

High-speed Data Acquisition System

Features

- ❑ High-speed Data Acquisition & Analysis Tool
- ❑ Acquisition System Greatly Simplifies Capturing Data from Cirrus Logic Industrial Evaluation Boards
- ❑ LabVIEW®-based Data Capture Software
- ❑ Real-time Data Capture
 - Save Data Captures for Later Analysis
- ❑ Frequency Domain, Time Domain, and Statistical Analysis
- ❑ Convenient USB Interface to a Windows®-based PC
- ❑ Provides 100% Electrical Isolation Between the Capture System & the Evaluation Board

General Description

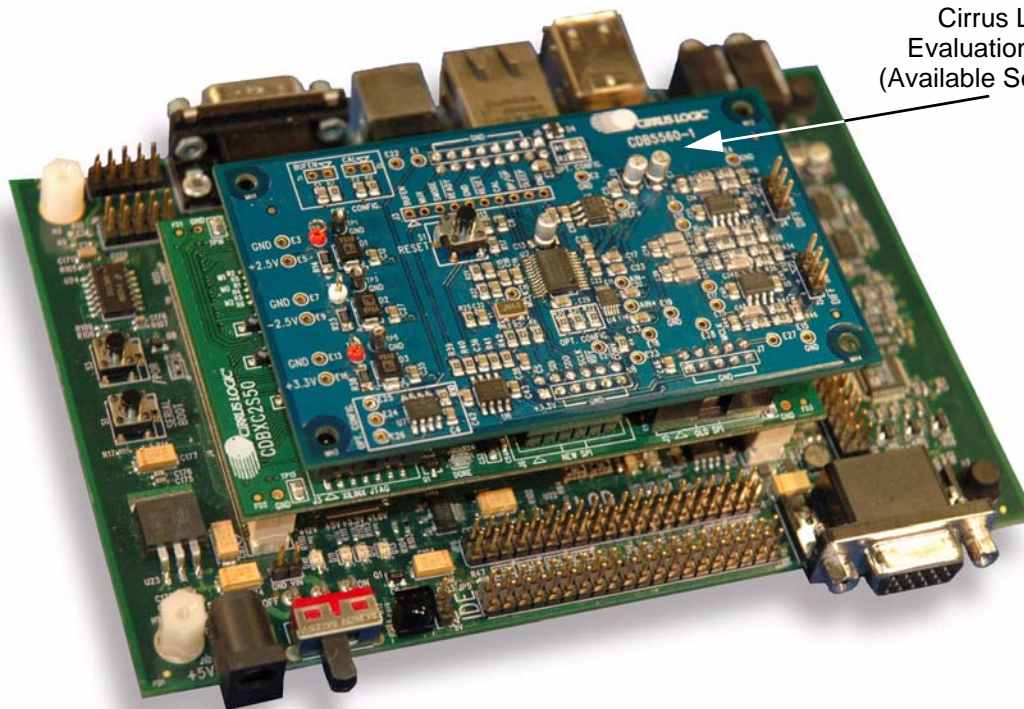
The CapturePlus™ II data acquisition system is a development tool that interfaces a Cirrus Logic evaluation board to a PC-compatible computer. Digital data is collected in a high-speed digital FIFO, then transferred to the PC over a USB connection. Evaluation software is included to analyze the data and demonstrate the ADC's performance.

The data acquisition system is designed to be easily interfaced to Cirrus Logic evaluation boards. The supplied host interface software configures the CapturePlus II interface board allowing the same hardware to be used with a variety of Cirrus Logic ADC development systems.

The host interface software includes advanced statistical analysis functionality. The software was developed using National Instruments LabVIEW®, a software development system for instrument control and data acquisition and analysis applications. The evaluation software permits time domain, frequency domain, and histogram analysis.

ORDERING INFORMATION

CDB-CAPTPL2 CapturePlus II System

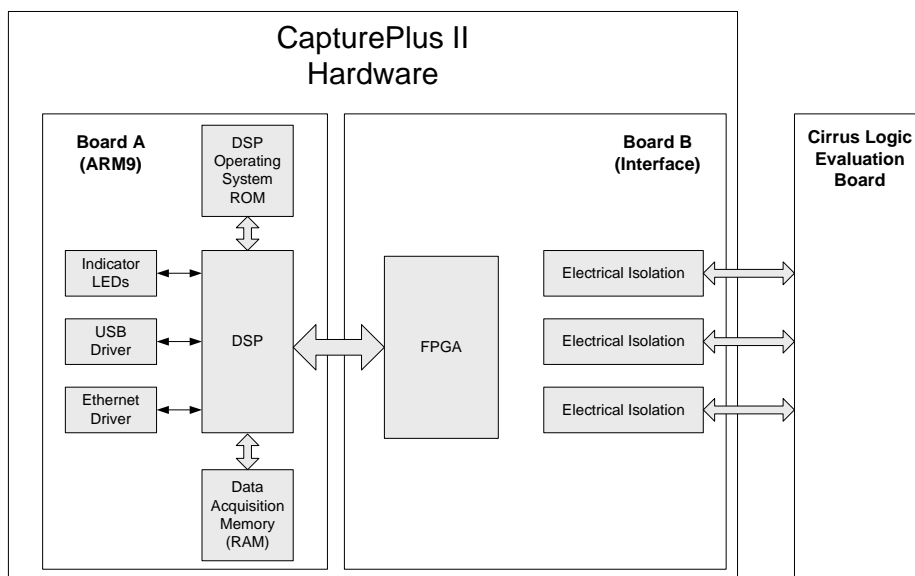


Cirrus Logic
Evaluation Board
(Available Separately)

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1. CAPTUREPLUS II HARDWARE OVERVIEW



1.1 Kit Contents

The following items are included in the CapturePlus II kit.

- Cirrus Logic ARM9-based Control/Communications Board
- CapturePlus II Data Acquisition Software on CDROM
- RS-232 9-pin Null Modem Cable
- USB Cable
- Power Supply (Does not supply power to the evaluation board.)

1.2 Required Items Not Supplied

The following items are required to use the CapturePlus II system and are not included in the kit.

- Cirrus Logic Evaluation Board and Data Sheet
- Power Supplies to Run the Evaluation Board (varies depending on evaluation board used)
- PC Running Windows[®] 2000 or Later or Windows NT[®] and an Available USB 2.0 Port
- Internet Access to Download any CapturePlus II Software Updates from www.cirrus.com/Industrialsoftware.

1.3 Minimum PC System Requirements

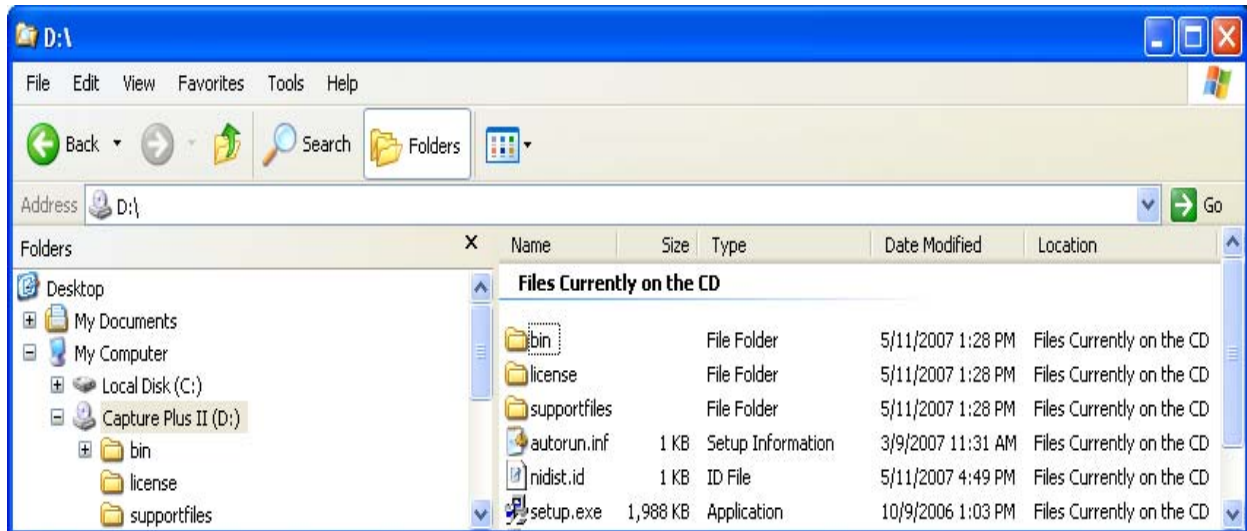
The PC system requirements for the Cirrus Logic CapturePlus II system are:

- Windows 2000 or Later or Windows NT
- Intel[®] Pentium[®] 600 MHz or Higher CPU
- Video Resolution of 1024 x 768 or Greater
- Minimum 1 GB RAM (2 GB recommended for large data captures)
- Minimum 100 MB Free Hard Drive Space

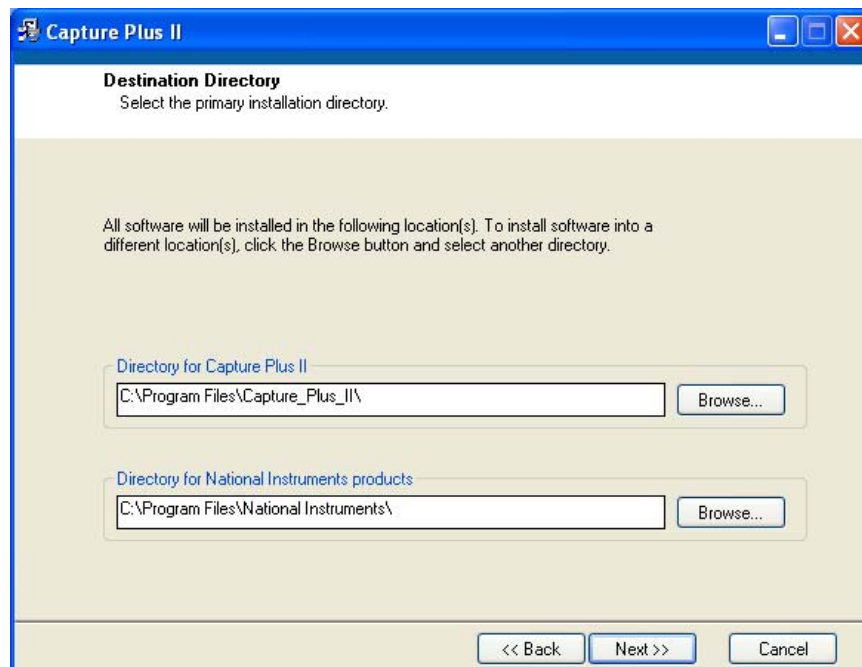
2. SOFTWARE SETUP

The following section assumes the software is being installed from the CD-ROM included in the kit. The complete software install package and any software updates can be downloaded from www.cirrus.com/Industrialsoftware.

1. Insert the CapturePlus II CDROM into the PC.
2. If the CapturePlus II installer program does not start automatically, navigate to the CDROM root directory and run the SETUP.EXE program.

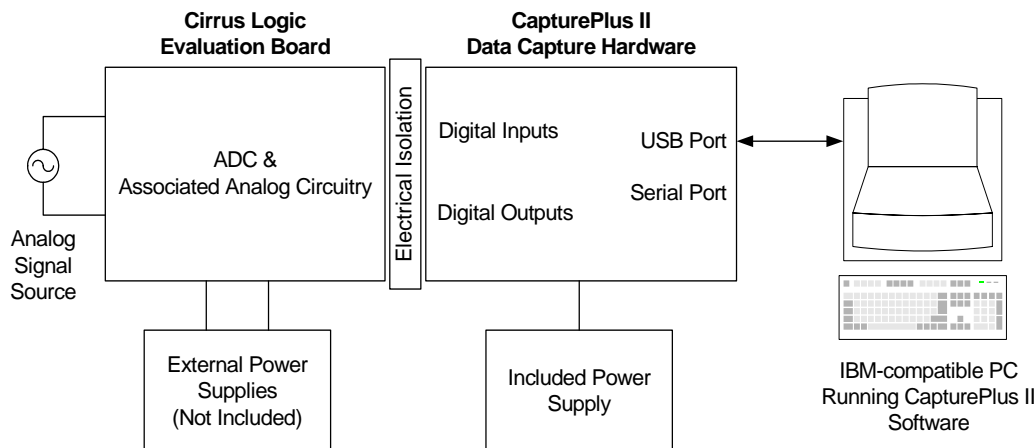


3. Follow the instructions presented by the CapturePlus II Installation Wizard. The default GUI installation location is *C:\Program Files\Capture_Plus_II*. The default runtime engine installation location is *C:\Program Files\National Instruments*.



3. HARDWARE SETUP

The following section describes the connections between the Cirrus Logic evaluation board and the CapturePlus II system. It then describes the connections between the CapturePlus II system and the PC.



1. Plug the ADC evaluation board into the connectors on the top of the CDBXC2S50 board.
2. Connect the USB cable between the CapturePlus II USB connector and the PC USB port.
3. With the CapturePlus II system power switch in the *OFF* position, plug the brick power supply into the CapturePlus II system. Plug the power supply into a 100-240 VAC, 50/60 Hz, 1.0 A outlet.
4. Connect the required power supplies to the appropriate connectors on the evaluation board.
5. Slide the CapturePlus II system power switch to the *ON* position. Press and release the *Reset (/POR)* switch, S3.
6. Turn on the power supplies connected to the evaluation board.
7. Start the CapturePlus II software.

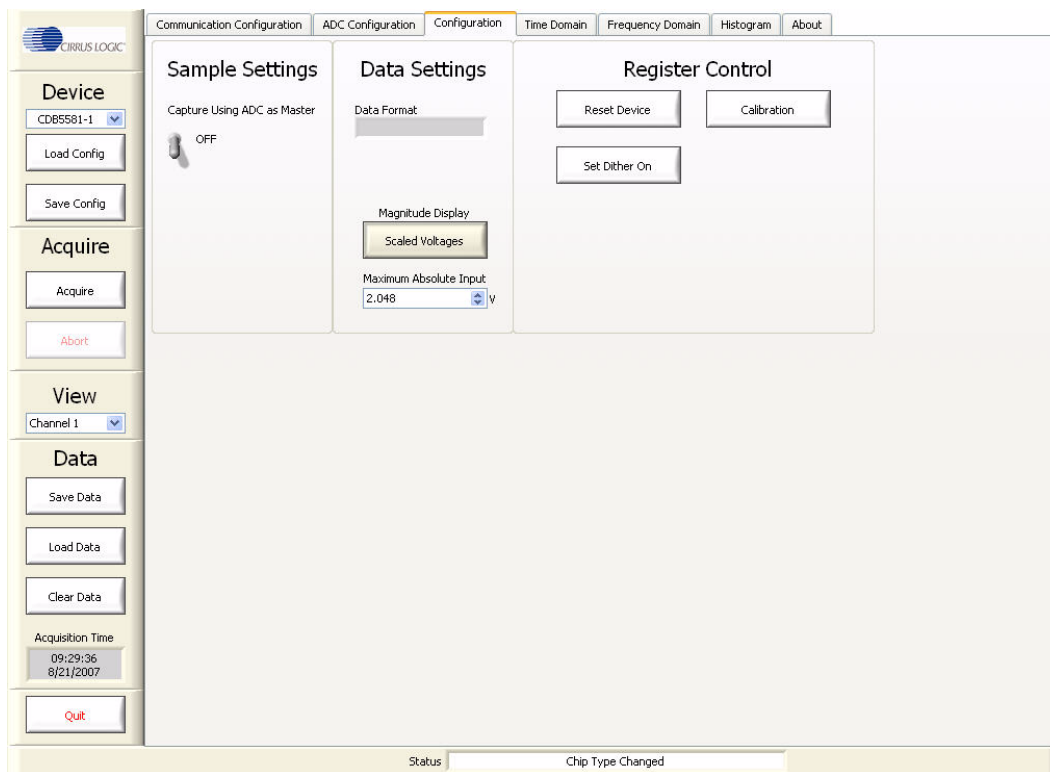
4. SOFTWARE DESCRIPTION

The CapturePlus II Software user interface is divided into two sections:

- The data control sub-panels are located on the left-hand side and bottom of the GUI display and are always available.
- The tabs at the top of the GUI panels are always present and provide convenient access to configuration and data collection panels.
- Click on a tab to display the desired panel.

