

FUTEK

ADVANCED SENSOR TECHNOLOGY, INC.

Operating Manual

FUTEK Rotary Torque Sensors

TRD/ TRH/ TRS 600/605/705 Series

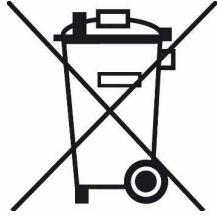


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1. Important Information

1.1 *Disposal Instructions for Electrical and Electronic Equipment*



Do not discard old electronic instruments in municipal trash. For disposal at end of life, please return this product to an authorized local electronic waste disposal service or contact the nearest Futek Instrument sales office for return instructions.

2. Application and Key Features

- Torque sensor with strain gages measuring system
- Wear-resistant transmission of the measuring signal, integrated amplifier
- Measurement of constant and variable torques
- Torque measurement on the rotating shaft
- Integrated system for rotation angle measurement (TRD/TRH/TRS 605 models only)
- Application in the laboratory, manufacture and quality control
- Ideal for use with power tools (TRD/TRH 605 models only) and test stand construction (TRS605 model only)
- Suitable for low and high speed ranges

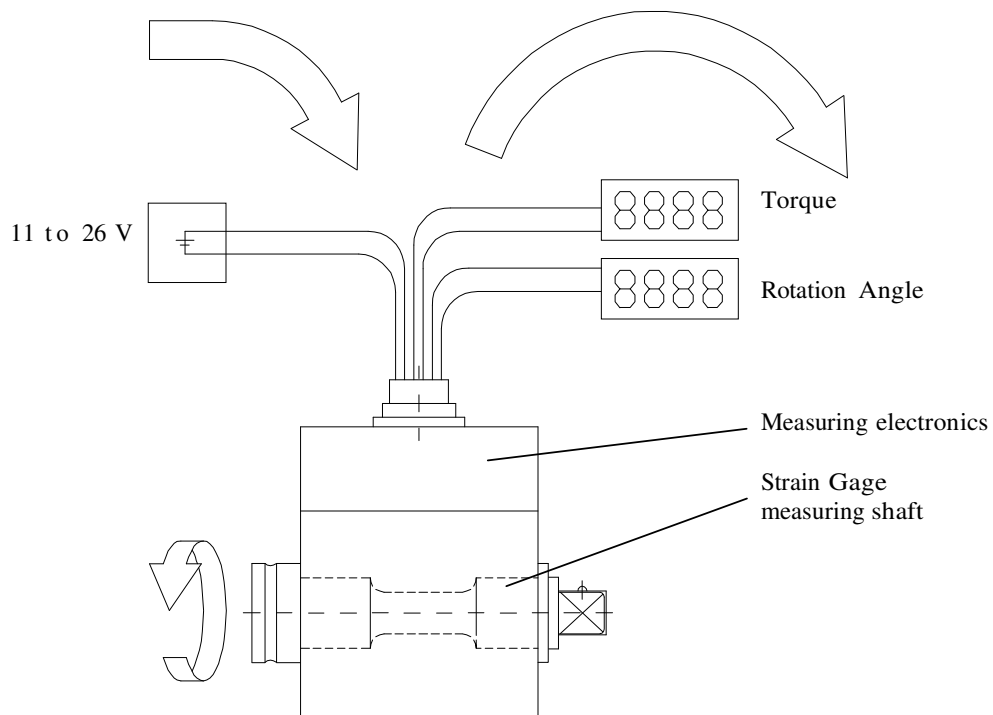


Fig. 1: Rotary Torque Sensor

3. Description of the Measuring System

3.1. Mechanical Design

Torque Sensors consist of a base body which contains the measuring shaft. The shaft ends are performed as standard square connections or standard hexagon ends. On the measuring shaft there is a torsion distance with strain gauges and a signal amplifier with A/D transformer. The connection box of the base body contains the stationary electronics for the signal formation.

