

# Electrical Part Turn Actuators for Continuous Modulating Control RHD8000 ... RHD16000 (Contract)

Rated Torque 8000 ... 16000 Nm  
(6000...12000 ft-lbs)

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# Electrical Part Turn Actuators for Continuous Modulating Control RHD8000 ... RHD16000 (Confrac)

## Service Instruction

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# 1 Important information

## 1.1 General

Read and save all instructions prior to installing, operating, and servicing this product. If any of the instructions are not understood, contact your ABB representative for clarification.

## 1.2 Symbols

In order that you can make the best use of this document and to ensure safety during commissioning, operation and maintenance of the equipment, please note the following explanation of the symbols used.

Explanation of the symbols used:

Symbol	Signal Word	Definitions
	<b>DANGER</b>	DANGER indicates an <b>imminently hazardous</b> situation which, if not avoided, <b>will result</b> in death or serious injury. (High level of risk.)
	<b>WARNING</b>	WARNING indicates a <b>potentially hazardous</b> situation which, if not avoided, <b>could result</b> in death or serious injury. (Medium level of risk.)
	<b>CAUTION</b>	CAUTION indicates a <b>potentially hazardous</b> situation which, if not avoided, <b>could result</b> in minor or moderate injury. (Low level of risk.)
	<b>NOTICE</b>	NOTICE indicates a <b>potentially harmful</b> situation which, if not avoided, <b>may result</b> in damage of the product itself or of adjacent objects. (Damage to property)
	<b>IMPORTANT</b>	IMPORTANT indicates useful hints or other special information which, if not observed, could lead to a decline in operating convenience or affect the functionality. (Does not indicate a dangerous or harmful situation.)

As well as the instructions in this document, you must also follow the generally applicable accident prevention and safety regulations.

If the information in this document is insufficient in any situation, please contact our service department, who will be happy to help you.

Please read this document carefully before installation and commissioning.

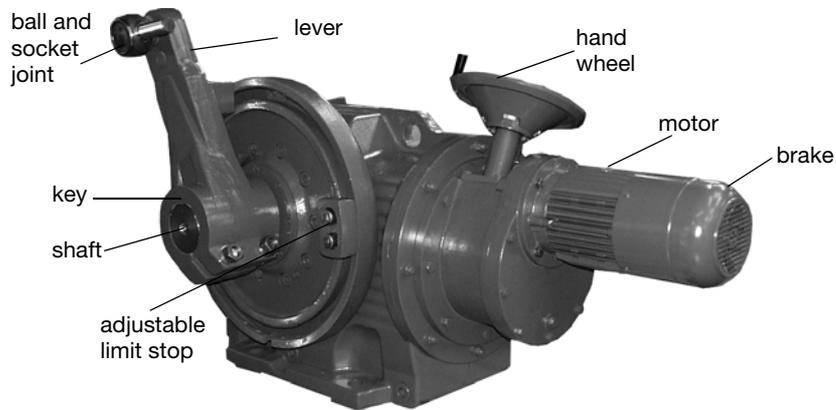
**To ensure proper performance, use qualified personnel who have been trained, qualified and certified by ABB to install, operate, update, tune, and maintain the actuator, the electronic units and the wiring.  
ABB will not take any responsibility for personal injuries or material damages which were caused by non-trained, non-qualified or non-certified personnel.**

## 1.3 Transport and storage

Carefully inspect for shipping damage. Damage to the shipping carton is usually a good indication that it has received rough handling. Report all damage immediately to the freight carrier and your ABB representative. Verify that the items on the packing list or bill of lading agree with your own.

**2 Introduction**

This service instruction refers to the ABB part-turn actuators RHD8000 and RHD16000. It amends and deepens the routine maintenance description in the standard instruction, which we strongly recommend also be available for all maintenance work.



(d0128rxa)

Fig. 1: RHD8000 / RHD16000; main components

**2.1 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, qualified and certified by ABB for these tasks are authorized to mount and adjust the actuator and to make the electrical connection. ABB will not take any responsibility for personal injuries or material damages which were caused by non-trained, non-qualified or non-certified personnel.
- 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.
- Refill the oil and check all mechanical and electrical interfaces for proper connection once the installation, commissioning, service or maintenance work is done.

**2.2 Tools**

**IMPORTANT**



Maintenance at CONTRAC actuators requires tools which are usually available in a workshop. Please consider that all dimensions are based on the metric system. This applies also for the wrench sizes, threads etc. Using improper tools may damage the actuator or its components.

Use appropriate sleeves for the installation of the sealing rings (see chpt. 4.2 for details).

**3 Lubrication**

The spur wheel gearings of RHD8000 and RHD16000 are oil lubricated. They contain the oil quantity acc. to 3.1. In order to avoid any overpressure in the gearbox (e. g. due to thermal influence) replace the uppermost check plug by the separately supplied vent screw once the actuator is installed.

Standard actuators are delivered with a vent screw with a metal cap. Actuators which are equipped with an anti-condensation heater are delivered with a vent screw with a plastic cap.

**3.1 Mounting position and filling capacity**

The standard delivery filling capacity corresponds to the required amount for mounting position IMB3.

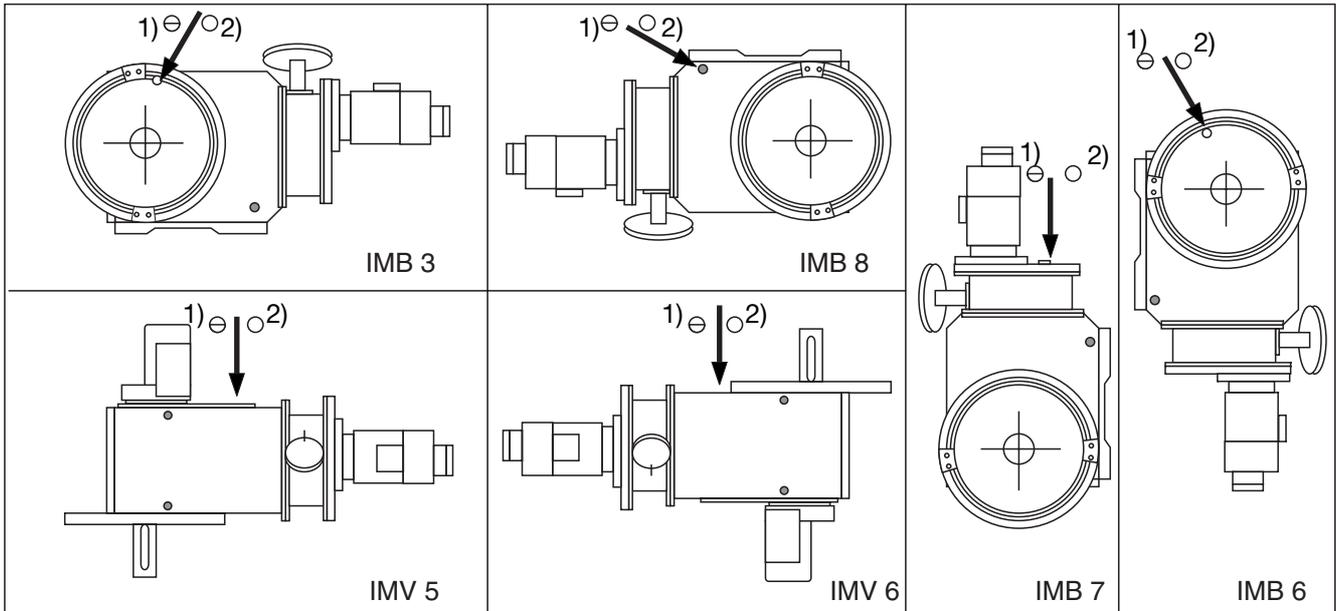


Fig. 2: Mounting position RHD8000 / RHD16000; 1) = inspection screw, 2) = venting screw

Mounting position <b>RHD8000</b>	<b>IMB 3</b>	<b>IMB 6</b>	<b>IMB 7</b>	<b>IMB 8</b>	<b>IMV 5</b>	<b>IMV 6</b>
Minimum oil quantity; approx. [l]	57	55	74	61	52	53
Min. oil level [mm] under inspection screw	135	215	45	110	80	85
Mounting position <b>RHD16000</b>	<b>IMB 3</b>	<b>IMB 6</b>	<b>IMB 7</b>	<b>IMB 8</b>	<b>IMV 5</b>	<b>IMV 6</b>
Minimum oil quantity; approx. [l]	88	contact manufacturer for other mounting orientation				
Min. oil level [mm] under inspection screw	155					

Table 1: Oil level

The arrow indicates the position of the inspection screw <sup>1)</sup> and the vent screw <sup>2)</sup>. After having mounted the actuator, replace the highest inspection screw with the separately delivered vent screw.

**3.2 Oil specifications**

	<b>Oil types</b>	
Ambient temperature	Oil type used by manufacturer for first filling	Possible other oil types
- 10°C ... + 65°C	ESSO Spartan EP 220 (L-CKC to ISO TR 3498)	Aral Degol BMB 220 BP Energol GR-XP 220, Shell Omala 220 Mobilgear 630
- 30°C ... + 50°C	Mobil SHC 629	-----

Table 2:

### 3.2.1 Oil change

Use the lowermost plug to drain the oil. If the actuator basement does not allow to put an appropriate catchment device under the lowermost drain plug keep this one closed and open the uppermost drain plug. Push the pipe of a hand pump through this opening until the end reaches the bottom. Use the hand pump to get the oil manually out into the catchment device.

#### NOTICE



*Do not mix oil for different temperature ranges. Dispose of the waste oil in compliance with the respective local regulations. Make sure that no waste oil reaches the water cycle.*

Proceed as follows to drain or change the oil (consider previous hints):

- provide a container capable to take the expected oil quantity acc. to table 1
- open or undo the venting screw (fig. 2)
- unscrew the lowermost inspection screw and use it to drain the oil
- make sure that all of the oil is out of the actuator
- screw in and tighten the drain screw
- complete other maintenance work (if required)
- refill the appropriate amount of oil and tighten the venting screw

## 4 Maintenance

Contrac actuators feature a robust construction. As a result, they are highly reliable and require only little maintenance. The maintenance intervals depend upon the effective load.

The built-in microprocessor evaluates the actual load factors (e.g. torques, movements, temperatures, etc.) and derives the remaining operating time until the next routine maintenance is required. Use the configuration program for viewing this information.

#### CAUTION



*All maintenance work must be carried out by qualified specialists who have been trained for this task. Switch-off the power supply and protect the actuator against unintentional switch-on prior to any maintenance. Make sure that disconnecting the power or any mechanical linkage does not endanger the any process or person. Make sure that the actuator is not exposed to process forces during the maintenance work.*

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 provides that the actuator is disconnected from the damper and that all electrical supply is disconnected.

4.1 Lever

4.1.1 Lever removal

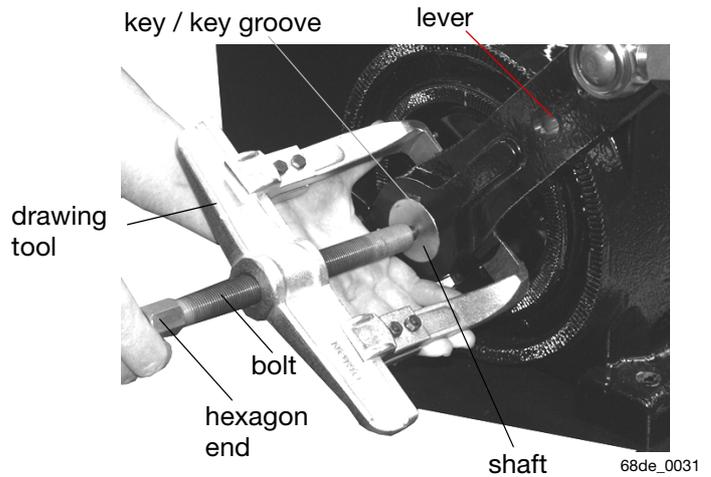
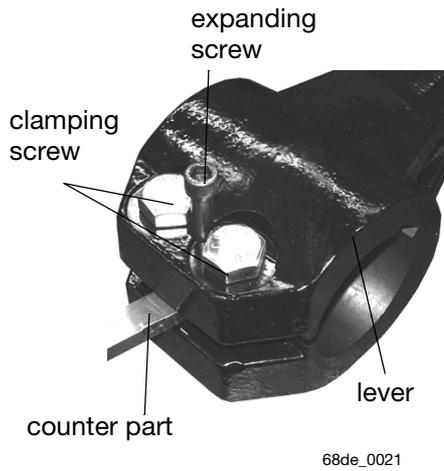


Fig. 3: Lever removal

- loosen the clamping screw
- use an expanding screw to spread the lever seat
- push a counter part (soft metal) into the lever gap in order to protect the expanding screw thread
- put the claws of the drawing tool behind the lever and place the bolt end on the shaft
- put an appropriate tool onto the hexagon end of the drawing tool bolt
- turning the bolt clockwise will pull the lever from the shaft end

STOP



*Pay attention to the lever weight in order to avoid injuries!*

4.1.2 Lever installation

NOTICE



*Make sure that the shaft surface and the lever bore are clean and free of grease before you install the lever!*

- push the key into the shaft groove
- use an expanding screw to spread the lever seat
- push a counter part (soft metal) into the lever gap in order to protect the expanding screw thread
- take the lever and align its key groove and the key in the shaft
- push the lever onto the shaft end
- finally tighten the clamping screw(s)

