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EVAL-AD7172-2SDZ User Guide
UG-762

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Evaluating the AD7172-2 Low Power, 24-Bit, 31.25 kSPS, Sigma-Delta ADC with True Rail-to-Rail Buffers

FEATURES

Full featured evaluation board for the AD7172-2
PC control in conjunction with the system demonstration platform (SDP), see the EVAL-SDP-CB1Z from Analog Devices, Inc., for additional information
PC software for control and data analysis (time domain)
Standalone capability

EVALUATION KIT CONTENTS

EVAL-AD7172-2SDZ evaluation board
Evaluation software CD
7 V to 9 V ac-to-dc adapter
Plastic screw washer set

EQUIPMENT NEEDED

DC signal source

GENERAL DESCRIPTION

The EVAL-AD7172-2SDZ evaluation kit features the AD7172-2, a low power, 24-bit, 31.25 kSPS, Σ-Δ analog-to-digital converter (ADC) with true rail-to-rail buffers, on-board power supply regulation, and an external amplifier section for amplifier evaluation. A 7 V to 9 V ac-to-dc adapter is regulated to 5 V and 3.3 V; this supplies the AD7172-2 and support components. The EVAL-AD7172-2SDZ connects to a USB port via the SDP on the EVAL-SDP-CB1Z controller board.

The EVAL-AD7172-2SDZ evaluation software fully configures the AD7172-2 device functionality via a user accessible register interface and provides dc time domain analysis in the form of waveform graphs, histograms, and associated noise analysis for ADC performance evaluation.

Full details about the device are available in the AD7172-2 data sheet, which should be consulted when using the EVAL-AD7172-2SDZ.

EVAL-AD7172-2SDZ BLOCK DIAGRAM

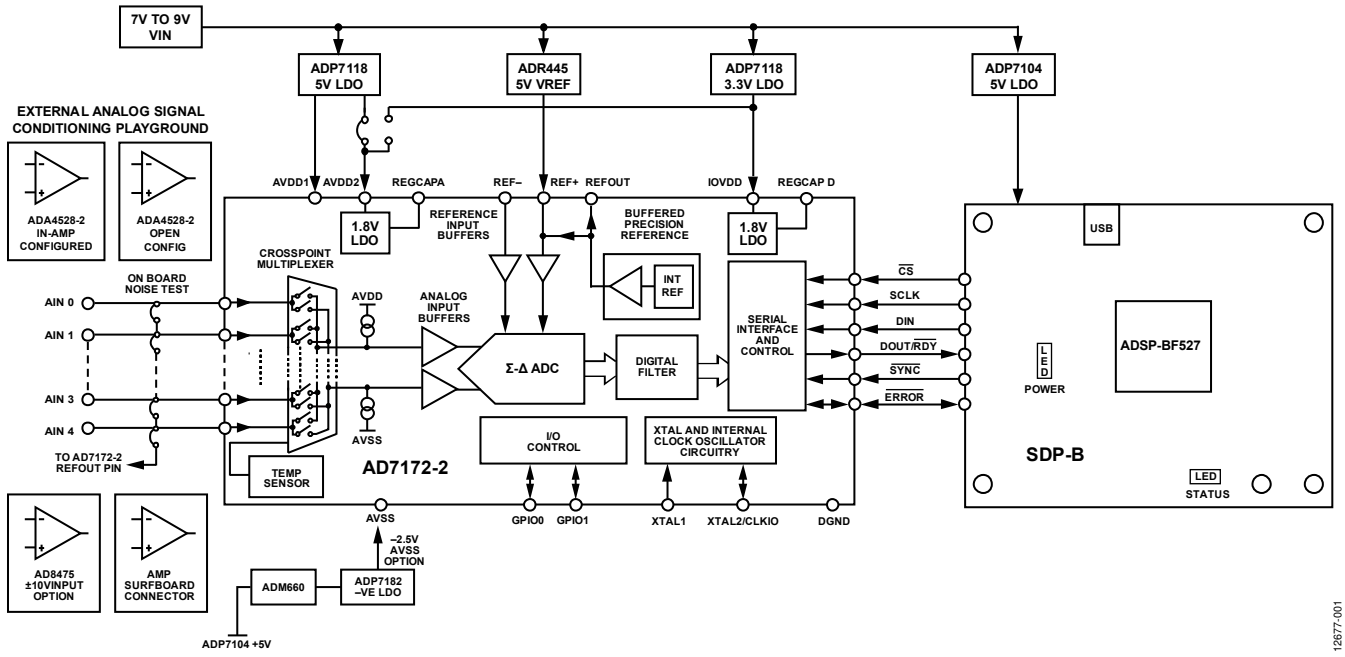

Figure 1.

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REVISION HISTORY

3/15—Revision 0: Initial Version

EVAL-AD7172-2SDZ QUICK START GUIDE

RECOMMENDED QUICK START GUIDE

Follow these steps to set up the EVAL-AD7172-2SDZ:

1. Disconnect the EVAL-SDP-CB1Z board from the USB port of the PC.
2. Install the EVAL-AD7172-2SDZ software from the enclosed CD. Restart the PC after installation.
3. Connect the EVAL-SDP-CB1Z board to the EVAL-AD7172-2SDZ board, as shown in Figure 2.
4. Fasten the two boards together with the enclosed plastic screw washer set.
5. Connect the external 9 V power supply to the J5 connector of the EVAL-AD7172-2SDZ board, as shown in Figure 2. Set LK2 to Position B.
6. Connect the EVAL-SDP-CB1Z to the PC via the USB cable. For Windows® XP, you may need to search for the EVAL-SDP-CB1Z drivers.
7. Choose to automatically search for the drivers for the EVAL-SDP-CB1Z board if prompted by the Windows operating system.
8. Launch the EVAL-AD7172-2SDZ software from the Analog Devices subfolder in the **Programs** menu.

