Data sheet

GEN series
GN402

Optical Fiber Isolated 100 MS/s Input Card

Special features

- **Single-channel isolated analog input subsystem**
- **Rugged enclosure**
- **Shock and vibration resistant**
- **Wide operating temperature range, up to 70 °C (158 °F)**
- **Digital fiber optic connection, noise/error and drift free**
- **Cable length up to 12 km**
- **Automatic cable length phase compensation**
- **1 isolated, unbalanced differential input per transmitter**
- **± 20 mV to ± 100 V input ranges**
- **Analog/digital anti-alias filters**
- **Calibration values stored in transmitter**

The optical fiber isolated system consists of up to four transmitter units (GN114) connected to the GN402 receiver card built into any GEN series mainframe using a digital fiber optic cable. By converting the analog signal into a digital signal and transmitting the signal to the receiver card via fiber optic cable, the transmission does not add any drift or error to the measured signal. The automatic cable length compensation phase matches all fiber optic isolated channels to any standard analog input channel.
The GN114 transmitter is exclusively DC powered(1), offers remote operation, excellent signal fidelity and elimination of ground problems.

The GN114 offers an improved temperature range and an increased mechanical robustness with a stainless-steel housing. Optimum anti-alias protection is achieved by the 6-pole analog anti-alias filter combined with a fixed sample rate Analog-to-Digital converter. At lower sample rates the digital anti-alias filters allow for a large range of 8th order Bessel IIR filters with precise phase match and ultra low noise output.
Using the full transient and data recorder feature set of the GN402 with the powerful Perception software eliminate the need to use separate data acquisition hardware or software.

(1) HBM does not supply power sources for this digitizer.

Capabilities Overview	
Receiver model	GN402 (supports up to 4 GN114 transmitters)
Transmitter model	GN114 (requires a GN402 receiver card)
Maximum sample rate per channel	100 MS/s (ADC and DAC)
Memory per receiver	2 GB (1 GS)
Analog channels	1 input per transmitter (GN114) Receiver card (GN402) recreates an analog output signal for each transmitter
Anti-alias filters	Fixed bandwidth analog AA-filter combined with a range of fixed bandwidth digital AA-filter
ADC resolution	14 bit (ADC and DAC)
Isolation	Transmitter to receiver and transmitter to earth
Input type	Isolated, unbalanced differential inputs
Passive voltage/current probes	Passive, single-ended voltage probes
Sensors	Not supported
TEDS	Not supported
Real-time cycle based calculators	Not supported
Real-time formula database calculators (option)	Not supported
EtherCat® output	Not supported
Digital Event/Timer/Counter	Not supported
Standard data streaming (up to 200 MB/s)	Supported
Fast data streaming (up to 1 GB/s)	Not supported
Slot width	1

