FEATURES
3 generic, easy-to-use evaluation boards
Shipped with an assortment of Analog Devices in-amps
Solder in the in-amp to be tested
Test pins already populated
Decoupling capacitors already populated

EVAL-INAMP-62RZ board
Compatible with LT1167, LT1168, LT6370, AD620, AD621, AD622, AD623, AD627, AD8223, and AD8225 in SOIC or PDIP

EVAL-INAMP-82RZ board
Compatible with AD8221, AD8226, AD8227, AD8228, AD8229, AD8421, AD8428, and AD8429 in SOIC package

EVAL-INAMP-82RMZ board
Compatible with AD8220, AD8221, AD8226, AD8227, AD8228, AD8236, and AD8421 in MSOP package

GENERAL DESCRIPTION
This user guide describes three generic evaluation boards that can be used to evaluate many of Analog Devices, Inc., instrumentation amplifiers. For information on the performance of a specific instrumentation amplifier, see the data sheet for that instrumentation amplifier.

EVAL-INAMP-62RZ (SOIC or PDIP)
The EVAL-INAMP-62RZ is designed for evaluation of instrumentation amplifiers in the legacy pinout. This board can be used to evaluate the LT1167, LT1168, LT6370, AD620, AD621, AD622, AD623, AD627, AD8223, and AD8225 instrumentation amplifiers. In addition to the basic in-amp connection, circuit options enable the user to adjust the offset voltage, apply an output reference, or provide shield drivers with user-supplied components. The board is shipped with an assortment of instrumentation amplifier ICs in the legacy SOIC pinout. These include the LT1167, LT1168, LT6370, AD620, AD621, AD622, AD623, AD8223, and AD8225. The board also has an alternative footprint for a through-hole, 8-lead PDIP.

EVAL-INAMP-82RZ (SOIC)
The EVAL-INAMP-82RZ is designed for evaluation of instrumentation amplifiers in the high performance pinout. This board can be used to evaluate the AD8221, AD8226, AD8227, AD8228, AD8229, AD8421, AD8428, and AD8429 in SOIC packages. The board is shipped with an assortment of instrumentation amplifier ICs in the high performance SOIC pinout. These include the AD8221, AD8226, AD8421, AD8428, and AD8429. The evaluation board is arranged so that users can easily solder on the gain resistor. The in-amp reference pin can connect to ground through a solder short or connect to the source of the user through the test pin. A small prototyping area allows interfacing to another part in an SOIC package.

Users can add their own SMA or SMB connector to interface the evaluation board with complementary tools, such as an analog-to-digital converter (ADC) evaluation board, available from Analog Devices.

EVAL-INAMP-82RMZ (MSOP)
The EVAL-INAMP-82RMZ board is exactly the same as the EVAL-INAMP-82RZ board, except that it is designed for the MSOP pinout. This board can be used to evaluate the AD8220, AD8221, AD8226, AD8227, AD8228, AD8236, and AD8421 in MSOP packages. The EVAL-INAMP-82RMZ board ships with an assortment of in-amp ICs in the high performance MSOP pinout, typically AD8220, AD8221, AD8226, AD8228, and AD8421.
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REVISION HISTORY
10/2019—Rev. C to Rev. D
Added LT1167, LT1168, and LT6370. Throughout
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AD62x Series and the AD822x Series Instrumentation
Amplifiers to Evaluation Boards for Instrumentation
Amplifiers: AD620 to AD623, AD627, AD822x, LT1167,
LT1168, LT6370, AD8236, AD8421, AD8428, and AD8429. 1
Added EVAL-INAMP-62RZ, EVAL-INAMP-82RZ, and EVAL-INAMP-82RMZ Board Photograph Section ............................................................... 1
Changes to Figure 2 ..................................................... 3
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PDIP) Section, EVAL-INAMP-82RZ (SOIC) Section, and
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Changes to Quick Start for the EVAL-INAMP-82RZ and EVAL-INAMP-82RMZ Boards Section .............................................................. 7

