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Data sheet

GEN series
GN810

Basic 200 kS/s Input Card



Special features

- **8 analog channels**
- **Single ended inputs**
- **± 1 V to ± 50 V input range**
- **User selectable digital Bessel and FIR filters**
- **200 kS/s sample rate**
- **16 bit resolution**
- **128 MB memory**
- **Single metal BNC for each channel**

Basic 200 kS/s Input Card

The GEN DAQ Basic 200 kS/s Input Card is a general purpose signal conditioner for use with voltage inputs, externally conditioned signals or probes and current clamps.
The basic signal conditioner provides eight channels of single ended voltage inputs from ± 1 V to ± 50 V full scale with full offset and 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.

The on-board transient memory size is 64 Mega-Samples (128 Mega-Bytes). The memory is shared among enabled channels. 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. The model uses standard metal BNC connectors, whose shells are connected to ground. The inputs are 1 MΩ impedance and are compatible with probes and current clamps.

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Capabilities Overview	
Model	GN810
Maximum sample rate per channel	200 kS/s
Memory per card	128 MB
Analog channels	8
ADC resolution	16 bit
Digital event/Timer/Counter support	no
Isolation	no
Input type	Analog single ended

GEN series GN810 Block diagram

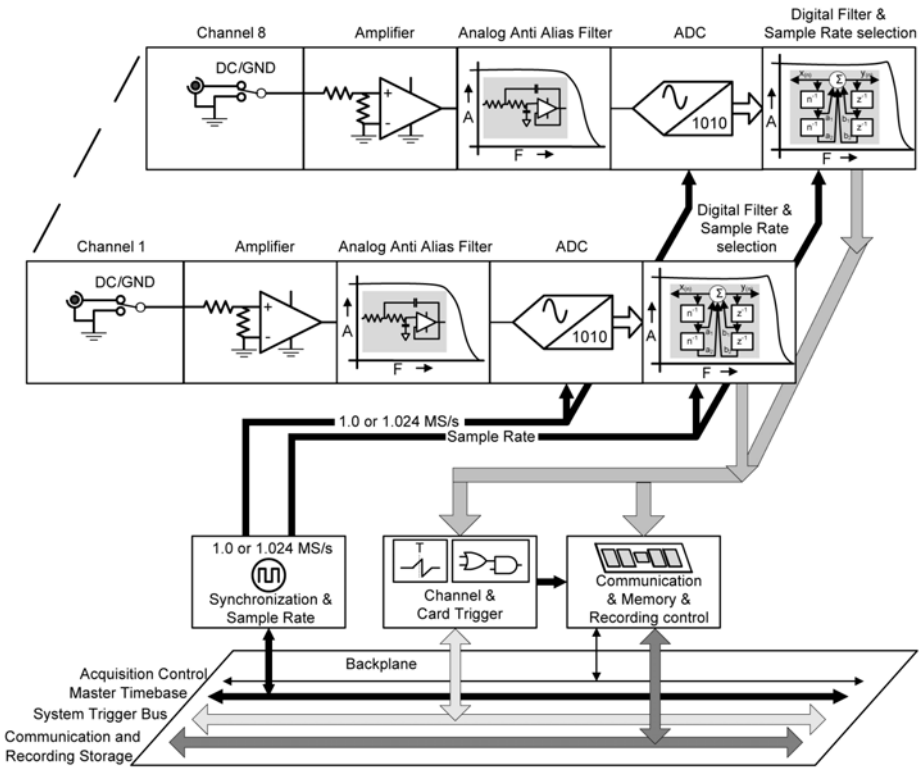


Figure 1.1: Block diagram GEN series GN810

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.*

Analog Input Section	
Channels	8
Connectors	Metal BNC, 1 per channel
Input type	Analog single ended
Input coupling	DC, GND
Impedance	1 MΩ ± 1% // 65 pF ± 10%

