

FEATURES

EASY TO USE

Pin-Strappable Gains of 10 & 100

All Errors Specified for Total System Performance

Higher Performance than Discrete In-Amp Designs

Available in 8-Pin DIP and SOIC

Low Power, 1.3 mA max Supply Current

Wide Power Supply Range (± 2.3 V to ± 18 V)

EXCELLENT DC PERFORMANCE

0.15% max, Total Gain Error

± 5 ppm/ $^{\circ}$ C, Total Gain Drift

125 μ V max, Total Offset Voltage

1.0 μ V/ $^{\circ}$ C max, Offset Voltage Drift

LOW NOISE

9 nV/ $\sqrt{\text{Hz}}$, @ 1 kHz, Input Voltage Noise

0.28 μ V p-p Noise (0.1 Hz to 10 Hz)

EXCELLENT AC SPECIFICATIONS

800 kHz Bandwidth (G = 10), 200 kHz (G = 100)

12 μ s Settling Time to 0.01%

APPLICATIONS

Weigh Scales

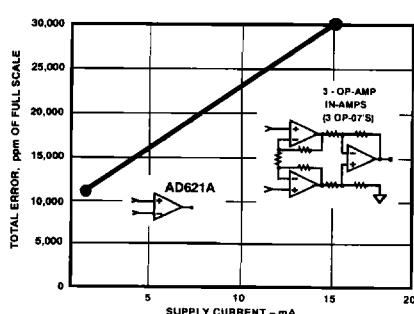
Transducer Interface & Data Acquisition Systems

Industrial Process Controls

Battery Powered and Portable Equipment

PRODUCT DESCRIPTION

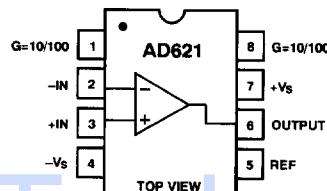
The AD621 is an easy to use, low cost, low power, high accuracy instrumentation amplifier which is ideally suited for a wide range of applications. Its unique combination of high performance, small size and low power, outperforms discrete in amp implementations. High functionality, low gain errors and low gain drift errors are achieved by the use of internal gain setting resistors. Fixed gains of 10 and 100 can be easily set via external pin strapping. The AD621 is fully specified as a total system, therefore, simplifying the design process.



Three Op Amp IA Designs vs. AD621

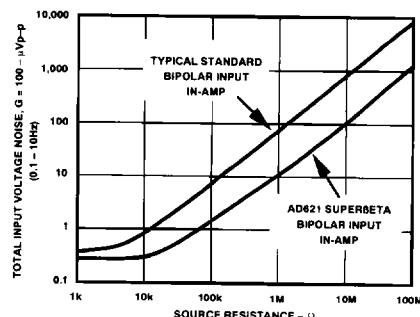
CONNECTION DIAGRAM

8-Pin Plastic Mini-DIP (N),
Cerdip (Q) and SOIC (R) Packages



For portable or remote applications, where power dissipation, size and weight are critical, the AD621 features a very low supply current of 1.3 mA max and is packaged in a compact 8-pin SOIC, 8-pin plastic DIP or 8-pin cerdip. The AD621 also excels in applications requiring high total accuracy, such as precision data acquisition systems used in weigh scales and transducer interface circuits. Low maximum error specifications including nonlinearity of 10 ppm, gain drift of 5 ppm/ $^{\circ}$ C, 50 μ V offset voltage and 0.6 μ V/ $^{\circ}$ C offset drift ("B" grade), make possible total system performance at a lower cost than has been previously achieved with discrete designs or with other monolithic instrumentation amplifiers.

When operating from high source impedances, as in ECG and blood pressure monitors, the AD621 features the ideal combination of low noise and low input bias currents. Voltage noise is specified as 9 nV/ $\sqrt{\text{Hz}}$ at 1 kHz and 0.28 μ V p-p from 0.1 Hz to 10 Hz. Input current noise is also extremely low at 0.1 pA/ $\sqrt{\text{Hz}}$. The AD621 outperforms FET input devices with an input bias current specification of 1.5 nA max over the full industrial temperature range.



