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EZ-PD™ Analyzer Utility User Guide

Doc. No. 002-12896 Rev. *B

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Contents

1. Introduction

Thank you for your interest in the EZ-PD™ Analyzer Utility. This is a Windows-based utility that works in conjunction with the CY4500 EZ-PD™ Protocol Analyzer to capture the Power Delivery (PD) traffic occurring on the Configuration Channel (CC) lines of a Type-C connection; this is a very handy debugging tool for developers.

Note that the EZ-PD™ Analyzer Utility supports decoding of PD packets as per **USB PD Specification Revision 2.0, V1.2**.

1.1 Getting Started

This user guide describes the features of the EZ-PD™ Analyzer Utility and how to use it. The EZ-PD™ Analyzer Utility section explains how to use the tool. The Troubleshooting section lists the troubleshooting procedure.

1.2 Additional Learning Resources

Visit the CCG web page at www.cypress.com/CCG for the list of Type-C products from Cypress and additional learning resources including datasheets and application notes.

1.3 Technical Support

For assistance, go to www.cypress.com/go/support or contact our live customer support at +1 (800) 858-1810 (in the U.S.) or +1 (408) 943-2600 (international) and follow the voice prompt.

1.4 Document Conventions

Table 1. Document Conventions for Guides

Convention	Usage
`Courier New`	Displays file locations, user-entered text, and source code: `C:\ ...cd\icc\`
Italics	Displays file names and reference documentation: The “Configuration Options” section of the *HX3 datasheet* gives more details about the use of pin straps
File > Open	Represents menu paths: File > Open > New Project
Bold	Displays commands, menu paths, and icon names in procedures: Click the **File** icon and then click **Open**.
Times New Roman	Displays an equation: 2 + 2 = 4
Text in gray boxes	Describes Cautions or unique functionality of the product.

1.5 Abbreviations

Table 2. List of Abbreviations

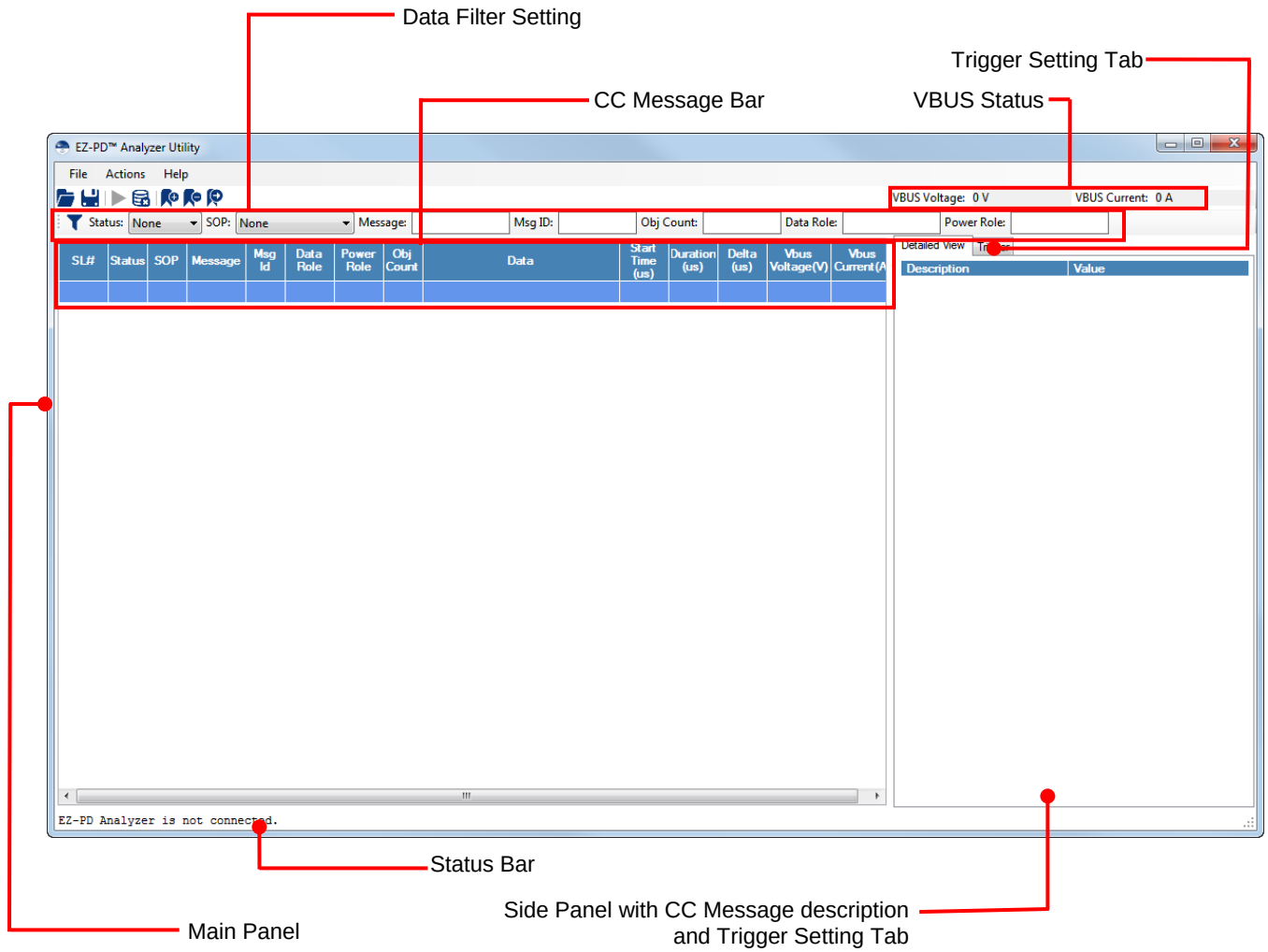
Abbreviation	Meaning
GUI	Graphical User Interface
PD	Power Delivery
SOP	Start Of Packet
Msg ID	Message Identification
CC	Configuration Channel
PC	Personal computer
Obj Count	Object Count
USB	Universal Serial Bus

2. EZ-PD™ Analyzer Utility

2.1 EZ-PD™ Analyzer Utility GUI

Start the EZ-PD™ Analyzer Utility from **Start** > **All Programs** > **Cypress** > **EZ-PD Analyzer Utility** > **EZ-PD Analyzer Utility**. The **EZ-PD™ Analyzer Utility** GUI is displayed, as shown in Figure 1.

Figure 1. GUI Layout of EZ-PD™ Analyzer Utility



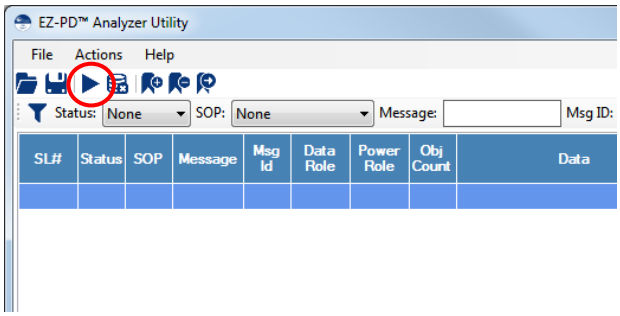
2.2 Capturing and Viewing PD Packets

Before capturing PD Packets, ensure that the CY4500 EZ-PD™ Protocol Analyzer hardware is connected and ready to use. Ensure that the message displayed on the status bar at the bottom shows “EZ-PD Analyzer is connected”.

