ATESTEO

Excellence in drivetrain testing

DF Plus Series Manual

DF Plus Series Manual
Version 2.3

Your contact for service requests
ATESTEO GmbH & Co. KG
Konrad-Zuse-Str. 3
52477 Alsdorf
Germany

T +49 (0) 2404 9870-0
service-pm@atesteo.com
www.atesteo.com

1 Introduction

Thank you for choosing an ATESTEO quality product. Please read the system description carefully so you make the most of the versatile features of your product.

This operating manual is a component of the DF plus-series and should always be carefully kept with the DF plus-series until it is disposed of.

It is impossible to eliminate every danger to persons or material that the DF plus-series might present. For this reason, every person working at the DF plus-series or is involved in its transport, setting up, control, maintenance or repair must be properly instructed and be informed of the possible dangers.

For this purpose, the operating instructions and, especially, the safety instructions must be carefully read, understood and observed.

Company ATESTEO reserves the right to carry out changes at its products which serve the technical further development the company ATESTEO. These changes aren't documented expressly in every individual case.

This operator's manual and the information contained in it were compiled with the advisable care.

Company ATESTEO GmbH & Co.KG takes on no liability for misprints or other faults or damages resulting from it the company ATESTEO GmbH & Co.KG, however.

The brands mentioned in this operator's manual and product names are trademarks or registered trademarks of the respective title holders.

Please do not miss to contact us if there is anything in the operating instructions that you cannot clearly understand. We are grateful for any kind of suggestion or criticism that you may wish to make; please let us know or write to us. This will help us to make the operating instruction still more user-friendly in taking account of your wishes and requirements.

1.1 Change log

V2.3 22.11.2021:

- First version with change log
- Contact details of service team updated
- Pin assignment: TTL3.3/5.0 corrected

1.2 Manufacture

ATESTEO GmbH & Co.KG
(Hereinafter referred to as manufacturer)

Konrad-Zuse-Str. 3
52477 Alsdorf
Germany

T +49 (0) 2404 9870-0

info@atesteo.com
www.atesteo.com

Service:
service-pm@atesteo.com

2 Manufacturer´s Declaration

Manufacturer´s Declaration according to 2014/30/EU

The manufacturer: **ATESTEO GmbH**

declares, that the measuring system
named: **DF1, DF2, DF3, DF4, DF5, DF6**

(in the versions V2, plus or DT)

is conformed to the requirements of the EMV-directive 2014/30/EU.

Reference to relevant harmonized standards:

- EN62326-1:2013 (electrical equipment for measurement, control and laboratory use)
  EMC requirements – Part 1: general requirements (IEC 61326-1: 2012; German version EN 61326-1:2013)
- EN61326-2-3:2013 (electrical equipment for measurement, control and laboratory use))
  EMV-requirements – part 2-3: particular requirements- test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning (IEC 61326-2-3:2012)

Alsdorf, 01.08.2018

Dipl.-Ing. Wolfgang Schmitz
CEO

3 Disposal and environment

Electrical and electronic products are subject to special conditions for disposal. Proper disposal of old equipment prevents health hazards and environmental damage.

Packaging

The original packaging of ATESTEO equipment can be recycled, as it is made of recyclable material. However, you should keep the packaging for at least the warranty period. In the event of a complaint, the torque flange, as well as the accessories, must be returned in the original packaging.

Due to ecological aspects, the return of the empty packaging should be waived.

Legally prescribed labeling for disposal

Electrical and electronic devices bearing the symbol  are subject to European Directive 2002/96 / EC on waste electrical and electronic equipment. The symbol indicates that waste equipment that is no longer usable must be disposed of separately from regular household waste in accordance with European environmental protection and recycling regulations.

However, the disposal regulations vary from country to country, which is why we ask you, if necessary, your supplier how to dispose your waste.

4 Safety Instructions

4.1 General safety instructions

The manual must be read carefully before start-up, maintenance work or any other work on the torque measuring system. Prerequisite for the safe and proper handling of the equipment knows all safety instructions and safety regulations of the attachment.

Every safeguard needs to be correctly mounted and fully functional before any start-up.
Shafts or adapters mounted to the torque meter must be properly designed, so that critical bending moment is avoided.

Exclusively qualified laborers are allowed to do maintenance work on any electrical components (see chapter Qualified personnel).
If the torque meter is sold on, these safety instructions must be included.

4.2 Explanation of symbols and notice

Warnings
Warnings are indicated by symbols in these safety instructions. The hints are going through
Signal words are introduced, which express the extent of the hazard. It is imperative that you follow the instructions and act with care to avoid accidents, personal injury and material damage.

Information
Draws attention to important information about correct handling.

Caution
Warns of a potentially dangerous situation in which failure to comply with safety requirements can result in slight or moderate physical injury.

4.3 Appropriate use

The torque meter is highly accurate and resistant to rotational speed. The signals from the flange serve to control the test bench and to analyses the components.
The torque flange is used just for torque measurement tasks within the load limits in the specification (see Technical specs). Any other use is not permitted. The torque meter is not allowed for use as a safety component.

Note
It´s only permitted when rotor is installed as described in the mounting instruction.

4.4 Modifications/conversions

Any modifications/ conversions of the design or safety engineering of the torque meter without the explicit agreement from ATESTEO will lead to the loss of warranty or liability. Any damages or injuries of personnel therefrom are in responsibility of the operator.

4.5 Operator's responsibility

Standards
The ATESTEO torque meter was designed and constructed taking account of a risk analysis and careful selection of harmonized standards and other technical specifications with which it complies. It represents the state of the art and guarantees a maximum degree of safety.

Qualified personnel
Qualified personnel are persons who by reason of their training, experience, instruction and their knowledge of the relevant standards, regulations, accident prevention rules and working conditions have been authorized by the person responsible for the safety of the machine/product to perform the appropriate activities required, and thereby are able to recognize and prevent potentially dangerous situations (For the definition of skilled workers see VDE 0 105 or IEC 364, which also regulate the prohibition of the employment of unqualified persons).
Knowledge of first aid and the local rescue organization must also be available.

Transportation, assembly, installation, commissioning, maintenance and repair will be performed by qualified personnel or controlled by responsible skilled hands.

Safety relevant disconnecting device
The torque meter cannot implement any safety relevant cut-offs. It is in the operator´s responsibility to integrate the torque meter into superior safety system.

The electronical conditioning the measurement signal should be designed so that measurement signal failure does not subsequently cause damage.

Residual risks

The power and scope of delivery of the torque meter covers only a subset of the torque measurement technology. Safety aspects of torque measurement technology must be planned, implemented and taken into account by the system planner, supplier or operator in such a way that residual risks are minimized. Each existing regulations must be observed. Attention should be drawn to residual risks associated with torque measuring technology

In the case of a shaft break, you must ensure that there is no risk of injury. This should be done with a shaft protection cover in a closed test room with corresponding security doors. During operation, no person should stay in the test room.

Usage recommendations for personal protective equipment

Working in a workshop generally requires the wearing of safety shoes.

Use suitable gloves when handling corrosive or irritating solutions and adhesives.

4.6 Transport and storage

Check the delivery immediately for completeness and shipping damage.

Use working gloves during transport/ assembly/ maintenance.

Storage

- Do not store outdoors
- Store dry and dust-free
- do not expose to aggressive media
- protect from sunlight
- avoid mechanical shocks
- Storage temperature according data sheet

If stored for more than 3 months, regularly check the general condition of all parts and packaging.

4.7 Safety notes for assembly

Tightening torque
When tightening the screws, the specified tightening torques (see mounting instruction) must be observed.

Electric wire

All cables must be professionally laid according to the actual standards.

Rotating parts
Rotating parts must be earthed- risk of static electricity.

4.8 Safety notes for operation

As accident prevention a covering has to be fitted once the torque meters have been mounted. This is the fact if the torque meter is already fully protected by the design of the machine or by existing safety precautions. Please pay attention to following requirements for the covering as accident prevention:

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

Note
Improper use and handling as well as constructional changes will invalidate the EC declaration of conformity.

4.9 Load limits

Observe technical data sheets when using the torque meter. Pay particular attention to never exceed the respective maximum loads. For example:

- Load limits
- Torque oscillation width,
- Temperature limits,
- Longitudinal limit force, lateral limit force or limit bending moment,
- Limits of electrical load-carrying capacity,
- Limit rotation speed.

5 Delivery

The package contains the following terms:

1. Torquemeter (Rotor)
2. DF plus Stator
3. TCU 5 (Torque Control Unit)
4. Central cable
5. 12-pin connector
6. 16-pin connector
7. Operating manual
8. Test report
9. Optional speed detection system

6 General functionality

The DF plus series is suitable for the highly dynamic measurement of torques at high load and highest resolution. The following figure shows the measuring system, which consists of a torque measuring shaft, a stator and an evaluation unit.

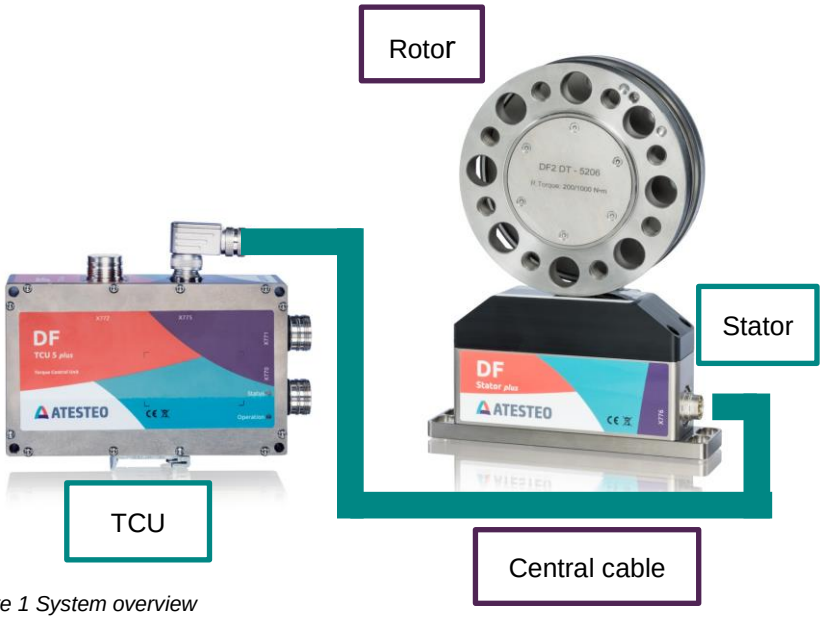


Figure 1 System overview

The torque measuring shaft and the stator communicate via bidirectional telemetry, while the rotor is simultaneously powered inductively via the stator. The torque is detected via a strain gauge full bridge in the measuring body of the torque measuring shaft. The position of the measuring body is shown in the following figure:

The electrical difference voltage of the full bridge is amplified in the torque measuring shaft and digital data words are converted. For error-free signal transmission, the data words are supplemented by a checksum and transmitted modulated to the stator. The stator demodulates the data words and transmits them via an RS422 interface to the evaluation unit. In the evaluation unit, the signals can additionally be filtered with an adjustable low-pass filter.
The evaluation unit also offers the connection options for the system peripherals. These include a CAN interface, two frequency outputs (Md1, Md2), three galvanically isolated analog outputs (Md1, Md2, Speed), three digital alarm outputs and five digital inputs. The measuring system can be comfortable configured via the Web interface. This also offers the possibility to easily and quickly check measured values and system functions.

A wide range of flange types allows easy connection to your application. The maximum load and the maximum measuring range can be individually adapted to your needs if wanted. Our DT version uses a second measuring channel with a separately calibrated measuring range. The measured values of both measuring channels are transmitted at the same time.

The torque measuring shaft additionally monitors the temperature of the measuring body, which is used to eliminate temperature influences and can be called up as an additional CAN message from the evaluation unit.

The exchange of torque measuring shafts is enormously simplified and accelerated by the DF plus-series. On the one hand, the stator does not enclose the torque measuring shaft, as a result of which it can be easily removed and replaced by another without much effort and on the other hand an electronic data sheet is sent from the measuring shaft, which enables automatic configuration of the evaluation unit. The new measuring shaft is immediately ready for use.

Optionally, the measuring system can be equipped with a speed measurement. For the capture, a magnet ring on the rotor and a sensor head on the stator are in use. The magnetic ring has two pole tracks, which are offset by 90 ° to each other. So the speed can be determined as well as the direction of rotation. The two tracks can be tapped as RS422 signals at the system outputs. In addition, the speed is measured in the evaluation unit and made available as a digital value via CAN and as a voltage value via the third analog output.

Note

Please note that the torque meter is a high-precision measuring instrument. Mechanical effects e.g. hammer impacts lead to deformation of the measuring body, which changes its torsional behavior and thus worsens the measuring accuracy! Before mounting, make sure that the fits of your adapters comply with the specified installation tolerances and that they are free from contamination. Only in this way precise measurements and optimum concentricity can be guaranteed.

Note

The magnet ring (for the optional speed detection) can be damaged by strong magnetic field, as e.g. occur with a permanent magnet.

