

Mounting instructions

Torque transducer – Flexplate

TCA MPZ1901036



measurement with confidence

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1 Safety Instructions

FCC Compliance & Advisory Statement



Important

Any changes or modification not expressly approved in writing by the party responsible for compliance could void the user's authority to operate the device. Where specified additional components or accessories elsewhere defined to be used with the installation of the product, they must be used in order to ensure compliance with FCC regulations.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

Model	Measuring range	FCC ID
TCA	800 N·m	2ADAT-TCAF2

Label example with FCC ID.

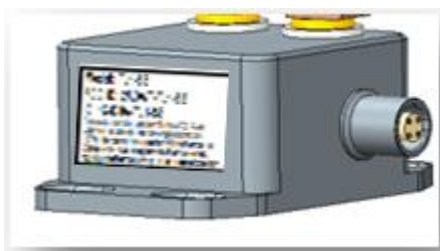


Fig 1.1: Location of the label on the stator of the device

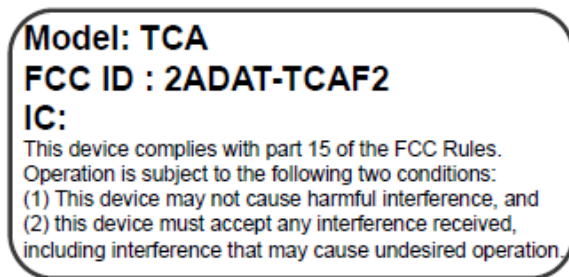


Fig. 1.2 Example of the label

Appropriate use

Flexplates are used exclusively for torque measurement tasks as well as control and adjustment tasks directly connected thereto. Use for any additional purpose shall be deemed to be not in accordance with the regulations.

Stator operation is only permitted when the rotor is installed.

The flexplate may only be installed by qualified personnel in compliance with the specifications and with the safety requirements and regulations of these mounting instructions. It is also essential to observe the applicable legal and safety regulations for the application concerned. The same applies to the use of accessories.

The flexplate is not intended for use as a safety component. Please also refer to the section: "Additional safety precautions". Proper and safe operation requires proper transportation, correct storage, siting and mounting, and careful operation.

Loading capacity limits

The data in the technical data sheets must be complied with when using the flexplate. In particular, the respective maximum loads specified must never be exceeded. The values stated in the specifications-must not be exceeded, for example, for

- limit torque,
- longitudinal limit force, lateral limit force or limit bending moment,
- torque oscillation width,
- breaking torque,
- temperature limits,
- the limits of the electrical loading capacity.

Use as a machine element

The flexplate can be used as a machine element. When used in this manner, it must be noted that, to favor greater sensitivity, the transducer is not designed with the safety factors usual in mechanical engineering. Please refer here to the section "Loading capacity limits", and to the specifications.

Accident prevention

According to the prevailing accident prevention regulations, once the flexplates have been mounted, a covering agent or cladding has to be fitted as follows:

- The covering agent or cladding must not be free to rotate.
- The covering agent or cladding should prevent squeezing or shearing and provide protection against parts that might come loose.
- Covering agents and cladding must be positioned at a suitable distance or be so arranged that there is no access to any moving parts within.
- Covering agents and cladding must still be attached even if the moving parts of the torque flange are installed outside people's movement and working range.

The only permitted exceptions to the above requirements are if the flexplate is already fully protected by the design of the machine or by existing safety precautions.

Additional safety precautions

The flexplate cannot (as a passive transducer) implement any (safety-relevant) cutoffs. This requires additional components and constructive measures for which the installer and operator of the plant is responsible. The layout of the electronics conditioning the measurement signal should be such that measurement signal failure does not cause damage.

The scope of supply and performance of the flexplate covers only a small area of torque measurement technology. In addition, equipment planners, installers and operators should plan, implement and respond to safety engineering considerations in such a way as to minimize residual dangers. Pertinent national and local regulations must be complied with.

General dangers of failing to follow the safety instructions

The flexplate corresponds to the state of the art and is failsafe. Flexplates can give rise to residual dangers if they are incorrectly operated or inappropriately mounted, installed and operated by untrained personnel. Every person involved with siting, starting-up, operating or repairing a torque flange must have read and understood the mounting instructions and in particular the technical safety instructions. The flexplate can be damaged or destroyed by non-designated use of the flexplate or by non-compliance with the mounting and operating instructions, these safety instructions or any other applicable safety regulations (safety and accident prevention regulations),

when using the flexplate. Flexplates can break, particularly in the case of overloading. The breakage of a flexplate can also cause damage to property or injury to persons in the vicinity of the flexplate.

If the flexplate is not used according to the designated use, or if the safety instructions or specifications in the mounting and operating instructions are ignored, it is also possible that the flexplate may fail or malfunction, with the result that persons or property may be adversely affected (due to the torques acting on or being monitored by the flexplate).

Conversions and modifications

The flexplate must not be modified from the design or safety engineering point of view except with our express agreement. Any modification shall exclude all liability on our part for any damage resulting therefrom.

Selling on

If the flexplate is sold on, these mounting instructions must be included with the flexplate.

Qualified personnel

Qualified personnel means persons entrusted with siting, mounting, starting up and operating the product, who possess the appropriate qualifications for their function.

This includes people who meet at least one of the three following requirements:

- Knowledge of the safety concepts of automation technology is a requirement and as project personnel, you must be familiar with these concepts.
- As automation plant operating personnel, you have been instructed how to handle the machinery. You are familiar with the operation of the equipment and technologies described in this documentation.
- As commissioning engineers or service engineers, you have successfully completed the training to qualify you to repair the automation systems. You are also authorized to activate, ground and label circuits and equipment in accordance with safety engineering standards.

2 Markings used

2.1 Symbols on the transducer

Label example

Model: TCA
FCC ID : 2ADAT-TCAF2
IC:
This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received,
including interference that may cause undesired operation.