2.2.1 Capture PD Packets

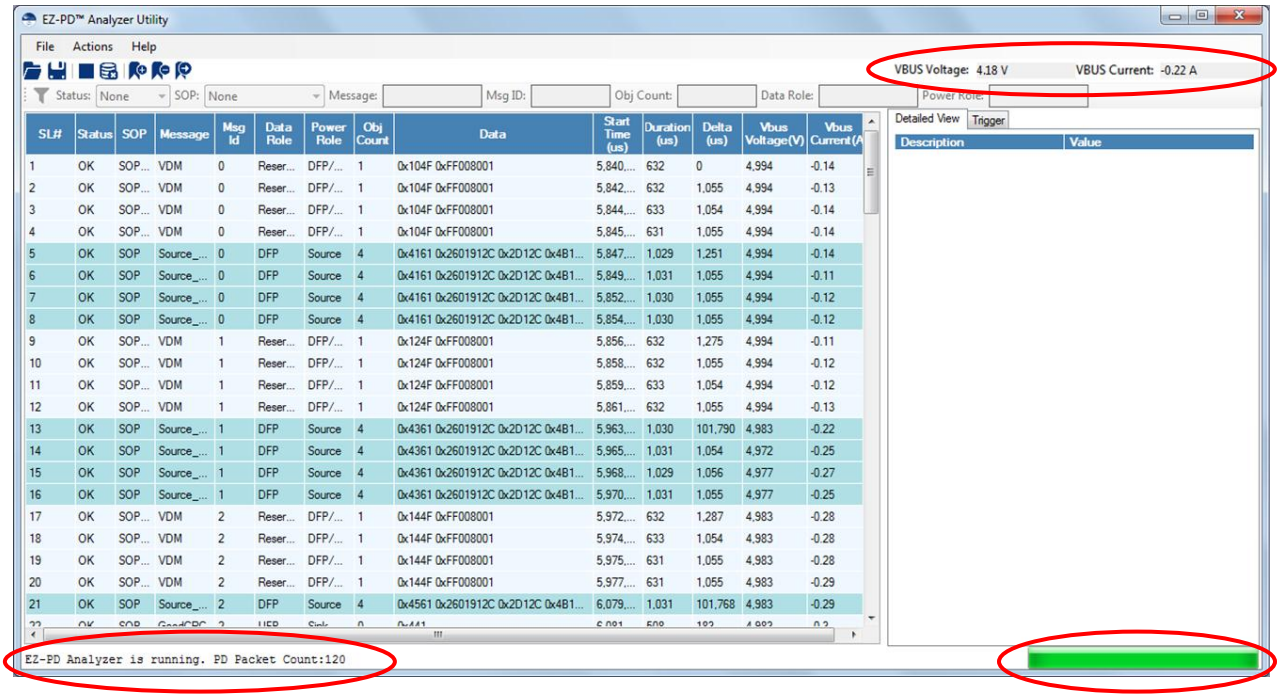
To capture the PD Packets, click **Start Capturing** on the tool bar as shown in Figure 2 or select **Actions** > **Start Capturing**.

Figure 2. Capturing PD Packets on the EZ-PD™ Analyzer Utility



The status bar indicates that the EZ-PD™ Analyzer is running. It also displays the total number of PD packets displayed on the GUI. The progress bar located at the bottom right corner turns green whenever PD packets are received by the utility. The captured PD packets are displayed in the main panel as shown in Figure 3. Each of the PD packet displayed is assigned with a serial number (SL#).

Figure 3. PD Packets Captured Using the EZ-PD™ Analyzer Utility



The various fields of PD packets which are displayed in the Main Panel of the GUI are described in Table 3.

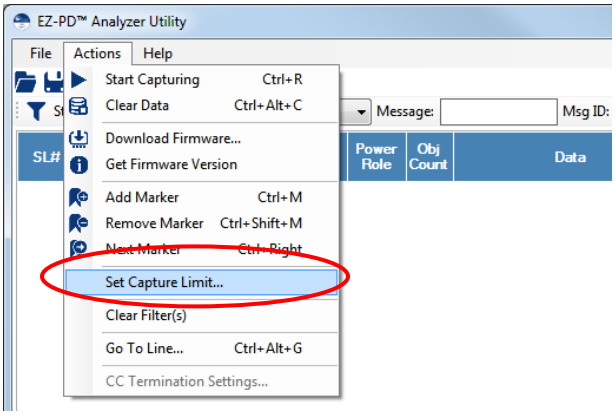
Table 3. Details of captured PD Packets

Field Name	Description
SL#	Message serial no.
Status	Overall status of the message
SOP	K-code marker used to delineate the start of the packet
Message	PD Message Type
Msg Id	Identifier for the message
Data Role	Current Data Role of the Port
Power Role	Current Power Role of the Port
Obj Count	Number of 32-bit data object(s) that follow the header
Data	32-bit data object with header
Start Time (us)	Start time of PD message
Duration (us)	Duration of PD message
Delta (us)	Time difference between previous and current PD message
Vbus (mV)	Vbus voltage during the PD message capture

Note that VBUS status (Voltage and Current) are displayed live at the right top corner of the GUI as shown in Figure 3 as long as the CY4500 EZ-PD™ Protocol Analyzer hardware is connected to the Windows system (PC/Laptop). The typical accuracy of the VBUS current displayed is +/- 0.15 A and the VBUS voltage displayed is +/- 1%.

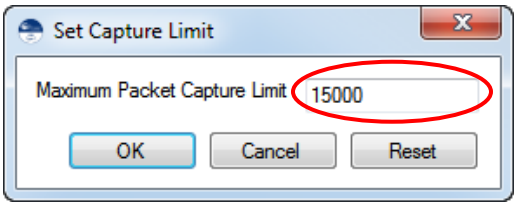
Note: The EZ-PD Analyzer Utility can capture and display a maximum number of 25000 PD packets. This maximum capture limit can be configured using **Actions > Set Capture Limit** as shown in Figure 4.

Figure 4. Invoking Data Capture Limit



Specify the value for the data capture limit as shown in Figure 5. The default value is set to 15000 packets.

