

## RHD250 to 4000 (Contrac)

### Electrical rotary actuator



Electrical rotary actuator for the operation of final control elements.

—  
RHDE250  
RHDE500  
RHDE800  
RHDE1250  
RHDE2500  
RHDE4000

### Introduction

Compact actuator for the operation of final control elements with preferably 90° rotary movement such as valve flaps, ball valves, etc.

The nominal torque is transferred through a lever actuator. A special electronic unit controls the actuator. The special electronic unit serves as the interface between actuator and control system.

### Additional Information

Additional documentation on RHD250 to 4000 (Contrac) is available for download free of charge at [www.abb.com/actuators](http://www.abb.com/actuators).

Alternatively simply scan this code:



## Table of contents

<b>1 Safety</b> .....	<b>3</b>	Fuses .....	24
General information and instructions.....	3	Electronic unit for field installation.....	24
Warnings.....	3	Electronic units for rack installation .....	24
Intended use .....	4	Fuse location EBN853 .....	25
Improper use.....	4	Fuse location EBN861 / EBS862.....	25
Notes on data safety .....	4	External fuses for EBN861 / EBS862 .....	26
Warranty provisions.....	4	Fuse location in EBS852.....	26
Manufacturer's address.....	4		
<b>2 Introduction</b> .....	<b>5</b>	<b>6 Exchange of position sensor</b> .....	<b>27</b>
Safety and precautions.....	5	Dismounting.....	27
Tools .....	5	Mounting.....	27
		Mounting.....	28
<b>3 Lubrication</b> .....	<b>6</b>	<b>7 Electrical test values</b> .....	<b>29</b>
Mounting position.....	6	Test values (position sensor) .....	29
Oil change.....	6	Test values (Brake and Motor) .....	30
RHD oil types.....	7	Brake voltage.....	30
		Motor voltage .....	30
<b>4 Maintenance</b> .....	<b>8</b>	Winding resistance .....	30
Safety instructions.....	8	<b>8 Troubleshooting</b> .....	<b>31</b>
General .....	8	LED signals at commissioning and service field.....	31
Lever .....	8		
Lever removal.....	8	<b>9 Troubleshooting</b> .....	<b>31</b>
Lever installation .....	9	General.....	32
Ball-and-socket-joint .....	9	Failures at brake, fuse or wiring .....	33
Tightening torques and dimensions of lever screws ..	10	Operation mode (MAN / AUT) .....	34
Sealing ring of output drive shaft.....	11	Input configuration .....	35
Sealing ring of hand wheel drive / hand wheel shaft .....	12	Operation behind step controller .....	36
Sealing of the position sensor drive .....	12	Failure Diagram.....	37
RHD250...RHD800 .....	12	Failure due to response of positioning loop monitoring	
RHD1250... RHD4000 .....	13	38	
Motor.....	13	General.....	38
Motor assignment and tightening torque.....	13	User interface menus.....	39
Motor removal.....	14		
Motor flange O-ring .....	14		
Motor disassembly / assembly .....	15		
Exchange of motor bearings.....	18		
Exchange of motor shaft sealing ring .....	18		
Brake adjustment.....	19		
Brake of motor series 1 .....	19		
Brake of motor series 2.....	19		
<b>5 Electrical connections</b> .....	<b>20</b>		
General .....	20		
Covers.....	20		
Electronic Unit EBN853 (Contrac) / EBN861 (Contrac) /			
EBS862 (Contrac) .....	21		
Analog / Digital.....	21		
PROFIBUS DP®.....	22		
Electronic Unit EBN852 (Contrac) .....	23		
Analog / Digital.....	23		

# 1 Safety

## General information and instructions

These instructions are an important part of the product and must be retained for future reference.

Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly. The specialist personnel must have read and understood the manual and must comply with its instructions.

For additional information or if specific problems occur that are not discussed in these instructions, contact the manufacturer.

The content of these instructions is neither part of nor an amendment to any previous or existing agreement, promise or legal relationship.

Modifications and repairs to the product may only be performed if expressly permitted by these instructions.

Information and symbols on the product must be observed.

These may not be removed and must be fully legible at all times.

The operating company must strictly observe the applicable national regulations relating to the installation, function testing, repair and maintenance of electrical products.

## Warnings

The warnings in these instructions are structured as follows:

### **DANGER**

The signal word '**DANGER**' indicates an imminent danger. Failure to observe this information will result in death or severe injury.

### **WARNING**

The signal word '**WARNING**' indicates an imminent danger. Failure to observe this information may result in death or severe injury.

### **CAUTION**

The signal word '**CAUTION**' indicates an imminent danger. Failure to observe this information may result in minor or moderate injury.

### **NOTICE**

The signal word '**NOTICE**' indicates possible material damage.

### **Note**

'**Note**' indicates useful or important information about the product.

## ... 1 Safety

### Intended use

Control actuators are used exclusively for operating final control elements (valves, valve flaps, etc.).

They may only be operated using a suited Contrac electronic unit for field installation or mounting rack installation.

In addition to this operating instruction, the relevant documentation for the electronic unit and software tool must be observed.

### Improper use

The following are considered to be instances of especially improper use of the device:

- For use as a climbing aid, for example for mounting purposes.
- For use as a bracket for external loads, for example as a support for piping, etc.
- Material application, for example by painting over the housing, name plate or welding/soldering on parts.
- Material removal, for example by spot drilling the housing.

### Notes on data safety

This product is designed to be connected to and to communicate information and data via a network interface.

It is operator's sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be).

Operator shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and / or theft of data or information.

ABB Automation Products GmbH and its affiliates are not liable for damages and / or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and / or theft of data or information.

### Warranty provisions

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using underqualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

### Manufacturer's address

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32425 Minden

Germany

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#### Customer service center

Tel: +49 180 5 222 580

Email: [automation.service@de.abb.com](mailto:automation.service@de.abb.com)

## 2 Introduction

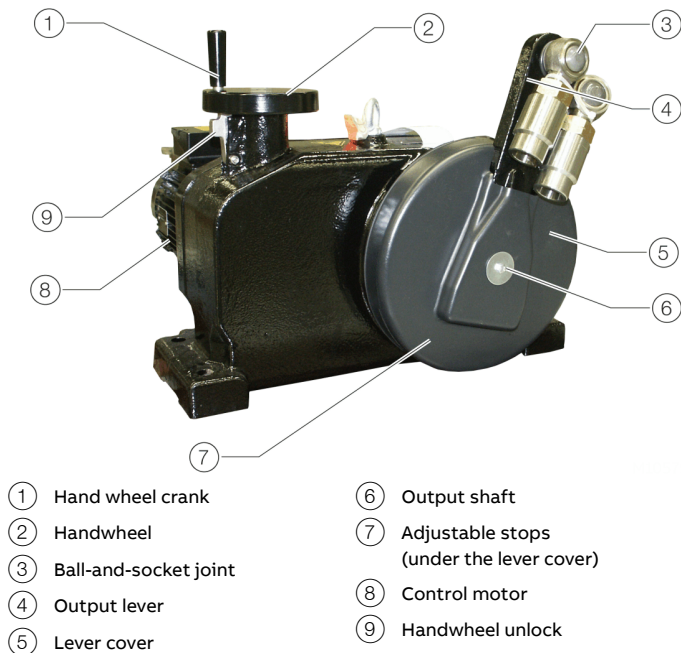


Figure 1: RHD (illustrations may differ from actual installation)

This service instruction refers to the ABB rotary actuators RHD250 to RHD4000.

It amends and deepens the routine maintenance description in the standard instruction, which we strongly recommend being also available for all maintenance work.

## Safety and precautions

When mounting the actuator in areas which may be accessed by unauthorized persons, take the required protective measures.

- The actuators perform movements for positioning vanes and valves. Handle properly and with care. Otherwise, a hazard of bruise injuries may arise.
- When changing the oil of the actuator, thoroughly remove any oil that may have run down on the floor during the procedure to avoid accidents.
- Dispose of the waste oil in compliance with the respective local regulations. Make sure that no waste oil reaches the water cycle.
- Only qualified specialists who have been trained for these tasks are authorized to mount and adjust the control actuator, and to make the electrical connection.
- When working on the actuator itself or the electronics always observe the locally valid accident prevention regulations and the regulations concerning the construction of technical installations.
- Use the eye bolt at the actuator to lift or lower it. Only load it vertically. Do not lift or lower the actuator when it is mounted on a valve or similar final control element.
- Switch-off the voltage supply; make sure that unintentional switching on is not possible.
- Make sure that switching off the power supply does not affect the plant process.
- Make sure that the final control element is not exposed to process forces.

## Tools

### NOTICE

#### Damage to the device due to improper tools!

Using improper tools may damage the actuator or its components.

- Only use proper tools for maintenance work.

#### Note

- Maintenance at Contrac actuators requires tools which are usually available in a workshop. Please consider that all dimensions are based on the metrical system. This applies also for the wrench sizes, threads etc.
- Use appropriate sleeves for the installation of the sealing rings (see **Sealing ring of output drive shaft** on page 11 for details).

### 3 Lubrication

#### Mounting position

The spur gearing of the actuator RHD250 / RHD500 / RHD800 / RHD1250 / RHD2500 / RHD4000 (Contrac) are lubricated with oil. They contain the max. oil quantity when leaving the manufacturer. Once the actuator is installed replace the uppermost check plug by the separately supplied venting plug.

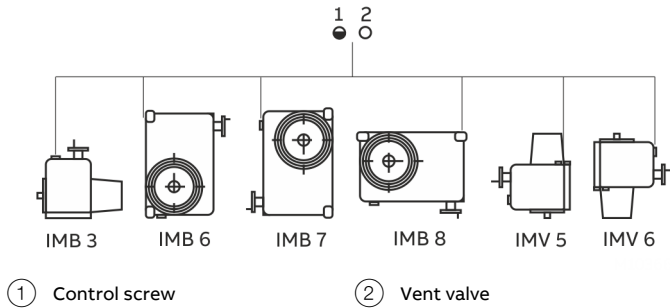


Figure 2: Permissible mounting positions

The mounting positions presented are permissible. To facilitate mounting and maintenance, however, it is recommended that you use position IMB 3. For each mounting position, you should check the specified oil level before commissioning, see **Filling volumes** on page 7.

To achieve this, allow for the following minimum distances:

Actuator	A
RHD250	40 mm (1.57 in)
RHD500 / RHD800	30 mm (1.18 in)
RHD1250 / RHD2500	40 mm (1.57 in)
RHD4000	40 mm (1.57 in)

#### Oil change

##### Note

Oils for different temperature ranges may not mixed.

During an oil change, thoroughly remove any oil that may have escaped to avoid accidents.

Dispose of old oil according to local regulations. Make sure that the oil does not enter the water cycle. Make sure that any oil leaking from the device cannot come into contact with hot components.

##### Proceed as follows to drain or change the oil:

1. Provide a collecting vessel capable of holding the expected oil quantity in accordance with **Filling volumes** on page 7.
2. Open and release the vent valve, see **Mounting position** on page 6.
3. Unscrew the lowermost drain plug to drain the oil.
4. Collect the oil in the collection vessel.
5. Make sure all of the oil has been removed from the actuator housing.
6. Screw the drain plug back in.
7. Refill with the proper volume of oil in accordance with **Filling volumes** on page 7 and securely tighten the vent valve.

## RHD oil types

Ambient temperature	Oil types - DIN 51517	
	Default oil filled with delivery	Alternative oil
-10 to 65 °C (15 to 150 °F)	Castrol Alpha BMP 220 – DIN 51517	ESSO Spartan EP 220 – DIN 51517 / ISO 12925-1 BP Energol GR-XP 220 – DIN 51517 Shell Omala 220 – DIN 51517 / ISO 12925-1 Mobilgear 630 – DIN 51517 / ISO 12925-1
-30 to 50 °C (-20 to 130 °F)	Mobil SHC 629 – DIN 51517 / ISO 12925-1	-
-1 to 85 °C (30 to 185 °F)	Mobil SHC 632 – DIN 51517 / ISO 12925-1	-

## Filling volumes

RHD250					
Mounting position	IMB 3	IMB 6	IMB 7	IMV 5	IMV 6 / IMB 8
Minimum oil level l (gal)*	Approx. 4.7 (1.24)	Approx. 4.7 (1.24)	Approx. 4.7 (1.24)	Approx. 4.7 (1.24)	Approx. 4.7 (1.24)
Minimum oil level under inspection plug mm (in)	40 (1.57)	12 (0.47)	15 (0.59)	35 (1.38)	Lower edge of upper oil plug

RHD500 / RHD800					
Mounting position	IMB 3	IMB 6	IMB 7	IMV 5	IMV 6 / IMB 8
Minimum oil level l (gal)*	Approx. 10 (2.65)	Approx. 11.5 (3.04)	Approx. 10 (2.65)	Approx. 10 (2.65)	Approx. 10 (2.65)
Minimum oil level under inspection plug mm (in)	57 (2.24)	Lower edge of upper oil plug	15 (0.59)	37 (1.46)	Lower edge of upper oil plug

RHD1250 / RHD2500						
Mounting position	IMB 3	IMB 6	IMB 7	IMB 8	IMV 5	IMV 6
Minimum oil level l (gal)*	Approx. 29 (7.67)	Approx. 32 (8.47)	Approx. 24 (6.34)	Approx. 24 (6.34)	Approx. 33 (8.72)	Approx. 26.5 (7.01)
Minimum oil level under inspection plug mm (in)	75 (2.95)	90 (3.54)	200 (7.87)	Lower edge of upper oil plug. Delivered filled with 33 l (8.72 gal*).	34 (1.34)	35 (1.38)

RHD4000						
Mounting position	IMB 3	IMB 6	IMB 7	IMB 8	IMV 5	IMV 6
Minimum oil level l (gal)*	Approx. 29 (7.67)	Approx. 32 (8.47)	Approx. 24.5 (6.47)	Approx. 24 (6.34)	Approx. 34 (8.98)	Approx. 26.5 (7.01)
Minimum oil level under inspection plug mm (in)	75 (2.95)	90 (3.54)	200 (7.87)	Lower edge of upper oil plug. Delivered filled with 33 l (8.72 gal*).	34 (1.34)	35 (1.38)

\* US liquid gallon

## 4 Maintenance

### Safety instructions

#### **⚠ WARNING**

##### **Risk of injury due to live parts!**

Risk of death or serious injuries due to electricity and unexpected machine movements. In automatic mode the motor is always under power, even at standstill.

- When working on the actuator or the related subassembly, switch off the supply voltage for the electronic unit and separate anti-condensation heater (option), and take precautions to prevent unintentional switch-on.

Repair and maintenance activities may only be performed by authorized customer service personnel.

When replacing or repairing individual components, use original spare parts.

### General

Contrac actuators feature a robust construction. As a result, they are highly reliable and require minimal maintenance. The maintenance intervals depend upon the effective load and are therefore not specified here.

The built-in microprocessor evaluates the actual load factors (e.g. torques, forces, temperatures, etc.) and derives the remaining operating time until the next routine maintenance is required.

