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## Evaluating the **AD7768-1** 24-Bit, 256 kSPS, Sigma-Delta ADC with Power Scaling

### FEATURES

Full featured evaluation board for the **AD7768-1**  
 PC control in conjunction with **EVAL-SDP-CH1Z**  
 PC software control and data analysis  
 Time and frequency domain  
 Standalone hardware capability

### EQUIPMENT NEEDED

**EVAL-SDP-CH1Z** system demonstration platform  
 DC/ac signal source (audio precision or similar high  
 performance signal source)  
 PC running Windows 7, Windows 8, or Windows 10 with  
 USB 2.0 port

### EVALUATION KIT CONTENTS

EV-AD7768-1FMCZ evaluation board

### GENERAL DESCRIPTION

The EV-AD7768-1FMCZ evaluation kit features the **AD7768-1** 24-bit, 256 kSPS analog-to-digital converter (ADC). The EV-AD7768-1FMCZ board connects to the USB port of the PC via the **EVAL-SDP-CH1Z** motherboard. By default, power is supplied from the **EVAL-SDP-CH1Z** supply, which is regulated to 5 V and 3.3 V to supply the **AD7768-1** and support components.

The EV-AD7768-1FMCZ software fully configures the **AD7768-1** device register functionality and provides dc and ac time domain analysis in the form of waveform graphs, histograms, and associated noise analysis for ADC performance evaluation.

The EV-AD7768-1FMCZ is an evaluation board that allows the user to evaluate the features of the ADC. The user PC software executable controls the **AD7768-1** over USB through the system demonstration platform (**EVAL-SDP-CH1Z**).

### EVALUATION BOARD PHOTOGRAPH

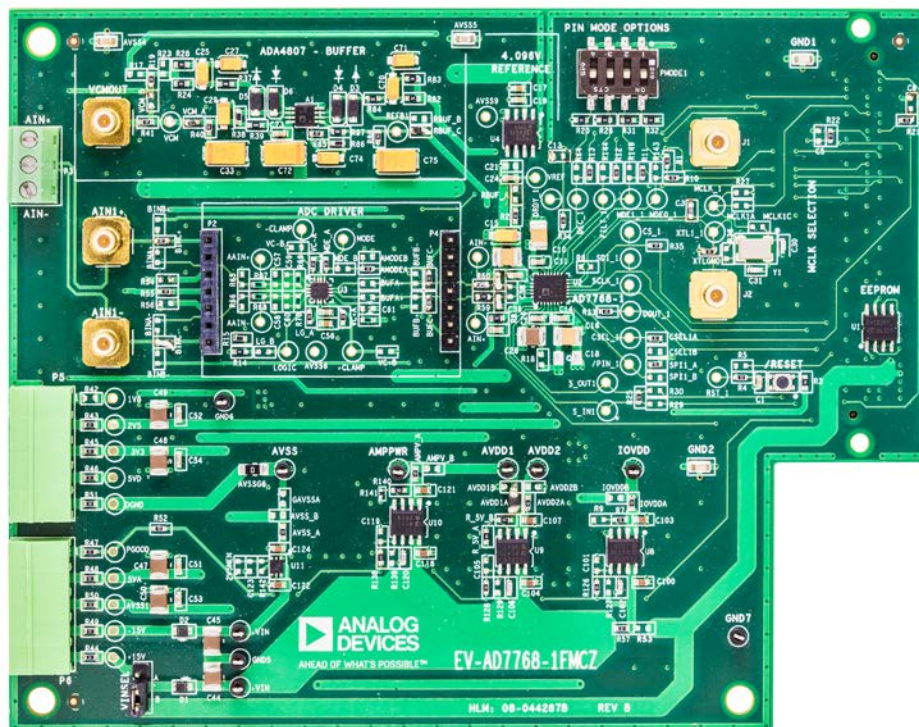


Figure 1.

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**REVISION HISTORY**

4/2018—Revision 0: Initial Version

## QUICK START GUIDE

To begin using the evaluation board, take the following steps:

1. Ensure the [EVAL-SDP-CH1Z](#) system demonstration platform board is disconnected from the PC. Install the [AD7768-1](#) evaluation board software. Restart the PC after the software installation is complete. For complete software installation instructions, see the Software Installation Procedures section.
2. Connect the [EVAL-SDP-CH1Z](#) system demonstration platform board to the unpowered EV-AD7768-1FMCZ evaluation board. The J4 connector of the [EVAL-SDP-CH1Z](#) system demonstration platform board connects to the receiving socket, P1, on the AD7768-1FMCZ printed circuit board (PCB).
3. Ensure the evaluation boards are connected firmly together by screwing them together.
  - a. Ensure the VINSEL link is set to Position B; this provides power to the [AD7768-1](#) evaluation board from the [EVAL-SDP-CH1Z](#).
4. Connect the 12 V dc supply to the [EVAL-SDP-CH1Z](#) system demonstration platform board and then connect to the PC using the supplied USB cable. Choose to automatically search for the drivers for the [EVAL-SDP-CH1Z](#) if prompted by the operating system.
5. Launch the EV-AD7768-1FMCZ software from the **Analog Devices** subfolder in the **Programs** menu.

To power off, first close the software. Then press the reset button on the [EVAL-SDP-CH1Z](#) before disconnecting the power or USB.

## ANALOG INPUTS AND FRONT-END CIRCUIT

The AIN1+ and AIN– analog inputs are accessible through either the Subminiature Version B connectors (SMBs) or the terminal blocks (see Figure 2).

The default connections on the evaluation board are set as follows:

- Connect from the input terminals through the driver amplifier.
- Analog inputs from an external source are biased to a common mode using the on-board common-mode voltage (VCM). VCM defaults to  $(AVDD1 - AVSS)/2$ , which equates to 2.5 V on the EV-AD7768-1FMCZ.
- For the [ADR4540](#), a 4.096 V low noise reference is used by default, allowing an absolute input range of 0 V to 4.096 V on each input.
- The driver amplifier is not terminated at the inputs for any particular source impedance.