4.1.3 Ball and socket joint

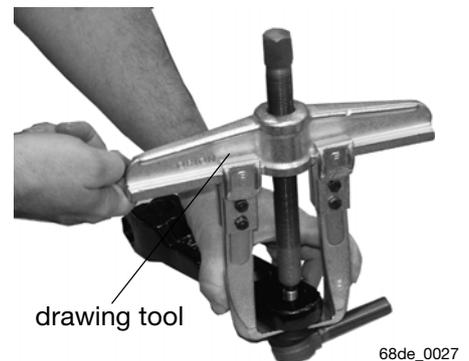
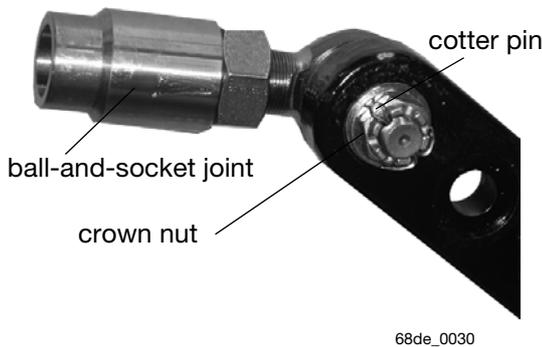


Fig. 4: Ball-and-socket-joint (exemplary depiction; details may be different)

NOTICE



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

4.1.3.1 Removal

- remove the cotter pin
- loosen the crown nut and put it aside
- use an appropriate drawing tool to press the ball-and-socket joint out; if there is no appropriate drawing tool available use a copper (or similar, non-iron) hammer to drive the joint out

4.1.3.2 Installation

- push the bolt of the ball-and-socket joint into the lever hole
- put the crown nut onto the bolt and tighten it with the required torque; see 4.1.4 for details.
- secure the crown nut with a **NEW** cotter pin

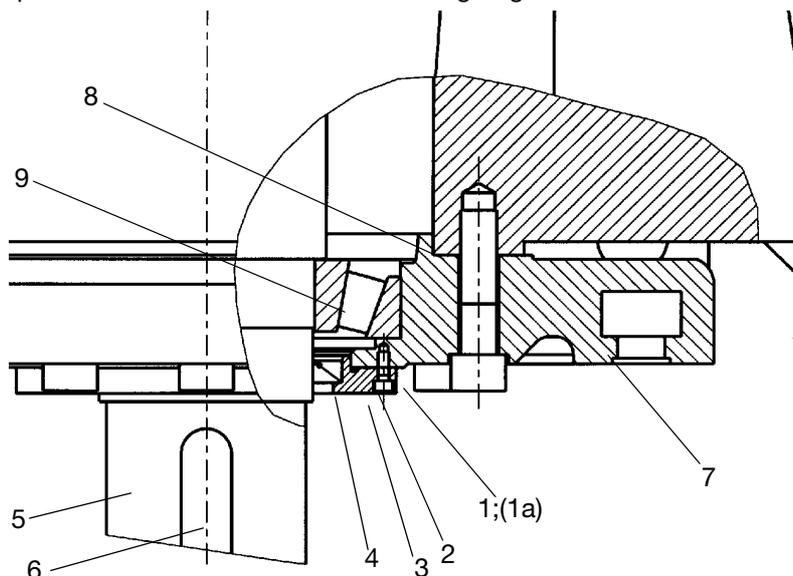
**4.1.4 Dimensions of lever screws**

Actuator	Clamping Screw (tightening torque)	Limit stop screws (tightening torque)	Expanding screw (diam. / min. length / min. thread length)	Crown nut (tightening torque)
RHD8000	M27x160-10.9 (1400 Nm / 1032 ft-lbs)	M24x70-8.8 (670 Nm / 494 ft-lbs)	16 mm / 80 mm / 45 mm	M38x1.5 (750 Nm / 553 ft-lbs)
RHD16000	M27x160-10.9 (1400 Nm / 1032 ft-lbs)	M24x70-8.8 (670 Nm / 494 ft-lbs)	16 mm / 80 mm / 45 mm	M38x1.5 (750 Nm / 553 ft-lbs)

Table 3:

**4.2 Sealing ring of output drive shaft**

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



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Fig. 5:

In order to change the O-ring (2) and sealing ring (4) of the output drive shaft proceed as follows:

- remove lever or coupling from the output shaft (5) as described in 4.1.1
- make sure that the oil level is below the O-ring (2) or below the flange collar (8)
- if necessary drain the oil (see chpt. 3.2.1)
- remove the key (6) and loosen and remove the sealing flange screws (1)
- two tapholes (thread size: M6 for RHD8000; M8 for RHD16000) on the bolt circle (1) allow the use of forcing screws (1a); turn these screws clockwise to remove the flange (3); the thread length of the forcing screws should be at least 25 mm
- pull the flange (3) from the shaft

**NOTICE**



*Pay attention to the flange weight.*

- turn the forcing screws (1a) out
- take the O-ring (2) and the sealing ring (4) out
- clean the shaft and the flange; slightly grease the sealing ring

- replace the O-ring (2) and the sealing ring (4); see fig. 6 for details
- cover the key groove (6) in the shaft prior to the flange re-installation in order to avoid any damage of the new sealing ring
- push the flange carefully over the shaft (5) and fasten the screws (1) crosswise; tightening torque for screws (1) = 23 Nm (17 ft. lbs)
- remove key cover and re-install lever or coupling

In case you also want to change the bearing (9) use the two tapholes (thread size: M16) with appropriate forcing screws (thread length at least 75 mm) to get the toothed flange (limit stop carrier) (7) out. It is sealed with a special sealing compound. In case of removal / re-installation remove the old compound material and prepare the contact surfaces with new sealing compound. ABB recommends to use Loctite Type 574.



Fig. 6: Flange and sealing ring (exemplary picture)

**IMPORTANT** Make sure that the „open“ side of the sealing ring points towards the oil.

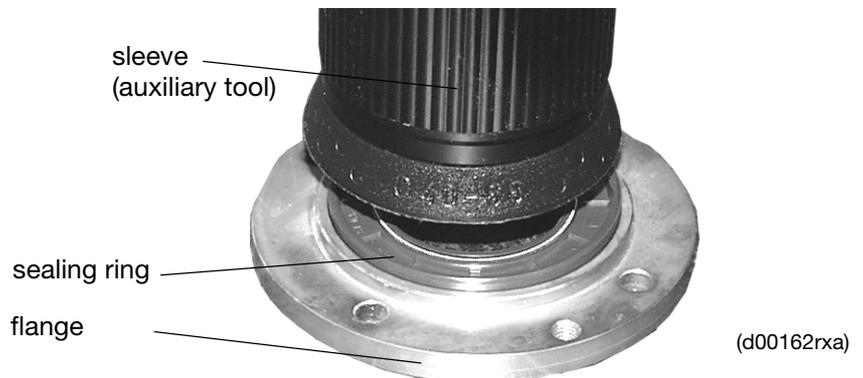


Fig. 7: Use of auxiliary tool for sealing ring installation (exemplary picture)

4.3 Sealing ring of hand wheel drive / hand wheel shaft

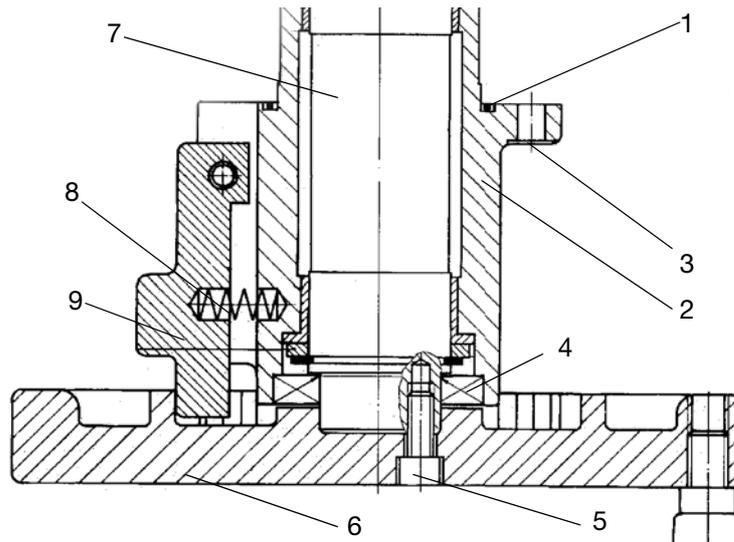


Fig. 8: Handwheel

*Restoring process forces may move the actuator when you release the handwheel!*



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

- Make sure that the oil level is below the O-ring (1).
- Drain the oil if necessary (see chpt. 3.2.1 for details).
- Turn flange screws (3) out.
- Pull entire hand wheel drive assembly out of the gearing engagement.
- Replace the O-ring (1).
- 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.
- Take the shaft sealing ring (4) out.
- Grease the new the shaft sealing ring (4) slightly with oil and put it into the groove; consider the exemplary hints and illustration of chpt. 4.2.
- Fasten the hand wheel (6) and re-install the entire assembly; tightening torque for the screws (3) = 20 Nm (15 ft-lbs)

4.4 Sealing of the position sensor drive

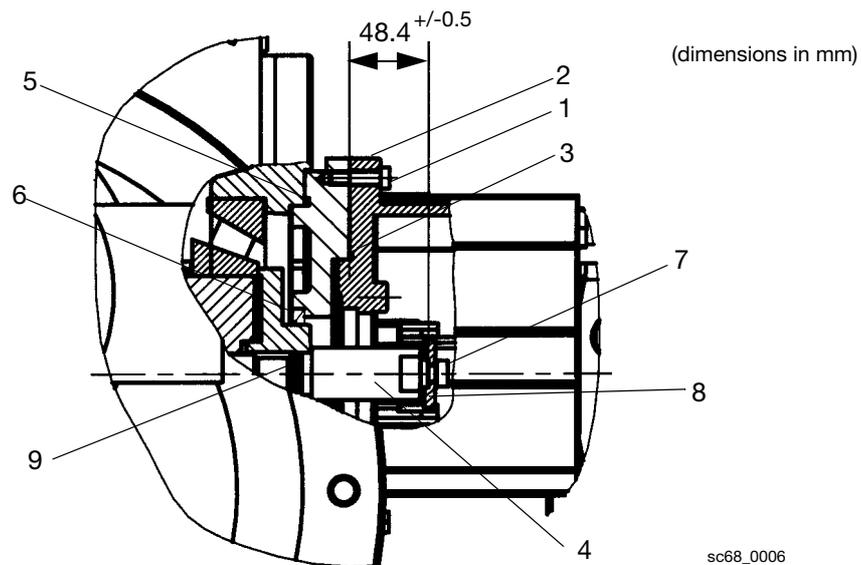


Fig. 9:

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**4.4.1 Change of O-ring in transmitter hood**

- undo hood fastening screws (1)
- pull the hood (2) from the pivot (4) and put it aside
- replace the O-ring (2)

**4.4.2 Change of O-ring and sealing ring in bearing flange**

- undo the flange screws (not shown in fig. 9)
- pull the flange carefully from the pivot (4)
- replace the O-ring (5) and the sealing ring (6)

**4.4.3 Change of shaft O-ring**

- remove the position sensor
- put a spanner on the spanner flat of the pivot (4) and undo the pivot
- replace the O-ring (9); grease the new O-ring prior to re-tightening the pivot
- tighten the pivot with a torque of 300 Nm

Assemble the devices in reverse order.

**4.5 Motor**

By the time of printing this document Contrac actuators use 2 basic motor series. Motor type MCS 90 of the series 1 feature a „C“ at the end of the name code, motor type MCS 90 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 4.5.1 for details.

