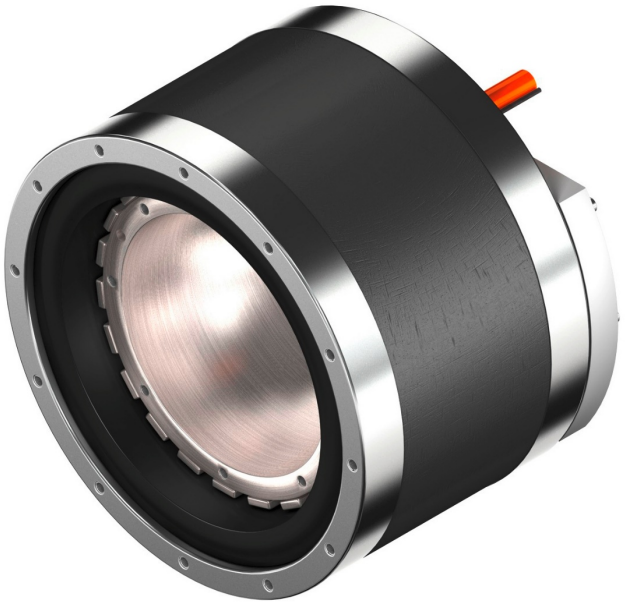
HIWIN®



Assembly instructions

DMR Torque Motor

DMR-01-0-EN-2110-MA

www.hiwin.de

Imprint

HIWIN GmbH

Brücklesbünd 1

D-77654 Offenburg, Germany

Phone +49 (0) 7 81 9 32 78-0

Fax +49 (0) 7 81 9 32 78-90

info@hiwin.de

www.hiwin.de

Contents

1 General

1.1 About these assembly instructions

1.1.1 Requirements

We assume that

- OperatingOperating personnel are trained in the safe operation of the industrial robot and have read these assembly instructions and understood their contents in full,Operating personnel are trained in the safe operation of the torque motors and torque motor components and have read these assembly instructions and understood their contents in full
- Maintenance personnel maintain and repair the robot in such a way that it presents no danger to personsthe environment or property.Maintenance personnel maintain and repair the torque motors and torque motor components in such a way that it presents no danger to persons, the environment or property

1.1.2 Availability

Ensure that these assembly instructions are available at all times to persons working on or with the torque motors and their components.

1.2 Presentation and layout conventions used in these assembly instructions

1.2.1 Instructions for actions

Instructions for actions are provided in sequential order and identified with a triangle symbol. The results of the actions are accompanied by a tick symbol.

Example:

- ▶ Position torque motor on mounting holes.
- ▶ Insert mounting bolts into mounting holes and tighten in spiral sequence with a torque of 10 Nm.
- ✓ The torque motor is mounted.

1.2.2 Lists

Lists are identified through the use of bullet points.

Example:

Torque motors and their components must not be operated in the following areas:

- Outdoors
- In areas where there is a risk of explosion
- …

1.2.3 Presentation of safety information

Safety information is always indicated by a signal word and sometimes with a hazard-specific symbol (see section 1.2.4 Symbols used).

The following signal words/hazard levels are used:

⚠ **Danger!** Immediate danger!

Failure to follow this safety instruction will result in severe or fatal injury!

⚠ **Warning**! Potentially dangerous situation!

Failure to follow this safety instruction could result in severe or fatal injury!

⚠ **Attention!** Potentially dangerous situation!

Failure to follow this safety instruction could result in moderately severe or minor injury!

Caution! Potentially dangerous situation!

Failure to follow this safety instruction could result in damage to property or the environment!

1.2.4 Symbols used

The following symbols are used in these assembly instructions and on the components:

Warning symbols			
	Warning of dangerous electrical voltage!		Warning of hot surfaces!
	Warning of magnetic fields!		Warning of crushing risk!
	Environmentally hazardous substance!		

Instruction symbols			
	Wear safety gloves!		Release prior to work!

Note:

Provides general information and recommendations.

1.3 Warranty and liability

The manufacturer's "General Terms and Conditions of Sale and Delivery" apply.

1.4 Manufacturer information

Address	HIWIN GmbH Brücklesbünd 1 77654 Offenburg, Germany
Telephone	+49 (0) 781 / 9 32 78 - 0
Technical customer service team	+49 (0) 781 / 9 32 78 - 77
Fax	+49 (0) 781 / 9 32 78 - 90
Technical customer service team fax	+49 (0) 781 / 9 32 78 - 97
E-mail	info@hiwin.de
Internet	www.hiwin.de

1.5 Product monitoring

As the manufacturer of the torque motor components, please inform HIWIN of:

- Accidents
- Potential risks involving the torque motors
- Any unclear information in these assembly instructions

2 Basic safety information

⚠ **Warning**! Danger due to strong magnetic fields!

Strong magnetic fields in the vicinity of the torque motor components (if the rotor is supplied separately or the rotor and stator are supplied separately) pose a health hazard to persons with implants that can be influenced by magnetic fields (e.g., pacemakers).

- Persons with implants that can be influenced by magnetic fields must keep a safety distance of at least 0.3 m from the torque motor components!

Caution! Danger of property damage!

Strong magnetic forces can destroy watches and magnetisable data carriers in the vicinity of the torque motor components.

- Do not bring watches and magnetisable data carriers within close range (<100 mm) of the torque motor components!

2.1 Proper use

The torque motors are electrical components and are intended exclusively for installation in machines in commercial and industrial areas.
Torque motors are part of rotative drive systems for the exact, time-controlled positioning of permanently mounted loads, such as system components, in an automated system.
The torque motors are designed for installation and operation in any position. The loads to be moved must be fixed into position on the rotor.
The torque motor components must not be used outdoors or in hazardous areas where there is a risk of explosions.
The torque motors components may only be used as described for the intended purpose.

- Torque motors may only be operated within their specified performance limits (see “Torque motors” catalogue).
- For safe operation of torque motors, suitable safety precautions must be taken to protect the motor against overload.
- The assembly instructions and the maintenance and servicing instructions must be complied with for the intended use requirement of the torque motors to be complied with.
- Any other use of the torque motor components is considered improper use.
- Only original spare parts from HIWIN GmbH may be used.

2.2 Reasonably foreseeable misuse

Torque motors and their components must not be operated in the following areas:

- Outdoors
- In areas where there is a risk of explosion

2.3 Conversions or modifications

Conversions or modifications to the torque motors and their components are not permitted!

2.4 Residual risks

No residual risks emanate from the torque motor components during normal operation. Dangers that may arise during commissioning, maintenance and servicing are specified in the respective chapters.

2.5 Requirements for personnel

Only instructed personnel or qualified personnel may carry out work on the torque motor components! They must be familiar with the safety equipment and regulations before they start work (see Table 2.1).