Figure 5. Setting Data Capture Limit

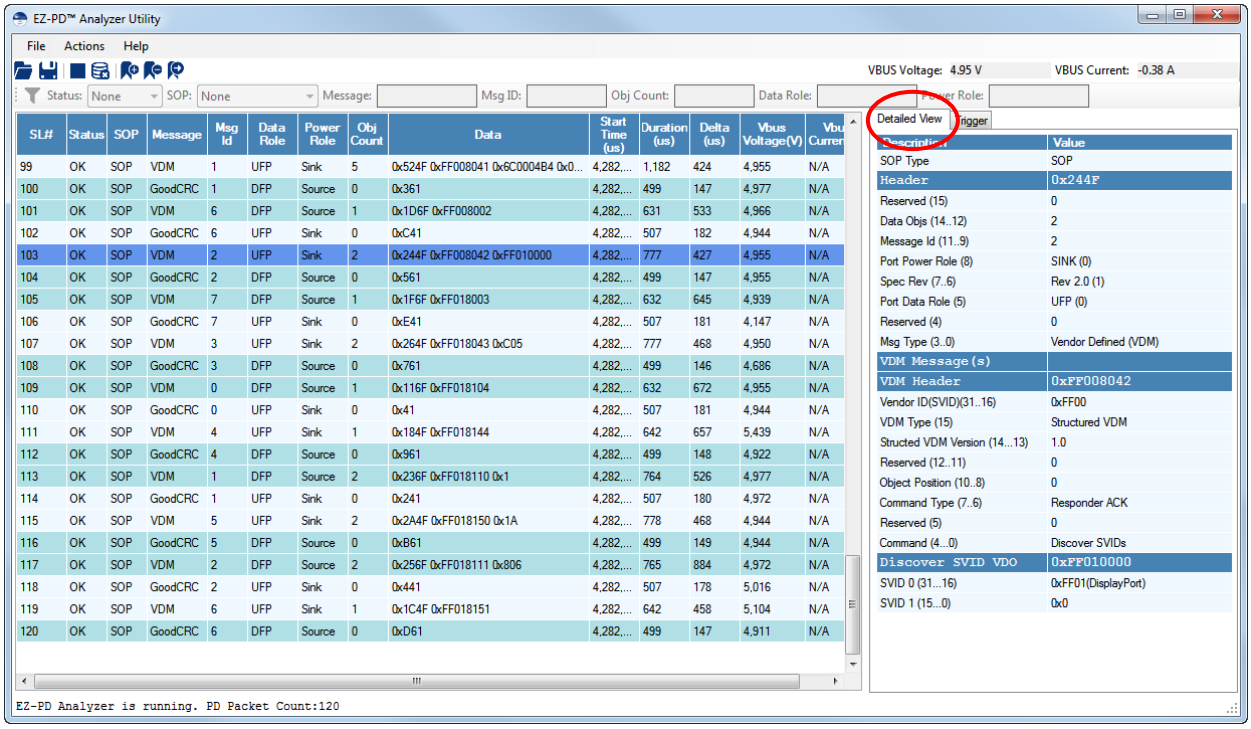


The utility will stop capturing the PD packets once the currently set capture limit is reached. A dialog box will be shown to save and/or clear the captured data.

2.2.2 View Packet Details

Click a PD packet to view its details in the side panel under the **Detailed View** tab as shown in Figure 6.

Figure 6. Details of the selected PD Packet

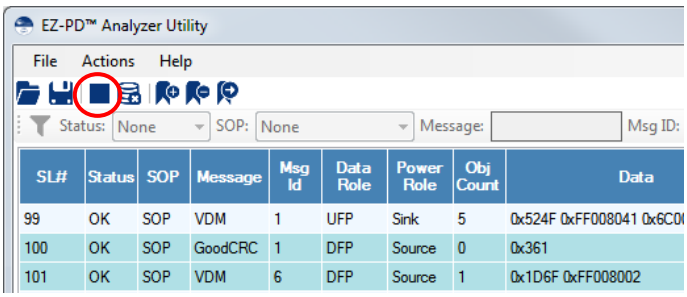


The **Detailed View** tab lists all the attributes of a selected PD packet. Refer to Section 6 (Protocol Layer) of the USB PD Specification Revision 2.0, V1.2 to get more details about the type of PD messages (Control Messages & Data Messages) and their attributes.

2.2.3 Stop Packet Capture

Click the **Stop Capturing** icon in the tool bar as shown in Figure 7 or select **Actions > Stop Capturing.**

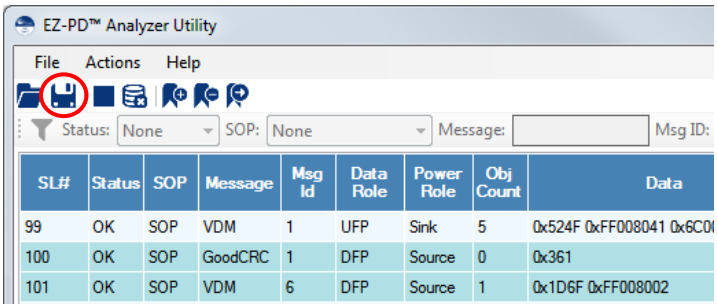
Figure 7. Stop Capturing PD Packets



2.2.4 Save PD Packets

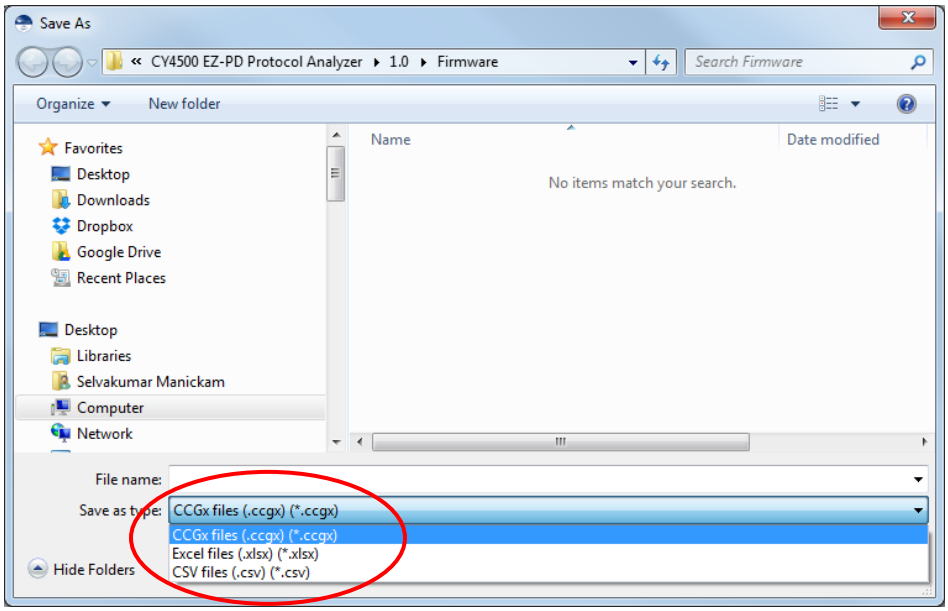
Click the **Save File** icon in the tool bar as shown in Figure 8 or select **File > Save** to save the captured PD Packets.

Figure 8. Save PD Packets



The packets can be saved in any of the following 3 file formats (.ccgx / .xlsx / .csv) as shown in Figure 9.

Figure 9. File formats for PD Packets

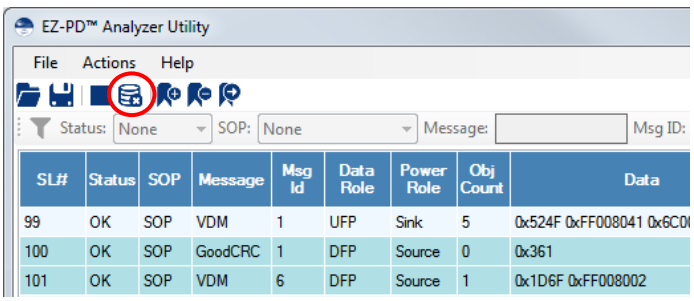


Note that .ccgx file is a proprietary Cypress format. Files stored in this format can be opened only using the EZ-PD Analyzer Utility.

