



# OPERATING MANUAL

Linear actuators

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MC55/24 · MC55/230 · MC55Y



### **Operating manual**

MC100/24 · MC100/230 · MC103/24 · MC103/230



### **Operating manual**

MC160/24 · MC160/230 · MC161/24 · MC161/230  
MC163/24 · MC163/230



### **Operating manual**

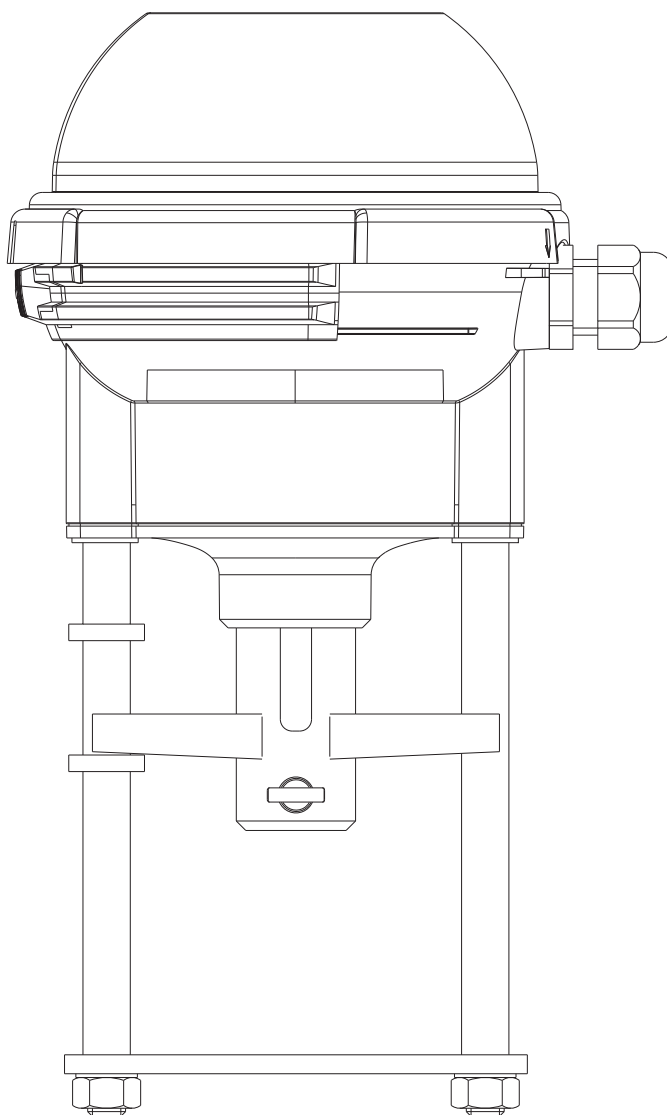
MC220/24 · MC220/230 · MC223/24 · MC223/230



### **Operating manual**

MC250/24 · MC250/230 · MC253/24 · MC253/230  
MC500/24 · MC500/230 · MC503/24 · MC503/230





# Operating Manual

## Linear actuators

MC55/24 • MC55/230 • MC55Y

## General information

Amendment	Version	Date	Modifications
	1.0	June 2006	Initial preparation
	2.0	June 2007	Revision
	3.0	May 2008	Complete revision and amendment
	3.1	Juli 2009	Amendment MC65
	3.2	March 2011	Revision
	3.3	November 2011	Revision

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Concerning all data, information, and illustrations in this manual we reserve the right of technical modifications and improvements. No claims can be considered for alteration or rework of already delivered lift drives.

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# 1 Safety

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



**DANGER**

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## **DANGER**

Directly threatening hazard leading to death or serious physical injuries.

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**WARNING**

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## **WARNING**

Potentially hazardous situation which may lead to death or serious physical injuries.

---



**CAUTION**

---

## **CAUTION**

Potentially hazardous situation which could lead to minor physical injuries. Indicates a hazard which may cause material damage.

---



**ATTENTION**

---

## **ATTENTION**

Potentially hazardous situation where the product or an object in its environment may get damaged.

---

**Hint:** Utilisation instructions and other useful information.

## 1.1 Proper use

Linear actuators MC55/24, MC55/230, MC55Y 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.

Concurrence 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 is decisive for linear actuator technical data and mains power supply requirements.

Any utilisation for tasks other than the aforementioned usage in accordance with specification and operating with mains power supply ratios other than those permitted is not deemed to be utilisation in accordance with specification. The operator bears sole liability for the risk to persons and machine and other assets in the event of utilisation not in accordance with specification.

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 authorization 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 MC55/24, MC55/230, MC55Y.

### 1.5 During operation

Safe operation is only possible if transportation, storage, installation, operation and maintenance are carried out safely and materially and professionally correctly.

#### **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 and other 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.

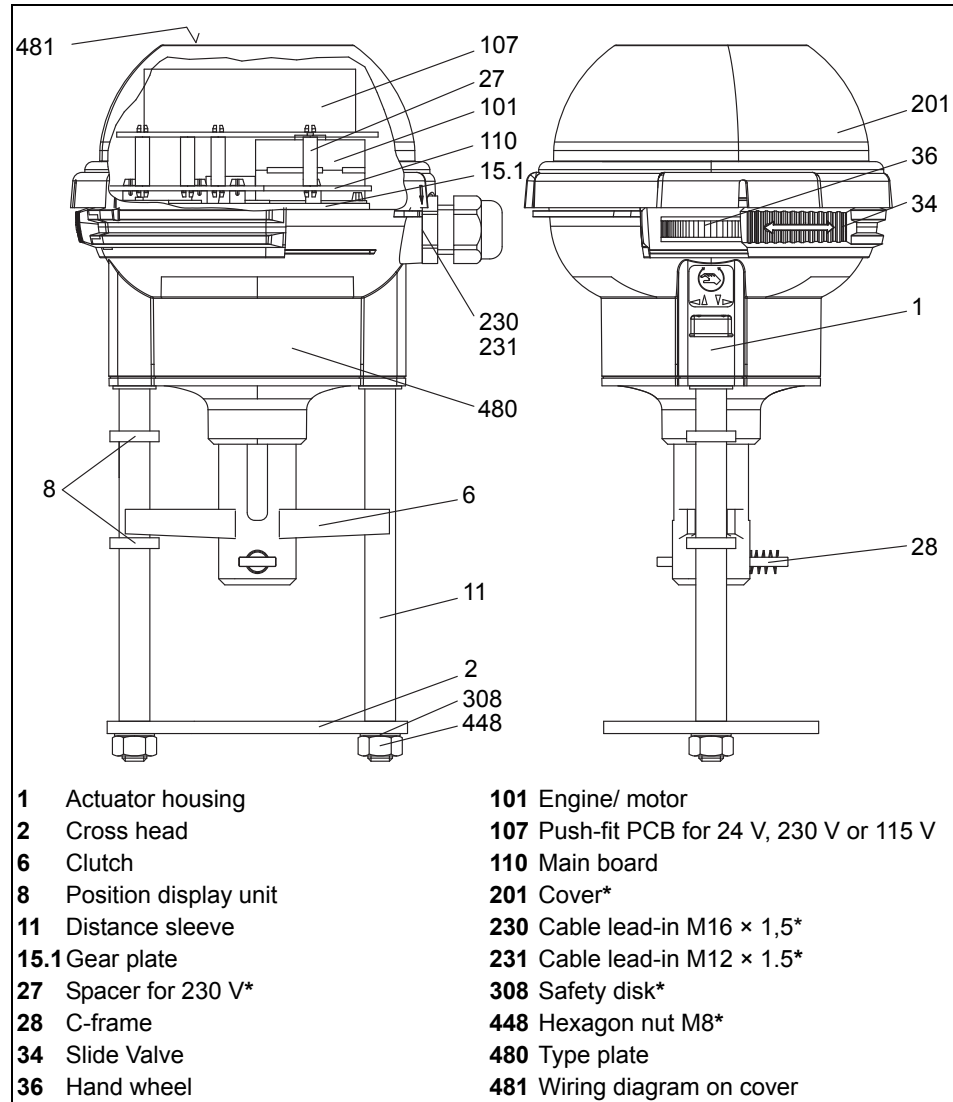
### 1.6 Working environment

Read the data concerning the working environment in the Technical Data.

## 2 Product Specification

The linear actuators control a stepper motor by means of a micro controller. The rotational movement of the stepper motor is converted into a linear movement by spur gears and a threaded spindle with spindle nut.

### 2.1 Component parts



**diagram 1** Component part denominations

\* This component part is available as a spare part.

## 2.2 Operating modes

The linear actuator can be operated manually or automatically.

- In manual mode stroke is adjusted via the hand wheel.
- In automatic mode stroke is controlled electrically.

### 2.2.1 Continuous mode MC55Y

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 input signals:

- 0 ... 10 V DC / 2 ... 10 V DC
- 0 ... 20 mA / 4 ... 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 ... 10 V DC

### 2.2.2 Three-point mode MC55/24, MC55/230

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 spindle nut will be extended.
- When the control voltage is applied to terminal 3, the spindle nut will be retracted.

**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 ... 10 V DC

## 2.3 Functions

### 2.3.1 Binary signal / frost protection function MC55Y

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.

As soon as the electric circuit between B1 and B2 is closed, the desired value of the input signal will be started.

⇒ 5.5 *Setting the limit position for MC55Y* on page 21

### 2.3.2 Blockage detection

When the linear actuator is mechanically blocked the blockage detector will turn off the motor as soon as one of the two limit positions have been reached or a blockage occurs due to overload.

### 2.3.3 Wire break detection MC55Y

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

The linear actuator moves to the limit position set by jumper JP2 if the input signal drops below 1 V or 2 mA.

⇒ 5.5 *Setting the limit position for MC55Y* on page 21

### 2.3.4 Actuating time

The time required for the spindle nut to travel a defined distance is called actuating time. Actuating time is specified in s/mm. Jumper JP3 on the plug-in jumper wire is used to set the actuating time.

⇒ 5.3 *Setting the actuating time* on page 19

### 2.3.5 Manual operation

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

- Motor and control electronics are turned off in manual mode to make hoisting movements of the control impossible.

⇒ 6.1 *Changing between manual and automatic mode* on page 22

## 2.4 Technical data

Type	MC55/24, MC55Y	MC55/230
<b>Supply voltage:</b>	24 V AC $\pm$ 10% 24 V DC $\pm$ 10%	230 V AC + 6% -10% 115 V AC $\pm$ 10%
<b>Power consumption</b>	3,5 VA	7 VA
<b>Weight</b>	1.5 kg	1.5 kg
<b>Dimensions</b>	See technical data sheets	
<b>Stroke MC55</b>	max. 20 mm	max. 20 mm
<b>Frequency</b>	50/60 Hz $\pm$ 5%	50/60 Hz $\pm$ 5%
<b>Ambient temperature</b>	0 to +60°C	0 to +60°C
<b>Enclosure protection</b>	IP 54 IP 30 in manual mode	IP 54 IP 30 in manual mode
<b>Operating mode</b>	S3-50% ED	S3-50% ED
<b>Actuating time</b>	9 or 5 s/mm	9 or 5 s/mm
<b>Actuating force</b>	0.6 kN  During 24 V DC the specified actuating force can only be reached with the help of an aligned AC voltage.	0.6 kN

table 1 Technical data

Type	MC55/24, MC55/230	MC55Y
<b>Input signal Y/ Resistance of load</b>	<ul style="list-style-type: none"> <li>• Three-point</li> </ul>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 2 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 0 ... 20 mA / 510 <math>\Omega</math></li> <li>• 4 ... 20 mA / 510 <math>\Omega</math></li> </ul>
<b>Output signal X/ Load rating</b>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / resistance of load <math>\geq</math> 1200 <math>\Omega</math>, <math>I_{max}</math>. 8 mA</li> </ul>	
<b>Cable impedance between B1 and B2</b>	<ul style="list-style-type: none"> <li>• max. 10 <math>\Omega</math></li> </ul>	


table 2 Technical data signals

#### 2.5 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).

⇒ 2.1 *Component parts* on page 6

	
<b>MC55Y</b>	<b>08203017/01/0408</b>
AC 50/60 Hz	24V
max 3.5 VA	IP 54/30

**diagram 2** Example of type plate

## 3 Transportation & Storage

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### **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 to the specified transport and storage temperatures between -20 to +65°C.



## 4 Assembly

Prior to assembling the linear actuator:

- ⇒ 4.1 *Checking the scope of delivery* on page 11
- ⇒ 4.2 *Preparing assembly* on page 11

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

- ⇒ 4.3 *Mounting the linear actuator on the valve* on page 12
- ⇒ 4.4 *Assembling/disassembling the cover* on page 13
- ⇒ 4.5 *Electrical connection* on page 14

### 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

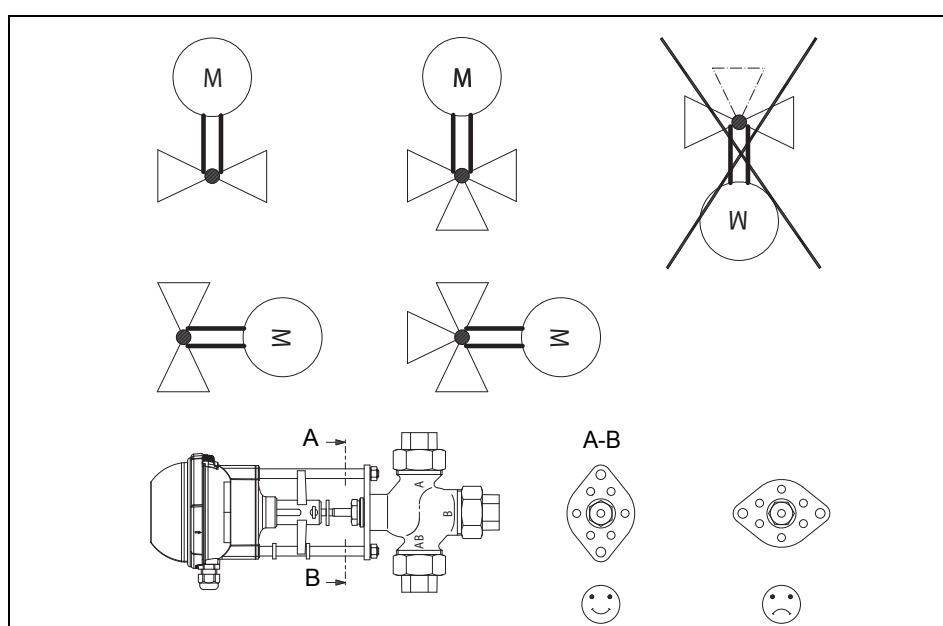


#### A non-attached valve causes damage!

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

- Always operate the linear actuator with a valve attached.

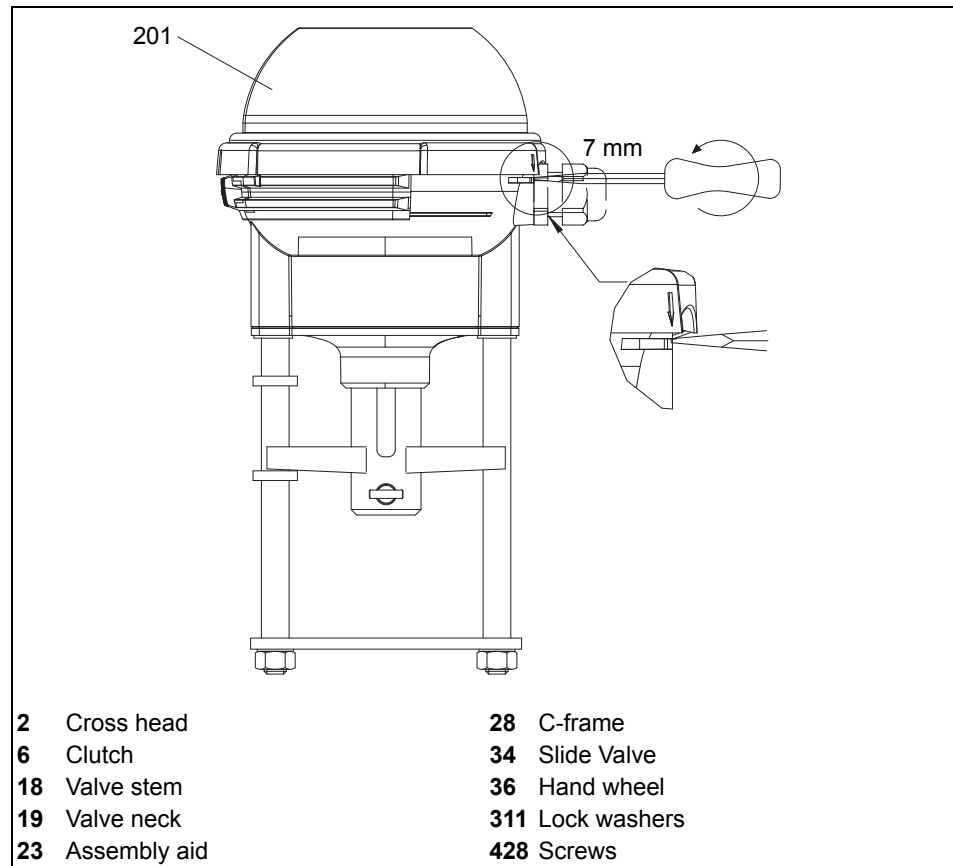
- 1 Allow for about 140 mm space above the cover at the site of installation.
- 2 Check the working environment before assembling and commissioning the linear actuator:
- 3 Ensure that the valve is correctly fitted. For details please see assembly instructions for valve.
- 4 Determine the assembly position of the linear actuator. Do not arrange linear actuators in a hanging position.



**diagram 3** 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 will have to mount the linear actuator on the valve.



**diagram 4** Mounting the linear actuator on the valve

#### ■ How to assemble linear actuator:

- 1 Place actuator with crossbeam (2) on valve neck (19).  
⇒ *diagram 4* on page 12
- 2 Insert the C-frame (28) and, using a mounting aid, pull the valve stem upwards (18) (23) until the valve stem (18) locks inside the clutch (6).
- 3 Fix the crossbeam (2) of the actuator with the help of screws(428) spanner width 13 and lock washers (311) on the valve neck (19).

#### ■ How to disassemble the linear actuator

- 1 Follow the sequence of operation in reverse order.

## 4.4 Assembling/disassembling the cover



**WARNING**

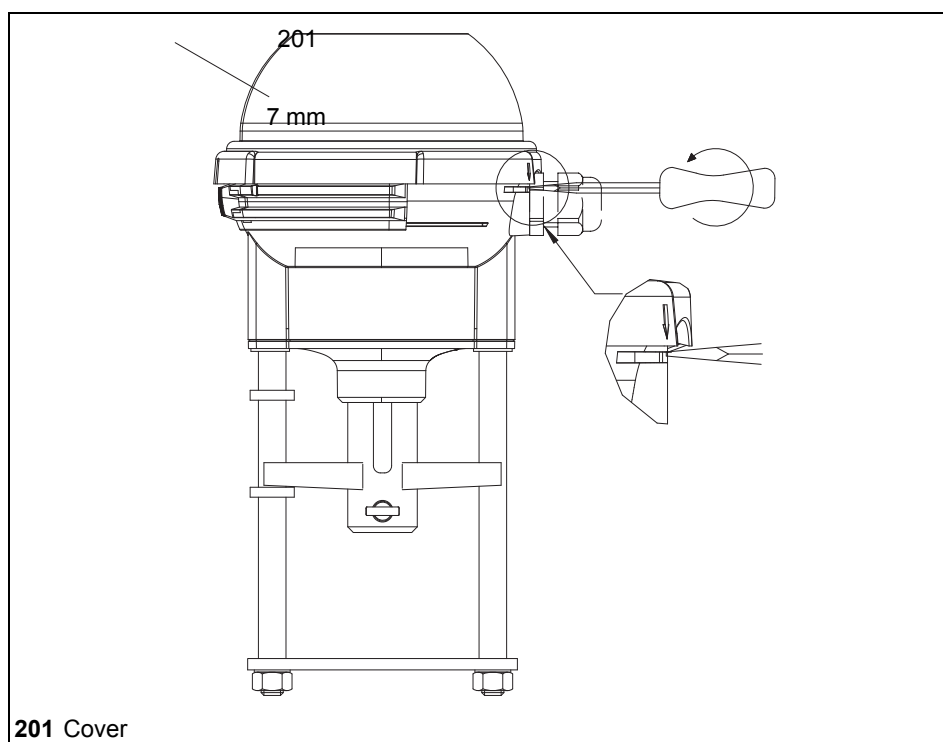
### Risk of injury from electric shock by live parts!

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

**diagram 5** Removing the cover

- 2 Remove the cover (**201**) carefully.

### ■ How to attach the cover

**Hint:** The cover may be mounted in any position.

- 1 Place the cover (**201**) on top and push it down to make it fit by applying moderate force.
- 2 Check the cover for correct fit to ensure air-tightness for the actuator housing.

## 4.5 Electrical connection



### Danger of life caused by incompetent 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.
- ⇒ 1.3 Personnel on page 5



### 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 stabilizer.

⇒ 2.4 Technical data on page 9

#### ■ How to establish electrical connection

- 1 Remove the cover (201).  
⇒ How to remove the cover on page 13
- 2 Run the cable through the screw joint to the terminal strip.
- 3 Connect the power supply according to the wiring diagram.  
⇒ diagram 6 on page 15

**Hint:** The wiring diagram (481) is on the cover (201).

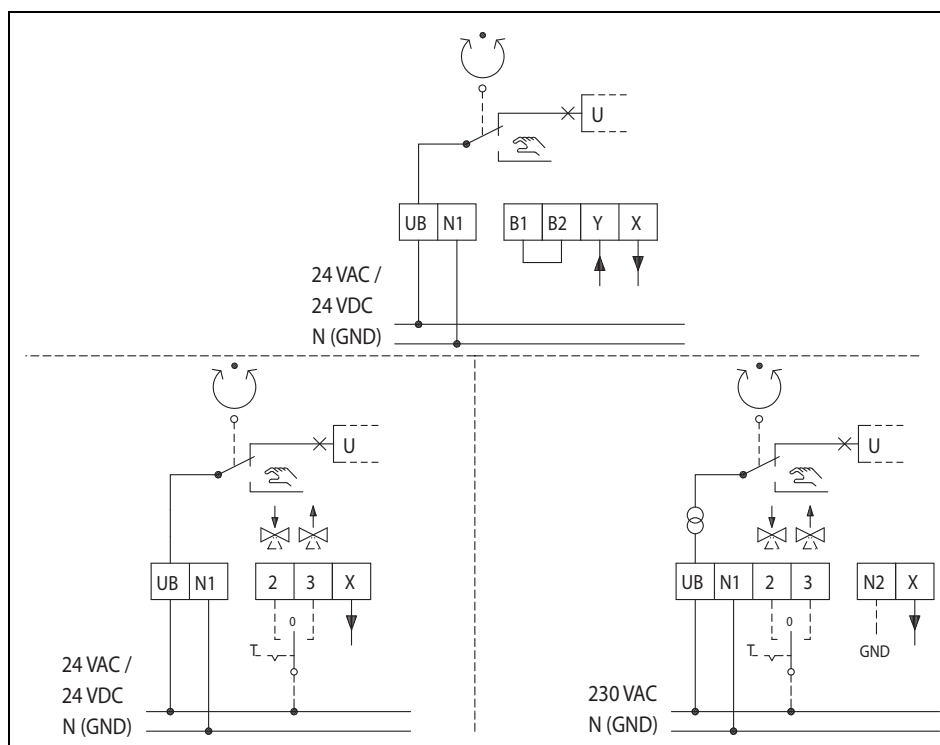


### Malfunctions caused by incorrect zero potential!

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.
- ⇒ table 3 on page 15

- 4 Tighten the screw joints.



**diagram 6** Circuit diagram

Terminal	Description
<b>UB, N1</b>	Supply voltage:
<b>2</b>	Control voltage for downward movement during three-point mode
<b>3</b>	Control voltage for upward movement during three-point mode
<b>B1, B2</b>	Binary input / frost protection function
<b>N2</b>	Zero potential of signal X at 230 V AC <ul style="list-style-type: none"> <li>If you run the actuator in three-point mode at 230 V you will have to connect N2 before you can use X.</li> </ul>
<b>Y</b>	Input signal continuous mode
<b>X</b>	Output signal

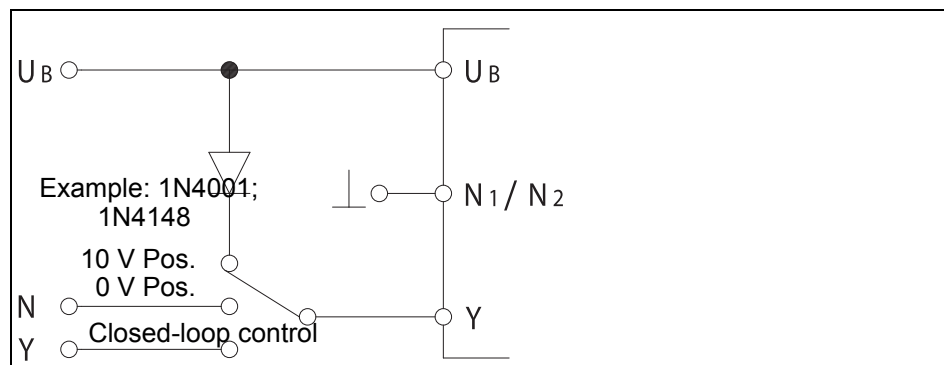
**table 3** Key to wiring diagram

### 4.5.1 Controller independent circuit MC55Y

When working with 24 V supply voltage and 0 ... 10 V DC / 2 ... 10 V DC 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 V AC via a diode and a three-step toggle switch to terminal Y.



**diagram 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 on the plug-in jumper selected by jumper JP2 at 2 ... 10 V DC .
- ⇒ 5.1 *Operating parameters and jumper settings* on page 19  
 ⇒ 5.5 *Setting the limit position for MC55Y* on page 21

### 4.5.2 Remove push-fit PCB and transformer MC55/230

To change settings you have to remove the push-fit PCB (**107**) on the 230 V model.

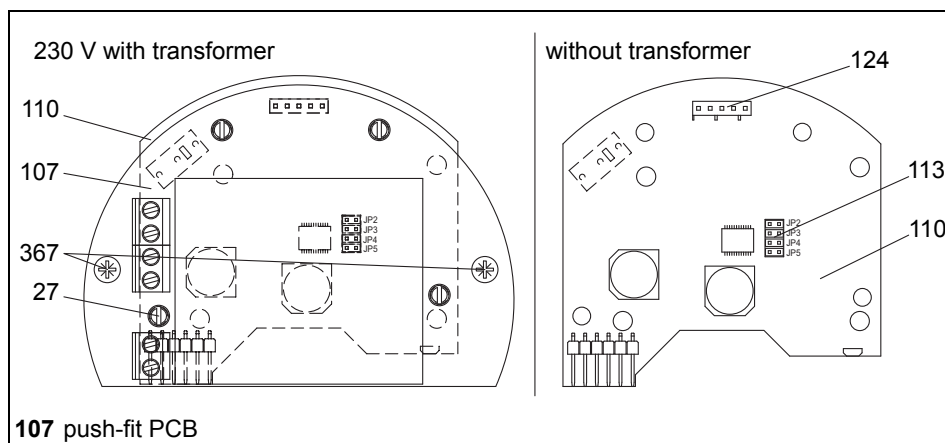


#### Risk of injury from electric shock by live parts!

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 Detach the two screws (**367**)
  - 2 Pull off the push-fit PCB (**107**) in a straight movement from the spacers (**27**) and hold the gear plate by pressing it against the motor.
  - 3 Access to plug-in jumpers (**113**) JP2 to JP5 is now established.
  - 4 After making changes to the setting carefully put the PCB back on.
- Hint:** When doing so, make sure that the socket strip fits correctly on the pin strip (**124**).
- 5 Tighten both screws (**367**).



**diagram 8** Remove push-fit CB and transformer

## 5 Commissioning



### Risk of injury from electric shock by live parts!

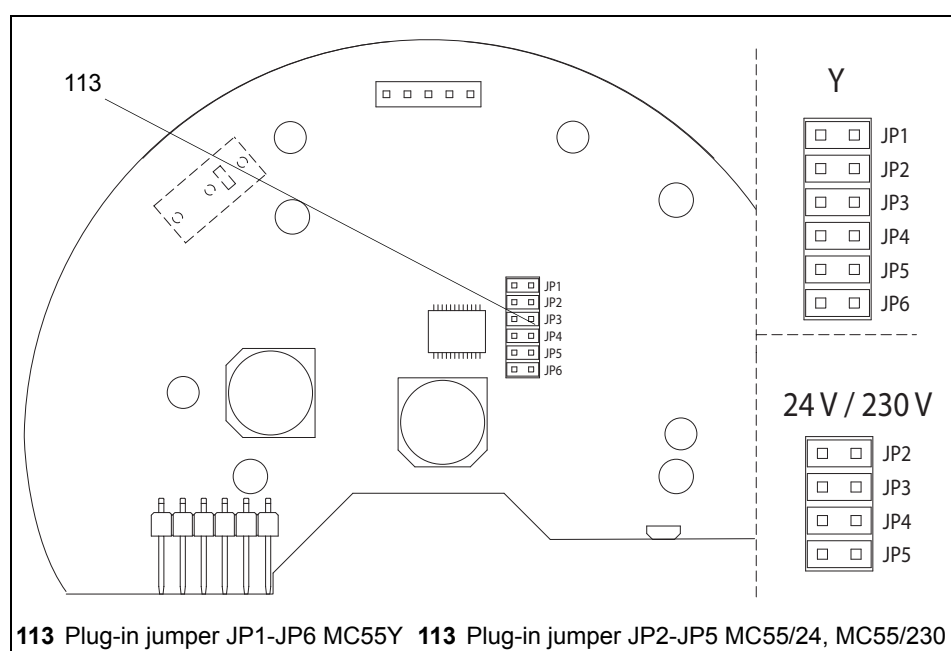
When the power supply is on there is a danger of electric shock due to live parts.

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

The jumpers on the plug-in jumper are used to set the operating parameters **(113)**. The plug-in jumper and the jumpers are underneath the push-fit PCB **(107)** in the actuator housing **(1)**.

⇒ 4.4 Assembling/disassembling the cover on page 13

⇒ 4.5.2 Remove push-fit PCB and transformer MC55/230 on page 17



**diagram 9** Plug-in jumper position on the main PCB



## 5.1 Operating parameters and jumper settings

Before starting to operate the linear actuator you will have to set the operating parameters with the help of the jumpers.



### Malfunctions caused by incorrect jumper setting JP5

The jumper JP5 must be set to “on” at all times.

- Ensure that jumper JP5 is set to “on”.



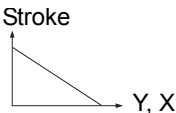
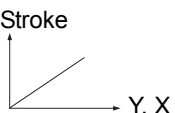
Jumper	on 	off 
JP1	Input signal (Y) 0 ... 10 VDC or 0 ... 20 mA	Input signal (Y) 2 ... 10 VDC or 4 ... 20 mA
JP2	Limit position actuator spindle moved out	Limit position actuator spindle moved in
JP3	Actuating time 9 s/mm	Actuating time 5 s/mm
JP4	Y, X characteristic curve 	Y, X characteristic curve 
JP5	Ready for operation	-
JP6	Input signal (Y) in mA	Input signal (Y) in V

table 4 Jumper settings MC55Y



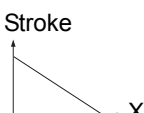
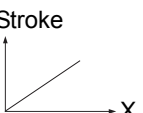
Jumper	on 	off 
JP2	No function	No function
JP3	Setting time 9 s/mm	Setting time 5 s/mm
JP4	X-characteristic curve 	X-characteristic curve 
JP5	Ready for operation	-

table 5 Jumper settings MC55/24, MC55/230

## 5.2 Setting the input signal for MC55Y

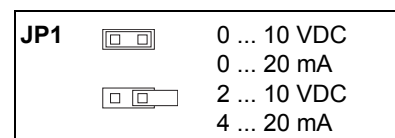
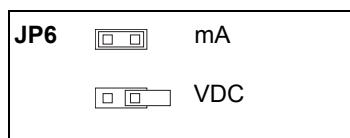


diagram 10 Setting the input signal

⇒ Additional information: *Input signal (Y)* on page 7

## 5.3 Setting the actuating time

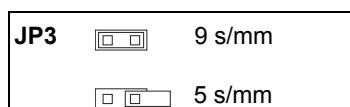


diagram 11 Set actuating time

⇒ 2.3.4 *Actuating time* on page 8

## 5.4 Setting the actuating direction

You can reverse the actuating direction for the linear actuators on the plug-in jumper (113) using jumper JP4 (reverse operation).

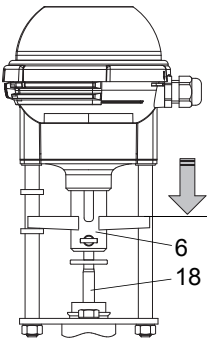
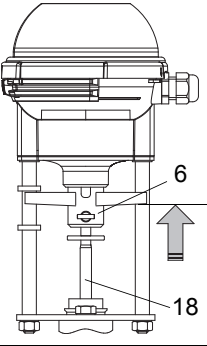


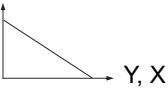
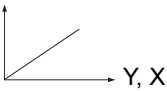
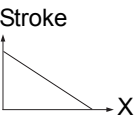
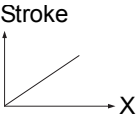
Actuator setting	Normal operation	Reverse operation
	Y = 10 V DC Y = 20 mA X = 10 V DC	Y = 0 V DC Y = 2 V DC Y = 0 mA Y = 4 mA X = 0 V DC
	Y = 0 V DC Y = 2 V DC Y = 0 mA Y = 4 mA X = 0 V DC	Y = 10 V DC Y = 20 mA X = 10 V DC
<b>JP4</b>		
<b>MC55Y</b>	Stroke 	Stroke 
<b>MC55/24 MC55/230</b>	Stroke 	Stroke 

table 6 Setting the actuating direction

## 5.5 Setting the limit position for MC55Y

Use Jumper JP2 to select a limit position for the linear actuator.

- JP2 ON: Limit position with extended spindle nut
- JP2 OFF: Limit position with retracted spindle nut

The limit position is approached in the following situations:

- Due to wire break detection by the Y signal (2 ... 10 V DC or 4 ... 20 mA only),
- Due to a binary signal (When electric circuit between terminal B1 and B2 is interrupted),

## 5.6 Commissioning

- 1 Check whether all fitting and assembly work has been competently finished.  
⇒ 4 *Assembly* on page 11
- 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.  
⇒ 4.4 *Assembling/disassembling the cover* on page 13
- 4 Ensure that the linear actuator is set to automatic mode.  
⇒ 6.1 *Changing between manual and automatic mode* on page 22
- 5 Ensure that the operating parameters are set correctly.  
⇒ 5.1 *Operating parameters and jumper settings* on page 19
- 6 Apply supply voltage. The linear actuator will now move to the reference point. The linear actuator is ready for operation.

## 6 Operation

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

⇒ 5 Commissioning on page 18

### 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 spindle nut 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.

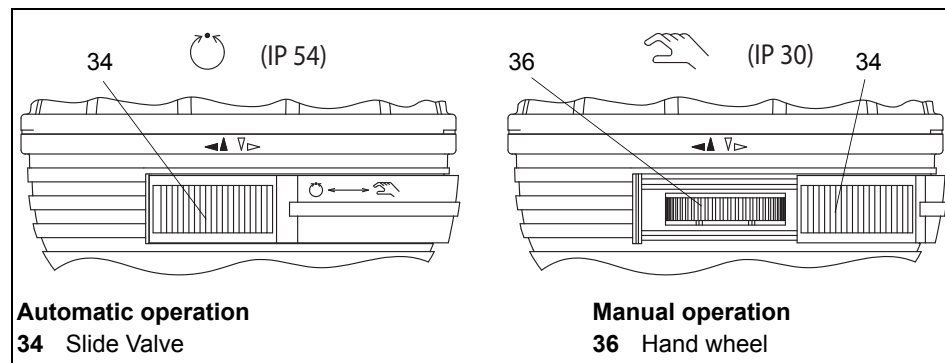


diagram 12 Selecting automatic mode

#### ■ How to change-over in manual mode

- 1 Push the slide bar (**34**) into manual position until you hear an audible locking sound.