Figure 2. Analog Inputs

## EVALUATION BOARD HARDWARE

### HARDWARE LINK OPTIONS

The default link options are listed in Table 1. The power input to the evaluation board can be taken from the [SDP-H1](#) or from the P5 connector or P6 connector. The default option takes 12 V of power from the [EVAL-SDP-CH1Z](#), which is passed to the [ADP7118](#) on-board low dropout regulators (LDOs).

**Table 1. Default Link and Solder Link Options**

Name	Link No.	Default Link Option	Description
GPIO0	R1	R10	GPIO0 connection; DEC_1 test point R1 selects the driver amplifier power mode R10 selects the general purpose input/output (GPIO) connection to the <a href="#">SDP-H1</a> board R143 selects the pin mode switch for power mode selection
	R10		
	R143		
GPIO1	R11	R11	GPIO1 connection; Filt_1 test point R11 selects the GPIO connection to the <a href="#">SDP-H1</a> board R149 selects the pin mode switch for power mode selection
	R149		
GPIO2	R12	R12	GPIO2 connection; MDE1_1 test point R12 selects the GPIO connection to the <a href="#">SDP-H1</a> board R144 selects the pin mode switch for filter selection
	R144		
GPIO3	R13	R13	GPIO3 connection; MDE0_1 test point R13 selects the GPIO connection to the <a href="#">SDP-H1</a> board R64 selects the pin mode switch for decimation rate control
	R64		
PIN/SPI	SPI1_A	SPI1_A	Selects pin or serial peripheral interface (SPI) mode on the AD7768-1 SPI1_A ties Pin 6 to the IOVDD voltage level, selecting SPI control SPI1_B ties Pin 6 to GND, selecting pin mode control
	SPI1_B		
MCLK	MCLK1A	MCLK1A	Selects the source of the AD7768-1 master clock MCLK1A selects the 16 MHz clock from the <a href="#">SDP-H1</a> board MCLK1C selects the 16.384 MHz crystal (XTAL), Y1 If none of the above are shorted with 0 $\Omega$ links, then an external clock can be applied on J1; in other words, remove all 0 $\Omega$ links to use an external MCLK applied on J1
	MCLK1C		
CLK_SEL	CSEL1A	CSEL1A	Selects the clock source for PIN control mode CSEL1A ties Pin 8 to GND, selecting a complementary metal oxide semiconductor (CMOS) clock option in pin mode CSEL1B ties Pin 8 to IOVDD, enabling the XTAL excitation circuitry in pin mode
	CSEL1B		
XTL1	R36	XTLGND	Set up for XTAL1 (Pin 13) R36 inserted for XTAL operation XTLGND inserted for normal CMOS clock operation
	XTLGND		
SYNC_IN	R25	R25	Sets up the synchronization mechanism for the AD7768-1 R25 shorts SYNC_OUT to SYNC_IN, meaning the AD7768-1 SYNC pulse does not need occur synchronous to the MCLK edge; SPI or start (GPIO) SYNC pulses can be used R29 inserted allows a sync connection from the <a href="#">SDP-H1</a> connector
	R29		
Voltage Input Select	VINSEL	B	Selects the input to the LDOs A selects the power input from Connector P6 B selects 12 V from the <a href="#">SDP-H1</a> board
	A B		
IOVDD	IOVDDA	IOVDDA	Selects the IOVDD source IOVDDA selects the <a href="#">ADP7118ARDZ-3.3</a> LDO IOVDDB selects the external IOVDD source on Connector P5
	IOVDDB		
AVDD1	AVDD1A	AVDD1A	Selects the AVDD1 source AVDD1A selects the 5 V LDO output AVDD1B selects the external AVDD1 source on Connector P6
	AVDD1B		

Name	Link No.	Default Link Option	Description
AVDD2	AVDD2A AVDD2B	AVDD2A	Selects the AVDD2 source AVDD2A selects the 5 V LDO output AVDD2B selects the external AVDD2 source on Connector P5
AVSS	AVSS_A AVSS_B AVSSGX	AVSS_A  AVSSG6	Selects the AVSS voltage reference AVSS_A selects the –2.5 V output from the <a href="#">ADP7182</a> –2.5 V LDO AVSS_B selects the external AVSS source on Connector P6 AVSSG6 shorts AVSS and DGND by default; it can be shorted in numerous locations around the board
AMPV <sub>s</sub> +	AMPV_A AMPV_B	AMPV_A	Selects the amplifier and reference voltage supplies AMPV_A uses the 7 V output from the on-board adjustable 7 V LDO AMPV_B uses the 5 V output from the on-board 5 V LDO
ADC Driver Input	BIN1A+/ BIN1A– BIN1B+/ BIN1B– BIN1C+/ BIN1C–	BIN1A+/BIN1A–	Selects the input to the ADC driver amplifier BIN1A+/BIN1A– connect the analog inputs to the ADC driver  BIN1B+/BIN1B– bypass the driver amplifier  BIN1C+/BIN1C– select the amplifier mezzanine card option for evaluating different driver amplifiers
ADC Driver Output	BUF1A+/ BUF1A– BUF1B+/ BUF1B– BUF1C+/ BUF1C–	BUF1A+/BUF1A–	Routes the output to the ADC driver amplifier BUF1A+/BUF1A– connect the driver amplifier output to the <a href="#">AD7768-1</a>  BUF1B+/BUF1B– bypass the driver amplifier for a direct connection to the <a href="#">AD7768-1</a> BUF1C+/BUF1C– select the output of the amplifier mezzanine card for evaluating driver amplifiers
VCM Selection	VCM_A VCM_B	VCM_A	Selects the path for the VCM signal to the driver amplifiers VCM_A selects a buffered and filtered VCM signal VCM_B takes the VCM straight from the <a href="#">AD7768-1</a> , unbuffered
Reference Buffer	RBUF_A RBUF_B RBUF_C	RBUF_C	Selects the path for the <a href="#">ADR4540</a> reference RBUF_A routes the reference directly to the ADC, unbuffered RBUF_B routes the reference directly to the ADC through large filtering capacitors and is unbuffered to the ADC RBUF_C routes the reference to the ADC through the <a href="#">ADA4807-2</a> buffer

### On-Board Connectors

Table 2 provides information about the external on-board connectors on the EV-AD7768-1FMCZ.

