Evaluation Board for the ADE9113 Isolated Sigma Delta ADC with SPI

FEATURES

- Full featured evaluation board for the ADE9103, ADE9112, and ADE9113
- 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-ADE9113EBZ evaluation board
- SDP-B adapter board
- MCU adapter board

ADDITIONAL EQUIPMENT NEEDED

- EVAL-SDP-CB1Z (must order separately) includes a USB cable
- User-selectable microcontroller board (not included)
- 3 current sensing shunts
- Precision current and voltage signal source
- PC running Windows 7, Windows 8.1, or Windows 10 with a USB 2.0 port

ONLINE RESOURCES

- ADE9103/ADE9112/ADE9113 data sheet
- ADE9103/ADE9112/ADE9113 evaluation software (EVAL-ADE9113KTZ SW)
- Design and integration files: schematics, layout files, and bill of materials

GENERAL DESCRIPTION

The EVAL-ADE9113KTZ evaluation kit includes two boards that work together (along with the EVAL-SDP-CB1Z) to evaluate the performance of the ADE9113 isolated Σ-Δ analog-to-digital converter (ADC) in a context close to an actual 3-phase meter implementation. Although this kit can also be used to test the similar functionality of the ADE9103 and ADE9112 ADC, the EVAL-ADE9113KTZ is populated with only ADE9113 devices and thus only the ADE9113 is referred to in this user guide. Evaluation software, written in LabVIEW®, provides access to the registers of every ADE9113 using a PC interface. Additionally, the microcontroller unit (MCU) adapter board is compatible with an Arduino® shield type connector, allowing custom firmware development or use of the reference code with the Nucleo-F103RB.

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REVISION HISTORY

11/2023—Revision 0: Initial Version

TYPICAL SETUP

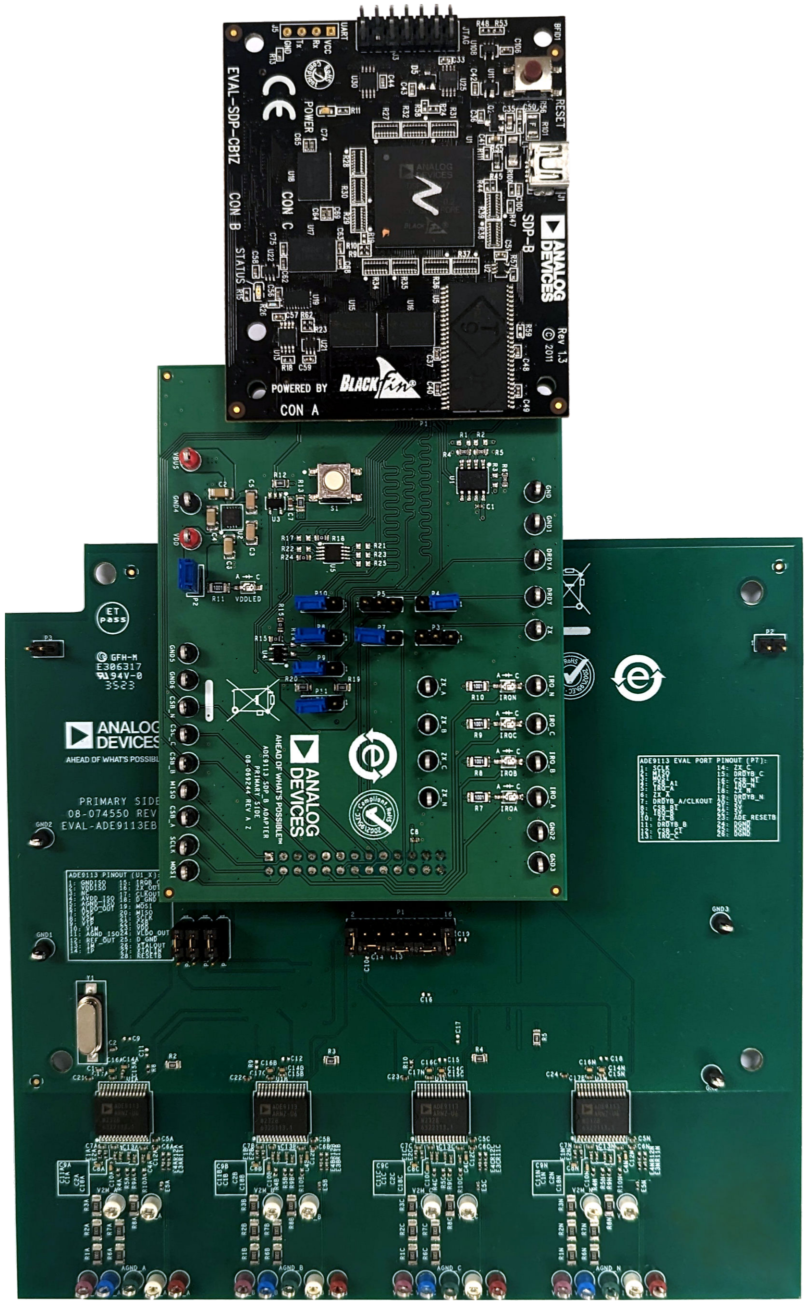

Figure 1. ADE9113EBZ Connected to the SDP-B Adapter and SDP-B Boards

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OVERVIEW

To evaluate the ADE9113, three boards are connected together (see Figure 1). The EVAL-ADE9113EBZ, which is populated with four ADE9113 ADCs, can be used as an implementation example of a 3-phase energy meter (see Figure 2).

The SDP-B adapter board and MCU adapter board are both provided in the evaluation kit. The 26-pin connector, P6, on the SDP-B adapter board, or P6 on the MCU adapter board is connected to the P7 connector on the EVAL-ADE9113EBZ evaluation board.

The SDP-B adapter board is connected to the SDP-B Black*fin* board (also referred to as SDP-B or EVAL-SDP-CB1Z) using a 120-pin connector. The EVAL-SDP-CB1Z must be ordered separately when ordering the EVAL-ADE9113KTZ; the kit and the SDP-B board are purchased and packaged separately but must be used together. Alternatively, the MCU adapter board is connected to an off-the-shelf microcontroller board through the Arduino type connectors, P1, P2, P3, P4, and P5. This microcontroller board is not provided; however, it can aid in the development of firmware on the system of choice.

