

## Evaluating the ADA4571W-1, Integrated AMR Angle Sensor and Signal Conditioner

### FEATURES

- ▶ USB 2.0 interface
- ▶ Jumper or computer controlled temperature compensation and power-down modes enable
- ▶ Measurement test points and coaxial connectors

### EVALUATION KIT CONTENTS

- ▶ ADA4571W-1 magnetic stimulus
- ▶ Dipole magnet
- ▶ Hand movable mounting
- ▶ Readback electronics

### DOCUMENTS NEEDED

- ▶ ADA4571W-1 data sheet

### HARDWARE NEEDED

- ▶ 6V to 12V bench supply (optional)
- ▶ SDP-S controller board
  - ▶ USB cable (supplied with the SDP-S controller board)

### SOFTWARE NEEDED

- ▶ LabVIEW 2015 software downloadable from the EVAL-ADA4571W-1SDZ product page

### GENERAL DESCRIPTION

The EVAL-ADA4571W-1SDZ evaluation board features the ADA4571W-1 in an end of shaft magnet configuration, as shown in Figure 1. The evaluation kit is composed of an ADA4571W-1 motherboard, a magnetic stimulus on a hand turnable mount, a USB interface, and an SDP-S controller board. The required LabVIEW 2015 graphical user interface (GUI) software for Windows® is available to download from the EVAL-ADA4571W-1SDZ product page.

The EVAL-ADA4571W-1SDZ evaluation board features an on-board 5V regulator, a 4-channel simultaneous sampling, analog-to-digital converter (ADC), and jumpers for enabling the temperature compensation and power-down modes within the ADA4571W-1. The ADA4571W-1 motherboard also features test points and unpopulated coaxial connectors for the three outputs of the device.

The SDP-S controller board controls the ADC on the ADA4571W-1 motherboard, which reads back the ADA4571W-1 outputs to change the digital inputs to the ADA4571W-1, interface with the GUI, and supply power to the evaluation board through the USB connection.

Full specifications on the ADA4571W-1 are available in the ADA4571W-1 data sheet available from Analog Devices, Inc., and must be consulted with this user guide when using the EVAL-ADA4571W-1SDZ evaluation board.

### ADA4571W-1 END OF SHAFT MAGNETIC EVALUATION SYSTEM

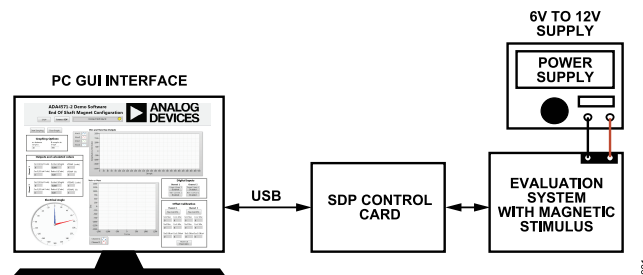


Figure 1. ADA4571W-1 End of Shaft Magnetic Evaluation System

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**REVISION HISTORY****3/2026—Revision 0: Initial Version**

## EVALUATION BOARD QUICK START PROCEDURES

### SOFTWARE INSTALLATION PROCEDURES

Install the [SDP-S](#) controller board drivers and LabVIEW 2015 run-time engine before using the LabVIEW 2015 GUI.

#### LabVIEW 2015 Run-Time Engine

To install the LabVIEW 2015 run-time engine, follow the instructions on the National Instruments website.

#### SDP Installation

To install the SDP drivers, download the **SDPDrivers.exe** file from the [SDP-S](#) product page, and do the following steps:

1. To initialize the installation, run the **SDPDrivers.exe** executable file.
2. When the SDP drivers setup wizard appears, click **Next** (see [Figure 2](#)).



Figure 2. SDP Driver Installation Wizard

3. When the **Choose Install Location** window appears (see [Figure 3](#)), click **Install**. To select a different destination folder, in the **Destination Folder** area, click **Browse**, select a destination, then click **Install**.

