Evaluating the AD7490 Successive Approximation ADC

FEATURES
Full featured evaluation board for the AD7490
PC control in conjunction with the system demonstration platform (EVAL-SDP-CB1Z)
PC software for control and data analysis (time and frequency domain)
Standalone capability

EVALUATION KIT CONTENTS
EVAL-AD7490SDZ evaluation board
Evaluation software CD for the AD7490
9 V mains power supply adapter

ADDITIONAL EQUIPMENT NEEDED
EVAL-SDP-CB1Z system demonstration platform
Precision analog signal source
SMB cables
USB cables
PC running Windows XP SP2, Windows Vista, or Windows 7 with USB 2.0 port

ONLINE RESOURCES
Documents
AD7490 data sheet
EVAL-AD7490SDZ user guide
Required Software
EVAL-AD7490SDZ evaluation software

GENERAL DESCRIPTION
The EVAL-AD7490SDZ is a full featured evaluation board that can be used to easily evaluate all features of the AD7490. The AD7490 is a 12-bit, high speed, low power, successive approximation ADC. The device operates from a single 2.7 V to 5.25 V power supply and features throughput rates of up to 1 MSPS. The device contains a low noise, wide bandwidth, track-and-hold amplifier that can handle input frequencies of greater than 1 MHz.

The evaluation board can be controlled via the system demonstration platform (SDP). The EVAL-SDP-CB1Z board allows the evaluation board to be controlled via the USB port of a PC using the AD7490 evaluation software. The EVAL-AD7490SDZ generates all required power supplies on board and supplies power to the EVAL-SDP-CB1Z controller board. On-board components include the following:

- AD8034: low cost, 80 MHz FastFET™ op amp
- ADP1613: step-up PWM dc-to-dc switching converter
- ADP3303-5: high accuracy anyCAP* 200 mA low dropout linear regulator
- ADP7104: 20 V, 500 mA, low noise, CMOS LDO
- ADM1185: quad voltage monitor and sequencer
- ADP190: logic controlled, high-side power switch
- ADG3308: low voltage, 1.15 V to 5.5 V, 8-channel, bidirectional logic level translator
- ADR3425: micropower, high accuracy voltage reference
- REF192: precision micropower, low dropout, low voltage reference

![Functional Block Diagram](image)

Figure 1.
TABLE OF CONTENTS

Features .............................................................................................. 1
Evaluation Kit Contents .................................................................... 1
Additional Equipment Needed .......................................................... 1
Online Resources .............................................................................. 1
General Description ......................................................................... 1
Functional Block Diagram ............................................................... 1
Revision History ............................................................................... 2
Getting Started .................................................................................. 3
  Quick Start Steps .......................................................................... 3
  Software Installation Procedures ................................................ 4
  Evaluation Board Setup Procedures ............................................ 7
Evaluation Board Hardware ............................................................. 8
  AD7490 Device Description ....................................................... 8
  Power Supplies ............................................................................ 8
Link Configuration Options ............................................................. 9
  Setup Conditions ......................................................................... 9
Evaluation Board Circuitry .............................................................. 11

Analog Inputs ................................................................................... 11
  Bias-Up Option ........................................................................... 11
  Reference Options ....................................................................... 11
  Sockets/Connectors ..................................................................... 11
Modes of Operation .......................................................................... 12
  SDP Controlled Mode .................................................................. 12
  Standalone Mode ......................................................................... 12
How to Use the Software for Evaluating the AD7490 ....................... 13
  Setting Up the System for Data Capture ..................................... 13
  Overview of the Main Window ................................................... 15
  Generating a Waveform Analysis Report ..................................... 17
  Generating a Histogram of the ADC Code Distribution .............. 18
  Generating a Fast Fourier Transform of AC Characteristics .......... 19
  Generating a Summary of the Waveform, Histogram, and Fast Fourier Transform ................................................. 20
  Related Links ............................................................................... 21

REVISION HISTORY

12/14—Rev. 0 to Rev. A
  Changes to Standalone Mode Section ......................................... 12

3/13—Revision 0: Initial Version
GETTING STARTED

QUICK START STEPS

To begin using the evaluation board, do the following:

1. With the EVAL-SDP-CB1Z board disconnected from the USB port of the PC, install the AD7490 evaluation board software from the CD included in the evaluation board kit. The PC must be restarted after the software installation is complete. (For complete software installation instructions, see the Software Installation Procedures section.)

