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Operator manual

Torque sensor

DRFS | DRFS-I-w

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This operator manual is not a quality agreement or durability guarantee as set out in Section 443 of the German Civil Code.

Specification changes, typing and printing errors reserved.

Table of contents

1. Introduction....4
2. Area of application and application notes....4
3. Description and operation....5
3.1. Torsion shaft....5
3.2. Housing....5
3.3. Measurement process....5
3.4. Disturbances and their compensation....6
4. Conditions at the place of use....6
4.1. Ambient temperature....6
4.2. Moisture and dust....6
4.3. Chemical influences....6
4.4. Deposits....6
5. Mechanical installation....6
5.1. Precautions when assembling....6
5.2. General assembly guidelines....6
6. Set-up of the measurement chain....7
7. Electrical connection....8
7.1 Wiring instructions....8
7.2. Connector....8
7.3. Assignment of the connector....8
7.4. Extension cables....9
7.5. Power supply....9
8. Assignment....10
8.1. DRFN without options (DRFN-A)....10
8.1.1. Build in EMC circuit....10
8.2. DRFN with angle measurement (DRFN-w)....11
8.2.1. Build in EMC circuit....11
9. Measurement signals....12
10. Disposal....12
11. Angle measurements at high rpm....13
11.1. With GMV2:....13
11.2. With external analysis circuit:....13

Important instructions:

The torque sensors of the DRFS and DRFS-I series can be used as machine elements (e.g. for controlling, checking or monitoring torque tools). In mass-critical applications, the installation position of the drive and measuring side must be considered.
Please note that the sensors are not designed with the safety factors (2...20) that are usual in machine designs in order to achieve high measurement sensitivity.
Please pay particular attention to the specified overload factors.
Torque sensors of the DRFS and DRFS-I series have mounts for machine-operated screwing tools. When using hand-operated screwing tools, there is a risk of breakage of the hexagon mount.
Where people and property could be damaged in the event of breakage, the user must take appropriate safety measures (e.g. covers, overload protection).
Observe the relevant accident prevention regulations!
The torque sensor is not approved for use in Ex areas.
If the sensor is opened within the warranty period, the warranty claim expires.
The sensor may only be opened by qualified personnel.

1. Introduction

The torque sensors are available with different sized tool recivers according to the measuring ranges. Torque sensors measure torques in Nm.

2. Area of application and application notes

The torque sensors measure both clockwise and counterclockwise loads. In the case of clockwise loads, the output signal is positive. The type plate provides information about the end value of the measuring range.
The torque sensors measure dynamic torques just as precisely as static torques. The low masses and high torsional rigidity are a particular advantage here.
Note the signal increase of the sensor specified in the data sheet.
The torque sensors are largely maintenance-free due to their contactless transmission of the measuring signal. Their electrical measurement signals can be transmitted to remote measuring stations and displayed, recorded, further processed and used for control and regulation tasks.
As a precision measuring device, the torque sensors require careful handling during transport and installation, as impacts or dropping, for example, can damage the sensor. Torque peaks that exceed the permissible overload can lead to the destruction of the torsion shaft. Where such peaks cannot be safely excluded, the next larger sensor must be used.
The limits for the permissible mechanical, thermal and electrical stresses are listed in the data sheet. They must be strictly adhered to. Please take this into account when planning the measuring arrangement, during installation and during operation.

3. Description and operation

3.1. Torsion shaft

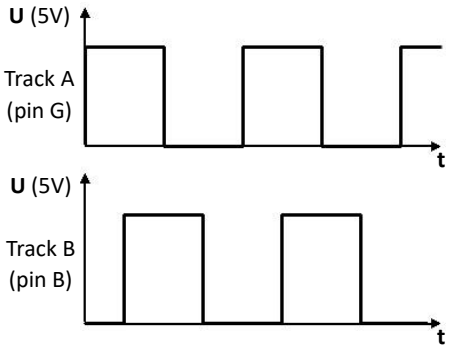
The torsion shaft is made of hardened steel. The rotation of the torsion shaft within its elastic range, which is proportional to the torque, is evaluated using strain gauges applied to it. The strain gauges are arranged in a Wheatstone bridge circuit. The frictional connection is made on the drive or output side with a norm hexagon.

3.2. Housing

The housings of the torque sensors are made of high-strength aluminium, the surface is hard anodized for protection. The torsion shaft is supported twice in the housing by deep groove ball bearings. Evaluation electronics for torque and optional angle of rotation are mounted on the housing.