The SDP-B Black*fin* board consists of an ADSP-BF527 microcontroller that handles all the communications from the PC to the ADE9113 devices populating the evaluation board (see Figure 3).

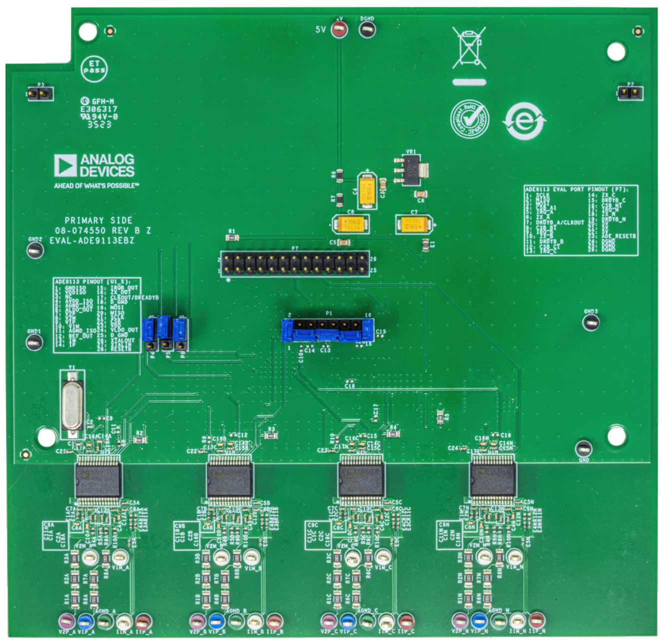

Figure 2. EVAL-ADE9113EBZ Evaluation Board

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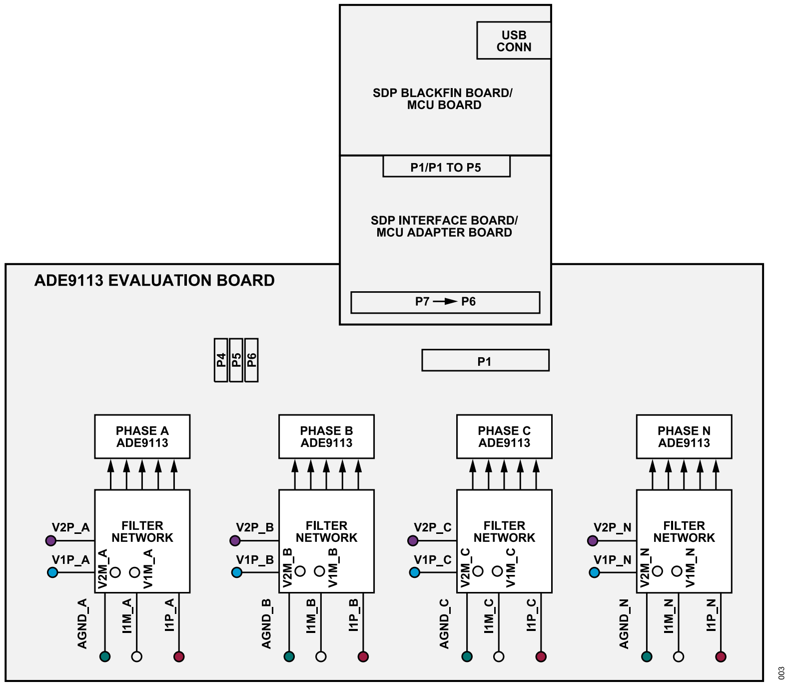

Figure 3. EVAL-ADE9113KTZ Evaluation Kit Connection Diagram

POWERING UP THE EVAL-ADE9113KTZ BOARDS

When using the SDP-B setup, the boards receive power via the USB cable that is connected to the PC. A 3.3 V regulator then powers the SDP-B board microcontroller and the ADCs of the ADE9113 populating the evaluation board. No additional power source is required for the EVAL-ADE9113KTZ boards.

When using the MCU adapter board, power is passed to the MCU adapter board and the EVAL-ADE9113EBZ from the MCU board plugged into the shield form factor headers. No additional power source is required; however, the header on the MCU adapter board can be used to wire up a custom connection to an external MCU.

If power is not available through the MCU adapter board, the EVAL-ADE9113EBZ has two test points to apply an external 5 V supply, a positive test point (**+V**), and a negative test point (**DGND**).

ANALOG INPUTS

Current and voltage signals are connected at the test pins placed on the EVAL-ADE9113EBZ. All analog input signals are filtered using the on-board antialiasing filters before the signals are connected to the ADCs of the ADE9113. The components used on the EVAL-ADE9113EBZ are the values recommended for use with the ADE9113.

Current Sense Inputs (I1P_x and I1M_x Test Pins)

Every ADE9113 measures the voltage across a shunt at its IP and IM pins. Figure 4 shows the structure used for the Phase A current.

The R11A and C5A and R12A and C6A RC networks are the antialiasing filters. The default corner frequency of these low-pass filters (LPFs) is 7.073 kHz (150 Ω and 150 nF). These filters can easily be adjusted by replacing the components on the EVAL-ADE9113EBZ.

The E3, E4, and E5 ferrite beads filter any high frequency noise that may be induced into the wires.

The absolute maximum voltage on the IP and IM pins of the ADE9113 is ±1.4 V. The maximum signal level permissible at the IP pin of the ADE9113 is ±0.040625 V peak, which is the full-scale input level of ±0.03125 V with room for a common mode. The signal range must not exceed ±0.040625 V, with respect to AGND_x, for specified operation.

The Phase A shunt is connected between the I1P_A and I1M_A test pins.

The other current channels (that is, Phase B, Phase C, and Phase N) have an identical input structure. The Phase B shunt is connected between the I1P_B and I1M_B test pins, the Phase C shunt is connected between I1P_C and I1M_C, and the Phase N shunt is connected between I1P_N and I1M_N.

The shunt maximum value is a function of the maximum current to be measured on every phase, as follows:

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$$R = \frac{31.25 \times 10^{-3}}{\sqrt{2}} \times \frac{1}{I_{FS}} \qquad (1)$$

where:

$\frac{31.25 \times 10^{-3}}{\sqrt{2}}$ is the RMS value of the full-scale voltage accepted at the ADC input.

I_{FS} is the maximum full-scale current to be measured.