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

**4.5.1 Motor assignment and tightening torque**

Actuator	Motor screws	Motor flange screws	Tightening torque
RHD8000-15	MC 112 BA	--	69 Nm (50 ft-lbs)
RHD8000-80	MCS 90 BA	79 Nm (58 ft-lbs)	22 Nm (16 ft-lbs)
RHD16000-30	MC 112 BA	--	69 Nm (50 ft-lbs)

Table 4: Tightening torque for motor screws

**4.5.2 Motor removal**

*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*

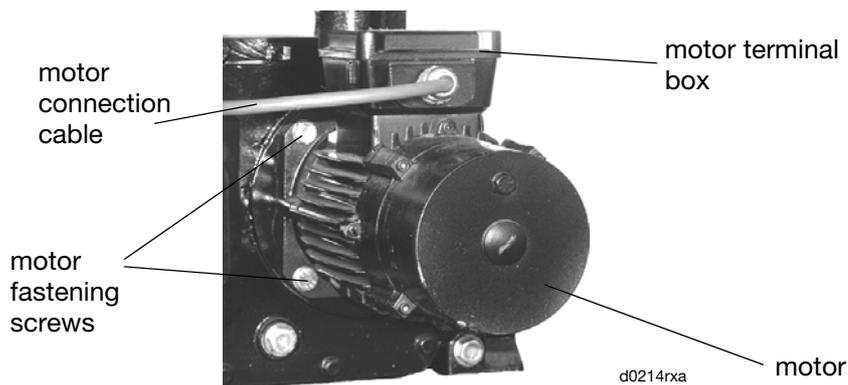


Fig. 10: Rear motor view (exemplary depiction; motor of series 1)

- disconnect the motor / actuator from any electrical supply
- disconnect motor connection cable in motor terminal box
- make sure the oil level is below the lowest motor part; if necessary drain the oil (see 3.2.1 for details)
- undo the 4 motor fastening screws
- pull the motor carefully out
- once the motor overhaul is finished, replace the motor sealing ring in any case
- install the motor in reverse order

### 4.5.3 Motor O-ring

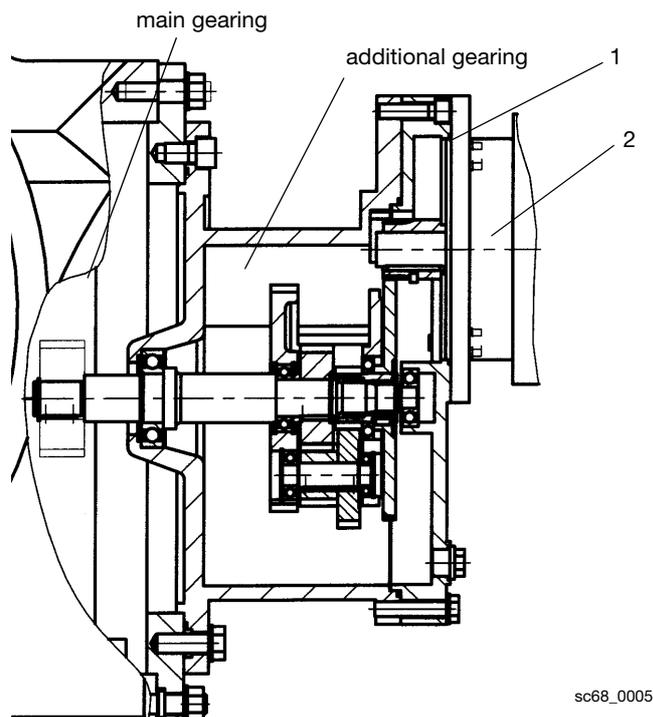


Fig. 11

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

- disconnect the electrical power supply prior to any maintenance
- make sure, that the oil level is below the O-ring (1); drain the oil (if required) acc. to 3.2.1
- disconnect the cables in the motor terminal box
- turn the motor screws out and put the motor (2) aside; remove O-ring (1)
- put new O-ring (2) into the flange groove and fasten the motor with the screws; tightening torque see table 4

**4.5.4 Motor disassembly / assembly**

**4.5.4.1 Motors with fan on rear shaft end**

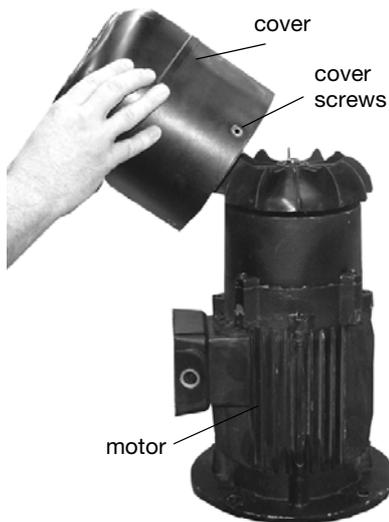


Fig. 12: Cover removal

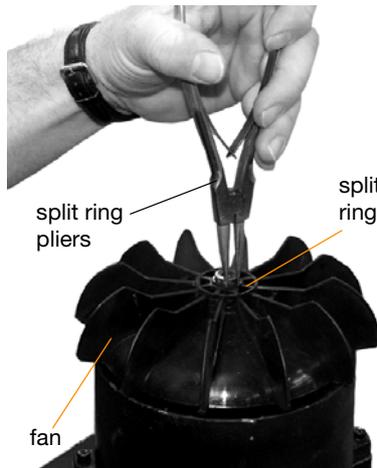


Fig. 13: Split ring removal

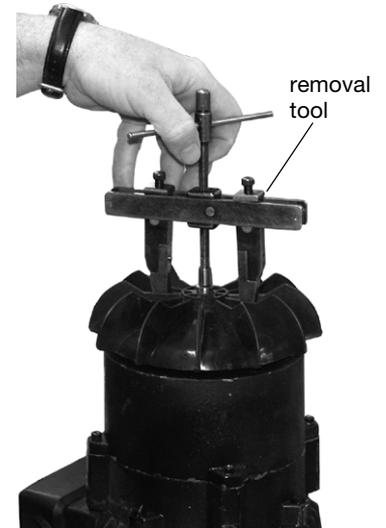


Fig. 14: Removal tool

- undo cover screws and remove the cover
- use appropriate split ring pliers and removal tool to remove split ring and fan
- remove fan

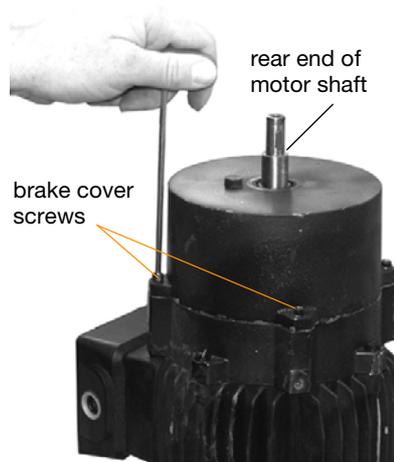


Fig. 15:



Fig. 16:

- undo brake cover screws
- remove brake cover

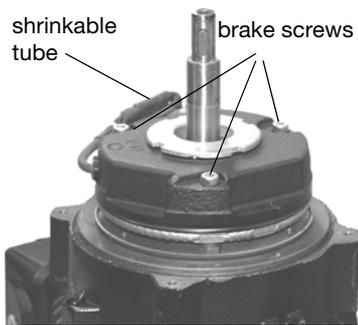


Fig. 17: Brake (motor series 1)

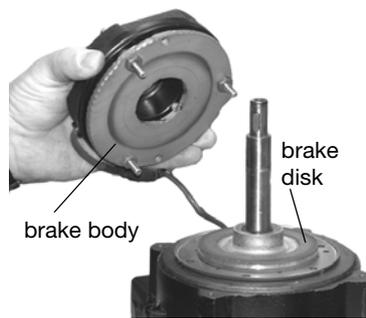


Fig. 18: Brake body removal (motor series 1)

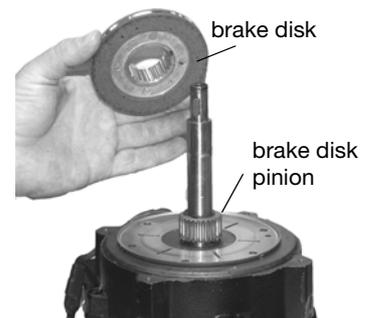
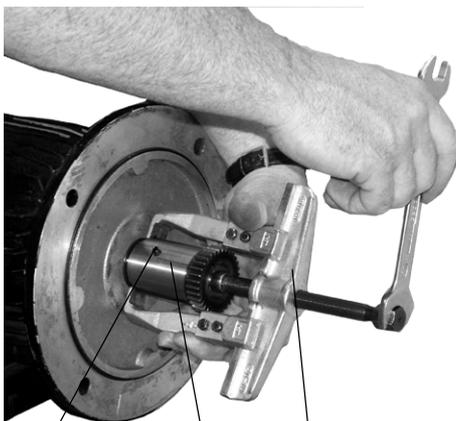


Fig. 19: Brake disk removal (motor series 1)

- undo brake screws
- open shrinkable tube and disconnect the cable
- take the brake body apart
- take the brake disk apart
- remove the retaining ring from the brake disk pinion and pull the pinion from the shaft
- (see chpt. 4.6 for brake adjustment)



pinion screw pinion removal tool

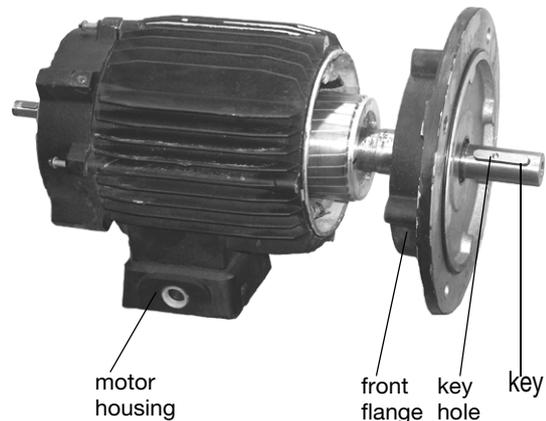


Fig. 20: pinion removal (example: motor series 1) Fig. 21: Flange removal (example: motor series 1)

- undo the pinion screw; use an appropriate retainer to secure the screw for the re-assembly (DELO-ML 5228 or LOCTITE 243; both medium-firm; detachable)
- use an appropriate removal tool to pull the pinion from the shaft
- do not damage the threaded center hole
- remove the key; note the key position (key hole) before you take it out of the shaft groove
- pull the front flange with motor shaft out of the housing



Fig. 22: pinion removal

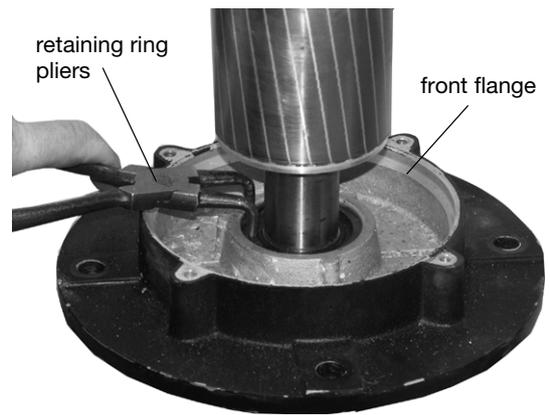


Fig. 23: (example: motor series 1

- remove bearing support washer (spring washer); take care to place it properly when re-assembling the motor
- use appropriate retaining ring pliers to remove the bearing retaining ring out of the front flange
- pull the shaft out of the flange

**4.5.5 Exchange of motor bearings**

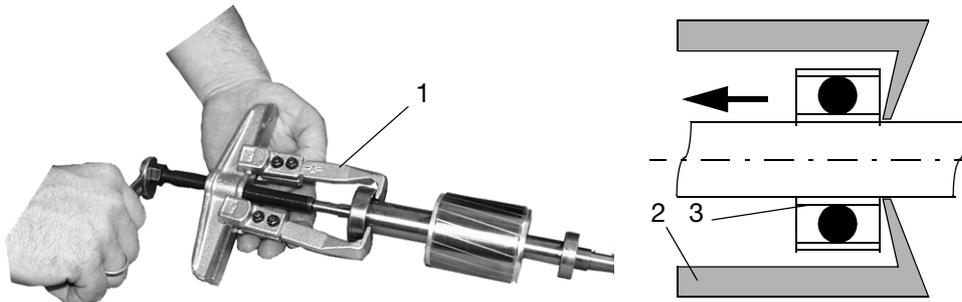


Fig. 24: Removal of motor ball bearing (exemplified; illustration applies to all motors)

- use an appropriate extraction tool (1) for bearing removal
- make sure that the extraction tool claws (2) pull at the inner ball bearing ring (3)

4.5.6 Exchange of motor shaft sealing ring

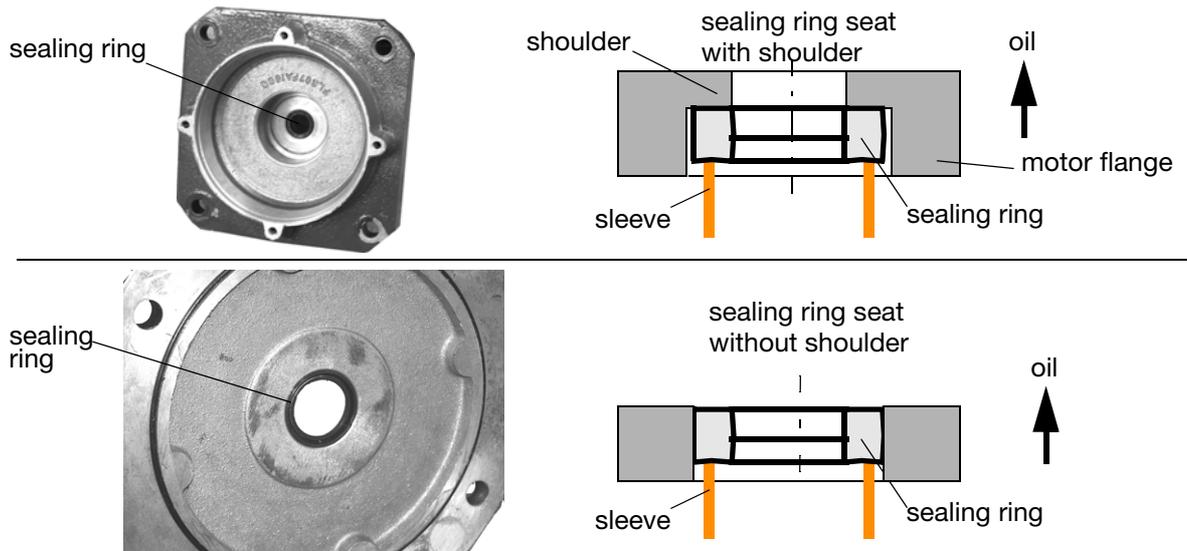


Fig. 25: Inside of the motor flange (exemplary depiction)

- take the old sealing ring out
- grease the new sealing ring and press it into the flange as shown in fig. 25; make sure that the „open“ part of the sealing ring points towards the oil (when the motor is mounted to the actuator); see fig. 25.
- assemble in reverse order; use a customary sealant for both motor flanges
- check the brake gap after re-assembly; see chpt. 4.6 for details.