3.3. Measurement process

The torsional force causes the torsion shaft and thus the strain gauges to be elastically deformed. The strain gauges change their ohmic resistance in proportion to their change in length. The subsequent electronics transmit the measurement signal to the housing in an optically frequency-modulated manner.
The conversion into an analog voltage in the external electronics is proportional to the change in frequency. This is available in a galvanically isolated manner for further evaluation.
The pulse disk on the torsion shaft is scanned with an encoder in the housing. With the angle of rotation option, two square wave signals with 360 pulses per revolution shifted by 90° are available for further evaluation.
The angle of rotation option enables detection of the direction of rotation. When rotating clockwise on the drive side, track A leads track B by 90°.



3.4. Disturbances and their compensation

Bending, axial and radial forces are disturbances and should therefore be avoided.
Shielded cables must be used for the electrical connection.
The torque sensors have been tested for their electromagnetic compatibility (EMC) in accordance with EN 55011/03.91 (DIN VDE 0875-11/07.92) or prEN 50082-2/1993 (E DIN EN 50082-2/03.94).

4. Conditions at the place of use

4.1. Ambient temperature

To achieve optimal results, the nominal temperature range must be complied with. The best operating conditions are constant and, if necessary, slowly changing temperatures. The specified temperature errors apply if the temperature does not change faster than 5K/h. One-sided radiant heat or cooling must be avoided and appropriate measures taken if necessary.

4.2. Moisture and dust

The torque sensors of the DRFS and DRFS-I series correspond to protection class IP40 according to DIN 40050.
Note: Moisture must not penetrate the Conector plug of the sensor.

4.3. Chemical influences

The torque sensors are not protected against chemical influences.
They cannot be used in aggressive environments.

4.4. Deposits

Dust, dirt and other foreign bodies must not accumulate so that it can enter the bearing or the connectors.

5. Mechanical installation

5.1. Precautions when assembling

- If necessary, the housing must be protected against rotation
- Handle the sensor carefully
- Make sure that the connecting elements are securely fastened.
- For fast-running tools or where people can be injured by loose parts, form F according to DIN3121 is preferable.

5.2. General assembly guidelines

Bending, axial and radial forces are disturbances, and therefore causes of measurement errors.

6. Set-up of the measurement chain

In order to measure with the sensor, a complete measurement chain must be set up.
The measurement chain consists of:

- Torque sensor
- Connection cable
- Control units, supply and evaluation device
- A recording device, e.g. printer (if required)

A power supply unit is required to provide the sensor with the necessary operating voltage. The sensor contains the complete measuring amplifier, so no additional amplifier is required. The measuring signal can be processed directly (e.g. PC) or displayed and evaluated using power supply and evaluation devices.

7. Electrical connection

7.1 Wiring instructions

Electric and magnetic fields often cause interference voltages to be coupled into the measuring circuit. This interference is primarily caused by power lines running parallel to the measuring cables, but also by contactors or electric motors located nearby.
Interference voltages can also be coupled in galvanically, particularly by grounding the measuring chain at several points, resulting in potential differences.

Please note the following information for the connectiton

- Connect the supply voltage correctly (not polarity reversal protected)
- Do not lay the measuring cable parallel to power or control cables.
- Avoid stray fields from transformers, motors and contactors.
- Do not ground the sensor, evaluation and display device more than once.
- Connect all devices in the measuring chain to the same protective conductor.

7.2. Connector

The sensors are equipped with a 12-pin Binder type connector.

7.3. Assignment of the connector

The pin assignments for the connector can be found on the following pages. The sensor generates a galvanically isolated measurement signal internally. The grounds must not be bridged directly on the sensor, as this would otherwise lead to measurement errors depending on the cable length to the supply and evaluation device. If necessary, they can be bridged on the supply and evaluation device.
The "control" is used to test the sensor. This emits its maximum signal of e.g. +5V (with clockwise load). The control level is 4.5V up to the supply voltage, with the reference ground point being the analog ground.
It is recommended to terminate all connections on the power supply or evaluation device with 100nF against housing ground.

7.4. Extension cables

Extension cables must be shielded and have low capacitance.
We recommend using the cables we offer that meet these requirements.
When extending cables, ensure that the connection is flawless and the insulation is good.
Make sure that the cable cross-section is large enough to ensure that the sensor receives sufficient supply voltage.
Recalibration is not required when extending the cable.

7.5. Power supply

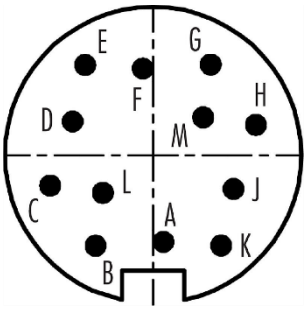
Make sure the polarity is correct. The rise time of the supply voltage 12V
should be less than 1ms, otherwise the DC/DC converter on the external electronics may not start to oscillate.

