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EZ-PD Protocol Analyzer Utility User Guide

Document Number: 002-30697 Rev. *A

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Contents

1. General Overview

Thank you for your interest in the EZ-PD™ Protocol Analyzer Utility User Guide. This is a cross platform 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 Protocol Analyzer Utility User Guide supports decoding of PD packets as per USB PD Specification Revision 3.0, V2.0 dated August 29, 2019.

1.1 Getting Started

This user guide describes the features of the EZ-PD Protocol Analyzer Utility and how to use it.

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 .

1.4 Document Conventions

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 pinstripes
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

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

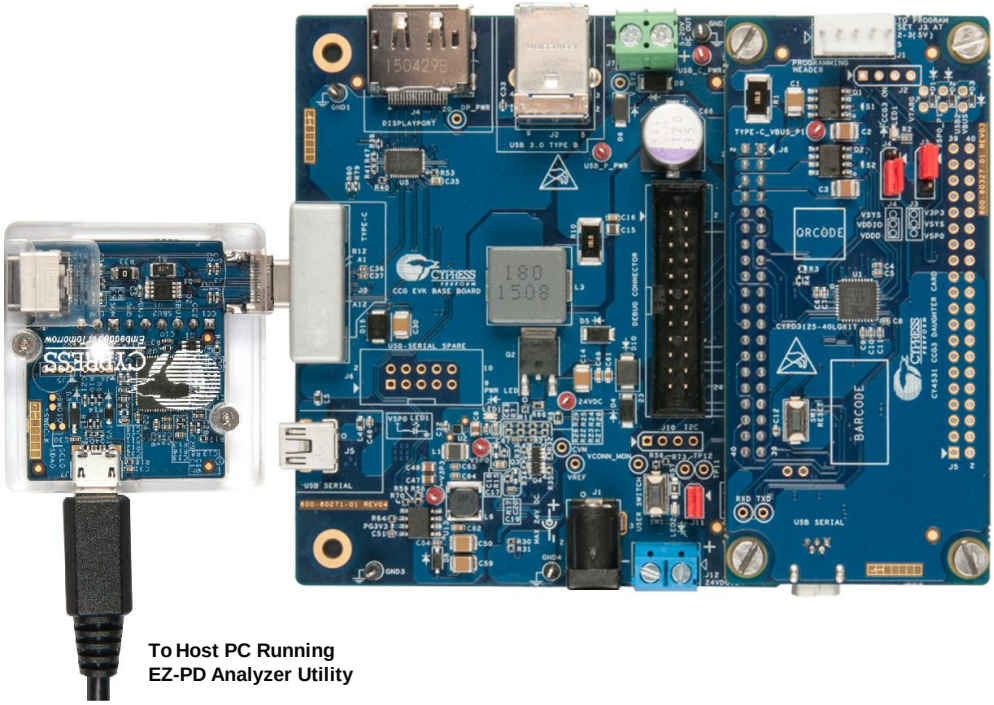
2. EZ-PD Protocol Analyzer Utility

2.1 EZ-PD Protocol Analyzer Utility GUI

Do the following to run the CY4500 EZ-PD Protocol Analyzer and capture the Power Delivery Packets on the CC bus:

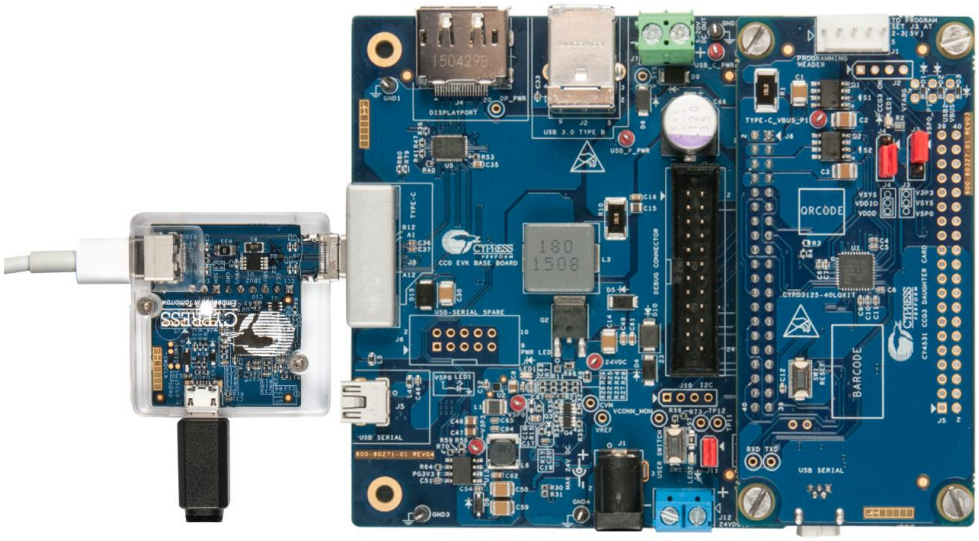
1. Using a USB Micro-B cable, connect the USB Micro-B receptacle (Connector J7) of the Protocol Analyzer board to the host PC. LED1 of the board starts blinking in white color.
2. Connect the USB Type-C plug (Connector J3) of the Protocol Analyzer board to the Type-C host device. In this user guide, the CY4531 EZ-PD CCG3 Evaluation Kit (EVK; not provided with this analyzer) is used as a Type-C host device as an example.
3. Verify that your setup looks similar to the image shown below:

Figure 1. Setup for Operating CY4500 EZ-PD Protocol Analyzer



4. Connect a USB Type-C power adapter (not provided with the analyzer) to the USB Type-C receptacle (Connector J2) of the Protocol Analyzer board. Verify that your setup looks similar to the image shown in Figure 2. The USB Type-C power adapter mentioned here is just an example. Any USB Type-C device can be used in its place.

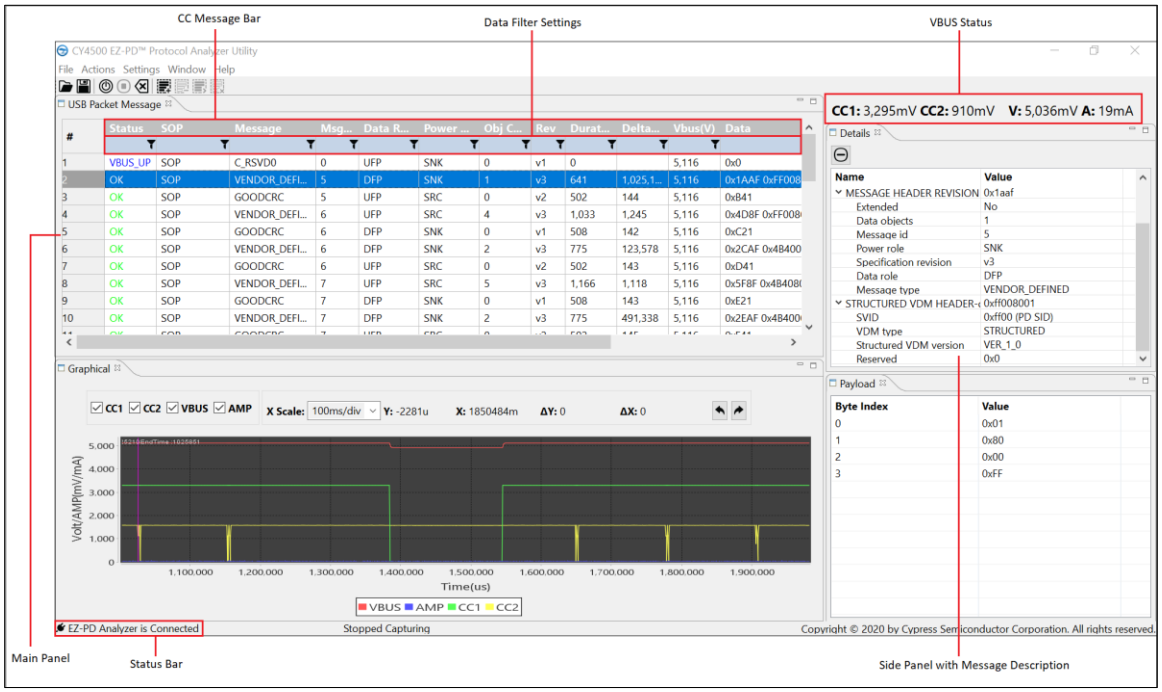
Figure 2. Completing the Setup for Operating the Protocol Analyzer



2.1.1 Windows

To start the Protocol Analyzer Utility tool, go to **Start** > **All Programs** > **Cypress** > **EZ-PD Protocol Analyzer Utility** > **CY4500 EZ-PD Protocol Analyzer Utility.exe**.

