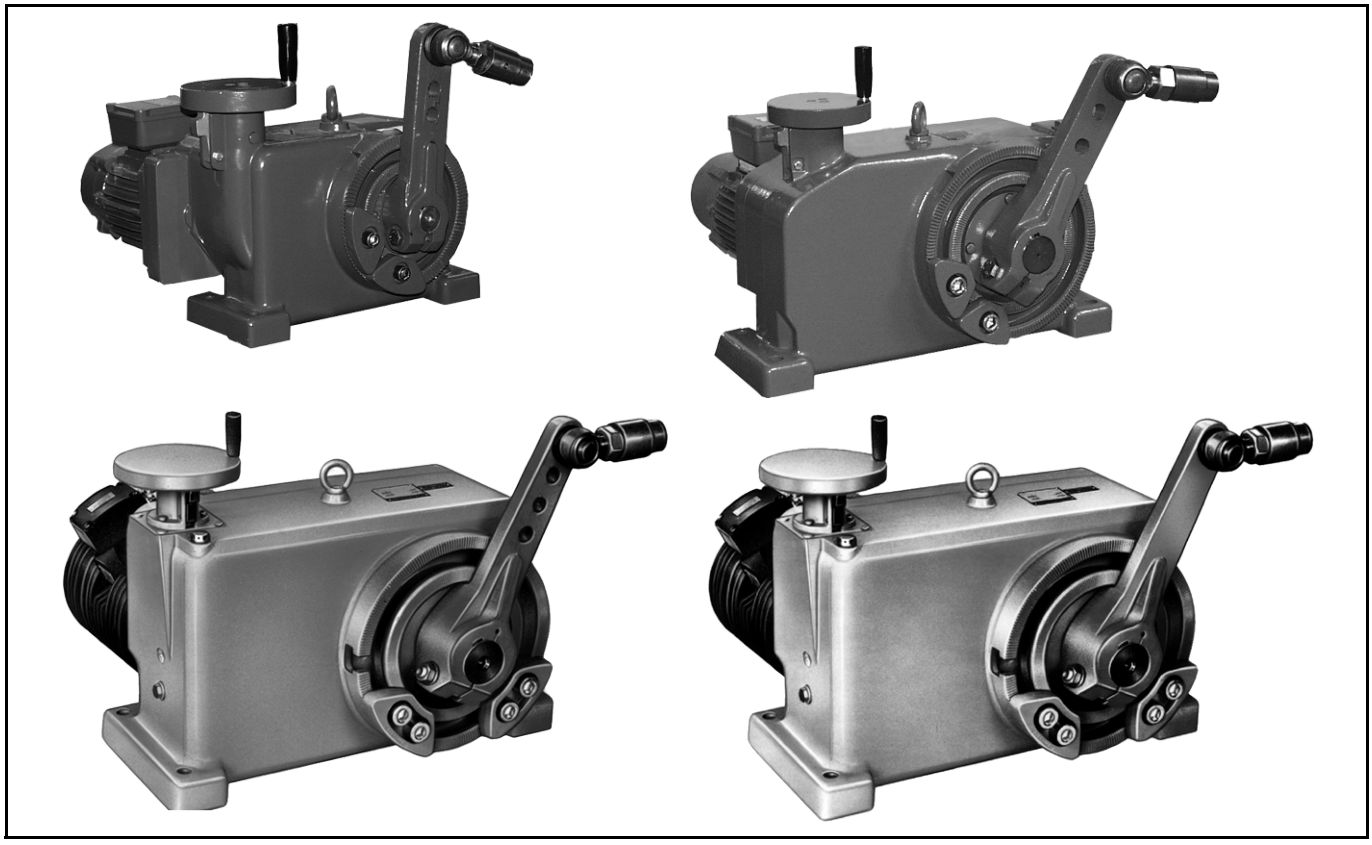
Electrical Part Turn Actuators for Continuous Modulating Control

Contrac RHD 250 ... RHD 4000

Rated Torque
250 ... 4000 Nm

Instruction

42-68-165EN Rev. 1



Content

Legend

ELECTRICAL WARNING

.An instruction with reference to electrical components or equipment. It draws attention to the risk of injury or death to persons or damage to the product, process or surroundings

WARNIG

General instruction that draws attention to the risk of injury or death to persons or damage to the product, process or surroundings

INFORMATION

Further reference for more detailed information or technical details.

1. Device Identification

1.1 Actuator ID Label

1	**Antrieb / Actuator: CONTRAC ....**			
2	F-Nr./No	NL		Made in Germany
3	M =	Jahr/Year	CE	
4	t =	IP 66		
5	min.....max.	max.		
6	Öl / Oil:			
7	Mit / With Elektronik/Electronics EBN 851 / EBS 852			
8				
9				
10				
	Automation D-32425 Minden			

1. Actuator type
2. Device number / No. of non-standard version
3. Rated torque / Year of manufacture
4. Permissible ambient temperature
5. Min./max. positioning travel / Min./max. speed
6. Filled-in oil type
7. Associated electronics
8. Not used
9. Not used
10. Available for customer-specific information

2. General

2.1 Proper use

The actuators are intended to be used exclusively for actuating final control elements (valves, vanes, etc.). Do not use these actuators for any other purpose. Otherwise, a hazard of personal injury or of damage to or impairment of the operational reliability of the device may arise.

2.2 Safety and precautions

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

- The actuators perform movements for positioning vanes and valves. Handle properly and with care. Otherwise, a hazard of bruise injuries may arise.
- When changing the oil of the actuator, thoroughly remove any oil that may have run down on the floor during the procedure to avoid accidents.
- Dispose of the waste oil in compliance with the respective local regulations. Make sure that no waste oil reaches the water cycle
- Only qualified specialists who have been trained for these tasks are authorized to mount and adjust the control actuator, and to make the electrical connection.
- When working on the actuator itself or the electronics always observe the locally valid accident prevention regulations and the regulations concerning the construction of technical installations.

3. Storage

The actuators may be stored under moist and aggressive condition for a short time. The equipment is protected against external corrosive influences. However, direct exposure to rain, snow, etc. must be avoided
Actuators, equipped with an anti condensation heater, are additionally protected by desiccant, which is placed in the following locations:
Motor: . . . . . under brake cover
Position sensor: . . . . . under position sensor cover
Electronics (delivered separately): . . . . in terminal enclosure

The desiccant guarantees sufficient protection for approximately 150 days. It can be regenerated at a temperature of 90° C within 4 h.
The desiccant must be removed prior to commissioning the actuator or the electronics.

3.1 Long-time storage

If you intend to store or transport the device for a longer time, we recommend to wrap it in plastic foil and add desiccant. Regularly check if the desiccant is still active.

4. Delivery settings

If not otherwise specified by the customer, the actuators are delivered with the following standard configuration:

Behavior in 0/100% position:	Shut-off with rated torque
Setpoint function:	Linear; setpoint = positioning value
Input (setpoint):	4 ... 20 mA [1)]
Function:	Positioner, parameter: setpoint
Output (actual value):	4 ... 20 mA [1)]
Digital inputs: [1)]	DI 1 switch-over manual/automatic and v.v. DI 2 / DI 3 manual control +/-
Digital outputs: [1)]	DO 1 ready to operate, DO 2/3 end position signalling
Range:	Not adjusted

The configuration of your actuator may differ from the standard configuration specified above. It can be called up for display using the configuration program.

