1 YEAR
WARRANTY

CE

User's Guide

Shop online at

omega.com®

OMEGA®

www.omega.com
e-mail: info@omega.com

ISO 9001 CERTIFIED CORPORATE QUALITY
STAMFORD, CT

ISO 9002 CERTIFIED CORPORATE QUALITY
MANCHESTER, UK

TQ504
Torque Transducer

omega.com®
OMEGA®

OMEGAnet® Online Service www.omega.com	Internet e-mail info@omega.com

Servicing North America:

USA:
ISO 9001 Certified
One Omega Drive, P.O. Box 4047
Stamford CT 06907-0047
TEL: (203) 359-1660 FAX: (203) 359-7700
e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec) H7L 5A1
TEL: (514) 856-6928 FAX: (514) 856-6886
e-mail: info@omega.ca

For immediate technical or application assistance:

USA and Canada: Sales Service: 1-800-826-6342 / 1-800-TC-OMEGA®
Customer Service: 1-800-622-2378 / 1-800-622-BEST®
Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN®
TELEX: 996404 EASYLINK: 62968934 CABLE: OMEGA

Mexico: En Español: (001) 203-359-7803 e-mail: espanol@omega.com
FAX: (001) 203-359-7807 info@omega.com.mx

Servicing Europe:

Benelux:
Postbus 8034, 1180 LA Amstelveen, The Netherlands
TEL: +31 (0)20 3472121 FAX: +31 (0)20 6434643
Toll Free in Benelux: 0800 0993344
e-mail: sales@omegaeng.nl

Czech Republic:
Rudé armády 1868, 733 01 Karviná 8
TEL: +420 (0)69 6311899 FAX: +420 (0)69 6311114
Toll Free: 0800-1-66342 e-mail: info@omegashop.cz

France:
11, rue Jacques Cartier, 78280 Guyancourt, France
TEL: +33 (0)1 61 37 29 00 FAX: +33 (0)1 30 57 54 27
Toll Free in France: 0800 466 342
e-mail: sales@omega.fr

Germany/Austria:
Daimlerstrasse 26, D-75392 Deckenpfronn, Germany
TEL: +49 (0)7056 9398-0 FAX: +49 (0)7056 9398-29
Toll Free in Germany: 0800 639 7678
e-mail: info@omega.de

United Kingdom:
ISO 9002 Certified
One Omega Drive, River Bend Technology Centre
Northbank, Irlam, Manchester
M44 5BD United Kingdom
TEL: +44 (0)161 777 6611 FAX: +44 (0)161 777 6622
Toll Free in United Kingdom: 0800-488-488
e-mail: sales@omega.co.uk

INDEX

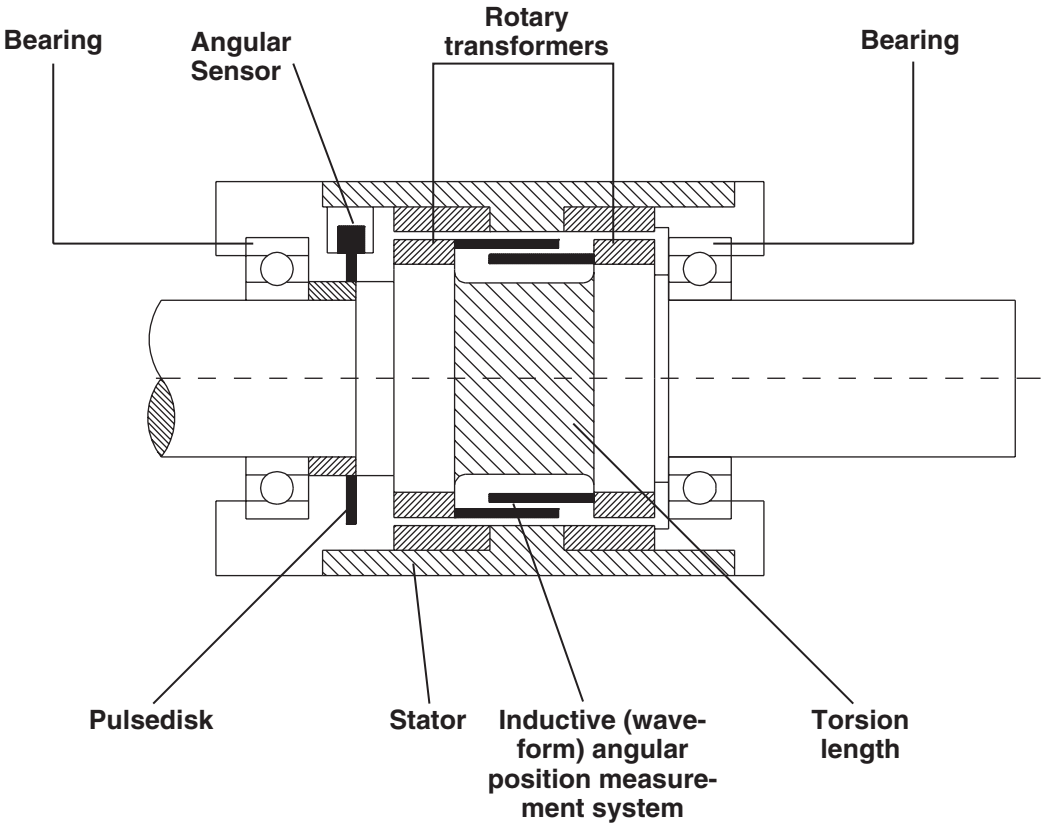
See Data Sheet for technical specifications

