

User Manual for GRL USB Type C Power Delivery Performance Analyzer (GRL-USB-PD-A1)



This material is provided as a reference to install Rev 1.07.03 of Granite River Labs (GRL) USB-PD Type-C™ Power Delivery Performance Analyzer A1 Software.

For software support, contact support@graniteriverlabs.com.

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1 Overview

GRL-USB-PD-A1 can be used to analyze behavior between any USB Type-C based device like Apple Mac's, Chromebooks and Android phones, Thunderbolt 3 docks, DisplayPort adapters, Qualcomm Quick Charge AC adapters, USB PD power banks, Cable E-Markers, etc. Using passive adapters, the GRL-USB-PD-A1 can also check for power and USB Power Delivery protocol communication over Apple Lightning connectors, and analyze charging behavior over USB micro-B and Type-A connectors.

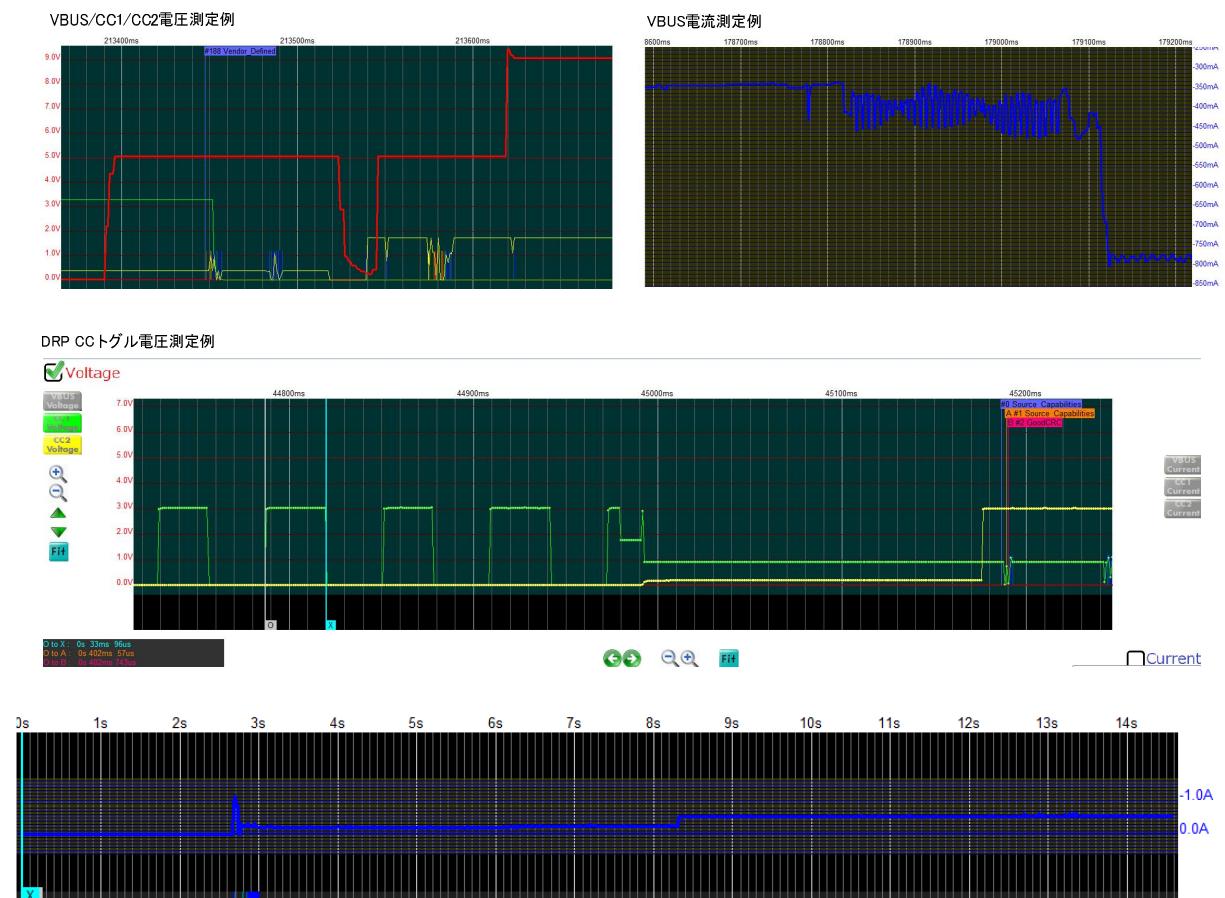
GRL-USB-PD-A1 Analyzer connected between two USB Type-C™ devices captures the voltage / current information of the VBUS / CC / VCONN signals exchanged between the USB Type-C™ devices. The captured data is transmitted to the control PC connected to the USB Micro-B port. The GRL-USB-PD-A1 software decodes the captured data and gives a graphical representation of the voltage and current signals captured.

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1.1 Features

1.1.1 Voltage and Current of VBUS / CC1 / CC2 Signal Analysis

The VBUS / CC1 / CC2 signal can be measured to the precision of 1 millisecond accuracy. The software performs a detailed analysis of Power Delivery message, VBUS voltage and Current change.



1.1.2 Power Delivery Message Decode

The contents of the captured PD messages are displayed in detail in accordance with the USB PD Specification.

PDメッセージヘッダ詳細表示例

#	Timestamp	CH	OS	Power	Data	Type	Mes...	Description
21	45s 361ms 725us	CC1	SOP	Source	UFP	Source_Capabilities	0	[1]<Fixed> 5000[mV]/3000[mA] (Dual-Role Power)/(ExPowered)/(USB Communications/D
22	45s 362ms 826us	CC1	SOP	Sink	DFP	GoodCRC	0	
23	45s 363ms 910us	CC1	SOP	Sink	DFP	Request	6	Position=4 (Operating Current=1500[mA])(Max Operating Current=1500[mA])(USB Comn
24	45s 364ms 601us	CC1	SOP	Source	UFP	GoodCRC	6	
25	45s 365ms 349us	CC1	SOP	Source	UFP	Accept	1	

Offset	Length	Field name	Value	Description	HEX	ASCII
0..4	5	Message Type	01h (1)	Source_Capabilities	01	.
5	1	Port Data Role	0h (0)	UFP	00	.
6..7	2	Specification Revision	1h (1)	Revision 2.0	01	.
8	1	Port Power Role	1h (1)	Source	01	.
9..11	3	MessageID	0h (0)		00	.
12..14	3	Number of Data Objects	4h (4)		04	.
15	1	Extended	0h (0)	Control or Data Message	00	.

Source_Capabilities Power Data Object 詳細表示例

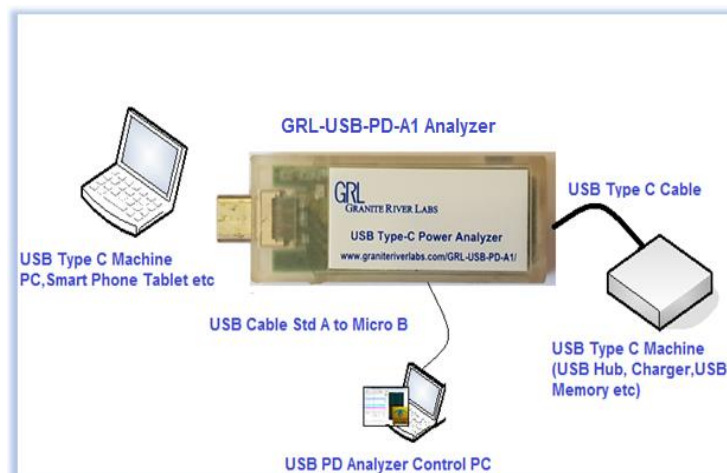
#	Timestamp	CH	OS	Power	Data	Type	Mes...	Description
21	45s 361ms 725us	CC1	SOP	Source	UFP	Source_Capabilities	0	[1]<Fixed> 5000[mV]/3000[mA] (Dual-Role Power)/(ExPowered)/(USB Communications)/(Data Role Swap
22	45s 362ms 826us	CC1	SOP	Sink	DFP	GoodCRC	0	
23	45s 363ms 910us	CC1	SOP	Sink	DFP	Request	6	Position=4 (Operating Current=1500[mA])(Max Operating Current=1500[mA])(USB Commnications Cap
24	45s 364ms 601us	CC1	SOP	Source	UFP	GoodCRC	6	
25	45s 365ms 349us	CC1	SOP	Source	UFP	Accept	1	

Offset	Length	Field name	Value	Description	HEX	ASCII
0..9	10	Maximum Current in 10mA units	12Ch (300)	3000 [mA]	2C 01	..
10..19	10	Voltage in 50mV units	12Ch (300)	15000 [mV]	2C 01	..
20..21	2	Peak Current	0h (0)		00	.
22..23	2	Reserved	0h (0)		00	.
24	1	Unchunked Extended Messages Supported	0h (0)		00	.
25	1	Dual-Role Data	0h (0)		00	.
26	1	USB Communications Capable	0h (0)		00	.
27	1	Externally Powered	0h (0)		00	.
28	1	USB Suspend Supported	0h (0)		00	.
29	1	Dual-Role Power	0h (0)		00	.
30..31	2	Fixed supply	0h (0)	Fixed supply (Vmin=Vmax)	00	.

