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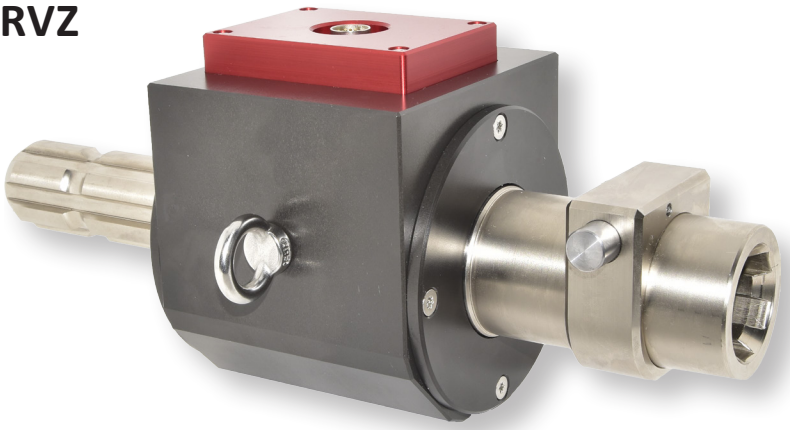
Operator manual

DRVZ



English

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.

Content

Important instructions

The torque sensors of the DRVZ series can be used as machine elements (e.g. test bench).

Please note that the sensors are not designed with the usual safety factors (2...20) in machine designs in favor of high measurement sensitivity.

Pay particular attention to the specified overload factors.

Where people can be injured and property can 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 the Ex area.

If the sensor is opened or dismantled within the warranty period, the warranty claim becomes void.

1. Introduction

The torque sensors of the DRVZ series are suitable for torqueand angle of rotation measurements of PTO drives. Up to 1800 Nm can be measured.
The non-contact transmission of supply voltage and measurement signal enables low-wear and largely maintenance-free continuous operation.
Further technical specifications can be found in the data sheet at the end of these operating instructions.

2. Area of application and application notes

The torque sensors measure clockwise and counterclockwise loads.
The type plate provides information about the full scale value.

The torque sensors measure dynamic torques just as precisely as static torques. The low masses and high torsional rigidity are of particular advantage in this context. Note the signal increase of the sensor specified in the data sheet.

The torque sensors are largely maintenance-free due to their non-contact measurement signal transmission. Their electrical outputs can be transmitted to remote test benches, where they can be displayed, recorded, processed and used for control and regulation operations.

As a precision measuring device, the torque sensors require careful handling during transport and installation, since, for example, impacts or vibrations can damage the sensor. Torque peaks above the rated overload can lead to the destruction of the torsion shaft. Where such peaks cannot be ruled out with certainty, they must be intercepted.

The limits for the permissible mechanical, thermal and electrical stresses are listed in the data sheet. It is imperative that they are complied with. Please take this into account when planning the measuring arrangement, during installation and finally during operation.

3. Description and operation

3.1 Torsion shaft

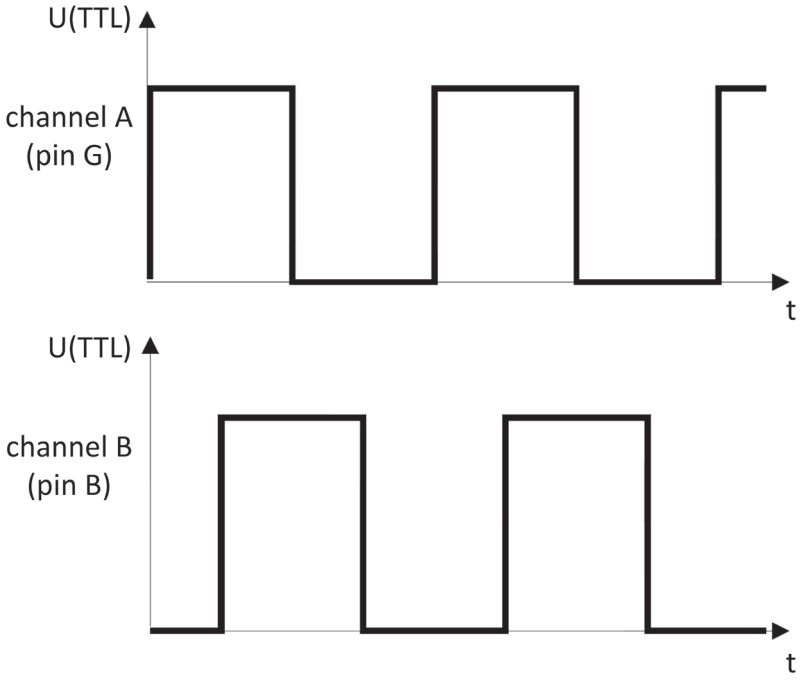
The torsion shaft is made of hardened steel. The twisting of the torsion shaft, which is proportional to the torque, is evaluated within its elastic range on its applied strain gauges. The strain gauges are arranged in a Wheatstone bridge circuit. The frictional connection takes place via a shaft with external and internal teeth according to ISO500-3:2014 Type 1. The torsion shaft can optionally be equipped with a pulse disc for angle measurement (see data sheet).

