

Evaluating the **ADPD103** Photometric Front End

FEATURES

- Supports the detection of UART
- UDP transfer capability
- ADPD103** full configuration
 - Register level
 - Parameter level
- Graph view
 - Time graph
 - Frequency graph

EVALUATION KIT CONTENTS

- EVAL-ADPD103Z-GEN** evaluation board
- Mini USB cable

ADDITIONAL EQUIPMENT NEEDED

- PC running Windows 7 operating system

ADDITIONAL SOFTWARE NEEDED

- .NetFramework 4.0

ONLINE RESOURCES

- ADPD103** data sheet

GENERAL DESCRIPTION

The **EVAL-ADPD103Z-GEN** evaluation board provides the user with a simple means of connecting their own optics to the **ADPD103** photometric front end to evaluate the **ADPD103** in a number of different applications, from vital signs monitoring to industrial sensing. The evaluation board includes the OpenMarket WaveTool graphical user interface (GUI) that provides the user with low level and high level configurability, real-time frequency and time domain analysis, and User Datagram Protocol (UDP) transfer capability so that the evaluation board can easily interface to the user's development system.

The USB port powers the **EVAL-ADPD103Z-GEN**. On-board voltage regulators provide voltage supplies for the **ADPD103**, **ADuCM360**, and FTDI Chip FT232. There are on-board regulators that provide 3.3 V and 4.3 V LED supplies, as well as a selectable option to add an external LED supply. The evaluation board provides an LED and photodiode (PD) for a finger photoplethysmography (PPG) measurement that is useful for a quick functionality check of the evaluation system.

The schematic and board layout, as well as the board itself, indicate signal names for easy identification. For additional information on the functionality of the **ADPD103**, refer to the **ADPD103** datasheet.

EVALUATION BOARD PHOTOGRAPH

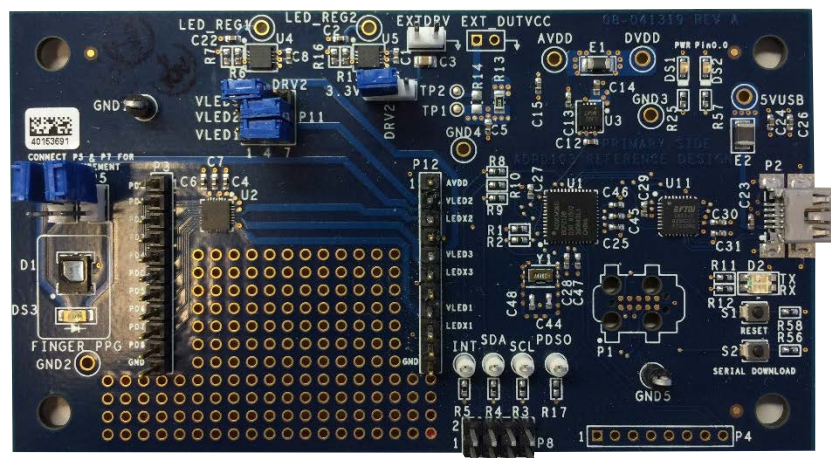


Figure 1. **EVAL-ADPD103Z-GEN** Evaluation Board

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REVISION HISTORY

4/16—Revision 0: Initial Version

INSTALLATION

INSTALL WAVETOOL

Download the [ADPD103 OpenMarket WaveTool](#) software package from the [EVAL-ADPD103Z-GEN](#) page on [analog.com](#). Unzip the folder and run the **ADPD103_OpenMarket_WaveTool_Setup.exe** file found in the **WaveTool_x_x_x** folder, following the prompts for software installation.

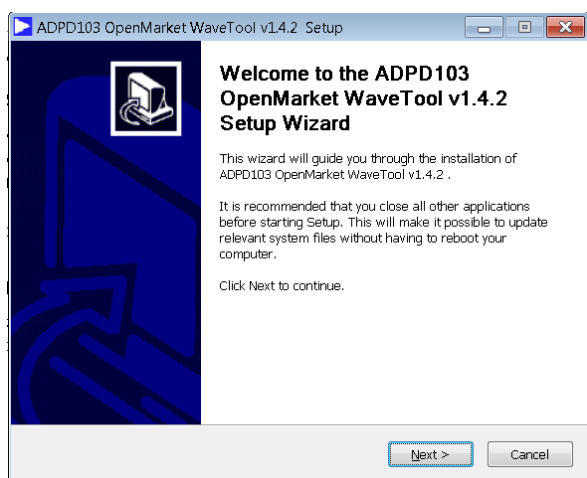


Figure 2. WaveTool Setup

CHECKING THE USB SERIAL CONNECTION IN WINDOWS 7

Connect the USB cable to the [EVAL-ADPD103Z-GEN](#) evaluation board. Ensure that the COM port driver is installed correctly. To verify proper installation, go to **Control Panel > All Control Panel Items > System > Device Manager**, as shown in Figure 3. In this case, the proper COM Port selection is **USB Serial Port (COM16)**.

The [EVAL-ADPD103Z-GEN](#) evaluation board uses an FT-232RL USB UART IC. If the USB driver installation does not install properly, refer to the *FTDI Driver Installation* guide found on the FTDI website.

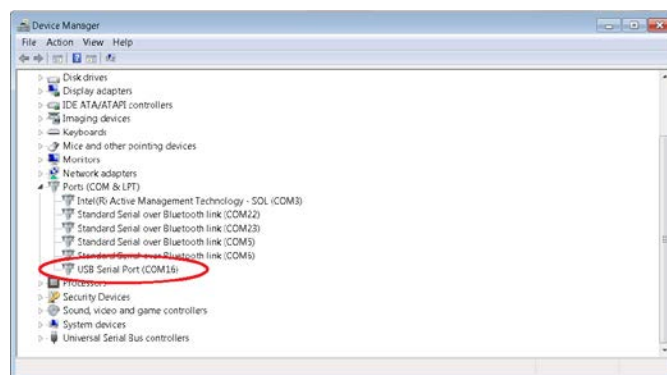


Figure 3. USB-COM Port in Windows® 7

RUNNING THE TOOL

To start the WaveTool application, navigate to the [ADPD103 OpenMarket WaveTool](#) from the **Start** menu and click **ADPD103_Tool**.

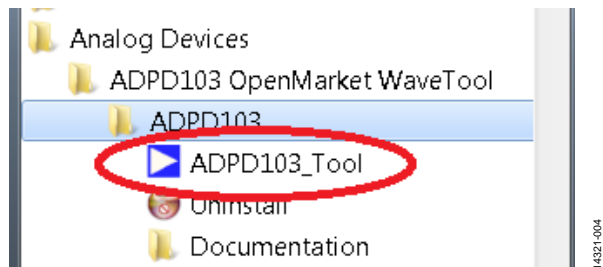


Figure 4. Navigate to **ADPD103_Tool** from **Start** Menu

At startup, the application automatically checks whether the installed WaveTool version is up to date. If there is a newer version available, the user is prompted to download the new version, as shown in Figure 5.

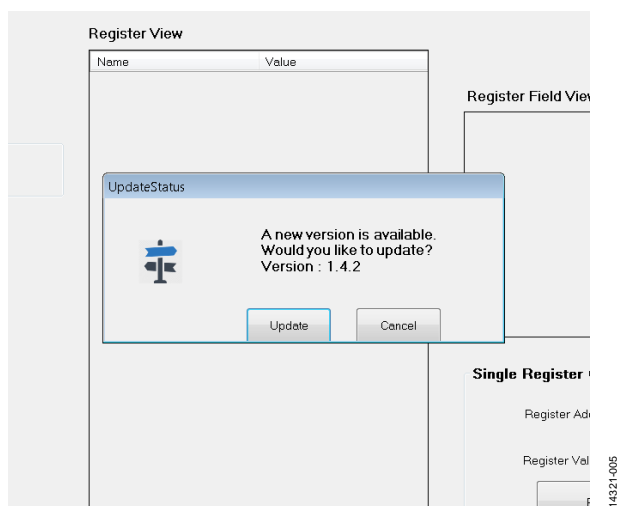


Figure 5. Automatic Version Update Prompt

USB UART CONNECTION

After the application opens, select **File > Connect** (see Figure 6) and from the drop-down menu, select either **Auto Connect** or **Select Port**, depending on whether specific COM port selection is necessary.

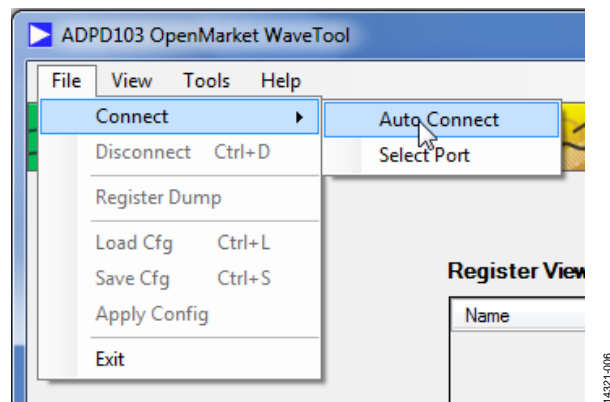


Figure 6. UART Connect

If a specific COM port selection is not needed, select **Auto Connect** to automatically connect the WaveTool to the device. Choose **Select Port** to connect the WaveTool to the device via a particular COM port as shown in Figure 7.