QUICK START NOISE TEST

Use the following procedure to test the noise performance:

1. Insert Link LK5 to Link LK9 to initiate the noise performance test mode. In this mode, analog input channels short to the REFOUT pin.
2. Click **Sample** to acquire samples from the ADC (see Figure 7).

The **Samples** numeric control in the top right corner of the **AD7172-2 Evaluation Software** window sets the number of samples collected in each batch (see Figure 7).

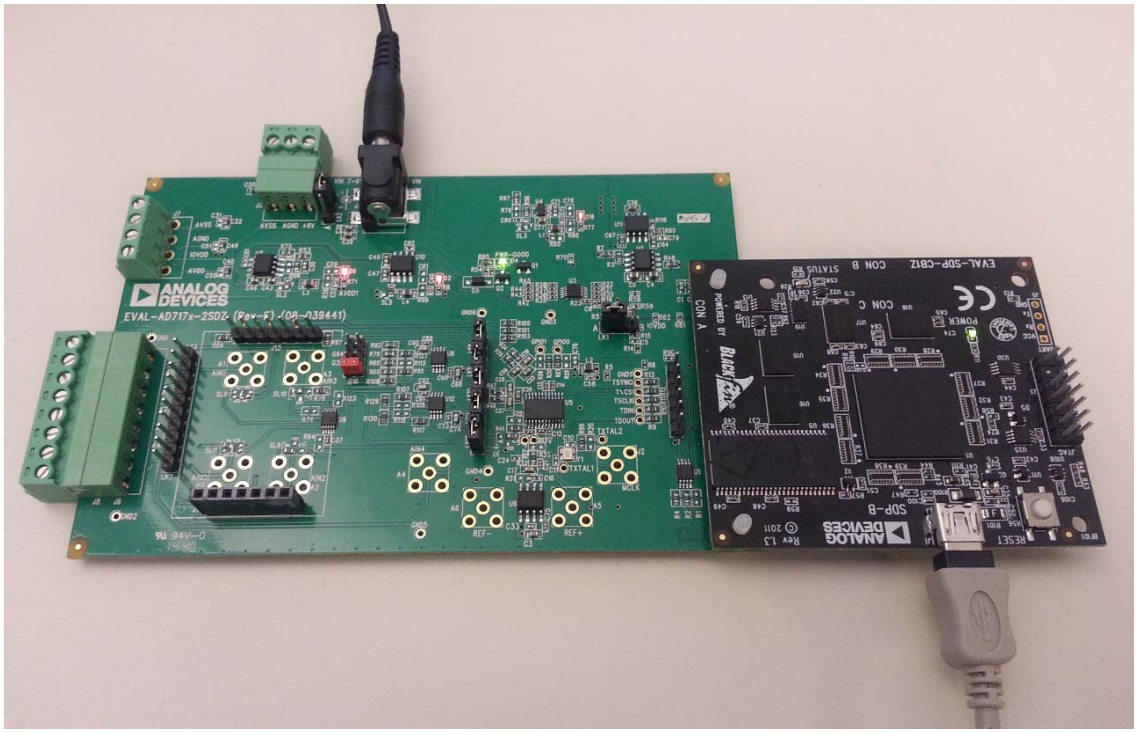

Figure 2. Hardware Configuration, Setting Up the EVAL-AD7172-2SDZ

EVALUATION BOARD HARDWARE

DEVICE DESCRIPTION

The AD7172-2 is a highly accurate, high resolution, multiplexed, 2-/4-channel (fully differential/single-ended) Σ-Δ ADC. The AD7172-2 has a maximum channel-to-channel scan rate of 6.21 kSPS (161 µs) for fully settled data. The output data rates range from 1.25 SPS to 31.25 kSPS. The device includes integrated rail-to-rail analog input and reference input buffers, an integrated precision 2.5 V reference, and an integrated oscillator.

See the AD7172-2 data sheet for complete specifications. Consult the data sheet in conjunction with this user guide when using the EVAL-AD7172-2SDZ. Full details for the EVAL-SDP-CB1Z are available on the Analog Devices website.

HARDWARE LINK OPTIONS

See Table 1 for default link options. By default, the EVAL-AD7172-2SDZ is configured to operate from the supplied 9 V ac-to-dc adapter connected to the J5 connector. The 5 V supply required for the AD7172-2 comes from the on-board low dropout (LDO) regulator. The ADP7118, with a 5 V output voltage, receives its input voltage from the J3 connector or the J5 connector (depending on the position of LK2) and generates a 5 V output.

