Seismometer Preamplifier Manual

Seismometer Preamplifier Manual

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1 Introduction

The Preamplifier is a single channel amplifier for passive seismometers, for use in Nanometrics networks where both high sensitivity and wide dynamic range are required.

Please read carefully the appropriate sections of this manual before storing, installing, or operating the Preamplifier. If you need technical support, please submit your request by e-mail or fax. Please include a full explanation of the problem and supporting data, to help us direct your request to the most knowledgeable person for reply.

E-mail:	support@nanometrics.ca
FAX:	To: Support
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2 Organization of this manual

This manual includes both reference and procedural information. Reference information is contained in Chapter 4, "Technical description", and in the appendixes. Procedural information is contained in Chapter 5, "User guide".

Please read carefully the section "Handling and storage precautions" before installing or using the Preamplifier.

The information in this manual is	s divided into these chapters:
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Chapter	Contents
1. Introduction	Introduction, and technical support contact information
2. Organization of this manual	An overview of the manual contents
3. Unpacking and post-delivery inspection	Important information on inspecting the shipment and handling the equipment
4. Technical description	An overview of Preamplifier features and specifications
5. User guide	Procedures for installing and maintaining the Preamplifier
Appendix A	Connector pinouts
Appendix B	Specifications

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3 Unpacking and post-delivery inspection

This chapter provides information on how to check the completeness of the shipment and the condition of the shipped items, instructions on what to do if there are any problems with the shipment, and lists some precautions for handling and storage of the Preamplifier. The information in this manual is supplemental and should be used in conjunction with system warranty information.

Unpacking the shipment

Open the shipment and check the contents for completeness against the packing slip. Visually inspect the equipment for any damage that may have occurred in transit. If there are any problems with the shipment, please contact Nanometrics Support.

Handling and storage precautions

The Preamplifier should not be stored or operated in an environment with a temperature below -20 degrees Celsius or above 60 degrees Celsius. Appendix B contains detailed specifications.

4 Technical description

This section contains a brief overview of the Preamplifier operation. Appendix B contains detailed specifications.

Operational description

The Preamplifier is a wide dynamic range, low noise, and low frequency single channel amplifier for amplifying signals from a passive seismometer such as a GS-13 or GS-21. It is connected to the passive sensor and to a single-channel Nanometrics HRD24 digitiser with shielded cables. Power to the Preamplifier is supplied by the digitiser.

Prior to the amplifier stage, the Preamplifier provides protection against voltage spikes greater than +/-13 VDC; and filtering, using a fifth-order Bessel low-pass filter, against RF higher than 1 MHz. It can provide one channel for calibration between the sensor and HRD. Damping for the sensor is set using resistors . Amplifier gain is selectable within the range 20 to 46 dB. Typically, the system-specific damping and gain are set at the factory and would not need to be changed.

5 User guide

This chapter contains procedural information for installing, operating and maintaining the Preamplifier.

Handling and storage precautions

The Preamplifier should not be stored or operated in an environment with a temperature below -20 degrees Celsius or above 60 degrees Celsius.

Installing the Preamplifier

- 1. Mount the Preamplifier using the mounting points on the cover.
- 2. Connect the digitiser cable and the seismometer cable to the appropriate connectors, as labelled on the Preamplifier box.
- 3. Ground the Preamplifier at the grounding point.



Figure 1: Preamplifier installation

Operating and maintaining the Preamplifier

Once the Preamplifier is properly connected, it requires no scheduled maintenance. The Preamplifier does not contain any user-serviceable parts. If there is a hardware problem with the Preamplifier, return it to Nanometrics for repair.

Resetting the damping and gain

The system-specific damping and gain are set at the factory and should never need to be adjusted. Adjustment of these settings requires disassembly of the Preamplifier.

To disassemble the Preamplifier

- 1. Remove the Preamplifier from the mounting point.
- 2. Disconnect the sensor cable, data cable, and grounding strap.
- 3. Remove the Preamplifier cover.
- 4. Remove the jam nuts securing the digitiser and sensor connectors.
- 5. Remove the six screws securing the PCB to the box.
- 6. Remove the PCB and place it on a dry, non-conductive, anti-static surface.