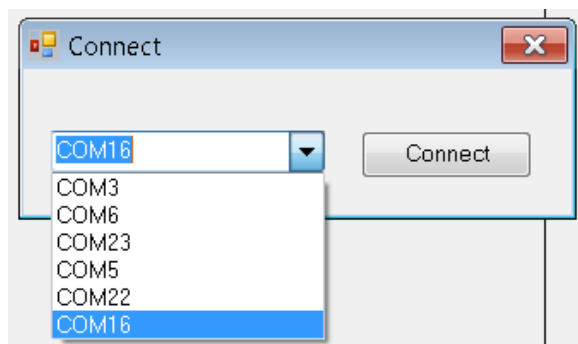


Figure 7. Port Selection

MAIN SCREEN

The main screen is divided into two different modes: register level and parameter level/high level.

The register level configuration is used to access each register or to load a complete list of registers that are already stored in a configuration file on the PC.

The parameter level/high level configuration performs a high level configuration of the device without the need for individual register writes. The high level configuration screen is used to setup parameters such as LED current, number of LED pulses, AFE integration time, and so forth.

USING THE REGISTER VIEW CONFIGURATION

Figure 8 shows the ADPD configuration window in **Register View**. The following controls and descriptions are listed in the configuration window:

- **Firmware Version**—shows the firmware version.
- **Config File in Use**—information about the configuration file that is in use.

- **Register View** shows the current register values of the device. Change register values by entering a hexadecimal value and then the **Enter** key on the keyboard.
- **Register Field View** shows how the register is subdivided into fields that determine how each bit field is used. For example, in Figure 8 it shows that the PAD_IO_CTRL Register 0x02 is composed of the bit fields INT_POL, INT_DRV, and INT_ENA to configure the operation of the INT pin.
- The **Single Register Control** allows reading and writing of individual registers.
- Load a configuration file (.dcfg) by choosing **File > LoadCfg** and selecting a .dcfg file that came with the software installation or a custom .dcfg file developed by the user for a desired configuration.
- Save a configuration file (.dcfg) by choosing **File > SaveCfg**.
- The **Go to High Level** button switches to the **High Level Control** view.

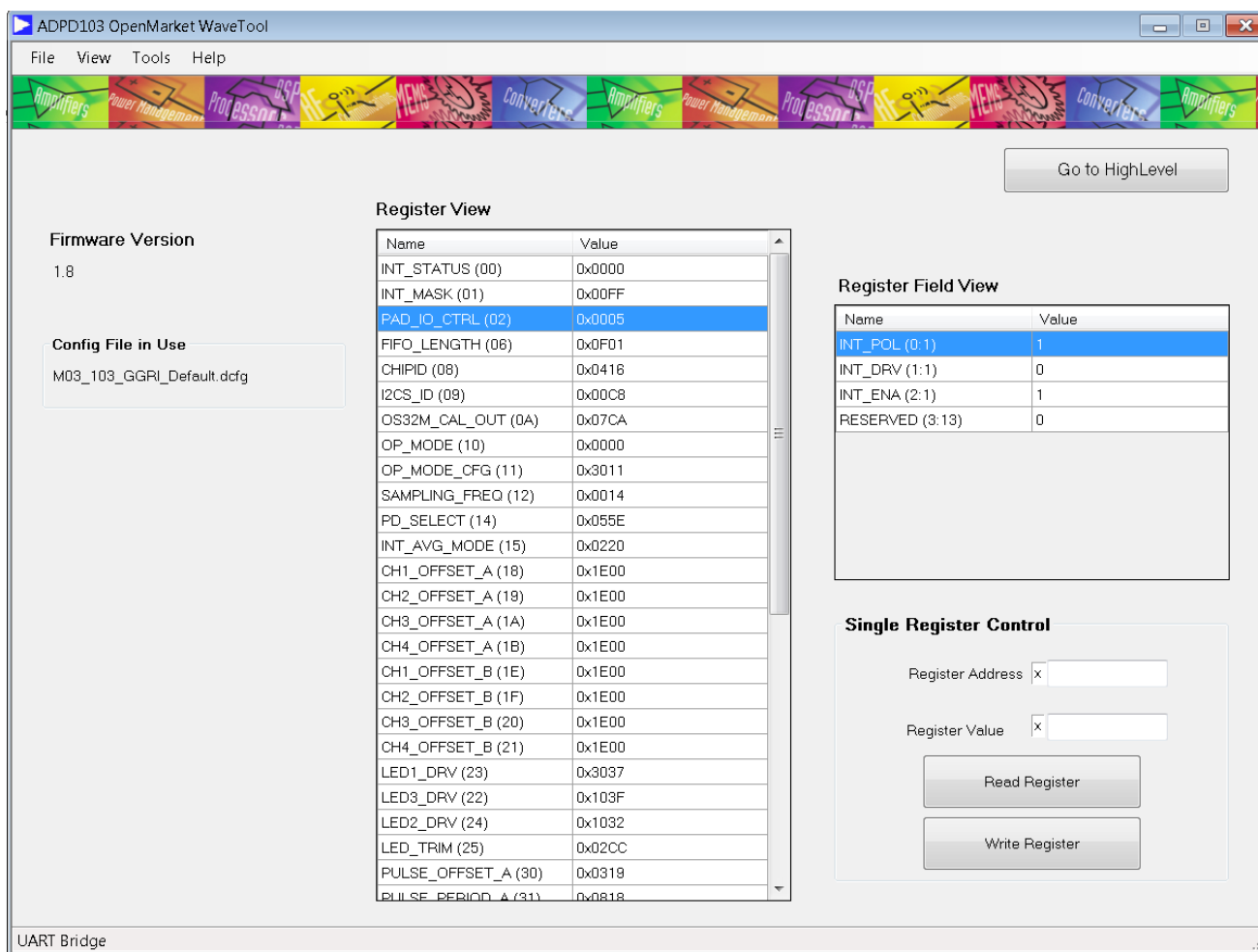


Figure 8. Main Screen Register Level View

Register View

To view the registers of the device, select **Register View**, shown in Figure 8. The **Name** column is the register name as defined by the register map, followed by (in parentheses) the address in abbreviated hexadecimal format (see Figure 9). The **Value** column shows the register value of the corresponding register in full hexadecimal format.

Register View	
Name	Value
INT_STATUS (00)	0x0000
INT_MASK (01)	0x00FF
PAD_IO_CTRL (02)	0x0005
FIFO_LENGTH (06)	0x0000
CHIPID (08)	0x0416
I2CS_ID (09)	0x00C8
OS32M_CAL_OUT (0A)	0x07E8
OP_MODE (10)	0x0000
OP_MODE_CFG (11)	0x3011
SAMPLING_FREQ (12)	0x0014
PD_SELECT (14)	0x055E
INT_AVG_MODE (15)	0x0220
CH1_OFFSET_A (18)	0x1E00
CH2_OFFSET_A (19)	0x1E00
CH3_OFFSET_A (1A)	0x1E00
CH4_OFFSET_A (1B)	0x1E00
CH1_OFFSET_B (1E)	0x1E00

Figure 9. Register View

Clicking any register in the **Register View** fields reveals the register categories in the **Register Field View**, as shown in Figure 10. The **Register Field View** is read only.

Name	Value
RESERVED (0:5)	0
SLOTA_INT_STATUS (5:1)	0
SLOTB_INT_STATUS (6:1)	0
RESERVED (7:1)	0
FIFO_STATUS (8:8r)	0

Figure 10. Register View Showing Operation Control Registers

Enter data in cells in the **Value** column of the **Register View** in either hexadecimal or decimal format. A hexadecimal number is entered with a 0x prefix to the number, whereas a decimal number does not include these prefix characters. For example, entering 0xFF (hexadecimal) or 255 (decimal), results in the same value written to the register.

Hovering over a cell in the **Value** column shows the delineation of the register fields for the current value (see Figure 11), whereas hovering over a cell in the **Name** column shows a description of the corresponding register.

INT_MASK (01)	0x00FF	SLOTA_INT_MASK (5:1)	1
PAD_IO_CTRL (02)	0x0005	INT_MASK @ 0x1	
I2CS_CTL_MATCH (06)	0x0F01	0x00FF	
CHIPID (08)	0x0416	Field (r)	Value
I2CS_ID (09)	0x00C8	RESERVED	1F
OS32M_CAL_OUT (0A)	0x07E8	SLOTA_INT_MASK	1
SW_RESET (0F)	0x0000	SLOTB_INT_MASK	1
OP_MODE (10)	0x0000	RESERVED	1
		FIFO_INT_MASK	0
		RESERVED	0

Figure 11. Register Value Field Delineation on Hover

The **Register View** has a context sensitive window exposed by right-clicking the mouse anywhere on the grid, as shown in Figure 12.

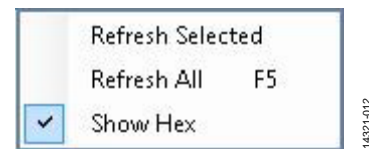


Figure 12. Register View Context Menu

By using this menu, it is possible to refresh the selected register, refresh all registers, or select whether the selected register displays in hexadecimal or decimal format. The selection of hexadecimal vs. decimal is persistent across opening and closing of the tool.

