

SIRIUS®

 **DEWESoft®**

TECHNICAL REFERENCE MANUAL

SIRIUS® V25-1



4.2. Enclosure Overview

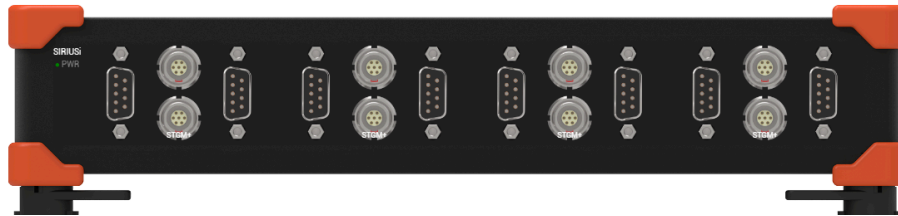
SIRIUS® systems are available in different enclosure types. The following list provides a short high-level overview and the following sub-chapters cover the details.

- **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.
- **Compact Systems:** A compact box that can contain up to 4 measurement slices and an optional SBOX 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 SBOX: 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 SBOX, display and optional batteries with 1 or 2 measurement slices.

Enclosure	Modular solution	Compact Systems				High-channel rack mountable systems			Portable all-in-one systems		Lab system
	SIRIUS	R4 / R4 HUB	R2 / R2 HUB	R2rt / R4rt	R1B / R2B	R8	R8D	R8DB	R2DB	R1DB	R3
Input type	ch-ch isolated (SIRIUSi), pair isolated (SIRIUSi HD) or differential slices (SIRIUS)										
Max SIRIUS slices	Flexible	4	2	2 / 4	1 / 2	8			2	1	3
Max DualCore/HS channels	8 per slice	32	16	16 / 32	8 / 16	64			16	8	24
Max HD channels (no counters possible)	16 per slice	64	32	16 / 32	16 / 32	128			32	16	48
Max counters	8 per slice	32				64			16	8	24
Max digital input/digital outputs	24 DI / 8 DO	96 DI / 32 DO				192 DI / 64 DO			48 DI / 16 DO	24 DI / 8 DO	72 DI / 24 DO
Analog out	Only USB with fan	Yes	Yes		No	Yes	No		No		Yes
Max CAN ports	1	4	2		1	8			2	1	
Computer system	Optional SBOXe, SBOXfe	Integrated SBOXse				Integrated SBOXre			Integrated SBOXse		Standard PC
Display	External (MOB DISP 12)		External			External	Integrated 17" Full-HD		Integrated 12" Full-HD		External
Batteries	External BP2i, BP4i	External BP2i, BP4i				External BP2i, BP4i		Integrated	Integrated		-
Power Supply	9-36 V DC	12-36 V DC	12-36 V DC	12-36 V DC	12-36 V DC	12-36 V DC	12-36 V DC	18-24 V DC	9-36 V DC	9-36 V DC	110 V / 220 V AC

4.2.1. Modular solution

A single SIRIUS® slice can have up to 8 measurement modules. Each measurement module typically has one analog channel. Some modules also have an optional counter channel (e.g. ACC+). HD modules have 2 analog channels.



SIRIUSi-8xSTGM+

We offer several standard chassis with predefined modules, 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
- EtherCAT®



Hint

You can use your SIRIUS® slices independently or combine them to a single fully-synchronized multi-channel measurement system with the clever click mechanism.

4.2.1.1. Single slice: USB

This chapter describes the SIRIUS® USB single slice enclosure.



Important

The LED indicator on the front side shows system status.

LED status	Description
 Green	Power is connected, system self-test PASSED.
 Red Blinking	Power is connected, system self-test error! - RAM - I2C bus (PLL, Temperature) - CAN (optional) - EtherCAT (optional)
 Green Blinking	“Easy device identification” feature. When selected in the setup, the corresponding SIRIUS Green LED indicator is blinking.

