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Data sheet

GEN series
GN410

Bridge ISO 200 kS/s Input Card



Special features

- **Quarter/Half/Full bridge support**
- **Strain gauge bridge sensors**
- **Positive and negative shunt calibration**
- **Voltage or current excitation**
- **4 analog channels**
- **Up to 10 wire bridge connections**
- **Zero-balance by adding voltage to sensor**
- **User bridge completion cards**
- **Balanced differential inputs**
- **± 2 mV to ± 10 V input range**
- **50 V DC Isolation**
- **User selectable digital Bessel and FIR filters**
- **1 MS/s sample rate**
- **16 bit resolution**
- **128 MB memory**

Bridge ISO 200 kS/s Input Card

The Bridge ISO 200 kS/s Input Card supports quarter, half and full bridges with constant voltage or constant current excitation. In basic sensor mode string pots, PT100 and other voltage or current excited sensors can be used. Built-in shunts offer the possibility of positive or negative shunting of the Wheatstone bridge. For quarter bridge support the card has a 350 Ω built-in resistor. For other strain gauges like 120 Ω, the user bridge completion card offers an user adaptable solution. To lower partial discharges within the cable used, a common mode driven guard is available. The card provides four channels of isolated balanced differential inputs from ± 2 mV to ± 10 V full scale with auto-zero capability.

Every channel is equipped with an independent full range input amplifier, 7-pole Bessel and Butterworth anti-alias filter, 16-bit Analog-to-Digital converter and several selections of digital filtering. Each channel also features two set-points for trigger or alarm purposes. Extensive acquisition and trigger modes allow many different ways to capture valuable data even at the highest sample rates. All channels are synchronously sampled at full speed without multiplexing and almost immeasurable crosstalk.

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HBM

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Capabilities Overview	
Model	GN410
Maximum sample rate per channel	200 kS/s
Memory per card	128 MB
Analog channels	4
ADC resolution	16 bit
Isolation	Channel to channel and channel to chassis
Input type	Analog isolated balanced differential
Probe support	No
Sensor support	Quarter, half and full bridges using either voltage or current excitation. Force, Pressure, MEMS-type Accelerometers and Potentiometric Displacement and other strain gauge bridge sensors using either voltage or current excitation
TEDS support	No
Real-time calculations	No
Digital event/Timer/Counter support	No
Fast data streaming	No
Slot width	1

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GEN series GN410 Block diagram

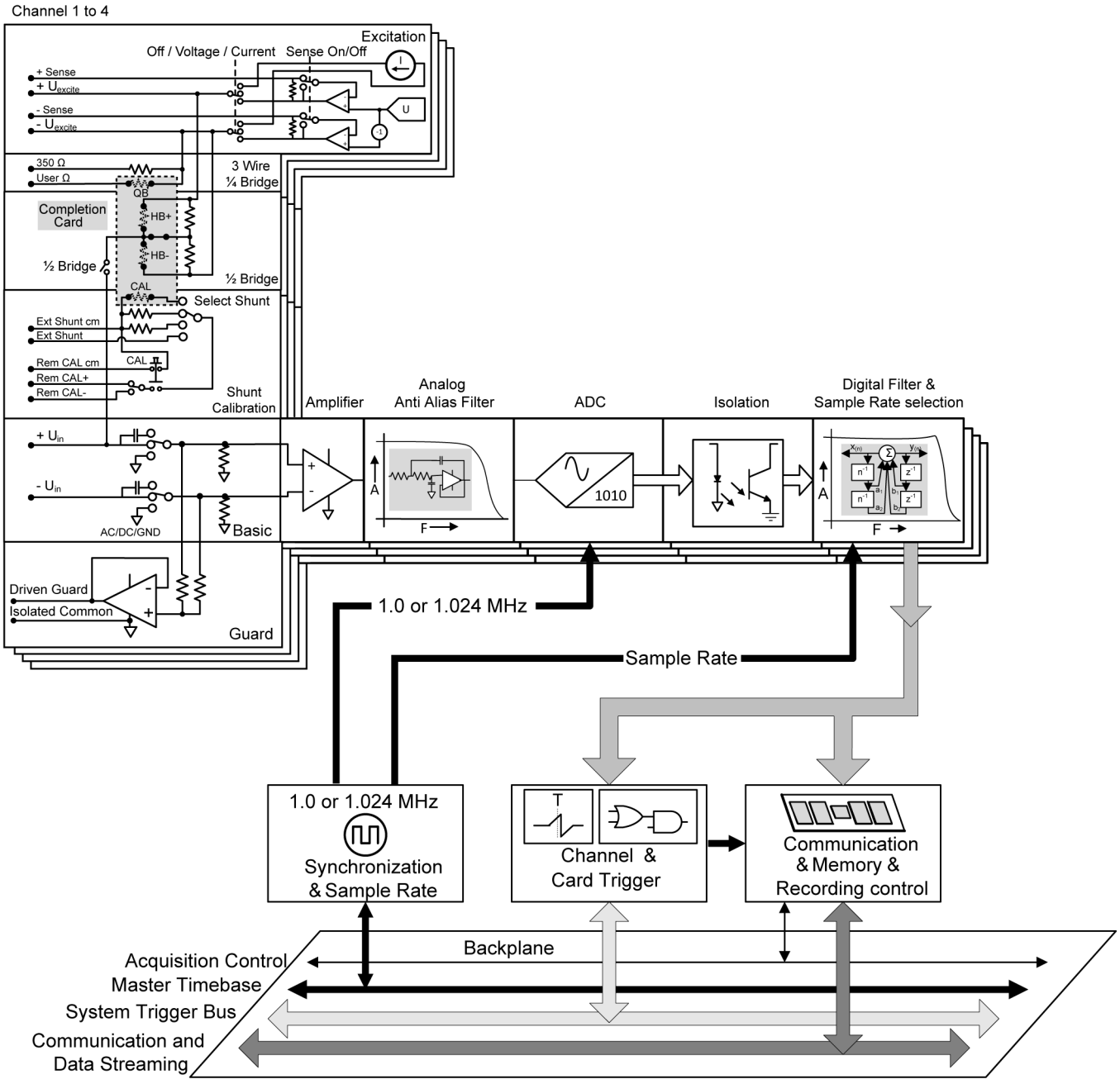


Figure 1.1: Block Diagram GEN series GN410

Note *The listed specifications are valid for cards that are calibrated and used in the same mainframe and slots as they were at the time of calibration. When the card is removed from its original location and placed in another slot and/or mainframe the following specifications are invalidated due to thermal differences within the configurations: Offset error, Gain error and MSE. Typically the resulting specification will be double.*

