Operating Instructions **BA 373-E66**

Baelz-electrodyn
Actuator for modulating duty
Motorized linear actuator baelz 373-E66

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1. 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.

1.1 Intended use

baelz 373-E66-150-22 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 manual are intended for the adjustment of the valve stroke.

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.

1.2 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.

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1.3 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.

1.4 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-E66-080-25 (8kN)
baelz 373-E66-150-22 (15kN)

1.5 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.

1.5.1 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.

1.5.2 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.

1.6 Work environment

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

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2. PRODUCT DESCRIPTION

2.1 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.).

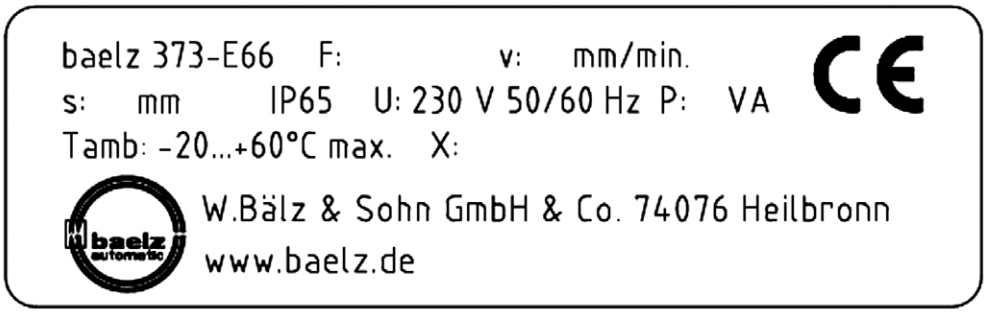


Figure 1: Baelz identification label for motorized actuators

2.2 Specifications

Type		Baelz 373-E66	
Actuating force	kN	8,0	15,0
Positioning speed [1]	mm/min	25	22
Power consumption (230 V)	VA	34	
Nominal current (230 V)	A	0.15	
Type of motor [3]		syn	
Motor protection [4]		B	
Max. stroke	mm	80	
Supply voltages [2] [5]		24 V / 115 V / 230 V 50/60 Hz +-10%	
Type of duty acc. to IEC 34-1		S4 – 30% ED 600 c/h	
Cable gland		2 x M16x1.5 and 1 dummy plug	
Electrical connection		Inside terminal board, terminal assignment acc. to electrical connection diagram	
Switch-off in end position		2 load-dependent switches, max. 250 V AC, rating for resistive load, max. 10 A, for inductive load, max 5 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 fixture	
Manual adjustment		with side-mounted handwheel	
Enclosure protection acc. to EN 60529		IP 65	
Trapezoidal thread		Tr 20 x 4	
Connection type		DIN 3210 G0 (also refer to options)	
Weight	kg	13.0	

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 stall proof motor
5) see price list for possible combinations

Figure 2: Specifications table

2.3 Accessories and options

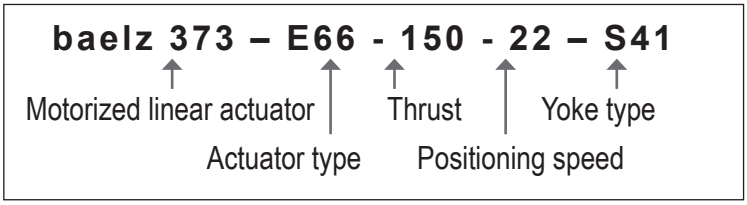
Options package 1	(continuous control)
2 WE	2 additional limit switches (S3 and S4) for signalling end positions or intermediate positions, freely adjustable, max. 250 V AC, rating for resistive load max. 5 A, for inductive load max. 3 A
FG	Potentiometer 1000 ohms, linearity error ≤ 0.5%, max. 1.5 W, contact current 30 mA
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: Table - Options package 1

Options package 2	(3-point control)
2 WE	2 additional limit switches (S3 and S4) 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
FG	Potentiometer 5000 ohms, linearity error ≤ 0.5%, max. 1.5 W, contact current 30 mA
ESR	Electronic position transmitter, 2 wire technique, output 4...20 mA, connection 24 V DC, requires 5000 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 4: Table - Options package 2

2.4 Type name



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2.5 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

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3. 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.

4. MOUNTING

4.1 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.

Caution

Damage caused by missing valve!

- 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.

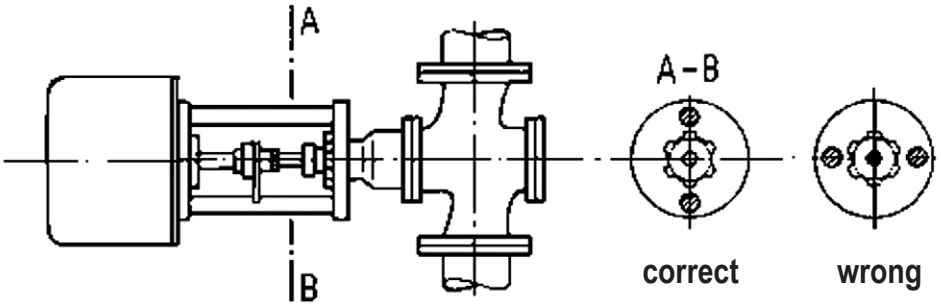

Figure 5: Mounting position

4.2 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.

