DATEL

AM-227
Low Cost, Ultra-Stable Isolation Amplifier

T-79-35

FEATURES

- 1000V dc Isolation
- 0.005% Nonlinearity
- 166 dB Minimum, CMRR
- 0.2 Microvolt/°C offset drift
- 10 to 1000 Gain range

GENERAL DESCRIPTION

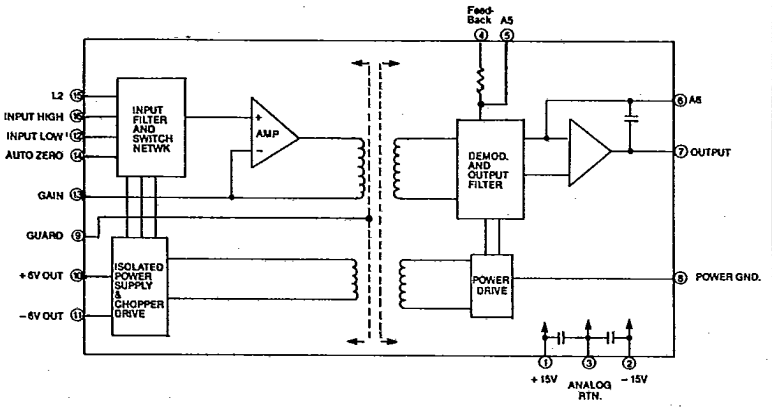
DATEL's AM-227 is a low-cost, precision modular isolation amplifier designed specifically for applications involving the amplification of low-level, low frequency signals in the presence of high common mode interference. The ultra-low drift, high accuracy, and high CMRR make it possible to accurately amplify microvolt-level signals with a user selectable gain range of 10 to 1000. Gain nonlinearity is specified as low as ±0.005% FSR maximum with gain selection accomplished through the addition of one external resistor.

The AM-227 offers excellent dc input characteristics including an unadjusted offset voltage of ±150 microvolts, common mode rejection ratio of 166 dB minimum and common mode isolation voltage of 1000V dc. Offset voltage drift is 0.5 microvolt/°C maximum and long term stability is typically as low as 2 microvolts/year.

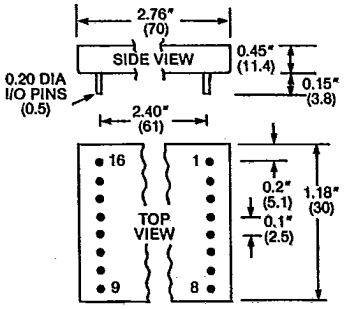
The AM-227 includes a chopper-stabilized input amplifier, power oscillator, demodulator, and 3-pole 60 dB/decade filtering. An output buffer amplifier provides ±10V dc at ±5 mA. The isolated ±6V power outputs can be used in a simple open input indication network.

Its combination of high performance, low cost and small size make the AM-227 an excellent choice for applications involving thermocouple temperature measurements, remote data acquisition systems, strain gauge measurements, and precision telemetry systems.

Power requirement is ±15V dc. The AM-227 is packaged in a compact 2.8 x 1.2 x 0.45 inch, shielded steel case. Operation is specified over the industrial 0°C to +70°C temperature range.



MECHANICAL DIMENSIONS INCHES (MM)



INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	+15V POWER IN	9	GUARD
2	– 15V POWER IN	10	+6V OUT
3	ANALOG RTN	11	–6V OUT
4	FEEDBACK	12	INPUT LO
5	A5	13	GAIN
6	A6	14	AUT. ZER. RTN.
7	OUTPUT	15	L2
8	POWER GND	16	INPUT HIGH

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FUNCTIONAL SPECIFICATIONS, AM-227

Typical at +25°C, ±15V dc supplies unless otherwise noted.

INPUT CHARACTERISTICS	
Linear Differential Input Voltage Range[1]	±10 mV to ±1V full-scale
Offset Voltage, RTI[2], G = 100	±600 μV
G = 1000	±150 μV
Input Bias Current, max.	2 nA (0.5 nA typ.)
Input Resistance, Differential Mode	100 MΩ
Input Impedance, Common Mode	10^{10} Ω for 80 pF
Differential Mode	100 MΩ shunted by 22 kΩ in Series with 1.5 μF
Overload Input Impedance	22 kΩ
Common Mode Rejection Ratio, min.[3]	166 dB (176 dB typ.)
Common Mode Isolation Voltage, max.	1000V dc, 750V RMS
OUTPUT CHARACTERISTICS	
Output Voltage Range	±10V
Output Impedance, DC	0.1Ω
Output Load, max.	±5 mA and 500 pF
Ouput Short-Circuit Protection	Continuous to Ground
Output Chopper Noise[4]	1 mV peak-to-peak at approximately 10 kHz
PERFORMANCE	
Gain Range[5]	10 to 1000
Gain Equation[6]	$G = 10^4/R_G$
Gain Nonlinearity, max., G = 10	±0.05% FSR
G = 50–500	±0.005% FSR
G = 1000	±0.01% FSR
Gain Tempco, max., G = 10–500	±20 ppm FSR/°C(±10 ppm FSR/°C typ.)
G = 1000	±30 ppm FSR/°C(±20 ppm FSR/°C typ.)
Input Offset Temp. Drift, RTI, max.	±0.5 μV/°C(0.2 μV/°C typ.)
Input Bias Current Temp. Drift	50 pA/°C
Warm-Up Drift[7], RTI	<2 μV
Long Term Drift, RTI	1 μV/month, non-cumulative, 2 μV/year
Small Signal Bandwidth[8]	5 Hz
Power Supply Sensitivity	±2 μV/% change in V_S
ISOLATED POWER SUPPLY OUTPUT	
Voltage, with respect to Input Low	±6V dc nominal
Current, Full Load	±3 mA
Regulation, No Load to Full Load	6%
Ripple	20 mV peak-to-peak at 10 kHz
INPUT POWER REQUIREMENTS	
Positive Supply, No Load	+15V ±3% at +5 mA
Negative Supply, No Load	−15V ±3% at −3 mA
PHYSICAL/ENVIRONMENTAL	
Operating Temperature Range[9]	0°C to +70°C
Storage Temperature Range	−55°C to +85°C
Relative Humidity	0 to 85%, non-condensing to +40°C
Package Size	1.2 x 2.8 x 0.5 in (30 x 70 x 12 mm)

