ANALOG DEVICES

EVAL-ADE1202EBZ User Guide
UG-1679

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Evaluating the ADE1202 Dual-Channel, Configurable, Isolated Digital Input

FEATURES

Full featured evaluation board for the ADE1202
PC control in conjunction with the EVAL-SDP-CB1Z system demonstration platform (SDP)
PC software for control and data analysis
Standalone capability

EVALUATION KIT CONTENTS

EVAL-ADE1202EBZ

ADDITIONAL EQUIPMENT NEEDED

EVAL-SDP-CB1Z (must be ordered separately), includes a mini USB cable
Voltage signal source
PC running Windows 10 with USB 2.0 port

DOCUMENTS NEEDED

ADE1202 data sheet
ADE1202 schematic
ADE1202 PCB layout
ADE1202 bill of materials

SOFTWARE NEEDED

EVAL-ADE120XEBZ evaluation software

GENERAL DESCRIPTION

The EVAL-ADE1202EBZ is a full featured evaluation board, designed to allow the user to easily evaluate the ADE1202 dual-channel, configurable, isolated digital binary input IC performance in a context similar to a real binary input interface application. The evaluation kit requires purchasing the controller board for the system demonstration platform (EVAL-SDP-CB1Z). The evaluation kit includes evaluation software, written in LabVIEW®, which provides access to the registers and features of the device through a PC interface.

Consult the ADE1202 data sheet in conjunction with this user guide when using the EVAL-ADE1202EBZ.

