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Instruction Manual

Basic Line Torque Sensor
Type 4520A...

CE

4520A_002-515e-04.11

Foreword

This manual applies to the Basic Line Torque Sensor Type 4520A… .

The instruction manual must be kept on hand for future use, and must be available at the site of implementation of the NC joining system, as needed.

The specifications in this manual can change at any time without prior notification. Kistler reserves the right to improve and to change the product for the purpose of technical progress without the obligation to inform persons and organizations as the result of such changes.

Original language of these operating instructions: German

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Content

Total Pages 25

1. Introduction

Please take the time to thoroughly read this instruction manual. It will help you with the installation, maintenance, and use of this product.

To the extent permitted by law Kistler does not accept any liability if this instruction manual is not followed or products other than those listed under Accessories are used.

Kistler offers a wide range of products for use in measuring technology:

- Piezoelectric sensors for measuring force, torque, strain, pressure, acceleration, shock, vibration and acoustic-emission
- Strain gage sensor systems for measuring force and torque
- Piezoresistive pressure sensors and transmitters
- Signal conditioners, indicators and calibrators
- Electronic control and monitoring systems as well as software for specific measurement applications
- Data transmission modules (telemetry)
- Electromechanical NC joining modules and force-displacement monitors
- Test bed systems for electric motors and gear units for laboratory, manufacturing, and quality assurance

Kistler also develops and produces measuring solutions for the application fields engines, vehicles, manufacturing, plastics and biomechanics sectors.

Our product and application brochures will provide you with an overview of our product range. Detailed data sheets are available for almost all products.

If you need additional help beyond what can be found either on-line or in this manual, please contact Kistler's extensive support organization.

2. Important Information

2.1 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 Kistler Instrument sales office for return instructions.

3. Application and Key Features

- Measuring ranges from 1 ... 1 000 N·m
- Speed up to 10 000 min^{-1}
- Torque meter 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 speed measurement
- Application in the laboratory, manufacture and quality control
- Great value for money

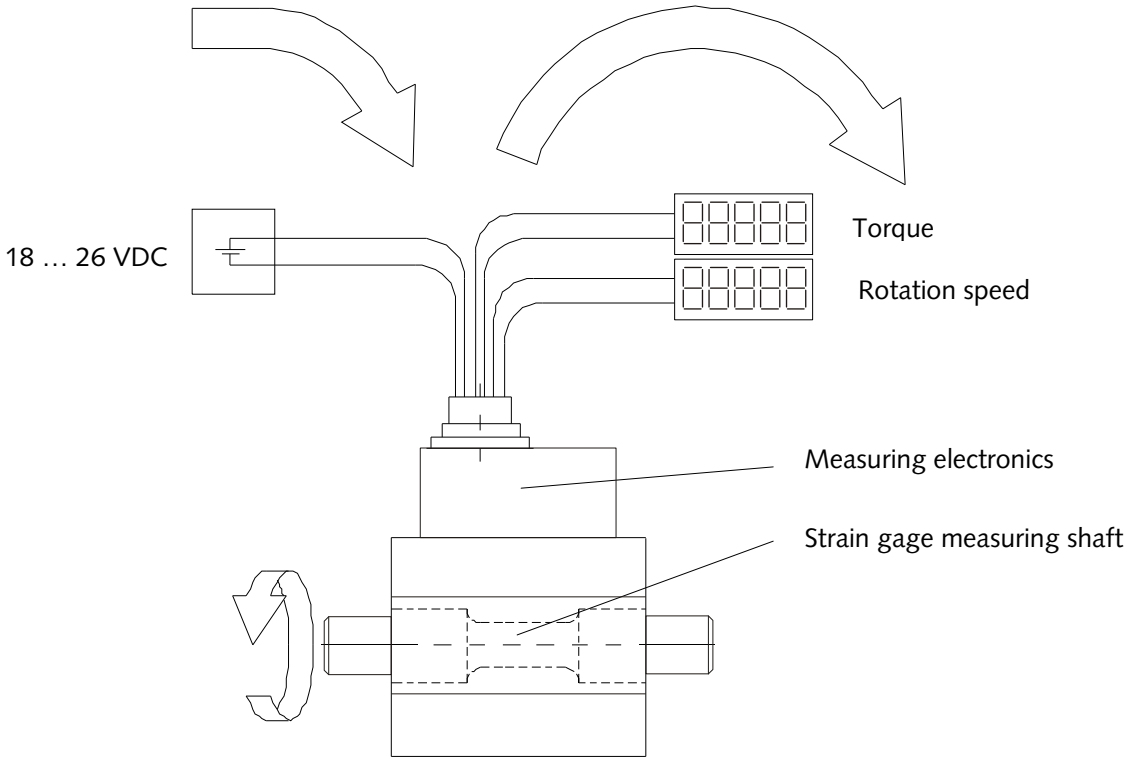


Fig. 1: Basic Line torque sensor Type 4520A...

4. Description of the Measuring System

4.1 Mechanical Design

Basic Line torque sensors Type 4520A… consist of a base body which contains the measuring shaft. On the measuring shaft there is a torsional section with strain gages and electronics with signal amplifier and A/D transformer.
The connection box of the base body contains the stationary electronics for the signal formation.
The base body of the sensor offers different assembly positions.