Table 2.1: Requirements for personnel

Activity	Qualifications
Commissioning	Qualified personnel of the operator or manufacturer
Normal operation	Instructed personnel
Cleaning	Instructed personnel
Maintenance	Qualified personnel of the operator or manufacturer
Servicing	Qualified personnel of the operator or manufacturer

2.6 Safety equipment

Table 2.2: Personal protective equipment

Operating phase	Personal protective equipment
Commissioning	The following personal protective equipment is required when standing or working near the torque motor components: ○ Safety shoes
Normal operation	The following personal protective equipment is required when standing or working near the torque motor components: ○ Safety shoes
Cleaning	The following personal protective equipment is required when cleaning the torque motor components: ○ Safety shoes
Servicing and maintenance	The following personal protective equipment is necessary during maintenance and servicing: ○ Safety shoes

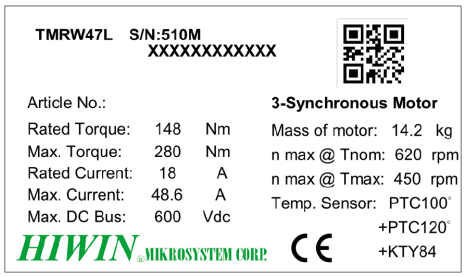
2.7 Markings on the torque motor components

2.7.1 Warning symbols

Pictograms	Type and source of danger	Protective measure
	Danger due to strong magnetic fields!	Persons whose health is endangered by strong magnetic fields must keep a safety distance of 1 m from the torque motor components!
	Danger due to electric shock!	Disconnect the torque motor components from the power supply before servicing or maintenance!
		
	Danger due to hot surfaces!	Before touching hot surfaces, let them cool down!

2.7.2 CE label on type plate

Fig. 2.1: Type plate



3 Description of torque motor components

3.1 Application

Torque motors are part of rotative drive systems for the exact, time-controlled positioning of permanently mounted loads, such as system components, in an automated system.

The torque motors are designed for installation and operation in any position. The loads to be moved must be fixed into position on the rotor.

The torque motors are supplied as built-in components. When delivered, the rotor and stator are secured by assembly claws.

3.2 Structure of torque motor components

Stator:

The cooling channels of the outer ring are omitted in the stators of the DMR motors. The inner ring also consists of the motor plates and the windings cast in epoxy resin.

Rotor:

The rotor of DMR motors is made of nickel-plated steel with rare-earth magnets. The rotor is mounted on the rotating part of the customer machine.

Fig. 3.1: Structure of torque motors

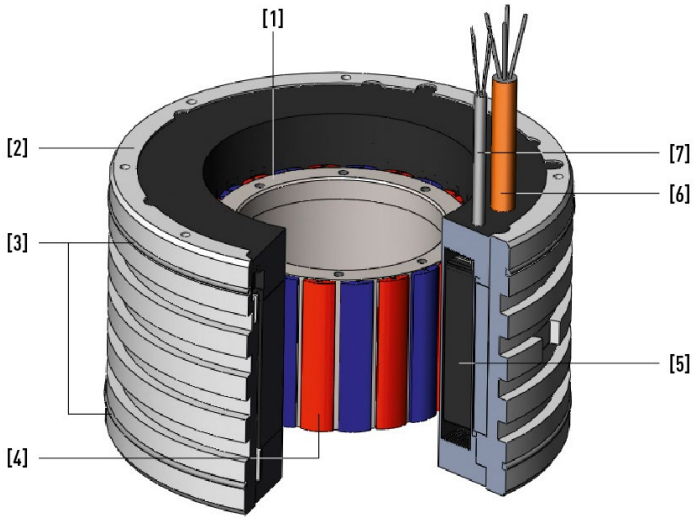


Table 3.1: Main parts of a torque motor

Number	Description
1	Rotor
2	Stator
3	Groove for O-ring
4	Rare-earth magnets
5	Motor winding
6	Motor cable
7	Temperature sensor cable

3.3 Functional description

The torque motors of the DMR series are ready-to-install motor elements consisting of stator and rotor. They are similar in structure to an internal rotor. The rotor is designed as a ring element. Due to their power density, they enable high accelerations and thus short cycle times. They are 3-phase servo motors with a large number of poles.

3.3.1 Properties

- Brushless drive
- Hollow shaft rotor
- Wear-free
- High power density
- Maintenance-free

3.3.2 Advantages

- High efficiency
- Extremely dynamic
- Low maintenance costs
- Compact installation dimensions
- Simple control

Note:

It is important to ensure high rigidity between torque transmission and the recording of the controlled variable (generally distance measurement) when a direct drive is integrated.

Note:

Resonances within the bandwidth of the control loop impair performance, as the drive is backlash-free.

3.3.3 Specifications of torque motor components

Table 3.2: DMR torque motors

Model	Outer diameter [mm]	Continuous torque [Nm]	Peak torque [Nm]	Built into HIWIN rotary table (see “Rotary tables” catalogue)
DMR03	110	3.5	10.5	TMS0
DMR14	150	11.3	33.8	TMS1
DMR18	150	22.5	67.5	TMS1
DMR32	193	10.0	30.0	TMS3
DMR34	193	20.0	60.0	TMS3
DMR38(L)	193	40.0	120.0	TMS3
DMR3C(L)	193	60.0	180.0	TMS3
DMR74	291	50.0	150.0	TMS7
DMR76(L)	291	75.0	225.0	TMS7
DMR7C(L)	291	150.0	450.0	TMS7

4 Transport and setup

4.1 DMR delivery

⚠ **Warning**! Danger of crushing due to strong attraction forces!

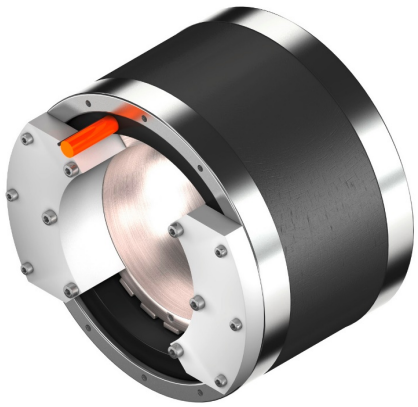
Risk of injury due to crushing and damage to the rotor or stator due to very strong attraction forces with unpacked rotors.

- Ensure that the assembly claws are not released until the rotor and the stator are fixed in placed with a bearing!
- If the rotor is supplied separately, you must be aware of the strong magnetic fields!

4.1.1 Delivery condition

The DMR torque motors are usually pre-assembled when delivered. To avoid damage during transport, the rotor is fixed in the stator with assembly claws (see Fig. 4.1).

Fig. 4.1: DMR torque motor with assembly claws



4.1.2 Packaging

The torque motor components are wrapped in foil on delivery and are situated in a padded cardboard outer packaging.

- Do not remove the foil wrapping until immediately before installation.

4.1.3 Scope of delivery

- Rotor secured in the stator via assembly claws
- Stator without cooling ducts (DMR) and motor and temperature sensor cable with open cable ends
- Type plate
- Safety notes

Separate delivery of the rotor is possible.

4.2 Transport to the installation location

⚠ **Warning!** Danger due to strong magnetic fields!

Strong magnetic fields in the vicinity of the torque motor components (if the rotor is supplied separately or the rotor and stator are supplied separately) pose a health hazard to persons with implants that can be influenced by magnetic fields (e.g., pacemakers).

- Persons with implants that can be influenced by magnetic fields must keep a safety distance of at least 0.3 m from the torque motor components!

Caution! Danger of property damage!

Strong magnetic forces can destroy watches and magnetisable data carriers in the vicinity of the torque motor components.

- Do not bring watches and magnetisable data carriers within close range (<100 mm) of the torque motor components!

Caution! Possible damage to the torque motor components!

Torque motor components can be damaged by mechanical stress.

- Do not transport any additional loads on the torque motor components during transport!
- Secure torque motor components against tipping before transport!