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REVISION HISTORY

12/2019—Revision 0: Initial Version

EVALUATION BOARD PHOTOGRAPH

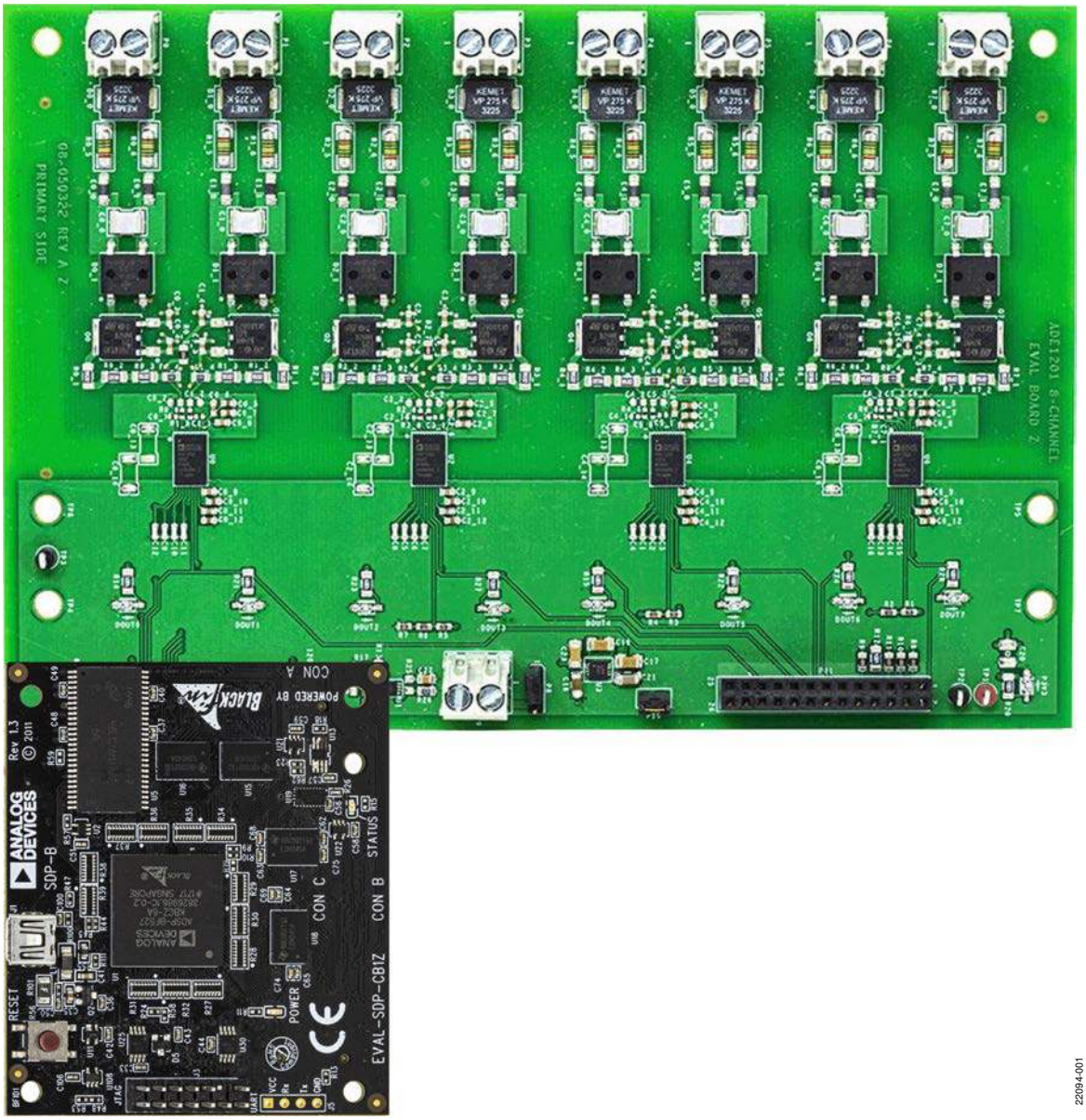

Figure 1. EVAL-ADE1202EBZ (Top) Connected to the EVAL-SDP-CB1Z (Bottom)

