IPETRONIK

IPEMEASURE
Instrumentation

IPEmotion PlugIn IPETRONIK-X V02.14.02

July 2020 **02.07.2021**

Contents

1 Important and general information

1.1 Important information (extract)

Please follow these instructions before and during the use and application on any IPETRONIK product!

1.1.1 Safety and Warning instructions

Please follow the instructions **and** information as contained in the user manual!

1. The user can **influence an electronic system by applying the IPETRONIK product**. This might cause risk of personal injury or property damages.
2. The **use and application of the IPETRONIK product is permitted only to qualified professional staff**, as well as, only in appropriate manner and in the designated use.
3. **Before using an IPETRONIK measurement system** in the vehicle it **has to be verified** that **no function of the vehicle, which is relevant for secure operation, might be influenced**:
   - by the installation of the IPETRONIK measurement system in the vehicle,
   - by an potential malfunction of the IPETRONIK system during the test drive.

   In order to avoid possible danger or personal injury and property damages, appropriate actions are to be taken; such actions have to bring the entire system into a secured condition (e.g. by using a system for emergency stop, an emergency operation, monitoring of critical values).

   Please check the following points to avoid errors:

   - Adaption of sensors to components of the electrical system / electronics, brake system, engine and transmission control, chassis, body.
   - Tap of one or several bus systems (CAN, LIN, ETHERNET) including the required electrical connection(s) for data acquisition.
   - Communication with the vehicle's control units (ECUs), especially with such of the brake system and/or of the engine and transmission control (power train control system).
   - Installation of components for remote data transmission (mobiles, GSM/GPRS modems, WiFi and Bluetooth components).

4. IPETRONIK devices are designed for applications in **extended temperature ranges** > 70 °C (158 °F). A high environmental temperature and the module's self-heating may cause burns of the skin when touching the hot surface. In order to avoid the risk of injury we recommend to take care for appropriate safety precautions (e.g. contact protection, covering/enclosure, warning sign, ...)..
5. **Before** directly or indirectly using **the data acquired by an IPETRONIK measurement system to calibrate control units, please review the data regarding to plausibility**.
6. With regard to the application of IPETRONIK products in vehicles during use on public roads the manufacturer and/or registered user of the vehicle **has to ensure that all changes/modifications have no influence concerning the license of the vehicle or its license of operation.**
7. **User does agree to the instructions and regulations as mentioned above.** In case the user does not agree with the instructions and regulations as mentioned above, he has to notify this expressly and immediately in writing to IPETRONIK before confirming the sales contract.

1.1.2 Liability, Warranty, Copyright, License agreement

Limitation of liability

Any liability of IPETRONIK, its representatives, agents and the like, especially with regard to personal injury or damage to property of any kind, shall be excluded (within the legally admissible framework), as far as, the instructions and warnings, as mentioned below, have not been followed.

Warranty

Products, accessories and services have a 24 months warranty.

All product data, specifications, drawings, etc., correspond to the current condition of the indicated creation date. For the purpose of optimizing technical processes and production, some details of our modules and accessory components may be modified at any time without prior notification.

Although the present document has been prepared with the utmost attention to detail, it may not be exempt of misprints, typing or transcription errors. These errors are not covered by any warranty.

1.2 General information

1.2.1 About this manual

This manual describes the X-System structure and how to use the IPETRONIK IPEmeasure modules Mx-SENS2 4, Mx-SENS2 8, Mx-SENS 8, Mx-STG2 and Sx-STG with IPEmotion (PlugIn IPETRONIK-X).

System requirements

PC component	minimum	recommended
Screen resolution	1080 x 800 pixel	1920 x 1200 pixel
Processor	2 GHz	3 GHz Multi-Core
RAM	2048 MB	6144 MB
Storage medium type		SSD
IPEmotion	IPEmotion 2020 R1	IPEmotion 2020 R2

IPEmotion PlugIn IPETRONIK-X

Descriptions in this documentation refer to the current release. In contrast to previous versions (< V02.00), current and subsequent releases also support a configuration and data acquisition with IPETRONIK CAN modules which are connected to the PC by a CAN interface. So far the PlugIn IPETRONIK CAN was necessary for this operation mode. Please note, that modules require the latest firmware.

This PlugIn is supported by IPEmotion 2017 / IPEmotion 2018 (≥ V07.00.00) and Windows 7 / 8.1 / 10 (32 bit and 64 bit systems). Microsoft .NET 4.5.1 Framework is required!

Please follow the recommendations at 5.1 PlugIn IPETRONIK-X .

PTP driver and Windows 7

In case of an error message during the PlugIn installation under Windows 7 (Windows requires a digital signed driver.), Windows needs to be updated in order to ensure the identification of the driver signature certificate. Refer to 5.1.4 PTP driver > Driver signature

Some firewall settings might block the PTP communication. In this case, the PlugIn uses an alternative algorithm to synchronize the measurement between X devices and PC. However, timestamps would be more inaccurate, this should be avoided by configuring the firewall in a way to accept PTP communication.

IPEmotion

Descriptions in this documentation refer to releases with the version numbers from IPEmotion 2015 R1 (V05.00.00) to IPEmotion 2017 R3.1 (V07.02.01).

Firmware

Using the PlugIn IPETRONIK-X V02.00 and higher versions, modules require the following firmware:

- X-Modules: firmware version (≥ V02.00)
- CAN-Modules firmware version (≥ V04.00) Update using CAN download ≥ V02.03.03 and latest M-FW-Update-Library

Refer to 5.1.1 System requirements Firmware PlugIn IPETRONIK-X V02.xx

Software components

that will be installed during PlugIn setup:

- Microsoft Visual C++ 2013 Redistributable
- CAN-Server V01.17.04
- IPETRONIK PTP driver V1.6.0.0

Network adapter

Make sure that the network adapter connected to the Mx/Sx devices is correctly configured as DHCP client!

Depending on the interface settings, the use of several network adapters may cause network communication errors. Please disable unused network adapters at your PC!

CAN interface

IPEcan requires a Firmware version > 2.8!

1.2.2 Legend of used icons

Tip *This icon indicates a useful tip that facilitates the application of the software.*

Information *This icon indicates additional information for a better understanding.*

Attention! *This icon indicates important information to avoid potential error messages.*

1.2.3 Support

Headquarters:

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Limited commercial partnership with its head office in Baden-Baden, registry court HRA No. 201313

IPETRONIK Verwaltungs-GmbH Baden-Baden is an individually liable society,
registry court Mannheim HRB No. 202089

CEOs: Andreas Wocke, Christian Buchholz

Technical support and product information

www.ipetronik.com e-mail: support@ipetronik.com

2 System

2.1 Features

The IPEmotion PlugIn IPETRONIK-X offers you the ability to use IPEmeasure Ethernet technology within IPEmotion. The devices of the Mx-/Sx-Series in combination with IPEmotion software allows an unlimited and clear use of the IPEmotion main navigation tabs Acquisition, View, and Analysis.

The Ethernet technology of the X-Series modules offers the following user benefits:

- Significantly higher performance compared to CAN
- No separate hardware for the connection of a notebook / a PC is required
- High market acceptance in office communication and industry

The X-Serie modules, basing on the well-proven IPETRONIK M and SIM modules have been extended to meet higher requirements, e.g. in the field of the service strength (RLDA = Road Load Data Acquisition). The specific properties are:

- Higher channel sampling rates (Mx-SENS up to 10 kHz, Sx-STG up to 40 kHz, Mx-SENS2 4 fast up to 400 kHz)
- Higher aggregate sampling rates (Mx-SENS: up to 80 kHz, Sx-STG: up to 320 kHz, Mx-SENS2 4 up to 400 kHz)
- > 4 MHz total sampling rate within a system:
- Support of higher numbers of fast channels
- Smaller housing construction

IPETRONIK X system distinguishes currently between the following devices:

- Mx-SENS 8, Mx-SENS2 4, Mx-SENS2 4 (PlugIn ≥ V02.01 required)
- Sx-STG, Mx-STG2 (PlugIn ≥ V02.04 required)

Each device is an independent acquisition system and can be used as a stand-alone devices, as well as, in combination with other modules (Mx-SENS and Sx-STG in the system network).

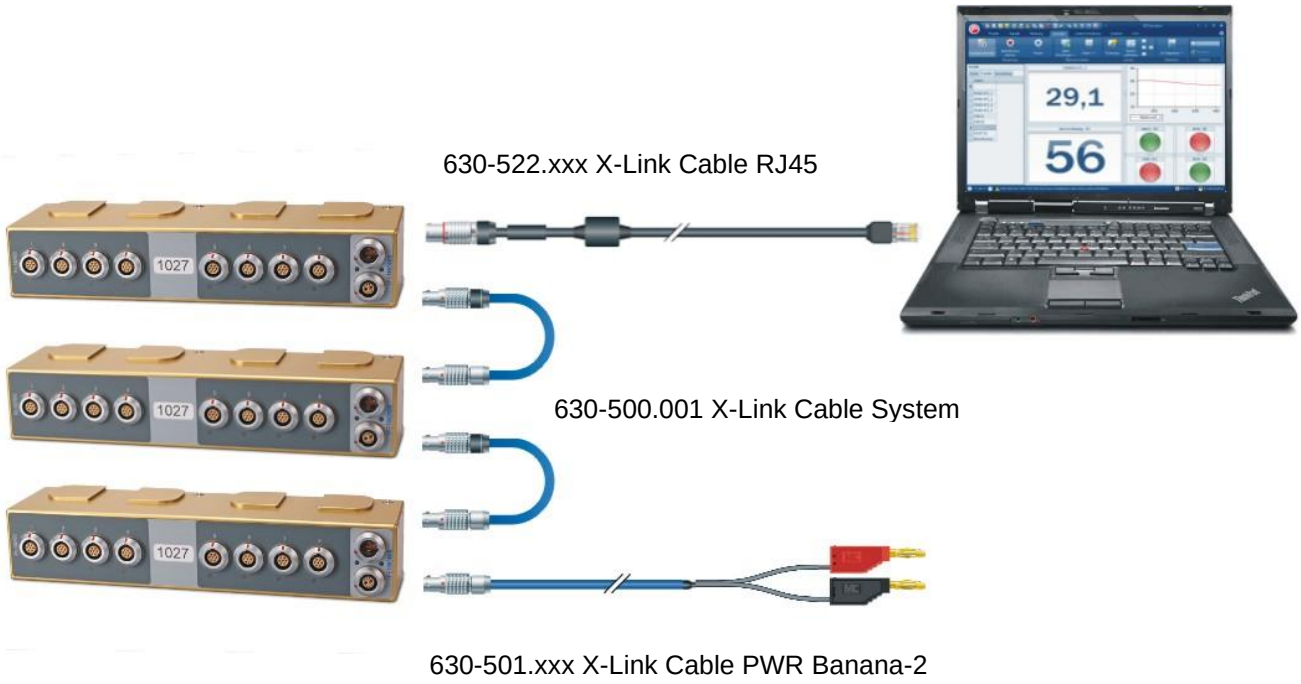
2.2 Accessories

2.2.1 USB2ETH Mx/Sx

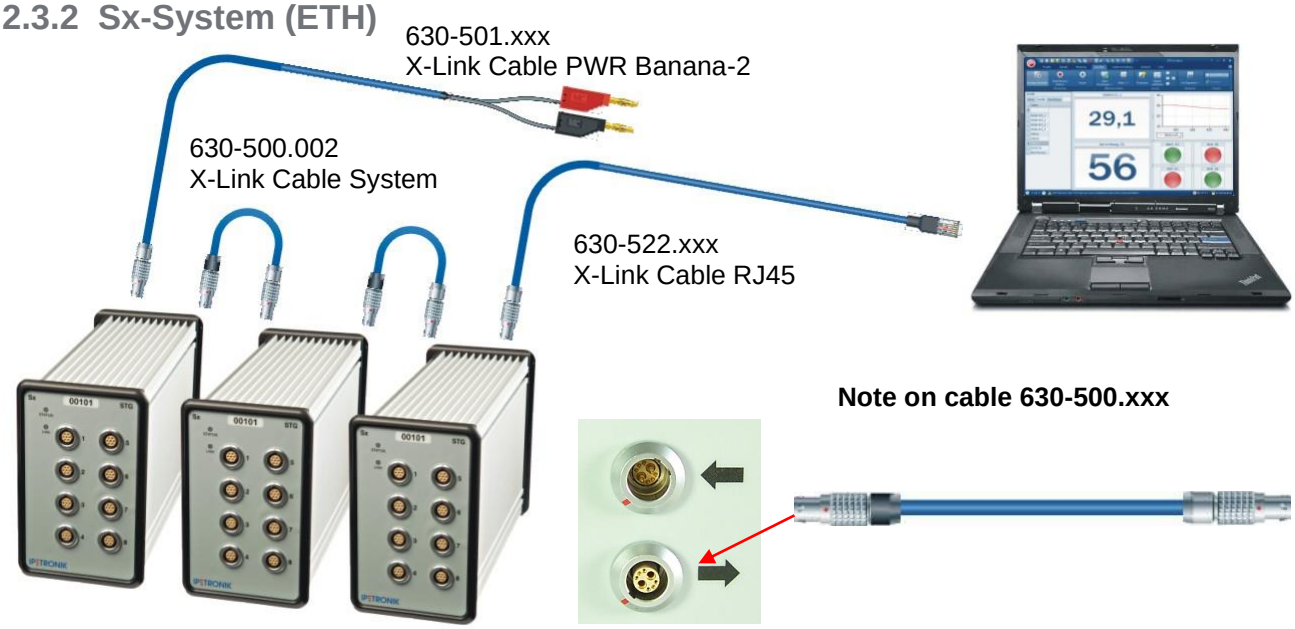
It is possible to use the USB2ETH adapter for notebooks and PCs which don’t have any free Ethernet interface, This adapter allows a connection of the module chain to a free USB interface.

2.3 System overview

2.3.1 Mx-System (ETH)



2.3.2 Sx-System (ETH)

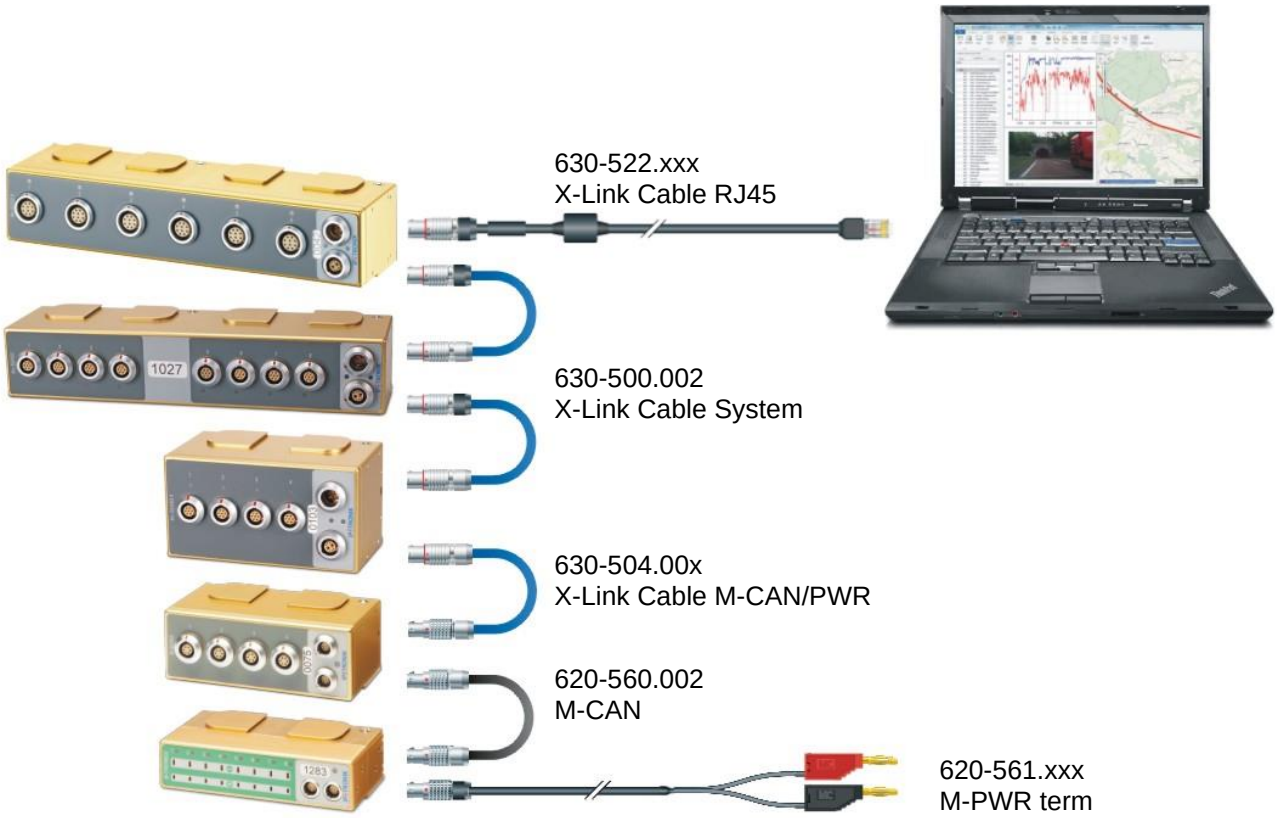


First daisy-chain all modules using the respective cables, then switch on the power supply!

You can mix Mx- and Sx-Modules within a system.
Connection cable 630-500.003 (length 30 cm) can be also used for mixed Mx/Sx systems.

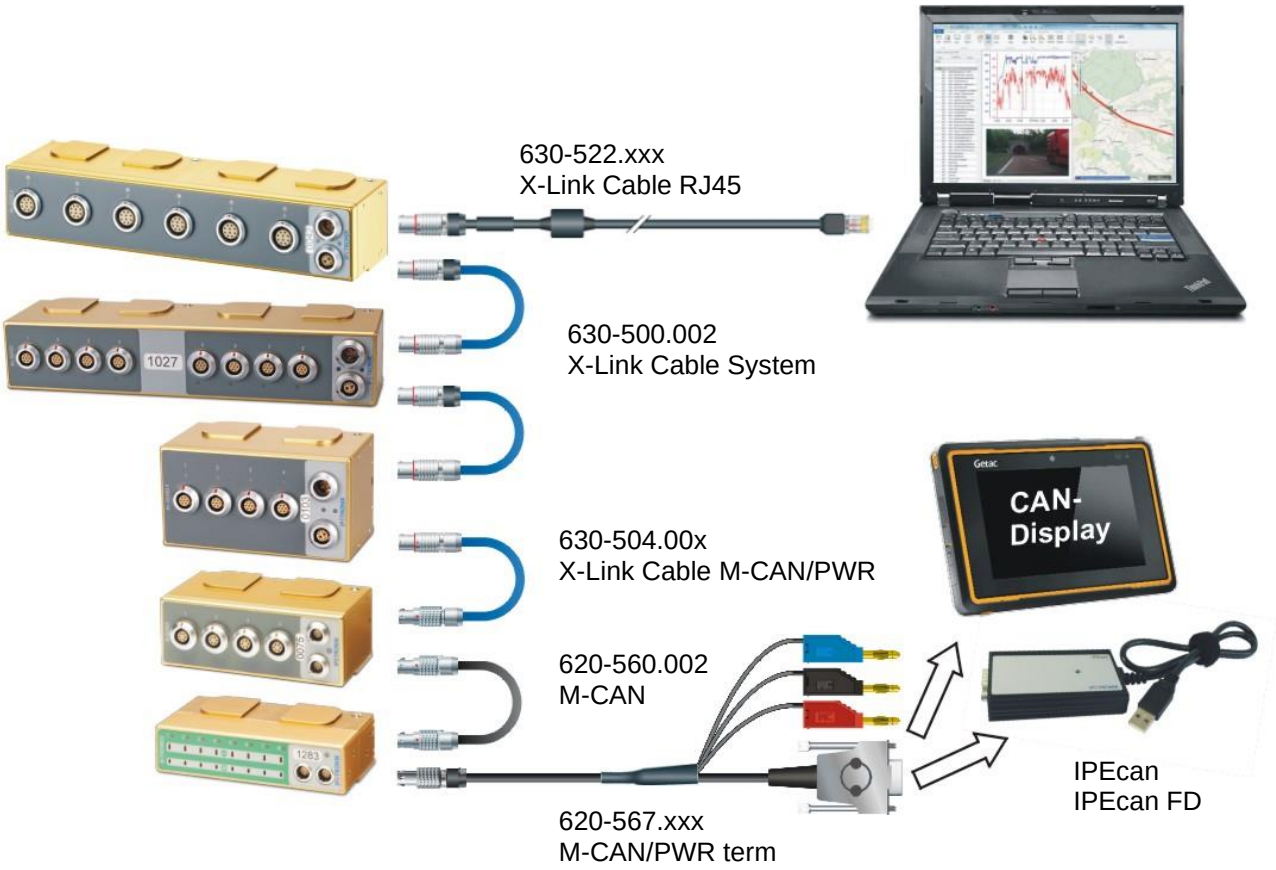
Synchronization PlugIn IPETRONIK X with Mx-SENS / Sx-STG 25 - 50 µs
(Depends on the accuracy of the HF input filter)

2.3.3 X-System with CAN modules (ETH)



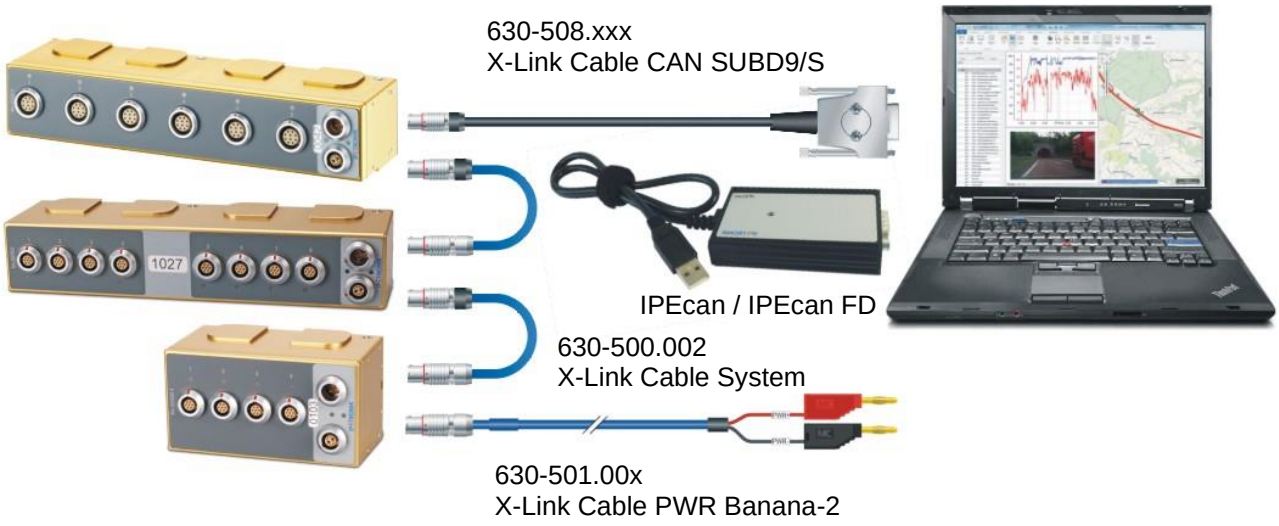
PlugIn synchronization between IPETRONIK X / IPETRONIK-CAN *1 - 2 ms*
PlugIn synchronization between IPETRONIK X / CAN Measurement *1 - 2 ms*

2.3.4 X-System with CAN modules (ETH + CAN)



Depending on the channel settings, X-Series modules support data output to Ethernet and/or CAN bus. In addition to the Ethernet connection, CAN data can be collected by a PC with CAN interface or a CAN data display at the other end of the daisy chain.

2.3.5 Using X modules within a CAN-System



X-Series modules can be used as CAN device within a CAN bus system with other devices (M-Series). Although the configuration of the X modules requires an Ethernet connection, the CAN bus is used for data acquisition. We recommend to setup the CAN bus data acquisition by the import of a CANdb file (xxx.dbc). Detecting and setting up X devices via CAN bus (PlugIn IPETRONIK-X, IPETRONIK-CAN is not supported).

2.4 Connecting two X-Systems to the PC

By using two network adapters, a simultaneous operation of two independent X-Sytems connected to one notebook / PC is supported. Please consider, that the IP ranges have to differ from one another.

Proceed as follows:

- Connect the 1st system and define its IP range.
- Connect the 2nd system and configure an IP range that differs from the 1st system.

2.5 System LED indication

2.5.1 Status

STATUS LED	Meaning
Off	No power supply
Green continuous	Power supply switched on, ready for operation
Green 1 Hz 25% / 75% flashing	Measurement running
Green 5 Hz 50% / 50% flashing	Boot up, Initialization, Firmware download running
Red continuous	Internal error (hardware)
Red 1 Hz 50% / 50% flashing	Communication error, e.g. connector unplugged resp. not fully plugged in, cable broken or squeezed, faulty bus communication Firmware download successfully completed
Redt 5 Hz 25% / 75% flashing	Bus overload
Green/Red 1 Hz 50% / 50% flashing	Supply voltage out of range, check voltage level

2.5.2 Link

LINK LED	Meaning
Off	Status IN: Ethernet disconnected Status OUT Ethernet disconnected
Green 1 Hz 50% / 50% flashing	Status IN: Ethernet connected Status OUT Ethernet disconnected
Yellow 1 Hz 50% / 50% flashing	Status IN: Ethernet disconnected Status OUT Ethernet connected
Green/Yellow 1 Hz 50% / 50% flashing	Status IN: Ethernet connected Status OUT Ethernet connected

2.6 Automatic Rebooting / Restarting of X Devices

Beginning with V02.14.00, the plugin is able to reboot X devices in certain situations.

The intention is to support the user in such cases, that changing certain device or system settings require restarting the whole device chain. In these case the reboot is done automatically by the software such that it is no further action is needed by the user (here, powering off and on the X device chain after changing certain settings and doing a hardware initialisation).

The automatic reboot is done per (X) system (ethernet connector). It requires, that ALL X devices that are connected on the same ethernet interface have a firmware of V02.12.00 or newer.

The reboot command is sent in following situations:

Changing the IP-Address settings from the PlugIn's options dialog (and at least one device responded on that command)

At the end of the hardware initialisation.

In the situation of (1), the command is sent always!

This is due to the fact, that it possible to call the command for changing the IP-Address independent from any configuration, hardware detection or initialisation - therefore it is unknown, how many or which devices are connected to the bus or not.

In the situation of (2), the command is executed directly after the hardware initialisation in following situations:

- The system is a X system, meaning there is at least one X-Device in the system
- All configured X devices do have a firmware version of V02.12 or newer installed and
- Prior to the initialisation on of the following has been done
- The system parameter "Internal time synchronisation" has been changed
- The front number of any X device has been changed
- The device type has been changed into any of the X device types
- The configuration has been loaded and is yet not initialised
- A device has been manually added

The options dialog has been closed with "OK" (this automatically reloads the configuration and such the situation above is encountered)

However, there are some limitations and drawbacks:

The X-PlugIn does not know anything about the devices, that are NOT in the configuration but are connected to the same ethernet connector.

Therefore, it is possible, that all devices in the configuration have a firmware V02.12 or newer, but there are further devices connected with firmware smaller than V02.12. In such situations, the PlugIn does send the reboot command on the bus. However, the devices not supporting the command do not restart. This leads into the situation, that the IP addresses / bus master / PTP operation mode are set new in the rebooting devices but not in the others. After such situation, the device chain has to be restarted manually by powering off and on the whole chain. Otherwise, the communication is corrupted and the whole chain is no more working!

Further, the reboot is always executed in above situations since the plugin does not know the device states (hardware) after loading or manually editing a a configuration. Therefore, the reboot is done always.

The rebooting itself takes approximately 6 seconds. If changing the IP address, the process takes a bit longer, since the PlugIn does not know, which devices are connected and has no information about the time, when the devices are restarted and ready for measurement again. Therefore, a time out value of 10s is used here.

2.7 CAN ID range notification

A warning message is added to channels with a manually configured CAN ID in the range of 0x0280 ... 0x02FF. Since this range is being reserved for communication by IPETRONIK measurement devices, configuring these for measurement messages leads to problems in the general communication (measurement start, stop, detection, initialisation and resetting).
However, if such IDs are configured, a CANdb measurement with e.g. the IPEmotion PlugIn Protocols is possible (a device restart might be needed).

2.8 Resetting Sensor Excitation after Change of Sensor Mode

If the sensor mode of a channel has been changed, the sensor excitation (if supported) is automatically changed to 0 V. This is done to prevent sensors from potential damage.

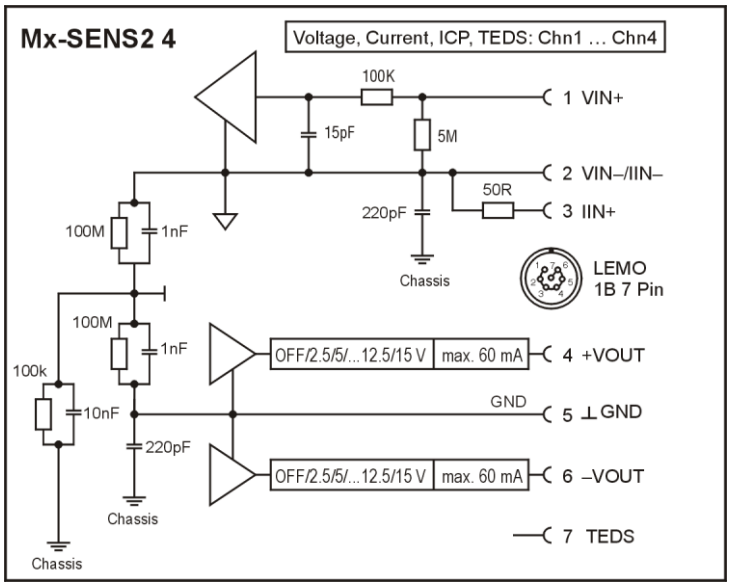
Note that there are some channels and sensor modes with a fix sensor excitation. If the sensor mode is changed to such mode (e.g. IEPE) or on such channel (e.g. channels 1-20 of a M-SENS 24), the specific sensor excitation is applied as has been before.