Note:

There are no magnetic fields in the vicinity of components in their original packaging.

- Transport torque motor components to the installation site using suitable lifting equipment (observe weights, see appendix).
- Ensure even load distribution when lifting.

4.3 Installation location requirements

4.3.1 Environmental conditions

Ambient temperature	+ 5 °C up to + 40 °C
Installation location	level, dry, vibration-free
Atmosphere	non-corrosive, non-explosive

4.3.2 Safety equipment to be provided by the operator

Possible safety equipment/measures:

- Personal protective equipment according to UVV
- Electrosensitive protective equipment
- Mechanical safety equipment

4.4 Storage

⚠ **Warning!** Danger due to strong magnetic fields!

Strong magnetic fields in the vicinity of the torque motor components (if the rotor is supplied separately or the rotor and stator are supplied separately) pose a health hazard to persons with implants that can be influenced by magnetic fields (e.g., pacemakers).

- Persons with implants that can be influenced by magnetic fields must keep a safety distance of at least 0.3 m from the torque motor components!

Note:

There are no magnetic fields in the vicinity of components in their original packaging.

- Store torque motors in the transport packaging.
- Do not store the torque motor in an explosive atmosphere or in an environment contaminated with chemicals.
- Store torque motor components only in dry, frost-free rooms with a non-corrosive atmosphere.
- Make sure that the motors are not exposed to vibrations or impacts during storage.
- Clean and protect used torque motor components before storing.
- The ambient temperature when storing the motors is between -10 and +50 °C.
- Attach warning signs of magnetic fields when storing the components.

4.5 Unpacking and setup

Caution! Possible damage to the torque motor components!

Torque motor components can be damaged by mechanical stress.

- Do not transport any additional loads on the torque motor components during transport!
- Secure torque motor components against tipping before transport!

Note:

The torque motors must be set up and operated indoors only.

- Remove protective film.
- Carefully transport components to the intended installation site.
- Ensure that the maintenance points are freely accessible.
- Dispose of packaging in an environmentally-safe manner.

5 Assembly and connection

⚠ **Danger!** Danger due to electrical voltage!

Dangerous currents may flow before and during assembly, disassembly and repair work.

- Work may only be carried out by qualified electricians when the device is de-energised!
- Before working, disconnect the torque motor from the power supply and secure it against being switched on again!

⚠ **Warning**! Danger of crushing due to strong attraction forces!

Risk of injury due to crushing and damage to the rotor or stator due to very strong attraction forces with unpacked rotors.

- Ensure that the assembly claws are not released until the rotor and the stator are fixed in placed with a bearing!

⚠ **Attention!** Danger from suspended loads or falling parts!

Lifting heavy loads can cause damage to health!

- Use appropriately dimensioned lifting equipment for positioning heavy loads!
- Comply with the applicable industrial safety regulations for handling suspended loads.

Note:
Assembly of the torque motor components only by qualified personnel.

Note:
Do not use spacers, washers or similar in the assembly of the torque motors.

Note:
Suitable position measurement must be integrated for a closed control loop.

Note:
For safe operation of torque motors, suitable safety precautions must be taken to protect the motor against overload.

5.1 Requirements for the adjacent construction

5.1.1 Rotor

In order to rule out the possibility of motor malfunction due to the influence of the magnets, a gap of approx. 1 mm should be maintained between the adjacent construction and the magnets. In Table 5.1, you will also find the maximum values for the outer and inner diameters of the adjacent construction as well as the requirements for the flatness of the mounting surface.

Fig. 5.1: Rotor with adjacent construction

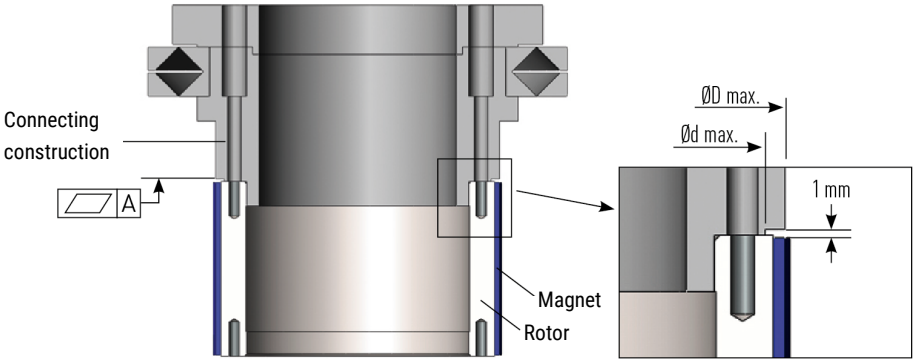


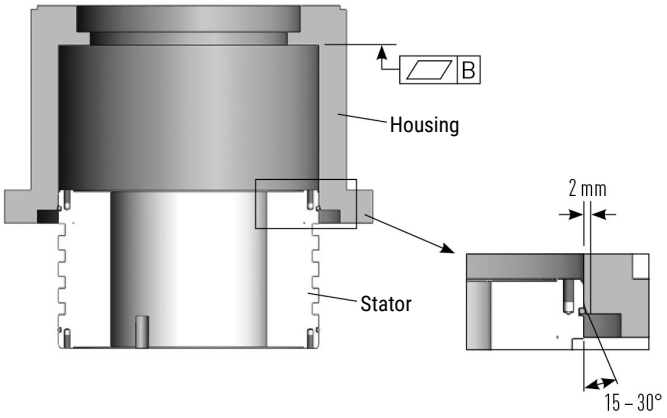
Table 5.1: Requirements when mounting the rotor – DMR

Motor type	ØD [mm]	Ød [mm]	Flatness A [mm]	Flatness B [mm]
DMR0X	57.0	48.5	0.05	0.05
DMR1X	83.5	73.0	0.05	0.05
DMR3X	136.0	127.0	0.05	0.05
DMR7X	232.0	220.0	0.10	0.10

5.1.2 Stator

The recommended values for the tolerance of the inner diameter of the housing (and the mounting holes of the stator) is H7. For the values for the flatness of the stator mounting surface, please refer to Table 5.1 (flatness B).

Fig. 5.2: Stator with housing



5.1.3 Rotor – stator concentricity

When installing HIWIN torque motors, care must be taken to ensure maximum concentricity between the stator and rotor. Tolerance values for the axle offset are between ± 0.1 mm.

5.1.3.1 Radial forces between rotor and stator

Concentricity deviations create radial forces between the stator and the rotor.