EVALUATION BOARD CONNECTION DIAGRAM

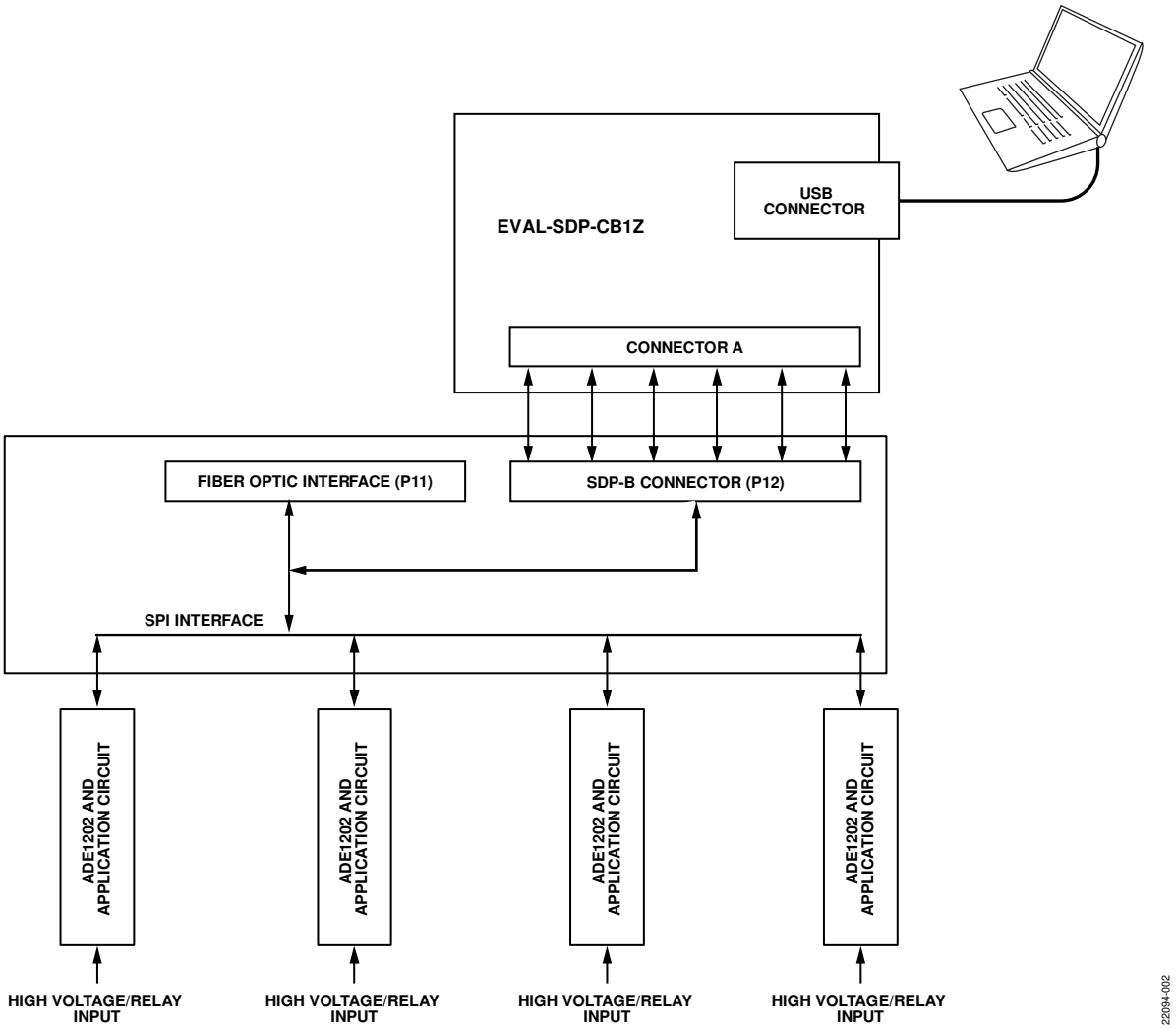

Figure 2. Evaluation Board Connection Diagram Showing a Direct Connection to the SDP

EVALUATION BOARD HARDWARE

OVERVIEW

The EVAL-ADE1202EBZ and the SDP-B (also referred to as the EVAL-SDP-CB1Z or the Blackfin® SDP board) are both required to evaluate the ADE1202.

When ordering the EVAL-ADE1202EBZ, order the EVAL-SDP-CB1Z. The evaluation kit and the SDP-B are purchased and packaged separately but must be used together.

The EVAL-ADE1202EBZ board is connected to the SDP-B board using the 120-pin connector, P12, as shown in Figure 2. The SDP-B board has an ADSP-BF527 microcontroller that handles all communications from the PC to the ADE1202 devices on the evaluation board.

For certain types of electromagnetic compatibility (EMC) and electromagnetic interface (EMI) testing, the SDP-B and the PC must be separated from the EVAL-ADE1202EBZ. One way to separate these devices from the EVAL-ADE1202EBZ is to isolate the signals sent between the SDP-B and the EVAL-ADE1202EBZ using a fiber optic interface. Connection to the serial port interface (SPI) and the digital output (DOUTx) signals from the four ADE1202 devices under test (DUTs) are available via P11.

POWERING UP THE EVALUATION BOARD

The ADE1202 can be powered by an external dc power supply or by the SDP-B board. The SDP-B board is powered through the USB connection from the PC. The EVAL-ADE1202EBZ board can be powered through one of the following methods:

1. Through an external 3.3 V power supply. Connect the power supply to the TP1 and TP2 terminals. Jumper P8 and Jumper P10 must be open.
2. Through the SDP-B board. Short Jumper P8, and short Pin 1 and Pin 2 on Jumper P10, which is the default method to power the evaluation board.
3. Through an external 5 V power supply to Jumper P9. Short Pin 2 and Pin 3 on Jumper P10 and short Jumper P8.

When the EVAL-ADE1202EBZ board is powered on, the P3V3 LED is lit green.

Table 1 and Table 2 list the test points, terminals, jumpers, and connectors on the EVAL-ADE1202EBZ.

ANALOG INPUTS

The ADE1202 channels are designed to work with high voltage digital inputs of 10 V dc to 300 V dc and 8 V rms to 240 V rms ac. The input signals connect to the terminal blocks (P0, P1, P2, P3, P4, P5, P6, and P7) on the EVAL-ADE1202EBZ. Connect the BI+ input to Pin 1 and the BI−input to Pin 2 for each connector. All high voltage input signals are passed through an EMI or EMC compliant and reverse polarity protected application circuit before the signals are connected to the ADE1202. The components used on the EVAL-ADE1202EBZ are the recommended values and types to use with the ADE1202. Refer to the ADE1202 bill of materials or the Applications Information section of the ADE1202 data sheet for more details.

There are four ADE1202 devices on the EVAL-ADE1202EBZ. Table 1 identifies which evaluation board terminal block corresponds to each ADE1202 device.

Table 1. EVAL-ADE1202EBZ Channel Assignment

Device	Binary Input	Evaluation Board Input Terminals
ADE1202, U0	1	P0
	2	P1
ADE1202, U2	1	P2
	2	P3
ADE1202, U4	1	P4
	2	P5
ADE1202, U6	1	P6
	2	P7

Table 2. EVAL-ADE1202EBZ Jumpers, Test Points, and Connectors

Jumpers, Test Points, and Connectors	Description
TP1 (P3V3)	Connects to an external 3.3 V supply to power the ADE1202
TP2, TP3, TP4, TP5, TP6	GND
P8	A 3-pin jumper that connects either the SDP-B board 5 V supply or an external voltage source
P9	2-pin connector that connects the 5 V external supply
P10	2-pin jumper that connects the 3.3 V output of the on-board regulator, U3, to power the ADE1202 ICs
P11	26-pin SPI and DOUTx breakout connector
P12	120-pin SDP connector
P13	3.3 V (output of U3)

DIGITAL INPUT AND OUTPUT

The ADE1202 devices are connected to a common SPI bus on the EVAL-ADE1202EBZ. Then, connect the bus to the SDP-B board. Use the hardware addressing mode of the ADE1202 to communicate directly with each individual device using one SPI with one $\overline{CS}$ line.