4.2.1.2. Single slice: Rear side

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



SIRIUS rear side

Name	Description
CAN	CAN bus DSUB-9 male connector
SYNC	Two 4-pin LEMO female sync connectors
USB	USB-mini to transfer the data to the SBOX or PC
GND	Protective Ground banana plug and M4 screw insert.
POWER IN	2-pin LEMO male connector
POWER OUT	2-pin LEMO female connector

Analog-out connectors

The optional analog output version of the SIRIUS Single Slice has 8 additional BNC connectors for the analog output channels on the rear side (for detailed information see chapter: Analog out option).



Rear side connectors of the analog-out version

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.

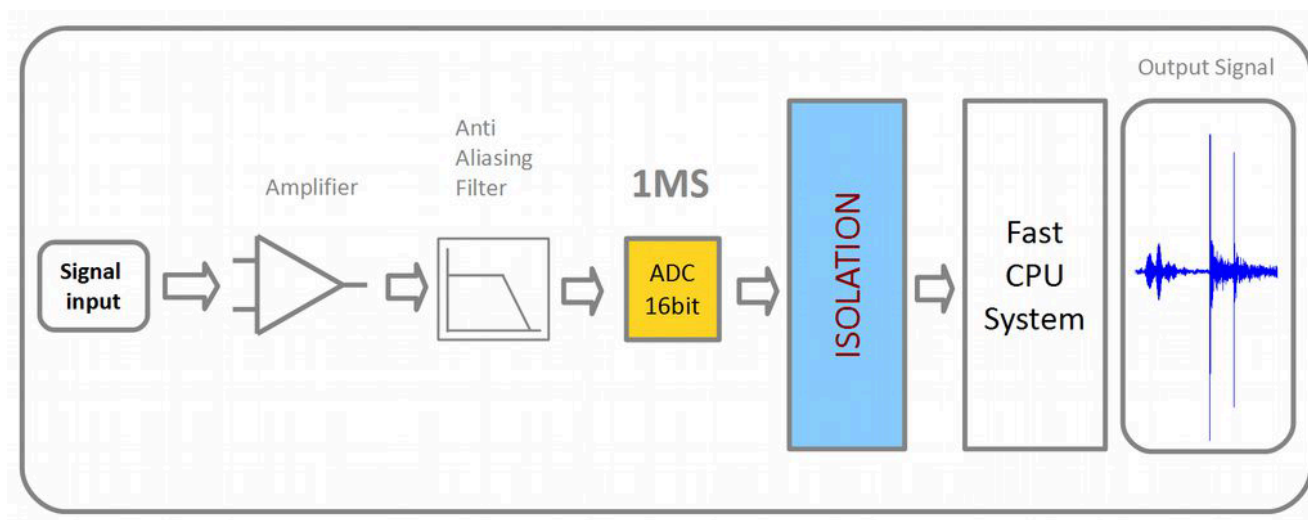


Important

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.

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 analog anti-aliasing filter (100 kHz, 5th order Bessel) is combined with a free programmable digital IIR filter block inside the FPGA. For bandwidth requirements of up to 2 MHz the complete filter chain can be bypassed.