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Analog Input Section	
Ranges	± 1 V, ± 2 V, ± 5.0 V, ± 10 V, ± 20 V, ± 50 V Each fixed range supports a variable gain with 1000 steps (0.1 %). Variable gain creates 1000 extra ranges between 2 fixed ranges.
Offset	± 50 % in 1000 steps (0.1 %); ± 50 V range has fixed 0 % offset
DC Offset error	
Bessel IIR and FIR	0.1 % of Full Scale ± 10 µV
Offset error drift	± 100 ppm/°C (± 180 ppm/°F)
DC Gain error	
Bessel IIR and FIR	0.1 % of Full Scale ± 10 µV
Gain error drift	± 70 ppm/°C (± 130 ppm/°F)
Maximum static error (MSE)	
Bessel IIR and FIR	0.1 % of Full Scale ± 10 µV
RMS Noise	
Bessel IIR and FIR	0.02 % of Full Scale ± 10 µV
Input overload protection	
Maximum voltage	± 250 V DC
Overload recovery time	Restored to 0.1 % accuracy in less than 1 µs after 200 % overload

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 200 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.	
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.
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.
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

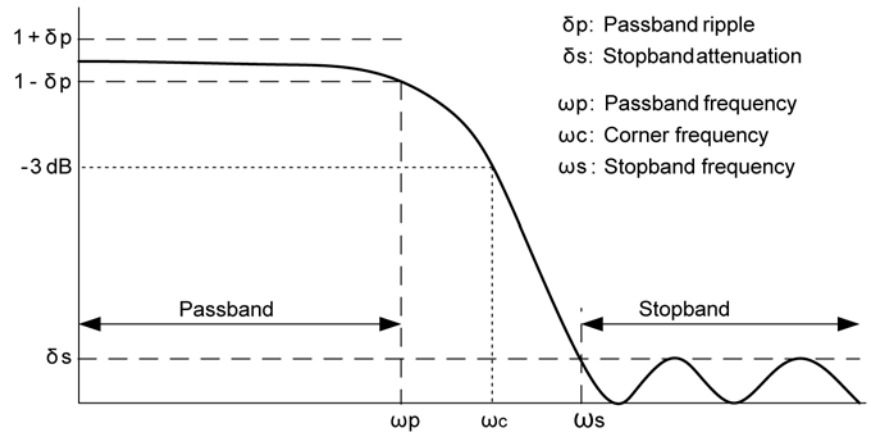


Figure 1.2: Digital Bessel IIR Filter

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 aliasing filter bandwidth	220 kHz ± 20 kHz (-3 dB)
Analog anti aliasing filter characteristic	7-pole Bessel, optimal step response
Bessel IIR filter characteristic	6-pole Bessel style IIR
Bessel IIR filter user selection	Auto tracking to sample rate divided by: 10, 20, 40, 100 User selects divide factor from current sample rate, software then adjusts filter when sample rate is changed
Bessel IIR filter bandwidth (ωc)	Auto tracking the sample rate with the selected Bessel IIR filter user selection from 0.0125 Hz to 20 kHz
Bessel IIR passband flatness (ωp)(1)	0.1 dB; DC to 3 kHz @ ωc = 20 kHz
Bessel IIR filter stop band attenuation (δs)	-60 dB
Bessel IIR filter roll-off	-36 dB/Octave