4.1 Data Control Sub-panels

The data control sub-panels are located on the left-hand side and bottom of the GUI display. They are always visible.



Sub-panel Descriptions:

- **Device:** Configures the CapturePlus II system to capture data from the evaluation board.
- **Acquire:** Configures software parameters for acquiring data sets from the evaluation board.
- **View:** Selects the analog input channel for which data is displayed.
- **Data:** Save, load, or clear the data set in PC memory.
- **Quit:** Exits the software.

4.1.1 Device Sub-panel

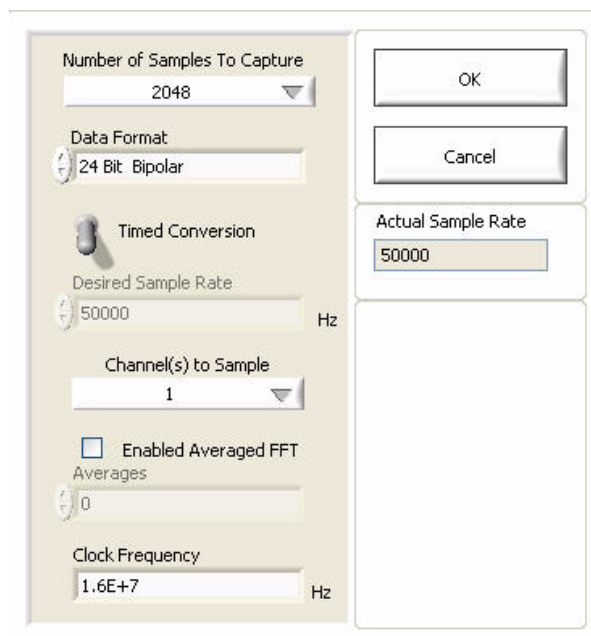
The *Device* sub-panel configures the CapturePlus II system to capture data from the evaluation board. This sub-panel is always available.

Sub-panel Descriptions:

- **Pull-down menu:** The pull-down menu selects the Cirrus Logic evaluation board and associated device. In most cases, the software will read the evaluation board EEPROM and automatically select the appropriate menu item.
- **Load Config:** Loads the ADC internal register configuration file. Information in the configuration file can be used to configure ADC internal registers. However, this function is not supported for all Cirrus Logic ADCs.
- **Save Config:** Saves the ADC internal register configuration file. The software makes a copy of the ADC internal register configuration and saves it in the configuration file.

4.1.2 Acquire Sub-panel

The *Acquire* sub-panel configures the software parameters for acquiring data sets from the evaluation board. This sub-panel is always available. Click on the *Acquire* button to open this sub-panel.



Sub-panel Descriptions:

- **Number of Samples to Capture:** Selects number of data samples to acquire. Note: Capturing data sets is PC memory intensive. The PC requires sufficient memory to run the PC operating system, CapturePlus II software, and to store captured data sets. Insufficient memory may limit the ability to acquire larger data sets. A minimum of 1 gigabyte of RAM is recommended.
- **Data Format:** Displays the format of the data samples being acquired. The software automatically fills in the *Data Format* window based upon the evaluation board part number displayed in the *Device* sub-panel. Change the data format between *Bipolar* and *Unipolar* by activating the adjacent Up/Down buttons.

- **Timed Conversion or Continuous Conversion:** Click on the toggle switch to change between *Timed Conversion* and *Continuous Conversion* modes.

In *Timed Conversion* mode the CapturePlus II system forces the *Desired Sample Rate* to be met by applying the correct timing delay to the ADC trigger. Enabling *Timed Conversion* mode activates the *Desired Conversion Rate* window. Timed conversion sample rates are calculated based on the frequency displayed in the *Clock Frequency* window. Not all Cirrus Logic ADCs support *Timed Conversion* mode operation.

In *Continuous Conversion* mode the ADC is free running: the data sample rate is determined by how fast the free running ADC converts data. This creates a conversion window equal to or less than the *Desired Conversion Rate* value.

- **Desired Sample Rate:** Displays the ADC data acquisition sample rate. The software automatically fills in the *Desired Sample Rate* field with a default value based upon the evaluation board part number displayed in the *Device* sub-panel. Change the *Desired Sample Rate* by activating the adjacent Up/Down buttons, or by clicking on the text box and manually entering a new value. Note that *Timed Conversion* mode must be selected for this control to work.
- **Channel(s) to Sample:** Configures which analog input channel(s) to sample. When the *OK* button is pressed, the requested number of samples are collected from the evaluation board and are split among the enabled channels. For example, with two channels selected, the CapturePlus II system will collect (*Number of Samples to Capture* / 2) samples per channel. Not all Cirrus Logic evaluation boards support multiple channels.
- **Enabled Averaged FFT:** Enable FFT averaging by clicking on the *Enabled Averaged FFT* box. The box will become active, and the *Averages* control window will become available.
- **Averages:** Displays the number of contiguous data sets to be acquired for generating an averaged FFT within the *Frequency Domain* tab. The *Averages* field can be changed by activating the adjacent Up/Down buttons, or by clicking on the text box and manually entering a new value. To activate the *Averages* window see the description on configuring the *Enabled Averaged FFT* box. Note that doubling the number of data sets being averaged decreases the FFT spot noise floor by 3 dB, allowing more detailed spectral analysis.
- **Clock Frequency:** Displays the ADC master clock frequency. The software automatically fills in the *Clock Frequency* window with a default value based upon the evaluation board part number displayed in the *Device* sub-panel and is the default value for the evaluation board detected. The *Clock Frequency* can be changed by applying an external clock source and changing the *Clock Frequency* window to reflect the new master clock frequency.
- **Actual Sample Rate:** Displays sample rate used by the CapturePlus II system when the system controls the conversion rate.
- **OK:** Clicking this button initiates the data acquisition sequence.
- **Cancel:** Closes the *Capture From ADC* data acquisition sub-panel and no data acquisition sequence is initiated.
- **Abort:** Halts data collection at the end of the current data set collection cycle (on *Device* sub-panel).

4.1.3 View Sub-panel

Use the *View* sub-panel to select the evaluation board analog input channel data set on which the software performs calculations and plots data graphs. This sub-panel is always available, however there may be only one channel's data set available for viewing.

4.1.4 Data Sub-panel

Use the *Data* sub-panel to save, load, or clear the present ADC data set. This sub-panel is always available.

Sub-panel Descriptions:

- **Save Data:** Saves current data set to a memory storage drive / device. There are two file formats and three options for saving data:

CapturePlus II Format (.ad2): Use the *CapturePlus II Format (.ad2)* option to save the unprocessed data set. Only the last captured data set can be saved. If multiple data sets have been captured to generate an averaged FFT, only the last captured data set can be saved.

Save FFT Graph Information (.csv): Use the *Save FFT Graph Information (.csv)* option to save the plotted FFT bin data, ADC test circuit performance data, and initial test conditions information. This file option becomes available after the software is finished plotting an FFT within the *Frequency Domain* tab. Use this option to save the bin data for either a single data set FFT or an averaged data set FFT.

Save Histogram Graph Information (.csv): Use the *Save Histogram Graph Information (.csv)* option to save the histogram bin data. To make this option available select the *Histogram* tab and click on the *Analyze* button. This action creates the histogram bin data from the raw data set. Only the most recent histogram bin data set can be saved. If multiple data sets have been captured only the last captured data set can be saved.

NOTE: Loading .csv format files is not supported.

- **Load Data:** Loads the .ad2 format data set from memory storage drive / device.
- **Clear Data:** Clears last data set stored in PC memory.
- **Acquisition Time:** Displays the real time clock and time stamp for the data set being captured.

4.1.5 Quit Sub-panel

The *Quit* sub-panel provides a *Quit* button for exiting the software. This sub-panel is always available.

4.1.6 Status Sub-panel

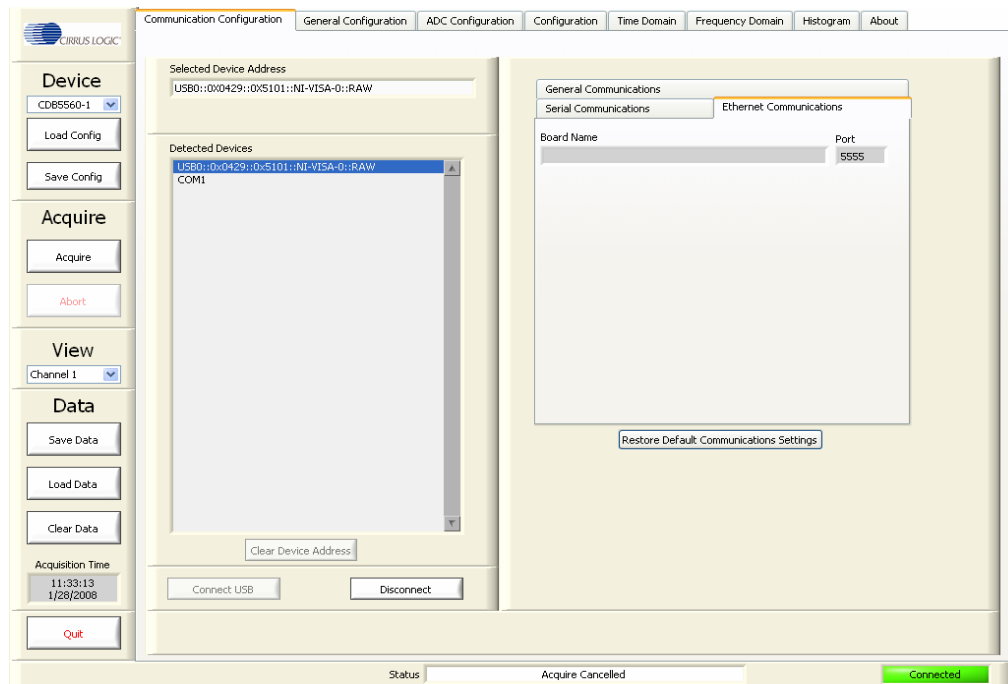
The *Status* sub-panel reports the status of the most recent software action taken. This sub-panel is always available.



The *Status* sub-panel will be indicated when data is ready to be analyzed within the *Frequency Domain* and *Histogram* tabs.

4.2 Menu Tabs

The menu tabs are always present at the top of the software panels and provide access to configuration and data collection panels. The menu tab selects the currently displayed panel.

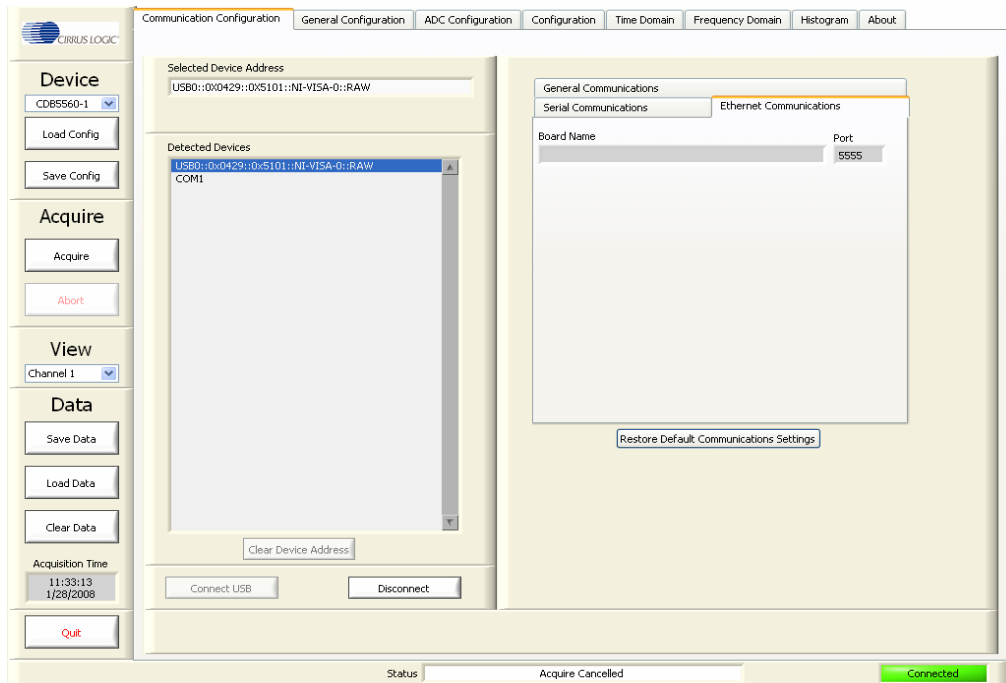


Sub-panel Descriptions:

- **Communication Configuration:** Displays the *Communication Configuration* panel.
- **General Configuration:** Displays the scaling configuration for all software-generated graphs and calculations.
- **ADC Configuration:** Displays the *ADC Configuration* panel.
- **Configuration:** Displays the *Configuration* panel.
- **Time Domain:** Displays the *Time Domain* analysis panel.
- **Frequency Domain:** Displays the *Frequency Domain* analysis panel.
- **Histogram:** Displays the *Histogram* panel for statistical analysis.
- **About:** Displays the *About* panel.

4.2.1 Communication Configuration Tab

The *Communication Configuration* panel establishes the communications link between the CapturePlus II system and the PC running the software. Select the *Communication Configuration* tab to display this panel. Click on any other tab to exit this panel.



The *Communication Configuration* panel consists of the following sub-panels:

- **Selected Device Address:** Displays communication address selected.
- **Detected Devices:** Displays USB and Serial Port addresses available for selection.
- **General Communications:** Displays default port configurations for both the serial port and the USB port. (Communication using the Ethernet port is not supported at this time.)

USB Communications

A USB communication link must be established between the PC and the CapturePlus II hardware before the CapturePlus II system can operate.