7 System description

System overview (components)

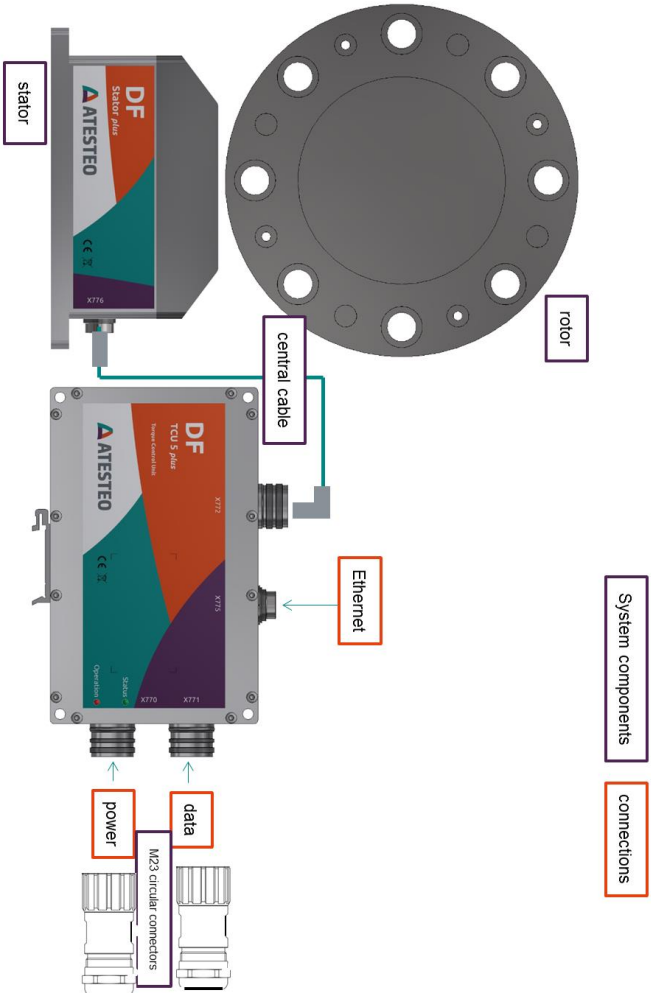


Figure 2 DF system overview (electrical)

System overview

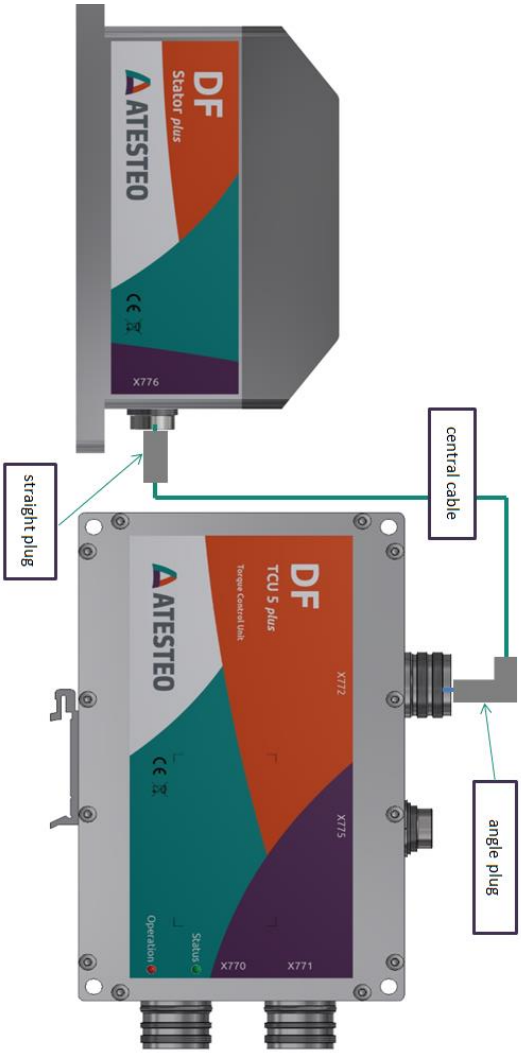


Figure 3 Central cable

System overview (functional areas)

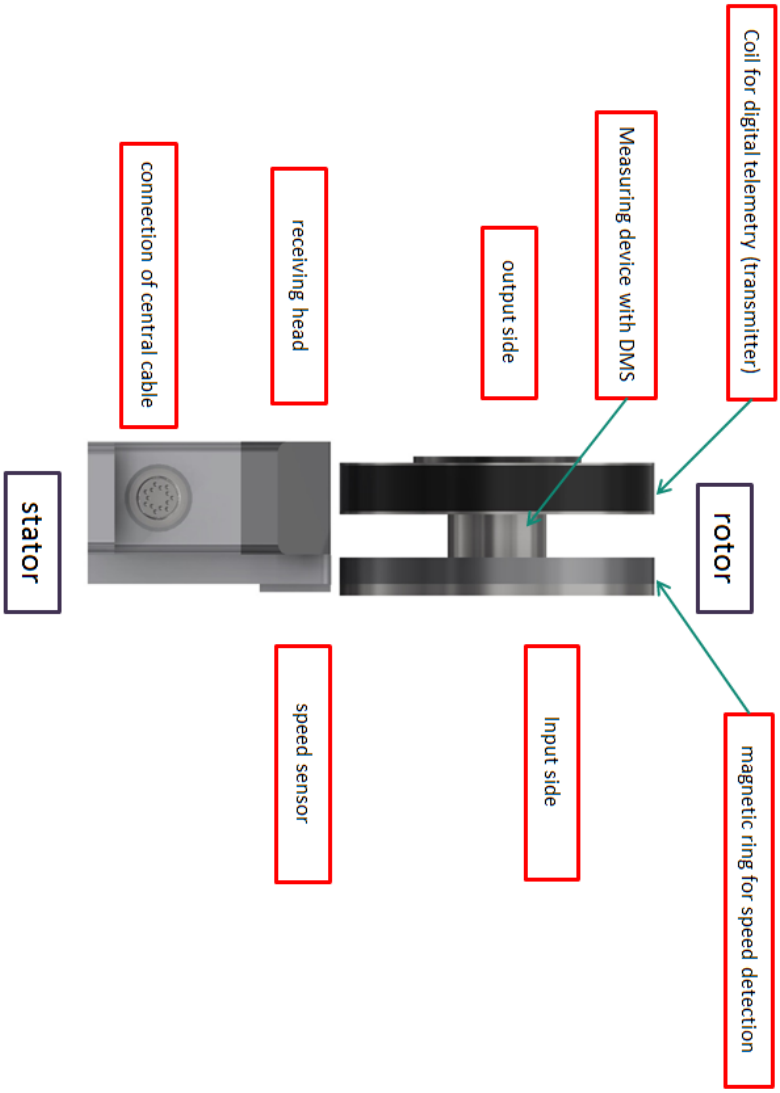


Figure 4 DF system overview (functional)

System overview (mechanical)

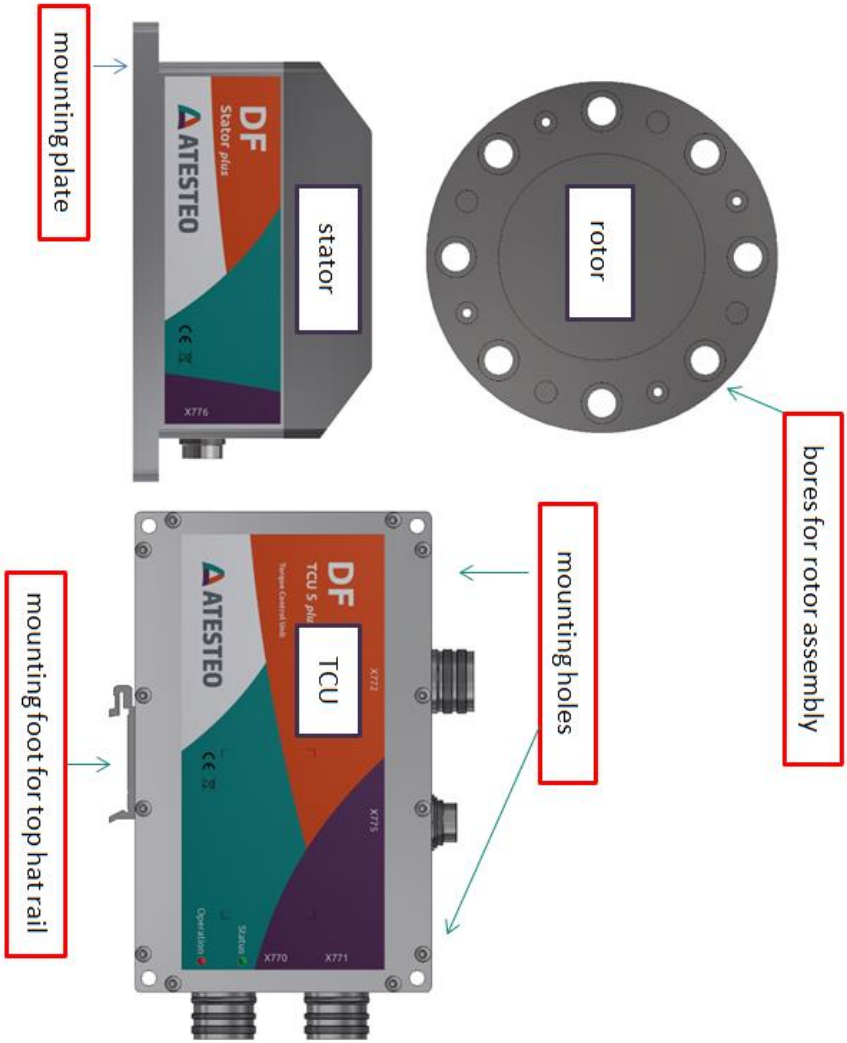


Figure 5 DF System overview (mechanical)

System overview (location nameplates)

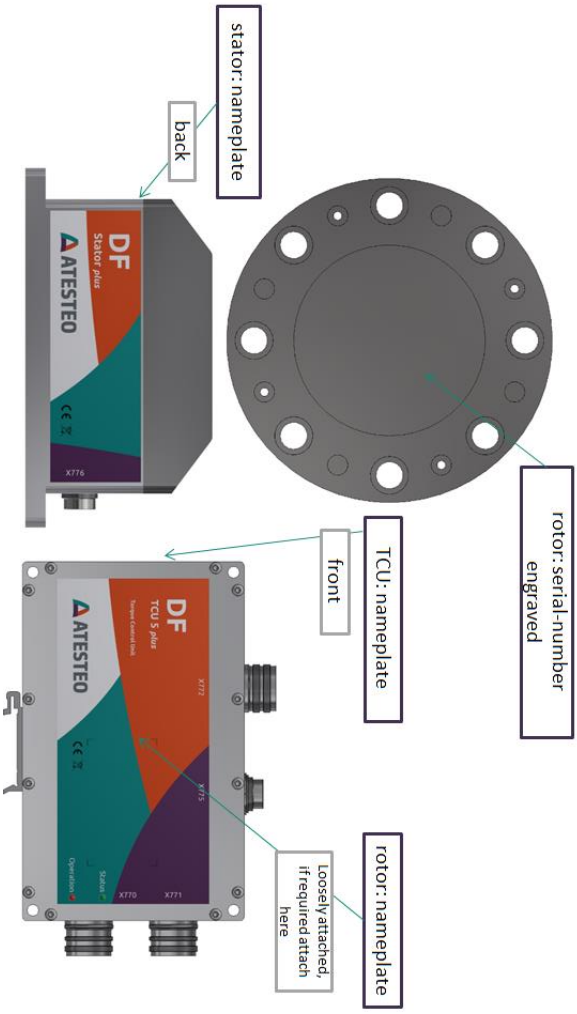
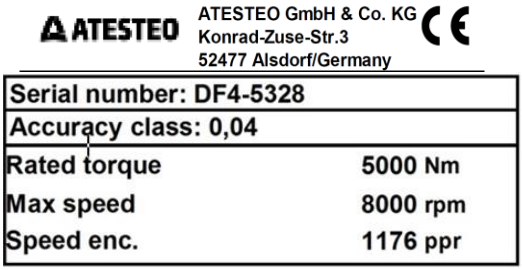


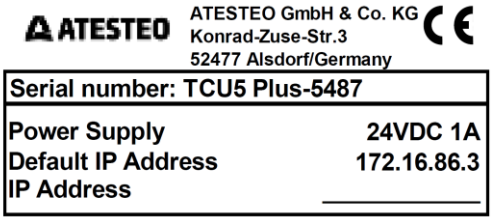
Figure 6 Position of nameplates

Nameplates

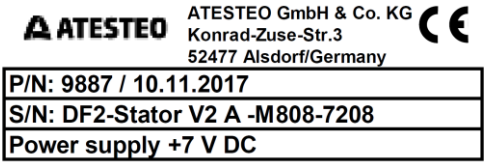
Rotor



TCU



Stator



Special design features

- The one-sided hollow measuring body can be slid onto the drive shaft for assembly (inline concept). Critical operating parameters such as "engageable masses" or limited limit speeds can thus be mitigated.
- By eliminating the stator ring and the wide positioning distance between the rotor and the stator head, the overall installation of the measuring system as well as the replacement of individual components is very convenient.
- The evaluation unit, which is needed to start-up the measuring system, provides all interfaces for a comfortable and up-to-date further processing of the measurement data.
- The free design of the torque measuring device also offers an extension as a dual-range measuring flange up to a torque ratio of up to 1: 5, without any appreciable impairment of the mechanical properties.

8 Mounting

8.1 Assembly of the rotor

You need a torque wrench for mounting the rotor.

Mounting torque meter with input side to drive train.

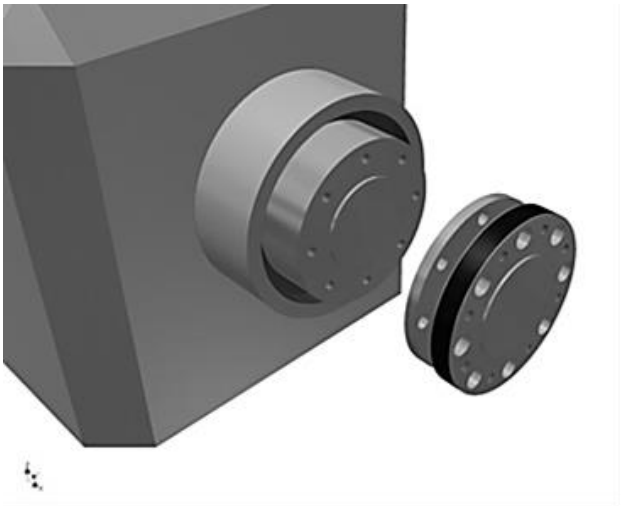
Type	Amount of screws	Tightening torque
DF1	6x M8 12.9	43 Nm
DF2	8x M10 12.9	84 Nm
DF3	8x M12 12.9	145 Nm
DF4	8x M14 12.9	235 Nm
DF5	8x M16 12.9	365 Nm

Table 1 Tightening torques

You can see the screwing depth in the following table:

Measuring shaft	Thread size	screw depth of the flange (mm)	
		min.	max.
DF1	M8x1.25	8	14
DF2	M10x1.5	10	14
DF3	M12x1.75	12	14
DF4	M14x2	14	17
DF5	M16x2	16	17

Table 2 Screw dimensions



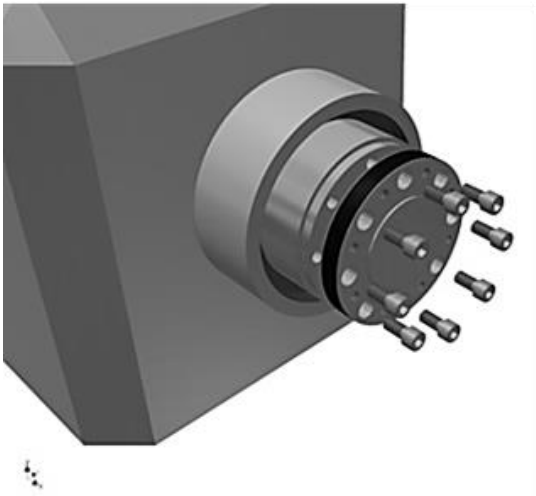


Figure 7 Rotor mounting

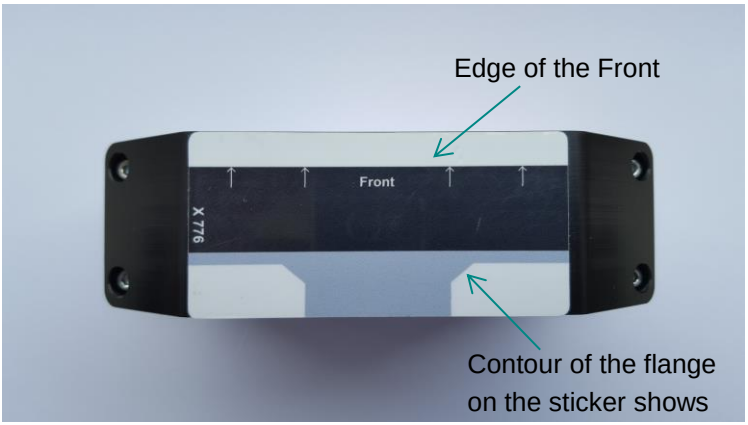


Figure 8 Top-view of the stator

The **DF stator** must be positioned under the measuring flange that the output flange of the rotor covers the black area of the stator (sticker).

