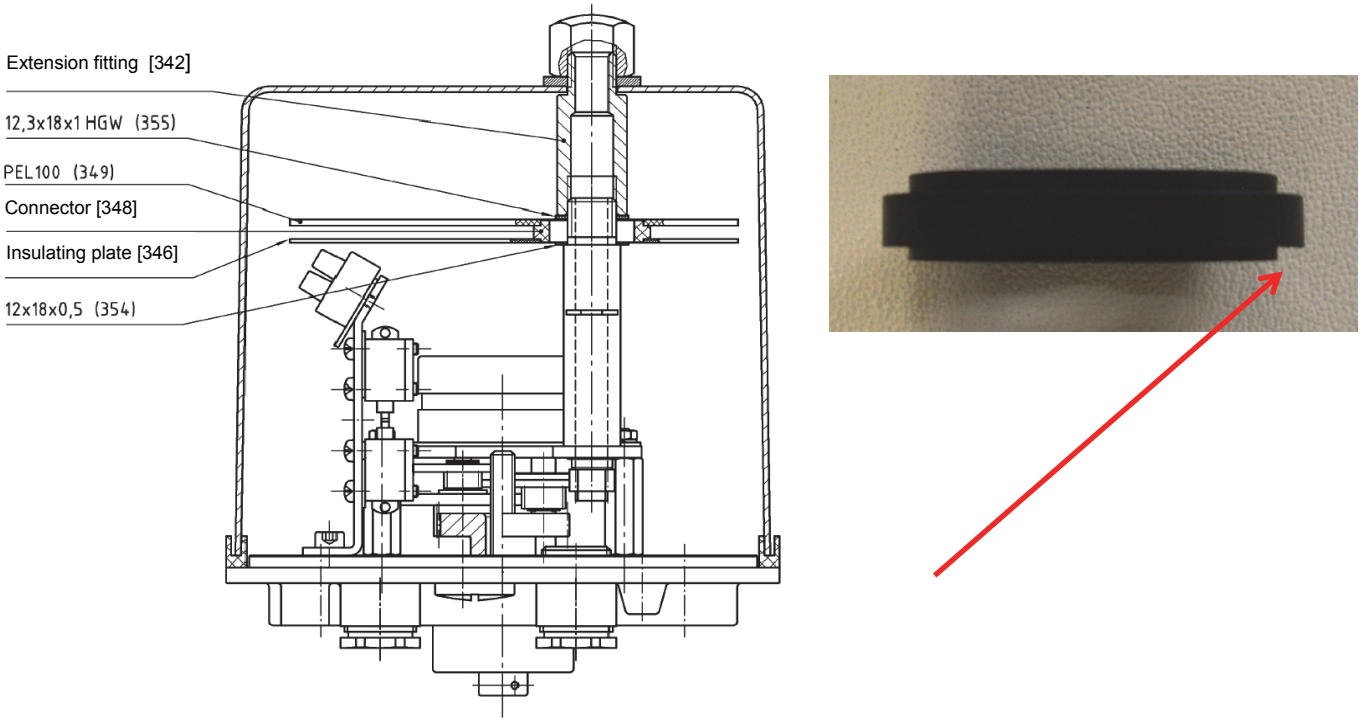


Figure 11: Installation of the positioning electronics

- Please note that the narrow edge of the connector (348) is intended for the insulating plate.
- Install the cable for the potentiometer and the cable for the motor control as specified in the diagrams provided and secure them with cable ties.

10.1 Operating principle of the positioning electronics

The positioning electronics is designed for the control and positioning of actuators. By applying a continuous input signal, the positioner moves the actuator to the defined position. To do so, the positioner compares the controlled variable (actual value) and the reference variable (set point). If these two values deviate, the positioner issues a voltage signal (manipulated variable) to control the valve until the set point and the actual value are within a tolerance band. To determine the actual value, a potentiometer to record the actuator's travel movement is required in the actuator. The LEDs on the positioner board indicate the status of the positioning electronics.

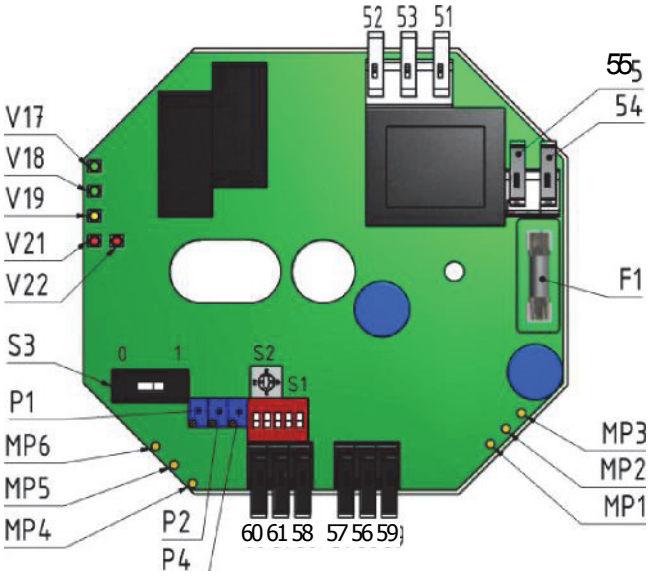


Figure 12: Positioning electronics

LED	Meaning	Indicator
V17	Supply voltage ok	green
V18	Actuator spindle retracts	green
V19	Actuator spindle extends	yellow
V21	Dead band active	red
V22	E1 < 4 mA	red

Use potentiometers P1, P2 and P4 as well as selector switches S2 and S3 to adjust settings, e.g. stroke calibration, split-range operation, reversed actuator action and dead band. The DIP switch settings of switch S1 allow additional functions to be adjusted (e.g. preset zero, spreading of the potentiometer signal and behaviour upon signal failure). The positioner comes with a minimum dead band of 200 ms to prevent sudden changes of the actuator action or rapid activation and deactivation of the actuator. By default, the positioner has a feedback signal that returns the current position of the valve. The signal range corresponds to the input signal range. The feedback signal is not isolated from the input. The type of the control signal (voltage or current) is determined by the terminal assignment.