3.2 Housing

The torque sensor housings are made of high-strength aluminum, the surface is hard-anodized for protection. The torsional shaft is supported in the housing between two deep groove ball bearings. The sensor housing is protected against twisting by means of a ring screw.

3.3 Measurement process

The torsional shaft, and thus the strain gauges, are elastically deformed by the torsional force. The strain gages change their ohmic resistance in proportion to their change in length. The subsequent electronics transmit the measurement signal contact-free and frequency-modulated to the external electronics in the housing.
In proportion to the change in frequency, the external electronics convert the first output into an analogue voltage and the second output into a frequency. Those are galvanically isolated and available for further evaluation.
The pulse disk on the torsional shaft is sampled with an encoder in the housing. With the angle of rotation option, there are two square-wave signals shifted by 90°, each with 360 pulses per revolution.
The direction of rotation can be detected with the angle of rotation option, since channel A is 90° ahead of channel B when rotating counterclockwise rotation.



3.4 Disturbances and their compensation

Bending, axial and radial forces are disturbance variables and should therefore be avoided.

Shielded cables should be used for the electrical connections. The electromagnetic compatibility (EMC) of the torque sensors are tested for compliance with EN 55011:2011.
They were also tested for interference immunity according to the following standards:

- 61000-4-2:2009
- 61000-4-3:2009
- 61000-4-4:2009
- 61000-4-5:2009
- 61000-4-6:2009
- 61000-4-8:2009

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 comply with protection class IP67 according to DIN 40050.

4.3 Chemical influences

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

4.4 Deposits

Dirt, dust or other foreign objects must not accumulate so that they can damege the seals.

5. Mechanical installation

5.1 Precautions when assembling

- Handle the sensor carefully.
- **IMPORTANT!**
  When instaling the sensor must not be overloaded, not even temporarily. It is strongly recommended to electrically connect the sensor before mounting and to monitor the torque signal in order not to exceed the measuring range!
- Misalignments in the axial and radial direction must be avoided.
- A good electrical connection of the housing to grounded parts must be ensured.

5.2 General assembly guidelines

Bending, axial and radial forces are disturbance variables, i.e. causes of measurement errors.

Thermal expansion of the construction must be taken into account.