Total Voltage Noise vs. Source Resistance

This is an abridged data sheet. To obtain the most recent version or complete data sheet, call our fax retrieval system at 1-800-446-6212.

AD621—SPECIFICATIONS

Gain = 10 (typical @ +25°C, $V_S = \pm 15$ V, and $R_L = 2\text{ k}\Omega$ unless otherwise noted)

| Parameter | Conditions | AD621A | | | AD621B | | | AD621S ¹ | | | Units |
|--|---------------------------------|----------------|--------------|----------------|--------------|----------------|--------------|---------------------|--------------|--------------|--------------------------------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| GAIN | | | | | | | | | | | |
| Gain Error | $V_{OUT} = \pm 10$ V | | | 0.15 | | | 0.05 | | | 0.15 | % |
| Nonlinearity | $R_L = 2\text{ k}\Omega$ | 2 | 10 | ± 5 | 2 | 10 | ± 5 | 2 | 10 | ± 5 | ppm of FS |
| $V_{OUT} = -10$ V to +10 V | | -1.5 | | | -1.5 | | | -1 | | | ppm/ $^{\circ}\text{C}$ |
| Gain vs. Temperature | | | | | | | | | | | |
| TOTAL VOLTAGE OFFSET | | | | | | | | | | | |
| Offset (RTI) over Temperature | $V_S = \pm 15$ V | 75 | 250 | | 50 | 125 | | 75 | 250 | | μV |
| Average TC | $V_S = \pm 5$ V to ± 15 V | | 400 | | | 215 | | | 500 | | μV |
| Offset Referred to the Input vs. Supply (PSR) ² | $V_S = \pm 5$ V to ± 15 V | 1.0 | 2.5 | | 0.6 | 1.5 | | 1.0 | 2.5 | | $\mu\text{V}/^{\circ}\text{C}$ |
| $V_S = \pm 2.3$ V to ± 18 V | 95 | 120 | | 100 | 120 | | 95 | 120 | | | dB |
| TOTAL NOISE | | | | | | | | | | | |
| Voltage Noise, (RTI) | 1 kHz | 13 | 17 | | 13 | 17 | | 13 | 17 | | $\text{nV}/\sqrt{\text{Hz}}$ |
| RTI | 0.1 Hz to 10 Hz | 0.55 | | | 0.55 | 0.8 | | 0.55 | 0.8 | | $\mu\text{V p-p}$ |
| Current Noise | f = 1 kHz | 100 | | | 100 | | | 100 | | | $\text{fA}/\sqrt{\text{Hz}}$ |
| | 0.1 Hz–10 Hz | 10 | | | 10 | | | 10 | | | pA p-p |
| INPUT CURRENT | | | | | | | | | | | |
| Input Bias Current over Temperature | $V_S = \pm 15$ V | 0.5 | 2.0 | | 0.5 | 1.0 | | 0.5 | 2 | | nA |
| Average TC | | | 2.5 | | | 1.5 | | | 4 | | nA |
| Input Offset Current over Temperature | | 3.0 | | | 3.0 | | | 8.0 | | | pA/ $^{\circ}\text{C}$ |
| Average TC | | 0.3 | 1.0 | | 0.3 | 0.5 | | 0.3 | 1.0 | | nA |
| | | | 1.5 | | | 0.75 | | | 2.0 | | nA |
| | | | | | | 1.5 | | | 8.0 | | pA/ $^{\circ}\text{C}$ |
| INPUT | | | | | | | | | | | |
| Input Impedance | | | | | | | | | | | |
| Differential | | 10 2 | | | 10 2 | | | 10 2 | | | $\text{G}\Omega/\text{pF}$ |
| Common-Mode | | 10 2 | | | 10 2 | | | 10 2 | | | $\text{G}\Omega/\text{pF}$ |