1. Applications and typical attributes

- Torque transducer with inductive angular position measurement system.
- Measurement of constant and variable torques.
- Torque measurement on a rotating shaft.
- For laboratory, production and quality assurance applications.
- Built- in instrument amplifier.
- Built- in angle-of-rotation transducer.

2. Description of the measurement system

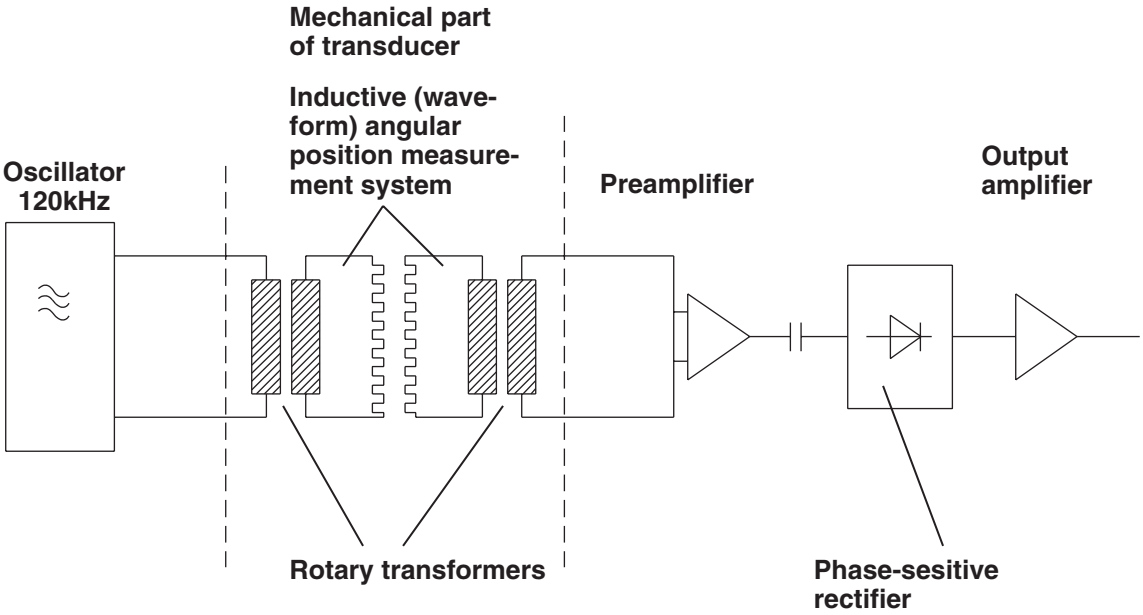
2.1 Mechanical design



- The transducer consists of a stator through which a bearing-mounted shaft passes.
- A certain length of the shaft is utilized to convert the torque into a proportional torsional angle.
- This torsional angle or angle of twist is measured between the two ends of this shaft length by an inductive (wave-form) angular position measurement system.
- The inductive angular position measurement system converts the angle of twist into a proportional electrical signal.

- The electrical power for operation of the inductive angular position measurement system, which rotates along with the shaft, is provided by means of a rotary transformer.
- The electrical output signal, which is proportional to the torque, is transferred to the stator by a second rotary transformer.
- The connection box on the stator contains the electronics, the power supply unit, and the instrument amplifier.

