

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-ADE120XEZ 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.

TABLE OF CONTENTS

Features	1	Evaluation Board Software.....	6
Evaluation Kit Contents.....	1	Installing the Drivers	6
Additional Equipment Needed	1	Installing the EVAL-ADE120XEBZ Software	6
Documents Needed.....	1	Main Window	6
Software Needed	1	Evaluation Software Functions	8
General Description	1	Auto Identification	8
Revision History	2	User Configuration Registers	8
Evaluation Board Photograph.....	3	Interrupts Window.....	9
Evaluation Board Connection Diagram	4	ADC Scope Window.....	10
Evaluation Board Hardware	5	MTR Scope Window.....	11
Overview.....	5	Interrupts Detect Panel.....	11
Powering Up the Evaluation Board.....	5	Troubleshooting.....	12
Analog Inputs.....	5	Evaluation Board Schematics and Artwork.....	13
Digital Input and Output.....	5		

REVISION HISTORY

12/2019—Revision 0: Initial Version

EVALUATION BOARD PHOTOGRAPH

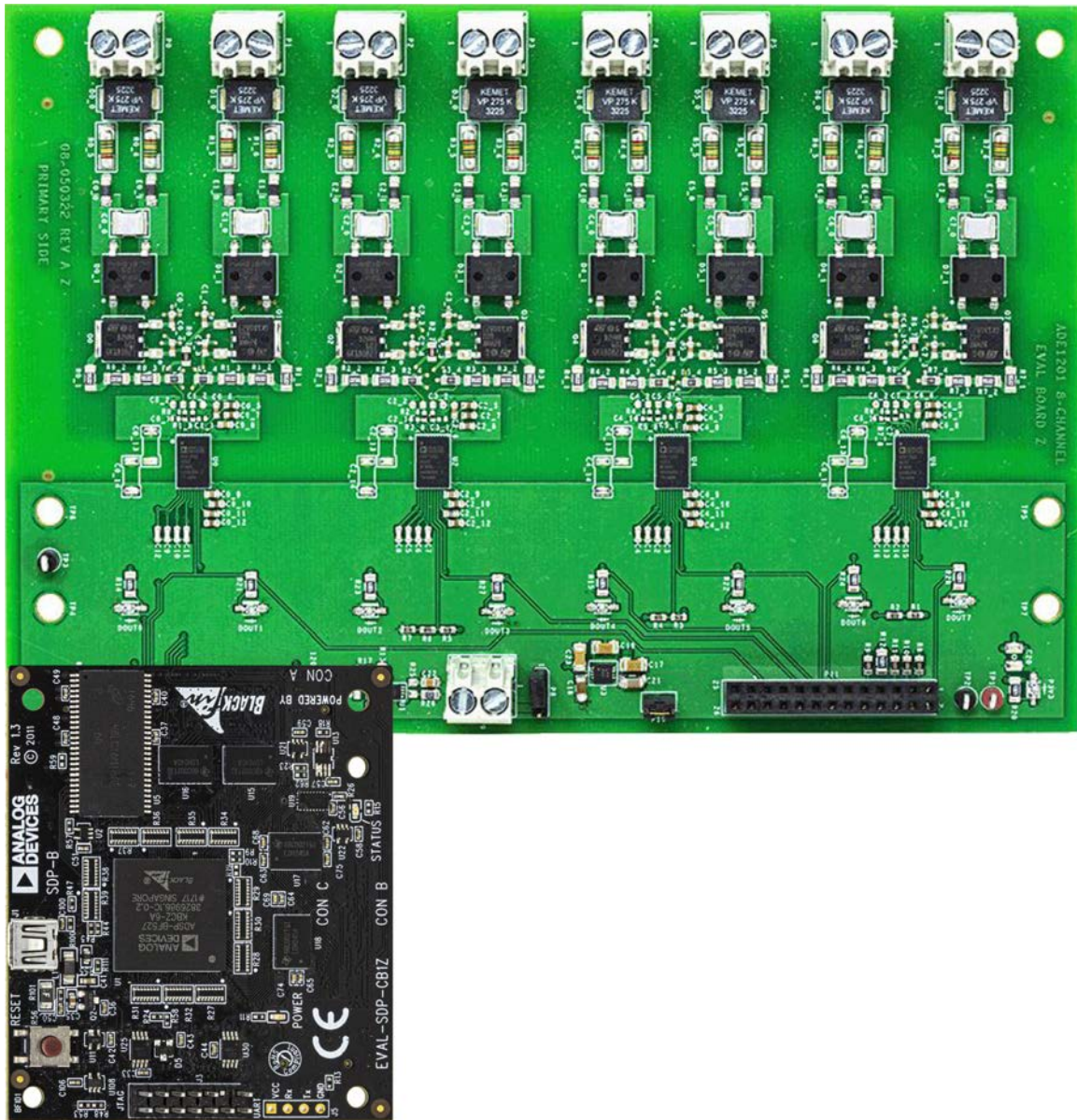


Figure 1. EVAL-ADE1202EBZ (Top) Connected to the EVAL-SDP-CB1Z (Bottom)

22094-001

EVALUATION BOARD CONNECTION DIAGRAM

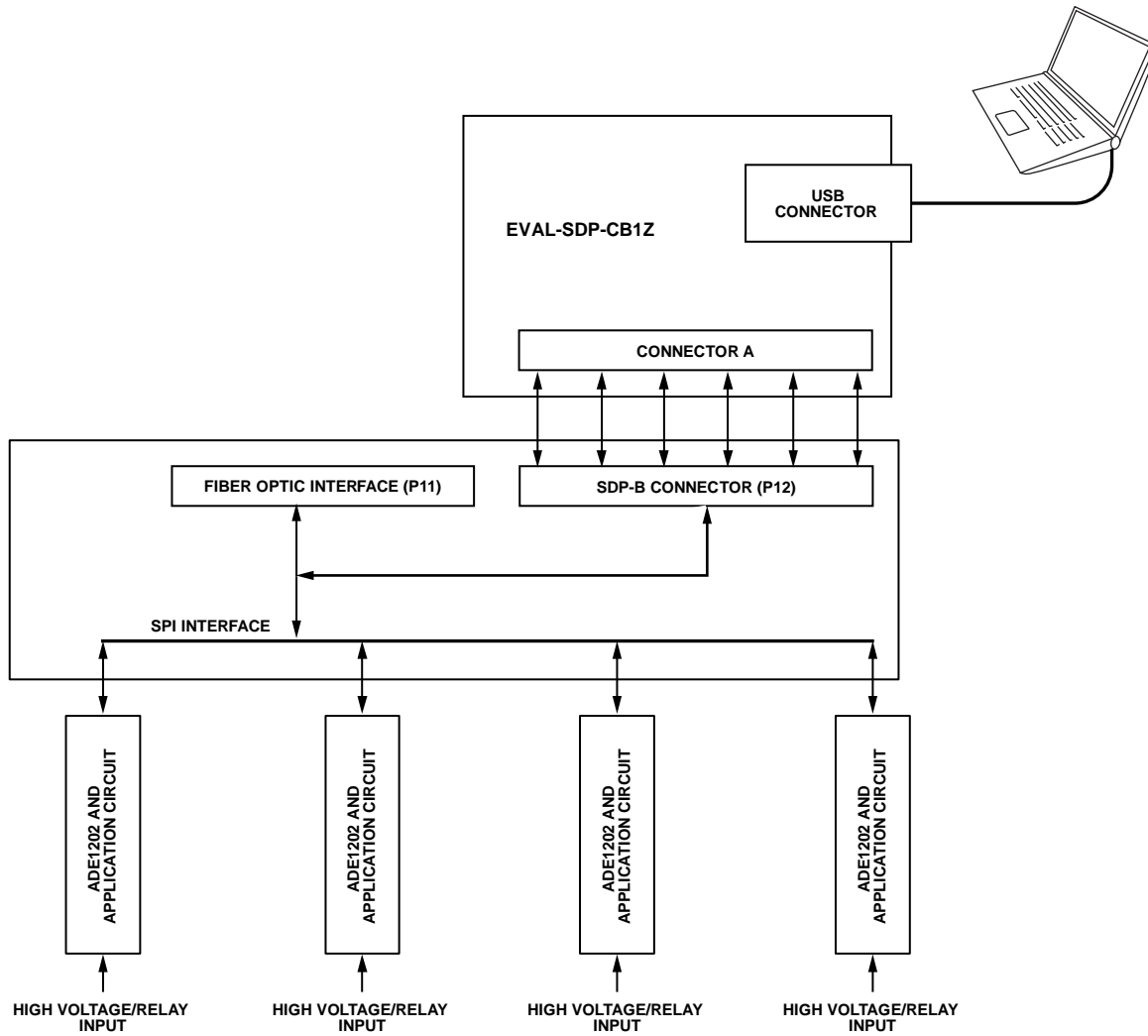


Figure 2. Evaluation Board Connection Diagram Showing a Direct Connection to the SDP

22094-002

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.

