

SIRIUS®

 **DEWESoft®**

TECHNICAL REFERENCE MANUAL

SIRIUS® V25-1



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 1 MS/s)
 - 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 20 kS/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 1 MHz (high-speed) and can be directly connected to native USB ports on the measurement PC (or SBOX). 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/s 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).



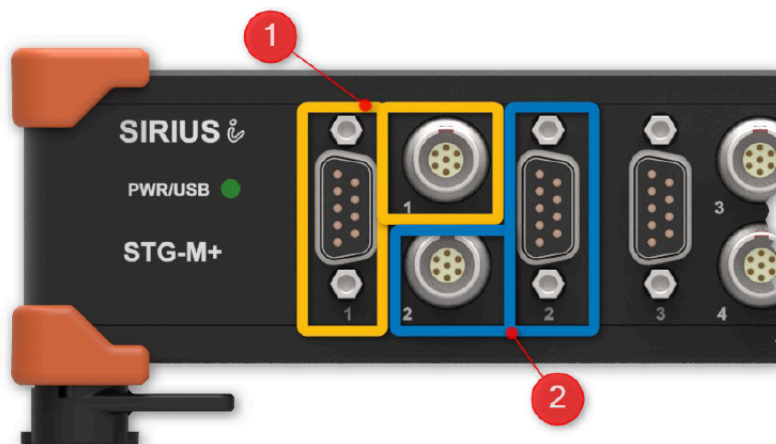
Important

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.



Important

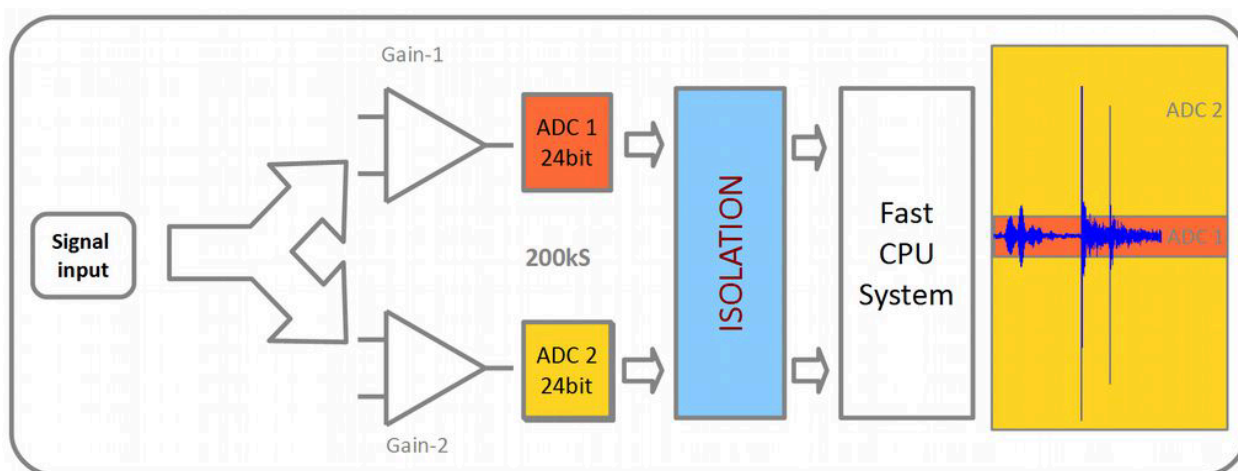
The EtherCAT version of SIRIUS works with a range of 9 - 36V, and not up to 48V, even though the range is up to 48V for other product lines with EtherCAT.



SIRIUSi-STGM+ module

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.