Fig. 5.3: Illustration of the radial forces arising in the event of concentricity deviations between stator and rotor

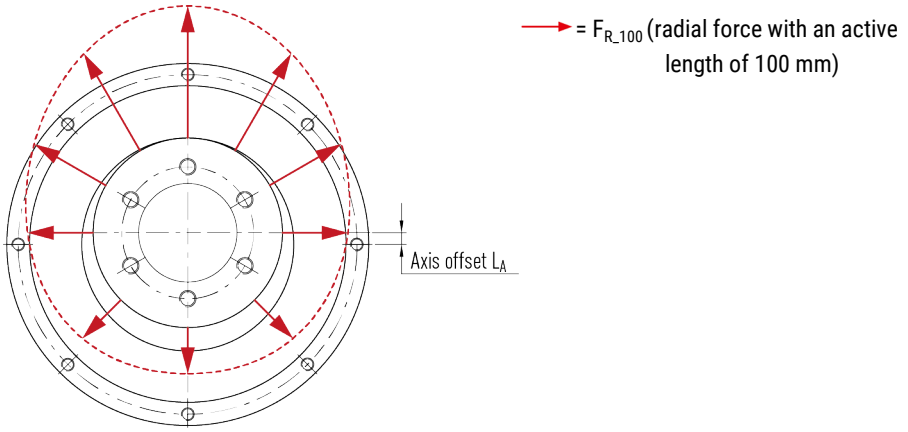


Table 5.2: Overview of radial forces for a torque motor with an active length of 100 mm

Series	F_{R_100} [N/mm]
DMR0X	1,346
DMR1X	1,787
DMR3X	1,878
DMR7X	2,121

For torque motors with other active lengths, the radial force can be calculated using the following formula:

$$\text{Radial force} = F_{R100} \text{ x } \frac{\text{L (mm)}}{100 \text{ mm}} \text{ x } \frac{\text{LA (mm)}}{1 \text{ mm}}$$

F_{R_100} Radial force with an active length of 100 mm [N]

L_A Axis offset [mm]

L Active length of sheet metal pack

(For values see Table 5.3)

Table 5.3: Active length L of DMR series

Series	Active length L [mm]
DMR_2	20.0
DMR_3	32.5
DMR_4	40.0
DMR_6	60.0
DMR_8	80.0
DMR_C	120.0

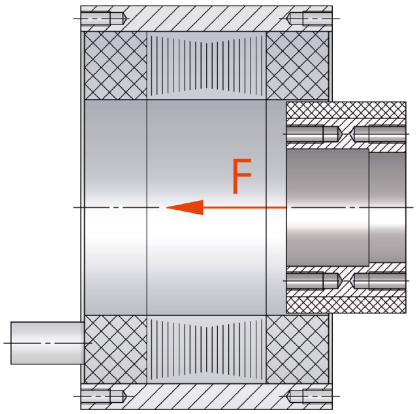
Example calculation of the radial forces of a DMR_2 with a concentricity deviation of 0.1 mm:

$$\text{Radial force} = 3{,}574 \text{ N x } \frac{20 \text{ mm}}{100 \text{ mm}} \text{ x } \frac{0.1 \text{ mm}}{1 \text{ mm}} = 71.48 \text{ N}$$

5.1.3.2 Axial forces between stator and rotor

When the rotor is inserted into the stator, axial forces of 10 N per magnet are generated between the two components. These forces arise independently of the axial position of the rotor in the stator.

Fig. 5.4: Illustration of the axial forces between stator and rotor



5.2 Installation of torque motor

Torque motors can be mounted in two ways:

- The stator and rotor are mounted together. By default, the assembly claws are located on the side of the motor cable outlet. At the customer's request, the assembly claws can also be fitted on the other side.
- The stator and rotor are mounted one after the other. For this purpose, an insertion aid is constructed on the basis of the customer's mechanics.

The procedure for both methods is described below using the example of a DMR torque motor.

5.2.1 Joint assembly of stator and rotor

⚠ **Warning**! Danger due to strong magnetic fields!

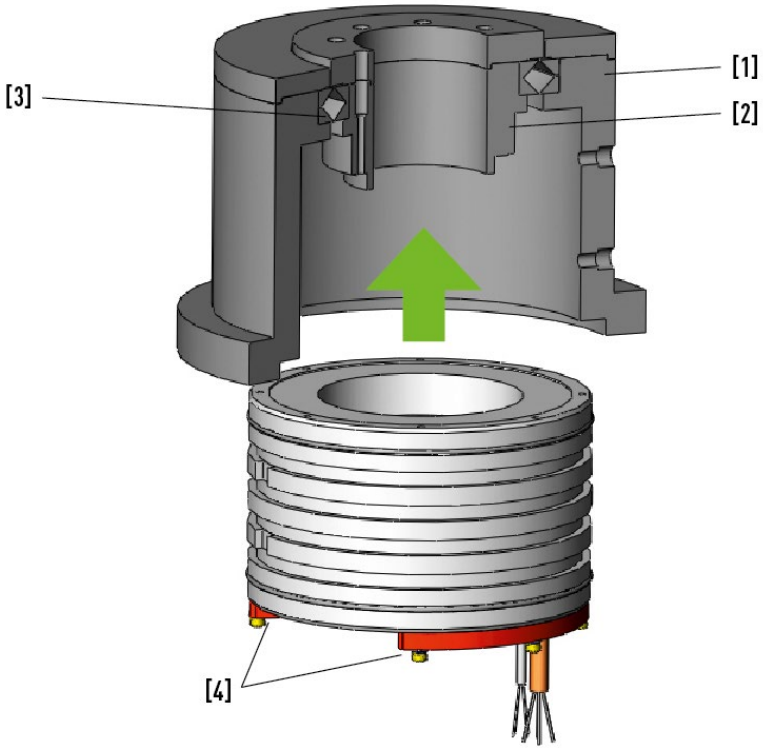
Strong magnetic fields in the vicinity of the torque motor components (if the rotor is supplied separately or the rotor and stator are supplied separately) pose a health hazard to persons with implants that can be influenced by magnetic fields (e.g., pacemakers).

- Persons with implants that can be influenced by magnetic fields must keep a safety distance of at least 0.3 m from the torque motor components!

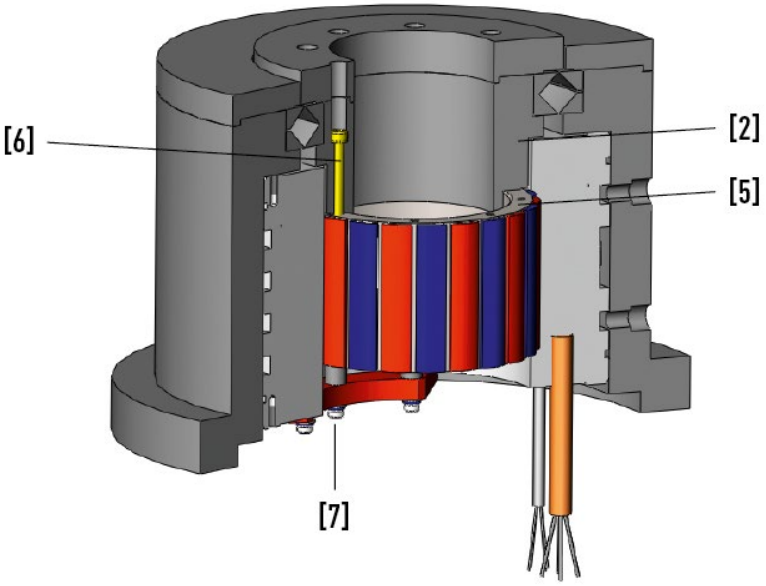
⚠ **Warning**! Danger of crushing due to strong attraction forces!

Risk of injury due to crushing and damage to the rotor or stator due to very strong attraction forces with unpacked rotors.