[1)] Not available with fieldbus communication

5. Sub Assemblies

1: hand wheel
2: ball and socket joint
3: lever
4: adjustable limit stop
5. drive shaft
6. gear box
7. hand wheel
8. servo motor
9. hand wheel lock
10: position transmitter

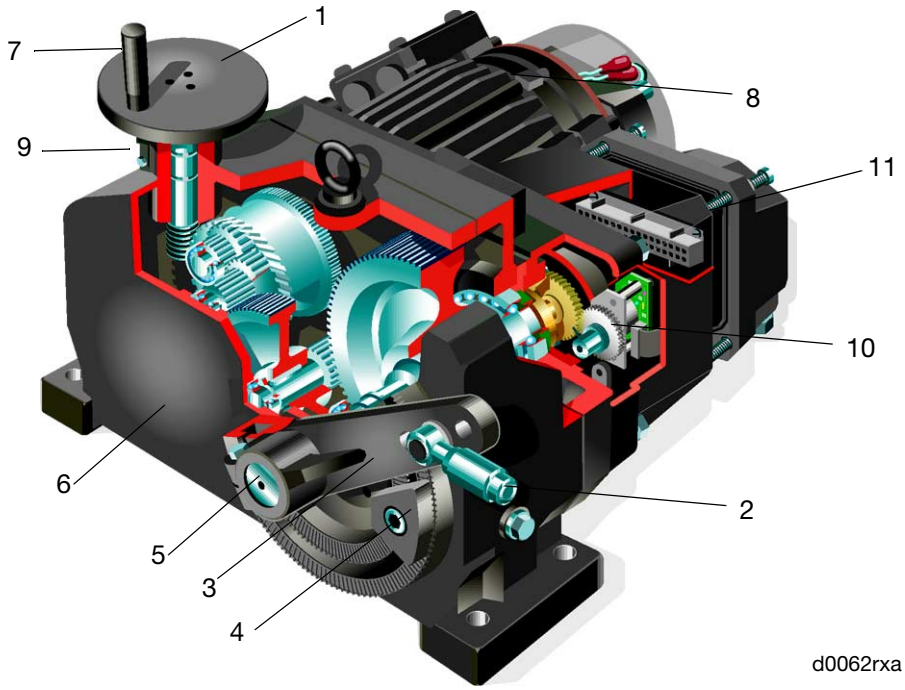


Fig. 1: Sectional view RHD ...

5.1 Operation

5.1.1 Automatic mode

The motor (8) triggered by the power electronics drives the output shaft via oil-lubricated spur gears. The output shaft (5) transmits the torque via a lever (3) with ball-and-socket joints (2) and a coupling rod to the final control element. A position sensor (10) detects backlash-free the curent shaft position.
Adjustable mechanical limit stops (4) absorb potentially occuring torque peaks in the end positions.
The brake (8) at the rear motor shaft end acts as a retainer when the power is off.

5.1.2 Handwheel mode

- Allows you to move the actuator manually when the electrical power is off.
- Press down the handwheel lock (9).
- Turn the handwheel to move the part turn actuator to the desired position.
- Release the lock.

6. Technical Data

6.1 Technical Data RHD 250 ... RHD 800

	RHD 250-10	**RHD 500-10**	**RHD 800-10**
Rated torque [Nm]	250	500	800
Starting torque [Nm]	appr. 1.2 x rated torque (break-away torque in end positions 2 x rated torque for short time)		
Rated speed [°/s] adjustable on power electronics	9.0 ... 0.1		
Motor	MCS 71 BA		MCS 80 BA
Weight	approx. 45 kg	approx. 90 kg	
Associated electronics For field mounting: For rack mounting:	EBN 853 EBS 852		
Power supply (on electronics)	115 V AC (94 V ... 130 V) or 230 V AC(190 V ... 260 V); 47.5 ... 63 Hz		
Maximum power consumption at 115/230 V AC [A]	1.8 / 0.9	2.2 / 1.1	--- / 2.5
Current input in positioning mode	approx. 40 ... 50% of $I_{max.}$, each		

Table 1:

6.2 Techical Data RHD 1250 ... RHD 4000

	RHD 1250-12	RHD 2500-10	RHD 2500-25	RHD 4000-10	RHD 4000-40
Rated torque [Nm]	1250	2500		4000	
Starting torque [Nm]	appr. 1.2 x rated torque (break-away torque in end positions 2 x rated torque for short time)				
Rated speed [°/s] adjustable on power electronics	7.5 ... 0.1	9.0 ... 0.1	6.0 ... 0.1	9.0 s ... 0.1 s	2.25 s ... 0.1 s
Motor	MCS 80 BA	MC 90 BA	MCS 80 BA	MC 100 BA	MC 90 BA
Weight	approx. 240 kg	approx. 250 kg	approx. 240 kg	approx. 270 kg	approx. 265 kg
Associated electronics For field mounting: For rack mounting:	 EBN 853 EBS 852	 EBN 861 EBS 862	 EBN 853 EBS 852	 EBN 861 EBS 862	 EBN 853 EBS 852
Power supply (on electronics)	AC 115 V (94 V ... 130 V) or AC 230 V (190 V ... 260 V); 47.5 ... 63 Hz	AC 230 V (190 V ... 260 V); 47.5 ... 63 Hz	AC 115 V (94 V ... 130 V) or AC 230 V (190 V ... 260 V); 47.5 ... 63 Hz	AC 230 V (190 V ... 260 V); 47.5 ... 63 Hz	AC 115 V (94 V ... 130 V) or AC 230 V (190 V ... 260 V); 47.5 ... 63 Hz
Maximum current consumption at 115/230 V AC [A]	6.0 A / 3.0 A	-- / 5.3 A	4.8 A / 2.4 A	-- / 10.0 A	4.0 A / 2.0 A
Current input in positioning mode	approx. 40 ... 50% of $I_{max.}$, each				

Table 2:

7. Lubrication

The spur wheel gerings of RHD 250 ... RHD 4000 are oil lubricated. They contain the max. oil quantity when leaving the manufacturer. Once the actuator is installed replace the uppermost check screw by the separately supplied venting screw

Do not pollute the synthetic Mobil SHC 629 oil, nor mix it with mineral oils. Prior to changing over to synthetic lubricant oil always throroughly clean the set of gears!

	Oil types	
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 3:

7.1 Mounting position and filling capacity

7.2 Mounting position RHD 250 ... RHD 2500

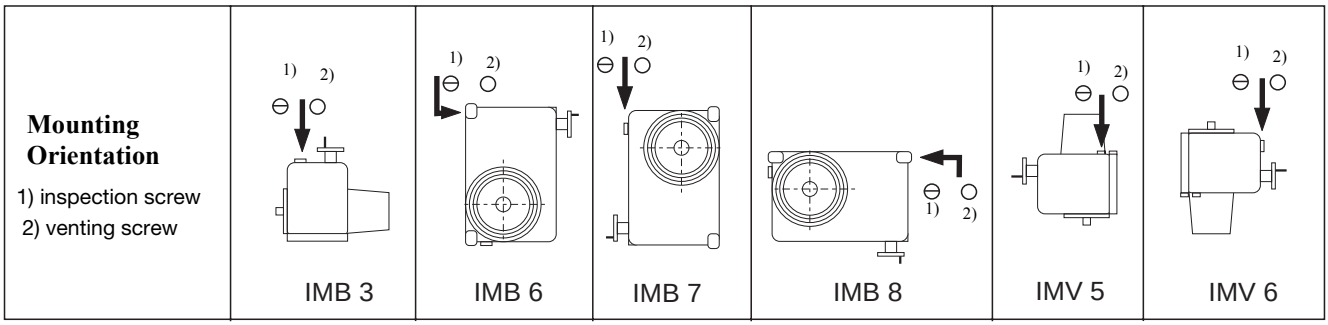


Fig. 2: Mounting position RHD 250 ... RHD 2500; 1) = inspection screw, 2) = venting screw

Minimum oil quantity; approx. [l]	4.7	4.7	4.7	4.7	4.7	4.7
Min. oil level [mm] under inspection screw	40	12	15	Lower edge of upper oil screw	35	Lower edge of upper oil screw

Table 4: Filling capacity RHD 250

Minimum oil quantity; approx. [l]	10	11.5	10	10	10	10
Min. oil level [mm] under inspection screw	57	Lower edge of upper oil screw	55	Lower edge of upper oil screw	37	Lower edge of upper oil screw

