ANALOG DEVICES

EVAL-ADE1201EBZ User Guide
UG-1731

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Evaluating the ADE1201 Single Channel, Configurable, Isolated Digital Input

FEATURES

Fully featured evaluation board for the ADE1201
PC control in conjunction with the SDP EVAL-SDP-CB1Z controller board
PC software for control and data analysis
Standalone capability

EVALUATION KIT CONTENTS

EVAL-ADE1201EBZ

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

ADE1201 data sheet
ADE1201 schematic
ADE1201 PCB layout
ADE1201 bill of materials

SOFTWARE NEEDED

EVAL-ADE120xEBZ evaluation software

GENERAL DESCRIPTION

The EVAL-ADE1201EBZ is a fully featured evaluation board designed to evaluate the ADE1201 single channel, configurable, isolated digital binary input IC performance in a context similar to a real binary input interface application. The system demonstration platform (SDP) EVAL-SDP-CB1Z controller board (SDP-B) must be purchased separately from the evaluation kit. The evaluation kit includes evaluation software, written in LabVIEW®, which provides access to the registers and features of the device through a PC interface.

For full specifications on the ADE1201, consult the ADE1201 data sheet, which must be used in conjunction with this user guide when using the EVAL-ADE1201EBZ.

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REVISION HISTORY

12/2019—Revision 0: Initial Version

EVALUATION BOARD PHOTOGRAPH

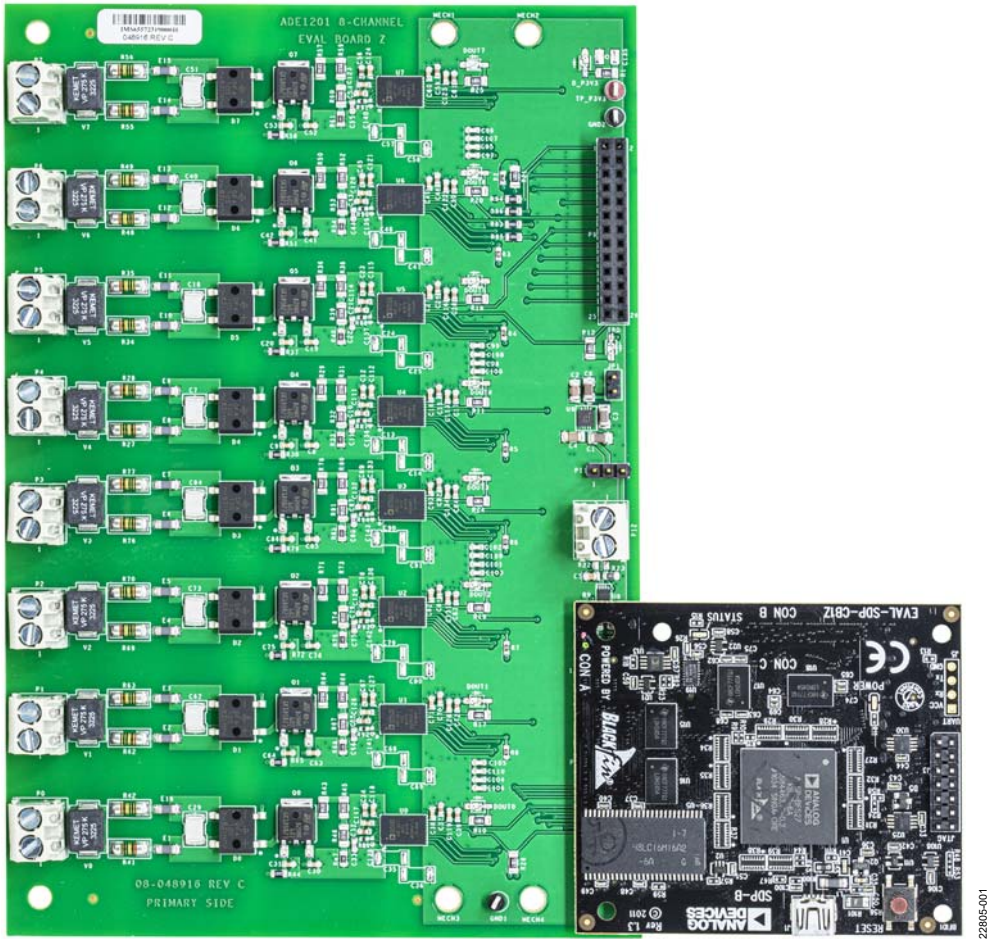

Figure 1. EVAL-ADE1201EBZ (Left) Connected to the SDP-B Board (Right)