To open communication to a USB connection perform the following steps:

- Select an available USB device address by double clicking on a USB address within the *Detected Devices* sub-panel. The selected address will appear in the *Selected Device Address* sub-panel, the *Connect USB* and *Clear Device Address* buttons will become available, and the *Disconnect* button will be unavailable.
- Click on the *Connect USB* button. When USB communication is established, the *Connected* indicator at the bottom right corner of the screen will become bright green and read “Connected”. The *Connect USB* and *Clear Device Address* buttons will become unavailable. The *Disconnect* button will become available.

To close communication to a USB connection perform the following steps:

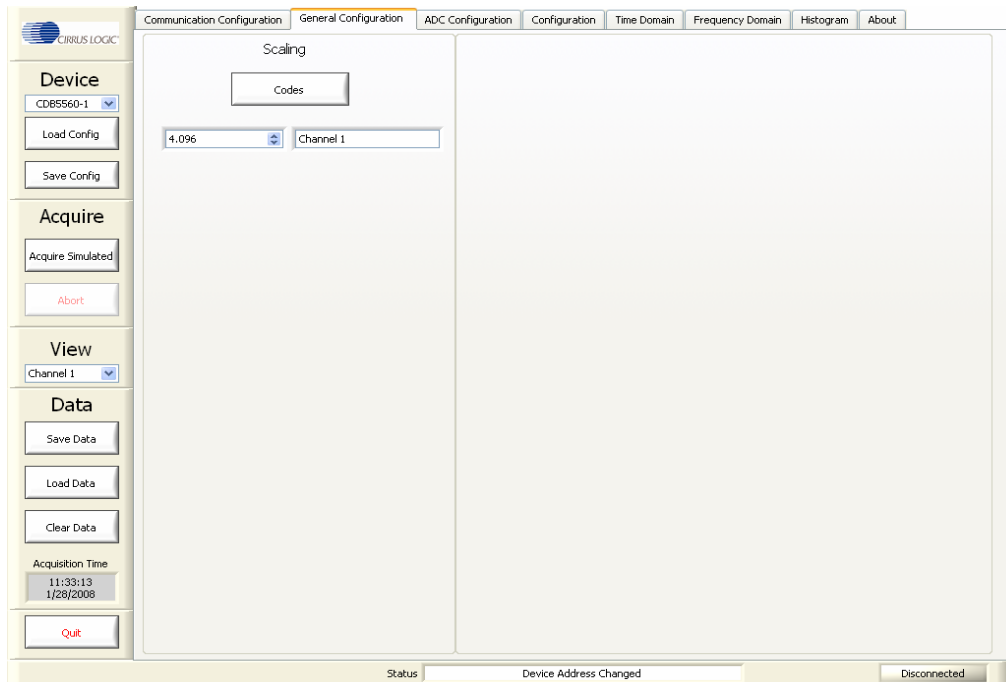
- Click on the *Disconnect* button. When USB communication is disconnected, the *Connected* indicator will turn gray and read “Disconnected”. The *Connect USB* and *Clear Device Address* buttons will become available.
- To remove a USB device address from the *Selected Device Address* sub-panel, click on the *Clear Device Address* button.

Serial Port Communications

Serial port communications between the PC and the CapturePlus II hardware is NOT required for the CapturePlus II system to operate.

4.2.2 General Configuration Tab

The *General Configuration* tab provides access to configure the scaling for all software-generated data graphs and calculations. Click on any other tab to exit this panel.



The *General Configuration* panel contains the following sub-panels:

Scaling: Use this button to select the magnitude units used for all software-generated data graphs and calculations. Click on the button to toggle the magnitude units between *Codes* (ADC output codes) and *Voltage* (scaled voltage).

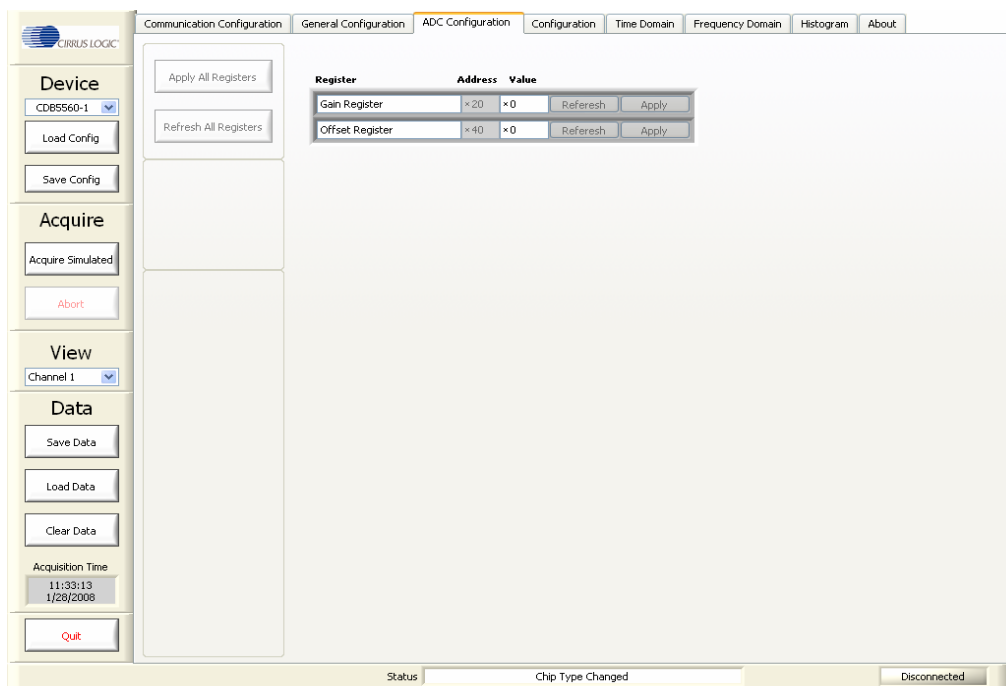
Reference Inputs: This function provides x-axis magnitude scaling for all software-generated data graphs. The software automatically fills in the *Reference Inputs* voltage (the maximum absolute input voltage), based upon the evaluation board part number displayed in the *Device* sub-panel. The voltage displayed provides the 0 dB FS baseline magnitude scaling for all software-generated data graphs. If the voltage reference device is changed, rescale the data graphs manually by entering a new *Reference Inputs* voltage. The data graphs are scaled by the ratio of the new voltage entered divided by the original 0 dB FS baseline voltage.

Note: This value should only be changed if the voltage reference on the ADC evaluation board is changed, otherwise the voltage scaling will be incorrect. In addition, any modifications to the analog input circuitry must be evaluated for effects on voltage scaling.

4.2.3 ADC Configuration Tab

The *ADC Configuration* tab provides a method for reading and writing to the ADC digital gain and offset registers. Select the *ADC Configuration* tab to display this panel. Click on any other tab to exit this panel.

NOTE: This tab is not be available for all Cirrus Logic evaluation boards/ADCs.

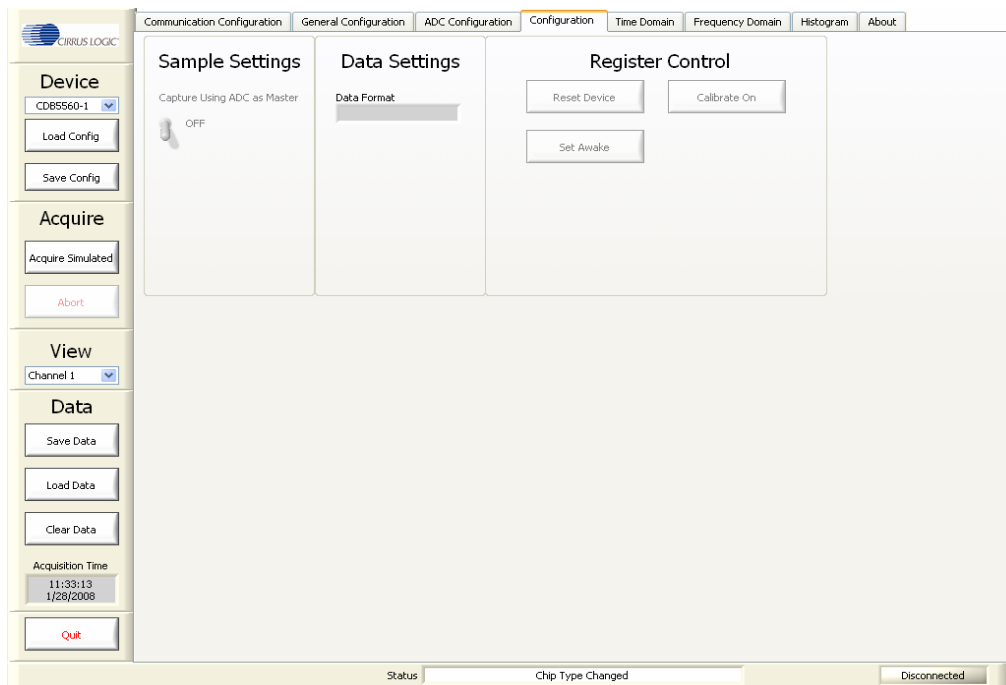


The *ADC Configuration* panel consists of the following sub-panels:

- **Gain Register:** Displays the ADC GAIN Register contents in hexadecimal. Access to the gain register *Value* window contents is enabled with a mouse click on the *Value* window. The *Apply* button writes the contents of the *Value* window to the ADC gain register. The *Refresh* button reads the value from the ADC gain register and displays it in the *Value* window.
- **Offset Register:** Displays the ADC offset register contents in hexadecimal. Access to the ADC offset register *Value* window contents is enabled with a mouse click on the *Value* window. The *Apply* button writes the contents of the *Value* window to the ADC offset register. The *Refresh* button reads the value from the ADC offset register and displays it in the *Value* window.
- **Apply All Registers:** Writes contents of all *Value* windows to the ADC registers.
- **Refresh All Registers:** Reads contents from ADC registers and displays the contents in the *Value* windows.

4.2.4 Configuration Tab

The Configuration tab provides access to configure the ADC and the data acquisition system. Click on any other tab to exit this panel.



The *Configuration* panel contains the following sub-panels:

- **Sample Settings:** Provides a switch for manually setting the ADC SPI communications port in master mode or slave mode. When the *Capture Using ADC as Master* switch is in the on position, the ADC SPI is set to master mode and the ADC controls the SPI port data rate using an internally generated SCLK. When the *Capture Using ADC as Master* switch is in the off position, the ADC SPI is set to slave mode, the CapturePlus II system controls the SPI port data rate asynchronous to MCLK, and the SCLK is asynchronous to MCLK.
- **Data Settings:** Displays the SPI data format.
- **Register Control:** Provides buttons for controlling ADC functionality.

Reset Device: Click on the *Reset Device* button to force a reset of the ADC.

Calibration: Click on the *Calibration* button to run an ADC calibration sequence. Each time the button cycles from “Calibrate Off” to “Calibrate On”, a single ADC calibration sequence will be initiated.

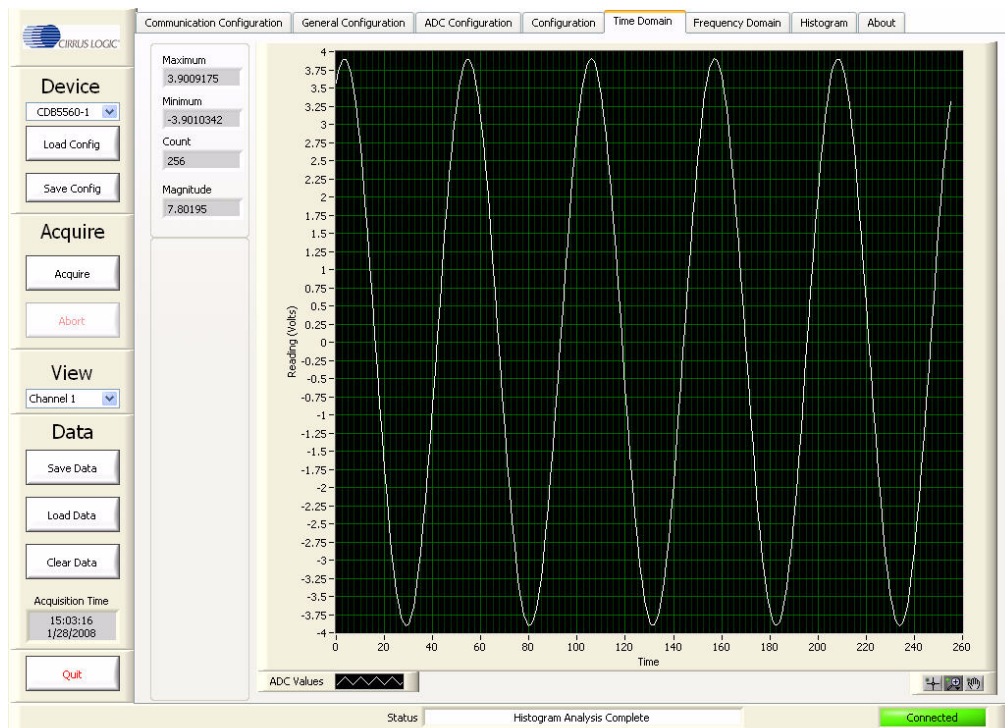
Note: The calibration function is not supported for all Cirrus Logic ADCs.

Set Dither On / Set Dither Off or Set Awake / Set Sleep: Text on the button indicates the next available state. Click on the button to set the next state. Example: Click on the button to change dither setting. When the button text reads *Set Dither On* the dither function is currently off. Clicking on the button will turn dither on. Similarly, when the button displays *Set Dither Off* the dither function is currently turned on.

Note: For certain ADC evaluation boards this button does not exist. The functionality of this button changes depending upon the evaluation Board that is connected to the CapturePlus II system.

4.2.5 Time Domain Tab

The *Time Domain* tab displays the data set in the time domain. Select the *Time Domain* tab to display this panel. Click on any other tab to exit this panel.