EVALUATION BOARD SOFTWARE

The EVAL-ADE1202EBZ is supported by Windows®-based software that allows the user to access the functionalities of the ADE1202. The software communicates with the SDP-B board using the USB port of the PC. The SDP-B microcontroller communicates with the ADE1202 on the EVAL-ADE1202EBZ to process the requests sent from the PC. The software installs as **EVAL-ADE120X Evaluation Software**.

INSTALLING THE DRIVERS

Administrator privileges are necessary to install and run the EVAL-ADE120XEBZ software. Disconnect the SDP-B board from the PC before installing the EVAL-ADE120XEBZ software. All the necessary drivers required for running the EVAL-ADE120XEBZ software are packaged with the installer.

INSTALLING THE EVAL-ADE120XEBZ SOFTWARE

The software package contains an installer that installs the EVAL-ADE120XEBZ evaluation software. The program is a LabVIEW-based program that runs on the PC. Refer to the **README.txt** file in the installation folder for a link to install the appropriate LabVIEW run-time engine prior to installing the evaluation software.

To install and launch the EVAL-ADE120XEBZ evaluation software, use the following procedure:

1. Navigate to **EVAL-ADE120XEBZ** > **Installer** > **Volume** in the software package. Double-click **setup.exe** to launch the set-up program that automatically installs all the software components, including the uninstall program, and creates the required directories.
2. To launch the software, click **Start** > **All Programs** > **ADE120X** and then click **EVAL-ADE120XEBZ_ Evaluation_Software**. When starting the software for the first time, some users may need to right-click **EVAL-ADE120X_Evaluation_Software.exe** and select **Run as the Administrator**.

The EVAL-ADE120XEBZ evaluation software program and the run-time engine are uninstalled using the **Add/Remove Programs** option in the PC **Control Panel**.

Before installing the EVAL-ADE120XEBZ evaluation software, uninstall any previous version of the evaluation software by using the following procedure:

1. Select the **Add/Remove Programs** option in the Windows **Control Panel.**
2. Select the previous version of the EVAL-ADE120XEBZ evaluation software to uninstall and click **Add/Remove**.

MAIN WINDOW

When the software executable opens, the main window of the evaluation software appears, as shown in Figure 3. When the main window opens for the first time, the evaluation software prompts the user to select the matching hardware, as shown in Figure 4. Then, click **Select** to proceed.

