DREHMO
VALVE ACTUATORS

c-matic

Electric actuator
with integral controls

Operation instructions
Assembly and commissioning

Read operation instructions first.

- Heed safety instructions.
- These operation instructions are part of the product.
- Store operation instructions during product life.
- Pass on instructions to any subsequent user or owner of the product.

Target group:

This document contains information for assembly, commissioning and maintenance staff.

Table of contents

1 Safety

1.1 Prerequisites for the safe handling of the product

Standards/directives

The end user or the contractor 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.

Depending on the device version, this includes:

- Configuration guidelines for the respective fieldbus or network applications

Safety instructions/warnings

All personnel working with this device must be familiar with the safety and warning instructions in this manual and heed 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 end user or contractor of the plant 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.

Commissioning

Prior to commissioning, imperatively 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.

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.
- Heed recognised rules for occupational health and safety.
- Heed national regulations.
- During operation, the housing warms up and surface temperatures > 60 °C may occur. To prevent possible burns, we recommend checking the surface temperature using an appropriate thermometer and wearing protective gloves, prior to working on the device.

Protective measures

The end user or the contractor 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 written consent of the manufacturer.

1.2 Range of application

DREHMO actuators are designed for the operation of industrial valves, e.g. globe valves, gate valves, butterfly valves and ball valves.

If temperatures are to be expected at the valve flange or the valve stem, which exceed the permissible ambient temperatures, (e.g. due to hot media), please consult 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 (S1)
- Buried service
- Continuous underwater use (observe enclosure protection)
- Potentially explosive atmospheres
- 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 operation instructions are valid for the clockwise closing standard version, i.e. driven shaft turns clockwise to close the valve.

1.3 Warnings and notes

The following warnings draw special attention to safety-relevant procedures 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 results 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 could result in minor or moderate injury. May also be used with property damage.**

NOTICE — **Potentially hazardous situation. Failure to observe this warning could result in property damage. Is not used for personal injury.**

The ⚠ safety symbol warns of a potential personal injury hazard.

The signal word (e.g. DANGER) indicates the level of hazard.

1.4 References and symbols

The following references and symbols are used in these instructions:

The ⓘ symbol stands for the **Information** concept. This text provides important notes and information.

Information: If the **Information** term is part of instruction, the text will give important notes and information to this action step.

Symbol for CLOSED (valve closed)

Symbol for OPEN (valve open)

Result of a process step

Describes the result of a preceding process step.

Action step

Describes one single action step.

Reference to the page number

Refers to the page number for further information. To return from the target to the previous view, it is possible to jump back to the previous view within PDF documents: When using Adobe Acrobat via **Menu > Previous view** or using the key combination **Alt + left**.

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. For commissioning, service and maintenance, additional actuator-relevant data is indicated on the name plates.

Figure 1: Actuator name plate

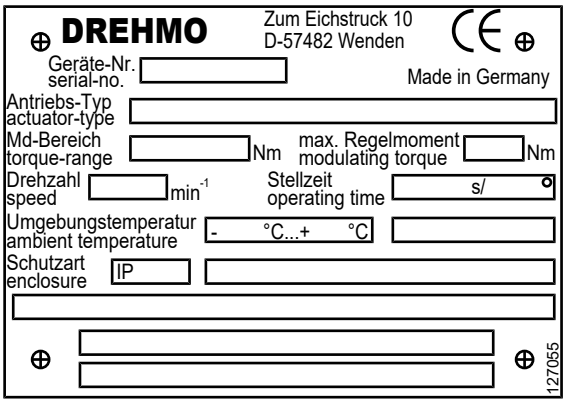
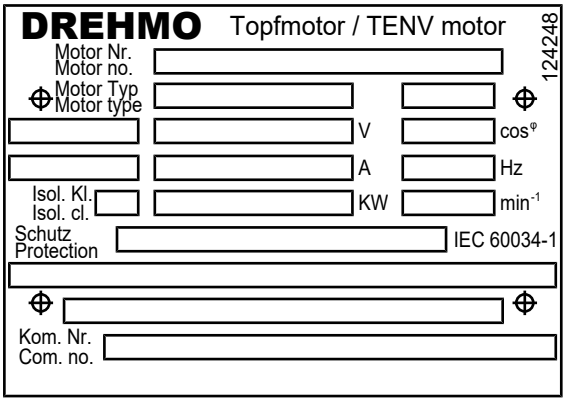


Figure 2: Motor name plate



Please always state the device 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:

Table 1: Type code

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	MC	Actuator with c-matic controls
4		Actuator for OPEN-CLOSE duty S2 ≤ 15 min
	R	Type of duty for modulating actuator: S4 max. 35 % on time

Position	Value range	Signification
5	30 – 2,000	Nominal torque in Nm for multi-turn actuators
	75 – 1,800	Nominal torque in Nm for part-turn actuators
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/DIN 3338
	B, V, W, L/D, H, FH, FW	Valve attachment types for part-turn actuators according to EN ISO 5211/DIN 3210
8	-	Line
9	5 – 160	Output speed in rpm for multi-turn actuators. The indication always refers to the 50 Hz value. Apply the 1.2 factor for actuators with 60 Hz (6 – 192). The exact speed is shown in a separate field.
	7 – 75	Operating time for 90° in seconds for part-turn actuators. The indication always refers to the 50 Hz value. Apply the 0.8 factor for actuators with 60 Hz (6 – 63). The exact operating time is shown in a separate field.
10		Blank
11		Standard actuator
	Ex	Explosion-proof actuator

2.3 Designation of the integral controls

Classification of the types of duty of actuators.

Class A: Open-close duty

The actuator runs from end position CLOSED to end position OPEN and vice versa. Without intermediate stops.

- xMCxx2-xxxx-xxxx-xxx

Class B: Inching/positioning duty

The actuator runs from end position CLOSED to end position OPEN and vice versa. With intermediate stop.

- xMCxx3-xxxx-xxxx-xxx or xMCxx4-xxxx-xxxx-xxx

Class C: Modulating duty

The actuator runs from end position CLOSED to end position OPEN and vice versa. With intermediate stop. Modulating function. Modulating actuators are equipped with a special worm and metal gears.

- xMCxx5-xxxx-xxxx-xxx

Class D: Continuous modulating duty

Actuators are not sized for continuous duty.

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

Suspended load!

Death or serious injury.

- → Do NOT stand below suspended load.
- → Fix ropes or slings around housing, NOT to handwheel, stem protection cover or motor eyebolt.
- → Actuators mounted on valves: Attach ropes or hooks for the purpose of lifting by hoist to valve and NOT to actuator.
- → Actuators mounted to gearboxes: Attach ropes or hooks for the purpose of lifting by hoist only to the gearbox using eyebolts and NOT to the actuator.
- → Secure load against falling, sliding or tilting.
- → Perform lift trial at low height to eliminate any potential danger e.g. by tilting.

Please refer to the illustration below for appropriate actuator transport.

Figure 3: 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 should be predominantly used. Otherwise, switch on the operating voltage.

NOTICE

Danger of corrosion 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.
- → If there is no external additional heater, switch on integral controls.

For long-term storage (more than 6 months), observe the following points:

- Prior to storage: Protect uncoated surfaces, in particular output drive parts and mounting surfaces using long-term corrosion protection agents.
- At an interval of approx. 6 months: Check uncoated surfaces for corrosion. Should traces of corrosion be detected, renew the corrosion protection.
- Ensure that actuators are fully operational by performing a test run every 6 months.

3.3 Packaging

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

4 Valve attachment

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

DREHMO actuators can be mounted in any position. If the perpendicular valve shaft is freely accessible, this requires the least effort. To fix the DREHMO actuator to the final element (valve), threaded holes are provided at the actuator mounting flange. The dimensions of the actuator mounting flange with output drive types comply with EN ISO 5210/DIN 3338 (multi-turn actuators) or EN ISO 5211/DIN 3210 (part-turn actuators) standards.

a) DREHMO actuators are self-locking up to output speeds of 80/96 rpm (@ 50/60 Hz).

b) Actuators with speeds of 120/160 rpm @ 50 Hz, or 144/192 rpm @ 60 Hz are not self-locking and therefore not suitable for pulling loads.

c) For more information on actuators with brakes, refer to Types of duty for different versions [▶ 49].

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 the handwheel results in clockwise rotation of the output drive (view on the motor name plate).

NOTICE

Damage to actuator and mounted elements by handwheel operation!

→ The set tripping torques do not limit the forces applied by the handwheel.

→ Operation via handwheel 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 Dismantling and mounting of the stem nut (output drive type A)

For output drive type A, make sure that the unbored stem nut (delivered unbored if not stated otherwise in the order) must be provided with a thread bore in compliance with the available stem, prior to mounting the DREHMO actuator onto the valve.

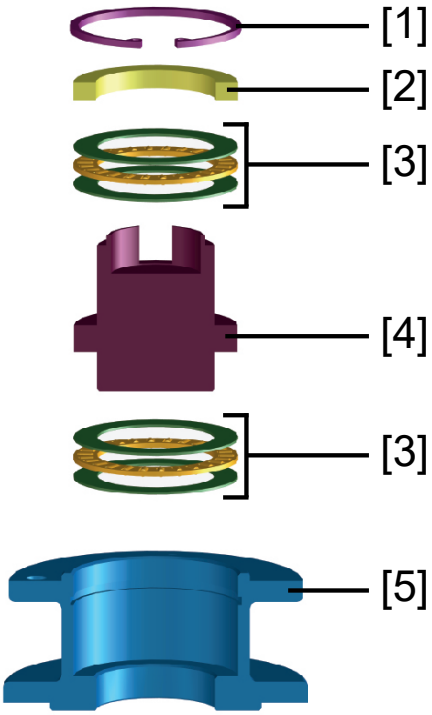
NOTICE

Lubrication of bearing points required!

→ Apply sufficient Lithium soap EP multi-purpose grease to axial needle roller and cage assemblies and contact bearing faces when mounting stem nut A.

→ Ensure that all hollow spaces of the bearings are filled with grease.

Figure 4: Stem nut A



[1]	Retaining ring	[2]	Shim washer
[3]	Axial bearing with two bearing washers	[4]	Stem nut
[5]	Output mounting flange		

How to proceed

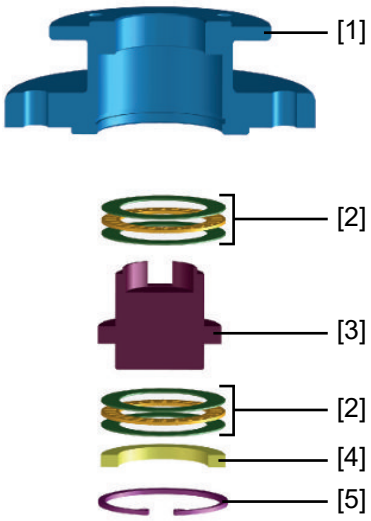
1. Dismantle output mounting flange [5] from actuator.
2. Remove retaining ring [1].
3. Remove stem nut [4] including shim washer [2] and axial bearing with the two bearing washers [3].
4. Drill threaded hole.
5. Fit stem nut in reversed order while greasing the bearings.
6. Apply a thin film of sealing agent (e.g. Marston Durapress) at sealing faces of output mounting flange [5] prior to assembly.

