Signal Conditioning Amplifier

FEATURES

- Accepts all strain gage inputs (foil and piezoresistive), potentiometers, DCDTs, etc.
- Selectable bridge excitation, 0.7 to 15 VDC (11 steps), plus 0.2 to 7 VDC continuously variable
- Fully adjustable calibrated gain from 1 to 11,000
- Dual-range (±5000 με and ±25,000 με) automatic bridge balance, with battery backup to retain balance in power-off condition
- All bridge completion built in, including 120 or 1000 and 350 Ω dummies
- Dual polarity two-step double shunt calibration
- Bandpass:
  - o 55 kHz (–0.5 dB)
  - o 125 kHz (–3 dB)
- Switchable active filter—a 6-pole Butterworth is standard
- Two simultaneous buffered outputs
- Playback mode to filter and observe or re-record previously recorded low-level data
- Input impedance above 100 MΩ

DESCRIPTION

The 2300 System conditions and amplifies low-level signals to high-level outputs for multiple-channel simultaneous dynamic recording and display on external devices. Among its features, each 2310B Module includes a built-in power supply, active filtering, two simultaneous outputs, playback mode, wide frequency response, and voltage injection bridge balance.

Up to ten 2310B Modules can be mounted in a Model 2350 Rack Adapter; or up to four modules in a Model 2360B Portable Enclosure.

The 2310B Modules may be interchanged between the 2350 Rack Adapter and the 2360B Portable Enclosure to best satisfy testing requirements.

FRONT PANEL

REAR PANEL

ADDITIONAL DETAILS

The 2310B Conditioner/Amplifier Modules accept inputs from strain gages, load/pressure/DC displacement transducers, potentiometers, RTDs and nickel temperature sensors, without any internal modification. Controls on the 2310B 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.

Calibration: Momentary two-position switches, ±A and ±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- and high-pass active filters

Electronic Bridge Balance Section: Three-position switch—OFF, ON, RESET—for electronic bridge balance; auto ranging up to ±25 000 με with non-volatile zero storage; yellow light indicates high-range operation or over range 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

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

Amplifier Balance: Adjusts amplifier offset

Excitation Level: Twelve-position switch; values arranged for doubling power with each step, with one 0.2 to 7 VDC continuously variable

Amplifier Gain Section: Continuously variable potentiometer (1.00 to 11.00) plus push-button course gain 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, Unamplified Input, Amplified Output

AC Line Switch: Selects nominal 115 or 230 VAC operation

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

Low-Level Output: Full-scale ±1.4V level available at this BNC connector for driving various recording devices and low-level analog-to-digital converters

High-Level Output: Full-scale ±10V level available at this BNC connector for driving an oscilloscope, digital voltmeter, analog-to-digital converter, etc.

Input Receptacle: All sensor inputs made through a 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 are nominal or typical at +23°C unless noted.

MODEL 2310B - SIGNAL CONDITIONING AMPLIFIER

PARAMETER	SPECIFICATIONS
INPUT	
Strain Gages	Quarter, half or full bridge (50 Ω to 1000 Ω); Built-in 120 and 350 Ω dummy gages; 1000 Ω dummy capability. Foil or piezoresistive strain gage types.
Transducers	
DCDT displacement transducers	
Potentiometers	
EXCITATION	
Fixed Settings:	11 positions: 0.7, 1, 1.4, 2, 2.7, 3.5, 5, 7, 10, 12 and 15 VDC, 1% max.
Variable Setting:	0.2 to 7 VDC
Current:	0–100 mA, min, limited at 175 mA, max.
Regulation (0–100 mA ±10% line change):	±0.5 mV; ±0.04%, max measured at remote sense points. (Local sense: –5 mV, typical, @ 100 mA, measured at plug)
Remote Sense Error:	0.0005% per Ω of lead resistance (350 Ω load)
Noise and Ripple:	0.05% p-p, max (DC to 10 kHz)
Stability:	±0.02%/°C
Level:	Normally symmetrical about ground; either side may be grounded with no effect on performance
BRIDGE BALANCE	
Method	Counter-emf injection at pre-amp; automatic electronic; dual range; can be disabled on front panel