ATTENTION

#### **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 hand wheel when you realise that the required effort increases noticeably!
- Never use force !

- 2 Use the hand wheel to turn the spindle nut to the desired position. Turn the hand wheel until the preset potentiometer increases. Do not use force!

#### ■ How to change-over in automatic mode

- 1 Push the slide bar to (**34**) position automatic mode.
- 2 The linear actuator first moves to both limit positions and afterwards to the position specified by the controller.

## 7 Maintenance, care and repairs

The linear actuator requires little maintenance. You do not have to carry out continuous or periodical maintenance.

## 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 data of linear actuators as well as the requirements for the public power supply.



### 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.

⇒ 2.1 Component parts on page 6

## 9 Decommissioning and disposal

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

## 10 Removal of faults

### 10.1 How to remedy faults

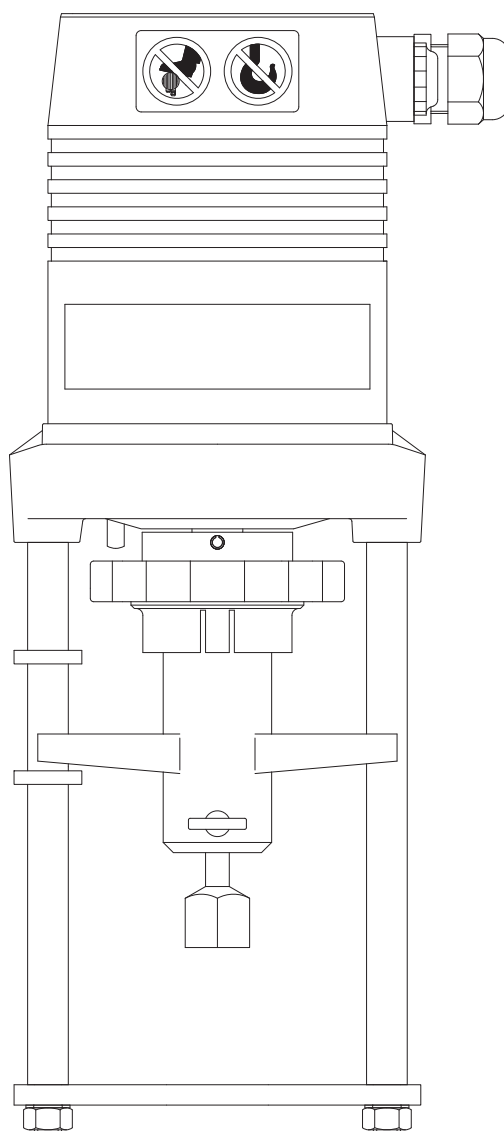
If the linear actuator does not work properly follow the sequence of operations described below in order to remedy the fault:

- 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.  
⇒ 10.2 Check list for breakdown on page 24
- 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.	Slide bar (34) in position manual mode	<input type="checkbox"/> Switch the slide bar to position automatic mode.
	Power cut	<input type="checkbox"/> Determine cause and remedy.
	Fuse defective (in control cabinet)	<input type="checkbox"/> Determine cause and remedy, replace fuse.
	Linear actuator incorrectly connected	<input type="checkbox"/> Set the connection correctly according to the wiring diagram (on the cover).
	Short circuit due to humidity	<input type="checkbox"/> 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	<input type="checkbox"/> Correct setting for connection
	Motor has winding damage (burnt-out) <ul style="list-style-type: none"> <li>• e.g. voltage too high</li> <li>• Electronic system defective</li> </ul>	<input type="checkbox"/> 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.	<input type="checkbox"/> Measure the current data; if required, recalculate and replace connecting cables!
	Public power supply fluctuations greater than admissible tolerance ⇒ 2.4 <i>Technical data</i> on page 9	<input type="checkbox"/> Improve public power supply conditions
3. Linear actuator pauses intermittently or initialises frequently	Slack contact in feeder line	<input type="checkbox"/> Check connections (terminal strips / connecting cables) and tighten, as required.
4. Linear actuator does not move to limit position. Valve does not open/close.	Valve is stuck	<input type="checkbox"/> Provide smooth-running valve
	Excessive system pressure	<input type="checkbox"/> 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: <ul style="list-style-type: none"> <li>• Interfering signals</li> <li>• Signal variations</li> </ul>	<input type="checkbox"/> Check input signal Y on linear actuator, remove cause of fault
	Main PCB defective	<input type="checkbox"/> Disassemble the linear actuator and send it in for repair.

**table 7** Check list breakdown



# Operating Manual

## Linear actuators

MC100/24 • MC100/230 • MC103/24 • MC103/230

## General information

<b>Amendment</b>	<b>Version</b>	<b>Date</b>	<b>Modifications</b>
	1.0	Januar 2006	Initial preparation
	2.0	March 2008	Complete revision and amendment
	2.1	March 2011	Revision

**Copyright** The copyright for this operating manual as well as all rights in case of patent awarding or registration of registered design remains with the manufacturer!

**Subject to alteration** The regulations, directives, standards etc. are compliant with the current state of information at the time of development and are not subject to modification service. They must be applied by the operator at his own responsibility in their latest valid version.

Concerning all data, information, and illustrations in this manual we reserve the right of technical modifications and improvements. No claims can be considered for alteration or rework of already delivered lift drives.

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# 1 Safety

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



**DANGER**

---

## **DANGER**

Directly threatening hazard leading to death or serious physical injuries.

---



**WARNING**

---

## **WARNING**

Potentially hazardous situation which may lead to death or serious physical injuries.

---



**CAUTION**

---

## **CAUTION**

Potentially hazardous situation which could lead to minor physical injuries. Indicates a hazard which may cause material damage.

---



**ATTENTION**

---

## **ATTENTION**

Potentially hazardous situation where the product or an object in its environment may get damaged.

---

**Hint:** Utilisation instructions and other useful information.

## 1.1 Proper use

Linear actuators MC100/24, MC100/230, MC103/24, MC103/230 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.

Concurrence 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 is decisive for linear actuator technical data and mains power supply requirements.

Any utilisation for tasks other than the aforementioned usage in accordance with specification and operating with mains power supply ratios other than those permitted is not deemed to be utilisation in accordance with specification. The operator bears sole liability for the risk to persons and machine and other assets in the event of utilisation not in accordance with specification.

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 authorization 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 MC100/24, MC100/230, MC103/24, MC103/230.

### 1.5 During operation

Safe operation is only possible if transportation, storage, installation, operation and maintenance are carried out safely and materially and professionally correctly.

#### **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 and other 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.

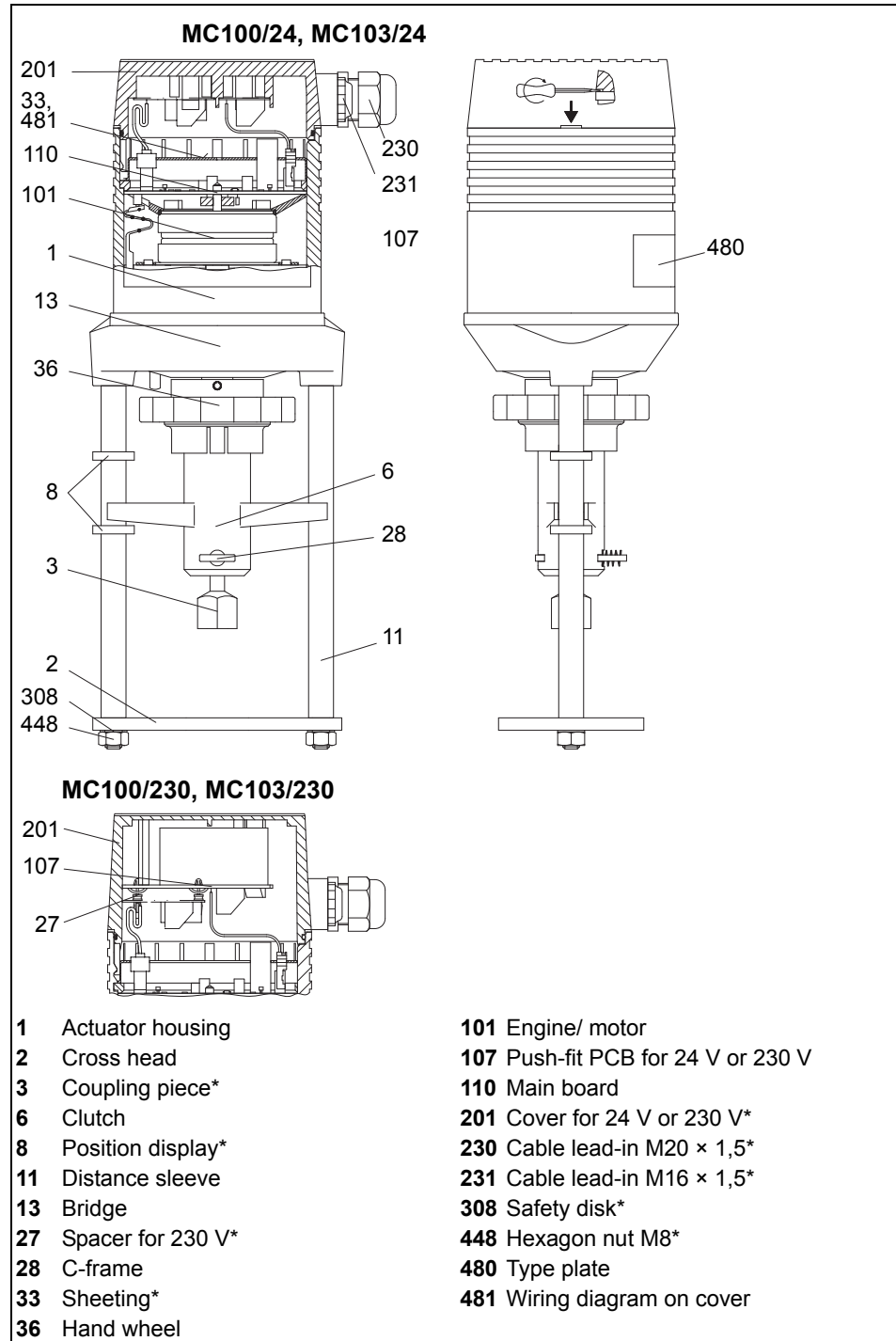
### 1.6 Working environment

Read the data concerning the working environment in the Technical Data.

## 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 spindle nut.

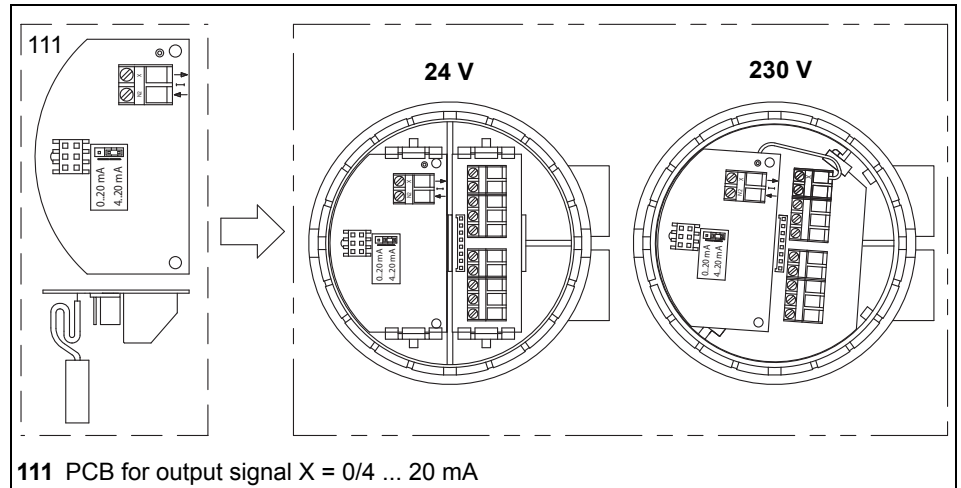
### 2.1 Component parts



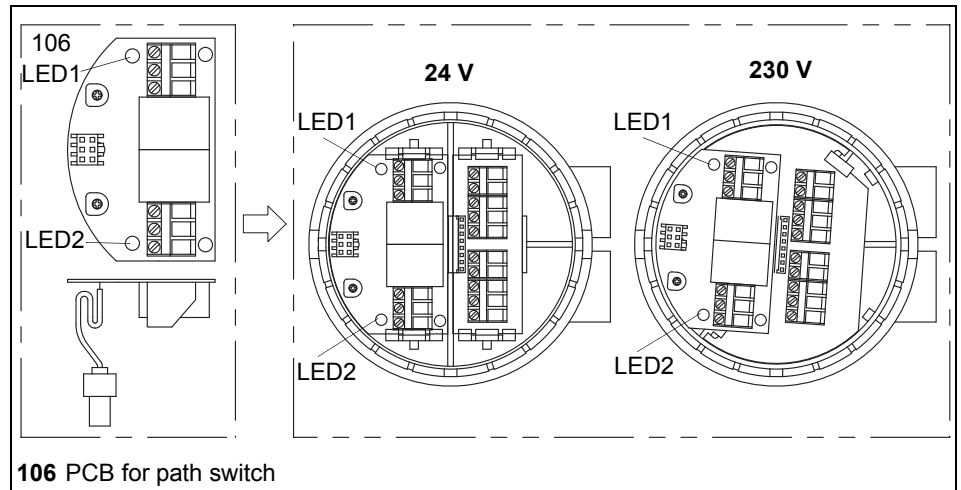
**diagram 1** Component part denominations

\* This component parts is available as a spare part!

## 2.2 Accessories



**diagram 2** PCB for mA output signal in cover



**diagram 3** Position switch PCB in cover

**Hint:** 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 hand wheel.
- In automatic mode stroke is controlled electrically.

### 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 input signals:

- 0 ... 10 V DC / 2 ... 10 V DC
- 0 ... 20 mA / 4 ... 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 ... 10 V DC
- 0 ... 20 mA or 4 ... 20 mA (accessory PCB for output signal **(111)**)

### 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 spindle nut will be extended.
- When the control voltage is applied to terminal 3, the spindle nut 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

⇒ 6.2 LED display on page 30

### 2.4.3 Wire break detection

Wire break detection is only available for continuous mode with an input signal 2 ... 10 V DC and 4 ... 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.

⇒ 6.2 LED display on page 30

#### 2.4.4 Actuating time

The time required for the spindle nut 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.

⇒ 5.3 *Setting the actuating time* on page 23

#### 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 spindle nut.

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

⇒ 5.4 *Setting the hysteresis* on page 24

#### 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.

⇒ 6.1 *Changing between manual and automatic mode* on page 29

#### 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 .

⇒ 5.6 *Setting auto test and auto pause* on page 24

#### 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.

⇒ 5.6 *Setting auto test and auto pause* on page 24

#### 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.

⇒ 5.8 *Setting a potential-free path switch* on page 25

## 2.5 Technical data

Type	MC100/24, MC103/24	MC100/230, MC103/230
<b>Supply voltage:</b>	24 V AC $\pm$ 10% 24 V DC $\pm$ 10%	115 V AC $\pm$ 10% 230 V AC + 6% -10%
<b>Power consumption</b>	6 VA	12 VA
<b>Weight</b>	2.5 kg	2.5 kg
<b>Dimensions</b>	See technical data sheets	
<b>Stroke</b>	max. 20 mm	max. 20 mm
<b>Frequency</b>	50/60 Hz $\pm$ 5%	50/60 Hz $\pm$ 5%
<b>Ambient temperature</b>	0 to +60°C	0 to +60°C
<b>Enclosure protection</b>	IP 54	IP 54
<b>Operating mode</b>	S3-50% ED	S3-50% ED
<b>Actuating time</b>	12, 9, 4, 1.9 s/mm	12, 9, 4, 1.9 s/mm
<b>Actuating force</b>	1.0 kN	1.0 kN
	During 24 V DC the specified actuating force can only be reached with the help of an aligned AC voltage.	

table 1 Technical data

<b>Input signal Y/ Resistance of load</b>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 2 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 0 ... 20 mA / 510 <math>\Omega</math></li> <li>• 4 ... 20 mA / 510 <math>\Omega</math></li> </ul>
<b>Output signal X/ Load rating</b>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / resistance of load <math>\geq</math> 1200 <math>\Omega</math>, <math>I_{max}</math>. 8 mA</li> <li>• 0 ... 20 mA / resistance of load <math>\leq</math> 500 <math>\Omega</math> - with accessory PCB for output signal <b>(111)</b></li> <li>• 4 ... 20 mA / resistance of load <math>\leq</math> 500 <math>\Omega</math> - with accessory PCB for output signal <b>(111)</b></li> </ul>
<b>Response signal R/ load rating</b>	• 24 V DC / minimum impedance $\geq$ 480 $\Omega$ / $I_{max}$ . 35 mA
<b>Cable impedance between B1 and B2</b>	• max. 10 $\Omega$

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).

⇒ 2.1 Component parts on page 6

<b>CE</b>		
<b>MC100/24</b>		
F.-Nr.: 07204142/01/0607		
AC 50 Hz 24 V	6 VA	1,0 kN
Y=0...10 V DC	IP 54	4 s/mm
X=0...10 V DC	S3-50% ED	Stroke 20 mm

diagram 4 Example of type plate

## 3 Transportation & Storage



### 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 to the specified transport and storage temperatures between -20 to +65°C.

## 4 Assembly

Prior to assembling the linear actuator:

- ⇒ 4.1 Checking the scope of delivery on page 12
- ⇒ 4.2 Preparing assembly on page 12

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

- ⇒ 4.3 Mounting the linear actuator on the valve on page 13
- ⇒ 4.4 Assembling/disassembling the cover on page 14
- ⇒ 4.5 Electrical connection on page 15

### 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

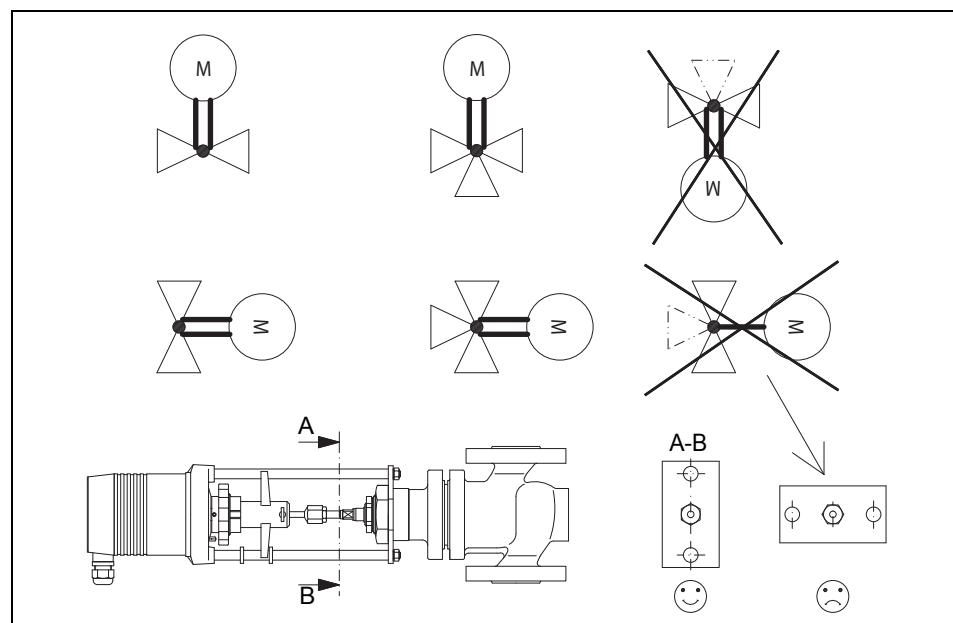


#### A non-attached valve causes damage!

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

- Always operate the linear actuator with a valve attached.

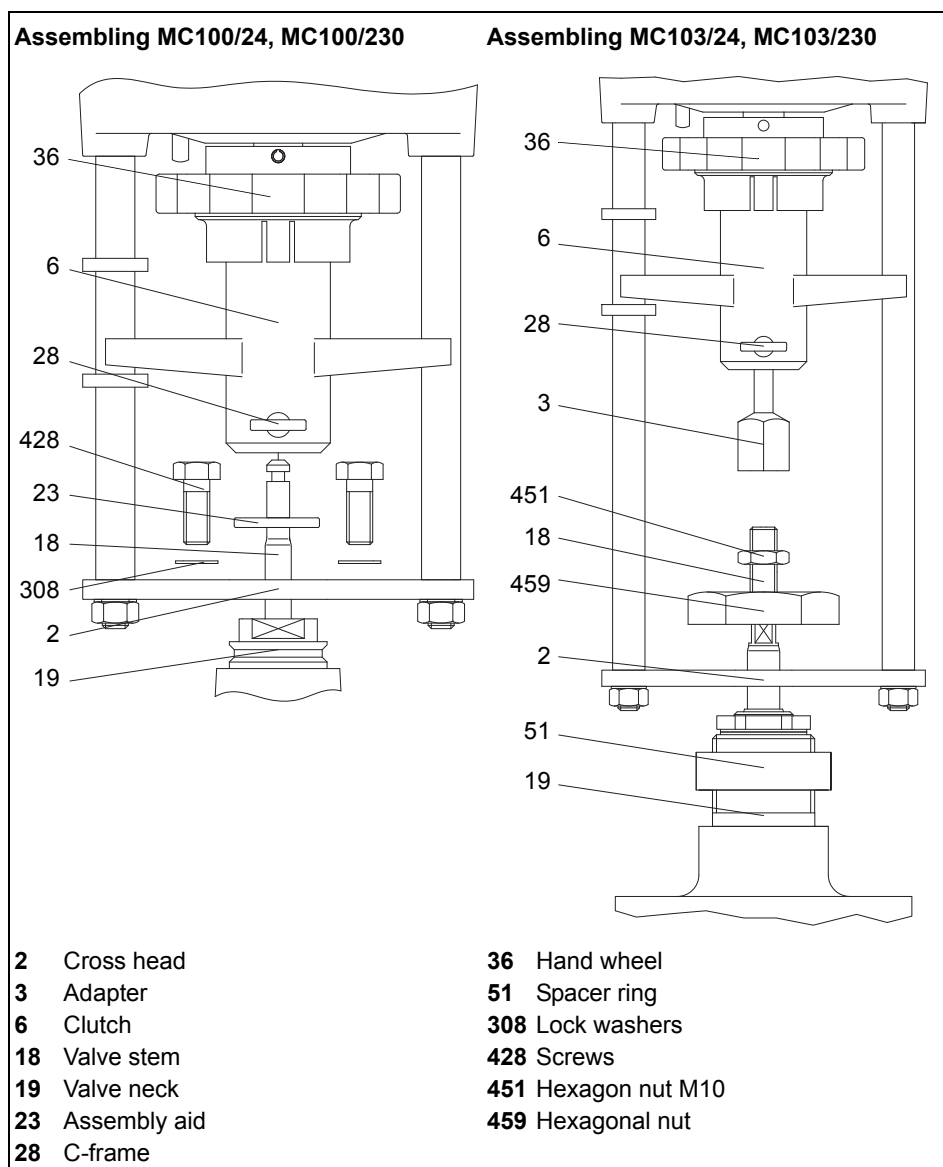
- 1 Allow for about 140 mm space above the cover at the site of installation.
- 2 Check the working environment before assembling and commissioning the linear actuator:
- 3 Ensure that the valve is correctly fitted. For details please see assembly instructions for valve.
- 4 Determine the assembly position of the linear actuator. Do not arrange linear actuators in a hanging position.



**diagram 5** 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 will have to mount the linear actuator on the valve.



**diagram 6** Mounting the linear actuator on the valve

#### ■ How to assemble linear actuator type MC100:

- 1** Place actuator with crossbeam (**2**) on valve neck (**19**).  
⇒ *diagram 6* on page 13
- 2** Insert the C-frame (**28**) and, using a mounting aid, pull the valve stem upwards (**18**) (**23**) until the valve stem (**18**) locks inside the clutch (**6**).
- 3** Fix the crossbeam (**2**) of the actuator with the help of screws (**428**) spanner width 13 and lock washers (**308**) on the valve neck (**19**).

■ **How to assemble linear actuator type MC103:**

- 1 Insert the C-frame (28).  
⇒ *diagram 6* on page 13
- 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.

#### 4.4 Assembling/disassembling the cover

The cover contains the terminals for electric connection.



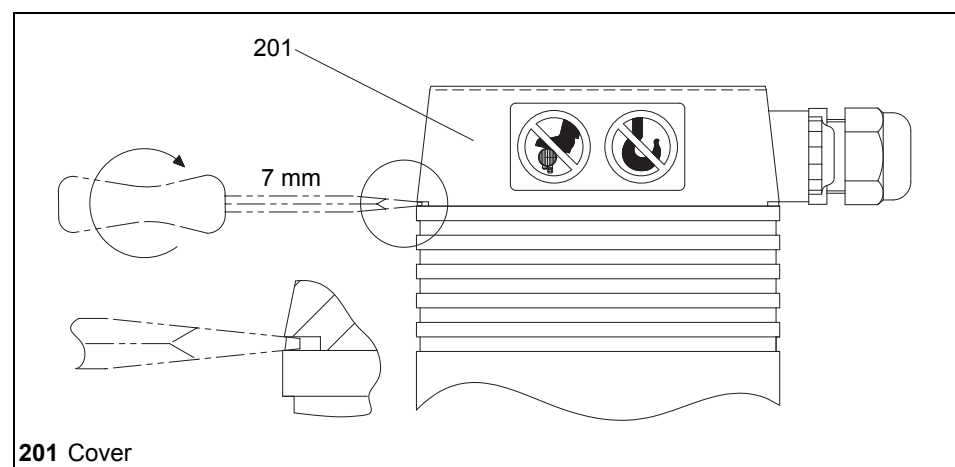
**Risk of injury from electric shock by live parts!**

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).



**diagram 7** Removing the cover



### **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 and the **(110)** 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.

**Hint:** 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



### **Danger of life caused by incompetent 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.
- ⇒ 1.3 *Personnel* on page 5



### **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 stabilizer.

⇒ 2.5 *Technical data* on page 10

### ■ How to establish electrical connection

- 1 Remove the cover (201).  
⇒ *How to remove the cover* on page 14
- 2 Run the cable through the screw joint in the cover to the terminal.
- 3 Connect the power supply according to the wiring diagram.  
⇒ *diagram 8* on page 16

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



**ATTENTION**

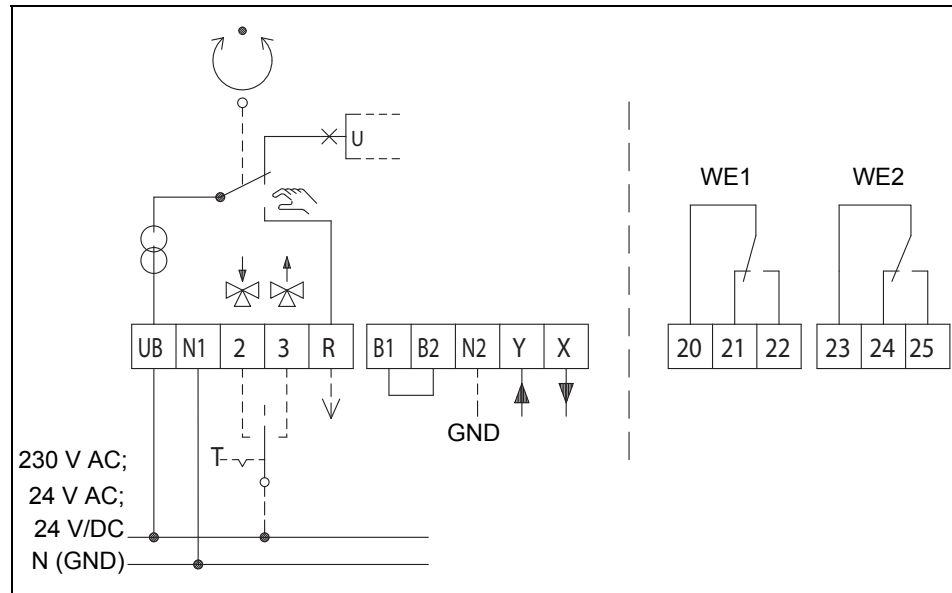
### Malfunctions caused by incorrect zero potential!

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.

⇒ *table 3* on page 17

- 4 Tighten the screw joints.



**diagram 8** Circuit diagram

Terminal	Description
<b>UB, N1</b>	Supply voltage:
<b>2</b>	Control voltage for downward movement during three-point mode
<b>3</b>	Control voltage for upward movement during three-point mode
<b>R</b>	Response signal during "manual" mode <ul style="list-style-type: none"> <li>• R= 24 V DC max. 35 mA</li> </ul>
<b>B1, B2</b>	Binary input / frost protection function
<b>N2</b>	Zero potential of signals X, Y and R <ul style="list-style-type: none"> <li>• 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.</li> <li>• If you run the actuator in continuous mode at 230 V you will have to connect N2.</li> <li>• 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.</li> </ul>
<b>Y</b>	Input signal continuous mode
<b>X</b>	Output signal continuous mode
<b>20, 21, 22</b>	Terminals path switch unit PS1
<b>23, 24, 25</b>	Terminals path switch unit PS2

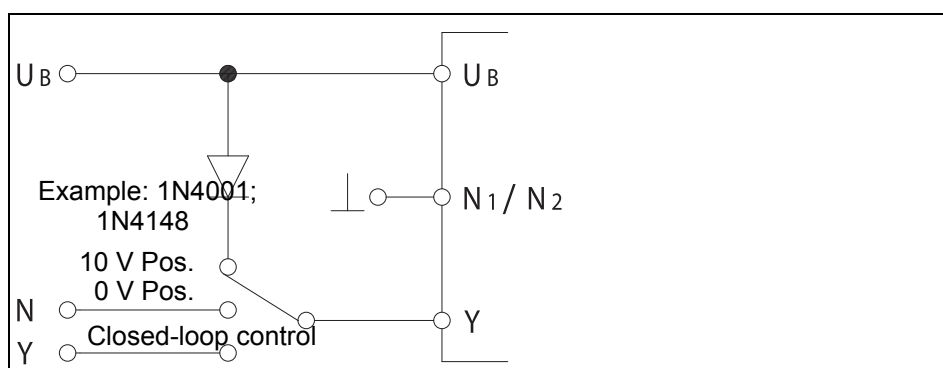
**table 3** Key to wiring diagram

#### 4.5.1 Controller independent circuit

When working with 24 V supply voltage and 0 ... 10 V DC / 2 ... 10 V DC 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 V AC via a diode and a three-step toggle switch to terminal Y.



**diagram 9** 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 ... 10 V DC.

⇒ 5.1 *Operating parameters and encoding switch settings* on page 23  
⇒ 5.7 *Setting the limit position* on page 25

## 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)**

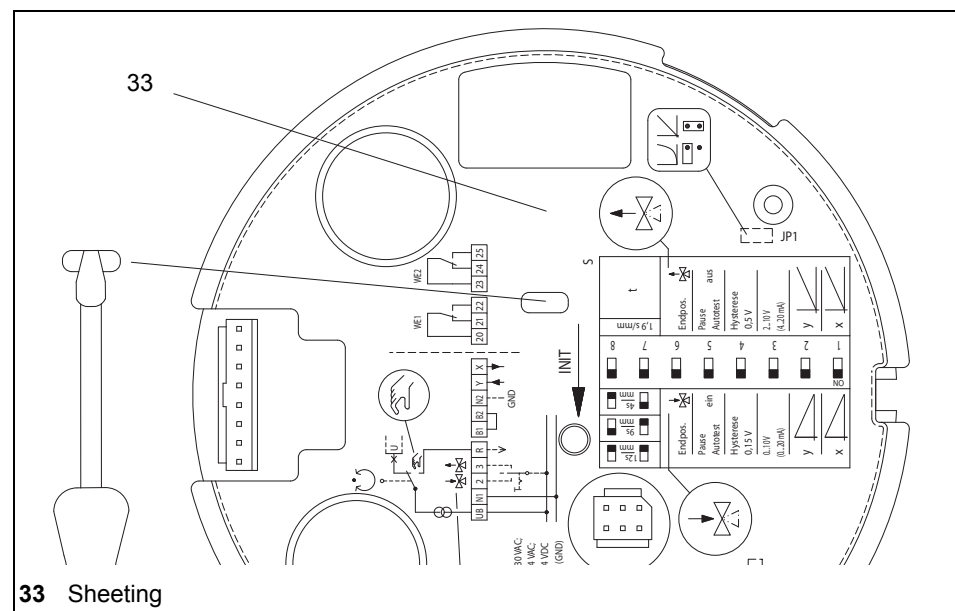


### Risk of injury from electric shock by live parts!

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 in 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 it off.



**33** Sheeting

**diagram 10** 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)**.



## 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 ... 20 mA **(111)**

**Hint:** Optional operation with mA output signal or path switch possible

⇒ \* *This component parts is available as a spare part!* on page 6

### 4.6.1 Fitting a PCB for a path switch

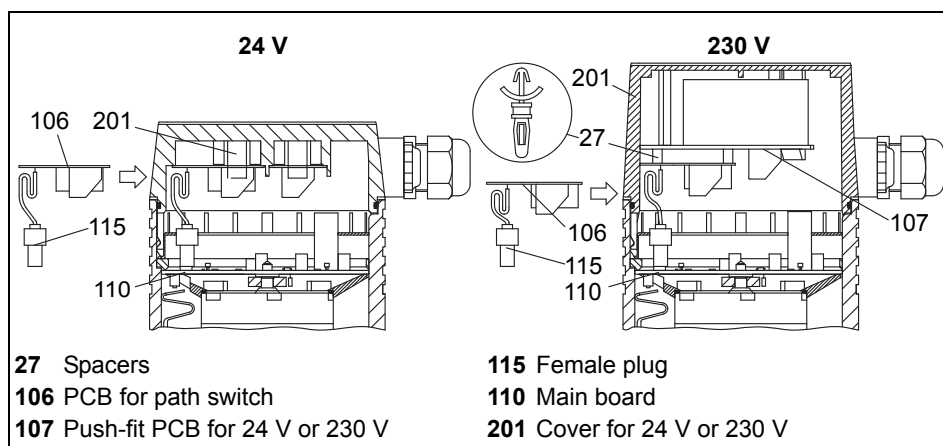


#### Risk of injury from electric shock by live parts!

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

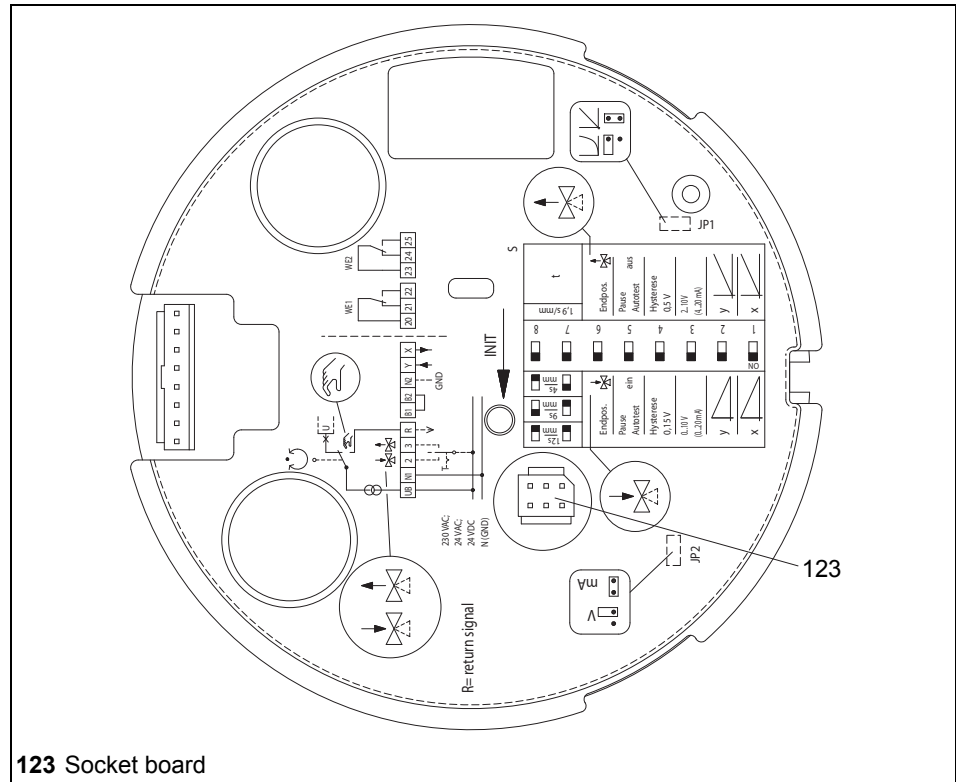
- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system.
- Secure against unauthorised restarting.