**Table 2. On-Board Connectors**

Connector	Function
P1	Connects all digital signals to the <a href="#">SDP-H1</a> board
P5/P6	External power connections
P3	DC analog inputs
AIN1+/AIN1–	SMB analog inputs for ac signals
VCMOUT	VCM output from the <a href="#">ADA4807-2</a> buffer
J1	SMB connector for the external MCLK
J2	SMB connector for the low voltage differential signaling (LVDS) clock on the XTAL1 pin

## POWER SUPPLIES

The evaluation board requires an external power supply—either a bench top supply or the 12 V output from the [EVAL-SDP-CH1Z](#). VINSEL selects which source to use. Select Position A on VINSEL to power the board externally through P6. Select Position B on VINSEL to power the EV-AD7768-1FMCZ using the [SDP-H1](#) board.

Linear regulators generate the required power supply levels from the input voltage selected on VINSEL. The [ADP7118](#) regulators (U8, U9, and U10) supply 5 V to AVDD1 and AVDD2, 7 V to the ADC driver amplifier, [ADR4540](#), [ADA4807-2](#) (reference and reference buffer, respectively), and the 3.3 V [ADP7118](#) for IOVDD.

Each supply is decoupled at the point where it enters the board and again at the point where it connects to each device.

## EVALUATION BOARD SETUP PROCEDURES

After following the instructions in the Software Installation Procedures section, set up the evaluation and SDP board as detailed in this section.

### **Warning**

The evaluation software and drivers must be installed before connecting the evaluation board and the [EVAL-SDP-CH1Z](#) to the USB port of the PC to ensure the evaluation system is correctly recognized when it is connected to the PC.

### **Configuring the Evaluation and SDP Board**

Connect the [EVAL-SDP-CH1Z](#) to P1 on the EV-AD7768-1FMCZ board. Screw the two boards together



## EVALUATION BOARD SOFTWARE SOFTWARE INSTALLATION PROCEDURES

The EV-AD7768-1FMCZ evaluation kit includes a link to the software to be installed on your PC before you begin using the evaluation board. Download the software at [www.analog.com/EV-AD7768-1FMCZ](http://www.analog.com/EV-AD7768-1FMCZ).

There are two parts to the installation: the **AD7768-1** evaluation board software installation and the **EVAL-SDP-CH1Z** system demonstration platform board drivers installation.

### Installing the **AD7768-1** Evaluation Board Software

To install the **AD7768-1** evaluation board software, take the following steps:

1. The EVAL-AD7768FMCZ evaluation software requires the .NET 3.5 framework to operate correctly. Ensure the correct .NET framework is installed before continuing with the installation. Check if the .NET 3.5 framework is installed by taking the following steps:
  - a. In the Windows **Control Panel**, go to **Programs > Programs and Features**.
  - b. Select the **Turn Windows Features on or off** section. This selection lists the features currently installed. Select **.NET Framework 3.5 (includes .NET 2.0 and 3.0)**. Figure 3 shows this dialog box as it appears in Windows 10.

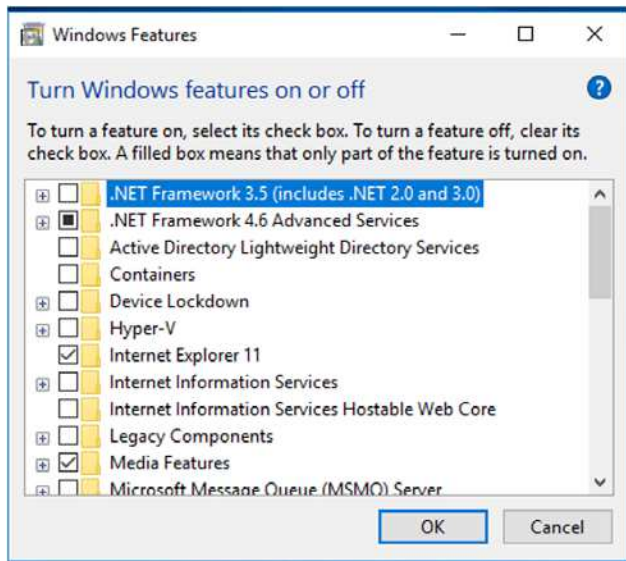


Figure 3. Turning Windows Features On or Off

- c. After selecting the checkbox and clicking **OK**, the dialog box shown in Figure 4 appears. An internet connection is needed for this step. Select **Download files from Windows Update**.

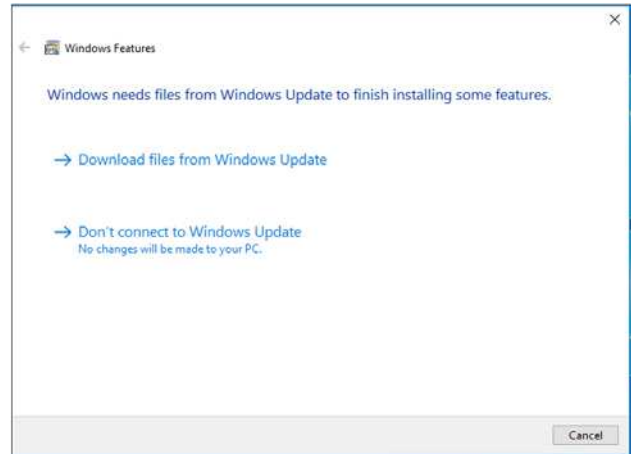


Figure 4. Prompt to Download Windows Updates

2. Disconnect the **EVAL-SDP-CH1Z** system demonstration platform board from the USB port of the PC, and run the executable.
3. Double click the **setup.exe** file to begin the evaluation board software installation. The software is installed to the following default location: **C:\Program Files\Analog Devices\AD7768-1**.
4. A dialog box appears asking for permission to allow the program to make changes to the computer (see Figure 5). Click **Yes**.