6. Set-up of the measurement chain

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

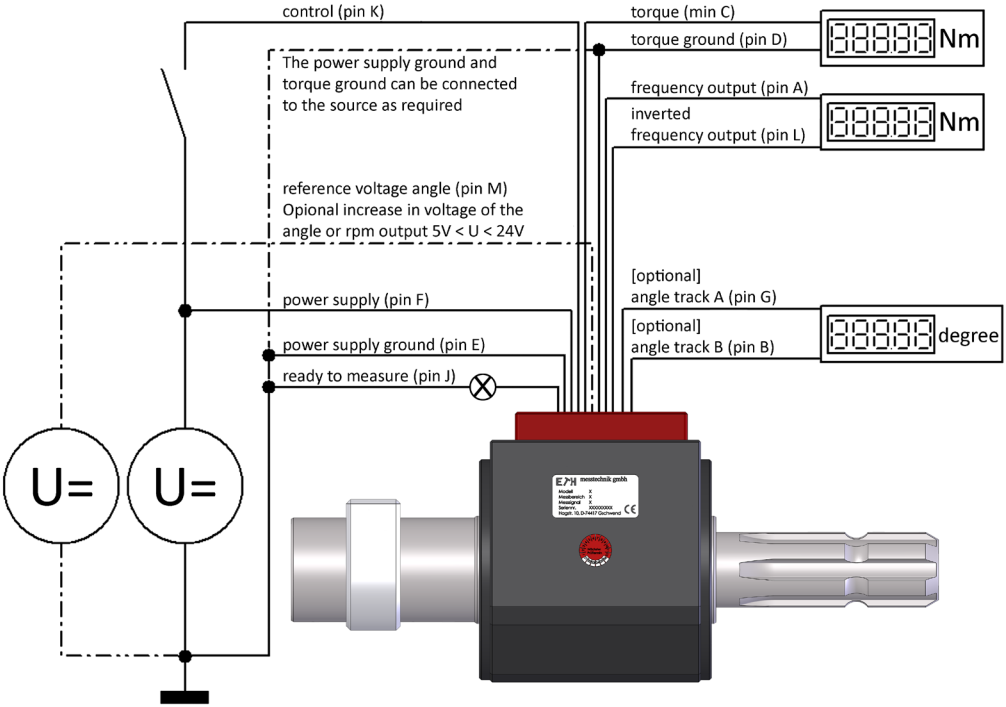
The measurement chain consists of:

- torque sensor
- connection cable
- supply and evaluation unit

A DC voltage source is necessary to supply the sensor with the necessary operating voltage. The sensor includes the complete measuring amplifier, so that no additional amplifier is necessary. The measurement signal can be further processed directly (e.g. PLC control, PC measurement card) or displayed and evaluated with evaluation devices.

7. Electrical connection

The reference ground for the voltage and frequency output is pin D. The reference ground for the supply and the rpm and angle output is pin E.



7.1 Wiring instructions

Electrical and magnetic fields often cause interference voltages to be coupled into the measuring circuit. These disturbances are primarily caused by power lines running parallel to the measuring lines, but also by contactors or electric motors in the vicinity. In addition, interference voltages can be coupled in galvanically, in particular by grounding the measuring chain at several points, resulting in potential differences.

Please note the following instructions.

- Only use shielded and low-capacitance measuring cables.
- Connect the supply voltage correctly.
- Do not lay measuring cables parallel to power lines.
- Avoid stray fields from transformers, motors and contactors.
- Do not earth the sensor, evaluation and display device more than once. Connect all devices in the measurement chain to the same protective conductor.

7.2 Connectors

The sensors are equipped with a 12-pin IP67 built-in connector Binder type 723.

7.3 Pin assignment for the connectors

The pin assignments of the connectors are on the following pages. The sensor internally generates a galvanically isolated measuring signal. The grounds must not be connected directly to the sensor, otherwise measurement errors will occur depending on the cable length to the supply and evaluation device. If required, these can be connected to the supply and evaluation device.

7.4 Control activation pin K

The “control activation” is used to test and adjust the measurement chain. The maximum signal swing is applied to the current output signal. Therefore, this function should only be used in an unloaded and tared condition. The drive level is 4.5V to supply voltage; the reference ground point is the supply ground.

7.5 Extension cables

Extension cables must be shielded and have low-capacitance. We recommend using the cables we offer, as they meet these requirements. In the case of cable extensions, ensure that the connection is flawless and that the insulation is adequate. It must be ensured that the cable cross-section is large enough to ensure sufficient supply voltage at the sensor. Recalibration is not necessary when the cable is extended.

7.6 Power supply

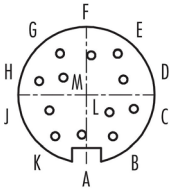
The torque sensor is equipped with a wide voltage input. Voltages from 10 V - 28.8 V are tolerated. With voltages above 28.8 V, the internal protective circuit becomes conductive and the electronics of the torque sensor can be damaged if the overvoltage lasts longer. We recommend installing a 250mA fuse (semi time-lag) in the supply line.