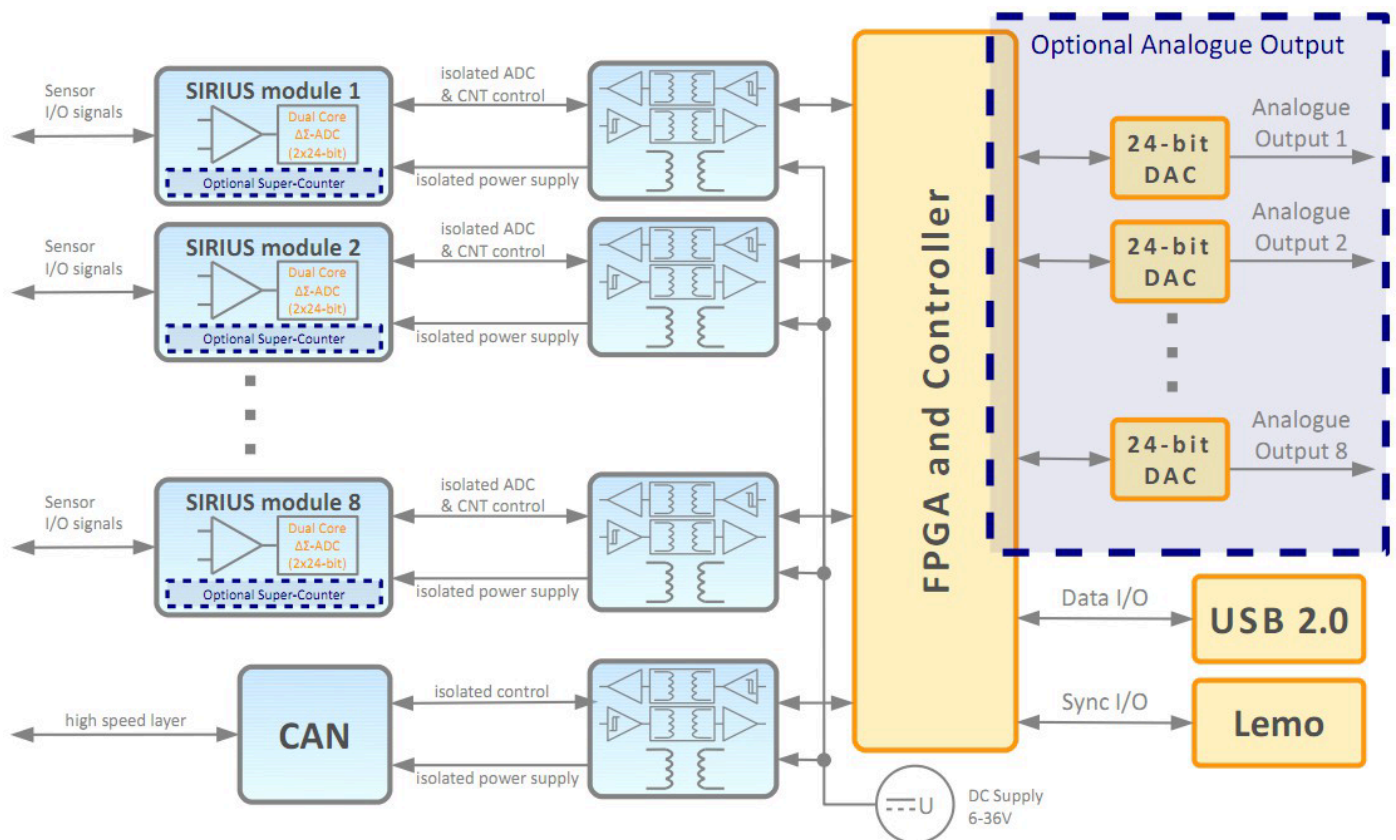


SIRIUS High Speed

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.