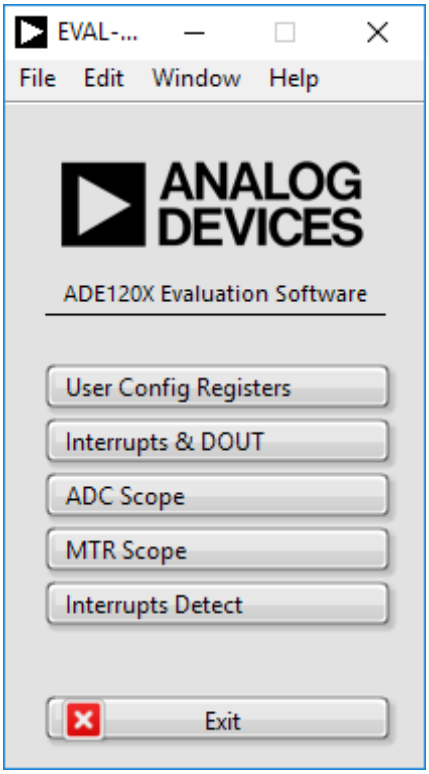

Figure 3. Main Window of the Evaluation Software

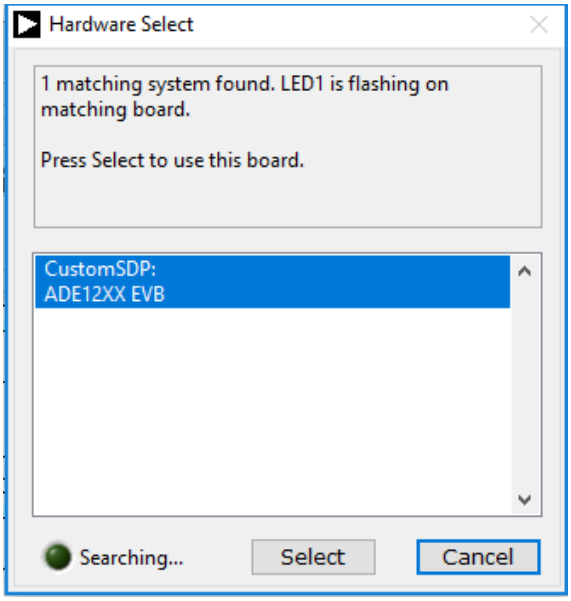

*Figure 4. **Hardware Select** Window*

The SDP code version and other pertinent hardware information are displayed in the connection data window, as shown in Figure 5. Click the **Window** menu in the main window and then select **Connection Info** in the dropdown menu to open the **Connection Data** window shown Figure 5.

Connect all the necessary hardware and power up the evaluation system before using the software windows for communication.

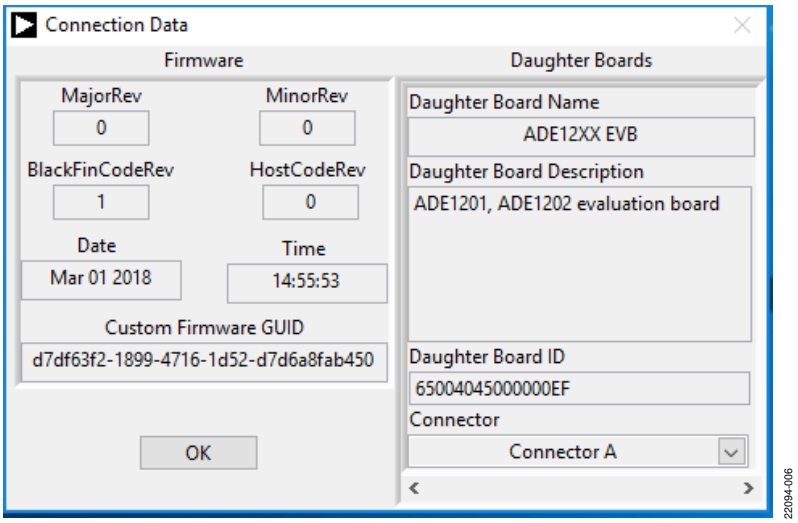

*Figure 5. **Connection Data** Window*

EVALUATION SOFTWARE FUNCTIONS

The main window (see Figure 3) consists of five options to evaluate a particular functionality of the ADE1202. The five options available for evaluation include the following:

- User configuration registers
- Interrupt and DOUT
- ADC scope
- MTR scope
- Interrupts detect

Clicking any of these five options opens a corresponding window. To close any of these windows, click the same option in the main window or click the **Close** button. Multiple windows can be left open on the monitor to evaluate the different ADE1202 features simultaneously.

AUTO IDENTIFICATION

There are four ADE1202 devices on each EVAL-ADE1202EBZ board that allow the user to set up and test eight binary input channels in total. The EVAL-ADE120XEBZ evaluation software automatically identifies the connected devices using the hardware addressing mode functionality, as shown in Figure 6. After identifying the connected devices, the EVAL-ADE120XEBZ evaluation software populates the register fields with the default values in all windows.

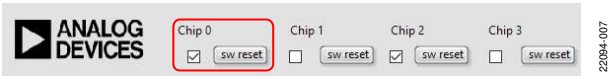

Figure 6. ***Auto Identified Devices***

USER CONFIGURATION REGISTERS

The **User Configuration Registers** option in the main window allows the user to write to all user configurable registers except the MASK register, see Figure 7. The MASK register is discussed further in the Interrupts Window section.

The ADE1202 powers up with default register values automatically populated in the register fields in the **User Config Registers.vi** panel, as shown in Figure 7. Click **Read Registers** to read the register values and output the results to the table. Enter the file path in the **File Path** text box for saving the register values. Click **Save Register Values To File** to generate a text file of the register values. The saved text file can also be edited and used to write back to the registers. When writing back to the registers, edit the hexadecimal register value in the text file, specify the file in the **File Path** box, and then click **Load Register Values From File**. Clicking **Load Register Values From File** updates the table in the **User Config Registers.vi** window with the values from the file. Clicking **Write Registers** writes to all the writable registers within the ADE1202. The user can edit the hexadecimal register values directly in the **User Config Registers.vi** window. Differences in the **Write** field and **Read** field values are displayed in red text by the EVAL-ADE120XEBZ evaluation software. When clicking the **Write Registers** button or the **Load Register Values From File** button, the EVAL-ADE120XEBZ evaluation software unlocks the ADE1202, writes the register change to the appropriate device, and locks the device. The user can perform a device software reset by clicking the **sw reset** button, as shown in Figure 6.