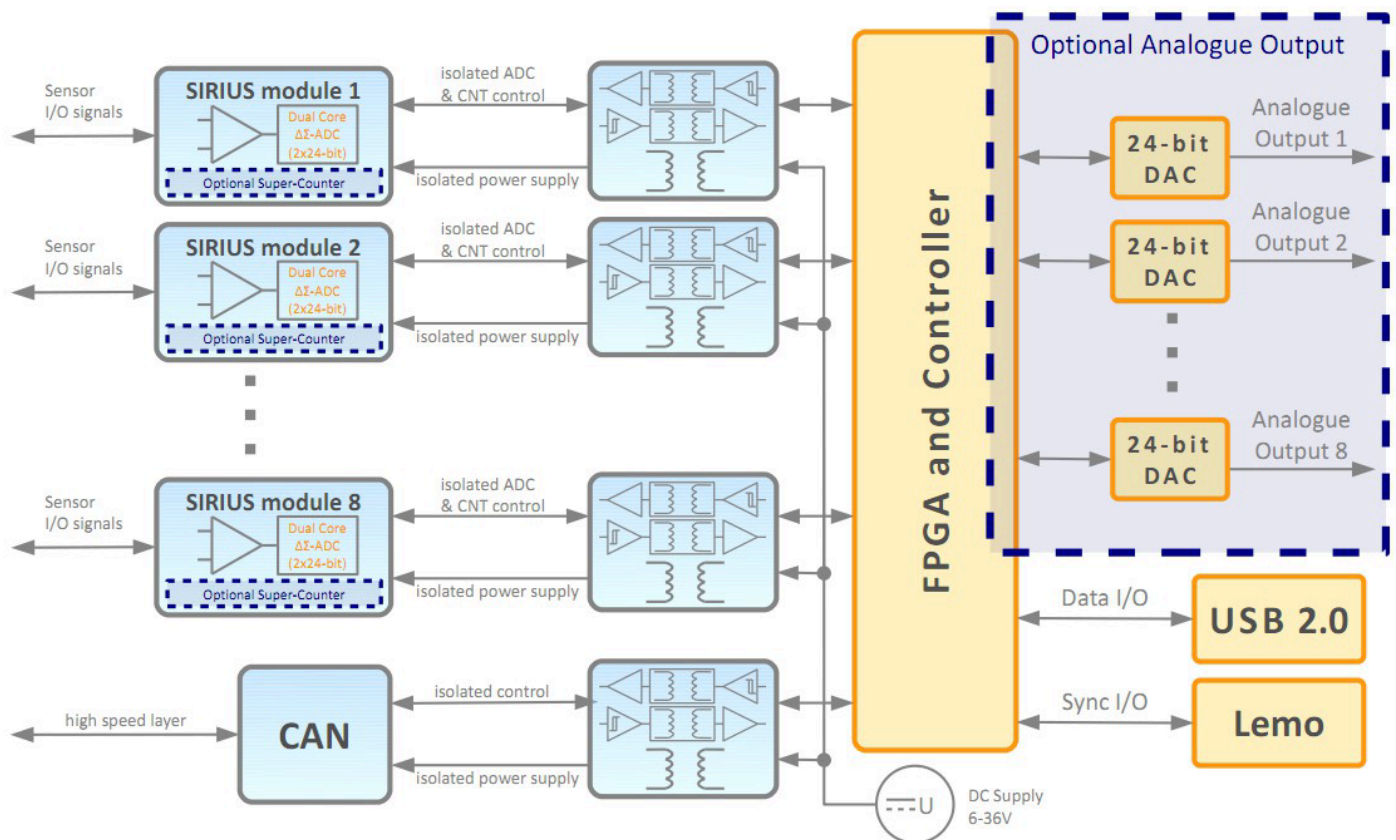


SIRIUS Dual Core

5.2.5. Isolated version: USB

The (standard) SIRIUSi modules are isolated between each other 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 analog inputs are not isolated between themselves (they have the same ground) that is available on the GND connector pin (e.g. The analog input and the counter of one ACC+ module share the same GND).



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.

5.3.1.12. SIRIUSi 8xUNI



SIRIUSi 8xUNI

5.3.2. Customized slice

We can build a customized slice with modules that you choose and in any order..



