DEWESoft®

measurement innovation

SIRIUS®
Technical Reference Manual
Version: 1.5.5

Thank you!

Thank you very much for your investment in our unique data acquisition systems. These are top-quality instruments which are designed to provide you years of reliable service. This guide has been prepared to help you get the most from your investment, starting from the day you take it out of the box, and extending for years into the future.

www.dewesoft.com

Table Of Contents

1 Notice

The information contained in this document is subject to change without notice.

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Warranty Information:

A copy of the specific warranty terms applicable to your Dewesoft product and replacement parts can be obtained from your local sales and service office.

To find a local dealer for your country, please visit this link: http://www.dewesoft.com/contact and scroll down to the list of Worldwide distributors.

Calibration

Every instrument needs to be calibrated at regular intervals. The standard norm across nearly every industry is annual calibration. Before your Dewesoft data acquisition system is delivered, it is calibrated. Detailed calibration reports for your Dewesoft system can be requested. We retain them for at least one year, after system delivery.

Support

Dewesoft has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or Dewesoft directly.

Austria	Slovenia
Dewesoft GmbH Grazerstrasse 7 A-8062 Kumberg Austria / Europe Tel.: +43 3132 2252 Fax: +43 3132 2252-2 Web: http://www.dewesoft.com The telephone hotline is available Monday to Thursday between 09:00-12:00 (GMT +1:00) 13:00-17:00 (GMT +1:00) Friday: 09:00-13:00 (GMT +1:00)	Dewesoft d.o.o. Gabrsko 11a 1420 Trbovlje Slovenia / Europe Tel.: +386 356 25 300 Fax: +386 356 25 301 Web: http://www.dewesoft.com The telephone hotline is available Monday to Friday between 08:00 and 16:00 CET (GMT +1:00)

Service/repairs

The team of Dewesoft also performs any kinds of repairs to your system to assure a safe and proper operation in the future. For information regarding service and repairs please contact your local distributor first or Dewesoft directly.

Restricted Rights Legend:

Use Austrian law for duplication or disclosure.

Dewesoft GmbH
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1.1 Safety instructions

Your safety is our primary concern! Please be safe!

Safety symbols in the manual

WARNING 	Calls attention to a procedure, practice, or condition that could cause body injury or death.

WARNING 	Calls attention to the danger of voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.

CAUTION 	Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

General Safety Instructions

WARNING	The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Dewesoft GmbH assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as option and will not be shipped as standard parts.

Environmental Considerations

Information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling a Dewesoft system:

System and Components Recycling

Production of these components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at it's end of life! Please recycle this product in an appropriate way to avoid an unnecessary pollution of the environment and to keep natural resources.

This symbol indicates that this system complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further information about recycling on the Dewesoft web site www.dewesoft.com

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. However we take care about our environment and the product is lead free.

General safety and hazard warnings for all Dewesoft systems

- Safety of the operator and the unit depend on following these rules
- Use this system under the terms of the specifications only to avoid any possible danger.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- DO NOT touch internal wiring!
- DO NOT use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- You may not connect higher voltages than rated to any connectors.
- The power-cable and -connector serve as Power-Breaker. The cable must not exceed 3 meters, disconnect function must be possible without tools.
- Maintenance must be executed by qualified staff only.

- During the use of the system, it might be possible to access other parts of a more comprehensive system. Please read and follow the safety instructions provided in the manuals of all other components regarding warning and security advices for using the system.
- With this product, only use the power cable delivered or defined for the host country.
- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), a non interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals.
- Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please read the corresponding specifications in the product manual carefully.
- The inputs must not, unless otherwise noted (CATx identification), be connected to the main circuit of category II, III and IV.
- The power cord separates the system from the power supply. Do not block the power cord, since it has to be accessible for the users.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, get it examined by authorised personnel only.
- Adverse environmental conditions are:
  - Moisture or high humidity
  - Dust, flammable gases, fumes or dissolver
  - Thunderstorm or thunderstorm conditions (except assembly PNA)
  - Electrostatic fields, etcetera.
- The measurement category can be adjusted depending on module configuration.
- Any other use than described above may damage your system and is attended with dangers like short-circuit, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to Dewesoft sales and service office for service and repair to ensure that safety features are maintained.
- DO NOT service or adjust alone. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
- If you assume a more risk less use is not provided any more, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more risk less operation is not possible any more, if
  - the system is damaged obviously or causes strange noises.
  - the system does not work any more.
  - the system has been exposed to long storage in adverse environmental.
  - the system has been exposed to heavy shipment strain.
- DO NOT touch any exposed connectors or components if they are live wired. The use of metal bare wires is not allowed. There is a risk of short cut and fire hazard!
- Warranty void if damages caused by disregarding this manual. For consequential damages NO liability will be assumed!
- Warranty void if damages to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE).
- Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.
- Prevent using metal bare wires! Risk of short circuit and fire hazard!

- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy over-voltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details please refer to the specifications.
- Make sure that your hands, shoes, clothes, the floor, the system or measuring leads, integrated circuits and so on, are dry.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Avoid operation in the immediate vicinity of:
  - high magnetic or electromagnetic fields
  - transmitting antennas or high-frequency generators
  - for exact values please refer to enclosed specifications.
- Use measurement leads or measurement accessories aligned to the specification of the system only. Fire hazard in case of overload!
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatise the system unpowered to room temperature.
- Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors still might be charged, even if the system has been removed from the power supply.
- The electrical installations and equipments in industrial facilities must be observed by the security regulations and insurance institutions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- The measuring systems are not designed for use at humans and animals.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Please be careful with the product. Shocks, hits and dropping it from already lower level may damage your system.
- Please also consider the detailed technical reference manual as well as the security advices of the connected systems.

This product has left the factory in safety-related flawless and in proper condition.
In order to maintain this condition and guarantee safety use, the user has to consider the security advices and warnings in this manual.

EN 61326-3-1:2008

IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.7 of IEC 61326-1.
Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this product family standard, IEC 61326-3-1.

Devices and systems according to IEC 61508 or IEC 61511 which are considered as “operationally well-tried”, are excluded from the scope of IEC 61326-3-1.

Fire-alarm and safety-alarm systems, intended for protection of buildings, are excluded from the scope of IEC 61326-3-1.

2 About this document

This is the Technical Reference Manual for SIRIUS® Version 1.5.5.

Sirius® is a versatile data acquisition hardware line which comes in many different form factors and can be equipped with a wide range of different amplifiers, so that you can use it for virtually any measurement task. Each system also includes a professional license for our award-winning DEWESoft® data acquisition software.

The manual is divided into several chapters. You will find:

- A detailed description of the Sirius® hardware and the main combination and expansion options
- A description of the connection variants and the pin assignments on the inputs and outputs
- A comprehensive introduction to the configuration of the modules using DEWESoft®
- Detailed technical data: Specifications, etc.

2.1 Legend

The following symbols and formats will be used throughout the document.

IMPORTANT	Gives you an important information about a subject. Please read carefully!

HINT	Gives you a hint or provides additional information about a subject.

EXAMPLE	Gives you an example to a specific subject.

Example	Meaning	Description
Cancel	Button	a button that you can click
File	Menu Item	a menu item, will open a sub menu or a dialogue
Times New Roman	List Item	an item in a list (or tree) that you can select
Events	Tab Sheet	a tab sheet that you can select
C:\Program Files\OpenOffice.org 3\readme.txt	File Path and Name	a file name or path
Windows Key	a term	any kind of term (maybe also compound)
SNR: 85dB	Preliminary info	Preliminary information: e.g. specifications that are not confirmed yet

Table 1: Layout formats used in the documentation

2.2 Online versions

2.2.1 SIRIUS® technical reference manual

The most recent version of this manual can be downloaded from our homepage:

http://www.dewesoft.com/download

In the *HW Manuals* section click the download link for the *SIRIUS® users manual*.

2.2.2 DEWESoft® tutorials

The DEWESoft® tutorials document, provides basics and additional information and examples for working with DEWESoft® and certain parts of the program.

The latest version of the DEWESoft® tutorials can be found here:
http://www.dewesoft.com/download

In the the *SW Manuals* section click the download link of the *DEWESoft 7 tutorials* entry.

3 Getting started

This chapter will help you to install the software, connect your SIRIUS® system to the PC via USB and will show you how to configure DEWESoft®.

To follow these steps, you need the following items:

- your brand new SIRIUS® system (included in the shipment)
- your SIRIUS® USB stick (included in the shipment)
- your PC with Windows 10
  Note: older versions like Windows® 7 may also work

3.1 Software installation

This chapter will explain how to correctly install all the required software for your SIRIUS® system on your measurement PC.

The software installation procedures and screen-shots in chapter 3.1 Software installation refer to Windows® 10 unless otherwise noted.

3.1.1 DEWESoft® installation

This chapter includes information about installing DEWESoft® on your computer in order to use your SIRIUS® system.

IMPORTANT

Do not connect your SIRIUS® system to the PC before the software installation is finished.

A general guideline of how to install DEWESoft® can be found here:
http://www.dewesoft.com/download?file=Dewesoft7_QuickStart.doc

SIRIUS® is supported in DEWESoft® 7.1 or higher. It is recommended to always use the latest DEWESoft® version, which is DEWESoft® X2 at the time of writing.

Attach the SIRIUS®-USB stick to your computer and start the DEWESoft® installer by double clicking on the full installer executable file: at the time of writing it is called `DEWESoft_FULL_X2_SP8_b18.exe` (see Illustration 1).

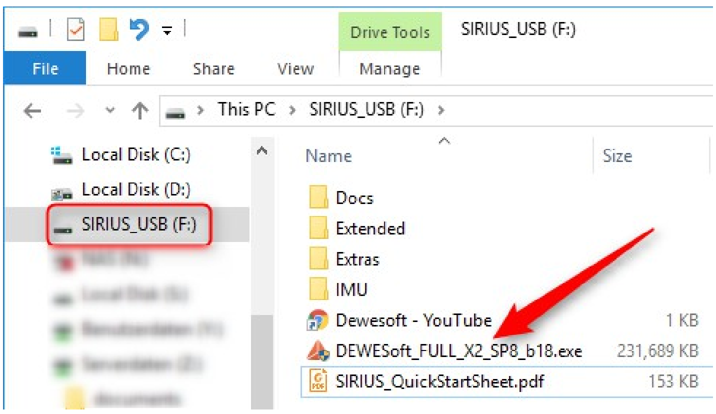


Illustration 1: DEWESoft® installer file

HINT

In the future, there may be a newer version of the installer:
e.g. `DEWESoft_FULL_X2_SP9.exe`, `DEWESoft_FULL_X3.exe`, etc.

3.1.1.1 Uninstall previous version

If you already have an older incompatible version of DEWESoft® installed, the installer may show you this error dialogue:

Illustration 2: Uninstall previous version message

DEWESoft® can be uninstalled like any other windows program:
Right-click on the Windows® button in the Task-Bar and then select *Programs and Features* from the pop-up menu.

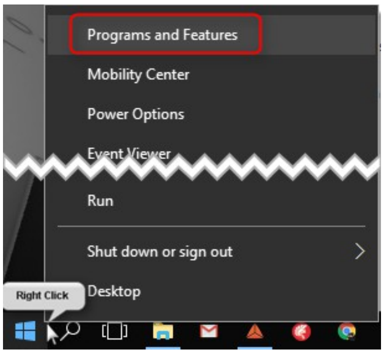


Illustration 3: Programs and Features

Find your old DEWESoft® installation in the list of installed programs, right-click the list item, select **Uninstall** from the pop-up menu and follow the instructions of the uninstall wizard.
It is recommended to reboot Windows® after the uninstallation has finished.

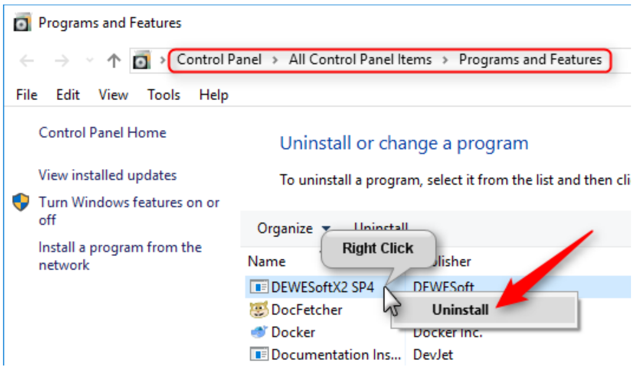


Illustration 4: Uninstall DEWESoftX

3.1.1.2 Installing new DEWESoft® version

The first screen you see is the Welcome Screen:

click **Next >** to continue.

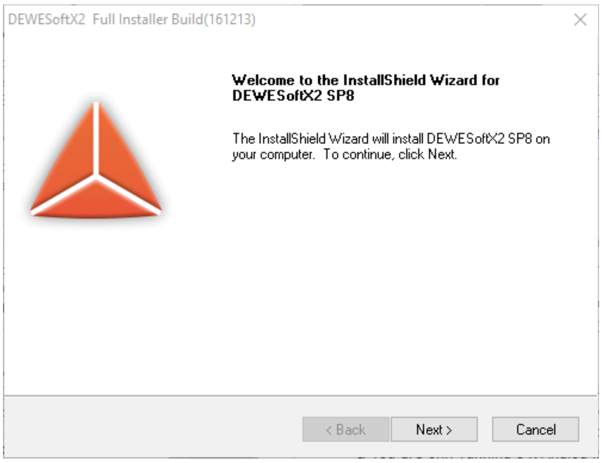


Illustration 5: Installer: Welcome Screen

In the *License Agreement* screen, read the license conditions carefully.

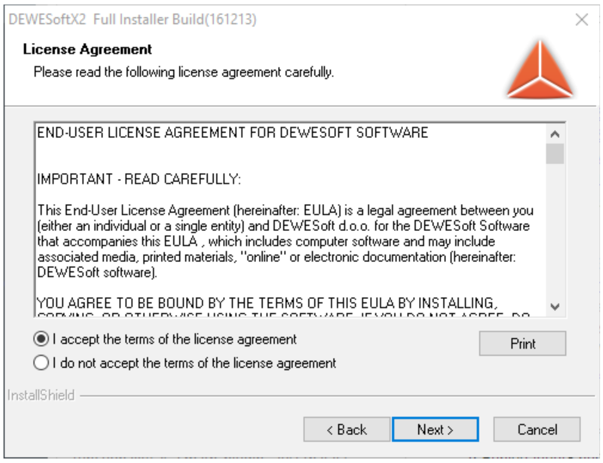


Illustration 6: Installer: License Agreement

If you agree, select the *I accept the terms of the license agreement* radio box and click **Next >** to continue.

In the *Setup Type* page, you must select the type of installation.

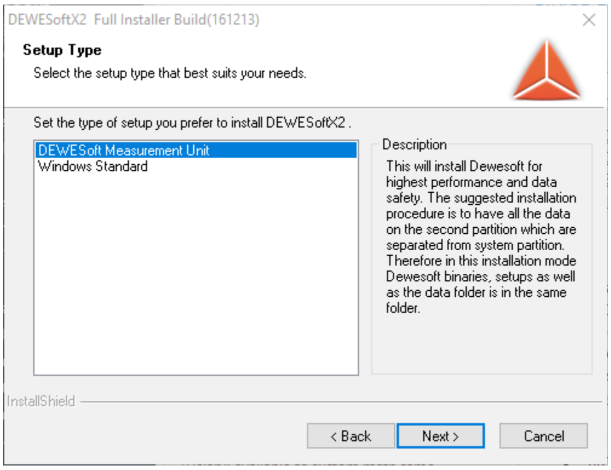


Illustration 7: Installer: Setup Type

The default and recommended setup type is *DEWESoft Measurement Unit*.

Note, that the path of the DEWESoft® installation may vary depending on the setup type that you chose and on the number of hard-disk-partitions that are available on your system:

In Illustration 8, you can see that two hard-disk-partitions `C:` and `D:` exist (`E:` is a DVD drive)

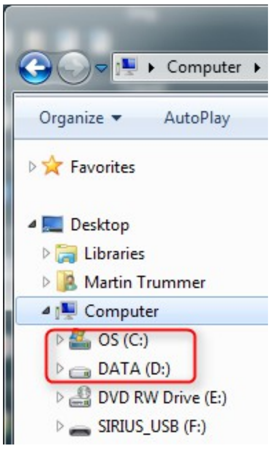


Illustration 8: Two partitions (Win 7)

In Illustration 9, you can see that only one hard-disk-partition `C:` exist (D: is a DVD drive)

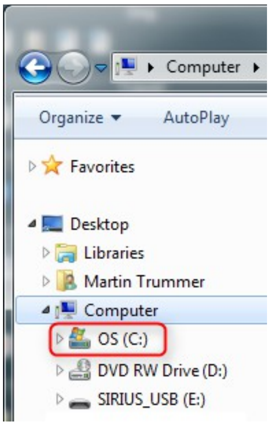


Illustration 9: One partition (Win 7)

DEWESoft measurement unit

The setup type *DEWESoft Measurement Unit* will install DEWESoft® for highest performance and data safety.

If you have 2 or more hard-disk-partitions, then we recommend to to have all the data on the second partition (or even second hard disk or array of disks) which are separated from the system partition. The System partition gets fragmented over time and then the writing performance dramatically drops
Therefore in this installation mode DEWESoft® binaries, setups as well as the data folder will be installed in the same folder e.g. `D:/Dewesoft7`) on the second hard-drive-partition.
If you ever need to install a new operating system or need to reformat the system hard-drive-partition, the DEWESoft® installation can remain: just the device drivers need to be reinstalled.

Directory	Explanation	Default path
`Bin`	contains `DEWSoft.exe`	`D:\DEWESoft7\Bin\X2`
`Addons`	`.dll` files for AddOns must be copied into this directory	`D:\DEWESoft7\Bin\X2\Addons`
`Data`	this is where DEWESoft® will store your measurement data	`D:\DEWESoft7\Data`
`Setups`	this is where your DEWESoft® setup files will be stored	`D:\DEWESoft7\Setups`
`System`	this is where DEWESoft® project files are stored	`D:\DEWESoft7\System\X2`
`Log`	this is where DEWESoft® will store log files	`D:\DEWESoft7\System\X2\Logs`

Table 2: DEWESoft® directories (Measurement Unit Installation)

Windows standard

The setup type *Windows Standard* will install DEWESoft® binaries in the Windows `program files` folder and setups and data files in the `My documents` folder.

This installation fully complies with Windows installation policies and is recommended for installing DEWESoft® for viewing the data on corporate computers with strict IT policies.

Directory name	Default path
`Bin`	`C:\Programme\DEWESoft7\Bin\X2`
`Addons`	`C:\Programme\DEWESoft7\Bin\X2\Addons`
`Data`	user dependant directory: `C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\Data`
`Setups`	user dependant directory: `C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\Setups`
`System`	user dependant directory: `C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\System\X2`
`Log`	user dependant directory: `C:\Dokumente und Einstellungen\All Users\Dokumente\DEWESoft7\System\X2\Logs`

Table 3: DEWESoft® directories (Windows Standard Installation)

click **Next >** to continue.

The installer now let's you choose the *Destination Location* for the installation:

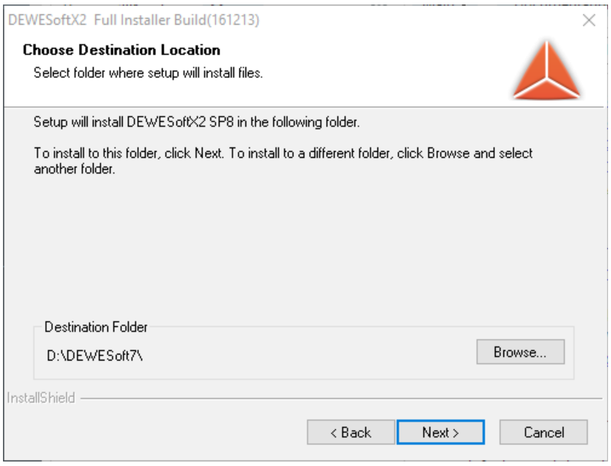


Illustration 10: Installer: Destination Location

Note that the path shown in the screen shot above is dependant on what setup type you have chosen.

IMPORTANT

It is recommended to not change the installation location!
This might cause problems with some plugins and features of DEWESoft®.

click **Next >** to continue.

Enter your customer information:

click **Next >** to continue.

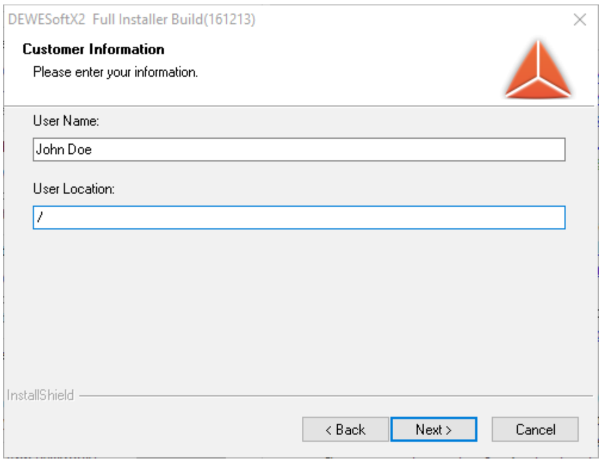


Illustration 11: Installer: Customer Info

Select the optional features that you want to install from the list.
On production PCs it is recommended to only install the features, that you really need.

click **Next >** to continue.

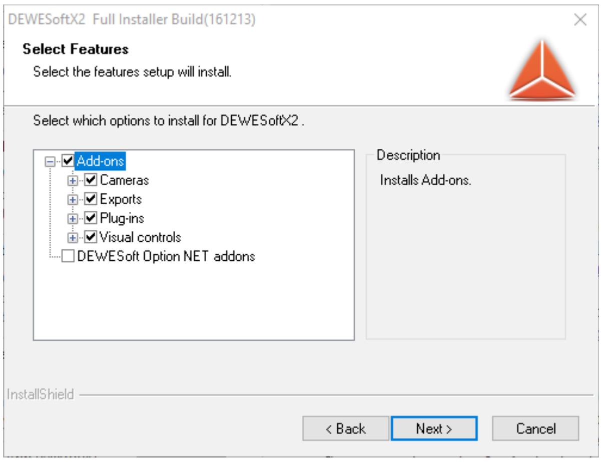


Illustration 12: Installer: Select Features

HINT

The information in the red rectangle of Illustration 11 is only available for setup type *Windows Standard*.

Select the language that you want to use in DEWESoft®:

Click **Next >** to continue.

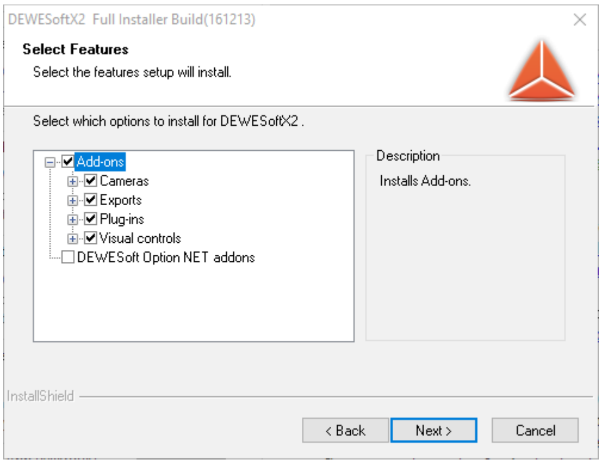


Illustration 13: Installer: Select Language

Now the installer has all the information that is required to start the installation:

Press **Install** to start the installation.

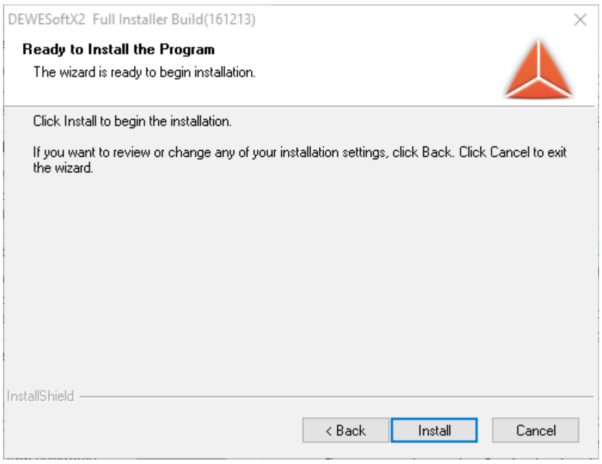


Illustration 14: Installer: Ready To Install

You may get a Windows Security warning (see Illustration 15). You can safely click on *'Install this driver software anyway'* and continue the installation.

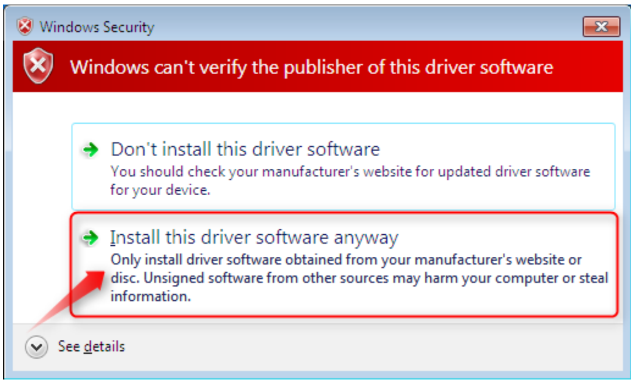


Illustration 15: Windows Security Warning (Win 7)

You may also get another Windows Security dialogue (see Illustration 16). You can check the *'Always trust software from "Dewesoft"'* check-box and click the **Install** button to continue the installation.

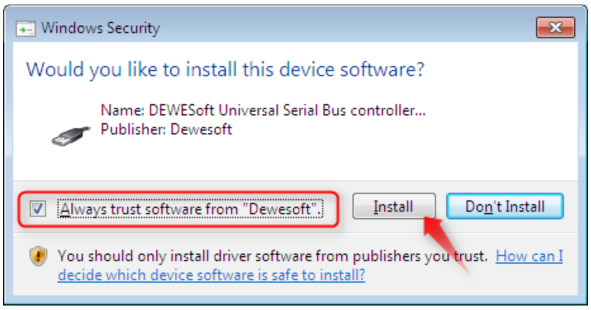


Illustration 16: Windows Security Dialogue (Win 7)

Note: Depending on the features, that you have selected, you may also see some other installer windows.

When the DEWESoft® installation has completed successfully, you will see the final screen:

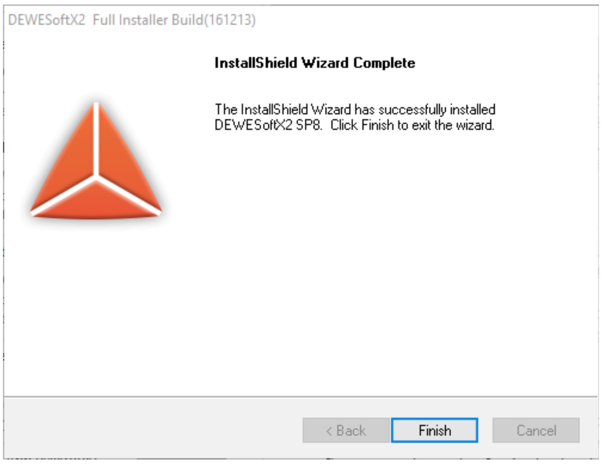
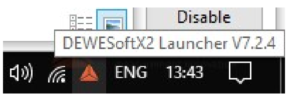


Illustration 17: Installer: Complete

Click **Finish** and then restart Windows®. After the restart you will notice that there is a new icon in the Windows task tray: You can use it to control the DEWESoft® launcher. The DEWESoft® launcher will be started automatically when you connect a Dewesoft measurement device (e.g. SIRIUS®, DEWE-43, ..) to a USB port of your PC.



3.2 Connecting a Single Slice

First connect the power supply to the connector named *POWER IN* (see Illustration 18 unten) of your SIRIUS® system/s (see Power In on page 32).

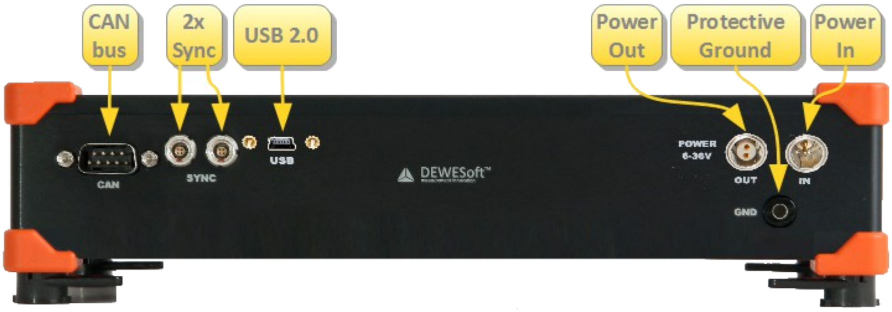


Illustration 18: SIRIUS® chassis: connectors on the rear side

see also: 4.1.1.1 Single Slice USB on page 31

Illustration 19: USB cable

Then connect the USB cable (Illustration 19 oben) to the rear-side of the SIRIUS® system (see connector named *USB* in Illustration 18 oben). Finally connect the other side of the USB cable to the USB port of your computer:

When you connect your Dewesoft USB device for the first time to the USB port, Windows® 10 will automatically try to find a driver.

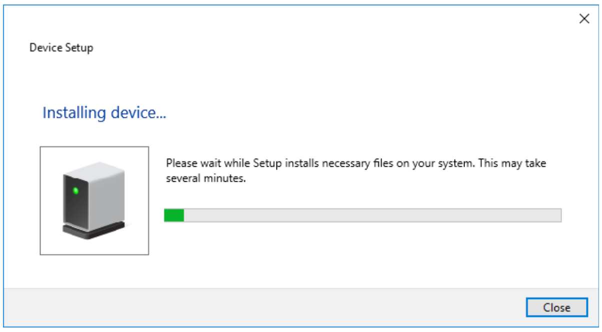


Illustration 20: Installing USB driver

When the driver installation is complete Windows will show a notification message:

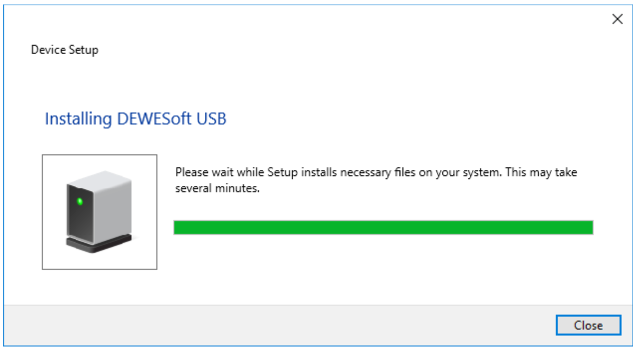


Illustration 21: USB driver installation succeeded

Then the Dewesoft launcher will pop up and show you a list of all connected devices and their status.
Finally click **Run Dewesoft…** to start DEWESoft®.

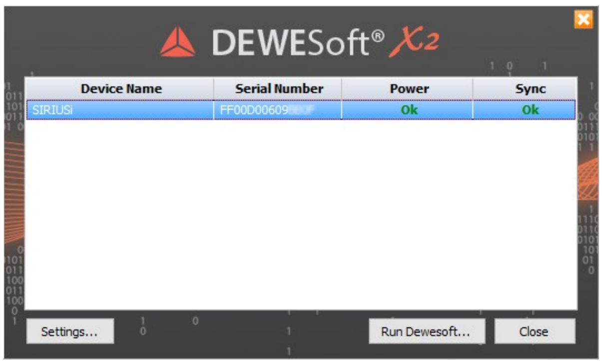


Illustration 22: Dewesoft Launcher

If you see the Power **Missing** status in the Dewesoft Launcher, then connected the power cable to the measurement slice. As soon as the power is available, the status will switch to **Ok**.

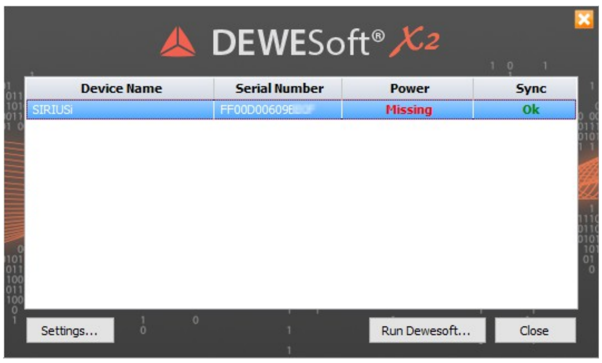


Illustration 23: Dewesoft Launcher: Power Missing

3.3 Connecting Multiple Slices

When you connect multiple slices to the same S-BOX or PC, you must also connect the slices with synchronisation cables to the *SYNC* connectors (see Illustration 18 on page 22) on the rear side.

When everything is okay, the status will be **Ok** and you can click the **Run Dewesoft…** button to start DEWESoft®.

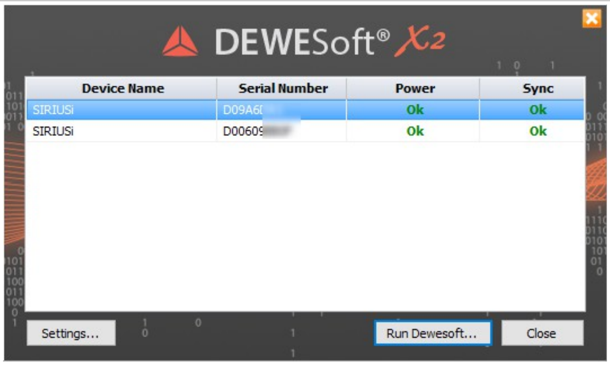


Illustration 24: Dewesoft Launcher: All Okay

If the Sync status is **Missing**, then you must connect a sync cable to the measurement slices. Then the Sync status of both devices will switch to **Ok**.

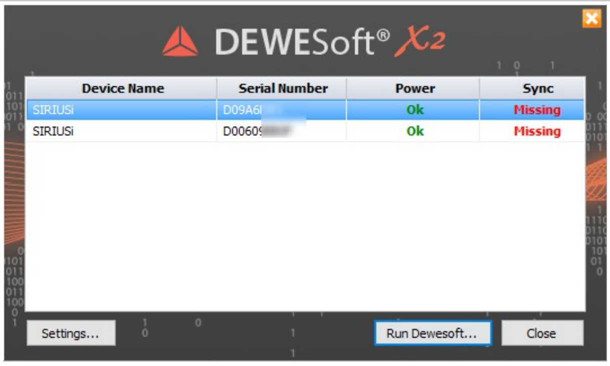


Illustration 25: Dewesoft Launcher: Sync Missing

3.4 Simple Measurement

This chapter describes measurement basics, how to configure SIRIUS® and gives some details on the measurement setup.

3.4.1 Help - Manual

Note that this is document is just a quick start guide. For detailed information about DEWESoft® consult the Manual. To open the manual you can press the ϕ key or click on **Help** and then select `Manual` from the pop-up menu.

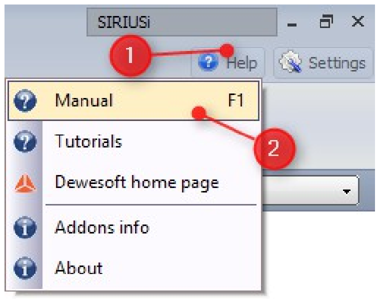


Illustration 26: Help - Manual

When DEWESoft® has started up, you will be in the *Acquisition* mode and see the *Setup files* list.

Click on *Ch. setup* (on the right of *Setup files*) to switch to the *Channel setup* mode.

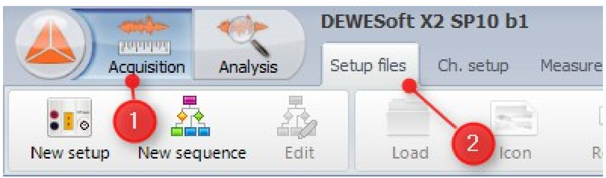


Illustration 27: Setup files

3.4.2 Analogue channel setup

In the analogue channel setup screen you can see all channels of your connected SIRIUS® systems. Per default only the first channel will be set to *Used*.

Unused channels will not show up in measure mode and can thus not be used for display, calculations or storing: thus, we will also set the other 7 channels to used. You can left-click on the Used column of channel 2 (❶), hold the mouse button and move the mouse down to channel 8 (❷): then release the mouse button and all 7 channels will be selected – this is shown by the black rectangle around the buttons. Then you can click into the selected region to toggle *Used/Unused* for all 7 channels at once. The selected channels will also be highlighted in the small preview image of the device (❸).

When you press the **Setup** button of a channel (the column at the right edge of the channel table – not shown in this screen-shot), you can change all settings of the channel amplifier.

You can also change the sample rate of the SIRIUS® slice (❹).

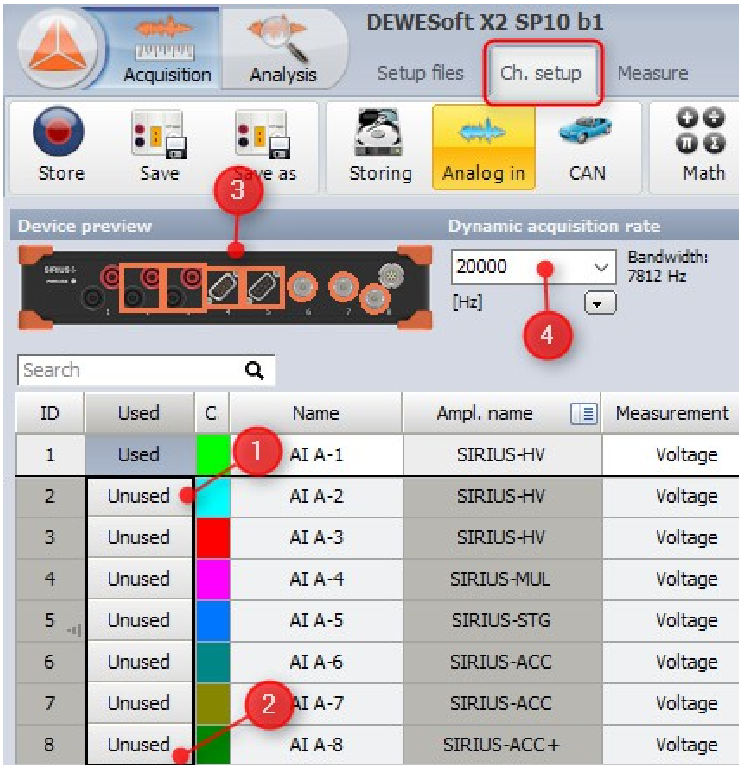


Illustration 28: Channel setup screen

3.4.2.1 Sample rate

One of the most important settings is the sample rate. The sample rate defines how many data points, SIRIUS® will transfer to DEWESoft®. So a higher sample rate also means that more data needs to be transferred via USB to your computer.

The sampling speed mainly depends on your application. To display your signal in time domain with a good time resolution, you should sample 10 to 20 times faster than the frequency of the signal that you want to measure. (for example 1 kS/s for a 50 Hz sine-wave).

If you have a lot of high frequency components, it may be necessary to sample 100 times faster (e.g. 5 kS/s for the 50 Hz sine-wave) or even more.

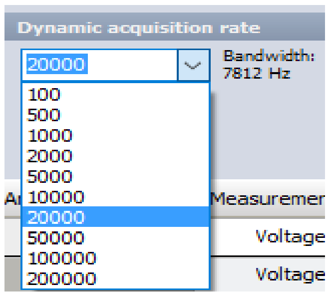


Illustration 29: Sample Rate

If you display only the frequency domain (FFT analysis), a 2.5 times faster sampling would be sufficient (125 S/s for the 50 Hz sine-wave).

The higher the sampling rate, the better the time resolution. But also the file size will increase.

3.4.3 Measurement Mode

A click on *Measure* (at the right side of *Ch. Setup* in Illustration 28) will take you to the *Recorder* screen measure mode where you can already see live data (Note: the data will not be stored yet!):

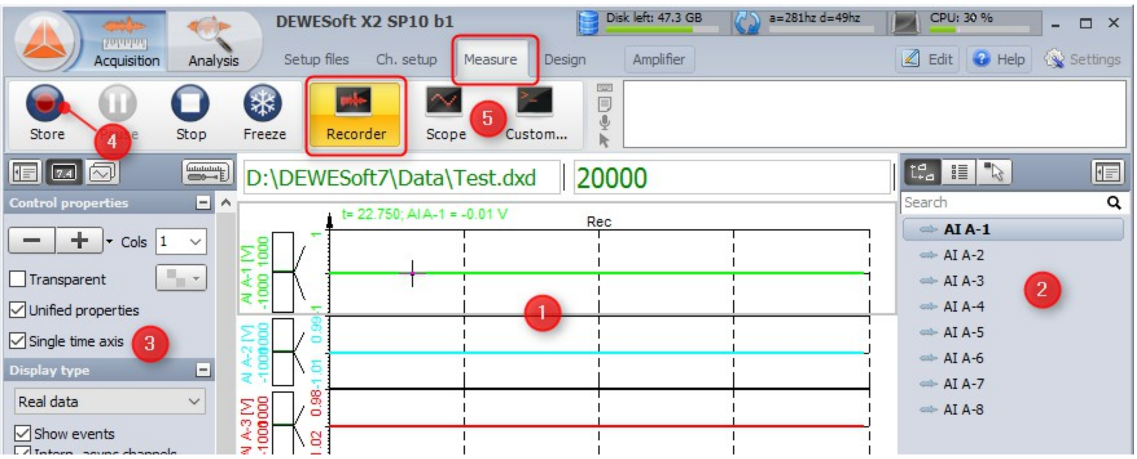


Illustration 30: Measure mode

In measure mode you can have several measurement screens (❺). DEWESoft® will create 3 default screens: *Recorder*, *Scope* and *FFT*, but you can also create new screens or change the visual displays of the existing screens as you like. See the chapter *Displays design* in the online-help (see 3.4.1 Help - Manual on page 23) for more details.

The most important sections of the Measure mode are highlighted in screen-shot Illustration 30:

❶: show the live measurement data in different measurement instruments which are depending on the selected measurement screen. In this case we see a recorder instrument witch displays all your measurement channels. You can use the channel-selector list (❷) to assign measurement channels to the instruments. Each instrument has different settings. ❸ shows the settings of the currently selected recorder instrument.

To start storing the data to a file, press the **Store** button (❹). When you are done, press the **Stop** button to stop recording.

Now DEWESoft® has created a datafile with all the data that you have seen during the recording session. You can now click the **Analysis** button (on the left-top of the screen to the right of the **Acquisition** button) to go to *Analysis* mode.

3.4.4 Analysis Mode

When you have just stopped a measurement, DEWESoft® will automatically open the last recorded data file in *Review* mode, so that you can start the analysis right away:

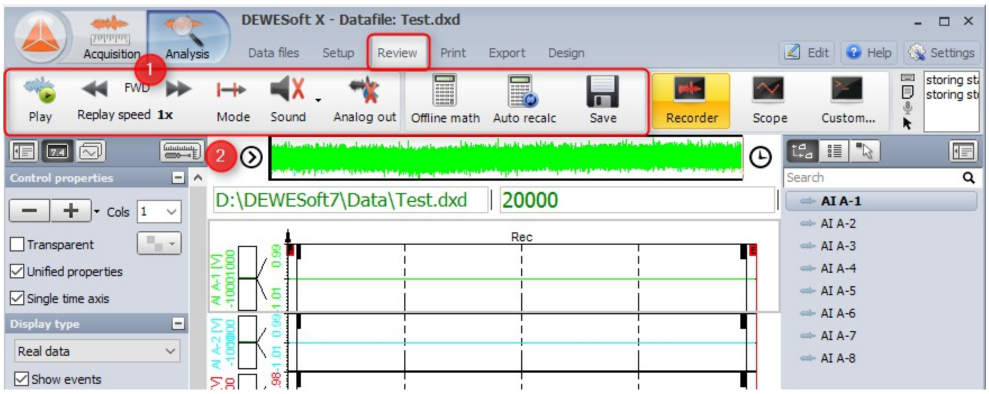


Illustration 31: Analysis Mode: Review

The Review mode is much like the Measurement Mode. You will see the same measurement screens, the channel-selector list and the properties of the currently selected instrument.

Differences are:

❶: you have additional tool-buttons

❷: there is a *Signal overview* window which will show you the whole data of one selected channel of the data file

Now you can use the cursors to analyse you data, zoom in and out of the data, click Offline math to add computations based on your data, etc. You can also change the design of your measurement screens, print reports based on your data and export the data to other file formats for further analysis.

Details about all these functions can be found in the *Analyse* chapter of the online-help (see 3.4.1 Help - Manual on page 23).

3.5 Advanced configuration

Note, that the DEWESoft® launcher has already done the hardware setup for you – you can check this in the Settings dialogue.
Click the *Settings* button (❶) – and then click the *Settings* Menu item (❷)

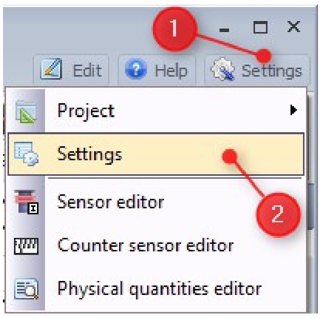
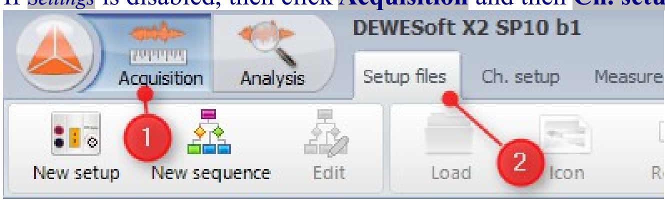


Illustration 32: Open Settings Dialogue

HINT

If *Settings* is disabled, then click **Acquisition** and then **Ch. setup**:



Now that you are in channel *Channel Setup mode*, the *Settings* option will be enabled.

In the Analog tab sheet, `DEWESoft USB` must be selected in order to user you SIRIUS® device (see ❶ in the image).

All SIRIUS® devices will be shown in the device list (❷).

If you add a device while this screen is open (or if your device is not shown yet), you can press the **Refresh** button (❸) to scan for devices.

When you select a device from the list you will see all the device details and settings in the right area (❹).

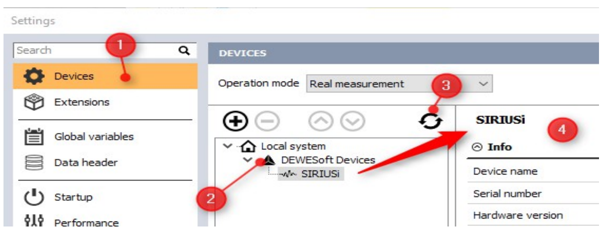


Illustration 33: DEWESoft®: Demo mode

At the bottom of the Sirius® settings you can see the *CAN* section. When you click on the wrench-icon (❶) you can change the settings for this CAN port via the options menu.

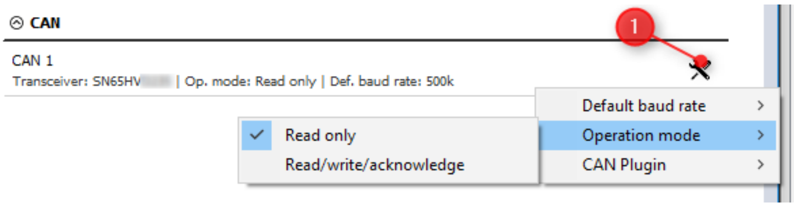


Illustration 34: SIRIUS® CAN port

3.5.1 Counters and CAN

The use of analogue inputs, CAN and digital interface is the same as with all other DAQ devices, which are supported in DEWESoft®. Please consult the DEWESoft® online-help for more information (see 3.4.1 Help - Manual on page 23).

3.6 Licensing

As soon as you activate your SIRIUS® system in the hardware setup (see 3.5 Advanced configuration oben), DEWESoft® will be licensed and you are ready to go (the license information is stored in the SIRIUS® device). No need for any online or offline licensing!

Note, that all licenses regarding SIRIUS® will only work when the SIRIUS® system is connected to your PC and the device has been activated in the hardware setup.

3.7 Troubleshooting

If your SIRIUS® device is not found by DEWESoft®:

- If you did not restart Windows after the software installation, restart now
- Make sure, that you have started DEWESoft® version 7.1 or higher (7.0.x versions do not support SIRIUS®)
- Make sure that the external power supply is connected and okay
- Disconnect the USB cable and reconnect it. If this does not work, try to connect the USB cable to another USB port of your PC
- Check if *DEWESoft USB device* shows up in the Windows *Device Manager (under the node called Universal Serial Bus controllers*)
- Try to restart DEWESoft®
- Try to restart the PC

4 System Overview

This chapter contains all information about Sirius® systems. The various measurement modules, have their own chapter: see 5 SIRIUS® Measurement Modules on page 63.

SIRIUS® is a data acquisition system, which offers the highest flexibility for inputs like voltage, current, temperature, strain, vibration, pressure, counters, CAN and more. The data-transfer to the PC can be done via USB or EtherCAT®.

The SIRIUS® system consists of *Slices* which contain up to 8 measurement *Modules* (see Illustration 36).

Each SIRIUS® module typically has one analogue channel. The HD-series has 2 channels per module. Some modules are available with an additional counter channel - those modules have a plus sign + at the end: e.g. SIRIUS ACC+, SIRIUS STGM+

Optionally available is a version with 8 analogue outputs on the rear side of a Slice (5.22 Analogue out OPTION on page 139).

Multiple Slices can be combined and synced together to get a multi-channel solution.

Illustration 35: SIRIUS® hardware components

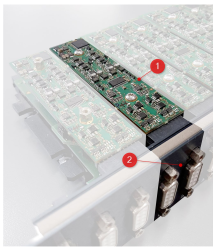


Illustration 36: Sirius® HD-module with two DB9 connectors

4.1 Enclosure Overview

SIRIUS® systems are available in different enclosure types. The following list provides a short high-level overview and the following sub-chapters cover the details.

- **Modular Solution**: Rugged slices with up to 8 measurement modules. This solution is very flexible, because you can use each slice independently or combine multiple slices for a single measurement.
- **Boxed Solution**: A compact box that can contain up to 4 measurement slices and an optional S-BOX slice. This solution is more compact than using 4 single slices and also more convenient, because all the slices are wired together internally: you don't need to interconnect the slices with external USB/Sync/Power/GND cables.
- **Rack**: A rugged solution for up to 8 measurement slices with integrated S-BOX: This solution has all the advantages of the Boxed Solution, but double the channel count. Moreover there are versions with integrated display and batteries available.
- **Instruments:** A rugged and portable solution including S-BOX, display and optional batteries with 1 or 2 measurement slices.

Enclosure → / Feature↓	Modular Solution (fanless option)	Boxed Solution	Rack Enclosure			Instruments	
			SIRIUS-R8	SIRIUS-R8D	SIRIUS R8DB	SIRIUS-R2DB	SIRIUS-R2D
Max. Slices	-	4	8			2	
Max. Channels	16	64	128			32	
Analogue out OPTION	Only for USB with fan[1]	Yes	Yes	-	-	-	
Max. Counter	8	32	64			16	
Max. Digital In/Out	24DI/8DO	96DI/32DO	192DI/64DO			48/16	
Max. CAN	1	4	8			2	
PC system	Option[2]: SIRIUS-SBOXe SIRIUS-SBOXfe	Option SIRIUS-SBOXe	Integrated: SIRIUS-SBOXre			Integrated	
Integrated Display	-	-	-	17" Full-HD	17" Full-HD	12"	
Batteries	External option	External option	External option		Integrated	Integrated	External option
Power Supply	9-36V_{DC}	9-36V_{DC}	12-36V_{DC}	12-36V_{DC}	18-24V_{DC}	9-36V_{DC}	

Table 4: Features of Enclosure Types

4.1.1 Modular Solution

A single SIRIUS® slice can have up to 8 measurement modules (see 5 SIRIUS® Measurement Modules on page 63).

Each measurement module has typically one analogue channel. Some modules also have an optional counter channel (e.g. ACC+). HD modules have 2 analogue channels.

Illustration 37: SIRIUSi 8xSTGM+

We offer several standard chassis with predefined modules (see 5.3 SIRIUS® Slice Configuration on page 69), but you can also choose a customized slice with any combination of the SIRIUS® measurement modules.

You can choose between 2 different data-transfer options:

- **USB**: see 4.1.1.1 Single Slice USB on page 31
  Note: USB also supports the Analogue-Out Connectors (page 32)
- **EtherCAT®**: see 4.1.1.2 Single Slice EtherCAT® on page 32

Click mechanism

You can use your SIRIUS® slices independently or combine them to a single fully-synchronised[3] multi-channel measurement system with the clever click-mechanism (see also 4.2.1 Click mechanism on page 34).

Illustration 38: 3 single SIRIUS® slices

1 EtherCAT® only supports signal conditioning mode (no arbitrary analogue out)
2 S-BOX is available as separate standalone single slice version which can physically be connected via the Click mechanism (see page 34)
3 You need to connect sync-cables to the sync-connectors (at the back of the measurement slices)

4.1.1.1 Single Slice USB

This chapter describes the Sirius® USB single slice enclosure.

Power/USB LED

The LED on the front-side shows the Power/USB status:

LED status	Description
Green	USB and power are connected – ready for measurement
Red	USB is connected, but power is missing. You must connect the *Power* plug: see Power In on page 32
Off	USB is not connected – SIRIUS® is switched off. Note: Since SIRIUS® will be switched on only via USB the LED even remain off when you have connected the *Power* plug – you MUST connect USB – see 4.3.1.1 USB Connector on page 37

Table 5: Power/USB LED Status

Rear side connectors

The SIRIUS® USB chassis has following connectors at the rear side:

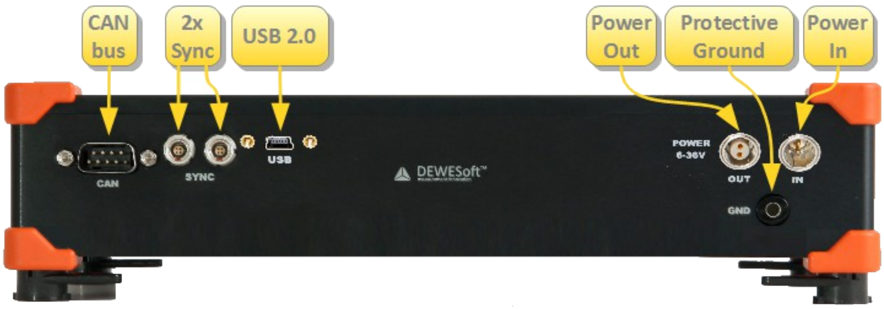


Illustration 39: SIRIUS chassis: connectors on the back side

- **CAN** bus: see 4.3.2.1 CAN (DSUB-9) on page 38
- **2xSync** Connectors: see 4.3.1.3 Sync Connector on page 38
- **USB** Mini connector to transfer the data to the S-BOX or PC: see 4.3.1.1 USB Connector on page 37
- **GND**: Protective Ground banana plug: see 4.3.2.2 GND Connector on page 39

Power Out

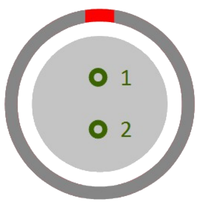


Illustration 40: Power Out Connector 2pin

Pin	Name
1	V+
2	V-

The Power Out power plug that can be used to chain several chassis together.

Power Out connector (on the device): `EXG.1B.302.CLL`
Mating connector (for the cable): `FGG.1B.302.CLAD52Z`

Power In

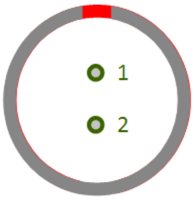


Illustration 41: Power In Connector 2pin

Pin	Name
1	V+
2	V-

For the power supply an unregulated DC voltage between 6 and 36 Volts is required, which is connected to LEMO 1B connector on the rear side of the chassis.

Power In connector (on the device): *EXJ.1B.302.CLA*
Mating connector (for the cable): *FGJ.1B.302.CLLD52Z*

Analogue-Out Connectors

The optional analogue output version of the Single Slice USB has 8 additional BNC connectors for the analogue output channels on the rear side (see also: 5.22 Analogue out OPTION on page 139):

Illustration 42: Rear side connectors of the Analogue-out version

4.1.1.2 Single Slice EtherCAT®

The following Illustration shows the connectors on the rear side of the SIRIUS® EtherCAT® slice (see also 5.1.2 EtherCAT® Data Transfer on page 63):

Illustration 43: SIRIUS® EtherCAT® rear side

- Status **LED**s: The blinking codes of the 3 green LEDs: *L, D, L* adhere to the EtherCAT® specification.
  - *L* means Link: i.e. the In- (left *L*-LED) or Out-connector (right *L*-LED) is linked to another slice or to the measurement PC
  - *D* is for Data: it is active only when the data transfer is active
    this requires that power is connected AND the slice is linked to another slice or a PC
- **EtherCAT® In** and **Out**: see 4.3.1.2 EtherCAT® connector on page 37
- The **USB** 2.0 Mini connector can optionally be used to increase the data-throughput of the EtherCAT® device (see also 5.1.2 EtherCAT® Data Transfer on page 63): i.e. the data can be transferred via EtherCAT® and USB at the same time to get data rates that are not possible with EtherCAT® alone.
  Note: when you use multiple slices, then DEWESoft® must be the EtherCAT® master.
  see also 4.3.1.1 USB Connector on page 37
- **GND**: Protective Ground banana plug and screw connector: see 4.3.2.2 GND Connector on page 39

4.1.2 Boxed Solution

In a single box you can have 1, 2, 3 or 4 slices, plus an optional S-BOX (see 4.5 SIRIUS-SBOXe on page 41) at the bottom. The Boxed solution is only available as USB (not EtherCAT®).

Illustration 44: S-BOX and one slice

Illustration 45: 2-slices

Illustration 46: 4-slices

The main advantage over the Modular Solution is that all the cabling between the slices is done internally.