Table 5: Filling capacity RHD 500 ... RHD 800

Minimum oil quantity; approx. [l]	29	32	24	24	33	26,5
Min. oil level [mm] under inspection screw	75	90	200	Lower edge of upper oil screw Caution! Filled with 33 l when supplied!	34	35

Table 6: Filling capacity RHD 1250 ... RHD 2500

7.3 Mounting position RHD 4000

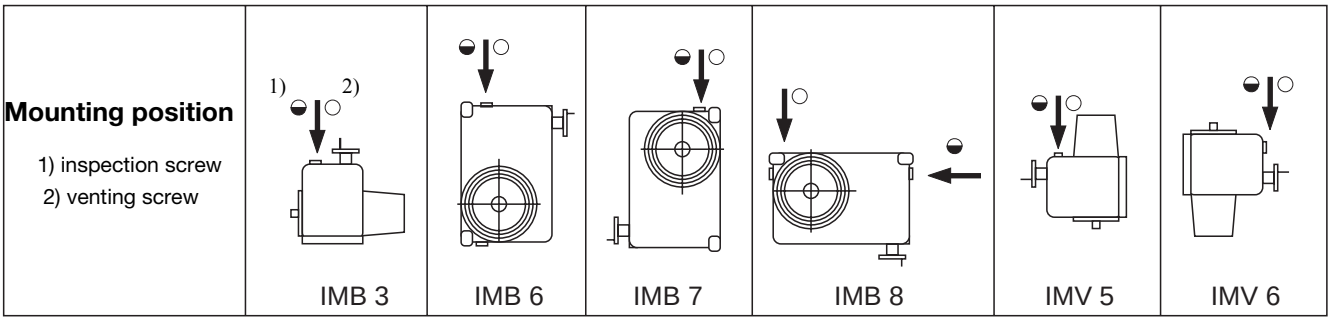


Fig. 3: Mounting Position RHD 4000; 1) = inspection screw, 2) = venting screw

Minimum oil quantity; approx. [l]	29	32	24.5	22.5	34	26.5
Min. oil level [mm] under inspection screwe	75	90	200	Lower edge of upper oil screw Caution! Filled with 34 l when supplied!	34	35

Table 7: Filling capacity RHD 4000

8. Mounting

8.1 Actuator Check

- Is the actuator filled with the appropriate oil type?
- Is enough oil in the actuator?
- Did you fasten the separately delivered vent screw in the highest bore (depending on the mounting orientation)?

8.2 Mounting Orientation

All mounting orientations shown in Figure 2 and 3 are permissible. To facilitate mounting and maintenance, however, it is recommended to use orientation IMB 3.

8.3 Mounting Instructions

- Make sure that the actuator is accessible from all sides to ensure convenient handwheel operation, electrical connection, and replacement of assemblies.
- Avoid direct exposure to rain, snow and other environmental influences. Select the mounting site accordingly.
- Exclusively mount the actuator on a rigid, non-vibrating support to avoid relative motion between the actuator and the valve.
- When mounting the actuator close to heat sources use an insulating layer or shielding.

8.4 Mounting the Actuator to the Valve

8.4.1 Preparing the Equipment

- Make sure that the shaft and lever bore surface are clean and free of grease.
- Determine the length of the stay tube (not included in the scope of delivery).
- Move the valve to the “CLOSED“ position.
- Move the actuator to the corresponding end position using the handwheel. Observe the permissible angle.
- Refer to Figure 4 for the required length of the link tube.
- Drill a cone bore into the valve lever for mounting the second ball-and-socket joint, as seen in Figure 4.
- Insert the ball-and-socket joint, secure with crown nut and split-pin.
- Remove the welding bushings and weld them to the stay tube (C 15 to DIN 17210)
- Insert the link rod between the two ball-and-socket joints and screw it in.
- If required adjust “L” by turning the link rod.
- When all adjustment steps are finished, fasten the counter nuts.

8.4.2 Adjusting the Stops in Dependence of the Travel

- Move the output lever / valve to the position requiring fine adjustment.
- Put the stop onto the toothing as close to the output lever as possible and fasten with screws.
- Move the output lever towards the stop using the handwheel; turn the coupling rod for fine adjustment.
- Fasten the counter nuts.
- Fasten the stop in the other mounting position close to the end position, depending on the toothing.

8.4.3 Adjusting the Stops in Dependence of the Torque

- First proceed as described above for travel-dependent adjustment.
- Prior to re-fastening the counter-nut lock the handwheel and then turn the coupling rod in such a way that an initial tension occurs in the valve’s closing position.
- Fasten the counter-nuts.

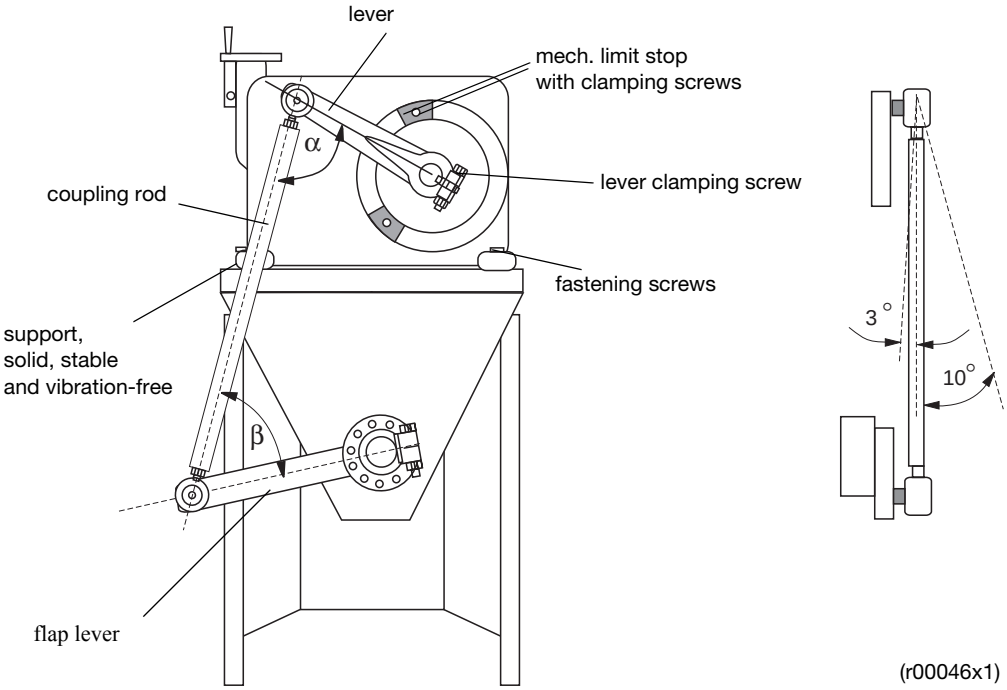


Fig. 4: Mounting RHD ... (example)

$\alpha \geq 15$ ° (≥ 20 ° for RHD 800 ... RHD 4000)
β according to dimensions specified by the valve manufacturer

8.4.4 Mechanical settings

	RHD 250	**RHD 500** **RHD 800**	**RHD 1250** **RHD 2500**	**RHD 4000**
clamping screws for mech. limit stop tightening torque:	79 Nm	195 Nm	670 Nm	670 Nm
lever clamping screw tightening torque:	79 Nm	195 Nm	390 Nm	390 Nm
fastening screw boring diameter: tensile strength:	12 mm ≥ 400 N/mm^2	18 mm ≥ 400 N/mm^2	20 mm ≥ 400 N/mm^2	20 mm ≥ 400 N/mm^2

Table 8:

8.5 Lever dimensions

8.5.1 Lever for RHD 250

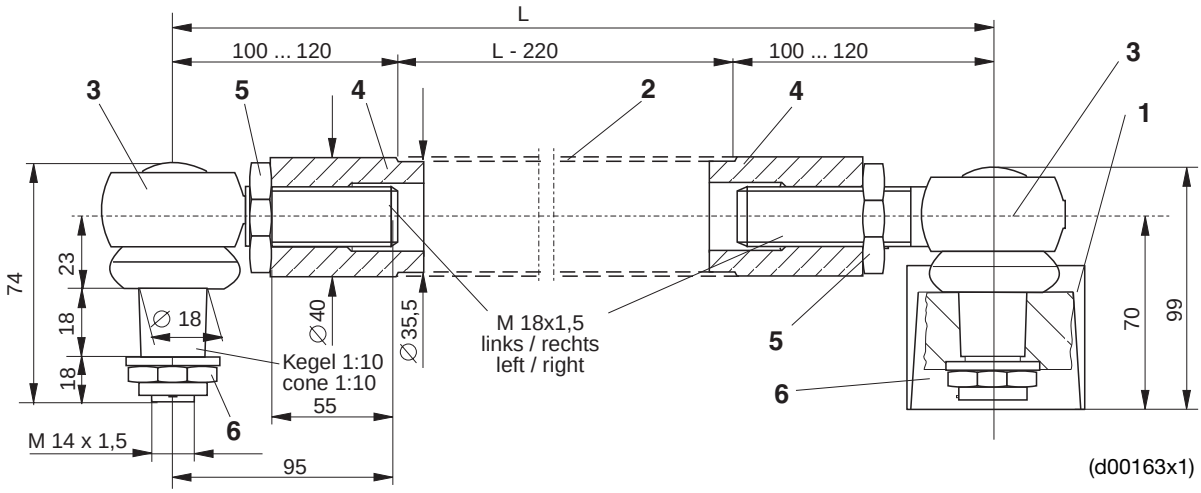


Fig. 5: lever RHD 250

1. Output shaft
2. Link tube
3. Ball-and-socket joint
4. Welding bushings (C15 to DIN 17210)
5. Counter nuts
6. Crown nuts

8.5.2 Lever for RHD 500 / 800

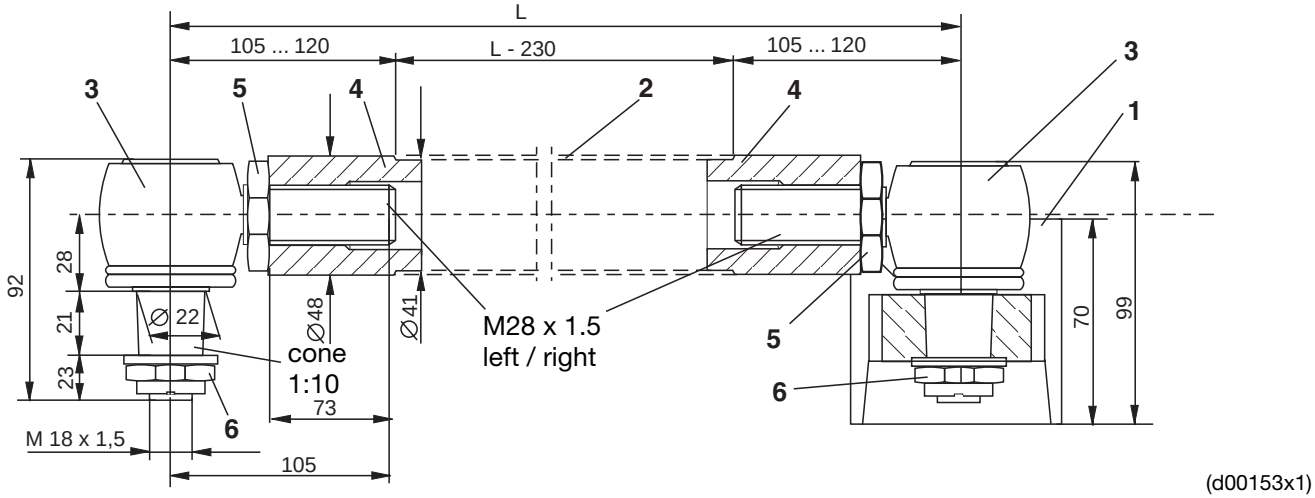


Fig. 6: lever RHD 500 / RHD 800

1. Output shaft
2. Link tube
3. Ball-and-socket joint
4. Welding bushings (C15 to DIN 17210)
5. Counter nuts
6. Crown nuts

8.5.3 Lever for RHD 1250 / RHD 2500

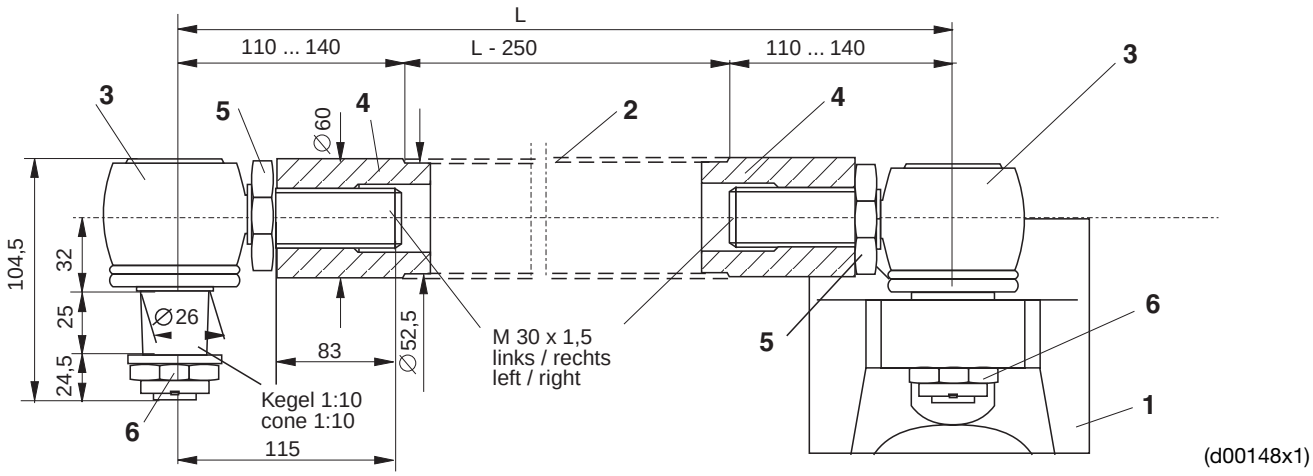


Fig. 7: lever for RHD 1250 / RHD 2500

1. Output shaft
2. Link tube
3. Ball-and-socket joint
4. Welding bushings (C15 to DIN 17210)
5. Counter nuts
6. Crown nuts

8.5.4 Lever for RHD 4000

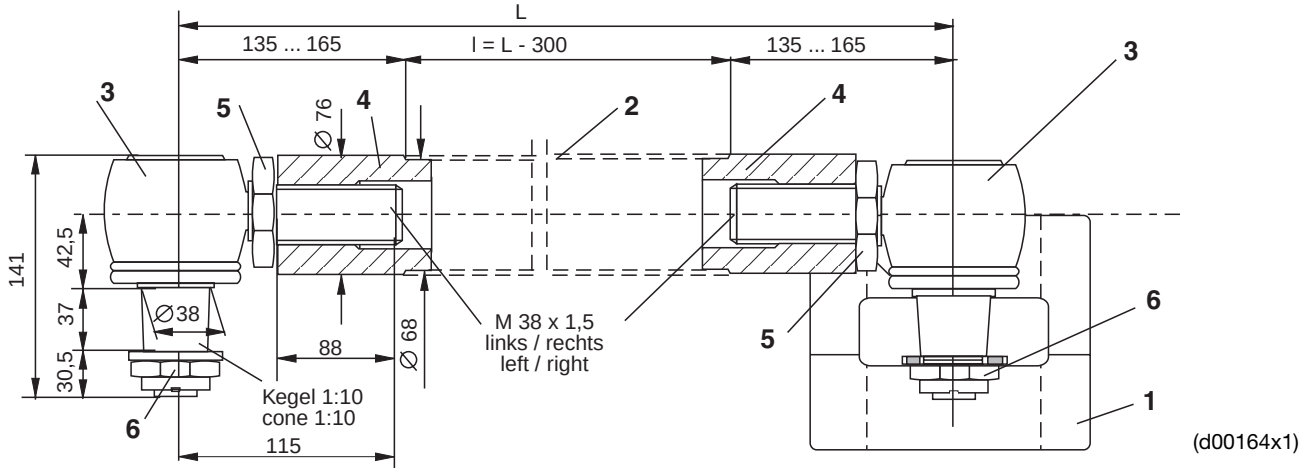


Fig. 8: lever for RHD 4000

1. Output shaft
2. Link tube
3. Ball-and-socket joint
4. Welding bushings (C15 to DIN 17210)
5. Counter nuts
6. Crown nuts