Block Diagram

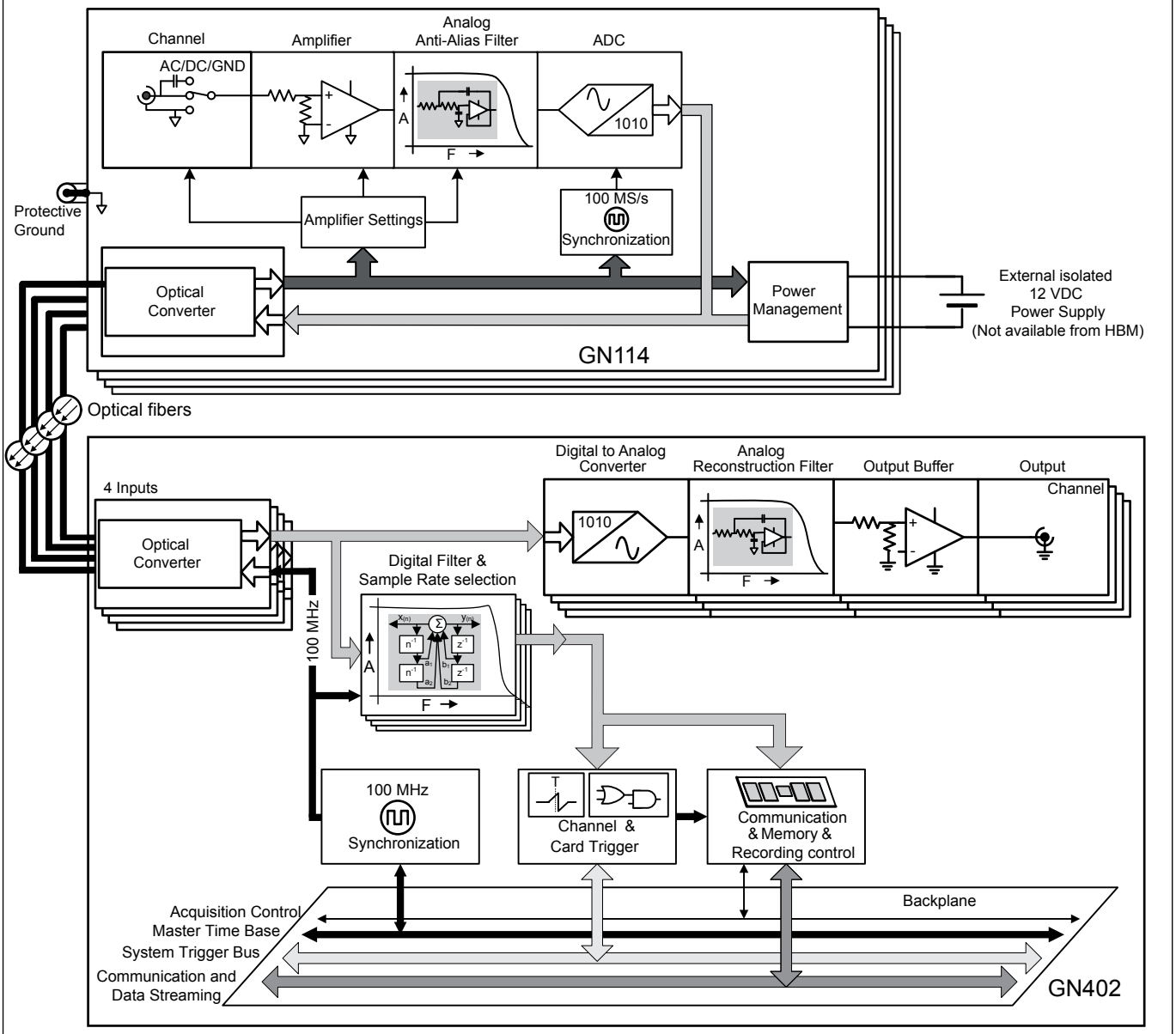


Figure 1.1: Block Diagram GN402 with GN114

Note *Each transmitter is calibrated independent from the receiver card. Calibration details are stored inside the transmitter to ensure calibrated measurements and traceability. The use of the digital optical fiber cable allows the use of any length of cable without effecting the calibration results.*
The isolated analog outputs of the GN402 card are calibrated independent from the transmitters ensuring a full calibrated output no matter which transmitter is connected.

Analog Input GN114 (Transmitter)	
Channels	1
Connector	1; metal BNC
Input type	Isolated, unbalanced differential inputs (BNC connected to isolated common)
Input Coupling	
Coupling modes	AC / DC / GND / Reference
AC coupling frequency	1.6 Hz (±10%); - 3 dB

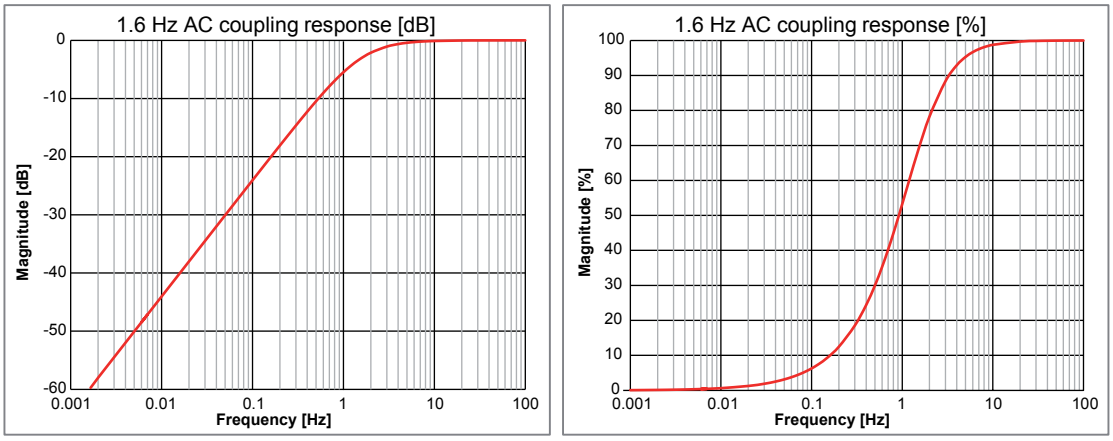
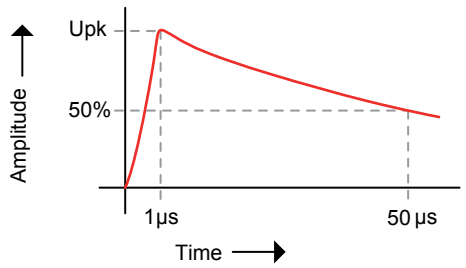


Figure 1.2: Representative AC coupling response

Impedance	1 MΩ (± 2%) // 38 pF (± 5%)
Ranges	± 20 mV, ± 50 mV, ± 100 mV, ± 200 mV, ± 500 mV, ± 1 V, ± 2 V, ± 5 V, ± 10 V, ± 20 V, ± 50V and ± 100 V
Offset	± 50% in 1000 steps (0.1%) ± 100 V range has fixed 0% offset
DC Offset error	
Wideband	0.1% of range ± 50 µV
Bessel filter	0.1% of range ± 50 µV
Offset error drift	±(60 ppm + 10 µV)/°C (±(36 ppm + 6 µV)/°F)
DC Gain error	
Wideband	0.1% of reading ± 50 µV
Bessel filter	0.1% of reading ± 50 µV
Gain error drift	±100 ppm/°C (± 60ppm/°F)
RMS Noise (50 Ω terminated)	
Wideband	0.05% of range ± 100 µV
Bessel filter	0.05% of range ± 100 µV
Common mode (referred to ground while protective ground is not connected) Requires a protected LAB environment and EN50191:2000 compliant work procedures	
Rejection (CMR)	> 100 dB @ 80 Hz
Maximum common mode voltage	Limits set by fiber cable and transmitter air gap isolation as well as external 12 V DC power supply added by user
Input bias current	< 2 nA
Rise time	14 ns

Analog Input GN114 (Transmitter)	
Input overload protection	
Overvoltage impedance change	The activation of the overvoltage protection system results in a reduced input impedance. The overvoltage protection is not active for as long as the input voltage remains less than 200% of the selected input range or 250 V, whichever value is the smallest.
Maximum nondestructive voltage	± 125 V DC; Ranges < ± 2 V ± 250 V DC; Ranges ≥ ± 2 V
Impulse protection	1.2/50 µs; 800 V peak  **Figure 1.3:** Example of 1.2/50 µs impulse
Overload recovery time	Restored to 0.1% accuracy in less than 50 ns after 200% overload Restored to 10% accuracy in less than 10 ns after 200% overload