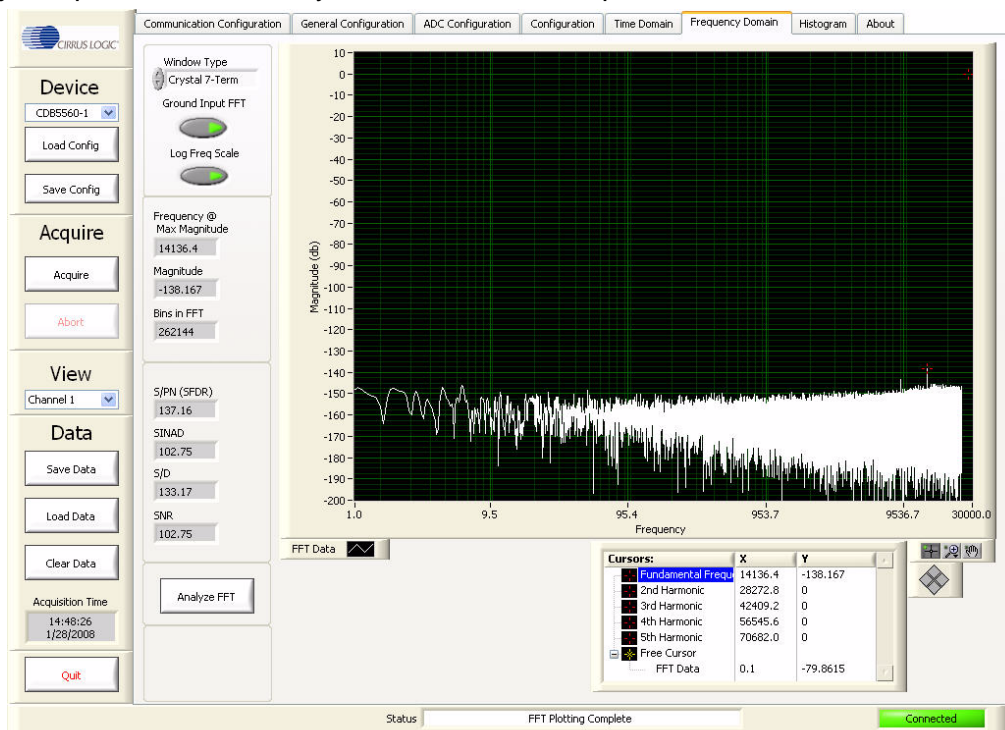


The *Time Domain* tab consists of the following controls:

- **Data Graph:** The Data Graph provides an x-y plot of the data set in the time domain.
 - X-axis:** Plots the sample number: Use the x-axis scaling to determine the position of any sample within the data set sequence. For any given plotted data point, the number displayed along the x-axis represents the sample number in the data set sequence.
 - Y-axis:** Plots the magnitude of the reading in either volts or bits. Use the y-axis scaling to measure the magnitude of the plotted data.
 - ADC Values:** This menu provides data set graphing options. Click on the *ADC Values* button to open the *ADC Values* menu.
 - Graph Zoom:** The Graph Zoom functions are available at the bottom right corner of the graph. Also, the *Minimum* and *Maximum* x-axis and y-axis index numbers can be manually changed by applying a clicking on the minimum and maximum index numbers and entering a new value.
- **Maximum:** Displays the maximum y-axis value for the graphed data set. Units are the same as the data graph y-axis units (volts or bits).
- **Minimum:** Displays the minimum y-axis value for the graphed data set. Units are the same as the data graph y-axis units (volts or bits).
- **Count:** Displays the data set sample size.
- **Magnitude:** Displays the difference between the maximum and minimum values for the graphed data set. Units are the same as the Data Graph y-axis units (volts or bits).

4.2.6 Frequency Domain Tab

The *Frequency Domain* tab displays the data set in the frequency domain. Select the *Frequency Domain* tab to display this panel. Click on any other tab to exit this panel.



The *Frequency Domain* tab consists of the following controls:

- **Data Graph:** The Data Graph provides an x-y plot of the data set in the frequency domain.
 - X-axis:** Plots Frequency in Hertz. The x-axis index is in units of Hertz for the FFT frequency bins. Bin size is based upon the ADC data sample rate.
 - Y-axis:** plots voltage magnitude (dBFS). The y-axis provides an index in units of Voltage dBFS for the voltage magnitude of a given FFT frequency bin.
 - ADC Values:** This menu provides data set graphing options. Click on the ADC Values icon to open the ADC Values menu.
 - Graph Zoom:** The Graph Zoom functions are available at the bottom right corner of the graph. Also, the Minimum and Maximum x-axis and y-axis index numbers can be manually changed by applying a clicking on the minimum and maximum index numbers and entering a new value.
- **Window Type:** Change the FFT windowing function by activating the *Window Type Up / Down* buttons. Display the current data set using the selected windowing function by clicking the *Analyze FFT* button.

Three windowing functions are available:

Rectangular: The Rectangular Windowing Function is optimized for measuring FFT broad band noise. It is used primarily for examining the noise floor produced by a Grounded Input FFT without any input signal.

Hodie 5 Term: The Hodie 5 Term Windowing Function is a proprietary 5-term digital filter optimized for examining an FFT with spectral content. It has a processing loss of 3.457 dB and side lobe

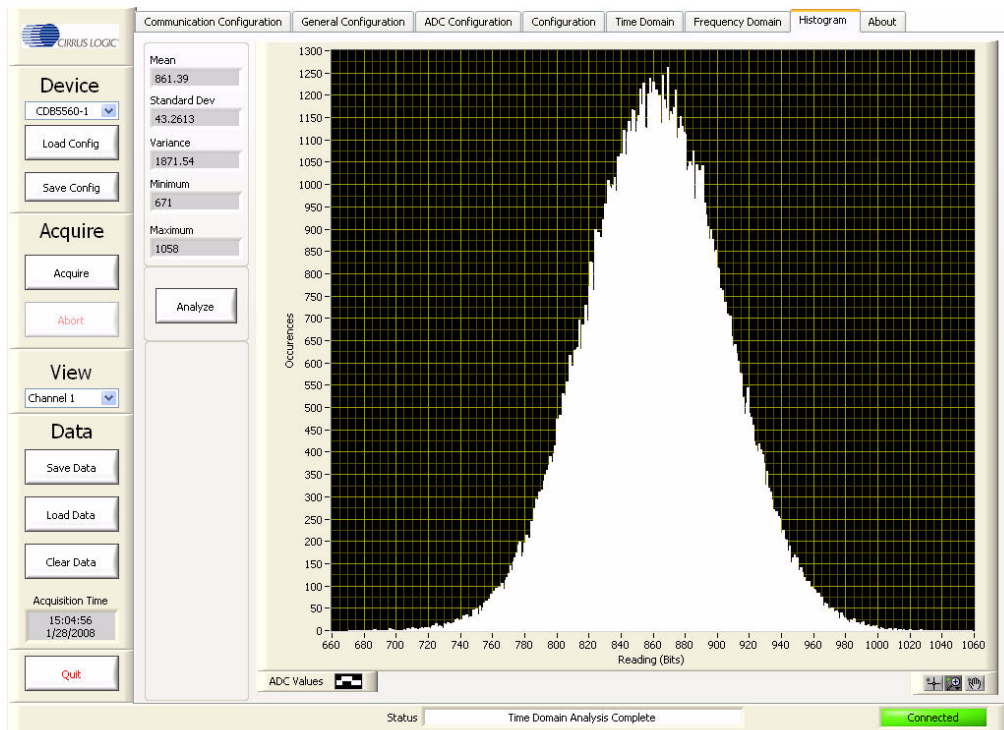
attenuation of 125 dB.

Crystal 7 Term: The Hodie 5 Term Windowing Function is a proprietary 7-term digital filter optimized for examining an FFT with spectral content. It has a processing loss of 4.203dB and side lobe attenuation of 175dB.

- **Grounded Input FFT:** Click on this button to change the voltage reference value used to calculate the dynamic performance values. When the button is a light green color, the performance calculations are for a grounded input FFT and an artificially generated 0 dBFS signal number (equivalent to a full-scale input voltage) is used to calculate noise and distortion. When the button is a dark green color, the externally applied analog input signal peak amplitude displayed in the FFT is the reference voltage used to calculate noise and distortion.
- **Linear / Log Freq Scaling:** Click on this button to change the data graph x-axis scaling between linear and logarithmic. When the button is a dark green color, the data graph x-axis scaling will be linear. When the button is a light green color, the data graph x-axis scaling will be logarithmic.
- **Frequency @ Max Magnitude:** The frequency value displayed is the input signal's fundamental frequency as observed in the data graph (highest amplitude peak).
- **Magnitude:** The magnitude value displayed is the input signal's magnitude as observed in the data graph. The magnitude value displayed will include the windowing loss value given in the *Window Type* description. Calculate the actual signal peak by adding the window loss to the magnitude value.
- **FFT Bin Count:** The bin count value displayed is the number of bins used to generate the FFT. The bin count is one-half the data set sample size.
- **S/PN(SFDR):** Signal-to-peak noise (spurious free dynamic range). Measurement provides S/PN(SFDR) for the present data set and is in units of dBFS (voltage ratio). Measurement references either the analog input signal magnitude (if the *Grounded Input FFT* switch is disabled) or 0 dBFS (if the *Grounded Input FFT* switch is enabled and bright green).
- **SINAD:** Signal-to-Noise and distortion. Measurement provides SINAD data for the present data set and is in units of dBFS (voltage ratio). The SINAD calculation's signal variable uses either the analog input signal magnitude (if the *Grounded Input FFT* switch is disabled) or 0 dBFS (if the *Grounded Input FFT* switch is enabled and bright green).
- **S/D:** Signal-to-Distortion. Measurement provides S/D data for the present data set and is in units of dBFS (volts). The S/D calculation's signal variable uses the analog input signal magnitude (*Grounded Input FFT* switch is disabled).
- **SNR:** Signal-to-noise ratio. Measurement provides SNR data for the present data set and is in units of dBFS (volts). The SNR calculation's signal variable uses either the analog input signal magnitude (if the *Grounded Input FFT* switch is disabled and dark green) or 0 dBFS (if the *Grounded Input FFT* switch is enabled and bright green).
- **Analyze FFT:** After acquiring a single data set the software will pause and wait for the *Analyze FFT* button to be activated before performing the analysis and displaying the results. Likewise, to update the data graph after making changes to the *Window Type*, *Grounded Input FFT*, or *Linear / Log Freq Scaling* controls, activate the *Analyze FFT* button. Alternately, when averaging multiple contiguous data sets the software will automatically perform the analysis and display the results.
- **Cursors:** The *Cursors* sub-panel displays the frequency and magnitude value of the fundamental frequency and the 2nd to 5th harmonic frequencies as determined by the software. It also displays the frequency and magnitude values for the user-controlled cursor. The cursor magnitude values are referenced to 0 dBFS.

4.2.7 Histogram Tab

The *Histogram* tab displays the data set using statistical analysis. Select the *Histogram* tab to display this panel. Click on any other tab to exit this panel.



The *Histogram* tab consists of the following controls:

- **Analyze:** After acquiring one or more data sets the Software will pause and wait for the *Analyze* button to be activated. Click on the *Analyze* button to analyze the data set and display the results. Only the last data set acquired is analyzed.
- **Data Graph:** The Data Graph provides a histogram distribution of the data set.
 - X-axis:** Plots the reading (bits or volts). The x-axis index units are selected by the *Magnitude Display* button within the *Configuration* panel.
 - Y-axis:** Plots occurrences: The y-axis indicates the number of times a particular value occurred.
 - ADC Values:** This menu provides data set graphing options. Click on the *ADC Values* menu to activate it.
 - Graph Zoom:** This menu provides graph zoom options. Click on the *Graph Zoom* buttons to access the zoom functions. Also, the x-axis and y-axis scaling can be changed by clicking on the minimum or maximum index numbers and manually entering a new value.
- **Mean:** The mean statistical measurement is in units of volts or LSBs (least significant bits). The mean statistical measurement units are set by the *Magnitude Display* button in the *General Configuration* menu.
- **Standard Dev:** The standard deviation statistical measurement is in units of volts or LSBs (least significant bits). The standard deviation statistical measurement units are set by the *Magnitude Display* button in the *General Configuration* menu. If the units are volts, the standard deviation represents volts RMS.

- **Variance:** The variance statistical measurement is in units of volts² or LSBs² (least significant bits). The variance statistical measurement units are set by the *Magnitude Display* button in the *General Configuration* menu.
- **Minimum:** The minimum statistical measurement is in units of volts or LSBs (least significant bits). The minimum statistical measurement units are set by the *Magnitude Display* button in the *General Configuration* menu.
- **Maximum:** The maximum statistical measurement is in units of volts or LSBs (least significant bits). The maximum statistical measurement units are set by the *Magnitude Display* button in the *General Configuration* menu.

4.2.8 About Tab

The *About* panel displays copyright information for the Cirrus Logic CapturePlus II data acquisition software. Select the *About* tab to display this panel. Click on any other tab to exit this panel.



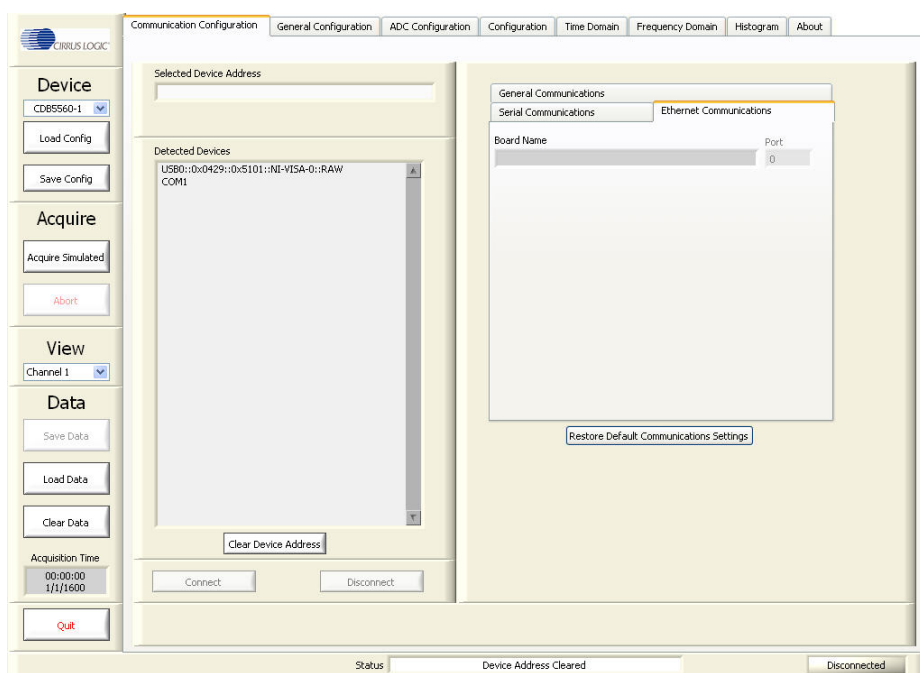
5. CONFIGURING THE CapturePlus II SYSTEM

The following sections describe how to configure the CapturePlus II system.

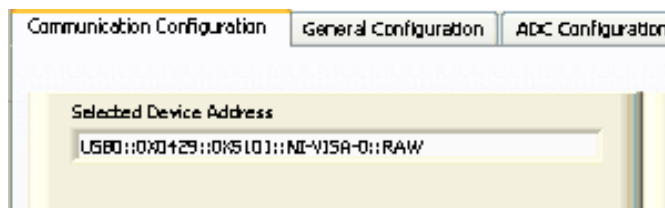
The CapturePlus II system is designed to interface with a wide variety of Cirrus Logic evaluation boards. For this example set-up, the instructions show the CapturePlus II system being interfaced to a Cirrus Logic evaluation board.

