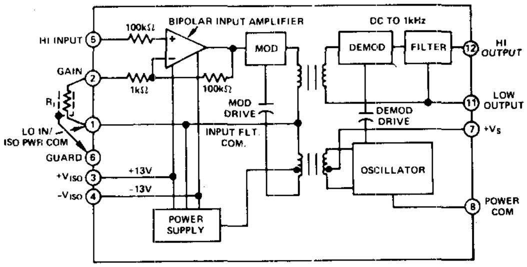
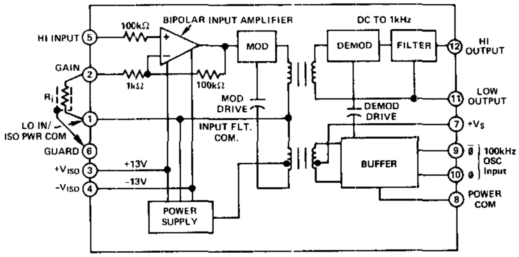


MODEL 290A

	Page
Isolated Power Supply: ±13V dc @ ±5mA (290A)	Vol. II 5-21
Low Nonlinearity: 0.1% @ 10V pk-pk Output	
High Gain Stability: 0.001%/1000 Hours; 0.01%/°C	
Small Size: 1.5" × 1.5" × 0.62"	
Low Input Offset Voltage Drift: 10μV/°C (Gain = 100V/V)	
Wide Input/Output Dynamic Range: 20V pk-pk	
High CMV Isolation: 1500V dc, Continuous	
Wide Gain Range: 1 to 100V/V	

5



MODEL 292A

Multichannel Capability Using External Oscillator (292A)	Vol. II 5-21
Isolated Power Supply: ±15mA (292A)	
Low Nonlinearity: 0.1% @ 10V pk-pk Output	
High Gain Stability: 0.001%/1000 Hours; 0.01%/°C	
Small Size: 1.5" × 1.5" × 0.62"	
Low Input Offset Voltage Drift: 10μV/°C (Gain = 100V/V)	
Wide Input/Output Dynamic Range: 20V pk-pk	
High CMV Isolation: 1500V dc, Continuous	
Wide Gain Range: 1 to 100V/V	

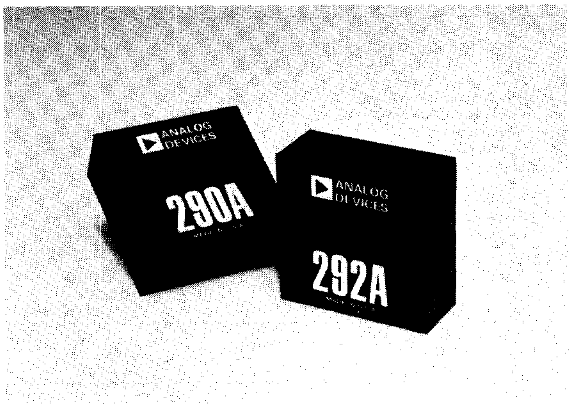
ANALOG DEVICES

Low Cost, Single and Multichannel Isolation Amplifier

MODELS 290A, 292A

FEATURES
Low Cost
Multichannel Capability Using External Oscillator (292A)
Isolated Power Supply: ±13V dc @ ±5mA (290A) or ±15mA (292A)
Low Nonlinearity: 0.1% @ 10V pk-pk Output
High Gain Stability: 0.001%/1000 Hours; 0.01%/°C
Small Size: 1.5" X 1.5" X 0.62"
Low Input Offset Voltage Drift: 10μV/°C (Gain = 100V/V)
Wide Input/Output Dynamic Range: 20V pk-pk
High CMV Isolation: 1500V dc, Continuous
Wide Gain Range: 1 to 100V/V

APPLICATIONS
Ground Loop Elimination in Industrial and Process Control
High Voltage Protection in Data Acquisition Systems
Off-Ground Signal Measurements



GENERAL DESCRIPTION

Models 290A and 292A are low cost, compact, isolation amplifiers that are optimized for single and multichannel industrial applications, respectively. The model 290A has a self-contained oscillator and is intended for single channel applications. A single external synchronizing oscillator can drive up to 16 model 292As or, a virtually limitless number of model 292As can be configured using multiple oscillators. The user can supply the external oscillator circuit or specify model 281 oscillator module, which includes a voltage regulator for operation over a wide single supply voltage range of +8V to +28V.

