## 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<sup>™</sup> Power Delivery Performance Analyzer A1 Software.

For software support, contact <a href="mailto:support@graniteriverlabs.com">support@graniteriverlabs.com</a>.

## Table of Contents

Table of Contents	. 2
1 Overview	.4
1.1 Features	.4
1.1.1 Voltage and Current of VBUS / CC1 / CC2 Signal Analysis	.4
1.1.2 Power Delivery Message Decode	.5
1.2 Connection image	.6
1.3 Power Delivery Protocol Analysis View	.6
2 Revision Record	.6
3 Specification	.7
3.1 Supported USB Type-C ™ / Power Delivery Standard	.7
3.2 USB Type-C ™ VBUS / CC / VONN signal monitoring function	.7
3.3 GRL-USB-PD-A1 Analyzer Dimensions and Weight	.7
3.4 GRL-USB-PD-A1 Analyzer Electrical specifications	.7
3.5 GRL-USB-PD-A1 Analyzer Environment specification	.7
3.6 GRL-USB-PD-A1 Analyzer Protocol Analysis Host PC Operating Environment	.7
4 Set Contents	.8
4.1 Hardware components	.8
4.2 Software Components	.8
5 Appearance	.8
5.1 USB Type-C ™ Plug connector	.8
5.2 USB Type-C ™ Receptacle connector	.8
5.3 USB Micro-B connector	.8
5.4 Status Indicator LED	.9
5.4.1 LED State Description	.9
6 Installation method	.9
6.1 Connection of GRL-USB-PD-A1 Analyzer to Control PC	.9
6.1.1 Connection diagram for the software installation	.9
6.2 GRL-USB-PD-A1 Analyzer Driver Installation	.9
7 GRL-USB-PD-A1 Protocol Analyzer Application Usage	11
7.1 Launching the GRL-USB-PD-A1 Application	11
7.2 Start Capture	11
7.3 Record Settings	11
7.4 VBUS Current Direction Setting	12
7.5 Save Setting of Capture File	12
7.6 Capture File Setting Details	13

8	Operation method14
	8.1 Connection diagram14
	8.2 Start GRL-USB-PD-A1 Application14
	8.3 Capture Start Operation14
	8.4 Capture Stop operation15
	8.5 Clear Capture Data15
	8.6 Analysis of Capture Data15
9	Feature Description15
	9.1 PD Message-Column Settings15
	9.2 Operation screen
	9.3 Description of Various Tool bars17
	9.4 Present VBUS / CC1 / CC2 voltage / Current Status Indication17
	9.5 PD Message List
	9.6 PD Message Find Operation19
	9.7 PD Message -Auto Scroll
	9.8 PD Message- Display Filter Setting20
	9.9 PD Message-Font Setting
	9.10 File Export Operation
	9.11 PD Message Time Stamp Feature

## 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 <sup>™</sup> devices captures the voltage / current information of the VBUS / CC / VCONN signals exchanged between the USB Type-C <sup>™</sup> 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.

USB Type-C <sup>TM</sup> and USB-C <sup>TM</sup> are trademarks of USB Implementers Forum.

#### 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.

#	Timestamp	CH	OS	Powe	r Data	Туре	Type Mes						
21	45s 361ms 725us	CC1	SOP	Source	e UFP	Source_Capabilities	0	[1] <fixed></fixed>	5000[mV]/3000[mA] (Dual-Role Por	wer)(ExPowered)	(USB Communications)(D		
22	45s 362ms 826us	CC1	SOP	Sink	DFP	GoodCRC	0						
23	45s 363ms 910us	CC1	SOP	Sink	DFP	Request	uest 6 dCRC 6		Position=4 (Operating Current=1500[mA])(Max Operating Current=1500[mA])(USB Con				
24	45s 364ms 601us	CC1	SOP	Sour	e UFP	GoodCRC	odCRC 6						
25	45s 365ms 349us	CC1	SOP	Sour	e UFP	Accept	1						
21	15 015 000			<b>8</b> .1		0.1000							
⊡- Pac	:ket #21	-12		Offset	Length	Field name		Value	Description	HEX	ASCII		
-	– Message Header=4141h			04	5	Message Type		01h (1)	Source_Capabilities	01			
	Data Object [1] = 2E	019120	Ch	5	1	Port Data Role		0h (0)	UFP	00			
-	Data Object [2] = 00	02D12	Ch	67	2	Specification Revision		1h (1)	Revision 2.0	01			
	Data Object [3] = 00	048120	_n ~h	8	1	Port Power Role		1h (1)	Source	01			
	- Data Object [4] = 0006412Ch		-11	911	3	MessageID		0h (0)		00			
				1214	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	Туре	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</fixed>
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 Commincations Capa
24	45s 364ms 601us	CC1	SOP	Source	UFP	GoodCRC	6	
25	45s 365ms 349us	CC1	SOP	Source	UFP	Accept	1	
•						m		
-						and the second state		The state of the s