5.1 Communication Configuration

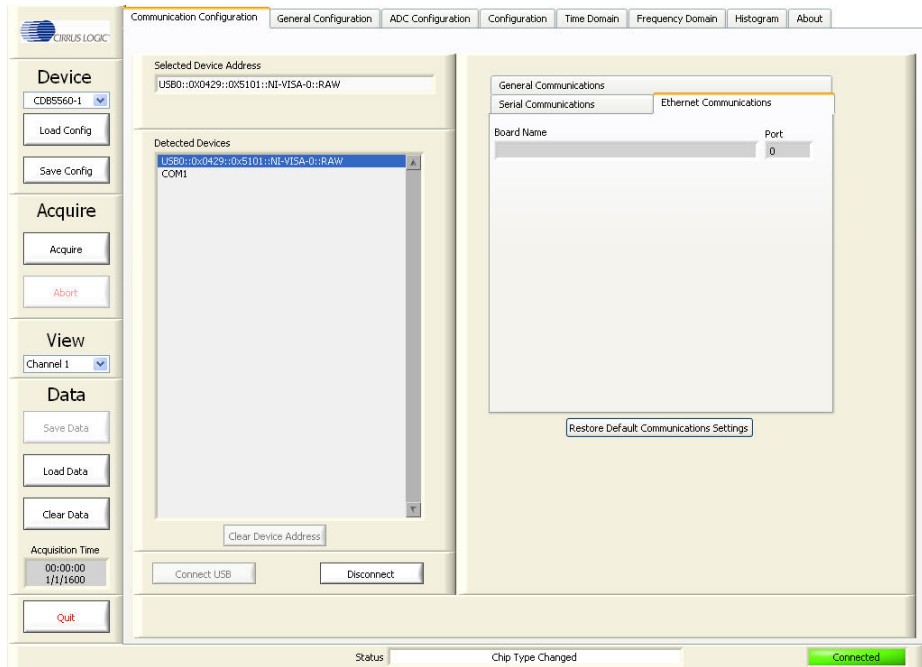
Select the *Communication Configuration* window (selected by clicking on the *Communication Configuration* tab at the top of the screen). When the CapturePlus II system is finished booting up, the *Detected Devices* field will display a USB device address.



Click on the displayed USB address and it will appear in the *Selected Device Address* field.

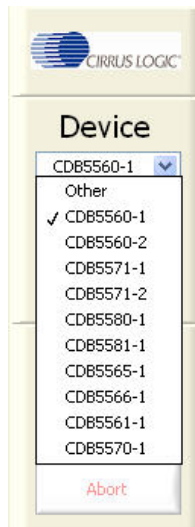


Click the *Connect USB* button to connect the communications port. When a communications port is configured and communicating, the *Connect USB* button will no longer be highlighted and the *Connected* indicator will change to a bright green color.



5.2 Selecting the Cirrus Logic Evaluation Board Type

In most cases the CapturePlus II system will automatically identify the evaluation board connected to the system. The software displays the selected evaluation board in the *Device* window. If the software *Device* window does not identify the correct evaluation board then use the *Device* pull-down menu to select the correct evaluation board. The evaluation board must have a separate power source (in addition to the CapturePlus II power supply) applied to it before the CapturePlus II system can identify it.



APPENDIX A. TESTING THE CIRRUS LOGIC CDB556x/7x/8x EVALUATION BOARD

The following sections describe several basic tests performed to establish basic system functionality and baseline noise and distortion levels.

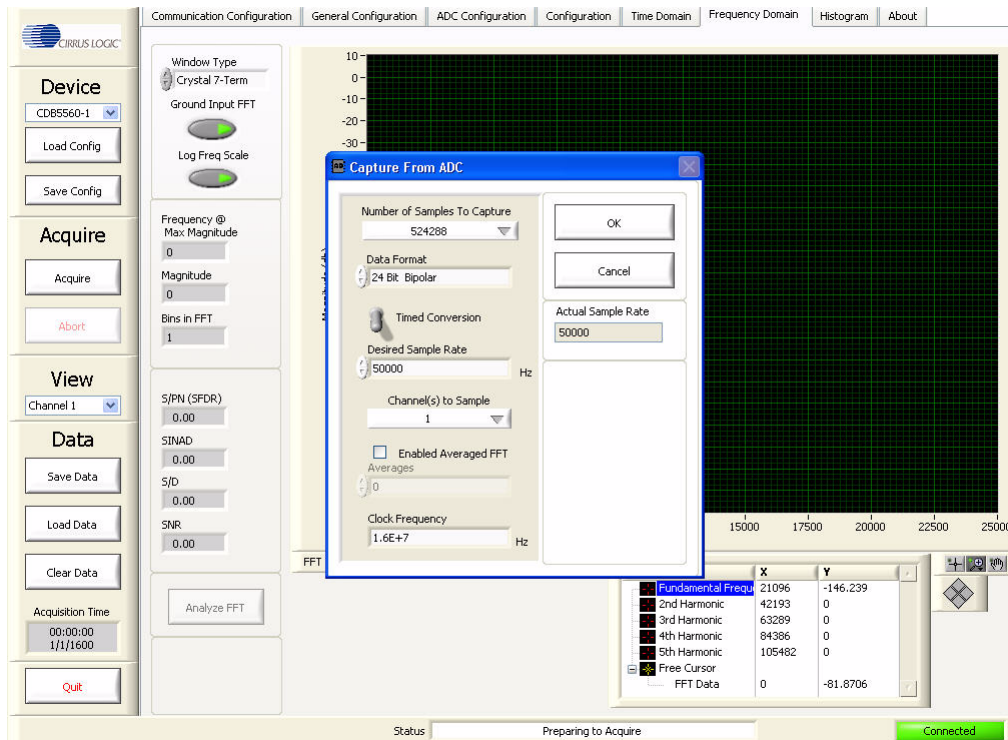
A.1 Baseline Testing for Noise & Distortion

A.1.1 Baseline Noise & Distortion Test - Non-Averaged FFT

Connect the evaluation board power inputs to a bench supply having the appropriate voltages.

Connect the evaluation board's analog input(s) to circuit ground (in most cases, the 50 Ω termination resistors on the input will be adequate).

Select the *Frequency Domain* window (selected by clicking on the *Frequency Domain* tab at the top of the screen). Activate the *Grounded Input FFT* and *Log Freq Scale* buttons. Select the *Window Type* to be *Crystal 7-Term*.



The screenshot displays the CapturePlus II software interface. The main window is titled "Frequency Domain" and shows a plot of the FFT magnitude spectrum. The x-axis represents frequency in Hz, ranging from 15000 to 25000. The y-axis represents magnitude in dB, ranging from -30 to 10. A dialog box titled "Capture From ADC" is open, showing the following settings:

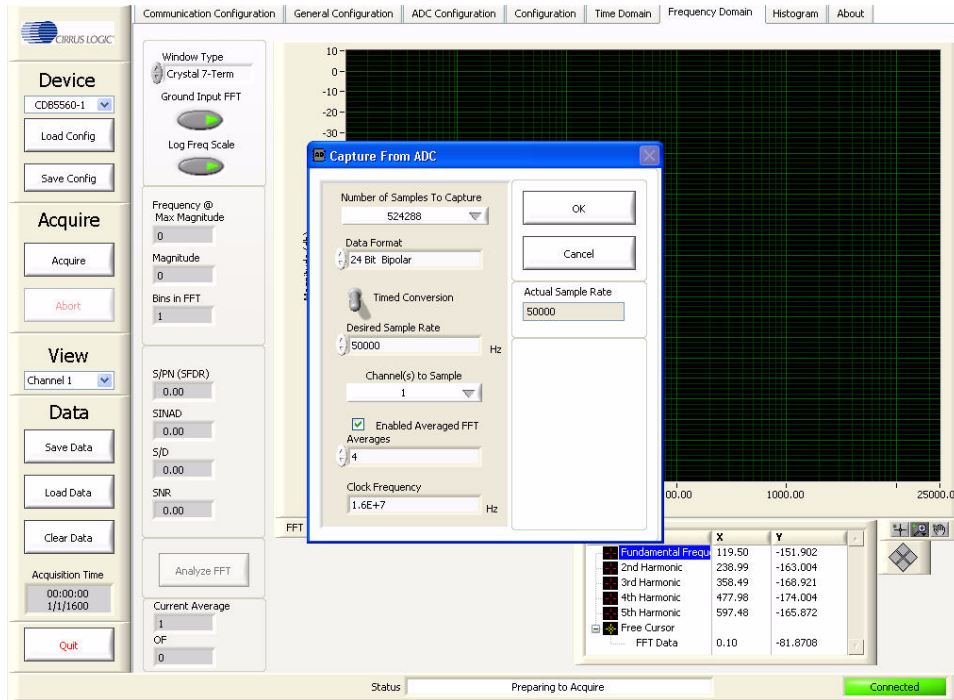
- Number of Samples To Capture: 524288
- Data Format: 24 Bit Bipolar
- Timed Conversion:
- Desired Sample Rate: 50000 Hz
- Actual Sample Rate: 50000
- Channel(s) to Sample: 1
- Enabled Averaged FFT:
- Averages: 0
- Clock Frequency: 1.6E+7 Hz

The "Capture From ADC" dialog box has "OK" and "Cancel" buttons. Below the dialog box, a table displays the FFT data:

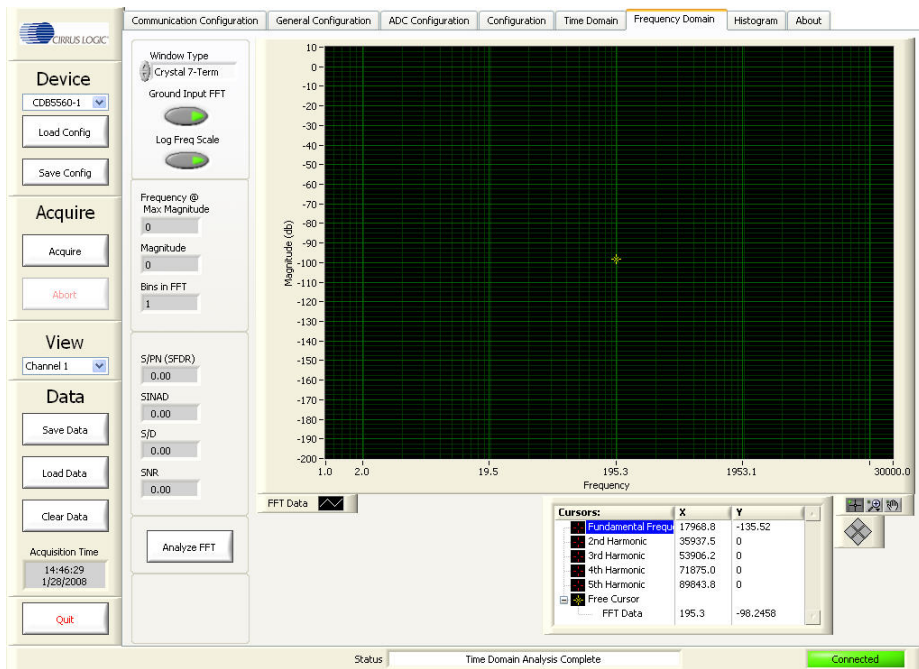
Component	X	Y
Fundamental Freq	21096	-146.239
2nd Harmonic	42193	0
3rd Harmonic	63289	0
4th Harmonic	84386	0
5th Harmonic	105482	0
Free Cursor	0	-81.8706
FFT Data		

The software interface includes a left sidebar with sections for "Device" (CDB5560-1), "Acquire", "View", and "Data". The "Frequency Domain" tab is selected at the top. The status bar at the bottom indicates "Preparing to Acquire" and "Connected".

Activate the *Acquire* button. Within the *Acquire* sub-panel set *Select Number of Samples to Capture* to 524288.

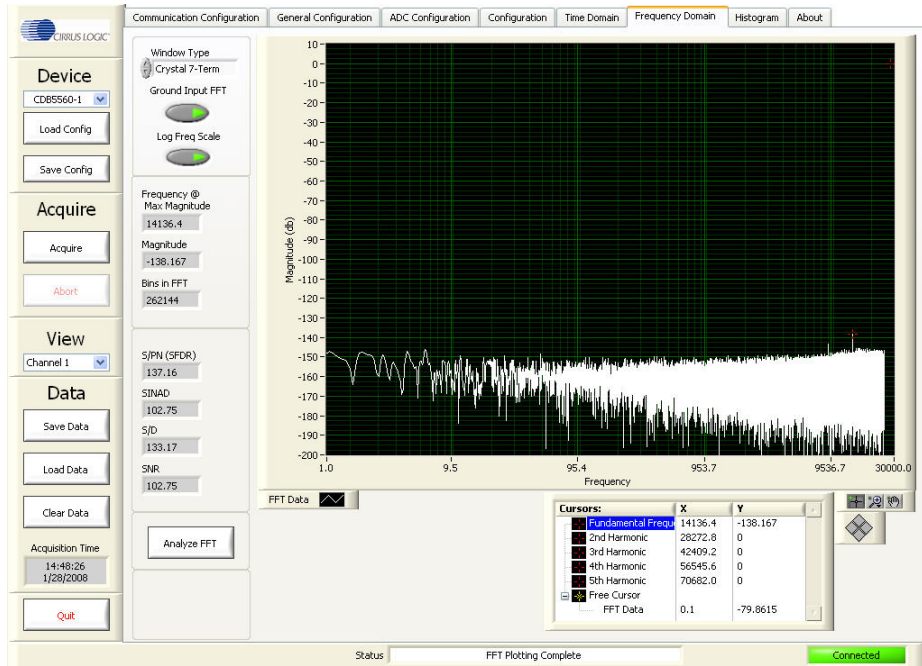


Start the test run by clicking *OK*. Run time for this test is less than 1 minute for a 100 kSps ADC. When the data has been captured and is ready to be displayed, the *Status* window at the bottom of the screen will display *Time Domain Analysis Complete*.



Click on the *Analyze FFT* button to display the FFT data.

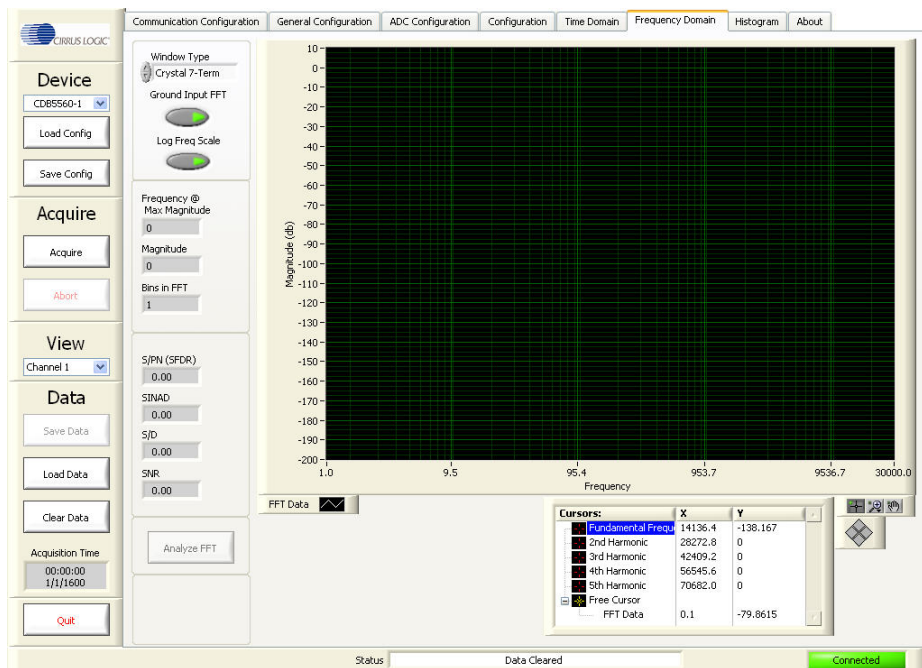
A typical FFT plot resulting from running a baseline test is shown below. Key information calculated from the captured data and displayed is the SFDR, SINAD, S/D, and SNR.