EVALUATION BOARD CONNECTION DIAGRAM

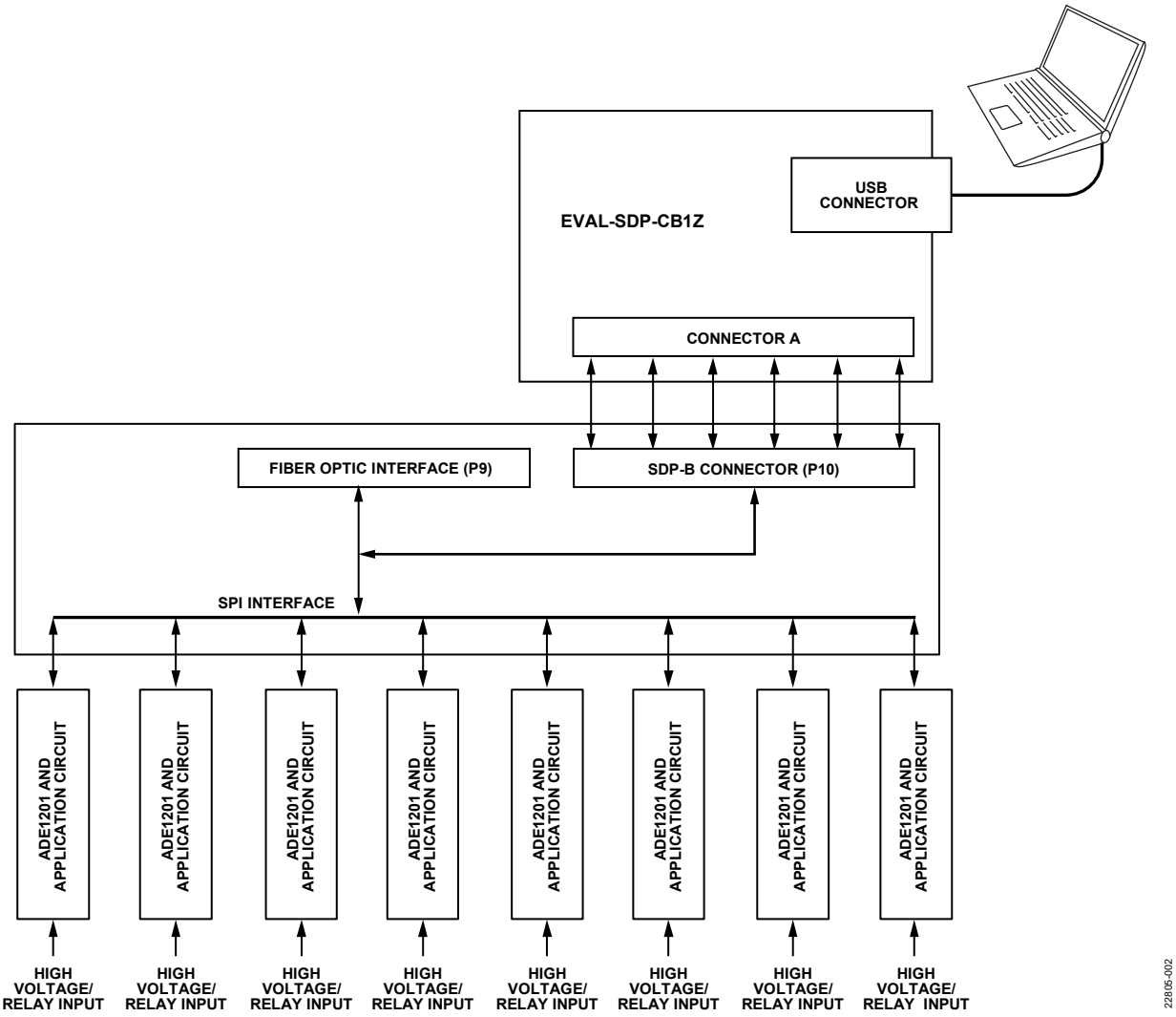

Figure 2. Evaluation Board Connection Diagram Showing Direct Connection to SDP-B Board

EVALUATION BOARD HARDWARE

OVERVIEW

The EVAL-ADE1201EBZ and the SDP-B (also referred to as the Blackfin® SDP board) are both required to evaluate the ADE1201.

When ordering the EVAL-ADE1201EBZ, also order the SDP-B board. The evaluation kit and the SDP-B board are purchased and packaged separately, but must be used together.

The EVAL-ADE1201EBZ is connected to the SDP-B board using the 120-pin connector, P10, as shown in Figure 2. The SDP-B board has an ADSP-BF527 microcontroller that handles all communications from the PC to the eight ADE1201 devices on the EVAL-ADE1201EBZ.