5.5. SIRIUS® HD and HS specifications

SIRIUS HS

	HS-HV	HS-LV	HS-ACC	HS-CHG	HS-STG
Connectors	BANANA	DSUB-9, BNC, BANANA	BNC	BNC, TNC	DSUB-9
Counter version	✗	✓	✓	✓	✓
Isolated version	✓	✓	✓	✓	✓
Differential version	✗	✓	✓	✓	✓
EtherCAT version	✓	✓	✓	✗	✓
Rack version	✓	✓	✓	✓	✓
Fanless version	✓	✓ (see 1)	✗	✗	✗
Channels per slice	8	8	8	8	8
Data rate / channel	1 MS/s	1 MS/s	1 MS/s	1 MS/s	1 MS/s
Resolution	16-bit	16-bit	16-bit	16-bit	16-bit
Bandwidth	2 MHz	1 MHz	500 kHz	500 kHz	1 MHz
Voltage ranges	±2000 V ... ±20 V	±100 V ... ±50 mV	±10 V ... ±200 mV	±10 V ... ±100 mV	±50 V ... ±20 mV
Input coupling	DC	DC, AC 1 Hz (3, 10 Hz SW)	DC, AC 1 Hz (3, 10 Hz SW)	DC, AC 0.1 Hz, 1 Hz, 10 Hz, 100 Hz	DC, AC 1 Hz (3, 10 Hz SW)
Sensor excitation	✗	2...30 V bipolar, 0...24 V unipolar, max. 0.2 A / 2 W	IEPE 4 mA, 8 mA	IEPE 4, 8, 12 mA	0...20 V max. 0.8 W, 0...60 mA max 0.5 W
Bridge connection	✗	Full	✗	✗	Full, ½, ¼ 350 Ω, ¼ 120 Ω, 3 or 4 wire
Programmable shunt	✗	✗	✗	✗	59.88 kΩ, 175 kΩ bipolar
IEPE input	✗	DSI-ACC	✓	✓	DSI-ACC
Resistance	✗	✗	✗	✗	✓
Temperature (PTx)	✗	DSI-RTD	✗	✗	✓
Thermocouple	✗	DSI-TH	✗	✗	DSI-TH
Potentiometer	✗	✗	✗	✗	✓
LVDT	✗	DSI-LVDT	✗	✗	DSI-LVDT
Charge	✗	DSI-CHG	✗	1 k ...100 k pC	DSI-CHG
Current	✗	ext. shunt, DSI	ext. shunt	ext. shunt	ext. shunt, DSI
TEDS	✗	✓	✓	✓	✓
Isolation voltage	CAT II 1000 V	1000 V	1000 V	1000 V	1000 V
Power consumption per channel	1 W/ch	1.2 W/ch	2 W/ch	1.2 W/ch	2 W/ch
Advanced functions	High voltage, high bandwidth, high isolation	High sensor power and multi range	Sensor error detection, high speed	Sensor error detection in IEPE and CHG mode (injection)	High speed, supports all strain types and high input range

(1) 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.

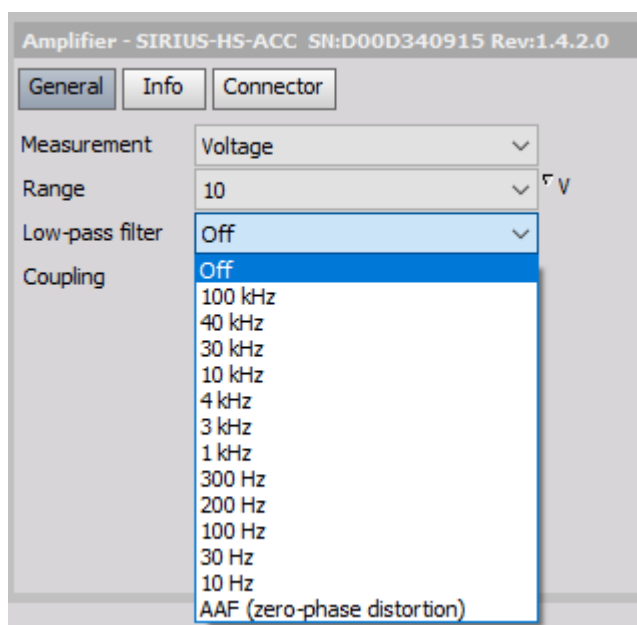
Power	
Power Supply	9 - 36 V DC
Power consumption	Typ. 15 - 35 W
Environmental	
Operating Temperature	-10 to 50 °C (40 °C for fanless series)
Storage Temperature	-40 to 85 °C
Humidity	5 to 95 % RH non condensing @ 60 °C
IP rating	IP20 (IP50 for fanless series)
Shock & Vibration	Vibration sweep sinus (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)

