

1. Description of BROSA force measuring pin

1.1 Structure and function

BROSA force measuring pin, types 0201, 0202 and 0203, are used to measure the force in double shear connections in or on machines and devices of all kinds. Figure 1 shows the typical structure:

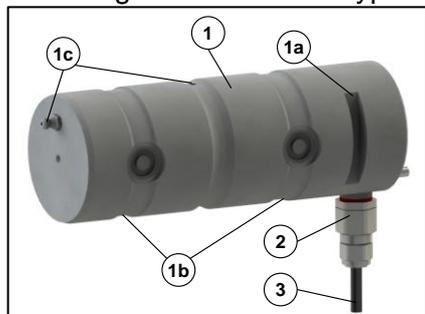


Figure 1: Structure of the force measuring pin

The force measuring pin consists of a cylindrical measuring body (1), which absorbs the load to be measured and exhibits the properties for torsional and axial securing (1a) as well as a connection support (2) firmly connected to the measuring body in some cases, on which - if not placed directly on the measuring body - the necessary elements for the electrical connection (plug or cable, 3) are attached and which - if not placed in the measuring body - contains the measurement electronics. The constrictions (1b) present in the measuring body for metrological reasons can be equipped with flexible filling material depending on the application or available as an option. Optionally, the measuring body can contain elements to lubricate the bearing (1c). Measuring body and, if applicable, the connection support are made of stainless steel.

Force measuring pin MOP type 0202 includes integrated mechanical overload protection.

Figure 2 shows the typical installation conditions:

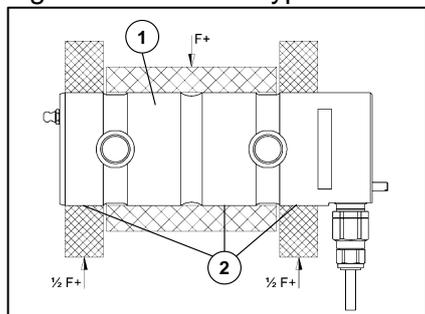


Figure 2: Installation conditions

The force measuring pin (1) is inserted into the mounting holes (2), arranged corresponding to the diameter, of the double shear connection and secured against unintended movement based on the relevant properties (see Figure 1). Force F transmitted from the connection is transmitted to the

measuring electronics through analysis of the resulting deformation of the measuring body and output as an electric signal.

Versions with two measuring directions (X-Y force measuring pin) and / or two measuring systems, either with output signals on separate connectors / cables or combined in one plug / cable, are available as options. More information can be found in the technical data sheets, which may be obtained free of charge from BROSA.

1.2 Information about explosion protection

The force measuring pin type 0201 and the force measuring pin MOP type 0202 are optionally available in an intrinsically-safe version for use in potentially explosive atmospheres. Following specifications apply:

- Ignition protection type:
Ex II2G Ex ib IIC T4 Gb
- Certificate number:
BVS 03 ATEX E 241
- Safety limits:
 - o Maximum voltage $U_i = 26,4V$
 - o Maximum current $I_i = 51mA$
 - o Internal-capacitance $C_i = 24nF + \text{power-capacitance}$
 - o Internal-inductance $L_i = \text{power-inductance}$

⚠ WARNING! The usage of the intrinsically-safe force measuring pin in zone 0 is not permitted.

The force measuring pin Ex d type 0203 has a flameproof enclosure and can be adapted for potentially explosive atmospheres. Following specifications apply:

- Ignition protection type:
 - o II 2G Ex d IIC T4 Gb / Ex d IIC T4 Gb
 - o II 2G Ex d IIB T4 Gb / Ex d IIB T4 Gb
- Certificate number:
 - o ATEX: BVS 09 ATEX E 037 X
 - o IECEx: IECEx BVS 14.0110 X
- Safety limits:
 - o Active operating mode:
 - Input voltage $U_E = 9...36 V DC$
 - Input current $I_E = 5...100 mA$
 - o Passive operating mode:
 - Input voltage passive $U_E = 1...10 V DC$
 - Input current $I_E = 3...30 mA$

⚠ WARNING! The usage of force measuring pins Ex d in zone 0 is not permitted.

1.3 Label (nameplate, indication of measuring direction)

Each BROSA force measuring pin is provided with a nameplate containing the information applicable for

each variety. Depending on the structural design, it can be attached either on the front (Figure 3, 1a) or on the periphery (Figure 3, 1b).