PD/パケットのPreamble, BMC 詳細情報表示例

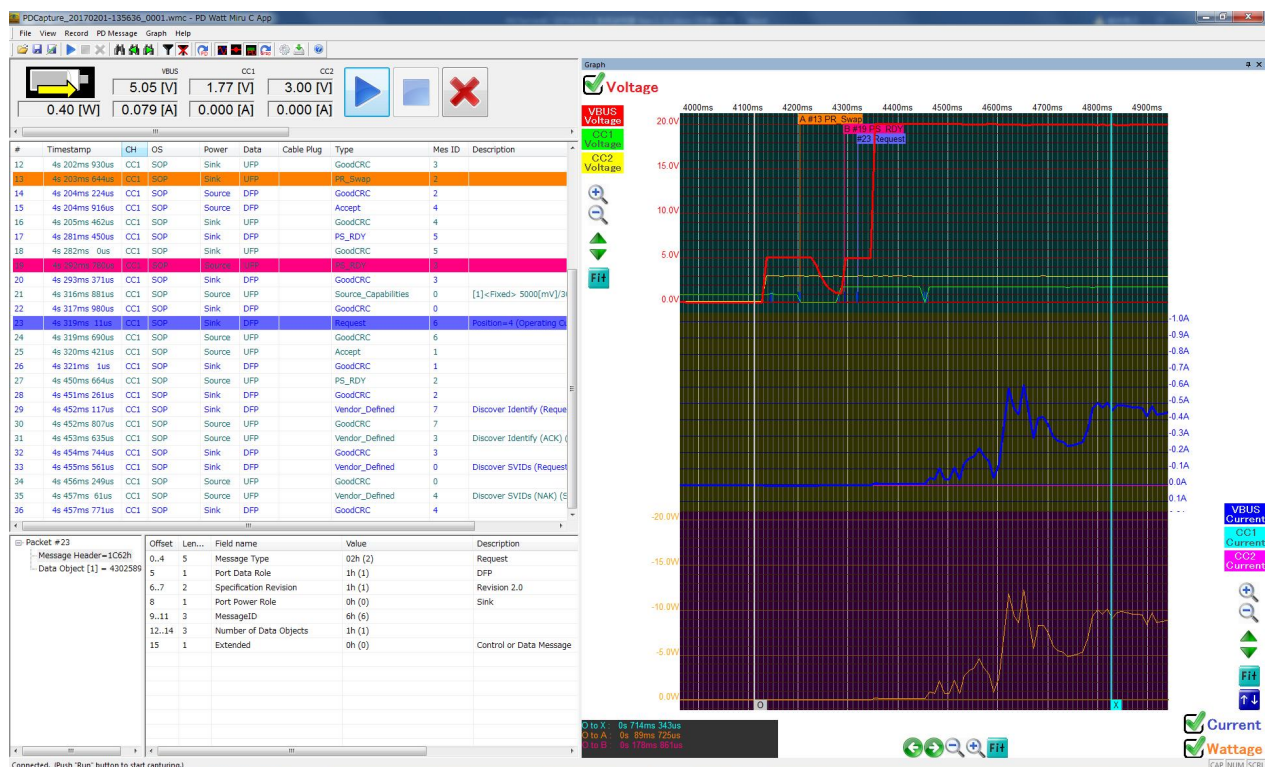
Edges	Ave.UI[us]	Preamble...	BMC	Payload	CRC	Message Bytes (HEX)	Message Bytes (ASCII)
481	3.247	64	01010101010101010101010101...	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]1414C21910E2C21D2000C21B4000C214600023D43...	96034D32h	41 41 2C 91 01 2E 2C D1 02 ...	AA.....A..
228	3.307	64	01010101010101010101010101...	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]16009184F3D3[EOP]	3D3F4819h	61 00	a.
288	3.307	64	01010101010101010101010101...	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]26C1698520349A6C9867[EOP]	7689C6A9h	62 1C 96 58 02 43	b..X.C
233	3.254	64	01010101010101010101010101...	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]14D06001A06D[EOP]	D60A1006h	41 0D	A.
229	3.247	64	01010101010101010101010101...	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]343038F54830[EOP]	03845F83h	43 03	C.
226	3.313	64	01010101010101010101010101...	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]16205392133D[EOP]	D3312935h	61 02	a.
233	3.254	64	01010101010101010101010101...	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]164503FE00979[EOP]	97900EF3h	46 05	F.
228	3.307	64	01010101010101010101010101...	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]164000C825A3[EOP]	3A528C00h	61 04	a.
298	3.307	64	01010101010101010101010101...	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]16F6F1108B00FF7A6A833FE0D1	F33BA6A7h	AF 1F 01 80 00 FF	o

1.2 Connection image



1.3 Power Delivery Protocol Analysis View

The image below shows the detailed view of PD Message decode and corresponding CC-Line, VBus and Current measurement.



2 Revision Record

Version	Revision Date	Description of Changes	Author(s)
1.0.0	1/12/2017	Added Sections 1 to 6	sky@graniteriverlabs.com
1.0.5	27/9/2018	Modified LED States (Section 5.4)	gpong@graniteriverlabs.com

3 Specification

3.1 Supported USB Type-C™ / Power Delivery Standard

- Universal Serial Bus Type-C™ Cable and Connector Specification Revision 1.2
- Universal Serial Bus Power Delivery Specification Revision 2.0, V1.2
- Universal Serial Bus Power Delivery Specification Revision 3.0, V 1.0a
- Universal Serial Bus Power Delivery Firmware Update Specification Revision 1.0
- Universal Serial Bus Type-C™ Authentication Specification Revision 1.0
- VESA DisplayPort Alt Mode on USB Type-C Standard Ver.1.0a

3.2 USB Type-C™ VBUS / CC / VONN signal monitoring function

- Corresponding VBUS voltage: 0 to 20.0 V (resolution about 10 mV)
- Corresponding VBUS current: 0 to 5.0 A (resolution about 1 mA)
- Corresponding CC 1 / CC 2 voltage: 0 to 5.0 V (Resolution about 10 mV)
- Corresponding CC 1 / CC 2 current: 0 to 1.2 A (resolution about 1 mA)
- Sampling cycle: Approximately 1 to 1000 ms (can be specified by application)

3.3 GRL-USB-PD-A1 Analyzer Dimensions and Weight

- External dimensions: W 21.8 X L 61.6 X H 8.3 ± 0.2 mm
- Mass: 16 g

3.4 GRL-USB-PD-A1 Analyzer Electrical specifications

- Supply voltage: DC + 5.0V ± 10%
- Device consumption current: 32.0 mA (Typical value during operation)

3.5 GRL-USB-PD-A1 Analyzer Environment specification

- Operating temperature range: 5 ~ + 40 °C
- Operating humidity range: 35 to 85% RH (with no condensation)
- Restriction on the use of hazardous substances: REACH, RoHS

3.6 GRL-USB-PD-A1 Analyzer Protocol Analysis Host PC Operating Environment

- Supported PC: Windows® PC with USB host
- Supported OS: Windows® 7/8 / 8.1 / 10 (32 bit / 64 bit)
- Hard disk for saving captured data, mouse, keyboard, display mounted mandatory

4 Set Contents

4.1 Hardware components

- GRL-USB-PD-A1 Analyzer body
- USB cable connecting controller to the host PC is not included in the product. Please prepare separately.

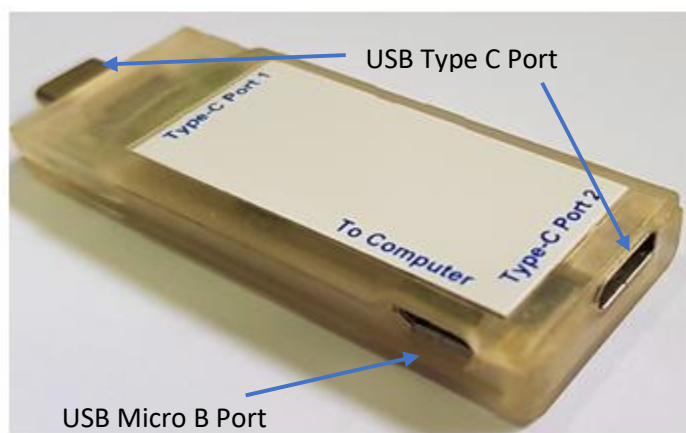
4.2 Software Components

- GRL-USB-PD-A1 Analyzer application executable file "· USB-PD-A1.exe"
- GRL-USB-PD-A1 Analyzer Instruction Manual (this book)

Please download the latest software from the following link

<http://graniteriverlabs.com/usb-type-ctm-power-delivery-performance-analyzer-grl-usb-pd-a1/>

5 Appearance



5.1 USB Type-C™ Plug connector

To connect a USB Type-C™ device that performs PD protocol analysis.

5.2 USB Type-C™ Receptacle connector

To connect a USB Type-C™ device that performs PD protocol analysis.

5.3 USB Micro-B connector

To connect the control PC for GRL-USB-PD-A1 Analyzer viewer.

5.4 Status Indicator LED

5.4.1 LED State Description

LED State	Description
Both OFF □ □	No VBUS is detected or VBUS is less than 1V.
Blue ON Green OFF ◆ □	VBUS is detected as more than 1V. VBUS current more than 10mA flows from Receptacle -> Plug.
Blue OFF Green ON □ ◆	VBUS is detected as more than 1V. VBUS current more than 10mA flows from Plug -> Receptacle.
Both ON ◆ ◆	VBUS is detected as more than 1V. Less than 10mA flows on VBUS.