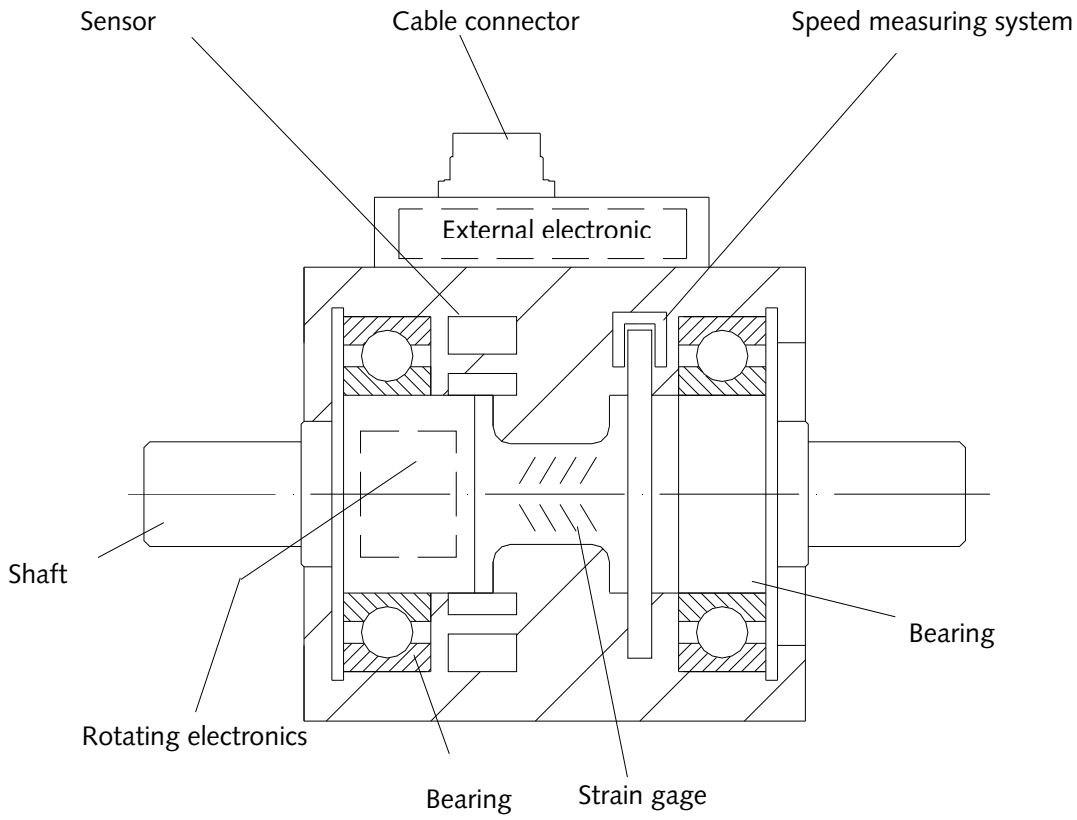


Fig. 2: Mechanical design Basic Line torque sensor Type 4520A...

4.2 Electrical Block Diagram

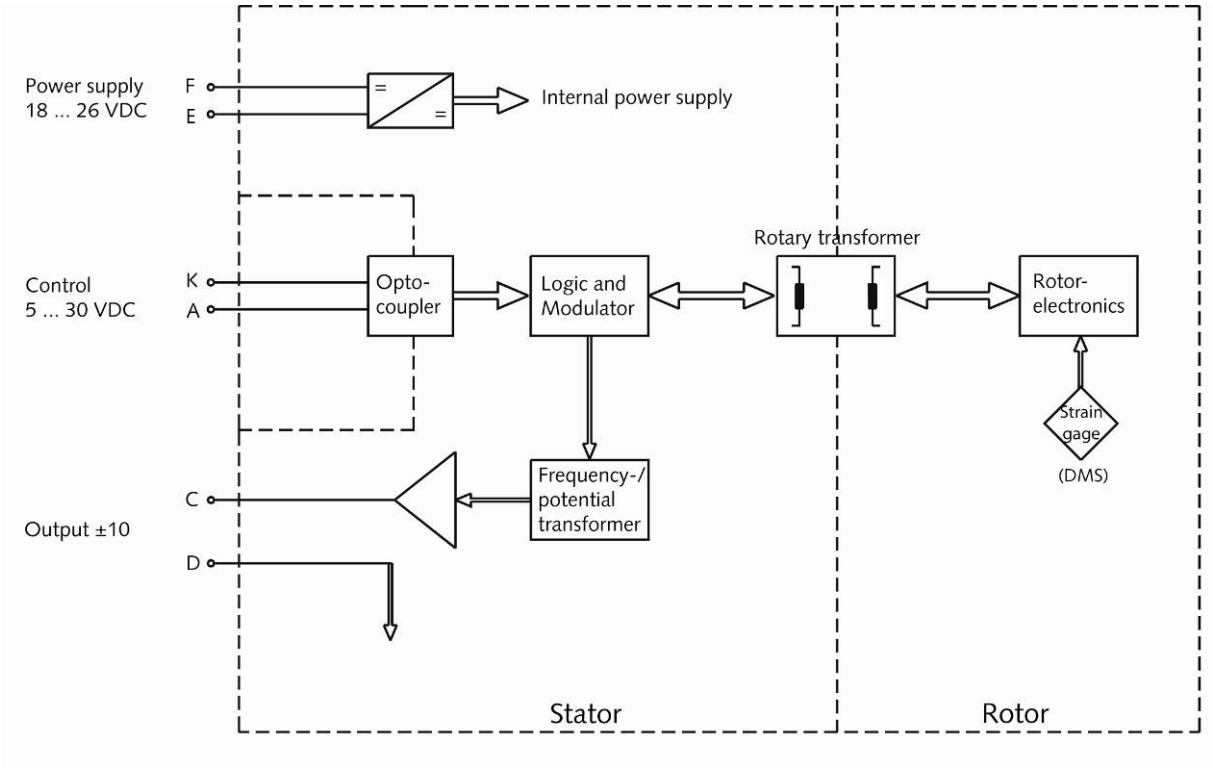


Fig. 3: Electrical block diagram

4.2.1 Examples of Application

Strict use of electrical isolation for feed and measuring signal.

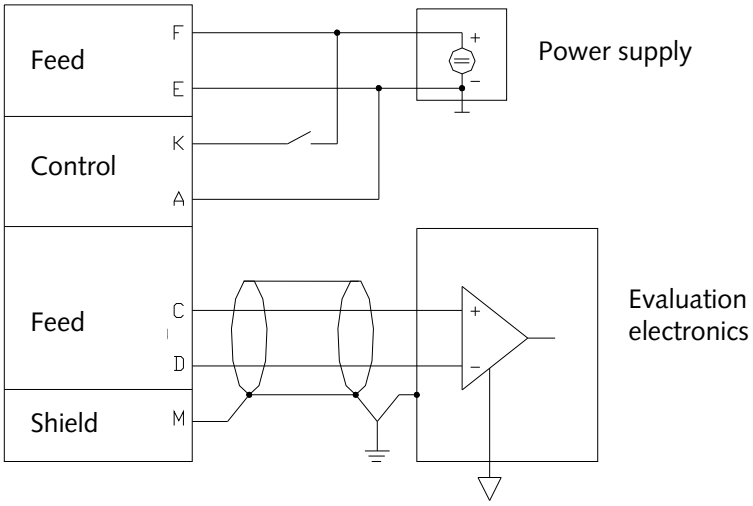


Fig. 4: Separate speed and measuring supply

Shared access measuring supply for feed and measuring supply.