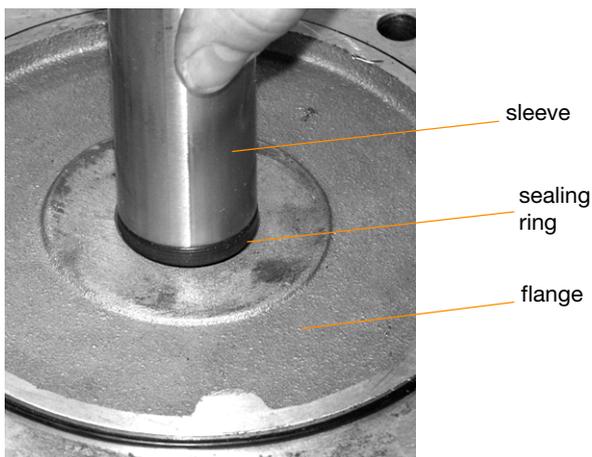


Fig. 26: Mounting the sealing ring

## 4.6 Brake adjustment

### 4.6.1 Brake of motor series 1

**STOP**



*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.*

*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!*

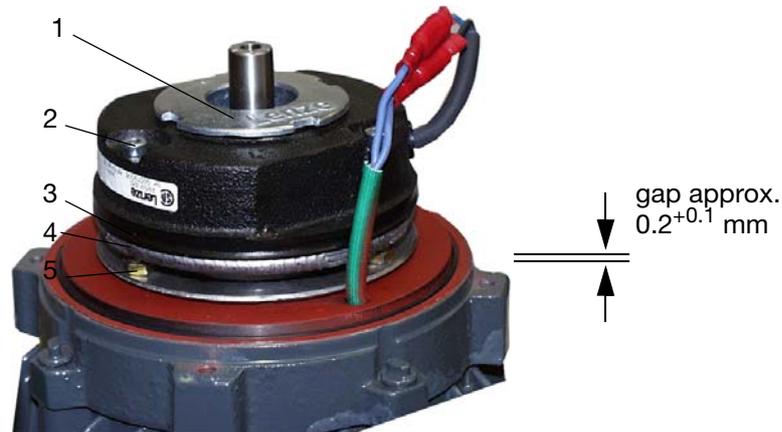


Fig. 27:

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" ... 0.012"). 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:

- disconnect the voltage supply
- remove the brake cover
- loosen the socket head screws (2)
- put a thickness gauge (0.2 mm) between the coil body (3) and the thrust plate (4)
- turn the counter nuts (5) until the thickness gauge is tautly between coil body (3) and thrust plate (4)
- tighten the socket head screws (2) evenly

#### 4.6.2 Brake of motor series 2

**STOP**



*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.*

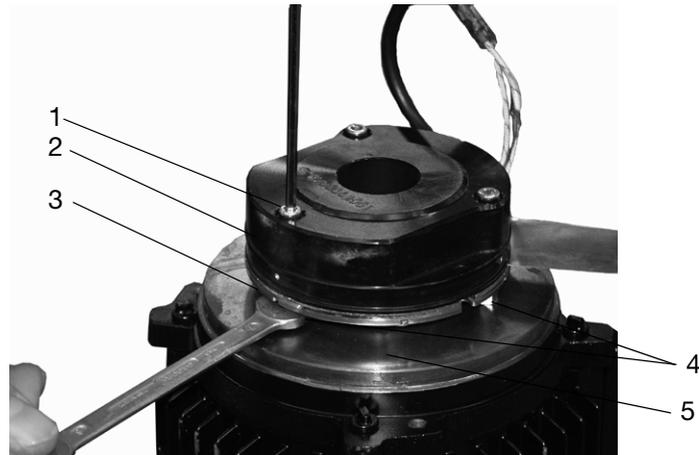


Fig. 28: Brake for motors; series 2

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" ... 0.012"). 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:

- disconnect the voltage supply
- remove the brake cover
- turn the socket head screws (1) completely out
- take the brake body (2) off
- turn the hexagon nuts (4) cw until they are in touch with the brake body (2)
- put the brake body (2) onto the shaft and tighten the screws (1); hand screwed
- turn the hexagon nuts (4) ccw until they are in touch with the base plate (5)
- evenly turn the socket head screws (1) approx 1/3 turn ccw (approx  $120^\circ$ ); this also lifts the hexagon nuts (4)
- turn the hexagon screws (4) until they are in touch with the brake body (5)
- check the gap between brake body (2) and thrust plate (3) using a thickness gauge  $0.2^{+0.1}$  mm (0.008" ... 0.012")

## 5 Electrical Connection

### 5.1 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.

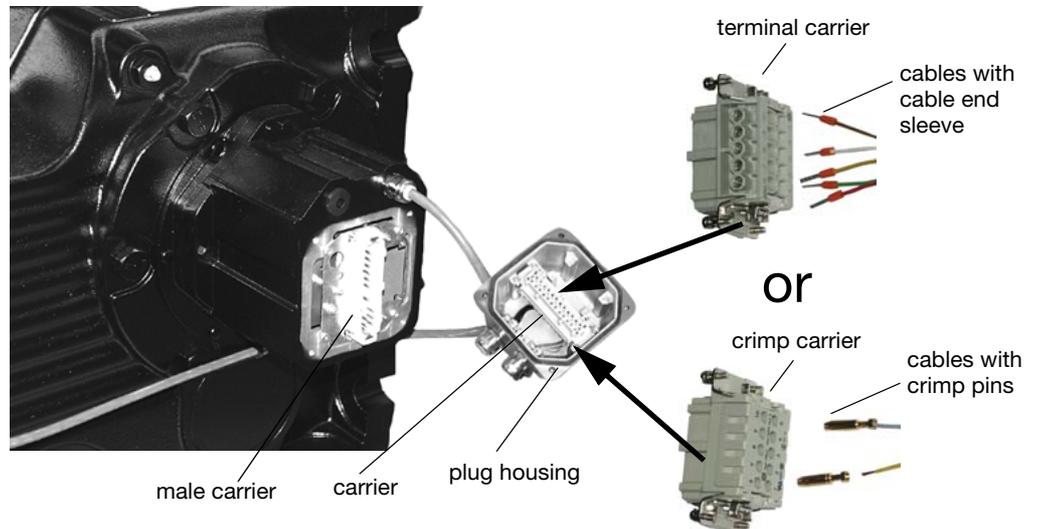


Fig. 29: Exemplary illustration of cable connection to the actuator; plug housing may contain alternatively a terminal carrier or a crimp carrier.

**CAUTION**



*Disconnect the actuator and electronic unit from the mains supply before you start working at the electrical components. Make sure that switching off the actuator does not affect the process!*

### 5.2 Covers

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 fig. 30 to get an even load

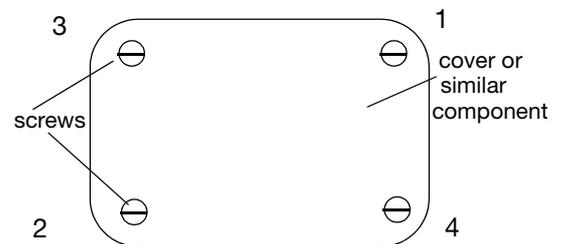


Fig. 30: Exemplary cover

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.

5.3 Wiring diagrams

5.3.1 EBN853 / EBN861 <sup>1)</sup> / EBS862 (HART) <sup>1)</sup>

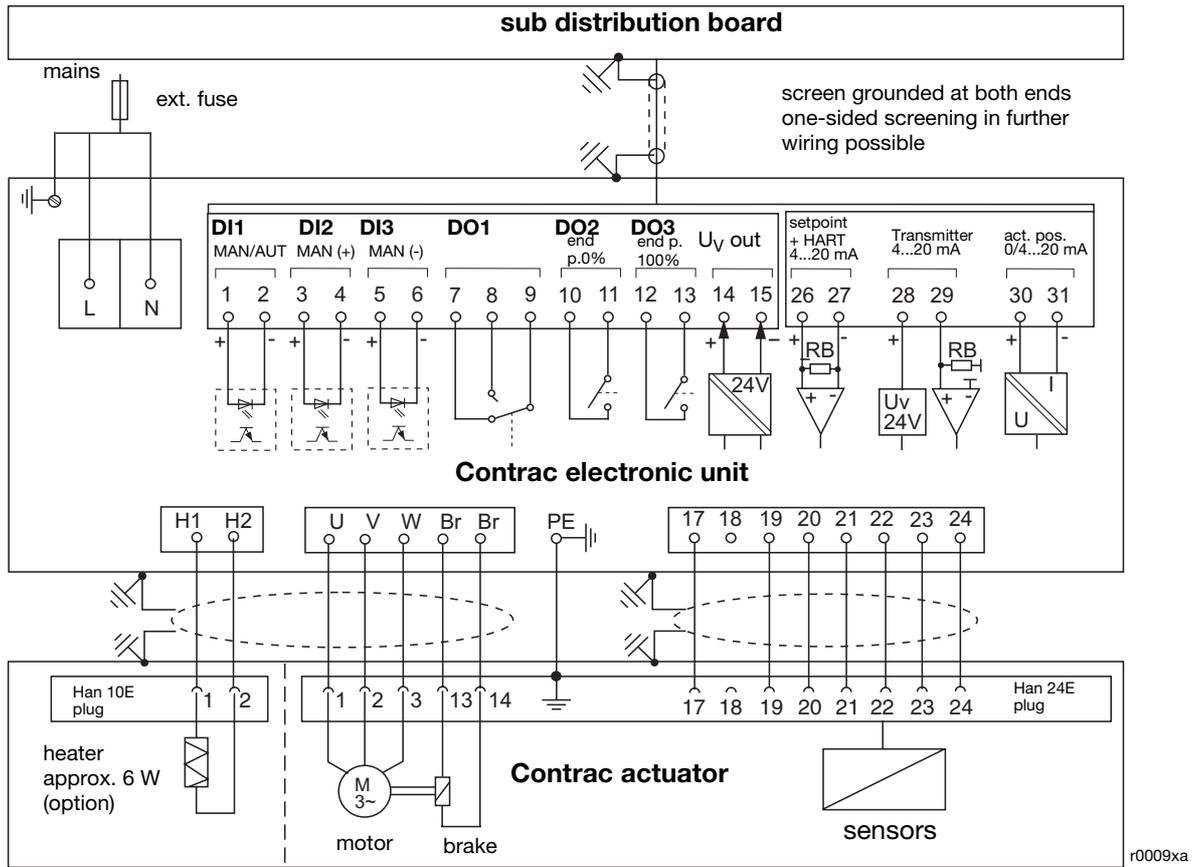


Fig. 31: <sup>1)</sup> in some cases the wiring for the voltage feed for the optional heater in the actuator may be done as shown in fig. 33