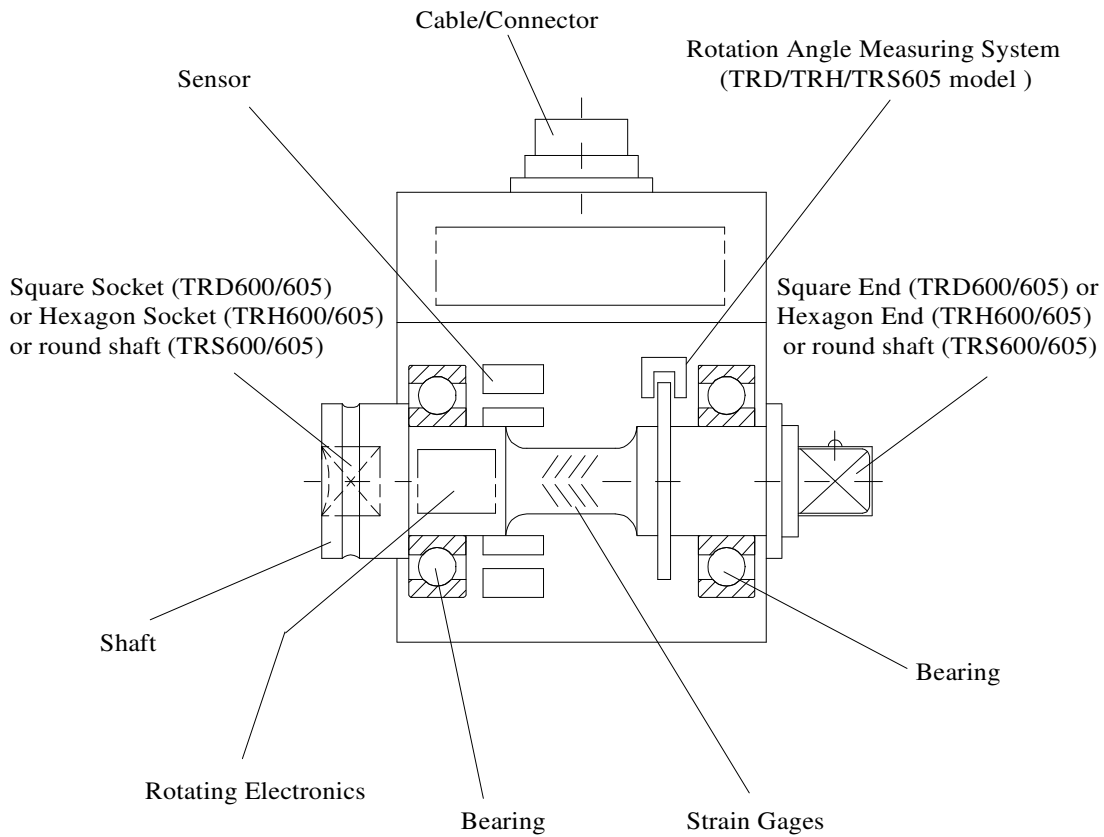


Fig. 2: Mechanical Design Non-contact Torque Sensor

3.2. Electrical Block Diagram (TRD/TRH/TRS 605 model)

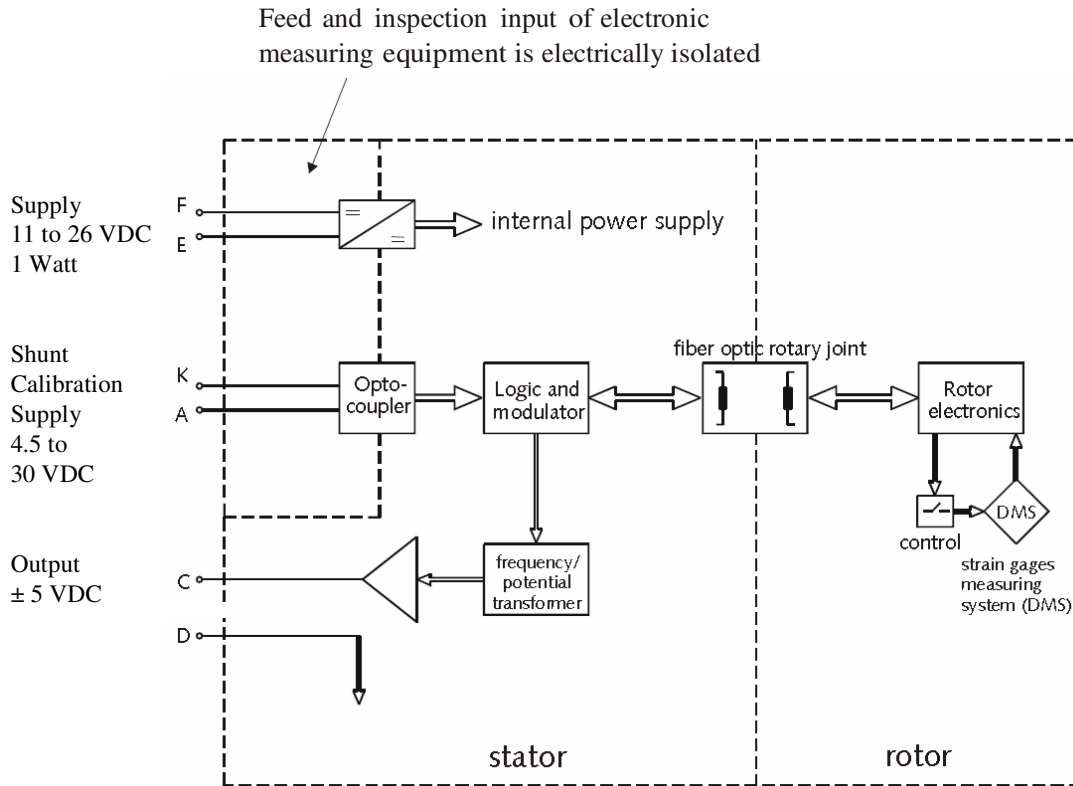


Fig. 3: Electrical block diagram

3.2.1. Examples of Application

Example of electrical isolation for supply and signal measurement.

