

DREHMO

VALVE ACTUATORS

A member of the AUMA Group

DREHMO C-matic

**Electric actuator
with integral controls**



Assembly, operation and servicing instructions
for multi-turn, part-turn and linear actuators

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This operating manual is part of the supply and should be kept for future use.

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1 Safety instructions

This section deals with basic, safety-relevant information relating to DREHMO actuators. We would like to ask you to thoroughly read the instructions prior to working on the actuators.

1.1 Basic information on safety

Standards/directives

DREHMO products are designed and manufactured in compliance with recognised standards and directives. This is certified in a Declaration of Incorporation and an EC Declaration of Conformity. Plant operators or plant manufacturers must ensure that all legal requirements, directives, guidelines, national regulations and recommendations with respect to assembly, electrical connection, commissioning and operation are met at the place of installation.

Safety instructions/warnings

All personnel working with this device must be familiar with the safety and warning instructions in this manual and observe the instructions given. Safety instructions and warning signs on the device must be observed to avoid personal injury or property damage.

Qualification of staff

Assembly, electrical connection, commissioning, operation, and maintenance must be carried out by suitably qualified personnel authorised by the plant operators or plant manufacturers only. Prior to working on this product, the staff must have thoroughly read and understood these instructions and, furthermore, know and observe officially recognised rules regarding occupational health and safety. Work performed in potentially explosive atmospheres is subject to special regulations which have to be observed. The plant operators or plant manufacturers are responsible for respect and control of these regulations, standards, and laws.

Commissioning

Prior to commissioning, it is important to check that all settings meet the requirements of the application. Incorrect settings might present a danger to the application, e.g. cause damage to the valve or the installation. The manufacturer will not be held liable for any consequential damage. Such risk lies entirely with the user.

1. SAFETY INSTRUCTIONS

Operation

Prerequisites for safe and smooth operation:

- Correct transport, proper storage, mounting and installation, as well as careful commissioning.
- Only operate the device if it is in perfect condition while observing these instructions.
- Immediately report any faults and damage and allow for corrective measures.
- Observe recognised rules for occupational health and safety.
- Observe national regulations.
- During operation, the housing warms up and surface temperatures $>60^{\circ}\text{C}$ may occur. To prevent possible burns, we recommend checking the surface temperature using an appropriate thermometer and wearing protective gloves, if required, prior to working on the device.

Protective measures

The plant operators or plant manufacturers are responsible for implementing required protective measures on site, such as enclosures, barriers, or personal protective equipment for the staff.

Maintenance

To ensure safe device operation, the maintenance instructions included in this manual must be observed.

Any device modification requires prior consent of the manufacturer.

1.2 Range of application

DREHMO actuators are designed for the operation of gate valves, butterfly valves, and ball valves. If temperatures outside the range for ambient temperature specifications as marked on the name plate (e.g. due to hot media) are to be expected, you are requested to contact the manufacturer. Other applications require explicit (written) confirmation by the manufacturer. The following applications are not permitted, e.g.:

- Industrial trucks according to EN ISO 3691
- Lifting appliances according to EN 14502
- Passenger lifts according to DIN 15306 and 15309
- Service lifts according to EN 81-1/A1
- Escalators
- Continuous duty
- Buried service
- Continuous submersion (observe enclosure protection)
- Potentially explosive areas
- Radiation exposed areas in nuclear power plants

No liability can be assumed for inappropriate or unintended use. Observance of these operation instructions is considered as part of the device's designated use.

Information: These instructions apply to the clockwise closing standard version, i.e. the driven shaft turns clockwise to close the valve.

1.3 Warnings

The following warnings draw special attention to safety-relevant sections in these operation instructions, each marked by the appropriate signal word (**DANGER**, **WARNING**, **CAUTION**, **NOTICE**).

DANGER	Indicates an imminently hazardous situation with a high level of risk. Failure to observe this warning could result in death or serious injury.
WARNING	Indicates a potentially hazardous situation with a medium level of risk. Failure to observe this warning could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation with a low level of risk. Failure to observe this warning may result in minor or moderate injury. May also be used with property damage.
NOTICE	Potentially hazardous situation. Failure to observe this warning may result in property damage. Not used for injuries or death.

Structure of the warning instructions for **DANGER**, **WARNING**, **CAUTION** and **NOTICE**:



WARNING

Type of hazard and respective source!

Possible cause(s) in case of failure to respect safety instructions, actions for risk avoidance and further optional measures.

The safety symbol of the triangle on the base line is used for warning of an potential risk of injury. The signal word indicates the level of hazard. Failure to observe the blue information symbol may result in property damage (not used for injuries or death).



NOTICE

Type of hazard and respective source!

Possible cause(s) in case of failure to respect safety instructions, actions for risk avoidance and further optional measures.

2 Identification

The following section describes the characteristics allowing identification of the respective DREHMO actuator.

2.1 Name plates

Each actuator is equipped with an actuator and a motor name plate including information required for unambiguous identification (refer to figure 2.1). For commissioning, service and maintenance, additional actuator-relevant data is indicated on the name plates.

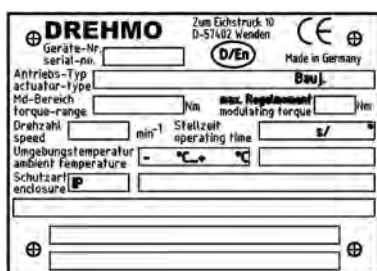


Figure 2.1: Actuator name plate

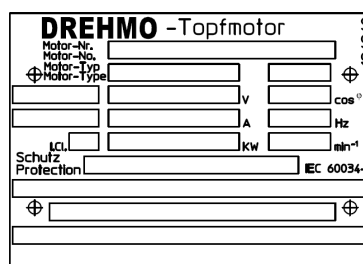


Figure 2.2: Motor name plate

Please always state the serial number for any product inquiries. The product can be unambiguously identified using this number and the technical data as well as order-related data pertaining to the device can be requested.

2.2 Actuator designation

The following example is used to explain the actuator designation:

Value range	D	*	*	*	*	-	*	-	*		*
Position	1	2	3	4	5	6	7	8	9	10	11

Position	Value range	Signification
1	D	DREHMO actuator
2		Multi-turn actuator
	P	Part-turn actuator
3		Actuator without controls
	MC	Actuator with C-matic controls
	iM	Actuator with i-matic or i-maticC controls
4		Actuator for open-close operation, type of duty S2 <15 Min
	R	Type of duty for modulating actuator: S4 max. 35 %ED
5	30 to 2000	Nominal torque in Nm for multi-turn actuators D...
	30 to 1800	Nominal torque in Nm for part-utrn actuators DP...
6	-	Line
7	A, AF, B, B1, B2, B3, B3DO, B4, C, D, DO, DOU, DSTO, DSTU, E, EDO	Valve attachment types for multi-turn actuators according to EN ISO 5210
	B, V, W, L/D, H, FH, FW	Valve attachment types for part-turn actuators according to EN ISO 5211
8	-	Line
9	5 to 160 (50 Hz) 6 to 192 (60 Hz)	Output drive speed in rpm for multi-turn actuators D...
	8 to 60 (50 Hz) 6 to 50 (60 Hz)	Operating time for 90° in seconds for part-turn actuators DP...
10		Blank
11		Standard actuator
	Ex	Explosion-proof actuator

Table 2.2: Type code

3 Transport, storage and packaging

This section of the operation instructions deals with safe transport, appropriate storage and packaging. The information given shall avoid property damage and personal injury.

3.1 Transport

DANGER
Hovering load! Risk of death or serious injury



- Do NOT stand below hovering load.
- Fix ropes or slings around housing, NOT to handwheel, stem protection cover or motor eyebolt.
- If the actuator is mounted to a valve, fix ropes or slings at the valve.
- If a gearbox is mounted to the actuator, fix ropes or slings at gearbox.

Please refer to figure 3.1 below for appropriate actuator transport.



Figure 3.1: Transport

3.2 Storage

Mounting or storage in humid environments requires appropriate actions for avoiding condensation inside the actuator. If the actuator is equipped with an externally supplied additional heater, this heater must be predominantly used. Otherwise, switch on the operating voltage. If the device is to be stored for a long period (more than 6 months), the following points must be observed:

- Protect uncoated surfaces, in particular the output drive parts and mounting surface with corrosion protection agent prior to storage.
- Check uncoated surfaces for corrosion approximately every 6 months.
- Ensure that actuators are fully operational by performing a test run every 6 months.

NOTICE

Danger of corrosion and damage to the control unit due to inappropriate storage



- Store in a well-ventilated, dry and closed room.
- Protect against dampness from the floor and ambient humidity.
- Cover to protect against dust and dirt.
- Apply suitable corrosion protection agent to uncoated surfaces.
- Switch on device heater.

NOTICE

Damage on display caused by temperatures outside permissible level



- Make sure that display temperature does not fall below $-30\text{ }^{\circ}\text{C}$

3.3 Packaging

Our products are protected by special packaging for transport when leaving the factory. The packaging consists of environmentally friendly materials which can easily be separated and recycled. We use the following packaging materials: wood, cardboard, paper, and PE foil. For the disposal of the packaging material, we recommend recycling and collection centres.

4 Mounting to valve

This section deals with mounting the actuator on a valve, while detailing the specialities of the different version. In any case, check the actuator first for any damage. Replace damaged parts by original spare parts.

DREHMO actuators can be mounted in any position. Mounting is easiest if the vertically fitted valve shaft is freely accessible. To fix the DREHMO actuator to the valve, threaded holes are provided at the actuator mounting flange. The dimensions of the actuator mounting flange with output drive types comply with standards EN ISO 5210 (multi-turn actuators) or EN ISO 5211 (part-turn actuators).

4.1 Handwheel operation

Both actuator or valve can be operated manually at any time via the handwheel in case of power failure. Switching between motor operation and handwheel operation is not required. Clockwise rotation of handwheel results in clockwise rotation of output drive (for view on motor name plate).

WARNING

Damage to actuator and mounted elements by handwheel operation



- The set tripping torques do not limit the forces applied by the handwheel.
- Manual operation only
- Power drive for handwheel operation is only available on request with the manufacturer.
- Use of levers of any type is not permitted.

4.2 Removal and fitting of stem nut (output drive type A)

For output drive type A, make sure that the unbored stem nut (delivered unbored unless stated otherwise) must be provided with a thread bore in compliance with available stem prior to mounting the DREHMO actuator onto the valve.

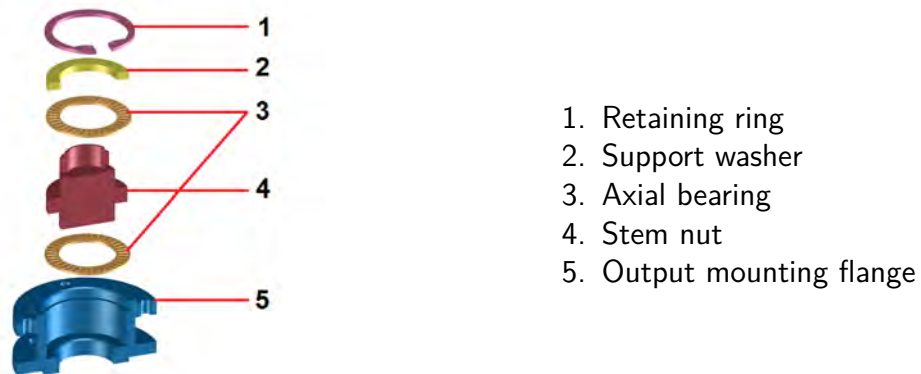


Figure 4.1: Stem nut type A

Remove output mounting flange (5) from actuator. Remove retaining ring (1) and remove stem nut (4) including support washer (2) and axial bearing (3). Perform thread bore. Reverse the process to reassemble stem nut. Apply a thin film of sealing agent (e.g. Curil K2) at sealing faces of output mounting flange (5) prior to assembly.

4.3 Removal and fitting of stem nut (output drive type A-HP)

For better distinction, each of the new stem nuts is marked with a turned marking groove at the shoulder circumference.

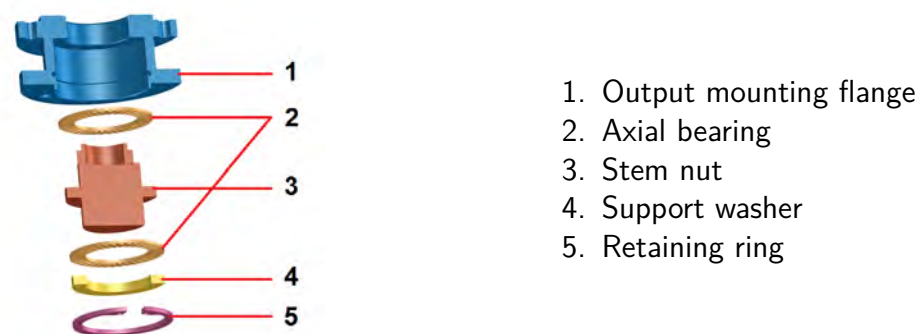
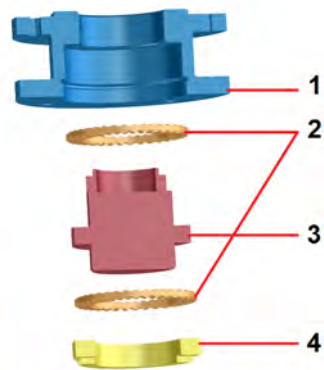


Figure 4.2: Stem nut type A HP with retaining ring



1. Output mounting flange
2. Axial bearing
3. Stem nut
4. Locking nut

Figure 4.3: Stem nut type A HP with thread ring

Remove retaining ring (5) / locking nut (4) and remove stem nut (3), axial bearing (2). If the output drive has a retaining ring the support washer (4) has to be removed too. Perform thread bore. Reverse the process to reassemble stem nut.

