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for Future Generations

ELC 100
ELC 160
ELC 220

Installation manual for ELC range
linear electric actuators

CE

Contents

Read these operating instructions carefully particularly the following safety instructions prior to installation and operation.

CAUTION / NOTE / WARNING
as indicated in the manual.

1.1 Proper use

ELC 100, ELC 160 and ELC 220 linear actuators are controlled by three-point control or constant control. Linear actuators in the series described in these operating instructions are used for valve stroke adjustment.

Compliance of the above type designation with the linear actuator rating plate must be checked prior to starting any operations in order to guarantee utilisation in accordance with specification. The data on the rating plate specifies the actuator technical details and mains power supply requirements.

It is the users' responsibility to ensure that the equipment is operated safely and that all staff working with or on the equipment are properly trained for the work they are performing and aware of their liabilities in terms of health and safety in the workplace. It is extremely important that precautions are taken to avoid spark or static discharge in any areas of potentially explosive atmosphere.

The intended use also includes the compliance with accident preventions, DIN VDE regulations and safe working practices for all measures described in these operating instructions in due consideration of prevailing rules.

The intended use also includes the compliance with accident preventions, DIN VDE regulations and safe working practices for all measures described in these operating instructions in due consideration of prevailing rules.

1.2 Information for the operator

Always keep the operating instructions available at the linear actuator deployment site.

Observe the current health and safety, accident prevention and DIN VDE standards for installation, operation and maintenance.

Take into consideration any additional regional, local or in-house safety regulations.

Ensure that every person entrusted with one of the tasks specified in these operating instructions has read and understood these instructions.

1.3 Personnel

Only qualified personnel may work on these linear actuators or in their vicinity. Qualified persons are those persons entrusted with installation, assembly, commissioning and operation or maintenance of the linear actuators and possessing the appropriate qualifications for their activity. The necessary and prescribed qualifications include:

- Training / instruction or authorisation to turn on / off circuits and appliances / systems according to EN 60204 (DIN VDE 0100 / 0113) and the standards of safety technology
- Training or instruction according to the standards of the safety technology concerning care and use of adequate safety and work protection equipment
- First aid training

Work in a safe manner and refrain from any working practice which endangers the safety of persons or damages the linear actuator or other assets in any way whatsoever.

1.4 Prior to starting work

Prior to starting any work, check that the type designations specified here concur with the data on the linear actuator rating plate.

Linear actuators ELC 100, ELC 160, ELC 220.

1.5 During operation

Safe operation is only possible if transportation, storage, installation, operation and maintenance are carried out according to the instructions in this manual and the applicable national and international standards.

Transportation, installation and assembly

Observe the general set-up and safety regulations for heating, ventilation, air-conditioning and pipework design. Use tools correctly. Wear the necessary personal protection safety equipment.

Repairs and maintenance

Ensure that qualified personnel switch off the linear actuator prior to maintenance or repair work in accordance with DIN VDE.

2. Product specification

The linear actuators control a stepper motor by means of a micro controller. The stepper motor's rotational movement is converted into a linear movement via planetary gears and a threaded spindle with rotary guard.

2.1 Component parts

2.1.1 Component parts ELC 100

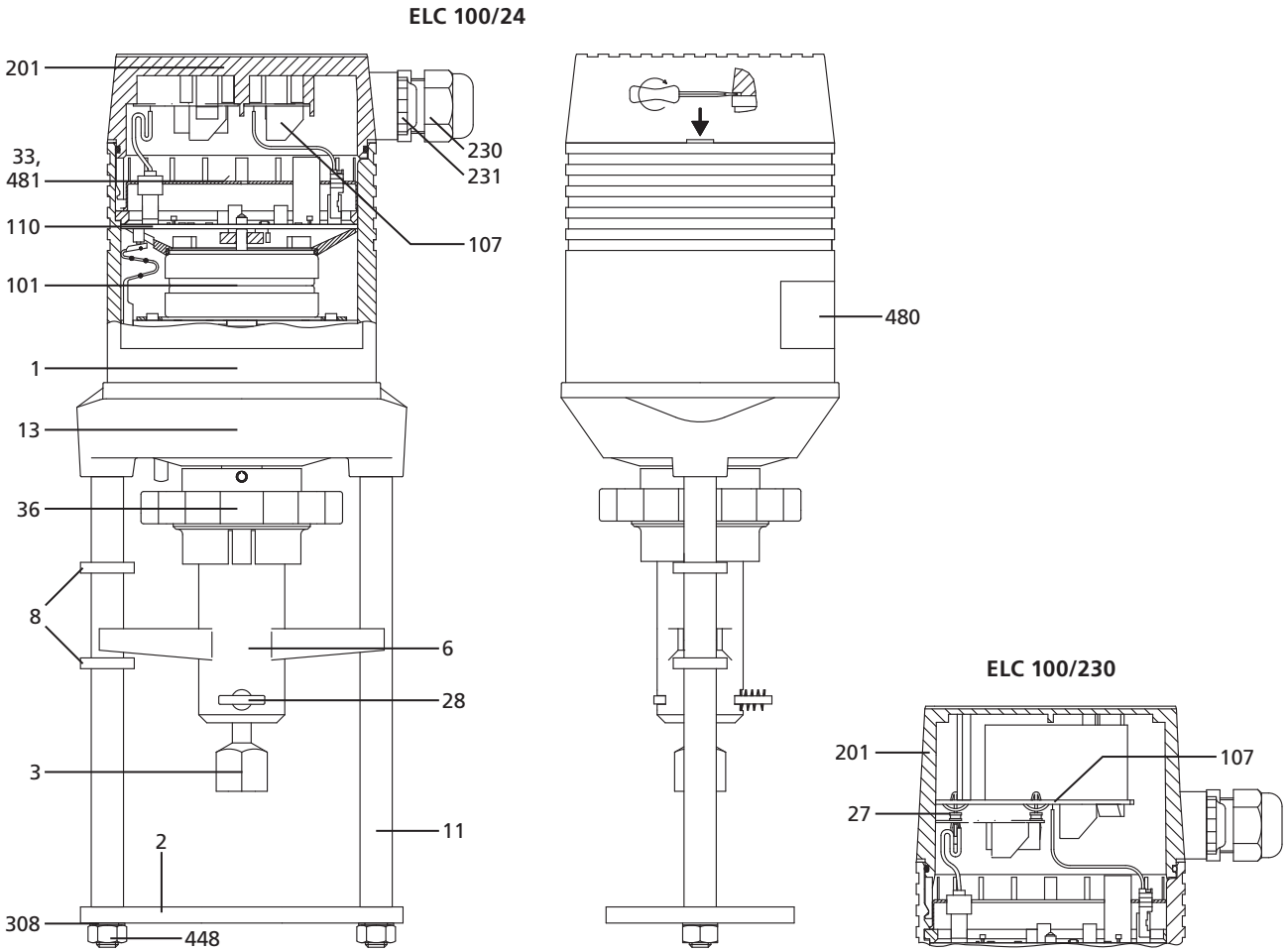


Fig 2.1 Component part denominations

ITEM	DESCRIPTION
1	Actuator housing
2	Crossbeam (optional)
3	Coupling piece*
6	Clutch
8	Position display*
11	Distance sleeve
13	Bridge
27	Spacer for 230 V*
28	C-frame
33	Sheeting*
36	Handwheel

ITEM	DESCRIPTION
101	Engine/motor
107	Push-fit PCB for 24 V or 230 V
110	Main board
201	Cover for 24 V or 230 V*
230	Cable lead-in M20 × 1.5*
231	Cable lead-in M16 × 1.5*
308	Safety disk*
448	Hexagon nut M8*
480	Type plate
481	Wiring diagram on cover

* This component part is available as a spare part.