4.3 Dismantling and mounting of the modified stem nut (output drive type A-HP)

For better distinction, these stem nuts are marked with a turned marking groove at the shoulder circumference.

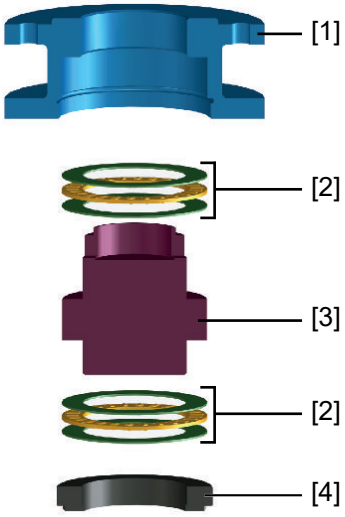
NOTICE! Lubrication of bearing points required!

Figure 5: Stem nut A-HP with retaining ring



[1]	Output mounting flange	[2]	Axial bearing with two bearing washers
[3]	Stem nut	[4]	Shim washer
[5]	Retaining ring		

Figure 6: Stem nut A-HP with locking nut



[1]	Output mounting flange	[2]	Axial bearing with two bearing washers
[3]	Stem nut	[4]	Locking nut

How to proceed

1. Remove retaining ring [5]/locking nut [4].
2. Take out stem nut [3] and axial bearing with two bearing washers [2].
3. If it is an output drive with retaining ring, also remove the shim washer [4].
4. Drill threaded hole.
5. Fit stem nut in reversed order while greasing the bearings.

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 x D (refer to figure Insulating flange [▶ 15]). A remaining width of joint of 0 mm must not be fallen short of.

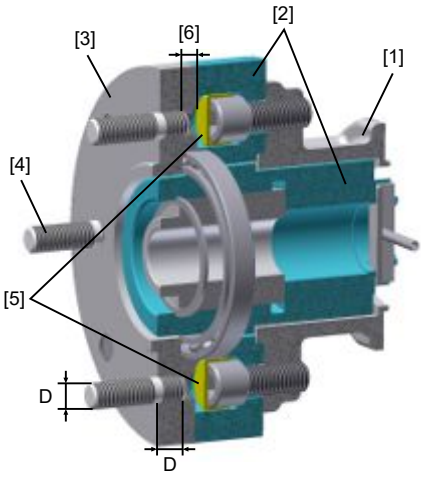
Caution: Isolating spark gaps for lightning conditions between multi-turn actuator and pipeline are not included in the delivery! A potential supplier is the DEHN company, product TFS (Trennfunkenstrecke, German for isolation spark gaps).

NOTICE

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

→ Due to the restricted permissible force at the insulating flange, horizontal mounting is not permissible for actuators with standard motors (with separate terminal box) and with TM2 or TB2 pot-type motors.

Figure 7: Insulating flange

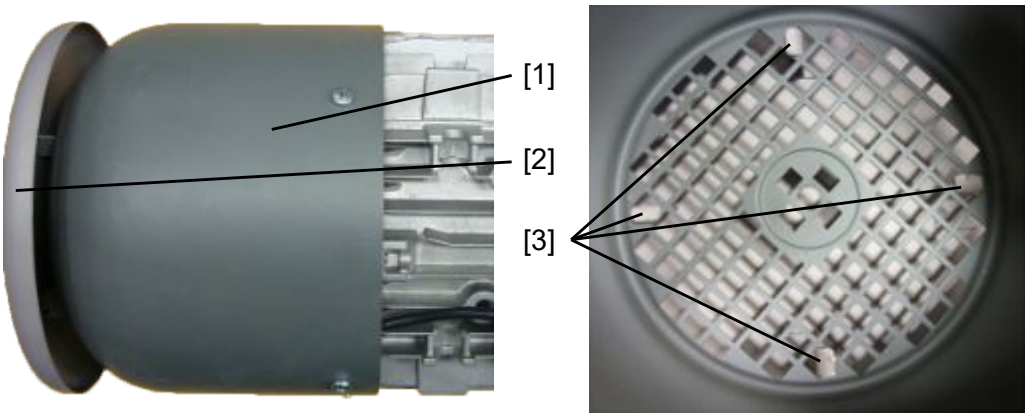


[1]	Input mounting flange	[2]	Insulating body
[3]	Output drive flange	[4]	Stud
[5]	Insulating caps	[6]	Remaining width of joint (> 0 mm)

4.5 Rain protection hood

For HEW-RUF motors, the rain protection hood [2] is always used in combination with the fan cover [1] (refer to Rain protection hood [▶ 15]). 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 protection hood [2] with positive connection can be removed. For this, straighten the four lugs [3] using appropriate universal pliers or similar. Finally, the fan cover [1] must be refitted.

Figure 8: Rain protection hood



[1]	Fan cover	[2]	Rain protection hood
[3]	Lugs		

4.6 Assembly

Direct mounting

For direct mounting, the actuator is fitted without intermediate gearing to the valve. For this, multi-turn actuators are equipped with output drive type B3 as a standard. A, AF, B, B1, B2, B3DO, B4, C, D, DO, DOU, DSTO, DSTU, E and EDO output drive types are also 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. If required, use handwheel to operate actuator to a suitable position. Fasten actuator crosswise to valve using appropriate screws.

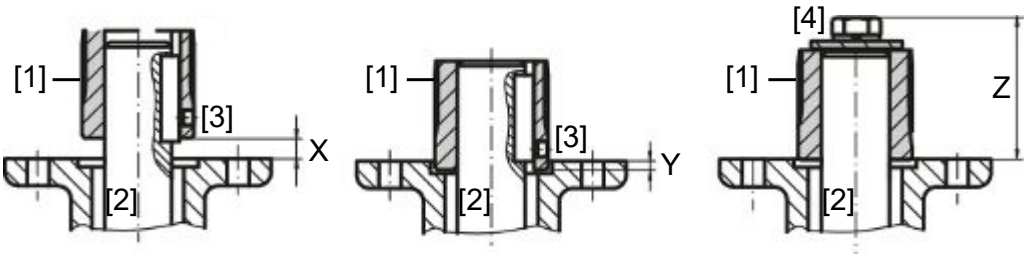
Output drive type A is an exception. First fasten output drive on the stem until it is flush on the valve. Rotate the drive assembly down the valve shaft to mate with the valve flange. Align the fixings and attach loosely, rotate the drive coupling to take up the free play and ensure close coupling of 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. Finally screw the flange tightly to the actuator.

Table 2: Tightening torques

Screw strength class 8.8 ($\mu_G \approx 0.12$)										
Threads	M6	M8	M10	M12	M14	M16	M18	M20	M30	M36
Tightening torques in Nm	10	25	49	85	135	210	300	425	1,450	2,600

Part-turn actuators are equipped with an unbored output drive plug sleeve as a standard. B, V, W, L/D and H output drive plug sleeves are also available on request. The output drive plug sleeve has splines at the outer diameter. Apply suitable grease to the splines prior to mounting to the valve. The output drive plug sleeves can be inserted into the actuator with an offset at certain angles. Heed the fitting dimensions according to Assembly [▶ 17].

Figure 9: Sectional view of various couplings



[1] Coupling
[2] Valve shaft
[3] Grub screw
[4] Screw

Increased fastening torque for powder coated flanges possibly required!

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

How to proceed

1. Operate actuator with handwheel to mechanical end stop.
2. Valve and part-turn actuator must be in the same position CLOSE/CLOSE or OPEN/OPEN.
3. Thoroughly degrease the bearing faces of the output mounting flanges and apply a suitable sealing agent (e.g. Marston Durapress).
4. Apply a small quantity of grease to the valve shaft [2].
5. Place coupling [1] onto valve shaft [2] and secure against axial slipping by using a grub screw [3], a retaining ring or a screw [4]. Observe dimensions X, Y or Z.

Table 3: Coupling fitting dimensions

Type, size, output mounting flange	X_{max} in mm	Y_{max} in mm	Z_{max} in mm
DPMC(R) 75/150/299-F05/07	3	2	40
DPMC(R) 75/150/299-F10	3	2	66
DPMC(R) 300/450-F10	4	5	50
DPMC(R) 300/450-F12	4	5	82
DPMC(R) 600/900-F12	5	10	62
DPMC(R) 600/900-F14	5	10	102
DPMC(R) 1200/1800-F14	8	10	77
DPMC(R) 1200/1800-F16	8	10	127

6. Apply acid-free grease to splines on coupling.
7. Fit part-turn actuator.
8. Should the flange bores not match with the threads.
   ⇨ Slightly rotate handwheel until bores line up.
   ⇨ If required, shift actuator by one tooth on the coupling.
9. Fasten actuator with suitable screws.

We recommend fitting the screws using thread sealing agent. Tighten screws crosswise with a torque according to Tightening torques [▸ 16].

Indirect mounting

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

4.7 End stops for part-turn actuators

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

The internal end stops limit the swing angle. They protect the valve in manual 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

Caution: The end stop setting sequence depends on the valve. We recommend starting with end stop CLOSED for butterfly valves and with end stop OPEN for ball valves.

For butterfly valves, turn handwheel clockwise to mechanical end stop CLOSED, then slowly rotate one turn counterclockwise. For ball valves, turn counterclockwise until the actuator has reached end position OPEN.

Adjust actuator in accordance with the possible angular steps and slide it carefully onto the 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.

4.8 Setting the mechanical end stop screw for part-turn actuators

DPMC(R) 75 – 1800 (with planetary gearing)

⚠CAUTION

Exposed, rotating parts (discs/balls) at the valve!

Pinching and damage by 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.

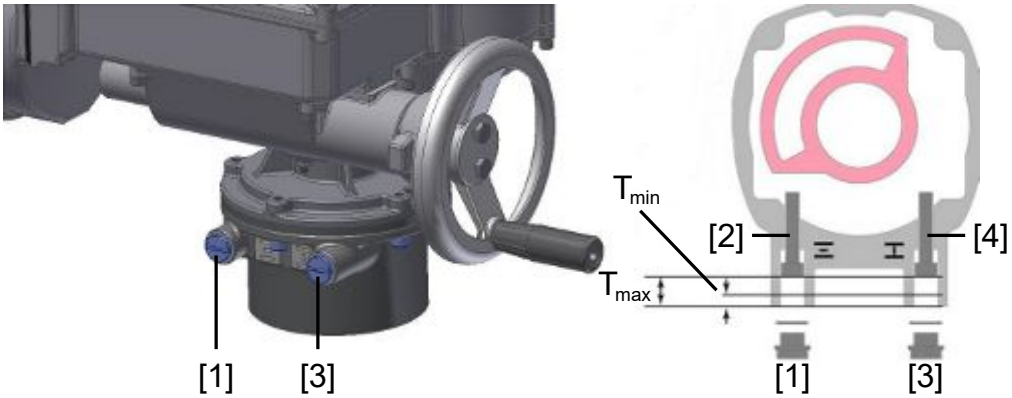
→ Observe dimension $T_{min..}$.