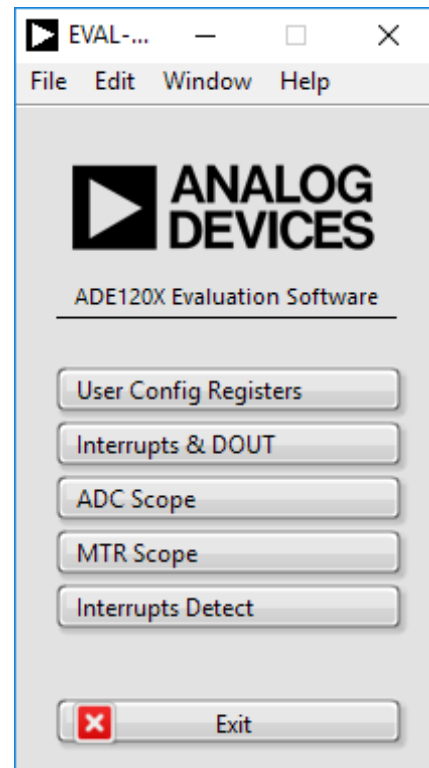


Figure 3. Main Window of the Evaluation Software

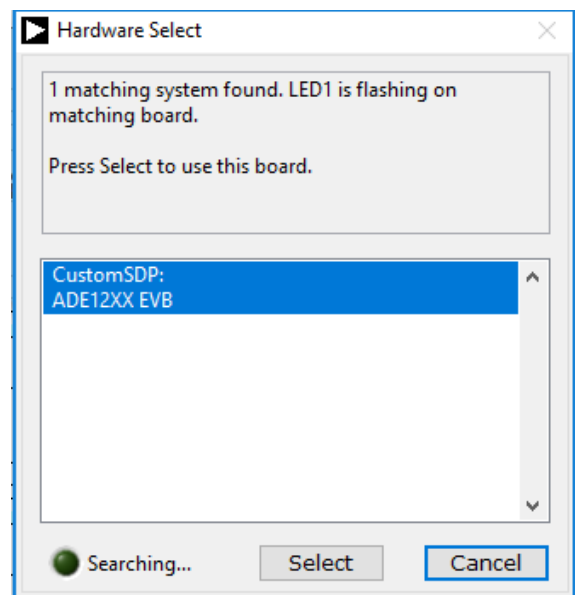


Figure 4. Hardware Select Window

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.

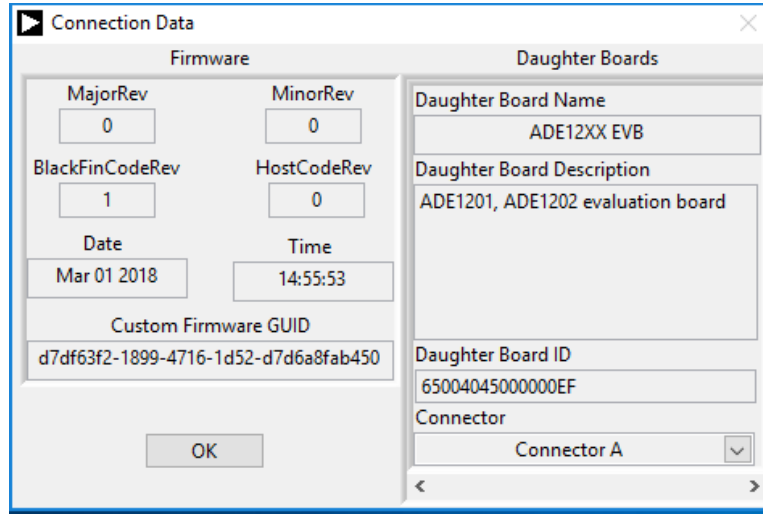


Figure 5. **Connection Data** Window

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-ADE120XEZBZ 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-ADE120XEZBZ evaluation software populates the register fields with the default values in all windows.

