Service Instruction

Electrical Part Turn Actuators for Continuous Modulating Control
RHD250 ... RHD4000 (Contrac)
Rated Torque 250 ... 4000 Nm
(200...3000 ft-lbs)
Electrical Part Turn Actuators for Continuous Modulating Control RHD250 ... RHD4000 (Contrac)

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:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Signal Word</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOP</td>
<td>DANGER</td>
<td>DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. (High level of risk.)</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>WARNING</td>
<td>WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. (Medium level of risk.)</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>CAUTION</td>
<td>CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. (Low level of risk.)</td>
</tr>
<tr>
<td>![Warning Symbol]</td>
<td>NOTICE</td>
<td>NOTICE indicates a potentially harmful situation which, if not avoided, may result in damage of the product itself or of adjacent objects. (Damage to property)</td>
</tr>
<tr>
<td>![Information Symbol]</td>
<td>IMPORTANT</td>
<td>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.)</td>
</tr>
</tbody>
</table>

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 RHD250... RHD4000. It amends and deepens the routine maintenance description in the standard instruction, which we strongly recommend also be available for all maintenance work.

Fig. 1: RHD...; 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 RHD250... RHD4000 are oil lubricated. They contain the max. oil quantity when leaving the manufacturer. In order to avoid any overpressure in the gearbox (e.g. due to thermal influence) replace the uppermost check plug by the separately supplied venting plug once the actuator is installed.

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

3.1 Mounting position and filling capacity

3.1.1 Mounting position RHD250... RHD2500

<table>
<thead>
<tr>
<th>Mounting Orientation</th>
<th>IMB 3</th>
<th>IMB 6</th>
<th>IMB 7</th>
<th>IMB 8</th>
<th>IMV 5</th>
<th>IMV 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) inspection screw</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) venting screw</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2:

<table>
<thead>
<tr>
<th>Minimum oil quantity; approx. [l]</th>
<th>4.7</th>
<th>4.7</th>
<th>4.7</th>
<th>4.7</th>
<th>4.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. oil level [mm] under inspection screw</td>
<td>40</td>
<td>12</td>
<td>15</td>
<td>Lower edge of upper oil screw</td>
<td>35</td>
</tr>
</tbody>
</table>

Table 1: Filling capacity RHD250

<table>
<thead>
<tr>
<th>Minimum oil quantity; approx. [l]</th>
<th>10</th>
<th>11.5</th>
<th>10</th>
<th>10</th>
<th>10</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. oil level [mm] under inspection screw</td>
<td>57</td>
<td>Lower edge of upper oil screw</td>
<td>55</td>
<td>Lower edge of upper oil screw</td>
<td>37</td>
<td>Lower edge of upper oil screw</td>
</tr>
</tbody>
</table>

Table 2: Filling capacity RHD500... RHD800

<table>
<thead>
<tr>
<th>Minimum oil quantity; approx. [l]</th>
<th>29</th>
<th>32</th>
<th>24</th>
<th>24</th>
<th>33</th>
<th>26.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. oil level [mm] under inspection screw</td>
<td>75</td>
<td>90</td>
<td>200</td>
<td>Lower edge of upper oil screw</td>
<td>Caution! Filled with 33 l when supplied!</td>
<td>34</td>
</tr>
</tbody>
</table>

Table 3: Filling capacity RHD1250... RHD2500
3.1.2 Mounting position RHD4000

![Fig. 3: Mounting Position RHD4000; 1) = inspection screw, 2) = venting screw](image)

<table>
<thead>
<tr>
<th>Mounting Orientation</th>
<th>IMB 3</th>
<th>IMB 6</th>
<th>IMB 7</th>
<th>IMB 8</th>
<th>IMV 5</th>
<th>IMV 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) inspection screw</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) venting screw</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Filling capacity RHD4000!

3.2 Oil specifications

<table>
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<tr>
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<th>Oil type used by manufacturer for first filling</th>
<th>Possible other oil types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ 1°C... + 85°C 1)</td>
<td>Mobil SHC 632</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>- 10°C... + 65°C</td>
<td>ESSO Spartan EP 220 (L-CKC to ISO TR 3498)</td>
<td>Aral Degol BMB 220</td>
</tr>
<tr>
<td></td>
<td>- 30°C... + 50°C</td>
<td>Mobil SHC 629</td>
<td>BP Energol GR-XP 220</td>
</tr>
</tbody>
</table>

Table 5:  
1) only available as non-standard solution

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 to 4  
- open or undo the venting screw (fig. 3)  
- 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

- 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

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

4.1.2 Lever installation

MAKE SURE THAT THE SHAFT SURFACE AND THE LEVER BORE ARE CLEAN AND FREE OF GREASE BEFORE YOU INSTALL THE LEVER!