Use the configuration program to view this information.

Apart from the load dependent maintenance intervals determined by the microprocessor we recommend routine maintenance at least every 10 years.

The following description of the maintenance work provide that the actuator is disconnected from the damper and that all electrical supply is disconnected.

### Lever

#### Lever removal

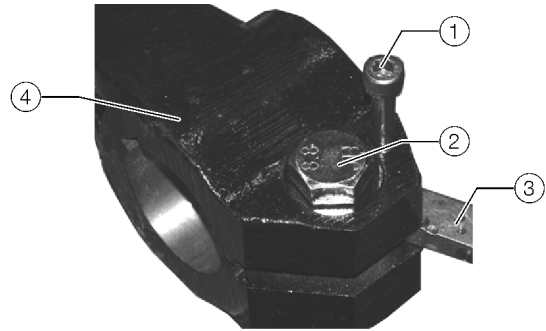


Figure 3: Lever mounted on the shaft

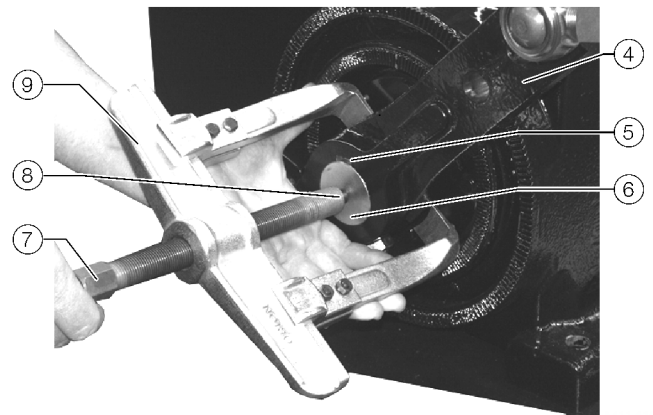


Figure 4: Use of draw-off tool for lever removal

In some case it may be useful to detach the linkage bar from the ball-and-socket-joint, however, it is not absolutely necessary.

Refer to **Figure 3** and **Figure 4** for the removal procedure:

1. Loosen the clamping screw (1).
2. Use an expanding screw (2) to spread the lever seat.
3. Push a counterpart (3) (soft metal) into the lever gap in order to protect the expanding screw thread.
4. Put the claws of the drawing tool (9) behind the lever (4) and place the bolt end (8) on the shaft (6).
5. Put an appropriate tool onto the hexagon end (7) of the drawing tool bolt.
6. Turning the bolt clockwise will pull the lever from the shaft end.



## Lever installation

### NOTICE

Make sure that the shaft surface and the shaft bore in the lever are clean and free of grease or any other lubricant.

1. Put the appropriate key ⑤ into the groove in the shaft.
2. Use an expanding screw to spread the lever seat.
3. Push a counterpart (soft metal) into the lever gap in order to protect the expanding screw thread.
4. Push the lever onto the shaft until it is nearly in the same position as it was before.
5. Put the lever clamping bolt into the lever and tighten the nut(s), refer to **Tightening torques and dimensions of lever screws** on page 10 for torque values.

## Ball-and-socket-joint

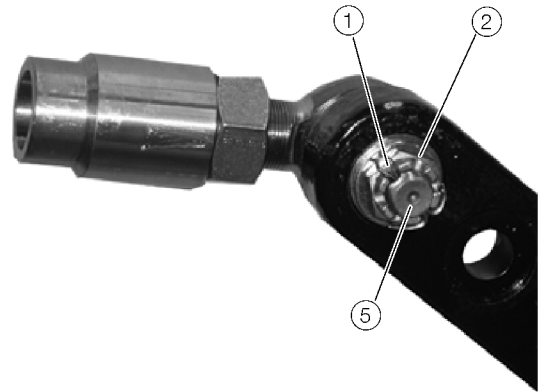


Figure 5: Ball-and-socket-joint

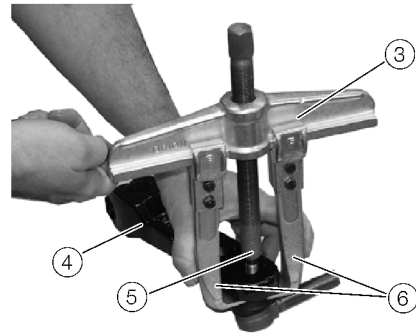


Figure 6: Use of draw-off tool

In some case it may be useful to detach the linkage bar from the ball-and-socket-joint, however, it is not absolutely necessary.

## ... 4 Maintenance

### ... Lever

#### Note

The ball-and-socket joint may be mounted / removed with the lever mounted on the shaft or with dismantled lever. If the lever remains mounted on the shaft, move it into a position, where you get free access from the rear lever side.

#### Removal

1. Pull the cotter pin ① out of the castle nut ②.
2. Screw-off the castle nut.
3. Put an appropriate draw-off tool ③ onto lever ④ and joint bolt ⑤ (see **Figure 6** for details); make sure that the claws ⑥ grip symmetrically behind the lever and that the bolt tip is on the joint bolt center.
4. Put a wrench onto the opposite bolt end and turn the bolt clockwise.
5. Press the joint bolt out of the lever.

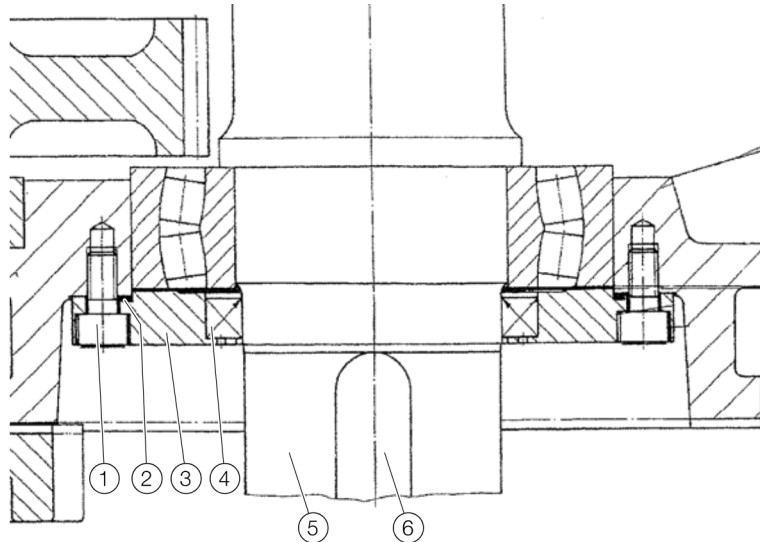
#### Installation

1. Push the bolt of the ball-and-socket joint into the lever hole.
2. Put the crown nut onto the bolt and tighten it with the required torque, refer to **Tightening torques and dimensions of lever screws** on page 10 for torque values.
3. Secure the crown nut with a **new** cotter pin ①.

### Tightening torques and dimensions of lever screws

Actuator	Clamping Screw (tightening torque)	Limit stop screw (tightening torque)	Crown nut (tightening torque)	Expanding screw (diam. / min. length / min. thread length)
RHD250	M12×50-8.8 (79 Nm / 58 ft-lbs)	M12×35-8.8 (79 Nm / 58 ft-lbs)	M18×1.5 (165 Nm / 122 ft-lbs)	8 mm / 35 mm / 25 mm
RHD500 / RHD800	M16×80-8.8 (195 Nm / 144 ft-lbs)	M16×35-8.8 (195 Nm / 144 ft-lbs)	M28×1.5 (370 Nm / 273 ft-lbs)	8 mm / 45 mm / 25 mm
RHD1250 / RHD2500	M20×110-8.8 (390 Nm / 288 ft-lbs)	M24×55-8.8 (670 Nm / 494 ft-lbs)	M30×1.5 (455 Nm / 336 ft-lbs)	10 mm / 55 mm / 20 mm
RHD4000	M20×120-8.8 (390 Nm / 288 ft-lbs)	M24×55-8.8 (670 Nm / 494 ft-lbs)	M38×1.5 (750 Nm / 553 ft-lbs)	12 mm / 65 mm / 35 mm

## Sealing ring of output drive shaft



- |                         |           |
|-------------------------|-----------|
| (A) Drive pinion        | (D) Motor |
| (B) Output shaft        | (E) Brake |
| (C) Handwheel mechanism |           |

Figure 7: Sectional view of PME120

The following general explanations for the sealing ring replacement do not exclusively apply for the output shaft but also for the other sealing rings.

In order to change the O-ring (1) and sealing ring (2) of the output drive shaft proceed as follows:

1. Remove lever or coupling from the output shaft (5).
2. Make sure that the oil level is below the O-ring (2).
3. If necessary, drain the oil (see **Mounting position** on page 6).
4. Remove the key (6).
5. Loosen and remove the flange screws.
6. Two tap holes (thread size: M6) on the bolt circle for the flange screws allow to use forcing screws; turn these screws clockwise to remove the flange (3); the thread length of the forcing screws should be at least 25 mm.
7. Pull the flange (3) from the shaft.
8. Turn the forcing screws out.
9. Take the O-ring (1) and the sealing ring (2) out.
10. Clean the shaft and the flange; slightly grease the sealing ring.
11. Replace the O-ring and the sealing ring.
12. Cover the key groove in the shaft prior to the flange re-installation in order to avoid any damage of the new sealing ring.

13. Push the flange carefully over the shaft and fasten the flange screws crosswise; tightening torque for the flange screws = 2.8 Nm (2.01 ft-lbs).

14. Remove key cover and re-install key (4), lever or coupling.

### Note

Make sure that the 'open' side of the sealing ring points towards the oil

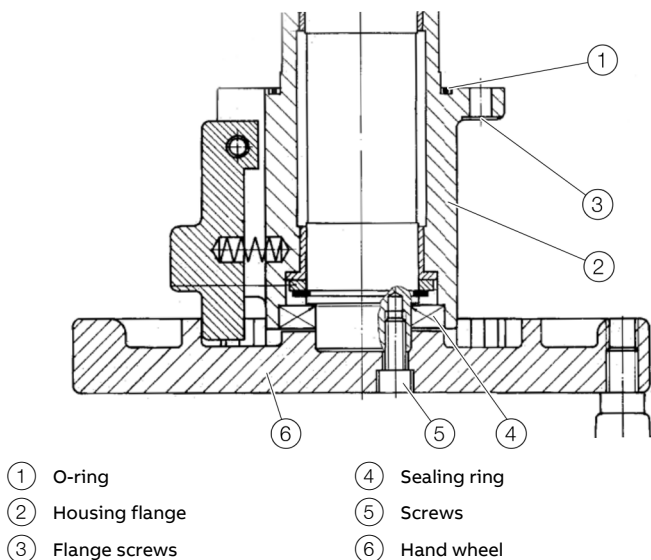


- |                  |                             |
|------------------|-----------------------------|
| (1) Sealing ring | (3) Sleeve (auxiliary tool) |
| (2) Flange       |                             |

Figure 8: Flange and sealing ring / Use of auxiliary tool for sealing ring installation (exemplary picture)

## ... 4 Maintenance

### Sealing ring of hand wheel drive / hand wheel shaft



- |                  |                |
|------------------|----------------|
| ① O-ring         | ④ Sealing ring |
| ② Housing flange | ⑤ Screws       |
| ③ Flange screws  | ⑥ Hand wheel   |

Figure 9: Handwheel

### **⚠ DANGER**

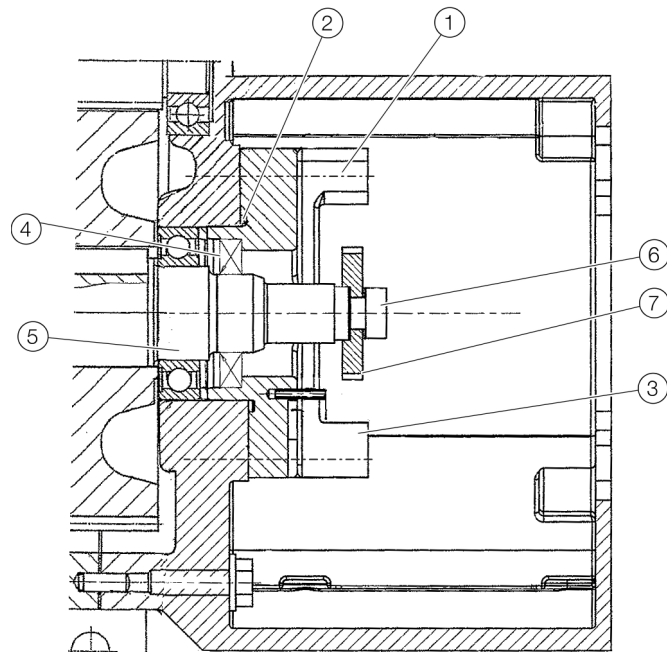
**Danger to life due to unexpected movement of the actuator!**  
Restoring process forces may move the actuator when you release the handwheel!

In order to change the handwheel O-ring ① of the drive proceed as follows:

1. Make sure that the oil level is below the O-ring ①.
2. Drain the oil if necessary (see **Oil change** on page 6 for details).
3. Turn flange screws ③ out.
4. Pull entire hand wheel drive assembly out of the gearing engagement.
5. Replace the O-ring ①.
6. If additionally the shaft sealing ring ④ needs to be replaced, turn the wheel fastening screws ⑤ out and put the hand wheel ⑥ aside.
7. Take the shaft sealing ring ④ out.
8. Grease the new the shaft sealing ring ④ slightly with oil and put it into the groove; consider the exemplary hints and illustration of **Sealing ring of output drive shaft** on page 11.
9. Fasten the hand wheel ⑥ and re-install the entire assembly; tightening torque for the screws ③ = 20 Nm (15 ft-lbs).

### Sealing of the position sensor drive

RHD250...RHD800



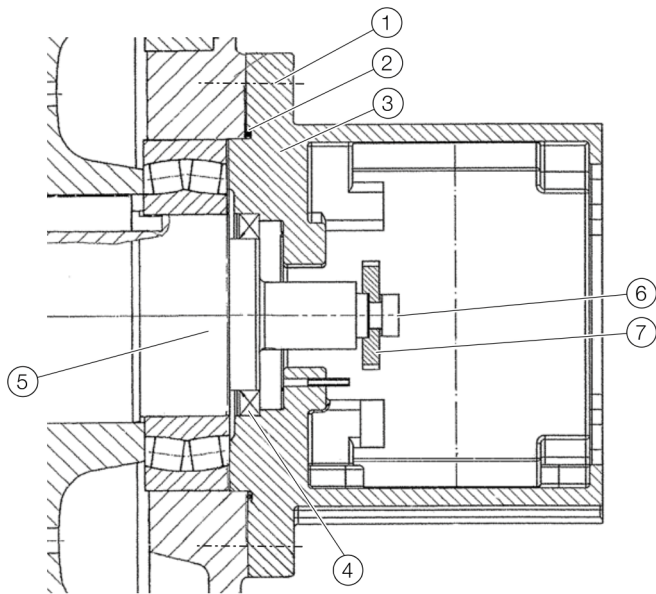
- |                          |                 |
|--------------------------|-----------------|
| ① Flange fastening screw | ⑤ Shaft         |
| ② O-ring                 | ⑥ Hexagon screw |
| ③ Flange                 | ⑦ Pinion        |
| ④ Sealing ring           |                 |

Figure 10: Position sensor drive

In order to change the O-ring ② and the sealing ring ④, firstly remove the position sensor **Dismounting** on page 27 and proceed as follows:

1. Make sure that the oil level is below the O-ring ②.
2. Drain the oil if necessary (**Mounting position** on page 6 for details).
3. Loosen the hexagon screw ⑥ and pull apart the pinion ⑦.
4. Undo flange fastening screws ①.
5. Pull the flange ③ with sealing ring ④ carefully from the shaft ⑤ and put it aside.
6. Replace the O-ring ②.
7. Pull the old sealing ring ④ out of the groove.
8. Grease the new sealing ring slightly with oil and put it in.
9. Clean the shaft and the contact surfaces of the flange.
10. Carefully push the flange ③ with O-ring ② and sealing ring ④ on the shaft; take care that the shaft end does not damage the sealing ring.
11. fasten the flange ③ and tighten the screws ① crosswise with 8.3 Nm (6.12 ft-lbs).
12. fasten the pinion ⑦ and tighten the hexagon screw ⑥ with 42 Nm (31 ft-lbs).