Interlink the power and measuring supply, evaluation electronic is to be made.

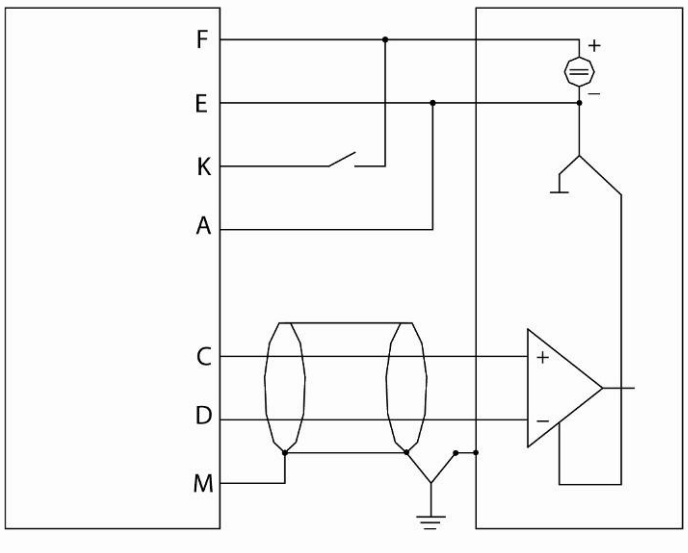


Fig. 5: Power and measuring supply in the evaluation electronic combined

4.3 Electrical Configuration of Speed Measurement

NOTE

Speed measurement is effected photo-electrically by evaluating the light, which shines through a grid wheel.

A gallium-arsenide light diode serves as transmitter emitting in the near infrared. In a phototransistor the light is converted into an electric signal and after a pulse shaper made available as "*open collector*" signal. The input current amounts max. 16 mA.