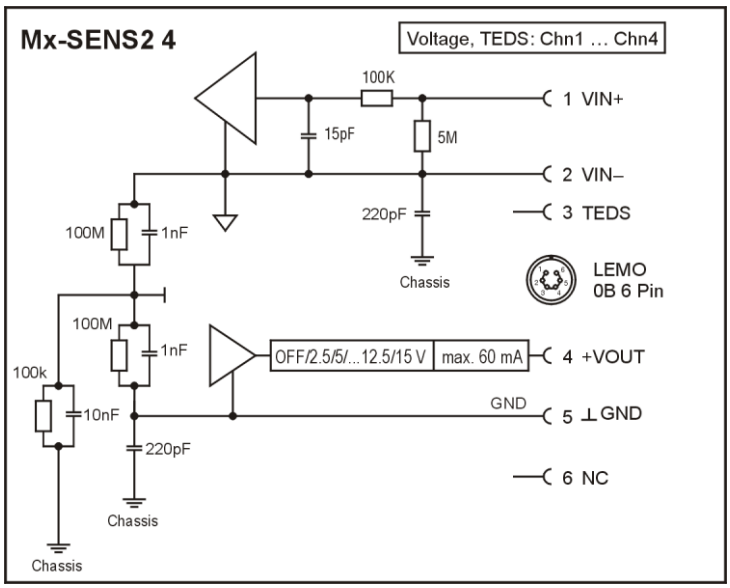
3 X-LINK modules

3.1 Mx-SENS2 4 fast

Fast 4-Channel Analog Measurement Device with Excitation

- 4 fast analog signal inputs for voltage / current supporting channel sample rates up to 400 kHz
- 4 galvanically isolated sensor excitations (up to ±15 V, ±60 mA), supply voltage selectable
- 10 bipolar voltage measurement ranges
- Current measurement range ±20 mA
- ICP mode supporting IEPE sensors (Integrated Electronics Piezo Electric)
- TEDS support
- Offset and target value adjust functions
- Status LED at each input channel (sensor break indication and configuration aid)
- Measurement data output to Ethernet using XCPonEthernet
Measurement data output to CAN
- Complete galvanic isolation (inputs, excitation, CAN, Ethernet, power supply, enclosure)
- Designed for automotive in-vehicle use
- Toolless module to module connection

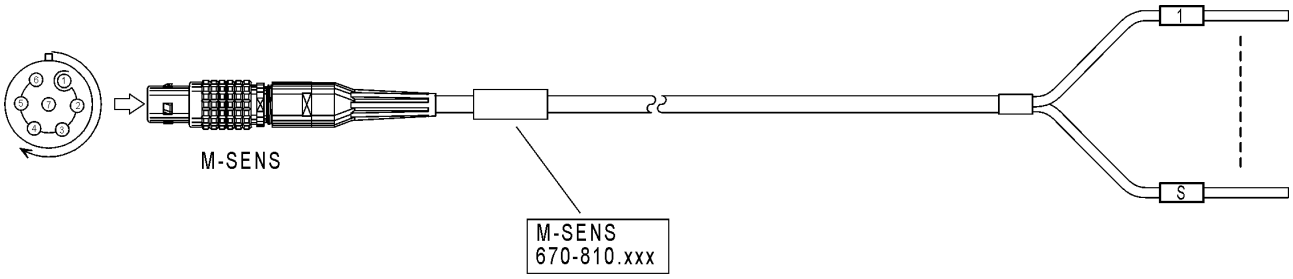


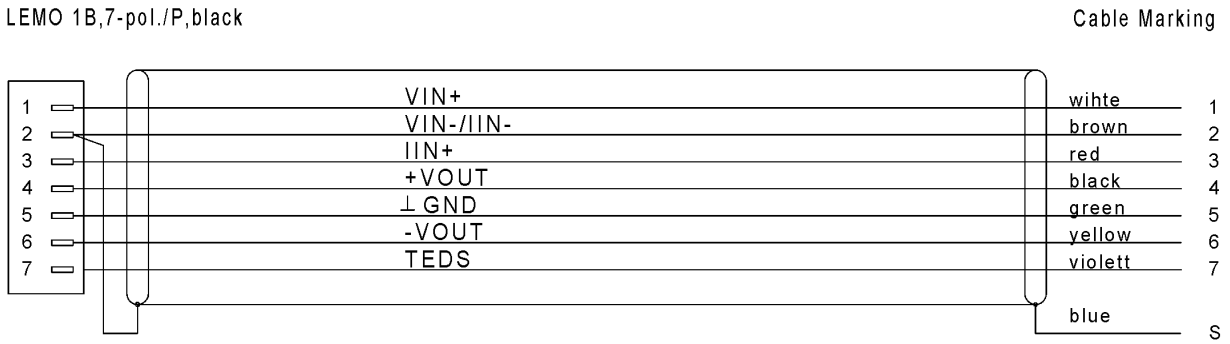


3.1.1 Input cables

Standard (open)

670-810.xxx M-SENS (TEDS) Cable open





Specific (assembled, open)

620-695.xxx Mx-SENS 1B 7pin Adapter BNC/S-ICP/TEDS for ICP measurement

670-807.xxx SENS 1B 6pin Cable open (compatible to 670-810, no TEDS support)

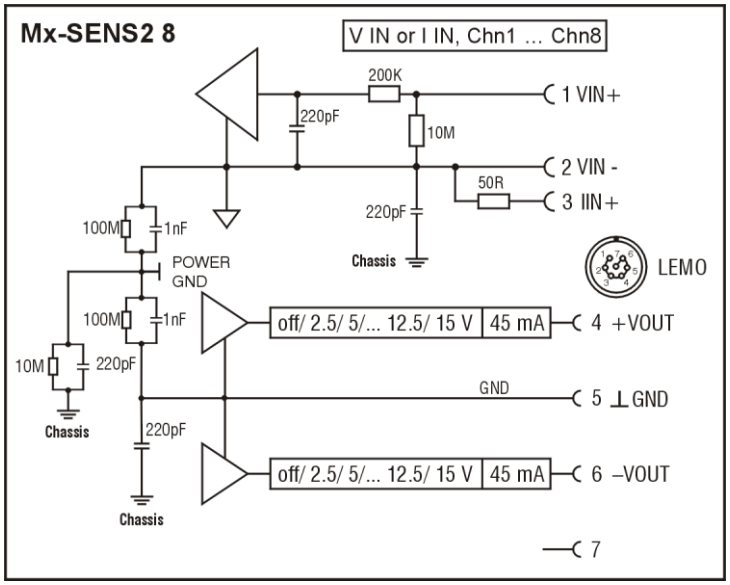
600-861.xxx SENS 1B 6pin Cable Banana 6 (compatible to 670-810, no TEDS support, all lines connected to banana plugs)

600-864.xxx SENS 1B 6pin Cable Banana 2 (VIN+/VIN- via banana plugs)

3.2 Mx-SENS2 8

Fast 8-Channel Analog Measurement Device with Excitation

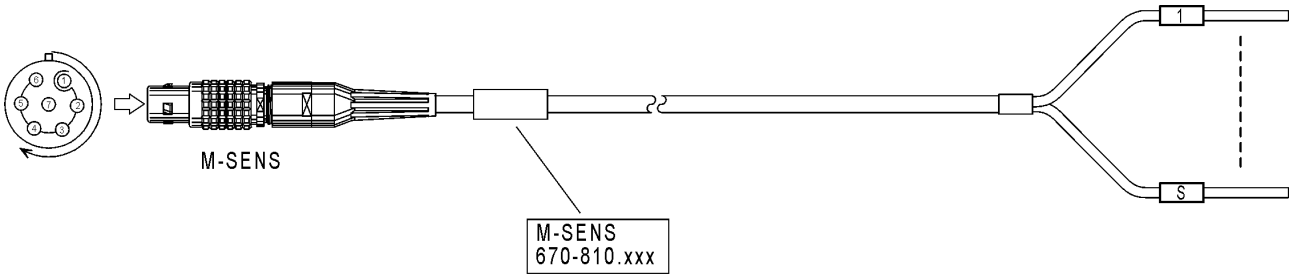
- 8 analog signal inputs for voltage / current
- 8 separate sensor excitations, supply voltage individually selectable (up to ±15 V, ±45 mA)
- 12 unipolar and 12 bipolar measuring ranges
- 2 current measuring ranges
- 10 mV range, e.g. for stanby current applications
- Offset and target value adjust functions
- Status LED at each input channel (channel identification / channel error idication)
- Measurement data output to Ethernet using XCPonEthernet, Measurement data output to CAN
- Complete galvanic isolation (inputs, excitation, CAN, Ethernet, power supply, enclosure)
- Designed for automotive use
- Toolless module to module connection

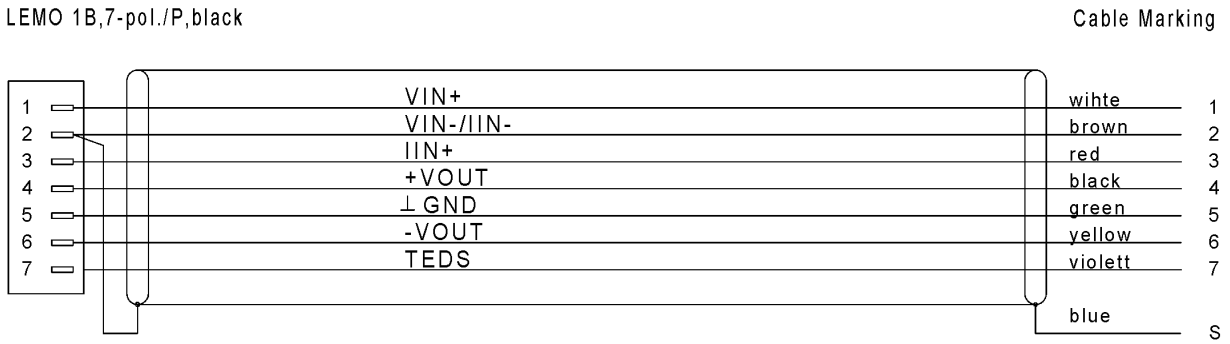


3.2.1 Input cables

Standard (open)

670-810.xxx M-SENS (TEDS) Cable open





Specific (assembled, open)

670-807.xxx SENS 1B 6pin Cable open (compatible to 670-810, no TEDS support)

600-861.xxx SENS 1B 6pin Cable Banana 6 (compatible to 670-810, no TEDS support, all lines connected to banana plugs)

600-864.xxx SENS 1B 6pin Cable Banana 2 (VIN+/VIN- via banana plugs)

3.3 Mx-STG2

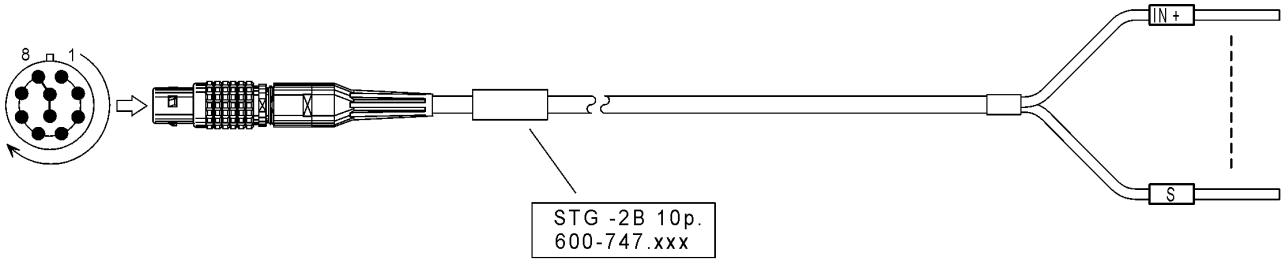
Fast 6-Channel Analog Measurement Device with Excitation

- 6 fast analog signal inputs for voltage supporting channel sample rates up to 100 kHz
- STG measurement mode supports different bridge types
- 6 separate dual sensor excitations (up to ±5 V, up to ±45 mA)
- Offset and target adjust functions within the measurement range
- Shunt check
- 6-wire and 4-wire bridge connection (full / half bridge)
- Internal resistors for bridge completion selectable
- TEDS class 2 support (input connectors Lemo 2B 10-pin)
- Channel status-LED for channel identification and error indication
- Measurement data output to Ethernet using XCPonEthernet, Measurement data output to CAN
- Complete galvanic isolation (signal inputs, excitation, CAN, Ethernet, power supply)
- Designed for automotive applications
- Toolless module to module connection

3.3.1 Input cables

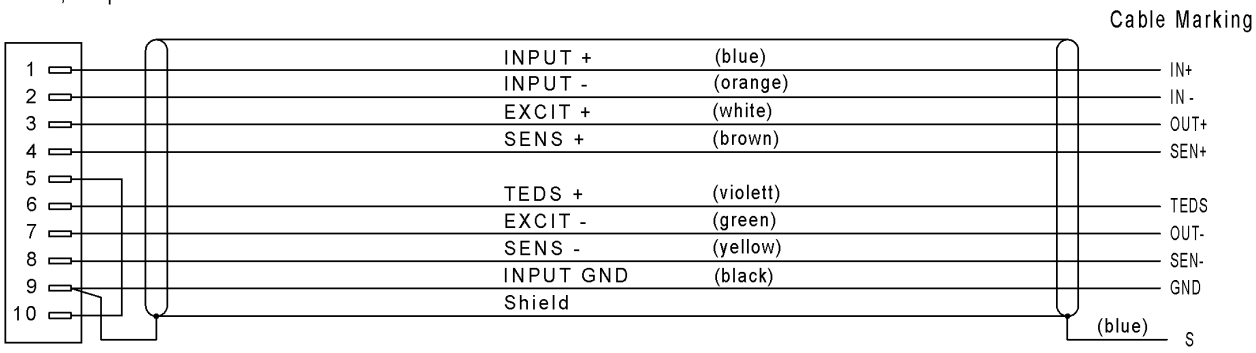
Standard (open)

600-747.xxx STG 2B 10p. Cable open (10-pin TEDS)



XXX = Length (dm)

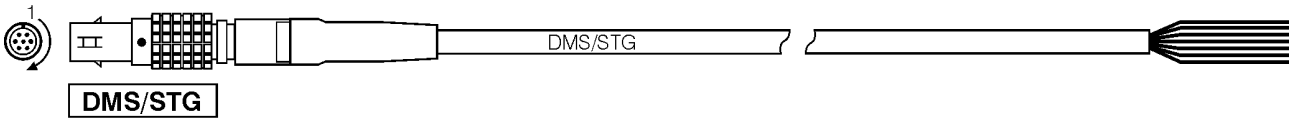
LEMO 2B, 10-pol./P



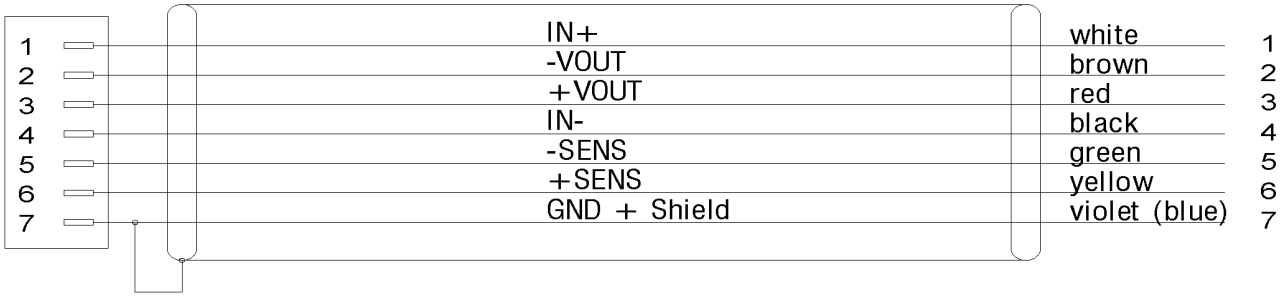
If you do not use IPETRONIK input cables, please pay attention to the correct pin configuration!

The connection Pin 5 <> Pin 10 is always required as the module identifies by this, when a sensor has been plugged in.

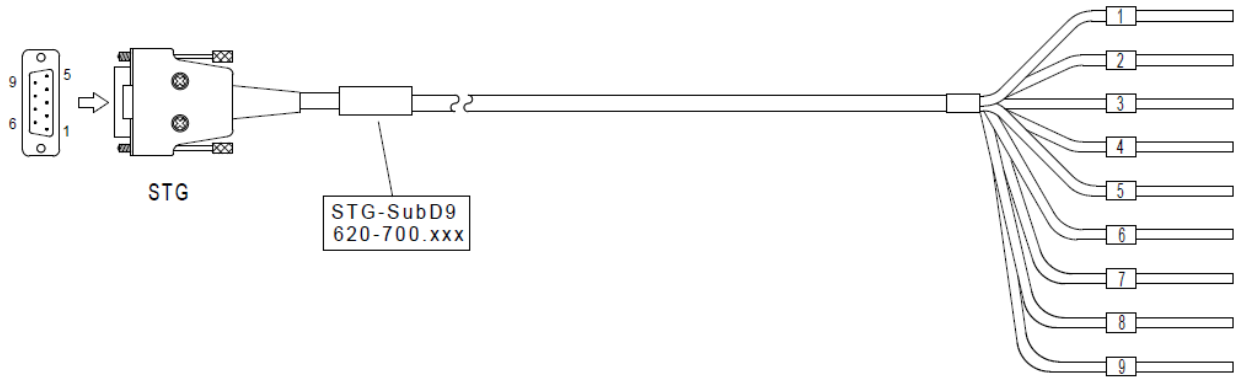
670-850.xxx DMS/STG Cable open (7-pin DMS compatible)

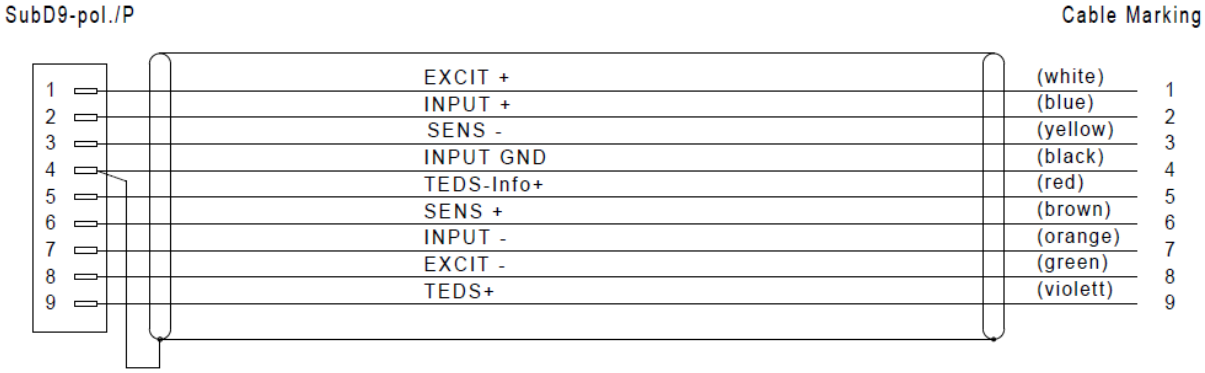


Lemo-Stecker 1B, 7-pol. (schwarz)
Lemo-male 1B, 7-pol. (black)



620-700.xxx STG SubD9/P Cable open (9-pin DSUB)





3.3.2 STG operation mode

Application

- Measurement with strain gages (full / half / quarter bridges)
- Measurement with sensors which provide a fixed ground (GND) reference (with no definite ground reference the input may drift, because of the high impedance of the signal input)

Features

- Bridge connection supporting 2-wire, 4-wire and also 6-wire technique
- Bridge completion using internal resistors
- Shunt check in configuration mode as well as in measurement mode
Adjustable shunt resistor 5 kΩ to 500 kΩ (minimum and maximum value depends on the current setting of the excitation voltage), connectable to each bridge section (quadrant).
The complete adjust data can be output to the software (CSV format) and can be loaded and applied to the sensor for verification of stability and repeatability.
- Sensor break detection for all 6 wires (IN [up to an input range of 200 mV], VOUT, SENS) indication by output of –Full Scale

Measurement ranges

- ±5 mV to ±1 V in 8 bipolar measurement ranges
- Measurement ranges ±5/ 10/ 20/ 50/ 100/ 200 mV, ±0.5/ 1,0 V

Adjustable differential voltages

- Mx-STG2 adjusts offset voltages up to ±0.9 x Full Scale (FS).

Common Mode Rejection Ratio (CMRR)

To guarantee a correct measurement of the input signal over the complete measurement range (uncropped signal amplitude), the input voltage on IN+ resp. IN- relating to the GND potential should not exceed 4 V.

Sensor excitation

- selectable bipolar voltage ±0.50 / ±1.25 / ±2.50 / ±5.00 V
- current load up to 45 mA per channel

Bridge completion

Refer to Sx-STG Bridge completion

Shunt check

Refer to Sx-STG Shunt check

TEDS

Refer to Sx-STG TEDS Class 2

3.4 Sx-STG

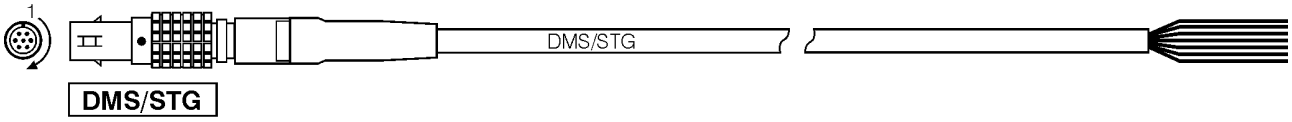
Fast 8-Channel Multi-Analog Measurement Device with Excitation

- 8 analog signal inputs for voltage measurement
- Measurement modes: SENS, STG, ICP, individual for each input
- 8 separate dual sensor excitations (up to ±15 V, up to ±45 mA)
- Offset and target adjust functions by hardware (maximum accuracy)
- Shunt check
- 6-wire and 4-wire bridge connection (full / half bridge)
- Internal resistors for bridge completion selectable
- TEDS support (input connectors Lemo 2B)
- Channel status-LED for channel identification and error indication
- Measurement data output to Ethernet using XCPonEthernet, Measurement data output to CAN
- Complete galvanic isolation (signal inputs, excitation, CAN, Ethernet, power supply)
- Designed for automotive in-vehicle use
- Toolless module to module connection as option

3.4.1 Input cables

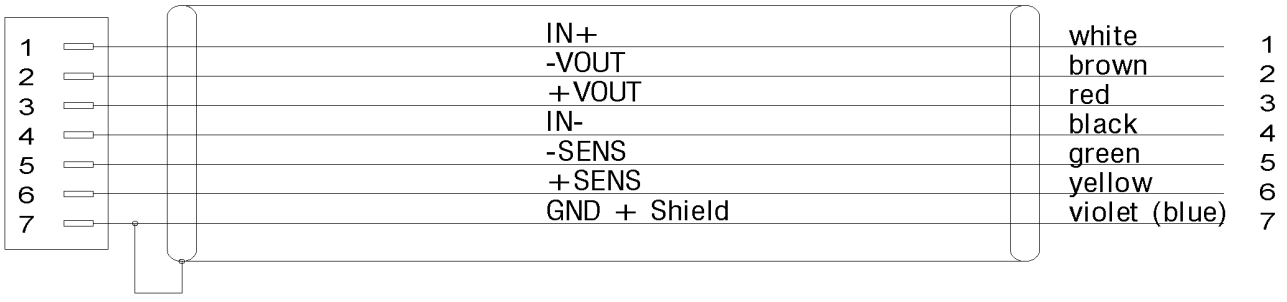
Standard (open)

670-850.xxx DMS/STG Cable open (7-pin DMS compatible)

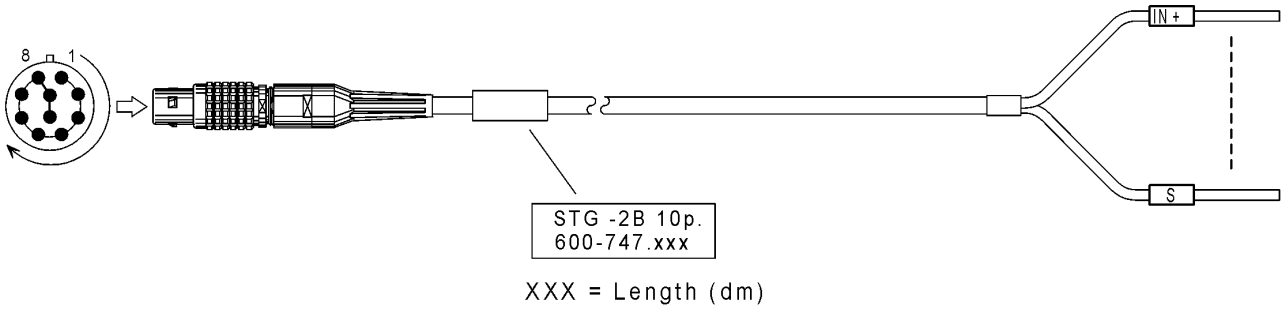


DMS/STG

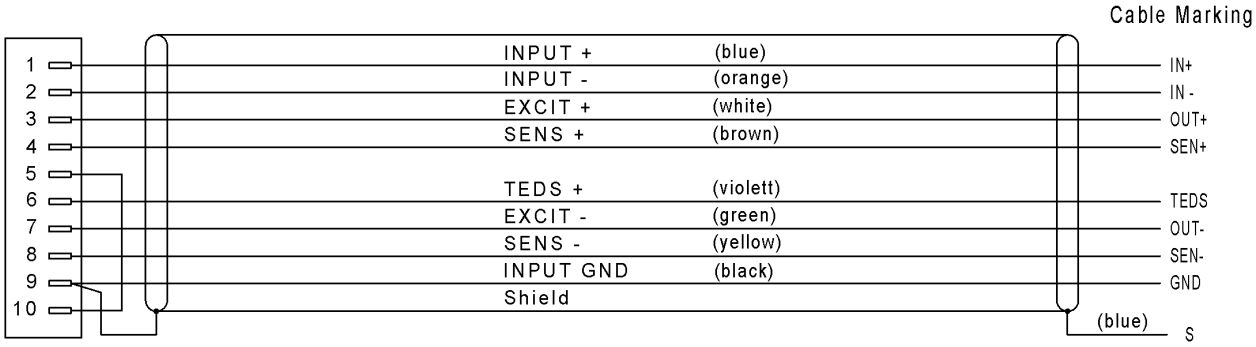
Lemo-Stecker 1B, 7-pol. (schwarz)
Lemo-male 1B, 7-pol. (black)



600-747.xxx STG 2B 10p. Cable open (10-pin TEDS)



LEMO 2B, 10-pol./P



If you do not use IPETRONIK input cables, please pay attention to the correct pin configuration!

The connection Pin 5 <> Pin 10 is always required as the module identifies by this, when a sensor has been plugged in.

3.4.2 Signal input modes

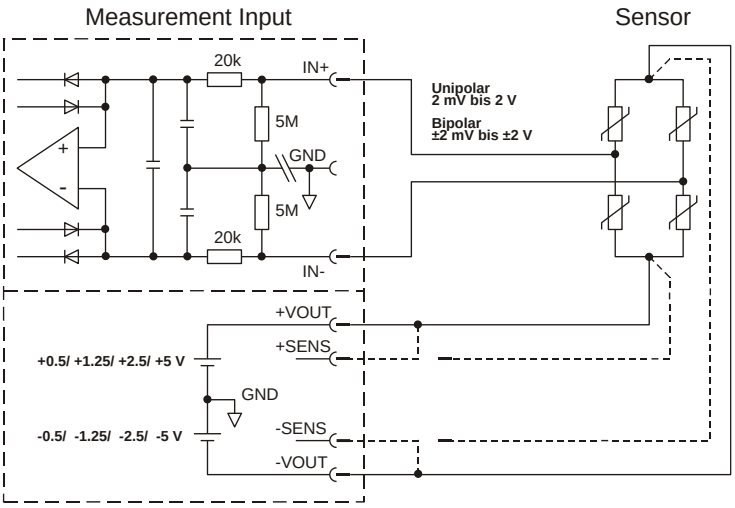
Each input channel can be set to one of three different signal input modes:

- **STG mode** strain gage applications (4-wire and 6-wire bridge connection)
- **SENS-Mode** sensors with integrated amplifier unit (3-wire, 4-wire connection), and common voltage measurement
- **ICP-Mode** ICP sensors (Integrated Circuit Piezoelectric, eg. acceleration transducers)

STG-Mode

Application

- Measurement with strain gages (full / half / quarter bridges)
- Measurement with sensors which provide a fixed ground (GND) reference (with no definite ground reference the input may drift, because of the high impedance of the signal input)



Features

- Bridge connection supporting 2-wire, 4-wire and also 6-wire technique
- Bridge completion using internal resistors
- Shunt check in configuration mode as well as in measurement mode

Adjustable shunt resistor 5 kΩ to 500 kΩ (minimum and maximum value depends on the current setting of the excitation voltage), connectable to each bridge section (quadrant).
The complete adjust data can be output to the software (CSV format) and can be loaded and applied to the sensor for verification of stability and repeatability.

- Sensor break detection for all 6 wires (IN [up to an input range of 200 mV], VOUT, SENS) indication by output of –Full Scale

Measurement ranges

- 0 ... 2 mV to 0 ... 2 V in 2 mV steps
- ±2 mV to ±2 V in 2 mV steps

Adjustable differential voltages (hardware adjust)

STG measurement ranges		STG measurement ranges		STG adjust ranges
unipolar min	unipolar max	bipolar min	bipolar max	Full Scale (FS) means the upper range limit of the corresponding measurement range
2 mV	30 mV	±2 mV	±30 mV	±3125 mV ±0,9 FS
32 mV	62 mV	±32 mV	±62 mV	±62.50 mV ±0,9 FS
64 mV	124 mV	±64 mV	±124 mV	±125.00 mV ±0,9 FS
126 mV	250 mV	±126 mV	±250 mV	±250.00 mV ±0,9 FS
252 mV	500 mV	±252 mV	±500 mV	±500.00 mV ±0,9 FS
502 mV	1000 mV	±502 mV	±1000 mV	±1000.00 mV ±0,9 FS
1002 mV	2000 mV	±1002 mV	±2000 mV	±2000.00 mV ±0,9 FS

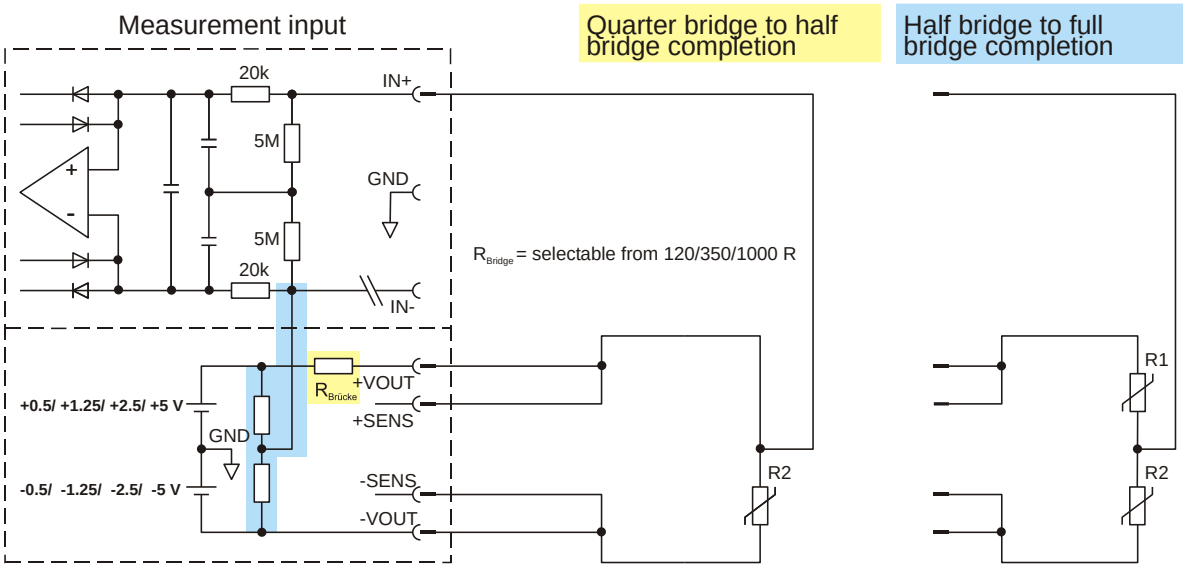
Common Mode Rejection Ratio (CMRR)

To guarantee a correct measurement of the input signal over the complete measurement range (uncropped signal amplitude), the input voltage on IN+ resp. IN- relating to the GND potential should not exceed 4 V.