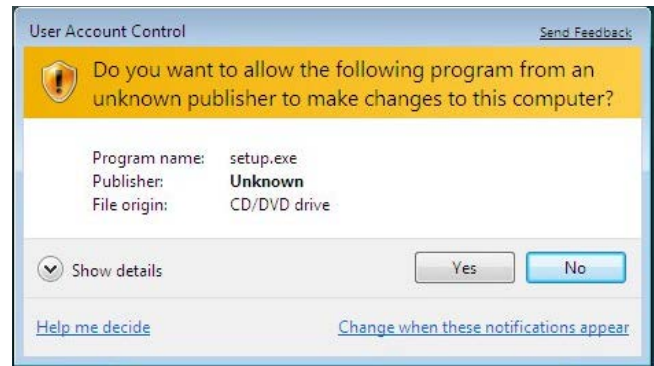


Figure 5. Granting Permission for the Program to Make Changes.

5. Select the location to install the software, and then click **Next**. Figure 6 shows the default locations, which are displayed when the window opens; select another location by clicking **Browse**.



Figure 6. Selecting the Location for Software Installation

6. A license agreement appears. Read the agreement, and then select **I accept the License Agreement** and click **Next** (see Figure 7).

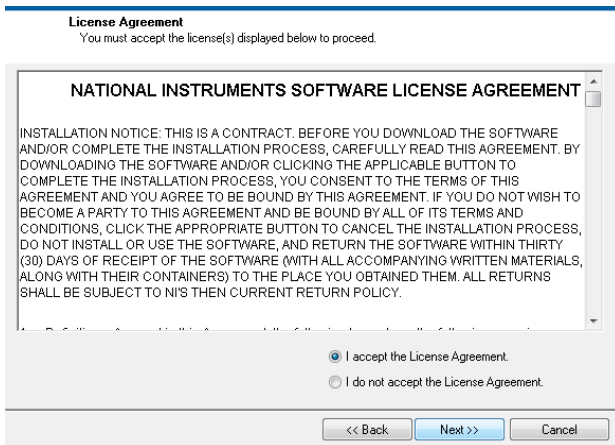


Figure 7. Accepting the License Agreement

7. A summary of the installation is displayed (see Figure 8). Click **Next** to continue.

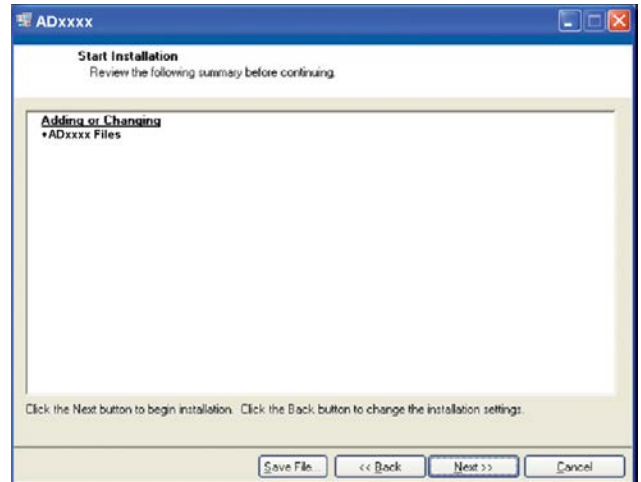


Figure 8. Reviewing a Summary of the Installation

8. A dialog box indicates when the installation is complete (see Figure 9). Click **Next**.

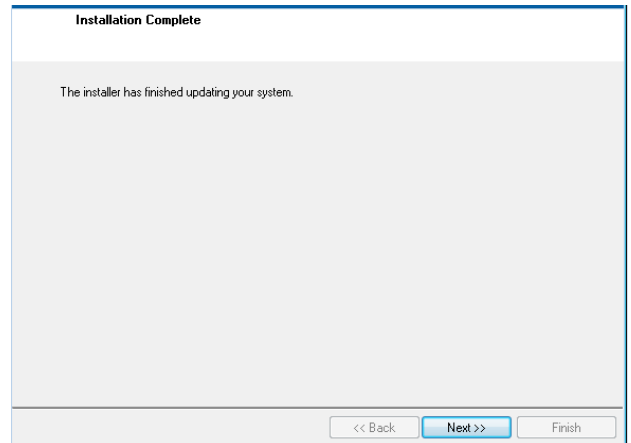


Figure 9. Indicating When the Installation is Complete

7. A summary of the installation is displayed (see Figure 8). Click **Next** to continue.

**Installing the EVAL-SDP-CH1Z System Demonstration Platform Board Drivers**

After the installation of the evaluation software is complete, a welcome window displays the installation information for the EVAL-SDP-CH1Z system demonstration platform board drivers.

To install the EVAL-SDP-CH1Z system demonstration platform board drivers, take the following steps:

1. With the EVAL-SDP-CH1Z system demonstration platform board still disconnected from the USB port of the PC, ensure that all other applications are closed, and then click **Next** (see Figure 10).