Note:

Radial air-gap between receiver and torque-meter: **3mm +1mm /-2mm.** Axial displacement of black area: **±1mm**

You need M6-screws for the mounting.

When mounting the stator, use all four slots.

First, the stator must be grounded. For details, see the section 8.5. The grounding screw should be used.

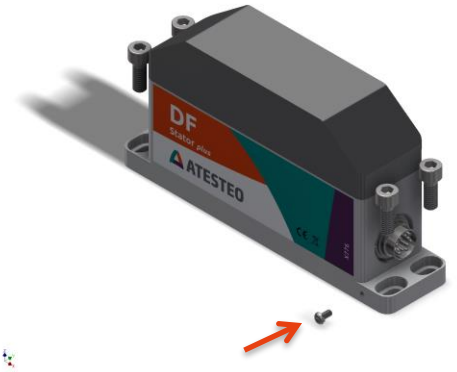
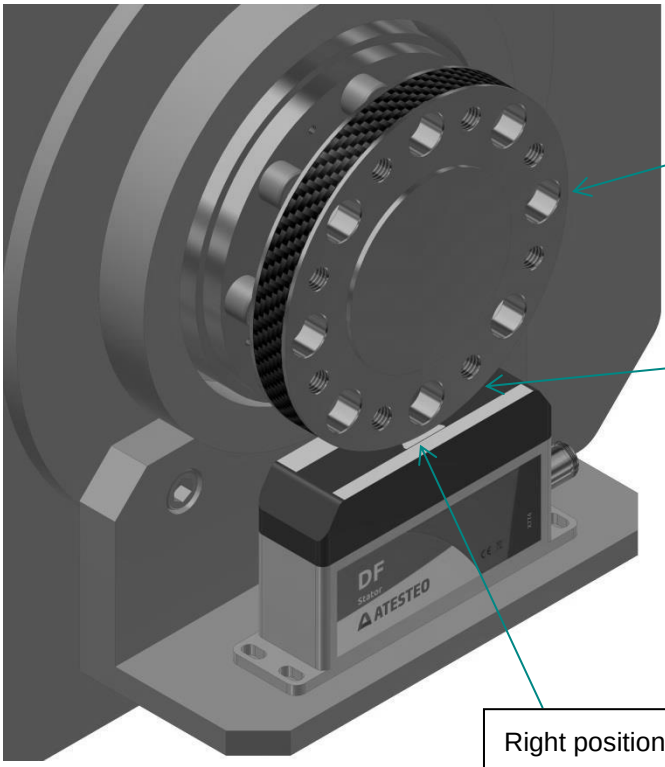


Figure 9 Side view of the stator

You can find information on the dimensioning of the stator mounting to the rotor in chapter 12.3.2.

The following images show the right placement (of the rotor and the stator).



See description

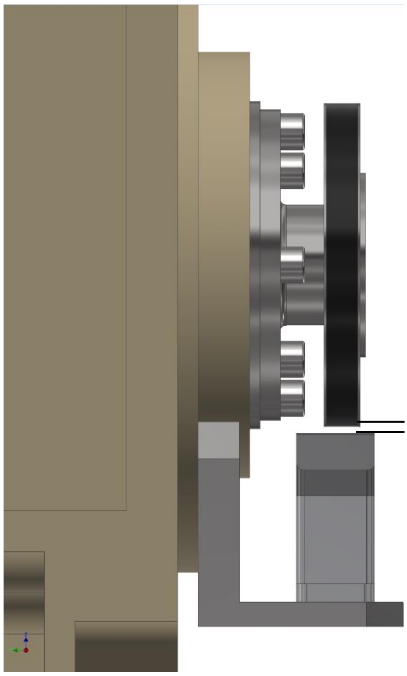


Figure 10 Alignment stator and rotor

8.2 Speed-measuring system (optional)

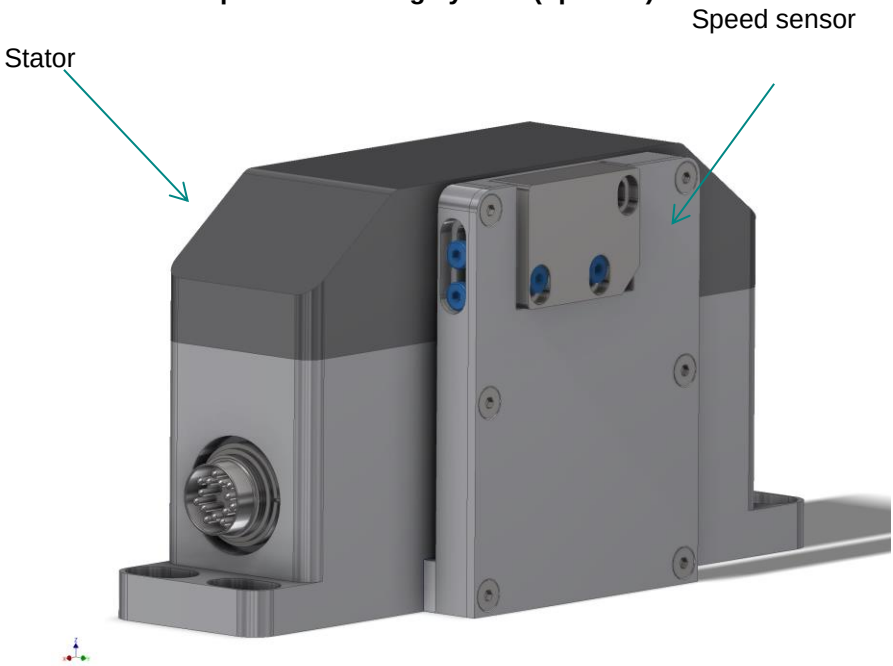


Figure 11 Optional speed detection system at stator

Delivery state

The speed measuring system is factory-set to nominal distance.
If an adjustment of the distance is necessary, please note:
max radial speed difference to magnetic ring is 1 mm

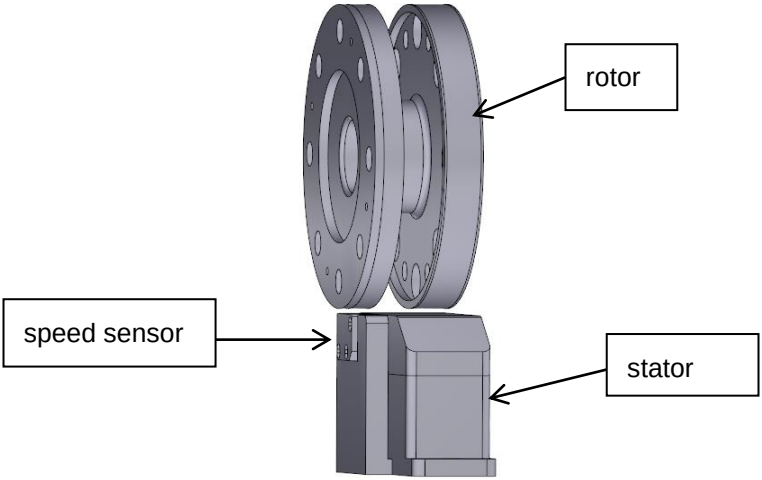
Speed sensor alignment
The LM10 encoder system consists of an LM10 readhead on MS magnetic scale offering a range of industry standard digital and analogue output options.
The LED indicator provides visual feedback of signal strength, error condition, for set-up and diagnostic use.
Green indicates good signal strength/set-up
Red indicates poor signal strength- adjustment required

Note: IB output type- LED flashes red.

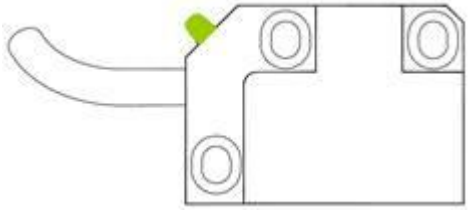
Technical data Speed sensor system:

Power supply	4.7 V to 7 V – reverse polarity protected; voltage on readhead (see note below) 5 V to 30 V for IB output type	
Power supply rise time (for PRG option only)	< 1 ms	
Power consumption (without any load)	< 35 mA for digital output types < 50 mA for analogue output type	
Environmental sealing	IP68 (according to IEC 60529)	
Temperature	Operating	-10 °C to +80 °C (cable under non-dynamic conditions: -20 °C to +85 °C)
	Storage	-40 °C to +85 °C
Shock	300 m/s2, 11 ms (IEC 60068-2-27)	
Vibration	300 m/s2, 55 Hz to 2000 Hz (IEC 60068-2-6)	

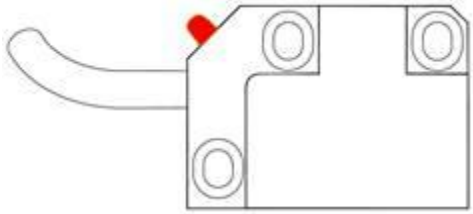
Mass	Readhead (1 m cable, no connector) 56.4 g, Cable (1 m) 34 g, Magnetic scale (1 m) 60 g, Cover foil (1 m) 3.5 g
Cable	Ø4.2±0.2 mm, PUR high flexible cable, drag-chain compatible, double-shielded 8 × 0.05 mm^2; durability: 20 million cycles at 20 mm bend radius



The speed-measuring system is equipped with an LED:
LED green: the signal strength is ok / Set-up



LED red: the signal strength is too low / Adjustment necessary



8.3 Assembly evaluation unit

The evaluation unit is not protected against splash or condensation water. That is why the evaluation unit should be assembled in a dry place with a maximum relative humidity of 80 %. The ambient temperature must be between +10 and +70 °C.

8.4 Type of installation

The evaluation unit can be mounted in two ways. It can be mounted on an electrically conductive 35 mm DIN rail or on an electrically conductive metal plate.

H-rail mounting

For mounting on a DIN rail, a metal clip is located on one side of the evaluation unit. The following figure shows the position of the metal clip:

Figure 12 Mounting of TCU5 (with clip)

The TCU can be easily hooked with the clip from top to bottom on the DIN rail. Please connect the DIN rail to the central ground point of the test bench via a grounding strap.

Metal plate installation

For mounting on a metal plate, there are four drill holes on the front of the evaluation unit. The following figure shows the position of the holes:

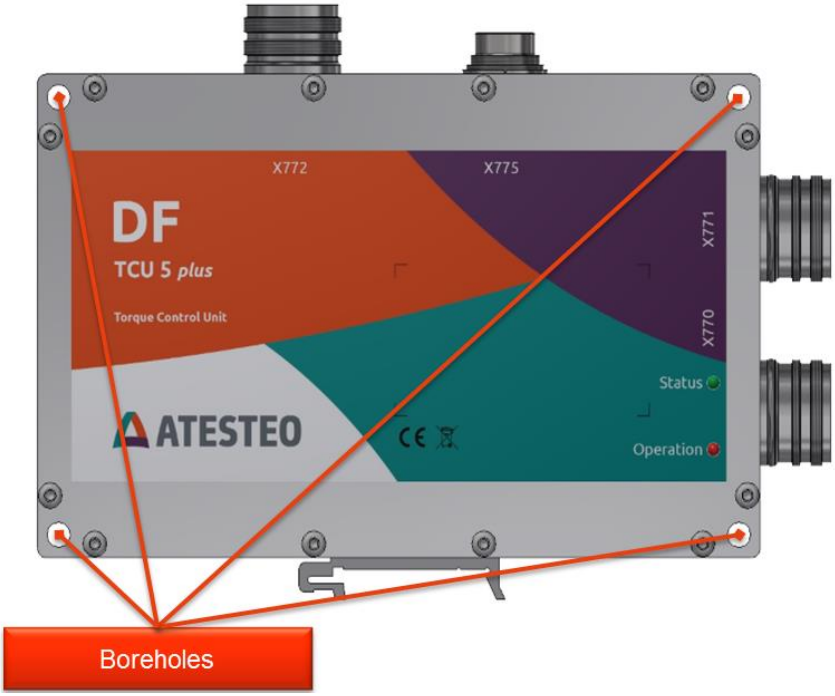
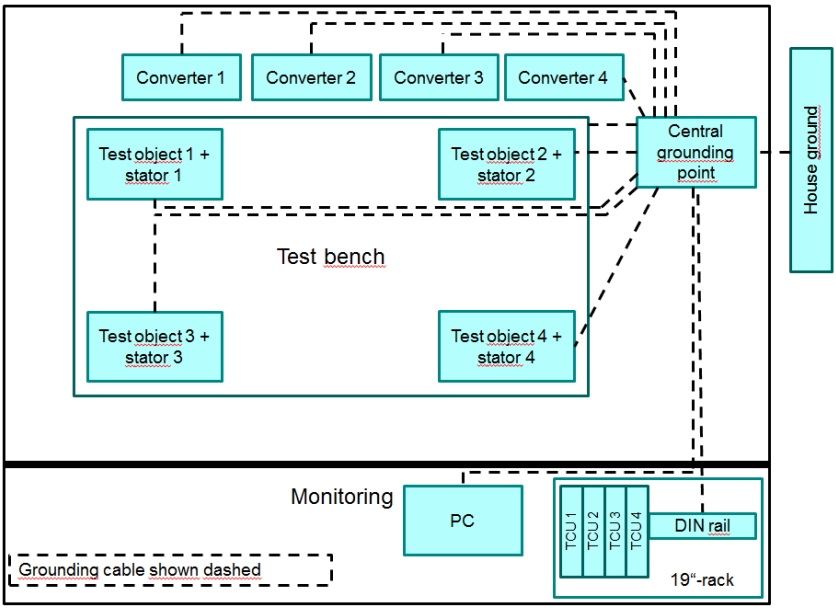


Figure 13 Mounting of TCU5 (with screws)

Attach the evaluation unit to the metal plate with four M5'ern cylinder head bolts. The drill holes for the screws each have a depth of 48 mm. Please connect the metal plate via a grounding strap to the central ground point of the test bench. The connection of the grounding strap should be placed as close as possible to the evaluation unit. For coated metal plates, the earth strap must be fastened to the evaluation unit via a ring cable lug on one of the four screws mentioned.