Table 1. Default Link and Solder Link Options

Link	Default Option	Description
LK1	A	Selects the voltage applied to the power supply sequencer circuit (U3); dependent on AVDD1. Place in Position A if using 5 V AVDD1, or Position B if using 2.5 V AVDD1.
LK2	B	Selects the external power supply from J3 (Position A) or J4 (Position B).
LK5 to LK9	Inserted	Inserting these links sets up the on-board noise test. In this mode, all inputs short to the common voltage via SL11.
SL1	A	Sets the voltage applied to the AVDD2 pin. Operates using the AVDD1 supply (default). Position B sets the AVDD2 voltage to a 3.3 V supply from the 3.3 V ADP7118 (U10) regulator.
SL2	A	Selects between an external or on-board AVDD1 source. Supplies AVDD1 from the 5 V ADP7118 (U7) (default).
SL3	A	Selects between an external or on-board AVSS source. Supplies AVSS from the −2.5 V ADP7182 (U4) (default).
SL4	A	Connects AIN4 to: A4/J6 (Position A), REFOUT pin on the AD7172-2 (Position B), or AVSS (Position C). Position B and Position C simplify using a single-ended input source.
SL5	B	Selects between an external or on-board IOVDD source. Supplies IOVDD from the 3.3 V ADP7118 (U10) (default). The EVAL-AD7172-2SDZ operates with a 3.3 V logic.
SL8	A	Routes A0 to: AIN0 pin on the AD7172-2 (Position A), Buffer/In-Amp U8 (Position B), Funnel Amplifier U9 with gain of 0.8× (Position C), or the J10-1 connector (Position D).
SL9	A	Routes A2 to: AIN2 pin on the AD7172-2 (Position A), Buffer U12 (Position B), or Funnel Amplifier U9 gain of 0.4× (Position C).
SL10	A	Routes A3 to: AIN3 pin on the AD7172-2 (Position A), Buffer U12 (Position B), or Funnel Amplifier U9 gain of 0.4× (Position C).
SL11	A	Routes A1 to: AIN1 pin on the AD7172-2 (Position A), Buffer/In-Amp U8 (Position B), Funnel Amplifier U9 with gain of 0.8× (Position C), or the J10-7 connector (Position D).
R49 to R51	Inserted	Connects AVSS and AGND for single-supply operation. To operate in split-supply mode, remove these links.

SOCKETS AND CONNECTORS

Table 2. Connector Details

Connector	Function	Connector Type	Manufacturer	Manufacturer Number	Order Code[1]
J1	Connector to the EVAL-SDP-CB1Z	120-way connector, 0.6 mm pitch	Hirose	FX8-120S-SV(21)	FEC1324660
J2	External MCLK input	Straight PCB mount SMB/SMA jack	Tyco	1-1337482-0	Not applicable
J3	External bench top voltage supply for the EVAL-AD7172-2SDZ	Power socket block, 3-pin, 3.81 mm pitch	Phoenix Contact	MC 1,5/ 3-G-3,81	FEC3704737
J5	External ac-to-dc adapter input for the EVAL-AD7172-2SDZ, 7 V to 9 V	DC power connectors, 2 mm SMT power jack	Kycon	KLDX-SMT2-0202-A	MOUSER 806-KLDX-SMT20202A
J6	Analog input terminal block; wired connection to external source or sensor	Power socket block, 8-pin, 3.81 mm pitch	Phoenix Contact	MC 1,5/ 8-G-3,81	FEC3704774
J9	External bench top voltage supply option for AVDD1/AVDD2, IOVDD, and AVSS inputs on the AD7172-2	Screw terminal block, 3.81 mm pitch	Phoenix Contact	MKDS 1/4-3.81	FEC3704592
J10	Optional header	7-way, 2.54 mm pin header	Samtec	SSW-107-01-T-S	FEC1803478
J13	Optional header	7-way, 2.54 mm socket	Samtec	TLW-107-05-G-S	FEC1668499
A0 to A4	Analog inputs to ADC	Straight PCB mount SMB/SMA jack	Tyco	1-1337482-0	Not applicable
A7	PMOD compatible header	6-Pin SIL header (0.1 inch pitch)	Harwin	20-9990646	FEC 1022255

[1] Order codes starting with FEC are for Farnell.

SERIAL INTERFACE

The EVAL-AD7172-2SDZ connects via the serial peripheral interface (SPI) to the Blackfin® ADSP-BF527 on the EVAL-SDP-CB1Z. There are four input signals: $\overline{CS}$, SCLK, DIN, and $\overline{SYNC}$, and one output signal from the ADC, DOUT/$\overline{RDY}$ (see Figure 1).

To operate the EVAL-AD7172-2SDZ in standalone mode, disconnect the evaluation board from the EVAL-SDP-CB1Z controller board. Use the test points labelled on the EVAL-AD7172-2SDZ to connect the signals to an alternative digital capture setup or the PMOD compatible header (A7).

POWER SUPPLIES

Power the EVAL-AD7172-2SDZ from the ac-to-dc adapter connected to J5, or from an external bench top supply applied to J3 or J9. Linear LDO regulators generate the required voltages from the applied input voltage (V_{IN}) rail when using J3 or J5. Use J9 to bypass the on-board regulators. An ADP7118 regulator is used to generate the 5 V (single-supply) and 2.5 V (split-supply) supplies for the AVDD1 and AVDD2 rails to the ADC; a second ADP7118 generates 3.3 V supply for the IOVDD rail. The ADP7104 supplies 5 V for the EVAL-SDP-CB1Z controller board as well as 5 V for the ADM660 voltage converter to generate −5 V to supply the ADP7182. The ADP7182 generates the −2.5 V supply for AVSS when operating in split-supply mode. Each supply is decoupled where it enters the board and again at each device in accordance with the schematic. Table 3 shows the various power supply configurations available, including split-supply operation.

