Operation Manual for Torque Transducer

For T22 Pulley Torque Transducer

Valid for...	T22
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Modification	Technical changes reserved.

References in this Text

1.6 Warning Notes; Page 5

Attention must be paid to the accident prevention regulations of the trade associations. Coverings and casings are necessary before operating the transducer. This is also valid for commissioning, maintenance and troubleshooting.
Duties of the coverings and casings are:

- ⇒ Protection from detaching parts
- ⇒ Protection from contusion and shear
- ⇒ Prevention from reaching rotating parts
- ⇒ Prevention from being tangled up and/or getting caught by parts

Coverings may:

- ⇒ Not grind
- ⇒ Not rotate

Coverings are also necessary outside of operating and motion travel areas of persons. These demands can be modified if other sufficient safety devices are available. During operation, the safety precautions must be operative. By vibrations, damages can occur on the device.

4 Mechanical Assembly; Page 7

Before the assembly, connection elements must be cleaned with dissolver (i.e. acetone), no foreign particles may adhere to them.

Caution: During the assembly inadmissibly large forces may not act on the transducer.

During the assembly, the transducer must be supported to protect it from falling down.

6.1 Engaging; Page 11

Warming-up period of the torque transducer is approx. 5 min.

6.4.2 Natural Resonances; Page 12

An operation of the device in natural resonance can lead to permanent damages.

Contents

1 Read First

1.1 Safety and Caution Symbols

Caution:
Injury Risk for Persons
Damage of the Device is possible.

Note:
Important points to be considered.

1.2 Intended Use

Torque transducers are intended for the measurement of torques and can be used for control tasks. The valid safety regulations should be absolutely respected. The torque transducers are not safety components in the sense of the intended use. The transducers need to be transported and stored appropriately. The assembly, commissioning and disassembling must take place professionally.

1.3 Dangers

The torque transducer is fail-safe and corresponds to the state of technology.

1.3.1 Neglecting of Safety Notes

At inappropriate use, remaining dangers can emerge (i.e. by untrained personnel). The operation manual must be read and understood by each person entrusted with the assembly, maintenance, repair, operation and disassembly of the torque transducer.

1.3.2 Remaining Dangers

The plant designer, the supplier, as well as the operator must plan, realize and take responsibility for safety-related interests for the transducer. Remaining dangers must be minimized. Remaining dangers of the torque measurement technique must be pointed out.
Human mistakes must be considered. The construction of the plant must be suitable for the avoidance of dangers. A danger-analysis for the plant must be carried out.

1.4 Reconstructions and Modifications

Each modification of the transducers without our written approval excludes liability on our part.

1.5 Personnel

The installation, assembly, commissioning, operation and the disassembly must be carried out by qualified personnel only. The personnel must have the knowledge and make use of the legal regulations and safety instructions.

1.6 Warning Notes

Attention must be paid to the accident prevention regulations of the trade associations. Coverings and casings are necessary before operating the transducer. This is also valid for commissioning, maintenance and troubleshooting.
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- ⇒ Protection from detaching parts
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2 Term Definitions

2.1 Terms

Measuring Side:

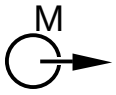
Mechanical connection of the torque transducer in which the torque to be measured is applied. Usually this side has the smallest moment of inertia.

Drive Side:
Mechanical connection of the torque transducer on the opposite side of the measuring side, usually with the largest moment of inertia. At static torque transducers the housing is fastened on this side.

Low Torque Resistance Side:
The shaft of the arrangement (drive, load) which can be turned considerably smaller with torque than the nominal torque of the torque transducer $M << M_{henn}$.

2.2 Definition of the Pictograms on the Torque Transducer

The measuring side of the torque transducer is designated as follows:

Measuring side: 

or M

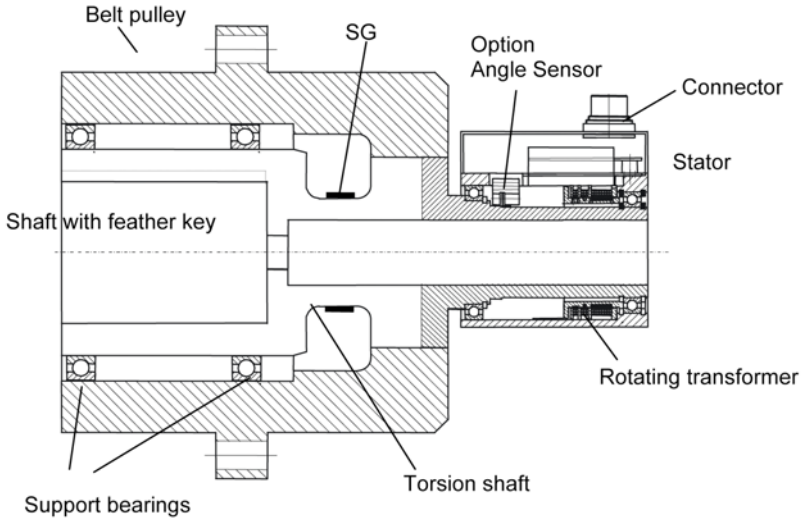
More information can be found on the data sheet, or consult factory (800) 947-5598 if needed.

