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Instruction manual and data sheet

Torque Sensor Series 2300

PREMIUM QUALITY
MADE IN GERMANY



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NCTE AG® Torque Sensor Series 2300 Instruction Manual and Data Sheet.

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D-82041 Oberhaching

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State: September 2020

Instruction manual

| | | |
|------|---|---|
| 1 | General | 5 |
| 1.1 | Customer service address..... | 5 |
| 1.2 | Warranty..... | 5 |
| 1.3 | Scope of delivery | 5 |
| 1.4 | Declaration of conformity | 6 |
| 2 | Safety..... | 7 |
| 2.1 | Intended use | 7 |
| 2.2 | Duration of use | 7 |
| 2.3 | Structural change..... | 7 |
| 2.4 | Training of the operating personnel..... | 7 |
| 2.5 | Transport and handling | 7 |
| 3 | Torque Sensor Series 2300 | 8 |
| 3.1 | Short description | 8 |
| 3.2 | Assembly and disassembly | 8 |
| 3.3 | Interface description | 8 |
| 3.4 | Starting up | 8 |
| 3.5 | Operation during regular mode..... | 9 |
| 3.6 | Irregular operation, actions in case of failures..... | 9 |
| 3.7 | Safety instructions | 9 |
| 3.8 | Shaft preservation | 9 |
| 3.9 | Service, maintenance and repair | 9 |
| 3.10 | Disposal..... | 9 |

Data sheet

| | | |
|----|--------------------------------|----|
| 1 | Key Facts | 10 |
| 2 | Torque ranges..... | 10 |
| 3 | Load characteristics | 10 |
| 4 | Technical characteristics..... | 11 |
| 5 | EMV Emission data | 12 |
| 6 | Dimensions | 12 |
| 7 | Wiring diagram | 13 |
| 8 | Sensor wiring | 13 |
| 9 | Angle sensor | 14 |
| 10 | Order options | 14 |
| 11 | Accessories | 15 |

Instruction manual

1 General

Dear customers,

Thank you for your decision to buy our sensor products. You have chosen a high quality and extremely precise torque measuring system.

This manual contains all the information necessary for you and the installation, operating and maintenance personnel to use your measuring system under the intended conditions of use. It contains important information to ensure proper and safe installation and operation.

For these reasons, the Instruction manual must always be available at the place of use of the torque measuring system and always ready to hand.

We reserve the right to make changes in the course of product improvements. We try to maintain compatibility with previous versions. All information without guarantee subject to technical changes.

For further questions we are of course also available after the purchase at any time.

Please use our contact address.

1.1 Customer service address

NCTE AG
Raiffeisenalle 3
D-82041 Oberhaching

Phone: +49 (0)89 665 619 0

Email: sales@ncte.de

Web: <https://ncte.com/>

1.2 Warranty

The warranty period is 12 months from the date of delivery from the factory, provided that the product is used in accordance with its intended purpose, in compliance with the maintenance and calibration regulations and the General Terms and Conditions of Business.

You can find these, current instruction manuals and data sheets on: <https://ncte.com/serienprodukte/>

1.3 Scope of delivery

The torque sensor system consists of a calibrated sensor, signal acquisition / -processing integrated in the housing, a 5 m long connection cable with plug (Binder plug no. 99-0426-10-08) and keystone (round shaft).

Enclosed you will find the corresponding calibration certificate and the warning notes.

1.4 Declaration of conformity

The manufacturer

NCTE AG
Raiffeisenalle 3
D-82041 Oberhaching

hereby declares that the following product

| | |
|----------------------|---|
| Product designation: | Torque sensor series 2300 |
| Trade designation: | Series 2300 |
| Model names: | 2300-1 2300-2.5 2300-5 2300-10 2300-20 2300-50 2300-100 |

conforms to the requirements of the EMC Directive 2014/30/EU – including its amendments in force at the time of this declaration.

The following harmonized standards were applied:

EN 61000-6-2:2019-11
EN 61000-6-4:2020-09
EN 61326-1:2013-07
EN 61326-1:2018-09 (Draft)

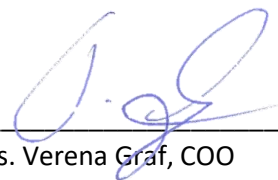
The following national laws, standards and specifications were applied:

Electromagnetic compatibility law – EMVG

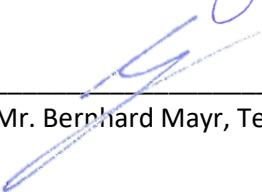
Place: Oberhaching
Date: September 15th 2020



Dr. Jürgen Uebbing, CEO



Ms. Verena Graf, COO



Mr. Bernhard Mayr, Technical Director

2 Safety

Please note the enclosed sheet on the warning notes.