Figure 5 shows how a shunt is connected to the Phase A current input structure. The shunt is connected between the phase line and the phase load of the energy meter Phase A line inputs. The I1P_A and I1M_A test pins are connected to the shunt measurement poles, while AGND_A, the test pin that is the ground of the Phase A ADE9113 side, is connected to the ground pole of the shunt.

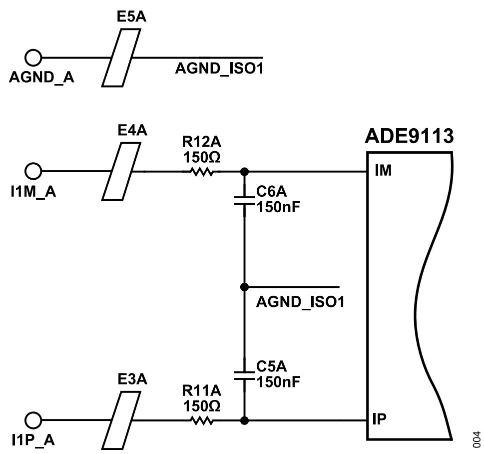

Figure 4. Phase A Current Input Structure on the EVAL-ADE9113EBZ

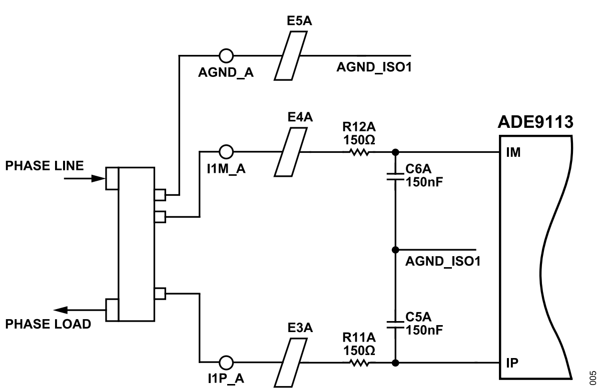

Figure 5. Example of a Shunt Connection

Phase Voltage Sense Inputs (V1P_x Test Pins)

The phase-to-neutral voltage input connections on the EVAL-ADE9113EBZ can be directly connected to the line voltage sources between V1P_A and AGND_A for Phase A to the neutral voltage, between V1P_B and AGND_B for Phase B to the neutral voltage, and between V1P_C and AGND_C for Phase C to the neutral voltage. These voltages are attenuated using a simple resistor divider network before they are supplied to the ADE9113. The attenuation network on the voltage channels is designed so that the corner frequency (3 dB frequency) of the network matches the antialiasing filters in the current channel inputs to prevent the occurrence of large energy errors at low power factors.

The V1P_A path in Figure 6 shows a typical connection of the Phase A voltage inputs; the resistor divider consists of three 330 kΩ resistors (R6A, R7A, and R8A) and one 1 kΩ resistor (R9A). The antialiasing filter R9A and C18A matches the R10A and C4A filter in the V1M path. The absolute maximum voltages on the V1P and V1M pins of the ADE9113 are ±2 V. The maximum signal level permissible at the V1P pin of the ADE9113 is ±0.5 V peak. The signal range must not exceed ±0.6 V with respect to AGND_ISO1 for the specified operation. Test point V1M_A is available if using the ADC differentially is required. An external voltage divider must be added to V1M_A to match V1P_A.

Auxiliary Voltage Sense Inputs (V2P_x Test Pins)

The auxiliary voltage input connections on the EVAL-ADE9113EBZ can be directly connected to the line voltage sources between V2P_x and AGND_x for the Phase A, B, C, or N auxiliary voltage.

The V2P_x path is similar to the V1P_A path shown in Figure 6

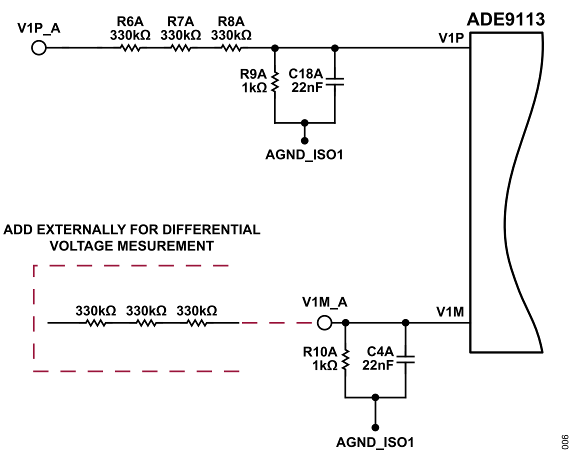

Figure 6. Phase A Voltage Input Structure on the EVAL-ADE9113EBZ

Isolated Ground Pins Management

The ADE9113 package has four isolated ground pins, two are GND_{ISO}, Pin 1 and Pin 3, two are AGND, Pin 5 and 11. Internally, Pin 1 and Pin 3 are tied together, and Pin 5 and Pin 11 are tied together. The AGND_x test point is directly connected to the AGND pins, and it is only connected to GND_{ISO} through the ferrite beads, E1x and E2x. This division is critical to help manage RF emissions and, therefore, any external connections are connected to AGND.

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SETTING UP THE EVAL-ADE9113EBZ AS AN ENERGY METER

Figure 7 shows a typical setup for the EVAL-ADE9113EBZ. In this example, an energy meter for a 3-phase, 4-wire wye distribution system is shown. Shunts are used to sense the phase currents and are connected as shown in Figure 7. The line voltages are connected directly to the EVAL-ADE9113EBZ as shown. The EVAL-ADE9113EBZ is supplied from one power supply provided by the PC through the USB cable.

Figure 8 shows a setup for the EVAL-ADE9113EBZ as an energy meter for a 3-phase, 3-wire, delta distribution system. The Phase B voltage is considered as a reference, and the V1P_x test pins of Phase A and Phase C of the ADCs on the ADE9113 are connected to it.