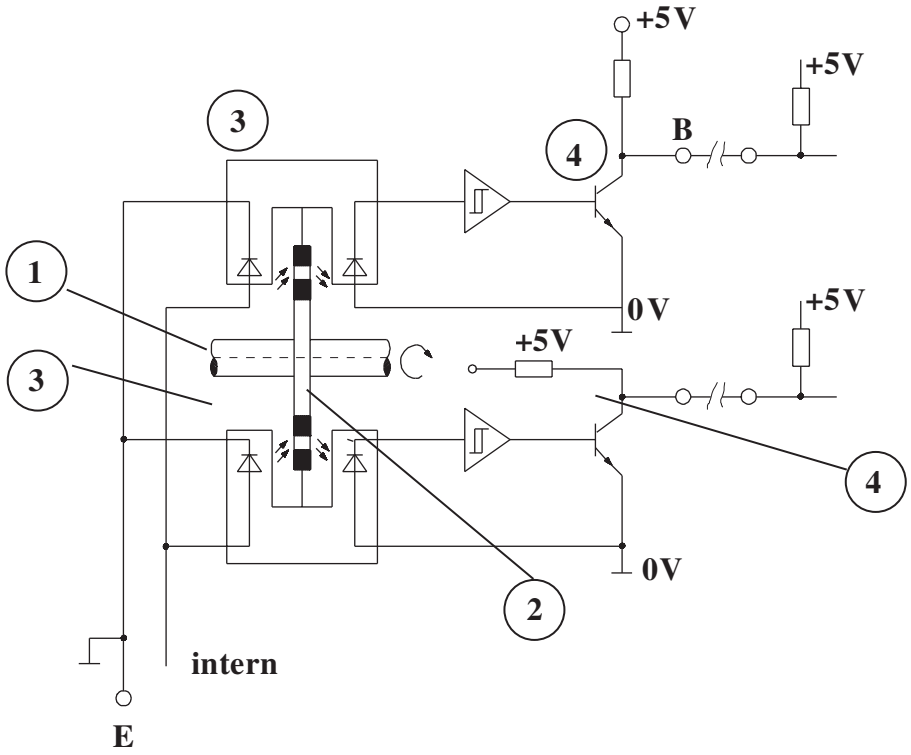
2.2 Electrical design



The built-in electronics comprise the following functional groups:

- Oscillator for generation of the AC input voltage
- Preamplifier for the output signal
- Phase-sensitive rectifier for conversion of the AC output signal into a DC voltage
- Output amplifier

2.3 Angle-of-rotation transducer



Schematic of angle-of-rotation measurement system

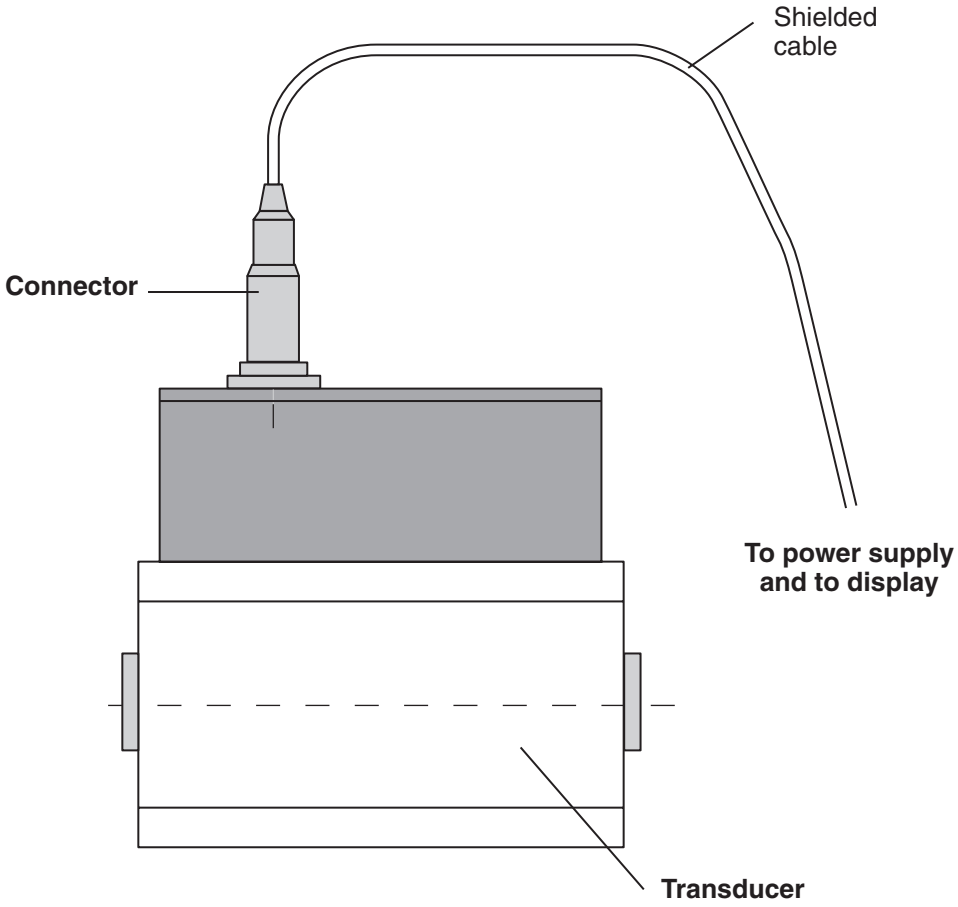
1. Rotating shaft
2. Encoder disk
3. Double-arm photoelectric barrier
4. Open-collector output (external pull-up resistor required)*

Features:

- 360 slots in the encoder disk
- Two double-arm photoelectric barriers 90° apart.
- Number of pulses generated proportional to angle of rotation.