| Input Voltage Range ³ over Temperature | $V_S = \pm 2.3$ V to ± 5 V | $-V_S + 1.9$ | $+V_S - 1.2$ | $-V_S + 1.9$ | $+V_S - 1.2$ | $-V_S + 1.9$ | | $+V_S - 1.2$ | $+V_S - 1.2$ | | V |
| | | $-V_S + 2.1$ | $+V_S - 1.3$ | $-V_S + 2.1$ | $+V_S - 1.3$ | $-V_S + 2.1$ | | $+V_S - 1.3$ | $+V_S - 1.3$ | | V |
| over Temperature | $V_S = \pm 5$ V to ± 18 V | $-V_S + 1.9$ | $+V_S - 1.4$ | $-V_S + 1.9$ | $+V_S - 1.4$ | $-V_S + 1.9$ | | $+V_S - 1.4$ | $+V_S - 1.4$ | | V |
| Common-Mode Rejection Ratio DC to 60 Hz with 1 k Ω Source Imbalance | | $-V_S + 2.1$ | $+V_S - 1.4$ | $-V_S + 2.1$ | $+V_S - 1.4$ | $-V_S + 2.1$ | | $+V_S - 1.4$ | $+V_S - 1.4$ | | V |
| $V_{CM} = 0$ V to ± 10 V | 93 | 110 | | 100 | 110 | | 93 | 110 | | | dB |
| OUTPUT | | | | | | | | | | | |
| Output Swing | $R_L = 10\text{ k}\Omega$, | | | | | | | | | | |
| over Temperature | $V_S = \pm 2.3$ V to ± 5 V | $-V_S + 1.1$ | $+V_S - 1.2$ | $-V_S + 1.1$ | $+V_S - 1.2$ | $-V_S + 1.1$ | | $+V_S - 1.2$ | $+V_S - 1.2$ | | V |
| over Temperature | | $-V_S + 1.4$ | $+V_S - 1.3$ | $-V_S + 1.4$ | $+V_S - 1.3$ | $-V_S + 1.6$ | | $+V_S - 1.3$ | $+V_S - 1.3$ | | V |
| Short Current Circuit | $V_S = \pm 5$ V to ± 18 V | $-V_S + 1.2$ | $+V_S - 1.4$ | $-V_S + 1.2$ | $+V_S - 1.4$ | $-V_S + 1.2$ | | $+V_S - 1.4$ | $+V_S - 1.4$ | | V |
| | | $-V_S + 1.6$ | $+V_S - 1.5$ | $-V_S + 1.6$ | $+V_S - 1.5$ | $-V_S + 1.6$ | | $+V_S - 1.5$ | $+V_S - 1.5$ | | V |
| ± 18 | | | | ± 18 | | | | ± 18 | | | mA |
| DYNAMIC RESPONSE | | | | | | | | | | | |
| Small Signal, -3 dB Bandwidth | | 800 | | | 800 | | | 800 | | | kHz |
| Slew Rate | 10 V Step | 0.75 | 1.2 | 12 | 0.75 | 1.2 | 12 | 0.75 | 1.2 | 12 | V/ μs |
| Settling Time to 0.01% | | | | | | | | | | | μs |
| REFERENCE INPUT | | | | | | | | | | | |
| R_{IN} | | 20 | | | 20 | | | 20 | | | k Ω |
| I_{IN} | $V_{IN}+, V_{REF} = 0$ | +50 | +60 | +50 | +60 | +50 | +60 | +50 | +60 | +50 | μA |
| Voltage Range | | $-V_S + 1.6$ | $+V_S - 1.6$ | $-V_S + 1.6$ | $+V_S - 1.6$ | $-V_S + 1.6$ | $+V_S - 1.6$ | $-V_S + 1.6$ | $+V_S - 1.6$ | $+V_S - 1.6$ | V |
| Gain to Output | | 1 ± 0.0001 | | 1 ± 0.0001 | | 1 ± 0.0001 | | 1 ± 0.0001 | | | |
| POWER SUPPLY | | | | | | | | | | | |
| Operating Range | | ± 2.3 | ± 18 | ± 2.3 | ± 18 | ± 2.3 | ± 18 | ± 2.3 | ± 18 | ± 18 | V |
| Quiescent Current over Temperature | $V_S = \pm 2.3$ V to ± 18 V | 0.9 | 1.3 | 1.1 | 1.6 | 0.9 | 1.3 | 0.9 | 1.3 | 1.6 | mA |
| | | | | | | | | | | | mA |
| TEMPERATURE RANGE | | | | | | | | | | | |
| For Specified Performance | | | | | | | | | | | |
| | | -40 to +85 | | | -40 to +85 | | | -55 to +125 | | | °C |