For certain types of electromagnetic compatibility (EMC) and electromagnetic interface (EMI) testing, the SDP-B board and the PC must be separated from the EVAL-ADE1201EBZ. One way to separate these devices from the EVAL-ADE1201EBZ is to isolate the signals sent between the SDP-B board and the EVAL-ADE1201EBZ using a fiber optic interface. Connections to the serial port interface (SPI) and the digital output (DOUT1) signals from the eight ADE1201 devices under test (DUTs) are available via the P9 connector.

POWERING UP THE EVALUATION BOARD

The EVAL-ADE1201EBZ can be powered either 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-ADE1201EBZ can be powered through one of the following methods:

- Through an external 3.3 V power supply. Connect the power supply to the TP_P3V3 and GND1 terminals. Jumper P11 and Jumper JP1 must be open.
- Through the SDP-B board. Short Jumper JP1 and short Pin 1 and Pin 2 on Jumper P11, which is the default method to power the EVAL-ADE1201EBZ.
- Through an external 5 V power supply to Jumper P9. Short Pin 2 and Pin 3 on Jumper P11 and short Jumper P12.

When the EVAL-ADE1201EBZ is powered on, the D_P3V3 light emitting diode (LED) is illuminated green.

Table 1 and Table 2 list the test points, terminals, jumpers, and connectors on the EVAL-ADE1201EBZ.

ANALOG INPUTS

The ADE1201 channels are designed to work with high voltage digital inputs from ±10 V to ±300 V. The input signals connect to the terminal blocks (P0 to P7) on the EVAL-ADE1201EBZ. 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, reverse polarity protected application circuit before the signals are connected to the ADE1201. The components used on the EVAL-ADE1201EBZ are the recommended values and types to use with the ADE1201. Refer to the ADE1201 bill of materials or the ADE1201 data sheet for more details.

There are eight ADE1201 devices on the EVAL-ADE1201EBZ. Table 1 identifies which EVAL-ADE1201EBZ terminal block corresponds to each ADE1201 device.

Table 1. EVAL-ADE1201EBZ Channel Assignment

Device	Binary Input	EVAL-ADE1201EBZ Input Terminals
ADE1201, U0	1	P0
ADE1201, U1	2	P1
ADE1201, U2	3	P2
ADE1201, U3	4	P3
ADE1201, U4	5	P4
ADE1201, U5	6	P5
ADE1201, U6	7	P6
ADE1201, U7	8	P7

Table 2. EVAL-ADE1201EBZ Jumpers, Test Points, and Connectors

Jumpers, Test Points, and Connectors	Description
TP_P3V3	Test point, connects to an external 3.3 V supply to power the ADE1201
GND1, GND2	GND test points
P11	3-pin jumper, connects the input of the U9 on-board regulator to either the SDP-B board 5 V supply or to an external voltage source
P12	2-pin connector, connects the EVAL-ADE1201EBZ to the 5 V external supply
JP1	2-pin jumper, connects the 3.3 V output of the U9 on-board regulator to power the ADE1201 ICs
P9	26-pin SPI and DOUT1 breakout connector
P10	120-pin SDP connector
P8	3.3 V (output of U9 regulator)

DIGITAL INPUT AND OUTPUT

The ADE1201 devices are connected to a common SPI bus on the EVAL-ADE1201EBZ. One SPI bus with one $\overline{CS}$ line is used to address all eight ADE1201devices using the hardware addressing feature of the ADE1201 device.

EVALUATION BOARD SOFTWARE

The EVAL-ADE1201EBZ is supported by the Windows®-based EVAL-ADE120xEBZ evaluation software that allows the user to access the functionalities of the ADE1201. The EVAL-ADE120xEBZ evaluation software communicates with the SDP-B board using the USB port of the PC. The SDP-B microcontroller communicates with the ADE1201 on the EVAL-ADE1201EBZ to process the requests sent from the PC. The installation file is named **EVAL-ADE1201 Evaluation Software**.

Before installing the EVAL-ADE120xEBZ evaluation software, take the following steps to uninstall any previous version of the EVAL-ADE120xEBZ evaluation software:

1. Click 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**.

INSTALLING THE DRIVERS

Administrator privileges are necessary to install and run the EVAL-ADE120xEBZ evaluation software. Disconnect the SDP-B board from the PC before installing the EVAL-ADE120xEBZ evaluation software. All drivers required for running the EVAL-ADE120xEBZ evaluation software are packaged with the installer.

