An Axiometrix Solutions Brand

Steering wheel CLS^{x}

Manual

Edition 5 - 23.10.2023

imc Test & Measurement GmbH • Voltastr. 5 • 13355 Berlin • Germany

Disclaimer of liability

The contents of this documentation have been carefully checked for consistency with the hardware and software systems described. Nevertheless, it is impossible to completely rule out inconsistencies, so that we decline to offer any guarantee of total conformity.

We reserve the right to make technical modifications of the systems.

Copyright

Open Source Software Licenses

Some components of imc products use software which is licensed under the GNU General Public License (GPL). Details are available in the About dialog.

A list of the open source software licenses for the imc measurement devices is located on the imc STUDIO/imc WAVE/imc STUDIO Monitor installation medium in the folder "*Products**imc DEVICES**OSS*" or "*Products**imc DEVICEcore**OSS*" or "*Products**imc STUDIO**OSS*". If you wish to receive a copy of the GPL sources used, please contact our Hotline.

Notes regarding this document

This document provides important notes on using the device / the module. Safe working is conditional on compliance with all safety measures and instructions provided. The manual is to be used as a kind of reference book. You can skip the description of the modules you do not have.

Additionally, all accident prevention and general safety regulations pertinent to the location at which the device is used must be adhered to.

If you have any questions as to whether you can set up the device / module in the intended environment, please contact the imc hotline. The measurement system has been designed, manufactured and unit-tested with all due care and in accordance with the safety regulations before delivery and has left the factory in perfect condition. In order to maintain this condition and to ensure safe operation, the user must observe the notes and warnings contained in this chapter and in the specific sections applicable to the concrete device. Never use the device outside the specification.

This will protect you and prevent damage to the device.

Special notes

Warning

Warnings contain information that must be observed to protect the user from harm or to prevent damage to property.

Note

Notes denote useful additional information on a particular topic.

Reference

A reference in this document is a reference in the text to another text passage.

Table of contents

1 General introduction

1.1 imc Customer Support / Hotline

If you have problems or questions, please contact our Customer Support/Hotline:

imc Test & Measurement GmbH

Hotline (Germany): **+49 30 467090-26**

E-Mail: hotline@imc-tm.de

Internet: https://www.imc-tm.com

International partners

For our international partners see https://www.imc-tm.com/imc-worldwide/.

Tip for ensuring quick processing of your questions:

If you contact us **you would help us**, if you know the **serial number of your devices** and the **version info of the software**. This documentation should also be on hand.

- The device's serial number appears on the nameplate.
- The program version designation is available in the About-Dialog.
- For optimal support, we might require information as weight of vehicles to be tested, speed and max values of forces and torques. Specific information shared with us will always be kept privately.

1.2 Legal notices

Quality Management

imc Test & Measurement GmbH and CAEMAX Technologie GmbH holds DIN-EN-ISO-9001 certification. You can download the CE Certification, current certificates and information about the imc quality system on our website:
https://www.imc-tm.com/quality-assurance/.

imc Warranty

Subject to the general terms and conditions of imc Test & Measurement GmbH.

Liability restrictions

All specifications and notes in this document are subject to applicable standards and regulations, and reflect the state of the art well as accumulated years of knowledge and experience. The contents of this document have been carefully checked for consistency with the hardware and the software systems described. Nevertheless, it is impossible to completely rule out inconsistencies, so that we decline to offer any guarantee of total conformity. We reserve the right to make technical modifications of the systems.

The manufacturer declines any liability for damage arising from:

- failure to comply with the provided documentation,
- inappropriate use of the equipment.

Please note that all properties described refer to a closed measurement system and not to its individual slices.

Important information for customers who want to adapt their own adaptors for the sensors

imc also manufactures customer specific adaptors for the sensors against payment, so that the sensors can be installed professionally at the customer's site and used according to the contract.

If customers produce the adaptors on their own request, imc points out the following as a precaution:

- The contractual usability of imc sensors requires that they are installed professionally with custom-made adaptors. Otherwise, the contractual usability and especially the compliance with the specifications given for the sensors cannot be guaranteed.
- The customer's claims for defects against imc for adaptors manufactured by the customer himself extend only to the sensors and not to the adaptors. imc does not assume any liability for defects that the imc sensors can be used with the adaptors manufactured by the customer according to the contract, especially that the specifications given for the imc sensors are met. If the customer makes the adaptors himself, imc is not liable for defects. This does not apply if the customer can prove that his own production is not the cause of the defect.
- Furthermore, the General Terms and Conditions of imc Test & Measurement GmbH apply.

Guarantee

Each device is subjected to a 24-hour "burn-in" before leaving imc. This procedure is capable of detecting almost all cases of early failure. This does not, however, guarantee that a component will not fail after longer operation. Therefore, all imc devices are granted liability for a period of two years. The condition for this guarantee is that no alterations or modifications have been made to the device by the customer.

Unauthorized intervention in the device renders the guarantee null and void.

Notes on radio interference suppression

The imc CLS^x steering wheel sensor satisfy the EMC requirements for an use in industrial settings.

Any additional products connected to the product must satisfy the EMC requirements as specified by the responsible authority (within Europe[1]) in Germany the BNetzA - "Bundesnetzagentur" (formerly BMPT-Vfg. No. 1046/84 or No. 243/91) or EC Guidelines 2014/30/EU. All products which satisfy these requirements must be appropriately marked by the manufacturer or display the CE certification marking.

Products not satisfying these requirements may only be used with special approval of the regulating body in the country where operated.

All lines connected to the CLS^x steering wheel sensor should not be longer than 30 m and they should be shielded and the shielding must be grounded.

Note

The EMC tests were carried out using shielded and grounded input and output cables with the exception of the power cord. Observe this condition when designing your setup to ensure high interference immunity and low jamming.

[1] If you are located outside Europe, please refer the appropriate EMC standards used in the country of operation.

Cables and leads

In order to comply with the value limits applicable to Class B devices according to part 15 of the FCC regulations, all signal leads connected to the CLS^x steering wheel sensor must be shielded.

Unless otherwise indicated, no connection leads may be long leads (< 30 m) as defined by the standard IEC 61326-1. Only cables with suitable properties for the task (e.g. isolation for protection against electric shock) may be used.

ElektroG, RoHS, WEEE, CE

The imc Test & Measurement GmbH is registered with the authority as follows:
WEEE Reg. No. DE 43368136
valid from 24.11.2005

Reference

https://www.imc-tm.com/elekrog-rohs-weee/ and https://www.imc-tm.com/ce-conformity/

FCC-Notice

This product has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult our imc Hotline or an experienced technician for help.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this product that are not expressly approved by imc may void the user's authority to operate this equipment.

1.3 Explanation of symbols

Reference

... indicates where to find further or related information.

Note

... highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

Warning

... indicates a hazardous situation or even a potentially hazardous situation that may result in property hazardous situation that may result in property damage if not avoided.

Attention

... indicates a possible risk of injury.

2 Safety

This section provides an overview of all important aspects of protection of the users for reliable and trouble-free operation. Failure to comply with the instructions and protection notes provided here can result in serious danger.

Responsibility of the operator

The CLS^x steering wheel sensor is for use in commercial applications. The user is therefore obligated to comply with legal regulations for work safety.

Along with the work safety procedures described in this document, the user must also conform to regulations for safety, accident prevention and environmental protection which apply to the work site. If the product is not used in a manner specified by the manufacturer, the protection supported by the product may be impaired.

The user must also ensure that any personnel assisting in the use of the CLS^x sensor have also read and understood the content of this document.

Operating personnel

This document identifies the following qualifications for various fields of activity:

- *Users of measurement engineering*: Fundamentals of measurement engineering. Basic knowledge of electrical engineering is recommended. Familiarity with computers and the Microsoft Windows operating system. Users must not open or structurally modify the measurement device.
- *Qualified personnel* are able, due to training in the field and to possession of skills, experience and familiarity with the relevant regulations, to perform work assigned while independently recognizing any hazards.

Warning

- **Danger of injury due to inadequate qualifications!**
- Improper handling may lead to serious damage to personnel and property. When in doubt, consult qualified personnel.
- Work which may only be performed by trained imc personnel may not be performed by the user. Any exceptions are subject to prior consultation with the manufacturer and are conditional on having obtained corresponding training.

Special hazards

This segment states what residual dangers have been identified by the hazard analysis. Observe the safety notes listed here and the warnings appearing in subsequent chapters of this manual in order to reduce health risks and to avoid dangerous situations. Existing ventilation slits on the sides of the device must be kept free to prevent heat accumulation inside the device. Please operate the device only in the intended position of use if so specified.

Danger

Lethal danger from electric current!

- Contact with conducting parts is associated with immediate lethal danger.
- Damage to the insulation or to individual components can be lethally dangerous.

Therefore:

- In case of damage to the insulation, immediately cut off the power supply and have repair performed.
- Work on the electrical equipment must be performed exclusively by expert electricians.
- During all work performed on the electrical equipment, it must be deactivated and tested for static potential.

Injuries from hot surfaces!

- Devices from imc are designed so that their surface temperatures do not exceed limits stipulated in EN 61010-1 under normal conditions.

Therefore:

- Surfaces whose temperature can exceed the limits under circumstances are denoted by the symbol shown at left.

Industrial safety

We certify that the CLS^x sensor in all product configuration options corresponding to this documentation conforms to the directives in the accident prevention regulations in "Electric Installations and Industrial Equipment" (DGUV Regulation 3)*. This confirmation applies exclusively to the CLS^x sensor system, but not to all other components included in the scope of delivery.

This certification has the sole purpose of releasing imc from the obligation to have the electrical equipment tested prior to first use (§ 5 Sec. 1, 4 of DGUV Regulation 3). This does not affect guarantee and liability regulations of the civil code.

* previously BGV A3.

Observe notes and warnings

Devices from imc have been carefully designed, assembled and routinely tested in accordance with the safety regulations specified in the included certificate of conformity and has left imc in perfect operating condition. To maintain this condition and to ensure continued danger-free operation, the user should pay particular attention to the remarks and warnings made in this chapter. In this way, you protect yourself and prevent the device from being damaged.

Read this document before turning on the device for the first time carefully.

Warning

Before touching the device sockets and the lines connected to them, make sure static electricity is diverted to ground. Damage arising from electrostatic discharge is not covered by the warranty.

3 Delivery and operation

3.1 After unpacking

The delivery must be checked for completeness and transport damage immediately upon receipt. In case of externally visible transport damage, proceed as follows:

- Do not accept the delivery or accept it only with reservations,
- Note the extent of the damage on the transport documents/delivery bill of the carrier,
- Initiate a complaint.

The complete system is delivered in a case.

Contents:

- Sensor
- Control unit
- Remote control
- Steering adaptor
- Screws for mounting the adaptors
- Steering column adaptor
- Bracket for fixing the stator part
- Central screw for fixing the original steering wheel
- Auxiliary tool for removal
- Power supply
- Ethernet cable (blue)
- Manual on CD
- ESP adaptor (optional)
- CAN Interface (optional) and CAN Terminator (optional)

Fig. 1: Transport suitcase

3.2 Before commissioning

Before using the CLS^x sensors, the user must have read and understood the manual, especially the instructions for installation and use. Of particular importance are the hub and rim adapters, which must be inspected and maintained according to the instructions in this manual - before and after each test drive.

3.3 Notes on connecting

3.3.1 Precautions for operation

Certain ground rules for operating the system, aside from reasonable safety measures, must be observed to prevent danger to the user, third parties, the device itself and the measurement object. These are the use of the system in conformity to its design, and the refraining from altering the system, since possible later users may not be properly informed and may ill-advisedly rely on the precision and safety promised by the manufacturer.

Note

If you determine that the device cannot be operated in a non-dangerous manner, then the device is to be immediately taken out of operation and protected from unintentional use. Taking this action is justified under any of the following conditions:

I. the device is visibly damaged,
II. loosed parts can be heard within the device,
III. the device does not work,
IV. the device has been stored for a long period of time under unfavorable conditions (e. g. outdoors or in high-humidity environments).

1. Observe the specs in the chapter "Technical Specs " and the application hints about the individual system in order to prevent damage to the unit through inappropriate signal connection.
2. Note when designing your experiments that all input and output leads must be provided with shielding which is connected to the ground ("CHASSIS") at one end in order to ensure high resistance to interference and noisy transmission.
3. Unused, open channels (having no defined signal) should not be configured with sensitive input ranges since otherwise the measurement data could be affected. Configure unused channels with a broad input range or short them out. The same applies to channels not configured as active.
4. Avoid prolonged direct exposure to sunlight.