NOTES

¹See Analog Devices military data sheet for 883B tested specifications.

²This is defined as the supply range over which PSRR is defined.

³Input Voltage Range = CMV + (Gain × V_{DIFF}).

Specifications subject to change without notice.

Gain = 100 (typical @ +25°C, $V_S = \pm 15$ V, and $R_L = 2\text{k}\Omega$ unless otherwise noted)

| Parameter | Conditions | AD621A | | | AD621B | | | AD621S ¹ | | | Units |
|--|---|--------------|--------------|--------------|--------------|--------------|---------|---------------------|--------------|---------|------------------------------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| GAIN | | | | | | | | | | | |
| Gain Error | $V_{OUT} = \pm 10$ V | | | 0.15 | | | 0.05 | | | 0.15 | % |
| Nonlinearity | | | | | | | | | | | |
| $V_{OUT} = -10$ V to +10 V | $R_L = 2\text{k}\Omega$ | 2 | 10 | ± 5 | 2 | 10 | ± 5 | 2 | 10 | ± 5 | ppm of FS |
| Gain vs. Temperature | | | | | | | | | | | ppm/ $^{\circ}$ C |
| TOTAL VOLTAGE OFFSET | | | | | | | | | | | |
| Offset (RTI) | $V_S = \pm 5$ V to ± 15 V | 35 | 125 | | 25 | 50 | | 35 | 125 | | μ V |
| over Temperature | $V_S = \pm 5$ V to ± 15 V | | 185 | | | 215 | | | 225 | | μ V |
| Average TC | $V_S = \pm 5$ V to ± 15 V | 0.3 | 1.0 | | 0.1 | 0.6 | | 0.3 | 1.0 | | μ V/ $^{\circ}$ C |
| Offset Referred to the Input vs. Supply (PSR) ² | $V_S = \pm 2.3$ V to ± 18 V | 110 | 140 | | 120 | 140 | | 110 | 140 | | dB |
| TOTAL NOISE | | | | | | | | | | | |
| Voltage Noise, (RTI) | 1 kHz | 9 | 13 | | 9 | 13 | | 9 | 13 | | $\text{nV}/\sqrt{\text{Hz}}$ |
| RTI | 0.1 Hz to 10 Hz | 0.28 | | | 0.28 | 0.4 | | 0.28 | 0.4 | | μ V p-p |
| Current Noise | f = 1 kHz | 100 | | | 100 | | | 100 | | | $\text{fA}/\sqrt{\text{Hz}}$ |
| | 0.1 Hz–10 Hz | 10 | | | 10 | | | 10 | | | pA p-p |
| INPUT CURRENT | | | | | | | | | | | |
| Input Bias Current | $V_S = \pm 15$ V | 0.5 | 2.0 | | 0.5 | 1.0 | | 0.5 | 2 | | nA |
| over Temperature | | | 2.5 | | | 1.5 | | | 4 | | nA |
| Average TC | | 3.0 | | | 3.0 | | | 8.0 | | | pA/ $^{\circ}$ C |
| Input Offset Current | | 0.3 | 1.0 | | 0.3 | 0.5 | | 0.3 | 1.0 | | nA |
| over Temperature | | | 1.5 | | | 0.75 | | | 2.0 | | nA |
| Average TC | | 1.5 | | | 1.5 | | | 8.0 | | | pA/ $^{\circ}$ C |
| INPUT | | | | | | | | | | | |
| Input Impedance | | | | | | | | | | | |
| Differential | | 10 2 | | | 10 2 | | | 10 2 | | | |
| Common-Mode | | 10 2 | | | 10 2 | | | 10 2 | | | |
| Input Voltage Range ³ | $V_S = \pm 2.3$ V to ± 5 V | $-V_S + 1.9$ | $+V_S - 1.2$ | $-V_S + 1.9$ | $+V_S - 1.2$ | $-V_S + 1.9$ | | $+V_S - 1.2$ | $-V_S + 1.9$ | | $\text{G}\Omega/\text{pF}$ |