Analog to Digital Conversion	
Sample rate per channel	0.1 S/s to 100 MS/s
ADC resolution; one ADC per channel	14 bit
ADC type	CMOS pipelined multi step flash converter, LTC2254
Time base accuracy	Defined by mainframe: ± 3.5 ppm (1); aging after 10 years ± 10 ppm
Binary sample rate	Not supported
Maximum binary sample rate	N/A
External time base sample rate	0 S/s to 10 MS/s
External time base level	TTL
External time base minimum pulse width	50 ns

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

Testing and Control Section	
Power On/Off (transmitter)	Controlled by Perception
Reference signal accuracy	Switched on via “Coupling” in Perception
Square wave	504 Hz ± 1.8 V and ± 0.09 V
Amplitude	± 0.5%
Frequency	± 2%
Control Out	Switched on via "Control-Out" in Perception
Open collector output	< 50 mA; Sink current
Maximum open voltage	12 V; Remotely controlled (open/closed) from Perception software to control e.g. external power supply

Anti-Alias Filters

Using different filter selections (Wideband/Bessel/Bessel IIR) or different filter bandwidths can result in phase mismatches between channels.

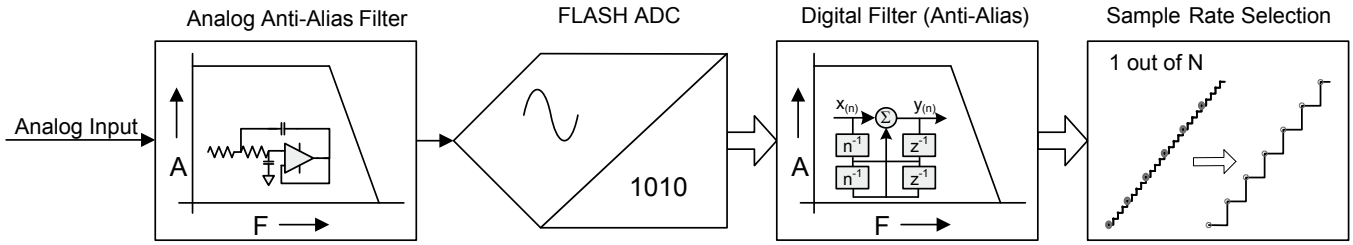


Figure 1.4: Combined analog and digital anti-alias filter block diagram

Anti-aliasing is prevented by a steep, fixed frequency analog anti-alias filter in front of the Analog to Digital Converter (ADC). The ADC always samples at a fixed sample rate. The fixed sample rate of the ADC avoids the need for different analog anti-alias filter frequencies.
Directly behind the ADC, the high precision digital filter is used as anti-alias protection before the digital downsampling to the desired user sample rate is performed. The digital filter supports a range of fixed bandwidth anti-alias filters. Compared to analog anti-alias filters, the programmable digital filter offers additional benefits like higher order filter with steep roll-off, a larger selection of filter characteristics, noise-free digital output and no additional phase shifts between channels that use the same filter settings.

Wideband	When wideband is selected, there is neither an analog anti-alias filter nor any digital filter in the signal path. Therefore, there is no anti-alias protection when wideband is selected. Wideband should not be used if working in a frequency domain with recorded data. Using wideband, enhanced resolution is not supported at lower sample rates.
Bessel (Fc @ -3 dB)	This analog Bessel filter can be used to reduce the higher bandwidth signals, but is also used to prevent aliasing at the 100 and 50 MS/s sample rates. For lower sample rates, the digital Bessel IIR filter must be used to prevent aliasing. Bessel filters are typically used when looking at signals in the time domain. They are best used for measuring transient signals or sharp edge signals like square waves or step responses. Using the Bessel filter, enhanced resolution is not supported at lower sample rates.
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 to prevent aliasing at lower sample rates. This can only be used for sample rates up to 50 MS/s. Bessel filters are typically used when looking at signals in the time domain. They are best used for measuring transient signals or sharp edge signals like square waves or step responses. Enhanced resolution is supported by using over sampling combined with a digital filter at the following sample rates: 15 bit resolution at 25 MS/s and lower, 16 bit resolution at 10 MS/s and lower.

Wideband (No Anti-Alias Protection)

When wideband is selected, there is neither an analog anti-alias filter nor any digital filter in the signal path. Therefore, there is no anti-alias protection when wideband is selected.

Wideband bandwidth	Between 27 MHz and 36 MHz (-3 dB)
0.1 dB passband flatness (1)	DC to 1 MHz