- put the appropriate key into the groove in the shaft
- 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
- push the lever onto the shaft until it is nearly in the same position as it was before
- put the lever clamping bolt(s) into the lever and tighten the nut(s); refer to chpt. 4.1.4 for torque values
4.1.3 Ball and socket joint

Fig. 5:

**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

<table>
<thead>
<tr>
<th>Actuator</th>
<th>Clamping Screw (tightening torque)</th>
<th>Limit stop screw (tightening torque)</th>
<th>Expanding screw (diam. / min. length / min. thread length)</th>
<th>Crown nut (tightening torque)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHD250 RHD500/RHD800 RHD1250/RHD2500 RHD4000</td>
<td>M12x35-8.8 (79 Nm / 58 ft-lbs)</td>
<td>M12x35-8.8 (79 Nm / 58 ft-lbs)</td>
<td>8 mm / 35 mm / 25 mm</td>
<td>M18x1.5 (165 Nm / 122 ft-lbs)</td>
</tr>
<tr>
<td>RHD250 RHD500/RHD800 RHD1250/RHD2500 RHD4000</td>
<td>M16x35-8.8 (195 Nm / 144 ft-lbs)</td>
<td>M16x35-8.8 (195 Nm / 144 ft-lbs)</td>
<td>8 mm / 45 mm / 25 mm</td>
<td>M28x1.5 (370 Nm / 273 ft-lbs)</td>
</tr>
<tr>
<td>RHD250 RHD500/RHD800 RHD1250/RHD2500 RHD4000</td>
<td>M20x110-8.8 (390 Nm / 288 ft-lbs)</td>
<td>M24x55-8.8 (670 Nm / 494 ft-lbs)</td>
<td>10 mm / 55 mm / 20 mm</td>
<td>M30x1.5 (455 Nm / 336 ft-lbs)</td>
</tr>
<tr>
<td>RHD250 RHD500/RHD800 RHD1250/RHD2500 RHD4000</td>
<td>M20x120-8.8 (390 Nm / 288 ft-lbs)</td>
<td>M24x55-8.8 (670 Nm / 494 ft-lbs)</td>
<td>12 mm / 65 mm / 35 mm</td>
<td>M38x1.5 (750 Nm / 553 ft-lbs)</td>
</tr>
</tbody>
</table>

Table 6:
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.

![Diagram of sealing ring replacement process]

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
- make sure that the oil level is below the O-ring (2)
- if necessary drain the oil (see chpt. 3.2.1 for details)
- remove the key (6)
- loosen and remove the sealing flange screws (1)
- two tap holes (thread size: M6) on the bolt circle for screw (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
- turn the forcing screws (1a) out
- clean the shaft and the flange; slightly grease the sealing ring
- replace the O-ring (2) and the sealing ring (4); see fig. 7 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

Fig. 7: Flange and sealing ring (exemplary picture)
IMPORTANT  Make sure that the "open" side of the sealing ring points towards the oil.

Fig. 8: Use of auxiliary tool for sealing ring installation

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

STOP  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:

- 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

4.4.1 RHD250...RHD800

In order to change the O-ring (3) and the sealing ring (4), firstly remove the position sensor (see 6.1) and proceed as follows:

- make sure that the oil level is below the O-ring (2)
- drain the oil if necessary (see chpt. 2.3 for details)
- loosen the hexagon screw (6) and pull apart the pinion (7)
- undo flange fastening screws (1)
- pull the flange (3) with sealing ring (4) carefully from the shaft (5) and put it aside
- replace the O-ring (2)
- pull the old sealing ring (4) out of the groove
- grease the new sealing ring slightly with oil and put it in
- clean the shaft and the contact surfaces of the flange
- 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
- fasten the flange (3) and tighten the screws (1) crosswise with 8.3 Nm (6.12 ft-lbs)
- fasten the pinion (7) and tighten the hexagon screw (6) with 42 Nm (31 ft-lbs)
In order to change the O-ring (3) and the sealing ring (4), firstly remove the position sensor (see 6.1) and proceed as follows:

- make sure that the oil level is below the O-ring (2)
- drain the oil if necessary (see chpt. 2.3 for details)
- loosen the hexagon screw (6) and pull apart the pinion (7)
- undo hood fastening screws (1)
- pull the hood (3) with sealing ring (4) carefully from the shaft (5) and put it aside
- replace the O-ring (2)
- pull the old sealing ring (4) out of the groove
- grease the new sealing ring slightly with oil and put it in
- clean the shaft and the contact surfaces of the hood
- 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
- fasten the hood (3) and tighten the screws (1) crosswise with 23 Nm (17 ft-lbs)
- fasten the pinion (7) and tighten the hexagon screw (6) with 42 Nm (31 ft-lbs)
4.6  Motor

By the time of printing this document Contrac actuators use 2 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.

4.6.1  Motor assignment and tightening torque

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

Table 7: Tightening torque for motor screws

4.6.2  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

STOP

Fig. 12: Rear motor view (exemplified)
- disconnect the motor / actuator from any electrical supply
- disconnect motor connection cable in motor terminal box
- drain the oil (see chpt. 2.3 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
4.6.3 Motor flange O-ring

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 (4)
- drain the oil if necessary (see chpt. 3.2.1 for details)
- disconnect the cables in the motor terminal box
- turn the motor screws (1) out and put the motor aside; remove O-ring (2)
- turn the screws (5) of the add. flange out and put the flange (3) aside; remove O-ring (4)
- replace O-ring (4)
- mount the additional flange (3) at the actuator housing and fasten it with the flange screws (5)
- put the new O-ring (2) into the flange groove and fasten the motor with the screws (1); consider tightening torque shown in table 7.

4.6.4 Motor disassembly / assembly

4.6.4.1 Motors without fan on rear shaft end

Additionally remove the brake for motor ball bearing replacement.
- undo brake cover screws (1) and put cover (2) aside
- disconnect the two cables
- undo the brake fastening screws (3) and put brake body with disk aside
4.6.4.2 Motors with fan on rear shaft end

- undo the cover screws and remove the cover
- use appropriate split ring pliers and removal tool to remove the split ring and the fan
- remove the fan
- undo brake cover screws
- remove brake cover
- undo brake screws
- open shrinkable tube and disconnect cable
- take brake body apart
- take brake disk apart
- remove retaining ring from brake disk pinion and pull the pinion from the shaft (see also fig. 15; r h)
- (see chpt. 4.7 for brake adjustment
- undo pinion screw; use appropriate retainer to secure the screw when re-assembling (DELO-ML 5228 or LOCTITE 243; both medium-firm; detachable)
- use 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 front flange with motor shaft out of the housing
4.6.5 Exchange of motor bearings

- 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)

4.6.6 Exchange of motor shaft sealing ring

- take the old sealing ring out
- grease the new sealing ring and press it in the flange as shown in fig. 30; make sure that the „open“ part of the sealing ring points towards the oil (when the motor is mounted to the actuator); see fig. 30.
- assemble in reverse order; use a customary sealant for both motor flanges
- check the brake gap after re-assembly; see chpt. 4.7 for details.
4.7 Brake adjustment

4.7.1 Brake of motor series 1

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. 32:

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
4.7.2 Brake of motor series 2

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. 33: 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°); 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.

STOP 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. 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.
5.3 Wiring diagrams

5.3.1 EBN853 / EBN861 / EBS862 (HART)

Fig. 36: In some cases the wiring for the voltage feed for the optional heater in the actuator may be done as shown in fig. 38

5.3.2 EBN853 / EBN861 (PROFIBUS DP)

Fig. 37:
5.3.3 EBS852 (HART)