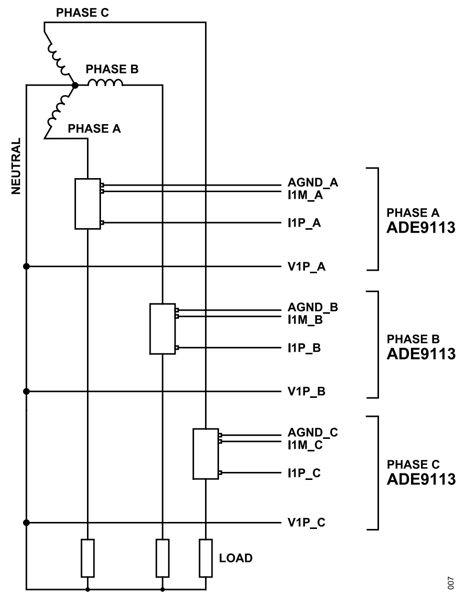

Figure 7. Typical Setup for the EVAL-ADE9113EBZ for 3-Phase, 4-Wire, Wye Distribution System

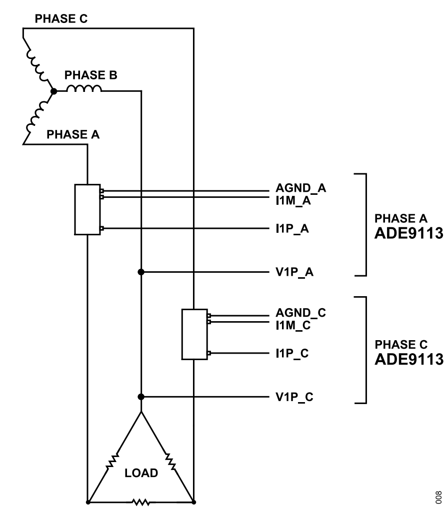

Figure 8. Typical Setup for the EVAL-ADE9113EBZ for 3-Phase, 3-Wire Delta Distribution Systems

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Using the EVAL-ADE9113EBZ with Another Microcontroller

It is possible to manage the EVAL-ADE9113EBZ with a different microcontroller mounted on another board. The EVAL-ADE9113EBZ can be connected to this microcontroller board through the P1, P2, P3, P4, and P5 connectors on the MCU adapter board. These connectors are setup in an Arduino form factor that is compatible with a variety of microcontroller development boards. The SDP-B adapter and the SDP-B Black*fin* boards are, in this case, left unused.

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The EVAL-ADE9113KTZ is supported by Windows® based software that allows the user to access all the functionality of the ADE9113. The **EVAL-ADE9113KTZ SW** runs on the PC and communicates with the SDP-B via a USB, which in turn, communicates with the ADE9113 ADCs on the EVAL-ADE9113EBZ to process requests. If microcontroller firmware level interaction with the ADE9113 is required, the MCU adapter can be used instead of the SDP-B adapter board with the SDP-B.

INSTALLING THE EVAL-ADE9113KTZ SOFTWARE

To set up the EVAL-ADE9113KTZ software, install the following: **EVAL-ADE9113KTZ SW**, **ADI SDP Drivers**, and **LabVIEW 2019 SP1 Runtime** by taking the following steps:

1. Download the **EVAL-ADE9113KTZ SW** installer from the EVAL-ADE9113 product page.
2. Run the **EVAL-ADE9113KTZ SW** installer executable (.exe) file.
3. Follow the prompts shown on the screen to complete the installation for **EVAL-ADE9113KTZ SW**. The default settings are recommended (see Figure 9).
4. The installer for the SDP drivers automatically pops up next. Follow the prompts on the screen again to complete the installation (see Figure 10).
5. Download **LabVIEW 2019 SP1 Runtime** from the NI website, which may require users to create or log in to an NI account.
6. Run the installer executable file and follow the on screen prompts to complete the installation.

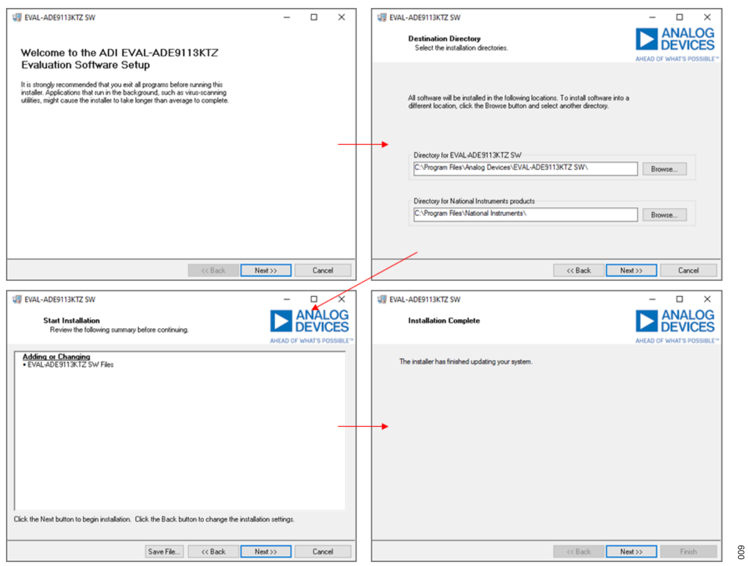

Figure 9. EVAL-ADE9113KTZ SW Installation

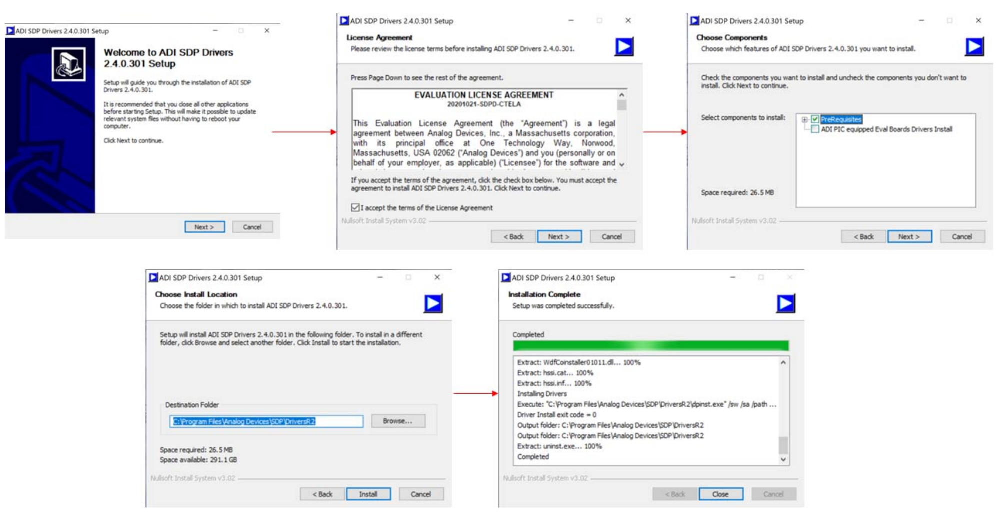

Figure 10. SDP Drivers Installation

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HARDWARE SETUP

Before running the software, the three boards must be connected and the jumpers must be configured as follows:

1. Connect the SDP-B adapter (P6) to the EVAL-ADE9113EBZ (P7) via the 26-pin connector.
2. Connect the SDP-B (J2) to the SDP-B adapter (P1) using the 120-pin connector. See Figure 13 for reference.
3. For the SDP-B adapter and the EVAL-ADE9113EBZ, the jumper configuration selects the communication mode: daisy chain SPI or direct SPI. Refer to Table 1, Table 2, Figure 11, and Figure 12 to install the jumpers accordingly.