Table 3. Power Supply Configurations[1]

Configuration	Input Voltage Range (V)	Description
Single-Supply (Regulated)	7 to 9	The 7 V to 9 V input is regulated to 5 V for AVDD1/AVDD2 and 3.3 V for IOVDD. This also powers the external 5 V reference. See the Single-Supply (Regulated) section.
Single-Supply (Unregulated)	7 to 9, 5, and 3.3	The input is unregulated and connects directly to AVDD1/AVDD2 and IOVDD from J5. The 7 V to 9 V input powers the external 5 V reference. See the Single-Supply (Unregulated) section.
Split-Supply (Regulated)	+7 to +9 and −2.5	The 7 V to 9 V input is regulated to 2.5 V for AVDD1/AVDD2 and 3.3 V for IOVDD. The 7 V to 9 V input powers the external 5 V reference, and the −2.5 V input connects to AVSS directly (unregulated). See the Split-Supply (Regulated) section.
Split-Supply (Unregulated)	+7 to +9, ±2.5, and +3.3	The input is unregulated and connects directly to AVDD1/AVDD2 and IOVDD from J5. The 7 V to 9 V input powers the external 5 V reference. See the Split-Supply (Unregulated) section.

[1] Only one configuration can be used at a time.

POWER SUPPLY CONFIGURATIONS

Single-Supply (Regulated)

There are two available power supply options for the single-supply (regulated) configuration.

- Connect the ac-to-dc adapter (included) to J5 and set LK2 to Position B.
- Connect the bench top power supply to J3, set LK2 to Position A, and ensure that AVSS = AGND = 0 V.

Set all other links and solder links to the default settings as outlined in Table 1.

Single-Supply (Unregulated)

To set up the EVAL-AD7172-2SDZ, use the following procedure:

1. Move SL2 and SL5 to Position A.
2. Connect the two terminals of J9 (AGND and AVSS).
3. Connect the 0 V input (GND) to J9 at the AGND terminal.
4. Connect the 5 V input to J9 at the AVDD terminal.
5. Connect the 3.3 V input to J9 at the IOVDD terminal.
6. Connect the 7 V to 9 V input to J5.

Set all other links and solder links to the default settings as outlined in Table 1.

Split-Supply (Regulated)

To set up the EVAL-AD7172-2SDZ, use the following procedure:

1. Remove R49 to R51. These links connect AVSS to AGND.
2. Insert a 0 Ω resistor at R85.
3. Set LK1 to Position B, which sets the input to the power monitor circuitry to work with the lower AVDD1 supply of 2.5 V.
4. Connect a bench top power supply to J5 and set LK2 to Position B.
5. Set LK1 to Position B, which sets the input to the power monitor circuitry to work with the lower AVDD1 supply of 2.5 V.

Set all other links and solder links to the default settings as outlined in Table 1.

Split-Supply (Unregulated)

To set up the EVAL-AD7172-2SDZ, use the following procedure:

1. Move SL2, SL3, and SL5 to Position A.
2. Remove R49 to R51.
3. Connect the 0 V input (GND) to J9 at the AGND terminal.
4. Connect the 2.5 V input to J9 at the AVDD terminal.
5. Connect the −2.5 V input to J9 at the AVSS terminal.
6. Connect the 3.3 V input to J9 at the IOVDD terminal.
7. Connect the 7 V to 9 V input to J5.
8. Set LK1 to Position B, which sets the input to the power monitor circuitry to work with the lower AVDD1 supply of 2.5 V.

Set all other links and solder links to the default settings as outlined in Table 1.

ANALOG INPUTS

The EVAL-AD7172-2SDZ primary analog inputs can be applied in two separate ways.

- At the J6 connector on the left side of the board
- At the A0 to A4 SMB/SMA footprints on the evaluation board

The analog inputs route directly to the associated analog input pins on the AD7172-2 provided that the LK5 to LK9 links (on-board noise test) are removed. The EVAL-AD7172-2SDZ software is set up to analyze dc inputs to the ADC. The AD7172-2 input buffers work for dc input signals.

REFERENCE OPTIONS

The EVAL-AD7172-2SDZ includes an external 5 V reference, the ADR445. The AD7172-2 includes an internal 2.5 V reference. The default operation is to use the external reference input, which is set to accept the 5 V ADR445 on the EVAL-AD7172-2SDZ.

EVALUATION BOARD SOFTWARE

SOFTWARE INSTALLATION

The EVAL-AD7172-2SDZ evaluation kit includes software on a CD. Click the **setup.exe** file from the CD to run the installer. The default installation location for the software is **C:\Program Files\Analog Devices\EVAL-AD7172-2SDZ**.

Install the evaluation software before connecting the EVAL-AD7172-2SDZ and the EVAL-SDP-CB1Z to the USB port of the PC to ensure that the evaluation system is correctly recognized when connected to the PC.

To install the software, take the following steps:

1. Install the EVAL-AD7172-2SDZ software.
2. Install the EVAL-SDP-CB1Z system demonstration platform board drivers.
3. Place the software and drivers in the appropriate locations by proceeding through all of the installation steps.
4. After the software and drivers install, connect the EVAL-SDP-CB1Z board to the PC.

The installer may prompt you to allow the program to make changes to the computer. Click **Yes** to proceed (see Figure 3).

