**Evaluating the ADL5309 Dual, 188 dB Range, 10 pA to 25 mA, Logarithmic Converter**

## FEATURES

- Full featured evaluation board for the ADL5309
- Supports external electrical input or on-board photodiode for optical input
- On-chip or external photodiode bias
- ADC control for $V_{OUT1}$, $V_{OUT2}$, and digital thermometer

## EVALUATION KIT CONTENTS

ADL5309-EVALZ evaluation board

## EQUIPMENT NEEDED

- DC power supply (5 V and 100 mA)
- Two precision source measurement units (for example, Keithley model 236 or Keithley model 238)
- Two triaxial cables
- Two triax-to-BNC adapters (triax center to BNC center, triax shield to BNC shield, or triax inner guard may be connected to BNC shield or left floating)
- Two BNC-to-SMA adapters
- Two digital multimeters
- Oscilloscope
- DC2026C (Linduino One) board (required only for adjusting the internal registers of the ADL5309, and not needed for the evaluation of the ADL5309 in factory default settings)

## DOCUMENTS NEEDED

- ADL5309 data sheet

## EVALUATION BOARD PHOTOGRAPH

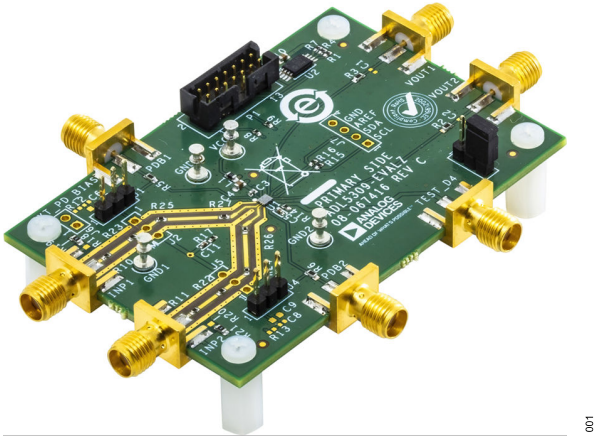


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*Figure 1. ADL5309-EVALZ Evaluation Photograph*

## GENERAL DESCRIPTION

The ADL5309-EVALZ evaluation board allows for the evaluation of the ADL5309 logarithmic converter IC.

The ADL5309 is comprised of dual monolithic logarithmic transimpedance amplifiers that are optimized for the measurement of low frequency and wide dynamic range signal power in fiber optic systems. The device produces a highly accurate, temperature compensated output voltage proportional to the logarithm of the ratio between the input current at Pin INP and an internally generated reference current.

The logarithmic slope and intercept are both factory-trimmed to a nominal value of 200 mV/decade and 10 pA, respectively. Both can be adjusted through the $I^2C$ interface.

A digital representation of the OUT1 and OUT2 outputs, along with a digital thermometer, is available through the $I^2C$ interface. A 14-bit successive approximation register (SAR) analog-to-digital (ADC), controlled through the $I^2C$ interface, samples the OUT1 channel output, OUT2 channel output, and the digital thermometer output.

Full specifications on the ADL5309 are available in the ADL5309 data sheet available from Analog Devices, Inc., and must be consulted with this user guide and the ADL5309-EVALZ evaluation board.

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## REVISION HISTORY

**6/2024—Revision 0: Initial Version**

## EVALUATION BOARD TEST SETUP

The complete ADL5309 evaluation system includes the ADL5309-EVALZ evaluation board, the DC2026C (Linduino One) board, and the ADL5309 Analysis | Control | Evaluation (ACE) plug-in. Plug-ins are product-specific applications downloaded and run in the ACE software in a Microsoft Windows environment. For ACE software installation and usage instructions, go to www.analog.com/ACE. The ADL5309-EVALZ communicates with ACE through the Linduino One board.

Typically, a Linduino One board is shipped with the ADL5309-KIT-EVALZ board as a kit. For more information, refer to the ordering guide section of the ADL5309 data sheet. A 14-conductor ribbon cable provides $I^2C$ and regulated +3.3 V connections between the interface board and the evaluation board.