On delivery, unfasten both screws for the end stop to allow alignment of actuator to valve. The minimum and maximum dimensions for adjustment indicated in the table below must neither be exceeded nor fallen short of. When setting up the actuator, the valve must be in position CLOSED.

Table 4: Setting limits of the stop screws for planetary gearings

Actuator type 90°	T_{max}	T_{min}
DPMC(R) 75/150/299	17 mm	11 mm
DPMC(R) 300/450	20 mm	12 mm
DPMC(R) 600/900	23 mm	13 mm
DPMC(R) 1200/1800	23 mm	12 mm

Figure 10: Cross section of compartment for end stop screws



[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

4.8.1 Set end stop CLOSED

How to proceed

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.

4.8.2 Set end stop OPEN

How to proceed

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 critical aspects and information for installation and modification of the electrical connection are presented.

5.1 Important notes

⚠DANGER

Electric shock due to presence of hazardous voltage if the PE conductor is NOT connected!

Death or serious injury.

→ Connect all protective earth conductors (if required use external earth connection).

→ Power the device only once the protective earth conductor has been connected.

⚠WARNING

Electric shock due to the presence of hazardous voltage!

Failure to observe this warning could result in death, serious injury, or property damage.

→ The electrical connection must be carried out exclusively by suitably qualified personnel.

→ Prior to connection, heed basic information contained in this chapter.

⚠WARNING

Excessive heating of the motor!

→ Plan and implement the required protective measures within the system.

→ When using a solid-state relay (SSR), one of the three phases is always connected to the motor and is therefore not switched. Consequently, there is a risk of motor overheating in case of fault. This is to be prevented by an all-pole disconnection of the actuator.

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.

In addition, heed the following points:

- Observe indications on name plate.
- Compare mains voltage.
- The 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.
- To ensure the immunity level (EMC) of the actuator, we recommend shielding all connecting cables of the actuator with the exception of the mains supply.
- If the DREHMO actuators are operated with separately mounted controls, the connecting cables between actuators and separately mounted controls must be shielded in any case.
- Heed twisted signal cable pairs according to wiring diagram.
- For cable glands (including screw 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).
- Appropriate fuses for cable protection must be installed in front of each actuator. Fuse specifications must be calculated on the basis of published motor data.
- The 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.

5.2 Connection terminals

Various options are available for actuator connections. For precise indications relating to possible cable cross sections and, if applicable, pertaining tightening torques, refer to Technical data overview [▶ 48].

5.3 Voltage range and fuses

DANGER

Electric shock due to the presence of hazardous voltage!

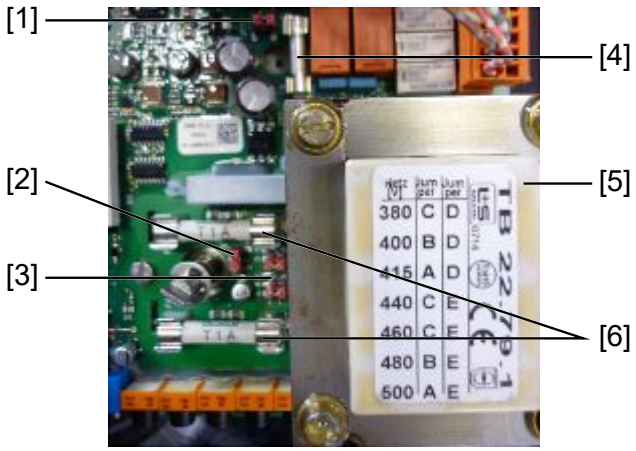
Death or serious injury.

→ Only remove the cover of primary fuses when the actuator is not live.

The fuses are located on the c-matic controls. Loosen the four screws of the controls cover and lift the cover to access the fuses. The c-matic controls can be folded open. For this, loosen the screw opposite the hinge and open the c-matic controls.

Next to the transformer, there is a cover providing a contact protection to the primary fuses and the jumpers J2 (A, B, C), J3 (D, E) and J10.

Figure 11: Fuses and transformer with fitting instructions for the jumpers



[1]	Jumper J11	[2]	Jumper J10
[3]	Jumpers J2 and J3	[4]	Secondary fuse
[5]	Transformer	[6]	Primary fuses

Both primary fuses are sized for 1 A and 500 V. The supply voltage of the c-matic controls can be set with jumpers J2 and J3. For this, fit the jumper according to the indications on the transformer [5].

There is another fuse on the secondary side which is sized for 1.6 A and 250 V. It is located near the transformer and protects the path for switching the relays for motor control and the provision of the internal supply voltage. The fuse for the external 24 V supply (option) is located on the DMC-09 board [▶ 26] (local controls). The latter is sized for 0.8 A and 250 V.

5.4 Phase sequence correction

The actuator includes an automatic phase sequence correction, the connection errors of the rotary field of the supply voltage will be automatically corrected.

⚠WARNING

The automatic phase sequence correction only works for three-phase AC voltage up to 500 V!

Output drive movement in incorrect direction of rotation in motor operation possible. Risk of personal injury and property damage.

→ For voltages higher than 500 V, pay special attention to the correct connection of the power supply (clockwise rotary field) according to terminal plan!

The base board has two jumpers, J10 and J11, (refer to following table), by means of which the phase sequence correction can be influenced. Use the J10 jumper to change between 50 and 60 Hz. LED H4 will blink if there are problems with the phase sequence correction due to mains failure. In this case the phase sequence correction can be deactivated with the J11 jumper. Pay special attention to the correct connection of the supply voltage (clockwise rotary field) according to terminal plan.

Table 5: Selection of the mains frequency and the use of the phase sequence correction

	Jumper to 1 and 2	**Jumper to 2 and 3**
J10	50 Hz mains frequency	60 Hz mains frequency
J11	Phase sequence correction activated	Phase sequence correction deactivated

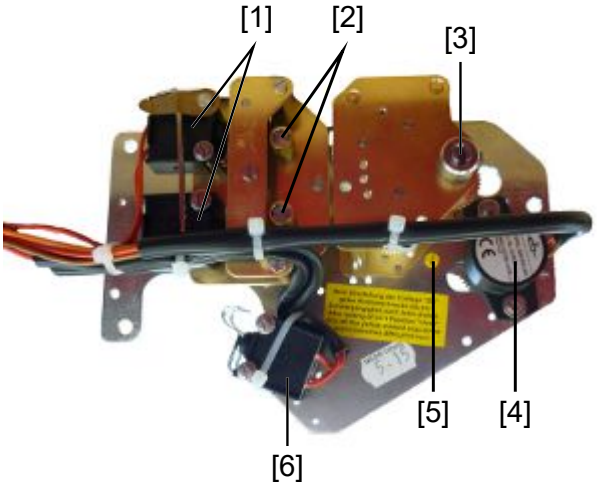
6 Limit switching module

In this chapter, the limit switching module used in DREHMO actuators is described. The limit switching module (if available) is located below the housing cover. The housing cover can be removed by unfastening the four outer screws.

6.1 Design of the 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. The illustration below shows a typical version.

Figure 12: Limit switching module



[1]	Limit switches	[2]	Adjustment screws for limit positions
[3]	Shaft for mechanical position indication	[4]	Potentiometer
[5]	Transit screw	[6]	Torque switches

The torque and limit switches are operated via adjustable cams and are also available as tandem switches as an option. For torque switches, labels are fixed to the cams indicating the permissible setting range.

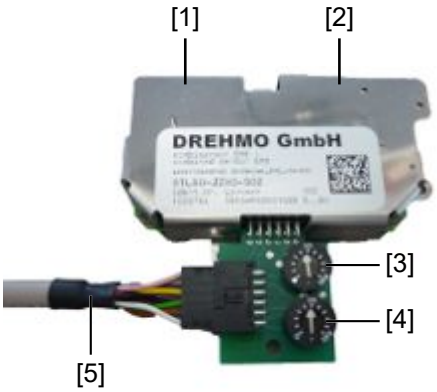
7 Combined sensor within c-matic controls

In this chapter, the combined sensor, which can be used as an option in DREHMO actuators of the c-matic type, will be presented. The combined sensor (if available) is located below the housing cover. The housing cover can be removed by unfastening the four outer screws.

7.1 Design of the combined sensor

The combined sensor records limit positions and torques. It is generally equipped with two potentiometers which allow the setting of the respective torque. The combined sensor with additional board is shown in the illustration below.

Figure 13: Combined sensor with setting potentiometers

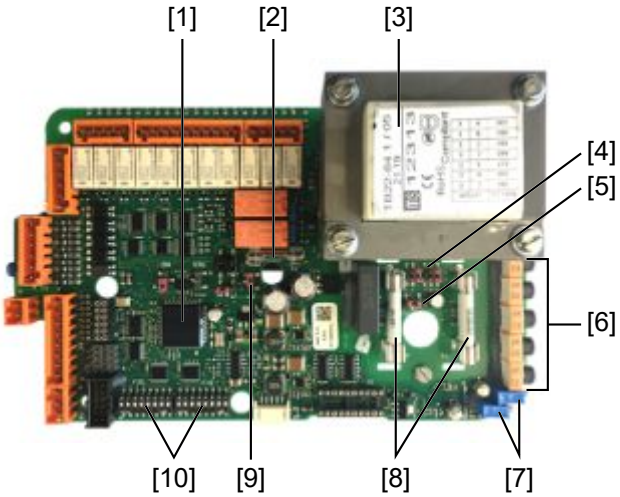


[1]	Torque sensing	[2]	Limit position recording
[3]	Potentiometer for setting the torque in direction CLOSE (setting between 30 – 100 %)	[4]	Potentiometer for setting the torque in direction OPEN (setting between 30 – 100 %)
[5]	Connecting cable for the combined sensor		

8 Local controls boards

The following illustrations show the fully equipped boards. Depending on the version, individual elements might be missing on the board.

Base board DMC-02.8

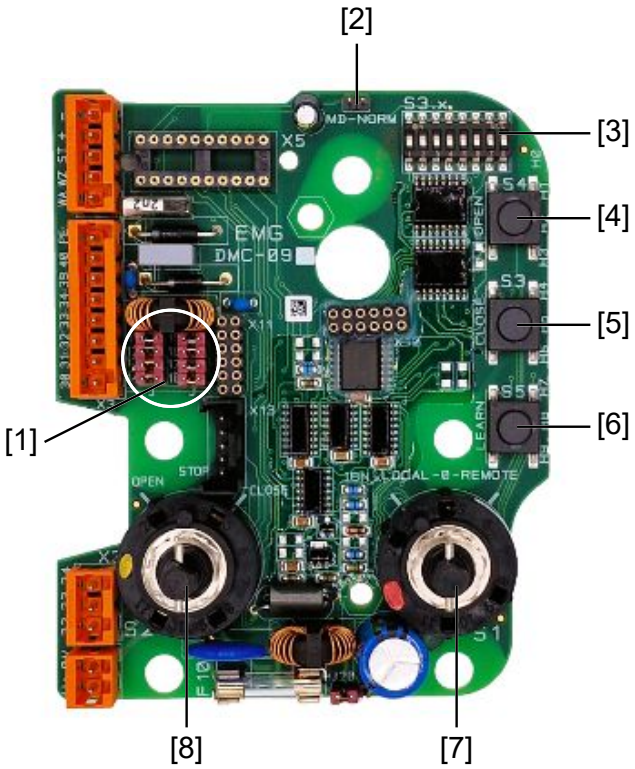


[1]	Microcontroller	[2]	Secondary fuse
[3]	Transformer	[4]	Jumpers J2 and J3
[5]	Jumper J10	[6]	Potentiometers R4 – R8
[7]	Potentiometers R1 and R2	[8]	Primary fuses
[9]	Jumper 11	[10]	DIP switches S1 and S2

There is a microcontroller on the base board which controls the actuator. The microcontroller assesses the applied torque and the position of the set stroke. For this, it assesses the signals provided by the limit switching module or the combined sensor and monitors the motor temperature. The voltage range of the c-matic controls is set via two jumpers according to the table attached to the transformer. The base board is protected by two primary fuses and one secondary fuse.