2.1 Intended use

The sensors of the series 2300 are designed exclusively for measuring torque and/or speed. The respective load range can be taken from the data sheet and must not be exceeded.

Proper use also includes compliance with the commissioning, assembly, operating, ambient and maintenance conditions specified by the manufacturer.

Any use beyond these is considered improper. The manufacturer is not liable for any damage resulting from such use.

2.2 Duration of use

A factory recalibration should be executed annually. See corresponding label on the sensor.

2.3 Structural change

Unauthorized conversions or changes to the torque measuring system are prohibited for safety reasons and lead to the immediate expiration of the warranty claims.

2.4 Training of the operating personnel

Assembly, commissioning and maintenance personnel must have read and understood the complete operating instructions, especially Chapter "2 Safety". The operator is recommended to have this confirmed in writing.

2.5 Transport and handling

During handling, storage and transport, make sure that the sensor is not exposed to strong magnetic or electromagnetic fields (e.g. degaussing coils).

3 Torque Sensor Series 2300

The 2300 series is the most cost-effective entry into professional torque measurement technology.

3.1 Short description

This series is mainly used in automotive test facilities, professional testing construction, climatic exposure test cabinets (exceeding dew point), process monitoring and medical engineering.

Transmitted torque can be measured statically and dynamically in real time. Each sensor can be configured individually with a lot of extras, such as angle sensor.

Series 2300 offers a wide range of output signals such as 0-10 V, 4-20 mA, CAN-Bus or USB. USB is offered including a special NCTE software enables to show data in real time.

The sensor is provided as a complete unit with integrated evaluation electronic, including 5 m cable, keystones and factory calibration certificate and in case of digital output 2.8 m USB cable is also included.

3.2 Assembly and disassembly

When mounting the sensor, make sure that the measuring shaft is exactly aligned with the connecting shafts. It must then be possible to push the key adapters of the connection shafts onto the key adapter connections of the sensor without any effort. No force must be exerted on the housing in the axial direction during fastening. The sensor can be secured against rotation by means of the flat surface (optional sensor holder). The cable length must not exceed 5m. Using a cable other than the one supplied by NCTE or an identical cable with a different cable length may impair the function of the sensor system.

The disassembly may only be done without applying torque to the measuring shaft.

3.3 Interface description

Mechanical interfaces:

For power transmission, adapter connections are provided at both ends of the keystone round shafts.

Electrical interface:

A socket for power supply and signal output is attached to the upper side of the housing.
(Pin assignment see Chapter "7 Wiring diagram")

3.4 Starting up

After mounting the sensor, the following must be observed:

- Switch on power supply and check voltage value.
(Voltage peaks at the sensor must be avoided, devices must be checked accordingly before connection to the sensor)
- Connect the sensor to the power supply. (using the cable supplied)
- Record the output signal of the sensor with high resistance.
(e.g. A/D converter, oscilloscope, PC measuring card)
- Record output signal in mechanically unloaded state of the sensor.

3.5 Operation during regular mode

Optimal measuring values are achieved when the sensor is used while maintaining the specific nominal torque. If the permissible operating conditions are observed, the sensor operates trouble-free and maintenance-free.

3.6 Irregular operation, actions in case of failures

If the sensor is mechanically overloaded (e.g. if the maximum permissible longitudinal force or torque limit is exceeded or if there are strong vibrations), the sensor may be damaged and the signal output may be distorted. In this case do not open the device. Contact NCTE AG directly.

3.7 Safety instructions

The following safety instructions should be followed for smooth operation:

- Opening the sensor or even single screws is not allowed.
- The shaft retaining rings on the shaft ends must not be loosened.
- The fastening nut of the plug must not be loosened or tightened.
- Only use power supplies safely disconnected from the mains voltage.
- Regarding the electrical and mechanical load of the sensor, the specifications according to the sensor-specific nameplate and the table in Chapter “4 Technical characteristics” must be observed.
- The sensor is not to be used as support bearing. The existing fastening options serve exclusively to secure the housing against twisting.
- To protect your system, we recommend increasing the torque over several stages.