The ADL5309-EVALZ evaluation board requires a 3 V power supply with at least 100 mA of current. The current input pins, INP1 and INP2, are connected to the source measurement units (SMUs) outputs. The VOUT1and VOUT2 outputs are connected to digital multimeters (DMM). The PC is connected to the Linduino One board that communicates with the $I^2C$ interface of the ADL5309 IC. The PC runs the ADL5309 graphical user interface (GUI) plug-in through the ACE software, which sets the on-chip registers to control various parameters of the ADL5309 and displays the on-chip ADC digital output.

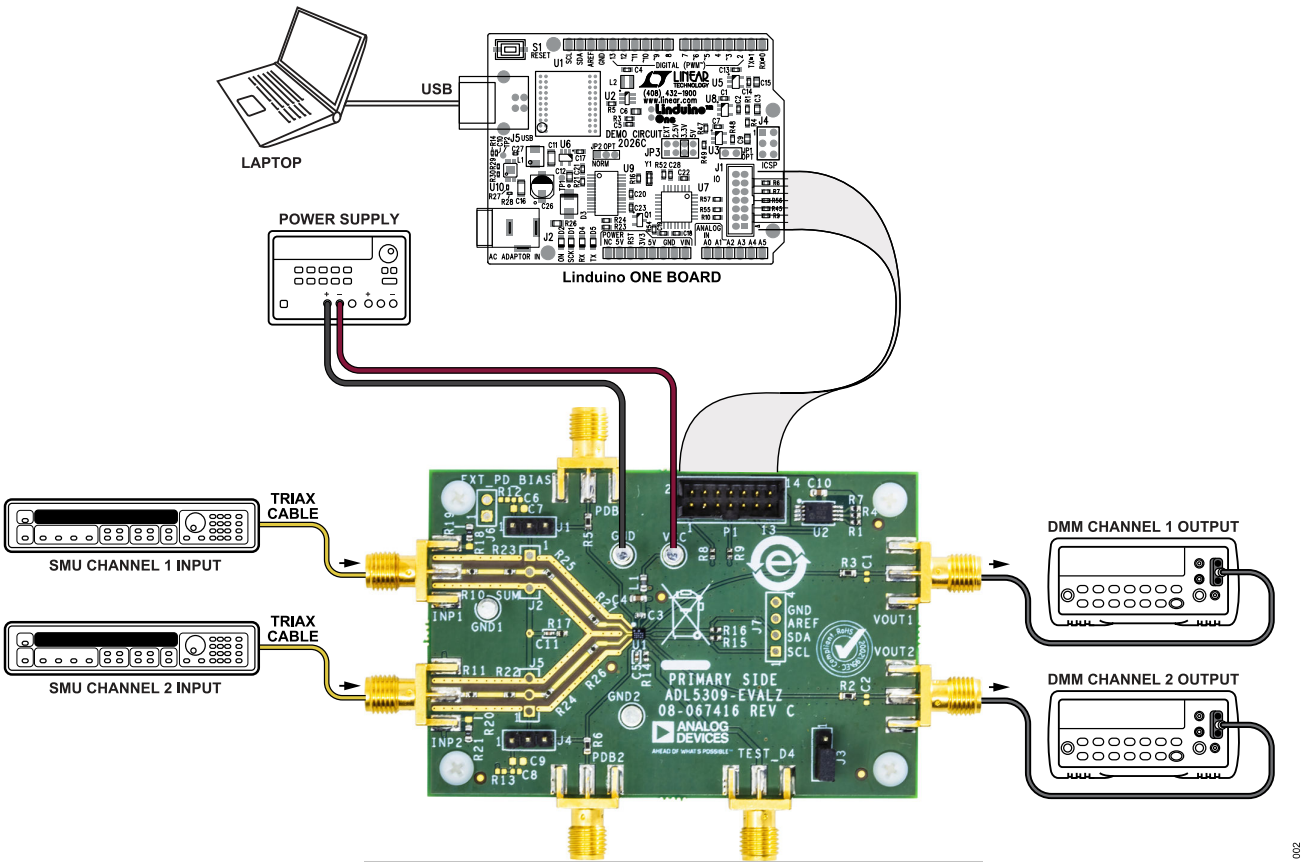


*Figure 2. ADL5309-EVALZ Basic Test Setup*

## QUICK TEST PROCEDURE

See Figure 2 to identify each component and connection. To prepare the ADL5309-EVALZ evaluation board for testing, complete the following steps. (If no internal register adjustments of the ADL5309 are required, skip all the steps related to the ACE software and the DC2026C (Linduino One) board):

