



# Measuring steering wheel

Operating manual

## Measuring steering wheel V 2.1 05/2022

Change log:

### **V2.1 03.05.2022:**

“Shunt calibration” replaced by “test signal”

Installation without adapter added

Difference between measurement body and adapter kit explained more clearly

Pictures of measurement body and cover added

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First updated version

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## 1 Product description

The product “measuring steering wheel” is used for installation inside of a vehicle. With an optional adapter kit it is mounted on top of the existing vehicle steering wheel. Without that adapter kit it can be mounted on the steering system after removing the original vehicle steering wheel. The “measuring steering wheel” measures the applied steering torque and optionally the rotation angle.

The product must be handled as measurement sensor. Misuse and wrong handling can damage the sensor or lead to wrong measurement results.

The measuring steering wheel is packed with an evaluation unit called “VETAS”. For operating the steering wheel, the manuals of VETAS hardware (“Manual VETAS 3 V3 EN.pdf”) and VECTO operating software (“VECTO.pdf”) must be read and understood. Please contact ATESTEO if you are missing files or if you have questions. You can also find the latest versions of the documents on the ATESTEO website.

### 1.1 Manufacturer

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### 1.2 Explanation of symbols and notices

The following symbols are used in this instruction manual:



**Danger/Hazard**



**Risk of crushing!**

Every chapter of these instructions is provided with one of the symbols listed, which are intended to emphasize the importance of the statements.

### 1.3 Safety instructions



#### **Risk of fatal injuries!**

**All safety instructions must be followed strictly.**

- The airbag of the original steering wheel must be deactivated and removed before installation of the measuring steering wheel. Usage of the measuring steering wheel with airbag is strictly prohibited and can lead to death.
- When using the adapter kit, the measuring steering wheel must be mounted fix on the original steering wheel.
- Without using the adapter kit, the measuring steering wheel must be mounted fix on the original steering system. A safe mounting solution must be chosen by operator based on the individual steering system of the vehicle.
- All mounting screws must be tightening. Before every measurement, the screws must be checked and fixed again if required. Lose connections of the measuring steering wheel can lead to sudden disconnection from the original steering wheel. Control of the vehicle can be lost and lead to death.
- After installation, the operator must check if the steering wheel can be rotated with full range. Starting a measurement without checking possible interferences can lead to limited steering angle and death.
- The measuring steering wheel must only be used on test tracks with safety installations such as run-off area. It may not be used on public roads!
- The vehicle driver must be familiar with the usage of the measuring steering wheel.
- The 12 V power supply of the measurement system must be secured against over load with fuses (vehicle fuses).

## 2 Equipment installation

### 2.1 Measurement body (torque sensor)

The torque sensor contains the electronic for measuring the torque (strain gauges, amplifiers, and controller) and the angle. The sensor consists of a rotor and stator which are connected by bearings.



Figure 1 Torque sensor (measuring steering wheel) without adapter kit

### 2.2 Optional adapter kit components

The adapter kit is optional. The components of this kit are used to install the measuring steering wheel on top of the original steering wheel.



Figure 2 Cover for the torque sensor

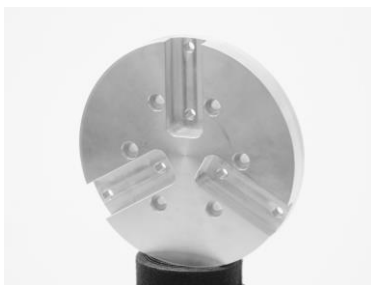


Figure 3 Connector disk (attached to the torque sensor)



Figure 4 Spline (3x bended with 10°, 3x not bended)



Figure 5 Clamping material set (3x)



Figure 6 Mounting screws



Figure 7 Torque sensor (with attached cover and connector disk)



Figure 8 Complete system incl. adapter kit

### 2.3 Mechanical installation with adapter kit

Remove the airbag of the original steering wheel. Please follow the instructions of the vehicle manufacturer.



#### **Risk of fatal injuries!**

**Airbag can explode when handled wrong during uninstallation.  
Installed airbag can cause death when used in combination with the  
measuring steering wheel!**

Once the airbag is removed, the installation of the measuring steering wheel can start.

#### 2.3.1 Holder mechanism

Take the connector disk (attached to the torque sensor) and fix three splines at the pre-defined positions. The bending direction of the splines is used to generate a distance between the original vehicle steering wheel and the connector disk. There are also three flat splines without any bending. Those can be used if the distance between original steering wheel and connector disk is already big enough.