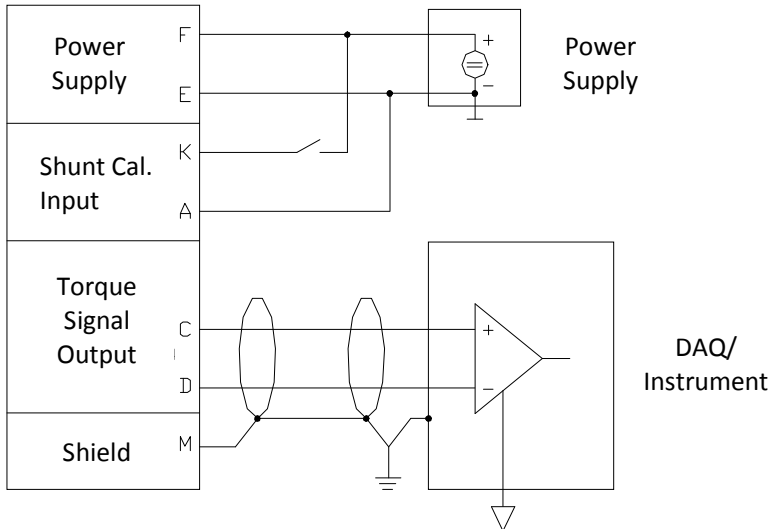


Fig. 4: Separate Encoder and Torque Measuring Power Supply Diagram

Example of combining the power supply and signal measurement in the Evaluation Electronic.

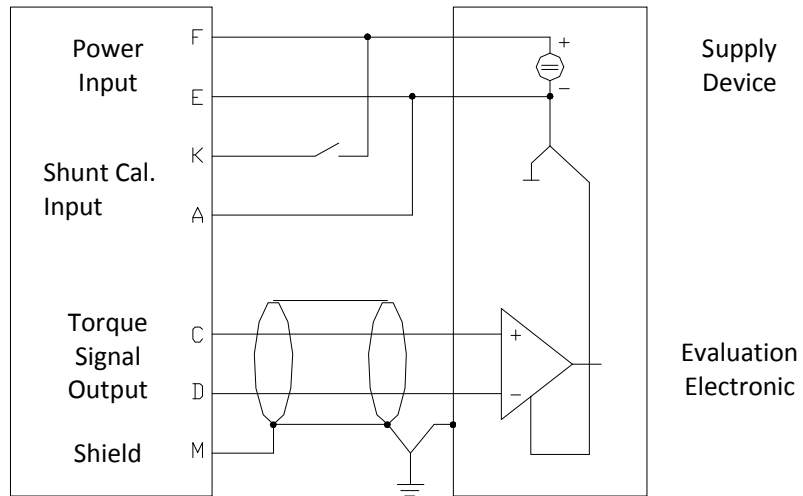


Fig. 5: Power and measuring supply in the evaluation electronic combined, Instruments containing Power Supply & Signal Device (IHH500 & IPM650)

3.3. Rotation Angle Measuring System (TRD/TRH/TRS/605/705)

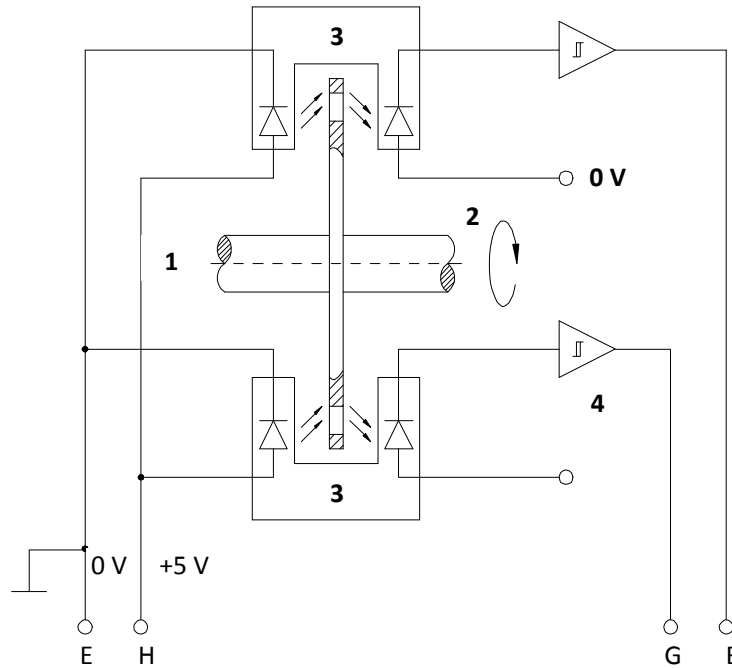


Fig. 6: Diagram showing the design of the rotation angle measuring system

1. Rotating Torque Shaft
2. Pulse Disk
3. Forked Light Barrier with LED and Photo Diode
4. Operation Amplifier

Features:

- 360 light-dark stripes on the pulse disk
- Two forked light barriers shifted by phase angle 90°
- Pulse number proportional to the rotation angle

3.4. Angle-Pulse Output (TRD/TRH/TRS/605/705)

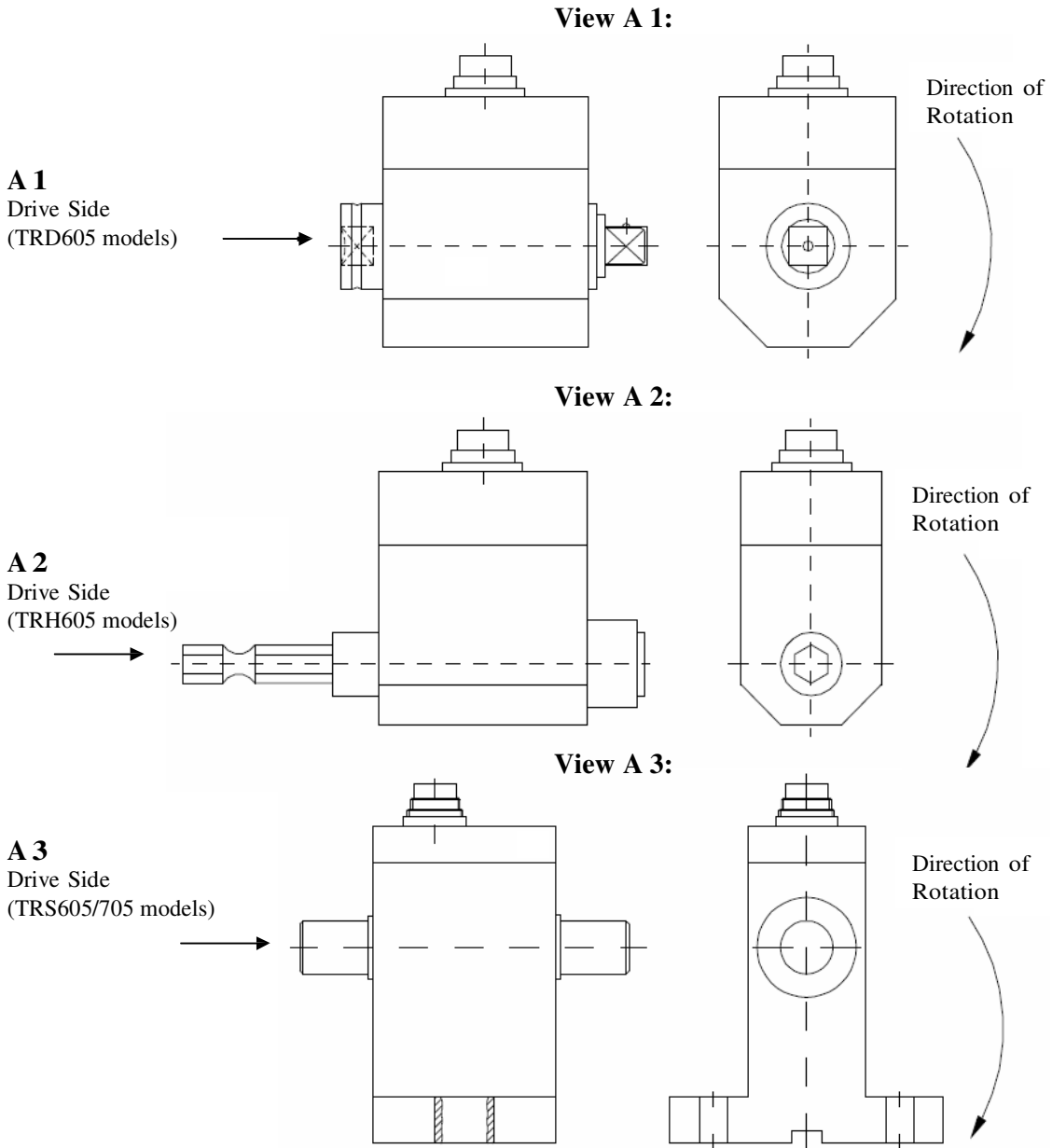
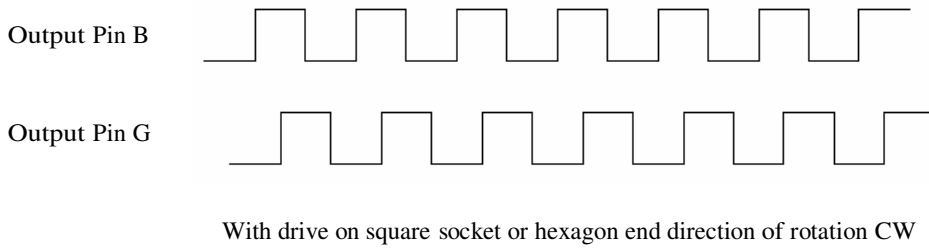


