Medical & Industrial Isolation Amplifiers

intronics

CALL TOLL FREE 1-800-367-0004

IA175 ULTRA-LINEAR ISOLATION AMPLIFIER WITH EXTERNAL SYNC CAPABILITY

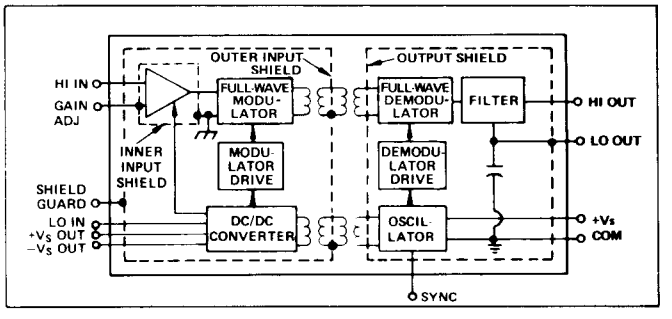
Fully Compatible with 12-Bit Acquisition Systems

FEATURES

- **UL Component Recognized**
- **Provision for External Synchronization**
- **High Linearity: 0.005% Peak, Typical**
- **High Input/Output Isolation: 5000VDC continuous, 3000VAC RMS**
- **1000:1 Programmable Gain**
- **Low Drift: ±0.01%/°C Maximum**
- **126dB Common-Mode Rejection**

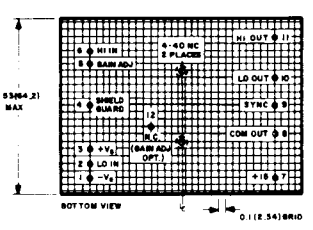
The Model IA175 Isolation Amplifier features very high linearity, input/output isolation, and common-mode rejection, very low drift, and externally programmable gain. Its 0.005% linearity assures compatibility with 12-bit data acquisition systems, and its ability to operate at common-mode input voltages up to 5000 VDC enables operation with single sources in high voltage systems and other hazardous locations. Common-mode rejection is at least 120 dB with source imbalance of up to 5000 ohms. Input voltage noise is 1μV, 10Hz to 1 kHz, and current noise is 10 pA for the same range. The gain of the amplifier is programmable from 1V/V to 1000V/V by means of an externally connected resistance value. The internal oscillator used to provide modulation and demodulation for input isolation can be synchronized with those of associated Model IA175 amplifiers by means of an external trigger, to avoid imposition of beat-frequency phenomena on the output signals. An independent ±14VDC, ±15 mA supply in the input section, with the same voltage isolation as the amplifier input, is used to power an external transducer, or preamplifier.

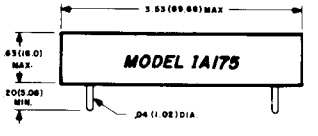
BLOCK DIAGRAM IA175



CONNECTION NOTES:

1. Gain Adjustment Resistor (R_g) is connected between GAIN and LO-IN pins.
2. If no output-offset adjustment is required, connect LO-OUT to COMMON pin. Otherwise, consult factory.





CHARACTERISTICS

(Typical, @ 25°C, V_S = +15 VDC unless otherwise noted.)

