Model 2210A
Signal Conditioning Amplifier

Description

Among the features of the 2210A Amplifier are isolated constant-voltage/constant-current excitation, guarded input structure with ±350V common-mode capability, ±10V and tape outputs, automatic wide-range bridge balance and four-pole Bessel low-pass filter.

Operating controls of the 2210A Amplifier are conveniently arranged and clearly marked to minimize the possibility of operator error. Constant-voltage or constant-current excitation, calibration configuration, and other optional operating modes are selected by easily accessible internal switches or jumpers.

Gain Controls: Continuously variable 1 to 3300. Gain potentiometer 1.00 to 11.00 plus gain switch X1, X10, X100, X300.
Filter Switch: Selects appropriate low-pass filter or wide-band operation.
Monitor Jacks: For ±10V output and bridge excitation.
EXCIT LED: Denotes constant-voltage (red) or constant-current (green) excitation.
EXCIT On-Off: Toggle switch removes excitation from the strain gage or transducer.
EXCIT Potentiometer: Sets excitation level for constant-voltage and constant-current excitation.
CAL Switch: Selects A or B preset calibration configuration.
Auto BAL Switch: Controls balance operation.
Auto BAL LED: Denotes balance mode: green during auto balance interval; red for overrange.
Balance Trim Potentiometer: Refines bridge balance when desirable.
Balance LED: Indicates bridge balance (off), positive unbalance (red), or negative unbalance (green).
AMP Zero Potentiometer: Sets electrical zero of amplifier.

Specifications

All references to microstrain assume a gage factor of 2.00.
All specifications nominal or typical at +23 deg C unless noted.

Input:
Input Impedance:
dc-coupled: 22 megohms shunted by 250 pF.
ac-coupled: 1.1 microfarad in series with 20 kilohms; low frequency cutoff (3 dB) 8 Hz nom.

Source Current:
±10 nA typical; ±20 nA maximum.

Configuration:
2- to 10-wire plus guard shield accepts quarter-, half-, or full-bridge strain gage or transducer inputs. Internal half-bridge, dummy 350 ohm and dummy 120 ohm completion gages, remote sense and four-wire calibration capability provided. 1000 ohms completion capability also provided. Accepts inputs from ground-referenced or isolated devices.

Differential Input:
Maximum differential input voltage of ±50 Vdc or peak ac.

Common-Mode Input:
Maximum common-mode inputvoltage of ±350 Vdc or peak ac.

Guard Impedance:
Greater than 250 kilohms to output common; greater than 1000 megohms to power and rack ground.

Amplifier:
Gain:
1 to 3300; continuously variable; direct reading. Gain steps X1, X10, X100, X300; with 10-turn counting knob, X1 to X11. Accuracy ±0.5%.

Linearity:
±0.01% of full scale at dc.

Frequency Response:
dc to 100 kHz: 3 ±0.2 dB at all gain settings and full output. dc to 50 kHz: 0.5 dB max at all gain settings and full output.

Gain Step vs Frequency Response (3 dB):

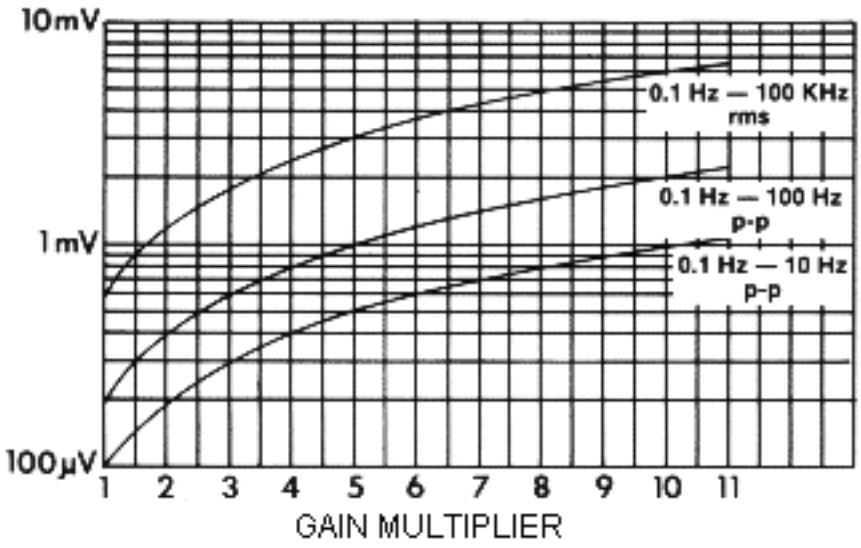
X300	100 kHz
X100	120 kHz
X10	135 kHz
X1	240 kHz

Slew Rate:
6.3 V/microsec min at all gain settings.