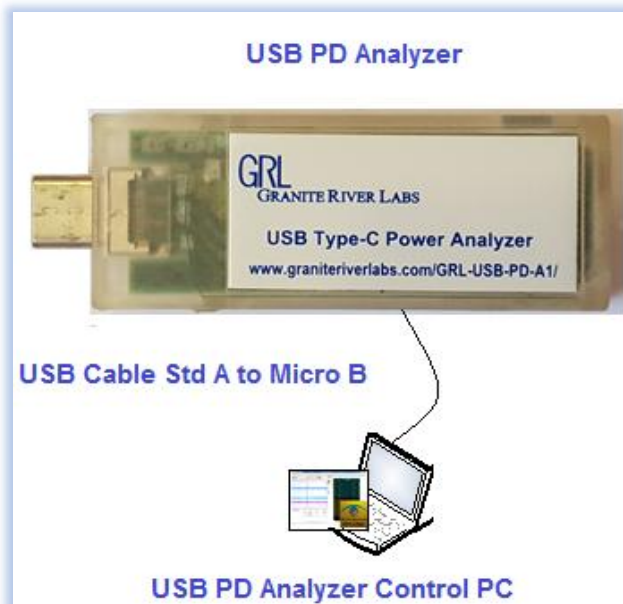
6 Installation method

Download the GRL-USB-PD-A1 software installer from the below link to the Control PC. Double click the installer and follow the screen instructions to complete software installation. Ensure to have sufficient space on the hard disk.

6.1 Connection of GRL-USB-PD-A1 Analyzer to Control PC

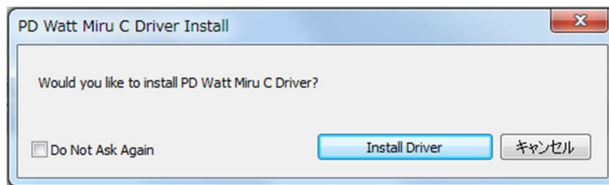
Please connect the micro-B USB port of GRL-USB-PD-A1 Analyzer to the USB port of Control PC with USB cable.

6.1.1 Connection diagram for the software installation

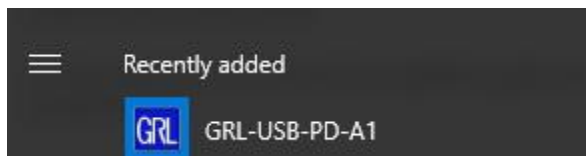


6.2 GRL-USB-PD-A1 Analyzer Driver Installation

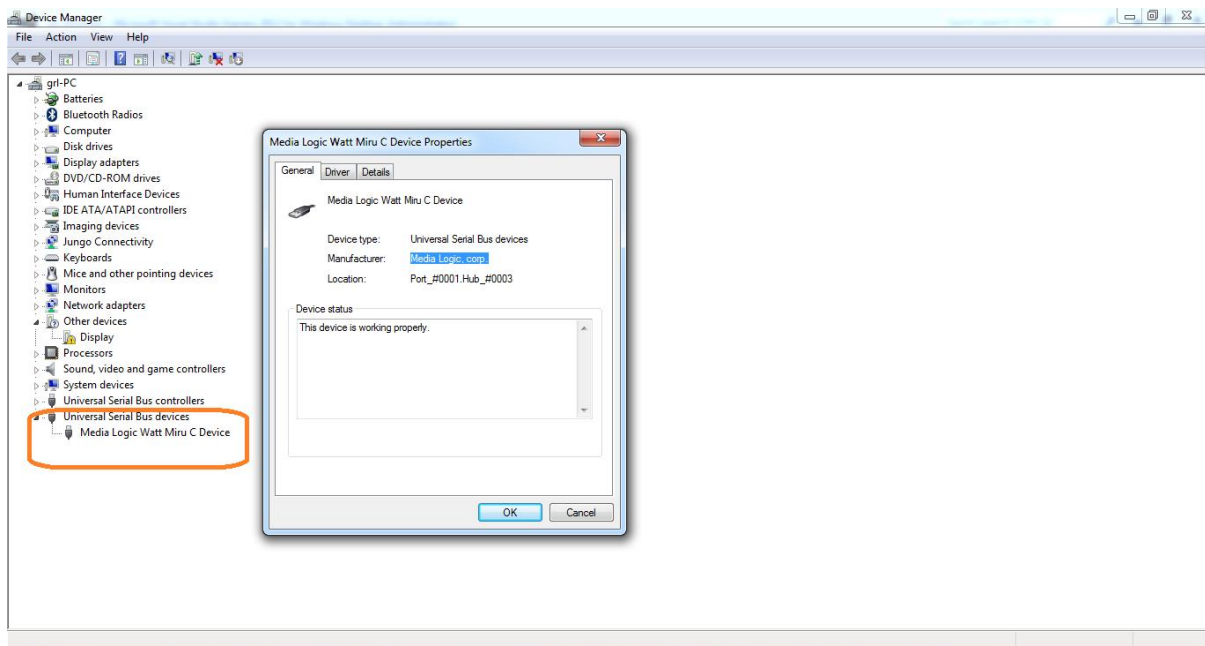
When connecting for the first time, installation of the driver is necessary. Follow the procedure below to install driver on control PC.



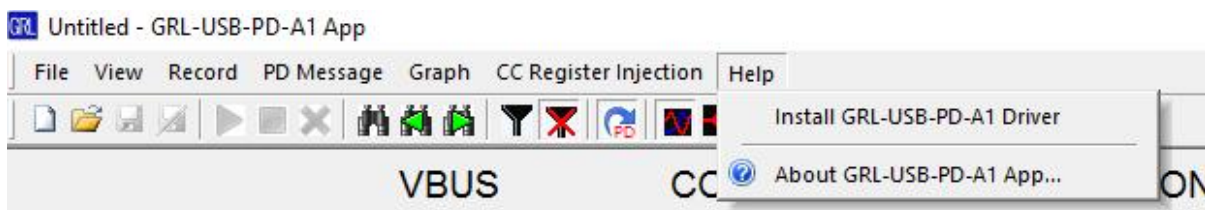
Select the GRL-USB-PD-A1 application from the windows menu as shown below.



Automatic installation of GRL-USB-PD-A1 driver will start. If the driver is successfully installed, "Media Logic Watt Miru C Device" will be displayed in "Universal Serial Bus Devices" of Device Manager. Device manager screen at driver installation successfully.



In the case when the driver is not installed select "Install GRL-USB-PS-A1 Driver" from the help menu to install the driver.



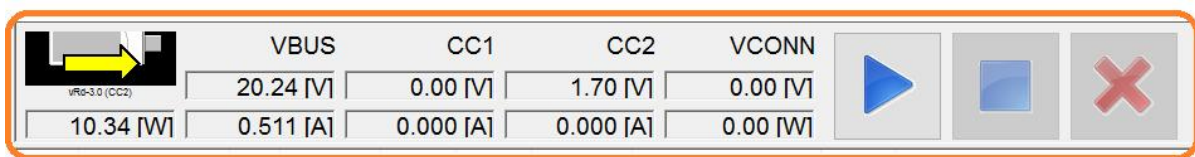
7 GRL-USB-PD-A1 Protocol Analyzer Application Usage

7.1 Launching the GRL-USB-PD-A1 Application

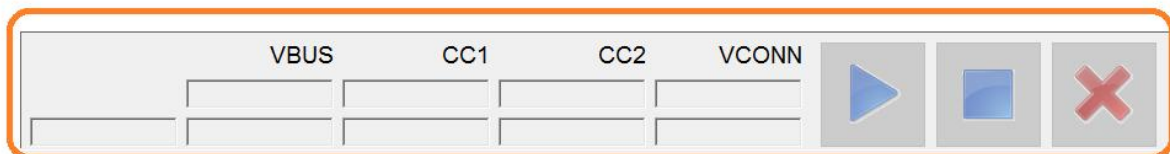
Double-click the GRL-USB-PD-A1 icon on the desktop to and start the application.



When GRL-USB-PD-A1 software is recognized correctly, the "start button" is activated and the voltage / current information of VBUS / CC1 / CC2 is displayed as shown below.

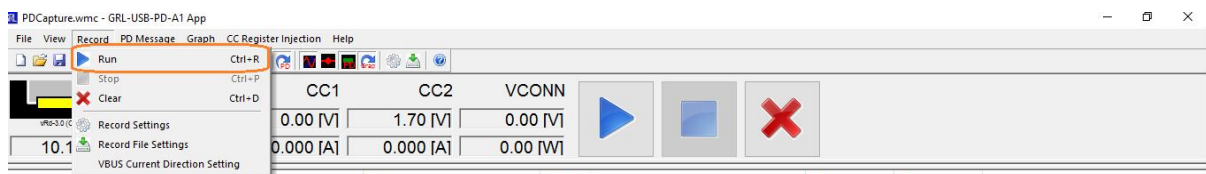


If GRL-USB-PD-A1 software is not recognized correctly, "Start button" will be disabled and voltage / current information of VBUS / CC1 / CC2 will not be displayed as shown below. Please re install the GRL-USB-PD-A1 software.