For example, in Figure 13, the Time Slot B offset registers (**CHx_OFFSET_B**) display in decimal format but others, such as LED drive settings (**LEDx_DRV**), display in hexadecimal format.

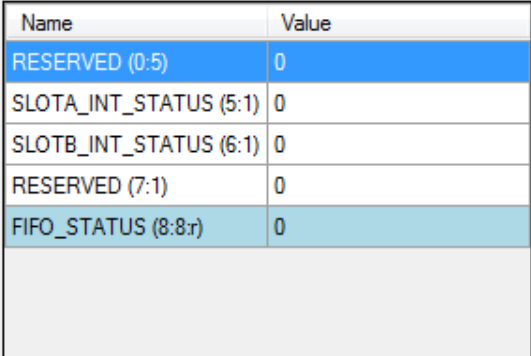
CH1_OFFSET_B (1E)	7680
CH2_OFFSET_B (1F)	7680
CH3_OFFSET_B (20)	7680
CH4_OFFSET_B (21)	7680
LED1_DRV (23)	0x3037
LED3_DRV (22)	0x103F
LED2_DRV (24)	0x1032
LED_TRIM (25)	0x02CC

Figure 13. Register Values in Decimal and Hexadecimal Format

Register Field View

The **Register Field View** is a read-only view to see specific register field value(s). It automatically tracks the currently selected register in **Register View**.

The **Register Field View** is composed of two columns as shown in Figure 14.



Name	Value
RESERVED (0:5)	0
SLOTA_INT_STATUS (5:1)	0
SLOTB_INT_STATUS (6:1)	0
RESERVED (7:1)	0
FIFO_STATUS (8:8:r)	0

Figure 14. Register Field View

The **Register Field View** section shows each register field, where the **Name** column consists of the field name (start bit: length in bits), and the **Value** column provides the hexadecimal value (without the prefix characters, 0x) of that field.

Single Register Control

The **Single Register Control** section includes controls to read or write an individual register.

The **Read Register** button reads and displays the value of the register entered in the **Register Address** field.

The **Write Register** button writes the register with the value entered in the **Register Value** field.

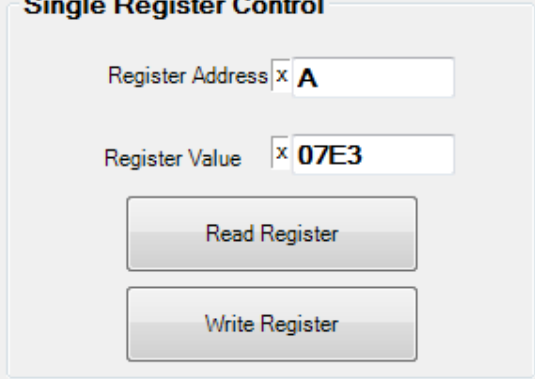


Figure 15. Single Register Control

PARAMETER LEVEL (HIGH LEVEL)

Figure 16 shows the [ADPD103](#) high level configuration window. This window offers an entire set of high level parameter controls. The configurable parameters are as follows:

- **Sampling Frequency**—adjusts the sampling rate.
- **Internal Average** (identical for both slots)—controls the output data rate, which is equal to the sampling frequency divided by the internal average. For example, a sampling frequency of 400 Hz and an internal average setting of 4, as shown in Figure 16, results in an output data rate of 100 Hz.
- **ADPD Slot Mode**—specifies all the ADPD slot modes.
- **Slot A Control and Slot B Control**
 - **LED Control**
 - **LED**—selects the specific LED from a drop-down menu.
 - **LED Status**—specifies the status of the LED, whether it is in the on or off state.
 - **Number Of Pulses**—sets the number of LED pulses.
 - **TIA Gain**—sets the gain of the TIA via a drop-down menu.
- **Timing Control**—see the [ADPD103](#) datasheet for detailed descriptions of the timing controls.
 - **AFE Width**—sets the AFE integration time in microseconds.
 - **Pulse Width**—sets the LED pulse width in microseconds.
 - **Pulse Offset**—sets the LED pulse offset in microseconds.
 - **AFE Offset**—sets the coarse AFE integration offset in microseconds.
 - **AFE Fine Offset**—sets the fine AFE integration offset in nanoseconds.
- **LED 1, LED 2, LED 3 current controls**
 - **I_LED Coarse**—coarse setting for the LED current via a drop-down menu.
 - **Scale Factor**—100% or 40% scale factor applied to the coarse LED current setting.
 - **Final I_LED**—this is controlled by applying a fine tuning value by using the slider. The **Final I_LED** current displays in mA.

To switch to the register level configuration, click the **Go to RegisterLevel** button.

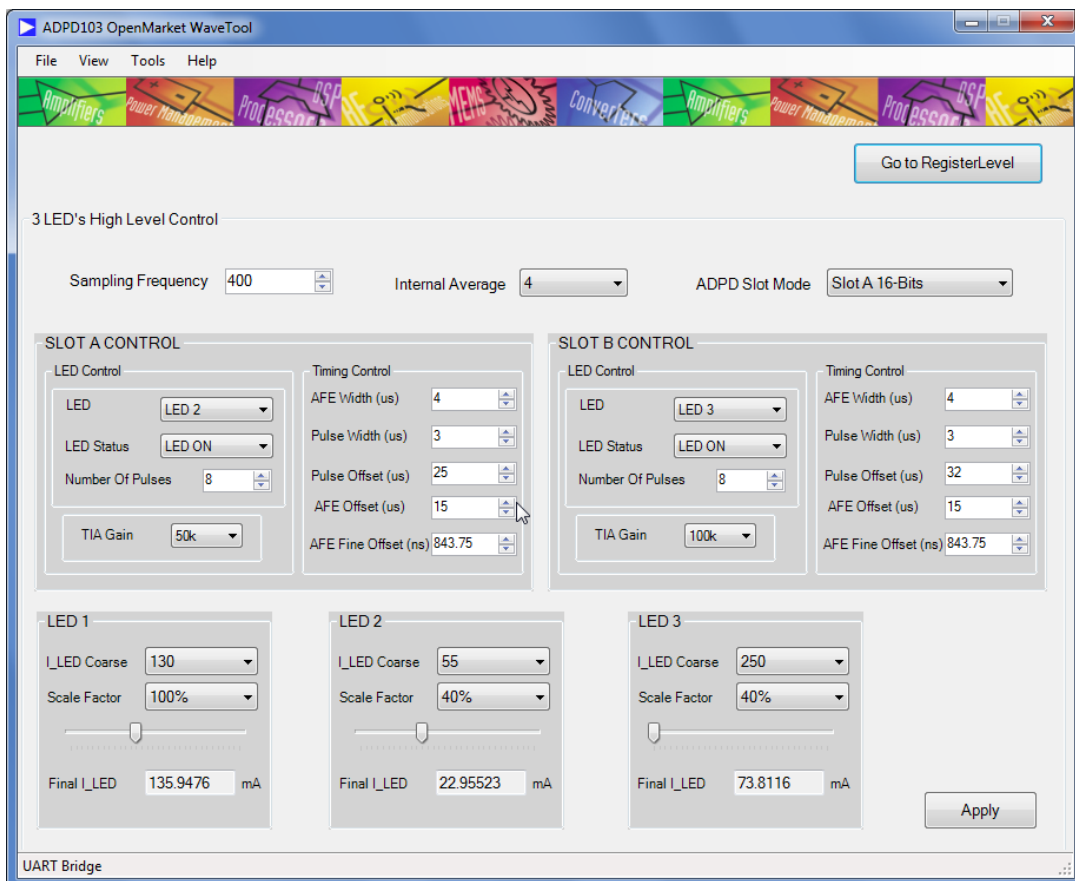


Figure 16. Main Screen High Level View

ADPD SLOT MODE

The ADPD slot mode contains Slot A, Slot B, and their sum and digital integration modes.

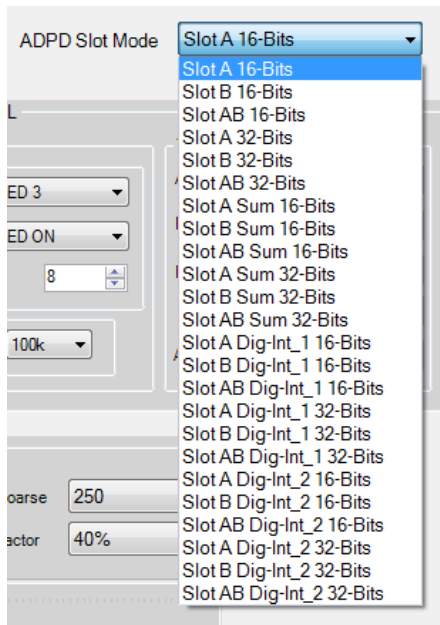


Figure 17. ADPD Slot Mode

Slot A (16 Bits)

The 4-channel, 16-bit data displays in the **Time View** for Time Slot A only. Selected channel data in the **Channel Select** drop-down box displays in FFT view.

Slot B (16 Bits)

The 4-channel, 16-bit data displays in the **Time View** for Time Slot B only. Selected channel data in the **Channel Select** drop-down box displays in FFT view.

Slot AB (16 Bits)

The 4-channel, 16-bit data displays in the **Time View** for both Time Slot A and Time Slot B. Selected channel data in the **Channel Select** drop-down box displays in FFT view.