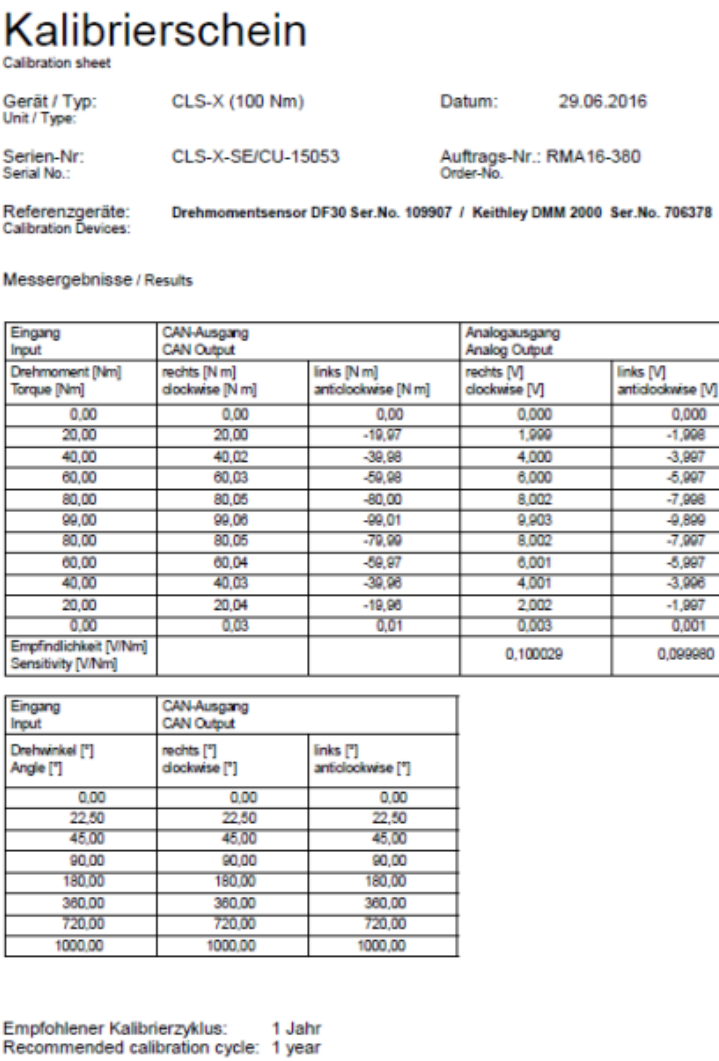
4 Maintenance and service

4.1 Maintenance

Due to its design, the CLS^{x}-CU is protected against contamination of its electronic parts. In the event of contamination, the CLS^{x}-CU may only be cleaned externally in the switched-off state using non-aggressive agents such as isopropyl alcohol.

4.2 Calibration

External influences such as mechanical forces or extreme temperature fluctuations that occur during regular use of the CLS^{x} can affect the properties of the sensor. Therefore, **imc recommends an annual calibration of the CLS^{x}**, in order to continue to guarantee all properties and the high accuracy.



Kalibrierschein
Calibration sheet

Gerät / Typ: Unit / Type: CLS-X (100 Nm) Datum: 29.06.2016

Serien-Nr: Serial No.: CLS-X-SE/CU-15053 Auftrags-Nr.: RMA16-380 Order-No.

Referenzgeräte: Calibration Devices: **Drehmomentsensor DF30 Ser.No. 109907 / Keithley DMM 2000 Ser.No. 706378**

Messergebnisse / Results

Eingang Input	CAN-Ausgang CAN Output		Analogausgang Analog Output	
Drehmoment [Nm] Torque [Nm]	rechts [N m] clockwise [N m]	links [N m] anticlockwise [N m]	rechts [V] clockwise [V]	links [V] anticlockwise [V]
0,00	0,00	0,00	0,000	0,000
20,00	20,00	-19,97	1,999	-1,998
40,00	40,02	-39,98	4,000	-3,997
60,00	60,03	-59,98	6,000	-5,997
80,00	80,05	-80,00	8,002	-7,998
99,00	99,06	-99,01	9,903	-9,899
80,00	80,05	-79,99	8,002	-7,997
60,00	60,04	-59,97	6,001	-5,997
40,00	40,03	-39,96	4,001	-3,996
20,00	20,04	-19,96	2,002	-1,997
0,00	0,03	0,01	0,003	0,001
Empfindlichkeit [V/Nm] Sensitivity [V/Nm]			0,100029	0,099980

Eingang Input	CAN-Ausgang CAN Output	
Drehwinkel [°] Angle [°]	rechts [°] clockwise [°]	links [°] anticlockwise [°]
0,00	0,00	0,00
22,50	22,50	22,50
45,00	45,00	45,00
90,00	90,00	90,00
180,00	180,00	180,00
360,00	360,00	360,00
720,00	720,00	720,00
1000,00	1000,00	1000,00

Empfohlener Kalibrierzyklus: 1 Jahr
Recommended calibration cycle: 1 year

Reference Calibration

For further information on the calibration process,
please contact imc or your local distributor 6.

4.3 Storage

When storing the CLS^x, it has to be protected against:

- Electrostatic charging (which may lead to destruction of electronic parts)
- Humidity (which leads to corrosion)

Permissible **storage temperature**: -10...40 °C

Note Storage

The cables required for operation of the CLS^x sensors must be stored without kinks. The individual modules must not be damaged mechanically when being packed.

4.4 Transport

Only transport the sensor in the suitcase (see fig. 1) 13 or in suitable packaging that provides protection against impact and shock. In case of damage, please inform the customer service 6 immediately. Transport damage is excluded from the warranty claim.

5 Introduction

The CLS^x steering sensor is a steering sensor for modern measurement technology. Its small size, light weight, flexibility and universal application possibilities are unique.

We strongly recommend that you familiarize yourself with the basic features of the CLS^x steering sensor before you start installing and performing measurements!

5.1 Abbreviations

CLSx	imc steering wheel sensor - the complete system
CLSx-SE	steering wheel sensor
CLSx-CU	control unit of the steering wheel sensor
ESP	electronic stability control
TSW	Top Steering Wheel

5.2 Application

The CLS^x steering sensor is used for the acquisition, signal processing, transmission and

output of measurement data relating to the steering wheel. In particular, steering torque,

steering angle, rotational speed and acceleration as well as acceleration in x-, y- and z-direction are measured and displayed.

The sensor is integrated between the original steering wheel and the steering column - all original steering wheel functions are retained.

The manufacturer declines any responsibility in case of improper use.

6 Technical Components

6.1 Steering wheel sensor (CLSx-SE)

Fig. 2: Steering wheel sensor CLS^x-SE

6.1.1 General parameters

Parameter	Value	Remarks
Sensor height	approx. 30 mm	without adaptor
Sensor weight	approx. 0.6 kg	without adaptor
Mechanical overload	>100 % of the measurement range	
Breaking load	>500 Nm	
Adaption	vehicle specific adaptors for each vehicle type	
Operating temperature	-20 °C to +80 °C	

6.1.2 Steering Torque

Steering Torque		
Parameter	**Value**	**Remarks**
Measuring principle	temperature compensated strain gauge application	
Measurement range	±100 Nm/±200 Nm	others upon request, e.g. ±250 Nm
Accuracy	0.1% FS	
Bandwidth	0 to 800 Hz	sampling rate 5 kHz

Reference Technical Specs

Please find more technical specs, e.g. steering angle, steering velocity range: in chapter Technical Specs -> CLS 94.

6.2 Control unit (CLSx-CU)

Fig. 3: CLS^x Control unit (CLS^x-CU), front view

6.2.1 General paramters

Parameter	Value	Remarks
Dimensions	approx. 170 x 130 x 53 mm	
Weight	approx. 0.8 kg	
Power supply	9 to 36 V DC	
Power consumption	approx. 10 W	
Operating temperature	-20 °C to +65 °C	
Display	2.83 inch IPS display	resolution 320 x 240 px

6.2.2 Terminal connections

Fig. 4: CLS^x Control unit (CLS^x-CU), rear view

Parameter	Value	Remarks
Laboratory sockets	sockets for the DC power supply (9 to 36 V DC) red: + blue: -	banana sockets
Power	socket for the power supply	Tuchel plug
Remote	socket for the remote control	
Sensor	socket for the steering wheel snsor CLS^x-SE	
CAN 1 / CAN 2	CAN Interface	1 node, 2 sockets
Ethernet	10/100 Mbit	network connection for the parameterization
SD Card	storage of the parameter files	front right
Out 1 .. Out 6 (front)	BNC socket for max. 6 analog outputs	freely configurable

6.2.3 Power socket

Socket type:

Company: Binder

Series: 581

Type 99 2005 00 03

Pin	Function
1	free
2	DC -
3	DC +

6.2.4 CAN

6.2.4.1 General information

- 1 CAN node witch 2 sockets
- CAN 2.0b according to ISO 11989 Standard, standard (11 bit) and extended (29 bit)
- Socket type: DSUB-9 (9-pin)

6.2.4.2 Pin configuration

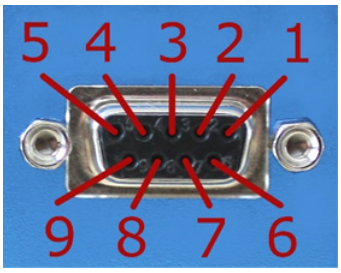


Fig. 5: DSUB-9 socket

Pin	CiA name	function
1	--	n.c.
2	CAN_L	CAN_L
3	CAN_GND	CAN_GND
4	--	n.c.
5	--	n.c.
6	--	n.c.
7	CAN_H	CAN_H
8	--	n.c.
9	--	n.c.

6.2.4.3 CAN terminator resistance

Note

The CLS^x control unit does not have an integrated CAN terminating resistor. If the control unit is operated at the end of a CAN bus chain, a 120 Ω terminating resistor must be inserted between the CLS^x-CU and the CAN connection.

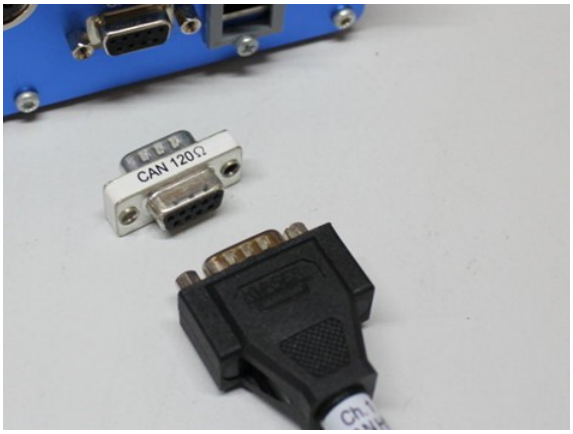


Fig. 6: CAN terminating resistor

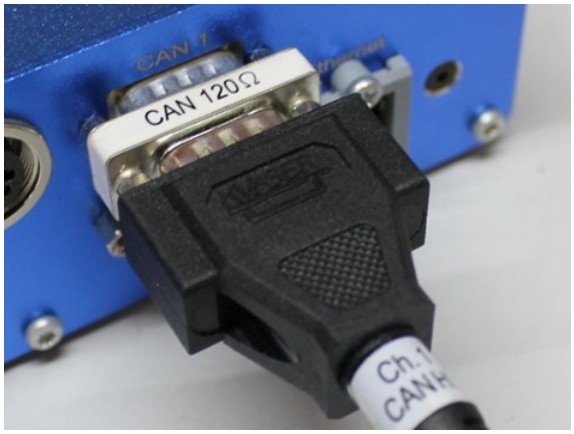


Fig. 7: plugged-in CAN terminating resistor

6.2.5 Remote control

Fig. 8: CLS^x remote control

TORQUE	Autozero of the steering torque
ANGLE	Autozero of the steering angle

6.3 Adaptor

6.3.1 Steering wheel adaptor

Fig. 9: CLS^x Steering wheel adaptor

6.3.2 Steering column adaptor

Fig. 10: CLS^x Steering column adaptor

6.3.3 ESP adaptor

Fig. 11: ESP adaptor (example)

The CLS^{x} ESP adaptor is plugged onto the steering column adaptor. It is used to obtain the angle information and is required for the ESP system.

Warning **Attention**

The CLS^{x} ESP adaptor is manufactured customer-specific - depending on the desired vehicle type. For any fastening of the respective ESP adaptor, please get in touch with the responsible contact person at imc.