In Illustration 47 you can see that the upper 3 slices each have a CAN connector only. Their USB/Sync/Power/GND are all internally wired to the bottom slice.

The bottom slice does of course also have a CAN connector, plus all the other connectors of a Single Slice USB (see 4.1.1.1 Single Slice USB on page 31).

Thus you only need to connect one USB cable to your PC to get the data of all 4 slices.

Note: You can use the click-mechanism to attach other items to the Boxed Solution: see 4.2.1 Click mechanism on page 34.

Illustration 47: Rear side of a box with 4 slices

4.1.3 Extended Height Enclosure

Some modules may require a higher enclosure, depending on the connector type.
For example, Illustration 48 shows 2 SIRIUS-STGM-DB (see 5.12.3 STGM-DB on page 93) in a Boxed Solution (see 4.1.2 Boxed Solution on page 33)

The higher enclosures are available for the *Single*- and for the Boxed Solution only (not for Rack, etc.).

Illustration 48: Extended Height Enclosure

4.1.4 Rack Enclosure

Most SIRIUS modules[4] are also available as modular rack system in the following versions:

- **Rack**: see 4.10 SIRIUS-R8 on page 50
- **Rack** with **Display**: see 4.11 SIRIUS-R8D on page 54
- **Rack** with **Display** and **Battery**: 4.12 SIRIUS R8DB on page 57

Notes for the rack series:

- All rack versions contain an integrated PC (see 4.7 SIRIUS-SBOXre on page 45) and you can choose up to 8 Sirius® measurement slices
- All module combinations are possible (except for the Extended Height Enclosure modules)
  The Dual-Core series can be mixed with **HD** (**H**igh **D**ensity) and **HS** (**H**igh **S**peed) modules.
  You can even mix isolated and differential slices.
- All slices are internally connected via USB/Sync/Power/GND
- In comparison to the Modular Solution the Rack has the CAN connectors at the same side as the analogue channels.
- The analogue output option is available only for for the dual core series on SIRIUS-R8 (the other Rack versions have the display where the analogue output would be).

Illustration 49: Sirius® Rack slice

Illustration 50: Sirius® Rack with 8 measurement slices

4.2 Miscellaneous

4.2.1 Click mechanism

You can use your SIRIUS® slices independently or combine them to a single fully-synchronised[5] multi-channel measurement system.

The clever click-mechanism makes it easy to physically attach different enclosure types to each other. It is available for Modular Solution, Boxed Solution, SIRIUS-SBOXe, SIRIUS-SBOXfe, SIRIUS-R2DB and some accessories (see 7 Accessories on page 157): e.g. the the Battery Pack.

Illustration 51: 3 Single SIRIUS® slices combined

4 e.g. the Extended Height Enclosures are not available for the Rack
5 You need to connect sync-cables to the sync-connectors (at the back of the measurement slices)

4.2.2 USB Hubs vs. Native Ports

USB, short for Universal Serial Bus, is an industry standard that defines the cables, connectors and communications protocols.

USB 2.0 has a theoretical maximum bandwidth of 480 Mbit/s (High Speed or High Bandwidth). Due to bus access constraints, the effective throughput of the *High Speed* signalling rate is limited to about 30 MB/s.

The SIRIUS slices use the USB 2.0 protocol for communication to the PC/SBOX and they have USB Type A receptacles. This is enough, even for 8 SIRIUS high-speed channels @ 1MS/s.

USB 3.0 a new *SuperSpeed* transfer mode, with associated new backwards-compatible plugs, receptacles, and cables. The *SuperSpeed* plugs and receptacles have blue inserts (in comparison to the black ones of USB 2.0).
The theoretical maximum data signalling rate of the new *SuperSpeed* mode is 5.0 Gbit/s. However the specification considers it reasonable to achieve only around 3.2 Gbit/s (0.4 GB/s or 400 MB/s).

A USB hub is a device that expands a single native USB port into several, so that there are more ports available to connect devices.
If a USB hub is used, the USB bandwidth is shared by the connected USB devices (i.e. SIRIUS® slices) and thus you may not be able to use the max. possible sampling rate (of the SIRIUS slice). Note, that also the USB connectors on laptops are often internally connected to a USB hub.

The specifications section of each S-BOX chapter in this manual, will explicitly mention how many USB 2.0 native ports are available. SIRIUS HS slices should always be connected to the native ports, so that you can use the maximum sampling rate.

Let's for example take a look at the 4 USB 3.0 type A connectors at the front of an SBOXe. The specification section for the 4 USB 3.0 connectors includes a note, like this: *NOTE: USB 2.0 → only 2 native ports*.
This means, that the 2 USB connectors at the left side are internally connected to a USB 2.0 hub, which is connected to one native USB 2.0 port.
The same is true for the 2 USB connectors at the right side.

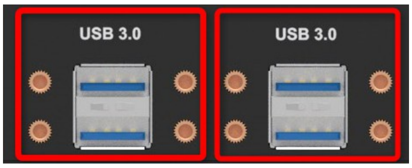


Illustration 52: USB 3.0 Type A

So, when you want to connect 2 SIRIUS high-speed slices to these connectors, you should connect one slice on any of the left connectors and the other slice on any of the right connectors.
If you connect both on either the left or right side only, then the 2 slices will internally be routed over a USB hub and you cannot use the full sampling rate.

It is also important to understand that the USB 3.0 connection is completely independent: i.e. you can connect 4 USB 3.0 devices to the ports and use the full USB 3.0 bandwidth for each of those 4 devices.

HINT	You only need to care about native ports and hubs when you use external USB ports of the S-BOX. The internal wiring (e.g. in the SIRIUS-R8 - see 4.10 SIRIUS-R8 on page 50), is designed with great care, so that none of the USB ports are shared and every single measurement slice can use the full maximum sampling rate: for all 64 (dual-core, high-speed) channels or 128 (high-density) channels. R2D/R2DB i7 version: USB 3.0 ports on the front do not work in BIOS, but only work after Windows boots!

4.2.3 GPS Option

Table 6 unten shows the specifications of the optional GPS receivers that you can order for your S-BOX (including R8, R8DB, etc.).

See also: 4.3.3.1 GPS Connector (DSUB 9) on page 39

GPS Receiver		10 Hz	100 Hz	
RTK		No	No	Yes
Update Rate		10 Hz	1-100Hz programmable	
WAAS/EGNOS/MSAS		-	Yes	Yes
Signals Tracked				
GPS		L1	L1	L1, L2, L2C
GLONASS		L1	L1	L1, L2, L2C
SBAS		Yes	Yes	Yes
Accuracy	Positioning			
Stand-alone	horizontal	2.5m	1.2m	1.2m
	vertical	3m	1.8m	1.8m
SBAS	horizontal	1m	0.8m	0.8m
	vertical	3m	1.2m	1.2m
DGPS	horizontal	-	0.3m	0.3m
	vertical	-	0.5m	0.5m
RTK	horizontal	-	-	*±2cm
	vertical	-	-	*±2cm
Velocity		1 km/h	0.1 km/h	0.1 km/h
PPS Accuracy		50nsec	30nsec	30nsec
RTK				
RTK Initialization Time		-	-	< 10 sec
RTK Initialization Reliability		-	-	> 99%
Correction Data Input		-	-	RTCM SC104 2.x and 3.x, CMR, CMR+
Acquisition Time				
Hot Start		<3s	<10s	<10s
Cold Start		<30s	<60s	<60s
Limitations				
Velocity		500m/s	514m/s	514m/s
Acceleration		5g	20g	20g
Altitude		18000 m	18000 m	18000 m

Table 6: GPS Specifications

4.2.3.1 RTK

The RTK (Real Time Kinematic) option is only available for the 100Hz receiver (see Table 6 oben). With this option it is possible to get an accuracy of 2 cm.

For details, please refer to the *"RTK Manual"* on our download page http://www.dewesoft.com/download.

Upgrading to RTK

When your S-BOX already has an 100Hz GPS receiver the upgrade to the 100Hz+RTK Option can easily done. It just requires an upgrade to the software license. Since no hardware change is needed, this can be done at the customers site.

4.3 Connectors

4.3.1 General

4.3.1.1 USB Connector

USB connectors are used by:

- Sirius® measurement slices to transfer the measurement data to the SBOX (or PC): see also 5.1.1 USB Data Transfer on page 63.
- Sirius® SBOX: to connect Sirius® USB slices or other USB devices. The USB connector can transfer data and provide power to connected devices ($5V_{DC}$).

Currently we have 2 USB versions in use:

USB 2.0

USB 2.0 has a maximum signalling rate of 480 Mbit/s (High Speed or High Bandwidth).

The Illustrations to the right show a Mini and Standard size USB 2.0 sockets.

See also: 4.2.2 USB Hubs vs. Native Ports on page 35

Illustration 54: USB 2.0 Mini

Illustration 53: 2xUSB 2.0

USB 3.0

USB 3.0 “*SuperSpeed*” has backwards-compatible plugs, receptacles, and cables. *SuperSpeed* plugs and receptacles are identified with a distinct logo and blue inserts in standard format receptacles.

Note: DEWESoft® specific connectors also have screws to the right and left of the connector so that you can fix the USB cables.
R2D/R2DB i7 version: USB 3.0 ports on the front do not work in BIOS, but only work after Windows boots!

Illustration 55: 2xUSB 3.0

4.3.1.2 EtherCAT® connector

The EtherCAT® connector can provide power and transfer the measurement data plus synchronisation signal in one single cable. Sirius® EtherCAT® slices have 2 connectors, so that you can easily chain multiple slices together.
See also: 5.1.2 EtherCAT® Data Transfer on page 63

Pinout

Illustration 56: EtherCAT® pinout

Pin	Name	Colour
1	V+	Red
2	GND	Blue
3	RD-	Blue
4	RD+	White
5	TD-	Red
6	TD+	Yellow

Connectors (on the device):
`EGG.1T.308.CLN LemoT 8pin FEMALE`
`EGJ.1T.308.CLD LemoT 8pin MALE`

Mating connector (for the cable):
`FGG.1T.308.CLA.1433 cable, MALE`
`FGJ.1T.308.CLL.1433 cable FEMALE`

4.3.1.3 Sync Connector

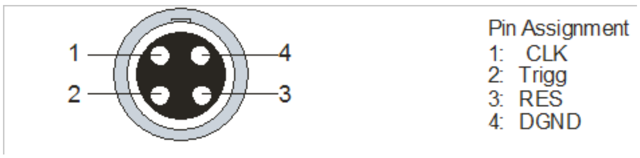
The sync connectors are required when you want to use multiple Sirius® USB slices for the same measurement.
The signal that is transferred over this cable makes sure that the measurement data of the different slices are perfectly synchronized to each other.

For more details on Synchronisation see chapter 8.2 Synchronisation on page 163.

Illustration 57: Sync cable

Sync connectors have 2 use-cases:

- SBOX: When you have an SBOX with GPS option (see 4.2.3 GPS Option on page 36), you can use the SBOX as clock master. In this case the SBOX will use the GPS signal to generate the synchronization signal for the attached measurement modules: e.g. the SIRIUS-SBOXe (see page 41) has one sync connector at the front.
- Sirius® USB slices:
  When there are 2 connectors it's easy to chain several SIRIUS® chassis (or DEWE-43, DS-CAN2, etc.) together.
  Note that there is no distinction between IN and OUT – it does not matter which connector you use.



Interface connector: `EEG.00.304.CLL`
Mating connector: `FGG.00.304.CLAD27Z`

When IRIG-synchronisation is used, the IRIG signal is on pins 1, 2.

Illustration 58: Sync connector: pin-out (LEMO 4pin)

4.3.2 Sirius® Connectors

4.3.2.1 CAN (DSUB-9)

A Controller Area Network (CAN bus) is a vehicle bus standard often used in Automotive applications. SIRIUS slices usually the CAN connector on the backside, the Rack version on the front side.
The DEWESoft® software setup for CAN is described in chapter: 3.5 Advanced configuration on page 26.

Pin	Name	Description
1	+5V	5V supply max. current: 500mA
2	CAN_LOW	CAN low
3	DGND	Digital Ground
4	RES	Reserved
5	RES	Reserved
6	DGND	Digital Ground
7	CAN_HIGH	CAN high
8	RES	Reserved
9	+12V	12V supply max. current: 200mA

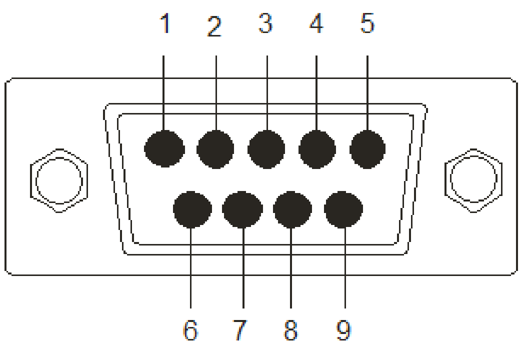


Illustration 59: SIRIUS-CAN: pin-out (DSUB-9)

4.3.2.2 GND Connector

For correct measurements, it is highly recommended to ground the SIRIUS®. The GND connector is usually a banana connector. There may also be a screw connector: e.g. SIRIUS-R8 (page 50).

WARNING

It is mandatory to connect a ground cable to the *GND* connector when you are working with high voltages: e.g. when you are working with the HV modules (see 5.9 HV on page 78).

4.3.3 SBOX connectors

4.3.3.1 GPS Connector (DSUB 9)

The voltages and the Remote-On features are always available, but the the GPS data and PPS are only available, when you have one of the GPS options: see 4.2.3 GPS Option on page 36.

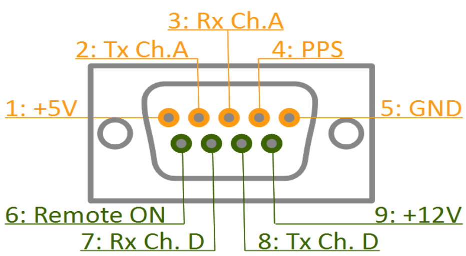


Illustration 60: GPS Connector

Pin	Name
1	+5V (max. 0.5A)
2	TXD GPS port A
3	RXD GPS port A
4	GPS PPS
5	GND
6	Remote-On[6]
7	RXD GPS port D
8	TXD GPS port D
9	+12V (max. 0.5A)

To power the system on, press the Power switch OR apply a voltage between 3 and 30V to Remote-On pin

To power off the system press the Power switch or reduce the voltage on Remote-On below 0.5V for more than one second.

GPS port A is used for GPS-Display or for the RF-modem when RTK option is in use.

GPS port D is reserved. Do not connect!

4.3.3.2 GPS Antenna Connector

GPS is only available when you have an S-BOX with GPS Option: see 4.2.3 GPS Option on page 36.

Connect the GPS Antenna to the **GPS ANT** SMA Female Jack connector and make sure that there is an unobstructed line of sight to four or more GPS satellites.

4.3.3.3 Ethernet Connector (RJ45)

The standard Ethernet Connector can be used to connect your S-BOX to your company LAN.

When you use a Power Junction box you can also use the standard Ethernet connector to operate EtherCAT® devices (e.g. Sirius® EtherCAT® Slices or Krypton™).

6 Remote-On may not be available for units before Q1/2013. For newer units may also have the same function on the 3rd pin of the power connector.

4.4 SIRIUS-SBOX: General Information

The SIRIUS-SBOX is an integrated powerful PC in a rugged SIRIUS® chassis: with an Intel® Core™ processor and a fast SSD drive. The SIRIUS-SBOX is available in different versions and enclosures (see 4.1 Enclosure Overview on page 29): as standalone single slice or integrated in a Boxed Solution, Rack, etc.

The following chapters will describe the different versions in detail.

Naming convention:

- SBOX**e**: the **e** is short for **E**therCAT®: this version has an EtherCAT® connector
- SBOX**f**e: the **f** is short for **f**anless: this version has no fans (and also an EtherCAT® connector)
- SBOX**r**e: the **r** is short for **r**ack: this version is used in the rack housings: e.g. SIRIUS-R8 (and also an EtherCAT® connector)

General SBOX features:

- **High speed CPU**
  Powerful Intel® Core™ processor
- High speed interfaces
  USB 3.0 (nearly 10 times faster than USB 2.0) and **GLAN** interfaces provide highest bandwidth for data-transfer
- **EtherCAT®** interface
  Directly connect SIRIUS**e** devices. You only need one cable for power, synchronisation and data.
- **Removable** High speed **SSD**
  The high-speed Solid State Disk is fast enough for transient recording of measurement data and external high-speed videos at the same time.

*Illustration 61: SBOX**e** with removable SSD*

- **Flash option**
  For even better performance and maximum safety and convenience, we recommend separating the operating system from the measurement data.
  With the S-BOX-FLASH250 option, the operating system is stored on an internal flash disk with 250 GB, while the measurement data is stored on the exchangeable SSD.
  This allows you to quickly change the SSD (where your valuable data is stored).
  This feature also allows to continue storing on a new media immediately.

4.5 SIRIUS-SBOXe

The SIRIUS-SBOX*e* version is an SBOX with EtherCAT® interface. It is available in the Modular Solution and also in the Boxed Solution (see 4.1 Enclosure Overview on page 29).

4.5.1 Specifications SBOXe

Interfaces and options	
USB Front	4x USB 3.0 NOTE: USB 2.0 uses only 2 native ports see 4.2.2 USB Hubs vs. Native Ports on page 35
USB Rear	2x USB 2.0 (single root hub)
Ethernet	2x GLAN (RJ45) 1xfront, 1xrear, 1x WLAN (RP-SMA Female Jack)
EtherCAT®	100Mbps Full Duplex LEMO 8pin female (*EGG.1T.308.CLN*)
Synchronisation	1x SIRIUS SYNC: see 4.3.1.3 Sync Connector on page 38
Video	1x DVI (VGA and HDMI compatible)
Optional GPS	10Hz or 100Hz or 100Hz+RTK
GPS display	External on DSUB9f connector +remote power on
Power out	Switched supply on L1B2f (max. 8A)

Technical specifications		
Processor	Intel® Core™ i7 (4 cores – 8 threads)	
CPU clock frequency	2.1 GHz	
Chipset	QM57	
Memory	4 GB	
Storage	Removable SSD	240GB, 960GB as option others on request
Flash	S-BOX-FLASH250 option	
Power Supply	9-36V_{DC}	
Power Consumption	Typ. 25W (max. 55W)	

Physical Specifications	
Operating Temperature	-10 to 50°C
Storage Temperature	-40 to 85°C
Dimensions	265 x 150 x 75 [mm]
Humidity	95% RH non condensing @ 60°C
Shock & Vibration	VIBRATION SWEEP SINUS (EN 60068-2-6:2008) VIBRATION RANDOM (EN 60721-3-2: 1997 - Class 2M2) SHOCK (EN 60068-2-27:2009) MIL-STD-810D

4.5.2 Front side

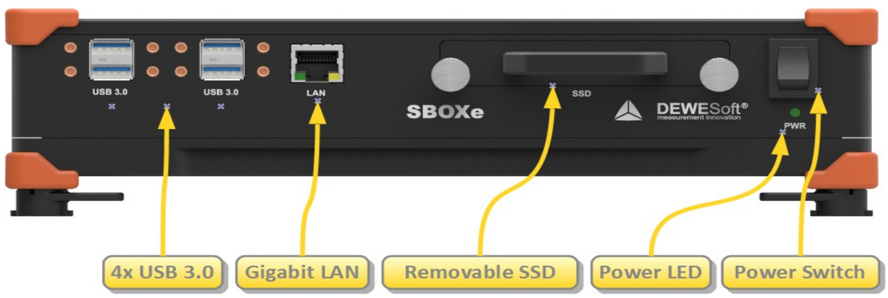


Illustration 62: SIRIUS-SBOXe: Connectors at the front side

- 4x **USB** 3.0 connector: see 4.3.1.1 USB Connector on page 37
- **LAN**: 1x Ethernet 1Gbps, RJ45 connector: see 4.3.3.3 Ethernet Connector (RJ45) on page 39
- **SSD**: removable Solid State Disk
- **PWR**: Power Led: is green when Power is available and switched on
- **PWR switch**: To switch the S-BOX on/off. This can also be done via the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39

4.5.3 Rear side

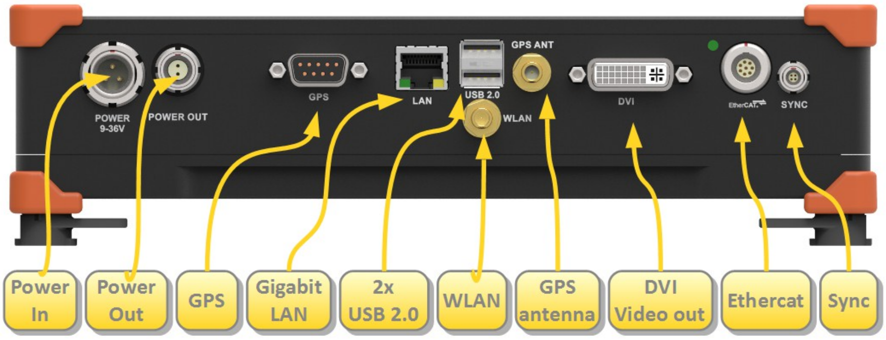


Illustration 63: SIRIUS-SBOXe: Connectors at the rear side

- **POWER**: Power input: 3 pin LEMO: see 4.5.3.1 Power In Connector on page 42
- **POWER OUT**: Power output: 2 pin LEMO: see 4.5.3.2 Power Out on page 42
- **GPS**: GPS output connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
- **LAN**: Ethernet 1Gbps, RJ45 connector: see 4.3.3.3 Ethernet Connector (RJ45) on page 39
- **USB 2.0**: 2x USB 2.0: see 4.3.1.1 USB Connector on page 37
- **WLAN**: WLAN antenna: WiFi 802.11 b/g/n
- **GPS ANT**: GPS antenna: see 4.3.3.2 GPS Antenna Connector on page 39
- **DVI**: 1x DVI Video out (VGA and HDMI compatible)
- **EtherCAT®** connector: see 4.3.1.2 EtherCAT® connector on page 37
- **SYNC**: 1x Sync Out: see 4.3.1.3 Sync Connector on page 38
  only useful when you have the GPS option: see 4.2.3 GPS Option on page 36.

4.5.3.1 Power In Connector

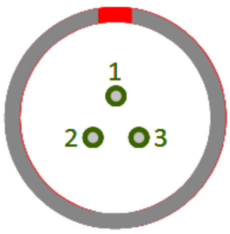


Illustration 64: Power Connector 3pin

Pin	Name
1	V+
2	GND
3	Remote-On[7]

Power connector (on the S-BOX): *ECJ.2B.303.CLA*
Mating connector (for the cable): *FGJ.2B.303.CLLDxx*

To power the system on/off, press the Power switch, or use the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39.

4.5.3.2 Power Out

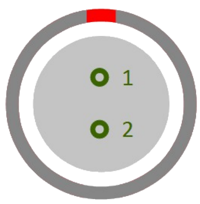


Illustration 65: Power Connector 2pin

Pin	Name
1	V+
2	GND

Power connector (on the housing): *EEG.1B.302.CLL*
Mating connector (for the cable): *FGG.1B.302.CLADxxZ*

Daisy chain cable: *L1B2m-L1B2f-0.4m*

7 If not available then use pin 6 of the GPS connector

4.6 SIRIUS-SBOXfe

The SIRIUS-SBOX*fe* version is an SBOX with EtherCAT® interface. It is available for the Modular Solution. It includes the Intel® Core™ i7 (3517UE) high speed CPU which is the most powerful processor of the Intel® Core™ processor family for *f*anless operation.

4.6.1 Specifications SBOXfe

Interfaces and options	
USB Front	4x USB 3.0 NOTE: USB 2.0 has only 2 native ports: see 4.2.2 USB Hubs vs. Native Ports on page 35
USB Rear	2x USB 2.0 (single root hub)
Ethernet	2x GLAN (RJ45) 1xfront, 1xrear, 1x WLAN (RP-SMA Female Jack)
EtherCAT®	100Mbps Full Duplex LEMO 8pin female (`EGG.1T.308.CLN`)
Synchronisation	1x SIRIUS SYNC: see 4.3.1.3 Sync Connector on page 38
Video	1x DVI (VGA and HDMI compatible)
Optional GPS	10Hz or 100Hz or 100Hz+RTK
GPS display	External on DSUB9f connector +remote power on
Power out	Switched supply on L1B2f (max. 8A)

Technical specifications		
Processor	Intel® Core™ i7-3517UE (2 cores – 4 threads)	
CPU clock frequency	1.7 GHz (2 cores, 4 threads)	
Chipset	QM77	
Memory	4 GB	
Storage	Removable SSD	240GB, 960GB as option others on request
Flash	S-BOX-FLASH250 option	
Power Supply	9-36V_{DC}	
Power Consumption	max. 30W	

Physical Specifications	
Operating Temperature	-10 to 50°C
Storage Temperature	-40 to 85°C
Dimensions	265 x 150 x 80 [mm]
Humidity	95% RH non condensing @ 60°C
Shock & Vibration	VIBRATION SWEEP SINUS (EN 60068-2-6:2008) VIBRATION RANDOM (EN 60721-3-2: 1997 - Class 2M2) SHOCK (EN 60068-2-27:2009) MIL-STD-810D

4.6.2 Front Side

Illustration 66: SIRIUS-SBOXfe Frontside

- **PWR**: Power Led: is green when Power is available and switched on
- **PWR switch**: To switch the S-BOX on/off. This can also be done via the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
- **SSD**: removable Solid State Disk
- **LAN**: 1x Ethernet 1Gbps, RJ45 connector: see 4.3.3.3 Ethernet Connector (RJ45) on page 39
- 4x **USB** 3.0 connector: see 4.3.1.1 USB Connector on page 37

4.6.3 Rear Side

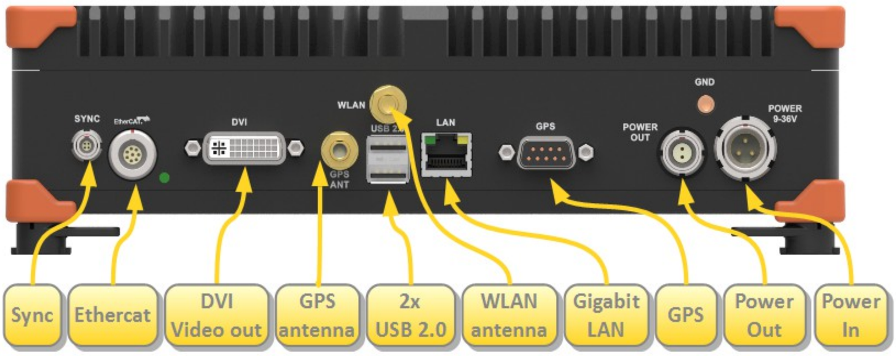


Illustration 67: SIRIUS-SBOXfe: Connectors at the rear side

- **SYNC**: 1x Sync Out: see 4.3.1.3 Sync Connector on page 38
  only useful when you have the GPS option: see 4.2.3 GPS Option on page 36.
- **EtherCAT®**: see 4.3.1.2 EtherCAT® connector on page 37
- **DVI**: 1x DVI Video out (VGA and HDMI compatible)
- **GPS ANT**: GPS antenna: see 4.3.3.2 GPS Antenna Connector on page 39
- **WLAN**: WLAN antenna: WiFi 802.11 b/g/n
- **USB 2.0**: 2x USB 2.0: see 4.3.1.1 USB Connector on page 37
- **LAN**: Ethernet 1Gbps, RJ45 connector: see 4.3.3.3 Ethernet Connector (RJ45) on page 39
- **GPS**: GPS output connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
- **POWER OUT**: Power output: 2 pin LEMO: see 4.6.3.2 Power Out Connector on page 44
- **GND**: Protective Ground: see 4.3.2.2 GND Connector on page 39
- **POWER**: Power input: 3 pin LEMO: see 4.6.3.1 Power In Connectoron page 44

4.6.3.1 Power In Connector

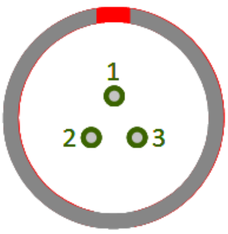


Illustration 68: Power Connector 3pin

Pin	Name
1	V+
2	GND
3	Remote-On[8]

Power connector (on the S-BOX): `ECJ.2B.303.CLA`
Mating connector (for the cable): `FGJ.2B.303.CLLDxx`

To power the system on/off, press the Power switch, or use the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39.

4.6.3.2 Power Out Connector

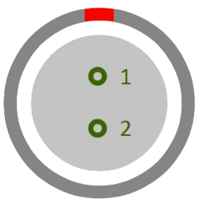


Illustration 69: Power Connector 2pin

Pin	Name
1	V+
2	GND

Power connector (on the housing): `ECG.1B.302.CLL`
Mating connector (for the cable): `FGJ.1B.302.CLADxxZ`

8 If not available then use pin 6 of the GPS connector

4.7 SIRIUS-SBOXre

The SIRIUS-SBOX*re* version is an S-BOX with EtherCAT® interface that can be used in *r*ack enclosures (see 4.1.4 Rack Enclosure on page 34).

4.7.1 Specifications SBOXre

Interfaces and options	
USB	4x USB 3.0 NOTE: USB 2.0 → only 2 native ports: see 4.2.2 USB Hubs vs. Native Ports on page 35
Ethernet	1x GLAN (RJ45) 1x WLAN (RP-SMA Female Jack)
Option SBOXre-2GLAN	Instead of WLAN you can order a 2nd GLAN
EtherCAT®	100Mbps Full Duplex LEMO 8pin female (`EGG.1T.308.CLN`)
Synchronisation	1x SIRIUS SYNC: see 4.3.1.3 Sync Connector on page 38
Video	1x DVI (VGA and HDMI compatible)
Optional GPS	10Hz or 100Hz or 100Hz+RTK
GPS display	External on DSUB9f connector +remote power on
Power out	Switched supply on L1B2f max. 8A (shared with EtherCAT® connector)

Technical specifications		
Processor	Intel® Core™ i7 (4 cores – 8 threads)	
CPU clock frequency	2.1 GHz	
Chipset	QM57	
Memory	4 GB	
Storage	Removable SSD	240GB, 960GB as option others on request
Flash	S-BOX-FLASH250 option	

4.7.2 Front Side

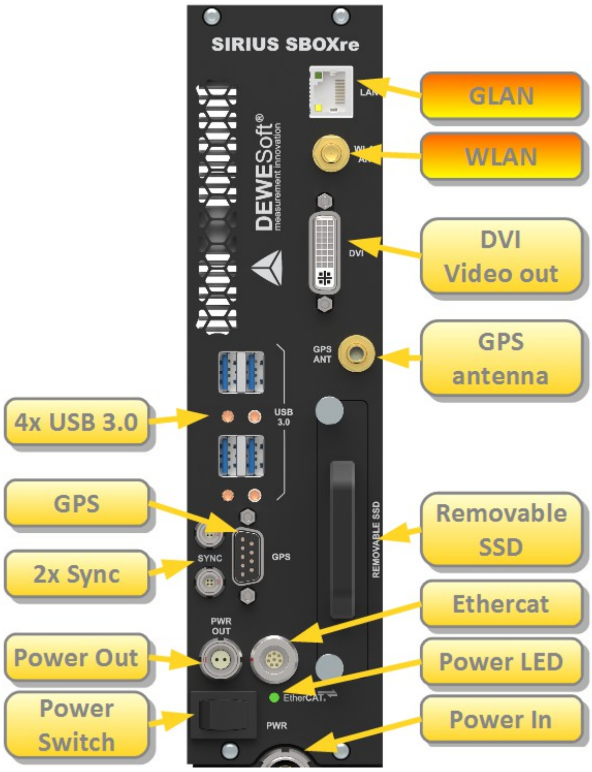


Illustration 70: SBOXre

This version has 1 LAN and 1 WLAN connector.

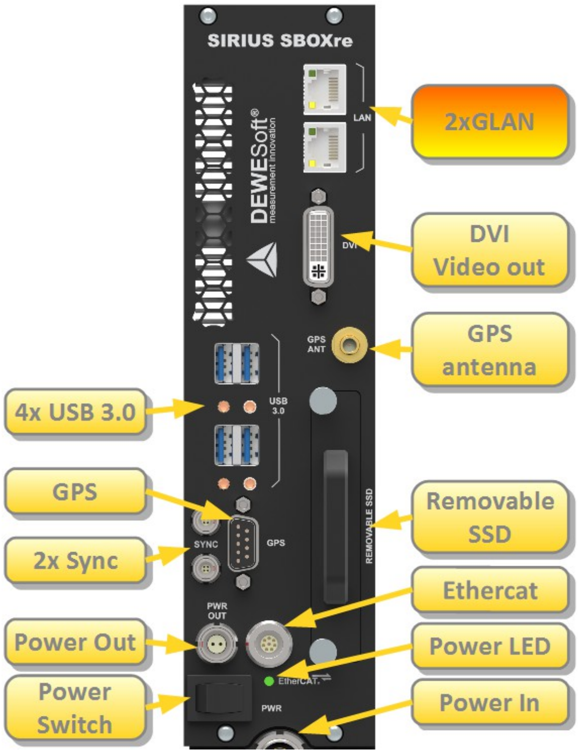


Illustration 71: SBOXre-2GLAN

This version has 2 LAN connectors, but no WLAN

- **LAN**: 1 (SBOXre) or 2 Ethernet (SBOXre-2GLAN) 1Gbps, RJ45 connector: see 4.3.3.3 Ethernet Connector (RJ45) on page 39
- **WLAN**: WLAN antenna: WiFi 802.11 b/g/n (not for SBOXre-2GLAN)
- **DVI**: 1x DVI Video out (VGA and HDMI compatible)
- **GPS ANT**: GPS antenna: see 4.3.3.2 GPS Antenna Connector on page 39
- **SSD**: Removable Solid State Drive
- **EtherCAT®** connector: see 4.3.1.2 EtherCAT® connector on page 37
- **PWR**: Power Led: is green when Power is available and switched on
- **PWR switch**: To switch the S-BOX on/off. This can also be done via the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
- **PWR OUT**: Power output: 2 pin LEMO: see 4.7.2.1 Power Out Connector on page 46
- **SYNC**: 2x Sync: see 4.3.1.3 Sync Connector on page 38
- **GPS**: GPS output connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
- **USB 3.0**: 4x USB 3.0: see 4.3.1.1 USB Connector on page 37

4.7.2.1 Power Out Connector

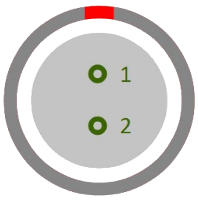


Illustration 72: Power Connector 2pin

Pin	Name
1	V+
2	GND

Power connector (on the housing): `EGG.1B.302.CLL`
Mating connector (for the cable): `FGG.1B.302.CLADxxZ`

4.8 SIRIUS-R2DB

The SIRIUS-R2DB is a battery powered portable instrument, designed according MIL standards and capable of withstanding rugged conditions in heavy environments such as construction and in Military applications.
It consists of an integrated S-BOX, a Multi-touch display, 2 batteries (included) and can have up to 2 SIRIUSir/r slices (32 channels).
The batteries can be hot-swapped during operation via the front-side battery bay.

Illustration 73: R2DB

4.8.1 R2DB: PC Specifications

Interfaces and options	
USB Front	4x USB 3.0 NOTE: USB 2.0 has only 2 native ports: see 4.2.2 USB Hubs vs. Native Ports on page 35
Ethernet	2x GLAN (RJ45) 1x WLAN (RP-SMA Female Jack)
EtherCAT®	100Mbps Full Duplex LEMO 8pin female (`EGG.1T.308.CLN`)
Synchronisation	2x SIRIUS SYNC: see 4.3.1.3 Sync Connector on page 38
Video	1xHDMI
GPS Antenna	For GPS option
GPS display	External on DSUB9f connector +remote power on

PC specifications	
Processor	Intel® Core™ i3 processor i7 upgrade available
CPU clock frequency	2x2.1GHz (2 cores, 4 threads)
Memory	4 GB (up to 16 on request)
SSD (OS + Data)	240GB, 500GB (mSATA) as option
Optional GPS	10Hz 100Hz 100Hz + RTK

4.8.2 R2DB: Specifications

Specifications		
Power In	$9\text{-}36V_{DC}$	
Power Out	Switched supply on Lemo 1B2f	
Power Out	Max. 60W	
Max. Output Voltage	11-16V	without external supply
	24V	with external supply
Power Out (EtherCAT®)	5A max.	
Power Consumption	40W max (no charging, no slices)	
Physical Dimensions	332x225x194 [mm]	
Display	12.1“ Full-HD, Multi-touch	
Resolution	WXGA 1280x800	
Brightness	700 cd/m²	
Operating Temperature	0 to 40°C	
Storage Temperature	-20 to 60°C	
Charging Power	40 W	
Batteries		
Number of Batteries	2	
Hot-Swap	YES	
Total capacity (min)	12.5Ah (at fully charged state)	
Weight (32 ch. system)		
Without batteries	9.7 kg	
With all batteries	11kg	
Single battery	0.65 kg	
Humidity	95% RH non condensing @ 60°C	
Shock & Vibration	VIBRATION SWEEP SINUS (EN 60068-2-6:2008) VIBRATION RANDOM (EN 60721-3-2: 1997 - Class 2M2) SHOCK (EN 60068-2-27:2009) MIL-STD-810D	

Table 7: Specifications R2DB

4.8.3 Frontside

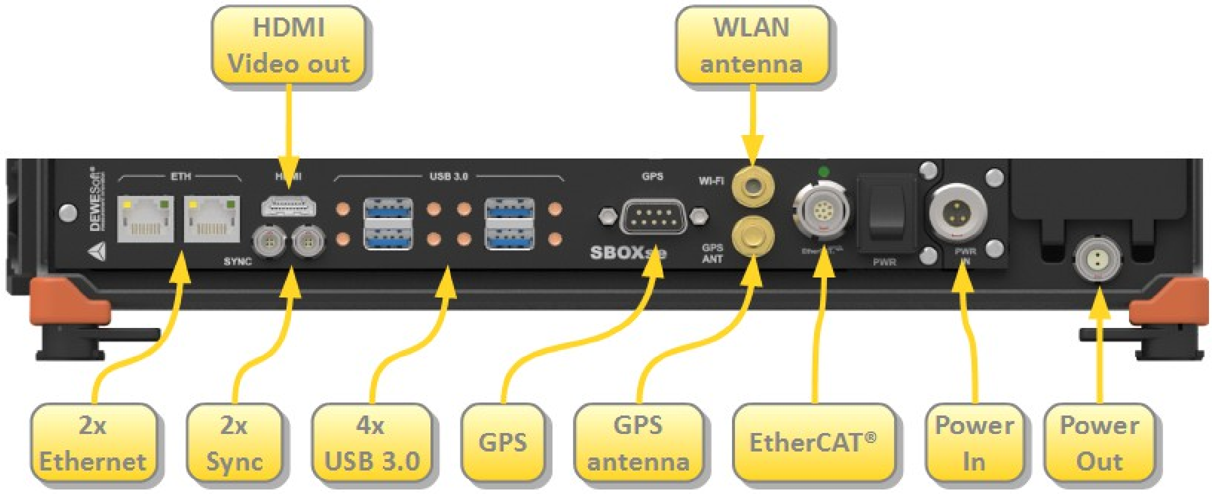


Illustration 74: R2DB Front-side

4.8.3.1 Connectors

On the front-side of the R2DB you can find these connectors:

- **ETH**: 2x Ethernet 1Gbps, RJ45 connector: see 4.3.3.3 Ethernet Connector (RJ45) on page 39
- **HDMI**: 1x HDMI Video Output
- **SYNC**: 2x Sync: see 4.3.1.3 Sync Connector on page 38
- **USB 3.0**: 4x USB 3.0: see 4.3.1.1 USB Connector on page 37
  i7 version: USB 3.0 ports on the front of the R2DB do not work in BIOS but only work after Windows boots
- **GPS**: GPS output connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
- **WiFi**: WLAN antenna: WiFi 802.11 b/g/n
- **GPS ANT**: GPS antenna: see 4.3.3.2 GPS Antenna Connector on page 39
- **EtherCAT**®: EtherCAT® connector: see 4.3.1.2 EtherCAT® connector on page 37
- **PWR switch**: To switch the S-BOX on/off. This can also be done via the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
- **PWR-IN**: 3 pin LEMO: see 4.8.3.2 Power In Connector on page 48
- **Power out**: 2 pin LEMO: see 4.8.3.3 Power Out Connector on page 49

4.8.3.2 Power In Connector

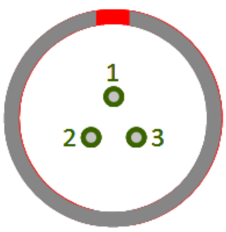


Illustration 75: Power Connector 3pin

Pin	Name
1	V+
2	GND
3	Remote-On[9]

Power connector (on the housing): `ECJ.2B.303.CLA`
Mating connector (for the cable): `FGJ.2B.303.CLLD__`

To power the system on/off, press the Power switch, or use the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39.

9 If not available then use pin 6 of the GPS connector

4.8.3.3 Power Out Connector

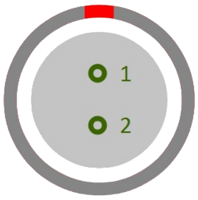


Illustration 76: Power Connector 2pin

Pin	Name
1	V+
2	GND

Power connector (on the housing): `EEG.1B.302.CLL`
Mating connector (for the cable): `FGG.1B.302.CLAD__Z`

4.9 SIRIUS-R2D

The SIRIUS-R2D is a battery portable instrument, designed according MIL standards and capable of withstanding rugged conditions in heavy environments such as construction and in Military applications.
It consists of an integrated S-BOX, a Multi-touch display and can have up to 2 SIRIUS*ir/r* slices (32 channels).

The specifications of R2D are identical to SIRIUS-R2DB, except that R2D does not have integrated batteries.

Illustration 77: Sirius® R2D

4.10 SIRIUS-R8

The SIRIUS-R8 is a rugged chassis which provides 8 slots for SIRIUS® measurement modules and has an integrated powerful PC: with an Intel® Core™ i7 processor and a fast SSD drive.

The SIRIUS-R8 has the highest possible data through-put, since each measurement module has a dedicated USB2 line to the CPU (no USB-hub).

See also: 4.7 SIRIUS-SBOXre on page 45 and 4.13.4 Dimensions: R8 on page 61

- High speed CPU
  Intel® Core™ i7 is the most powerful processor of the Intel® Core™ processor family.
- High speed interfaces
  USB 3.0 (nearly 10 times faster than USB 2.0) and GLAN interfaces provide highest bandwidth for data-transfer from and to the S-BOX.
- Removable High speed SSD
  With 180 MB/s write rate to the Solid State Disk, there is enough capability not only for transient recording, but also for e.g. external high-speed video cameras.
- Flash option
  For even better performance and maximum safety and convenience, we recommend separating the operating system from the measurement data.
  With the S-BOX-FLASH250 option, the operating system is stored on an internal flash disk with 250 GB, while the measurement data is stored on the exchangeable SSD
  This allows for a quick exchange of the SSD where your valuable data is stored on.
  This feature also allows to continue storing on a new media immediately.

Illustration 78: SIRIUS-R8 front-side

4.10.1 Specifications R8

The R8 enclosure has an integrated S-BOXre (see 4.7 SIRIUS-SBOXre on page 45).

Specifications	
Power In	12-36V_{DC}
Power Consumption	Typ. 25 W (max. 55W) (without any slices)
Physical Dimensions	447x313x150 [mm]
Weight	5kg (excl. SIRIUS slices)
Operating Temperature	-10 to 50°C
Storage Temperature	-40 to 85°C
Humidity	95% RH non condensing @ 60°C
Shock & Vibration	VIBRATION SWEEP SINUS (EN 60068-2-6:2008) VIBRATION RANDOM (EN 60721-3-2: 1997 - Class 2M2) SHOCK (EN 60068-2-27:2009) MIL-STD-810D

Table 8: R8 Specifications

4.10.2 Front Side

Illustration 79: SIRIUS-R8: Frontside

- **S-BOXre** (or S-BOXre-2GLAN):
  - **LAN**: 1 (SBOXre) or 2 Ethernet (SBOXre-2GLAN):
    1Gbps, RJ45 connector: see 4.3.3.3 Ethernet Connector (RJ45) on page 39
  - **WLAN**: WLAN antenna: WiFi 802.11 b/g/n (not for SBOXre-2GLAN)
  - **DVI**: 1x DVI Video out (VGA and HDMI compatible)
  - **GPS ANT**: GPS antenna: see 4.3.3.2 GPS Antenna Connector on page 39
  - **SSD**: Removable Solid State Drive
  - **PWR**: Power Led: is green when Power is available and switched on
  - **PWR switch**: To switch the S-BOX on/off. This can also be done via the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
  - **EtherCAT®** connector: see 4.3.1.2 EtherCAT® connector on page 37
  - **PWR OUT**: Power output: 2 pin LEMO: see 4.7.2.1 Power Out Connector on page 46
  - **GPS**: GPS output connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
  - **SYNC**: 2x Sync: see 4.3.1.3 Sync Connector on page 38
  - **USB 3.0**: 4x USB 3.0: see 4.3.1.1 USB Connector on page 37
- **GND Banana/Screw**: Protective Ground: see 4.3.2.2 GND Connector on page 39
- **POWER**: Power input: 3 pin LEMO: see 4.10.2.1 Power In connector on page 52

4.10.2.1 Power In connector

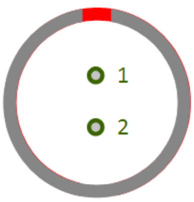


Illustration 80: Power Connector 2pin

Pin	Name
1	V+
2	GND

Power connector (on the S-BOX): `ECJ.2B.302.CLA`
Mating connector (for the cable): `FGJ.2B.302.CYMD92`

To power the system on/off, press the Power switch, or use the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39.

4.10.3 Rear Side

The rear side of the measurement slices can have the analogue out option: see 5.22 Analogue out OPTION on page 139.

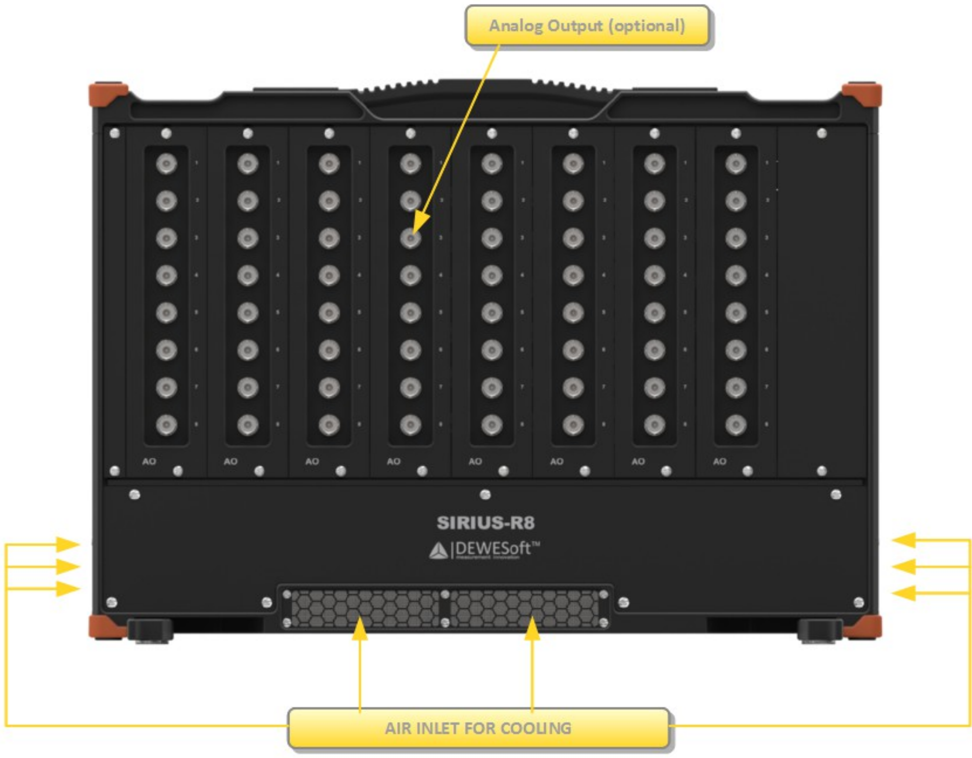


Illustration 81: SIRIUS-R8: Rearside

4.11 SIRIUS-R8D

The SIRIUS-R8D is a rugged chassis which provides 8 slots for SIRIUS® measurement modules and has an integrated powerful PC: with an Intel® Core™ i7 processor and a fast SSD drive.

Note: The Analogue out option (see 5.22 Analogue out OPTION on page 139) is not available (because of the display).

The SIRIUS-R8D has the highest possible data through-put, since each measurement module has a dedicated USB2 line to the CPU (no USB-hub).

Illustration 82: SIRIUS-R8D (left: front-side, right: rear-side)

- High speed CPU
  Intel® Core™ i7 is the most powerful processor of the Intel® Core™ processor family.
- High speed interfaces
  USB 3.0 (nearly 10 times faster than USB 2.0) and GLAN interfaces provide highest bandwidth for data-transfer from and to the S-BOX.
- Removable High speed SSD
  With 180 MB/s write rate to the Solid State Disk, there is enough capability not only for transient recording, but also for e.g. external high-speed video cameras.
- Flash option
  For even better performance and maximum safety and convenience, we recommend separating the operating system from the measurement data.
  With the S-BOX-FLASH250 option, the operating system is stored on an internal flash disk with 250 GB, while the measurement data is stored on the exchangeable SSD
  This allows for a quick exchange of the SSD where your valuable data is stored on.
  This feature also allows to continue storing on a new media immediately.

4.11.1 Specifications R8D

The R8D enclosure has an integrated S-BOXre (see 4.7 SIRIUS-SBOXre on page 45).

Specifications	
Power In	12-36V_{DC}
Power Consumption	Typ. 35 W, (max. 65) (without any slices)
Physical Dimensions	447x313x165 [mm]
USB	Front: 3xUSB3.0, 1xUSB2.0 Rear: 4xUSB3.0 (on the S-BOXre)
Display	17" Full-HD, Multi-touch
Resolution	1920 × 1080
Brightness	400 cd/m²
Weight	7.3kg (excl. SIRIUS slices)
Operating Temperature	-10 to 50°C
Storage Temperature	-40 to 85°C
Humidity	95% RH non condensing @ 60°C
Shock & Vibration	VIBRATION SWEEP SINUS (EN 60068-2-6:2008) VIBRATION RANDOM (EN 60721-3-2: 1997 - Class 2M2) SHOCK (EN 60068-2-27:2009) MIL-STD-810D

Table 9: R8D Specifications

4.11.2 Front Side (Display)

Illustration 83: SIRIUS-R8D: Front-side

- **USB 3.0**: 3x USB 3.0: see 4.3.1.1 USB Connector on page 37
- **USB 2.0**: 1x USB 2.0: see 4.3.1.1 USB Connector on page 37
- **PWR**: Power Led: is green when Power is available and switched on
- **PWR switch**: To switch the S-BOX on/off. This can also be done via the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39

4.11.3 Rear Side

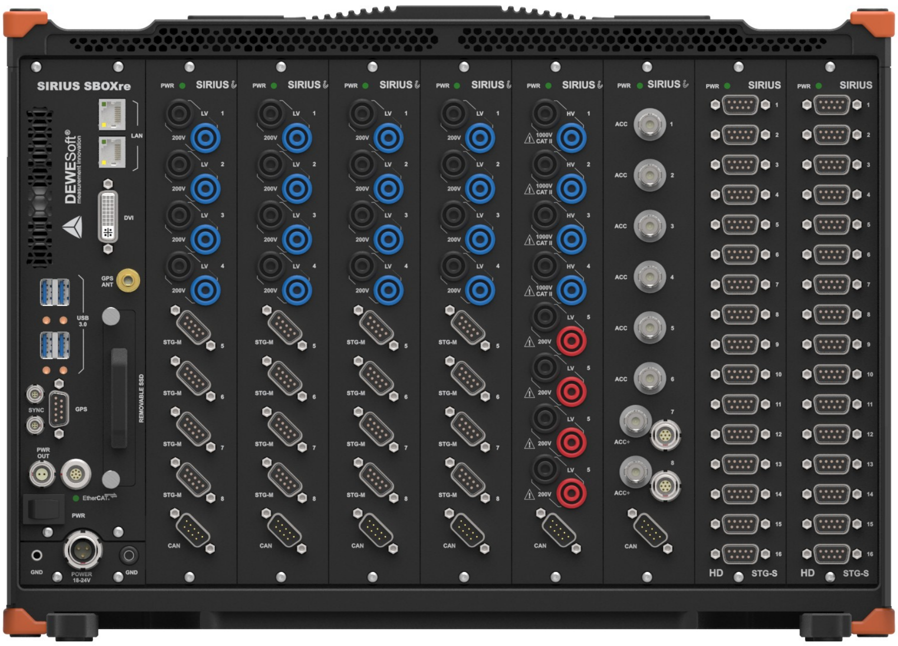


Illustration 84: SIRIUS-R8D: Rear-side

- **S-BOXre** (or S-BOXre-2GLAN): see chapter 4.7 SIRIUS-SBOXre on page 45 for details
  - **LAN**: 1 (SBOXre) or 2 Ethernet (SBOXre-2GLAN):
    1Gbps, RJ45 connector: see 4.3.3.3 Ethernet Connector (RJ45) on page 39
  - **WLAN**: WLAN antenna: WiFi 802.11 b/g/n (not for SBOXre-2GLAN)
  - **DVI**: 1x DVI Video out (VGA and HDMI compatible)
  - **GPS ANT**: GPS antenna: see 4.3.3.2 GPS Antenna Connector on page 39
  - **SSD**: Removable Solid State Drive
  - **PWR**: Power Led: is green when Power is available and switched on
  - **PWR switch**: To switch the S-BOX on/off. This can also be done via the *Remote-On* pin of the GPS connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
  - **EtherCAT®** connector: see 4.3.1.2 EtherCAT® connector on page 37
  - **PWR OUT**: Power output: 2 pin LEMO: see 4.7.2.1 Power Out Connector on page 46
  - **GPS**: GPS output connector: see 4.3.3.1 GPS Connector (DSUB 9) on page 39
  - **SYNC**: 2x Sync: see 4.3.1.3 Sync Connector on page 38
  - **USB 3.0**: 4x USB 3.0: see 4.3.1.1 USB Connector on page 37
- **GND Banana/Screw**: Protective Ground: see 4.3.2.2 GND Connector on page 39
- **POWER**: Power input: 3 pin LEMO: see 4.10.2.1 Power In connector on page 52

4.12 SIRIUS R8DB

The SIRIUS R8DB is much like the SIRIUS R8D, but it also includes batteries.

Note: The Analogue out option (see 5.22 Analogue out OPTION on page 139) is not available (because of the display).

Illustration 85: SIRIUS R8DB

4.12.1 Specifications R8DB

The R8D includes an integrated SBOXre: see chapter 4.7 SIRIUS-SBOXre on page 45 for details.