Various functions or options can be set via the DIP switches S1 and S2. With the two potentiometers R1 and R2, the zero point or the amplification of the 4 – 20 mA signal can be set when using a limit switching module. Depending on the version, the potentiometers R4 – R8 have different functions (refer to Potentiometer [▶ 40]).

Local controls DMC-09

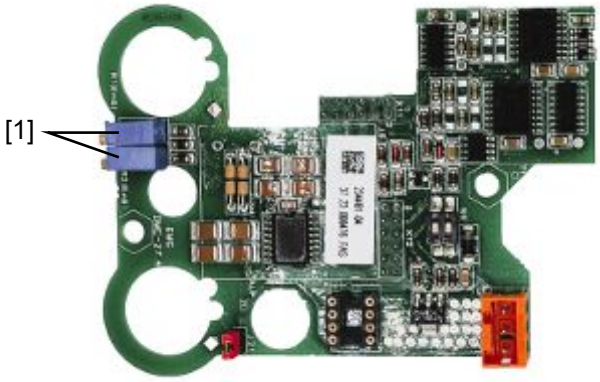


[1]	Jumper J11 – J18	[2]	Torque jumper
[3]	DIP switch S3	[4]	Push button S4 for operation command in direction OPEN
[5]	Push button S3 for operation command in direction CLOSE	[6]	Push button S5 (LEARN push button)
[7]	Rotary switch S1 for selecting the operation mode	[8]	Rotary switch S2 for selecting the operation command

This board serves for local operation of the actuator and for commissioning.

It has two rotary switches with the functions Local/Off/Remote/(LEARN) and Open/Stop/Close. The “Learn” function can only be selected for actuators with combined sensor. In addition, there are three push buttons which can be used to operate or commission the actuator even when the cover is open. The torque zero point of the combined sensor is calibrated by means of the torque jumper. DIP switch S3 is also located on this board. Jumpers J11 to J18 are used for the galvanic isolation of analogue signals.

AD converter DMC-27



[1] Potentiometers R1 and R2

This board converts the position signal of the combined sensor into a 4 – 20 mA signal. As an option, the board is available with galvanic isolation for the analogue output signal and/or the input signal.

Display board DMC 30

For more detailed information on this board, refer to Electronic position indicator [▸ 29].

9 Local controls

⚠CAUTION

Hot surfaces, e.g. due to higher ambient temperatures or due to strong direct sunlight!

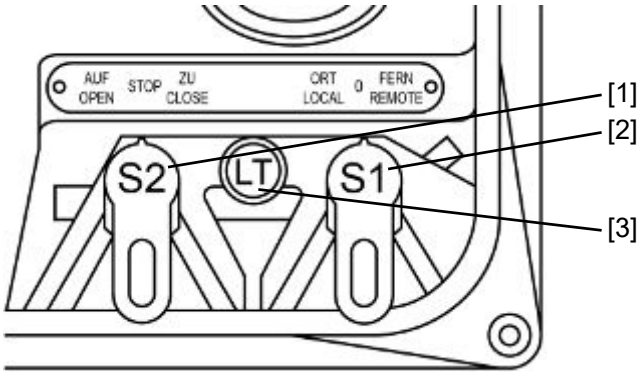
Risk of burns

→ Check surface temperature and wear protective gloves.

The actuators are equipped with local controls and operation elements for local control.

The local controls of the c-matic controls basically consist of two selector switches. If the actuator is equipped with combined sensor for recording travel and torque, the indicated LEARN push button is also available on the local controls (refer to illustration below).

Figure 14: Local controls with two selector switches



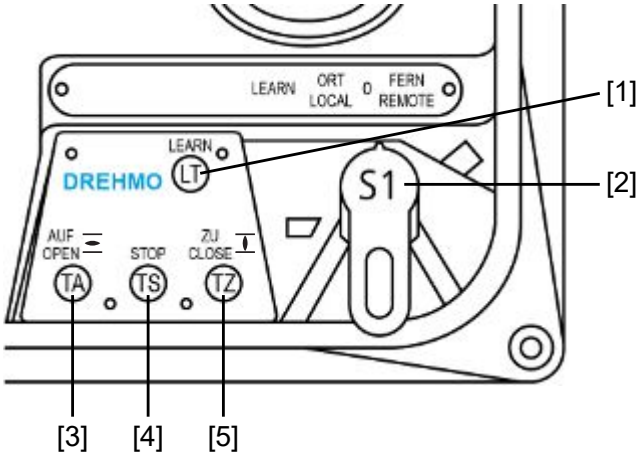
[1] Switch S2

[2] Switch S1

[3] Optional LEARN push button LT (for combined sensor only)

Another version of the local controls only uses one selector switch. In this version, the second selector switch was replaced by three push buttons. Also for this version the LEARN push button will only be available when using a combined sensor.

Figure 15: Local controls with three push buttons and one selector switch



[1] Optional LEARN push button LT (for combined sensor only)

[2] Switch S1

[3] Push button TA

[4] Push button TS

[5] Push button TZ

The pertaining board is the DMC-21. It is equipped with two jumpers which can be plugged in four positions (J34, J35, J37 and J38). In the factory, the jumpers are plugged at positions J34 and J35 and thus activate the self-retaining of the push buttons. To enable the push-to-run operation for the push buttons, re-plug the jumpers to positions J37 and J38.

9.1 Switches/push buttons on the housing cover

Switches	Local controls	Function
S1	Selector switch	Commissioning (in combination with combined sensor), Local, 0, Remote
S2	Control switch	Open, Stop, Close
S3	LEARN push button	Commissioning (in combination with combined sensor)

9.2 Lockability of the local controls

The selector switch LEARN - LOCAL - 0 - REMOTE can be locked in positions LOCAL - 0 - REMOTE with a commercial padlock. Depending on the requirements, individual keys and lock systems can be provided while indicating the number of keys per lock.

9.3 Electronic position indicator

Actuators of the c-matic device family can be equipped with an LCD indicator unit. The indication shows the current actuator position scaled in percent between end position CLOSED (0 %) and end position OPEN (100 %). The indicated position value is derived from the internally generated 4 – 20 mA actual value signal. For some device variants, this current signal is also applied to the control plug (refer to terminal plan).

Apart from information on the position, the following additional information is displayed:

- When connecting an operating voltage, the current firmware version is indicated for approx. 3 seconds on the display.
- In case of an open current loop of the required 4 – 20 mA actual value signal, the error code E1 is displayed.

Figure 16: Electronic position indicator

[1] Jumper
[2] Watchdog
[3] 3 LED indication lights

The printed board is equipped with four jumpers which are only required during production. As shown in the illustration, the jumpers must remain open. The three small coloured LEDs, just like the indication lights, are used to signal the end positions and the fault signal according to the pertaining symbols. The blinking LED watchdog signals the correct function of the sequential control programmed on the microcontroller.

10 Commissioning

The procedure for commissioning DREHMO c-matic actuators is described below.

⚠WARNING

All working steps are performed while cover is removed.

Danger of pinching and contact with live parts.

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

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

a) Clockwise rotation of the output drive shaft corresponds to direction CLOSE.

b) Counterclockwise rotation of the output drive shaft corresponds to direction OPEN.

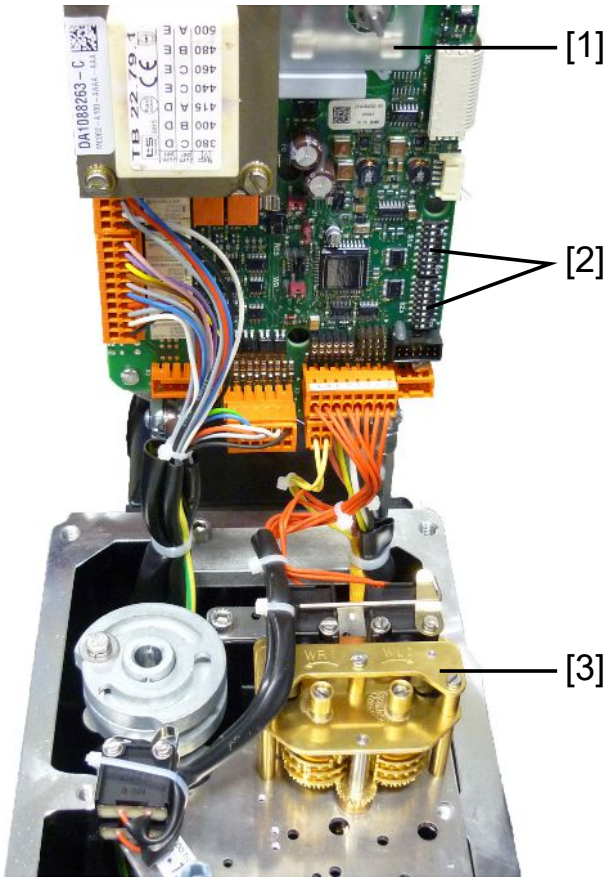
c) DR and WR switches are designated for torque and limit position in direction CLOSE.

d) DL and WL switches are designated for torque and limit position in direction OPEN.

e) Even if the output signal of the measuring amplifier is not to be used, unscrew the transit screw (refer to Design of the limit switching module [▶ 23]).

10.1 Version with limit switching module

Figure 17: Actuator variant with limit switching module



[1] Setting the power supply for the controls

[2] DIP switches for parametrisation

[3] Limit switching module

10.1.1 Setting the torque values

Torques are set in the factory according to the specifications in the purchase order. They will only be entered on the name plate if explicitly ordered. If no torques are specified in the order, the minimum adjustable torque will be set in the factory. Torques can be continuously adjusted within the range indicated on the name plate, using the attached dials.

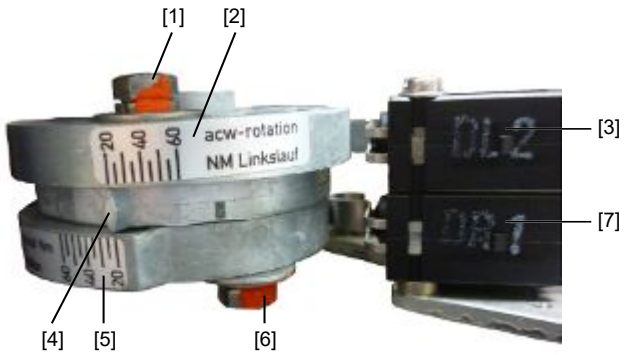
NOTICE

Maximum permissible torque exceeded!