NOTICE

Excessive lubricant application can impair the tightness of the actuator



- The actuators have a lifetime lubrication
- A device for permanent lubrication of a stem (only output drive type A and A-HP) can be inquired of the manufacturer

4.4 Insulating flange

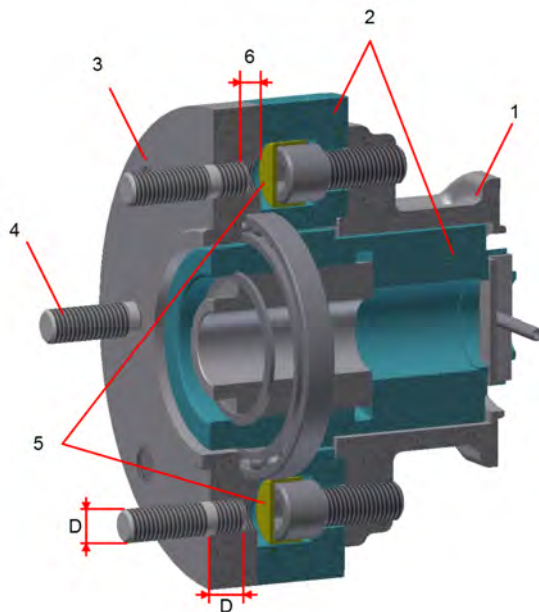
When using an insulating flange, heed the length of the screws used. They must not be too long: otherwise the insulating caps within the flange or even the flange as such will be damaged. We therefore recommend using studs according to DIN 938 with a depth of thread of $1 \times D$ (refer to figure 4.4) for assembly. A remaining width of joint of 0 mm must not be fallen short of.

NOTICE

Risk of damage at insulating flanges when using motors with mounted terminal box (standard motors) and horizontal mounting position!



- Due to the limited permissible forces on the insulating flange, horizontal mounting positions are not allowed for actuators with standard motors (external clamp cage).



1. Input mounting flange
2. Insulating body
3. Output drive flange
4. Stud
5. Insulating caps
6. Remaining width of joint (> 0 mm)

Figure 4.4: insulating flange

4.5 Rain protection hood

For HEW-RUF motors, the rain protection hood (2) is always used in combination with the fan cover (1) (siehe Abbildung 4.5). This is the responsibility of the supplier! The hood must only be disassembled at the customers' for upward mounted shafts (protection hood points downward). For this, the fan cover (1) must be disassembled first. After this, the rain hood (2) with positive connection can be removed. For this, straighten the four lugs (3) using appropriate universal pliers. Finally, the fan cover (1) must be refitted.

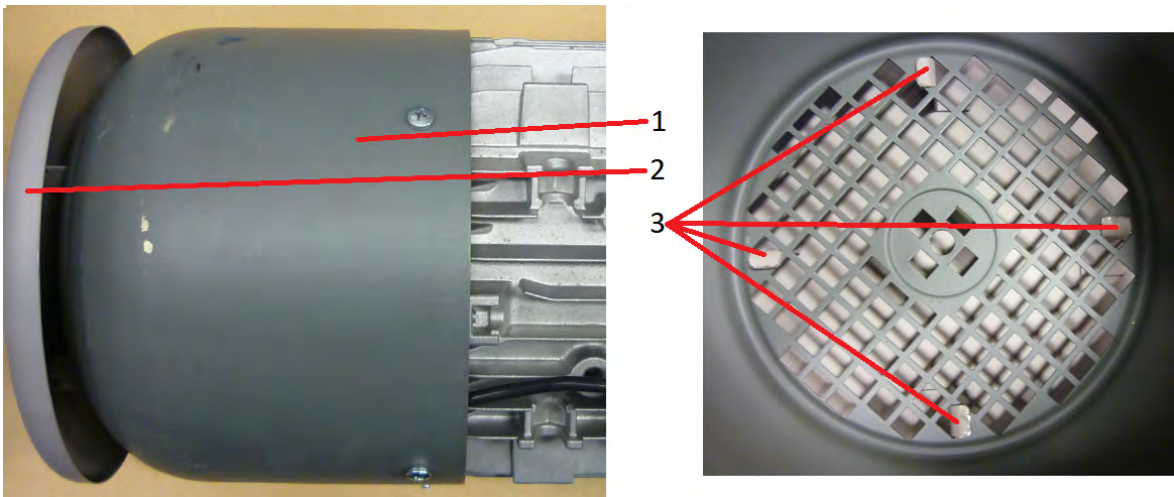


Figure 4.5: Regenschutzhaube

4.6 Assembly

Direct mounting

For direct mounting, the actuator is fitted without intermediate gearing to the valve. For this purpose, part-turn actuators are equipped with an unbored (standard) output drive plug sleeve. The output drive plug sleeve is equipped with splines on the outside (to be coated with appropriate grease prior to assembly) and can therefore be inserted into the actuator at different angles. As standard, multi-turn actuators are available with output drive type B3. Output drives A, B1, B2, B4, E, C and D are available on request.

Align actuator on valve, then rotate the device until fixing holes of actuator and valve align and the output drive is correctly placed on the valve flange. Fasten actuator crosswise to valve using appropriate screws.

Output drive type A is an exception. This output drive type must be fastened to the valve first. Rotate the drive assembly down the valve shaft to mate with the valve flange. Align the fixings and attach loosely, rotate the drive coupling to take up the free play and ensure close coupling of the flanges, before fastening tightly. Then the actuator is placed on the drive assembly and can be rotated to the correct position via the handwheel before fixing tightly into position.

Screw strength class 8.8 ($\mu_t \approx 0.12$)										
Threads	M6	M8	M10	M12	M14	M16	M18	M20	M30	M36
Tightening torque in Nm	10	25	49	85	135	210	300	425	1450	2600

Table 4.1: Tightening torques

The actuator is mounted to the valve using an output drive plug sleeve (refer figure 4.6). Ensure compliance of fitting dimensions according to table 4.2 below.

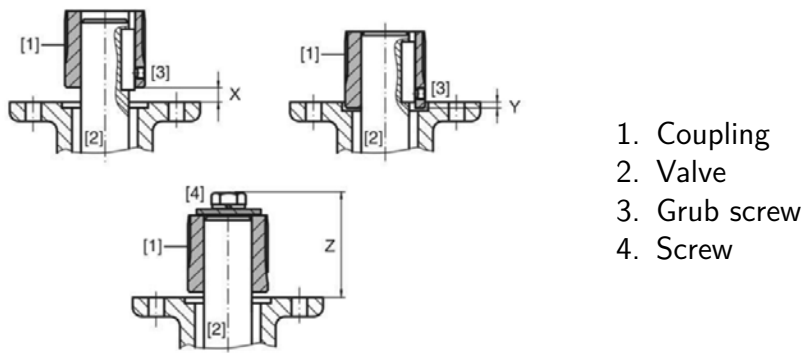


Figure 4.6: Cross sections of different couplings

NOTICE

Increased fastening torque for powder coated flanges possibly required



- Thanks to powder coating on flange surfaces and flange threads, we achieve top quality and permanent corrosion protection. However, increased fastening torque of up to 2 Nm across all screw dimensions might be required. Consequently, tools might already be required when fastening the screws (typically a socket is sufficient). This was considered when specifying the screw connection and is totally uncritical in practice.

1. Use handwheel to run actuator to mechanical end stop.
2. Thoroughly degrease mounting surfaces of output mounting flanges and apply appropriate sealing agent (e.g. Curil K2).
3. Apply a small quantity of grease to the valve shaft [2].
4. Place coupling [1] onto valve shaft [2] and secure against axial slipping by using a grub screw [3], a retaining ring or a screw. Thereby, ensure that dimensions X, Y or Z are observed (refer to figure 4.6 and table 4.2).
5. Apply non-acidic grease at splines of coupling.
6. Fit part-turn actuator.
7. If flange bores do not match thread:
 - a) Slightly rotate handwheel until bores line up.
 - b) If required, shift actuator position by one tooth on the coupling.
8. Fix actuator using suitable screws.

We recommend applying liquid thread sealing material to the screws. Fasten screws cross-wise to a torque according to table 4.1.

Type, size - output mounting flange	X _{max} in mm	Y _{max} in mm	Z _{max} in mm
DP..(R)75/150/299-F05/07	3	2	40
DP..(R)75/150/299-F10	3	2	66
DP..(R)300/450-F10	4	5	50
DP..(R)300/450-F12	4	5	82
DP..(R)600/900-F12	5	10	62
DP..(R)600/900-F14	5	10	102
DP..(R)1200/1800-F14	8	10	77
DP..(R)1200/1800-F16	8	10	127
DP..30,59,119	1		
DP..319,799	1.5		
DP..1599	3		

Table 4.2: Coupling fitting dimensions

Indirect mounting

For indirect mounting DREHMO actuators can be supplied with base and lever or with base and shaft. Connection between actuator and valve is provided by the customer (e.g. via lever arrangement).

4.7 Additional settings for part-turn actuators

End stops in part-turn actuator

The internal end stops limit the swing angle. They protect the valve in the event of manual handwheel operation. End stop setting is generally performed by the valve manufacturer prior to installing the valve into the pipework.

CAUTION

Exposed, rotating parts (discs/balls) at the valve!
Hazard of crushing hands or feet and damage to valve or actuator.



- End stops should be set by suitably qualified personnel only.
- Never completely remove the setting screws [2] and [4] to avoid grease leakage (refer to figure 4.8).

Note: The setting sequence for the end stops depends on the valve. We recommend to start with the end stop CLOSE for butterfly valves and with end stop OPEN for ball valves.

On delivery, unfasten both screws for the end stop (figure 4.7) to allow alignment of actuator to valve. The minimum and maximum dimensions for adjustment indicated in tables 4.3, 4.4 and 4.5 must not be exceeded. The valve must be in CLOSED position during actuator mounting.

Type of actuator 90°	Mid position a	Max.	Min.
DP30, 59,119	11 mm	14 mm	8 mm
DP319, 799	35 mm	40 mm	31 mm
DP1599	40 mm	46 mm	35 mm

Table 4.3: Setting limits of hexagon and pin-shaped stop screws with lock nuts

Type of actuator 90°	Mid position a	Max.	Min.
DP319, 799	3.5 mm	8.5 mm	-0.5 mm
DP1599	3 mm	9 mm	-2 mm

Table 4.4: Setting limits of pin-shape stop screws without lock nut

Type of actuator 90°	T	T _{min}
DP75/150/299	17mm	11mm
DP300/450	20mm	12mm
DP600/900	23mm	13mm
DP1200/1800	23mm	12mm

Table 4.5: Setting limits of stop screws for planetary gearings

The end stop screws are mechanical limits for manual operation and may not be approached during motor operation!

Turn handwheel clockwise to mechanical stop, then slowly rotate one turn counterclockwise. The output drive plug sleeve must be fitted in the actuator. After finish boring, slide output drive plug sleeve on valve shaft and secure if required.

Apply a thin film of sealing agent (e.g. Curil K2) at output mounting flanges prior to assembly. Align actuator to the possible angle steps and slowly push on output drive plug sleeve.

In case the dog of the hollow shaft does not engage into the respective keyway of the output drive plug sleeve, rotate the handwheel until hollow shaft engages. Slowly rotate handwheel until flange bores align, then fasten actuator using flange screws. If more than one handwheel turn is required, put the actuator to the initial position, lift it and place it again onto the output drive plug sleeve by moving one indent.

Setting the mechanical end stop screws

DP . . 30/59/119 (without gearbox) /319/799/1599 (with spur gearbox)

The actuator is in the respective end position. This position must match the valve end position. Insert and turn stop screw for the respective end position (figure 4.7) until resistance is felt. Then rotate by one turn in the opposite direction and secure with lock nut.

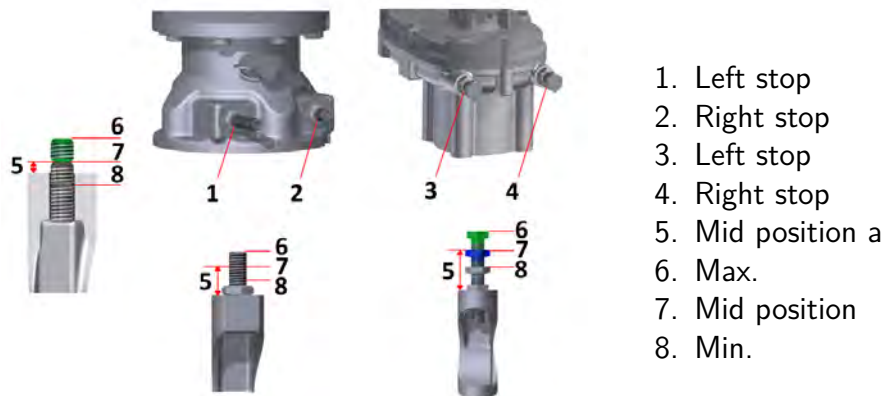


Figure 4.7: End stop screws

Slightly open valve by approximately half a turn of the handwheel (for end position CLOSED) or slightly close (for end position OPEN). Then perform end stop setting.