Noise:
(350 ohm source impedance, dc-coupled)

Referred-to-input (RTI):
1 microvolt 0.1 Hz to 10 Hz p-p; 2 microvolts 0.1 Hz to 100 Hz p-p
3 microvolts 0.1 Hz to 100 kHz rms

Referred-to-Output (RTO):
Output related noise is a function of the setting of the gain multiplier potentiometer. Refer to the graph below for noise referred-to-output.



Zero Stability:
±2 microvolts RTI, ±200 microvolts RTO at constant temp.

Temperature Coefficient of Zero:
±l microvolt/deg C RTI, ±100 microvolt/deg C RTO; -10 deg to 60 deg C.

Common-Mode Rejection:

Gain	**CMR (dB)**
X1	82
X10	102
X100	122
X300	135

Common-Mode Voltage:
±350 Vdc or peak ac, max operating.

Standard Output:
±10V at 10 mA max;

Tape Output:
1.0 Vrms at 10 mA max; **or**

Output ac-coupled:
±10V at 10 mA max (7 Hz, 3 dB).

Output Monitor:
±10V standard monitored via front-panel jacks.

Output Isolation:
>1000 megohms from power and rack ground.

Output Protection:
Protected against continuous short.

Capacitive Loading:
Up to 0.15 microfarad.

Low-Pass Filter:
Four-pole Bessel low-pass filter with selectable 3 dB bandwidths of 1 Hz, 10 Hz, 100 Hz, 1 kHz and 10 kHz.

Constant-Voltage Excitation:
Range:
0.50 to 15.0 Vdc at 85 mA max.

Noise:
±100 microvolts ±0.002% p-p dc to 20 kHz.

Line Regulation:
±200 microvolts ±0.01 % max for line voltage change of 10% from nominal.

Load Regulation:
±200 microvolts ±0.01% max for load variation of 10% to 90% of full load.

Stability:
±0.01%/deg C or 100 microvolts/deg C, whichever is greater.

Remote Sense:
Error <0.0005%/ohms of lead resistance.

Monitoring:
Front-panel monitoring jacks.

Isolation:
Isolated from power ground and output common; floats with guard.

Constant-Current Excitation:
Range:
0.50 to 15.0 mA dc or 1.00 to 30.0 mA dc. Compliance voltage 0.50 to

16.0V.

Noise:
(1 microamps + 10 microvolts) p-p; dc to 20 kHz.

Line Regulation:
±1 microamps ±0.01% max for line voltage change of ±10% from nominal.

Load Regulation:
±1 microamps ±0.01% max for 100% load change.

Stability:
±0.01%/deg C or 1 microamp/deg C, whichever is greater.

Monitoring:
Front-panel monitoring jacks; 10 mV/mA.

Isolation:
Isolated from power ground and output common; floats with Guard.

Balance:
Method:
Electronically injected automatic balance.

Range:
±15 000 microstrain (7.5 mV/V) RTI (X2 with internal jumper).

Resolution:
0.50/microstrain RTI (X2 with internal jumper).

Balance Time:
4 seconds typical; 8 seconds max.

Accuracy:
±2 mV RTO; ±2 microstrain RTI.

Balance Trim:
±375 microstrain (188 microvolts/V) RTI.

Storage:
Digital with battery backup. Battery life 3-5 years.

Activation:
Activated by front-panel switch or by optically isolated remote switch or low TTL level.

Calibration:
Four internal shunt calibration resistors, ±0.1% tolerance:

174.8K	1000 microstrain (0.50 mV/V)	350 ohms bridge;
874.8K	200 microstrain (0.10 mV/V)	350 ohms bridge;
59.94K	1000 microstrain (0.50 mV/V)	120 ohms bridge.

Activated by front-panel switch, or by optically isolated remote contact closure or low TTL level.
Internal selector switches for selection of two-point unipolar, bipolar, or two-point double shunt calibration circuits.
Calibration resistors plug into fixed terminals (no soldering).

Size:
7 H x 1.71 W x 17.88 D in (178 x 43 x 454 mm).

Weight:
3.7 lb (1.67 kg).