5.3.2 EBN853 / EBN861 (PROFIBUS DP)

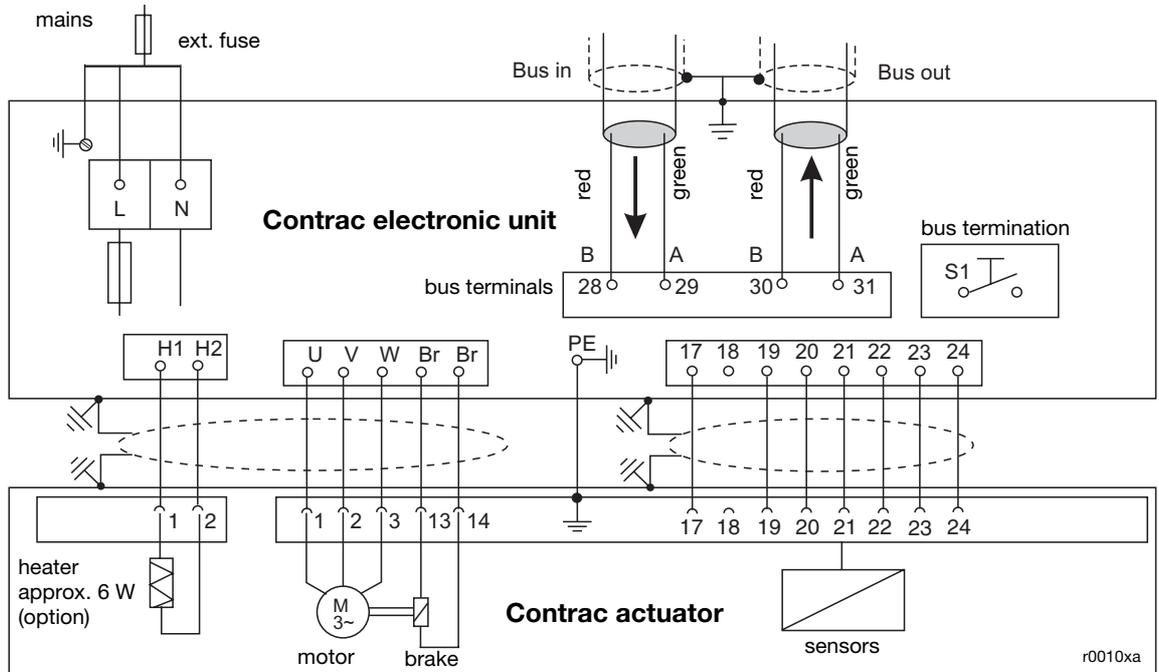
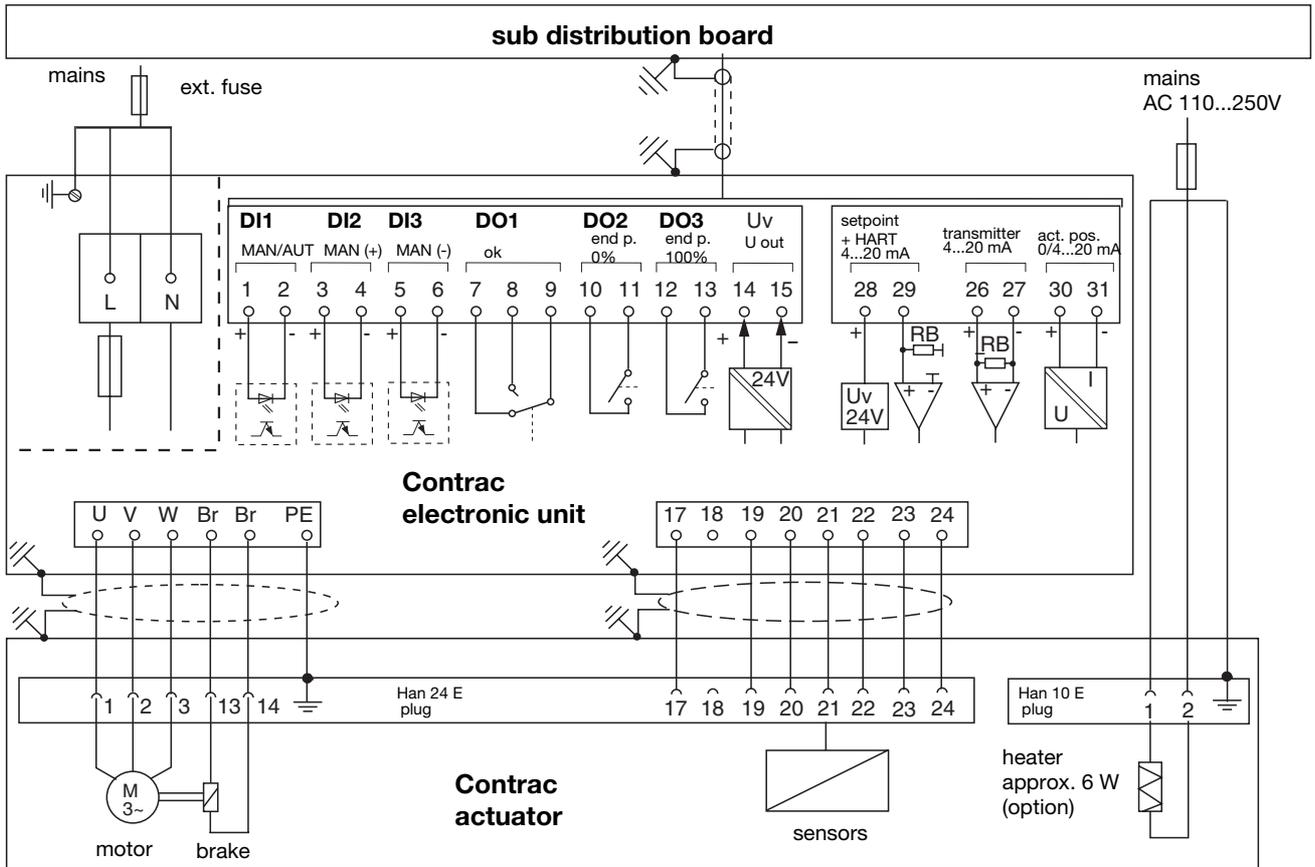


Fig. 32:

**5.3.3 EBS852 (HART)**



r0363x1

Fig. 33:

**5.4 Fuses**
**5.4.1 Electronic units for field installation**

Electronic Unit	Fuse type	Fuse dimens.	Location	U = 115 V U = 230 V	
<b>EBN853</b>	External fuse	--	external	16 A, slow	
	Mains fuse	5 x 20 mm	in connection chamber	12.5 A, slow	10 A, slow
	Analogue setpoint input	5 x 20 mm	in connection chamber	40 mA; fast	
	Motor brake	5 x 20 mm	power board	0.315 A; medium	
	Intermediate circuit fuse	6.3 x 32 mm	power board	10 A, super-fast	
	Anti condensation heater	5 x 20 mm	in connection chamber	2 A; slow	
<b>EBN861</b>	External fuses <sup>1)</sup>	--	external	--	35 A fuse 16 A thermal safety cutout
	Motor brake	5 x 20 mm	on board (power section)	--	0.315 A, medium
	Intermediate circuit fuse	6.3 x 32 mm	power board	--	16 A, super fast
	Fuse f. DO1, DO2, DO3	5 x 20 mm	in connection chamber	-----	3 x 0.2 A; medium

<sup>1)</sup> The 35 A fuse and the thermal circuit breaker(16 A) are included in the scope of delivery. They ensure safe operation for the switch-on characteristic of the power electronic unit EBN861. Note that the cable cross section between the fuse and the electronic unit must be at least 2.5 mm<sup>2</sup> (#13 AWG).

Table 5:

**5.4.2 Electronic units for rack installation**

Electronic Unit	Fuse type	Fuse dimens.	Location	U = 115 V U = 230	
<b>EBS852</b>	External fuse	--	external	16 A, slow	
	Mains fuse	5 x 20 mm	connection chamber	12.5 A slow	10 A slow
	Motor brake	5 x 20 mm	power board	315 mA; medium	
	Intermediate circuit fuse	6.3 x 32 mm	power board	10 A; super fast	
	Fuse f. DO1, DO2, DO3	5 x 20 mm	connection chamber	0.2 A; medium	
<b>EBS862</b>	External fuses <sup>1)</sup>	--	external	--	35 A fuse 16 A thermal safety cutout
	Motor brake	5 x 20 mm	on board (power section)	--	0.315 A, medium
	Intermediate circuit fuse	6.3 x 32 mm	power board	--	16 A, super fast
	Fuse f. DO1, DO2, DO3	5 x 20 mm	in connection chamber	-----	3 x 0.2 A; medium

Table 6:

<sup>1)</sup> The 35 A fuse and the thermal circuit breaker (16 A) are included in the scope of delivery. They ensure safe operation for the switch-on characteristic of the power electronic unit EBS862. Note that the cable cross section between the fuse and the electronic unit must be at least 2.5 mm<sup>2</sup> (#13 AWG).

**5.4.3 Fuse location EBN853**

**NOTICE**

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

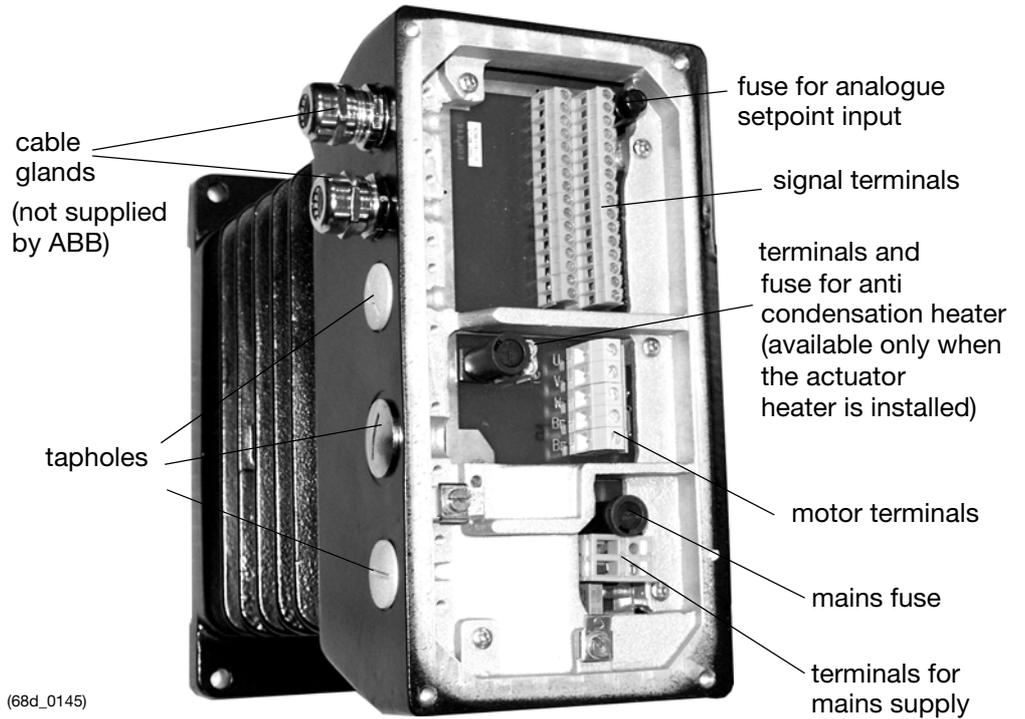


Fig. 34: Fuses in connection-housing part

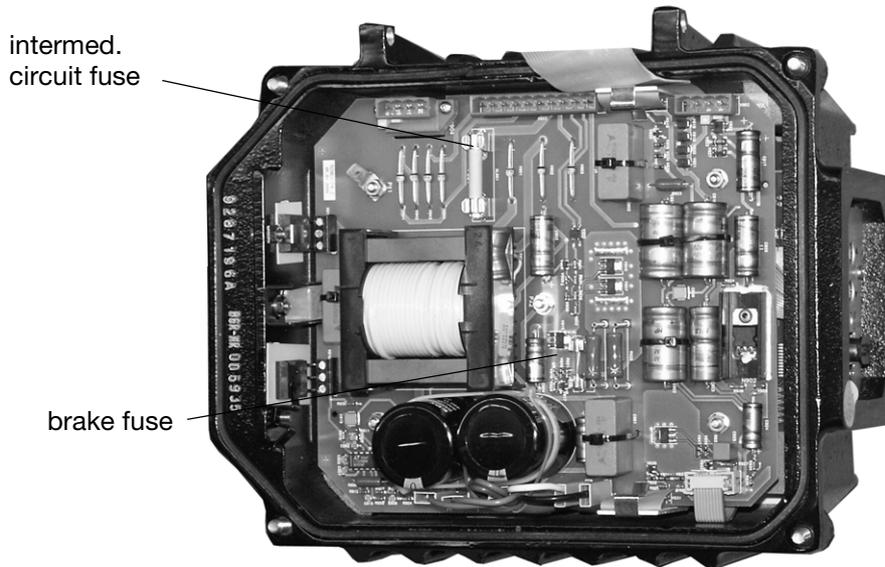


Fig. 35: Fuses in control-housing part

5.4.4 Fuse location EBN861 / EBS 862

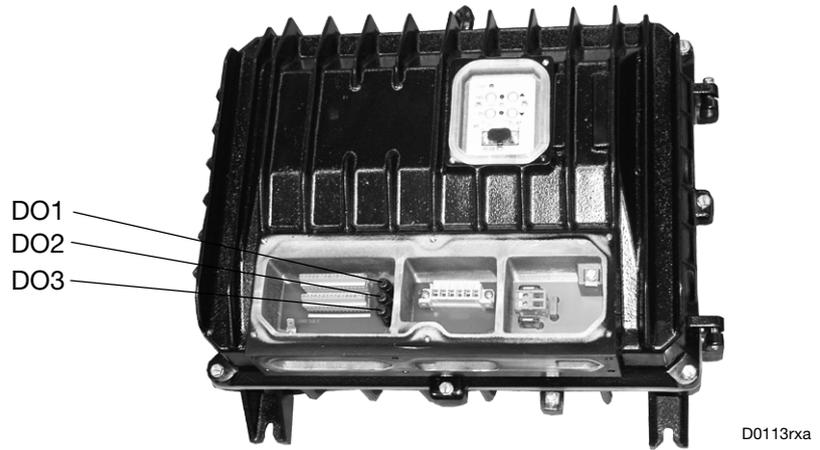


Fig. 36:



Fig. 37: Fuses in EBN861 / EBS862

5.4.5 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).

