

MODULAR HIGH-PERFORMANCE INSTRUMENTATION AMPLIFIER

FEATURES

- Gains from 0.01 to 5,000
- 0.1% or 0.02% gain accuracy
- 100 kHz bandwidth
- 300 Volt common mode
- 2 or 6-pole selectable low-pass filter
- Voltage substitution calibration
- Dual, 100 mA, floating outputs
- Optional AC input coupling



DESCRIPTION

Model 70A is a full featured, wideband, differential instrumentation amplifier that can be used for a variety of applications. Designed to condition, amplify and filter low level analog signals it is used for data acquisition, analog recording, line driving, data filtering and signal isolation.

The basic element is a very stable, low noise differential amplifier with wideband response. Input impedance is 50 Megohms, linearity is 0.01% and common mode rejection is 130 dB for up to 300 Volts. Bandwidth exceeds 100 kHz for gains from 1 to 1000.

Eleven switch selectable gains and a variable gain multiplier provide continuous coverage from 1 to 5,000. Gain accuracy is $\pm 0.1\%$ with $\pm 0.02\%$ available as an option. The 70A-5 has a two pole, switch selectable, low pass filter with Bessel response. The 70A-6 is the same, but with six pole Bessel response. Butterworth response is also available.

Model 70A provides two independently buffered ± 10 Volt full scale outputs each with 100 milliampere drive current. Output impedance is less than 0.1 Ohm for driving long lines and capacitive loads. Output is short circuit protected and current is limited to safeguard external equipment.

Front panel switches select gain step, calibrated or variable gain and filter frequency. Multiturn screwdriver controls set variable gain and input and output zero. The input attenuator and AC/DC coupling options have front panel controls.

Each amplifier is floating and line powered providing channel to channel isolation. It is fully enclosed in a metal case and mechanically secured when installed in the enclosure. Ten amplifiers mount in a $5\frac{1}{4}$ inch high rack enclosure with a rear mounted connector panel. Mating connectors are supplied with the rack enclosure

SPECIFICATIONS

INPUT

Impedance50 Megohms shunted by 200 pF.
 Source Imped.1,000 Ohms in any unbalance. Input may be grounded or floating.
 ProtectionWill withstand differential input of ± 50 Volts and common mode voltage of ± 350 Volts.
 CalibrationAmplifier input is switched to a voltage calibration bus for application of externally supplied calibration signal. Activated individually for each channel by a control input. Connecting the control input to output common selects calibration.
 AC CouplingSwitch selected DC or AC input coupling with cutoff, -3 dB, frequency of 2.5 Hz. Input impedance with AC selected is 200K Ohms.
 Input AttenuatorSwitch selected input attenuation of 0.01 (Option C) $\pm 0.1\%$ providing gains from 0.01 to 5,000. Input impedance with attenuator selected is 2 Megohms, frequency response is 50 kHz and common mode rejection is 70 dB.

GAIN

Gain StepsEleven steps: 1, 2, 5, 10, 20, 50, 100, 200, 500, 1,000 and 2,000.
 Variable GainScrewdriver adjustable gain multiplier increases the gain to cover the range between steps. Switch selects variable or calibrated gain. RTO errors and noise are multiplied by variable gain setting.
 Accuracy $\pm 0.1\%$.
 Accuracy (Option A) $\pm 0.02\%$.
 Stability $\pm 0.01\%$ for 6 months, $\pm 0.002\%/^{\circ}\text{C}$ for fixed gain steps.
 Linearity $\pm 0.01\%$.

OUTPUTS (Applies to Both Outputs)

Rated $\pm 10\text{V}$ at 100 mA. Output current limited to 150 mA. No instability with capacitive loads to 1 μF .
 ImpedanceLess than 0.1 Ohm in series with 5 μH .
 ResponseEach output may be configured by jumper for wideband or filtered response.

DYNAMIC RESPONSE

BandwidthLess than 3 dB down at 100 kHz for all gains 1 to 1,000. Bandwidth is reduced in proportion to gain above 1,000.
 Filter (70A-5)Switch selectable, 12 dB/octave Bessel low pass with 3 dB bandwidth steps of 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz and Wideband. Butterworth response is available.
 Filter (70A-6)Switch selectable, 36 dB/octave Bessel low pass with 3 dB bandwidth steps of 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz and Wideband. Butterworth response is available.
 Setting Time75 μs to within $\pm 0.1\%$ final value.
 OL RecoveryRecovers from 5 times full scale overload to within $\pm 0.1\%$ in less than 400 μs at gain 1000, and faster at lower gains.
 Slew Rate3.1 V/ μs RTO, 1.5 V/ μs RTI.

ZERO

AdjustmentFront panel controls provide independent adjustment of input and output zero.
 Stability $\pm 5 \mu\text{V}$ RTI, $\pm 0.5 \text{ mV}$ RTO. Temperature coefficient is $\pm 0.4 \mu\text{V}/^{\circ}\text{C}$ RTI, $\pm 0.15 \text{ mV}/^{\circ}\text{C}$ RTO.
 Source Current $\pm 1 \text{ nA}$ and $\pm 0.5 \text{ nA}/^{\circ}\text{C}$.

COMMON MODE

Rejection130 dB at DC, 123 dB at 60 Hz for gain 1,000, and 1K Ohm source unbalance. At lower gains common mode rejection is 63 dB plus gain in dB. CMR decreases at a rate not exceeding 6 dB/octave from value at 60 Hz.
 Voltage $\pm 300\text{V}$ DC or peak AC operating.

NOISE

10 Hz1 μV RTI plus 0.5 mV RTO, peak.
 10 kHz3 μV RTI plus 0.3 mV RTO, RMS.
 100 kHz7 μV RTI plus 0.6 mV RTO, RMS.

GENERAL

Rack Enclosures19-inch wide enclosures hold 10 amplifiers in $5\frac{1}{4}$ inches of panel height. Depth is $20\frac{1}{4}$ inches. Convection cooling is usually adequate for up to 20 channels and a fan assembly is available for larger installations.
 ConnectorsSignal connectors are: Input - XLR-3-32 (mate XLR-3-11C), Output 1 - MS3102A-24-28S (mate MS3106A-24-28P), Output 2 - MS3102A-24-28SX (mate MS3106-24-28PX), Remote Control - MS3102A-10SL-4P (mate 3106A-10SL-4S) and Calibration - XLR-4-32 (Mate XLR-4-11C). Mating connectors and power cord are supplied.
 Power Req.115 or 230 VAC, $\pm 10\%$, 47 to 400 Hz, 7 Watts.
 Temp Range 0°C to $+55^{\circ}\text{C}$ operating. Storage from -25°C to $+71^{\circ}\text{C}$.
 HumidityUp to 95% without condensation.

MODELS AND OPTIONS

70A-5Instrumentation Amplifier with Two-Pole Bessel Filter.
 70A-6Instrumentation Amplifier with Six-Pole Bessel Filter.
 A $\pm 0.02\%$ Gain Accuracy.
 BUButterworth Filter Response.
 CInput Attenuator (not available with option P).
 PDC/AC Input Coupling (not available with option C).

RACK ENCLOSURES

R10ACV-11510 Channels, 115 VAC.
 R10ACV-23010 Channels, 230 VAC.
 FM3AFan Assembly, 115 VAC.