Models 290A and 292A design features include: adjustable gain, from 1 to 100V/V, dual isolated power, ±13V dc, ±1500V dc off ground isolation, 100dB minimum CMR at 60Hz, 1kΩ source imbalance, in a compact 1.5" X 1.5" X 0.6" module. Models 290A and 292A achieve low input noise of 1μV pk-pk (10Hz bandwidth, G = 100V/V), nonlinearity of ±0.1% @ 10V pk-pk output, and an input/output dynamic range of 20V pk-pk.

Using modulation techniques with reliable transformer isolation, models 290A and 292A will interrupt ground loops, leakage paths, and voltage transients, while providing dc to 2kHz (−3dB) response.

WHERE TO USE MODELS 290A AND 292A

Industrial Applications: In data acquisition systems, computer interface systems, process signal isolators and high CMV instrumentation, models 290A and 292A offer complete galvanic isolation and protection against damage from transients and fault voltages. High level transducer interface capability is afforded with 20V pk-pk input signal range at a gain of 1V/V operation. In portable single or multichannel designs, single power supply operation (+8V to +16V) enables battery operation.

DESIGN FEATURES AND USER BENEFITS

Isolated Power: Dual ±13V dc output, completely isolated from the input power terminals (±1500V dc isolation), provides the capability to excite floating signal conditioners, front end buffer amplifiers and remote transducers such as thermistors or bridges.

Adjustable Gain: Models 290A and 292A adjustable gain offers compatibility with a wide class of input signals. A single external resistor enables gain adjustment from 1V/V to 100V/V providing flexibility in both high level transducer interfacing as well as low level sensor measurement applications.

Floating, Guarded Front-End: The input stage of models 290A and 292A can directly accept floating differential signals or it may be configured as a high performance instrumentation front-end to accept signals having CMV with respect to input power common.

High Reliability: Models 290A and 292A are conservatively designed, compact modules, capable of reliable operation in harsh environments. They have a calculated MTBF of over 400,000 hours and are designed to meet MIL-STD-202E environmental testing as well as the IEEE Standard for Transient Voltage Protection (472-1974: Surge Withstand Capability).

For detailed information, contact factory.

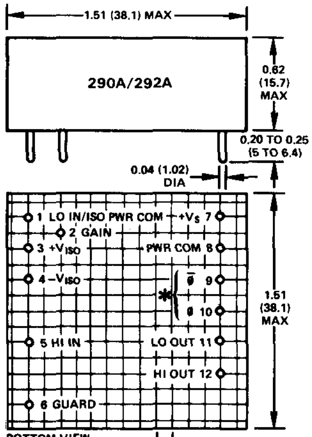
SPECIFICATIONS (typical @ +25°C; G = 100V/V and V_S = +15V dc, unless otherwise noted)