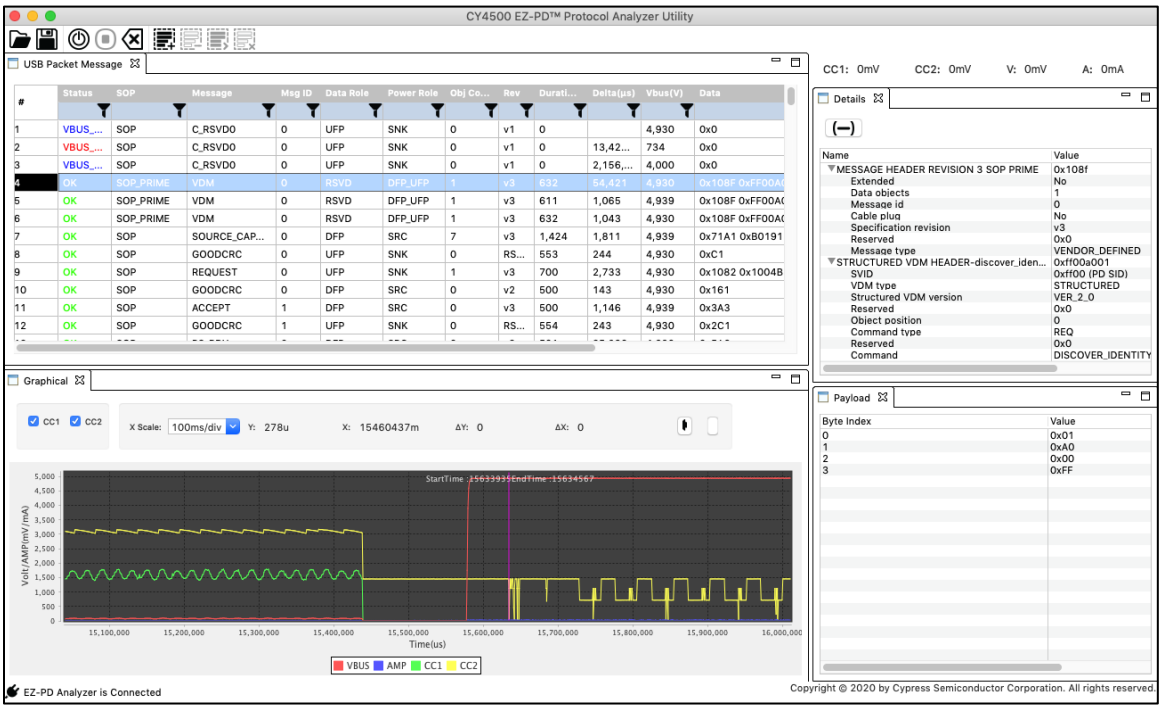
Figure 3. GUI Layout of EZ-PD Analyzer Utility



2.1.2 macOS

Extract *CY4500EZ-PD_Protocol_Analyzer_Macosx.zip*. Open **CY4500_EZ_PD_Protocol_Analyzer_Utility** to start the Protocol Analyzer Utility tool.

Figure 4. GUI Layout of the Utility in MacOS



2.1.3 Linux

In 64-bit system, use *CY4500EZ-PD_Protocol_Analyzer_Linux_x64.zip*; in 32-bit systems, use *CY4500EZ-PD_Protocol_Analyzer_Linux_x86.zip*. Extract the zip file and launch the terminal inside extracted folder.

Run one-time commands:

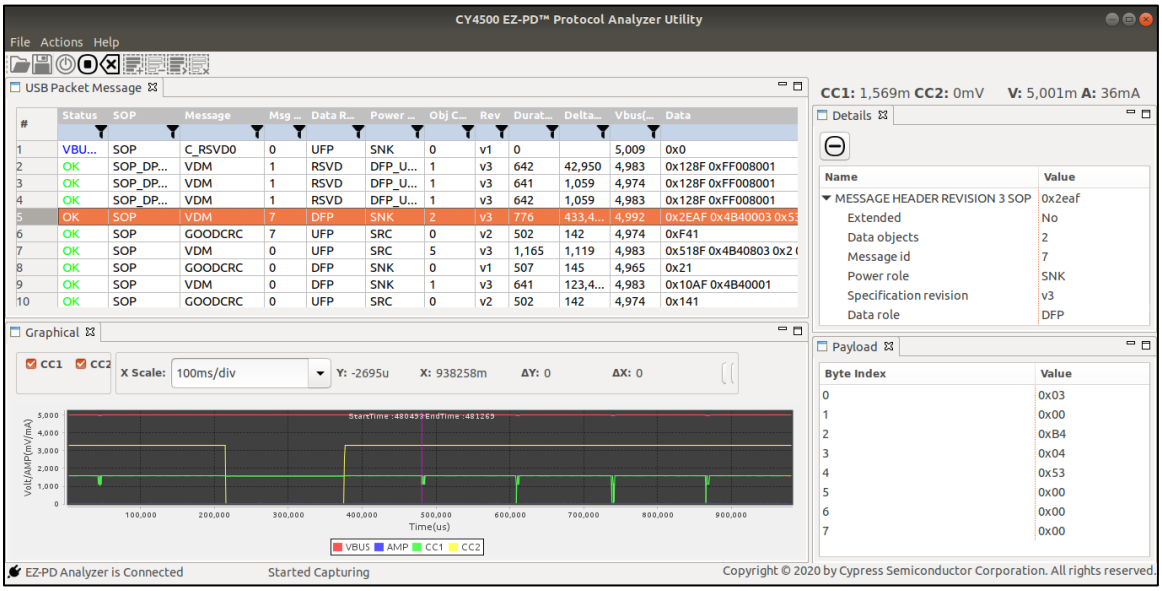
```
export SWT_GTK3=0
```

```
chmod a+x CY4500_EZ_PD_Protocol_Analyzer_Utility
```

To launch EZ-PD™ Protocol Analyzer Utility tool, run

```
sudo ./CY4500_EZ_PD_Protocol_Analyzer_Utility
```

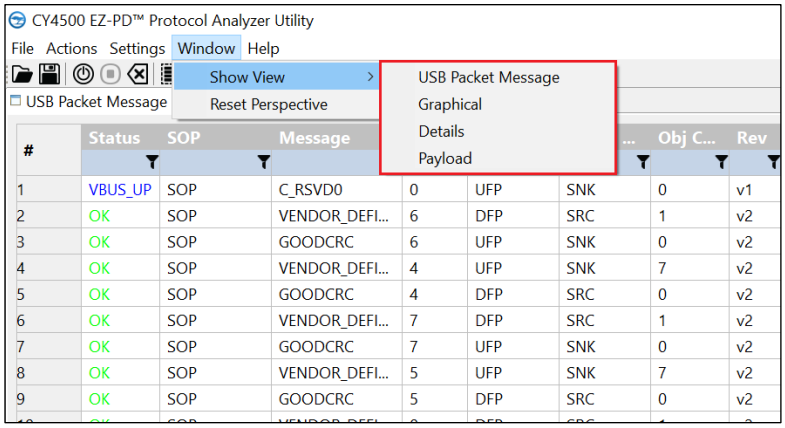
Figure 5. GUI Layout of the Utility in Ubuntu



2.1.4 Show View

To open View, click **Window > Show View** on the menu bar and select respective view from the menu items.

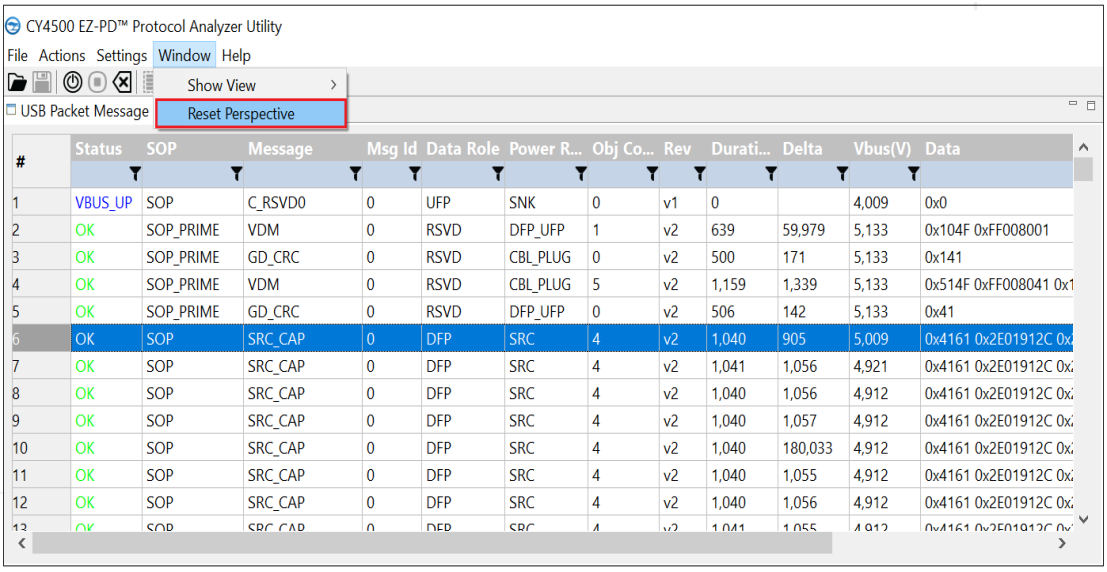
Figure 6. Show View



2.1.5 Reset Perspective

To rearrange the views to the default layout, select **Window > Reset Perspective**.