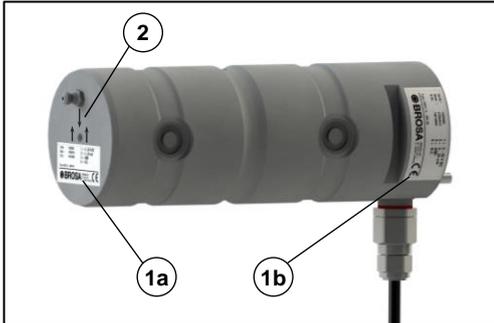


Figure 3: Nameplate positions, measuring direction

The measuring direction is indicated on the front side with an arrow (Figure 3, 2).

A simplified indication of the measuring direction (elimination of the two lower arrows illustrated in Figure 3) is possible.

In the optionally available version with two measuring directions, the measuring directions are labelled as shown in Figure 4

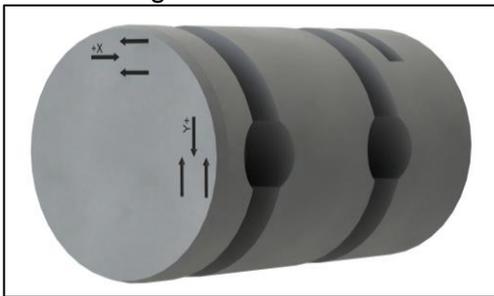


Figure 4: Measuring direction X-Y-KMA

2. Advice on safe handling of BROSA force measuring pin

⚠ WARNING! Non-compliance with the following instructions can lead to damage to the sensor and / or impaired measurement results. The analysis of an erroneous measurement can result in personal injury or material damage.

⚠ WARNING! Despite their sturdy design, BROSA force measuring pin may not be used for any other than the intended purpose (see. Section 1.1). With improper use, dangers to life and limb of the user or third parties and / or impairment of the device in which the force measuring pin is implemented or other material assets can arise.

2.1 Handling

⚠ WARNING! BROSA sensors contain quality measurement electronics. Make sure you handle them carefully.

- BROSA force measuring pin are delivered in transport-safe packaging. We recommended

that you remove the sensors from the package immediately prior to installation.

- The mass of the force measuring pin is to be observed when selecting appropriate handling equipment and / or lifting gear; it is indicated on the nameplate.
- BROSA force measuring pin must be secured against falling. Do not throw sensors!
- Use as a tool (e.g. striking, slotting or lever tool) is not permitted; it can cause damage to the sensor and thus falsify the measurement results.

2.2 Installation and commissioning

2.2.1 General

We recommended taking the following actions in the given order using the four-eye principle.

- Inspecting the sensor - measuring point assignment: It must be ensured that the sensor to be installed is designed for use at the intended measuring point. For this purpose, check information on the nameplate, in particular the item or the identification number and the measuring range, against the data of the measuring point.

⚠ WARNING! A sensor not designed for the respective measuring point must not be installed.

- Inspection of the sensor for intactness and function: It must be ensured that the sensor to be incorporated is free of damage of any kind.

⚠ WARNING! A damaged sensor must not be installed!

- Installation of the sensor in the measuring point: The force measuring pin is to be inserted into the mounting holes.

⚠ WARNING! The force measuring pin must not be driven in by means of percussion tools!

After insertion, the force measuring pin must be secured against axial movement and rotation with the appropriate elements. Attention must be paid to the correct alignment of the force measuring pin to the intended measuring direction (see front mark, compare Section 1.2.)

⚠ WARNING! A misaligned sensor leads to erroneous measurement results!

- Establishment of electrical connection: The elements on the sensor for the electrical connection are to be connected to the power supply and the evaluation system of the device. In doing so, the information given on the nameplate for plug or cable assignment and, if applicable, the installation guidelines of the cable are to be observed.

⚠ WARNING! An incorrect or incomplete electrical connection impairs or prevents measurement.

- e) Functional check: After completed mechanical (see c) and electric (see d) installation, load on the sensor is to be applied over the entire measuring range; the output measurement signals are to be subjected to a plausibility check.

⚠ WARNING! If, due to unusual events (e.g. deformation or unusual noise), measurement results are considered implausible or there is suspicion that the sensor is malfunctioning for any other reason, it must not be put into operation.