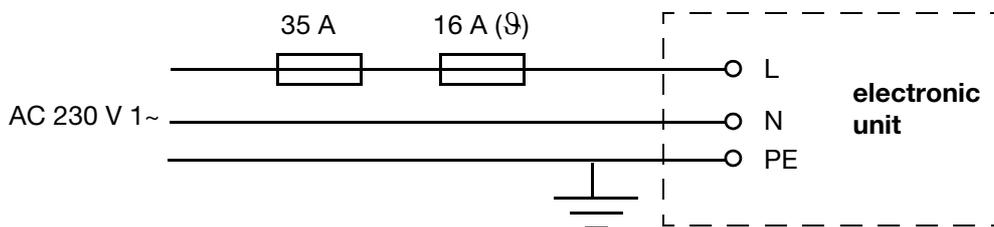


Fig. 38: External fuses



Fig. 39: External fuse; 35 A

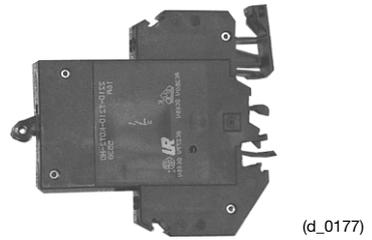
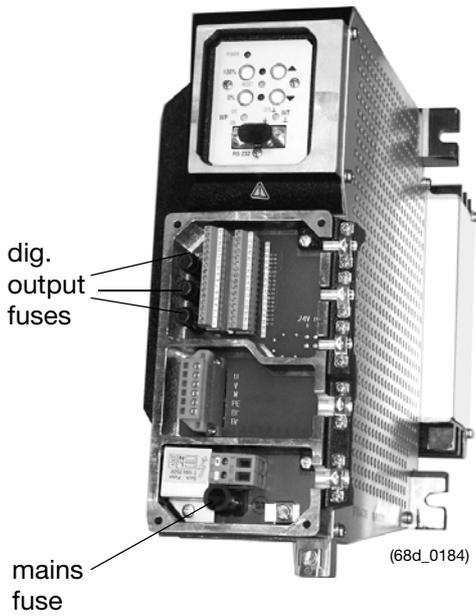
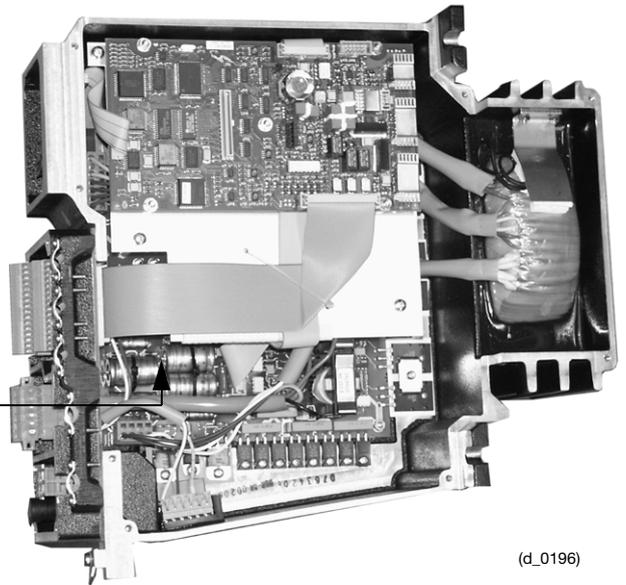


Fig. 40: Thermal circuit breaker; 16 A

**5.4.6 Fuse location in EBS852**

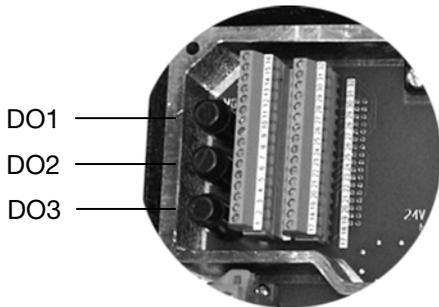


(68d\_0184)

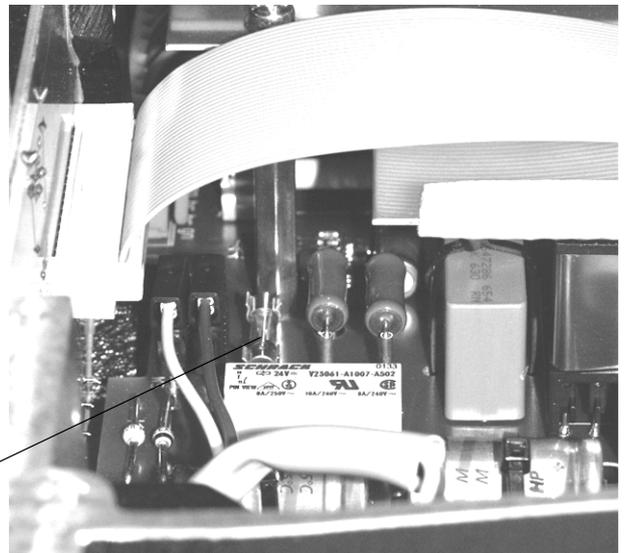


(d\_0196)

**Details: digital output fuses**



detail view of output fuses (68de\_0026)



(detail view)

(d\_0194)

Fig. 41: Fuses in EBS852; connection area (left) and main pcb (right)

**6 Exchange of position sensor**

**6.1 Dismounting**

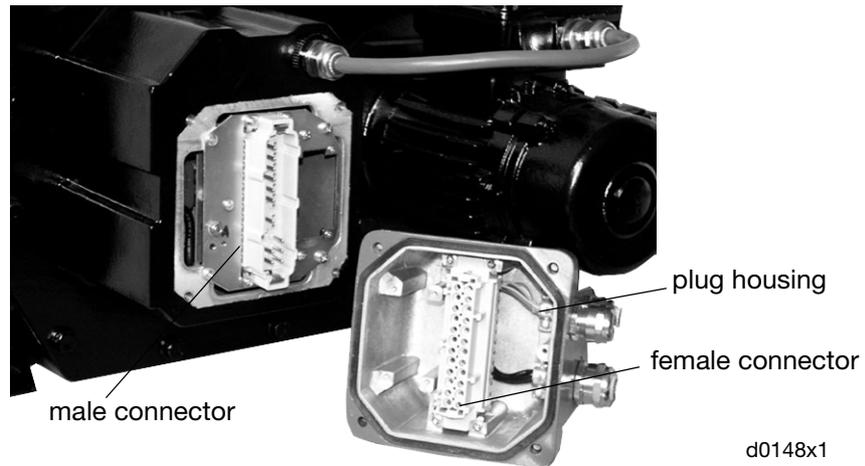


Fig. 42: Exemplary depiction; example shows RHD500 (without heater)

- drive actuator into 50% position (referred to rated actuator operating range)
- delete the current position settings by pressing the 2 drive buttons on the LCP for at least 5 sec
- switch-off the voltage supply
- disconnect electrically
- remove male connector
- loosen both fastening screws (1) of position sensor (fig. 43 + 44) and take the sensor out
- detach the plug from the sensor pcb.

**6.2 Mounting**

The toothed gear pair of the position sensor is held in place by a tension spring (3), to ensure backlash-free motion when the direction of rotation is reversed.

- set the stop pin to the center position, as shown in figure 43.
- align the sensor and its gears with the actuator; set the first toothed gear in 09:00 o'clock position (fig. 44) onto the drive shaft gear (4).
- slightly move the sensor back and forth to pre-tension the toothed gears with the difference "z" until the second toothed gear snaps in.
- fasten the screws (1) tightly.
- fasten sensor cable plug on sensor pcb
- for the remaining assembly steps follow the disassembly procedure in reverse order
- after mounting is completed readjust the actuator range as described in the setup section of this manual

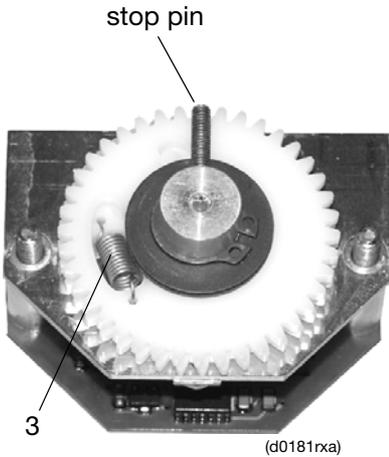


Fig. 43: Position sensor

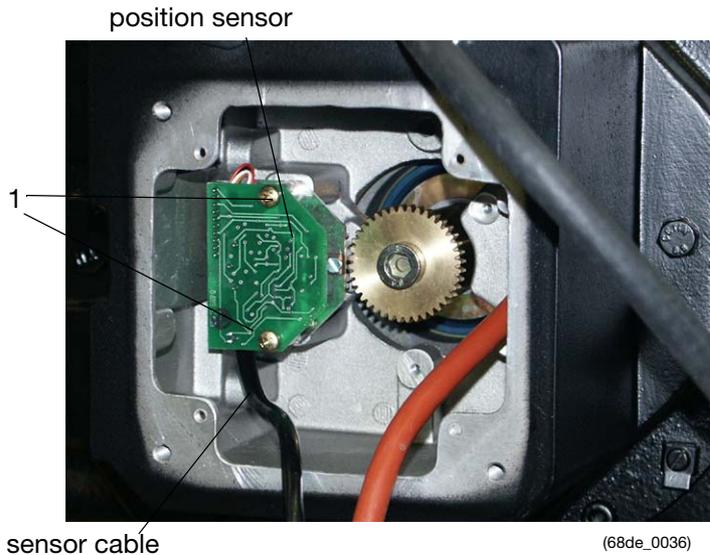


Fig. 44: Mounting position

## 7 Electrical Test Values

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



### 7.1 Test values (position sensor)

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

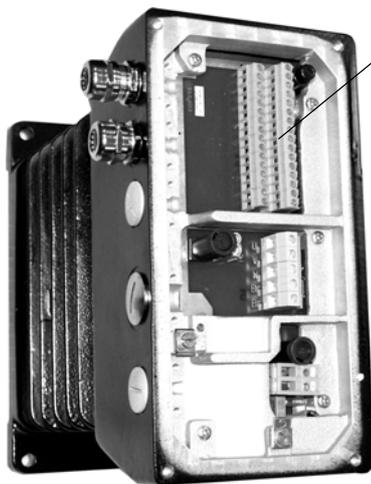


Fig. 45: Signal terminal location; exemplified for EBN853

- term. 17: DC +15 V; +/- 15% (supply); refer to term 22
  - term. 18: not used
  - term. 19: clock
  - term. 20: data
  - term. 21: reference potential for position signal
  - term. 22: reference potential for temp. signal and supply voltage
  - term. 23: position proportional voltage signal (0.4... 4.4 V); refer to term. 21; end positions of actuator must be adjusted
  - term. 24: temperature proportional voltage signal; refer to term. 22; ( $\Delta V$  approx. 22.4 mV / °C; approx. 1.8 V at 20°C)
- (see fig. 45 for terminal position)

### 7.2 Test values

Brake voltage: DC 135 V with AC 115/AC230 V mains supply  
 Motor voltage: check for currents symmetry (i. e. with clip-on ammeter)

### 7.3 Winding resistance (motor)

**CAUTION**



Disconnect the voltage supply and the actuator plug prior to any resistance measuring. Make sure that switching off the actuator does not affect the process. Disconnect the cables (no. 1, 2, 3, 5, 6) in the terminal box in order to avoid any measurement error.

Open the motor terminal box. Refer to the values in table 7 for proper resistance values of motor and brake windings.

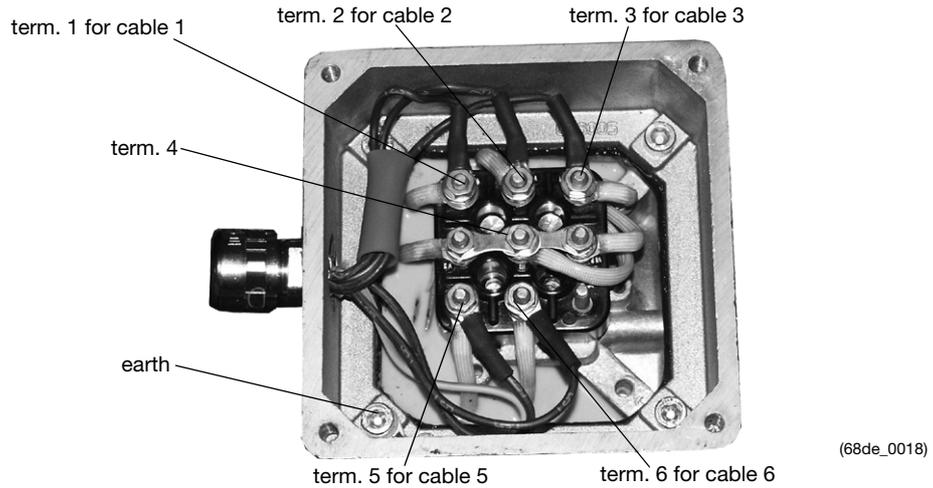


Fig. 46: Motor terminal box for; MCS80BA, MC90BA, MC100BA; position of the cable gland may vary; cable numbers are printed on the cable; terminal no. only for reference purpose (expl. picture for motor series 1)

	MC 90 BA	MC 112 BA
Winding resistance $\pm 5\%$ at 20° C (motor); term. 4 - 1; 4 - 2; 4 - 3	3.7 Ohm	1.4 Ohm
Winding resistance $\pm 5\%$ at 20° C (brake); term. 1 - 2	1290 Ohm	1020 Ohm

Table 7: Winding resistance

**WARNING**



*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*

## 8 Failure detection

### 8.1 LED signals at local control panel

Provided the electronic unit is supplied with voltage (green LED on LCP „ON“), the red LED on the local control panel 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 can not be moved via command buttons or commands from the process control system; reset is only possible once the failure reason is eliminated Out of adjusted range may require re-centering the position sensing potentiometer.