5.7.2. HS general specifications

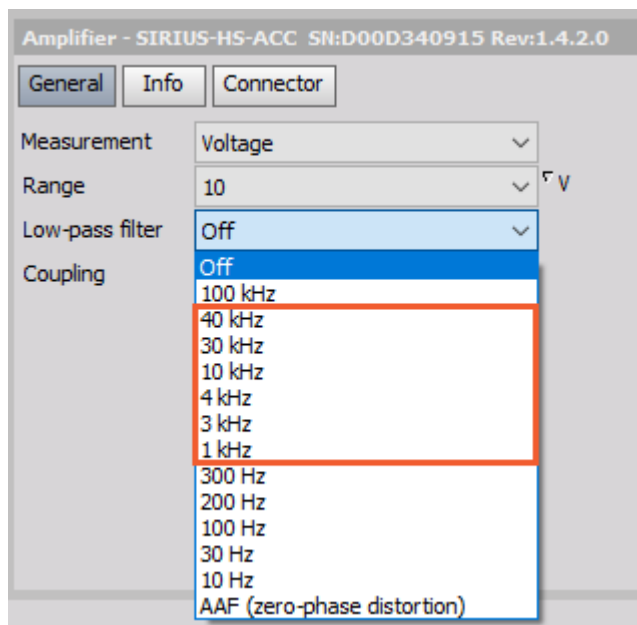
ADC	
Type	16-bit SAR
Sampling Rate	Simultaneous 1 MS/sec
Analog anti alias filter	Bypass or analog 100 kHz 5th order Bessel
Digital low pass filter	Software selectable
Digital filter Characteristic	Bypass, Butterworth or Bessel
Filter Order	2nd , 4th, 6th or 8th
Ratio Sample rate to Filter Freq.	From 2 to 100
Topology	Cascaded IIR Filter (up to 4 sections)

5.7.3. Low-pass filters on Sirius HS

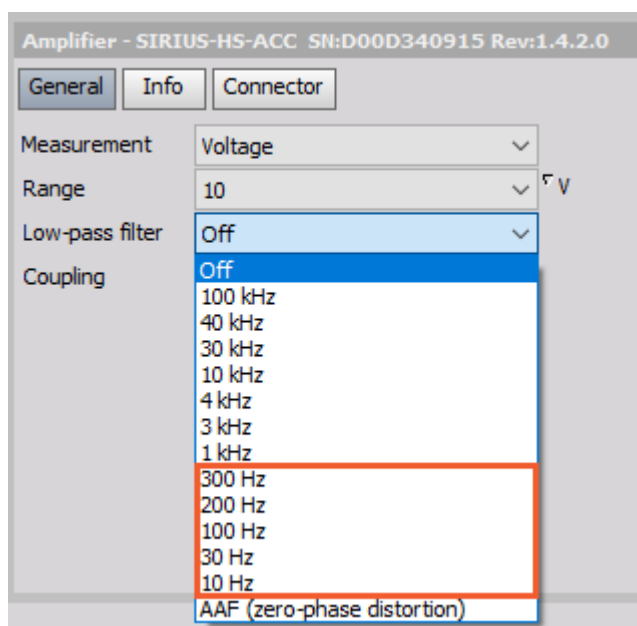
- The **100 kHz filter** is a hardware filter and is always applied except for when the "Off" option is selected in the dropdown menu.
This hardware filter is a Bessel 5th order filter.



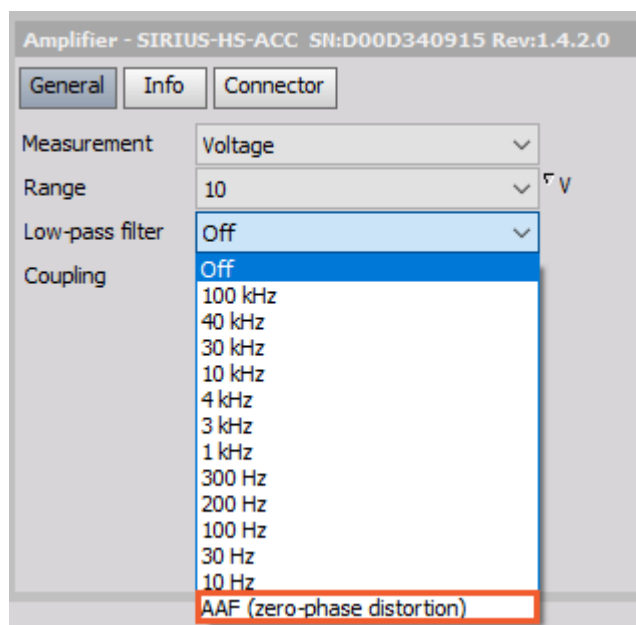
- IIR filters **between 40 and 1 kHz** are firmware filters, which means, that they are calculated on the FPGA.