→ Settings exceeding the maximum indicated torque are not permissible.

Use setting discs to set the torques for which a torque signal will be issued. To set the torque in direction OPEN, loosen the upper transit screw. To set the torque in direction CLOSE, loosen the bottom transit screw. Once the respective screw has been loosened, turn the pertaining disc until the desired value on the scale is aligned with the setting mark. Fasten the respective screw again.

Figure 18: Torque setting

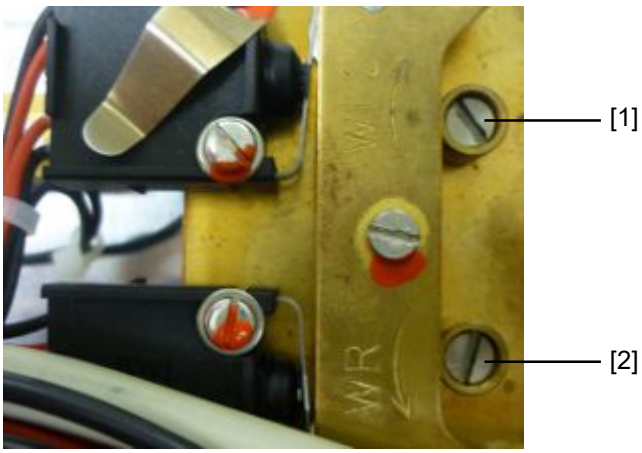


[1]	Transit screw for torque adjustment OPEN	[2]	Scale with setting range for torque in direction OPEN
[3]	Torque switch for direction OPEN (in standard version)	[4]	Setting mark
[5]	Scale with setting range for torque in direction CLOSE	[6]	Transit screw for torque adjustment CLOSE
[7]	Torque switch for direction CLOSE (in standard version)		

10.1.2 Setting the limit positions

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

Figure 19: Limit switches in standard version



[1] Setting screw for limit position OPEN [2] Setting screw for limit position CLOSED

For setting a limit position, operate the actuator 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. Therefore, make sure not to modify the selected position while operating the desired switch. Once the respective limit switch has tripped, refrain from turning the setting screw! Repeat the complete setting procedure if you have accidentally turned too far.

10.1.3 Setting the reduction gearing

Depending on the actuator running time, set the reduction gearing according to the tables below. The reduction gearing converts the travel into a 300° angle signal. The signal is required for both the mechanical position indication and the 4 – 20 mA position feedback (both optional).

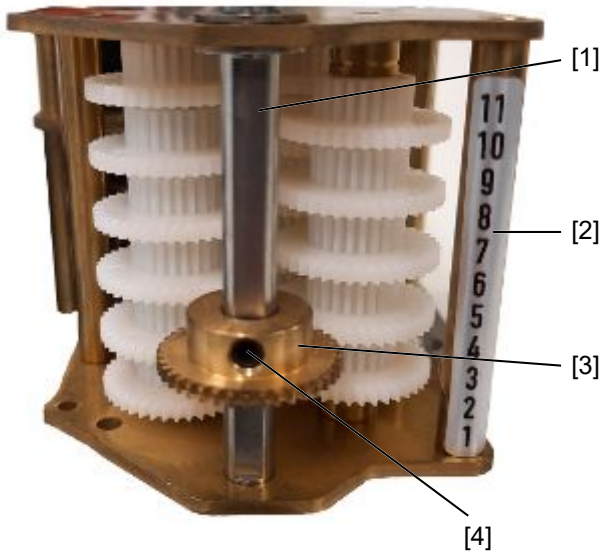
To re-set the reduction gearing, loosen the fastening screw and retain the shaft. After unfastening the screw, the sliding gear wheel can be moved up (smaller angle for the mechanical position indicator) or down (larger angle for the mechanical position indicator). Once the new position of the sliding gear wheel has been reached, tighten fastening screw again.

NOTICE

Heed correct position of the sliding gear wheel!

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

Figure 20: Reduction gearing



[1]	Shaft of the mechanical position indicator	[2]	Scale with possible positions
[3]	Sliding gear wheel	[4]	Fastening screw

On the bottom of the mounting plate, the limit switching module is equipped with a driving gear. The variant for section III is shown in the illustration below. For section II, a larger gear is installed instead of a small one. The counter gear is mounted on a shaft within the actuator.

Figure 21: Drive pinion

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

Table 6: Setting options for the reduction gearing for multi-turn actuators

Transmission ratio of limit switch wheels	Turns per stroke (min. and max.)	Position of the sliding gear wheel
1:3 (section III)		1
1:3 (section III)		2
1:3 (section III)		3
1:3 (section III)	**1.38 – 2.49**	**4**
1:3 (section III)	**2.5 – 4.5**	**5**

Transmission ratio of limit switch wheels	Turns per stroke (min. and max.)	Position of the sliding gear wheel
1:3 (section III)	**4.6 – 8.2**	**6**
1:3 (section III)	**8.3 – 15**	**7**
1:3 (section III)	**15.1 – 27.2**	**8**
1:3 (section III)	**27.3 – 49.6**	**9**
1:3 (section III)	**49.7 – 90.1**	**10**
1:3 (section III)	**90.2 – 135**	**11**
3:1 (section II)		1
3:1 (section II)		2
3:1 (section II)		3
3:1 (section II)	12.4 – 22.4	4
3:1 (section II)	22.5 – 40.8	5
3:1 (section II)	40.9 – 74.2	6
3:1 (section II)	74.3 – 135	7
3:1 (section II)	**135 – 245**	**8**
3:1 (section II)	**246 – 446**	**9**
3:1 (section II)	**447 – 811**	**10**
3:1 (section II)	**812 – 1,450**	**11**

The values of the sliding gear wheel positions 1 – 3 are available on request.

Preferably use **the marked** setting ranges.

Default setting unless ordered otherwise!

a) For output speed of 5 – 50 rpm, the factory setting is section III.

b) For output speed of 80 – 160 rpm, the factory setting is section II.

How to proceed

During setting, proceed as follows:

1. If the desired turns/stroke ratio was available on delivery, the actuator has been correctly set in the factory.
2. Determine output rotations per travel (e.g. output speed **per minute** multiplied by operating time **in minutes**).
3. Determination of section II or III set in the factory. Determine output speed (e.g. by name plate designation on the actuator name plate e.g. D 60 A-40 = 40 rpm).
   Section III set: Actuators with output speed 5 – 50 rpm
   Section II set: Actuators with output speed 25 – 160 rpm

Alternative determination:

Move sliding gear [3] to position 1. Apply approx. 13 handwheel turns while observing the mechanical position indicator (if available). If the rotation angle detected exceeds 150°, section III has been set, otherwise section II.

4. Set the reduction gearing according to the calculated value by re-positioning the sliding gear wheel in accordance with the tables on the setting options [▶ 33].

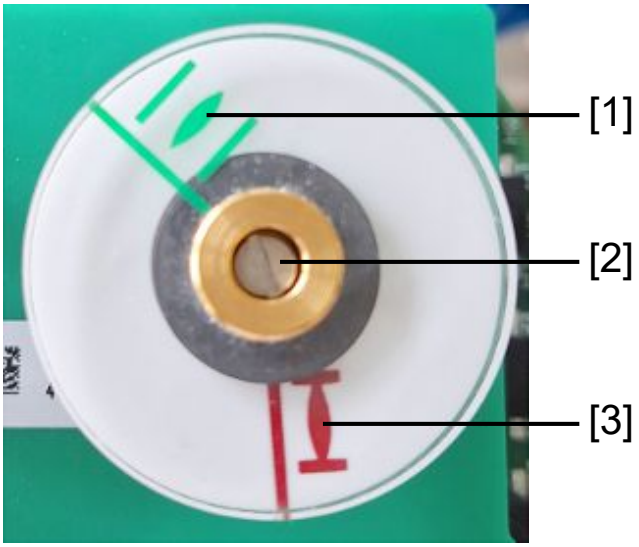
Table 7: Setting options for the reduction gearing for part-turn actuators

Additional gearing	SQ	SQ	SQ
Size	DP 75 – DP 450	DP 600 – DP 900	DP 1200 – DP 1800
Swing angle	90°	90°	90°
Reduction ratio	5.5	11	25.3
Number of teeth LS module	II/45:15	II/45:15	II/45:15
turns/stroke min	1.375	2.75	6.325
Sliding gear wheel position	2	1	2
Turning angle α cam shaft	177.5	214.5	271.3
Modulation in %	59.1	71.5	90.4

10.1.4 Setting the mechanical position indicator

The figure below shows the components of the mechanical position indicator.

Figure 22: Mechanical position indicator



[1] Adjustable disc for position OPEN
[2] Transit screw
[3] Adjustable disc for position CLOSED

Turn the indication elements to adjust the mechanical position indicator. Both discs can be turned against each other 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 is set higher than approx. 270° or lower than approx. 90° for the selected travel, check the setting at the reduction gearing below and adjust, if required (refer to Setting the reduction gearing [▶ 33]).

10.1.5 Setting the analogue position value

On delivery, 4 mA (usually end position CLOSED) are set. The following is required for setting the position transmitter:

- Set end positions CLOSED/OPEN via limit switches (refer to Setting the limit positions [▶ 31])
- Operate actuator to end position CLOSED
- Set reduction gearing
- The 4 mA value can be set via the potentiometer R1 (refer to [7] Base board DMC-02.8 [▶ 25]), if required. For this, connect a multimeter to terminals X1:23 and X1:24 and set 4 mA.
- Loosen the limit sensor locking by unscrewing the transit screw (refer to [5] Limit switching module [▶ 23]) until a slight sluggishness due to screw locks can be felt.
- Operate actuator to end position OPEN and use potentiometer R2 (refer to [7] Base board DMC-02.8 [▶ 25]) to set the 20 mA value.
- Operate actuator back to end position CLOSED, verify the 4 mA and correct using potentiometer R1 if required.

NOTICE

Complete removing of the transit screw will destroy the thread of the mounting plate.