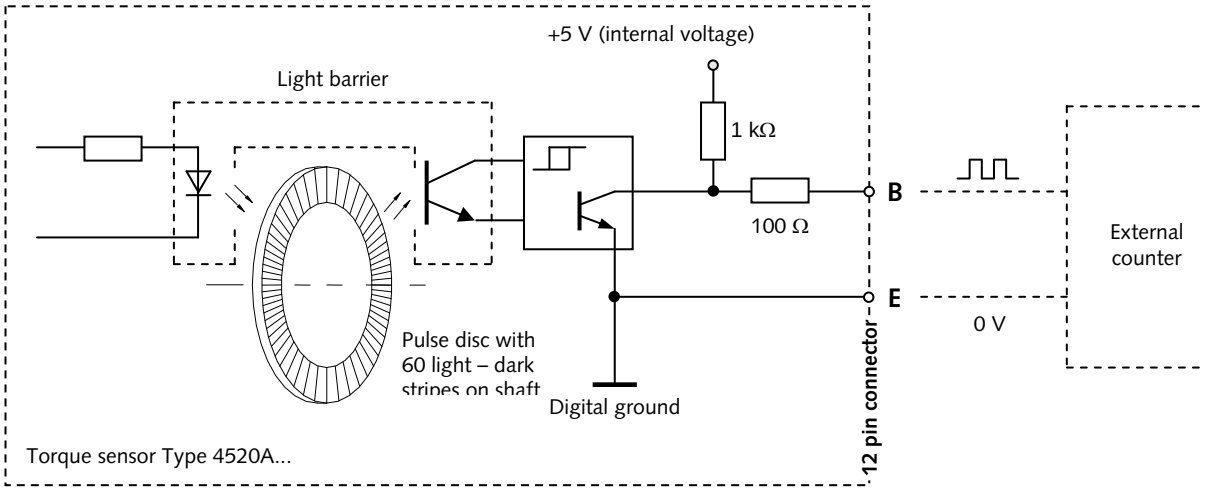


Fig. 6: Electrical block diagram of speed measurement

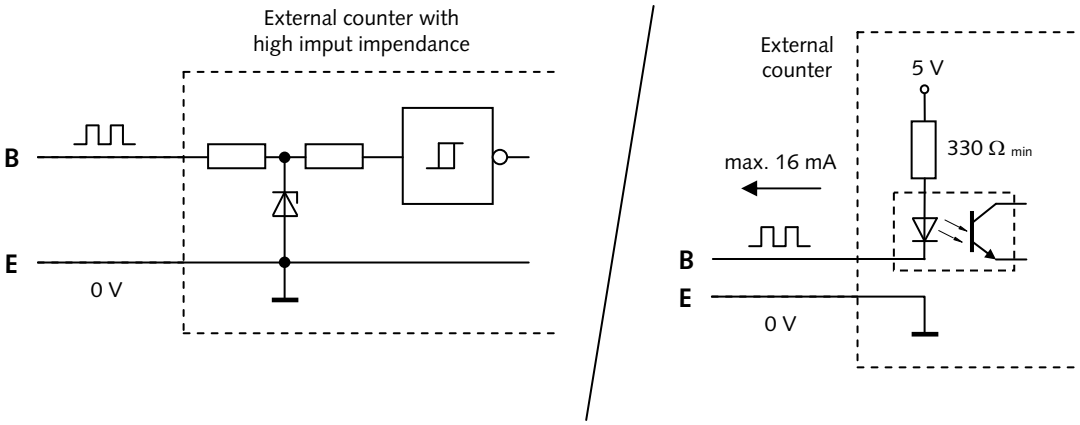


Fig. 7: Electrical CMOS- or TTL input circuit/optically isolated input circuit

5. Electrical Connections of the Sensor

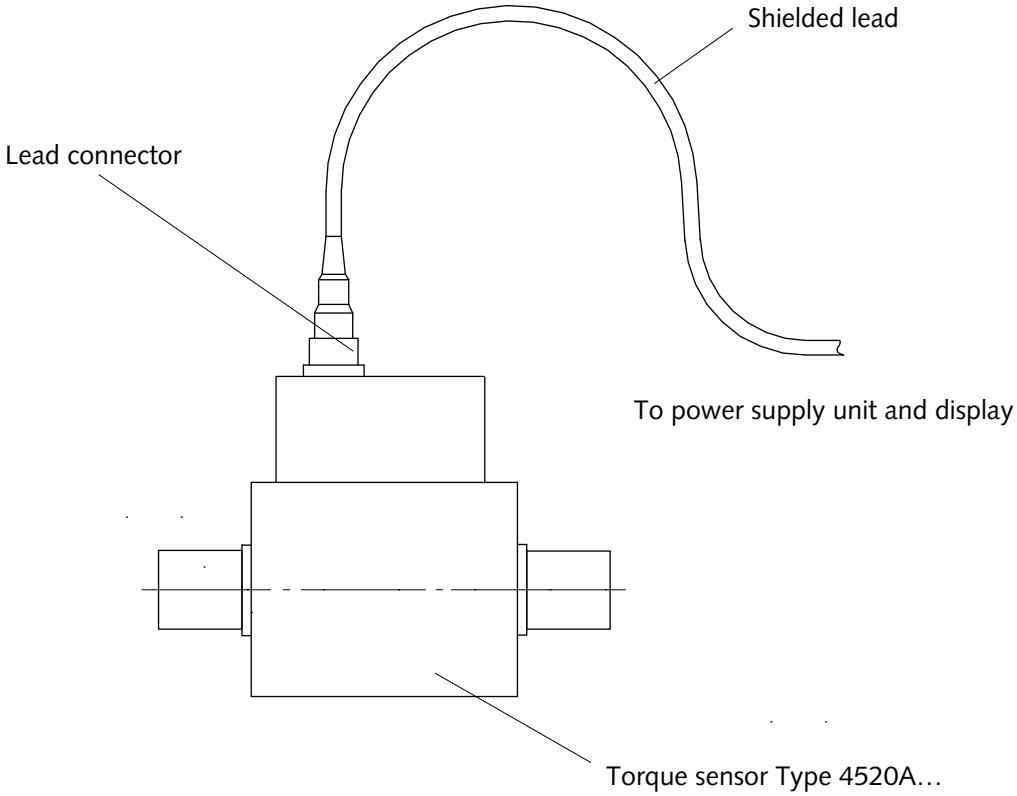
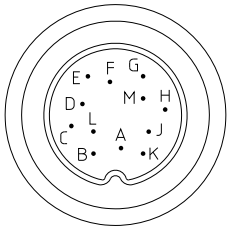


Fig. 8: Electrical connections

- Shielded lead of 0,14 mm² nominal cross section

5.1 Plug Connection

Pin Allocation of Built-in 12 pin Connector



Function	Pin		Descripption
Power Supply	F	$+U_B$	18 ... 26 VDC, power consumption <2 W
	E	GND	Reference for U_B and angle signals
Shield	M		In sensor; connected to case
Torque output	C	U_A	±10 VDC at M_{nom} at >2 kΩ 10 VDC at control signal revolution $R_{i.C}$ = 10 Ω, output with short-circuit protection connection to AGND
	D	AGND	Reference for U_A
Speed sensor	B	Track A	Open collector output Internal 1 kΩ resistance to 5 VDC (pull up), TTL-level
Input 100 % control input	K	Control	Off: 0 ... 2 VDC On: 5 ... 30 VDC
	A	KGND	Reference for control
	G		Reserved
	H		Reserved
	J		Reserved
	L		Reserved

5.1.1 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, e.g. 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 fixing 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 singal to prevent that the voltage drop on the 0 V-supply line affects the measured signal.