Figure 10. Beginning the Drivers Installation

2. Select the location to install the drivers and click **Next** (see Figure 11).



Figure 11. Selecting the Location for the Drivers Installation

3. Click **Install** (see Figure 12).



Figure 12. Granting Permission to Install Drivers

4. To complete the driver installation, click **Finish**, which closes the installation wizard (see Figure 13).

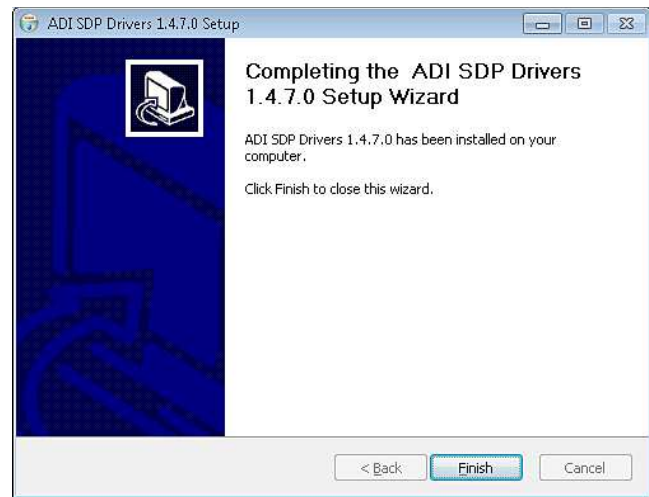


Figure 13. Completing the Drivers Setup Wizard

5. Before using the evaluation board, restart the computer (see Figure 14).

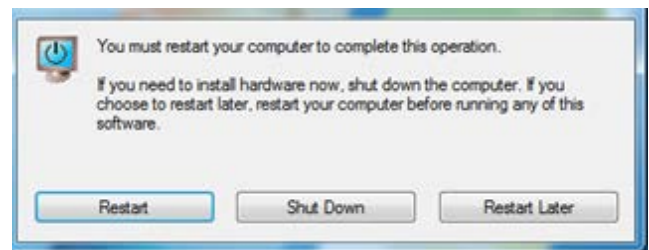


Figure 14. Restarting Your Computer

**SETTING UP THE SYSTEM FOR DATA CAPTURE**

After completing the steps in the Evaluation Board Software section and the Evaluation Board Hardware section, set up the system for data capture as follows:

1. Run the **Found New Hardware Wizard** after the **EV-AL-SDP-CH1Z** system demonstration platform board is plugged into the PC. If using Windows XP, the user may need to search for the **EV-AL-SDP-CH1Z** drivers. Automatically search for the drivers for the **EV-AL-SDP-CH1Z** system demonstration platform board if prompted by the operating system.
2. Check that the evaluation board is connecting to the PC correctly using the **Device Manager** of the PC. Access the **Device Manager** as follows:
  - a. Right click **My Computer** and then click **Manage**.
  - b. A dialog box appears asking for permission to allow the program to make changes to the computer. Click **Yes**.
  - c. The **Computer Management** window appears. Click **Device Manager** from the list of **System Tools** (see Figure 15).
  - d. If the **EV-AL-SDP-CH1Z** system demonstration platform board appears under **ADI Development Tools**, the driver software is installed and the evaluation board is connecting to the PC correctly.

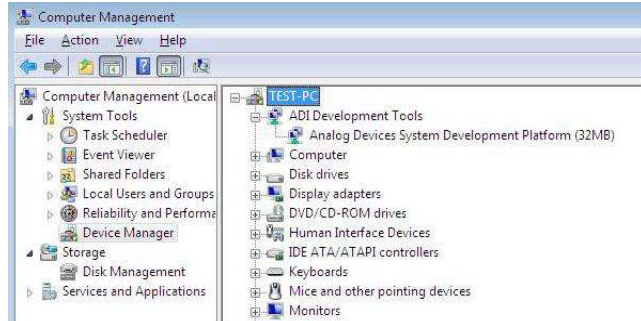


Figure 15. Checking That the Evaluation Board Is Connected to the PC Correctly

**Launching the Software**

After completing the steps in the Setting Up the System for Data Capture section, take the following steps to launch the **AD7768-1** software:

1. From the **Start** menu, select **Programs > Analog Devices > AD7768-1 Evaluation Software**. The main window of the software then displays.
2. If the **AD7768-1** evaluation system is not connected to the USB port via the **EV-AL-SDP-CH1Z** when the software is launched, a connectivity error displays (see Figure 16). Connect the evaluation board to the USB port of the PC, wait a few seconds, click **Refresh**, and then follow the on screen instructions.

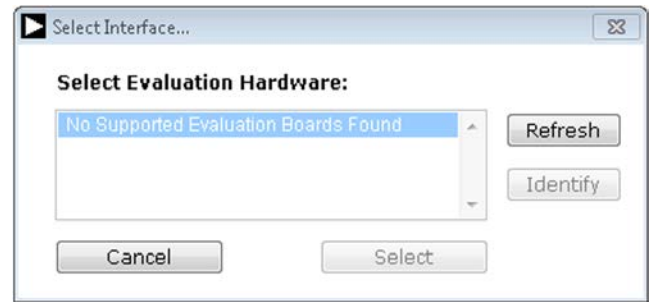


Figure 16. Connectivity Error Alert

## SOFTWARE OPERATION

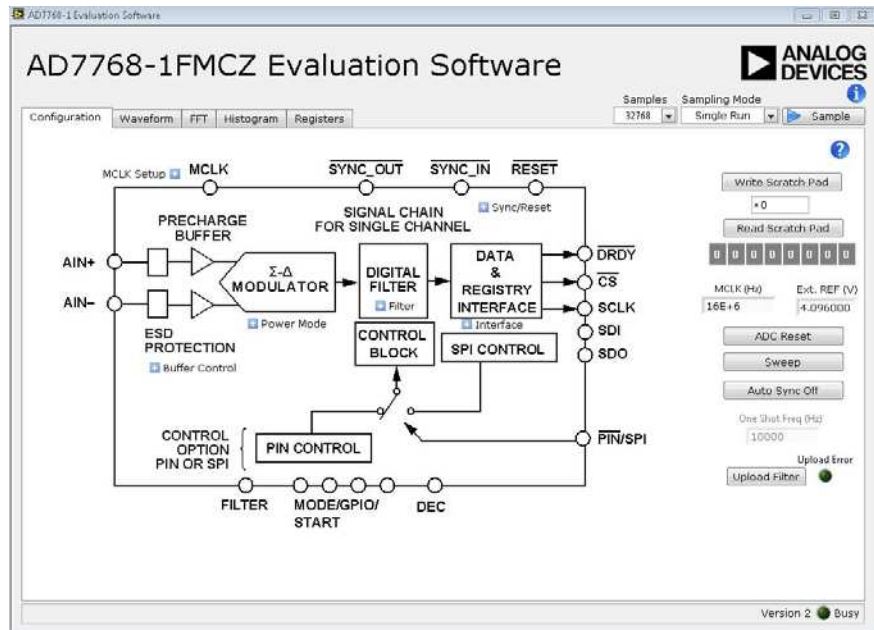


Figure 17. Configuration Tab

**Overview of the Main Window**

The main window contains the significant control buttons and analysis indicators of the evaluation software.