Specifications		
Power In	18-24V_{DC}	
Power Consumption	Typ. 35W (max. 65W) without charging (without any slices)	
Power Out (Lemo 1B)		
Max. Output Voltage	11-16V	Running on batteries
	Same as power in	With external supply
Physical Dimensions	447x313x205 [mm]	
USB	Front: 3xUSB3.0, 1xUSB2.0 Rear: 4x3.0 (on the S-BOXre)	
Display	17“ Full-HD, Multi-touch	
Resolution	1920 × 1080	
Brightness	400 cd/m²	
Operating Temperature	0 to 40°C	
Storage Temperature	-20 to 60°C	
Charging Power	60 W	
Batteries		
Number of Batteries	4	
Min. battery life	1.5h (at max. rated power)	
Hot-Swap	YES	
Wrong polarity protection	YES	
Total capacity (min)	25Ah (at fully charged state)	
Weight		
Without batteries	9.3kg (excl. SIRIUS slices)	
With all batteries	11.9kg (excl. SIRIUS slices)	
Single battery	0.65kg	
Humidity	95% RH non condensing @ 60°C	
Shock & Vibration	VIBRATION SWEEP SINUS (EN 60068-2-6:2008) VIBRATION RANDOM (EN 60721-3-2: 1997 - Class 2M2) SHOCK (EN 60068-2-27:2009) MIL-STD-810D	

Table 10: R8DB: Specifications

4.13 Dimensions

All solutions (Modular Solution, Boxed Solution, S-BOX) have the same depth:

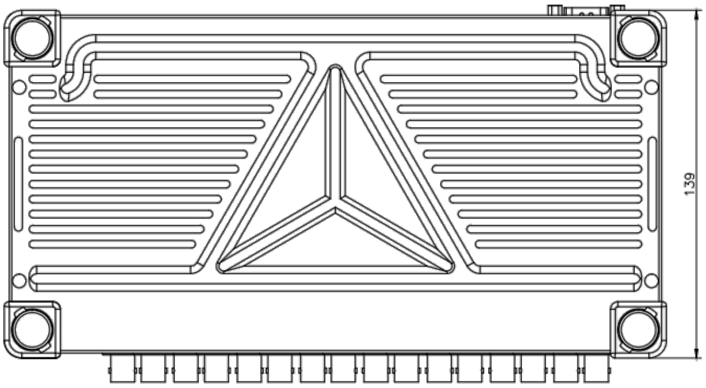


Illustration 86: Dimensions: Single Slice (Modular Solution)

4.13.1 Dimensions: Modular Solution

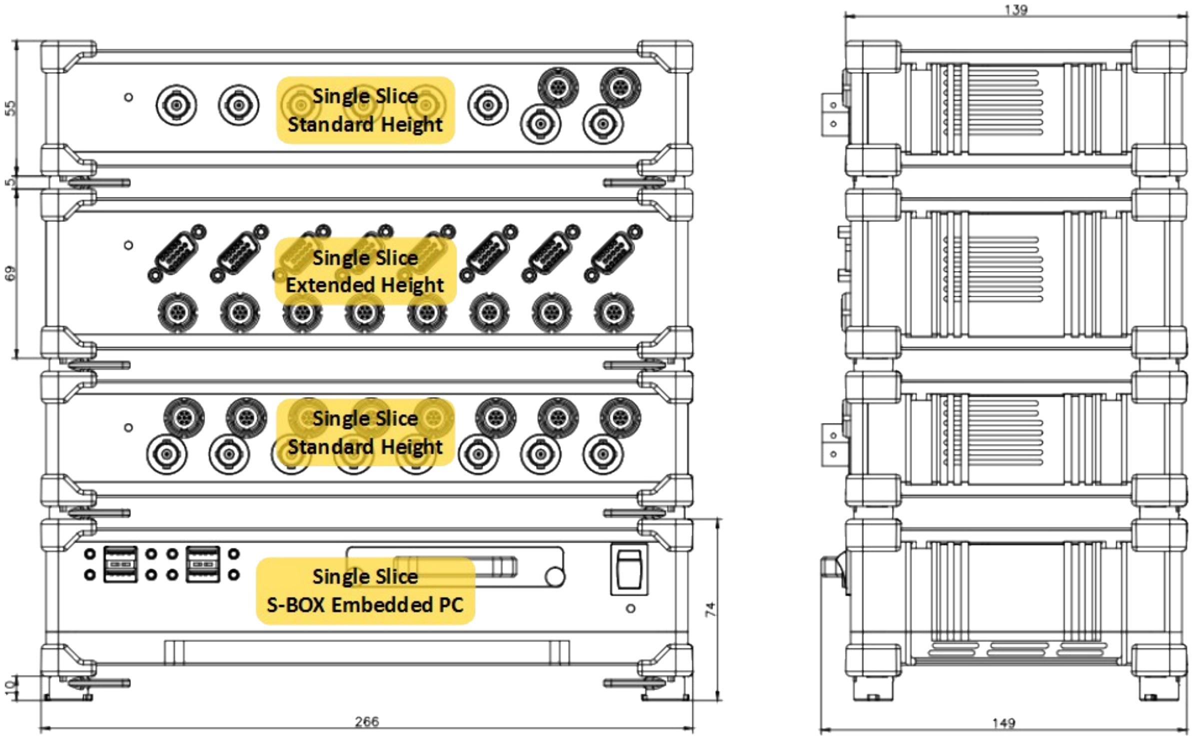


Illustration 87: Dimensions: Modular Solution

4.13.2 Dimensions: Boxed Solution

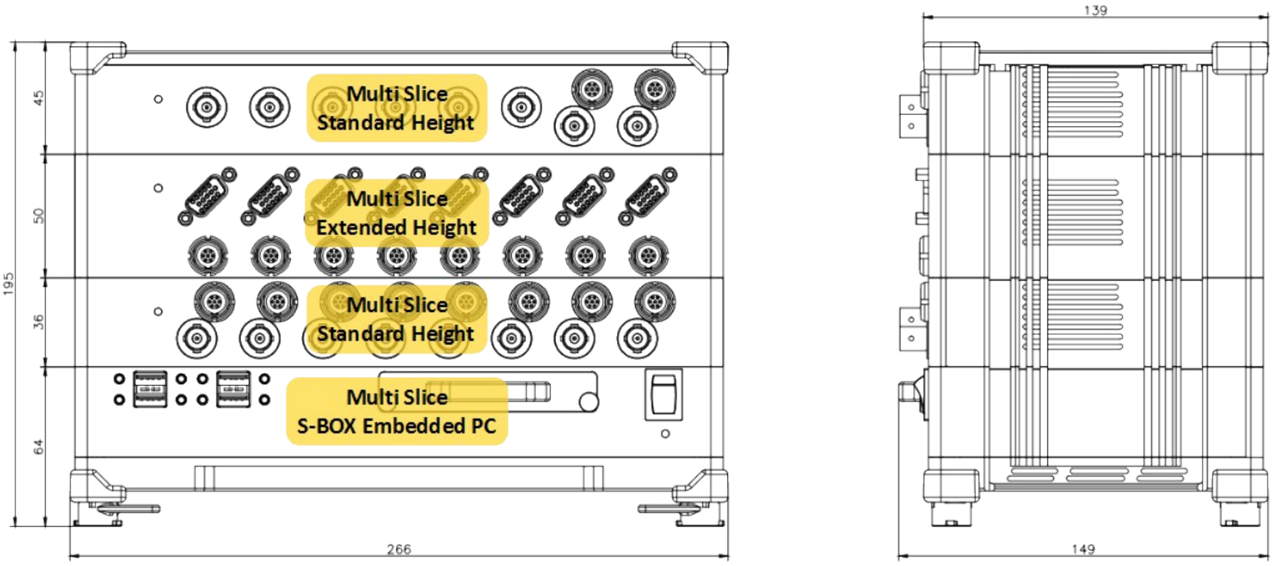


Illustration 88: Dimensions: Boxed Solution

4.13.3 Dimensions: R2DB, R2D

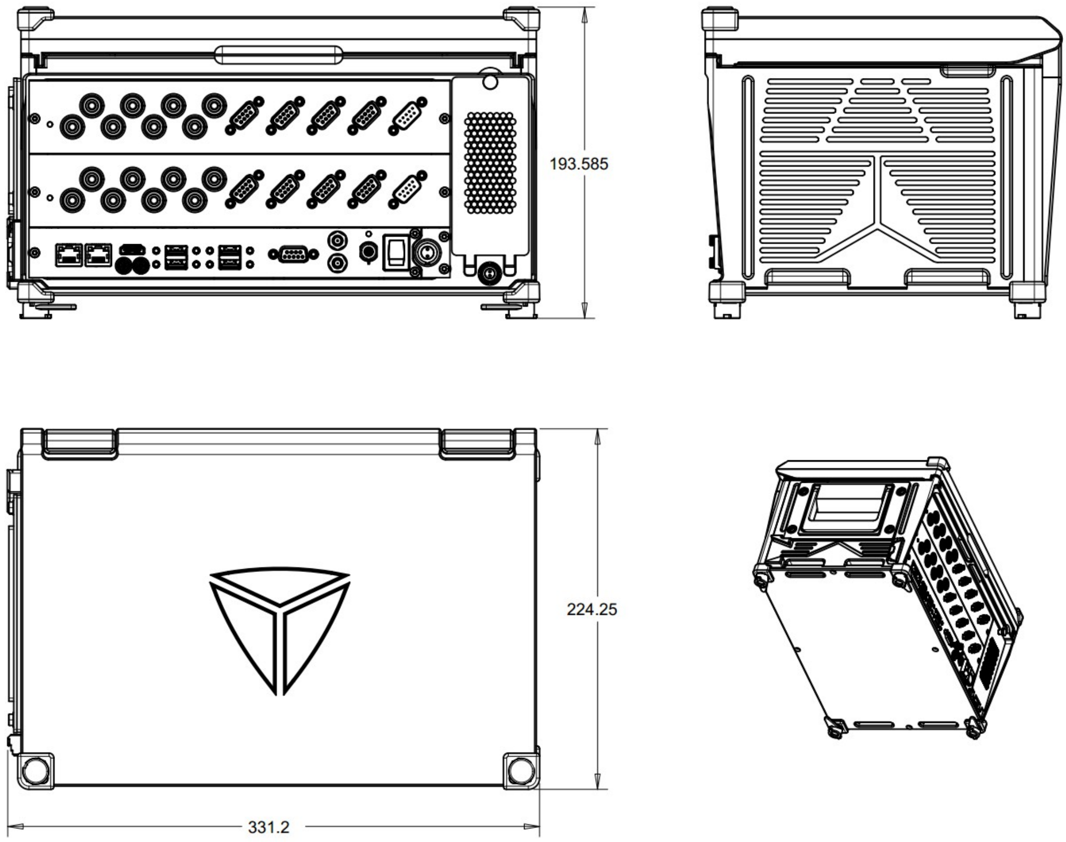


Illustration 89: Dimensions: R2DB

4.13.4 Dimensions: R8

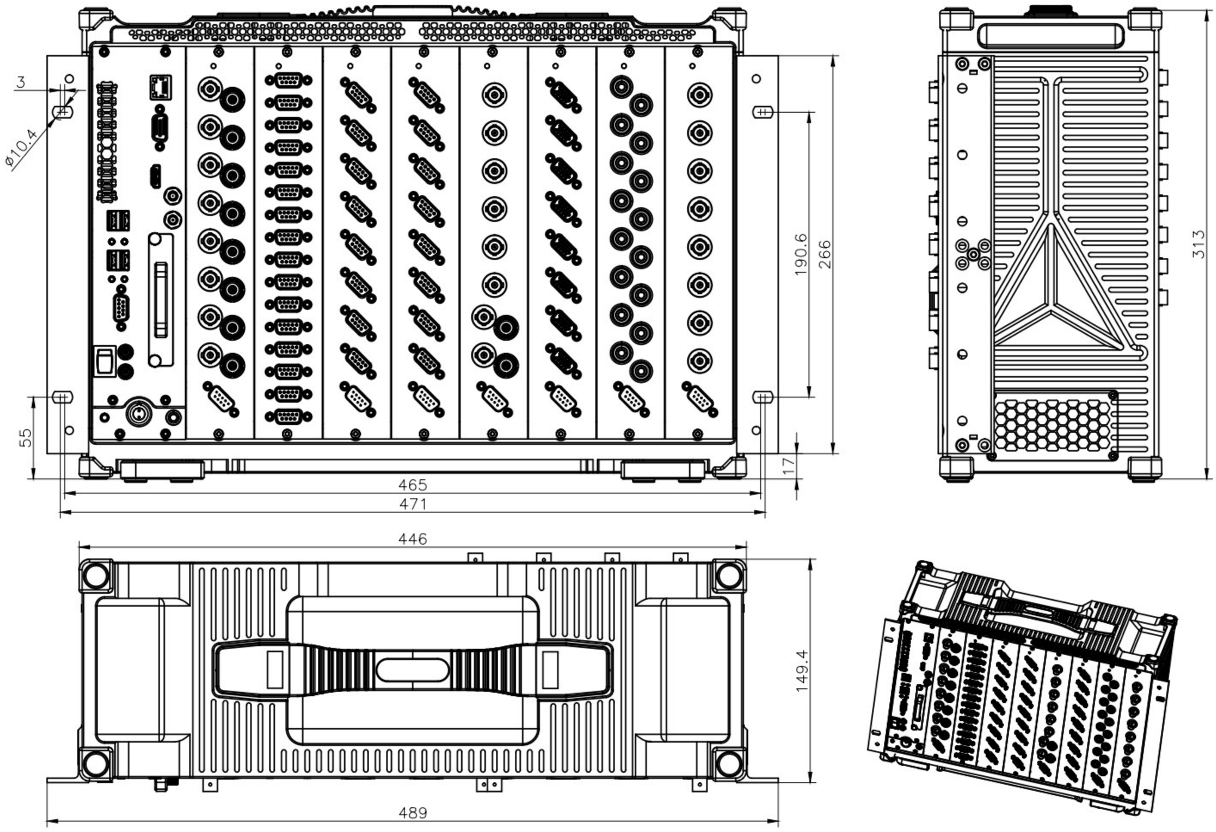


Illustration 90: SIRIUS® R8 dimensions

4.13.5 Dimensions: R8D

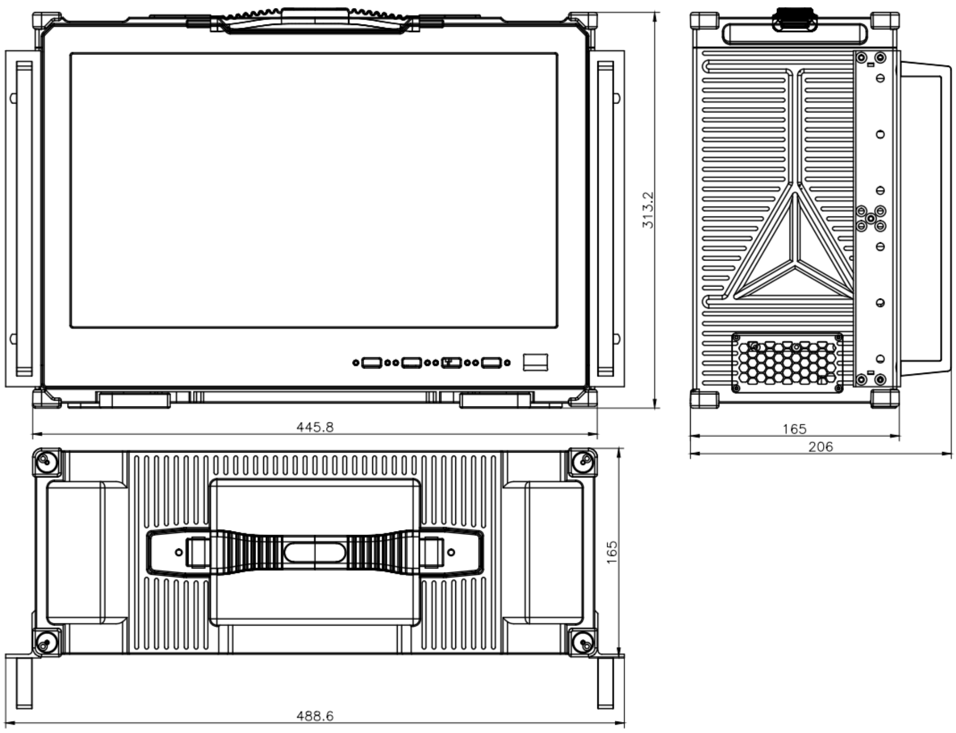
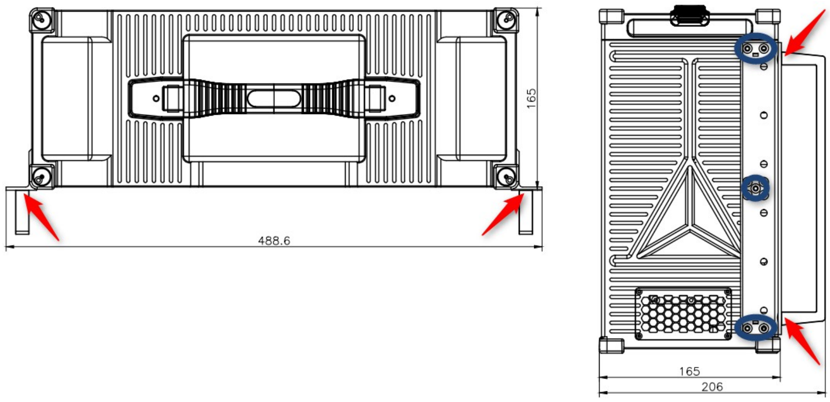


Illustration 91: Dimensions: R8D

4.13.5.1 Rack Mounting

Front Handle Aluminium:
Screw **M5x10** TX RF

19" Bracket:
Screw **M4X8** TX RF



4.13.6 Dimensions: R8DB

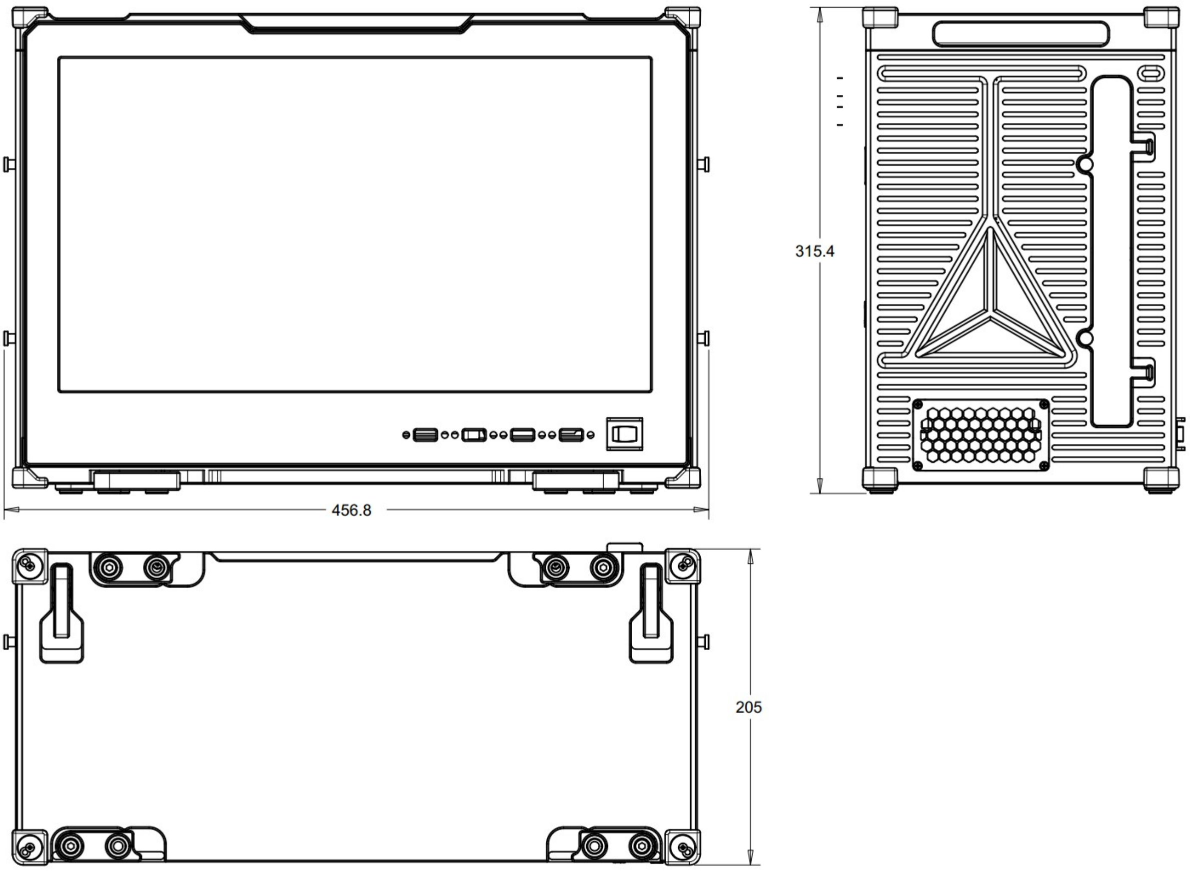


Illustration 92: SIRIUS R8DB dimensions

5 SIRIUS® Measurement Modules

5.1 Data Transfer Overview

Dewesoft offers SIRIUS® slices that can use different data-transfer technologies:

- USB
  - high data-throughput allows for high sampling rates (up to 1MS)
  - extra connectors for power and synchronisation required
  - direct connection to USB ports on the PC
- Standard EtherCAT®
  - only one single cable needed for data, synchronisation and power
  - data-throughput allows for sampling rates up to 20kS/s
  - direct connection to standard Ethernet port on the PC possible
- DS-EtherCAT+
  - this is a Dewesoft enhancement to the EtherCAT® standard, so that we can combine the advantages of Standard Ethernet and USB data-transfer

5.1.1 USB Data Transfer

USB is a high speed data bus being able to transmit full speed data for all channels to the measurement PC.

The SIRIUS® USB slices allow sampling rates of up to 1MHz (high-speed) and can be directly connected to native USB ports on the measurement PC (or S-BOX): see also 4.3.1.1 USB Connector on page 37, 4.2.2 USB Hubs vs. Native Ports on page 35.

In comparison to the EtherCAT® version, the SIRIUS®-USB slices need extra connectors for power supply and synchronisation.

5.1.2 EtherCAT® Data Transfer

EtherCAT® - Ethernet for Control Automation Technology - is a 100 Mbit Ethernet-based fieldbus system. The protocol is standardized in IEC 61158 and is suitable for both hard and soft real-time requirements. EtherCAT® can be used for applications that require short data update times with low communication jitter (for precise synchronisation purposes).

IMPORTANT	When connecting EtherCAT® devices to the computer please make sure that you connect the EtherCAT® cable directly to the Ethernet card of your PC without the use of network switches or hubs.

5.1.2.1 Standard EtherCAT® features

Strong points of standard EtherCAT®:

- Point to point communication
- High distance between modules possible (75 m)
- Only a single cable for power, data and synchronisation
- 100x faster than CAN bus
- Real time performance
- Physically fully compatible to Ethernet: i.e. same connector, no Gate-modules or adapters required

Weak points of standard EtherCAT®:

- Master sends the empty message train
  i.e. when DEWESoft® is the master and does not send the empty message for some reason, there will be no data on the bus
- Real time performance required from computer
- No data-buffer on the devices
- Ethernet packet (no TCP/IP) is prone to data-loss
- Time synchronisation is mostly done based on master precision of sending messages

→ this makes standard EtherCAT® good for **real-time** application, but not good for **data-acquisition**.

Since the standard EtherCAT® is originally intended for real time, it lacks few very important elements. This is why DEWESoft®uses an enhanced DS-EtherCAT+ protocol:

5.1.2.2 DS-EtherCAT+

In comparison to standard EtherCAT® the DS-EtherCAT+ protocol has following benefits:

- *Buffering*: DEWESoft® EtherCAT® devices buffer the measurement data for some seconds, so that all data can still be accessed, even if the Master (i.e. DEWESoft® on Windows®) is a little late.
- *Synchronisation*: DEWESoft® EtherCAT® devices can acquire the samples at an exact time stamp. The timestamp can be provided by an external timing source (e.g. GPS or IRIG)
- *Retransmit:* since EtherCAT® packets are below the TCP/IP level, the standard protocol does not handle lost packets. The enhanced DS-EtherCAT+ protocol will detect lost packets and retransmit them.

Notes:

- Since the SIRIUS® devices are EtherCAT® slaves, an external EtherCAT® master is required
- EtherCAT® needs a dedicated network interface: i.e. you cannot mix EtherCAT® to your existing Intranet (LAN network) or Internet1 (i.e. connect them to the same Ethernet-switch)
- In comparison to the SIRIUS-USB slices, the SIRIUS EtherCAT® modules do not have CAN and no analogue output

HINT	The maximum number of samples per device using EtherCAT® bus is 160 kS/sec for all transmitted channels: i.e. for 8 channels the rate would be 20 kHz. The maximum speed per bus is limited to the 100 Mbit EtherCAT® bus speed. When DEWESoft® is the master, it can utilize approximatively half of this bandwidth, but other masters might be more efficient.

5.1.2.3 EtherCAT® specifications

Max. Sample Rate ADC Type[10]	20kS/sec (Dual Core), 10kS/sec (High Density) Note: High-speed modules are NOT supported.
Max. Throughput per slice	640 kByte/sec (=160kS/sec total rate)
Max. Throughput per chain	3200 kByte/sec (=800kS/sec total rate)
Max. distance between slices	75 meters[11]
Max. number of slices[12]	100 (additional power injectors required)
Connector type	Lemo 1B 8 pin (Data and power supply)

Table 11: EtherCAT5.1.2.3 ® specifications

10 The data rate decreases when you activate counter channels (8 Byte per counter channel)
11 The distance can easily be increased by using fibre optics instead of standard Ethernet cables
12 When the max. allowed current and supply voltage dropout is reached, you must add power injectors

5.1.3 Data Transfer Combinations

DEWESoft® can only acquire data from Dewesoft Hardware which uses the DS-EtherCAT+ protocol.

The SIRIUS EtherCAT® slices have 2 modes of operation:

- Buffered mode: for DEWESoft® software
- Standard EtherCAT® mode: for standard EtherCAT® masters

5.2 Technology overview

Module

Each Sirius® slice can contain up to 8 measurement modules.

Illustration 93 shows an open Sirius® HD measurement slice.

The highlighted green PCB ❶ is a single measurement module. You can see ❷ that this HD slice has 2 connectors (and thus 2 channels) which are both connected to the same measurement module.

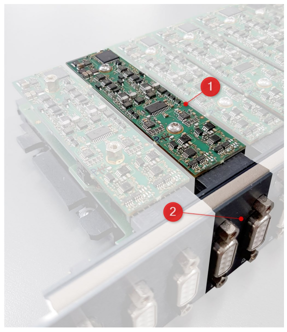


Illustration 93: HD-module

Illustration 94 Shows 2 STG-M+ modules in different colours. The first module (❶) is surrounded by yellow boxes, the 2nd module (❷) is highlighted with blue boxes.

Each module has a DB-9 connector for the analogue signals and a LEMO connector for the digital signals.

Note, that the counter connectors for the 2 modules share the common vertical space. Thus you must always configure these modules as pairs.

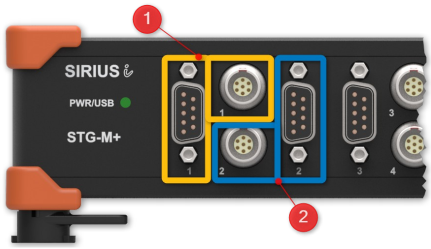
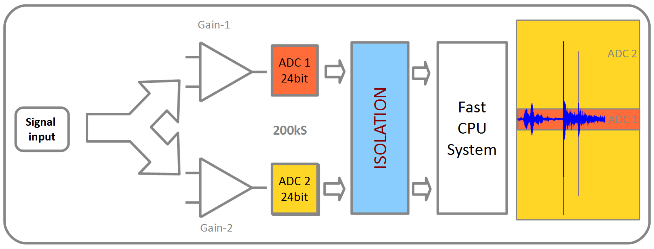


Illustration 94: STGM+

5.2.1 SIRIUS® Dual Core series: High Dynamic (up to 160 dB)

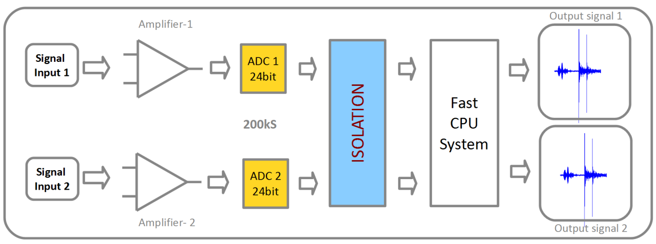
This new technology solves the often faced problem that the signal is just much higher than expected and therefore clipped. Dewesoft DUAL CORE ADC technology always gives you the full possible measuring range, because the signal is measured with a high and a low gain at the same time.



5.2.2 SIRIUS®-HD-series: High density (16 channel per slice)

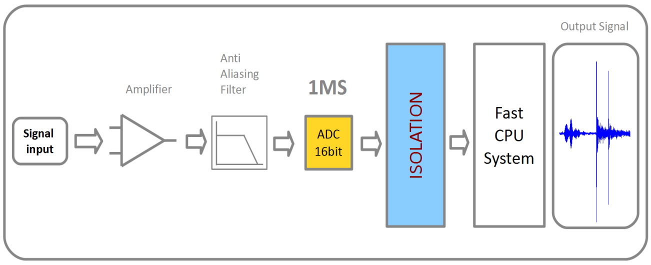
For highest channel density this solution offers 24Bit resolution with up to 200 kS/sec sample rate.

Note: the 2 amplifiers of the HD-modules share a common GND and are isolated against all other modules.



5.2.3 SIRIUS®-HS series: High speed and bandwidth

This series combines high bandwidth with alias free acquisition with 16 Bit of up to 1 MS/sec acquisition rate.
The analogue anti-aliasing filter (100 kHz, 5th order, Bessel) is combined with a free programmable digital IIR filter block inside the FGPA.
For bandwidth requirement of up to 2 MHz the complete filter chain can be bypassed.



5.2.4 Isolated version: EtherCAT®

The basic concept is the same like on the isolated USB version but the EtherCAT® slices do not have CAN or analogue-output. They also do not have a separate sync-connector, since the synchronisation is done via the EtherCAT® protocol.

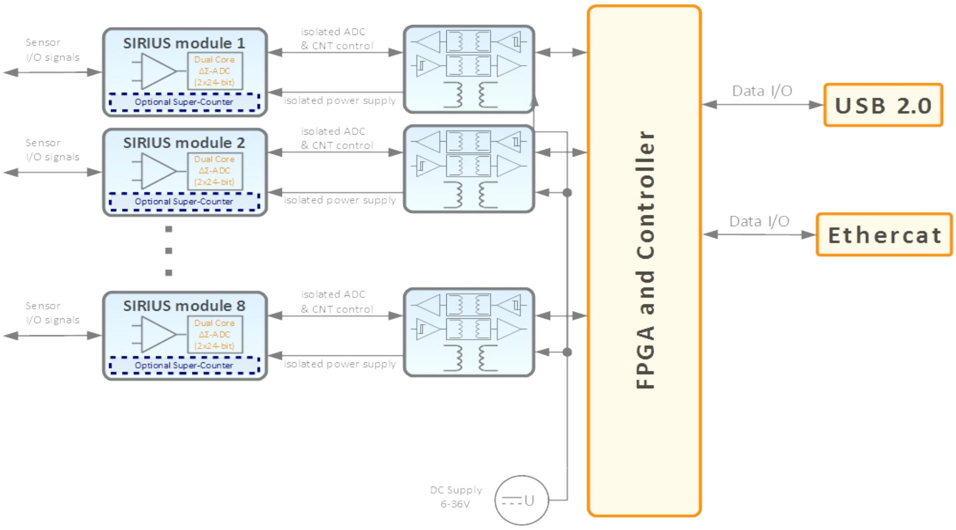


Illustration 95: EtherCAT® Motherboard

WARNING

Be careful with voltages >25 VAC or >35 VDC!
These voltages are already high enough in order to get a perilous electric shock by touching the wiring.

5.2.5 Isolated version: USB

The (standard) SIRIUS*i* modules are **isolated** between themselves and the main board.

Some modules generate power for electronics and for external pins: this power supply is again **isolated** against other modules, the main board and the housing.
Inside of one module, the power supply pins, counter and analogue inputs are not isolated between themselves (they have the same ground) that is available on the GND connector pin (e.g. The analogue input and the counter of one ACC+ module share the same GND).

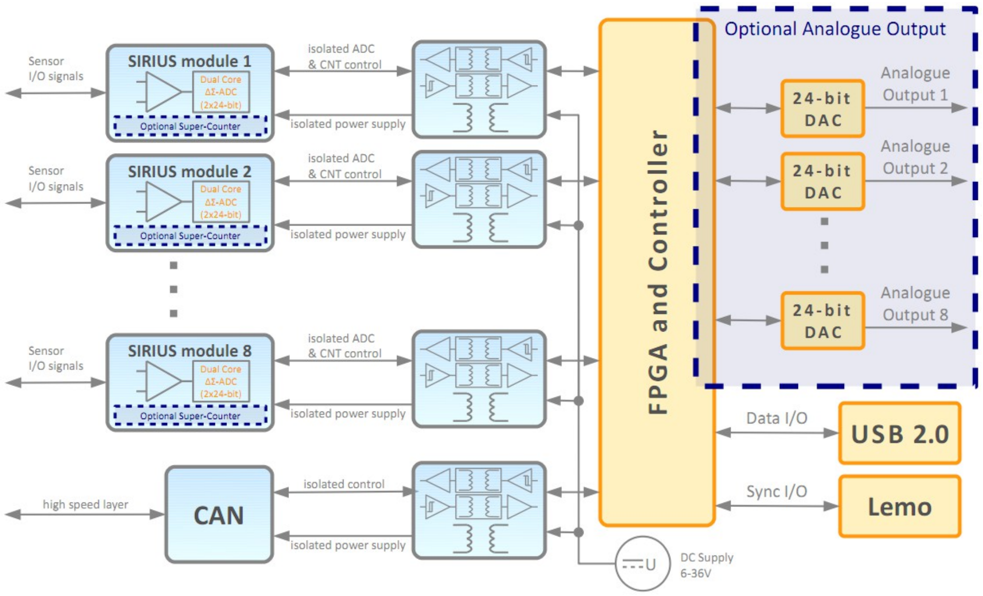


*Illustration 96: **Isolated** Motherboard*

WARNING	Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.

5.2.6 Differential version: USB

The basic concept is the same like on the isolated version but without galvanic isolation for the module power supply and the data interface.

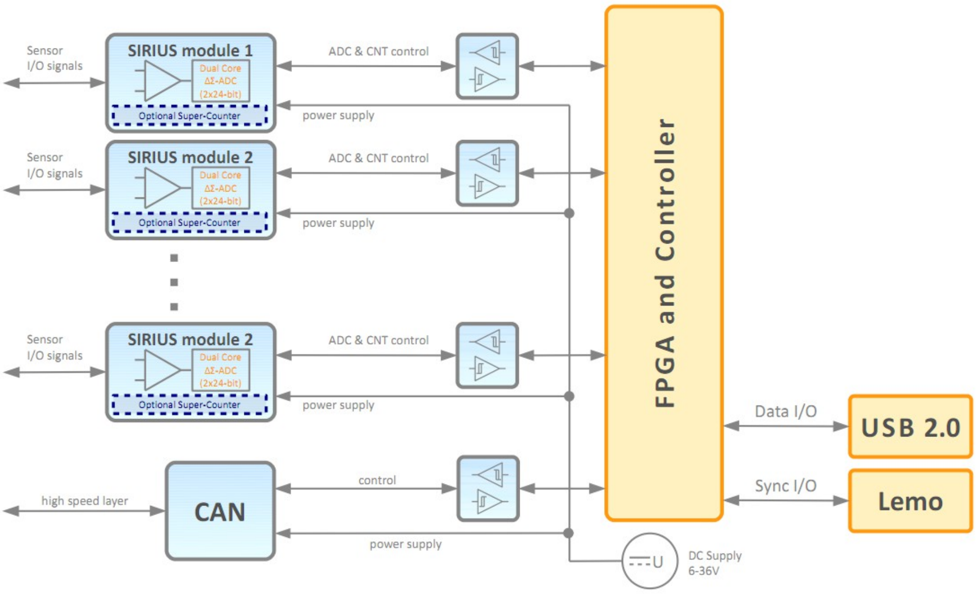


Illustration 97: Differential Motherboard

WARNING	Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.

5.3 SIRIUS® Slice Configuration

Standard Slice

SIRIUSi 8xACC

8 x ACC channels (see page 73)

SIRIUSi 6xACC, 2xACC+

6 x ACC, 2 x ACC+ channels (see page 73)

SIRIUSi 8xMULTI

8 x MULTI channels (see page 84)

SIRIUSi 8xSTGMv2

8xSTGMv2 channels (see page 91)

SIRIUSi 8xSTG

8 x STG modules (see page 102)

SIRIUSi 8xSTG-L2B10f

8xSTG-L2B10f channels (see page 106)

SIRIUSi HV

8 x HV channels (see page 78)

SIRIUSi-HS 8xHS-ACC

8xHS-ACC channels (see page 123)

SIRIUS-HD 16xHD-STGS

16 x HD-STGS channels (see page 118)

SIRIUS-HD 16xHD-LV

16 x HD-LV channels (see page 115)

Customized Slice

We can build a customised slice with exactly the modules that you want, in the order that you want.
Example:
2 x ACC, 2 x ACC+, 1x MULTI, 1x STG, 2x HV

5.4 SIRIUS® Dual Core specifications

	High Dynamic: Dual Core with 2x24Bit						
Analogue modules	**ACC**	**CHG**	**HV**	**LV**	**MULTI**	**STG**	**STGM**
With counter and DIO	**ACC+**	**CHG+**	**-**	**LV+**	**-**	**STG+**	**STGM+ STGM-DB**
Isolated version *i*	■	■	■	■	■	■	■
Differential version	■	■	-	■	■	■	■
EtherCAT® version	■	■	■	■	■	■	■
Rack version *r*[14]	■	■	■	■	■	■	■
Fanless version *f*	■	-	■	■[15]	-	-	■
Analogue Inputs[16]							
Inputs per module	1	1	1	1	1	1	1
Data Rate per Channel [Hz] – USB	200k	200k	200k	200k	200k	200k	200k
Data Rate per Channel [Hz] – EtherCAT®	20k	20k	20k	20k	20k	20k	20k
Vertical Resolution	2 * 24bit	2 * 24bit	2 * 24bit	2 * 24bit	2 * 24bit	2 * 24bit	2 * 24bit
Bandwidth	70 kHz	70 kHz	70 kHz	70 kHz	70 kHz	70 kHz	70 kHz
Voltage	±10 V, ±500 mV	±10 V, ±500 mV	±1200 V, ±50 V	±200 V to ±100 mV	±10 V to ±50 mV	±50 V to ±100 mV	±10 V to ±10 mV
Input coupling	DC, AC 0.1,1 Hz (3,10Hz SW)	DC, AC 0.1, 1, 10, 100Hz	DC	DC, AC 1 Hz (3,10Hz SW)	DC	DC, AC 1 Hz (3,10Hz SW)	DC
Sensor Excitation	-	-	-	2-30V bipol. 0-24V unipol max.0.2A/2W	0-12 V (<44mA) and fixed 12 V, 5 V	0-20V <0.8W, 0-60mA <0.5W	0-15 V, max. 44mA
Bridge connections (internal completion)	-	-	-	Full	Full, Half, ¼ .120/350Ω 3-wire	Full, Half, ¼.120/350Ω 3 or 4-wire	Full, Half, ¼ 120/350Ω 3-wire
Programmable Shunt (default Values)	-	-	-	-	59.88kΩ	59.88kΩ, 175kΩ bipolar	100 kΩ, bipolar
IEPE/ICP Sensors	2-20 mA (prog.)	4, 8 or 12 mA	-	DSI®	DSI®	DSI®	DSI®
Resistance	-	-	-	DSI®	DSI®	■	DSI®
Temp. (Pt100 to Pt2000)	-	-	-	DSI®	DSI®	■	DSI®
Temp. Thermocouple	-	-	-	DSI®	DSI®	DSI®	DSI®
Potentiometer	-	-	-	-	■	■	■
Charge	-	100,000 pC, 10,000 pC	-	DSI®	DSI®	DSI®	DSI®
Charge input coupling		0.01 .. 100 Hz					
Current	ext. Shunt	ext. Shunt	-	ext. Shunt	ext. Shunt	ext. Shunt	ext. Shunt
TEDS interface	■	■	-	■	■	■	■
Advanced Functions	Sensor error detection, high dynamic range	Sensor error detection in IEPE and charge mode (injection)	High Voltage High Isolation	High sensor power and multi range	Analogue and digital inputs, analogue out	Supports all strain types and high input range	Low power, Sensor&Amp. balance, Bipolar shunt
Analogue Input Connectors							
Connector type (Default)	BNC	BNC, TNC	Banana	DB9, BNC, Banana	DB15, L2B16f	DB9, L2B7f, L2B10f	DB9, L2B8f L2B16f
Digital types	only on + slices						
Counter (connector)	1 ch(L1B7f)	1 ch(L1B7f)	-	1 ch(L1B7f)	1 ch(DB15) 1 ch(L2B16f)	1 ch(L1B7f) 1ch(L2B10f)[13]	1 ch(L1B7f)
Digital Input (connector)	3 ch(L1B7f)	3 ch(L1B7f)	-	3 ch(L1B7f)	3 ch(DB15) 3 ch(L2B16f)	3 ch(L1B7f) 1ch(L2B10f)[13]	3 ch(L1B7f)
Digital Output (connector)	1 ch(L1B7f)	1 ch(L1B7f)	-	1 ch(L1B7f)	-	1 ch(L1B7f) 1ch(L2B10f[13]	1 ch(L1B7f)
Additional Information							
Isolation Voltage[18]	1000V	1000V	CAT II 1000V	1000V	1000V	1000V	1000V
Power Consumption/Max[19]	8W/15W	10W/18W	8W	10W/25W	15W/25W	15W/25W	11W/20W

Table 12: Dual Core Specifications

13 One digital IO per amplifier with Lemo 2B10f connector

5.5 SIRIUS® HD and HS specifications

	High Density: 24Bit, 16ch. per slice			High Speed: 16 Bit with high bandwidth				
Analogue modules	**HD-ACC**	**HD-LV**	**HD-STGS**	**HS-ACC**	**HS-CHG**	**HS-HV**	**HS-LV**	**HS-STG**
With counter and DIO	-	-	-	**HS-ACC+**	**HS-CHG+**	-	**HS-LV+**	**HS-STG+**
Isolated version i	■	■	■	■	■	■	■	■
Differential version	■	■	■	■	■	-	■	■
EtherCAT® version	■	■	■	-	-	-	-	-
Rack version r[14]	■	■	■	■	■	■	■	■
Fanless version f	-	-	-	-	-	■	■[15]	-
Analogue Inputs[16]								
Inputs per module	2	2	2	1	1	1	1	1
Data Rate/ channel [Hz] USB	200k	200k	200k	1 M	1 M	1 M	1 M	1 M
Data Rate/ channel [Hz] EtherCAT	10k	10k	10k	-	-	-	-	-
Vertical Resolution	24 Bit	24 Bit	24 Bit	16 Bit	16 Bit	16 Bit	16 Bit	16 Bit
Bandwidth	70 kHz	70 kHz	70 kHz	500 kHz	500/200[17] kHz	2 MHz	1 MHz	1 MHz
Voltage	±10 V to ±200 mV	±100 V to ±100mV	±10 V to ±10 mV	±10 V to ±200 mV	±10 V to ±100 mV	±1600 V to ±20 V	±100 V to ±50 mV	±50 V to ±20mV
Input coupling	DC, AC 0.1,1Hz (3,10Hz SW)	DC	DC	DC, AC 1 Hz (3,10Hz SW)	DC, AC (0.1, 1, 10, 100Hz)	DC	DC, AC 1 Hz (3,10Hz SW)	DC, AC 1 Hz (3,10Hz SW)
Sensor Excitation	-	2..30V bipolar 0..24V unipol. max.0.2A/2W	0 .. 12 Volt, max. 44mA	-	-	-	2..30V bipolar 0..24V unipol. max.0.2A/2W	0 .. 20 V max. 0.1A/0.8W, 0 .. 60 mA
Bridge connections (internal completion)	-	Full	Full, Half, ¼ 120/350Ω 3 wire	-	-	-	Full	Full, Half, ¼ 120/350Ω 3 or 4-wire
Programmable Shunt (default Values)	-	-	100 kΩ	-	-	-	-	59.88kΩ, 175kΩ, bipol.
IEPE/ICP Sensors	4,8 or 12mA	DSI®	DSI®	4 or 8mA	4,8 or 12mA	-	DSI®	DSI®
Resistance	-	DSI®	DSI®	-	-	-	DSI®	■
Temp. (Pt100 to Pt2000)	-	DSI®	DSI®	-	-	-	DSI®	■
Temp. Thermocouple	-	DSI®	DSI®	-	-	-	DSI®	DSI®
Potentiometer	-	-	■	-	-	-	-	■
Charge	-	DSI®	DSI®	-	100,000 pC to 1,000 pC	-	DSI®	DSI®
Charge input coupling					0.01 .. 100 Hz			
Current	ext. Shunt	ext. Shunt	ext. Shunt	ext. Shunt	ext. Shunt	-	ext. Shunt	ext. Shunt
TEDS interface	■	■	■	■	■	-	■	■
Advanced Functions	Sensor error detection	Low power, high input range, high sensor supply	Low power, Sensor and Amplifier balance	High speed, Sensor error detection,	Sensor error detection in IEPE and charge mode (injection)	High Voltage High Bandwidth	High sensor power and multi range	High speed, Support all strain types and high input range
Analogue input connectors								
Connector type (Default)	BNC	DB9, BNC	DB9, L1B10f	BNC	BNC	Banana	DB9, BNC, Banana	DB9
Digital types				only on + slices				
Counter (connector)	-	-	-	1 ch(L1B7f)	1 ch(L1B7f)	-	1 ch(L1B7f)	1 ch(L1B7f)
Digital Input (connector)	-	-	-	3 ch(L1B7f)	3 ch(L1B7f)	-	3 ch(L1B7f)	3 ch(L1B7f)
Digital Output (connector)	-	-	-	1 ch(L1B7f)	1 ch(L1B7f)	-	1 ch(L1B7f)	1 ch(L1B7f)
Additional Information								
Isolation Voltage[18]	500 V	500 V	500 V	1000 V	1000 V	CAT II 1000 V	1000 V	1000 V
Power Cons./Max[19]	11W/22W	11W/22W	11W/22W	15W/22W	10W/18W	8W	10W/25W	15W/25W

Table 13: HD and HS Specifications

WARNING

Be careful with voltages >25 VAC or >35 VDC!
These voltages are already high enough in order to get a perilous electric shock by touching the wiring.

14 Rack version modules not available with extended height (e.g. STGM-DB).
15 Fanless operation only for BNC or Banana version (without excitation)
16 Pinout of analogue input connector may limit functionality. DSI®-Option requires DB9 connector.
17 200kHz for Charge
18 Applies only to isolated SIRIUS version
19 One complete slice with same modules

5.6 General Specifications

The general specifications in Table 14 apply to all Sirius® measurement slices unless otherwise noted at the specific measurement slice.

Misc	
Power Supply	$9\text{-}36V_{DC}$
Operating Temperature	-10 to 50°C (40°C for fanless series[1])
Storage Temperature	-40 to 85°C
Humidity	5% to 95% RH non condensing @ 60°C
Shock & Vibration	Sweep sinus (EN 60068-2-6:2008) Random (EN 60721-3-2: 1997 - Class 2M2) Shock (EN 60068-2-27:2009) MIL-STD-810D
EMC	EN 61326-1, EN 61000-3-2, EN61000-3-3
Acquisition rate	
Time base accuracy	Typical: 5 ppm, Max: 20 ppm
Synchronisation	
Delay between slices	50 nsec
USB: Max. Sync-cable length	100 m (Master/Slave), 200 m (IRIG)
EtherCAT®: Max. cable length	75m
Sync Connector	
Level (Input/Output)	TTL compatible
Max. Output Current	±24mA (±50mA for 1sec)

Table 14: SIRIUS® Modules: General Specifications

5.6.1 General Counter Specifications

Counter	
Timebase	102.4MHz
Time base accuracy	Typical: 5 ppm, Max: 20 ppm
Max. Bandwidth	10MHz
Input Filter	500 ns, 1µs, 2µs, 4µs, 5µs and 7.5µs
Input Level Compatibility	TTL (Low: <0.8, High > 2V)
Input Impedance	100kΩ pull-up to +3.3V
Input Protection	±25Volt continuous
Alarm output	Open collector, max. 100mA/30Volt
Sensor supply	5V/100mA;12V/50mA

Table 15: General Counter Specifications

WARNING

Be careful with voltages >25 VAC or >35 VDC!
These voltages are already high enough in order to get a perilous electric shock by touching the wiring.

CAUTION

That the GND of the counter connector has the same potential as the GND of the analogue channel on the same module.
Note: on ACC+ and CHG+ the In- is connected via 50Ω to the module GND.

1 50°C with airflow of 3m/sec

5.7 ACC / ACC+

The ACC modules are perfect for sound and vibration IEPE channels.

5.7.1 ACCv2: Specifications

Inputs	Voltage, IEPE, current (ext. Shunt), ACC+ only: counter, discrete	
ADC Type	24bit delta-sigma dual core with anti-aliasing filter (5.2.1 SIRIUS® Dual Core series: High Dynamic (up to 160 dB) page 65)	
Sampling Rate	Simultaneous 200kS/sec	
Ranges (Dual Core Low Range)	±10V (±500mV)	±500mV (NA)
Input Accuracy (Dual Core)	±0.1% of reading ±10(1)mV	±0.1 of reading ±1(NA)mV
Dynamic Range@50kS (Dual Core)	145 dB (165 dB)	138 dB (NA)
Typ. SNR@50kS (Dual Core)	107 dB (125 dB)	100 dB (NA)
Typ. CMR @ 50Hz (1kHz)	140 dB (120 dB)	140 dB (120 dB)
Gain Drift	Typical 10 ppm/K, max. 30 ppm/K	
Offset Drift	Typical 0.5 μV/K + 2 ppm of range/K, max 2 μV/K + 10 ppm of range/K	
Gain Linearity	<0.02%	
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1° (@ 200 kS/sec)	
Channel Cross talk	>160 dB @ 1kHz	
Input Coupling	DC, AC 0.1 Hz,1Hz (3 Hz, 10 Hz per SW)	
Input Impedance	1 MΩ (270kΩ for AC coupling ≥ 1Hz)in parallel with 100pF	
Overvoltage Protection	In+ to In-: 50 V continuous; 200V peak (10msec)	
IEPE mode		
Excitation	2, 4, 8, 12, 16 or 20mA	
Compliance voltage	25 Volt	
Output Impedance	>100 kΩ	
Sensor detection	Shortcut: <4Volt; Open: > 19Volt	
Counters (ACC+ type only)	1 counter/3 digital input, fully synchronised with analogue data	
Counter Modes	counting, waveform timing, encoder, tacho, gear-tooth sensor	
General Counter Specifications	See 5.6.1 General Counter Specifications on page 72	
Additional Specifications		
Input connector	BNC	
TEDS support	IEPE mode only	

Table 16: SIRIUS-ACC8 specifications

5.7.2 ACC BNC

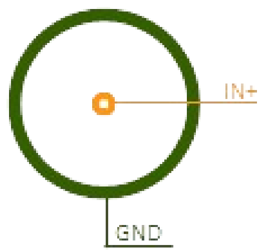


Illustration 98: SIRIUS-ACC: pin-out (BNC)

*Illustration 99: SIRIUS*i*8xACC*

5.7.3 ACC+ (Counter) L1B7f

As an additional function to the ACC module, the ACC+ module also has a 7-pin Lemo connector for digital counters.

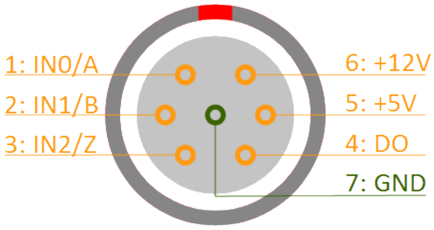


Illustration 100: CNT: counter pin-out (LEMO 7pin)

Illustration 101: SIRIUSi 8xACC+

Connector type	L1B7f Connector on the module: *EGG.1B.307.CLL* Mating cable connector: *FGG.1B.307.CLAD52*

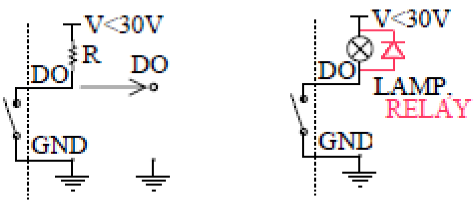
Table 17: ACC+ counter connector type

WARNING

GND of the counter input is connected via a 50Ω resistor to *In-* of the analogue channel.

Digital Output Configuration

The "switch" of the open collector output is closed when active.



5.7.4 ACC: Voltage

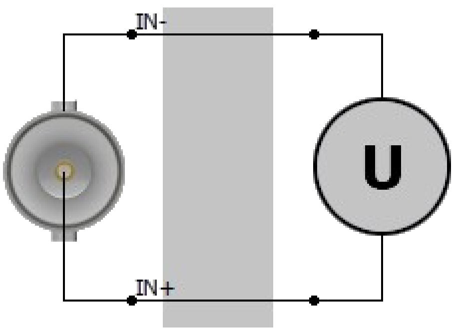


Illustration 102: ACC Voltage

5.7.5 ACC: IEPE

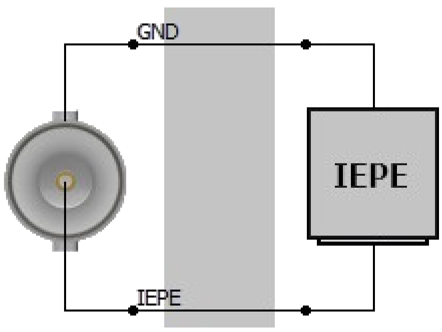


Illustration 103: ACC IEPE

5.8 CHG / CHG+

5.8.1 CHG: Specifications

Inputs	Voltage, IEPE, Charge, current (ext. Shunt),	
ADC Type	24bit delta-sigma dual core with 100/5 kHz analogue anti-aliasing filter	
Sampling Rate	Simultaneous 200kS/sec	
Ranges (Dual Core Low Range)	±10V (500mV)	±500mV (NA)
Input Accuracy (Dual Core)	±0.05% of reading ±5 (0.5) mV	±0.05 of reading ±0.5 mV
Typ. Dynamic Range@10kS (Dual Core)	140 dB (155 dB)	130 dB (NA)
SNR@50kS (Dual Core)	107 dB (124 dB)	98 dB (NA)
Typ. CMR @ 50Hz (1 kHz)	140 dB (120 dB)	140 dB (120 dB)
Gain Drift	Typical 10 ppm/K, max. 30 ppm/K	
Offset Drift	Typical 1 µV/K + 5 ppm of range/K, max 5 µV/K + 10 ppm of range/K	
Gain Linearity	<0.02%	
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1° (@ 200 kS/sec)	
Channel Cross talk	180 dB @ 50Hz; 160 dB @ 1kHz	
Input Coupling	DC, AC (0.1 Hz, 1 Hz, 10 Hz or 100 Hz)	
Input Impedance	1 MΩ in parallel with 100pF	
Overvoltage Protection	In+ to In-: 50 V continuous; 200V peak (10msec)	
IEPE mode		
Excitation	4, 8 or 12 mA	
Compliance voltage	25 Volt	
Output Impedance	>100 kΩ	
Sensor detection	Shortcut: <4 Volt; Open: > 19Volt	
Charge ranges (Low Range)	±100 000 pC (5000 pC)	±10 000 pC (500 pC)
Input accuracy (HPF 0.1Hz)	±0.5% of reading ±20 pC	±0.5% of reading ±5 pC
Dynamic Range@10kS (Dual Core)	130 dB (150 dB)	120 dB (140dB)
SNR@50kS (Dual Core)	107 dB (120 dB)	105 dB (118 dB)
Input coupling	0.01 Hz, 0.03 Hz, 0.1 Hz, 0.5 Hz, 1 Hz, 10 Hz or 100 Hz	
Charge injection	$1V_{rms}$, 20 Hz, 0.5% accuracy	
Counters (only in CHG+ type)	1 counter/3 digital input, fully synchronised with analogue data	
Counter Modes	counting, waveform timing, encoder, tacho, gear-tooth sensor	
General Counter Specifications	See 5.6.1 General Counter Specifications on page 72	
Additional Specifications		
Input connector	BNC or TNC (others on request)	
TEDS support	IEPE mode only	

Table 18: SIRIUS-CHG specifications

5.8.2 CHG BNC

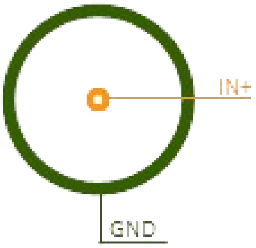


Illustration 104: SIRIUS-CHG: pin-out (BNC)

Illustration 105: SIRIUSi 8xCHG

5.8.3 CHG+ (Counter) L1B7f

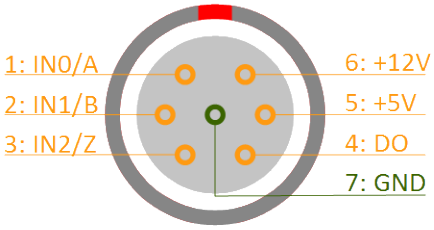


Illustration 106: CNT: counter pin-out (LEMO 7pin)

Illustration 107: SIRIUSi 8xCHG+

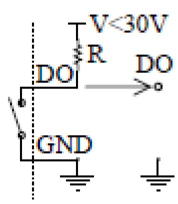
Connector type	L1B7f Connector on the module: *EGG.1B.307.CLL* Mating cable connector: *FGG.1B.307.CLAD52*

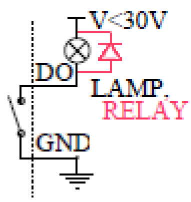
Table 19: CHG+ counter connector type

WARNING 	GND of the counter input is connected via a 50Ω resistor to In- of the analogue channel.

Digital Output Configuration

The “switch” of the open collector output is closed when active.





5.8.4 CHG: Voltage

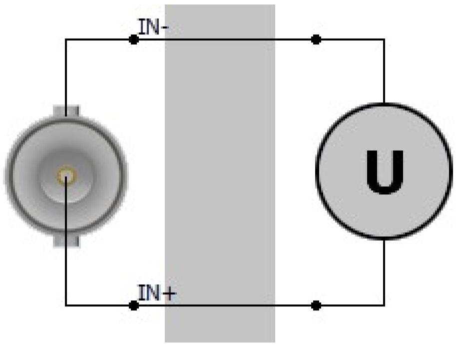


Illustration 108: CHG Voltage

5.8.5 CHG: IEPE

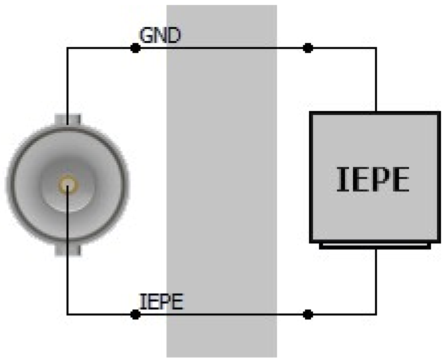


Illustration 109: CHG IEPE

5.8.6 CHG: Charge

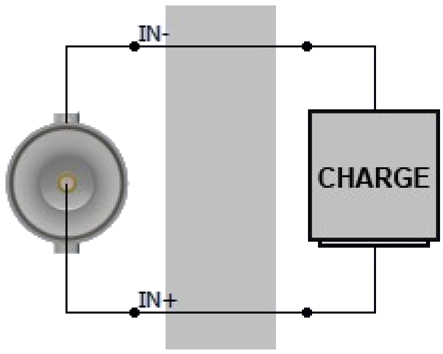


Illustration 110: CHG Charge

5.9 HV

The HV modules are perfect for high voltage measurements.