GAIN (Non-Inverting)	
Range	1 to 1000V/V
Formula	1 + (30kΩ/Rg)
Deviation from Formula	±1%
vs. Temperature (0 to +70°C)	±0.005%/°C
vs. Temperature (0 to +70°C)	±0.01%/°C max.
Nonlinearity, ±5V Output	±0.01% max.
Nonlinearity, ±10V Output	±0.02% max.
INPUT VOLTAGE RATINGS	
Linear Differential Range	±10V min.
Max. Safe Differential Input rms.	
Continuous	125V rms
Peak Pulse, 5 ms Duration, One Pulse/Sec	±600V
Max. CMV, Inputs to Outputs/Power Common	
Peak AC, 60 HZ, 1 Minute	3,000V
Peak DC Continuous	±5,000V
CMR, Inputs to Outputs, 60 Hz	
Balanced Source Impedance	126dB
5kΩ Source Imbalance	120dB
CMR, Inputs to Guard, 60 Hz	
5kΩ Source Imbalance	80dB
Max. Leakage Current, Inputs to Common	
115 VAC, 60Hz	8μA max.
INPUT IMPEDANCE	
Differential	10^9Ω‖3 pF
Overload	27kΩ
Common Mode	10^{11}Ω‖20pf
INPUT BIAS CURRENT	
Initial, @ +25°C	±2nA
vs. Temperature (0 to +70°C)	±0.01nA/°C
INPUT NOISE	
Voltage,	
0.01 Hz to 10Hz	3μV p-p
10Hz to 1kHz	1μV rms
Current	
0.01Hz to 10Hz	1pA p-p
FREQUENCY RESPONSE	
Small Signal, −3dB Gain = 100V/V	1kHz
Full Power, 20V p-p Output	500Hz
Slew Rate	30mV/μs
OFFSET VOLTAGE, REFERRED TO INPUT	
Initial, @ +25°C	±(1 + 5/G)mV
vs. Temperature (0 to +70°C)	
Gain = 1V/V (μV/°C max.)	±35
Gain = 100V/V (μV/°C max.)	±15
At other Gains (μV/°C max.)	±(15 + 20/G)
vs. Supply Voltage	±(1 + 20/G)μV/V
RATED OUTPUT	
Voltage, 50kΩ Load	±10V min.
Output Ripple, 20 kHz	10mV p-p
Output Impedance	1.0kΩ
Max. CMV, Output Common to Power Common	
Peak AC or DC Continuous	±50Vpk
ISOLATED POWER CIRCUIT	
Voltage, ±15 mA Load	±14 VDC
Accuracy	±5%
Current	±15 mA min.
Regulation	
No load to full load	+0, −2%
Δ Gain	±0.005%
Δ Output Offset	±100μV
Δ Input Offset	±5μV
POWER SUPPLY, SINGLE POLARITY	
Voltage, for rated performance	+15VDC, ±0.5V
Voltage, operating	+12 to +18VDC
Current, quiescent	70mA
Current, full load	100mA
External Sync. Frequency	7 - 8 kHz, 5VDC @ 50% duty cycle
TEMPERATURE RANGE	
Rated Performance	0°C to 70°C
Storage	−55°C to +85°C
CASE DIMENSIONS	3.5" x 2.5" x .62"
MATING SOCKET	S132
NOMINAL WEIGHT	1.3 ounces

IA184 LOW-COST, HIGH-LINEARITY ISOLATION AMPLIFIER WITH EXTERNAL SYNC CAPABILITY

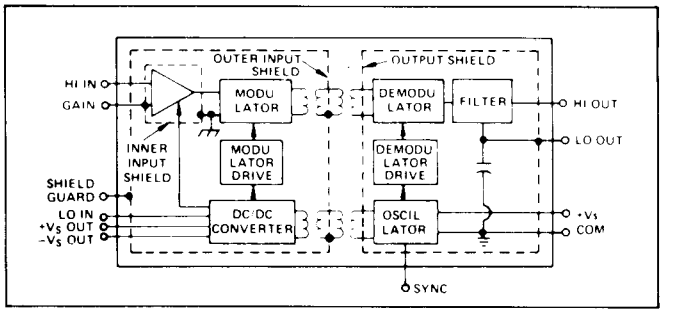
Fully Compatible with 10-Bit Data Acquisition Systems

FEATURES

- **UL Component Recognized (IA184)**
- **Provision for External Synchronization**
- **High Linearity: 0.025% Peak, Typical**
- **2500 V Input/Output Isolation**
- **126 dB Common-Mode Rejection**
- **1000:1 Programmable Gain**
- **Small Size: only 1.5″ x 1.5″ x 0.63″**