Example

SIRIUS costume slice containing: 2x ACC, 2x ACC+, 1x MULTI, 1x STG and 2x HV



SIRIUSi-CUSTOM-2xACC-BNC-2xACC+-1xMULTI-1xSTG-2xHV-BAN

5.4. SIRIUS® Dual Core specifications

	UNI	STG	STGM	MULTI	ACC
Connectors	DSUB-9, L2B10f	DSUB-9, L2B7f, L2B10f	DSUB-9, L2B7f, L2B10f	DSUB-15, L2B16f	BNC, TNC
Counter version	✓	✓	✓	✓	✓
Isolated version	✓	✓	✓	✓	✓
Differential version	✓	✓	✓	✓	✓
EtherCAT version	✓	✓	✓	✓	✓
Rack version	✓	✓	✓	✓	✓
Fanless version	✗	✗	✓	✗	✓
Channels per slice	8	8	8	8	8
Data rate / channel	200 kS/sec USB, 20 kS/sec EtherCAT	200 kS/sec USB, 20 kS/sec EtherCAT	200 kS/sec USB, 20 kS/sec EtherCAT	200 kS/sec USB, 20 kS/sec EtherCAT	200 kS/sec USB, 20 kS/sec EtherCAT
Resolution	24-bit dual core	24-bit dual core	24-bit dual core	24-bit dual core	24-bit dual core
Bandwidth	70 kHz	70 kHz	70 kHz	70 kHz	70 kHz
Voltage ranges	±100 V, ±10 V, ±1 V, ±100 mV, ±10 mV	±50 V, ±10 V, ±1 V, ±100 mV	±10 V, ±1 V, ±100 mV, ±10 mV	±10 V, ±1 V, ±100 mV, ±50 mV	±10 V, ±500 mV
Input coupling	DC, AC 0.3 Hz / 0.16 Hz (1, 3, 5, 10, 20 Hz SW)	DC, AC 1 Hz (3, 10 Hz SW)	DC	DC	DC, AC 0.1 Hz, 1 Hz
Sensor excitation	0..20 V max. 0.8 W, 0..60 mA max 0.5 W, IEPE 2..20 mA	0..20 V max. 0.8 W, 0..60 mA max 0.5 W	0..15 V max. 44 mA	0..12 V max. 44 mA	IEPE 2, 4, 8, 12, 16, 20 mA
Bridge connection	Full, ½, ¼ 350 Ω, ¼ 120 Ω 3, 4 wire	Full, ½, ¼ 350 Ω, ¼ 120 Ω 3, 4 wire	Full, ½, ¼ 350 Ω, ¼ 120 Ω 3 wire	Full, ½, ¼ 350 Ω, ¼ 120 Ω 3 wire	✗
Programmable shunt	59.88 kΩ, 175 kΩ bipolar	59.88 kΩ, 175 kΩ bipolar	100 kΩ bipolar	59.88 kΩ	✗
IEPE input	✓	DSI-ACC	DSI-ACC	DSI-ACC	✓
Resistance	✓	✓	✗	✗	✗
Temperature (PTx)	✓	✓	DSI-RTD	DSI-RTD	✗
Thermocouple	DSI-TH	DSI-TH	DSI-TH	DSI-TH	✗
Current	ext. shunt, DSI	ext. shunt, DSI	ext. shunt, DSI	ext. shunt, DSI	ext. shunt
Potentiometer	✓	✓	✓	✓	✗
LVDT	DSI-LVDT	DSI-LVDT	DSI-LVDT	DSI-LVDT	✗
Charge	DSI-CHG	DSI-CHG	DSI-CHG	DSI-CHG	✗
TEDS	✓	✓	✓	✓	✓
Isolation voltage	1000 V	1000 V	1000 V	1000 V	1000 V
Power consumption per channel	2 W/ch	2 W/ch	1.3 W/ch	1.3 W/ch	1 W/ch
Advanced functions	Supports all strain types, IEPE sensors and high input range	Supports all strain types and high input range	Low power, sensor and amplifier balance, bipolar shunt	Analog Output, Low power, sensor and amplifier balance	Sensor error detection, high dynamic range
(I) Fanless operation only for BNC or Banana version (without excitation)					

5.7. General specification

The general specifications apply to all SIRIUS® measurement slices unless otherwise noted at the specific measurement slice.

Power	
Power Supply	9 - 36 V DC
Power consumption	Typ. 15 - 35 W
Environmental	
Operating Temperature	-10 to 50 °C (40 °C for fanless series)
Storage Temperature	-40 to 85 °C
Humidity	5 to 95 % RH non condensing @ 60 °C
IP rating	IP20 (IP50 for fanless series)
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
Dimensions	266 mm x 149 mm x 55 mm 266 mm x 149 mm x 69 mm (extended slice)
Acquisition rate	
Time base accuracy	Typical 5 ppm, Max: 20 ppm
Synchronisation	
Delay between slices	50 nsec
Max. Sync-cable length	100 m (Master/Slave), 200 m (IRIG)
EtherCAT®: Max. cable length	100 m
Sync Input / Output	
Level (Input/Output)	TTL compatible
Max. Output Current	±24 mA (±50 mA for 1 sec)

5.16. UNI/UNI+

The UNI module is very similar to the STG module but in comparison to it the UNI module also supports IEPE measurement.