## RHD1250... RHD4000



- |                        |                 |
|------------------------|-----------------|
| ① Hood fastening screw | ⑤ Shaft         |
| ② O-ring               | ⑥ Hexagon screw |
| ③ Hood                 | ⑦ Pinion        |
| ④ Sealing ring         |                 |

Figure 11:

In order to change the O-ring ② and the sealing ring ④, firstly remove the position sensor **Dismounting** on page 27 and proceed as follows:

1. Make sure that the oil level is below the O-ring ②
2. Drain the oil if necessary (**Mounting position** on page 6 for details).
3. Loosen the hexagon screw ⑥ and pull apart the pinion ⑦
4. Undo hood fastening screws ①
5. Pull the hood ③ with sealing ring ④ carefully from the shaft ⑤ and put it aside
6. Replace the O-ring ②
7. Pull the old sealing ring ④ out of the groove
8. Grease the new sealing ring slightly with oil and put it in
9. Clean the shaft and the contact surfaces of the hood
10. Push carefully the hood ③ with O-ring ② and sealing ring ④ on the shaft; take care that the shaft end does not damage the sealing ring
11. Fasten the hood ③ and tighten the screws ① crosswise with 23 Nm (17 ft-lbs)
12. Fasten the pinion ⑦ and tighten the hexagon screw ⑥ with 42 Nm (31 ft-lbs)

## Motor

By the time of printing this document Contrac actuators use two basic motor series.

Motor type MC..71..... MC..100 of the series 1 feature a 'C' at the end of the name code, motor type MC..71..... MC..100 of the series 2 feature a 'D'.

Motor type MC..112 of the series 1 features a 'B' at the end of the name code, motor type MC..112....of the series 2 features a 'C'.

See 4.6.1 for details.

Both series differ in minor details which are named where applicable.

### Motor assignment and tightening torque

#### Tightening torque for motor screws

Actuator	Motor	Add. flange	Tightening torque
RHD250-10	MCS 71 BA / MCSS71BA	—	20 Nm (15 ft-lbs)
RHD500-10	MCS 71 BA / MCSS71BA	—	20 Nm (15 ft-lbs)
RHD800-10	MCS 80 BA / MCSS80BA	—	20 Nm (15 ft-lbs)
RHD1250-12	MCS 80 BA / MCSS80BA	—	20 Nm (15 ft-lbs)
RHD2500-10	MC 90 BA	46 Nm (34 ft-lbs)	40 Nm (30 ft-lbs)
RHD2500-25	MCS 80 BA	—	20 Nm (15 ft-lbs)
RHD4000-10	MC 100 BA	79 Nm (58 ft-lbs)	69 Nm (50 ft-lbs)
RHD4000-40	MC 90 BA	46 Nm (34 ft-lbs)	40 Nm (30 ft-lbs)

## ... 4 Maintenance

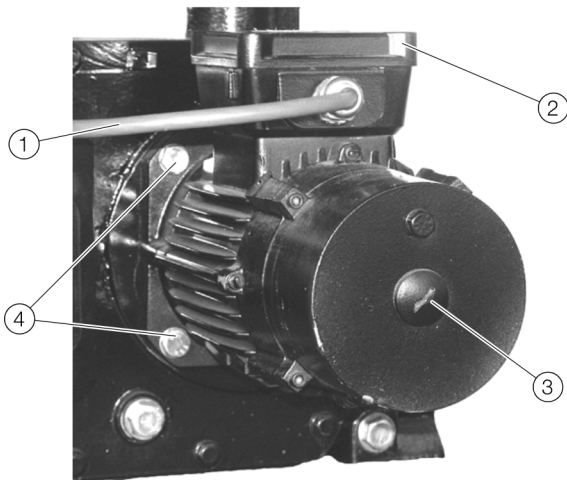
### ... Motor

#### Motor removal

#### **⚠ DANGER**

**Danger to life due to unexpected movement of the actuator!**

Note that the actuator position may be changed accidentally by the external load on the drive when the brake is released, or the motor is removed.

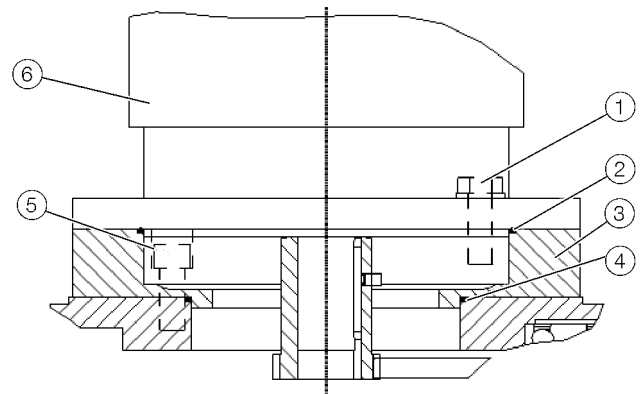


- |                          |                          |
|--------------------------|--------------------------|
| ① Motor connection cable | ③ Motor                  |
| ② Motor terminal box     | ④ Motor fastening screws |

Figure 12: Rear motor view (exemplified)

1. Disconnect the motor / actuator from any electrical supply.
2. Disconnect motor connection cable in motor terminal box.
3. Drain the oil (see **Mounting position** on page 6 for details).
4. Undo the 4 motor fastening screws.
5. Pull the motor carefully out.
6. Once the motor overhaul is finished, replace the motor sealing ring in any case.
7. Install the motor in reverse order.

#### Motor flange O-ring



- |               |          |
|---------------|----------|
| ① Motor screw | ④ O-ring |
| ② O-ring      | ⑤ Screw  |
| ③ Flange      | ⑥ Motor  |

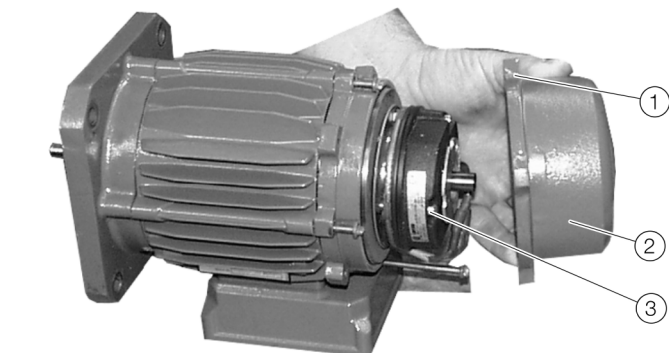
Figure 13: Exemplary depiction of motor connection; additional flange ③ not used for all motors

In order to change the flange O-ring proceed as follows:

1. Disconnect the electrical power supply prior to any maintenance
2. Make sure that the oil level is below the O-ring ④
3. Drain the oil if necessary **Mounting position** on page 6.
4. Disconnect the cables in the motor terminal box
5. Turn the motor screws ① out and put the motor aside; remove O-ring ②
6. Turn the screws ⑤ of the add. flange out and put the flange ③ aside; remove O-ring ④
7. Replace O-ring ④
8. Mount the additional flange ③ at the actuator housing and fasten it with the flange screws ⑤
9. Put the new O-ring ② into the flange groove and fasten the motor with the screws ①; consider tightening torque shown **Motor assignment and tightening torque** on page 13.

## Motor disassembly / assembly

### Motors without fan on rear shaft end

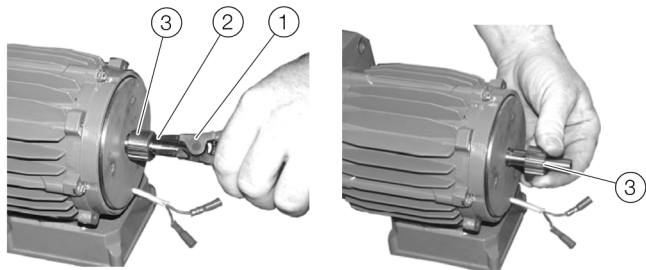


- ① Brake cover screw
- ② Cover
- ③ Brake fastening screw

Figure 14: Brake cover removal (I); example shows motor of series 1

Additionally remove the brake for motor ball bearing replacement.

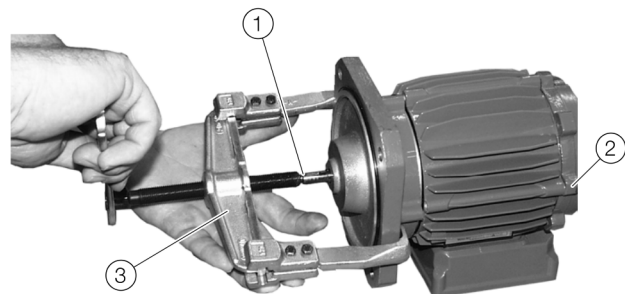
1. Undo brake cover screws ① and put cover ② aside.
2. Disconnect the two cables.
3. Undo the brake fastening screws ③ and put brake body with disk aside.



- ① Retaining ring plier
- ② Retaining ring
- ③ Brake pinion

Figure 15: Brake removal (II); example shows motor of series 1

4. Use an appropriate retaining ring pliers ① to get the retaining ring ② for the brake pinion ③ out.
5. Pull the brake pinion ③ from the shaft.



- ① Key
- ② Flange screw
- ③ Extraction tool

Figure 16: Removal of the motor flange; example shows motor of series 1

6. Remove the drive pinion.
7. Pull the key ① out of the motor shaft.
8. Undo motor flange screws ②.
9. Use an appropriate extraction tool to pull the flange from the stator housing (see **Figure 16**).

## ... 4 Maintenance

### ... Motor

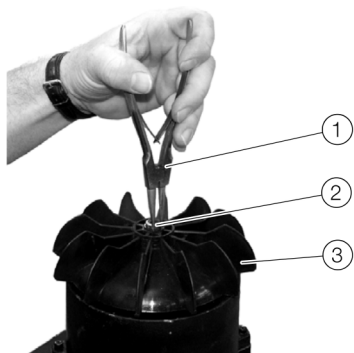
Motors with fan on rear shaft end



- ① Cover
- ② Cover screws
- ③ Motor

Figure 17: Cover removal

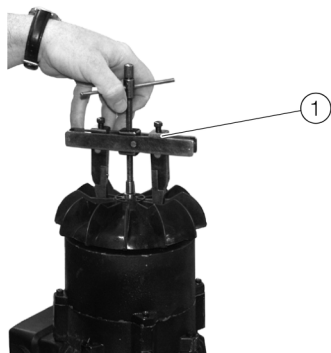
1. Undo the cover screws ② and remove the cover ①.



- ① Split ring pliers
- ② Split ring
- ③ Fan

Figure 18: Split ring removal

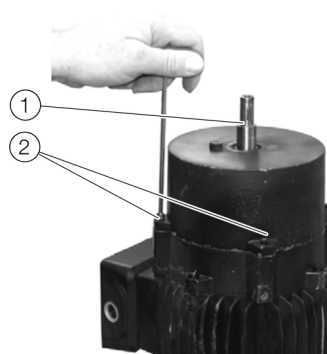
2. Use appropriate split ring pliers ① and removal tool to remove the split ring ② and the fan ③.



- ① Removal tool

Figure 19: Removal tool

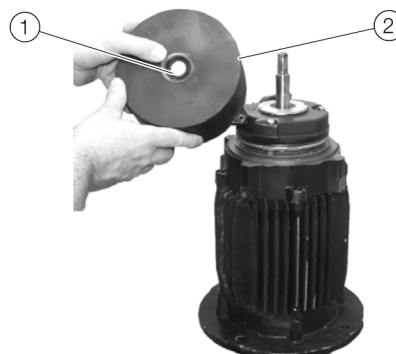
3. Remove the fan.



- ① Rear end of motor shaft
- ② Brake cover screws

Figure 20: Undo brake cover

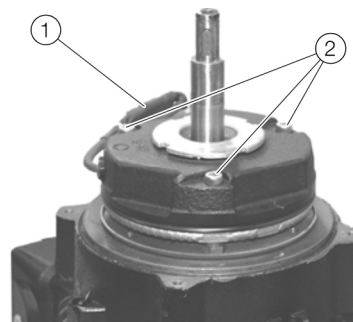
4. Undo brake cover screws ②.



- ① Sealing ring
- ② Brake cover

Figure 21: Remove brake cover

5. Remove brake cover ②.



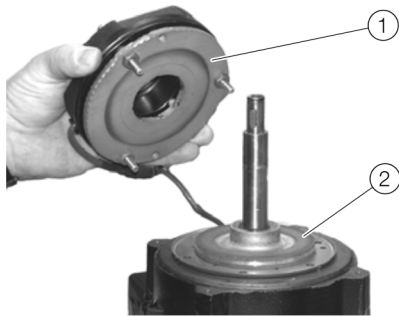
- ① Shrinkable tube
- ② Brake screws

Figure 22: Brake (motor series 1)

6. Undo brake screws ②.

7. Open shrinkable tube ① and disconnect cable.

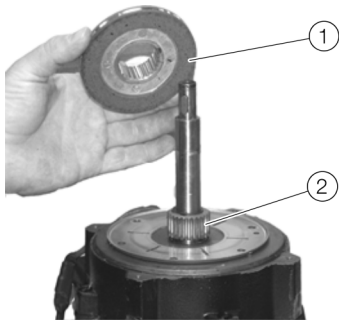




① Brake body                      ② Brake disk

Figure 23: Brake body removal (motor series 1)

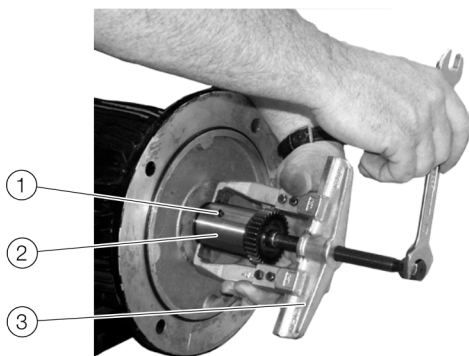
8. Take brake body ① apart.