2.2.2 Additional information for operation in potentially explosive atmospheres

⚠ WARNING! Only sensors with corresponding labelling are approved for potentially explosive atmospheres.

If the cable end is connected within the hazardous area, it must be happen in a terminal box / control cabinet which is approved according 94/9 EG. If connected outside the hazardous area, it must be connected according to the general conditions for electrical equipment.

2.2.2.1 Types 0201 and 0202 in intrinsically-safe version

The sensors are to be installed according to the following guidelines:

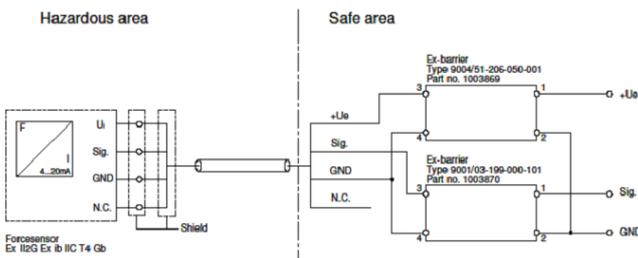


Figure 5: Connecting example sensor Ex i

The supply and the measurement signal are conducted over barriers or isolation amplifiers in hazardous areas. You can also use barriers of other manufacturers if they comply with the safety limits. The connecting cables in hazardous areas must be approved for this application. The 250-ohm resistor with connected in parallel voltmeter in Figure 5 symbolizes the entrance of the ampere-meter.

2.2.2.2 Type 0203

The connection of the potential compensation must be observed. Cables supplied by BROSA are approved for the use in hazardous areas if they are fixed laid (strain-relieved).

2.3 Operation and maintenance

2.3.1 Operation

BROSA force measuring pin operate automatically; attaching tools is not required for operation. Direct manual intervention by the operator is not necessary; therefore, there no requirements for the operator to wear protective equipment during operation. However, the relevant requirements for the device in which the force measuring pin is implemented must be observed.

BROSA force measuring pin emit neither airborne acoustic noise nor non-ionising radiation.

Operation of BROSA force measuring pin is permitted only within the parameters and properties given in the technical data sheets and on the nameplate. Among others, these are:

- Measuring range
- Temperature range
- Permissible supply voltage
- Electrical protection class
- Material

It must be ensured that no parasitic influences such as forces transverse to the measuring direction are led over the force measuring pin.

Inductive or capacitive couplings to the connection cable(s) of the sensor can distort the measurement result and must be avoided. Some examples of these kinds of couplings are: Caused by unfavourable cable routing (parallel power lines, frequency converters, transformers, motors, incorrect grounding / shielding and the like).

When performing electric welding in the vicinity of the sensor, all connections must be disconnected and isolated. It must be ensured that no welding current is flowing through the sensor.

⚠ WARNING! Operation outside the specified parameters or contrary to existing properties or improper use may damage the sensor and cause it to fail or output faulty measuring results. If the sensor is overloaded, this can lead to the overall machine being equally overloaded and possibly endangering its stability.

2.3.2 Maintenance

In its capacity as a sensor, BROSA force measuring pin are maintenance-free. However, as load-transmitting elements, they are subject to mechanical stress, so every force measuring pin must be checked regularly for proper condition and the bearing must be relubricated if necessary. The time between the inspections and the lubrication intervals depends on the intensity of use and must be determined by the end user.

An inspection includes the following points:

- Visual inspection for damage to the measuring body and wiring as well as soiling

- Function test / plausibility check

The causes of any errors are to be identified and remedied. If the test indicates an improper sensor state, it must be taken out of operation. If a malfunction or damage is detected on the sensor, it must be sent to the manufacturer's factory for diagnosis and, if necessary, repaired.

 **WARNING!** The sensor must only be repaired at the factory. Intervention (e.g. opening, mechanical processing and the like) done by parties other than the manufacturer's factory means the safe operation of the sensor is no longer ensured and voids the warranty.

2.4 Disassembly

We recommended performing the following actions in the given order.

- a) Establishment of load-free state in the measuring point: The force measuring pin is to be unloaded before removal.

 **WARNING!** Removal of a force measuring pin under load poses serious dangers to life and limb of bystanders and can cause major damage. This is therefore not permitted.