Fig. 38:
5.4 Fuses

5.4.1 Electronic unit for field installation

<table>
<thead>
<tr>
<th>Electronic Unit</th>
<th>Fuse type</th>
<th>Fuse dimens.</th>
<th>Location</th>
<th>U = 115 V</th>
<th>U = 230 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBN853</td>
<td>External fuse</td>
<td>--</td>
<td>external</td>
<td>16 A, slow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mains fuse</td>
<td>5 x 20 mm</td>
<td>in connection chamber</td>
<td>12.5 A, slow</td>
<td>10 A, slow</td>
</tr>
<tr>
<td></td>
<td>Analogue setpoint input</td>
<td>5 x 20 mm</td>
<td>in connection chamber</td>
<td>40 mA; fast</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motor brake</td>
<td>5 x 20 mm</td>
<td>power board</td>
<td>0.315 A; medium</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intermediate circuit fuse</td>
<td>6.3 x 32 mm</td>
<td>power board</td>
<td>10 A, super-fast</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anti condensation heater</td>
<td>5 x 20 mm</td>
<td>in connection chamber</td>
<td>2 A; slow</td>
<td></td>
</tr>
</tbody>
</table>

Table 8:

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 power electronics EBN861. Note that the cable cross-sectional area between the fuse and the electronics must be at least 2.5 mm² (#13 AWG).

5.4.2 Electronic units for rack installation

<table>
<thead>
<tr>
<th>Electronic Unit</th>
<th>Fuse type</th>
<th>Fuse dimens.</th>
<th>Location</th>
<th>U = 115 V</th>
<th>U = 230 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBS852</td>
<td>External fuse</td>
<td>--</td>
<td>external</td>
<td>16 A, slow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mains fuse</td>
<td>5 x 20 mm</td>
<td>connection chamber</td>
<td>12.5 A, slow</td>
<td>10 A, slow</td>
</tr>
<tr>
<td></td>
<td>Motor brake</td>
<td>5 x 20 mm</td>
<td>power board</td>
<td>315 mA; medium</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intermediate circuit fuse</td>
<td>6.3 x 32 mm</td>
<td>power board</td>
<td>10 A; super fast</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuse f. DO1, DO2, DO3</td>
<td>5 x 20 mm</td>
<td>connection chamber</td>
<td>0.2 A; medium</td>
<td></td>
</tr>
<tr>
<td>EBS862</td>
<td>External fuses¹)</td>
<td>--</td>
<td>external</td>
<td>35 A fuse</td>
<td>16 A thermal safety cutout</td>
</tr>
<tr>
<td></td>
<td>Motor brake</td>
<td>5 x 20 mm</td>
<td>on board (power section)</td>
<td>0.315 A; medium</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intermediate circuit fuse</td>
<td>6.3 x 32 mm</td>
<td>power board</td>
<td>16 A; super fast</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuse f. DO1, DO2, DO3</td>
<td>5 x 20 mm</td>
<td>in connection chamber</td>
<td>3 x 0.2 A; medium</td>
<td></td>
</tr>
</tbody>
</table>

Table 9:

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 power electronics EBS862. Note that the cable cross-sectional area between the fuse and the electronics must be at least 2.5 mm² (#13 AWG).
5.4.3 Fuse location EBN853

*NOTICE*

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

Fig. 39: Fuses in connection-housing part

Fig. 40: Fuses in control-housing part
5.4.4 Fuse location 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 mm² (#13 AWG).
5.4.6 Fuse location in EBS852

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

Fig. 44: External fuse; 35 A
Fig. 45: Thermal circuit breaker; 16 A
Fig. 46: Fuses in EBS852; connection area (left) and main pcb (right)

Details: digital output fuses

fuse f. DO1
fuse f. DO2
fuse f. DO3

detail view of output fuses
brake fuse

(detail view)
Exchange of position sensor

6.1 Dismounting

- 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. 48 + 49) 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 48.
- align the sensor and its gears with the actuator; set the first toothed gear in 09:00 o’clock position (fig. 49) 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
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:

- **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;
  \( (\Delta V \approx 22.4 \text{ mV} / ^\circ\text{C}) \)
  \( \approx 1.8 \text{ V at } 20^\circ\text{C} \)

(see fig. 50 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)
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 10 for proper resistance values of motor and brake windings.
**Electrical Test Values**

**Figure 51:** Motor terminal box for MCS71BA; 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).

**Figure 52:** 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).

**Table 10: Winding resistance**

<table>
<thead>
<tr>
<th></th>
<th>MCS 71 BA</th>
<th>MCS 80 BA</th>
<th>MC 90 BA</th>
<th>MC 100 BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winding resistance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>± 5% at 20°C (motor)</td>
<td>21 Ohm</td>
<td>7.7 Ohm</td>
<td>3.7 Ohm</td>
<td>3.7 Ohm</td>
</tr>
<tr>
<td>term. 4 - 1; 4 - 2; 4 - 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winding resistance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>± 5% at 20°C (brake)</td>
<td>2180 Ohm</td>
<td>1660 Ohm</td>
<td>1290 Ohm</td>
<td>1079 Ohm</td>
</tr>
<tr>
<td>term. 5 - 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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 the 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 range“ may require re-centering the position sensing potentiometer (see section 6).