2.2.5 Clear PD Packets

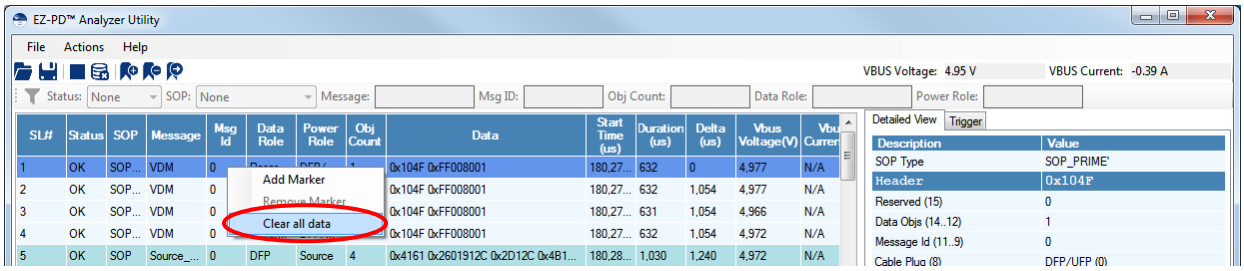
Click the **Clear Data** icon in the tool bar as shown in Figure 10 or select **Actions > Clear Data** to clear all the captured PD Packets. Clearing the PD packets resets the serial number (SL#) and the PD packets which are captured subsequently will start with SL# 1.

Figure 10. Clearing the captured PD Packets



The captured packets also can be cleared by clicking the right mouse button on the main panel and by clicking **Clear all Data** as shown in Figure 11.

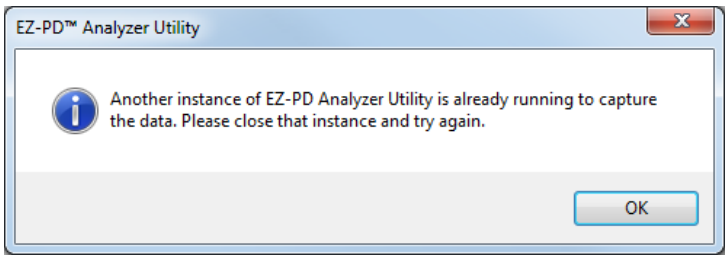
Figure 11. Clearing the captured PD Packets from the Main Panel



Note 1: If PD packets are being received at the time of invoking **Clear all Data**, those PD packets may get displayed with continuous serial nos. even after clearing the existing PD packets. Click **Clear all Data** again to clear them and to reset the serial number for the PD packets to be captured subsequently.

Note 2: Multiple instances of the EZ-PD Analyzer Utility can be run on a given Windows system. However the data capture can be done only by the instance that was started first. If data capture is invoked on any other instances, the error message shown in Figure 12 will be displayed.

Figure 12. Data capture error message



2.3 Working with PD Packets

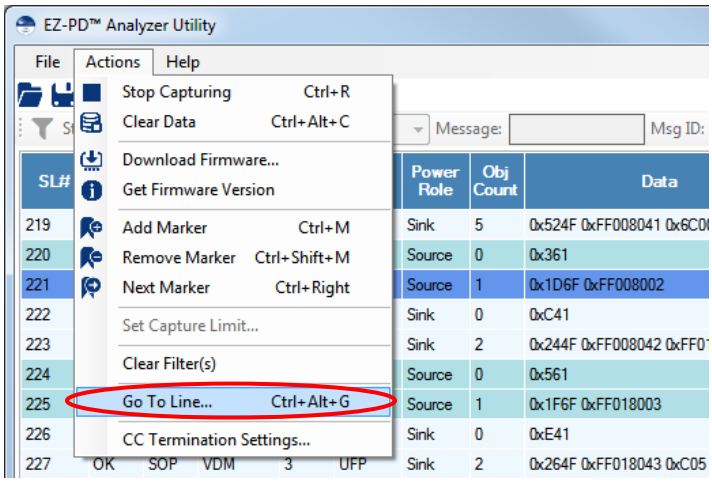
2.3.1 Open Saved PD Packet Files

The saved PD Packet files (.ccgx) can be viewed even when the EZ-PD™ Protocol Analyzer hardware is not connected to the PC/Laptop. Click the **Open File** button on the tool bar (or select **File > Open**). Browse and select the saved CCGX file.

2.3.2 Go To a PD Packet based on Serial Number

Click **Actions > Go To Line…** as shown in Figure 13 and enter the serial number (SL#) to select a PD packet in the Main Panel based on the serial number.

Figure 13. Invoking Go To Line



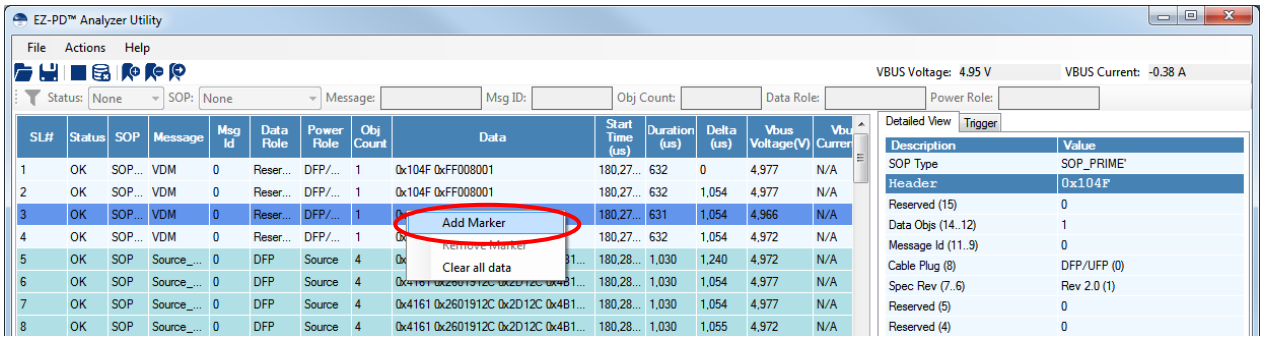
2.3.3 Mark PD Packets

The PD Packets displayed in the main panel can be marked to locate them quickly.

Right-click a packet and select **Add Marker**, as shown in Figure 14. The marked packet gets highlighted in red.

Note: The red highlight is not shown if a marked packet is in selected state. De-select the marked packet by right clicking another packet or by clicking on the side panel to see the highlighting in red.

