

FEATURES

- Voltage & current excitation with remote sensing
- Isolated excitation and input
- 300 Volts common mode
- Automatic zero and balance
- Resistive or DAC shunt calibration
- Gains 1 to 5,000
- 50 kHz Bandwidth, 100 kHz optional
- Six-pole, low-pass filter
- Dual analog outputs
- Program monitoring of output and excitation



INPUT ISOLATED TRANSDUCER SIGNAL CONDITIONING

Series 6100 is an automated, transducer signal conditioning amplifier system. The basic mainframe holds 32 channels, which is expandable to 1,024 channels. It is available with RS-232, IEEE-488, USB or Ethernet interface and software for Windows.

The 6160 is a two-channel transducer amplifier-filter module. Each channel has isolated input and excitation, 50 kHz bandwidth and two outputs that can be programmed for filtered or wideband response. Bandwidth of 100 kHz is optional.

The bridge input is ten-wire shielded; input (2), excitation (2), sense (2) and shunt calibration (4) with programmable constant voltage or constant current excitation. Programmable bridge completion eliminates plug-in jumpers, loose resistors and component soldering. Automatic bridge balancing ahead of the instrumentation amplifier accommodates large unbalances without limiting gain or dynamic range.

The input and excitation are isolated from the outputs, power and control interface. This gives the user complete freedom to ground the input transducer without creating ground loops that introduce noise and offset errors. The isolation provides for operation with up to ± 300 Volts of common mode applied to the input.

The differential instrumentation amplifier has programmable gains from 1 to 5,000 and automatic zero. The standard filter is a six-pole Bessel with four programmable bandwidths and wideband. An optional four-pole Bessel filter has continuously programmable bandwidth with 1 Hz resolution below 1 kHz and 5 Hz above 1 kHz. Each channel has two buffered, ± 10 Volt outputs. The output and excitation can be monitored by software using any of the supported interfaces.

A "features card" provides shunt calibration using dedicated inputs. The standard is two-step, resistive shunt calibration that may be applied to internal or external bridge arms. Four-step resistive shunt calibration and shunt calibration using a DAC with 16-bit resolution are also available. Voltage substitution employing an external, traceable standard is provided for gain calibration. Automatic zero and gain calibration are implemented in PI610 software.

The mainframe interfaces are IEEE-488, RS-232, Ethernet and USB 2.0. The basic 6100 has both the IEEE-488 and RS-232 interfaces. The the 6100U has a USB 2.0 interface. Ethernet interface is provided using an adapter. Previously programmed operating parameters and the balance and calibration settings are automatically loaded during power-up and by a software issued Reset.

User programming is facilitated by a high-level instruction set that resides in the mainframe or USB driver. The 6160 is programmed by text strings sent from the user's application. Optional Windows application software, PI610, is fully configured and ready to use. It provides menu programming of operating parameters or can download parameters from an Access compatible database file. It graphically displays amplifier excitation voltage and current and output. PI610 may also be used as a component module DLL with LabView, Visual Basic, Excel or other windows programming language to design custom control and operator interfaces.

Panel60 is maintenance and calibration software for all Series 6000 and 6100 products. It is a beneficial tool that enables the technician to verify amplifier settings and configuration and make adjustments to gain, zero, balance and other calibrated parameters. A calibration system, ACS2000, automatically calibrates amplifier gain and excitation and certifies the amplifier to the published specification with an archived record of measured performance.

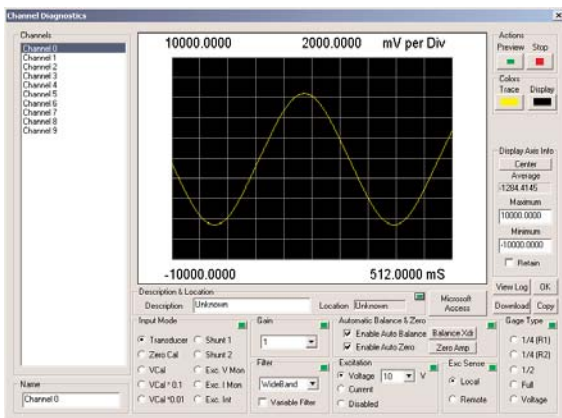


SYSTEM

- Fully programmable, no manual controls
- Thirty-two channels per enclosure, up to 1,024 channels per system
- Programmed operating parameters are automatically loaded at power-up
- Two sets of high and low-level alarms
- Integral tray routes input and output cables to exit from the rear
- Choice of IEEE-488, RS232, USB 2.0 or Ethernet interface for programming and control
- Automatic calibration system, ACS2000, provides fast and automated calibration and certification to traceable standards.