INSTALLING THE EVAL-ADE120XEBZ EVALUATION SOFTWARE

The software package contains an installer that installs the EVAL-ADE120xEBZ evaluation software. The EVAL-ADE120xEBZ evaluation software is a LabVIEW-based program that runs on the PC. Refer to the README file in the installation folder to access a link to install the appropriate LabVIEW run-time engine before installing the EVAL-ADE120xEBZ evaluation software.

To install and launch the EVAL-ADE120xEBZ evaluation software, take the following steps:

1. Navigate to **EVAL-ADE120XEBZ** > **Installer** > **Volume** in the software package. Double-click the **setup.exe** file to launch the setup program that automatically installs all the software components (including the uninstall program) and creates the required directories.
2. To launch the EVAL-ADE120xEBZ evaluation software, click **Start** > **All Programs** > **ADE120X** and then click **EVAL-ADE120XEBZ_Evaluation_Software**. When starting the EVAL-ADE120xEBZ evaluation software for the first time, it may be required to right-click the **EVAL-ADE120X_ Evaluation_Software.exe** file and select **Run as the Administrator**.

To uninstall the EVAL-ADE120xEBZ evaluation software program and the run-time engine, use the **Add/Remove Programs** option in the Windows **Control Panel**.

MAIN WINDOW

When the software executable opens, the main EVAL-ADE120xEBZ evaluation software window 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. Click **Select** to proceed.

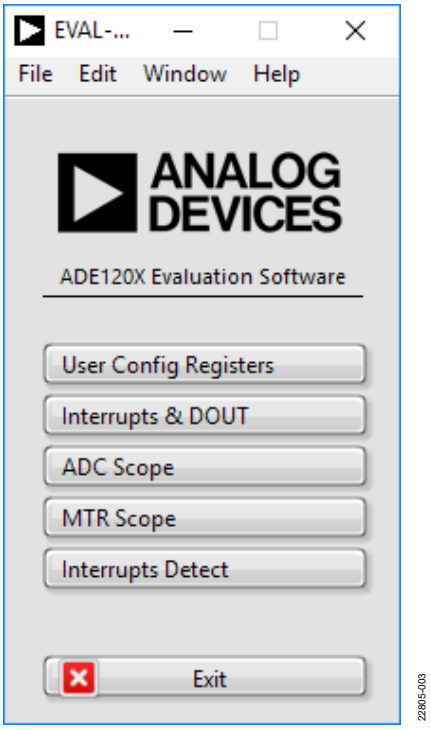

Figure 3. EVAL-ADE120xEBZ Evaluation Software Main Window

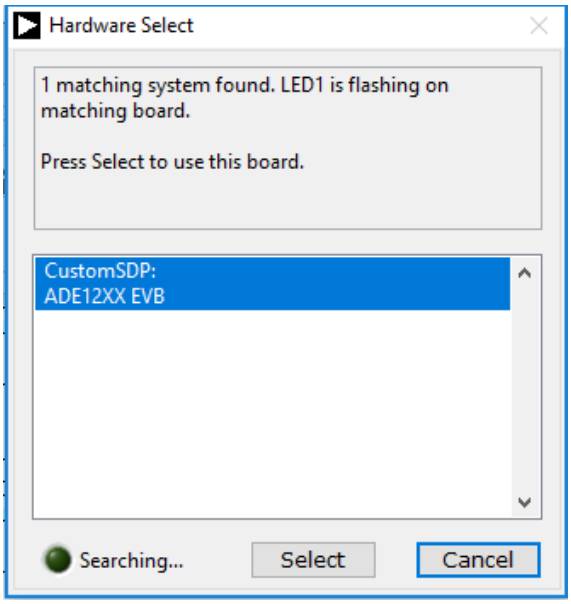

*Figure 4. **Hardware Select** Window*

The SDP code version and other pertinent hardware information are displayed in the **Connection Data** window, as shown in Figure 5. To open the **Connection Data** window shown in Figure 5, click the **Window** menu in the main EVAL-ADE120xEBZ evaluation software window and click **Connection Info** in the dropdown menu.

Connect all necessary hardware and power up the EVAL-ADE1201EBZ before using the software windows for communication.