Slot A (32 Bits)

The 4-channel, 32-bit data displays in the **Time View** for Time Slot A only. Selected channel data in the **Channel Select** drop-down box displays in FFT view.

Slot B (32 Bits)

The 4-channel, 32-bit data displays in the **Time View** for Time Slot B only. Selected channel data in the **Channel Select** drop-down box displays in FFT view.

Slot AB (32 Bits)

The 4-channel, 32-bit data displays in the **Time View** for both Time Slot A and Time Slot B. Selected channel data in the **Channel Select** drop-down box displays in FFT view.

Slot A Sum (16 Bits)

The sum of 4-channel, 16-bit data displays in the **Time View** for Time Slot A only. Selected summation sample data in the **Channel Select** drop-down box displays in FFT view.

Slot B Sum (16 Bits)

The sum of 4-channel, 16-bit data displays in the **Time View** for Time Slot B only. Selected summation sample data in the **Channel Select** drop-down box displays in FFT view.

Slot AB Sum (16 Bits)

The sum of 4-channel, 16-bit data displays in the **Time View** for both Time Slot A and Time Slot B. Selected summation sample data in the **Channel Select** drop-down box displays in FFT view.

Slot A Sum (32 Bits)

The sum of 4-channel, 32-bit data displays in the time view for Time Slot A only. Selected summation sample data in the **Channel Select** drop-down box displays in FFT view.

Slot B Sum (32 Bits)

The sum of 4-channel, 32-bit data displays in the **Time View** for Time Slot B only. Selected summation sample data in the **Channel Select** drop-down box displays in FFT view.

Slot AB Sum (32 Bits)

The sum of 4-channel, 32-bit data displays in the **Time View** for both Time Slot A and Time Slot B. Selected summation sample data in the **Channel Select** drop-down box displays in FFT view.

Slot A Dig Int-1 (16-Bits)

16-bit digital integrated sample data displays in the **Time View** for Time Slot A only. Selected sample data in the **Channel Select** drop-down box displays in FFT view.

Slot B Dig Int-1 (16 Bits)

16-bit digital integrated sample data displays in the **Time View** for Time Slot B only. Selected sample data in the **Channel Select** drop-down box displays in FFT view.

Slot AB Dig Int-1 (16 Bits)

16-bit digital integrated sample data displays in the **Time View** for Time Slot A and Time Slot B. Selected sample data in the **Channel Select** drop-down box displays in FFT view.

Slot A Dig Int-2 (16 Bits)

16-bit digital integrated sample and background data displays in the **Time View** for Time Slot A only. Selected sample or background data in the **Channel Select** drop-down box displays in FFT view.

Slot B Dig Int-2 (16-Bits)

16-bit digital integrated sample and background data displays in the **Time View** for Time Slot B only. Selected sample or background data in the **Channel Select** drop-down box displays in FFT view.

Slot AB Dig Int-2 (16 Bits)

16-bit digital integrated sample and background data displays in the **Time View** for Time Slot A and Time Slot B. Selected sample or background data in the **Channel Select** drop-down box displays in FFT view.

Slot A Dig Int-1 (32 Bits)

32-bit digital integrated sample data displays in the **Time View** for Time Slot A only. Selected sample data in the **Channel Select** drop-down box displays in the FFT view.

Slot B Dig Int-1 32 Bits:

32-bit digital integrated sample data displays in the **Time View** for Time Slot B only. Selected sample data in the **Channel Select** drop-down box displays in the FFT view.

Slot AB Dig Int-1 (32 Bits)

32-bit digital integrated sample data displays in the **Time View** for Time Slot A and Time Slot B. Selected sample data in the **Channel Select** drop-down box displays in the FFT view.

Slot A Dig Int-2 (32 Bits)

32-bit digital integrated sample and background data display in the **Time View** for Time Slot A only. Selected sample or background data in the **Channel Select** drop-down box display in the FFT view.

Slot B Dig Int-2 (32 Bits)

32-bit digital integrated sample and background data display in the **Time View** for Time Slot B only. Selected sample or background data in the **Channel Select** drop-down box display in the FFT view.

Slot AB Dig Int-2 (32 Bits)

32-bit digital integrated sample and background data display in the **Time View** for Time Slot A and Time Slot B. Selected sample or background data in the **Channel Select** drop-down box display in the FFT view.

LOAD AND SAVING CONFIGURATIONS

To load and save device configuration files use **File > Load Cfg** and **File > Save Cfg**, respectively, as shown in Figure 18 and Figure 19. Load configuration (**Load Cfg**) loads the set of registers mentioned in the user selected **.dcfg** file to **ADPD103**. Save configuration (**Save Cfg**) saves all writable registers of **ADPD103** to a **.dcfg** file via the **Open** file dialog box.

Find sample configuration files installed with the WaveTool application in the **SampleCfgs** folder.

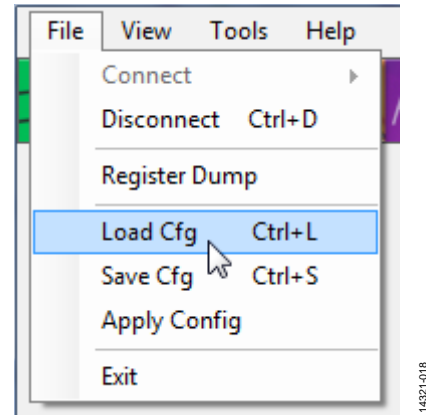


Figure 18. Load Configuration

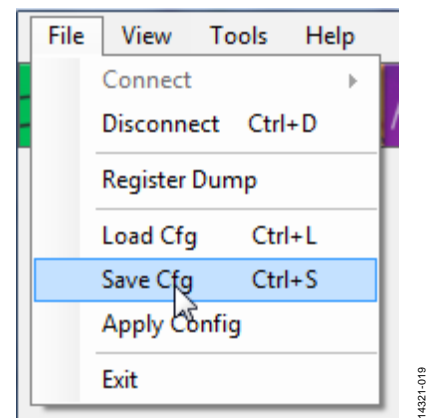


Figure 19. Save Configuration

Selecting **Load Cfg** opens up a file dialog window. Device configuration files have the extension **.dcfg**. Once loaded, the configuration file used by the evaluation board is indicated in the main window, as shown in Figure 20. The full path of the **.dcfg** file is shown when the mouse hovers over the file name. If no file is loaded, then it is indicated as **None**.

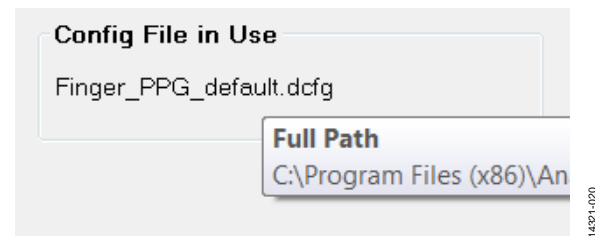


Figure 20. Configuration File in Use

A configuration file uses the following format:

Address Data #(comment optional)

Where the address can be in 8-bit or 16-bit format and the data must be in 16-bit format, as follows:

```
14 0555 #setup input PD configuration
15 0220 #number of averages = 4
18 1F80 #slot A channel 1 ADC offset
19 1F80 #slot A channel 2 ADC offset
```

APPLY CONFIGURATION

A previously loaded configuration remains in the memory of the tool until overwritten by a new load configuration (**LoadCfg**). Therefore, to return to a loaded configuration quickly, it is not necessary to reload the configuration, instead select **File > Apply Config**.

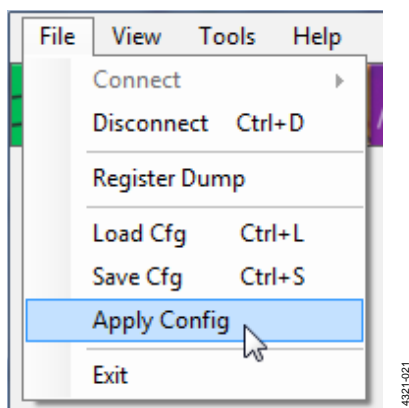


Figure 21. Apply Configuration

DUMP REGISTERS

With the tool, it is possible to dump all the registers to a single file by selecting **File > Register Dump**, as shown in Figure 22.

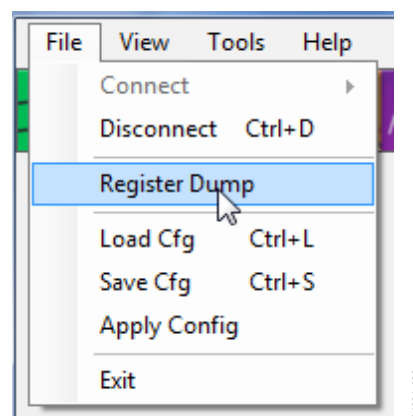


Figure 22. Dump Register

Registers are dumped into a text file with a filename given by the user upon opening the **File** dialog box, a window that prompts the user to save the file to a specific location with a specific name.

The following is an example of a register dump:

```
PD_SELECT (14) 0555
INT_AVG_MODE (15) 0220
CH1_OFFSET_A (18) 1F80
CH2_OFFSET_A (19) 1F80
```

Note that, the register is listed by name (address in hexadecimal value).