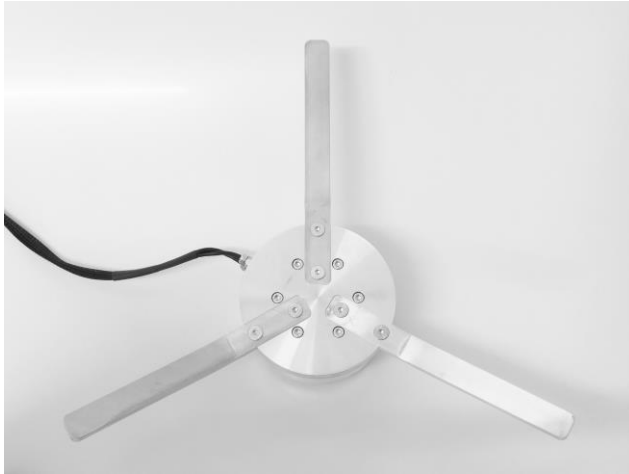


Figure 9 Connector disk with splines

Use two screws of type M6x16 to fix one spline.

### 2.3.2 Clamping mechanism

The clamping mechanism is used to fix the previously mentioned holder with the original steering wheel. First take the three parts shown in Figure 10.



Figure 10 Clamping components

Item	Description
1	Flat connector
2	Fixing block
3	Round connector

Table 1 Clamping components

This set must be installed three times with 120° angle between each set. It's a good way to do the assembly with two persons. One person is holding the parts, the other one is fixing the screws.

#### Assembly of one clamping set on the original steering wheel:

Take the “fixing block” and hold it behind the original steering wheel. Attach the “Round connector” to the “Fixing block” at the front side of the steering wheel. Place the “Flat connector” on top of the rear side of the “Round connector”. Make sure the track in both parts are combined. They will clamp the spline later.

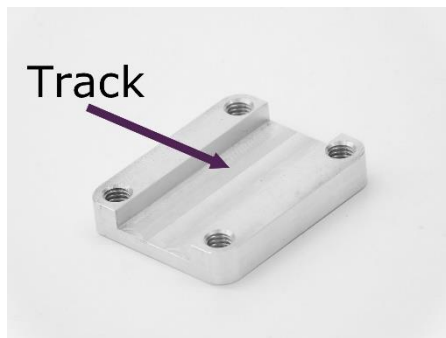


Figure 11 Track on the clamping material

Use the “mounting screws” (see Figure 6) to fix the set together. They must be installed with the black handle on the backside of the steering wheel. Before tightening well, insert a spline into the track for each clamping set.



Figure 12 View onto a mounted clamping set on a spline

If all three clamps are connected with the holder and the original steering wheel, check if the **installation is concentric** and the rotation of the steering wheel is **possible without any blockade**. The concentricity of the holder can be optimised by using the distance markers at each spline.

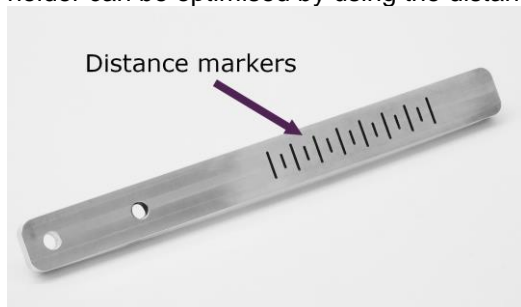


Figure 13 Distance markers at a spline

Once the holder and the clamps are connected together, make sure that all screws, the one at the disk and at the clamping mechanism are tightened well.



#### Risk of fatal injuries!

**If screws are not tightened well, steering control can be lost during driving! Risk of death. Check screws before every drive.**

### 2.3.3 Steering wheel



Figure 14 Steering wheel

Place the steering wheel on top of the torque sensor (onto the cover, see Figure 2). Use screws of type M6x10 to fix the steering wheel (six screws).



**Risk of fatal injuries!**

**If screws are not tightened well, steering control can be lost during driving! Risk of death. Check screws before every drive.**

### 2.4 Mechanical installation without adapter kit

Remove the airbag of the original steering wheel. Please follow the instructions of the vehicle manufacturer.



**Risk of fatal injuries!**

**Airbag can explode when handled wrong during uninstallation. Installed airbag can cause death when used in combination with the measuring steering wheel!**

Once the airbag is removed, remove the original vehicle steering wheel. The measuring steering wheel has a fix interface for connected to other parts. The pitch circle diameter and the screw information of this interface are given on the drawing of the measuring steering wheel. With this interface, the system can be mounted on top of the steering system of the vehicle. In most cases, an **adapter is required**. This adapter must be designed and manufactured on demand. ATESTEO can support on the design and manufacturing of adapters.