Setting end stop CLOSED

1. Move valve to end position CLOSED with handwheel.
2. If the valve end position is not reached:
 - Slightly turn setting screw [2] or [4] counterclockwise until valve end position CLOSED can be correctly set.
 - Turning the setting screw [2] or [4] clockwise decreases the swing angle.
 - Turning the setting screw [2] or [4] counterclockwise increases the swing angle.
3. Turn setting screw [2] or [4] clockwise until end stop is reached, then turn in opposite direction by one turn.
4. Secure setting screw [2] or [4] with lock nut.

Now, end stop CLOSED setting is complete and end position CLOSED setting can be performed. Having completed this procedure, end stop OPEN can be immediately set.

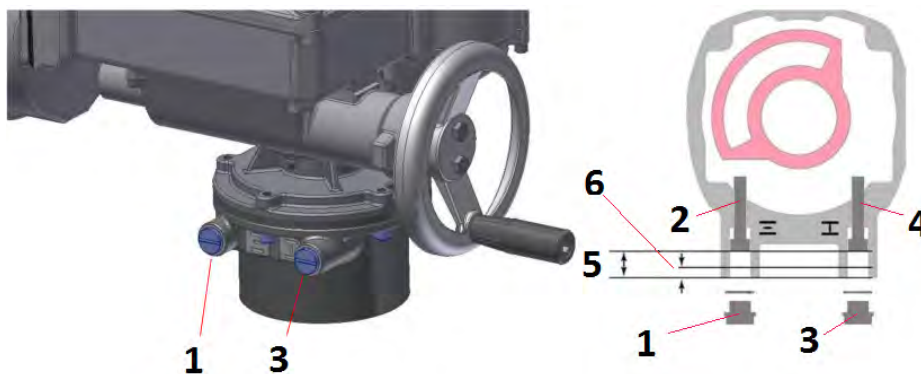
Setting end stop OPEN

1. Move valve to end position OPEN with handwheel.
2. If the valve end position is not reached:
 - Slightly turn setting screw [1] or [3] counterclockwise until valve end position OPEN can be correctly set.
 - Turning the setting screw [1] or [3] clockwise decreases the swing angle.
 - Turning the setting screw [1] or [3] counterclockwise increases the swing angle.
3. Turn setting screw [1] or [3] clockwise until end stop is reached, then turn in opposite direction by one turn.
4. Secure setting screw [1] or [3] with lock nut.

Setting the mechanical end stop screws

DP. . . (R)75-1800 (with planetary gearing)

Note: The setting sequence for the end stops depends on the valve. We recommend to start with the end stop CLOSE for butterfly valves and with end stop OPEN for ball valves.



1. Screw plug for end stop OPEN
2. Setting screw for end stop OPEN
3. Screw plug for end stop CLOSED
4. Setting screw for end stop CLOSED
5. T
6. T_{\min}

Figure 4.8: Cross section of compartment for end stop screws

Setting end stop CLOSED

1. Remove screw plug [3].
2. Move valve to end position CLOSED with handwheel.
3. If the valve end position is not reached:
 - Slightly turn setting screw [4] counterclockwise until valve end position CLOSED can be correctly set.
 - Turning the setting screw [4] clockwise decreases the swing angle.
 - Turning the setting screw [4] counterclockwise increases the swing angle.
4. Turn setting screw [4] clockwise until end stop is reached, then turn in opposite direction by one turn.
5. Check O-ring in screw plug and replace if damaged.
6. Fasten and tighten screw plug [3].

Now, end stop CLOSED setting is complete and end position CLOSED setting can be performed. Having completed this procedure, end stop OPEN can be immediately set.

Setting end stop OPEN

1. Remove screw plug [1].
2. Move valve to end position OPEN with handwheel.
3. If the valve end position is not reached:
 - Slightly turn setting screw [2] counterclockwise until valve end position OPEN can be correctly set.
 - Turning the setting screw [2] clockwise decreases the swing angle.
 - Turning the setting screw [2] counterclockwise increases the swing angle.
4. Turn setting screw [2] clockwise until end stop is reached, then turn in opposite direction by one turn.
5. Check O-ring in screw plug and replace if damaged.
6. Fasten and tighten screw plug [1].

Now, end stop OPEN setting is complete and end position OPEN setting can be performed.

5 Electrical connection

This section deals with the electrical connection of DREHMO actuators. Safety-related aspects, information on installation and modification of electrical connection are presented.

5.1 Important notes

DANGER

Risk of direct contact with open live parts



- The electrical connection must be carried out exclusively by suitably qualified personnel.
- Prior to connection, observe basic information contained in this chapter.

Work on the electrical system or equipment and electrical installation work on actuators must only be carried out by skilled electricians themselves or by specially instructed personnel under the control and supervision of such an electrician and in accordance with the applicable electrical engineering rules.

The following points must also be observed:

- Observe indications on name plate
- Compare mains voltage
- Actuator is connected in compliance with the terminal plan supplied.
Should the terminal plan not be available, please request another copy from the manufacturer indicating the device number.
- It is recommended to select shielded actuator connecting cables with the exception of the main power supply, to ensure actuator EMC.
- Since DREHMO actuators can be operated with separately mounted controls, the connecting cables between actuator and controls must be selected as shielded versions.
- For cable glands (including plugs!) make sure that the required IP enclosure protection is guaranteed and suitable for connecting cables.
- The connecting cables must comply with the requirements in terms of electrical connection data and load (mechanical, thermal and chemical).
- All actuators must be equipped with appropriate fuses for cable protection. Fuse specification must be calculated on the basis of published motor data.
- Actuators and the pertaining switching and distribution devices have to be considered within the framework of the protective actions for the connected mains.

DREHMO actuators are not equipped with an internal protective device against failures within the power circuit.

WARNING

Impermissible heating up of the motor



- Any protective measures have to be provided at plant level.
- When using an solid state relay, the third phase is always connected with the motor. Consequently, there is a risk of motor overheating in case of fault. This can be prevented by all-pole disconnection of the actuator.

DANGER

Hazardous voltage while protective earth conductor is NOT connected! Electric shock possible.



- Connect all protective earth conductors (if required use external earthing screw).
- Power the device only once the protective earth conductor has been connected.

5.2 Connection terminals

Different versions are available for actuator connections. Refer to chapter 12 for precise indications relating to possible cable cross sections .

5.3 Voltage range und fuses

There is an electric shock protection next to the current transformer that covers the primary side fuses and the jumpers J2 (A, B, C), J3 (D, E) and J10 (see figure 5.1).

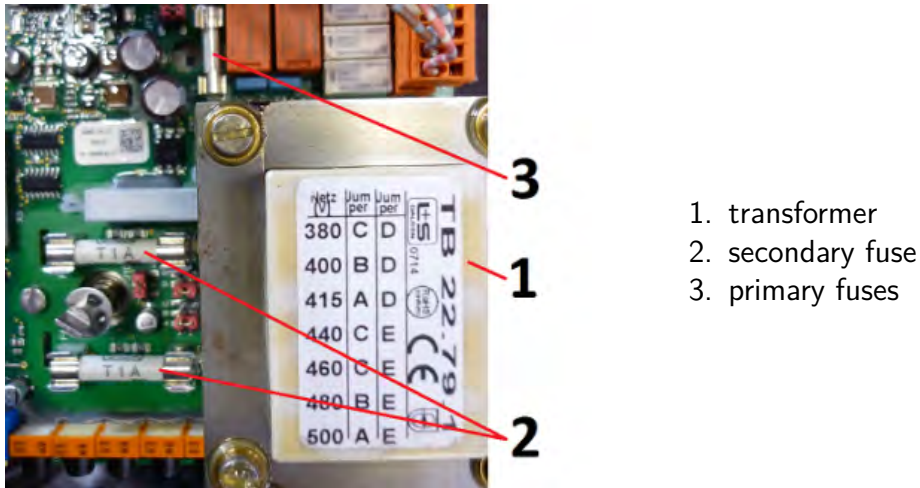


Figure 5.1: Fuses and transformer with information about the positioning of the jumpers

The nominal values of the fuses are 1 A and 500 V. For the different input voltages the jumpers J2 and J3 have to be set like it is written in the documentation on the transformer.

There is an additional fuse on the secondary side of the transformer with the nominal values of 1.6 A and 250 V. It is located nearby the transformer and is used to protect the line for switching the relays and providing the internal power supply. The fuse for the external 24 V supply (optional) is located on the board DMC-09 (local control station). This fuse has 0.8 A and 250 V as nominal values.

5.4 Phase sequence correction

The actuator has an automatic phase sequence correction to adjust the phase sequence if necessary.



WARNING

The automatic phase sequence correction works only at 3ph AC up to 500 V

- Voltages higher than 500 V require special diligence for correct power connection (clockwise phase sequence) according to the wiring diagram

The basic board has two jumpers to adjust the phase sequence correction (refer to table 5.1). The jumper J10 switches the frequency of the phase sequence correction between 50 and 60 Hz. If LED H4 is blinking there are problems with the phase sequence correction due to mains faults. In this case it is possible to disable the phase sequence correction with jumper J11 but take special care for correct power connection (clockwise phase sequence) according to the wiring diagram!

	Jumper in position 1 and 2	Jumper in position 2 and 3
J10	50 Hz mains frequency	60 Hz mains frequency
J11	Phasesequence correction enabled	Phasesequence correction disabled

Table 5.1: selection of power grid frequency and use of the phase sequence correction

6 Limit switching module

This chapter describes the limit switching module used in DREHMO actuators. The limit switching module is located below the housing cover (if it is in use). Remove the housing cover by loosening the four outer screws.

6.1 Design of the conventional limit switching module

The limit switching module records limit positions and torques. In addition, it can be equipped with mechanical and/or electronic elements to display the valve position. A typical version is shown in figure 6.1.

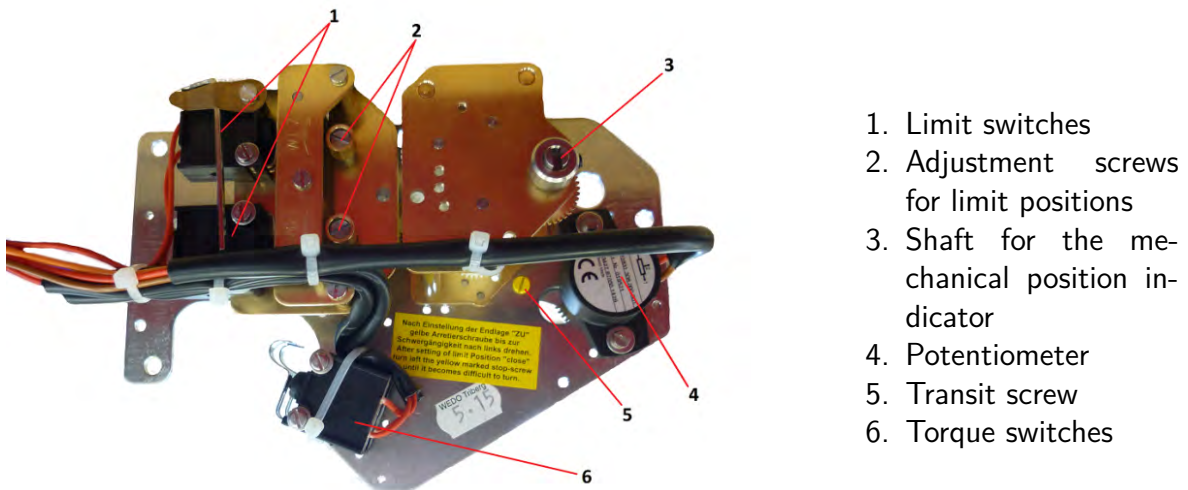


Figure 6.1: Limit switching module

Torque and limit switches are operated by means of adjustable cams. As an option, torque and limit switches are available as tandem switches. For torque switches, labels are fixed to the cams indicating the permissible setting range.

7 Combined sensor in a C-matic control

The combined sensor that can be used in DREHMO actuators of type C-matic will be presented in this chapter. The combined sensor is located below the housing cover. Remove the housing cover by loosening the four outer screws.

7.1 Setup of the combined sensor

The combined sensor is used to get information about the actual position and torques. There are two additional potentiometer to adjust the corresponding torque. The combined sensor with the add-on board is shown in figure 7.1.