| over Temperature | | $-V_S + 2.1$ | $+V_S - 1.3$ | $-V_S + 2.1$ | $+V_S - 1.3$ | $-V_S + 2.1$ | | $+V_S - 1.3$ | $-V_S + 2.1$ | | $\text{G}\Omega/\text{pF}$ |
| Input Voltage Range ³ | $V_S = \pm 5$ V to ± 18 V | $-V_S + 1.9$ | $+V_S - 1.4$ | $-V_S + 1.9$ | $+V_S - 1.4$ | $-V_S + 1.9$ | | $+V_S - 1.4$ | $-V_S + 1.9$ | | $+V_S - 1.2$ V |
| over Temperature | | $-V_S + 2.1$ | $+V_S - 1.4$ | $-V_S + 2.1$ | $+V_S - 1.4$ | $-V_S + 2.1$ | | $+V_S - 1.4$ | $-V_S + 2.3$ | | $+V_S - 1.3$ V |
| Common-Mode Rejection Ratio DC to 60 Hz with 1 k Ω Source Imbalance | $V_{CM} = 0$ V to ± 10 V | 110 | 130 | | 120 | 130 | | 110 | 130 | | dB |
| OUTPUT | | | | | | | | | | | |
| Output Swing | $R_L = 10\text{k}\Omega$, $V_S = \pm 2.3$ V to ± 5 V | $-V_S + 1.1$ | $+V_S - 1.2$ | $-V_S + 1.1$ | $+V_S - 1.2$ | $-V_S + 1.1$ | | $+V_S - 1.2$ | $-V_S + 1.1$ | | $+V_S - 1.2$ V |
| over Temperature | | $-V_S - 1.4$ | $+V_S - 1.3$ | $-V_S - 1.4$ | $+V_S - 1.3$ | $-V_S - 1.6$ | | $+V_S - 1.3$ | $-V_S + 1.6$ | | $+V_S - 1.3$ V |
| over Temperature | $V_S = \pm 5$ V to ± 18 V | $-V_S + 1.2$ | $+V_S - 1.4$ | $-V_S + 1.2$ | $+V_S - 1.4$ | $-V_S + 1.2$ | | $+V_S - 1.4$ | $-V_S + 1.2$ | | $+V_S - 1.4$ V |
| Short Current Circuit | | $-V_S + 1.6$ | $+V_S - 1.5$ | $-V_S + 1.6$ | $+V_S - 1.5$ | $-V_S + 2.3$ | | $+V_S - 1.5$ | $-V_S + 2.3$ | | $+V_S - 1.5$ V |
| ± 18 | | | | ± 18 | | | | ± 18 | | | mA |
| DYNAMIC RESPONSE | | | | | | | | | | | |
| Small Signal, -3 dB Bandwidth | | | 200 | | 200 | | | 200 | | | |
| Slew Rate | | 0.75 | 1.2 | | 0.75 | 1.2 | | 0.75 | 1.2 | | kHz |
| Settling Time to 0.01% | 10 V Step | 0.75 | 1.2 | 12 | 0.75 | 1.2 | 12 | 0.75 | 1.2 | 12 | V/ μ s |
| μ s | | | | | | | | | | | |
| REFERENCE INPUT | | | | | | | | | | | |
| R_{IN} | | 20 | | | 20 | | | 20 | | | k Ω |
| I_{IN} | | +50 | +60 | | +50 | +60 | | +50 | +60 | | μ A |
| Voltage Range | $V_{IN^+}, V_{REF} = 0$ | $-V_S + 1.6$ | $+V_S - 1.6$ | $-V_S + 1.6$ | $+V_S - 1.6$ | $-V_S + 1.6$ | | $+V_S - 1.6$ | $-V_S - 1.6$ | | V |
| Gain to Output | | 1 ± 0.0001 | | | 1 ± 0.0001 | | | 1 ± 0.0001 | | | |
| POWER SUPPLY | | | | | | | | | | | |
| Operating Range | $V_S = \pm 2.3$ V to ± 18 V | ±2.3 | ±18 | | ±2.3 | ±18 | | ±2.3 | ±18 | | V |
| Quiescent Current over Temperature | | 0.9 | 1.3 | | 0.9 | 1.3 | | 0.9 | 1.3 | | mA |
| | | 1.1 | 1.6 | | 1.1 | 1.6 | | 1.1 | 1.6 | | mA |
| TEMPERATURE RANGE | | | | | | | | | | | |
| For Specified Performance | | | −40 to +85 | | | −40 to +85 | | | −55 to +125 | | °C |