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:

<table>
<thead>
<tr>
<th>condition:</th>
<th>E6.1</th>
<th>LED signal: Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>possible failure:</td>
<td>E6.3</td>
<td>sensor memory failure</td>
</tr>
<tr>
<td>one reason / measure to solve the malct.</td>
<td>R6.2</td>
<td>replace sensor; see chpt. 6</td>
</tr>
</tbody>
</table>

(in this case the user will find more detailed information about the sensor replacement in chapter 6)
9.1 General

Actuator does not move

- E1.1: LEDs signalize „malfunction“ (see chpt. 8)
  - No
  - Yes: R1.1: see chpt. 9.6

- E1.2: Power LED on local control panel is „ON“
  - No
  - Yes: R1.2: see chpt. 9.2

- E1.3: Internal mains fuse ok?
  - No
  - Yes

- E1.4: Power supply „ON“?
  - No
  - Yes

- E1.5: Voltage level acc. to data label?
  - No
  - Yes

R1.3: Replace fuse (see E1.5 if the fuse blows again)
R1.4: Hook-up the voltage supply; check external fuse
R1.5: Use electronic unit for appropriate voltage level or ensure appropriate voltage level
R1.6: Electronic unit defective; replace electronic unit
9.2 Failures at brake, fuse or wiring

E1.1: Yes

E 2.1: Actuator can be moved over entire range via drive buttons on LCP

No

R 2.1 See 9.3

Yes

E2.2: Motor / brake wiring acc. to wiring diagram? (see chpt. 5.3)

No

E 2.3: Disconnect actuator and valve. Actuator can be moved?

No

E3.3: Brake fuse ok?

No

E 3.4: Motor winding resistance acc. to table 10

Yes

E3.5: Check brake. „Click sound“ audible?

No

E 3.6: Fuse of interm. circuit ok?

Yes

E 3.7: Remove motor (Oill) Gearing smoothly rotatable over entire range?

No

R 2.2: Correct wir- ing

R 2.3: Replace fuse

R 2.4: Motor defective

R 2.5: Adjust brake gap

R 2.6: Repl. fuse

R 2.7: Act. runs mech. hard

R 2.8: Motor / brake defective

R 2.9: Valve runs hard

Yes
9.3 Operation mode (MAN / AUT)

- **E 2.1:** Yes
  - E 3.1: Actuator is set to AUTO mode via software (A 1 chpt. 9.9)

- **E 3.2:** „Simulation“ mode active? (D 3 chpt. 9.9)
  - Yes
  - E 3.3: „Test“ mode active? (D 2 chpt. 9.9)
    - Yes
    - R 3.4 see chpt. 9.4 (pos. after set-point) (C 4 chpt. 9.9)
    - No
    - R 3.5 see chpt. 9.5 (pos. after step controller) (C 4 chpt. 9.9)
  - No

- **E 3.3:** „Test“ mode active? (D 2 chpt. 9.9)
  - Yes
  - R 3.4 see chpt. 9.4 (pos. after set-point) (C 4 chpt. 9.9)
  - No

- **R 3.1:** Set actuator to AUTO mode via config. software.
  - If the actuator is still in MAN mode after switching on again, change the settings for „Behaviour after voltage recovery“ to „Switch to AUTO“ (C 2 chpt. 9.9)

- **R 3.2:** De-activate „Simulation“ mode (D 3 chpt. 9.9)

- **R 3.3:** De-activate „Test“ mode (D 2 chpt. 9.9)
9.4 Input configuration

E 3.3: No
E 4.1: Actuator is set to AUTO mode (A 1 chpt. 9.9)

No
Yes

E 4.2: Fuse for setpoint signal ok? see chpt. 5.4

No
Yes

E 4.3: Setpoint signal measurable and polarity ok?