6.3.4 TSW adaptor

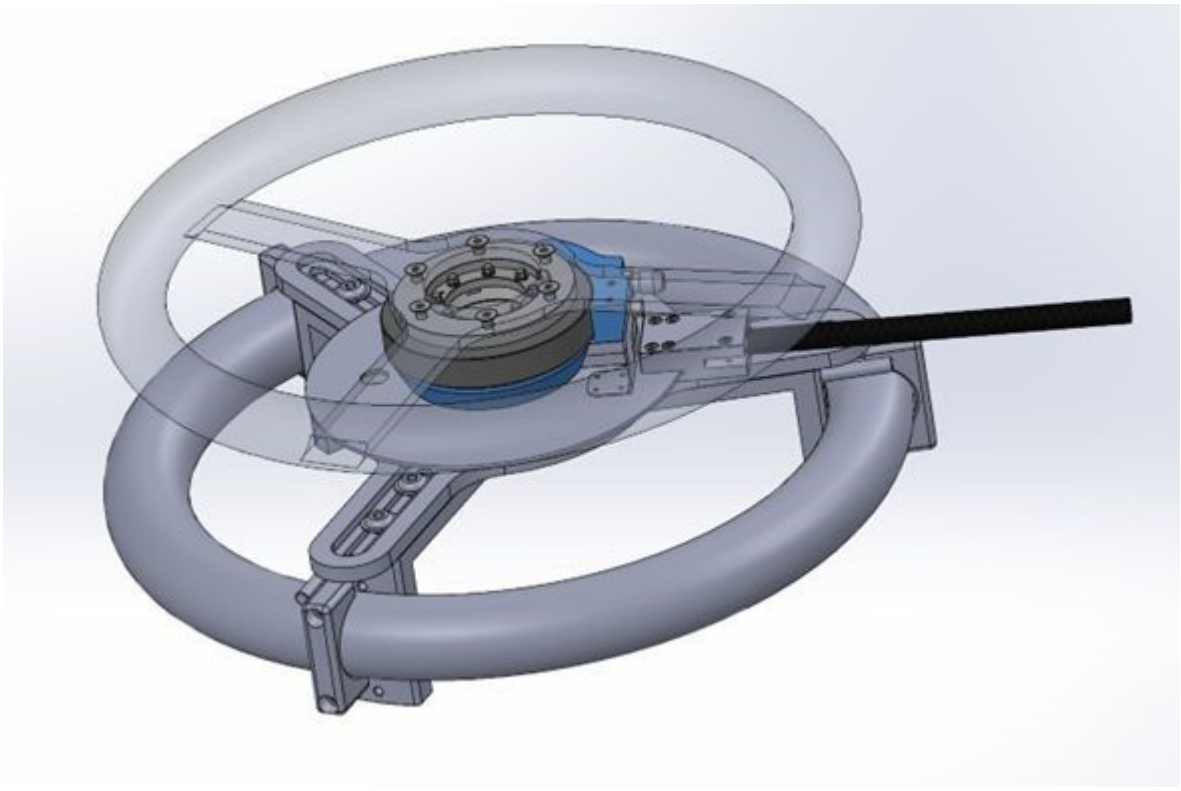


Fig. 12: TSW adaptor

The innovative adaptor for mounting the CLS^x steering sensor is suitable for all steering wheels from Ø 280 mm to Ø 430 mm.

Highlights

- Suitable for standard vehicle steering wheels,
  other sizes on request
- Stator support for the steering angle fixation included
- Including steering wheel for CLS^x steering wheel sensor (Ø 350 mm)
- Weight including CLS^x and steering wheel approx. 4.4 kg

Warning

- Before installing the universal adaptor, the **driver airbag** must be **deactivated** or removed if a driver airbag is present.
- The universal adaptor must only be installed by qualified personnel.
- After installation of the universal adaptor, the general operating permit of the vehicle expires.
  For the tests, only qualified drivers may use the vehicle on routes approved for this.

7 Properties

7.1 Measurement channels

The following measurement channels are available for CLS^{x}:

- Steering torque
- Steering angle
- Rotational speed
- Rotational acceleration
- Acceleration in x, y and z direction

Note

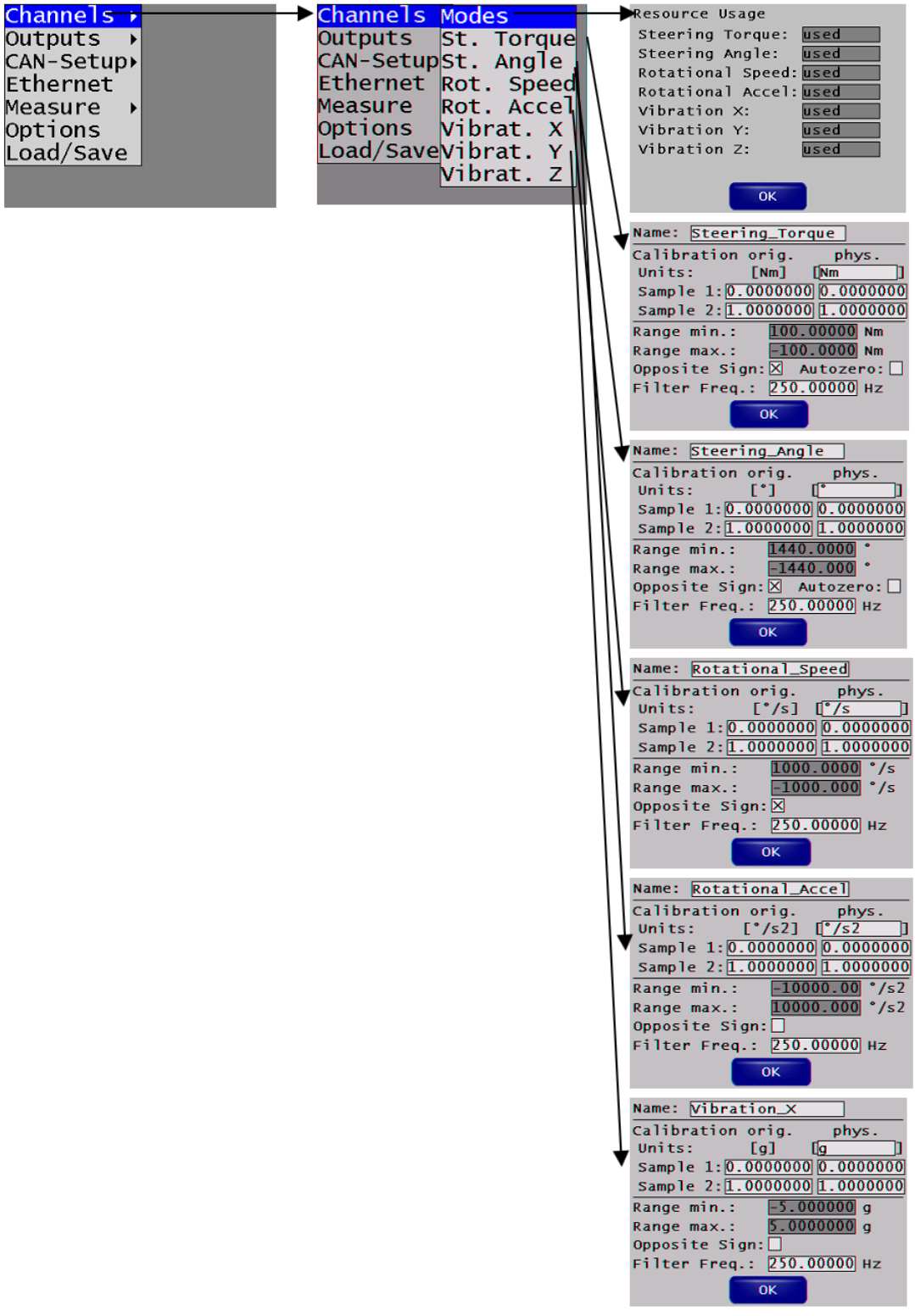
For the technical data, e.g. steering torque, steering angle, rotational speed, rotational acceleration and the acceleration in x, y and z direction, please refer to chapter "Technical Specs" 94.

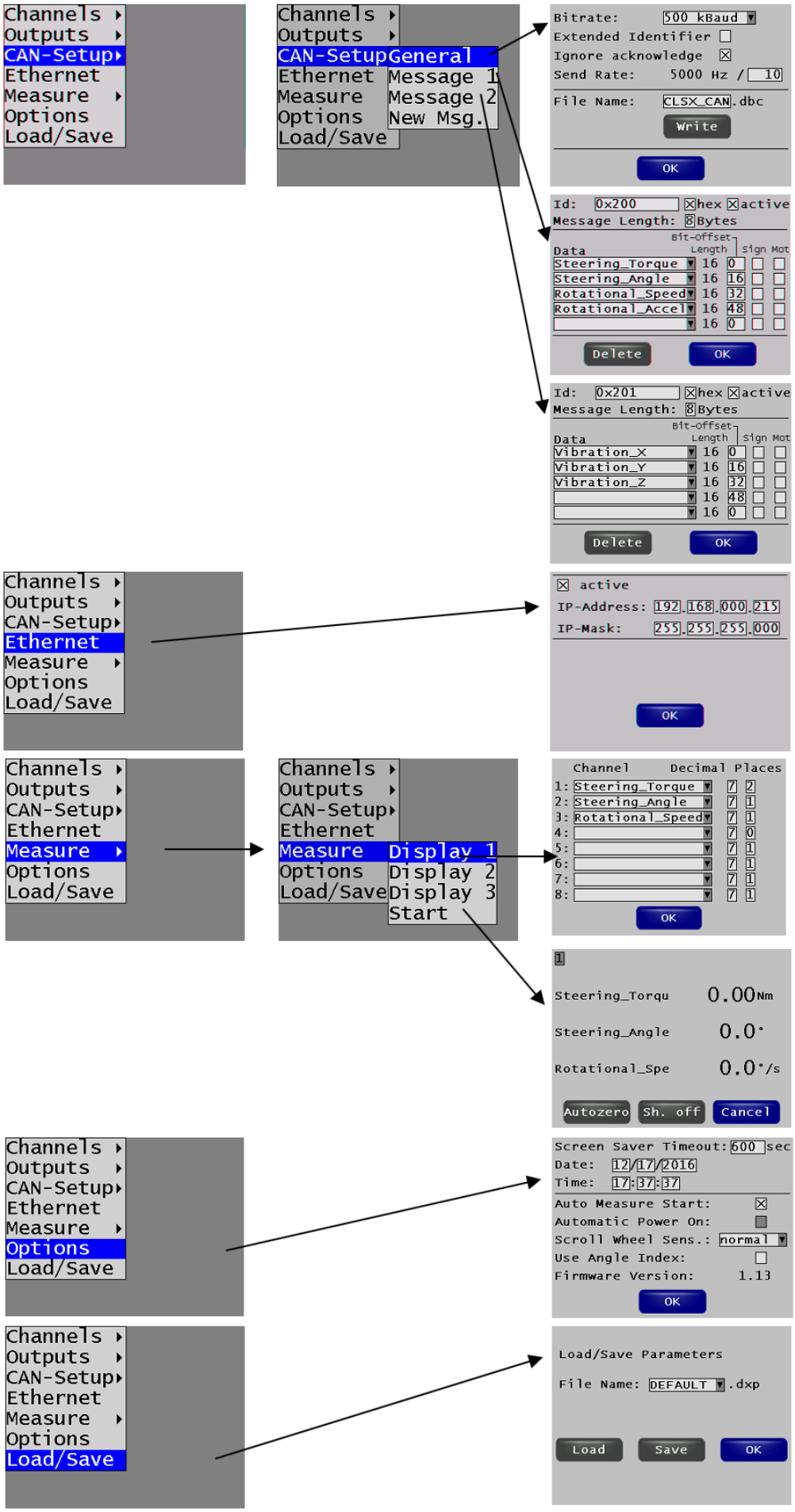
7.2 Control unit firmware

7.2.1 General information

The CLS^{x} firmware is a convenient user interface for operating the system and output configuration. With only a few simple steps, the system can be adjusted to the respective customer requirements.

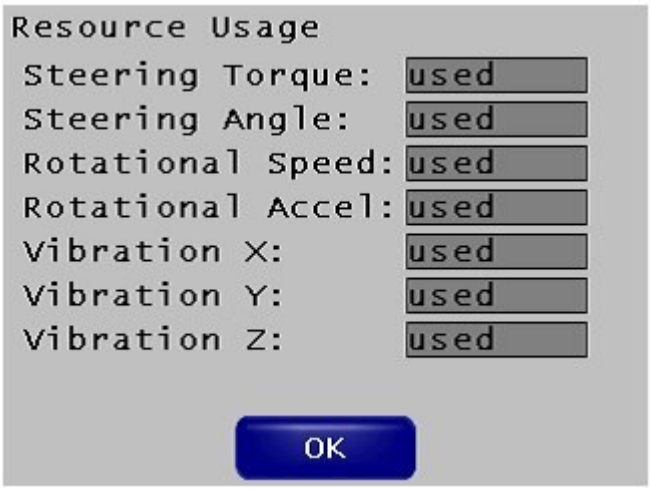
7.2.2 Menu overview




Channels
Outputs
CAN-Setup
Ethernet
Measure
Options
Load/Save
General
Message 1
Message 2
New Msg.
Bitrate: 500 kBaud
Extended Identifier
Ignore acknowledge
Send Rate: 5000 Hz / 10
File Name: CLSX_CAN.dbc
Write
OK
Id: 0x200 hex active
Message Length: 8 Bytes
Bit-Offset
Data Length Sign Mot
Steering_Torque 16 0
Steering_Angle 16 16
Rotational_Speed 16 32
Rotational_Accel 16 48
Delete
Id: 0x201 hex active
Message Length: 8 Bytes
Vibration_X 16 0
Vibration_Y 16 16
Vibration_Z 16 32
active
IP-Address: 192.168.000.215
IP-Mask: 255.255.255.000
Display 1
Display 2
Display 3
Start
Channel Decimal Places
1: Steering_Torque 7 2
2: Steering_Angle 7 1
3: Rotational_Speed 7 1
4: 7 0
5: 7 1
6: 7 1
7: 7 1
8: 7 1
Steering_Torqu 0.00Nm
Steering_Angle 0.0°
Rotational_Spe 0.0°/s
Autozero
Sh. off
Cancel
Screen Saver Timeout: 600 sec
Date: 12/17/2016
Time: 17:37:37
Auto Measure Start:
Automatic Power On:
Scroll Wheel Sens.: normal
Use Angle Index:
Firmware Version: 1.13
Load/Save Parameters
File Name: DEFAULT .dxp
Load
Save