- IIR filters with cut-off frequencies **lower than 1 kHz** are Software filters. If one of these filters is selected in the dropdown menu, then in addition to the software filter, with the selected cut-off frequency, a firmware filter with 1 kHz cut-off frequency is applied (the type and order of this filter is the same as the software one).



4. **AAF (zero-phase distortion)** has a cut-off frequency of 80 kHz, if the channel sample rate is equal or above 160 kHz. When a lower sample rate is selected, then the cut-off frequency of the AAF is equal to half the sampling rate of that channel.



5. **Special case:** If on a channel, that has a sample rate divider, a IIR filter is applied whose cut-off frequency is greater then 0.4 times the channels sampling rate, then in addition to the selected IIR filter a filter with a cut-off frequency at 0.4 times the sampling rate of the channel is also applied to the filter chain.

5.22. HS-HV

The HV modules are perfect for high-speed, high-sample-rate, wide-bandwidth high voltage measurements.

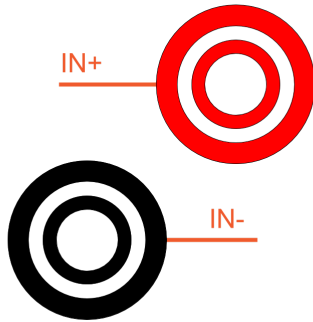
5.22.1. HS-HVv2: Specifications

Inputs				
Input types	Voltage			
ADC Type	16-bit SAR			
Sampling Rate	Simultaneous 1 MS/s			
Filtering	See "HS general specifications"			
Analog bandwidth	2 MHz			
Voltage Mode				
Ranges	±1600 V, ±800 V, ±400 V, ±200 V, ±100 V, ±50 V, ±20 V			
Input Accuracy (see 1)	Signal frequency	Accuracy		
	DC	±0.03 % of reading ±0.02 % of range ±0.04 V		
	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 1000 kHz	±5 % of reading ±0.5 % of range		
Typ. Noise floor	Sample rate/Range →	1600 V	400 V	100 V
	1 MS/s	-83 dB	-79 dB	-71 dB
	200 kS/s	-85 dB	-85 dB	-82 dB
	20 kS/s	-100 dB	-97 dB	-90 dB
Typ. CMR @ 50 Hz / 1 kHz / 10 kHz	85 dB / 75 dB / 50 dB			
Gain Drift	Typical 25 ppm/K, max. 50 ppm/K			
Offset Drift	Typical 1 mV/K + 10 ppm of range/K, max 2 mV/K + 15 ppm of range/K			
Gain Linearity	<0.02 %			
Channel Cross talk	-115 dB @ 50 Hz; -90 dB @ 1 kHz			
Input Coupling	DC			
Input Impedance	10 MΩ 2 pF			
Overvoltage category	CAT II 1000 V			
Maximum input voltage	2000 Vdc or 2000 Vpk (1414 Vacrms)			
Additional Specifications				
Input connector	Banana			
TEDS support	NA			
1) 50 V Range (1.2 MHz) and 20 V range (700 kHz) have limited bandwidth				

