PACIFIC INSTRUMENTS
A **VPG** Brand

FULLY AUTOMATED SIGNAL CONDITIONING AMPLIFIER

FEATURES

- **Voltage & current excitation**
- **Remote sensing & excitation interrupt**
- **Two-range automatic balance**
- **DAC shunt calibration**
- **4-step, bipolar resistive shunt calibration**
- **Gains 1 to 10,000**
- **Voltage substitution calibration**
- **300 Volt common mode**
- **Eight low-pass filters, dual outputs**
- **Digital excitation & output monitors**
- **Windows software**

DESCRIPTION

Series 9300 are fully programmable, modular signal conditioning amplifiers for use with transducers and other low-level signal sources. An on-board microprocessor automates operation, reducing setup time and assuring high-quality measurement data. Programming and control are by IEEE-488 interface using a high-level programming language or Windows software. The optional control panel enables setting and display of operating parameters locally with display of excitation voltage and current and amplifier output.

The 9355 is a transducer amplifier with a guarded 2 to 10 wire input. It has bridge completion, programmable constant voltage and constant current excitation with remote sensing and excitation interrupt, automatic balance, shunt calibration, programmable gain instrumentation amplifier and programmable filter. DAC controlled shunt calibration with 4096 steps is standard and 4-step, bipolar double resistive shunt is optional.

Within the 9355, bridge completion and calibration components mount on a plug-in, front panel installed completion card that has a holder for channel identification data. Switches on the completion card set transducer specific operating parameters and identification. Completion cards are available for special requirements such as dynamic strain, 28 Volt excitation, voltage-mode charge, input attenuation and many other standard and customer-specific applications. Consult the web site or a sales office for a full list of available completion cards.

Gain is programmable from 1 to 10,000 with 0.05% resolution and 32 preset steps. Ten gain steps are factory calibrated providing ±0.1% accuracy. The remaining gain steps may be user calibrated or employed as variable gains for engineering units calibration. The amplifier operates from grounded or floating sources providing 120-dB rejection for common mode voltages to ±300 Volts.

Buffered Data and Tape outputs supply ±10 Volts full scale. Each output may be selected for wideband or filtered response. The standard filter is a four-pole, Bessel low-pass with eight programmable bandwidths and wideband. Output and excitation can be read over the computer interface and on the optional control panel. The control panel sets and displays excitation, gain and filter; controls balance, zero, calibration and input modes and displays the output and excitation voltage or current level.

Channels may be programmed individually or as a group using IEEE-488 or RS232. Adapters are available for Ethernet. Programmed operating parameters are kept in non-volatile memory and are automatically restored when the system is powered up or reset. PACWin93 control and display software is optionally available for operation under Windows 2000/XP. User programming is supported by a high-level instruction set and National Instruments LabView driver. PI660 software includes a feature for programming the 9355s when used as the front end for Pacific's Series 6000 data acquisition system.

Ten channels, each with integral isolated power supply, mount in a 7-inch high rack enclosure. Multiple enclosures can accommodate up to 160 channels on each bus address. Interface adapters are available for Ethernet and USB 2.0. Consult the web site or sales office for alternative interfaces.

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SIGNAL CONDITIONING

- Input configuration determined by plug-in completion card, no rewiring to change gage types

- Versatile 2-10-wire shielded input handles all gages

- Line powered - isolated excitation and outputs

- Programmable voltage or current excitation, 0.01% stability

- Remote sensing improves accuracy by regulating excitation at the gage

- Automatic voltage-injection balance does not decrease input range even for large unbalances

- Software enabled automatic calibration using voltage substitution and/or shunt. Four-step shunt using zero force plug-in resistor card is optionally available

- Gains from 1 to 10,000 in calibrated steps or user selected with 0.05% resolution

- Four-pole Bessel low-pass filter with eight programmable bandwidths from 10 Hz to 30 kHz and wideband (100 kHz) Other filter choices available

- IEEE-488 & RS232 interfaces for programming and control of up to 160 channels

CONTROL PANEL (OPTION)

- Program and display gain, filter frequency, excitation and calibration mode

- Monitors amplifier output, excitation voltage and current

- Menu buttons select and move up or down through menus on bright LED display. Enter button selects submenus and enters parameter values

- Displays channel number, error messages and user programmed alphanumeric messages

PACWIN93 SOFTWARE

- Ready-to-run, Windows 2000/XP compatible, no user programming required

- Program channels by selecting them from a transducer database that contains the operating parameters

- Use Channel Specification window to view and change channel programming

- Monitor output, excitation voltage or current on scrolling strip chart and tabular windows