3 Product Description

The transducer measures static and dynamic torques. The mounting position of the torque transducer is horizontally.
Caution: It is to be differentiated between measuring side and drive side, see data sheet of the transducer: http://www.interfaceforce.com or consult factory (800) 947-5598.

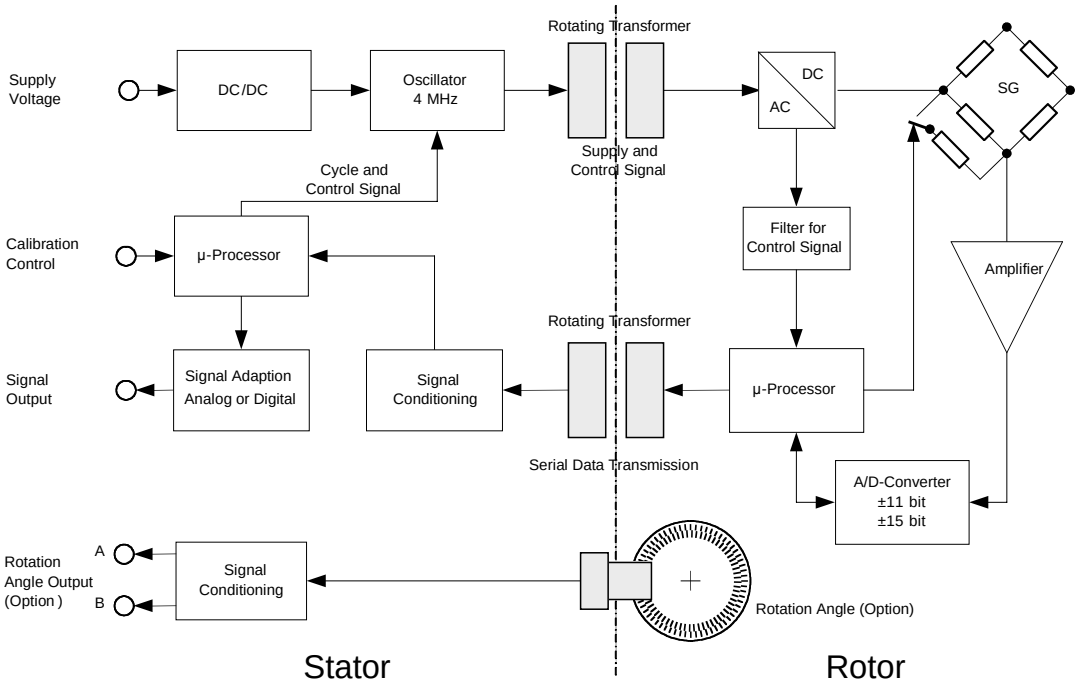
3.1 Mechanical Setup

The transducers consist of a torsion shaft. Depending on design, the mechanical connection possibilities are executable with round shafts or feather key connections etc. The torsion shaft, applied with two strain gauge full bridges, is bedded in a housing through ball bearings. For the signal transmission and/or the supply of the strain gauge full bridges, a rotating transformer, according to the principle of a transformer, is arranged in the transducer. For supply and measuring signal conditioning, electronics are integrated in the stator and the rotor.



3.2 Electrical Setup

The supply of the rotor electronics occurs by an alternating voltage, generated in the stator, which transfers to the rotor through a rotating transformer. There, it is rectified and stabilized. With this supply, the strain gauge bridge is fed.
For the electrical calibration control of the transducer, a control signal is up-modulated to the supply by the µ-processor in the stator and transferred to the rotor. There, it is filtered and evaluated by the µPC, which also activates the internal switch for the detuning of the strain gauge bridge.
The measuring signal of the strain gauge bridge is conditioned in an amplifier and then converted into a digital signal, which will be transferred to the stator by another rotating transformer. Compared to the analog signal, the measuring signal in digital form is much more disturbance-free. The remaining distance of the measuring signal within the transducer occurs in digital form, completely. Thus, the measuring system achieves a high reliability of operation.
This signal is further conditioned in the stator, comes into a µ-processor, then - depending upon transducer type - it is converted to a voltage signal, digital signal or to current and will then reach the output of the transducer and can be directly measured at the connector.