CHANNEL MODULES

- Isolated input and excitation for use with grounded or floating transducers
- Programmable voltage or current excitation with remote sensing
- Programmable bridge completion, no jumpers or rewiring to change gage types
- Versatile 10-wire shielded input handles all gages
- High-resolution gain and excitation programming
- Two or four-step shunt, DAC shunt and voltage substitution calibration
- Automatic balance, zero and calibration make test setup quick and easy
- Test connector on front of module gives access to excitation, sense, inputs and output.



PI610 SOFTWARE

- Ready to run or component module DLL software
- Design a custom GUI using Visual Basic, LabView, Access or Excel
- Use spreadsheet, database or built-in screens to program channel settings
- Copy function makes adding channels quick and easy
- Simplify calibration using automatic procedures.
- Controls external voltage standard for traceable gain calibration
- Real-time graphical display of excitation and output is useful for detecting installation problems

CONSTANT VOLTAGE

Voltage	Programmable from 0.1 to 20 Volts with 0.5 mV resolution. Calibrated 2-Volt steps $\pm 0.1\%$.
Remote Sense	Programmable local or remote sense, sense current less than 10 μA .
Current	50mA limited to 70mA maximum.
Regulation	$\pm 0.01\%$ over input voltage range and no-load to full-load.
Stability	$\pm 0.01\%$ for 30 days. Temperature coefficient less than $\pm 0.005\%/^{\circ}\text{C}$
Noise	200 μV peak-to-peak, DC to 10 kHz
Monitor.....	Excitation voltage or current is read by a program instruction. Accuracy is $\pm 0.2\%$.

CONSTANT CURRENT

Output Range	Programmable 0.1mA to 51.2 mA with 1 μA resolution. Calibrated 5 mA steps $\pm 0.1\%$.
Compliance	0.1 to 20 Volts.
Regulation	$\pm 0.01\%$ or $\pm 0.1\mu\text{A}$ for 10% line change.
Noise	2 μA or 5 μV peak-to-peak DC to 10 kHz.
Stability	$\pm 0.01\%$ or $\pm 2 \mu\text{A}$ for 30 days. Temperature coefficient is less than $\pm 0.005\%$ or $\pm 1 \mu\text{A}/^{\circ}\text{C}$.
Monitor.....	Excitation voltage or current is read by a program instruction. Accuracy is $\pm 0.2\%$.

INPUT - BRIDGE

Configuration	2 to 10 wire plus shield; input (2), excitation (2), sense (2) and shunt calibration (4). Programmable bridge completion for half bridges and 120 Ohm and 350 Ohm quarter bridges. Other gage resistances by request.
Bridge Balance	Automatic by program control. Balance accuracy $\pm 0.05\%$ of range, $\pm 1 \text{ mV RTO}$. Stability $\pm 0.02\%$ for 8 hours, $\pm 0.005\%/^{\circ}\text{C}$. Range set by resistor up to 25 mV/V, 2.5 mV/V (350 Ohms) installed.
Impedance	50 Megohms, shunted by 500 pF.
Protection	± 50 Volts, differential and ± 350 Volts common mode.

CALIBRATION

Shunt (Standard)	Two steps of single shunt. Calibration resistors are installed on terminals. Program selection of internal or external shunt connection.
Shunt Resistors.....	Installed shunt resistors provide 0.502 and 0.250, $\pm 0.1\%$ mV/V for 350 Ohm bridge. Customer specified and 0.01% shunt resistors are available.
Voltage	Alternate input for external calibration source. Programmable 1, 0.1 and 0.01, attenuation with $\pm 0.01\%$ accuracy. Attenuator output may be connected to bus for external monitoring.
Zero Calibration	Amplifier input disconnected and shorted for zero calibration.