9. Electrical Connection

9.1 Wiring Diagram EBN 853 (Standard)

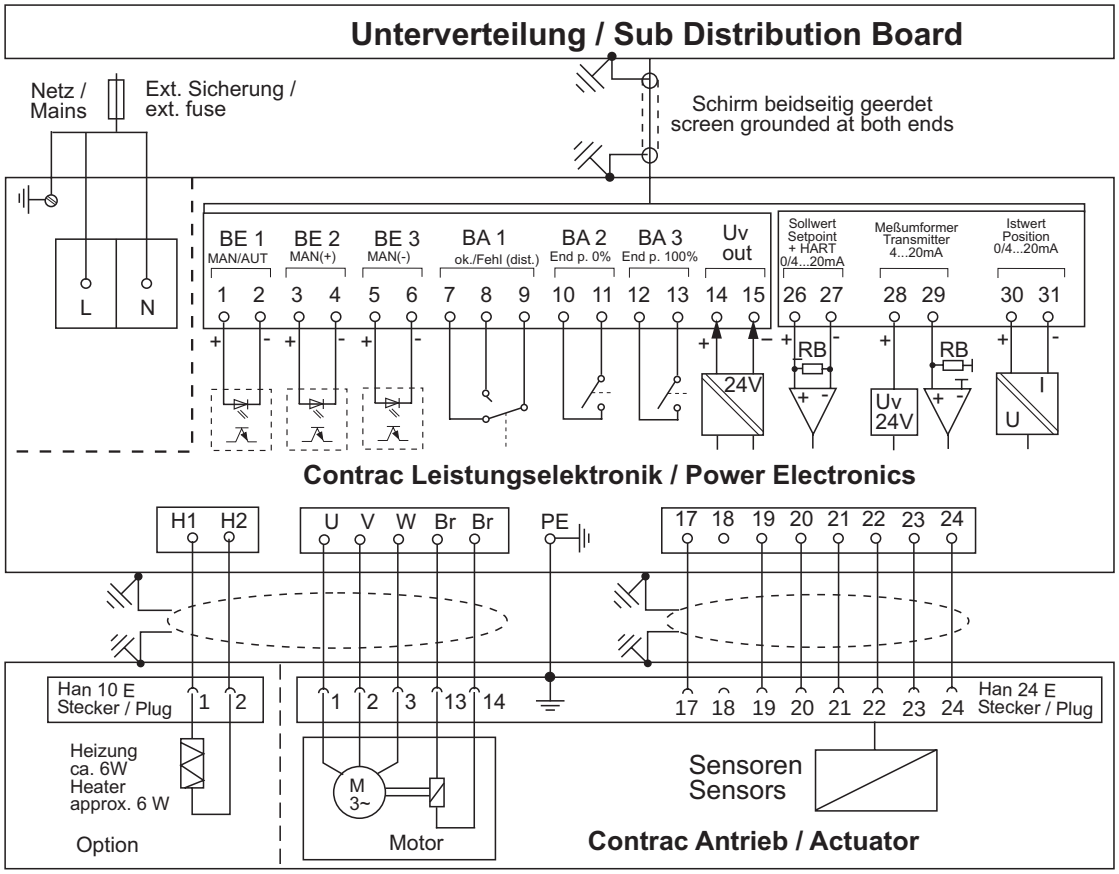


Fig. 9: Wiring diagram for standard triggering of of EBN 853 (optional with heater)

9.2 Wiring Diagram EBN 861 (Standard)

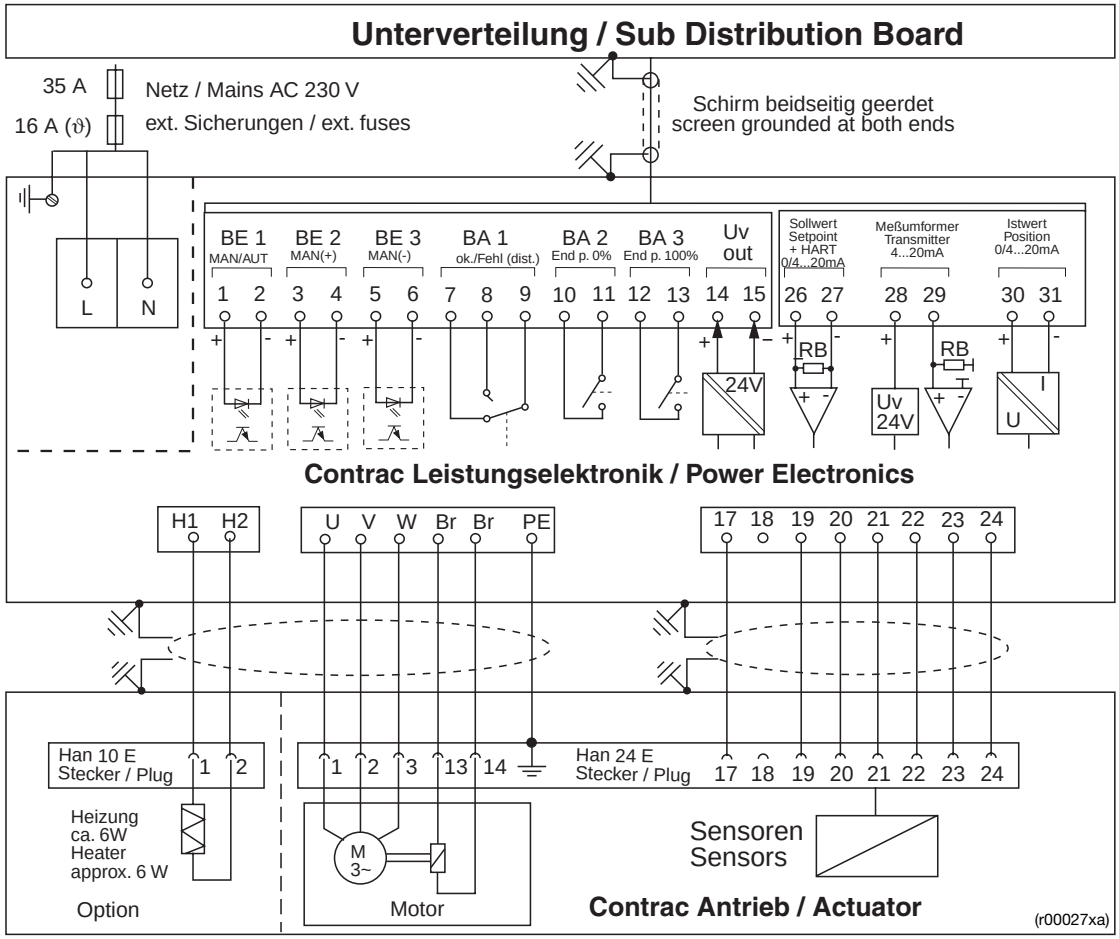


Fig. 10: Wiring diagram for standard triggering of of EBN 861 (optionally with heater)

The following steps must be performed to switch the actuator to automatic mode (AUT):

- Activate digital inputs DI 1, DI 2 and DI 3 via the configuration program.
- Make sure that the supply voltage is available on digital input 1 (DI 1).
- Activate AUT mode via the configuration program.