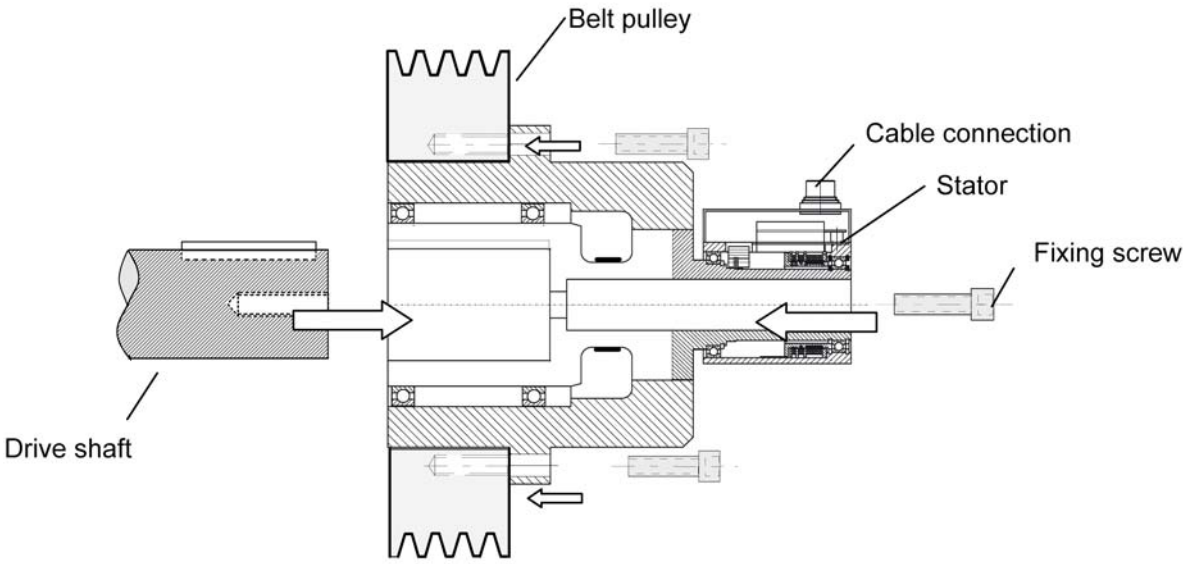
Block diagram for serial signal transmission

4 Mechanical Assembly

Before the assembly, connection elements must be cleaned with dissolver (i.e. acetone), no foreign particles may adhere to them.

Caution: During the assembly inadmissibly large forces may not act on the transducer.

During the assembly, the transducer must be supported to protect if from falling down.



Assembly Sequence:

- Mount belt pulley on torque transducer and secure it with screws (i.e. use adhesive for the screw locking).
- Shift torque sensor onto drive shaft.
- Secure torque transducer axially with lock screw (i.e. secure screw with lock screw adhesive).

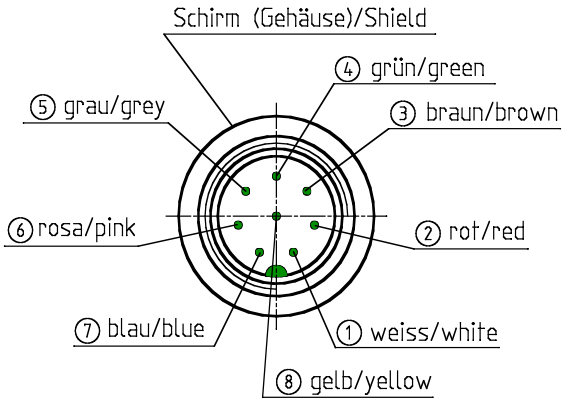
Apply twist lock for stator (see data sheet for mounting possibility). The cable connection may not be used as a twist lock. Use an elastic element or a catch.

5 Electrical Connection

5.1 Pin Connection

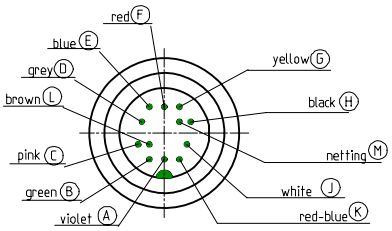
Also see test certificate.