3.8 Shaft preservation

The shafts are protected on both sides with a film of anti-corrosion wax. We recommend to leave the protection permanently. If technically necessary, remove the protective film with spirit/ethanol.

3.9 Service, maintenance and repair

As part of your test and measurement equipment management, we recommend regular inspection of your test and measurement equipment. Please also observe the relevant standards and guidelines.

Maintenance plan by NCTE AG

| | |
|---|-----------------|
| Calibration: | Every 12 months |
| Check the wiring, connectors and shaft: | Every 12 months |

Repairs and recalibrations can only be carried out by NCTE AG personnel.

3.10 Disposal

The device must be returned to **NCTE AG, Raiffeisenallee 3, D-82041 Oberhaching** for disposal.

Data sheet

1 Key Facts

| Technical | Distinctive features |
|---|--|
| <ul style="list-style-type: none"> Nominal torque: up to 100 Nm, bidirectional Speed: ≤ 10000 rpm Accuracy: ≤ ±0.5 % Operating temperature: -30 °C to +85 °C Protection class: IP50 Output signal options: 0-10V / 4-20 mA / CAN-Bus / USB Cut-off frequency: 1.000 Hz | <ul style="list-style-type: none"> Made in Germany Short delivery time (< two weeks) Excellent price / performance ratio Integrated electronic (Plug & Play) Completely contactless measuring system Delivery including 5 m cable and calibration certificate Suitable accessories (bracket, readout unit) |

2 Torque ranges

| Model line Series 2300 | Nominal torque bidirectional (+/-) [Nm] | Limiting torque unidirectional [Nm] | Limiting torque bidirectional (+/-) [Nm] | RPM [rpm] |
|---------------------------|---|---|--|--------------|
| ∅ 8 mm | 1 | 1.3 | 1.3 | 10000 |
| ∅ 9 mm | 2.5 | 3.25 | 3.25 | |
| | 5 | 6.5 | 6.5 | |
| | 10 | 13 | 13 | |
| | 20 | 26 | 26 | |
| ∅ 15 mm | 50 | 65 | 65 | |
| | 100 | 130 | 130 | |

Note: In case of overload, the sensor leads to an offset in measurement. In such case, the sensor needs to be recalibrated at NCTE AG. The sensor should be operated only within the specified nominal torque range.

3 Load characteristics

| Series 2300 Measuring range | Axial force [N] ¹ | Limit transverse force [N] | Limit bending moment [Nm] |
|--------------------------------|------------------------------|----------------------------|------------------------------|
| 1 | 500 | 8 | 1 |
| 2.5 and 5 | 1000 | 20 | 2.5 |
| 10 and 20 | 1000 | 30 | 12.5 |
| 50 and 100 | 1000 | 100 | 41.7 |

Any irregular stress (bending moment, transverse or axial force, exceeding the nominal torque) up to the specified static load limit is only permissible as long as none of the other stresses can occur. Otherwise the limit values must be reduced. If 30 % of the limit bending moment and 30 % of the limit transverse force are present in each case, only 40 % of the axial force is permissible, whereby the nominal torque must not be exceeded.

¹ Specified values only apply to direct axial force on the shaft. If the axial force acts on the circlip, only 50 % of the force is permissible.