Figure 7. Reset Perspective menu of the Analyzer Utility



2.1.6 Go to Packets

To select PD message based on column value, select **Actions** > **Find Message** as shown in Figure 8 and Figure 9.

Figure 8. Find Message Menu

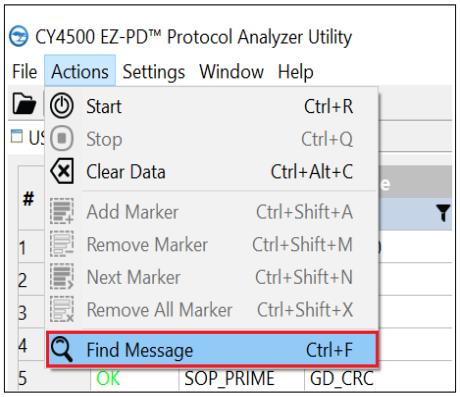
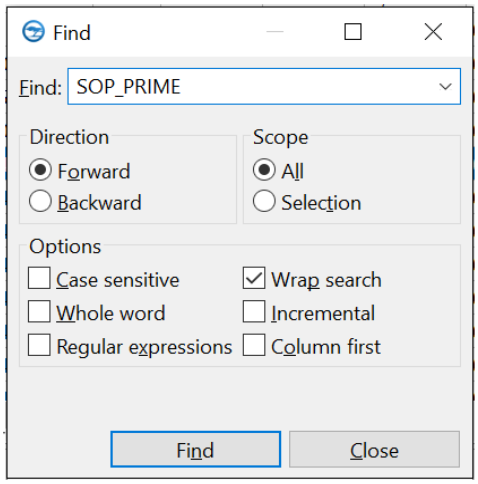


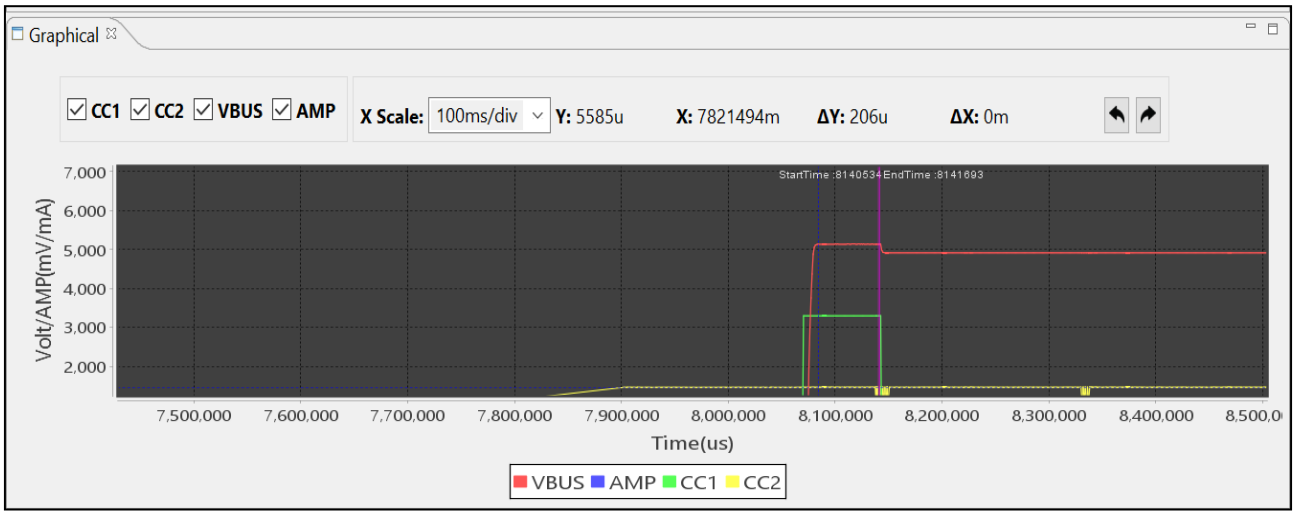
Figure 9. Find Message Dialog Box



2.1.7 Graphical View

Select **Window > Show View > Graphical**.

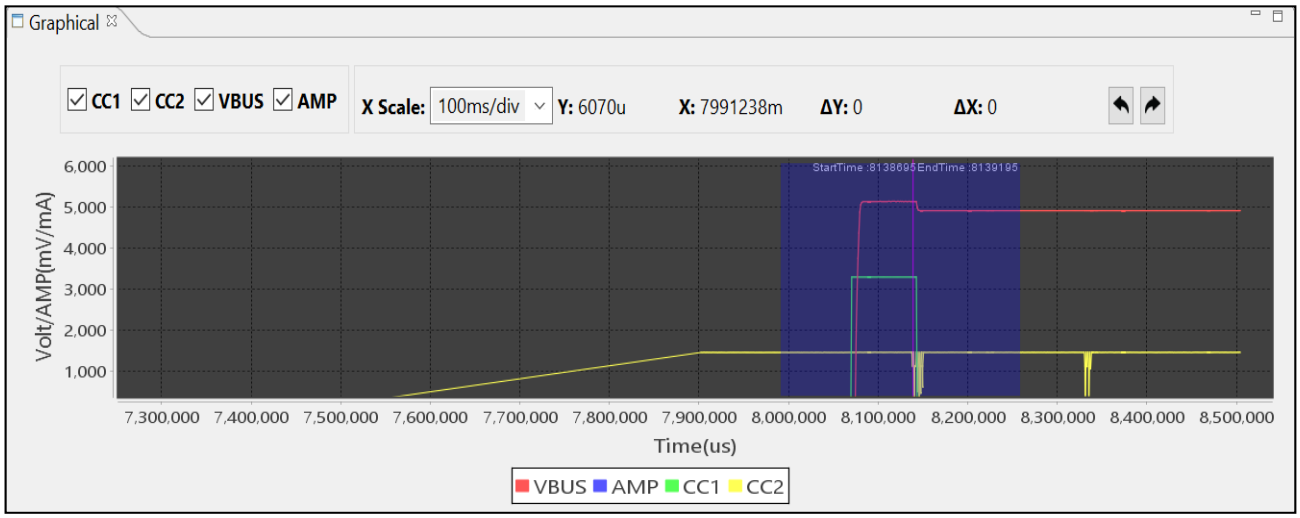
Figure 10. Graphical View



2.1.7.1 Zoom In

To zoom into the graph, select the area of interest by dragging the cursor from top left corner to bottom right corner which highlights the selected region in blue as shown in Figure 11.

Figure 11. Graph zoom-in

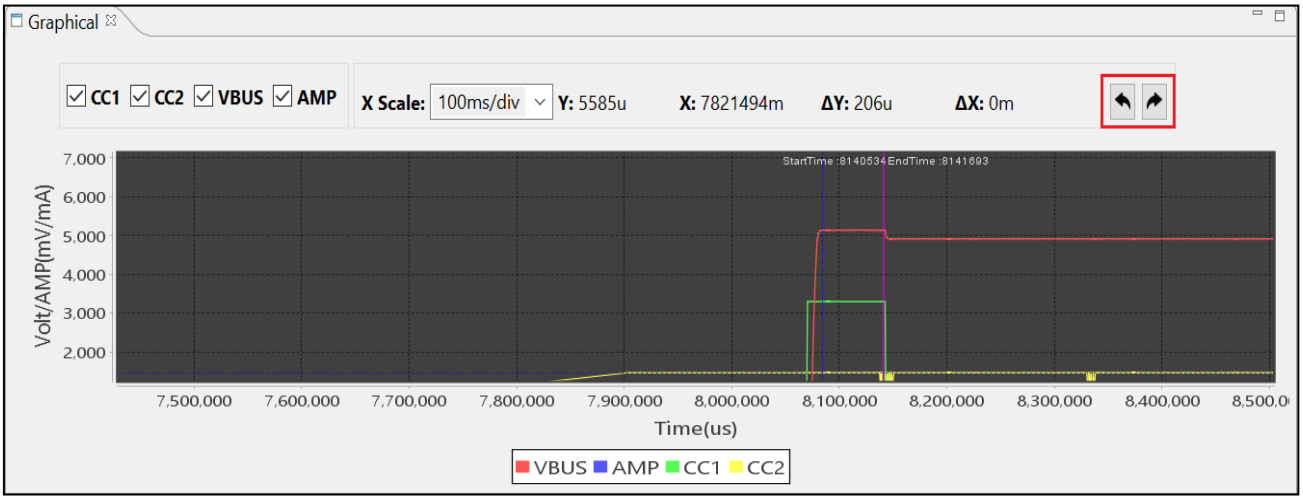


You can also zoom-in and zoom-out of the graph using the pinch-to-zoom technique.

2.1.7.2 Navigation

To navigate towards left or right of the graph over the Time axis, use the left and right arrow buttons respectively on the top right corner of the Graphical view window.