10.2 Mounting the positioning electronics

Mechanical assembly is done at the factory. After the actuator has been mounted on the valve and the switching and signalling unit have been adjusted, set the potentiometer zero point as described in chapter 8. Installing the potentiometer.

10.3 Electrical connection

Danger **Risk of electric shock!**

Power connection and commissioning of the actuator require specialized technical knowledge regarding the erection of electric power installations (according to DIN VDE 0100), of the accident prevention regulations and of the special requirements for commissioning the linear actuator. These procedures must be performed by qualified personnel only. Failure to heed this warning may result in death, serious injury or substantial material damage!

- When making the electrical connection, be sure that the power supply is turned OFF! Ensure protection against unintentional reconnection to power!
- For wiring and connection of the electrical lines, observe the DIN/VDE regulations for the erection of electric power installations and the regulations of the local energy supplier.
- Check compliance of the line voltage and the line frequency with the specifications on the identification label of the actuator and on the identification label of the actuator motor.
- Always select the line cross section so as to match the actuator's power consumption and the required line length. The permissible wire cross section is 0.8...2.5 mm^2 (AWG 28...12).
- Disconnection from power supply, system side: to disconnect the power supply to the actuator and de-energize the actuator for maintenance and calibration/adjustment, install a suitable main breaker in the system, which guarantees that all poles (except the grounding conductor) are disconnected when turning off. This main breaker must be lockable when switched off and must be protected against unintentional reconnection to power.
- Mains protection, system side: max. 6 A.

10.3.1 Terminal assignment

Terminal X4:

To avoid interference, route the signal lines separately from the voltage supply lines. Particularly when using voltage signals, we recommend to use a shielded cable and to connect the shield to the protective earth (PE) connection on the actuator housing.

Terminal	Function	
60	Output mA	0 (4)...20 mA
61	Output Volt	0 (2)...10 V
58	GND	Ground
57	GND	Ground
56	Input Volt	0 (2)...10 V
59	Input mA	0 (4)...20 mA

The impedance of the current input is 50 Ω. When using the voltage input, the impedance is 20 kΩ.

Terminal X2:

Terminal	Function		
54	L	Power input Phase	50/60 Hz
55	N	Power input Neutral	

Terminal X3:

Terminal	Function		
51	L↑	Phase, spindle retracts	50/60 Hz
52	N	Neutral, power input	
53	L↓	Phase, spindle extends	50/60 Hz

Connector X4:

The potentiometer is plugged onto the positioner's printed circuit board using a connector.

Pin	Function	
1	Maximum value	blue
2	Sensing at the slider	green
3	Zero	red

Figure 13: Pin assignment table

10.3.2 Determining input and output signals

The actuator is either preset to 0...10 V, 0...20 mA or to 2...10 V, 4...20 mA .Depending on the configuration, the lines for the input and output signals are connected to terminal X4.