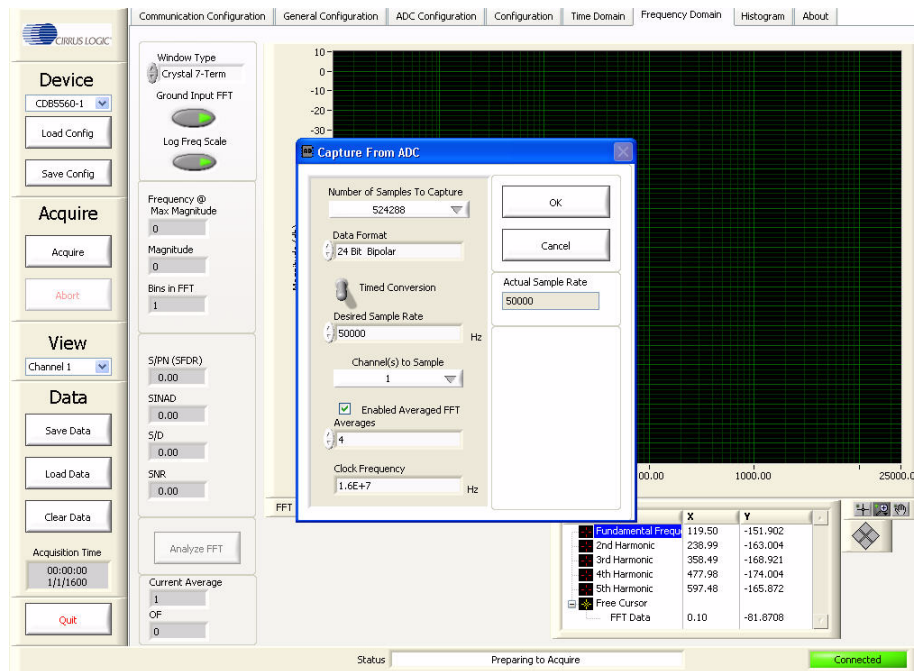
A.1.2 Baseline Noise & Distortion Test - Averaged FFT

Connect the evaluation board's analog input(s) to circuit ground.

Select the *Frequency Domain* window (selected by clicking on the *Frequency Domain* tab at the top of the screen). Activate the *Grounded Input FFT* and *Log Freq Scale* buttons. Select the *Window Type* to be *Crystal 7-Term*.

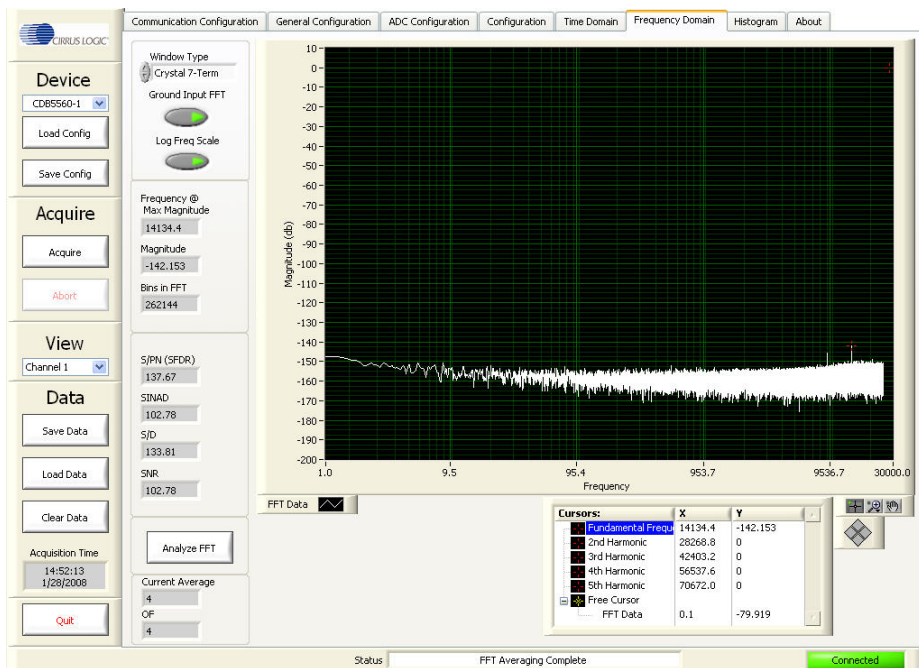


Activate the *Acquire* button. Within the *Acquire* sub-panel set *Select Number of Samples to Capture* to 524288. Click on *Enable Averaged FFT*. In this example, *Averages* have been set to 4.



Start the test run by clicking *OK*. Run time for this test is approximately 1 minute for a 100 kSps ADC.

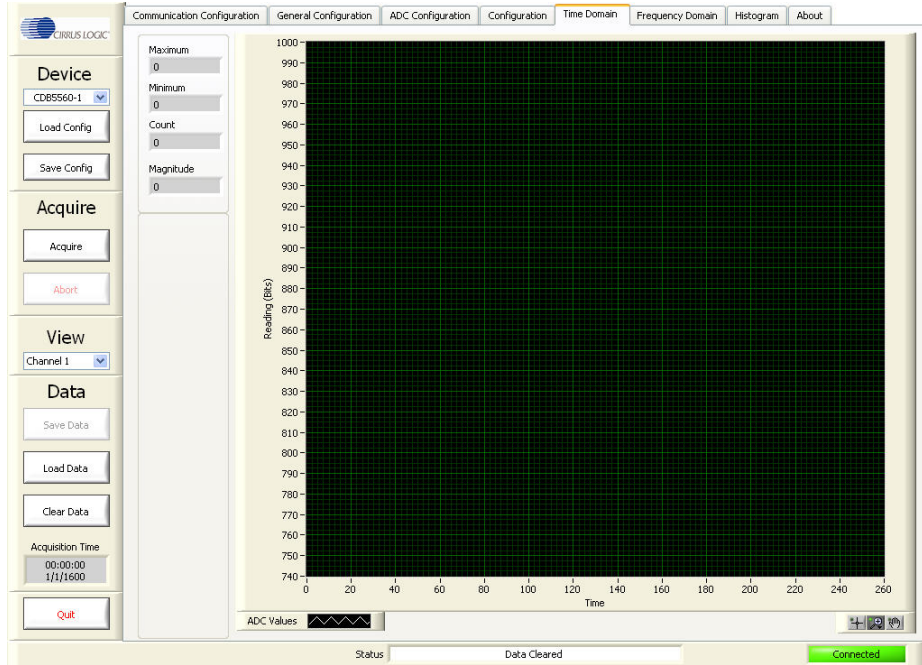
A typical FFT plot resulting from running a baseline test is shown below. Key information calculated from the captured data and displayed is the SFDR, SINAD, S/D, and SNR.



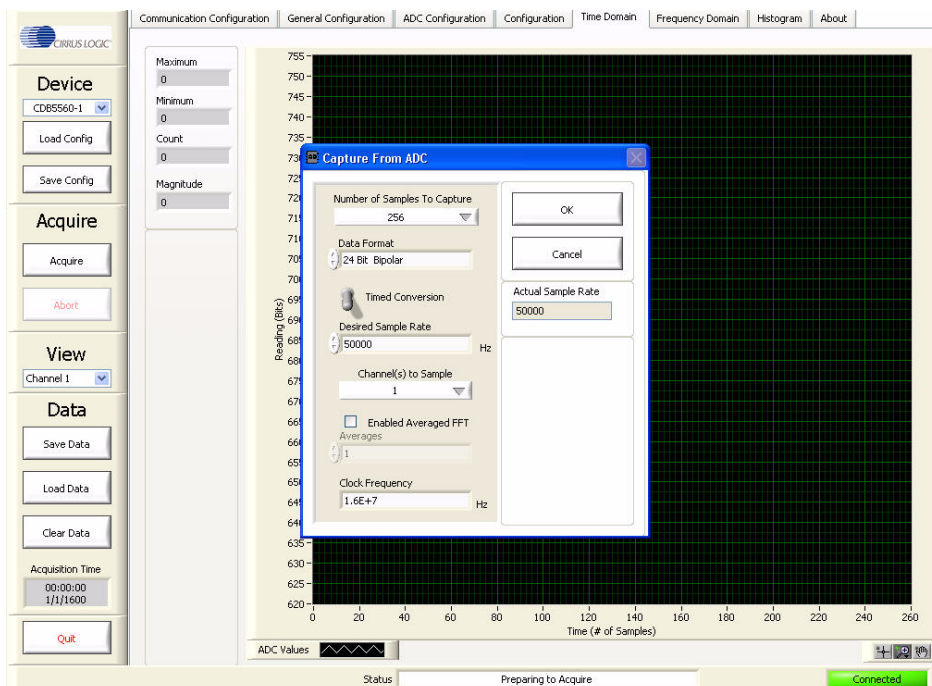
A.1.3 Baseline Noise & Distortion Test - Time Domain Analysis

Connect the evaluation board's analog input(s) to circuit ground.

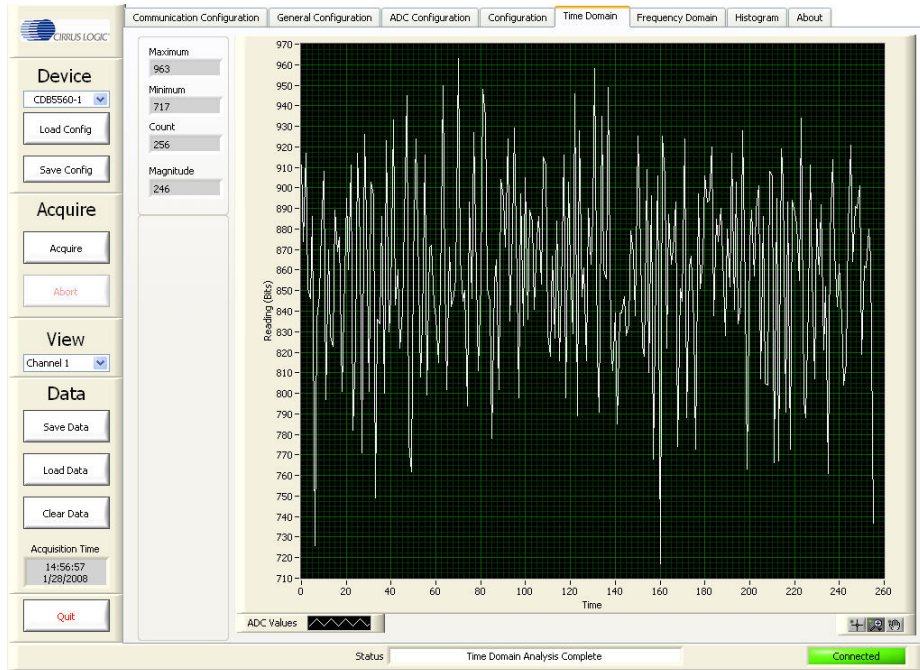
Select the *Time Domain* window by clicking on the *Time Domain* tab at the top of the screen.



Click on the Acquire button. Within the Acquire sub-panel set Select Number of Samples to Capture to the desired sample size. This example uses a sample size of 256 to display data with a high level of detail. To examine a portion of the displayed data use the graphical zoom features located at the bottom right corner.



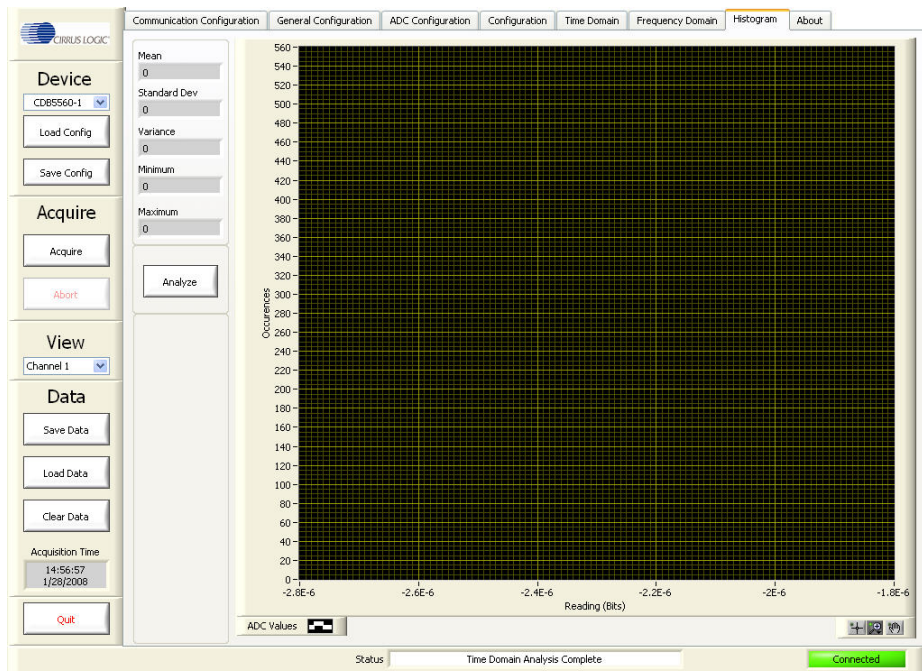
Start the test run by clicking *OK*. Upon completing the data capture, the screen will automatically display the results. A typical time domain plot resulting from running a baseline test is shown below. Key information calculated from the captured data and displayed is maximum, minimum, count (sample count), and magnitude.