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Analog Input Section	
Channels	4
Connectors	16 pin Lemo with connector chassis grounded, 1 per channel Lemo EGG.2B.316.CYM
Mating connector	Lemo FGG.2B.316.CLAD52
Input type	Analog isolated balanced differential
Input impedance	2 * 10 MΩ ± 1% // 130 pF ± 10%
Input coupling	
Coupling modes	AC, DC, GND
AC coupling frequency	0.16 Hz, ± 10 %; -3 dB

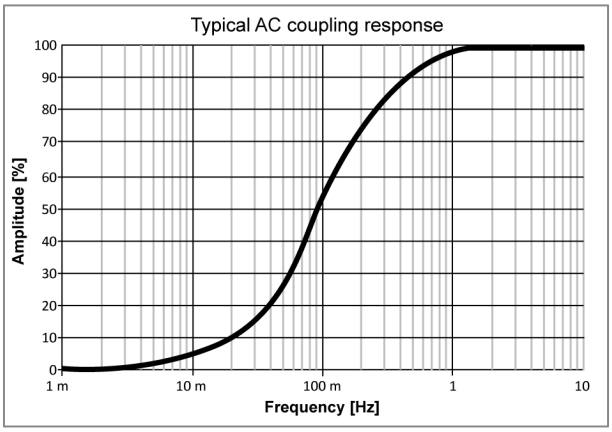


Figure 1.2: Typical AC coupling response

Ranges	± 2 mV, ± 5 mV, ± 10 mV, ± 20 mV, ± 50 mV, ± 0.1 V,± 0.2 V, ± 0.5 V, ± 1.0 V,± 2.0 V, 5.0 V± , ± 10.0 V Each range supports a variable gain in 1000 steps (0.1 %). This creates 1000 extra ranges between 2 specified ranges
Offset	± 50 % in 1000 steps (0.1 %) ± 10 V range has fixed 50 % offset
DC Offset error	
Wideband	0.2 % of Full Scale ± 120 µV
Bessel IIR and FIR	0.1 % of Full Scale ± 40 µV
Offset error drift	± 100 ppm/°C (± 180 ppm/°F)
DC Gain error	
Wideband	0.1 % of Full Scale ± 40 µV
Bessel IIR and FIR	0.1 % of Full Scale ± 40 µV
Gain error drift	± 100 ppm/°C (± 180 ppm/°F)
Maximum static error (MSE)	
Wideband	0.2 % of Full Scale ± 120 µV
Bessel IIR and FIR	0.1 % of Full Scale ± 40 µV
RMS Noise	
Wideband	0.02 % of Full Scale ± 30 µV
Bessel IIR and FIR	0.02 % of Full Scale ± 30 µV
Common Mode	
Rejection Ratio (CMRR)	> 72 dB @ 80 Hz
Common Mode voltage	± 10 V RMS to amplifier ground ± 50 V RMS to isolated ground
Input overload protection	
Maximum voltage	± 35 V DC
Overload recovery time	Restored to 10 % accuracy in 1 µs after 200 % overload Restored to 0.1 % accuracy in 10 µs after 200 % overload

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Bridge Mode	
Supported sensors	Quarter/half/full bridge; strain gauge based sensors: load cells, force transducers, torque transducers and pressure transducers
Quarter bridge completion	3 wire support; the 3rd wire keeps the measurement wire current free eliminating wire resistance errors through the measurement wire
Built-in quarter bridge completion resistor	350 Ω, 0.11 %, 0.6 ppm/°C (1.1 ppm/°F), wired to separate connector pin
Built-in half bridge completion resistors	2 times 10 kΩ, 0.1 %, 2 ppm/°C (3.6 ppm/°F) tracking
Bridge completion card	
Access/Replacement	Access in front panel of bridge card, removable without opening mainframe
Shunt resistor	1 user mountable shunt resistor
Half bridge completion resistor	2 user mountable half bridge completion resistors When used bypasses the built-in half bridge completion resistors
Quarter bridge completion resistor	1 user mountable quarter bridge completion resistor Wired to separate connector pin
Bridge excitation modes	User selectable Off, constant voltage or constant current
Constant voltage excitation	
Selectable excitation voltage	Bipolar ± 1.0 V to ± 7.5 V DC, selectable in 0.02 V steps, maximum 85 mA
Excitation voltage accuracy	0.5 % of Full Scale
Excitation voltage sense	User selectable On/Off 2 separate connector pins available, wiring required no internal bypass
Constant current excitation	
Excitation current	2.0 mA to 40.0 mA, selectable in 0.05 mA steps, using ± 7.5 V DC
Excitation current accuracy	0.5% of Full Scale
Bridge balance	
Operation principal	Voltage added to bridge to electrically balance the bridge: remaining offset corrected by software auto zero
Maximum bridge balance voltage	± 250 mV
Bridge balance gain error	0.5% of Full Scale
Bridge balance restore	Reloadable bridge balance after power down
Auto zero and balance	Parallel execution of auto zero and balance on all channels on multiple cards reducing zero and balance time significantly
Bridge shunt	
Bridge shunt resistor selection	Software selectable 4 sources 2 built-in shunt resistors, bridge completion card, external shunt
Bridge shunt method	Software selectable to positive or negative excitation voltage Separate pins available to wire both selections
External shunt	2 separate connector pins to wire shunt out to sensor connection points
Built-in shunt resistors	
Type	Metal foil
First shunt resistor	20 kΩ, 0.11 %, 0.6 ppm/°C (1.1 ppm/°F)
Second shunt resistor	100 kΩ, 0.11 %, 0.6 ppm/°C (1.1 ppm/°F)
Driven guard	The measured common mode voltage on positive and negative input is active driven by a low ohmic output to the driven guard pin. Connecting the driven guard to the cable shield minimizes the potential difference between shield and signal wires. Lower potential difference lowers the effect called partial discharge between shield and signal wires. Partial discharges result in noise on the measured signal.