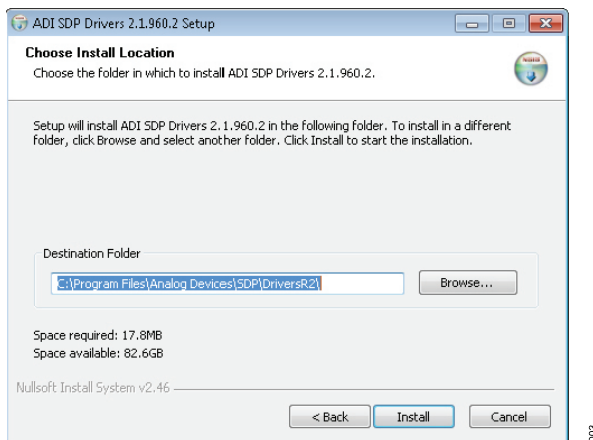


Figure 3. Choose Install Location Window

4. To complete the installation of the SDP drivers, click **Finish**.
5. Before running the LabVIEW GUI, connect the SDP-S controller board to the motherboard and plug the SDP-S controller board into the PC with the supplied USB cable. The computer now recognizes the SDP-S controller board, and the LabVIEW 2015 GUI opens.

#### Running the LabVIEW GUI

To run the GUI, download the LabVIEW GUI software from the [ADA4571W-1](#) product page, and do the following steps:

1. Place the downloaded executable file and supporting files in a convenient location for use (see [Figure 4](#)). It is recommended to place these files on the root C drive of the PC. Note that do not separate the executable file from the other files that are downloaded or the executable file cannot run.

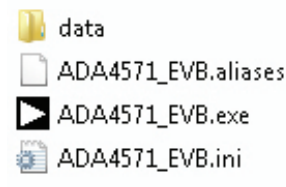


Figure 4. Place Downloaded Files on the PC

2. To launch the LabVIEW GUI, double-click the **ADA4571\_EVB.exe** file.

## EVALUATION BOARD HARDWARE

The EVAL-ADA4571W-1SDZ end of shaft evaluation system comprises of a printed circuit board (PCB) with the [AD7866](#) ADC and an external mountable magnetic stimulus.

The [ADA4571W-1](#) evaluation system can be powered directly from the host PC USB, from an external bench supply, or through the on-board 5V regulator ([ADP3336](#)).

To power the motherboard through an on-board 5V reference, apply 6V to 12V across the P7 to P8 connectors and configure the jumpers accordingly. If the bench supply features current limiting, it is recommended to set the current limit to 100mA as a precaution.

### JUMPER CONFIGURATION

To understand the purpose of each jumper, see [Figure 13](#).

Configure the P10 motherboard default jumper as follows:

- ▶ Install a jumper on P10 between the USB\_VBUS supply and the +5V\_ANALOG supply to power the evaluation board through the USB connection at the PC.
- ▶ Alternatively, install a jumper on P10 between +5V\_REG supply and the +5V\_ANALOG supply to power the evaluation board through the external bench supply

### DEVICE UNDER TEST (DUT) OUTPUTS

The outputs of the ADA4571W-1 can be monitored at the test points located on the evaluation board.

All outputs from the ADA4571W-1 are also sampled by the on-board ADC and are available in the LabVIEW GUI.

EVALUATION BOARD SOFTWARE

STARTING THE EVALUATION GUI

To power the evaluation board using the ADP3336 on-board 5V supply, install a jumper on P10, connecting the +5V\_REG supply and the +5V\_ANALOG supply. Using an external power supply, plug the positive supply for the evaluation board into the red terminal, P7, and plug the negative terminal into P8 on the ADA4571W-1 motherboard. The evaluation board requires between 6V and 12V, which is then regulated to 5V on the ADA4571W-1 motherboard using the on-board ADP3336. This supply powers both the on-board ADC (AD7866) as well as the ADA4571W-1.

To use the EVAL-ADA4571W-1SDZ evaluation board with full USB power, install a jumper on P10, connecting the USB\_VBUS supply and the +5V\_ANALOG supply. The 5V USB power supplies the ADA4571W-1.

OVERVIEW OF THE MAIN ADA4571W-1 GUI WINDOW

Figure 5 shows the main ADA4571W-1 GUI window after launching it.

When launching the GUI, the SDP-S controller board must be recognized by the GUI before proceeding. To read the EEPROM identification of the motherboard and ensure that the correct program is in use, click the **Connect SDP** button. If the SDP-S controller board is not connected, or if the drivers are not installed correctly, an error message appears. Ensure that the drivers are installed correctly, and that the PC recognizes the SDP-S controller board, if this occurs.

When the SDP-S controller board is properly connected, and the program recognizes the motherboard, the status bar reads **SDP Board Ready** and the yellow LED turns green (see Figure 5).

Initially, all figures are blank. To begin sampling the ADA4571W-1, click **Start Sampling**.