8. Assignment

8.1. DRFS without options (DRFS-A)

Pin	Assignment
A	NC
B	NC
C	Voltage output
D	GND (Voltage output)
E	GND (Supply)
F	Supply +12V
G	NC
H	Memory chip
J	NC
K	Control input
L	NC
M	NC

Pin arrangement (Plug-in side)



GND (Voltage output) and GND (Supply) are internally galvanically isolated, if necessary, bridge at the power source (not at the sensor).

The memory chip is used and shipped exclusively in conjunction with GMV2 and ValueMaster$_{base}$.

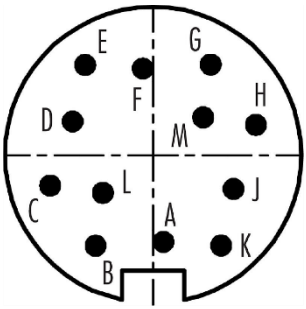
8.1.1. Build in EMC circuit

Between Voltage output and GND (Voltage output), GND (Supply) and Supply, GND (Supply) and Calibration input is a ceramic capacitor with 100nF / 50V soldered in.
We recommend that you also carry out these measures on the socket housing of the supply.

8.2. DRFS-I with angle measurement (DRFS-I-w)

Pin	Assignment
A	NC
B	Angle output track B = 90°
C	Voltage output
D	GND (Voltage output)
E	GND (Supply, angle output)
F	Supply +12V
G	Angle output track A = 0°
H	Memory chip
J	NC
K	Control input
L	NC
M	NC

Pin arrangement (Plug-in side)



GND (Voltage output) and GND (Supply) are internally galvanically isolated, if necessary, bridge at the power source (not at the sensor).

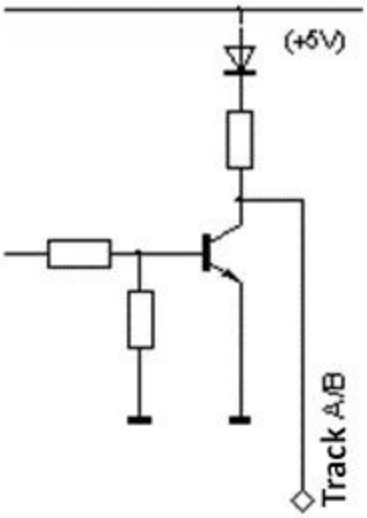
The memory chip is used and shipped exclusively in conjunction with GMV2 and ValueMaster$_{base}$.

8.2.1. Build in EMC circuit

Between Voltage output and GND (Voltage output), GND (Supply, angle output) and Supply, GND (Supply, angle output) and Calibration input is a ceramic capacitor with 100nF / 50V soldered in.
We recommend that you also carry out these measures on the socket housing of the supply.

9. Measurement signals

The sensor delivers a direct current proportional to the torque, e.g. 0-5V.
The output voltage is positive when the load is to the clockwise, and negative when the load is to the counterclockwise.
The outputs for rpm or angle of rotation are equipped with an open collector.
A pull-up with 10k Ohm is built in internally. It delivers a 5V level decoupled via a diode. If required, an external pull-up can be used in accordance with the data sheet.



10. Disposal

The sensor can be sent back to us free of charge for disposal, complete with measuring cable. As soon as you have packed it, send a message to sales@eth-messtechnik.de and we will commission our parcel service to pick it up.
Unfortunately, we cannot accept parcels sent to us freight collect and without notification.

11. Angle measurements at high rpm

Notice:

Please note the maximum speed of the sensor!

11.1. With GMV2:

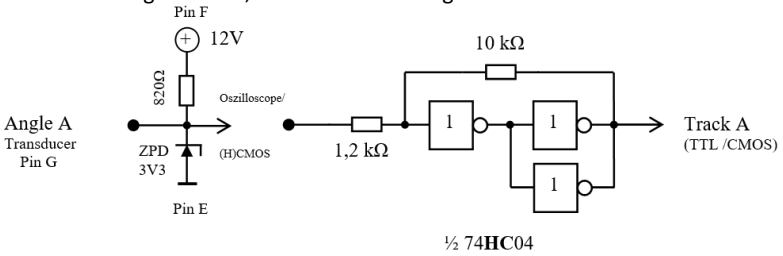
Cable length:	maximum rpm:
2.5 m	10,000 min^{-1}
5 m	10,000 min^{-1}
10 m	6000 min^{-1}

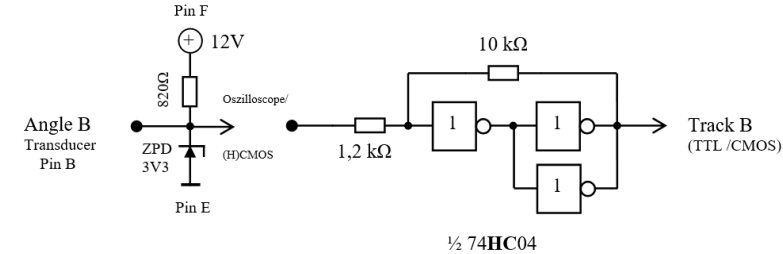
11.2. With external analysis circuit:

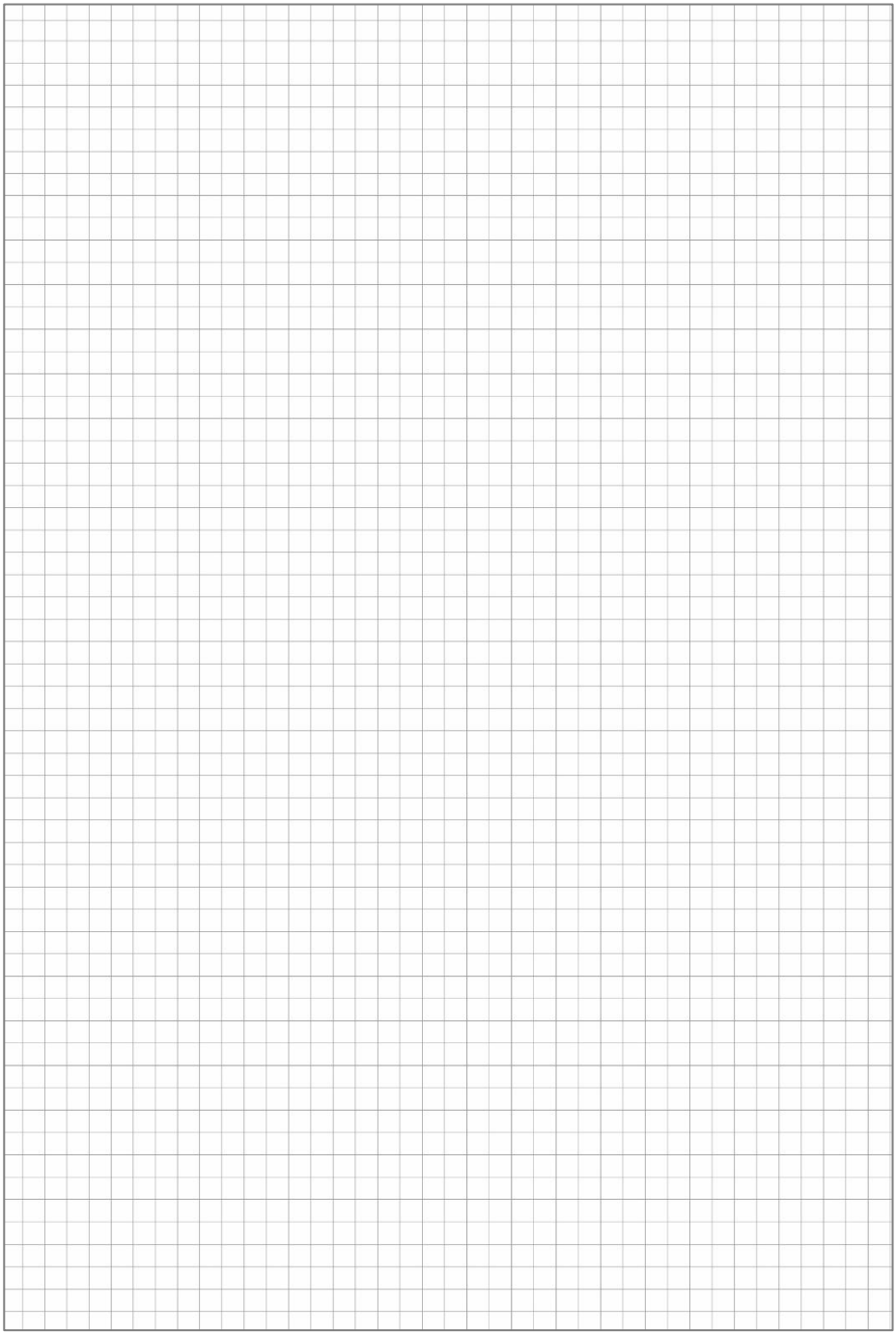
Maximum rpm:

Cable length	R-Pull-up (5V … 12V)	
	10kΩ	1,2kΩ
2.5m	4000 min^{-1}	15,000 min^{-1}
5m	2000 min^{-1}	12,000 min^{-1}
10m	1000 min^{-1}	10,000 min^{-1}

With the following evaluation circuit, speeds of over 15,000 min^{-1} are possible even with a cable length of 10 m.
The signal level is suitable for (H)CMOS and evaluation with an oscilloscope.
For standard digital levels, the circuit on the right can be added.







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