5.2 Instruction for Electrical Installation

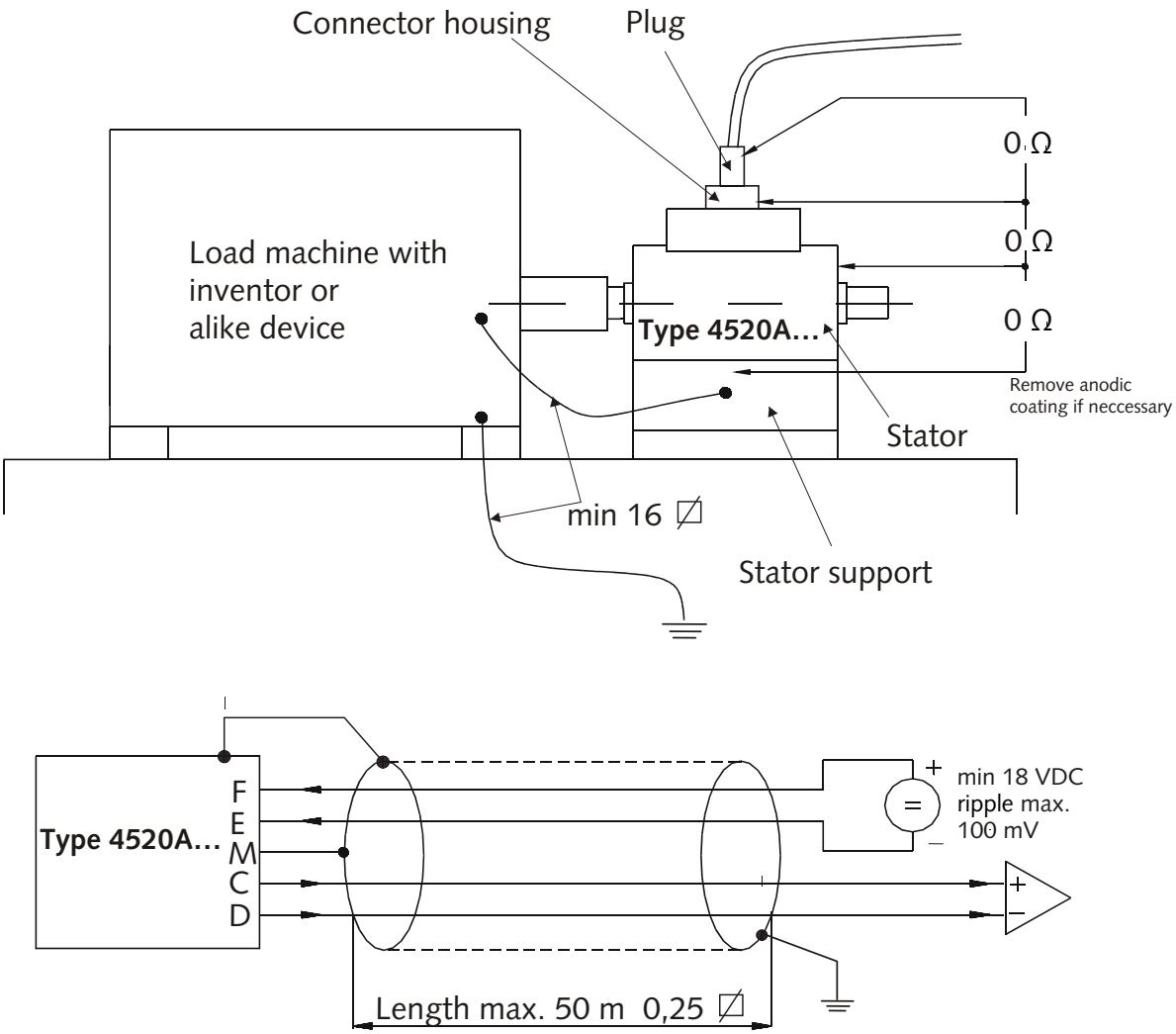


Fig. 9: Electrical installation

NOTE

- Please ensure correct functioning of the shield for the connection cable!
- To improve the electrical contact area between stator housing base and machine base, it's recommended to remove the anodization of the bottom of the stator housing.

5.3 Connecting Cable

5.3.1 Cable Diagram with Plugs on Both Sides, Article No.: KSM072030-5

wh= white
bn=brown
rd= red
bk= black
bu= blue
pk= pink
gn= green
gy= grey
vt= violett
ye= yellow

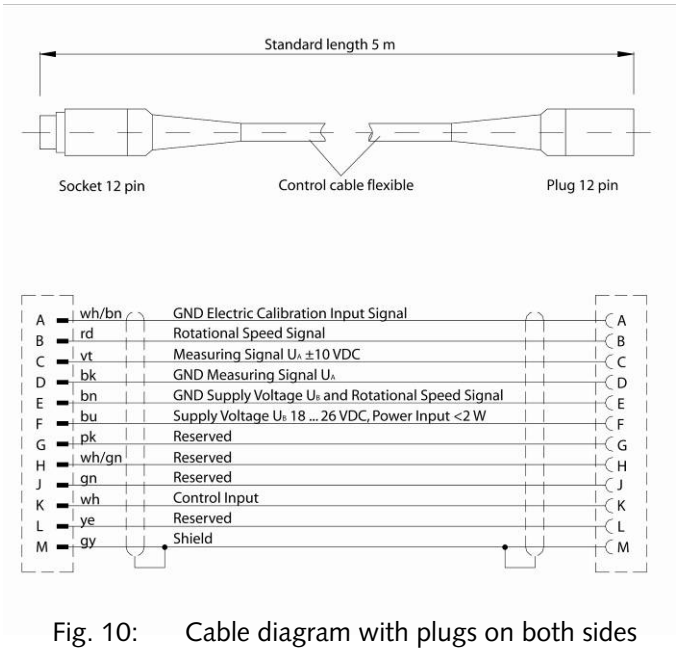


Fig. 10: Cable diagram with plugs on both sides

5.3.2 Cable Diagram, Plug (Sensor), open Ends, Article No.: KSM012497

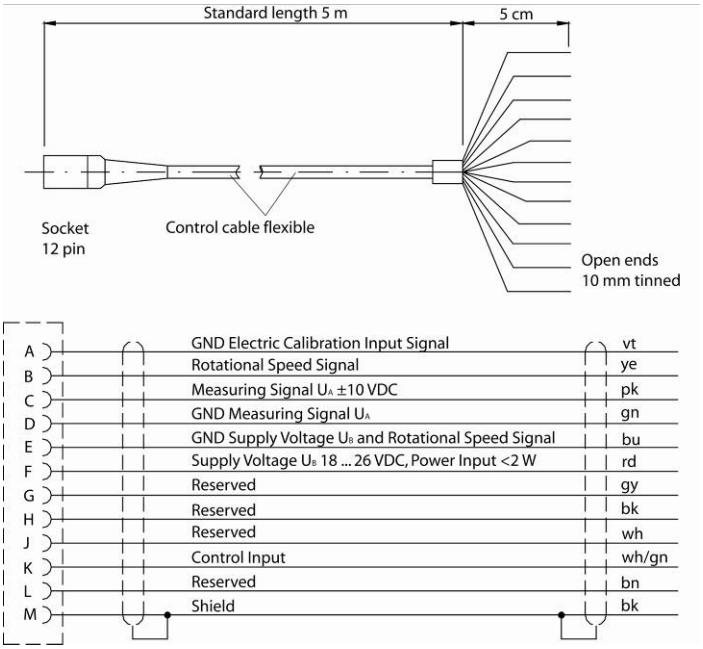


Fig. 11: Cable diagram with cable socket and open ends

6. Mechanical Installation of the Torque SensorFehler! Textmarke nicht definiert.

There are different methods of installing the torque sensor, depending on the application.
Since very high lateral forces and bending moments may occur even at small axial displacement, the torque sensor must always be mounted with couplings.

Generally:

- The plant must be secured with a burst protection corresponding to the machine protection law.
- We recommend calculating the shafting according to the torsion- and bending critical speeds. These speeds should be avoided during operation. For a safe operation of the unit we recommend to remain approx. 30 % below or above the critical speeds.
- After installation depending on speed the unit should be balanced according to DIN 2060.
- The machine vibrations should be checked according to VDI 2056.

Literature:

Dubbel pocket book for machine engineering, published by Springer.

F. Holzweißig, H. Dreßig, textbook of machine dynamics, published by Springer.
DIN 2056 evaluation rules for mechanic vibrations of machines.

6.1 Possible Installation Type 4520A...

Torque sensor between drive and brake

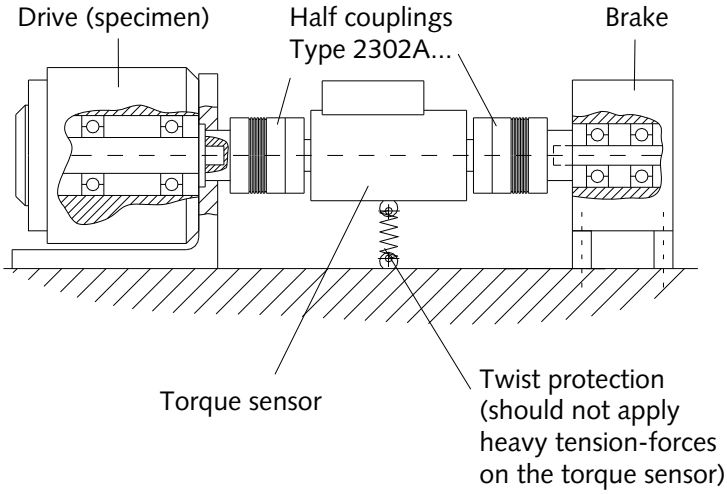


Fig. 12: Together with the half couplings the torque sensor forms a full coupling

Couplings compensate for axial-radial and angular misalignment.