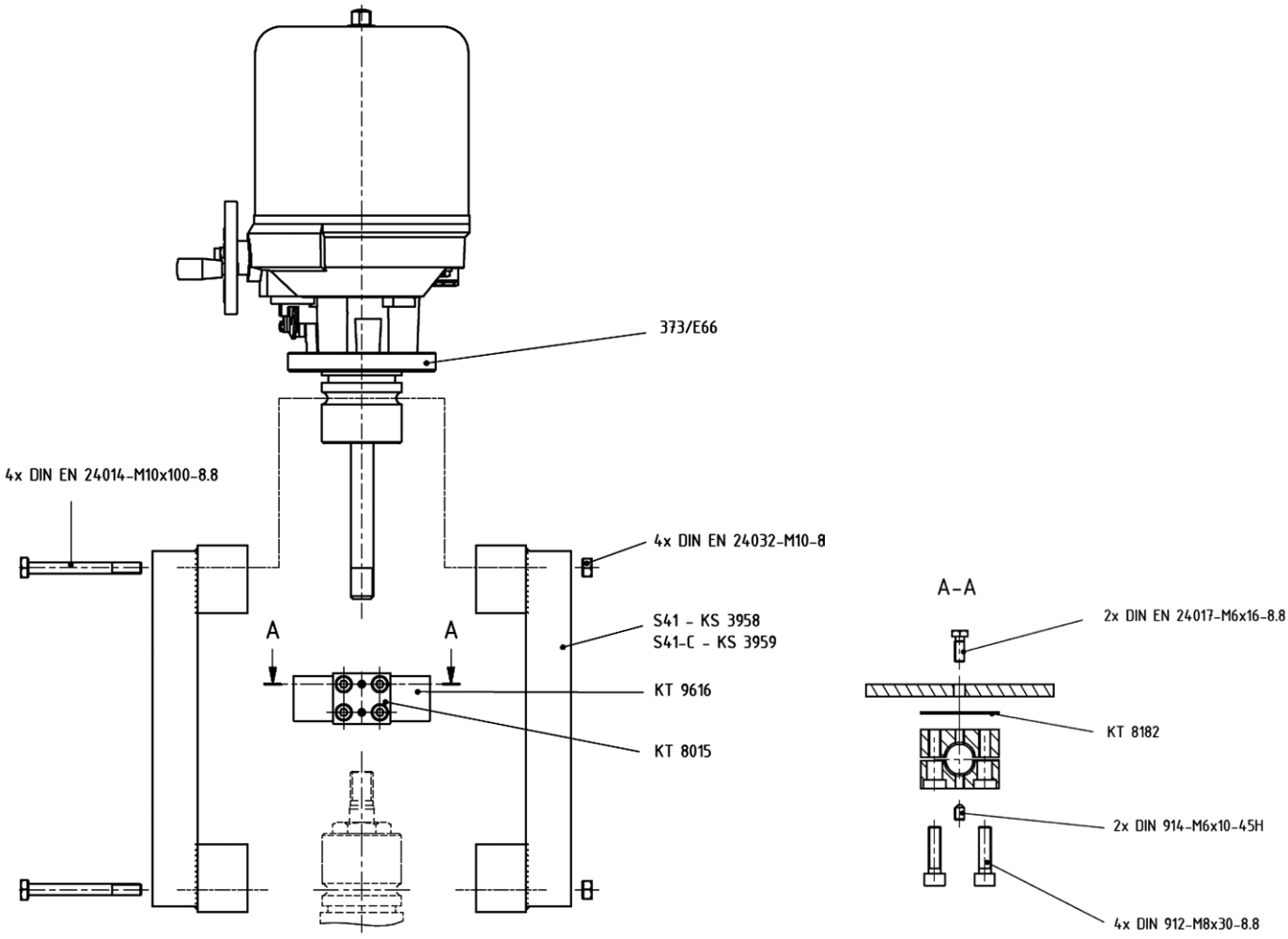

Figure 6: Assembly with valve

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.

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4.3 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 motion into a linear motion. Load-dependent and travel-dependent switches define the stops for the end positions.

4.3.1 Manual adjustment

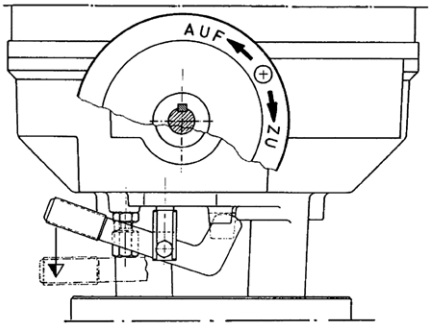

Figure 7: Manual adjustment

Do not disengage or engage the handwheel / disengaging lever while the motor is in motion.

Manual adjustment may only be done when the motor is not in motion. For the adjustment,

- push down the disengaging lever with your left hand in the direction of the extending connecting rod
- At the same time, turn the handwheel with your right hand until it has noticeably engaged
- To operate the linear actuator, turn the handwheel keeping the disengaging lever in engaged position

Turn the handwheel clockwise

➔ The actuator connecting rod extends

Turn the handwheel counter-clockwise

➔ The actuator connecting rod retracts

The linear actuator will automatically return to motor operation as soon as the disengaging lever is released.

4.4 Removing the cover

Danger

Disconnect the supply line before any maintenance procedures or adjustment of the actuator

- Unscrew the cap nut
- Remove the sealing washer
- Hold the cover on the jacket and slightly turn the cover while pulling it off

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4.5 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.

4.6 Making the electrical connection

Risk of electric shock!

Danger

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. Remove the sheath from the cables.
2. Strip the wires.
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.

5. 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 44 mm.
In case of a stroke >44 mm, make sure not to damage the adjusting lever [260] when manually extending the spindle!
Should it be necessary to adjust the stroke or if adjustment to a valve is required, set the stroke as describe in chapter 6.

5.1 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.

5.2 Test run

5.2.1 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.

5.2.2 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.

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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!**

6. 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)!**

6.1 Switching and signalling unit

This actuator can be equipped with a switching and signalling unit **[114]**.
This unit includes:

- 2 travel-dependent switches "WE"– S3 and S4 **[282]** which can be used as limit switches or signal switches (as special version also available with 4 WE)
- 1 potentiometer **[283]** as signalling module

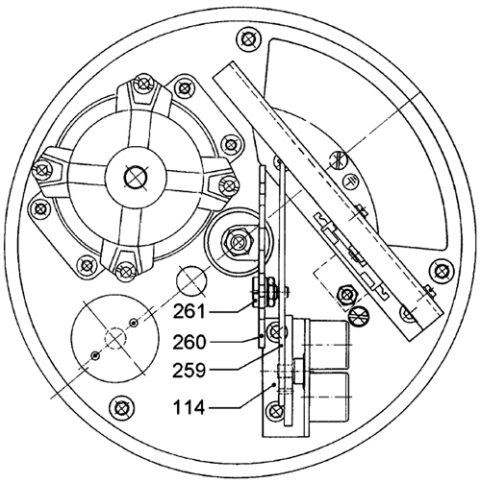

Figure 8: Switching/signalling unit

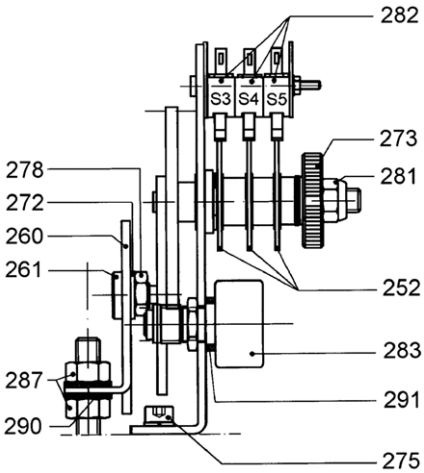

Figure 9: Switching/signalling unit, side view

It is operated by the axial motion of the connecting rod via the adjusting lever **[260]** with continuously adjustable slider **[261]** which is fitted to the threaded bolt of the connecting rod. The slider engages in the slot of the driving lever **[259]**. The axial motion is converted into a rotary motion which is transferred to a gear wheel which then operates the potentiometer and the cam shaft for WE switches S3 and S4.

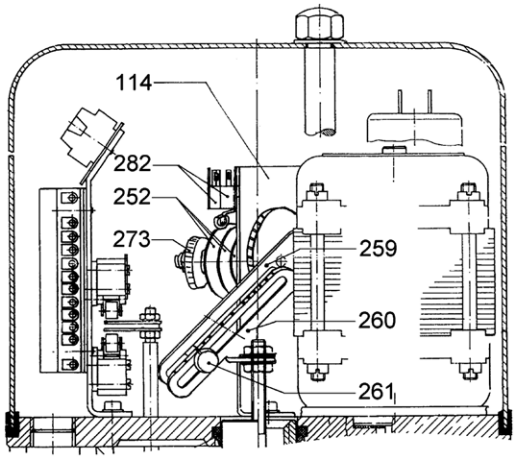

Figure 10: Position of the switching and signalling unit in the actuator

If the linear actuator (actuator with yoke mounted on the valve) is supplied with integrated switching and signalling unit with WE switches S3 and S4 **[282]** and/or potentiometer, the slider **[261]** in the adjusting lever **[260]** is adjusted to the travel specified in the order.

To avoid any risk of damage, actuators with yoke not mounted to the valve, do not have the adjusting lever **[260]** mounted to the threaded bolt of the connecting rod. The adjusting lever **[260]** with slider **[261]**, the Baelz anti-rotation fixture, self-locking nuts **[287]** and Teflon washers **[290]** are supplied separately with the actuator.