4 Technical characteristics

| No. | Accuracy class ² | | 0.5 | | | | | | |
|-----|--|-------------------|---------------------------|------------|----------|----------------------------|-----------|-----------|------------|
| | Description | Unit | Value | | | | | | |
| 1 | Linearity deviation incl. hysteresis | %ME ³ | < ±0.5 | | | | | | |
| 2 | Rotational Signal Uniformity (RSU) | | < ±0.5 | | | | | | |
| 3 | Repeatability | | < ±0.05 | | | | | | |
| | Output signal general | Unit | Value | | | | | | |
| 4 | Cut-off frequency, -3dB point, Bessel characteristic | Hz | 1000 | | | | | | |
| 5 | Analog signal | V mA | 0 ... 10 | | | 4 ... 20 | | | |
| 6 | Signal at torque = zero ⁴ | V mA | 5 | | | 12 | | | |
| 7 | Signal at positive nominal torque ⁵ | V mA | 9 | | | 20 | | | |
| 8 | Signal at negative nominal torque ⁵ | V mA | 1 | | | 4 | | | |
| 9 | Calibration parameter (normed) ⁵ | V/Nm mA/Nm | 4 V/ Measurement range | | | 8 mA/ Measurement range | | | |
| 10 | Error output | V mA | 0/10 | | | <4/20< | | | |
| 11 | Output resistance(Voltage Output) | Ω | < 1 | | | | | | |
| 12 | Output resistance (Current output) | k Ω | ≥ 250 | | | | | | |
| | Effect of temperature | Unit | Value | | | | | | |
| 13 | Zero point drift over temperature | %/10 K | < 0.1 | | | | | | |
| 14 | Signal drift over temperature within nominal temperature range | %/10 K | < 0.1 | | | | | | |
| | Power supply | Unit | Value | | | | | | |
| 15 | Supply voltage | VDC | 5 ... 28 | | | | | | |
| 16 | Current consumption (max.) | mA | 37 ... 45 | | | | | | |
| 17 | Start-up peak | mA | < 100 | | | | | | |
| 18 | Absolute max. supply voltage | VDC | 30 | | | | | | |
| | General information | Unit | Value | | | | | | |
| 19 | Protection class according to EN 60529 ⁵ | IP | 50 | | | | | | |
| 20 | Reference temperature | °C | +15 ... +35 | | | | | | |
| 21 | Operational temperature range | °C | -30 ... +85 | | | | | | |
| 22 | Storage temperature range | °C | -30 ... +85 | | | | | | |
| | Nominal torque (bidirectional) | Nm | 1 | 2.5 | 5 | 10 | 20 | 50 | 100 |
| 23 | Weight | g | 391 | 380 | 390 | 550 | | | |
| 23 | Moment of inertia | g mm ² | 270 | 546 | 698 | 4535 | | | |

² The accuracy class means that the linearity deviation as well as the circulation modulation, individually, are each less than or equal to the value specified as the accuracy class. The accuracy class must not be confused with a classification according to DIN 51309 or EA-10/14.

³ %ME: Related to the measuring range.

⁴ The exact sensor-specific values can be found in the calibration certificate supplied.

⁵ Wiring connected.

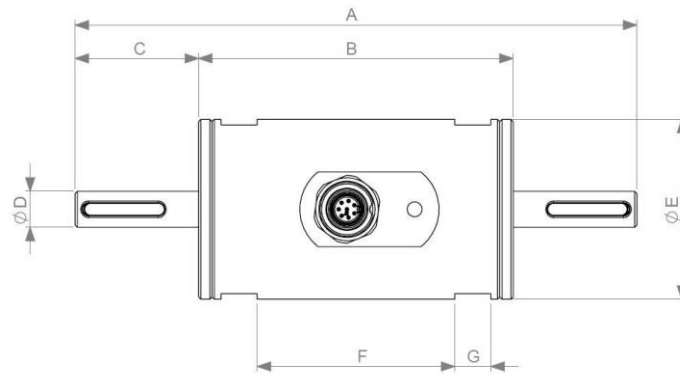
5 EMV Emission data

EMV immunity and emitted interference (DIN EN IEC 61000-6-2 / DIN EN IEC 61000-6-4 / DIN EN 61326-1)

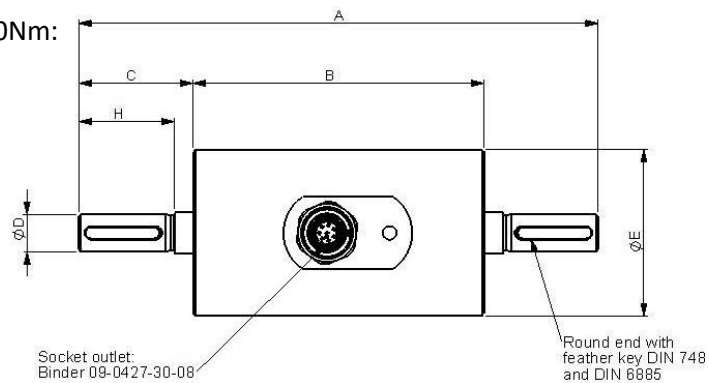
| Examination | Test specification | Admission | Evaluation criteria |
|---|-------------------------|-------------------------------|-----------------------|
| Discharge of static electricity (ESD) | IEC 61000-4-2 | ± 4 kV Contact discharge | B passed |
| Electromagnetic HF-field | IEC 61000-4-3 | 80 - 1000 MHz; 10 V/m; 80% AM | A passed |
| Rapid transients | IEC 61000-4-4 | ± 1 kV | B passed |
| High frequency, asymmetrical | IEC 61000-4-6 | 0.15 - 80 MHz; 10V; 80% AM | A passed |
| Examination | Test specification | Admission | Evaluation criteria |
| Interference voltage 0.15 - 30 MHz | CISPR 11:2009 + A1:2010 | Class B | Limit values observed |
| Radio interference field strength 30 - 1000 MHz | CISPR 11:2009 + A1:2010 | Class B | Limit values observed |