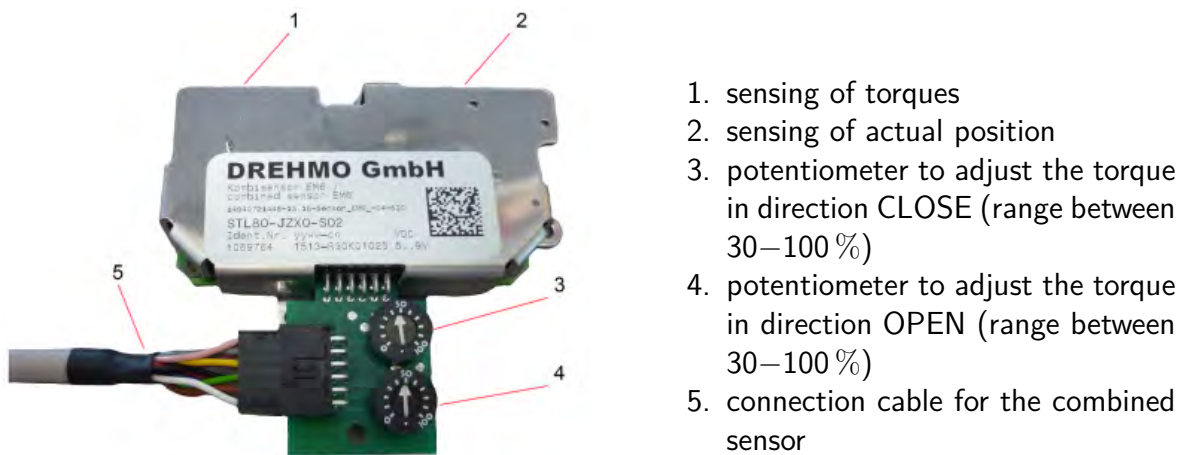


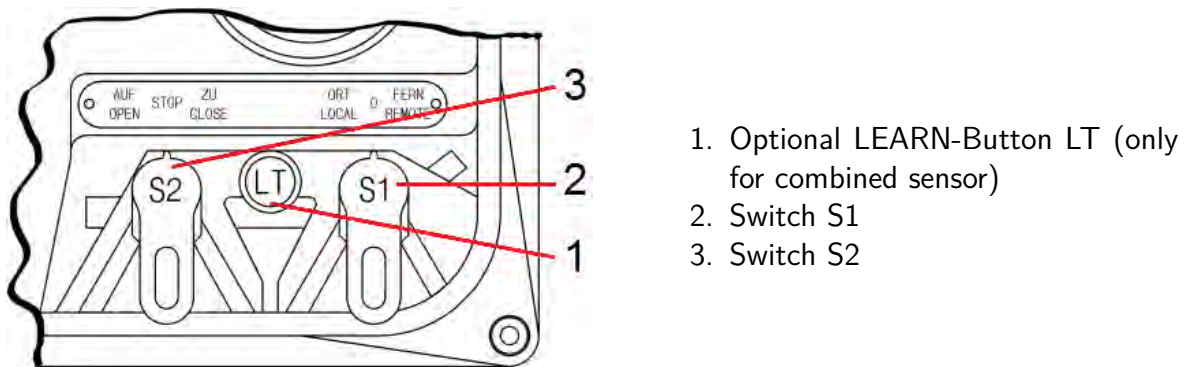
Figure 7.1: combined sensor with adjustment potentiometers

8 Local control station

The actuators are equipped with control elements to locally control the actuator. There are DIL-switches and a field of jumpers to define the behavior of the actuator. The number of available DIL-switches depends on the constellation of the control

8.1 Local control station

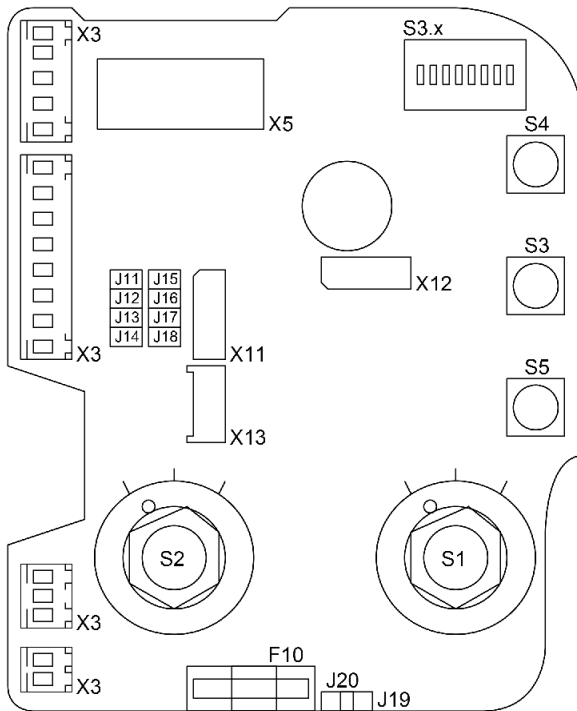
The local control unit of the C-matic control ist shown in figure 8.1 and consists basically of two selection switches. The shown LEARN-button will be on the local control unit too, if the version of the actuator uses a combined sensor to get information about the actual position and the torques.



1. Optional LEARN-Button LT (only for combined sensor)
2. Switch S1
3. Switch S2

Figure 8.1: Local control station

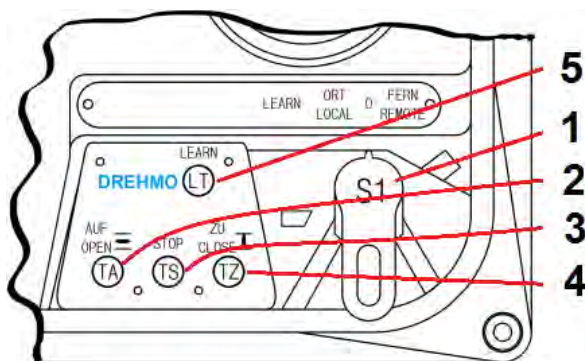
The corresponding board is the DMC-09 which is shown in the following figure 8.2.



1. S1: selection of operation mode
2. S2: selection of command
3. S3: command to drive the actuator clockwise
4. S4: command to drive the actuator counter clockwise
5. S5: LEARN-button

Figure 8.2: Local control station

Another version of the local control unit uses only one selection switch. The second one was replaced by three buttons (refer to figure 8.3). Even in this version the LEARN-button is only available if the actuator is equipped with a combined sensor. The corresponding



1. Switch S1
2. Button TA
3. Button TS
4. Button TZ
5. Optional LEARN-button LT (only for combined sensor)

Figure 8.3: Local control station

board is the DMC-21. On this board are two jumper which can be set into four positions (J34, J35, J37 and J38). For holding operation the jumpers must be set to the positions J34 and J35 which is the factory setting. For inching operation the jumpers must be set to the positions J37 and J38.

8.2 Switches/Buttons on the cover of the actuator

- S1 selection switch: LEARN (in combination with combined sensor), local, 0, remote
- S2 control switch: open, stop, close
- S3 LEARN-button: LEARN (in combination with combined sensor)

8.3 Internal buttons (on interface board DMC-09)

- S1 local drive clockwise (CLOSE for clockwise closing valves)
- S2 local drive counter clockwise (OPEN for clockwise closing valves)
- S3 LEARN-button (in combination with combined sensor)

8.4 Locking the local control unit

The selection switch S1 can be locked in the positions local, 0 and remote by using a normal padlock. Individual closing mechanisms or master key system can be supplied by state the wished number of keys per closing mechanism according to the corresponding requirements.

8.5 Electronic position indication

Actuators of type C-matic can be equipped with an LC-Display. The LCD displays the actual position in percentage between the end position close (0%) and the end position open (100%). The position information is derived from the internally generated 4 – 20 mA position feedback signal. This signal might also be available on terminals of the control connector, according to the wiring diagram.

Beside the position information, the LCD might display additional information:

- On actuator power-up the LCD displays the actual firmware revision code for the duration of about three seconds.
- In case of an open loop in the 4 – 20 mA feedback signal which is used to generate the display information, an error code E1 is displayed.

The printed circuit board comprises four jumpers, intended for use during production. The jumpers have to be left open (as shown in figure 8.4).



Figure 8.4: LCD-Local control station

The three small colored LEDs are used for end position and common failure indication same as the local lamps. A separate heart-beat sign is available as an indication for the correct running of the μ -controller program.

9 Commissioning

The following chapter describes the commissioning step for DREHMO C-matic actuators .

NOTICE

All explanations below relating to commissioning apply to actuators with clockwise closing valves.



- Clockwise output drive rotation corresponds to direction CLOSE
- Counterclockwise output drive rotation corresponds to direction OPEN
- DR and WR switches are designated for torque and limit position in direction CLOSE
- DL and WL switches are designated for torque and limit position in direction OPEN
- Even if the output signal of the measuring amplifier is not to be used, the transit screw must be unscrewed (refer to 5 in picture 6.1)

CAUTION

All working steps are performed while cover is open. Danger of pinching and contact with live parts



- The actuator may only be opened by suitable trained and qualified staff

9.1 C-matic control unit with conventional limit and torque switches

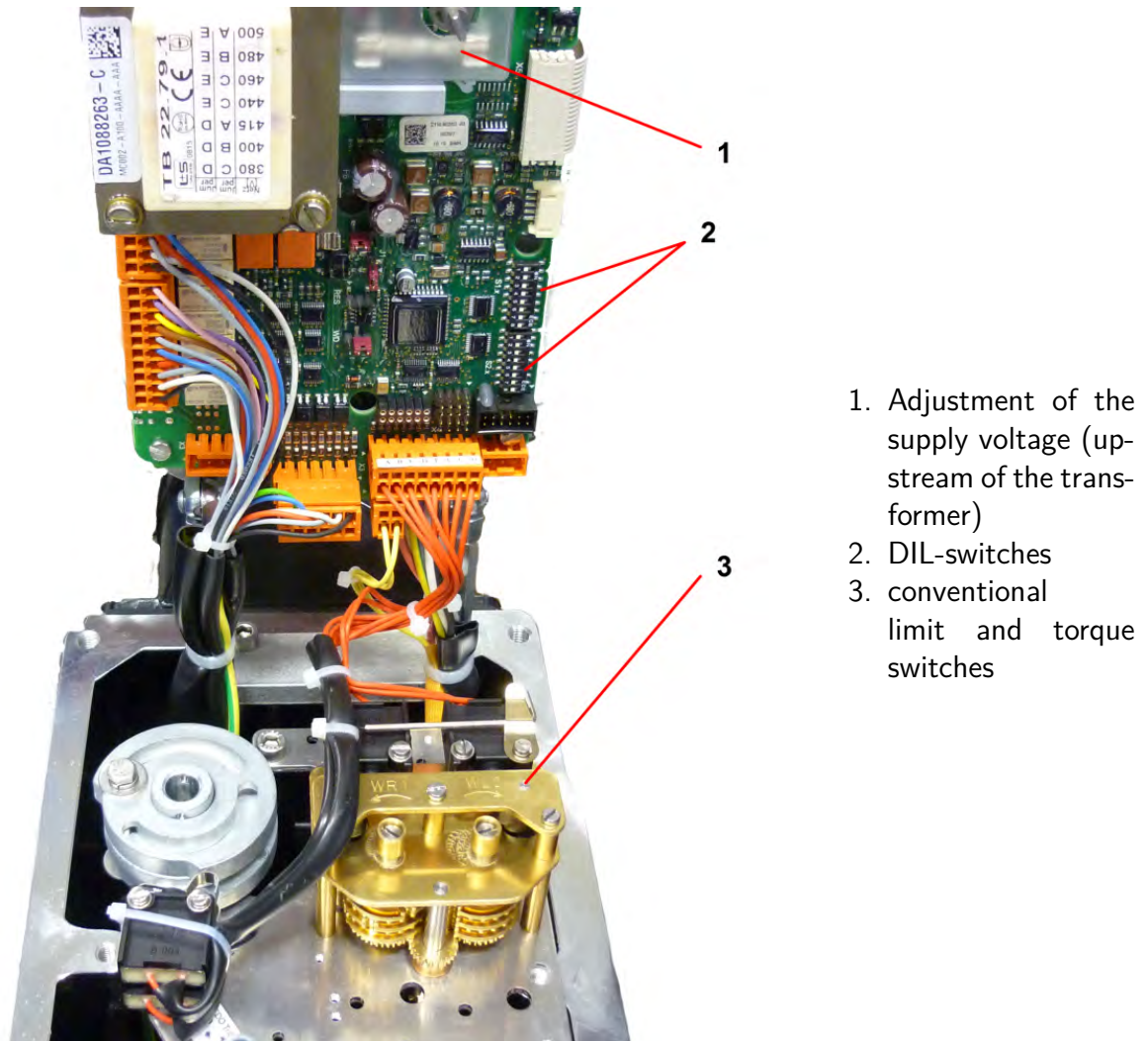
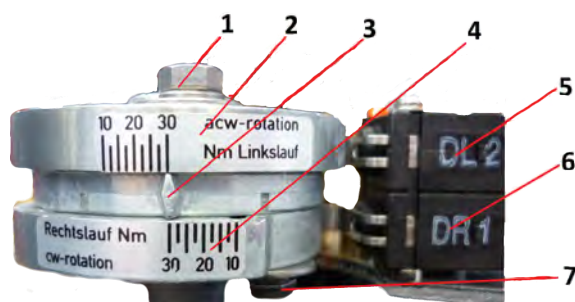


Figure 9.1: C-matic control unit with conventional limit and torque switches

9.1.1 Setting the torque values

The torques are set by manufacturer as instructed according to the order. The torques are only indicated on the name plate if this is specifically requested. If no torques are specified on the order, the smallest possible torque is set by the manufacturer. The torque can be infinitely varied within the range given on the name plate by means of the torque scales affixed to the unit

Use the setting screws for torque setting if torque signals are to be used (refer to figure 9.2). Loosen screw on top of the cams if torque setting is to be performed in direction OPEN. The screw on the bottom of the cams is used for torque setting in direction CLOSE. After unfastening the respective screw, the cams can be readjusted by turning. Turn the cam until the desired value on the scale is aligned with the mark. Finally, fasten the appropriate screw.