5.16.1. UNI Specifications

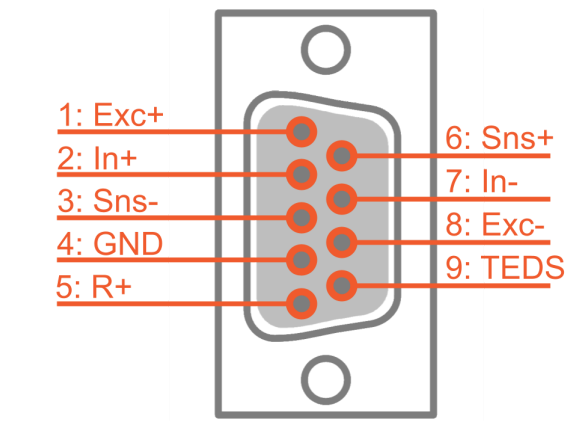
Inputs					
Input types	Voltage Full/Half/Quarter bridge strain (120 Ω and 350 Ω) IEPE Potentiometer, RTD, Resistance Current (ext. Shunt)				
ADC Type	24-bit delta-sigma dual core with anti-aliasing filter				
Sampling Rate	Simultaneous 200 kS/s				
Voltage Mode					
Dual Core Ranges (Low)	±100 V (±5 V)	±10 V (±500 mV)	±1 V (±50 mV)	±100 mV (±5 mV)	±10 mV (±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	±0.1 (0.1) mV
Offset Accuracy after Balance Amplifier	±1 mV	±0.1 mV	±0.02 mV	±0.01 mV	±0.01 mV
Typ. Dynamic Range @ 10 kS/s (Dual Core)	-147 dB (-160 dB)	-147 dB (-165 dB)	-144 dB (-153 dB)	-137 dB (-137 dB)	-117 dB (-117 dB)
Typ. Noise floor @ 10 kS/s (Dual Core)	-109 dB (-122 dB)	-109 dB (-126 dB)	-108 dB (-114 dB)	-100 dB (-100 dB)	-80 dB (-80 dB)
Typ. CMR @ DC...50 Hz / 400 Hz / 1 kHz	84 / 74 / 67 dB	104 / 103 / 100 dB	112 / 105 / 99 dB	121 / 107 / 98 dB	121 / 107 / 98 dB
Gain Drift	Typical 10 PPM/K, max. 40 PPM/K				
Offset Drift	range ≥ 100 mV: Typical 0.3 μV/K + 2 ppm of range/K, max 0.8 μV/K + 10 ppm of range/K range 10 mV: Typical 0.5 μV/K, max 1.8 μV/K				
Gain Linearity	range ≥ 100 mV: <0.02 % range 10 mV: <0.03 %				
Inter Channel Phase-mismatch	0.02° * fin [kHz] + 0.1° (@ 200 kS/s)				
Channel Crosstalk	-120 dB @ 10 kHz				
Input Coupling	DC AC 0.3 Hz for 100 V range; AC 0.16 Hz for all other ranges; (1 Hz, 3 Hz, 5 Hz, 10 Hz, 20 Hz per SW)				
Input Impedance	2 MΩ between IN+ and IN- for 100 V Range; all other Ranges > 1 GΩ				
Max. Common Mode Voltage	Isolated version: ±500 V				
	Differential version: 100 V Range: ±120 V; all other Ranges: ±12 V				
Overvoltage Protection	100 V Range: 200 V; all other Ranges: 100 V (200 V peak for 10 ms)				
Excitation Voltage					
Excitation Voltage	Free programmable (16-bit DAC)				
Predefined levels	0, 1, 2.5, 5, 10, 15 and 20 VDC				