5.22.2. HS-HVv3: Specifications

Inputs				
Input types	Voltage			
ADC Type	16-bit SAR			
Sampling Rate	Simultaneous 1 MS/s			
Filtering	See "HS general specifications"			
Analog bandwidth	2 MHz (1.5 MHz for 50 V range, 800 kHz for 20 V range)			
Voltage Mode				
Ranges		±2000 V, ±1000 V, ±400 V, ±200 V, ±100 V, ±50 V, ±20 V		
Input Accuracy	Signal frequency	Accuracy		
	DC	±0.03 % of reading ±0.02 % of range ±0.04 V		
	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 1000 kHz	±5 % of reading ±0.5 % of range		
Typ. Noise floor	Sample rate/Range →	2000 V	400 V	100 V
	1 MS/s	-84 dB	-80 dB	-71 dB
	200 kS/s	-86 dB	-85 dB	-83 dB
	20 kS/s	-100 dB	-96 dB	-91 dB
Typ. CMR @ 50 Hz / 1 kHz / 10 kHz	95 dB / 75 dB / 55 dB			
Gain Drift	Typical 25 ppm/K, max. 50 ppm/K			
Offset Drift	Typical 1 mV/K + 10 ppm of range/K, max 2 mV/K + 15 ppm of range/K			
Gain Linearity	<0.02 %			
Channel Cross talk	-115 dB @ 50 Hz; -90 dB @ 1 kHz			
Input Coupling	DC			
Input Impedance	10 MΩ 2 pF			
Overvoltage category	CAT II 1000 V			
Maximum input voltage	2000 Vdc or 2000 Vpk (1414 Vacrms)			
Additional Specifications				
Input connector	Banana			
TEDS support	NA			

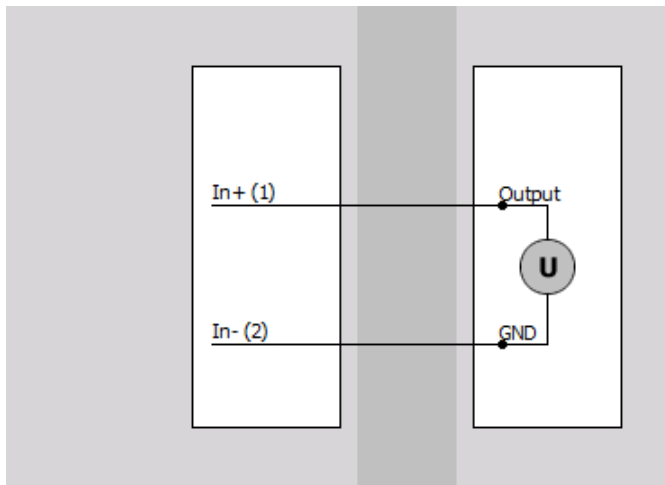
5.22.3. HS-HV



SIRIUSi-HS-8xHV

HS-HV connector: pin-out (Banana plug)

5.22.3.1. HS-HV: Voltage



6.1.6. SIRIUS® High Speed: Anti-Aliasing

Sirius HS has a fast 1 MS/sec SAR type AD converter. That means that the ADC by itself doesn't filter the incoming signal, but acquires it »as is« at the time of sampling.

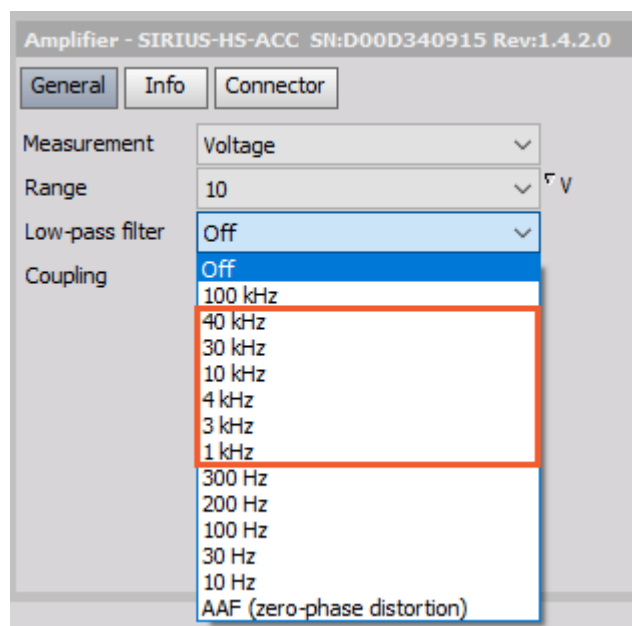
This is very useful in some cases where we want to have bandwidth of the signal as high as possible, for example when capturing transients, non sine wave (rectangular, triangular) signals, when acquiring voltage and current from frequency inverters and others.

Then the bandwidth must be as high as possible. With Dewesoft HS-HV and HS-LV the bandwidth of the amplifier is as high as 2 MHz, ACC module has 500 kHz ...