8.5 Grounding at the test bench

Today's demands of test stand claims require a powerful and high-frequency clocking hardware. Electronic components are sensitive towards electromagnetic emission. That's why the avoiding of electromagnetic emissions is really important when it comes to test facility planning. The DF plus Series hardware is designed to derive electromagnetic interference. These protection circuits only work if the stator and the evaluation unit are each connected via their own cables directly to a central mass point with the test bench ground. It is the same for the remaining hardware in the test bench. If all the components are directly connected to a mass point without detours it enables a low –impedance dissipation of broadband electromagnetic interference and at the same time it avoids unwanted ground loops by different line potentials.
The following illustration outlines the example of a point-to-point grounding concept:



In addition to a sophisticated earthing concept, it makes sense to separate all power cables by the use of separate cable ducts from the sensitive signal lines of the test bench. A spatial separation of the power cables is the best option, but if it is not possible the cables should at least not be laid parallel to each other. The central cable between the stator and the TCU transmits sensitive signals. That's why it shouldn't be laid with the power cables. To add the cable shield protects the cable against external interference. A diligent planning of the grounding concept and the guideways can avoid costly error search and error correction on the fully assembled test bench!

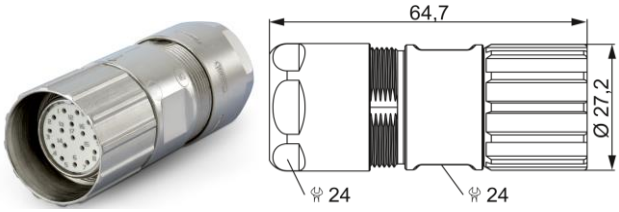
8.6 The wiring of the evaluation unit

The evaluation unit has four device plugs. The respective connector designation is written on the housing cover of the evaluation unit. Device connectors X770 and X771 connect the evaluation unit to the test bench peripherals. Device plug X772 connects the Ethernet interface to the evaluation unit. The central cable connects the device plug X775 of the evaluation unit with the stator. The central cable is not allowed to be longer than 50m. Only use the following cable connectors:

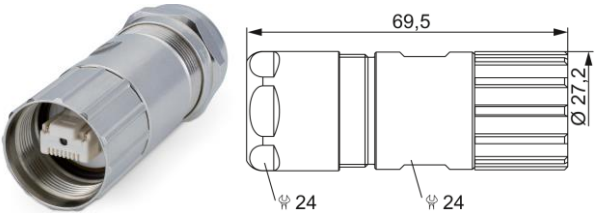
Device plugs	Cable connector (manufactures – manufacturer part number)
X770 (12-polig)	Hummel – 7106500000 + Hummel - 7001912104
X771 (16-polig)	Hummel – 7106500000 + Hummel - 7001916103
X772 (Rj45)	Hummel – 7R10400000*[1] + Hummel – A7RJ-821M51*[1] Or protective cap: Hummel – 7010900102
X775	Binder – 99 5629 75 12

*[1]) not included in the scope of supply

Cable connector for connection X770 and X771



Cable connector for connection X772



If you do not use the housing plug X772, please use the protective cap (included in the delivery) to protect it from electromagnetic field and dirt particles. You can find the pin assignment of the individual plugs in the appendix.

8.7 Power and data cable

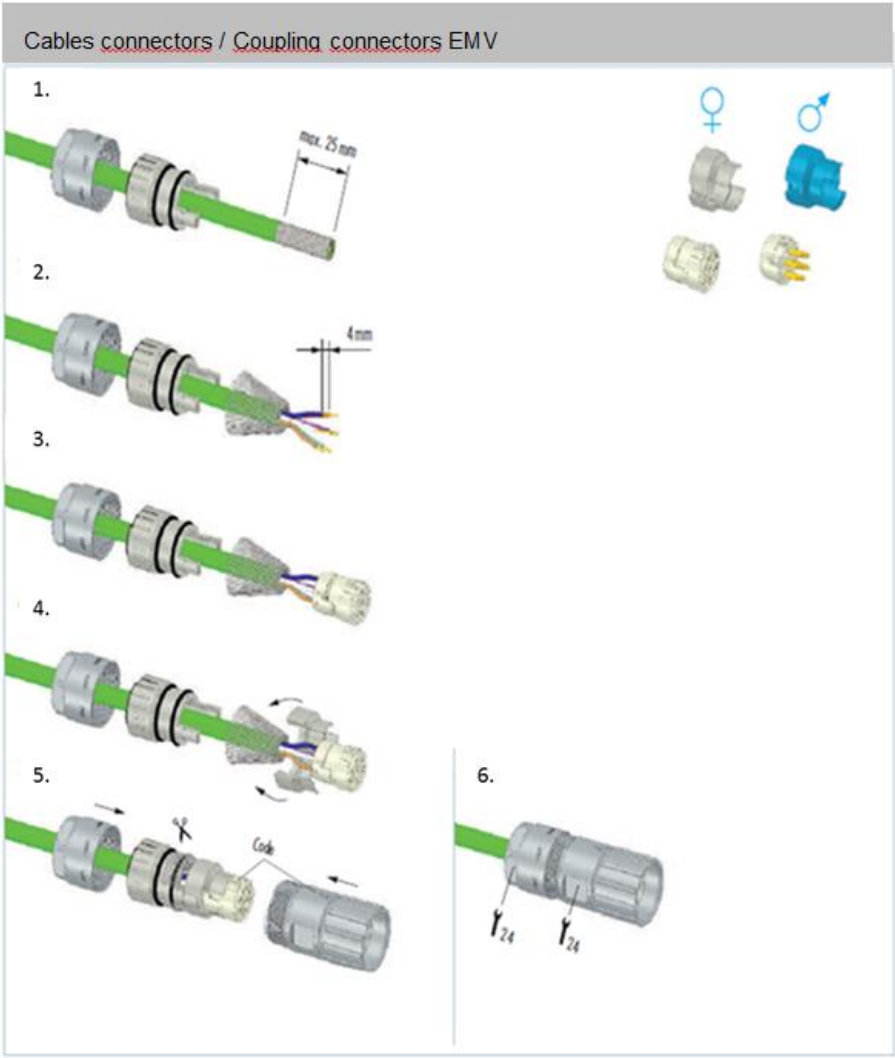
In order to comply with the EMC standards EN61000-6-4 / VDE 0839 parts 6 to 4, the following procedure for connecting and lying the central cable is recommended:
Please use a shielded cable with 4x 2x 0.14mm² (twisted pair) + 4x 0.5mm² for connection to X770 and a shielded cable with 8x 2x 0.25mm² wire (twisted pair) for connection to X771. The shielding of the cables must be placed on both ends. The shield must also be placed on the measuring shaft side and in the measuring cabinet.

Pin assignment see appendix.

Information
We recommend installing a fuse in the control cabinet with an on-and off-switch.

Information
Prefabricated cables are optionally available ex works.

8.8 Assembling the power and data cable



9 Calibration

The measuring system DF plus is delivered with a test report. It shows the slope in digits / Nm. The optional calibration protocol shows the calibration values in several stages.
On request, a DAkkS-certified calibration according to DIN 51309 can be carried out.
The following figure shows the example of a standard test report:

ATESTEO
Excellence in drivetrain testing

Torque transducer test report

Serial number: DF2S DT - 5375

Range1

Rated Torque:	150	Nm
Calibrated Torque:	150	Nm
Sensitivity cw:	2623,5100	Digits/Nm
Sensitivity ccw:	2623,8430	Digits/Nm
Test signal:		Nm
Accuracy (Nonlinearity and hysteresis):	0,04% of rated torque	
Temperature effect on zero:	0,04% of rated torque / 10°C	

Range2

Rated Torque:	600	Nm
Calibrated Torque:		Nm
Sensitivity cw:	667,3792	Digits/Nm
Sensitivity ccw:	667,4242	Digits/Nm
Test signal:		Nm
Accuracy (Nonlinearity and hysteresis):	0,04% of rated torque	
Temperature effect on zero:	0,04% of rated torque / 10°C	

Compensated Temperatur Range (Rotor/Stator): 10°C/10°C to 70°C/70°C
Gravitational Constant Alsdorf: 9,81106 m/s²
Ambient Temperature: 21,2 °C

Remarks:
Maximum Speed: 20000 rpm
Speed Disc: ppr
Warming Up Time: 30 minutes

Date: Signed:

Figure 14 Test report example

The following figure shows a detailed calibration protocol, which is recommended as an option:

ATESTEO
Excellence in drivetrain testing

Certificate of Calibration

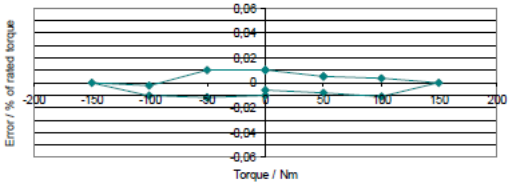
Serial number :	DF2S DT - 5375	**Sensitivity cw [Digits/Nm]:**	2623,5100
Rated Torque/Nm:	150	**Sensitivity ccw [Digits/Nm]:**	2623,8430

Accuracy (Nonlinearity and hysteresis): 0,04% of rated torque
Temperature Effect On Zero : 0,04 % of rated torque / 10°C
Compensated Temperatur Range(Rotor/Stator): 10°C/10°C to 70°C/70°C

Instrument	Model	No. Int.	Ser. No.	Last Cal.	Next Cal.
Voltmeter					
Calibration rig	Teststand5	PR5-5 multi		19.02.2015	19.02.2020
Temperature/°C:	21,2°C				

Instruments are traceable by their No. Int.

		Calibration Value	Actual reading	Deviation	Deviation	Deviation
Weight/kg	Torque/Nm	Digits	Digits	Digits	Torque/Nm	%of rated torque
0	0	-1193	-1218	-24,5	-0,01	-0,006
10	50	129982,5	129951	-32,0	-0,01	-0,008
20	100	261158	261117	-41,5	-0,02	-0,011
30	150	392333,5	392334	0,0	0,00	0,000
20	100	261158	261176	17,5	0,01	0,004
10	50	129982,5	130003	20,0	0,01	0,005
0	0	-1193	-1156	37,5	0,01	0,010
0	0	-1193	-1156	37,5	0,01	0,010
-10	-50	-132385,2	-132346	39,7	0,02	0,010
-20	-100	-263577,3	-263585	-7,2	0,00	-0,002
-30	-150	-394769,5	-394770	0,0	0,00	0,000
-20	-100	-263577,3	-263618	-40,2	-0,02	-0,010
-10	-50	-132385,2	-132434	-48,3	-0,02	-0,012
0	0	-1193	-1231	-37,5	-0,01	-0,010



Date: Signed:

Figure 15 Calibration certificate example (factory calibration)

10 Start-up

10.1 The first switch on

Before you switch on for the first time, make sure that all system components have been connected and aligned in accordance with the installation instructions in this manual. Check all connections for a secure stop. The DF plus series has three LEDs which indicate the respective operating status. Two LEDs are located on the evaluation unit and one LED on the side wall of the DF plus stator.

After being switched on, the measuring system goes through different states, which are indicated by different blink codes of the two LEDs on the evaluation unit. Switch on the supply voltage for the evaluation unit and check the flashing code of the LEDs. First, both LEDs will be lit simultaneously for 5 seconds. The system is in the boot process. Then both LEDs go out. Subsequently, the run and the receipt of the data sheet starts. In this process the green led light blinks with a speed of 8 Hz and the red led light with the speed of 1 Hz. This procedure shouldn’t last longer than 30 seconds. The evaluation unit changes to the normal operating mode after receiving the electrical data sheet. In this case, the green LED illuminates every second for a period of one second while the red LED remains off. In the case that the evaluation unit displays a different flashing code, you will find an overview of all flashing codes with the associated system states in the chapter "LED coding of the TCU and the DF plus STATOR". Then check the LED of the DF plus Stator. This should light up green at optimum reception levels. If the LED does not light up, the DF plus Stator may need to be re-aligned under the torque sensor.

The following chapter describes the setup of the web interface needed to configure the measuring system.

10.2 Installation of a Web browser

One of the following web browsers is required, to use the web interface:

Firefox

http://www.mozilla.org/en-US/firefox/all/a

Chrome

https://www.google.com/intl/de/chrome/browser/index.html?standalone=1#eula

Internet Explorer

http://windows.microsoft.com/de-de/internet-explorer/ie-11-worldwide-languages

Note
Please use the latest version of the browser

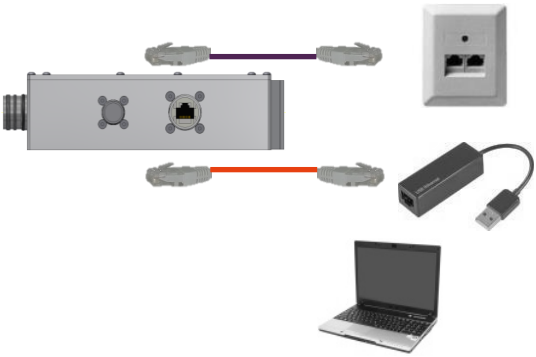
10.3 Network connection

You need a CAT5-Patchcable and an RJ35-connection to connect the TCU5 to an evaluation computer.

Three options to connect to network:

1. **Connect directly**

   Connect with a patch cable directly from the Ethernet socket of the computer.



2. **Connect with network-to-USB adapter:**

   The adapter needs to be installed on the computer. Now connect TCU 5 with a patch cable to the adapter.