7.3 Settings

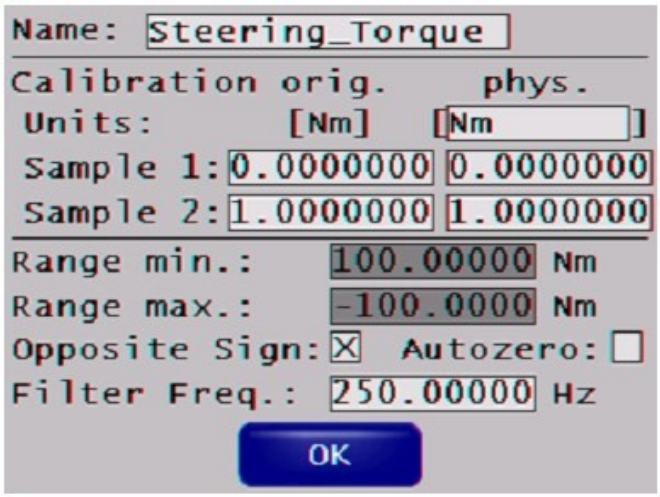
7.3.1 Menu: Channels -> Modes



Overview of all available measuring channels

Name of the box	Effect
OK	Exit menu item

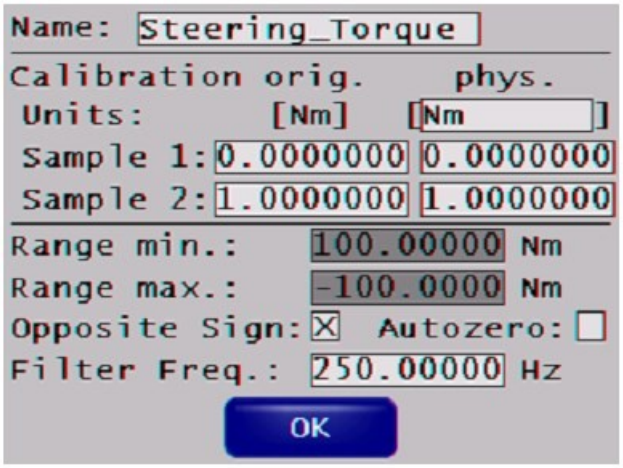
7.3.2 Menu: Channels -> Steering Torque



Display and setting of channel parameters.

Name of the box	Function
Name	Change channel name
Calibration	Input of the two-point calibration for the measuring channel (or change of the physical unit). Online calculation during measurement: the measured values were converted and displayed accordingly.
Range min / Range max.	Measurement ranges of the channels
Opposite Sign	Reverses the polarity sign of the measured value Box not activated: clockwise +  counterclockwise - Box activated: clockwise -  counterclockwise + 
Autozero	Box checked: allows Autozero of this channel via *Measure → Autozero*. Box not checked: no Autozero of this channel is performed if *Measure → Autozero* (but Autozero via remote control is possible)
Filter Freq.	Cut-off frequency of the anti-aliasing filter (30 ... 1250 Hz) Filter type: 6 pole Butterworth characteristic, low pass
OK	Exit menu item

7.3.3 Menu: Channels -> Steering Angle

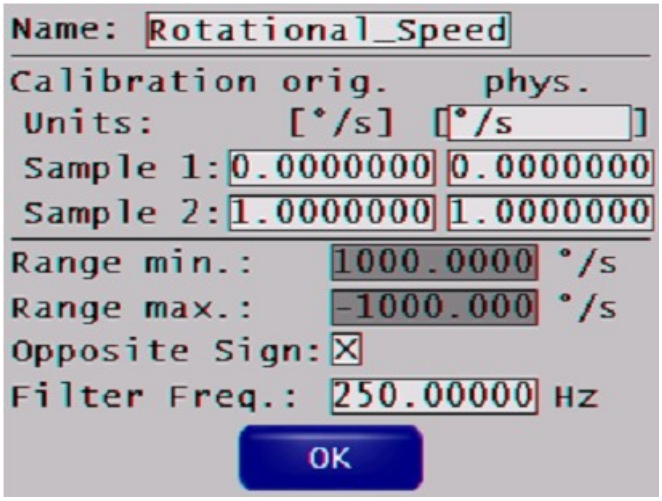


Display and setting of channel parameters.

Name of the box	Function
Name	Change channel name
Calibration	Input of the two-point calibration for the measuring channel (or change of the physical unit). Online calculation during measurement: the measured values were converted and displayed accordingly. Example: Conversion from degree to radian 
Range min / Range max.	Measurement ranges of the channels
Opposite Sign	Reverses the polarity sign of the measured value Box not activated: clockwise → **positive direction** counterclockwise → **negative direction** Box activated: clockwise → **negative direction** counterclockwise → **positive direction**

Autozero	Box checked: allows Autozero of this channel via *Measure → Autozero*. Box not checked: no Autozero of this channel is performed if *Measure → Autozero* (but Autozero via remote control is possible)
Filter Freq.	Cut-off frequency of the anti-aliasing filter (30 ... 1250 Hz) Filter type: 6 pole Butterworth characteristic, low pass
OK	Exit menu item

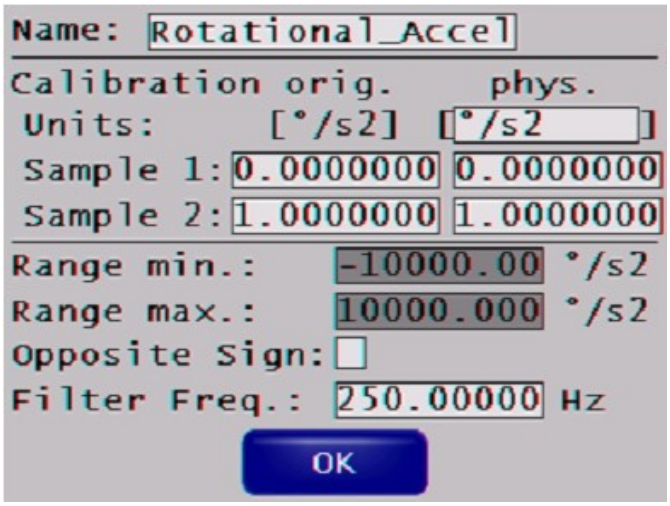
7.3.4 Menu: Channels -> Rotational Speed



Display and setting of channel parameters.

Name of the box	Function
Name	Change channel name
Calibration	Input of the two-point calibration for the measuring channel (or change of the physical unit). Online calculation during measurement: the measured values were converted and displayed accordingly.
Range min / Range max.	Measurement ranges of the channels
Opposite Sign	Reverses the polarity sign of the measured value Box not activated: clockwise **positive direction** counterclockwise **negative direction** Box activated: clockwise **negative direction** counterclockwise **positive direction**
Filter Freq.	Cut-off frequency of the anti-aliasing filter (30 ... 1250 Hz)
OK	Exit menu item

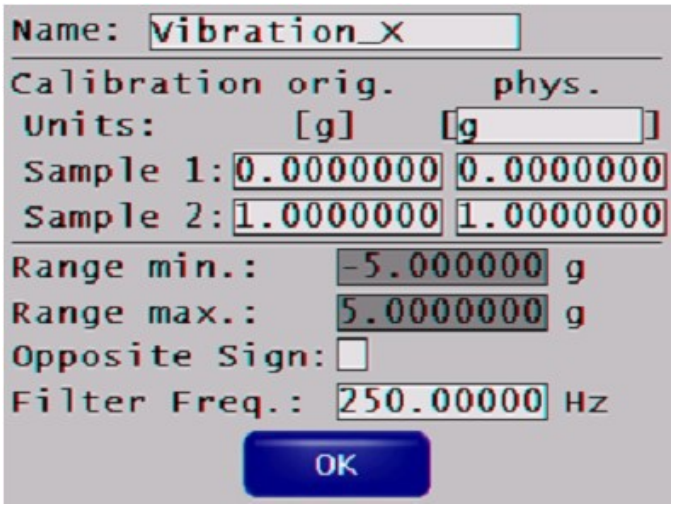
7.3.5 Menu: Channels -> Rotational Acceleration



Display and setting of channel parameters.

Name of the box	Function
Name	Change channel name
Calibration	Input of the two-point calibration for the measuring channel (or change of the physical unit). Online calculation during measurement: the measured values were converted and displayed accordingly.
Range min / Range max.	Measurement ranges of the channels
Opposite Sign	Reverses the polarity sign of the measured value
Filter Freq.	Cut-off frequency of the anti-aliasing filter (30 ... 1250 Hz) Filter type: 6 pole Butterworth characteristic, low pass
OK	Exit menu item

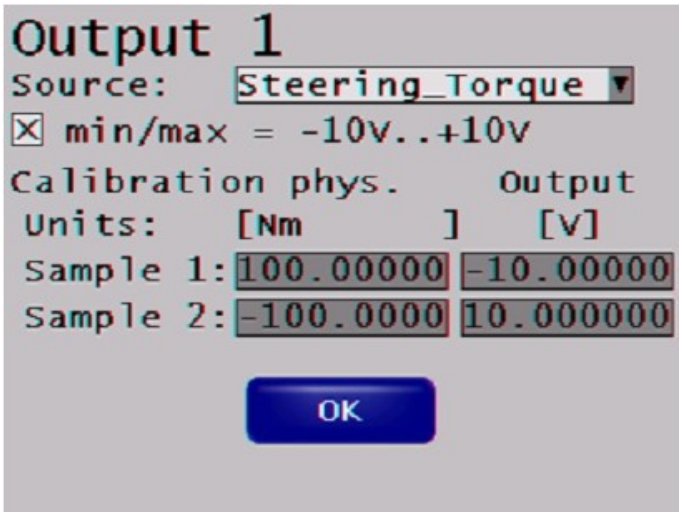
7.3.6 Menu: Channels -> Vibration X, Y, Z



Display and setting of channel parameters.

Name of the box	Function
Name	Change channel name
Calibration	Input of the two-point calibration for the measuring channel (or change of the physical unit). Online calculation during measurement: the measured values were converted and displayed accordingly.
Range min / Range max.	Measurement ranges of the channels
Opposite Sign	Reverses the polarity sign of the measured value
Filter Freq.	Cut-off frequency of the anti-aliasing filter (30 ... 1250 Hz) Filter type: 6 pole Butterworth characteristic, low pass
OK	Exit menu item

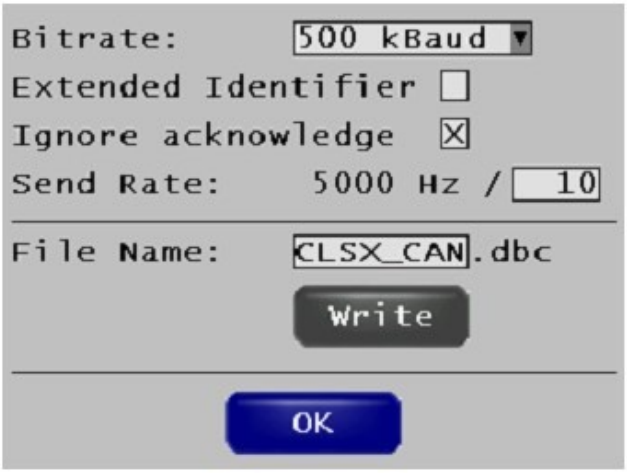
7.3.7 Menu: Outputs -> Output 1..6



Configuring the analog outputs (BNC sockets on the front)

Name of the box	Function
Source	Selection of the measuring channel for analog output
min/max=-10V..10V	Box activated: the voltage range of the analog output is ±10 V. (-10 V is the smallest measured value, +10 V the largest of the measuring range).
Calibration	Set the range for the analog output (max. output ±10 V). Deactivate "min/max=-10V..+10V" and enter the desired range in "*Sample 1*" and "*Sample 2*".
OK	Exit menu item

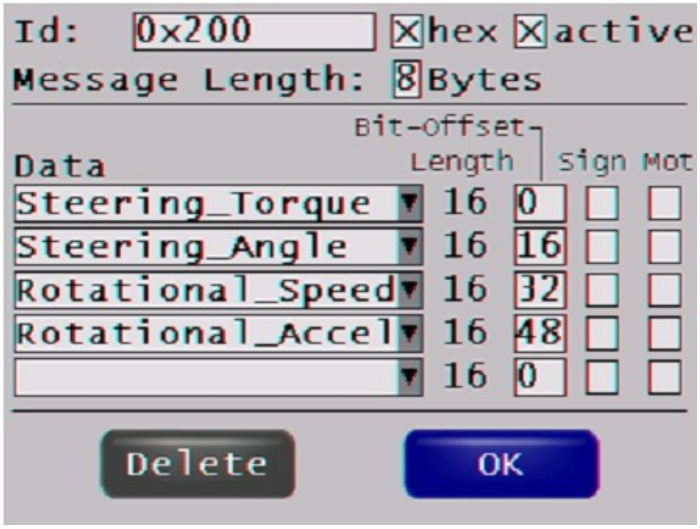
7.3.8 Menu: CAN-Setup -> General



Configure the CAN interface

Name of the box	Function
Bitrate	Selection of the desired baud rate of the CAN bus (50 kBaud up to 1000 kBaud)
Extended Identifier	Box enabled: Extended Message Identifiers (29 bit) is used Box not activated: Standard Message Identifiers (11 bit)
Ignore acknowledge	Box enabled: Transmission of CAN messages without waiting for the acknowledge message of the receiver.
Send rate	Reduction of the output rate of the CAN messages from 5000 Hz to a lower output rate. **Example:** *Send rate: 5000 Hz/10* → the output rate is 500 Hz
File Name	Name selection .dbc-file
Write	Create the .dbc file of the current configuration
OK	Exit menu item