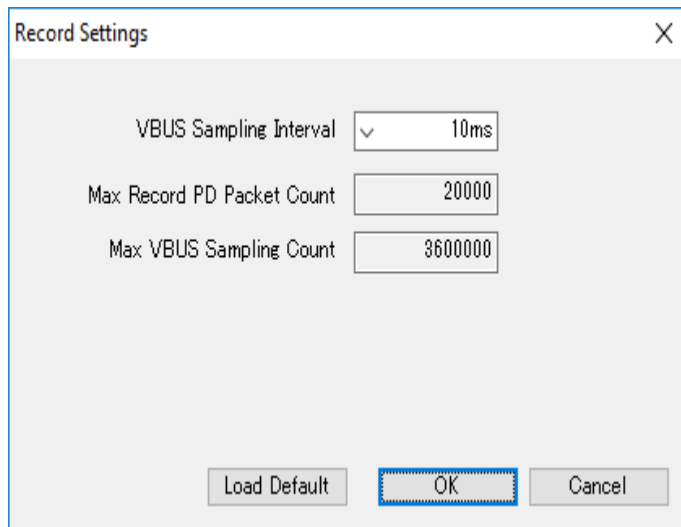
7.2 Start Capture

Select Run option from the Record Menu for enabling the capture of the transactions between the PD devices as shown below.



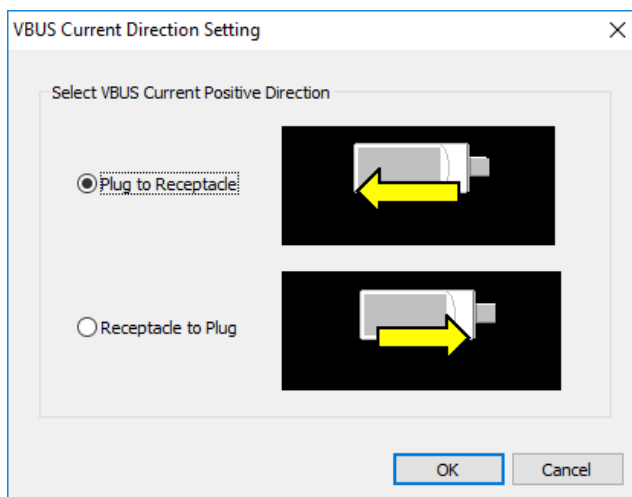
7.3 Record Settings

For the VBUS/CC1/CC2 Sampling Interval can be specified before starting the capture. The sampling interval would range from 1ms to 1000ms. By default the value is set to 10ms.



7.4 VBUS Current Direction Setting

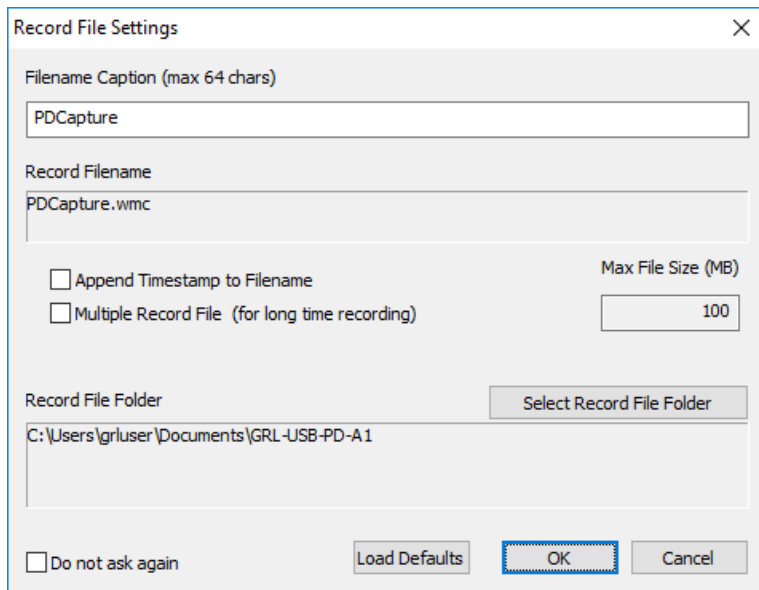
In the USB Type-C™ Power Delivery environment, the supply direction (Sink / Source) of VBUS between Type-C device devices varies depending on the type of connected device and the situation. In this product, the supply direction of VBUS is expressed using "positive / negative of VBUS current value". By Default, when VBUS is supplied from the Type - C plug to the Type - C receptacle of this equipment, the VBUS current is a positive value, and when VBUS is supplied from the Type - C receptacle to the Type - C plug direction VBUS current is a negative value.



To change the VBUS supply direction where the VBUS current value is a positive value, select from the menu [Record] - [VBUS Current Direction Setting].

7.5 Save Setting of Capture File

The file name of the capture file is determined according to "Capture file save setting" and a capture file is created.



The image shows a 'Record File Settings' dialog box with the following fields and controls:

- Filename Caption (max 64 chars):** A text box containing 'PDCapture'.
- Record Filename:** A text box containing 'PDCapture.wmc'.
- Append Timestamp to Filename:** An unchecked checkbox.
- Multiple Record File (for long time recording):** An unchecked checkbox.
- Max File Size (MB):** A text box containing '100'.
- Record File Folder:** A text box containing 'C:\Users\grluser\Documents\GRL-USB-PD-A1'.
- Select Record File Folder:** A button next to the folder path.
- Do not ask again:** An unchecked checkbox.
- Buttons:** 'Load Defaults', 'OK' (highlighted with a red border), and 'Cancel'.

When a capture file with the same file name already exists at the start of capture, it is forcibly saved with the new capture file and the old capture file is deleted. If you want to keep the old capture file, either change the capture file name or check the "Append Timestamp to Filename" checkbox and add the capture start time to the file name so that it will be a different file name and the maximum file size of the capture file is 100 MB. When the capture data size exceeds 100 MB, the capture stops automatically (Default setting). If you want to capture more than 100MB, please check the "Multiple Record File" checkbox. When the Multiple Record File setting is enabled, when the capture file size exceeds 100 MB, the next capture file is automatically created and the capture is continued automatically. A 4-digit serial number is automatically added to the capture file name.

7.6 Capture File Setting Details

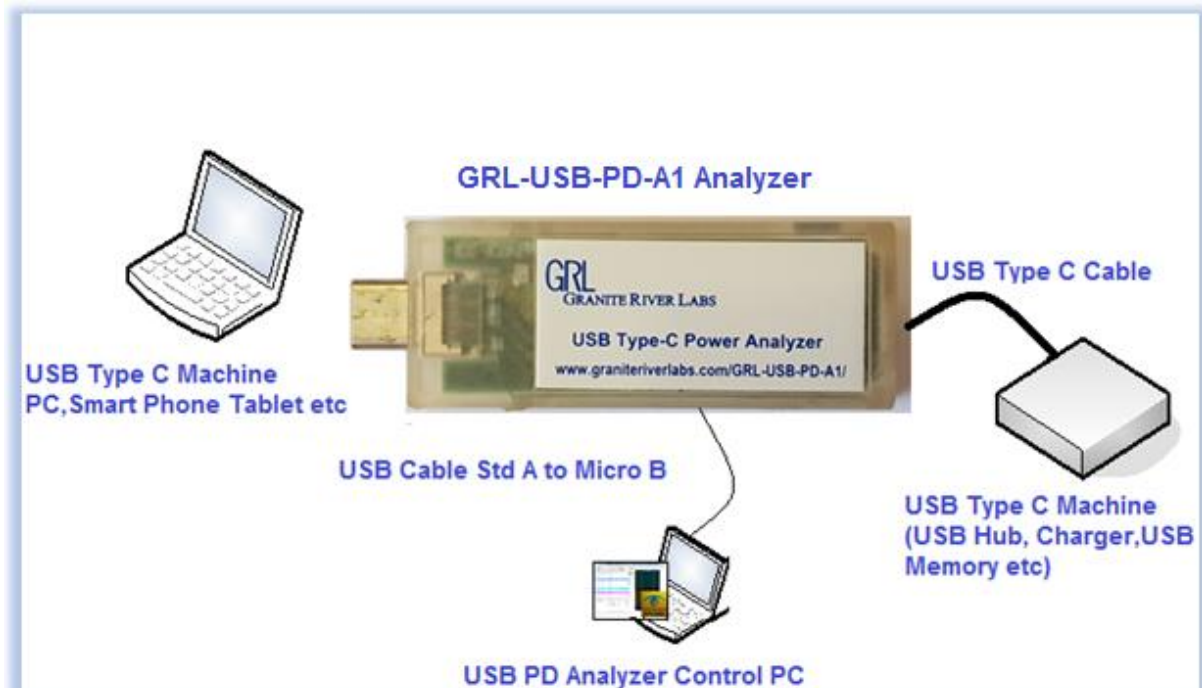
Setting item	Description
Filename Caption	Specifies the file name of the capture file. (Without the extension)
Append the Timestamp to Filename	Append the current time information to the capture file Example: Current time 2016 years 11 months 30 days 17 : 12 minutes 32 seconds. Capture file name "PDCapture_ 20161130-171232 .wmc"
Multiple Record File	Sets the operation exceeds the maximum file size, or maximum possible capture. Unchecked: Capture automatically stops. Checked: Multiple capture files would be created appended with four digit serial number.(from 0001 upto 9999) Example: "PDCapture_ 0001 .wmc", "PDCapture_20161130-171232_ 0001 .wmc"
Max File Size (MB)	Sets the maximum file size for the capture file
Record File Folder	Set the folder to save the capture file.
Do not ask again	Unchecked: This dialog is displayed before starting the Capture of the PD transaction's.

Checked: This dialog is not displayed before starting the Capture of the PD Transactions. Note: Capture file save settings is can be changed from the menu or toolbar.