8. Pin assignment

8.1 Standard cable AK12.4

AK12.4 for active sensors
12-pin connector

pin	colour	assignment DRVZ
A	green	frequency output
B	red/ blue	angle output track B = 90 °
C	yellow	voltage output
D	white	ground (voltage/ frequency output)
E	grey	ground (supply, rpm/ angle output)
F	pink	supply +10… 28,8V
G	grey/ pink	rpm & angle output track A = 0°
H	purple	memory chip
J	black	message ready for operation
K	red	control input
L	brown	inverted frequency output
M	blue	voltage reference angle signal



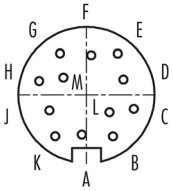
Contact arrangement (plug-in side)

PIN D and PIN E are internally electrically isolated.
If necessary, connect to the supply source (not to the sensor).

8.2 Robot cable AK12.5

AK12.5 for active sensors
12-pin connector

pin	colour	assignment DRVZ
A	black	frequency output
B	red	angle output track B = 90 °
C	brown	voltage output
D	white	ground (voltage/ frequency output)
E	yellow	ground (supply, rpm/ angle output)
F	purple	supply +10... 28,8V
G	green	rpm & angle output track A = 0°
H	pink	memory chip
J	grey	message ready-to-run
K	grey/ pink	control input
L	blue/ red	inverted frequency output
M	blue	voltage reference angle signal



contact arrangement (plug-in side)

PIN D and PIN E are internally electrically isolated.
If necessary, connect to the supply source (not to the sensor).

External EMC circuit
A 100 nF / 50 V ceramic capacitor can be soldered between pins C and D at the evaluation on the evaluation side of line-related interference.

9. Measurement outputs

The sensor supplies a torque-proportional DC voltage of e.g. ±10 V. The output voltage is positive for clockwise load, and negative for counterclockwise load. In addition, the sensor outputs a differential frequency signal of 10 kHz ± 5 kHz. The torque sensor has a permitted zero point deviation of ±50 mV/ ±50 Hz. A taring option must be provided for precise measurements.

The outputs for rpm or angle are equipped with an active driver. Without an external voltage reference, the rpm, angle and ready-to-run outputs provide a TTL level.

The sensor has a ready-to-run signal (**pin J**). If the output delivers a HIGH level, the measurement electronics are basically working. If the level is LOW, there is an error.

If higher levels are required (e.g. for PLC inputs), a voltage reference can be specified via **pin M**. The voltage reference tolerates a voltage of 5V - 24V.

10. Maitenance and recalibration

The sealing rings must be greased regularly. Dry running will damage the seal.

Regardless of use, we recommend recalibration every 2 years (see certificate or inspection label) at ETH. Maintenance is also carried out.

11. 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.

12. Datasheet

Torque sensor

DRVZ

1800 Nm max. on 1⅜“ shaft
according to ISO 500-3:2014 Type 1

for drives with PTO shafts

angle of rotation measurement
with 2x360 increments

NEW!

On request also available:

1800 Nm max. on 1⅜“ shaft
according to ISO 500-3:2014 Type 2

2500 Nm max. on 1¾“ shafts
according to ISO 500-3:2014 Type 3

Features DRVZ

- contactless signal transmission
- built-in measuring amplifier
- rotation angle measurement (optional)
- extended EMC strength
- adjustable output level of rpm and angle signal (5V-24V)
- Frequency output 10kHz ±5kHz
- large input voltage range (10-28,8V)
- strain gauge technology
- robust design for use in field applications
- IP67
- easy installation
- accurate results (0.2% accuracy)

The torque sensor DRVZ provides a precise measurement of torque and angle of rotation when testing systems that are driven by PTO shafts, such as a tractor gearbox.

The contactless transmission of supply voltage and measuring signal enables low-wear and largely maintenance-free continuous operation.
The integrated measuring amplifier provides an analog and galvanically isolated output signal of 0 ± 10V or 10kHz ±5kHz with a supply voltage of 10 to 28.8V DC.