- 1 Open the cover **(201)** of the linear actuator.  
⇒ 4.4 *Assembling/disassembling the cover* on page 14
- 2 **24 V:** Clipping the path switch PCB **(106)** to the safety catches on the cover **(201)**  
*diagram 11* on page 19.
- 3 **230 V:** Push the path switch PCB **(106)** onto the three spacers of **(27)** the push-fit PCB **(107)**.



**diagram 11** 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.



**diagram 12** Socket board for position switch PCB on main PCB

- 5 Set the position switches.  
⇒ 5.8 *Setting a potential-free path switch* on page 25

#### 4.6.2 Fitting the PCB for the mA output signal

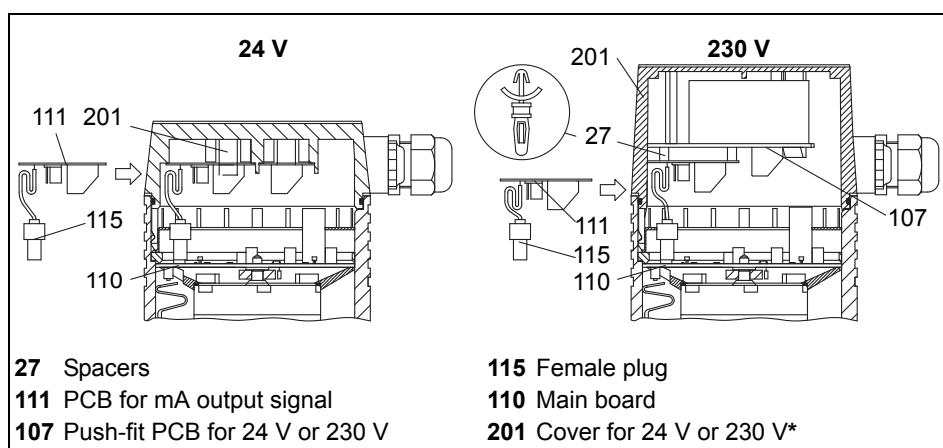


##### **Risk of injury from electric shock by live parts!**

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

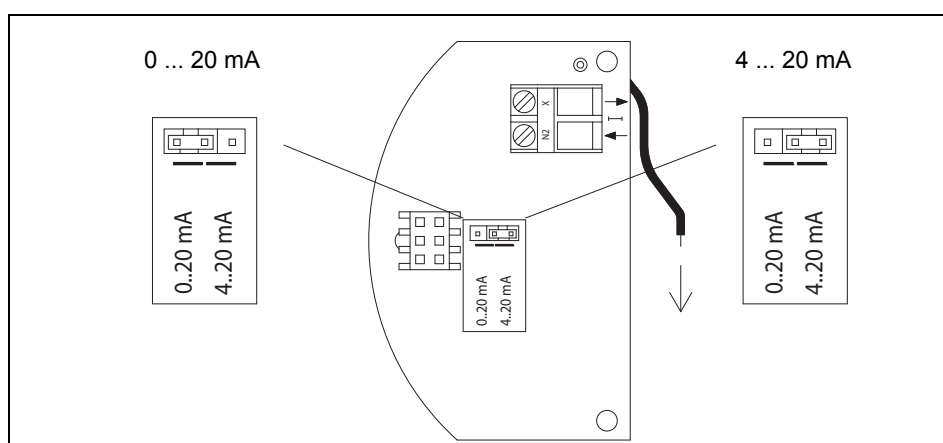
- Prior to commencing any work, ensure that the actuator is safely disconnected from the power supply system.
- Secure against unauthorised restarting.

- 1 Open the cover (**201**) of the linear actuator.  
⇒ 4.4 *Assembling/disassembling the cover* on page 14
- 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**).  
⇒ *diagram 13* on page 21

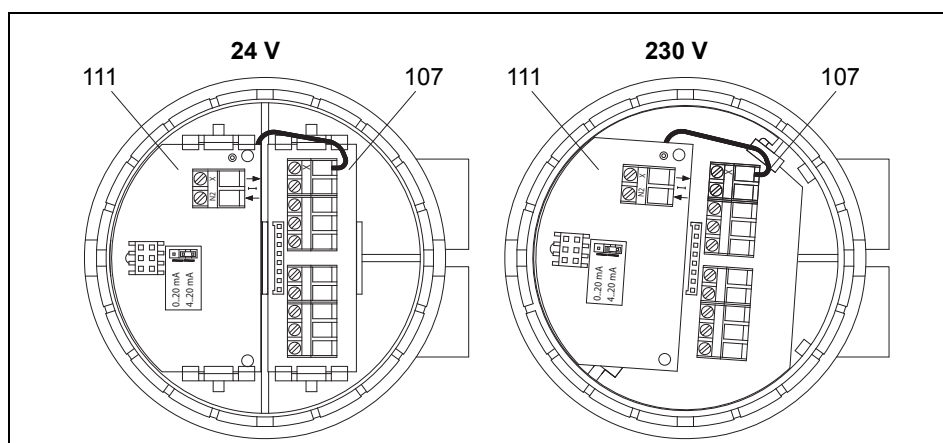


**diagram 13** Fitting a PCB for the mA output signal

- 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 ... 20 mA
  - Jumper left: 0 ... 20 mA



**diagram 14** Setting the PCB for the mA output signal



**diagram 15** Connecting the PCB for the mA output signal to the push-fit PCB

## 5 Commissioning



### Risk of injury from electric shock by live parts!

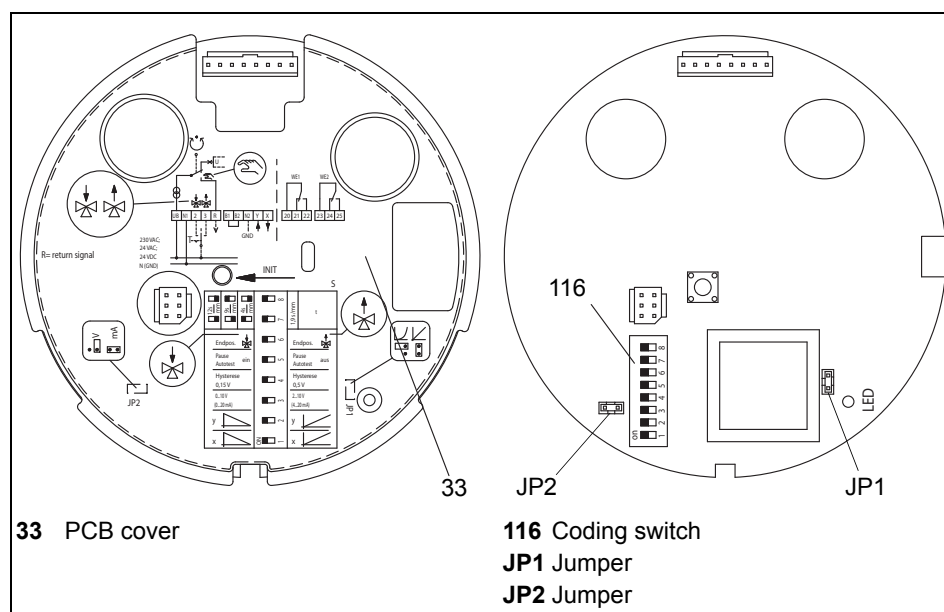
When the power supply is on there is a danger of electric shock due to live parts.

- 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**).

⇒ 4.4 Assembling/disassembling the cover on page 14

⇒ 4.5.2 Removing the PCB cover on page 18



**diagram 16** PCB cover, encoding switch and jumper

## 5.1 Operating parameters and encoding switch settings

Before starting to operate the linear actuator you will have to set the operating parameters with the help of the encoding switches and jumpers.

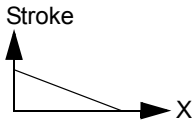
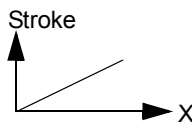
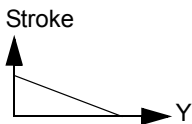
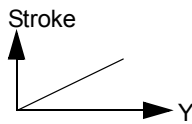
Switch / jumper	on	off
<b>S1</b>	X-characteristic line 	X-characteristic line 
<b>S2</b>	Y-characteristic line 	Y-characteristic line 
<b>S3</b>	Input signal (Y) 0 ... 10 V DC or 0 ... 20 mA	Input signal (Y) 2 ... 10 V DC or 4 ... 20 mA
<b>S4</b>	Hysteresis 0.15 V	Hysteresis 0.5 V
<b>S5</b>	Auto test and auto pause on	Auto test and auto pause off
<b>S6</b>	Limit position actuator spindle extended	Limit position actuator spindle retracted
<b>S7, S8</b>	S7 and S8 are used to set the actuating time (1.9...12 s/mm)	
<b>JP1</b>	Characteristic line linear	Characteristic line is exponential (1/50)
<b>JP2</b>	Input signal (Y) in mA	Input signal (Y) in V

table 4 Encoding switch and jumper settings

## 5.2 Setting the input signal

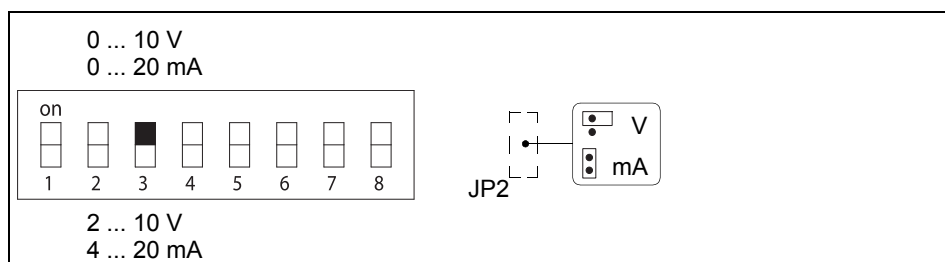


diagram 17 Setting the input signal

⇒ Additional information: *Input signal (Y)* on page 8

## 5.3 Setting the actuating time

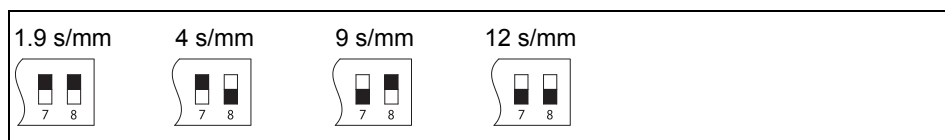


diagram 18 Set actuating time

⇒ For further information see 2.4.4 *Actuating time* on page 9

### 5.4 Setting the hysteresis

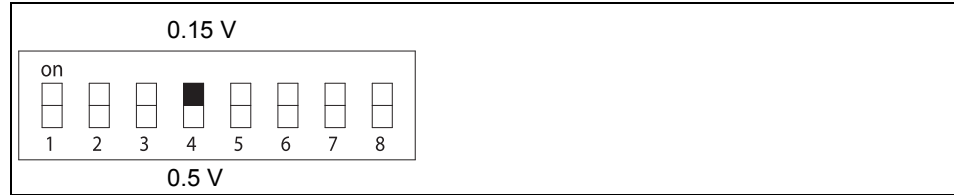


diagram 19 Set hysteresis

⇒ Additional information: 2.4.5 Hysteresis on page 9

### 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 spindle nut
- S6 OFF: Limit position with retracted spindle nut

The limit position is approached in the following situations:

- Due to wire break detection by the Y signal (2 ... 10 V DC or 4 ... 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.
  - ⇒ 5.10 Commissioning on page 28
  - ⇒ 5.9 Initialising the path measuring system on page 27



ATTENTION

### 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**).
  - ⇒ 4.4 Assembling/disassembling the cover on page 14
 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.

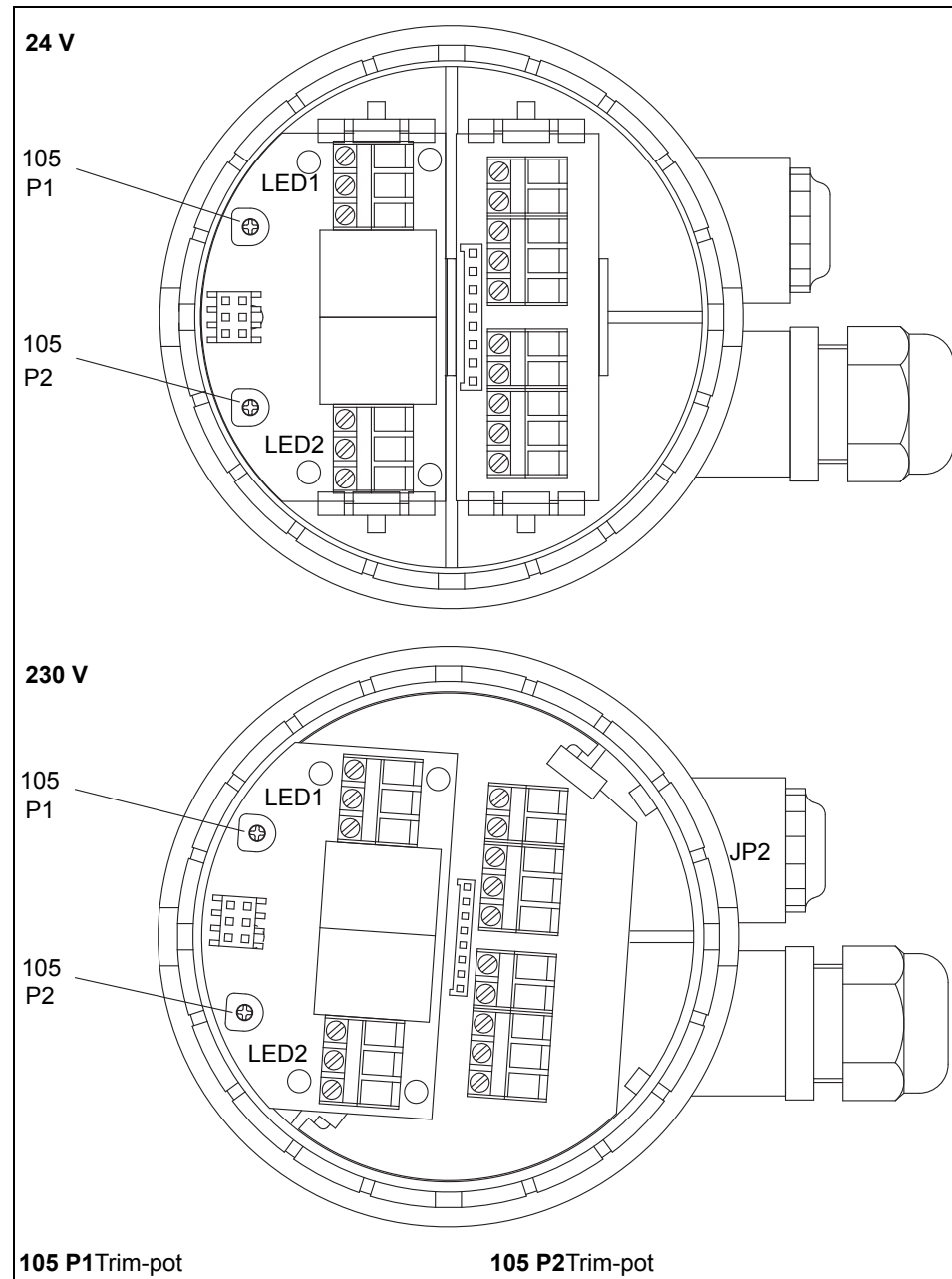


diagram 20 Position switch PCB in cover

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

<b>Nominal load</b>	8 A, 250 V AC 8 A, 30 V DC
<b>Switch voltage</b>	max. 400 V AC max. 125 V DC

table 6 Contact load of path switch

- 6 Disconnect the actuator from the supply and connect the path switch contacts.
- 7 Close the cover (**201**) of the linear actuator  
⇒ How to attach the cover on page 15



## 5.9 Initialising the path measuring system



### 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

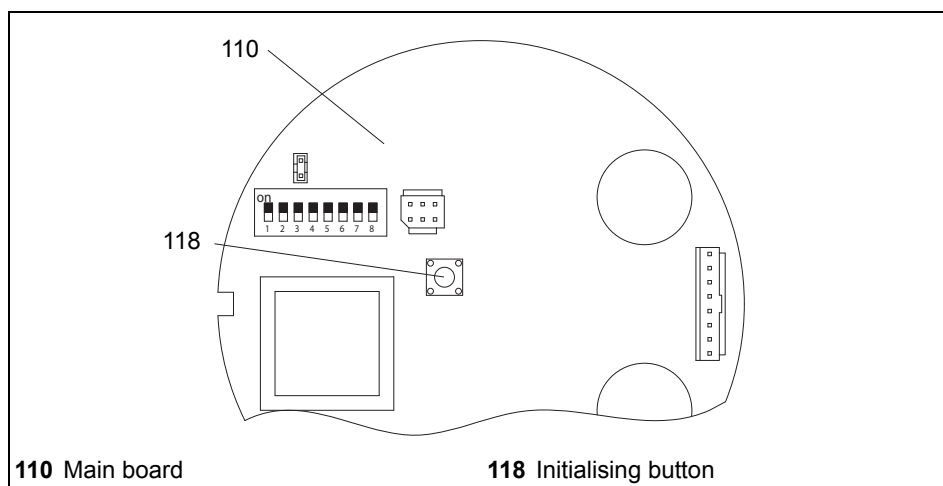


### Risk of injury from electric shock by live parts!

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)**.  
⇒ 4.4 Assembling/disassembling the cover on page 14
- 2 Ensure that supply voltage is applied.
- 3 Press the initialising button **(118)** and keep it pressed for at least 1 second.



**diagram 21** 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.  
⇒ *diagram 8* on page 16

### 5.10 Commissioning

- 1 Check whether all fitting and assembly work has been competently finished.  
⇒ *4 Assembly* on page 12
- 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.  
⇒ *4.4 Assembling/disassembling the cover* on page 14
- 4 Ensure that the linear actuator is set to automatic mode.  
⇒ *6.1 Changing between manual and automatic mode* on page 29
- 5 Ensure that the operating parameters are set correctly.  
⇒ *5.1 Operating parameters and encoding switch settings* on page 23
- 6 Ensure that the path measuring system is initialised.  
⇒ *5.9 Initialising the path measuring system* on page 27
- 7 Apply supply voltage. The linear actuator will now move to the reference point. The linear actuator is ready for operation.

## 6 Operation

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

⇒ 5 Commissioning on page 22

⇒ 5.9 Initialising the path measuring system on page 27

### 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 spindle nut 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.

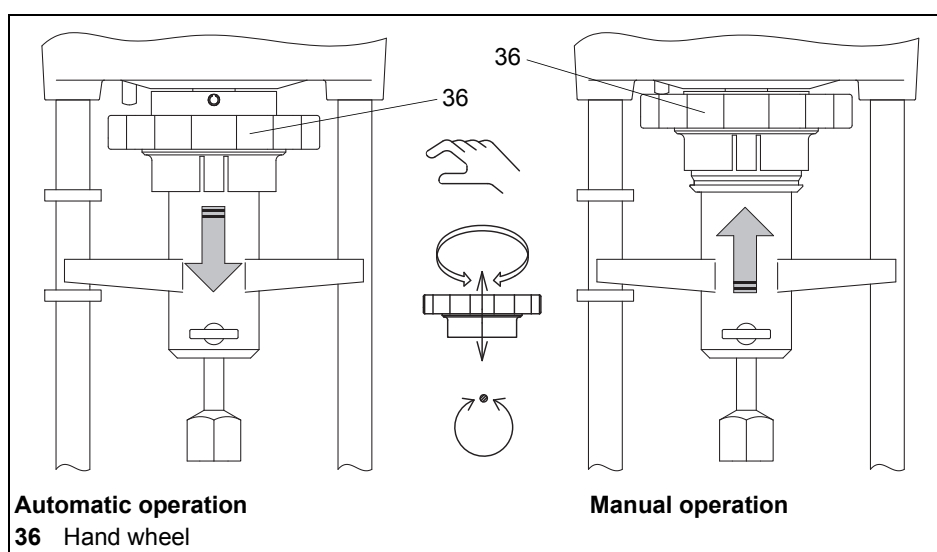


diagram 22 Selecting automatic mode

#### ■ How to change-over in manual mode

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



#### **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 hand wheel when you realise that the required effort increases noticeably!
- Never use force !

- 2 Use the hand wheel to turn the spindle nut to the desired position. Turn the hand wheel until the preset potentiometer increases. Do not use force!

#### ■ How to change-over in automatic mode

- 1 Push the hand wheel (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.

⇒ 10.2 Check list for breakdown on page 32










LED	Operating status / error
 Duration	<b>Normal operation, ready for operation</b> The LED is permanently lit, actuator waiting for traverse command.
 ⊗  ⊗ 0,5s 0,5s 0,5s 0,5s	<b>Standard Operation</b> Actuator carries out traverse command.
 ⊗  ⊗ 0,2s 1,5s 0,2s 1,5s Short – long rhythm	<b>Wire break detection</b> Input signal has dropped below 1 V or below 2 mA in operating modes 2 ... 10 V DC or 4 ... 20 . ⇒ 2.4.3 Wire break detection on page 8
 ⊗  ⊗ 1,5s 1,5s 1,5s 1,5s Long – long rhythm	<b>Blockage detection (continuous mode only)</b> The linear actuator is mechanically blocked. ⇒ 2.4.2 Blockage detection on page 8
 ⊗  ⊗ 1,5s 0,2s 1,5s 0,2s Long – long rhythm	<b>Continuous signal on terminal 2 and 3</b> 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 little maintenance. You do not have to carry out continuous or periodical maintenance.

## 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 data of linear actuators as well as the requirements for the public power supply.



### 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.

⇒ 2.1 Component parts on page 6

⇒ \* This component parts is available as a spare part! on page 6

## 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.

⇒ 5.9 *Initialising the path measuring system* on page 27

### 10.1 How to remedy faults

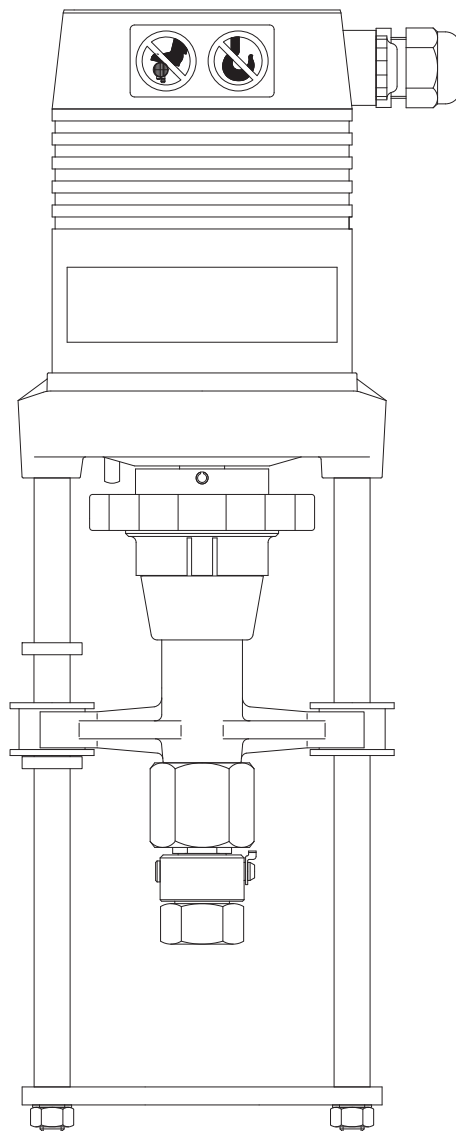
If the linear actuator does not work properly follow the sequence of operations described below in order to remedy the fault:

- 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.  
⇒ 10.2 *Check list for breakdown* on page 32
- 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.	Hand wheel (36) is in position manual mode	<input type="checkbox"/> Switch hand wheel to position automatic mode.
	Power cut	<input type="checkbox"/> Determine cause and remedy.
	Fuse defective (in control cabinet)	<input type="checkbox"/> Determine cause and remedy, replace fuse.
	Linear actuator incorrectly connected	<input type="checkbox"/> Set connection correctly according to wiring diagram (on cover).
	Short circuit due to humidity	<input type="checkbox"/> 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	<input type="checkbox"/> Correct setting for connection
	Motor has winding damage (burnt-out) <ul style="list-style-type: none"> <li>• e.g. voltage too high</li> <li>• Electronic system defective</li> </ul>	<input type="checkbox"/> 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.	<input type="checkbox"/> Measure the current data; if required, recalculate and replace connecting cables!
	Public power supply fluctuations greater than admissible tolerance ⇒ 2.5 <i>Technical data</i> on page 10	<input type="checkbox"/> Improve public power supply conditions
3. Linear actuator pauses intermittently or initialises frequently	Slack contact in feeder line	<input type="checkbox"/> Check and tighten connections (terminal strips)
4. Linear actuator does not move to limit position. Valve does not open/close.	Valve is stuck	<input type="checkbox"/> Provide smooth-running valve
	Excessive system pressure	<input type="checkbox"/> 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: <ul style="list-style-type: none"> <li>• Interfering signals</li> <li>• Signal variations</li> </ul>	<input type="checkbox"/> Check input signal Y on linear actuator, remove cause of fault
	Main PCB defective	<input type="checkbox"/> Replace main PCB or disassemble linear actuator and send it in for repair
6. LED flashes in long / long rhythm	Blockage detection was triggered	<input type="checkbox"/> Press INIT and observe actuator during initialisation.
		<input type="checkbox"/> Check valve for smooth-running along entire traverse range
7. LED flashes in short / long rhythm	Wire break was detected	<input type="checkbox"/> Measure desired value voltage and current on linear actuator
8. LED flashes in long / short rhythm	Relay contact adhesive	<input type="checkbox"/> Check controller

**table 8** Check list breakdown



# Operating Manual

## Linear actuators

MC160/24 • MC160/230 • MC161/24 • MC161/230  
MC163/24 • MC163/230

## General information

Amendment	Version	Date	Modifications
	1.0	April 2003	Initial preparation
	2.0	December 2007	Complete revision and amendment
	2.1	March 2011	Revision

**Copyright** The copyright for this operating manual as well as all rights in case of patent awarding or registration of registered design remains with the manufacturer!

**Subject to alteration** The regulations, directives, standards etc. are compliant with the current state of information at the time of development and are not subject to modification service. They must be applied by the operator at his own responsibility in their latest valid version.

Concerning all data, information, and illustrations in this manual we reserve the right of technical modifications and improvements. No claims can be considered for alteration or rework of already delivered lift drives.

**Manufacturer** **HORA**  
 Geschäftsbereich Flow Control  
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# 1 Safety

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



**DANGER**

## **DANGER**

Directly threatening hazard leading to death or serious physical injuries.



**WARNING**

## **WARNING**

Potentially hazardous situation which may lead to death or serious physical injuries.



**CAUTION**

## **CAUTION**

Potentially hazardous situation which could lead to minor physical injuries. Indicates a hazard which may cause material damage.



**ATTENTION**

## **ATTENTION**

Potentially hazardous situation where the product or an object in its environment may get damaged.

**Hint:** Utilisation instructions and other useful information.

## 1.1 Proper use

Linear actuators MC160/24, MC160/230, MC161/24, MC161/230, MC163/24, MC163/230 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.

Concurrence 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 is decisive for linear actuator technical data and mains power supply requirements.

Any utilisation for tasks other than the aforementioned usage in accordance with specification and operating with mains power supply ratios other than those permitted is not deemed to be utilisation in accordance with specification. The operator bears sole liability for the risk to persons and machine and other assets in the event of utilisation not in accordance with specification.

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 authorization 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 MC160/24, MC160/230, MC161/24, MC161/230, MC163/24, MC163/230.

### 1.5 During operation

Safe operation is only possible if transportation, storage, installation, operation and maintenance are carried out safely and materially and professionally correctly.

#### **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 and other 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.

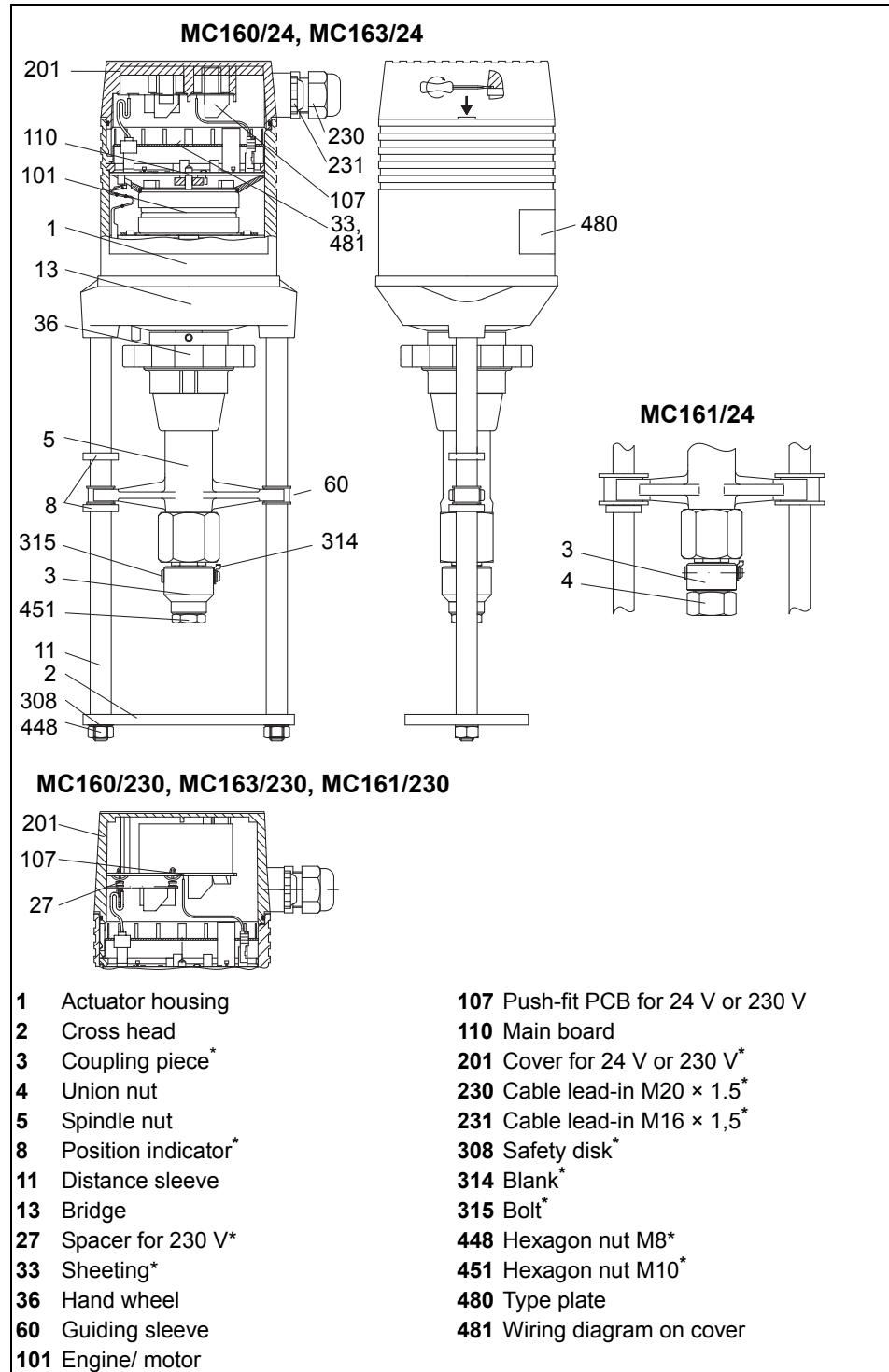
### 1.6 Working environment

Read the data concerning the working environment in the Technical Data.

## 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 spindle nut.

### 2.1 Component parts



**diagram 1** Component part denominations

\* This component part is available as a spare part!

## 2.2 Accessories

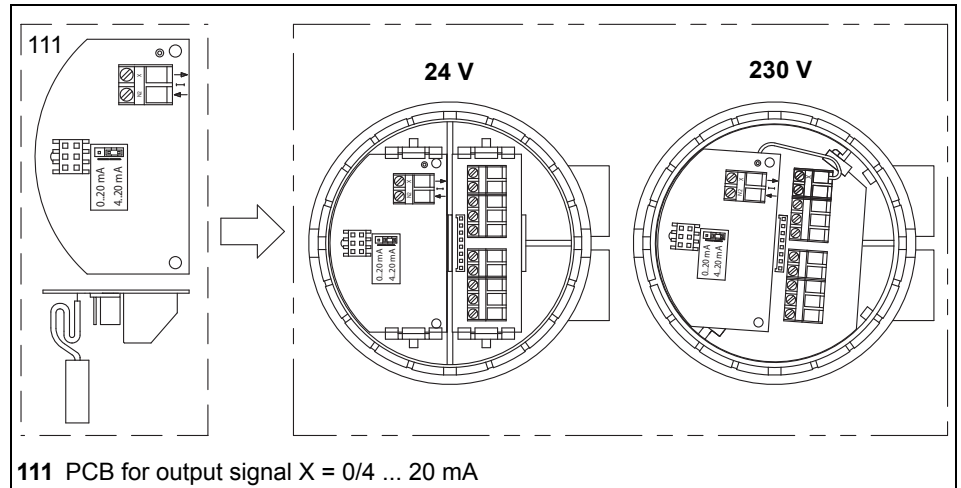


diagram 2 PCB for mA output signal in cover

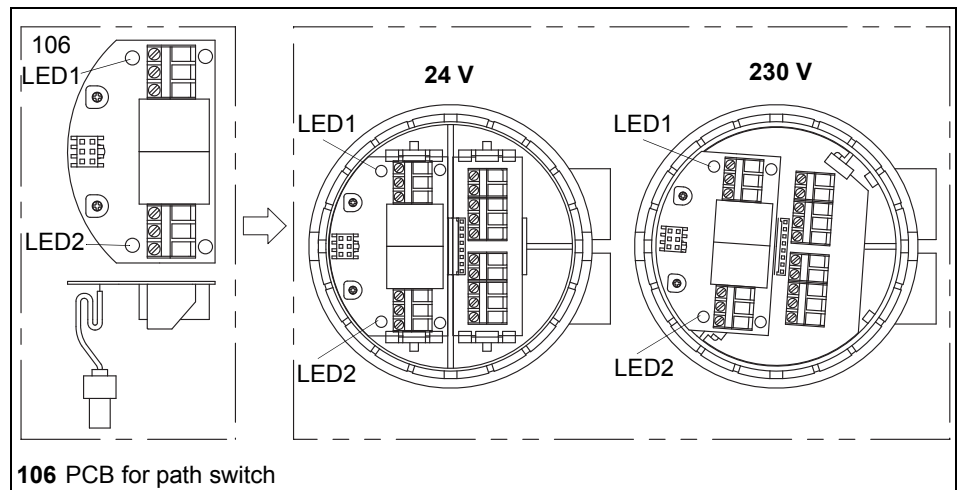


diagram 3 Position switch PCB in cover

**Hint:** 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 hand wheel.
- In automatic mode stroke is controlled electrically.

### 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 input signals:

- 0 ... 10 V DC / 2 ... 10 V DC
- 0 ... 20 mA / 4 ... 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 ... 10 V DC
- 0 ... 20 mA or 4 ... 20 mA (accessory PCB for output signal **(111)**)

### 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 spindle nut will be extended.
- When the control voltage is applied to terminal 3, the spindle nut 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

⇒ 6.2 LED display on page 32

### 2.4.3 Wire break detection

Wire break detection is only available for continuous mode with an input signal 2 ... 10 V DC and 4 ... 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.

⇒ 6.2 LED display on page 32

#### 2.4.4 Actuating time

The time required for the spindle nut 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.