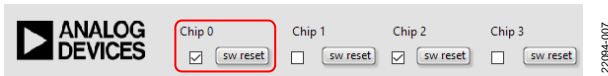


Figure 6. Auto Identified Devices

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-ADE120XEZBZ evaluation software. When clicking the **Write Registers** button or the **Load Register Values From File** button, the EVAL-ADE120XEZBZ 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.

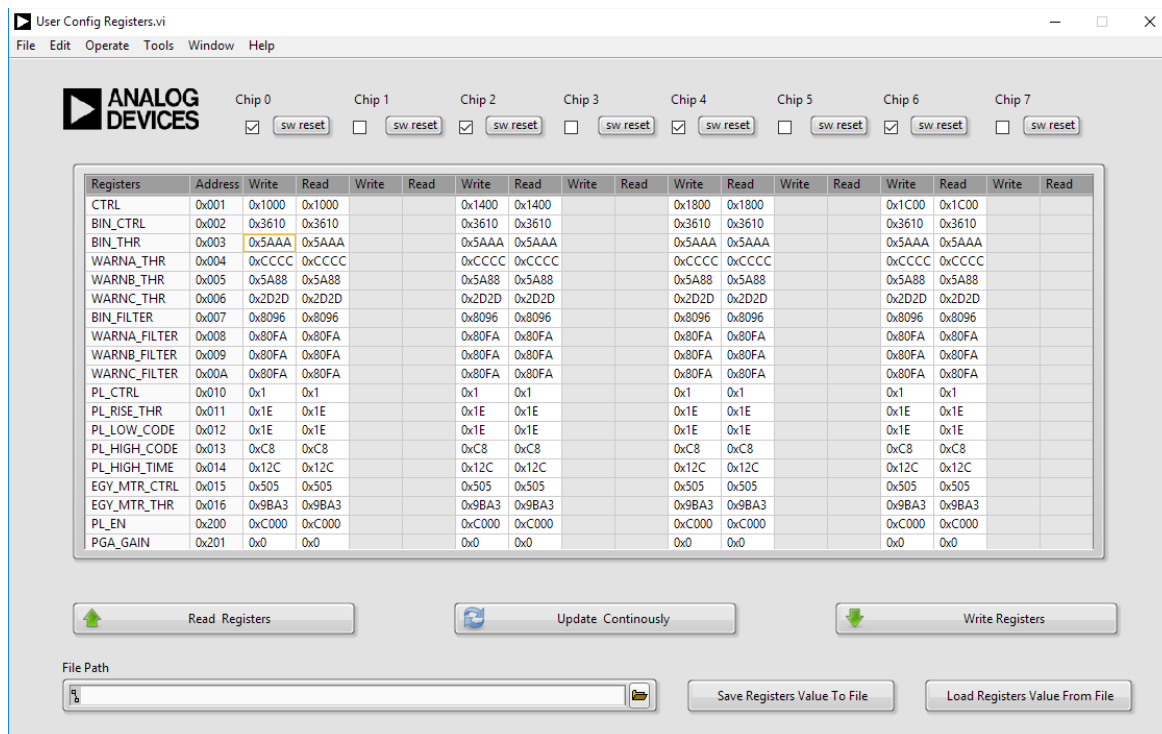


Figure 7. User Configuration Registers Window

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`.