CALIBRATION OPTIONS

Shunt (S4)	Four-steps of single shunt with $\pm 0.1\%$ resistors. Customer specified and $\pm 0.01\%$ shunt resistors are available..
DAC Shunt (DAC) ..	Programmable 16-bit DAC shunt. Two programmable range resistors increase range and resolution.

AMPLIFIER

Range.....	$\pm 2 \text{ mV}$ to ± 10 Volts full scale.
Gain	Programmable from 1 to 5,000 with 0.05% resolution.
Gain Steps	Sixteen calibrated gain steps are provided: 1, 2, 3, 5, 10, 20, 30, 50, 100, 200, 300, 500, 1,000, 2,000, 3,000 and 5,000 with $\pm 0.05\%$ accuracy.
Gain Stability	$\pm 0.02\%$ for 30 days, $\pm 0.005\%/^{\circ}\text{C}$.

Linearity	$\pm 0.01\%$ for gains < 1000, $\pm 0.02\%$ for gain 1000 and higher.
Common Mode	80 dB plus gain in dB to 120 dB for balanced input and 110 dB for a 350 Ohm source unbalance, DC to 60 Hz.
CM Voltage	± 300 Volts operating.
Zero	Automatic zero to $\pm 2 \mu\text{V RTI}$ or $\pm 1.0 \text{ mV RTO}$ whichever is greater.
Zero Stability	$\pm 5 \mu\text{V RTI}$, $\pm 1 \text{ mV RTO}$ at constant temperature, $\pm 1 \mu\text{V RTI}$, $\pm 0.2 \text{ mV RTO}/^{\circ}\text{C}$.
Source Current	$\pm 25 \text{ nA}$, $\pm 0.05 \text{ nA}/^{\circ}\text{C}$.
Noise (10 kHz).....	2.0 $\mu\text{V RTI}$ plus 0.3 mV RTO, RMS.
Bandwidth	50 kHz (-3 dB) for gains 1 to 1,000, 20kHz (-3 dB) for gains above 1,000.
Bandwidth (HF)	100 kHz (-3 dB) for gains 1 to 1,000, 50 kHz (-3 dB) for gains above 1,000.
Slew Rate.....	5 V/ μs .
Overload Recovery....	120 μs to within $\pm 0.1\%$ for a 10 times overload to ± 10 Volts.
Monitor.....	Output is read by a program instruction. Resolution is $\pm 0.003\%$.
Output	Two ± 10 Volt full scale buffered outputs. Each may be program selected for filtered or wideband response.

FILTER (STANDARD)

Type	Six-pole, low-pass Bessel (36 dB/octave).
Frequency.....	Four programmable filter bandwidths, 150 Hz, 625 Hz, 2.5 kHz, 10 kHz and wideband.
Frequency (HF)	Four programmable filter bandwidths, 300 Hz, 1.25 kHz, 5 kHz, 20 kHz and wideband.

FILTER (OPTIONS)

Type	Four-pole, low-pass Bessel (24 dB/octave)
Freq. (PFBE2)	4 Hz to 1 kHz, 1 Hz resolution, 1 kHz to 10 kHz, 5 Hz resolution, $\pm 2\%$ accuracy.
Freq. (PHFBE2)	10 Hz to 1 kHz, 1 Hz resolution, 1 kHz to 20 kHz, 5 Hz resolution, $\pm 2\%$ accuracy.

INTERFACE CONNECTORS

All connectors for input and output of analog and control signals are mounted on the front edge of the 6160 module. All mating connectors, except BNC type, are furnished.	
Transducer	Each channel has a 15-pin Type D input connector
Output	Outputs for both channels are in a 9-pin Type D connector.
Test	15-Pin Type D connector provides access to excitation, sense, inputs and output. Uses the 6087 Test Fixture to access signals in the connector.