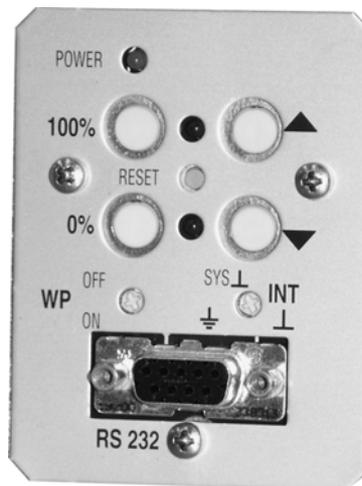


Fig. 47: Local Control Panel

## 9 Trouble Shooting

**NOTICE**



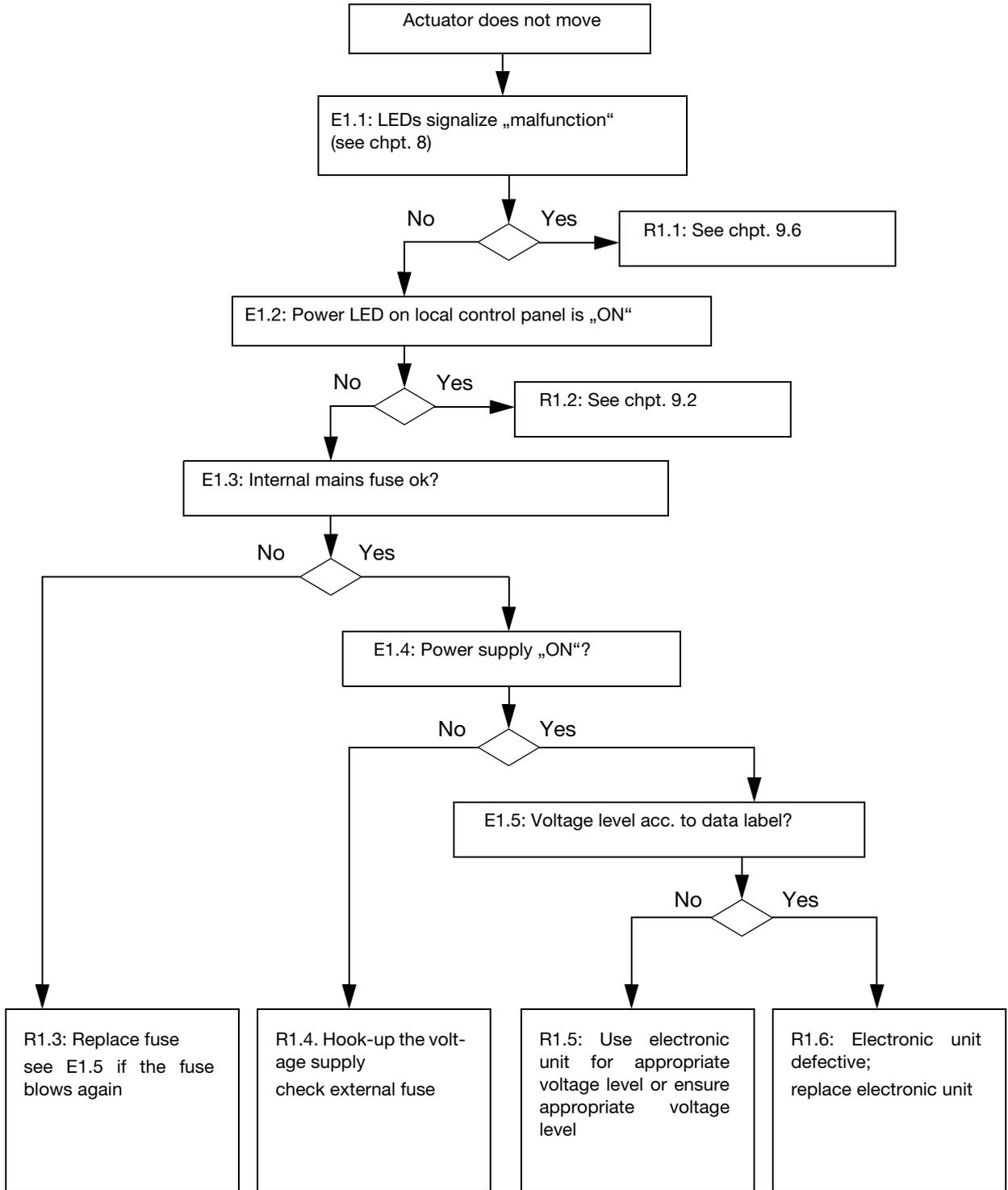
Check wiring, polarity and all plug and terminal connections before you start detailed trouble shooting.

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.

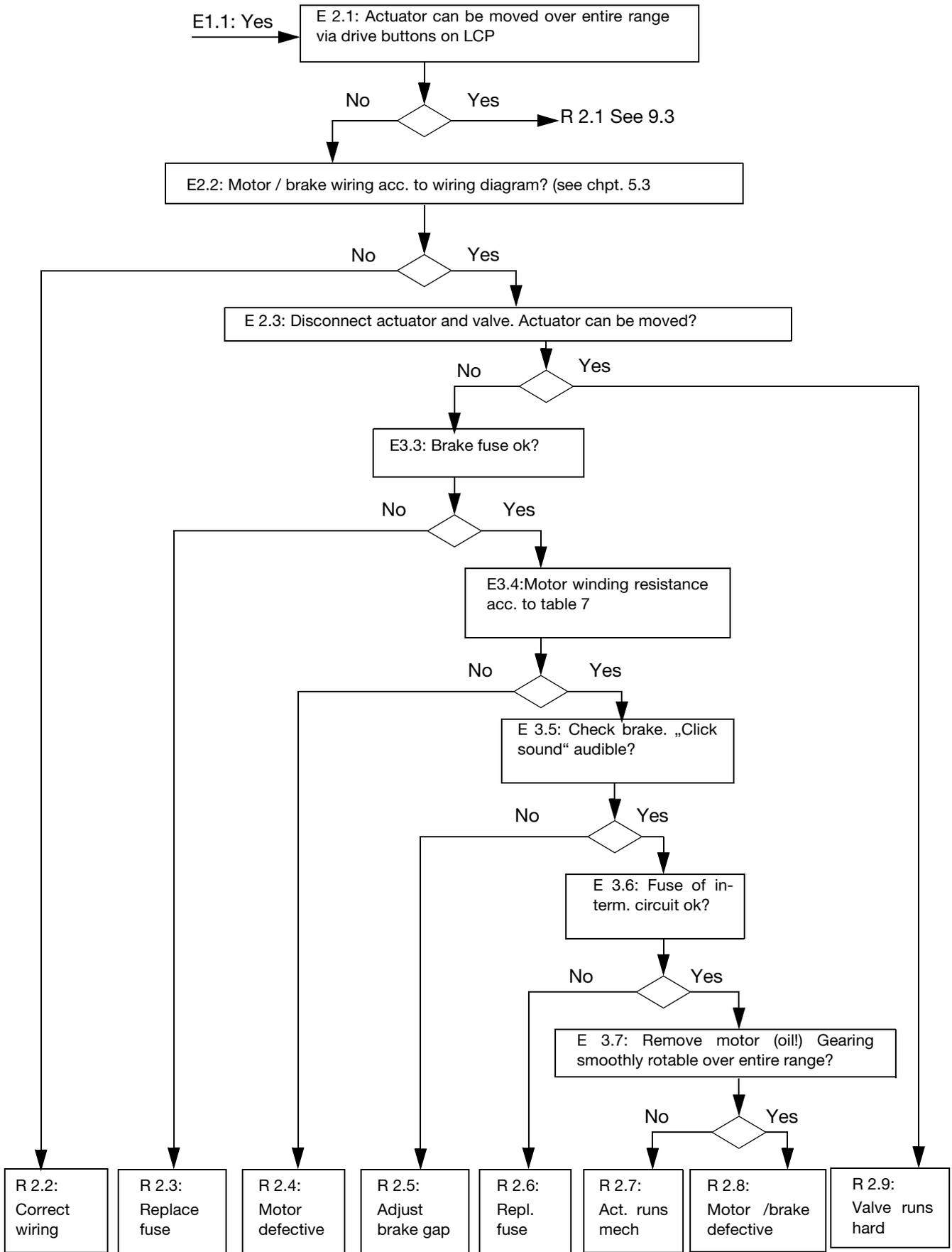
**Example:**

condition:	E6.1	LED signal: Failure
possible failure:	E6.3	sensor memory failure
one reason / measure to solve the malfcn.	R6.2	replace sensor; see chpt. 6 (in this case the user will find more detailed information about the sensor replacement in chapter 6)