USER WRITTEN SOFTWARE

- High level resident instruction set, National Instruments LabView driver

- Operating parameters and status can be read back for setting verification
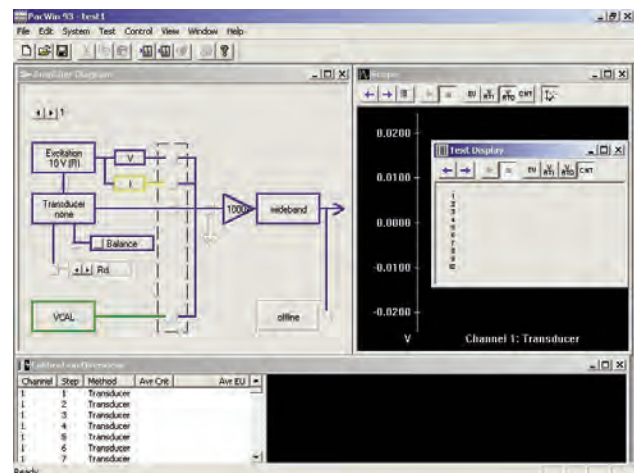
SPECIFICATIONS

INPUT

Configuration ....2 to 7 wires (10 wires with C4) plus shield. Input components mount on plug-in completion card inserted through the front panel with holder for channel identification.

Input Stability........±50 ppm/°C.

Bridge Balance ......Automatic by program command. Balance is digitally stored in non-volatile memory to retain setting when power is off. All outputs programmed to zero during balancing operation.

Balance Range ......Range resistors mounted in bifurcated terminals on the completion card. Shipped with 2.5mV/V and 16mV/V balance ranges for 350 Ohm bridge.

Balance Resolution ..0.025%.

Balance Accuracy ..±0.05% of range, ±2mV RTO.

Balance Disable ....Balance can be removed by program command without changing the setting.

Completion ....Components mount in bifurcated terminals on completion card. Switches select local or remote sense and excitation voltage or current for front panel monitor.

Transducer I.D. ......Eight switches on the completion card are for entry of a transducer specific identification code. Switches select one of 32 programmed sets of default operating parameters.

AC/DC Coupled ......Programmable AC/DC coupled input. Lower frequency response in AC coupled mode is -3dB at 1.6 Hz.

VOLTAGE EXCITATION / TRANSDUCER POWER

Voltage Excitation ..Programmable from 0.5 to 15 Volts (limited to 25 Volts) with 10mV resolution. 32 Excitation steps. 15 Steps: 1,2,3,4....,15 Volts are factory calibrated within ±0.2%. 100mA limited to 140mA.

Voltage Regulation ....±0.01% or ±200µV for 10% line change or no load to full load.

Voltage Exc Stability..±0.01% or ±500µV for 8 hours.

Voltage Exc Noise ..100µV plus 0.001% peak-to-peak (0.1Hz to 20kHz).

Temp Coefficient....±0.005% or ±100µV/°C.

Response ....5µS to ±0.1% for no load to full load.

Isolation ....10,000 Megohms shunted by 1pF to power and rack grounds.

Voltage Exc Sense..Switch on completion card selects local or remote sensing in voltage excitation mode. Full output is supplied at the transducer with up to 1 Volt line drop. Reverts to local sense mode if sense leads disconnected. Sense Current is 10µA maximum.

Voltage Monitor......Terminals on the front panel measure excitation. Voltage or current monitor is selected by a switch on the completion card. Also, Excitation level is displayed on the control panel and returned by program command. Analog representation of the excitation level is present on the data outputs during execution of the program command.

CURRENT EXCITATION / TRANSDUCER POWER

Current Excitation ....Programmable 1mA to 100mA (limited to 25 Volts) with 50µA resolution. 32 Excitation steps. Ten steps: 10,20,30....100 mA are factory calibrated to ±0.2% accuracy.

Compliance............0.1 to 15 Volts.

Current Regulation....±0.01% or ±0.1µA for 10% line change.

Current Exc Stability ..±0.01% or ±2µA for 8 hours.

Current Exc Noise..1µA or 5µV peak-to-peak (.1Hz to 20kHz).

Temp Coefficient....±0.005% or ±1µA/°C.

Response ....50µS to ±0.1% for 10% load change.

Current Monitor......Terminals on the front panel measure excitation. Voltage or current monitor is selected by a switch on the completion card. Also, Excitation level is displayed on the control panel and returned by program command. Analog representation of the excitation level is present on the data outputs during execution of the program command..

AMPLIFIER

Gain ....1 to 10,000 with 0.05% resolution. Ten factory calibrated gains with ±0.1% accuracy: 1, 2, 5, 10, 20, 50, 100, 200, 500, and 1000. Total of 32 gain steps, 10 of which are preset at factory. Balance may be programmed by user.

Gain Stability ....±0.02% for six months. Temperature coefficient is ±0.004%/°C maximum.

Gain Linearity ....±0.01%.

Input Impedance ..50 Megohms shunted by 200pF (100K Ohms when AC Coupling is enabled - Option P only).

Input Protection ....±50 Volts differential, and ±350 Volts common mode.

Common Mode ......120dB DC to 60Hz for gain 1,000 and above. At lower gains, CMR is 63dB plus gain in dB. CMR decreases at a rate not exceeding 6dB/octave from the specified value at 60Hz. (350 Ohm source unbalance).

CM Voltage ....±300 Volts DC or peak AC operating.

Zero ....Automatic zero to ±1µV RTI or ±0.5mV RTO whichever is greater at power up and change of gain or filter setting.