6 Dimensions

Series 2300 – 1Nm:

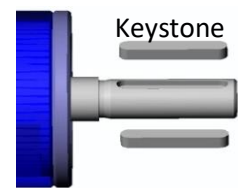


Series 2300 – 2.5Nm to 100Nm:



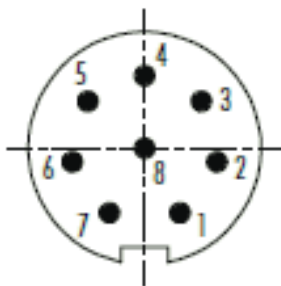
| Dimensions | Series 2300 | | |
|---------------------|-------------|-------------------|----------|
| Shaft size | ∅ 8 mm | ∅ 9 mm | ∅ 15 mm |
| Nominal torque [Nm] | 1 | 2.5 - 5 - 10 - 20 | 50 - 100 |
| A | 125 | 125 | 139 |
| B | 70 | 70 | 70 |
| C | 27.5 | 27.5 | 35 |
| D | 8g6 | 9g6 | 15g6 |
| E | 40 | 40 | 50 |
| F | 44 | - | - |
| G | 8 | - | - |
| H | - | 23 | - |

| Dimensions keystone [mm] | | | | Keystone | | |
|--------------------------|-------|-------|--------|----------|--------|--------|
| Round shaft | Width | Depth | Length | Height | Length | Amount |
| ∅ 8 mm | 3 | 1.3 | 18.5 | 3 | 18 | 1 |
| ∅ 9 mm | 3 | 1.8 | 18.5 | 3 | 18 | 1 |
| ∅ 15 mm | 5 | 3 | 25.5 | 5 | 25 | 1 |



For high alternating loads, torque transmission by positive and frictional locking via a suitable fit is recommended.

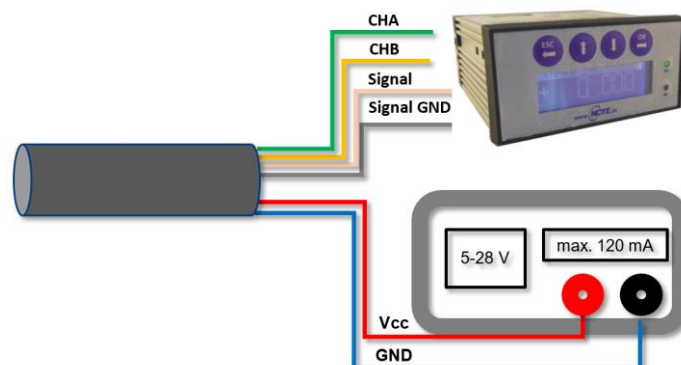
7 Wiring diagram



Connector
Power supply and outputs

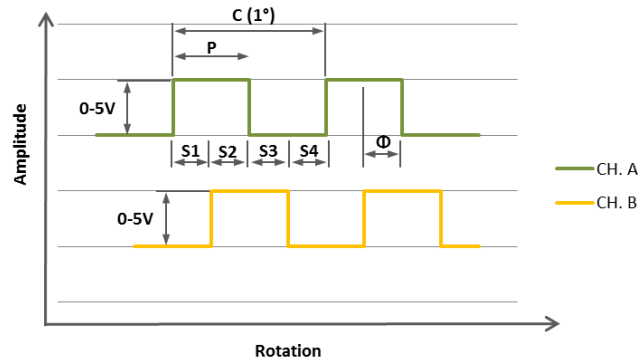
| Type | Binder Plug Series 712-M9 IP67 (Colour coding acc. to DIN 47100) | | |
|------|--|--------------------------------------|----------------------------|
| Pin | Colour | Description | Value |
| 1 | White | USB/CAN-Bus | D-/H |
| 2 | Brown | USB/CAN-Bus | D+/L |
| 3 | Green | Angle Channel A | 0V ... 5V |
| 4 | Yellow | Angle Channel B | 0V ... 5V |
| 5 | Grey | Analog GND | - |
| 6 | Pink | Signal Output analog Voltage/Current | 0V ... 10V 4mA ... 20mA |
| 7 | Blue | Ground GND | - |
| 8 | Red | Ground V _{CC} | 5V ... 28V |