① Brake disk                      ② Brake disk pinion

Figure 24: Brake disk removal (motor series 1)

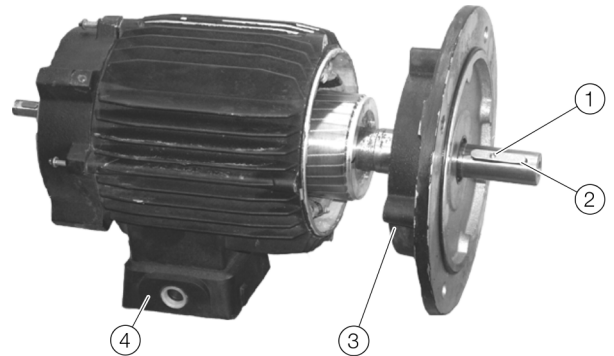
- 9. Take brake disk ① apart.
- 10. Remove retaining ring from brake disk pinion ② and pull the pinion from the shaft (see **Figure 15** on page 15)
- 11. See **Brake adjustment** on page 19.



① Pinion screw                      ③ Removal tool  
② Pinion

Figure 25: Pinion removal

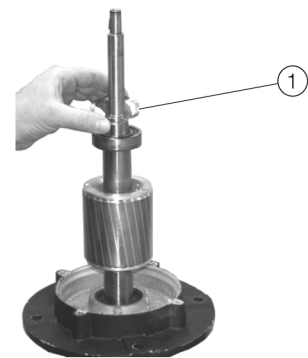
- 12. Undo pinion screw ①; use appropriate retainer to secure the screw when re-assembling (DELO-ML 5228 or LOCTITE 243; both medium-firm; detachable)
- 13. Use appropriate removal tool ③ to pull the pinion ② from the shaft.
- 14. Do not damage the threaded center hole



① Key hole                      ③ Front flange  
② Key                              ④ Motor housing

Figure 26: Remove the key

- 15. Remove the key ②; note the key position (key hole ①) before you take it out of the shaft groove
- 16. Pull front flange ③ with motor shaft out of the motor housing ④.



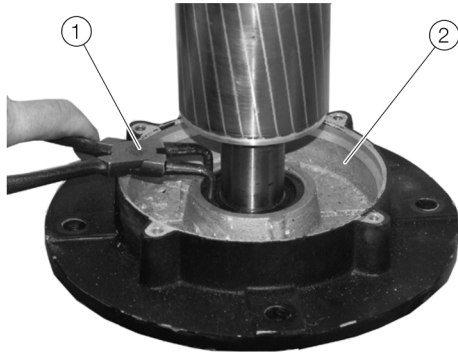
① Spring washer

Figure 27: Pinion removal

- 17. Remove bearing support washer (spring washer ①); take care to place it properly when re-assembling the motor.

## ... 4 Maintenance

### ... Motor

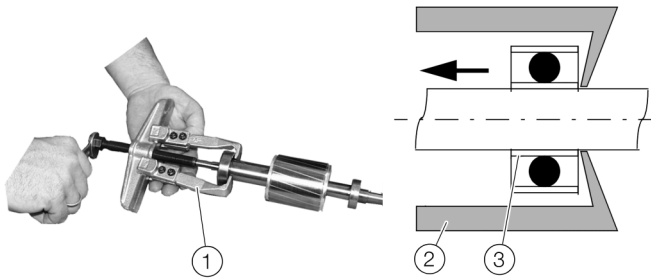


- ① Retaining ring pliers
- ② Front flange

Figure 28:

18. Use appropriate retaining ring pliers ① to remove the bearing retaining ring out of the front flange ②.
19. Pull the shaft out of the flange.

### Exchange of motor bearings

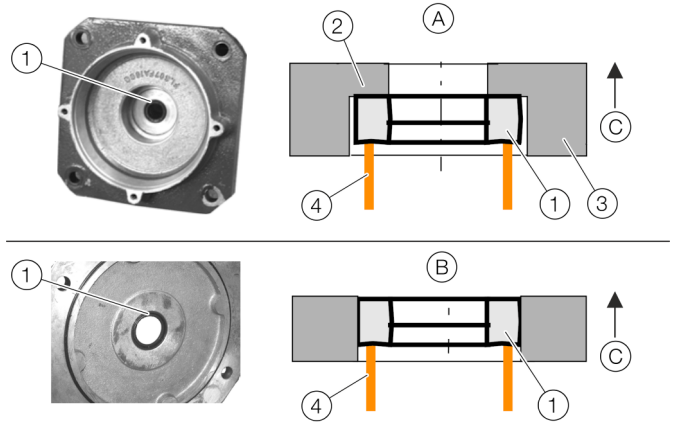


- ① Extraction tool
- ② Tool claws
- ③ Inner ball bearing ring

Figure 29: Removal of motor ball bearing (exemplified; illustration applies to all motors)

1. Use an appropriate extraction tool ① for bearing removal.
2. Make sure that the extraction tool claws ② pull at the inner ball bearing ring ③.

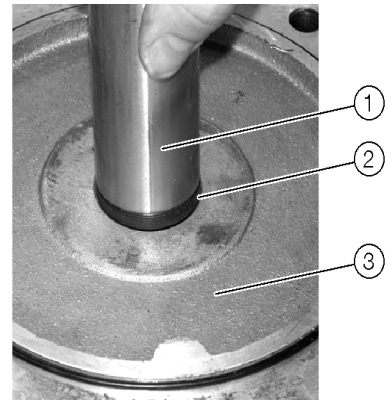
### Exchange of motor shaft sealing ring



- (A) Sealing ring seat with shoulder
- (B) sealing ring seat without shoulder
- (C) Oil
- ① Sealing ring
- ② shoulder
- ③ Sleeve
- ④ Motor flange

Figure 30: Inside of the motor flange

1. Take the old sealing ring out
2. Grease the new sealing ring and press it in the flange as shown in Figure 30; make sure that the 'open' Part of the sealing ring points towards the oil (when the motor is mounted to the actuator); see Figure 30.
3. Assemble in reverse order; use a customary sealant for both motor flanges
4. Check the brake gap after re-assembly; see **Brake adjustment** on page 19 for details.



- ① Sleeve
- ② Sealing ring
- ③ Flange

Figure 31: Mounting the sealing ring

## Brake adjustment

### Brake of motor series 1

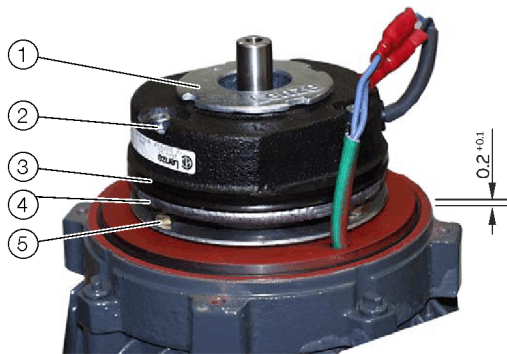
#### **⚠ WARNING**

##### Risk of injury

Note that the actuator position may be changed accidentally by the external load on the drive when the brake is released or the motor is removed.

#### Note

Do not turn the slotted nut ①. It preloads the brake spring. Any disadjustment may reduce the brake force and thus disable the brake to hold the actuator in position!



- |                      |                |
|----------------------|----------------|
| ① Slotted nut        | ④ Brake disk   |
| ② Socket head screws | ⑤ Counter nuts |
| ③ Coil body          |                |

Figure 32: Brake of motor series 1

In automatic mode the brake is permanently released. Therefore, it is not exposed to wear and does usually not require any re-adjustment. The gap between coil body and brake disk should be approx.  $0.2^{+0.1}$  mm (0.008 to 0.012 inch). To check the gap switch-off the voltage supply and put a thickness gauge between the coil body ③ and the brake disk ④. If the brake requires an adjustment (e. g. after replacement) proceed as follows:

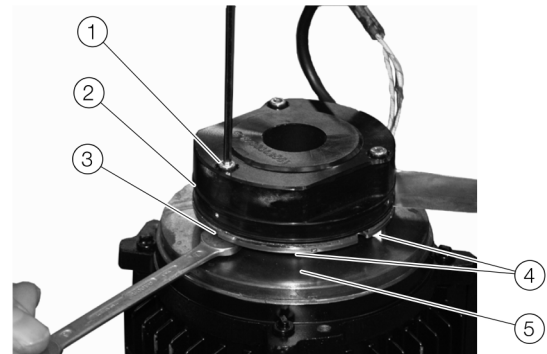
1. Disconnect the voltage supply.
2. Remove the brake cover.
3. Loosen the socket head screws ②.
4. Put a thickness gauge (0.2 mm) between the coil body ③ and the thrust plate ④.
5. Turn the counter nuts ⑤ until the thickness gauge is tautly between coil body ③ and thrust plate ④.
6. Tighten the socket head screws ② evenly.

### Brake of motor series 2

#### **⚠ WARNING**

##### Risk of injury

Note that the actuator position may be changed accidentally by the external load on the drive when the brake is released or the motor is removed.



- |                      |              |
|----------------------|--------------|
| ① Socket head screws | ④ Brake disk |
| ② Coil body          | ⑤ Base plate |
| ③ Thrust plate       |              |

Figure 33: Brake of motor series 2

In automatic mode the brake is permanently released. Therefore, it is not exposed to wear and does usually not require any re-adjustment. The gap between coil body and brake disk should be approx.  $0.2^{+0.1}$  mm (0.008 to 0.012 inch). To check the gap switch-off the voltage supply and put a thickness gauge between the coil body ② and the brake disk ④. If the brake requires an adjustment (e. g. after replacement) proceed as follows:

1. Disconnect the voltage supply.
2. Remove the brake cover.
3. Turn the socket head screws ① completely out.
4. Take the brake body ② off.
5. Turn the hexagon nuts ④ cw until they are in touch with the brake body ②.
6. Put the brake body ② onto the shaft and tighten the screws ①; hand screwed.
7. Turn the hexagon nuts ④ ccw until they are in touch with the base plate ⑤.
8. Evenly turn the socket head screws ① approx 1/3 turn ccw (approx 120°); this also lifts the hexagon nuts ④.
9. Turn the hexagon screws ④ until they are in touch with the brake body ⑤.
10. Check the gap between brake body ② and thrust plate ③ using a thickness gauge  $0.2^{+0.1}$  mm (0.008 to 0.012 inch).

## 5 Electrical connections

### **⚠ WARNING**

#### **Risk of injury due to live parts!**

Risk of death or serious injuries due to electricity and unexpected machine movements. In automatic mode the motor is always under power, even at standstill.

- When working on the actuator or the related subassembly, switch off the supply voltage for the electronic unit and separate anti-condensation heater (option), and take precautions to prevent unintentional switch-on.

### General

The cable between actuator and electronic unit is connected to the electronic unit via terminals and to the actuator via a plug. The plug housing may contain a carrier for terminals or for the cable ends with crimp sockets.

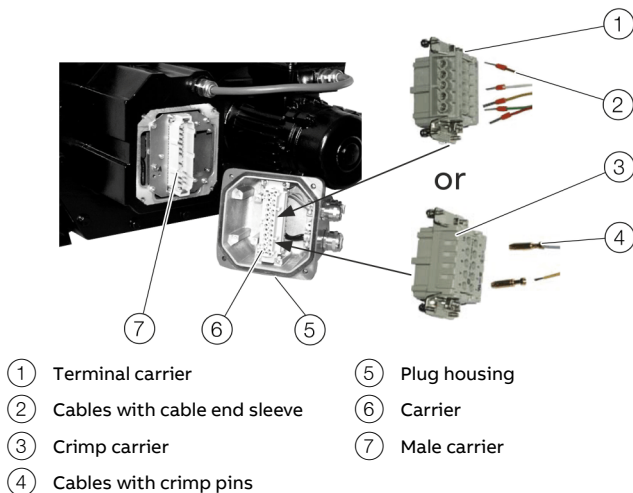
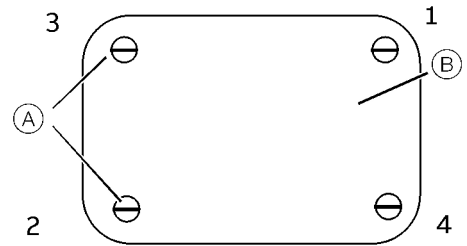


Figure 34: Exemplary illustration of cable connection to the actuator; plug housing may contain alternatively a terminal carrier or a crimp carrier.

### Covers



(A) Screws

(B) Cover or similar component

Figure 35: Exemplary cover

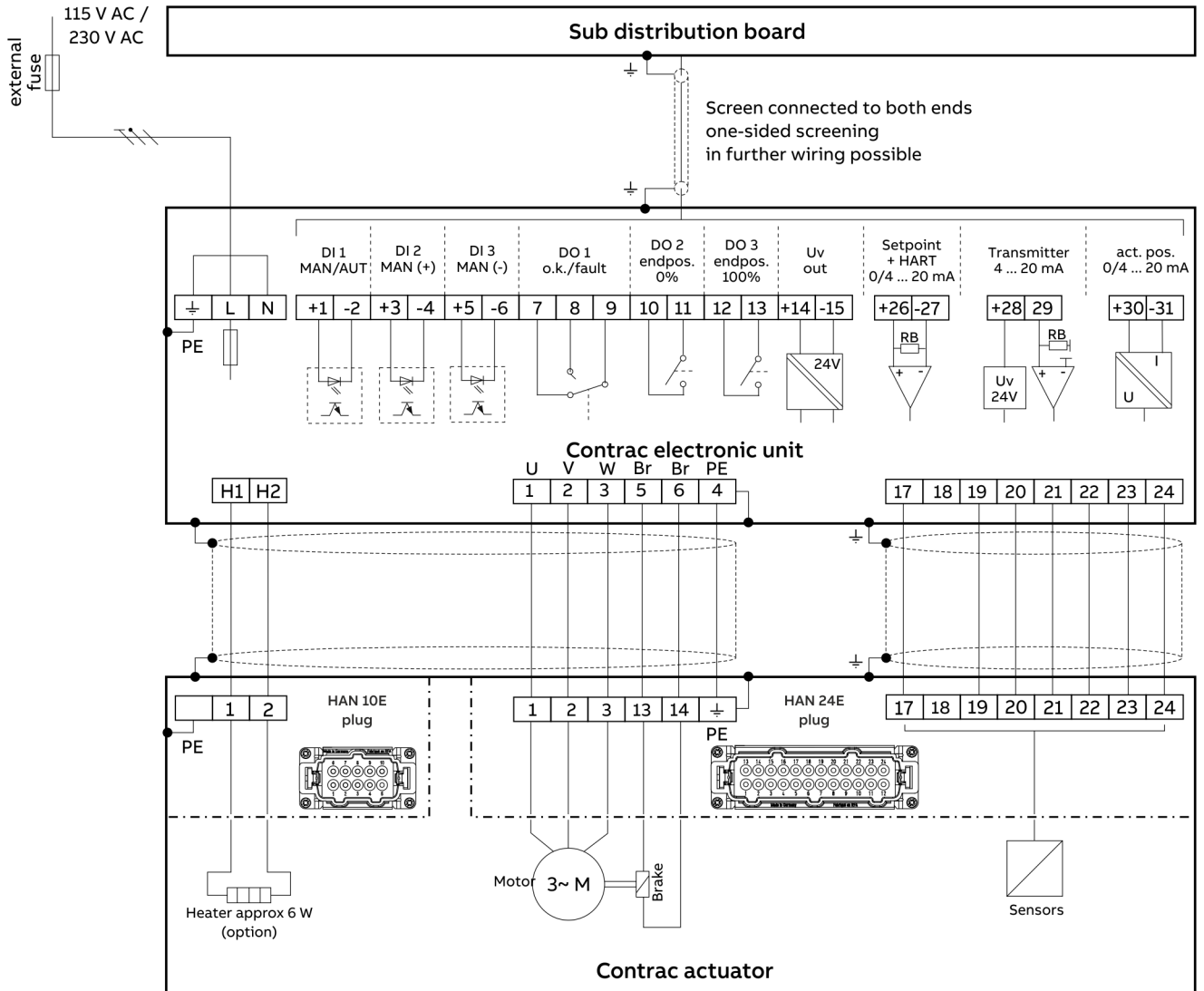
Terminal covers and other components at the Contrac actuators and electronic units are fastened with 4 or more screws (only 2 screws for local control panel cover).