*Figure 3. AD7172-2 **User Account Control** Permission Dialog Box*

You may receive a security warning as part of the EVAL-SDP-CB1Z controller board driver installation. Click **Install** to proceed with the installation of the driver (see Figure 4). Without this confirmation, the software cannot operate correctly.

Figure 4. EVAL-SDP-CB1Z Drivers Installation Confirmation Dialog Box

After installation is complete, connect the EVAL-AD7172-2SDZ to the EVAL-SDP-CB1Z, as shown in Figure 2. Connect the EVAL-SDP-CB1Z board via the USB cable to the computer. Follow these steps to verify the EVAL-SDP-CB1Z controller board driver is installed and working correctly:

1. Run the **Found New Hardware Wizard** (this window pops up automatically once the EVAL-SDP-CB1Z connects to the computer).
2. Once the drivers are installed, check that the board is connected correctly by going to the **Device Manager** of the PC. Go to **My Computer > Manage > Device Manager**, (see Figure 5).
3. The EVAL-SDP-CB1Z appears under the **ADI Development Tools** as **Analog Devices System Development Platform (32MB)** or a similar title.

These steps confirm the installation is complete.

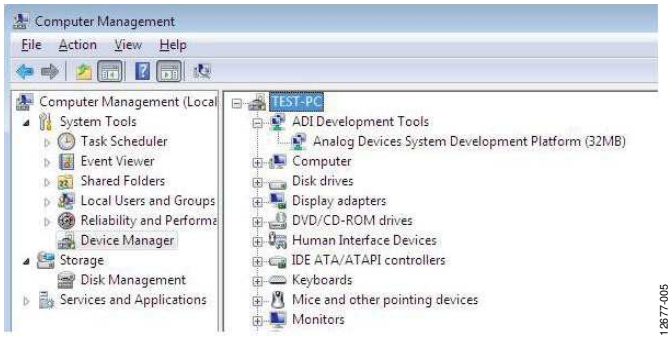

Figure 5. Device Manager

LAUNCHING THE SOFTWARE

The AD7172-2 software can be launched when the EVAL-AD7172-2SDZ and EVAL-SDP-CB1Z are correctly connected to the PC.

To launch the AD7172-2 software, complete the following steps:

1. From the **Start** menu, click **Programs > Analog Devices > EVAL-AD7172-2SDZ**. The main window of the software displays (see Figure 7).
2. If the EVAL-AD7172-2SDZ is not connected to the USB port via the EVAL-SDP-CB1Z when the software is launched, the **Select Interface…** dialog box appears (see Figure 6).
3. Connect the evaluation board to the USB port of the PC, wait a few seconds, and click the green double arrows, shown in Figure 6, to rescan the USB ports. Once connected, click **Work Online** to proceed (see Figure 6).