* The ohmic value of the resistor depends on the maximum speed of rotation and the cable length (e.g. 1500 rpm and a 4 m cable, R=3.3kΩ).

3. Electrical connection of the torque transducer



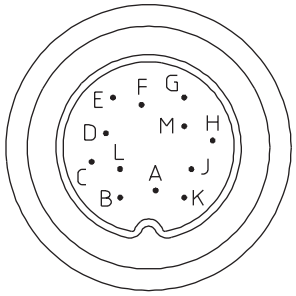
- Cable type: at least 12 conductors, e.g. LIYCY 12 x 0.14
- Max. cable length: 15 m

3.1 Connector pin assignments

Description of interface for Type, art.-no.: 7203

Function	Pin		Description
supply voltage	A	$-U_B$	-10.5..-16V, ≤ 30mA
angle output	B	⊀1	360 impulse per revolution duty cycle 50/50 ±20%
moment output	C	U_a	±5V bei $\pm Md_{nenn}$ on ≥ 2k_ +5V at calibration Ri=10_, output short circuit proof acc. GND
moment output	D	GND	GND Reference for U_a
supply voltage	E	GND	GND Reference for U_b, R_{kod}, Kal, <1), <2
supply voltage	F	$+U_b$	+10,5V..+16V, ≤ 30mA
angle output	G	<2	Signal 90°lagging to signal on Pin B on rotation to the right
speed puls output	H	-	60-pulse / rotation
free	J		
calibration input	K	Kal	Off: 0V – 2V; On: 3,5V – 30V Input impendence: > 100 k_
measuring range coding	L	R_{kod}	free
shield	M		not used in the transducer