6.2 Mounting and setting the switching and signalling unit

After the linear actuator has been assembled on the valve as described in chapter 4.2, install the separately supplied or previously removed adjusting lever (see figures 8, 9 and 10):

- Use the handwheel to move the actuator to the end position "connecting rod extended" until DE switch S1 switches (check with a measuring instrument, if necessary)
- Screw a self-locking nut **[287]** onto the threaded bolt of the connecting rod
- Place a Teflon washer **[290]** onto the nut
- Rotate the camshaft so that the driving lever **[259]** points up
- Hang the adjusting lever **[260]** with slider **[261]** into the slot of the driving lever
- Position the adjusting lever **[260]** so as to be above the threaded bolt of the connecting rod
- Rotate the camshaft back to its original position and place the adjusting lever onto the threaded bolt
- Fit the Baelz anti-rotation fixture
- Place the second Teflon washer **[290]** onto the threaded bolt
- Screw the second self-locking nut **[287]** onto the threaded bolt
- Turn the two hex nuts **[287]** to adjust the adjusting lever **[260]** on the threaded bolt of the connecting rod such that adjusting lever **[260]** and driving lever **[259]** are exactly in parallel in their tilted position
- Tighten adjusting lever **[260]** with nuts **[287]** and ensure parallel alignment of the two levers when viewed from the top

When tightening the upper nut **[287]** with an open-end wrench with width across flats 10, hold the lower nut **[287]** to prevent deformation of the threaded bolt.

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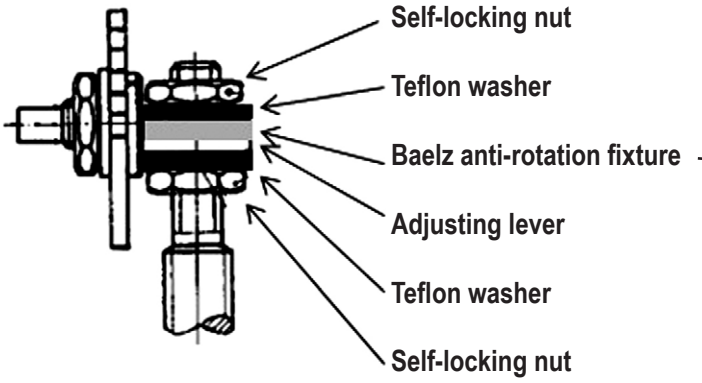

Figure 11: Adjusting lever position detection

Figure 12: Adjusting lever with anti-rotation fixture

6.3 Setting a different travel

Please make sure not to damage the adjusting lever [260] when manually extending the spindle!

If the travel has to be adjusted, the adjustment must be made in the end position "connecting rod extended".

Adjusting lever **[260]** and driving lever **[259]** must be exactly in parallel in their tilted position.

- Use an open-end wrench with width across flats 10 to loosen the flat nut **[278]** on the slider **[261]**
- Move the slider **[261]** and use the marks on the adjusting lever to set the desired travel; retighten the flat nut **[278]**

The travel of the actuator type E66 is continuously adjustable from 16–80 mm. It is therefore possible to set any desired intermediate position (travel marks at 16 – 20 – 25 – 30 – 35 – 40 – 50 – 60 – 70 – 75 – 80 mm).

6.4 Setting the potentiometer

- Use the handwheel to move the actuator to the end position "connecting rod extended" until DE switch S1 is switched. Make sure the adjusting lever **[260]** (see figure 8) and driving lever **[259]** are parallel in their tilted position
- Use a screwdriver to move the potentiometers' slider to its end position by turning the potentiometer shaft on the rear of the potentiometer counter-clockwise until a stop is felt
- Move the actuator through the adjusted travel range to the end position "connecting rod retracted". The potentiometers will rotate to the other end position
- Use a measuring instrument (ohmmeter) to monitor the potentiometer movement and check whether the potentiometer is moved through its entire rotation angle

When reaching the end position, the potentiometers must not reach their stops as this would activate the sliding clutch between the potentiometer pinion and the potentiometer shaft. A reproducibility of the results is then no longer ensured.

- In this case, adjust a larger travel using the slider **[261]** in the adjusting lever **[260]** (refer to chapter 6.3)

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6.5 Setting the limit switches S3 and S4

- Retract the actuator connecting rod by the set travel
- Unscrew the knurled nut **[273]** up to the self-locking nut **[281]**
- Insert a screwdriver into one of the cam slots (of the cam set next to the mounting angle) for switch S3 **[282]**
- Rotate the cam until the switching roll of switch S3 is lifted by the cam and the switch switches; if necessary use a measuring instrument to check the switching point
- Set the switching cam for switch S4 **[282]** for "extending connecting rod" or intermediate positions as required
- After completing the setting, retighten the knurled nut **[273]**

Do not change the position of the self-locking nut **[281]**. The switching cams cannot be turned easily. The use of driving lever **[259]** to hold the gear wheel when turning the switching cams is recommended. It must generally be ensured that WE switches S3 and S4 **[282]** can only be operated from the direction of the switching cams **[252]**.

If necessary, the switching lever position can be changed after loosening the screw connection of the switches and by opening the switches.

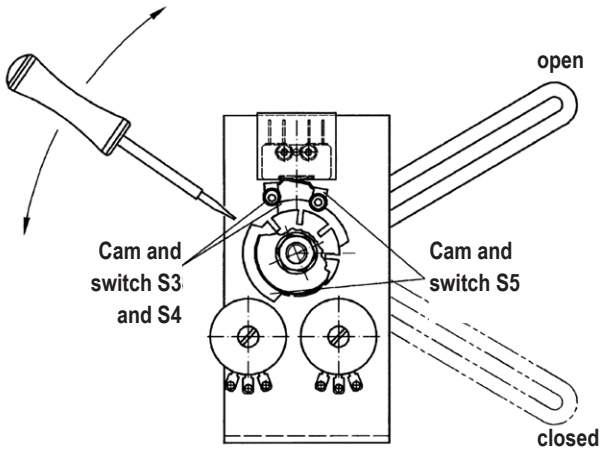

Figure 13: Cam setting

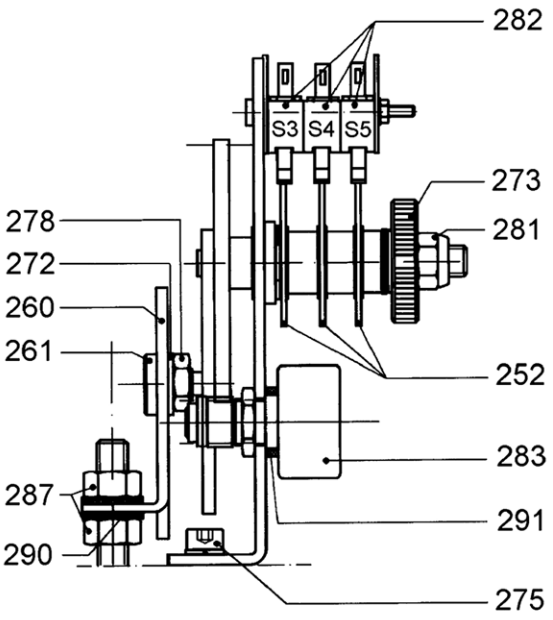

Figure 14: Switching and signalling unit

7. POSITIONING ELECTRONICS

7.1 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 set point, 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.