Label example with FCC ID number,



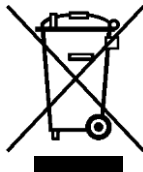
Location of label on the stator unit.

Symbol:



Meaning: Read and note the data in this manual

Symbol:








Meaning: Statutory waste disposal mark

The electrical and electronic devices that bear this symbol are subject to the European waste electrical and electronic equipment directive 2002/96/EC. The symbol indicates that, in accordance with national and local environmental protection and material recovery and recycling regulations, old devices that can no longer be used must be disposed of separately and not with normal household garbage, see also Chapter 10.

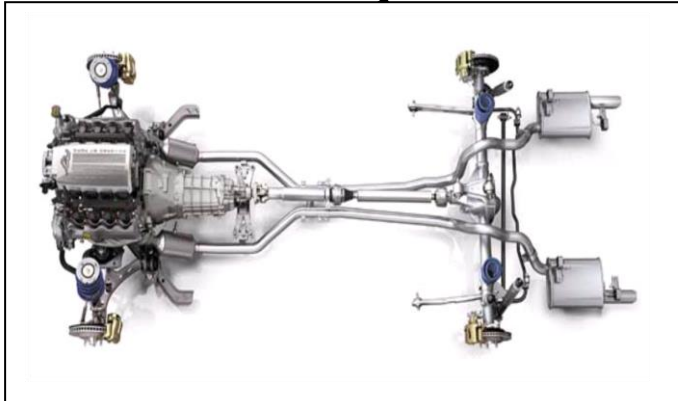
2.2 The markings used in this document

Important instructions for your safety are specifically identified. It is essential to follow these instructions in order to prevent accidents and damage the property.

Symbol	Meaning
 WARNING	This marking warns of a <i>potentially</i> dangerous situation in which failure to comply with safety requirements <i>can</i> result in death or serious physical injury.
 CAUTION	This marking warns of a <i>potentially</i> dangerous situation in which failure to comply with safety requirements <i>can</i> result in slight or moderate physical injury.
NOTE	This marking draws your attention to a situation in which failure to comply with safety requirements <i>can</i> lead to damage to property.
 Important	This marking draws your attention to <i>important</i> information about the product or about handling the product.
 Tip	This marking indicates application tips or other information that is useful to you.
	This marking draws your attention to information about the product or about handling the product.
<i>Emphasis</i>	Italics are used to emphasize and highlight texts.

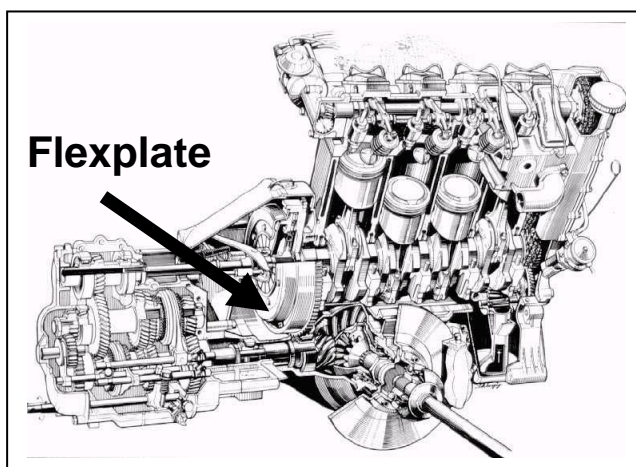
3 Application

The flexplate has especially been developed in order to measure the torque between motor and transducer in automatic transmissions.



Measurements and physical attributes almost correspond with the original component, compact rotor electronic and rotor-/stator antenna, technical data, as supply voltage 9 ... 36 V DC; analogue output 0 ... 10 V DC and temperature range up to 120°C are adapted to the conditions in the vehicle. Advantages:

- Measurements possible at serial-produced motors and transmissions
- No/little falsification of measured values, e.g. by additional mass moment of inertia or stiffness.
- Measurements possible under real conditions during drive-operation



4 Structure and mode of operation

The torque transducer consists of two separate parts: the rotor and the stator. The rotor comprises the measuring body and the signal transmission elements. Strain gauges (SGs) are installed on the measuring body. The rotor electronics generates the bridge excitation voltage and transmits the measuring signal to the stator unit and are located at the outer circumference of flex plate. Diametric on the opposite side a balancing weight is mounted. The wireless transmission of power supply and measuring signal occurs via rotor and stator antenna made from a printed board circuit. The rotor and stator antenna have to be aligned on the same axe.

The stator antenna is connected on a housing that contains the electronics for the automatic self-tuning function of the antenna.

The connection cable, 5m long, connects the stator housing with the evaluation unit which contains the electronics for voltage adaptation and the signal conditioning.

Connectors and screw terminals for the torque signal and the voltage supply are located on the evaluation unit. The stator antenna ring should be mounted more or less concentrically with some gap of 3mm to the rotor antenna (see chapter 4).