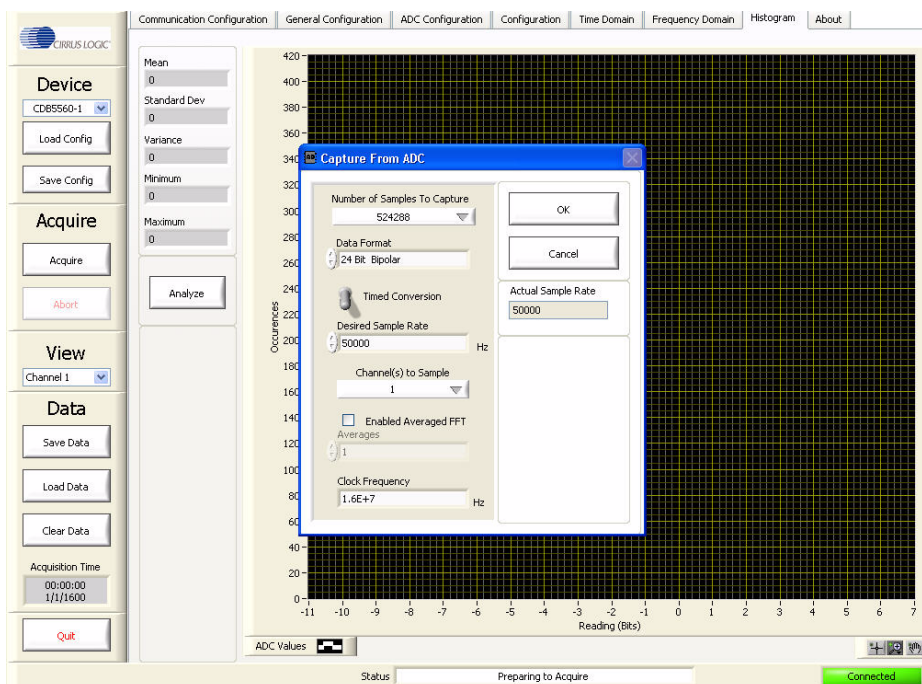
A.1.4 Baseline Noise & Distortion Test - Histogram Analysis

Connect the evaluation board's analog input(s) to circuit ground.

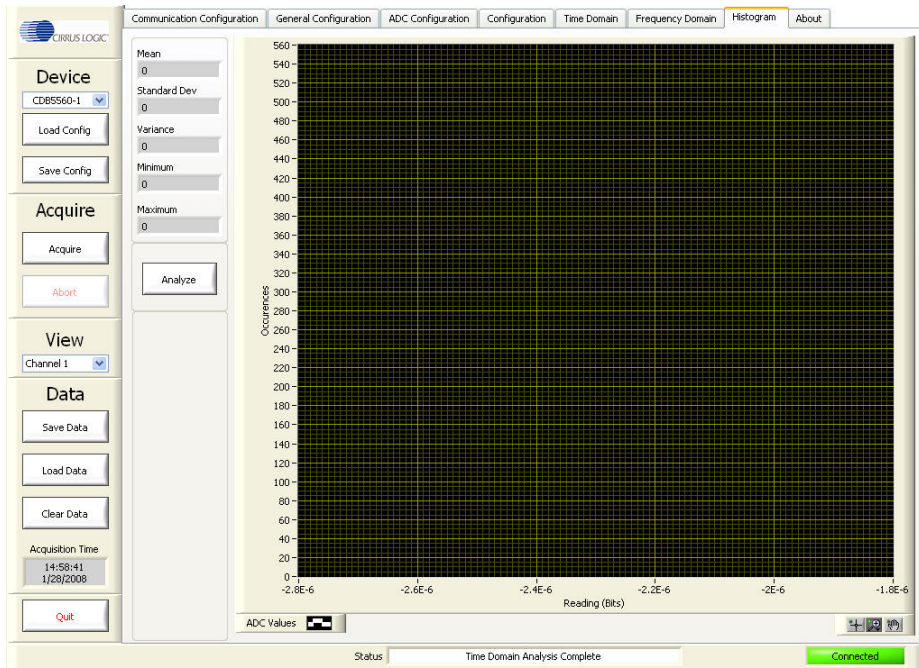
Select the *Histogram* window by clicking on the *Histogram* tab at the top of the screen.



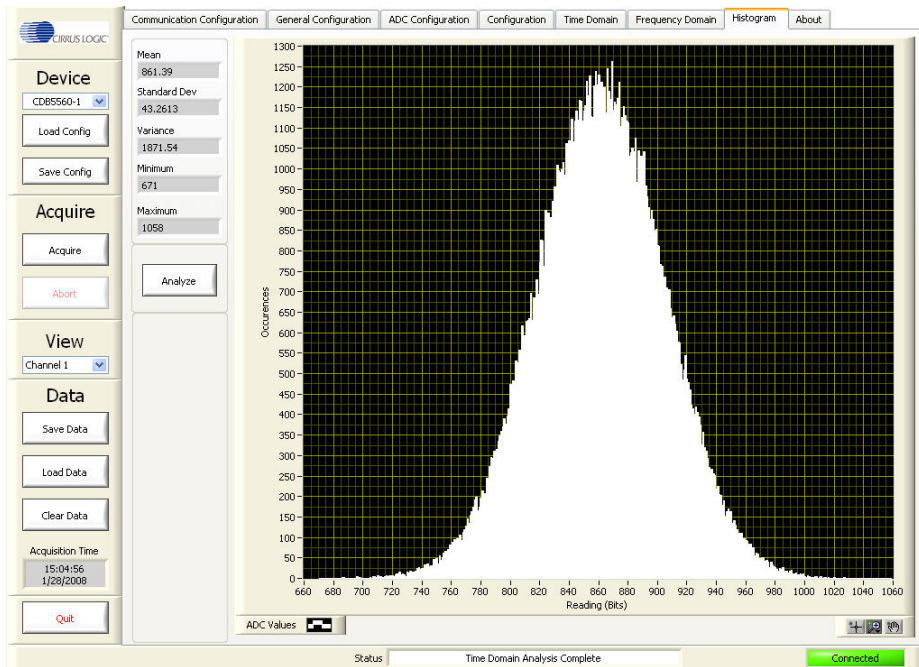
Click on the *Acquire* button. Within the *Acquire* sub-panel, set *Select Number of Samples to Capture* to 524288. Set the *Channel(s) to Capture* to the desired channel(s).



Start the test run by clicking **OK**. When the data has been captured and is ready to be displayed, the *Status* window at the bottom of the screen will display “Time Domain Analysis Complete”.



Click on the **Analyze** button to display the histogram data. A typical histogram plot resulting from running a baseline test is shown below. Key information calculated from the captured data and displayed is mean, standard deviation, variance, minimum, and maximum.

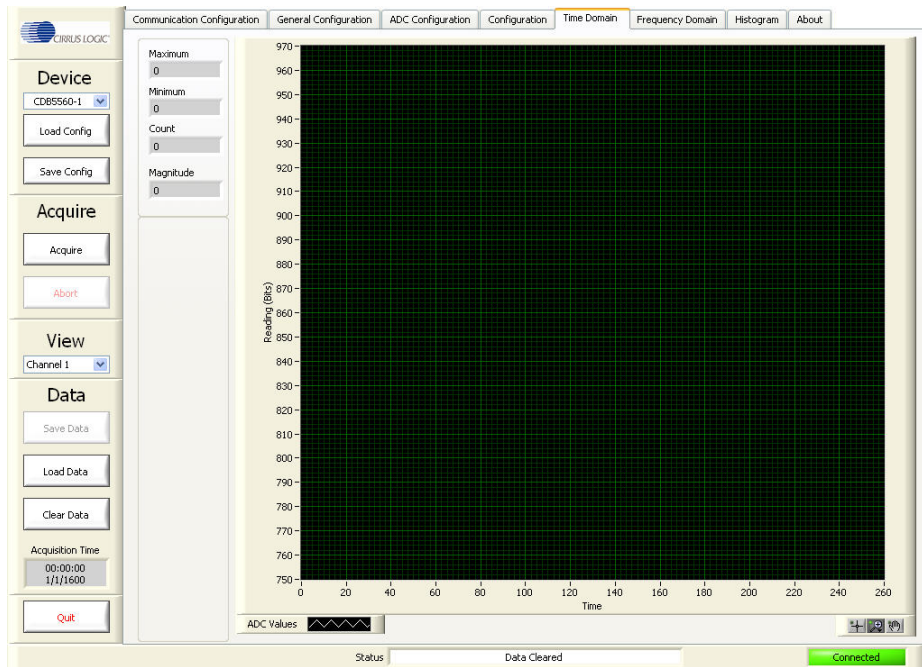


A.2 Measuring Analog Input Signals

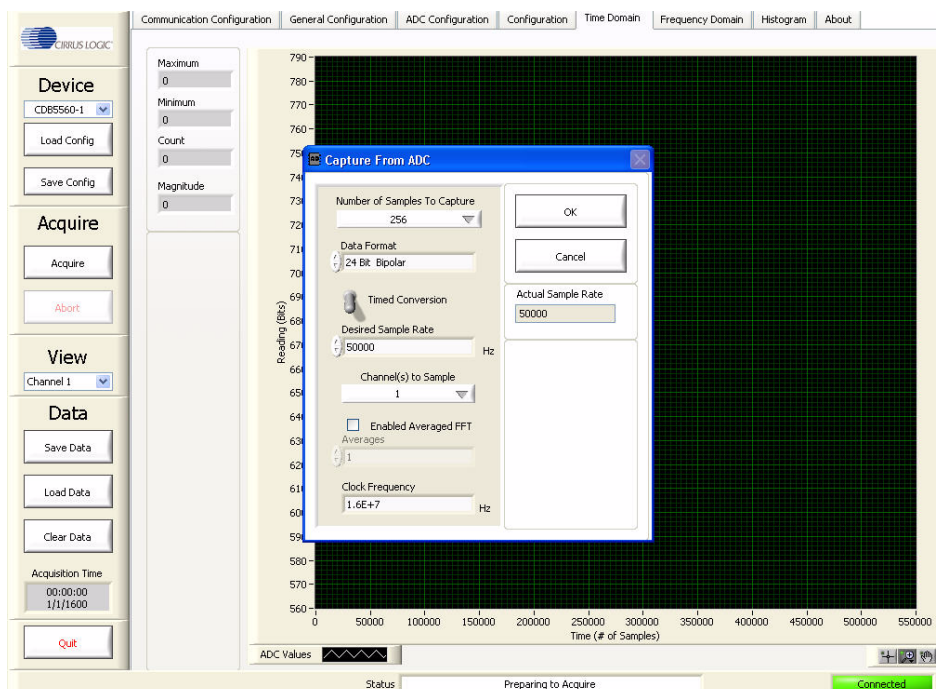
A.2.1 Setting Up the Input Signal Amplitude

Connect the signal source to the evaluation board analog input(s).

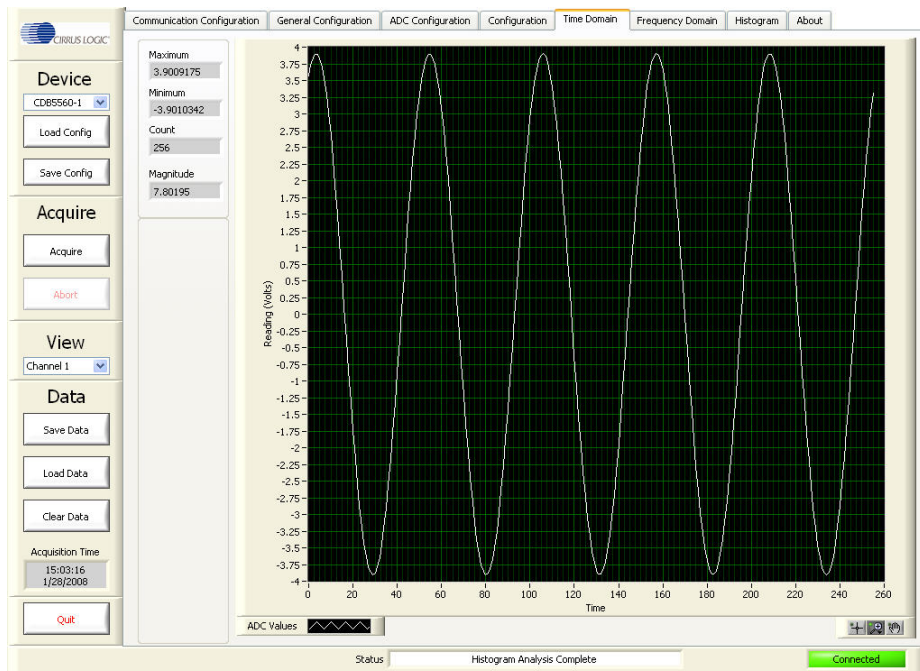
Select the *Time Domain* window by clicking on the *Time Domain* tab at the top of the screen.



Click on the *Acquire* button. Within the *Acquire* sub-panel set *Select Number of Samples to Capture* to a small sample size; this example uses 256 to speed up the data capture process. Set the *Channel(s) to Capture* to the desired channel(s).



Start the test run by clicking **OK**. At the end of the test run the screen will automatically display the results. A typical time domain plot from capturing a -0.5 dB input signal with a 24-bit ADC is shown below.



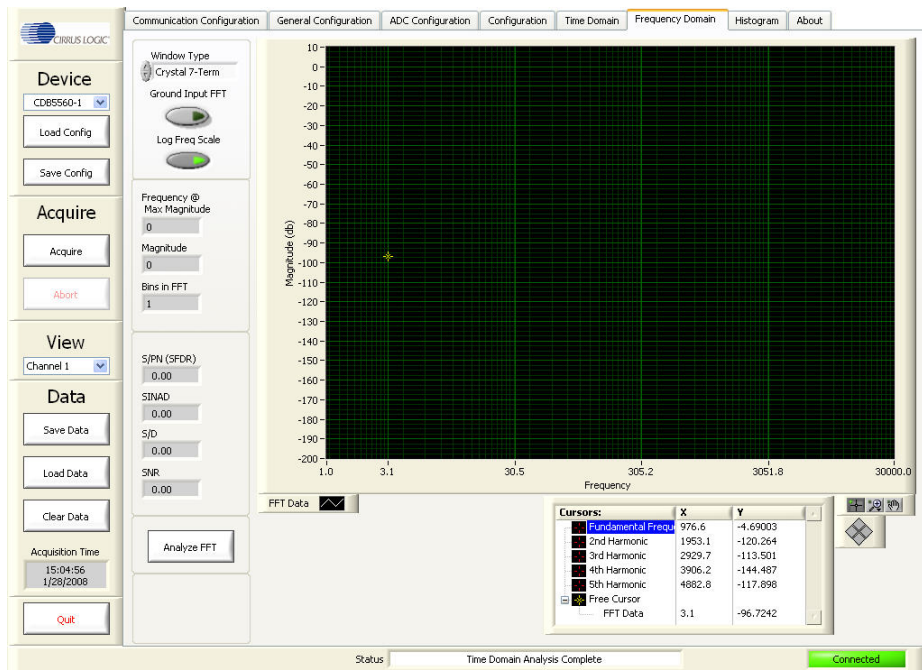
Setting the desired signal level may require several iterations of adjusting the analog input signal level and then capturing and viewing the data.