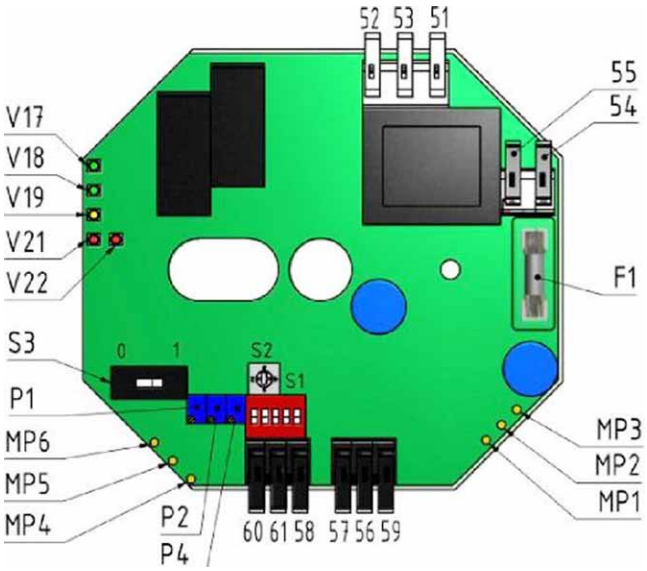

Figure 15: Positioning electronics

LED	Meaning	Indicator
V17	Supply voltage ok	green
V18	Actuator spindle retracts	green
V19	Actuator spindle extends	green
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.

7.2 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 6.4.

7.3 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.

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7.3.1 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	Intput 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 16: Pin assignment table

7.3.2 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.

7.4 Commissioning and settings

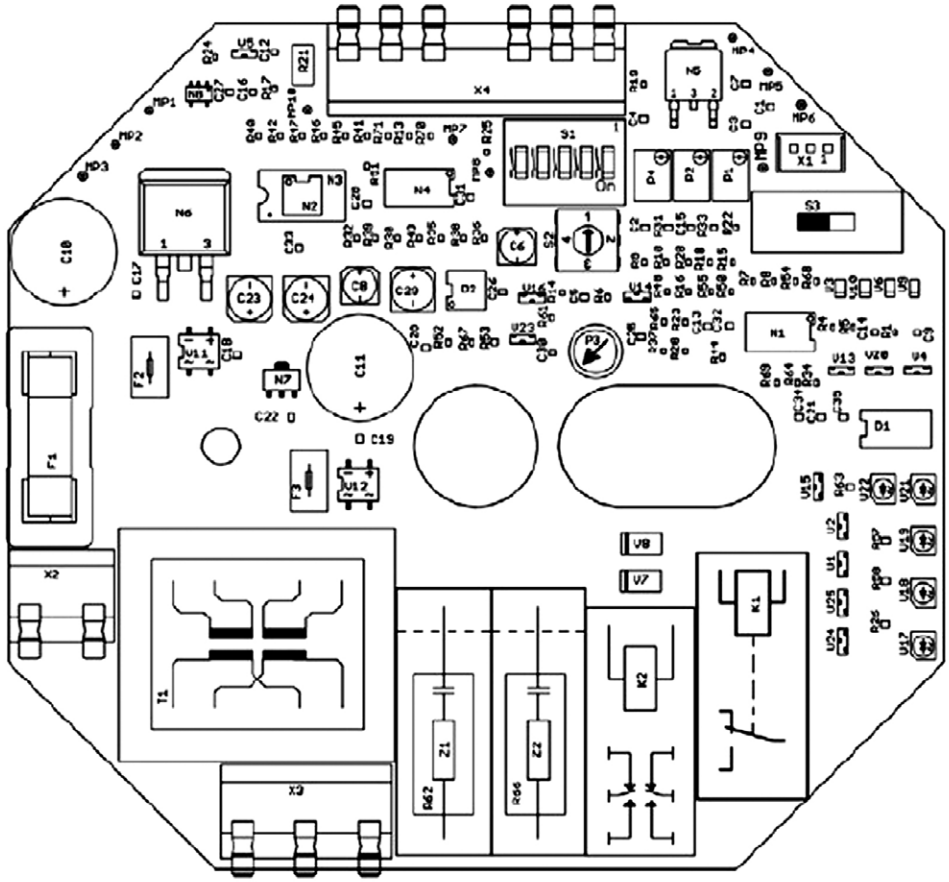

Figure 17: Positioning electronics

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	Fail as is	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 18: Settings table

7.5 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.

7.5.1 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.

7.5.2 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.

7.6 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.

7.7 Reversing the actuator action

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

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7.8 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
S1.1	S1.2	S1.3	S1.4	S1.5			
	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**		

Figure 19: Cable break detection

7.9 Split range control

To adjust split-range control, apply the set point for the upper end position (e.g. 12 mA) to 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 upper value that can be set for the lower deactivation point is ~13.2 mA or ~6.6 V.

Check the end positions by moving the valve to its upper and lower end position.

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7.10 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 chapter 7.5 Calibrating the positioning electronics to the travel.

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

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

Figure 20: 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:

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

Figure 21: 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

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7.11 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	24 V AC /110 V AC / 230 V AC
Terminals	Snap-fit terminals for 1.5 mm^2 Solid wire or wire with wire end ferrules
Ambient temperature	-10 °C...+50 °C

Figure 22: Specifications

8. ELECTRONIC POSITION TRANSMITTER "ESR"

This actuator can also be equipped with an electronic position transmitter. It is installed in the linear actuator as an additional module in combination with a special switching and signalling unit [114]. The electronic non-contact position transmitter converts a rotary motion into an output signal. This output signal is a DC current of 4 ... 20 mA for two-wire connection. A special switching and signalling unit converts the axial motion of the actuator connecting rod into a rotary motion. It features a crown wheel which engages in the outer gear wheel of the electronic position transmitter.
.

The electronic position transmitter is protected against reverse polarity.
It is designed for direct electrical connection via two- wire connection with an output current of 4 ... 20 mA.

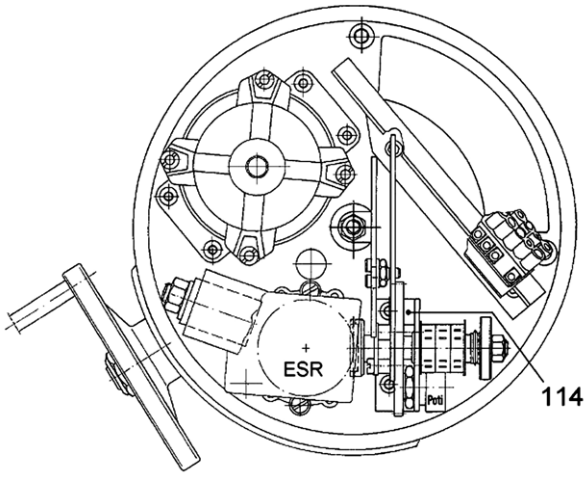

Figure 23: Top view of cover with "ESR"

8.1 Functional principle of the electronic position transmitter

The rotary motion generated by the switching and signalling unit is transmitted by the gear wheel to a rotor inside the electronic position transmitter. The rotor position is measured with a capacitive pick-up system.
Ten stator segments (see figure 24) are excited using successive pulses (2). The phase relationship of the signal – capacitively decoupled from the rotor – depends on the rotation angle. The signal is amplified (4) and is converted via the phase comparator (5) and the voltage/current converter (6) into an output current proportional to the rotation angle.

1 Voltage stabilization
2 Pulse generator
3 Stator-rotor
4 Amplifier
5 Phase comparator
6 U/I converter
7 Three-wire connection
8 Two-wire connection
9 Load

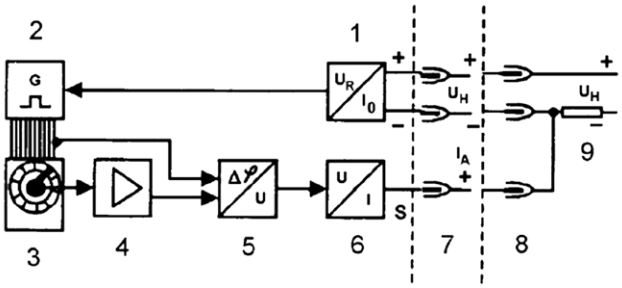

Figure 24: ESR block diagram

8.2 Electronic position transmitter specifications

Electrical connection	Two-wire connection
Auxiliary power UH	12-30V VDC
Max. load RB	50 (UH-12) Ω
Output current	4-20 mA
Operating current	max. 30mA

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8.3 Electrical connection of the electronic position transmitter

To avoid interference, route the signal line separately from the voltage supply line to the actuator using tinned copper braided sleeving.