Of course this kind of amplifier strategy also passes through higher harmonics, which in other cases (when we are interested in real frequency contents of the signal) doesn't work well. In such cases we need the strong anti-alias filtering of the signals. What makes it even more difficult is that each application requires different cutoff frequencies.

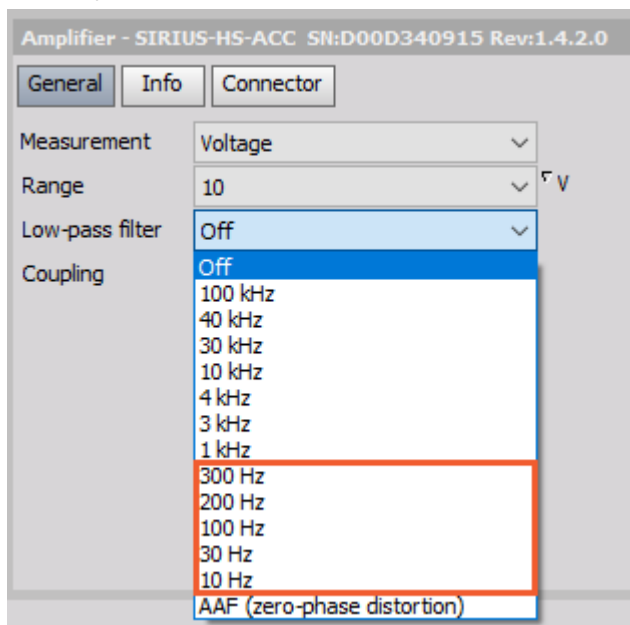
SIRIUS-HS can use 5 different filters which can be turned on or off:

- The first one is a 5th order Bessel analog hardware filter with cut-off frequency at 100 kHz, cutting off the high frequency content in the analog world before ADC conversion. When the filter is switched OFF, amplifiers will also acquire high frequency content.
- IIR filters between 40 and 1kHz are Firmware filters, which means that they are calculated on the FPGA. The filters can be selected from the drop-down list in the Low-pass filter options in Channel settings



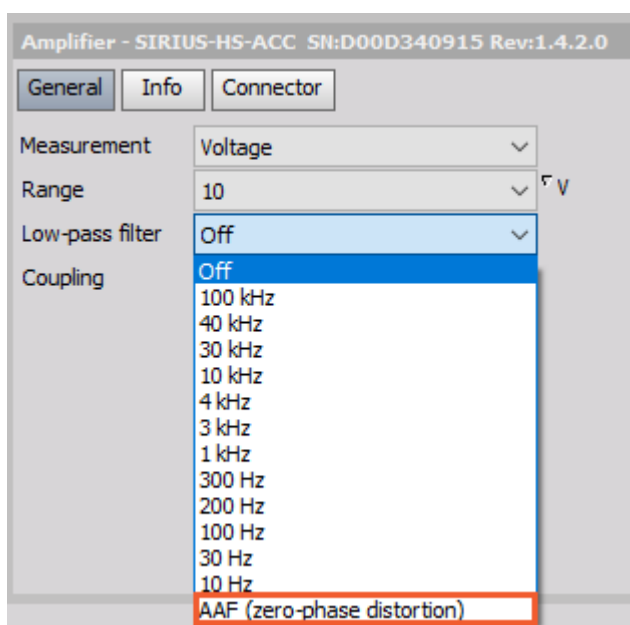
Firmware filters

- IIR filters with cut-off frequencies lower than 1 kHz are Software filters. If one of these filters is selected in the dropdown menu, then in addition to the software filter, with the selected cut-off frequency, a firmware filter with 1 kHz cut-off frequency is applied (the type and order of this filter is the same as the software one)



Software IIR filters

- AAF (zero-phase distortion - FIR filter) filter/decimator with the cutoff frequency dependent from sampling rate. The cut-off frequency of 80 kHz is set, if the channel sample rate is equal or above 160 kHz. When a lower sample rate is selected, then the cut-off frequency of the AAF is equal to half the sampling rate of that channel.



AAF (zero-phase distortion filter)