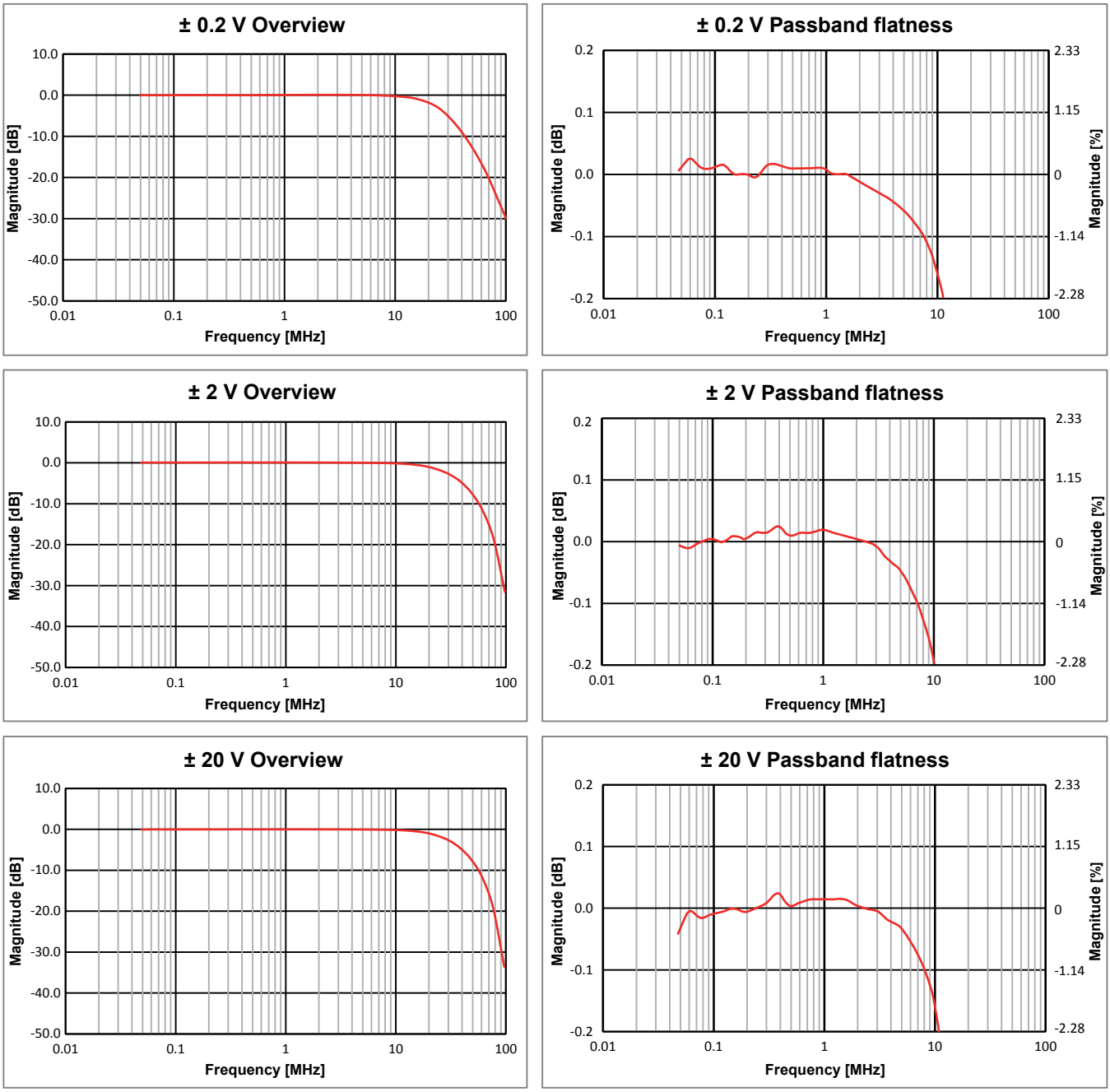
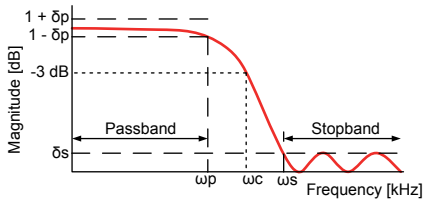


Figure 1.5: Representative Wideband examples

(1) Measured using a Fluke 5700 calibrator, DC normalized

Bessel and Bessel IIR filter (Digital Anti-Alias)



δp: Passband ripple
δs: Stopband attenuation

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

Figure 1.6: Digital Bessel IIR Filter

When Bessel IIR filter is selected, this is always a combination of the analog Bessel anti-alias filter and a digital Bessel IIR filter.	
Analog anti-aliasing filter bandwidth	10 MHz ± 1 MHz (-3 dB)
Analog anti-aliasing filter characteristic	6-pole Bessel, optimal step response
Bessel IIR filter characteristic	8-pole Bessel style IIR
Bessel IIR filter user selection	User selectable fixed frequencies. If anti-aliasing must be prevented, care must be taken to adapt the selected filter frequency when the sample rate is changed.
Bessel IIR filter bandwidth (ωc)	50 kHz, 100 kHz, 125 kHz, 200 kHz, 250 kHz, 400 kHz, 500 kHz, 1 MHz, 1.25 MHz, 2 MHz, 2.5 MHz, 4 MHz, 5 MHz; fixed bandwidth selections
Bessel IIR 0.1 dB passband flatness (ωp)(1)	DC to 1 MHz @ ωc = 5 MHz
Bessel IIR filter stop band attenuation (δs)	60 dB
Bessel IIR filter roll-off	48 dB/Octave

(1) Measured using a Fluke 5700 calibrator, DC normalized

Bessel and Bessel IIR filter (Digital Anti-Alias)