- Remove the cable gland or dummy plug from the actuator housing
- Screw the appropriate cable gland for the shielded control cable into the actuator housing
- Remove the sheath from the cable so that the individual wires have a sufficient length for connection to terminals 25–28
- Cut the braided sleeving to a length of approx. 9–12 mm to the outer sheath
- Then slide the union nut, the rubber seal and the inner cone bushing onto the stripped end of the cable
- Put the braided sleeving over the inner cone bushing
- Slide the outer cone bushing onto the cable end and under the braided sleeving
- Push the cable through the lower part of the gland into the actuator until the outer cone bushing stops
- Push the rubber seal into the lower part of the gland
- Screw on and tighten the union nut
- Strip the inner sheath of the cable approx. 1 cm above the actuator housing
- Strip off approx. 5 mm of the insulation from the individual wire ends
- For the stranded wires, slide the wire end ferrules onto the stripped end and crimp them to the wires
- When routing and securing the lines in the actuator, ensure they are protected against moving or rotating parts and will not be damaged when removing or mounting the cover

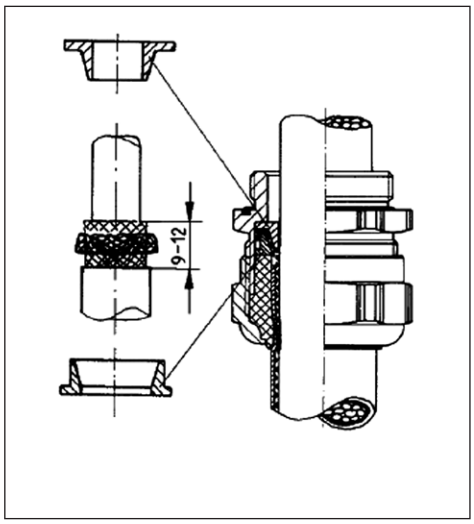

Fig.: 25 Gland for shielded cable

Connection

Positive pole to terminal 25, negative pole to terminal 26; signal therefore picked up in the supply line without return wire

Applying the operating voltage

12–30 VDC

8.4 Setting the electronic position transmitter

The position transmitter can be operated in two modes. The operating modes are selected with the mode selector (1).

Normal mode "N":

- rising characteristic when rotating the gear wheel clockwise or retracting connecting rod or
- falling characteristic when rotating the gear wheel counter-clockwise or extending connecting rod

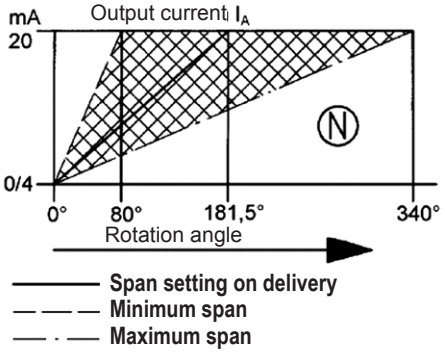

Fig. 26-1: Adjustment range for measuring span in normal mode

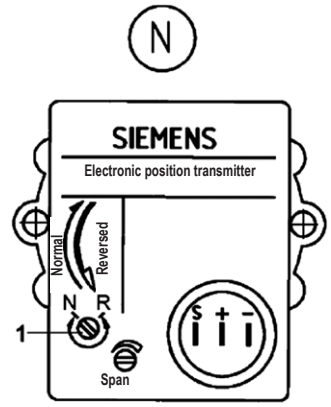

Fig. 26-2: Selector for mode (1) and span

Reverse mode "R":

- rising characteristic when rotating the gear wheel counter-clockwise or extending connecting rod, or
- falling characteristic when rotating the gear wheel clockwise or retracting connecting rod

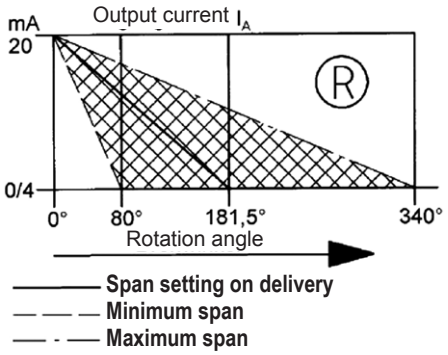

Fig. 26-3: Adjustment range for measuring span in reverse mode

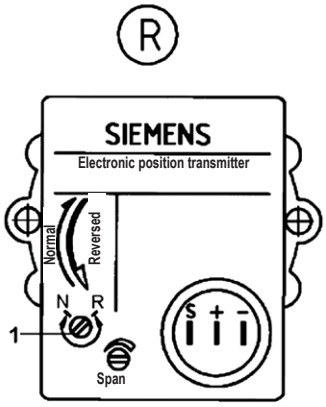

Fig. 26-4: Selector for mode (1) and span

8.4.1 Setting to Normal mode "N"

- Adjust the travel on the switching and signalling unit (refer to chapters 6.2 and 6.3)
- Turn the selector (1) on the electronic position transmitter fully clockwise to stop "N".

Make sure the mode selector (1) is always set to the end position to prevent a malfunction of the position transmitter (the lower and upper range values cannot be adjusted). Turn the screw carefully to avoid damage to the stop in the end position.

8.4.2 Setting to Reverse mode "R"

- Adjust the travel on the switching and signalling unit (refer to chapters 6.2 and 6.3)
- Turn the selector (1) on the electronic position transmitter fully counter-clockwise to stop "R".

Make sure the mode selector (1) is always set to the end position to prevent a malfunction of the position transmitter (the lower and upper range values cannot be adjusted). Turn the screw carefully to avoid damage to the stop in the end position.

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8.4.3 Adjusting the output current to 0 or 4 mA

- Move the actuator to the position at which the output current is to be 4 mA
- Manually rotate the black adjustment wheel (2) against the white actuator gear wheel (1), or use a screwdriver for rotating, to adjust the output current to 3.98–4.02 mA (for two-wire connection).

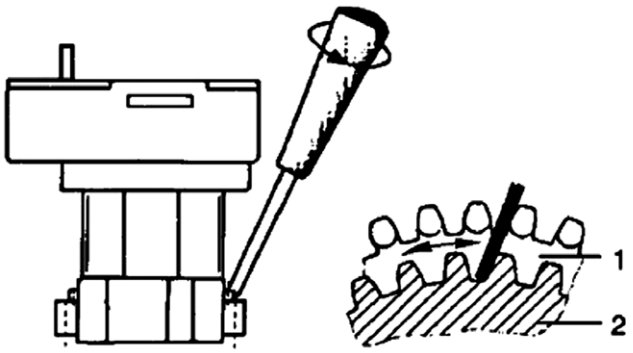

Fig. 26: Adjusting the output current to 0 or 4 mA

8.4.4 Adjusting the output current to 20 mA

- Move the actuator to the position at which the output current is to be 20 mA
- Use the span selector (3) to adjust the output current to 20 +/- 0.02 mA
- Check the setting and repeat the adjustment if necessary

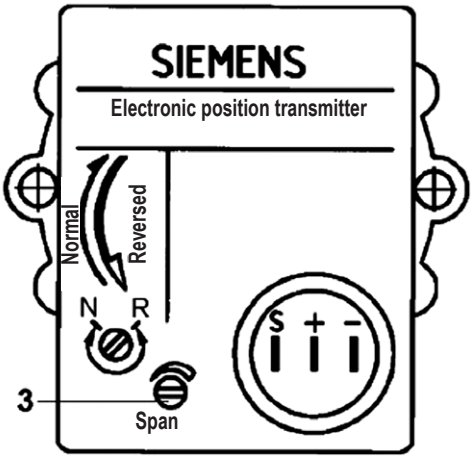

Fig. 27: Adjusting the output current to 20 mA

9. HEATER

We recommend to install a heating resistor to prevent condensation underneath the cover in the event of

- considerable fluctuations in ambient temperature
- high humidity
- outdoor installation

The heating resistor is controlled by a thermostatic switch "TW" (bimetallic contact). The heating is deactivated at a temperature of approx. +60 °C and is reactivated at a temperature of approx. +40 °C. A continuous operating voltage is required for operation. The heating resistor is connected to terminal 7 and 8 of the horizontal terminal strip. Please specify the operating voltage when ordering as it is required to determine the resistance.