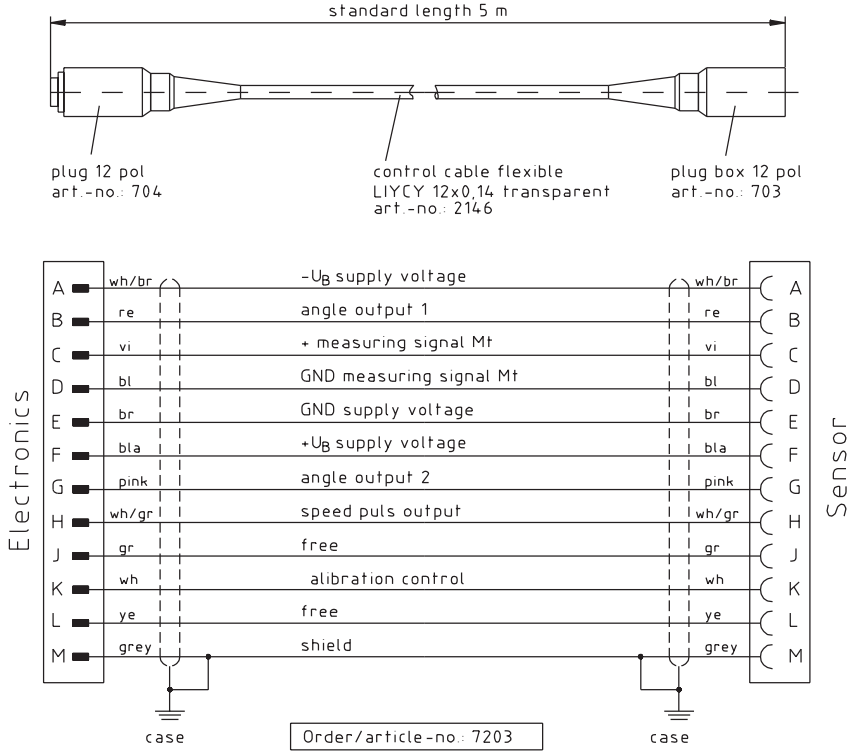
Top view of connector on transducer



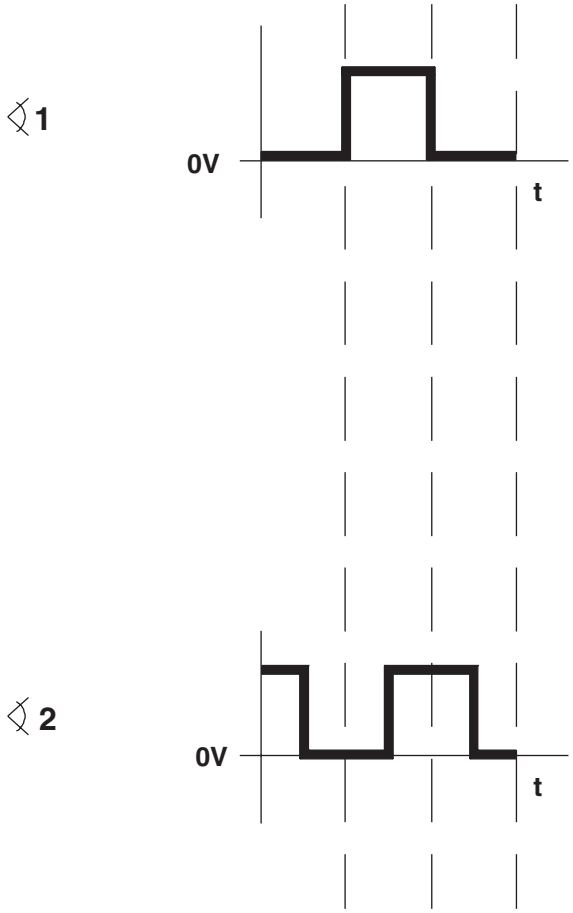
Angle outputs: open collector outputs with internal 10kΩ pull-up to +Vop

Built in connector: Binder Series 680, type 09-0331-80-12 or equivalent

Cable diagram with plugs on both sides



3.1.1 Signals, angle outputs



Positive pulse

Option

Pulse 90° phase-shifted with respect to angle

Example application:
Detection of direction of rotation (clockwise/counter-clockwise)

3.2 Laying of the output signal cables

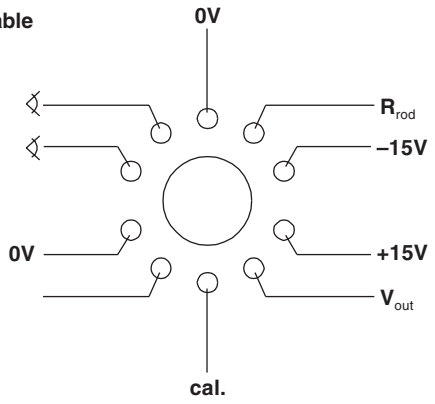
-Note on safety-

- Do not lay together with control lines or lines carrying a high current.
- Do not lay close to strong electromagnetic fields, e.g. those of transformers, welding equipment, contactors, motors, etc.
- If the above is unavoidable, the cables must be laid in grounded heavygage steel conduit.
- At the transducer, lay the cables in a sling in order to prevent vibration-induced damage to them.

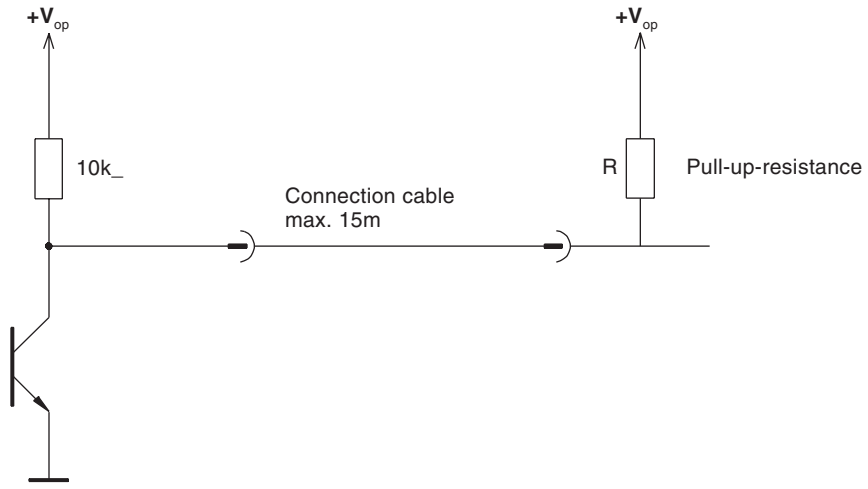
3.3 Placement of conducters in cable

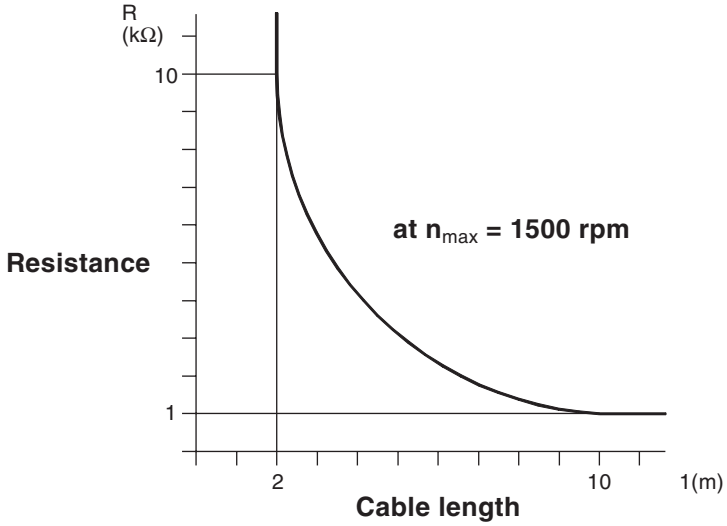
In order to prevent the measurement signal being distorted by the angle pulses, the corresponding conductors should be separated within the cable.