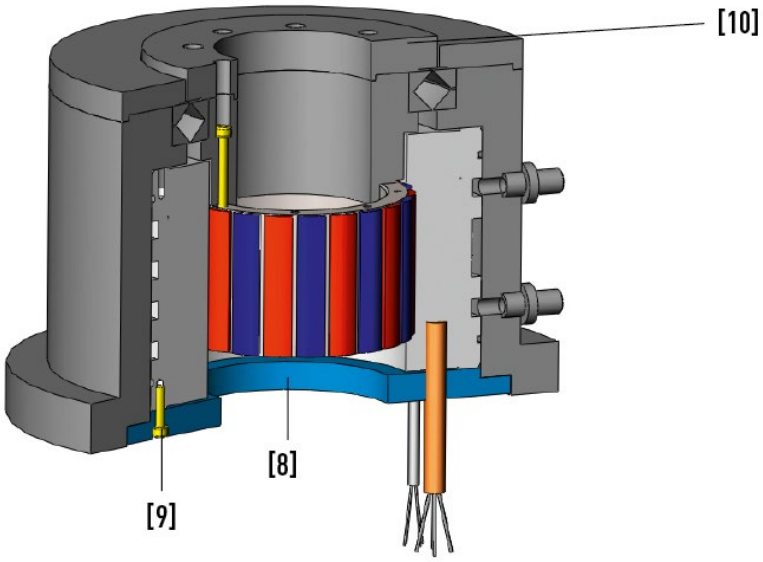
- Ensure that the assembly claws are not released until the rotor and the stator are fixed in placed with a bearing!



- Mount the housing **[1],** adjacent construction **[2]** and bearing **[3].**
- Place the stator (with assembly claws **[4]**) in the housing. Make sure that the coolant inlets and outlets are aligned flush with the outlet of the motor cable. Also make sure not to damage the O-rings to prevent leaks. See also section 5.1.2 Stator.



- Fasten the rotor **[5]** to the adjacent construction **[2].** Observe the tightening torques for the mounting bolts **[6]** (see Table 5.4).
- Undo the screws **[7]** of the assembly claws and remove the claws **[4]**.



- Install the base plate **[8]** and tighten the mounting bolts **[9]** of the stator. Observe the tightening torques for the mounting bolts (see Table 5.4).
- Move the turntable **[10]** to check whether the rotor rotates smoothly and without interference.
- Assemble the remaining parts, such as the encoder.
- ✓ The torque motor is mounted.

5.2.2 Separate assembly of stator and rotor with an insertion aid

⚠ **Warning**! Danger due to strong magnetic fields!

Strong magnetic fields in the vicinity of the torque motor components (if the rotor is supplied separately or the rotor and stator are supplied separately) pose a health hazard to persons with implants that can be influenced by magnetic fields (e.g., pacemakers).

- Persons with implants that can be influenced by magnetic fields must keep a safety distance of at least 0.3 m from the torque motor components!

⚠ **Warning**! Danger of crushing due to strong attraction forces!

Risk of injury due to crushing and damage to the rotor or stator due to very strong attraction forces with unpacked rotors.

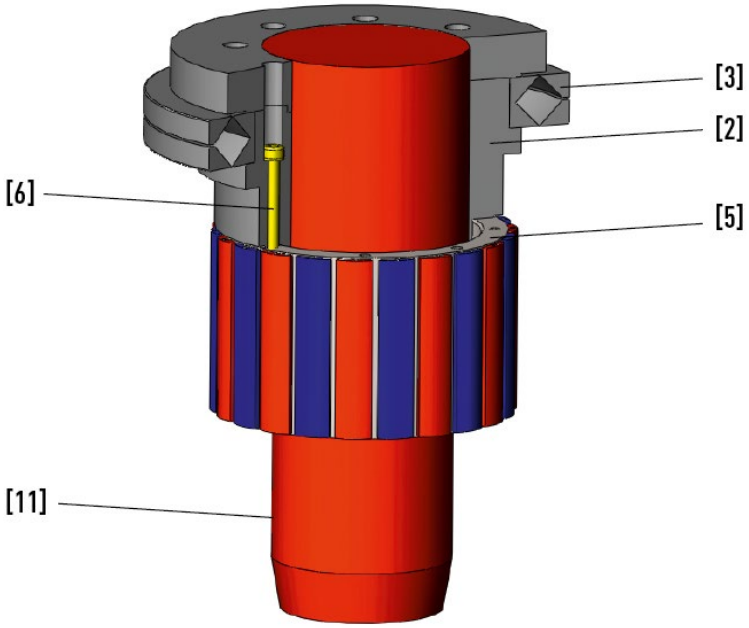
- Ensure that the assembly claws are not released until the rotor and the stator are fixed in placed with a bearing!

Requirements for the insertion aid:

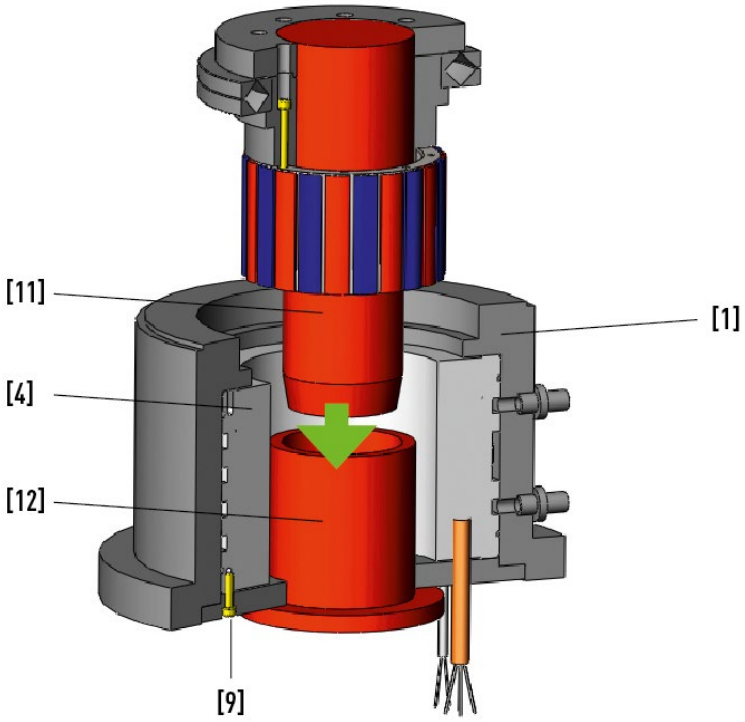
- The insertion aid is provided by the customer.
- The insertion aid consists of two parts, the mandrel and the insertion sleeve.
- The insertion aid must absorb the attraction forces of the magnets.
- The insertion aid must absorb the tilting moments created by the magnets. **Guidance must be ensured before the tilting moments occur**, therefore the length of the insertion aid must be greater than the height of the rotor.
- The insertion aid should slide easily, the recommended fit pairing is H7/f7.

Note:

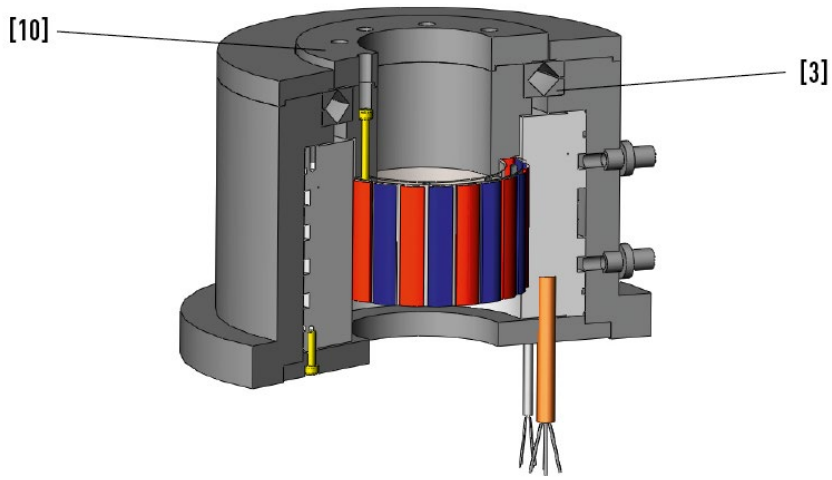
The rotor must be fitted with the mandrel before assembly in order to absorb the magnetic attraction forces between the rotor and stator and to rule out other assembly problems.