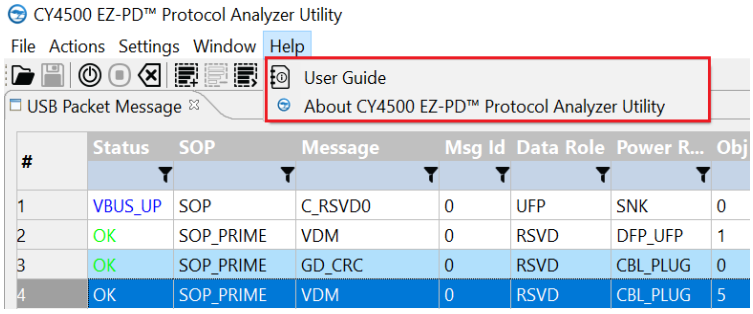
Figure 12. Graph navigating



2.1.8 Help View

You can access the User Guide of EZ-PD™ Protocol Analyzer Utility and get details about version of the tool from **Help** menu on menu bar as in Figure 13.

Figure 13. Help View



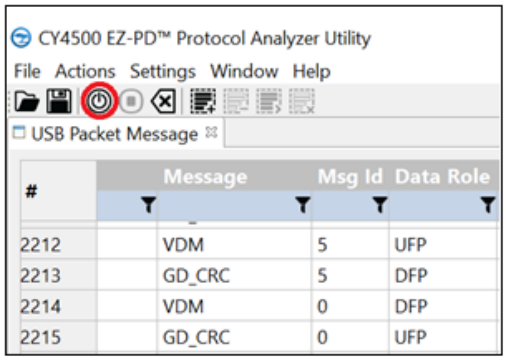
2.2 Capturing and Viewing PD Packets

Before capturing PD Packets, ensure that the CY4500 EZ-PD Protocol Analyzer hardware is connected and ready to use. Make sure that the message displayed on the status bar at the bottom shows "**EZ-PD Analyzer is connected**".

2.2.1 Capture PD Packets

Click **Start** on the tool bar or select **Actions > Start**.

Figure 14. Capturing PD Packets on the EZ-PD™ Analyzer Utility



The status bar indicates that the 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 15. Each of the PD packet displayed is assigned with a serial number (SL#).

Figure 15. PD Packets Captured Using the Analyzer Utility

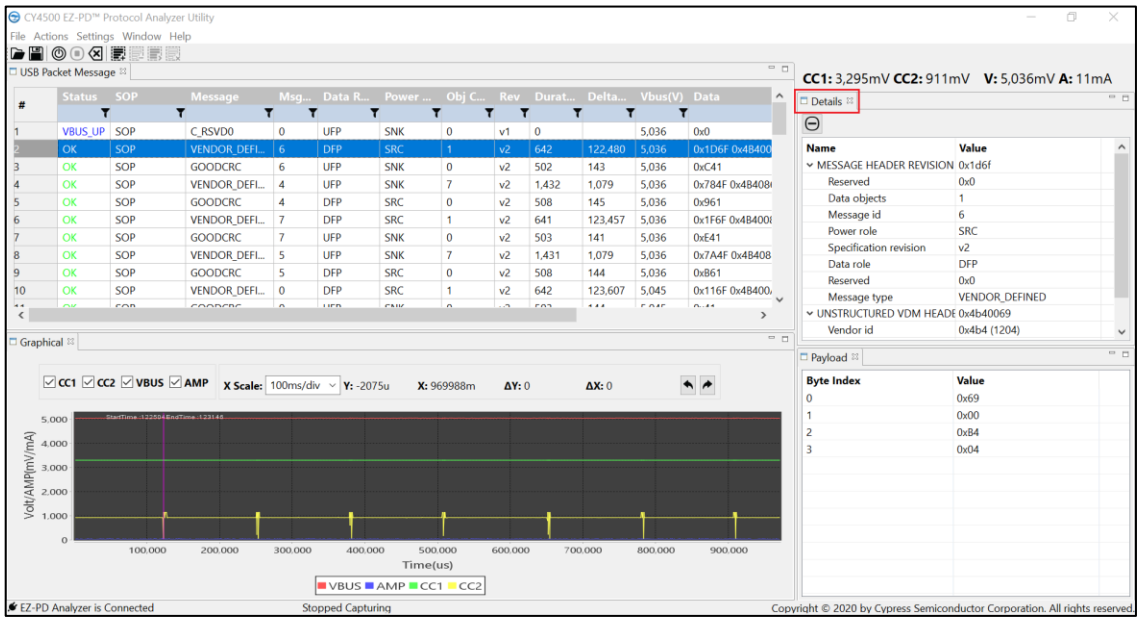


Table 1. Details of captured PD Packets

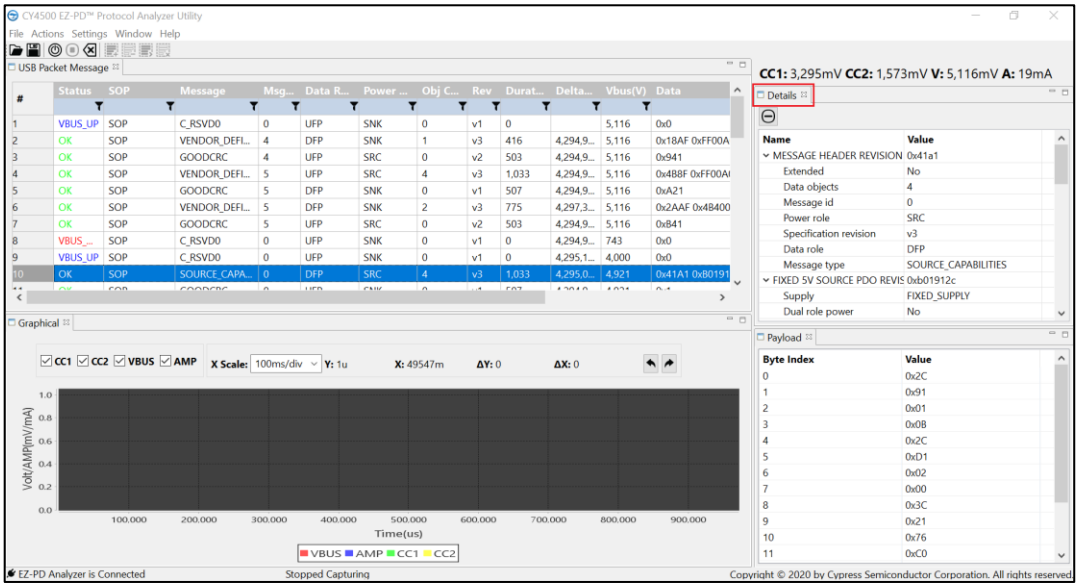
Field Name	Description
SL#	Message serial no.
Status	Overall status of the message
SOP	K-code marker used to delineate the start of the packet
Message	PD Message Type
Msg Id	Identifier for the message
Data Role	Current Data Role of the Port
Power Role	Current Power Role of the Port
Obj Count	Number of 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: VBUS status (Voltage and Current) is displayed live at the right top corner of the GUI if the Protocol Analyzer hardware is connected to the system (PC). The typical accuracy of the VBUS current displayed is +/- 0.15 A and the VBUS voltage displayed is +/- 1%.

2.2.2 View Packet Details

Click a PD packet in USB Packet Message window to view its details in the side panel under the **Details** View tab.

Figure 16. Details of the Selected PD Packet

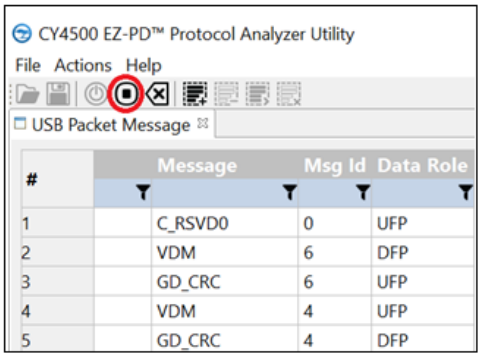


The **Details View** tab lists all the attributes of a selected PD packet. See Section 6 (Protocol Layer) of the USB PD Specification Revision 2.0, V1.2 to get more details about the type of PD messages (Control Messages and Data Messages) and their attributes.

2.2.3 Stop Packet Capture

Click the **Stop** icon in the tool bar or select **Actions** > **Stop.**

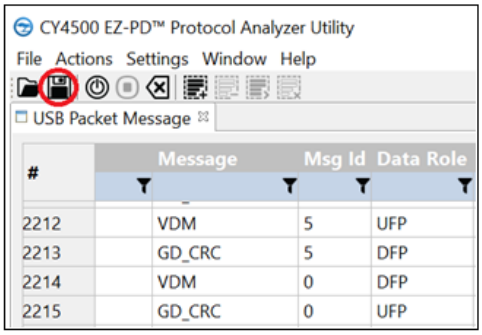
Figure 17. Stop Capturing PD Packets



2.2.4 Save PD Packets

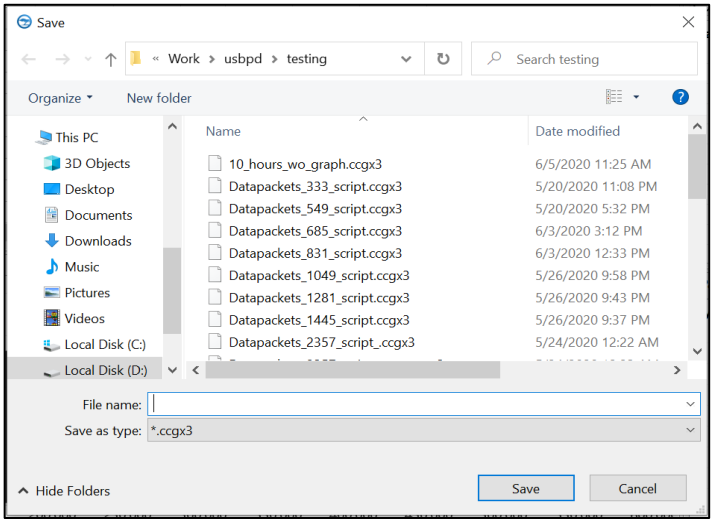
Click the **Save** icon in the tool bar or select **File** > **Save**.