Accuracy	±0.05 % ±2 mV	
Drift	±10 ppm/K ±100 µV/K	
Load stability	0 % to 100 % load <0.01 %	
Noise @ 10 V / 350 Ω	<150 µVrms @ 10 kS/s	
Line regulation over 20 Ω of change	<0.005 % @ 120 Ω load	
Sense Impedance to Exc / to GND	100 kΩ / >100 MΩ	
Current limit	100 mA (max. 800 mW)	
Protection	Continuous short to ground	
Excitation Current		
Excitation Current	Free programmable (16-bit DAC)	
Predefined levels	0.1, 1, 2, 5, 10, 20 and 60 mA DC	
Ranges	0.1 mA - 10 mA	>10 mA - 60 mA
Accuracy	0.05 % ±2 µA	0.1 % ±20 µA
Drift Typical	15 ppm/K	45 ppm/K
Compliance voltage	20 Volt, max. 500 mW	
Output Impedance	>100 MΩ	
Bridge Connection Types		
Bridge types	Full / Half / Quarter bridge (3-wire or 4-wire) / Quarter Constant Current (2-wire or 4-wire)	
Ranges	2 mV/V...1000 mV/V free programmable with Dual Core	
Internal Bridge Completion	Half and Quarter bridge 120 Ω and 350 Ω	
Typ. Bridge Completion Accuracy	0.05 %; TCR: 2 ppm/K (others on request)	
Internal Shunt Resistor	59.88 kΩ, 175 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	
IEPE mode		
IEPE Current	Free programmable (16-bit DAC)	
Predefined levels	2, 4, 8, 12, 16 or 20 mA	
Compliance voltage	25 Volt	
Output Impedance	>100 kΩ	
Sensor detection	Shortcut: <4 Volt; Open: >19 Volt	
Counters (only on UNI+ type)		
Inputs	1 digital counter input 3 digital inputs Fully synchronised with analog data Alarm output	
Counter Modes	counting, waveform timing, encoder, tacho, gear-tooth sensor	
General Counter Specifications	See "SIRIUS counter specifications"	
Additional Specifications		
Input connector	DSUB-9, 8-pin LEMO-2B, 10-pin LEMO-2B, 16-pin LEMO-2B (others on request)	

5.16.2. UNI



SIRIUSi 8xUNI

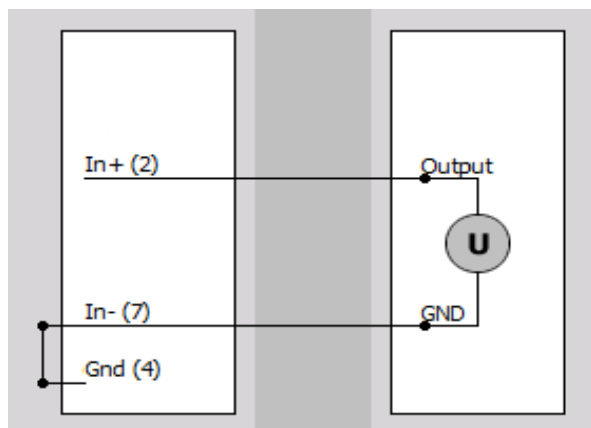


UNI connector: pin-out (DSUB-9 female)

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

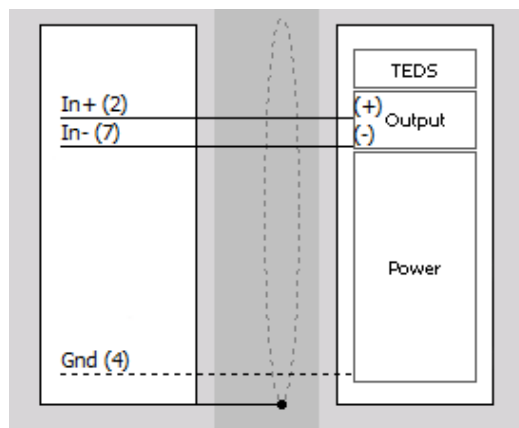
5.16.2.1. UNI: Voltage

Voltage - Single ended



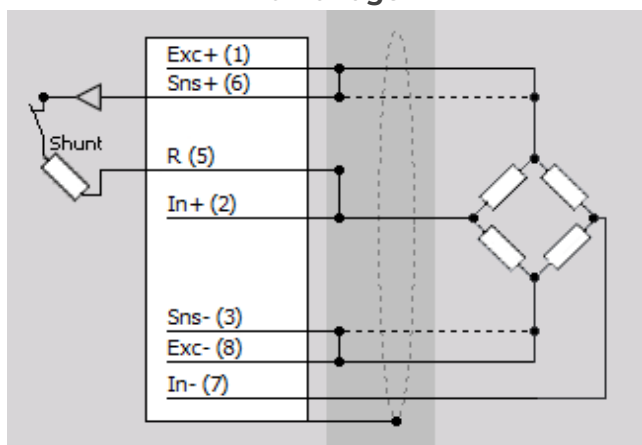
Voltage - Differential

Use only when sensor Output (+) and Output (-) are referenced to Gnd. Gnd must be connected.