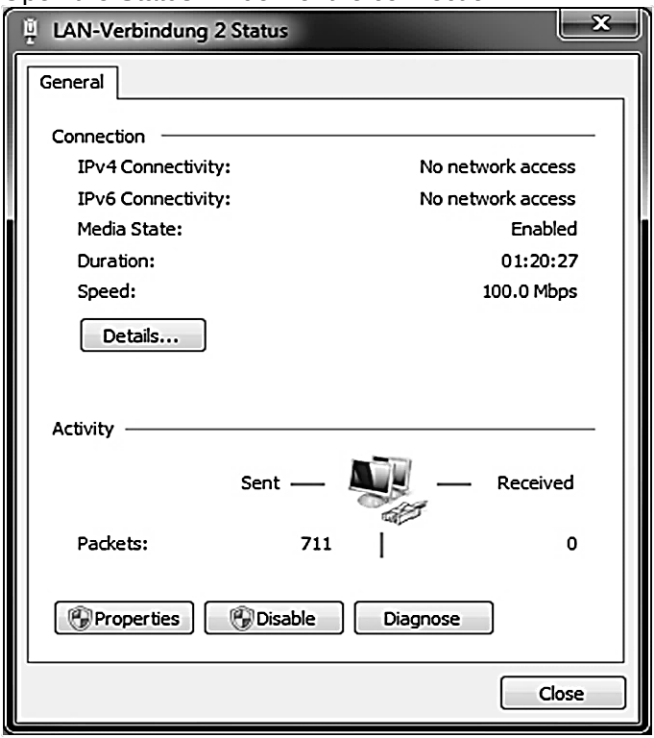
3. **Connect in domain network:**

   Connect the TCU 5 using the patch cable with a free network socket.

10.4 Network settings [Windows 7]

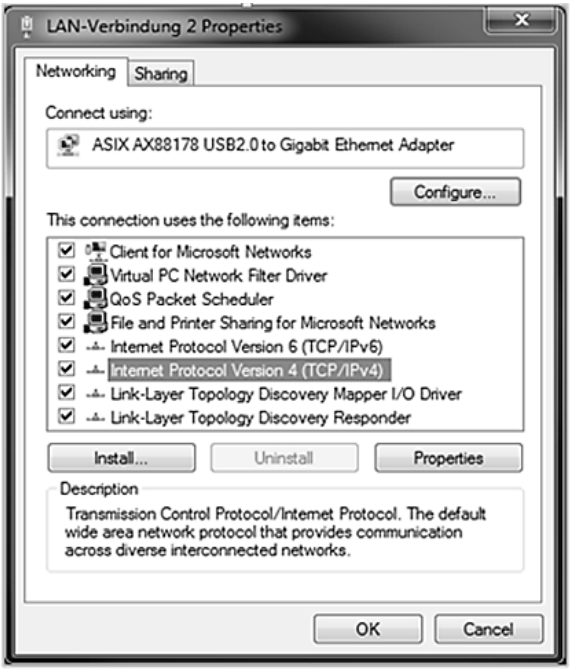
Network settings need to be changed, if option one or two is selected.

1. Navigate to “Network and Sharing Center”
2. Open the Status window of the connection



3. To see the Connection Properties, click on:

4. Select “Internet Protocol Version 4”

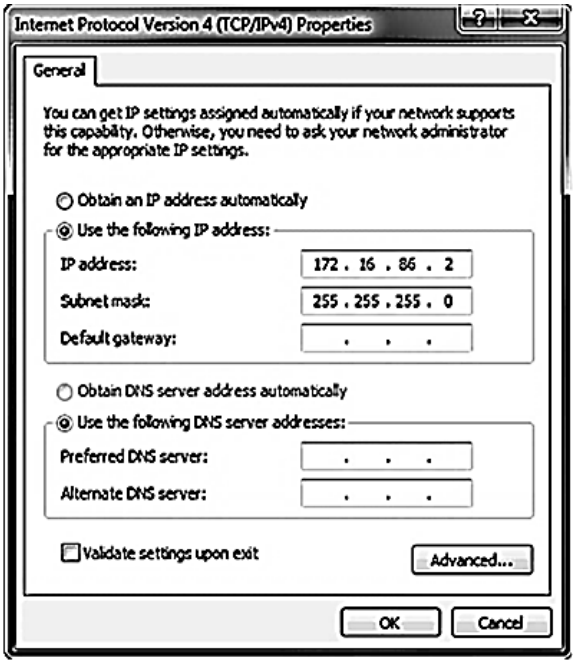


5. Then click on 

6. Enter the following values

    a. **IP address**: 172.16.86.2

    b. **Subnet mask**: 255.255.255.0

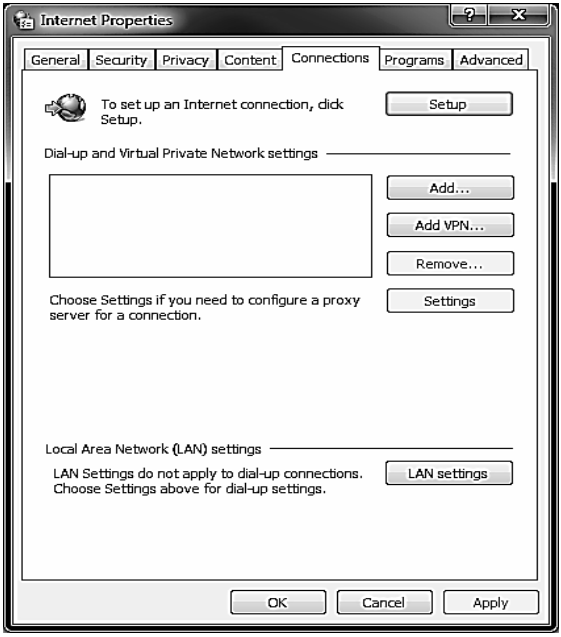


Note

Administrator rights are required

10.5 Proxy configuration [Windows 7]

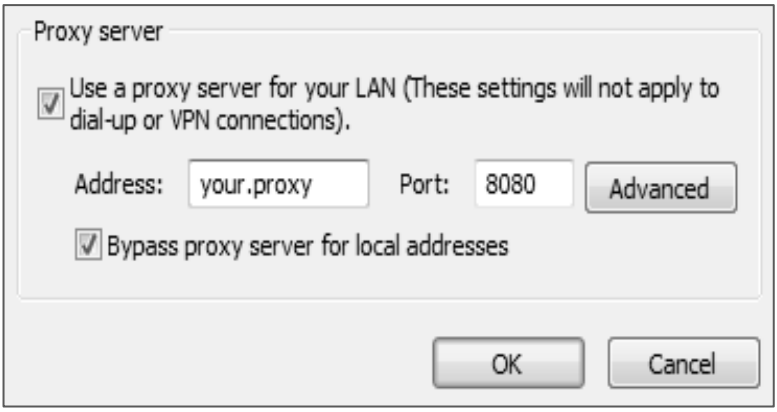
1. Navigate to “Internet Properties”

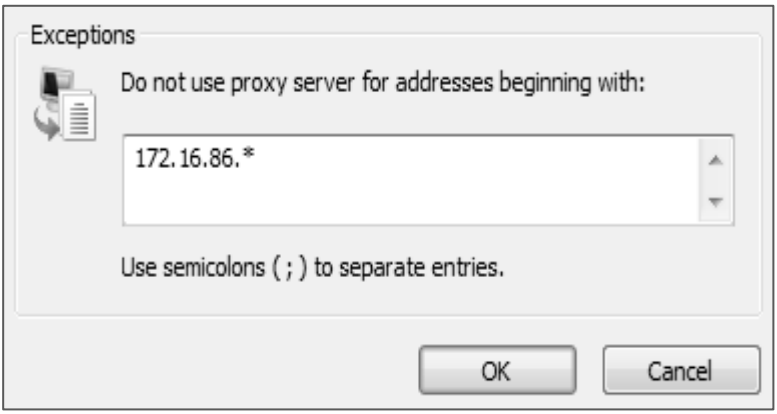


2. Choose the “Connections” tab
3. Click on 

4. Navigate to Proxy Settings by clicking 

5. Input the new proxy exception
    a. **Proxy exception**: 172.16.86.*


Proxy server
Use a proxy server for your LAN (These settings will not apply to dial-up or VPN connections).
Address:
your.proxy
Port:
8080
Advanced
Bypass proxy server for local addresses
OK
Cancel


Exceptions
Do not use proxy server for addresses beginning with:
172.16.86.*
Use semicolons (;) to separate entries.
OK
Cancel

10.6 Web interface

The web address of the TCU 5 plus is needed to open the web interface. There are three different ways to open it.

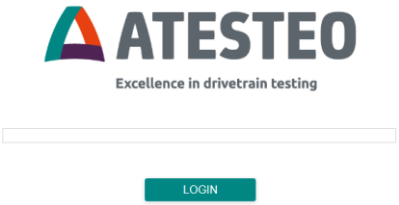
The web address contains of "tcuv-" and [SERIAL NUMBER].

Or you can use the following IP address to open the web interface:

http://172.16.86.3

11 Operation of the web interface

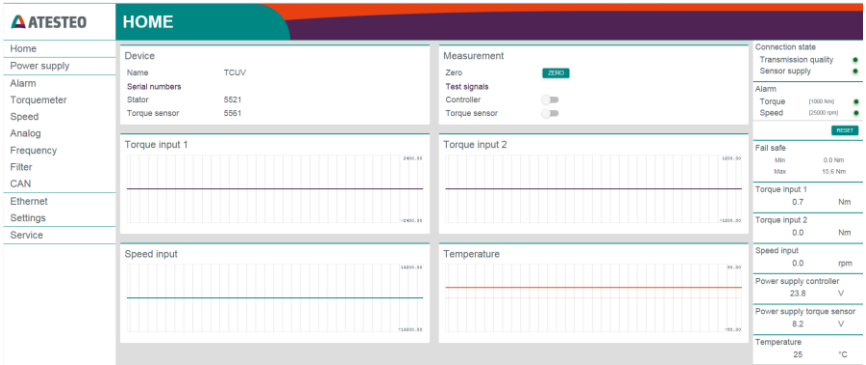
LOGIN



The password must be entered to log in. If the password is not changed, the password is: admin.

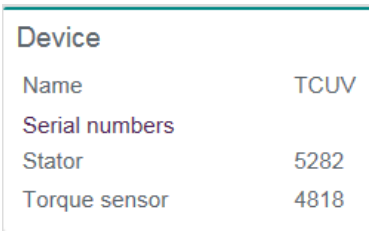
Important
The password can be changed in the item settings menu. Protect you measuring system from unauthorized access!

11.1 Home Menu



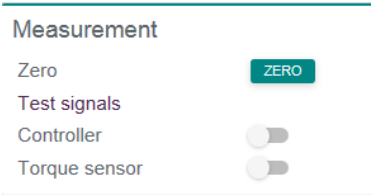
The Web-Interface is divided into different parts:

Device information:



This overview of currently connected
devices includes information about the
name of the TCU 5 plus and the serial number
of the stator and the torque sensor.
The device name is editable in the Settings menu.

Measurement features:



The measuring signal is set to zero by pushing the ZERO -button.
The test signals are enabled or disabled by the –buttons.

The test signal of the TCU 5 plus simulates an output value equal to the set rated torque.

The test signal of the torque sensor generates an offset jump on the first amplifier of the measuring chain in the rotor. This makes it possible to detect deviations of the torque input 1 and 2. The height of the offset jump can be found in the supplied test report.

Note:

Test signals must be disabled before measuring

11.1.1 Graph overview

Diverse signals are displayed in the main part of the home page. These signals graphically represent Torque input 1, Torque input 2[1], Acceleration input[1], the Speed input[1] and the Temperature of the torque sensor. Graphs are automatically scaled according to their nominal value.

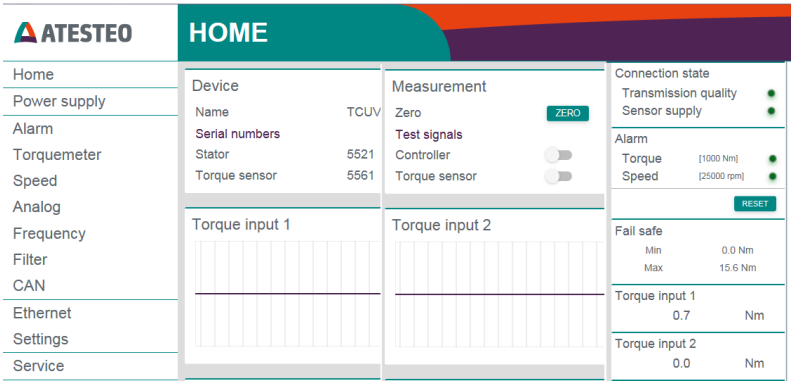
Note

Signals are not displayed in real-time. This may lead to delayed representations.

[1] Depending on the configuration of the current system

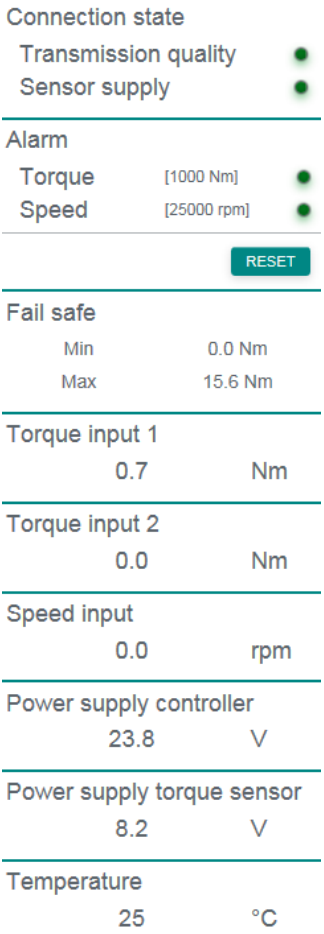
11.1.2 Navigation menu

If the navigation bar is closed, click on the company logo to open it again.



11.2 System overview

The signal bar is shown on the right-hand side of the website.



A Optimal (green) **|** Okay (yellow) **|** Bad (red)
B Transmitting (green) | No Transmitting (gray)
C Value below Threshold (green) | Value above Threshold (red)

Note

Signals are not displayed in real-time. This may lead to delayed representations.

Important

Check the supply voltage and the orientation between torque sensor and stator-antenna to guarantee an optimal transmission quality.

Connection state

The “Connection state” tab contains information about the transmission status of the system. The LED “’Transmission quality” is an indicator of transmission quality of measured data from torque meter to torque control unit. The “Sensor supply” LED indicates the status of the torque sensor supply voltage.

Alarm states

Alarm values are displayed in the “Alarm” section. Red indicates that threshold is exceeded. Alarms can be reset by pressing RESET-button. Alarm limits can be set in the “Alarm” settings menu.

Measured data

Below the alarm states the measured data of the different system inputs: Torque input 1, Torque input 2[2], Acceleration input[2], Speed input[2], Power supply torque sensor, Power supply controller, Torque sensor Temperature and Fail safe[2] are displayed numerical.