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Deleted Applications Section .......................................... 1
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Added EVAL-INAMP-62RZ Details Section ......................... 3
Added Quick Start for the EVAL-INAMP-62RZ Boards Section .... 4
Changes to Gain Adjustment Section ................................. 4
Added Table 1 and Table 2; Renumbered Sequentially ............. 4
Changed Appendix Heading to User Options ....................... 6
Added Quick Start for the EVAL-INAMP-82RZ Section and
EVAL-INAMP-82RMZ Boards Section ................................. 7
Changes to Ordering Guide ............................................. 8

12/2007—Revision 0: AD623-EVALZ Initial Version

6/2003—Revision 0: AD623-EVAL Initial Version
EVAL-INAMP-62RZ DETAILS

Figure 2. EVAL-INAMP-62RZ Schematic Diagram
QUICK START FOR THE EVAL-INAMP-62RZ BOARD

CIRCUIT OPTIONS

**Single-Supply Operation**

A jumper is provided to select between single or dual power supplies. The evaluation board is shipped with W14 in the dual-supply position. To convert to single supply, place W14 in the position marked with a ground symbol.

The LT6370 8-lead plastic SOIC package exposed pad (V+) can be left floating when the device is used on the EVAL-INAMP-62RZ board.

**Gain Adjustment**

The gain of the AD621 is pin selectable where G = 1 (default) or G = 100 (strap Pin 1 and Pin 8). In contrast, the gain of the AD620, AD622, and AD623 devices is resistor dependent (the resistor is connected between the RG pins). Without a resistor, the gain is unity. Table 1 to Table 3 provide calculated gains for each device. See the individual product data sheet for the gain equations.

<table>
<thead>
<tr>
<th>Desired Gain</th>
<th>% Standard Value of RG (Ω)</th>
<th>Calculated Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>100 k</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>24.9 k</td>
<td>5.02</td>
</tr>
<tr>
<td>10</td>
<td>11 k</td>
<td>10.09</td>
</tr>
<tr>
<td>20</td>
<td>5.23 k</td>
<td>20.12</td>
</tr>
<tr>
<td>33</td>
<td>3.09 k</td>
<td>33.36</td>
</tr>
<tr>
<td>40</td>
<td>2.55 k</td>
<td>40.21</td>
</tr>
<tr>
<td>50</td>
<td>2.05 k</td>
<td>49.78</td>
</tr>
<tr>
<td>65</td>
<td>1.58 k</td>
<td>64.29</td>
</tr>
<tr>
<td>100</td>
<td>1.02 k</td>
<td>99.04</td>
</tr>
<tr>
<td>200</td>
<td>499</td>
<td>201.4</td>
</tr>
<tr>
<td>500</td>
<td>200</td>
<td>501</td>
</tr>
<tr>
<td>1000</td>
<td>100</td>
<td>1001</td>
</tr>
</tbody>
</table>

**External Reference or Offset Adjustment**

When shipped, the reference of the EVAL-INAMP-62RZ board is connected to ground. Certain single-supply applications (for example, an ADC connected to the output of the in-amp) require a symmetrical output voltage centered on a nonzero value. The reference can be equal to half the supply, or an application-specific voltage can be provided by an ADC. The user can install a jumper at W13 and connect an external reference to the EXT_REF pin. To maintain proper operation of the in-amp, provide the reference by a voltage source.

Similarly, a provision is made for an offset adjustment of ±1.12 V by installing the parts listed in Table 6. Although the A2 and A3 ICs can be used with a single or dual power supply connection, A1 requires a dual supply. To enable the offset feature, install a shunt in Position W11. To adjust the offset of the in-amp, ground both inputs and measure the output voltage. Adjust Potentiometer R1 for 0 V.

**LOAD RESISTOR**

Although not required for normal operation, a load resistor can be inserted at Position R8.