In some cases, they are additionally sealed with a soft rubber gasket. In order to avoid a gap between the housing and the cover (or the other component) tighten these screws evenly crosswise according to the order in the basic sketch in Figure 35 to get an even load.

Start with one screw and tighten it slightly. Then tighten the 2nd, opposite screw in the same manner. Continue with the remaining screws. Finally tighten the screws in the same order. This will ensure a tight seal.

### Electronic Unit EBN853 (Contrac) / EBN861 (Contrac) / EBS862 (Contrac)

Analog / Digital



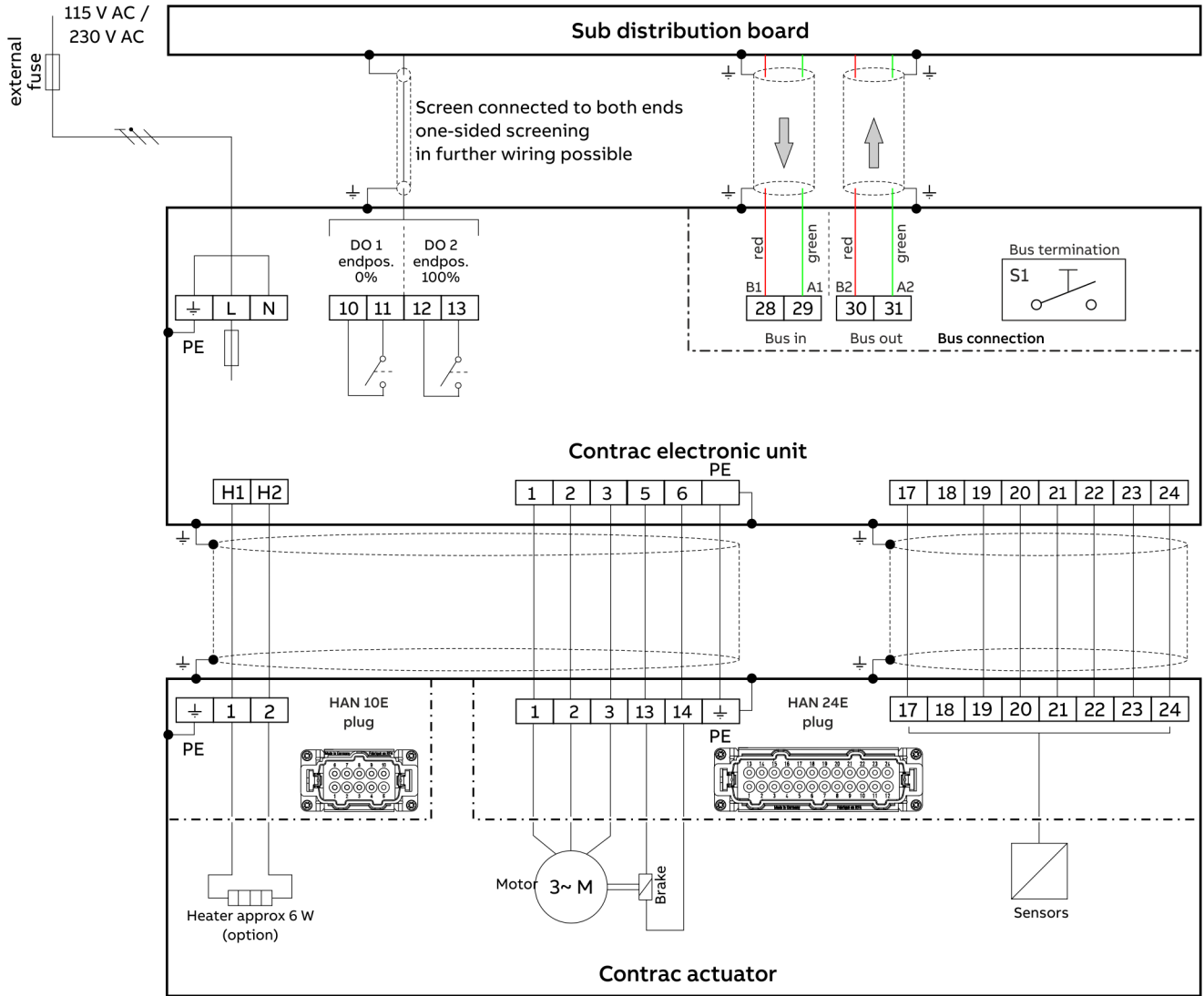
BE = digital input  
 BA = digital output

Figure 36: Control via analog input 0/4 to 20 mA, HART® communication or digital inputs

## ... 5 Electrical connections

### ... Electronic Unit EBN853 (Contrac) / EBN861 (Contrac) / EBS862 (Contrac)

#### PROFIBUS DP®

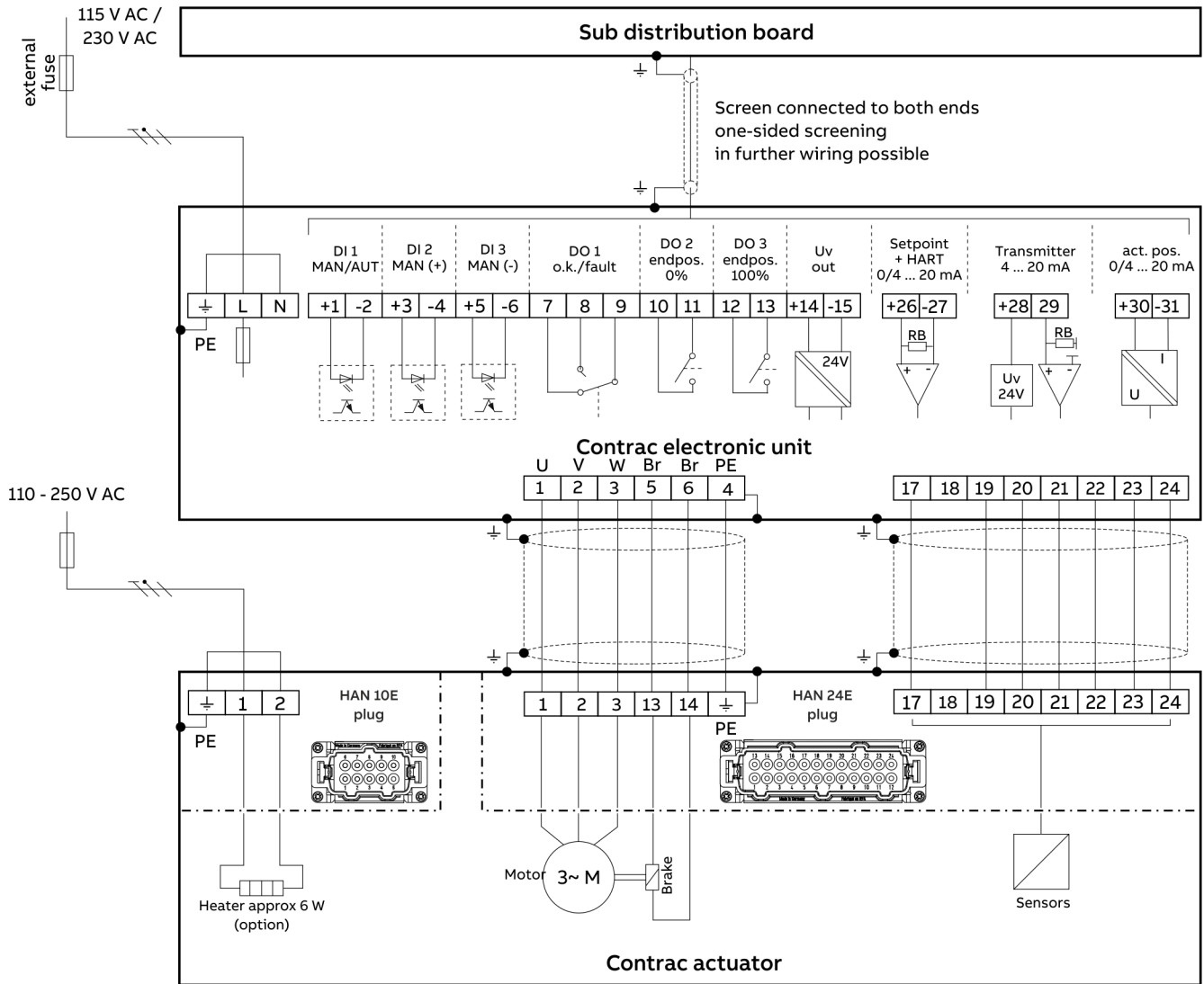


BA = digital output

Figure 37: Control via fieldbus PROFIBUS DP®

# Electronic Unit EBN852 (Contrac)

## Analogue / Digital



BE = digital input  
 BA = digital output

Figure 38: Control via analogue input 0/4 to 20 mA, HART® communication or digital inputs

## ... 5 Electrical connections

### Fuses

#### Electronic unit for field installation

Type	Fuse	Installation location	Rated current of fuse		Design
			at 115 V AC	at 230 V AC	
EBN853	External fuse	External	16 A, slow		—
	Mains fuse	In connection chamber	12.5 A, slow	10 A, slow	5 × 20 mm
	Analogue setpoint input	In connection chamber	40 mA, fast		5 × 20 mm
	Motor brake	power board	0.315 A; medium		5 × 20 mm
	Intermediate circuit fuse	power board	10 A, super-fast		6.3 × 32 mm
	Anti condensation fuse	In connection chamber	2 A; slow		5 × 20 mm
EBN861	External fuse <sup>1</sup>	external	—	35 A fuse 16 A thermal safety cutout	—
	Motor brake	on board (power section)	—	0.315 A, medium	5 × 20 mm
	Intermediate circuit fuse	power board	—	16 A, super fast	6.3 × 32 mm
	Fuse f. DO1, DO2, DO3	in connection chamber	—	3 × 0.2 A; medium	5 × 20 mm

1 The 35 A fuse and the thermal safety cutout (16 A) are included in the scope of delivery. They ensure safe operation for the special switching conditions of electronic unit EBN861. Note that the cable cross-sectional area between the fuse and the electronics must be at least 2.5 mm<sup>2</sup> (#13 AWG).

#### Electronic units for rack installation

Type	Fuse	Installation location	Rated current of fuse		Design
			at 115 V AC	at 230 V AC	
EBS852	External fuse	External	16 A, slow		—
	Mains fuse	In connection chamber	12.5 A, slow	10 A, slow	5 × 20 mm
	Motor brake	power board	0.315 A; medium		5 × 20 mm
	Intermediate circuit fuse	power board	10 A, super-fast		6.3 × 32 mm
	Fuse f. DO1, DO2, DO3	In connection chamber	2 A; slow		5 × 20 mm
EBS862	External fuse <sup>1</sup>	external	—	35 A fuse 16 A thermal safety cutout	—
	Motor brake	on board (power section)	—	0.315 A, medium	5 × 20 mm
	Intermediate circuit fuse	power board	—	16 A, super fast	6.3 × 32 mm
	Fuse f. DO1, DO2, DO3	in connection chamber	—	3 × 0.2 A; medium	5 × 20 mm

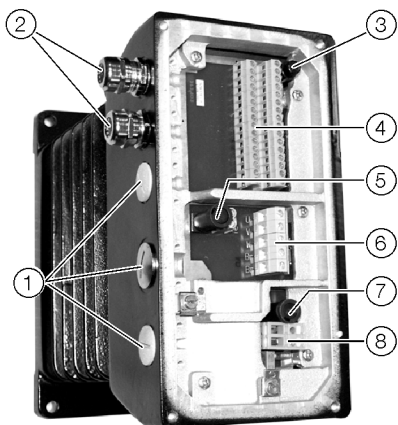
1 The 35 A fuse and the thermal safety cutout (16 A) are included in the scope of delivery. They ensure safe operation for the special switching conditions of electronic unit EBN861. Note that the cable cross-sectional area between the fuse and the electronics must be at least 2.5 mm<sup>2</sup> (#13 AWG).



**Fuse location EBN853**

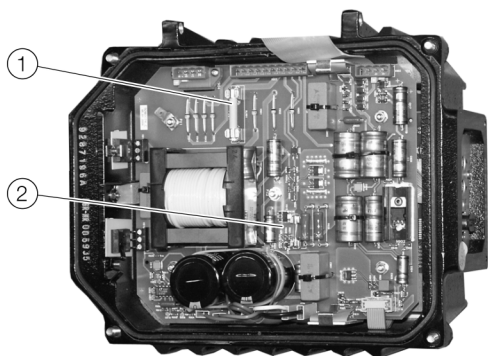
**NOTICE**

Remove the cover of the connection chamber carefully in order to avoid any damage.