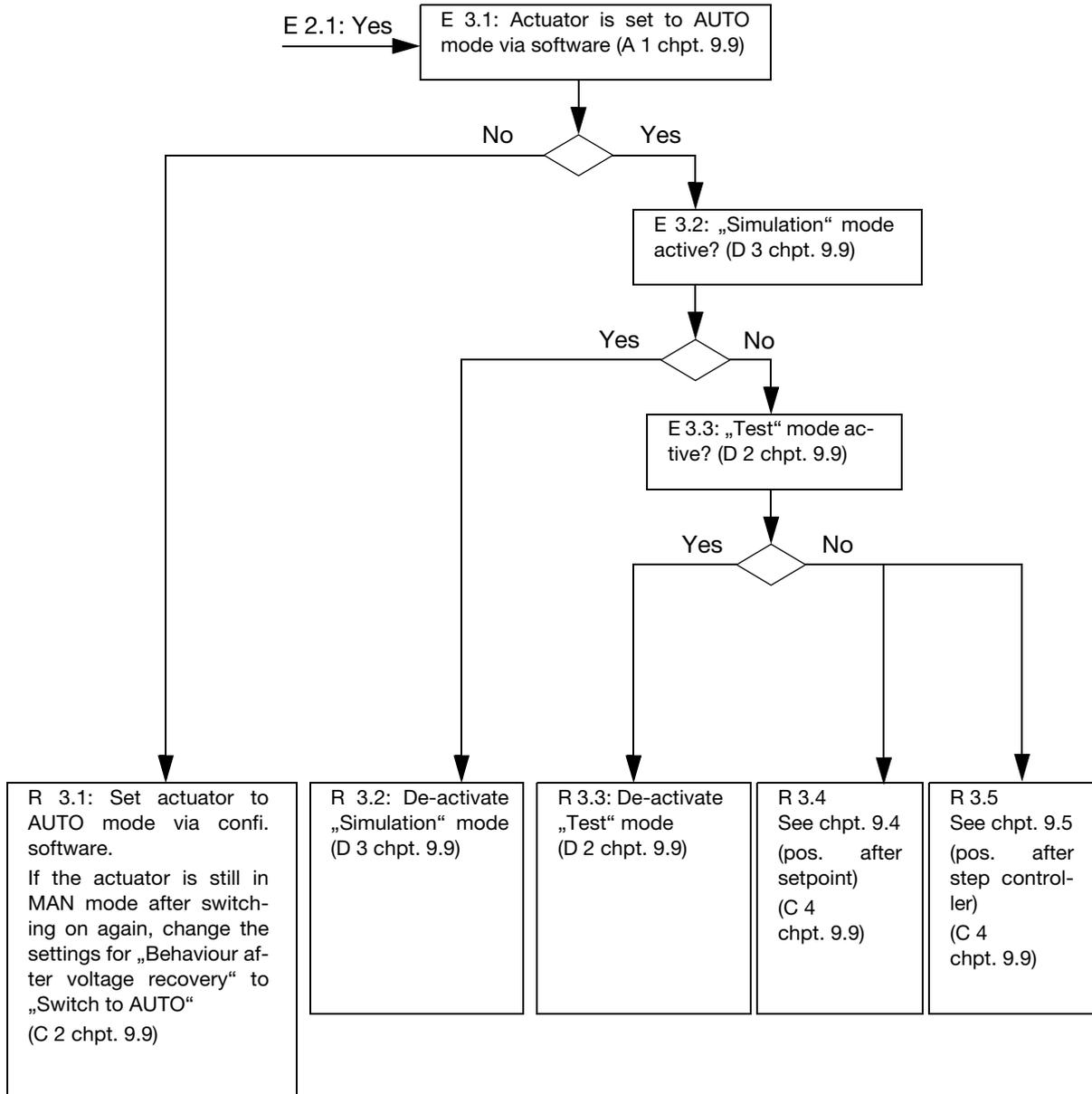
9.1 General



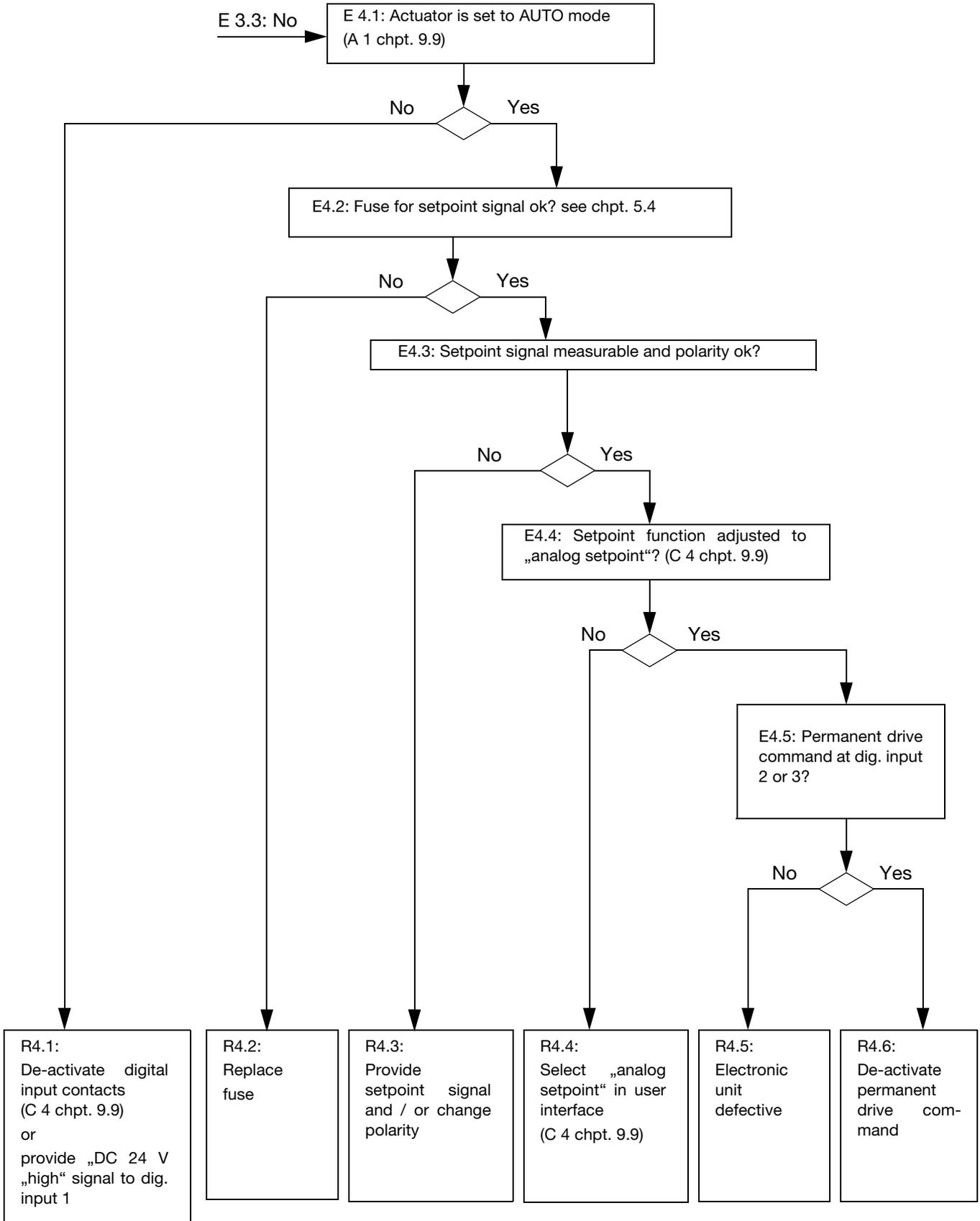
**9.2 Failures at brake, fuse or wiring**



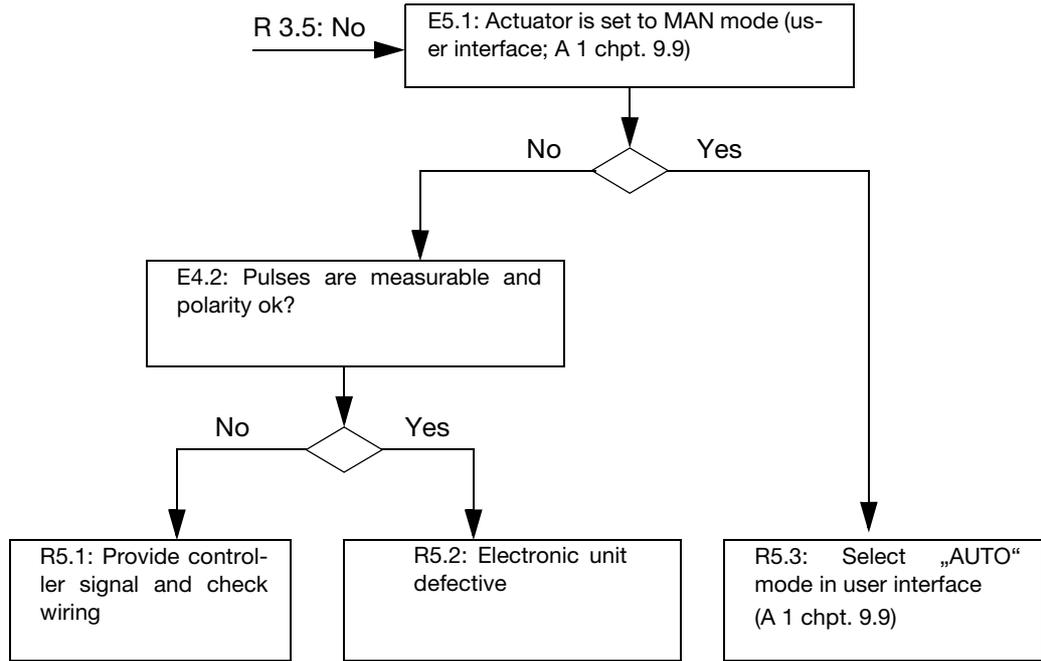
9.3 Operation mode (MAN / AUT)



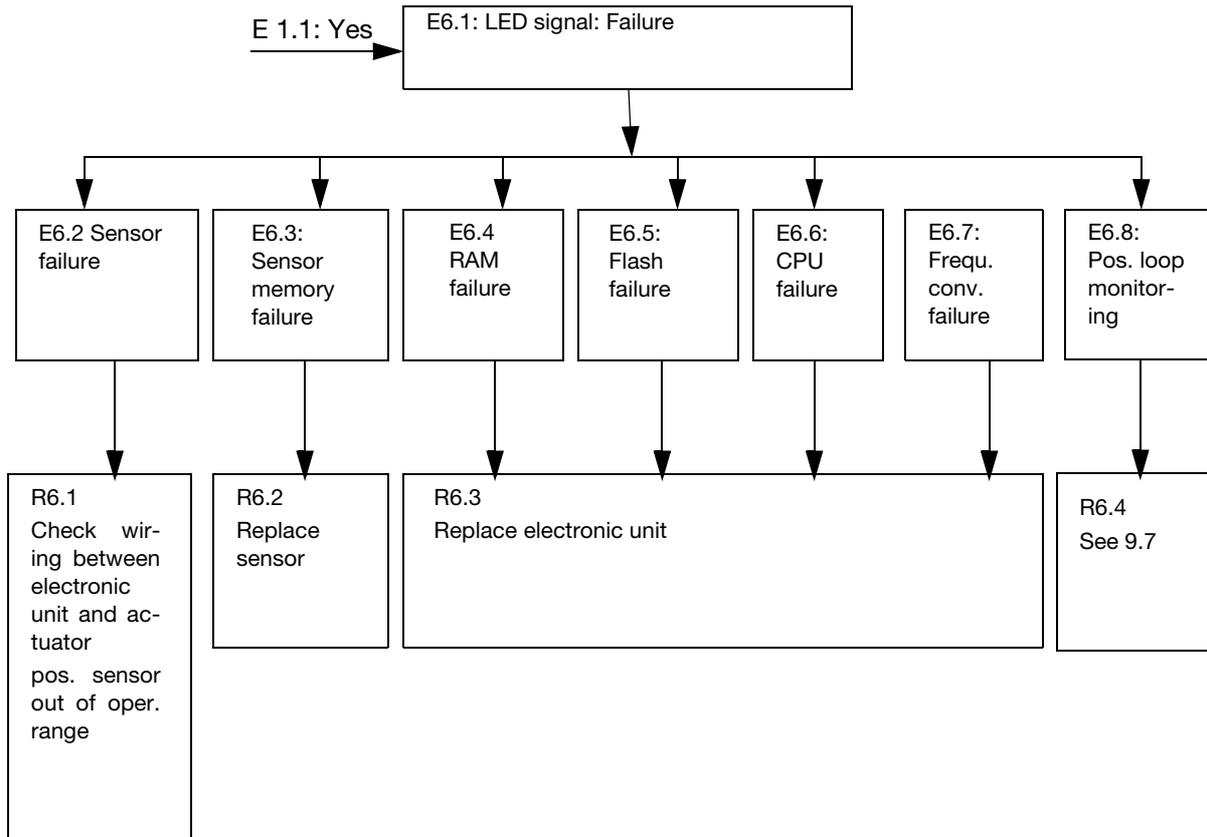
**9.4 Input configuration**



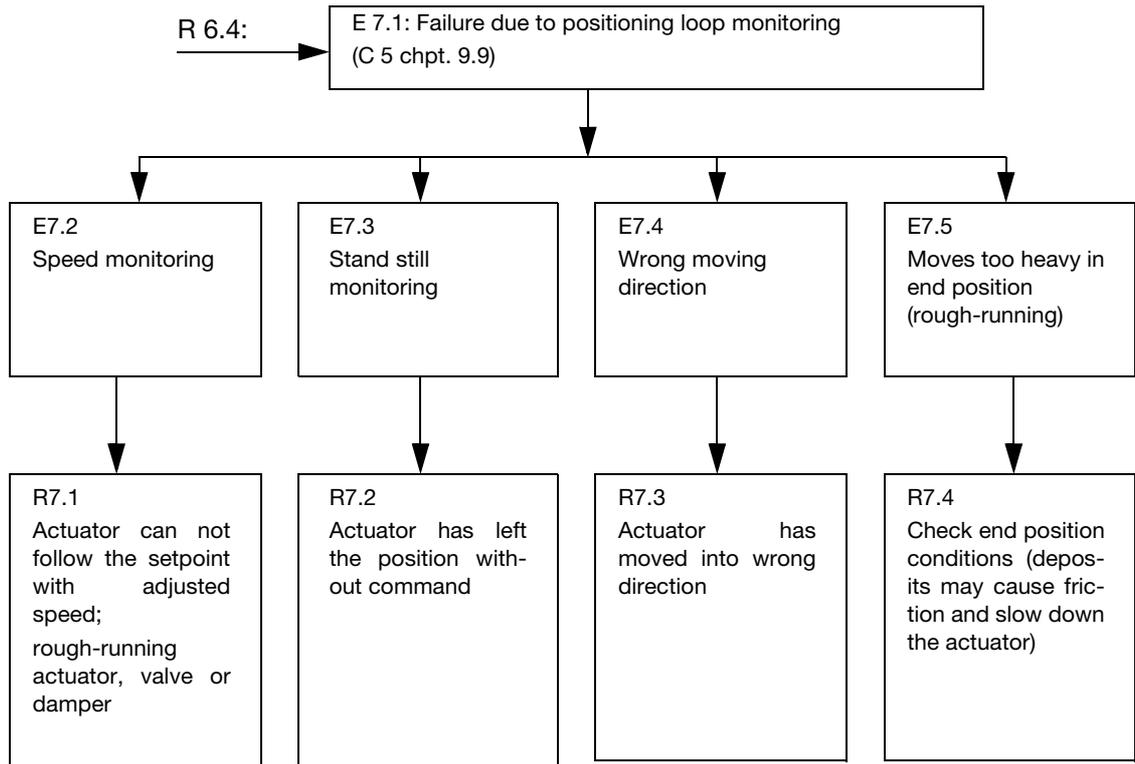
**9.5 Operation behind step controller**



**9.6 Failure Diagram**



**9.7 Failure due to response of positioning loop monitoring**



**9.8 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 behaviour 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 behaviour 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 set point**

- 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 set point 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

**9.9 User Interface Menus**

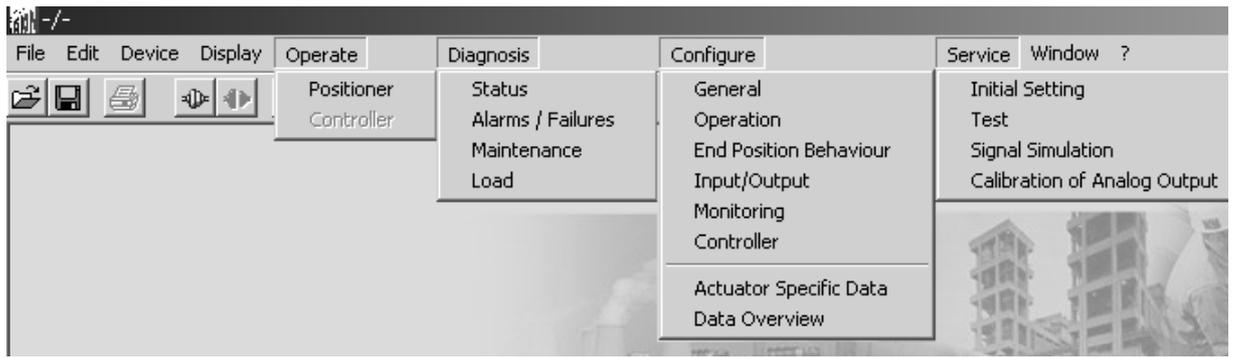


Fig. 48: Trouble shooting related menus in the user interface (digitally manipulated screen shot)

The following table represents the first 2 menu levels (see also fig. 48) of the graphical user interface as far as the trouble shooting is concerned. Some of the subjects in chpt. 9 refer to the user interface. Use the numbering in table 8 to facilitate the navigation. The user interface software does not use any numbering in the menus.

<b>A Operate</b>	<b>B Diagnosis</b>	<b>C Configure</b>	<b>D Service</b>
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 position behaviour	D 3 Signal Simulation
	B 4 Load	C 4 Input / Output	D 4 Calibration of anal. output
		C 5 Monitoring	
		C 6 Controller	
		C 7 Actuator specific data	
		C 8 Data overview	

Table 8: Trouble shooting related menus of the user interface

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