1. Locking screw for torque adjustment OPEN
2. Scale with setting range for torque in direction OPEN
3. Setting mark (in this instance 30 Nm for both directions)
4. Scale with setting range for torque in direction CLOSE
5. Torque switch for direction OPEN in standard version
6. Torque switch for direction CLOSE in standard version
7. Locking screw for torque adjustment CLOSE

Figure 9.2: Torque setting

**DANGER****Exceeding the maximum permitted torque**

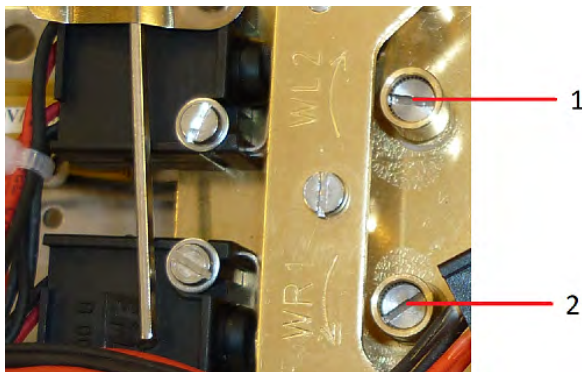
- A setting above the maximum permitted torque is not permitted.

**DANGER****Regard the permitted torque range for additional gears, if used**

- For actuators that are delivered with an additional gear or thrust unit by the manufacturer, the permitted torque range is written outside the housing cover.

9.1.2 Setting the limit positions

For setting the limit positions for OPEN and CLOSE, use the setting screws as shown in figure 9.3.



1. Setting screw for limit position OPEN
2. Setting screw for limit position CLOSED

Figure 9.3: Limit switches in standard version

For setting a limit position, operate the actuators into the desired position. Press the screw downward by means of the screwdriver and turn in direction of the arrow. The limit position is set when the cam operates the appropriate limit switch. After the setting procedure, release the screw.

Setting screws for limit positions engage in short intervals while being turned. Once cam lines up with switch and it operates, stop turning. If the cam is turned too far by mistake,

repeat the entire setting process from the beginning.

If optional switches are fitted for intermediate position signalling, they are operated by means of the shaft cams of the mechanical position indicator. Operate to the respective intermediate position for the setting procedure. Then turn the handwheel by approx. 30° into the opposite direction. For setting the respective cam on the shaft of the mechanical position indicator, slightly unfasten the release screw (figure 9.7, item 1). After cam setting, fasten the screw (Not too tight! Do not exceed 0.5–0.7 Nm). Check the set tripping points by operating over full travel.

9.1.3 Setting the reduction gearing of the limit switching unit for multi-turn actuators

To reset the reduction gearing according to table 9.1, loosen the fixing screw item 4 in figure 9.4. After unfastening the screw, the sliding wheel can be moved up (smaller angle for the mechanical position indicator) and down (larger angle for the mechanical position indicator). As soon as the new position of the sliding wheel has been reached, fasten the fixing screw.



NOTICE

Observe correct position of the sliding wheel!

- The splines of the sliding wheel must fully engage into the counterwheel.

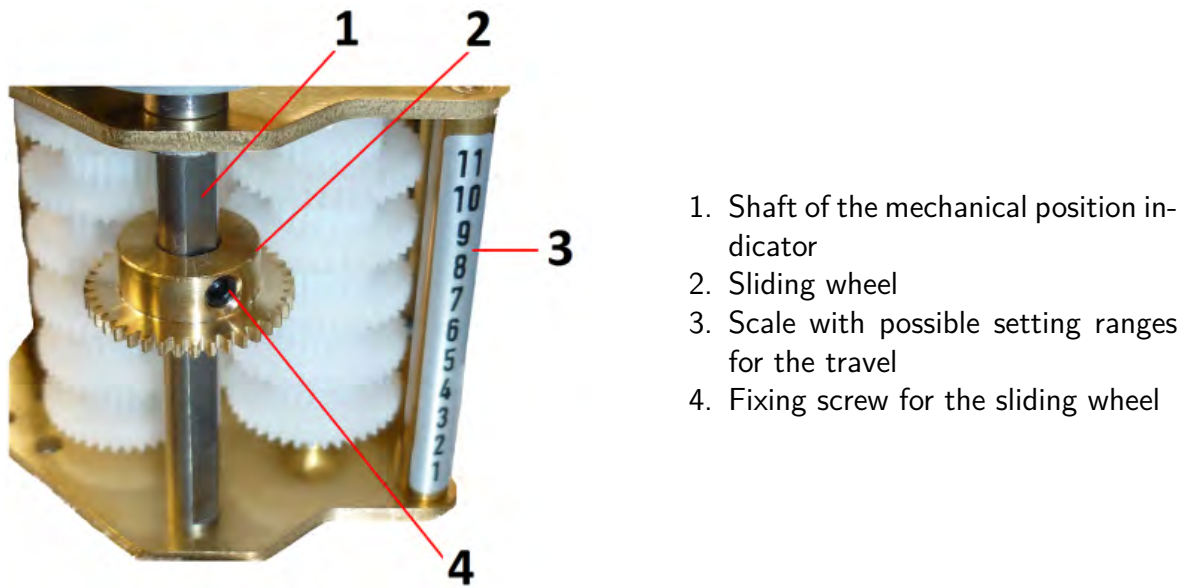


Figure 9.4: Reduction gearing

There is a gear wheel at the bottom of the base plate. The figure 9.5 shows the version for section III. For section II there would be a big instead of a little gear wheel. The opposite gear wheel is mounted on an output drive of the actuator.

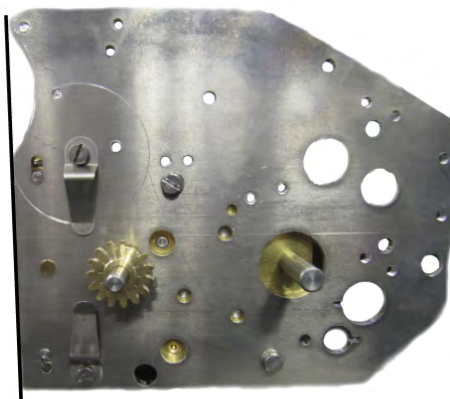


Figure 9.5: limit switching unit input drive gear wheel

The reduction gearing is available for a range between 1.38 – 1,450 turns/stroke. The range is divided into two sections: III (1.38 – 135 turns/stroke, large gear wheel to small gear wheel) and II (12.4 – 1450 turns/stroke; small gear wheel to large gear wheel). Changing between these ranges requires exchanging the gear wheels on the bottom of the limit switch base plate. By moving the sliding wheel in one of the positions 4 – 11, the required travel range can be selected.

Transmission ratio of limit switch wheels	Turns per travel (min. and max.)	Position of sliding wheel
1:3 (SectionIII)		1
1:3 (SectionIII)		2
1:3 (SectionIII)		3
1:3 (SectionIII)	1.38 – 2.49	4
1:3 (SectionIII)	2.5 – 4.5	5
1:3 (SectionIII)	4.6 – 8.2	6
1:3 (SectionIII)	8.3 – 15	7
1:3 (SectionIII)	15.1 – 27.2	8
1:3 (SectionIII)	27.3 – 49.6	9
1:3 (SectionIII)	49.7 – 90.1	10
1:3 (SectionIII)	90.2 – 135	11
3:1 (SectionII)		1
3:1 (SectionII)		2
3:1 (SectionII)		3
3:1 (SectionII)	12.4 – 22.4	4
3:1 (SectionII)	22.5 – 40.8	5
3:1 (SectionII)	40.9 – 74.2	6
3:1 (SectionII)	74.3 – 135	7
3:1 (SectionII)	135 – 245	8
3:1 (SectionII)	246 – 446	9
3:1 (SectionII)	447 – 811	10
3:1 (SectionII)	812 – 1450	11

Table 9.1: Setting the reduction gearing of the limit switching unit for multi-turn actuators

The values of the sliding wheel positions 1 – 3 are available on request.
 Selection of the highlighted options is recommended and preferred.

NOTICE

If no stroke range is specified on the order, the reduction gear will be preset at factory



- For output speed of 5–50 turns/minute the factory setting is section III
- For output speed of 80–160 turns/minute the factory setting is section II

Setting:

1. If the required rev/stroke ratio of the actuator is communicated to the manufacturer upon ordering, the actuator is correctly set in the factory.
2. Determine actuator revolutions per stroke (e.g. actuator speed per minute x acting time in minutes).
3. Determine factory-preset range II or III. Determine actuator speed (via type designation on the actuator rating plate, e.g. D60 A-40 = 40 rpm)
Range III preset: actuators with output speed 5-50 rev/stroke.
Range II preset: actuators with output speed 25 -160 rev/stroke.

Alternative determination:

Turn sliding wheel into position 1. Perform approx. 13 handwheel turns while observing the mechanical position indication (if existing) or the operating cams of the intermediate position switches. If the angle of rotation is $> 150^\circ$, range III has been preset otherwise range II.

4. Set the reduction gearing according to the calculated value by shifting the sliding wheel with regard to table 9.1.

9.1.4 Setting the reduction gearing of the limit switching unit for part-turn actuators

This limit switching unit is of similar design, however equipped with a reduction gearing including mere 5 stages (refer to figure 9.6).



1. Reduction gearing with five stages

Figure 9.6: Setting the reduction gearing of the limit switching unit for part-turn actuators

The reduction gearing has a variable setting range, resulting from the plug-in sequence of the gear wheels at the bottom of the mounting plate. The sections II (small on large gear wheel) + III (large on small gear wheel) can be respectively preselected by exchanging the gear wheels on the bottom of the limit switching base plate. For section I, use two gear wheels of identical size. The setting options of this reduction gearing are specified in the following table 9.2.

Additional gearing	Without	SQ	SQ	SQ
Size	DP30...DP119	DP75... DP450	DP600... DP900	DP1200... DP1800
Swing angle	90° 180°	90°	90°	90°
Reduction ratio	none none	5,5	11	25,3
Number of teeth LS	III/15:45 III/15:45	I/30:30	II/45:15	II/45:15
tr/stroke min.	0.25 0.5	1.375	2.75	6.325
Sliding wheel position	1 2	2	1	2
Turning angle α Cam shaft	175.4 193	177.5	214.5	271.3
Settling time %	58.5 64.3	59.1	71.5	90.4

Table 9.2: Setting the reduction gearing of the limit switching unit for part-turn actuators

NOTICE

Different layout for DP319, DP799, DP1599



- The actuators DP319, DP799 und DP1599 are equipped with a limit switching unit with 11 stages (refer to section 9.1.3)

9.1.5 Setting the mechanical position indicator

Figure 9.7 shows the components of the mechanical position indicator.

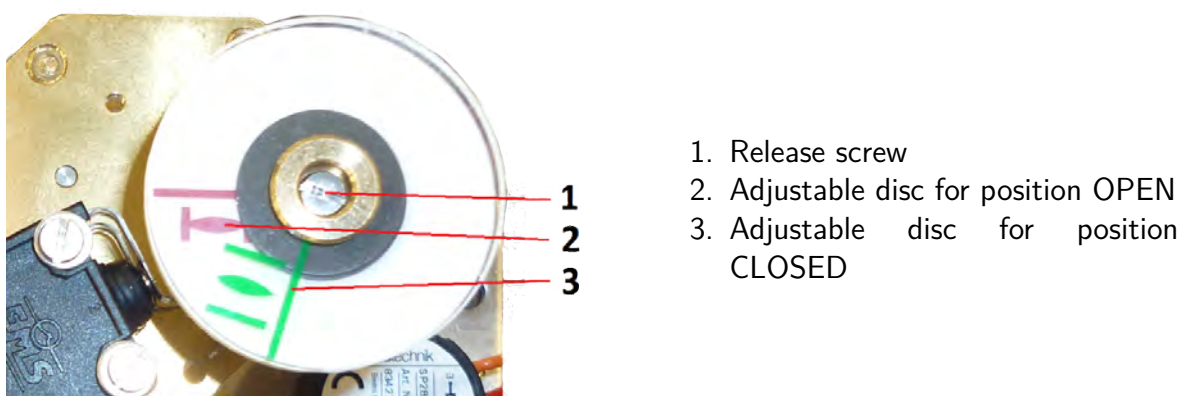


Figure 9.7: Mechanical position indicator

Turn the disc to adjust the mechanical position indication. Both discs can be turned by hand (do not unfasten the screw). For this purpose, the valve must be operated to the respective limit position.

If the mechanical position indication moves more than 270° or less than 90° for the selected travel, check the setting at the reduction gearing and adjust if required (please also refer to table 9.1).

9.1.6 Adjustment of the analog position signal

When delivered, the 4 mA signal (usually final position CLOSED) is adjusted. The analogue position indicator is adjusted as follows:

- Adjust CLOSED / OPEN final positions using the limit switches (see section 9.1.2).
- Move the actuator into the final position CLOSED.
- The 4 mA-value can be set using potentiometer R1, if necessary. For this purpose, loop a multimeter on terminal X3 / 23 and set 4 mA.
- Loosen the screw 3 (refer to 5 in picture 6.1) at the limit sensor potentiometer until a slight sluggishness from the lock nut can be perceived.