2. Connect the EVAL-SDP-CB1Z board to the EVAL-AD7490SDZ board as shown in Figure 2. Screw the two boards together using the nylon screw-nut set included in the evaluation board kit to ensure that the boards are connected firmly together.

3. Connect the 9 V power supply adapter included in the evaluation board kit to Connector J702 on the EVAL-AD7490SDZ board.

4. Connect the EVAL-SDP-CB1Z board to the PC using the supplied USB cable. If you are using Windows® XP, you may need to search for the EVAL-SDP-CB1Z drivers. Choose to automatically search for the drivers for the EVAL-SDP-CB1Z board if prompted by the operating system.

5. Launch the EVAL-AD7490SDZ software from the Analog Devices subfolder in the Programs menu.

Figure 2. Hardware Configuration—Setting Up the EVAL-AD7490SDZ (EVAL-AD7490SDZ on Left and EVAL-SDP-CB1Z on Right)
SOFTWARE INSTALLATION PROCEDURES

The EVAL-AD7490SDZ evaluation kit includes a CD containing software to be installed on your PC before you begin using the evaluation board.

There are two parts to the installation:

- AD7490 evaluation board software installation
- EVAL-SDP-CB1Z system demonstration platform board drivers installation

Warning

The evaluation board software and drivers must be installed before connecting the evaluation board and EVAL-SDP-CB1Z board to the USB port of the PC to ensure that the evaluation system is correctly recognized when it is connected to the PC.

Installing the AD7490 Evaluation Board Software

To install the AD7490 evaluation board software,

1. With the EVAL-AD7490SDZ board disconnected from the USB port of the PC, insert the installation CD into the CD-ROM drive.
2. Double-click the setup.exe file to begin the evaluation board software installation. The software is installed to the following default location: C:\Program Files\Analog Devices\AD7490.
3. A dialog box appears asking for permission to allow the program to make changes to your computer. Click Yes.
4. Select the location to install the software, and then click Next.
5. A license agreement appears. Read the agreement, and then select I accept the License Agreement and click Next.
6. A summary of the installation is displayed. Click Next to continue.

![Figure 6. AD7490 Evaluation Board Software Installation: Reviewing a Summary of the Installation](image)

7. A dialog box informs you when the installation is complete. Click Next.

![Figure 7. AD7490 Evaluation Board Software Installation: Indicating When the Installation Is Complete](image)

---

**Installing the EVAL-SDP-CB1Z System Demonstration Platform Board Drivers**

After the installation of the evaluation board software is complete, a welcome window displays for the installation of the EVAL-SDP-CB1Z system demonstration platform board drivers.

1. With the EVAL-SDP-CB1Z board still disconnected from the USB port of the PC, make sure that all other applications are closed, and then click Next.

![Figure 8. EVAL-SDP-CB1Z Drivers Setup](image)

2. Select the location to install the drivers, and then click Next.

![Figure 9. EVAL-SDP-CB1Z Drivers Setup: Selecting the Location for Drivers Installation](image)
3. Click **Install** to confirm that you would like to install the drivers.

![Windows Security](image1.png)

**Figure 10. EVAL-SDP-CB1Z Drivers Setup: Granting Permission to Install Drivers**

4. To complete the drivers installation, click **Finish**, which closes the installation wizard.

![AD1 SDP Drivers 1.4.1.0 Setup Wizard](image2.png)

**Figure 11. EVAL-SDP-CB1Z Drivers Setup: Completing the Drivers Setup Wizard**

5. Before using the evaluation board, you must restart your computer. A dialog box opens, giving you the following options: **Restart**, **Shut Down**, or **Restart Later**. Click the appropriate button.

![AD7xxx Demo](image3.png)

**Figure 12. EVAL-SDP-CB1Z Drivers Setup: Restarting the Computer**
EVALUATION BOARD SETUP PROCEDURES

The AD7490 evaluation board connects to the EVAL-SDP-CB1Z system demonstration board. The EVAL-SDP-CB1Z board is the controller board, which is the communication link between the PC and the main evaluation board. Figure 2 shows a photograph of the connections made between the AD7490 daughter board and the EVAL-SDP-CB1Z board.