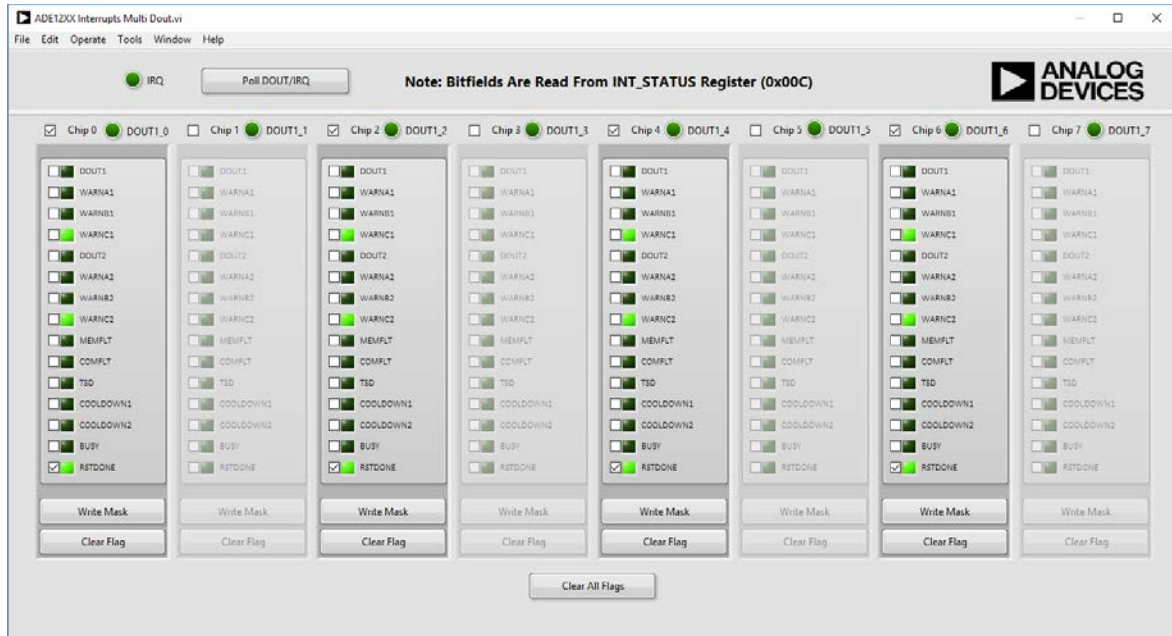


Figure 8. Interrupts Window

22094-009

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.

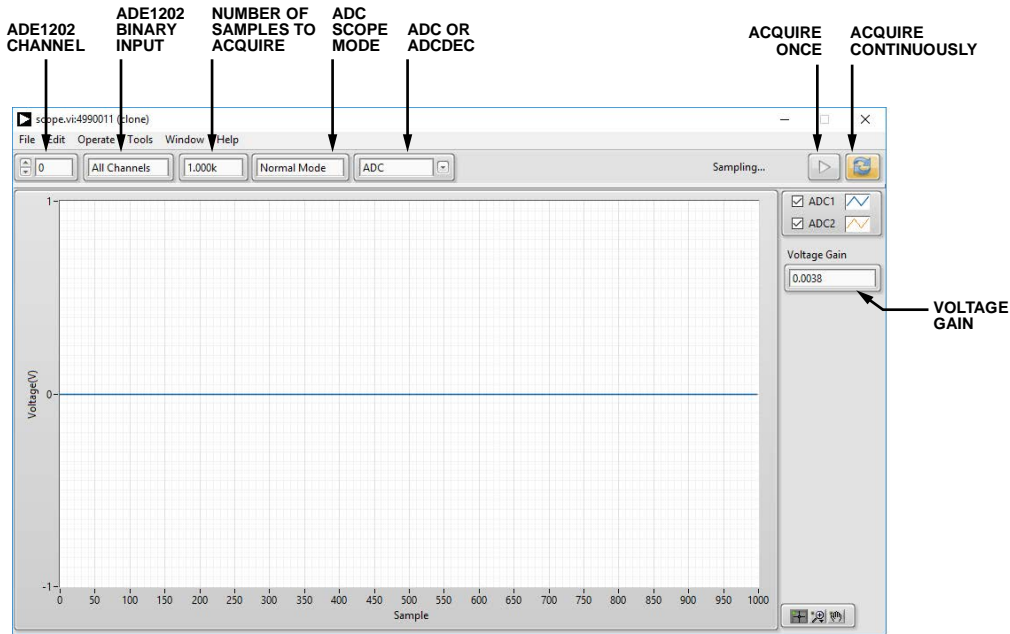


Figure 9. ADC Scope Window

22084-010

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).