**Configuration Tab and AD7768-1 Block Diagram**

The **Configuration** tab is the tab displayed by default when the software first opens (see Figure 17). An overview of the [AD7768-1](#) block diagram is shown, along with buttons that open pop up menus for quick configuration of the device.

The **Waveform** tab (see Figure 19) displays captured waveform data. This tab also contains options to save the resulting data and shows the header data output from the conversion results if the header data output is enabled.

The **FFT** tab (see Figure 22) and **Histogram** tab (see Figure 23) show a more in depth analysis of the output data. This data can be saved to a file.

Use the **Registers** tab to change the configuration of the [AD7768-1](#) (see Figure 24).

**Sample Button**

Click **Sample** to start ADC sampling; results are reported in the **Waveform**, **FFT**, and **Histogram** tabs. The mode of operation can be set using the **Sampling Mode** button; the mode can be continuous sampling or a single run. Continuous sampling mode operates similarly to automating the sample button, rather than taking a stream of continuous data.

**Number of Samples**

The number of samples per channel is variable and can be changed using the **Samples** control.

**MCLK**

The **MCLK (Hz)** control in the **Configuration** tab must match the frequency of the ADC clock source. It is set to 16 MHz by default.

**V<sub>REF</sub>**

The **Ext. REF (V)** control in the **Configuration** tab must match the reference voltage of the ADC. This control is set to 4.096 V by default to match the [ADR4540](#) output on the evaluation board.

**ADC Reset**

Clicking **ADC Reset** in the **Configuration** tab sends a reset command to the ADC via the SPI and resets the device to its default configuration.

**Status Indicator and Busy light**

The status bar at the bottom of the screen indicates the current state of the [AD7768-1](#) software. The **Busy** indicator illuminates when the software is busy performing an action. Do not carry out any actions when this indicator is lit.



**Pop Up Buttons**

The pop up buttons allow quick configuration of the EV-AD7768-1FMCZ. The pop up buttons allow quick configuration by the user of the more common register settings. Figure 18 shows the pop up menu for the power mode selection. The register section allows configuration of the full suite of available registers.

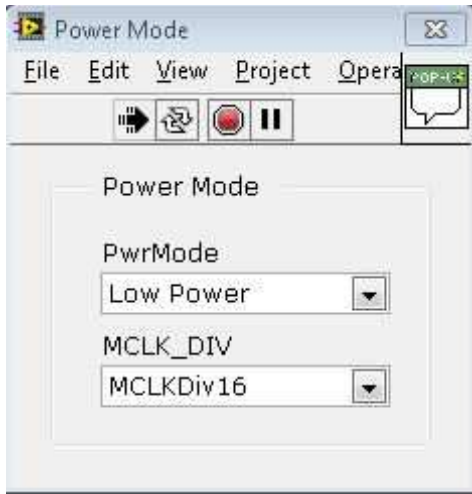


Figure 18. Pop Up Button Menu for **Power Mode** Selection

**Waveform Tab**

The **Waveform** tab displays a time domain graph of the sampled data. Controls beneath the graph allow zooming and panning. Amplitude information is given beneath the graph for the analysis channel selected.

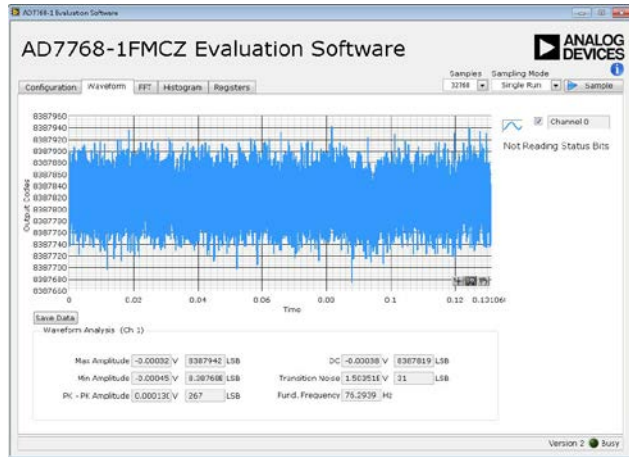


Figure 19. **Waveform** Tab

If postprocessing of the waveform data is required, each of the plots in the AD7768-1 evaluation software can be exported, as shown in Figure 20. Right click on the graph and select the options shown in Figure 20. It is also possible to manipulate the data as shown in Figure 21. The controls for zoom, zoom to fit, and so on are located in the bottom right corner of each graph.

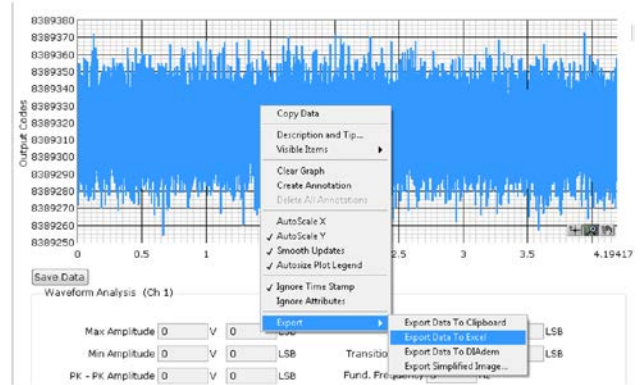


Figure 20. Exporting Data from a Graph

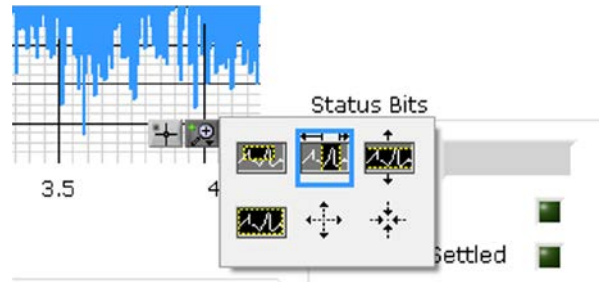


Figure 21. Graph Manipulation

**FFT Tab**

The **FFT** tab shows a frequency domain graph of the sampled data. Controls beneath the graph allow zooming and panning and control over amplitude and frequency scaling. Frequency and amplitude information is given beneath the graph for the selected analysis channel.