After following the instructions in the Software Installation Procedures section, set up the evaluation and SDP boards as detailed in this section.

Warning

The evaluation software and drivers must be installed before connecting the evaluation board and EVAL-SDP-CB1Z board to the USB port of the PC to ensure that the evaluation system is correctly recognized when it is connected to the PC.

Configuring the Evaluation and SDP Boards

1. Connect the EVAL-AD7490SDZ board to Connector A or Connector B of the EVAL-SDP-CB1Z board (see Figure 2).
   a. Screw the two boards together using the nylon screw-nut set included in the evaluation board kit to ensure that the boards are connected firmly together.
2. Connect the 9 V power supply adapter included in the evaluation board kit to Connector J702 of the EVAL-AD7490SDZ board. (Alternatively, a bench power supply can be used to power the EVAL-AD7490SDZ via Connector J700. See Table 1 for more information about the connections and options for the required power supplies.)
3. Connect the EVAL-SDP-CB1Z board to the PC using the supplied USB cable.
EVALUATION BOARD HARDWARE

AD7490 DEVICE DESCRIPTION

The AD7490 can interface to microprocessors or DSPs, and an extended performance version of the device, AD7490-EP, is available that supports defense and aerospace applications (AQEC). For more information about the AD7490 or AD7490-EP, refer to the AD7490 or AD7490-EP data sheet, which should be consulted in conjunction with this user guide.

POWER SUPPLIES

The EVAL-AD7490SDZ can be used in two modes: SDP controlled mode and standalone mode (see the Modes of Operation section for more information).

When the EVAL-AD7490SDZ board is used in conjunction with the EVAL-SDP-CB1Z board (SDP controlled mode), connect the ac transformer to Connector J702 on the EVAL-AD7490SDZ board. The VDD, VDRIVE, and op amp supplies are generated on board. When the EVAL-AD7490SDZ board is used in standalone mode, the VDD, VDRIVE, and op amp supplies must be sourced from external sources (see Table 1).

In SDP controlled mode and standalone mode, each supply is decoupled on the EVAL-AD7490SDZ using 10 µF and 0.1 µF capacitors. A single ground plane is used on this board to minimize the effect of high frequency noise interference.

Table 1. External Power Supplies Required

<table>
<thead>
<tr>
<th>Power Supply</th>
<th>Connector</th>
<th>Voltage Range</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN</td>
<td>J700 or J702</td>
<td>7 V to 9 V</td>
<td>Supplies all on-board power supplies, generating all required voltages to run the evaluation board</td>
</tr>
<tr>
<td>+12 V</td>
<td>J100</td>
<td>+12 V to +16.5 V</td>
<td>Supplies the positive rail of the amplifier</td>
</tr>
<tr>
<td>−12 V</td>
<td>J100</td>
<td>−12 V to −16.5 V</td>
<td>Supplies the negative rail of the amplifier</td>
</tr>
<tr>
<td>VDD</td>
<td>J703</td>
<td>2.7 V to 5.25 V</td>
<td>Supplies the ADC</td>
</tr>
<tr>
<td>VDRIVE</td>
<td>J3</td>
<td>2.7 V to 5.25 V</td>
<td>Supplies the digital interface circuitry</td>
</tr>
</tbody>
</table>

1 When VIN is supplied, all other power supplies are available on board. If the VIN supply is not used, all other power supplies must be sourced from an external source.
**LINK CONFIGURATION OPTIONS**

There are multiple jumper (Lkx) and solder link (Swx) options that must be set correctly to select the appropriate operating setup before using the evaluation board. The functions of these options are outlined in Table 2.

**SETUP CONDITIONS**

Before applying power and signals to the evaluation board, ensure that all link positions are as required by the operating mode. There are two modes in which to operate the evaluation board. The evaluation board can be operated in SDP controlled mode to be used with the SDP board, or the evaluation board can be used in standalone mode.

Table 3 shows the default positions in which the links are set when the evaluation board is packaged. When the board is shipped, it is assumed that the user is operating with the SDP board (SDP controlled mode).