Example: 10-conductor cable



The cable length has virtually no influence on the measurement signal, but in the case of the angle outputs the external pull-up resistances must be properly adjusted.





4. Mechanical installation of the torque transducer

Transducer with fixed stator:

2 holes are provided in the transducer housing for this purpose.

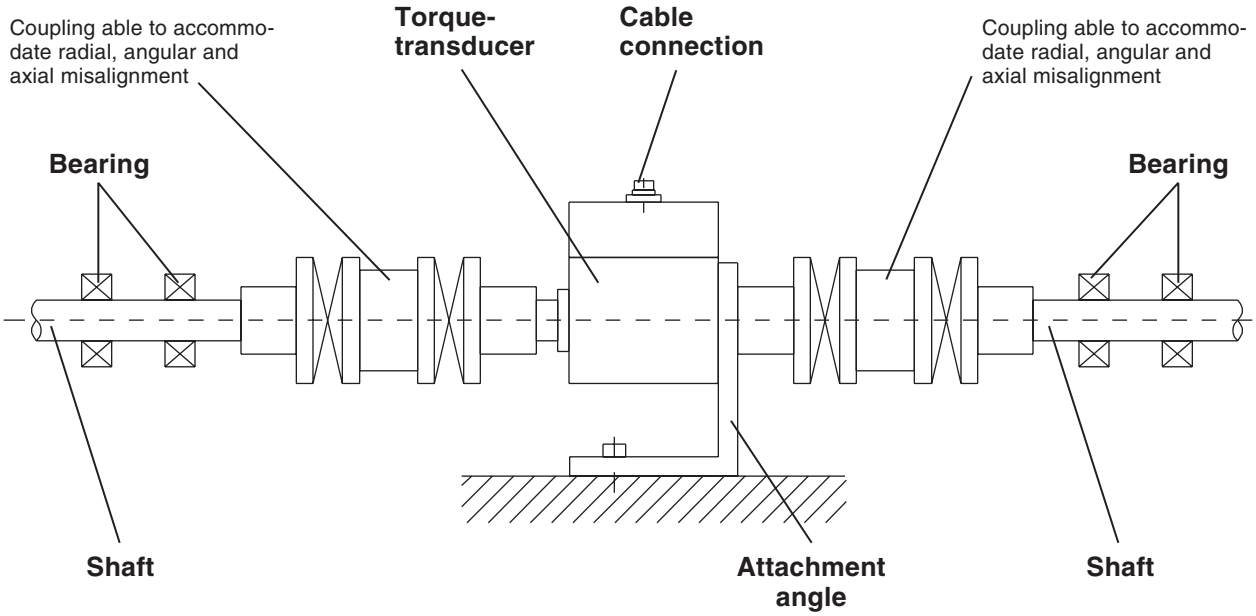
- Use displaceable couplings as both shaft ends that are capable of accommodating angular, radial and axial misalignment.
- Good results have been obtained with miniature couplings stiff against torsion such as those described in data sheet 8303.

At torques of 50 Nm or greater, it is also possible to install the transducer without fixed stator:

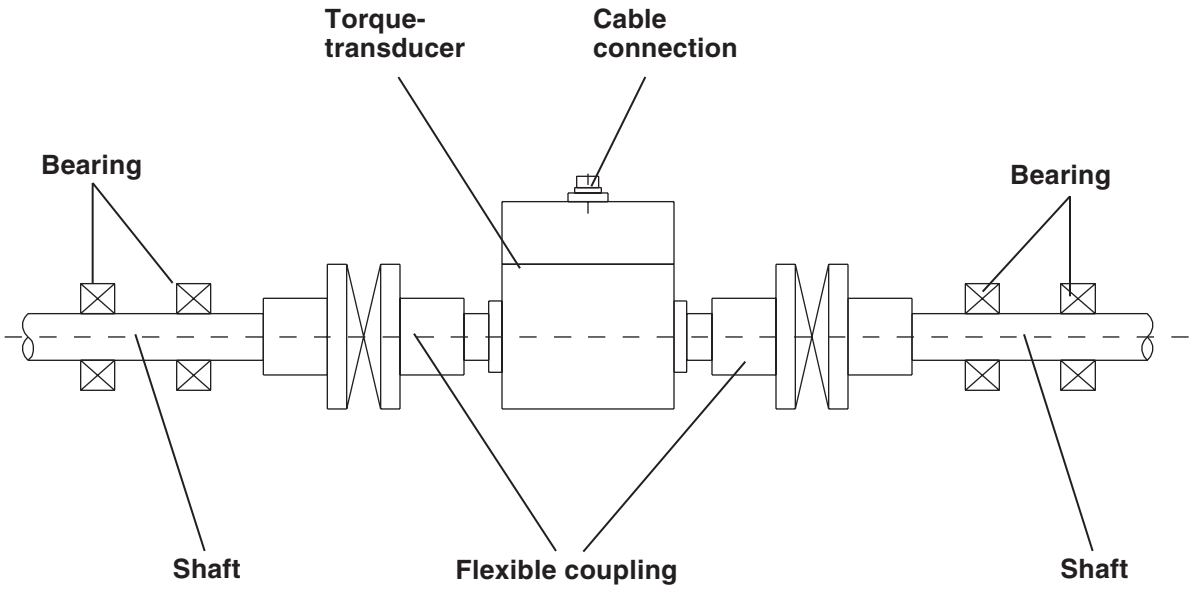
- In this case, use flexible couplings at both ends.

Caution: during installation no impermissibly high torques may be allowed to arise between the two ends of the torque transducer shaft.

4.1 Suggestions for installation



Transducer with fixed stator and couplings able to accommodate angular, radial and axial misalignment at both ends.



Transducer installed without fixed stator, with flexible coupling at each end.

This type of installation is possible at torques of 50 Nm and greater.

5. Mechanical calibration

To perform this, a calibration setup with lever arm and weights is needed to create a torque.

Steps for calibration:

a) Apply the rated torque to the transducer, then remove the load again.

b) Precisely adjust the transducer to the zero point.

c) Apply a known torque to the transducer.

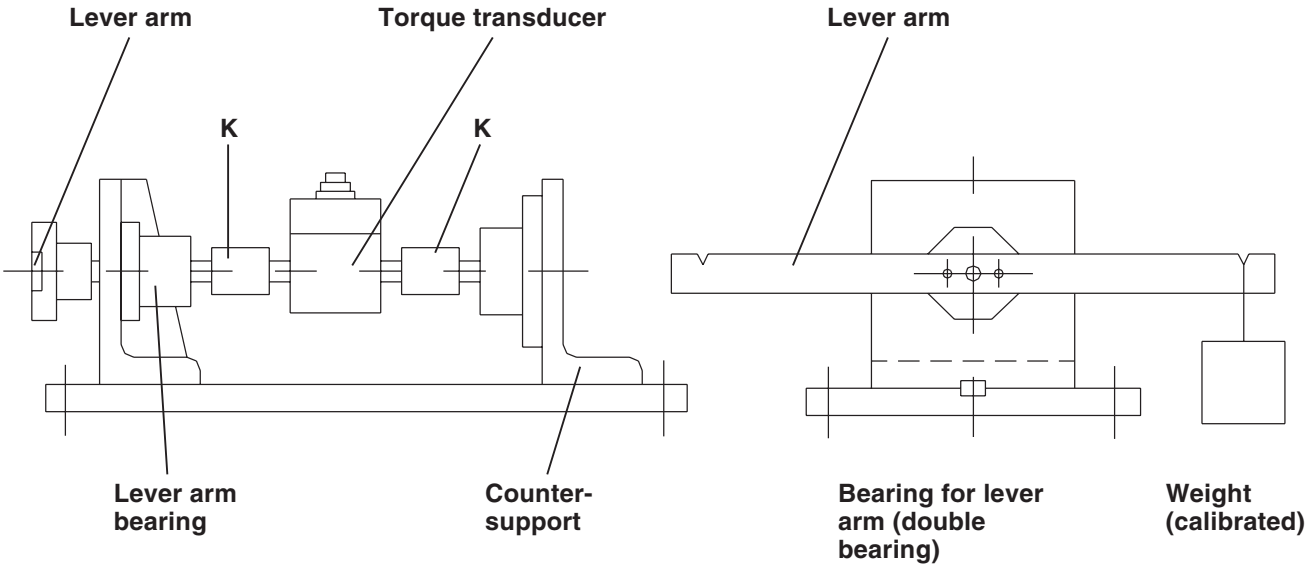
d) Set the indicator to the proper value.

Recording of a calibration curve:

a) Calibrate the transducer as described above.

b) Progressively apply greater torques to the transducer in steps of 1/10 up to the full rated torque. Then gradually remove the torque in the same way. At each step, wait at least 30 seconds for the torque reading to stabilize, and then record.