10.4 Commissioning and settings

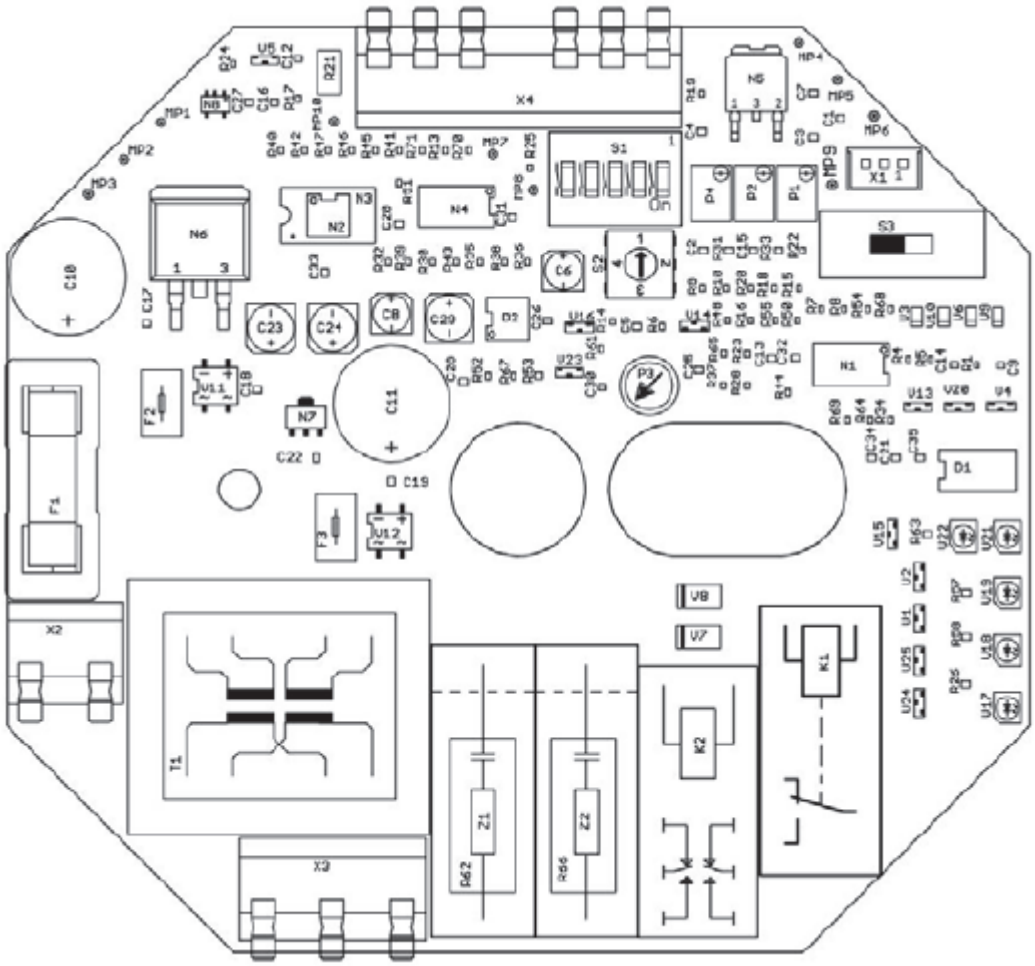


Figure 14: Positioning electronics

Potentiometers

P1	Lower limit adjustment	Turn clockwise to lower the limit
P2	Upper limit adjustment	Turn clockwise to lower the limit
P4	Span adjustment	Turn counter-clockwise to spread the potentiometer signal

Switch

	Description	ON	OFF
S1.1	Preset zero	0 mA	4 mA
S1.2	Spreading	Off	On
S1.3	FAIL CLOSE	On	Off
S1.4	FAIL OPEN	On	Off
S1.5	Behaviour upon failure	On	Off

	Description	Position	
S2	Dead band	1	1.5%
		2	1.0%
		3	0.5%
		4	0.25%
S3	Inversed action / action reversal	0	Off
		1	On

Measurement points

	Description		Signal
Mp1	Supply voltage +15 V		+15 V
Mp2	Supply voltage -5 V		-5 V
Mp3	Ground		
Mp4	Voltage at max. value (actual value)	at 0...10 V or 0...20 mA	10.1 V
Mp5	Voltage coming from potentiometer slider		
Mp6	Voltage at min. value (actual value)	at 0...10 V or 0...20 mA at 2...10 V or 4...20 mA	0 V 2 V

F1	Fuse	250 mA /230 V 1 A /24 V
V1 + V2	Quenching circuit	Spark quenching at relay contacts may be required

Figure 15: Settings table

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10.5 Calibrating the positioning electronics to the travel

The positioning electronics are adjusted by the manufacturer for the specified travel. Therefore only minor calibration should be required. The following requirements must be fulfilled before proceeding:

- The actuator is properly mounted on the valve
- The switching and signalling unit is properly adjusted to the valve stroke
- The potentiometer's zero point corresponds to the stroke's lower end position
- The limit switches have been adjusted to the valve stroke

The positioning electronics can be adjusted so that the actuator is switched off either by the switches (DE, WE) or the positioning electronics when it reaches the end positions.
If the actuator is switched off by the switches, adjust the potentiometers on the positioning electronics so that the LEDs just remain illuminated when the end position is reached.

10.5.1 Setting the zero

At the input, set the lower set point (0 or 4 mA, 0V) for the lower end position.
Turn potentiometer P1 counter-clockwise until the actuator is switched off by the associated switch and LED V19 just remains illuminated. This can be checked by turning the potentiometer back.

10.5.2 Setting the end position

For the upper end position, use potentiometer P2 in combination with LED V18 to preset the set point for the upper end position.
Turn potentiometer P2 clockwise to shift the tripping point upward. When the actuator is to be switched off by the switches, change the potentiometer setting until the LED just remains illuminated.

If the potentiometer's angle of rotation cannot be fully used due to a very small travel, use the spreading function to adapt the input range. This function is activated by setting switch S1.2 to OFF.
Turn potentiometer P4 counter-clockwise to shift the upper tripping point downward.

10.6 Setting the dead band

The set dead band of the actuator depends on the actuator. This parameter is factory-set and should not be changed. If the dead band setting is too narrow, the actuator will oscillate around the set point, which will cause premature wear of positioner and actuator. If oscillations are detected, these can be reduced by increasing the dead band. Make sure the setting is retained when replacing the positioning electronics.

10.7 Reversing the actuator action

If the actuator travel is to be reversed as compared to the set point, this can be done by changing the setting of switch S3. It may then be necessary to adapt the end positions or travel.

10.8 Detecting wire breaks

The wire break detection function permits detection of incorrect input signals. This function can be activated or deactivated using switch S1.5. To use this function, the input signal must be set to 4...20 mA or 2...10 V. When using the wire break detection function with the input signal set to 0...20 mA or 0...10 V, a malfunction of the positioner will occur. The fail-safe function is triggered as soon as the input signal is below 3.5 mA.
Use switches S1.3 and S1.4 to set the actuator behaviour in case of a signal failure.