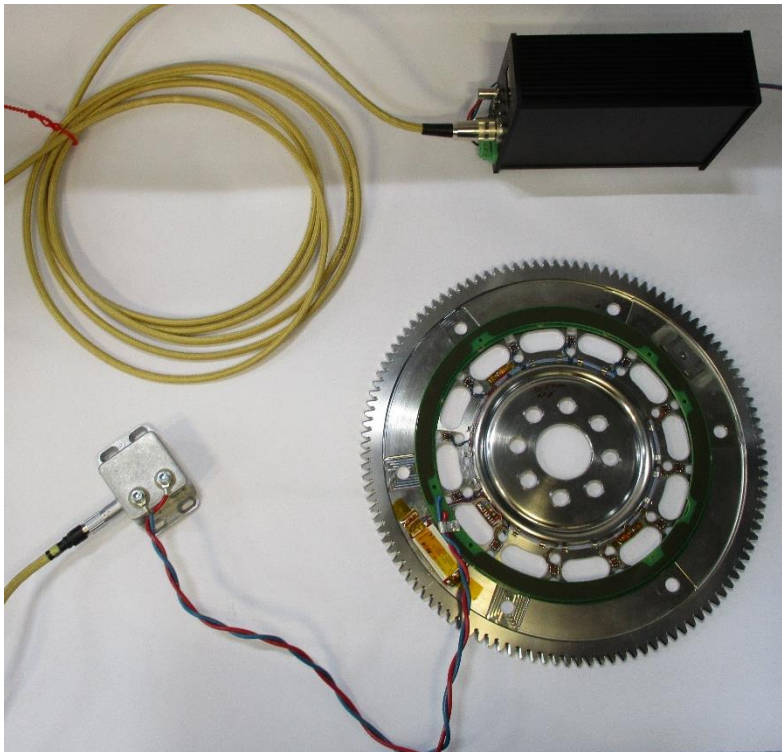


Fig. 4.1: Transducer with stator antenna and evaluation unit



Fig. 4.2: EMI suppressor



Important

The use of the shielding plates is important to ensure compliance with FCC regulations. If the shielding plates has to be removed for any purpose (e.g. installation or maintenance), they must be replaced in the original position before the product is used.

5 Mechanical installation

5.1 Important precautions during installation

NOTE

A flexplate is a precision measurement element and therefore needs careful handling. Dropping or knocking the flexplate may cause permanent damage. Make sure that the flexplate cannot be overloaded, even while it is being mounted.

-
- Handle the flexplate with care.
 - Check the effect of bending moments, critical rotational speeds and natural torsional oscillations, to prevent the transducer being overloaded by increases in resonance.
 - Make sure that the flexplate cannot be overloaded.



WARNING

There is a danger of the flexplate breaking if it is overloaded. This can cause danger for the operating personnel of the system in which the flexplate is installed.

Implement appropriate safety measures to avoid overloads and to protect against resulting dangers.

-
- If alternating loads are expected, use threadlocker (medium strength, e.g. LOCTITE No. 242) to glue the screws into the counter thread to exclude prestressing loss due to screw slackening.
 - Comply with the mounting dimensions to enable correct operation.



Important

Even if the unit is installed correctly, the zero-point adjustment made at the factory can shift by up to approx. 0.5% of the characteristic value. If this value is exceeded, we advise you to check the mounting conditions. If the residual zero offset when the unit is removed is greater than 1% of the sensitivity, please send the transducer back to the Darmstadt factory for testing.

5.2 Conditions on site

The flexplate must be protected against coarse dirt particles, dust, oil, solvents and humidity.

There is wide ranging compensation for the effects of temperature on the output and zero signals of the flexplate (see "Specifications" section). If there are no static temperature ratios, for example, because of the temperature differences between the measuring body and the flange, the values given in the specifications can be exceeded. In this case, ensure static temperature ratios by cooling or heating, depending on the application. As an alternative, check if thermal decoupling is possible, e.g. by means of heat radiating elements such as multiple disc couplings.

5.3 Installation orientation

The torque flange can be installed with any orientation.

With clockwise torque, when using the voltage output mode a positive output signal (0 V...+10 V) or when using the frequency output mode an output frequency of 10 kHz ... 15 kHz is present on the output (corresponding zero to nominal torque load).

5.4 Installation

Please first mount the rotor to its final position. The stator antenna is flexible mountable and can be installed afterwards.

5.6 Mounting the rotor

1. Clean the plane surfaces of the flexplate and the counter flange.
For safe torque transfer, the faces must be clean and free from grease.
Use a piece of cloth or paper soaked in solvent. Make sure that no solvent drips into the inside of the transducer and that the transmitter coils are not damaged during cleaning.



Important

If alternating loads are expected, use threadlocker (medium strength, e.g. LOCTITE No. 242) to glue the screws into the counter thread to exclude prestressing loss due to screw slackening.