Fail safe

The overload channel is used to better analyze misconduct at the test bench. While the standard measurement channels can capture torque values up to 110% of the nominal moment, the overload channel allows measurements of up to 300% of the nominal moment with an accuracy of 0.1%.

[2] Depending on the configuration of the current system

Measurements of the overload channel are recorded at a speed of 2 kHz. The sensor determines the absolute maximum or minimum of the measured values in 800ms and then sends them to the TCU.

In addition to the web display, the overload values can also be issued via CAN.

11.3 Power supply

In the menu “Power supply” the supply voltage of the torque sensor will be adjusted. The power-switch activates and deactivates the power supply. If the power supply is activated, a search is started automatically, which sets the optimum operating point. This also applies to system startup. Because the inductively transmitted power depends on the gap between torque sensor and stator-antenna the supply voltage has to be readjusted after change of position. The optimal supply voltage of the torque sensor is 8,0 V ±0,3 V. There are 2 methods for adjusting:

1. Manuel mode: By pressing the SEARCH button, the optimal supply voltage is automatically set.
2. Automatic search: The search always starts when the system relies on the working range of 8V±>1.5V! If the search starts, the system is no longer ready to measure. System status must always be checked.

Note
Please check the table with the CAN states in chapter 11.10.

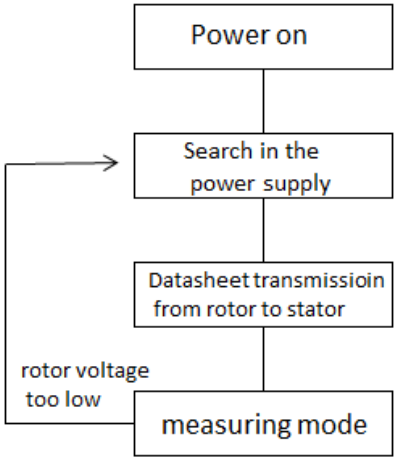
In the following section, the influence of the torque sensor voltage to the signal quality is shown:

Sensor voltage	LED supply	Sensor	Description
8,0 V ± 0,3 V	Green		Optimal supply voltage
8,0 V ± > 1,5 V	Red		Poor supply voltage. Possibly interrupted transmission, possibly invalid measurement values

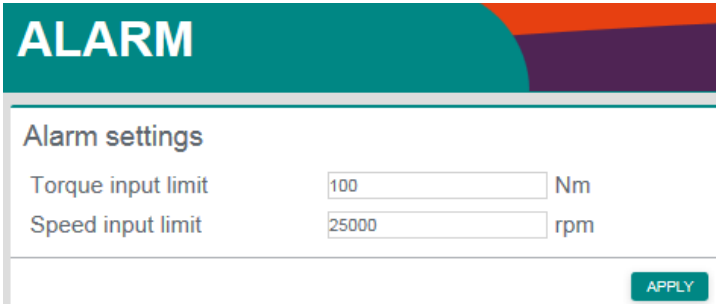
Table 3 Power supply of rotor

Important

The optimal torque sensor supply voltage should be at 8 V. Power supply will be deactivated and set back to zero, if a critically value is adjusted, in order to prevent damage of inductive power supply components.



11.4 Alarm settings



Alarm thresholds for speed[3] and torque can be set.

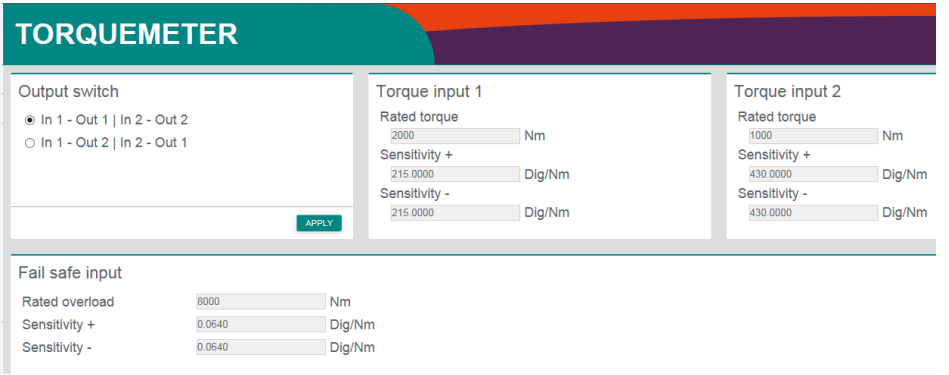
Torque input limit
If the measuring signal exceeds the set limit value, the alarm is triggered, both via the status word (CAN bus) and via the x771 plug.

Important

In dual-range systems, only the large measuring range is considered.

[3] Depending on the configuration of the current system

11.5 Torquemeter



Important

Improper values can falsify measurements or in worst case damage the measurement device. Proper values can be found in the test report.

Setting display is locked for input, as the values are automatically adopted by the rotor. Manual changes of the settings can be changed in the setting menu

Output switch[4]

Output signals can be swapped. The output swap affects the following outputs:

[4] Depending on the configuration of the current system

Effects of the output swap	
Output	**State**
Website output	Not swapped
Frequency output[1]	Swapped
Analog output (voltage)[1(*)]	Swapped
Analog output (current)[1(*)]	Swapped
CAN output[1]	Not swapped

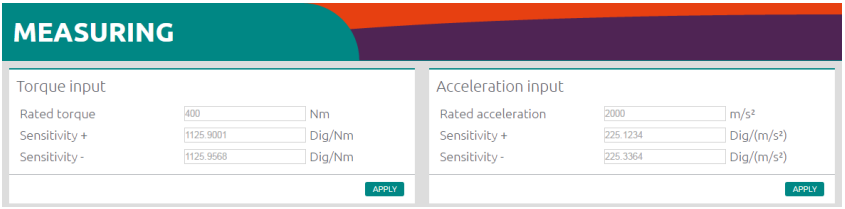
If a dual-channel torque transducer (DFx DT) and only one channel for torque measurement are available in its measuring socket, then it is possible to set which torque channel is actively switched to output 1 here. You can reserve the outputs Torque1 and Torque2 in that way.

Ana1_out	Torque1
Ana2_out	Torque2
Ana3_out	Speed
Ana4_out	Not assigned

Ana1_out	Torque2
Ana2_out	Torque1

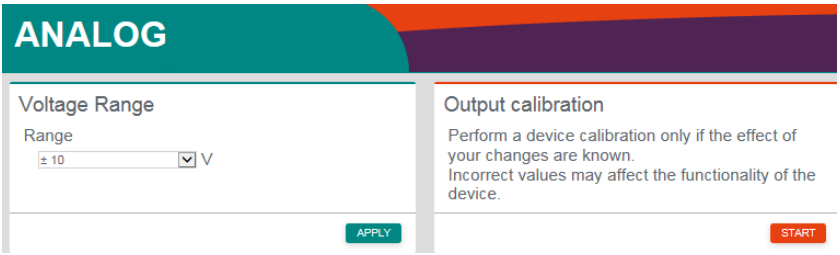
Ana3_out	Speed
Ana4_out	Not assigned

11.6 Measuring[1]

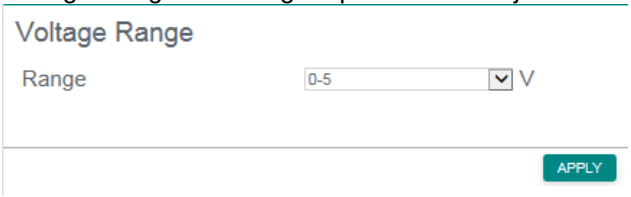


The Measuring Menu appears if the system measures acceleration. Data input is performed as described in the previous chapter.

11.7 Analog settings



Voltage[5] range of analog outputs can be adjusted.



[5] Depending on the configuration of the current system

Default output configuration (Output switch off)

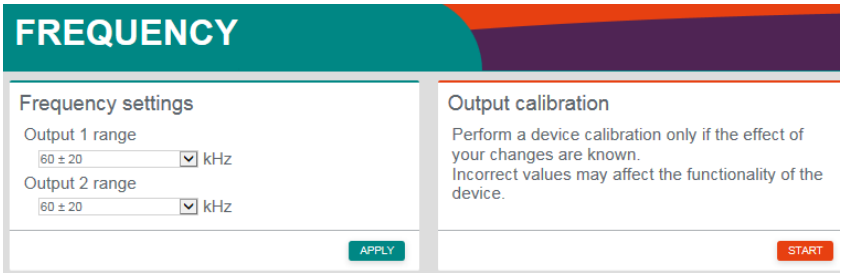
Input	
torque1	Ana1_out
torque2	Ana2_out
speed	Ana3_out

Switched output configuration (Output switch on)

Input	Output
torque1	Ana2_out
torque2	Ana1_out
speed	Ana3_out

Important
The outputs may only be calibrated by trained personnel.
Incorrect values falsify measurements.
The outputs are calibrated at the factory and there is no need to recalibrate them.

11.8 Frequency settings



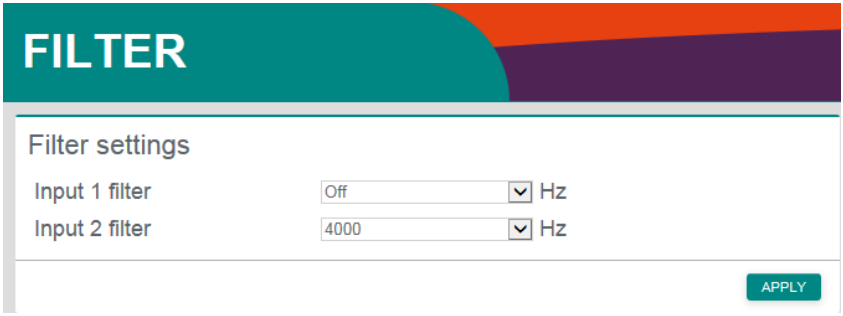
Various output ranges can be set in the "Frequency" menu. For a dual-channel torque transducer, both ranges can be set separately

Output calibration

Outputs must not be calibrated by an untrained user. Incorrect values can falsify the measurement. Outputs are calibrated at the factory and usually do not need to be recalibrated.

11.9 Filter settings

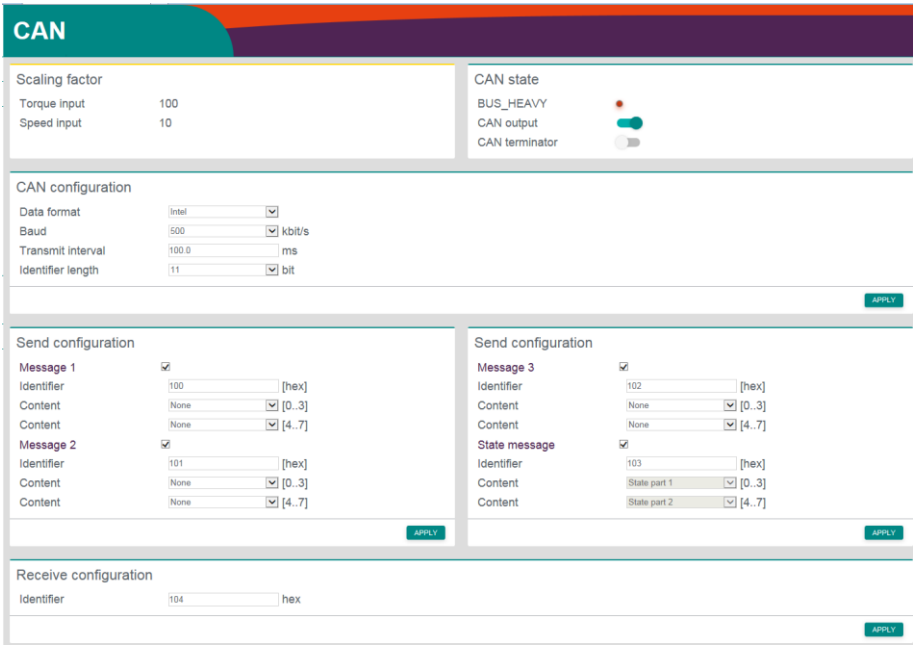
The filter-settings influence the input signal.



The TCU provides a digital IIR filter 1st order. It is related to the torque input channels. For each input channel, the filter can be activated and the cut-off frequency can be set in the corresponding dropdown-box. The following cut-off frequencies between 1 Hz and 4000 Hz are supported:
1 Hz, 10 Hz, 50 Hz, 100 Hz, 150 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz.

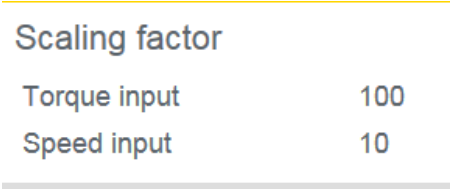
The APPLY **-button is clicked to save the settings**.

11.10 CAN settings



CAN communication can be configured in the CAN menu.

Scaling factor



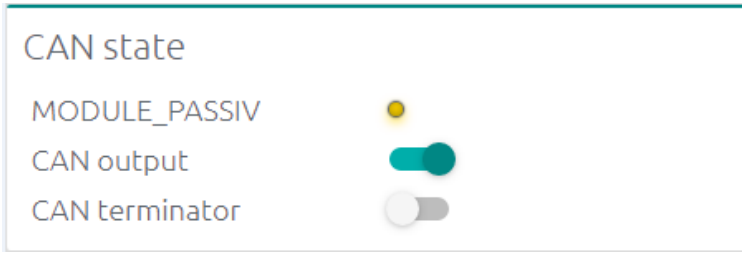
The torque values are transmitted in integer format. To generate three decimal places in the TCU, the measured value is multiplied by 100. In order to obtain the true measured value in the measurement data acquisition, the received value must be divided by 100.

11.10.1 CAN state

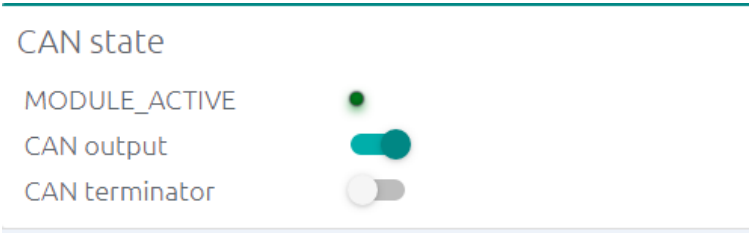
CAN transmission is enabled and disabled by toggling the -button.

The “CAN State” tab also contains information about the current state of the CAN bus. The different states are explained in the following sections.