Sensor excitation

- selectable bipolar voltage ±0.50 / ±1.25 / ±2.50 / ±5.00 V
- current load up to 45 mA per channel

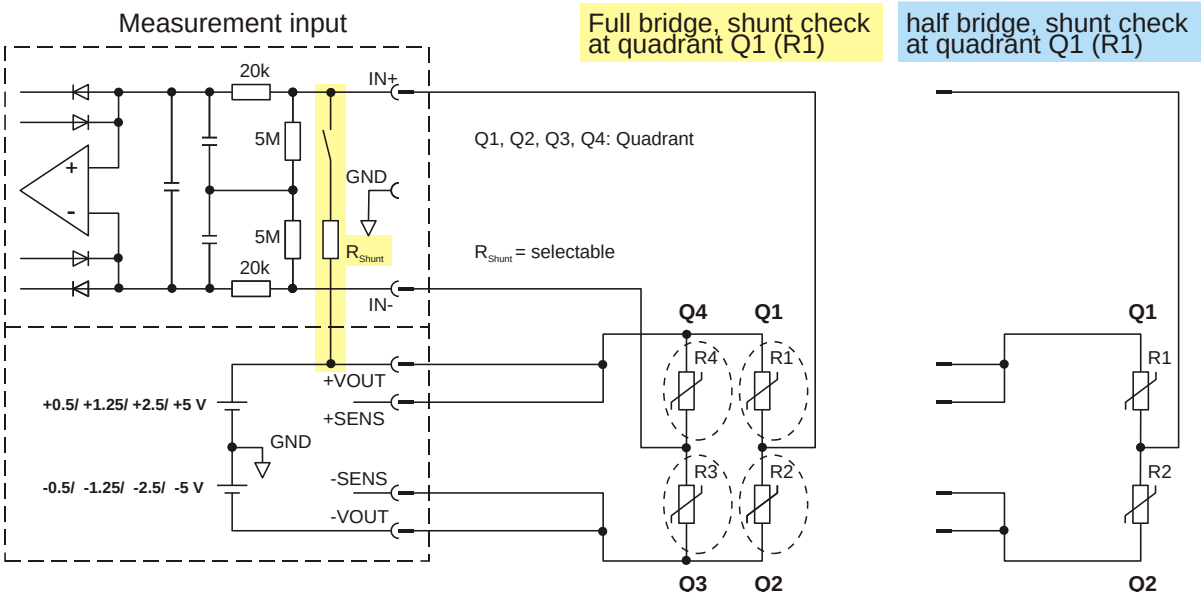
Bridge completion



Sx-STG supports the following types of bridge completion:

- quarter bridge to full bridge (fixed half bridge + selectable supplementation resistor)
- half bridge to full bridge (fixed half bridge)

Shunt check



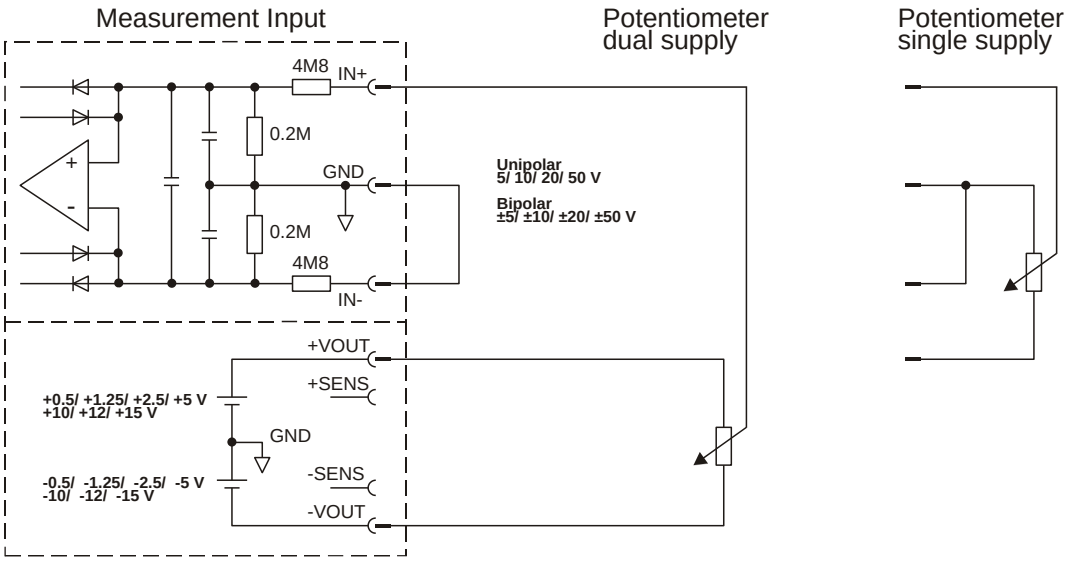
With the shunt check an internal resistor is temporarily connected to one quadrant (section) or consecutively to all sections of the bridge circuit. This has a definite affect on the output of the bridge. Is the shunt check executed before start and after the end of each measurement task, the correct function (offset, gain, stability) of the sensor can be validated by comparing the results.

The shunt check can be initiated during

- the configuration mode
- the measurement mode

The parameters of the shunt check can be output in CSV format to the software to be stored and used later on. In order to identify the shunt check results within the data record, start and end of the shunt check process is marked with a series of -FS (Minus Full Scale) values.

SENS-Mode



Applications

- Measurement with sensors without a direct ground (GND) reference
- Voltage measurement up to ±50 V

Features

- Sensor connection supporting 3-wire and 4-wire technique
- Sensor break detection for the 4 wires (IN, VOUT)

indication by output of –Full Scale

Measurement ranges

- 0.01 / 0.02 / 0.05 / 0.1 / 0.2 / 0.5 / 1 / 2 / 5 / 10 / 20 / 50 V
- ±0.01 / ±0.02 / ±0.05 / ±0.1 / ±0.2 / ±0.5 / ±1 / ±5 / ±10 / ±20 / ±50 V

Adjustable differential voltages (hardware adjust)

SENS measurement ranges		SENS adjust ranges
unipolar	bipolar	
5 V	±5 V	±2.25 V
10 V	±10 V	±4.50 V
20 V	±20 V	±9.00 V
50 V	±50 V	±22.50 V

Common Mode Rejection Ratio (CMRR)

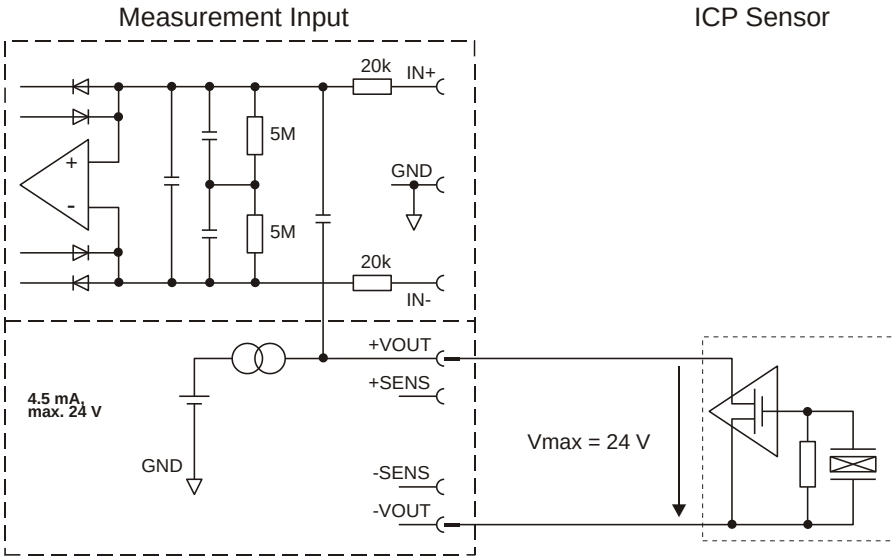
To guarantee a correct measurement of the input signal over the complete measurement range (uncropped signal amplitude), the input voltage on IN+ resp. IN- relating to the GND potential should not exceed the limits listed in the table below.

SENS measurement ranges		max. input voltages
unipolar	bipolar	IN+, IN- related to channel GND
5 V	±5 V	±20 V
10 V	±10 V	±20 V
20 V	±20 V	±40 V
50 V	±50 V	±100 V

Sensor excitation

- adjustable unipolar voltage 0.50 / 1.25 / 2.50 / 5.00 / 10.00 / 15.00 V
- adjustable bipolar voltage ±0.50 / ±1.25 / ±2.50 / ±5.00 / ±10.00 / ±12.00 / ±15.00 V
- current load up to 45 mA per channel

ICP-Mode



Applications

- Measurement with ICP sensors (Integrated Circuit Piezoelectric), mainly dynamic acceleration transducers
- Other piezo electric sensors (e.g. condenser microphone) can be supported

Features

- DC decoupling through input capacitor
- Output of the actual measurement value depending on the configured sampling rate (output rate to LAN). In order to avoid measurement errors (aliasing) it may be reasonable to set the sampling rate to a higher frequency.
- High speed regulation for sensor excitation current

Measurement ranges

- ±0.1/ ±0.2/ ±0.5/ ±1.0/ ±2.0/ ±5.0 V
- Frequency response 5 Hz … 16 kHz

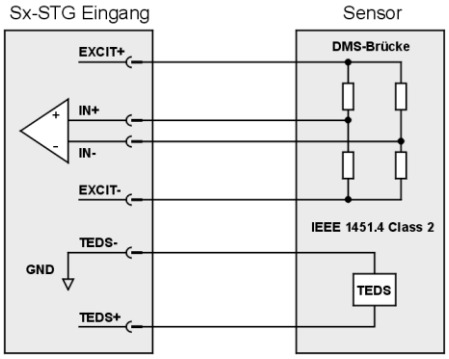
Sensor excitation

- regulated supply current of typically 4.5 mA,

at a maximum off-load voltage of approx. 24 V

3.4.3 TEDS Class 2

The LEMO 2B version of Sx-STG is capable of supporting the use of Transducer Electronic Data Sheet (TEDS) enabled transducers. As a globally recognized industry Plug & Play standard, TEDS is defined under IEEE 1451.4 and distinguishes between two interface classes.
As soon as the input connector is plugged in, the Sx-STG module automatically detects Class II TEDS sensors (e.g. multi-wire interfaces with bridge-type sensors) and is able to read out sensor-specific data about the TEDS +/- interface, using a serial, master/slave model of communication.



3.4.4 Channel LED indication

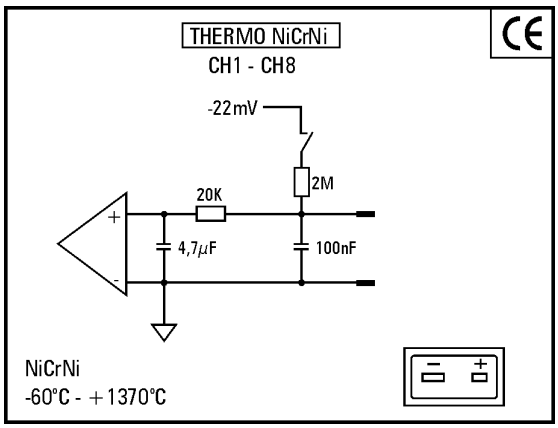
Channel LED	Meaning
Off	Device start up, channel inactive
Yellow 1 Hz flashing	Identification of the selected channel during configuration.
Yellow continuous	Waiting for user action! Sensor has been pluged in, but channel has not been initialized resp. channel is still inactive
Green continuous	OK - Signal measurement is running. (Sensor connected)
Red 1 Hz flashing	Error - source of fault could be: - over-current on excitation detected - sensor break or bridge break detected - counter overflow - general hardware error
Red continuous	No sensor pluged in although channel is active

4 CAN modules

4.1 M-THERMO2

8-Channel Temperature Measurement for K-Type Thermocouples

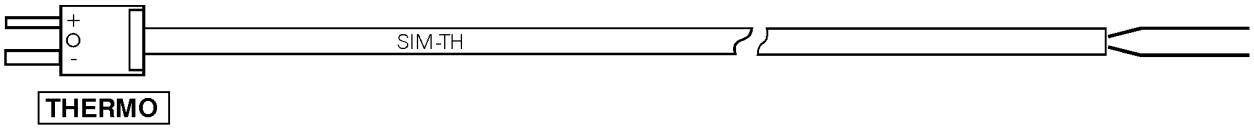
- 8 Thermocouple measurement inputs type K (NiCr/NiAl)
- Cold junction compensation per channel
- Separate ADC for each channel
- Status LED at each input channel (sensor break indication and configuration aid)
- Measurement data output to CAN
- Complete galvanic isolation (inputs, CAN, power supply, enclosure)
- Designed for engine compartment applications
- Toolless module to module connection



4.1.1 Input cables

Standard (open)

600-888.xxx SIM-TH-MIN Cable open



Anschlußbelegung / Connection

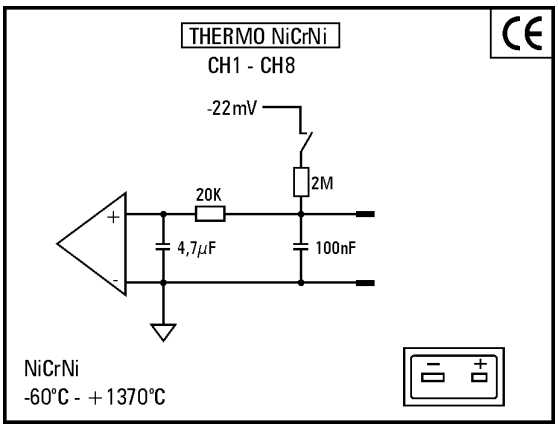
SUB-MIN-Stecker, 2-pol. (grün)
SUB-MIN-male, 2-pol. (green)

Pin-Nr. Pin-№	Bezeichnung Designation	Litze-Nr. / Farbe Wire-№ / Colour
+	NiCr	grün / green
-	Ni	weiß / white

4.2 M-THERMO2 u

8-Channel Universal Thermocouple Inputs

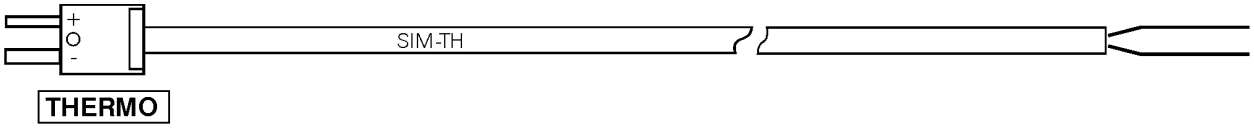
- 8 Universal thermocouple inputs supporting type J, K, N, R, S, T, E
- Cold junction compensation for each channel
- Separate ADC for each channel
- Status LED at each input channel (sensor break indication and configuration aid)
- Measurement data output to CAN
- Complete galvanic isolation (inputs, CAN, power supply, enclosure)
- Designed for automotive use
- Toolless module to module connection



4.2.1 Input cables

Standard (open)

600-888.xxx SIM-TH-MIN Cable open



Anschlußbelegung / Connection

SUB-MIN-Stecker, 2-pol. (grün)
SUB-MIN-male, 2-pol. (green)

Pin-Nr. Pin-Nº	Bezeichnung Designation	Litze-Nr. / Farbe Wire-Nº / Colour
+	NiCr	grün / green
-	Ni	weiß / white

4.3 M-UNI2

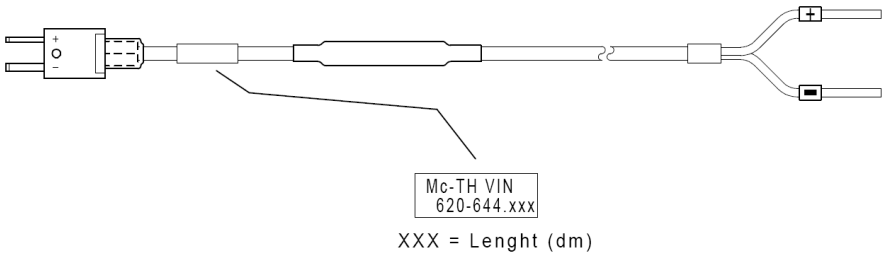
8-Channel Multi Input for K-Type Thermocouples and Voltage

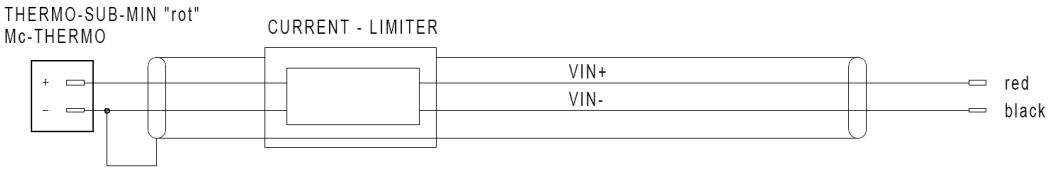
- 8 analog measuring inputs for:
- K-Type thermocouples (NiCr/NiAl)
- Voltage up to ±30 V
- Cold junction compensation per channel
- Separate 24 Bit ADC for each channel
- Status LED at each input channel (sensor break indication and configuration aid)
- Measurement data output to CAN
- Complete galvanic isolation (inputs, CAN, power supply, enclosure)
- Designed for engine compartment applications
- Toolless module to module connection

4.3.1 Input cables

Standard (open)

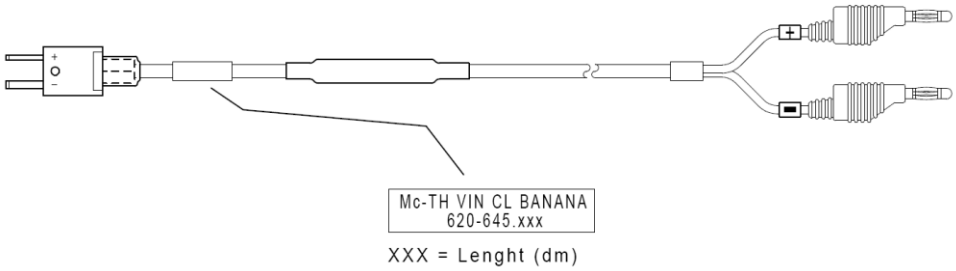
620-644.xxx Mc-THERMO VIN CL Cable open

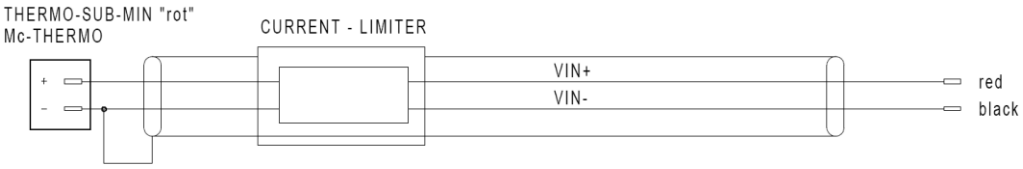




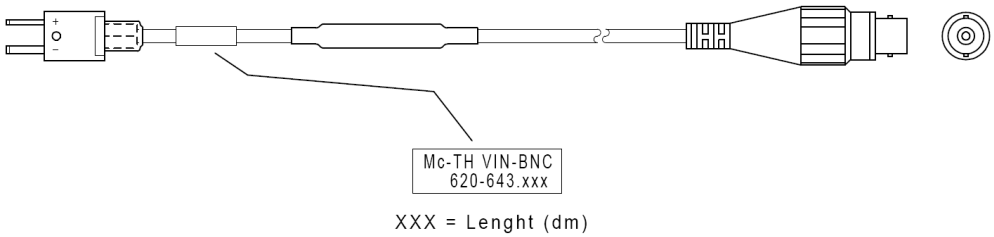
Specific (assembled)

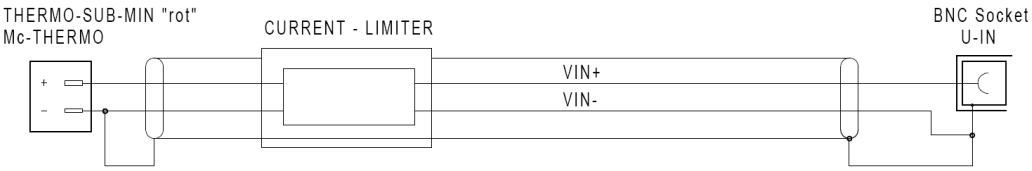
620-645.xxx Mc-THERMO VIN CL Cable Banana





620-643.xxx Mc-THERMO VIN CL Cable BNC/S





4.4 M-TDC

8-Channel Thermocouple Measurement

- 8 Thermocouple measurement inputs type K (NiCr/NiAl)
- Cold junction compensation per channel (RTD)
- Separate 24 bit ADC for each channel
- Complete galvanic isolation (inputs, CAN, power supply, enclosure)
- Designed for engine compartment applications
- Direct connection of thermocouple cables (no plugs required)
- Toolless module to module connection

4.4.1 Input cables

Standard (open)

Thermocouple cable

- Type K accuracy class 1 - DIN IEC 584 (1.5°C)
- Teflon based shell material
- Shell material operating temperature range -190 …. 260 °C (-310 … 500 °F)
- Cable core: 7 line wires à Ø 0.2 mm
- Cable cross section Ø 0.22m²
- Accessory: Pincer

4.5 M-RTD2

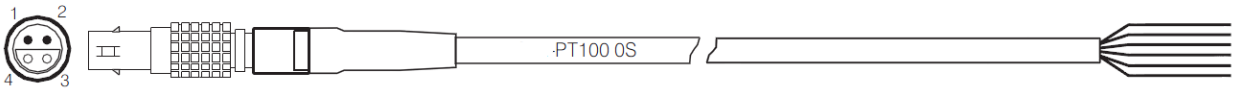
4-Channel RTD Temperature Input

- 4 measurement inputs for RTD
- Measurement data output to CAN
- Complete galvanic isolation (inputs, excitation, CAN, power supply, enclosure)
- Designed for engine compartment applications
- Toolless module to module connection

4.5.1 Input cables

Standard (open)

670-937.xxx PT100/RTD 0S Cable open

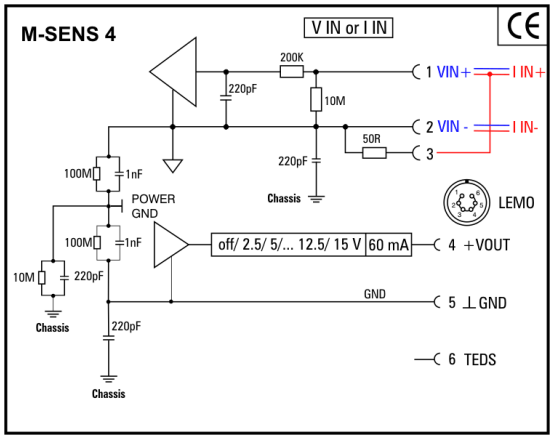


Anschlußbelegung / Connection		
Lemo-Stecker 0S, 4-pol. (schwarz) Lemo-male 0S, 4-pol. (black)		
Pin-Nr. **Pin-№**	**Bezeichnung** **Designation**	**Litze-Nr. / Farbe** **Wire-№ / Colour**
1 (P)	PT IN +	1 white
2 (P)	I OUT+	2 brown
3 (S)	PT IN -	3 red
4 (S)	I OUT-	4 black
Chassis	Shield	S (Shield, thick) blue

4.6 M-SENS2

4-Channel Analog Input with Sensor Excitation

- 4 measurement inputs for voltage / current
- 4 separate sensor excitations, supply voltage individually selectable (up to 15 V, 60 mA)
- 12 unipolar and 12 bipolar measuring ranges
- TEDS support (optional)
- Measurement data output to CAN
- Complete galvanic isolation (signal inputs, excitation, CAN, power supply, enclosure)
- Designed for engine compartment applications
- Toolless module to module connection



4.6.1 Input cables

Standard (open)

670-807.xxx SIM-SENS Kabel offen (M-SENS, M-SENS2)

Anschlußbelegung / Connection

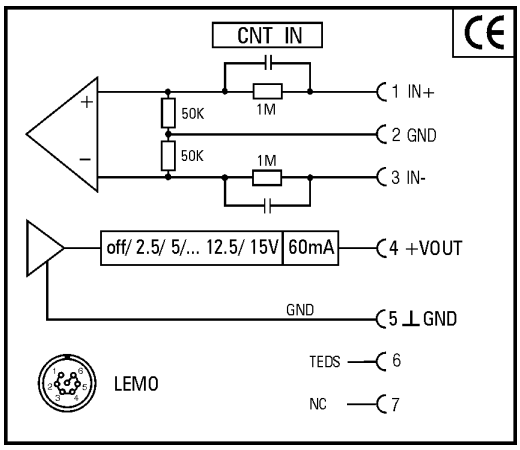
Lemo-Stecker 1B, 6-pol. (schwarz)
Lemo-male 1B, 6-pol. (black)

Pin-Nr. / Pin-№	Bezeichnung / Designation	Litze-Nr. / Farbe / Wire-№ / Colour
1	VIN +	1 white
2 Shield	VIN -/ IIN -	2 brown
3	IIN +	3 red
4	+ VOUT	4 black
5	⊥GND	5 green
6	- VOUT	6 yellow
		S (Shield, thick) blue

4.7 M-CNT2

4-Channel Universal Counter with Sensor Excitation

- 4 signal inputs with adjustable ON and OFF thresholds
- Measurement modes: frequency from period duration, period duration, pulse duration, pause duration, duty cycle, event counter, detection of rotating direction (mode frequency and event counter)
- 4 separate sensor excitations, supply voltage individually selectable (up to 15 V, 60 mA)
- Status LED at each input channel indicates signal processing
- Measurement data output to CAN
- Complete galvanic isolation (signal inputs, excitation, CAN, power supply)
- Designed for engine compartment applications
- Toolless module to module connection



4.7.1 Input cables

Standard (open)

670-858.xxx CNT/FRQ-IN Cable open

Anschlußbelegung / Connection

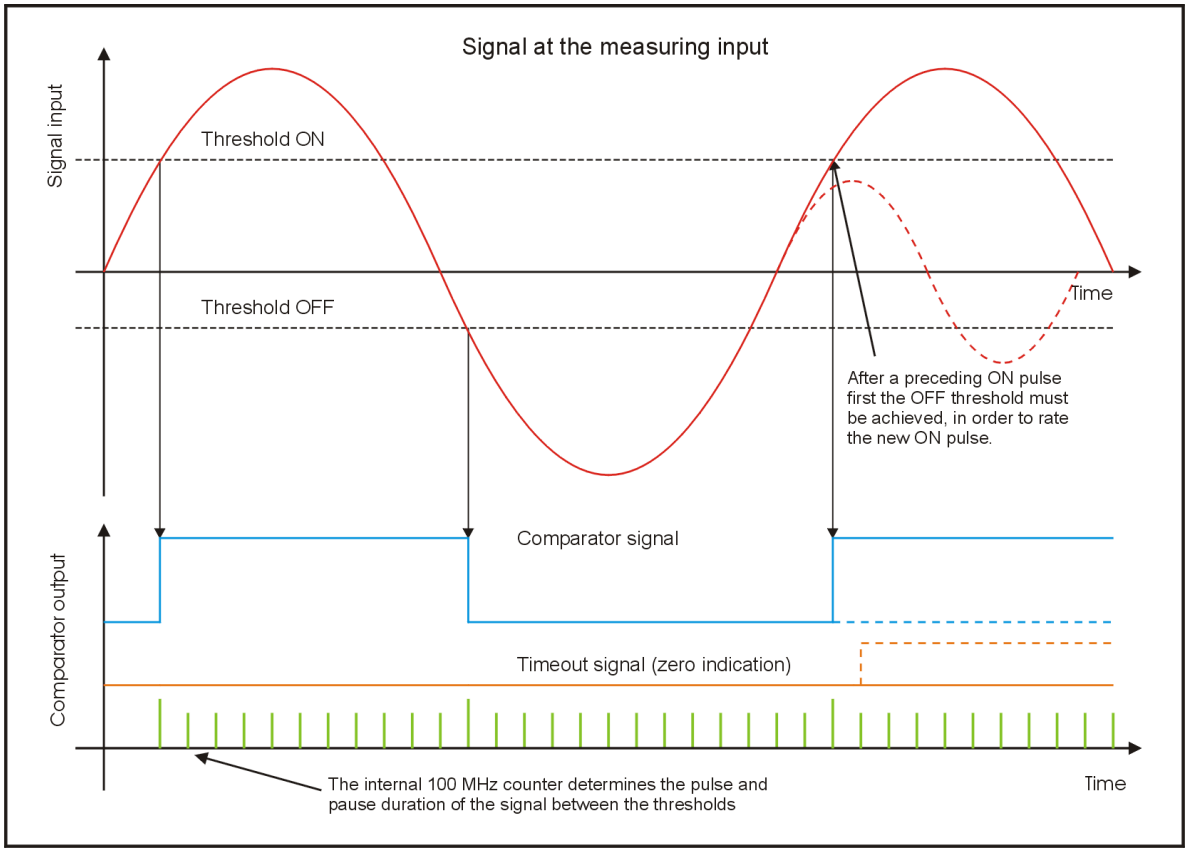
Lemo-Stecker 1B, 7-pol. (schwarz)
Lemo-male 1B, 7-pol. (black)

Pin-Nr. Pin-№	Bezeichnung Designation	Litze-Nr. / Farbe Wire-№ / Colour
1	IN +	1 white
2	GND	2 brown
3	IN -	3 red
4	+ Power	4 black
5	POWER GND	5 green
6	TEDS	6 yellow
7	NC	7 violet
Chassis	Shield	S (Shield, thick) blue

4.7.2 Input / Principle details

Measuring method

The analog and digital input signal is evaluated with a programmable comparator threshold (switching threshold, hysteresis) and the following 48 bit counter. The FPGA and the digital signal processor (DSP) convert the respective counter values online into a frequency output (and duty cycle or time period).



The input signal is compared with the defined switching thresholds by using a comparator (see image). The result is a square wave voltage similar to the frequency at the comparator output. The pulse and the interval duration of this square wave voltage is detected with the internal 100 MHz counter.

If the timeout expires without any detection of an ON threshold, the zero indication will output the user defined minimal value. The setting of the timeout is recommended in order to avoid time delays in signal evaluation. A correct signal evaluation is supported only with sequent detections of ON and OFF thresholds.

Frequency

The frequency is acquired with the interval duration acquisition described above. The reciprocal value of the counter result of the interval duration measurement is scaled and sent correspondingly to the measuring range setting.

Duty cycle

The counter value of the pulse duration is divided by the counter value of the interval duration and correspondingly scaled and sent to the measuring range setting.

If the frequency is too low (or 0 Hz), 0 % (low level) or 100 % (high level) is sent depending on the signal level.

The thresholds on and off do usually differ and cause different results of the pulse duration and the duty cycle if the signal edges are low, depending on the defined thresholds.

Interval duration

The interval duration is acquired with the acquisition described above. The counter value between two thresholds on is detected, scaled, and sent correspondingly to the measuring range setting.

Pulse duration

The pulse duration is acquired with the acquisition described above. The counter value between the threshold on and the threshold off is detected, scaled, and sent correspondingly to the measuring range setting.

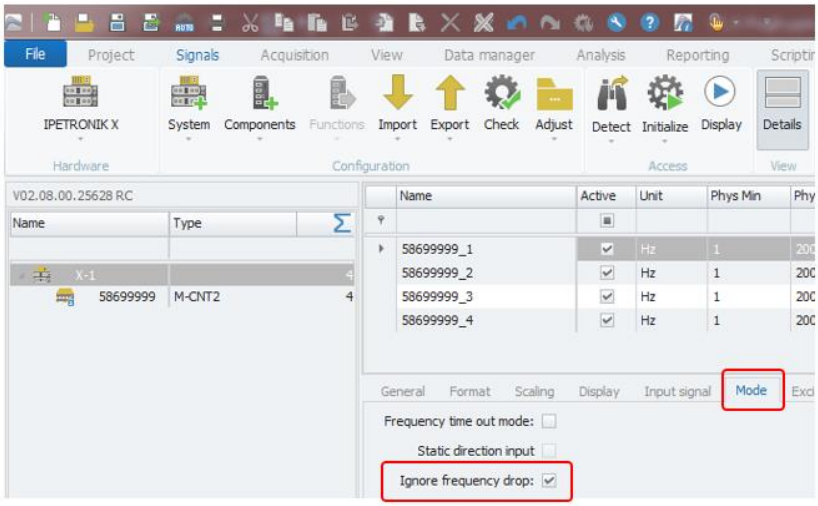
The thresholds on and off do usually differ and cause different results of the pulse duration if the signal edges are low, depending on the defined thresholds.

Pause duration

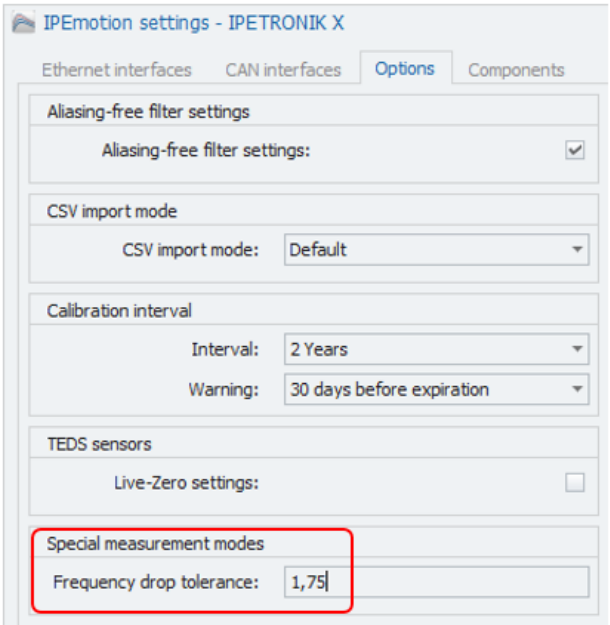
The pause duration acquisition corresponds to the pulse duration acquisition with inverted input signal.