5.9.1 HVv2 Specifications

Inputs	Voltage	
ADC Type	24bit delta-sigma dual core with 100/5 kHz analogue anti-aliasing filter (5.2.1 SIRIUS® Dual Core series: High Dynamic (up to 160 dB) page 65)	
Sampling Rate	Simultaneous 200kS/sec	
Ranges (Dual Core Low Range)	±1200V (±50V)	±50V (NA)
Gain accuracy	±0.05% of reading	
Offset accuracy (Dual Core)	±100 (50) mV	±50 mV
Typ. Dynamic Range@10kS (Dual Core)	142 dB (158 dB)	132 dB (NA)
Typ. SNR@50kS (Dual Core)	107 dB (120 dB)	95 dB (NA)
Typ. CMR @ 50Hz (1kHz)	85 dB (60 dB)	85 dB (60 dB)
Gain Drift	Typical 5 ppm/K, max. 30 ppm/K	
Offset Drift	Typical 1 mV/K + 1 ppm of range/K, max 2 mV/K + 5 ppm of range/K	
Gain Linearity	<0.02%	
Inter Channel Phase-mismatch	0.04° * f_{in} [kHz] + 0.2° (@ 200 kS/sec)	
Channel Cross talk	115 dB @ 50Hz; 90 dB @ 1kHz	
Input Coupling	DC	
Input Impedance	10 MΩ || 2pF	
Protection class	CAT III 600 V; CAT II 1000 V	
Overvoltage Protection	In+ to In-: 1.8 kV_{RMS}, Inx to GND: 1.4kV_{RMS})	
Additional Specifications		
Input connector	Banana	
TEDS support	NA	

Table 20: SIRIUS-HV specifications

5.9.2 HV: Banana

The HV modules are perfect for high voltage measurements.

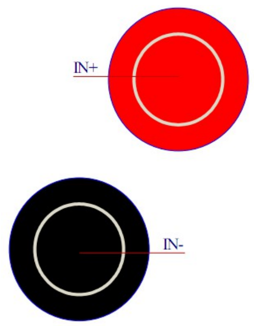


Illustration 111: SIRIUS-HV pin-out Banana plug

Illustration 112: SIRIUSi8xHV-BAN

WARNING

It is mandatory to connect a ground cable to the *GND* connector of the SIRIUS® when you are working with high voltages (see also 4.3.2.2 GND Connector on page 39)

5.9.2.1 HV: Voltage

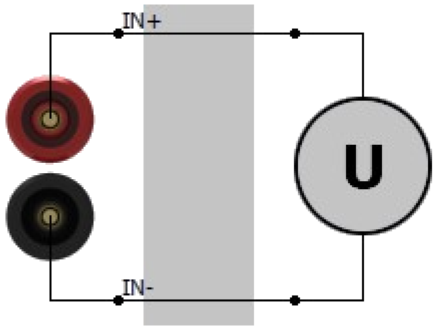


Illustration 113: SIRIUS-HV: Voltage

5.10 LV / LV+

5.10.1 LVv2 Specifications

Inputs	Voltage, full bridge strain, current (ext. Shunt)			
ADC Type	24bit delta-sigma dual core with 100/5 kHz analogue anti-aliasing filter (5.2.1 SIRIUS® Dual Core series: High Dynamic (up to 160 dB) page 65)			
Sampling Rate	Simultaneous 200kS/sec			
Dual Core Ranges (Low Range)	±200V (10 V)	±10V (500 mV)	±1V (50 mV)	±100mV (5 mV)
Gain accuracy	±0.05% of reading			
Offset accuracy (Dual Core)	± 40 (20) mV	±2 (1) mV	± 0.2 (0.2) mV	± 0.1 (0.1) mV
Offset accuracy after Balance Amplifier	2mV	0.1mV	0.02mV	0.01mV
Typ. Dynamic Range@10kS (Dual Core)	136 dB (146 dB)	137 dB (152 dB)	137 dB (147 dB)	130 dB (132 dB)
Typ. SNR@10kS (Dual Core)	109 dB (118 dB)	109 dB (126 dB)	109 dB (116 dB)	97 dB (97 dB)
Typ. CMR @ 50Hz/400Hz/1kHz/10kHz	70 / 70 / 60 / 55 dB	95 / 95 / 89 / 84 dB	105 / 105 / 100 /95 dB	115 / 112 / 107 / 102 dB
Gain Drift	Typical 10 ppm/K, max. 30 ppm/K			
Offset Drift	Typical 0.3 µV/K + 5ppm of range/K, max: 2 µV/k + 10 ppm of range/K			
Gain Linearity	<0.02%			
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1° (@ 200 kS/sec and 10 V range)			
Channel Cross talk	120 dB @ 10kHz (range ≤ 10 V); 95 dB @ 10kHz (range = 100V)			
Input Coupling1[1]	DC, AC 1Hz (3 Hz, 10 Hz per SW)			
Input Impedance	200 V Range: 1 MΩ; all other ranges 10 MΩ between IN+ or In- against GND			
Max. common mode voltage	Isolated version: ±500 V Differential version: 200 V range: ±200 V; all other Ranges: ±12 V			
Input Overvoltage Protection	200 V Range: 300 V; all other ranges: 100 V (250 V peak for 10 msec)			
Excitation Voltage	Unipolar or Bipolar Software selectable (programmable with 16 Bit DAC)			
Excitation Level unipolar	0 .. 24 Volt; Predefined levels: 1, 2.5, 5, 10, 12, 15, 20 and V_{DC}			
Excitation Level bipolar	2 .. 30 Volt; Predefined levels: 2.5, 5, 10, 12, 15, 24 and 30 V_{DC}			
Accuracy	±0.1 % ±5 mV			
Drift	±50 ppm/K ±100µV/K			
Stability 10% to 90% load (bipolar)	< 0.01%			
Current limit	200 mA (2 Watt max. per channel, 12 Watt max. per Slice)			
Protection	Continuous short to ground			
Bridge connection types	Full bridge			
Ranges @ 10 V_{exc}(low range)	2mV/V…1000mV/V free programmable with Dual Core			
Input short, Sensor offset adjust	Software selectable			
Counters (only on LV+ type)	1 counter/3 digital input, fully synchronised and alarm output			
Counter modes	Counting, waveform timing, encoder, tacho, gear-tooth sensor			
General Counter Specifications	See 5.6.1 General Counter Specifications on page 72			
Additional Specifications				
Misc function	Excitation control monitoring, Amplifier Short, Single Ended/Differential			
Input connector	DSUB 9, BNC, Banana (others on request)			
TEDS support	Standard + DSI® adapters			

Table 21: SIRIUS-LV specifications

1 In- must be within ±10V referred to GND(iso); for Ranges >10 V the DC value of In- is not rejected

5.10.2 LV+ (Counter) L1B7f

As an additional function to the ACC module, the ACC+ module also has a 7-pin Lemo connector for digital counters.

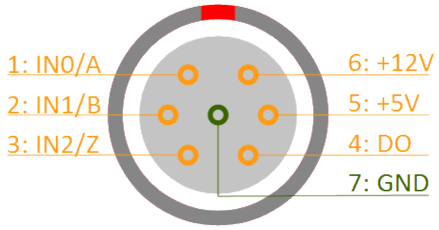


Illustration 114: CNT: counter pin-out (LEMO 7pin)

Illustration 115: SIRIUSi 8xLV+

Connector type	L1B7f Connector on the module: *EGG.1B.307.CLL* Mating cable connector: *FGG.1B.307.CLAD52*

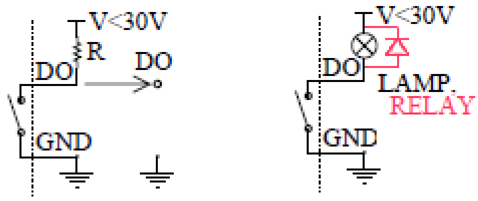
Table 22: LV+ counter connector type

WARNING

GND of the counter input is connected to the *GND* of the analogue channel.

Digital Output Configuration

The "switch" of the open collector output is closed when active.



5.10.3 LV BAN

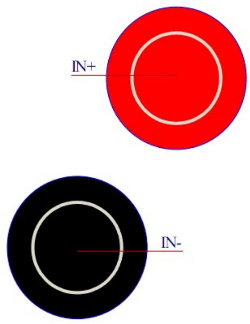


Illustration 116: SIRIUS-LV pin-out Banana plug

Illustration 117: SIRIUSi 8xLV-BAN

5.10.4 LV BNC

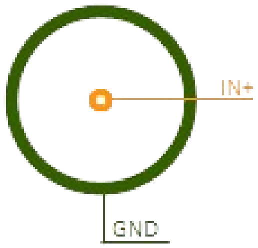


Illustration 118: SIRIUS-LV: pin-out (BNC)

Illustration 119: SIRIUS𝓲 8xLV+BNC

5.10.5 LV DSUB-9

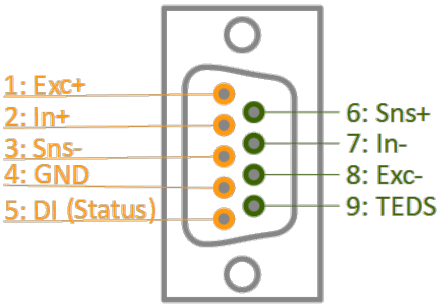


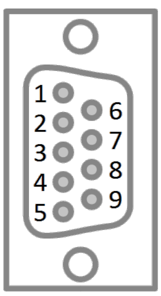
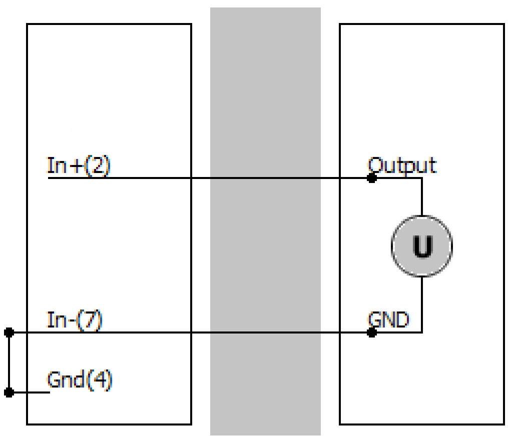
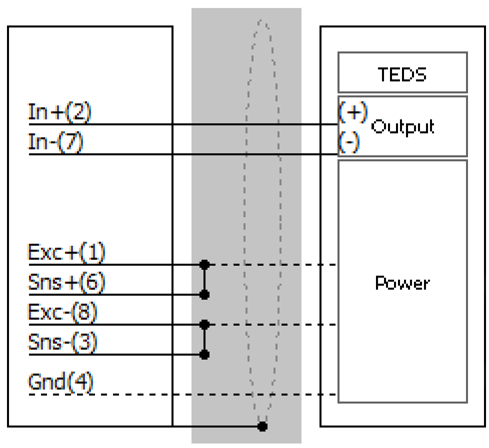
Illustration 120: SIRIUS-LV pin-out DSUB-9

Illustration 121: SIRIUS𝓲 8xLV DSUB-9

Digital Status Input

Pin 5 *DI (Status)* can be used for digital status input: i.e. show alarm status in DEWESoft® when a current clamp is open.

5.10.5.1 LV DSUB-9: Voltage

	Voltage - Single Ended	**Voltage – Differential** Use only when the sensor is powered by the excitation voltage of the module.
		

5.10.5.2 LV DSUB-9: Current

<table>
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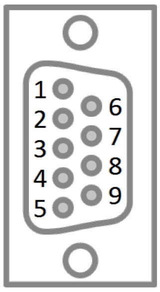
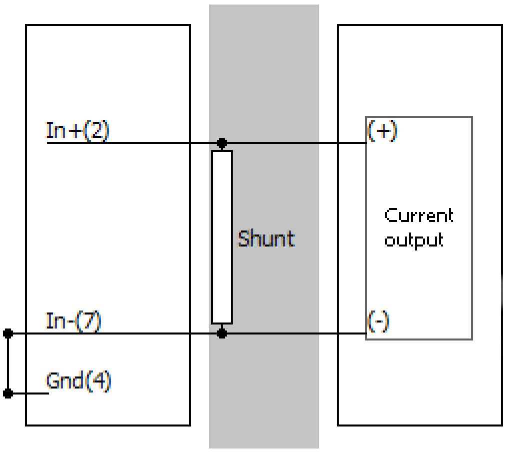
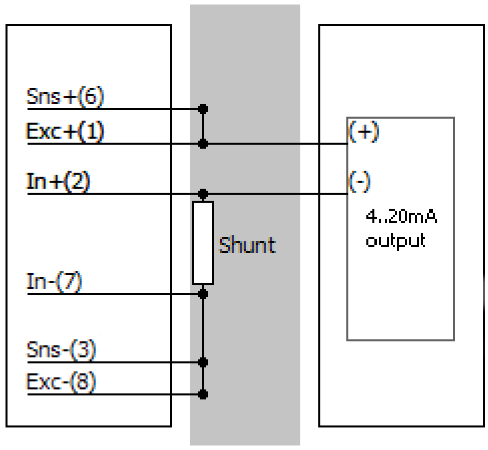
<tr><td>
</td><td>
</td><td>
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5.10.5.3 LV DSUB-9: Bridge

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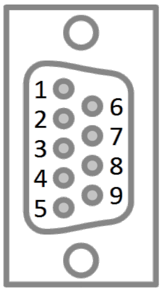
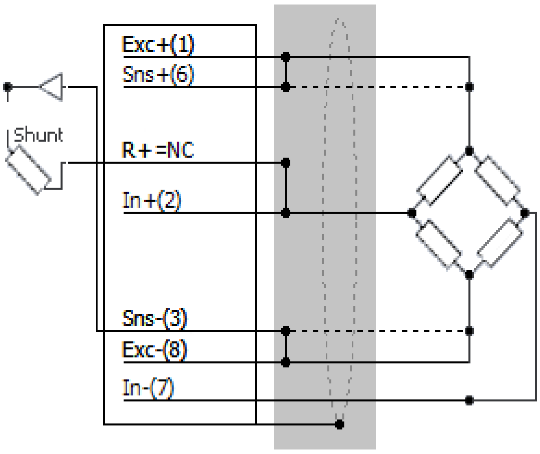
<tr><td>
</td><td>
</td></tr>
</table>

5.11 MULTI

The MULTI modules are perfect for multi-purpose analogue in/out and digital/counters.

5.11.1 MULTI: Specifications

Inputs	Voltage, full, ½, ¼ bridge (120Ω and 350Ω), current (ext. Shunt), counter, digital			
ADC Type	24bit delta-sigma dual core with 100/5 kHz analogue anti-aliasing filter (5.2.1 SIRIUS® Dual Core series: High Dynamic (up to 160 dB) page 65)			
Sampling Rate	Simultaneous 200kS/sec			
Dual Core Ranges (Low)	±10V (±500mV)	±1V (50mV)	±100mV (±5mV)	±50mV (±2.5mV)
Input Accuracy	±0.05% of value ±10mV	±0.05% of value ±1mV	±0.05% of value ±0.2mV	±0.05% of value ±0.2mV
Typ. Dynamic Range@10kS (Dual Core)	137 dB (152 dB)	137 dB (147 dB)	135 dB (137 dB)	133 dB (133 dB)
Typ. SNR@10kS (Dual Core)	105 dB (121 dB)	104 dB (111 dB)	100 dB (101 dB)	95 dB (95 dB)
Typ. CMR @ 400Hz (1kHz)	86 dB (84 dB)	96 dB (95 dB)	112 dB (102 dB)	112 dB (102 dB)
Gain Drift	Typical 10 ppm/K, max. 40 ppm/K			
Offset Drift	Typical 0.3 µV/K + 5 ppm of range/K, max 2 µV/K + 10 ppm of range/K			
Gain Linearity	<0.02%			
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1° (@ 200 kS/sec)			
Channel Cross talk	120 dB @ 10kHz			
Input Coupling/ Impedance	DC / 10 MΩ			
Overvoltage Protection	In+ to In-: 50 V continuous; 200V peak (10msec)			
Excitation Voltage	Free programmable (16 Bit DAC)			
Predefined levels	0, 1, 2.5, 5, 10 and 12 V_{DC}			
Accuracy	±0.1 % ±10 mV			
Drift	±50 ppm/K ±100 µV/K			
Stability 10% to 90% load	<0.01%			
Current limit	45mA (0.4W max. Power)			
Protection	Continuous short to ground			
Additional Fixed Excitations	12V (max. 50 mA); 5 V (max. 100 mA) Accuracy 5%			
Bridge Connection Types	Full bridge, ½ bridge, ¼ bridge (3-wire)			
Ranges	2mV/V…1000mV/V free programmable with Dual Core			
Internal Bridge Completion	½ bridge 1 kΩ and ¼ bridge 120Ω and 350Ω			
Typ. Bridge Completion Accuracy	0.05 %; TCR: 5 ppm/K (others on request)			
Internal Shunt Resistor	59.88 kΩ, software selectable (others on request)			
Typ. Shunt Resistor Accuracy	0.05 %; TCR: 10 ppm/K (others on request)			
Input Short, Sensor Offset Adjust	Software selectable			
Counters	**1 counter/3 digital input, fully synchronised with analogue data**			
Counter Modes	counting, waveform timing, encoder, tacho, gear-tooth sensor			
Input Level Compatibility	CMOS, LVTTL (protected up to ±25Volt continuous)			
FRONT Analogue Out[20]	1 channel, 24 bit sigma delta 200 kHz, ±10V			
Accuracy	±0.1% of reading ±0.02 V			
Temperature Drift	±50ppm/K of reading ± 200 µV/K			
Output Impedance	< 10 Ω			
Maximum Output Current / Load	20 mA / > 1000 Ω			
Output Protection	Continuous short to ground			
Additional Specifications				
Input connector	High Density DSUB-15, LEMO-2B 16pin (others on request)			
TEDS support	Standard + DSI® adapters			

Table 23: SIRIUS-MULTI specifications

20 Not available when ordered with the Analogue-out OPTION (see 5.22 Analogue out OPTION on page 139)

5.11.2 MULTI DSUB-15

Illustration 122: SIRIUSi 8xMULTI

Pin	Name	Description
1	TEDS	TEDS
2	Exc-	Excitation -
3	Exc+	Excitation +
4	R+	¼ Bridge/Shunt
5	In+	Input +
6	Aout	Analogue output
7	Sns+	Sense +
8	Sns-	Sense -
9	GND	Ground
10	In-	Input -
11	+5V	+5V supply
12	+12V	+12V supply
13	IN0/A	Counter input IN0/A
14	IN1/B	Counter input IN1/B
15	IN2/Z	Counter input IN2/Z

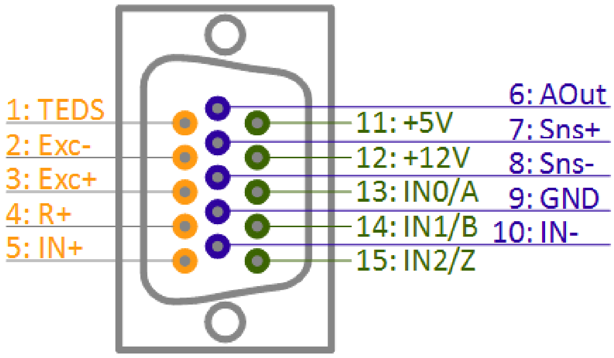
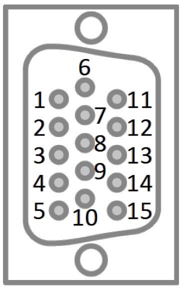


Illustration 123: SIRIUS-MULTI pin-out DSUB-15

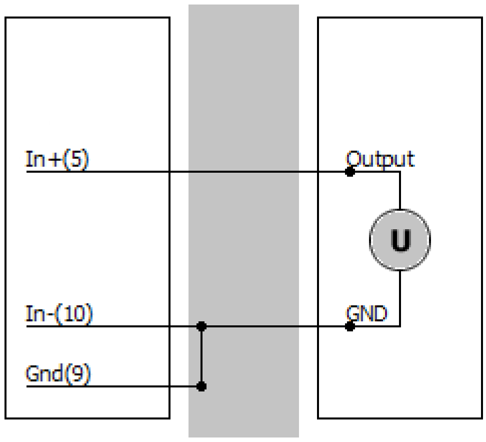
HINT

You can use the analogue input, analogue output and counters at the same time.

5.11.2.1 MULTI DSUB-15: Voltage

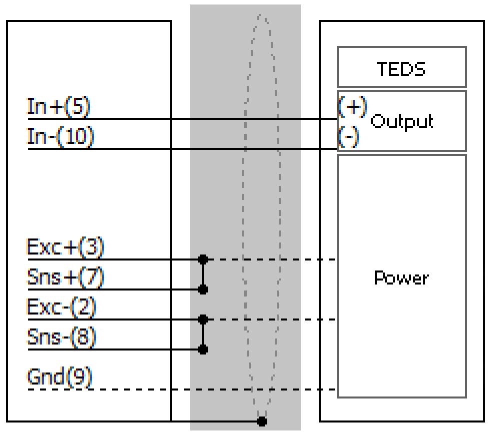


Voltage - Single Ended

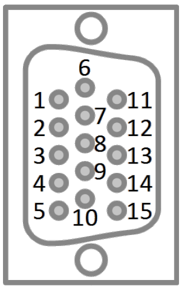


Voltage – Differential

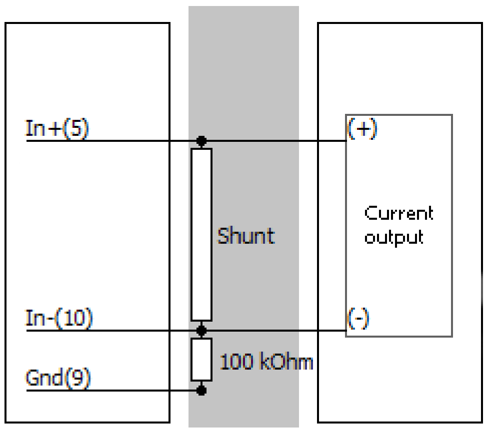
Use only when the sensor is powered by the excitation voltage of the module.



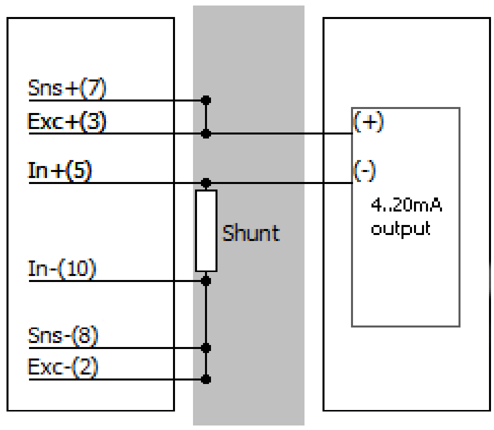
5.11.2.2 MULTI DSUB-15: Current



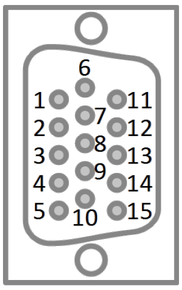
External Direct Shunt

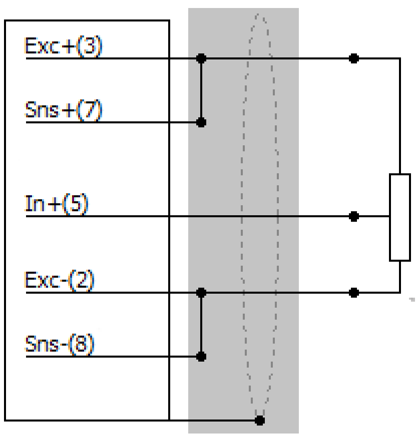


External Loop Powered Shunt

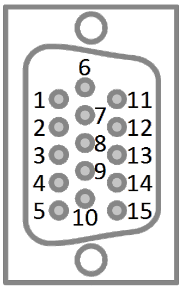


5.11.2.3 MULTI DSUB-15: Potentiometer

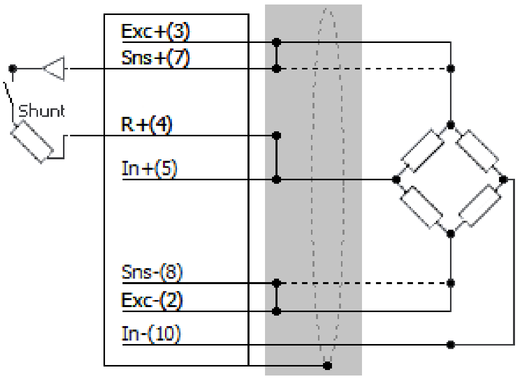




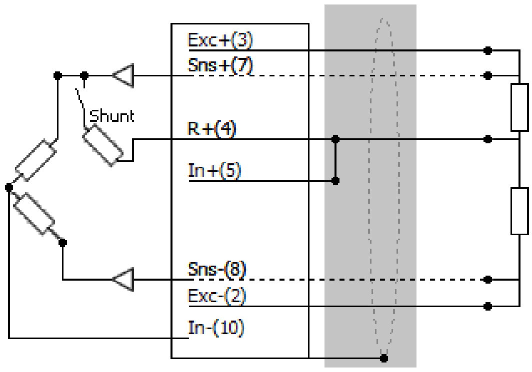
5.11.2.4 MULTI DSUB-15: Bridge



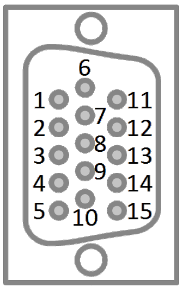
Full Bridge

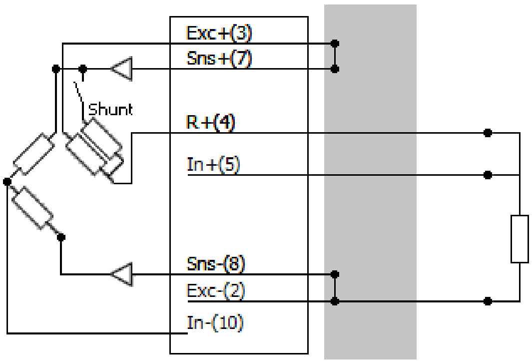


Half Bridge



Quarter Bridge – 3 wire





5.11.3 MULTI-L2B16f

Pin	Name	Description
1	TEDS	TEDS
2	Exc+	Excitation +
3	Exc-	Excitation -
4	R+	¼ Bridge/Shunt
5	In+	Input +
6	Aout	Analogue output
7	Sns+	Sense +
8	Sns-	Sense -
9	GND	Ground
10	In-	Input -
11	+5V	+5V (max. 100mA) supply
12	+14V5	+14.5V (max. 50mA) supply
13	IN0/A	Counter input IN0/A
14	IN1/B	Counter input IN1/B
15	IN2/Z	Counter input IN2/Z
16	-14V5	-14.5V (max. 50mA) supply

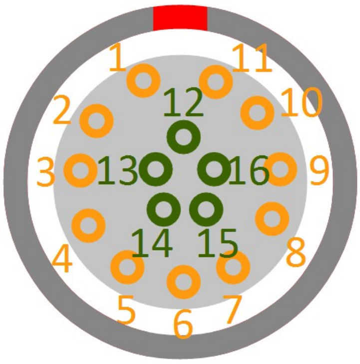
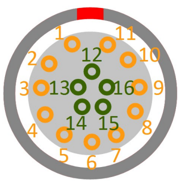
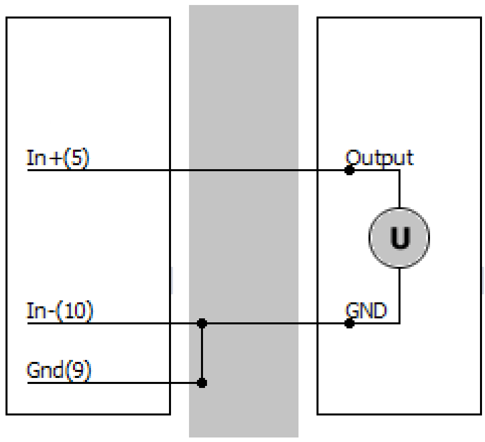
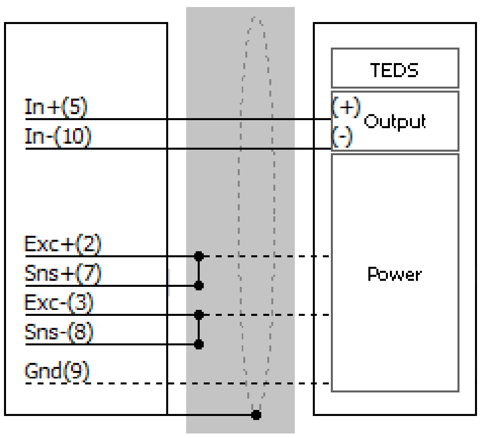


Illustration 124: SIRIUS-MULTI-L2B16F pin-out

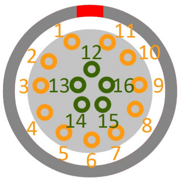
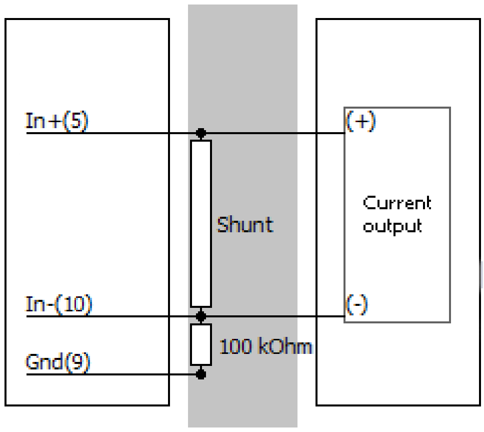
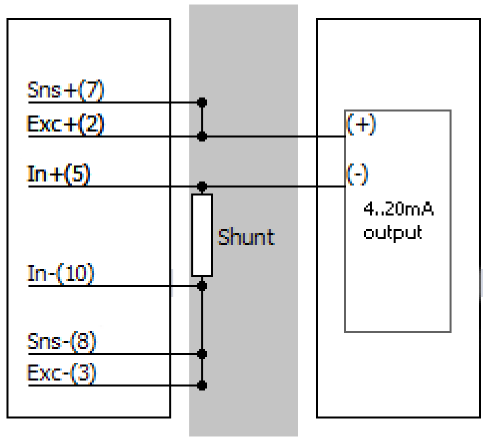
HINT

You can use the analogue input, analogue output and counters at the same time.

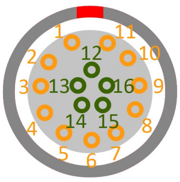
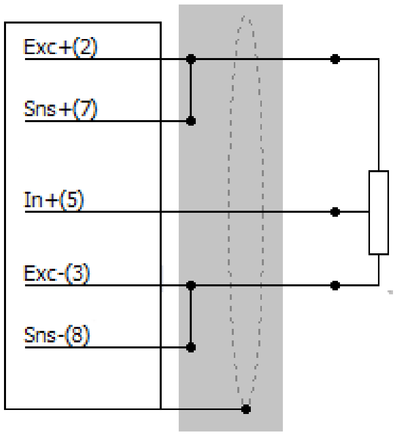
5.11.3.1 MULTI-L2B16f: Voltage

	Voltage - Single Ended	**Voltage – Differential** Use only when the sensor is powered by the excitation voltage of the module.
		

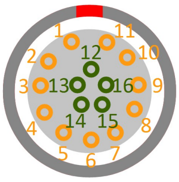
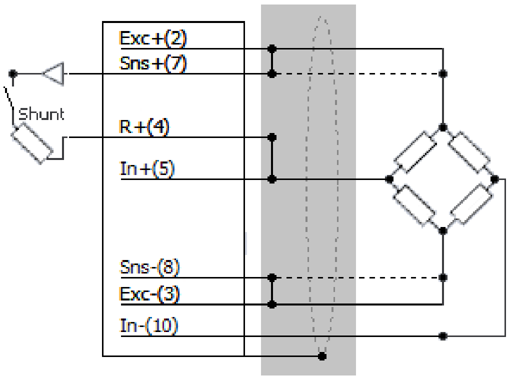
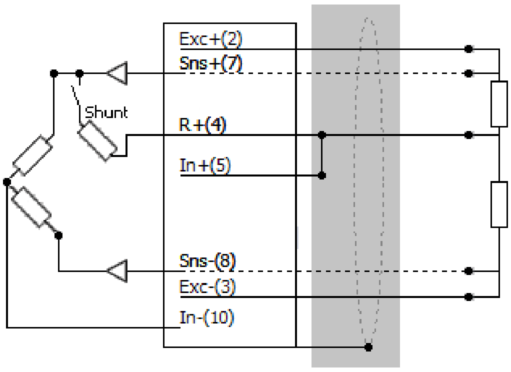
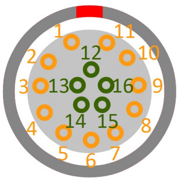
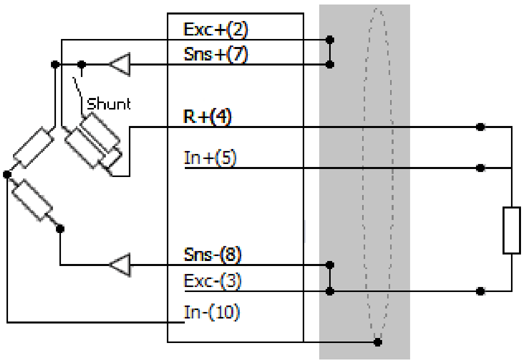
5.11.3.2 MULTI-L2B16f: Current

	External Direct Shunt	External Loop Powered Shunt
		

5.11.3.3 MULTI-L2B16f: Potentiometer

5.11.3.4 MULTI-L2B16f: Bridge

	Full Bridge	Half Bridge
		
	Quarter Bridge – 3 wire	
		

5.12 STGM / STGM+

The STG-M module is a universal amplifier perfectly fitting for strain gage and voltage measurements.

5.12.1 STGMv3: Specifications

Inputs	Voltage, full bridge strain, ½ bridge strain, ¼ bridge strain (120Ω and 350Ω), current (ext. Shunt)			
ADC Type	24bit delta-sigma dual core with 100/5 kHz analogue anti-aliasing filter (5.2.1 SIRIUS® Dual Core series: High Dynamic (up to 160 dB) page 65)			
Sampling Rate	Simultaneous 200kS/sec			
Dual Core Ranges (Low)	±10V (±500mV)	±1V (50mV)	±100mV (±5mV)	±10mV (±0.5mV)
Gain accuracy	±0.05% of reading			
Offset accuracy (Dual Core)	±5 (2) mV	±0.5 (0.2) mV	±0.1 (0.1) mV	±0.1 (0.1) mV
Offset accuracy after Balance Amplifier	0.2mV	0.02mV	0.02mV	0.02mV
Typ. Dynamic Range@10kS (Dual Core)	137 dB (152 dB)	137 dB (147 dB)	130 dB (132 dB)	112 dB (112 dB)
Typ. SNR@10kS (Dual Core)	105 dB (121 dB)	104 dB (111 dB)	95 dB (95 dB)	75 dB (75 dB)
Typ. CMR @ DC...50Hz/400Hz/1kHz	88/ 86 / 84dB	97/ 96 / 95dB	111/ 110 / 102dB	111/ 110 / 102dB
Gain Drift	Typical 10 PPM/K, max. 40 PPM/K			
Offset Drift	Typical 0.3 µV/K + 5 ppm of range/K, max 2 µV/K + 10 ppm of range/K			
Gain Linearity	<0.02%			
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1° (@ 200 kS/sec)			
Channel Cross talk	145 dB @ 1kHz			
Input Coupling	DC			
Input Impedance	10 MΩ			
Max. Common Mode Voltage	Isolated version: ±500 V Differential version: ±12 V			
Overvoltage Protection	In+ to In-: 50 V continuous; 200V peak (10msec)			
Excitation Voltage	Free programmable (16 Bit DAC)			
Predefined levels	0, 1, 2.5, 5, 10 and 15 V_{DC}			
Accuracy	±0.05 % ±2 mV			
Drift	±50 ppm/K ±100 µV/K			
Load stability: 0% to 100% load	<0.01%			
Noise @ 10V/350Ω	< 150 µVrms@10 kS			
Line regulation over 20Ω of change	< 0.005% @ 120Ω load			
Sense Impedance to Exc / to GND	100 kΩ / > 100 MΩ			
Current limit	45mA			
Protection	Continuous short to ground			
Bridge Connection Types	Full bridge, ½ bridge, ¼ bridge (3-wire)			
Ranges	2mV/V…1000mV/V free programmable with Dual Core			
Internal Bridge Completion	½ bridge 1 kΩ and ¼ bridge 120Ω and 350Ω			
Typ. Bridge Completion Accuracy	0.05 %; TCR: 5 ppm/K (others on request)			
Internal Shunt Resistor	59.88 kΩ, software selectable (others on request)			
Typ. Shunt Resistor Accuracy	0.05 %; TCR: 10 ppm/K (others on request)			
Input Short, Sensor Offset Adjust	Software selectable			
Counters (only on STGMv3+ type)	1 counter / 3 digital input, fully synchronised and alarm output			
Counter Modes	counting, waveform timing, encoder, tacho, gear-tooth sensor			
General Counter Specifications	See 5.6.1 General Counter Specifications on page 72			
Additional Specifications				
Input connector	DSUB-9, Lemo2B 8pin, Lemo2B 16pin (others on request)			
TEDS support	Standard + DSI® adapters			

Table 24: SIRIUS STG-M specifications

5.12.2 STGM+ (Counter) L1B7f

The STGM+ is the same as the STG-M but has an additional Lemo7 connector for the counter. Thus the enclosure is higher than the standard enclosure (see 4.1.3 Extended Height Enclosure on page 33).

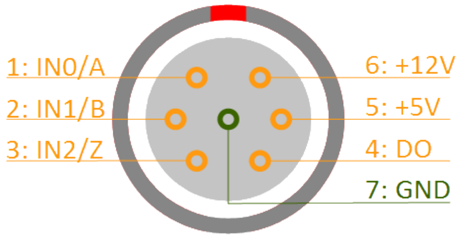


Illustration 125: CNT: counter pin-out (LEMO 7pin)

Illustration 126: SIRIUSi 8xSTGM+

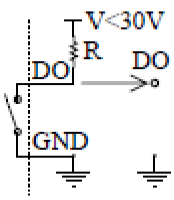
Connector type	L1B7f Connector on the module: *EGG.1B.307.CLL* Mating cable connector: *FGG.1B.307.CLAD52*

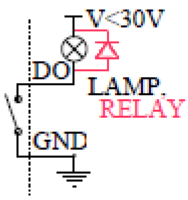
Table 25: STGM+ Counter Specifications (per module)

WARNING	GND of the counter input is connected to the GND of the analogue channel.

Digital Output Configuration

The "switch" of the open collector output is closed when active.





5.12.3 STGM-DB

The STGM-DB is the same as the STG-M but has an additional DSUB-37 male connector for 8 counter or 24 digital inputs and an additional DSUB-25 female connector for 8 digital outputs.
Thus the enclosure is higher than the standard enclosure (see 4.1.3 Extended Height Enclosure on page 33).

Illustration 127: SIRIUS-STGM-DB (2 slices)

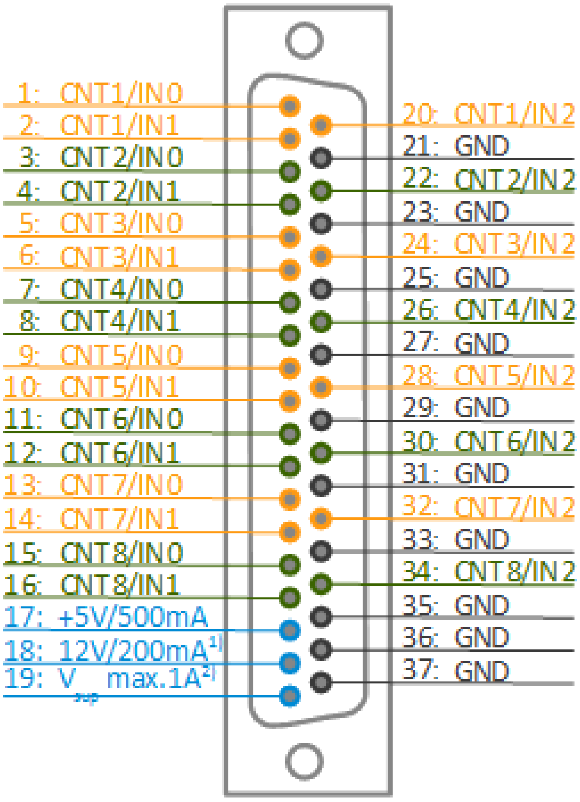


Illustration 128: DSUB 37 pins

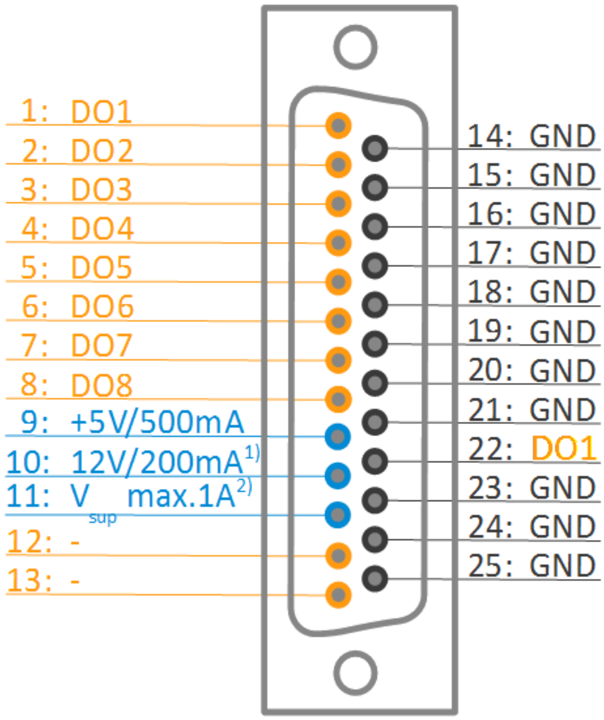


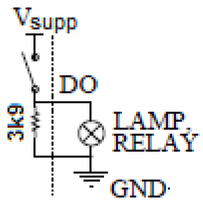
Illustration 129: DSUB 25 pins

1) this voltage is guaranteed to be <= 12V
When the supply voltage is <12V, then this voltage will be 2V lower than the supply voltage:
e.g. when the supply voltage is 10V, the voltage will be 8V
2) The supply voltage from the slice is routed to this pin.

Counters **Parallel use**	8 counter/24 digital inputs fully synchronised with analogue
Modes	counting, waveform timing, encoder, tacho, gear-tooth sensor
Digital Out	High side switch to supply voltage with internal 3.9 kΩ pull down, max. 150mA, short circuit protected.
Connector type	DSUB 37 male, DSUB 25 female

Table 26: STGM-DB Counter Specifications (per module)

Digital Output Configuration



5.12.4 STGM DSUB-9

Illustration 130: SIRIUSi 8xSTGM

Pin	Name	Description
1	Exc+	Excitation +
2	In+	Input +
3	Sns-	Sense -
4	GND	Ground
5	R+	¼ Bridge/Shunt
6	Sns+	Sense +
7	In-	Input -
8	Exc-	Excitation -
9	TEDS	TEDS

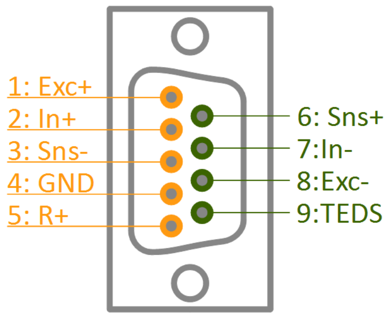
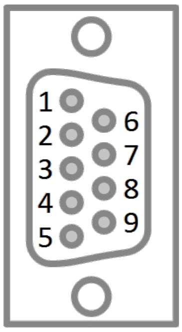
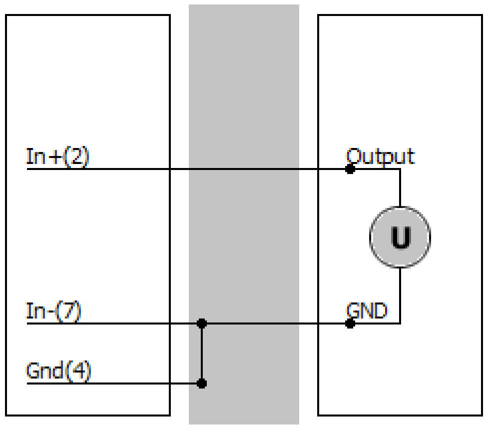
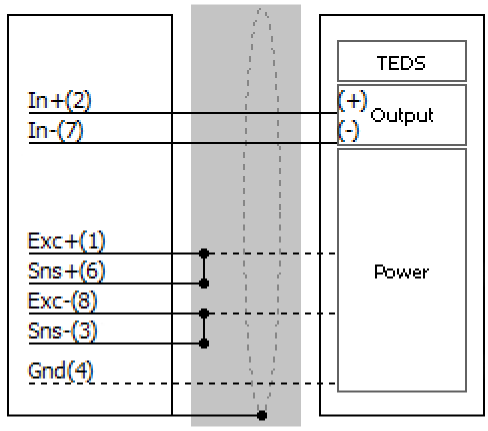
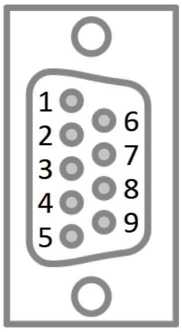
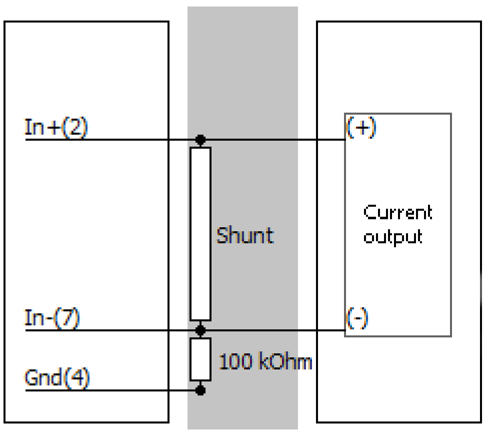
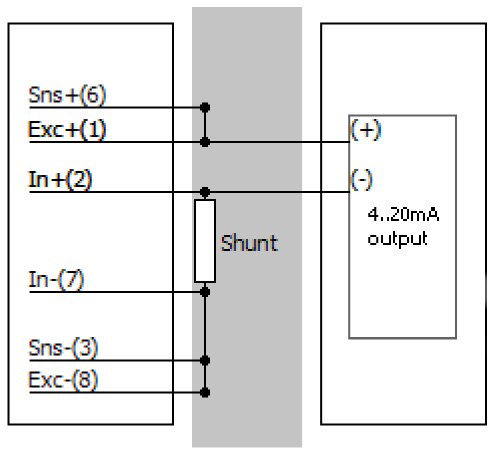


Illustration 131: SIRIUS-STGM pin-out DSUB-9

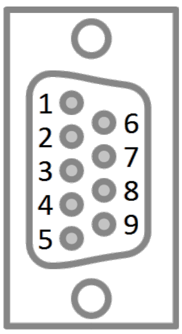
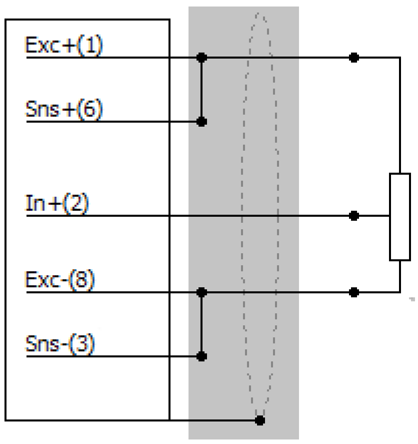
5.12.4.1 STGM DSUB-9: Voltage

	Voltage - Single Ended	**Voltage – Differential** Use only when the sensor is powered by the excitation voltage of the module.
		

5.12.4.2 STGM DSUB-9: Current

	External Direct Shunt	**External Loop Powered Shunt**
		

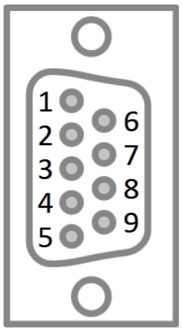
5.12.4.3 STGM DSUB-9: Potentiometer

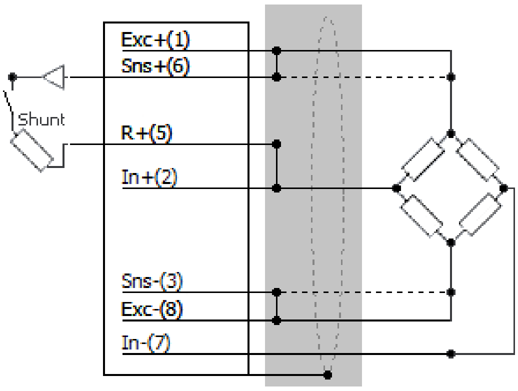
	

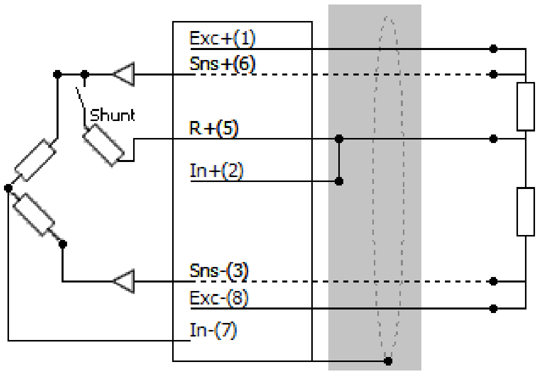
5.12.4.4 STGM DSUB-9: Bridge

Full Bridge

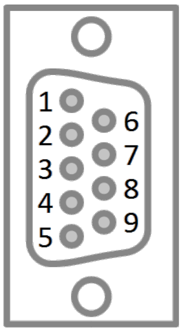
Half Bridge

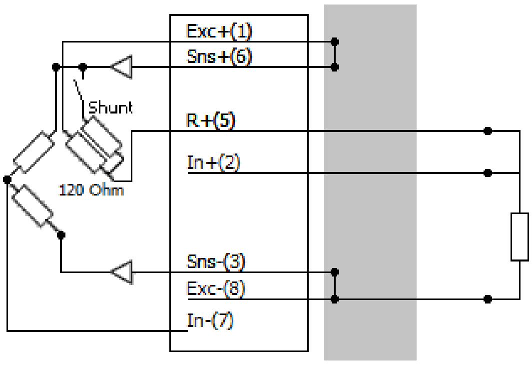






Quarter Bridge – 3 wire





5.12.5 STGM-L2B8f

Pin	Name	Description
1	Exc+	Excitation +
2	In-	Input -
3	In+	Input +
4	Exc-	Excitation -
5	SHD	Shield
6	Teds	Teds
7	GND	Ground
8	RES	Reserved

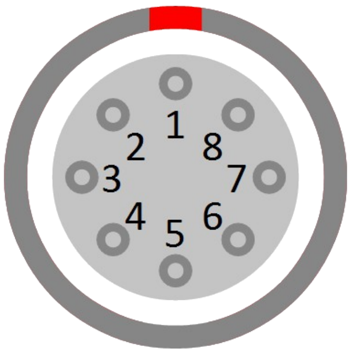


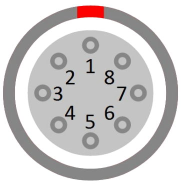
Illustration 132: SIRIUS-STG-M: pin-out Lemo 8-pin

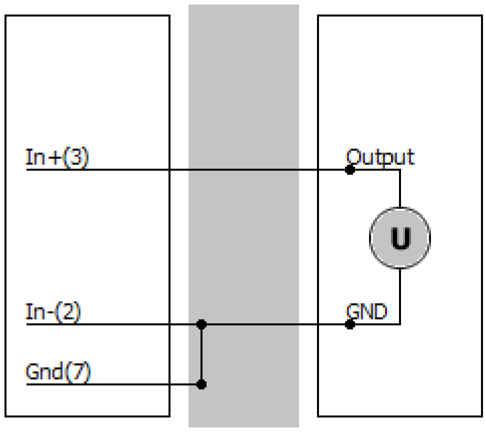
5.12.5.1 STGM-L2B8f: Voltage

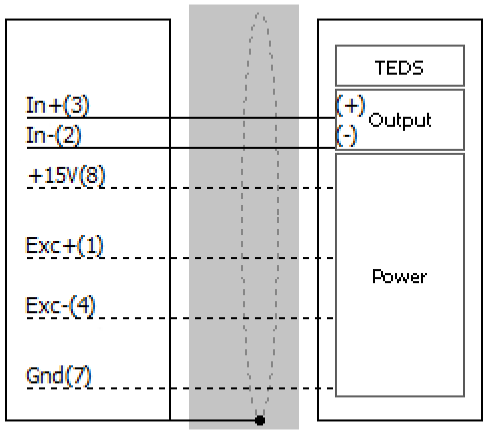
Voltage - Single Ended

Voltage – Differential

Use only when the sensor is powered by the excitation voltage of the module.



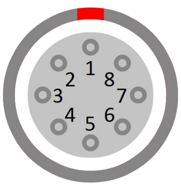


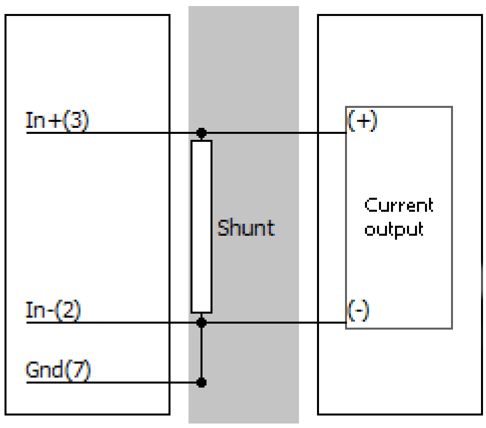


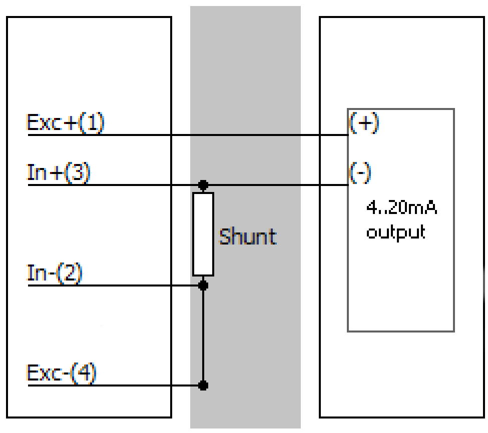
5.12.5.2 STGM-L2B8f: Current

External Direct Shunt

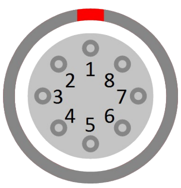
External Loop Powered Shunt

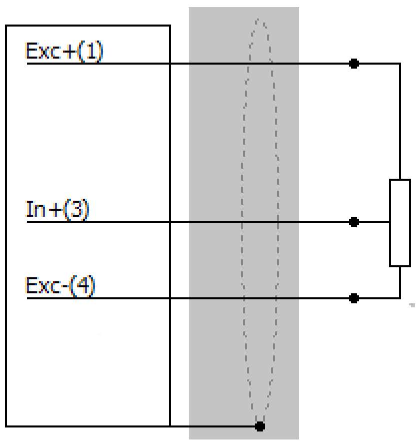






5.12.5.3 STGM-L2B8f: Potentiometer





5.12.5.4 STGM-L2B8f: Bridge

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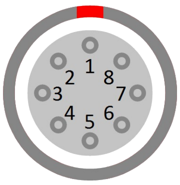
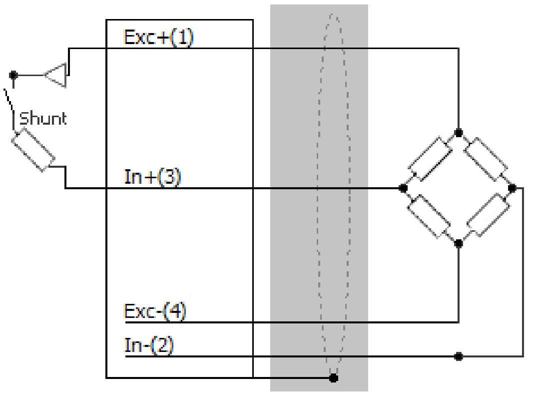
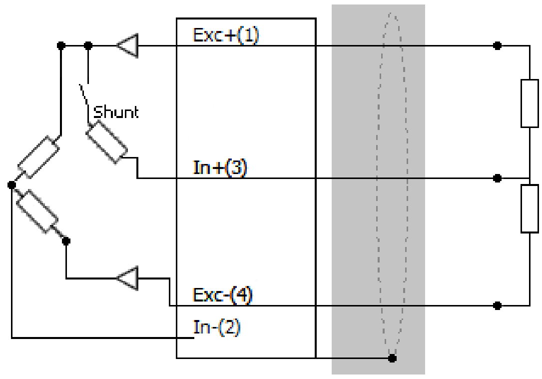
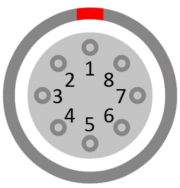
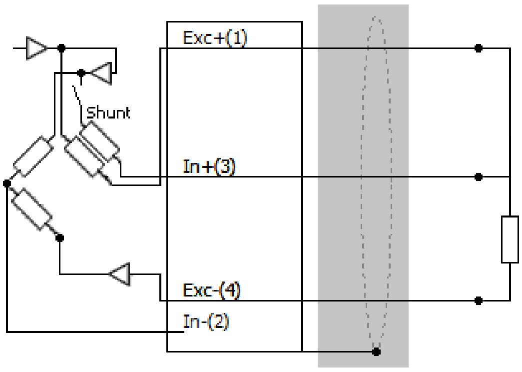
<tr><td>
</td><td>
</td><td>
</td></tr>
<tr><td></td><td>Quarter Bridge – 3 wire</td><td></td></tr>
<tr><td>
</td><td>
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5.12.6 STGM-L2B16f

Pin	Name	Description
1	TEDS	TEDS
2	Exc+	Excitation +
3	Exc-	Excitation -
4	R+	¼ Bridge/Shunt
5	In+	Input +
6	nc	Not Connected
7	Sns+	Sense +
8	Sns-	Sense -
9	GND	Ground
10	In-	Input -
11	+5V	+5V (max. 100mA) supply
12	+14V5	+14.5V (max. 50mA) supply
13	IN0/A	Counter input IN0/A
14	IN1/B	Counter input IN1/B
15	IN2/Z	Counter input IN2/Z
16	-14V5	-14.5V (max. 50mA) supply

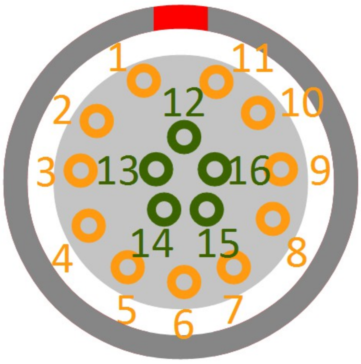
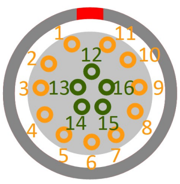
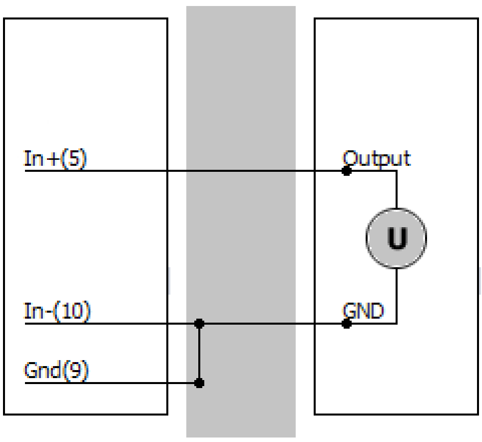
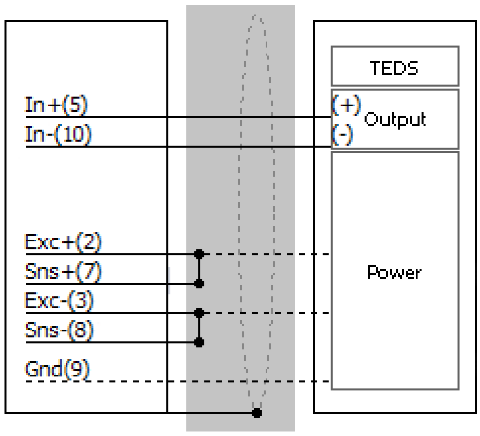


Illustration 133: SIRIUS-STGM-L2B16f pin-out

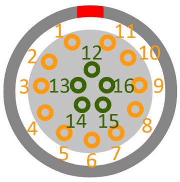
HINT

You can use the analogue input and counters at the same time.

