



# Vishay Measurements Group

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## Model 2311 Signal Conditioning Amplifier

### Description

While the Model 2311 provides wider frequency response and more versatile excitation, both [2310](#) and 2311 Signal Conditioner/Amplifier Modules accept inputs from strain gages, load/pressure/dc displacement transducers, potentiometers, thermocouples, RTD's and nickel temperature sensors, without any internal modification.

Controls on the 2311 are arranged in sections, permitting easy setup. Clearly marked push-button and single-purpose switches minimize the possibility of operator error during use. With the exception of the playback switch, all operational and monitor controls are on the front panel. Switches for selecting remote sense and specific shunt calibration configurations are located on the printed circuit board inside the unit.

### Front Panel

**Galvanometer:** Electronic adjustment for zero positioning and span of the galvanometer, remote from recorder.

**Calibration:** Momentary two-position switches,  $\pm A$  and  $\pm B$ , control shunt calibration levels; 4 point.

**LED Display:** Set up indicator for amplifier balance, bridge balance and for monitoring the output polarity.

**Filter Section:** Push-button controls for activating appropriate low-pass active filter, or selecting wide-band operation (WB).

**Electronic Bridge Balance Section:** Three-position switch--OFF, ON, RESET--for electronic bridge balance; auto ranging up to  $\pm 25\,000$  microstrain with nonvolatile zero storage; yellow light indicates high-range operation or



overrange condition. Vernier TRIM control is used to refine bridge balance when desired.

**AC IN:** Capacitive coupling in the amplifier; eliminates static component of the signal.

**Bridge Excitation:** ON-OFF switch for removing bridge excitation from the strain gage or transducer.

**Amplifier Balance:** Adjusts any amplifier offset.

**Excitation Level:** Twelve-position switch; values arranged for doubling power with each step. Also, variable setting: 0.4 to 6 Vdc.

**Amplifier Gain Section:** Continuously variable potentiometer (1.00 to 11.00) plus push-button multipliers control amplifier gain; direct-reading.

**Battery Test:** Momentary push button determines battery level for bridge zero storage.

**Main Power:** Turns unit on/off; LED pilot light.

**Pin Jacks:** Monitoring of EXCITATION.

### Rear Panel

**AC Line Switch:** Selects nominal 115 or 230 Vac operation. Recessed to eliminate inadvertent movement.

**Tape Playback Section:** Slide switch activates magnetic tape-playback operating mode. Connects the input to the filter circuits and post amplifiers. BNC input connector.

**Magnetic Tape Output:** Full-scale  $\pm 1.4V$  level available at this BNC connector for driving magnetic tape recorder.

**High-Level Output:** Full-scale  $\pm 10V$  level available at this BNC connector for driving an oscilloscope, DPM, ADC, etc.

**Output Receptacle:** All three outputs available at this connector for those who prefer to hard wire their connections (*mating plug included*). Outputs are 75 mA for galvanometers,  $\pm 1.4V$ , and  $\pm 10V$ .

**Input Receptacle:** All sensor inputs made through this 15-pin quarter-turn connector. Pin selection determines mode of operation (*mating plug included*).

**Power Connector:** Main power input from the rack adapter, portable enclosure or individual line plug. Additional pins for optional remote operation of shunt calibration, bridge excitation (ON/OFF), and electronic bridge balance.

## Specifications

All specifications nominal or typical at +23 deg C unless noted.

## **Input**

### *Strain Gages:*

Quarter(120 ohms or 1000 ohms and 350 ohms), half or full bridge (50 to 1000 ohms). Dummy resistors installed.

### *Transducers:*

Foil or piezoresistive strain gage types.

### *Potentiometer.*

### *DCDT displacement transducer.*

## **Excitation**

12 settings:

Variable setting: 0.4 to 6 Vdc, 0.7, 1, 1.4, 2, 2.7, 3.5, 5, 7, 10, 12 and 15 Vdc  $\pm 1\%$ , max.

### *Current:*

0-100 mA, limited at 175 mA, max.

### *Regulation (0-100 mA, $\pm 10\%$ line change):*

$\pm 0.5$  mV  $\pm 0.04\%$ , max measured at remote sense point. (Local sense: -5 mV, typical, at 100 mA, measured at plug.)

### *Remote Sense Error:*

0.0005%/ohms of lead resistance (350 ohm load).

### *Noise and Ripple:*

0.05% p-p, max (dc to 10 kHz).

### *Stability:*

0.02%/deg C.

### *Level:*

Normally symmetrical about ground; either side can be grounded with no effect on performance.

## **Bridge Balance:**

### *Method:*

Counter-emf injection at preamp; automatic electronic; dual range; can be disabled on front panel.