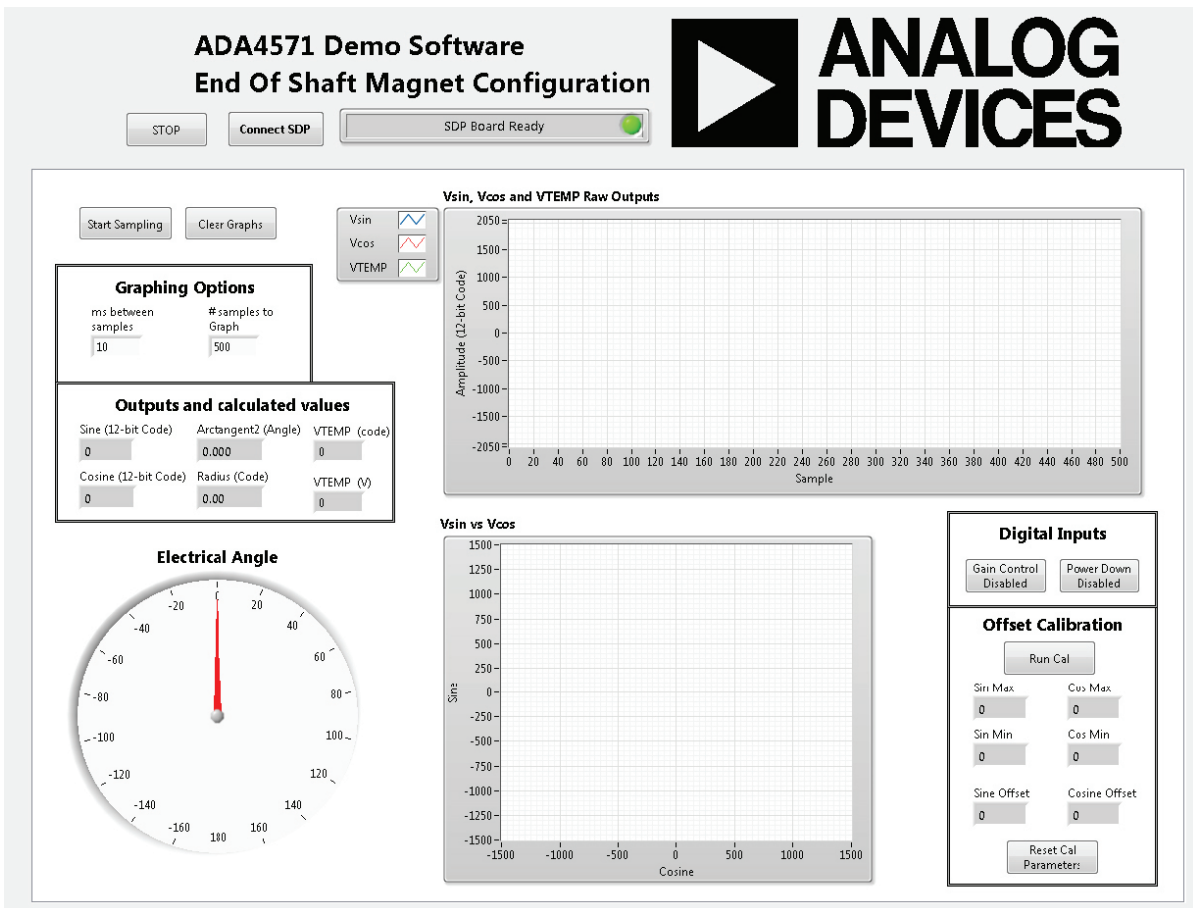


Figure 5. ADA4571W-1 Evaluation Board Software Main Window

EVALUATION BOARD SOFTWARE

**V<sub>SIN</sub>, V<sub>COS</sub>, and V<sub>TEMP</sub> Raw Outputs**

The **V<sub>SIN</sub>, V<sub>COS</sub>, and V<sub>TEMP</sub> Raw Outputs** graph shows the three outputs from the **ADA4571W-1** magnetic angle sensor (see [Figure 6](#)).