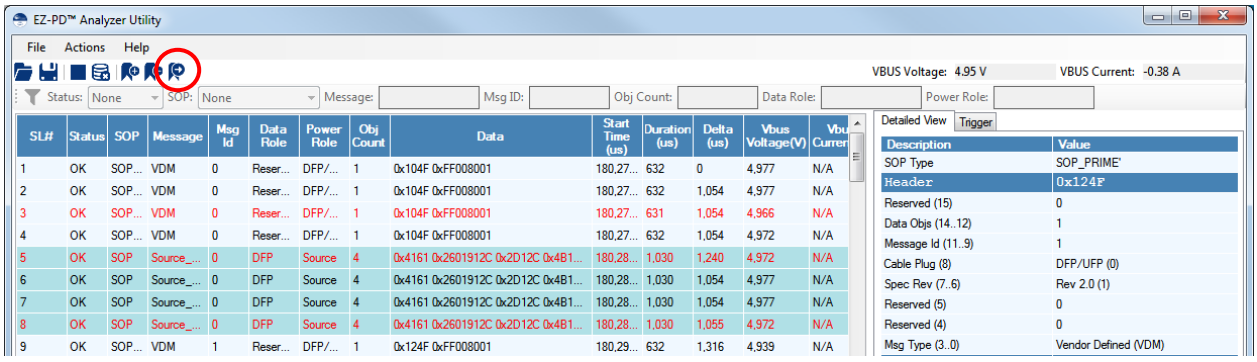
Figure 14. Adding Marker to PD Packets



2.3.4 Step through Marked PD Packets

Click the **Next Marker** button on the toolbar (or, select **Actions > Next Marker**) to step through marked packets as shown in Figure 15.

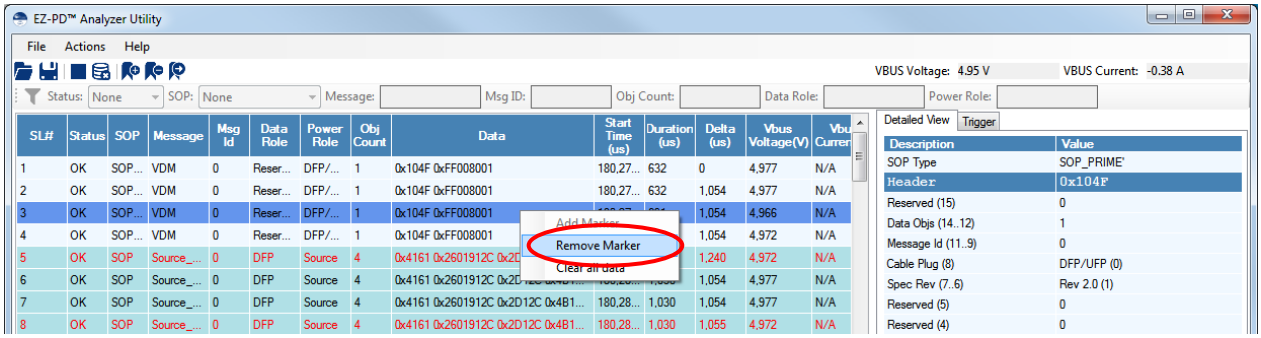
Figure 15. Accessing Marked PD Packets from the Next Marker Icon in the Tool Bar



2.3.5 Remove Marker

Right-click the marked packet and select **Remove Marker** as shown in Figure 16.

Figure 16. Removing a Marker



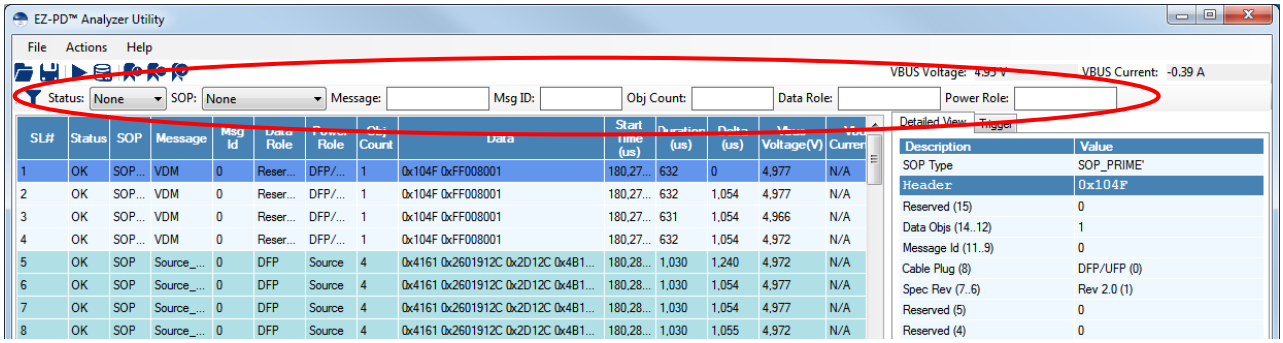
In order to remove all the markers, enter ‘Ctrl+A’ on the main panel to select all the packets, right-click and select **Remove Marker**.

Note: Invoking ‘Ctrl+A’ results in selection of an empty row at the bottom of the main panel. De-select it by entering ‘Ctrl+left click’ before invoking **Remove Marker.**

2.3.6 Use Packet Filters

The packets displayed in the main panel can be filtered based on certain parameters, such as **Status, SOP, Message, Msg ID, Obj Count, Data Role** and **Power Role** as shown in Figure 17. To filter the data packets, enter the filter value in the appropriate field on the Data Filter bar.

Figure 17. Setting up a Data Filter



2.4 Advanced Features

This section describes the two advanced features (Trigger & CC Terminations) supported by the EZ-PD Analyzer Utility.

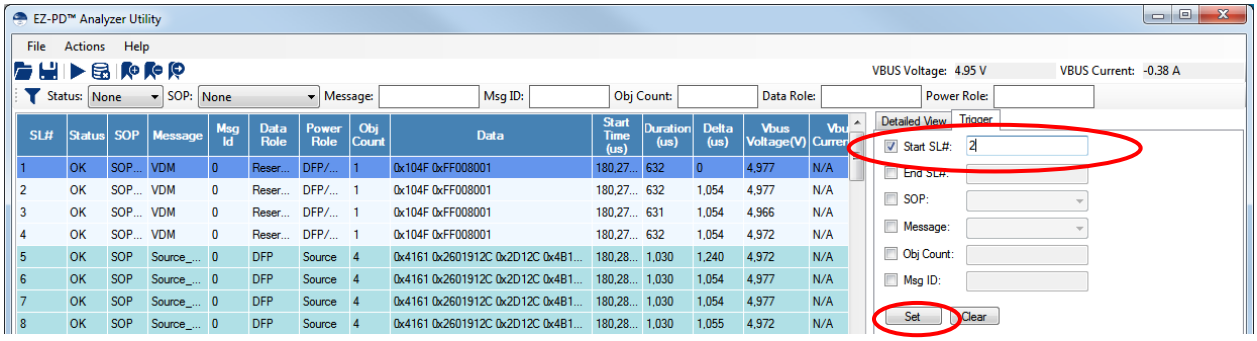
2.4.1 Trigger

For complex debugging where an external system needs to be triggered for a specific PD event or for a combination of PD events, the utility provides an option to set the trigger conditions.

Before invoking the Trigger feature on the EZ-PD Analyzer Utility, complete the hardware set-up required to capture the trigger output. Connect jumper cables (provided in CY4500 package) to the relevant trigger output GPIOs (SOM, EOM & MTR) and hook them to an oscilloscope.