Mode – Ignore Frequency Drop

The module supports in the mode tab sheet a function called: “Ignore frequency drop”. With this function it is possible to measure RPM when several teeth on the reflector or missing.



The drop voltage can be configured in the PlugIn options:



Status LED at the input

The status LED at the respective input indicates the acquisition of a frequency signal. This is the case if both switching thresholds of every value are reached (threshold on and off).

The status LED is on / flashes in time with the signal frequency if:

- the corresponding channel is active and
- the device is in the acquisition mode (acquiring data) and
- the switching thresholds are correctly defined.

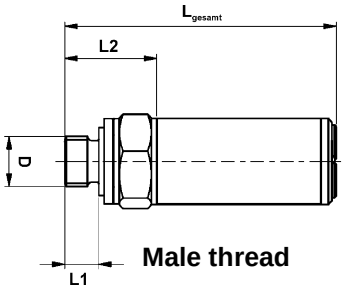
Due to the slowness of visual proceeding, only frequencies under approx. 10 Hz can be seen as a flashing. The LED is permanently on at higher signal frequencies.

4.8 CANpressure

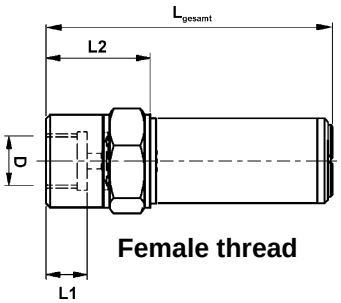
Automotive Pressure Sensor with Data Output to CAN

- Absolute or relative pressure gauge
- Various types of CANpressure covering a pressure range of 0 ... 1 bar to 0 ... 250 bars available
- Built-in sensor to measure the temperature at the gauge point
- Measurement data output to CAN
- Complete galvanic isolation (amplifier, CAN, power supply, enclosure)
- Designed for engine compartment applications

4.8.1 Pressure connections



Male thread



Female thread

Dimensions	D	L1	L2	Fastening torque	Wrench size
M 10 x 1 male	10 mm	8.5 mm	25.5 mm	17 ... 23 Nm	24 mm / 0.94 in
M 10 x 1 female	10 mm	9.5 mm	26.5 mm	17 ... 23 Nm	24 mm / 0.94 in
M 14 x 1,5 male	14 mm	9.5 mm	25.5 mm	17 ... 23 Nm	24 mm / 0.94 in
M 14 x 1,5 female	14 mm	10.5 mm	26.5 mm	17 ... 23 Nm	24 mm / 0.94 in
G ¼ male	13.2 mm	9.5 mm	25.5 mm	17 ... 23 Nm	24 mm / 0.94 in
G ¼ female	13.2 mm	10.5 mm	26.5 mm	17 ... 23 Nm	24 mm / 0.94 in

Keep the stated range of the fastening torque when mounting CANpressure to ensure full accuracy!

Do not exceed the upper limit of the fastening torque to avoid an irreversible damage of the pressure transmitter!

Pressure transducer (relative, absolut)	Overload pressure	Burst pressure
0 ... 1 bar / 0 … 14.5 psi	3 x FS (Full Scale)	> 200 bar / 2,901 psi
0 ... 2 bar / 0 … 29.0 psi	3 x FS	> 200 bar / 2,901 psi
0 ... 5 bar / 0 … 72.5 psi	3 x FS	> 200 bar / 2,901 psi
0 ... 10 bar / 0 … 145 psi	3 x FS	> 200 bar / 2,901 psi
0 ... 20 bar / 0 … 290 psi	3 x FS	> 200 bar / 2,901 psi
0 ... 25 bar / 0 … 363 psi	3 x FS	> 200 bar / 2,901 psi
0 ... 50 bar / 0 … 725 psi	3 x FS (Full Scale)	> 850 bar / 12,328 psi
0 ... 100 bar / 0 … 1,450 psi	3 x FS	> 850 bar / 12,328 psi
0 ... 150 bar / 0 … 2,175 psi	3 x FS	> 850 bar / 12,328 psi
0 ... 250 bar / 0 … 3,626 psi	3 x FS	> 850 bar / 12,328 psi
other pressure ranges	on request	
Medium compatibility Gases and fluids (also fuels and break fluids) up to 200 bar / 2,901 psi, other conditions on request		

4.9 SIM-STG

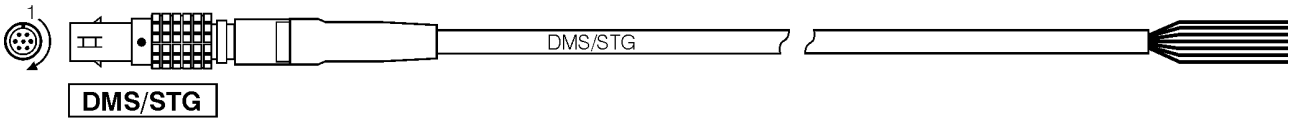
Fast 8-Channel Multi-Analog Measurement Device with Excitation

- 8 analog signal inputs for voltage measurements
- Measurement modes: SENS, STG, ICP, individual for each input
- Hardware filter and DSP software filter
- 8 separate dual sensor excitations (up to ±15 V, up to ±45 mA)
- Offset and target adjust functions, shunt check
- Internal resistors for bridge completion selectable
- Measurement data output to CAN
- Complete galvanic isolation (inputs, excitation, CAN, power supply, enclosure)
- Designed for automotive in-vehicle use

4.9.1 Input cables

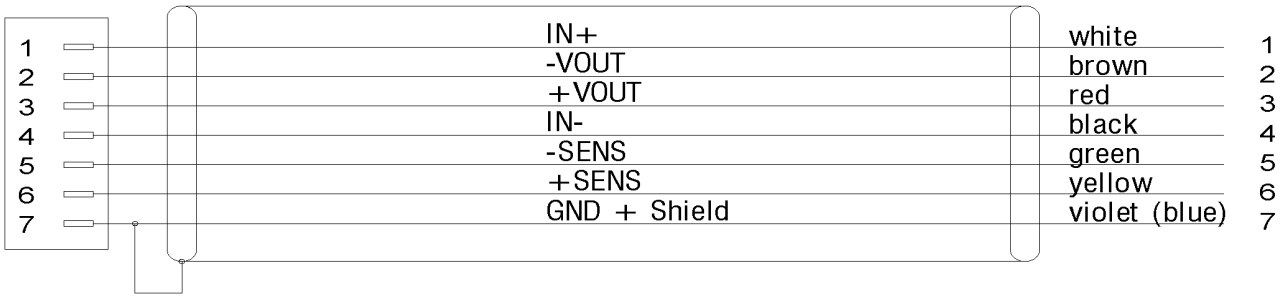
Standard (open)

670-850.xxx DMS/STG Cable open (7-pin DMS compatible)



DMS/STG

Lemo-Stecker 1B, 7-pol. (schwarz)
Lemo-male 1B, 7-pol. (black)



4.9.2 Signal input modes

Refer to Sx-STG

STG-Mode

Refer to Sx-STG

SENS-Mode

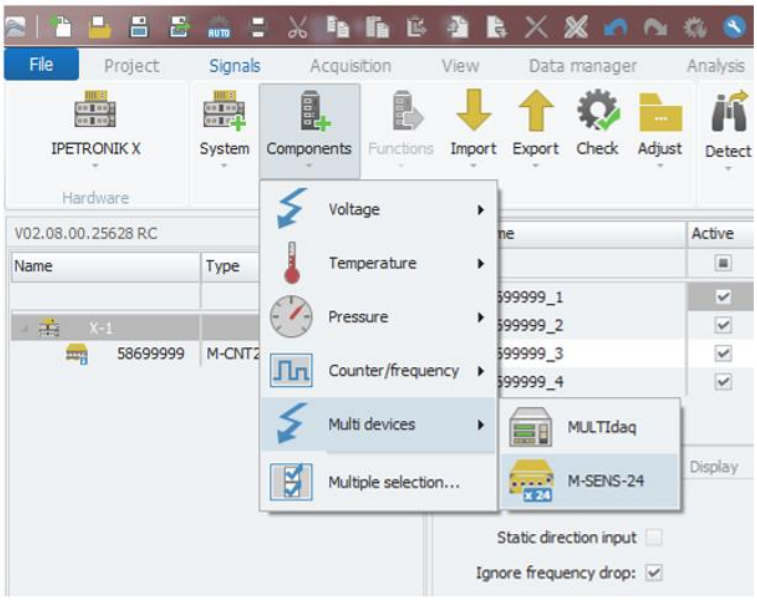
Refer to Sx-STG

ICP-Mode

Refer to Sx-STG

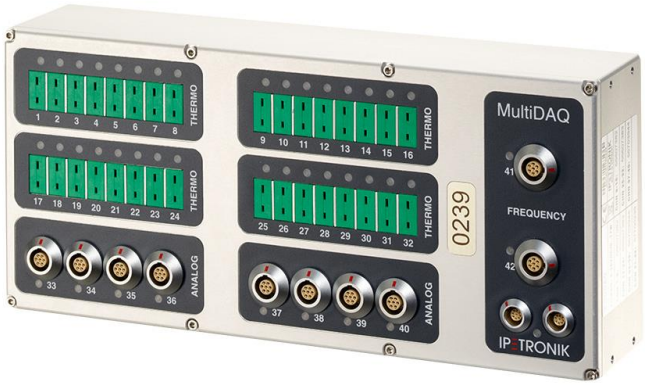
4.10 M-SENS 24

The M-SENS 24 module is based on 3 M-SENS modules which are integrated to one box.



4.11 Multi DAQ

The Multi DAQ is a universal module including counter inputs, analog inputs and temperature inputs.



For technical specifications refer to the following modules:

- M-SENS
- M-THERMO
- M-FRQ

5 IPEmotion

5.1 PlugIn IPETRONIK-X

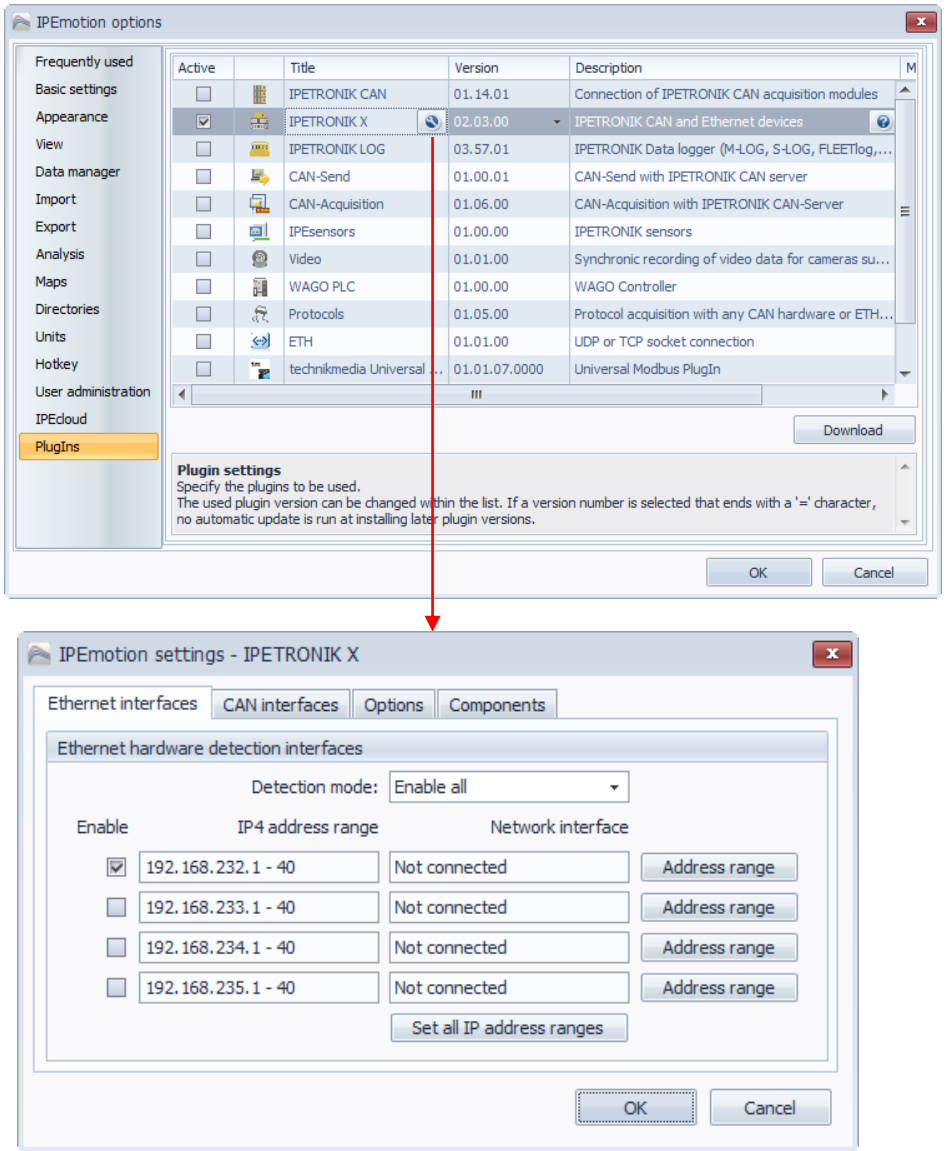
5.1.1 Installation

- Copy the installation file **Setup IPEmotion PlugIN IPETRONIK X.exe** to a local subdirectory on your PC.
- In case you do not have this file, at fist visit http://www.ipetronik.com/en/software/plug-ins .
- Search the PlugIn IPETRONIK-X and download latest version
- Start the file **Setup IPEmotion PlugIN IPETRONIK X.exe** located on your PC.
- Follow the steps provided by the InstallShield Wizard (Confirm the destination folder or define an individual directory).

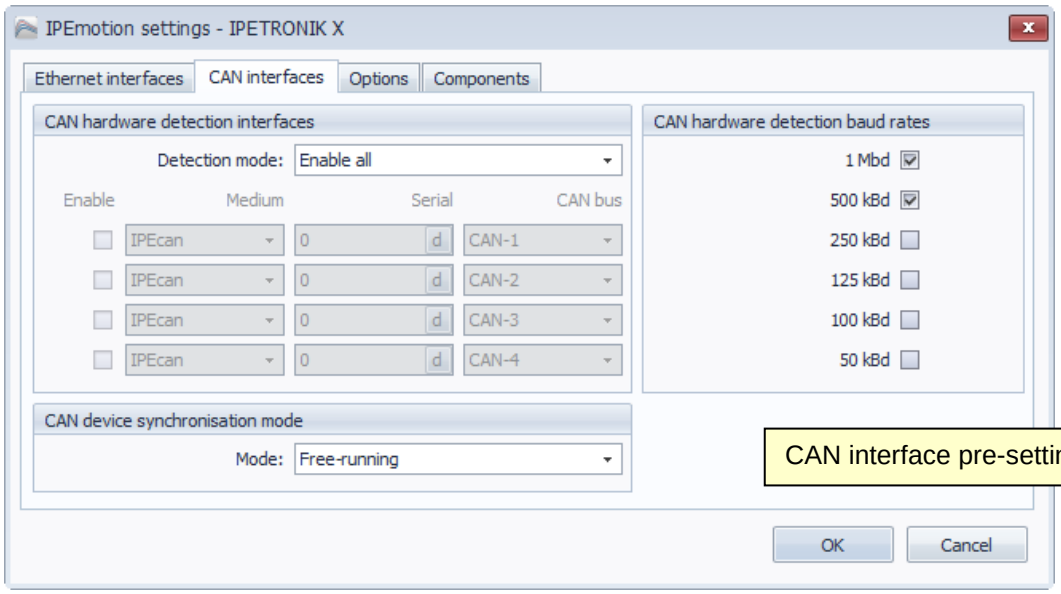
5.1.2 Activation

- Start **IPEmotion**.
- Select **Options** from the top icon bar.
- Select **PlugIns** from the left-hand lower area.
- Activate the PlugIn **IPETRONIK-X**
- Click **OK** to confirm your selection.

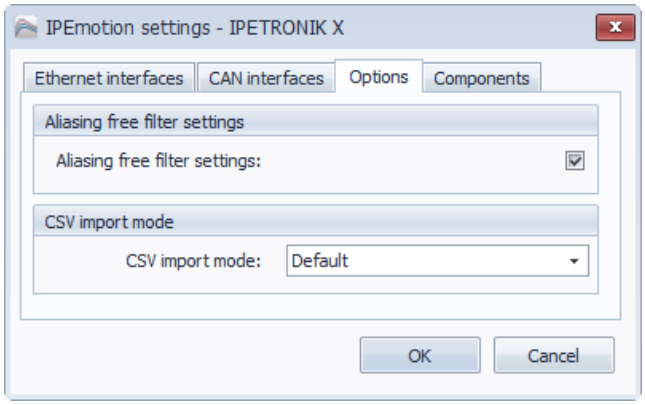
- Open the **PlugIn specific settings** by clicking to the wrench tool symbol if you need to modify settings for the ETH or CAN interface, e.g. to set the Ethernet IP range.



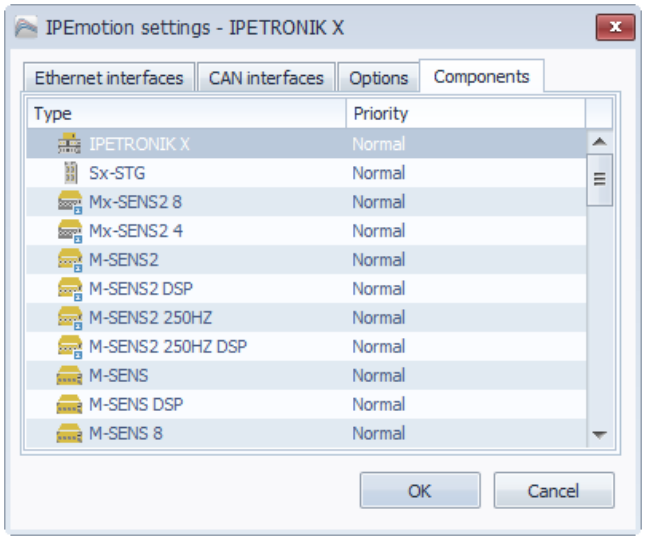
In order to operate the PlugIn IPETRONIK-X and IPETRONIK-CAN in parallel, you have to disable the use of the CAN modules (through the CAN interface) for the PlugIn IPETRONIK-X.



CAN interface pre-settings



Basic settings for the software filters (aliasing free sampling) and the CSV import (standard, device creation).



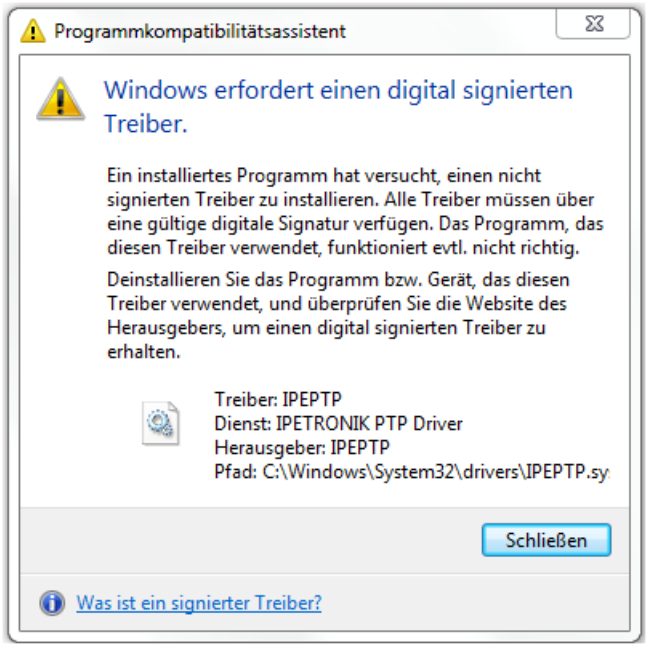
Basic settings for the device pool. Reduce the number of device types to be used by assigning a priority: High, Normal, Low, Not used.

5.1.3 PTP driver

For data synchronization and optimized data processing the IPEmotion PlugIn IPETRONIK-X makes use of the Windows 7 PTP driver. An accurate measurement data processing requires the correct operation of this driver.

Digital driver signature

The IPETRONIK PTP driver is digital signed with a certificate contaning a SHA-2 hashing algorithm. The SHA-2 code signing and verification functionality was not available with former Windows 7 installations. If Windows updates have not been executed regularly, an error message may occur when installing the driver.



Windows requires a digital signed driver.

In this case you have to update your computer manually.

Please visit this Microsoft website for detailed information:
https://technet.microsoft.com/en-us/library/security/3033929

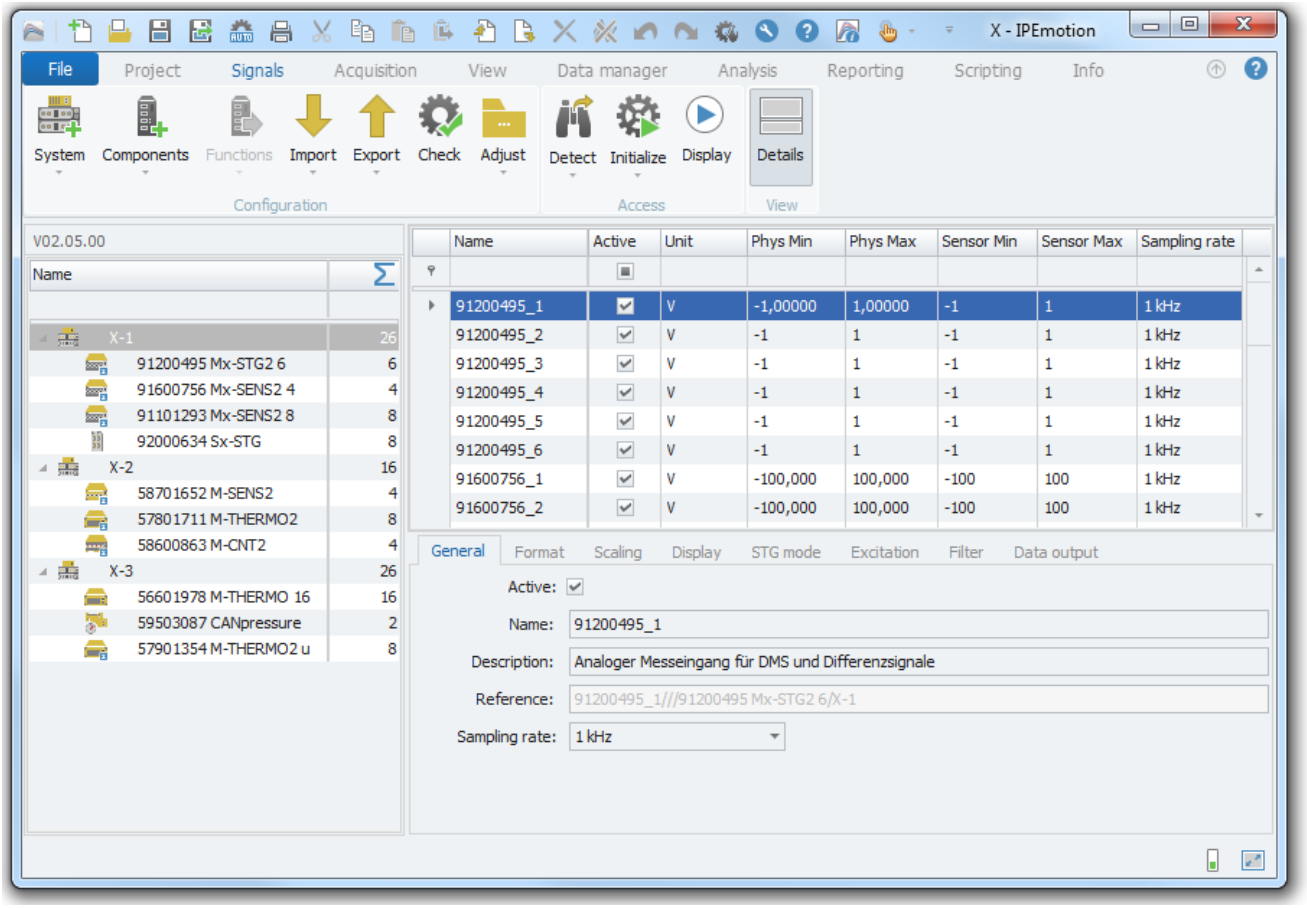
Please check if the following security updates have been installed on the PC:

- KB 3035131
- KB 3033929

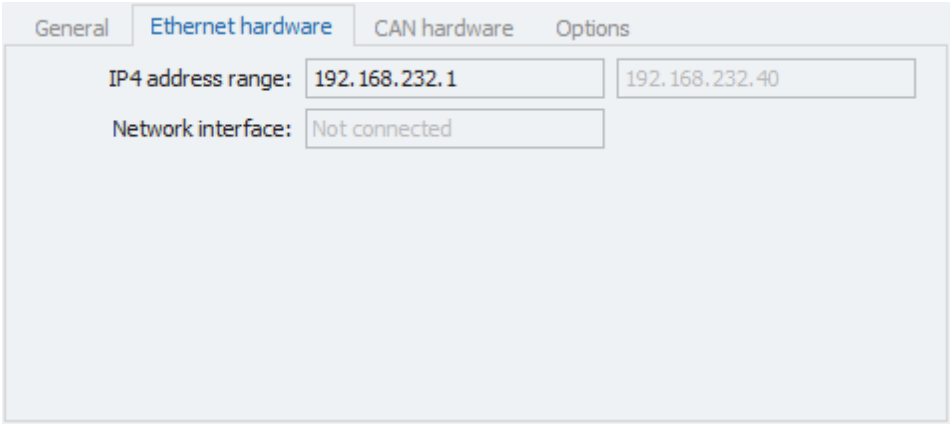
If not, please install them manually with the following order: 1. KB 3035131, 2. KB 3033929

It can be that the installation of the KB 3035131 reports that the patch is already installed (even if it is not displayed in the update list). Install the second patch and start the PlugIn IPETRONIK-X installation again.

5.1.4 System overview

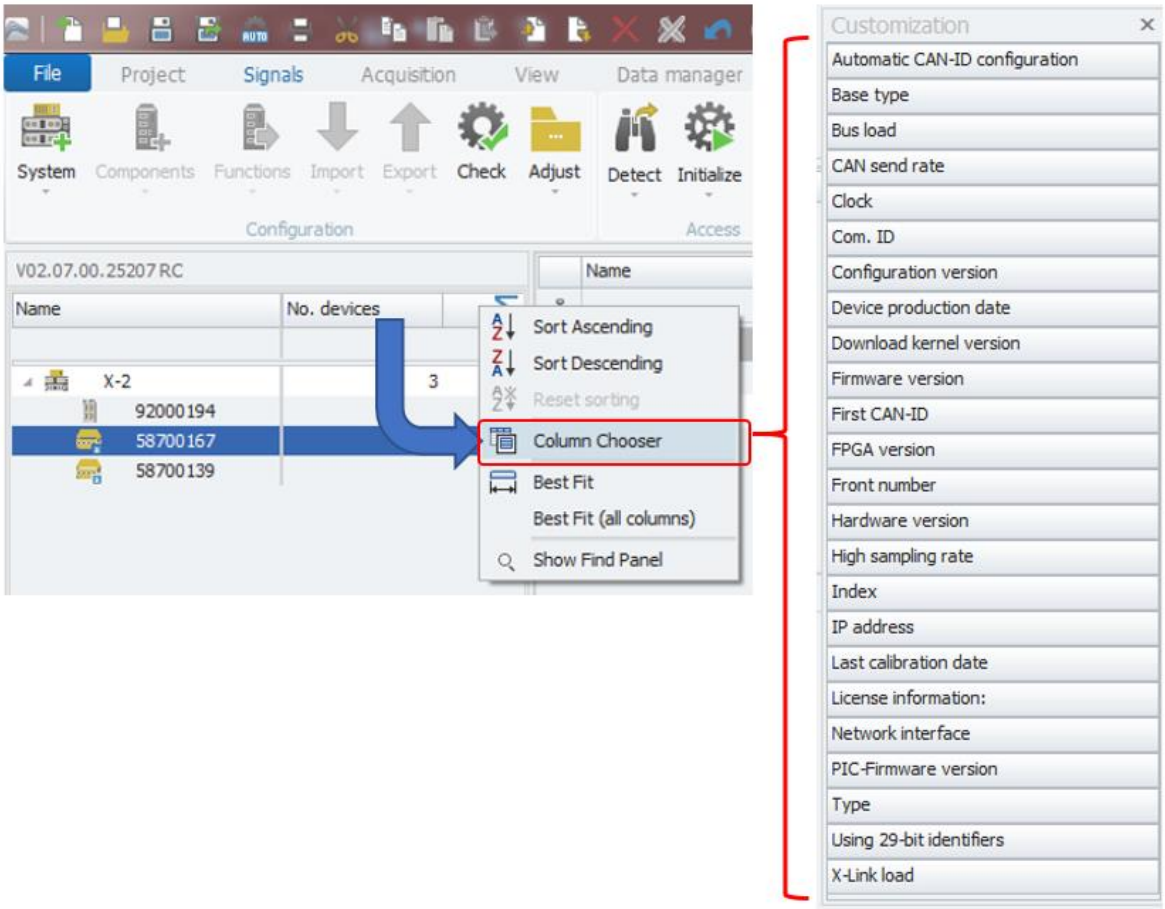


Ethernet hardware

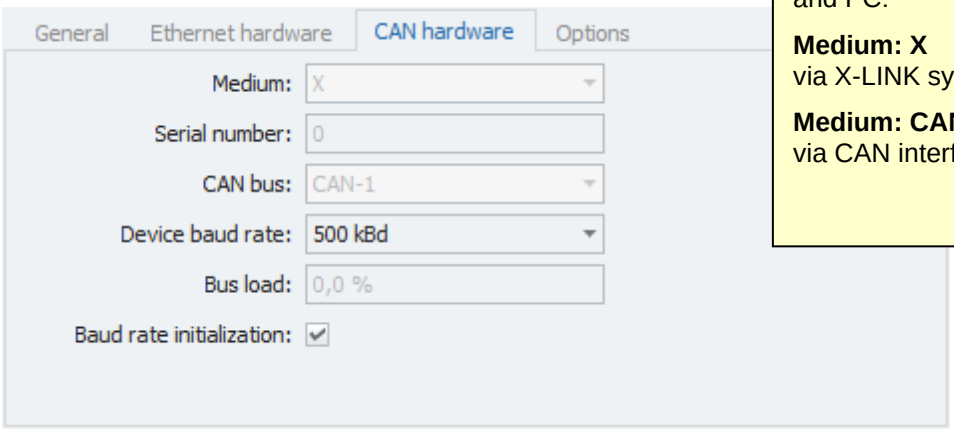


System tree – column chooser function

In the system tree you can use the column chooser to add additional information to the devices.