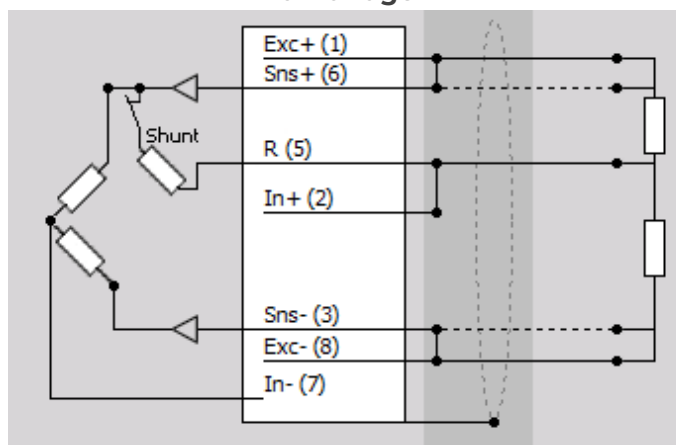


5.16.2.2. UNI: Bridge

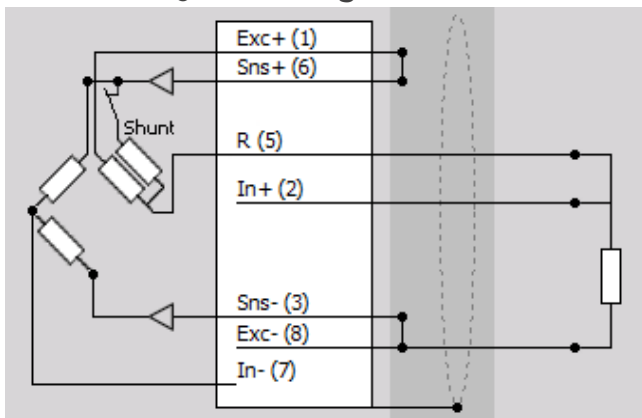
Full bridge



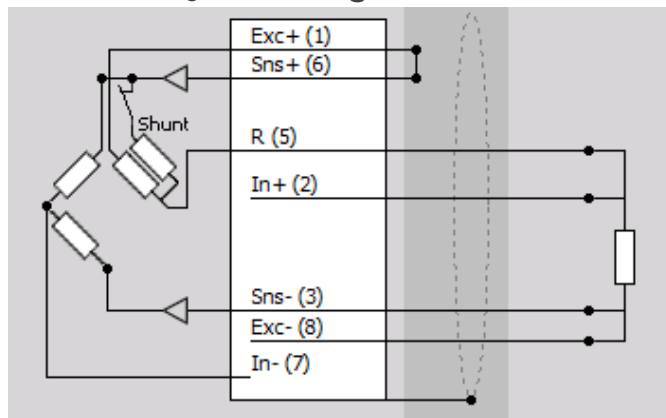
Half bridge



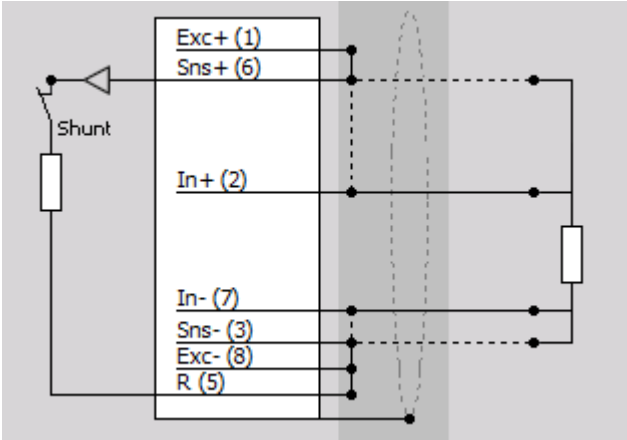
Quarter bridge – 3 wire



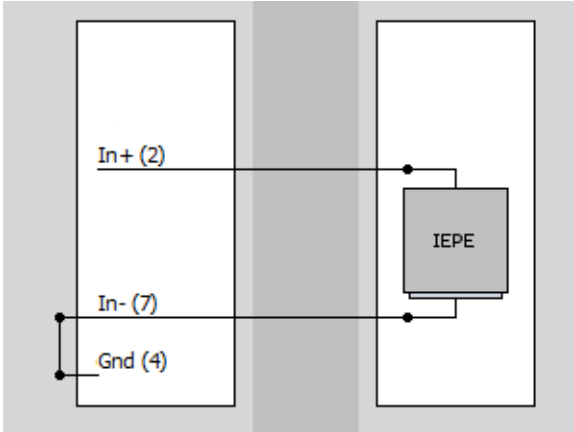
Quarter Bridge – 4 wire



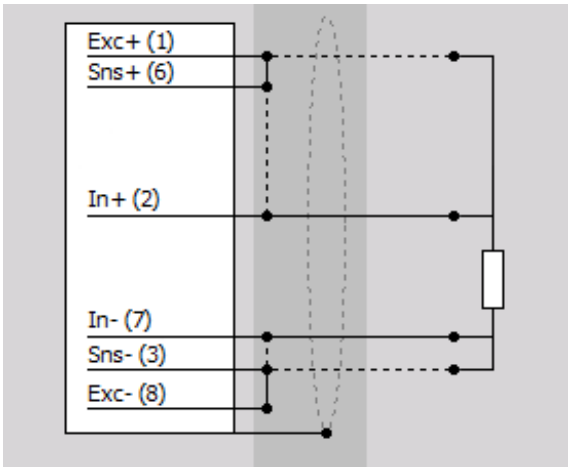
Quarter Bridge – Constant Current



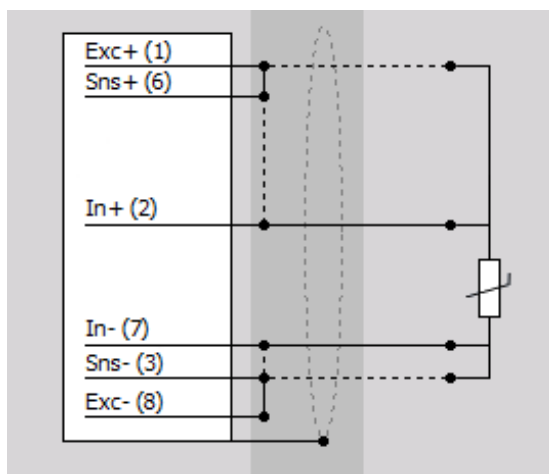
5.16.2.3. UNI: IEPE



5.16.2.4. UNI: Resistance