2. Fasten all screws with the specified torque.



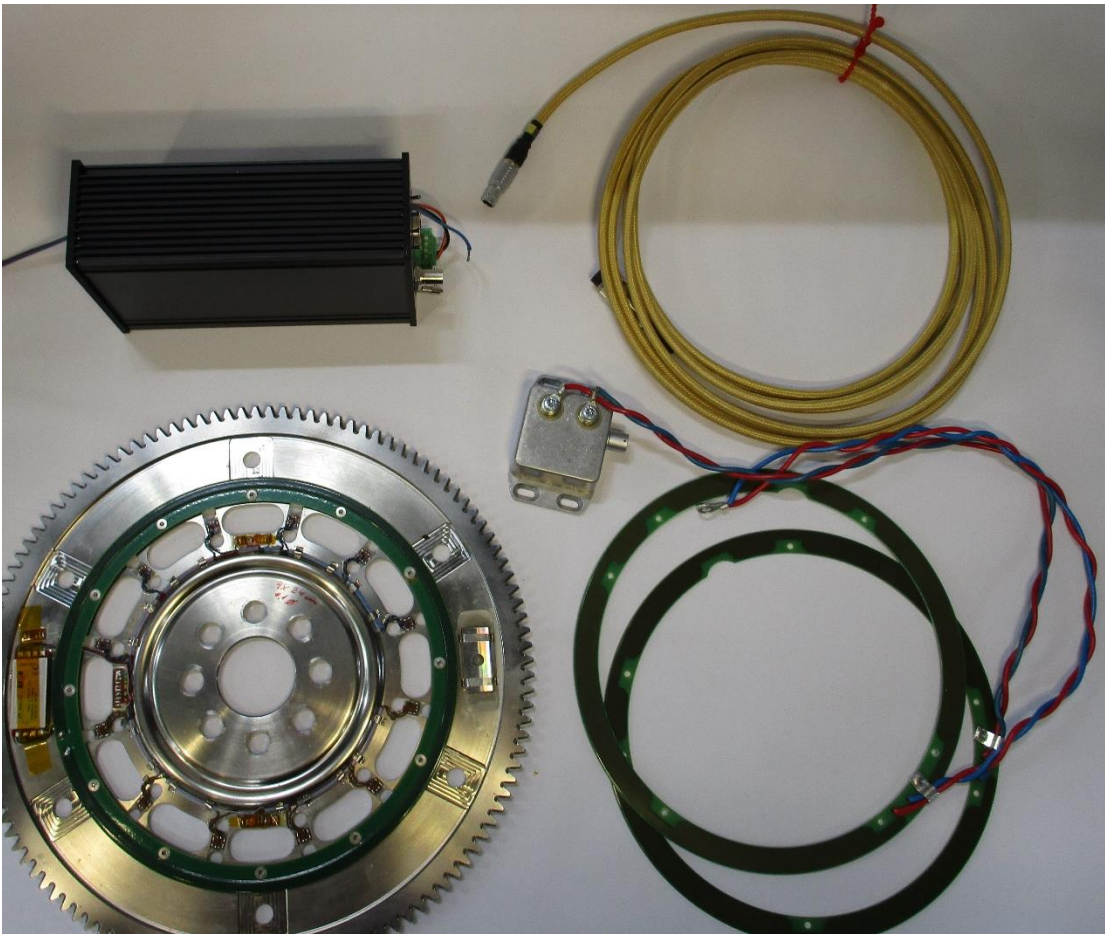
Important

Keep them in a safe place for future dismounting.

4.6 Installing the telemetry system

The telemetry system consists of the following component parts:

- Rotor antenna
- Stator antenna (2 pieces)
- Stator unit
- Evaluation unit
- Connection cable
- EMI suppressor (not shown in the picture)



The stator antenna (pcb board) is to be mounted on the engine on the designated place with small screws in adequate length or an adequate epoxy glue (for example HBM's X-280).

The shape of this pcb board must be fitted to the surface of engine for example with a file before fixation. This is necessary for not overtop to much the engine and to have the right gap between rotor and stator antenna after mounting the assembly.



Important

- Do not bend the connection cable
- Do not shorten or stretch the connection cable
- Do not guide the cable close to energy- or power circuit lines
- The stator antenna has to be mounted directly above the rotor antenna
- The stator antenna has to be mounted in the middle of the adjustment range of the rotor antenna
- The stator antenna must not touch the rotor antenna



CAUTION

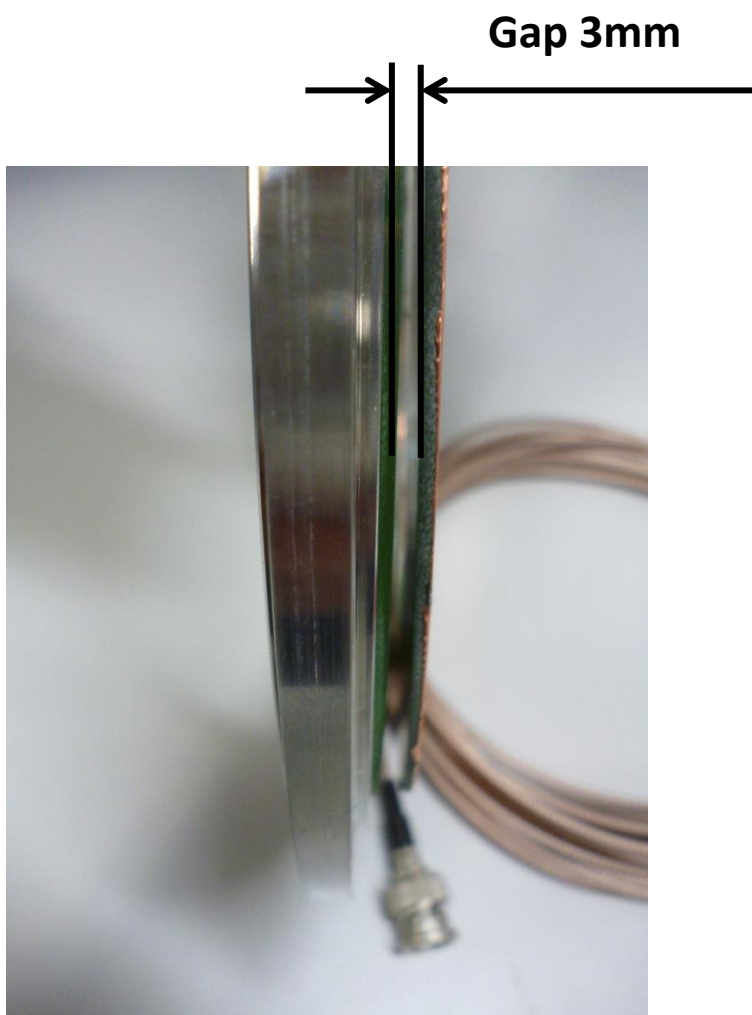
- At all mounting- dismounting or repair operations, switch of the power supply of the system.
- Connectors must not be under electric tension while it will be connected or disconnected
- There is a high current flow through the telemetry system. The entire system heats up accordingly.

4.6.1 Stator antenna and stator unit

The stator antenna is connected to the stator unit with a twisted cable pair (screw tightening torque 5N·m). The stator unit can be positioned and mounted flexibly according to the cable length. The stator unit is connected to the evaluation unit with a special cable of 5m length.