- b) Loosen the electrical connection
- c) Remove the mechanical securing elements
- d) Remove the force measuring pin

 **WARNING!** If the force measuring pin is to be reused, it should not be driven out by means of percussion tools!

2.5 Disposal

If the end of the service life is reached, the force measuring pin is to be taken to an environmentally-friendly disposal facility. Since the non-metallic components are a small proportion compared to the mass of the force measuring pin, it can be recycled as a whole as scrap steel. Assignment as stainless steel scrap is preferable.

If the sensor is stored before final disposal, an appropriate storage location is to be selected which prevents harmful substances from entering the environment. If necessary, the sensor must be cleaned.

 **WARNING!** BROSA force measuring pin contain traces of environmentally hazardous substances. This is also true of the impurities created during use. Contamination of the environment with these substances is to be prevented.

EC/EU Declaration of Conformity

in terms of Directives
2006/42/EC, Annex II Part 1 A,
2014/30/EU, Annex IV and
2014/34/EU, Annex X

Manufacturer: **BROSA AG**
Dr.-Klein-Straße 1
D-88069 Tett nang

On our own responsibility we hereby declare the products according to design/type

Force measuring pin type 0201
from serial number 16040001 onwards

to comply with the relevant regulations of the following directives:

2006/42/EC Machinery Directive
2014/30/EU EMC Directive

Products according to the mentioned design as an ATEX intrinsically safe version are marked as such and additionally comply with the relevant regulations of the following directive:

2014/34/EU ATEX Directive

The type examination related with the latter directive has been carried out by the following notified body:

DEKRA EXAM GmbH BVS 03 ATEX E 241
Dinnendahlstraße 9
D-44809 Bochum Notified Body No. 0158

The requirements for production and testing of the product are defined in a quality and environmental management system certified according to ISO 9001 and ISO 14001.

Page 2 of this Declaration contains the standards harmonized with the mentioned Directives and applied to the products according to the mentioned design/type.

Tett nang, April 20th, 2016

Martin Wagner
CEO

EC/EU Declaration of Conformity

in terms of Directives
2006/42/EC, Annex II Part 1 A,
2014/30/EU, Annex IV and
2014/34/EU, Annex X

Manufacturer: **BROSA AG**
Dr.-Klein-Straße 1
D-88069 Tett nang

On our own responsibility we hereby declare the products according to design/type

Force measuring pin MOP type 0202
from serial number 16040001 onwards

to comply with the relevant regulations of the following directives:

2006/42/EC Machinery Directive
2014/30/EU EMC Directive

Products according to the mentioned design as an ATEX intrinsically safe version are marked as such and additionally comply with the relevant regulations of the following directive:

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Tett nang, April 20th, 2016

Martin Wagner
CEO

List of applied, harmonized standards

2006/42/EG	
EN ISO 13849-1:2008 +AC:2009	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
2014/30/EU	
EN 61000-6-2:2005 +AC:2005	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments
EN 61000-6-3:2007 +A1:2011	Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments
EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements
EN 61326-2-3:2013	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-3: Particular requirements – Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning
2014/34/EU	
EN 60079-0:2012 +A11:2013	Explosive atmospheres – Part 0: Equipment – General requirements
EN 60079-11:2012	Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "I"

Person authorized to compile the technical files:

Joachim Fellner
Dr.-Klein-Straße 1
D-88069 Tett nang

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2014/34/EU, Annex X

Manufacturer: **BROSA AG**
Dr.-Klein-Straße 1
D-88069 Tettwang

On our own responsibility we hereby declare the products according to design/type

Force measuring pin Ex d type 0203
from serial number 16040001 onwards

to comply with the relevant regulations of the following directives:

2006/42/EC Machinery Directive
2014/30/EU EMC Directive

2014/34/EU ATEX Directive

The type examination related with the latter directive has been carried out by the following notified body:

DEKRA EXAM GmbH BVS 09 ATEX E 037 X
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EN 61000-6-3:2007 +A1:2011 +AC:2012	Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments
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EN 61326-2-3:2013	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-3: Particular requirements – Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning
2014/34/EU	
EN 60079-0:2012 +A11:2013	Explosive atmospheres – Part 0: Equipment – General requirements
EN 60079-1:2007	Electrical apparatus for explosive gas atmospheres – Part 1: Flameproof enclosures 'd'

Person authorized to compile the technical files:

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End of EC Declaration of Conformity