The connection of shaft and coupling hub is positively locked by a clamping element.
The torque measuring shaft is only a part of the power train. Radial and torsional vibrations may have a very bad impact on the performance of the torque shaft and the measuring signal.

For that reason the operating speed must not be near the critical speed, either it has to be far underneath or above it.

7. Mechanical Application and Mechanical Istallation of the Torque Sensor Type 4520A...

7.1 Frictional Torque Control in Production

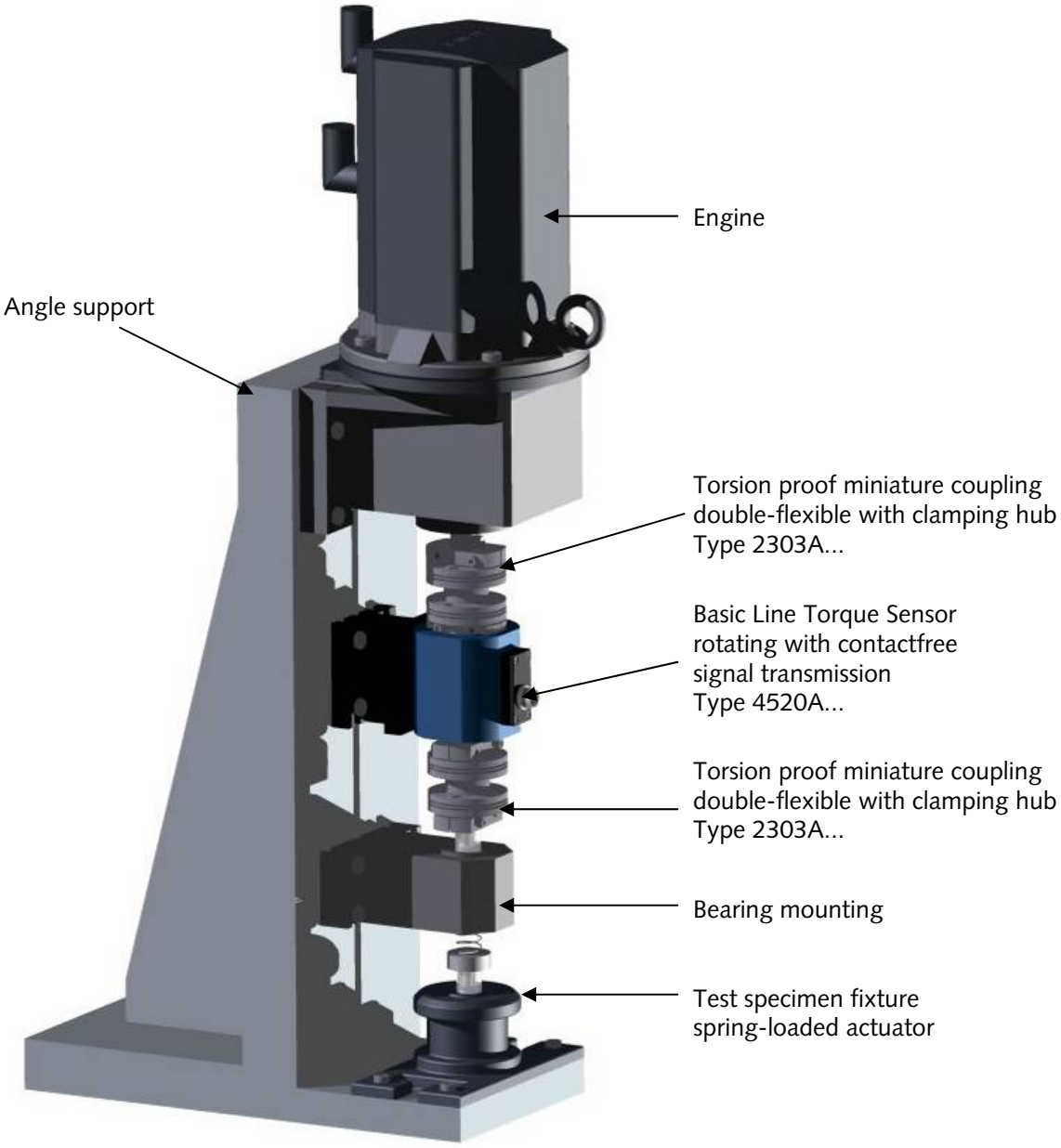
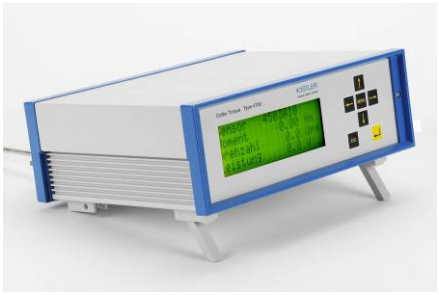


Fig. 13: Application example Type 4520A...

7.2 Torque Measuring Shaft Version RA



For the electric connection of measuring shaft and supply- and evaluation unit we recommend to use the shielded signal lead, Type KSM072030-5 with low capacity.

As supply and evaluation unit we suggest the Control Monitor CoMo Torque Type 4700A... .
The matching connection cable is Type KSM018538-2,5.

As an alternative solution the units Type 4704A…, model VA 3600 without display can be used.
Assembly set Type KSM035681 as accessories for VA3600 for the connection of the torque measuring shaft Type 4520A... .

The signal lead should not exceed a length of 30 meters. Do not run the lead parallel to power cables or control circuits.
The pin connection is explained in chapter "Plug Connection" of this manual.

On each side of the torque measuring shaft there is a high quality bearing installed. The installation can have any position, however offset couplings must always be applied to balance geometrical errors and keep false loads away from the torque measuring shaft.