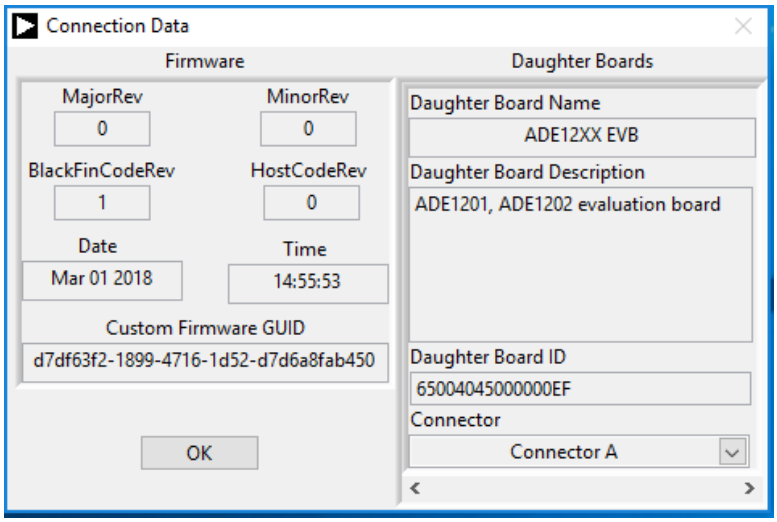

*Figure 5. **Connection Data** Window*

EVALUATION SOFTWARE FUNCTIONS

The main software window (see Figure 3) consists of five options to evaluate a particular functionality of the ADE1201. The five options available for evaluation include the following:

- **User Config Registers**
- **Interrupt & DOUT**
- **ADC Scope**
- **MTR Scope**
- **Interrupts Detect**

Click any of these five options to open a corresponding window. To close any of these windows, click the same option in the main software window or click the **Close** button. Multiple windows can be left open on the monitor to evaluate the different ADE1201 features simultaneously.

AUTO IDENTIFICATION

There are eight ADE1201 devices on each EVAL-ADE1201EBZ 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.

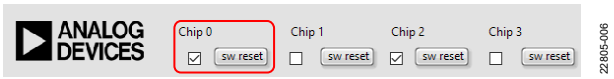

*Figure 6. **Auto Identified Devices***

USER CONFIGURATION REGISTERS

The **User Config 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 ADE1201 powers up with default register values automatically populated in the register fields in the **User Config Registers.vi** window, 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 to which the register values are saved. Click **Save Registers Value 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** text box, and then click **Load Registers Value From File** to update the table in the **User Config Registers.vi** window with the values from the file. To write to all writable registers within the ADE1201, click **Write Registers**. 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 either **Write Registers** or **Load Registers Value From File** is clicked, the EVAL-ADE120xEBZ evaluation software unlocks the ADE1201, writes the register change to the appropriate device, and then locks the device. To perform a device software reset, click **sw reset**, as shown in Figure 6.