ENCLOSURES AND INTERFACE

The rack enclosures provide slots for 16 modules, 32 channels using the 6160. They contain a channel controller and power supply that operates on 115 or 230 VAC. The basic 6100 Mainframe enclosure includes IEEE-488 and RS232 interfaces. One 6100 mainframe will control up to thirty-one 6001 slave enclosures. Ethernet is provided by an adapter on the 6100. The 6100U has a USB 2.0 interface. USB hubs are used to support multiple 6100U enclosures.

INDICATORS

Pwr/Adr.....	Indicates power is applied to the enclosure. Blinks when a channel in the enclosure is being addressed by a program instruction.
Reset	Indicates that enclosure reset is being asserted.
Calibration	Indicates that one or more channels are in a calibration mode.

PROGRAM INSTRUCTIONS

The following program instructions are provided to implement system programming and operation.

- AddressSelects single channel or group of channels for subsequent programming.
- ResetStops any operation in process, sets all programmable parameters to the stored settings.
- Gain.....Program gain of channel, followed by autozero.
- FilterProgram filter steps and wideband for a channel, followed by autozero.
- Auto-BalanceInitiate automatic balance, preceded by autozero.
- Cal EnableEnables or disables selected calibration mode.
- CalibrationSelects calibration mode and step.
- Excitation.....Select voltage or current excitation, set voltage or current level and select remote or local sensing.
- Verification.....Read back channel status and parameters.
- Read ExcitationReturns value of excitation voltage or current.
- Read OutputReturn value of channel output.

PHYSICAL

MODULE

- Size0.8 inch wide by 9 inches high by 9 inches deep.
- WeightApproximately 13 oz.
- MountingThe module slides into the enclosure on card guides accessed through the front door and is secured by locking extractors. Rear access is not required to change modules or input and output connectors.

RACK ENCLOSURE (Master & Slave)

- Module Slots16.
- Cable TrayA built-in tray routes input and output cables to exit from the rear of the enclosure.
- Cooling.....Built-in fan with replaceable filter.
- Size19 inches wide by 14 inches tall by 23 inches deep (including mating connectors).
- WeightApproximately 60 pounds, with all modules installed.
- Power.....115 or 230 VAC \pm 10%, 47 to 63 Hz.

ENVIRONMENTAL

- TemperatureOperating, 0°C to +50°C.
- Humidity95% without condensation.
- Shock/Vibration.....Normal shipping and handling of laboratory instruments.

CALIBRATION SYSTEM

Pacific Instruments Model ACS2000, Automated Calibration System will align, calibrate and certify Series 6000 analog input modules to factory or user performance specifications. A fully automated, PC controlled test station it has the flexibility to run a single performance test or complete calibration and certification procedures. Measured performance data is archived by unit serial number. A print utility generates hard copy test reports.

ORDERING INFORMATION

MODULE

- 6160Two-channel transducer amplifier, 50 kHz bandwidth.
- 6160HF.....Two-channel transducer amplifier, 100 kHz bandwidth.

OPTIONS

- 6000-PFBE2Continuously programmable filter, 4 Hz to 10 kHz.
- 6000-PHFBE2Continuously programmable filter, 10 Hz to 20 kHz.
- 6060-DACDAC shunt with 2 ranges.
- 6060-S4Four-step shunt calibration.

ENCLOSURES

- 6100Mainframe enclosure, 16 slot with IEEE-488 and RS232 interfaces.
- 6101Slave enclosure, 16-slot. Used with 6000 mainframes.
- 6100U.....Enclosure, 16-slot with USB 2.0 programming and control interface.

ENCLOSURE OPTIONS

- 6000-CPRemote connector panel with 15-pin, ¼ turn twist lock MIL type input connectors and BNC output connectors. Mating input connectors are furnished. Cable length is 2 meters.
- 6000-EEthernet adapter for 6100 Mainframe.
- 6087-6060Test fixture with 1 meter cable.

SOFTWARE

- PI610Operating software for Windows . Supplied as a turnkey application and component module DLL.
- PANEL60.....Maintenance and calibration software for Windows.

CALIBRATION SYSTEM

- ACS2000.....Calibration & certification system with fixture for Model 6160.



6087-6060 Test Fixture

Attached to the test connector on the 6160 module it provides test points for: Transducer input, amplifier input, shunt calibration, excitation output, excitation sense and amplifier output