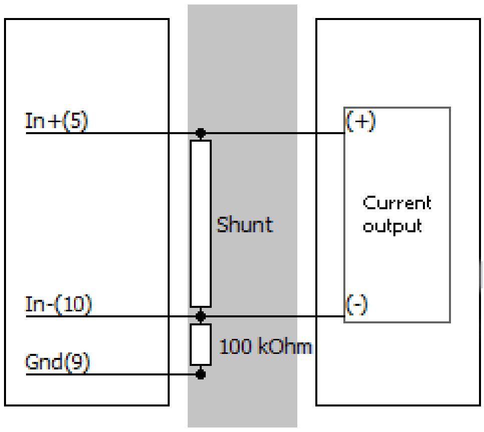
5.12.6.1 STGM-L2B16f: Voltage

	Voltage - Single Ended	**Voltage – Differential** Use only when the sensor is powered by the excitation voltage of the module.
		

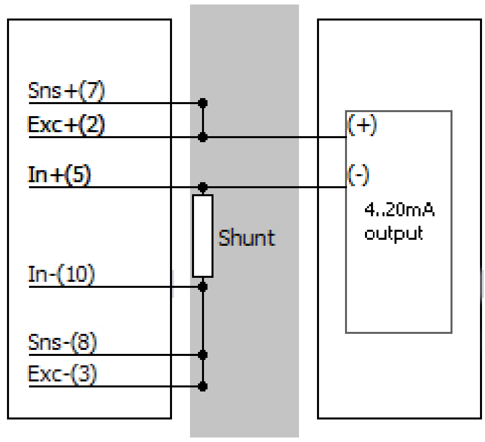
5.12.6.2 STGM-L2B16f: Current



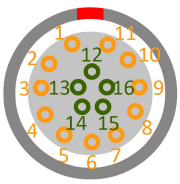
External Direct Shunt

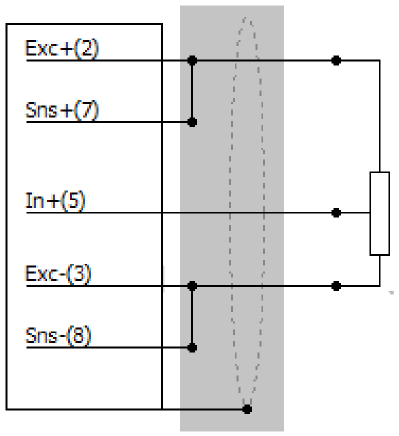


External Loop Powered Shunt



5.12.6.3 STGM-L2B16f: Potentiometer





5.12.6.4 STGM-L2B16f: Bridge

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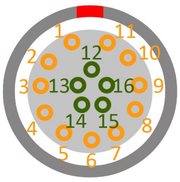
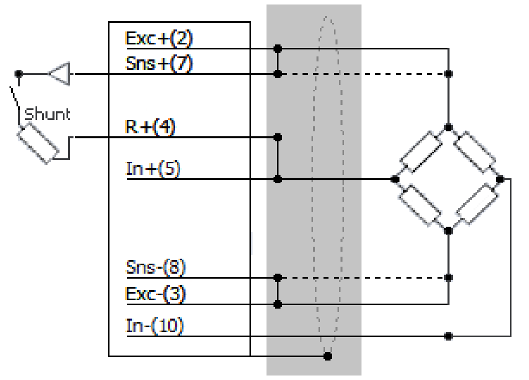
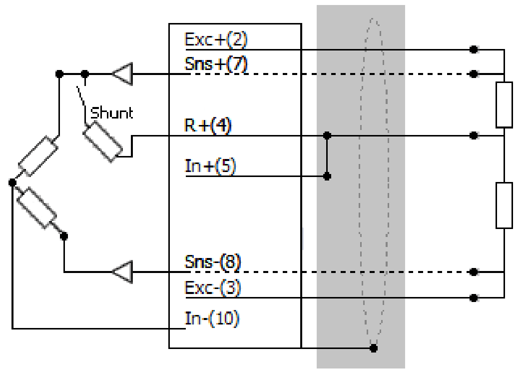
<tr><td></td><td>Full Bridge</td><td>Half Bridge</td></tr>
<tr><td>
</td><td>
</td><td>
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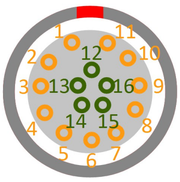
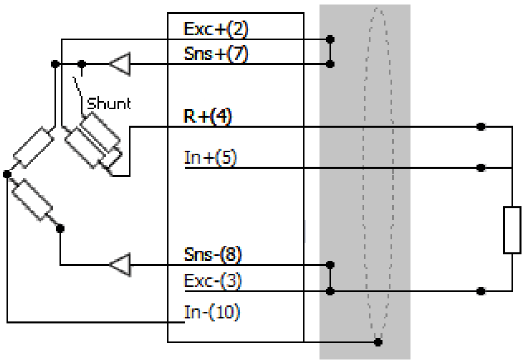
<tr><td></td><td>Quarter Bridge – 3 wire</td><td></td></tr>
<tr><td>
</td><td>
</td><td></td></tr>
</table>

5.13 STG / STG+

5.13.1 STGv3: Specifications

Inputs	Voltage, full bridge strain, ½ bridge strain, ¼ bridge strain, potentiometer, RTD, Resistance			
ADC Type	24bit delta-sigma dual core with 100/5 kHz analogue anti-aliasing filter (5.2.1 SIRIUS® Dual Core series: High Dynamic (up to 160 dB) page 65)			
Sampling Rate	Simultaneous 200kS/sec			
Dual Core Ranges (Low)	±50V (2.5 V)	±10V (500 mV)	±1V (50 mV)	±100mV (5 mV)
Gain Accuracy	±0.05% of reading			
Offset Accuracy (Dual Core)	±20(10)mV	±2(1)mV	±0.2(0.2)mV	±0.1(0.1)mV
Offset Accuracy after *Balance Amplifier*	±1mV	±0.1mV	±0.02mV	±0.01mV
Typ. Dynamic Range@10kS (Dual core)	137 dB (147 dB)	137 dB (152dB)	137 dB (147dB)	135dB (137 dB)
Typ. SNR@10kS (Dual Core)	108 dB (118 dB)	107 dB (125 dB)	107 dB (113 dB)	100 dB (100 dB)
Typ. CMR @ DC..50 Hz/400 Hz/1 kHz	56 / 56 / 56 dB	88 / 86 / 84 dB	97 / 96 / 95 dB	115 / 112 / 102 dB
Gain Drift	Typical 10 ppm/K, max. 30 ppm/K			
Offset Drift	Typical 0.3 µV/K + 2 ppm of range/K, max 0.8µV/K + 10 ppm of range/K			
Gain Linearity	<0.02%			
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1° (@ 200 kS/sec and 10V range)			
Channel Cross talk	120 dB @ 10kHz (Range ≤ 10V); 95 dB @ 10kHz (Range = 50V)			
Input Coupling[1]	DC, AC 1 Hz (3 Hz, 10 Hz per SW)			
Input Impedance	1 MΩ between IN+ and IN- for 50 V Range; all other Ranges > 1GΩ			
Max. common mode voltage	Isolated version: ±500 V Differential version: 50V Range: ±60 V; all other Ranges: ±12 V			
Input over-voltage protection	50 V Range: 300 V; all other Ranges: 50V (200 V peak for 10msec)			
Excitation Voltage	Free programmable (16 Bit DAC)			
Predefined levels	0, 1, 2.5, 5, 10, 15 and 20 V_{CD}			
Accuracy	±0.05 % ±2 mV			
Drift	±10 ppm/K ±100 µV/K			
Load stability: 0% to 100% load	< 0.01%			
Line regulation over 20 Ω of change	< 0.005% @ 120 Ω load			
Noise @ 10 Volt / 350 Ω	< 150 µVrms@10 kS			
Sense Impedance to Exc / to GND	100 kΩ / > 100 MΩ			
Current limit	100mA (max. 800mW)			
Protection	Continuous short to ground			
Excitation Current	Free programmable (16 Bit DAC)			
Predefined levels	0.1, 1, 2, 5, 10, 20 and 60 mA_{DC}			
Accuracy (> 10mA)	0.1% ±2µA [0.5% ±50 µA]			
Drift (> 10mA)	15 ppm/K [100 ppm/K]			
Compliance voltage	20 Volt, max. 500 mW			
Output Impedance	>1 MΩ			
Bridge connection types	full bridge, ½ bridge and ¼ bridge (3- or 4-wire)			
Ranges	2mV/V…1000mV/V free programmable with Dual Core			
Internal bridge completion	½ bridge and ¼ bridge 120Ω and 350Ω			
Bridge completion accuracy	0.05 %; TCR: 5 ppm/K (others on request)			
Internal Shunt resistor	59.88 kΩ and 175 kΩ, bipolar to Exc+ or Exc- (others on request)			
Shunt resistor accuracy	0.05 %; TCR: 10 ppm/K (others on request)			
Input short, Sensor offset adjust	Software selectable			
Counters (only on STGv3+ type)	1counter / 3 digital input, fully synchronised and alarm output			
Counter Modes	counting, waveform timing, encoder, tacho, gear-tooth sensor			
General Counter Specifications	See 5.6.1 General Counter Specifications on page 72			
Additional Specifications				
Misc. function	Excitation level monitoring, self check function			
Input Connector	DSUB-9, LEMO2B 7pin LEMO2B 10pin (others on request)			
TEDS support	Standard + DSI® adapters			

1 In- must be within ±10V referred to GND(iso); for Ranges 100 V the DC value of In- is not rejected

Table 27: SIRIUS-STG specifications

5.13.2 STG+ (Counter) L1B7f

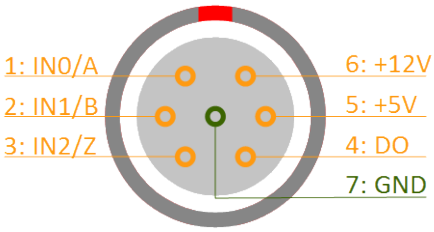


Illustration 134: CNT: counter pin-out (LEMO 7pin)

*Illustration 135: SIRIUS*i* 8xSTG+*

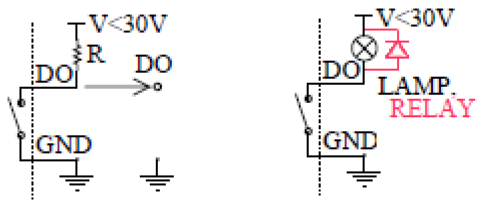
Connector type	L1B7f Connector on the module: `EGG.1B.307.CLL` Mating cable connector: `FGG.1B.307.CLAD52`

Table 28: STG+ counter connector type

WARNING	GND of the counter input is connected to the GND of the analogue channel.

Digital Output Configuration

The “switch” of the open collector output is closed when active.



5.13.3 STG-L2B7f

Illustration 136: STG8 with 7-pin Lemo connectors

Pin	Name	Description
1	Exc+	Excitation +
2	Sns+	Sense +
3	In+	Input +
4	Exc-	Excitation -
5	Sns-	Sense -
6	In-	Input -
7	R+	¼ Bridge/Shunt

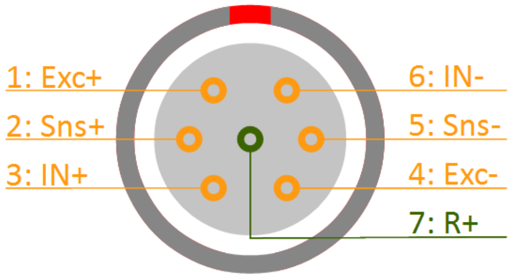


Illustration 137: SIRIUS-STG: pin-out Lemo 7-pin

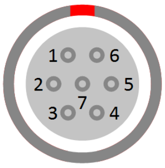
Mating Connector: `FGG.2B.307.CLADxx`

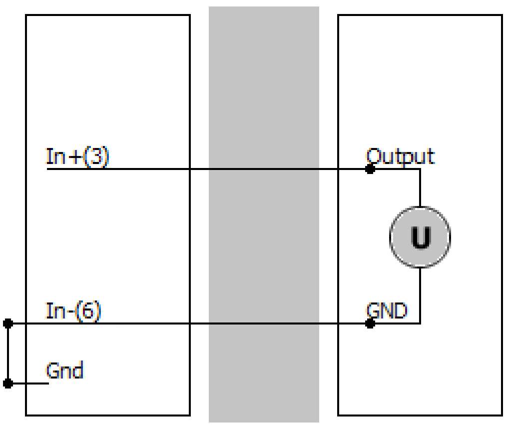
5.13.3.1 STG-L2B7f: Voltage

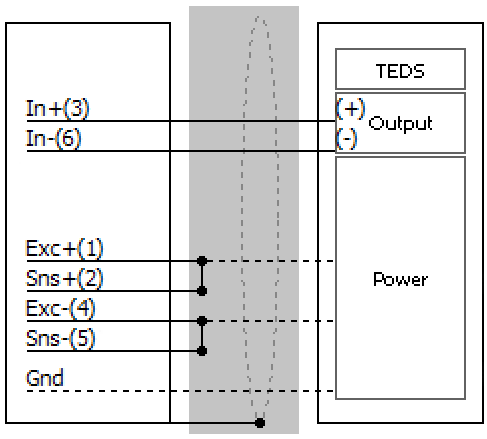
Voltage - Single Ended

Voltage – Differential

Use only when the sensor is powered by the excitation voltage of the module.



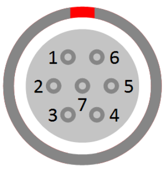


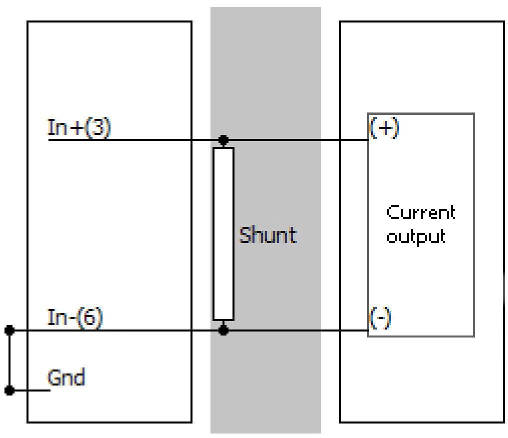


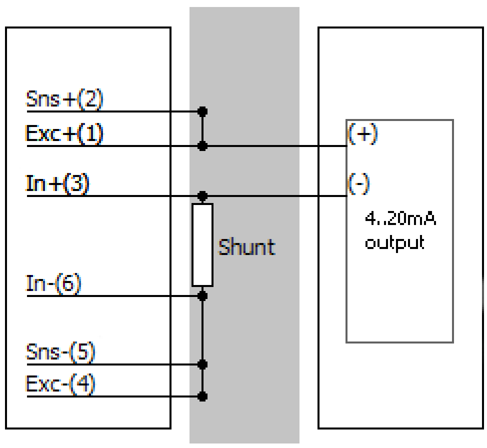
5.13.3.2 STG-L2B7f: Current

External Direct Shunt

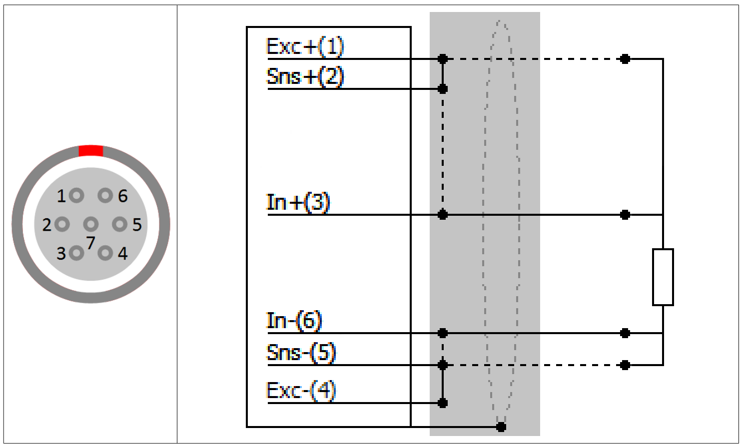
External Loop Powered Shunt



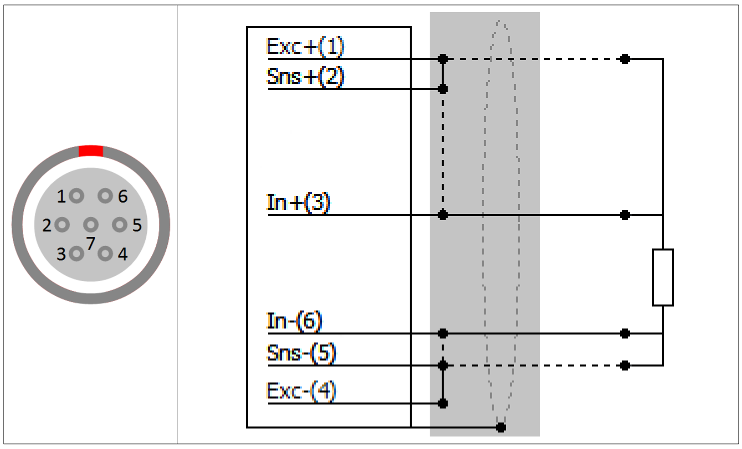




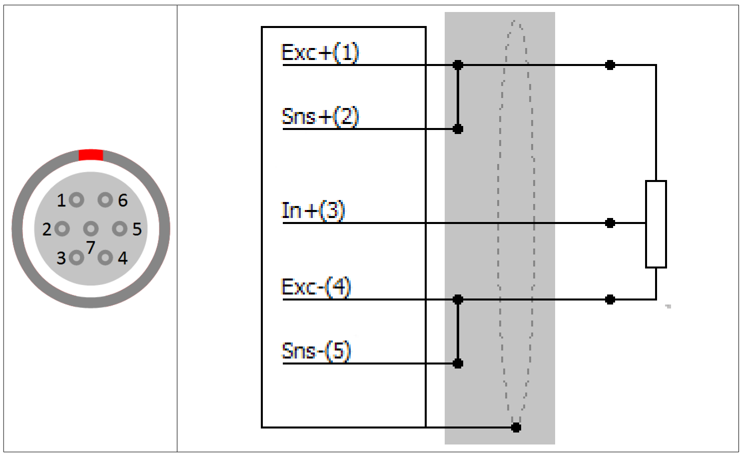
5.13.3.3 STG-L2B7f: Temperature



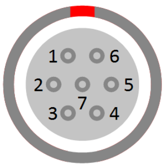
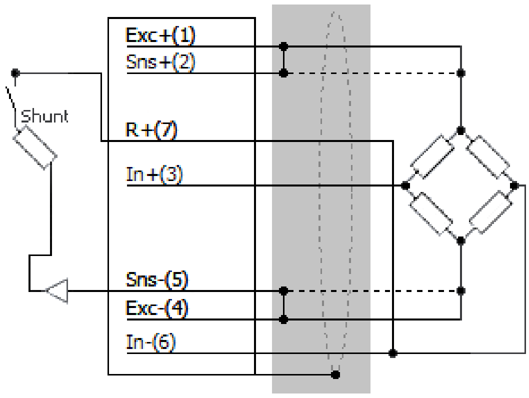
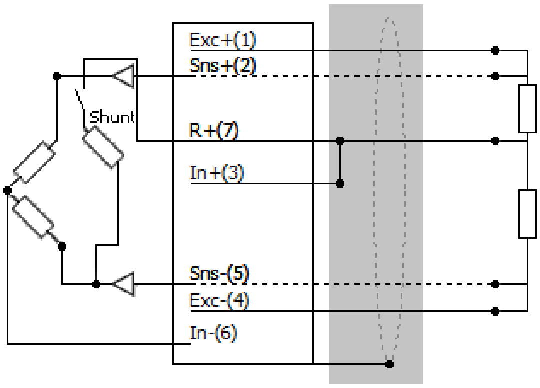
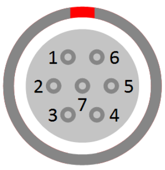
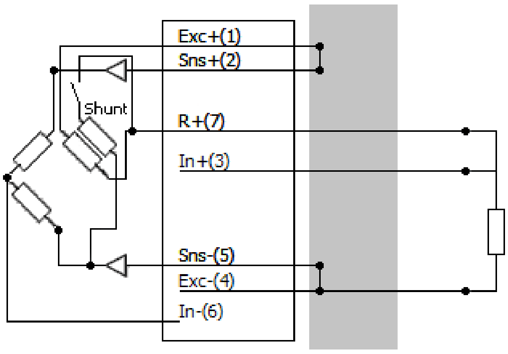
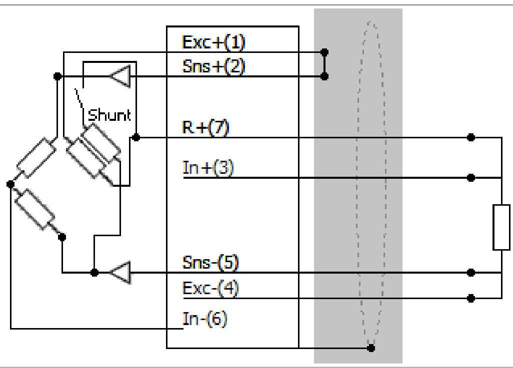
5.13.3.4 STG-L2B7f: Resistance



5.13.3.5 STG-L2B7f: Potentiometer



5.13.3.6 STG-L2B7f: Bridge

	Full Bridge	Half Bridge
		
	Quarter Bridge – 3 wire	**Quarter Bridge – 4 wire**
		

5.13.4 STG-L2B10f

Illustration 138: STG8 with 10-pin Lemo connectors

Pin	Name	Description
1	Exc+	Excitation +
2	Exc-	Excitation -
3	In+	Input +
4	In-	Input -
5	Sns+	Sense +
6	Sns-	Sense -
7	Di-Cnt	Digital I/O, Counter
8	TEDS	TEDs
9	R+/SHUNT	Resistance/SHUNT
10	GND	GND-iso

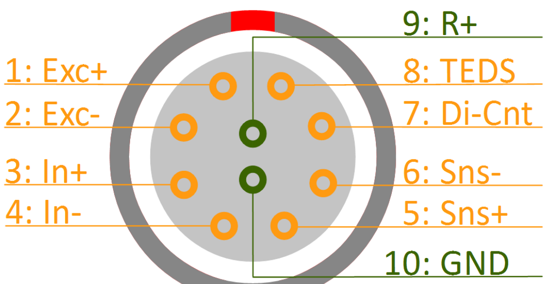
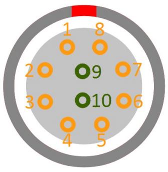
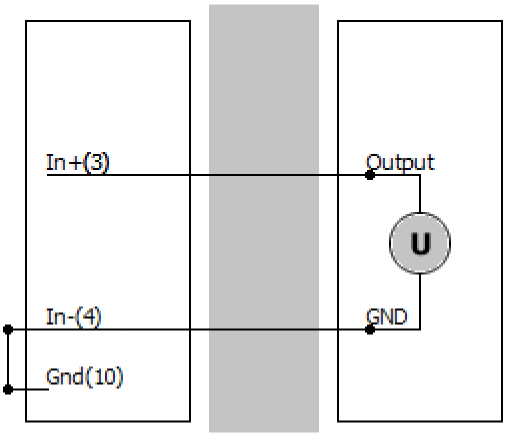
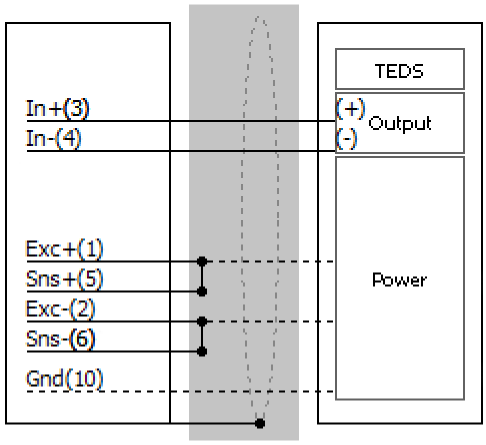


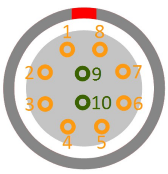
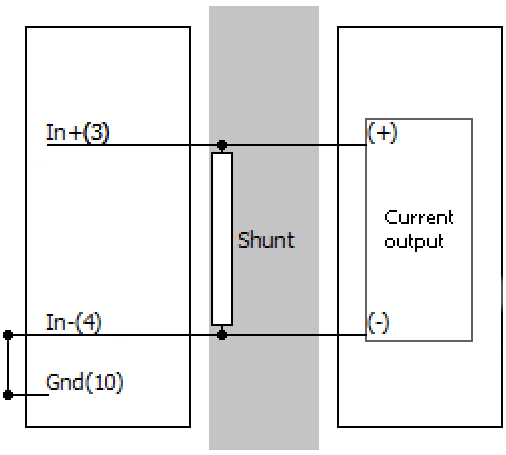
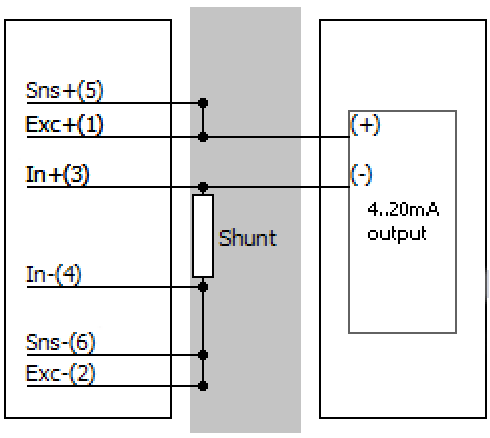
Illustration 139: SIRIUS-STG: pin-out Lemo 10-pin

Mating Connector: `FGG.2B.310.CLADxx`

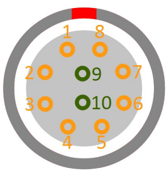
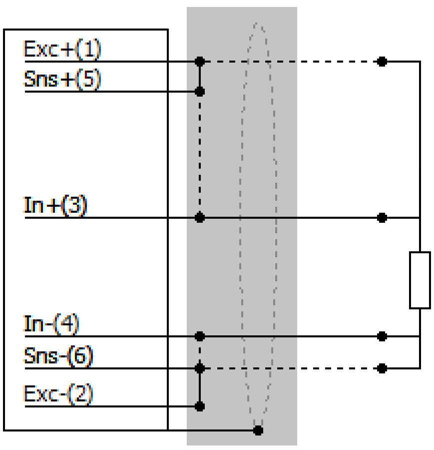
5.13.4.1 STG-L2B10f: Voltage

	Voltage - Single Ended	Voltage – Differential Use only when the sensor is powered by the excitation voltage of the module.
		

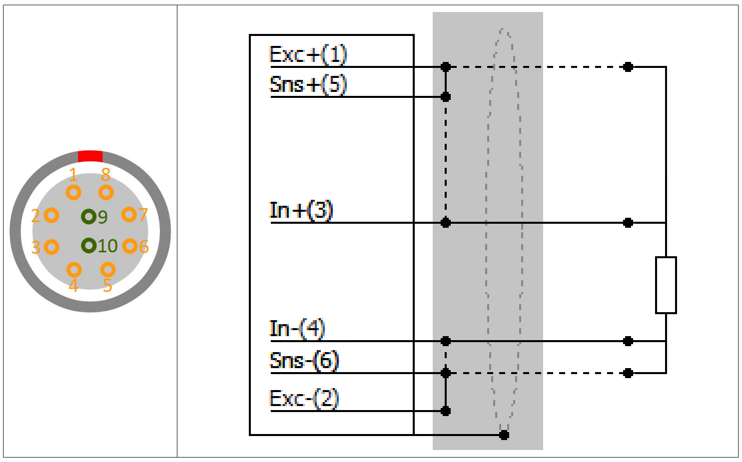
5.13.4.2 STG-L2B10f: Current

	External Direct Shunt	External Loop Powered Shunt
		

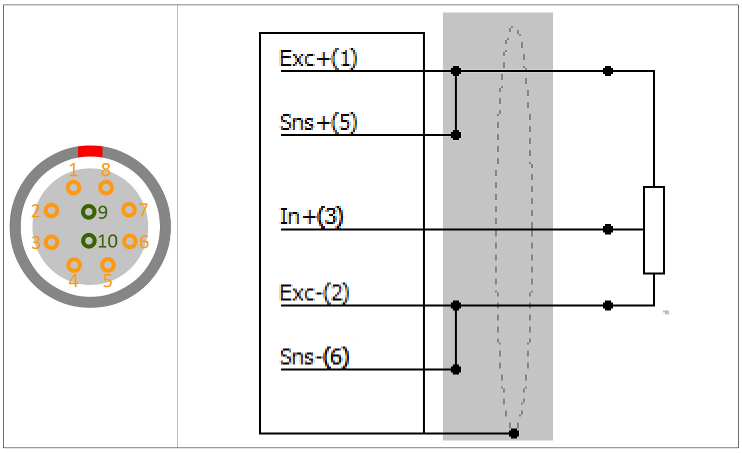
5.13.4.3 STG-L2B10f: Temperature

5.13.4.4 STG-L2B10f: Resistance



5.13.4.5 STG-L2B10f: Potentiometer



5.13.4.6 STG-L2B10f: Bridge

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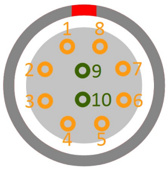
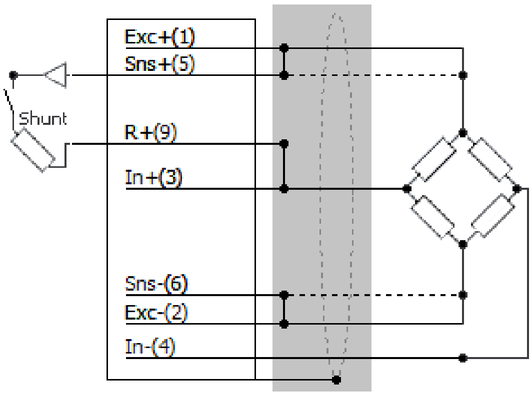
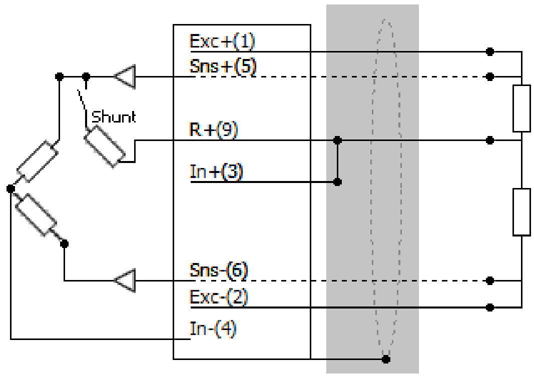
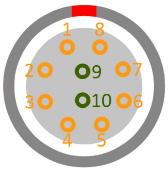
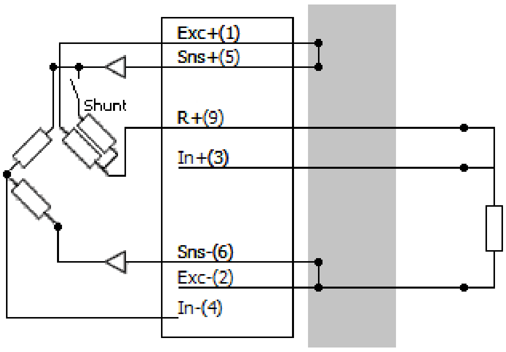
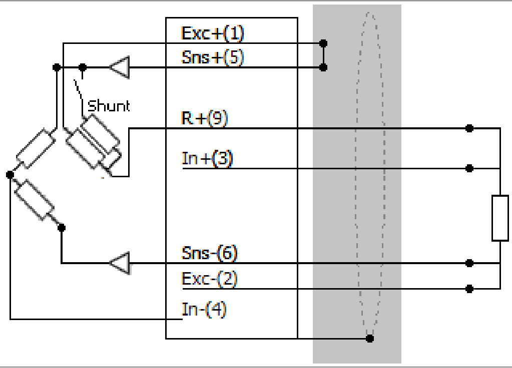
<tr><td></td><td></td><td></td></tr>
<tr><th></th><th>Quarter Bridge – 3 wire</th><th>Quarter Bridge – 4 wire</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>

5.13.5 STG DSUB-9

Illustration 140: SIRIUS 8xSTG DSUB9

Pin	Name	Description
1	Exc+	Excitation +
2	In+	Input +
3	Sns-	Sense -
4	GND	Ground
5	R+	¼ Bridge/Shunt
6	Sns+	Sense +
7	In-	Input -
8	Exc-	Excitation -
9	TEDS	TEDS

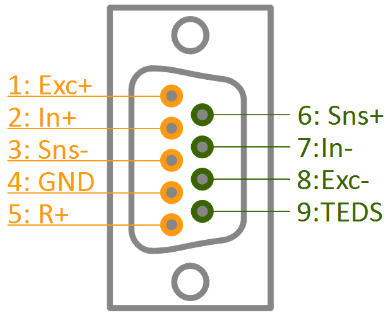
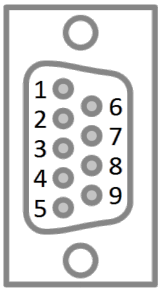
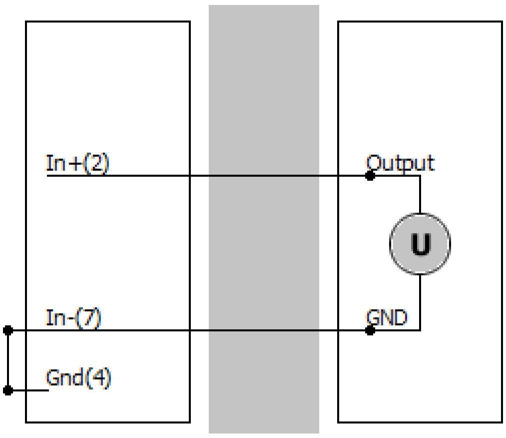


Illustration 141: SIRIUS-STG pin-out DSUB-9

5.13.5.1 STG DSUB-9: Voltage

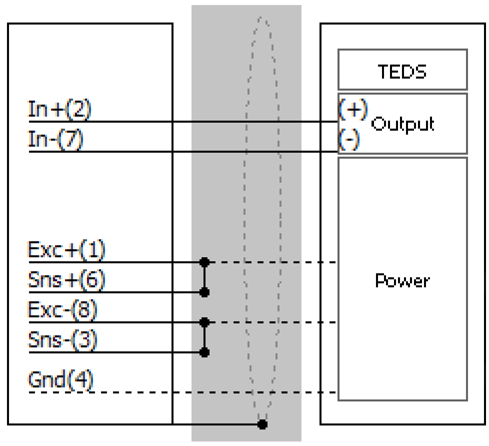


Voltage - Single Ended

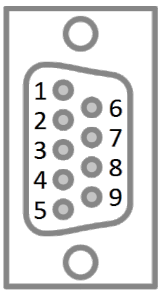


Voltage – Differential

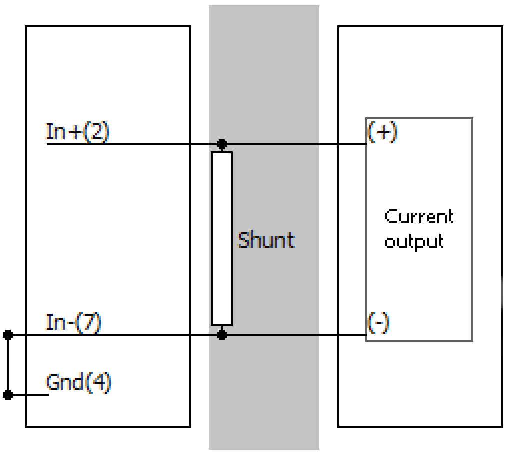
Use only when the sensor is powered by the excitation voltage of the module.



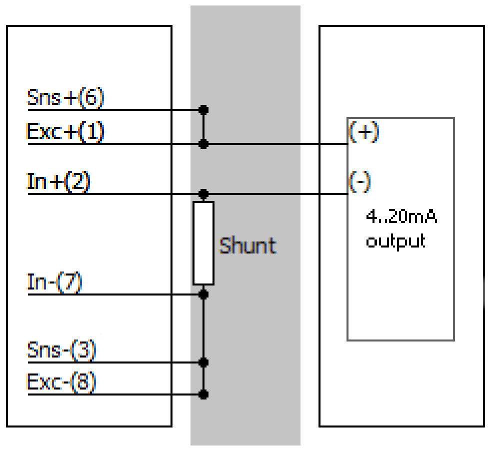
5.13.5.2 STG DSUB-9: Current



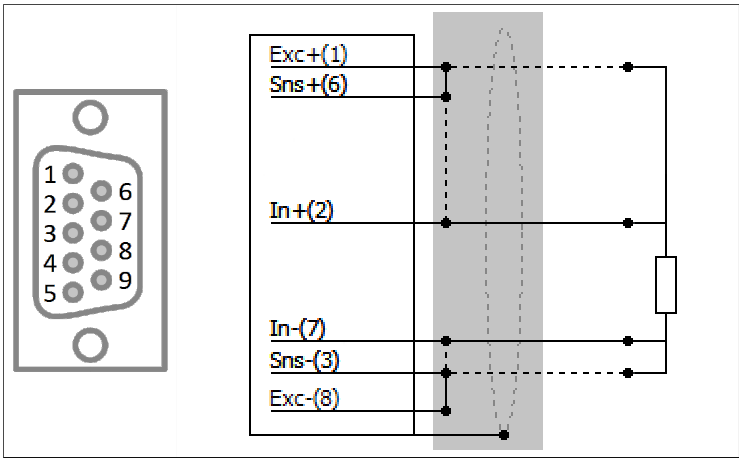
External Direct Shunt



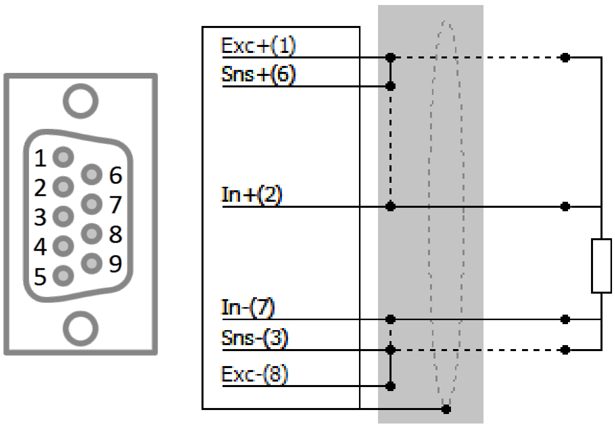
External Loop Powered Shunt



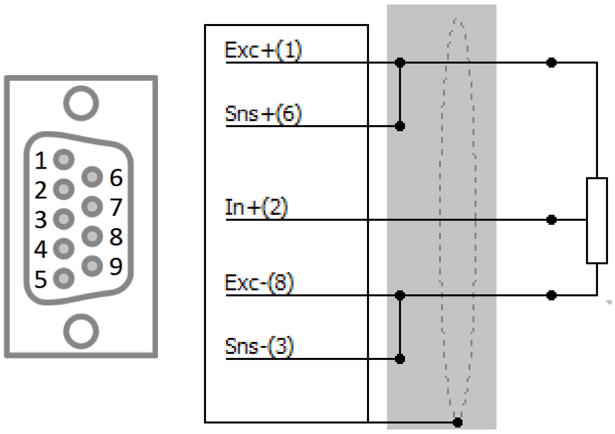
5.13.5.3 STG DSUB-9: Temperature



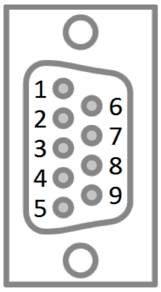
5.13.5.4 STG DSUB-9: Resistance



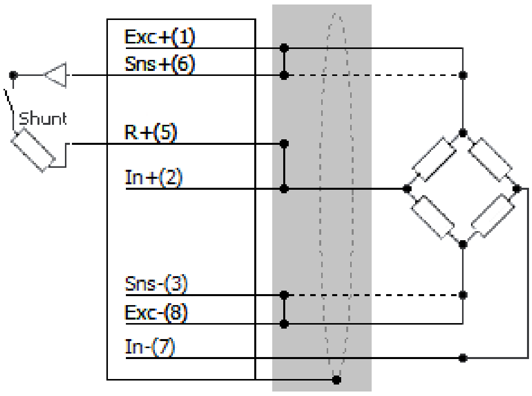
5.13.5.5 STG DSUB-9: Poti



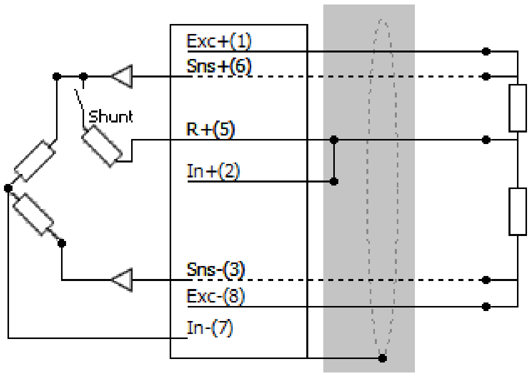
5.13.5.6 STG DSUB-9: Bridge

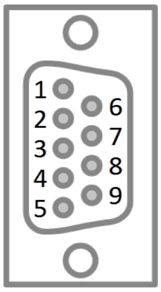


Full Bridge

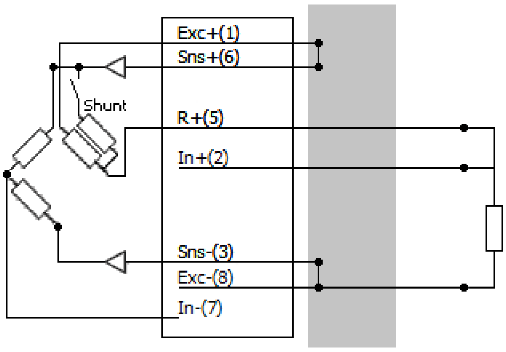


Half Bridge

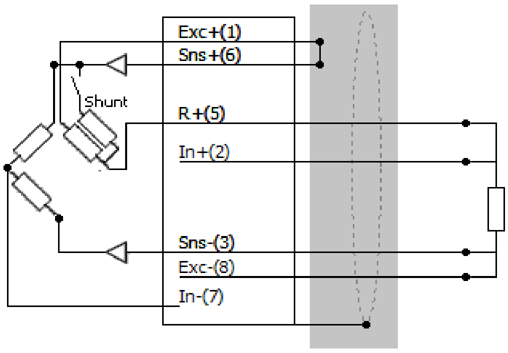




Quarter Bridge – 3 wire



Quarter Bridge – 4 wire



5.14 HD-ACC

5.14.1 HD-ACC Specifications

Inputs	Voltage, IEPE, current (ext. Shunt)			
ADC Type	24bit delta-sigma with 100kHz/5kHz anti-aliasing filter (5.2.2 SIRIUS®-HD-series: High density (16 channel per slice) page 65)			
Sampling Rate	Simultaneous 200kS/sec			
Ranges	±10 V	±5 V	±1 V	±200 mV
Gain accuracy	±0.05% of reading			
Offset accuracy	±2 mV	±1 mV	±0.2 mV	±0.1 mV
Typ. Dynamic Range@10kS	137 dB	137 dB	137 dB	131 dB
Typ. SNR@10kS	109 dB	109 dB	108 dB	102 dB
Typ. CMR @ 400 Hz (1kHz)	140 dB (120 dB)			
Gain Drift	Typical 10 PPM/K, max. 30 PPM/K			
Offset Drift	Typical 0.3 µV/K + 5 ppm of range/K, max 2 µV/K + 10 ppm of range/K			
Gain Linearity	<0.02%			
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1° (@ 200 kS/sec and 10 V Range)			
Channel Cross talk	150 dB @ 50Hz; 140 dB @ 1kHz			
Input Coupling	DC, AC 0.1 Hz, 1 Hz (3 Hz, 10 Hz per SW)			
Input Impedance	1 MΩ (270 kΩ for AC coupling ≥ 1 Hz) in parallel with 100 pF			
Over-voltage Protection	In+ to In-: 50 V continuous; 200V peak (10msec) In- to GND (differential version): 3 Volt			
IEPE mode				
Excitation	4, 8 or 12 mA			
Compliance voltage	22 Volt			
Output Impedance	> 100 kΩ			
Sensor detection	Shortcut: < 4 Volt; Open: > 10 Volt			
Additional Specifications				
Input connector	BNC			
TEDS support	IEPE mode only			

Table 29: SIRIUS-HD-ACC specifications

5.14.2 HD-ACC BNC

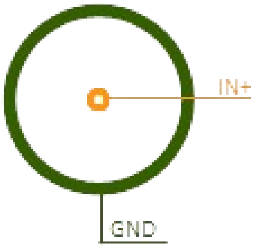


Illustration 142: SIRIUS-HD-ACC: pin-out (BNC)

Illustration 143: SIRIUSi 16xHD-ACC

5.14.3 HD-ACC: Voltage

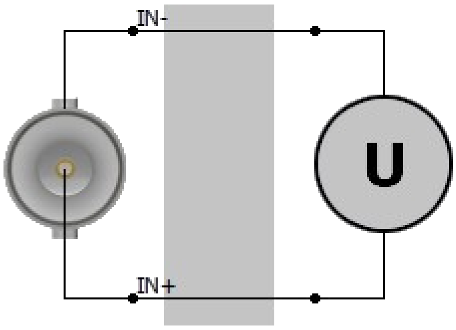


Illustration 144: HD-ACC Voltage

5.14.4 HD-ACC: IEPE

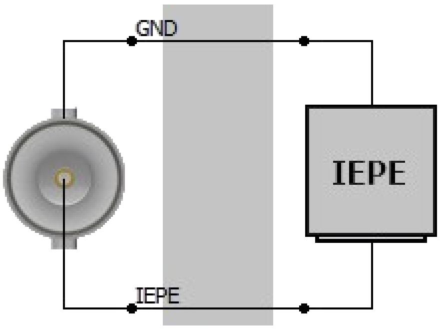


Illustration 145: HD-ACC IEPE

5.15 HD-LV

5.15.1 HD-LV: Specifications

Inputs	Voltage, full bridge strain, current (ext. Shunt)			
ADC Type	24bit delta-sigma with 100kHz/5kHz anti-aliasing filter (5.2.2 SIRIUS®-HD-series: High density (16 channel per slice) page 65)			
Sampling Rate	Simultaneous 200kS/sec			
Ranges	±100V	±10V	±1	±100mV
Gain accuracy	±0.05% of reading			
Offset accuracy	± 20 mV	± 2 mV	± 0.2 mV	± 0.1 mV
Dynamic Range@10kS	134 dB	137 dB	137 dB	125 dB
Typ. SNR@10kS	104 dB	104 dB	104 dB	95 dB
Typ. CMR @ 400Hz (1kHz)	74 dB (70 dB)	86 dB (84 dB)	96 dB (95 dB)	112 dB (102 dB)
Gain Drift	Typical 10 PPM/K, max. 40 PPM/K			
Offset Drift	Typical 0.3 µV/K + 5 ppm of range/K, max 2 µV/K + 10 ppm of range/K			
Gain Linearity	<0.02%			
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1° (@ 200 kS/sec and 10 V Range)			
Channel Cross talk	120 dB @ 10kHz (Range ≤ 10V); 76dB @ 1kHz (Range = 100V)			
Input Coupling	DC			
Input Impedance	1 MΩ for 100V Range; all other Ranges10 MΩ			
Max. common mode voltage	100V Range: ±100 V; all other Ranges: ±12 V			
Overvoltage Protection	In+ to In-: 100V Range: 200V; all other Ranges: 50V (200V for 10msec)			
Excitation Voltage	Unipolar or Bipolar Software selectable (programmable with 16 Bit)			
Excitation Level unipolar	0 .. 24 Volt; Predefined levels: 1, 2.5, 5, 10, 12, 15, 20 and 24 V_{DC}			
Exication Level bipolar	2 .. 30 Volt; Predefined levels: 2.5, 5, 10, 12, 15, 24 and 30 V_{DC}			
Accuracy	±0.1 % ±5 mV			
Drift	±50 ppm/K ±100 µV/K			
Stability 10% to 90% load	<0.01%			
Current limit	100mA (1 Watt max. per Channel, 12 Watt max. per Slice)			
Protection	Continuous short to ground			
Bridge Connection Types	Full bridge			
Ranges @ $10V_{Exc}$	2mV/V…1000mV/V free programmable			
Sensor Offset Adjust	Software selectable			
Additional Specifications				
Input connector	DSUB-9, BNC (others on request)			
TEDS support	Standard + DSI® adapters			

Table 30: Sirius HD-LV Specifications

5.15.2 HD-LV DSUB-9

Illustration 146: SIRIUS HD-LV DSUB-9

Pin	Name	Description
1	Exc+	Excitation +
2	In+	Input +
3	Sns-	Sense -
4	GND	Ground
5	n.c.	Not connected
6	Sns+	Sense +
7	In-	Input -
8	Exc-	Excitation -
9	TEDS	TEDS

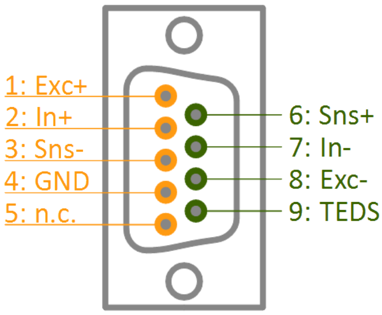


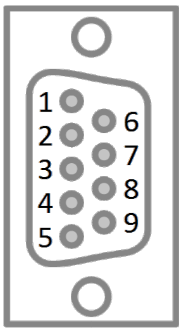
Illustration 147: 5.12.2 HD-LV pin-out DSUB-9

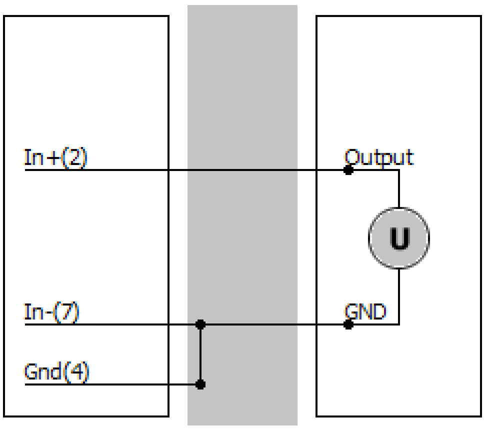
5.15.2.1 HD-LV: Voltage

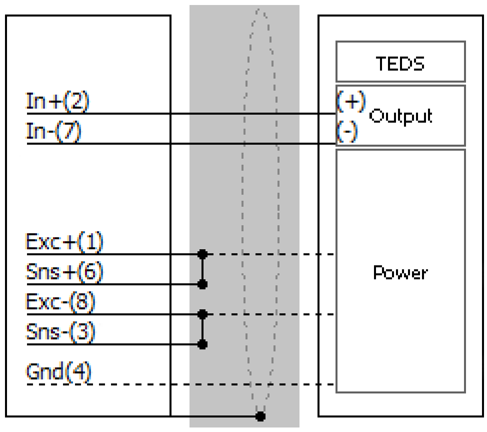
Voltage - Single Ended

Voltage – Differential

Use only when the sensor is powered by the excitation voltage of the module.