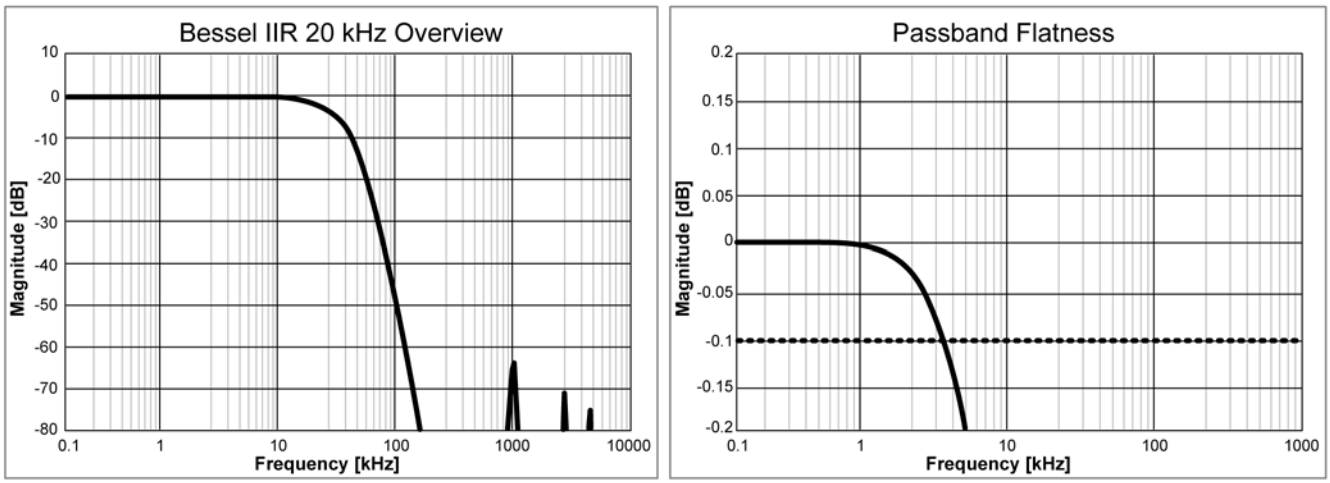


Figure 1.3: Bessel IIR ωc = 20 kHz, Overview and Passband Flatness

(1) Measured using Fluke 5700 calibrator, DC normalized

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FIR (Fc @ -0.1 dB) filter

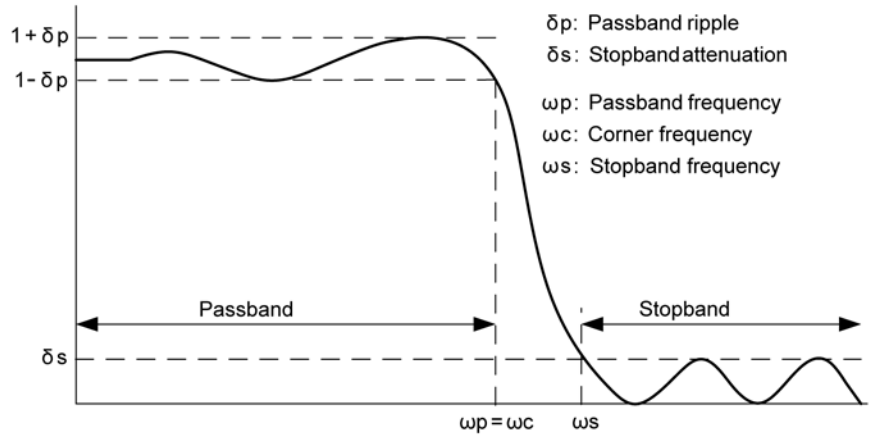


Figure 1.4: Digital FIR (Fc @ -0.1 dB) filter

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 (Fc @ -0.1 dB) filter.

Analog anti aliasing filter bandwidth	370 kHz ± 20 kHz (-3 dB)
Analog anti aliasing filter characteristic	7-pole Butterworth, extended passband response
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 overshoot on step response and pre-shoot to step response. This means ringing on the signal starts before the step input starts and the ringing continues after the step input ends.
FIR (Fc @ -0.1 dB) filter user selection	Auto tracking to sample rate divided by: 4, 10, 20, 40
FIR (Fc @ -0.1 dB) filter bandwidth (ωc)	Auto tracking the sample rate with the selected FIR (Fc @ -0.1 dB) filter user selection from 0.031 Hz to 50 kHz
FIR (Fc @ -0.1 dB) filter passband flatness (ωp) (1)	0.1 dB; DC to filter bandwidth (ωc)
FIR (Fc @ -0.1 dB) filter stopband attenuation (δs)	-60 dB
FIR (Fc @ -0.1 dB) filter roll-off	-72 dB/Octave