Figure 18. Save PD Packets



The trace can be saved in *.ccgx3 file format:

Figure 19. File Formats for PD Packets



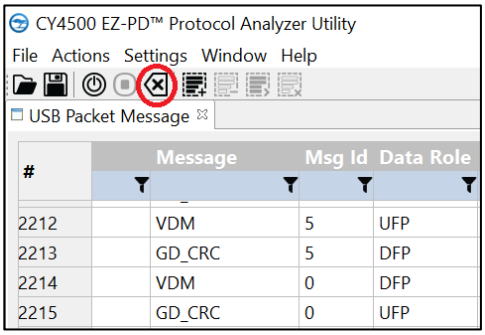
Note: *.ccgx3 file is a proprietary Cypress format. Files stored in this format can be opened using any XML editor.

2.2.5 Clear PD Packets

Click the **Clear** icon in the tool bar or select **Actions > Clear Data** to clear all the captured PD Packets.

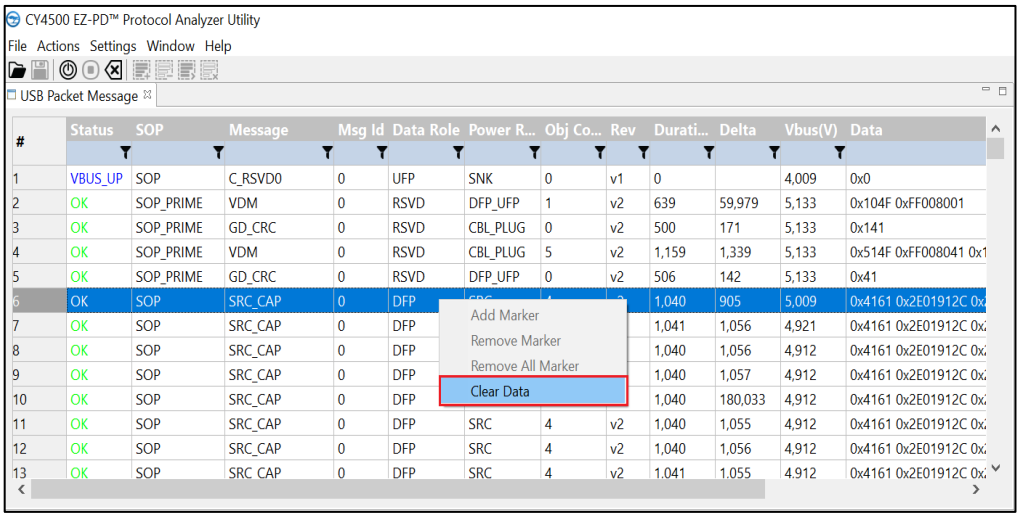
Clearing the PD packets resets the serial number (SL#) and the PD packets which are captured subsequently will start with SL# 1.

Figure 20. Clearing the Captured PD Packets



To clear the captured packets, right-click on the main panel and select **Clear Data**:

Figure 21. Clearing Captured PD Packets from the Main Panel



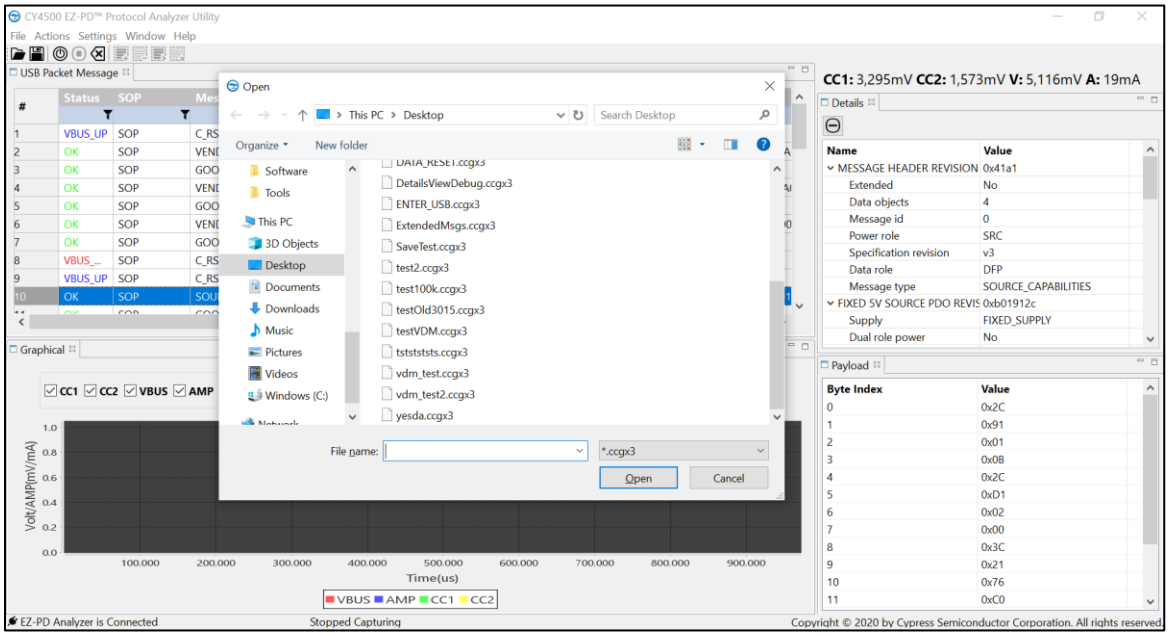
Note: If PD packets are received at the time of invoking **Clear Data**, the PD packets are displayed with a continuous serial number even after clearing the existing PD packets. Click **Clear Data** again to clear them and to reset the serial number for the PD packets to be captured subsequently.

2.3 Working with PD Packets

2.3.1 Open Saved PD Packet Files

The saved PD Packet files (*.ccgx3) can be viewed even when the Protocol Analyzer hardware is not connected to the PC. Click the **Open** button on the tool bar (or select **File > Open**). Browse and select the saved file.

Figure 22. Open Saved PD Packet Files



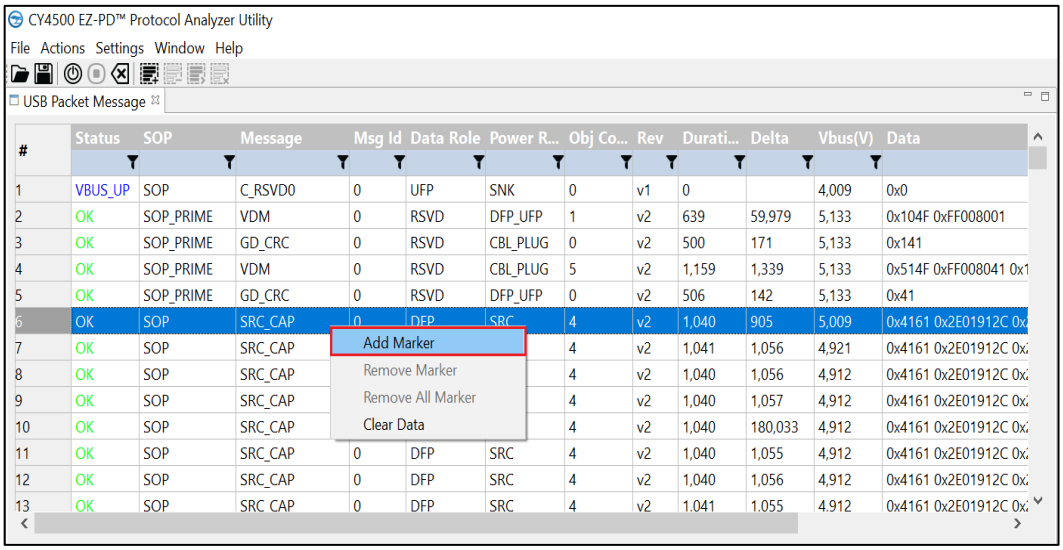
2.3.2 Mark PD Packets

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

Right-click on a packet and select **Add Marker** (or Add Marker in tool bar) . The marked packet gets highlighted in blue.