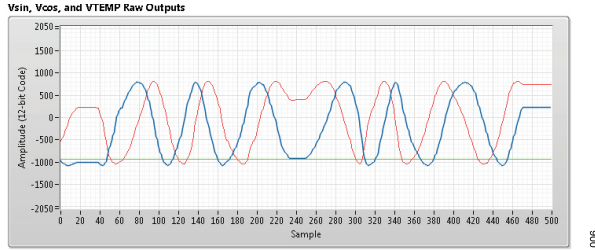


Figure 6. V<sub>SIN</sub>, V<sub>COS</sub>, and V<sub>TEMP</sub> Raw Outputs Graph

In [Figure 6](#), the blue and red waveforms indicate the V<sub>SIN</sub> channel and V<sub>COS</sub> channel outputs, respectively, and the green waveform indicates the V<sub>TEMP</sub> channel output. As the magnet rotates above the ADA4571W-1, the V<sub>SIN</sub> and V<sub>COS</sub> outputs change while staying 90° out of phase. These two channels, V<sub>COS</sub> and V<sub>SIN</sub>, report similar results that differ by the relative rotation of the sensor die and the voltage offset differences for the sine and cosine channels.

[Figure 6](#) shows the output waveforms sampled by the **AD7866** ADC. The waveforms are plotted in 12-bit code. The AD7866 simultaneously samples V<sub>SIN</sub> and V<sub>COS</sub>. An internal reference of 2.5V is subtracted in the hardware because the readout of the ADC is in twos complement. Therefore, the two signals center around 0 in the raw waveform plot. In a real application, it is important that these two channels are simultaneously sampled because extra errors can be introduced from the phase delay between the sampling of the individual channels. For every 50 samples of the V<sub>SIN</sub> and V<sub>COS</sub>, the AD7866 samples the V<sub>TEMP</sub> channel.

When powering the EVAL-ADA4571W-1SDZ evaluation board through the USB connector attached to the **SDP-S** controller board, some variation appears in the supply voltage of the ADA4571W-1. Because the readout of the AD7866 is in twos complement format, with respect to the internal 2.5V reference, the offset of these waveforms is higher than the inherent offset of the ADA4571W-1. After offset correction of the sine and cosine signals, which is recommended for the end use of the sensor, the offsets due to the ADC reference, as well as the sensor offset, are removed.

**Graphing Options**

When the EVAL-ADA4571W-1SDZ evaluation board is operating, it constantly samples the V<sub>SIN</sub> channel and V<sub>COS</sub> channel, and it samples the V<sub>TEMP</sub> channel after every 50 samples of the V<sub>SIN</sub> and the V<sub>COS</sub> channels.

To choose the interval between samples, enter different values in the **ms between samples** text box (see [Figure 7](#)). The default interval is 10ms. This delay is set after information is transferred from the AD7866.

The **# samples to Graph** field sets the number of samples to save and display in the graphs. The default number of samples saved and displayed is 200 samples.

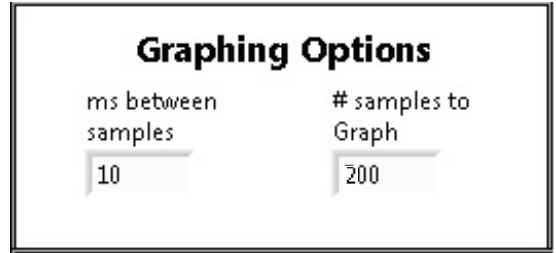


Figure 7. Graphing Options Pane

**Outputs and Calculated Values**

The values shown in the **Output and calculated values** pane show the ADA4571W-1 output information in number format (see [Figure 8](#)). Again, the V<sub>SIN</sub>, V<sub>COS</sub>, and V<sub>TEMP</sub> outputs are in 12-bit, twos complement format with respect to the 2.5V internal reference of the AD7866 ADC.

Outputs and calculated values		
Sine (12-bit Code)	Arctangent2 (Angle)	VTEMP (code)
491	17.201	-897
Cosine (12-bit Code)	Radius (Code)	VTEMP (V)
152	513.99	1.40503

Figure 8. Outputs and Calculated Values Pane

A calculated angle value is also shown in [Figure 8](#), given by the **Arctangent2 (Angle)** function field, and a calculated radius, given by the square root of the sum of squares for V<sub>SIN</sub> channel and V<sub>COS</sub> channel in the **Radius (Code)** field.

**Electrical Angle**

The electrical angle plot gives the calculated **Arctangent2 (Angle)** value in a visual format, as shown in [Figure 9](#). As the magnetic field angle changes at the anisotropic magneto resistive (AMR) sensors, the electrical angle changes.