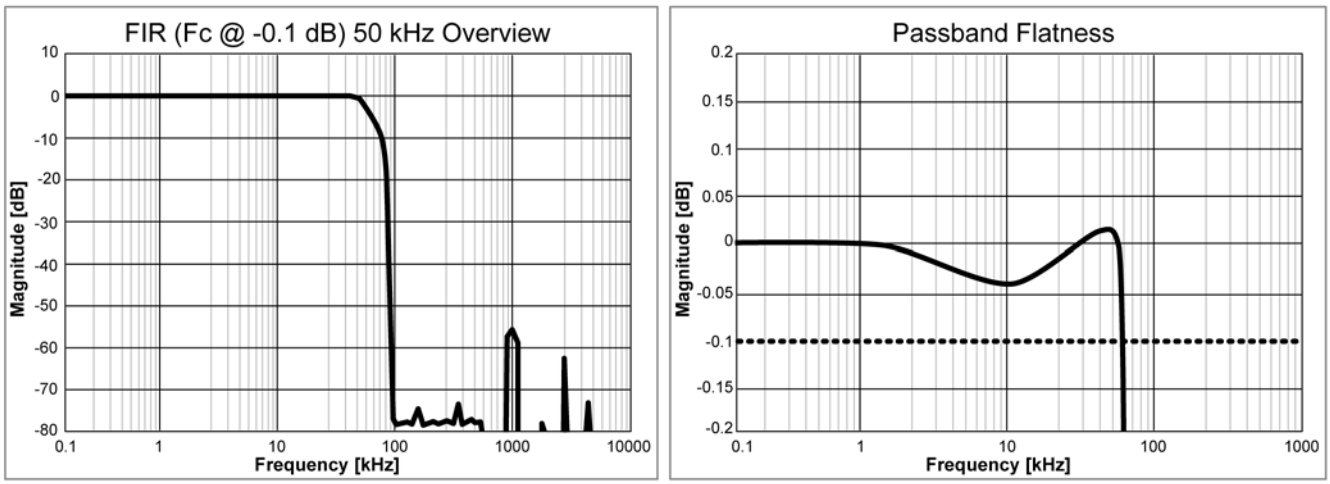


Figure 1.5: Typical FIR (Fc @ -0.1 dB) ωc = 50 kHz, Overview and Passband Flatness

(1) Measured using Fluke 5700 calibrator, DC normalized

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FIR (Fc @ -3 dB) filter

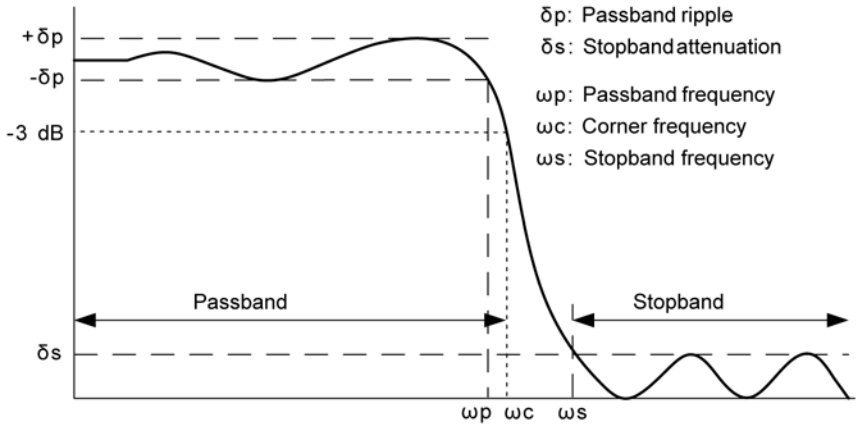


Figure 1.6: Digital FIR (Fc @ -3 dB) filter

When FIR (Fc @ -3 dB) filter is selected, this is always a combination of an analog Butterworth anti alias filter and a digital FIR (Fc @ -3 dB) filter. Adapted FIR filter with ωp reduced by a factor of ≈1.4 compared to the FIR (Fc @ -0.1 dB) filter. Supported by Perception V6.40 and higher.