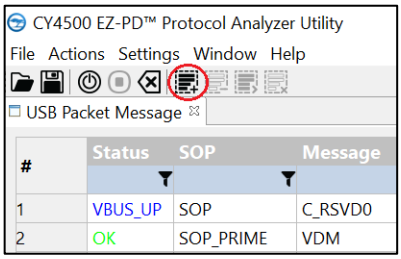
Note: The blue highlight is not shown if a marked packet is in selected state. De-select the marked packet by right-clicking another packet or by clicking on the side panel to see the highlighting in blue.

Figure 23. Adding Marker to PD Packets



#	Status	SOP	Message	Msg Id	Data Role	Power R...	Obj Co...	Rev	Durati...	Delta	Vbus(V)	Data
1	VBUS_UP	SOP	C_RSVD0	0	UFP	SNK	0	v1	0		4,009	0x0
2	OK	SOP_PRIME	VDM	0	RSVD	DFP_UFP	1	v2	639	59,979	5,133	0x104F 0xFF008001
3	OK	SOP_PRIME	GD_CRC	0	RSVD	CBL_PLUG	0	v2	500	171	5,133	0x141
4	OK	SOP_PRIME	VDM	0	RSVD	CBL_PLUG	5	v2	1,159	1,339	5,133	0x514F 0xFF008041 0x1
5	OK	SOP_PRIME	GD_CRC	0	RSVD	DFP_UFP	0	v2	506	142	5,133	0x41
6	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	905	5,009	0x4161 0x2E01912C 0x
7	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,041	1,056	4,921	0x4161 0x2E01912C 0x
8	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,056	4,912	0x4161 0x2E01912C 0x
9	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,057	4,912	0x4161 0x2E01912C 0x
10	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	180,033	4,912	0x4161 0x2E01912C 0x
11	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,055	4,912	0x4161 0x2E01912C 0x
12	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,056	4,912	0x4161 0x2E01912C 0x
13	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,041	1,055	4,912	0x4161 0x2E01912C 0x

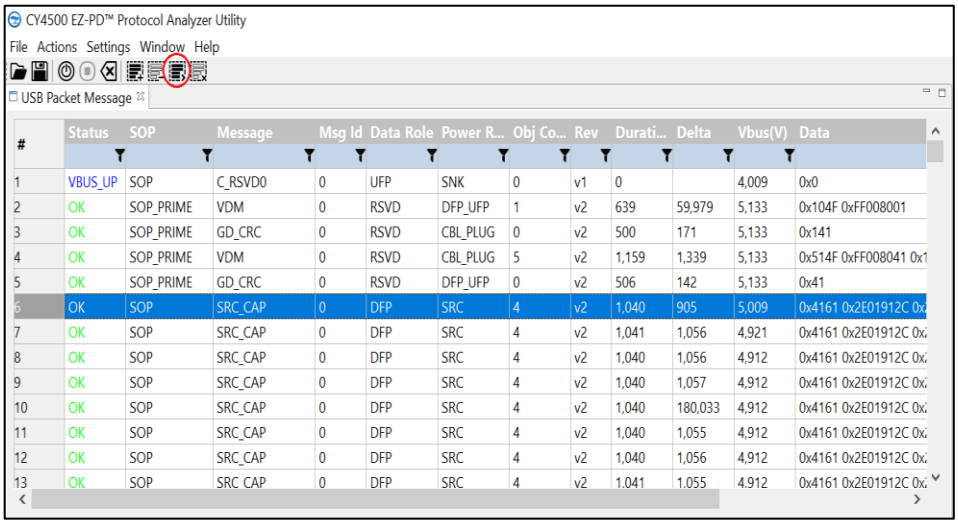
Figure 24. Adding Marker to PD Packets from Toolbar



2.3.3 Step Through Marked PD Packets

Click the **Next Marker** button on the toolbar (or select **Actions > Next Marker**) to step through marked packets.

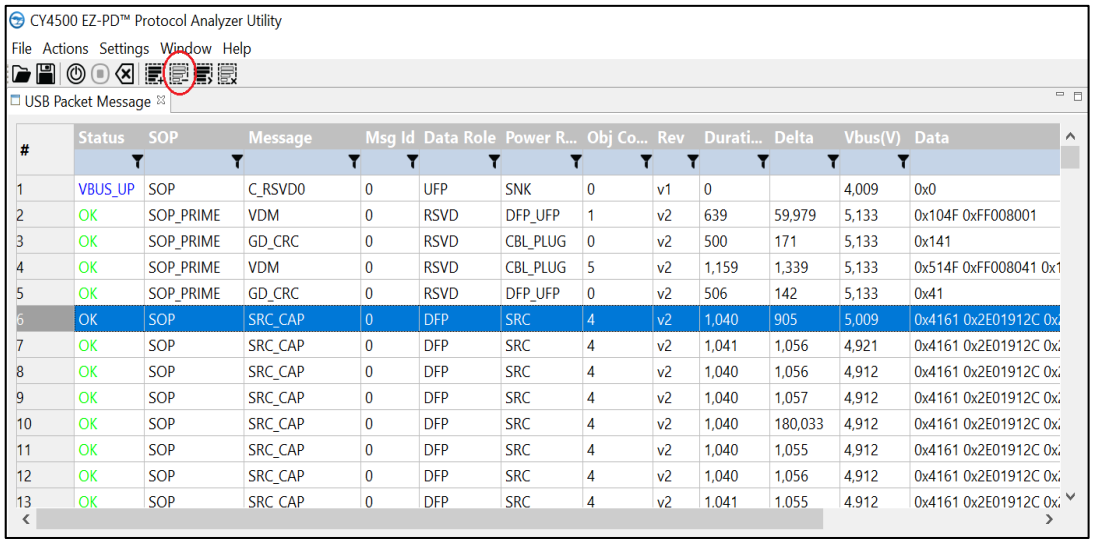
Figure 25. Accessing Marked PD Packets from the Next Marker Icon in the Toolbar



2.3.4 Remove Marker

Select the marked message and click **Remove Marker**.

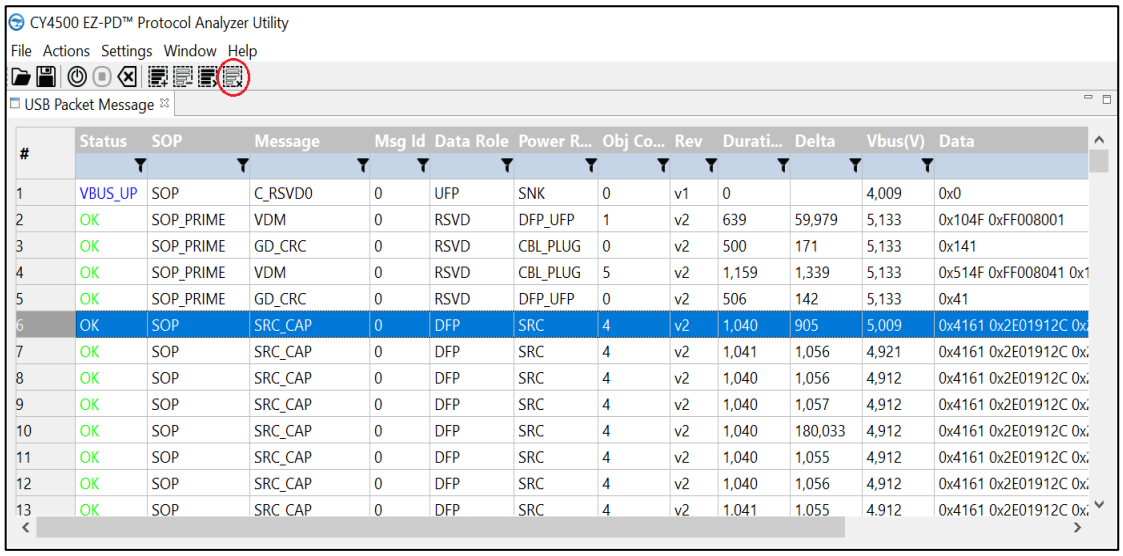
Figure 26. Removing a Marker



2.3.5 Remove All Markers

Click **Remove All Marker**.