GRAPH VIEW

Use **Graph View** for real-time frequency and time domain analysis of the **ADPD103** raw data. Access **Graph View** from the main window via the **View** menu tab, as shown in Figure 23. When the **Graph View** opens, it defaults to the time domain view (**Time View**) as shown in Figure 24. There is also a **Frequency View** tab for frequency domain analysis.

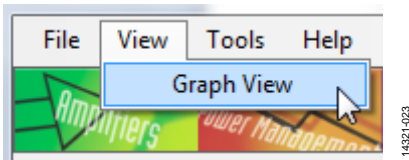


Figure 23. View Menu

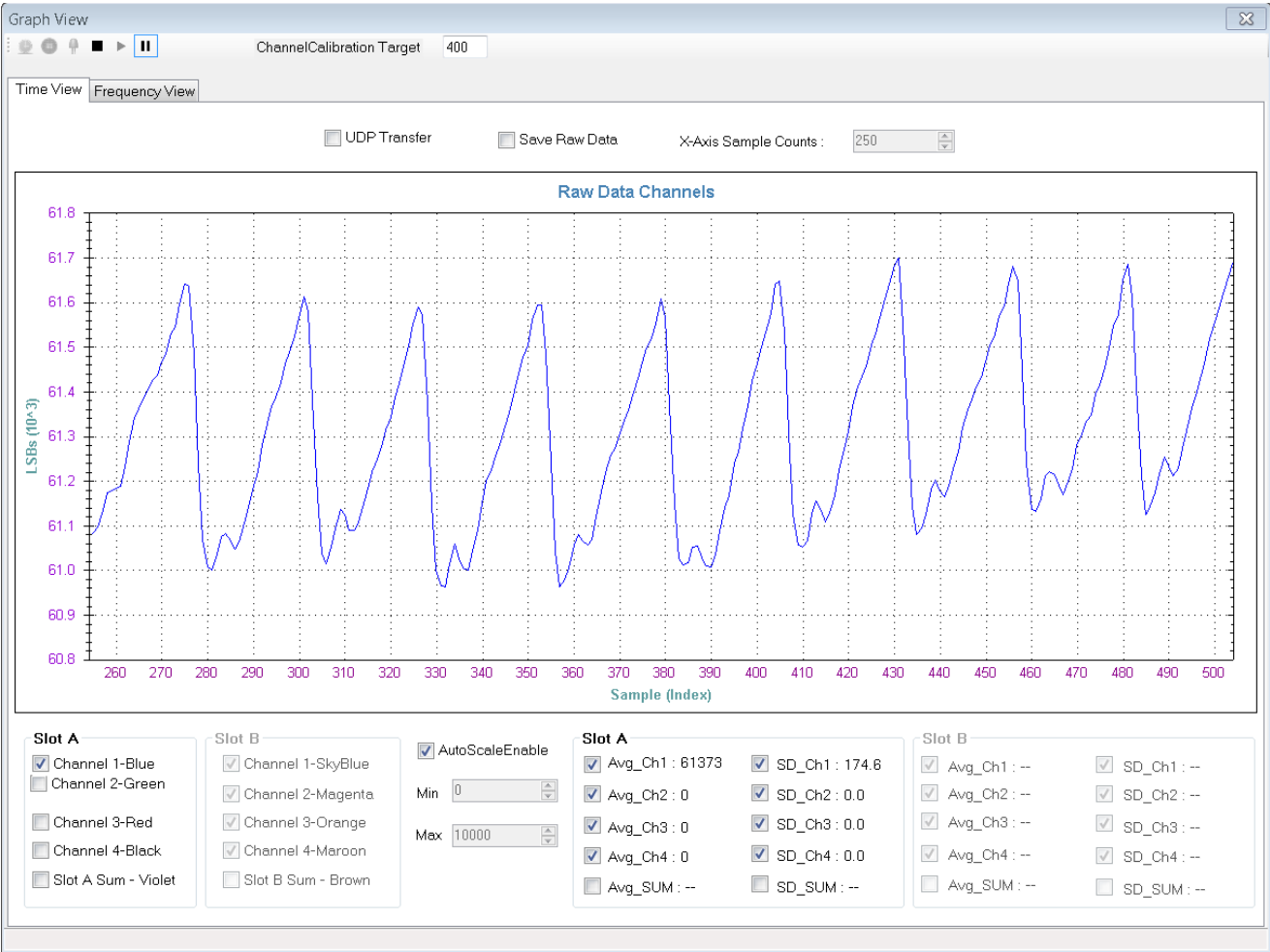


Figure 24. Time View

Time View

Time View displays the raw data from the sensor in time domain format. Plot or send the raw data through the UDP protocol to the host system that is controlled by a checkbox in the **Time View**, which has three controls:

- UDP on/plot off, where the **UDP Transfer** checkbox is checked (see Figure 25).



Figure 25. UDP On/Plot Off Mode

- UDP off/plot on, where the **UDP Transfer** checkbox is not selected (see Figure 26).

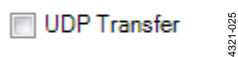


Figure 26. UDP Off/Plot On Mode

- UDP on/plot on, where the **UDP Transfer** checkbox fill is solid (see Figure 27).

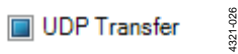


Figure 27. UDP On/Plot On Mode

In UDP on mode, the data is sent through UDP and does not display in the graph panel.

In UDP off/plot on mode, the data displays in the graph panel but is not sent through the UDP.

In UDP on/plot on mode, the data is sent through UDP and also displays in the graph panel.

The **UDP Transfer Tool**, a separate executable within the WaveTool package, receives the data from WaveTool and transfers the data to the assigned UDP port.

To save the raw data into a file, check the **Save Raw Data** checkbox, as shown in Figure 28. When the box is checked, the user is prompted to save the file.

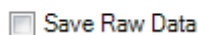


Figure 28. Checkbox to Save Sensor Raw Data to a File

Configure the x-axis sample count for graph plotting through the **X-Axis Sample Counts** field (see Figure 29).

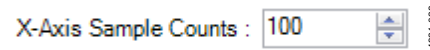


Figure 29. X-Axis Sample Count Configuration

Note that, the minimum value for sample count is limited to 100. If it is assigned with values smaller than 100, it automatically corrects to 100.

Time View shows the raw data graph that plots **Sample (index) vs. LSBs** data.

The plot of each individual channel is controlled using the checkboxes as shown in Figure 30.

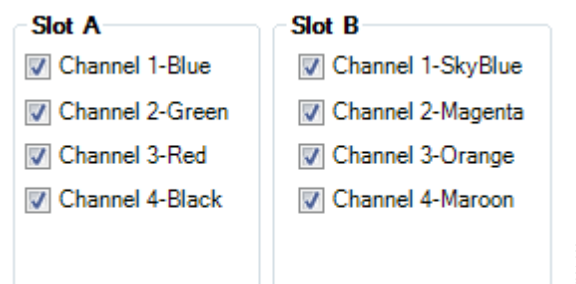


Figure 30. Channel Display Control

By clicking the checkbox the corresponding channel data is plotted with the specified color in the Raw Data graph.

The auto scaling of the time graph view can be enabled/disabled by a checkbox present at the bottom of the time graph. Also the minimum and maximum scale range can be adjusted while the auto scale option is disabled.

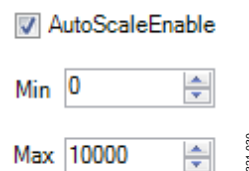


Figure 31. Auto Scale Control and Scale Range Setting

The average and standard deviation for every channel and sum of all channels are displayed along the bottom of the time graph view. These statistics are enabled or disabled by the checkbox preceded by each label as shown in Figure 32.

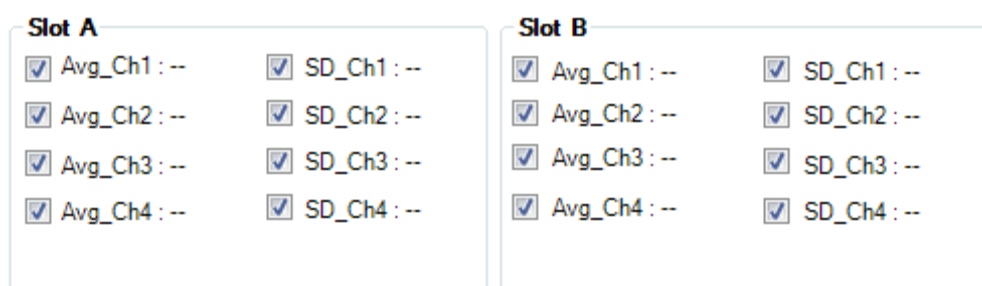


Figure 32. Average and Standard Deviation Display

General Controls

Using standard controls, the user can start (see Figure 33), stop the current mode and return to idle mode (see Figure 34), and pause the device in its current operating state (see Figure 35) whereby graphs are no longer updated but data is still retrieved from the device.



Figure 33. Start Icon



Figure 34. Stop and Return to Idle Icon



Figure 35. Pause and Resume Icon

FREQUENCY VIEW

Frequency View shows the fast fourier transform (FFT) of the raw data in the form of a graph that plots amplitude vs. frequency (Hz). The user can select the x-axis scale type as linear or logarithmic in the **XAxis Scale Type** drop-down list, as shown in Figure 36.