8-pin	Analog	
1	Excitation +	12 ... 28 VDC
2	Excitation GND	0V
3	Signal	±5V / (±10V)
4	Signal GND	0 V
5	Calibration control	L<2.0V; H>3.5V
6	Option angle A	TTL
7	Option angle B	TTL
8	NC	



View: socket on soldering side

12-pin	Analog		Digital	
A	NC		NC	
B	Option angle B	TTL	Option angle B	TTL
C	Signal	±5V / (±10V)	NC	
D	Signal GND	0 V	NC	
E	Excitation GND	0 V	Excitation GND	0V
F	Excitation +	12 ... 28 VDC	Excitation +	12 ... 28 VDC
G	Option angle A	TTL	Option angle A	TTL
H	NC		NC	
J	NC		Output B	RS485
K	Calibration control	L<2.0V; H>3.5V	NC	
L	NC		Output A	RS485
M	Housing		Housing	



View: socket on soldering side

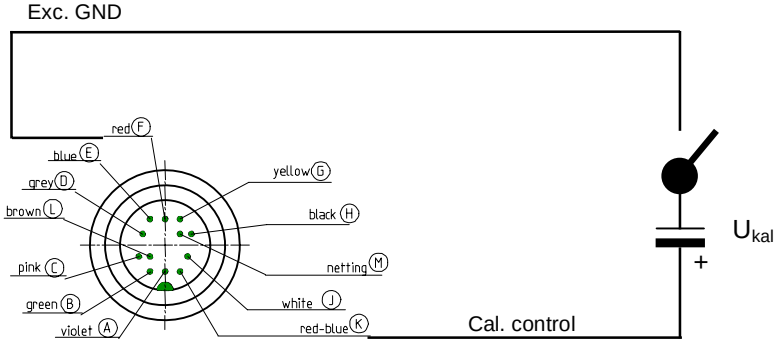
5.2 Calibration Control

Only use calibration control in unloaded condition of the torque transducer.

5.2.1 Calibration Control at Analog Output

By applying voltage of +5V to +28V the calibration control will switch on.
Voltage below 2.8V will switch off the calibration control.

12-pin	
E	Excitation GND
K	Calibration control



3.5 VDC < U_{kal} < 28 VDC

5.2.2 Calibration Control at RS485

The calibration control switch on is carried out by a command.
For this, consult factory (800) 947-5598.

5.3 Cable

Only use a shielded cable with preferably small capacity. We recommend measuring cables from our product range. They have been tested in combination with our transducers and meet the metrological requirements.

5.4 Shielding Connection

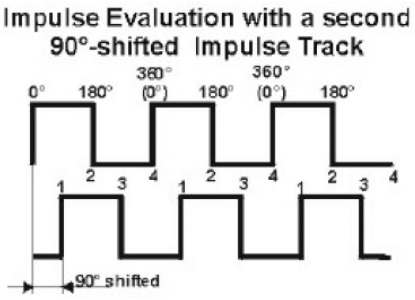
In combination with the transducer and the external electronics, the shield forms a Faraday Cage. By this, electro-magnetic disturbances do not have any influence on the measurement signal.

5.5 Running of Measuring Cables

Do not run measuring cables together with control or heavy-current cables. Always assure that a large distance is kept to engines, transformers and contactors, because their stray fields can lead to interferences of the measuring signals.
If troubles occur through the measuring cable, we recommend running the cable in a grounded steel conduit.

5.6 Angle (Option)

At angle or speed measurement, the pulses / revolutions are acquired. By a second transmitter trace, displaced by 90° and flank evaluation, the pulses / revolutions can be quadrupled. The trace, displaced by 90°, can also be used for the rotational direction detection.
See corresponding data sheet for the output levels.



Supply for angle transducer

Stabilized supply voltage	5V ±25 mV
Current consumption max.	20 mA

6 Measuring

6.1 Engaging

The warming-up period of the torque transducer is approx. 5 min. Afterwards the measurement can be started.

The warming-up period of the torque transducer is approx. 5 min.

6.2 Direction of Torque

Torque means clockwise or clockwise torque if the torque acts clockwise when facing the shaft end. In this case a positive electrical signal is obtained at the output.
Torque transducers can measure both, clockwise and counter-clockwise direction.

6.3 Static / Quasi-Static Torques

Static and/or quasi-static torque is a slowly changing torque.
The calibration of the transducers occurs statically on a calibration device.
The applied torque may accept any value up to the nominal torque.

6.4 Dynamic Torques

6.4.1 General

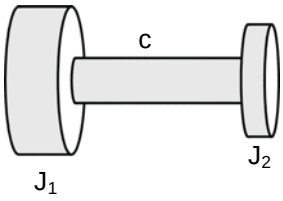
The static calibration procedure of torque transducers is also valid for dynamic applications.
Note: The frequency of torques must be smaller than the natural frequency of the mechanical measurement setup.
The bandwidth of alternating torque must be limited to 70% of the nominal torque.