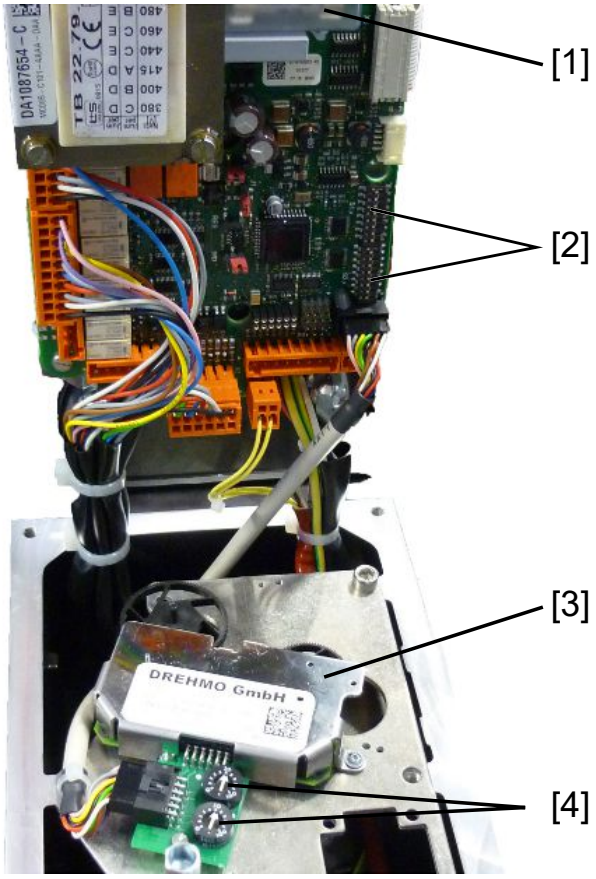
→ Only loosen transit screw until sluggishness can be felt.

NOTICE

If the screw is not loosened, the actuator mechanics of the sensor potentiometer might be damaged.

10.2 Version with combined sensor

Figure 23: Actuator variant with combined sensor



[1]	Setting the power supply for the controls	[2]	DIP switches for parametrisation
[3]	Combined sensor	[4]	Potentiometer for setting the torques in directions OPEN and CLOSE

10.2.1 Setting the limit positions

To set the limit positions, change integral controls to LEARN mode. For this, press and hold down LEARN push button. Then set switch S1 to LEARN. After approx. 10 seconds, the LEDs for the limit positions on the local controls (local lamps) start to blink and the LEARN push button may be released. For setting a limit position, hold down the respective direction switch/push button while holding down the LEARN push button. Once the limit position has been set, the pertaining LED on the local controls will stop blinking and remains statically illuminated. Now, the actuator can be operated to the other limit position (without leaving the commissioning mode).

If the actuator signals reaching a limit position although it has not yet been mechanically reached (this will be the case after 180 revolutions at the latest), this limit position can be deleted. This is done like setting a limit position by operating the respective direction switch/push button while holding down the LEARN push button. Thus, the preset range of the combined sensor is extended by 90 revolutions and the previously statically illuminated LED should now blink.

Once the mechanical end position has been reached, the respective end position can be set by operating the respective direction switch/push button while holding down the LEARN push button.

NOTICE

The commissioning mode has also been reached if only one LED of the local controls blinks and the second LED is statically illuminated!

→ The actuator is in the limit position which is indicated by the statically illuminated LED.

→ Delete limit position and proceed with setting the limit positions as described above.

10.2.2 Deleting both limit positions

To delete both limit positions at once, change to the commissioning mode and hold down the LEARN push button for 30 seconds. The LEDs of the local controls will blink for 10 seconds and will go out after a further 20 seconds. Once the LEDs go out, the LEARN push button can be released. The combined sensor is thereby set to 50 % travel with a stroke of ±90 revolutions.

10.2.3 Setting the analogue position value

The analogue position values, 4 mA for position CLOSED and 20 mA for position OPEN, are automatically adjusted once the two end positions have been set. Perform possible corrections via potentiometer R1 (EM6) for position CLOSED and via potentiometer R2 (EM6) for position OPEN. The two potentiometers are located on the AD converter DMC-27 [▶ 27] fitted on the local controls.

NOTICE

Readjustment of the analogue output signal for devices with combined sensor by the potentiometers R1 and R2 on board DMC-27.

→ R1 predominantly influences the offset (4 mA value), R2 predominantly the amplification of the analogue output signal (20 mA-value). The analogue output signal has been set to 4 – 20 mA in the factory and must therefore not be adjusted under standard conditions.

10.2.4 Setting the torques

The tripping torques are set in % of the max. actuator torque via potentiometers R9 and R10 assigned to the combined sensor. Values below 30 % are not permitted.

Figure 24: Combined sensor DMC

[1] Potentiometer R10 for torque in direction OPEN

[2] Potentiometer R9 for torque in direction CLOSE

Table 8: Adjustable tripping torques (example of DMC 500)

DMC 500		Torque setting
Clockwise rotation	**%**	**Counterclockwise rotation**
150 Nm	30	150 Nm
250 Nm	50	250 Nm
375 Nm	75	375 Nm
500 Nm	100	500 Nm

11 Parametrisation of the c-matic controls

To perform settings for the actuator behaviour, the c-matic controls are equipped with DIP switches and a jumper field. Note that the number of DIP switches to be used depends on the integral controls.

11.1 Arrangement of LEDs, potentiometers and push buttons

The base board DMC-02.7 was replaced by version DMC-02.8. The differences are explained below. Note the new design of the jumper field and the changed fuses F4 and F5. In addition, the plug of the serial interface is located on top of the board as of version DMC-02.8.

Figure 25: Board design up to DMC-02.7

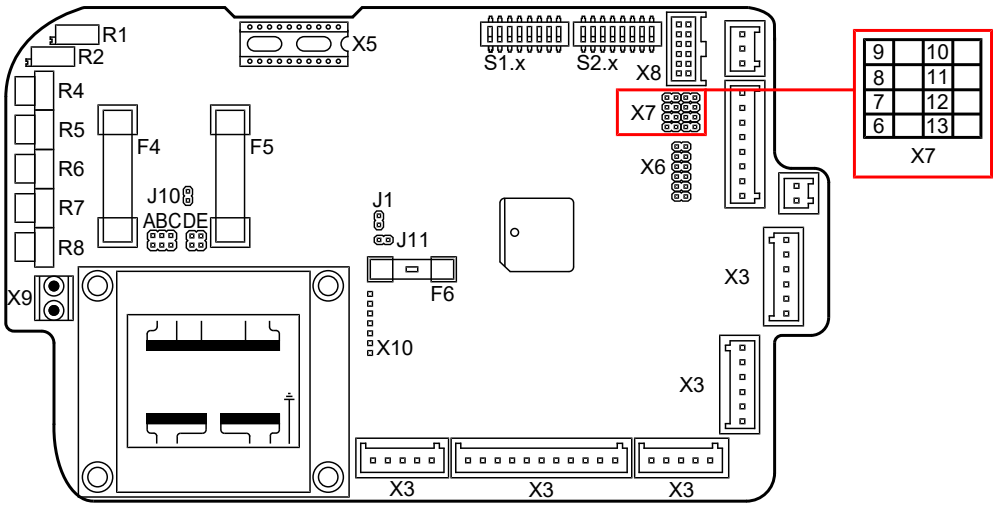
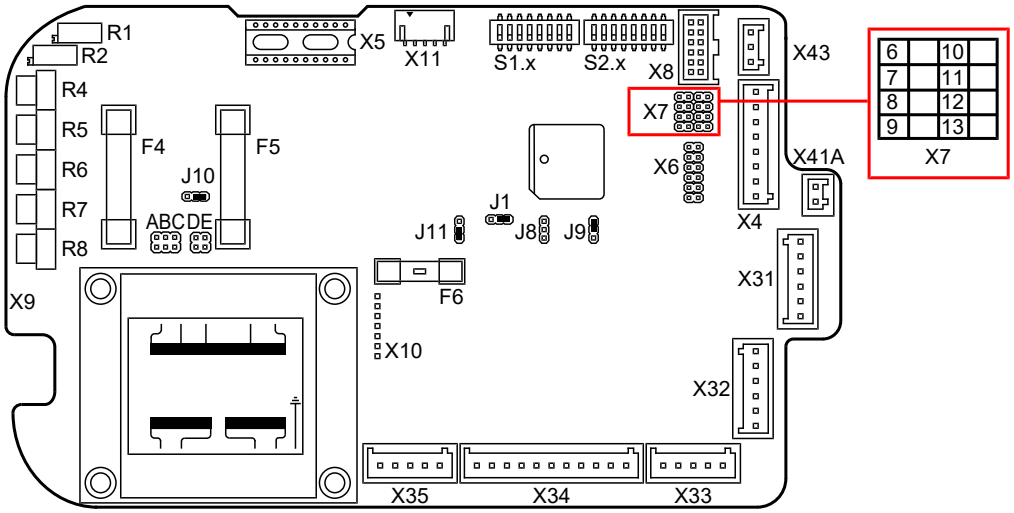


Figure 26: Board design from DMC-02.08



11.2 Potentiometer

DMC-02	R1	Zero point for 4 – 20 mA adjustment for the limit switching module. For the combined sensor, the respective potentiometers are located on the DMC-27.
	R2	Amplification for 4 – 20 mA adjustment for the limit switching module. For the combined sensor, the respective potentiometers are located on the DMC-27.
	R4	XP (version 005)/intermediate position 1 (version 004)
	R5	Safe position (version 005)/intermediate position 2 (version 004)
	R6	Stepping mode
	R7	Timer ON
	R8	Timer OFF
Combined sensor	R9	Setting of tripping torque for direction CLOSE (in front of combined sensor)
	R10	Setting of tripping torque for direction OPEN (in front of combined sensor)

11.3 LEDs

DMC-02	H0	Pending emergency shutdown (for firmware version V02.10 and higher)
	H1	End position OPEN
	H2	End position CLOSED
	H3	Seating OK (torque signal)
	H4	Actuator OK (motor overtemperature, phase sequence detection)
	H5	Intermediate position 1
	H6	Intermediate position 2
	H7	Internal flashing clock signal -> microcontroller OK
	H8	Timer start
	H9	Timer indication pulse pause
DMC-12	H10	Local lamp for fault indication
	H11	Local lamp for end position CLOSED
	H12	Local lamp for end position OPEN

11.4 Fault signals and diagnostics plan (extract)

H1	H2	H3	H4	Stroke s in mA	Signal	Possible cause/remedy
0	0	X	X	4 < s < 20	Intermediate position	
1	0	X	X	20	End position OPEN	
0	1	X	X	4	End position CLOSED	
X	X	1	X		Seating OK	
X	X	0	X		Torque seating	Valve jammed Tripping torque set too low Final position incorrect
X	X	X	1		Actuator OK	
X	X	X	0		Motor overtemperature	
X	X	X	B		Problems with phase sequence detection	

11.5 Connectors

DMC-02 (base board)	X1, X2	Customer connection, compact plug
	X3	Customer signals on DMC (to X1)
	X4	Limit switch connection/torque switch connection
	X5	Connector to local controls
	X6	Connector to interface board, Com1
	X7	Connector for jumpers (refer to Jumper TR (to X7) [▶ 42])
	X8	Connector to combined sensor with connected potentiometer board
	X10	Control for power unit
DMC-09 (local controls board)	X11	Connection for DC/DC converter
	X12	Connection for extensions
	X13	Connection for external local controls (option)