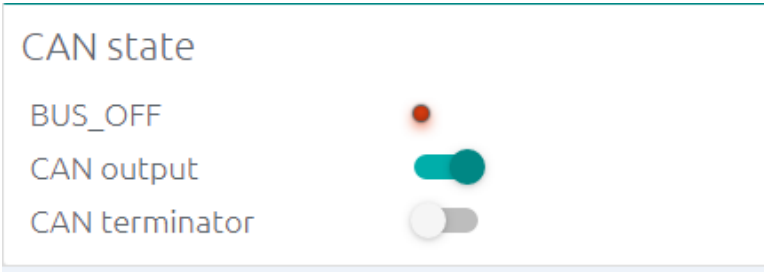
MODULE_ACTIVE: The CAN bus is working without any significant problems. The *receive error counter (RX)* and the *transmit error counter (TX)* are < 128.



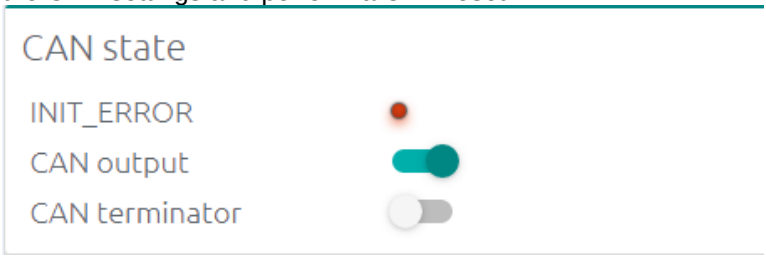
MODULE_PASSIV: The CAN bus works, however, a transmission or reception error occurred. TX or RX is > 127. In case that no more errors occurred, the counters are decremented and the status changes to MODULE_ACTIVE. Otherwise, the bus should be checked.



BUS_OFF: The CAN module has been disconnected due to many transmission errors (TX > 255).Check the CAN settings and perform a CAN reset.



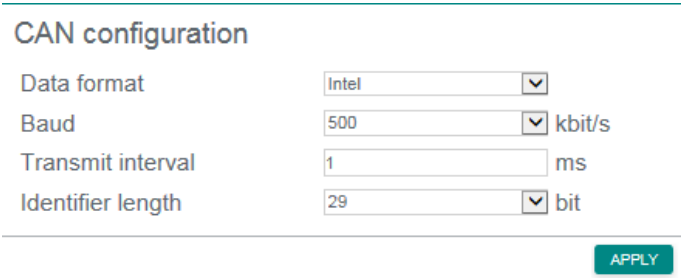
INIT_ERROR: The CAN module cannot connect to the CAN bus. Check the CAN settings and perform a CAN reset.



NOTE: CAN State can be reset by switching the output off and on again.

CAN Terminator
Connectable 120 Ω CAN connection resistor

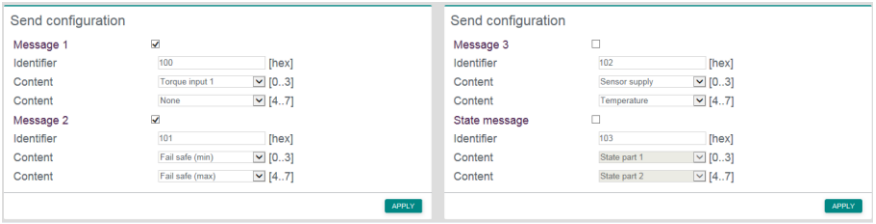
11.10.2 CAN configuration



The general CAN transmission can be configured. Selected values need to fit the values of the current receiver system.

- Baud (250kbit, 500kbit, 1Mbit)
- Transmit interval (between 0.5 and 1000 ms)
- Data format (Intel, Motorola)
- Identifier-Length (11 Bit, 29 Bit)

Send configuration



CAN messages are formatted (dependent on configurations) in the following way:

Intel	Data byte 0-3				Data byte 4-7			
Identifier	**D0**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D 7**
CAN-Identifier	Torque 1 x Factor				Torque 2 x Factor			
CAN-Identifier	Speed				0			
Motorola								
Identifier	**D3**	**D2**	**D1**	**D0**	**D7**	**D6**	**D5**	**D 4**
CAN-Identifier	Torque 1 x Factor				Torque 2 x Factor			
CAN-Identifier	Speed				0			

Four CAN messages at most can be configured depending on the CAN configuration. If the bus load exceeds 90% due to the configuration, the 3rd CAN message is blocked. This ensures that the CAN messages can continue to be transmitted reliably.

$$CAN - Message\ length_{11\ Bit\ id} = 130\ Bit$$

$$CAN - Message\ length_{29\ Bit\ id} = 148\ Bit$$

$$\frac{(CAN - sampling\ rate\ *\ message\ length)}{1000} = Bus\ load\ in\ kBit/s$$

$$\frac{(Bus\ load\ in \frac{kBit}{s} *\ Number\ of\ messages)}{Baud\ rate} * 100 = Bus\ load\ in\ \%$$

CAN Messages can be enabled and disabled. Messages one, two and three can be manually chosen and adjusted. The fourth message cannot be configured. It is reserved for the system state and the transmit interval is fixed at 1000ms.

Receive configuration

The receiving identifier for CAN message can be chosen. The following CAN messages can be received:

Messages		
Type	**Hex**	**Dec**
Zero	0x4B1	1201
Test signal controller (on)	0x4B2	1202
Test signal controller (off)	0x4B3	1203
MD1/MD2	0x4B5	1205
MD2/MD1	0x4B6	1206
State reset	0x4BB	1211
Request state	0x4BC	1212
Power supply (off)	0x514	1300
Power supply (on)	0x515	1301
Alarm reset	0x578	1400
Request Ethernet settings	0xD05	3333

Table 4 CAN message IDs for commands

The command must be included in the first 4 bytes [data bytes 0-3]. While receiving, distinction is made between Motorola and Intel. A response message is sent if a message is successfully received. The response massage is formatted in the following way:

Response message		
Identifier	**Data byte [0-3]**	**Data byte [4-7]**
receive identifier +1	last command	State part 1

11.11 Status word

The status word of DF PLUS-Series uses all 8 Byte of one CAN-Message and is separated in two parts. These are available separately in the selection menu for the CAN messages. The assignment within the CAN status message is fix. The following table shows the assignment:

State Part 2	State Part 1
Byte 7 - 4	Byte 3 - 0

Each State Part is 32 bits long. The following table describes the functions of the individual bits:

State Part 2			
Bit	Name	Description	Category
31	Rotor connected	Voltage search completed and nominal voltage reached	Connectivity
30	CAN active	CAN output activated	

State Part 2			
Bit	Name	Description	Category
29	-	Reserved	
28	-	Reserved	
27	-	Reserved	
26	-	Reserved	
25	-	Reserved	
24	-	Reserved	
23	-	Reserved	
22	-	Reserved	
21	Power supply	Rotor power supply activated	System supplys
20	Voltage search	System is in voltage search	
19	-	Reserved	
18	-	Reserved	
17	-	Reserved	
16	-	Reserved	
15	-	Reserved	
14	-	Reserved	
13	-	Reserved	
12	-	Reserved	
11	Test signal rotor	Test signal rotor was triggered (half measuring range)	Test/Service
10	Test signal controller	Test signal controller was triggered (full measuring range)	

State Part 2			
Bit	Name	Description	Category
9	Configuration mode	Controller is in configuration mode (Service)	
8	Calibration mode	Controller is in calibration mode (service, fixed CAN messages, no calculation)	
7	Watchdog	Counter 0-255 (Increments in transmission speed)	
6			
5			
4			
3			
2			
1			
0			

Table 5 CAN status word part 2

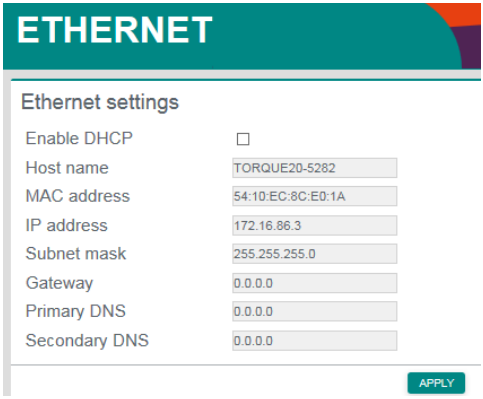
State Part 1			
Bit	Name	Description	Category
31	Alarm RX	System not ready for operation	Alarm/Error
30	Alarm MD	Torque exceeded	
29	Alarm N	Speed exceeded	
28	Alarm ACC	Acceleration exceeded	
27	-	Reserved	
26	-	Reserved	

State Part 1			
Bit	Name	Description	Category
25	Alarm Overcurrent	Royer current >= 1.4A || Royer current >= 1.2A (~ 5 minutes)	
24	Positioning error	Overcurrent during voltage search	
23	Version error	Incompatible equipment combination	
22	OS error	Fatal system error	
21	Current warning W1	Royer current >= 1.2A (~ 1 minute)	Warning
20	Current warning W2	Royer current >= 1.2A (~ 4 minute)	
19	Signal quality warning	Transmission rate < 24000 SPS	
18	-	Reserved	
17	-	Reserved	
16	-	Reserved	
15	-	Reserved	
14	-	Reserved	
13	-	Reserved	
12	-	Reserved	
11	System ready	System ready for operation	Measurement
10	Output switched	Signal input 1 is output to measurement output 2	

State Part 1			
Bit	Name	Description	Category
9	Zeroed outputs	The measuring system has been zeroed by the user	
8	Rotor rotating	Internal rotor speed > 0	
7	-	Reserved	
6	-	Reserved	
5	-	Reserved	
4	-	Reserved	
3	-	Reserved	
2	-	Reserved	
1	-	Reserved	
0	-	Reserved	

Table 6 CAN status word part 1

11.12 Ethernet settings



Relevant adjustments for embedded measurement system in the intranet can be configured.

Important

Improper settings can break the device. In some cases the device cannot be reconfigured! In that case the torque control unit must be reprogrammed in factory. Administration must be consulted before configuring to get the proper settings.
If the network settings of the TCU have been forgotten, the settings can be queries via the following CAN command:

Messages		
Type	**Hex**	**Dec**
Request Ethernet settings	0xD05	3333

Table 7 CAN command to request Ethernet settings

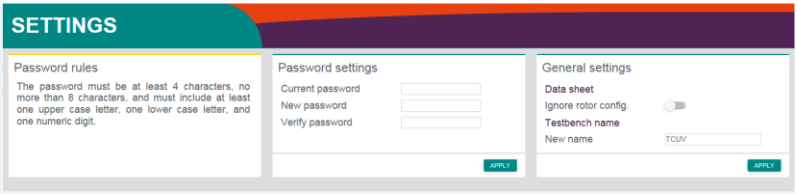
The response of the TCU has the following structure:

Type	**IP Address**				**Subnet Mask**			
Byte i	**Byte 0**	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**

Content (HEX)	AC	10	56	2	FF	FF	FF	0
Result (DEC)	172	16	86	3	255	255	255	0

Table 8 CAN Response code of TCU

11.13 General settings



A password and a device name for the measurement system can be adjusted.

Following characteristics must be fulfilled:

- Total length between 4 and 8 signs
- At least one upper-case letter
- At least one lower-case letter
- At least one digit

Important

Write down your password and keep it in a safe place. Please contact the service if you cannot remember your password anymore.

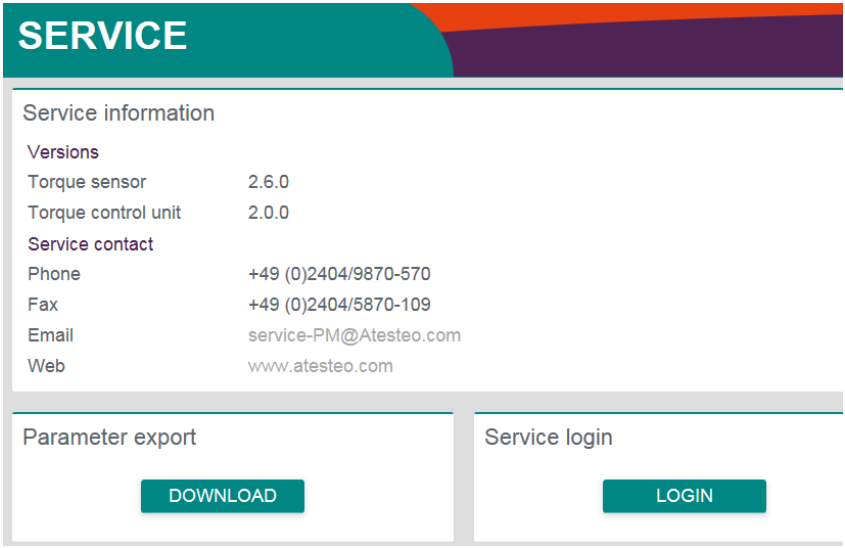
Username and password for first access:

Username: **customer**

Password: **admin**

Ignore rotor configuration:
Deactivates the automatic data sheet transfer and allows manual entry of parameters.

11.14 Service information



The up to date firmware version of the device and manufacturer's contact details can be found on the Service page.
For service purposes, it's also possible to export a list of system parameters.

12 Technical specification

12.1 LED coding of TCU and DF plus STATOR

The TCU has a red and green LED on the top to display the system status. The coding is described in the following table:

Red LED	Green LED	State / Meaning
Off	Off	System switched off.
Off	On	Test signal of rotor or TCU is active.
On	Off	Critical system error. System will reboot.
On	On	System is starting.
Blinking every 2 seconds	Blinking every 2 seconds	TCU is receiving the digital data sheet from the rotor.
Blinking every second	Every state	Disturbance in data transfer or insufficient power supply of the rotor.
Every state	Blinking every second	Normal operating.

Table 9 TCU LEDs

The DF STATOR has a green LED on the side to display the transmission status. The coding is described in the following table:

Green LED	State / Meaning
Off or sometimes off	The signal amplitude received by the torque sensor is too low. Please activate the power of torque sensor on the website or readjust the stator.
Permanent on	The signal amplitude received by the torque sensor is sufficient for data transmission.