DIP switch positions							Function
	X			X	**ON**		FAIL AS IS
X		X	X		**OFF**		
S1.1	**S1.2**	**S1.3**	**S1.4**	**S1.5**			
	X		X	X	**ON**		FAIL OPEN
X		X			**OFF**		
S1.1	**S1.2**	**S1.3**	**S1.4**	**S1.5**			
	X	X		X	**ON**		FAIL CLOSE
X			X		**OFF**		
S1.1	**S1.2**	**S1.3**	**S1.4**	**S1.5**			

Figure 16: Cable break detection table

10.9 Split range control

For setting the split-range control, use the set point for the upper end position (e.g. 12 mA) to activate the actuator. Turn potentiometer P2 until the stroke corresponds to the upper end position. Turning the potentiometer counter-clockwise causes the actuator spindle to retract.
The lowest value that can be set for the upper deactivation point is ~8 mA or ~4.0 V.
Then set the set point to the lower end position (e.g. 6 mA). Turning potentiometer P1 counter-clockwise causes the actuator spindle to extend. The highest value that can be set for the lower tripping point is ~13.2 mA or ~6.6 V.
Check the end positions by moving the valve to its upper and lower end position.

10.10 Changing the preset signal range for the set point

The positioning electronics can be preset using measurement points without the need for an input signal. For adjustment to the actuator, refer to 10.5 Calibrating the positioning electronics to the travel.

Adjusting the 4...20 mA or 2...10 V signal
Configuration of DIP switches S1:

	X				**ON**
X		X	X	X	**OFF**
S1.1	**S1.2**	**S1.3**	**S1.4**	**S1.5**	

Figure 17: Table for set point 4-20mA, 2-10V

- Apply voltage to terminals 54 and 55 of the positioning electronics
- Measure the voltage between measurement points 3 and 6
- Use potentiometer P1 to adjust the voltage to 2.0 V
- Measure the voltage between measurement points 3 and 4
- Use potentiometer P2 to adjust the voltage to 10.0 V

Adjusting the 0...20 mA or 0...10 V signal
Configuration of DIP switches S1:

X	X				**ON**
		X	X	X	**OFF**
S1.1	**S1.2**	**S1.3**	**S1.4**	**S1.5**	

Figure 18: Table for set point 0-20mA, 0-10V

- Apply voltage to terminals 54 and 55 of the positioning electronics
- Measure the voltage between measurement points 3 and 6
- Use potentiometer P1 to adjust the voltage to 0.0 V
- Measure the voltage between measurement points 3 and 4
- Use potentiometer P2 to adjust the voltage to 10.0 V

10.11 Specifications

Command signal	0(4)...20 mA, Ri approx. 50 Ω 0(2)...10 V, Ri > 100 kΩ
Feedback signal	0(4)...20 mA, load 500 Ω 0(2)...10 V corresponds to the command signal
Indicator	LEDs
Potentiometer	1000 Ω
Relay	Relay contacts max. 250 V / 50/60 Hz, 2 A
Power supply	24VAC /110V AC / 230 VAC
Terminals	Snap-fit terminals for 1.5 mm^2 solid wire or wire with wire end ferrules
Ambient temperature	-10 °C...+50 °C

Figure 19: Specifications table

10.12 Connection example

The circuit diagram is only an example and is only intended for general information. Always use the connection diagram enclosed with the actuator. The connection of load-dependent DE switches and travel-dependent WE switches depends on the application (valve type, deactivation in end position, ...) and must be defined by the operator.