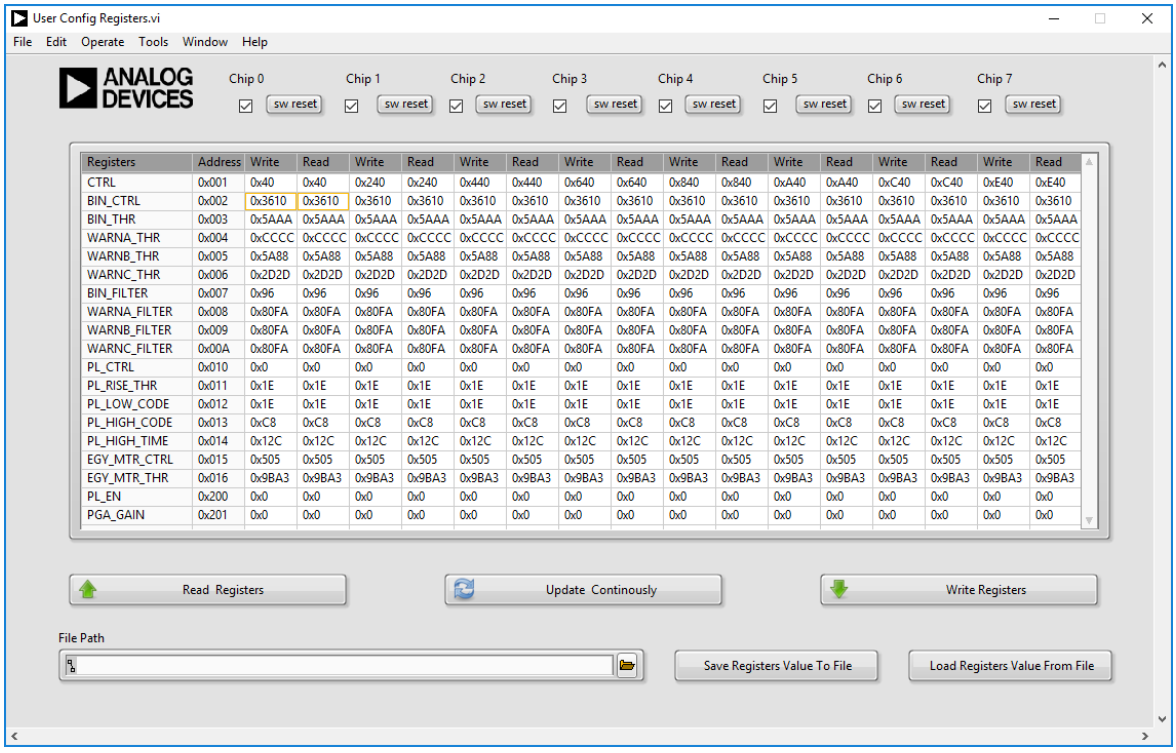

Figure 7. User Configuration Registers Window

INTERRUPTS WINDOW

The interrupts window displays the status of all interrupt events. The individual bits of the INT_STATUS register are illuminated with green LEDs in the interrupt window (see Figure 8). If a register LED is illuminated, the corresponding status bit is set to 1. Next to each LED, a checkbox represents the corresponding mask bit. 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.

To view the DOUT1 and $\overline{\text{IRQ}}$ pin logic levels, click **Poll DOUT/IRQ**. If an INT_STATUS register LED (**DOUT1_0** through **DOUT1_7**) is illuminated, the DOUT1 pins are high. DOUT1 and $\overline{\text{IRQ}}$ are driven by the ADE1201 and can only be polled by the user. If the **IRQ** LED is illuminated, it means that the active interrupt from any of the eight devices is present on the respective $\overline{\text{IRQ}}$ pin.