Fig. 7: Angle-pulse output

4. Electrical Connection

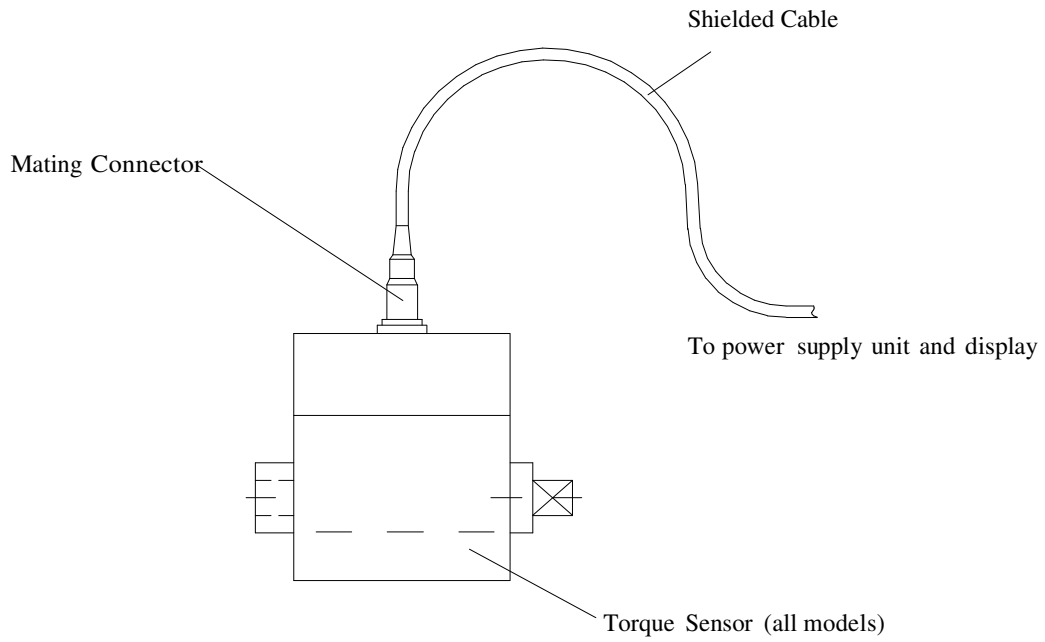


Fig. 8: Electrical Connections

- Use Futek ZCC911 cable

4.1. Instruction for Electrical Installation

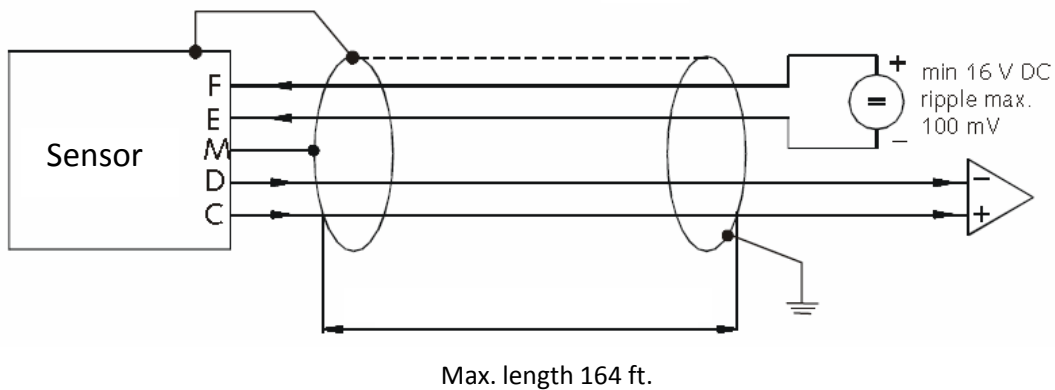
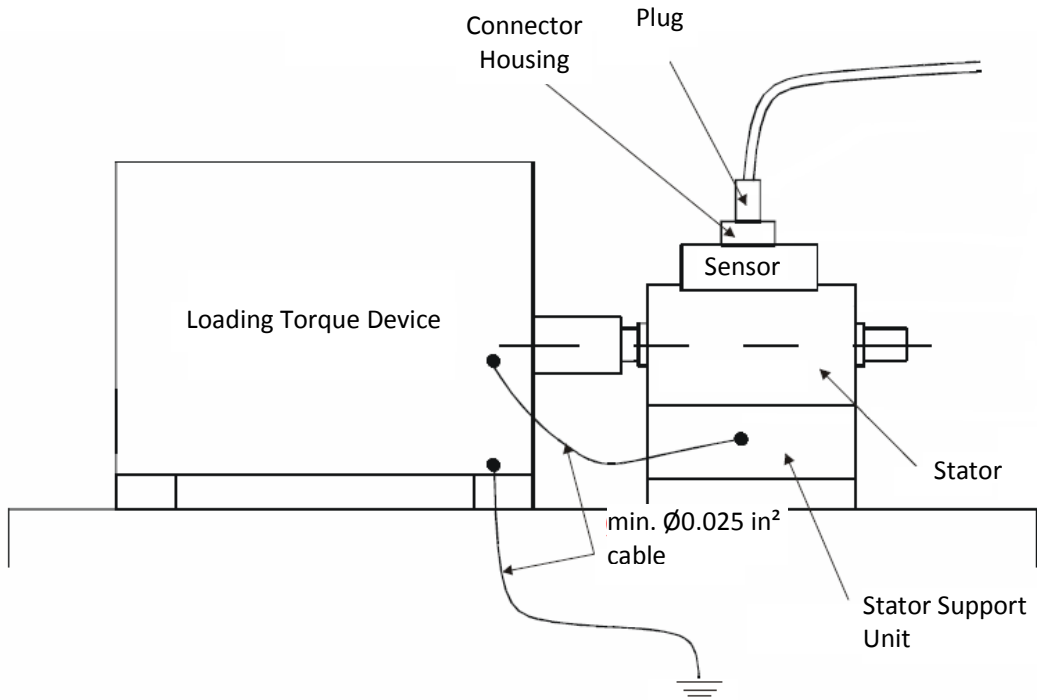