Use proper screws to fix the steering wheel.



### Risk of fatal injuries!

If screws are not tightened well, steering control can be lost during driving! Risk of death. Check screws before every drive.

## 2.5 Rotation angle measurement

Whenever precise measurements of the rotation angle are required, the torque sensor must be connected with a fix part of the vehicle body (e.g. front window). Since the installation position of the sensor varies in each vehicle, the connection must be custom-tailored depending on the test vehicle. The torque sensor has a M6 winding where a connection system has to be applied. Typically a threaded bar can be combined with a vacuum suction cup and connected to the torque sensor. Please keep in mind that rotation of the (original) steering wheel usually required an axial free play to prevent damages or indirect torque loads. ATESTEO can help you to find an appropriate connection solution.



Figure 15 Winding for connection system

## 2.6 Electrical installation

The torque sensor of the measuring steering wheel has two wires with pre-installed plugs. Insert the plug X930 into the slot X930 (2 pins, inductive power supply) at the VETAS3 evaluation unit. Then insert the plug X940 into the slot X940 at VETAS3 (7 pins, signal in).

Output signals from VETAS 3 can be analogue voltage output or frequency output. The technical description of the outputs is given in the VETAS manual. The torque signal is transferred on channel/plug 1. The angle signal is transferred on channel/plug 2. Please check the configuration of VETAS by VECTO software in case that a signal is missing.



Figure 16 Plugs at the torque sensor



### Risk of fatal injuries!

**Make sure the wires do not influence the driver during driving. Risk of death.**

Fix the wires at positions, where they do not influence the driver. Make sure the wires are not in tension since movement of the steering wheel will rotate the torque sensor few centimetres (if mounted without connection system to the vehicle body).



Figure 17 VETAS evaluation unit

## 2.7 Test signal

The test signal is triggered by the terminal. Please connect the VETAS 3 by serial port to your computer and start the terminal program (included in VECTO software, refer to VECTO software manual). Press key “b” to trigger the test signal (“Cal. Jump”). The measured value on your measurement devices can be compared to the data from the calibration sheet.

```

Terminal(FT42UK1)
ATESTEO
*****
* UETAS III V1.31 U-S/N:00000 R-S/N:00000 UNDEFINED
*****

Frequency Md1      -    0      (b) Cal. Jump      NORMAL
Frequency N1      -    0

Torque1 Md1 [Nm]   -57947.0 (1) Sensitivity1 [Hz/Nm]  1.000
Speed1 N1 [RPM]   0.0      (3) Sensitivity2 [Hz/K]   1.000
                          (5) Rated Torque [Nm]   20000.0
                          (6) Rated Temp [DgC]    150.0
                          (7) Zero Output 1 [Hz]   57947
                          (8) Zero Output 2 [Hz]   0
Analog Output A/B: Md1 / Tmp (9) Calibration Jump [Hz]  9995
Analog Output C: N2        (0) Calibration Jump [V]  16.1
                          (z) Imp/Rev      60
(p) PS. on/off           0      (m) Max. Speed      10000
(s) PS. voltage          16.3
(y) PS. AUTO voltage

Error Status 0x40      CAN status: ERR act
0:20:28:27      0 0 0 0

-n- Refresh Disp. -C- CAN Setup -A- Ana. Setup -S- Settings -#- Te on/off
    
```

Figure 18 Terminal view

### 3 Operation

The operation is done with VETAS hardware and VECTO software. Both systems are developed and provided by ATESTEO.

Before using the measuring steering wheel, make sure all safety instructions have been followed!



**Risk of crushing!**

**Fingers or hands can be crushed by the steering wheel and the splines. Before using the measuring steering wheel, make yourself familiar with the system.**

During the operation, make sure the measurement range of the measuring steering wheel is not exceeded. Excessive torque on the sensor could destroy the strain gauges.

Before starting a data acquisition, check if the sensor values are plausible.

## **4 Maintenance**

### **4.1 Storage**

When storing the measuring wheel, insert all screws into the torque sensor softly. Some screws cover holes at the body of the torque sensor and screws prevent dirt or dust from entering the electronic via those holes.

### **4.2 Calibration**

Calibration of the equipment should be done regularly according to customer requirements. Calibration service can be offered by ATESTEO. ATESTEO suggests to do the calibration every two years.



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