- Assemble the adjacent construction **[2],** and bearing **[3].**.
- Assemble the rotor **[5]** to the adjacent construction. Observe the tightening torques for the mounting bolts **[6]** (see Table 5.4).
- Fasten the mandrel **[11]** to the adjacent construction.



- Put the stator in the housing **[1]** and tighten the mounting bolts **[9]**. Observe the tightening torques for the mounting bolts (see Table 5.4).
- Assemble the insertion sleeve **[12]** on the lower side of the adjacent construction.
- Assemble the rotor by inserting the mandrel **[11]** into the insertion sleeve **[12]**.



- Fix the bearing **[3]** and remove the insertion aid **[11/12]**.
- Move the turntable **[10]** to check that the rotor rotates smoothly and without interference.
- Assemble the remaining parts, such as the encoder.

✓ The torque motor is mounted.

5.2.3 Tightening torque for mounting bolts for rotor and stator

We recommend mounting bolts of strength class 12.9 for the motor and stator. In Table 5.4, you will find information on the number and type of mounting holes and the recommended tightening torques.

Table 5.4: Tightening torques of mounting bolts – DMR

Motor type	Mounting hole		Number of mounting holes		Tightening torque [Nm]	
	Rotor	Stator	Rotor	Stator	Rotor	Stator
DMR03	M5 × 10DP	M4 × 8DP	6	8	8	4
DMR14 DMR18	M5 × 10DP	M4 × 8DP	6	8	8	4
DMR32 DMR34 DMR38(L) DMR3C(L)	M8 × 15DP	M5 × 15DP	8	18	25	8
DMR74 DMR76(L) DMR7C(L)	M8 × 15DP	M5 × 15DP	8	18	25	8

5.3 Electrical connection and protection against overload

⚠ **Danger!** Danger due to electrical voltage!

If the torque motor is not properly earthed, there is a risk of electric shock.

- Make sure that the torque motor is properly earthed via the PE rail in the control cabinet before connecting the electrical power supply!

⚠ **Danger!** Danger due to electrical voltage!

Electrical currents can also flow when the motor is not moving.

- Make sure that the torque motor is disconnected from the power supply before disconnecting the electrical connections of the motors!
- After disconnecting the drive amplifier from the power supply, wait at least 5 minutes before touching live parts or loosening connections!
- To be on the safe side, measure the voltage in the intermediate circuit of the drive amplifier. Wait until it has dropped below 40 V!

⚠ **Warning**! Danger of injury and damage to property!

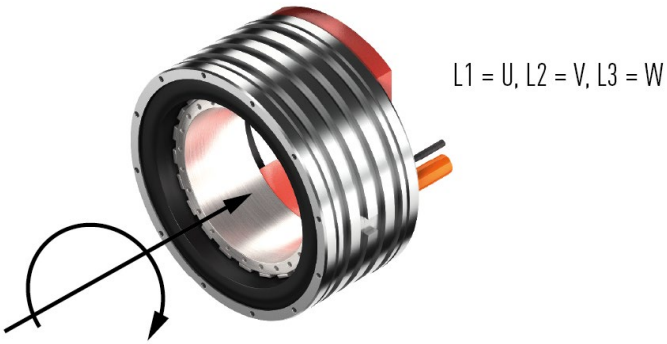
If the motor is overloaded, it can overheat and catch fire.

- Provide a safety device on the control unit and hardware side to protect the motor against overload!
- Connect PTC temperature sensors which issue warnings and switch off the system in case of overload!
- Connect PT1000 or KTY84 sensors to monitor temperature!
- Use of an I^2t model in the drive amplifier or the higher-level control unit for time limitation of currents above I_N!

5.3.1 Direction of rotation

If the motor cable is connected according to Table 5.4, the direction of rotation of the rotor is clockwise (view towards the rotor side without cable exit)

Fig. 5.5: Illustration of direction of rotor rotation



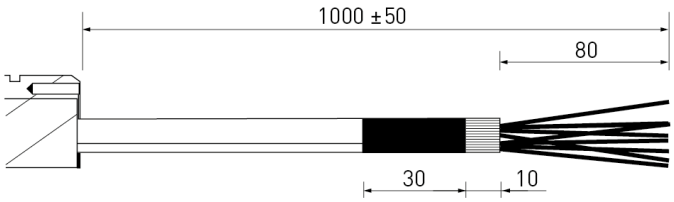
5.3.2 Motor and temperature sensor cable specifications

Note:

Maximum length of the motor and temperature sensor cable: 8 m.

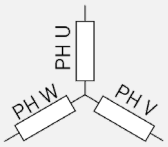
Suitable filters against voltage peaks must be used for longer cables.

Fig. 5.6: DMR motor and temperature sensor cable



IGUS Chainflex CF27 cables with UL and CE label are used:

Table 5.5: Motor cable wire structure

Colour	Number	Signal	Function	Diagram
Black-1	L1	PH U	Motor phase	
Black-2	L2	PH V	Motor phase	
Black-3	L3	PH W	Motor phase	
Green/yellow	Protective earth/ground		GND	

The cable size depends on the continuous current of the motor and can be found in the following tables.

Table 5.6: Motor cable cross-section and outer diameter

Cable cross-section [mm²]	Outer diameter [mm]	Motor type
4 × 1.5	10.5	DMR0X, DMR1X, DMR3X, DMR7X

Table 5.7: Temperature sensor cable

Motor	Cable type	Number and cable cross-section	Outer diameter [mm]
DMR	CF240	4 × 0.25 mm²	5.5

5.3.3 Function and connection of the temperature sensors

5.3.3.1 Temperature monitoring and motor protection

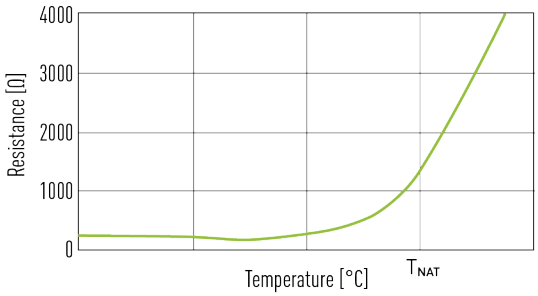
To protect the motor windings from thermal destruction, each motor is equipped with a PTC drilling, type SNM120 (according to DIN 44082-M180). Since the heating of the individual motor phases can be very different in direct drives, a PTC is mounted in each phase winding (U, V and W). The PTC element has a “quasi-switching” characteristic. This means that in the range of the nominal response temperature (switching threshold), the resistance increases abruptly (Fig. 5.7). Due to its low heat capacity and good thermal contact with the motor winding, the PTC reacts very quickly to a rise in temperature and, in conjunction with additional protective mechanisms on the control side, ensures reliable motor protection against overload. The PTCs in each phase winding of HIWIN motors are connected in series and the connection is led out via two wires.