Table 10 DF plus stator LED

12.2 Pin allocations

12.2.1 X770 Power supply / Frequency output

12-pin connector, type M23				
Pin	**Signal**	**Description**	**Cable color (cable optional)**	**Cross-Section in mm**
1	F2_out- *1	Frequency output ch. 2 – RS422	White	0,25
2	F2_out+ *1		Brown	0,25
3	N2_out+ *1	Speed pulses output track 2 – RS422	Gray	0,25
4	N2_out- *1		Pink	0,25
5	N1_out+ *1	Speed pulses output track 1 – RS422	Blue	0,25
6	N1_out- *1		Red	0,25
7	F1_out-	Frequency output ch. 1 – RS422	Yellow	0,25
8	F1_out+		Green	0,25
9	IP-reset_in	Reset IP-Configuration –3.3 – 30 V (via supply voltage)	White	0,5
10	Power+	Power supply 24 - 30 V / 1 A	Green	0,5
11	Power-		Yellow	0,5
12	Digital GND	Ground connection of digital signals	Brown	0,5

Table 11 X770

*1 Optional – depending on the configuration of the system

Frequency outputs

The frequency output F1 and F2 represents torque output 1 and 2. The second channel is only used if a DF system with dual telemetry was purchased (DFx DT).

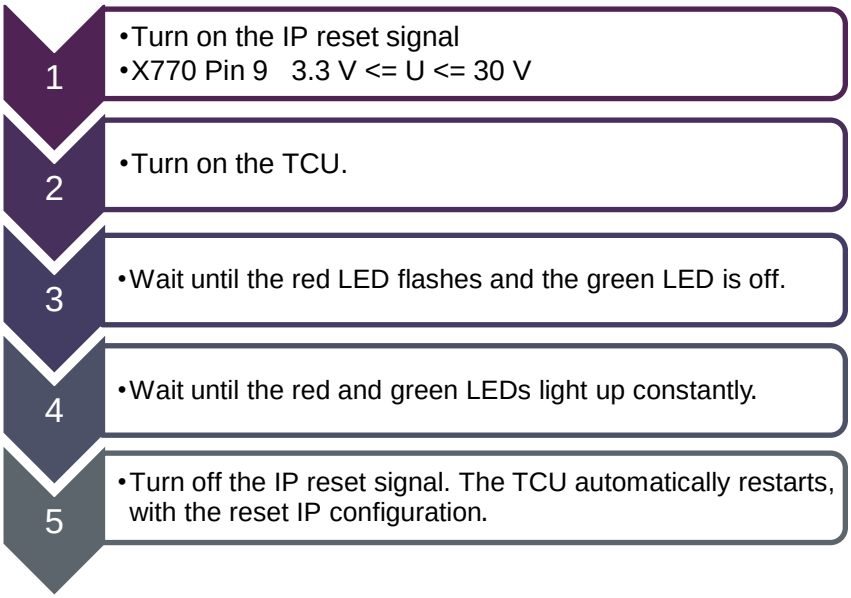
The frequency span is declared by the web interface. The maxima represent positive and negative rated torque of the respective channel. When the output switch is activated, the two frequency outputs are switched. The frequency outputs must be connected to RS422 receivers. Connecting an output to ground will damage the TCU. It is irrelevant whether it is a positive or a negative output signal.

Speed-pulses output

The speed-pulses-outputs N1 and N2 represent every single pulse of speed track 1 and 2. The amount of pulses per rounds is dependent on the number of increments parameter of the speed ring. The increments numbers of both tracks are identical and phase shifted by 90°. The speed-pulses output must be connected to RS422 receivers. Connecting an output to ground will damage the TCU. It is irrelevant whether it is a positive or a negative output signal.

IP-reset_in

The IP reset signal resets the IP configuration of the Ethernet interface to the factory setting (see product label). For security reasons, the following procedure must be used for recovery:



Power supply

Connect the positive and negative power pins with an external power supply. The power supply must have a supply voltage between 24 and 30 Volt and must be able to supply 1 A constant current.

12.2.2 X771 Analogue / CAN / Alarm / Input

16-pin connector, type M23				
Pin	**Signal**	**Description**	**Cable color (cable optional)**	**Cross-Section in mm**
1	Test_in	Activates controller test signal	White	0,25
2	Zero_in	Zero balance input – 3.3 – 30 V (via supply voltage)	Brown	0,25
3	Digital GND	Ground connection of digital signals	Green	0,25
4	Digital GND		Yellow	0,25
5	CAN_H	CAN HIGH connection	Grey	0,25
6	CAN_L	CAN LOW connection	Pink	0,25
7	An4_out *[1]	Galvanic isolated analog voltage output	Blue	0,25
8	An2_out *[1]	Galvanic isolated analog voltage output	Red	0,25
9	An3_out *[1]	Galvanic isolated analog voltage output	Black	0,25

16-pin connector, type M23				
10	An1_out *[1]	Galvanic isolated analog voltage output	Purple	0,25
11	Alarm-MD_out	Alarm torque limit – open-collector	Grey/Pink	0,25
12	Analog GND	Ground connection of analog signals	Red/Blue	0,25
13	Alarm-N_out	Alarm speed limit – open-collector	White/Green	0,25
14	Output-switch_out / Err-state_out	State of output-switch – open-collector / State of system-errors – open-collector. Depending on software version	Brown/Green	0,25
15	Alarm-reset_in	Reset all alarms – 3.3 – 30 V (via supply voltage)	White/Yellow	0,25
16	Aux_in	Not used – 3.3 – 30 V (via supply voltage)	Yellow/Brown	0,25

Table 12 X771

*[1] Optional – depending on the configuration of the system

Test_in
The test_in signal activates the controller testsignal as soon as the button is pressed for at least one second until the signal is switched off again. The test signal produces a positive full-scale at all outputs for measured values. A voltage level 3.3 – 30 V (via supply voltage) between test_in pin and digital GND is applied for the control. The signal is active high.

Zero_in
The zero_in signal activates the zeroing as soon as the button is pressed for at least one second. The zeroing is executed only once after trigging. The zeroing sets the instantaneous values of the torque inputs as a new zero points. A voltage level 3.3 – 30 V (via supply voltage) between zero_in pin and digital GND is applied for the control. The signal is active high.

CAN
The CAN interface allow the customer to receive the measured data in digital form and simultaneously send control signals to the TCU. The CAN_High and CAN_Low pins have to be connected with a 120 Ohm terminated CAN-Bus.

Analog_out
The analog outputs 1 and 2 represents torque output 1 and 2. The analog output 3 represents speed output. The analog output 4 is not in use. The voltage span is declared by the web interface. The maxima represent positive and negative rated values of the respective channel.

Output calibration

Output switch = 1

Ana1_out	torque1
Ana2_out	torque2
Ana3_out	speed
Ana4_out	N.C.

Output switch = 2

Ana1_out	torque2
Ana2_out	torque1
Ana3_out	speed
Ana4_out	N.C.

When the output switch is activated, output 1 and 2 are switched. The analog outputs 1-4 are single ended galvanic isolated voltage outputs with separately analog GND.

Alarm-MD_out
The alarm-MD output indicates that the torque threshold is exceeded. The threshold value is set in the Web Interface. The alarm remains active until the Alarm_Reset signal is triggered. The alarm output consists of an open collector circuit. In the active state, it connects the Alarm-MD_out pin with digital GND directly.

Alarm-N_out
The alarm-N output indicates that the speed threshold is exceeded. The threshold value is set in the Web Interface. The alarm remains active until the Alarm_Reset signal is triggered. The alarm output consists of an open collector circuit. In the active state, it connects the Alarm-N_out pin with digital GND directly.

Output-switch_out / Err-state_out
The function of this pin depends on the TCU firmware version:

> **Firmware less than V1.6.10: - Output-switch_out**
> The output-switch output indicates the state of the output-switch. On active state the output-switch is active.
> **Firmware greater than or equal V1.6.10: - Err-state_out**
> The error state output indicates whether the system is disturbed. On active state the system works without faults and full transmission.

The signal output consists of an open collector circuit. In the active state, it connects the output pin with digital GND directly.

Alarm-reset_in
The alarm-reset signal resets all alarm-signals as soon as the button is pressed for at least one second. The reset is executed only once after trigging. A voltage level 3.3 – 30 V (via supply voltage) between alarm-reset_in pin and digital GND must be applied for the control. The signal is active high.

12.2.3 X772 Ethernet

Can be connect with a standard Kat 5e cable for diagnostics or setup. For permanent installation inside the teststand use the special connector.
Hummel - 7R10400000

12.2.4 X773 Central cable

15-pin connector, type M16 – not for external periphery				
Pin	**Signal**	**Description**	**Cable color**	**Cross-Section in mm / typ**
A	Power+	Supply voltage	White	0,5 / straight
B	Power- *2		Brown	0,5 / straight
C	7V-Power+		Green	0,5 / straight
1	Data-in+	Digital rotor data – LVDS	White	0,25 / twisted
2	Data-in-		Brown	0,25 / twisted
3	7V-Power- *2	Supply voltage (Reserved)	NC	0,25 / twisted
4	N2-	Speed-pulses track 2	Green	0,25 / twisted
5	N2+		Yellow	0,25 / twisted
6	N1-	Speed-pulses track 1	Grey	0,25 / twisted
7	N1+		Pink	0,25 / twisted
8	Not used			
9	Not used			
10	Not used			
11	Not used			
12	Not used			

Table 13 X773

*2 Pin B and Pin 3 are connected together in the circuit-board of the stator-antenna

The following applies to double channel systems:

Channel 1 corresponds to the measuring channel with the **lower rated torque**.
Channel 2 corresponds to the measuring channel with the **higher rated torque**.

12.3 Mechanical data

12.3.1 Mounting distances

The stator must be aligned to the rotor. Distances mention in Table 14 must be observed. Afterwards, an optional speed detection system can be aligned according to the mounting distances table.

Type		DF1 plus	DF2 plus	DF3 plus	DF4 plus	DF5 plus
Mounting distances (without optional speed detection system)						
Nominal axial displacement (rotor - stator)	mm			7		
Tolerance to nominal axial displacement (rotor - stator)	mm			≤±1		
Nominal radial displacement (rotor - stator)	mm			3		
Tolerance to nominal radial displacement (rotor - stator)	mm			+1/-2		
Distance stator to dyno	mm	14.00	17.00	18.00	19.00	29.00
Speed measuring system Magneto resistive (2 tracks approx. 90 degree phase shifted)						
Nominal clearance (sensor - pole ring)	mm			0.7		
Working airgap (sensor - pole ring)	mm			0.1...2.0		
Nominal axial displacement (rotor - stator)	mm			7		
Tolerance to nominal axial displacement (rotor - stator)	mm			±0.5		

Table 14 Mounting distances

12.3.2 Dimensions of the rotor

Please check the dimensions of the rotor from the drawings. They can be requested from ATESTEO or can be found in the product data sheets.

12.3.3 Dimensions of the stator

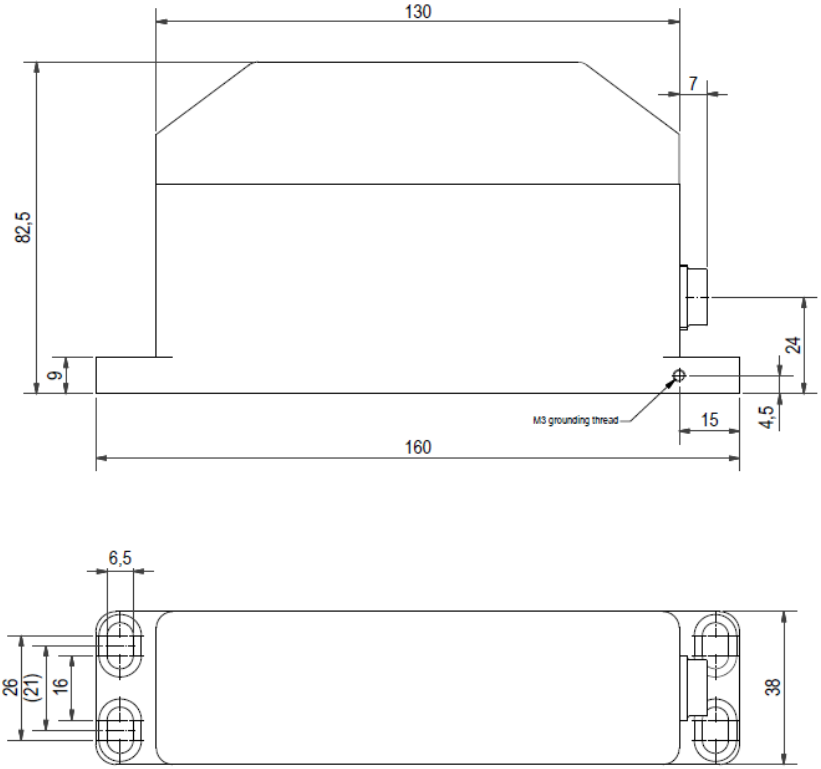


Figure 16 Dimensions of the stator

12.3.4 Dimensions of TCU 5

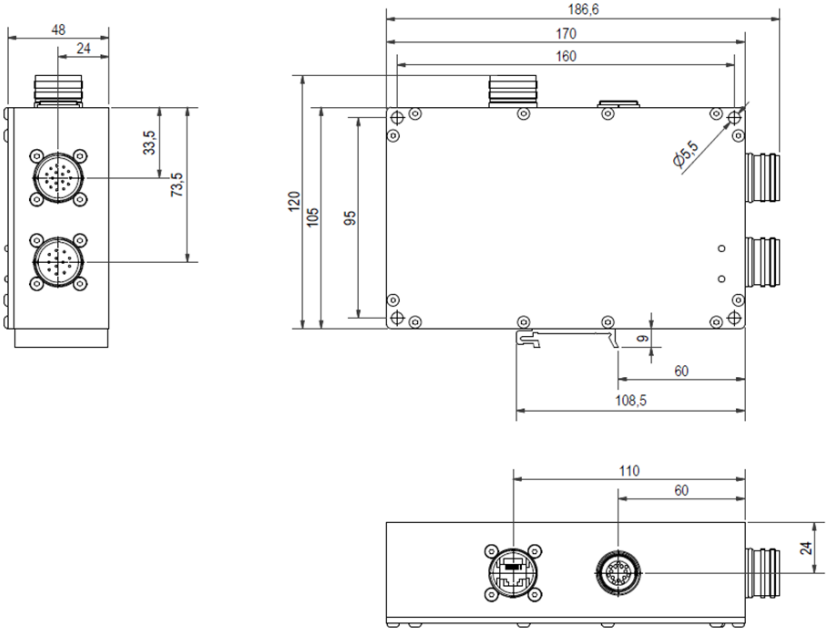


Figure 17 Dimensions of TCU5

13 Appendix

13.1 Table of figure

13.2 Table of tables

Your notes

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Your contact for service requests
ATESTEO GmbH & Co. KG
Konrad-Zuse-Str. 3
52477 Alsdorf / Germany
T +49 (0) 2404 9870-0
service-pm@atesteo.com
www.atesteo.com