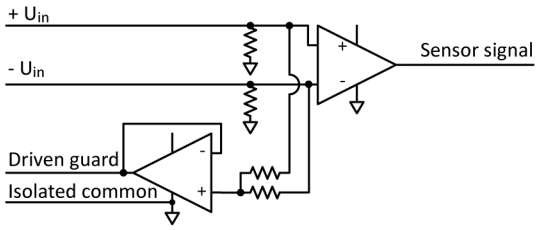


Figure 1.3: Driven guard

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Basic Sensor Mode

Supported sensors	Strain gauge bridge sensors using voltage or current excitation Force, Pressure, MEMS-type Accelerometers and Potentiometric Displacement transducers, PT100 and PT1000
Sensor excitation modes	User selectable Off, constant voltage or constant current
Constant voltage excitation	
Selectable excitation voltage	Bipolar ± 1.0 V to ± 7.5 V DC, selectable in 0.02 V steps, maximum 85 mA
Excitation voltage accuracy	0.5 % of Full Scale
Constant current excitation	
Excitation current	2.0 mA to 40.0 mA, selectable in 0.05 mA steps, using ± 7.5 V DC
Excitation current accuracy	0.5 % of Full Scale

Input Connector

Pin 1 : $+U_{excite}$
Pin 2 : $-U_{excite}$
Pin 3 : +Sense
Pin 4 : -Sense
Pin 5 : $+U_{in}$
Pin 6 : $-U_{in}$
Pin 7 : Driven guard
Pin 8 : Isolated common
Pin 9 : ¼ bridge user
Pin 10 : ¼ bridge 350Ω
Pin 11 : Remote CAL +
Pin 12 : Remote CAL -
Pin 13 : External shunt common
Pin 14 : External shunt
Pin 15 : Remote CAL common
Pin 16 : Isolated common

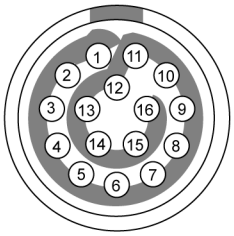


Figure 1.4: Input connector, solder cup view of male connector

Bridge Completion Card

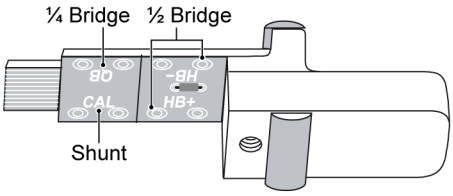


Figure 1.5: Shunt calibration completion plug-in module

Suggested resistors	Vishay S102C: 1 Ω to 150 kΩ ± 0.005 %, ± 2 ppm/°C, 0.6 W @ 75°C (167°F) Vishay S102K: 1 Ω to 100 kΩ ± 0.005 %, ± 1 ppm/°C, 0.4 W @ 75°C (167 °F)
Suggested mounting	Two resistors on top of each other

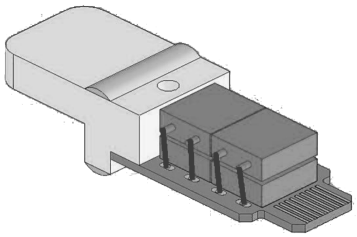


Figure 1.6: Mounted completion resistors

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Isolation

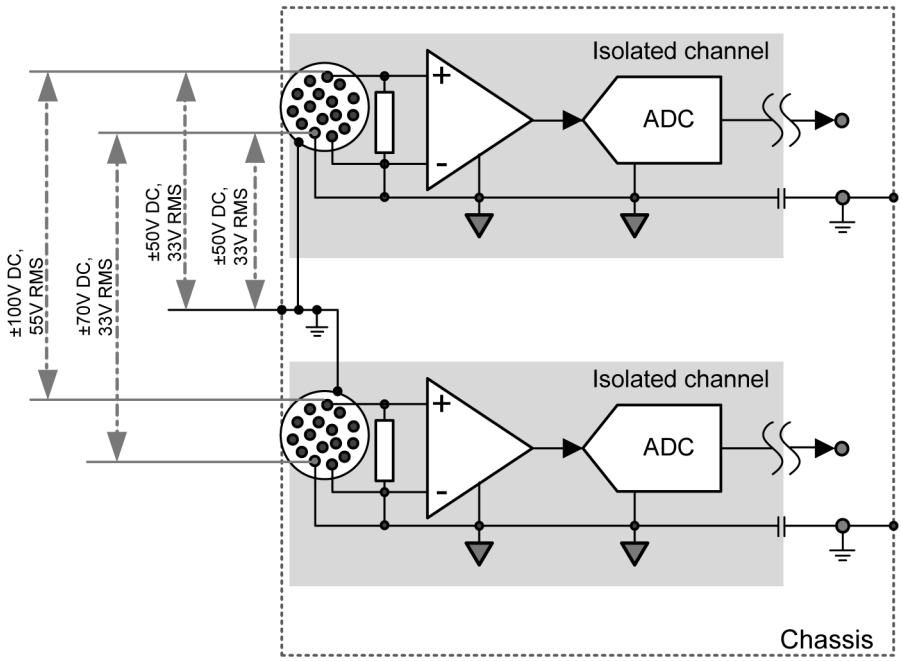


Figure 1.7: Isolation schematic

Channel to chassis (earth)	33 V RMS, ± 50 V DC
Channel to channel (Isolated GND to isolated GND)	33 V RMS, ± 70 V DC
Input signal-to-input signal	55 V RMS, ± 100 V DC

Analog to Digital Conversion

Sample rate; per channel	0.1 S/s to 200 kS/s
ADC resolution; one ADC per channel	16 bit
ADC Type	Successive Approximation Register (SAR); TI ADS8401IB
Time base accuracy	Defined by mainframe: ± 3.5 ppm (1); aging after 10 years ± 10 ppm
Binary sample rate	Supported; when Calculating FFT's produces rounded/integer BIN sizes
Maximum binary sample rate	204.8 kS/s
External time base sample rate	0 S/s to 100 kS/s
External time base level	TTL
External time base minimum pulse width	200 ns

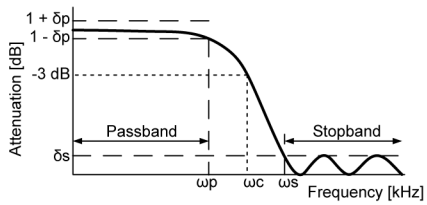
(1) Mainframes using Interface/Controller modules shipped before 2012: ± 30 ppm

Amplifier Bandwidth and Filtering

Using different filter selections (Bessel IIR/FIR/etc.) or different filter bandwidths will lead to phase mismatches between channels.	
Digital Bessel IIR (Fc @ -3 dB)	When Bessel IIR filter is selected, this is always a combination of an analog Bessel anti alias filter and a digital Bessel IIR filter. Bessel filters are typically used when looking at signals in the time domain. Best used for measuring transient signals or sharp edge signals like square waves or step responses.
Digital FIR (Fc @ -0.1 dB)	Standard FIR filter with corner frequency (Fc) defined at -0.1 dB. When FIR filter is selected, this is always a combination of an analog Butterworth anti alias filter and a digital FIR filter. Best used when working in the frequency domain. When working in the time domain this filter is best used for signals that are (close to) sine waves.
Digital FIR (Fc @ -3 dB) Supported by Perception V6.40 and higher	Adapted FIR filter with corner frequency (Fc) calculated as close as possible to -3 dB. When FIR filter is selected, this is always a combination of an analog Butterworth anti alias filter and a digital FIR filter. Best used when working in the frequency domain. When working in the time domain this filter is best used for signals that are (close to) sine waves.