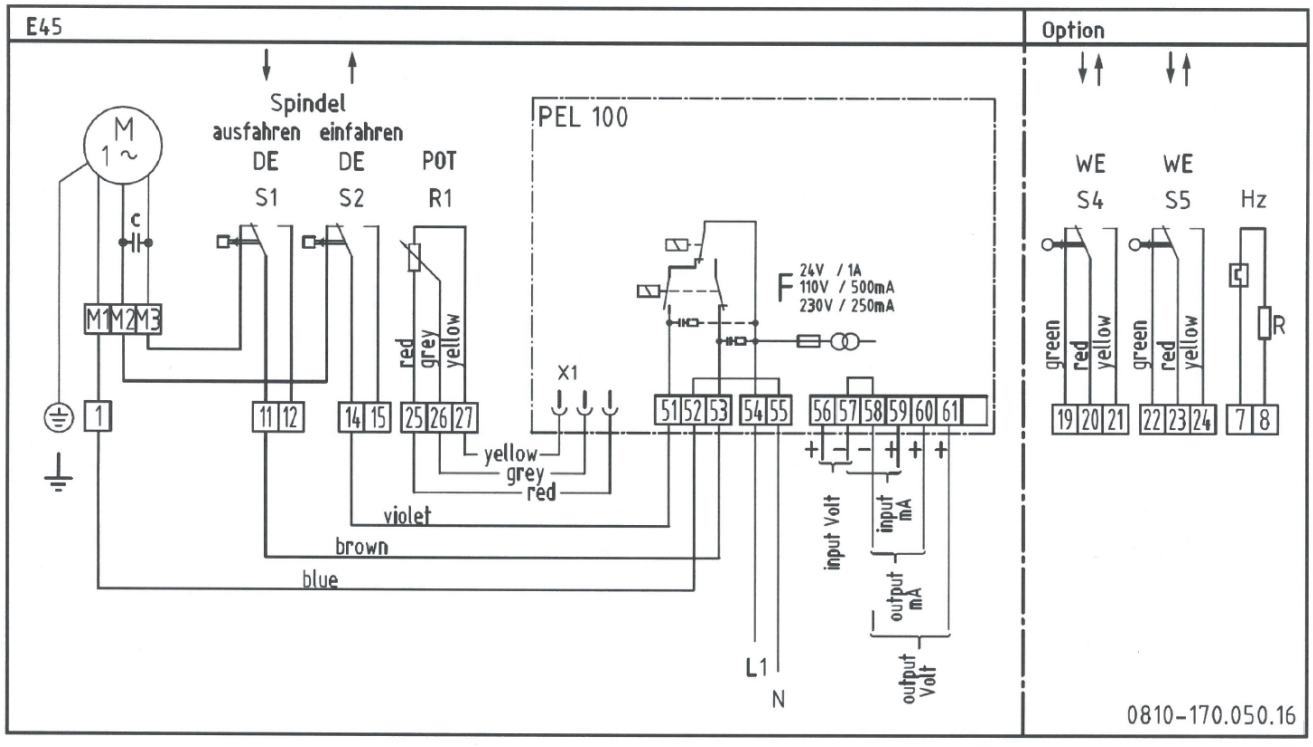

Figure 20: Connection diagram

11. Installing the electronic position transmitter

Actuators can also be equipped with an electronic position transmitter.
The electronic position transmitter converts the mechanical position of the actuator into:
a DC current of 4...20 mA.
A 2...10 V voltage signal can also be used by the integration of a 500 Ω resistor.
The action can be reversed with switch S1.

11.1 Mounting the position transmitter

Mechanical assembly is done at the factory. Retrofitting of the position transmitter is subject to specific requirements. Before installation of the position transmitter, it must be ensured that the actuator is equipped with the 5 kΩ potentiometer (and the switching and signalling unit, if applicable) required for operation. After the actuator has been mounted on the valve and the switching and signalling unit have been adjusted, set the potentiometer zero point as described in chapter 10.5 Calibrating the positioning electronics to the travel.

11.2 Electrical connection

Danger

Risk of electric shock!

Power connection and commissioning of the actuator require specialized technical knowledge regarding the erection of electric power installations (according to DIN VDE 0100), of the accident prevention regulations and of the special requirements for commissioning the linear actuator. These procedures must be performed by qualified personnel only.

Please observe the safety precautions!

11.3 Operating principle of the electronic position transmitter

The position transmitter can be calibrated directly on the device. All components required must be operational (10.5 Calibrating the positioning electronics to the travel).
The feedback signal and the required voltage source must be connected to actuator terminals 25 to 27, depending on the connection type.
Optionally the measuring instrument (ammeter) can also be connected to measurement points MP- and MP+.

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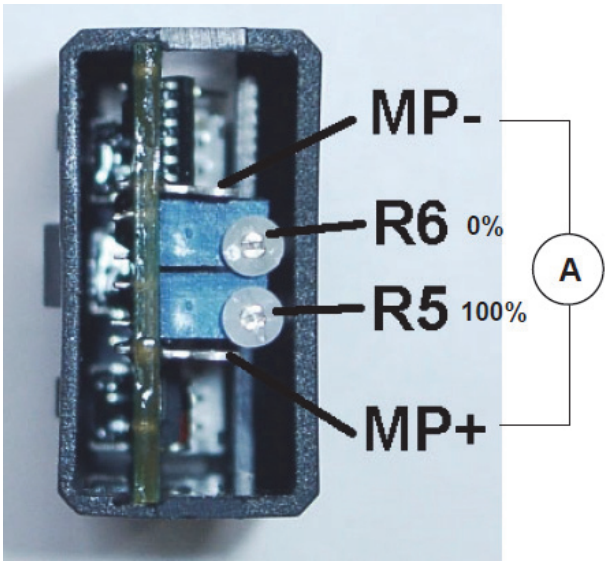

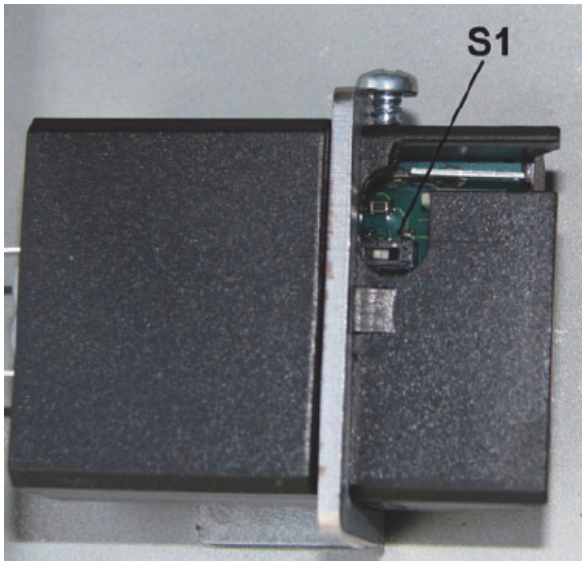

MP-	Connection ammeter - pole
MP+	Connection ammeter + pole
R6	Setting 0%, value 4 mA
R5	Setting 100%, value 20 mA
S1	Action reversal (switch in left position)

Figure 21: Installation of the position transmitter

11.4 Calibrating the electronic position transmitter

- Apply supply voltage
- The actuator is in the end position 0% (closed)
- Connect the measuring instrument for 0-20 mA to the measurement points (MP1 "-"/MP2 "+")
- The output current in the end position "0%" of a 2-wire connection is 4 mA.

The electrical circuit (external load) must be connected (observe max. load R_B), otherwise no current can be measured.

- Turn setting potentiometer R6 clockwise until the output current increases (see illustration).
- Turn setting potentiometer R6 counter-clockwise until the residual current is 4.0 mA.
- Move the actuator to end position "100%" (open).
- Use setting potentiometer R5 to set the upper output current of 20 mA.
- Move the actuator back to end position "0" (closed) and check that the minimum value is 4 mA. If necessary, correct with setting potentiometer R6.