Figure 27. Removing All Markers



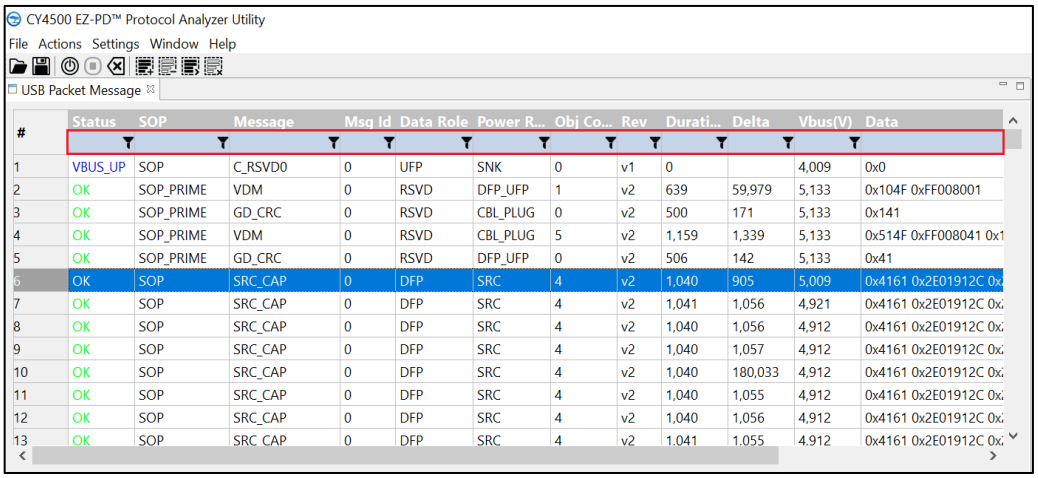
#	Status	SOP	Message	Msg Id	Data Role	Power R...	Obj Co...	Rev	Durati...	Delta	Vbus(V)	Data
1	VBUS_UP	SOP	C_RSVD0	0	UFP	SNK	0	v1	0		4,009	0x0
2	OK	SOP_PRIME	VDM	0	RSVD	DFP_UFP	1	v2	639	59,979	5,133	0x104F 0xFF008001
3	OK	SOP_PRIME	GD_CRC	0	RSVD	CBL_PLUG	0	v2	500	171	5,133	0x141
4	OK	SOP_PRIME	VDM	0	RSVD	CBL_PLUG	5	v2	1,159	1,339	5,133	0x514F 0xFF008041 0x1
5	OK	SOP_PRIME	GD_CRC	0	RSVD	DFP_UFP	0	v2	506	142	5,133	0x41
6	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	905	5,009	0x4161 0x2E01912C 0x
7	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,041	1,056	4,921	0x4161 0x2E01912C 0x
8	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,056	4,912	0x4161 0x2E01912C 0x
9	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,057	4,912	0x4161 0x2E01912C 0x
10	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	180,033	4,912	0x4161 0x2E01912C 0x
11	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,055	4,912	0x4161 0x2E01912C 0x
12	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,056	4,912	0x4161 0x2E01912C 0x
13	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,041	1,055	4,912	0x4161 0x2E01912C 0x

2.3.6 Use Packet Filters

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 28. While capturing PD packets, all possible values are displayed in these filters. When capture is stopped, only the values present in the captured trace will be displayed.

To filter data packets, enter the filter value in the appropriate field on the Data Filter bar.

Figure 28. Setting up a Data Filter

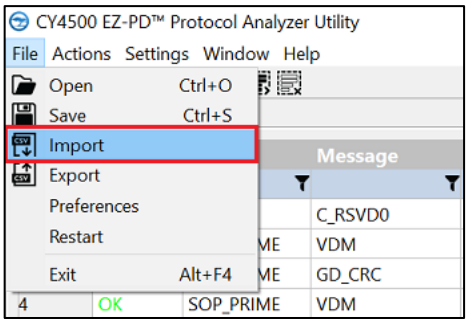


#	Status	SOP	Message	Msg Id	Data Role	Power R...	Obj Co...	Rev	Durati...	Delta	Vbus(V)	Data
1	VBUS_UP	SOP	C_RSVD0	0	UFP	SNK	0	v1	0		4,009	0x0
2	OK	SOP_PRIME	VDM	0	RSVD	DFP_UFP	1	v2	639	59,979	5,133	0x104F 0xFF008001
3	OK	SOP_PRIME	GD_CRC	0	RSVD	CBL_PLUG	0	v2	500	171	5,133	0x141
4	OK	SOP_PRIME	VDM	0	RSVD	CBL_PLUG	5	v2	1,159	1,339	5,133	0x514F 0xFF008041 0x1
5	OK	SOP_PRIME	GD_CRC	0	RSVD	DFP_UFP	0	v2	506	142	5,133	0x41
6	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	905	5,009	0x4161 0x2E01912C 0x
7	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,041	1,056	4,921	0x4161 0x2E01912C 0x
8	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,056	4,912	0x4161 0x2E01912C 0x
9	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,057	4,912	0x4161 0x2E01912C 0x
10	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	180,033	4,912	0x4161 0x2E01912C 0x
11	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,055	4,912	0x4161 0x2E01912C 0x
12	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,040	1,056	4,912	0x4161 0x2E01912C 0x
13	OK	SOP	SRC_CAP	0	DFP	SRC	4	v2	1,041	1,055	4,912	0x4161 0x2E01912C 0x

2.3.7 Import

Use the Import option to load the old tool data into current tool. It supports *.xlsx and *.csv format.

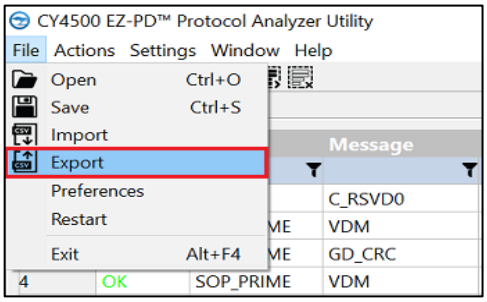
Figure 29. Import



2.3.8 Export

Use the Export option to save the data in *.csv format.

Figure 30. Export



2.3.9 Preference

There are two preference options:

- Multiple device support: If the user machine is connected with multiple devices, you can choose the device.
- Graph data enable/disable support: Enable or disable graph data loading using this option.

Figure 31. Preference Menu

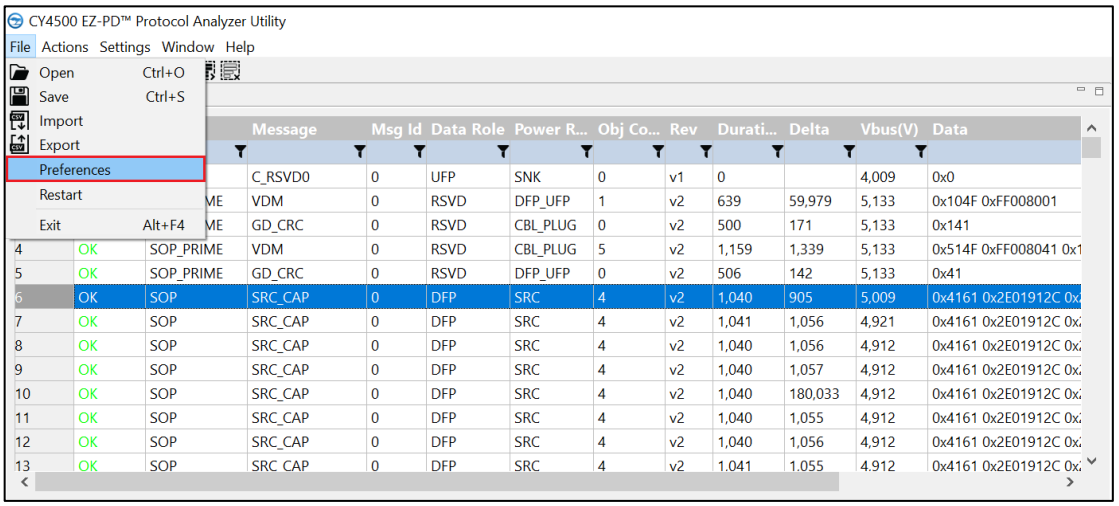
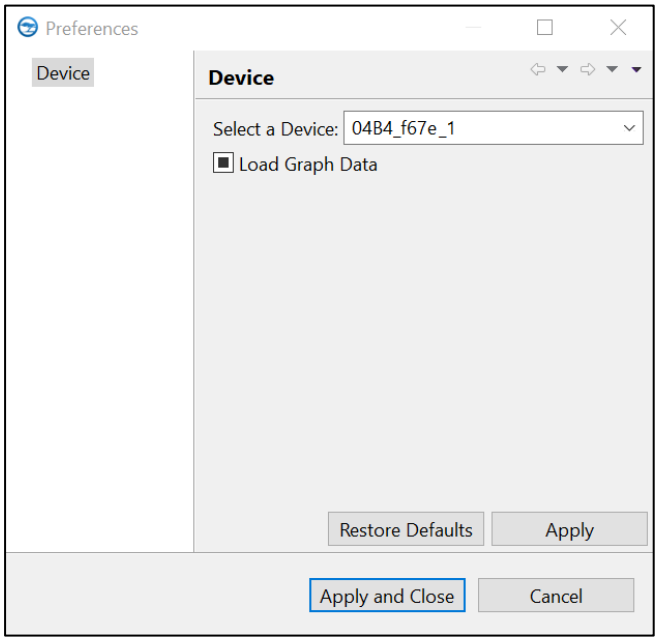


Figure 32. Preference Page

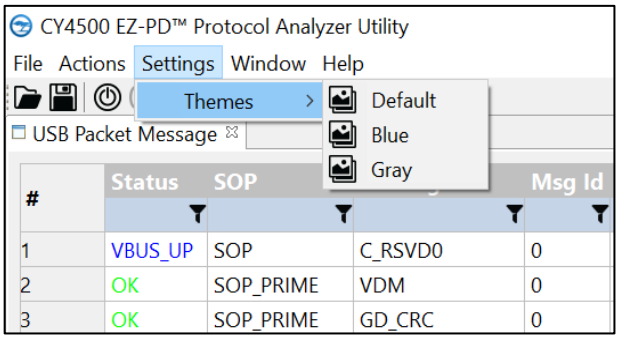


2.4 Working with Themes

2.4.1 Themes

The Analyzer GUI has three different themes: default, blue, and gray.