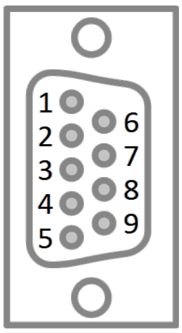


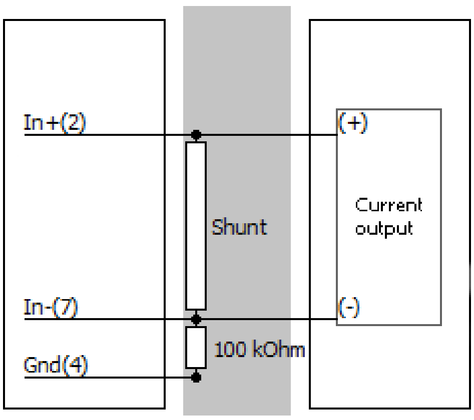


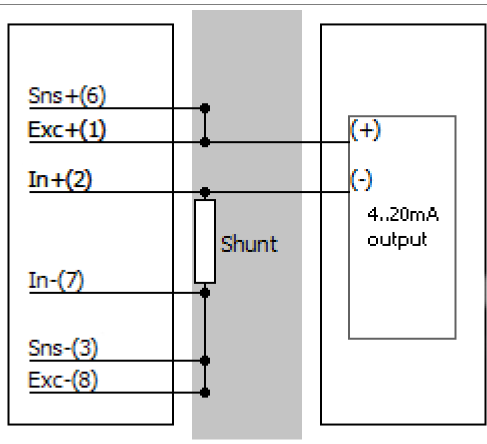
5.15.2.2 HD-LV: Current

External Direct Shunt

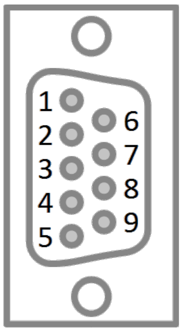
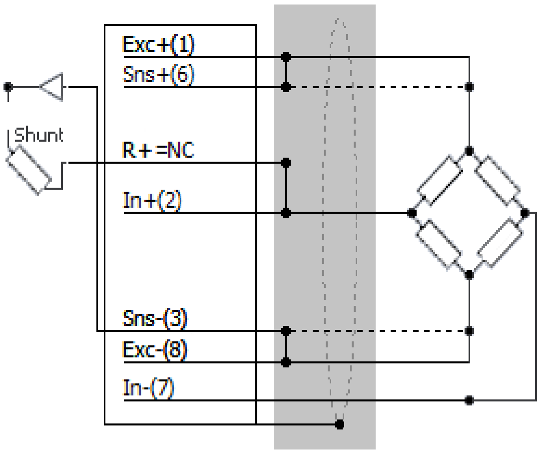
External Loop Powered Shunt







5.15.2.3 HD-LV: Bridge

	Full Bridge
	

5.15.3 HD-LV BNC

Illustration 148: SIRIUS HD-LV BNC

5.15.4 HD-LV BNC: Voltage

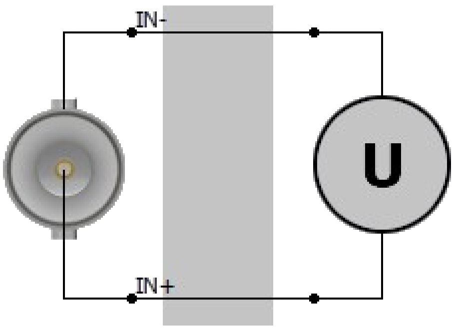


Illustration 149: HD-LV BNC Voltage

5.16 HD-STGS

5.16.1 HD-STGS: Specifications

Inputs	Voltage, full bridge strain, half bridge strain, quarter bridge strain (120Ω and 350Ω), current (ext. Shunt)			
ADC Type	24bit delta-sigma with 100kHz/5kHz anti-aliasing filter (5.2.2 SIRIUS®-HD-series: High density (16 channel per slice) page 65)			
Sampling Rate	Simultaneous 200kS/sec			
Dual Core Ranges (Low Range)	±10V	±1V	±100mV	±10mV
Gain Accuracy	±0.05% of reading			
Offset Accuracy	±2mV	±0.2mV	±0.1mV	±0.1mV
Offset Accuracy after *Balance Amplifier*	±0.2mV	±0.02mV	±0.01mV	±0.01mV
Dynamic Range@10kS	137 dB	137 dB	130 dB	112 dB
Typ. SNR@10kS	105 dB	104 dB	95 dB	75 dB
Typ. CMR @ 400Hz (1 kHz)	86 dB (84 dB)	96 dB (95 dB)	112 dB (102 dB)	112 dB (102 dB)
Gain Drift	Typical 10 PPM/K, max. 40 PPM/K			
Offset Drift	Typical 0.3 µV/K + 5 ppm of range/K, max 2 µV/K + 10 ppm of range/K			
Gain Linearity	<0.02%			
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1° (@ 200 kS/sec)			
Channel Cross talk	120 dB @ 10kHz			
Input Coupling	DC			
Input Impedance	10 MΩ			
Max. common mode voltage	±12 V			
Overvoltage Protection	In + to In-: 50 V continuous; 200V peak (10msec)			
Excitation Voltage	Free programmable (16 Bit DAC)			
Predefined levels	0, 1, 2.5, 5, 10 and 12 V_{DC}			
Accuracy	±0.05 % ±2 mV			
Drift	±50 ppm/K ±100 µV/K			
Stability 10% to 90% load	<0.01%			
Current limit	45mA (200mW max. Power)			
Protection	Continuous short to ground			
Bridge Connection Types	Full bridge, ½ bridge, ¼ bridge (3-wire)			
Ranges	2mV/V…1000mV/V free programmable			
Internal Bridge Completion	½ bridge and ¼ bridge 120Ω and 350Ω			
Bridge Completion Accuracy	0.05 %; TCR: 5 ppm/K (others on request)			
Internal Shunt Resistor	100 kΩ (others on request)			
Typ. Shunt Resistor Accuracy	0.05 %; TCR: 10 ppm/K (others on request)			
Input Short, Sensor Offset Adjust	Software selectable			
Additional Specifications				
Input connector	DSUB-9			
TEDS support	Standard + DSI® adapters			

Table 31: HD-STGS: Specifications

5.16.2 HD-STGS

Illustration 150: HD-STGS with 16 DSUB-9 connectors

Pin	Name	Description
1	Exc+	Excitation +
2	In+	Input +
3	Sns-	Sense -
4	GND	Ground
5	R+	¼ Bridge/Shunt
6	Sns+	Sense +
7	In-	Input -
8	Exc-	Excitation -
9	TEDS	TEDS

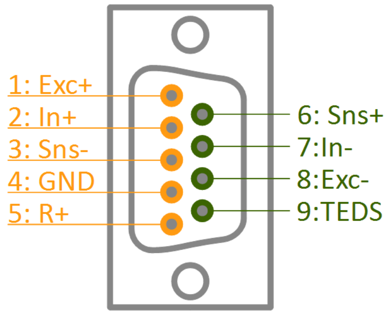
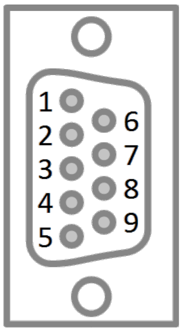
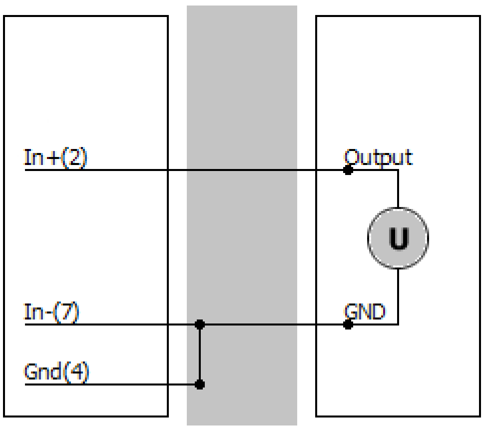
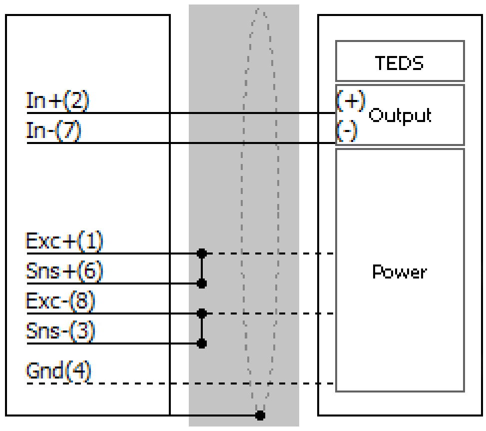
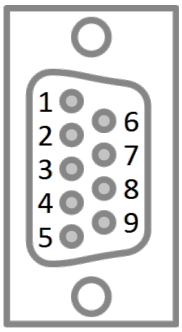


Illustration 151: SIRIUS-HD-STGS pin-out

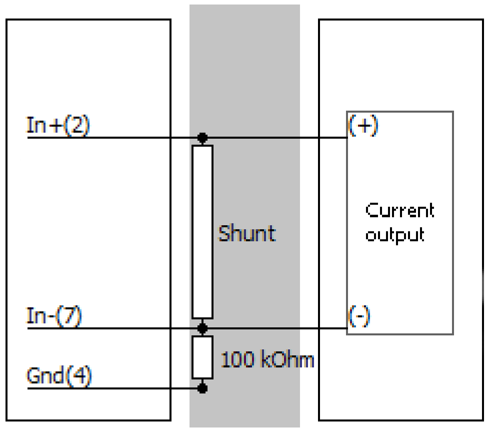
5.16.2.1 HD-STGS: Voltage

	Voltage - Single Ended	**Voltage – Differential** Use only when the sensor is powered by the excitation voltage of the module.
		

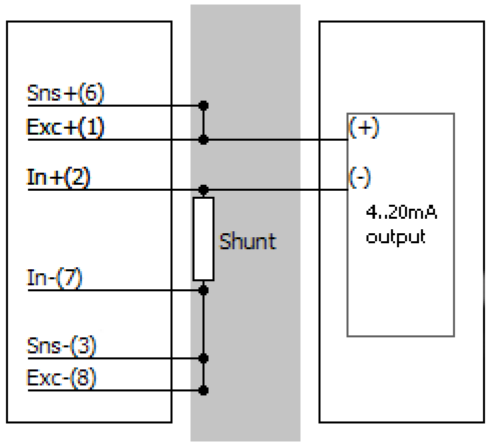
5.16.2.2 HD-STGS: Current



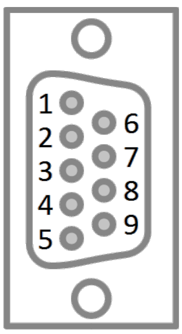
External Direct Shunt

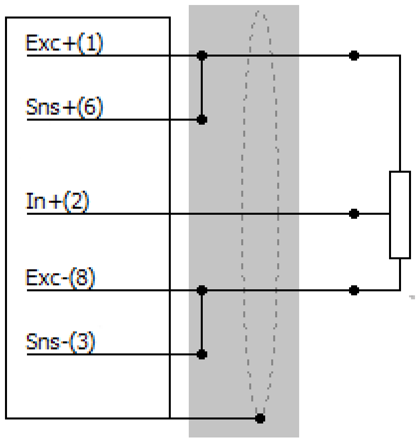


External Loop Powered Shunt

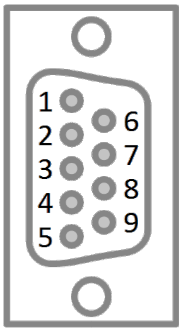
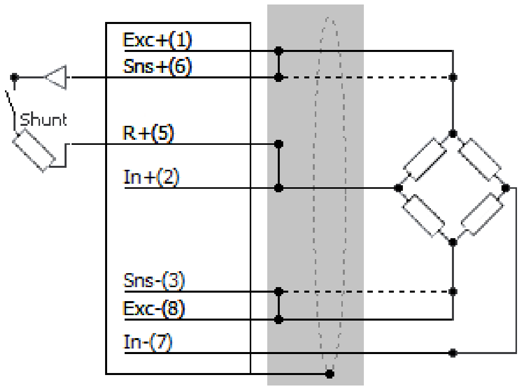
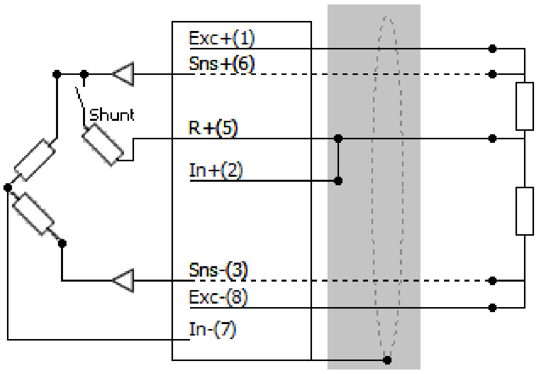
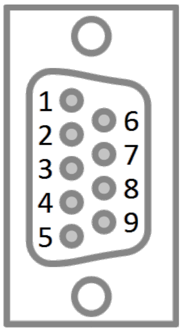
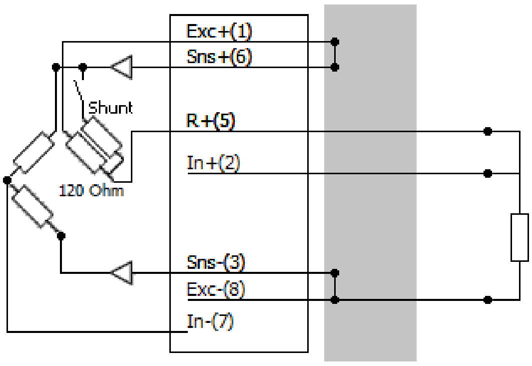


5.16.2.3 HD-STGS: Potentiometer





5.16.2.4 HD-STGS: Bridge

	Full Bridge	Half Bridge
		
	Quarter Bridge – 3 wire	
		

5.16.3 HD-STGS-L1B10f

Illustration 152: HD-STGS-L1B10f

Pin	Name	Description
1	In-	Input -
2	Sns+	Sense +
3	R+	¼ Bridge/Shunt
4	In+	Input +
5	Exc+	Excitation +
6	GND	Measurement GND
7	Exc-	Excitation -
8	Sns-	Sense -
9	Shield	connection to chassis
10	TEDS	TEDS

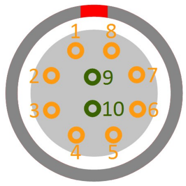


Illustration 153: SIRIUS-HD-STGS: pin-out Lemo 10-pin

SIRIUS Connector: `EEG.1B.310.CLN`
Mating Connector: `FGG.2B.310.CLADxx`

5.17 HS-ACC / HS-ACC+

5.17.1 HS-ACC: Specifications

Inputs	Voltage, IEPE, current (ext. Shunt), ACC+ only: counter, discrete			
ADC Type	16bit SAR with 100kHz 5th order analogue AAF filter or bypass (5.2.3 SIRIUS®-HS series: High speed and bandwidth page 66)			
Analogue bandwidth	500 kHz			
Sampling Rate	Simultaneous 1 MS/sec			
Voltage ranges	±10 Volt	±5 Volt	±1 Volt	±0.2 Volt
Input Accuracy	±0.05% of reading			
Offset Accuracy	±2mV	±1mV	±0.2mV	±0.1mV
Typ. SNR @ 100kHz	89 dB	89 dB	86 dB	83 dB
Typ. CMR @ 50Hz/400Hz/1kHz	120 / 96 / 88 dB	126 / 100 / 92 dB	140 / 110 / 102 dB	140 / 118 / 110 dB
Gain Drift	Typical 10 ppm/K, max. 30 ppm/K			
Offset Drift	Typical 0.5 µV/K + 10 ppm of range/K, max 3 µV/K + 20 ppm of range/K			
Gain Linearity	<0.02%			
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1°			
Channel Cross talk	120 dB @ 1kHz; 100 dB @ 10kHz			
Input Coupling	DC or AC (1Hz)			
Input Impedance	1 MΩ			
Overvoltage Protection	50 V continuous; 200V peak (10msec)			
Digital low pass filter				
Filter Characteristic	Butterworth or Bessel			
Filter Order	2nd , 4th, 6th or 8th			
Ratio Sample rate to Filter Freq.	From 2 to 100			
Topology	Cascaded IIR Filter (up to 4 sections)			
IEPE mode				
Excitation	4 or 8mA			
Compliance voltage	25 Volt			
Output Impedance	>100 kΩ			
Sensor detection	Shortcut: <4Volt; Open: > 19Volt			
Counters (HS-ACC+ type only)	1 counter/3 digital input, fully synchronised with analogue data			
Counter Modes	counting, waveform timing, encoder, tacho, gear-tooth sensor			
General Counter Specifications	See 5.6.1 General Counter Specifications on page 72			
Additional Specifications				
Input connector	BNC			
TEDS support	IEPE mode only			

Table 32: 5.13.1 HS-ACC specifications

5.17.2 HS-ACC BNC

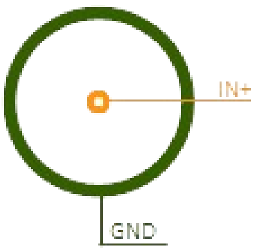


Illustration 154: SIRIUS-HS-ACC: pin-out (BNC)

Illustration 155: SIRIUS-HS-8xACC+BNC

5.17.3 HS-ACC+ (Counter) L1B7f

The HS-ACC+ modules are perfect for high speed sound and vibration IEPE channels plus counter applications. In addition to the HS-ACC module, it also has a 7-pin Lemo connector for digital counters.

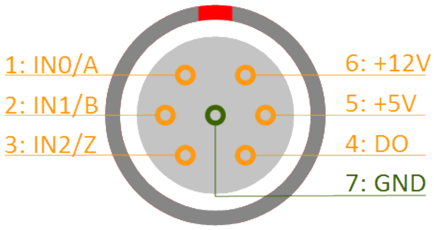


Illustration 156: HS-ACC+: counter pin-out (LEMO 7pin)

Illustration 157: SIRIUS-HS-ACC8+

Connector type	L1B7f Connector on the module: `EGG.1B.307.CLL` Mating cable connector: `FGG.1B.307.CLAD52`

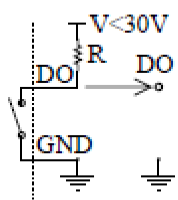
Table 33: HS-ACC+ Counter Specifications (per module)

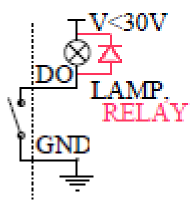
WARNING

GND of the counter input is connected via a 50Ω resistor to In- of the analogue channel.

Digital Output Configuration

The “switch” of the open collector output is closed when active.





5.17.4 HS-ACC: Voltage

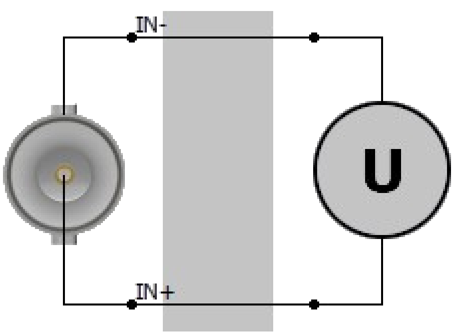


Illustration 158: HS-ACC Voltage

5.17.5 HS-ACC: IEPE

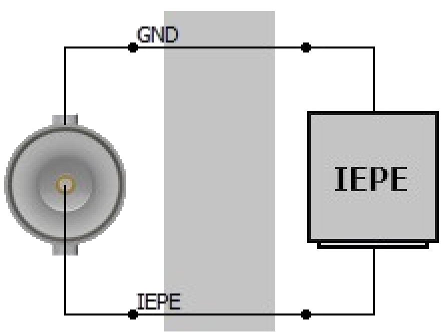


Illustration 159: HS-ACC IEPE

5.18 HS-CHG / HS-CHG+

5.18.1 HS-CHG: Specifications

Inputs	Voltage, IEPE, Charge, Current (ext. Shunt)				
ADC Type	16bit SAR with 100kHz 5th order analogue AAF filter or 500KHz bandwidth (5.2.3 SIRIUS®-HS series: High speed and bandwidth page 66)				
Analogue bandwidth	500 kHz (200 kHz for Charge)				
Sampling Rate	Simultaneous 1 MS/sec				
Voltage ranges	7 ranges: ±10, ±5, ±2, ±1, ±0.5, ±0.2, ±0.1 Volt				
Input Accuracy	**Signal frequency**	**Accuracy**			
	DC	±0.05% of reading ±0.02% of range ±50µV			
	up to 10kHz	±0.1% of reading ±0.05% of range			
	up to 100kHz	±2% of reading ±0.1% of range			
Typ. SNR	**Bandwidth/Range →**	**10 V**	**5 V**	**1 V**	**0.1 V**
	1 Mhz	88 dB	87 dB	85 dB	68 dB
	100 kHz	89 dB	89 dB	88 dB	83 dB
	10 kHz	> 100 dB	> 100 dB	> 100 dB	92 dB
Typ. CMR @ 50Hz/1kHz		>140/120dB	>140/124dB	>140/126dB	>140/126dB
Gain Drift	Typical 10 ppm/K, max. 30 ppm/K				
Offset Drift	Typical 0.5 µV/K + 10 ppm of range/K, max 3 µV/K + 20 ppm of range/K				
Gain Linearity	<0.02%				
Inter Channel Phase-mismatch	0.02° * f_{in} [kHz] + 0.1°				
Channel Cross talk	110 dB @ 1kHz; 90 dB @ 10kHz				
Input Coupling	DC or AC (0.1 Hz, 1 Hz, 10 Hz or 100 Hz)				
Input Impedance	1 MΩ / 100pF				
Overvoltage Protection	50 V continuous; 200V peak (10msec)				
Digital low pass filter					
Filter Characteristic	Butterworth, Bessel or Chebyshev				
Filter Order	2nd , 4th, or 8th				
Ratio Sample rate to Filter Freq.	From 2 to 100				
Topology	Cascaded IIR Filter (up to 4 sections)				
IEPE mode					
Excitation	4 or 8mA				
Compliance voltage	25 Volt				
Output Impedance	>100 kΩ				
Sensor detection	Shortcut: <4Volt; Open: > 19Volt				
Charge ranges	7 ranges: ±100 000, 50 000, 20 000, 10 000, 5000, 2000, 1000 pC				
Input Accuracy	±0.5% of reading ±0.05% of range ±2 pC				
Input Coupling	0.01 Hz, 0.03 Hz, 0.1 Hz, 0.5 Hz, 1 Hz, 10 Hz or 100 Hz				
Counters (only on HS-CHG+ type)	1 counter/3 digital input, fully synchronised with analogue data				
Counter Modes	counting, waveform timing, encoder, tacho, gear-tooth sensor				
General Counter Specifications	See 5.6.1 General Counter Specifications on page 72				
Additional Specifications					
Input connector	BNC (others on request)				
TEDS support	IEPE mode only				

Table 34: SIRIUS-HS-CHG specifications

5.18.2 HS-CHG BNC

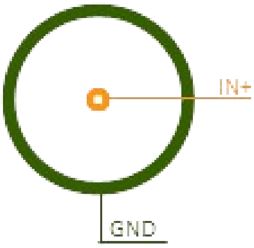


Illustration 160: SIRIUS-CHG: pin-out (BNC)

Illustration 161: SIRIUSi8xHS-CHG-BNC

5.18.3 HS-CHG+ (Counter) L1B7f

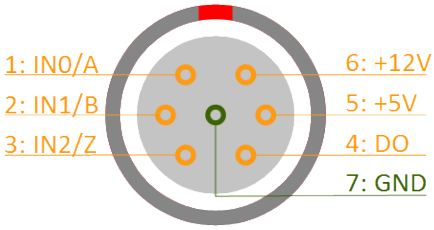


Illustration 162: CNT: counter pin-out (LEMO 7pin)

Illustration 163: SIRIUSi8xHS-CHG+

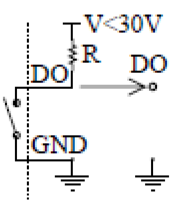
Connector type	L1B7f Connector on the module: `EGG.1B.307.CLL` Mating cable connector: `FGG.1B.307.CLAD52`

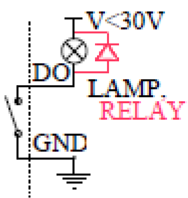
Table 35: HS-CHG+ counter connector type

WARNING	GND of the counter input is connected via a 50Ω resistor to In- of the analogue channel.

Digital Output Configuration

The “switch” of the open collector output is closed when active.





5.18.4 HS-CHG: Voltage

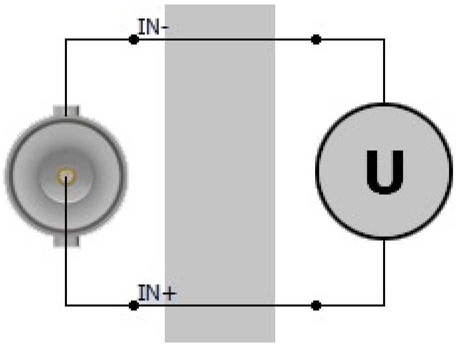


Illustration 164: HS-CHG Voltage

5.18.5 HS-CHG: IEPE

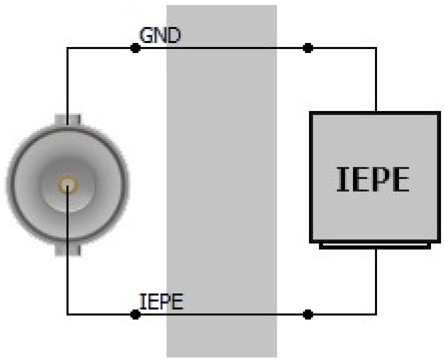


Illustration 165: HS-CHG IEPE

5.18.6 HS-CHG: Charge

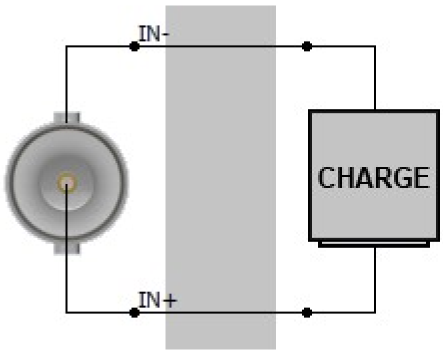


Illustration 166: HS-CHG IEPE

5.19 HS-HV

5.19.1 HS-HVv2: Specifications

Inputs	Voltage		
ADC Type	16bit SAR with 100kHz 5th order analogue AAF filter or bypass (5.2.3 SIRIUS®-HS series: High speed and bandwidth page 66)		
Sampling Rate	Simultaneous 1MS/sec		
Analogue bandwidth	2 MHz		
Voltage ranges	±1600 V, ±800 V, ±400 V, ±200 V, ±100 V, ±50 V, ±20 V		
	Signal frequency	**Accuracy**	
Input Accuracy[21]	DC	±0.03% of reading ±0.02% of range ±0.04V	
	Up to 1kHz	±0.03% of reading ±0.02% of range	
	Up to 10 kHz	±0.1% of reading ±0.05% of range	
	Up to 100 kHz	±2% of reading ±0.1% of range	
	Up to 1000 kHz	±5% of reading ±0.5% of range	
Typ. SNR	1600 Volt	400 Volt	100 Volt
BW: 2 MHz	83 dB	79 dB	71 dB
BW: 100 kHz	85 dB	85 dB	82 dB
BW: 10 kHz	100 dB	97 dB	90 dB
Typ. CMR @ 50Hz (1kHz)	85 dB @ 50 Hz; 75 dB @ 400 Hz; 50 dB @ 10 kHz		
Gain Drift	Typical 10 ppm/K, max. 40 ppm/K		
Offset Drift	Typical 1 mV/K + 1 ppm of range/K, max 2 mV/K + 5 ppm of range/K		
Gain Linearity	<0.02%		
Channel Cross talk	115 dB @ 50Hz; 90 dB @ 1kHz		
Input Coupling	DC		
Input Impedance	10 MΩ || 2pF		
Protection class	CAT III 600 V; CAT II 1000 V		
Over-voltage Protection	In+ to In-: 1.8 kV_{RMS}, Inx to GND: 1.4kV_{RMS}		
Digital low pass Filter			
Filter characteristic	Butterworth or Bessel		
Filter order	2nd, 4th, 6th or 8th		
Ratio Sample rate to Filter Freq.	From 2 to 1000		
Topology	Cascaded IIR Filter (up to 4 sections)		
Additional Specifications			
Input connector	Banana		
TEDS support	NA		

Table 36: SIRIUS-HS-HV specifications

21 50 V Range (1.2 MHz) and 20 V range (700 kHz) have limited bandwidth

5.19.2 HS-HV Banana

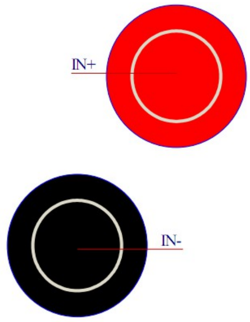


Illustration 167: SIRIUS-HS-HV pin-out Banana plug

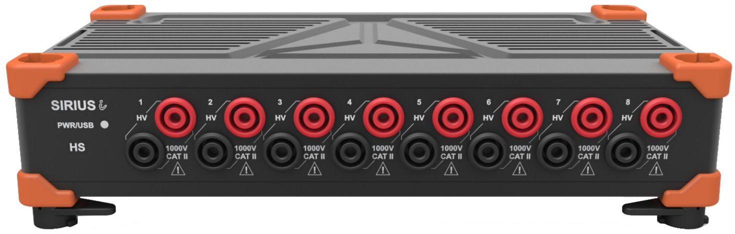


Illustration 168: SIRIUSi8xHS-HV-BAN

5.19.2.1 HS-HV: Voltage

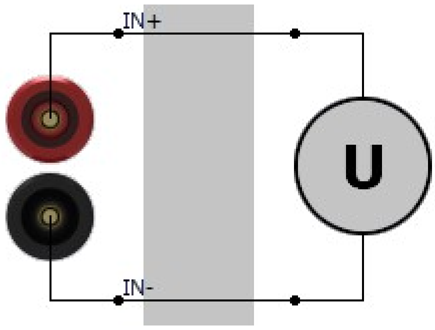


Illustration 169: HS-HV Voltage

5.20 HS-LV / HS-LV+

5.20.1 HS-LVv2 Specifications

Inputs	Voltage, current (ext. Shunt)			
ADC Type	16bit SAR with 100kHz 5^{th} order analogue AAF filter or bypass (5.2.3 SIRIUS®-HS series: High speed and bandwidth page 66)			
Sampling Rate	Simultaneous 1MS/sec			
Analogue bandwidth[1]	1 MHz			
Voltage ranges	11 ranges: ±100, 50, 20, 10, 5, 2, 1, 0.5, 0.2, 0.1 and 0.05 Volt			
Input Accuracy	Signal frequency	Accuracy		
	DC	±0.03% of reading ±0.02% of range ±100 µV (2mV for Ranges ≥ 10Volt)		
	Up to 1 kHz	±0.03% of reading ±0.02% of range		
	Up to 10 kHz	±0.1% of reading ±0.05% of range		
	Up to 100 kHz	±2% of reading ±0.1% of range		
Offset accuracy after Balance Amplifier	Range < 10 V: ±0.002% of range ±3 µV; Range ≥ 10 V: ±0.005% of range			
Typ. SNR	100 Volt	5 Volt	0.5 Volt	0.05 Volt
BW: 1 MHz	85 dB	86 dB	78 dB	59 dB
BW: 100 kHz	88 dB	88 dB	87 dB	76 dB
BW: 10 kHz	> 100dB	> 100dB	95 dB	86 dB
Typ. CMR	100 Volt	5 Volt	0.5 Volt	0.05 Volt
50 Hz	70 dB	88 dB	102 dB	102 dB
400 Hz	70 dB	86 dB	100 dB	100 dB
10 kHz	55 dB	70 dB	80 dB	80 dB
Gain Drift	Typical 10 ppm/K, max. 30 ppm/K			
Offset Drift	Typical 0.3 µV/K + 5 ppm of range/K, max 2 µV/K + 10 ppm of range/K			
Gain Linearity	<0.02%			
Inter channel phase mismatch	0.02° * fin [kHz] + 0.1° (5 V Range)			
Channel Cross talk	Range < 10 V: 120 dB @ 10kHz; Range ≥ 10 V: 95 dB @ 10kHz			
Input Coupling[2]	DC, AC 1 Hz (3 Hz, 10 Hz per SW)			
Input Impedance	Range < 10 V: 10 MΩ; Range ≥ 10 V: 1 MΩ || 110pF between INx to GND			
Max. Common Mode Voltage	Isolated version: ±500 V Differential version: Ranges ≥ 10Volt: ±100 V; all other Ranges: ±12 V			
Overvoltage Protection	Range < 10 V: 100V (200 V peak for 10msec); Range ≥ 10 V: 300 V cont.			
Digital low pass Filter				
Filter characteristic	Butterworth, Bessel or Chebyshev			
Filter order	2^{nd}, 4^{th} or 8^{th}			
Ratio Sample rate to Filter Freq.	From 2 to 1000			
Topology	Cascaded IIR Filter (up to 4 sections)			
Excitation Voltage	Unipolar or Bipolar Software selectable (programmable with 16 Bit)			
Excitation Level unipolar	0 .. 24 Volt; Predefined levels: 1, 2.5, 5, 10, 12, 15, 20 and 24 V_{DC}			
Exication Level bipolar	2 .. 30 Volt; Predefined levels: 2.5, 5, 10, 12, 15, 24 and 30 VDC			
Accuracy	±0.1 % ±5 mV			
Drift	±50 ppm/K ±100 µV/K			
Stability 10% to 90% load (bipolar)	<0.01%			
Current limit	200mA (2 Watt max. per Channel, 12 Watt max. per Slice)			
Protection	Continuous short to ground			
Input short, Sensor offset adjust	Software selectable			
Counters (only on HS-LV+ type)	1 counter/3 digital input, fully synchronised and alarm output			
Counter modes	counting, waveform timing, encoder, tacho, gear tooth sensor			
General Counter Specifications	See 5.6.1 General Counter Specifications on page 72			
Additional Specifications				
Input connector	DSUB 9, Banana, BNC (others on request)			
TEDS support	Standard + DSI® adapters			

Table 37: SIRIUS-HS-LV specifications

1 Bandwidth of ranges ≤0.2 Volt is limited to 800 kHz
2 In- must be within ±10V referred to GND(iso); for Ranges ≥ 10 V the DC value of In- is not rejected

5.20.2 HS-LV+ (Counter) L1B7f

As an additional function to the LV module, the LV+ module also has a 7-pin Lemo connector for digital counters.

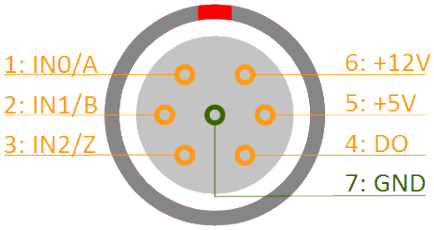


Illustration 170: CNT: counter pin-out (LEMO 7pin)

Illustration 171: SIRIUSi8xHS-LV+

Connector type	L1B7f Connector on the module: `EGG.1B.307.CLL` Mating cable connector: `FGG.1B.307.CLAD52`

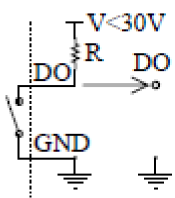
Table 38: HS-LV+ counter connector type

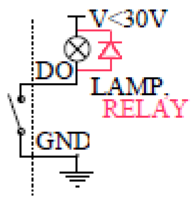
WARNING

GND of the counter input is connected to the GND of the analogue channel.

Digital Output Configuration

The "switch" of the open collector output is closed when active.





5.20.3 HS-LV BAN

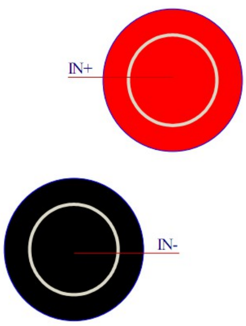


Illustration 172: SIRIUS-HS-LV pin-out Banana plug

Illustration 173: SIRIUSi8xHS-LV-BAN

5.20.4 HS-LV BNC

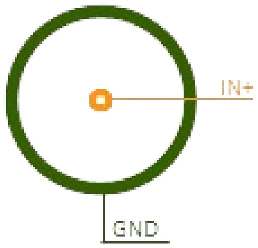


Illustration 174: SIRIUS-HS-LV: pin-out (BNC)

Illustration 175: SIRIUSi 8xHS-LV-BNC

5.20.5 HS-LV DSUB-9

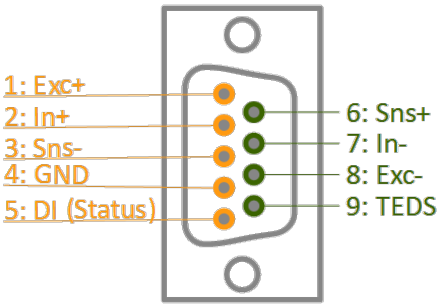


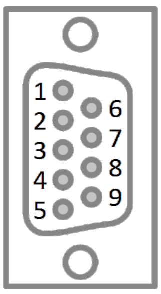
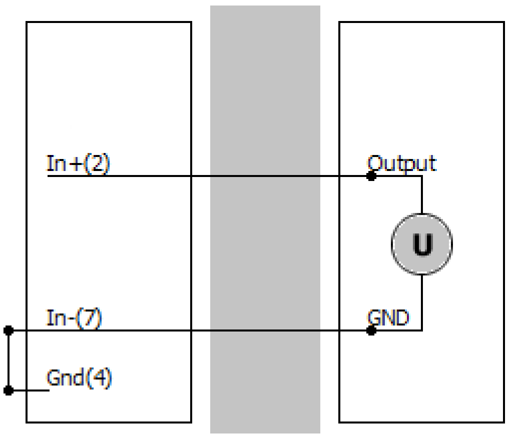
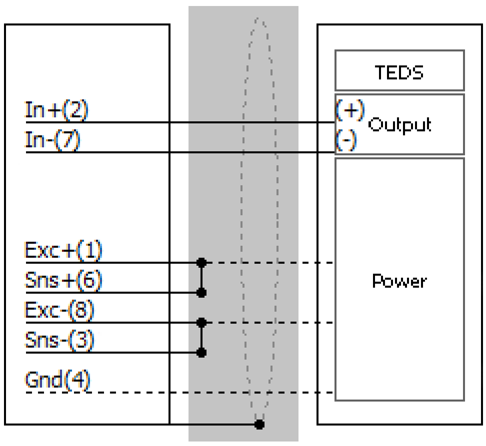
Illustration 176: SIRIUS-HS-LV pin-out DSUB-9

Illustration 177: SIRIUSi 8xHS-LV DSUB9

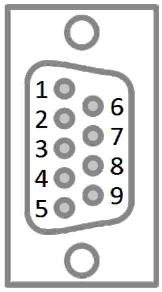
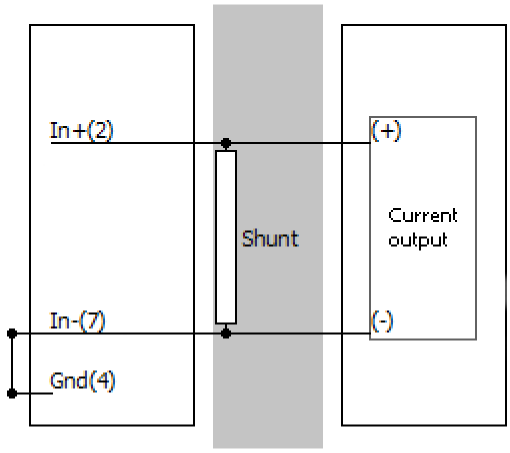
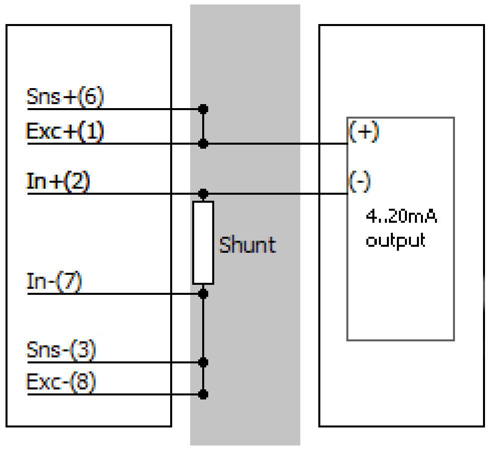
Digital Status Input

Pin 5 *DI (Status)* can be used for digital status input: i.e. show alarm status in DEWESoft® when a current clamp is open.

5.20.5.1 HS-LV DSUB-9: Voltage

	Voltage - Single Ended	**Voltage – Differential** Use only when the sensor is powered by the excitation voltage of the module.
		

5.20.5.2 HS-LV DSUB-9: Current

	External Direct Shunt	External Loop Powered Shunt
		

5.21 HS-STG / HS-STG+

5.21.1 HS-STG Specifications

Inputs	Voltage, full bridge strain, half bridge strain, quarter bridge strain (120Ω and 350Ω), current (ext. Shunt), resistance, temperature			
ADC Type	16bit SAR with 100kHz 5^{th} order analogue AAF filter or bypass (5.2.3 SIRIUS®-HS series: High speed and bandwidth page 66)			
Sampling Rate	Simultaneous 1MS/sec			
Analogue bandwidth[22]	1 MHz			
Voltage ranges	11 ranges: ±50, 20, 10, 5, 2, 1, 0.4, 0.2, 0.1, 0.04 and 0.02 Volt			
Input Accuracy	Signal frequency	Accuracy		
	DC	Range < 10 V: ±0.03% of reading ±0.04% of range ±10µV Range ≥ 10 V: ±0.05% of reading ±0.01% of range ±5 mV		
	Up to 1 kHz	±0.03% of reading ±0.02 of range		
	Up to 10 kHz	±0.1% of reading ±0.05% of range		
	Up to 100 kHz	±2% of reading ±0.1% of range		
	Up to 500 kHz	±10% of reading ±0.5% of range		
Offset accuracy after Balance Amplifier	Range < 10 V: ±0.002% of range ±3 µV; Range ≥ 10 V: Not performed			
Typ. SNR	50 Volt	5 Volt	0.2 Volt	0.02 Volt
BW: 1 MHz	87 dB	88 dB	81 dB	63 dB
BW: 100 kHz	88 dB	88 dB	85 dB	74 dB
BW: 10 kHz	>100 dB	>100 dB	94 dB	84 dB
Typ. CMR	50 Volt	5 Volt	0.2 Volt	0.02 Volt
50 Hz	70 dB	88 dB	102 dB	102 dB
400 Hz	70 dB	86 dB	100 dB	100 dB
10 kHz	55 dB	70 dB	80 dB	80 dB
Gain Drift	Typical 10 ppm/K, max. 30 ppm/K			
Offset Drift	typical 0.3 µV/K + 15 ppm of range/K, max 2 µV/K + 40 ppm of range/K			
Gain Linearity	<0.02%			
Inter channel phase mismatch	0.02° * fin [kHz] + 0.1° (5 V Range)			
Channel Cross talk	Range < 10 V: 120 dB @ 10kHz; Range ≥ 10 V: 95 dB @ 10kHz			
Input Coupling[23]	DC, AC 1 Hz (3 Hz, 10 Hz per SW)			
Input Impedance	Range < 10 V: 10 MΩ; Range ≥ 10 V: 1 MΩ between INx to GND			
Max. common mode voltage	Isolated version: ±500 V Differential version: Ranges ≥ 10Volt: ±60 V; all other Ranges: ±12 V			
Over voltage Protection	Range < 10 V: 100V (200 V peak for 10msec); Range ≥ 10 V: 300 V cont.			
Digital low pass Filter				
Filter characteristic	Butterworth, Bessel or Chebyshev			
Filter order	2^{nd}, 4^{th} or 8^{th}			
Ratio Sample rate to Filter Freq.	From 2 to 1000			
Topology	Cascaded IIR Filter (up to 4 sections)			
Excitation Voltage	Free programmable (16 Bit DAC)			
Predefined levels	0, 1, 2.5, 5, 10, 15 and 20 V_{DC}			
Accuracy	±0.05 % ±2 mV			
Drift	±10 ppm/K ±100 µV/K			
Load stability 0% to 100% load	<0.01%			
Line regulation over 20Ω of change	< 0.005% @ 120Ω load			
Noise @ 10 Volt / 350 Ω	< 200 μV_{rms}@10 kHz BW			
Sense Impedance to Exc / to GND	100 kΩ / 100MΩ			
Current limit	100mA (max. 800mW)			
Protection	Continuous short to ground			
Input short, Sensor offset adjust	Software selectable			

22 Bandwidth of ranges ≤0.2 Volt is limited to 800 kHz
23 In- must be within ±10V referred to GND(iso); for Ranges ≥ 10V the DC value of In- is not rejected

Excitation Current	Free programmable (16 Bit DAC)
Predefined levels	0.1, 1, 2, 5, 10, 20 and 60 mA_{DC}
Accuracy (> 10mA)	0.1% ±2µA [0.5% ±50 µA]
Drift (> 10mA)	15 ppm/K [100 ppm/K]
Compliance voltage	20 Volt, max. 300 mW
Output Impedance	>1 MΩ
Bridge Connection Types	full bridge, ½ bridge and ¼ bridge (3- or 4-wire)
Ranges	2 mV/V…1000 mV/V free programmable
Internal Bridge Completion	½ bridge and ¼ bridge 120Ω and 350Ω
Bridge Completion Accuracy	0.05 %; TCR: 5 ppm/K (others on request)
Internal Shunt Resistor	59.88 kΩ and 175 kΩ, bipolar (to +Exc and -Exc)
Typ. Shunt Resistor Accuracy	0.05 %; TCR: 10 ppm/K (others on request)
Sensor Balance Range	220% of Range (70% for input Range ≥ 5Volt)
Input Short, Sensor Offset Adjust	Software selectable
Counters (only on HS-STG+ type)	1 counter/3 digital input, fully synchronised and alarm output
Counter modes	counting, waveform timing, encoder, tacho, gear-tooth sensor
General Counter Specifications	See 5.6.1 General Counter Specifications on page 72
Additional Specifications	
Input connector	DSUB 9 (others on request)
TEDS support	Standard + DSI® adapters

Table 39: SIRIUS-HS-STG specifications

5.21.2 HS-STG+ (Counter) L1B7f

As an additional function to the ACC module, the ACC+ module also has a 7-pin Lemo connector for digital counters.

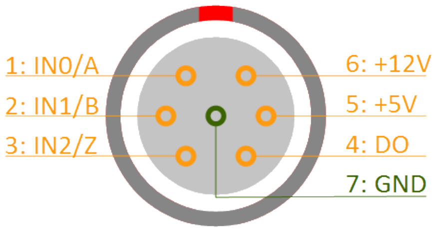


Illustration 178: CNT: counter pin-out (LEMO 7pin)

Illustration 179: SIRIUSi8xHS-STG+

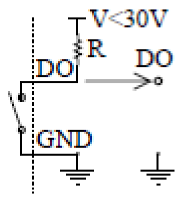
Connector type	L1B7f Connector on the module: *EGG.1B.307.CLL* Mating cable connector: *FGG.1B.307.CLAD52*

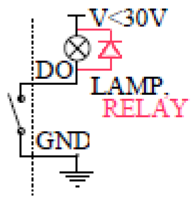
Table 40: HS-STG+ counter connector type

WARNING	GND of the counter input is connected to the GND of the analogue channel.

Digital Output Configuration

The "switch" of the open collector output is closed when active.





5.21.3 HS-STG: Sensor connection

To minimize electromagnetic influence, it is recommended to use twisted pair cables. The shield of the cable should be connected to GND_{iso} on pin 4 of the DB9 connector.

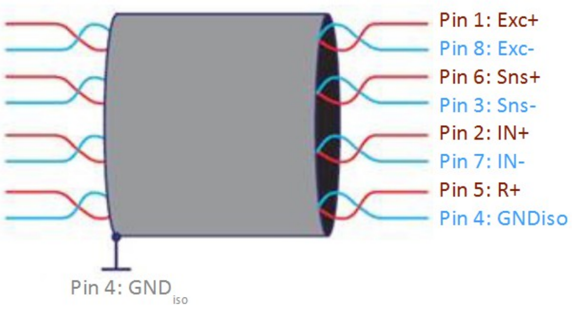


Illustration 180: HS-STG Sensor connection

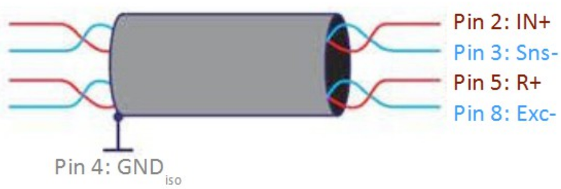


Illustration 181: HS-STG Sensor ¼ Bridge connection

HINT

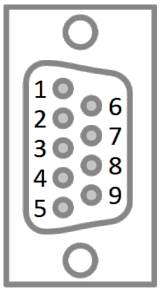
When your application requires a bandwidth ≥ 100kHz, it is recommended to use external bridge completion. This will fully symmetrical system configuration will guarantee the best possible noise reduction.

5.21.4 HS-STG DSUB-9

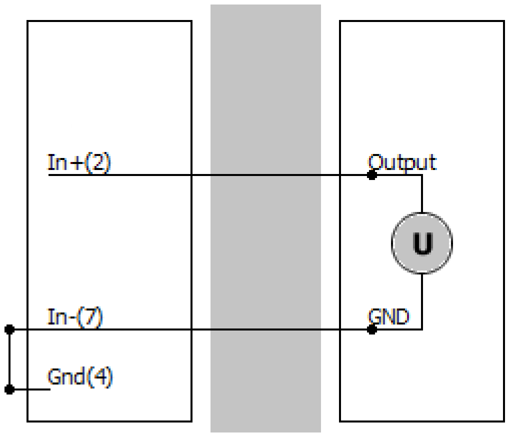
Illustration 182: SIRIUS-HS-STG pin-out DSUB-9

Illustration 183: SIRIUSi HS-STG DSUB9

5.21.4.1 HS-STG DSUB-9: Voltage

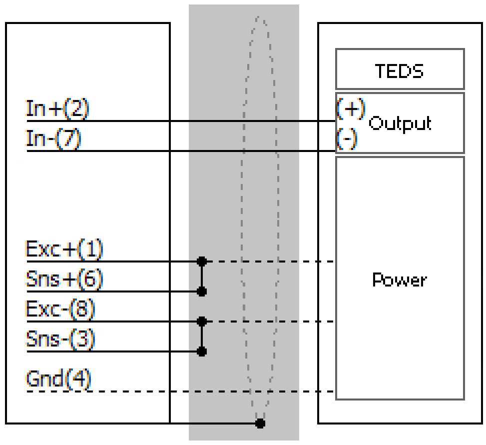


Voltage - Single Ended

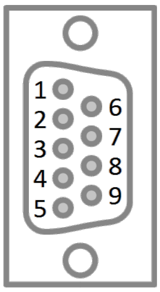


Voltage – Differential

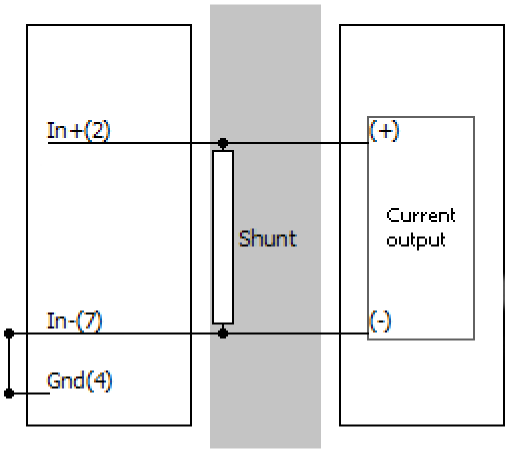
Use only when the sensor is powered by the excitation voltage of the module.



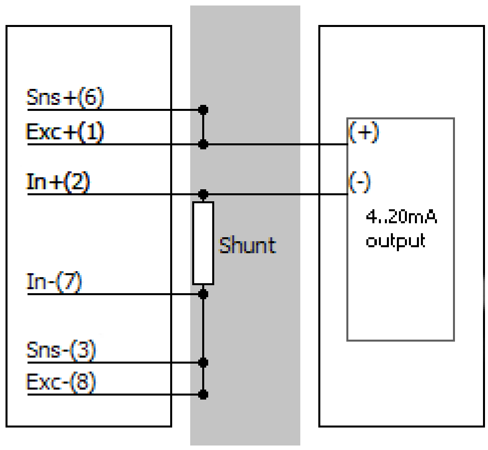
5.21.4.2 HS-STG DSUB-9: Current



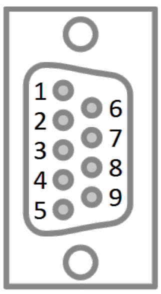
External Direct Shunt

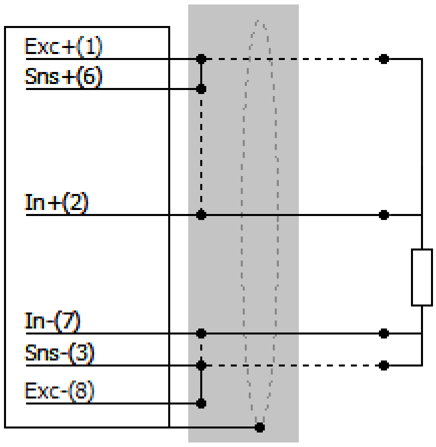


External Loop Powered Shunt

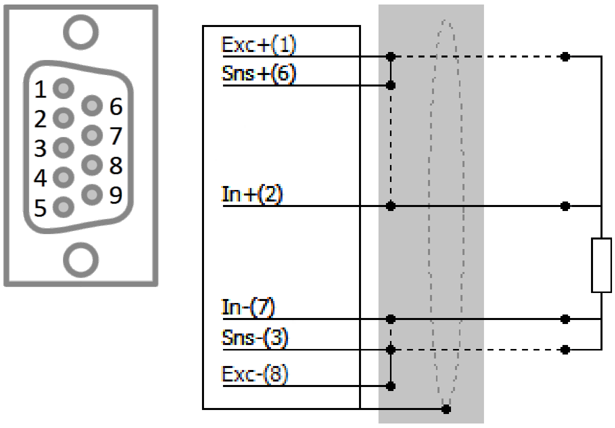


5.21.4.3 HS-STG DSUB-9: Temperature

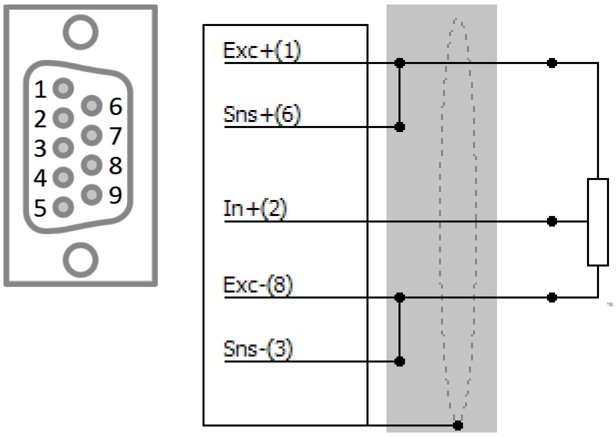




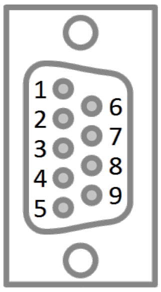
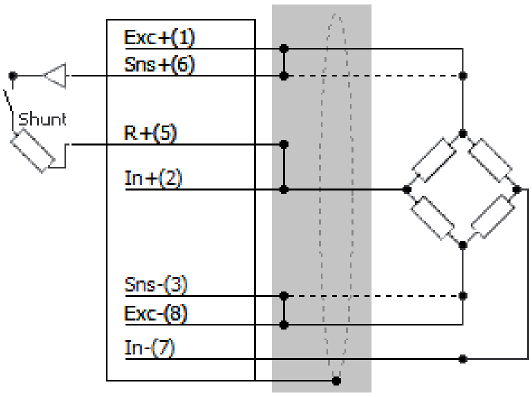
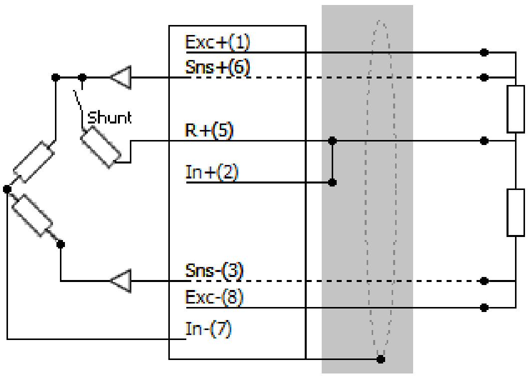
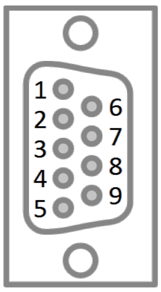
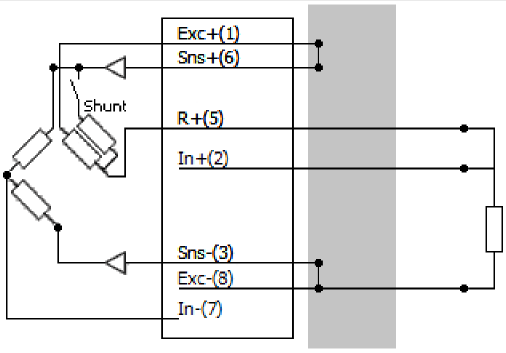
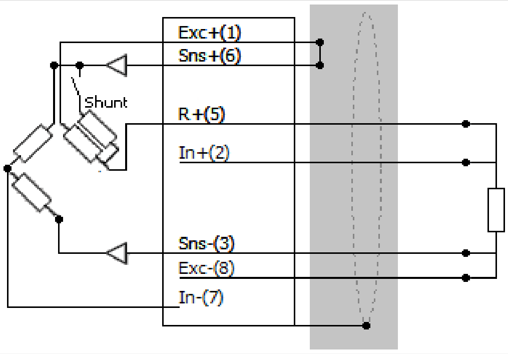
5.21.4.4 HS-STG DSUB-9: Res.



5.21.4.5 HS-STG DSUB-9: Poti



5.21.4.6 HS-STG DSUB-9: Bridge

	Full Bridge	Half Bridge
		
	Quarter Bridge – 3 wire	**Quarter Bridge – 4 wire**
		

5.22 Analogue out OPTION

The analogue output option adds 8 analogue output channels (BNC connectors) to the Sirius® slices and supports 4 different operation modes:

- Standalone digital signal conditioner
- Function Generator (Modal/Shaker control)
- File replay to analogue
- Channel Output

Illustration 184: Rear side connectors of the Analogue-out version

Notes:

- The analogue output options are only available on the USB Sirius® slices.
- The SIRIUS-HD slices do not support signal conditioning.
- The *Multi* modules (see 5.11 MULTI on page 84) have the analogue out channels per default on the front-side connectors. When you order a *Multi* module with additional Analogue out OPTION, the front-side analogue out will NOT be connected – only the analogue out of the rear BNC connectors.

5.22.1 Analogue out: Specifications

Outputs	Voltage		
DAC Type	24bit delta-sigma		
Sampling Rate	Simultaneous 200kS/sec		
Number Of Channels	8		
Function	File replay, conditioned AI output, FGEN (software option), channel output		
Specifications			
Full Scale	±10 V		
Analogue out bandwidth	40 kHz		
Accuracy	±0.1% of reading ±0.02 V		
Temperature Drift	±50 ppm/K of reading ±200 µV/K		
Output configuration	Single Ended		
SNR @ 50 (200) kS/s output rate	95 dB (86 dB) @ 100 kHz Bandwidth		
Inter channel phase mismatch	0.1° * f_{out} [kHz] + 0.1°		
THD	< -90 dB @ 1 kHz, 10 $V_{peak-peak}$		
Output Impedance	<1 Ω		
Maximum Output Current	20 mA		
Maximum load	> 1000Ω		
Output Protection	Continuous short to ground		
Signal Delay	**100S/s…50kS/s**	**50kS/s…100kS/s**	**100kS/s…200kS/s**
Signal conditioning mode[24]	14 Samples + 50µs	19 Samples + 2µs	12 Samples + 35µs
Additional Specifications			
Output connector	BNC		

Table 41: Analogue out specifications

24 SIRIUS-HD series does not support signal conditioning

5.22.1.1 Output oversampling

The analogue output channels use a special oversampling technology to produce accurate output results.
Illustration 185 shows the output of a standard measurement system (green signal) in comparison to the oversampled output of a Sirius® system (red signal). You can see that the Sirius® output looks like it was sampled with 1MHz, although the real sampling rate of the output signal is only 200kHz.

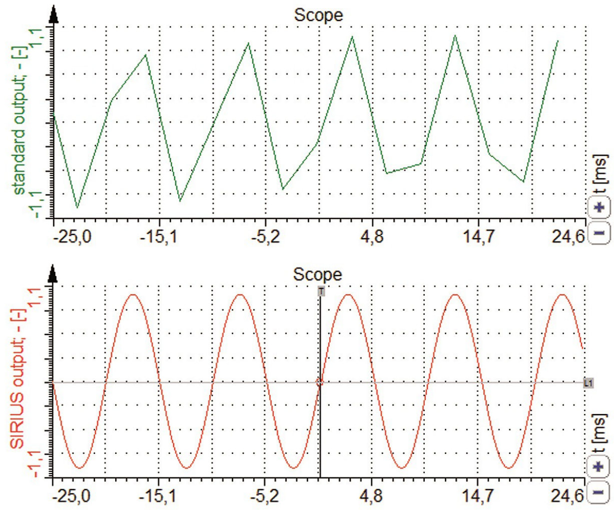


Illustration 185: Output oversampling

5.22.2 Standalone digital signal conditioner

In this mode, you use DEWESoft® to do the configuration once and then you can use the Sirius® slice a pure, standalone signal conditioner. Just connect the power-supply and the signal amplifier will be operational: No PC, DEWESoft® software,USB connection required. Since the signal processing is done in the SIRIUS PLC there is only a minimal delay of some 10 samples between the input and output (see 5.22.1 Analogue out: Specifications on page 139 for specific numbers).