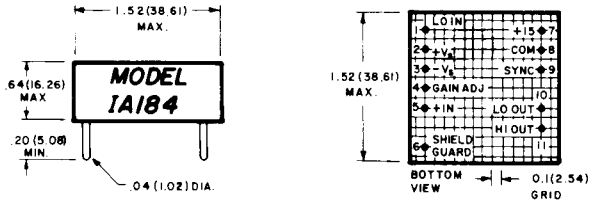
The Model IA184 Isolation Amplifier is an ultra-compact module offering high linearity, 2500-Volt input/output isolation, 126 dB common-mode rejection, externally programmable gain, a floating internal supply for powering an external transducer, and external synchronization of the internal oscillator used in obtaining the input isolation. Its 0.1% linearity assures compatibility with 10-bit data acquisition systems, and input voltage noise is held to 1μV, 10 Hz to 1 kHz, with 10 pA maximum current noise for the same range. The internal oscillator used to provide modulation and demodulation for input isolation can be synchronized with those of associated Model IA184 amplifiers by an external trigger, to prevent imposition of beat-frequency phenomena on the output signal. An independent ±15 VDC, ±15 mA supply in the input section, with the same voltage isolation as the input, can be used to power an external transducer or preamplifier.

BLOCK DIAGRAM IA 184



CONNECTION NOTES:

1. Gain Adjustment Resistor (R_g) is connected between GAIN and LO-IN pins.
2. If no output-offset adjustment is required, connect LO-OUT to COMMON pin. Otherwise, consult factory.



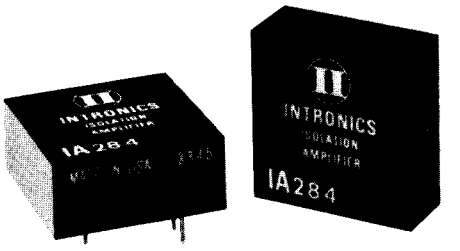
CHARACTERISTICS

(Typical, @ 25°C, V_S = +15 VDC unless otherwise noted.)

	IA184
GAIN (Non-Inverting)	
Range (50kΩ Load)	1 to 1000V/V
Formula	$\text{Gain} = (1 + \frac{100k\Omega}{Rg})$
Deviation from Formula	±3%
vs. Temperature (0 to +70°C)	±0.015%/°C
Nonlinearity, G = 1V/V to 10V/V	@ ±5V, ±0.025% @ ±10V, ±0.1% @ ±10V, ±0.2% max.
INPUT VOLTAGE RATING	
Linear Differential Range, G = 1V/V	±10V min.
Max. Safe Differential Input	
Continuous	125V rms
Pulse, 10ms Duration, 1 pulse/10 sec	±600Vpk max.
Max. CMV, Inputs to Outputs	
AC, 60 Hz, 1 Minute duration	2500V rms
Pulse, 10ms duration, 1 pulse/10 sec	±2500Vpk max.
With 510kΩ in series with Guard	±5000Vpk max.
Continuous, AC or DC	±2500Vpk max.
CMR, Inputs to Outputs, 60 Hz, R_S<5kΩ	
Balanced Source Impedance	126dB
5KΩ Source Imbalance	120dB
CMR, Inputs to Guard, 60 Hz	
1kΩ Source Imbalance	80db
Max. Leakage Current, Inputs to Power	
Common @ 115 VAC, 60 Hz	1.2μA rms max.
INPUT IMPEDANCE	
Differential	10^{4}Ω‖3 pF
Overload	27kΩ
Common Mode	5 x 10^{10}Ω‖20 pF
INPUT BIAS CURRENT	
Initial, @ + 25°C	±2nA
vs. Temperature (0 to +70°C)	±0.01nA/°C
INPUT NOISE	
Voltage	
0.05 Hz to 10Hz	3μV
10Hz to 1kHz	1μV rms
Current	
0.05Hz to 100Hz	5pA p-p
10Hz to 1kHz	10pA rms
FREQUENCY RESPONSE	
Small Signal, −3dB G = 1V/V to 10V/V	1kHz
Full Power, 10V p-p Output	
Gain = 1V/V	500Hz
Gain = 10V/V	500Hz
Recovery Time, to ±100μV after application of ±600Vpk differential input pulse	50ms
OFFSET VOLTAGE, REFERRED TO INPUT	
Initial, @ +25°C	±(1 + 5/G)mV
vs. Temperature (0 to +70°C)	
Gain = 1V/V (μV/°C max.)	±65
Gain = 100V/V (μV/°C max.)	±15
At other Gains (μV/°C max.)	±(15 + 50/G)
vs. Supply Voltage	±(1 + 50/G)μV/V
RATED OUTPUT	
Voltage, 50kΩ Load	±10V min.
Output Impedance	1kΩ
Max. CMV, Output Common to Power Common, Peak AC or DC Continuous	±50V pk
ISOLATED POWER OUTPUTS	
Voltage, ±5 mA Load	±15 VDC
Accuracy	±5%
Current	±15 mA min.
Regulation, NL to FL	+0, −3%
Ripple, 100kHz Bandwidth	100m V p-p
POWER SUPPLY, SINGLE POLARITY	
Voltage, Rated Performance	+15VDC, ±.5V
Voltage, Operating	+ (8 to 15.5) VDC
Current, Quiescent	+20mA
Current, Full Load	50mA
External Sync Freq.	33 to 37 kHz, 5VDC @ 50% duty cycle
TEMPERATURE RANGE	
Rated Performance	0 to +70°C
Storage	−55°C to +85°C
CASE DIMENSIONS	1.5″ x 1.5″ x 0.62″
NOMINAL WEIGHT	1.3 ounces
MATING SOCKET	S134