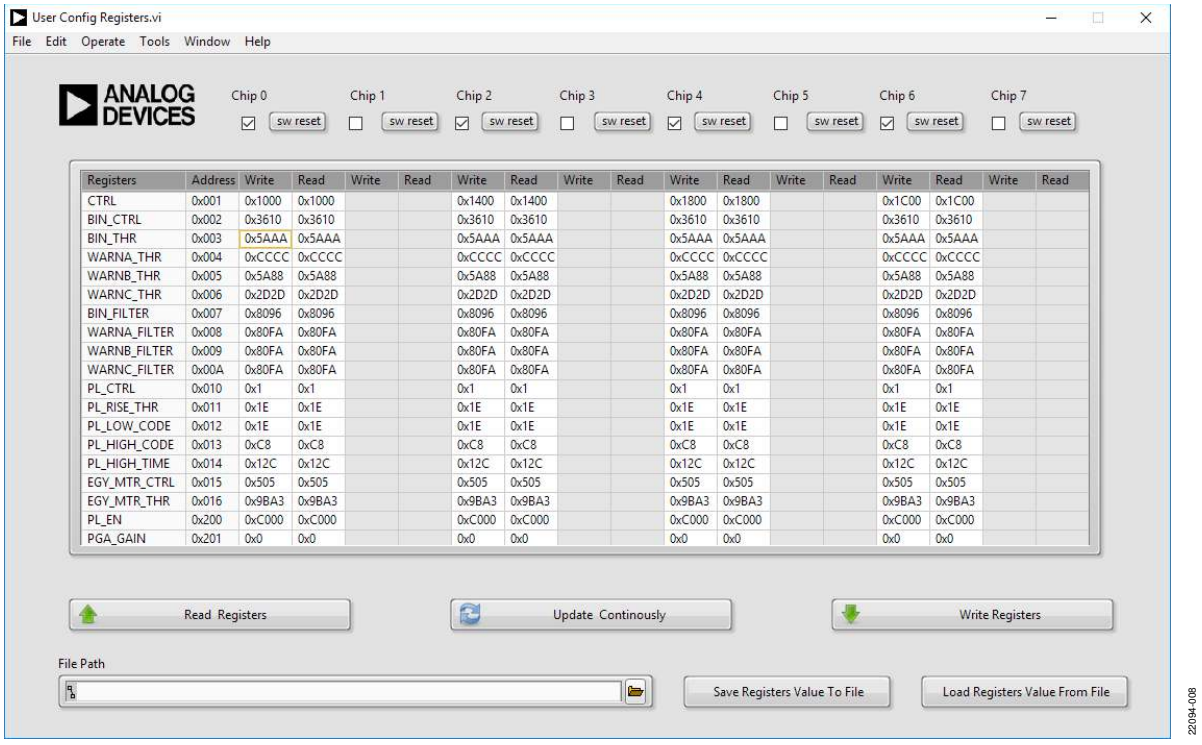

Figure 7. User Configuration Registers Window

INTERRUPTS WINDOW

The interrupts window displays the status of all interrupt events. The individual bits of the **INT_STATUS** registers are shown as green LEDs in the window, see Figure 8. If the LED is lit, then the corresponding status bit is set to 1. Next to each of the LEDs, a checkbox represents the corresponding Mask. To set the Mask bits, select the corresponding checkbox and click **Write Mask**. Click **Clear Flag** to reset all status bits simultaneously and to clear the interrupt request (IRQ).

To view the DOUT1 and DOUT2/$\overline{\text{IRQ}}$ pin logic levels, click **Poll DOUT/IRQ**. If the LED (**DOUT1_0** through **DOUT1_7**) is lit, the DOUT1 and DOUT2/$\overline{\text{IRQ}}$ pins are high. DOUT1 and DOUT2/$\overline{\text{IRQ}}$ are driven by the ADE1202 and can only be polled by the user. Note that the **IRQ** LED is unused because the EVAL-ADE1202EBZ configures DOUT2/$\overline{\text{IRQ}}$ as **DOUT2**.