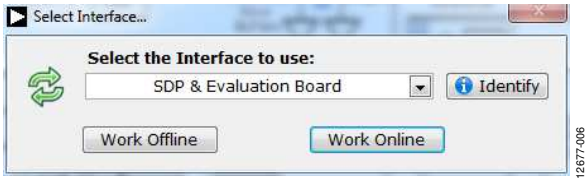

Figure 6. Select Interface Dialog Box

SOFTWARE OPERATION

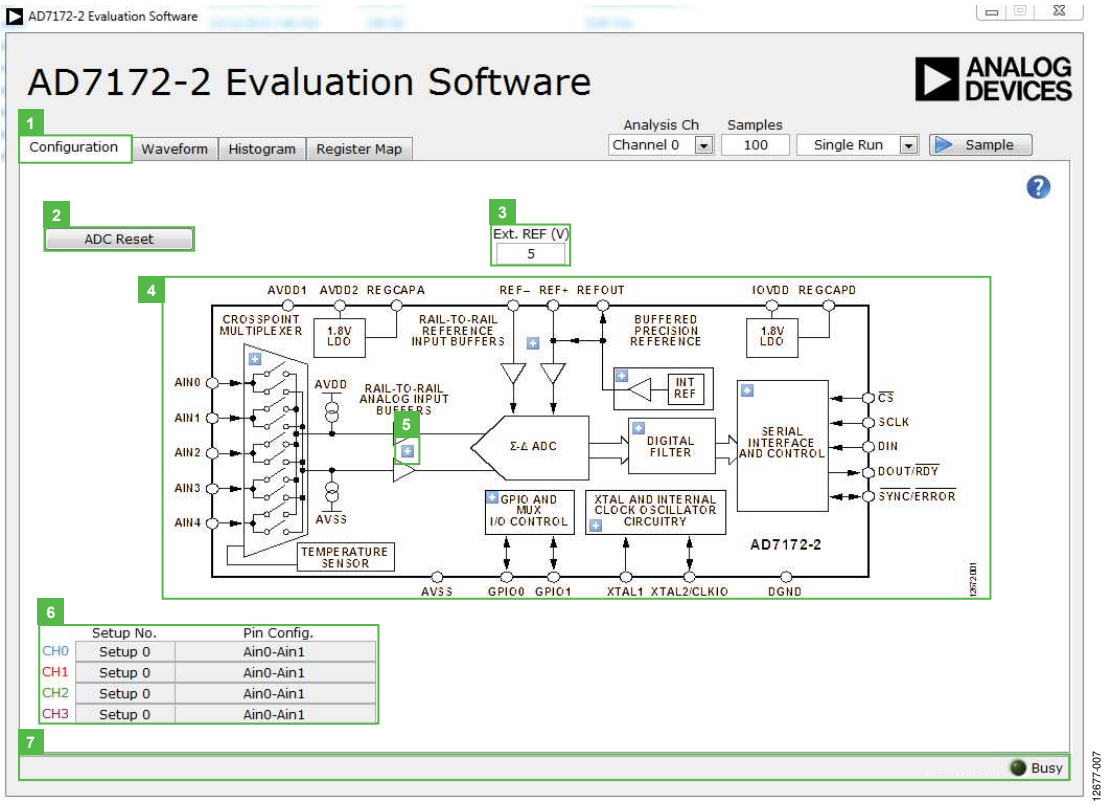

*Figure 7. **Configuration** Tab of the **AD7172-2** **Evaluation Software***

OVERVIEW OF THE MAIN WINDOW

The main window of the software displays the significant control buttons and analysis indicators of the AD7172-2 evaluation board software (see Figure 7). This window is divided into four tabs: **Configuration**, **Waveform**, **Histogram**, and **Register Map**

CONFIGURATION TAB

See Figure 7 for the **Configuration** (1) tab.

ADC Reset

Click the **ADC Reset** (2) button to perform a software a reset of the AD7172-2 (see Figure 7). There is no hardware reset pin. Perform a hard reset by removing power to the EVAL-AD7172-2SDZ. The software reset has the same effect as a hard reset

External Reference

The **Ext. REF (V)** (3) box sets the external reference voltage used for calculating the results on the **Waveform** and **Histogram** tabs (see Figure 7). The evaluation board has an external 5 V ADR445 reference that can be disconnected by removing R32. You can change the external reference voltage value within this box to ensure the correct calculation of results on the **Waveform** and **Histogram** tabs.

Functional Block Diagram

The functional block diagram (4) of the ADC shows each of the separate functional blocks within the ADC (see Figure 7). Click on one of the configuration buttons in this graph to open the configuration pop-up window for that block. Not all blocks have a configuration button.

Configuration Pop-Up Button

The configuration pop-up button (5) opens a window that allows for configuration of the relevant functional block (see Figure 7).

Channel Configuration Overview

The channel configuration overview (6) section shows the channel configuration including setup and analog inputs (see Figure 7). This allows for a quick check of how the ADC is setup.

Status Bar

The status bar (7) displays status updates such as **Analysis Completed** and **Reset Completed** during software use as well as the software version and **Busy** indicator (see Figure 7).

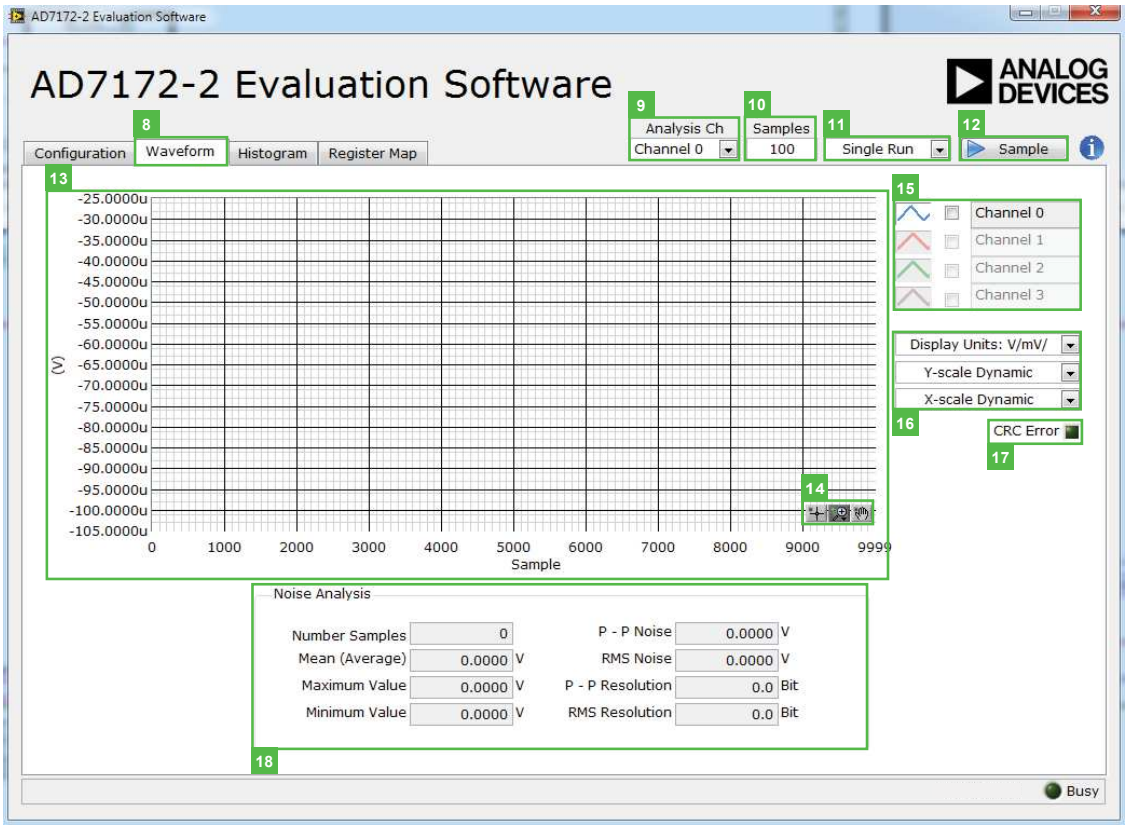

*Figure 8. **Waveform** Tab of the **AD7172-2** **Evaluation Software***

WAVEFORM TAB

See Figure 8 for the **Waveform** (8) tab.