**Table 2. Link Option Functions**

<table>
<thead>
<tr>
<th>Link No.</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK0</td>
<td>When inserted, this link connects the VIN0 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK1</td>
<td>When inserted, this link connects the VIN1 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK2</td>
<td>When inserted, this link connects the VIN2 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK3</td>
<td>When inserted, this link connects the VIN3 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK4</td>
<td>When inserted, this link connects the VIN4 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK5</td>
<td>When inserted, this link connects the VIN5 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK6</td>
<td>When inserted, this link connects the VIN6 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK7</td>
<td>When inserted, this link connects the VIN7 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK8</td>
<td>When inserted, this link connects the VIN8 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK9</td>
<td>When inserted, this link connects the VIN9 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK10</td>
<td>When inserted, this link connects the VIN10 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK11</td>
<td>When inserted, this link connects the VIN11 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK12</td>
<td>When inserted, this link connects the VIN12 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK13</td>
<td>When inserted, this link connects the VIN13 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK14</td>
<td>When inserted, this link connects the VIN14 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK15</td>
<td>When inserted, this link connects the VIN15 input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
</tbody>
</table>

<p>| SW0      | VIN0 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V. |
| SW1      | VIN1 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V. |
| SW2      | VIN2 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V. |
| SW3      | VIN3 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V. |
| SW4      | VIN4 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V. |
| SW5      | VIN5 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V. |
| SW6      | VIN6 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V. |
| SW7      | VIN7 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V. |
| SW8      | VIN8 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V. |</p>
<table>
<thead>
<tr>
<th>Link No.</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW9</td>
<td>VIN9 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V.</td>
</tr>
<tr>
<td>SW10</td>
<td>VIN10 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V.</td>
</tr>
<tr>
<td>SW11</td>
<td>VIN11 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V.</td>
</tr>
<tr>
<td>SW12</td>
<td>VIN12 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V.</td>
</tr>
<tr>
<td>SW13</td>
<td>VIN13 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V.</td>
</tr>
<tr>
<td>SW14</td>
<td>VIN14 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V.</td>
</tr>
<tr>
<td>SW15</td>
<td>VIN15 signal selection. In Position A, the input signal is passed to the input buffer amplifiers. In Position B, the buffer amplifier input is switched to 0 V.</td>
</tr>
<tr>
<td>LK22</td>
<td>When inserted, this link connects the VIN input to a 51 Ω input resistor tied to ground. The input is floating when this link is not inserted.</td>
</tr>
<tr>
<td>LK101</td>
<td>Op amp negative rail source selection. In Position A, −12 V is supplied from the on-board −12 V supply. In Position B, the negative rail is supplied from an external source via J100 Terminal 1.</td>
</tr>
<tr>
<td>LK102</td>
<td>Op amp positive rail source selection. In Position A, +12 V is supplied from the on-board +12 V supply. In Position B, the positive rail is supplied from an external source via J100 Terminal 3.</td>
</tr>
</tbody>
</table>

1 Ensure that LK101 and LK102 are always in corresponding positions (that is, both in Position A or both in Position B).
EVALUATION BOARD CIRCUITRY

ANALOG INPUTS
The analog inputs on the EVAL-AD7490SDZ are filtered and buffered by the AD8034 low cost, 80 MHz FastFET op amp.

The VIN0 to VIN3 inputs allow a signal to be connected to the board via SMB connectors. The default link positions of the EVAL-AD7490SDZ set the input impedance of these four channels to 51 Ω (see the Bias-Up Option section for more information). These signals can alternatively be connected via Header J1. For best signal quality on the VIN0 to VIN3 inputs, however, it is recommended to use the SMB connections to evaluate the performance of the AD7490.

Each analog input of the EVAL-AD7490SDZ allows a 51 Ω load to be placed on the input if required (see Table 2 for details).

BIAS-UP OPTION
There is an on-board, bias-up circuit available on the EVAL-AD7490SDZ that accepts a bipolar input and converts it to a unipolar signal, which can then be connected to any of the first four inputs, VIN0 to VIN3. The output power of this bias-up circuit is limited; therefore, the input impedance of these inputs increases from 51 Ω to 1051 Ω to allow full-scale signals to be generated.

LK0 to LK3 can be replaced with 0 Ω resistors if this function is not required.

REFERENCE OPTIONS
The following two on-board reference supplies are available:
- ADR3425: micropower, high accuracy voltage reference
- REF192: precision micropower, low dropout, low voltage reference

Alternatively, an external reference voltage can be applied to J3.