MODEL	290A		292A
GAIN (NONINVERTING)			
Range (50kΩ Load)		1 to 100V/V	
Formula		$\text{Gain} = \left[1 + \frac{100k\Omega}{1k\Omega + R_i\,(k\Omega)}\right]$	
Deviation from Formula		±3%	
vs. Time		±0.001%/1000 Hours	
vs. Temperature (–25°C to +85°C)[1]		±0.0075%/°C	
Nonlinearity, G = 1V/V to 100V/V[2]		±0.1% (±0.25%)[3]	
INPUT VOLTAGE RATINGS			
Linear Differential Range, G = 1V/V		±5V min (±10V min)[3]	
Max Safe Differential Input			
Continuous, 1 min		110V rms	
Max CMV, Inputs to Outputs			
ac, 60Hz, 1 Minute Duration		1500V rms max	
Continuous, ac		±1000V pk max	
Continuous, dc		±1500V pk max	
CMR, Inputs to Outputs, 60Hz, $R_S \leq 1k\Omega$			
Balanced Source Impedance		106dB	
1kΩ Hi In Lead Only		100dB min	
Max Leakage Current, Inputs to Power Common			
@ 115V ac, 60Hz		10μA rms max	
INPUT IMPEDANCE			
Differential		$10^8\,\Omega \| 70pF$	
Overload		100kΩ	
Common Mode		$5 \times 10^{10}\,\Omega \| 100pF$	
INPUT DIFFERENCE CURRENT			
Initial, @ +25°C		+3nA	
vs. Temperature (–25°C to +85°C)		±0.1nA/°C	
INPUT NOISE			
Voltage, G = 100V/V			
0.01Hz to 10Hz		1μV p-p	
10Hz to 1kHz		1.5μV rms	
Current			
0.05Hz to 100Hz		5pA p-p	
FREQUENCY RESPONSE			
Small Signal, –3dB, G = 1V/V		2.5kHz	
Slew Rate		50mV/μs	
Full Power, 10V p-p Output			
Gain - 1V/V thru 100V/V	2.0kHz(1.0kHz)[3]		3.0kHz(1.0kHz)[3]
OFFSET VOLTAGE REFERRED TO INPUT			
Initial, @ +25°C, Adjustable to Zero		±(5 + 50/G)mV	
vs. Temperature (–25°C to +85°C)	±(10 + 150/G)μV/°C		±(8 + 250/G)μV/°C
vs. Supply Voltage		±1mV/%	
RATED OUTPUT			
Voltage, 50k Load		±5V min (±10V min)[3]	
Output Impedance		1kΩ	
Output Ripple, 1MHz Bandwidth		10mV pk-pk	
OSCILLATOR DRIVE INPUT			
Input Voltage	N/A		8 to 16V pk-pk
Input Frequency	N/A		100kHz ±5%, max
ISOLATED POWER OUTPUTS			
Voltage Full Load		±13V dc	
Accuracy		±5%	
Current[4]	±5mA min		±15mA min
Regulation, No Load to Full Load		+0, –15%	
Ripple, 100kHz Bandwidth	200mV p-p		250mV p-p
POWER SUPPLY, SINGLE POLARITY			
Voltage, Rated Performance		+15V dc	
Voltage, Operating		+8V dc to +15.5V dc	
Current, Quiescent		+20mA	
TEMPERATURE RANGE			
Rated Performance		–25°C to +85°C	
Storage		–55°C to +85°C	
CASE DIMENSIONS		1.5" X 1.5" X 0.62"	

NOTES
[1] Gain temperature drift is specified as a percentage of output signal level.
[2] Gain nonlinearity is specified as a percentage of 10V pk-pk output span.
[3] These specs apply for a 20V pk-pk output span.
[4] Do not load V_{ISO} when operating at output spans greater than 10V pk-pk.
Specifications subject to change without notice.

OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).