Table 1. Jumper Configuration for SDP-B Adapter

	Jumper Position	
Header	Daisy-Chain SPI	Direct SPI
P2	Pin 1 to Pin 2	Pin 1 to Pin 2
P3, P5	Open	Open
P4, P7	Pin 1 to Pin 2	Pin 1 to Pin 2
P8 to P11	Pin 2 to Pin 3	Pin 1 to Pin 2

Table 2. Jumper Configuration for EVAL-ADE9113EBZ

	Jumper Position	
Header	Daisy-Chain SPI	Direct SPI
P1	Pin 1 to Pin 2	Pin 1 to Pin 2
	Pin 3 to Pin 5	Pin 3 to Pin 4
	Pin 7 to Pin 9	Pin 5 to Pin 6
	Pin 11 to Pin 13	Pin 7 to Pin 8
	Pin 15 Pin 16	Pin 9 to Pin 10
		Pin 11 to Pin 12
		Pin 13 to Pin 14
		Pin 15 to Pin 16
P4, P5, P6	Pin 1 to Pin 2	Pin 2 to Pin 3

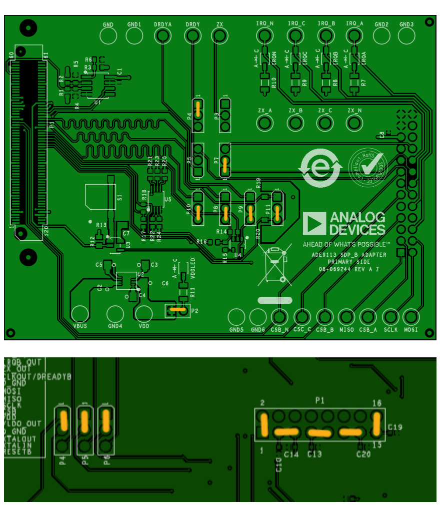

Figure 11. Jumper Configuration for Daisy-Chain SPI

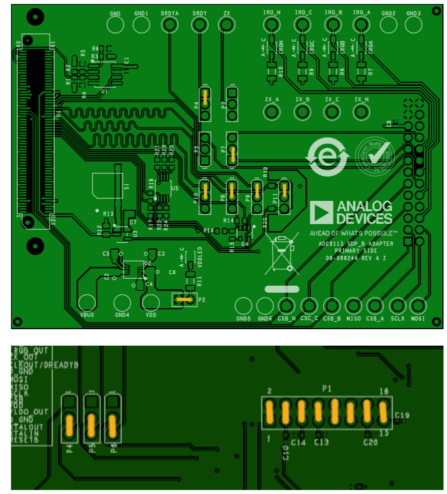

Figure 12. Jumper Configuration for Direct SPI

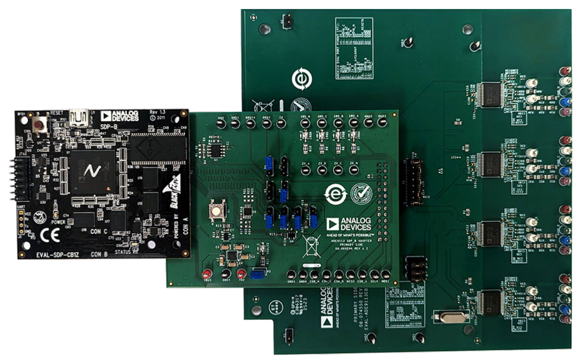

Figure 13. EVAL-ADE9113KTZ Hardware Setup for Daisy-Chain SPI

4. Use the USB cable to connect the SDP-B to the PC. The POWER LED on the SDP-B, and the VDDLED and IRQA on the SDP-B adapter, must turn green immediately. After a few seconds, the IRQB, IRQC, and IRQN LEDs turn on also. See Table 3 for a description of what these LEDs mean.

Table 3. LED Description

Name	Meaning When On
POWER	Power supplied to SDP-B
VDDLED	Power supplied to SDP-B adapter
IRQx	$\overline{\text{IRQ}}$ pin of the ADE9113 on Phase x is low

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USING THE EVAL-ADE9113KTZ SOFTWARE

With the EVAL-ADE9113KTZ software installation complete and the hardware properly configured and powered up, it is time to connect the hardware and the software. Go to **Start** > **Analog Devices** > **EVAL-ADE9113KTZ SW** or **C:\Program Files\Analog Devices\EVAL-ADE9113KTZ SW** and launch it. The dashboard shown in Figure 14 pops up.

Dashboard

The dashboard shown in Figure 14 allows users to connect the software to the hardware and to launch various tools as follows:

1. Select the communication mode to match how the jumpers are configured the Table 2.
2. Click **Connect** and then **Select**, as shown in Figure 14.
3. If the connection was successful, the LED in the dashboard turns green.
4. Double-click any of the items under **Tools** to launch them.

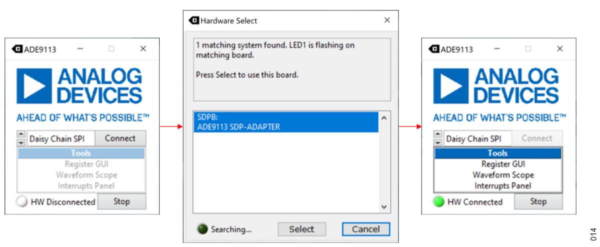

Figure 14. Establishing Connection Using the Dashboard

Register Graphical User Interface (GUI)

The Register GUI tool allows users to read from and write to any of the user-accessible registers in the ADE9113 devices.