11.6 DIP switches S1.1 to S1.8 on DMC-02

Switches	OFF	ON
S1.1	Push-to-run operation for external command	• Without integral positioner (S2.8 = OFF): Self-retaining for external command • With integral position controller (S2.8 = ON) reduced end position dead band (for firmware version 02.09 and higher)
S1.2	Limit seating in position OPEN	Torque seating in position OPEN
S1.3	Limit seating in position CLOSED	Torque seating in position CLOSED
S1.4	With 3 second torque bypass from end position CLOSED in direction OPEN	Without torque bypass from end position CLOSED in direction OPEN
S1.5	With 3 second torque bypass from end position OPEN in direction CLOSE	Without torque bypass from end position OPEN in direction CLOSE
S1.6	“Selector switch position LOCAL” signal	“Selector switch position LOCAL or position 0” signal
S1.7	“Running OPEN/Running CLOSE” signal, blinking	“Running OPEN/Running CLOSE” signal, static
S1.8	Collective failure with torque failure	Collective failure without torque failure

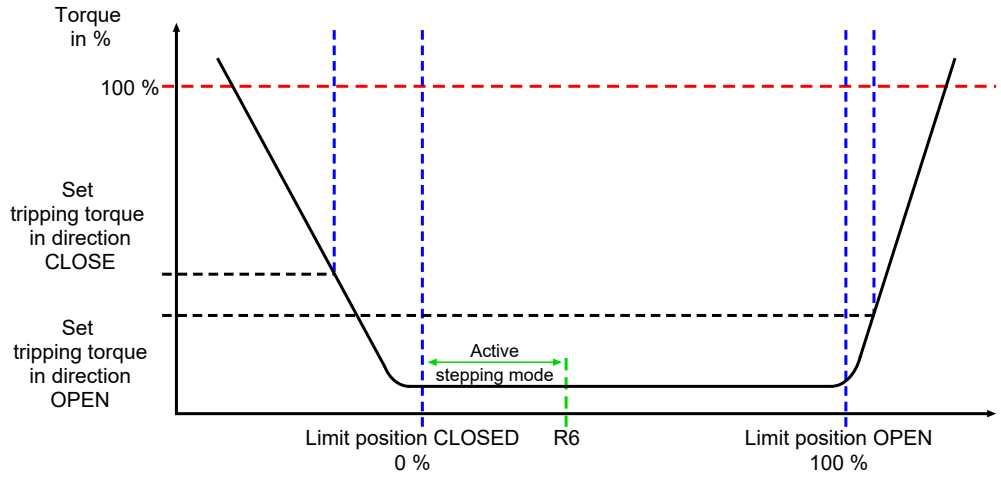
When activating the torque bypass, the torque monitoring is deactivated and the actuator tries to operate the valve at maximum torque (stall torque).

11.7 DIP switches S2.1 to S2.8 on DMC-02

Switches	OFF	ON
S2.1	Limit/torque switches	Combined sensor
S2.2	Directional torque indication	Non-directional torque indication (series connection) in direction OPEN or direction CLOSE
S2.3	No torque indication in end positions	Torque indication in end positions
S2.4	For push-to-run operation: Push-to-run operation also in the end positions	Self-retaining in the end positions (according to type of seating)
S2.5	End position signalling only in the final positions	End position signalling according to type of seating
S2.6	Collective failure for motor temperature > max. without delay	Like for OFF, but delay by 5 s, for UPS at least 1 s fixed
S2.7	Approach fail safe position for setpoint fault	Stop for setpoint fault
S2.8	Open-close actuator	Modulating actuator (only possible if an integral positioner is available)

For additional information refer to the illustration below.

Figure 27: Torque indications



11.8 DIP switches S3.1 to S3.8 on DMC-09

Switches	OFF	ON
S3.1	Stepping mode in direction OPEN deactivated	Stepping mode in direction OPEN activated
S3.2	Stepping mode in direction CLOSE deactivated	Stepping mode in direction CLOSE activated
S3.3	Start stepping mode according to setting of potentiometer R6	Start stepping mode via logic signal from special E1 (refer to terminal plan)
S3.4	Constant stepping mode	Degressive stepping mode
S3.5	Default fault signal according to S1.8 [▶ 41]	Fault signal according to S1.8 [▶ 41] and selector switch not in position Remote
S3.6	No torque bypass from intermediate position	1 second torque bypass from intermediate position
S3.7	Intermediate position signal (version 004)	Motor temperature too hot signal (in addition to fault signal)
S3.8	Clockwise closing valve (for combined sensor only)	Counterclockwise closing valve (for combined sensor only)

When activating the torque bypass, the torque monitoring is deactivated and the actuator tries to operate the valve at maximum torque (stall torque).

11.9 DIP switches S5.1 to S5.2 on DMC-27 for MCxx3/5 with combined sensor

Switches	OFF	ON
S5.1	Unlimited position signal	Position signal limited to 0 – 100 %
S5.2	reserved	

11.10 Jumper TR (to X7)

		Jumper open	Jumper inserted
TR6	Enabling local controls	Not enabled	Enabled
TR7	Enabling local controls	High active	Low active
TR8	Emergency shutdown function	Not enabled	Enabled
TR9	Emergency shutdown in position	CLOSED	OPEN
TR10	Differentiated local fault signal via red LED 10	Like collective fault output contact	Blinking for torque failure Static for motor overtemperature
TR11	Profibus protocol	Running OPEN/Running CLOSE	Intermediate positions 1 and 2
TR12	Emergency shutdown	High active	Low active

		Jumper open	Jumper inserted
TR13	Emergency shutdown	Only in REMOTE	In all operation modes

11.11 Jumpers J1, J8 and J9

	Position 1, 2	Position 2, 3
J1	24 V redundant: from internal and external	24 V exclusively from external
J8	Manual reset of the watchdog	Park position
J9	Use of the watchdog	Park position

Jumper J8 must always be plugged in the park position for standard operation.
Jumper J9 must always be plugged in position 1, 2.

11.12 Enabling local controls

The local controls can be disabled by an external signal (special E2). This function is activated by jumper TR6. Jumper TR7 is used to defined whether enabling is activated by a high signal (24 Volt) or a low signal (0 Volt). For enabled local controls, the local lamps OPEN and CLOSED will be blinking alternately.

11.13 Emergency shutdown

⚠WARNING

Accidental startup of the motor during maintenance tasks (even in operation mode OFF)!

Accidental operation of the mounted valve. Risk of personal injury and property damage.

→ If the actuator is operated from a central control room, inform the control room about pending tasks to be performed on the actuator.

Emergency shutdown is activated by setting jumper TR8. If jumper TR12 is connected, emergency shutdown is low active. This means, when cancelling the 24 Volt signal, (special E1), the actuator starts the emergency shutdown. Jumper TR9 defines whether the actuator runs in direction CLOSE or OPEN. Jumper TR13 defines whether emergency shutdown is only executed in operation mode REMOTE or in all operation modes (including OFF).

Since the emergency shutdown can be started any time, proceed with care during maintenance on the actuator.

11.14 Differentiated local fault signal

If jumper TR10 is connected, LED H10 blinks for torque fault. For motor overtemperature, LED H10 is continuously illuminated. If jumper TR10 is not connected, LED H10 will be continuously illuminated when a fault is present.

11.15 Stepping mode function (option)

R6	Stepping range left end stop 0 % stroke (position CLOSED) Stepping range right end stop 100 % stroke (position OPEN)
R7	Timer ON left end stop 0,5 s, right end stop 30 s
R8	Timer OFF left end stop 0,5 s, right end stop 30 s
H8	Timer start
H9	Indication of pulse-pause ratio

When looking at the integral controls from the handwheel side (integral controls not folded up), the following applies to the positions of the potentiometer:

at twelve o'clock position	10 % of the setting range
at three o'clock position	50 % of the setting range
at six o'clock position	90 % of the setting range

The setting of Timer ON and Timer OFF is implemented via R7 and R8. The set pulse-pause ratio is indicated via diode H9. For the arrangement of the elements refer to Arrangement of LEDs, potentiometers and push buttons [▶ 39].

If degressive stepping mode is activated by means of the switch S3.4, the time T-ON will be reduced from the set value (startup) to the minimum values with the stepping range. However, the time T-OFF is retained at the set value. Thus, the operating time is prolonged depending on the direction of rotation and the switches S3.1 and S3.2.

The time stages will expire before a newly set time is indicated. The active stepping range can be selected using R6. Left end stop (11 o'clock) corresponds to setting CLOSED, right end stop (7 o'clock) to position OPEN.

NOTICE

Heed the duty type restrictions!

→ Heed limit values according to Types of duty for different versions [▶ 49].

11.16 Positioner (option)

The positioner is activated via the AUTOMATIC input (refer to terminal plan Mcxx5...). The local controls switch must be in position REMOTE. If AUTOMATIC is not active, the actuator can be operated from Remote via operation commands OPEN/CLOSE. By comparing the position setpoint (4 – 20 mA) and the actual position value, the 3-point positioner determines the modulating tolerance. If this tolerance exceeds a certain Xp range which can be set with potentiometer R4, an internal operation command for reducing the modulating tolerance is generated. The Xp range can be continuously adjusted between 0.5 % and 5 % of the measuring range.

The following applies: Actual value = setpoint ± Xp x 0.5

When setting the Xp range (R4) make sure that it is not set unnecessarily sensitive (small). In cases in which the setpoint is subject to major variations, the Xp range should be set as large as reasonable. To ensure operation into the end positions in any case, the actuator interprets the target values of approx. 0 – 4 % and 96 – 100 % (refer to DIP switches S1.1 [▶ 41]) as command to run to the respective end position. Modulation is not possible within these ranges.

11.17 Intermediate positions of the MC004 version

Via setting potentiometers R4 and R5 (refer to Arrangement of LEDs, potentiometers and push buttons [▶ 39]), the intermediate positions 1 and 2 within the range of 0 % (4 mA) to 100 % (20 mA) of the stroke can be set.

11.18 Uninterruptible power supply USP

This equipment option delays the drop of the output contact by a least one second once the power supply of the integral controls has failed.

12 Servicing and maintenance

In this section, information is provided to be followed for maintenance, cleaning and disposing of DREHMO actuators.

12.1 Maintenance

We recommend participation in the regular training 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

Leaking of the actuator due to excessive lubricant!

→ The actuators are lubricated for life.

→ A fixture for permanent stem lubrication (output drive type A and A-HP) can be requested from the manufacturer.

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

Check open-close actuators 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 an actuator test run every 6 months.

Apply Klüber Isoflex Topas NB5051 to the sealing faces between the housing parts.

For technical questions, please contact the service. Have the serial number ready. The serial number can be found on the actuator name plate. Only have defective actuators overhauled in the factory of the manufacturer or an authorised workshop.

12.2 Troubleshooting and corrective actions

A functional test is required after corrective maintenance. Commissioning of actuator/valve must be performed if tripping parameters, valve or additional gearing have been changed.

The following table lists possible faults and pertaining remedies.

Table 9: Faults and remedies

Possible cause	Action
Motor voltage too low or not available or one phase is missing	Check mains
Incorrect setting of limit or torque switches	Verify settings
Motor temperature monitoring has tripped	Check running time, ambient temperature and load
Motor defective	Arrange for repair
Required valve torque is higher than actuator sizing torque	Verify required torque
Actuator has reached the end position and still runs in the same direction	Check rotary direction of actuator
Specified ambient temperature range is not respected	Respect temperature range, possibly special sizing required
Voltage drop on the supply cable is too high	Verify dimension of the cross section.