1. Verify that the ACE software is installed.
2. In the main ACE window, click **Tools > Manage Plug-ins > Available Plug-ins**. Then, in the search bar, search for **Board.ADL5309**. Select the search result and click **Install selected**.
3. With the output of the 3 V DC power supply turned off, connect the positive output of the power supply to the VCC turret on the ADL5309-EVALZ evaluation board and the negative output of the power supply to the GND turret.
4. With the output of each SMU turned off, connect the current source output of the SMU output to the evaluation board's INP1 and INP2 input SMA connectors using triax cables, triax-to-BNC adapters, and/or BNC-to-SMA adapters. The internal connection of the triax-to-BNC adapter should be triax center to BNC center, triax shield to BNC shield, and the triax inner guard may be connected to the BNC shield or left floating.
5. Install a jumper at the 2 to 3 position on the J3 header for regular $I^2C$ communication.
6. Verify DC2026C (Linduino One) board is set to 3.3 V with a jumper.
7. Connect the Linduino One board to the ADL5309-EVALZ evaluation board via the included 14-pin ribbon cable.
8. Turn on the 3 V DC power supply. Verify that the current is approximately 57 mA.
9. Connect the Linduino One board to a PC using the included USB cable. When the light-emitting diodes (LEDs) stop blinking, the hardware connections are complete.
10. Launch the ACE software on the PC.
11. The ACE software shows that the ADL5309 plug-in is available in the **Attached Hardware**. Double-click the plug-in to add to the system. A successfully connected system with a properly loaded plug-in is shown in Figure 3.
12. Click **Reset Board** and verify that the **Firmware Loaded** light indicator turns green.
13. Double-click the **ADL5309** icon. The ADL5309 GUI window opens, which shows the register settings that can be changed as shown in Figure 4. For more information, refer to the register summary section of the ADL5309 data sheet.
14. Apply input currents ($I_{INP}$) from the SMUs and measure the $V_{OUT1}$, $V_{OUT2}$, $V_{PDB1}$, and $V_{PDB2}$ voltages. For an example of expected test results for the default register setting, see Table 1.

***Table 1. Quick Test Expected Results***

| $I_{INP1}$ | $V_{OUT1}$ | $V_{PDB1}$ | $I_{INP2}$ | $V_{OUT2}$ | $V_{PDB2}$ |
|---|---|---|---|---|---|
| 1 nA | 0.4 V | 1.6 V | 1 nA | 0.4 V | 1.6 V |
| 1 µA | 1.0 V | 1.6 V | 1 µA | 1.0 V | 1.6 V |
| 10 mA ($V_{CC}$ = 5 V) | 1.8 V | 4.2 V | 10 mA | 1.8 V | 4.2 V |

## DRIVING THE INPUT USING AN ACTUAL PHOTODIODE

With some minimal modifications to the ADL5309-EVALZ evaluation board, two photodiodes may be used to evaluate the performance of the ADL5309. For the lowest input capacitance, install the photodiodes as close to the IC pins as possible.

Complete the following procedures for the necessary component changes:

1. Remove Resistor R27 for Input 1 and Resistor R26 for Input 2.
2. Connect the anodes of photodiodes at the R27 location for Input 1 and at R26 for Input 2 on the resistor pads next to the IC pins.
3. Connect the cathodes of the photodiodes to Pin 1 of the J2 header for Input 1 and at Pin 1 of the J5 header for Input 2.
4. Connect the optional photodiode shield and case pins to Pin 3 of the J2 header for Input 1 and Pin 3 of the J5 header for Input 2.
5. For a more mechanically robust photodiode connection with higher input board capacitance make the following changes:
   - Replace R24, R25, R26, and R27 with 0 Ω resistors.
   - Remove Resistor R22 and Resistor R23.
   - Install photodiodes with anodes at Pin 2 of the J2 header for Input 1 and Pin 2 of the J5 header for Input 2.
6. If no external photodiode bias is used, set the J1 jumper to the 2-3 position for Input 1 and set the J4 jumper to the 2-3 position for Input 2.
7. Similarly, If an external photodiode cathode bias is required, set the J1 jumper to the 1-2 position for Input 1 and the J4 jumper to the 1-2 position for Input 2. The external photodiode bias (PDB) should be applied to the J6 Pin 2. The J6 Pin 1 is ground.