NOTE

- When you connect the stator antenna, please take regard to a stress relief
- Use thread locker (medium strength, e.g. LOCTITE No. 242) to glue the screws into the counter thread to exclude pre-stressing loss due to screw slackening.
- Install and fasten the connection cables so that this will not be damaged by twirling parts.
- Align the stator like shown in the picture below



6 General information

- With extension cables, make sure that there is a proper connection with minimum contact resistance and good insulation.
- All cable connectors or swivel nuts must be fully tightened.

6.2 EMC protection

The product offered is a special assembly for stationary systems that is not available on the general market or a transducer for installation by system integrators and plant manufacturers. According to EMVG¹ §12 paragraph 2 and Directive 2004/1008/EC article 13 paragraph 1 this product does not require an EC declaration of conformity nor the CE marking.

This product is intended exclusively for subsequent processing by companies or persons that are experts in the field of electromagnetic compatibility (EMC). Relevant EMC protection requirements relating to the product offered are met when the following **Installation notes** are observed and implemented.

Installation notes

Please note the following points during installation and use:

- It is essential to observe the specifications and notes provided in the operating manual and the data sheet
- Connecting cables, in particular the measuring and control cables, need to be shielded
- Make sure that the transducer and shielding are connected extensively to ground.
- Ensure an interference-free environment, avoid radiation interference
- Devices connected to this product need to comply with protection requirements per EMVG (Gesetz über die elektromagnetische Verträglichkeit von Geräten / law on electromagnetic compatibility of instruments).



Important

You have to install the shield of the connection cable at the shielded housing of the electronics, to achieve the EMC-protection of the measuring chain. Make sure that the transducer and shielding are connected extensively to ground.

Electrical and magnetic fields often induce interference voltages in the measuring circuit. Therefore:

- Use shielded, low-capacitance measurement cables only
- Only use plugs that meet EMC guidelines.
- Do not route the measurement cables parallel to power lines and control circuits.
If this is not possible, protect the measurement cable with e.g. steel conduit.
- Avoid stray fields from transformers, motors and contact switches.
- Do not ground the transducer, amplifier and indicator more than once.
- Connect all devices in the measurement chain to the same grounded conductor.
- In the case of interference due to potential differences (compensating currents), supply voltage zero and housing ground must be disconnected on the amplifier and a potential equalization line established between the evaluation unit and the amplifier housing (copper conductor, minimum 10 mm² wire cross-section).
- Should differences in potential between the machine rotor and stator, because of unchecked leakage, for example, cause interference, this can usually be overcome by connecting the rotor definitively to ground, e.g. with a wire loop. The stator must be connected to the same (ground) potential.

6.3 Evaluation unit

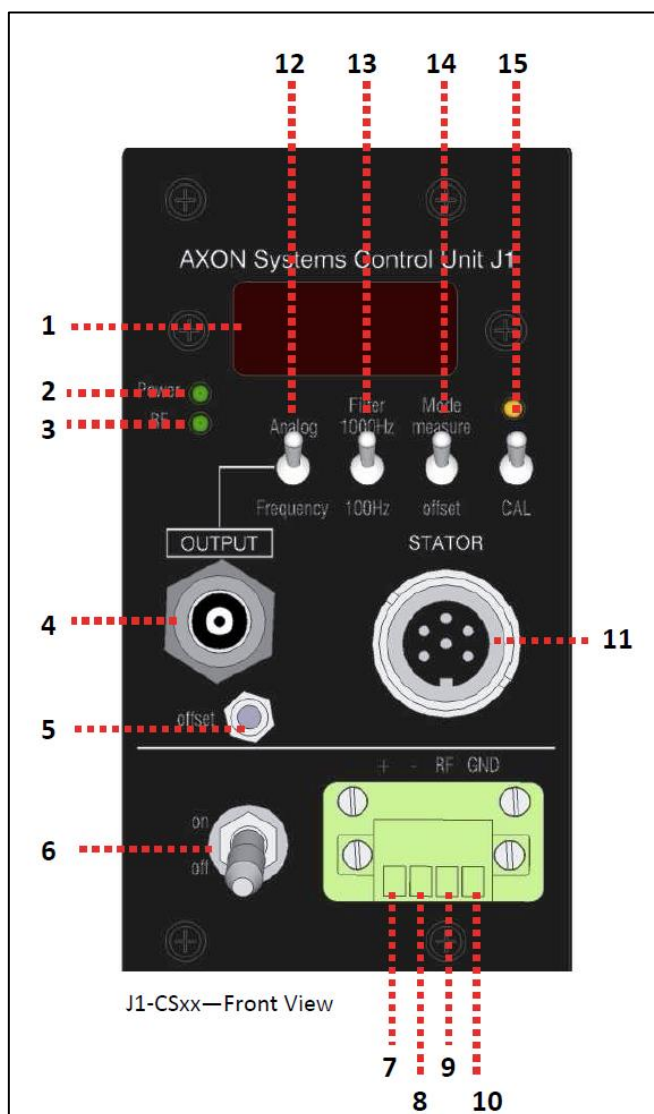


Fig. 6.1: Front view of the evaluation unit

Functional overview of the evaluation unit (See fig. 6.1)