CAN hardware



Data communication between modules and PC:

Medium: X
via X-LINK system and LAN interface

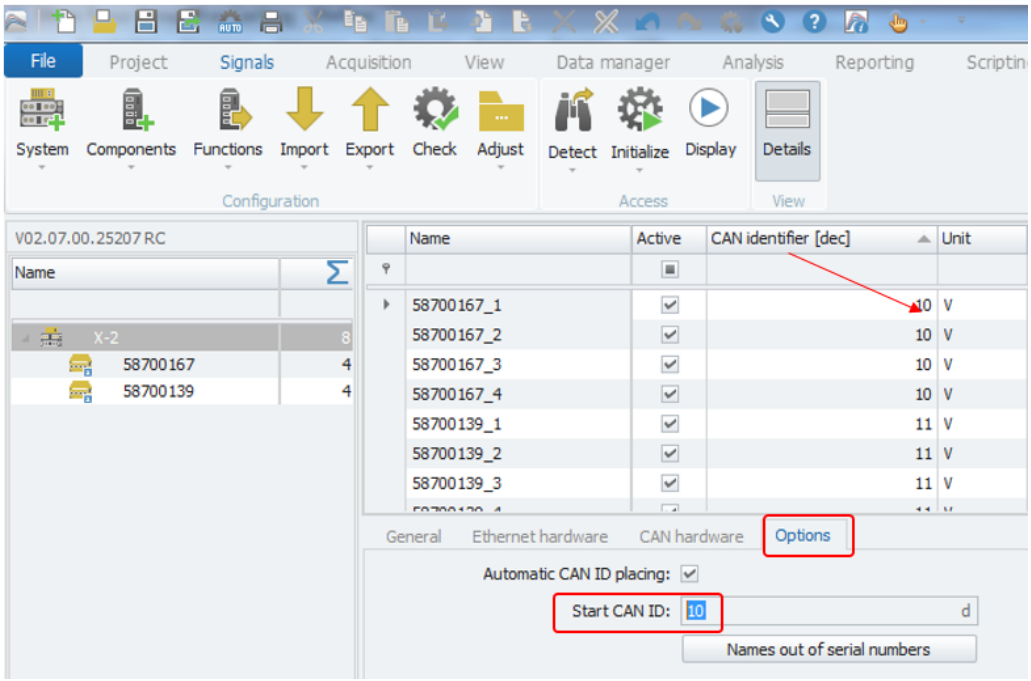
Medium: CAN
via CAN interface

The PlugIn IPETRONIK-X also supports a data acquisition from the CAN modules by the CAN interface only. This means it can be used as an alternative to the PlugIn IPETRONIK-CAN.

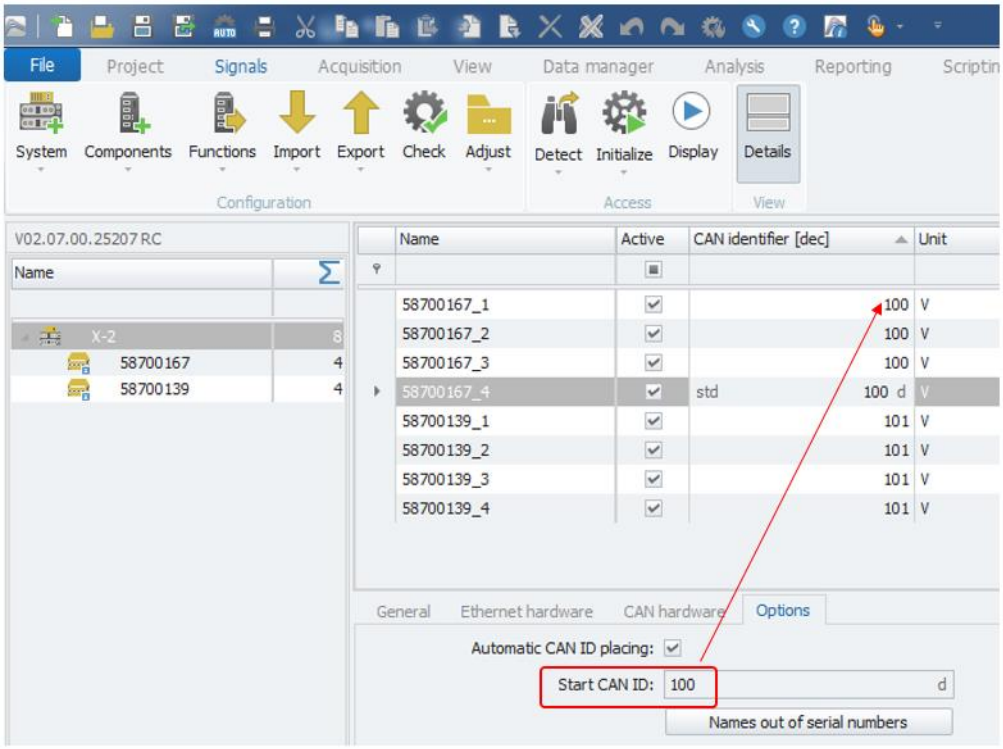
If you do so, please take care that the respective firmware (≥ V04.00) is loaded on the modules.

Options – Define start CAN ID

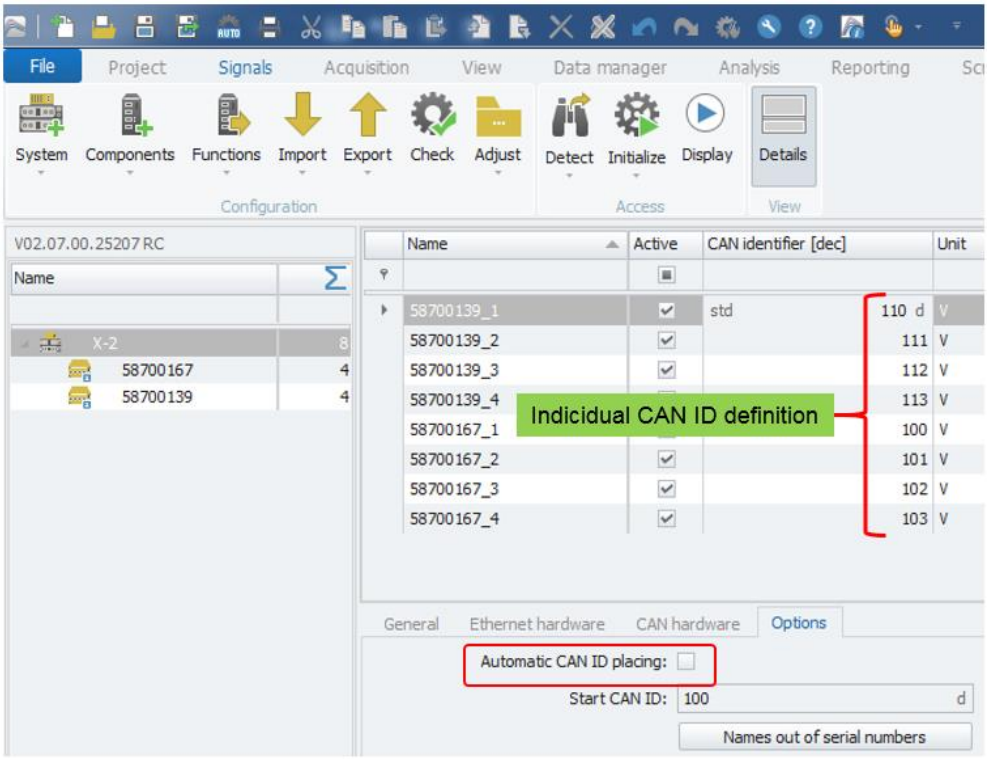
On interface level the start CAN ID can be defined. You can use the column chooser to add the column CAN ID the channel grid to get an overview of the defined CAN IDs. By default the first module will get CAN ID A.



In the example below the start CAN ID was set to 100. You can witch the CAN ID format from Hex. To decimal or binary format.



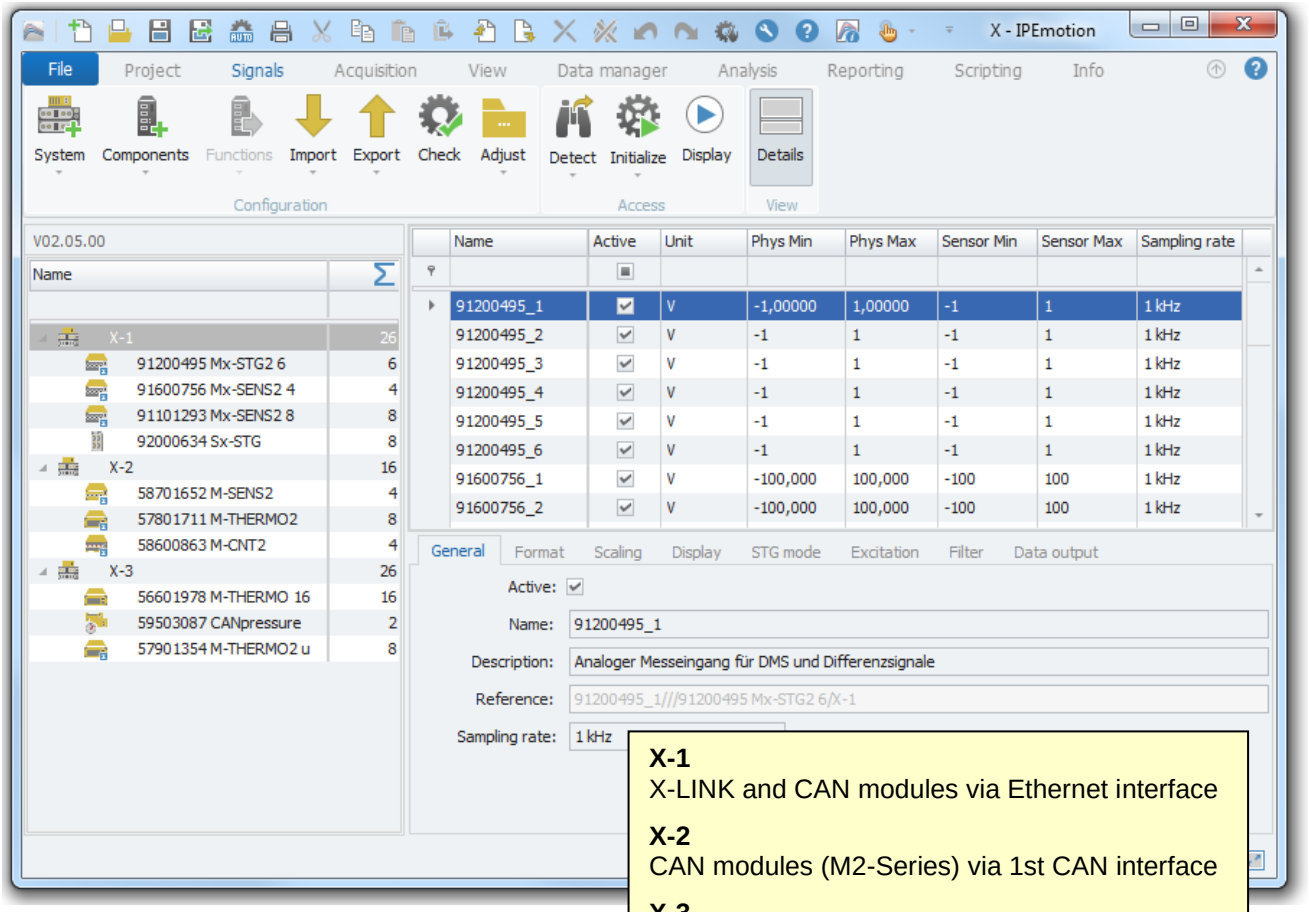
If you take the checkbox “Automatic CAN ID placing” out you can add individual CANID via the channel grid.



5.1.5 Using several DAQ systems and interfaces

The PlugIn IPETRONIK-X supports a simultaneous data acquisition using different Ethernet and/or CAN interfaces. The PlugIn will identify all interfaces (and connected devices), if they are available and if they have been installed correctly.

Alternatively you may create virtual systems (no real hardware connected) by the software.



Refer to **Options** > **PlugIns** > **IPETRONIK-X** for interface settings on LAN and CAN bus.

5.2 Using modules

5.2.1 PC network settings

IPETRONIK-X modules are supporting DHCP (Dynamic Host Configuration Protocol) and manage the IP addresses of the clients connected to the local network. Check and verify the **Properties of the LAN connection** from the system control of your PC:

Windows 7: Network and Services,
Windows XP: Settings > Network Connections)

Verify the setting **Receive IP-Address automatically** at the network settings **Internet protocol properties**.

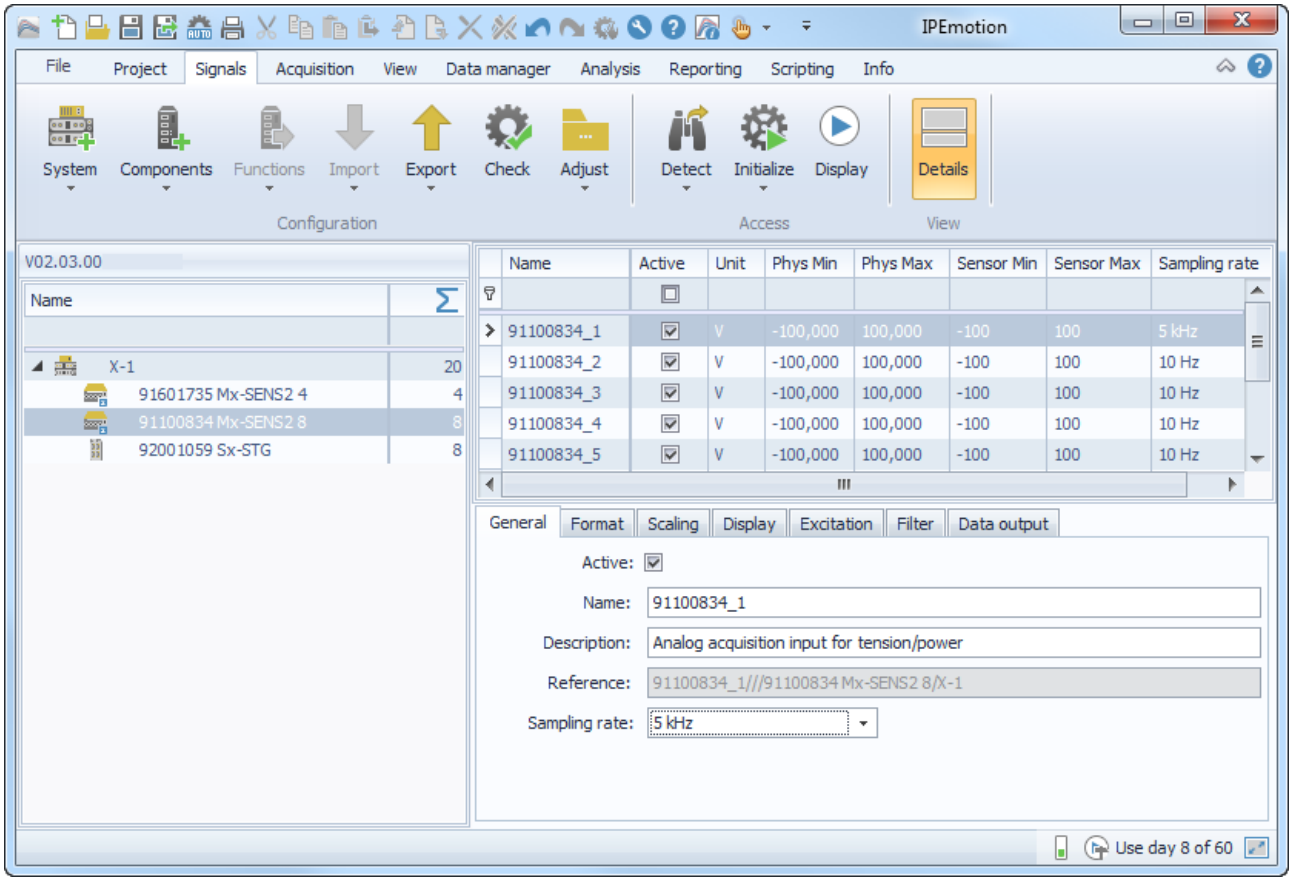
For Windows 7 we recommend to switch the User Account Control (UAC) off resp. to set it to the lowest level.

5.2.2 Connecting modules

- Daisy-chain all required modules using the respective cables as shown in the diagram System overview .
- Connect the data cable to the Ethernet interface of your DAQ PC.
- Connect the PWR cable with an appropriate power supply (output voltage 9 V_{DC} to 36 V_{DC}),
- Connect the sensors with the respective input cables to the measurement inputs.
- Switch on the power supply.

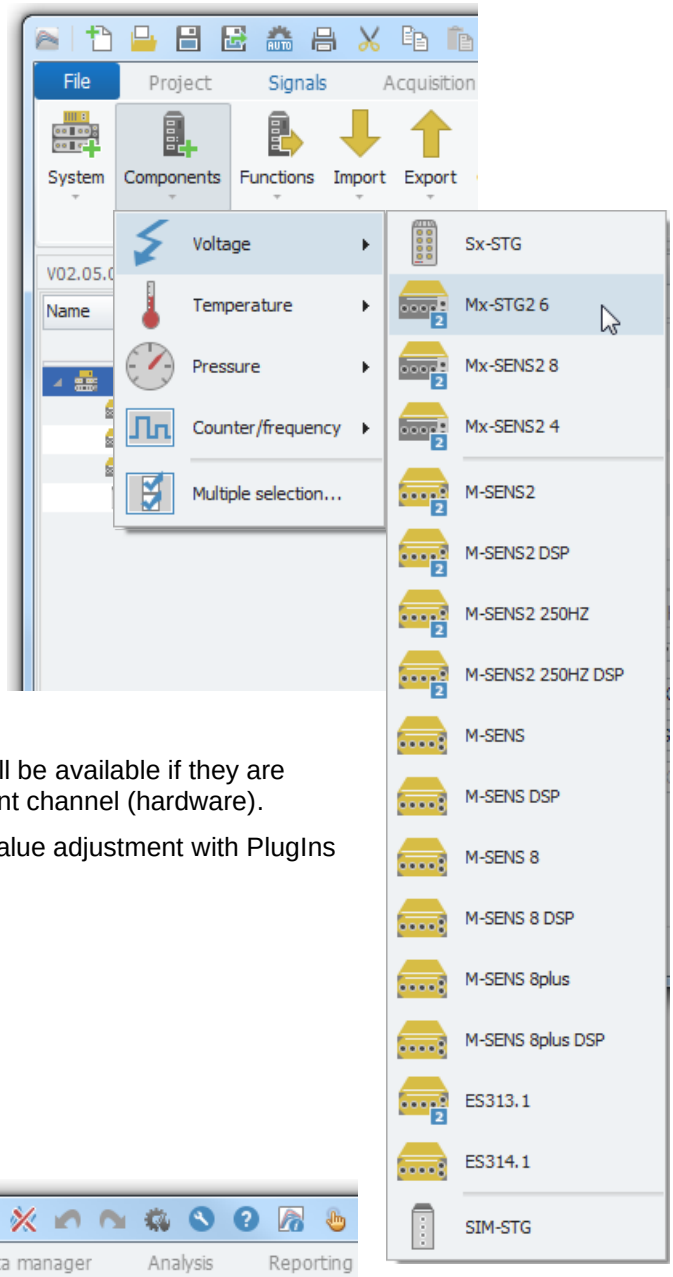
5.2.3 Detecting modules

- Move to the main tab **Signals**.
- Click **Detect** from the signals icon bar to identify connected modules.



5.2.4 Add new modules manually

- Go to the main tab **Signals**.
- Add an IPETRONIK X system (**Add system**)
- Select **Add components** from the menu bar.

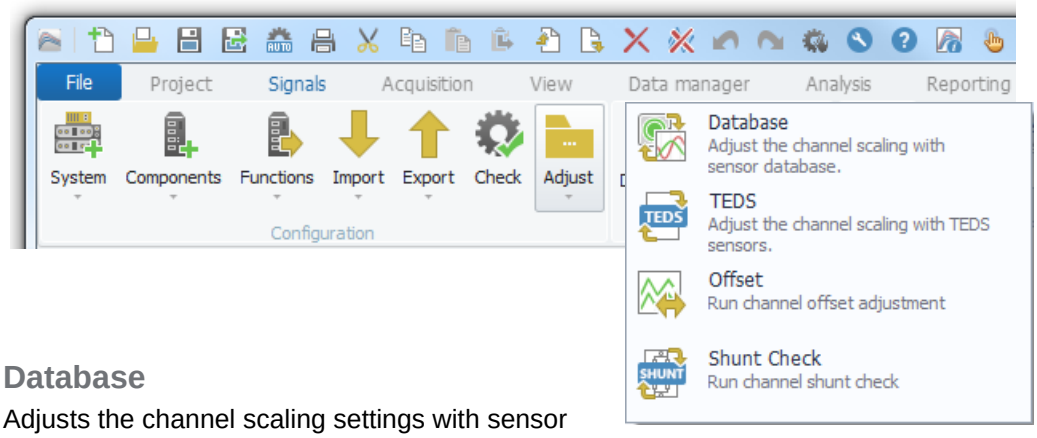


5.2.5 Adjust

Adjust functions are global IPEmotion features. They will be available if they are supported by the PlugIn (software) and the measurement channel (hardware).

IPEmotion will provide the extended Offset and target value adjustment with PlugIns IPETRONIK-X ≥ V02.00 and the following modules:

- M-SENS2 / Mx-SENS2 4
- M-SENS2 (with DSP, with 250 Hz Filter)
- M-SENS (with DSP)
- M-SENS 8 / M-SENS 8plus (with DSP)
- Mx-STG2 6 / Sx-STG
- SIM-STG



Database

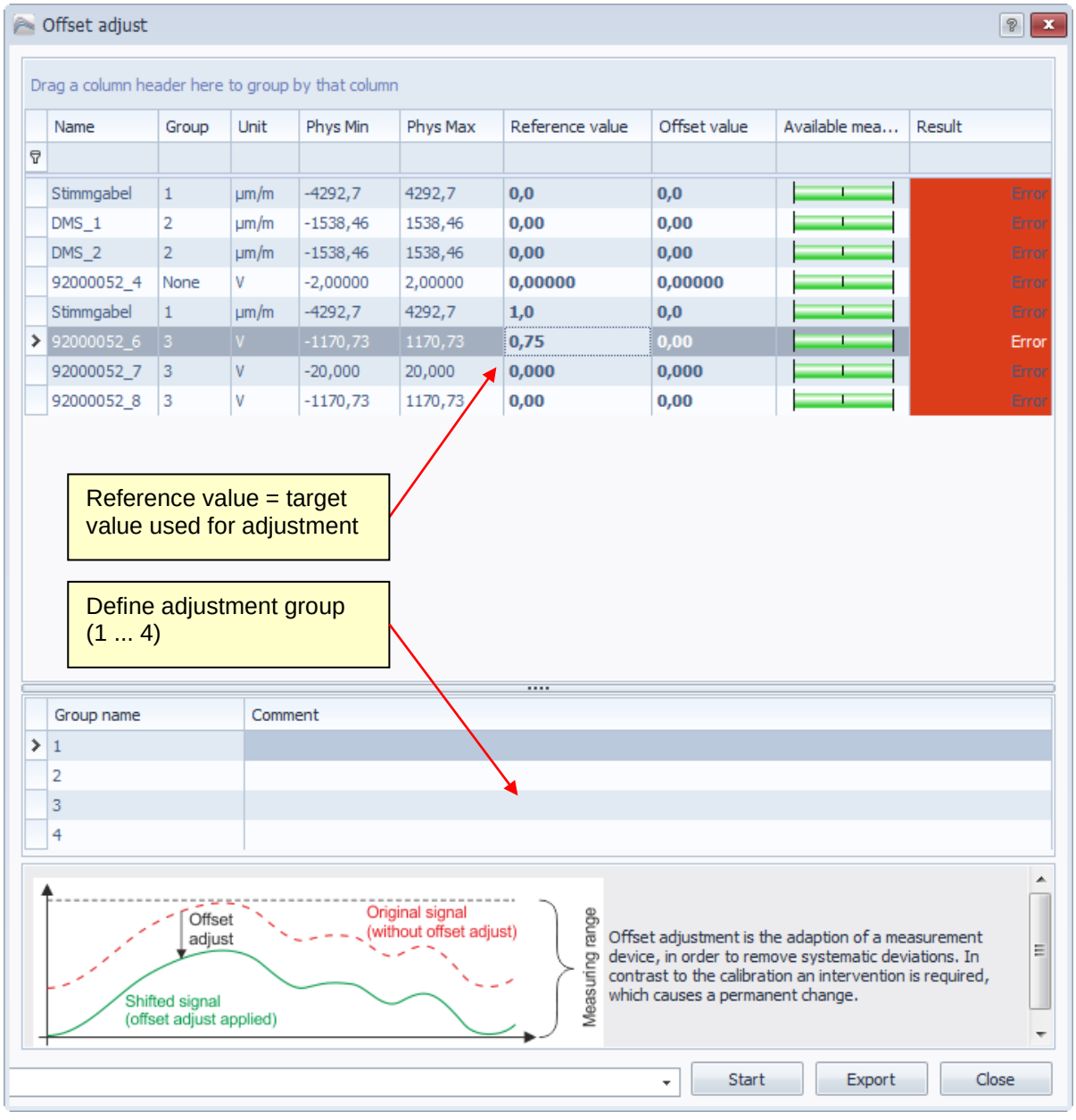
Adjusts the channel scaling settings with sensor settings from the sensor database.

TEDS

Adjusts the channel scaling settings with sensor settings from the TEDS chip of the connected sensor.

Offset

Executes an offset adjust for selected channels, resp. for all channels defined within a group. The reference value or target value can be defined by the user. As soon as the adjustment has finished, offset values, available measurement ranges and results of the adjustment command are displayed.



- All active channels which support the offset adjust are displayed.
- Select those channels who need to be adjusted:

all channels, the highlighted channels, all channels of a group.

- Press **Start** to execute adjustment.
- Offset values, available measurement ranges and results of the adjustment command are displayed.
- Press **Export** to save adjustment values to CSV or HTML file. These values will not saved in the module.

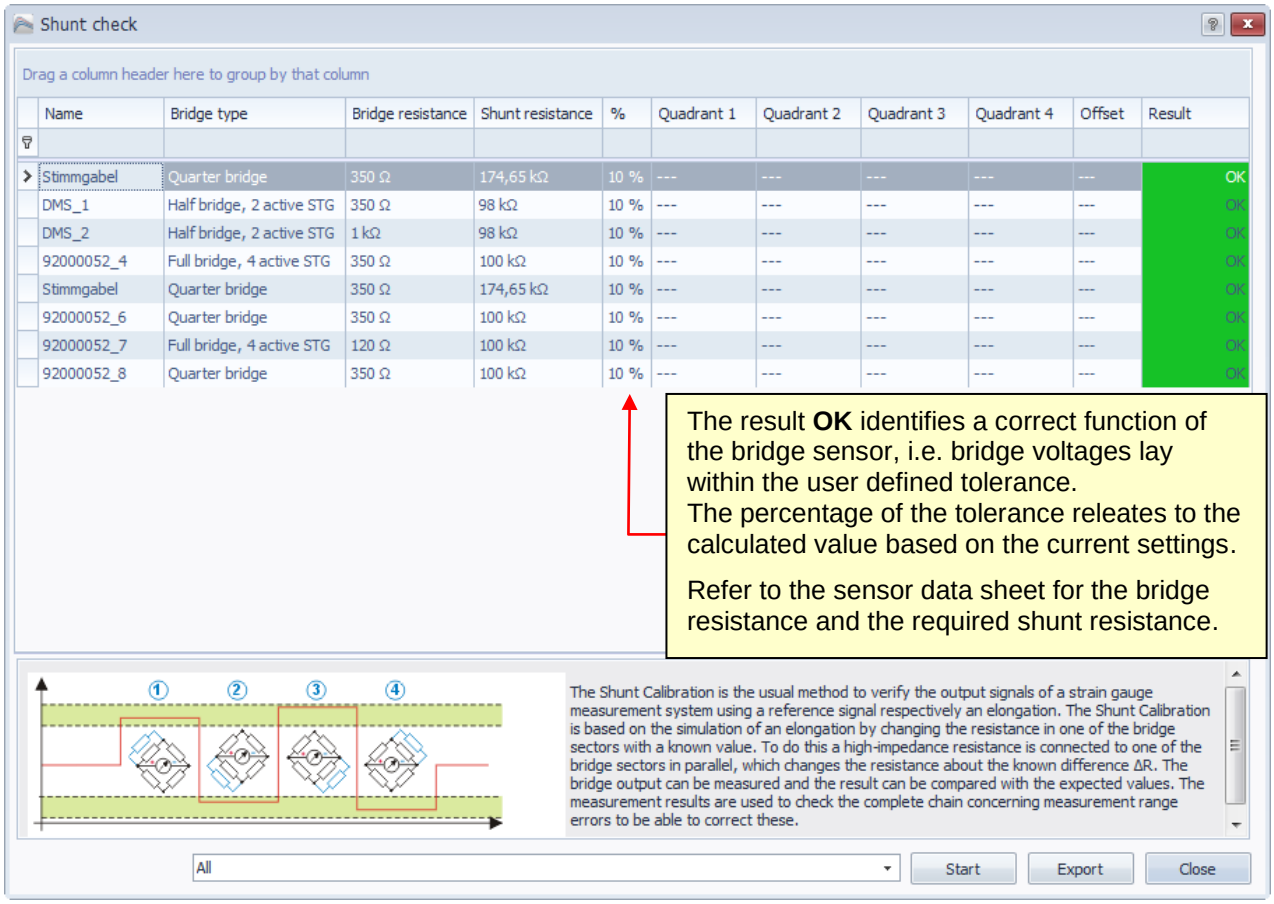
Sx-STG supports a real adjustment by hardware. This provides the user a full measurement range. (refer to Adjustable differential voltages for more information)

Offset adjust reports error warning (Sx-STG Lemo 2B)

Executing an offset adjust for one or several channels while not all active inputs are connected to a sensor will lead to an adjustment error.
Because of this incorrect adjustment procedure a potential offset will not be aligned and no adjustment values will be stored.

Shunt Check

The Shunt check feature verifies the correct operation of a strain gage sensor. Refer to Sx-STG > STG mode > Shunt check for more information.



- All active channels which support the shunt check are displayed..
- Select those channels who need to be checked:

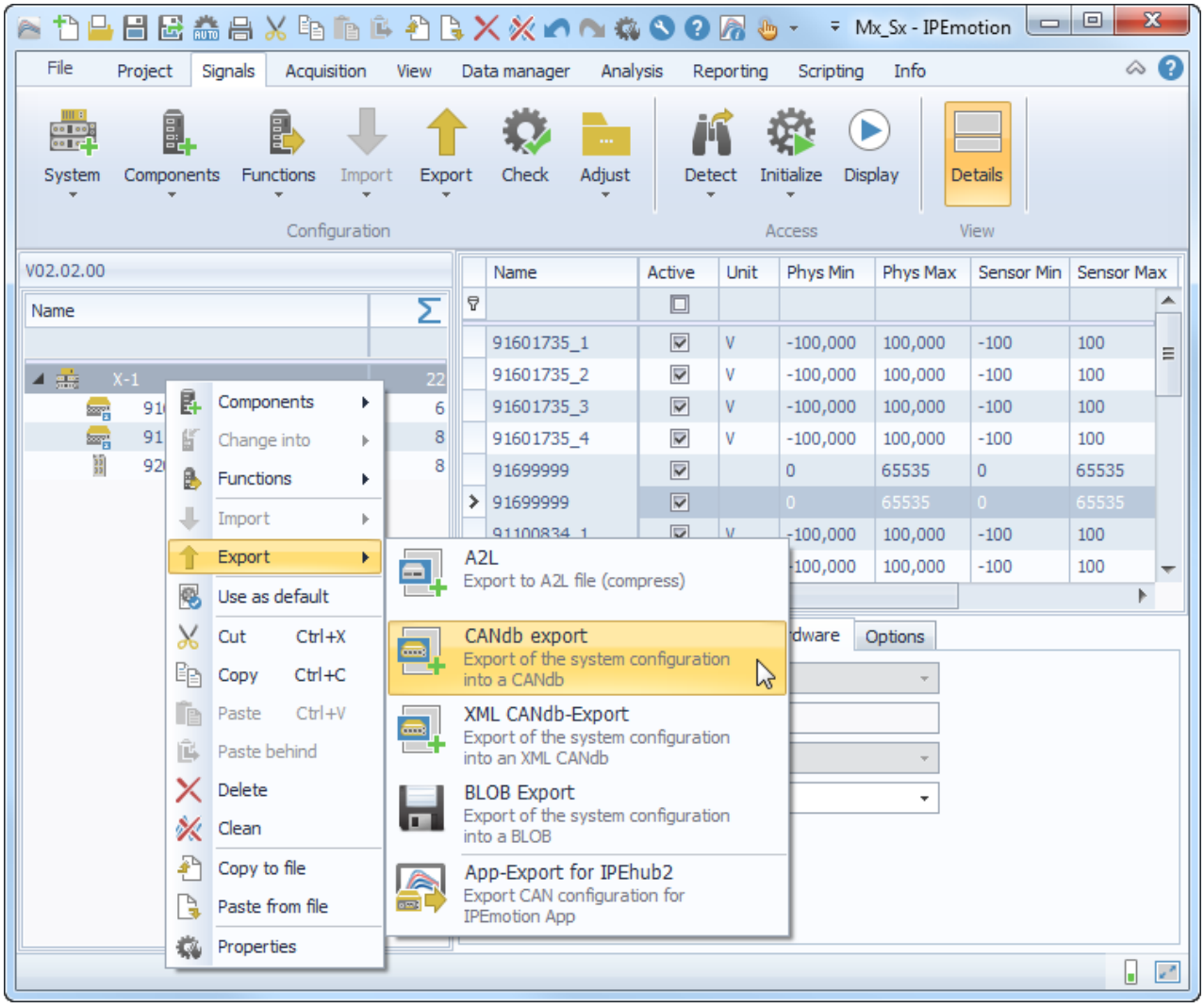
all channels, the highlighted channels

- Press **Start** to execute the shunt check.