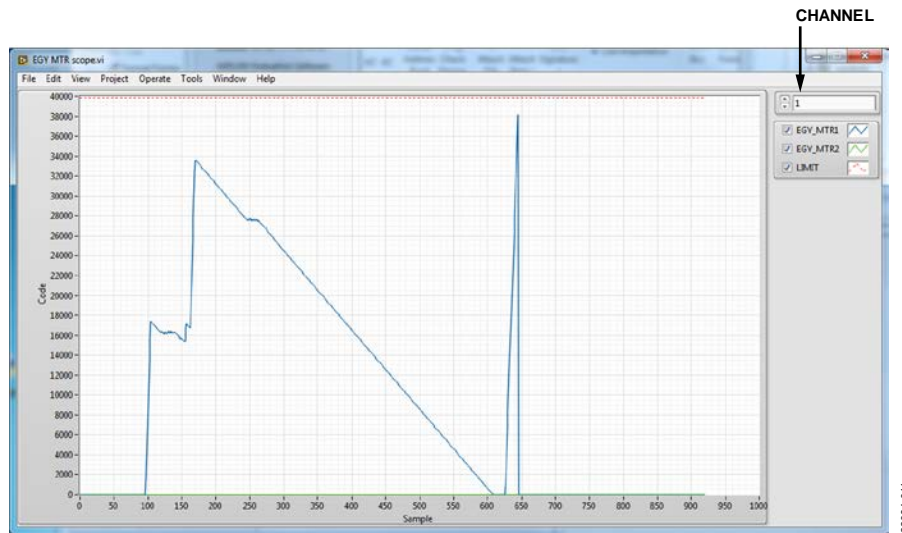


Figure 10. EGY MTR Scope Window

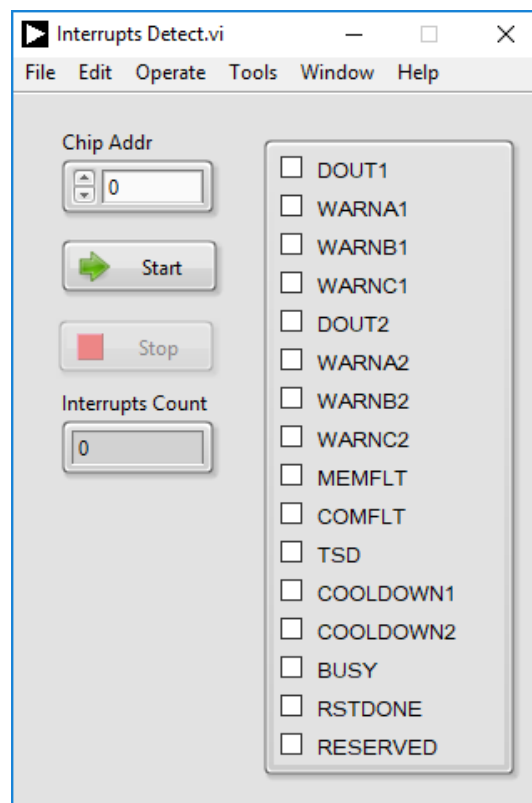


Figure 11. Interrupts Detect Panel

TROUBLESHOOTING

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

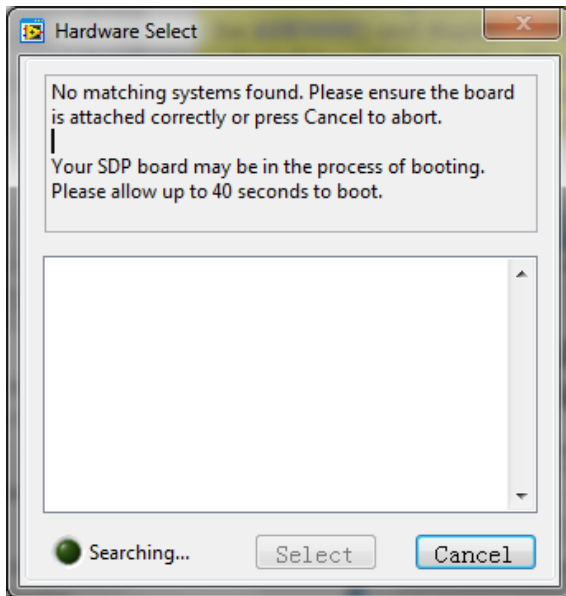


Figure 12. **Hardware Select** Message

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**.

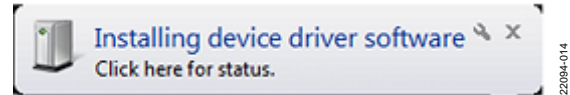


Figure 13. **Installing device driver software** Message

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.



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.

Legal Terms and Conditions

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, temporary, non-exclusive, non-sublicensable, 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: 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. 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 occurred 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 at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, 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.

©2019 Analog Devices, Inc. All rights reserved. Trademarks and registered trademarks are the property of their respective owners.
UG22094-0-12/19(0)



www.analog.com