BOTTOM VIEW
WEIGHT: 40 Grams
GRID 0.1 (2.54)
*PINS 9 AND 10 NOT PRESENT ON 290A

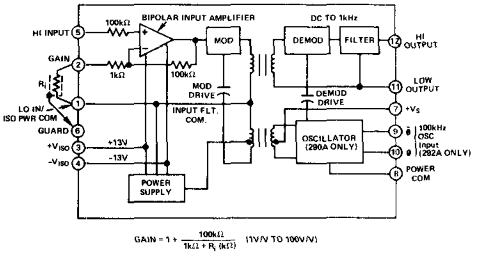


Figure 1. Block Diagram – Models 290A and 292A

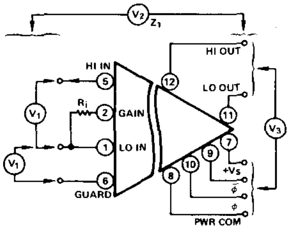


Figure 2. Model 290A and 292A Terminal Ratings

Symbol	Rating	Remarks
V_1	±110V rms (cont.)	Withstand Voltage, Steady State
V_2	±1000V pk (cont.)	Isolation, Steady State, ac
V_2	±1500V pk (cont.)	Isolation, Steady State, dc
V_2	±1500V rms (1 min)	Isolation, ac, 60Hz
V_3	±50V pk (cont.)	Isolation, dc
Z_1	50GΩ‖20pF	Isolation Impedance

Table I. Isolation Ratings Between Terminals

CAUTION:
ESD (Electro-static-discharge) sensitive device. Permanent damage may occur on unconnected devices subjected to high-energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. The protective foam should be discharged to the destination socket before devices are removed.

WARNING!
ESD SENSITIVE DEVICE

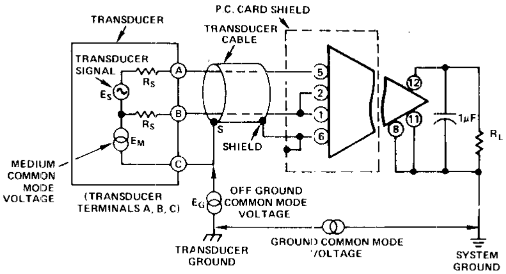
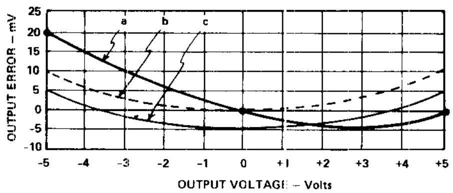


Figure 3. Transducer – Amplifier Interface

GAIN AND OFFSET TRIM PROCEDURE

In applying the isolation amplifier, highest accuracy is achieved by adjustment of gain and offset voltage to minimize the peak error encountered over the selected output voltage span. The following procedure illustrates a calibration technique which can be used to minimize output error. In this example, the output span is +5V to -5V and operation at Gain = 10V/V is desired.

1. Apply E_{IN} = 0 volts and adjust R_O for E_O = 0 volts.
2. Apply E_{IN} = +0.5V dc and adjust R_G for E_O = +5.0V dc.
3. Apply E_{IN} = -0.5V dc and measure the output error (see curve a).
4. Adjust R_G until the output error is one half that measured in step 3 (see curve b).
5. Apply +0.5V dc and adjust R_O until the output error is one half that measured in step 4 (see curve c).



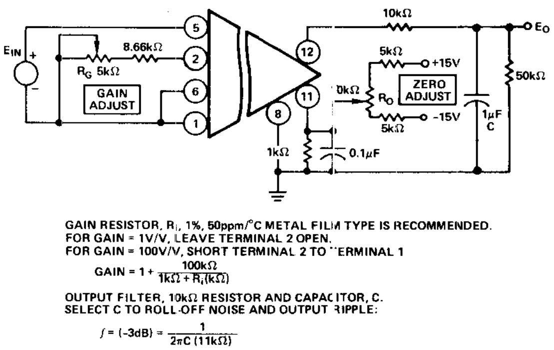


Figure 4. Gain and Offset Adjustment

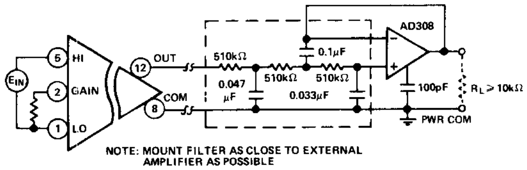


Figure 5. Selecting Bandwidth with a 3-Pole 5Hz Active Filter for Improved 60Hz Noise Reduction (typ 150dB @ 60Hz and 1kΩ Imbalance)