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NOTES

¹See Analog Devices military data sheet for 883B tested specifications.²This is defined as the supply range over which PSRR is defined.³Input Voltage Range = CMV + (Gain × V_{DIFF}).

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS¹

| | | |
|--|-------|-----------------|
| Supply Voltage | | ± 18 V |
| Internal Power Dissipation ² | | 650 mW |
| Input Voltage | | $\pm V_S$ |
| Differential Input Voltage | | ± 25 V |
| Output Short Circuit Duration | | Indefinite |
| Storage Temperature Range (Q) | | -65°C to +150°C |
| Storage Temperature Range (N, R) | | -65°C to +125°C |
| Operating Temperature Range | | |
| AD621A, B | | -40°C to +85°C |
| AD621S ³ | | -55°C to +125°C |
| Lead Temperature Range (Soldering 10 seconds) | | +300°C |

NOTES

¹Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

²Specification is for device in free air:

8-Pin Plastic DIP Package: $\theta_{JA} = 95^\circ\text{C/Watt}$

8-Pin Cerdip Package: $\theta_{JA} = 110^\circ\text{C/Watt}$

8-Pin SOIC Package: $\theta_{JA} = 155^\circ\text{C/Watt}$

³See Analog Devices' military data sheet for 883B specifications.

ESD SUSCEPTIBILITY

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 volts, which readily accumulate on the human body and on test equipment, can discharge without detection. Although the AD621 features proprietary ESD protection circuitry, permanent damage may still occur on these devices if they are subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid any performance degradation or loss of functionality.

ORDERING GUIDE

| Model | Temperature Range | Package Description | Package Option ¹ |
|---------------------------|-------------------|---------------------|-----------------------------|
| AD621AN | -40°C to +85°C | 8-Pin Plastic DIP | N-8 |
| AD621BN | -40°C to +85°C | 8-Pin Plastic DIP | N-8 |
| AD621AR | -40°C to +85°C | 8-Pin Plastic SOIC | R-8 |
| AD621BR | -40°C to +85°C | 8-Pin Plastic SOIC | R-8 |
| AD621SQ/883B ² | -55°C to +125°C | 8-Pin Cerdip | Q-8 |
| AD621ACHIPS | -40°C to +85°C | Die | |

NOTES

¹For outline information see Package Information section.

²See Analog Devices' military data sheet for 883B specifications.

METALIZATION PHOTOGRAPH

Dimensions shown in inches and (mm)
Contact factory for latest dimensions