8 Operation method

Follow the image below to connect the GRL-USB-PD-A1 Analyzer between the two Type C Devices. Connect micro USB Port of the A1 Analyzer to the Control PC.

8.1 Connection diagram



During Protocol Analysis, ensure to keep the GRL-USB-PD-A1 Analyzer always connected to the control PC with the USB cable. It is recommended to use a shorter USB cable.

You can connect and disconnect each USB Type-C™ device freely. Connect / disconnect each USB Type-C™ device according to the purpose of protocol analysis.

8.2 Start GRL-USB-PD-A1 Application

Refer to Section “Launching the GRL-USB-PD-A1 Application”

8.3 Capture Start Operation

Press "Start button" and start the capture.

At the start of capture, "Capture file save setting dialog" is displayed. Follow the instructions in “Save Setting of Capture File” to save the settings of Capture File. According to the settings, a capture file is created and capture is started.

When the capture is started, the voltage / current information of the captured VBUS / CC1 / CC2 is displayed in real time on the graph. Also, if a PD message is detected, the PD message detected is displayed in the PD message list.

8.4 Capture Stop operation

Please press "stop button" to stop capture.

Capture data is saved on the hard disk with the capture file name created according to the Capture File Save Settings.

8.5 Clear Capture Data

If you wish to erase capture data that is currently acquired while capturing, please press "Erase button".

Acquired PD message and voltage / current graph display will be discarded.

A capture file after capture continuation is newly created according to the Capture File Save Setting.

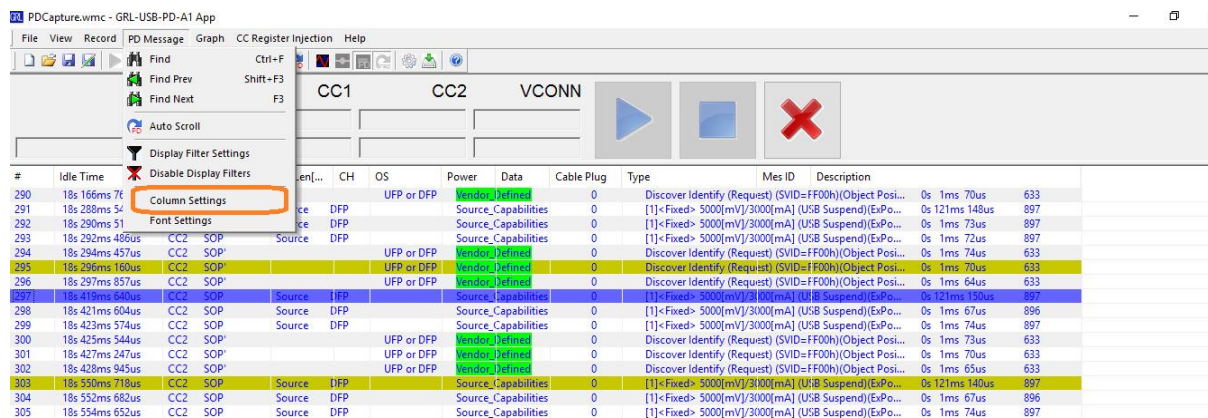
8.6 Analysis of Capture Data

Analyze the PD messages of capture data and analyze each VBUS / CC1 / CC2 voltage / current according to section "Operation Screen".

9 Feature Description

9.1 PD Message-Column Settings

To customize the column settings select PD Messages->Column Settings menu option



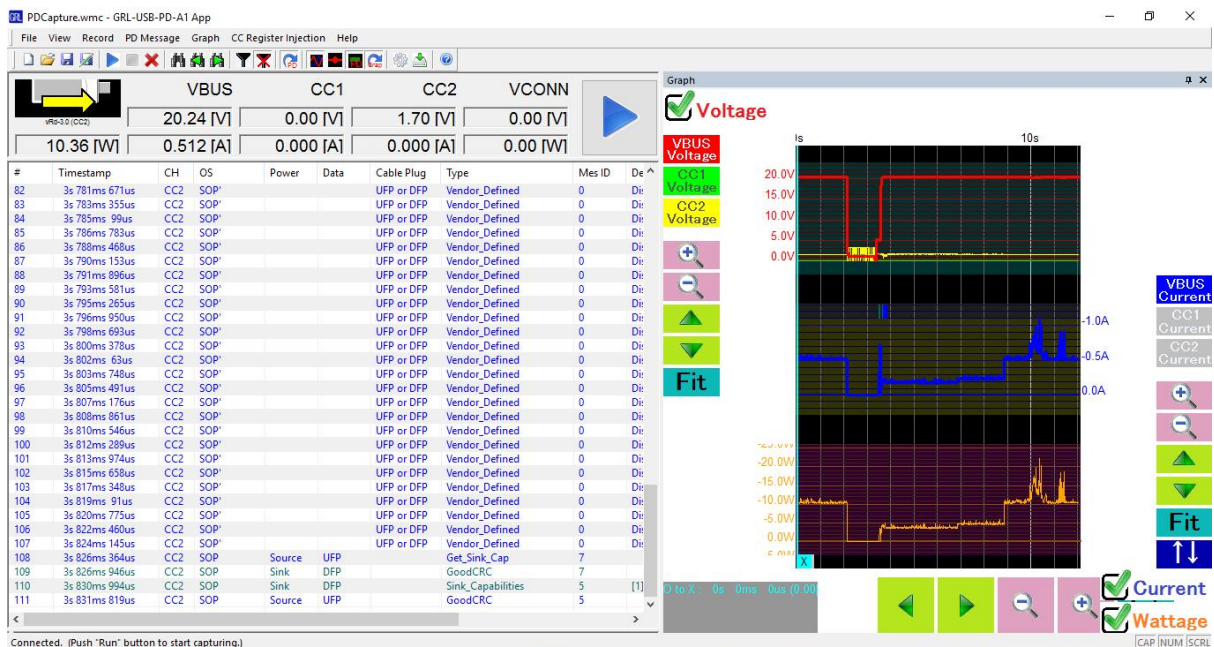
We can change the display order of the columns displayed in the PD Message by selecting Up or the Down buttons in the PD Messages Column Settings Dialog.

Show or Hide the columns can be done by selecting the Show Hide Buttons from the PD Messages Column Settings Dialog.

Order	Title	Description	Width	Show/Hide
0	#	Packet Number	50	Show
1	Idle Time	Idle Time	120	Show
2	Timestamp	Timestamp	120	Show
3	Pkt Len[us]	Packet Length [us]	70	Show
4	CH	Channel	40	Show
5	OS	Ordered Set	80	Show
6	Power	Port Power Role	60	Show
7	Data	Port Data Role	60	Show
8	Cable Plug	Cable Plug	80	Show
9	Type	Message Type	150	Show
10	Mes ID	MessageID	60	Show
11	Description	Description	300	Show
	VBUS Vol[V]	VBUS Voltage [V]	70	Hide
	VBUS Curr[A]	VBUS Current [A]	70	Hide
	CC1 Vol[V]	CC1 Voltage [V]	70	Hide
	CC1 Curr[A]	CC1 Current [A]	70	Hide
	CC2 Vol[V]	CC2 Voltage [V]	70	Hide
	CC2 Cur[A]	CC2 Current [A]	70	Hide
	Rev.	Specification Revision	40	Hide
	NumDOs	Number of Data Objects	60	Hide
	Extended	Extended	40	Hide
	Ex Chunked	Extended Chunked (Extended=1)	40	Hide
	Ex Chunk Num	Extended Chunk Number (Extended=1)	40	Hide
	Ex Request Chunk	Extended Request Chunk (Extended=1)	40	Hide
	Ex Data Size	Extended Data Size (Extended=1)	60	Hide
	Message Size	Message Size	60	Hide
	Header	Message Header	60	Hide
	Ex Header	Extended Message Header (Extended=1)	60	Hide
	Data Objects or ...	Data Objects (Extended=0) or Extended=1	200	Hide
	CRC	CRC	80	Hide
	Edges	Number of CC Edges	60	Hide
	Ave.UI[us]	Average Unit Interval [us]	80	Hide
	Preamble Len	Preamble Length [bits]	80	Hide
	BMC	BMC	200	Hide
	Payload	Data Payload	200	Hide
	Message Bytes ...	PD Message Bytes (HEX)	190	Hide

9.2 Operation screen

The operation screen of the protocol analysis application is as follows. Correlation between the PD Messages, Voltage and Current measurements can be verified.



Name	Description
Start button	USB type-c™ On the PD Start capturing messages, various types of voltage and current. At the start of the capture previous captured data will be discarded. Before starting the capture Save the captured data if you do not want to destroy the captured data.
Stop button	USB type-c™ On the PD Stops capturing messages, various types of voltage and current.
Clear button	Clears the data captured.
PD Message List	During the PD Data capture the decoded PD messages would be displayed in the list.
Detailed PD Message	The details of the selected PD message would in displayed in the Detailed PD Message Widow.
Status bar	Of the current PD Try the w C Of the view state.
Voltage and Current chart	Captured data VBUS/CC1/CC2 Of the voltage and current chart displays. View capture stop during the last captured data of voltage and current chart. While capturing the show in real time the data capture in voltage and current chart.
Various types of menu	Performs a variety of operations, such as saving captured data and read.
Various toolbars	Performs a variety of operations, such as saving captured data and read.

9.3 Description of Various Tool bars

The GRL-USB-PD-A1 application as various tool bar operations as shown below.