PERFORMANCE CHARACTERISTICS

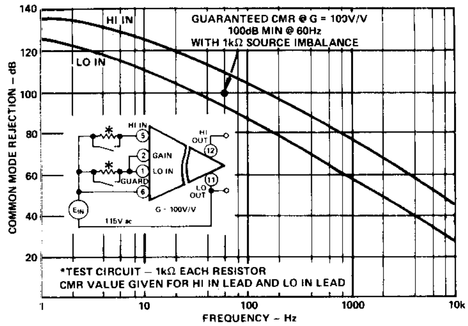


Figure 6. Typical Common Mode Rejection vs. Frequency

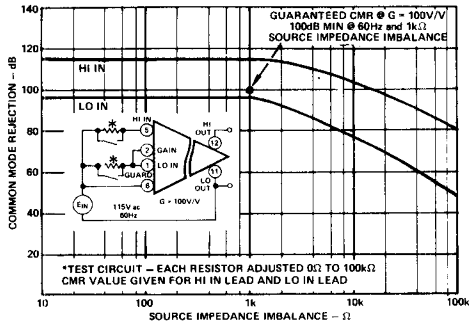


Figure 7. Typical Common Mode Rejection vs. Source Impedance Imbalance

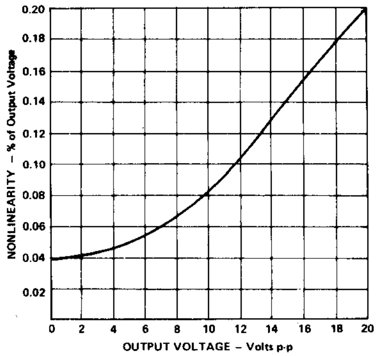


Figure 8. Typical Gain Nonlinearity vs. Output Voltage

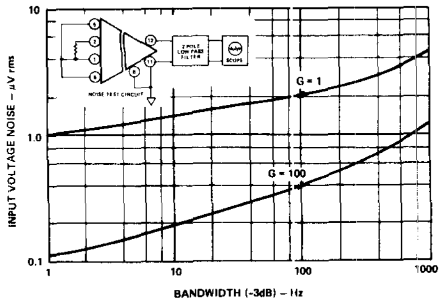


Figure 9. Typical Input Voltage Noise vs. Bandwidth

Input Offset Voltage Drift: Total input drift is composed of two sources, input and output stage drifts and is gain dependent. The curve of Figure 10 illustrates total input drift over the gain range of 1 to 100V/V.

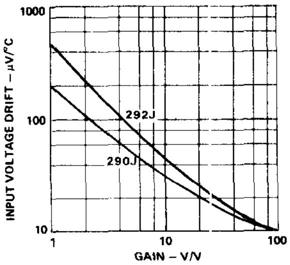
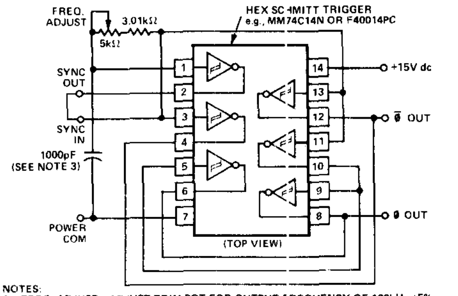


Figure 10. Typical Input Offset Voltage Drift vs. Gain

REFERENCE EXCITATION OSCILLATOR, MODEL 281

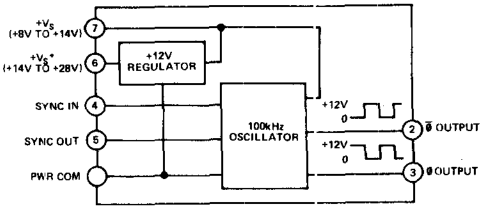
When applying model 292A, the user has the option of building a low cost 100kHz excitation oscillator, as shown in Figure 11, or purchasing a module from Analog Devices–model 281.