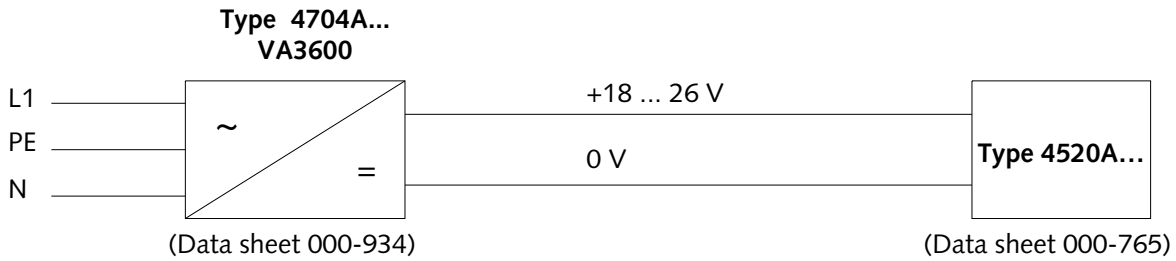
Radial, axial, diagonal and angular errors are compensated by:

- Multi-disk couplings, e.g. Type 2303A...
- Membran
- Claw couplings

7.3 Supply and Evaluation

The sensor may only be operated using filtered 24 VDC voltage.

Recommended supply voltage:



Terminal box for Type 4520A…

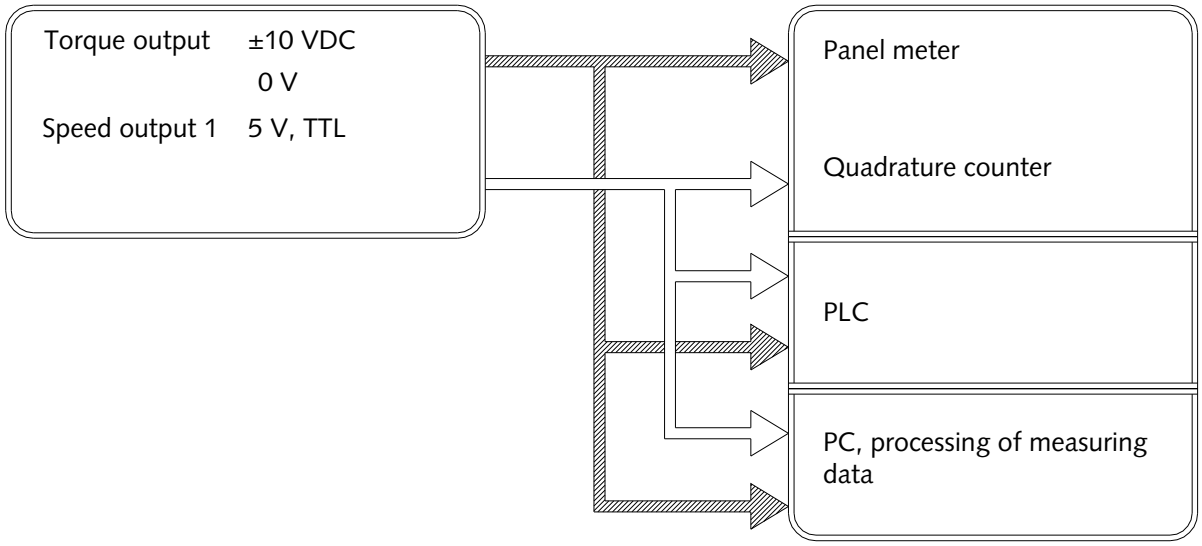


Fig. 14 Supply circuit and evaluation

8. Static Calibration

This procedure requires the use of a calibration device with a lever arm and weights for producing specific values of torque.

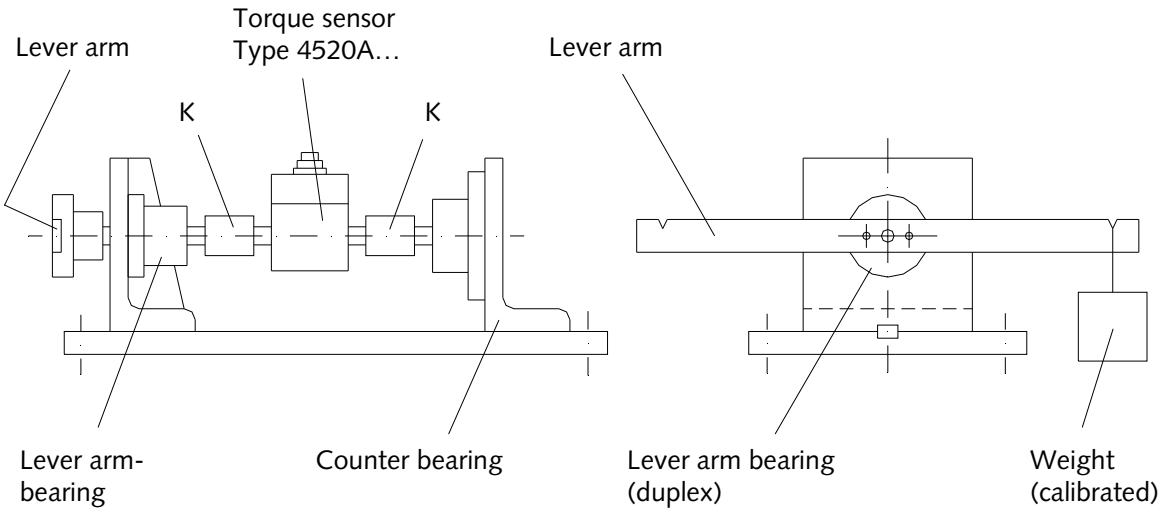
The calibration procedure is as follows:

- Apply the rated value of torque to the torque meter and then remove it again
- Adjust the zero reading accurately
- Apply a known value of torque to the torque meter
- Adjust the displayed reading to the corresponding value

Plotting a calibration curve

- Calibrate the torque meter as described above
- Apply torque in 1/10 steps up to the full rated value and then remove it again in the same way.
- A delay of at least 30 seconds must be allowed between the individual 1/10 steps so that each reading can stabilize before it is recorded.