Various operations can also be controlled from buttons on the tool bar.

9.4 Present VBUS / CC1 / CC2 voltage / Current Status Indication

The voltage / current state of VBUS / CC1 / CC2 of USB Type-C ™ is always displayed regardless of the capture start / stop status.

	VBUS	CC1	CC2	VCONN	
	20.24 [V]	0.00 [V]	1.69 [V]	0.00 [V]	
10.28 [W]	0.508 [A]	0.000 [A]	0.000 [A]	0.00 [W]	

9.5 PD Message List

The below image shows the list of PD messages captured.

#	Timestamp	CH	OS	Power	Data	Cable Plug	Type	Mes ID	Description	Idle Time	Pkt Len...
12	0s 728ms 765us	CC2	SOP			UFP or DFP	Soft_Reset	0		0s 0ms 354us	502
13	0s 730ms 316us	CC2	SOP			UFP or DFP	Soft_Reset	0		0s 1ms 48us	502
14	0s 731ms 867us	CC2	SOP			UFP or DFP	Soft_Reset	0		0s 1ms 49us	502
15	0s 733ms 431us	CC2	SOP			UFP or DFP	Soft_Reset	0		0s 1ms 62us	502
16	0s 735ms 70us	CC2	SOP	Sink	DFP		VCONN_Swap	2		0s 1ms 137us	502
17	0s 735ms 626us	CC2	SOP	Source	UFP		GoodCRC	2		0s 0ms 54us	511
18	0s 736ms 193us	CC2	SOP	Source	UFP		Reject	4		0s 0ms 56us	510
19	0s 736ms 775us	CC2	SOP	Sink	DFP		GoodCRC	4		0s 0ms 72us	505
20	0s 774ms 755us	CC2	SOP	Sink	DFP		Vendor_Defined	3	Discover Identify (Request) (SVID=FF00h)(Object Posi...	0s 37ms 475us	635
21	0s 775ms 445us	CC2	SOP	Source	UFP		GoodCRC	3		0s 0ms 55us	511
22	0s 776ms 110us	CC2	SOP	Source	UFP		Vendor_Defined	5	Discover Identify (ACK) (SVID=FF00h)(Object Positi...	0s 0ms 154us	1047
23	0s 777ms 227us	CC2	SOP	Sink	DFP		GoodCRC	5		0s 0ms 70us	505
24	0s 781ms 275us	CC2	SOP	Sink	DFP		Vendor_Defined	4	Discover SVIDs (Request) (SVID=FF00h)(Object Positi...	0s 3ms 543us	638
25	0s 781ms 965us	CC2	SOP	Source	UFP		GoodCRC	4		0s 0ms 52us	500
26	0s 782ms 589us	CC2	SOP	Source	UFP		Vendor_Defined	6	Discover SVIDs (ACK) (SVID=FF00h)(Object Positions...	0s 0ms 124us	779
27	0s 783ms 439us	CC2	SOP	Sink	DFP		GoodCRC	6		0s 0ms 71us	505

Packet #0

Message Header=3161h
Data Object [1] = 0A01912Ch
Data Object [2] = 0A03C12Ch
Data Object [3] = 0A06412Ch

Offset [bits]	Leng...	Field name	Value	Description	HEX	ASCII
0.9	10	Maximum Current in 1...	12Ch (300)	3000 [mA]	2C 01	„
10..19	10	Voltage in 50mV units	064h (100)	5000 [mV]	64 00	d.
20..21	2	Peak Current	0h (0)		00	-
22..23	2	Reserved	0h (0)		00	-
24	1	Unchunked Extended ...	0h (0)		00	-
25	1	Dual-Role Data	1h (1)		01	-
26	1	USB Communications ...	0h (0)		00	-
27	1	Unconstrained Powered	1h (1)		01	-
28	1	USB Suspend Supported	0h (0)		00	-
29	1	Dual-Role Power	0h (0)		00	-
30..31	2	Fixed supply	0h (0)	Fixed supply (Vmin=Vmax)	00	-

Capturing... 5min 18s 887ms 370us [File Size=9051KB (9%)] [PD Packets=112 (0%)] [VBUS Samples=28733 (0%)]

The below image shows the detailed view of selected PD Message's selected PD Object:

#	Idle Time	Timestamp	Pkt Len...	CH	OS	Power	Data	Cable Plug	Type	Mes ID	Description		
290	18s 166ms 766us	CC2	SOP			UFP or DFP	Vendor_Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi...		0s 1ms 70us	633	
291	18s 288ms 547us	CC2	SOP	Source	DFP		Source_Capabilities	0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...		0s 121ms 148us	897	
292	18s 290ms 517us	CC2	SOP	Source	DFP		Source_Capabilities	0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...		0s 1ms 73us	897	
293	18s 292ms 486us	CC2	SOP	Source	DFP		Source_Capabilities	0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...		0s 1ms 72us	897	
294	18s 294ms 457us	CC2	SOP			UFP or DFP	Vendor_Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi...		0s 1ms 74us	633	
295	18s 296ms 160us	CC2	SOP			UFP or DFP	Vendor_Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi...		0s 1ms 70us	633	
296	18s 297ms 857us	CC2	SOP			UFP or DFP	Vendor_Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi...		0s 1ms 64us	633	
297	18s 419ms 640us	CC2	SOP	Source	DFP		Source_Capabilities	0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...		0s 121ms 150us	897	
298	18s 421ms 604us	CC2	SOP	Source	DFP		Source_Capabilities	0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...		0s 1ms 67us	896	
299	18s 423ms 574us	CC2	SOP	Source	DFP		Source_Capabilities	0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...		0s 1ms 74us	897	
300	18s 425ms 544us	CC2	SOP			UFP or DFP	Vendor_Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi...		0s 1ms 73us	633	
301	18s 427ms 247us	CC2	SOP			UFP or DFP	Vendor_Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi...		0s 1ms 70us	633	
302	18s 428ms 945us	CC2	SOP			UFP or DFP	Vendor_Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi...		0s 1ms 65us	633	
303	18s 550ms 718us	CC2	SOP	Source	DFP		Source_Capabilities	0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...		0s 121ms 140us	897	
304	18s 552ms 682us	CC2	SOP	Source	DFP		Source_Capabilities	0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...		0s 1ms 67us	896	
305	18s 554ms 652us	CC2	SOP	Source	DFP		Source_Capabilities	0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...		0s 1ms 74us	897	

Packet #304

Message Header=31A1h
Data Object [1] = 1801912Ch
Data Object [2] = 0A03C1E3Ch
Data Object [3] = 0A0C1E3Ch

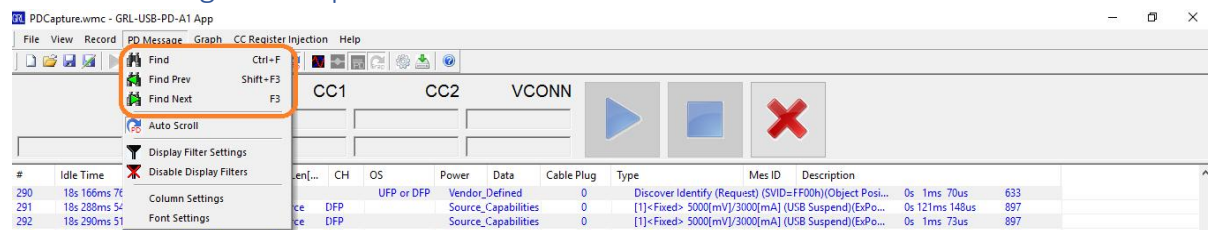
Offse...	Leng...	Field name	Value	Description	HEX	ASCII
0.9	10	Maximum Current in 10mA units	12Ch (300)	3000 [mA]	2C 01	„
10..19	10	Voltage in 50mV units	064h (100)	5000 [mV]	64 00	d.
20..21	2	Peak Current	0h (0)		00	-
22..23	2	Reserved	0h (0)		00	-
24	1	Unchunked Extended Messages S...	0h (0)		00	-
25	1	Dual-Role Data	0h (0)		00	-
26	1	USB Communications Capable	0h (0)		00	-
27	1	Unconstrained Powered	1h (1)		01	-
28	1	USB Suspend Supported	1h (1)		01	-
29	1	Dual-Role Power	0h (0)		00	-
30..31	2	Fixed supply	0h (0)	Fixed supply (Vmin=Vmax)	00	-

Disconnected. (Connect GRL-USB-PD-A1 Device to USB port.)