NOTES:
1. FREQ. ADJUST: ADJUST TRIM POT FOR OUTPUT FREQUENCY OF 100kHz ±5%.
2. FOR SLAVE OPERATION, REMOVE JUMPER FROM SYNC OUT AND SYNC IN PINS.
3. USE CERAMIC CAPACITOR, "COG" OR "NPO" CHARACTERISTIC.

Figure 11. 100kHz Oscillator Interconnection Diagram

The block diagram of model 281 is shown in Figure 12. An internal +12V dc regulator is provided to permit the user the option of operating over two, pin selectable, power input ranges; terminal 6 offers a range of +14V dc to +28V dc; terminal 7 offers an input range of +8V dc to +14V dc.



*LEAVE TERMINAL 6 OPEN, WHEN POWER IS APPLIED TO TERMINAL 7.

Figure 12. Model 281 Block Diagram

Model 281 oscillator is capable of driving up to 16 model 292As. As shown in Figure 13, an additional model 281 may be driven in a slave-mode to expand the total system channels from 16 to 32. By adding additional model 281s in this manner, systems of over 1000 channels may be easily configured.

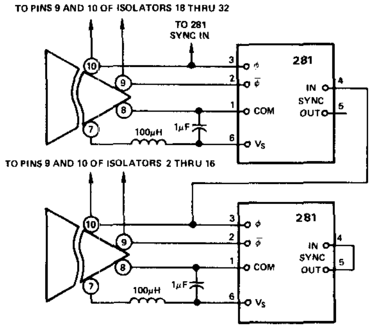


Figure 13. External Oscillator Interconnection

SPECIFICATIONS
(typical @ +25°C and V_S = +15V dc unless otherwise noted)

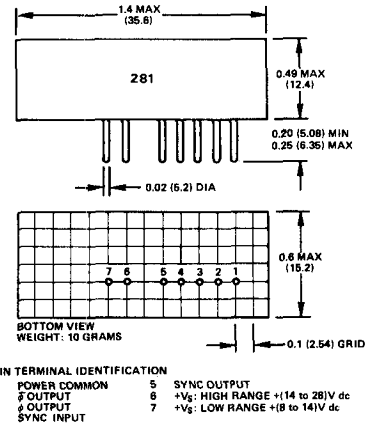
MODEL	281
OUTPUT	
Frequency	100kHz ±5%
Waveform	Squarewave
Voltage (ϕ and $\bar{\phi}$ terminals)	0 to +12V pk
Fan-Out[1,2]	16 max
POWER SUPPLY RANGE[3]	
High Input, Pin 6	+(14 to 28)V dc
Quiescent Current, N.L.	+5mA
F.L.	+16mA
Low Input, Pin 7	+(8 to 14)V dc
Quiescent Current, N.L.	+12mA
F.L.	+33mA
TEMPERATURE	
Rated Performance	0 to +70°C
Storage	-55°C to +85°C

NOTES
[1] Model 292A oscillator drive input represents unity oscillator load.
[2] For applications requiring more than 16 292As, additional 281s may be used in a master/slave mode. Refer to Figure 13.
[3] Full load consists of 16 model 292As and 281 oscillator slave.

Specifications subject to change without notice.
See Caution note on specifications table.

OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).



PIN TERMINAL IDENTIFICATION

1	POWER COMMON	5	SYNC OUTPUT
2	$\bar{\phi}$ OUTPUT	6	+Vs: HIGH RANGE +(14 to 28)V dc
3	ϕ OUTPUT	7	+Vs: LOW RANGE +(8 to 14)V dc
4	SYNC INPUT		

MATING SOCKET:
CINCH #16 DIP OR EQUIVALENT