⇒ 5.3 *Setting the actuating time* on page 25

#### 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 spindle nut.

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

⇒ 5.4 *Setting the hysteresis* on page 26

#### 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.

⇒ 6.1 *Changing between manual and automatic mode* on page 31

#### 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.

⇒ 5.6 *Setting auto test and auto pause* on page 26

#### 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.

⇒ 5.6 *Setting auto test and auto pause* on page 26

#### 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.

⇒ 5.8 *Setting a potential-free path switch* on page 27

## 2.5 Technical data

Type	MC160/24, MC161/24, MC163/24	MC160/230, MC161/230, MC163/230
<b>Supply voltage:</b>	24 V AC $\pm$ 10% 24 V DC $\pm$ 10%	115 V AC $\pm$ 10% 230 V AC + 6% -10%
<b>Power consumption</b>	6 VA	12 VA
<b>Weight</b>	MC160 / MC161 = 3.2 kg MC163 = 4.0 kg	MC160 / MC161 = 3.2 kg MC163 = 4.0 kg
<b>Dimensions</b>	See technical data sheets	
<b>Stroke</b>	MC160 = max. 30 mm MC161 = max. 20 mm MC163 = max. 30 mm	MC160 = max. 30 mm MC161 = max. 20 mm MC163 = max. 30 mm
<b>Frequency</b>	50/60 Hz $\pm$ 5%	50/60 Hz $\pm$ 5%
<b>Ambient temperature</b>	0 to +60°C	0 to +60°C
<b>Enclosure protection</b>	IP 54	IP 54
<b>Operating mode</b>	S3-50% ED	S3-50% ED
<b>Actuating time</b>	4 or 6 s/mm	4 or 6 s/mm
<b>Actuating force</b>	1.6 kN / 1 kN  During 24 V DC the specified actuating force can only be reached with the help of an aligned AC voltage.	1.6 kN / 1 kN

table 1 Technical data

<b>Input signal Y/ Resistance of load</b>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 2 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 0 ... 20 mA / 510 <math>\Omega</math></li> <li>• 4 ... 20 mA / 510 <math>\Omega</math></li> </ul>
<b>Output signal X/ Load rating</b>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / resistance of load <math>\geq</math> 1200 <math>\Omega</math>, <math>I_{max.}</math> 8 mA</li> <li>• 0 ... 20 mA / resistance of load <math>\leq</math> 500 <math>\Omega</math> - with accessory PCB for output signal (111)</li> <li>• 4 ... 20 mA / resistance of load <math>\leq</math> 500 <math>\Omega</math> - with accessory PCB for output signal (111)</li> </ul>
<b>Response signal R/ load rating</b>	<ul style="list-style-type: none"> <li>• 24 V DC / minimum impedance <math>\geq</math> 480 <math>\Omega</math> / <math>I_{max.}</math> 35 mA</li> </ul>
<b>Cable impedance between B1 and B2</b>	<ul style="list-style-type: none"> <li>• max. 10 <math>\Omega</math></li> </ul>

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).

⇒ 2.1 Component parts on page 6

<b>CE</b>		
<b>MC160/24</b>		
F.-Nr.: 07204142/01/0607		
AC 50 Hz 24 V	6 VA	1,6 kN
Y=0...10 V DC	IP 54	4 s/mm
X=0...10 V DC	S3-50% ED	Stroke 14 mm

diagram 4 Example of type plate

## 3 Transportation & Storage



### 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 to the specified transport and storage temperatures between -20 to +65°C.

## 4 Assembly

Prior to assembling the linear actuator:

- ⇒ 4.1 Checking the scope of delivery on page 12
- ⇒ 4.2 Preparing assembly on page 12

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

- ⇒ 4.3 Mounting the linear actuator on the valve on page 13
- ⇒ 4.4 Assembling/disassembling the cover on page 16
- ⇒ 4.5 Electrical connection on page 17

### 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

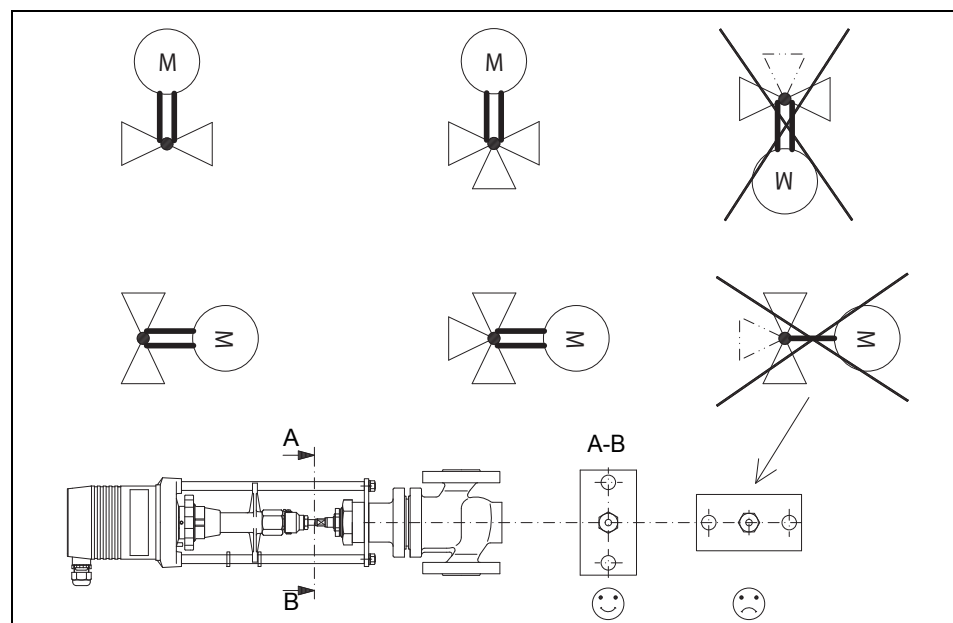


#### A non-attached valve causes damage!

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

- Always operate the linear actuator with a valve attached.

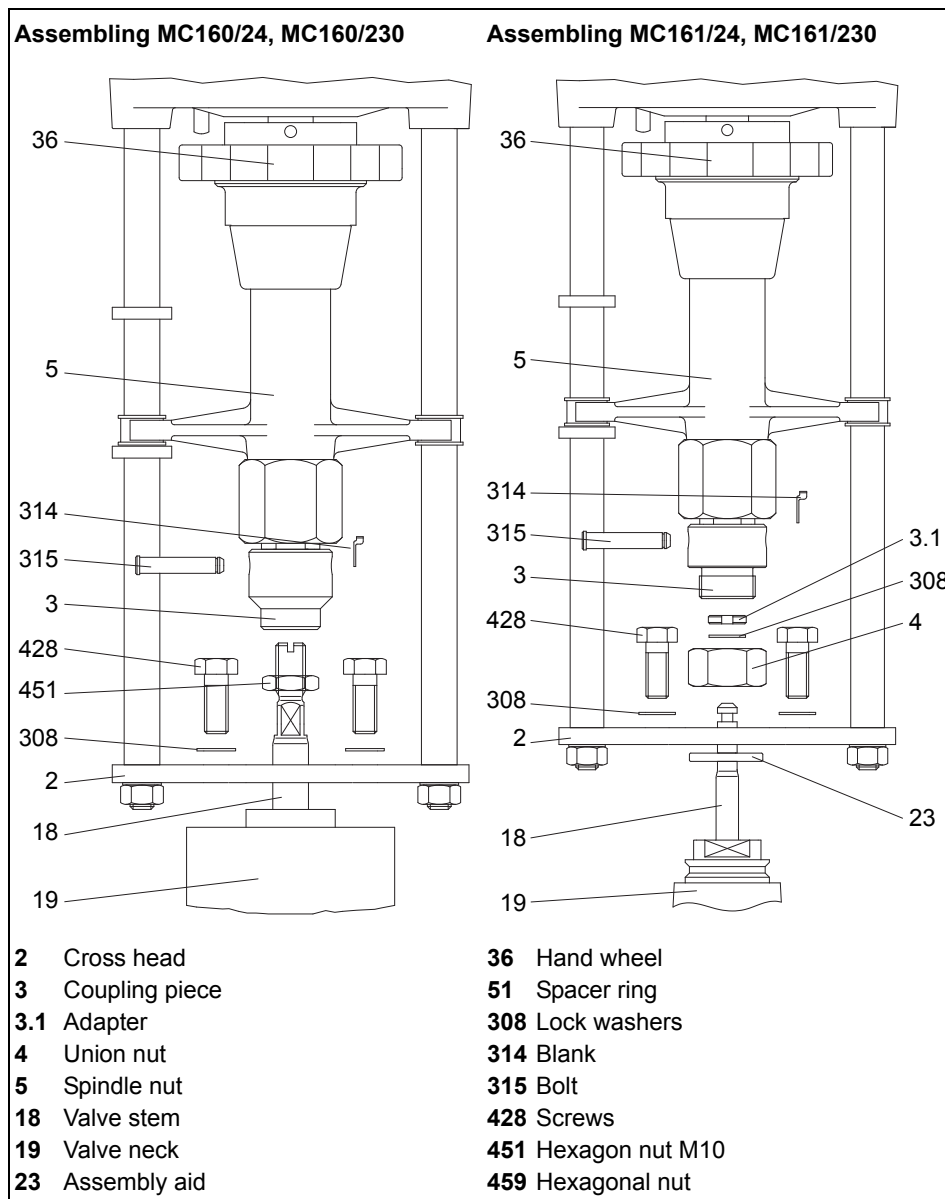
- 1 Allow for about 140 mm space above the cover at the site of installation.
- 2 Check the working environment before assembling and commissioning the linear actuator:
- 3 Ensure that the valve is correctly fitted. For details please see assembly instructions for valve.
- 4 Determine the assembly position of the linear actuator. Do not arrange linear actuators in a hanging position.



**diagram 5** 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 will have to mount the linear actuator on the valve.



**diagram 6** Mounting the linear actuator on the valve

#### ■ How to assemble linear actuator type MC160

- 1** Pull off the blank (**314**).  
⇒ *diagram 6* on page 13
- 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** Fix the valve stem (**18**) by the hexagon locknut (**451**), in order to prevent skewing.
- 6** Place actuator with crossbeam (**2**) on valve neck (**19**).
- 7** Attach the crossbar (**2**) of the actuator with the help of screws(**428**) spanner width 13 and blanks (**308**) to the valve neck (**19**).

8 Adjust the height of the spindle nut (5) with the help of the hand wheel (36) so that you can remount the bolt (315).

9 Fit on the blank (314)!

■ **How to assemble linear actuator type MC161:**

1 Pull off the blank (314).

⇒ *diagram 6* on page 13

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

3 Remove the mounting aid (23).

4 Place the hexagon nut (4) and the blank (308) over the valve stem.

5 Push the adapter (3.1) into the groove of the valve stem (18).

6 Screw the hexagon nut (4) spanner width 24 onto the clutch piece(3).

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

8 Fix the crossbeam (2) of the actuator with the help of screws(428) spanner width 13 and lock washers (308) on the valve neck (19).

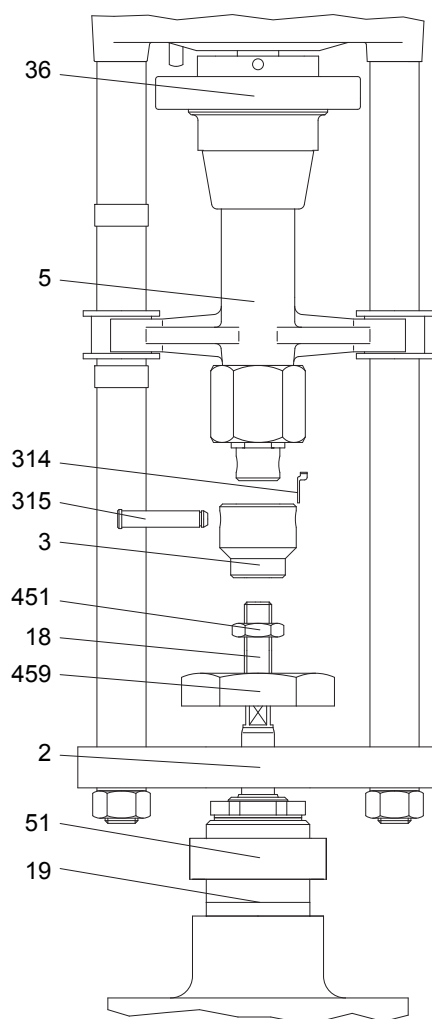
9 Adjust the height of the spindle nut (5) with the help of the hand wheel (36) so that you can remount the bolt (315).

10 Fit on the blank (314)!

■ **How to disassemble the linear actuator**

1 Follow the sequence of operation in reverse order.

## Assembling MC163/24, MC163/230



2	Cross head	51	Spacer ring
3	Coupling piece	314	Blank
5	Spindle nut	315	Bolt
18	Valve stem	451	Hexagon nut M10
19	Valve neck	459	Hexagonal nut
36	Hand wheel		

**diagram 7** Mounting the linear actuator on the valve

■ **How to assemble linear actuator type MC163:**

- 1 Pull off the blank (314).  
⇒ *diagram 7* on page 15
- 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 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 Fix the crossbeam (2) using a hexagon nut (459) spanner width 50.

- 9 Adjust the height of the spindle nut **(5)** with the help of the hand wheel **(36)** so that you can remount the bolt **(315)**.

Fit on the blank **(314)**!

#### ■ 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.



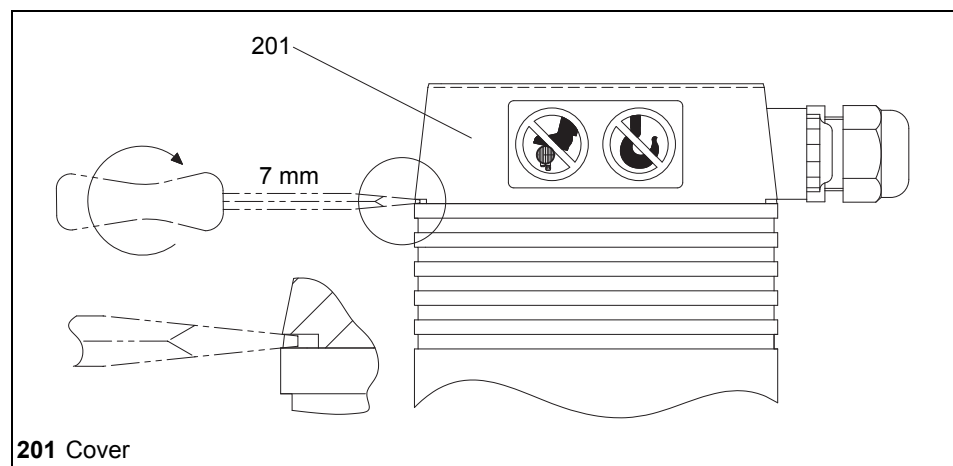
#### **Risk of injury from electric shock by live parts!**

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

diagram 8 Removing the cover



#### **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 and the **(110)** 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.

**Hint:** 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



### **Danger of life caused by incompetent 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.

⇒ 1.3 *Personnel* on page 5



### **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 stabilizer.

⇒ 2.5 *Technical data* on page 10

### ■ How to establish electrical connection

- 1 Remove the cover (201).  
⇒ *How to remove the cover* on page 16
- 2 Run the cable through the screw joint in the cover to the terminal.
- 3 Connect the power supply according to the wiring diagram.  
⇒ *diagram 9* on page 18

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



**ATTENTION**

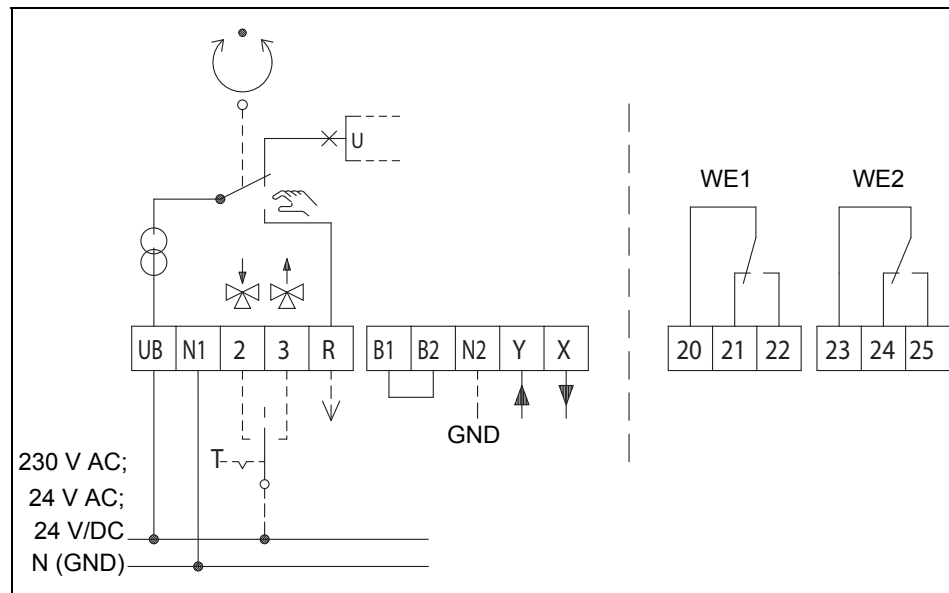
### Malfunctions caused by incorrect zero potential!

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.

⇒ *table 3* on page 19

- 4 Tighten the screw joints.



**diagram 9** Circuit diagram



Terminal	Description
<b>UB, N1</b>	Supply voltage:
<b>2</b>	Control voltage for downward movement during three-point mode
<b>3</b>	Control voltage for upward movement during three-point mode
<b>R</b>	Response signal during "manual" mode <ul style="list-style-type: none"> <li>• R= 24 V DC max. 35 mA</li> </ul>
<b>B1, B2</b>	Binary input / frost protection function
<b>N2</b>	Zero potential of signals X, Y and R <ul style="list-style-type: none"> <li>• 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.</li> <li>• If you run the actuator in continuous mode at 230 V you will have to connect N2.</li> <li>• 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.</li> </ul>
<b>Y</b>	Input signal continuous mode
<b>X</b>	Output signal continuous mode
<b>20, 21, 22</b>	Terminals path switch unit PS1
<b>23, 24, 25</b>	Terminals path switch unit PS2

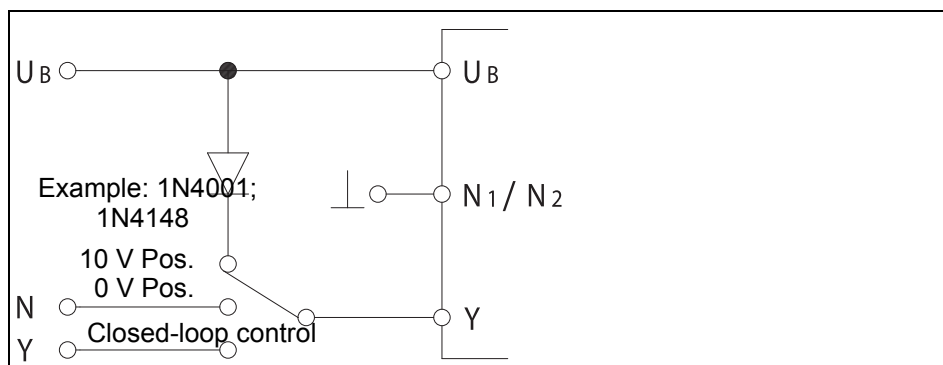
**table 3** Key to wiring diagram

#### 4.5.1 Controller independent circuit

When working with 24 V supply voltage and 0 ... 10 V DC / 2 ... 10 V DC 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 V AC via a diode and a three-step toggle switch to terminal Y.



**diagram 10** 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 ... 10 V DC.

⇒ 5.1 *Operating parameters and encoding switch settings* on page 25  
⇒ 5.7 *Setting the limit position* on page 27

## 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)**

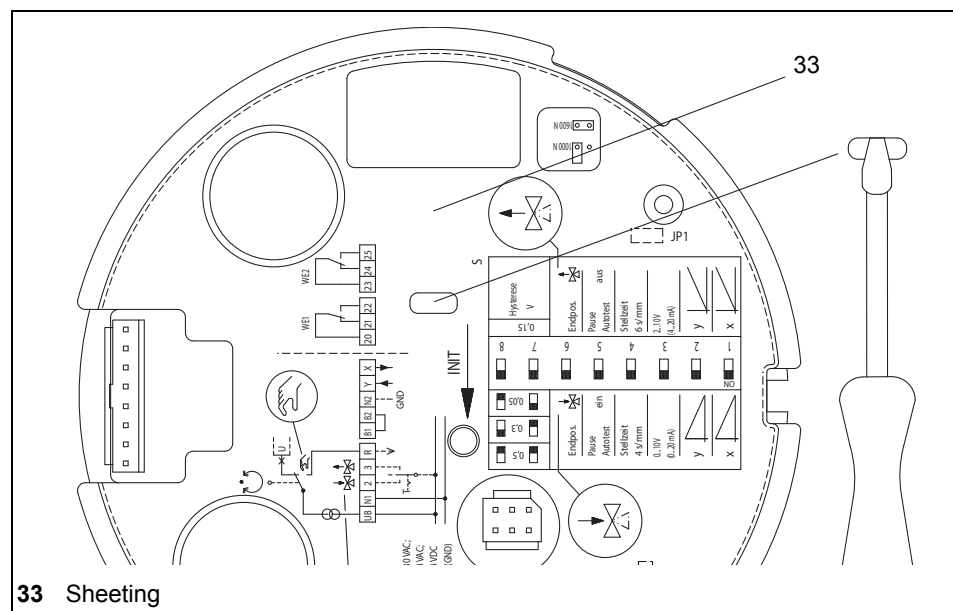


### Risk of injury from electric shock by live parts!

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 in 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 it off.



**33** Sheeting

**diagram 11** 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)**.

## 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 ... 20 mA **(111)**

**Hint:** Optional operation with mA output signal or path switch possible

⇒ 2.2 Accessories on page 7

### 4.6.1 Fitting a PCB for a path switch

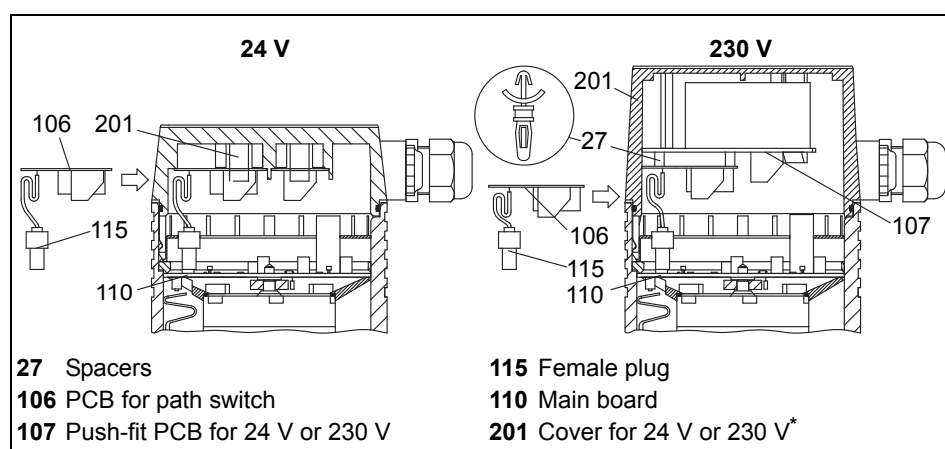


#### Risk of injury from electric shock by live parts!

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.

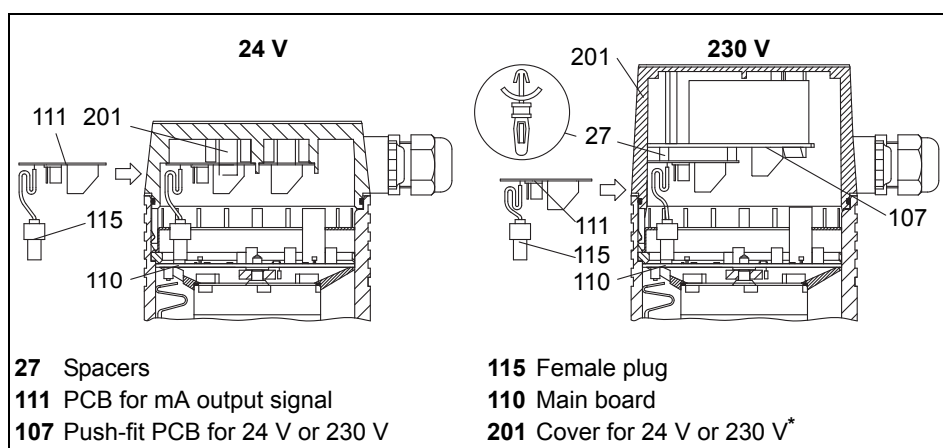
- 1 Open the cover **(201)** of the linear actuator.  
⇒ 4.4 Assembling/disassembling the cover on page 16
- 2 **24 V:** Clipping the path switch PCB **(106)** to the safety catches on the cover **(201)**  
*diagram 12 on page 21.*
- 3 **230 V:** Push the path switch PCB **(106)** onto the three spacers of **(27)** the push-fit PCB **(107)**.



**diagram 12** Assembling the path switch PCB inside the cover

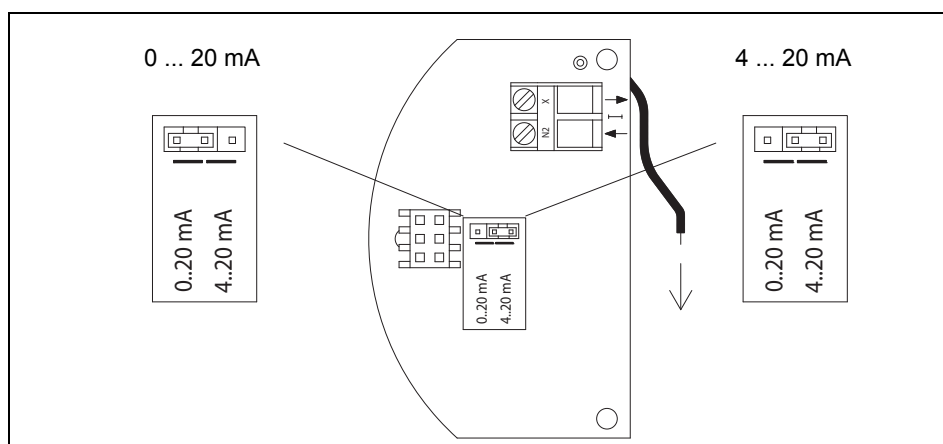
- 4 Plug the female plug into the **(115)** path switch PCB **(106)** on the socket board **(123)** of the main PCB **(110)**. In the process pay attention to the notches on the socket board and female plug.



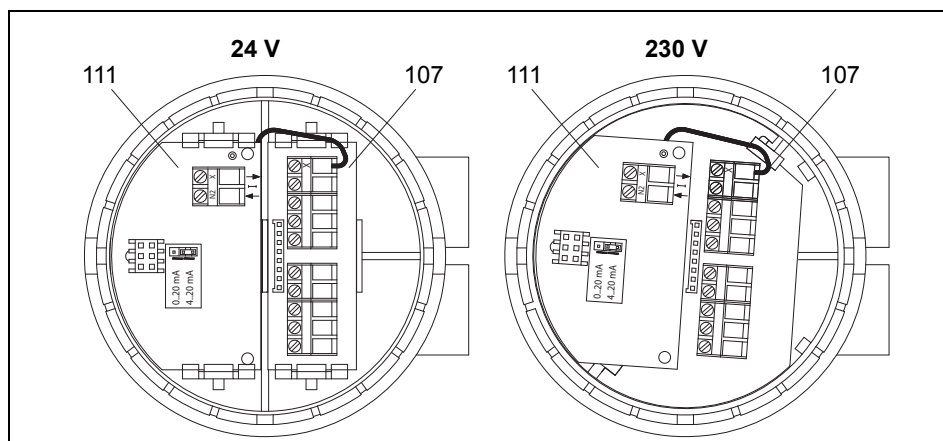


**diagram 14** Fitting a PCB for the mA output signal

- 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 ... 20 mA
  - Jumper left: 0 ... 20 mA



**diagram 15** Setting the PCB for the mA output signal



**diagram 16** Connecting the PCB for the mA output signal to the push-fit PCB

## 5 Commissioning



### 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**).

⇒ 4.4 Assembling/disassembling the cover on page 16

⇒ 4.5.2 Removing the PCB cover on page 20

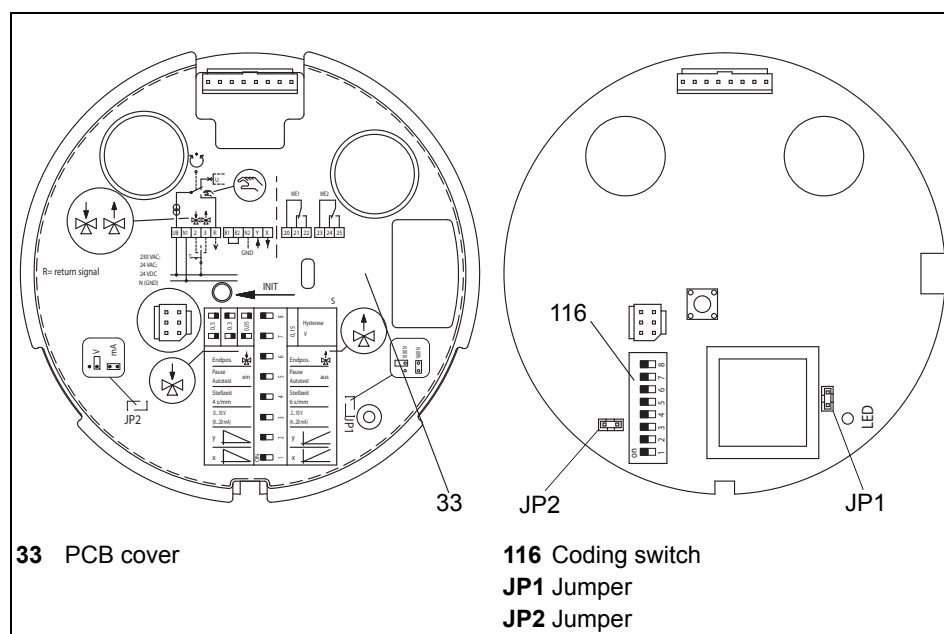


diagram 17 PCB cover, encoding switch and jumper

## 5.1 Operating parameters and encoding switch settings

Before starting to operate the linear actuator you will have to set the operating parameters with the help of the encoding switches and jumpers.

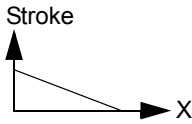
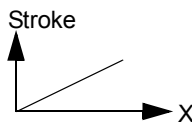
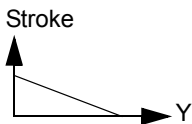
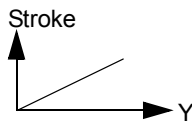
Switch / jumper	on	off
<b>S1</b>	X-characteristic line Stroke 	X-characteristic line Stroke 
<b>S2</b>	Y-characteristic line Stroke 	Y-characteristic line Stroke 
<b>S3</b>	Input signal (Y) 0 ... 10 V DC bzw. 0 ... 20 mA	Input signal (Y) 2 ... 10 V DC bzw. 4 ... 20 mA
<b>S4</b>	Actuating time 4s/mm	Actuating time 6 s/mm
<b>S5</b>	Auto test and auto pause on	Auto test and auto pause off
<b>S6</b>	Limit position actuator spindle extended	Limit position actuator spindle retracted
<b>S7, S8</b>	S7 and S8 are used to set the hysteresis (0.15...0.5V).	
<b>JP1</b>	Actuating force 1 kN	Actuating force 1.6 kN
<b>JP2</b>	Input signal (Y) in mA	Input signal (Y) in V

table 4 Encoding switch and jumper settings

## 5.2 Setting the input signal

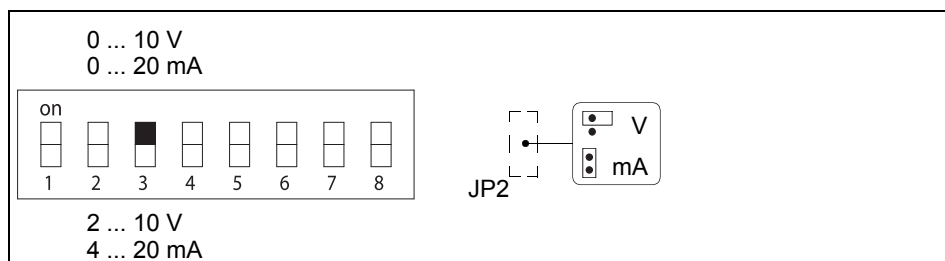


diagram 18 Setting the input signal

⇒ Additional information: *Input signal (Y)* on page 8

## 5.3 Setting the actuating time

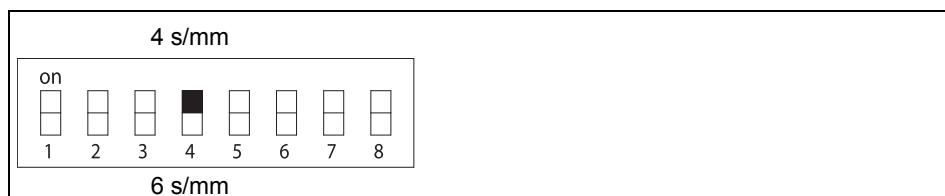


diagram 19 Set actuating time

⇒ Additional information: 2.4.4 *Actuating time* on page 9

## 5.4 Setting the hysteresis

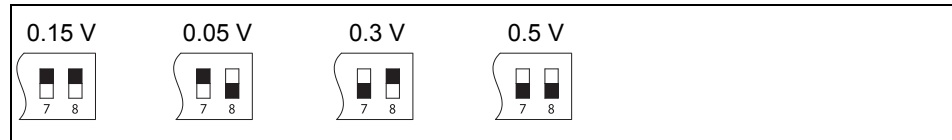


diagram 20 Set hysteresis

⇒ For further information see 2.4.5 Hysteresis on page 9

## 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)
<b>Encoding switch S1: X (output signal), encoding switch S2: Y (input signal)</b>		

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 spindle nut
- S6 OFF: Limit position with retracted spindle nut

The limit position is approached in the following situations:

- Due to wire break detection by the Y signal (2 ... 10 V DC or 4 ... 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.
  - ⇒ 5.10 Commissioning on page 30
  - ⇒ 5.9 Initialising the path measuring system on page 29



ATTENTION

### 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**).
  - ⇒ 4.4 Assembling/disassembling the cover on page 16
 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.