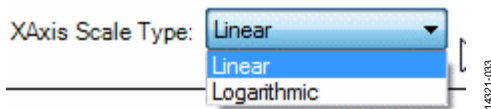


Figure 36. X-Axis Scale Type

The **FFT Samples** field provides the number of samples used to calculate the FFT.



Figure 37. FFT Samples

Note: The minimum value for sample count is limited to 50 samples. If it is assigned with values smaller than 50, it automatically corrects to 50.

The **Frequency View** displays any one of the enabled channels from the **Channel Select** drop-down list. For example, if Slot A is enabled, the user can select any one channel of Slot A, as shown in Figure 38.

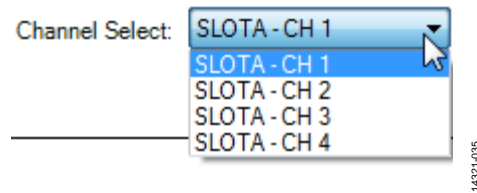


Figure 38. Slot A Channels

The linear scale of the FFT graph is shown in Figure 39 and the logarithmic scale of FFT graph is shown in Figure 40.

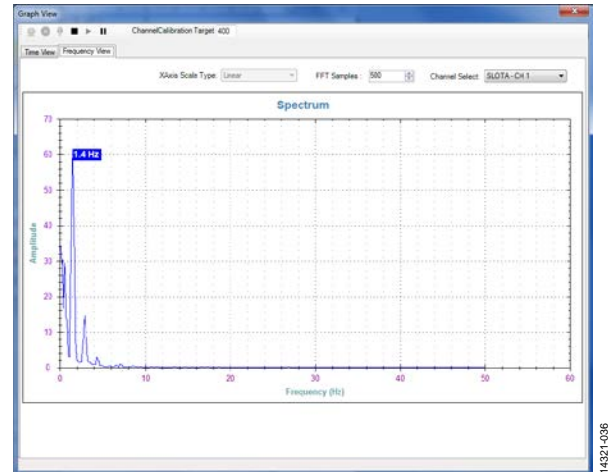


Figure 39. Linear FFT Graph

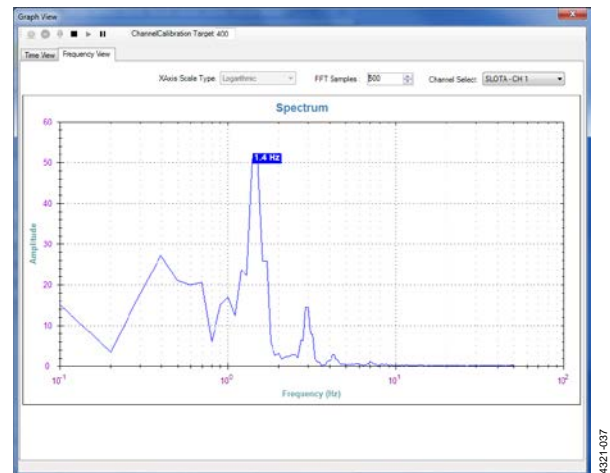


Figure 40. Logarithmic FFT Graph

TOOLS

OPTIONS

The **Options** selection from the **Tools** drop-down menu shows the general board settings as well as the UDP configuration.

General

The **General** tab contains information about the device, the platform, and the firmware version.

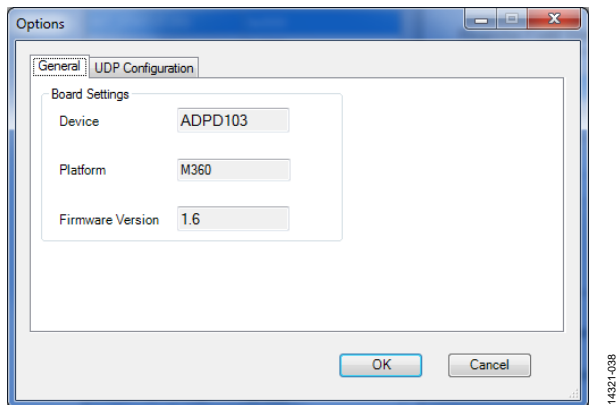


Figure 41. Options Window: General

UDP Configuration

The **UDP Configuration** tab allows the user to configure the port numbers for UDP communication. The UDP transfer tool sends the raw data to the client via the specified port numbers. The IP address field should be filled with the IP address in which the UDP transfer tool is running.

Use the **Raw Data Transfer Port** field to assign the port number for sending raw data from WaveTool to the data transfer tool.

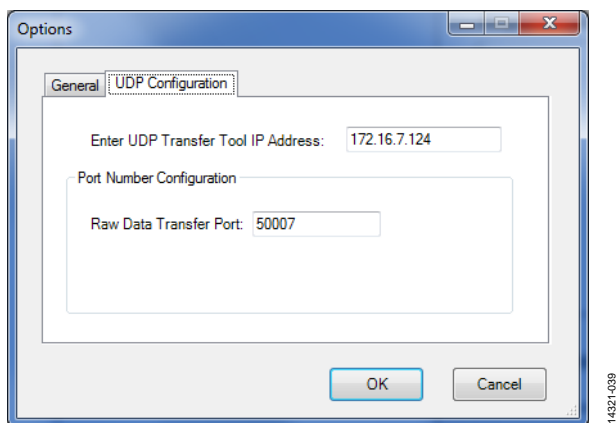


Figure 42. Options Window: UDP Configuration

AUTOMATIC UPDATE

The **Tools > Auto Update** function enables/disables the automatic software update functionality at the time of tool start. When **Auto Update** is enabled, it checks for the availability of a new **WaveTool** update and prompts the user to update the tool with the latest version.

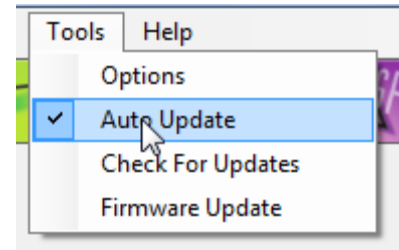


Figure 43. Auto Update

CHECK FOR UPDATES

Use the **Tools > Check For Updates** function to manually check for the availability of a new software update.

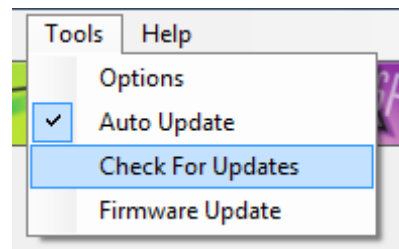


Figure 44. Check for Update

FIRMWARE UPDATE

Note: The WaveTool must be connected with the target board to perform the firmware update; otherwise, the WaveTool shows a disconnect message (see Figure 45).

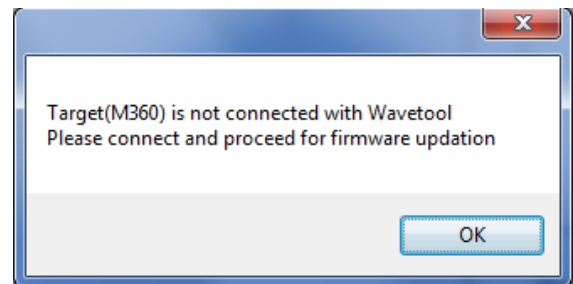


Figure 45. Connection Status for Firmware Update

Use the **Tools > Firmware Update** function to start the firmware update process.

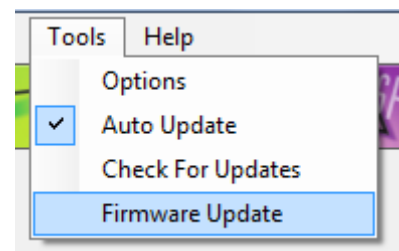


Figure 46. Firmware update

When **Firmware Update** is selected, the CM3WSD firmware flashing tool opens.

To flash the firmware, the user must ensure that the correct path and filename are selected in the file dialog box, as shown in Figure 47.

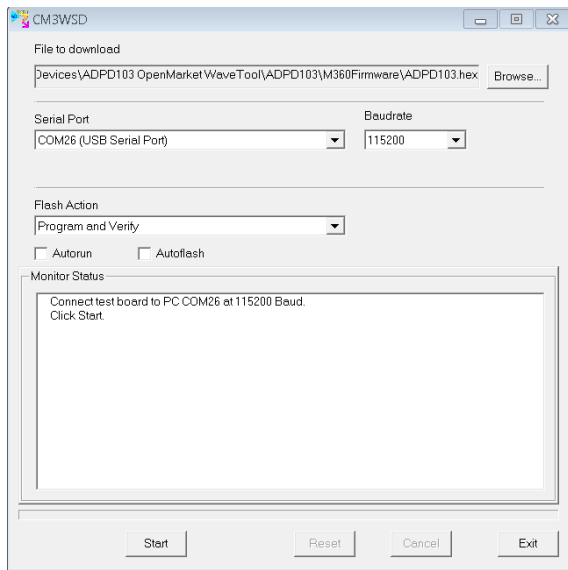


Figure 47. Firmware Flashing Tool

With the correct path/filename entered and the correct USB serial port selected, click **Start**. The user is then prompted to pulse the **Reset** button while holding down the **Download** button on the evaluation board (circled in Figure 48). The firmware download starts when this step is completed.