- ① Tap holes for cable glands
- ② Cable gland
- ③ Analog input fuse
- ④ Terminals (signals)
- ⑤ Anti-dewing heater fuse
- ⑥ Terminals (motor cable)
- ⑦ Power supply fuse
- ⑧ Terminals (power supply)

Figure 39: Fuses in connection-housing part



- ① Intermed. circuit fuse
- ② Brake fuse

Figure 40: Fuses in control-housing part

**Fuse location EBN861 / EBS862**

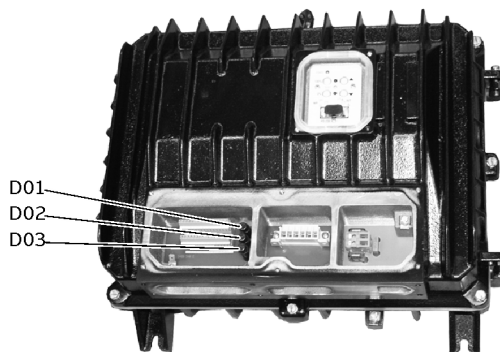
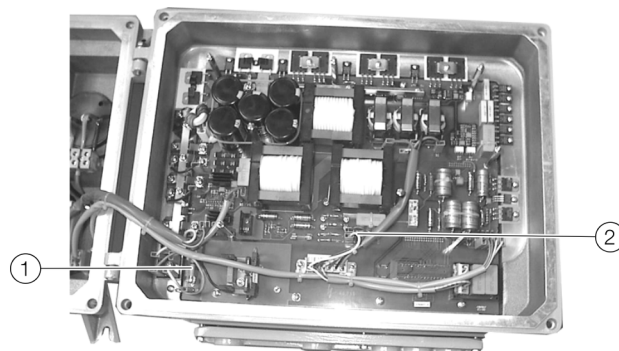


Figure 41:



- ① Intermed. circuit fuse
- ② Brake fuse

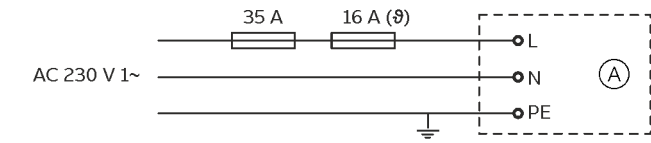
Figure 42: Fuses in EBN861 / EBS 862

## ... 5 Electrical connections

### ... Fuses

#### External fuses for EBN861 / EBS862

One 35 A fuse and the 16 A thermal circuit breaker are supplied together with the electronic unit EBN861 / EBS862. They ensure a safe operation with respect to the switch-on characteristic of these electronic units. The wire cross section must be at least 2.5 mm<sup>2</sup> (#13 AWG).



(A) Electronic unit

Figure 43: External fuses

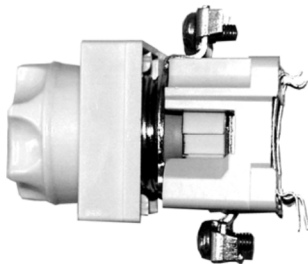


Figure 44: External fuse; 35 A

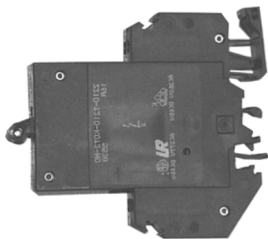


Figure 45: Thermal circuit breaker; 16 A

#### Fuse location in EBS852

### NOTICE

Remove the cover of the connection chamber carefully in order to avoid any damage of the fuses or the fuse holder.

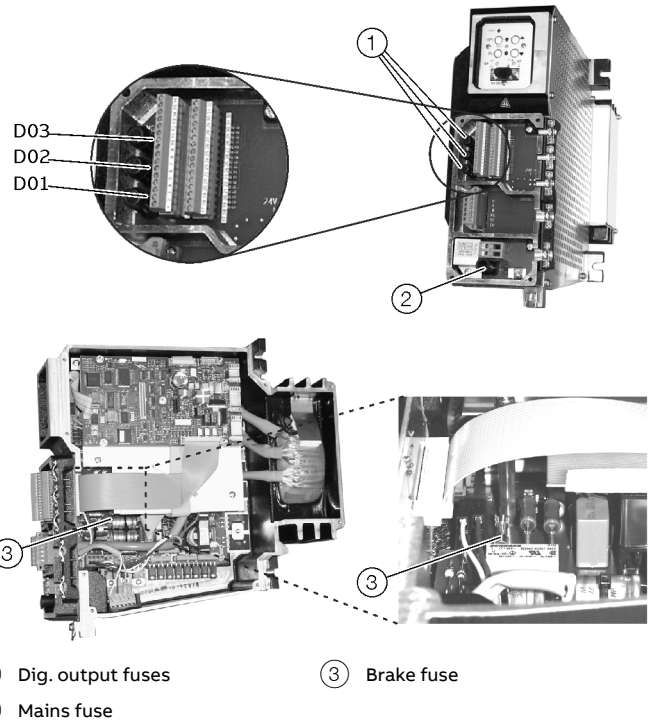
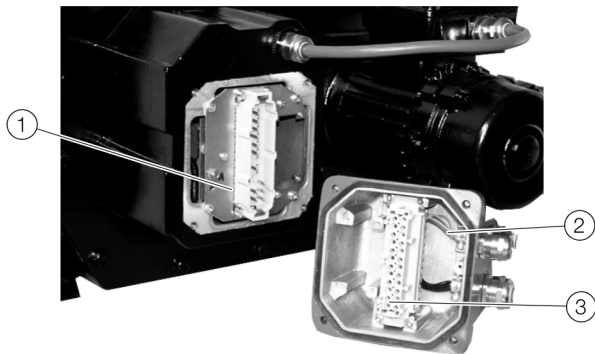


Figure 46: Fuses in EBS852; connection area (left) and main pcb (right)

## 6 Exchange of position sensor

### Dismounting

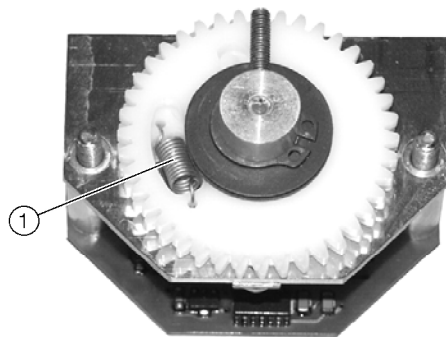


- ① Male connector
- ② Plug housing
- ③ Female connector

Figure 47: Example shows RHD500 (without heater)

1. Drive actuator into 50% position (referred to rated actuator operating range).
2. Delete the current position settings by pressing the 2 drive buttons on the LCP for at least 5 sec.
3. Switch-off the voltage supply.
4. Disconnect electrically.
5. Remove male connector.
6. Loosen both fastening screws ① of position sensor (Figure 51) and take the sensor out.
7. Detach the plug from the sensor pcb.

### Mounting

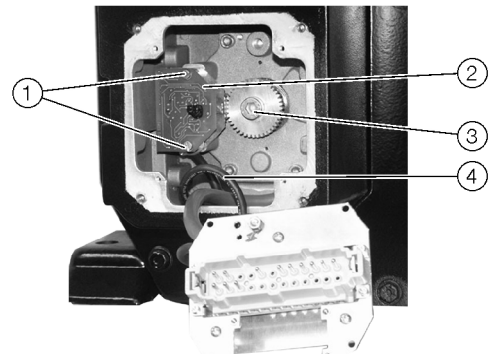


- ① Tension spring

Figure 48: Position sensor

The toothed gear pair of the position sensor is held in place by a tension spring ①, to ensure backlashfree motion when the direction of rotation is reversed.

1. Set the stop pin to the center position, as shown in Figure 50.



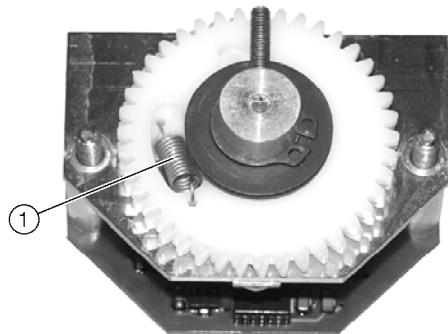
- ① Fastening screws
- ② Position sensor
- ③ Shaft gear
- ④ Sensor cable

Figure 49: Mounting position (Example shows RHD500)

2. Align the sensor and its gears with the actuator; set the first toothed gear in 09:00 o'clock position (Figure 51) onto the drive shaft gear ③.
3. Slightly move the sensor back and forth to pre-tension the toothed gears with the difference 'z' until the second toothed gear snaps in.
4. Fasten the screws ① tightly.
5. Fasten sensor cable plug on sensor pcb
6. For the remaining assembly steps follow the disassembly procedure in reverse order
7. After mounting is completed readjust the actuator range as described in the setup section of this manual

## ... 6 Exchange of position sensor

### Mounting

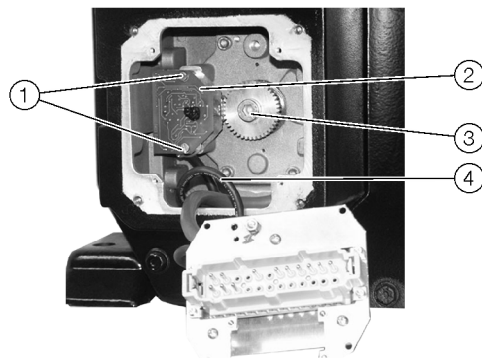


① Tension spring

Figure 50: Position sensor

The toothed gear pair of the position sensor is held in place by a tension spring ①, to ensure backlashfree motion when the direction of rotation is reversed.

1. Set the stop pin to the center position, as shown in Figure 50.



① Fastening screws

② Position sensor

③ Shaft gear

④ Sensor cable

Figure 51: Mounting position (Example shows RHD500)

2. Align the sensor and its gears with the actuator; set the first toothed gear in 09:00 o'clock position (Figure 51) onto the drive shaft gear ③.
3. Slightly move the sensor back and forth to pre-tension the toothed gears with the difference 'z' until the second toothed gear snaps in.
4. Fasten the screws ① tightly.
5. Fasten sensor cable plug on sensor pcb
6. For the remaining assembly steps follow the disassembly procedure in reverse order
7. After mounting is completed readjust the actuator range as described in the setup section of this manual

## 7 Electrical test values

### **⚠ DANGER**

#### **Danger to life due to unexpected movement of the actuator!**

Unexpected movement of the actuator may lead to very serious injuries or to death.

- Make sure that the actuator can move without posing a danger to people!

### **⚠ WARNING**

#### **Risk of injury due to live parts!**

Risk of death or serious injuries due to electricity and unexpected machine movements. In automatic mode the motor is always under power, even at standstill.

- When working on the actuator or the related subassembly, switch off the supply voltage for the electronic unit and separate anti-condensation heater (option), and take precautions to prevent unintentional switch-on.

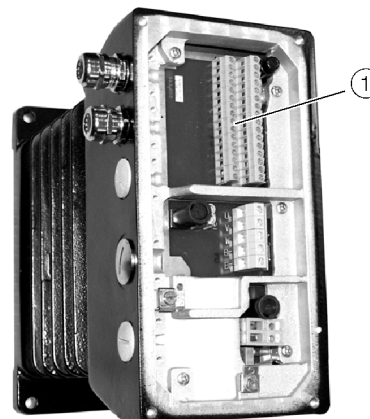
### **HINWEIS**

If you loosen the motor terminal box for whatever reason use an appropriate liquid sealing compound for the sealing surface (e. g. Elastosil E41) in addition to the rubber gasket before you fasten the box.

#### **Note**

Check wiring and proper terminal connections before you start the test procedure.

## Test values (position sensor)



① Signal terminals

Figure 52: Signal terminal location

The in- / output signals are assigned to terminals of the electronic unit as follows:

Terminal*	Value
17	DC +15 V; $\pm 15\%$ (supply); refer to terminal 22
18	not used
19	Clock
20	Data
21	Reference potential for position signal
22	Reference potential for temp. signal and supply voltage
23	Position proportional voltage signal (0.4 to 4.4 V); refer to terminal 21; end positions of actuator must be adjusted
24	temperature proportional voltage signal; refer to terminal 22; ( $\Delta V$ approx. 22.4 mV / °C; approx. 1.8 V at 20 °C)

\* see Figure 52 for terminal position)

## ... 7 Electrical test values

### Test values (Brake and Motor)

#### Brake voltage

DC 135 V with AC 115/AC230 V mains supply.

#### Motor voltage

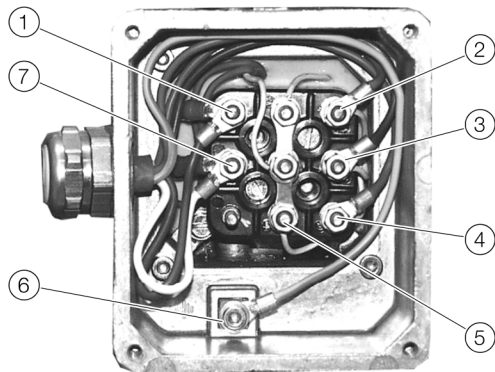
Check for currents symmetry (i. e. with clip-on ammeter).

#### Winding resistance

Depending on the actuator version proceed as follows:

- Open the motor terminal box.
- Refer to the values in table for proper resistance values of motor and brake windings.

Position of the cable gland may vary; cable numbers are printed on the cable; terminal no. only for reference purpose (expl. picture for motor series 1)

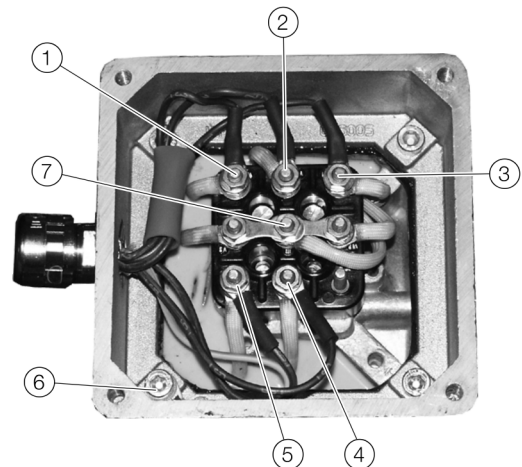


- |                          |                          |
|--------------------------|--------------------------|
| ① Terminal 6 for cable 6 | ⑤ Terminal 4             |
| ② Terminal 3 for cable 3 | ⑥ ground                 |
| ③ Terminal 2 for cable 2 | ⑦ Terminal 5 for cable 5 |
| ④ Terminal 1 for cable 1 |                          |

Figure 53: Motor terminal box for MCS71BA

#### MCS 71 BA

Measuring points	Resistance
Winding resistance $\pm 5\%$ at 20 °C (motor); terminal; 4-1 / 4-2 / 4-3	21 $\Omega$
Winding resistance $\pm 5\%$ at 20 °C (brake); terminal 5-6	2180 $\Omega$



- |                          |                          |
|--------------------------|--------------------------|
| ① Terminal 1 for cable 1 | ⑤ Terminal 5 for cable 5 |
| ② Terminal 2 for cable 2 | ⑥ ground                 |
| ③ Terminal 3 for cable 3 | ⑦ Terminal 4             |
| ④ Terminal 6 for cable 6 |                          |

Figure 54: Motor terminal box for; MCS80BA, MC90BA, MC100BA

#### MCS 80 BA

Measuring points	Resistance
Winding resistance $\pm 5\%$ at 20 °C (motor); terminal; 4-1 / 4-2 / 4-3	7.7 $\Omega$
Winding resistance $\pm 5\%$ at 20 °C (brake); terminal 5-6	1660 $\Omega$

#### MCS 90 BA

Measuring points	Resistance
Winding resistance $\pm 5\%$ at 20 °C (motor); terminal; 4-1 / 4-2 / 4-3	3.7 $\Omega$
Winding resistance $\pm 5\%$ at 20 °C (brake); terminal 5-6	1290 $\Omega$

#### MC 100 BA

Measuring points	Resistance
Winding resistance $\pm 5\%$ at 20 °C (motor); terminal; 4-1 / 4-2 / 4-3	3.7 $\Omega$
Winding resistance $\pm 5\%$ at 20 °C (brake); terminal 5-6	1079 $\Omega$

## 8 Troubleshooting

### LED signals at commissioning and service field

Provided the electronic unit is supplied with voltage (green LED on LCP 'ON'), the red LED on the commissioning and service field provide some basic status information:

Both LED are 'OFF'	Actuator is ok
Both LED are 'ON'	Actuator is in bootstrap mode (e. g. during data loading procedure); in this case the actuator is not available for the positioning loop.
Both LED flash Simultaneously	Actuator end positions are not set; actuator does not accept commands to the digital inputs and can only be moved via drive buttons on the local control panel (see also electronic unit instruction).
Both LED flash alternatively	Actuator failure (e. g. out of adjusted range); actuator cannot be moved via command buttons or commands from the process control system; reset is only possible once the failure reason is eliminated.