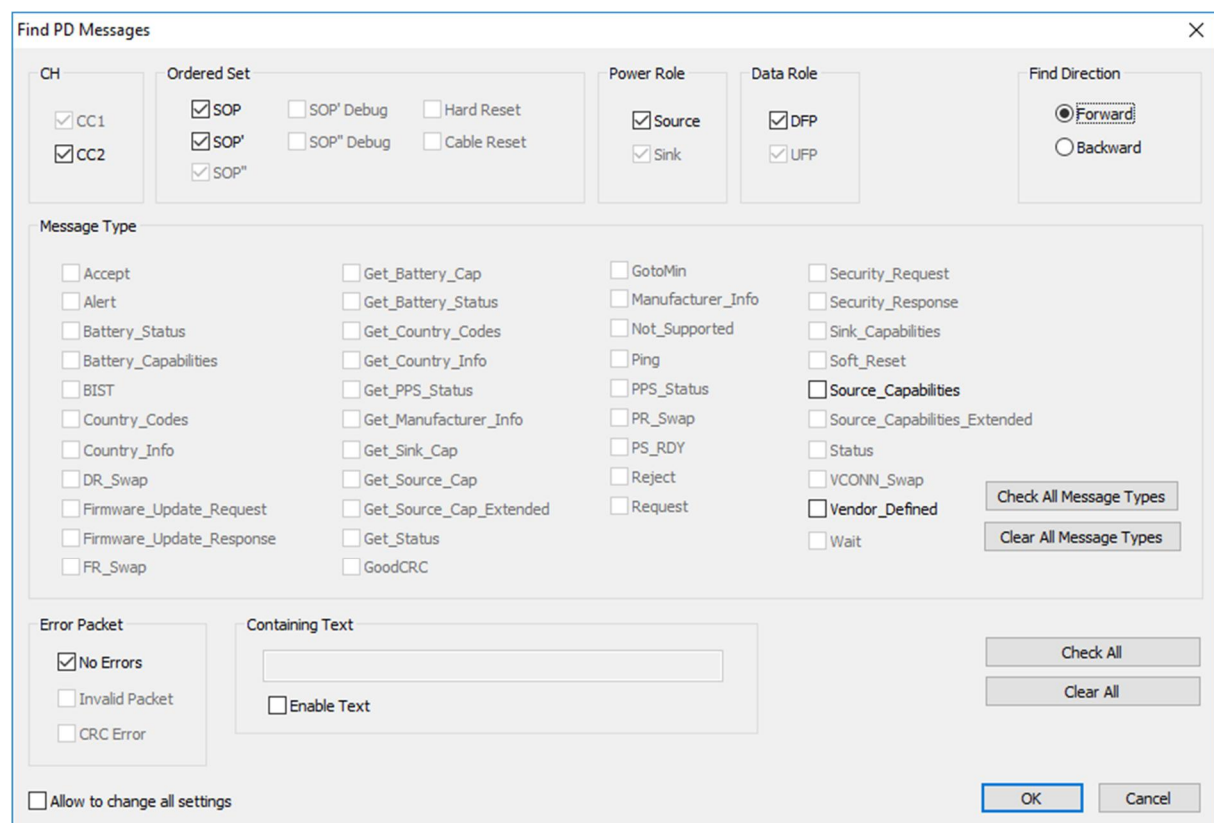
CAP NUM SC

Name	Description
PD Message List View	List of PD Messages captured during analysis
PD Packet Description	PD Message Header value with PD object list values of the selected PD Message in PD Message List View.
Selected PD Message Detail Header View	Decoded PD Message Header fields are listed
Selected PD Message's PDO object View	Decoded PD object fields are listed for the selected PDO object.

9.6 PD Message Find Operation



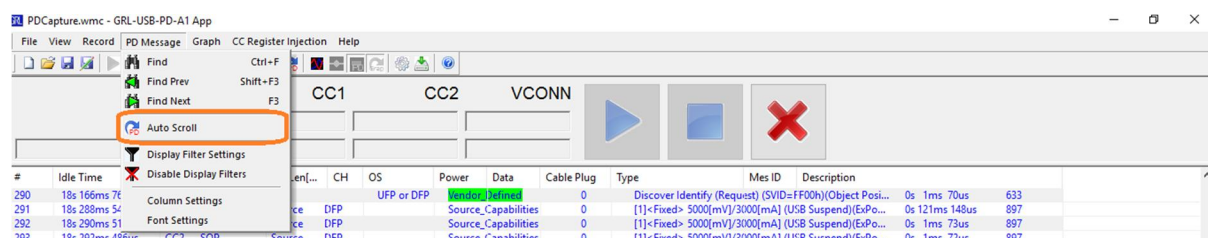
From the PD message list, you can search for a particular PD message. Select Find Option from PD Message Menu as shown above. The Find PD Messages dialog will be displayed.



We can specify the search criteria for the PD messages. If the matched PD messages to the search condition are found they would be highlighted in green in the PD Message List View. With the same search criteria, if you want to search for the previous or next PD message then Select Find Next or Find Prev options from PD Message Menu.

9.7 PD Message -Auto Scroll

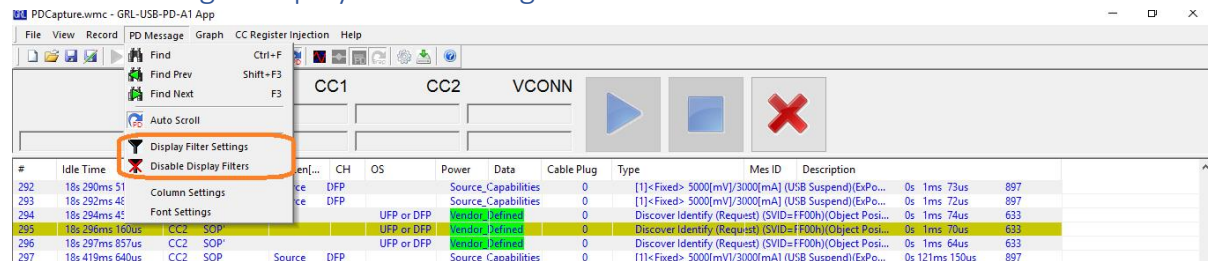
Select PD Message-> AutoScroll menu option to enable or disable the Auto Scroll feature.



During Capture, PD message will be automatically added to the PD message list.
The current display position of the list can be automatically moved with respect to the position of the newly added PD message.

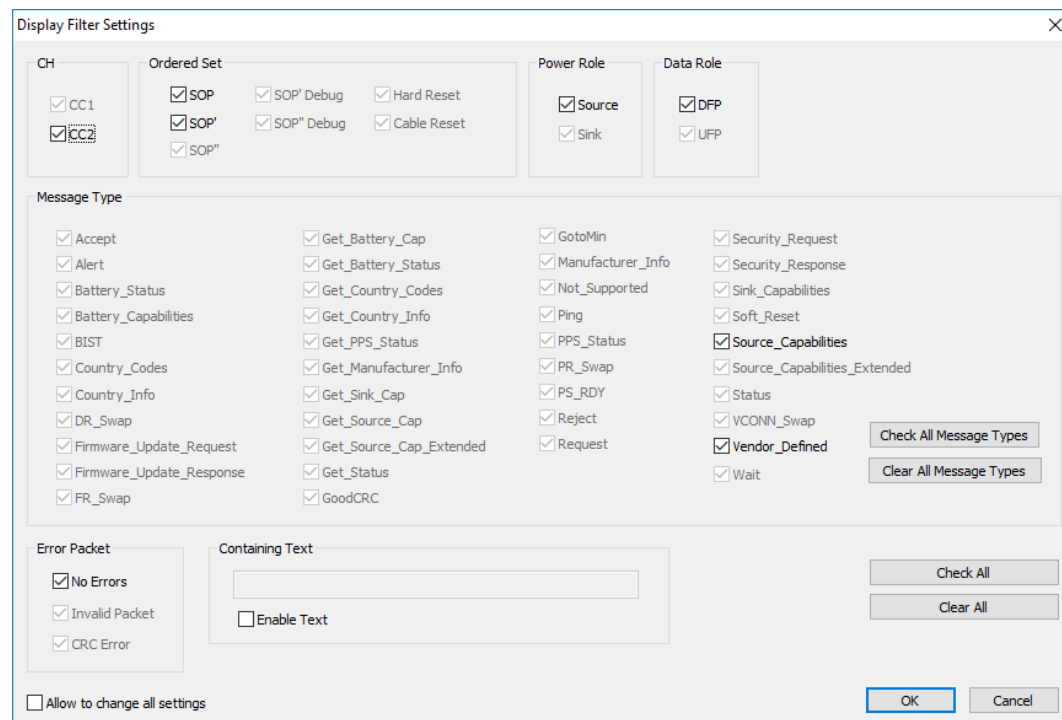
5.5 PD Message-

9.8 PD Message- Display Filter Setting

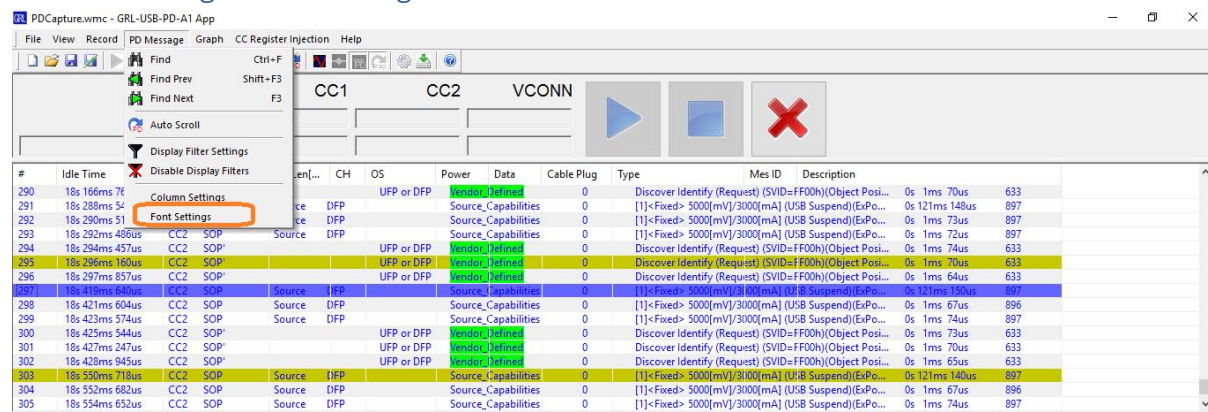


In the PD message list, it is possible to display only the specific PD messages. Select PD Message-> Display Filter Settings option. The Display Filter Settings Dialog will be displayed. We can choose the criteria to filter the messages.