Figure 8. Interrupts Window

ADC SCOPE WINDOW

The ADC scope window displays the values of the ADC register (Address 0x00E) or the ADCDEC register (Address 0x00F). The user selects which of the two registers the ADC scope displays. The registers are updated at 50 kHz. The ADC scope window reads the data at 50 kSPS when a single ADE1202 device is viewed. The user can set the channel and the number of samples to acquire. The data can be acquired once or continuously, as shown in Figure 9. The ADC scope window is set automatically to normal mode. The ADC scope has two other modes: the waveform capture with threshold trigger (WFB THR) mode and the waveform capture with interrupt trigger (WFB IRQ) mode. The WFB THR mode works the same way as the normal mode, except the samples are only captured when the ADC value reaches a specified threshold. In the WFB IRQ mode, samples are only captured when a predetermined IRQ event occurs. The **Voltage Gain** box reflects the voltage divider ratio of each channel on the EVAL-ADE1202EBZ.

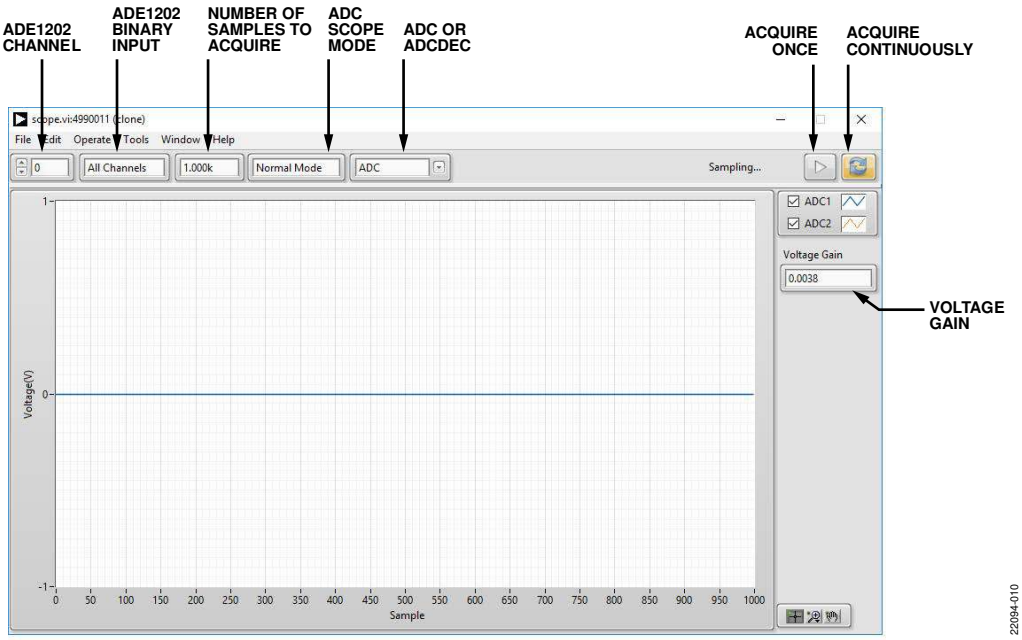

Figure 9. ADC Scope Window

MTR SCOPE WINDOW

The MTR scope window displays the values of the EGY_MTR1 and EGY_MTR2 registers (Address 0x017 and Address 0x018). In the ADE1202, EGY_MTR1 and EGY_MTR2 are updated at 100 kSPS. The MTR scope window reads the data continuously at 100 kSPS, when data for a single ADE1202 device is viewed. The user can set the channel as shown in Figure 10.

INTERRUPTS DETECT PANEL

The **Interrupts Detect** panel allows a user to capture the occurrence of any one of the fifteen interrupts available. To use the **Interrupts Detect** panel, the user must select at least one interrupt bit and press the **Start** button. The software continuously counts the interrupts as the interrupts occur and the panel shows the interrupts count. To stop the accumulation of interrupts, click the **Stop** button (see Figure 11).