Click on the **Trigger** Tab and set the trigger criteria as shown in Figure 18. Click **Set** to activate the trigger.

Figure 18. Setting Trigger condition from the Trigger tab



Following is the procedure to change or remove trigger criteria which has been activated:

a. Change the trigger criteria in the **Trigger** Tab

b. Click **Set** to activate the new trigger criteria

c. To clear all triggers, click on the **Clear** button below the trigger criteria

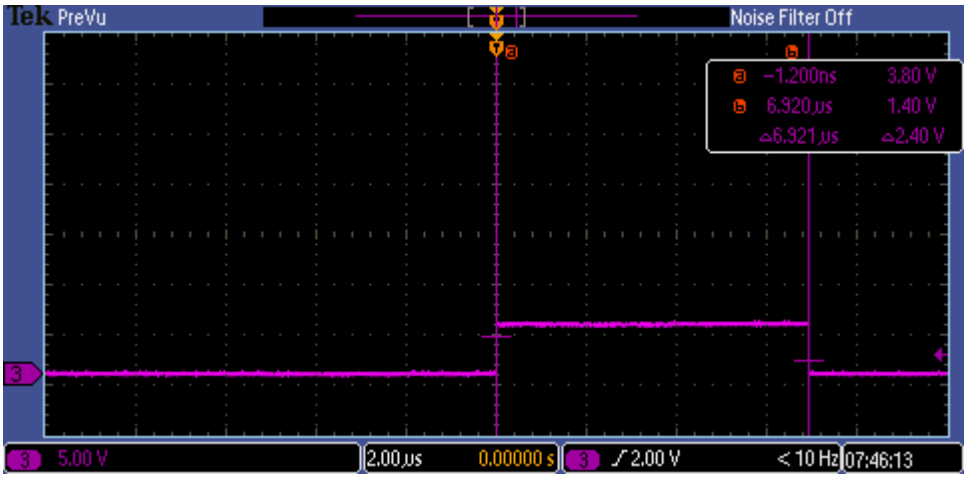
Note 1: Trigger and PD packet capture are independent activities. Activating a trigger does not require PD packet capture to be in progress.

Note 2: The trigger criteria shall get reset if the CY4500 hardware gets disconnected from the Windows system (PC/Laptop) on which the EZ-PD Analyzer Utility is running.

You can set six trigger conditions as follows:

- **Start SL#:** This trigger condition is tied to a GPIO (SOM-Start of Message) on the CY4500 EZ-PD™ Protocol Analyzer hardware. Depending on the SL# number set, the GPIO gets triggered. For example, if the **Start SL#** is set to '2', the GPIO will be triggered when the second PD packet is captured. An Oscilloscope capture on the GPIO under this trigger condition will be as shown in Figure 19.

Figure 19. Trigger waveform output



- **End SL#:** This trigger condition is tied to another GPIO (EOM-End of Message) on the EZ-PD™ Protocol Analyzer Hardware. Depending on the SL# number set, this GPIO gets triggered. For example, if the **End SL#** is set to '100', the GPIO will be triggered when the 100th CC message is captured.

  You can set four more trigger conditions: **SOP, Message, Obj Count** and **Msg ID**. The GPIO (MTR-Message Trigger) pin on the EZ-PD™ Protocol Analyzer Hardware is triggered by a single event or a combination of the events set by **SOP, Message, Obj Count** and **Msg ID.**

- **SOP** (Start of Packet): Select **SOP** and set the type of SOP. The MTR pin is triggered when the selected SOP type occurs. For example, if you set the type of SOP as SOP_PRIME, then the MTR pin gets triggered each time an SOP_PRIME packet is captured on the CC lines.
- **Message**: Select **Msg Type** and set the message type. The MTR pin is triggered when a message of the specified type is captured on the CC line. For example, if you set the message type as VDM, the MTR pin is triggered when a VDM message is captured on the CC lines.
- **Obj Count**: Select **Obj Count** and set its value. The MTR pin is triggered when a packet of the specified Object count is captured on the CC lines. For example, if you set the Obj Count as '1', the MTR pin gets triggered each time the Obj Count is '1'.
- **Msg ID**: Select **Msg ID** and set the value for the trigger condition. The MTR pin is triggered when a message with the specified message ID appears on the CC lines. For example, if you set the Msg ID as '1', the MTR pin gets triggered each time the Msg ID is '1'.

You can set these four trigger conditions individually or in combination, such as setting value for **SOP** and **Message** fields at the same time. Trigger occurs on the MTR GPIO when all the specified conditions are met.

2.4.2 CC Terminations (Rp, Rd & Ra)

The EZ-PD Analyzer Utility allows enabling the Rp, Rd & Ra terminations on the CC lines of the Type-C link. This feature helps CY4500 to emulate a 'Type-C Sink' or 'Type-C Source' or 'Type-C Cable' or 'Type-C Sink and Cable' role without connecting the actual device to the Type-C link and check the response from the peer device. In addition, the peer device may also generate PD packet traffic which can be captured in the EZ-PD Analyzer Utility.

Refer to the section on 'Configuration Channel' in the *Universal Serial Bus Type-C Cable and Connection Specification, Revision 1.2* to understand more about the CC terminations.

Table 4 lists the termination type, the corresponding role emulated by the CY4500 hardware and the pull-up/pull-down resistors used to enable the terminations.

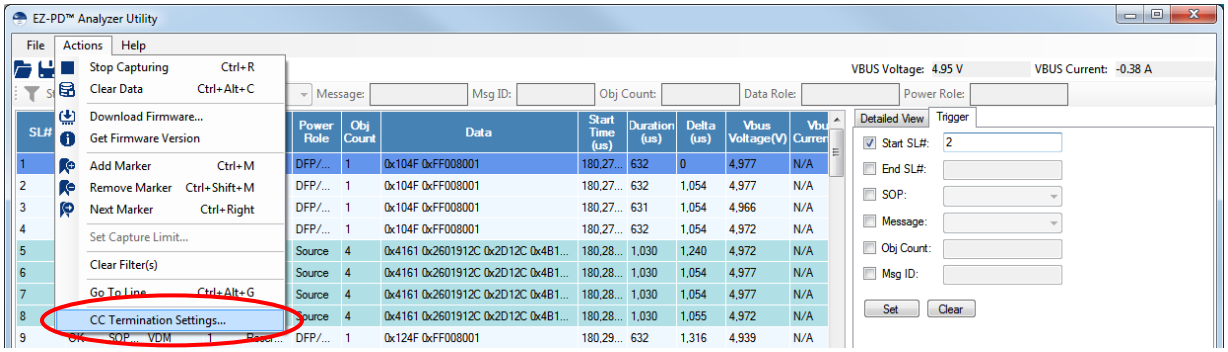
Table 4. Termination Type and the Role played by CY4500

Termination Type	Role	Termination resistor on the CC lines
Rp	Type-C Source	4.7K Ω pull-up resistor to 3.3V
Rd	Type-C Sink	5.1K Ω pull-down resistor
Ra	Powered Type-C Cable	1K Ω pull-down resistor
Ra + Rd	Powered Cable with Sink / VCONN powered Accessory	5.1K Ω & 1K Ω pull-down resistors in parallel

Prior to invoking the CC Termination Settings feature on the EZ-PD Analyzer Utility, connect the CC1 and CC2 pins of CY4500 EZ-PD Protocol Analyzer hardware's Type-C Signal Header to an oscilloscope using the jumper wires provided with CY4500. This is required to monitor the voltage levels on the CC lines.