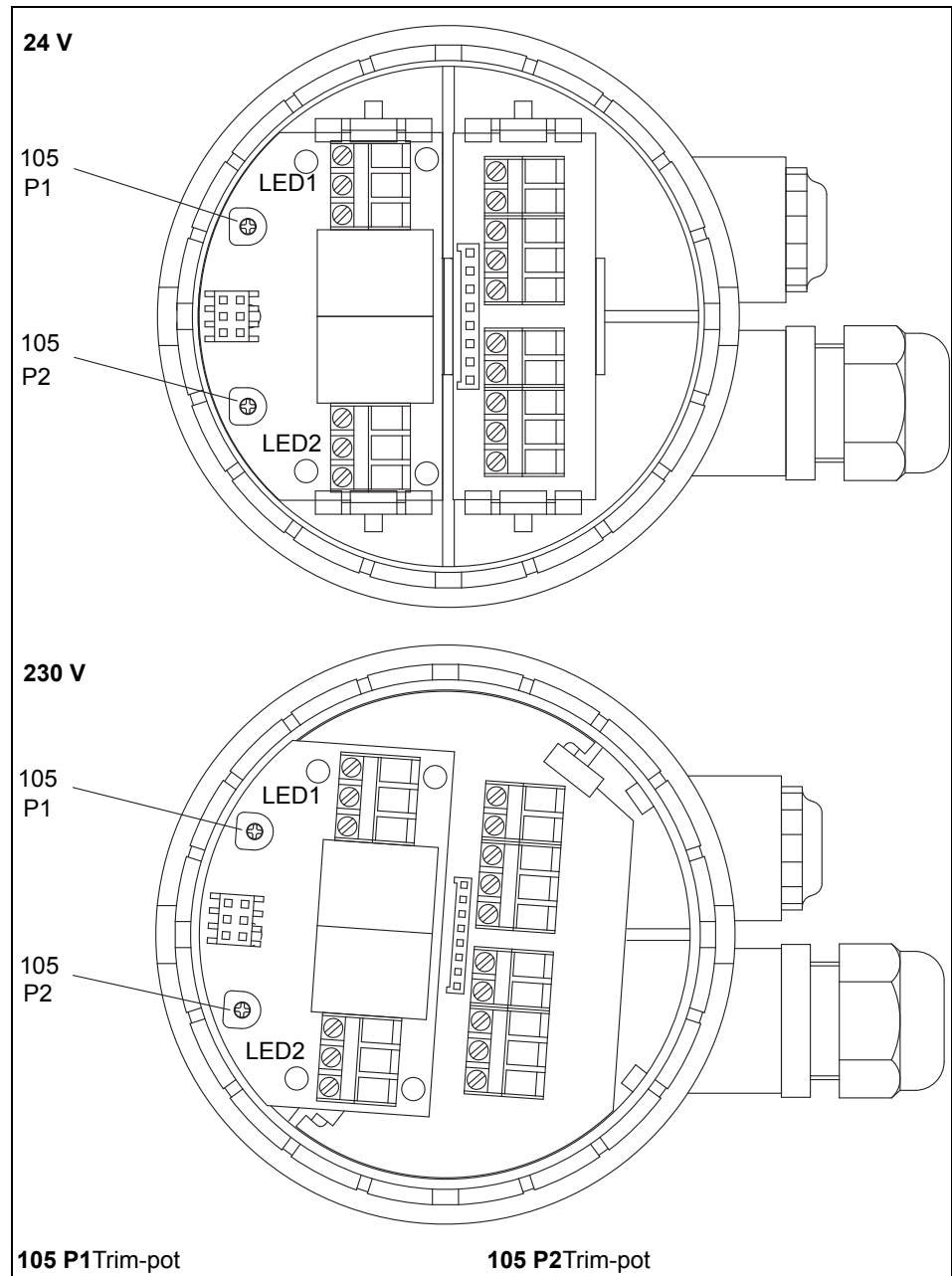


diagram 21 Position switch PCB in cover

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

<b>Nominal load</b>	8 A, 250 V AC 8 A, 30 V DC
<b>Switch voltage</b>	max. 400 V AC max. 125 V DC

table 6 Contact load of path switch

- 6 Disconnect the actuator from the supply and connect the path switch contacts.
- 7 Close the cover **(201)** of the linear actuator  
⇒ *How to attach the cover* on page 16

## 5.9 Initialising the path measuring system



### 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

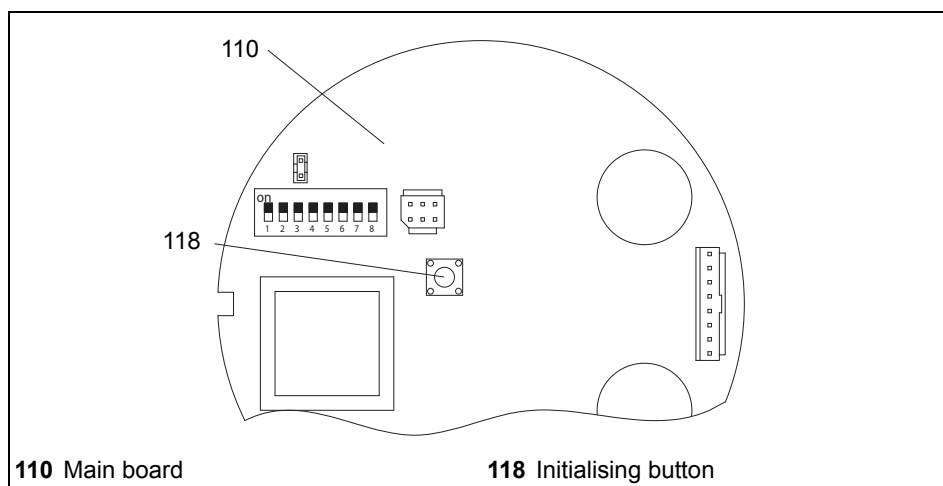


### Risk of injury from electric shock by live parts!

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**).  
⇒ 4.4 Assembling/disassembling the cover on page 16
- 2 Ensure that supply voltage is applied.
- 3 Press the initialising button (**118**) and keep it pressed for at least 1 second.



**diagram 22** 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.  
⇒ *diagram 9* on page 18

### 5.10 Commissioning

- 1 Check whether all fitting and assembly work has been competently finished.  
⇒ *4 Assembly* on page 12
- 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.  
⇒ *4.4 Assembling/disassembling the cover* on page 16
- 4 Ensure that the linear actuator is set to automatic mode.  
⇒ *6.1 Changing between manual and automatic mode* on page 31
- 5 Ensure that the operating parameters are set correctly.  
⇒ *5.1 Operating parameters and encoding switch settings* on page 25
- 6 Ensure that the path measuring system is initialised.  
⇒ *5.9 Initialising the path measuring system* on page 29
- 7 Apply supply voltage. The linear actuator will now move to the reference point.  
The linear actuator is ready for operation.

## 6 Operation

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

⇒ 5 Commissioning on page 24

⇒ 5.9 Initialising the path measuring system on page 29

### 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 spindle nut 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.

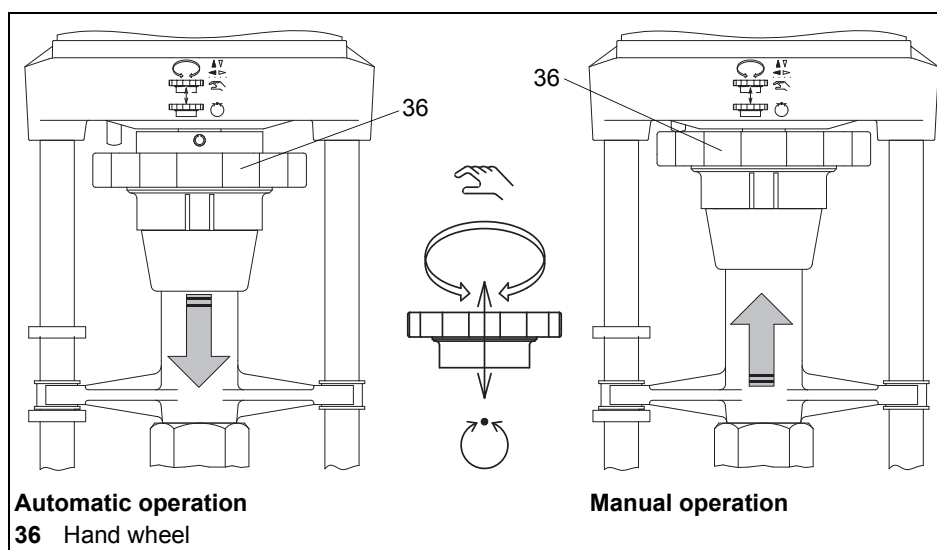


diagram 23 Selecting automatic mode

#### ■ How to change-over in manual mode

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



#### **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 hand wheel when you realise that the required effort increases noticeably!
- Never use force !

- 2 Use the hand wheel to turn the spindle nut to the desired position. Turn the hand wheel until the preset potentiometer increases. Do not use force!

#### ■ How to change-over in automatic mode

- 1 Push the hand wheel (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.

⇒ 10.2 Check list for breakdown on page 34










LED	Operating status / error
 Duration	<b>Normal operation, ready for operation</b> The LED is permanently lit, actuator waiting for traverse command.
 ⊗  ⊗ 0,5s 0,5s 0,5s 0,5s	<b>Standard Operation</b> Actuator carries out traverse command.
 ⊗  ⊗ 0,2s 1,5s 0,2s 1,5s Short – long rhythm	<b>Wire break detection</b> Input signal has dropped below 1 V or below 2 mA in operating modes 2 ... 10 V DC or 4 ... 20 . ⇒ 2.4.3 Wire break detection on page 8
 ⊗  ⊗ 2,5s 2,5s 2,5s 2,5s Long – long rhythm	<b>Blockage detection (continuous mode only)</b> The linear actuator is mechanically blocked. ⇒ 2.4.2 Blockage detection on page 8
 ⊗  ⊗ 1,5s 0,2s 1,5s 0,2s Long – long rhythm	<b>Continuous signal on terminal 2 and 3</b> 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 little maintenance. You do not have to carry out continuous or periodical maintenance.

## 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 data of linear actuators as well as the requirements for the public power supply.



### 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.

⇒ 2.1 Component parts on page 6

⇒ 2.2 Accessories on page 7

## 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.

⇒ 5.9 *Initialising the path measuring system* on page 29

### 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:

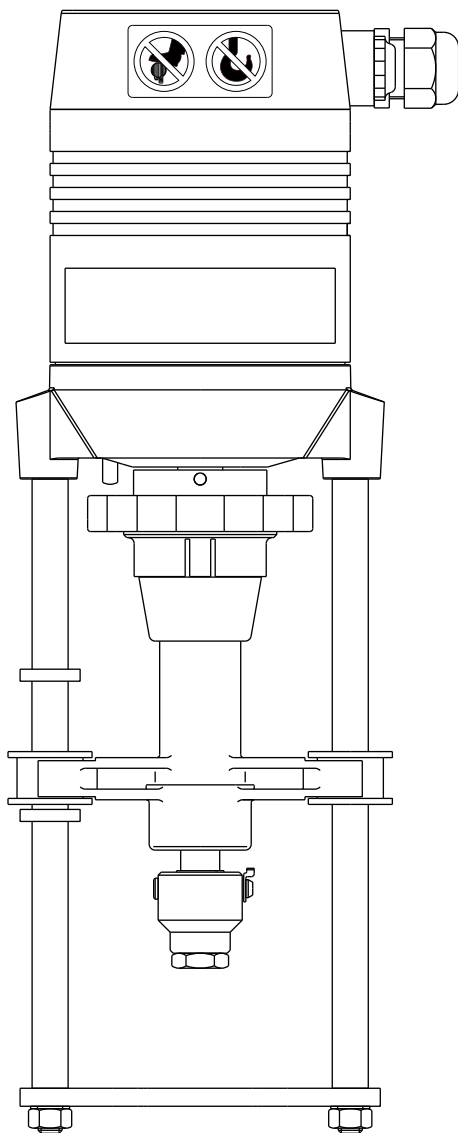
- 1 Check whether the linear actuator was correctly assembled.
- 2 Check the settings for the linear actuator against the specifications on the type plate.
- 3 Remedy the fault by following the check list.  
⇒ 10.2 *Check list for breakdown* on page 34
- 4 If you are unable to remedy the fault contact 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.	Hand wheel (36) is in position manual mode	<input type="checkbox"/> Switch hand wheel to position automatic mode.
	Power cut	<input type="checkbox"/> Determine cause and remedy.
	Fuse defective (in control cabinet)	<input type="checkbox"/> Determine cause and remedy, replace fuse.
	Linear actuator incorrectly connected	<input type="checkbox"/> Set connection correctly according to wiring diagram (on cover).
	Short circuit due to humidity	<input type="checkbox"/> 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	<input type="checkbox"/> Correct setting for connection
	Motor has winding damage (burnt-out) <ul style="list-style-type: none"> <li>• e.g. voltage too high</li> <li>• Electronic system defective</li> </ul>	<input type="checkbox"/> 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.	<input type="checkbox"/> Measure the current data; if required, recalculate and replace connecting cables!
	Public power supply fluctuations greater than admissible tolerance ⇒ 2.5 <i>Technical data</i> on page 10	<input type="checkbox"/> Improve public power supply conditions
3. Linear actuator pauses intermittently or initialises frequently	Slack contact in feeder line	<input type="checkbox"/> Check and tighten connections (terminal strips)
4. Linear actuator does not move to limit position. Valve does not open/close.	Valve is stuck	<input type="checkbox"/> Provide smooth-running valve
	Excessive system pressure	<input type="checkbox"/> 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: <ul style="list-style-type: none"> <li>• Interfering signals</li> <li>• Signal variations</li> </ul>	<input type="checkbox"/> Check input signal Y on linear actuator, remove cause of fault
	Main PCB defective	<input type="checkbox"/> Replace main PCB or disassemble linear actuator and send it in for repair
6. LED flashes in long / long rhythm	Blockage detection was triggered	<input type="checkbox"/> Press INIT and observe actuator during initialisation.
		<input type="checkbox"/> Check valve for smooth-running along entire traverse range
7. LED flashes in short / long rhythm	Wire break was detected	<input type="checkbox"/> Measure desired value voltage and current on linear actuator
8. LED flashes in long / short rhythm	Relay contact adhesive	<input type="checkbox"/> Check controller

**table 8** Check list breakdown





# Operating Manual

## Linear actuators

MC220/24 • MC220/230 • MC223/24 • MC223/230

## General information

Amendment	Version	Date	Modifications
	1.0	September 2021	Initial preparation

**Copyright** The copyright for this operating manual as well as all rights in case of patent awarding or registration of registered design remains with the manufacturer!

**Subject to alteration** The regulations, directives, standards etc. are compliant with the current state of information at the time of development and are not subject to modification service. They must be applied by the operator at his own responsibility in their latest valid version.

Concerning all data, information, and illustrations in this manual we reserve the right of technical modifications and improvements. No claims can be considered for alteration or rework of already delivered lift drives.

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# 1 Safety

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



**DANGER**

---

## DANGER

Directly threatening hazard leading to death or serious physical injuries.

---



**WARNING**

---

## WARNING

Potentially hazardous situation which may lead to death or serious physical injuries.

---



**CAUTION**

---

## CAUTION

Potentially hazardous situation which could lead to minor physical injuries. Indicates a hazard which may cause material damage.

---

**ATTENTION**

---

## ATTENTION

Potentially hazardous situation where the product or an object in its environment may get damaged.

---

**Hint:** Utilisation instructions and other useful information.

### 1.1 Proper use

Linear actuators MC220/24, MC220/230, MC223/24, MC223/230 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.

Concurrence 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 is decisive for linear actuator technical data and mains power supply requirements.

Any utilisation for tasks other than the aforementioned usage in accordance with specification and operating with mains power supply ratios other than those permitted is not deemed to be utilisation in accordance with specification. The operator bears sole liability for the risk to persons and machine and other assets in the event of utilisation not in accordance with specification.

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 authorization 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 MC220/24, MC220/230, MC223/24, MC223/230.

### 1.5 During operation

Safe operation is only possible if transportation, storage, installation, operation and maintenance are carried out safely and materially and professionally correctly.

#### **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 and other 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.

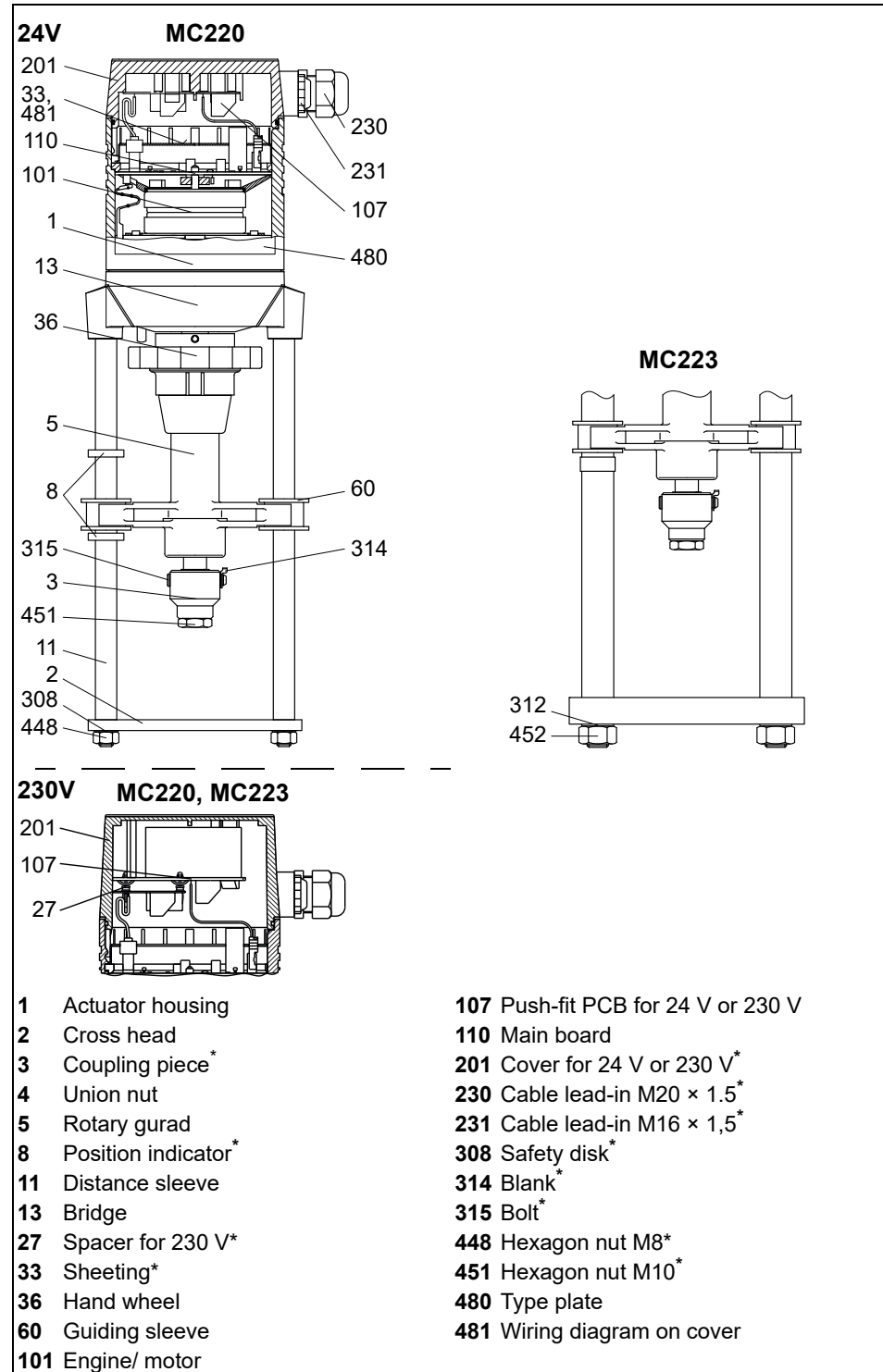
### 1.6 Working environment

Read the data concerning the working environment in the Technical Data.

## 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.

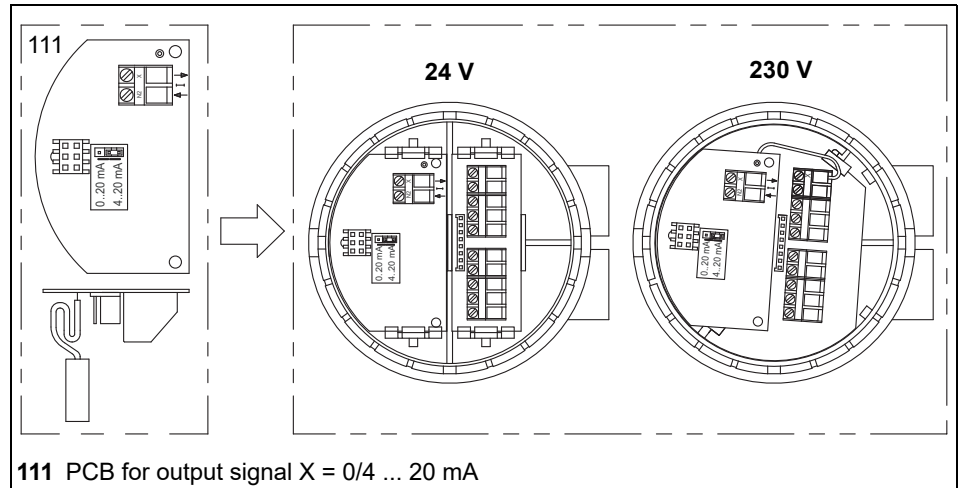
### 2.1 Component parts



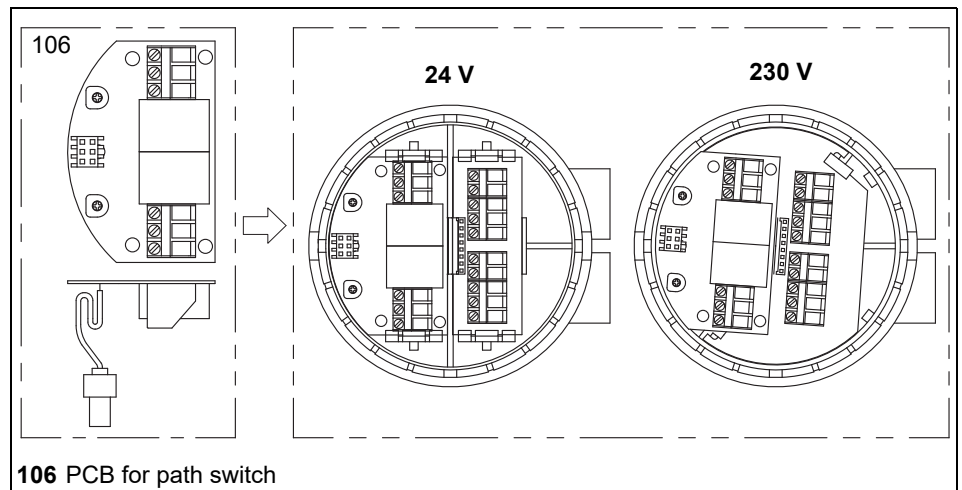
**diagram 1** Component part denominations

\* This component part is available as a spare part!

## 2.2 Accessories



**diagram 2** PCB for mA output signal in cover



**diagram 3** Position switch PCB in cover

**Hint:** 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 hand wheel.
- In automatic mode stroke is controlled electrically.

### 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 input signals:

- 0 ... 10 V DC / 2 ... 10 V DC
- 0 ... 20 mA / 4 ... 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 ... 10 V DC
- 0 ... 20 mA or 4 ... 20 mA (accessory PCB for output signal **(111)**)

### 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

⇒ 6.2 LED display on page 31

### 2.4.3 Wire break detection

Wire break detection is only available for continuous mode with an input signal 2 ... 10 V DC and 4 ... 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.

⇒ 6.2 LED display on page 31



#### 2.4.4 Actuating time

The time required for the rotary gurat to travel a defined distance is called actuating time. Actuating time is specified in s/mm.

#### 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 gurat.

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

⇒ 5.3 *Setting the hysteresis* on page 24

#### 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.

⇒ 6.1 *Changing between manual and automatic mode* on page 30

#### 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.

⇒ 5.5 *Setting auto test and auto pause* on page 25

#### 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.

⇒ 5.5 *Setting auto test and auto pause* on page 25

#### 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.

⇒ 5.7 *Setting a potential-free path switch* on page 26

## 2.5 Technical data

Type	MC220/24, MC223/24	MC220/230, MC223/230
<b>Supply voltage:</b>	24 V AC $\pm$ 10% 24 V DC $\pm$ 10%	115 V AC $\pm$ 10% 230 V AC $\pm$ 10%
<b>Power consumption</b>	6 VA	12 VA
<b>Weight</b>	MC220 = 3.2 kg MC223 = 4.0 kg	MC220 = 3.2 kg MC223 = 4.0 kg
<b>Dimensions</b>	See technical data sheets	
<b>Stroke</b>	MC220 = max. 30 mm MC223 = max. 30 mm	MC220 = max. 30 mm MC223 = max. 30 mm
<b>Frequency</b>	50/60 Hz $\pm$ 5%	50/60 Hz $\pm$ 5%
<b>Ambient temperature</b>	0 to +60°C	0 to +60°C
<b>Enclosure protection</b>	IP 54	IP 54
<b>Operating mode</b>	S3-50% ED	S3-50% ED
<b>Actuating time</b>	3 s/mm	3 s/mm
<b>Actuating force</b>	2,2 kN	2,2 kN
	During 24 V DC the specified actuating force can only be reached with the help of an aligned AC voltage.	

table 1 Technical data

<b>Input signal Y/ Resistance of load</b>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 2 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 0 ... 20 mA / 510 <math>\Omega</math></li> <li>• 4 ... 20 mA / 510 <math>\Omega</math></li> </ul>
<b>Output signal X/ Load rating</b>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / resistance of load <math>\geq</math> 1200 <math>\Omega</math>, <math>I_{max}</math>. 8 mA</li> <li>• 0 ... 20 mA / resistance of load <math>\leq</math> 500 <math>\Omega</math> - with accessory PCB for output signal <b>(111)</b></li> <li>• 4 ... 20 mA / resistance of load <math>\leq</math> 500 <math>\Omega</math> - with accessory PCB for output signal <b>(111)</b></li> </ul>
<b>Response signal R/ load rating</b>	<ul style="list-style-type: none"> <li>• 24 V DC / minimum impedance <math>\geq</math> 480 <math>\Omega</math> / <math>I_{max}</math>. 35 mA</li> </ul>
<b>Cable impedance between B1 and B2</b>	<ul style="list-style-type: none"> <li>• max. 10 <math>\Omega</math></li> </ul>

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).

⇒ 2.1 Component parts on page 6

<b>CE</b>		
<b>MC220/24</b>		
F.-Nr.: 07204142/01/0607		
AC 50 Hz 24 V	6 VA	2,2 kN
Y=0...10 V DC	IP 54	3 s/mm
X=0...10 V DC	S3-50% ED	Stroke 14 mm

diagram 4 Example of type plate

## 3 Transportation & Storage



### 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 to the specified transport and storage temperatures between -20 to +65°C.

## 4 Assembly

Prior to assembling the linear actuator:

- ⇒ 4.1 Checking the scope of delivery on page 12
- ⇒ 4.2 Preparing assembly on page 12

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

- ⇒ 4.3 Mounting the linear actuator on the valve on page 13
- ⇒ 4.4 Assembling/disassembling the cover on page 15
- ⇒ 4.5 Electrical connection on page 16

### 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

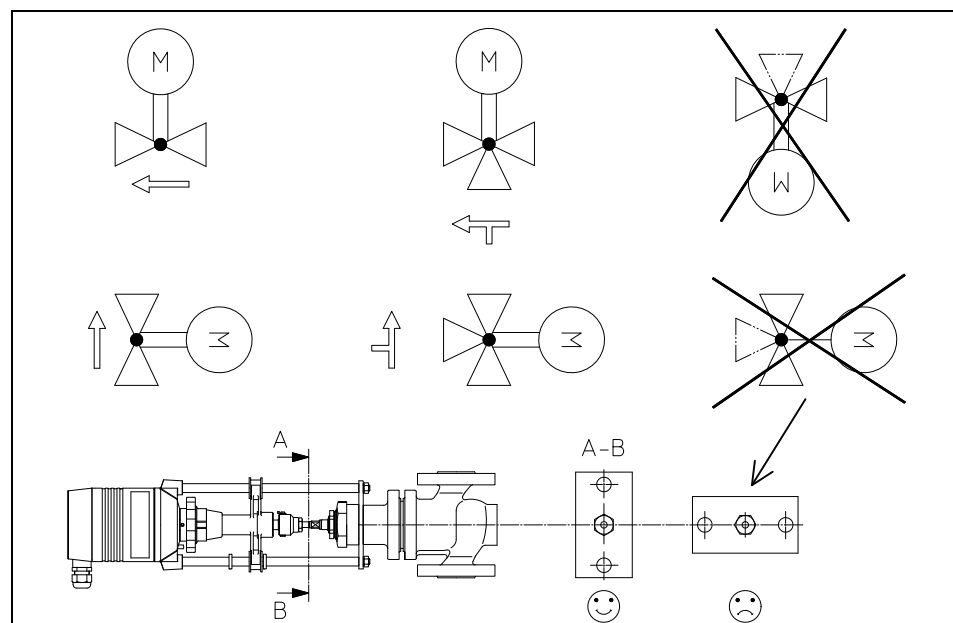
#### ATTENTION

#### A non-attached valve causes damage!

If you operate the linear actuator without valve, the rotary guard may fall off due to the missing stop.

- Always operate the linear actuator with a valve attached.

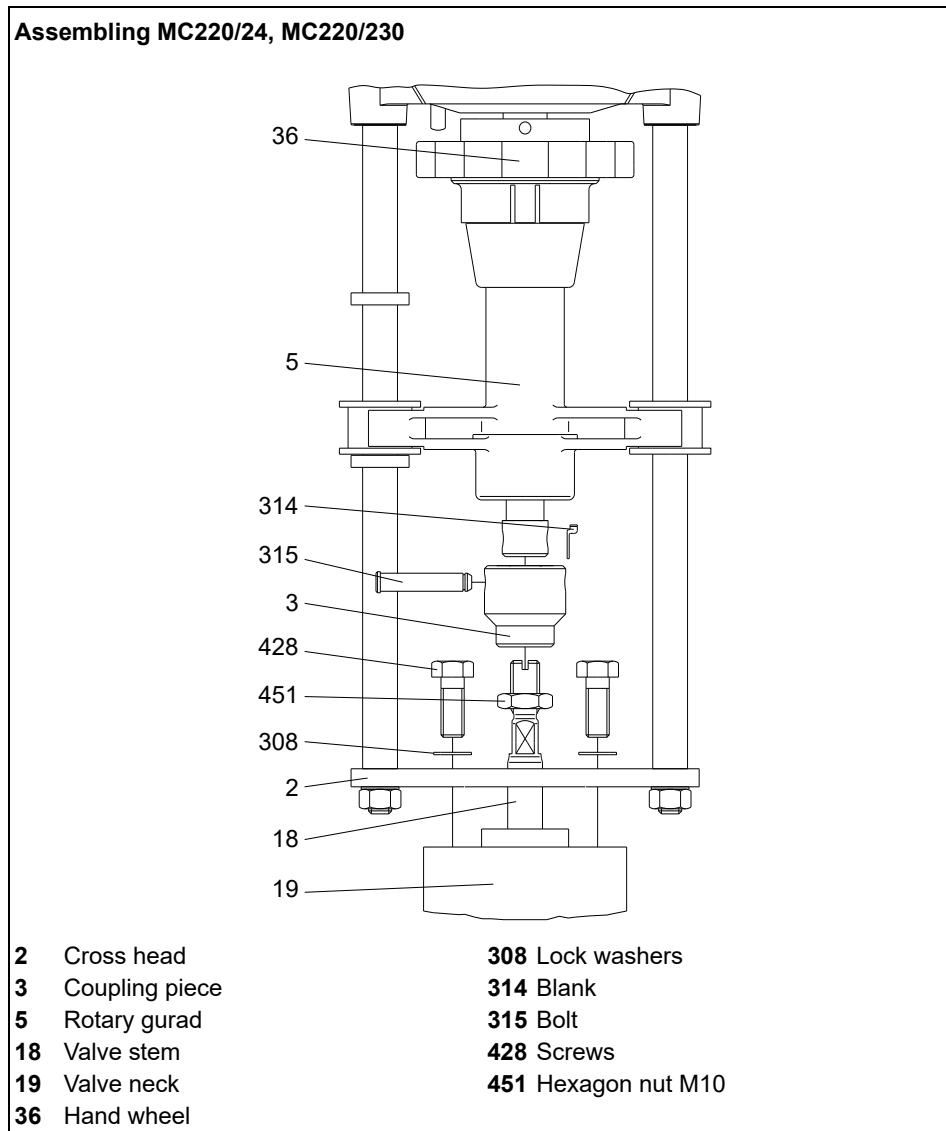
- 1 Allow for about 140 mm space above the cover at the site of installation.
- 2 Check the working environment before assembling and commissioning the linear actuator:
- 3 Ensure that the valve is correctly fitted. For details please see assembly instructions for valve.
- 4 Determine the assembly position of the linear actuator. Do not arrange linear actuators in a hanging position.



**diagram 5** 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 will have to mount the linear actuator on the valve.



**diagram 6** Mounting the linear actuator on the valve

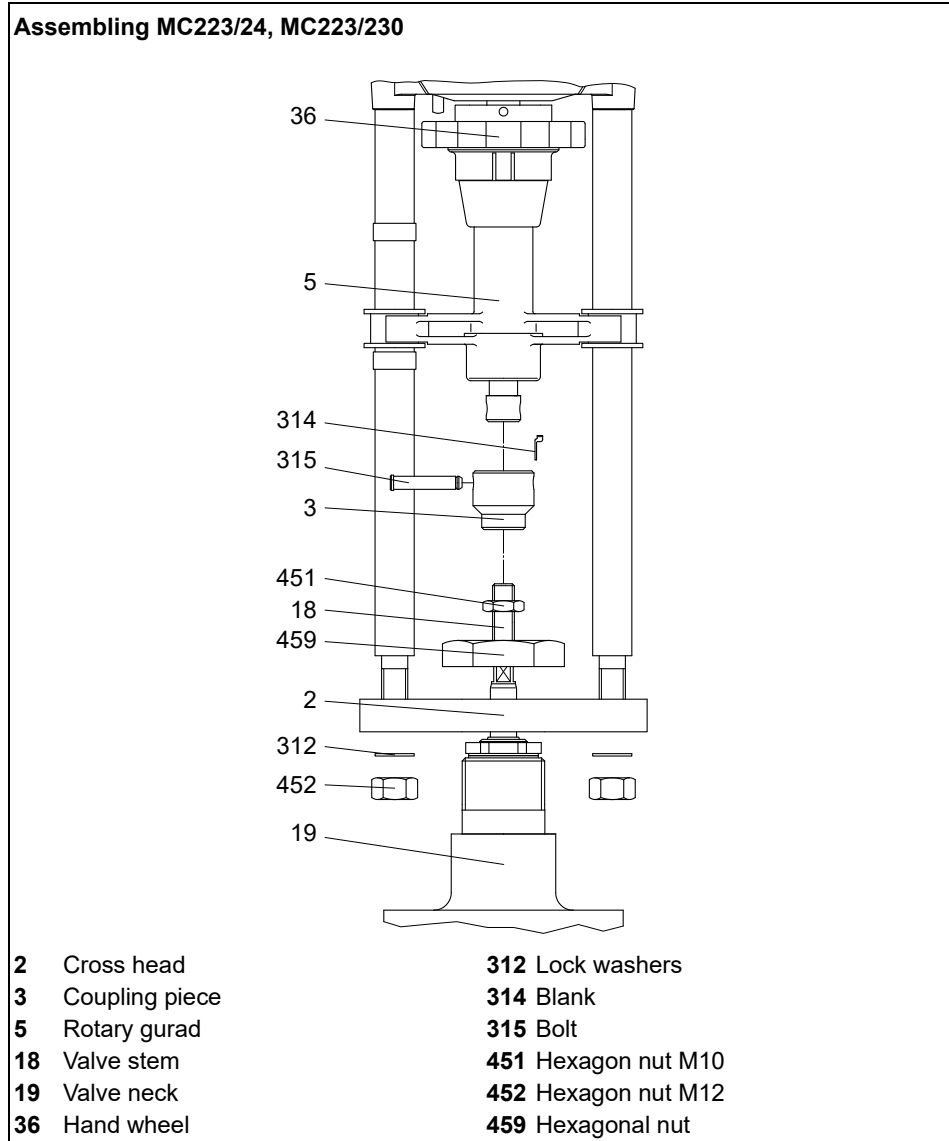
#### ■ How to assemble linear actuator type MC220

- 1** Pull off the blank (**314**).  
⇒ *diagram 6* on page 13
- 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 crossbar (**2**) of the actuator with the help of screws (**428**) spanner width 13 and blanks (**308**) to the valve neck (**19**).
- 7** Adjust the height of the rotary gear (**5**) with the help of the hand wheel (**308**) 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.



**diagram 7** Mounting the linear actuator on the valve

■ **How to assemble linear actuator type MC223:**

- 1 Pull off the blank (314).  
⇒ *diagram 7* on page 14
- 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 the cross beam (2) and the hexagon nut (459) onto the valve neck (19).
- 6 Fix the crossbeam (2) with the hexagon nut (459) using a spanner width 50.
- 7 Place the actuator with distance sleeves onto the cross beam (2).
- 8 Fix the actuator by means of lock washers (312) and hexagonal nuts (452).

- 9 Adjust the height of the rotary guard (5) with the help of the hand wheel (36) so that you can remount the bolt (315).
- 10 Fit on the blank (314)!
- 11 Fix the valve stem (18) with 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.