A.2.2 Measuring a Single Analog Input Signal

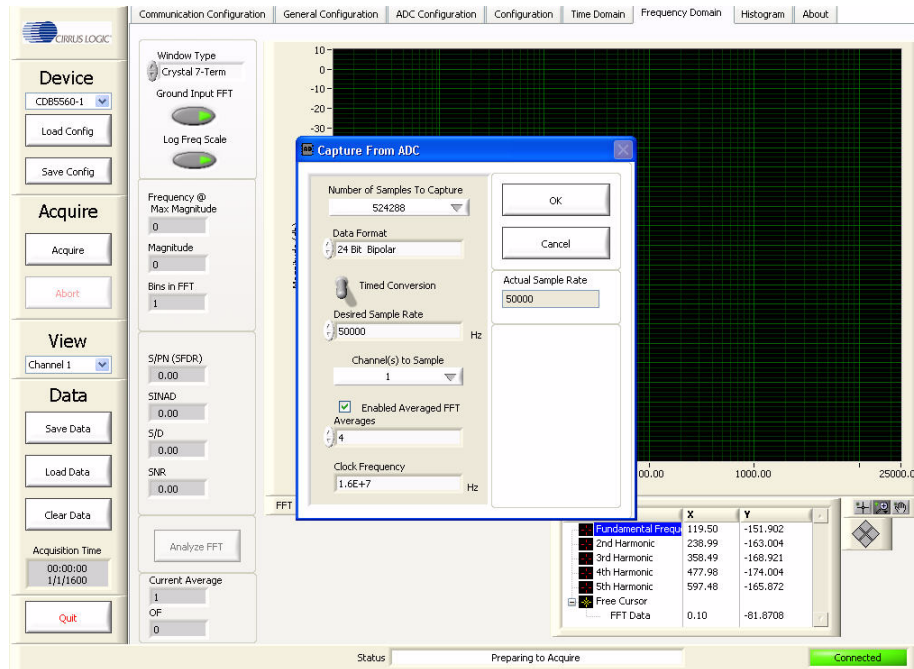
A test to determine the evaluation board performance with a full-scale input signal can be performed once the hardware and software are configured. The following describes testing of the system using a typical full-scale input signal.

Connect a 1 kHz, -0.5 dB signal into the evaluation board's analog input channel.

Select the *Frequency Domain* window by clicking on the *Frequency Domain* tab at the top of the screen. Deactivate the *Grounded Input FFT*. Activate the *Log Freq Scale* button. Several windowing functions are available. In this example, the *Window Type* has been set to *Crystal 7-Term*.

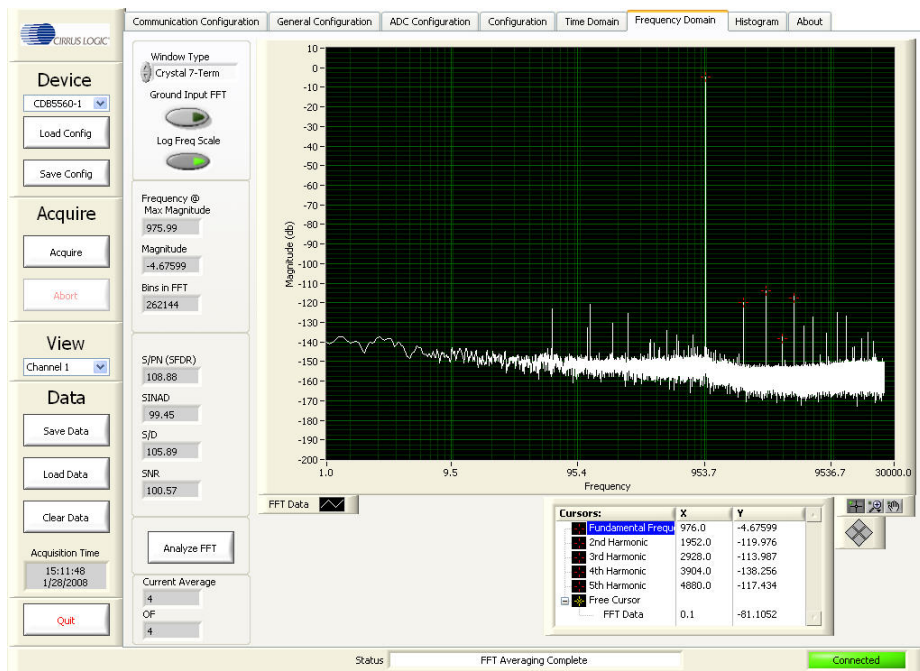


Click on the *Acquire* button. Within the *Acquire* sub-panel, set *Select Number of Samples to Capture* to 524288. Click on *Enable Averaged FFT*. In this example, *Averages* have been set to 4.



Start the test run by clicking *OK*. Run time for this test is approximately 1 minute for a 100 kSps ADC.

A typical FFT plot resulting from running a full-scale input test is shown below. Key information calculated from the captured data and displayed is the SFDR, SINAD, S/D, and SNR.



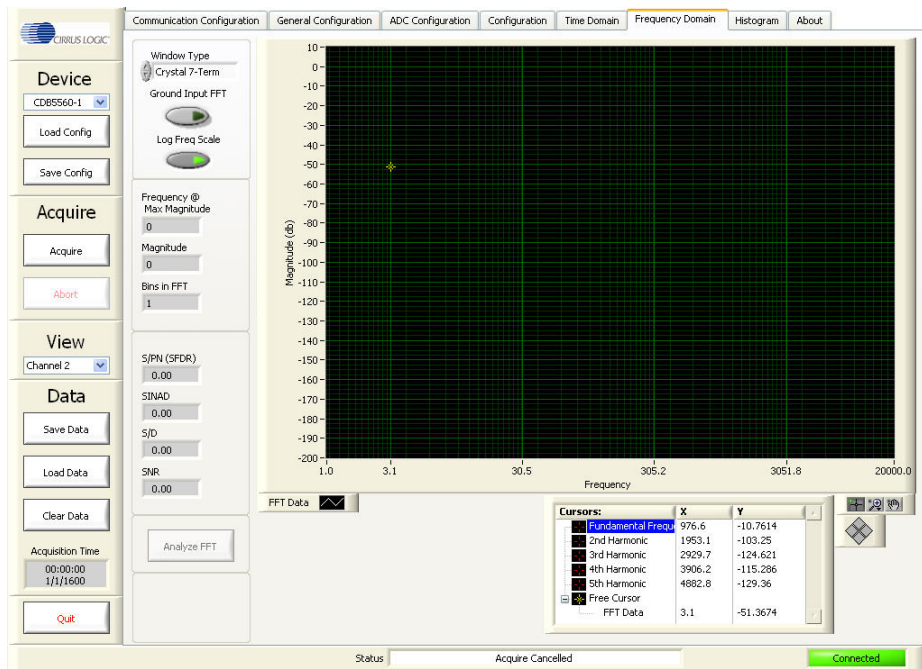
Notice that when running an averaged multiple FFT test, the user is not required to activate the *Analyze FFT* button to display the FFT graph. Only when capturing single data sets is the user required to activate the *Analyze FFT* button to display the FFT graph.

A.2.3 Measuring Multiplexed Analog Input Signals

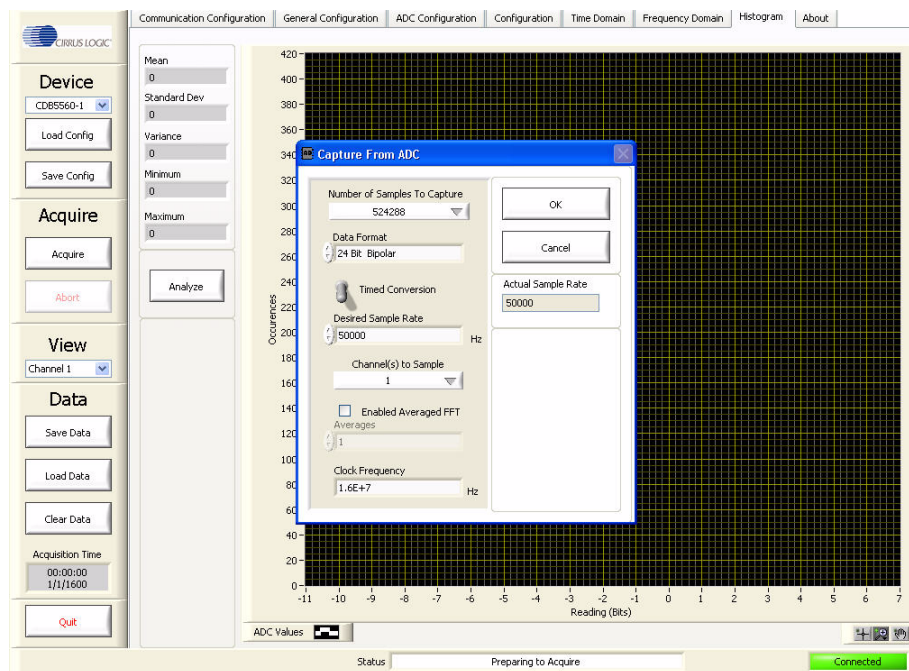
The following section demonstrates how testing the evaluation board performance with full-scale, multiplexed input signals is performed once the hardware and software are configured.

Connect a 1 kHz, -0.5 dB signal to one analog input channel, and a 5 kHz, -0.5 dB signal to the other analog input channel.

Select the *Frequency Domain* window by clicking on the *Frequency Domain* tab at the top of the screen. Deactivate the *Grounded Input FFT* button. Activate the *Log Freq Scale* button. Select the *Window Type* to be *Crystal 7 Term*.



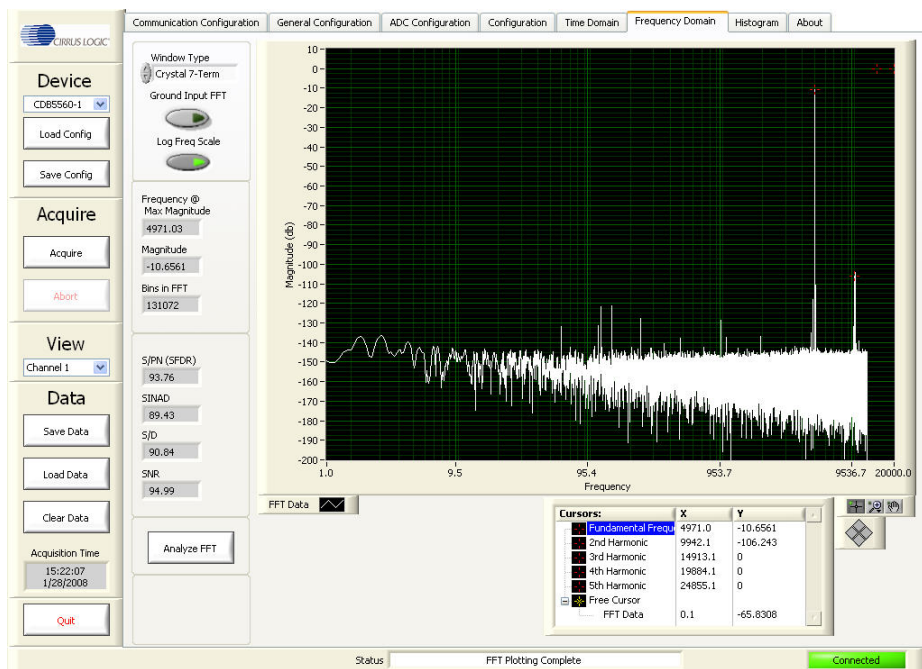
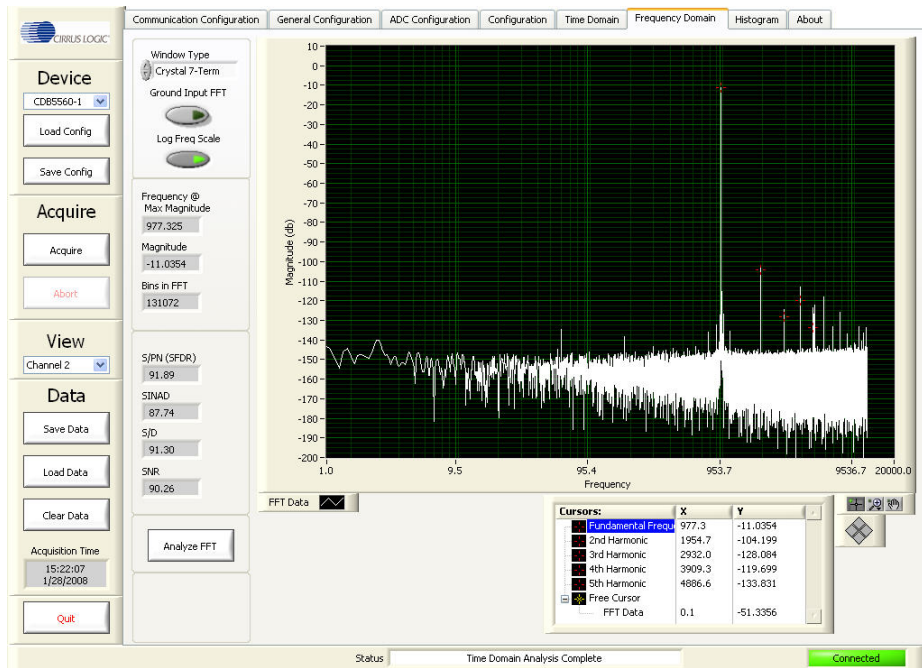
Click the *Acquire* button. Within the *Acquire* sub-panel, set *Select Number of Samples to Capture* to 524288. Click on *Enable Averaged FFT*. In this example, and *Channels to Sample* have been set to *All*.



Start the test run by clicking *OK*. To run this particular test setup takes approximately 1 minute for a 100 kSps ADC.

The following pair of FFT plots show the results of running a typical 2-channel, multiplexed, full-scale input test. Activate the desired view by selecting *Channel 1* or *Channel 2*. Note that during multiplexing, the ADC samples per-second rate remains the same but the total number of samples is split between the two channels. The resulting sample rate for each channel is half that of the ADC, and the Nyquist frequency for two channels is half that for a single channel.

Key information calculated from the captured data and displayed is the SFDR, SINAD, S/D, and SNR.



Notice that when running an averaged, multiple FFT test the user is not required to activate the *Analyze FFT* button to display the FFT graph. Only when capturing single data sets is the user required to activate the *Analyze FFT* button to display the FFT graph.

APPENDIX B. RECOMMENDATIONS FOR MAXIMUM PERFORMANCE

The following are some general recommendations for maximizing the performance of Cirrus Logic evaluation systems.

- When applying power to the evaluation board, use power supplies isolated from utility AC line and ground. Isolated power supplies typically inject less electrical noise than non-isolated power supplies.
- Connecting Analog Inputs
 1. Route power supply and communications cables away from analog input cables.
 2. Keep all cable lengths as short as possible, especially the analog signal input cables.
 3. Using twisted/shielded wire will reduce noise being induced onto the analog input cables.

APPENDIX C. FFT WINDOW LEAKAGE

Windowing functions which are used to make FFT (Fast Fourier Transform) plots more informative also generate a measurable error by spreading energy from the FFT signal peaks to the surrounding noise floor. This results from an effect known as “window leakage”.

The following table lists the windowing functions and their associated peak signal losses that are used by the Cirrus Logic CapturePlus II system.

Windowing Function	Peak Signal Loss	Side Lobe Attenuation
Rectangular	0 dB	0 dB
Hodie 5 Term (Proprietary)	3.457 dB	125 dB
Crystal 7 Term (Proprietary)	4.203 dB	175 dB

NOTES

Contacting Cirrus Logic Support

For all product questions and inquiries contact a Cirrus Logic Sales Representative. To find the one nearest to you go to www.cirrus.com

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