**CMRR PERFORMANCE**

The AD621 CMRR performance degrades at gains of 100 when using this board due to the high performance of the AD621.
GUARD DRIVERS

When interference from sources such as power lines must be reduced to levels below those provided by standard shielded cables, guard drivers may be effective. A guard equalizes the ac potential between the in-amp input and the cable shield of the line, effectively reducing the low frequency interference voltage.

A2 in Figure 3 is a dual op amp, AD708, driving the shield(s) of the input cable(s) from the gain resistor pins of the in-amp. The voltages at these pins are equal to the input voltages plus 0.6 V (see the device data sheet).

The EVAL-INAMP-62RZ provides single and differential guards. Differential guards drive the shields with essentially the same signals as the inputs, whereas the single guard can be used for dual conductor cables. In this mode, the +GUARD drives the shield at \( \frac{1}{2} \text{(VIN DIFF)} + 0.6 \text{ V} \).

To activate the guard drivers, +VAUX and −VAUX must be connected. For shielded cables at both inputs, install the W1, W2, W5, and W8 jumpers.

**Using a Single Guard**

When using the AD620, AD622, and AD623 for gains greater than 1, install Resistors R6 and R11 (which are each half the calculated resistance of RG) and Jumpers W1, W2, and W10. For a gain of 1, either Position R6 or Position R11 can be shorted to enable the guard driver input. Connect the shield to +GUARD.

On the header pins that do not bear the ground symbol, insert a shunt across Position W1.

The guard drivers can be assembled using the components listed in Table 6.

COMPONENT LOCATIONS

Figure 3 shows the component layout and the location of connections for the EVAL-INAMP-62RZ board.
USER OPTIONS

Table 4. Jumpers

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Function</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>+GUARD select</td>
<td>Allows the shield of the positive input cable to be connected to the guard driver or ground.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W2</td>
<td>−GUARD select</td>
<td>Allows the shield of the negative input cable to be connected to the guard driver or ground.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W3</td>
<td>+Input coupling</td>
<td>Installed; the positive input is dc-coupled.</td>
<td>Installed</td>
</tr>
<tr>
<td>W4</td>
<td>−Input coupling</td>
<td>Installed; the negative input is dc-coupled.</td>
<td>Installed</td>
</tr>
<tr>
<td>W5</td>
<td>Guard driver −IN</td>
<td>Connects the negative shield guard driver to Pin 1 of the in-amp.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W6</td>
<td>−V_s to − V_{aux}</td>
<td>Connects the negative supply voltage to the negative auxiliary voltage of the same value.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W7</td>
<td>+V_s to + V_{aux}</td>
<td>Connects the positive supply voltage to the positive auxiliary voltage of the same value.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W8</td>
<td>Guard driver +IN</td>
<td>Connects the positive shield guard driver to Pin 8 of the in-amp.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W9</td>
<td>Guard driver +IN</td>
<td>Connects the positive shield guard driver to ground.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W10</td>
<td>Guard driver +IN</td>
<td>Selects the single-shield guard driver.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W11</td>
<td>Reference input</td>
<td>Connects the reference of the in-amp to the offset-adjustable voltage reference.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W12</td>
<td>Reference input</td>
<td>Connects the reference of the in-amp to ground.</td>
<td>Installed</td>
</tr>
<tr>
<td>W13</td>
<td>Reference input</td>
<td>Connects the reference of the in-amp to an external reference supply.</td>
<td>Not installed</td>
</tr>
<tr>
<td>W14</td>
<td>In-amp −V_s source</td>
<td>Connects the in-amp −V_s pin to GND or to −V_s of the evaluation board.</td>
<td>Connected to −V_s</td>
</tr>
<tr>
<td>W15</td>
<td>Guard driver −IN</td>
<td>Connects the negative shield guard driver to ground.</td>
<td>Not installed</td>
</tr>
</tbody>
</table>