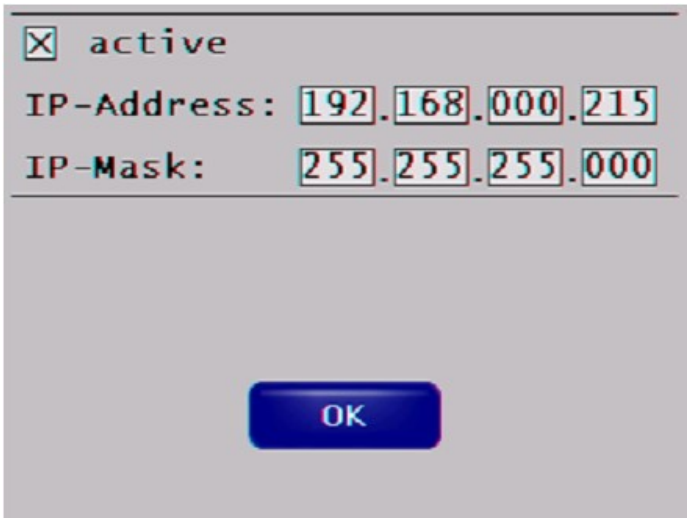
7.3.9 Menu: CAN-Setup -> Message 1/2



Configure the CAN message 1

Name of the box	Function
Id	CAN Identifier of the message
hex	Box activated: Identifier is displayed as hexadecimal value Box not activated: Identifier is displayed as decimal value
active	Box activated: CAN message is active, e.g. output of message during measurement. Box not activated: CAN message inactive
Message Length	Bit length in the CAN message (2-8 bytes).
Data	Selection of the channel to be transmitted
Bit-Offset	Start bit of the data channel in the CAN message
Sign	Binary coding of the measured value. Box activated: signed int Box not activated: unsigned int **Attention**: With both "signed int" and "unsigned int", positive and negative measured values can be represented.
Mot	Coding of the measured values Box activated: Motorola coding Box not activated: Intel coding
Delete	Delete CAN message
OK	Exit menu item

7.3.10 Menu: Ethernet



Configure of the Ethernet interface of the CLS^{x}-CU.

Name of the box	Function
active	Activation of the Ethernet Interface. Box not activated: Ethernet connection disabled
IP-Address	Entry of IP address of the CLS^{x}-CU. setting ex factory: 192.160.000.212
IP-Mask	Entry of the "subnet mask" of the IP address. setting ex factory: 250.250.250.000
OK	Exit menu item

7.3.11 Menu: Measure -> Display 1..3

Configure for online display of measurement channels during measurement.

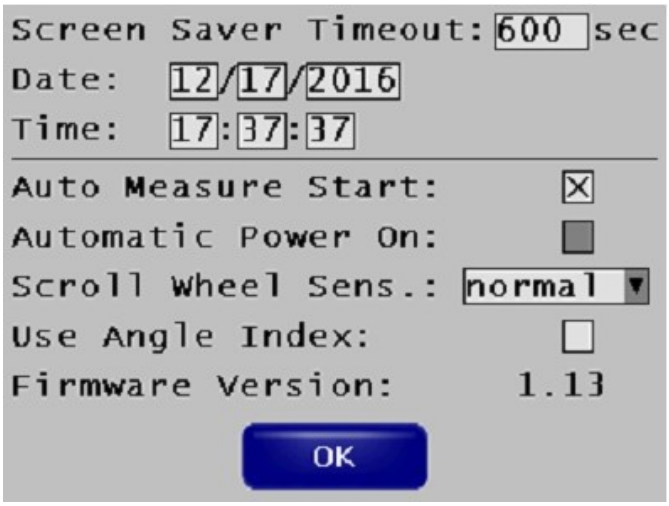
Name of the box	Function
Channel	Selection of the measuring channel and how it should be displayed.
Decimal	Number of decimal places to be displayed (applies to sign and decimal point)
Places	Number of decimal digits after the decimal point
OK	Exit menu item

7.3.12 Menu: Measure -> Start

Start the measurement, Autozero and Testshunt.

Name of the box	Function
1 ... 3	Display of the number of the online window
Autozero	Number of decimal points to be displayed (sign and decimal point)
Sh. off / Sh. on	Status of the shunt resistor (on/off). The shunt resistor is used, for example, to test the torque. • Sh. off: without shunt resistor • Sh. on: with shunt resistor (+80 Nm become the original signal)
Cancel	Exit menu item

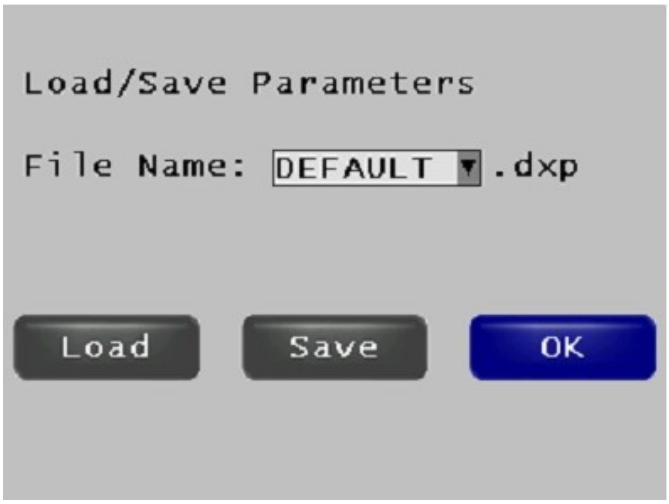
7.3.13 Menu: Options



More configuration options

Name of the box	Function
Screen Saver Timeout	Time period (in seconds) after the last input at which the CLS^x screen saver was activated.
Date, Time	Setting of time (hh:mm:ss) and date (mm/dd/yyyy).
Auto Measure Start	Box activated: automatic start of the measurement after power on. Box not activated: system start in configuration mode
Automatic Power on	turn off/on Automatic Power On option power: automatic reboot after power failure) • Box activated: CLS^x-CU boots automatically as soon as sufficient power is applied • Box not activated : manual restart by pressing the button in the middle of the scroll wheel
Scroll Wheel Sens.	Determines the sensitivity of the scroll wheel (lowest, low, normal, or high)
Use Angle Index	**Only with CLS^x option reference point!** • Box activated: use the angle value from the last zero adjustment as start value. • Box not checked : the current value is displayed, which can be zeroed
Firmware Version	Version number of the CLS^x-CU firmware
OK	Exit menu item

7.3.14 Menu: Load/Save



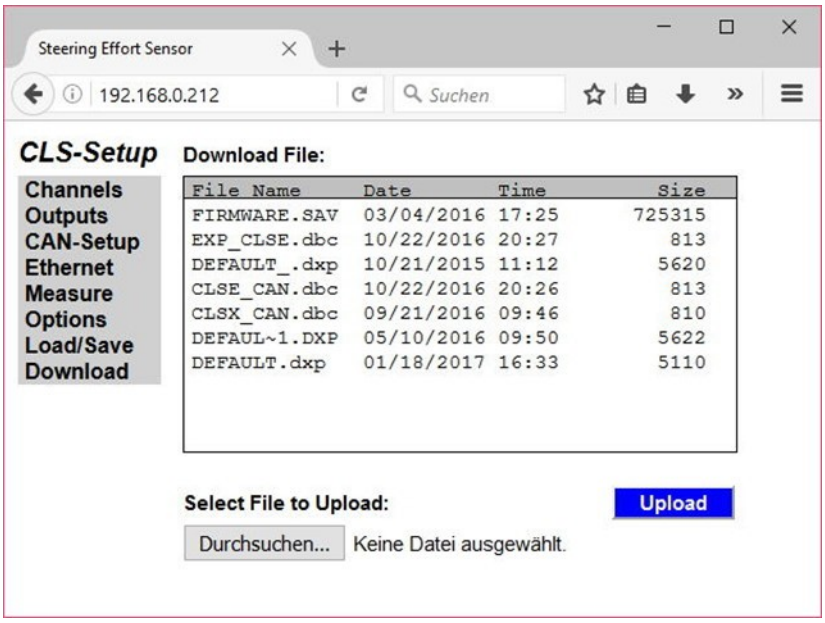
Loads and saves the various .dxp configuration files.

Name of the box	Function
File Name	Load an existing file: select file Save a configuration: enter file name
Load	Loads configuration of the desired file
Save	Saves the current configuration under the respective file name
OK	Exit menu item

Note

The configuration is saved under *Default.dxp* and is automatically loaded when the CLS^{x}-CU is started.

7.3.15 Menu: Download (Ethernet only)



Download and upload of *.dxp* and *CAN configuration files*.

Name of the box	Function
Download File	List of configuration files stored on the CLS^{x}-CU SD-card.
Select File to Upload	Selection of the file from the PC for uploading
Upload	Upload the selected file to the CLS^{x}-CU SD-card.

8 Installation and start

8.1 General information

The CLS^x steering sensor is an ideal measuring device for recording the steering torque, steering angle and associated measured values when testing steering systems of any vehicle. The manufacturer accepts no liability for improper use.

8.2 Important safety information

The CLS^x steering sensor may only be installed and operated by qualified personnel.

Warning Danger!

Removal of the airbag during the installation process is only permitted by specially trained personnel on the basis of the national laws applicable in the respective country!

8.3 Step by step installation of CLSx

Removal of the airbag during the installation process is only permitted by specially trained personnel on the basis of the national laws applicable in the respective country!

Warning Danger!

Removal of the airbag during the installation process is only permitted by specially trained personnel on the basis of the national laws applicable in the respective country!

Disconnect the airbag cable connection and remove the airbag completely. To re-establish the steering wheel multimedia cable connection, feed the cable through the CLS^x steering sensor after disconnecting the connector.

Opening the central steering wheel screw.

Remove the steering wheel from the steering column.

Place the CLS^{x} sensor with the steering column adaptor on the steering column. Make sure that the toothing of the adaptor is in the correct position. Gently slide the steering sensor halfway onto the steering column. Feed the LIN bus cable through the corresponding opening of the CLS^{x} steering sensor. Then press the steering sensor completely onto the steering column.

Place the CLS^{x} sensor with the steering column adaptor on the steering column.

Tighten the central screw according to the vehicle manufacturer's specifications.

Attach the steering wheel adapter to the CLS^{x} steering sensor using the appropriate screws provided.

Warning Attention

Please do not tighten the screws yet!

Tighten the 8 screws with a torque of **3.0 Nm** in the sequence shown in the picture below.

Now please tighten the 8 screws with the final torque of 6.0 Nm in the order shown in the picture below.

Note

This procedure is indispensable for precise steering torque measurement!

Attach one end of the fixation arm to the CLS^x steering sensor and try to find a suitable location to attach the other end. When this is done, tighten the two screw joints on the fixation arm.

Note

To enable precise angle measurement, make sure that the stator part of the CLS^x steering sensor is firmly fixed in relation to the steering column.

Put the original steering wheel onto the CLS^x steering sensor. Make sure that the teeth of the adaptor are in the correct position. Gently slide the steering wheel halfway onto the CLS^x adaptor. Connect the LIN bus cable to the plug/socket on the steering wheel. Now gently push the steering wheel completely onto the CLS^x adaptor.

Tighten the central screw according to the vehicle manufacturer's specifications.

Connect the airbag cable to the steering wheel.

Install the airbag according to the instructions of the respective vehicle manufacturer.

Warning Danger!

The installation of the airbag during the installation process is only permitted by specially trained personnel on the basis of the national laws applicable in the respective country!

Connect the CLS^{x} steering sensor cable to the sensor input of the control unit.

Select the steering wheel position according to the instructions of the respective vehicle manufacturer.

8.3.1 Integration of the ESP adaptor (optional)

The CLS^x ESP adaptor is manufactured customer-specific - depending on the desired vehicle type. For any fastening of the respective ESP adaptor, please get in touch with the responsible imc contact person.