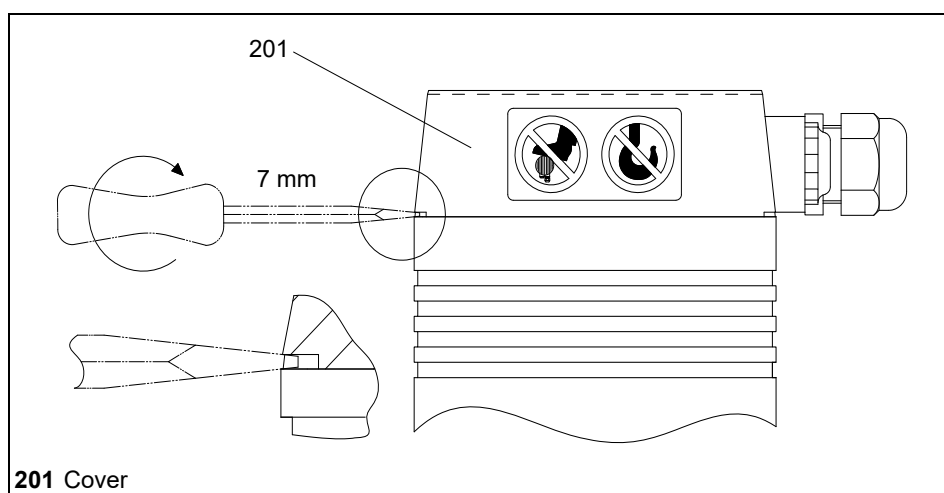
#### Risk of injury from electric shock by live parts!

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

diagram 8 Removing the cover

#### Damaged cables result in damage to devices!

**ATTENTION** 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 and the (110) 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.

**Hint:** 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



### **Danger of life caused by incompetent 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.

⇒ 1.3 *Personnel* on page 5



### **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 stabilizer.

⇒ 2.5 *Technical data* on page 10



### ■ How to establish electrical connection

- 1 Remove the cover (201).  
⇒ *How to remove the cover* on page 15
- 2 Run the cable through the screw joint in the cover to the terminal.
- 3 Connect the power supply according to the wiring diagram.  
⇒ *diagram 9* on page 17

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

### ATTENTION

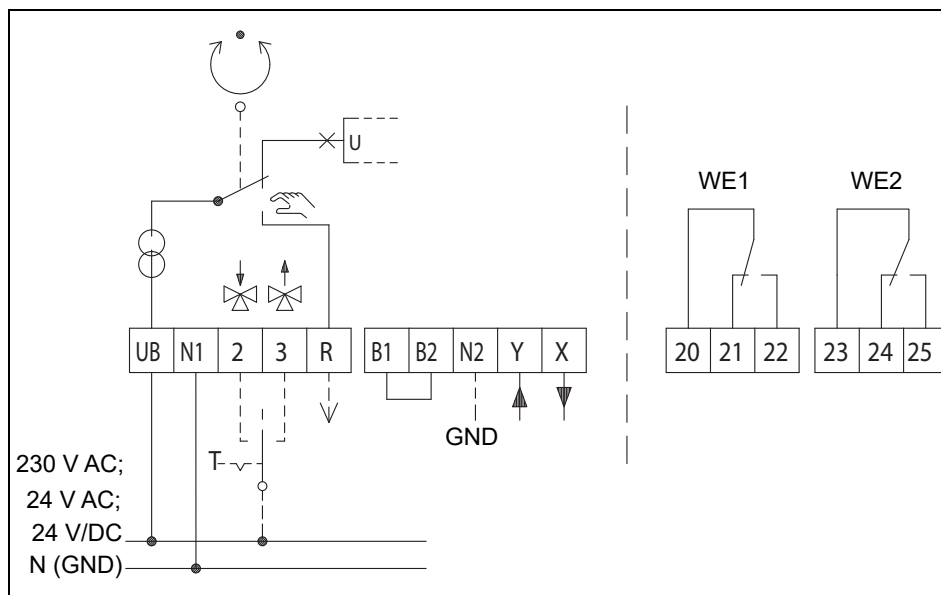
#### Malfunctions caused by incorrect zero potential!

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.

⇒ *table 3* on page 18

- 4 Tighten the screw joints.



**diagram 9** Circuit diagram

Terminal	Description
<b>UB, N1</b>	Supply voltage:
<b>2</b>	Control voltage for downward movement during three-point mode
<b>3</b>	Control voltage for upward movement during three-point mode
<b>R</b>	Response signal during "manual" mode <ul style="list-style-type: none"> <li>• R= 24 V DC max. 35 mA</li> </ul>
<b>B1, B2</b>	Binary input / frost protection function
<b>N2</b>	Zero potential of signals X, Y and R <ul style="list-style-type: none"> <li>• 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.</li> <li>• If you run the actuator in continuous mode at 230 V you will have to connect N2.</li> <li>• 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.</li> </ul>
<b>Y</b>	Input signal continuous mode
<b>X</b>	Output signal continuous mode
<b>20, 21, 22</b>	Terminals path switch unit PS1
<b>23, 24, 25</b>	Terminals path switch unit PS2

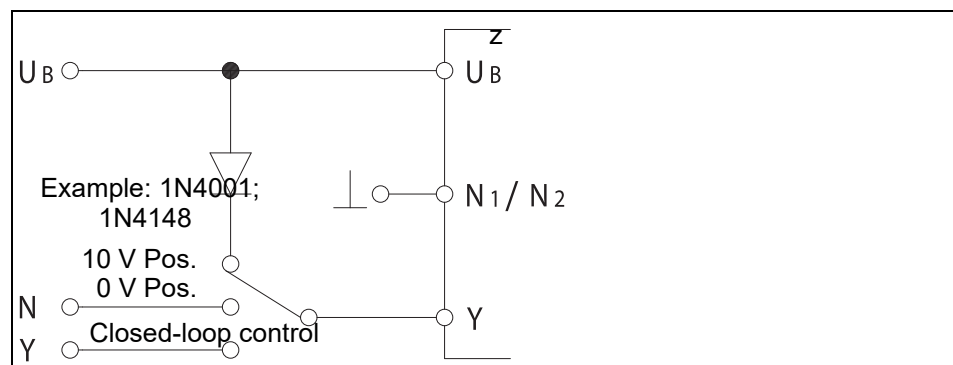
**table 3** Key to wiring diagram

#### 4.5.1 Controller independent circuit

When working with 24 V supply voltage and 0 ... 10 V DC / 2 ... 10 V DC 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 V AC via a diode and a three-step toggle switch to terminal Y.



**diagram 10** 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 ... 10 V DC.

⇒ 5.1 Operating parameters and encoding switch settings on page 24

⇒ 5.6 Setting the limit position on page 26

### 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)**

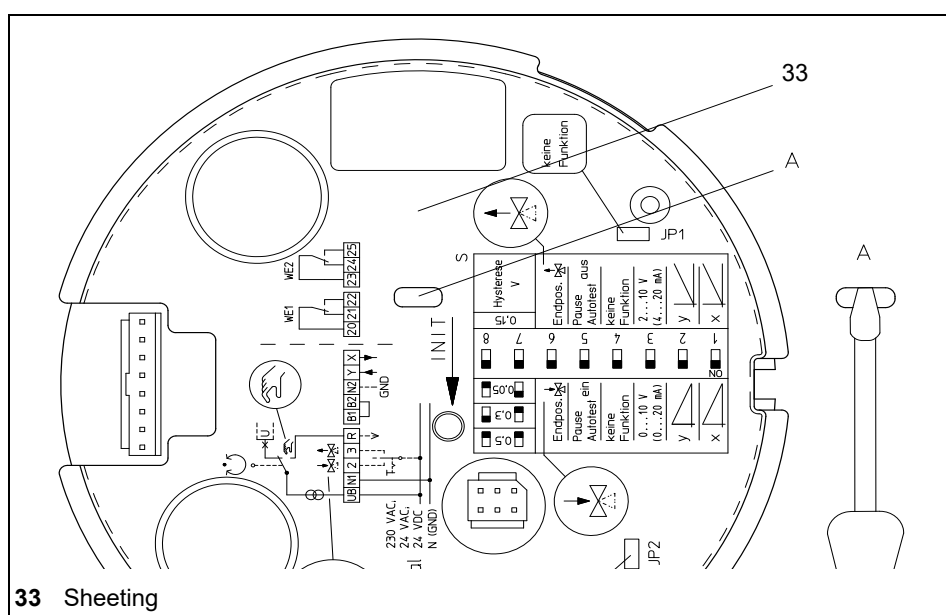


#### Risk of injury from electric shock by live parts!

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 in 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 it off.



**diagram 11** 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)**.

## 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 ... 20 mA **(111)**

**Hint:** Optional operation with mA output signal or path switch possible

⇒ 2.2 Accessories on page 7

### 4.6.1 Fitting a PCB for a path switch

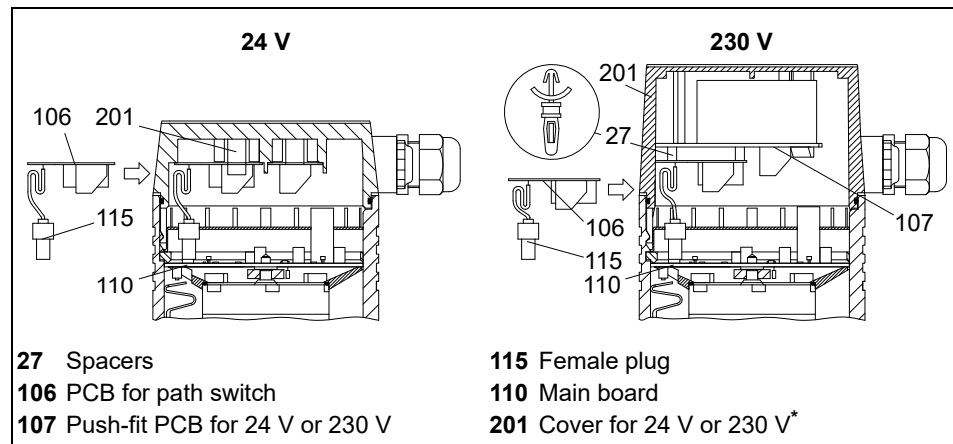


#### Risk of injury from electric shock by live parts!

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.

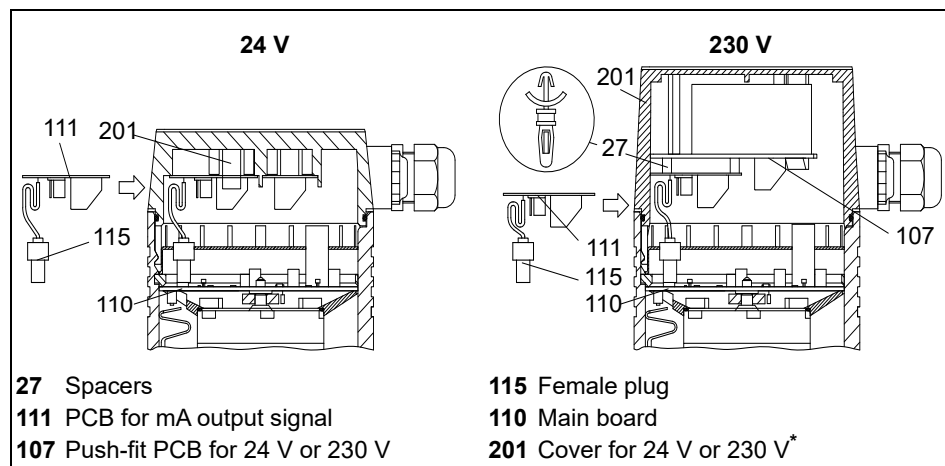
- 1 Open the cover **(201)** of the linear actuator.  
⇒ 4.4 Assembling/disassembling the cover on page 15
- 2 **24 V:** Clipping the path switch PCB **(106)** to the safety catches on the cover **(201)**  
*diagram 12 on page 20.*
- 3 **230 V:** Push the path switch PCB **(106)** onto the three spacers of **(27)** the push-fit PCB **(107)**.



**diagram 12** Assembling the path switch PCB inside the cover

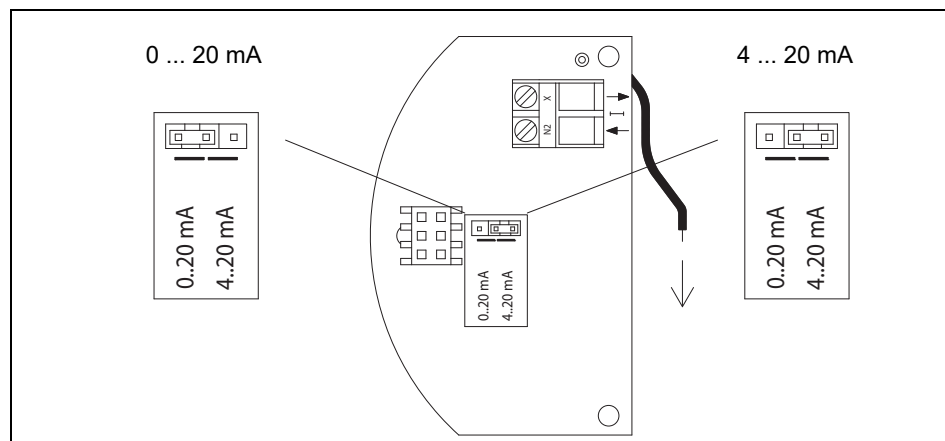
- 4 Plug the female plug into the **(115)** path switch PCB **(106)** on the socket board **(123)** of the main PCB **(110)**. In the process pay attention to the notches on the socket board and female plug.



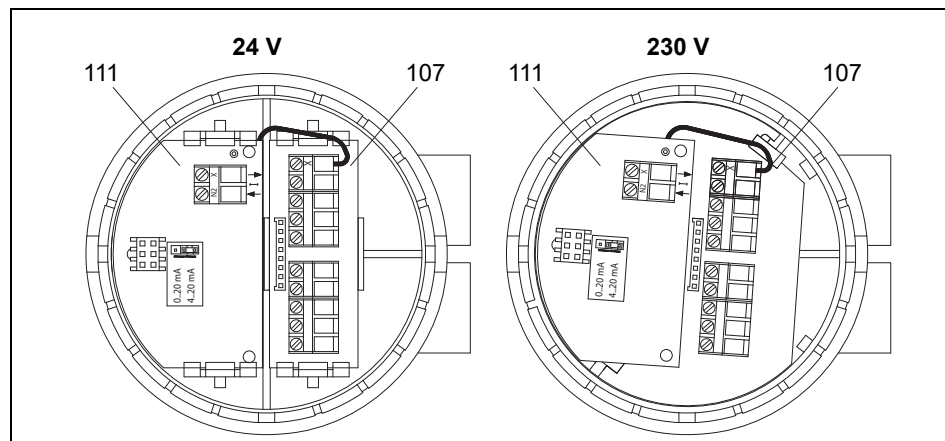


**diagram 14** Fitting a PCB for the mA output signal

- 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 ... 20 mA
  - Jumper left: 0 ... 20 mA



**diagram 15** Setting the PCB for the mA output signal



**diagram 16** Connecting the PCB for the mA output signal to the push-fit PCB

## 5 Commissioning



### 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**).

⇒ 4.4 Assembling/disassembling the cover on page 15

⇒ 4.5.2 Removing the PCB cover on page 19

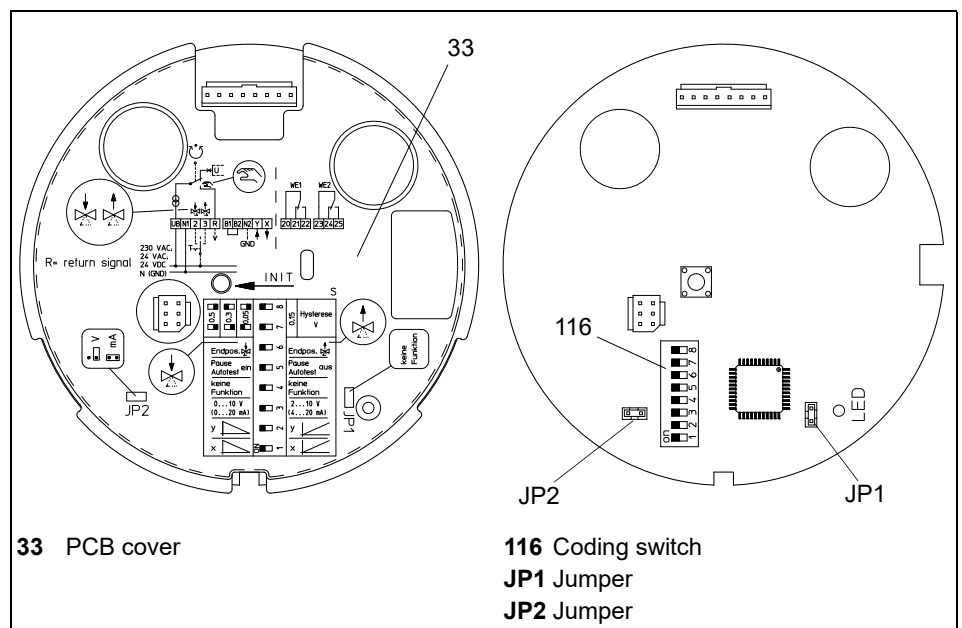


diagram 17 PCB cover, encoding switch and jumper

## 5.1 Operating parameters and encoding switch settings

Before starting to operate the linear actuator you will have to set the operating parameters with the help of the encoding switches and jumpers.

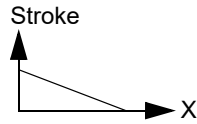
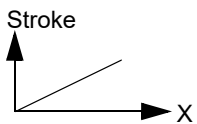
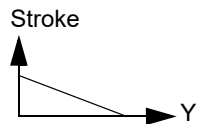
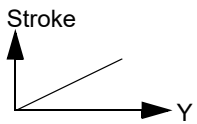
Switch / jumper	on	off
S1	X-characteristic line 	X-characteristic line 
S2	Y-characteristic line 	Y-characteristic line 
S3	Input signal (Y) 0 ... 10 V DC bzw. 0 ... 20 mA	Input signal (Y) 2 ... 10 V DC bzw. 4 ... 20 mA
S4	Actuating time 4s/mm	Actuating time 6 s/mm
S5	Auto test and auto pause on	Auto test and auto pause off
S6	Limit position actuator spindle extended	Limit position actuator spindle retracted
S7, S8	S7 and S8 are used to set the hysteresis (0.15...0.5V).	
JP1	Actuating force 1 kN	Actuating force 1.6 kN
JP2	Input signal (Y) in mA	Input signal (Y) in V

table 4 Encoding switch and jumper settings

## 5.2 Setting the input signal

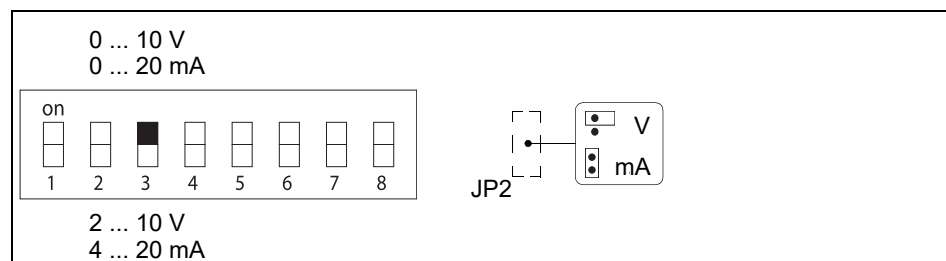


diagram 18 Setting the input signal

⇒ Additional information: *Input signal (Y)* on page 8

## 5.3 Setting the hysteresis

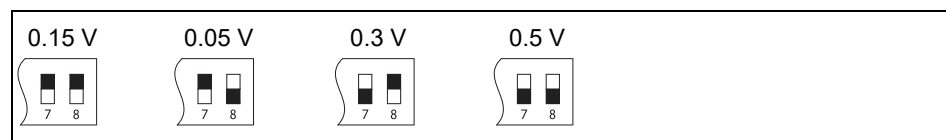


diagram 19 Set hysteresis

⇒ For further information see 2.4.5 *Hysteresis* on page 9

## 5.4 Setting the actuating direction

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



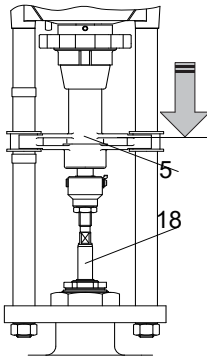
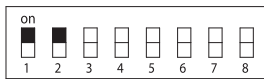
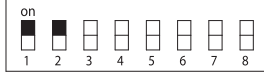
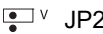
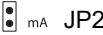

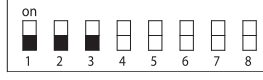

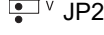

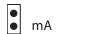
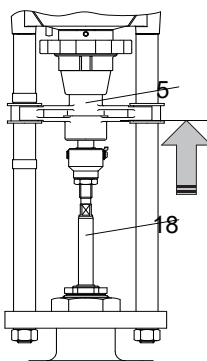
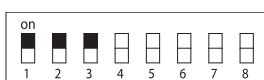
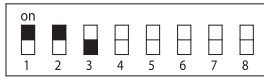
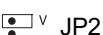
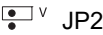


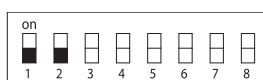
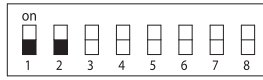
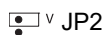

Actuator setting	Normal operation	Reverse operation (X and Y reversed)
	   JP2 Y = 10 V DC  JP2 Y = 20 mA	   JP2 Y = 0 V DC  JP2 Y = 2 V DC  JP2 Y = 0 mA  JP2 Y = 4 mA
	   JP2 Y = 0 V DC  JP2 Y = 2 V DC  JP2 Y = 0 mA  JP2 Y = 4 mA	   JP2 Y = 10 V DC  JP2 Y = 20 mA
<b>Encoding switch S1: X (output signal), encoding switch S2: Y (input signal)</b>		

table 5 Setting the actuating direction

## 5.5 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.

## 5.6 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 ... 10 V DC or 4 ... 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)

## 5.7 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.

⇒ 5.9 Commissioning on page 29

⇒ 5.8 Initialising the path measuring system on page 28

### ATTENTION

#### 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). <sup>JP2</sup>

- 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.



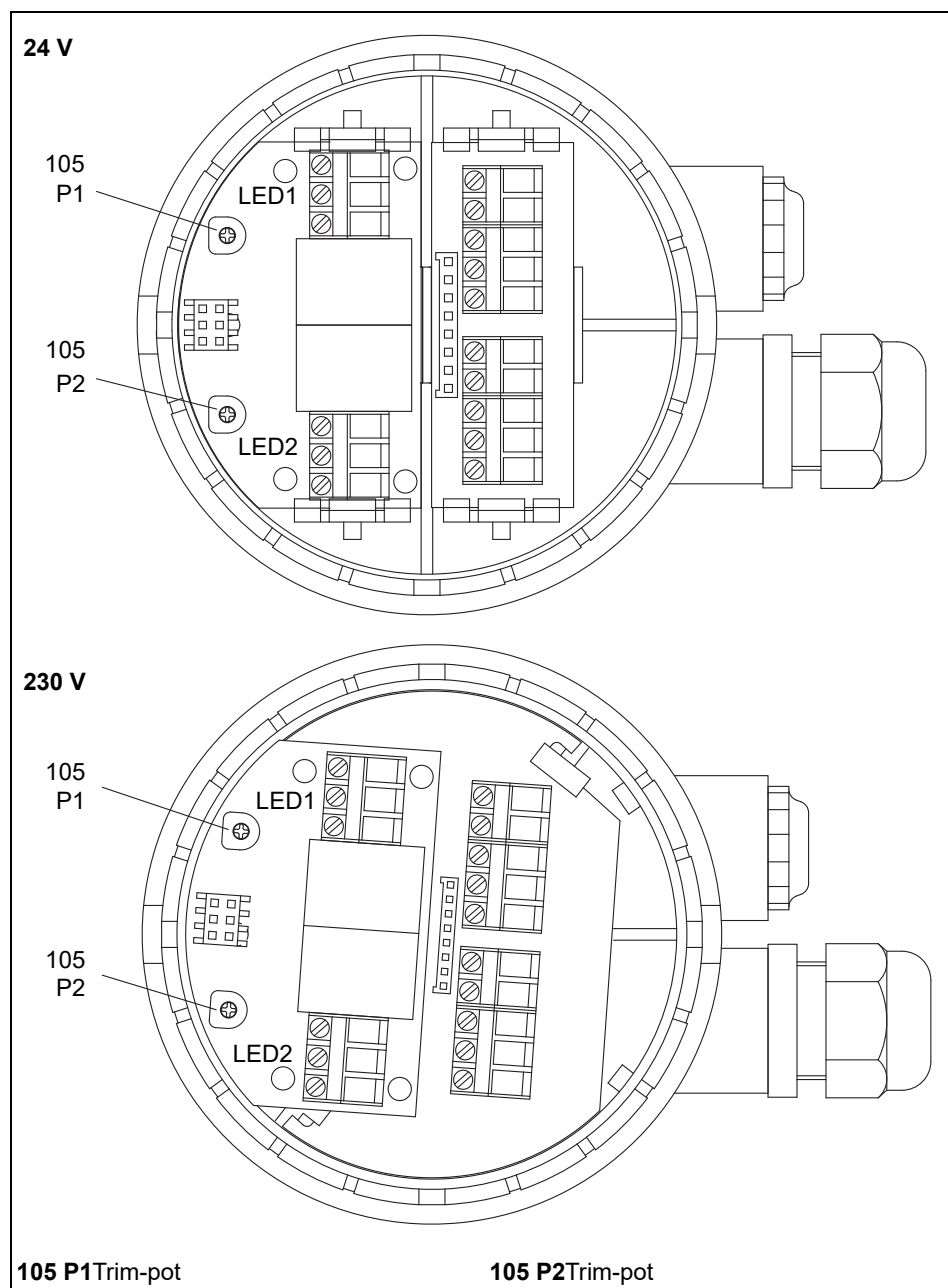
### WARNING

#### 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)**.  
⇒ 4.4 Assembling/disassembling the cover on page 15  
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.



**diagram 20** Position switch PCB in cover

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

<b>Nominal load</b>	8 A, 250 V AC 8 A, 30 V DC
<b>Switch voltage</b>	max. 400 V AC max. 125 V DC

**table 6** Contact load of path switch

- 6** Disconnect the actuator from the supply and connect the path switch contacts.
- 7** Close the cover (**201**) of the linear actuator
- ⇒ *How to attach the cover on page 15*

## 5.8 Initialising the path measuring system

### ATTENTION

#### 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

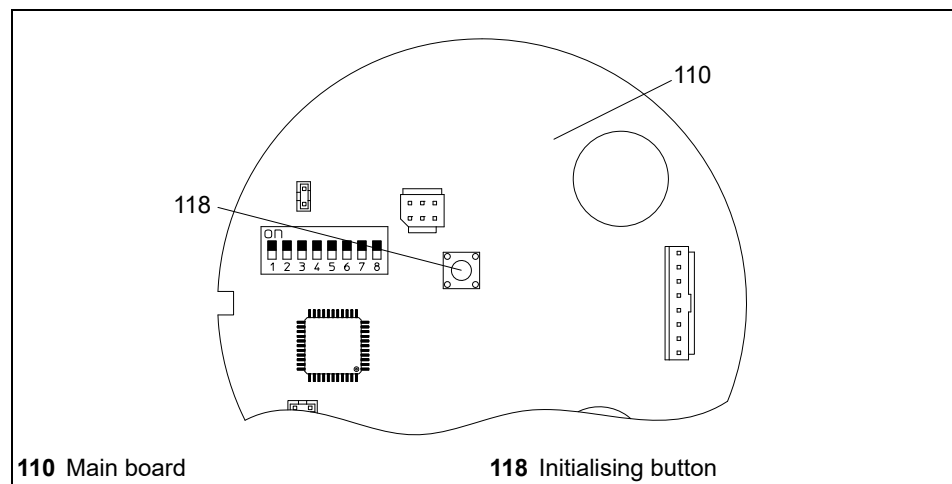


#### Risk of injury from electric shock by live parts!

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)**.  
⇒ 4.4 Assembling/disassembling the cover on page 15
- 2 Ensure that supply voltage is applied.
- 3 Press the initialising button **(118)** and keep it pressed for at least 1 second.



**diagram 21** 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.  
⇒ diagram 9 on page 17

## 5.9 Commissioning

- 1 Check whether all fitting and assembly work has been competently finished.  
⇒ *4 Assembly* on page 12
- 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.  
⇒ *4.4 Assembling/disassembling the cover* on page 15
- 4 Ensure that the linear actuator is set to automatic mode.  
⇒ *6.1 Changing between manual and automatic mode* on page 30
- 5 Ensure that the operating parameters are set correctly.  
⇒ *5.1 Operating parameters and encoding switch settings* on page 24
- 6 Ensure that the path measuring system is initialised.  
⇒ *5.8 Initialising the path measuring system* on page 28
- 7 Apply supply voltage. The linear actuator will now move to the reference point.  
The linear actuator is ready for operation.

## 6 Operation

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

⇒ 5 Commissioning on page 23

⇒ 5.8 Initialising the path measuring system on page 28

### 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.

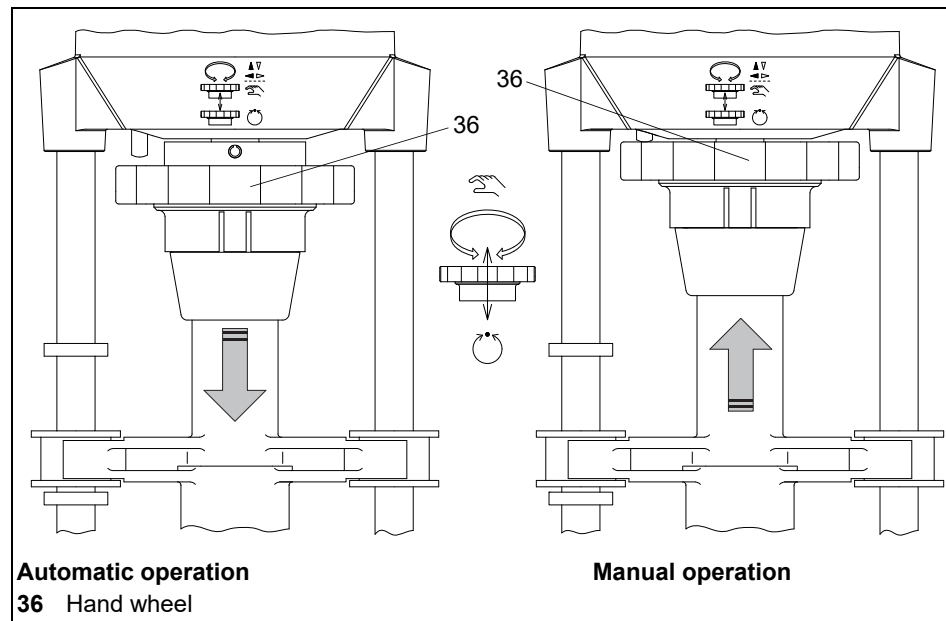


diagram 22 Selecting automatic mode

#### ■ How to change-over in manual mode

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

#### **Risk of damage to valve and actuator during manual mode!**

#### ATTENTION

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

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

- 2 Use the hand wheel to turn the rotary guard to the desired position. Turn the hand wheel until the preset potentiometer increases. Do not use force!

#### ■ How to change-over in automatic mode

- 1 Push the hand wheel (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.

⇒ 10.2 Check list for breakdown on page 33










LED	Operating status / error
 Duration	<b>Normal operation, ready for operation</b> The LED is permanently lit, actuator waiting for traverse command.
  0,5s 0,5s 0,5s 0,5s	<b>Standard Operation</b> Actuator carries out traverse command.
  0,2s 1,5s 0,2s 1,5s Short – long rhythm	<b>Wire break detection</b> Input signal has dropped below 1 V or below 2 mA in operating modes 2 ... 10 V DC or 4 ... 20 . ⇒ 2.4.3 Wire break detection on page 8
  2,5s 2,5s 2,5s 2,5s Long – long rhythm	<b>Blockage detection (continuous mode only)</b> The linear actuator is mechanically blocked. ⇒ 2.4.2 Blockage detection on page 8
  1,5s 0,2s 1,5s 0,2s Long – long rhythm	<b>Continuous signal on terminal 2 and 3</b> 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 little maintenance. You do not have to carry out continuous or periodical maintenance.

## 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 data of linear actuators as well as the requirements for the public power supply.

### ATTENTION

#### 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.

⇒ 2.1 Component parts on page 6

⇒ 2.2 Accessories on page 7

## 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.

⇒ *5.8 Initialising the path measuring system on page 28*

### 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.  
⇒ *10.2 Check list for breakdown on page 33*
- 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.	Hand wheel (36) is in position manual mode	<input type="checkbox"/> Switch hand wheel to position automatic mode.
	Power cut	<input type="checkbox"/> Determine cause and remedy.
	Fuse defective (in control cabinet)	<input type="checkbox"/> Determine cause and remedy, replace fuse.
	Linear actuator incorrectly connected	<input type="checkbox"/> Set connection correctly according to wiring diagram (on cover).
	Short circuit due to humidity	<input type="checkbox"/> 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	<input type="checkbox"/> Correct setting for connection
	Motor has winding damage (burnt-out) <ul style="list-style-type: none"> <li>• e.g. voltage too high</li> <li>• Electronic system defective</li> </ul>	<input type="checkbox"/> 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.	<input type="checkbox"/> Measure the current data; if required, recalculate and replace connecting cables!
	Public power supply fluctuations greater than admissible tolerance ⇒ 2.5 Technical data on page 10	<input type="checkbox"/> Improve public power supply conditions
3. Linear actuator pauses intermittently or initialises frequently	Slack contact in feeder line	<input type="checkbox"/> Check and tighten connections (terminal strips)
4. Linear actuator does not move to limit position. Valve does not open/close.	Valve is stuck	<input type="checkbox"/> Provide smooth-running valve
	Excessive system pressure	<input type="checkbox"/> 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: <ul style="list-style-type: none"> <li>• Interfering signals</li> <li>• Signal variations</li> </ul>	<input type="checkbox"/> Check input signal Y on linear actuator, remove cause of fault
	Main PCB defective	<input type="checkbox"/> Replace main PCB or disassemble linear actuator and send it in for repair
6. LED flashes in long / long rhythm	Blockage detection was triggered	<input type="checkbox"/> Press INIT and observe actuator during initialisation.
		<input type="checkbox"/> Check valve for smooth-running along entire traverse range
7. LED flashes in short / long rhythm	Wire break was detected	<input type="checkbox"/> Measure desired value voltage and current on linear actuator
8. LED flashes in long / short rhythm	Relay contact adhesive	<input type="checkbox"/> Check controller

**table 8** Check list breakdown





**HORA**

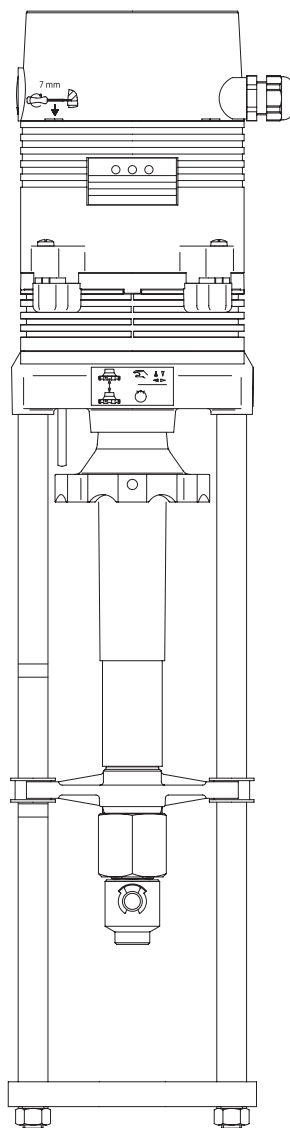
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# Operating Manual

## Linear Actuators

MC250/24 • MC250/230 • MC253/24 • MC253/230  
MC500/24 • MC500/230 • MC503/24 • MC503/230

## General information

Amendment	Version	Date	Modifications
	1.0	August 2004	Initial preparation
	2.0	July 2007	Complete revision and amendment
	2.1	March 2011	Revision

**Copyright** The copyright for this operating manual as well as all rights in case of patent awarding or registration of registered design remains with the manufacturer!