Analysis Channel

The **Noise Analysis** (18) section and Histogram Graph shows the analysis of the channel selected via the **Analysis Ch** (9) drop-down combo box (see Figure 8).

Samples

The **Samples** (10) numeric control and batch control (11) set the number of samples gathered per batch and whether only a single batch or multiple batches of samples are gathered. The **Samples** (10) numeric control is unrelated to the ADC mode. You can capture a defined sample set or continuously gather batches of samples. In both cases, the number of samples set in the **Samples** (10) numeric input dictates the number of samples (see Figure 8).

Sample

Click the **Sample** (12) button to start gathering ADC results. Results appear in the waveform graph (13) (see Figure 8).

Waveform Graph and Controls

The data waveform graph (13) shows each successive sample of the ADC output. The control toolbar (14) in the graph allows you to zoom in on the data. Click on the x-axis and y-axis to change the scales on the graph (see Figure 8).

Channel Selection

The channel selection (15) control allows you to choose which channels display on the data waveform. It also shows the analog inputs for that channel labeled next to the on and off controls (see Figure 8). These controls only affect the display of the channels and do not have any effect on the channel settings in the ADC register map

Display Units and Axis Controls

In the display units and axis controls box (16), click the **Display Units: V/mV/** drop-down combo box to select whether the data graph displays in units of voltages or codes (see Figure 8). This selection affects both the waveform graph and the histogram graph. The axis controls can be dynamic or fixed. When **Y-scale Dynamic** and **X-scale Dynamic** are switched on, the axis automatically adjusts to show the entire range of the ADC results after each sample batch. Click the drop-down arrows to select the fixed axis controls, which program the axis ranges to not adjust after each sample batch.

CRC Error

The **CRC Error** (17) LED icon illuminates when a cyclic redundancy check (CRC) error is detected in the communications between the software and the AD7172-2 (see Figure 8). The CRC functionality on the AD7172-2 is disabled by default and must be enabled for this indicator to work.

Noise Analysis

The **Noise Analysis** (18) section displays the results of the noise analysis for the selected analysis channel (see Figure 8). This section includes both noise and resolution measurements.

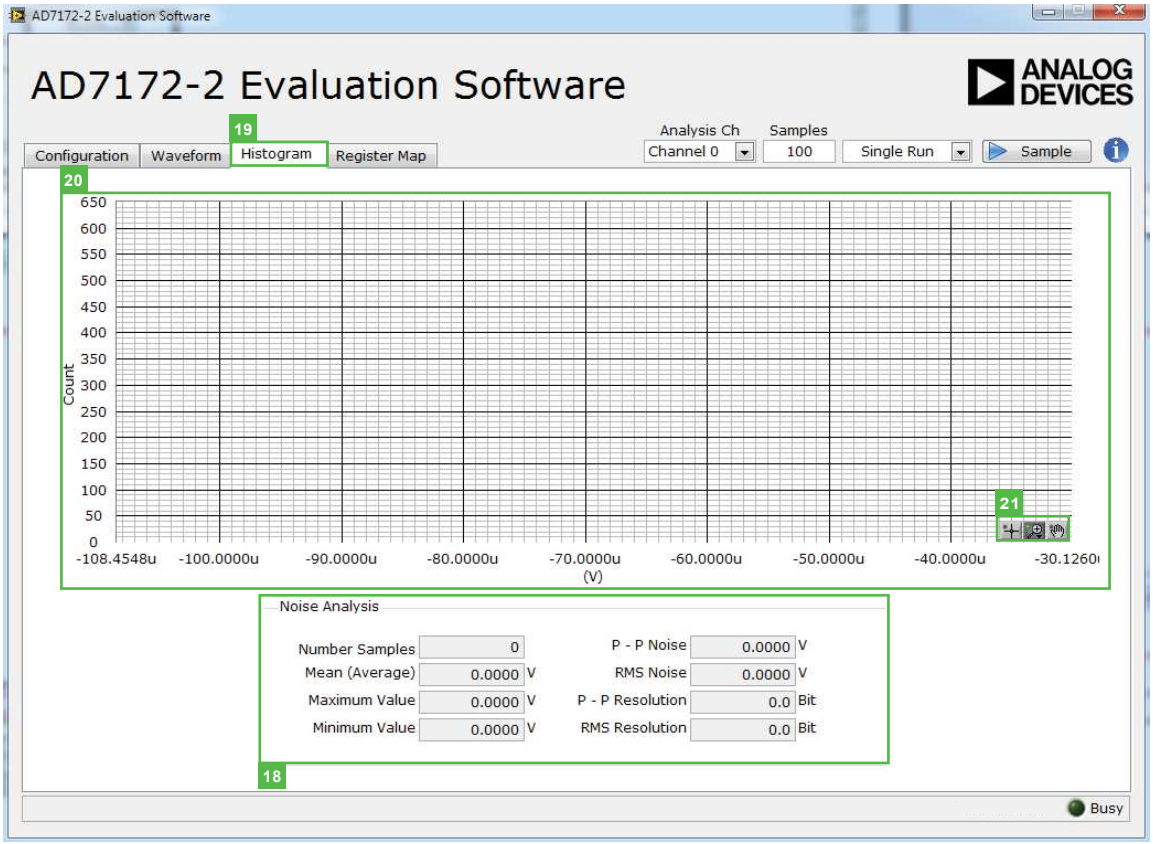

*Figure 9. **Histogram Tab** of the **AD7172-2** **Evaluation Software***

HISTOGRAM TAB

See Figure 9 for the **Histogram** (19) tab.