Any physical input signal is converted to an output voltage of max. ±10 V.

Note: The SIRIUS-HD slices do not support signal conditioning.

Features:

- Input: any analogue channel
- Signal conditioning
  - Scaling
  - Offset
  - Gain
- Redundant DAQ system
  - Simple math functions
- Standalone operation possible

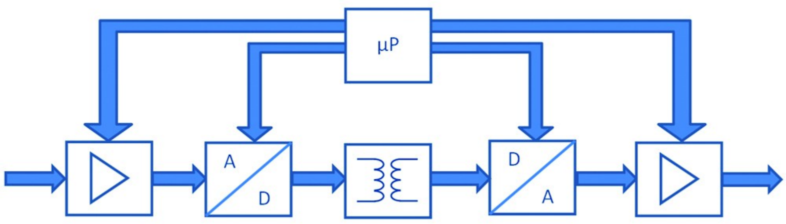


Illustration 186: Principle of Signal Conditioning

5.22.3 Function Generator (Modal/Shaker control)

The Function Generator (DEWESoft® software feature) is able to output signals like sine, triangle, rectangle, saw or even an arbitrary table. This can be done continuously or in Sweep / step sweep / burst / … and many more. Fine-tuning can be done LIVE during measurement.

First, add the Function Generator feature to your channel setup: Click the **More…** button ❶ and then select *Function Generator* ❷.

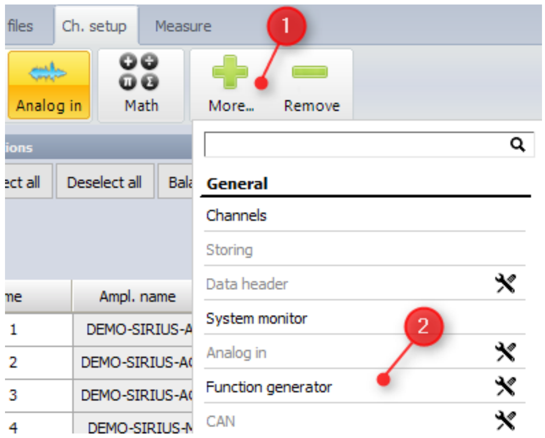


Illustration 187: Add Function generator feature

Now you will see the icon of the Function Generator feature in Channel Setup and can configure it accordingly. You can choose the *Function generator mode* ❶ and select the waveform for each channel ❷:

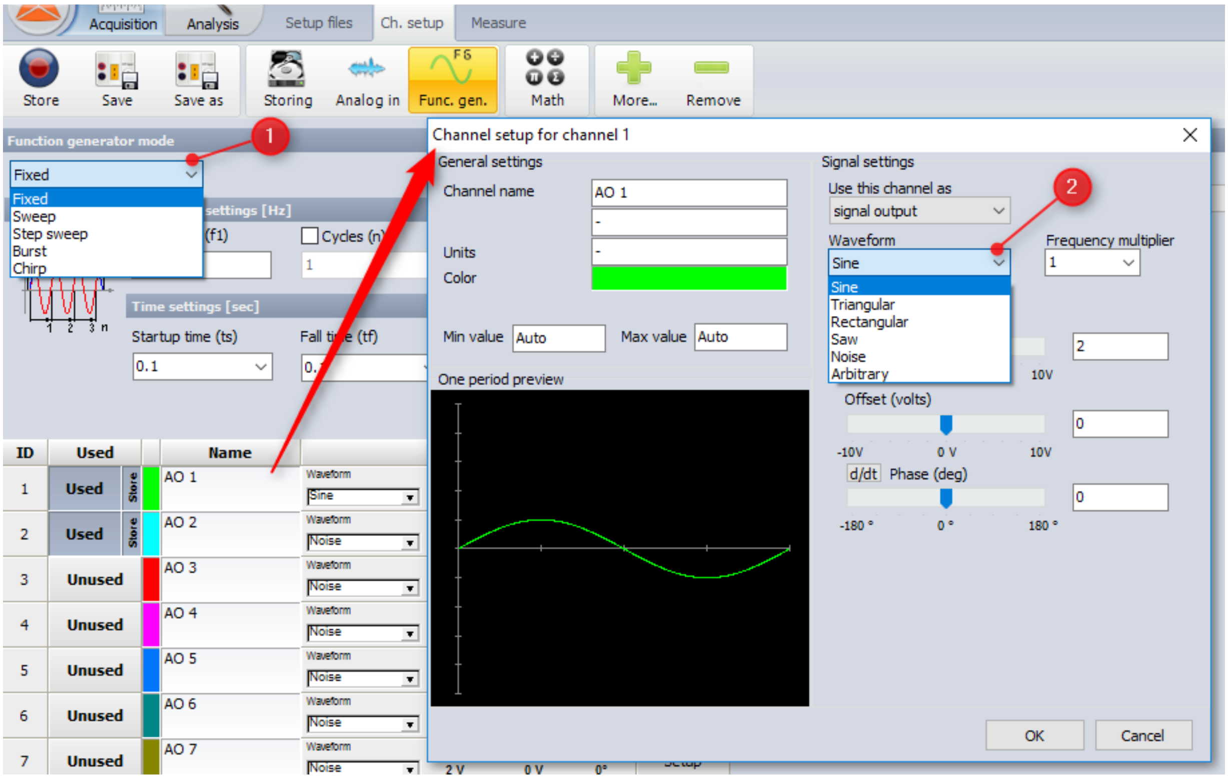


Illustration 188: Function Generator Channel Setup

When you do your measurement, you will see a new icon ❶ for the Function Generator. When you click it, you will see controls to change the Function Generator settings LIVE during measurement:

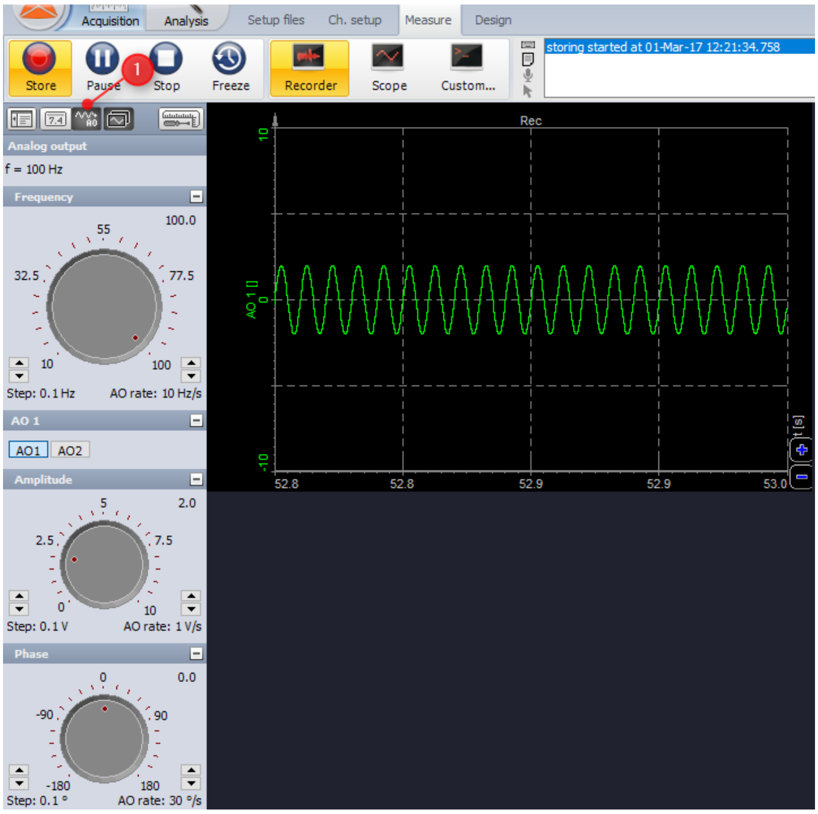


Illustration 189: Function Generator: Measurement

5.22.4 File replay to analogue

After the measurement is done, replay your data file and put out the conditioned channels on the rear side BNC connectors for post-analysis. Use SIRIUS® to feed a test-bed and simulate e.g. the vibrations during a test drive

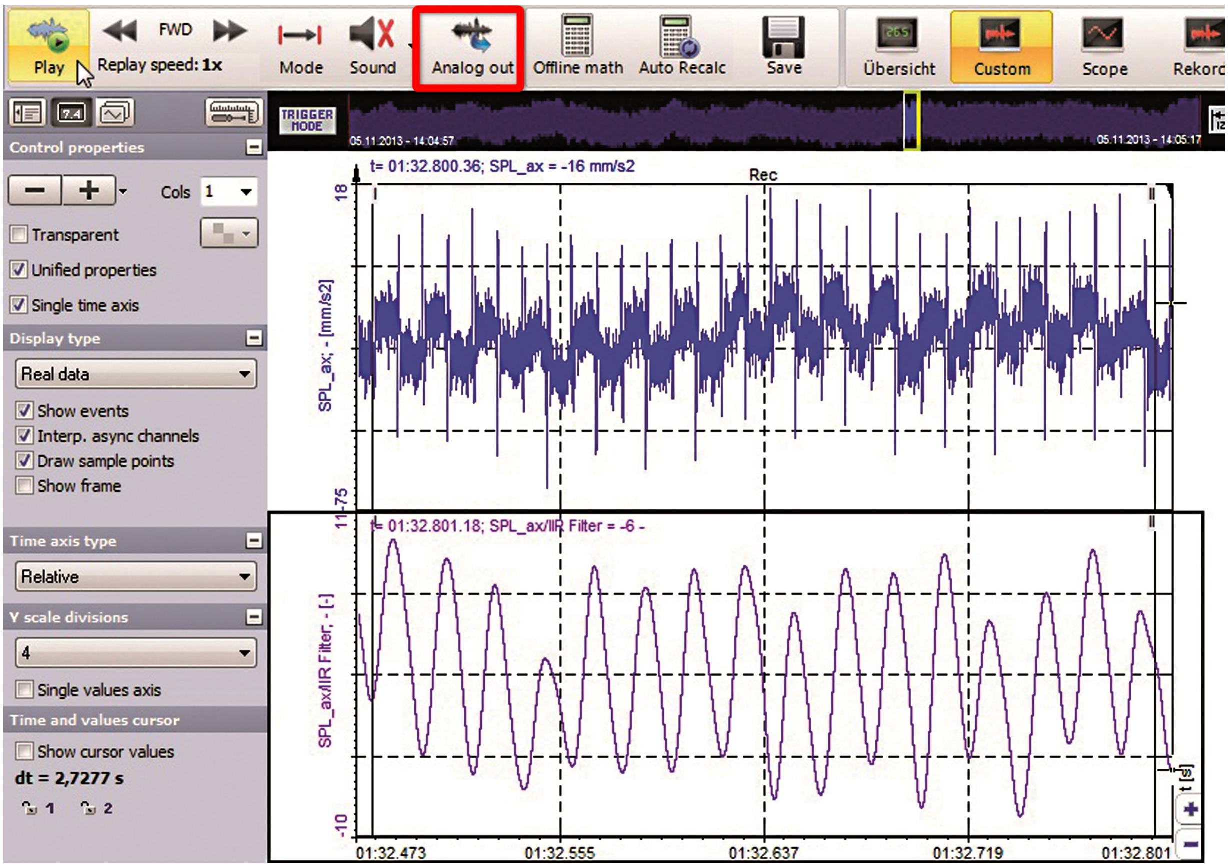


Illustration 190: Function Generator Replay

5.22.5 Channel Output

You can use DEWESoft® to output any channels to the analogue out BNC connectors. There are different ways to do that:

5.22.5.1 Manual via Input Controls

You can use Input control displays to manually change the values of the analogue out channels during measurement. In Design mode, drag&drop a new Input control display to the measurement screen. The default display type is Input field: you can enter a numeric value in the field and press enter to change the analogue output value. You can change the display type via the drop-down-list ❶.

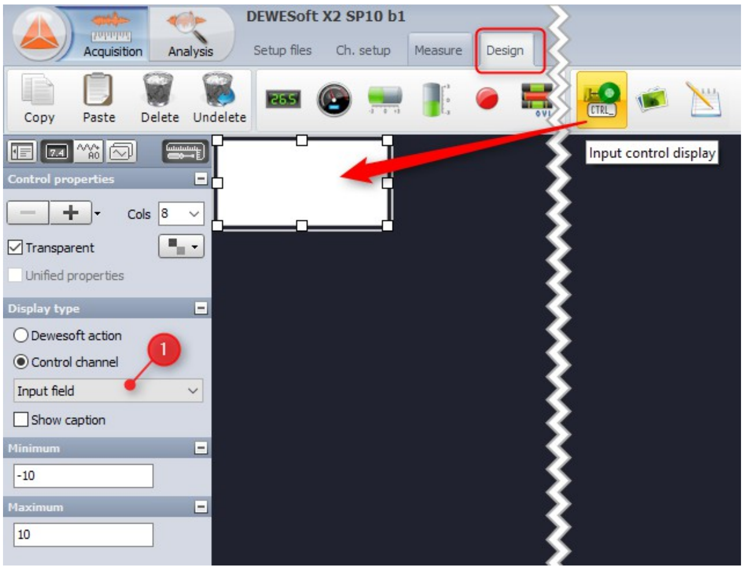


Illustration 191: Add Input control display

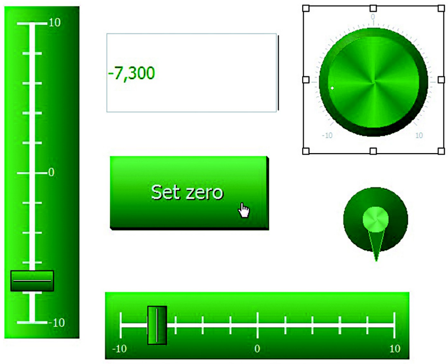


Illustration 192: Display Types

5.22.5.2 Asynchronous output mode

First, add the *Analog/digital out* feature to your channel setup:
Click the **More…** button ❶ and then select *Analog/digital out* ❷.

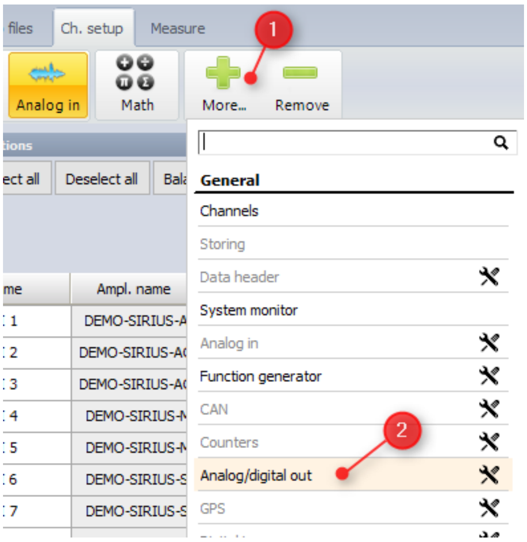


Illustration 193: Add Analog/digital out feature

Then, select *Value type* to *From channel* ❶ and now you can select the a DEWESoft® channel from the drop-down ❷ which will be used as input for the analogue output channel.

During measurement DEWESoft® will periodically write the current value of the input channel to the output channel: except a delay of some ten milliseconds.

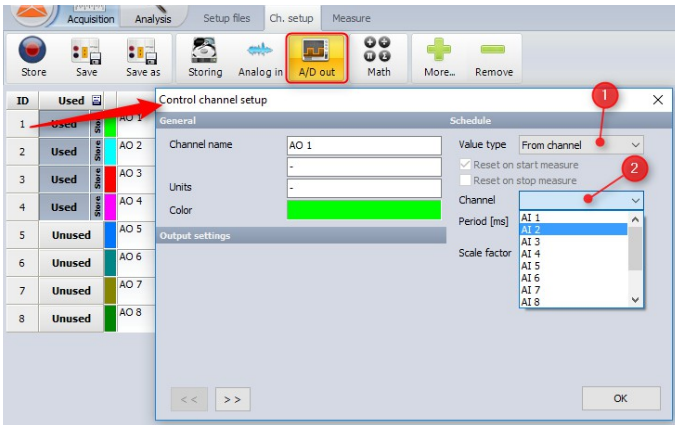


Illustration 194: Analog/digital out Ch. Setup

5.22.5.3 Synchronous output mode

First, add the Function Generator feature to your channel setup:
Click the **More…** button ❶ and then select *Function Generator* ❷.

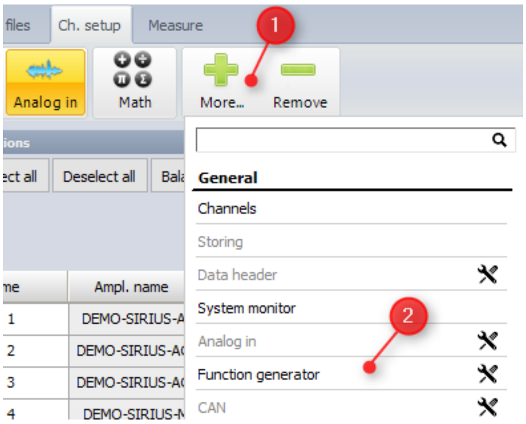


Illustration 195: Add Function generator feature

In the Function Generator Channel Setup, select *channel output* mode ❶ and now you can select a synchronous DEWESoft® channels as input ❷.

During measurement DEWESoft® will keep a short buffer of the input channel and then write the buffer to the output channel: i.e. the output channel will be delayed by about 1 second.

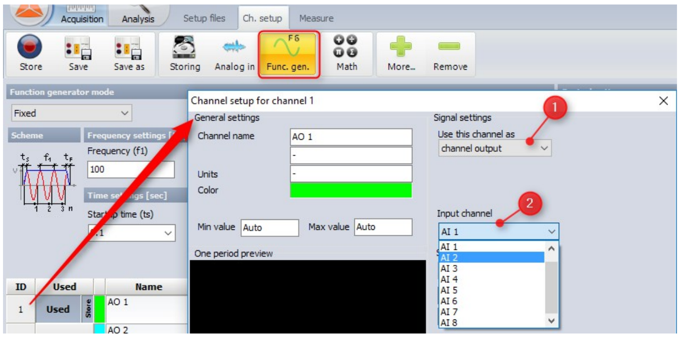


Illustration 196: Function generator: Channel output

6 Measurement

This chapter covers topics that you should be aware of when doing your measurement with Sirius®.

6.1 Filtering

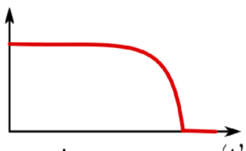
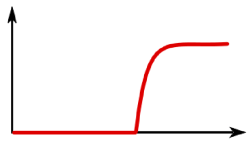
This chapter covers the filtering capabilities of the Sirius® measurement modules and of the DEWESoft® measurement software.

6.1.1 Filtering Glossary

This chapter describes some important terms related to filtering.

6.1.1.1 Frequency response

The frequency response of a filter can be classified into a number of different band-forms describing which frequency bands the filter passes (the passband) and which it rejects (the stop-band). To discuss the Sirius® filtering, we only need to consider 2 types frequency response:

Low pass filter	**High pass filter**
Low frequencies can pass, high frequencies are attenuated.	High frequencies can pass, low frequencies are attenuated.
	

6.1.1.2 Bandwidth

Bandwidth is the difference between the upper and lower frequencies in a continuous set of frequencies. It is typically measured in hertz, and refers to the baseband bandwidth in the context of this chapter: In the case of a low-pass filter or baseband signal, the bandwidth is equal to its upper cut-off frequency.
The practically useful definition that we use, is that the Bandwidth will refer to the frequencies beyond which frequency response is small (3 dB).

The diagram in Illustration 197 shows the definition of bandwidth (*B*) for a bandpass filter. f_0 is the centre frequency, f_H is the higher cut-off frequency, and f_L is the lower cut-off frequency. The *0 dB* level is the level of the peak of the bandpass response, which is not necessarily located at the centre frequency. Also the centre frequency is located at either the arithmetic or geometric mean of the upper and lower cut-offs depending on context and conventions.

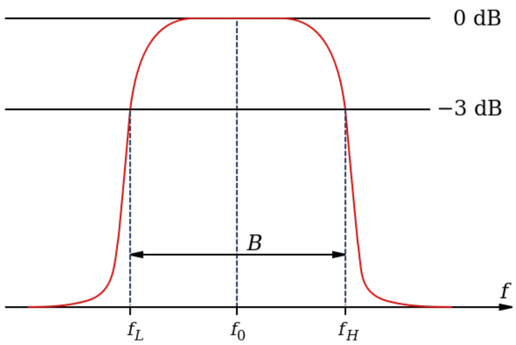


Illustration 197: Bandwidth[25]

25 Image Source. https://en.wikipedia.org/wiki/File:Bandwidth_2.svg

6.1.1.3 Filter Order

An ideal filter has full transmission in the pass band, complete attenuation in the stop band, and an abrupt transition between the two bands. In practice an ideal filter is not possible and can only be approached to a certain degree. The higher the *filter order*, the more the filter will approach the *ideal* filter; but this also means that the impulse response will be longer and that the latency will increase.

In Illustration 198 unten you can see 3 analogue filters (2nd, 4th and 8th order) and the Sirius® filter (which is a combination of analogue filter, oversampling and digital filter). Note, that filters with higher order have a sharper damping around the filter frequency:

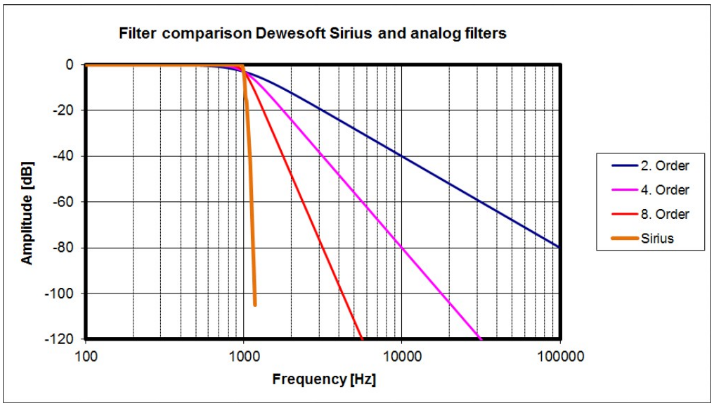


Illustration 198: Filter order

6.1.1.4 Aliasing

In signal processing, aliasing is an effect that causes different signals to become indistinguishable (or aliases of one another) when sampled.

When signals are sampled (see also 8.2.1.1 Sampling on page 163), the sampling frequency must be at least twice as high as the maximum frequency of the signal to avoid errors: this is called Nyquist theorem (Aliasing effect).

Illustration 199 below shows an example of aliasing. The red sine wave is the original signal, that we want to measure. But our sampling frequency is too low (the sampling points are shown as black lollipops). When we now reconstruct the sine wave by interpolating the sampled points, we get the blue signal, which is also a sine-wave, but has the wrong frequency!

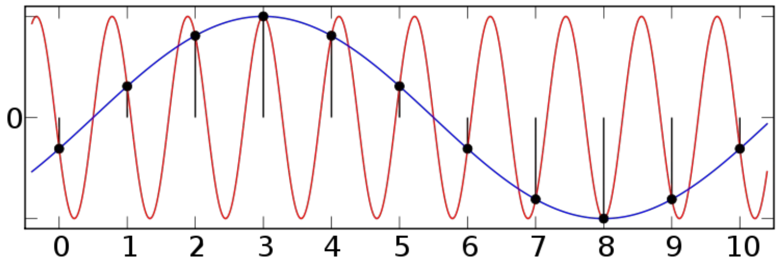


Illustration 199: Aliasing[26]

Real world measurement signal are hardly ever pure sine waves and can thus have many components (harmonics) above the Nyquist frequency. These harmonics are erroneously aliased back to the baseband and thus added to parts of the accurately sampled signal which produces a distorted measurement signal. Filtering can be used to block frequencies above the Nyquist bandwidth (which is half of the sample rate), to get correct measurement results.

26 Image Source: https://en.wikipedia.org/wiki/File:AliasingSines.svg

HINT

To get a better understanding of the aliasing effect, we recommend to take the DEWESoft® PRO training course: *Spectral analysis using the FFT*:
http://www.dewesoft.com/pro/course/spectral-analysis-using-the-fft-29
Our professional online training courses are available free of charge to registered users of our homepage.

Anti-aliasing

To avoid aliasing, we must cut all frequencies that are higher than half of the sample rate. But on the other hand, we do not want to damp the amplitude of the signal below the Nyquist frequency. To meet both goals, we need a filter (in this context called: anti-aliasing filter) with sharp damping at half of the sampling rate (which requires a high order filter).

6.1.1.5 Aliasing-free Bandwidth

In the previous chapters we have learned, that an ideal filter with infinitely sharp filter characteristics is not possible in real-world applications.
The frequency response in Illustration 200 unten shows the bandwidth (-3dB point) at about half of the sampling rate (Nyquist criteria). All frequencies higher than the Nyquist frequency will be folded back. But the frequencies above the Filter Stop-band are already attenuated so much, that they are negligible. Thus, the only guarantee that can be made, is that all frequencies in the aliasing free bandwidth are correct.

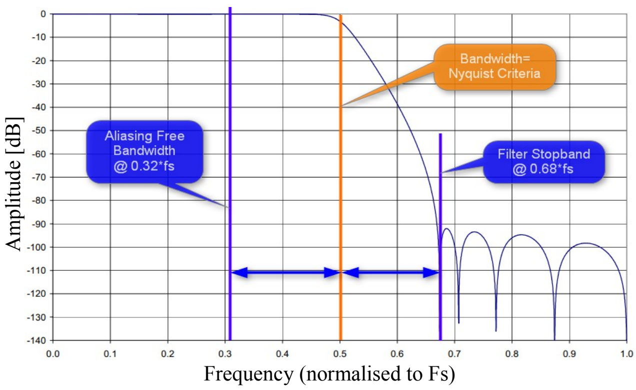


Illustration 200: Bandwidth vs. Aliasing-free Bandwidth

Illustration 200 oben shows the filter characteristics relative to the sample rate. To make it easier to understand, let's make an example with some concrete values. Let's assume a sampling rate of 1kS/sec. The bandwidth of this low-pass filter is at 500kHz. All input frequencies between 500Hz and 680Hz (=0.68*1kHz) can be folded back to the 320Hz to 500Hz range. All input frequencies higher than 680Hz are rejected by the filter anyway and can be ignored. Thus, the aliasing free bandwidth is 320Hz (since the range of 320Hz and 500 can already be due to the aliasing effect).

6.1.1.6 Filter technologies

Different technologies can be used to realise a filter. In this context we only need to consider two technologies: analogue and digital filters.

Analogue filters

Analogue filters are composed of passive electronics (i.e. capacitors, inductors, resistors) and operator on continuously varying signals. They can be described with linear differential equations: thus they are also called passive linear analogue electronic filters.
Good analogue filters are inherently difficult to design and even when you select all components carefully, 8th order is the best you can implement without significant inter-channel phase-mismatch.

Digital filters

A digital filter is a system that performs mathematical operations on a sampled, discrete-time signal to reduce or enhance certain aspects of that signal. In comparison to analogue filters, digital filters require complex electronics (i.e. a digital signal processor – aka. DSP) to calculate the filter-results.

There are 2 types of digital filters that will be used in the following discussion:

IIR filter

In theory the impulse response of an IIR (**I**nfinite **I**mpulse **R**esponse) filter does not become exactly zero past a certain point, but continues indefinitely. In practice, the impulse response even of IIR systems usually approaches zero and can be neglected past a certain point. IIR filters can have the same characteristics as analogue filters.

The main advantage that digital IIR filters have over FIR filters is their efficiency in implementation. A disadvantage is that linear phase is difficult to achieve.

FIR filter

A FIR (**F**inite **I**mpulse **R**esponse) filter, is a filter whose impulse response (or response to any finite length input) is of finite duration, because it settles to zero in a finite time.

An FIR filter has a number of useful properties which sometimes make it preferable to an infinite impulse response (IIR) filter. FIR filters:

- require no feedback: i.e. any rounding errors are not compounded by summed iterations
- are inherently stable: since the output is a sum of a finite number of finite multiples of the input values
- can easily be designed to be linear phase

The main disadvantage of FIR filters is that considerably more computation power is required compared to an IIR filter with similar sharpness or selectivity, especially when low frequency (relative to the sample rate) cut-offs are needed. However many DSPs (digital signal processors) provide specialized hardware features to make FIR filters approximately as efficient as IIR for many applications.

6.1.1.7 Oversampling

Oversampling means, that the sampling rate of the ADC is significantly higher, than its output rate. Oversampling improves resolution, reduces noise and helps avoid aliasing and phase distortion by relaxing anti-aliasing filter performance requirements.

EXAMPLE 1

When we want to measure a 1kHz sine-wave signal, the Nyquist theorem dictates, that we need at least a sample rate of 2kHz. When we now sample the signal with 4kHz (instead of the minimum required 2kHz), we oversample by the factor of 2.

6.1.2 Filter Design

Since ideal filtering is not possible, we need to carefully design our filters to achieve the desired results.

One important goal is that want to have a very sharp damping, so we need a high-order filter, which in turn means, that we will use a digital filter. Moreover we want to have a linear phase, so we choose a FIR filter (the performance of the DSP in Sirius® is powerful enough to handle this demanding computation).
Another important goal is to minimise errors introduced by aliasing. So the FIR filter alone will not be sufficient (since digital filters are subject to aliasing).

In the following examples, we assume that we want to measure a signal between 0 and 800Hz and we will consider how higher-frequency components in the input signal affect the measurement result.

6.1.2.1 Sampling and Digital Filter

Our first try is quite naïve: we sample the signal at 2kHz (over twice the frequency that we are interested in) and then apply a digital filter. Illustration 201 includes 3 diagrams (from top to bottom):

- *Input Signal*: e.g. the analogue signal that we input to the AD converter
- *Sampled Signal*: the output of the AD converter
- *Filtered Signal*: the output of the digital filter (the filter-input is the *Sampled Signal*)

Legend for Illustration 201:

- f_s: Sampling frequency: e.g. 2kHz
- f_n: Nyquist frequency: 1kHz
- f_f: Filter frequency: e.g. 800Hz
- f_{f2}: f_s-f_f: 1.2kHz

Sampled Signal: Since we have a sampling frequency of 2kHz all signals over 1kHz are folded back to the Nyquist band (due to aliasing) when they are sampled by the AD converter (dashed lines in Illustration 201): Thus the *Sampled Signal* will already contain the wrong signal components.
The digital filter will now attenuate all frequencies of the *Sampled Signal* (which already contains the aliased signals) that are higher than 800Hz.
Filtered Signal: Now the measurement result is wrong, because it also contains the aliased frequencies from the input signal (the red dashed line). Note, that we don't care about the aliased signal of the blue dashed line because this is still higher than 800Hz.

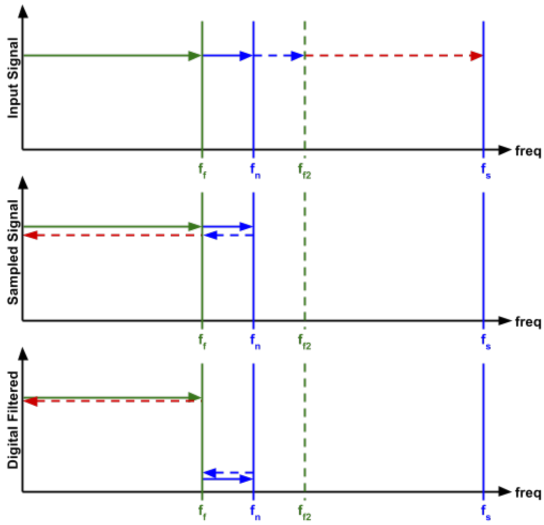


Illustration 201: Sampling and Digital Filter[27]

6.1.2.2 Oversampling and Digital Filter

Now, let us consider the effects of oversampling. Let's assume that we oversample by a factor of N=5. This means that our AD converter will now sample at a speed of 2kHz*5=10kHz and so the Nyquist frequency is 5kHz.

Legend for Illustration 202:

- f_{s*N}: Sampling frequency (oversampling): 10kHz
- f_{n*N}: Nyquist frequency: 5kHz
- f_f: Filter frequency: e.g. 800Hz
- f_{f2}: f_{s*N}-f_f: 9.2kHz

In comparison to the previous example (without oversampling), you can see that we get basically the same result – only the range of the wrong signal components (red-dashed line) is now much smaller. So oversampling somewhat improves the result, but it's still not perfect. We need to find a way to reduce the impact of the troublesome signal part (the red-dashed line).

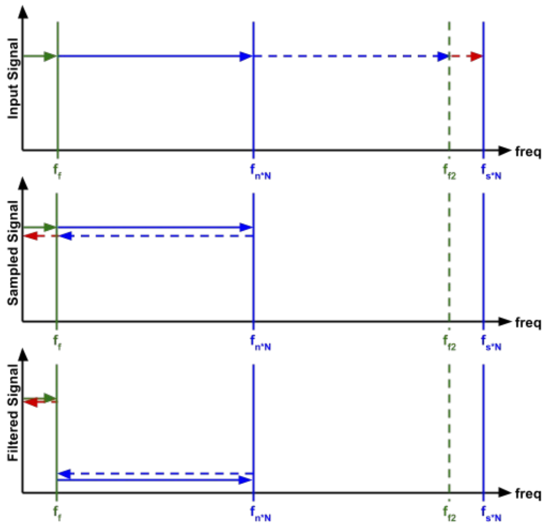


Illustration 202: Oversampling and digital filter[27]

27 Note, that some lines in the diagrams are moved a little bit up/down for readability, so that they don't overlap.

6.1.2.3 Analogue Filter, Oversampling & Digital Filter

As a final step, we now apply an analogue filter to the input signal **before** the AD converter (which uses oversampling).

Illustration 203 contains 4 diagrams – each of them shows the analogue filter curve as orange line. The 4 diagrams (from top to bottom) show:

- *Input Signal*: e.g. the analogue signal that we input to the AD converter
- *Analogue Filtered*: the output of the analogue filter
- *Sampled Signal*: the output of the AD converter
- *Digital Filtered*: the output of the digital filter (the filter-input is the *Sampled Signal*)

You can see that the analogue filter does not have a very sharp damping – but this is not required. The important thing is, that the attenuation of the analogue low-pass filter increases for higher frequencies.
Analogue filtered: The troublesome part of the input signal (red dashed line) is already highly damped before we even sample it! Also some other parts of the input signal are damped – but those parts are way higher than the frequency range, that we are interested in (f_f): so this is also not a problem.

Sampled Signal: the sampled signal shows the same folding effect as before, but this time the aliased frequencies have only very little amplitude (because of the analogue filter).

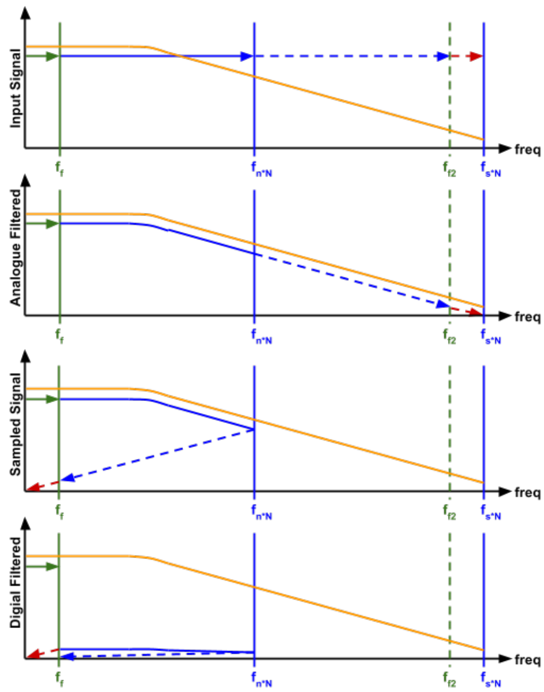


Illustration 203: *Analogue filter, oversampling and digital filter*[27]

Digital Filtered: the final digital FIR filter (with a sharp damping) further attenuates all signals above (f_f), so that we get an excellent measurement result over the whole frequency range (i.e. the effect of the aliasing is negligible).

Illustration 204 unten shows an overview of the components in the Sirius® DualCore and HD modules: after the amplifier there is an Analogue Filter followed by the ADC which uses oversampling and includes a Digital ADC Filter, so that we can get excellent aliasing-free measurement results:

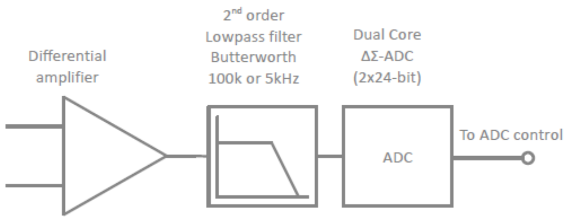


Illustration 204: *Filtering components in Sirius® DualCore and HD modules*

6.1.3 Sirius® DualCore & HD: Anti-Aliasing

To get the best possible anti-aliasing results, Dewesoft uses a combination of multiple technologies:analogue filtering, oversampling and digital filtering.

Here's a comparison of the Sirius® filter to some pure analogue filters:

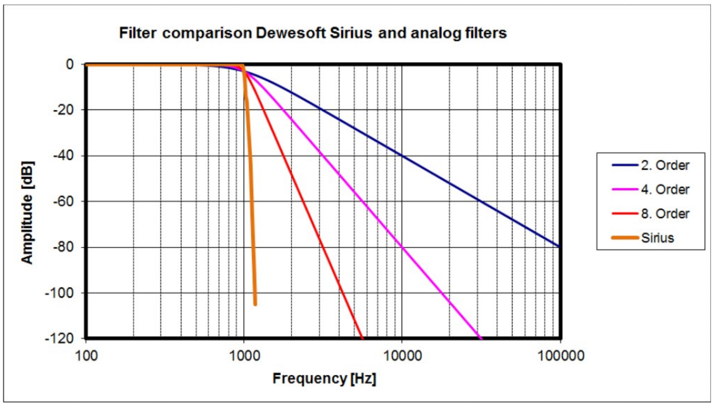


Illustration 205: Filter comparison: Sirius® DualCore vs. analogue filters

In Illustration 205 oben, you can see that the Sirius® filter (orange line) is close to perfection and outperforms any of the pure analogue filters (see 6.1.2 Filter Design on page 150 for details)

6.1.3.1 Analogue Filter

The analogue filter in the Sirius® modules is a 2nd order low-pass Butterworth filter which will switch its filter-frequency automatically depending on the sampling rate:

- when the sampling rate is <=2kS/s, the filter frequency is 5kHz
- else 100kHz

6.1.3.2 ADC oversampling

Sirius® will automatically adjust the oversampling depending on the sample-rate.
The digital filter cut off frequency is automatically set to half of the sample-rate and the internal sampling frequency is up to 256 times higher than the output rate:

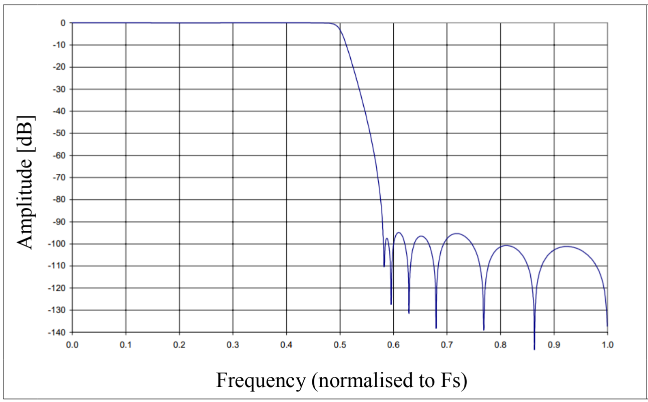
Digital Filter (vs. Sample Rate)	0.1kS/s…51.2 kS/s	51.2kS/s…102.4kS/s	102.4kS/s…200kS/s
Bandwidth (-3 dB)	0.494 fs	0.49 fs	0.38 fs
Alias-free Bandwidth	DC to 0.42fs	DC to 0.32fs	DC to 0.22fs
Alias Rejection	-95dB	-92dB	-97dB
Delay through ADC	12/fs	9/fs	5/fs
Oversampling	256	128	64

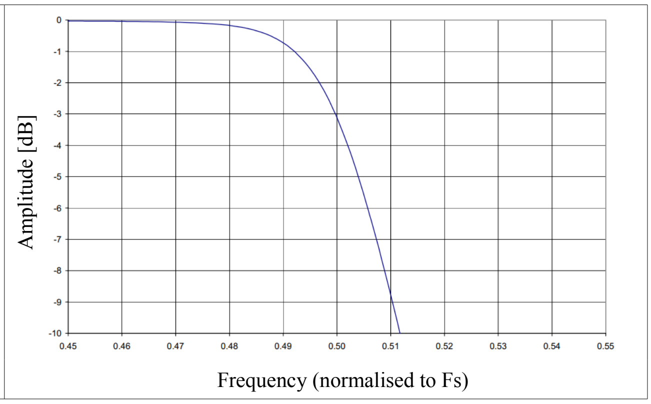
Note: Sirius® will automatically correct the delay caused by the ADC.

6.1.3.3 Digital ADC Filter

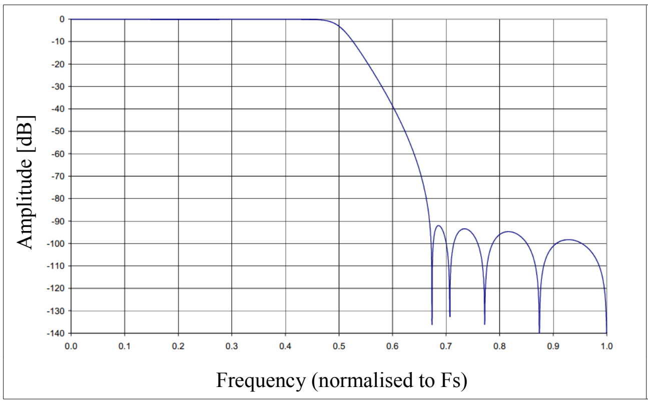
The filter characteristics of the digital ADC filter will also change automatically depending on the sample-rate:

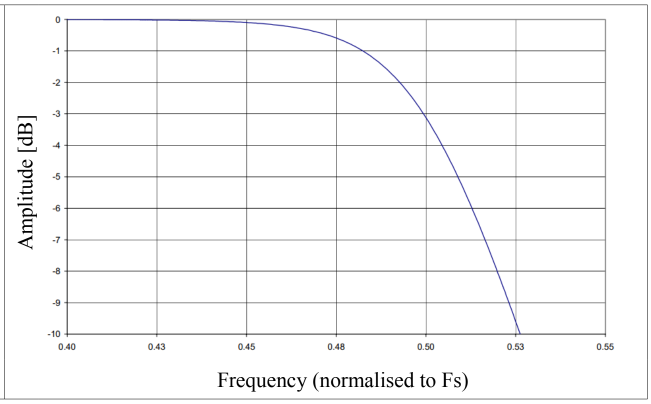
Sample rate 0.1kS/s to 51.2kS/s



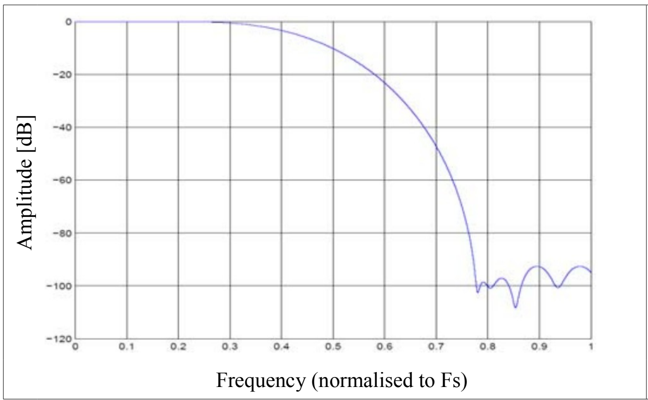


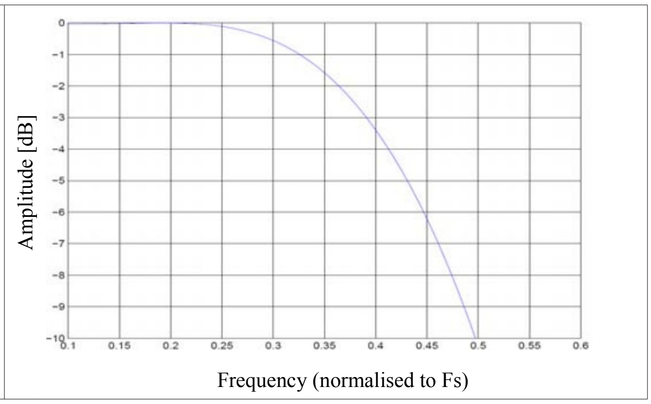
Sample rate 51.2kS/s to 102.4kS/s





Sample rate 102.4kS/s to 200kS/s





6.1.3.4 Overall Bandwidth

To get the overall bandwidth we must consider the bandwidth of the analogue filter and the ADC which is 70kHz.

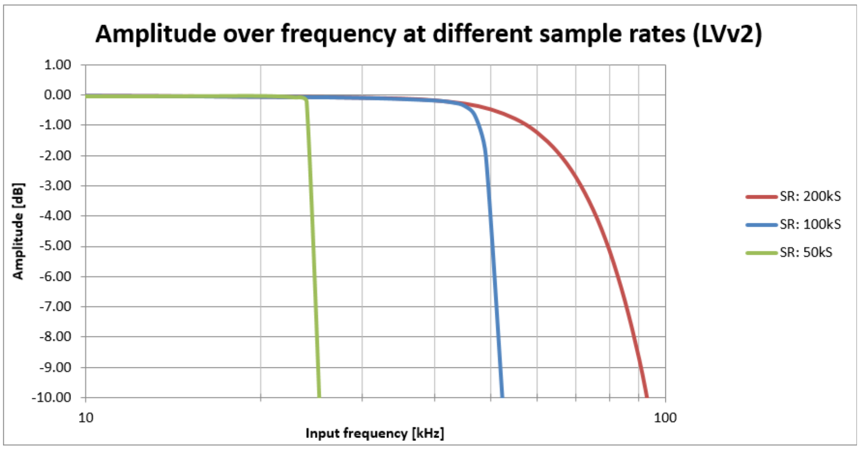


Illustration 206: Overall Bandwidth

6.1.3.5 Anti-Aliasing Filter

Illustration 207 unten shows an overview of the different filters and sampling rates in the frequency domain:

- The sample rate of Sirius is set to 2kS/s
- The analogue aliasing filter is automatically set to 5kHz (since the sampling rate is 2kS/s) and guarantees aliasing free acquisition
- The oversampling factor is automatically set to 256 (because the sampling rate is < 50kS/s) so that the internal sampling frequency of the Sigma-Delta ADC is 512 kS/s
- Finally the digital FIR filter of the ADC is set to 1kHz (half of the sampling rate)

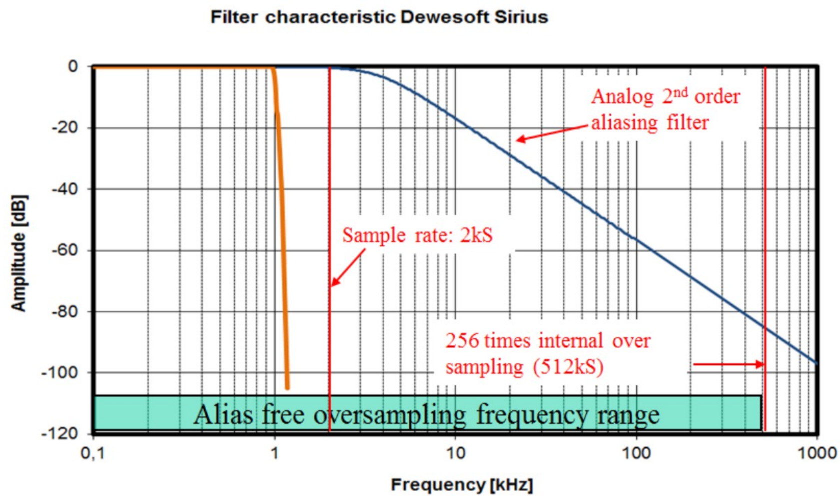


Illustration 207: Sirius® Anti-Aliasing Filter

6.1.4 DEWESoft®: Custom Low Pass Filter Settings

The filtering described in the previous chapters is done in the Sirius® measurement hardware: it assures that the data that Sirius® passes to the DEWESoft® software is aliasing free. But you must be careful not to introduce aliasing again in software.

One way that this can easily happen, is when you set a custom sampling rate on a single channel in the analogue channel setup:

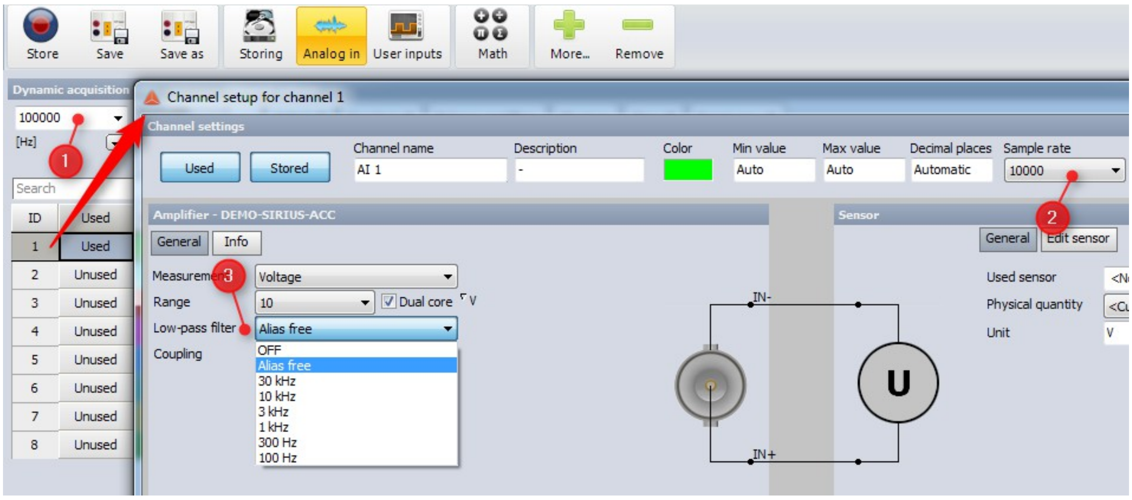


Illustration 208: Analogue Channel Setup – custom sample rate

In the example above you can see that the dynamic acquisition rate (❶) is set to 100kHz. The sample rate of the first analogue input channel (*AI 1*) is set to only 10kHz (❷). This means, that the Sirius® hardware will send the measurement data of all channels at a rate of 100kHz via USB to DEWESoft® and DEWESoft® will then reduce the data for channel *AI 1* to 10kHz.
This reduction could be done by simply using only every 10th input sample that we get from Sirius® (and thus skipping 9 out of 10 samples): we already know from the previous chapters that this will introduce aliasing!

DEWESoft® provides a convenient way to select how to tackle this problem: the custom *Low-pass filter* setting (❸ in Illustration 208) in the analogue channel setup:

- *OFF*: when you deactivate the Low-pass filter, the samples are skipped as described above and you will experience aliasing effects.
- *Alias free*: this setting, will automatically adjust the low-pass filter frequency, so that your measurement data is always aliasing free.
  Details: DEWESoft® will automatically set the filter-frequency to 0.4 of the reduced rate and use a Bessel filter of 8th order
  Note: when you do not set a custom sampling rate for the channel (i.e. ❶ and ❷ are the same in Illustration 208), then no filtering is required. Thus *Alias free* is the same as *OFF* in this case.
- *Custom frequency* (e.g. 100Hz, 300Hz, 1kHz, …): will set the filter frequency accordingly.

IMPORTANT	The custom low-pass filter is an IIR filter, so it will introduce a phase shift – similar to an analogue filter. Using a FIR filter for many channels is often not possible, because it requires considerably higher computation power (which cannot be provided by current general purpose CPUs). Note: if you want to use a FIR filter for your channel/s anyway, then you can disable the custom filter (set it to *OFF*) and add FIR filter Math-channels instead.

7 Accessories

Optional Sirius® Accessories and Sensors (e.g. DSI®-adapters, Battery Packs, Current Clamps, etc.) can be found in a separate document, which is available for download from our homepage:
http://www.dewesoft.com/download

In the *HW Manuals* section click the download link for the *Manual for DEWESoft Accessories and Sensors*.

8 Advanced Topics

The topics in this chapter are optional and only recommended for advanced users or Dewesoft staff.

8.1 Wireless Connection

This topic will show how to establish a wireless connection between an S-BOX running Windows 7 Professional and a Samsung Galaxy Tab 2 running Android 4.x.

8.1.1 Prerequisites

We assume that the Windows 7 PC has DEWESoft® and the DEWESoft®-NET option installed.

Note: you do not need to activate the DEWESoft®-NET option in DEWESoft® (and thus you also don't need to buy a valid license for the DEWESoft®-NET option) – in this example we just need the installation of the Ultra VNC server (which is automatically done when the DEWESoft®-NET option is being installed).

HINT	The procedure is prepared and tested only for the Dewesoft S-BOX – it may not work on other PC's: - It will only work on Windows 7 (e.g. Windows XP does not support Hosted WLAN) - User access control should be disabled - Not all WLAN drivers support Hosted WLAN

Detailed information about the *Hosted Network* feature of Windows 7 can be found here:
http://msdn.microsoft.com/en-us/library/dd815243%28VS.85%29.aspx

8.1.2 Hosted Network on Windows 7

The hosted network feature of Windows 7 creates a software-based wireless access point (AP) (sometimes referred to as a SoftAP) that uses a designated virtual wireless adapter. This allows the Windows 7 PC to create a wireless network that other devices can connect to.

We have prepared some scripts that will handle all the setup work – you will find the scripts in the `Extras\LAN_HostedNetwork` folder of your SIRIUS® installation USB stick.

The folder contains 3 script files – you just need to start the script `ApplyHostedNetwork.bat` as *Administrator:* See Illustration 209: First, hold down the *SHIFT* key and right-click the script `ApplyHostedNetwork.bat`. Then select *Run as administrator* from the pop-up menu.

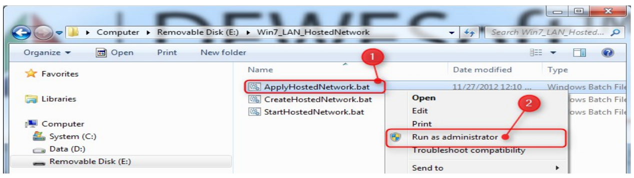


Illustration 209: Run as administrator

1. Read the notes and press any key to continue
2. enter the SSID of the hosted network: you will see the SSID in the list of available networks on your tablet
3. Enter a password to access the network.
   For this demonstration we use a simple password – you should use a more secure one (maybe with Caps, numbers and even special characters)

When the script is done, everything is correctly configured and set-up, you should already see our S-BOX network in the *Network list* of the S-BOX (see Illustration 211 unten).

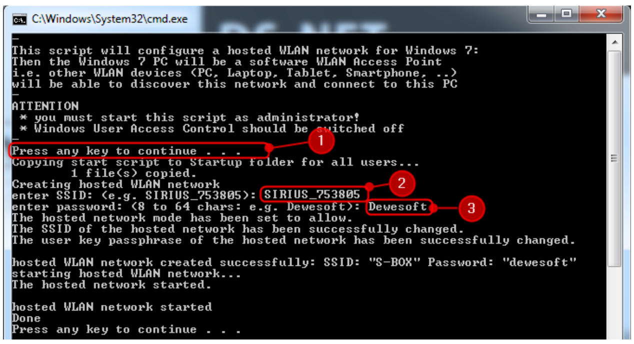


Illustration 210: Script

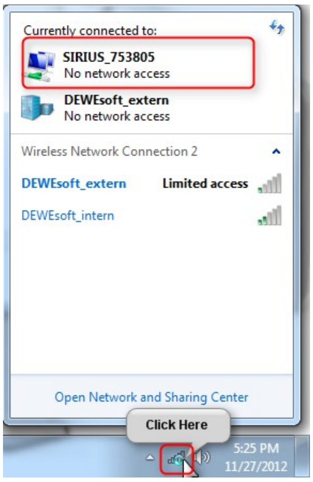
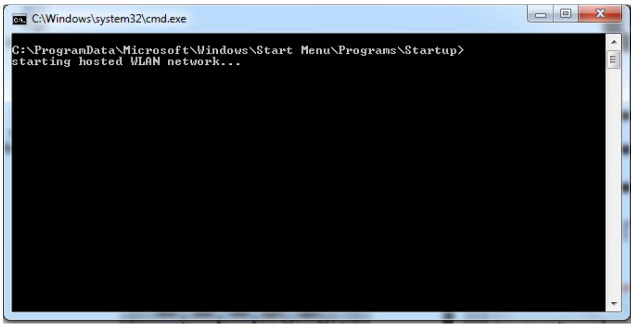


Illustration 211: Network

During the execution the script `StartHostedNetwork.bat` has been copied to the `Startup` folder of all Windows users (see Illustration 212): so when you restart your PC and log on for the next time, the hosted network will be started automatically – during a short time, you will see the Windows command shell:



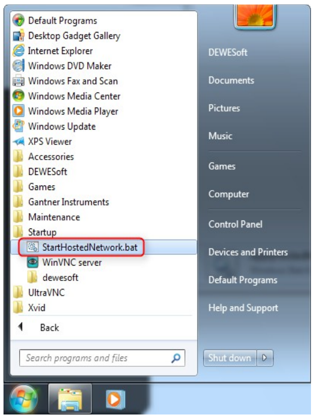


Illustration 212: Startup

HINT

If you ever want to deactivate the Hosted Network, just delete the `StartHostedNetwork.bat` script from the `Startup` folder and restart your PC.

8.1.3 Android: WiFi connection

In the list of available Wi-Fi networks of your Android tablet, you will already see the hosted WLAN network (see Illustration 213).