IA284 LOW COST, HIGH-LINEARITY ISOLATION AMPLIFIER

Fully Compatible with 10-Bit Data Acquisition Systems

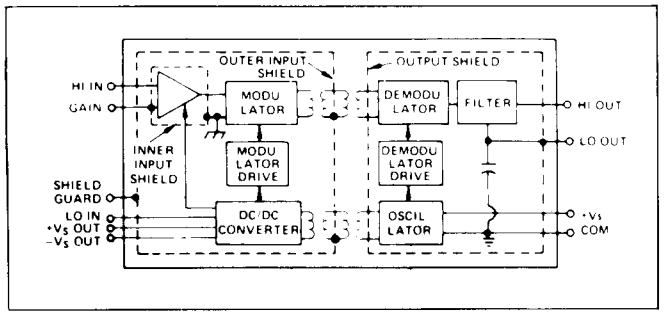


FEATURES

- **Linearity: 0.025% Peak, Typical**
- **2500 V Input/Output Isolation**
- **126 dB Common-Mode Rejection**
- **10:1 Programmable Gain**

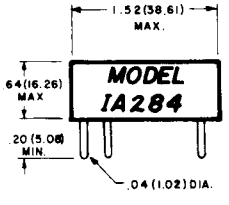
The Model IA284 Isolation Amplifier is an ultra-compact module offering high linearity, 2500-Volt input/output isolation, 126 dB common-mode rejection, programmable gain and a floating internal supply for powering an external transducer. Its .1% linearity assures compatibility with 10-bit data acquisition systems, and input voltage noise is held to 1 V, 10 Hz to 1 kHz, with 10 pA maximum current noise for the same range. An independent ± 15 VDC, ± 15 mA supply in the input section, with the same voltage isolation as the input, can be used to power an external transducer or preamplifier.

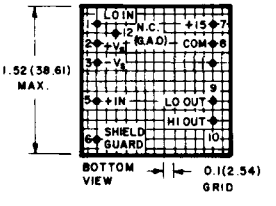
BLOCK DIAGRAM IA284



CONNECTION NOTES:

1. Gain Adjustment Resistor (R_g) is connected between GAIN and LO-IN pins.
2. If no output-offset adjustment is required, connect LO-OUT to COMMON pin. Otherwise, consult factory.





CHARACTERISTICS

(Typical, @ 25°C, V_S = +15 VDC unless otherwise noted.)