Table 4. Socket/Connector Functions

<table>
<thead>
<tr>
<th>Socket</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN0</td>
<td>Analog Input VIN0. Buffered to Vn0 on the AD7490.</td>
</tr>
<tr>
<td>VIN1</td>
<td>Analog Input VIN1. Buffered to Vn1 on the AD7490.</td>
</tr>
<tr>
<td>VIN2</td>
<td>Analog Input VIN2. Buffered to Vn2 on the AD7490.</td>
</tr>
<tr>
<td>VIN3</td>
<td>Analog Input VIN3. Buffered to Vn3 on the AD7490.</td>
</tr>
<tr>
<td>J1</td>
<td>VIN. Apply a bipolar signal to this pin. This signal is biased up on J3.</td>
</tr>
<tr>
<td>J2</td>
<td>Socket for EVAL-SDP-CB1Z evaluation controller board.</td>
</tr>
<tr>
<td>J3</td>
<td>Biased VIN. Unipolar version of signal applied to J1.</td>
</tr>
<tr>
<td>J5</td>
<td>VREF. External reference voltage.</td>
</tr>
<tr>
<td>J8</td>
<td>VDRIVE. External screw connection for VDRIVE.</td>
</tr>
<tr>
<td>J9</td>
<td>Analog Input VIN4 to Analog Input VIN15. Buffered to Vn4 to Vn15 pins of the AD7490.</td>
</tr>
</tbody>
</table>

Odd Pins | Even Pins
---|---
Pin 1—VIN4 | Pin 2—AGND
Pin 3—VIN5 | Pin 4—AGND
Pin 5—VIN6 | Pin 6—AGND
Pin 7—VIN7 | Pin 8—AGND
Pin 9—VIN8 | Pin 10—AGND
Pin 11—VIN9 | Pin 12—AGND
Pin 13—VIN10 | Pin 14—AGND
Pin 15—VIN11 | Pin 16—AGND
Pin 17—VIN12 | Pin 18—AGND
Pin 19—VIN13 | Pin 20—AGND
Pin 21—VIN14 | Pin 22—AGND
Pin 23—VIN15 | Pin 24—AGND
J100 | Op amp power supply screw terminal connectors. Supply rails for op amps.
J700 | 7 V to 9 V dc screw terminal connector.
J702 | 7 V to 9 V dc transformer power connector.
J703 | VDD screw terminal connector.
MODES OF OPERATION

SDP CONTROLLED MODE

The AD7490 uses a high speed serial interface that allows sampling rates of up to 1 MSPS. For more information about the operation of the serial bus, refer to the AD7490 data sheet.

The EVAL-AD7490SDZ communicates with the EVAL-SDP-CB1Z board using level shifters. The EVAL-SDP-CB1Z operates at a 3.3 V logic level, which allows $V_{\text{drive}}$ voltages that exceed 3.3 V to be used without damaging the SDP interface.

STANDALONE MODE

The EVAL-AD7490SDZ can also be used without the EVAL-SDP-CB1Z controller board. In this case, the EVAL-AD7490SDZ is connected to the digital interface using the test points.
HOW TO USE THE SOFTWARE FOR EVALUATING THE AD7490

SETTING UP THE SYSTEM FOR DATA CAPTURE

After completing the steps in the Software Installation Procedures and Evaluation Board Setup Procedures sections, set up the system for data capture as follows:

1. Allow the Found New Hardware Wizard to run after the EVAL-SDP-CB1Z board is plugged into your PC. (If you are using Windows XP, you may need to search for the EVAL-SDP-CB1Z drivers. Choose to automatically search for the drivers for the EVAL-SDP-CB1Z board if prompted by the operating system.)

2. Check that the board is connected to the PC correctly using the Device Manager of the PC.
   a. Access the Device Manager as follows:
      i. Right-click My Computer and then click Manage.
      ii. A dialog box appears asking for permission to allow the program to make changes to your computer. Click Yes.
      iii. The Computer Management box appears. Click Device Manager from the list of System Tools (see Figure 13).
   b. Analog Devices System Development Platform (32MB) should appear under ADI Development Tools, indicating that the EVAL-SDP-CB1Z driver software is installed and that the board is connected to the PC correctly.