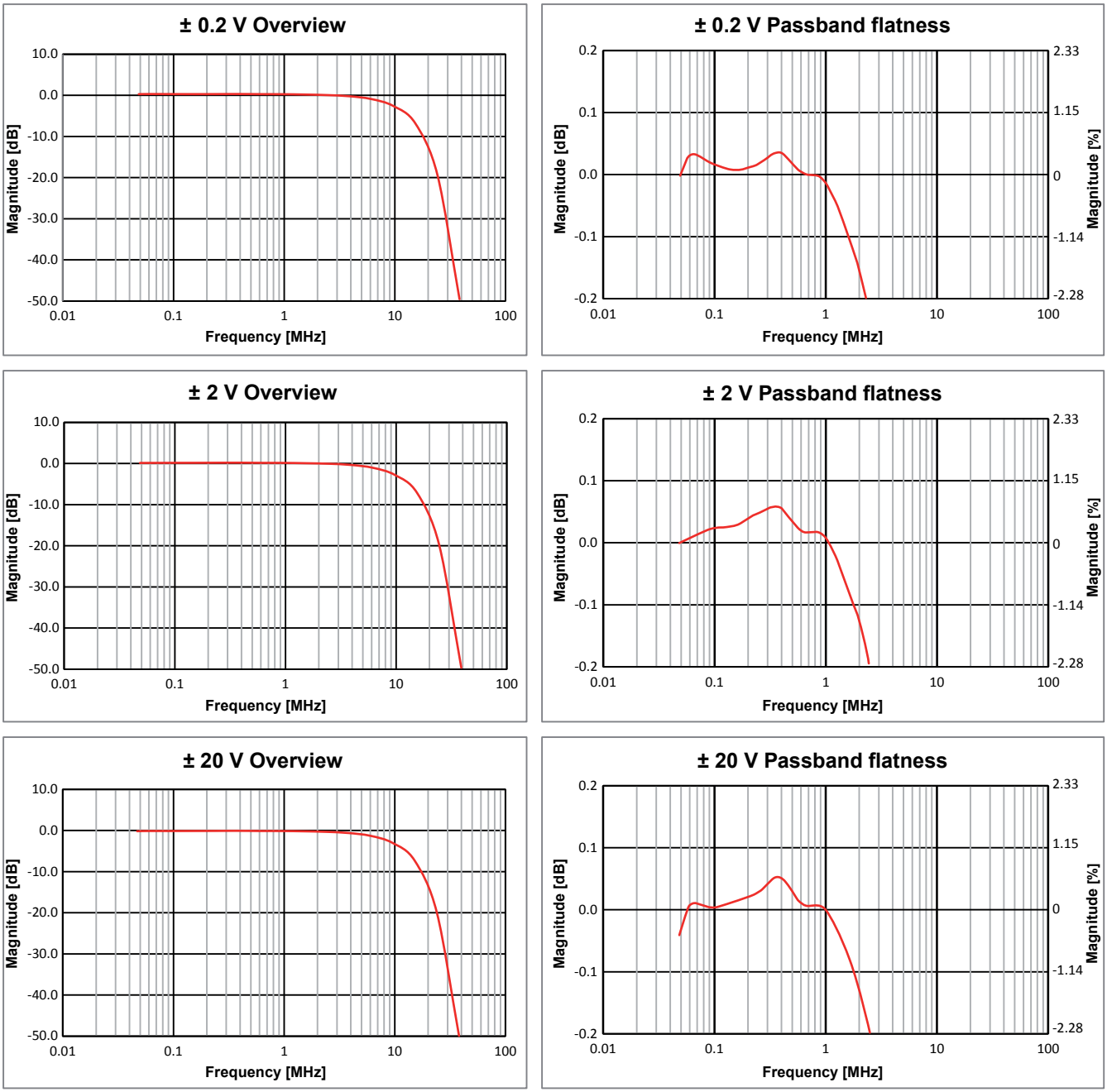


Figure 1.7: Representative Bessel and Bessel IIR examples

Channel to Channel Phase Match	
Using different filter selections (Wideband/Bessel/Bessel IIR) or different filter bandwidths results in phase mismatches between channels.	
Channel to channel phase difference	Maximum ± 10 ns
Fiber cable length compensation	Yes, automatic when optical communication is established Optical cable delay is compensated to phase match standard GEN DAQ channels.
Fiber cable delay	5 ns/m; delay compensated by cable length compensation

On-Board Memory	
Per card	2 GB (1 GS)
Organization	Automatic distribution amongst enabled channels
Memory diagnostics	Automatic memory test when system is powered on but 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 per channel, software selectable either trigger or qualifier
Pre- and post-trigger length	0 to full memory
Maximum 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
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
Cross channel triggering	
Measurement channels	Logical OR of triggers from all measured signals Logical AND of qualifiers from all measured signals
Calculated channels	Logical OR of triggers from all calculated signals (RTC and RT-FDB) Logical AND of qualifiers from all calculated signals (RTC and RT-FDB)
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 detection/rejection	Disable/Detect/Reject software 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

Triggering	
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 hold off	Disable channel trigger for 1 to 65 535 samples after trigger detected Maximum hold off time depends on sample rate
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	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 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 of waveform displays and the real-time meters while recording Supports fast displaying and zooming within extremely large recordings Supports fast calculations 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. Slow-Fast Sweep is not supported by the RT-FDB calculators.
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 depend 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 depend on Ethernet speed, PC used and data storage media used. In Dual mode the RT-FDB calculators sample based results are only calculated for the sweep sections of the recorded data. Due to the asynchronous nature of cycle based results, all cycle based results are continuously stored and used in both the sweep as well as the continuous sections of the recording.

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	900 MS	450 MS	225 MS	not used			720 MS	360 MS	180 MS
Max. sweep sample rate	100 MS/s			not used			100 MS/s		
Max. continuous FIFO	not used			900 MS	450 MS	225 MS	180 MS	90 MS	45 MS
Max. continuous sample rate	not used			20 MS/s			Sweep sample rate / 2 Maximum 20 MS/s		
Max. aggregate continuous streaming rate	not used			20 MS/s 40 MB/s	40 MS/s 80 MB/s	80 MS/s(1) 160 MB/s(1)	20 MS/s 40 MB/s	40 MS/s 80 MB/s	80 MS/s(1) 160 MB/s(1)

(1) Only mainframes with "fast data streaming" support can stream at this data rate continuously.

Single Sweep

Pre-trigger segment	0% to 100% of selected sweep length If trigger occurs before the pre-trigger segment is recorded, the pre-trigger segment is truncated to recorded data only.
Delayed trigger	Maximum 1000 seconds after a trigger occurred. The sweep is recorded immediately after a 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 restarts the post-trigger length. If, upon the detection of a new trigger, the extended post-trigger does not fit within the sweep memory, sweep stretch does not happen. The maximum sweep stretch rate is 1 sweep stretch per 2.5 ms.