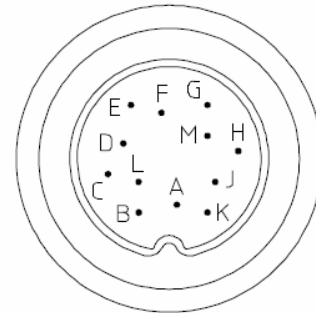
Fig. 9: Electrical Installation

4.2. Plug Connection (12 pin)

Function	Pin
Torque , Power Supply	F
Torque , Power Supply, Ground	*E
Torque , Signal Output	C
Torque , Signal Output, Ground	D
Angle , Power Supply	H
Angle , Power Supply, Ground	*E
Angle 1/ Speed , Signal Output	B
Angle 2 (90° shifted to Angle 2) , Signal Output	G
Shunt Calibration , Power Supply	K
Shunt Calibration , Power Supply, Ground	A
Shield , Inside the sensor to housing	M
Not Connected	J
Not Connected	L

* Torque and Angle share the same pin for Ground.

Top View Built-In Plug



4.2.1. Installing the Signal Lead

- Do not run the lead parallel to power cables or control circuits.
- Do not place the lead close to equipment producing strong electromagnetic fields, such as, transformers, welders, contactors, electric motors, etc. If such situations cannot be avoided, run the lead inside earthed steel conduit.
- Make a loop in the lead when affixing it at the torque sensor so that it is not damaged by vibration. If supply and evaluation unit are galvanically connected, a differential input must be used for the torque signal to prevent the voltage drop on the power supply ground affecting the torque output signal.

4.3. Connecting Cable

Cable Diagram with Plugs on Both Sides, Model ZCC914

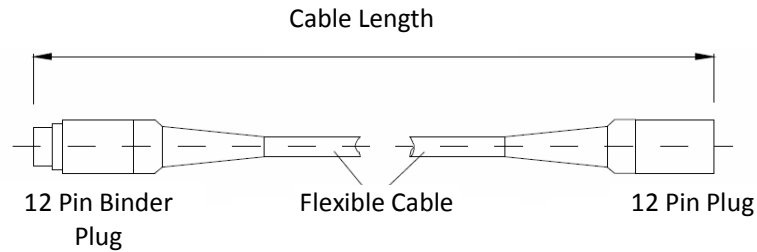


Fig. 10: Cable diagram with plugs on both sides

Binder Pin Out	Function
F	Torque , Power Supply
*E	Torque , Power Supply, Ground
C	Torque , Signal Output
D	Torque , Signal Output, Ground
H	Angle , Power Supply
*E	Angle , Power Supply, Ground
B	Angle 1/ Speed , Signal Output
G	Angle 2 (90° shifted to Angle 2) , Signal Output
K	Shunt Calibration , Power Supply
A	Shunt Calibration , Power Supply, Ground
M	Shield , Inside the sensor to housing
J	Not Connected
L	Not Connected

* Torque and Angle share the same pin for Ground.