Launching the Software

After completing the steps in the Setting Up the System for Data Capture section, launch the AD7490 software as follows:

1. From the Start menu, click Programs > Analog Devices > EVAL-AD7490SDZ. The main window of the software then displays.

2. If the EVAL-AD7490SDZ evaluation system is not connected to the USB port via the EVAL-SDP-CB1Z when the software is launched, a connectivity error displays (see Figure 14). Connect the evaluation board to the USB port of the PC, wait a few seconds, click Rescan, and follow the on-screen instructions.

When the software starts running, it searches for hardware connected to the PC. A dialog box indicates when the evaluation board attached to the PC is detected, and then the main window appears (see Figure 15).
Figure 15. Evaluation Software Main Window

NOTES
1. FOR DETAILS ABOUT THE AREAS HIGHLIGHTED IN RED, SEE THE OVERVIEW
   OF THE MAIN WINDOW SECTION.
OVERVIEW OF THE MAIN WINDOW
The main window of the software is shown in Figure 15 and has the features described in this section.

File Menu (Section 1)
The File menu (labeled 1 in Figure 15) offers the choice to

- **Load data**: load previously captured data or example files in .tsv (tab separated values) format for analysis (see Figure 16). (The default location for the example files is C:\Program Files\Analog Devices\AD7490\examples.)
- **Save Data as .tsv**: save captured data in .tsv format for future analysis (see Figure 17).
- **Print Front Panel Picture**: print the main window to the default printer.
- **Save Picture**: save the current screen capture.
- **Exit**: quit the application.

![Figure 16. Load File Dialog Box: Loading Previously Captured Data or Example Files in .tsv Format](image)

![Figure 17. Save File Dialog Box: Saving Data as .tsv](image)

Part Information Box (Section 2)
The Part Information box (labeled 2 in Figure 15) displays the generic being evaluated and is for informational purposes only.

Resolution Box (Section 3)
The Resolution box (labeled 2 in Figure 15) displays the resolution of the AD7490 in bits.

Sampling Rate Box (Section 4)
The default sampling frequency in the Sampling Rate box (labeled 4 in Figure 15) matches the maximum sample rate of the ADC selected from the drop-down menu. Although you can adjust the sampling frequency, there are limitations in terms of the sample frequencies that can be entered. If an unusable sample frequency is input, the software automatically adjusts the sample frequency accordingly. Units can be entered as, for example, 10k for 10,000 Hz. The software automatically adjusts the sample frequency according to the ability of the ADC being evaluated. For example, if you enter a value that is beyond the ability of the device, the software indicates this and reverts to the maximum sample frequency.

Number of Channels Selected Box (Section 5)
The Number of Channels Selected box (labeled 5 in Figure 15) displays the number of channels being sampled. Multiple channels can be sampled in sequence.

Tabs Area (Section 6)
There are four tabs available in the tabs area (labeled 6 in Figure 15) of the main window: Waveform, Histogram, FFT, and Summary. These tabs display the data in different formats. Navigation tools are provided within each tab to allow you to control the cursor, zooming, and panning (see Figure 15) within the graphs displayed.

Each tab is described in more detail in the Generating a Waveform Analysis Report; Generating a Histogram of the ADC Code Distribution; Generating a Fast Fourier Transform of AC Characteristics; and Generating a Summary of the Waveform, Histogram, and Fast Fourier Transform sections.

# Samples Box (Section 7)
The # Samples box (labeled 7 in Figure 15) allows you to select the number of samples to analyze. When Sample or Continuous is clicked, the software requests this number of samples to be taken. This is the total number of samples taken on all channels.
Reset Button (Section 8)
Clicking Reset (labeled 8 in Figure 15) sets the AD7490 to a known setup (see Figure 18).

![Figure 18. Resetting AD7490 to a Known Setup](image)

Registers Button (Section 9)
Clicking Registers (labeled 9 in Figure 15) opens the Control Register dialog box (see Figure 19).

![Figure 19. Control Register Dialog Box](image)

Sample Button (Section 10)
Clicking Sample (labeled 10 in Figure 15) performs a single capture, acquiring a set number of samples at the selected sampling rate.