Analog anti aliasing filter bandwidth	370 kHz ± 20 kHz (-3 dB)
Analog anti aliasing filter characteristic	7-pole Butterworth, extended passband response
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 overshoot on step response and pre-shoot to step response. This means ringing on the signal starts before the step input starts and the ringing continues after the step input ends.
FIR (Fc @ -3 dB) filter user selection	Auto tracking to sample rate divided by: 4, 10, 20, 40
FIR (Fc @ -3 dB) filter bandwidth (ωc)	Auto tracking the sample rate with the selected FIR (Fc @ -3 dB) filter user selection from 0.031 Hz to 50 kHz
FIR (Fc @ -3 dB) filter passband flatness (ωp) (1)	0.1 dB; DC to ≈ωc/1.4 (Adapted FIR filter behavior)
FIR (Fc @ -3 dB) filter stopband attenuation (δs)	-60 dB
FIR (Fc @ -3 dB) filter roll-off	-72 dB/Octave

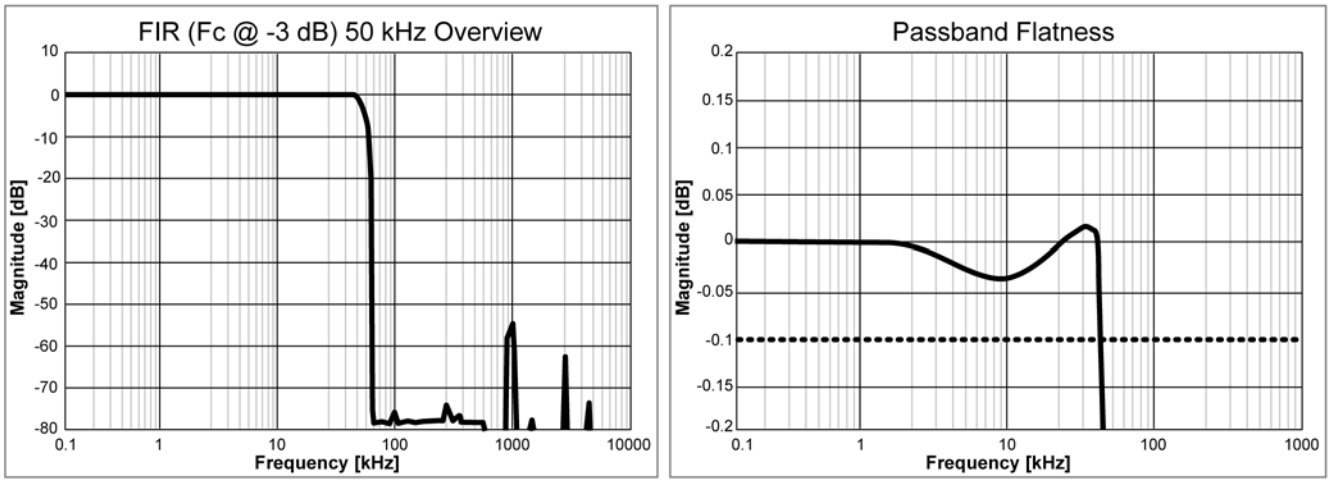


Figure 1.7: Typical FIR (Fc @ -3 dB) ωc = 50 kHz, Overview and Passband Flatness

(1) Measured using Fluke 5700 calibrator, DC normalized

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Channel to Channel Phase Match	
Using different filter selections (Bessel IIR/FIR/etc.) or different filter bandwidths will lead to phase mismatches between channels.	
Bessel IIR (Fc @ -3 dB), 20 kHz Filter frequency; 10 kHz sine wave	
Channels on card	0.4 deg (0.1 µs)
GN810 Channels within mainframe	0.4 deg (0.1 µs)
FIR (Fc@ -0.1dB) and FIR (Fc @ -3 dB), 50 kHz Filter frequency; 10 kHz sine wave	
Channels on card	0.4 deg (0.1 µs)
GN810 Channels within mainframe	0.4 deg (0.1 µs)
GN810 Channels across mainframes	Defined by synchronization method used (None, IRIG, GPS, Master/Slave)