Table 5. Input/Output

<table>
<thead>
<tr>
<th>Input/Output</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>+V_s/−V_s</td>
<td>Positive and negative rails of the in-amp.</td>
</tr>
<tr>
<td>GND</td>
<td>Ground for the board. GND1, GND2, GND3, and GND4 designate pins.</td>
</tr>
<tr>
<td>+IN/−IN</td>
<td>Positive and negative inputs of the in-amp.</td>
</tr>
<tr>
<td>+GUARD/−GUARD</td>
<td>Positive and negative terminals for use with a shielded cable.</td>
</tr>
<tr>
<td>EXT_REF</td>
<td>External reference input for the in-amp.</td>
</tr>
<tr>
<td>OUTPUT</td>
<td>Output of the in-amp.</td>
</tr>
<tr>
<td>+V_{aux}/−V_{aux}</td>
<td>Auxiliary power rails for guard drivers and offset reference circuitry.</td>
</tr>
</tbody>
</table>

Table 6. User-Supplied Parts for Guard and Offset Circuits

<table>
<thead>
<tr>
<th>Reference Designation</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guard Drivers</td>
<td></td>
</tr>
<tr>
<td>C5, C6</td>
<td>0.1 μF, 25 V ceramic capacitor</td>
</tr>
<tr>
<td>A2</td>
<td>AD708JN dual precision op amp</td>
</tr>
<tr>
<td>Offset Regulators</td>
<td></td>
</tr>
<tr>
<td>C7 to C10</td>
<td>0.1 μF, 25 V ceramic capacitor</td>
</tr>
<tr>
<td>A1</td>
<td>OP177 precision op amp</td>
</tr>
<tr>
<td>CS1, CS2</td>
<td>J500 240 μA current source</td>
</tr>
<tr>
<td>R9, R10</td>
<td>5.9 kΩ, 1% metal film resistor</td>
</tr>
</tbody>
</table>
QUICK START FOR THE EVAL-INAMP-82RZ AND EVAL-INAMP-82RMZ BOARDS

The quick start instructions in this section assume that the evaluation board is in default condition, as shown in Table 7. This section describes two separate evaluation boards, where the EVAL-INAMP-82RZ has an SOIC footprint and the EVAL-INAMP-82RZ has an MSOP footprint.

Table 7. Factory Setting

<table>
<thead>
<tr>
<th>Connection</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1 is soldered.</td>
<td>REF is tied to ground.</td>
</tr>
</tbody>
</table>

Follow Step 1 through Step 3 to get started using these boards (see Figure 4).

1. Connect a ±2.3 V to ±15 V supply to +VS and −VS. (Consult the specific data sheet for power supply operating range.)
2. Drive the inputs with a signal.
3. Measure the output on a multimeter or oscilloscope. The output voltage is the voltage measured between VOUT (OUT) and VREF (REF). The output can drive another device, such as an ADC.

Do not leave the in-amp inputs floating, that is, without a dc return path. This often occurs when the inputs are connected to a transformer, a thermocouple, or a pair of series capacitors. The inputs should have a dc path to ground, as shown in Figure 5 and Figure 6.

The circuit shown in Figure 6 has series capacitors, C1 and C2, between the signal generator and the input. The series capacitors prevent a dc current from flowing into the input transistors of the instrumentation amplifier. Two matched 10 kΩ resistors are used between the instrumentation amplifier inputs and ground to provide the necessary current path. Closely match these resistors to reduce offset and CMRR errors.

OUTPUT

Make output measurements by monitoring the voltage between the OUT and REF tie points of the board, as shown in Figure 7. If an external voltage reference is used, the output can be measured, referred to ground, as shown in Figure 5. The evaluation board offers an SMA/SMB outline. By default, the output voltage measured using an SMA/SMB connector is with respect to ground.

REFERENCE

The reference level of the instrumentation amplifier can be set by driving the REF pin with a precision voltage reference or by using the solder jumper, W1. By default, W1 is soldered, shunting REF to ground. If a reference voltage other than ground is used, the solder must be removed from W1 before driving REF with the reference voltage, as shown in Figure 5.
NOTES

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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