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Bessel IIR Filter



δp: Passband ripple
δs: Stopband attenuation

ωp: Passband frequency
ωc: Corner frequency
ωs: Stopband frequency

Figure 1.8: Digital Bessel IIR Filter

When Bessel IIR filter is selected, this is always a combination of an analog Bessel anti alias filter and a digital Bessel IIR filter	
Analog anti alias filter	
Characteristic	7-pole Bessel, optimal step response
Bandwidth	120 kHz ± 20 kHz (-3dB) All Ranges < 100 mV 220 kHz ± 20 kHz (-3 dB) All Ranges ≥ 100 mV
Digital Bessel IIR filter	
Characteristic	6-pole Bessel style IIR
User selection	Auto tracking to sample rate divided by: 10, 20, 40, 100 User selects divide factor, software then adjusts filter when sample rate is changed
Bandwidth (ωc)	User selectable from 0.0125 Hz to 20 kHz
Passband flatness (ωp)(1)	0.1 dB; DC to 2 kHz
Stopband attenuation (δs)	-60 dB
Roll-off	36 db/Octave

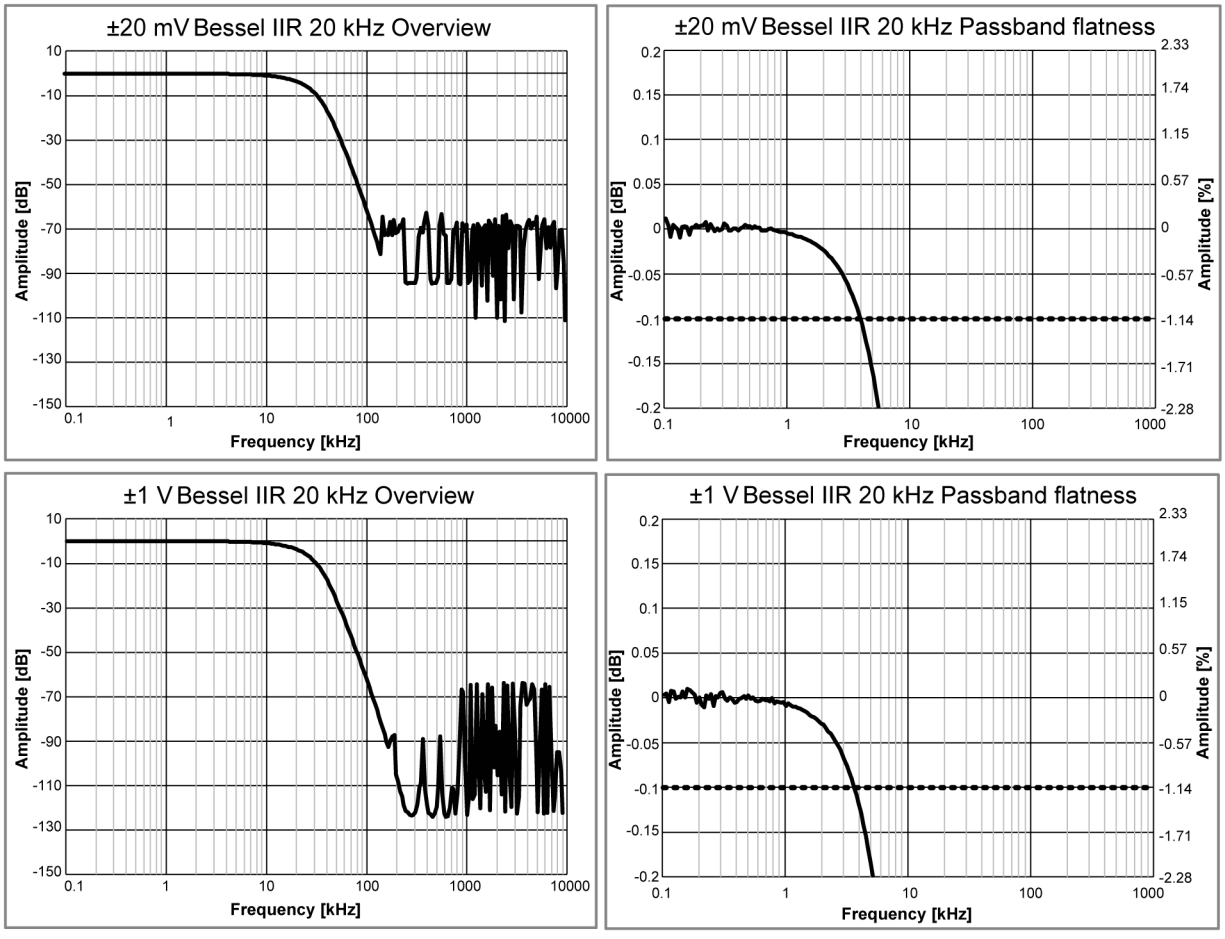
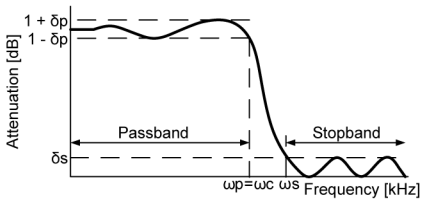


Figure 1.9: Typical Bessel IIR 20 kHz Overview and passband flatness

(1) Measured using Fluke 5700 calibrator, DC normalized

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FIR (Fc @ -0.1 dB) Filter



δp: Passband ripple
δs: Stopband attenuation

ωp: Passband frequency
ωc: Corner frequency
ωs: Stopband frequency

Figure 1.10: Digital FIR (Fc @ -0.1 dB) filter

When FIR (Fc @ -0.1 dB) filter is selected, this is always a combination of an analog Butterworth anti alias filter and a digital FIR filter	
Analog anti alias filter	
Characteristic	7-pole Butterworth, extended passband response
Bandwidth	140 kHz ± 20 kHz (-3 dB) All Ranges < 100 mV 350 kHz ± 20 kHz (-3 dB) All Ranges ≥ 100 mV
Digital FIR (Fc @ -0.1 dB) filter	
Characteristic	12-pole FIR; FIR is a pure digital characteristic. Closest analog resemblance to Elliptic filters, however FIR has both ringing on the signal before the step input starts as well as ringing after the step input completes.
User selection	Auto tracking to sample rate divided by: 4, 10, 20, 40 User selects divide factor, software then adjusts filter when sample rate is changed
Bandwidth (ωc)	User selectable from 0.031 Hz to 50 kHz
Passband flatness (ωp) (1)	0.1 dB; DC to ≈ωc For all Ranges < 100 mV ωp limited to 10 kHz due to anti alias filter
Stopband attenuation (δs)	-60 dB
Roll-off	-72 dB/Octave