Figure 33. Theme Option in Settings



2.5 Upgrade Firmware

The Protocol Analyzer hardware comes with the latest firmware pre-installed during manufacturing. However, if a new firmware version is available, the analyzer can be updated manually using the Firmware update tool provided in the package.

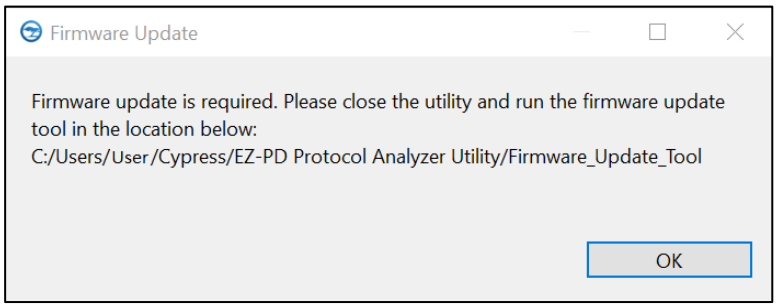
On the host PC, launch the EZ-PD Protocol Analyzer Utility using the steps provided in Section 2.1.1 . Ensure that the Protocol Analyzer hardware is connected.

Start capture by selecting **Actions > Start**. If the analyzer has an old firmware, a Firmware Update dialog box appears as shown in Figure 34. Update the firmware of the analyzer using the Firmware Update tool (EZPD_Firmware_Update_Tool.exe) available at the following location:

<Install Directory>\EZ-PD Protocol Analyzer Utility\Firmware_Update_Tool.

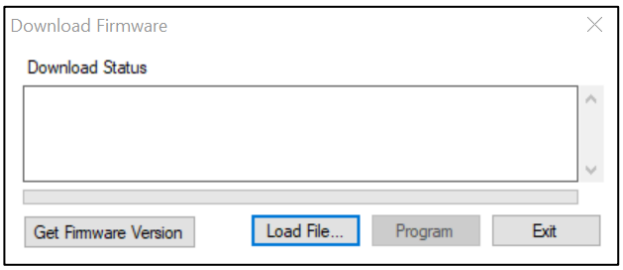
The firmware update tool is available only on Windows.

Figure 34. Firmware Update Dialog Box in Windows



The GUI of the Firmware Update tool is as shown in Figure 35.

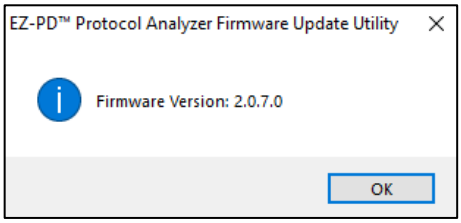
Figure 35. GUI of Firmware Update Tool



The firmware update tool can be used to:

1. Retrieve the current firmware version:
    a. Click **Get Firmware version**.
    b. Wait for the firmware version dialog box to appear as shown in Figure 36:

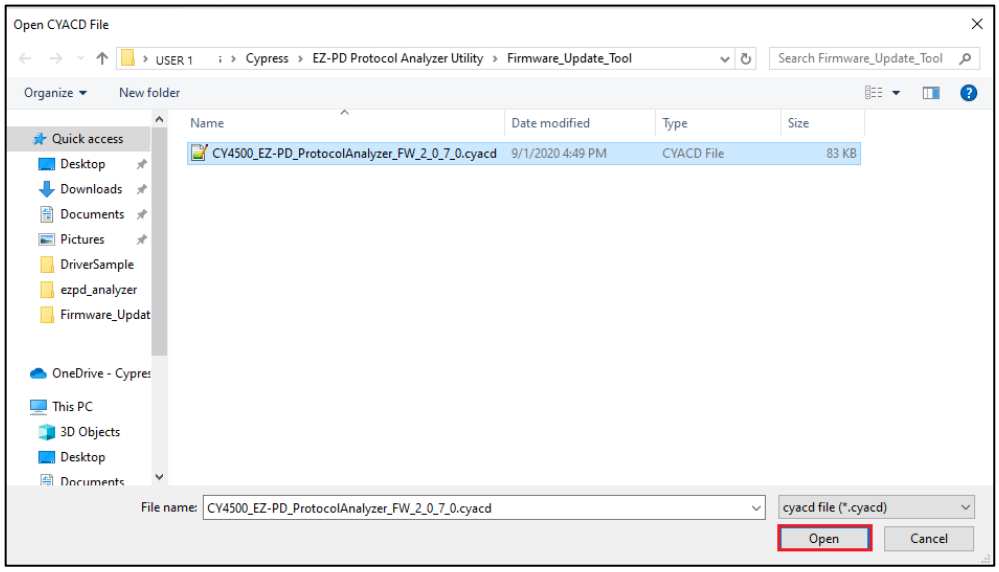
Figure 36. Firmware Version Dialog Box



2. Update the CY4500 EZ-PD Protocol Analyzer firmware:
    a. Click **Load File…** and select the CY4500 firmware file in .cyacd format as shown in Figure 37. Click **Open**.

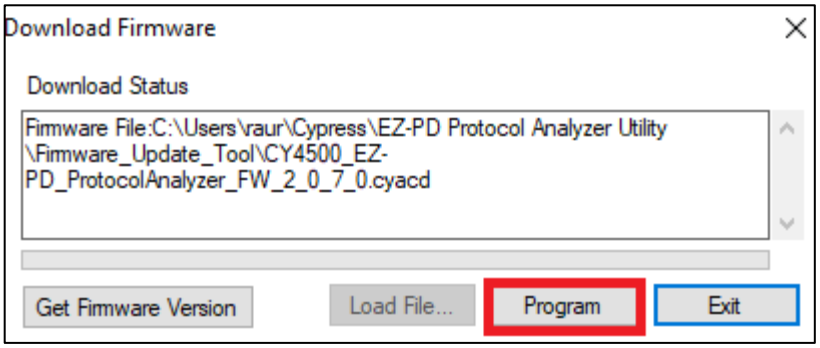
    The binary file provided with the utility is available at the following location *<Install Directory>\EZ-PD Protocol Analyzer Utility\Firmware_Update_Tool*.

Figure 37. Selecting the CY4500 Firmware File



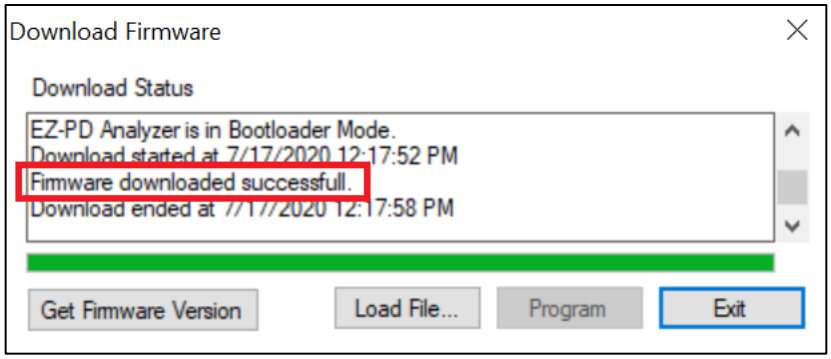
b. Click **Program** to initiate the firmware download process as shown in Figure 38.

Figure 38. Initiating Firmware Download



c. This starts the firmware download process. Click **Exit** when complete as shown in Figure 39.

Figure 39. Completion of Firmware Download



d. The steps to update the firmware are now complete. The CY4500 EZ-PD Protocol Analyzer hardware restarts with the new firmware used in step a and is ready to use.

3. Troubleshooting Guide

Problem	Possible Cause	Possible Solution
When the 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 contacts, or the Type-C device is not inserted properly into the Protocol Analyzer hardware.	Check the Type-C plug for any abnormality for loose contacts. Insert the Type-C device under test or cable fully inside the CY4500 Hardware.
Unable to start PD capture.		Restart the EZ-PD Protocol Analyzer Utility tool.
Unable to run the Protocol Analyzer Utility tool	Version of Java installed may not be compatible	Check the Java version installed in the system. Install Java 8 if any other version is installed in the system. If more than one version of Java is installed, make sure that Java 8 is used by default

Revision History

Document Title: EZ-PD Protocol Analyzer Utility User Guide Document Number: 002-30697		
Revision	Issue Date	Description of Change
**	01/07/2020	Initial Release.
*A	09/04/2020	Added EZ-PD™ Protocol Analyzer usage steps Added Figure 1 and Figure 2. Added steps to open EZ-PD™ Protocol Analyzer Utility in different operating systems Added Figure 4 and Figure 5. Added details about enhancements in Packet Filters under section 2.3.6 Added steps to troubleshoot when user is not able to launch EZ-PD™ Protocol Analyzer Utility tool Updated Firmware Upgrade section in 2.5 Added Figure 34 and Figure 35.