Multiple Sweeps	
Pre-trigger segment	0% to 100% of selected sweep length If trigger occurs before the pre-trigger segment is recorded, the pre-trigger segment is truncated to recorded data only.
Delayed trigger	Maximum 1000 seconds after a trigger occurred. The sweep is recorded immediately after a 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 restarts the post-trigger length. If, upon the detection of a new trigger, the extended post-trigger does not fit within the sweep memory, sweep stretch does not happen. The maximum sweep stretch rate is 1 sweep stretch per 2.5 ms.
Sweep storage	Sweep storage is started immediately after the trigger for this sweep has been 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 are stored one by one, starting with the first recorded sweep.
Sweep storage rate	Determined by the total number of selected channels and mainframes, mainframe type, Ethernet speed, PC storage medium and other PC parameters. For details, please refer to the mainframe datasheet.
Exceeding sweep storage rate	Trigger event markers are stored in a recording. No sweep data is stored. New sweep data is 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 per recording
Maximum slow sample rate	Fast sample rate divided by two or 20 MS/s per channel, whichever is the smallest sample rate
Maximum sample rate switches	20, sample rate switching always stops when sweep ends
Minimum time between sample rate switches	2.5 ms

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

Dual	
Dual Sweep Specification	
Pre-trigger segment	0% to 100% of selected sweep length If trigger occurs before the pre-trigger segment is recorded, the pre-trigger segment is truncated to recorded data only.
Delayed trigger	Maximum 1000 seconds after a trigger occurred. The sweep is recorded immediately after a 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 restarts the post-trigger length. If, upon the detection of a new trigger, the extended post-trigger does not fit within the sweep memory, sweep stretch does not happen. The maximum sweepstretch rate is 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 is started immediately after the trigger for this sweep has been 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 are stored one by one, starting with the first recorded sweep.
Sweep storage rate	Determined by the continuous sample rate, total number of channels and mainframes, mainframe type, Ethernet speed, PC storage medium and other PC parameters. For details, please refer to mainframe datasheet.
Exceeding sweep storage rate	Continuous recorded data is not stopped, trigger event markers are stored in recording and no new sweep data is stored. A new sweep is 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 the continuous streaming rate
Maximum recording time	Until storage media filled or user selected time
Maximum aggregate streaming rate per mainframe	Determined by mainframe, Ethernet speed, PC storage medium and other PC parameters. For details, please refer to the mainframe datasheet. When the average aggregate streaming rate is exceeded, the sweep storage speed is automatically reduced to increase the aggregate streaming rate until the sweep storage is stopped completely.
Exceeding aggregate storage rate	When a streaming rate higher than the aggregate streaming rate of the system is selected, the continuous memory acts as a FIFO. As soon as this FIFO fills up, the recording is suspended (no data is recorded temporarily). During this period, the internal FIFO memory is transferred to the storage medium. When the internal memory (Continuous and Sweep memory) is completely empty, the recording is automatically resumed. User notifications are added to the recording file for post recording identification of storage overrun.

Fiber optic link	
Light source	Class 1 laser product
Transfer rate	2 Gbit/s
Wavelength	1310 nm
Dynamic range	+ 9 dB
Connector	LC duplex
Cable	
Isolation	10^{15} Ω/m
Maximum length	12 km (7.45 miles); using ISO/IEC 11801 type OS2 cable and no extra couplers. Each extra LC-LC coupler reduces cable length by approximately 100 m (328 ft)
Type	Duplex Single Mode, 9/125 µm, ISO/IEC 11801 type OS2

Analog Output GN402 (Receiver)	
Channels	4; 1 per transmitter channel (GN110, GN111, GN112 and GN113)
Connector	4; Metal BNC, one BNC per channel on receiver front panel
Conversion	100 MS/s D-to-A converter per channel
DAC Resolution	14 bit (0.006%)
Outputs	
Output filter	Lowpass 10 MHz @ – 3 dB; 6th order Bessel reconstruction filter
Output impedance	13 Ω typical
Calibrated Full Scale Output level	± 5 V; 1 MΩ load
Propagation delay (input to output)	
Wideband	< 1 µs
Bessel filter @ 50 kHz	12 µs

Power Requirement GN114 (Transmitter)	
DC input	11.0 V to 15.0 V, nominal 12 V DC **Note** *HBM doesn't offer a power supply for use with this transmitter.*
Power consumption	6 VA typical, 9 VA maximum
Warnings	
Low voltage warning	10.4 V
Automatic shut down	9.2 V
Overheat	
Red LED	90 °C; At receiver front panel indicates a transmitter internal temperature (Externally, approx. 70 °C)
Overheat protection	
Transmitter shutdown	95 °C; Automatic restart trial every five minutes after shutdown (Externally, approx. 75 °C)
Connector	Lemo FGG.1B.303

Physical, Weight and Dimensions GN114	
Weight	1.3 kg (2.9 lb)
Dimensions including handles	122.4 mm (4.82") x 237.0 mm (9.33") x 45.6 mm (1.79") (W x D x H)
Shielding and casing	Stainless steel (304) housing.
Cooling fans	0
Protective ground	M6 screw terminal