8.3.2 Summary of the disassembly

- Remove the airbag of the standard steering wheel according to the guidelines and instructions of the vehicle manufacturer. Disconnect the cable connection to the airbag.
- Open the central screw, disconnect the LIN Bus cable and remove the original steering wheel.
- Open and secure the CLS^x adaptor screws - Pull off the CLS^x adaptor
- Unscrewing the quick-release fasteners of the fixing arm. Opening the fixation arm fasteners with subsequent removal.
- Carefully pulling the LIN bus cable through the cable opening of the CLS^x steering sensor.
- Open the steering wheel screw, pull it out and store it safely.
- Take the included threaded auxiliary tool to remove the CLS^x steering sensor and place it on the CLS^x steering sensor and secure it with 4 steering wheel adapter screws.
- Then turn the black screw clockwise and carefully pull the CLS^x steering sensor from the steering column.

Note Attention

To avoid damaging the CLS^x steering sensor or the adapter splines, always use the auxiliary tool for removing the CLS^x steering sensor.

- Then install the standard steering wheel according to the guidelines and instructions of the vehicle manufacturer.
- Then install the airbag of the series steering wheel according to the guidelines and instructions of the vehicle manufacturer. Connect the cable connection to the airbag.

Warning Danger!

The installation of the airbag during the installation process is only permitted by specially qualified personnel on the basis of the national laws applicable in the respective country!

8.4 TSW - Top Steering Wheel for CLSx sensor

The TSW top steering wheel allows you to use a CLS^x steering effort sensor without having to completely remove the original steering wheel. To do this, the TSW adaption together with the CLS^x is simply placed on the original steering wheel, aligned and fixed. In this way, you equip your vehicle with the CLS^x steering sensor in a very short time.

8.4.1 Individual parts

The complete TSW adaption is delivered with the following components:

Sports steering wheel	
Sports steering wheel adapter	
Torque arm	

Linkage, joints, retaining bolts and suction cup for torque arm	
Steering wheel fastening	
Dial gauge with mounting unit (for centered mounting of the TSW adaption system)	
Various screws	

8.4.2 Required tools

For the assembly you need:

- An Allen wrench set
- An AF 9 open-ended wrench
- An AF 10 open-ended wrench
- An AF 21 open-ended wrench
- A torque wrench with AF 4,5 wrench nut
- Adhesive tape or cable ties

8.4.3 Important safety information

The TSW top steering wheel with the CLS^{x} steering sensor may only be installed and operated by qualified personnel.

Warning Danger!

Removal of the airbag during the installation process is only permitted by specially trained personnel on the basis of the national laws applicable in the respective country!

8.4.4 Step by step installation TSW

Removal of the airbag during the installation process is only permitted by specially trained personnel on the basis of the national laws applicable in the respective country.

Disconnect the airbag cable connection and remove the airbag completely.

Mount the sports steering wheel adapter to the sports steering wheel. Use DIN 7991 M 5 x 12 countersunk screws for this purpose. Align the sports steering wheel adapter so that the small hole in the sports steering wheel adapter is in the position shown in the picture below, where it is marked in red.


07/09/2021 13:01


07/09/2021 13:01
COMPETITION

Mount the CLS^x steering sensor to the sports steering wheel adapter. The upper side of the CLS^x steering sensor faces the sports steering wheel. Follow the instructions below for the sequence and tightening torque of the screws.

Tighten the 8 screws with a torque of 3.0 Nm in the sequence shown in the picture below.

Now tighten all 8 screws with the final torque of 6.0 Nm in the order shown in the picture below.

Warning

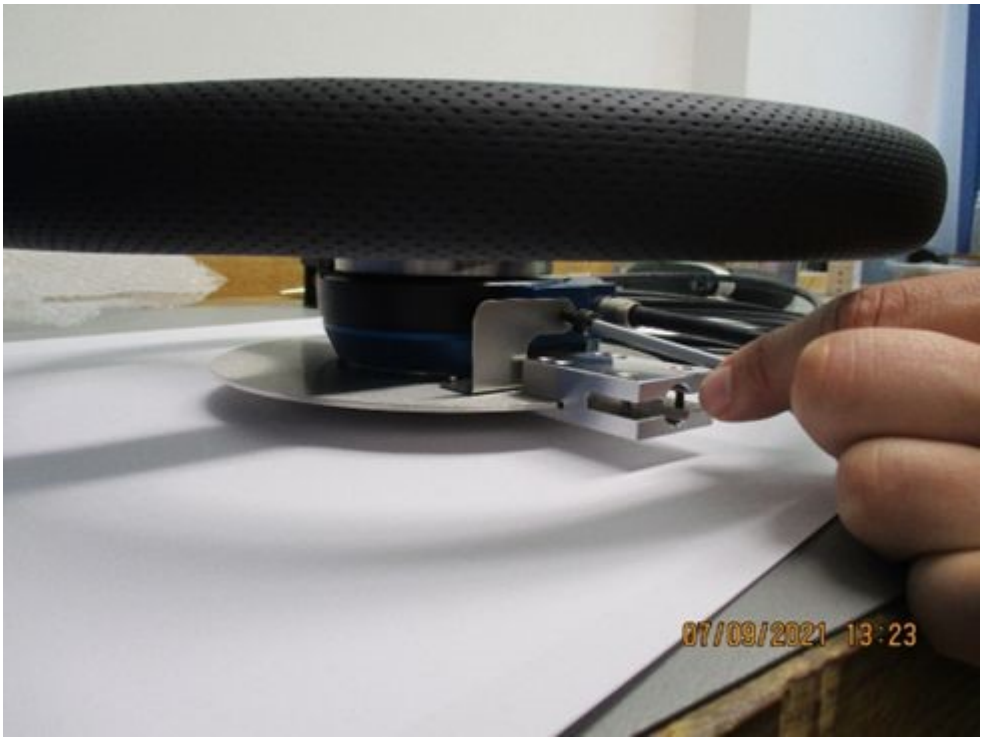
This procedure is indispensable for precise steering torque measurement!

Mount the torque arm to the CLS^{x} steering sensor. Again, follow the instructions below for the sequence and tightening torque for the screws.

Tighten the 8 screws with a torque of 3.0 Nm in the sequence shown in the picture below.

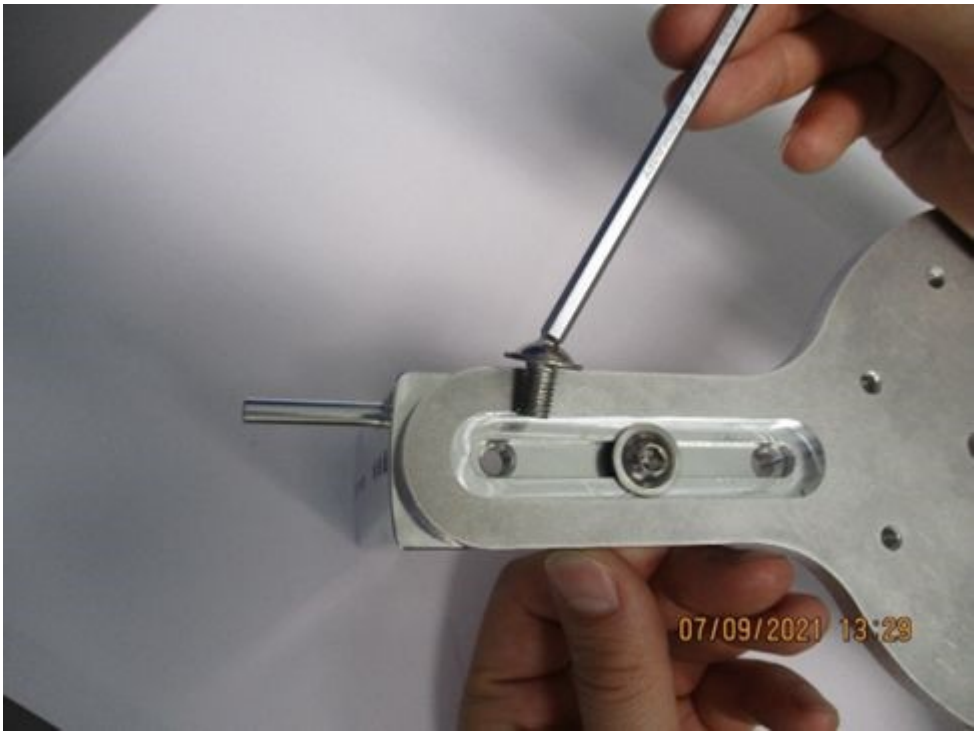
Now tighten all 8 screws with the final torque of 6.0 Nm in the order shown in the picture below.

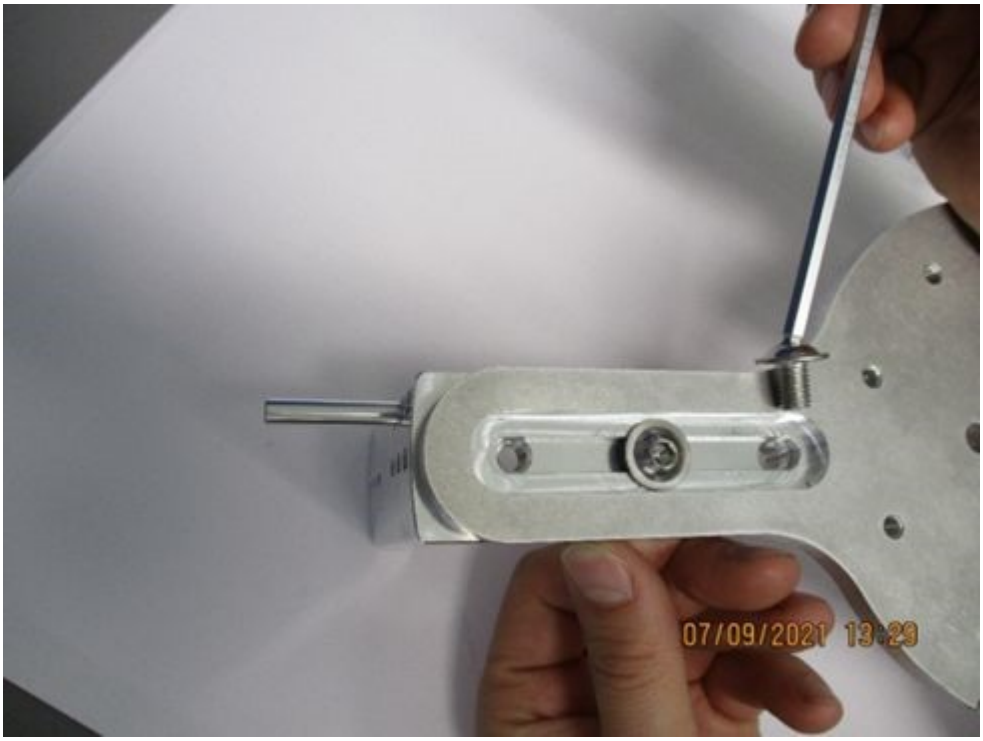
Mount the retaining bracket of the torque arm to the CLS^x steering sensor. Use the DIN 912 M 5 x 8 cylinder-head screw for this purpose.



The steering wheel fastening is designed for variable steering wheel diameters. It can be individually adjusted via slotted holes.

For a rough adjustment, there are three screw holes for screws below the oblong hole. Select one of these depending on whether you are using a rather small or large steering wheel.





Use the three slotted holes to set the inner radius of your steering wheel as well as possible; the fine adjustment is then made directly on the steering wheel.

Depending on your wanted distance between the steering wheel fastening and the vehicle steering wheel, you can choose three predefined distances. Here you need to attach lateral positioning pins (see red marking in the picture below).

Turn your steering wheel to the zero position. The upper half should be free on the inside (as seen in the picture). If there is a spoke on your steering wheel, turn the steering wheel 180 ° until the upper area is free.

Position the steering wheel fastening. The vertical axis of the upper spoke of the steering wheel fastening should go exactly vertically downwards and exactly through the center of the original steering wheel.

Fix the steering wheel fastening on the upper spoke with the bracket.

In the next step the exact centering of the assembly will follow. To do this, install the dial gauge. Attach it to the inside of the side window with the suction cup. The sensor of the dial gauge must rest on the fit in the center of the steering wheel fastening.

Turn the steering wheel by 360 °. Using the dial gauge, you see what deviation you will get in the individual spoke of the steering wheel fastening. You must compensate for this deviation as well as possible via the slotted holes. A deviation of ±0.5 mm will be acceptable.

Once the steering wheel fastening is centered, fix it to the remaining spokes with the brackets.

The interim status now looks as follows:

Mount the CLS^{x} with the sports steering wheel that you have prepared before on to the TSW adaption.

The torque arm must be inserted into the fit of the steering wheel fastening.

The disc of the torque arm shows a hole (red marking in the picture below). Turn the disc in each case so that it is placed one after the other over the 9 holes for the screws. Fasten the assembly with the 9 DIN 7991 M 6 x 12 screws. Tighten them to hand tightness.

Attach a carbon rod to the torque arm.

Assemble the mount for the torque arm with the joints and the carbon rods. Adapt this to your requirements. If necessary, you can also shorten the carbon rod. In practice, it has proven useful to first fix the carbon rods with the screws in the joints so that they no longer slip loosely, but remain adjustable.

Attach the suction cup mount to the windscreen in a way that your field of vision remains as free as possible, e.g. underneath the rear-view mirror.

Lead the CLS^x sensor cable out along the carbon rod and fasten it with adhesive tape or cable tie.

Connect the CLS^x sensor cable to the sensor input of the CLS^x control unit (CU).