The panel has three distinct sections:

1. **Find**: shows the register maps and bookmarks on the top, and the registers in the selected map at the bottom.
2. **Interact**: displays information about the selected registers and provides controls to interact with these selected registers.
3. **Scripting/Documentation**: allows users to interact with the registers using scripts or display information about the registers.

Note that the top nibble of the address serves as a phase offset, and only the bottom byte represents the actual address of the ADE9113 register, meaning that addresses starting with 0x1xx belong to Phase A, addresses starting with 0x2xx belong to Phase B, and so on.

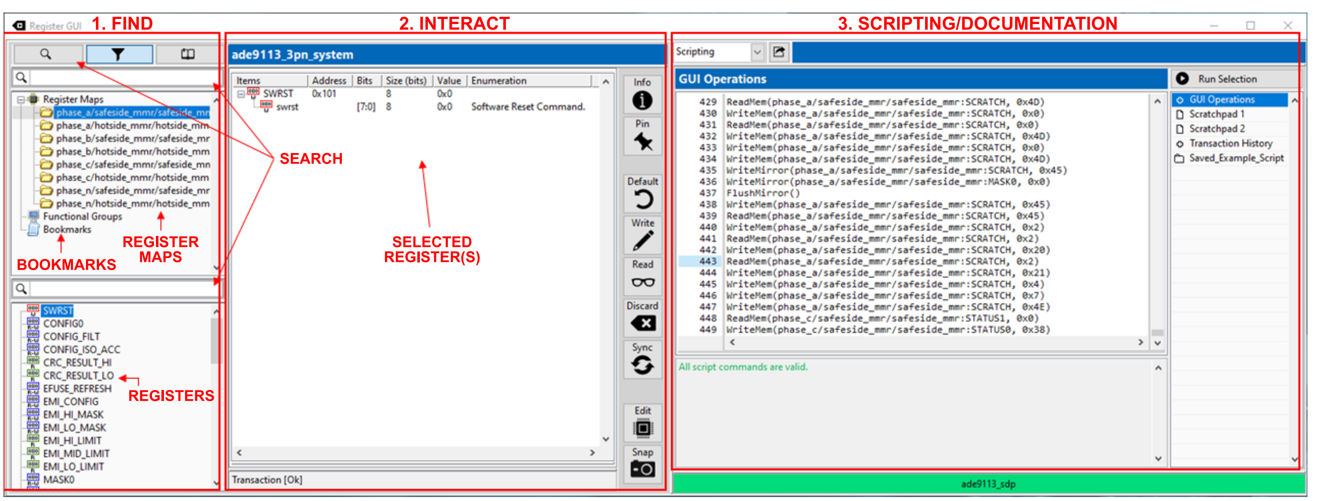

Figure 15. Register GUI Layout

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Hovering the mouse pointer over buttons displays a description. An overview follows:

1. Reading and writing as follows:
   a. Select the register you want to interact with in the **Find** section. The icons next to the register names convey the access permission: red is write only, blue is read and write, and green is read only.
   b. To read, click the **Read** button.
   c. To write, double-click on the **Value** field, enter the desired value, and click the **Write** button. To see other **Write** options, right-click the button.
   d. Click the **Edit** button to access a more visual way of doing a read or a write. Note that if a value or name is in bold and/or has an asterisk next to it, it means that it has been modified in the panel but not written to the device. All panels are updated whenever a read is executed, but values in registers may have changed between reads.
2. To select multiple registers together use the standard **Ctrl** + **Left Click** and **Shift** + **Left Click** shortcuts while clicking on the registers to select and display them in the **Interact** section together.
3. Bookmarks allow you to group registers together for simple access and interaction as follows:
   - To bookmark registers, select them in the **Find** section, then right-click, and select **Add selected bookmarks**.
   - To see all the bookmarked registers together click **Bookmarks** in the **Find** section.
   - The currently visible registers can be filtered to show just the bookmarked ones by clicking on the **Filter Bookmarks** button in the top-right corner of the **Find** section.
4. Pinning allows multiple registers to permanently stay in the **Interact** section of the window.
   a. To pin multiple registers within the same register map, select the registers as previously explained in Step 2, and then click the **Pin** icon.
   b. To pin registers from multiple register maps, take the following steps:
      1. Pin registers from one register map, as described in Step 4, a.
      2. Select registers from another register map. The previously pinned registers as well as the newly selected registers are now shown in the **Interact** section of the window.
      3. Click the **Pin** icon to unpin all registers.
      4. Click the **Pin** icon again, which now pins all registers currently in the **Interact** section of the window.
      5. Repeat Step 4b2 through Step 4b4 with as many other register maps as needed.
5. Snapshots use the **Snapshot UI Manager** to save register values in a file and apply the registers at a later time (see Figure 16).
   a. Save to a file as follows:
      1. Select the registers you would like to save.
      2. Click **Snap** to launch the **Snapshot UI Manager**, and then click **Take Snap**.
      3. If needed, add comments and rename the file by changing the **Snapshot Name** and then clicking **Rename Memory**.
      4. Click **Save to File** to save the snapshot as a **.snpsht** file in **C:\Users**<Your Username>**\Documents\LabVIEW Data\cfg\Snapshot Files**.

      Tip: To take a snapshot of all registers belonging to all phases, use **Shift** + **Left Click** to select all register maps, and then **Shift** + **Left Click** to select all registers. This process brings all the registers to the **Interact** section. Now, follow Step 6a2 through Step 6a4 to take a snapshot.
   b. To write from a file, take the following steps:
      1. Click **Snap** to launch the **Snapshot UI Manager**.
      2. Select the desired snapshot file, and then click **Apply**.

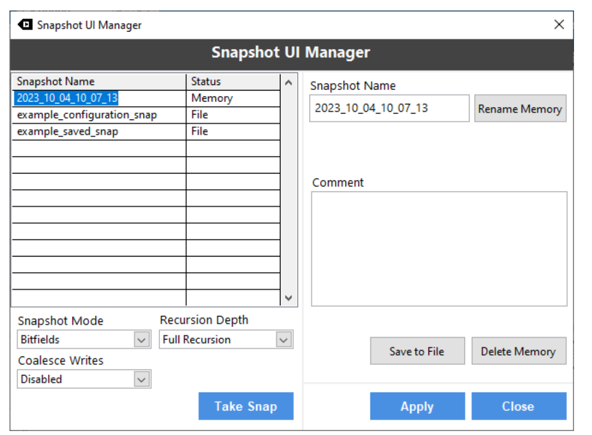

Figure 16. Snapshot UI Manager

6. Script-based interaction is found in the **Scripting** section and allows text-based interaction with the registers via the four tabs on the right. GUI operations shows the operations performed by using the **Interact** buttons. **Scratchpad 1** and **Scratchpad 2** allow you to modify registers using a script as follows:
   a. Enter newline delimited commands in the same format as the GUI operations window (see Table 4).
   b. Click **Run** to execute the script.