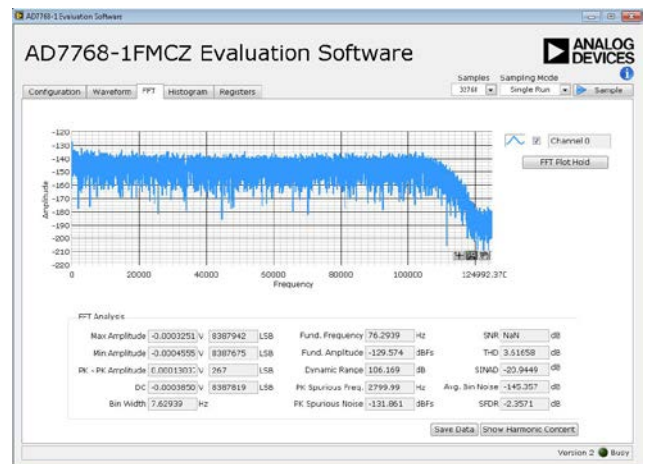


Figure 22. **FFT** Tab

**Histogram Tab**

The **Histogram** tab shows a histogram of the sampled data. Controls beneath the graph allow zooming, panning, and control over amplitude scaling. Amplitude information is given beneath the graph for the selected analysis channel.

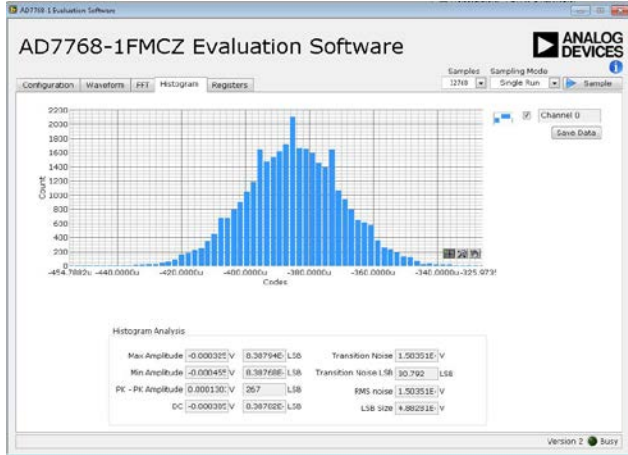


Figure 23. Histogram Tab

**Registers Tab**

The **Registers** tab allows precise control of the AD7768-1 registers, allowing them to be read back and written to. The registers are grouped together and can be altered in a number of ways, as shown in Figure 24. The register to be written to can be selected from the register map, located on the left hand side of the **Registers** tab. Individual register bits can be changed from the register section, or the entire register can also be written to by writing the required hexadecimal value. Dropdown options can be selected from the **Bitfields** section, or the entire bitfield can be written to with a hexadecimal value.

A particular register configuration can be saved to be loaded again at a later time.

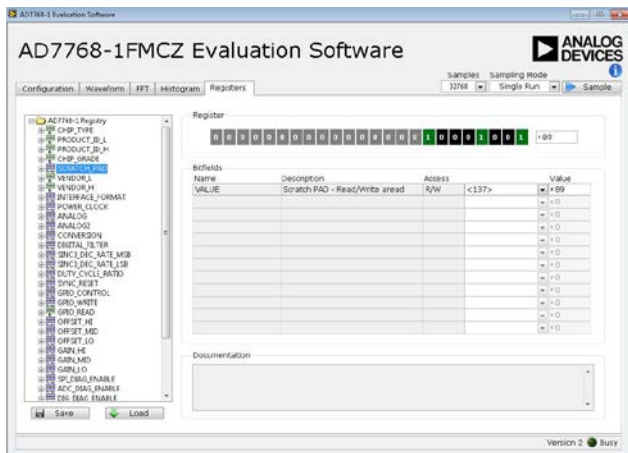


Figure 24. Registers Tab

**Scratch Pad**

The scratch pad shown in Figure 25 is located on the **Configuration** tab. The scratch pad can verify that read and write operations are functioning correctly from the AD7768-1 graphic user interface (GUI) to the AD7768-1 device on the EV-AD7768-1FMCZ. The same scratch pad is also located in the **Register** tab, Register Address 0x0A.

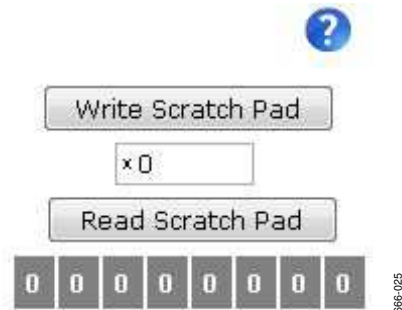


Figure 25. Scratch Pad for Register Read/Write Debug

**Sweep**

To aid in evaluation of the AD7768-1, a sweep function automatically steps through one of two options selectable by the user. The first sweep option performs fast Fourier transform (FFT) analysis on decimation rates from 32 to 1024 on each of the three power modes.

The second sweep option performs FFT analysis on each combination of an analog input precharge buffer and a reference buffer.

The data saved to the file in both cases includes root mean squared (RMS) noise, dynamic range, signal-to-noise ratio (SNR), and total harmonic distortion (THD). The button to start a sweep is located on the **Configuration** tab, as shown in Figure 27.



Figure 26. Available Sweep Options

**Auto Sync Off**

After each configuration change of the AD7768-1, a synchronization pulse is required, as per the data sheet. By default, the EV-AD7768-1FMCZ software provides this pulse over the SPI (SYNC\_IN is shorted to SYNC\_OUT on the evaluation board) each time the **Sample** button is pressed. This automatic SYNC operation can be prevented by pressing the **Auto Sync Off** button as shown in Figure 27; this is needed if evaluating the device in one shot mode, for example, or if a very slow output data rate (ODR) is selected, in which case the user may wish to manually issue a synchronization pulse to capture only fully settled data.