NOTICE

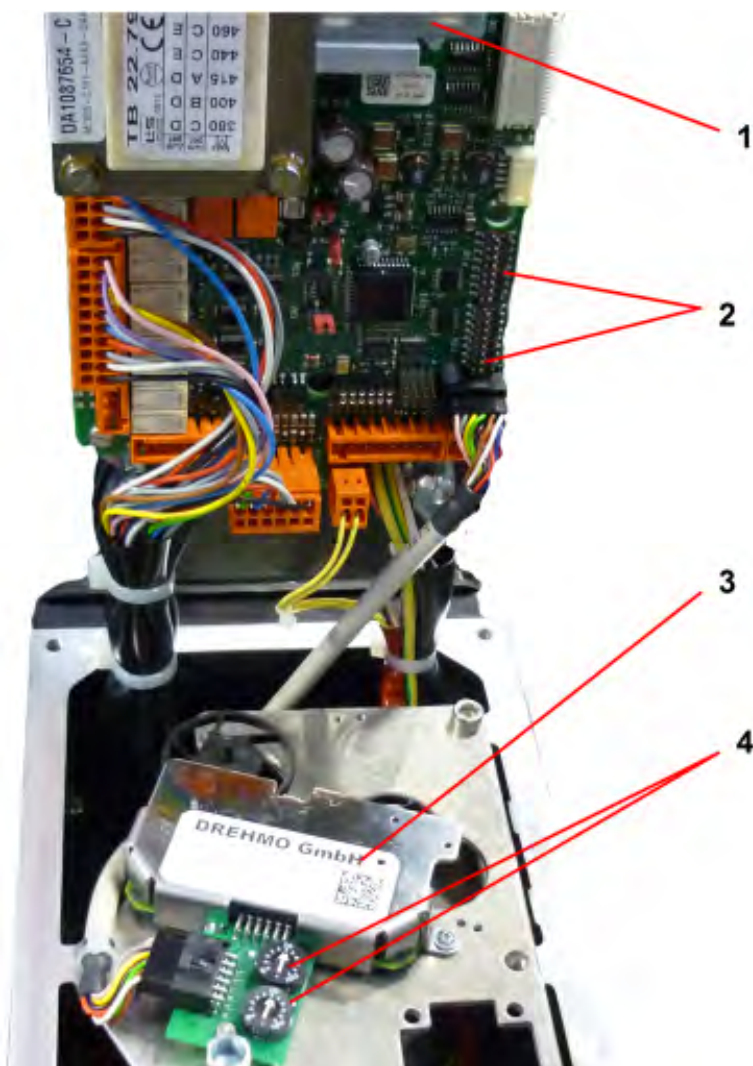
Complete removal of the transit screw will lead to destruction of the thread.

- Loose transit screw only until a slight sluggishness from the lock nut can be perceived

If the screw is not loosened, mechanical damage of sensor potentiometer gear can occur.

- Move the actuator into the limit position OPEN.
- Set the 100 %- value (20 mA) using potentiometer R2 and the 0 %-value (4 mA) using potentiometer R1.

9.2 C-matic control unit with combined sensor



1. Adjustment of the supply voltage (upstream of the transformer)
2. DIL-switches
3. Combined sensor
4. Torque setting potentiometers for directions CLOSE and OPEN

Figure 9.8: C-matic control unit with combined sensor

9.2.1 Setting limit positions

The control unit has to be set to LEARN mode to set the limit positions. Push the LEARN button and keep it pressed, put selector switch S1 in the LEARN position. After 10 seconds the LEDs on the local control unit (local lamps) begin to flash and the LEARN button can be released. As long as selector switch S1 remains in the LEARN position, the actuator remains in the LEARN mode. Use drive command while pressing the LEARN button down to set the corresponding limit position. Once the limit position is set the corresponding LED on the local control unit stops flashing and stays on. The actuator can be driven to the next limit position (without leaving the LEARN mode) by using the controls on the local control station

The limit position must be deleted, if the actuator indicates a limit position without reaching it mechanically (this is the case after 180 turns). Deleting a limit position works like setting it, by using the corresponding drive command while pressing the LEARN button. This will extend the range of the combined sensor by 90 turns and the LED that was on should be flashing now.

When the mechanical limit position is reached, the corresponding limit position can be set by using the corresponding drive command while pressing the LEARN button.

NOTICE

The LEARN mode is also reached if one LED of the local control unit is flashing and the second one stays on



- The actuator is in the limit position that is indicated by the LED that is not flashing
- Delete the limit position and set the limit position like it is described before

9.2.2 Erasing predefined limit positions

Press the LEARN button for 30s to delete both limit positions at once. First the LEDs of the local control unit will start to flash and will turn off later. Since the LEDs turn off the LEARN button can be released. The combined sensor is set to a position of 50% with a range of ± 90 turns.

9.2.3 Adjustment of the analog position signal

When delivered, the 4 mA signal is adjusted and usually linked to final position CLOSED. The analogue position indicator is adjusted as follows:

- Adjust CLOSED / OPEN final positions using the cobined sensor (see section 9.2.1).
- Move the actuator into the final position CLOSED.
- The 4 mA-value can be set using potentiometer R1 (on the board DMC27), if necessary. For this purpose, loop a multimeter on terminal X3 / 23 and set 4 mA.
- Move the actuator into the limit position OPEN.
- Set the 100 %- value (20 mA) using potentiometer R2 (on the board DMC27).

9.2.4 Setting the torques

The torques can be adjusted with the potentiometers R9 and R10 in % of the maximum actuator output torque (refer to the table shown in figure 9.9).

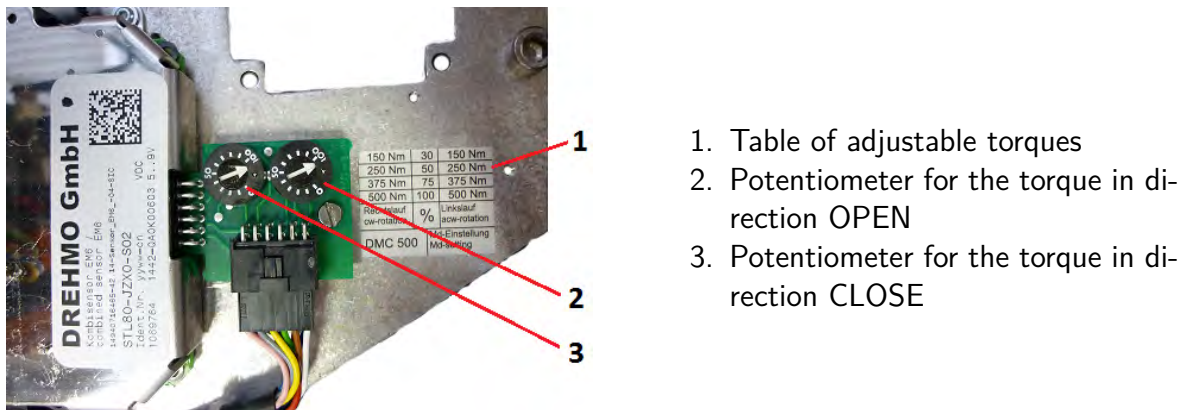


Figure 9.9: Combined sensor for actuators of type C-matic

10 Parameterization of a C-matic control unit

The control unit of type C-matic has got DIL-switches and a jumper field to setup the behavior of the actuator. The number of available DIL-switches depend on the constellation of the control unit.

10.1 Arrangement of LED, potentiometer and push buttons

The basic board DMC-02.7 (figure 10.1) has been replaced by the Version DMC-02.8 (figure 10.2). Due to important changes for the user both versions are illustrated. Some of the main changes are the reconfiguration of the jumper field and the fuses F4 and F5. Also the socket for the serial interface is now located on the top side of the board.

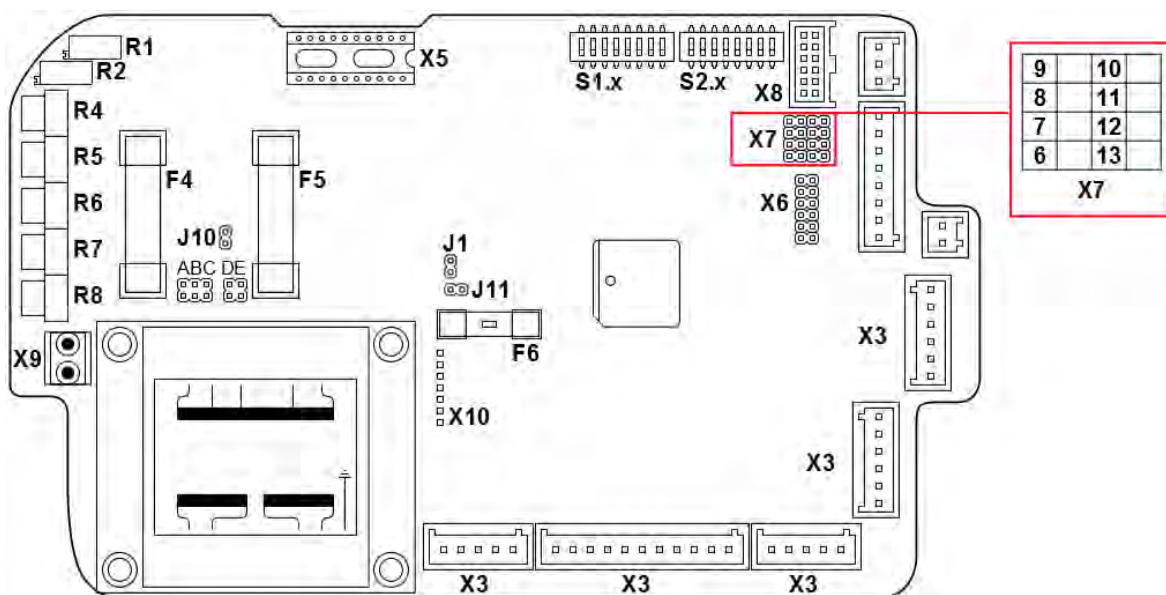


Figure 10.1: Board design up to DMC-02.7

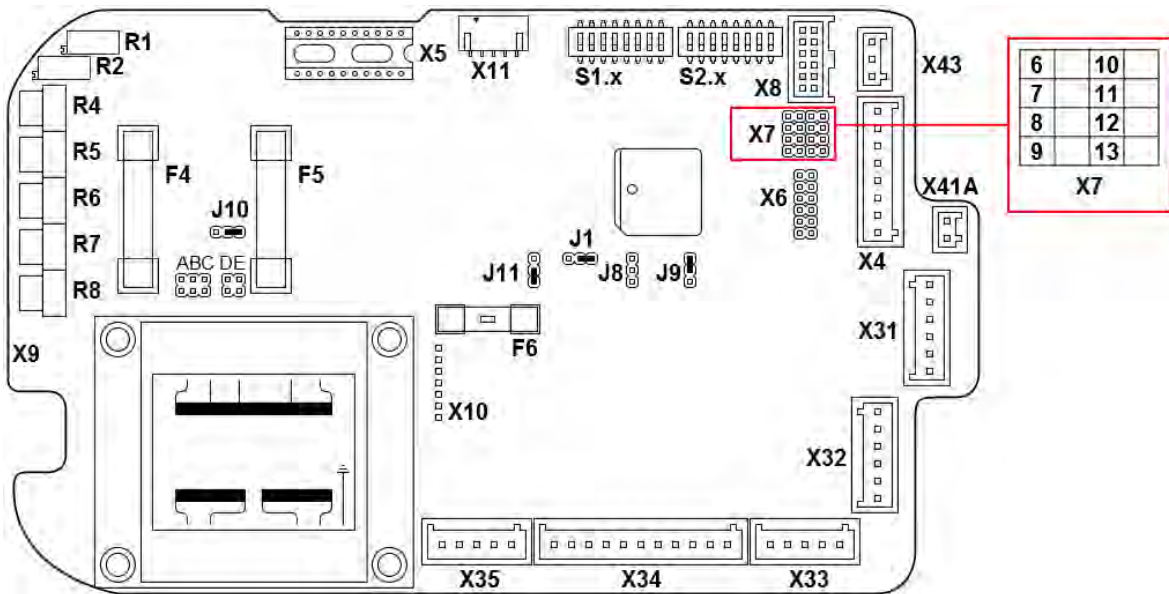


Figure 10.2: Board design DMC-02.8

10.2 Potentiometer

DMC-02	R1	Zero point for adjustment 4 – 20 mA position signal. The corresponding potentiometers for the combined sensor are located on the DMC-27
	R2	Gain for balancing the 4 – 20 mA position signal. The corresponding potentiometers for the combined sensor are located on the DMC-27
	R4	XP (version 005) / intermediate position 1 (version 004)
	R5	Fail safe position (version 005) / intermediate position 2 (version 004)
	R6	timer operated area
	R7	T-ON
	R8	T-OFF
combined sensor	R9	Adjustment switch-off torque for CLOSE direction (upstream of combined sensor)
	R10	Adjustment switch-off torque for OPEN direction (upstream of combined sensor)

10.3 Light emitting diodes

DMC-02	H0	ESD command active (since FW-Version V02.10)
	H1	final position OPEN
	H2	final position CLOSE
	H3	Selected switch-off mode OK (torque failure)
	H4	Actuator OK (motor temperature, phase sequence correction)
	H5	Intermediate position 1 is reached
	H6	Intermediate position 2 is reached
	H7	Internal flashing clock signal / microcontroller OK
	H8	Timer start indication
	H9	Timer operation indication ON-OFF
DMC-12	H10	Local lamp for indication of failures
	H11	Local lamp for final position OPEN
	H12	Local lamp for final position CLOSE