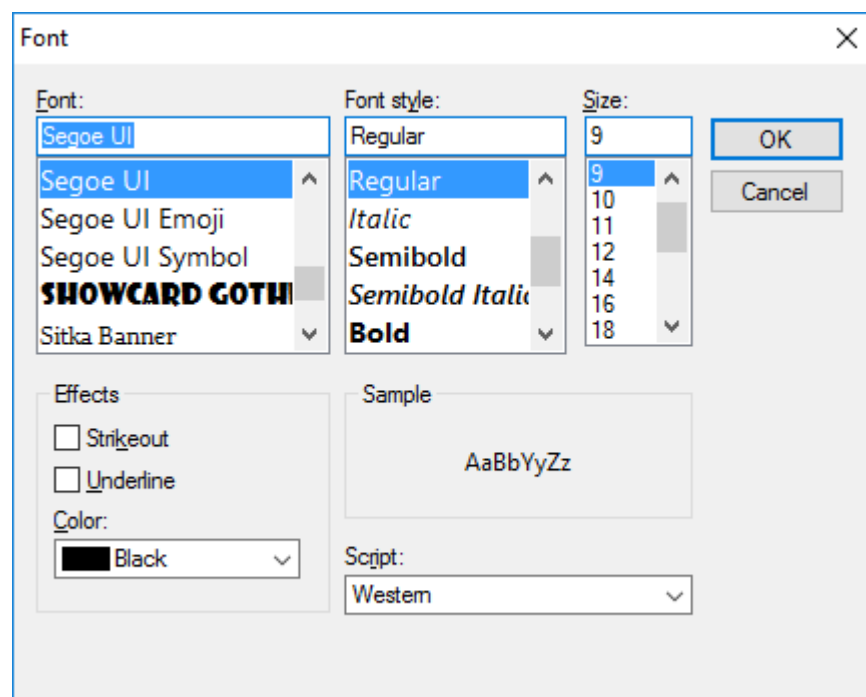
If you want to Disable or Enable the display filter, Select Menu Option PD Messages->Disable Display Filters.



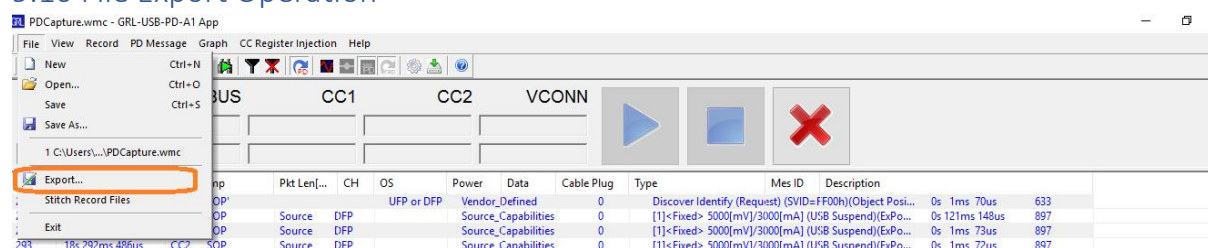
9.9 PD Message-Font Setting



Select PD Message-> Font Settings to change the font of the PD Messages displayed.



9.10 File Export Operation



From File Menu Select Export Option to export the captured data to .csv or .wmc format. The Export Dialog would be displayed.

The screenshot shows the 'Export' dialog box with the following settings:

- From:**
 - ☒ Capture Top
 - ☐ Packet Number: 0
 - ☐ Marker: Marker X (0s 0ms 0us)
- To:**
 - ☒ Capture End
 - ☐ Packet Number: 308
 - ☐ Marker: Marker O (0s 0ms 0us)
- Export Items:**
 - ☒ PD Messages
 - ☐ Voltage / Current
 - ☐ Both
- Export Type:**
 - ☒ CSV
 - ☐ WMC
- PD Message Options:**
 - ☒ Visible Columns Only
- Voltage / Current Options:**
 - ☒ VBUS Voltage
 - ☒ VBUS Current
 - ☒ VBUS Wattage
 - ☒ CC1 Voltage
 - ☒ CC1 Current
 - ☒ CC2 Voltage
 - ☒ CC2 Current
- Export File Name:** C:\Users\grluser\Documents\GRL-USB-PD-A1\PDapture_export.csv
- Buttons:** File, Abort, Export, Cancel

From the Export Dialog we can choose to export the selected data to the specified file format. We have option to export the PD Messages along with the Voltage and the Current values in the .csv format. The Export file path would be displayed in the Export Dialog. By clicking the Export button the exported file would be saved in the destination folder.

Note: Marker information will not be exported.

This screenshot is identical to the one above, showing the 'Export' dialog box with the following settings:

- From:**
 - ☒ Capture Top
 - ☐ Packet Number: 0
 - ☐ Marker: Marker X (0s 0ms 0us)
- To:**
 - ☒ Capture End
 - ☐ Packet Number: 308
 - ☐ Marker: Marker O (0s 0ms 0us)
- Export Items:**
 - ☒ PD Messages
 - ☐ Voltage / Current
 - ☐ Both
- Export Type:**
 - ☒ CSV
 - ☐ WMC
- PD Message Options:**
 - ☒ Visible Columns Only
- Voltage / Current Options:**
 - ☒ VBUS Voltage
 - ☒ VBUS Current
 - ☒ VBUS Wattage
 - ☒ CC1 Voltage
 - ☒ CC1 Current
 - ☒ CC2 Voltage
 - ☒ CC2 Current
- Export File Name:** C:\Users\grluser\Documents\GRL-USB-PD-A1\PDapture_export.csv
- Buttons:** File, Abort, Export, Cancel

9.11 PD Message Time Stamp Feature

During Data capture the Timestamp information would be updated in the PD Message List.

By default, the time stamp would be showing the Current Position value. For particular PD message the start time is configurable. The Timestamp can be set to Absolute Value. Right click on the PD Message List and select "Set Time Stamp Origin ->Absolute". We can see the absolute time stamp values displayed in PD Message List.

The image shows a software interface with a context menu open over a list of PD messages. The menu option 'Set Time Stamp Origin' is selected, and a sub-menu is displayed with 'Absolute' and 'Current Position' options. 'Absolute' is highlighted. Below, the PD Message List is shown with the 'Timestamp' column updated with absolute values.

Context Menu Options:

- Set Marker
- Clear Marker
- Clear All Markers
- Set Marker A
- Clear Marker A
- Set Marker B
- Clear Marker B
- Set Time Stamp Origin (selected)
- Column Settings

PD Message List (Timestamps updated to Absolute):

Time	Timestamp	Pkt Len[...]	CH	OS	Power	Data	Cable Plug	Type	Mes ID	Description
- 0s 30ms 99us	CC2 SOP			UFP or DFP	Vendor Defined		0	Discover Identify (Request) (SVID=FF00h)(Object Posi...	- 0s 30ms 99us	633
- 0s 28ms 402us	CC2 SOP			UFP or DFP	Vendor Defined		0	Discover Identify (Request) (SVID=FF00h)(Object Posi...	0s 1ms 64us	633
- 0s 26ms 700us	CC2 SOP			UFP or DFP	Vendor Defined		0	Discover Identify (Request) (SVID=FF00h)(Object Posi...	0s 1ms 69us	633
0s 0ms 0us	CC2 SOP	Source	DFP		Source_Capabilities		0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...	0s 26ms 67us	896
0s 1ms 963us	CC2 SOP	Source	DFP		Source_Capabilities		0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...	0s 1ms 67us	896
0s 3ms 926us	CC2 SOP	Source	DFP		Source_Capabilities		0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...	0s 1ms 67us	896
0s 5ms 895us	CC2 SOP			UFP or DFP	Vendor Defined		0	Discover Identify (Request) (SVID=FF00h)(Object Posi...	0s 1ms 73us	633
0s 7ms 597us	CC2 SOP			UFP or DFP	Vendor Defined		0	Discover Identify (Request) (SVID=FF00h)(Object Posi...	0s 1ms 69us	633
0s 9ms 299us	CC2 SOP			UFP or DFP	Vendor Defined		0	Discover Identify (Request) (SVID=FF00h)(Object Posi...	0s 1ms 69us	632
0s 131ms 1us	CC2 SOP	Source	DFP		Source_Capabilities		0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...	0s 121ms 70us	896
0s 132ms 969us	CC2 SOP	Source	DFP		Source_Capabilities		0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...	0s 1ms 72us	896
0s 134ms 938us	CC2 SOP	Source	DFP		Source_Capabilities		0	[1]<Fixed> 5000(mV)/3000(mA) (USB Suspend)(ExPo...	0s 1ms 73us	896
0s 136ms 901us	CC2 SOP			UFP or DFP	Vendor Defined		0	Discover Identify (Request) (SVID=FF00h)(Object Posi...	0s 1ms 67us	633
0s 138ms 603us	CC2 SOP			UFP or DFP	Vendor Defined		0	Discover Identify (Request) (SVID=FF00h)(Object Posi...	0s 1ms 69us	633
0s 140ms 299us	CC2 SOP			UFP or DFP	Vendor Defined		0	Discover Identify (Request) (SVID=FF00h)(Object Posi...	0s 1ms 63us	633

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