The shunt check results depend on these settings
- Bridge type
- Bridge resistance
- Excitation (sensor)
- Shunt resistance

- The shunt check is executed consecutively on all arms of the bridge.
- Current values for each quadrant, as well as status results are displayed with the shunt check.
- Press **Export** to save shunt-check values to CSV or HTML file.

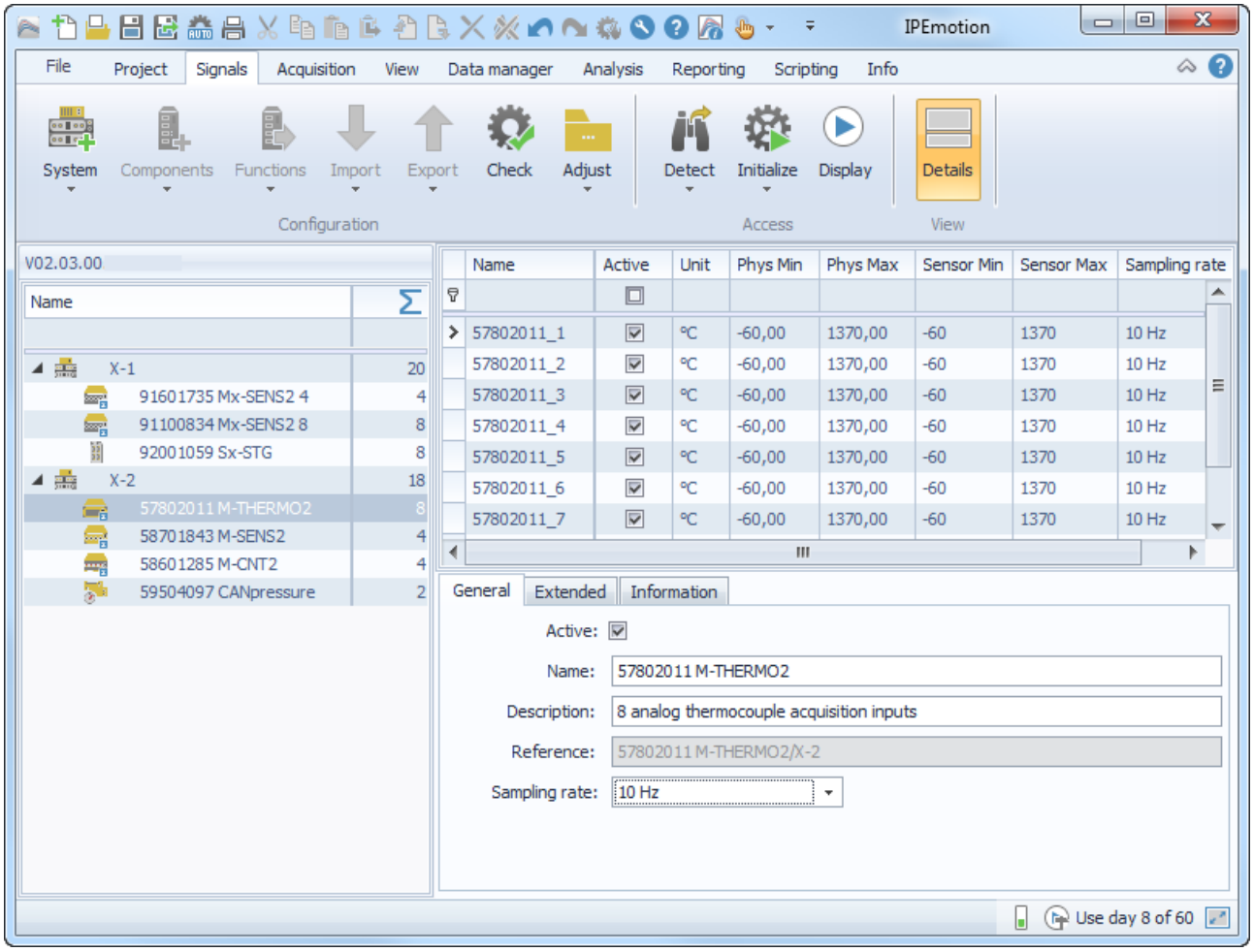
Export of a CANdb



- Highlight the X-System at the left-hand system structure.
- Select **Export** from the tool bar or from the context menu (right-hand mouse button).
- Select **CANdb export** or **XML CANdb export** and enter an individual file name to save the settings of all CAN signals used in the system (CAN output channel and CAN-Monitoring signals) to the DBC description file.

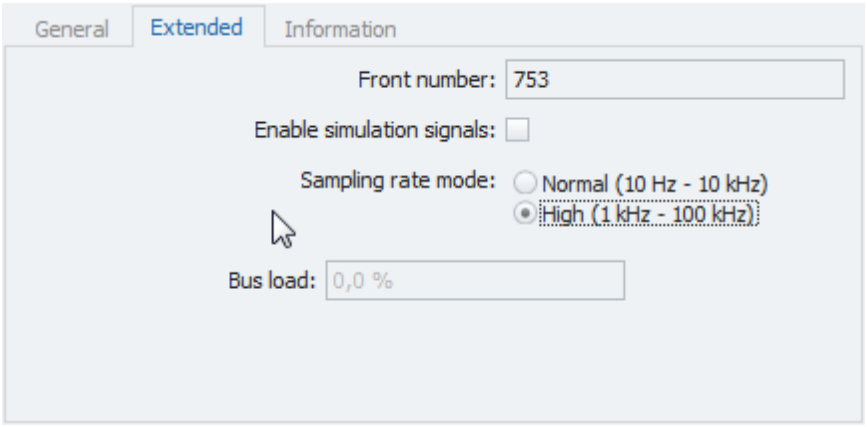
5.3 Module settings

5.3.1 Overview



5.3.2 Extended module settings

- Switch to the main tab **Signals**.
- Select the respective module at the left-hand system structure.
- Enter the **Extended** tab from the configuration area at the right-hand down area.



Front number

The front number defines the last 5 digits of the device number.

Enable simulation signals

This simulation tests the connected measurement chain including all devices. During simulation, a ramp of all signals is generated and an acquisition with all available sampling rates is run. Please note that this simulated test of the complete hardware does not include the AD converter.

Sampling rate mode (Sx-STG, Mx-STG2, Mx-SENS2 4)

Normal

- Sampling rates 1 Hz to 10 kHz supported
- up to 4 different sampling rates per module
- A2L-Export of the current settings supported to output measurement data to external software (CANape, INCA)

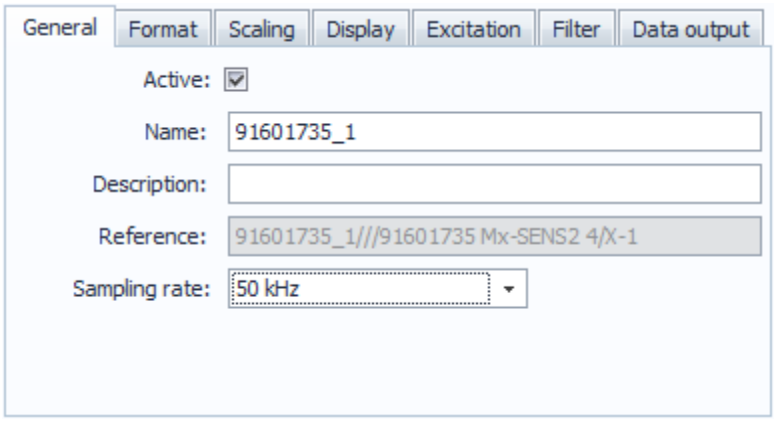
High

- Sampling rates 1 kHz to 40 kHz (100 kHz with Mx-SENS2 4, Mx-STG2) supported (IPEmotion)
- a single sampling rate valid for all channels of the module

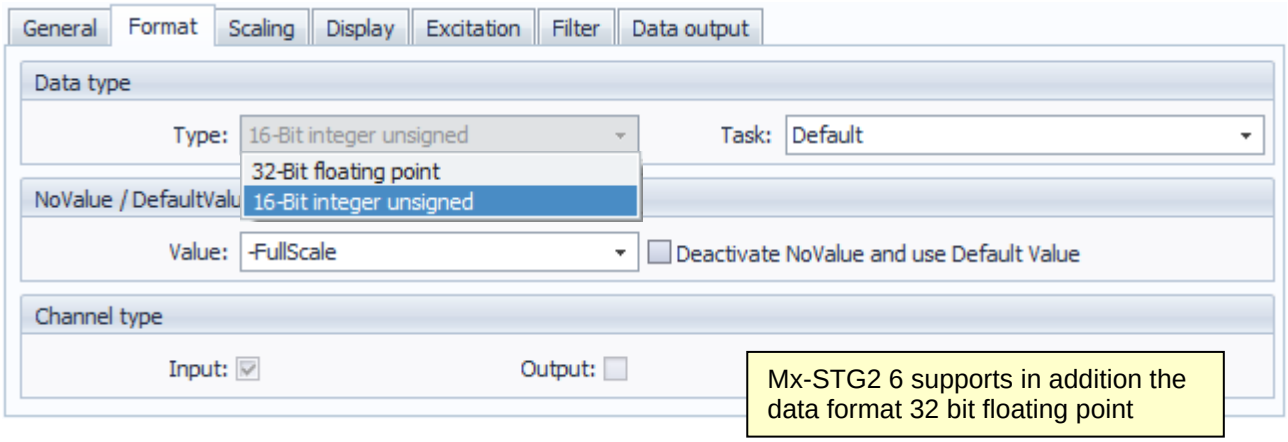
5.4 Channel settings

5.4.1 Common settings

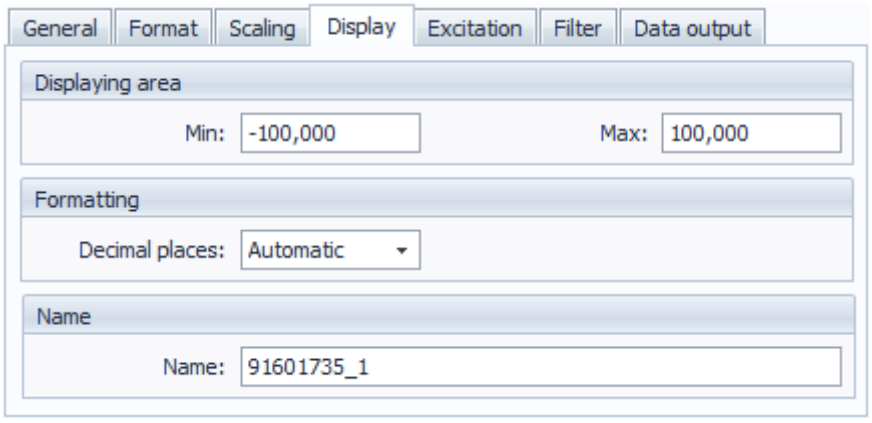
General



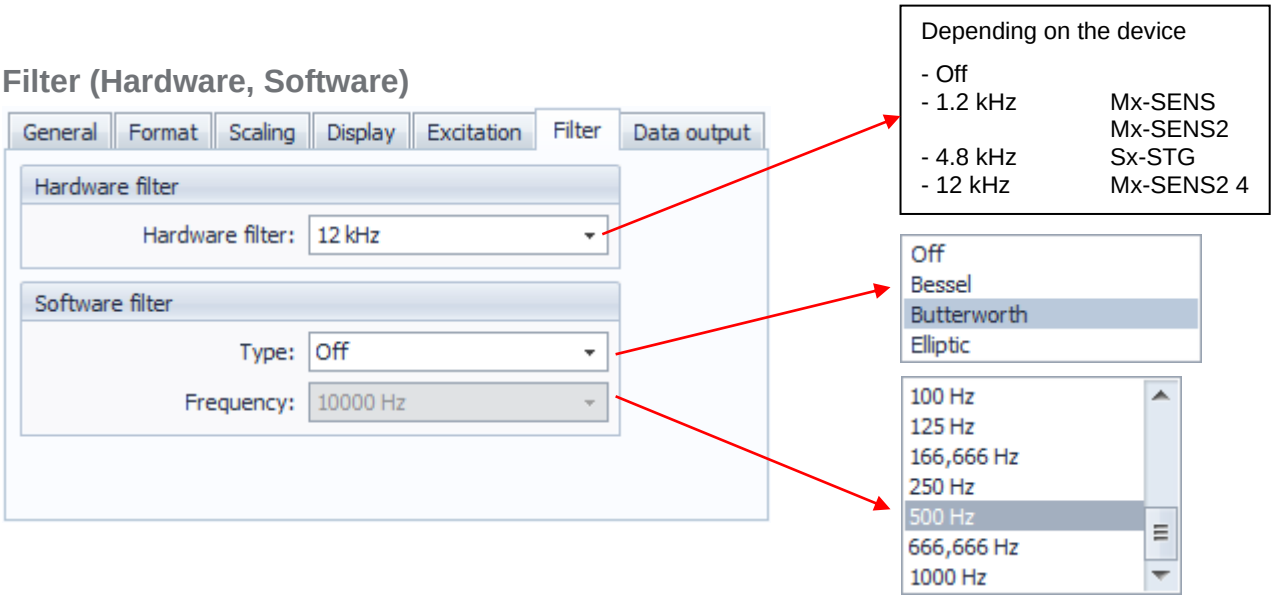
Format



Display



Filter (Hardware, Software)



Deactivating the hardware filter causes the risk of incorrect acquisition through aliasing effects!

The hardware filter blocks interfering frequency spectra (harmonics) in periodic signals.

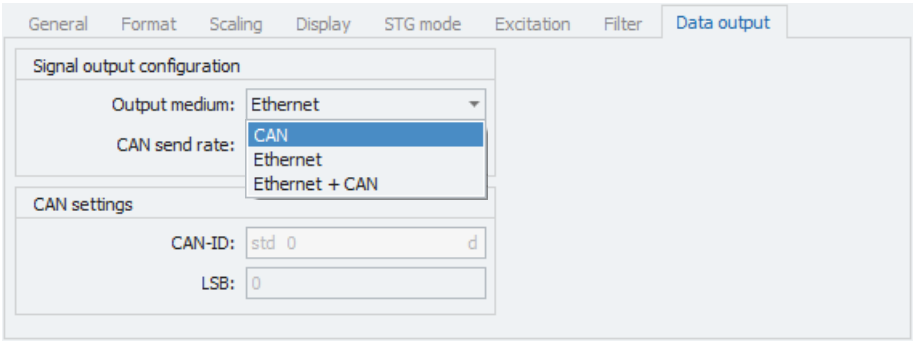
*Go to **PlugIn Options** and activate **Aliasing-free filter settings** (Options tab)*

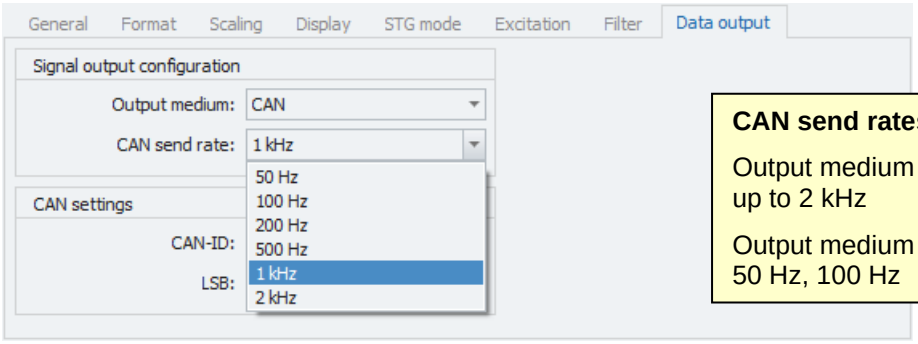
in order to automatically adapt software filter settings for aliasing free measurement.

Data output (Ethernet, CAN)

Use the **Data output** tab of the respective channel to output measurement signals to CAN and/or Ethernet.

Highlight an input channel and enter the **Data output** tab to select the signal output medium.





CAN send rates

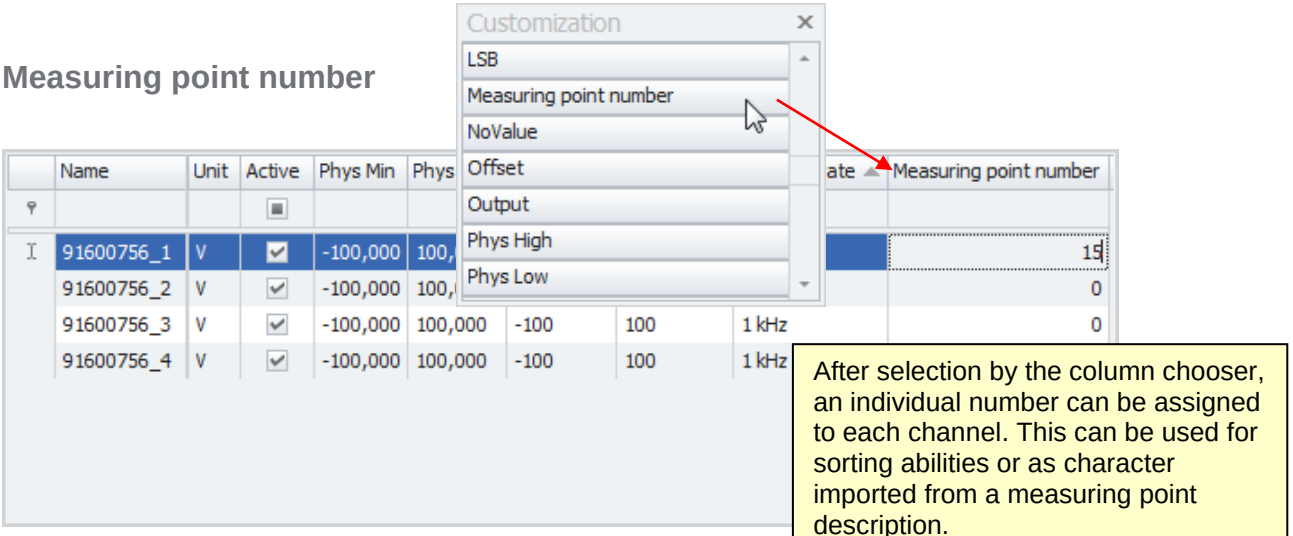
Output medium CAN:
up to 2 kHz

Output medium Ethernet + CAN:
50 Hz, 100 Hz

The system assigns CAN IDs automatically based on the following:

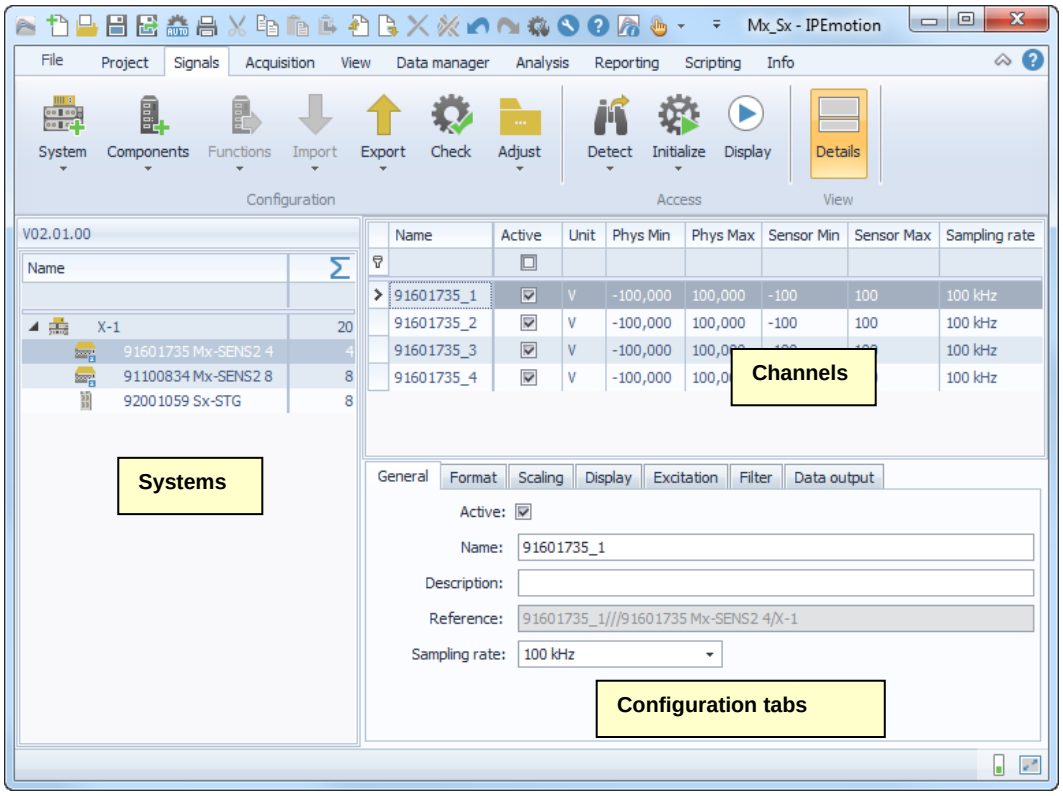
- channels/modules with high data rate get a low CAN ID
- within the same data rate, a descending sequence based on the serial number is used
- CAN IDs of unused channels will be reserved
(e. g. with an 8 channel device, but only 4 channels activated:
channel 1 … 4 activated > ID 11 start bit 0, 8, 16, 32
channel 5 … 8 inactive > ID 12 start bit 0, 8, 16, 32).

Measuring point number



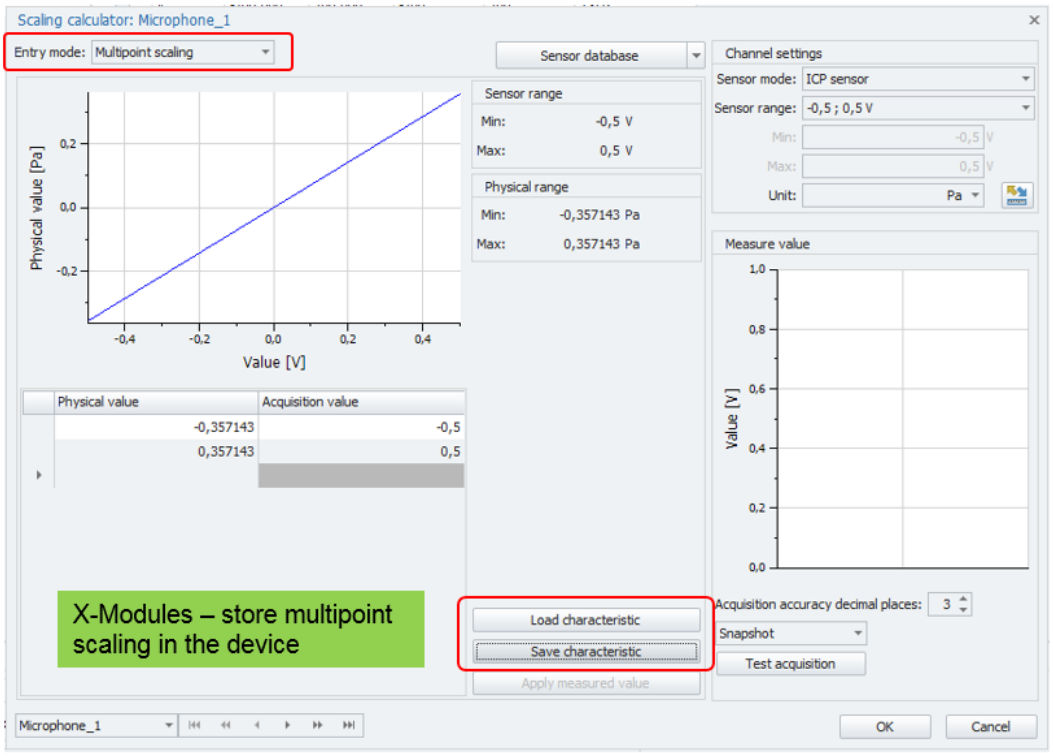
After selection by the column chooser, an individual number can be assigned to each channel. This can be used for sorting abilities or as character imported from a measuring point description.

5.4.2 Mx-SENS2 4, Mx-SENS2 8, Mx-SENS

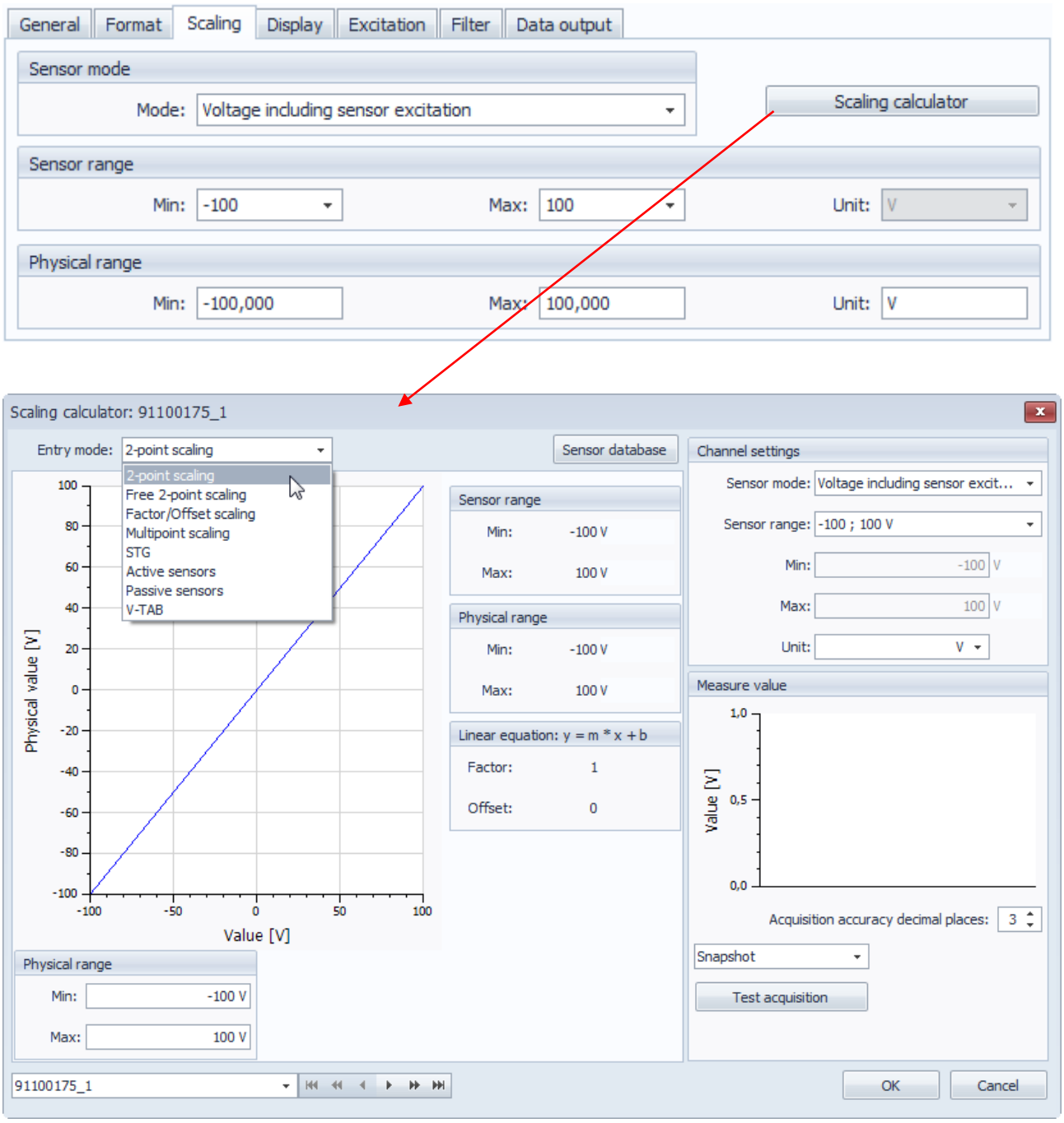


5.4.3 Multipoint Scaling – stored in the X-device

The X-devices Mx-SENS2 4, Mx-STG2 6, Mx-SENS2 8, and Sx-ST support multipoint scaling function in the device. The scaling points are stored in the device and are there available in 3rd party software tools like INCA or CANape where the modules are integrated via A2L file.



Channel scaling

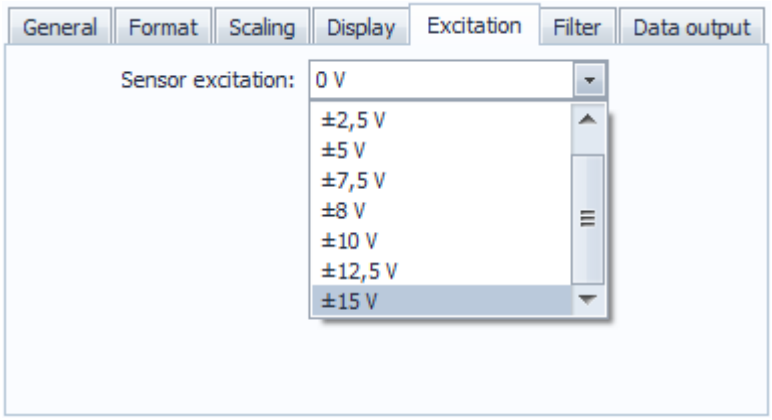


With the scaling calculator, you can also perform a 2-point scaling by defining real signals. Proceed as follows:

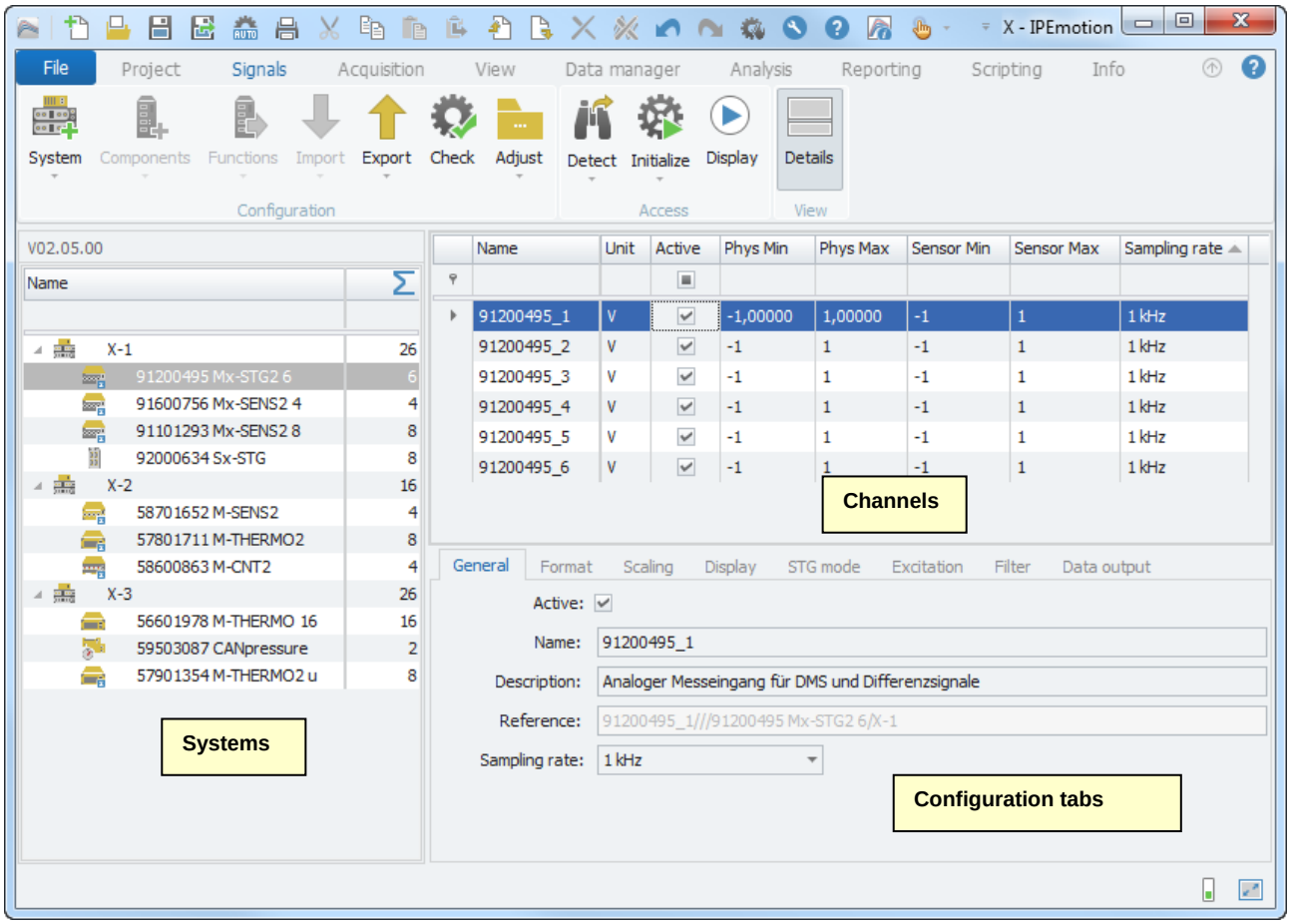
> set the lower pressure value	*Measured signal corresponds to x bar (calculate value pair 1)*
> set higher pressure value	*Measured signal corresponds to y bar (calculate value pair 2)*

Depending on the setting, the test acquisition is detected as a unique value (snapshot) or as an average value (average over values, average over time).