2.1.2 Component parts ELC 160, ELC 220

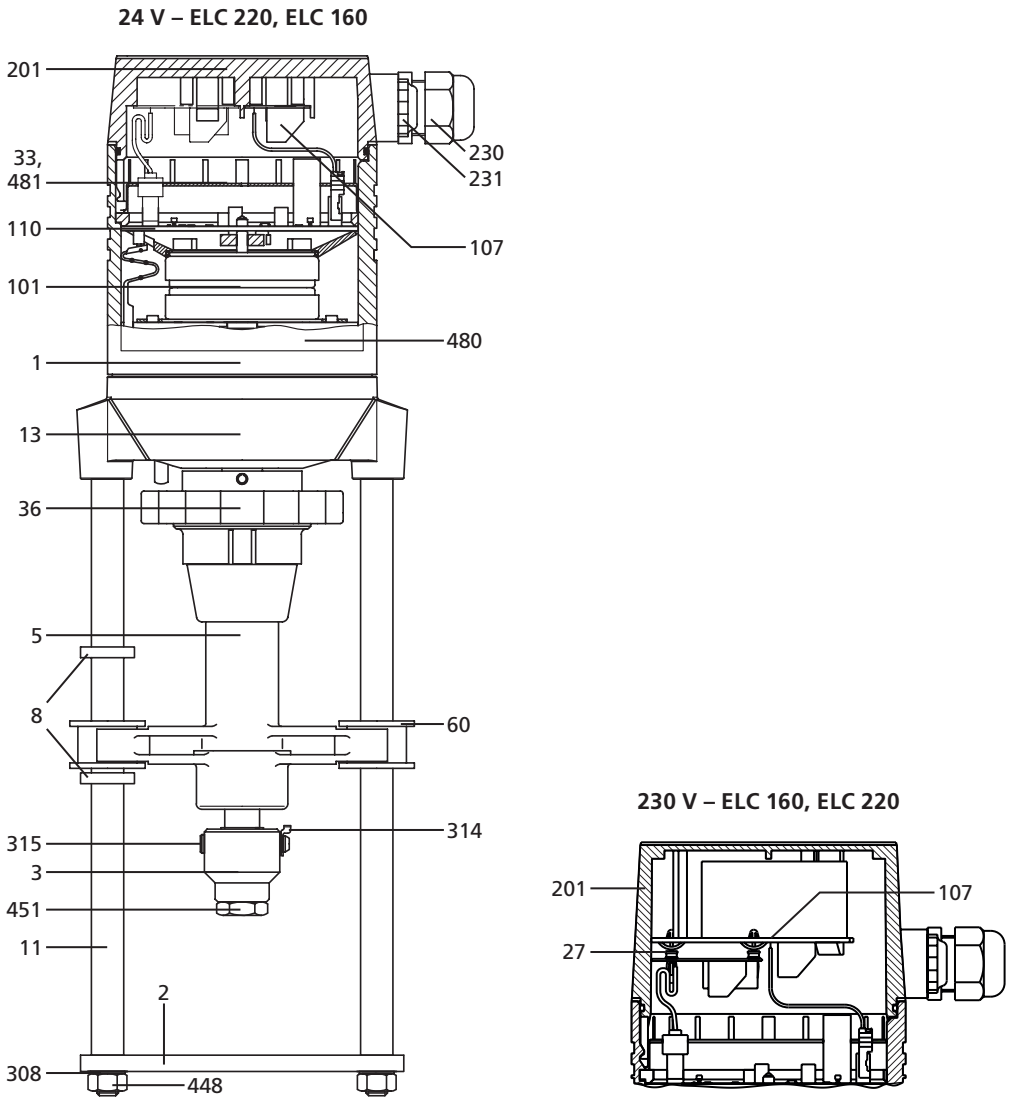


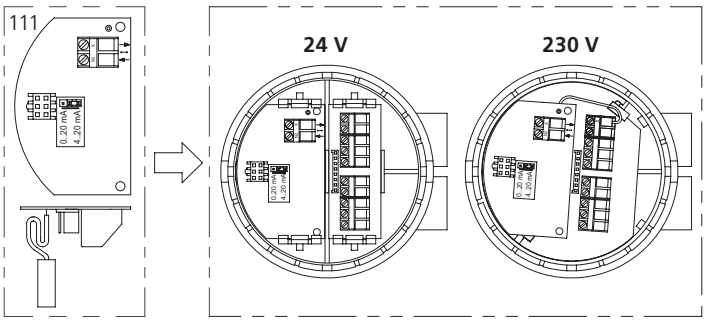
Fig 2.2 Component part denominations

ITEM	DESCRIPTION
1	Actuator housing
2	Crossbeam (optional)
3	Coupling piece*
5	Rotary guard
8	Position indicator*
11	Distance sleeve
13	Bridge
27	Spacer for 230 V*
33	Sheeting*
36	Handwheel
60	Guiding sleeve
101	Engine/motor

ITEM	DESCRIPTION
107	Push-fit PCB for 24 V or 230 V
110	Main board
201	Cover for 24 V or 230 V*
230	Cable lead-in M20 × 1.5*
231	Cable lead-in M16 × 1.5*
308	Safety disk*
314	Blank*
315	Bolt*
448	Hexagon nut M8*
451	Hexagon nut M10*
480	Type plate
481	Wiring diagram on cover

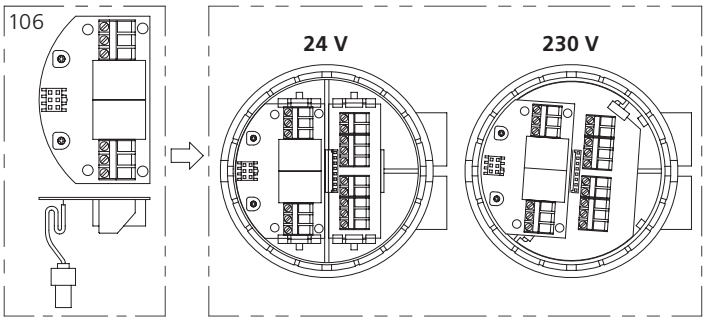
* This component part is available as a spare part.

2.2 Accessories



111 PCB for output signal X = 0/4 to 20 mA

Fig 2.3 PCB for mA output signal in cover



106 PCB for path switch

Fig 2.4 Position switch PCB in cover

Optional operation with mA output signal or path switch possible.

2.3 Operating modes

The linear actuator can be operated manually or automatically.

- In manual mode, stroke is adjusted via the handwheel
- In automatic mode, stroke is controlled electronically

2.3.1 Continuous mode

In continuous mode, the system control presets the position of the linear actuator whilst inside the linear actuator the input signal (Y) of the system control is continuously compared with the output signal (X) of the linear actuator. In doing so the output signal depends on the position of the linear actuator (travel).

The linear actuator keeps moving until the input signal and the output signal match.

Input signal (Y)

The input signal (Y) of the system control specifies the desired position for the linear actuator. It is applied in the form of an analogue signal to terminal Y.

Possible analogue input signals:

- 0 to 10 VDC / 2 to 10 VDC
- 0 to 20 mA / 4 to 20 mA

Output signal (X)

The output signal (X) determines the actual position of the linear actuator. It is applied to terminal X in the form of an analogue signal.

0% to 100% valve lift is put out as:

- 0 to 10 VDC
- 0 to 20 mA or 4 to 20 mA
  (accessory PCB for output signal (**111**))
  When using the option "Output signal (X) as current output (0/4 to 20 mA)", deviations of the output signal (X) up to max. 5% to the input signal (Y) may occur in the medium stroke range. This deviation is due to the design and does not represent a defect.

2.3.2 Three-point mode

The direction of rotation is set via the control voltage at terminal 2 and terminal 3 on the main PCB:

- When the control voltage is applied to terminal 2, the rotary guard will be extended
- When the control voltage is applied to terminal 3, the rotary guard will be retracted

2.4 Functions

2.4.1 Binary signal / frost protection function

The terminals B1 and B2 on the main PCB are bridged during normal operation. If the electric circuit between B1 and B2 is interrupted, the linear actuator will store the current position and afterwards move automatically to its limit position.

All other control signals will be ignored during this process.

The linear actuator will remain in limit position until the electric circuit between B1 and B2 has closed.

- In three-point mode the linear actuator will automatically return to the stored position
- In continuous mode the desired value of the input signal will be restarted

2.4.2 Blockage detection

If the linear actuator is blocked manually, the linear actuator will briefly move back and then retry to reach the required position. If this is still unsuccessful after a total of 7 attempts the linear actuator will be turned off in order to prevent damage to the linear actuator and the control element.

Blockage detection is indicated by LED.

See Section 6.2, LED display.

2.4.3 Wire-break detection

Wire break detection is only available for continuous mode with an input signal 2 to 10 VDC and 4 to 20 mA.

When the input signal drops below 1 V or 2 mA in continuous mode the linear actuator will move to the limit position set by encoding switch S6.

Wire break detection is indicated by the LED.

See Section 6.2, LED display.

2.4.4 Actuating time

The time required for the rotary guard to travel a defined distance is called actuating time. Actuating time is specified in s/mm. Encoding switch S4 is used to set the actuating time (except for Model ELC 220).

See Section 5.4, Setting the hysteresis.

2.4.5 Hysteresis

Hysteresis equals the difference of the input signal (Y) that is required after a reversal of signal direction in order to move the rotary guard.

It serves to prevent permanent oscillation of the actuator motor around a certain hoisting position during minor input signal alterations.

See Section 5.4, Setting the hysteresis.

2.4.6 Manual mode and response signal

In manual mode it is possible to change the lift without supply voltage.

- Motor and control electronics are turned off in manual mode to make hoisting movements of the control impossible
- The moment you set the linear actuator to manual mode the control switches a signal to terminal R, provided supply voltage is applied

See Section 6.1, Changing between manual and automatic mode.

2.4.7 Auto test

If a valve is not actuated for a long time the valve cone may get stuck. The auto test function acts as a preventative measure. When you turn on the auto test function for the linear actuator, the linear actuator will automatically move after c. 10 days without actuation to the limit position set by encoding switch S6 and return to initial position.