5.1 A simple calibrating setup

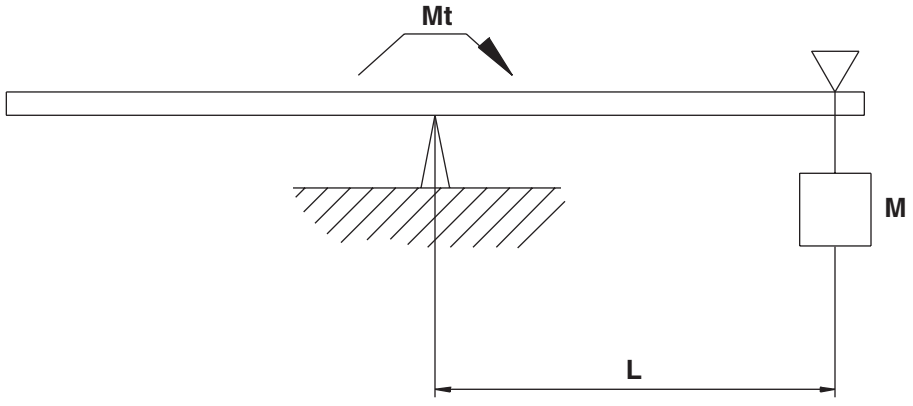


K = coupling able to accommodate axial and radial misalignments

5.2 Sample calculation of lever arm length

$$L = \frac{Mt}{m - g}$$

Mt = torque
L = required lever arm length
m = required mass
g = 9.80665 m/sec² - normal gravitational acceleration (varies slightly from place to place)

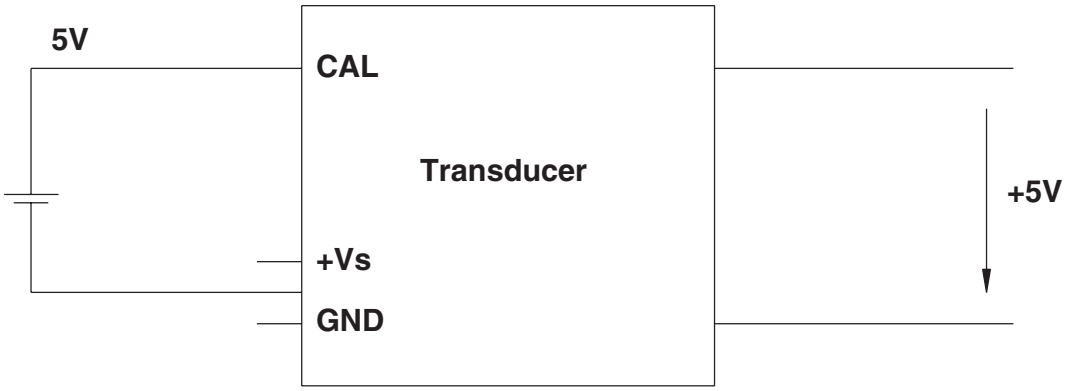


eg. m = 1 kg. Mt = 10 Nm

$$L = \frac{10Nm \quad sec^2}{1\ kg \_ 9.80665} = 1{,}0197\ m$$

5.3 Electrical calibration

A calibration control facility is integrated in the transducer to permit electrical calibration.



Procedure for electrical calibration:

- Remove all mechanical loads from the transducer (no torque).
- Apply the calibration voltage Vc to pin K referenced to pin E.
- An output signal corresponding to the rated torque will be emitted.

6. Maintenance

- Type IE transducers require virtually no maintenance.
- The service life expectancy of the bearings within the rated temperature range is approx. 20,000 hours.
- The service life expectancy of the bearing within the operating temperature range is approx. 10,000 hours.
- The bearings can only be replaced in the factory.
- For high-precision applications: recalibrate the transducer once annually (calibration at the factory or using an appropriate calibration setup).
- Once a month, check the cable connectors to make sure that they are securely seated.
- Check the cables for damage once a month.

7. Troubleshooting guide for transducer shaft

Problem	Probable causes	Remedial action
Shaft does not rotate freely	Bearings are defective due to: a) Torsional or flexional vibrations b) Excessive axial or radial loads c) Old or soiled bearings d) Bent shaft	Return to factory
Zero point displacement ≤ 2 %	Rotational vibration Shock forces	Readjust zero point on instrument amplifier
Zero offset between 2% and 5% of range	Transducer has been overloaded Shock forces Rotational vibration	The zero point can be recalibrated once at the instrument amplifier
Transducer has hysteresis between clockwise and counter-clockwise torque	Transducer has been overloaded by changing loads or rotational Rotation vibration	Return to factory

NOTES:

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

Where Do I Find Everything I Need for Process Measurement and Control? OMEGA...Of Course!

Shop online at www.omega.com

TEMPERATURE

- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

M2958/0602