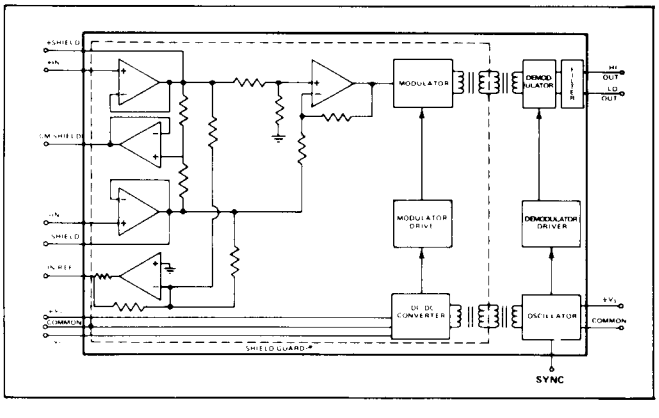
	IA284
GAIN (Non-Inverting)	
Range (50kΩ Load)	1 to 10 V/V
Formula	Gain = $(1 + \frac{100k\Omega}{10.7k\Omega + Rg})$
Deviation from Formula	±3%
vs. Temperature (0 to +70°C)	±0.015%/°C
Nonlinearity, G = 1V/V to 10V/V	@ ±5V, ±0.025% @ ±10V, ±0.1% @ ±10V, ±0.2% max.
INPUT VOLTAGE RATING	
Linear Differential Range, G = 1V/V	±10V min.
Max. Safe Differential Input	
Continuous	240V rms
Pulse, 10ms Duration, 1 pulse/10 sec	6500V pk max.
Max. CMV, Inputs to Outputs	
AC, 60 Hz, 1 Minute duration	2500V rms
Pulse, 10ms duration, 1 pulse/10 sec	±2500Vpk max.
With 510kΩ in series with Guard	±5000Vpk max.
Continuous, AC or DC	±2500Vpk max.
CMR, Inputs to Outputs, 60 Hz, R_S<5kΩ	
Balanced Source Impedance	126dB
5KΩ Source Imbalance	120dB
CMR, Inputs to Guard, 60 Hz	
1kΩ Source Imbalance	80db
Max. Leakage Current, Inputs to Power	
Common @ 115 VAC, 60 Hz	1.2μA rms max.
INPUT IMPEDANCE	
Differential	10^4Ω‖ 30pF
Overload	390kΩ
Common Mode	5 x 10^9Ω‖20 pF
INPUT DIFFERENCE CURRENT	
Initial, @ + 25°C	±2nA
vs. Temperature (0 to +70°C)	±0.01nA/°C
INPUT NOISE	
Voltage	
0.05 Hz to 10Hz	8μV
10Hz to 1kHz	10μV rms
Current	
0.05Hz to 100Hz	5pA p-p
10Hz to 1kHz	10pA rms
FREQUENCY RESPONSE	
Small Signal, −3dB G = 1V/V to 10V/V	1kHz
Full Power, 10V p-p Output	
Gain = 1V/V	500Hz
Gain = 10V/V	500Hz
Recovery Time, to ±100μV after application of ±600Vpk differential input pulse	50ms
OFFSET VOLTAGE, REFERRED TO INPUT	
Initial, @ +25°C	±(1 + 5/G)mV
vs. Temperature (0 to +70°C)	
Gain = 1V/V (μV/°C max.)	±65
Gain = 100V/V (μV/°C max.)	±15
At other Gains (μV/°C max.)	±(15 + 50/G)
vs. Supply Voltage	±(1 + 50/G)μV/V
RATED OUTPUT	
Voltage, 50kΩ Load	±10V min.
Output Impedance	1kΩ
Max. CMV, Output Common to Power Common, Peak AC or DC Continuous	±50V pk
ISOLATED POWER OUTPUTS	
Voltage, ±5 mA Load	±15 VDC
Accuracy	±5%
Current	±15 mA min.
Regulation, NL to FL	+0, −15%
Ripple, 100kHz Bandwidth	100m V p-p
POWER SUPPLY, SINGLE POLARITY	
Voltage, Rated Performance	+15 VDC, ±.5V
Voltage, Operating	+(8 to 15.5) VDC
Current, Quiescent	+20mA
TEMPERATURE RANGE	
Rated Performance	0 to +70°C
Storage	−55°C to +85°C
CASE DIMENSIONS	1.5" x 1.5" x 0.62"
NOMINAL WEIGHT	1.3 ounces
MATING SOCKET	S134

IA294
MEDICAL ISOLATION AMPLIFIER
LOW NOISE, WITH ACTIVE INPUT REFERENCE AND SHIELD DRIVES

FEATURES
- **UL component recognized**
- **True instrumentation front-end**
- **Active input reference**
- **Active shield drives**
- **Low noise: 8 μv P-P, .05 to 100 Hz.**
- **High CMRR: 126 dB input to output, 120 dB input to guard**
- **Isolated Power: ±15V @ 15 mA**
- **Small size: 2″ x 3 ″**
- **External Sync capability for multi-channel monitors**