Item	Function description
1	Display Shows analog output voltage. For monitoring only - accurate measurement values to be read out on the output BNC connector
2	LED power The LED indicates the on/off status of the device
3	LED RF-level The LED indicates an acceptable RF signal strength from the transmitter
4	BNC output Voltage $\pm 10\text{V}$ / frequency $10\text{kHz} \pm 5\text{kHz}$ (select with switch no. 12)
5	Potentiometer „offset“ Potentiometer for offset correction within the range of $\pm 1\text{V}$
6	Main switch On / off switch (self-locking, pull to switch)
7	Supply voltage (+) 9 V....36 V DC
8	Supply voltage GND
9	RF output (+) Analog output correlating to the strength of the received RF-Signal. Acceptable RF-Level is received, when voltage is above 3,4V
10	RF output GND Ground connection of the telemetry system. Connect with main ground of vehicle / test field
11	Stator-connection Female connector for cable to stator unit
12	“Analog / frequency” output switch Switch for setting the output format of the measurement signal. Analog: $\pm 10\text{V}$, frequency: $10\text{kHz} \pm 5\text{kHz}$ TTL
13	Filter switch Changes the filter frequency on output between 1.000Hz and 100Hz (-3dB). For slow signals set on 100 Hz to get extra low noise signals.
14	Mode switch „measure / offset“ Switch up to „measure“: Normal measuring mode. The offset can be adjusted with the potentiometer Switch down to „offset“: The Control Unit generates internally an exact 0V output signal which is only affected by the offset potentiometer. So the offset value can be precisely determined and re-adjusted by setting any desired value.
15	Shunt cal-function on (push button) Push button to release shunt cal-function. Cal-function will be released for app. 5 seconds (the orange LED above the button is activated for this time span).

Table 6.1: Functions of the evaluation unit

Technical details

Supply voltage	9...36 VDC
Max. power consumption	30 VA
Signal bandwidth	Switchable 1000 Hz / 100Hz
Voltage output	±10 V
Frequency output	5 ... 15 kHz TTL
Signal-to-noise ratio	63dB (1000Hz) / 83dB (100Hz)
Signal transit time	450µs
Wireless shunt calibration	Key button at control unit
Protection class	IP40
Weight	700 grams
Temperature range	-10 ... +70 °C

Table 6.2: Technical details of the evaluation unit

Dimensions of the evaluation unit

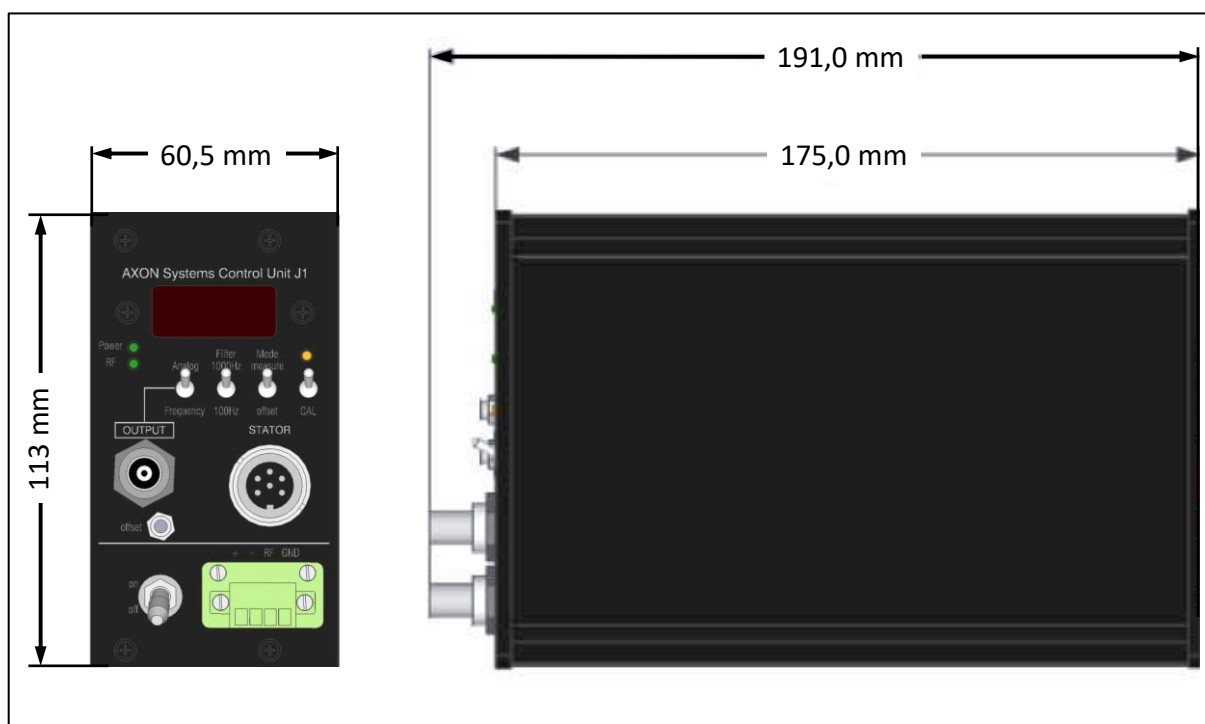


Fig. 6.2: Main dimensions of the evaluation unit

6.4 Supply voltage

The transducer must be operated with a separated extra low voltage (supply voltage 9 ... 36 VDC).

The supply voltage is electrically isolated from signal outputs and shunt signal inputs. Connect a separated extra low voltage of 9 V ... 36 V DC to bracket 7 (+) and bracket 8 (-) of the evaluation unit.

The cable can be up to 50m long for voltages $\geq 24V$, otherwise it can be up to 20m long.

The current during operation is about 0,7...0,9A.



Important

At the instant of power-up, a current of up to 1,5 A may flow, which could switch off power packs with electronic current limiters.

6.5 Use of EMI suppressor

To suppress high frequencies two EMI suppressors on the cable between rotor and stator has to be used. Use at **least 3 loops** of the cable for the ring EMI suppressor. The snap ferrite has to be mounted on the cable directly behind the connector at the Axon control unit.

Fastening must be done in an area not subject to mechanical loads (i.e. no unwanted vibrations, etc.) using cable ties fit for the specific application.