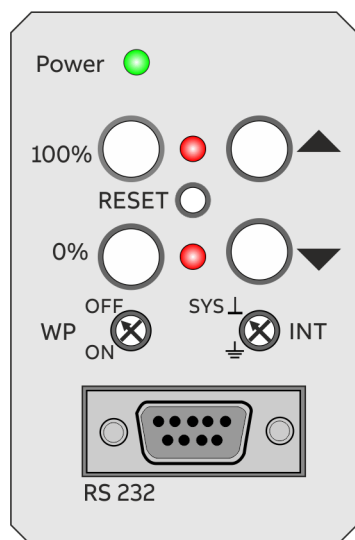


Figure 55: Commissioning and service field

## 9 Troubleshooting

### NOTICE

Check wiring, polarity and all plug and terminal connections before you start detailed trouble shooting.

The following chapter specifies various possible failure events or conditions, which should be checked.

Follow the block diagrams to find the associated reason, result or measure to solve the malfunction.

#### Example:

Condition	E6.1	LED signal: Failure
Possible failure	E6.3	Sensor memory failure
One reason / measure to solve the malfunction	R6.2	Replace sensor; see <b>Exchange of position sensor</b> on page 27 (in this case the user will find more detailed information about the sensor replacement in <b>Exchange of position sensor</b> on page 27).

## ... 9 Troubleshooting

### General

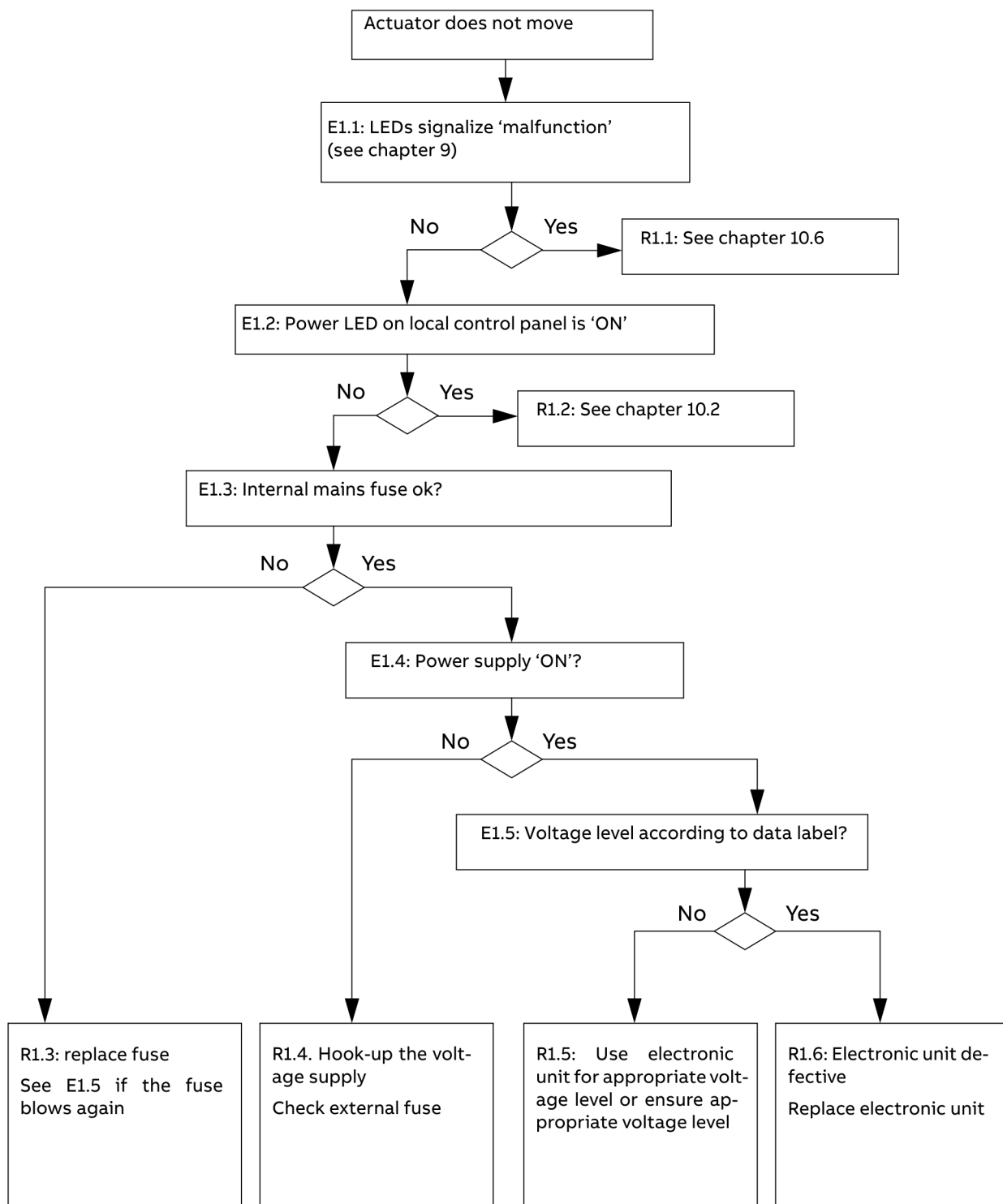


Figure 56: General



### Failures at brake, fuse or wiring

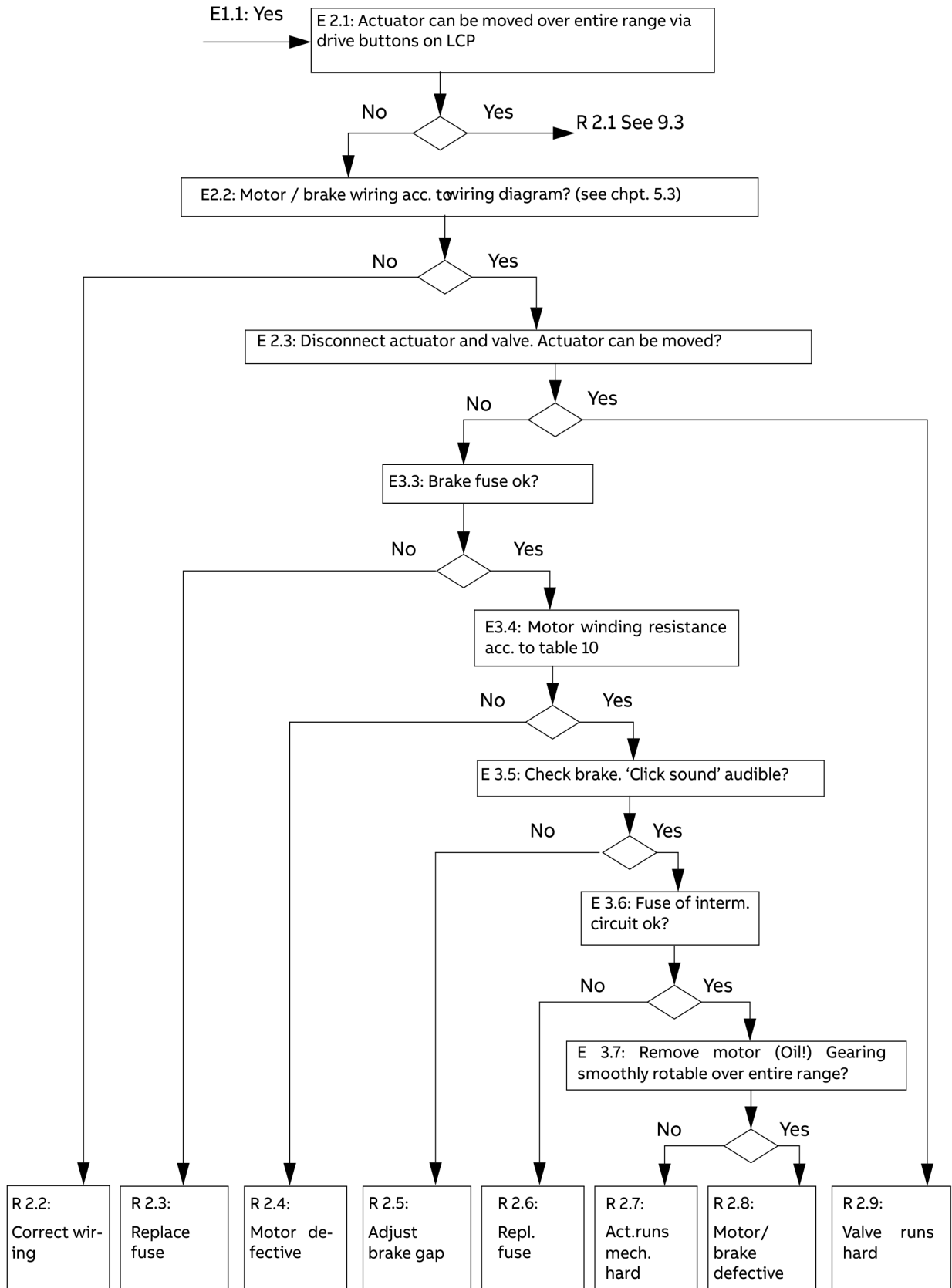


Figure 57: Failures at brake, fuse or wiring

## ... 9 Troubleshooting

### Operation mode (MAN / AUT)

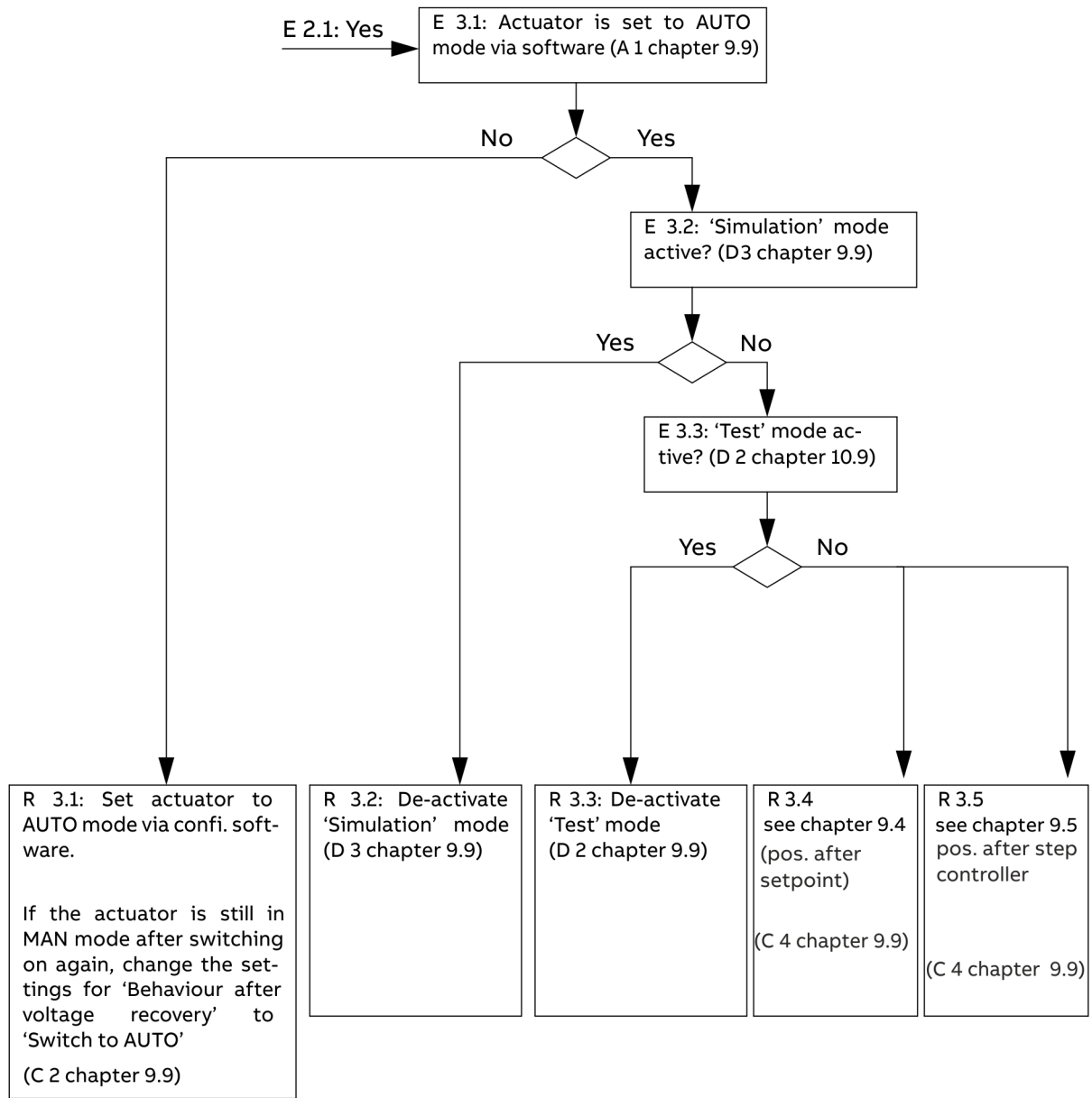


Figure 58: Operation mode (MAN / AUT)