12.3 Replace fuses of the supply voltage of the integral controls

DANGER

Electric shock due to the presence of hazardous voltage!

Death or serious injury.

→ Disconnect from mains before opening.

→ Only replace fuses when not live.

Prior to replacing the fuses, disconnect actuator from the mains. Replace defective safety fuses F4/F5 within the actuator with commercial fuses (refer to Technical data overview [▶ 48]). The fuses are located below the transparent cover next to the transformer.

12.4 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. Actuators for ambient temperatures ranging from –25 °C to +70 °C are filled with oils according to the table below. The indicated oil filling applies to open-close and modulating actuators.

CAUTION

Impermissible heating up of actuator by oil leakage.

Reduced life, irreversible damage to the gearing and the components possible.

→ The seals of the actuator must be replaced in case of leakage.

→ Refill the correct quantity of oil.

Table 10: Oil filling

Actuator type	Quantity [l]	Oil type
DPMC(R) 75…1800	1.4	Shell Tellus S2 VX 68
DMC(R) 30/59	1.4	Shell Tellus S2 VX 68
DMC(R) 60/120/249	2.4	Shell Tellus S2 VX 68
DMC(R) 250/500/1000	3.2	Shell Tellus S2 VX 68
DMC(R) 250/500/1000[1)] Speed [rpm @ 50 Hz]: 81, 121, 161, 201	3.7	Shell Tellus S2 VX 68
DMC(R) 250/500/1000[1)] Speed [rpm @ 60 Hz]: 97, 145, 193	3.7	Shell Tellus S2 VX 68
DMC 2000[1)]	9	Shell Omala S2 GX 100

1) Applies to actuators with planetary gearing and brake motor.

For other temperature ranges, the oil filling may deviate. The pertaining data can be requested from the manufacturer.

Ensure leak tightness of the device by inspections at regular intervals. Pay special attention to the following issues:

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

12.5 Cleaning

Clean the actuator using conventional soap solutions (alkaline solutions). To avoid heat accumulation or excessive surface temperatures, motor cooling fins must never be covered.

NOTICE

Residues of conductible foreign particles within the actuator!

→ Use of compressed air for cleaning the actuator is not permitted.

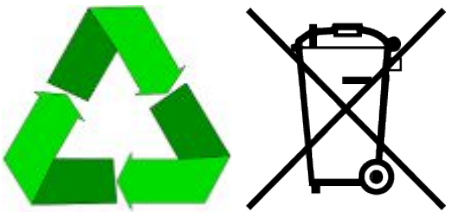
Warning instructions on the device must neither be removed nor covered by paint!

Use of any cleaning agents inside the actuator is not permitted. Any contamination may be removed using lintless cloths free of any contamination. Use of compressed air is not permitted.

12.6 Disposal

During decommissioning and disassembly of actuators, 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.
- Heed the national regulations for waste disposal.

13 Technical data

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

13.1 Contact and water protection

The enclosure protection (IP...) is marked on the name plate of the actuator. In the standard version, the actuator is suitable for outdoor installation. It is completely protected against dangerous contact, ingress of dust and harmful ingress of water for temporary immersion in water (enclosure protection IP68 (5 m for 24 hours) in compliance with EN 60529/IEC 60529). Further IP enclosure protection types are available on request as options.

NOTICE

Enclosure protection not guaranteed!

→ Ensure use of proper cable glands while observing the enclosure protection and the cable diameters.

→ Seal unused cable entry openings with suitable screw plugs.

→ For K5 corrosion protection, use plastic cable glands to prevent damage to the protection layer.

13.2 Technical data overview

Table 11: Technical data overview

Rated voltage	Refer to indications on motor name plate in V ±10 %.
Rated current consumption	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 strength	Overvoltage class II according to EN 61010-1
Electrical connection	Determine cable cross section on the basis of motor data, cable length and the regional regulations! Compact plug/socket connector Ø100 mm: (available cross sections) Signal cables: up to 2.5 mm^2 Power: up to 6 mm^2 Compact plug/socket connector Ø150 mm: (available cross sections) Signal cables: 0.5 mm^2 – 2.5 mm^2 Power: 0.5 mm^2 – 2.5 mm^2 0.5 mm^2 – 6 mm^2 (option) 1.5 mm^2 – 16 mm^2 (option)
Fuses	F4/F5 500 V/1 A/T/6.3 x 32 mm (Article number: K002.277) for DMC-2.8 500 V/1 A/T/5 x 30 mm for DMC-2.7 F6 250 V/1.6 A/T/5 x 20 mm (Article number: K008.276) F10 250 V/0.8 A/T/5 x 20 mm (Article number: 133940)
Contact rating Overvoltage category I	Max. 230 V AC 0.3 A, 30 V DC 2 A (resistive load) Voltage: 5 – 30 V Current: 4 – 400 mA/U x I ≤ 0,12 VA (gold-plated contacts)
Electrical load	≤ 300 Ω
Motor temperature class	Refer to indications on name plate
Ambient temperature range	Refer to indications on name plate in °C
Enclosure protection	Refer to indications on name plate
Pollution degree	Within the actuator, pollution degree 1 (IEC 60664-1). Outside the actuator, pollution degree 2

Vibration	The actuators are designed for a vibration range of 10 – 100 Hz with 2 g (high cross-over frequency according to IEC 600068-2-6).
Installation altitude	≤ 1,000 m above sea level > 1,000 m above sea level on request

NOTICE

Deviating cross sections for fieldbus interfaces!

→ In combination with a fieldbus interface, there might be restrictions with regard to the cable cross sections and the contact load. For more detailed information, refer to the operation instructions of the respective fieldbus interface.

13.3 Types of duty for different versions

It is imperative to heed the types of duty even if the running times per valve cycle (OPEN and CLOSED) exceed the limited operating times. The type of duty depends upon the temperature range on the actuator name plate. Type of duty S2 - xx min (short-time duty) for multi-turn actuators and S4 - xx % (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. Once this time has expired, the actuator has to pause until it has cooled down to ambient temperature +2 Kelvin. In S4 type of duty, 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).

Modulating actuators with solid state relay are generally limited to a maximum of 1,200 starts per hour. For reversing contactors to 300 c/h (refer to EN 60034-1). Multi-turn actuators are limited to max. S4 - 25 % on-time.

⚠CAUTION

Excessive temperature when exceeding the max. permissible number of starts!

Reduced life, irreversible damage to the gearing and the components possible.

→ The maximum number of starts must not exceed 1,200 c/h for modulating applications. Depending on the actuator type and the ambient temperature range, it is imperative to heed the restriction indicated on the name plate.

⚠CAUTION

Failure to observe the operation modes!

Reduced life, irreversible damage to the gearing and the components possible.

→ Adhere to any restrictions (refer to name plate) applicable for the actuators.

⚠CAUTION

Pulling loads

→ A brake motor is used for the following actuators:
D 250/500/1000
- Speed [rpm @ 50 Hz]: 81, 121, 161, 201
- Speed [rpm @ 60 Hz]: 97, 145, 193
D 2000 all speeds

→ For TB motors:
The brake including connection is designed as spring-applied brake. Stopping for pulling loads can be guaranteed up to a torque effective at the output drive of 300 Nm.

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

13.4 Weights and maximum tripping torques

In the table below, weights, speeds and maximum run torques of the actuators are indicated.

Table 12: Technical data

Actuator type	Output speed in rpm or operating speed in s/90° at 50 Hz	Maximum run torque in Nm	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 249[1)]	120	100	33.5
DMC 250	5 – 50	125	69.5
DMC 250	80 – 160	125[2)]	69.5
DMCR 250	5 – 40	125	69.5
DMC 500	5 – 80	250	80.5
DMC 500	120	250[2)]	80.5
DMC 500	160	200[2)]	80.5
DMCR 500	5 – 40	200	80.5
DMC 1000	5 – 50	500[2)]	90.5
DMC 1000	80	400[2)]	90.5
DMCR 1000	5 – 10	500	90.5
DMC 2000	40 – 80	1,000	220
DMC 2000[3)]	160	300	220
DPMC(R) 75	8 – 34	33.5	38
DPMC(R) 150	8 – 34	75	38
DPMC(R) 299	8 – 34	150	38
DPMC(R) 300	8 – 34	150	40
DPMC(R) 450	8 – 34	225	40
DPMC(R) 600	8 – 67	300	46
DPMC(R) 900	8 – 67	450	46
DPMC 1200	7 – 75	600	51
DPMC(R) 1200	18 – 75	600	51
DPMC 1800	7 – 75	900	51
DPMC(R) 1800	18 – 75	900	51

1) 200 Nm maximum tripping torque.

2) For these devices, the gearing heats up more than the motor. The heating up is not detected by the actuator. It is therefore imperative to heed the maximum run torque and the type of duty.

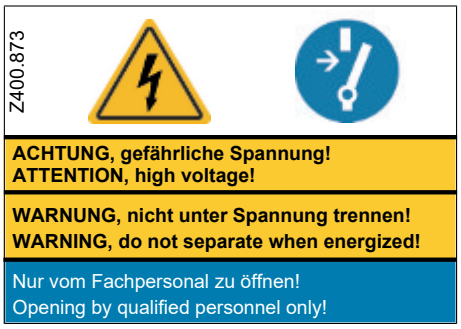
3) For this version, the maximum tripping torque is restricted to 1,000 Nm.

14 Externally fixed notes

Warning and service instructions, which must be visibly attached to the actuator for the entire lifetime, are listed in this chapter. It is not permitted to apply a top coat on these warnings.

Figure 28: Label with address of the manufacturer

Figure 29: Label with warning of hazardous voltage



15 Certificates

The following chapter contains the Declarations of Conformity and Incorporation and any further certificates if applicable for the actuator type range described in these operation instructions.

NOTICE

The printed documents are up to date to the date of publication of these operation instructions.

→ The latest version of the respective document can be downloaded from our website www.drehmo.com.

Refer to

EU Declaration of Conformity [▷ 53]

DREHMO GmbH
Zum Eichstruck 10
57482 Wenden/Germany

DREHMO
VALVE ACTUATORS

CE

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	Matic C	i-matic
D(R) 30 - D(R) 2000	DMC(R) 30 - DMC(R) 2000	DiM(R) 30 - DiM(R) 2000
DP(R) 75 - DP(R) 1800	DPMC(R) 75 - DPMC(R) 1800	DPiM(R) 75 - 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/AC2005
EN 61000-6-4:2007/A1:2011
EN 61000-3-2:2014[1)]
EN 61000-3-11:2000[1)]

[1)] Matic C and i-matic

Low Voltage Directive (2014/35/EU)

EN 61010-1:2010
EN 60034-1:2010/AC: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 complied.

Person responsible for documentation:
Dr. Rüdiger Stenzel, Zum Eichstruck 10, 57482 Wenden/Germany

Wenden, 2022-01-01

K. Ewald, General Manager

This declaration does not imply an assurance of properties. The safety precautions in the supplied product documents are to be observed. This declaration shall lose its validity in the event of unauthorised modification of the equipment.

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