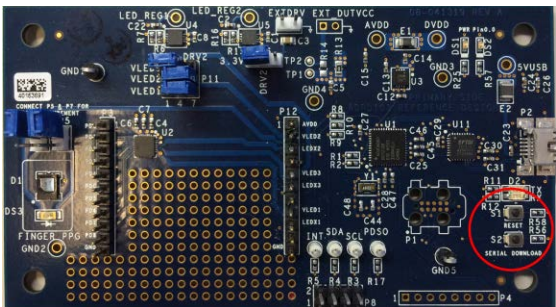


Figure 48. Serial Download and Reset Buttons to Flash Firmware

When the firmware download has completed, click **Reset** in the **CM3WSD** window and then **Exit**. The user can now return to the WaveTool and reconnect the device via **File > Connect** to commence testing with the updated firmware.

SEND REPORT

If the software update failed for ten times continuously, it opens the pop-up window shown in Figure 49.

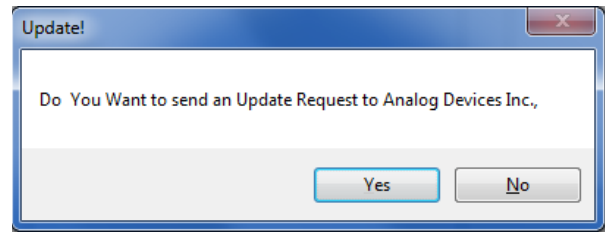


Figure 49. Report Alert

When the user clicks **Yes**, another window appears (see Figure 50).

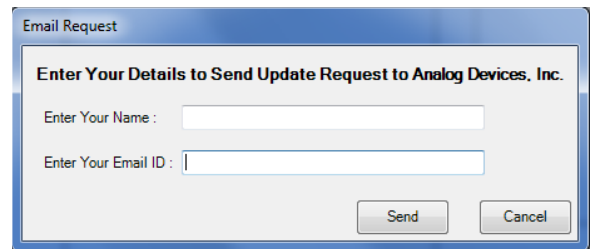


Figure 50. Email Window

Enter your name in the **Enter Your Name** field and your user email ID (this is the email address you used when registering to receive the software package) in the **Enter Your Email ID** field. After entering your user name and email ID, click **Send** to initiate the report to Analog Devices.

EXITING APPLICATION

There is a two-step process to exit the application.

1. Disconnect the device via **File > Disconnect Ctrl+D**, as shown in Figure 51.

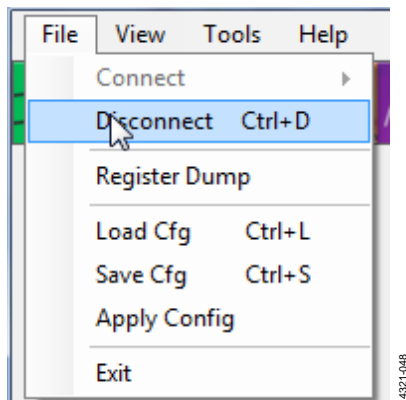


Figure 51. Disconnect

2. Exit via **File > Exit**, as shown in Figure 52.

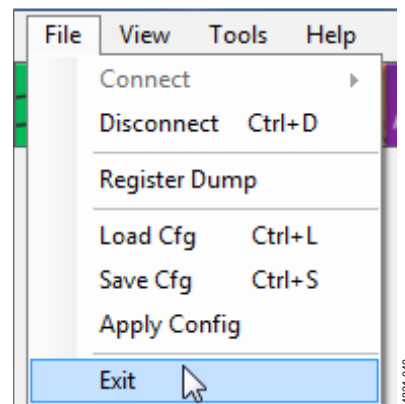


Figure 52. Exit

UDP TRANSFER TOOL

This section explains the raw data reception and its data format for various modes from the UDP transfer tool over UDP protocol.

UDP TRANSFER TOOL SETUP

To setup the UDP transfer tool, follow these steps:

1. Open WaveTool and go to **Tools > Options > UDP Configuration**. Enter the IP address of the remote machine where the UDP transfer tool is running.

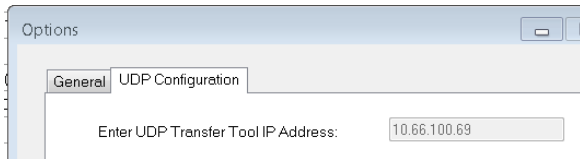


Figure 53. UDP Configuration

2. Connect the hardware (**File > Connect > Auto Connect** or **File > Connect > Select Port**) using the UART bridge on the host machine.

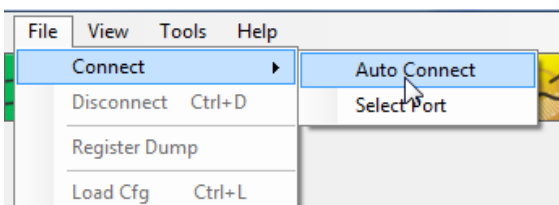


Figure 54. Connection

3. Open **Graph View** and check the **UDP Transfer** box in the **Time View** tab.

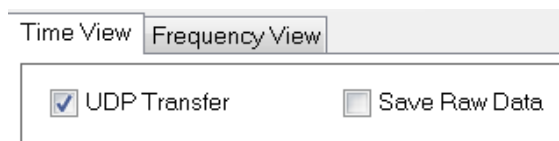


Figure 55. Enable UDP Transfer

4. Click the play button to send the raw data through the UDP protocol.

To save the raw data being transferred via UDP to a data file, open the receiver tool (**UDPTransferTool.exe**) and enter the IP address of the system.

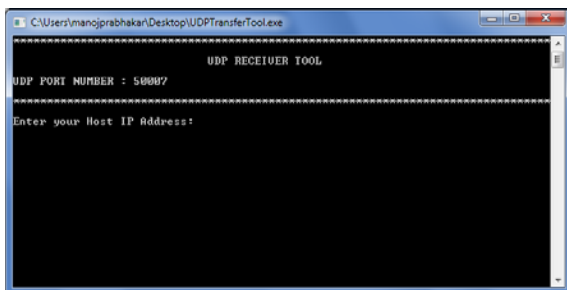


Figure 56. UDP Receiver Tool

1. Enter the file name to save the raw data from WaveTool and press enter.

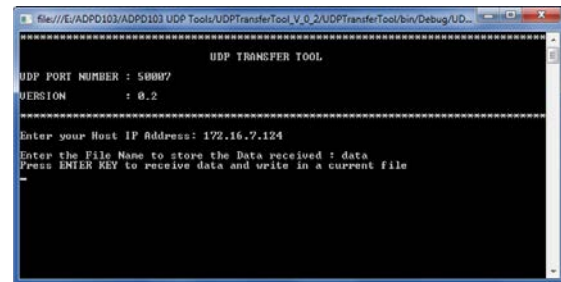


Figure 57. Decision to Continue or Stop

2. The received packet count is continuously displayed in the tool and the raw data is stored in the file.

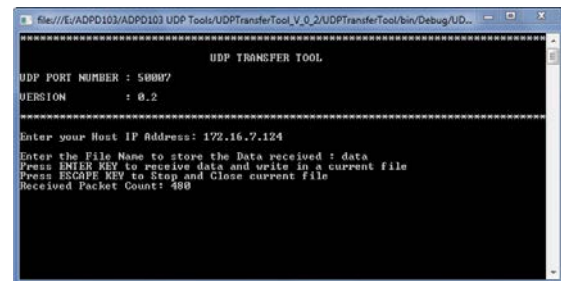


Figure 58. Receiving Raw Data

3. Press the **ESC** key to stop receiving the data and close the current file.



Figure 59. Closing the File

RAW DATA FORMAT

Before using the UDP transfer tool, ensure that WaveTool is opened and running with UDP transfer enabled. See Figure 60 for an example of stored sample raw data.

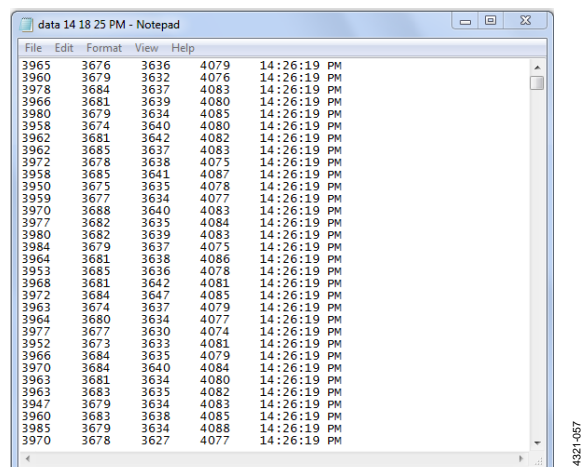


Figure 60. Sample Data

The sample data transmits in the form of ASCII bytes. The sample data format is as follows:

F0136CFC0000000FE90000105000000EA000000FCC

- The first two characters (F0) represent sync.
- Next two characters (13) represent size.
- Next two characters (6C) represent sequence number.
- Next four characters (FC00) represent time stamp.
- The remaining characters represent the hexadecimal channel raw data and its count (based on the slot modes of the WaveTool).