4.3.1. Cable Diagram, Plug (Sensor), Open Ends, Model ZCC911

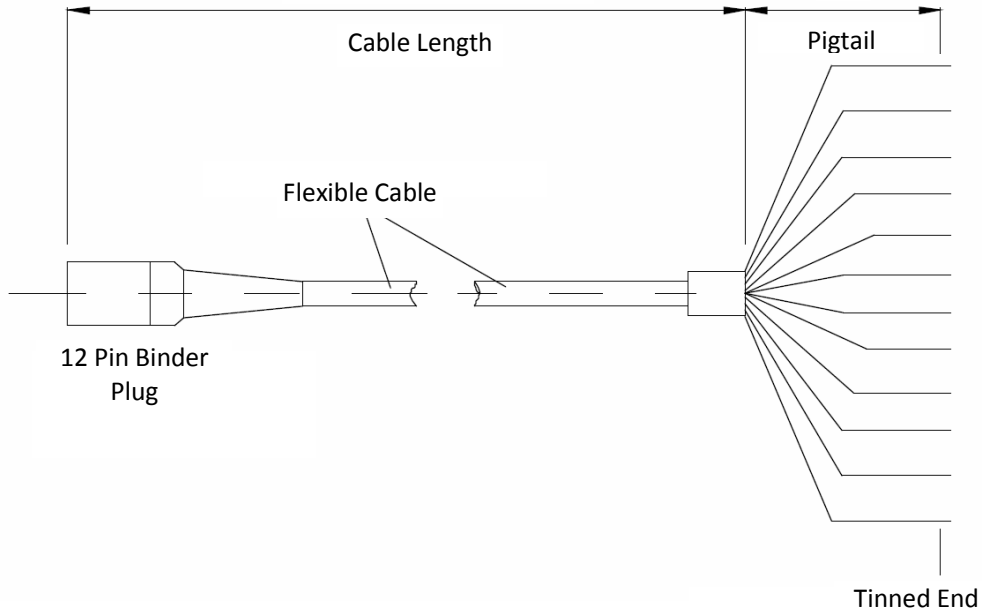


Fig. 11: Cable Diagram, Plug (Sensor), Open Ends

Binder Pin Out	Function	Wiring Code
F	Torque , Power Supply	Red
*E	Torque , Power Supply, Ground	Black
C	Torque , Signal Output	Green
D	Torque , Signal Output, Ground	White
H	Angle , Power Supply	Orange
*E	Angle , Power Supply, Ground	Black
B	Angle 1/ Speed , Signal Output	Blue
G	Angle 2 (90° shifted to Angle 2) , Signal Output	Brown
K	Shunt Calibration , Power Supply	Purple
A	Shunt Calibration , Power Supply, Ground	Yellow
M	Shield , Inside the sensor to housing	-
J	Not Connected	-
L	Not Connected	-

5. Mechanical Application

5.1. TRD/TRH 600/605 models

- Torque sensor series TRD600/605 have square connections for plug-in tools according to DIN 3121.
- Torque sensor series TRH600/605 have hexagon connections according to DIN 3126, form E/F.
- The torque sensor is attached to a drive spindle as shown below