9.3 **Signal input and output** (conventional control)

9.3.1 Standard

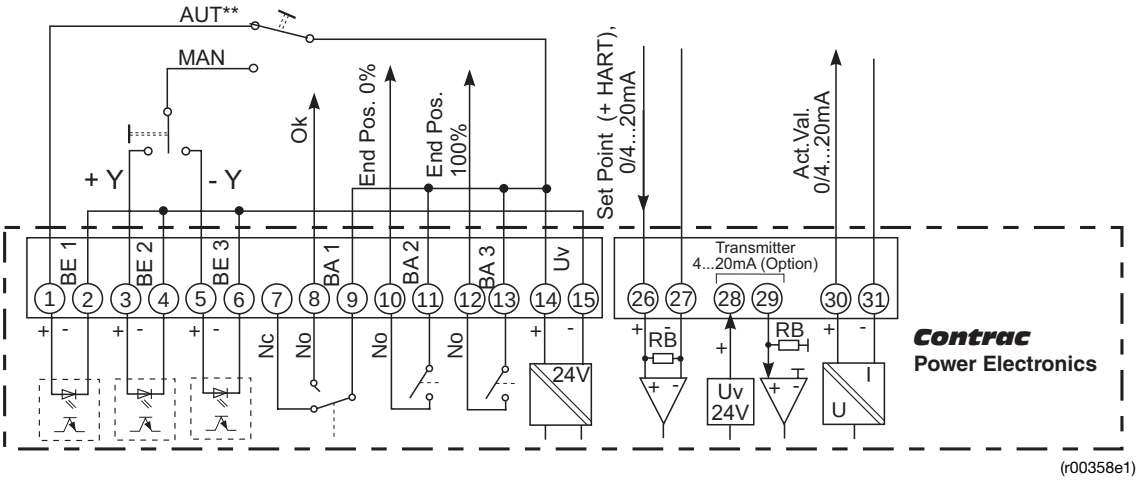


Fig. 11:

** Write-protected when applying +24 V DC to DI 1.

9.3.2 Behind a step controller

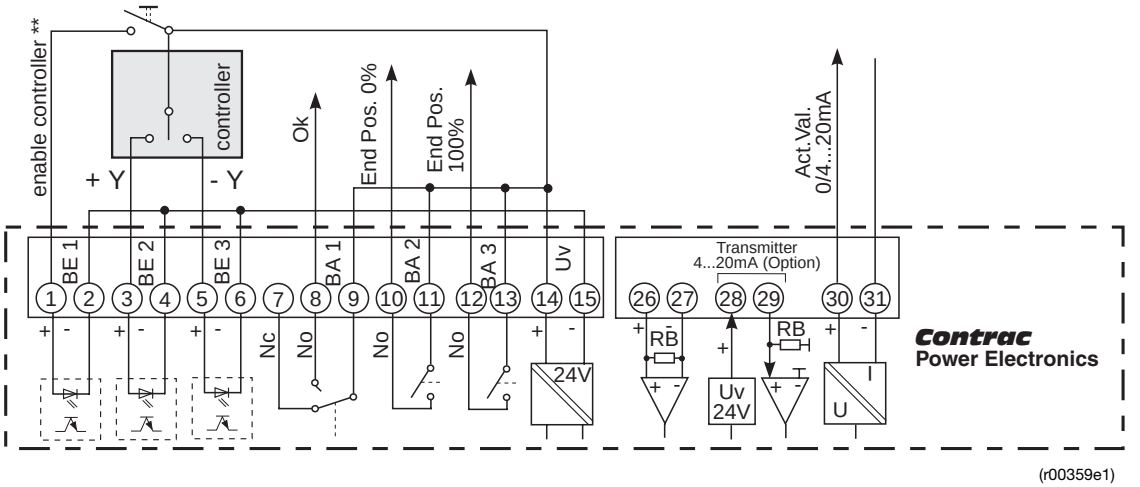


Fig. 12:

** Write-protected when applying +24 V DC to DI 1.
Refer to Operating Instructions 42/68-820 (Power Electronics for Field-Mounting) and 42/68-821 (Rack-Mounting Electronics) for installation details.