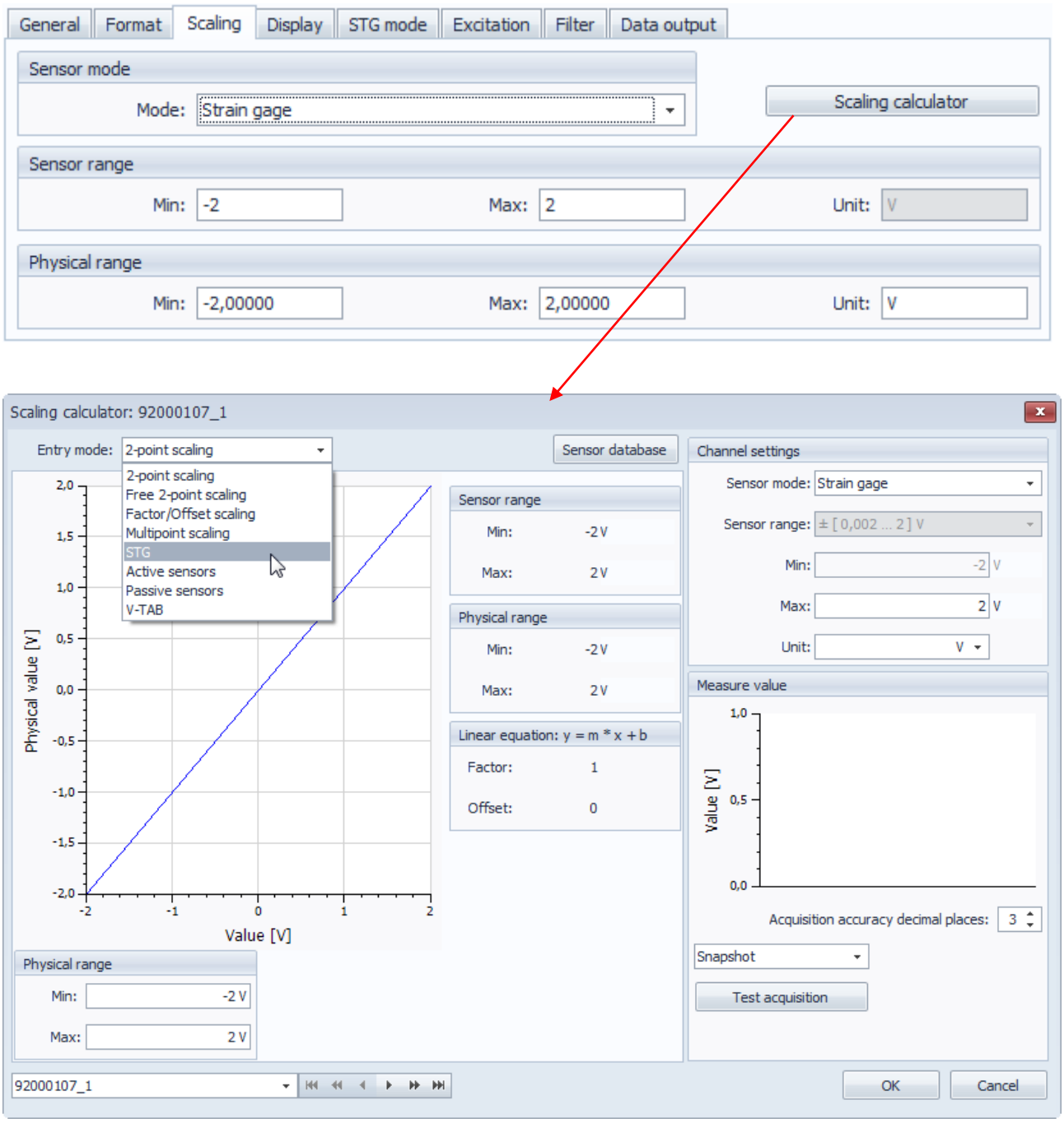
Excitation


General
Format
Scaling
Display
Excitation
Filter
Data output
Sensor excitation:
0 V
±2,5 V
±5 V
±7,5 V
±8 V
±10 V
±12,5 V
±15 V

5.4.4 Mx-STG2, Sx-STG



Channel scaling



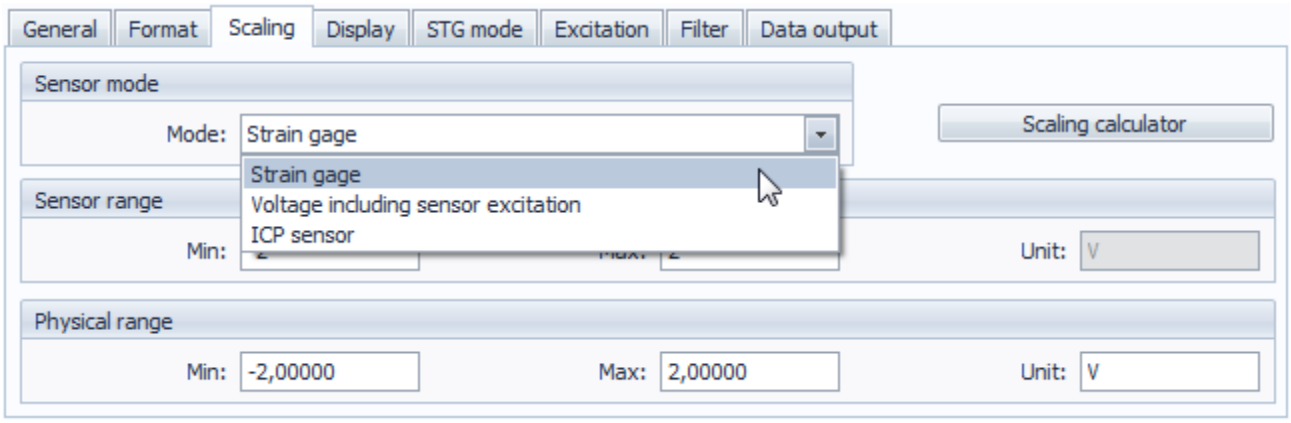
Using the scaling calculator, you can perform 1-point (factor/offset), 2-point and multi point scalings.

Proceed as follows for a 2-point scaling with real signals (e.g. for a pressure measurement):

> set the lower force value	*Measured signal corresponds to x N (calculate value pair 1)*
> set higher force value	*Measured signal corresponds to y N (calculate value pair 2)*

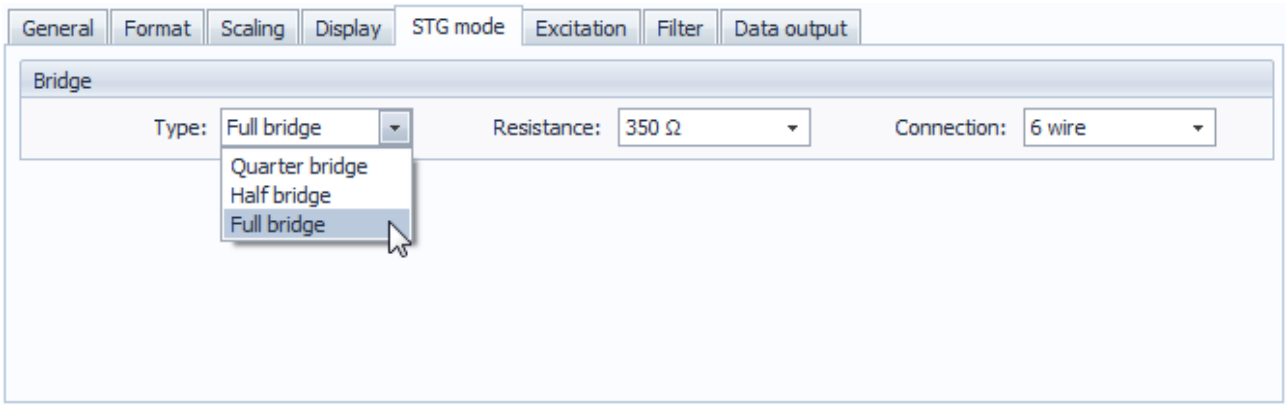
Depending on the setting, the test acquisition is detected as a unique value (snapshot) or as an average value (average over values, average over time).

Scaling: Mode selection (Sx-STG only)

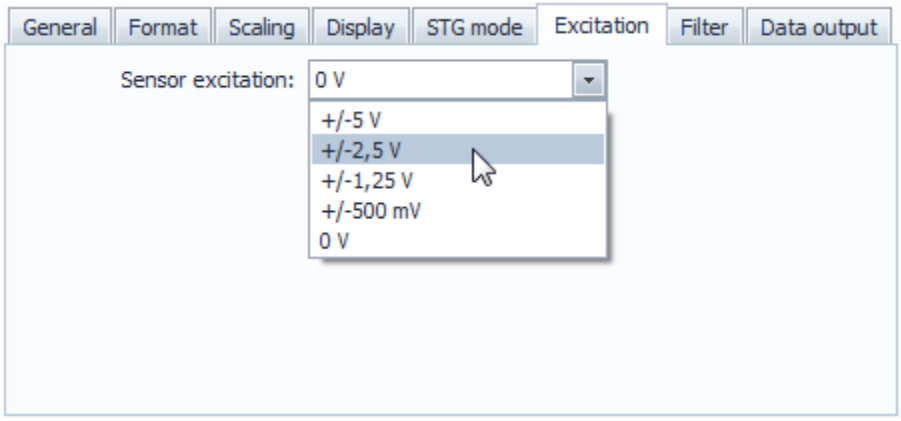


*For Sx-STG the tab **STG mode** is displayed only when the Sensor mode **Strain gage** is selected!*
*For Mx-STG2 the sensor mode is set to **Strain gage** (fixed setting).*

STG mode



Excitation

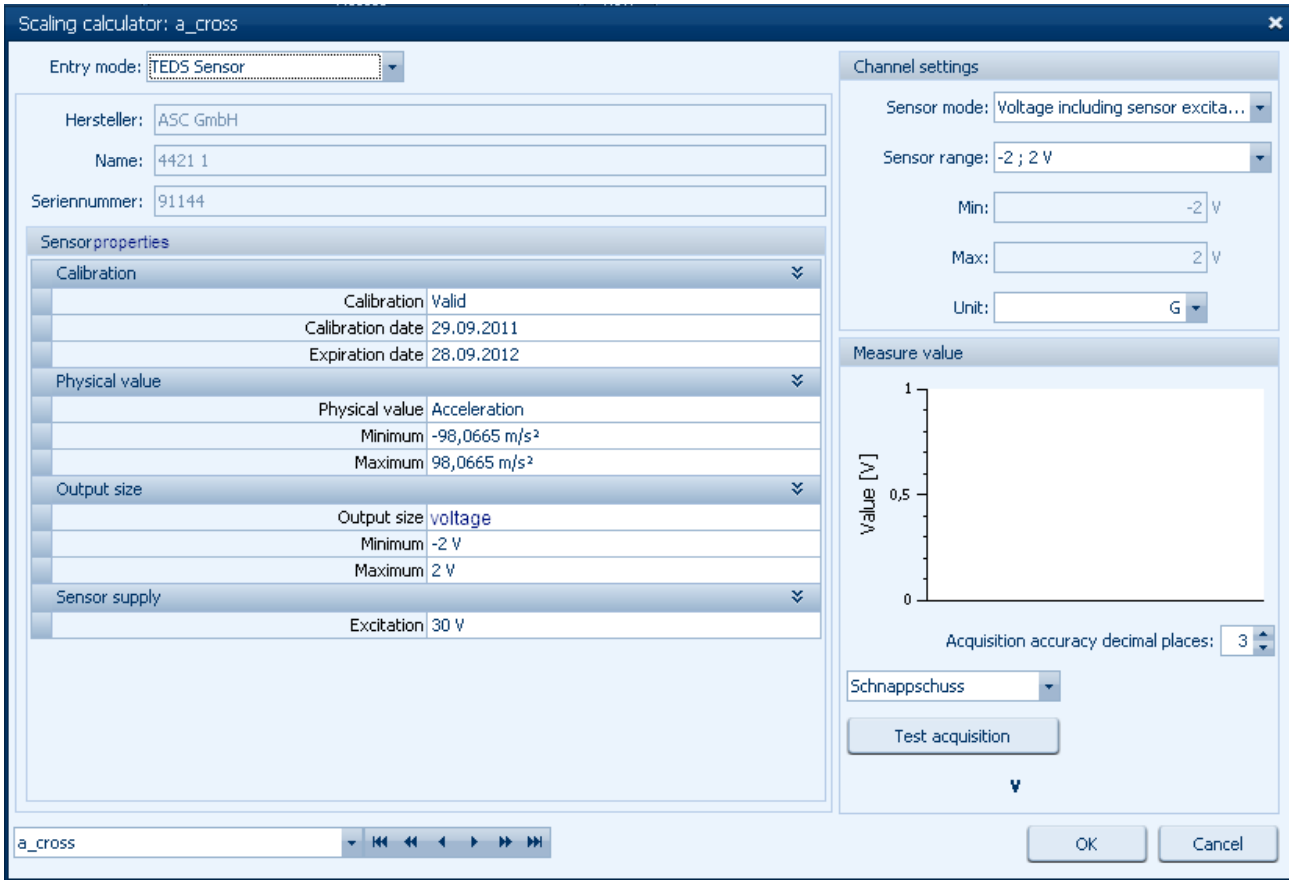


*As the supply voltagel **+/- 5 V** may cause a damage of the bridge circuit when selecting the setting **Resistance 120 Ω** in the **STG mode** tab, this voltage is available only for **350 Ω** and **1 kΩ** bridge resistors!*

Using TEDS sensors

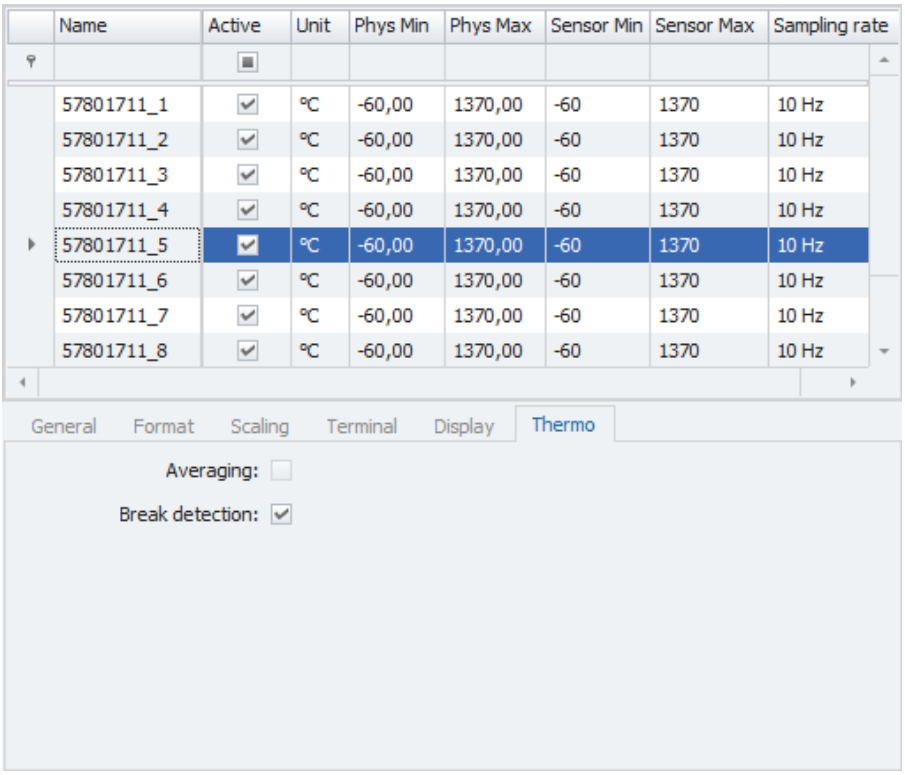
Mx-STG2 and Sx-STG type LEMO 2B (TEDS) support the use of TEDS sensors once the input connector has been plugged in.

- Connect the TEDS sensor with a free input channel of Mx-STG2/Sx-STG.
- Move to the **Signals** tab.
- Click **Detect** from the icon bar at the upper area of the channel grid, alternatively
- Click **Synchronize** from the icon bar at the upper area of the channel grid (drop down menu **Detect**) to reload latest settings.
- Mx-STG2/Sx-STG now reads all configuration data from the sensor's chip and provide them with the Scaling Calculator (Entry mode: **TEDS Sensor**).

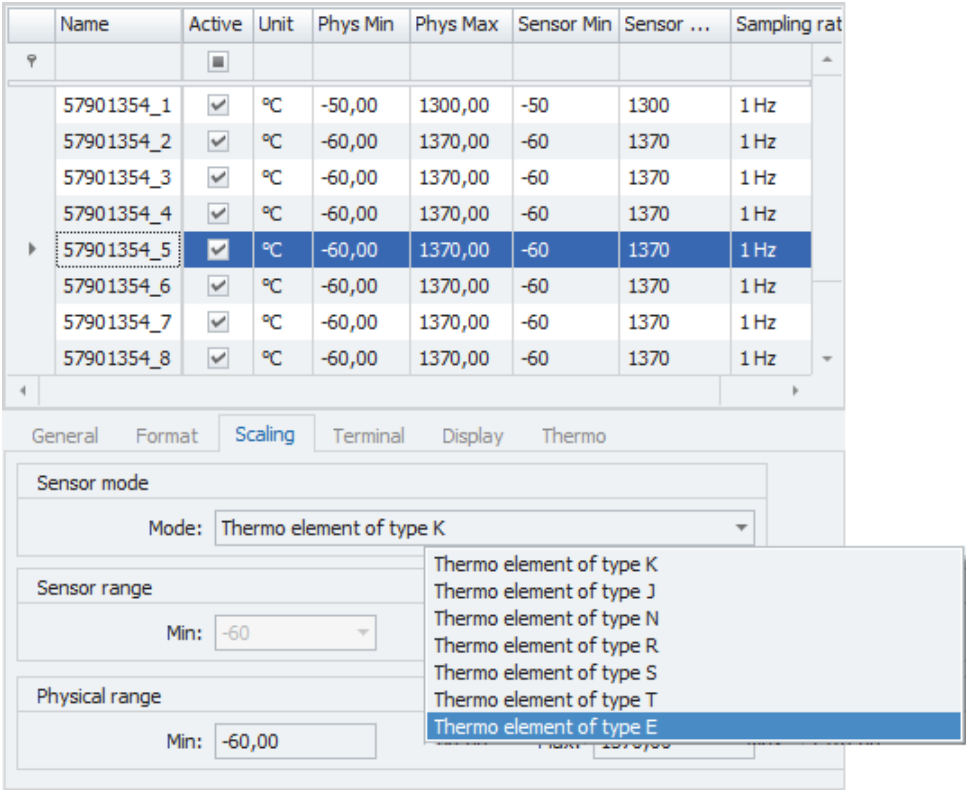


5.4.5 M-THERMO2, M-THERMO2 u

Averaging, Break detection

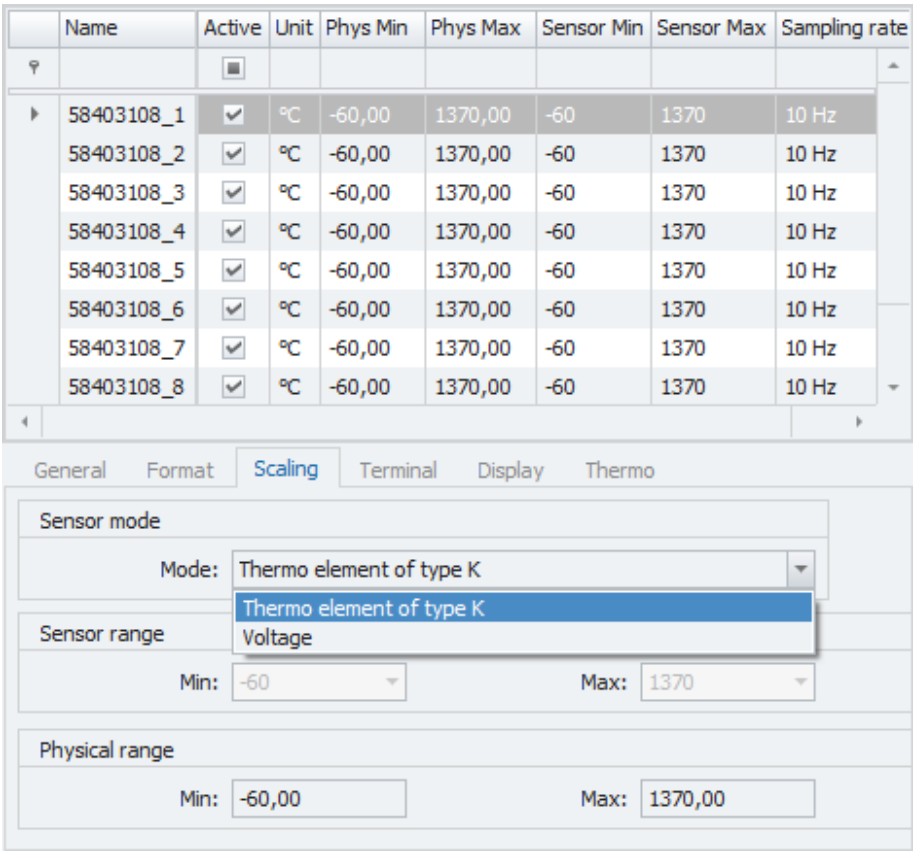


Thermocouple (M-THERMO2 u only)



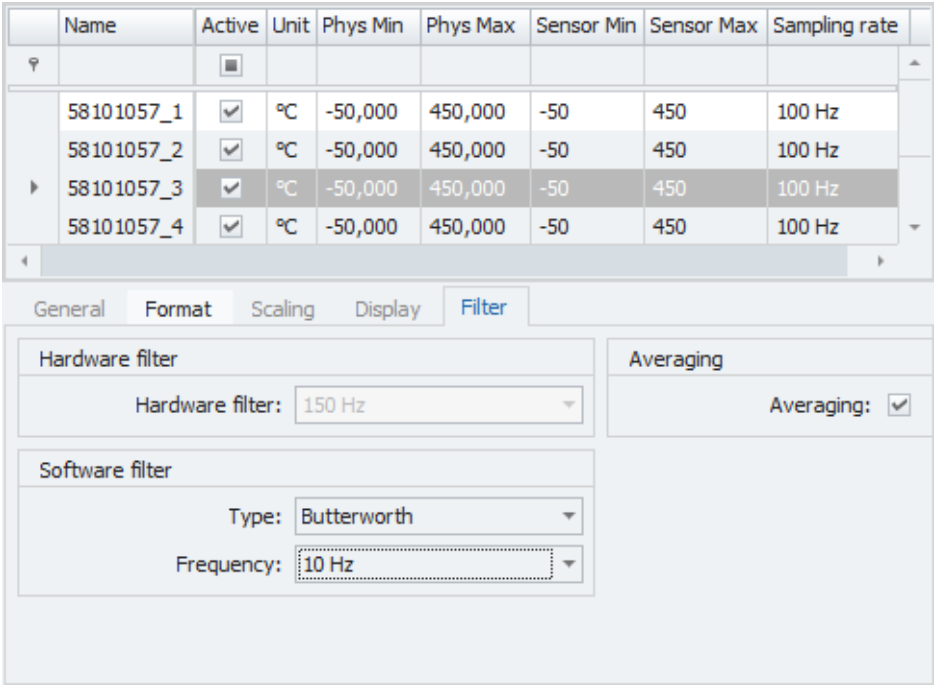
5.4.6 M-UNI2

Mode(Thermo, Voltage)



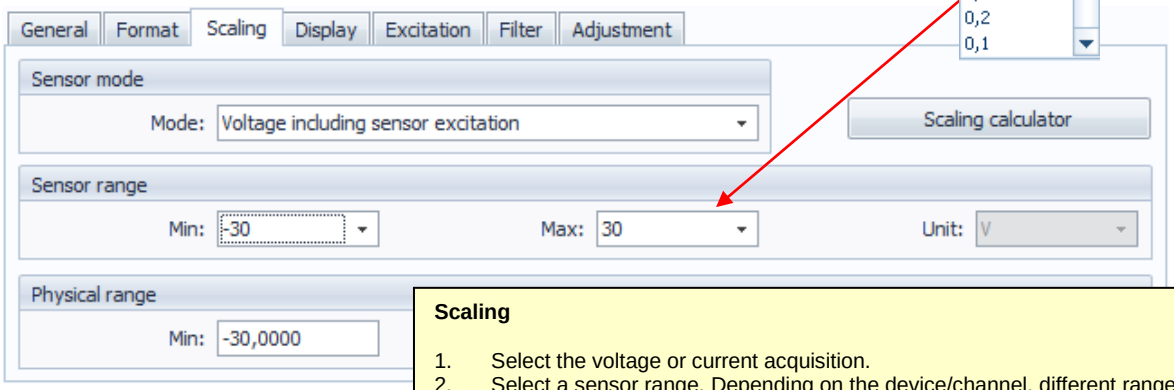
5.4.7 M-RTD2

Filter, Averaging



5.4.8 M-SENS2

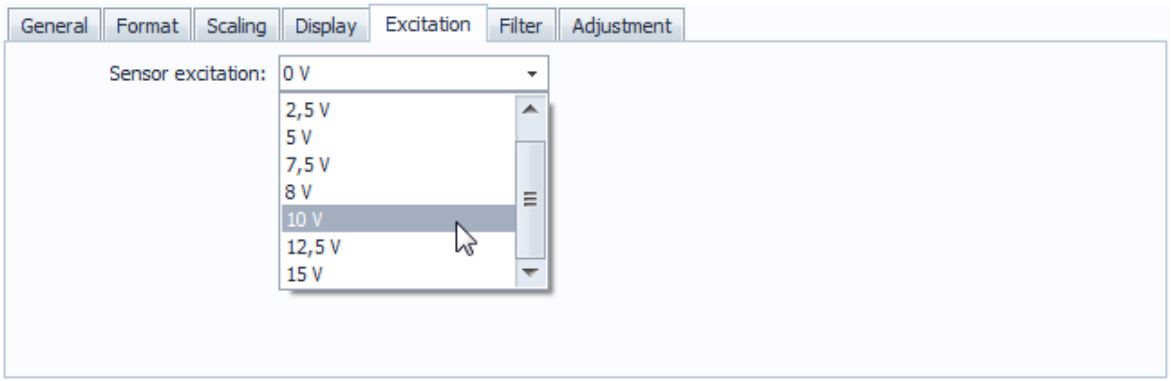
Scaling, measuring range



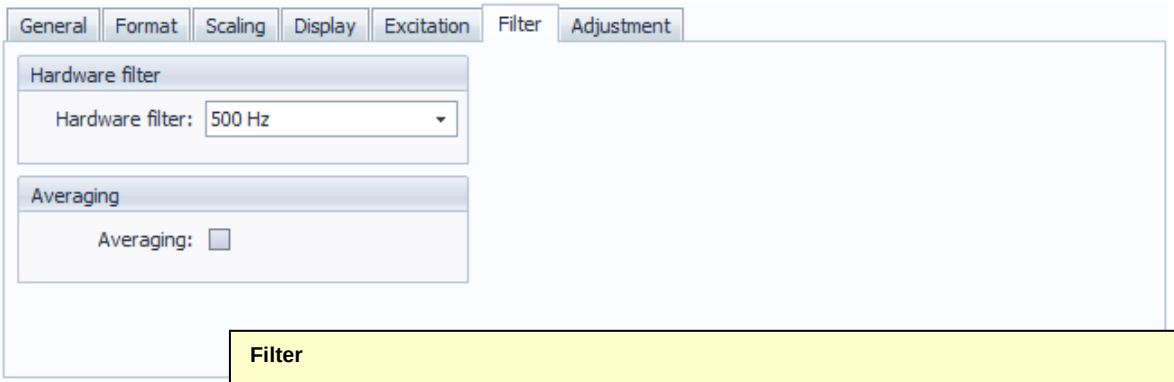
Scaling

1. Select the voltage or current acquisition.
2. Select a sensor range. Depending on the device/channel, different ranges are available.
3. Define a physical range and the unit with the scaling calculator – if required.

Sensor, initial excitation



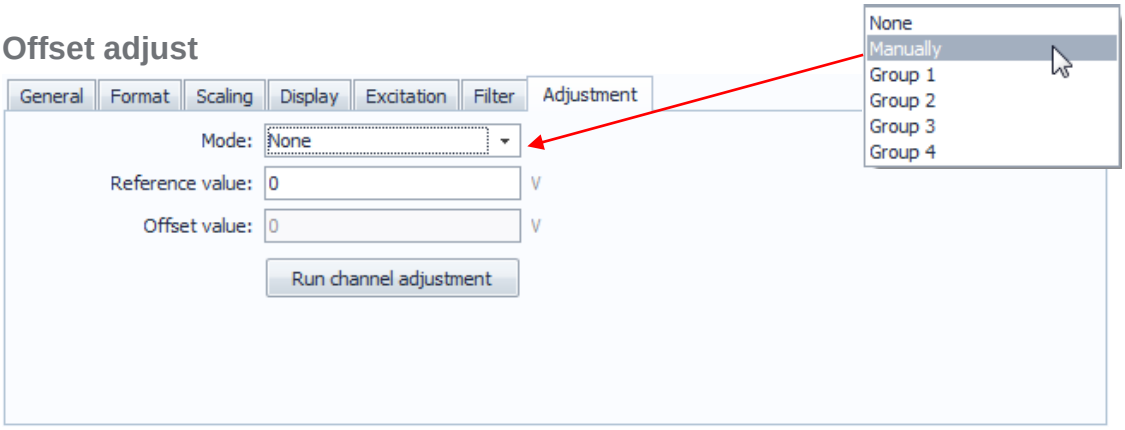
Filter, averaging



Filter

1. Activate the hardware filter for avoiding aliasing effects. This is always recommended for measuring with periodic signals.
2. Activate the block averaging (floating average) for smoothing disturbing signal interrupts or noise components. The average value is online calculated from the samples of the CAN data rate. (Example: CAN output rate = device sample rate: 100 Hz, internal sample rate: 2 kHz > cyclic average calculation from 2000 / 100 = 20 samples)
3. Activate the software filter for additionally filtering the signal. Select the filter type (Bessel, Butterworth, Tschebychev) and the cut-off frequency (0.1 Hz...495.0 Hz, depending on the sampling rate).