   Other script files can be easily created by selecting the desired lines and then right click and select **Save Selected Script**. This saves the script in **C:\Users**<Your Username>**\Documents\LabVIEW Data\scripts**. Lastly, the **Transaction History**

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shows a timestamped version of all the reads and writes to the registers.

Table 4. Example Scripting Operations

Command	Description
WriteMem (phase_a/safeside_mmr/safe-side_mmr:SCRATCH, 0x12)	Write 0x12 to the Phase A SCRATCH register
ReadMem (phase_c/safeside_mmr/safe-side_mmr:STATUS1)	Read the Phase C STATUS1 register
Wait (2000m)	Wait for 2000 ms
Import (Saved_Script)	Insert a saved script named Saved_Script
Dialog ("message")	Pop up dialog box with message

7. For documentation, detailed information about the selected registers can be viewed in two ways: click the **Info** button in the **Interact** section or use the dropdown menu in the **Scripting/Documentation** section.
8. For searching, go to the **Find** section for a few ways to filter through the register map:
   - Use the two search bars in the **Find** section for quick navigation. The **Tab** and **Shift** + **Tab** shortcuts can be used to switch between the search bars.
   - To search the entire register map for all four phases, launch the **Search** dialog from the top left corner of the **Find** section. This feature supports regular expressions too.

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Waveform Scope

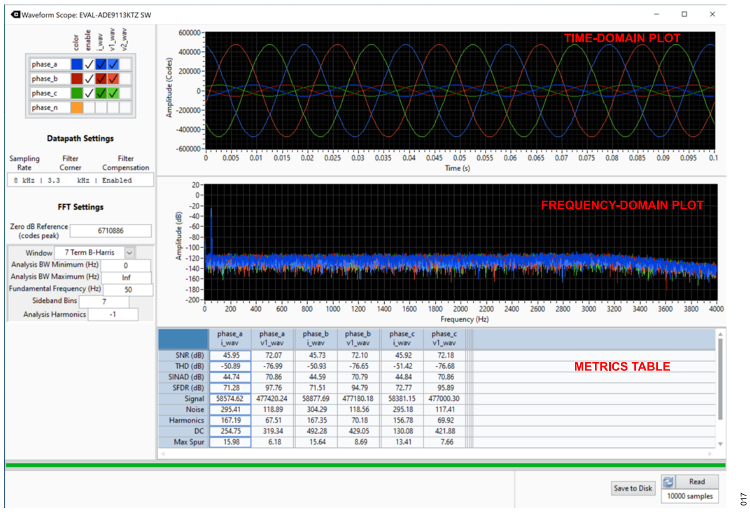

Figure 17. Waveforms Scope with 50 V, 1 A at 50 Hz on Phase A, Phase B, and Phase C

The waveform scope provides a visualization of the ADC outputs against time, as well as a frequency domain analysis of the captured samples (see Figure 17).

1. Capturing Data: The SDP-B configures the ADE9113 devices, collects their outputs, and then sends the collected data to the EVAL-ADE9113KTZ software for plotting and analysis.
   a. Configure the datapath using the **Datapath Settings** dropdown menu. Note that the EVAL-ADE9113KTZ does not support a 32 kHz sampling rate with direct SPI.
   b. On the bottom right corner of the window, select the number of samples to collect on each phase.
   c. Click **Read** to capture samples once, which writes the datapath configuration to the ADCs, and then starts collecting samples.
   d. Enable the **Reread** button and then click **Read** to capture and display batches of samples in succession. Disable **Reread** to stop.
2. Spectral Analysis: The EVAL-ADE9113KTZ software then performs spectral analysis on the samples shown in the **Time-Domain Plot** to get the **Frequency-Domain Plot** and the **Metrics Table**.
   a. Set the **Zero dB Reference (codes peak)** point. By default, it is set to the full-scale ADC output, 6710886, meaning that the full-scale ADC inputs that produce full-scale ADC outputs map to 0 dB.
   b. Select one of the ten provided FFT window types using the **Window** dropdown menu.
   c. Set the **Analysis BW Minimum (Hz)**, **Analysis BW Maximum (Hz)**, **Fundamental Frequency (Hz)**, **Sideband Bins**, and **Analysis Harmonics** as desired. These parameters are used to calculate the values in the **Metrics Table**. For tips, hover the mouse pointer over the options.

The Metrics Table displays the parameters described in Table 5. To calculate these parameters, the following are extracted from the FFT in this given order:

- Signal: the FFT bin containing the entered **Fundamental Frequency (Hz)**.
- DC: the bin containing 0 Hz.
- Spur: the bin containing the highest remaining tone.
- Harmonics: the bins containing multiples of the fundamental.
- Noise: everything that is left.

Table 5. Parameters Calculated from Spectral Analysis

Parameter	Description
SNR (dB)	Signal-to-noise ratio
THD (dB)	Total harmonic distortion
SINAD (dB)	Signal-to-noise-and-distortion ratio
SFDR (dB)	Spurious-free dynamic range
Signal	Maximum codes obtained from the fundamental frequency
Noise	Maximum codes obtained from noise frequencies
Harmonics	Maximum codes obtained from harmonic frequencies
DC	Maximum codes obtained from DC (0 Hz)
Max Spur	Maximum codes obtained from the spur frequency

3. Save to File: The captured and calculated data can be saved to **.csv** files for the user to process as follows (see Table 6 for a description of the files):
   a. On the bottom right corner of the window, click **Save to Disk**.
   b. Pick the destination directory using the pop-up menu. Note that only the phases enabled during the **Read** get saved.

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Table 6. Output File Descriptions

File Name	Contents
metadata.csv	Values from the datapath and FFT settings
waveforms.csv	Captured codes on each channel and STATUSx and auxiliary register values vs. time in seconds
ffts.csv	Calculated FFT values in dB vs. frequency in Hz
metrics.csv	Values in FFT metrics table

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Interrupts Panel

The **Interrupts Panel** allows you to visualize and modify the STATUSx and MASKx registers of all four ADE9113 devices simultaneously.