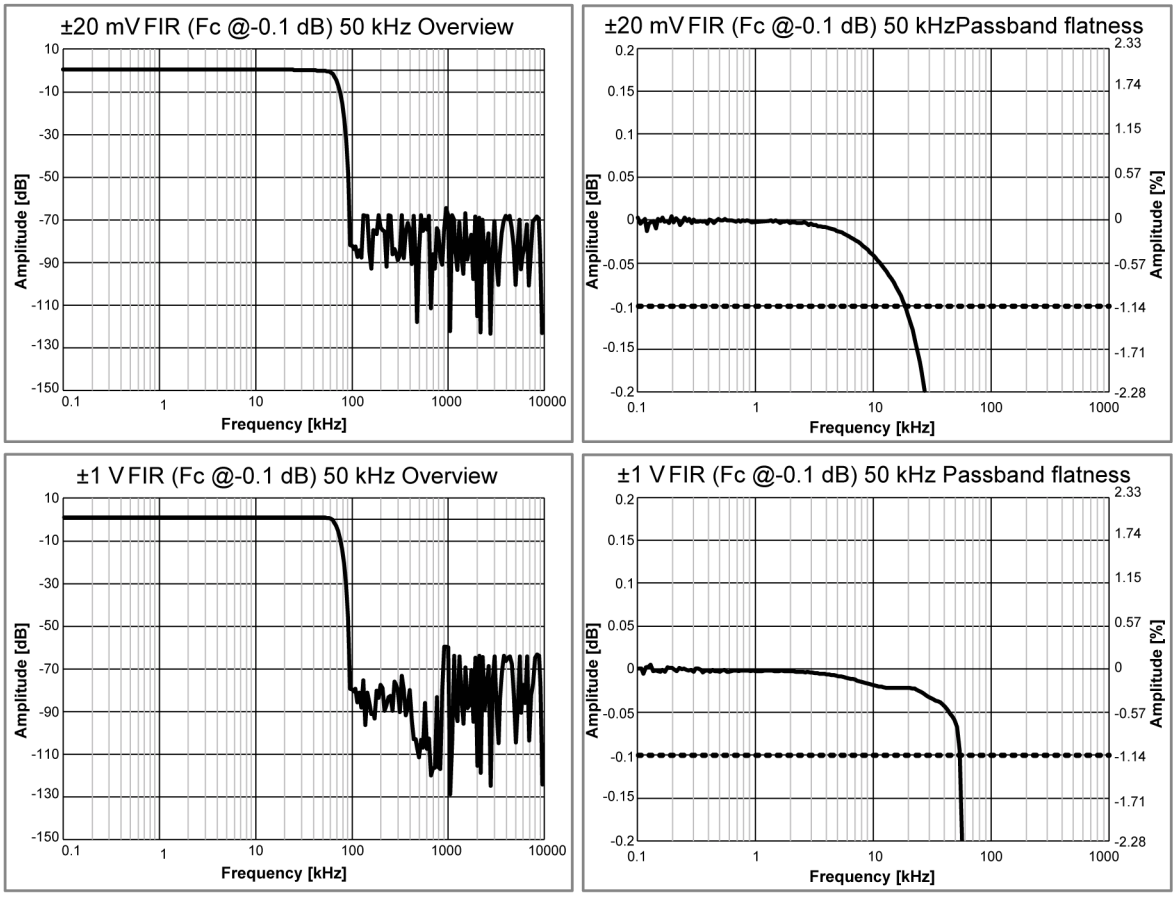
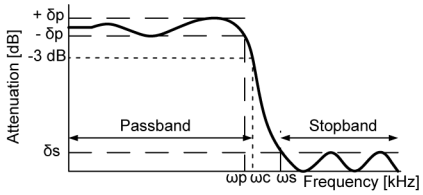


Figure 1.11: Typical FIR (Fc @ -0.1 dB) 50 kHz Overview and passband flatness

(1) Measured using Fluke 5700 calibrator, DC normalized

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FIR (Fc @ -3 dB) Filter



δp: Passband ripple
δs: Stopband attenuation

ωp: Passband frequency
ωc: Corner frequency
ωs: Stopband frequency

Figure 1.12: Digital FIR (Fc @ -3 dB) filter

When FIR (Fc @ -3 dB) filter is selected, this is always a combination of an analog Butterworth anti alias filter and a digital FIR filter	
Analog anti alias filter	
Characteristic	7-pole Butterworth, extended pass band response
Bandwidth	140 kHz ± 20 kHz (-3 dB) All Ranges < 100 mV 350 kHz ± 20 kHz (-3 dB) All Ranges ≥ 100 mV
Digital FIR (Fc @ -3 dB) filter	
Characteristic	12-pole FIR; FIR is a pure digital characteristic. Closest analog resemblance to Elliptic filters, however FIR has both ringing on the signal before the step input starts as well as ringing after the step input completes.
User selection	Auto tracking to sample rate divided by: 4, 10, 20, 40
Bandwidth (ωc)	User selectable from 0.031 Hz to 50 kHz
Passband flatness (ωp)(1)	0.1 dB; DC to ≈ωc/1.4 (Adapted FIR filter behavior) For all Ranges < 100 mV ωp limited to 10 kHz due to anti alias filter
Stopband attenuation (δs)	-60 dB
Roll-off	72 dB/Octave