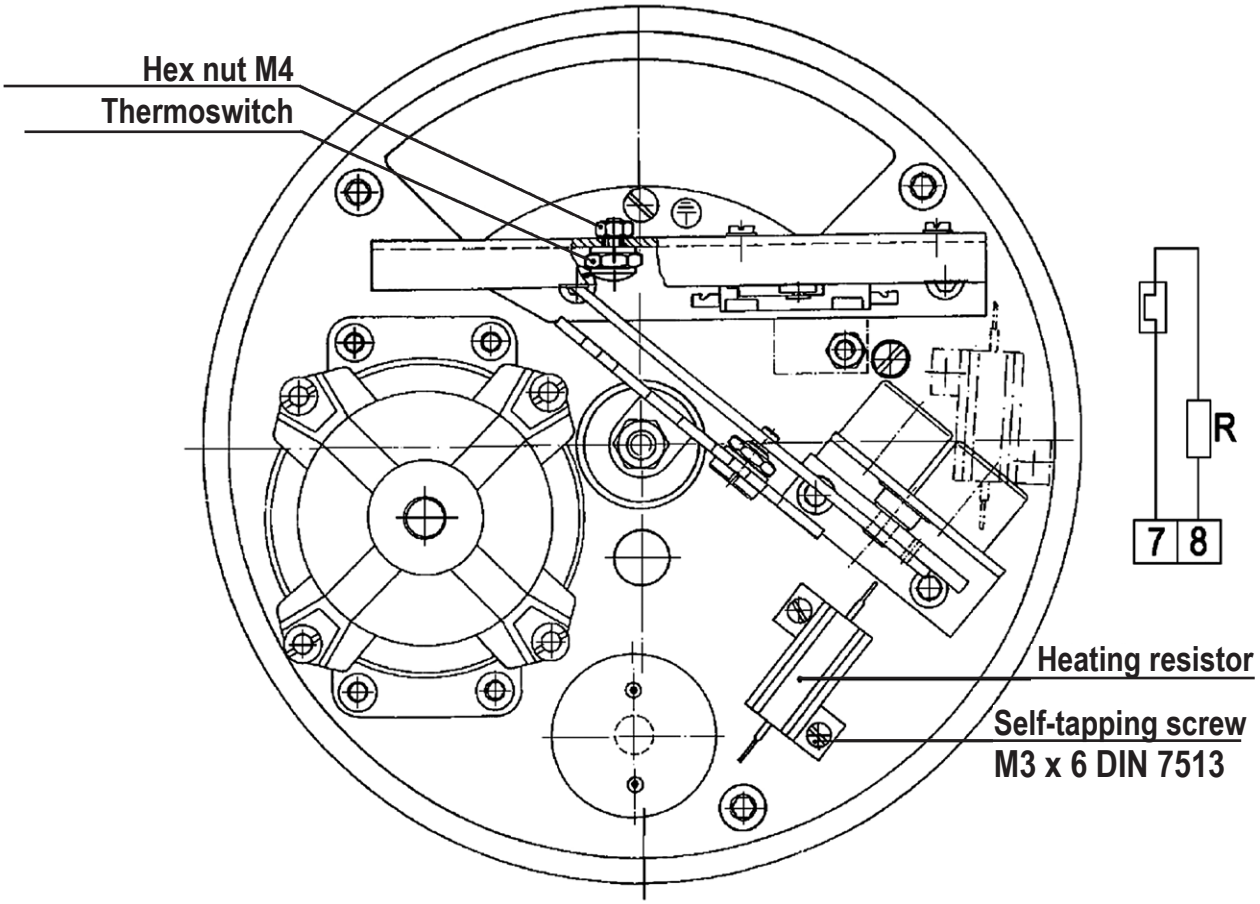

Figure 28: Heating resistor with thermoswitch

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10. CONNECTION EXAMPLES

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.

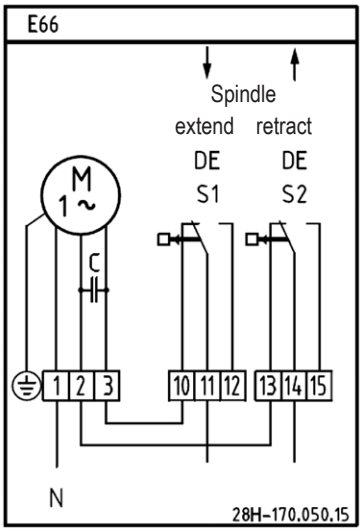

Fig.: Connection diagram, basic version

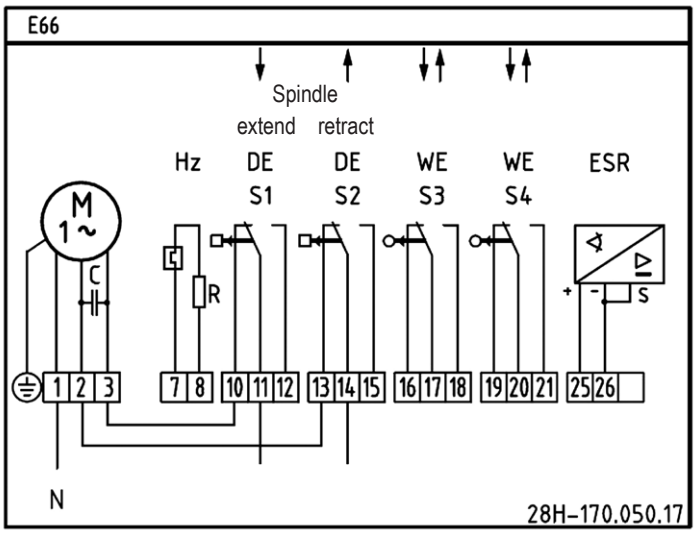

Fig.: Connection diagram, complete version (with options package 2)