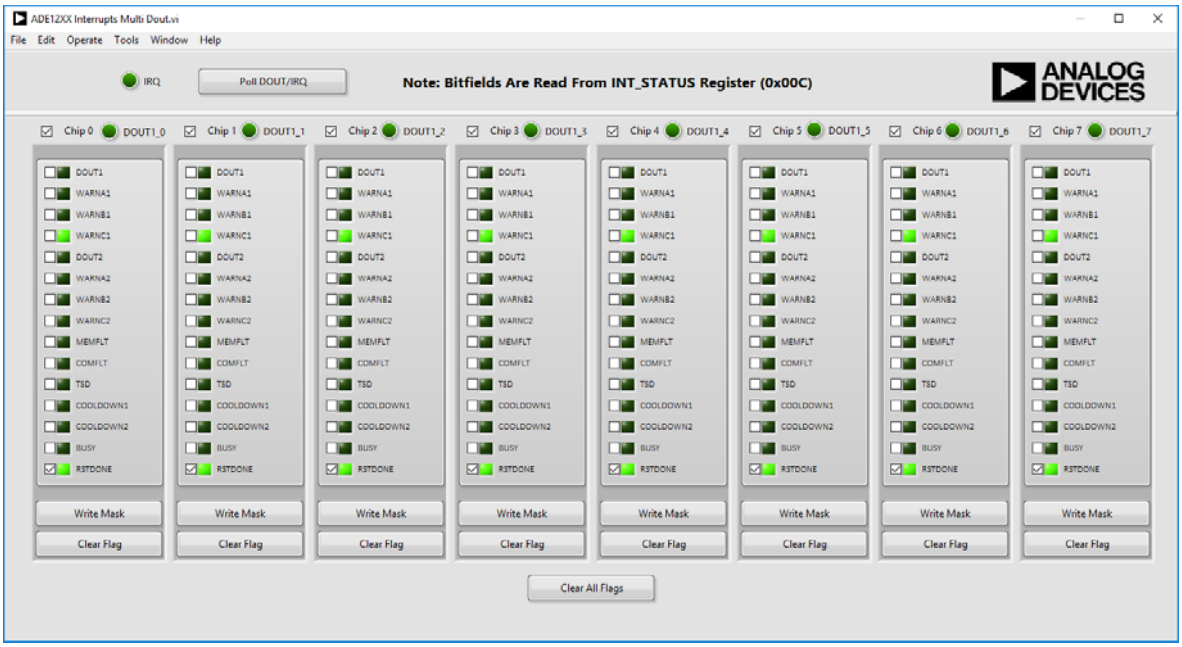

Figure 8. Interrupts Window

ADC SCOPE WINDOW

The analog-to-digital converter (ADC) scope window displays the values of the ADC register (Address 0x00E) or the ADCDEC register (Address 0x00F). Select which of the two registers the ADC scope displays using the dropdown menu labeled **ADC** in Figure 9. The registers are updated at 100 kHz. The ADC scope window reads the data at 100 kSPS when a single ADE1201 device is viewed. Set the channel and the number of samples to acquire by entering the correct values in the appropriate text boxes, as shown in Figure 9. The data can be acquired once or continuously, as shown in Figure 9. The ADC scope window is automatically set to normal mode. The ADC scope has two other modes: waveform capture with threshold trigger (WFB THR) mode and waveform capture with interrupt trigger (WFB IRQ) mode. WFB THR mode works the same way as normal mode, except the samples are only captured when the ADC value reaches a specified threshold. In WFB IRQ mode, samples are only captured when a predetermined interrupt occurs. The **Voltage Gain** box reflects the voltage divider ratio of each channel on the EVAL-ADE1201EBZ.

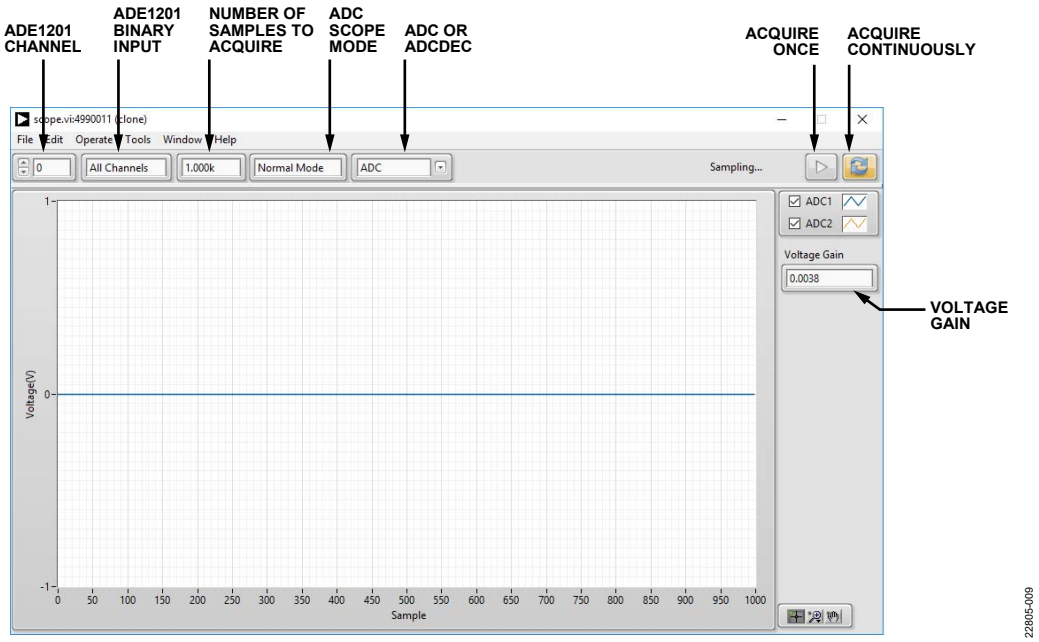

Figure 9. ADC Scope Window

MTR SCOPE WINDOW

Click the **MTR Scope** option shown in Figure 3 to open the window shown in Figure 10, which displays the values of the EGY_MTR1 register (Address 0x017). In the ADE1201, EGY_MTR1 is updated at 100 kSPS. The MTR scope window reads the data continuously at 100 kSPS when data for a single ADE1201 device is viewed. The user can set the channel, as shown in Figure 10.

INTERRUPTS DETECT WINDOW

Click the **Interrupts Detect** option shown in Figure 3 to open the window shown in Figure 11, which allows the user to capture the occurrence of any one of the fifteen interrupts available. To use the interrupts detect window, select at least one interrupt bit and click **Start**. The EVAL-ADE120xEBZ evaluation software continuously counts the interrupts as the interrupts occur, and the window shows the interrupts count. To stop the accumulation of interrupts, click **Stop** (see Figure 11).