The panel is divided into four main sections representing the four phases. Each section has three subsections, representing the three pairs of STATUSx and MASKx registers, and buttons to write to these registers. Every row in a subsection shows the bit name and the corresponding values in the STATUSx (circle) and MASKx (square) registers.

The circles and squares serve as both controls and indicators, showing the values read after each **Read All**, and the values in the circle and square booleans before each **Write** are the values written to the registers.

Take the following steps to read from or write to the registers:

1. To read,
   a. Click the **Read All** button to update all registers once.
   b. Enable the **Reread** button to update all registers every 200 ms. Note that to prevent reads and writes from colliding, the **Read All** and **Write** buttons in **Interrupts Panel** are disabled when **Waveform Scope** is in **Reread** mode, and vice versa.
2. To write,
   a. Disable **Reread**, if enabled.
   b. Select the values you want to write by clicking on the circles and squares.
   c. Click the corresponding **Write** button to execute the operation. The program automatically reads and displays the values in all registers right after each write.

Figure 19 shows how to clear **crc_chg** on Phase C without clearing the other interrupts. Because writing true to an interrupt bit clears it, write a true to **crc_chg** and false to the other bits in STATUS0 (that is, 0b00010000). To do this, deselect the STATUS0 bits other than **crc_chg** (**com_up** and **reset_done** in this case), and then click the **Write STATUS0** button. Because each write is automatically followed by a **Read All**, the updated values are visible on the panel immediately.

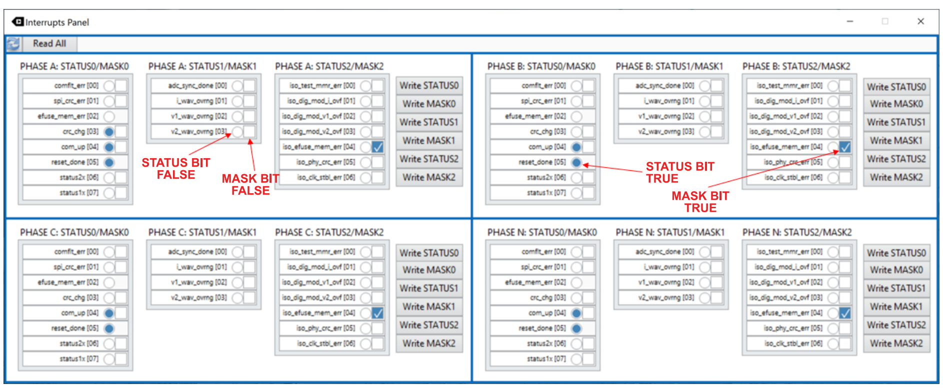

Figure 18. Interrupts Panel

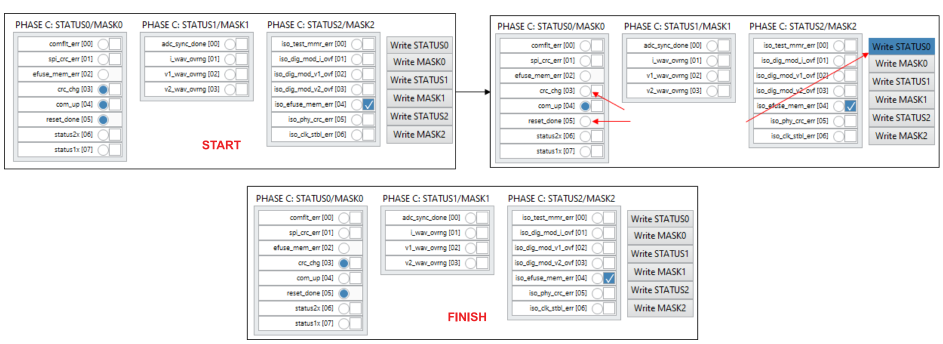

Figure 19. Example: Clearing an Interrupt

EVALUATION BOARD SOFTWARE

TROUBLESHOOTING

Table 7 lists troubleshooting issues, causes, and possible solutions.

Table 7. Troubleshooting Common Problems

Issue	Cause	Possible Solution
POWER LED Does Not Turn on When the USB Is Connected	The SDP-B is not receiving power.	First, check if the cable is connected properly to the PC as well as the SDP-B. Then, try a different USB cable. Or, the SDP-B may be broken.
VDDLED Does Not Turn On	The SDP interface board is not receiving power.	First, ensure that the SDP-B is powered up. Then, confirm that the SDP-B and the SDP-B adapter board are connected properly via the 120-pin connector. Finally, check if the jumper on P2 is installed.
IRQA, IRQB, IRQC, and/or IRQN Do Not Light Up on Startup Even Though VDDLED Is on	The $\overline{IRQ}$ pin on the corresponding ADE9113 devices is floating or high.	Confirm that the SDP interface board and the EVAL-ADE9113EBZ boards are connected properly via the 26-pin connector.
Dialog Box Displaying **Test R/W Failed: Check if correct SPI mode is selected and clocks are enabled!** Appears	Communication to all four ADE9113 devices is checked while establishing connection between the software and the hardware by reading and writing to their registers. This message indicates that the check failed.	First, confirm that the SDP interface board and the EVAL-ADE9113EBZ boards are connected properly via the 26-pin connector. Then, ensure that the jumper configuration matches the communication mode selected on the **Dashboard**. Finally, try restarting the **EVAL-ADE9113KTZ SW** and connecting to it again.
Dashboard Displays **HW Link Broken**	The connection between the PC and the SDP-B was lost, or the test R/W described previously failed.	First, confirm that the hardware connection between the PC, SDP-B, SDP interface board, and EVAL-ADE9113EBZ is proper. Then, verify that the jumpers are installed correctly according to the communication mode selected on the **Dashboard**. Finally, try restarting the **EVAL-ADE9113KTZ SW** and connecting it again.
SPI Error Messages on the Bottom of Register GUI	SPI transactions between the SDP-B and the ADE9113s failed	Ensure that the jumpers are installed correctly.

If none of these solutions work, see the Energy Monitoring and Metering Forum on ADI *Engineer*Zone for further support.

NOTES

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

ANALOG DEVICES

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