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11.5 Reversing the action of the electronic position transmitter

If the output signal of the position transmitter is to be reversed, slide switch S1 must be set to the left position.

Position	not reversed:	reversed:
100 % position OPEN	20 mA	4 mA
0% position CLOSED	4 mA	20 mA

11.6 Specifications

Electrical connection	2-wire connection
Supply voltage U_v	24 V DC
Load **Rb**	(U_v-12V) / 20mA
Output current	4-20 mA
Operating current	max. 20 mA

11.7 Circuit diagram

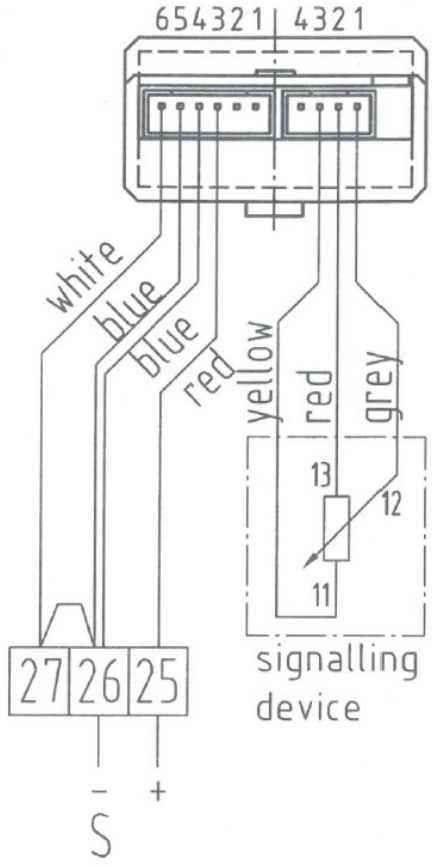
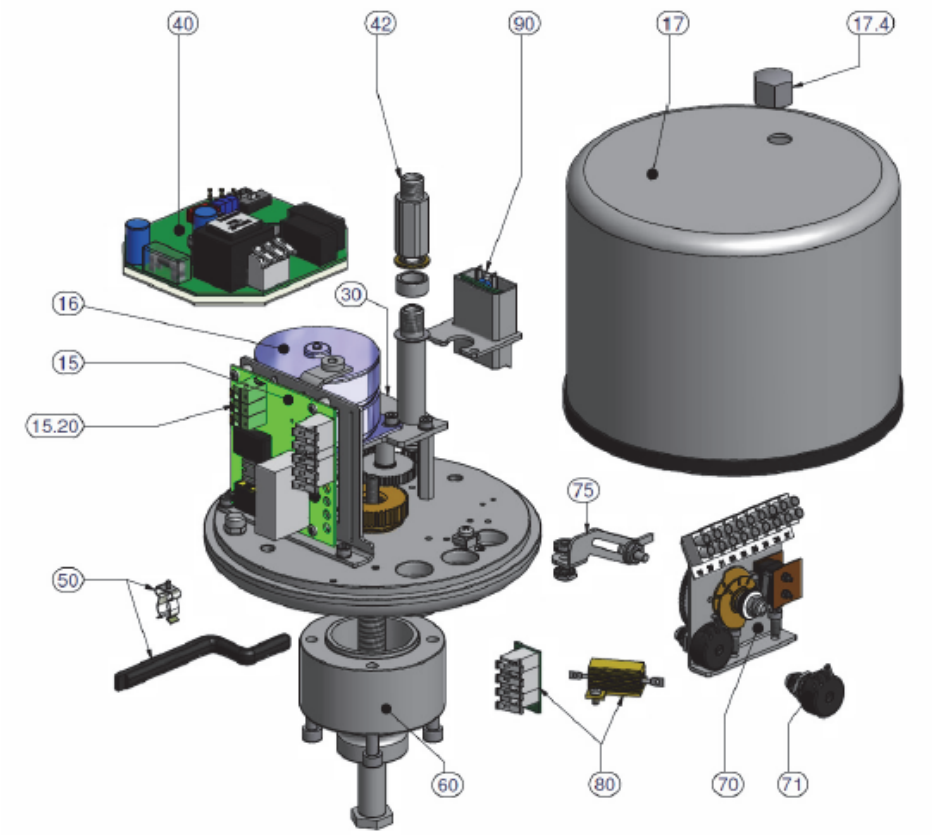


Figure 22: Position transmitter circuit diagram

12. Spare parts



Item	Description	
15	Mounting panel cpl.	
15.20	PCB cpl.	
16	Motor cpl.	
17	Cover cpl.	
17.4	Cap nut	
30	Mounting plate cpl.	
40	Positioning electronics PEL 100	
42	Extension	
50	Hand crank cpl.	
60	Flange cpl. Incl. connecting rod	
70	Remote transmitter cpl.	
71	Potentiometer cpl.	
75	Adjusting lever cpl.	
80	Heater cpl.	
90	ESR 200 cpl.	

Item	Description	

Figure 23: Spare parts list

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When ordering accessories or spare parts, make sure to observe the specifications on the identification label of your actuator. The actual technical data of the linear actuators and the power supply requirements are the specifications indicated on the identification label.

Damage to the device caused by non-conforming spare parts!

Attention

Spare parts must comply with the technical requirements specified by the manufacturer.

- Always use original spare parts.

13. Decommissioning and disposal

Dispose of the actuator in accordance with applicable, country-specific regulations and laws.