**Subject to alteration** The regulations, directives, standards etc. are compliant with the current state of information at the time of development and are not subject to modification service. They must be applied by the operator at his own responsibility in their latest valid version.

Concerning all data, information, and illustrations in this manual we reserve the right of technical modifications and improvements. No claims can be considered for alteration or rework of already delivered lift drives.

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# 1 Safety

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



**DANGER**

## **DANGER**

Directly threatening hazard leading to death or serious physical injuries.



**WARNING**

## **WARNING**

Potentially hazardous situation which may lead to death or serious physical injuries.



**CAUTION**

## **CAUTION**

Potentially hazardous situation which could lead to minor physical injuries. Indicates a hazard which may cause material damage.



**ATTENTION**

## **ATTENTION**

Potentially hazardous situation where the product or an object in its environment may get damaged.

**Hint:** Utilisation instructions and other useful information.

## 1.1 Proper use

Linear actuators MC250/24, MC250/230, MC253/24, MC253/230, MC500/24, MC500/230, MC503/24, MC503/230 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.

Concurrence 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 is decisive for linear actuator technical data and mains power supply requirements.

Any utilisation for tasks other than the aforementioned usage in accordance with specification and operating with mains power supply ratios other than those permitted is not deemed to be utilisation in accordance with specification. The operator bears sole liability for the risk to persons and machine and other assets in the event of utilisation not in accordance with specification.

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 authorization 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 MC250/24, MC250/230, MC253/24, MC253/230, MC500/24, MC500/230, MC503/24, MC503/230.

### 1.5 During operation

Safe operation is only possible if transportation, storage, installation, operation and maintenance are carried out safely and materially and professionally correctly.

#### **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 and other 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.

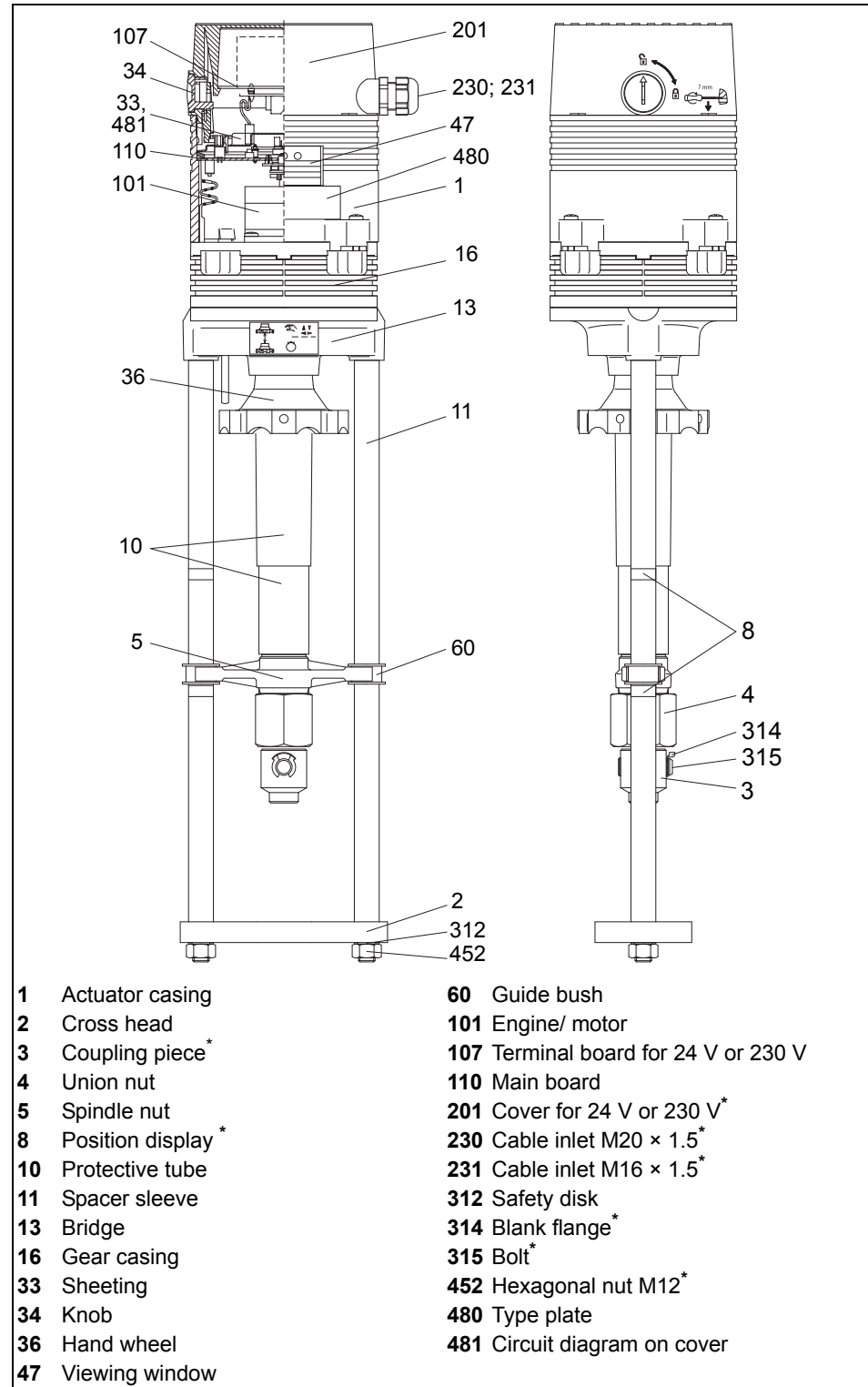
### 1.6 Working environment

Read the data concerning the working environment in the Technical Data.

## 2 Product Specification

The linear actuator controls a step motor with the aid of a microcontroller. The rotational motion of the step motor is transformed into a linear motion via a planetary gearbox and a leadscrew with spindle nut.

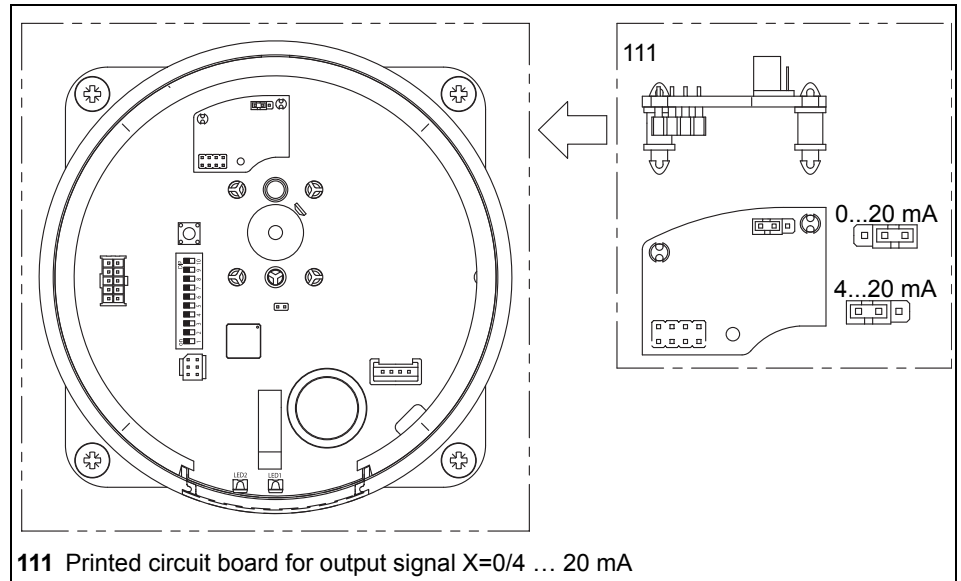
### 2.1 Components



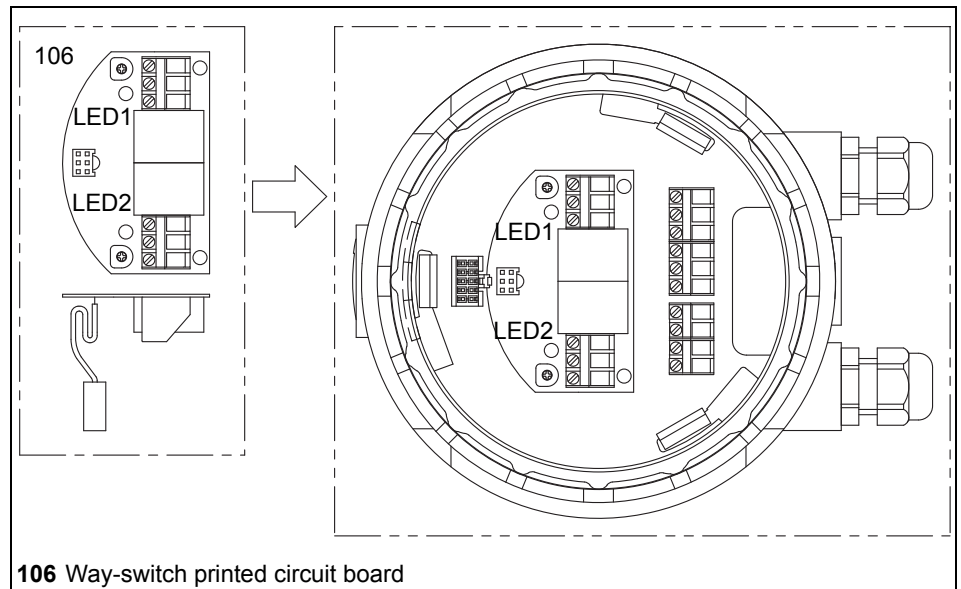
**Diagram 1** Component drawings

\* This component is available as a spare part!

## 2.2 Accessories



**Diagram 2** Printed circuit board for mA output signal on the motherboard



**Diagram 3** Way-switch printed circuit board in cover

## 2.3 Operating modes

The linear actuator can be operated in Manual or Automatic mode.

- The lift is adjusted via the handwheel in Manual mode.
- The lift is electrically controlled in Automatic mode.

### 2.3.1 Continuous mode

In Continuous mode the position of the linear actuator is specified by the system control. The input signal (Y) from the system control in the linear actuator is continually compared with the output signal (X) from the linear actuator for this purpose. The output signal is dependent on the position of the linear actuator (travel) in this instance.

The linear actuator moves until the input signal and the output signal correspond.

**Input signal (Y)** The input signal (Y) from the system control specifies the reference position for the linear actuator. It is an analogue signal on terminal Y.

The following input signals are possible:

- 0 ... 10 V DC / 2 ... 10 V DC
- 0 ... 20 mA / 4 ... 20 mA

**Output signal (X)** The output signal (X) specifies the actual position of the linear actuator. It is an analogue signal on terminal X.

0% to 100% valve lift is output as:

- 0 ... 10 V DC
- 0 ... 20 mA or 4 ... 20 mA (Printed circuit board for output signal as optional extra **(111)**)

### 2.3.2 Three-point mode

The direction of movement is specified via a control voltage on terminal 2 and terminal 3 on the motherboard:

- If the control voltage on terminal 2 is on, the spindle nut extends.
- If the control voltage on terminal 3 is on, the spindle nut retracts.

## 2.4 Functions

### 2.4.1 Binary signal / Frost protection function

Terminals B1 and B2 on the motherboard are bridged in Normal mode. If the circuit between B1 and B2 is broken, the linear actuator stores the actual position and then moves automatically to its limit position.

All other control signals are ignored during this process.

The linear actuator remains in the limit position until the circuit between B1 and B2 is closed again.

- In Three-point mode the linear actuator then returns automatically to the stored position.
- In Continuous mode the reference value of the input signal is again approached.

### 2.4.2 Lock detection

If the linear actuator becomes mechanically locked, it returns briefly and tries again to reach the required position. If this does not happen after a total of 7 attempts, the linear actuator is switched off to avoid damage to linear actuator and actuator.

The lock detection is displayed via the green LED in the **(47)** viewing window.

⇒ *Table 7* on page 30

### 2.4.3 Internal temperature monitoring

The actuator has internal temperature monitoring.

**Overheating protection** If the temperature in the actuator casing exceeds a limit value, the motor will be switched off. Once the motor has cooled down, it is automatically switched on again.

**Actuator heating** If the temperature in the actuator drops below 15 °C, the motor is switched to heating in the operating pauses. The actuator heating switches off automatically at a constant temperature of approx. 22 °C. The actuator heating does not affect the functions of the actuator.

Heating capacity:

- 12.5 W at temperatures from approx. 8 °C to approx. 15 °C
- 18 W at temperatures below 8 °C

The heating prevents the build-up of water condensation in the actuator and at the same time guarantees the smooth running of the gears even at temperatures up to approx. - 10°C.

Heating operation and motor switch-off are displayed via the LED in the **(47)** viewing window.

⇒ *Table 8 Red LED display* on page 30

#### 2.4.4 Open-circuit detection

Open-circuit detection is only available in Continuous mode with an input signal 2 ... 10 V DC and 4 ... 20 mA.

If the input signal drops below 1 V or 2 mA in Continuous mode, the linear actuator moves to the limit position set by coding switch S7.

Open-circuit detection is displayed via the green LED in the **(47)** viewing window.

⇒ *Table 7 Green LED display* on page 30

#### 2.4.5 Set time

The time the spindle nut takes to travel a defined path, is called actuating time. The actuating time is indicated in s/mm. The actuating time is set by coding switch S5.

⇒ *5.3 Set actuating time* on page 23

#### 2.4.6 Hysteresis

The differential of the input signal (Y) required after a reversal of the signal direction so that the spindle nut is moved, is called hysteresis.

It is used to avoid permanent oscillation of the actuator motor around a specific lift position in the event of slight input signal changes.

⇒ *5.4 Set hysteresis* on page 24

#### 2.4.7 Manual mode and feedback signal

The lift can be manually changed in Manual mode without power supply.

- The electronic motor and control are switched off in Manual mode so that lift movements by the control are not possible.
- As soon as the linear actuator is switched to Manual mode, the control switches a signal to Terminal R, if the power supply is on.

⇒ *6.1 Switching between Manual and Automatic modes* on page 29

### 2.4.8 Autotest

If a valve is not actuated over a long period, the valve cone may seize. The Autotest function prevents this. If the Autotest function of the linear actuator is switched on, the linear actuator moves after approx. 10 days without actuation automatically in rapid traverse to the limit position set by coding switch S7 and returns to the starting position.

⇒ 5.6 Set Autotest and Autopause on page 24

### 2.4.9 Autopause

The actuator uses this function to count the actuator commands which mean a change in direction. In the event of more than 20 different directional actuator commands per minute, a compulsory pause of 3 s is imposed.

⇒ 5.6 Set Autotest and Autopause on page 24

### 2.4.10 Potential-free way-switch (optional extra)

The optional way-switch printed circuit board **(106)** can be used to set two lift positions at which a potential-free electrical contact is opened or closed.

⇒ 5.8 Set potential-free way-switch on page 25

## 2.5 Technical data

Type	MC250/24, MC253/24, MC500/24, MC503/24	MC250/230, MC253/230, MC500/230, MC503/230
Supply voltage	24 V AC ± 10% 24 V DC ± 10%	115 V AC ± 10% 230 V AC + 6% -10%
Power consumption	max. 18 VA	max. 25 VA
Weight	MCxx0 = 7 kg MCxx3 = 7,4 kg	MCxx0 = 8,2 kg MCxx3 = 8,6 kg
Dimensions	See Technical Datasheets	
Stroke	max. 2.36 in	max. 2.36 in
Frequency	50/60 Hz ± 5%	50/60 Hz ± 5%
Ambient temperature	-10 to +140.00°F	-10 to +140.00°F
Enclosure protection	IP 54	IP 54
Operating mode	S3-50% ED	S3-50% ED
Set time	3,5 bzw. 5 s/mm	3,5 bzw. 5 s/mm
Actuating power	MC25x = 2,5 kN MC50x = 5 kN	MC25x = 2,5 kN MC50x = 5 kN
	The specified actuating power is only achieved in operation at 24 V DC with rectified AC voltage.	

Table 1 Technical data

<b>Input signal Y/ Input resistor (resistance of load)</b>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 2 ... 10 V DC / 77 k<math>\Omega</math></li> <li>• 0 ... 20 mA / 510 <math>\Omega</math></li> <li>• 4 ... 20 mA / 510 <math>\Omega</math></li> </ul>
<b>Output signal X/ Load capacity</b>	<ul style="list-style-type: none"> <li>• 0 ... 10 V DC / resistance of load <math>\geq</math> 1200 <math>\Omega</math>, <math>I_{\max}</math>. 8 mA</li> <li>• 0 ... 20 mA / resistance of load <math>\leq</math> 500 <math>\Omega</math> - with printed circuit board for output signal as optional extra <b>(111)</b></li> <li>• 4 ... 20 mA / resistance of load <math>\leq</math> 500 <math>\Omega</math> - with printed circuit board for output signal as optional extra <b>(111)</b></li> </ul>
<b>Feedback signal R/Load capacity</b>	<ul style="list-style-type: none"> <li>• 24 V DC / Minimum resistance <math>\geq</math> 480 <math>\Omega</math> / <math>I_{\max}</math>. 35 mA</li> </ul>
<b>Transmission resistance between B1 and B2</b>	<ul style="list-style-type: none"> <li>• max. 10 <math>\Omega</math></li> </ul>

Table 2 Technical Data Signals

## 2.6 Ratingplate

The rating plate is located on the linear actuator casing.

This includes the type designation and the fabrication number (F.No.) with the date of manufacture (last four digits).

⇒ 2.1 Components on page 6



 		
<b>MC500/230</b>		
F.-Nr.: 07204142/01/0607		
AC 50 Hz 230 V	max. 25 VA	5 kN
Y=0...10 V DC	IP 54	5 s/mm
X=0...10 V DC	S3-50% ED	Stroke 60 mm

Diagram 4 Example of a rating plate

## 3 Transport and storage



### Risk of injury in the event of non-compliance with safety regulations!

- Wear the necessary personal and other safety equipment.
- Avoid knocks, shocks, vibrations and similar to the linear actuator.
- Store the linear actuator (and if necessary the complete actuating unit) in a dry place.
- Observe the transportation and storage temperature of -20 to +65°C.

## 4 Assembly

Prior to installation of the linear actuator:

- ⇒ 4.1 Check the scope of supply on page 12
- ⇒ 4.2 Prepare for installation on page 12

Installation of the linear actuator includes the following tasks:

- ⇒ 4.3 Mount linear actuator on valve on page 13
- ⇒ 4.4 Fit/remove cover on page 14
- ⇒ 4.5 Connect the electrics on page 15

### 4.1 Check the scope of supply

- 1 Check the packaging for damage.
- 2 Dispose of the packaging in an environmentally friendly manner.
- 3 Check against the delivery note that the delivery is complete.
- 4 Report any missing or damaged products to the manufacturer.

### 4.2 Prepare for installation



ATTENTION

#### Damage due to valve not being fitted!

If the linear actuator is operated without valve, then the spindle nut may fall out due to the missing stop.

- Therefore, only operate the linear actuator with a valve fitted.

- 1 Ensure that there is space of approx.200 mm above the cover at the installation site.
- 2 Check the working environment prior to fitting the linear actuator and commissioning:
- 3 Ensure that the valve is fitted correctly. See Valve Installation Instructions for further information.
- 4 Determine the installation position of the linear actuator. Linear actuators may not be installed in a suspended position.

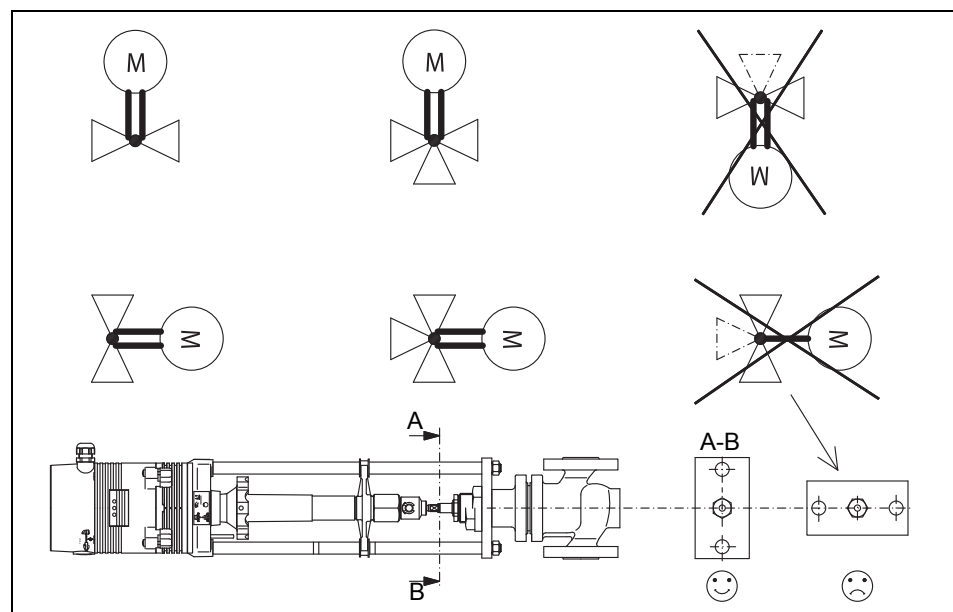
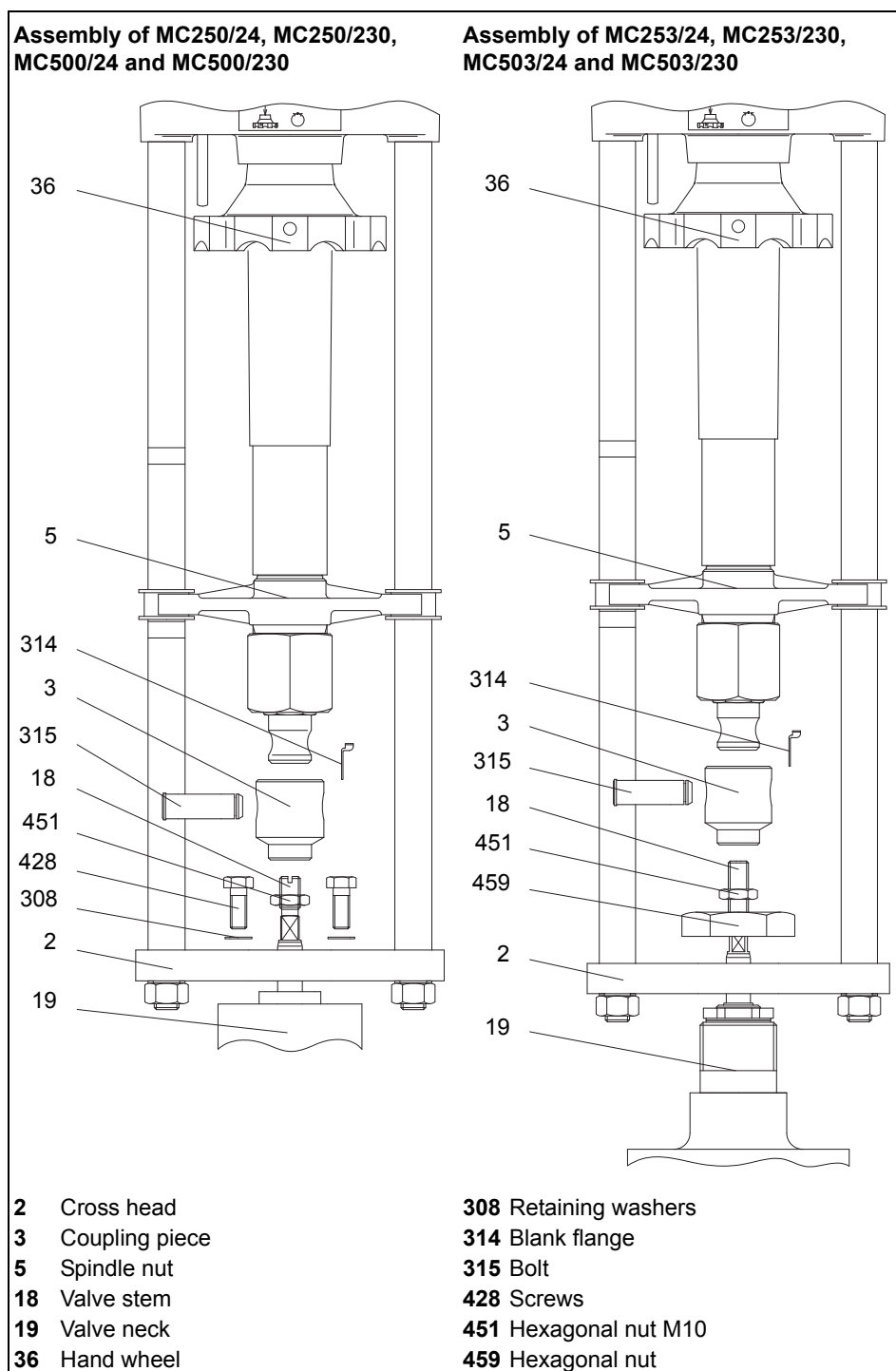


Diagram 5 Installation positions for linear actuator and valve



### 4.3 Mount linear actuator on valve

If the linear actuator and the valve are delivered separately, the linear actuator must then be mounted on the valve.



**Diagram 6** Mount linear actuator on valve

■ **Proceed as follows to install the linear actuator:**

- 1 Remove the blank (314) flange.  
⇒ *Diagram 6* on page 13
- 2 Remove the bolt (315) from the coupling (3) or force it out.

- 3 Rotate the hexagonal nut M10 (451) wrench size 17 onto the valve spindle (18).
  - 4 Rotate the coupling (3) onto the valve spindle (18).
  - 5 Use the flat hexagonal nut to lock the valve spindle (18) to secure it against distortion.
  - 6 Place the actuator with traverse (2) onto the valve neck (19).
  - 7 **For Types MC253, MC503:**  
Fix the traverse (2) with a hexagonal nut (459) wrench size 50.
  - 8 **For Types MC250, MC500:**  
Fix the traverse (2) of the actuator with screws (428) wrench size 13 and retaining washers (308) on the valve neck (19).
  - 9 Use the handwheel (36) to adjust the spindle nut (5) upwards so that the bolt(315) can be refitted.
  - 10 Fit the blank (314) flange!
- **Proceed as follows to dismantle the linear actuator:**
- 1 Carry out the installation sequence steps in reverse order.

#### 4.4 Fit/remove cover

The terminals for the electrical connection are located in the cover.



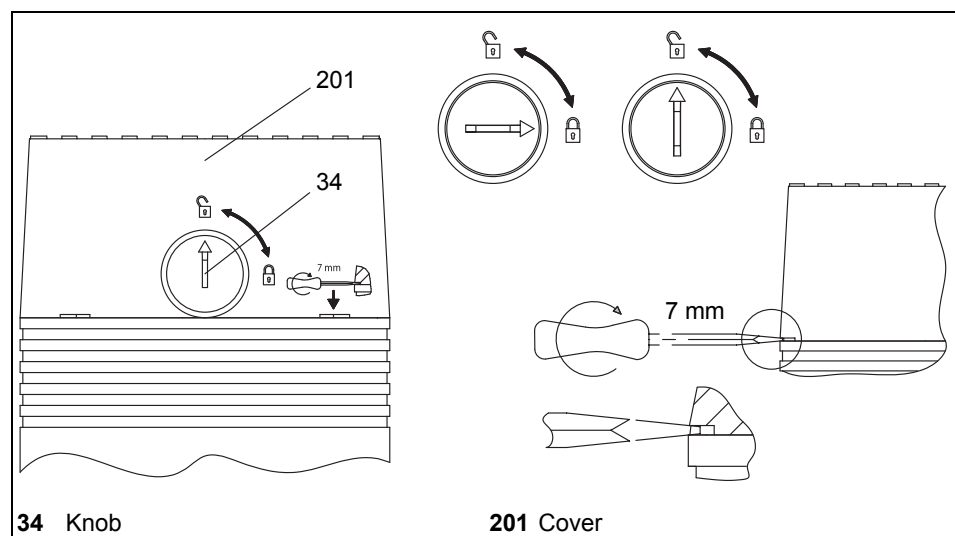
##### Electric shock due to live components!

If the power supply is switched off, there is danger of electric shock due to live components.

- Prior to starting work ensure that the actuator is disconnected safely from the mains power supply.
- Secure against unauthorised switching-on.
- Remove the cover only temporarily.

■ **Proceed as follows to remove the cover:**

- 1 Unlock the cover (201). Use a screwdriver (34) to turn the rotary knob counter-clockwise through 90° as far as the stop.



**Diagram 7** Remove cover

- 2 Insert a screwdriver into a groove in the cover and lift off the (201) cover.



### Damage to the equipment due to damaged wiring!

When removing the cover it is possible to tear or damage the wiring in the cover.

- Remove the cover carefully.

- 3 Remove the cover **(201)** carefully.
  - 4 Disconnect the plug connection between motherboard **(110)** and cover **(201)**.
- **Proceed as follows to replace the cover:**
- 1 Insert the cables previously removed into the plug connector in the motherboard **(110)**.

Take care not to damage the grooves in the plug connector and bush.

**Hint:** The cover **(201)** can be fitted in four different positions offset by 90° respectively. This enables convenient laying of the connecting cable in the event of different installations of the linear actuator.

- 2 Put the cover **(201)** on and press it into place with moderate application of force.
- 3 Check the correct fit of the cover to ensure the tightness of the actuator casing.
- 4 Lock the cover **(201)**. Use a screwdriver **(34)** to turn the rotary knob clockwise through 90° as far as the stop.

## 4.5 Connect the electrics



### Danger of death if carried out by unqualified personnel!

Connection of the electrics by unqualified personnel may cause death, serious physical injury or considerable material damage as a result.

- Ensure that this work is only carried out by qualified personnel.

⇒ 1.3 *Personnel* on page 5



### Electric shock due to live components!

Once the power supply has been switched on, there is risk of electric shock due to live components.

- Prior to starting work ensure that the actuator is disconnected safely from the mains power supply.
- Secure against unauthorised switching-on.

- **Proceed as follows to prepare for the power connection:**
- 1 Ensure that the power supply concurs with the data on the linear actuator rating plate.
  - 2 Design the cable profile in accordance with the actuator power and the necessary cable length in order to avoid operating faults.
  - 3 Lay the mains cables for a power supply of > 48 V separately from the signal and control cables.

If the cables are laid in a common cable duct, screened control cables must be used.

**4** Check the power supply voltage.

If the required tolerance of the power supply voltage cannot be maintained with a mains transformer, an AC voltage regulator must be used.

⇒ 2.5 Technical data on page 10.

■ **Proceed as follows to switch the electrics on:**

**1** Remove the **(201)** cover.

⇒ Proceed as follows to remove the cover: on page 14.

**2** Feed the cable through the screw connector in the cover to the terminal strip.

**3** Connect the electrics in accordance with the circuit diagram.

⇒ Diagram 8 on page 16

**Hint:** The circuit diagram **(481)** is located on the printed circuit board cover **(33)**.



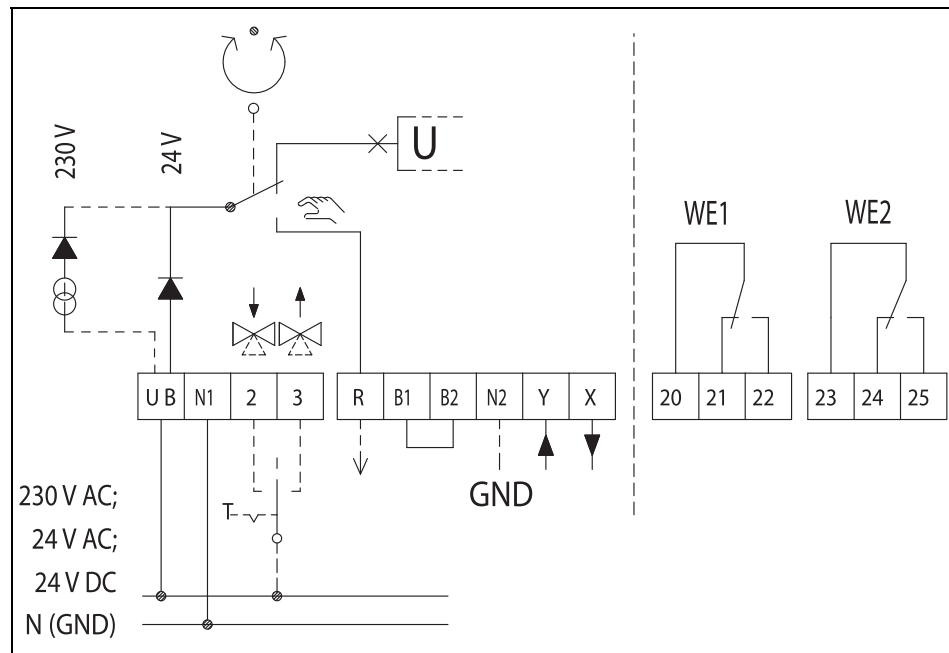
**Malfunction due to incorrect zero potential!**

If the linear actuator is electrically supplied by signal generators with different zero potentials, this may cause incorrect dynamic performance.

- Ensure that the zero potentials are correctly used.

⇒ Table 3 on page 17

**4** Tighten the screw connections.



**Diagram 8** Wiring diagram

Terminal	Description
<b>UB, N1</b>	Supply voltage
<b>2</b>	Control voltage for downward movement in Three-point mode
<b>3</b>	Control voltage for upward movement in Three-point mode
<b>R</b>	Feedback signal in "Manual mode" • R= 24 V DC max. 35 mA
<b>B1, B2</b>	Binary input / Frost protection function
<b>N2</b>	Zero potential for signals X, Y and R • If the zero potentials for signals X, Y and R are identical to the zero potential for the power supply, terminals N1 and N2 can be bridged. • If the actuator is operated in Continuous mode at 230 V, N2 must be closed. • If the actuator is operated in Three-point mode at 230 V, N2 must be closed, if X and R also need to be used.
<b>Y</b>	Input signal for Continuous mode
<b>X</b>	Output signal for Continuous mode
<b>20, 21, 22</b>	Terminals for way-switch unit WE1
<b>23, 24, 25</b>	Terminals for way-switch unit WE2

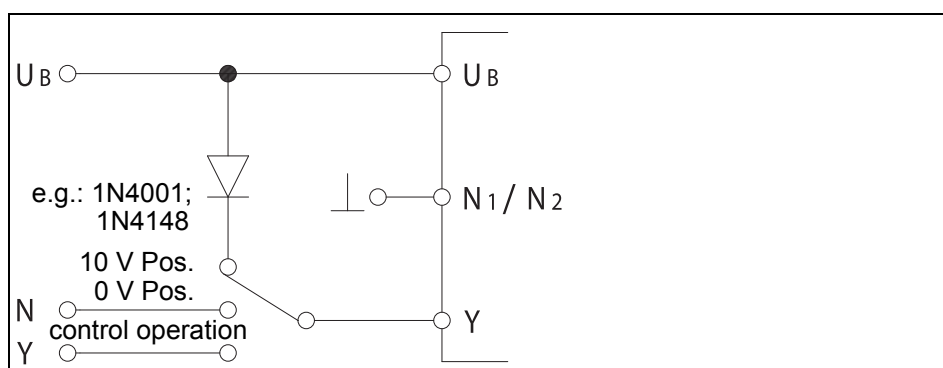
**Table 3** Circuit diagram legend

#### 4.5.1 Control-independent switching

If operating with 24 V power supply and 0 ... 10 V DC / 2 ... 10 V DC input signal, the actuator can be switched to control-independent using the three-stage switch in the control cabinet.

■ **Proceed as follows to switch the actuator to control-independent:**

- 1 Connect the 24 V AC power supply via a diode and a three-stage switch to terminal Y.



**Diagram 9** Control-independent switching

- 2 This switch can be used to move the linear actuator into the following positions:
    - Control mode through input signal Y (Normal mode)
    - 10 V-Position
    - 0 V-Position, at 2 ... 10 V DC the linear actuator can be moved to the position selected by coding switch S7.
- ⇒ 5.1 *Operating parameters and coding switch positions* on page 22  
5.7 *Set limit position* on page 25

### 4.5.2 Remove printed circuit board cover

The printed circuit board cover must be removed **(33)** first in order to adjust the linear actuator via the coding switches.