## Input configuration

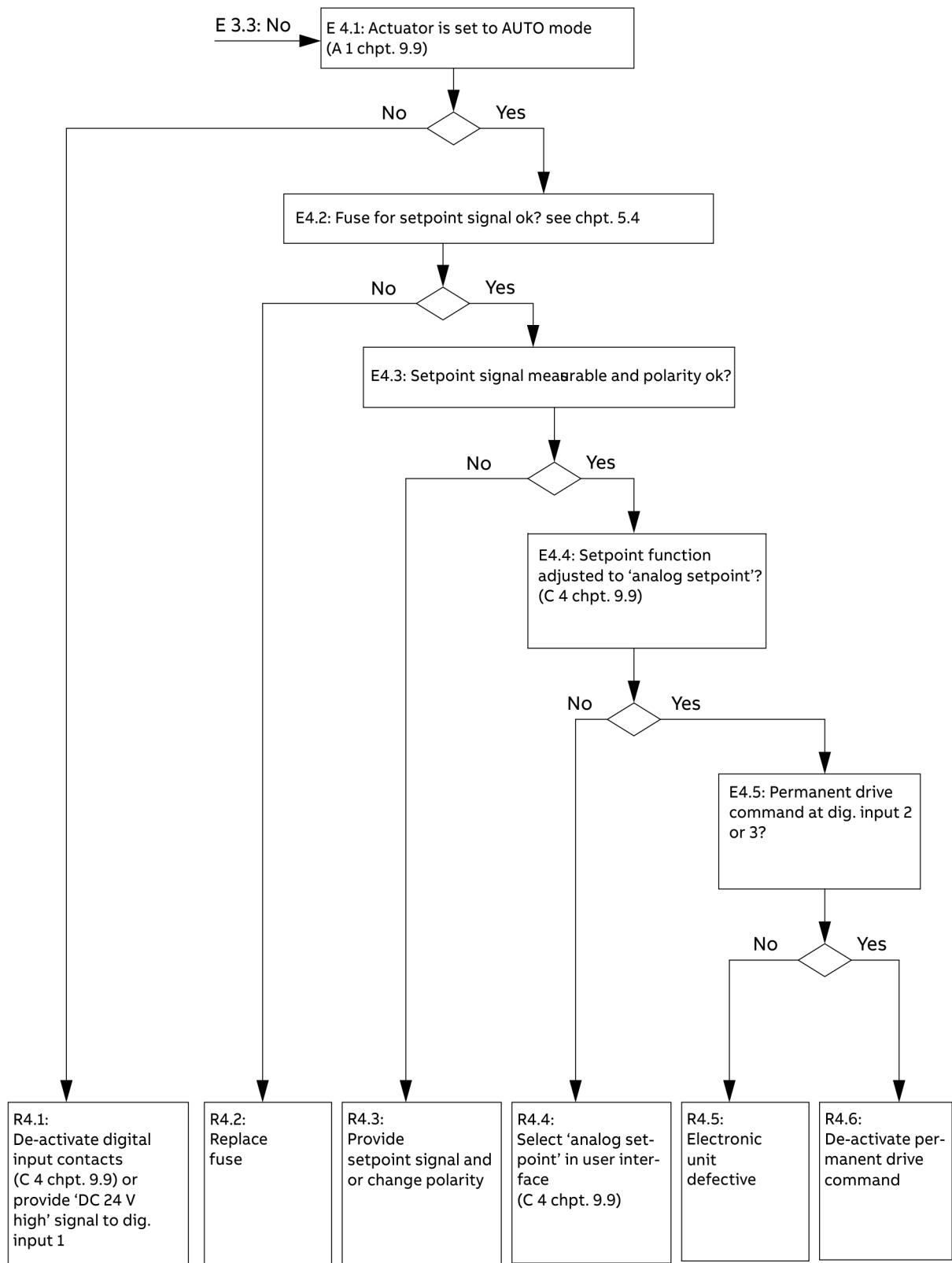


Figure 59: Input configuration

# ... 9 Troubleshooting

## Operation behind step controller

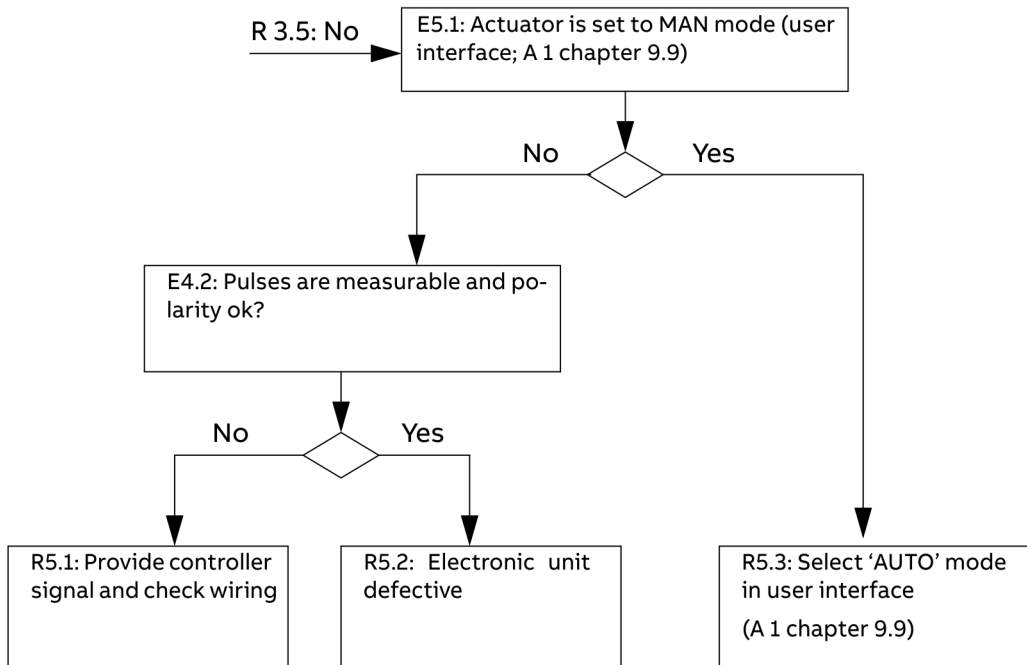


Figure 60: Operation behind step controller

## Failure Diagram

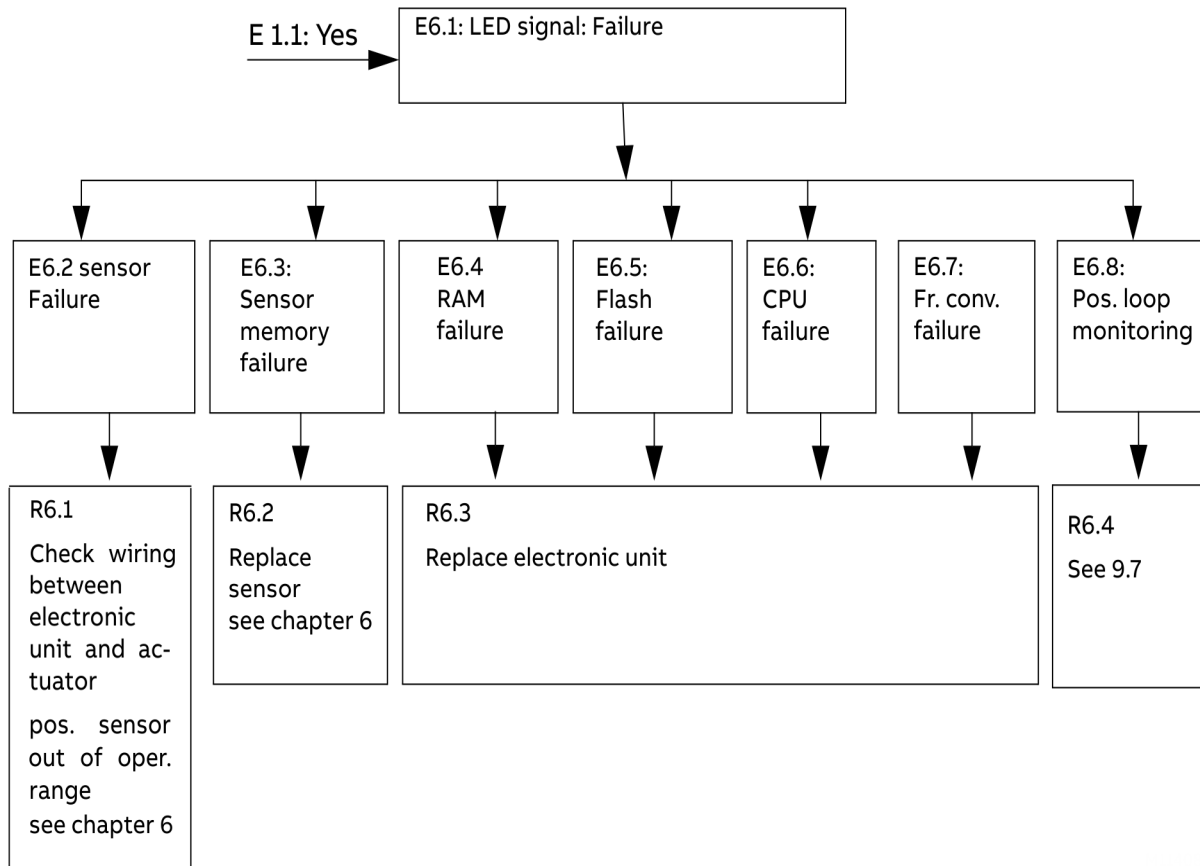


Figure 61: Failure Diagram

## ... 9 Troubleshooting

### Failure due to response of positioning loop monitoring

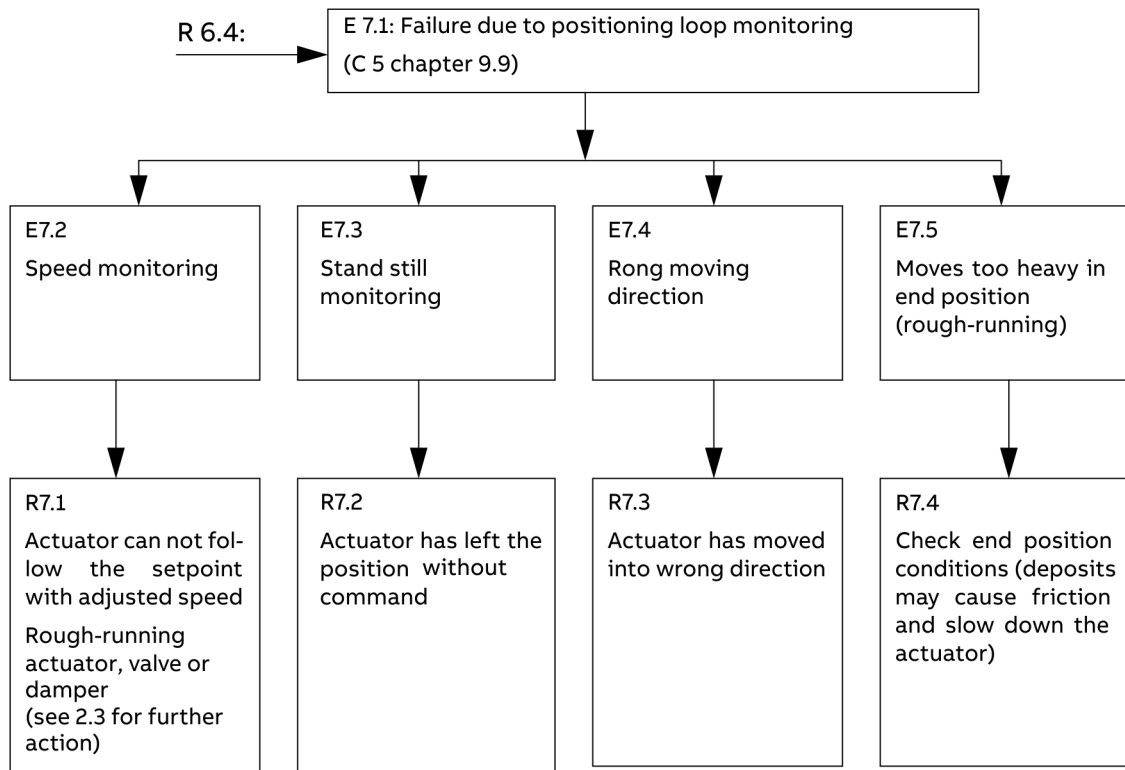


Figure 62: Failure due to response of positioning loop monitoring

## General

### Actuator runs with creeping speed in one or both end positions

- Check the software settings for leaving the end position; if 'break-away' is activated, the actuator moves with increased torque / force but with reduced speed.

### Imprecise behavior in step-control mode

- Use graphical user interface to check function assignment of digital input settings; select 'step controller'.

### Actuator over-runs end position(s)

- Change the software settings for the end position behavior to 'Position-dependent switch-off' and enter the associated switch-off position.
- Adjust the mechanical limit stops in order to avoid an end position over-run.

### Actuator moves into an end position once it reaches a setpoint

- De-activate 'close tight' in the software settings for modulating control near the end position.

### Actuator position does not correspond to setpoint although the position signal corresponds to the setpoint

- De-activate the programmable setpoint in the software settings for the setpoint characteristic.

### Actuator follows the setpoint only within a limited range

- De-activate 'split range' in the software settings for the setpoint characteristic.

## User interface menus

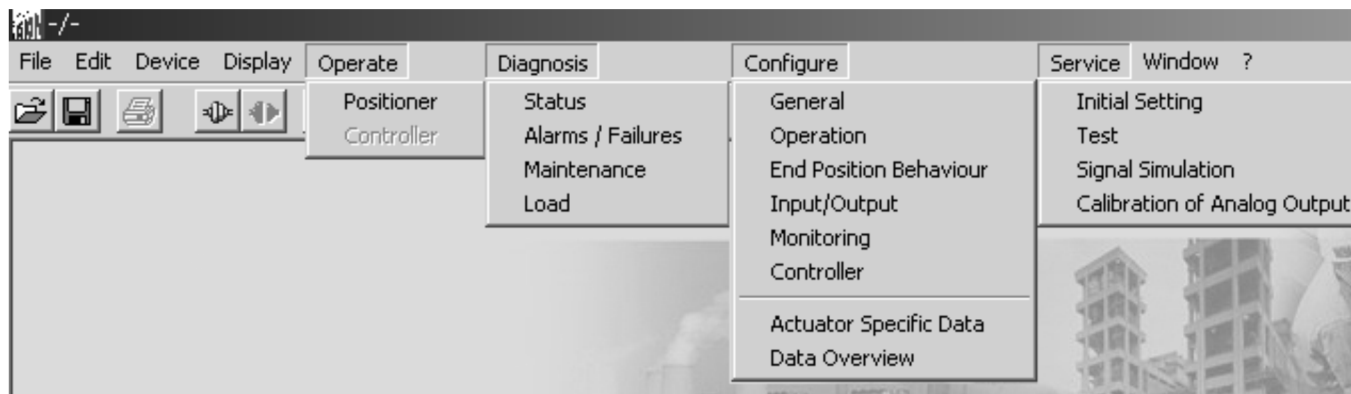


Figure 63: Troubleshooting related menus in the user interface (digitally manipulated screen shot)

The following table represents the first 2 menu levels (see also **User interface menus** on page 39) of the graphical user interface as far as the troubleshooting is concerned. Some of the subjects in **Troubleshooting** on page 31 refer to the user interface.

Use the numbering in table 5 to facilitate the navigation. The user interface software does not use any numbering in the menus.

A Operate	B Diagnosis	C Configure	D Service
A 1 Positioner	B 1 Status	C 1 General	D 1 Initial setting
A 2 Controller	B 2 Alarms / Failures	C 2 Operation	D 2 Test
	B 3 Maintenance	C 3 End positioner	D 3 Signal simulation
	B 4 Load	C 4 Input / Output	D 4 Calibration of analog output
		C 5 Monitoring	
		C 6 Controller	
		C 7 Actuator specific data	
		C 8 Data overview	

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