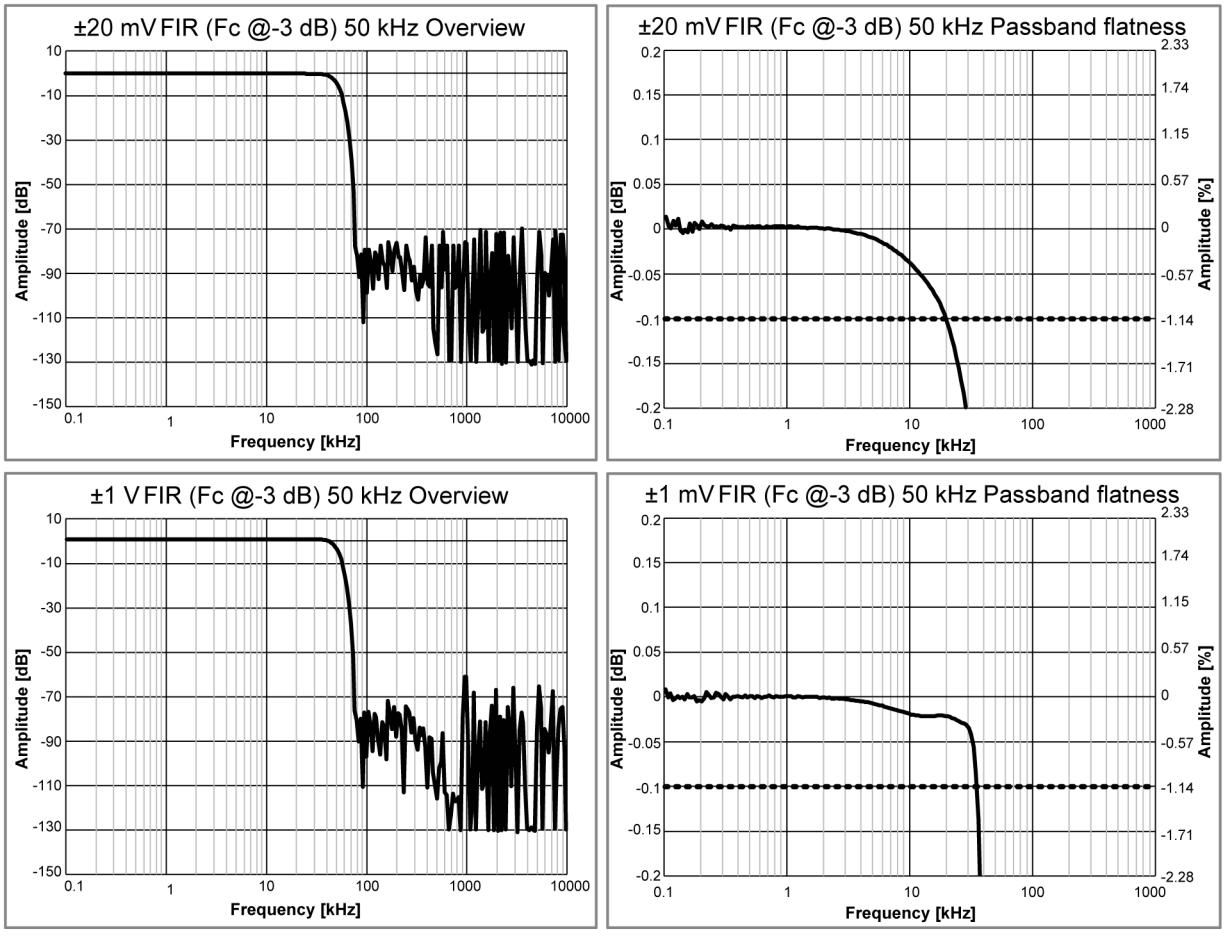


Figure 1.13: Typical FIR (Fc @ -3 dB) 50 kHz Overview and passband flatness

(1) Measured using Fluke 5700 calibrator, DC normalized

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On-board Memory	
Per card	128 MB (64 MS)
Organization	Automatic distribution amongst enabled channels
Memory diagnostics	Automatic memory test when system is powered and not recording
Storage sample size	16 bits, 2 bytes/sample

Digital Events/Timer/Counter	
Digital event inputs	Not supported
Digital event outputs	Not supported
Timer/Counter	Not supported

Triggering	
Channel trigger/qualifier	1 per channel; fully independent either trigger or qualifier
Pre- and post-trigger length	0 to full memory
Trigger rate	400 triggers per second
Manual trigger (Software)	Supported
External Trigger In	
Selection per card	User selectable On/Off
Active edge	Rising/Falling mainframe selectable, identical for all cards
Minimum pulse width	500 ns
Delay	± 1 µs + maximum 1 sample period (for decimal and binary time base)
Send to External Trigger Out	User can select to forward External Trigger In to the External Trigger Out BNC
External Trigger Out	
Selection per card	User selectable On/Off
Active level	High / Low / Hold High; selectable per mainframe, identical for all cards
Pulse width	High / Low: 12.8 µs Hold high: Active from first mainframe trigger to end of recording Pulse width created by mainframe
Delay	516 µs ± 1 µs + maximum 1 sample period using decimal time base 504 µs ± 1 µs + maximum 1 sample period using binary time base
Cross channel triggering	
Channels on card	Logical OR; Analog triggers of all channels Logical AND; Qualifiers of all channels
Cards in mainframe	User selectable through system trigger bus Selections: Send/Receive/Transceive (Send & Receive)
System trigger bus	
Connections	3 System trigger busses connecting all cards within mainframe 1 Master/Slave bus connecting all cards within mainframe and connecting all mainframes when using Master/Slave option
Operation	Logical OR of all triggers of all cards Logical AND of all qualifiers of all cards
Analog channel trigger levels	
Levels	Maximum 2 level detectors
Resolution	16 bit (0.0015 %); for each level
Direction	Rising/Falling; Single direction control for both levels based on selected mode
Hysteresis	0.1 to 100 % of Full Scale; defines the trigger sensitivity
Pulse detect/reject	Disable/Detect/Reject selectable. Maximum pulse width 65 535 samples
dY/dT conversion	dY : 16 bit (0.0015 %) for both levels dT : 1 to 1023 samples. dT setting shared for both levels
Analog channel trigger modes	
Basic	POS or NEG crossing; single level
Dual level	One POS and one NEG crossing; Two individual levels, OR-ed
Window	Arm/trigger and a disarm level; Trigger on peak-level changes in a uni-polar signal
Dual Window	Arm/trigger/disarm per level; Trigger on peak-level changes in a bi-polar signal
Sequential	One arm and one trigger level; eliminate false triggering due to noise or hysteresis

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Triggering	
Analog channel qualifier modes	
Basic	Above or below level check. Enable/disable trigger with single level
Dual (level)	Outside or within bounds check. Enable/disable trigger with dual level
Trigger holdoff	Disable channel trigger for 1 to 65 535 samples after trigger detected Maximum holdoff time sample rate dependent
Interval timer	
Modes	Less than, trigger when rate is too low More than, trigger when rate is too high Between, trigger when rate between lower and upper limit Not between, trigger when rate is not between lower and upper limit
Interval timers	Start timer and width Timer
Timer value	1 to 65 535 samples
Event counter	Counts channel trigger events before card trigger is activated 1 to 256 trigger events

Alarm Output	
Selection per Card	User selectable On/Off
Alarm modes	Basic or Dual
Basic	Above or below level check
Dual (level)	Outside or within bounds check
Alarm levels	
Levels	Maximum 2 level detectors
Resolution	16 bit (0.0015 %); for each level
Alarm output	Active during valid alarm condition, output supported through mainframe
Alarm output delay	515 µs ± 1 µs + maximum 1 sample period using decimal time base 503 µs ± 1 µs + maximum 1 sample period using binary time base