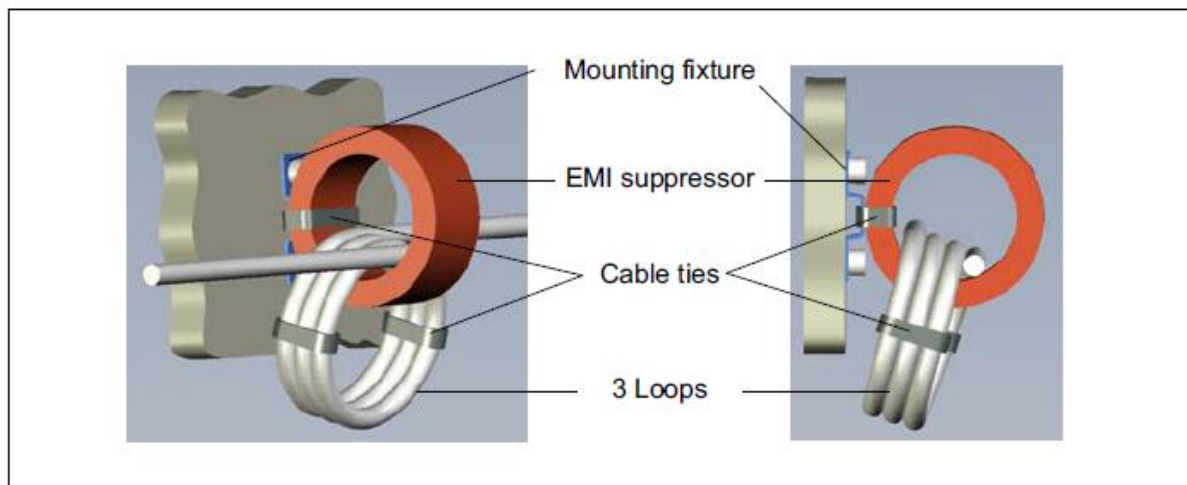


Fig 6.1: Installation example EMI suppressor



Information

Consider longer cable of approximately 40cm due to the installation of the EMI suppressor. The max. distance of EMI suppressor to connector is 500mm.

If the EMI suppressors have to be removed for any purpose (e.g. for maintenance), they must be replaced on the cable. Use only EMI suppressor of the correct type.

Ring ferrite:

Type: Vitroperm 500F

Model No.: T60006-L2063-W517

Size: external diameter x internal diameter x height = 63 x 50 x 25

Snap Ferrite:

Type: Würth 742 711 31



Fig 6.2: Picture of installation example of both EMI suppressors



Important

The use of the EMI suppressor on the power cable is mandatory to ensure compliance with FCC regulations.

7 Shunt signal

The special torque flange delivers an electrical shunt signal that can be activated from the evaluation unit for measuring chains with HBM components. The transducer generates a shunt signal of about 50% of the nominal (rated) torque; the precise value is specified on the type plate.

After activation of push button no. 15 (see Fig. 6.1), the shunt signal is activated for a time span of 5s. Adjust the amplifier output signal to the shunt signal supplied by the connected transducer to adapt the amplifier to the transducer.



Information

The transducer should not be under load when the shunt signal is being measured, as the shunt signal is mixed additively.

Triggering the shunt signal

Push button no. 15 (see Fig. 6.1) on the evaluation unit to activate the shunt signal for a time span of 5s.

8 Functionality testing

You can check the functionality of the rotor and the stator from the LEDs on the evaluation unit.



Fig. 8.1: LEDs on the evaluation unit

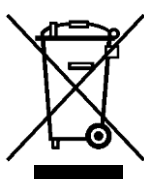
LED	Color	Significance
LED no. 2 (power status)	Green (permanently lit) <i>normal operation</i> Off (not lit)	The main switch (no. 6 in Fig. 6.1) is on and the evaluation unit is under power The main power is off
LED no. 3 (RF level status)	Green (permanently lit) <i>normal operation</i> Off (not lit)	The LED indicates an acceptable RF signal strength The RF signal strength is too low, the transmission between rotor and stator is broken. Check rotor / stator alignment
LED (cal-function status)	Off (not lit) <i>normal operation</i> Orange (permanently lit)	The shunt signal is not active. The shunt signal is active as long as the LED is lit.

9 Maintenance

The torque transducer is maintenance-free.

10 Waste disposal and environmental protection

All electrical and electronic products must be disposed of as hazardous waste. The correct disposal of old equipment prevents ecological damage and health hazards.



Symbol:

Meaning: **Statutory waste disposal mark**

The electrical and electronic devices that bear this symbol are subject to the European waste electrical and electronic equipment directive 2002/96/EC. The symbol indicates that, in accordance with national and local environmental protection and material recovery and recycling regulations, old devices that can no longer be used must be disposed of separately and not with normal household garbage.