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PARAMETER	SPECIFICATIONS		
Ranges (auto ranging):	• ±5000 με (±1% bridge unbalance or ±2.5 mV/V), resolution 2.5 με (0.0012 mV/V); • ±25,000 με (±5% bridge unbalance or ±12.5 mV/V), resolution 12.5 με (0.006 mV/V)		
Balance Time:	2 seconds, typical		
Manual Vernier Balance Range:	100 με (0.050 mV/V)		
Interaction:	Essentially independent of excitation and amplifier gain		
Storage:	Non-volatile digital storage without line power for up to two years		
SHUNT CALIBRATION			
Circuit (two-level, dual polarity)	• Single-shunt (for stress analysis) across any bridge arm, including dummy gage • Double-shunt (for transducers) across opposite bridge arms • Provision for four dedicated leads to shunt external arms • CAL circuit selected by switches on PC board		
Fixed Settings:	• ±200 and ±1000 με @ GF=2 across dummy half bridge; • ±1000 με @ GF=2 across dummy gage (120 Ω and 350 Ω). • ±1 mV/V (double shunt) for 350 Ω transducer.		
Remote-Operation Relays (**Option Y**)	Four relays (plus remote-reset relay for bridge balance and relay for excitation on/off). Each relay requires 10 mA @ 5 VDC except excitation on/off 25 mA		
AMPLIFIER			
Gain:	1 to 11, 000 continuously variable. Direct reading, ±1% max. 10-turn counting knob (X1 to X11) plus decade multiplier (X1 to X1000)		
Frequency Response, All Gains Full Output	**DC coupled:** DC to 125 kHz, -3 dB max. DC to 55 kHz, -0.5 dB max. **AC coupled:** 1.7 Hz typ. to 125 kHz, -3 dB max.		
Frequency Response Versus Gain, Full Output:	Gain	-0.5 dB	-3 dB
	1-11	120 kHz	300 kHz
	10-110	90 kHz	230 kHz
	100-1100	70 kHz	150 kHz
	1000-11000	55 kHz	125 kHz
Slew Rate:	7.8 V/μs typical		
Input Impedance:	100 MΩ, min, differential or common-mode, including bridge balance circuit		

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PARAMETER	SPECIFICATIONS
Bias Current:	±40 nA, typical max., each input
Source impedance:	0 to 1000 Ω each input
Common-Mode Voltage:	±10 V
Common-Mode Rejection (gain over X100):	• Shorted input: 100 dB, min, at DC to 60 Hz; 90 dB, min, DC to 1 kHz; • 350 Ω balanced input: 90 dB, typical, DC to 1 kHz
Stability (gain over X100):	±2 µV/°C, max, RTI (referred to input)
Noise (gain over X100, all outputs)	• 0.01 to 10 Hz: 1 µV p-p RTI • 0.5 to 125 kHz: 6µ VRMS, max, RTI
FILTER	
Characteristic:	Low-pass active six-pole Butterworth standard
Frequencies (–3 ±1 dB):	10, 100, 1000 and 10,000 Hz and wide-band
Outputs Filtered:	Either one or both (switch-selected on printed circuit board)
AMPLIFIER OUTPUTS	
Standard Output:	±10 V @ 5 mA, min.
Slew Rate:	7.8 V/µs (typical)
Low-Level Output:	±1.414 V (1 VRMS) @ 5 mA, min.
Linearity @ DC:	±0.02%
Either output can be short-circuited with no effect on the other	
PLAYBACK	
Input:	±1.414 V full scale; input impedance 20 kΩ
Gain:	X1 to low-level output; X7.07 to standard output
Filter Selection:	As specified above
Outputs:	Both as specified above
ENVIRONMENTAL	
Temperature:	32°to 122°F (0°C to +50°C)
Humidity:	10% to 90%, non-condensing
POWER	105 V to 125 V or 210 V to 250 V (switch-selected), 50/60 Hz, 10 watts, max
Keep-alive supply (for bridge balance)	Lithium 3.6 V, 1/2 AA or equal; Shelf life approximately two years
SIZE	
Panel:	8.75 H x 1.706 W in (222.2 x 43.3 mm)
Case Depth Behind Panel:	15.9 in (404 mm)
WEIGHT	6 lb (2.7 kg)

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MODEL 2350 - RACK ADAPTER

A prewired rack adapter which accepts up to ten Model 2310B plug-in amplifier modules. The Model 2350 also fits standard 19-in (483-mm) mainframe electronic equipment racks so that multi-channel system configurations can be conveniently housed.

PARAMETER	SPECIFICATIONS
APPLICATION	• Fits standard 19-in (483-mm) electronic equipment rack • Accepts up to ten 2310B Amplifiers • AC line completely wired • Wiring for remote calibration with Option Y
POWER	115 or 230 VAC switch selected in amplifiers, 50/60 Hz, 100 Watts max.
SIZE	8.75 H x 19 W x 19.06 D overall (222 x 483 x 484 mm)
WEIGHT	13.5 lb (6.1 kg)

MODEL 2360B - 4-CHANNEL ENCLOSURE

Model 2360B Portable Enclosure includes all AC wiring. Accepts up to four amplifier modules.

PARAMETER	SPECIFICATIONS
APPLICATION	• Accepts up to four 2310B Amplifiers • AC line completely wired • Wiring for remote calibration with Option Y
POWER	115 or 230 VAC switch selected in amplifiers, 50/60 Hz, 100 Watts max.
SIZE	9.06 H x 7.20 W x 18.90 D in (229 x 183 x 480 mm)
WEIGHT	6.75 lb (3.1 kg)

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