See Section 5.6, Setting auto test and auto pause.

2.4.8 Auto pause

This function is used by the actuator to count the traverse commands per minute that involve a change of direction. If there are more than 20 direction varying traverse commands per minute this will result in a compulsory pause of 3 s.

See Section 5.6, Setting auto test and auto pause.

2.4.9 Potential-free limit switch (accessory)

The optional path switch PCB allows you (106) to set two actuating positions within which a potential-free contact is opened or closed.

See Section 5.8, Setting a potential-free path switch.

2.5 Technical data

Type	ELC 100/24, ELC 160/24, ELC 220/24	ELC 100/230, ELC 160/230, ELC 220/230
Supply voltage	24 VAC ± 10% 24 VDC ± 10%	115 VAC ± 10% 230 VAC ± 10%
Power consumption	6 VA	12 VA
Weight	ELC 100 = 2.5 kg ELC 160 / ELC 220 = 3.2 kg	ELC 100 = 2.5 kg ELC 160 / ELC 220 = 3.2 kg
Dimensions	See technical data sheets	
Stroke	ELC 100 = max. 20 mm ELC 160 = max. 30 mm ELC 220 = max. 30 mm	ELC 100 = max. 20 mm ELC 160 = max. 30 mm ELC 220 = max. 30 mm
Frequency	50/60 Hz ± 5%	50/60 Hz ± 5%
Ambient temperature	0 to +60°C	0 to +60°C
Enclosure protection	IP 54	IP 54
Operating mode	S3-50% ED	S3-50% ED
Actuating time	ELC 100 = 12, 9, 4, 1.9 s/mm ELC 160 = 4 or 6 s/mm ELC 220 = 3 s/mm	ELC 100 = 12, 9, 4, 1.9 s/mm ELC 160 = 4 or 6 s/mm ELC 220 = 3 s/mm
Actuating force	ELC 100 = 1.0 kN ELC 160 = 1.6 kN / 1 kN ELC 220 = 2.2 kN	ELC 100 = 1.0 kN ELC 160 = 1.6 kN / 1 kN ELC 220 = 2.2 kN

Table 1 Technical data

Input signal Y/Resistance of load	0 to 10 VDC / 77 kΩ 2 to 10 VDC / 77 kΩ 0 to 20 mA / 510 Ω 4 to 20 mA / 510 Ω
Output signal X/Load rating	0 to 10 VDC / resistance of load ≥ 1200 Ω, $I_{max.}$8 mA 0 to 20 mA / resistance of load ≤ 500 Ω - with accessory PCB for output signal (**111**) 4 to 20 mA / resistance of load ≤ 500 Ω - with accessory PCB for output signal (**111**)
Response signal R/Load rating	24 VDC / minimum impedance ≥ 480 Ω, $I_{max.}$35 mA
Cable impedance between B1 and B2	max. 10 Ω

Table 2 Technical data signals

2.6 Type plate

The type plate is attached to the housing of the linear actuator.

It bears the type denomination, serial number (s/no) and date of manufacture (last four digits).

See Section 2.1, Component parts.

ELC250SR-0000-0

F.-Nr.: 09200000/01/0310		Zertifikats-Nr.:		
AC 50 Hz 230 V	80 VA	25 kN	Hub 40 mm	T60
Y= 3-Punkt	IP 54	5 s/mm	Stellzeit	
X= 0 to 10 VDC	S3-50% ED	0.1 s/mm	Rückstellzeit	

Fig 2.2 Example of type plate

2.7 Prototype test

EU-prototype test in accordance with the guidline 2014/68/EU which is only valid when the actuator is used with HORA valves BR 225, BR 240S or BR240E. Prototype test in accordance with regulations of EN14597; paragraph DX17 and EN60730.

- Further data must be taken from the operating manual BR225 / 240S / 240E with ELC 100SR and ELC 250SR, the prototype test certificate or the Conformity Declaration

3. Transportation and storage

⚠ **CAUTION**

Non-compliance with safety regulations may result in injury.

- **WEAR THE REQUIRED PERSONAL AND OTHER SAFETY EQUIPMENT**
- Avoid impacts, blows, vibrations etc. to the linear actuator
- Store the linear actuator (and, where appropriate, the entire controlling device) in a dry place
- Keep the specified transport and storage temperatures between -20 to +65 °C

4. Assembly

Prior to assembling the linear actuator:

See Section 4.1, Checking the scope of delivery.

See Section 4.2, Preparing assembly.

The following sequence of operations is part of the linear actuator assembly:

See Section 4.3, Mounting the linear actuator on the valve.

See Section 4.4, Assembling/disassembling the cover.

See Section 4.5, Electrical connection.

4.1 Checking the scope of delivery

1 Check the packaging for damage.

2 Dispose of packaging in an environmentally-friendly manner.

3 Check the delivered items against the delivery note in order to see whether the delivery is complete.

4 Report any missing or damaged products to the manufacturer.

4.2 Preparing assembly

⚠ NOTE

Malfunction due to exceeding the stroke range.

If the stroke range of the valve exceeds the stroke range of the linear actuator, the linear actuator will malfunction.

Ensure there is stroke limitation in the valve.

⚠ NOTE

A non-attached actuator causes damage.

If you operate the linear actuator without connection to a valve, the spindle nut may fall off due to the missing stroke.