Note:

Protecting the motor solely by means of temperature monitoring using PTC elements may be insufficient. This is the case, for example, when the motor is operated with currents above I_N.

HIWIN advises the use of additional protective measures on the control side here, such as I^2t monitoring for the time limitation of currents above I_N.

Fig. 5.7: Characteristic curve of PTC sensors (T_{NAT} = nominal response temperature)



5.3.3.2 Temperature measurement

The inverter has the option of adapting the temperature-dependent motor parameters to the measured motor temperature. To determine the current motor temperature, it is common to integrate a PTC thermistor in the motor.

The PTC thermistor is placed between two phase windings in the motor. If overtemperature occurs in a phase winding that is not monitored, this cannot be displayed or evaluated immediately. Furthermore, the characteristic of the PTC thermistor shows sluggish behaviour compared to the PTC, which is not sufficient for fast shutdown.

Note:

Evaluation of the PTC thermistor for the purpose of motor protection is not permitted.

Fig. 5.8: Temperature sensors: Standard DMR

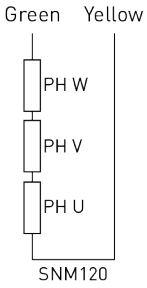
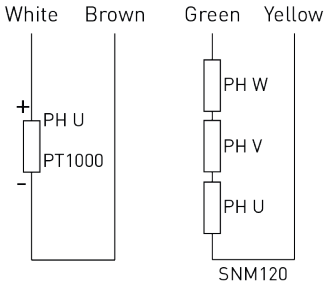


Fig. 5.9: Type B temperature sensors: Optional special version for DMR



Note:

The PTCs do not have a linear characteristic curve and are therefore not suitable for determining the current motor temperature.

Note:

Connection of the PTC is mandatory to protect the motor.

5.3.3.3 Connection to the drive amplifier

The temperature monitoring circuits can normally be connected directly to the drive control. If the specifications of the protective separation according to EN 61800-5-1 are to be fulfilled, the sensors must be connected to the decoupling modules offered by the drive manufacturers.

5.3.4 Power supply for drive amplifier – typical values

Note:
Observe the assembly instructions for the drive amplifier used.

- The minimum cross-section of the mains supply cable is based on the local regulations (see VDE 0100 part 523, VDE 0298 part 4), the ambient temperature and the required nominal voltage of the drive amplifier.

Table 5.8: Typical values for the power supply

Amplifier nominal current [A]	Connected load [kVA]	Max. cable cross-section of the clamping elements [mm^2]	Recommended fuse (gL) [A]
4.0	1.7	2.5	1 × 10
5.5	2.3	2.5	1 × 16
5.7	4.2	2.5	3 × 10
10.0	7.3	2.5	3 × 16
17.0	12.4	4.0	3 × 25

6 Commissioning

6.1 Switching on torque motor

⚠ **Warning**! Danger of injury and damage to property!

If the motor is overloaded, it can overheat and catch fire.

- Provide a safety device on the control unit and hardware side to protect the motor against overload!
- Connect PTC temperature sensors which issue warnings and switch off the system in case of overload!
- Connect PT1000 or KTY84 sensors to monitor temperature!
- Use of an I^2t model in the drive amplifier or the higher-level control unit for time limitation of currents above IN!

⚠ **Attention!** Risk of burns!

Motor heating can cause burns if the motor is touched!

- Provide protective device and warnings on the motor!

Caution! Danger of property damage!

Uncontrolled movements of the rotor in the event of a power failure can cause property damage!

- Make sure that suitable end stops are fitted to the end positions or that the parking brake (optional) is activated.

Note:

On the operator's side, a control unit in accordance with DIN EN ISO 12100 must be provided to prevent unintentional start-up of the machine after energy has been restored, a fault has been rectified or the machine has stopped.

- Switch off control unit.
- Remove motor cable.
- If applicable, connect the cable of the distance measuring system.
- Switch on control unit.
- If necessary, check the distance measuring system (see separate assembly instructions for drive amplifier and distance measuring system).
- Switch off control unit.
- Connect motor cable (see chapter 5.3).
- Switch on control unit.
- Carry out a trial run at a slow speed.
- Carry out a trial run under operating conditions.

✓ The torque motor is ready for operation.

6.2 Programming

Note:

The programming of the torque motor depends on the control unit used and the drive amplifier. Observe the assembly instructions of the control unit and drive amplifier.

Please observe the technical data of the respective motor data sheet (see “Torque motors” catalogue) and ensure that these have been correctly interpreted according to the assembly instructions of the control unit and drive amplifier.

The limit values specified in the motor data sheet, especially for current and temperature, must be strictly observed.

To ensure safe operation and protection of the motor, additional parameters may need to be set depending on the control unit and drive amplifier used. Responsibility for correct commissioning and protection of the motor in application lies with the personnel entrusted with commissioning.

For questions regarding commissioning, please contact the manufacturer of the control unit and the drive amplifier.

7 Maintenance and cleaning

⚠ **Warning**! Unauthorised maintenance of the system

Unauthorised work on the unit may cause injury and invalidate the warranty.

- Have the system serviced by qualified personnel only!

Note:

Only use suitable media that are not dangerous for humans. Observe the manufacturer's safety data sheets.

For maintenance work

- Secure the torque motor against unauthorised switch-on.
- De-energise the torque motor.
- Secure the torque motor against unauthorised restart.

Note:

Ensure that the permissible ambient conditions, voltage and current loads are observed!

- Direct drive components are maintenance-free because they work on a non-contact basis.

7.1 Cleaning

⚠ **Attention!** Aggressive media

There is a risk of injury and damage to the torque motor components if aggressive media are used for cleaning.

- Only use suitable media that are not dangerous for humans!
- Check safety data sheets!

Dirt can accumulate on the torque motor components and stick over time. That is why you must check the torque motor components regularly for dirt and remove it if necessary, e.g. with 70% alcohol.

8 Faults

8.1 Motor faults

Table 8.1: Fault table

Fault	Possible cause	Remedy
Motor will not start	Supply lines interrupted	Check connections, plug connector contacts may be pressed in. Correct if necessary. The plug connectors have a seal, which means that a certain amount of screw resistance needs to be overcome.
	Fuse has been triggered by the motor protection equipment	Check motor protection equipment for the correct setting, or correct the fault
Motor turns in the wrong direction	Encoder setting incorrect	Check settings
	Input phase error	Cross 2 phases of the motor
Burning smell	Setup parameters of the controller are incorrect	1. Check controller settings 2. Check cooling system
	Cooling system not working correctly	
	Controller setting does not match the motor parameters	
Communication fault	Motor phase connected incorrectly	Check drive amplifier, target value
Motor is humming and has a high power input	Rotor blocked	Check motor for smooth running
	Brake blocked	Check air pressure or power supply
	Fault on encoder line	Check encoder line
	Problem with motor insulation	Check resistance values > 50 MΩ (phase/earth and phase/sensor)
Motor is heating up too much (measure temperature)	Controller setting incorrect	Check controller settings
	Overload	Measure power. If necessary, use larger motor or reduce load
	Insufficient cooling	Adjust cooling air supply or clear cooling air paths. If necessary, retrofit fans
	Ambient temperature too high	Note permissible temperature range
	Nominal operating mode exceeded, e.g. due to excessive duty cycle	Adjust the motor's nominal operating mode to suit the required operating conditions
	Bearing damage	Check bearing
Unnatural friction noise or friction torque too high	Problem with centring of the motor	Check installation
	Contamination of air gap	Remove contamination

8.2 Operating faults with a drive amplifier

When operating the torque motor with drive amplifier, the faults described in 8.1 Motor faults can also occur. You will find explanations of the faults that occur and information on how to resolve them in the assembly instructions for the respective drive amplifier.