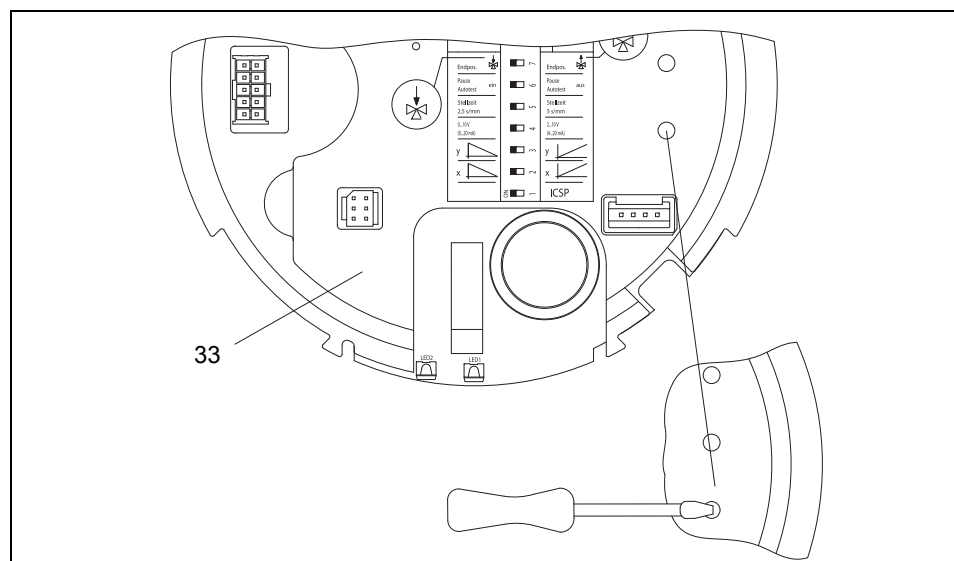


#### Electric shock due to live components!

If the power supply is switched off, there is danger of electric shock due to live components.

- Prior to starting work ensure that the actuator is disconnected safely from the mains power supply.
- Secure against unauthorised switching-on.

- 1 Insert a screwdriver into a groove in the cover **(201)** and lift the **(201)** cover out.
- 2 Insert a small screwdriver into the groove provided in the printed circuit board cover for this purpose**(33)** and remove it with care.



**Diagram 10** Remove the printed circuit board cover from the actuator casing.

- 3 Once the printed circuit board cover**(33)** has been removed from the actuator casing, **(1)** coding switches S1 to S10 will be accessible.

### 4.6 Optional extras installation

Optional extras are only part of the scope of supply of the linear actuator if expressly ordered! The linear actuators are prepared for retrofitting the following:

- Way-switch printed circuit board **(106)**
- Printed circuit board for output signal  $X=0/4 \dots 20 \text{ mA}$  **(111)**

⇒ 2.2 *Accessories* on page 7

### 4.6.1 Way-switch printed circuit board installation

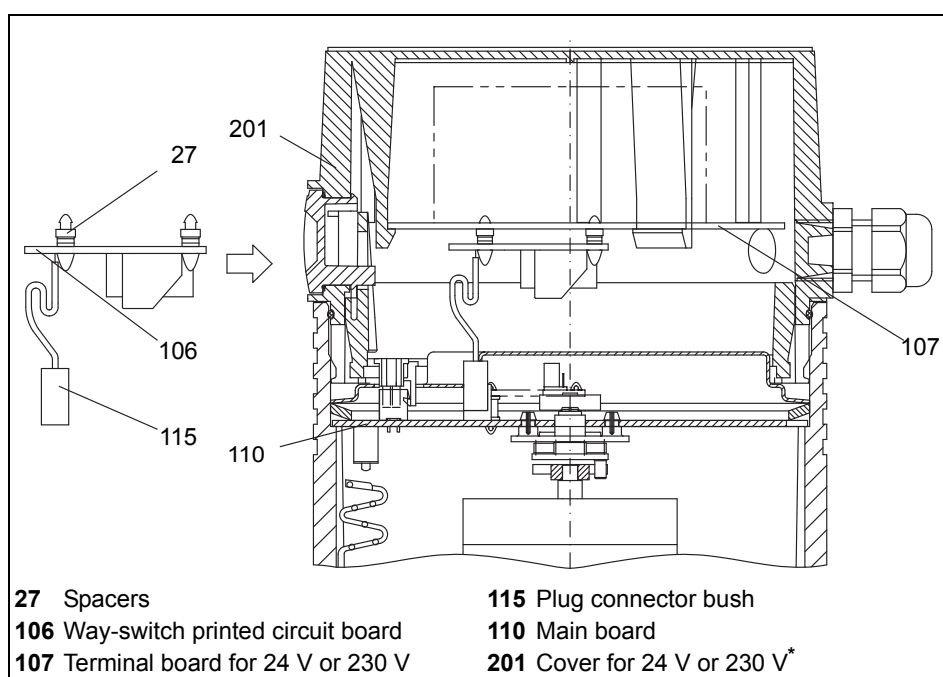


#### Electric shock due to live components!

If the power supply is switched off, there is danger of electric shock due to live components.

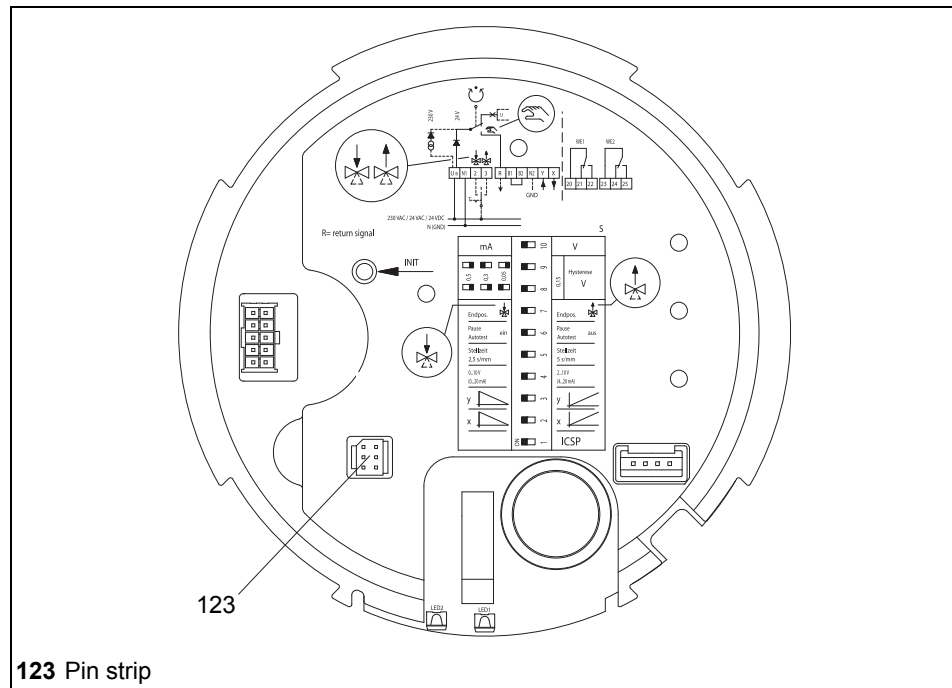
- Prior to starting work ensure that the actuator is disconnected safely from the mains power supply.
- Secure against unauthorised switching-on.

- 1 Open the linear actuator **(201)** cover.  
⇒ 4.4 Fit/remove cover on page 14
- 2 Press the way-switch printed circuit board **(106)** onto the terminal board **(27)** using the **(107)** three spacers.



**Diagram 11** Installation of the way-switch printed circuit board in the cover

- 3 Place the plug connector bush **(115)** for the way-switch printed circuit board **(106)** on the pin strip **(123)** on the **(110)** motherboard. Pay attention to the grooves in the pin strip and plug connector bush.



**Diagram 12** Pin strip for way-switch printed circuit board on the motherboard

- 4 Adjust the way-switch.  
⇒ 5.8 Set potential-free way-switch on page 25

#### 4.6.2 Fit the printed circuit board for mA output signal.



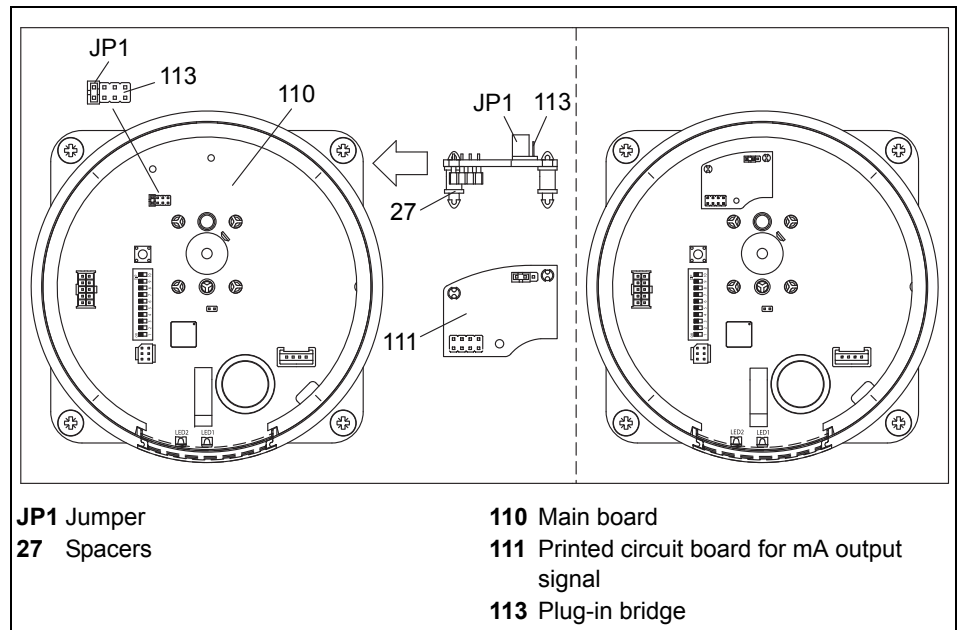
##### Electric shock due to live components!

If the power supply is switched off, there is danger of electric shock due to live components.

- Prior to starting work ensure that the actuator is disconnected safely from the mains power supply.
- Secure against unauthorised switching-on.

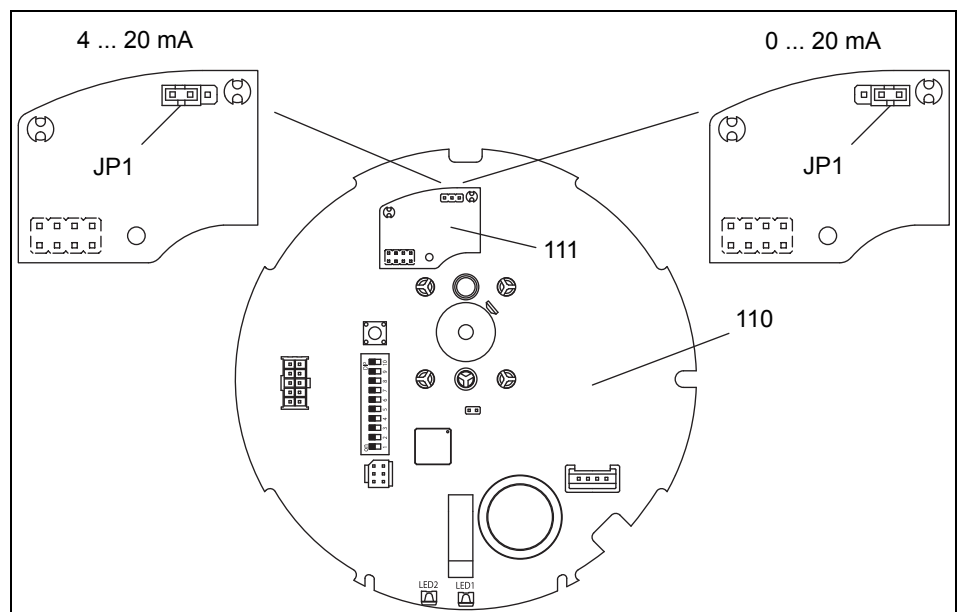
- 1 Open the cover (**201**) and remove the printed circuit board cover(**481**).  
⇒ 4.4 Fit/remove cover on page 14  
⇒ 4.5.2 Remove printed circuit board cover on page 18
- 2 Remove the jumper (**JP1**) from the motherboard (**110**).
- 3 Put the jumper (**JP1**) onto the plug-in bridge (**113**) for the printed circuit board for mA output signal.
- 4 Plug the printed circuit board for mA output signal (**111**) together with its pin strip into the plug-in bridge (**113**) on the motherboard (**110**).
- 5 Lock the spacers (**27**) into the holes in the motherboard.





**Diagram 13** Installation of the printed circuit board for mA output signal

- 6** Select the output signal range with the jumper (**JP1**):
- Jumper right: 0 ... 20 mA
  - Jumper left: 4 ... 20 mA



**Diagram 14** Set signal range for mA output signal X

## 5 Commissioning



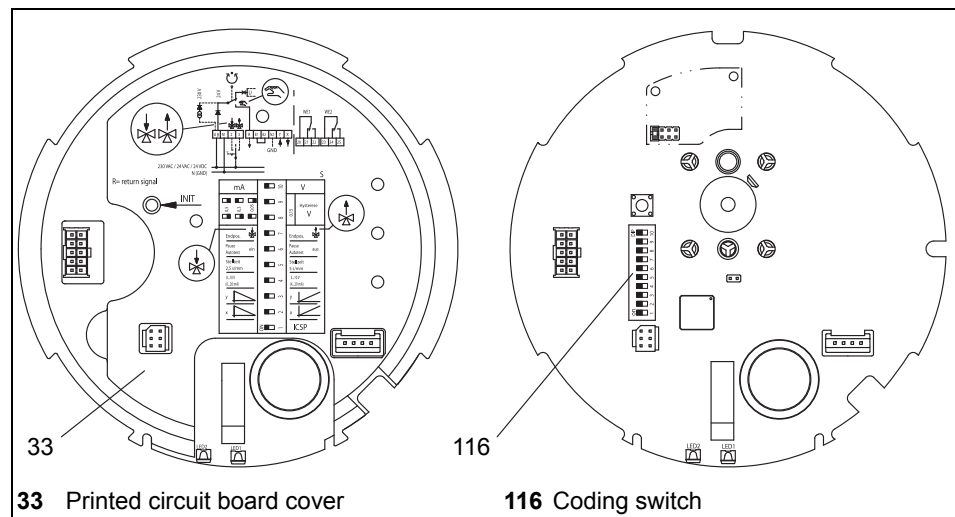
### Electric shock due to live components!

If the power supply is switched off, there is danger of electric shock due to live components.

- Prior to starting work ensure that the actuator is disconnected safely from the mains power supply.
- Secure against unauthorised switching-on.

The operating parameters are set (**116**) on the coding switches. The coding switches are located under the printed circuit board cover (**33**) in the actuator casing (**1**).

- ⇒ 4.4 Fit/remove cover on page 14
- ⇒ 4.5.2 Remove printed circuit board cover on page 18



**Diagram 15** Printed circuit board cover and coding switches

### 5.1 Operating parameters and coding switch positions

The operating parameters must be set with the coding switches before the linear actuator can be operated.



### Malfunctions due to incorrect switch position S1

Switch S1 must always be at "on".

- Ensure that switch S1 is at "on".

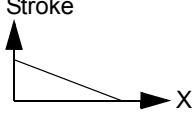
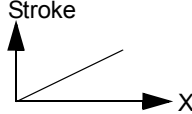
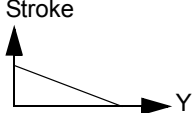
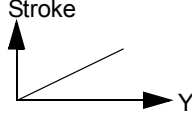
Switch	on	off
S1	Ready for operation	-
S2	X characteristic curve 	X characteristic curve 
S3	Y characteristic curve 	Y characteristic curve 
S4	Input signal (Y) 0 ... 10 V DC or 0 ... 20 mA	Input signal (Y) 2 ... 10 V DC or 4 ... 20 mA
S5	Actuating time 3.5 s/mm	Actuating time 5 s/mm
S6	Autotest and Autopause on	Autotest and Autopause off
S7	Limit position for actuator spindle extended	Limit position for actuator spindle retracted
S8, S9	The hysteresis (0.05 ... 0.5 V) is set using S8 and S9.	
S10	Input signal (Y) in mA	Input signal (Y) in V

Table 4 Coding switch positions

## 5.2 Set input signal

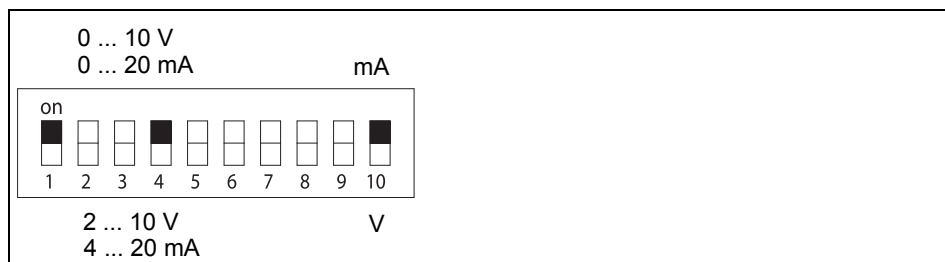


Diagram 16 Set input signal

⇒ Further information: *Input signal (Y)* on page 8

## 5.3 Set actuating time

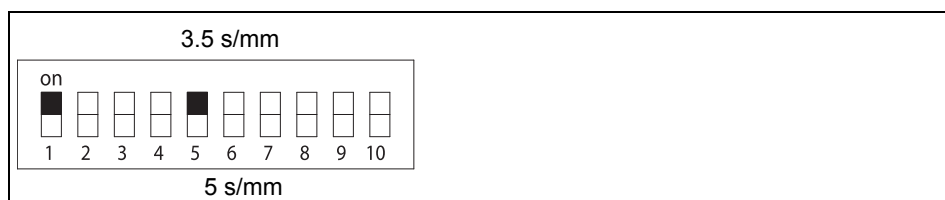


Diagram 17 Set actuating time

⇒ Further information: 2.4.5 *Set time* on page 9

### 5.4 Set hysteresis

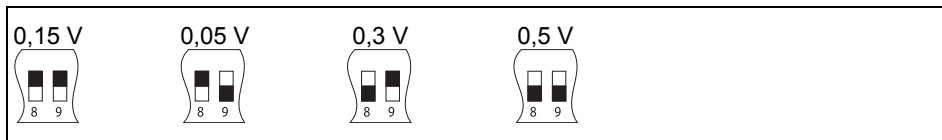


Diagram 18 Set hysteresis

⇒ For further information 2.4.6 Hysteresis on page 9

### 5.5 Set actuating direction

The actuating direction of the linear actuator can be reversed at the coding switch (inverted operation).

Actuator position	Normal operation	Inverted operation (X and Y inverted)
<p>Coding switch S2: X (output signal), coding switch S3: Y (input signal)</p>		

Table 5 Set actuating direction

### 5.6 Set Autotest and Autopause

If coding switch S6 is at ON, Autotest and Autopause are active.

Approaching the limit switch in rapid traverse is triggered approx. every 10 days in Autotest. A new zero balance is carried out automatically.

A 3-second pause (2-minute measuring cycle) is carried out in Autopause after more than 20 actuator commands in different directions per minute.

It is not possible to select these two functions separately.

## 5.7 Set limit position

Select the limit position for the linear actuator using coding switch S7:

- S7 ON: Limit position with extended spindle nut
- S7 OFF: Limit position with retracted spindle nut

The limit position is approached in the following situations:

- In the event of open-circuit detection by the Y signal (only for 2 ... 10 V DC or 4 ... 20 mA),
- In the event of a binary signal (circuit is broken between terminals B1 and B2),
- in Autotest,
- upon disruption of the power supply (manual adjustment).

## 5.8 Set potential-free way-switch

Set the two way-switches via trimmer potentiometers P1/P2 independently from one another. Carry out the specified working steps for each way-switch once.

### ■ Proceed as follows to set a way-switch:

- 1 Ensure that the linear actuator has been started up and initialised.

⇒ 5.10 Commissioning on page 28

5.9 Initialise the path-measuring system on page 27



### Malfunction due to inaccurately set way-switch!

If the actuator has been set to Manual mode (without power supply), the way-switch can only be set inaccurately (Centre position of the arm corresponds to the switching point for approx. 50% lift in this instance).

- Switch the actuator to Automatic mode in order to set the way-switch accurately.

- 2 Move the actuator into a position where a switching event should be triggered.

The following working steps must be carried out with the power supply switched on.

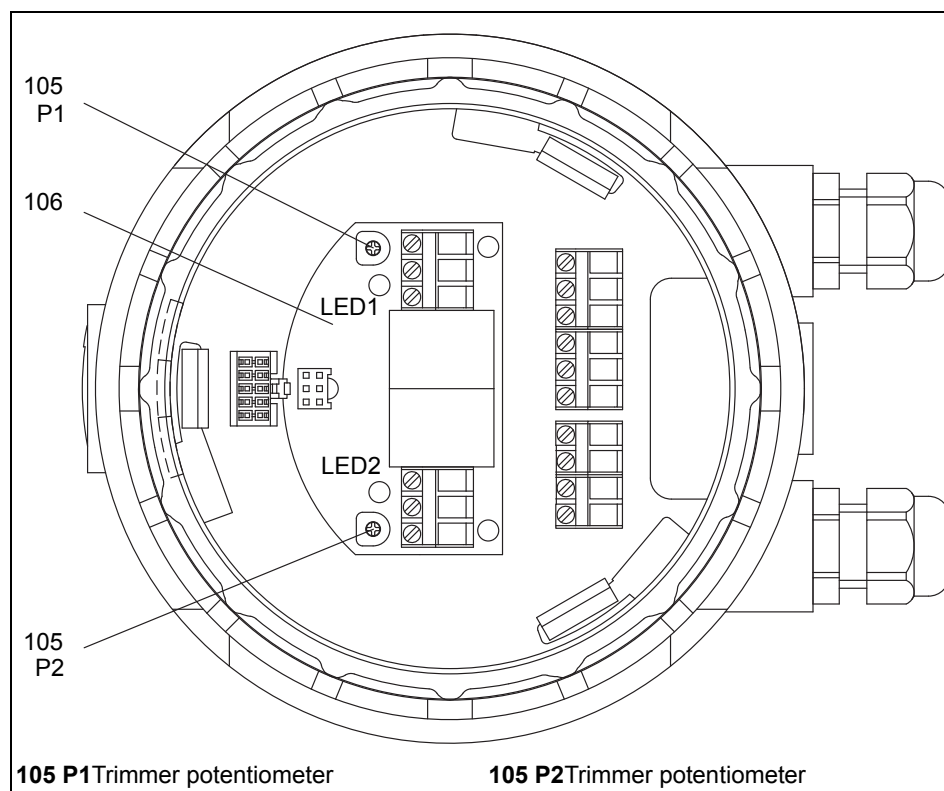


### Electric shock due to live components!

Once the power supply has been switched on, there is risk of electric shock due to live components.

- Take care not to touch any live components.
- Take care not to cause a short circuit on a printed circuit board with the tool.

- 3 Open the cover **(201)**.  
⇒ 4.4 Fit/remove cover on page 14  
The way-switch printed circuit board is located in the cover **(106)**.
- 4 Use a screwdriver to turn the trimmer potentiometer until the way-switch switches. The associated LED goes on or off during this operation.  
Use potentiometer P1 **(105 P1)** to set way-switch 1.  
LED 1 indicates the switching status.  
Use potentiometer P2 **(105 P2)** to set way-switch 2.  
LED 2 indicates the switching status.



**Diagram 19** Way-switch printed circuit board in cover

- 5 Observe the permitted way-switch contact load:

<b>Nominal load</b>	8 A, 250 V AC 8 A, 30 V DC
<b>Switching voltage</b>	max. 400 V AC max. 125 V DC

**Table 6** Way-switch contact load

- 6 Switch off the power supply to the actuator and connect the way-switch contacts.
- 7 Close the linear actuator **(201)** cover  
⇒ Proceed as follows to replace the cover: on page 15

## 5.9 Initialise the path-measuring system



### Linear actuator starts up automatically!

Immediately upon connecting the power supply, the linear actuator moves automatically to a path-measuring system reference point.

- Wait until the reference point has been reached and the linear actuator stops.

The incremental path-measuring system must be initialised upon completion of the following tasks:

- In the event of initial start-up
- After repairs to the valve or the actuator
- After changing the valve or the actuator

The initialisation can be triggered in two ways.

### ■ Proceed as follows to initialise via the initialising button

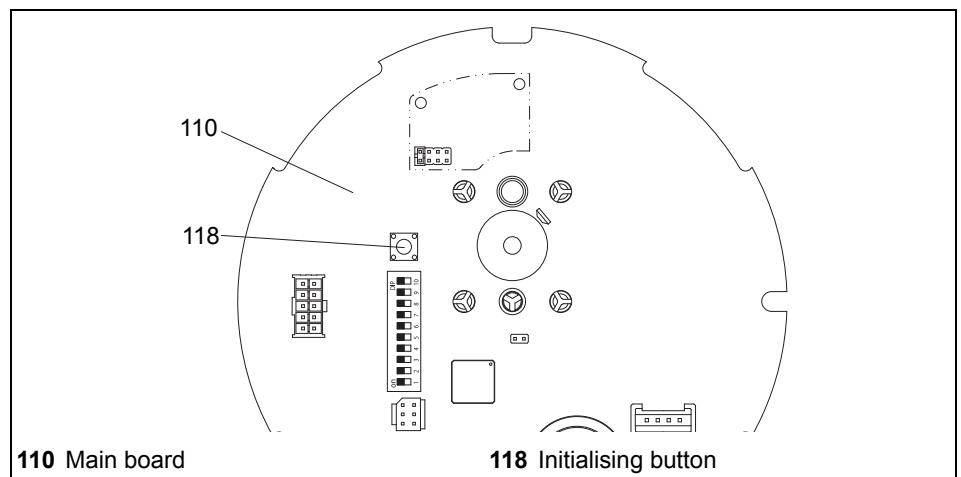


### Electric shock due to live components!

Once the power supply has been switched on, there is risk of electric shock due to live components.

- Take care not to touch any live components.
- Take care not to cause a short circuit on a printed circuit board with the tool.

- 1 Open the cover **(201)**.  
⇒ 4.4 Fit/remove cover on page 14
- 2 Ensure that the power supply is on.
- 3 Press the initialising button **(118)** and keep it depressed for at least 1 second.



**Diagram 20** Initialise the path-measuring system

### ■ Proceed as follows to initialise via the connecting terminals

- 1 Connect the power supply simultaneously to terminals 2 and 3. Ensure that the power supply remains on for at least 1 second.  
⇒ Diagram 8 on page 16

### 5.10 Commissioning

- 1 Check that all installation and assembly tasks have been completed correctly.  
⇒ *4 Assembly* on page 12
- 2 Ensure that the electric actuation of the linear actuator is ensured without danger to persons or equipment or the system.
- 3 Ensure that the linear actuator is correctly fixed and the linear actuator cover is closed.  
⇒ *4.4 Fit/remove cover* on page 14
- 4 Ensure that the linear actuator is switched to Automatic mode.  
⇒ *6.1 Switching between Manual and Automatic modes* on page 29
- 5 Ensure that the operating parameters have been correctly set.  
⇒ *5.1 Operating parameters and coding switch positions* on page 22
- 6 Ensure that the path-measuring system has been initialised.  
⇒ *5.9 Initialise the path-measuring system* on page 27
- 7 Connect the power supply. Then the linear actuator moves to the reference point.

The linear actuator is ready for operation.



## 6 Operation

Before the linear actuator can be operated, it must be initialised and the operating mode selected.

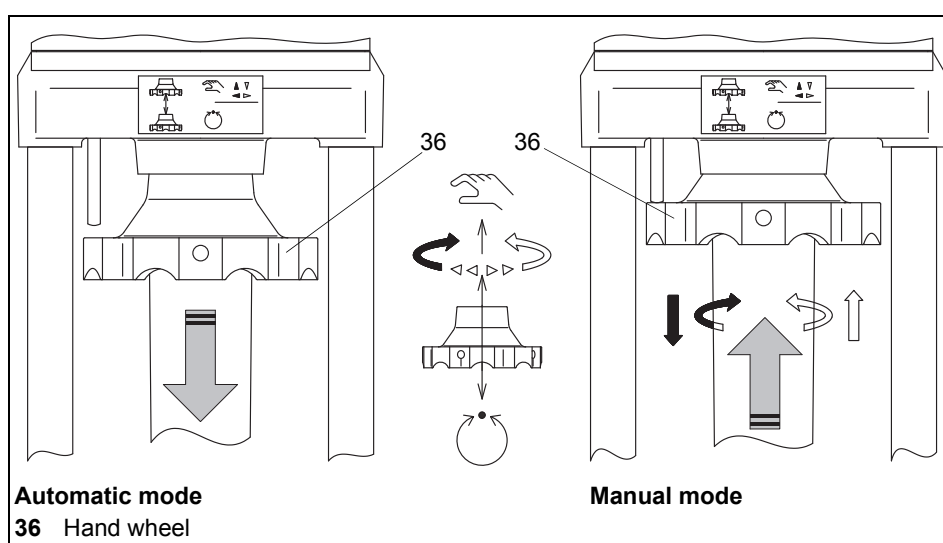
⇒ 5 Commissioning on page 22

5.9 Initialise the path-measuring system on page 27

### 6.1 Switching between Manual and Automatic modes

The linear actuator can be operated in Automatic mode or in Manual mode (manual adjustment).

- In Automatic mode the spindle nut moves into the position specified by the control.
- In Manual mode the spindle can be adjusted manually, e.g. for inspection purposes. The output signal (X) is not available in Manual mode.



**Diagram 21** Select Automatic mode

#### ■ Proceed as follows to switch to Manual mode

- 1 Move the handwheel (36) into the manual mode position and rotate it until the handwheel locks.



#### **Risk of damage to valve and actuator in Manual mode!**

The valve can get damaged if it is pressed too firmly into its seat when closing in Manual mode.

- Do not rotate the handwheel any further if the amount of effort needs to be increased!
- Never use force.

- 2 Use the handwheel to rotate the spindle nut into the required position. Rotate the handwheel until the rotational resistance increases. Do not use force!

#### ■ Proceeds as follows to switch to Automatic mode

- 1 Move the handwheel (36) into the automatic mode position.
- 2 The linear actuator moves first of all into the position specified by coding switch S7 and then into the position specified by the control.

## 6.2 LED display

The LEDs in the viewing window (47) indicate operating states or faults.

⇒ 10.2 Operating faults checklist on page 32










Green LED	Operating status / fault
 duration	<b>Normal operation, standby</b> The LED illuminates continuously, actuator awaits drive command.
 ⊗  ⊗ 0,5s 0,5s 0,5s 0,5s	<b>Standard Operation</b> Actuator carries out drive command.
 ⊗  ⊗ 0,2s 1,5s 0,2s 1,5s Short - long rhythm	<b>Open-circuit detection</b> In operating modes 2 ... 10 V DC or 4 ... 20 mA, the input signal has dropped below 1 V or below 2 mA. ⇒ 2.4.4 Open-circuit detection on page 9
 ⊗  ⊗ 2,5s 2,5s 2,5s 2,5s Long - long rhythm	<b>Lock detection (only in Continuous mode)</b> The linear actuator is mechanically locked. ⇒ 2.4.2 Lock detection on page 8
 ⊗  ⊗ 1,5s 0,2s 1,5s 0,2s Long - short rhythm	<b>Continuous signal on terminals 2 and 3</b> An initialisation run starts in the event of simultaneous control signal on terminals 2 and 3 (max. 4 attempts). The linear actuator switches off automatically after 4 failed attempts.

Table 7 Green LED display





Red LED	Operating status / fault
 OFF	<b>Temperature within normal range</b>
 duration	<b>Heating operation</b> ⇒ Actuator heating on page 9
 ⊗  ⊗ 0,25s 0,25s 0,25s 0,25s Flashes regularly	<b>Actuator overheats</b> ⇒ Overheating protection on page 8

Table 8 Red LED display

## 7 Maintenance, Care and Repairs

The linear actuator is low-maintenance. No routine or periodic maintenance is required.

## 8 Spare parts

Check the data on the linear actuator rating plate when ordering optional extras or spare parts. The data on the rating plate is decisive for linear actuator technical data and mains power supply requirements.



### Equipment damage due to defective spare parts!

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

- Use only original spare parts.

⇒ 2.1 Components on page 6

⇒ 2.2 Accessories on page 7

## 9 Shutdown and Disposal

Dispose of the linear actuator in accordance with national regulations and legislation.

## 10 Troubleshooting

The path-measuring system needs to be re-initialised after troubleshooting.

⇒ 5.9 Initialise the path-measuring system on page 27

### 10.1 Troubleshooting

If the linear actuator does not work perfectly, proceed as follows to eliminate the fault:

- 1 Check that the linear actuator was installed correctly.
- 2 Check the linear actuator settings and the rating plate data.
- 3 Eliminate the faults using the checklist.  
⇒ 10.2 Operating faults checklist on page 32
- 4 If this fault still cannot be eliminated, contact the manufacturer.
- 5 Please quote the following for all queries and returning goods to the manufacturer:
  - F-No. (Fabrication No. = Contract No.)
  - Type designation
  - Power supply and frequency
  - Additional equipment
  - Error report
- 6 If the fault cannot be eliminated by the inquiry, the equipment can be returned to the manufacturer.

## 10.2 Operating faults checklist

Fault	Cause/reason	Remedy
1. Linear actuator does not work.	Handwheel (36) is in manual mode position	<input type="checkbox"/> Switch handwheel to automatic mode position.
	Mains power failure	<input type="checkbox"/> Establish cause and eliminate.
	Fuse defective. (in the electrical cabinet)	<input type="checkbox"/> Establish cause and eliminate, change fuse.
	Linear actuator incorrectly connected	<input type="checkbox"/> Rectify connection in accordance with circuit diagram (on the cover).
	Short circuit due to humidity	<input type="checkbox"/> Establish cause, dry the linear actuator, change hood seal and screw connections if necessary ad/or fit protective hood.
	Short circuit due to incorrect connection	<input type="checkbox"/> Rectify connection
2. Linear actuator runs in an unstable manner, i.e. switches between clockwise and counter-clockwise rotation.	Motor has coil damage (burnt out) <ul style="list-style-type: none"> <li>• e.g. due to too high voltage</li> <li>• Electronic system defective</li> </ul>	<input type="checkbox"/> Establish cause, measure current data Compare with rating plate and table, Remove linear actuator and return to manufacturer for repair.
	Voltage drop due to too long connecting cables and/or too small cross-section.	<input type="checkbox"/> Measure linear actuator current data, recalculate and change connecting cables if necessary.
3. Linear actuator cuts out from time to time or initialises frequently.	Mains power fluctuations greater than permissible tolerance ⇒ 2.5 <i>Technical data</i> on page 10	<input type="checkbox"/> Improve mains power ratios
	Supply cable has loose contact	<input type="checkbox"/> Check and tighten connections (terminal strips)
4. Linear actuator does not move to the limit positions. Valve does not close/open.	Valve jams	<input type="checkbox"/> Ensure smooth running valve
	Too high system pressure	<input type="checkbox"/> Correct system pressure
5. Linear actuator does not move or does not move correctly to the position specified by input signal Y.	Input signal Y faulty: <ul style="list-style-type: none"> <li>• Error signals</li> <li>• Signal fluctuations</li> </ul>	<input type="checkbox"/> Check input signal Y on linear actuator, eliminate cause of fault
	Motherboard faulty	<input type="checkbox"/> Change motherboard, remove linear actuator and return to manufacturer for repair if necessary.
6. Green LED flashes in long / long rhythm	Lock detection has responded	<input type="checkbox"/> Press INIT and observe actuator during initialisation. <input type="checkbox"/> Check valve for smooth running over entire lift range.
7. Green LED flashes in short / long rhythm	Open circuit detected	<input type="checkbox"/> Measure reference value voltage or current on linear actuator.
8. Green LED flashes in long / short rhythm	Relay contact adherence	<input type="checkbox"/> Check control
9. Red LED flashes regularly	Actuator overheats	<input type="checkbox"/> Motor has switched off automatically. Automatic start-up after cooling down

**Table 9** Operating faults checklist