1 Allow for about 140 mm space above the cover at the site of installation.

2 Check the working environment before assembling and commissioning the linear actuator.

3 Ensure that the valve is correctly fitted. For details please see assembly instructions for the valve.

4 Determine the assembly position of the linear actuator. Do not arrange linear actuators in a hanging position.

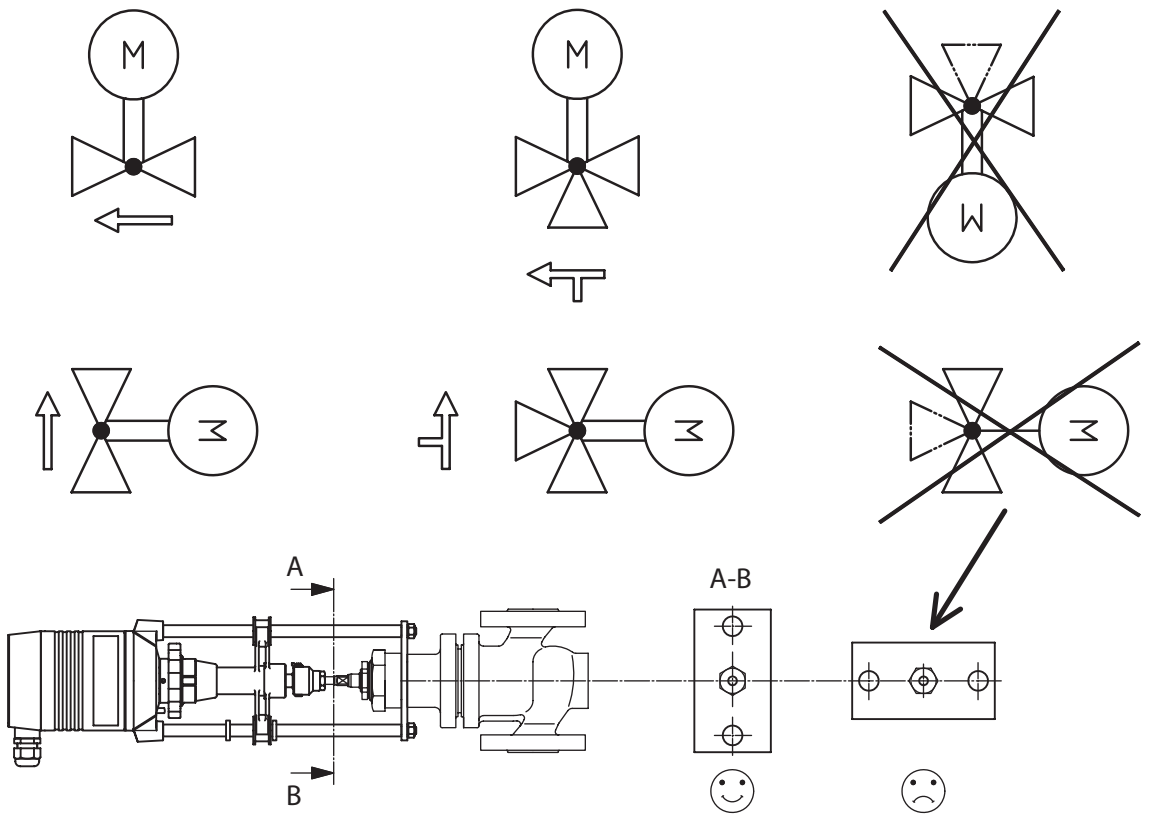


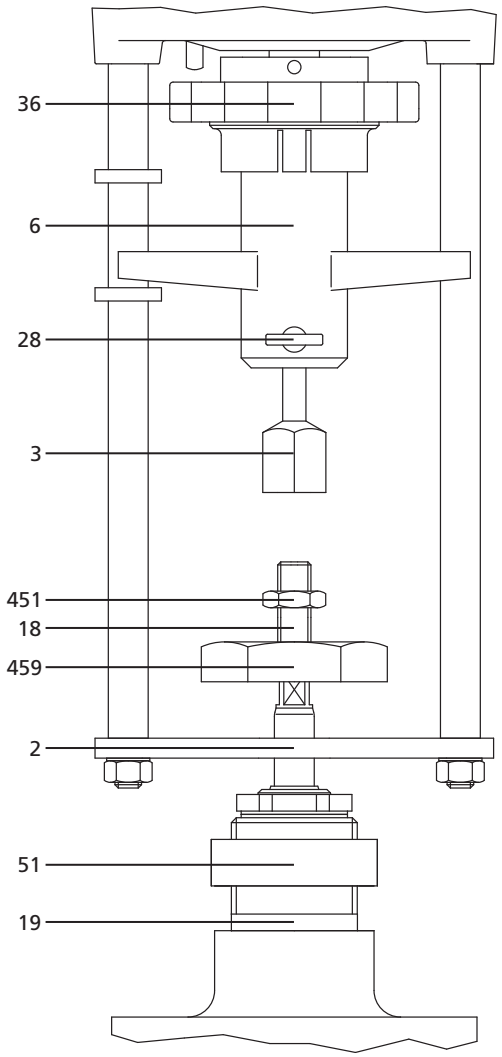
Fig 4.1 Assembly positions for linear actuator and valve

4.3 Mounting the linear actuator on the valve

If the linear actuator and the valve are supplied separately, you must mount the linear actuator on the valve.

4.3.1 Assembling ELC 100

ELC 100/24, ELC 100/230



ITEM	DESCRIPTION
2	Crossbeam (optional)
3	Adapter
6	Clutch
18	Valve stem
19	Valve neck
28	C-frame
36	Handwheel
51	Spacer ring
451	Hexagon nut M10
459	Hexagonal nut

Fig 4.2 Mounting the linear actuator on the valve

How to assemble linear actuator type ELC 100

1 Insert the C-frame (28). *See Fig 4.2*.

2 Pull the adapter (3) off the clutch (6).

3 Screw the hexagon locknut M10 (451) spanner width 17 onto the valve stem (18).

4 Screw the adapter (3) onto the valve stem (18).

5 Fix the valve stem (18) by the hexagon locknut (451), in order to prevent skewing.

6 Fit the spacer (51) on the valve neck (19).

7 Fit the actuator and crossbeam (2) and hexagon nut (459) on the valve neck (19).

8 Insert the C-frame (28) and pull the valve stem upwards (18) until the valve stem locks (18) into the clutch (6).

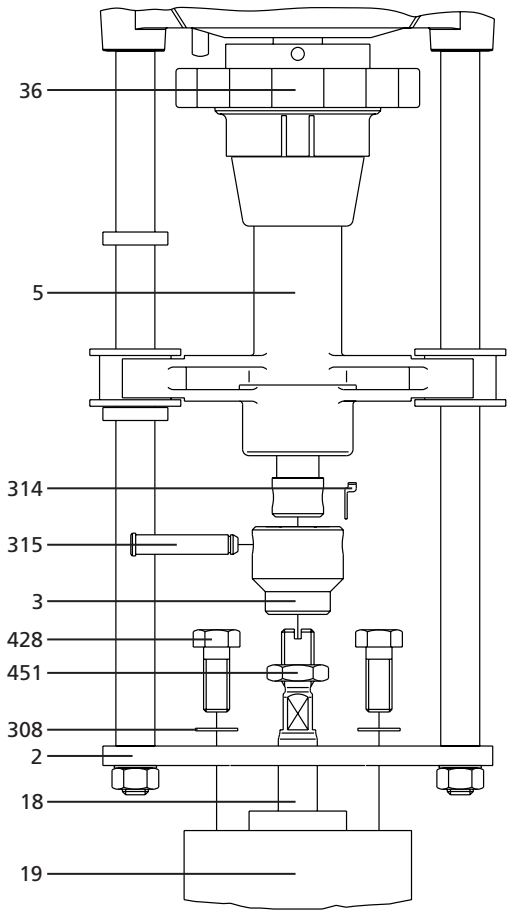
9 Fix the crossbeam (2) using a hexagon nut (459) spanner width 50.

How to disassemble the linear actuator

1 Follow the sequence of operation in reverse order.

4.3.2 Assembling ELC 160/24, ELC 160/230, ELC 220/24, ELC 220/230

ELC 160/24, ELC 160/230, ELC 220/24, ELC 220/230



ITEM	DESCRIPTION
2	Crossbeam
3	Coupling piece
5	Rotary guard
18	Valve stem
19	Valve neck
36	Handwheel
308	Lock washers
314	Blank
315	Bolt
428	Screws
451	Hexagon nut M10

Fig 4.3 Mounting the linear actuator on the valve

How to assemble linear actuator type ELC 160 / ELC 220

1 Pull off the blank (314). *See Fig. 4.3.*

2 Pull out the bolt (315) from the clutch piece (3) or drive it out.

3 Screw the hexagon locknut M10 (451) spanner width 17 onto the valve stem (18).

4 Screw the clutch piece (3) onto the valve spindle (18).

5 Place actuator with crossbeam (2) on valve neck (19).

6 Attach the crossbeam (2) of the actuator with the help of screws (451) spanner width 13 and blanks (308) to the valve neck (19).

7 Adjust the height of the rotary guard (5) with the help of the handwheel (36) so that you can remount the bolt (315).

8 Fit on the blank (314).

9 Fix the valve stem (18) by the hexagon locknut (451), in order to prevent skewing.

How to disassemble the linear actuator

1 Follow the sequence of operation in reverse order.

4.4 Assembling/disassembling the cover

The cover contains the terminals for electric connection.

⚠ WARNING

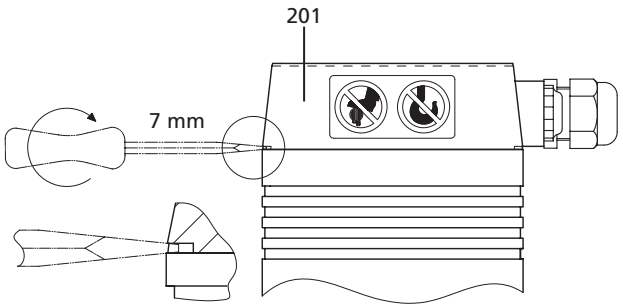
Risk of injury from electric shock by live parts.

When the power supply is on there is a danger of electric shock due to live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system
- Secure against unauthorised restarting
- Remove the cover only momentarily

How to remove the cover

1 Insert a screwdriver in the notch of the cover and lift the cover (201).



201 Cover

Fig 4.4 Removing the cover

⚠ NOTE

Damaged cables result in damage to devices.

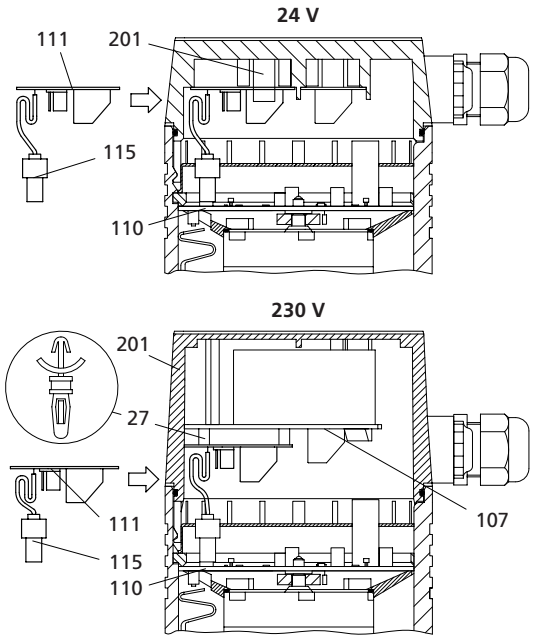
When lifting the cover you may tear off or damage the cabling inside the cover. Carefully remove the cover.

2 Remove the cover (201) carefully.

3 Disconnect the plug-in connection between the main PCB (110 - see Figure 4.5) and the cover (201).

How to attach the cover

1 Plug the previously pulled off cables back into the main PCB (110). Pay attention to the notches on plug and socket.



27 Spacers
111 PCB for mA output signal
107 Push-fit PCB for 24 V or 230 V
115 Female plug
110 Main board
201 Cover for 24 V or 230 V*

Fig 4.5 Fitting a PCB for the mA output signal

You can mount the cover (201) in four, different, positions each of which is transposed by 90°. This allows the best possible laying of the connecting cable for different installations of the linear actuator.

2 Place the cover (201) on top and push it down to make it fit by applying moderate force.

3 Check the cover for correct fit to ensure air-tightness for the actuator housing.

4.5 Electrical connection

⚠ WARNING

Danger of life caused by unqualified staff.