Histogram Graph and Controls

The data histogram graph (20) shows the number of times each sample of the ADC output occurs. The control toolbar (21) in the histogram graph allows you to zoom in on the data (see Figure 9). Click on the x-axis and y-axis to change the scales on the graph (see Figure 9).

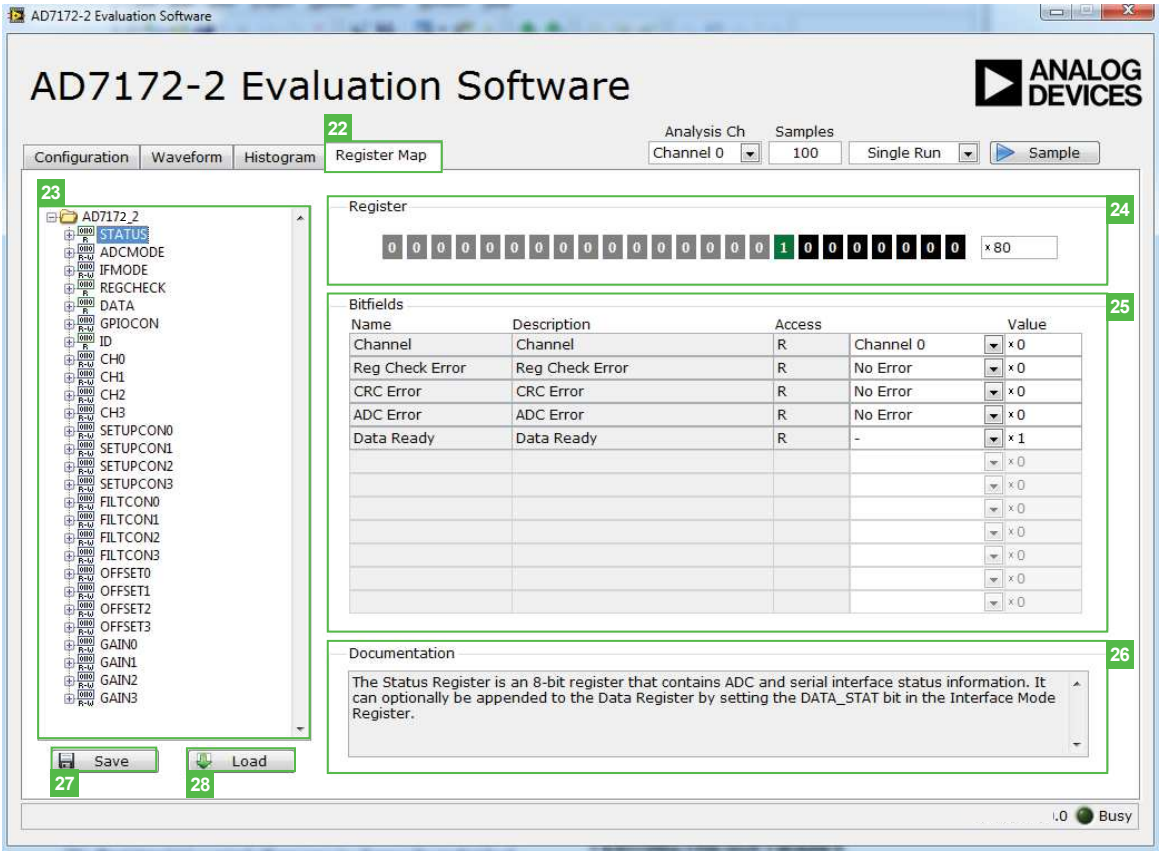

*Figure 10. **Register Map** Tab of the **AD7172-2** **Evaluation Software***

REGISTER MAP TAB

See Figure 10 for the **Register Map** (22) tab.

Register Tree

The register tree (23) control shows the full register map in a tree control. Each register is shown. Click on the **Expand** button next to each register to show all the bit fields contained within that register (see Figure 10).

Register

The **Register** (24) control allows you to change the individual bit of the register selected in the register tree (23). Click on the bit in the register tree (23) or program the register value directly into the number control on the right (see Figure 10).

Bitfields

The **Bitfields** (25) list shows all the bit fields of the register selected in the register tree (23). Change the values using the drop-down menu or by directly entering a value into the number control on the right (see Figure 10).

Documentation

The **Documentation** (26) field contains the documentation for the register of the bit field selected in the register tree (23) (see Figure 10).

Save and Load

The **Save** (27) and **Load** (28) buttons allow you to save the current register map setting to a file and load the setting from the same file (see Figure 10).

EXITING THE SOFTWARE

To exit the software, click the **Close** button at the top right corner of the **AD7172-2** **Evaluation Software** window (see Figure 7).

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.

UG12677-0-3/15(0)

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