Click on our network (*SIRIUS_753805*) to open the connection dialogue, enter the password *Dewesoft* and click **Connect**.

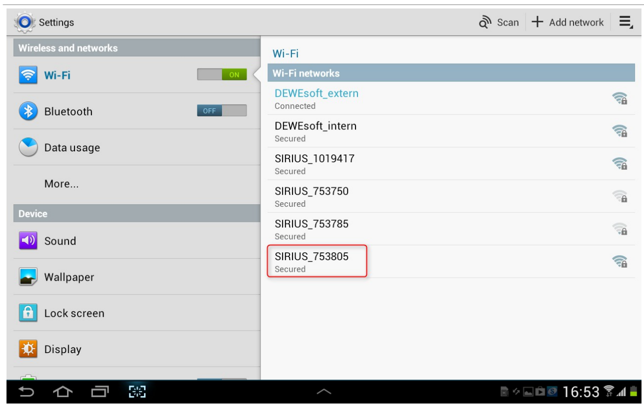


Illustration 213: Android Wi-Fi Network List

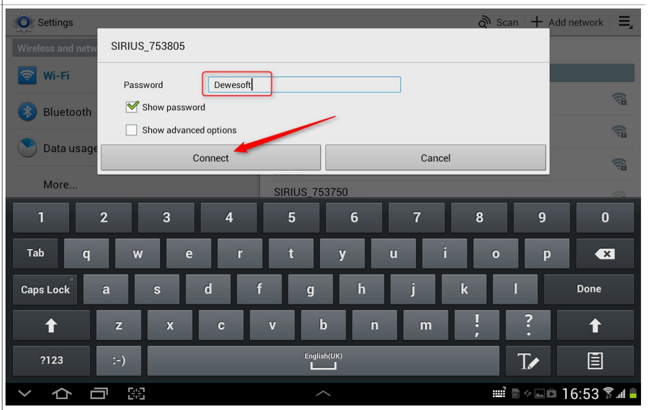


Illustration 214: Android Wi-Fi Connect

That's it. The WLAN network in the Wi-Fi list of your Android device should now show *Connected*.

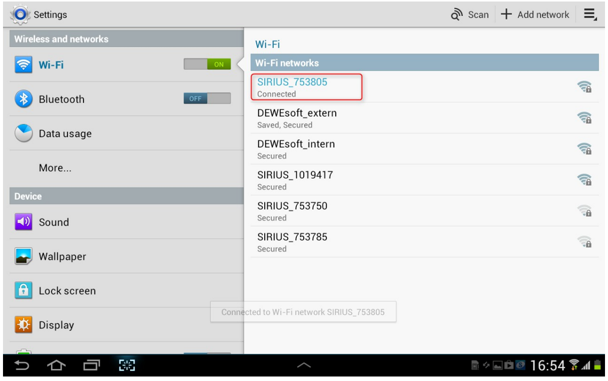


Illustration 215: Android Wi-Fi Connected

8.1.4 Android: VNC

Next, we need a program to connect to the VNC server on the S-BOX. There are many different VNC programs available in the *Google Play Store*. For this demonstration we will use the free program *Jump Desktop Free* (for detailed description and help see: http://jumpdesktop.com/).

First, install the *Jump Desktop Free* program on your tablet via the *Google Play Store*.

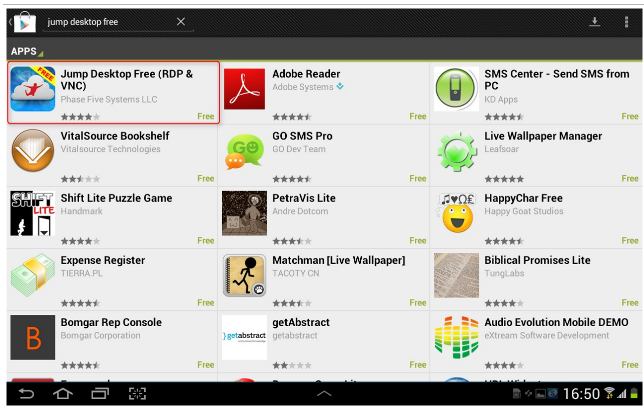


Illustration 216: Google Play Store

After the installation is complete, just click on the *Jump* icon on your desktop to start the VNC program:

Illustration 217: Jump Icon

Select the setup type *Manual Setup*:

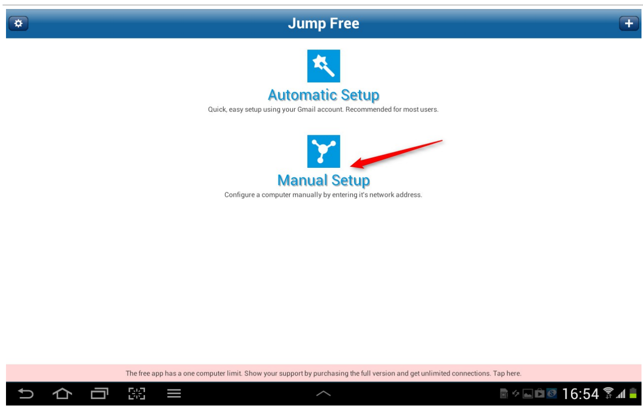


Illustration 218: Setup Type

In the Add Connection dialogue enter the IP-address `192.168.173.1` (this id the default IP address of the hosted WLAN network that we have created on the S-BOX) and select *VNC* as *Connection Type*. Then click the **Save** button.

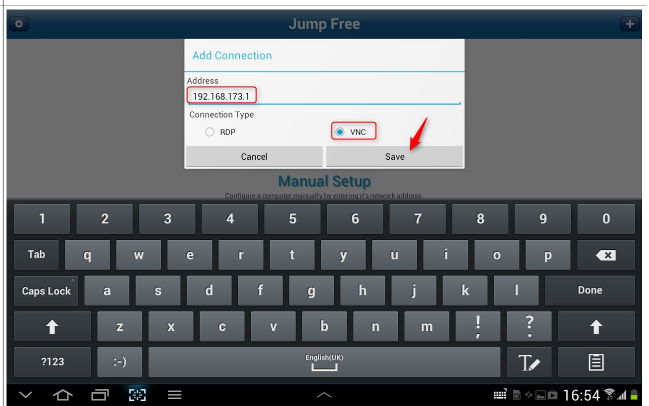


Illustration 219: Add Connection

Next, you will see all settings of the connection. You can change the *Display Name* if you like.
Click the **Back** button ⮌ to get back to the *Connection List*:

Illustration 220: Connection Settings

In the connection list you can click anywhere in area ❶ to open the connection – or click on the wrench symbol ❷ to change the settings of the connection.
Note: the free version of the *Jump Desktop* software only supports one connection.

Illustration 221: Connection List

When you open the connection, the program will connect to the Ultra VNC server running on the S-BOX.
When you do this for the first time, you must enter the password for the VNC server. The default password of the DEWESoft® VNC instance is the small letter *a*. Enter the password and click **Login**.

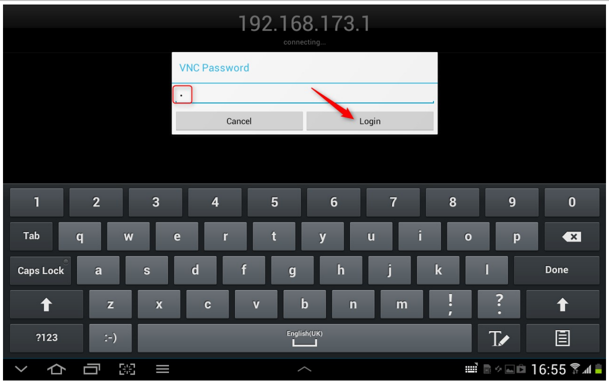


Illustration 222: VNC password

You will immediately see the screen of the S-BOX and you have complete control over the S-BOX. You can use the mouse, enter text and use all special keys via the *Jump Desktop* program.

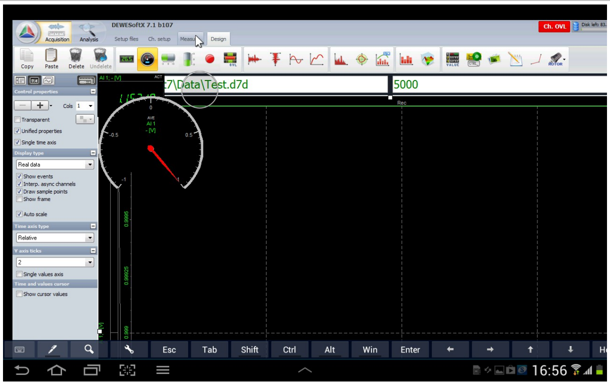


Illustration 223: Active VNC Connection

Click	Tap the screen
Double click	Double tab the screen
Right click	Long tab or two finger tab
Left mouse drag	2 quick taps and drag (don't lift your finger up after the 2nd tap - like on a trackpad)
Scroll Wheel	Two finger vertical swipe (up or down)
Zoom	Pinch the screen (2 fingers)
Quickly show or hide keyboard	Three finger tap

Table 42: Jump Desktop: Important gestures

8.2 Synchronisation

When acquiring data from multiple measurement channels, the degree to which the data of the different channels can be correlated to each other in time can be very important. If the data of the different channels is not synchronised, your analysis may be inaccurate or even completely wrong. The faster you acquire the data, the more important synchronisation becomes (e.g. when you only acquire one data point for a temperature measurement per minute for a relatively short measurement period, synchronisation to other measurement channels may be irrelevant).

Since this is such an important point, DEWESoft® offers you a wide range of possible ways to synchronise you data. To understand all the DEWESoft® features and settings, it is important to know the basics and the definition of the terms that are used in this discussion: so the following glossary should give us a sold foundation for the advanced topics that will follow.

When we talk about synchronisation in this chapter, we always mean inter-device-synchronisation between different measurement devices: e.g. between 2 SIRIUS® systems or between SIRIUS® and DEWE-43 or a DS-NET system, etc. Also the data from different channels and modules inside one measurement system are subject to synchronisation. This intra-device-synchronisation is usually very accurate and thus negligible.

8.2.1 Synchronisation Glossary

8.2.1.1 Sampling

The analogue signals that we want to measure are continuous time signals. Since all computer based systems are digital, we need to convert those continuous time signals to discrete time signals: this process is called sampling.
A sample refers to a value at a point in time.

The Illustration 224 shows the continuous analogue signal.

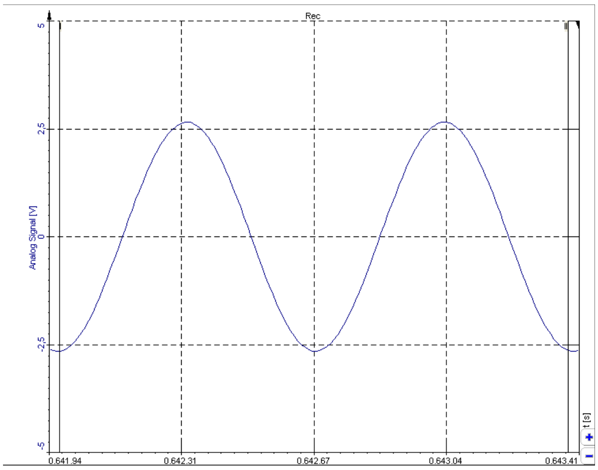


Illustration 224: Continuous signal

Illustration 225 unten shows the sampled version of the signal in Illustration 224. The actual data consists only of the sampled points that you see as red dots in the diagram. The lines in between the points are just interpolated.

Illustration 226 unten shows another sampled version of the signal in Illustration 224. But in comparison to Illustration 225 we used a lower sample rate in this case. Because of the lower sample rate, we have fewer data points acquired and thus the interpolated signal does not resemble the original signal as good as Illustration 225 does.

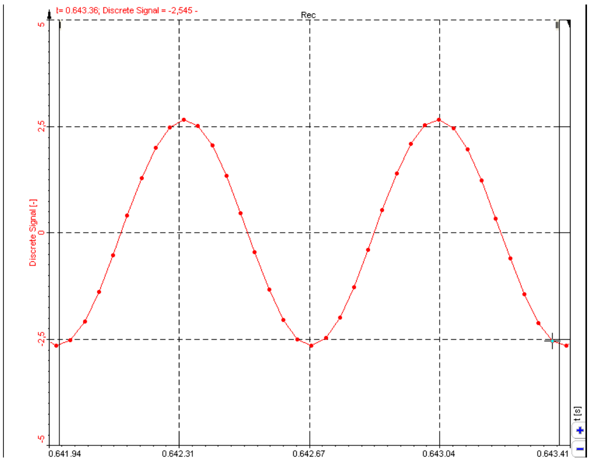


Illustration 225: Sampled (discrete) signal

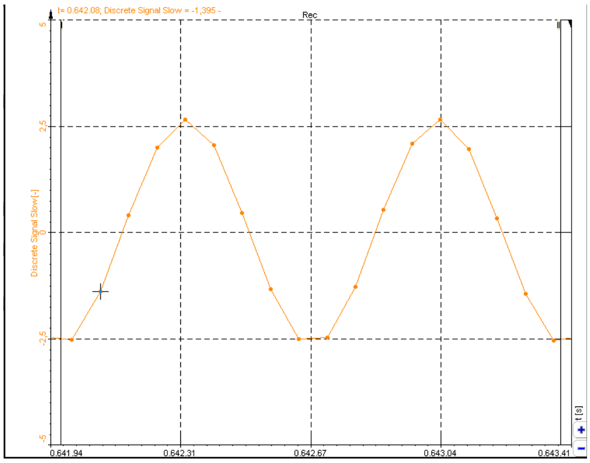


Illustration 226: Slower sampled (discrete) signal

The sampling rate (aka. sample rate, sampling frequency) defines the number of samples per second taken from the continuous signal to create the discrete signal. The unit for the sampling rate is hertz (Hz) .
The inverse of the sampling frequency is the sampling period or sampling interval, which is the time between samples.

8.2.1.2 Clock

A clock signal is a particular type of signal that oscillates between a high and a low state and is utilized like a metronome to coordinate actions.

E.g. each SIRIUS® chassis has an internal clock. The sampling of the data-points is always correlated to this clock – so that the data-points of all channels (on all modules) refer to the same point in time[28].

8.2.1.3 Masterclock

Masterclock is a DEWESoft® term that refers to the main clock that is used to synchronise data and actions inside the DEWESoft® software.

Clockmaster is another DEWESoft® term that refers to the hardware device that provides the masterclock to DEWESoft®.

There are several possible source for the masterclock:

- whenever you have activated an analogue device (e.g. SIRIUS®, DEWE-43) in DEWESoft® it will be used as clockmaster
- when you have no hardware devices activated at all, then the computer's clock will be used

28 Like all real-world devices also the clock generator of SIRIUS® is not ideal. But this is negligible related to the sample rates.

In the example of Illustration 227 we have used one channel called *DEWE-43_Voltage* (from a DEWE-43 of course), one mathematical channel called *Math DEWE43-half* (which just divides the value of the *DEWE-43_Voltage* channel by 2) and one channel of a DS-NET called *V1*.

Since DEWE-43 is an analogue device (just like SIRIUS®), it will be the clockmaster. The mathematical channel will be synchronised with the masterclock: thus the points ❶ and ❷ are perfectly aligned.

The channels of the DS-NET system are of course asynchronous in this case, thus the data point ❸ is not aligned to the synchronous channels.

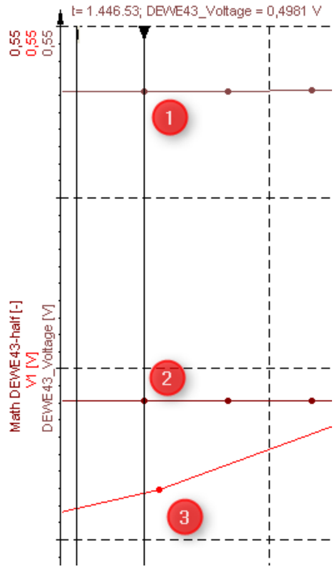


Illustration 227: Masterclock

8.2.1.4 Sampling jitter

The sampling frequency is normally assumed to be constant. Samples should be converted at regular intervals.

In real-world application this can not be achieved. The error introduced is called sampling jitter, which describes the time variation of the real clock in relation to the ideal clock.

8.2.1.5 Sync / Async channels

In DEWESoft® there are 2 fundamentally different types of channels: synchronous (e.g. analogue data) and asynchronous (e.g. CAN data) channels.

Synchronous channels always have exactly one data point related to the masterclock and the time between 2 adjacent data points is always constant.

In the example below you can see 3 synchronous channels and that the data points of all the channels are perfectly aligned to each other.

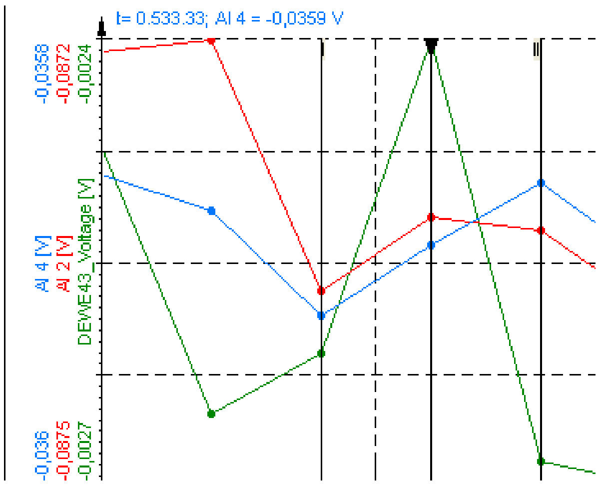


Illustration 228: Synchronous channels

Asynchronous channels may have data points at any instant of time and the time between 2 adjacent data points may vary.

In the example below you see the green signal which is a synchronous channels of a SIRIUS® (which is clock master) and 3 channels from 3 different DS-NET systems which are of course asynchronous. When you take a look at he black line denoted with ❶ in Illustration 229 you can see that the asynchronous data points are not aligned to the green synchronous data points and also not aligned to each other.

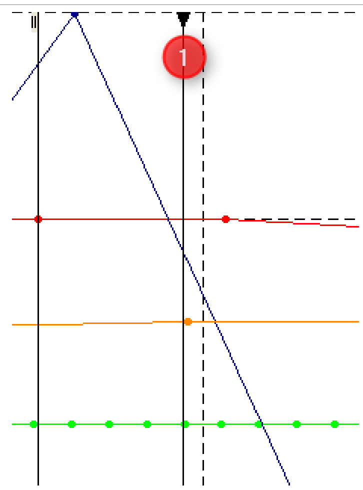


Illustration 229: Asynchronous channels

Sync channels are much easier to handle because of the fact that the time between all their data points is equal. This also makes some computations much easier (which means, that CPU power is much lower).
E.g. displaying sync channels in a recorder is easy, but displaying asynchronous channels in a recorder requires many more calculations and thus much more CPU power (because we need to calculate the right horizontal position for each data point).

Some functions in DEWESoft® only work with synchronous channels: e.g. in the channel list of the FFT or scope screen only sync channels will show up – async channels cannot be used.

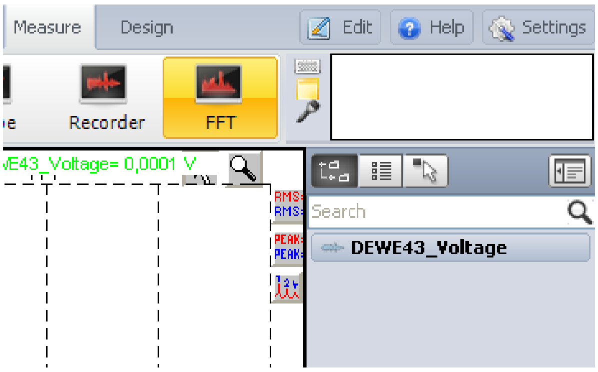


Illustration 230: FFT screen: only sync channels

In the recorder screen you can also use async channels. The Illustration 231 shows the Recorder screen with the same channel setup as Illustration 230.

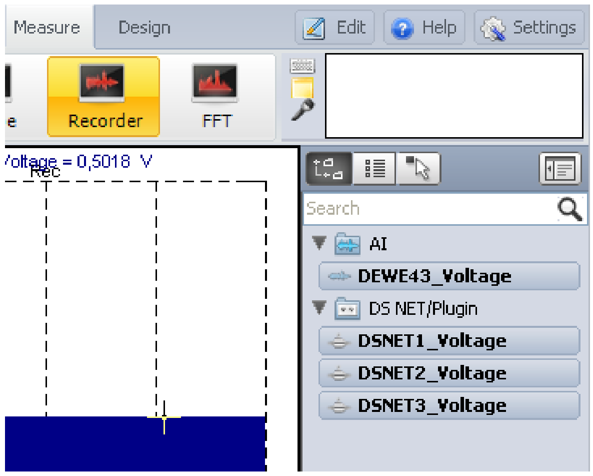


Illustration 231: Recorder screen: also async channels

8.2.2 Sync options

When you have several measurement systems, each of those systems has it's own internal clock (e.g. 2 SIRIUS® systems). Since no real-world hardware is perfect the 2 clocks will run at slightly different speeds and thus will drift more and more apart from each other.

Hardware synchronisation

The best way to synchronise the clocks of several devices is to use some sort of hardware synchronisation that transmits a signal that can be used by the devices to synchronise their clocks to each other.

Depending on your Sirius® enclosure version you have these options:

- Sirius® **USB slices**: Connect the slices via sync cables: see 4.3.1.3 Sync Connector on page 38
- Sirius® **EtherCAT®: slices** You do not need additional cables, because the EtherCAT® cable already includes synchronisation lines (in addition to power and data lines): see also 4.3.1.2 EtherCAT® connector on page 37
- Sirius® **Boxed Solution** and **Rack** versions: You do not need additional cables, because the synchronisation is wired internally. See also: 4.1.2 Boxed Solution on page 33 and 4.1.4 Rack Enclosure on page 34

Additional notes:

- You can synchronise SIRIUS® systems to each other or also to other devices (e.g. DEWE-43, DS-NET)
- Note that the hardware synchronisation function is not related in any way to the setting of the clockmaster

No synchronisation

If you use no synchronisation at all the time shift between the signals of the 2 devices will become bigger and bigger the longer the measurement takes.

At the beginning of the measurement the 2 signals will be very good aligned. In Illustration 232 you can only see one of the signals, because the second one is exactly the same and thus hidden behind the red one.

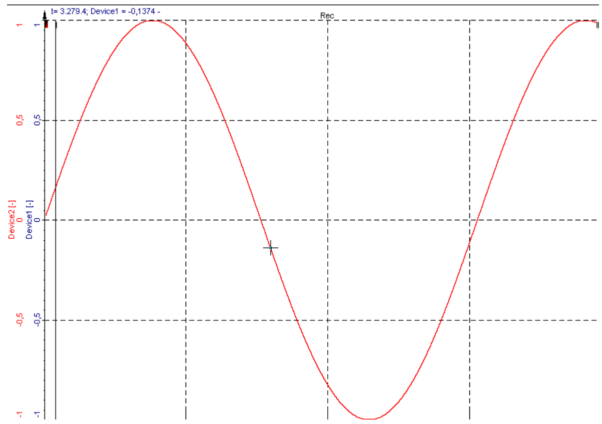


Illustration 232: No sync: start of measurement

After some time (depending on the relative clock drift of the 2 devices), you will see that the signals are not perfectly aligned any more...

...and the longer the measurement takes, the worse the offset will become.

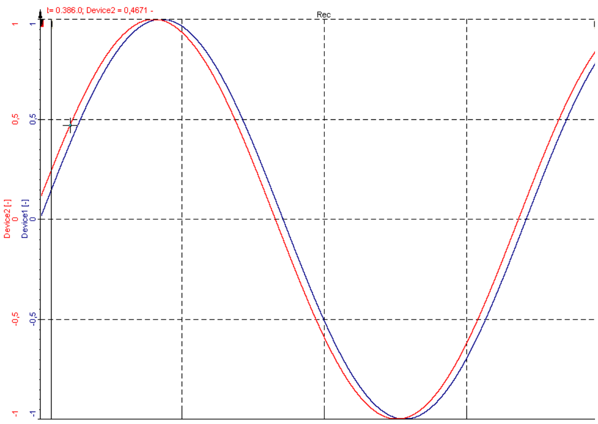


Illustration 233: No sync: small offset

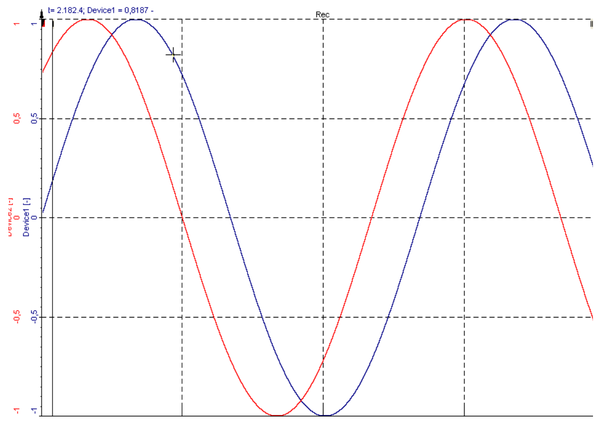


Illustration 234: No sync: big offset

Software synchronisation

When the data that we get from asynchronous devices includes also a time-stamp, DEWESoft® can do a so called *software synchronisation*. In this case, the channels will still be asynchronous and will have a time delay relative to other synchronous channels, but at least the time-drift will stay almost constant.

The DS-NET plug-in will always use soft sync for asynchronous channels.

Illustration 235 shows 3 channels of 3 different DS-NET systems. DSNET1 and DSNET2 are connected via hardware sync cables (DSNET3 is not).
We do not use any analogue device.

You can see that the channels of the synchronised systems DSNET1_Voltage, DSNET2_Voltage are perfectly aligned to each other and the the asynchronous channel DSNET3_Voltage of the 3rd (not hardware-synchronised) system is delayed by some milliseconds (which is often acceptable when you are measuring slow signals).

Even if you leave that measurement running for days and weeks, the time drift will stay almost constant.

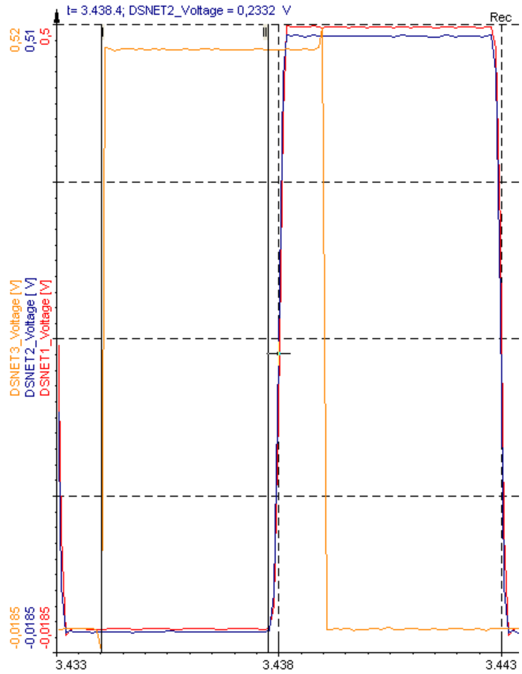


Illustration 235: Soft sync

8.2.2.1 One PC and 2 SIRIUS® USB devices

In this case you must connect your SIRIUS® chassis systems with special synchronisation cables (see Illustration 236). The cables have 4 pin *Lemo* connectors which fit into the *SYNC* connectors on the back side of the SIRIUS® chassis (see Illustration 19 on page 22).

These cables can be ordered as options to your SIRIUS® system under the following designations: SYNC-CBL-05M (0.5m length), SYNC-CBL-3M (3m length).

Illustration 236: HW-sync cable

8.2.2.2 Several PCs and SIRIUS® devices

The NET option allows to combine the data of multiple DEWESoft® instances, running on different PCs (or S-BOXes) in one measurement. This is useful if you have a locally distributed measurement task, or if you need more processing power, than a single CPU can provide.
The data-transfer between the different PCs is done over Ethernet: so all the PCs must be connected to the same LAN. Moreover we need to connect all involved Sirius® slices with a sync-cable. One of the PCs will be the Master, which can start/stop the measurement on all PCs and this Master will also be configured to provide the synchronisation signal to the Slave units.

Please consult the DEWESoft® user manual (3.4.1 Help - Manual on page 23) for detailed information about the NET option.

Master setup

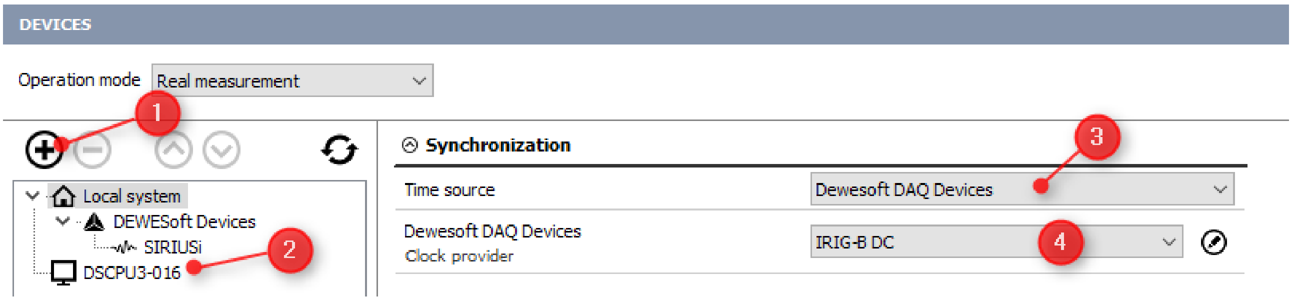


Illustration 237: NET Option Master Setup

In the settings dialogue of the Master unit, click (❶) and then add the **Dewesoft NET** option (click the plus button at the right side of the *Measurement unit* line. Then select your slave unit/s. The slave unit/s will now show up in the device list (❷).
We need to configure the *Synchronization* settings of the master, so that it will generate the IRIG signal which will be transferred via the sync-cable to the slave measurement units: as *Time source* select *Dewesoft DAQ Devices* (❸) and as *Clock provider* select *IRIG-B DC* (❹).

Slave Setup

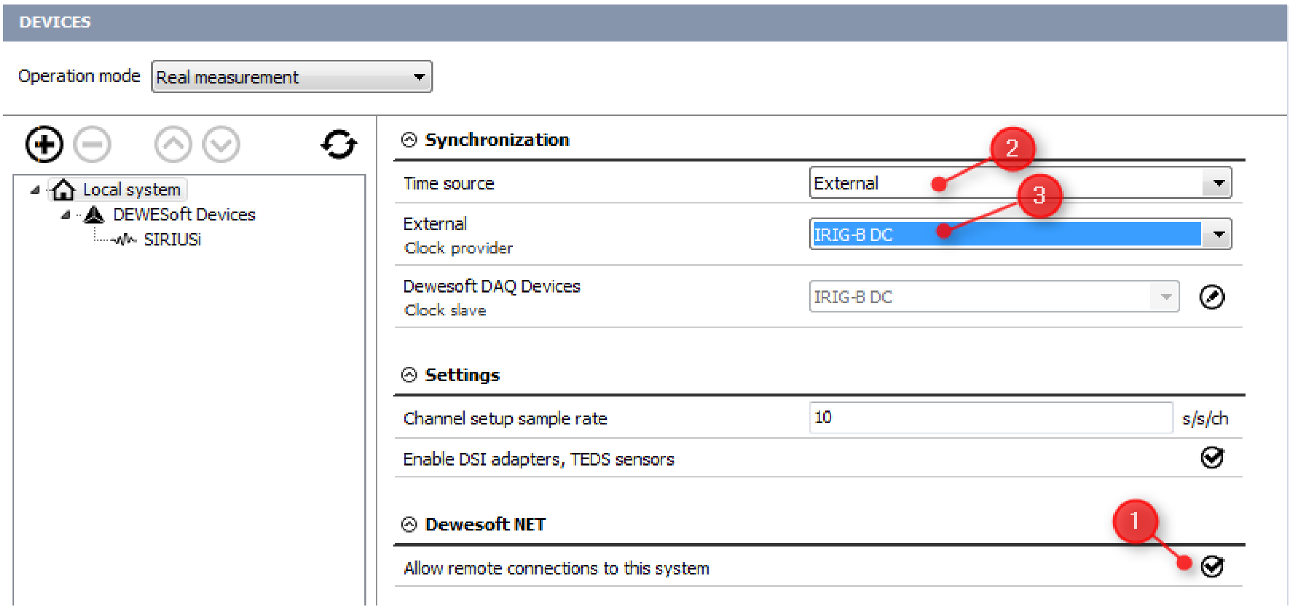


Illustration 238: NET Option Slave Setup

We must configure the slave measurement unit/s to receive the synchronisation signal from the Master. In the *Settings* dialogue, activate the *Dewesoft NET* option (❶). Then set the *Time source* to *External* (❷) and the *Clock provider* to *IRIG-B DC* (❸).

8.3 Firmware upgrade

This chapter shows how to upgrade the firmware of your Sirius® measurement system. Note: the firmware upgrade procedure should only be executed by experienced personnel and only when explicitly told so, by the Dewesoft support team.

IMPORTANT

Make sure, that the communication to the Sirius® and the power supply are not interrupted during the firmware upgrade procedure. Otherwise the system may become broken and you must send it back for repair.

The Firmware upgrade process includes 2 steps:

1. Update of the System Firmware: this is the firmware of the Sirius® slice. It is responsible to read the measurement data from the modules and transfer the data via USB to DEWESoft®
2. Update of the Module Firmware: each Sirius® slice may have up to 8 modules. Different module-types (e.g. ACC, STG, HV, ..) require different firmware

IMPORTANT

When you use multiple Sirius® systems for one measurement (i.e. connected via synchronisation cables), make sure, that all systems have the same firmware installed.

8.3.1 Preparation

8.3.1.1 Download

First, you need to download the Firmware upgrade tool and the firmware archives from our web-page: http://www.dewesoft.com/download#Drivers

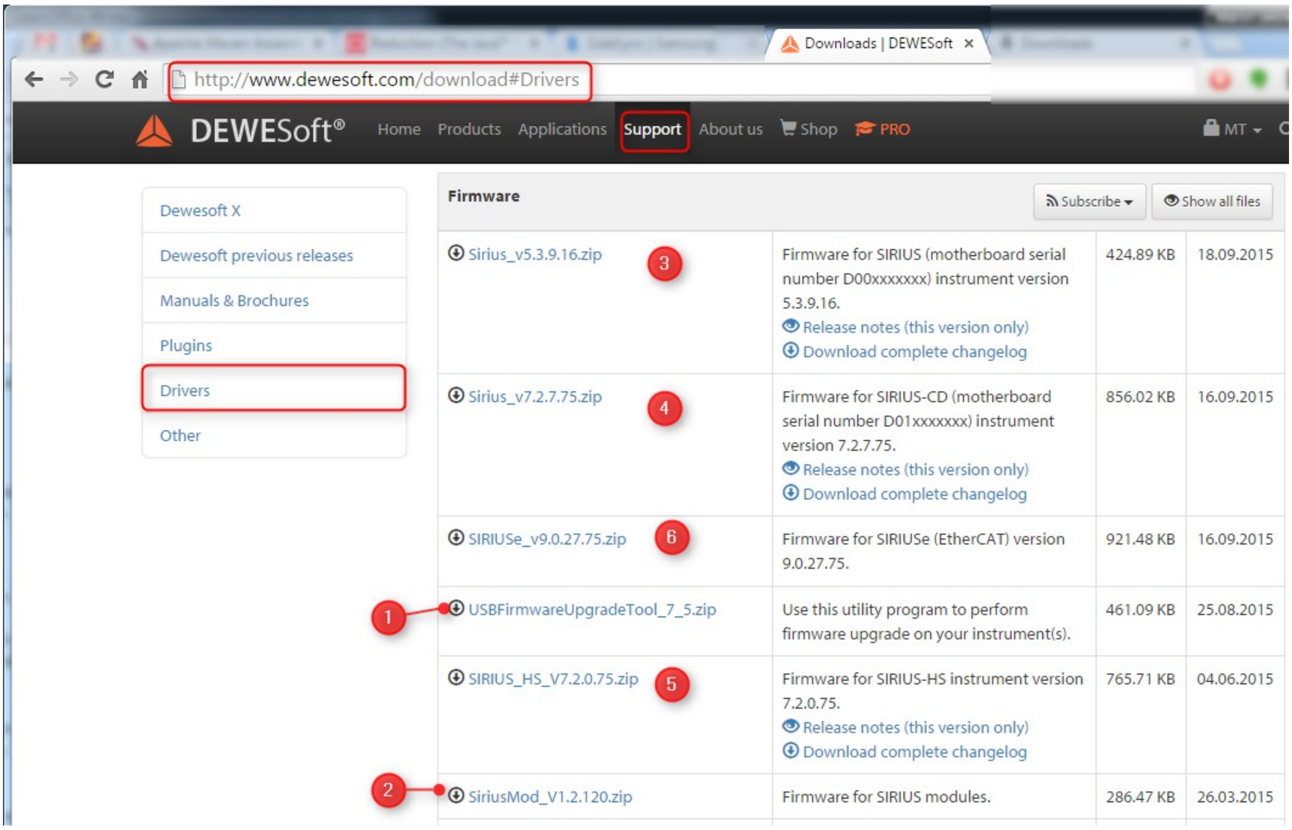


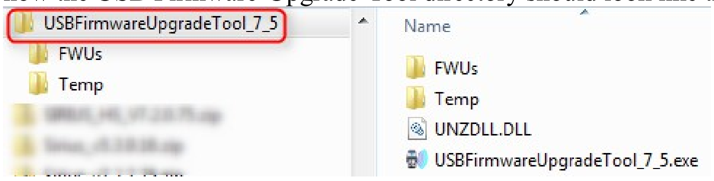
Illustration 239: Web-page: Firmware download

#	Filename example[29]	Description
❶	`USBFirmwareUpgradeTool_7_5.zip`	Required. This is the firmware update tool that will copy the new firmware from your PC via USB to the Sirius® system
❷	`SiriusMod_V1.2.120.zip`	Required when you want to update the firmware of the modules (see 8.3.3 Module Firmware Upgrade) This archive contains the firmware for all Sirius® modules (e.g. ACC, LV, HD-LV, HS-LV, …)
❸	`Sirius_v5.3.9.16.zip`	Required when you want to update the firmware of a Sirius® Dual Core system that has a motherboard serial number starting with *D00*.
❹	`Sirius_v7.2.7.75.zip`	Required when you want to update the firmware of a Sirius® Dual Core system that has a motherboard serial number starting with *D01*.
❺	`SIRIUS_HS_V7.2.0.75.zip`	Required when you want to update the firmware of a Sirius® High Speed system.
❻	`SIRIUSe_v9.0.27.75.zip`	Required when you want to update the firmware of a Sirius® EtherCAT® system.

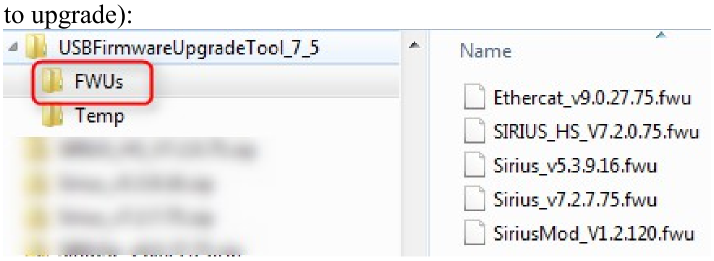
8.3.1.2 Extract

Now we need to extract the downloaded archives and do some preparation for the firmware upgrade tool.

- extract the USB Firmware-Upgrade-Tool archive and start the executable: `USBFirmwareUpgradeTool_7_5.exe`
  now the USB Firmware-Upgrade-Tool directory should look like this:



- the firmware upgrade too will create 2 new directories (in the directory where you have just has started the executable): `Temp` and `FWUs`
- extract the firmware archives, that you have downloaded (they all contain one file with the extension `.fwu`)
- copy (or move) all these `.fwu` files to the `FWUs` directory
  now your `FWUs` directory should look like this (maybe fewer files, depending on what Sirius® system you need to upgrade):



29 Since the file-names include a version number, it is likely that you will see higher numbers on the web-page when your read this doc.

8.3.2 System Firmware Upgrade

Make sure that the *DEWESoft USB* is selected in the *Device* drop-down and then select the correct firmware for your Sirius® system:

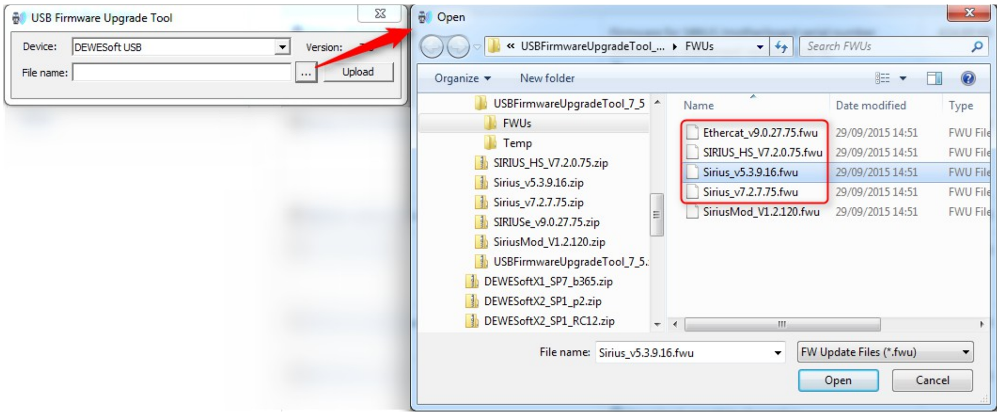
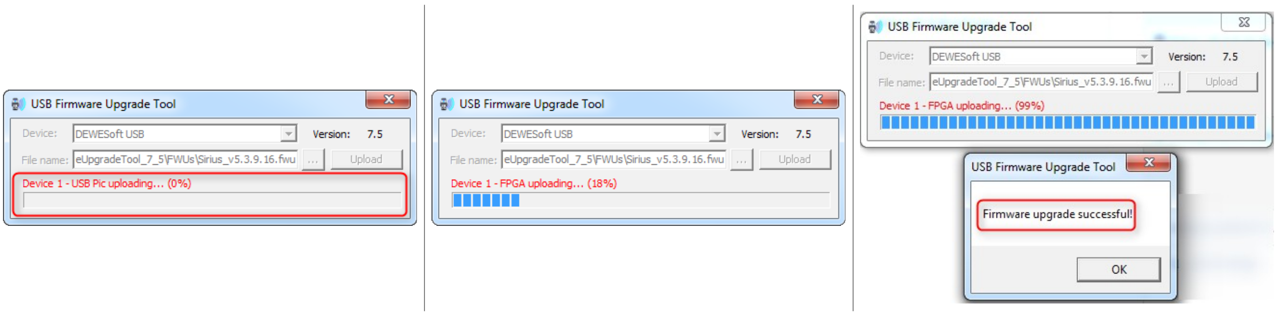


Illustration 240: Select the correct System Firmware

IMPORTANT	
IMPORTANT	Before you start the upload of the system firmware, it is a good idea to check again, if you have the correct version for your system. Read the description on the web-page and also the hints in chapter 8.3.1.2 Extract on page 172. When you accidentally upload a wrong firmware it's usually not a big deal: If this happens, you cannot use the system in DEWESoft®, but you can usually just start the Firmware-upgrade tool again an upload the firmware again (this time the correct one, hopefully). The worst thing to do is to interrupt the firmware-upgrade – then your system may be broken and you may need to send it back for repair.

So, after checking again, that you have the correct version of the firmware, press the **Upload** button, and wait until the upload process is finished:
Do not interrupt the firmware-upload!



8.3.3 Module Firmware Upgrade

For the module firmware upgrade, follow the same procedure as for the system firmware upgrade.

- Select the device *DWUSB Sirius - Modules* from the top drop-down list
- Make sure to select the firmware file for the modules (the file-name starts with `SirisuMod_`)

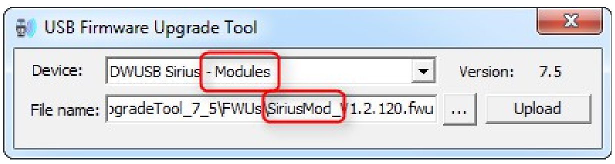
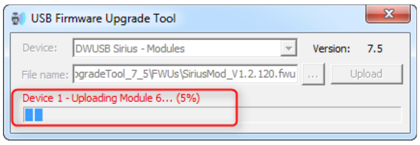
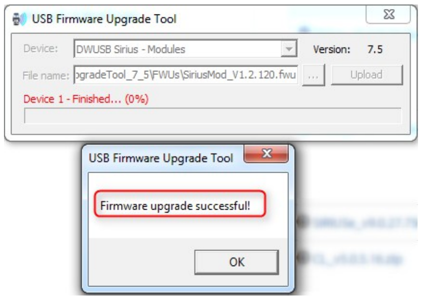


Illustration 241: Firmware-upgrade of Modules

Finally click the **Upload** button and wait until all modules have been updated:



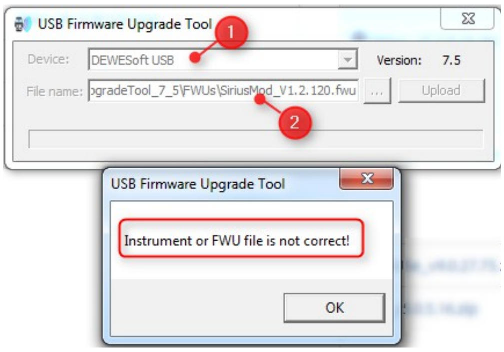


8.3.4 Troubleshooting

Instrument or FWU file is not correct!

When you get this error-message, it means, that the selected firmware file does not match the selected *Device*.

In the example screenshot to the right, we have selected the Sirius® **modules** firmware file, but the *Device* is set to *DEWESoft USB* .
So you must either change the *Device* to *DWUSB Sirius - Modules* or select a System firmware file.



9 Appendix

9.1 Glossary and abbreviations

This glossary includes explanations of some of the most important terms and abbreviations that are used in documentation.

Bit

Bit, the basic unit of information storage, a single binary digit that is either 0 or 1.

see also Baud (Bd)

Baud (Bd)

is synonymous to symbols per second per second. It is the unit of symbol rate, also known as baud rate or modulation rate; the number of distinct symbol changes.

A baud rate, by definition, means the number of times a signal in a communications channel changes state or varies.

EXAMPLE 2

A 2400 baud rate means that the channel can change states up to 2400 times per second.

This is often confused with the bit rate (expressed in bit/s), which is related, but may be different.
The number of bit per baud is determined by the modulation technique.

EXAMPLE 3

If we use a baud rate of 2400,and a phase modulation (which can transmit four bits per baud), this means that we can transfer 9600 bit/s.
2400 baud x 4 bits per baud = 9600 bps

The baud rate (communication speed) between the DS GATE and the measurement modules can be configured via software.

CJC

Cold junction compensation.

Thermocouples measure the temperature difference between two points, not absolute temperature. To measure a single temperature one of the junctions - normally the cold junction - is maintained at a known reference temperature, and the other junction is at the temperature to be sensed.

Having a junction of known temperature, while useful for laboratory calibration, is not convenient for most measurement and control applications. Instead, they incorporate an artificial cold junction using a thermally sensitive device such as a thermistor or diode to measure the temperature of the input connections at the instrument, with special care being taken to minimize any temperature gradient between terminals. Hence, the voltage from a known cold junction can be simulated, and the appropriate correction applied. This is known as cold junction compensation.

dB

The decibel (dB) is a logarithmic unit that indicates the ratio of a physical quantity (usually power or intensity) relative to a specified or implied reference level. A ratio in decibels is ten times the logarithm to base 10 of the ratio of two power quantities.

Dewesoft

Dewesoft refers to the company.

DEWESoft® refers to the software suite for data acquisition, data processing, data analysis and much more.

see www.dewesoft.com

DEWE-43

Dewesoft's hand-held USB measurement instrument (perfect for use with a laptop) can measure with sample rates up to 200kS/s per channel. It has 8 analogue inputs, 8 counter inputs, 24 digital inputs and 2 CAN ports.
This hand-held instrument is most flexible to acquire signals like voltage, current, temperature, strain, vibration, pressure and more. Perfect to do recording, signal analysis, machine analysis, FFT and reporting.

The DEWE-43 can be hardware synchronised with SIRIUS® and DS-NET systems.

Illustration 242: DEWE-43

Dynamic Range

Dynamic Range is the ratio of a specified full scale input range to the to the minimum detectable value (peak spurious signal). The value for dynamic range is expressed in decibels (dB).

DSP

A digital signal processor (DSP) is a specialized microprocessor with an optimized architecture for the fast operational needs of digital signal processing.

The measurement modules use DSPs to process the the measured data.

FFT

Fast Fourier transformation (FFT) can be used to show the frequency components of the acquired signals in amplitude and frequency. DEWESoft® has a built-in visual control that makes FFT easy to use.

FPGA

A field-programmable gate array (FPGA) is an integrated circuit designed to be configured by the customer or designer after manufacturing: hence *field-programmable*.

GND

the electrical ground (aka. earth)

GPS

The Global Positioning System (GPS) is a space-based global navigation satellite system that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites.

Hz

The hertz (symbol: Hz) is the SI unit of frequency defined as the number of cycles per second of a periodic signal.

IRIG-B

The Inter Range Instrumentation Group (IRIG) is the standards body of the Range Commanders Council (RCC). They publish a number of standards: e.g. IRIG time-codes The different time-codes defined in the Standard have alphabetic designations. A, B, D, E, G, and H.
IRIG-B has a Bit rate of 100 Hz.

LED

A light-emitting diode is a semiconductor light source.

It is used in all modules of the SIRIUS® system to indicate the status of the modules.

LEMO

LEMO is the name of the high quality push-pull connectors that are used for cable connections: e.g. the power-supply cable and the sync cables of the SIRIUS® system.
The company that produces these connectors is also called LEMO (www.lemo.com)

Microsoft®

Microsoft® Corporation is a public multinational corporation head-quartered in Redmond, Washington, USA that develops, manufactures, licenses, and supports a wide range of products and services predominantly related to computing through its various product divisions.

DEWESoft® is a Windows®-based application and thus a Windows® operating system must be installed on the measurement PC where DEWESoft® is installed.

see www.microsoft.com

NET Option

aka. DEWESoft NET, DEWE NET

With DEWE-NET your measurement system can be controlled remotely with ease of use you couldn't imagine before. DEWE-NET also serves as the centre of Distributed Data Acquisition systems where you have multiple systems located either together or scattered across an entire continent. IRIG and GPS time will take care that data will stay synchronised, no matter how long the acquisition runs.

OS

An operating system (OS) is a set of system software running on a device that manages the system hardware.

This may refer to the operating system of a PC (Windows is required for DEWESoft®) or to the operating system of the SIRIUS® system.

PC

SIRIUS® systems are typically connected to a Personal Computer which runs DEWESoft® to fetch the measurement data.

See also: Host System

RMS

Root Mean Square (RMS), also known as the quadratic mean, is a statistical measure of the magnitude of a varying quantity. It is especially useful when variates are positive and negative, e.g., sinusoids. RMS is used in various fields, including electrical engineering.

RTD

Resistance thermometers, also called resistance temperature detectors or resistive thermal devices (RTDs), are temperature sensors that exploit the predictable change in electrical resistance of some materials with changing temperature; e.g. Pt100 and Pt1000

SNR

Signal to Noise Ratio (SNR) is the ratio of the RMS value of the full scale input range to the total RMS noise measured with the inputs shorted together. The value for SNR is expressed in decibels (dB).

SNTP

Simple Network Time Protocol (SNTP) is a protocol for synchronising the clocks of computer systems over packet-switched, variable-latency data networks. It is a simpler and less accurate version of the Network Time Protocol (NTP).

Synchronisation cable

These synchronisation cables can be used to synchronise several SIRIUS® chassis with each other: see 8.2 Synchronisation for details.

USB

Universal Serial Bus is a specification to establish communication between devices and a host controller (usually PCs).

SIRIUS® systems use a USB connection to connect to a PC.

Windows®

A PC operating system by Microsoft®. DEWESoft® will work on Windows® XP, Windows® Vista and Windows® 7. Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

9.2 Documentation version history

Revision number: 1238
Last modified: Fr 09 Aug 2019, 11:51

Version	Date [dd.mm.yyyy]	Notes

1.3.0	13.11.2014	☑ New orange logo and style
		☑ *non-isolated* is now called *differential*
		☑ Added CHG, LV, HD-ACC, HS-CHG, HS-HV, HS-LV, HS-STG
		☑ Replaced STGM with STGMv2, HV with HVv2 and STG with STGv2
		☑ Added SIRIUS-R2D, SIRIUS-R8D, updated SIRIUS-R8
		☑ Corrected specs
		  ☑ HS-ACC (sampling rate)
		  ☑ MULTI: Bridge Ranges
		  ☑ HD-LV: ADC type, Over-voltage Protection
		  ☑ HD-STGS: ADC type, Bridge Ranges, Exc. Voltage, removed Counters
		  ☑ Analogue-out: bandwidth
		  ☑ Expanded general specifications
		☑ SBOXx-GPS: removed 1Hz: all others are optional
		☑ Added power connector pins and mating connectors

1.3.1	23.01.2015	☑ Added HD-ACC module ☑ Added HD-LV BNC ☑ Updated Specs: LV2 , Multi, STGv2, STGMv2, HS-ACC, HS-CHG, HS-STG
1.4.0	18.04.2015	☑ Added EtherCAT® information
1.4.1	01.10.2015	☑ Updated image of EtherCAT single slice version in chapter 4.2.2: now you see the USB connector ☑ Updated pin-out images of BNC connectors ☑ SIRIUS® is now a registered trademark ☑ Added chapter 6 Measurement including Anti-Aliasing ☑ Added chapter for Firmware-upgrade ☑ ACC+: corrected Sensor Supply voltage (was 14V – now 12V) ☑ Digital Filter (vs. Sample Rate): removed from Specifications tables and moved to “ADC oversampling chapter” and corrected the frequency ranges ☑ MSI-BR-TH are now called MSI-TH ☑ Chapter “HS-LV DSUB-9”: corrected connectors and wiring diagrams ☑ CHG and HS-CHG: added missing Input coupling 0.5Hz ☑ Added chapter for “R8D Mounting”
1.4.2	13.11.2015	☑ General Specifications: Updated Humidity, added Acquisition rate – Time base accuracy ☑ HVv2, HS-HV: updated Input Impedance ☑ Corrected description of Illustration in 5.21.2 HS-STG+ (Counter) L1B7f
1.4.3	02.03.2016	☑ The Accessories chapter has been moved to a separate document (Accessories & Sensors) ☑ Corrected article number of sync mating connector
1.4.4	09.03.2016	☑ Replaced R2D with R2DB ☑ Corrected the Power connector types ☑ Corrected image of SBOXf backside-connectors ☑ Removed 20Hz GPS option ☑ Removed old documentation history entries (pre 1.3.0) from this table

Version	Date [dd.mm.yyyy]	Notes

1.5.0	09.03.2017	☑ Added R8DB, R2D, SBOXre
		☑ changes: SBOX2→SBOXe, FLASH120→FLASH250, SIRIUSf-SBOX→SBOXfe, Single slice→Modular solution, Mulit-slice→Boxed Solution
		☑ Updated specifications of all SBOXes
		☑ Updated specifications to HS-LVv2 and HS_HVv2, HD-STGS (dynamic Range)
		☑ Counter modules:
		  ☑ added chapter "General Counter Specifications" and clarification of the GND connection
		  ☑ updated images
		☑ Added "R2DB Power-Out Specifications", pinning table for 5.13.5 STG DSUB-9, description for "Module" in chapter 5.2 Technology overview,
		table with GPS specifications, MIL-STD-810D to Specifications, chapter "HS-STG: Sensor connection"
		☑ Added Mating Connector info to STG-L2B7f, STG-L2B10f and HD-STGS L1B10f
		☑ Update STGM to STGMv3 (Excitation Voltage: Predefined levels)
		☑ Updated STGv2 to STGv3:
		  ☑ Updated Typ. CMR
		  ☑ Max. common mode voltage
		☑ Updated ACC to ACCv2 (IEPE mode Excitation)
		  ☑ Updated: Offset drift, Channel cross talk, Input coupling, Input Impedance
		☑ Updated HS-LV Input Impedance
		☑ HD-LV: added max. common mode voltage
		☑ HD-STGS: Max. common mode voltage
		☑ Corrected ADC link in specs of: HS-HV, HS-LV, HS-STG
		☑ HS-STG: update: offset drift, Max. common mode voltage, Offset accuracy after Balance Amplifier, Input accuracy
		☑ Table 7: R2DB Battery Specifications: improved "Power Out" section
		☑ Major changes to chapter "4 Enclosure Overview"
		☑ Updated chapter 3 to newer DEWESoft® version and to Windows® 10
		☑ Updated chapter *8.2.2.2 Several PCs and SIRIUS® systems* related to the NET option
		☑ Updated chapter 5.22 Analogue out OPTION

1.5.1	22.09.2017	☑ "5.11.3.4 MULTI-L2B16f", "5.12.6.4 STGM-L2B16f": corrected pins for Exc+ and Exc- ☑ The numbers in the page-footer now in the document the numbers in the PDF ☑ SBOXe and SBOXfe USB rear ports ☑ Added Flyback diode at all open collector digital output schematics for relays ☑ HS-STG Analog input accuracy update
1.5.2	12.10.2017	☑ Added common mode voltage specs for isolated versions ☑ Added voltage warnings
1.5.3	19.12.2017	☑ Added front USB connector info for R2DB i7 version
1.5.4	27.02.2019	☑ Update general power supply in chapter 5.6 from 6-36V to 9-36V
1.5.5	09.08.2019	☑ ACCv2: Update of Dynamic Range Specifications @ 50kHz ☑ STGMv3: Update of Channel Cross talk specifications @ 1kHz