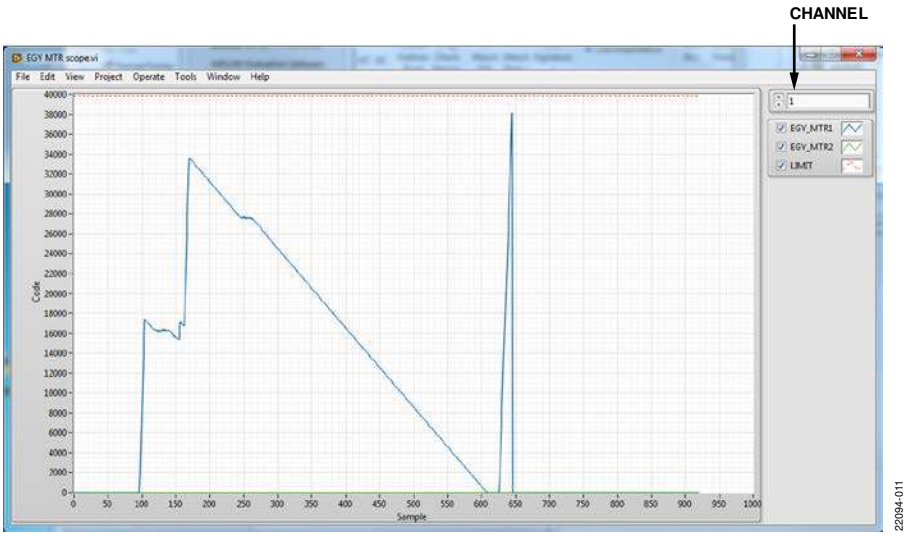

*Figure 10. **EGY MTR Scope** Window*

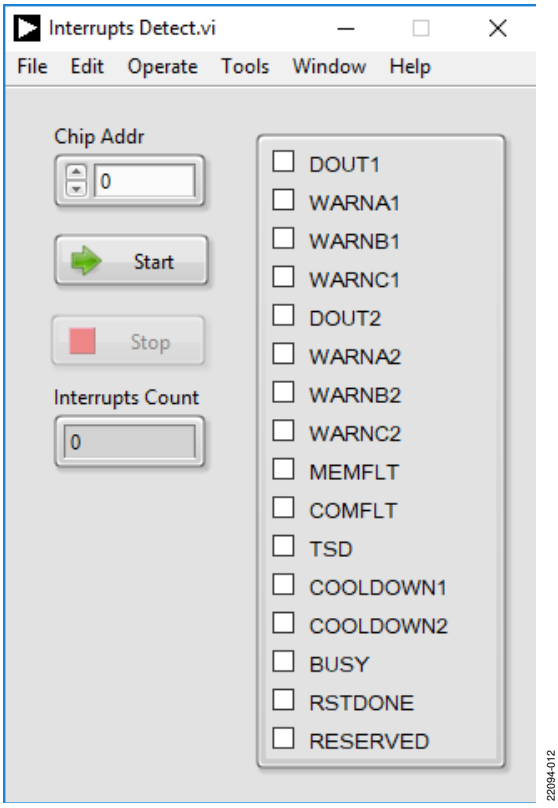

*Figure 11. **Interrupts Detect** Panel*

TROUBLESHOOTING

If the software does not detect the SDP-B board, the message in Figure 12 is displayed.

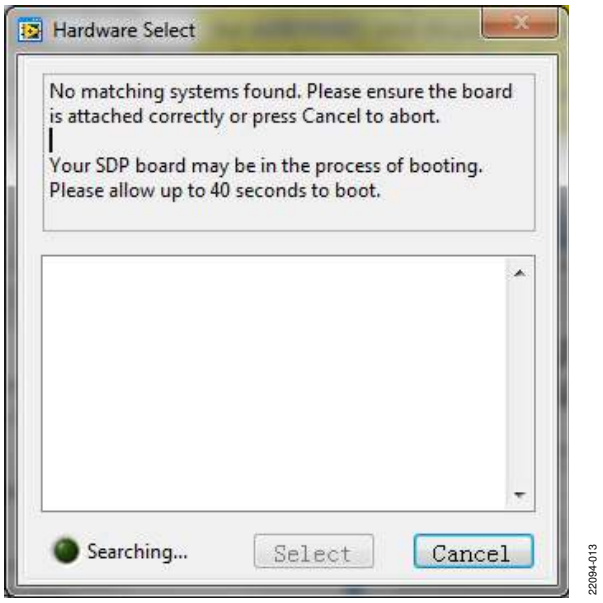

Figure 12. ***Hardware Select*** *Message*

If this message appears, take the following steps:

1. Verify that the SDP-B board is connected to the PC using the USB cable. The window in Figure 13 appears in the task bar when connected, and Windows then installs any necessary drivers.
2. When the window shown in Figure 4 appears, check if the LED on the SDP-B board is flashing. If the LED is flashing, click **Select**.

Figure 13. ***Installing device driver software*** *Message*

EVALUATION BOARD SCHEMATICS AND ARTWORK

The reference design schematics and artwork are available on the EVAL-ADE1202EBZ webpage. Refer to the ADE1202 data sheet for more details about the layout guidelines and external components in the recommended ADE1202 application circuit.