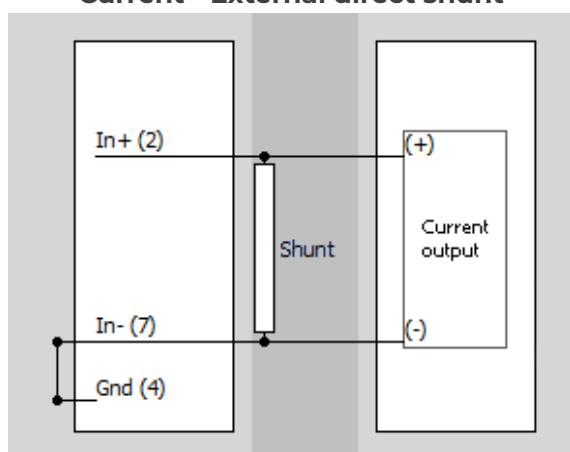


5.16.2.5. UNI: Temperature

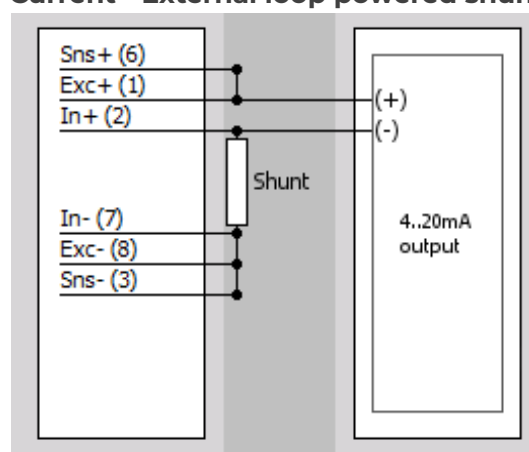


5.16.2.6. UNI: Current

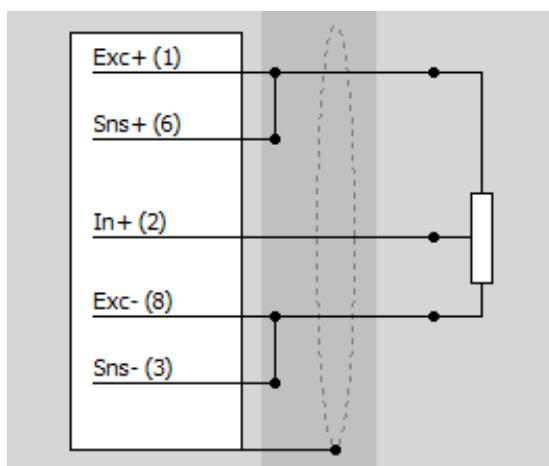
Current - External direct shunt



Current - External loop powered shunt



5.16.2.7. UNI: Potentiometer



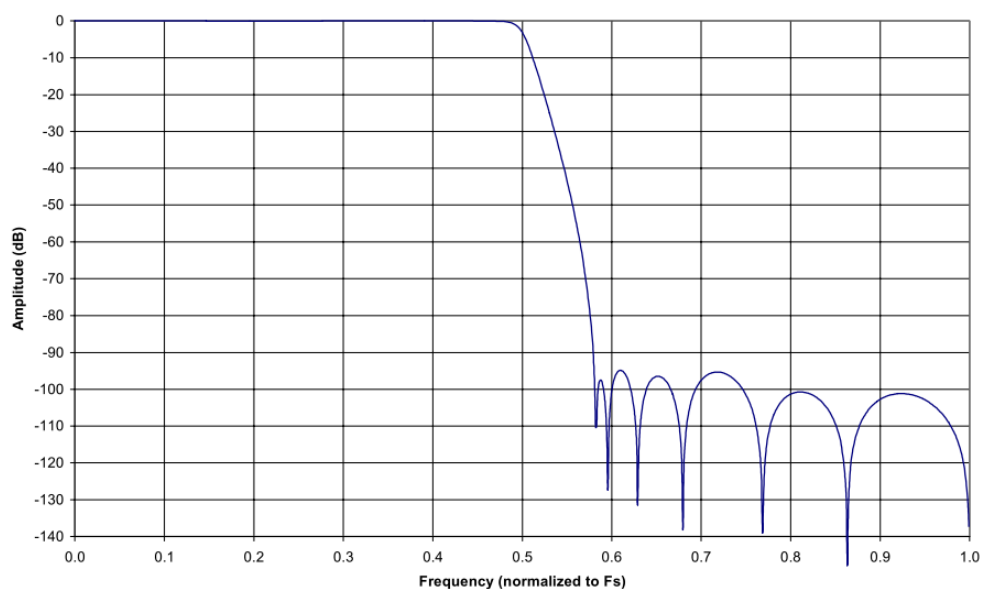
6.1.5.2. ADC digital filter and oversampling

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)	0.1 ... 51.2 kS/s	51.2 ... 102.4 kS/s	102.4 ... 204.8 kS/s
Bandwidth (-3 dB)	DC to 0.494 fs	DC to 0.49 fs	DC to 0.38 fs
Passband (-0.1 dB)	DC to 0.47 fs	DC to 0.45 fs	DC to 0.24 fs
Passband Ripple	-0.035 to +0.01 dB	-0.035 to +0.01 dB	-0.035 to +0.01 dB
Alias-free Bandwidth	DC to 0.42 fs	DC to 0.32 fs	DC to 0.22 fs
Alias Rejection	-95 dB	-92 dB	-97 dB
Delay through ADC	12 / fs	9 / fs	5 / fs
Oversampling	256	128	64

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



Sample rate 100 Hz to 51.2 kHz stopband rejection