8 Sensor wiring



9 Angle sensor

Optical angle sensor with 360 CPR.



| Parameter | Min. | Typ. | Max. | Units |
|---------------------------|---|------|------|-------|
| High Level Output Voltage | 2.4 | 5 | - | V |
| Low Level Output Voltage | 0 | - | 0.4 | V |
| Parameter | Description | | | |
| C | One cycle of 360 CPR (degrees) | | | |
| P | The duration of high state of the output within one cycle. | | | |
| S | The number of electrical degrees between a transition in Channel A and the neighbouring transition in Channel B. | | | |
| Φ | The number of electrical degrees between the centre of high state of Channel A and the Centre of high state of Channel B. | | | |




10 Order options

| Series 2300 accuracy 0,5 % | | | | | | | |
|---|--|---|---|---|---|---|------------------------------|
| Measuring range [Nm] | | | | | | | |
| 1 | including 5m cable and calibration certificate | | | | | | |
| 2.5 | including 5m cable and calibration certificate | | | | | | |
| 5 | including 5m cable and calibration certificate | | | | | | |
| 10 | including 5m cable and calibration certificate | | | | | | |
| 20 | including 5m cable and calibration certificate | | | | | | |
| 50 | including 5m cable and calibration certificate | | | | | | |
| 100 | including 5m cable and calibration certificate | | | | | | |
| Angle sensor | | | | | | | |
| 0 | Without angle sensor | | | | | | |
| 1 | Angle sensor 360 CPR | | | | | | |
| Analog output | | | | | | | |
| A | Voltage output 0-10V | | | | | | |
| S | Current output 4-20mA | | | | | | |
| Digital output (optional) | | | | | | | |
| U | USB incl. NCTE Software and 2.8 m cable | | | | | | |
| C | CAN-Bus | | | | | | |
| Shaft ends | | | | | | | |
| 0 | Round shaft with keystone | | | | | | |
| Protection class according to EN 60529 | | | | | | | |
| 0 | IP50 | | | | | | |
| 2300 | 10 | 1 | A | U | 0 | 0 | Example Sensor configuration |

We would be pleased to provide you with further information about series products in a personal conversation at Phone: +49 (0)89 66 56 19 30 or by e-mail: sales@ncte.de

Please note that for the **Sensor 2300 1Nm** sensor a separate holder (article no.: 400006-ATS100) is necessary, because the sensor housing has no fixing points / thread.

11 Accessories

| Bracket | | |
|---|--|--|
|  | | |
| 1 | Series 2300 1 Nm (Art. No. 400006-ATS100) | |
| Readout unit | | |
|  | | |
| A | Order number 400010-ATS001 (Art. No.: 400010005) | Sensor input: Voltage output 0-5 V and 0-10 V 1 x angle encoder input, A/B USB interface, Software Windows included SD card slot to use for data logging |
| S | Order number: 400010-ATS002 (Art. No.: 400010006) | Sensor input: current output 4-20 mA 1 x angle encoder input, A/B USB interface, Software for windows included SD card slot to use for data logging |
| Couplings | | |
|  | | |
| coupling types | Used for | D2 max. |
| KB2/15-26-8-D2 | 2300 – D8 | 10 |
| KB2/45-41-9-D2 | 2300 – D9 | 18 |
| KB2/100-47-9-D2 | 2300 – D9 | 25 |
| KB2/100-47-9-D2 | 2300 – D9 | 25 |
| KB4K/40-46-9-D2 | 2300 – D9 | 25,4 |
| KB4K/80-55-15-D2 | 2300 – D15 | 30 |
| KB4K/200-60-15-D2 | 2300 – D15 | 35 |

You can obtain further or additional accessories and special requests in a personal discussion with your contact person for series products by calling +49 (0)89 66 56 19 30 or by e-mail: sales@ncte.de.

Your experts for magnetostrictive sensors