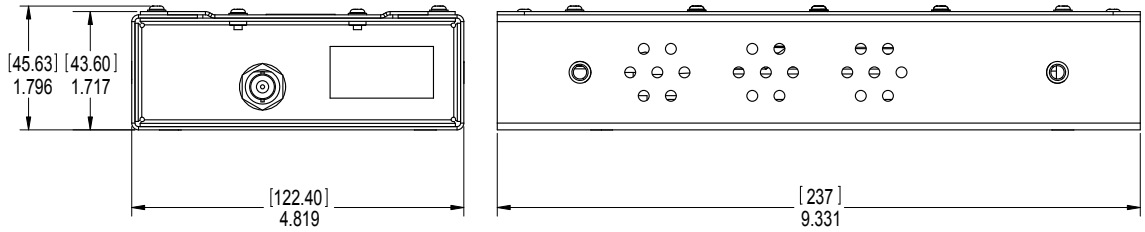


Figure 1.8: Dimensions GN114 transmitter

Environmental Specifications

Temperature Range	
Operational	GN114: -15 °C to +70 °C (+5 °F to +158 °F) GN402: 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)
Relative humidity	0% to 80%; non-condensing; operational
Protection class	IP20
Altitude	Maximum 2000 m (6562 ft) above sea level; operational
Shock: IEC 60068-2-27	
Operational	Half-sine 10 g/11 ms; 3-axis, 1000 shocks in positive and negative direction
Non-operational (MIL-PRF-28800F Class 1)	Half-sine 30 g/11 ms; 3-axis, 3 shocks in positive and negative direction
Transit drop test	Height 460 mm
Vibration: IEC 60068-2-64	
Operational	1 g RMS, ½ h; 3-axis, random 5 to 500 Hz
Non-operational	23 g RMS, 30 s; 3-axis, random 5 to 1500 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): 2014/35/EU
Electromagnetic Compatibility Directive (EMC): 2014/30/EU

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 (2013)	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 MHz to 2.7 GHz 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 150 kHz 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

KAB289: Fiber Cable Heavy Duty SM LC-LC (Option, to be ordered separately)

Heavy duty fiber optic duplex Single Mode cable

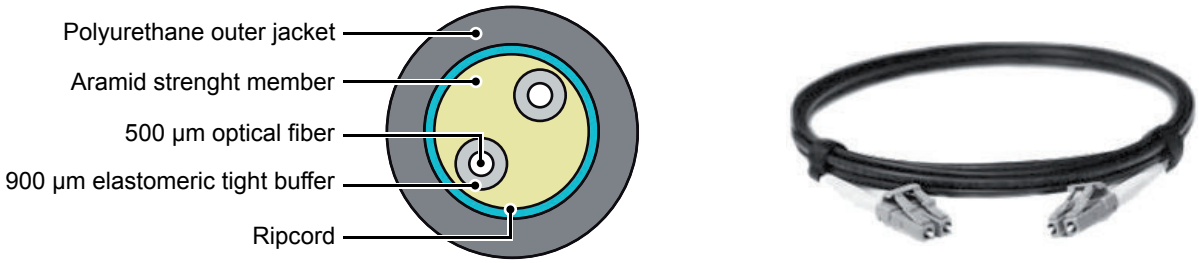


Figure 1.9: Block diagram and image

Connector type	LC - LC
Glass rating	OS2; Single Mode
Core/Cladding diameter	9/125 µm
Jacket size/diameter	5.8 mm (0.23")
Jacket rating	Low-smoke zero-halogen
Attenuation	≤ 0.5 dB/km @ 1310 nm
Available lengths	10, 20, 50, 100, 150 and 300 m (33, 66, 164, 328, 492 and 984 ft). For other lengths contact custom systems(1).
Bend radius	58 mm (2.3")
Crush resistance	2000 N/cm
Weight	Typcially 32 kg/km (21.5 lbs/1000 ft)
Operating temperature	-46 °C to +85 °C (-50.8 °F to 185 °F)

(1) Contact custom systems at: customsystems@hbm.com
Request quote/information for special products for GEN series.

Direct GN402 to GN114 Optical Cable Connection Example

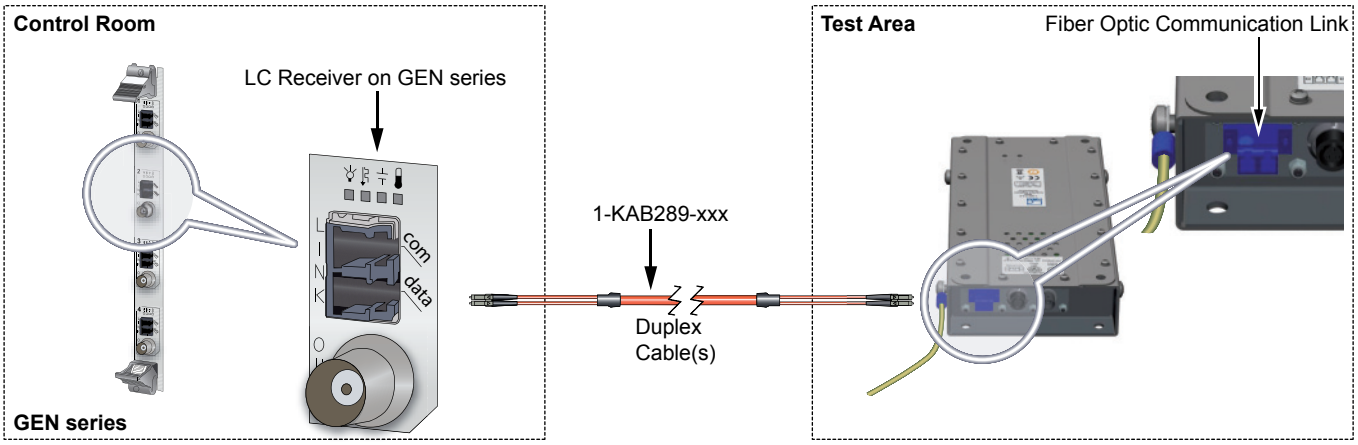


Figure 1.10: Application area of a fiber optic duplex cable (Example 1)

KAB288: Fiber Cable Standard SM LC-LC (Option, to be ordered separately)

Standard zipcord fiber optic duplex Single Mode patch cable

Figure 1.11: Block diagram and image

Connector type	LC - LC
Glass rating	OS2; Single Mode
Core/Cladding diameter	9/125 µm
Jacket size/diameter	Typically 2 mm (0.08") single core
Jacket rating	Low-smoke zero-halogen
Attenuation	≤ 0.5 dB/km @ 1310 nm
Available lengths	2, 10, 20, 50 and 100 m (6.6, 33, 66, 164 and 330 ft). For other lengths contact custom systems(1).
Bend radius	30 mm (1.2")
Weight	Typically 14 kg/km (9 lbs/1000 ft)
Operating temperature	-40 °C to +70 °C (-40 °F to 158 °F)

(1) Contact custom systems at: customsystems@hbm.com
Request quote/information for special products for GEN series.