Electrical connections carried out by unqualified staff may result in death, severe bodily injury or considerable material damage.

- Make sure that such all work is carried out by qualified staff

  See Section 1.3, Personnel.

⚠ WARNING

Risk of injury from electric shock by live parts.

When the supply voltage is turned on there is a risk of electric shock from live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system
- Secure against unauthorised restarting

How to prepare the electric connection

1 Ensure that the supply voltage matches the specifications on the type plate of the linear actuator.

2 To avoid breakdown, construct the line diameter according to actuating performance and required line length.

3 Lay the mains for a supply voltage of > 48 V separate from the signal and control wires.

When laying cables in a joint cable duct, use shielded control wires.

4 Check the supply voltage.

If the required tolerance is not achieved by a power transformer you will have to use an AC voltage stabiliser.

See Section 2.5, Technical data.

How to establish electrical connection

1 Remove the cover (201).

See How to remove the cover.

2 Run the cable through the screw joint in the cover to the terminal.

3 Connect the power supply according to the wiring diagram.

See Fig 4.6.

The wiring diagram (481) is on the PCB cover (33).

⚠ NOTE

Malfunctions caused by incorrect zero potential.

If the electric power supply for the linear actuator is fed by transducing sensors with varying zero potentials this may result in incorrect automatic controller action.

- Ensure that the zero potential is properly applied

  See Table 3.

4 Tighten the screw joints.

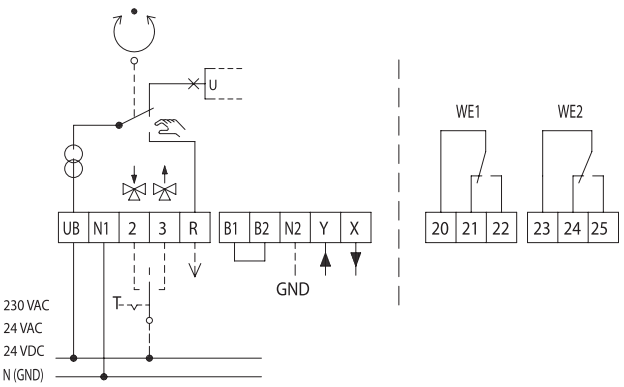


Fig 4.6 Circuit diagram

Terminal	Description
UB, N1	Supply voltage:
2	Control voltage for downward movement during three-point mode
3	Control voltage for upward movement during three-point mode
R	Response signal during "manual" mode • R= 24 VDC max. 35 mA
B1, B2	Binary input / frost protection function
N2	Zero potential of signals X, Y and R • When the zero potentials of signals X, Y and R are identical to the zero potential of the supply voltage it is possible to bridge terminals N1 and N2. • If you run the actuator in continuous mode at 230 V you will have to connect N2. • If you run the actuator in three-point mode at 230 V you will have to connect N2 if you wish to use X or R at the same time.
Y	Input signal continuous mode
X	Output signal continuous mode
20, 21, 22	Terminals path switch unit PS1
23, 24, 25	Terminals path switch unit PS2

Table 3 Key to wiring diagram

4.5.1 Controller independent circuit

When working with 24 V supply voltage and 0 to 10 VDC / 2 to 10 VDC input signal you can switch the actuator controller-independently via a three-step toggle switch in the control cabinet.

How to switch the actuator controller-independently

1 Run the supply voltage 24 VAC via a diode and a three-step toggle switch to terminal Y.

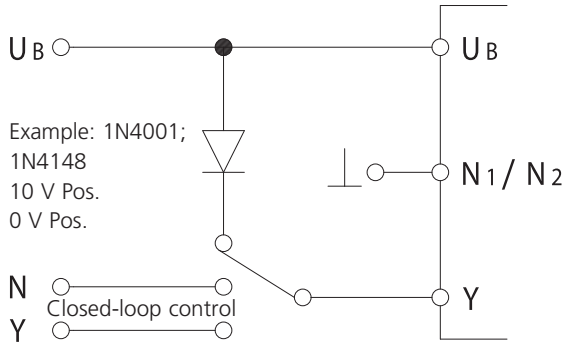


Fig 4.7 Controller independent circuit

2 Using the toggle you can move the linear actuator to the following positions:

- Closed-loop control by input signal Y (normal operation)
- 10 V-position
- 0 V-Position, the linear actuator can be moved to the position selected by encoding switch S6 at 2 to 10 VDC

See Section 5.1, Operating parameters and encoding switch settings.

See Section 5.7, Setting the limit position.

4.5.2 Removing the PCB cover

To set the linear actuator by using the encoding switch you will first have to remove the PCB cover. (33)

⚠ WARNING

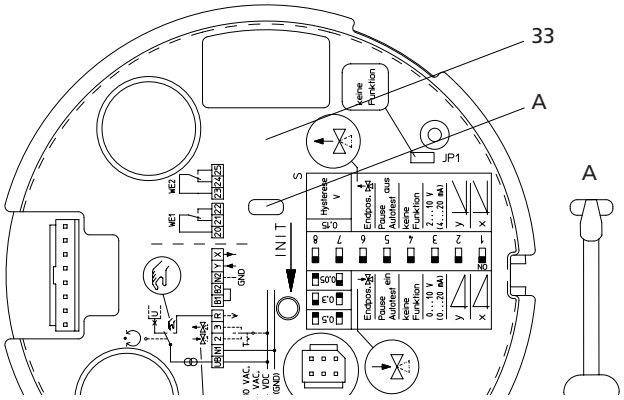
Risk of injury from electric shock by live parts.

When the power supply is on there is a danger of electric shock due to live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system
- Secure against unauthorised restarting

1 Insert the screwdriver into one of the notches on the cover (201) and lift off the cover (201).

2 Insert a small screwdriver in the designated notch on the printed circuit cover (33) and lift if off.



33 Sheeting

Fig 4.8 Remove the PCB cover in the actuator housing

3 Access to encoding switches S1 to S8 as well as jumpers JP1 and JP2 is achieved by removing the PCB cover (33) in the actuator casing (1 - see Figure 2.1).

4.6 Fitting accessories

Accessories are not part of the scope of delivery for the linear actuator unless expressly ordered. The linear actuators are prepared for retro-fitting with:

- PCB for path switch (106)
- PCB for output signal X=0/4 to 20 mA (111)

Optional operation with mA output signal or path switch possible.

See Section 2.2, Accessories.

4.6.1 Fitting a PCB for a path switch

⚠ WARNING

Risk of injury from electric shock by live parts.

When the power supply is on there is a danger of electric shock due to live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system
- Secure against unauthorised restarting

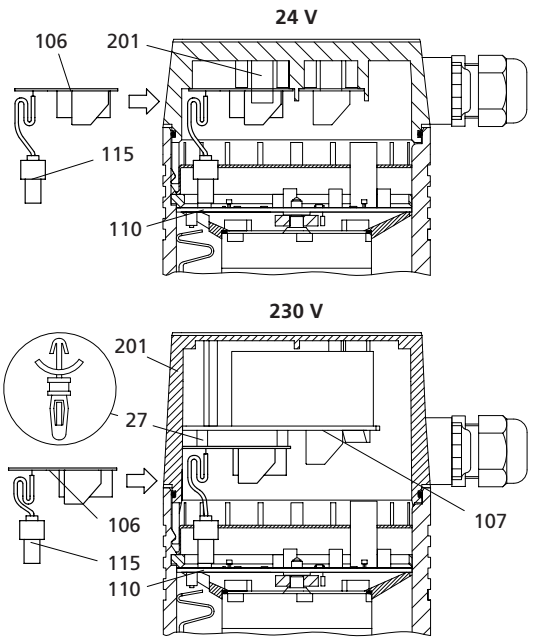
1 Open the cover (201) of the linear actuator.

See Section 4.4, Assembling/disassembling the cover.

2 **24 V:** Clipping the path switch PCB (106) to the safety catches on the cover (201).

See Fig 4.9.

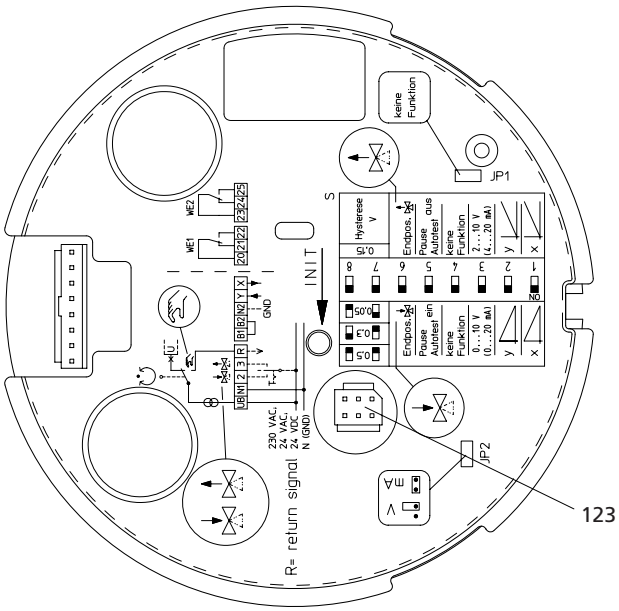
3 **230 V:** Push the path switch PCB (106) onto the three spacers (27) of the pushfit PCB (107).