14. Troubleshooting

If the actuator does not work properly, proceed as follows to correct the problem:

1 Check that the actuator is correctly installed.
2 Check the linear actuator settings and the specifications on the identification label.
3 Correct the problems as specified in the check list.
(see 11.2 Check list for operational malfunctions on page 32)
4 If the problem cannot be corrected, contact the manufacturer.

5 When sending inquiries to the manufacturer or when returning the device, always provide the following information:

F no. (factory number = order number)
Type identification
Supply voltage and frequency
Additional equipment
Failure report

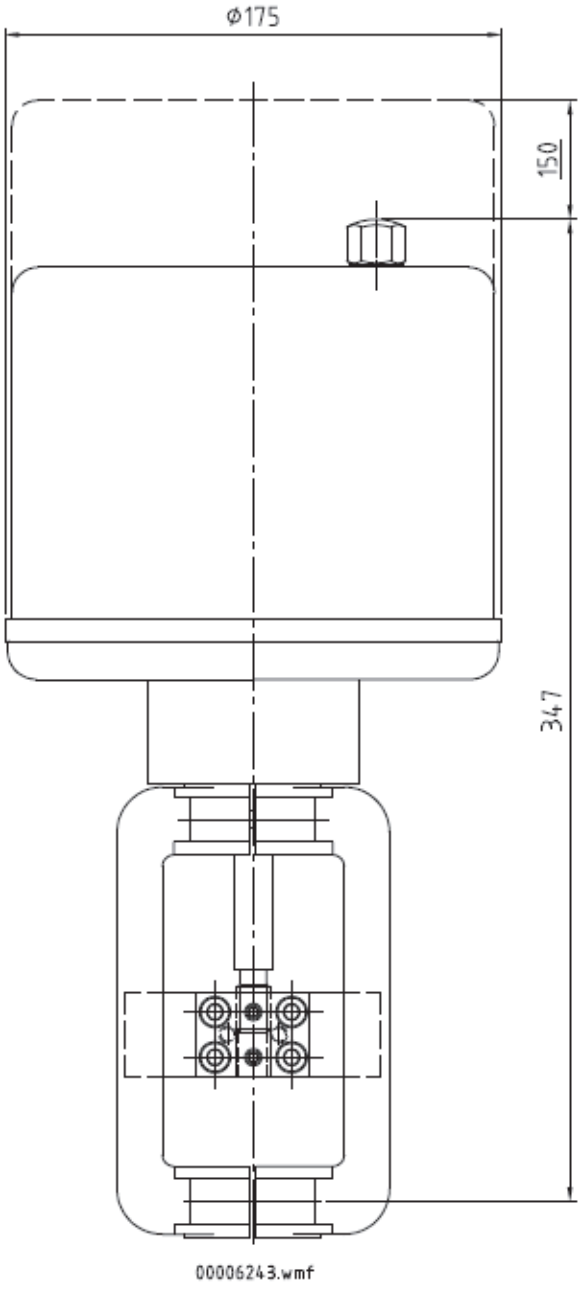
6 If, after the inquiry, the problem still cannot be corrected, the device can be returned to the manufacturer.

14.1 Check list for operational malfunctions

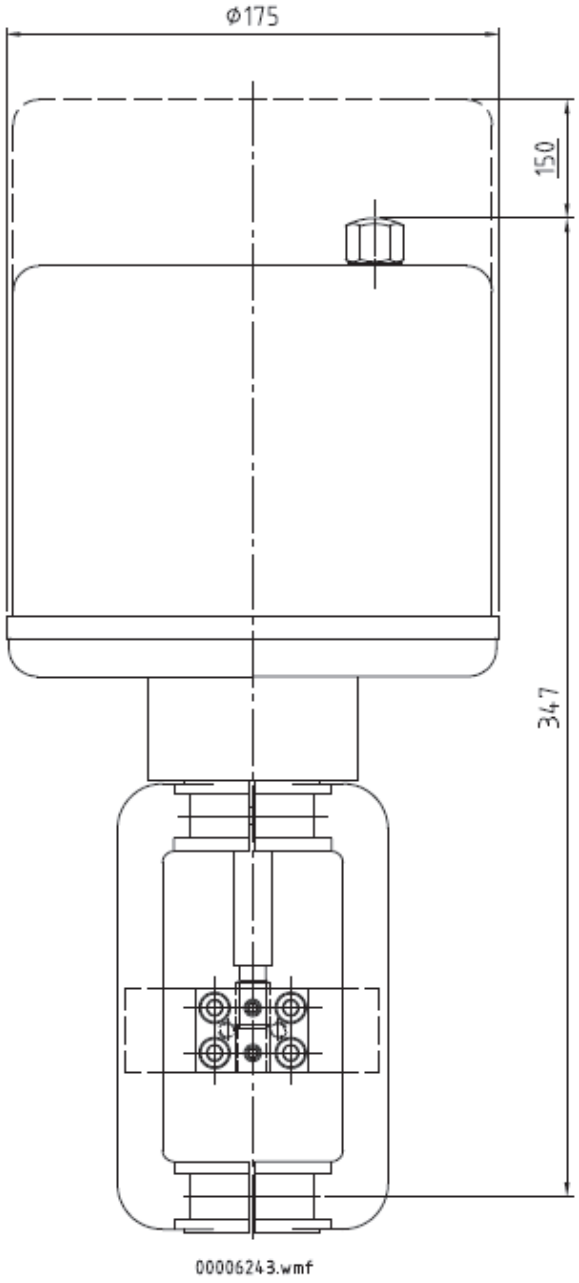
Malfunction	Cause	Action required
Actuator will not operate.	Power failure	Determine the cause and correct the problem.
	Defective fuse (in control cabinet)	Determine the cause and correct the problem, replace the fuse.
	Linear actuator incorrectly connected	Re-connect as specified on circuit diagram (on the cover).
	Short-circuit caused by humidity	Determine the cause, dry the linear actuator; replace cover seal and screw joints, and /or attach protective cover, as required. .
	Short-circuit caused by incorrect connection	Connect correctly.
	Motor winding damage, e.g., caused by high voltage, defective electronics	Determine the cause, measure current data, compare with identification label and table, remove linear actuators and return for repair.
	Voltage drop due to connecting cables being too long and / or with insufficient cross-section	Measure current data with linear actuator, recalculate connecting cables and replace, as applicable.
Unsteady linear actuator movement, i.e. moves between OPEN and CLOSED.	Power fluctuations exceed permissible tolerance.	Improve power supply conditions.
	Loose contact in supply line	Check and tighten connections (terminal strips).
Linear actuator stops temporarily	Valve jammed	Ensure smooth valve movement.
Linear actuator does not move to the end position. Valve fails to open / close.	System pressure too high	Adjust system pressure.
	Poor input signal - Interfering signals - Signal variations	Check input signal at linear actuator, correct the problem causing the malfunction.
Linear actuator fails to move or does not move correctly to the position defined by the input signal.	Main board defective	Replace main board, if necessary remove actuator and return for repair.