## QUICK TEST PROCEDURE

### USING THE ADCREF PIN

The ADCREF pin can be used to achieve improved accuracy while using the internal ADC for input current measurements.

Take the following steps to use the ADCREF interface to improve ADC readout accuracy:

1. Remove the R14 resistor.
2. Apply a reference voltage (for example, 2.000 V) to the TEST_D4 SMA.
3. Follow the instructions in the ADCREF Interface section of the ADL5309 data sheet.

## GRAPHICAL USER INTERFACE

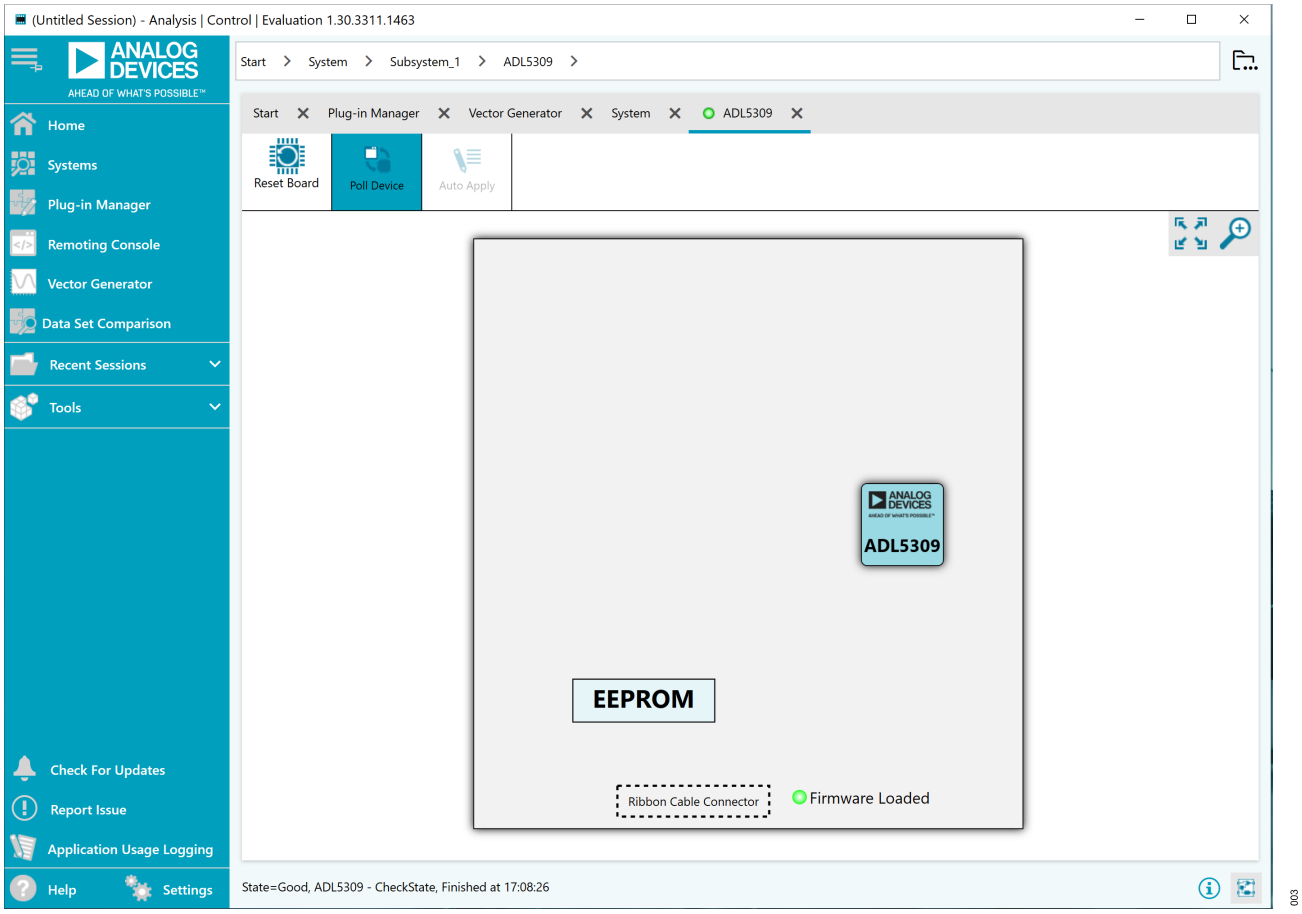


*Figure 3. Plug-in Manager View with the Evaluation Board Connected to the ACE System*

## GRAPHICAL USER INTERFACE

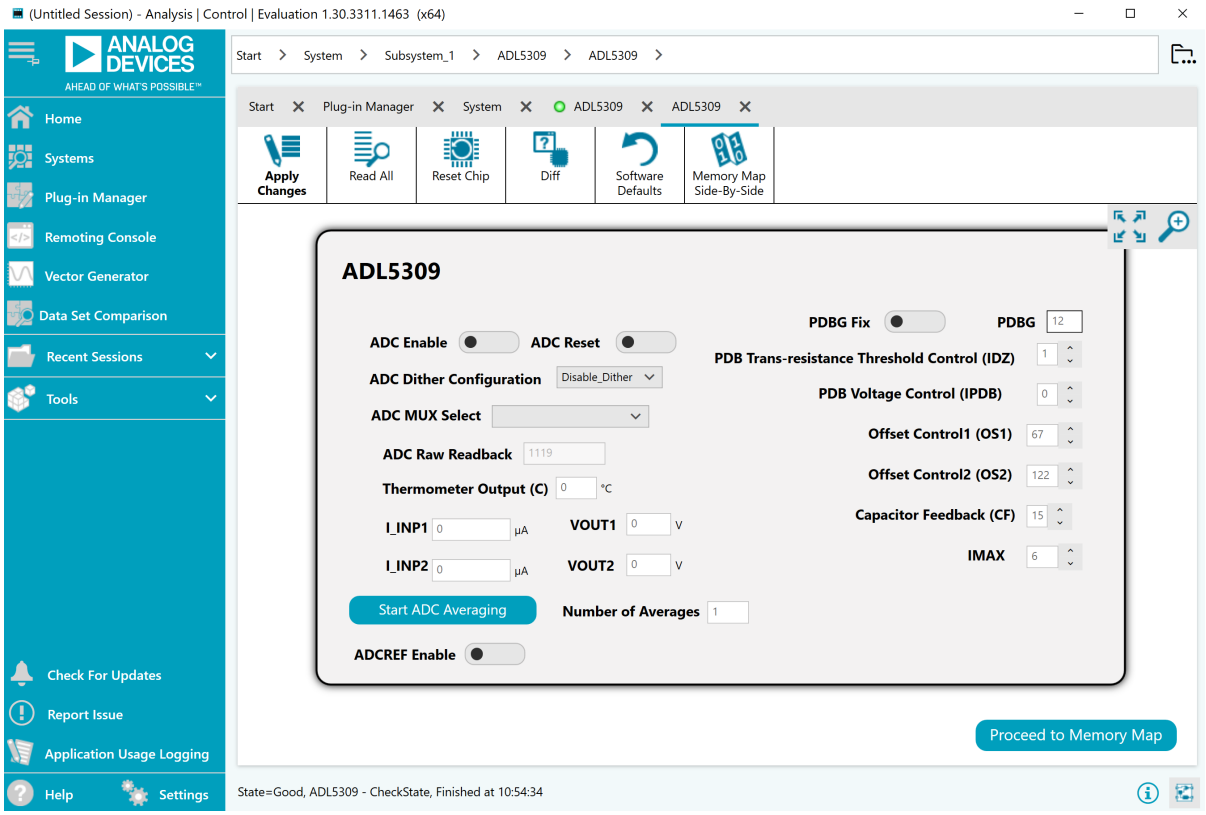


*Figure 4. Register Control GUI*

## 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.