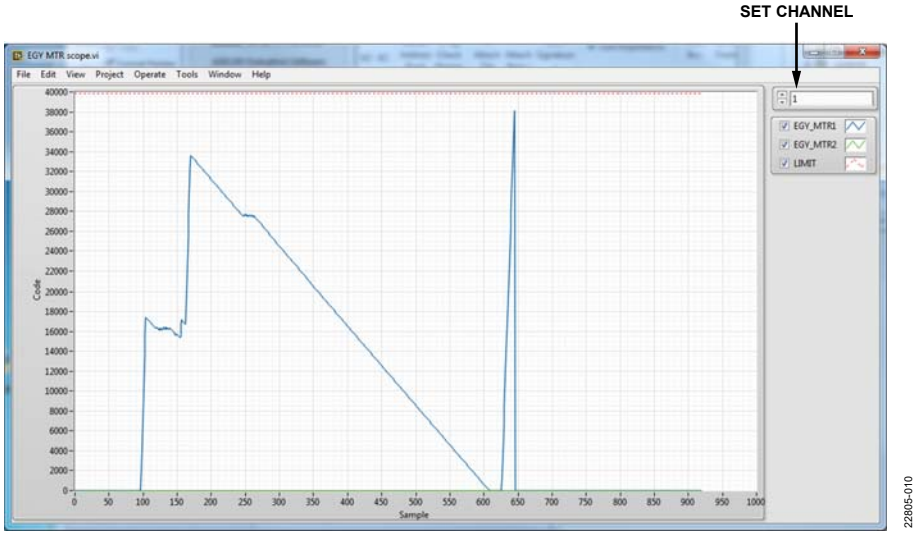

Figure 10. EGY MTR Scope Window

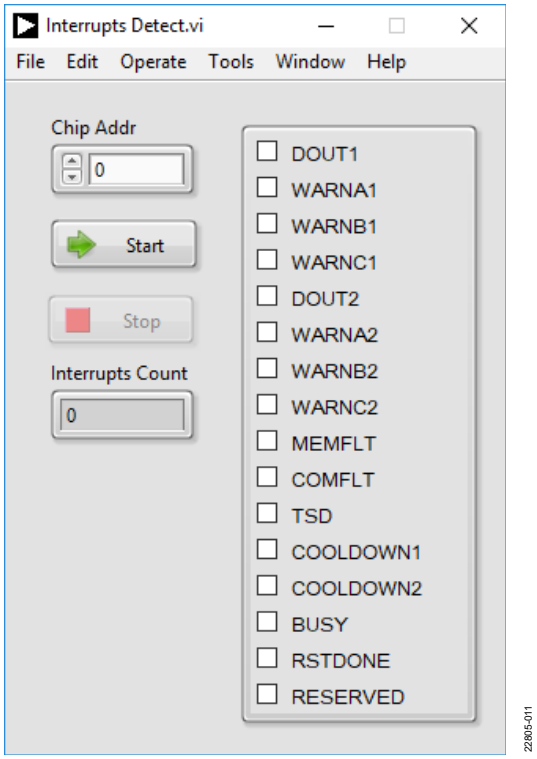

Figure 11. Interrupts Detect Window

TROUBLESHOOTING

If the EVAL-ADE120xEBZ evaluation software does not detect the SDP-B board, the message shown in Figure 12 displays.

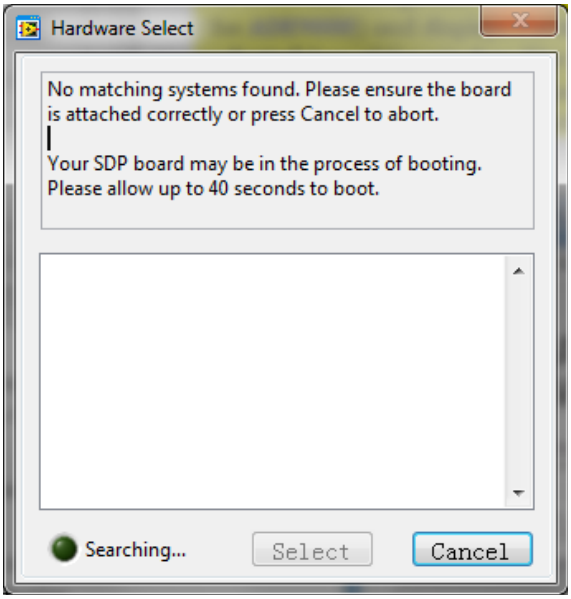

Figure 12. ***Hardware Select*** *Message*

When this message appears, take the following steps:

1. Verify that the SDP-B board is connected to the PC using the USB cable. When connected, the window in Figure 13 appears in the task bar and Windows 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**.

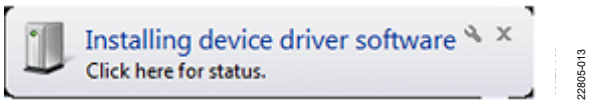

Figure 13. ***Installing device driver software*** *Message*

EVALUATION BOARD SCHEMATICS AND ARTWORK

The reference design schematics and artwork for the EVAL-ADE1201EBZ are available on the EVAL-ADE1201EBZ webpage. Refer to the ADE1201 data sheet for more details about the layout guidelines and external components in the recommended ADE1201 application circuit.