FOOTNOTES:

1. Absolute maximum safe differential input voltage is: 120V RMS, continuous.
2. Untrimmed, referred to input (RTI). Adjustable to zero.
3. At dc and from 50 to 800 Hz. G = 50 to 1000 with a 1 kΩ source imbalance.
4. 1 MHz bandwidth.
5. Non-inverting. Optimized for gains of 50 to 500.
6. See Technical Note 1.
7. 5 minutes.
8. 6 dB down at 5 Hz. See Technical Note 2 for information on the AM-227's internal filters.
9. It is possible to operate the AM-227 over the −25°C to +85°C temperature range with some degradation of performance.

TECHNICAL NOTES

1. The AM-227 gain may be set to any value from 10 to 1000 by connecting an external resistor (R_G) between the gain pin (Pin 13) and the input low pin (Pin 12). The gain is equal to $G = 10^4/R_G$ and untrimmed will be within ±3% of the calculated value. An RN55E resistor is recommended for temperature stability.
2. The AM-227 contains both input and output filters. The input filter is a one-pole RC (3 dB cut-off at 5 Hz) and the output filter is a two-pole Butterworth (3 dB cut-off at 5 Hz). Overall filtering is three-pole, 60 dB/decade roll-off (−60 dB at 50 Hz).
3. For normal operation of the AM-227, connect the auto-zero pin (Pin 14) to the input low pin (Pin 12). A stable voltage source may be connected to the auto zero pin for applications requiring an input offset that exceeds the range of the offset adjust. Signals present on the input high pin (Pin 16) and auto zero pin (if used) are measured with respect to the input low pin. For optimum linearity, each signal must be within ±1V of input low.

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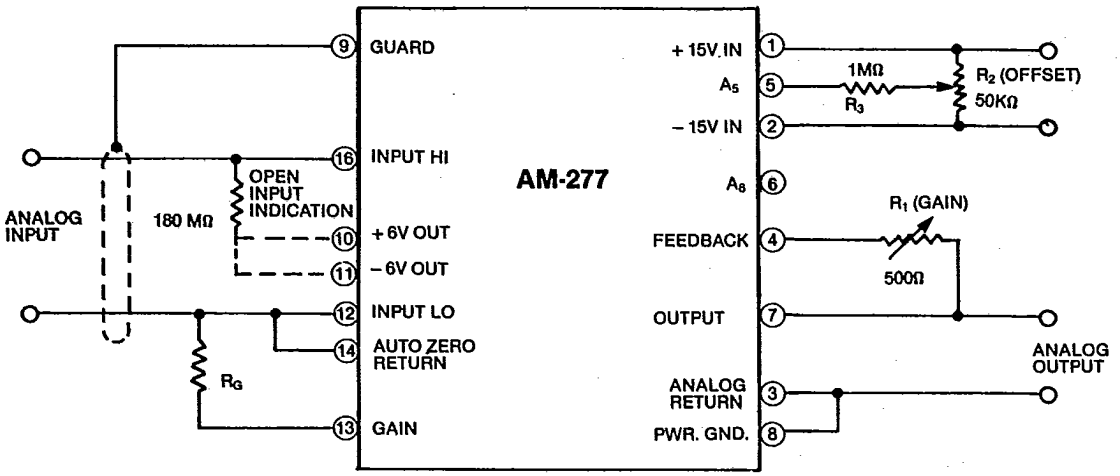
CONNECTION AND CALIBRATION

TYPICAL CONNECTION DIAGRAM



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GAIN SELECTION

The AM-227 gain can be set to any value from 10 to 1000 by simply connecting an external resistor (R_G) between the gain pin (Pin 13) and the Input Lo pin (Pin 12) as shown in the typical connection diagram. The selected gain is equal to $10^4/R_G$.

Absolute gain, unadjusted, will be within ±3% of the calculated value. For temperature stability, an RN55E resistor is recommended.

