Trillium360 GSN

SEISMOMETERS FOR GLOBAL SEISMIC MONITORING

BETTER UNDERSTANDING OF SEISMICITY ON A GLOBAL SCALE

Trillium360 GSN Vault

Trillium360 GSN Posthole

Trillium360 GSN Borehole

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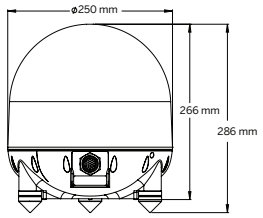
SEISMOMETERS FOR GLOBAL SEISMIC MONITORING

The Trillium 360 GSN Seismometers are highest-performing, lowest noise broadband seismometers in the world. Available in Vault, Posthole or Borehole form factors; the GSN series gives you full-bandwidth coverage for monitoring global and local seismicity with a single instrument.

Trillium 360 GSN Vault

Incorporates a patented thermal stability system to minimize the effect of diurnal temperature fluctuations



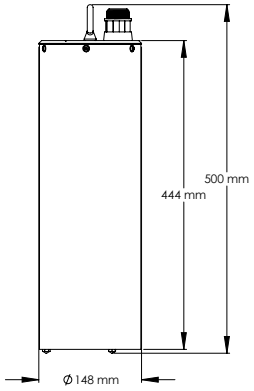
PHYSICAL

Case: (Enclosure) Powder-coated aluminum pressure vessel
Diameter: 250 mm
Height: 270 mm without leveling feet,
290 ±5 mm depending on leveling feet extension
Weight: 14 kg
Parasitic resonances: None below 150 Hz
Handling: Detachable carrying handle on case

Polar Certified Model available for operating temperatures down to –50°C

Trillium 360 GSN Posthole

A versatile seismometer with a robust, waterproof, stainless steel enclosure that protects the seismometer from hostile environments, suitable for installation in shallow direct burial, posthole, or at the bottom of deep boreholes



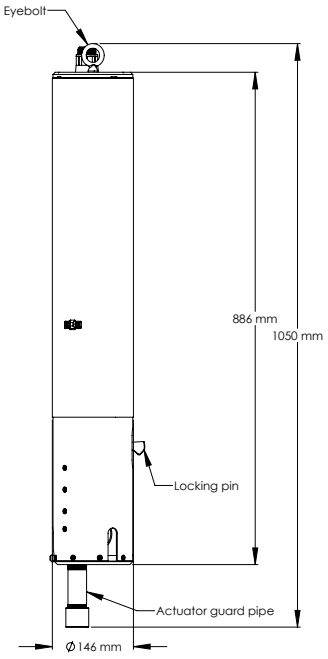
PHYSICAL

Case: Stainless steel pressure vessel
Diameter: 148 mm, including external magnetic shield
Height: 444 mm not including connector or feet
500 mm including feet and eyebolt
Weight: 18 kg
Parasitic resonances: None below 100 Hz
Handling: Eyebolt on lid for lifting cable.
1300 lbf (5800 N) rated

Polar Certified Model available for operating temperatures down to –50°C

Trillium GSN 360 Borehole

Designed for cased boreholes as deep as 500 m, with motorized a holelock to easily position the seismometer at any depth and fail-safe release mechanism



PHYSICAL

Case: Stainless steel pressure vessel and holelock
Diameter: 146 mm, including external magnetic shield
Height: 886 mm, not including connector or actuator guard pipe
1050 mm including connector and actuator guard pipe
Weight: 31 kg
Parasitic resonances: None below 100 Hz
Handling: Eyebolt on lid for lifting cable.
1300 lbf (5800 N) rated

* this drawing is not in proportion with the other line drawings on this page

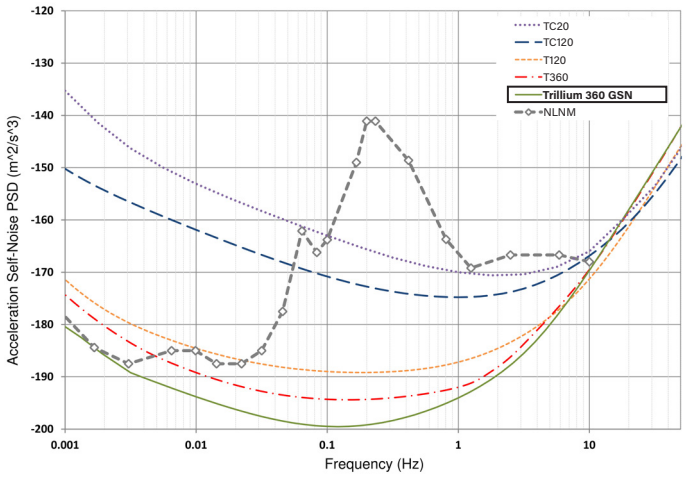
Outstanding performance

The Trillium 360 GSN Seismometer series is the culmination of more than 30 years experience designing and building the best seismological instrumentation in the world. Its industry-leading performance, including low self-noise, very wide bandwidth, precisely calibrated response and immunity to environmental effects makes it well suited for many applications, including the deployment of new seismic networks or the recapitalization and expansion of existing facilities.