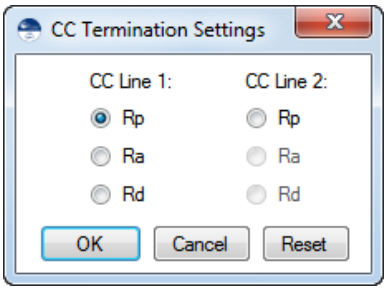
Invoke **Actions > CC Termination Settings…** as shown in Figure 20.

Figure 20. Invoking CC Termination Settings



Specify the termination settings for both the CC lines as shown in Figure 21. Check the response by monitoring the voltage level on the CC lines (CC1 and CC2) of the CY4500 EZ-PD Protocol Analyzer hardware. Also check if there are any PD packets captured by the EZ-PD Analyzer Utility.

Figure 21. Invoking CC Termination Settings



Note that the Rp, Rd & Ra terminations can be enabled only as per the combinations specified in Table 5. The EZ-PD analyzer utility enforces these combinations while accepting the input. Table 5 also explains the role emulated by CY4500, compatible devices to connect to and the expected response on the CC lines.

Table 5. Valid CC line terminations and expected response on the CC lines

Termination enabled on the CC lines		Role emulated by CY4500	Compatible devices to connect to CY4500	Expected response
CC1	**CC2**			
Rd	**-**	Type-C Sink with Plug	Type-C Source with Receptacle	Type-C Source detects attach and turns on VBUS
-	**Rd**			
Rd	**Rd**	Type-C Sink with Receptacle	Type-C Source with Plug	Type-C Source detects attach and turns on VBUS
		Debug Accessory Mode (DAM*) with Plug	Type-C Source with receptacle	Type-C Source detects DAM
Rd	**Ra**	Powered Cable with Sink / VCONN powered Accessory with Plug	Type-C Source with Receptacle	Type-C Source detects attach and turns on VBUS and VCONN
Ra	**Rd**			
Ra	**Ra**	Audio Accessory with Plug	Type-C Source with Receptacle	Type-C Source detects attach
-	**Rp**	Type-C Source with Plug	Type-C Sink with Receptacle	Type-C Sink presents Rd termination
Rp	**-**			
Rp	**Rp**	Type-C Source with Receptacle	Type-C Sink with Plug	Type-C Sink presents Rd termination
			VCONN powered accessory with Plug	VCONN powered accessory presents Ra and Rd termination

* - Refer to 'Terms and Abbreviations' section of *Universal Serial Bus Type-C Cable and Connection Specification, Revision 1.2* document to get more details

Note 1: The Rp & Rd CC Termination Settings feature of the EZ-PD Analyzer Utility should not be invoked when both Type-C Source and Sink are connected to the CY4500 hardware. This can result in unpredictable behavior of the source and sink.

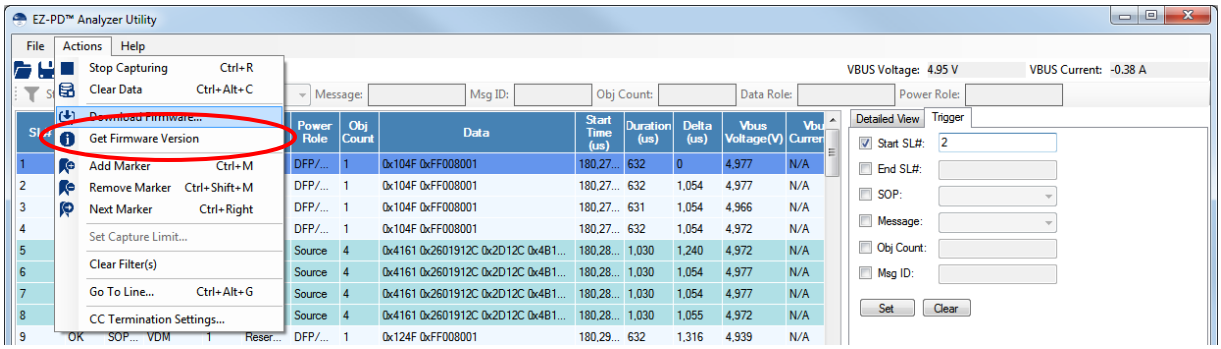
Note 2: In order to clear the termination settings, click the 'Reset' button on the 'CC Termination Settings' dialog box (Figure 21).

2.5 Upgrade Firmware

The CY4500 EZ-PD™ Protocol Analyzer Hardware comes with the latest firmware pre-installed during manufacturing. However if a new firmware version becomes available, the analyzer can be updated directly from the EZ-PD™ Analyzer Utility as described below.

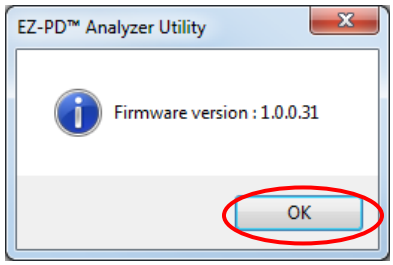
Check the current firmware loaded on the EZ-PD™ Protocol Analyzer Hardware by selecting **Actions** > **Get Firmware Version** as shown in Figure 22.

Figure 22. Get the current firmware version



Wait for the Firmware version dialog box to appear as shown in Figure 23.

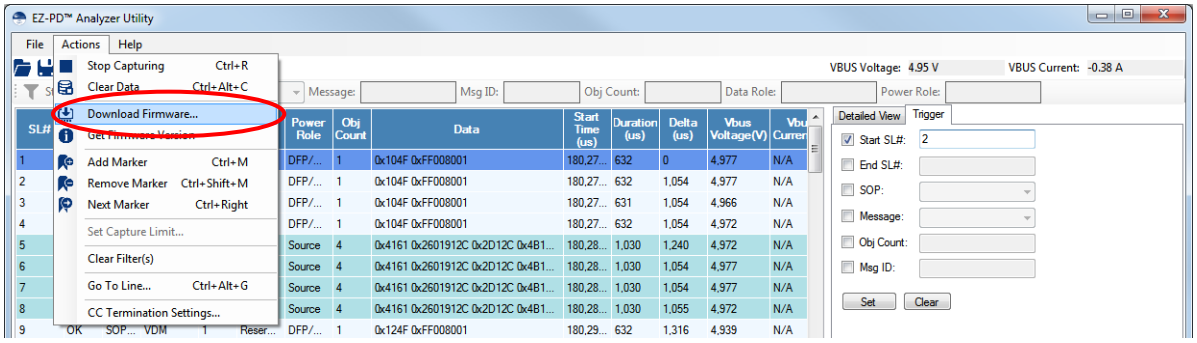
Figure 23. Firmware version dialog box



Click **OK** to return to the main menu. Proceed with rest of the instructions to download the firmware in case a newer version is available.