10.4 Fault signals and diagnosis (extract)

H1	H2	H3	H4	Stroke s in mA	Signal	Possible cause/ remedial action
0	0	X	X	$4 < s < 20$	Intermediate Pos.	
1	0	X	X	20	Position OPEN	
0	1	X	X	4	Position CLOSE	
X	X	1	X		Switch-off OK	
X	X	0	X		Torque failure	Valve jammed switch-off torque too low limit position setting incorrect
X	X	X	1		Actuator OK	
X	X	X	0		Motor overheated	
X	X	X	B		Problem with phase sequence correction	

10.5 Plugs

DMC-02 (basic board)	X1,X2	Customer connection, compact main plug
	X3	Customer signals on DMC (lead to plug X1)
	X4	Connection of limit switch and torque switch
	X5	Connector to local control station board
	X6	Connector for Profibus card, Com1
	X7	Connector for settings for special functions (refer section 10.10)
	X8	Plug connector for the combined sensor with additional potentiometer board
DMC-09 (local control station board)	X10	Controlsignals for the power switching unit
	X11	Connection for DC/DC converter
	X12	Connection for further extensions
	X13	Connection for external local control station (option)

10.6 DIL-switches S1.1 to S1.8 on DMC-02

Switch	OFF	ON
S1.1	Inching contact for external command	- not MC005 (S2.8 = Off): external command as maintained command - MC005 (S2.8 = On): reduced final position deadband (since FW-Vers. 02.09)
S1.2	Switch-off by limits in OPEN position	Switch-off by torque in OPEN position
S1.3	Switch-off by limits in CLOSED position	Switch-off by torque in CLOSED position
S1.4	3 sec torque override from CLOSED end position towards OPEN position	No torque override from CLOSED end position towards OPEN position
S1.5	3 sec torque override from OPEN end position towards CLOSED position	No torque override from OPEN end position towards CLOSED position
S1.6	Signal selector switch in LOCAL position	Signal selector switch in LOCAL or OFF position
S1.7	Running indication signal OPEN / CLOSE (flashing)	Running indication signal OPEN / CLOSE (not flashing)
S1.8	Collective fault including torque failure	Collective fault excluding torque failure

10.7 DIL-switches S2.1 bis S2.8 on DMC-02

Switch	OFF	ON
S2.1	Limit switch / torque switch	Combined sensor
S2.2	Directional torque signal	Non-directional torque signal (connected in series) in OPEN or CLOSED direction
S2.3	No Torque signal in end positions	Torque signal in end positions
S2.4	For inching operation: Tip inching operation till final end position	Maintained command in the end positions (according to the mode of switch-off)
S2.5	Final position signal only given for limit position	Final position signal according to the selected switch-off mode
S2.6	Immediate collective fault in the case of motor temperature is reached (no delay)	Collective fault with a time delay of 5 seconds.(For USV option fixed min. 1 sec)
S2.7	Approaching fail-safe-position in case of a fault of the set value	Actuator stops in case of a fault in the set value
S2.8	002...004/ ON-OFF actuator	modulating actuator (only for 005)

For additional information refer to figure 10.3

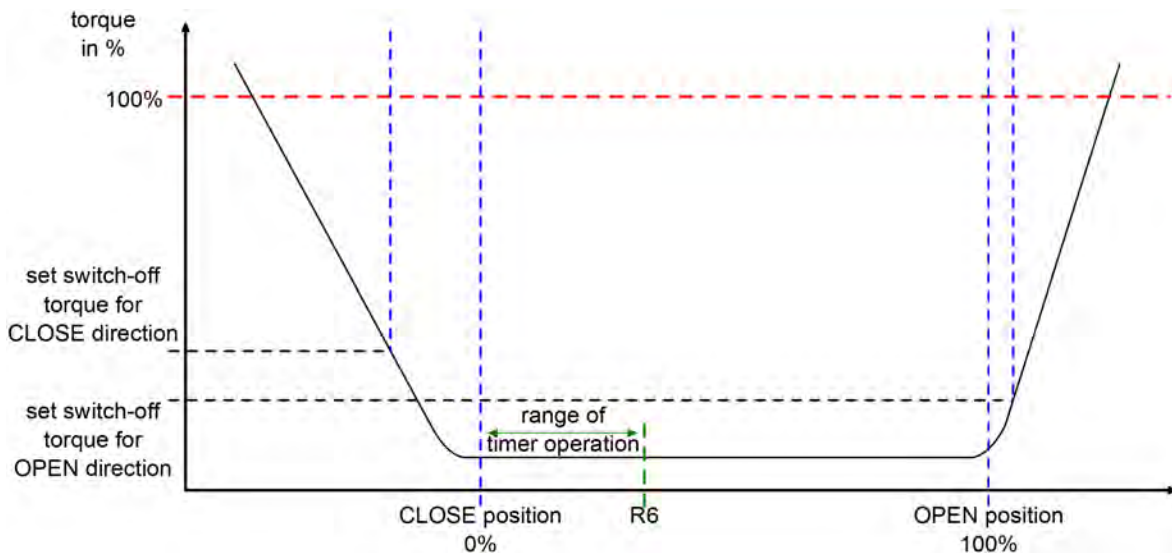


Figure 10.3: torque indication

10.8 DIL-switches S3.1 bis S3.8

Switch	OFF	ON
S3.1	Timer operation deactivated in OPEN direction	Timer operation activated in OPEN direction
S3.2	Timer operation deactivated in CLOSE direction	Timer operation activated in CLOSE direction
S3.3	Timer start according to the setting of potentiometer R6	Timer start by special logic signal E1 (see wiring schematic)
S3.4	Constant timer operation	Decreasing timer operation
S3.5	Regular fault signal according to S1.8	Fault signal according to S1.8 and if selector switch is not in REMOTE position
S3.6	No torque override from intermediate position	1 sec torque override from intermediate position
S3.7	Intermediate position signal (wiring version 004)	Additional fault signal for overheated motor
S3.8	Clockwise closing valve (only for combined sensor)	Counter clockwise closing valve (only for combined sensor)

10.9 DIL-switches S5.1 bis S5.2 on DMC-02 at MCxx3/5 with combined sensor

Switch	OFF	ON
S5.1	Output signal not limited	output signal limited to 0–100%
S5.2	Reserved for future use	

NOTICE

Adjustment of the analog signal for actuators equipped with a combined sensor by using the potentiometers R1 and R2 on the board DMC-27



- R1 is used to adjust the offset (4 mA-value), R2 to adjust the amplification (20 mA-value). The analogue output signal is factory set to 4 – 20 mA and therefore has not to be adjusted in normal cases.

10.10 Coding jumpers TR (located on X7)

		Jumper deactivated	Jumper activated
TR6	Release of local operation	disabled	enabled
TR7	Release logic true level	high-active	low-active
TR8	ESD (Emergency shut-down)	disabled	enabled
TR9	ESD position	CLOSED	OPEN
TR10	Differentiated local failure indication by red LED H10	Same as combined failure indication output	flashing by torque failure, static by motor overtemperature indication
TR11	Profibus protocol	Running indication open/close	intermediate position 1 and 2
TR12	ESD logic true level	high-active	low-active
TR13	ESD mode settings	only in remote mode	independent of operation mode

10.11 Jumper J1, J8 and J9

	Position 1,2	Position 2,3
J1	24 V internal and external supply	24 V only from external supply
J8	Manual watchdog reset	Deactivated
J9	Use of watchdog	Deactivated

Jumper J8 has to be in position 2,3 and Jumper J9 in position 1,2 for regular operation.

10.12 Release of local operation

Local operation can be disabled from remote by an additional external digital input signal named E2. The activation of this option is given by jumper TR6. Jumper TR7 defines the required voltage condition high (24 V) or low (0 V) for the activation. In case of released local control station, the local lamps OPEN and CLOSE are alternately flashing.

10.13 Emergency shutdown ESD

The activation of the ESD feature is done by means of jumper TR8. If jumper TR12 is activated, the required voltage level is 0 V, otherwise 24 V. The corresponding ESD command has to be connected on the additional external digital input signal named E1. Jumper TR9 defines the ESD final position OPEN or CLOSE. Jumper TR13 defines if the ESD will only be possible in operation mode REMOTE or independent of the operation mode. This includes the operation mode OFF.



DANGER
Unwanted motor start while maintenance
(even in operation mode OFF)

- If the actuator is controlled by a DCS, it is necessary to inform it about local work on the actuator

Special attention has to be paid while working on the actuator, since the ESD can take place at any time.

10.14 Differentiated local failure indication

If jumper TR10 is activated, the local red failure indication LED is flashing in case of a torque overload. In case of motor overtemperature it will stay on. Otherwise the red LED will stay on at any pending fault.

10.15 Timer operation (option)

R6	left stop of timer operation area 0 % of stroke (CLOSED position) right stop of timer operation area 100 % of stroke (OPEN position)
R7	T-ON left stop 0.5 s, right stop 30 s
R8	T-OFF left stop 0.5 s, right stop 30 s
H8	timer start
H9	timer display of ON-OFF ratio

Looking from the handwheel side on to the control unit (control unit not tilted upwards) the settings of the potentiometers are:

At 12 o' clock position	10 % of the setting range
At 3 o' clock position	50 % of the setting range
At 6 o' clock position	90 % of the setting range

The setting of T-On and T-Off is done by R7 and R8. The selected ON-OFF ratio is displayed by H9. For the arrangement of the elements refer to section 10.1

If activating the decreasing timer operation with S3.4, inside the range of the timer being active the time T-ON is reduced from its initial value (R7) when starting the movement to its minimum value. The time T-OFF however is held constant. The movement of the valve is thus slowed down.

Only when a cycle has elapsed a new cycle may be displayed. The activated timer range can be selected using R6. Max. left (11 o' clock potentiometer position) corresponds to the CLOSED position, max. right (7 o' clock potentiometer position) corresponds to the OPEN position.



NOTICE

Regard the restrictions to the duty cycle

- Do not exceed the limiting values in paragraph 12.3.

10.16 Positioner (optional)

The positioner is activated by means of the input command AUTOMATIC (see wiring diagram MCxx5...). The local control switch must be in the REMOTE position. If AUTOMATIC is not activated, the actuator can be moved using remote control by means of the OPEN / CLOSE commands. The deviation is determined by the 3-step controller comparing the nominal position (4–20 mA) with the actual position. If the deviation exceeds a certain X_p range defined using potentiometer R4, an internal control command is given to reduce the deviation. The X_p range can be progressively selected from 0.5 % – 5 % of the measuring range.

Note: actual value = nominal value $\pm X_p \times 0.5$

The X_p range (R4) should not be set too sensitive (i.e. too small). If the nominal value is relatively unsteady, the X_p range should be set to the highest value acceptable. The actuator construes setpoint values between approximately 0–4 % and 96–100 % (refer to DIL-switch S1.1) as commands to move the valve to the final positions. Therefore with C-matic actuators a valve cannot be controlled in these position ranges!

10.17 Intermediate positions (wiring version MC004)

Two additional free adjustable intermediate positions no. 1 and 2 can be set in the range between 0 % (4 mA) to 100 % (20 mA) of the stroke. For position setting use potentiometer R4 and R5.

10.18 Uninterrupted power supplies UPS

This option is required in the event of a main power failure to keep the feedback signals for a period of at least one second.

11 Servicing and maintenance

In this section, information is given to be observed when maintaining, cleaning or disposing of DREHMO actuators.

11.1 Maintenance

We recommend participation in the regular trainings for performing maintenance tasks. Basic special knowledge in electrical installation and mechanical engineering is sufficient (in Germany: industrial training - apprenticeship). Permitted maintenance work:

- Replace handwheel
- Replace output drive
- Check oil level

All other work not listed may only be performed by the manufacturer or by personnel authorised by the manufacturer.

NOTICE

Excessive lubricant application can impair the tightness of the actuator



- The actuators have a lifetime lubrication
- A device for permanent lubrication of a stem (only output drive type A and A-HP) can be inquired of the manufacturer

Correct commissioning is a prerequisite for reliable actuator operation. We recommend to checking the fixing screws between actuator and valve or gearbox for tightness once a year.

Open-close actuators must be checked for wear after a cumulated operating time of 150 hours, modulating actuators however at the latest after 10^6 starts! For safe and reliable service, we recommend - especially if infrequently operated - performing a test run every 6 months. Apply a thin film of Molykote 165 LT to the threads of unfastened housing screws prior to refastening. Apply a thin film of Klüber Isoflex Topas NB5051 to the sealing joints between the housing parts.

For technical queries, please contact our service department, always stating your device number (This number is indicated on the actuator name plate). Overhauling defective actuators is only permitted in the factory or with an authorised service centre.

11.2 Troubleshooting and corrective actions

After maintenance, perform functional tests in compliance with operation instructions. Commissioning of actuator/valve must be performed if tripping parameters, valve or addi-

tional gearing have been changed. The following table 11.1 contains a list of possible faults and remedial actions.

possible fault	remedial action
Insufficient motor voltage or no voltage at all / one phase missing.	Check the main power supply
Incorrect setting of limit or torque switches	Check the setting
Motor temperature protection has been activated	Check running time, ambient temperature and load
Motor defective	Arrange for repair
Required torque for valve operation is higher than the max setting torque of the actuator	Check the design data
Although the actuator has reached the end position the actuator moves into the same direction	Check actuator sense of rotation
Specified range of ambient temperature is not being adhered to	Observe the temperature range. A special design may be required
Excessive voltage drop in the supply line	Check the cross-section of the cable

Table 11.1: possible faults and remedial actions

11.3 Replacing fuses of the power supply

Disconnect power before replacing the fuses! Any defective safety fuses F4 / F5 located in the actuator must be replaced. The technical data of the fuses are shown in paragraph 12.2. The fuses are located beneath the transparent cover next to the transformer.