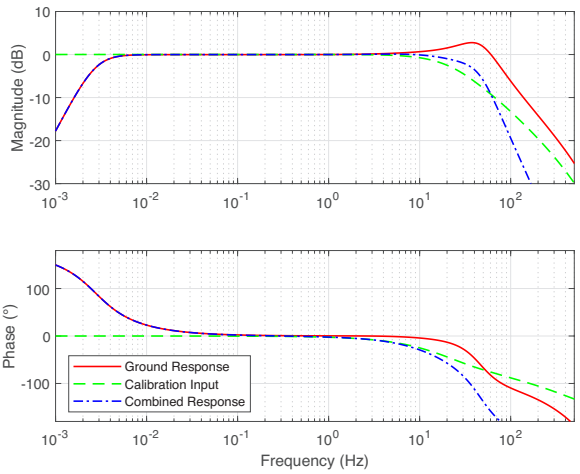
Easy to use

Its many simple-to-use features, such as automatic leveling and mass centering that can be remotely initiated, and digital case tilt reporting make for fast and successful installation every time.

- Very broadband, exceptional low-noise performance that meets GSN operational requirements
- Meets USGS Class A+ requirements
- An extended low-frequency range useful to beyond a 10,000-second time period
- Able to resolve below Peterson's new low-noise model (NLNM)
- Widest available flat response bandwidth, 360 seconds to 80 Hz
- A wide dynamic range with a clip level of ±10 mm/s
- Automatic leveling and mass centering that can be remotely initiated
- The lowest magnetic sensitivity of any broadband seismometer
- Ask about our harsh environment and extreme cold models



Acceleration Noise PSD



Transfer function amplitude and phase vs frequency

Comparison between 360 GSN Surface Vault, Posthole and Borehole Seismometers

	T360-SV1-GSN Trillium Vault 360	T360-PH1-GSN Trillium Posthole 360	T360-BH1-GSN Trillium Borehole 360
Global seismicity	●	●	●
Local and regional seismicity (exceptionally low noise at both high and low frequencies)	●	●	●
Operating tilt range ±5°		●	●
Environmentally robust:			
Rated to IP68 for outdoor use	●	●	●
Rated to IP68 for prolonged submersion		●	●
Above average magnetic immunity required	●	●	●
Digital tiltmeter reports tilt angle	●	●	●
Installation:			
Vault install	●		
Posthole, direct bury, borehole sand install		●	
Cased borehole locked at any depth			●