8.1 Construction of a Simple Calibration Device



K = loose half-couplings

Fig. 15: Calibration device

8.2 Calculation Example for Lever Arm Length

$$L = \frac{M}{m \cdot g}$$, whereby

M = Torque
L = Length of lever arm required
m = Mass required
g = 9.80665 m/s²
(= standard gravity – varies with location)

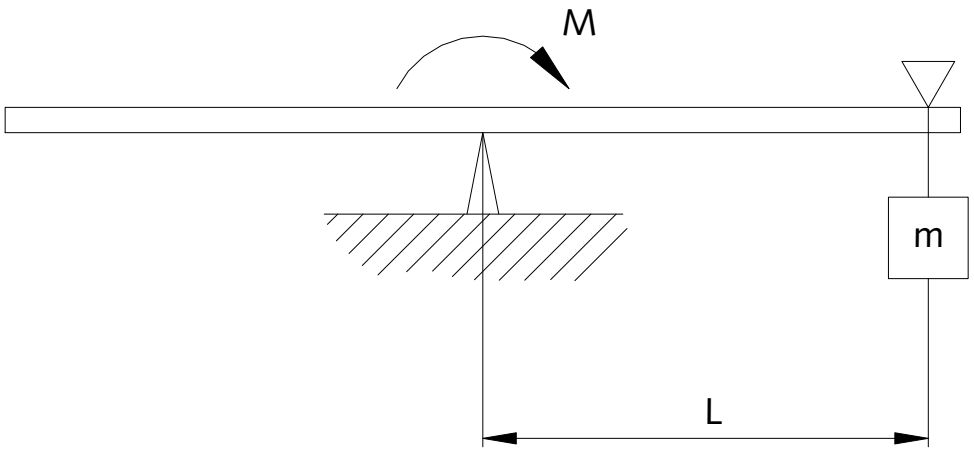


Fig. 14: Calculation of lever arm length

Example: m = 1 kg
Mt = 10 N·m

$$\rightarrow \quad L = \frac{10\ \text{N·m}\ \ \text{s}^2}{1\ \text{kg} \times 9{,}80665\ \text{m}} = 1{,}0197\ \text{m}$$

9. Maintenance

- Sensors of the Type 4520A… are almost maintenance-free.
- Durability of bearings in rated temperature range is approx. 20 000 hours.
- Durability of bearings in working temperature range is approx. 10 000 hours.
- Renewal of bearings can only be effected at works.
- Precision applications: Yearly calibration of sensor (calibration at works or with adequate calibration device).
- Control correct cable plug position monthly.
- Check cables for damages monthly.
- Annual re-calibration of torsional moment

10. Repairs

Fault	**Cause**Fehler! Textmarke nicht definiert.	**Remedy**
Shaft stiff to turn	Bearing defect 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 can be readjusted at the display.
Zero shift between approx. 2 and 5 % of full scale	Sensor wurde überlastet Drehschwingungen Stossmomente	The zero reading can be readjusted once at the display.
Hysteresis between clockwise and anticlockwise torque	Sensor durch hohe Wechsellast oder Drehschwingungen über-lastet.	Return to factory

11. Declaration of Conformity

CE-Konformitätserklärung

Hiermit erklären wir, dass die Bauart der nachfolgend bezeichneten Gerätes

Produktbezeichnung:	**Basic Line**	
Funktion:	Drehmomentsensor	
Typ:	4520A...	
Betriebsanleitung Nr.:	4520A_002-515d	Datenblatt: 4520A_000-765d

auf die sich diese Erklärung bezieht, den wesentlichen Anforderungen entspricht, die in den nachfolgend bezeichneten Richtlinien festgelegt sind:

EG-Richtlinie 2004/108/EG und Änderungsrichtlinien **EMV-Richtlinie** 2004/108/EG und Änderungsrichtlinien **EG-Richtlinie** 2006/95/EG und Änderungsrichtlinien

Die Konformität wird in Bezug auf folgende angewandte harmonisierte Europäische Normen erklärt

Norm	Normenbezeichnung
EN 61010-1 /202-8/2004-1	**Niederspannungs-Richtlinie:** Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel-, und Laborgeräte
EN 61000-6-3, 2007-9 **EN 55011, 2007-11** **EN 61000-6-2, 2006-3** **EN 61326-1, 2006-10** **EN 61000-4-2, 2009-12** **EN 61000-4-3, 2008-6** **EN 61000-4-4, 2005-7** **EN 61000-4-6, 2009-12**	**EMV-Richtlinie:** Fachgrundnorm Störaussendung Wohnbereiche Störaussendung ISM-Geräte, Grenzwertklasse B Störfestigkeit Industriebreiche mit den darin aufgeführten Grundnormen Elektrische Mess-, Steuer, Regel- und Laborgeräte- EMV-Anforderungen
Prüfbericht Nr.:	86232-1-BCD vom 04.01.1999 Fa. ELMAC, Reg. Nr.:TTI-P-G010/98-01, sowie Nachtrag vom 21.01.2010 Fa. Baudisch

Bei einer nicht mit Dr. Staiger, Mohilo + Co. GmbH abgestimmten Änderung der Maschine verliert die Erklärung ihre Gültigkeit.

Bevollmächtigter zur Zusammenstellung der technischen Dokumentation:
Dr. Staiger, Mohilo + Co. GmbH

Diese Erklärung wird verantwortlich für den Hersteller abgegeben durch:

Vorname, Name, Funktion:			Dipl. Ing. Franz Winter, Geschäftsführer	
Ort:	Maierhofstr. 35 73547 Lorch Deutschland	**Datum:**	30.03.11	**Unterschrift:**

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften.

12. Accessories and Ordering Key

Included Accessories

- None

Optional Accessories	Type/Art. No.
• Female cable connector with solder lug 12 pin	KSM000703
• Connecting cable, 5 m, 12 pin – flying leads	KSM124970-5
• Connecting cable, 2,5 m, 12 pin – CoMo Torque	KSM185380-2,5
• Control Monitor CoMo Torque evaluation instrument for torque sensors (see data sheet 4503A_000-595)	4700A
• Connecting cable, 5 m 12 pin neg. – 12 pin pos.	KSM07203-5

Ordering Key

Type 4520A ☐

Measuring Range in N·m	
1	1
2	2
5	5
10	10
20	20
50	50
100	100
200	200
500	500
1 000	1 000

Ordering Example **Type 4520A10**

Torque sensor: Rated torque 10 N·m

13. Index