Zero Stability ....±5µV RTI, ±0.5mV RTO at constant temperature. Temperature coefficient is ±1µV/°C RTI and ±0.15mV/°C RTO. Zero shift for any gain or filter setting is less than ±2mV RTO.

Source Current ......±1nA and ±0.5nA/°C.

Noise (10Hz) ....1µV RTI plus 0.5mV RTO, peak (350 Ohm source or bridge).

Noise (10kHz) ......2µV RTI plus 0.3mV RTO, RMS (350 Ohm source or bridge).

Noise (100kHz) ....4µV RTI plus 0.6mV RTO, RMS (350 Ohm source or bridge).

Bandwidth ....-3dB at 100kHz for all gains to 1,000. Bandwidth decreases proportional to gain above 1,000.

Slew Rate..............6 V/µS.

Settling Time ....75µS to within ±0.1% final value.

Overload Recovery ....100µS to within ±0.1% for a 10 times overload to ±10 Volts.

Overload Indication ..Latched status flag set and front panel LED illuminated when output exceeds ±10.5 Volts. LED is illuminated for 500mS or duration of overload, whichever is longer. Status flag reset by program command.

Analog Output........±10 Volts at 10mA. Output impedance less than 1 Ohm.
Tape Output: ±10 Volts at 10mA. Output impedance less than 1 Ohm.
Monitor (Analog): Terminals on the front panel for data output.
Monitor (Digital): Output voltage displayed on control panel and returned by program command.
Bandwidth: Jumper selected wideband or filtered response for each output.
Protection: Protected against continuous short. No instability with capacitive loads to 0.22µF.
Output Isolation: Less than 100nA RMS leakage to power or rack ground at 60Hz line frequency.

SPECIFICATIONS

FILTER

Type ....Four-pole Bessel (24dB/octave) low pass filter.

Frequency..............Programmable bandwidths of 10Hz, 30Hz, 100Hz, 300Hz, 1kHz, 3kHz, 10kHz, 30kHz, and wideband.

Other ....Other filter characteristics and cutoffs are available.

CALIBRATION

Shunt ....DAC: DAC controlled shunt calibration providing 4096 levels with selectable range.
Resistive: Four-step resistive, bipolar, double shunt calibration with 10-wire input. Zero-force, plug-in resistor card, calibration resistors not included.

Voltage Subst ....Program instruction selects alternate calibration input to the differential amplifier for application of an external calibration signal.

Zero ....Amplifier output is automatically set to zero. Performed at power up and gain or filter setting change.

MECHANICAL

Control Panel ....Monitor mode: Four-digit display is menu selected to indicate gain, filter frequency, excitation or output and calibration state.
Program mode: Menu selection of all operating parameters and modes. Three switches provide up and down menu or parameter selection and enter.
LED indicators: Indicate status of calibration, overload and power.

Programming ....The interface coupler is installed in the Master rack enclosure for program control using IEEE-488 or RS232 protocols. The instruction has the format of a command followed by multiple parameters. All programmed operating parameters and calibration status can be read back by program command.

Rack Enclosures ....Enclosures for 19" wide RETMA rack mounting hold ten transducer amplifiers using 7-inches of panel height. Depth is 26-inches. The initial ten channels require a Master enclosure which provides the IEEE-488 & RS232 interfaces. Subsequent channels, up to 160 total, mount in Slave enclosures that are provided with interconnecting cables to the Master enclosure. Input, output, interface, and power connectors are mounted on the rear panel. Rack enclosure frame is connected to power ground. A screw fastener secures each channel. 120 or 230 VAC, ±10%, 47 to 400Hz, 15 Watts. Panel indicator is illuminated when power is on and interface is enabled.

Connectors ....Input: R93-010 has 15-pin, ¼ turn twist lock MS 3102 style input connectors.
Mating connectors are supplied.
Output: Isolated BNC, 2 per channel.

Temperature ....0°C to +50°C operating, storage from -25°C to +71°C.

Humidity ....Up to 95% without condensation.

Dimensions............7" high x 1.63" wide x 17.75" deep.

Weight ....5 lbs.

ORDERING INFORMATION

9355Q ....Transducer Amplifier-Filter w/Control & Display Panel

9355QS4 ....Transducer Amplifier-Filter w/Control & Display Panel, Four-Step Double Shunt Calibration.

R93-010-M ....10-Ch Master Enclosure, IEEE-488/RS232 interface, MS Input Connectors.

R93-010-S ....10-Ch Slave Enclosure, MS Input Connectors.

9300-020 ....Bridge Completion Card (Standard)

9300-021-01 ....Low Impedance Charge Completion Card

9300-021-03 ....100:1 Balanced Attenuator Completion Card

9300-021-04 ....Voltage Completion Card

9300-021-05 ....Bridge, Single Shunt Cal Completion Card

9300-021-06 ....Voltage, AC Coupled Completion Card

9300-035 ....Transducer Amplifier

9300-036 ....Transducer Amplifier

9300-090 ....Bench Service Fixture.

FM3A ....Fan Assembly, 115VAC.

AMP93.................Maintenance Software

PACWin93A ....Operating Software