27 Spacers
106 PCB for path switch
107 Push-fit PCB for 24 V or 230 V
115 Female plug
110 Main board
201 Cover for 24 V or 230 V*

Fig 4.9 Assembling the path switch PCB inside the cover

4 Plug the female plug into the (115) path switch PCB (106) on the socket board (123) of the main PCB (110). In the process pay attention to the notches on the socket board and female plug.



123 Socket board

Fig 4.10 Socket board for position switch PCB on main PCB

5 Set the position switches.

See Section 5.8, Setting a potential-free path switch.

4.6.2 Fitting the PCB for the mA output signal

⚠ WARNING

Risk of injury from electric shock by live parts.

When the power supply is on there is a danger of electric shock due to live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system
- Secure against unauthorised restarting

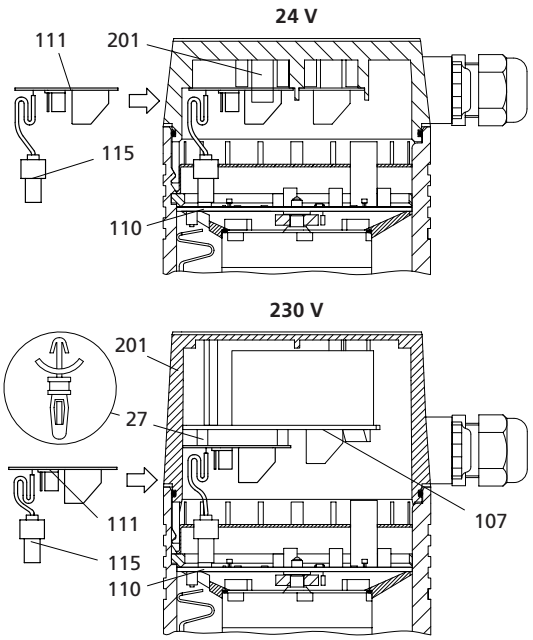
1 Open the cover (201) of the linear actuator.

See Section 4.4, Assembling/disassembling the cover.

2 **24 V:** Clip the PCB for the mA output signal to the safety catches inside the cover (201).

230 V: Push the PCB for the mA output signal onto the three spacers of the (27) push-fit PCB (107).

See Fig 4.11.



27 Spacers
111 PCB for mA output signal
107 Push-fit PCB for 24 V or 230 V
115 Female plug
110 Main board
201 Cover for 24 V or 230 V*

Fig 4.11 Fitting a PCB for the mA output signal

3 Push the female plug of the (115) PCB for the mA output signal onto the pin strip (123) of the main PCB (110). In the process pay attention to the notches on the socket board and female plug.

4 Attach the single cable from the PCB (111) for the mA output signal to terminal X of the push-fit PCB (107).

5 Use the jumper to select the signal range for the output signal:

- Jumper right: 4 to 20 mA
- Jumper left: 0 to 20 mA

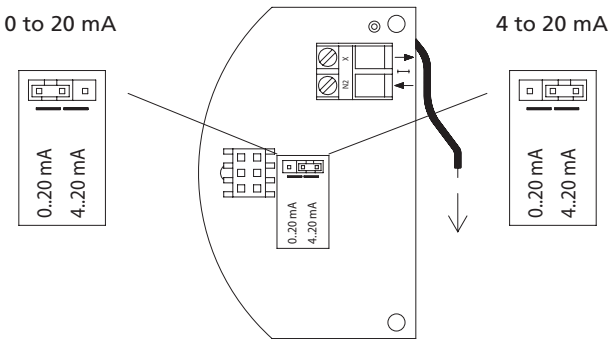


Fig 4.12 Setting the PCB for the mA output signal

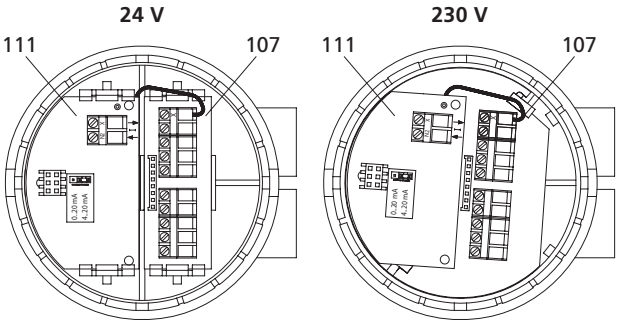


Fig 4.13 Connecting the PCB for the mA output signal to the push-fit PCB

⚠ WARNING

Risk of injury from electric shock by live parts.

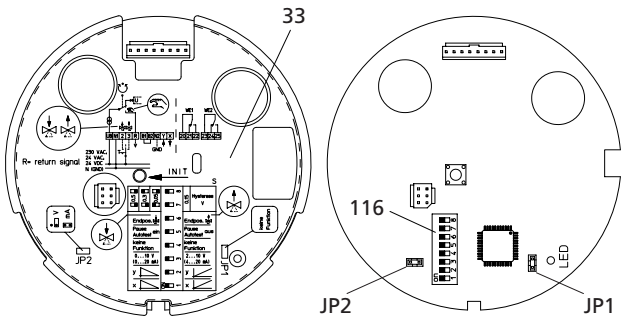
When the power supply is on there is a danger of electric shock due to live parts.

- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system
- Secure against unauthorised restarting

Operating parameters are set at the encoding switches (116) and jumpers. The encoding switches and jumpers are situated underneath the PCB cover (33) in the actuator housing (1).

See Section 4.4, Assembling/disassembling the cover.

See Section 4.5.2, Removing the PCB cover.



33 PCB cover

116 PCB cover
JP1 Jumper
JP2 Jumper

Fig 5.1 PCB cover, encoding switch and jumper

5.1 Operating parameters and encoding switch settings

Before starting to operate the linear actuator you must set the operating parameters using the encoding switches and jumpers.

Switch	On			Off		
S1	X characteristic curve		Stroke → Y	X characteristic curve		Stroke → X
S2	Y characteristic curve		Stroke → Y	Y characteristic curve		Stroke → Y
S3	Input signal (Y) 0 to 10 VDC or 0 to 20 mA			Input signal (Y) 2 to 10 VDC or 4 to 20 mA		
S4	ELC 100 Hysteresis 0.4 s/mm	ELC 160 Actuating time 2.5 s/mm	ELC 220 no function, do not adjust	ELC 100 Hysteresis 0.4 s/mm	ELC 160 Actuating time 5 s/mm	ELC 220 no function, do not adjust
S5	Autotest and Autopause on			Autotest and Autopause off		
S6	Limit position for actuator spindle extended			Limit position for actuator spindle retracted		
S7, S8 ELC 100	S7 and S8 are used to set the actuating time (1.9 to12 s/mm)					
S7, S8 ELC 160	S7 and S8 are used to set the hysteresis (0.05 to0.5V)					
JP1	ELC 100 Characteristic line linear	ELC 160 Actuating force 1 kN	ELC 220 no function, do not adjust	ELC 100 Characteristic line is exponential (1/50)	ELC 160 Actuating force 1.6 kN	ELC 220 no function, do not adjust
JP2	Input signal (Y) in mA			Input signal (Y) in V		

Table 4 Encoding switch and jumper settings

5.2 Setting the input signal

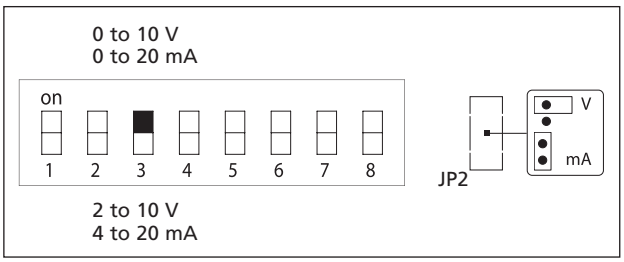


Fig 5.2 Setting the input signal

Additional information: Input signal (Y).

5.3 Setting the actuating time

Additional information: See Section 2.4.4, Actuating time.

5.3.1 ELC 100

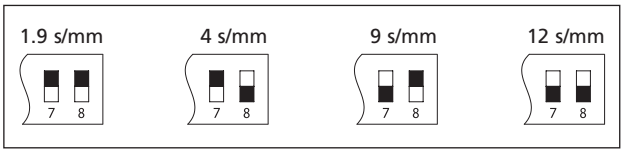


Fig 5.3 Set actuating time

5.3.2 ELC 160

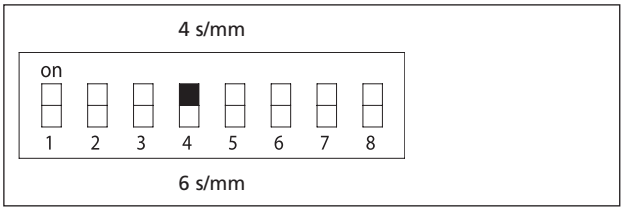


Fig 5.4 Set actuating time

5.4 Setting the hysteresis

For further information see Section 2.4.5, Hysteresis.