11.4 Oil filling

The actuator oil filling is specified for the actuator lifetime. For this reason, only oils approved by DREHMO GmbH may be used for the actuators. The actuators are filled with oil for ambient temperatures of -25°C to $+70^{\circ}\text{C}$ according to table 11.2.

Actuator type	Oil quantity [l]	Oil type
DPMC 30/59/119	1.4	Shell Tellus S2 VX 15
DPMC 319/799/1599	1.4	Shell Tellus S2 VX 68
DPMC 75/150...1800	1.4	Shell Tellus S2 VX 68
DMC/DMCR 30/59	1.4	Shell Tellus S2 VX 68
DMC/DMCR 60/120/249	2.4	Shell Tellus S2 VX 68
DMC/DMCR 250/500/1000	3	Shell Tellus S2 VX 68
DMC 2000	9	Shell Omala S2 G 100

Table 11.2: Oil filling

The oil filling may differ for other temperature ranges. If required, please contact the manufacturer for appropriate data. Tight sealing of the device must be checked at appropriate intervals during scheduled inspections. Particular attention must be paid to following parts:

- Oil leakage at handwheel hub
- Oil leakage at joints of the housing
- Oil leakage at seals of hollow shaft

WARNING

Impermissible heating up of actuator by oil leakage



- Seals must be replaced in case of leakage.
- Make sure to refill the correct oil type to the correct oil level.

11.5 Cleaning

Clean the actuator using conventional soap solutions (alkaline solutions). To prevent heat accumulation or excessive surface temperatures, make sure that the motor cooling fins are never covered.

The warning references on the device may not be removed or covered with color! Use of any cleaning agents within the actuator is not permitted. Any contamination may be removed using lintless cloths free of any contamination. Use of compressed air is not permitted.

**NOTICE****Residues of conductible foreign particles within the actuator**

- Use of compressed air for cleaning the actuator is not permitted!

11.6 Disposal

During decommissioning and disassembly of actuators, please observe any potential installation-specific hazards. If required, appropriate disposal can be offered by the manufacturer. Actuators can easily be separated and sorted according to materials used:



- electronic scrap
- various metals
- plastics
- greases and oils

The following generally applies:

- Generally, greases and oils are hazardous to water and must not be released into the environment.
- Arrange for controlled waste disposal of the disassembled material or for separate recycling according to materials.
- Observe the national regulations for waste disposal.

12 Technical Data

This section comprises the summary of all technical data of DREHMO actuators described in these operation instructions.

12.1 Contact and water protection

The type of enclosure protection (IPxx) is indicated on the actuator name plate. In standard version, the actuator is suitable for outdoor installation and completely protected against dangerous contact, ingress of dust and ingress water for temporary immersion in water (enclosure protection IP67 in compliance with EN 60529 / IEC 60529). Further IP enclosure protection types are available on request as options.

WARNING

Risk of deviating IP enclosure protection



- Ensure use of correct cable glands.
- Unused cable entries must be sealed using appropriate blanking plugs.
- If the actuator has a K5 corrosion protection, ensure use of plastic cable glands to prevent damage of the protective coating.



NOTICE

Damage to the display unit by direct sunlight

- Protect the display unit from direct sunlight and temperatures above 85 °C

12.2 Overview Technical data

Rated voltage	refer to indications on motor name plate in $V \pm 10\%$
Rated current	refer to indications on motor name plate in A
Mains frequency	refer to indications on motor name plate in Hz $-5\% - +3\%$
Rated power	refer to indications on motor name plate in kW
Insulation category	Overvoltage category II according to EN 61010-1
Electrical connection	<p>Cable cross section to be determined on the basis of motor data, of cable length and national regulations!</p> <p><i>Compact plug/socket connector</i> $\varnothing 100$ mm: (Applicable cross sections) Signal cables: up to 1.5 mm^2 Power: up to 6 mm^2 flexible (10 mm^2 solid)</p> <p><i>Compact plug</i> $\varnothing 150$ mm: (Applicable cross sections) Signal cables: $0.5 \text{ mm}^2 - 2.5 \text{ mm}^2$ Power: $0.5 \text{ mm}^2 - 2.5 \text{ mm}^2$ $0.5 \text{ mm}^2 - 6 \text{ mm}^2$ (optional) $1.5 \text{ mm}^2 - 16 \text{ mm}^2$ (optional)</p>
Fuses	<p>F4/F5 500 V/ 1 A/ T/ 6.3×32 mm (Part-No.: K002.277) for DMC2.8 500 V/ 1 A/ T/ 5×30 mm for DMC2.7</p> <p>F6 250 V/ 1.6 A/ T/ 5×20 mm (Part-No.: K008.276)</p> <p>F10 250 V/ 0.8 A/ T/ 5×20 mm (Part -No.: 133940)</p>
Contact rating Overvoltage category I	<p>max. 230 V AC 0.3 A, 30 V DC 2 A (resistive load) Voltage: $5 - 30$ V/ Current: $4 - 400$ mA/ $U \cdot I \leq 0.12$ VA (gold plated contacts)</p>

Electrical load	$\leq 300 \Omega$
Motor temperature class	Refer to indications on motor name plate
Ambient temperature range	Refer to indications on motor name plate in °C
Enclosure protection	Refer to indications on name plate
Pollution degree	Inside the actuator: pollution degree 1 (IEC 60664) Outside the actuator: pollution degree 2
Vibrations	The actuators are designed for vibrations in the range between 10–100 Hz with an amplitude of 2g (with high transition frequency according to EN 60068-2-6).

WARNING

Reduced heat dissipation for places of installation of > 1000 m above sea level.



- When exceeding the value, please contact the manufacturer, since load and isolation restrictions prevail for constant ambient temperature.

WARNING

Different cable cross sections for BUS interfaces



- There can be restrictions according to the applicable cable cross sections if a BUS interface is used. Please refer to the according BUS manual for further information.

The following table 12.1 lists the weights, the output drive speeds and the maximum modulating torques of the actuators.

Type of actuator	Output drive speed rpm / operating time s/90°	Maximum modulating torque	Average weight in kg
DMC 30	5 – 160	15	23
DMCR 30	5 – 40	15	23
DMC 59	5 – 160	30	25
DMCR 59	5 – 40	30	25
DMC 60	5 – 160	30	29.5
DMCR 60	5 – 40	30	29.5
DMC 120	5 – 160	60	33.5
DMCR 120	5 – 40	60	33.5
DMC 249	5 – 80	125	33.5
DMC 250	5 – 50	125	69.5
DMC 250	80 – 160	125 ¹	69.5
DMCR 250	5 – 40	125	69.5
DMC 500	5 – 80	250	80.5
DMC 500	120	250 ¹	80.5
DMC 500	160	200 ¹	80.5
DMCR 500	5 – 40	200	80.5
DMC 1000	5 – 50	500 ¹	90.5
DMC 1000	80	400 ¹	90.5
DMCR 1000	5 + 10	500	90.5
DMC 2000	40 – 80	1000	220
DMC 2000 ²	160	300	220
DPMC 30	8 – 60	15	24
DPMC 59	8 – 60	30	24
DPMC(R) 75	8 – 34	33.5	38
DPMC 119	8 – 60	60	24
DPMC(R) 150	8 – 34	75	38
DPMC(R) 299	8 – 34	150	38
DPMC(R) 300	8 – 34	150	40
DPMC 319	8 – 60	160	39
DPMC(R) 450	8 – 34	225	40
DPMC(R) 600	8 – 67	300	46
DPMC 799	8 – 60	400	39
DPMC(R) 900	8 – 67	450	46

¹For these actuators the heating of the gear exceeds that of the motor. The heating of the gear is not detected by the actuator. Do not exceed modulating torques and operation modes.

²The maximum torque for this actuator is limited to 1000 Nm

12. TECHNICAL DATA

Type of actuator	Output drive speed rpm / operating time s/90°	Maximum modulating torque	Average weight in kg
DPMC 1200	7 – 75	600	51
DPMC(R) 1200	18 – 75	600	51
DPMC 1599	8 – 60	800	48
DPMC 1800	7 – 75	900	51
DPMC(R) 1800	18 – 75	900	51

Table 12.1: Technical data

WARNING

Excessive temperature when exceeding the max. permissible modulating torque



- Make sure that the modulating torque of the valve does not exceed 50 % of the maximum permissible torque of the actuator, if not indicated otherwise in table 12.1.

12.3 Types of duty for different versions

The actuator duty should be adhered to, even if the operation times from open to close exceed the limit of the operating time. The type of duty depends upon the temperature range on the actuator name plates. Type of duty S2–xx min (short-time duty) for multi-turn actuators and S4–xx % on time (periodic intermittent duty with influence on starting procedure) for modulating actuators are to be considered.

With S2 duty rating, the maximum operating time of the actuator is indicated. After this time, the actuator must go in pause mode until cooling down to ambient temperature +2 K. With S4 duty rating, the on time value indicates the permitted running time with reference to the switching cycle. A switching cycle is defined as time between actuator start and next start (sum of actuator running time and pause time).

In general, modulating actuators are always limited to 1,200 switching operation per hour (indicated as c/h on the name plate) (with reversing contactors to 300 c/h)(refer to EN 60034-1). Multi-turn actuators are limited to max. S2–15 min.

WARNING**Excessive temperature when exceeding the max. permissible number of starts**

- The max. number of starts for modulating applications must not exceed 1,200 c/h. Depending on type of actuator and ambient temperature, restrictions with regard to number of starts according to the name plate must be observed.

WARNING**Failure to comply with specifications**

- Any restrictions (refer to name plate) applicable for the actuators must be adhered to!

DANGER**Pulling load**

- The following actuators are equipped with an additional brake motor: D1000 output speed 120 rpm and 160 rpm
D2000 all output speeds.

For TB motors:

The brake and the respective wiring is designed as a spring-applied brake. Stopping while pulling loads are active can be guaranteed up to an effective torque at the output drive of 300 Nm.

For standard motors:

The brakes of standard motors are generally not designed for stopping pulling loads.

13 External warnings

This chapter contains a list of warnings and service advices that have to be placed on the actuator and have to be visible for the lifetime of the actuator. It is not permitted to cover these warnings with paint! All given positions are relative to the viewing direction on the display.



Position: on the right side of the cover



Position: on the cover

14 Certificates

The following section contains the Declarations of Conformity and Incorporation as well as additional Certificates for the actuator type range described in these operation instructions if any.



NOTICE

The printed Documents are up-to-date to the date of publication of these instructions

- Please refer to <http://site.drehmo.com/en/downloads> for downloading further supplements to the printed documents.



EU Declaration of Conformity / Declaration of Incorporation

As the manufacturer DREHMO GmbH hereby declares that the electro-mechanical DREHMO® actuators and accompanying components from the following series

Standard

D(R) 15 - D(R) 2000
DP(R) 30 - DP(R) 1800

Matic C

DMC(R) 15 - DMC(R) 2000
DPMC(R) 30 - DPMC(R) 1800

i-matic

DiM(R) 15 - DiM(R) 2000
DPiM(R) 30 - DPiM(R) 1800

comply with the fundamental requirements of the Electromagnetic Compatibility Directive (2014/30/EU), the Low Voltage Directive (2014/35/EU) and the Machinery Directive (2006/42/EC).

EU Declaration of Conformity according to the Council Directive on the approximation of laws of the member states relating to the Electromagnetic Compatibility Directive (2014/30/EU) and the Low Voltage Directive (2014/35/EU)

The following harmonised standards in terms of the specified directives have been applied:

Electromagnetic Compatibility (2014/30/EU)

EN 61000-6-2: 2005

EN 61000-6-4: 2007+A1:2011

EN 61000-3-2: 2006+A1,A2:2009¹⁾ EN 61000-3-11: 2000¹⁾ ¹⁾Matic C and i-matic

Low Voltage Directive (2014/35/EU)

EN 61010-1: 2010

EN 60034-1: 2010

Declaration of incorporation in terms of EC Machinery Directive (2006/42/EC) Appendix II B

The following harmonised standards in terms of the Machinery Directive (2006/42/EC) have been applied:

EN ISO 12100: 2010

DREHMO® actuators are intended for assembly with valves. The commissioning phase should only be implemented if it has been ensured that the entire machine in which the DREHMO® actuators are installed complies with the regulations of the EC Machinery Directive (2006/42/EC). We comply with the following basic requirements according to appendix I of the Machinery Directive (2006/42/EG): Appendix I 1.1.2, 1.1.3, 1.1.5, 1.2.1, 1.2.6, 1.3.1, 1.3.7, 1.5.1, 1.6.3, 1.7.1, 1.7.3, 1.7.4

The manufacturer is obligated to electronically submit the documents for the incomplete machine to national authorities on request. The special technical documents pertaining to the machine according to Appendix VII part B have been compiled.

Person responsible for documentation:

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Wenden, 2016-04-20

W. Händel, General Manager

DREHMO

VALVE ACTUATORS

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