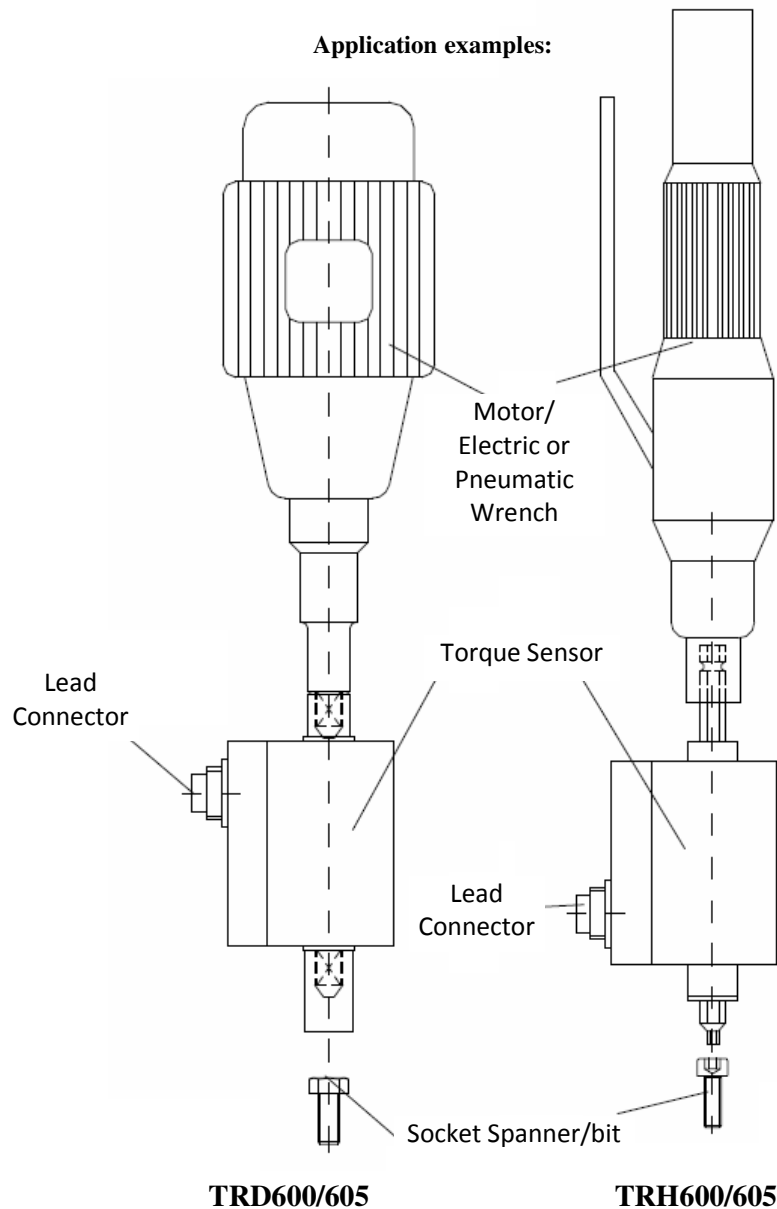


Fig. 12: Application examples models TRD600/605 & TRH600/605

5.2. Torque Measuring Shaft (Model TRS600/605/705)

The signal lead should not exceed a length of 100 ft. Do not run the lead parallel to power cables or shunt cal. circuits. The pin connection is explained in chapter 4.2 of this manual.

On each side of the torque measuring shaft there is a high quality bearing installed, and it contains an integrated housing base. The installation can have any position, however offset couplings must always be applied to balance geometrical false adjustments and like that keep false loads away from the torque measuring shaft.

Radial, Axial, Diagonal and Angular errors can be compensated by the use of:

- Multi-disk Couplings
- Diaphragm Coupling
- Claw Couplings

5.3. Possible Installation of Model TRS600/605/705

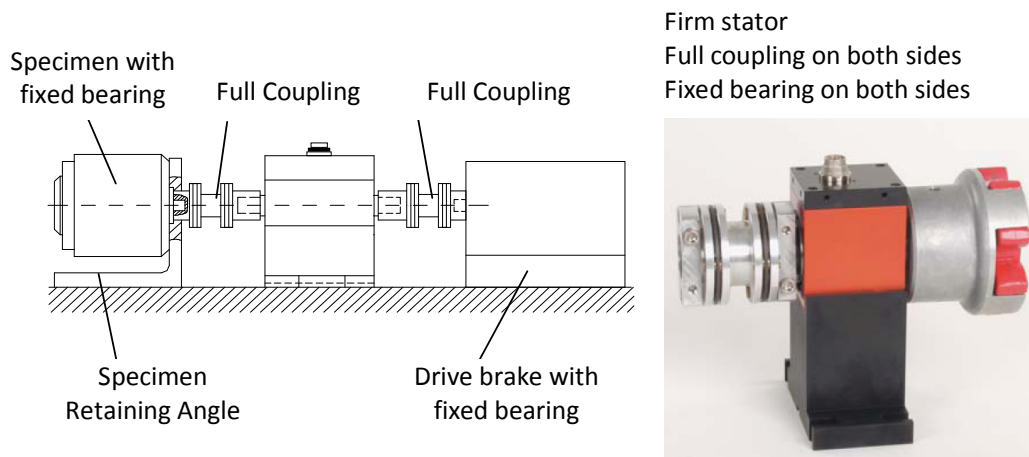


Fig. 13: Application example TRS705

Installation and operational Tips:

- The Keys on the shaft are removable, may require to be removed before installing the couplings.
- The sensor is only part of the complete drive shaft and depending on the speed the alignment must be made in a proper way. Each type of coupling can compensate certain misalignment (of radial, axial and angular character). Customer is responsible for damage to the shaft due to misalignment and overloading on the shaft.
- Radial and torsional vibrations can severely impact the performance of the torque sensor. For this reason speeds at or near the torque sensor's natural frequency should be avoided.
- For coupling recommendation, see link on website under support/futek manuals/ TRD/TRH/TRS-Series.

6. Maintenance

- TRD/TRH/TRS Series sensors are almost maintenance-free where the bearing needs to be replaced by factory after its life time.
- Durability of bearings in compensated temperature range is approx. 20,000 hours.
- Durability of bearings in operating temperature range is approx. 10,000 hours.
- For Precision applications: Calibration of the sensor should be done at FUTEK or with adequate calibration equipment.
- Calibration: Yearly calibration is recommended but it depends on the criticality of the application & requirement and may require smaller calibration intervals.
- Inspect torque sensor cable and mating connector for damage on a monthly basis.

7. Repairs

Fault	Possible Causes	Solution
Shaft stiff to turn	Bearing failure due to: a) Torsional or flexural vibration b) High axial or radial loads c) Worn bearings d) Bent shaft	Return to factory
Zero shift less than 2%	Torsional vibration Torsional Shock	The zero reading may be re-adjusted at display
Zero shift between approx. 2 and 5% of full scale	Torque sensor has been overloaded Torsional vibration Torsional shock	The zero reading may be re-adjusted at the display
Zero shift more than 5%	Torque sensor overloaded by high alternating loads or torsional vibration	Return to factory
Hysteresis between clockwise and counter-clockwise torque	Torque sensor overloaded by high alternating loads or torsional vibration	Return to factory