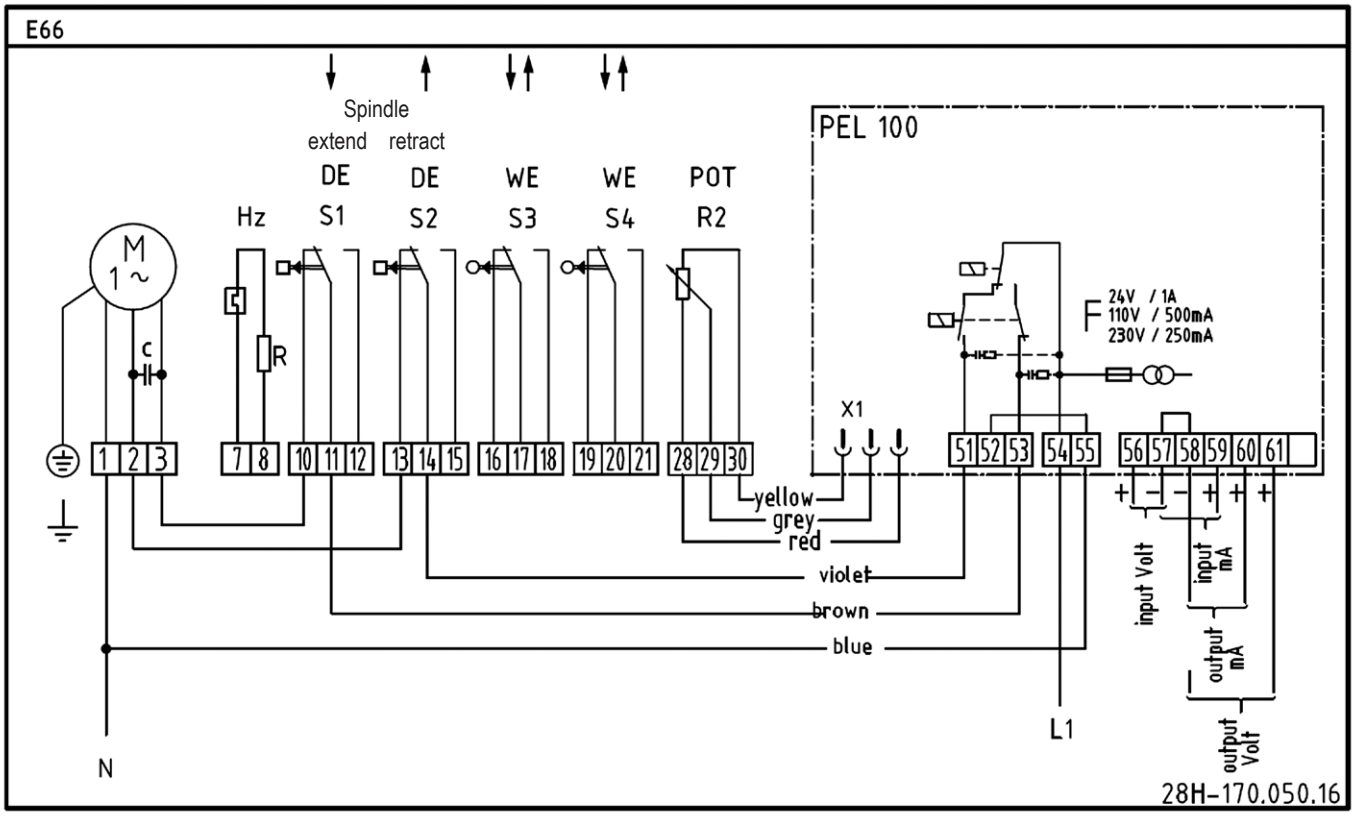

Figure 29: Connection diagram, complete version (with options package 1)

11. SPARE PARTS

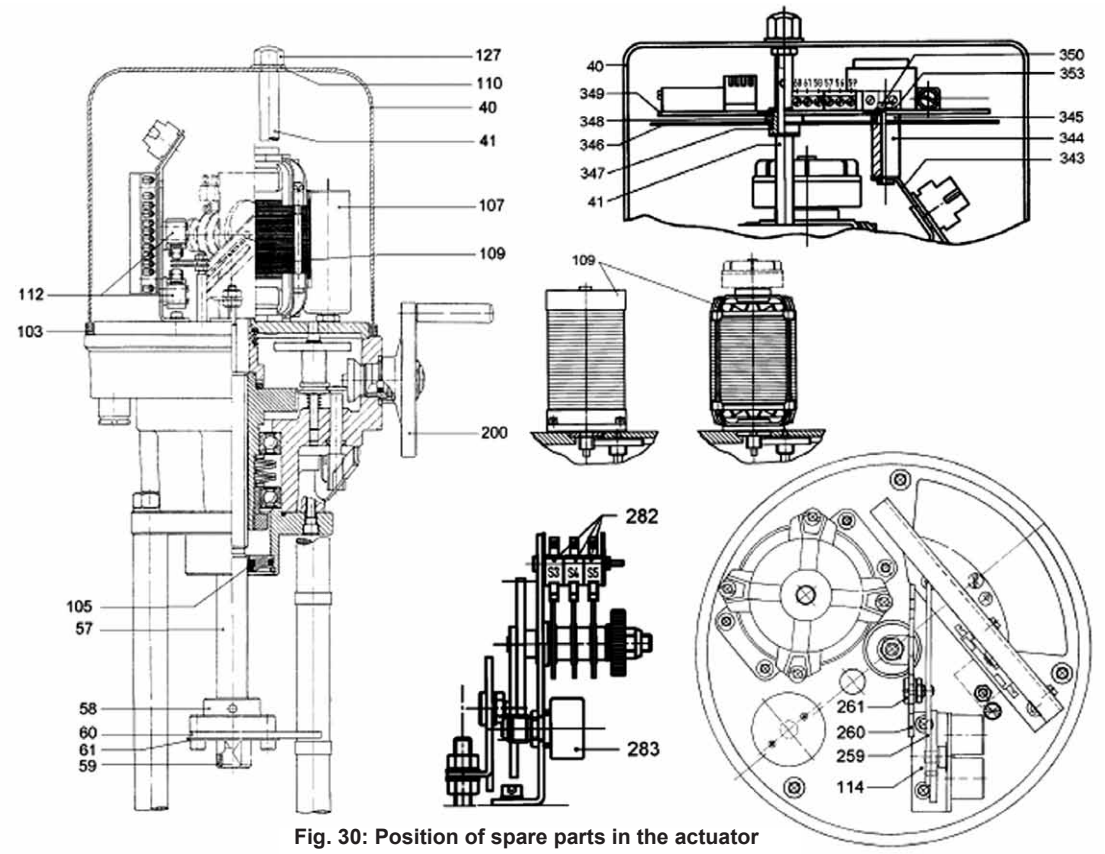

Fig. 30: Position of spare parts in the actuator

Comp./Pos.	Component description
40	Cover
41	Cover bolt
57	Connecting rod
58	Coupling flange
59	Threaded bushing
60	Anti-rotation flange
61	Lock washer
103	Cover seal
105	Wiper ring
107	Capacitor
109	Motor
110	Sealing washer
112	Load-dependent switches S1 and S2
127	Cap nut
200	Handwheel
260	Adjusting lever
261	Slider
282	Travel-dependent switches S3, S4, S5
283	Potentiometers R1 and R2
343	Bracket

Comp./Pos.	Component description
344	Spacer
345	Spacer bushing
346	Insulating plate for "PEL"
347	Connector
348	Spacer ring
349	"PEL" positioning electronics
350	Fillister head screw
351	Washer

Please specify on order:

- Type and serial number of the actuator (see identification label)
- Position number of the component
- Quantity

When replacing an AC motor (Pos. 109), the associated capacitor (Pos. 107) should also be replaced.

Figure 31: Spare parts list

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.

Attention

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

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

- Always use original spare parts.

12. DECOMMISSIONING AND DISPOSAL

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

13. 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 13.1 Check list for operational malfunctions on page 35)
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.