Figure 24: Check list for operational malfunctions

15. Dimension specifications



S21



S21 Spindle diameter 16mm

Figure 25: Dimension specifications

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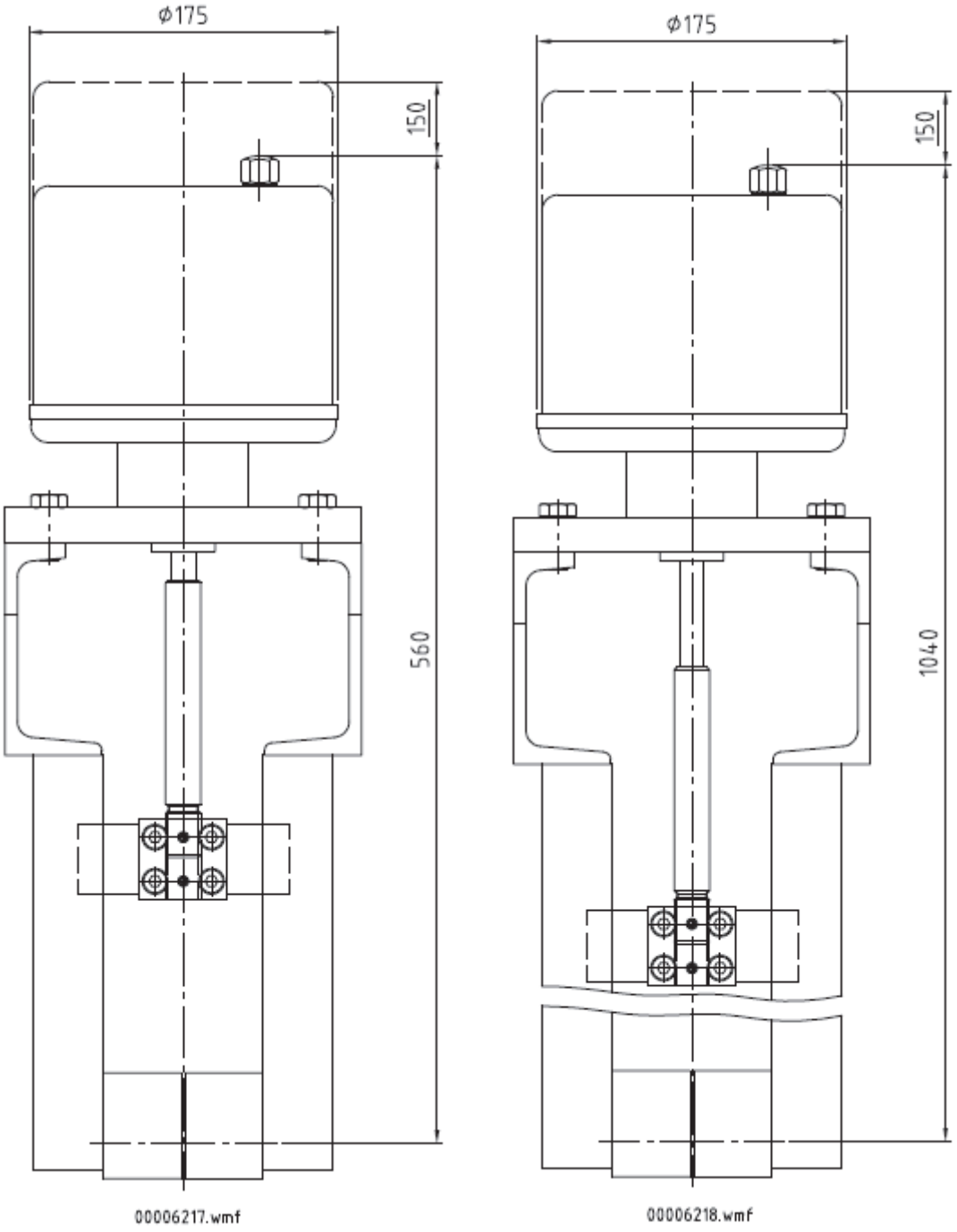

S31 S31-C

Figure 26: Dimension specifications