Real-Time Analysis	
StatStream® Patent Number : 7,868,886	Each channel includes real-time extraction of Maximum, Minimum, Mean, Peak-to-Peak, Standard Deviation and RMS values Supports the real-time Live scrolling and scoping waveform displays as well as the real-time meters during recording Supports the fast displaying and zooming within extremely large recordings Supports the fast calculation of statistical channel information

Acquisition Modes	
Single sweep	Triggered acquisition to on-board memory without sample rate limitations; for single transients or intermittent phenomena. No aggregate sample rate limitations.
Multiple sweeps	Triggered acquisition to on-board memory without sample rate limitations; for repetitive transients or intermittent phenomena. No aggregate sample rate limitations.
Slow fast sweep	Identical to single sweep acquisition with additional support for fast sample rate switches during the post-trigger segment of the slow rate single sweep settings. No aggregate sample rate limitations.
Continuous	Direct storage to PC or mainframe controlled hard disk without file size limitations; triggered or un-triggered; for long duration recorder type applications. Aggregate sample rate limitations depending on Ethernet speed, PC used and data storage media used.
Dual	Combination of Multiple sweeps and Continuous; recorder type streaming to hard disk with simultaneously triggered sweeps in on-board memory. Aggregate sample rate limitations depending on Ethernet speed, PC used and data storage media used.

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Recording Mode Details

	Single Sweep Multiple Sweeps Slow/Fast Sweep			Continuous			Dual Rate		
	Enabled Channels			Enabled Channels			Enabled Channels		
	1 Ch	2 Ch	4 Ch	1 Ch	2 Ch	4 Ch	1 Ch	2 Ch	4 Ch
Max. sweep memory	60 MS	30 MS	15 MS	not used			48 MS	24 MS	12 MS
Max. sweep sample rate	1 MS/s			not used			1 MS/s		
Max. continuous FIFO	not used			60 MS	30 MS	15 MS	12 MS	6 MS	3 MS
Max. continuous sample rate	not used			1 MS/s			Sweep Sample Rate / 2 Maximum 50 kS/s		
Max. aggregate continuous streaming rate	not used			0.2 MS/s 0.4 MB/s	0.4 MS/s 0.8 MB/s	0.8 MS/s 1.6 MB/s	0.05 MS/s 0.1 MB/s	0.1 MS/s 0.2 MB/s	0.4 MS/s 0.8 MB/s

Single Sweep

Pre-trigger segment	0 % to 100 % of selected sweep length If trigger occurs before pre-trigger segment is recorded, pre-trigger segment is truncated to recorded data only
Delayed trigger	Maximum 1000 seconds after a trigger occurred. Sweep is recorded immediately after delayed trigger time with 100 % post-trigger after this time point
Sweep stretch	User selectable On/Off When enabled, any new trigger event occurring in the post-trigger segment of the sweep will restart the post-trigger length. If upon the detection of a new trigger, the extended post-trigger doesn't fit within the sweep memory, sweep stretch will not happen. Maximum sweep stretch rate 1 sweep stretch per 2.5 ms.

Multiple Sweeps

Pre-trigger segment	0 % to 100 % of selected sweep length If trigger occurs before pre-trigger segment is recorded, pre-trigger segment is truncated to recorded data only
Delayed trigger	Maximum 1000 seconds after a trigger occurred. Sweep is recorded immediately after delayed trigger time with 100 % post-trigger after this time point
Maximum number of sweeps	200 000 per recording
Maximum sweep rate	400 sweeps per second
Sweep re-arm time	Zero re-arm time, sweep rate limited to 1 sweep per 2.5 ms
Sweep stretch	User selectable On/Off When enabled, any new trigger event occurring in the post-trigger segment of the sweep will restart the post-trigger length. If upon the detection of a new trigger, the extended post-trigger doesn't fit within the sweep memory, sweep stretch will not happen. Maximum sweep stretch rate 1 sweep stretch per 2.5 ms.
Sweep storage	Sweep storage starts immediately after the trigger for this sweep is detected. Sweep memory becomes available for reuse as soon as storage of the entire sweep for all enabled channels of this card has been completed. Sweeps will be stored one by one starting with the first recorded sweep.
Sweep storage rate	Determined by total number of selected channels and mainframes, mainframe type, Ethernet speed, PC storage medium and other PC parameters; see mainframe datasheet for details.
Exceeding sweep storage rate	Trigger event markers are stored in recording, no sweep data stored. New sweep data recorded as soon as enough internal memory is available to capture a full sweep when a trigger occurs.

Slow Fast Sweep

Maximum number of sweeps	1
Maximum slow sample rate	Fast sample rate divided by 2, or 50 kS/s per channel, whichever is the smallest sample rate
Maximum sample rate switches	400 sample rate switches per second, 200 000 switches maximum, switching stops when sweep ends

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Continuous	
Continuous modes supported	Standard, Circular recording, Specified time and Stop on trigger
Standard	User starts and stops recording. Automatic recording stop on storage media full
Circular recording	User specified recording history on storage media. All recorded data stores as quickly as possible on selected storage media. As soon as selected history time is reached, older recorded data is overwritten. Recording can be stopped by user, or any system trigger.
Specified time	Automatic recording stop after user specified time or on storage media full
Stop on trigger	Automatic recording stop after any system trigger or on storage media full
Continuous FIFO memory	Used by enabled channels to optimize continuous streaming rate
Maximum recording time	Until storage media filled, or user selected time or unlimited using circular recording
Maximum aggregate streaming rate per mainframe	Determined by mainframe, Ethernet speed, PC storage medium and other PC parameters; see mainframe datasheet for details
Exceeding aggregate streaming rate	When selecting a streaming rate higher than the aggregate streaming rate of the system, the continuous memory will act as a FIFO. As soon as this FIFO fills up, the recording suspends (temporarily no data is recorded). During this period, the internal FIFO memory is transferred to storage medium. When internal memory is completely empty again, the recording automatically resumes. User notifications added to recording file for post recording identification of storage overrun.