Table 1. UDP Data Format

F0	13	6C	FC00	0000FE9 0000105000000EA000000FCC
Sync (2)	Size (2)	Sequence number (2)	Time stamp (4)	Raw data

Table 2. UDP Data Count for Various Modes

Slot Mode	Data Format	Data Count
Slot A Sum, 16 Bits Slot B Sum, 16 Bits Slot A Sum, 32 Bits Slot B Sum, 32 Bits Slot A Dig Int, 16 Bits Slot B Dig Int, 16 Bits	0000FE9	1
Slot AB Sum, 32 Bits Slot A Dig Int, 32 Bits Slot B Dig Int, 32 Bits	0000FE9 00001050	2
Slot A, 16 Bits Slot B, 16 Bits Slot A, 32 Bits Slot B, 32 Bits	0000FE9 00001050 0000EA0 0000FCC	4
Slot AB, 16 Bits	0000F7E 0000105C 0000EA8 0000FCC 0000FE9 00001064 0000EAD 0000FCE	8

UDP CONTROLLER TOOL

Open the **UDP controller tool** (see Figure 61) and complete the **Enter your Host IP Address** field. This is the IP address of the system where the WaveTool is running.

After entering the corresponding IP address, the user can send and receive commands between the controller and the WaveTool.

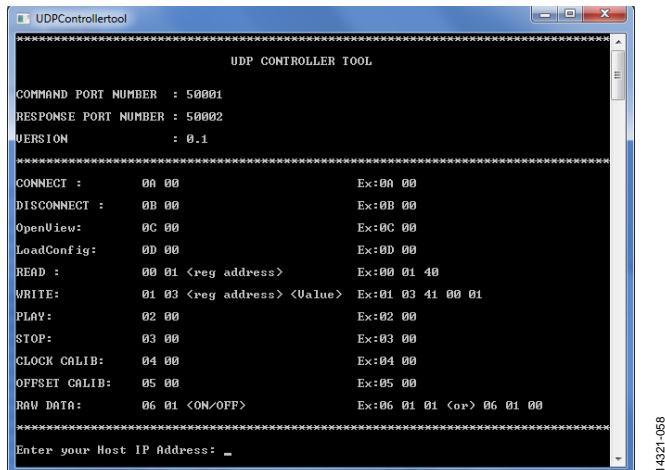


Figure 61. UDP Controller

PROCEDURE

Port Connection

To use the read register or write register functions, the port must be connected in the OpenMarket WaveTool. Connect the port using the following steps:

1. Open the **ADPD103 OpenMarket WaveTool** application.
2. Connect the port. From **File > Connect** select either
 - a. **Auto Connect** (to automatically select the port) or
 - b. **Select Port** (to manually select the port).
3. Ensure the UDP control IP address is assigned correctly.

Read Register

After connecting to the port, send the register read command as **00 01 <reg address>**, for example, send as 00 01 01 to read from register 0x01.

00 = register read command

01 = number of parameters

01 = register address

The response is received with the register value.

UDP CONTROLLER APPLICATION TESTING

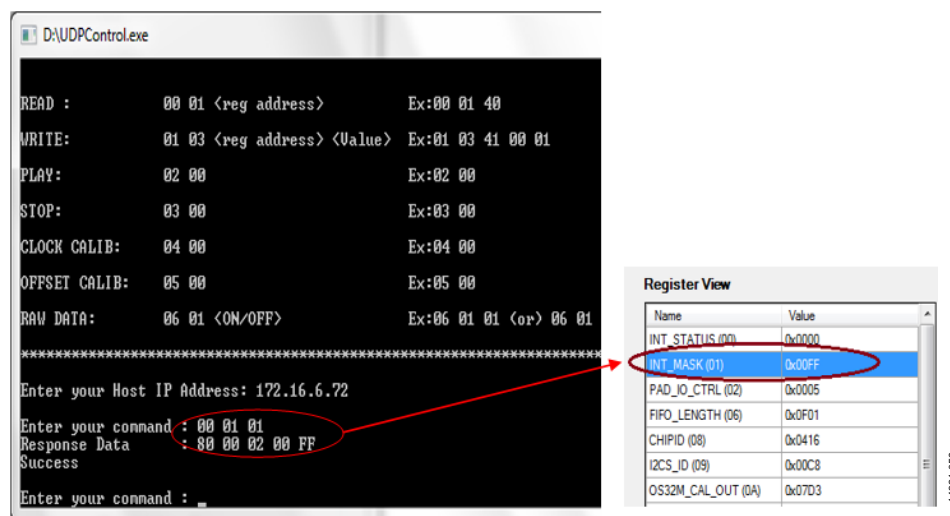


Figure 62. Read Register Operation

Write Register

After connecting the port following the instructions in the Port Connection section, send the register write command as **00 03** <reg address> <Value>, for example, send as 00 03 01 00 01, where

00 = register write command

03 = number of parameters

01 = register address

00 01 = register value

The response is received with the register value.

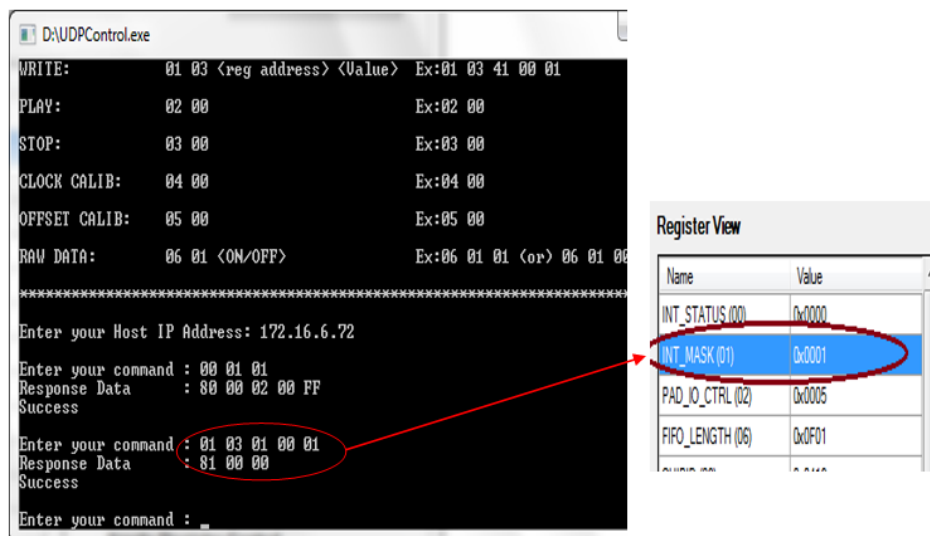


Figure 63. Write Register Operation

Run

Open the ADPD103 **OpenMarket WaveTool** application and connect the port (see the Port Connection section). If bridge is connected, then open the graph view: **View > Graph**.

Next, send the play command as **02 00**, where

02 = play command

00 = number of parameters

Stop

Open the ADPD103 **OpenMarket WaveTool** application and connect the port (see the Port Connection section). If bridge is connected, then open the graph view: **View > Graph**.

Next, send the stop command as **03 00**, where

03 = stop command

00 = number of parameters

Load Configuration

Open the ADPD103 **OpenMarket WaveTool** application and connect the port (see the Port Connection section). If bridge is

connected, then a command can be sent to WaveTool through the UDP.

Next, send the load configuration file command as **0D 00**, which gives a list of available configuration file names as shown in Figure 64.

Select the particular configuration file using the following command, based upon which configuration from the list is to be loaded. For example, **0D 01 (01/02/03...../07)**.

Likewise, commands can be given for connect, disconnect, open view, and raw data by referring to the command list in Table 3.

COMMANDS SUMMARY

Table 3 summarizes the list of commands, command code and example formats for various functions that are currently available in the WaveTool.

Table 3. Commands Summary

Command	Command Code ¹	Example
Connect	0A 00	0A 00
Disconnect	0B 00	0B 00
Open View	0C 00	0C 00
Load Configuration (Load Cfg)	0D 00	0D 00
Read	00 01 <reg address>	00 01 40
Write	01 03 <reg address> <Value>	01 03 41 00 01
Run	02 00	02 00
Stop	03 00	03 00
Raw Data	06 01 <ON/OFF>	06 01 01 (or) 06 01 00

¹ See Figure 61.


```

file:///F:/Backup/Mar_21/UDPControlTool_V_0_1/UDPControl/bin/Debug/UDPControl.EXE

READ :      00 01 <reg address>      Ex:00 01 40
WRITE:      01 03 <reg address> <Value> Ex:01 03 41 00 01
PLAY:       02 00                      Ex:02 00
STOP:       03 00                      Ex:03 00
CLOCK CALIB: 04 00                      Ex:04 00
OFFSET CALIB: 05 00                      Ex:05 00
RAW DATA:   06 01 <ON/OFF>             Ex:06 01 01 <on> 06 01 00

*****

Enter your Host IP Address: 172.16.7.37
Enter your Command : 0D 00

List of Configuration Files :

1 >dgdg.dcfg
2 >Finger_PPG_020916.dcfg
3 >Finger_PPG_default.dcfg
4 >gfg.dcfg
5 >hfhghghg.dcfg
6 >hjhghj.dcfg
7 >M03_103_GGRI_Default.dcfg

Enter load config command with any of above choice as shown below..
Eg.,0D 01 <01/02/03...>choice
Enter your command : _

```

Figure 64. List of .dcfg Files Available in WaveTool Configuration Directory

**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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