5.4.1 ELC 100

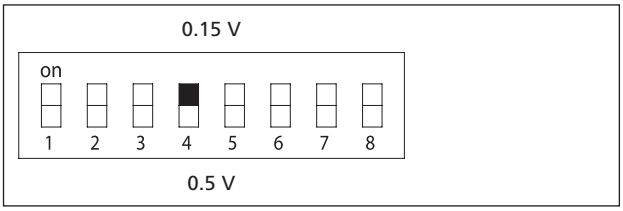


Fig 5.5 Set hysteresis

5.4.2 ELC 160

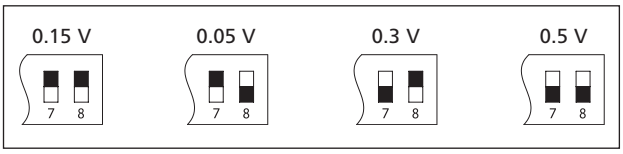


Fig 5.6 Set hysteresis

5.5 Setting the actuating direction

You can use the encoding switch (reverse operation) to reverse the actuating direction of the linear actuator.

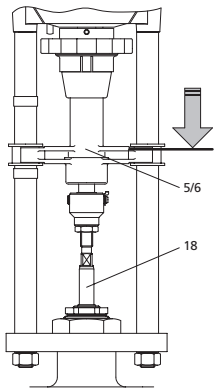
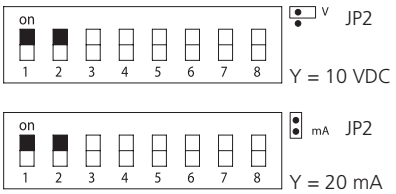
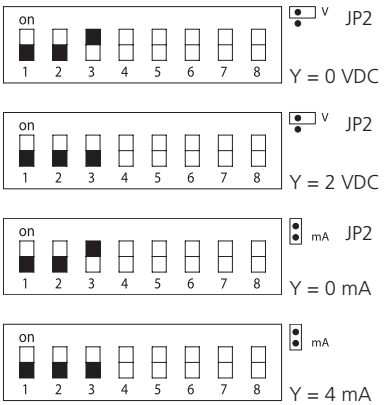
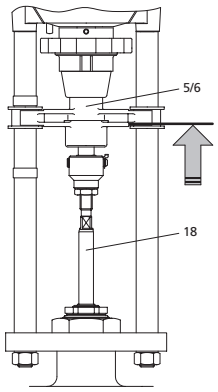
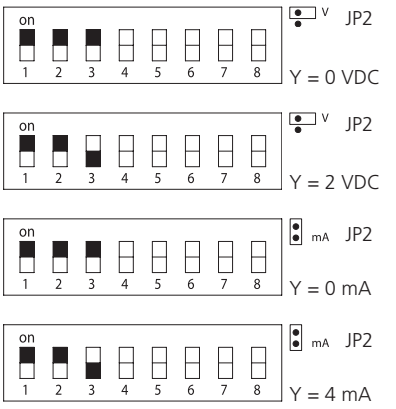
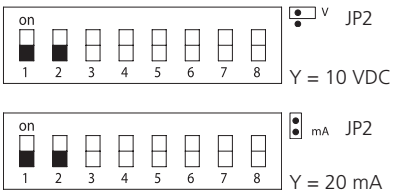
Actuator setting	Normal operation	Reverse operation (X and Y reversed)
		
		
Encoding switch S1: X (output signal), encoding switch S2: Y (input signal)		

Table 5 Setting the actuating direction

5.6 Setting auto test and auto pause

Auto test and auto pause are enabled when encoding switch S5 is set to ON.

Approximately every 10 days the auto test triggers a start-up towards the limit position in rapid traverse mode. Rebalancing takes place at the same time.

During auto pause a break of 3 seconds (measuring cycle 2 min) takes place after more than 20 direction varying traverse commands per minute.

These two functions cannot be selected individually.

5.7 Setting the limit position

Use encoding switch S6 to select the limit position for the linear actuator:

- S6 ON: Limit position with extended rotary guard
- S6 OFF: Limit position with retracted rotary guard

The limit position is approached in the following situations:

- Due to wire break detection by the Y signal (2 to 10 VDC or 4 to 20 mA only)
- Due to a binary signal (When electric circuit between terminal B1 and B2 is interrupted)
- During auto test
- After a cut in supply voltage (manual adjustment)

5.8 Setting a potential-free path switch

Trim-pots P1/P2 is used to set the path switches independently. Try out the sequence of operations for each position switch once.

How to set a path switch

1 Ensure that the linear actuator has been commissioned and initialised.

See Section 5.10, Commissioning.

See Section 5.9, Initialising the path measuring system.

⚠ NOTE

Malfunction caused by imprecisely set path switches.

If you have set the actuator to manual mode (without supply voltage) it is only possible to set the path switch approximately (central setting is the equivalent of a switch point of c. 50% lift).

- To set the path switch accurately, set the actuator to automatic mode

2 Move the actuator to the position where the switch event is to be triggered. Follow the sequence of operations below with the supply voltage turned on.

⚠ WARNING

Risk of injury from electric shock by live parts.

When the supply voltage is turned on there is a risk of electric shock from live parts.

- Take care not to touch any live parts
- Take care to apply the tool in a way that does not cause short-circuit

3 Open the cover (201).

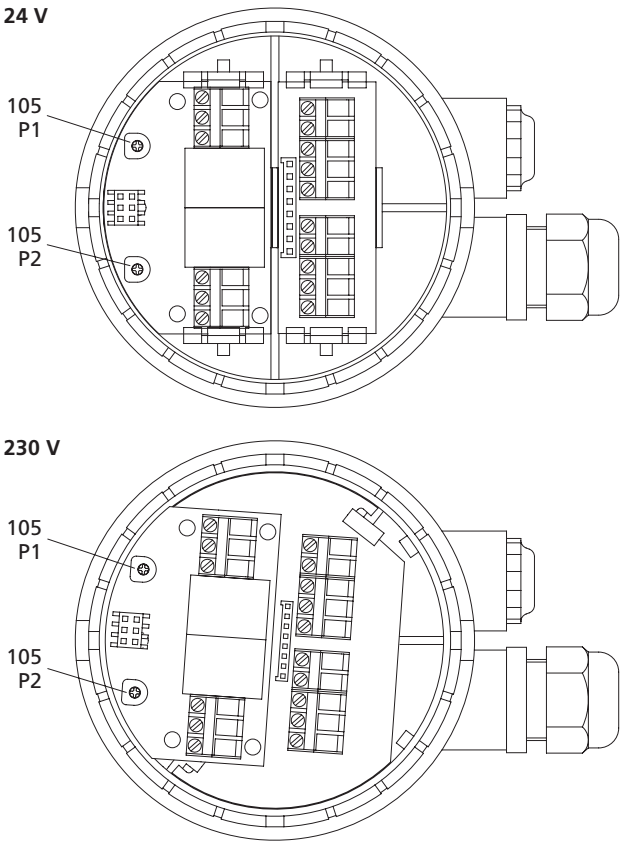
See Section 4.4, Assembling/disassembling the cover.

Inside the cover is the path switch PCB (111).

4 Use a screwdriver to adjust the trim-pot until the path switch switches. The related LED will either light up or switch off.

Potentiometer P1 (105 P1) is used to set path switch 1. LED 1 shows the switching status.

Potentiometer P2 (105 P2) is used to set path switch 2. LED 2 shows the switching status.



105 P1 Trim-pot **105** P2 Trim-pot

Fig 5.7 Position switch PCB in cover

5 Comply with the allowable contact load for the path switch:

Nominal load	8 A, 250 VAC 8 A, 30 VDC
Switch voltage	max. 400 VAC max. 125 VDC

Table 6 Contact load of the path switch

6 Disconnect the actuator from the supply and connect the path switch contacts.

7 Close the cover (201) of the linear actuator

See How to attach the cover.

5.9 Initialising the path measuring system

⚠ NOTE

Linear actuator starts automatically.

The linear actuator starts immediately after being connected to the supply voltage and automatically moves to a reference point of the path measuring system.

- Wait until this reference point has been reached and the linear actuator has stopped

The path measuring system has to be initialised after the following:

- At initial commissioning
- After repairs to the valve or actuator
- After a replacement of valve or actuator

Initialisation may be triggered in two different ways.

How to initialise via the initialising button

⚠ WARNING

Risk of injury from electric shock by live parts.

When the supply voltage is turned on there is a risk of electric shock from live parts.