9.4 Wiring diagram EBN 853 (field bus communication)

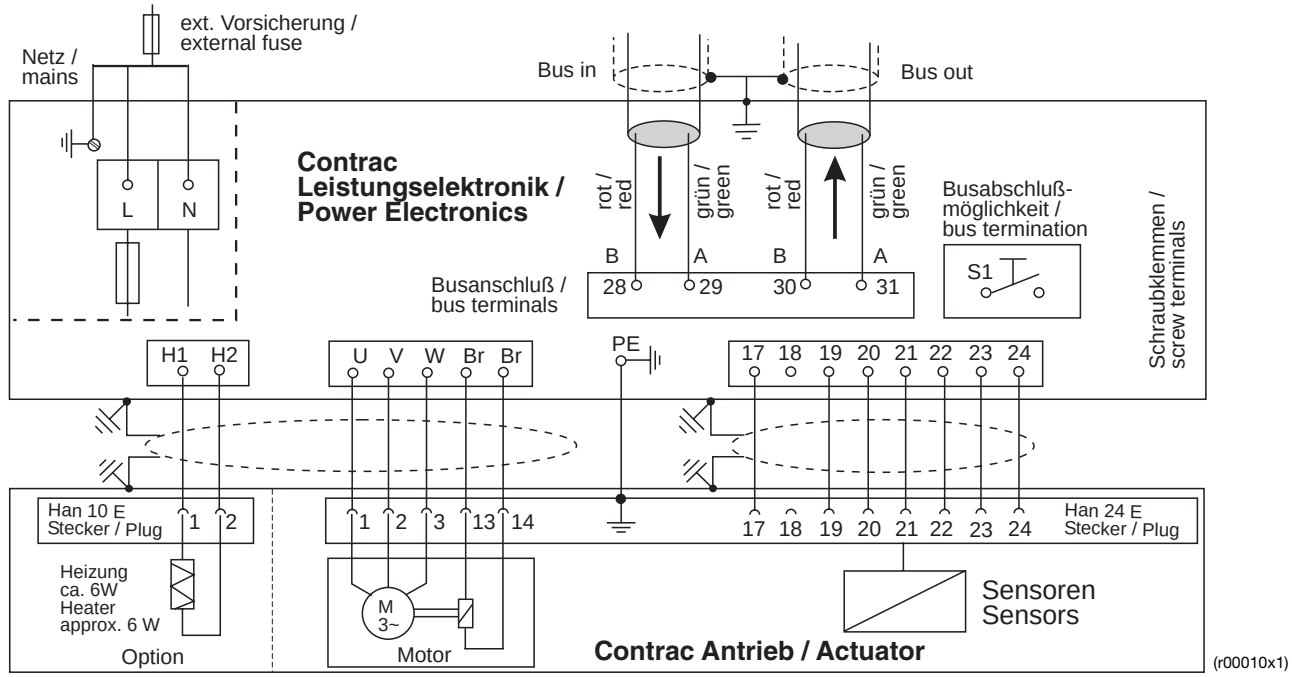


Fig. 13: Wiring diagram for EBN 853

9.5 Wiring diagram EBN 861 (field bus communication)

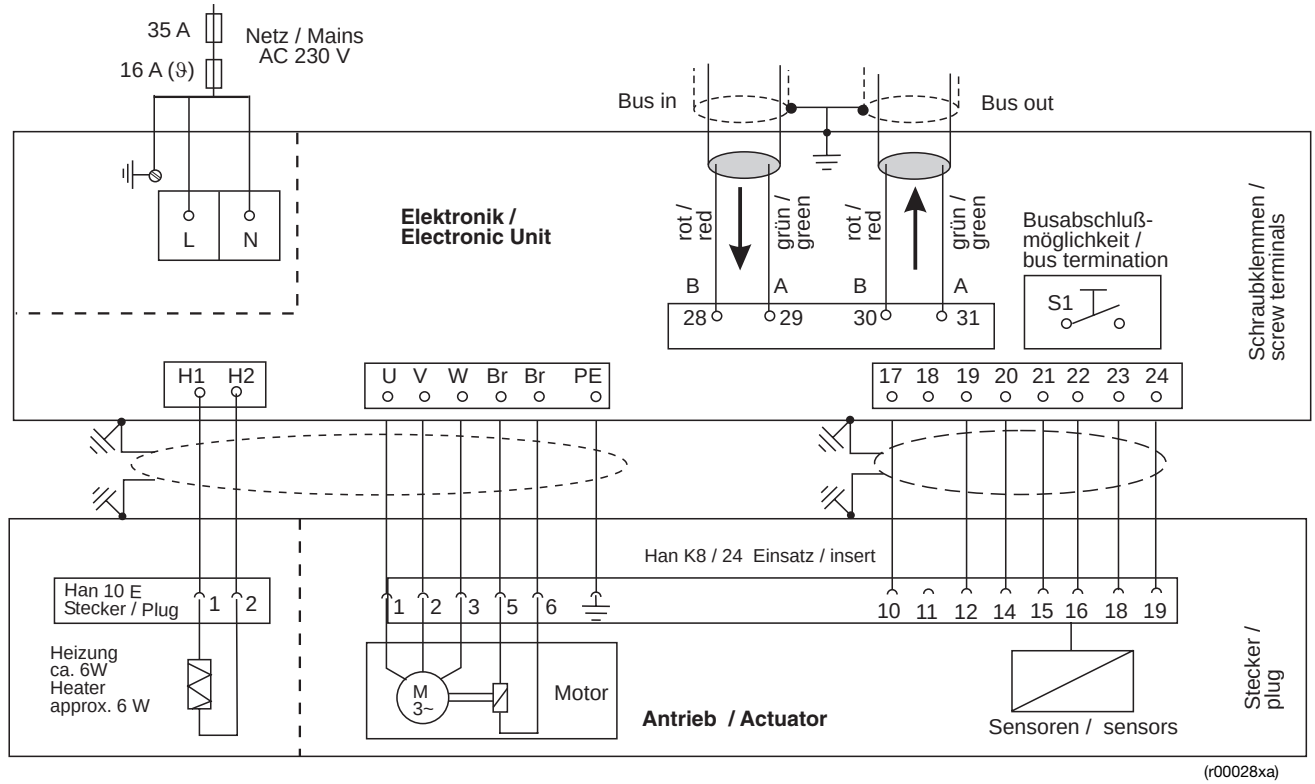


Fig. 14: Wiring diagram for EBN 861

9.6 Wiring diagram for electronics in mounting rack

See instructions 42/68-821EN for detailed information.

10. Setup

The basic settings (definition of end positions) can be made via the **L**ocal **C**ontrol **P**anel (LCP). It is used for adapting the actuator to the operating range and the effective direction without a PC. The actuator can be set up and configured completely using the appropriate configuration program.

The commissioning and service field is located on the electronics!

10.1 Setup via LCP

10.1.1 Operating elements

1.	Write-protect switch	(Default setting: OFF)
2.	LED for 100% position	Indication if adjustment procedure, saved position, or fault by different flash frequencies.
3.	Drive buttons	Press to cause drive motion
4.	Reset button	Press to restart processor and clear any 0% and 100% values.
5.	Power LED	Indicates available mains supply
6.	RS 232 socket	Connection socket to PC
7.	Potential toggle switch	Connection of reference potential to the system or protective earth (by default set to system)
8.	LED for 0% position	Indication if adjustment procedure, saved position, or fault by different flash frequencies..
9.	Accept button (0%)	Press to define current position as 0%; simultaneously press push button 11 to complete the adjustment procedure.
10.	Accept button (100%)	Press to define current position as 100%; simultaneously press push button 10 to complete the adjustment procedure

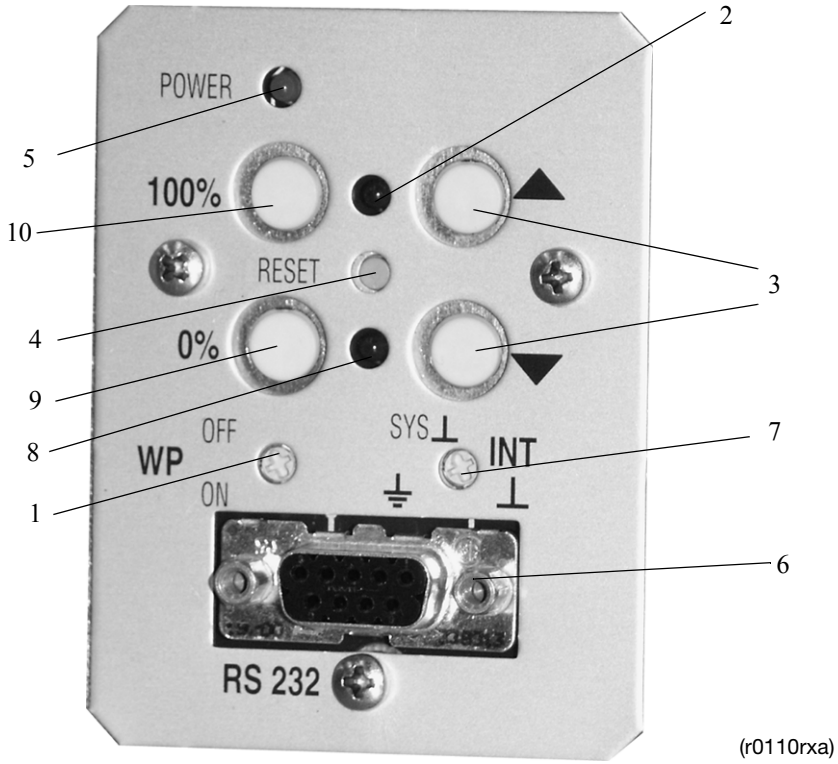


Figure 15: **L**ocal **C**ontrol **P**anel (LCP)

The actuator range is not preset in factory!

10.1.2 Initial situation

- Electronics connected to power supply and actuator
- Write-protect switch (1) set to “OFF” position
- Electronics in operating mode “MAN” (no signal on DI 1)
- No fault (if a fault occurs, both LEDs flash alternately at 4 Hz)

10.1.3 Setup procedure

- Undo the screws of the LCP cover
- Swing the cover to the side

10.1.3.1 “Setting” mode

- Set electronics to “setting” mode by pressing push buttons (3) and (5) simultaneously for approx. 5 seconds, until both LEDs (2 + 9) are flashing synchronously at approx. 4 Hz.

10.1.3.2 Defining first position (0% or 100%)

- Move to desired position by pressing push button (3) or (5).
- To accept the position, press push button (10) or (11); the associated LED flashes at approx. 1 Hz when value is correctly accepted, the other continues to flash at approx. 4 Hz

(Higher precision in 2nd position)

10.1.3.3 Defining second position (0% or 100%)

- Move to second position by pressing push button (3) or (5).
- To accept the position, press push button (10) or (11); both LEDs (2) and (9) are flashing at approx. 1 Hz when value is accepted correctly.