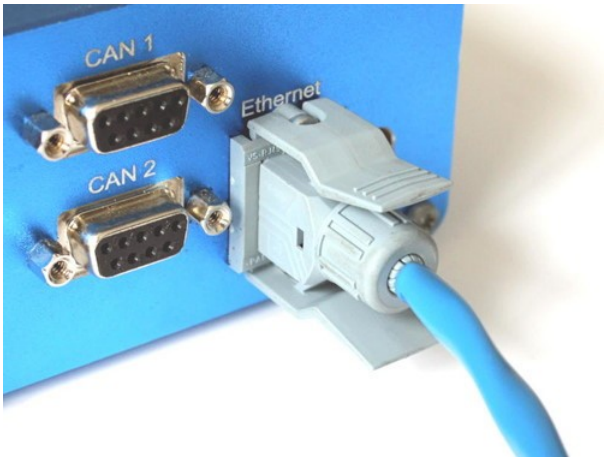
8.5 Configuration

With just a few steps, the CLS^{x} steering sensor is integrated into your individual measurement environment.

There are two ways to configure the CLS^{x} steering sensor:

- The configuration with the rotary wheel

- Configuration via Ethernet



8.5.1 Configuration with the rotary wheel

Press rotary wheel	Function	
1 rotary wheel, top	▪ UP ▪ close drop down menu	
2 rotary wheel, down	▪ DOWN ▪ open drop down menu	
3 rotary wheel, left	one menu step back/up	
4 rotary wheel, right	one menu step further/down	
5 center of the rotary wheel	▪ ENTER ▪ press for 5 seconds: ON / OFF	
rotary wheel, turn clockwise	one menu step further/down	
rotary wheel, turn counter clockwise	one menu step back/up	

8.5.2 Configuration via Ethernet

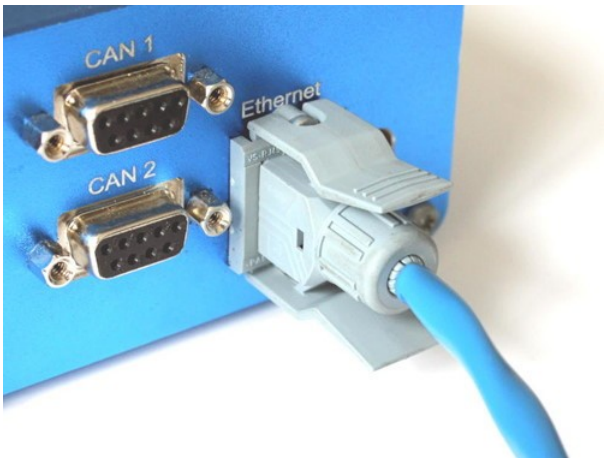
With this method you can comfortably configure the system via mouse/keyboard with your PC/notebook. The CLS^{x}-CU must be connected to your PC/notebook via Ethernet.

Note

If your system is configured via Ethernet, each keyboard entry must be linked to the

button to be transmitted to the CLS^{x}-CU.

- Connect the CLS^{x}-CU to your computer with the supplied blue Ethernet cable. Make sure that the Ethernet connector is engaged!



- Switch on the CLS^{x}-CU (press the button in the middle of the rotary wheel for 5 seconds).
- Check the Ethernet settings on your computer (DHCP off, IPV4, network wire addresses of the CLS^{x}-CU and the computer must be in the same network segment).

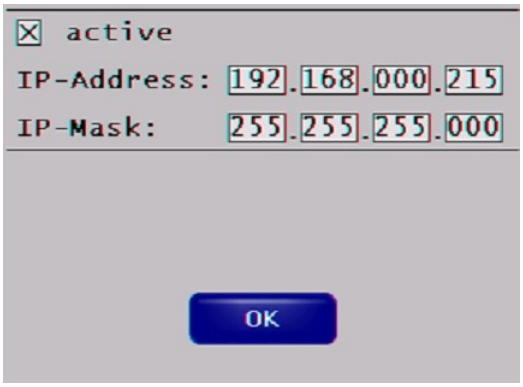
Protocol	IPv4
IP address	• Enter a static IP address (turn of the automatic IP address assignment). CLS^{x}-CU and PC must be in same network segment

Example

CLS^{x}-CU IP address 192.168.000.212
CLS^{x}-CU IP mask 255.255.255.000
Computer IP address 192.168.000.101
Computer IP mask 255.255.255.000

- Go to the *Ethernet* menu item in the CLS^{x}-CU.

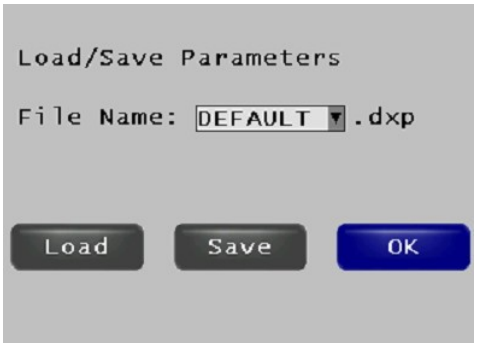
- Change the IP address and the IP mask according to your requirements. Make sure that the *active box* is activated in the Ethernet menu item and exit the menu by pressing the *OK* button.



Note

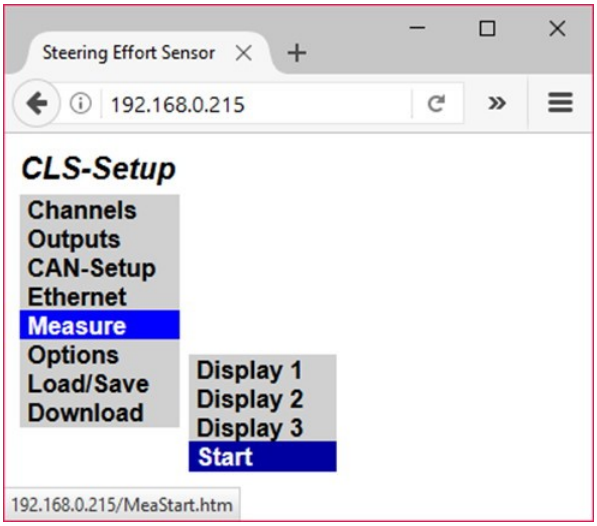
The pre setting (ex factory) of the CLS^{x}-CU Ethernet connection is:
IP-Address: 192.168.000.212
IP-Mask: 255.255.255.000

- Save a new Ethernet configuration as *DEFAULT.dxp* in the *Load/Save* section:
  Activate Save and confirm the message *Parameters saved!* with *OK*.



- Restart the CLS^{x}-CU by switching on the system. The CLS^{x}-CU can now be used with the new Ethernet settings.

- Open your web browser (e.g. Mozilla Firefox) on your computer. Enter the network address of the CLS^{x}-CU in your browser.



The CLS^{x} can be parameterized with the mouse/keyboard via your computer.

Note

If your system is configured via Ethernet, each keyboard entry must be linked to the

button to be transmitted to the CLS^{x}-CU.

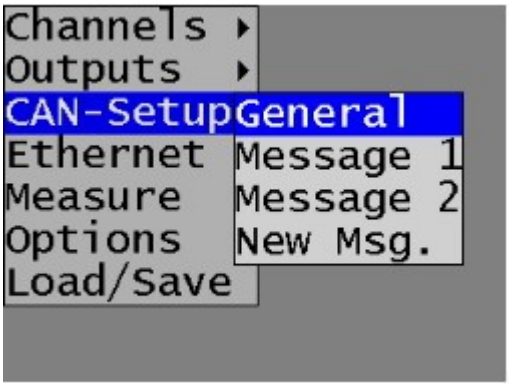
8.5.3 Configure data output

The CLS^x steering sensor allows data output in 2 ways:

- CAN output (CAN Output)
- Analog output

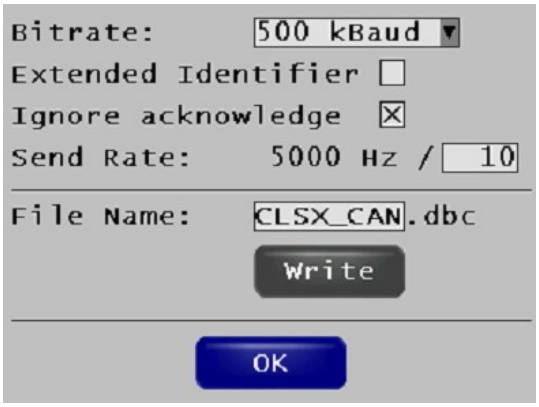
8.5.3.1 CAN output

- Setting the CAN parameters for the CLS^x steering sensor in relation to the possible settings for the CAN bus.
  Select *CAN Setup -> General*



  in order to set the basic parameters.

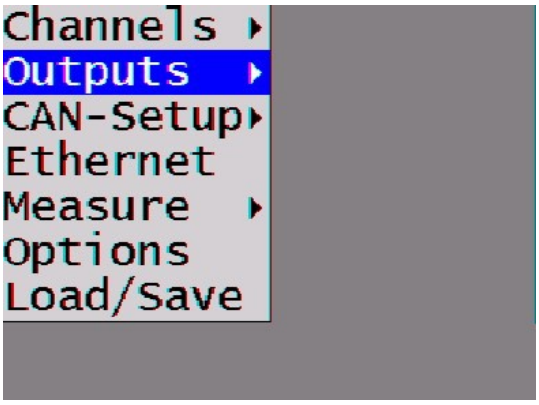
- Select the *Write* button in the *File Name* part to specify the *.dbc* file name for the current CAN configuration.



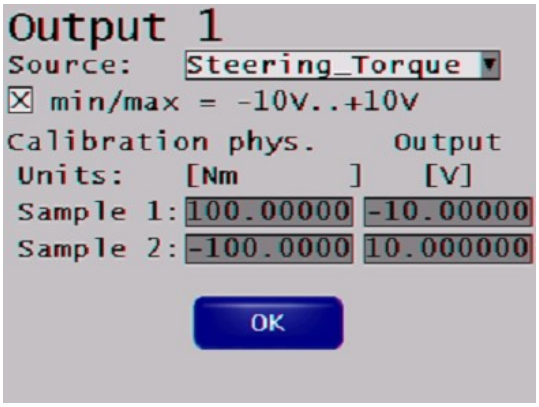
- Export thr .dbc file to your individual DAQ software
  (Export of Configuration/Parameter Files).

8.5.3.2 Analog output

- Select *Outputs* -> *Output X* to configure the analog output no. X (1-6) to configure.



- Select the measurement channel to be output from the Source drop-down menu.



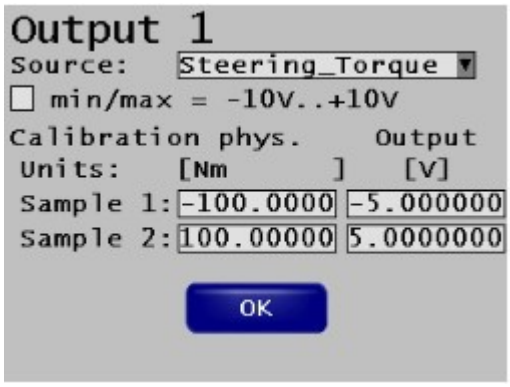
- To determine the measuring range for the signal output select for ±10 V
  min/max = -10 V ... +10 V
  by activating the box.
  To define another measuring range, deactivate this box and enter the desired output voltage range.

Note

The max/min output voltage is ±10 V.

Example

The output voltage range of ±100 Nm is supposed to be ±5 V
please enter the following values:



Note

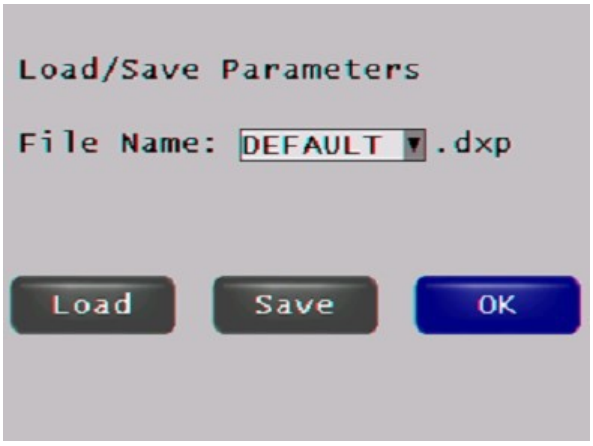
The max. 16 bit resolution of the analog output is only valid for an output voltage range of ±10 V. If the output voltage range is set to a lower value, the resolution is reduced accordingly.

8.5.4 Load/Save Configuration

8.5.4.1 Save the current configuration

- Select *Load/Save*.

- Enter a file name for the *.dxp* file in the *File Name* section.



Note

The configuration saved under *Default.dxp* is automatically loaded when the CLS^{x}-CU is restarted.

- Select *Save* to save the current configuration to the CLS^{x}-CU SD card.
  Confirm this under
  Parameters saved!
  with *OK*.