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 fully independent per channel 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)

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Triggering

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
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 then, trigger when rate is too low More then, 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	Counted 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 timebase 503 µs ± 1 µs + maximum 1 sample period using binary timebase

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

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Acquisition Modes	
Single sweep	Triggered acquisition to on-board memory without sample rate limitations; for single transients or intermittent phenomena.
Multiple sweeps	Triggered acquisition to on-board memory without sample rate limitations; for repetitive transients or intermittent phenomena.
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.
Continuous	Direct storage to PC or mainframe hard disk without file size limitations; triggered or un-triggered; for long duration recorder type applications.
Dual	Combination of Multiple sweeps and Continuous; recorder type streaming to hard disk with simultaneously triggered sweeps in on-board memory.

Single Sweep		
Sweep memory	60 MS; used by enabled channels only	
Maximum sweep length	60 MS divided by number of enabled channels	
	1 channel enabled	8 channels enabled
	60 MS/channel	7.5 MS/channel
Maximum sample rate	200 kS/s per channel, no aggregate rate limitations	
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		
Sweep memory	60 MS; used by enabled channels only	
Maximum sweep length	60 MS divided by number of enabled channels	
	1 channel enabled	8 channels enabled
	60 MS/channel	7.5 MS/channel
Maximum sample rate	200 kS/s per channel, no aggregate streaming rate limitations	
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 (1)	
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.	
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.	

(1) Specified for Perception V6.20 or higher

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Slow Fast Sweep		
Maximum number of sweeps	1	
Sweep memory	60 MS; used by enabled channels only	
Maximum sweep length	60 MS divided by number of enabled channels	
	1 channel enabled	8 channels enabled
	60 MS/channel	7.5 MS/channel
Maximum fast sample rate	200 kS/s per channel, no aggregate rate limitations	
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	

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 length 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	60 MS; used by enabled channels to optimize the continuous streaming rate	
Maximum sample rate	200 kS/s per channel	
Maximum streaming rate	1.6 MS/s (3.2 MB/s) when all channels enabled	
	1 channel enabled	8 channels enabled
	200 kS/s (400 kB/s)	1.6 MS/s (3.2 MB/s)
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 using a streaming rate selected 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 are added to recording file for post recording identification of storage overrun. (1)	

(1) Specified for Perception V6.20 or higher

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Dual [1]		
Dual Sweep Specifications		
Maximum sample rate	200 kS/s per channel, no aggregate streaming rate limitations	
Dual sweep memory	80 % of available channel memory 48 MS; used by enabled channels only	
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 sweep length	48 MS divided by number of enabled channels	
	1 channel enabled	8 channels enabled
	48 MS/channel	6 MS/channel
Maximum number of sweeps	200 000 per recording [1]	
Maximum sweep rate	400 triggers 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	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 selected 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 events 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 trigger occurs.	
Dual Continuous Specifications		
Continuous FIFO memory	12 MS; used by enabled channels to optimize the continuous streaming rate	
	1 channel enabled	8 channels enabled
	12 MS/channel	1.5 MS/channel
Maximum sample rate	Sweep sample rate divide by 2 or 50 kS/s per channel, whichever is the smallest sample rate	
Maximum streaming rate	50 kS/s (100 kB/s) per enabled channel	
	1 channel enabled	8 channels enabled
	50 kS/s (100 kB/s)	400 kS/s (800 kB/s)
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 continuous streaming rate, until sweep storage completely stops.	
Exceeding aggregate storage rate	When using a streaming rate selected 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 are added to recording file for post recording identification of storage overrun. [1]	

(1) Specified for Perception V6.20 or higher

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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 feet); 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 IEC60068-2-1 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 IEC60068-2-3 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 IEC60068-2-14 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 IEC60068-2-30 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 Channel ± 0.5 kV/± 1 kV using coupling network: performance criteria B
EN 61000-4-6	Immunity to conducted disturbances, induced by radio-frequency fields 0.15 to 80 MHz, 1000 Hz AM; mains - 10 Vrms, using clamp; channel - 3 Vrms, 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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