GAIN ADJUSTMENT

The gain of the AM-227 may be fine trimmed externally by connecting a 500Ω potentiometer (R_1) as shown in the typical connection diagram. A metal film resistor with a TCR of ±100 ppm/°C or less is recommended.

This adjustment is used to compensate for the tolerance of R_G and for unit-to-unit gain variability (3%) between multiple AM-227's. In applications where cost is of primary importance, a fixed resistor may be used.

OFFSET ADJUSTMENT

To externally zero the offset of the AM-227, connect the resistors R_2 (R_2 can be a 25 kΩ or 50 kΩ potentiometer) and R_3 as shown in the typical connection diagram. Metal film resistors with a TCR of ±100 ppm/°C or less should be used.

To adjust the offset, short the Input High (Pin 16), Input Low (Pin 12), and Auto Zero Return (Pin 14) pins to the Analog Return Pin (Pin 3). With the input momentarily connected to ground, set R_2 for zero volts at the output (Pin 7).

OPEN INPUT INDICATION

The ±6V isolated power supply (Pins 10 & 11) outputs may be used for an open input indication network. This simple network consists of a resistor of approximately 180 MΩ connected between the input high pin (Pin 16) and either the +6V out pin (Pin 10) or the −6V out pin (Pin 11). This produces a bleeder current of approximately 20 nA through the input source circuitry. If the source is opened, this bleeder current will drive the AM-227 output into saturation.

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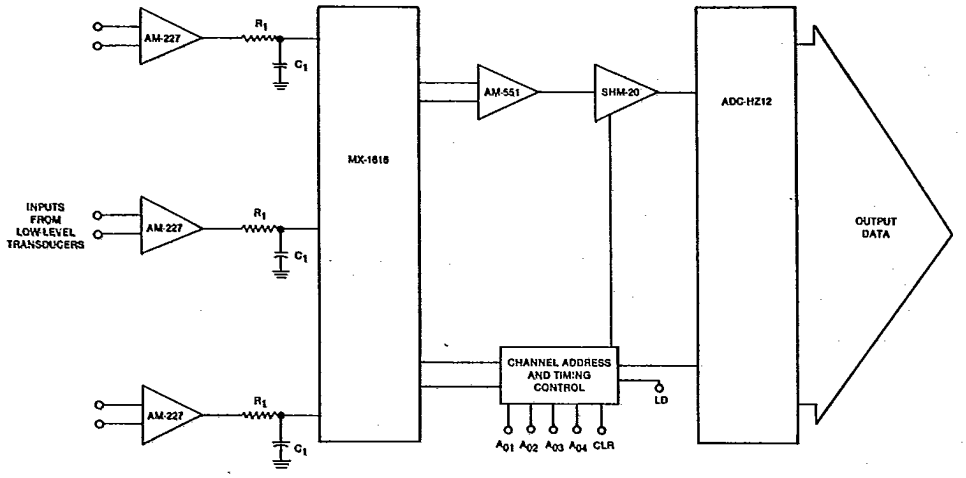
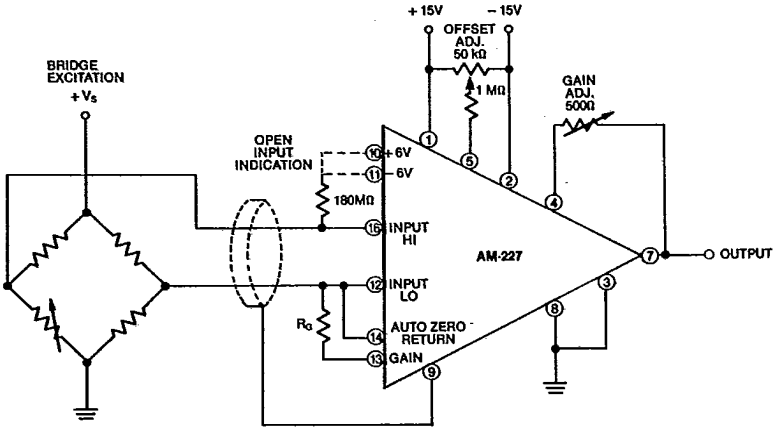
APPLICATION

MULTI-CHANNEL DATA ACQUISITION SYSTEM



For multichannel applications, the outputs of multiple AM-227 may be multiplexed to a common analog line. The single-pole filter (R_1, C_1) at the AM-227 output is used to eliminate errors due to dumped charge. Typical values for R_1 would be 50Ω–270Ω with a corresponding range for C_1 of 10,000 pF to 1,000 pF. This filter must be included for all high resolution (>12-bits) applications of the AM-227.

BRIDGE TRANSDUCER INTERFACE



The AM-227 is designed to interface with low-level signal transducers such as thermocouples and strain gages. Because the transducers are often situated in noisy industrial environments and the output signal produced is extremely small, they are often connected in a bridge circuit. The AM-227 provides the user with the high input impedance, high common mode rejection, isolation (for ground loop elimination) and gain required for bridge interfacing.

ORDERING INFORMATION

MODEL NO.	OPERATING TEMP. RANGE
AM-227	0°C to +70°C