EVALUATION BOARD SOFTWARE

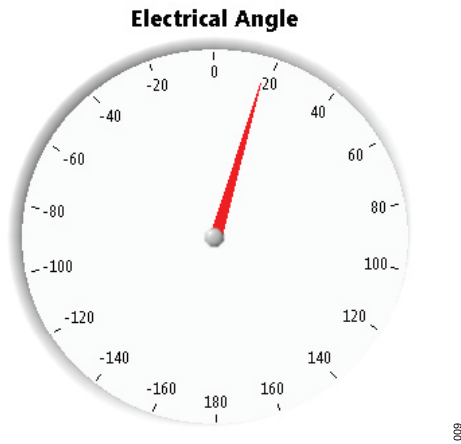


Figure 9. Electrical Angle Plot

**V<sub>SIN</sub> vs. V<sub>COS</sub> Plot**

The **V<sub>SIN</sub> vs. V<sub>COS</sub>** graph shows the electrical angle from the ADA4571W-1. However, there is more information shown in Figure 10, such as the radius of the output values that can give further diagnostic information to system. As long as the sensor is fully saturated, or the applied magnetic field strength exceeds 25kA/m, the radius value remains unchanged at a constant temperature. As the AMR effect is smaller at high temperatures, the radius value changes with respect to temperature. For the temperature coefficient values for the output amplitude for the V<sub>SIN</sub> and the V<sub>COS</sub> channels, refer to the ADA4571W-1 data sheet.

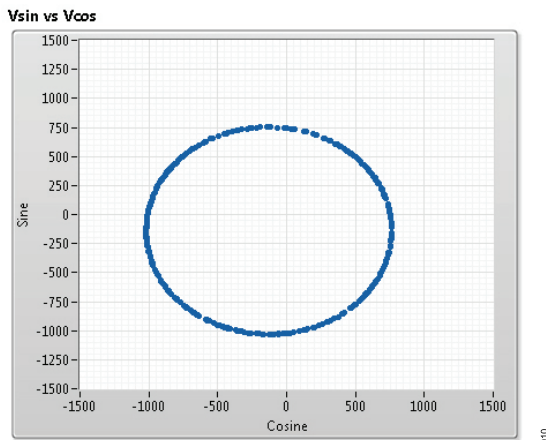


Figure 10. V<sub>SIN</sub> vs. V<sub>COS</sub> Graph

**Digital Inputs**

To toggle two digital inputs on the ADA4571W-1, click the buttons in the **Digital Inputs** pane (see Figure 11).

The **Power Down Disabled** button puts the ADA4571W-1 in a low power state by disabling the internal circuitry and placing the outputs in a high impedance state. For more details on the power-down current of the device, refer to the ADA4571W-1 data sheet .

The **Gain Control Disabled** button puts the device in gain control mode (see Figure 11). This mode alters the bridge supply voltage based on the internal temperature value of the ADA4571W-1.

Through gain control mode, the output amplitude temperature coefficient of the ADA4571W-1 reduces. For more details on output amplitude vs. temperature with the gain control mode enabled and disabled, refer to the ADA4571W-1 data sheet.



Figure 11. Digital Inputs Pane

**Offset Calibration**

An offset calibration is required to maximize the accuracy of the ADA4571W-1. The V<sub>SIN</sub> and V<sub>COS</sub> channels have inherent voltage offsets due to a resistor mismatch within the AMR sensor bridges. For more details on the offset voltage ranges for the outputs, refer to the ADA4571W-1 data sheet.

There are a few methods that can null the offsets for the outputs. The ADA4571W-1 GUI uses a maximum/minimum value to calculate these offsets. To run an offset calibration, click **Run Cal** (see Figure 12). When **Run Cal** is clicked, rotate the magnetic stimulus slowly through an entire mechanical rotation. This slow rotation ensures that the maximum and minimum output voltages are found for each channel.

The offset of each channel is calculated as the midpoint between the maximum and mid values captured during the calibration cycle. During normal operation, the offset value for each channel is subtracted from the current value before calculating the magnetic angle.

EVALUATION BOARD SOFTWARE

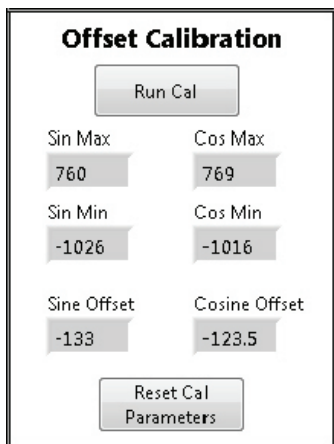


Figure 12. Offset Calibration Pane



## 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.

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