10.1.3.4 Saving the settings

- The settings are accepted by simultaneously pressing the push buttons (10 + 11); the LEDs (2 + 9) extinguish after a short time, and the adjustment procedure is completed.
- If the selected range is too small for the actuator, both LEDs will flash again at 4 Hz. Repeat the adjustment procedure a larger value (min. positioning travel). (See positioning travel specification on actuator ID label)

10.1.3.5 Correction after setup

- If the setting is to be corrected after accepting the first value, first press the Reset button (4) and then repeat the setting.
- If the correction is to be done after saving the settings, the entire adjustment procedure must be repeated.

10.2 Adjustment using the configuration program

Context-sensitive help information is available in the configuration program at all times. For basic handling and installation instructions refer to the associated manual, number 41/68-001.

A conductive ground connection is established between the PC and the CONTRAC electronics with the RS 232 communication cable. If the PC is grounded, this may cause a ground loop in the installation.

10.3 Indication at LCP

Function	Indication
Adjustment	
Change-over to adjustment mode: Press and hold both drive switches for approx. 5 seconds	Both LEDs flash synchronously at approx 4 Hz after time has expired.
Moving to an end position Use respective drive button on CSF	Both LEDs continue to flash at 4 Hz while driving.
Saving the first end position Press button 0% or 100%	The associated LED flashes at approx. 1 Hz, the other continues at 4 Hz.
Saving the second end position Press button 0% or 100%	The associated LED flashes at approx. 1 Hz synchronously to the first one.
Terminate adjustment Press 0% and 100% buttons simultaneously	Both LEDs are briefly lit together and then extinguish.
Operation	
Normal operation: MAN / AUT	LED off
Driving with button on CSF Priority over control system	LED off
Fault (both LEDs flash alternately at 4 Hz)	
Reset: Resets fault indications	If no other fault conditions exist, both LEDs extinguish.
Reset if operating range is exceeded; press and hold both drive button for 5 seconds, then press Reset button	After approx. 5 seconds the flash rhythm is briefly interrupted. After “Reset” the electronics switch to adjustment mode.

Table 9:

11. Maintenance

Contrac actuators have a robust construction. As a result, they are highly reliable and require only little maintenance. The maintenance intervals depend upon the effective load and are therefore not specified here.
The built-in microprocessor evaluates the actual load factors (e.g. torques, temperatures, etc.) and derives the remaining operating time until the next routine maintenance is required. Use the configuration program for viewing this information.

11.1 Motor and Gears

All maintenance work must be carried out by qualified specialists who have been trained for this task. As a rule, perform the following routine maintenance works:

- Check the shafts and gears.
- Check the motor pinion gear and the respective mating gear.
- Replace the motor's rotary shaft seal and ball bearings.
- Check the position sensor.
- Change the oil; then make a visual check and check for proper operation.

11.2 Adjusting the Brake

Note that the actuator setting may be changed accidentally by the repelling power of the valve when the brake is released!

In automatic mode the brake is permanently released. Therefore, it is not exposed to wear and does not require any re-adjustment.

11.3 Replacing the Position Sensor

11.3.1 Dismounting

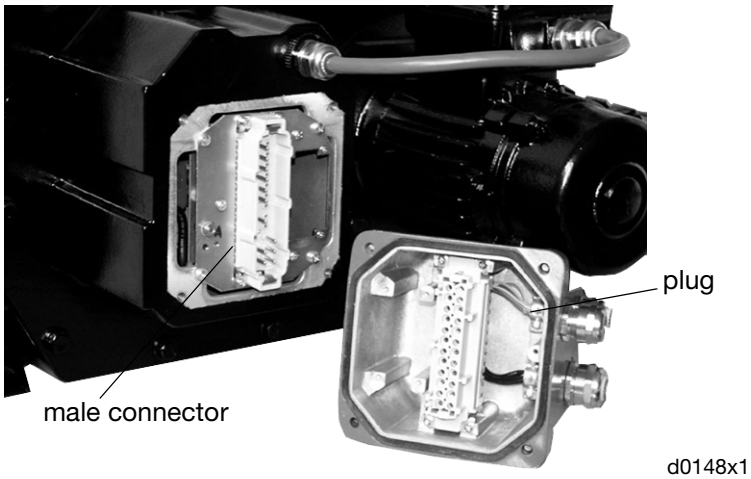


Fig. 16:

- drive actuator into 50% position (refered to rated actuator stroke)
- 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. 17 + 18) and take sensor out
- detach plug from sensor pcb.

11.3.2 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 17.
- align the sensor and its gears with the actuator; set the first toothed gear in 09:00 o'clock position (fig. 18) 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

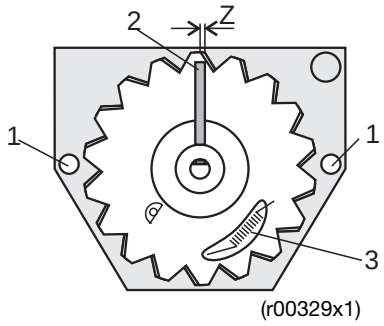


Fig. 17: Position sensor

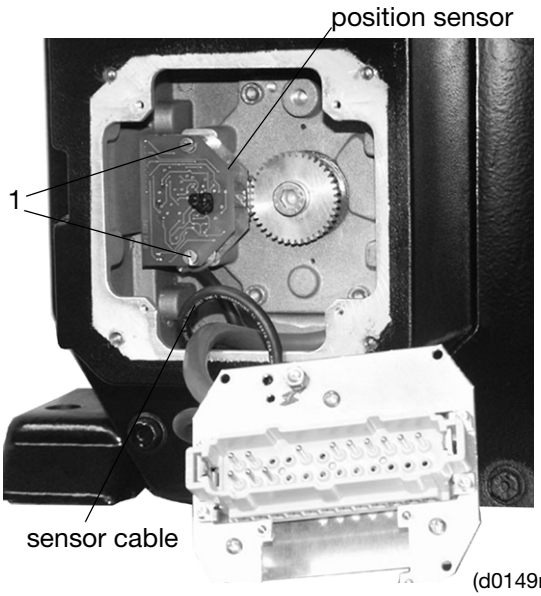


Fig. 18: Mounting position

After mounting is completed readjust the actuator range as described in the setup section of this manual.

12. Troubleshooting

This section only describes how to handle hardware errors. Refer to the configuration program's online help for errors related to the software.

Error	Possible reason	Measures to be taken
Valve cannot be moved by actuator	Malfunction of actuator or valve (e.g. cable gland fastened too tightly)	Disconnect the actuator from the valve. If the actuator is working properly then, the valve is likely to be defective. Otherwise, the actuator seems to be the error source.
Actuator does not react	No communication	Set up communication using the configuration program
	Motor / brake is defective	Check the winding resistances of the motor and brake. Check the brake fuse.
	Digital inputs of electronics are not connected	Connect
	Brake does not release (no audible "click" noise)	Check the air gap (should be around 0.25 mm) and the electrical connection of the brake. Check the winding resistance of the brake coil.
Actuator does not work in automatic mode, although "AUT" has been selected in the configuration program	Digital input 1 (DI 1) has not been connected.	Connect DI 1.
LEDs on the commissioning and service field are flashing simultaneously	Actuator has not been adjusted properly	Adjust the actuator.
Fault when approaching an end position	Actuator is working in the limit range of the position sensor	- Move the actuator either manually or with the CSF buttons to a position beyond the end position [1] (disconnect from valve if required). - Move actuator back. If required, reconnect to to the valve (if applicable) - Adapt actuator to new operating range

Table 10:

[1] If actuator end position = valve end position, mount the sensor as described in section 11.3.2.

12.1 Electrical test values

	MCS 071 BA	MCS 080 BA	MC 090 BA	MC 100 BA
Winding resistance ± 5% at 20° C (motor)	42 ohms	80 ohms	10 ohms	4.7 ohms
Winding resistance ± 5% at 20° C (brake)	2134 ohms	1688 ohms	1630 ohms	1377 ohms

Table 11:

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