**One Shot Mode**

In one shot mode, the AD7768-1 operates similar to a successive approximation register (SAR) in that the output data rate is set by the frequency of a pulse applied on the SYNC\_IN input. To enable this mode, set the CONV\_MODE bitfield in the conversion register, Address 0x18, to continuous one shot. This setting enables the user to enter the one shot mode, which calculates the time base on the evaluation software plots. **Auto Sync Off** is also selected in this mode.

**Digital Filter Upload**

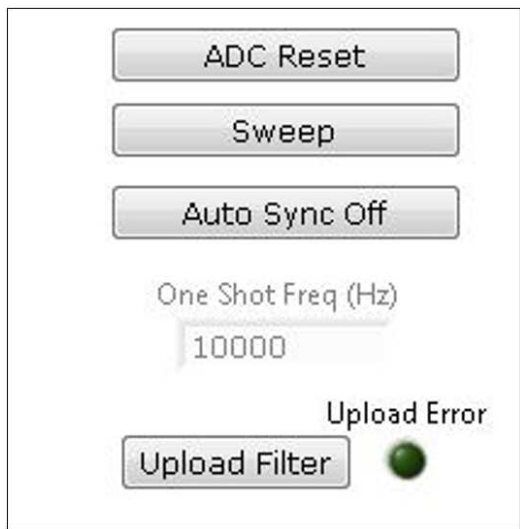


Figure 27. Filter Upload Option on the Main **Configuration** Tab

There is an option to upload a customized digital filter to the AD7768-1. This option replaces the default wideband filter coefficients with coefficients customized for a specific filter response. Consult the AD7768-1 data sheet for details on designing custom filters for upload to the AD7768-1.

Pressing the **Upload Filter** button allows the user to upload a set of 56 coefficients to the AD7768-1. The file format used for this upload must be a .csv file. The format of data must match that of the example files supplied with this software. Example files are named AD7768-1\_Low\_Ripple.csv and AD7768-1\_simple\_average.csv

Choosing the upload filter option automatically sets the device in fast power mode and selects the wideband filter option. After each upload, the AD7768-1 software reads back all 56 coefficients and checks these against the coefficients in the selected file. If there is any difference, this error is flagged in the upload error indicator. After the reset button is pressed, or if the AD7768-1 is powered off, the default wideband coefficients are loaded into the device again. The customized coefficients must be loaded each time the device is powered on or reset, if required.

Press the **FFT Plot Hold** button in the **FFT** tab to check that the filter upload was successful and that the filter characteristics are as expected. This action holds the highest amplitude value in each frequency bin for as long as the **FFT Plot Hold** button is selected.

**Status Bits**

If the status bits are enabled in the register map, the status bits for the conversion are displayed in the **Waveform** tab as shown in Figure 28. The status bits can be output by writing a 1 to Bit 4 of the INTERFACE\_FORMAT register, Address 0x14.



Figure 28. Status Bits

**Exiting the Software**

To exit the software, click the red X at the top right hand corner of the main window. Press the reset button on the EV-AD7768-1FMCZ before the EVAL-SDP-CH1Z is powered off.

### Example Data Capture

In this example, a sample is taken and analyzed with the [AD7768-1](#) software. The conditions required for operation are median mode, decimation  $\times 128$ , with a wideband filter.

1. Start the [AD7768-1](#) software. Wait for the **Busy** indicator to turn off. The software sets the power mode to fast and the filter to wideband on power-up.
2. Ensure that **MCLK (Hz)** and **Ext. REF (V)** are set to match the clock frequency and reference voltage supplied to the chip (by default, the values are 16 MHz and 4.096 V, respectively).
3. Set the number of samples per channel to 32,768 (default).
4. Configure the registers as required using the **Registers** tab. The **POWER\_CLOCK** register is set to 0x33 and the **DIGITAL\_FILTER** register is set to 0x42.
5. Click **Sample** to take a reading. Wait for the **Busy** indicator to turn off.
6. The sampled data is now present in the data capture tabs (**Waveform**, **FFT**, and **Histogram** tabs). Change between each of these tabs to view the results.
7. These settings give a dynamic range of approximately 114 dB, which can be seen on the FFT Analysis section of the **FFT** tab.
8. To export the raw data for further analysis, click on the **Waveform** tab. Right click the graph. Select **Export > Export Data To Excel**. The data can then be post processed in Microsoft Excel or passed to other analysis tools.

### Example $\overline{\text{PIN}}$ Control

In this example, the steps required to set the device into  $\overline{\text{PIN}}$  control mode with an externally applied MCLK are detailed. The  $\overline{\text{PIN}}$  control settings are low power mode, wideband, low ripple filter, and decimation by 64.  $\overline{\text{PIN}}$  control is only available in the LFCSP package.

To set the device into  $\overline{\text{PIN}}$  control mode, take the following steps:

1. Change the 0  $\Omega$   $\overline{\text{PIN}}$ /SPI link from SPI1\_A to SPI1\_B; this changes Pin 6 from high to low, therefore selecting  $\overline{\text{PIN}}$  control mode.
2. Change the following solder links on the [AD7768-1](#) evaluation board: move R13 to R64, move R12 to R144, move R11 to R149, and move R1 to R143.
3. On the PMODE1 switch, 1001 must be written to GPIO0 to GPIO3. To perform this setting, select the following options: set Switch 1 to the on position, set Switch 2 to the off position, set Switch 3 to the off position, and set Switch 4 to the on position.
4. Remove the 0  $\Omega$  link on MCLK1A. Add a 50  $\Omega$  resistor (or other) to Position C3 to terminate the external clock correctly.
5. Set the MCLK frequency on the **Configuration** tab (see Figure 17). The output data rate (ODR) is set using a combination of the [AD7768-1](#) MCLK and decimation rate. In  $\overline{\text{PIN}}$  control mode, the registers are not used to configure the part. The register map settings of the EV-AD7768-1FMCZ software are no longer automatically updated to reflect the settings of the device.



#### 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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