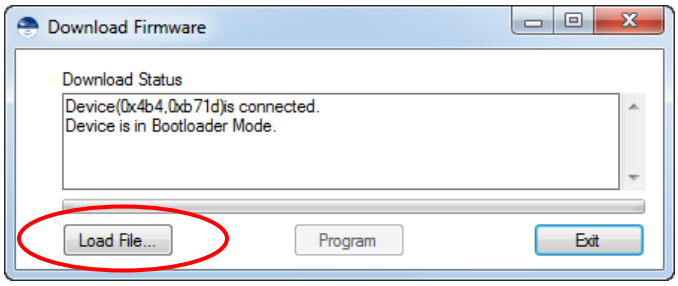
Select **Actions** > **Download Firmware** as shown in Figure 24.

Figure 24. Invoking Download Firmware



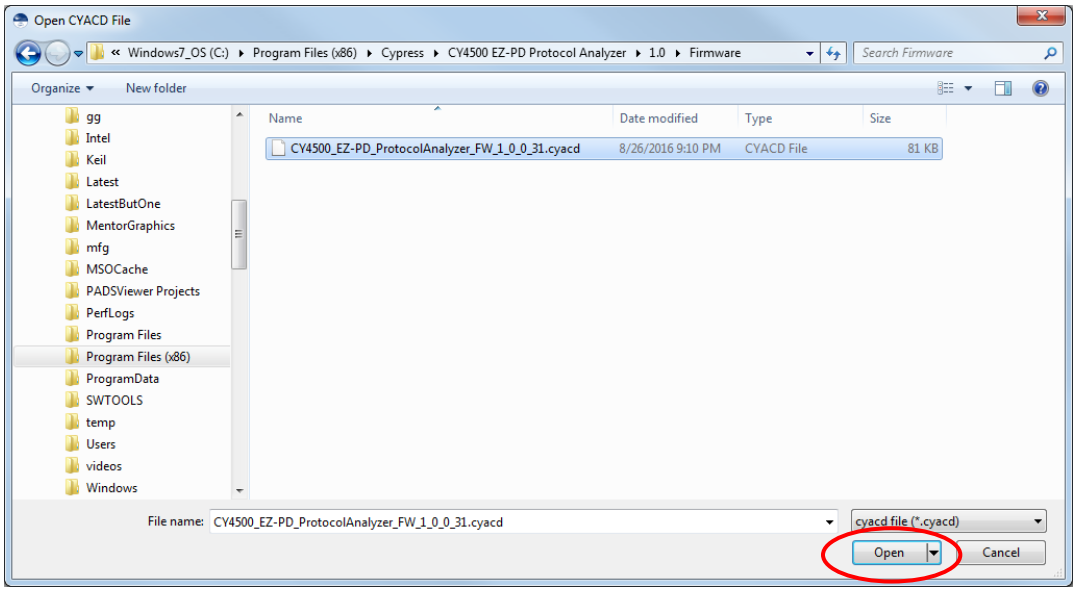
Wait for the Firmware Download dialog box to appear as shown Figure 25 and click **Load File…**

Figure 25. Firmware Download Dialog Box



Select the CY4500 firmware file (.cyacd) as shown in Figure 26 and click **Open.**

Figure 26. Selecting the CY4500 Firmware File

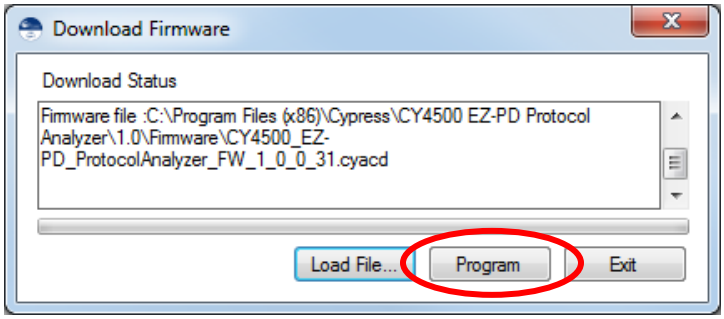


The CY4500 firmware file is included as part of the CY4500 Installer and it can be located at *<Install Directory>\CY4500 EZ-PD Protocol Analyzer\1.0\Firmware*.

Note: On Windows 32-bit platform the default *<Install Directory>* is *C:\Program Files\Cypress*; on the Windows 64-bit platform, it is *C:\Program Files (x86)\Cypress*

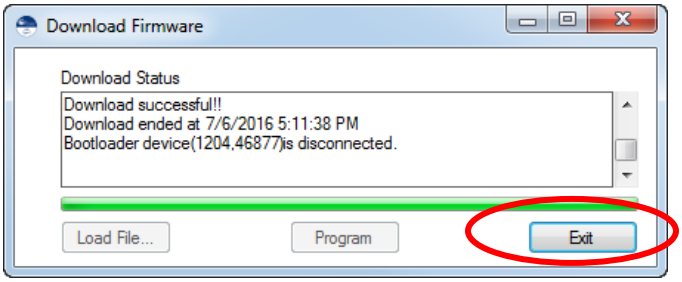
Click **Program** to initiate the firmware download as shown in Figure 27.

Figure 27. Initiating firmware download



Wait for the firmware download to complete as shown in Figure 28.

Figure 28. Completion of firmware download



The CY4500 EZ-PD Protocol Analyzer Hardware restarts with the latest firmware once the firmware download is successful. Click **Exit** to return to the main window of the utility.

3. Troubleshooting

3.1 Troubleshooting Guide

Problem	Possible Cause	Possible Solution
The EZ-PD™ Analyzer Utility does not detect the CY4500 EZ-PD™ Protocol Analyzer Hardware	Device driver is not bound to the device	Manually bind the driver following the procedure given in the *Quick Start Guide* provided with the CY4500 EZ-PD™ Protocol Analyzer
When the EZ-PD(TM) Analyzer Utility is run on a virtual machine environment such as VMWare, there may be a noticeable delay (which can be in the range of 15 seconds) to display the captured PD packets from the time 'Start Capture' is invoked on the utility.	The CPU bandwidth allocated for the virtual machine platform may not be adequate	Modify the Virtual Machine platform settings to use multiple CPU cores to provide more CPU bandwidth
PD Packets are not getting displayed after connecting the Type-C device under test	The Type-C connector may have loose contact or The Type-C device is not inserted properly into the CY4500 EZ-PD™ Protocol Analyzer Hardware	Check the Type-C plug for any abnormality for loose contact Insert the Type-C device under test or cable fully inside the CY4500 Hardware

Revision History

Document Revision History

Document Title: EZ-PD™ Analyzer Utility User Guide Document Number: 002-12896			
Revision	**Issue Date**	**Origin of Change**	**Description of Change**
**	07/07/2016	MKRS	Initial revision
*A	10/05/2016	SELV	Added details about the new features • CC Termination Settings (Ra, Rp & Rd) • Set Capture Limit • Go To Line Added details about the enhancements • Ability to run multiple instances Updated Troubleshooting section
*B	05/05/2017	SHEA	Updated logo and copyright