To set the gain

Amplifier gain is selectable within the range 20 to 46 dB. To obtain preamplifier voltage gain of G_P replace the gain setting resistor R16 with a resistor of the value

 $R_{GAIN SETTING} = 20000/(G_P - 5.9875)$

This should be a metal film type resistor to ensure low noise performance.

To set the damping

Replace the damping setting resistor R19 to obtain 0.7 of critical damping for the sensor being used. This should be a metal film type resistor to ensure low noise performance.

To reassemble the Preamplifier

- 1. Place the PCB into the enclosure top and fasten it with the screws. Torque the screws to 5.9 lbf.in (0.67 N.m).
- 2. Ensure the connector O-rings are clean and intact, and are properly seated in the grooves. Install the connector jam nuts onto the digitiser (19-pin) and sensor (26-pin) connectors, using a hex socket and torque wrench of the appropriate size, with torque as specified below:
 - a. Digitiser (19-pin) connector to 80-85 lbf.in (9-9.6 N.m)
 - b. Sensor (26-pin) connector to 90-95 lbf.in (10.2-10.7 N.m)
- 3. Ensure the main O-ring is clean and intact, and is properly seated in the box groove.
- 4. Put the cover onto the box and fasten it with the screws, finger-tight only at first. When all of the screws are in place torque each one, starting with the screws in the middle of the long edge of the cover and working towards the screws at the ends of the cover, to 5.9 lbf.in (0.67 N.m).

Appendix A: Connector pinouts

Digitiser

19-pin MIL circular connector	
Pin	Signal name
А	GND
В	+12V
С	CNTR1
D	CNTR3
Е	NC
F	AMPOUT-
G	Chassis
Н	AMPOUT+
J	NC
K	CAL1+
L	MP1
М	-12V
Ν	CAL1-
Р	CNTR2
R	NC
S	NC
Т	NC
U	NC
V	GND

Sensor

26-pin MIL circular connector	
Pin	Signal name
А	NC
В	Chassis
С	INPUT-
D	GND
Е	-12V
F	+12V
G	CNTR3
Н	CNTR1
J	NC

Pin	Signal name
Κ	MP1
L	NC
М	NC
Ν	CAL1+
Р	NC
R	Chassis
S	NC
Т	Chassis
U	INPUT+
V	GND
W	CNTR2
Х	NC
Y	NC
Ζ	CAL1-
a	NC
b	Chassis
с	NC

Appendix B: Specifications

Description

This is a wide dynamic range, low noise, and low frequency single channel amplifier for amplifying signals from a passive seismometer such as a GS-13. It is packaged in a small water resistant aluminum enclosure.

Included Parts

Preamplifier Manual

Specifications

	Frequency Response	+/- 0.02dB DC to 20 Hz
	Input Impedance	2 ΜΩ
		Provision for damping resistors
	Input Type	Balanced Differential
	Number of Channels	Single Channel
	Noise (typical)	less than 5 nV / root(Hz), > 100 Hz
		less than 10 nV / root(Hz), at 1Hz
	Gain	20 to 46 dB
		Set by resistor
	Damping	determined by input resistor in parallel with 2 $M\Omega$
	Common Mode Rejection	100 dB minimum
	Output	Balanced Differential
	Output impedance	100Ω maximum
	Output voltage	32 Vp-p Differential, maximum without clipping
	Drift with Temperature	+/-2 µV/deg C max. Differential
	Linearity	(150 - gain setting) dB
	Response	-3dB at 300Hz, 1st order slope to 100kHz
	RF filtering	5th order 1MHz:
		- passband 0 to 1MHz
		- stopband 10MHz to 1GHz, 80dB min.atten.
	Calibration signal path	differential calibration and ground signals carried through from output to input connectors
	Power Supply Rejection	110 dB, DC to 10 Hz
Po	ower	
	Power	< 200 mW
	Input Power	+/- 12 VDC direct from a Nanometrics HRD24 Series digitizer

Environmental

Temperature	-20 to 60 degC
Humidity	0-100% condensing
Size	approx. 206 mm l x 89 mm w x 26 mm h
Weight	0.5 kg
Packaging	rugged water resistant aluminum enclosure
Sensor Connector	26 pin MIL circular connector
Output Connector	19 pin MIL circular connector

Notes

- 1. Specify gain at time of order
- 2. Sensor cables must be properly shielded to ensure good performance
- 3. See 13321, Preamplifier assembly for mechanical dimensions