Continuous Button (Section 11)
Clicking Continuous (labeled 11 in Figure 15) performs a continuous capture from the ADC. Clicking Continuous a second time stops sampling.

Channel Display Buttons (Section 12)
Clicking the buttons in this area (labeled 11 in Figure 15) allows you to display multiple channel reads. (Note that for FFT analysis, you can select only one channel to be displayed.)

Exit Button (Section 13)
Clicking Exit (labeled 13 in Figure 15) closes the software. Alternatively, you can click Exit from the File menu.
GENERATING A WAVEFORM ANALYSIS REPORT

Figure 20 shows the waveform capture tab for a 48 kHz sine wave input signal.

The **Waveform Analysis** area (labeled 1 in Figure 20) reports the amplitudes recorded from the captured signal and the frequency of the signal tone.

![Figure 20. Waveform Tab](image-url)
GENERATING A HISTOGRAM OF THE ADC CODE DISTRIBUTION

The Histogram tab can be used to perform ac testing or, more commonly, dc testing. This tab shows the ADC code distribution of the input and computes the mean and standard deviation, which are displayed as Mean and Transition Noise, respectively, in the Histogram Analysis area (labeled 1 in Figure 21).

Figure 21 shows the histogram with ac input for a 48 kHz sine wave applied to the ADC input and the resulting calculations.

**AC Input**

To perform a histogram test of ac input,

1. Apply a signal source to the selected analog input on the board.
2. Click the Histogram tab from the main window.
3. Click Sample.

Raw data is then captured and passed to the PC for statistical computations, and various measured values are displayed in the Histogram Analysis area.

**DC Input**

A histogram test of dc input can be performed with or without an external source because the evaluation board has a buffered $V_{REF}/2$ source at the ADC input.

To perform a histogram test of dc input,

1. If an external source is being used, apply a signal source to the selected analog input. It may be required to filter the signal to ensure that the dc source is noise-compatible with the ADC.
2. Click the Histogram tab from the main window.
3. Click Sample.

Raw data is then captured and passed to the PC for statistical computations, and various measured values are displayed in the Histogram Analysis area.

---

**Figure 21. Histogram Tab**

![Image of the Histogram tab interface](image-url)
GENERATING A FAST FOURIER TRANSFORM OF AC CHARACTERISTICS

Figure 22 shows the FFT tab. This feature tests the traditional ac characteristics of the converter and displays a fast Fourier transform (FFT) of the results.

To perform an ac FFT test,

1. Apply a sinusoidal signal with low distortion (better than 115 dB) to the evaluation board at the selected analog input. To attain the requisite low distortion, which is necessary to allow true evaluation of the device, one option is to
   a. Filter the input signal from the ac source. Choose an appropriate band-pass filter based on the sinusoidal signal applied.
   b. If a low frequency band-pass filter is used when the full-scale input range is more than a few volts peak-to-peak, use the on-board amplifiers to amplify the signal, thus preventing the filter from distorting the input signal.

2. Click the FFT tab from the main window.
3. Click Sample.

As in the histogram test, raw data is then captured and passed to the PC, which performs the FFT and displays the resulting SNR, THD, and SINAD.

The Spectrum Analysis box displays the results of the captured data.

- The area labeled 1 in Figure 22 shows the input signal information.
- The area labeled 2 in Figure 22 displays the fundamental frequency and amplitude in addition to the second to fifth harmonics.
- The area labeled 3 in Figure 22 displays the performance data, including the SNR, THD, and SINAD.

![Figure 22. FFT Tab](image-url)
GENERATING A SUMMARY OF THE WAVEFORM, HISTOGRAM, AND FAST FOURIER TRANSFORM

Figure 23 shows the Summary tab. The Summary tab captures all the display information and provides it in one panel with a synopsis of the information, including key performance parameters such as SNR and THD.

Figure 23. Summary Tab
By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the “Evaluation Board”), you are agreeing to be bound by the terms and conditions set forth below (“Agreement”) unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you (“Customer”) and Analog Devices, Inc. (“ADI”), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, non-exclusive, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: (i) Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board; and (iii) permit any Third Party to access the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term “Third Party” includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any incurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board; however, ADI makes no warranties or representations of any kind with respect to it. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, WARRANTIES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS, IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER’S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI’s TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS ($100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.