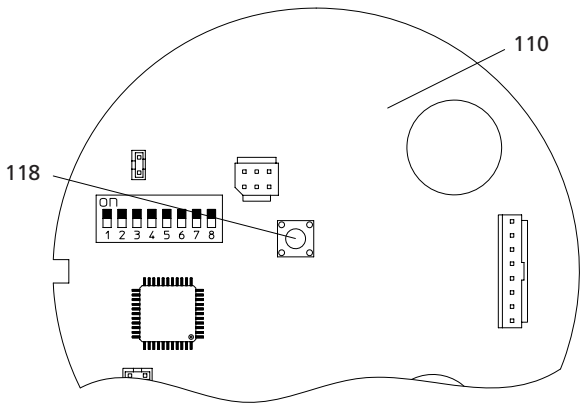
- Take care not to touch any live parts
- Take care to apply the tool in a way that does not cause short-circuit

1 Open the cover (201).

See Section 4.4, Assembling/disassembling the cover.

2 Ensure that supply voltage is applied.

3 Press the initialising button (118) and keep it pressed for at least 1 second.



110 Main board **118** Initialising button

Fig 5.8 Initialising the path measuring system

How to initialise via the connecting terminals

1 Apply supply voltage simultaneously to terminals 2 and 3, making sure that supply voltage is applied for at least 1 second.

See Fig 4.6.

5.10 Commissioning

1 Check whether all fitting and assembly work has been competently finished.

See Section 4, Assembly.

2 Ensure that the electrical actuation of the linear actuator can take place safely without putting people or devices at risk.

3 Ensure that the linear actuator is attached correctly and that the cover of the linear actuator is closed.

See Section 4.4 Assembling/disassembling the cover.

4 Ensure that the linear actuator is set to automatic mode.

See Section 6.1, Changing between manual and automatic mode.

5 Ensure that the operating parameters are set correctly.

See Section 5.1, Operating parameters and encoding switch settings.

6 Ensure that the path measuring system is initialised.

See Section 5.9, Initialising the path measuring system.

7 Apply supply voltage. The linear actuator will now move to the reference point.

The linear actuator is ready for operation.

Prior to commissioning the linear actuator you will have to initialise it and select the operating mode.

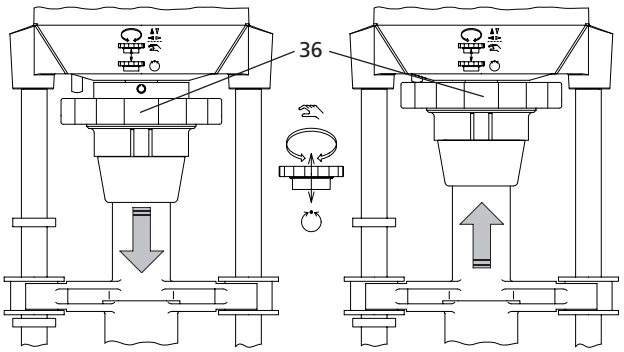
See Section 5, Commissioning.

See Section 5.9, Initialising the path measuring system.

6.1 Changing between manual and automatic mode

It is possible to run the linear actuator in automatic mode or manual mode (manual adjustment).

- In automatic mode the rotary guard moves to the position set by the controller
- In manual mode it is possible to set the spindle manually, e. g. for control purposes. Output signal (X) is not available in manual mode



Automatic operation **Manual operation**

36 Handwheel

Fig 6.1 Selecting automatic mode

How to change-over in manual mode

1 Move the handwheel (36) to manual mode position by turning until the handwheel locks noticeably.

⚠ NOTE

Risk of damage to valve and actuator during manual mode.

The valve may get damaged if it is pushed too hard into its receptacle during manual mode.

- Do not try and keep turning the handwheel when you realise that the required effort increases noticeably
- Never use force

2 Use the handwheel to turn the rotary guard to the desired position. Turn the handwheel until the preset potentiometer increases. Do not use force.

How to change-over in automatic mode

1 Push the handwheel (36) to automatic mode position.

2 The linear actuator first moves to the position specified by encoding switch S6 and then to the position preset by the controller.

6.2 LED display

The LED on the main PCB in the actuator indicates the operating status or errors.

See Section 10.2, Check list for breakdown.

LED	Operating status / error
☼ Duration	**Normal operation, ready for operation** The LED is permanently lit, actuator waiting for traverse command.
☼ ⊗ ☼ ⊗ 0.5s 0.5s 0.5s 0.5s	**Standard operation** Actuator carries out traverse command.
☼ ⊗ ☼ ⊗ 0.2s 1.5s 0.2s 1.5s Short – long rhythm	**Wire break detection** Input signal has dropped below 1 V or below 2 mA in operating modes 2 to 10 VDC or 4 to 20. *See Section 2.4.3, Wire break detection.*
☼ ⊗ ☼ ⊗ 2.5s 2.5s 2.5s 2.5s Long – long rhythm	**Blockage detection (continuous mode only)** The linear actuator is mechanically blocked. *See Section 2.4.2, Blockage detection.*
☼ ⊗ ☼ ⊗ 1.5s 0.2s 1.5s 0.2s Long – short rhythm	**Continuous signal on terminal 2 and 3** A simultaneous control signal at terminal 2 and 3 will result in an initialising cycle (max. 4 attempts). The linear actuator will automatically switch off after 4 unsuccessful attempts.

Table 7 Display LED

7. Maintenance, care and repairs

The linear actuator requires only periodic maintenance.
To ensure that the spindle is greased, drive the actuator to its end position once per day.

8. Spare parts

When ordering accessories and spare parts please quote the specifications engraved on the type plate of your linear actuator. The specifications on the type plate are standard for the technical date of linear actuators as well as the requirements for the public power supply.

⚠ **NOTE**

Damage to device caused by faulty spare parts.

Spare parts must match the technical data specified by the manufacturer.

- Use genuine spare parts at all times

See Section 2.1, Component parts.

See Section 2.2, Accessories.

9. Decommissioning and disposal

Dispose of the linear actuator according to national regulations and laws.

10. Removal of faults

After remedying faults you will have to re-initialise the path measuring system.

See Section 5.9, Initialising the path measuring system.

10.1 How to remedy faults

If the linear actuator does not work properly, follow the sequence of operations described below in order to remedy the fault:

1 Check whether the linear actuator was correctly assembled.

2 Check the settings for the linear actuator against the specifications on the type plate.

3 Remedy the fault by following the check list.
See Section 10.2, Check list for breakdown.

4 If you are unable to remedy the fault contact the manufacturer.

5 For all queries at the manufacturer's and when sending back the device please quote the following:

- SN (serial number = order number)
- Type denomination
- Supply voltage and frequency
- Accessory equipment
- Error report

6 If you are unable to remedy the fault despite inquiry you can send the device to the manufacturer.

10.2 Check list for breakdown

Fault	Cause/reason	Remedy
1. Linear actuator is not working.	Handwheel (36) is in position manual mode.	Switch handwheel to position automatic mode.
	Power cut.	Determine cause and remedy.
	Fuse defective (in control cabinet).	Determine cause and remedy, replace fuse.
	Linear actuator incorrectly connected.	Set the connection correctly according to wiring diagram (on cover).
	Short circuit due to humidity.	Determine cause, dry the linear actuator; replace cover seal or screw joints and/or attach protective cover, as required.
	Short circuit due to incorrect connection.	Correct the setting for connection.
	Motor has winding damage (burnt-out) • e.g. voltage too high • Electronic system defective	Determine cause, measure current data. Compare to type plate and table. Disassemble linear actuator and send it in for repairs.
2. Linear actuator running unsteadily, i.e. veering between clockwise and anti-clockwise rotation.	Drop of voltage due to excessively long connecting cables and/or insufficient diameter.	Measure the current data; if required, recalculate and replace connecting cables.
	Public power supply fluctuations greater than admissible tolerance. *See Section 2.5, Technical data*.	Improve public power supply conditions.
3. Linear actuator pauses intermittently or initialises frequently.	Slack contact in feeder line.	Check and tighten connections (terminal strips).
4. Linear actuator does not move to limit position. Valve does not open/ close.	Valve is stuck.	Provide smooth-running valve.
	Excessive system pressure.	Adjust system pressure.
5. Linear actuator does not move at all or not correctly to the position preset by input signal Y.	Input signal Y is faulty: • Interfering signals • Signal variations	Check input signal Y on linear actuator, remove cause of fault.
	Main PCB defective.	Replace main PCB or disassemble linear actuator and send it in for repair.
6. LED flashes in long/long rhythm.	Blockage detection was triggered.	Press INIT and observe actuator during initialisation.
		Check valve for smooth-running along entire traverse range.
7. LED flashes in short/long rhythm.	Wire break was detected.	Measure desired value voltage and current on linear actuator.
8. LED flashes in long/short rhythm.	Relay contact adhesive.	Check controller.

Table 8 Check list breakdown

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