TECHNICAL SPECIFICATIONS

Specifications subject to change without notice

TECHNOLOGY	VAULT	POSTHOLE	BOREHOLE
Topology	Symmetric triaxial	Symmetric triaxial	Symmetric triaxial
Feedback	Force balance with capacitive transducer	Force balance with capacitive transducer	Force balance with capacitive transducer
Leveling	Integrated bubble level, adjustable locking leveling feet	Internal automated leveling ±5º	Internal automated leveling ±5º
Leveling initiation	Control line or serial port command	Control line or serial port command	Control line or serial port command
Mass centering	Automatic motorized recentering, can be remotely initiated	Motorized recentering automatically initiated during leveling sequence, can be remotely initiated	Motorized recentering automatically initiated during leveling sequence, can be remotely initiated
Holelock	N/A	N/A	Motorized single jaw, non-jamming Adaptable to a wide range of hole sizes
Alignment	Vertical scribe marks for E/W, precision holes for 5/16 in. alignment rod for N/S	North line on top cap; optional alignment rod for downhole orientation	North line on top cap; optional alignment rod for downhole orientation
Digital tiltmeter	Reports case tilt from vertical for easy installation and remote troubleshooting	Reports case tilt from vertical for easy installation and remote troubleshooting	Reports case tilt from vertical for easy installation and remote troubleshooting
PERFORMANCE			
Self-noise	At or below the NLNM at all frequencies, see plot	At or below the NLNM at all frequencies, see plot.	At or below the NLNM at all frequencies, see plot.
Sensitivity	(Nominal) 2000 V•s/m; (Actual) 1998.4 V•s/m ±0.5%	(Nominal) 2000 V•s/m; (Actual) 1998.4 V•s/m ±0.5%	(Nominal) 2000 V•s/m; (Actual) 1998.4 V•s/m ±0.5%
Accuracy	±0.5%	±0.5%	±0.5%
Bandwidth	-3 dB points at 360 s and 79 Hz	-3 dB points at 360 s and 79 Hz	-3 dB points at 360 s and 79 Hz
Clip level	10 mm/s up to 12 Hz	10 mm/s up to 12 Hz	10 mm/s up to 12 Hz
Dynamic Range	169 dB @ 1 Hz	169 dB @ 1 Hz	169 dB @ 1 Hz
Transfer function	Lower corner poles within ±0.5% of nominal provided High-frequency response within ±1 dB of nominal up to 50 Hz	Lower corner poles within ±0.5% of nominal provided High-frequency response within ±1 dB of nominal up to 50 Hz	Lower corner poles within ±0.5% of nominal provided High-frequency response within ±1 dB of nominal up to 50 Hz
Temperature sensitivity	±10°C without recentering	±10°C without recentering	±10°C without recentering
Magnetic sensitivity	<0.03 $(m/s^2)/T$	<0.03 $(m/s^2)/T$	<0.03 $(m/s^2)/T$
INTERFACE			
Connector	19-pin MIL-C-26482, mounted on base	20-pin marine	20-pin marine
Velocity output	40 V peak-to-peak Selectable XYZ or UVW mode	40 V peak-to-peak Selectable XYZ or UVW mode	40 V peak-to-peak Selectable XYZ or UVW mode
Mass position output	Three independent voltage outputs	Three independent voltage outputs	Three independent voltage outputs
Control lines	Mass Center, Calibration Enable, XYZ/UVW mode	Auto-level and Mass Center, Calibration Enable, XYZ/UVW mode	Auto-level and Mass Center, Calibration Enable, XYZ/UVW mode
Calibration input	Single voltage input for all channels, independent calibration enable for each channel. Calibration in XYZ or UVW	Single voltage input for all channels, single calibration enable for all channels. Calibration in XYZ or UVW	Single voltage input for all channels, single calibration enable for all channels. Calibration in XYZ or UVW
Calebration enable	Isolated active-high referenced to DGND Three independent calibration enable inputs	Single calibration enable for all channels	Single calibration enable for all channels
Serial port	• RS-232 compatible serial IP (SLIP) with onboard HTTP web server to select sensor operating modes, to mass center, and to access state-of-health, virtual level bubble, firmware updates and metadata • Plug-and-Play automated workflow interface to select sensor operating modes, and to access state-of-health, virtual level bubble and metadata	• RS-232 compatible serial IP (SLIP) with onboard HTTP web server to select sensor operating modes, to mass center, and to access state-of-health, virtual level bubble, firmware updates and metadata • Plug-and-Play automated workflow interface to select sensor operating modes, and to access state-of-health, virtual level bubble and metadata	• RS-232 compatible serial IP (SLIP) with onboard HTTP web server to select sensor operating modes, to mass center, and to access state-of-health, virtual level bubble, firmware updates and metadata • Plug-and-Play automated workflow interface to select sensor operating modes, and to access state-of-health, virtual level bubble and metadata
POWER			
Power consumption	820 mW typical at 12 V input	820 mW typical at 12 V input	820 mW typical at 12 V input 2 A to operate holelock
Supply voltage	9 to 36 Volts DC isolated input	9 to 36 Volts DC isolated input For deep installations, a 24 V power system is recommended to allow for cable losses.	9 to 36 Volts DC isolated input For deep installations, a 24 V power system is recommended to allow for cable losses.
Protection	Reverse-voltage and over-voltage protected Self-resetting over-current protection	Reverse-voltage and over-voltage protected Self-resetting over-current protection	Reverse-voltage and over-voltage protected Self-resetting over-current protection
ENVIRONMENTAL			
Ingress Protection	Rated to IP68 and NEMA 6P to 2 m for prolonged immersion	Rated to IP68 and NEMA6P to 300 m for prolonged immersion. A dry hole is recommended for best seismic performance	Seismometer is rated to IP68 and NEMA6P to 300 m for prolonged immersion. A dry hole is recommended for best seismic performance. Holelock motor is rated to IP68 and NEMA6P to 30 m for prolonged immersion
Insulating cover	Optional insulating cover available for quick and convenient installation	N/A	N/A
Operating temperature	–20°C to 60°C (Standard Model) –50°C to 60°C (Polar Certified Model)	–20°C to 60°C (Standard Model) –50°C to 60°C (Polar Certified Model)	–20°C to 60°C
Storage temperature	–40°C to +70°C (Standard Model) –60°C to +70°C (Polar Certified Model)	–40°C to +70°C (Standard Model) –60°C to +70°C (Polar Certified Model)	–40°C to 70°C
Shock	20 *g* half sine, 5 ms without damage, 6 axes No mass lock required for transport	20 *g* half sine, 5 ms without damage, 6 axes No mass lock required for transport	20 *g* half sine, 5 ms without damage, 6 axes No mass lock required for transport
AVAILABLE MODELS	**T360-SV1-GSN:** Standard Model **T360-SV1-GSN-XC:** Polar Certified Model	**T360-PH1-GSN:** Standard Model **T360-PH1-GSN-XC:** Polar Certified Model	**T360-BH1-GSN:** Standard Model

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