6.4.2 Natural Resonances

Estimate of the mechanical natural frequencies:

$$f_0 = \frac{1}{2 \cdot \pi} \cdot \sqrt{c \cdot \left(\frac{1}{J_1} + \frac{1}{J_2} \right)}$$

f_0 = Natural Frequency in Hz
J_1, J_2 = Moment of Inertia in kg*m²
c = Torsional Rigidity in Nm/rad



An operation of the device in natural resonance can lead to permanent damages.

6.5 Speed Limits

The maximum speed indicated in the data sheet may not be exceeded in any operating state.

6.6 Disturbance Variables

By disturbances, measured value falsifications can occur by :

- Vibrations,
- Temperature gradients,
- Temperature changes,
- Arising disturbance variables during operation, i.e. imbalance,
- Electrical disturbances,
- Magnetic disturbances,
- EMC (electromagnetic disturbances),

Therefore avoid these disturbance variables by decoupling of vibrations, covers, etc.

7 Maintenance

7.1 Maintenance Schedule

Action	Frequency	Date	Date	Date
Control of cables and connectors	1x p.a.			
Calibration	< 26 months			
Control of fixation (flanges, shafts)	1x p.a.			
Have bearings exchanged by Interface, Inc.	20,000 hrs operating time			

7.2 Troubleshooting

This chart is used for searching for the most frequent errors and their elimination

Problem	Possible Cause	Troubleshooting
No signal	No transducer excitation	• Outside of permissible range • Connect excitation • Cable defect • No mains supply
	Signal output connected wrong	• Connect output correctly • Evaluation electronics defect
Transducer does not react to torque	Shaft not clamped	• Clamp correctly
	No power supply	• Outside of permissible range • Connect supply • Cable defect • No mains supply
	Cable defect	• Repair cable
	Connector connected wrong	• Connect correctly
Signal has dropouts	Axial position rotor to stator outside of tolerance	• Align rotor
	Cable defect	• Repair cable
Zero point outside of tolerance	Cable defect	• Repair cable
	Shaft mounted distorted	• Mount correctly
	Distorted shaft string	• Release from distortion
	Strong lateral forces	• Reduce lateral forces
	Distorted flanges	• Check evenness of flange-surfaces
	Shaft overloaded	• Send to manufacturer
Wrong torque indication	Calibration not correct	• Re-calibrate
	Transducer defect	• Repair by manufacturer
	Torque shunt	• Eliminate shunt
Oscillations	Alignment of shaft not correct	• Align correctly
	Unbalance	• Balance the corresponding parts

8 Decommission

All transducers must be dismantled professionally. Do not strike transducer housings with tools. Do not apply bending moments on the transducer, i.e. through levers. The torque transducer must be supported to avoid falling down during the dismantling.

9 Transportation and Storage

The transportation of the transducers must occur in suitable packing.
For smaller transducers, stable cartons, which are well padded, are sufficient (i.e., air cushion film, epoxy crisps, paper shavings). The transducer should be tidily packed into film so that no packing material can reach into the transducer (ball bearings).
Larger transducers should be packed in cases.

9.1 Transportation

Only release well packed transducers for transportation. The transducer should not be able to move back and forth in the packing. The transducers must be protected from moisture.
Only use suitable means of transportation.

9.2 Storage

The storage of the transducers must occur in dry, dust-free rooms, only.
Slightly lubricate shafts and flanges with oil before storing (rust).

10 Disposal

The torque transducers must be disposed according to the valid provisions of law.
Please consult factory (800) 947-5598.

11 Calibration

At the time of delivery, torque transducers have been adjusted and tested with traceable calibrated measuring equipment at factory side. Optionally, a calibration of the transducers can be carried out.

11.1 Proprietary Calibration

Acquisition of measurement points and issuing of a calibration protocol Traceable calibrated measuring equipment is being used for the calibration. The transducer data are being checked during this calibration.

11.2 DKD-Calibration

The calibration of the transducer is carried out according to the guidelines of the DKD. The surveillance of the calibrating-laboratory takes place by the DKD. At this calibration, the uncertainty of measurement of the torque-measuring instrument is determined. Further information can be obtained from Interface Inc.

11.3 Re-Calibration

The recalibration of the torque transducer should be carried out after 26 months at the latest.
Shorter intervals are appropriate:

- Overload of the transducer
- After repair
- After inappropriate handling
- Demand of high-quality standards
- Special traceability requirements

12 Data Sheet

See www.interfaceforce.com