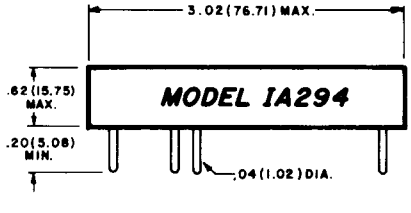
The Model IA294 Isolation Amplifier features small size, low noise, high common mode rejection, active guard and shield drives. CMRR is 126 dB input to output with balanced source impedance. CMRR from input to active input reference is 120 dB. This Isolation Amplifier contains most of the front-end circuitry that is found in monitor and diagnostic ECG's. The IA294 has a true instrumentation front-end for high CMRR, active right leg drive, sync capability for multichannel use, isolated power (±15 V @ 15 mA) and separate active drives for either, individual shielded inputs or a common outer shield. This model also features 6500 V input to output protection and 6500 V differential input protection for defibrillators. Input to output leakage current is less than 10 μA.

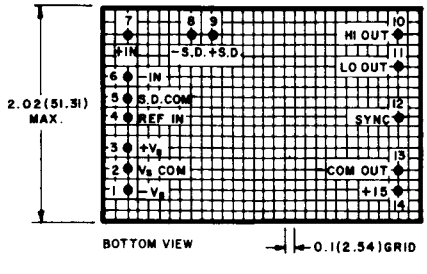
BLOCK DIAGRAM (IA294)



CHARACTERISTICS
(Typical @ 25 °C, V_S = +15 VDC unless otherwise noted.)

GAIN (NON-INVERTING)	10 V/V
ACCURACY	±2%
vs. Temperature	±.01%/°C
Non-Linearity	±0.1%
Differential Input Impedance	3 x 10^8Ω‖3pF
Common-Mode Input Impedance	5 x 10^{10}Ω‖20pF
INPUT VOLTAGE	±1 V min.
Max. Safe Differential Input	±240 V rms
Pulse, 10 ms Duration	±6500 V peak
Max. Safe Common Mode Input (DC cont.)	±5000 VDC
INPUT BIAS CURRENT	±2 nA
vs. Temperature	±.02 nA/°C
SAFETY CURRENT LIMITS	10μA max.
INPUT NOISE (5 K UNBALANCE)	
Voltage .05 to 100 Hz, pp	8μV
Voltage 10 Hz to 1 kHz, rms	5μV
Current .05 Hz to 1 kHz, rms	10 pA
COMMON MODE REJECTION	
Input to Output, CMV = 115 VAC, 60 Hz	
Balanced Source Impedance	126 dB
5kΩ Source Imbalance	120 db
Two Inputs to Input Reference	
CMV = 10V p-p, 60 Hz	
5kΩ Source Imbalance	120 dB
OUTPUT	
Range (50kΩ Load)	±10 V
Output Impedance	1 kΩ
Max. CMV, Outputs to power common	±30 V peak
Offset voltage referred to input	±5 mV
vs. Temperature (0° to 70°C)	±100μV/°C
vs. Supply Voltage	±20 μV/%
FREQUENCY RESPONSE	
Small Signal, −3 dB	1 kHz
Full Power, 6 V pp	500 Hz
Overload Recovery	20 msec
ISOLATED POWER OUTPUT	
Voltage, ±10 mA load	±15 VDC
Accuracy	±5%
Current, min.	±15 mA
NOMINAL WEIGHT	8 ounces
POWER SUPPLY, SINGLE POLARITY	
Voltage Rated Performance	±14.5 to +16 VDC
Current, Quiescent	+40 mA
TEMPERATURE RANGE	
Rated Performance	0°C to 70°C
Storage	−25°C to +85°C
SOCKET	S135