Direct GN402 to GN114 Optical Cable Connection Example

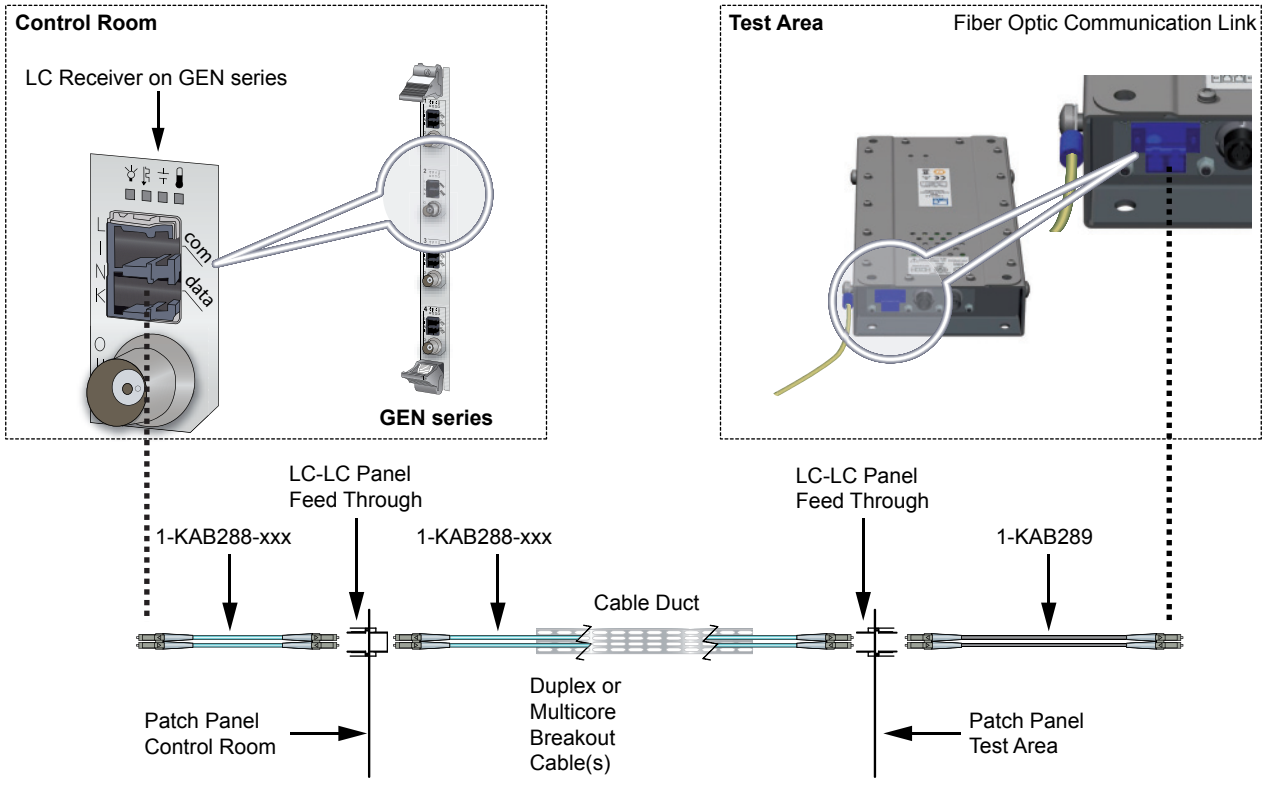


Figure 1.12: Application area of a fiber optic duplex cable (Example 2)

Ordering Information[1]			
Article		**Description**	**Order No.**
GN114 1 ch Transmitter		GN114 optical isolated transmitter HV, 100 MS/s, 14 bit, 25 MHz bandwidth, 12 V DC supply voltage, LC connector, uses 1310 nm optical communication. **Note** *HBM doesn't offer power supplies for this transmitter.*	1-GN114-2
GN402		GN402 optical isolated receiver, 4 channels, 4 x LC in, 4 x BNC out, 2 GB memory, uses 1310 nm optical communication	1-GN402-2

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

Accessories, to be ordered separately			
Article		**Description**	**Order No.**
Fiber cable standard SM LC-LC		GEN DAQ standard zipcord fiber optic duplex Single Mode 9/125 µm cable, 0.5 dB/km loss, LC-LC connectors, yellow, ISO/IEC 11801 type OS2. Typically used for fixed cable routing or LAB environments. Lengths: 2, 10, 20, 50 and 100 meters (6.5, 33, 66, 164 and 328 ft) Used with 1310 nm optical 1 Gbit or 10 Gbit Ethernet (1-G063-2 and 1-G066-2).	1-KAB288-2 1-KAB288-10 1-KAB288-20 1-KAB288-50 1-KAB288-100
Fiber cable heavy duty SM LC-LC		GEN DAQ heavy duty fiber optic duplex Single Mode 9/125 µm cable, 0.5 dB/km loss, LC-LC connectors, black, ISO/IEC 11801 type OS2. Typically used for test cell environments. Lengths: 10, 20, 50, 100, 150 and 300 meters (33, 66, 164, 328, 492 and 984 ft) Used with 1310 nm optical 1 Gbit or 10 Gbit Ethernet (1-G063-2 and 1-G066-2).	1-KAB289-10 1-KAB289-20 1-KAB289-50 1-KAB289-100 1-KAB289-150 1-KAB289-300

Note *Other fiber cable lengths can be ordered from custom systems.*

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