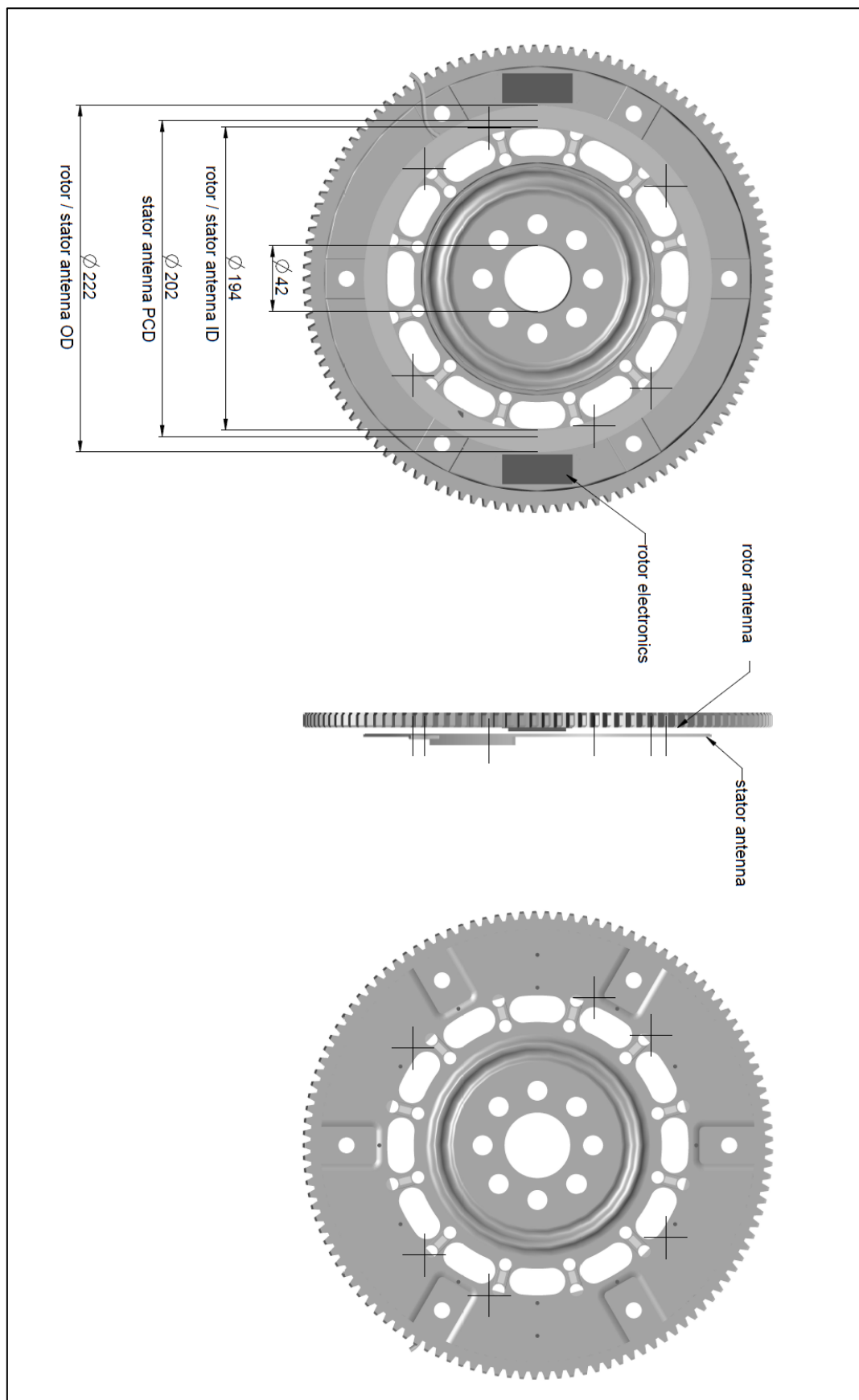
As waste disposal regulations may differ from country to country, we ask that you contact your supplier to determine what type of disposal or recycling is legally applicable in your country.

Packaging

The original packaging of HBM devices is made from recyclable material and can be sent for recycling. Store the packaging for at least the duration of the warranty. In the case of complaints, the torque flange must be returned in the original packaging.

For ecological reasons, empty packaging should not be returned to us.

11 Dimensions



12 Specifications

Type		Customized flexplate – MPZ1901036
Nominal torque M_{nom}	N·m	800
Measurement bandwidth	kHz	1
Sensitivity tolerance (deviation of the actual output quantity at M_{nom} from the nominal (rated) sensitivity)	%	±1
Thermal effects per 10 K in the nominal (rated) temperature range on the output signal, relative to the actual value of the signal spread	%	< ± 0,1
Linearity deviation including hysteresis, relative to the nominal (rated) sensitivity	%	< ± 0,1
Rel. standard deviation of repeatability	%	< ± 0,05 (typical ± 0,03)
Protection class acc. EN 60529		IP 54
Nominal (rated) temperature range (continuous)	°C	+10 ... +120
Short time operating temperature	°C	-10 ... +125
Storage temperature range	°C	-20 ... +120
Temperature range of evaluation unit	°C	-20 ... +75
Load limits ¹⁾		
Limit torque	%	150
Max. limit load of measuring body ²⁾	%	200
Breaking torque (static)	%	tbd
Longitudinal limit force (static)	N	tbd
Lateral force limit (static)	N	tbd
Bending limit moment (static)	N·m	tbd
Maximal speed	rpm	7000
Balancing quality	G	2,5

- 1) Each type of irregular stress (bending moment, lateral or longitudinal force, exceeding nominal (rated) torque) can only be permitted up to its specified static load limit, provided none of the others can occur at the same time. If this condition not met, the limit values must be reduced. If 30% of the bending limit moment and lateral limit force occur at the same time, only 40% of the longitudinal forces is permissible and the nominal (rated) torque must not be exceeded. The permissible bending moments, longitudinal forces and lateral forces can affect the measurement result by approx. 1% of the nominal (rated) torque. The load limits only apply for the nominal (rated) temperature range. At temperature <10°C, the load limits must be reduced by approx. 30% (viscosity reduction).
- 2) The data refer to static loading of the measuring body, not the screw connections.
- 3) The nominal (rated) torque must not be exceeded

13 Supplementary technical information

To ensure that the flexplate retains its characteristics once it is installed, we recommend that the customer also chooses the specified form and position tolerances, surface quality and hardness (42+4 HRC) for the connections provided.

14 Declaration of conformity

*Hottinger Baldwin Messtechnik GmbH.
Subject to modifications. All product descriptions are for
general information only. They are not to be understood
as a guarantee of quality or durability.*

*Hottinger Baldwin Messtechnik GmbH.
Änderungen vorbehalten. Alle Angaben beschreiben
unsere Produkte in allgemeiner Form. Sie stellen keine
Beschaffenheits- oder Haltbarkeitsgarantie im Sinne des
§443 BGB dar.*

Hottinger Baldwin Messtechnik GmbH
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Tel. +49 6151 803-0 • Fax: +49 6151 803-9100
Email: info@hbm.com • www.hbm.com

measure and predict with confidence