9 Disposal

Caution! Environmentally hazardous substances!

The risk posed to the environment depends on the type of materials used.

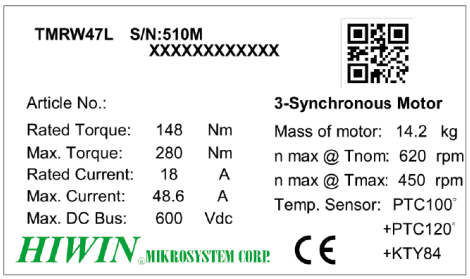
- Always clean contaminated components before disposal!
- Clarify proper disposal with disposal companies and, if necessary, with the responsible authorities!

Table 9.1: Disposal

Liquids	
Lubricants	Dispose of as hazardous waste in an environmentally-safe manner
Soiled cleaning cloths	Dispose of as hazardous waste in an environmentally-safe manner
Torque motor	
Cabling, electrical components	Dispose of as electrical waste
PP components	Sort by type before disposal
Aluminium components (housing)	Sort by type before disposal
Iron components	Sort by type before disposal
Copper components	Sort by type before disposal
Brass components, nickel-plated (plug connector material)	Sort by type before disposal
NBR components (seals)	Sort by type before disposal
Stainless steel components (screws)	Sort by type before disposal

10 Appendix 1: Type plate

Fig. 10.1: Type plate



11 Appendix 2: Order codes

Number		1	2	3	4	5
Order code		DMR	0	2	L	C
1	DMR	Torque motor: DMR: TM component				
2	0	Outer diameter: 0: Ø110 mm 1: Ø150 mm 3: Ø193 mm 7: Ø291 mm				
3	2	Rotor height: 2: 20 mm 3: 30 mm 4: 40 mm 6: 60 mm 7: 65 mm 8: 80 mm C: 120 mm				
4	L	Winding variant: None: Standard winding L: For high rotary speed				
5	C	Special equipment: 0: Without C: Customer-specific				

12 EU Declaration of Conformity

In the context of EU Machinery Directive 2014/35/EU (Low Voltage Directive)

Manufacturer

HIWIN GmbH

Brücklesbünd 1

77654 Offenburg,

Germany

This declaration applies only to the described product in its original, unmodified state. This declaration will become invalid if the product is converted or modified without prior approval.

Product designation: DMR torque motors

Year of manufacture: from 2021

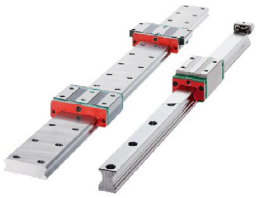
The manufacturer hereby declares that the product complies with the relevant provisions of EU Directive 2014/35/EU (Low Voltage Directive).

In addition, the product is also in conformity with the following European directives:

- According to Electromagnetic Compatibility Directive (2014/30/EU)

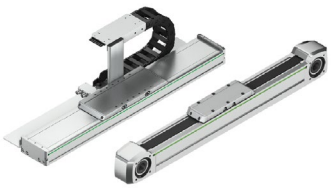
- According to RoHS Directive (2011/65/EU) on the restriction of hazardous substances

We live motion.

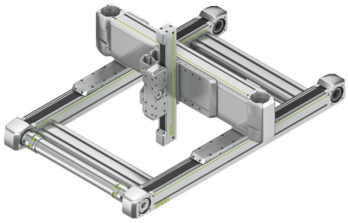


Linear Guideways

Ballscrews



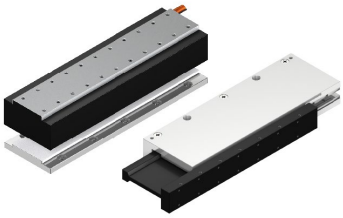
Linear Axes



Linear Axis Systems

Torque Motors

Robots



Linear Motors

Rotary Tables

Drives & Servo Motors

Germany
HIWIN GmbH
Brücklesbünd 1
D-77654 Offenburg
Phone +49 (0) 7 81 9 32 78 - 0
Fax +49 (0) 7 81 9 32 78 - 90
info@hiwin.de
www.hiwin.de

Taiwan
Headquarters
HIWIN Technologies Corp.
No. 7, Jingke Road
Taichung Precision Machinery Park
Taichung 40852, Taiwan
Phone +886-4-2359-4510
Fax +886-4-2359-4420
business@hiwin.tw
www.hiwin.tw

Taiwan
Headquarters
HIWIN Mikrosystem Corp.
No. 6, Jingke Central Road
Taichung Precision Machinery Park
Taichung 40852, Taiwan
Phone +886-4-2355-0110
Fax +886-4-2355-0123
business@hiwinmikro.tw
www.hiwinmikro.tw

France
HIWIN GmbH
4, Impasse Joffre
F-67202 Wolfisheim
Phone +33 (0) 3 88 28 84 80
contact@hiwin.fr
www.hiwin.fr

Italy
HIWIN Srl
Via Pitagora 4
I-20861 Brugherio (MB)
Phone +39 039 287 61 68
Fax +39 039 287 43 73
info@hiwin.it
www.hiwin.it

Poland
HIWIN GmbH
ul. Puławska 405a
PL-02-801 Warszawa
Phone +48 22 544 07 07
Fax +48 22 544 07 08
info@hiwin.pl
www.hiwin.pl

Switzerland
HIWIN Schweiz GmbH
Eichwiesstrasse 20
CH-8645 Jona
Phone +41 (0) 55 225 00 25
Fax +41 (0) 55 225 00 20
info@hiwin.ch
www.hiwin.ch

Slovakia
HIWIN s.r.o., o.z.z.o.
Mládežnicka 2101
SK-01701 Považská Bystrica
Phone +421 424 43 47 77
Fax +421 424 26 23 06
info@hiwin.sk
www.hiwin.sk

Czech Republic
HIWIN s.r.o.
Medkova 888/11
CZ-62700 Brno
Phone +42 05 48 528 238
Fax +42 05 48 220 223
info@hiwin.cz
www.hiwin.cz

Netherlands
HIWIN GmbH
info@hiwin.nl
www.hiwin.nl

Austria
HIWIN GmbH
info@hiwin.at
www.hiwin.at

Romania
HIWIN GmbH
info@hiwin.ro
www.hiwin.ro

Slovenia
HIWIN GmbH
info@hiwin.si
www.hiwin.si

Hungary
HIWIN GmbH
info@hiwin.hu
www.hiwin.hu

Denmark
HIWIN GmbH
info@hiwin.dk
www.hiwin.dk

China
HIWIN Corp.
www.hiwin.cn

Japan
HIWIN Corp.
info@hiwin.co.jp
www.hiwin.co.jp

USA
HIWIN Corp.
info@hiwin.com
www.hiwin.com

Korea
HIWIN Corp.
www.hiwin.kr

Singapore
HIWIN Corp.
www.hiwin.sg