8.5.4.2 Load a previously saved configuration

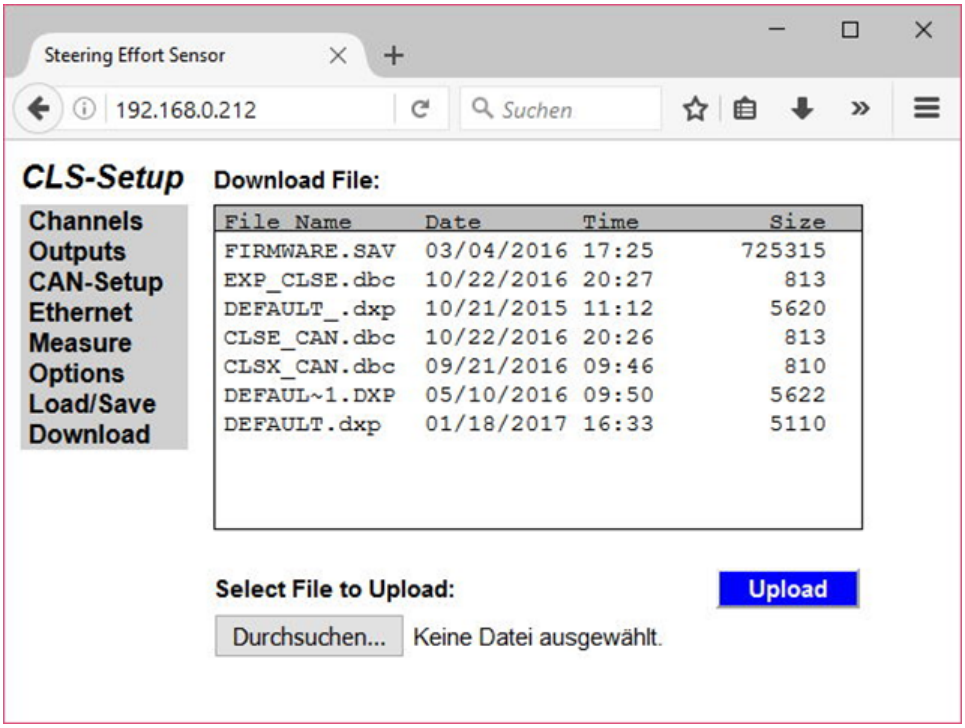
- Select *Load/Save*.

- Open the drop down menu in the *File Name* section and select the desired file from the list.
- Select *Load* and confirm the
  Parameters saved!
  by pressing the *OK* button.

9 Export the configuration/parameter files

9.1 File Exchange via the Ethernet interface

- Connect the CLS^{x}-CU to your computer via Ethernet (Configuration via Ethernet Connection 80) using the blue Ethernet cable.
- Start an internet browser to parameterize the CLS^{x}-CU web configuration.
- Tap on the *Download* menu item.



- To download files from the CLS^{x}-CU, click on the desired file and follow the download dialog of your web browser.
- For uploading files from the CLS^{x}-CU, select the desired file by clicking on it with the *Upload* button.

9.2 File Exchange via the SD Card

All parameter files stored on the SD memory card in the CLSx-CU can be loaded (the SD card slot is on the right side of the CLSx-CU).

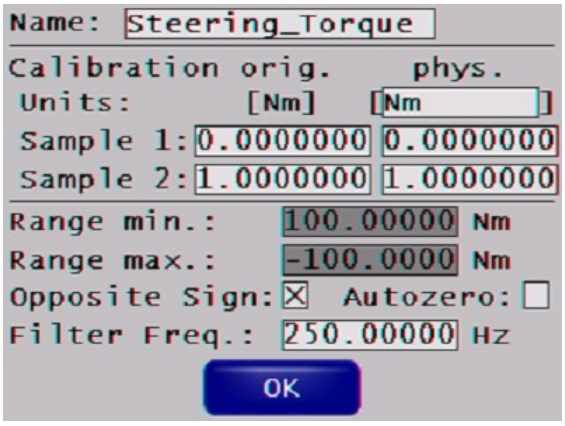
To save these files or to load new ones, change the SD card with the CLSx-CU switched off and insert it into your computer for further processing.

10 Performing a measurement

10.1 Autozero of the steering torque / angle

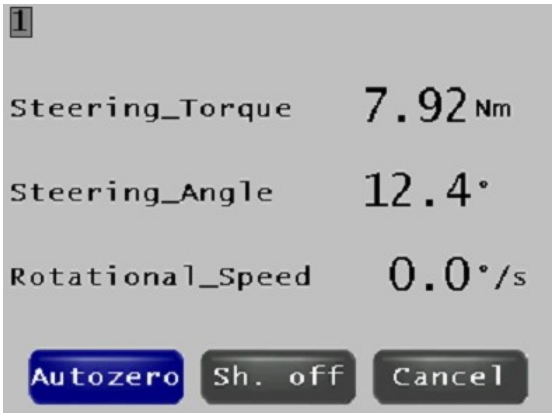
10.1.1 Firmware Autozero

- Select the desired channel for the Autozero:
  Select *Channels -> Torque*.
  Click the *Autozero* Box.

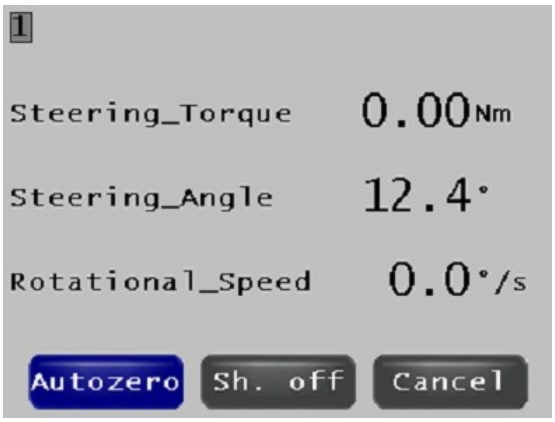


  To save these settings permanently, select *Load/Save* and save the current configuration as *DEFAULT.dxp*.
  Activate *Save* and confirm *Parameters saved!* with *OK*.

- Start the measurement (*Measure -> Start*).



  Activate *Autozero*



  The selected channel is now calibrated to zero.

Note

The Autozero adjustment value of the steering torque channel is permanently stored in the CLS^x and is available again at restart.

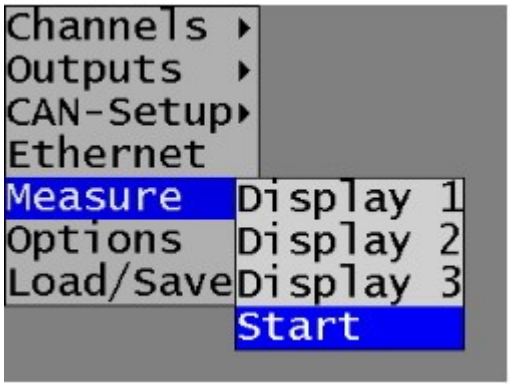
With the reference value option, this also applies to the steering angle.

10.1.2 Autozero via the remote control

- Activate the measurement by *Measure -> Start*.
- To trigger the zero adjustment for the steering torque press the TORQUE button on the remote control.
- To trigger the zero adjustment for the steering angle press the ANGLE button on the remote control.

10.2 Start/Stop measurement

- To start the measurement select
  Measure -> Start

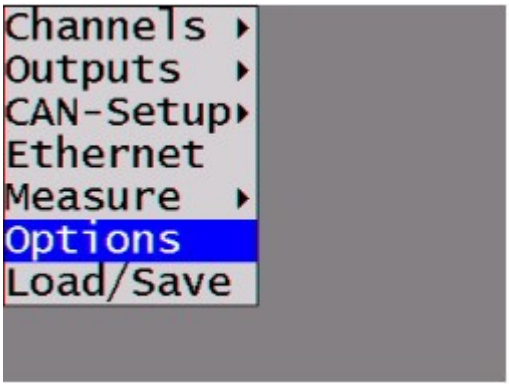


- To stop the measurement select
  Cancel

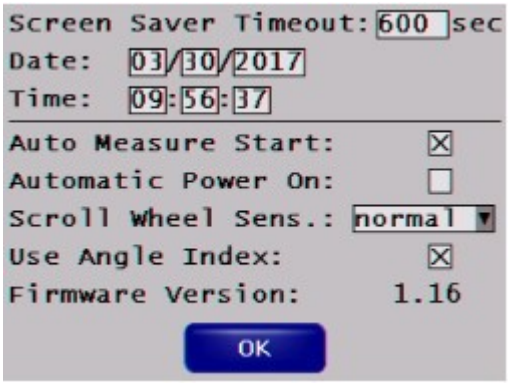
10.3 Setting the reference mark (optional)

With the Reference mark option, the reference point on the CLS^x angle encoder is used as the reference position. Just as the stator part of the angle encoder is fixed to the steering column, this reference point remains constant when the CLS^x system is installed in a vehicle. No autozeroing of the steering angle is required after a restart of the CLS^x CPU. This allows the comparability of measurements with the same vehicle but recorded on different days.

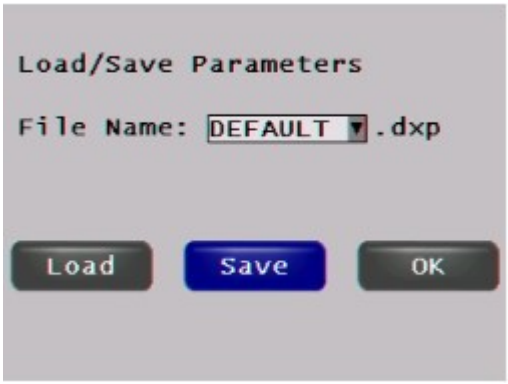
- Select in the CLS^x-CU configuration menu *Options*



- Activate the Use Angle Index box. Confirm with OK.



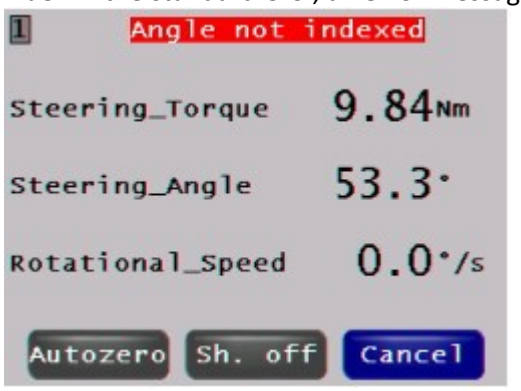
- Save your configuration as Default.dxp in the Load/Save section.



- Before you start the measurement, turn the steering wheel until you hit the reference mark on the stator part of the angle encoder - not until you get any permissible angle signal.

Note

- The reference mark option is activated after the reference mark has been hit on the stator part of the angle encoder.
- The Reference Mark option is not included in the standard CLS^x scope of delivery. If you select *Use Angle Index* in the standard CLS^x, an error message is displayed as follows:



11 Accessory

11.1 Mounting frame

Fig. 13: CLS^x-CU mounting frame (example)

12 Technical Specs

12.1 CLS

Steering Torque		
Parameter	**Value**	**Remarks**
Measuring principle	temperature compensated strain gauge application	
Measurement range	±100 Nm/±200 Nm	others upon request, e.g. ±250 Nm
Accuracy	0.1% FS	
Bandwidth	800 Hz	sampling rate 5 kHz
Filter cut-off frequency	0.034 Hz	

Steering Angle	Value	Remarks
Measuring principle	incremental angle encoder	
Measurement range	±1440 °	
Accuracy	0.045 °	
Bandwidth	800 Hz	sampling rate 5 kHz
Filter cut-off frequency	0.034 Hz	

Steering velocity range (angular velocity)		
Parameter	**Value**	**Remarks**
Measuring principle	Calculated from angle	
Measurement range	±2048 °/s	
Bandwidth	800 Hz	sampling rate 5 kHz
Filter cut-off frequency	0.034 Hz	

Acceleration		
Acceleration x, y and z	in the center of the steering column, measurement range up to 5 g in x, y and z direction	
Accuracy of x, y and z acceleration	0.1% FS	
Rotational acceleration	measurement range ±10000 °/sec^2	
Accuracy of rotational acceleration	0.2% FS	
Bandwidth	800 Hz	sampling rate 5 kHzs
Filter cut-off frequency	0.034 Hz	

General Data		
Parameter	**Value**	**Remarks**
Resolution of all CLS^x signal channels	16 bit	
Sensor height	approx. 30 mm	w/o adaptors
Sensor weight	approx. 0.6 kg	w/o adaptors
Cable length	5 m	length from sensor to control unit
Power consumption	approx. 8.5 W	at 12 V DC
Overload	>100% of the measurement range	
Mech. breaking torque	>500 Nm	
Adaption	special adaption sets for any car or truck manufacturer available	individual adaptor for steering wheel and steering column
Moment of inertia sensor steering wheel or column adaptor	 approx. 3200 g cm^2 typ. approx. 500 g cm^2	
Working temperature steering effort sensor control unit	 -20 °C to +80 °C -20 °C to +65 °C	

Control Unit		
Power supply	9 to 36 V DC	
CAN-Output	freely configurable	
Analog output	freely configurable, output range max. ±10 V	
Auto zero	with push-button for torque and angle at the panel or by remote control	

Index

U

W