No
Yes

E 4.4: Setpoint function adjusted to "analog setpoint"? (C 4 chpt. 9.9)

No
Yes

E 4.5: Permanent drive command at dig. input 2 or 3?

No
Yes

R4.1: De-activate digital input contacts (C 4 chpt. 9.9) or provide "DC 24 V "high" signal to dig. input 1
R4.2: Replace fuse
R4.3: Provide setpoint signal and or change polarity
R4.4: Select "analog setpoint" in user interface (C 4 chpt. 9.9)
R4.5: Electronic unit defective
R4.6: De-activate permanent drive command
9.5 Operation behind step controller

R 3.5: No

E5.1: Actuator is set to MAN mode (user interface; A 1 chpt. 9.9)

No

E4.2: Pulses are measurable and polarity ok?

No

R5.1: Provide controller signal and check wiring

Yes

R5.2: Electronic unit defective

R5.3: Select „AUTO“ mode in user interface (A 1 chpt. 9.9)

9.6 Failure Diagram

E 1.1: Yes

E6.1: LED signal: Failure

E6.2 Sensor failure

E6.3: Sensor memory failure

E6.4 RAM failure

E6.5: Flash failure

E6.6: CPU failure

E6.7: Frequency converter failure

E6.8: Pos. loop monitoring

R6.1 Check wiring between electronic unit and actuator pos. sensor out of oper. range see. chpt. 6

R6.2 Replace sensor see chpt. 6

R6.3 Replace electronic unit

R6.4 See 9.7

E6.8: Flash failure
9.7 Failure due to response of positioning loop monitoring

R 6.4: E 7.1: Failure due to positioning loop monitoring (C 5 chpt. 9.9)

E7.2 Speed monitoring
E7.3 Stand still monitoring
E7.4 Wrong moving direction
E7.5 Moves too heavy in end position (rough-running)

R7.1 Actuator can not follow the setpoint with adjusted speed rough-running actuator, valve or damper (see 2.3 for further action)
R7.2 Actuator has left the position without command
R7.3 Actuator has moved into wrong direction
R7.4 Check end position conditions (deposits may cause friction and slow down the actuator)

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

![User Interface Menus](image)

The following table represents the first 2 menu levels (see also fig. 54) 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 11 to facilitate the navigation. The user interface software does not use any numbering in the menus.

<table>
<thead>
<tr>
<th>A Operate</th>
<th>B Diagnosis</th>
<th>C Configure</th>
<th>D Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1 Positioner</td>
<td>B 1 Status</td>
<td>C 1 General</td>
<td>D 1 Initial setting</td>
</tr>
<tr>
<td>A 2 Controller</td>
<td>B 2 Alarms / Failures</td>
<td>C 2 Operation</td>
<td>D 2 Test</td>
</tr>
<tr>
<td></td>
<td>B 3 Maintenance</td>
<td>C 3 End position behaviour</td>
<td>D 3 Signal Simulation</td>
</tr>
<tr>
<td></td>
<td>B 4 Load</td>
<td>C 4 Input / Output</td>
<td>D 4 Calibration of anal. output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 5 Monitoring</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 6 Controller</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 7 Actuator specific data</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 8 Data overview</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 54:** Trouble shooting related menus in the user interface (digitally manipulated screen shot)

The following table represents the first 2 menu levels (see also fig. 54) 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 11 to facilitate the navigation. The user interface software does not use any numbering in the menus.

<table>
<thead>
<tr>
<th>A Operate</th>
<th>B Diagnosis</th>
<th>C Configure</th>
<th>D Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1 Positioner</td>
<td>B 1 Status</td>
<td>C 1 General</td>
<td>D 1 Initial setting</td>
</tr>
<tr>
<td>A 2 Controller</td>
<td>B 2 Alarms / Failures</td>
<td>C 2 Operation</td>
<td>D 2 Test</td>
</tr>
<tr>
<td></td>
<td>B 3 Maintenance</td>
<td>C 3 End position behaviour</td>
<td>D 3 Signal Simulation</td>
</tr>
<tr>
<td></td>
<td>B 4 Load</td>
<td>C 4 Input / Output</td>
<td>D 4 Calibration of anal. output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 5 Monitoring</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 6 Controller</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 7 Actuator specific data</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C 8 Data overview</td>
<td></td>
</tr>
</tbody>
</table>

**Table 11:** Trouble shooting related menus of the user interface