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Dual	
Dual Sweep Specification	
Pre-trigger segment	0 % to 100 % of selected sweep length If trigger occurs before pre-trigger segment is recorded, pre-trigger segment is truncated to recorded data only
Delayed trigger	Maximum 1000 seconds after a trigger occurred. Sweep is recorded immediately after delayed trigger time with 100 % post-trigger after this time point.
Maximum number of sweeps	200 000 per recording
Maximum sweep rate	400 sweeps per second
Sweep re-arm time	Zero re-arm time, sweep rate limited to 1 sweep per 2.5 ms
Sweep stretch	User selectable On/Off When enabled, any new trigger event occurring in the post-trigger segment of the sweep will restart the post-trigger length. If upon the detection of a new trigger, the extended post-trigger doesn't fit within the sweep memory, sweep stretch will not happen. Maximum sweepstretch rate 1 sweep stretch per 2.5 ms.
Sweep storage	In dual mode the storage of the continuous data is prioritized above the storage of the sweep data. If enough storage rate is available, the sweep storage starts immediately after the trigger for this sweep is detected. Sweep memory becomes available for reuse as soon as storage of the entire sweep for all enabled channels of this card has been completed. Sweeps will be stored one by one starting with the first recorded sweep.
Sweep storage rate	Determined by continuous sample rate, total number of channels and mainframes, mainframe type, Ethernet speed, PC storage medium and other PC parameters. See mainframe datasheet for details.
Exceeding sweep storage rate	Continuous recorded data not stopped, trigger event markers are stored in recording, no new sweep data stored. New sweep recorded as soon as enough internal memory is available to capture a full sweep when a trigger occurs.
Dual Continuous Specifications	
Continuous FIFO memory	Used by enabled channels to optimize continuous streaming rate
Maximum recording time	Until storage media filled, all recorded data will be stored including sweeps, or user selected time
Maximum aggregate streaming rate per mainframe	Determined by mainframe, Ethernet speed, PC storage medium and other PC parameters; see mainframe datasheet for details. When exceeding average aggregate streaming rate, sweep storage speed is automatically reduced to increase aggregate streaming rate, until sweep storage completely stops.
Exceeding aggregate storage rate	When selecting a streaming rate higher than the aggregate streaming rate of the system, the continuous memory will act as a FIFO. As soon as this FIFO fills up, the recording suspends (temporarily no data is recorded). During this period, the internal FIFO memory is transferred to storage medium. When internal memory (Continuous and Sweep memory) is completely empty again, the recording automatically resumes. User notifications added to recording file for post recording identification of storage overrun.

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Environmental Specifications

Temperature Range	
Operational	0 °C to +40 °C (+32 °F to +104 °F)
Non-operational (Storage)	-25 °C to +70 °C (-13 °F to +158 °F)
Thermal protection	Automatic thermal shutdown at 85 °C (+185 °F) internal temperature User warning notifications at 75 °C (+167 °F) (Supported by Perception V6.30 or higher)
Relative humidity	0 % to 80 %; non-condensing; operational
Protection class	IP20
Altitude	Maximum 2000 m (6562 ft); operational
Shock: IEC 60068-2-27	
Operational	Half-sine 10 g/11 ms; 3-axis, 1000 shocks in positive and negative direction
Non-operational	Half-sine 25 g/6 ms; 3-axis, 3 shocks in positive and negative direction
Vibration: IEC 60068-2-34	
Operational	1 g RMS, ½ h; 3-axis, random 5 to 500 Hz
Non-operational	2 g RMS, 1 h; 3-axis, random 5 to 500 Hz
Operational Environmental Tests	
Cold test IEC 60068-2-1 Test Ad	-5 °C (+23 °F) for 2 hours
Dry heat test IEC 60068-2-2 Test Bd	+40 °C (+104 °F) for 2 hours
Damp heat test IEC 60068-2-3 Test Ca	+40 °C (+104 °F), humidity >93 % RH for 4 days
Non-Operational (Storage) Environmental Tests	
Cold test IEC 60068-2-1 Test Ab	-25 °C (-13 °F) for 72 hours
Dry heat test IEC 60068-2-2 Test Bb	+70 °C (+158 °F) humidity <50 % RH for 96 hours
Change of temperature test IEC 60068-2-14 Test Na	-25 °C to +70 °C (-13 °F to +158 °F) 5 cycles, rate 2 to 3 minutes, dwell time 3 hours
Damp heat cyclic test IEC 60068-2-30 Test Db variant 1	+25 °C/+40 °C (+77 °F/+104 °F), humidity >95/90 % RH 6 Cycles, cycle duration 24 hours

Harmonized standards for CE compliance, according to the following directives

Low Voltage Directive (LVD): 2006/95/EC
ElectroMagnetic Compatibility directive (EMC): 2004/108/EC

Electrical Safety	
EN 61010-1 (2010)	Safety requirements for electrical equipment for measurement, control, and laboratory use - General requirements
EN 61010-2-030 (2010)	Particular requirements for testing and measuring circuits
Electromagnetic Compatibility	
EN 61326-1 (2006)	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
Emission	
EN 55011	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement Conducted disturbance: class B; Radiated disturbance: class A
EN 61000-3-2	Limits for harmonic current emissions: class D
EN 61000-3-3	Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems
Immunity	
EN 61000-4-2	Electrostatic discharge immunity test (ESD); contact discharge ± 4 kV/air discharge ± 8 kV: performance criteria B
EN 61000-4-3	Radiated, radio-frequency, electromagnetic field immunity test; 80 to 2700 MHz using 10 V/m, 1000 Hz AM: performance criteria A
EN 61000-4-4	Electrical fast transient/burst immunity test Mains ± 2 kV using coupling network. Channel ± 2 kV using capacitive clamp: performance criteria B
EN 61000-4-5	Surge immunity test Mains ± 0.5 kV/± 1 kV Line-Line and ± 0.5 kV/± 1 kV/± 2 kV Line-earth
EN 61000-4-6	Immunity to conducted disturbances, induced by radio-frequency fields 0.15 to 80 MHz, 1000 Hz AM; 10 V RMS @ mains, 10 V RMS @ channel, both using clamp: performance criteria A
EN 61000-4-11	Voltage dips, short interruptions and voltage variations immunity tests Dips: performance criteria A; Interruptions: performance criteria C

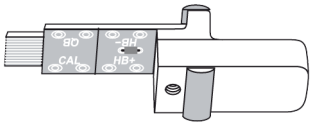
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Ordering Information[1]

Article		Description	Order No.
Bridge200k ISO		4 Channel, 16 bits, 200 kS/s, ± 2 mV to ± 10 V input range, 128 MB RAM (64 MS), isolated, balanced differential Bridge input, with 16 pin LEMO for each channel	1-GN410-2

(1) All GEN series systems are intended for exclusive professional and industrial use.

Options, to be ordered separately

Article		Description	Order No.
Bridge completion pack		GEN DAQ Bridge completion/shunt cal resistor cards, 4 additional pieces (4 pieces included in both GN410 and GN411)	1-G021-2
16 pin LEMO connect pack		LEMO connector for Bridge Card GN410 and GN411; 4 additional pieces (4 pieces included in both GN410 as well as GN411)	1-G069-2

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