13.1 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 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 32: Check list for operational malfunctions

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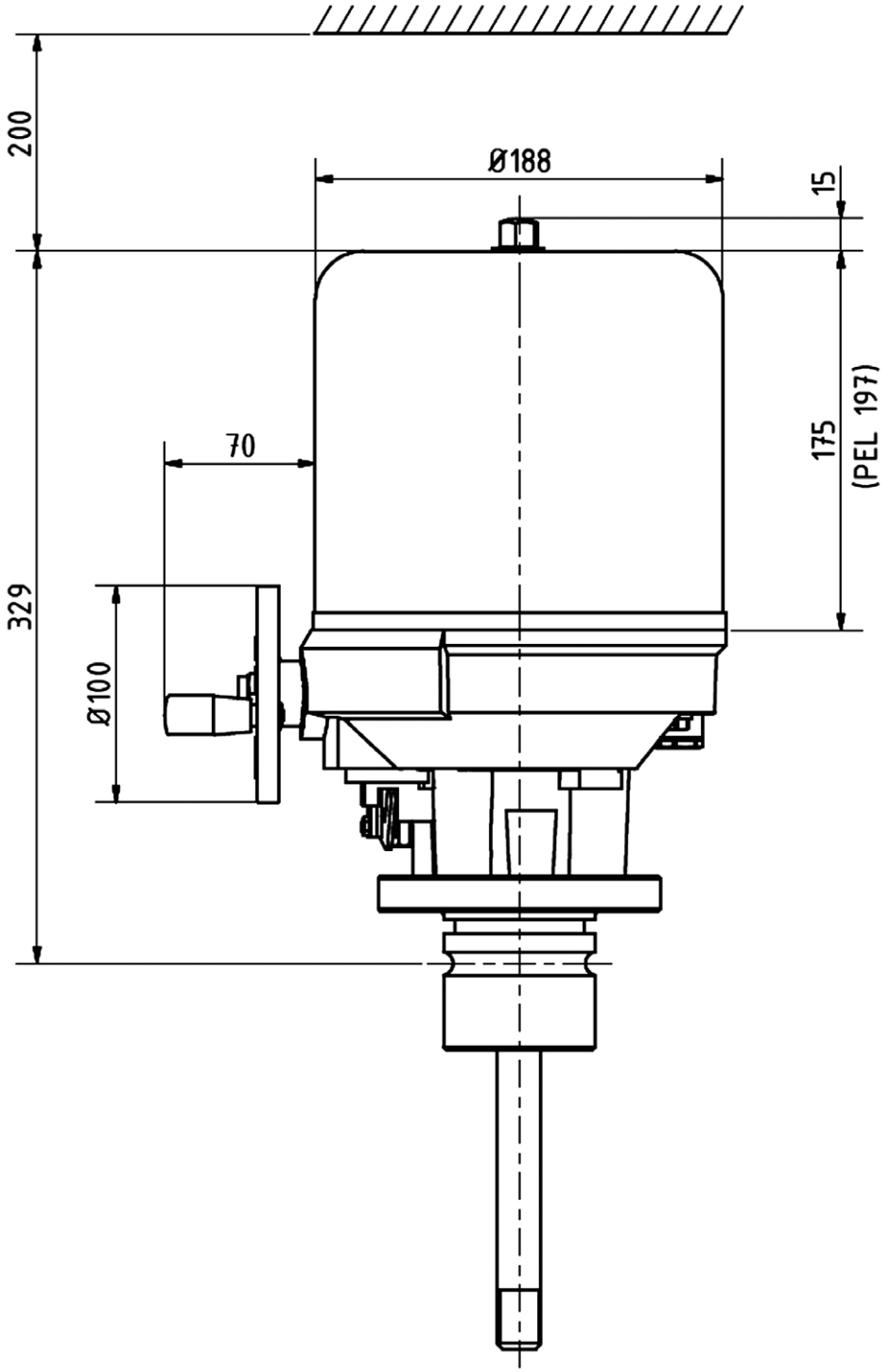
14. DIMENSION SPECIFICATIONS



S21 Spindle diameter 20mm

Figure 33: Dimension specifications E66

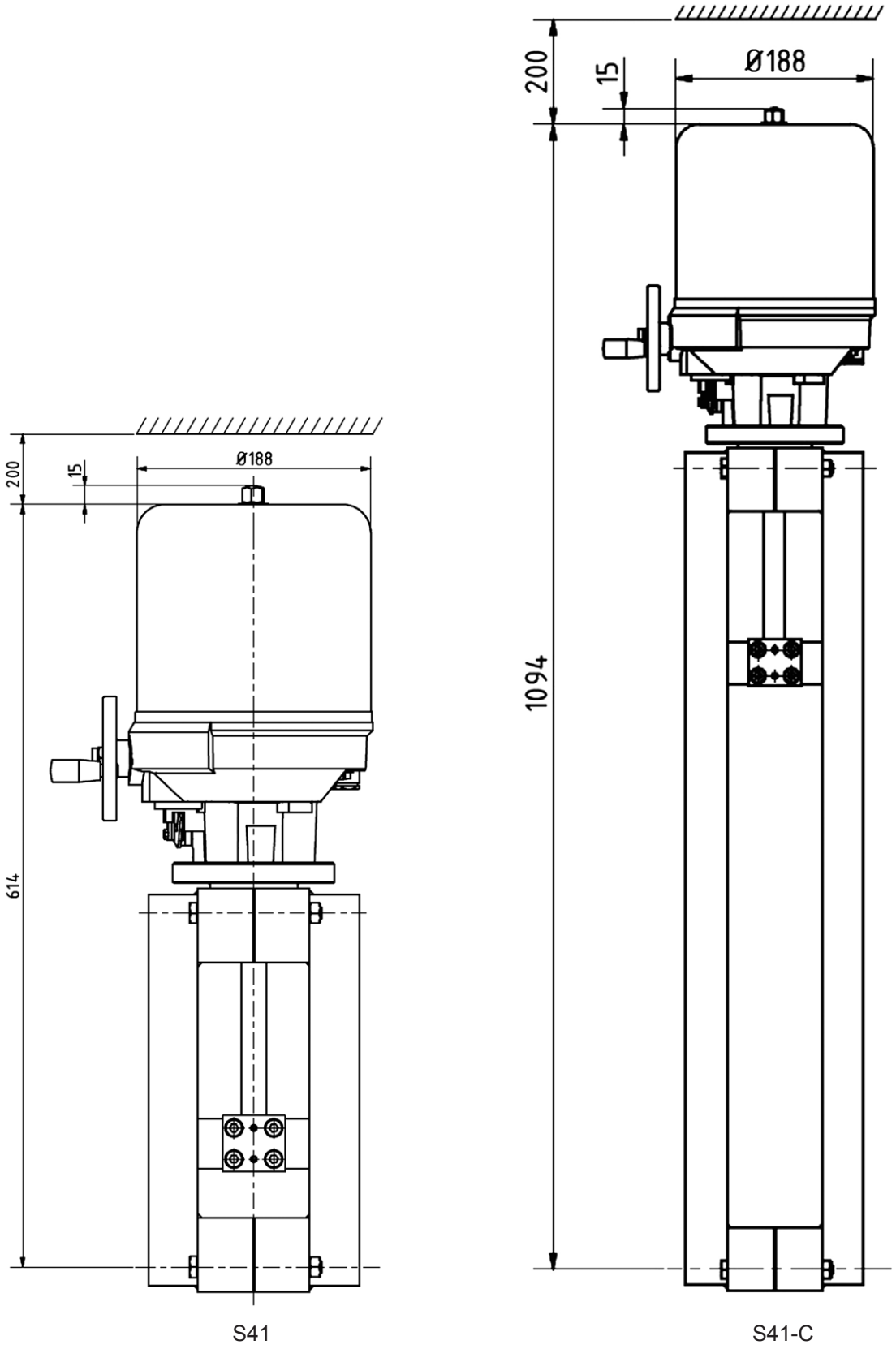


Figure 34: Dimension specifications E66 with yoke

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