### *Ranges (auto ranging):*

$\pm 5000$  microstrain (1% bridge unbalance or 2.5 mV/V), resolution 2.5

microstrain (0.0012 mV/V).

$\pm 25\,000$  microstrain (5% bridge unbalance or 12.5 mV/V), resolution 12.5 microstrain (0.006 mV/V).

*Balance Time:*

2 seconds, typical.

*Manual Vernier Balance:*

$\pm 50$  microstrain ( $\pm 0.025$  mV/V).

*Interaction:*

Essentially independent of excitation and amplifier gain.

*Storage:*

Digital; up to 2 years without line power.

### **Shunt Calibration:**

*Circuit (2-level, dual polarity):*

Single-shunt (for stress analysis) across any bridge arm, including dummy gage.

Double-shunt (for transducer) across opposite bridge arms.

*Provision for 4 dedicated leads to shunt external arms.*

*Cal circuit selected by switches on PC board.*

*Standard Factory-Installed Resistors ( $\pm 0.1\%$ ) Simulate:*

$\pm 200$  and  $\pm 1000$  microstrain at GF=2 across dummy half bridge;

$+1000$  microstrain at GF=2 across dummy gage (120 and 350 ohm);

$\pm 1$  mV/V (double-shunt) for 350 ohm transducer.

*Remote-Operation Relays (Option Y):*

4 relays (plus remote-reset relay for bridge balance and relay for excitation on/off). Each requires 10 mA at 5 Vdc, except excitation on/off 25 mA.

### **Amplifier:**

*Gain:*

1 to 11 000 continuously variable. Direct-reading.

$\pm 1\%$  max of reading.

*Ten-turn counting knob (X1 to X11) plus decade multiplier (X1 to X1000).*

*Frequency Response (all gains full output):*

dc coupled: dc to 50 kHz, -0.5 dB max.

dc to 125 kHz, -3 dB max.

ac coupled: 1.7 Hz to 125 kHz, -3 dB max.

*Frequency Response, Reduced Output (2 Vrms max):*

*Bandwidth (-3 dB) at Gain of:* 1-11, 200 kHz; 10-110, 170 kHz;  
100-1100, 135 kHz; 1000-11 000, 125 kHz.

*Input Impedance:*

100 megohms, min, differential or common-mode, including bridge balance circuit.

*Bias Current:*

$\pm 50$  nA, typical each input.

*Source Impedance:*

0 to 1000 ohms each input.

*Common-Mode Voltage:*

$\pm 10$ V.

*Common-Mode Rejection (gain over X100):*

Shorted input: 100 dB, min, at dc; 90 dB, min, dc to 1 kHz.  
350 ohms balanced input: 90 dB, typical, at 1 kHz.

*Stability (gain over X100):*

$\pm 2$  microvolts/deg C, max, referred to input (RTI).

*Noise (gain over X100, all outputs):*

0.01 to 10 Hz: 1 microvolt p-p RTI.  
0.5 Hz to 125 kHz: 5 microvolts rms, max, RTI.

**Filter:**

*Characteristic:*

Low-pass active 2-pole Butterworth standard.

*Frequencies (-3  $\pm$ 1 dB):*

10, 100, 1000 and 10 000 Hz and wide-band.

*Outputs Filtered:*

Any 1 or 2 or all (switch-selected on PC board).

NOTE: Consult [Applications Engineering Department](#) concerning optional filter characteristics and frequencies.

**Amplifier Outputs:**

*Standard Output:*

$\pm 10$ V at 5 mA, min.

*Tape Output:*

$\pm 1.414\text{V}$  (1 Vrms) at 5 mA, min.

*Galvanometer Output:*

$\pm 10\text{V}$  at 75 mA, min, current-limited at 100 mA, max (minimum load resistance for 0.05% linearity: 50 ohms).

Galvanometer attenuator (0-100%) and zero adjust ( $\pm 1\text{V}$ ) on front panel.

*Linearity at dc:*

0.02%.

Any output can be short-circuited with no effect on others.

**Playback:**

*Input:*

$\pm 1.414\text{V}$  full scale; input impedance 20 kilohms.

*Gain:*

X1 to tape output; X7.07 to standard output.

*Filter Selection:*

As specified above.

*Outputs:*

All three as specified above.

**Power:**

105 to 125V or 210 to 250V (switch-selected), 50/60 Hz, 10 watts, max.

*Keep-Alive Supply (for bridge balance):*

2 Eveready S76E or equal.

Shelf-life (approx. 2 years).

**Size & Weight:**

*Panel:*

8.75 H x 1.71 W in (222 x 43.3 mm).

*Case Depth Behind Panel:*

15.9 in (404 mm).

*Weight:*

6 lb (2.7 kg).