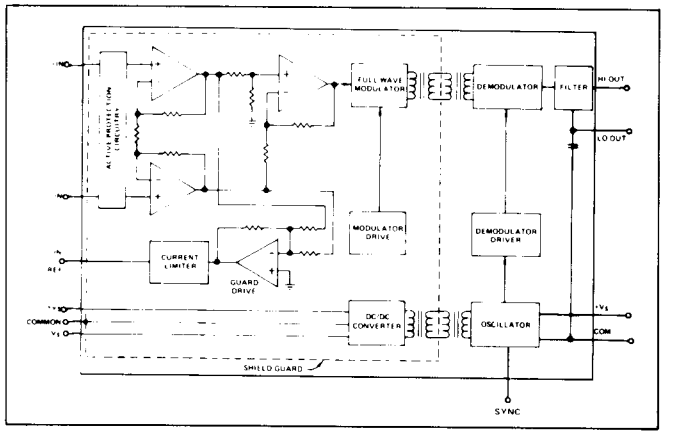
IA296
ULTRA LOW NOISE TRUE INSTRUMENTATION MEDICAL ISOLATION AMPLIFIER

FEATURES

- **UL Component Recognized**
- **Ultra Low Noise**
- **Failure of any internal component results in < 10 μA bias current**
- **Excellent CMRR: 170 dB; 160 dB with 5 kΩ source imbalance**
- **External Sync Capability**

The Model IA296 Isolation Amplifier features very high input/output isolation and very low noise. It can operate at common mode input voltages up to 5000 VDC continuous; CMRR is 170 dB with balanced source impedance, and 160 dB with 5 kΩ source imbalance. Input voltage noise is held to 0.3 μV, 10 Hz-1 kHz rms, and current noise to 4 pA, 0.5 Hz-1 kHz rms. Input bias current is only 200 pA, and on the failure of any component is limited to 10 μA. An independent ±12 VDC, 10 mA supply in the input section with the same voltage isolation as the amplifier input, is used to power optional external circuitry.

BLOCK DIAGRAM IA296



CHARACTERISTICS

(Typical @ 25 °C, V_S = +15 VDC unless otherwise noted.)

GAIN (NON-INVERTING)	10 V/V
ACCURACY	±2%
vs. Temperature	±0.015%/°C
Non-Linearity	±0.1%
Differential Input Impedance	3 x 10^8Ω‖ 2.2 nF
Common-Mode Input Impedance	10^{11}Ω‖ 10 pF
INPUT VOLTAGE	±0.5 V min.
Max. Safe Differential Input	±30 V rms
Pulse, 10 ms Duration	±500 V peak
Max. Safe Common Mode Input (DC cont.)	±5000 VDC
INPUT BIAS CURRENT	±200 pA
vs. Temperature	±5 pA/°C
SAFETY CURRENT LIMITS	10μA max.
INPUT NOISE (5 K unbalance)	
Voltage .05 to 100 Hz, pp	1.5μV
Voltage 10 Hz to 1 kHz, rms	0.3μV
Current .05 Hz to 1 kHz, rms	4 pA
COMMON MODE REJECTION	
Input to Output, CMV = 115 VAC, 60 Hz	
Balanced Source Impedance	170 dB
5kΩ Source Imbalance	160 db
Input to Reference, CMV = 10V p-p, 60 Hz	
5 kΩ Source Imbalance	120 dB
OUTPUT	
Range (50kΩ Load)	±5 V
Output Impedance	1 kΩ
Max. CMV, Outputs to power common	±30 V peak
Offset voltage referred to input	±5 mV
vs. Temperature (0° to 70°C)	±100μV/°C
vs. Supply Voltage	±20 μV/%
FREQUENCY RESPONSE*	
Small Signal, −3 dB,	1 kHz
Full Power, 6 V pp	500 Hz
Overload Recovery	20 msec
ISOLATED POWER OUTPUT	
Voltage, ±10 mA load	±12 VDC
Accuracy	±10%
Current	±10 mA
POWER SUPPLY, SINGLE POLARITY	
Voltage Rated Performance	±14.5 to +16 VDC
Current, Quiescent	+40 mA
TEMPERATURE RANGE	
Rated Performance	0°C to 70°C
Storage	−25°C to +85°C
NOMINAL WEIGHT	8 ounces
SOCKET	S132

*For 10kHz bandwidth specify P/N IA297 when consulting factory.