Offset adjust



The offset adjustment is supported by the respective device from the following firmware version:
M-SENS, M-SENS 8 >= V3.12.07
M-SENS 8plus >= V3.12.08

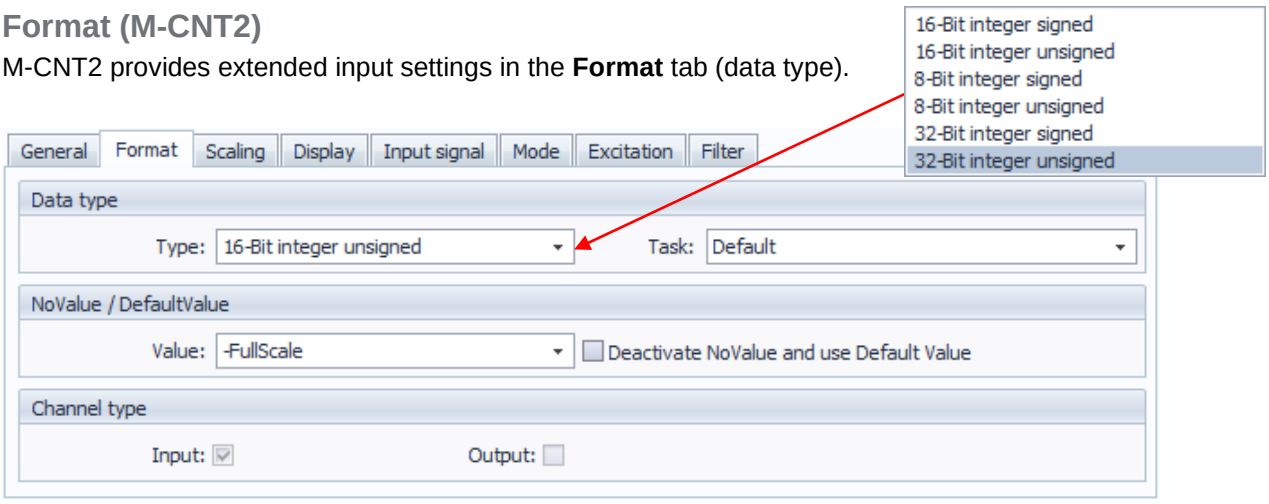
The calibration function with a broadcast command (IPEhotkey) also allows the offset adjustment during a running acquisition to a user defined target value (reference value). The following actions are permitted:

- **None** no offset calibration
- **Manually** only channels with this status are calibrated with the **Manual calibration** command
- **Group X** channels, which are assigned to a specific group (1…4), are calibrated with the desktop icon IPEhotkey and the **Calibration Group** command. The channel assignation to one group can also be effected for all devices (e.g. SENS type, STG, CAN*pressure* mixed in one group). A signal-based calibration is therefore possible.

5.4.9 M-CNT2

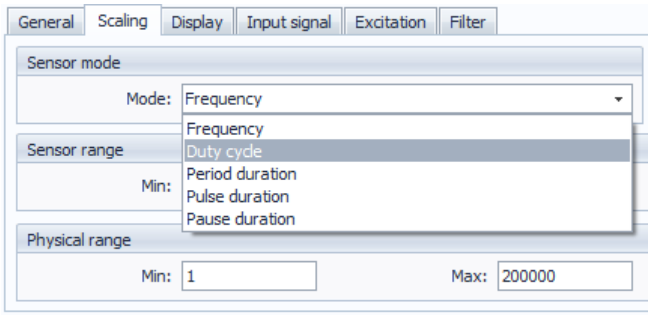
Format (M-CNT2)

M-CNT2 provides extended input settings in the **Format** tab (data type).

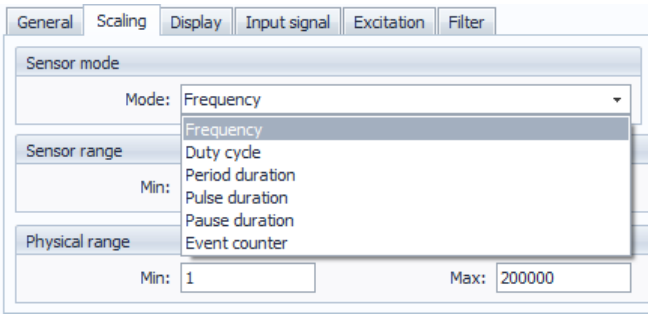


In addition to data types 8 Bit and 16 Bit integer signed/unsigned type 32 Bit integer signed/unsigned is selectable in order to transfer numerical values > 65535 to the DAQ software (requestet for measurement frequency > 65.5 kHz resp. counter reading > 65.5 k).

Scaling, measuring ranges



Scaling M-FRQ



Scaling M-CNT2

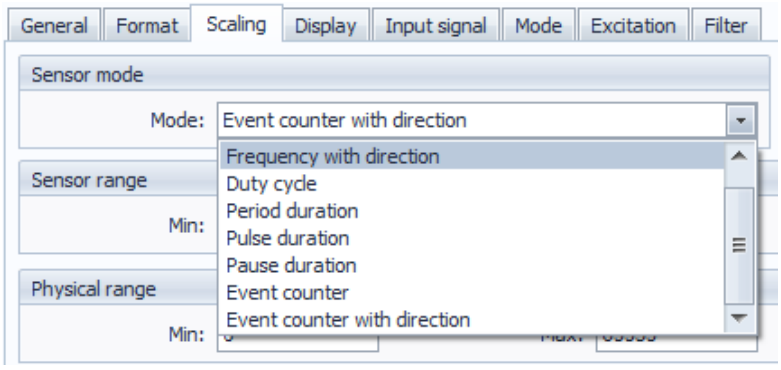
Scaling

1. Select the mode for frequency or period acquisition.
2. Select a sensor range. Depending on the device/channel, different ranges are available.
3. Define a physical range and the unit with the scaling calculator – if required.

Mode	Ranges			Remarks
	Min.	Max.	Unit	
Frequency	0 ... 200	0 ... 200	kHz	Maximum > Minimum minimum signal frequency 0.03 Hz maximum signal frequency 200 kHz
Duty cycle Range 0.01 % to 99.99 %	0 ... 100	0 ... 100	%	Maximum > Minimum minimum signal frequency 0.03 Hz maximum signal frequency: 10 kHz at 1 % duty cycle 250 kHz at 25 % duty cycle 500 kHz at 50 % duty cycle 250 kHz at 75 % duty cycle 10 kHz at 99 % duty cycle
Periodic duration	0 ... 200	0 ... 200	s	Maximum > Minimum maximum interval duration 200 s minimum interval duration 1 µs
Pulse duration	0 ... 200	0 ... 200	s	Maximum > Minimum maximum pulse duration 200 s minimum pulse duration 1 µs
Pause duration	0 ... 200	0 ... 200	s	Maximum > Minimum maximum pause duration 200 s minimum pause duration 1 µs
Event counter	0	127 ... 4.295 * 10^9	s	Depends on configured data type

Select values >=1 Hz for the frequency with **Sensor range Min***! This avoids an unnecessary long response time until the value 0 Hz or –FS is sent if a signal is missing or has the value approx. 0 Hz. The maximum response time at 0 Hz is 40 s.*

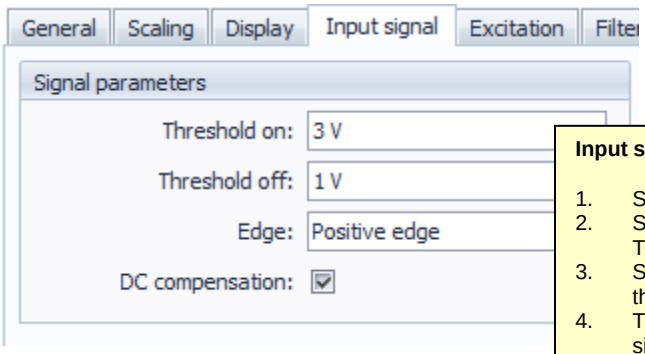
Indicating rotation direction



The **Scaling** tab offers special sensor modes **Frequency with direction** and **Event counter with direction** for channel 1/2 and channel 3/4.

Both settings support incremental sensors that provide a second phase-shifted output signal used for detection of the rotation direction. This can be used for positive / negative frequency / rpm indication or as up & down counter.

Input signal



Input signal

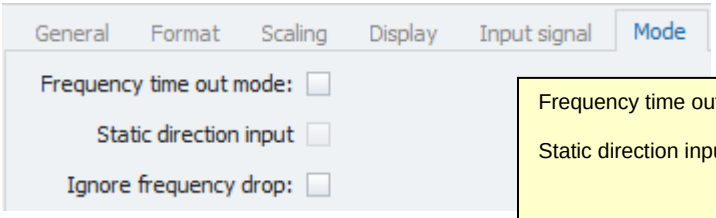
1. Select the upper threshold with *Threshold on* in a range of +/-40 V.
2. Select the lower threshold with *Threshold off* in a range of +/-40 V. The lower threshold must always smaller than the upper one.
3. Select an edge for defining the positive or negative signal edge. If the negative edge is selected, the input signal will be inverted.
4. The DC compensation disables the direct current component in the signal with a passive high-pass (1-pole, 0.8 Hz cut-off frequency).

An oscilloscope is recommended for displaying the signal behavior for configuring the switching thresholds on and off. If the sensor signal does not exceed the threshold on or fall below the threshold off, no exact acquisition is possible. In this case, the value does not change although the revolutions per minute increase and the sensor is connected correctly. Correct the threshold values in the configuration and run a test acquisition.

Please note that a lot of speed sensors send an almost ideal square wave signal in the lower frequency range, but the graph changes with increasing frequency (> saw tooth). This can also be caused by external capacities e.g. a (long) connection cable to the sensor.

Mode (M-CNT2)

Mode Frequency with/without direction

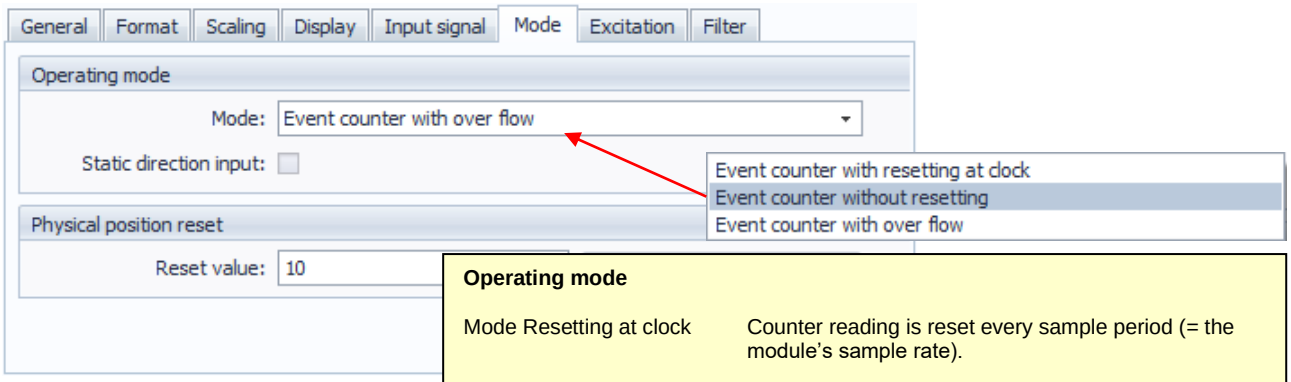


Frequency time out mode	Fixed gate time setting to 42 s
Static direction input	2nd signal used with input 2 resp. input 4 to define the direction of rotation. (for example: level high means right hand rotation, level low means left hand rotation)

*If the **Frequency time out mode** is activated, the maximum gate time of 42 s is set in the **Input signal** tab. This enables frequency measurement down to 0.0238 Hz, while lower frequencies will be output as 0 Hz. In order to indicate a rotation stop immediately, a short gate time is recommended, but this means, the minimum frequency that can be measured increases.*

***Example Input signal** tab > **Zero detection threshold**:*
Gate time: 0.5 s > minimum frequency that can be measured: 2 Hz (correlating to 120 rpm)

Mode Event counter with/without direction



Operating mode

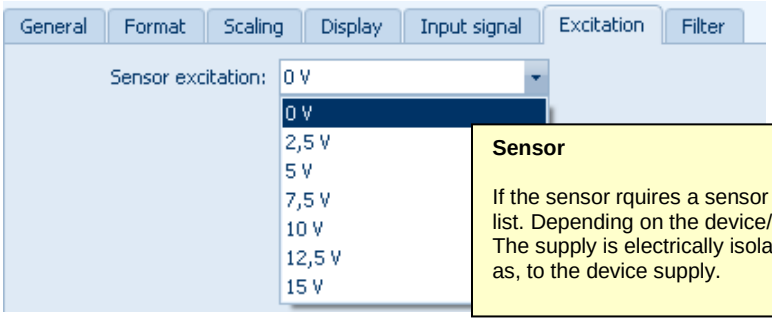
Mode Resetting at clock	Counter reading is reset every sample period (= the module's sample rate).
Mode Without resetting	Counter reading stops and remains un-changed as soon as the counter value reaches its upper range (zero reset with a measurement restart)
Mode Over flow	The counter reading starts from zero again, as soon as the counter value reaches its upper range.
Statisc direction input	2nd signal used with input 2 resp. input 4 to define the direction of rotation.

Physical position reset

Reset value	Predefining the reset value.
Reset position	Reset current value to 0.

For detecting the rotation direction the frequency identical but phase shifted signal (provided by the sensor) can be used at input 2 resp. input 4. Alternatively a static voltage signal can be used at input 2 / 4. Activate the checkbox „Static direction input" in this case.

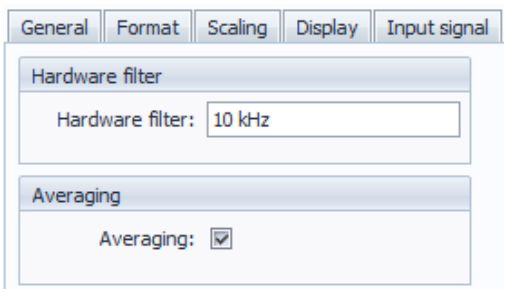
Sensor, initial excitation



Sensor

If the sensor rquires a sensor excitation, select the initial excitation from the list. Depending on the device/channel, different voltages are available.
The supply is electrically isolated to the input and channels nearby, as well as, to the device supply.

Filter / Averaging

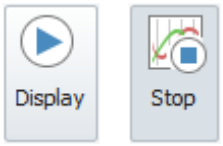


Filter

Select the hardware filter for avoiding aliasing effects. This is always recommended for measuring with periodic signals.

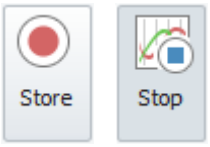
Averaging is calculated from the values acquired within the respective sample period. An internal sample rate of 5 kHz. (M-CNT2) is used.
Example
Module sample rate (means output rate to CAN bus) = 100 Hz
Averaging = 5000 Hz / 100 Hz = 50 values

5.5 Acquire measurement data



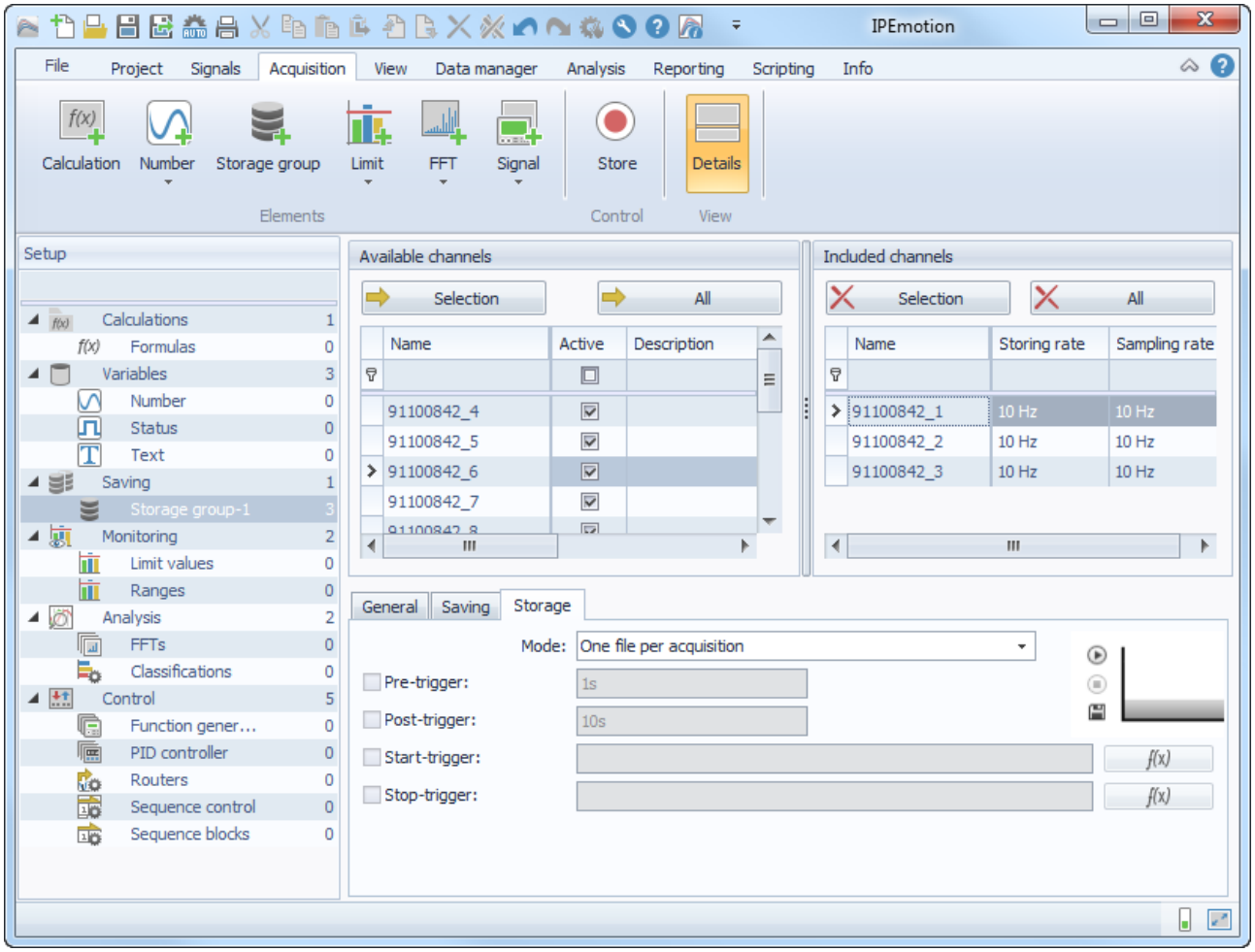
5.5.1 Visualization

- Move to the **Signals** tab.
- Select **Display** from the main menu.
- IPEmotion displays measurement values of all active channels continuously in the channel grid.
- Change to the **View** tab to create and arrange alphanumerical and graphical display components (numeric display, tachometer, bargraph, y-t-diagram, ...) or use the oscilloscope feature to display periodic signals at higher frequencies.
- Click **Stop** from the main menu to stop data visualization.



5.5.2 Storage

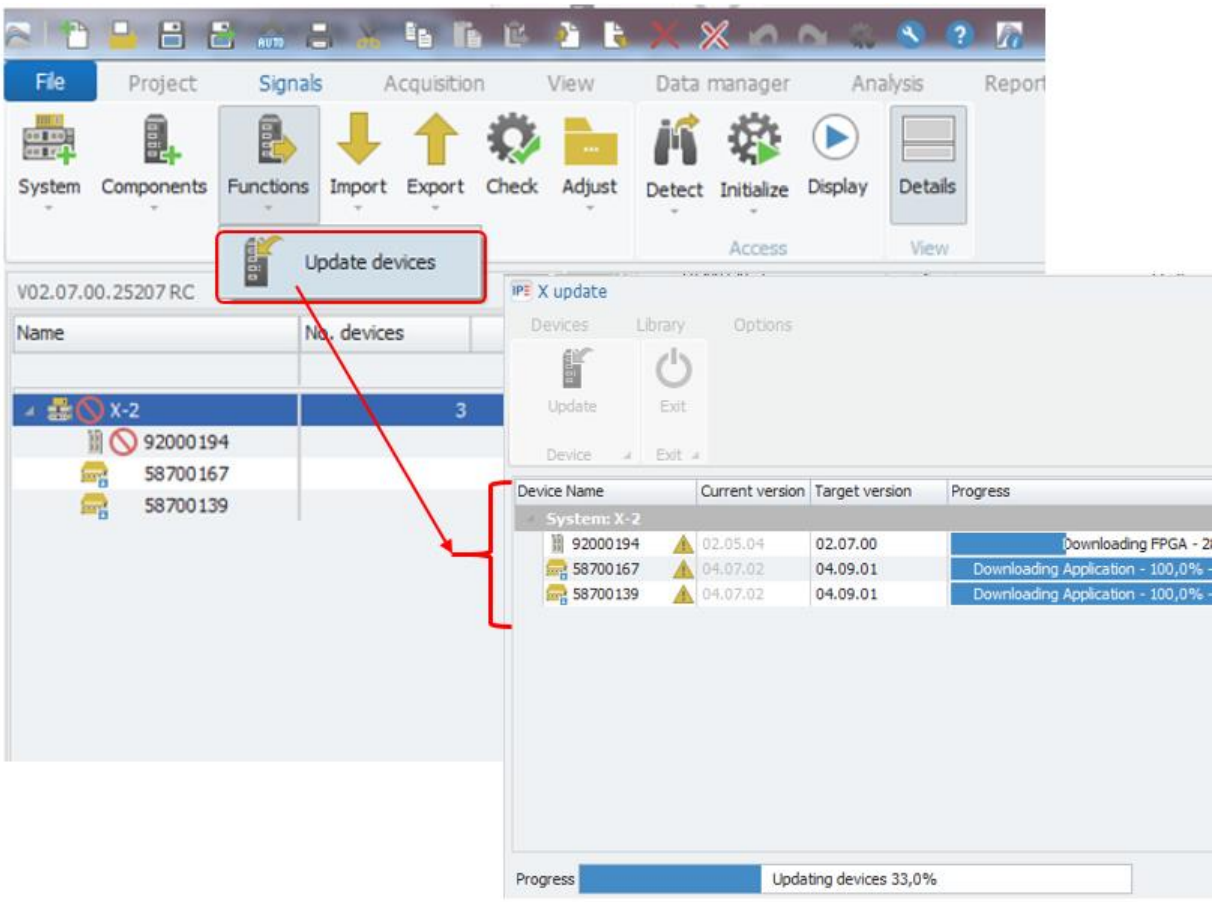
- Move to the **Acquisition** tab.
- Right click to **Saving** from the left-hand **Setup** structure, select **Storage group** from the context menu.
- Create one or more storage groups for your measurement task.
- Assign active channels (measurement signals) to your storage groups which you created previously.
- If required, change the storing rate to lower data rates or use the average function (MEAN).
- Define individual trigger events as required to control data storage.
- Click **Store** from the main menu to start data storage.
- Click **Stop** from the main menu to stop data storage.



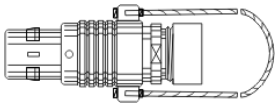
6 Firmware update

The firmware of the IPETRONIK X- and CAN devices is subject to continuous developments. Both product lines can get a firmware update over the X-PlugIn.

- Move to the **Signals** tab.
- Highlight the X-System.
- Select **Functions** > **Update devices** from the tool bar.
- Select **Update** to download new firmware to the connected modules, or first
- import the latest firmware files using **Check for updates** under **Library**.
- CAN and X-Modules can be updated over X-Update



6.1 Resetting modules



The system plug X-LINK DEF (X-LINK Module DEFAULT plug) is used for resetting X-devices to its default settings.

Resetting effects on

- configuration settings
- serialized device specific settings (e.g. shunt check, offset compensation)
- the IP address range (default range)

How to use

- Switch off the power supply
- Plug in X-LINK DEF at the respective system connector of the device
- Switlch on the power supply
- Wait 10 seconds
- Switch off the power supply
- Pull off X-LINK DEF

7 Appendix

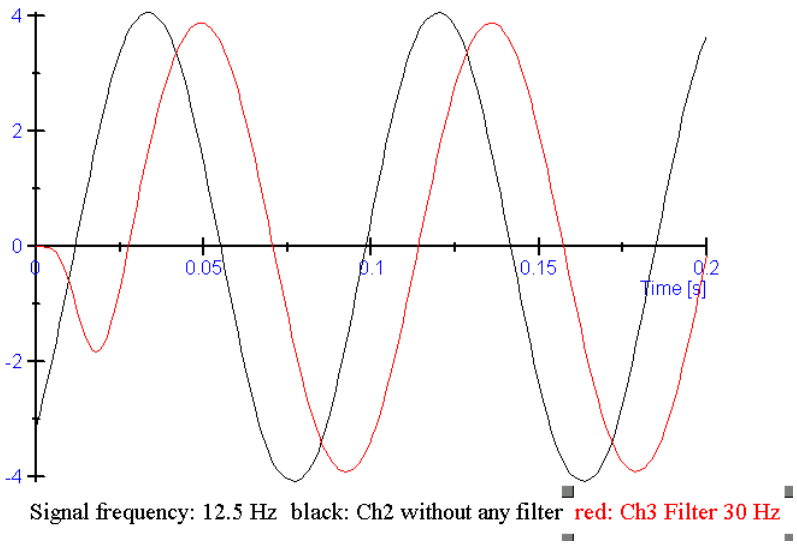
7.1 Filter in the measurement engineering

7.1.1 Why is it necessary to use filters?

Filters of analog measuring amplifiers are used for avoiding interrupting frequencies (frequency spectra, which do not contribute to the signal and/or which cannot be processed by the system). A low pass filter, which reduces the amplitudes of the frequencies above a specific cut-off frequency, is usually used for avoiding negative effects to the useful signal. The threshold in the range of the cut-off frequency (the barrier between the useful and the unrequested signal) is continuous.

Depending on the measuring task, the following filter properties are to be respected:

- Useful signals below the cut-off frequency are also damped. (A damping of 3 dB at the cut-off frequency means a reduction of the initial signal of 30 %.)
- Filters always cause a time shifting (phase shifting) between the initial signal and the filtered one. The value of the phase shifting depends on the type of filter and the filter order (pole number).



The image above shows the result of two inputs with the same input signal of 4 V amplitude and 12.5 Hz frequency.

Channel 2	black	without filter
Channel 3	red	with 30 Hz hardware filter (Bessel type)

Channel 3 clearly shows the damping, the phase shifting, as well as, the start oscillation of the filter.

7.1.2 How to use filters?

Modern systems offer qualified hardware filters and, if applicable, additional software filters.

Although today's microprocessors provide a high processing power, the use of hardware filters is still essential. Especially when users cannot exclude that (periodic) signals can pass the AD converter and software filter, which cannot process the signals. Every sampling system follows Shannon's sampling theorem whereby one must at least sample with twice the signal frequency. Otherwise, aliasing effects can occur, whereas the acquired frequency is considerably lower than the actual signal (see image below).

Why do we additionally filter with DSP?

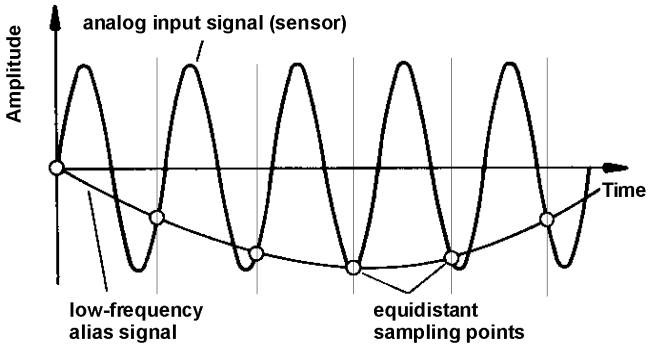
The hardware filter at the input excludes a distortion by frequency spectra above the system limit with the maximum sampling rate. Depending on the application, it can be required to lower the cut-off frequency.

Example:

M-SENS devices provide a switchable hardware filter with 150 Hz cut-off frequency. If the cut-off frequency is e.g. 50 Hz, interrupting frequency spectra (of devices with additional software filter) in the range between 50 Hz and the hardware filter frequency can be filtered with DSP. The filter frequency can be configured in defined steps up to the hardware filter frequency.

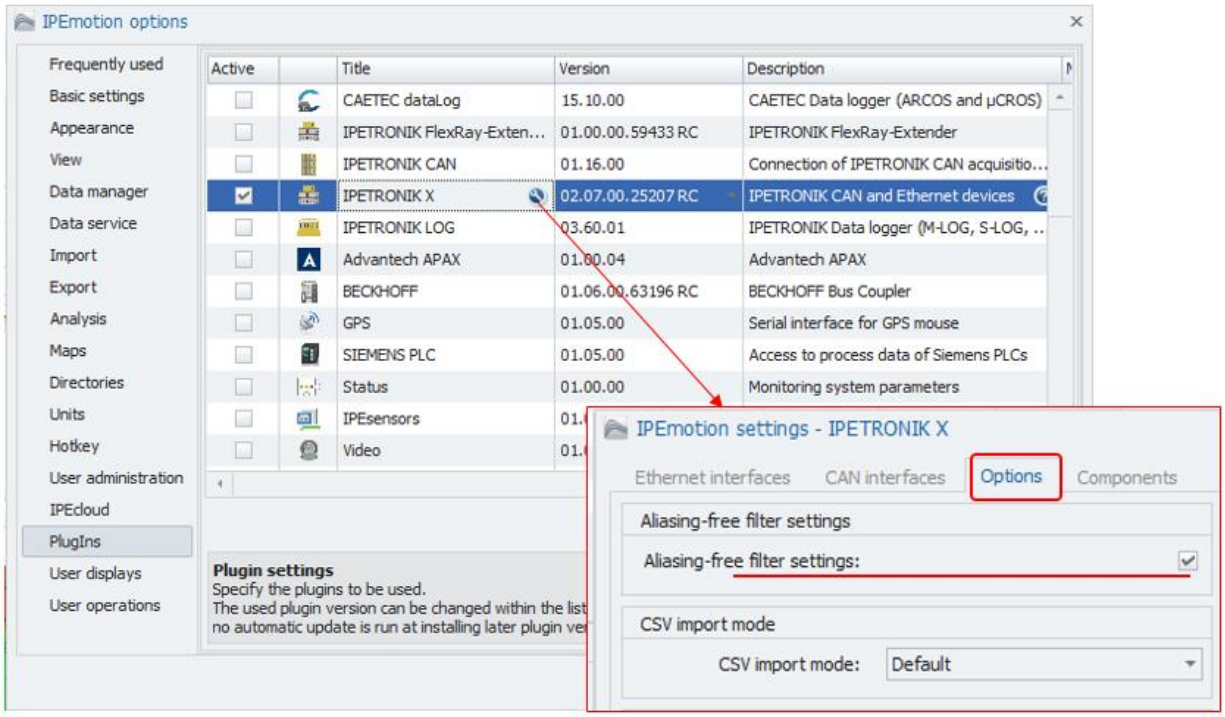
Aliasing effects in spite of hardware and software filter?

Despite sophisticated measurement engineering, errors can occur due to wrong settings. If, for example, a 100 Hz signal is acquired with a sampling rate of 100 Hz (also the output rate to the data bus). The system can independently acquire the correct signal, but the result is wrong because the sampling rate was set too low. If the signal is sent to the bus with a lower sampling / output rate, the result does not reflect the initial signal.



7.2 Alias free measurement - automatically

The X-PlugIn is supporting the PlugIn Options a default setting for alias free measurement.



This checkbox has an impact on the DSP and hardware software filter settings. The function is only supported for modules which have adjustable DSP and / or hardware filter.

If aliasing-free filtering is active, the software filter frequency is automatically adjusted when the sampling rate changes. The frequency is changed such that the new value is always the maximum possible frequency, where aliasing free measurement is guaranteed. If the filter frequency previously had been changed to a lower value intentionally, the filter frequency has to be changed manually by the user after the sample rate has been changed. This also applies, if the sample rate is decreased. The automatic adaptation of the software filter frequency is not applied, in case that the aliasing free measurement is disabled.