12.1 Elektrical specifications

Supply voltage:	10 - 28,8 V DC	
Power consumption:	at Ub 12 V approx. 180 mA (switching converter 2.2 W)	
Rise time 10-90 %:	400 µs	
Limit frequency -3 dB:	1 kHz	
	Voltage output:	Output frequency:
Output signal:	0 ± 10 V	10 kHz ± 5 kHz
Resolution:	16 bit ≙ 0,38 mV	16 bit ≙ 0,19 mHz
Max. output range:	± 11 V	± 6,3 KHz
Internal resistance:	100 Ω	–
Ripple:	< 100 mVss	–
Nonlinearity/max. measurement error (of full scale)	0,2%	0,2%
Error of Hysteresis:	0,1 %	0,1 %
Deviation at zero point:	≤ 50 mV	≤ 50 Hz
Operating temperature:	0 - 60 °C	
Compensated temperature range:	5 - 45 °C	
Temperature error		
Zero point:	0,05 % / K	
Sensitivity:	0,05 % / K	
Mechanical overload:	50 %	
Internal protection:	IP67	
Connection:	12pin-connector (circular connector series 680)	

Interference emission

Basic standard	Frequency range
EN55011 Limit class B	150 kHz - 6 GHz

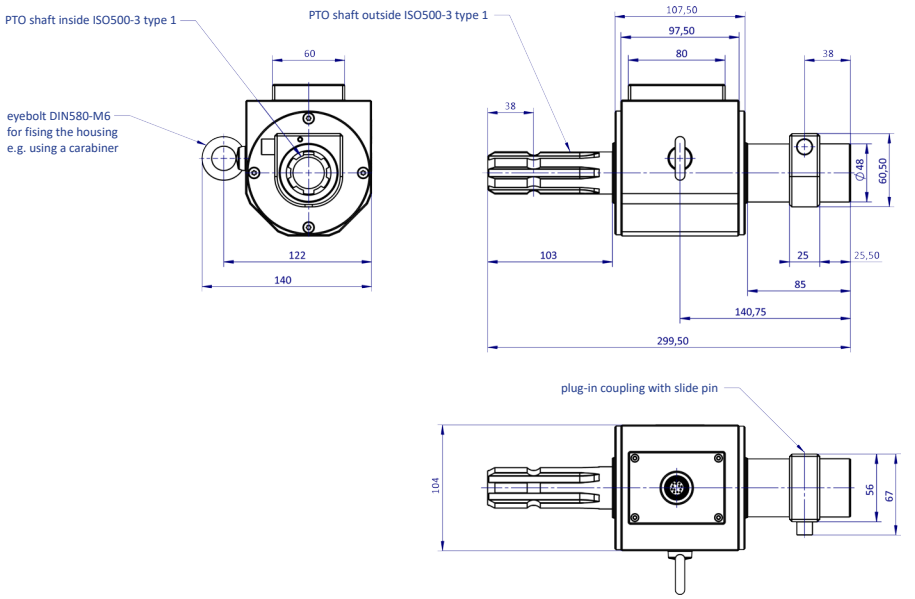
Immunity to interference

Basic standard	Testing accuracy	coupling	Result
EN61000-4-2:2009 Electrostatic discharge (ESD)	4 kV	direct	A
EN61000-4-2:2009 Electrostatic discharge (ESD)	4 kV	indirect	A
EN61000-4-3:2009 Electromagnetic fields	10 V/m	indirect	A
EN61000-4-4:2009 Bursts	2 kV	indirect	A
EN61000-4-5:2005 Surge voltages	1 kV	direct	B
EN61000-4-6:2009 Conductor-borne RF disturbances	10 V/m	indirect	A
EN61000-4-8:2005 Power frequency magnetic fields	30 A/m	indirect	A

A: Deviation of outputs during the test < 0.3 % of full scale
B: Deviation of outputs during the test > 0.3 % of full scale

	Angle (w)
Output:	TTL or over voltage on pin 5 V < U < 24 V
Impedance:	22 Ω
I_{max}:	20 mA
Increments/rev.:	2 x 360
Resolution:	1°
Phase shift:	Channel A 90° at right spin of propulsion side

12.2 Mechanical specifications



Measuring range:	0 - 1800 Nm
Max. RPM	max. 2000 min^{-1}
Spring constant:	347 x 10^3 Nm / rad
Mass moment of inertia:	7399 g x cm^2
Permissible axial load*	1300 N
Permissible radial load*	5200 N

*** The axial and radial load values apply to the non-fixed housing**

DRVZ-□-□-□

- W ⇨ Angle
- ⇨ Type
- ⇨ Measuring range

Available accessories

Supply and display unit: GMV2
ValueMaster$_{base}$

ETH Measuring cable: AK12.4 with IP67
AK12.4 with IP67

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