⊡-Packet #21	Offset	Length	Field name	Value	Description	HEX	ASCII
Message Header=4141h	09	10	Maximum Current in 10mA units	12Ch (300)	3000 [mA]	2C 01	
Data Object [1] = 2E01912Ch	1019	10	Voltage in 50mV units	12Ch (300)	15000 [mV]	2C 01	
Data Object [2] = 0002D12Ch	2021	2	Peak Current	0h (0)		00	2
Data Object [3] = 0004B12Ch	2223	2	Reserved	0h (0)		00	x
Data Object [4] = 0000412Ch	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	22
	27	1	Externally Powered	0h (0)		00	
	28	1	USB Suspend Supported	0h (0)		00	
	29	1	Dual-Role Power	0h (0)		00	
	3031	2	Fixed supply	0h (0)	Fixed supply (Vmin=Vmax)	00	3

#### 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	01010101010101010101010101010101	[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	010101010101010101010101010101	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]16009184F3D3[EOP]	3D3F4819h	61 00	a.
288	3.307	64	010101010101010101010101010101	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]26C1698520349A6C9867[EOP]	7689C6A9h	62 1C 96 58 02 43	bX.C
233	3.254	64	010101010101010101010101010101	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]14D06001A06D[EOP]	D60A1006h	41 0D	Α.
229	3.247	64	01010101010101010101010101010101	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]343038F54830[EOP]	03845F83h	43 03	C.
226	3.313	64	01010101010101010101010101010101	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]16205392133D[EOP]	D3312935h	61 02	a.
233	3.254	64	01010101010101010101010101010101	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]64503FE00979[EOP]	97900EF3h	46 05	E.
228	3.307	64	01010101010101010101010101010101	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]164000C825A3[EOP]	3A528C00h	61 04	a.
298	3 307	64	01010101010101010101010101010101	[SYNC-1][SYNC-1][SYNC-1][SYNC-2]E6E1100800EE7A6AB33E[E0P]	F33BA6A7h	6F 1F 01 80 00 FF	0

#### 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	n Record		
Version	Revision	<b>Description of Changes</b>	Author(s)
	Date		
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 <sup>™</sup> / Power Delivery Standard

- Universal Serial Bus Type-C TM 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<sup>™</sup> Authentication Specification Revision 1.0
- VESA DisplayPort Alt Mode on USB Type-C Standard Ver.1.0a

#### 3.2 USB Type-C <sup>™</sup> 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  $8.3 \pm 0.2$  mm
- Mass: 16 g

#### 3.4 GRL-USB-PD-A1 Analyzer Electrical specifications

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

#### 3.5 GRL-USB-PD-A1 Analyzer Environment specification

- $\cdot$  Operating temperature range: 5  $\sim$  + 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 <sup>™</sup> Plug connector

To connect a USB Type-C <sup>™</sup> device that performs PD protocol analysis.

#### 5.2 USB Type-C <sup>™</sup> Receptacle connector

To connect a USB Type-C <sup>™</sup> 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 De	.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.

all Driver キャンセル
Help
Install PD Watt Miru C Driver
About PD Watt Miru C App CC2

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.

File Action Veer Help	A Device Manager	
<ul> <li>Image of the second s</li></ul>	File Action View Help	
Order Seis Butacoft Radios     Butacoft Radios     Duk dives     Duk dives     Dub Adives		
	gri+PC     Batteies     Gunputer     Dipley adapters     Dipley     Media Logic Watt Miru C Device     Media Logic Watt Miru C Device     Ok Cancel     Ok Cancel     Ok Cancel	

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.

	VBUS	CC1	CC2	VCONN		
vRd-3.0 (CC2)	20.24 [V]	0.00 [V]	1.70 [V]	[V] 00.0		X
10.34 [W]	0.511 [A]	[A] 000.0	[A] 000.0	[W] 00.0		

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.

VBUS	CC1	CC2	VCONN		
					×

#### 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.

PDCapture.wmc - GRL-USB-PD-A1 App						-	٥	×
File View Record PD Message Graph	h CC Registe	er Injection Help						
🗋 💕 🛃 ▶ Run	Ctrl+R	🔞 🛛 🖬 🖬 🕻	2 🔅 📩 💿					
Stop X Clear	Ctrl+P Ctrl+D	CC1	CC2	VCONN				
wRe-3.0 (C 🍈 Record Settings		0.00 [V]	1.70 [V]	0.00 [V]				
10.1 📥 Record File Settings		[A] 000.0	[A] 000.0	[W] 00.0				
VBUS Current Direction S	etting		N-1	Dennis	 11			

#### 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.

Record Settings	×
VBUS Sampling Interval	√ 10ms
Max Record PD Packet Count	20000
Max VBUS Sampling Count	3600000
Load Default	OK Cancel

#### 7.4 VBUS Current Direction Setting

In the USB Type-C <sup>TM</sup> 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.

VB	US Current Direction Setting		Х
	Select VBUS Current Positive D	irection	
	Plug to Receptade		
	○ Receptacle to Plug		
		OK Cancel	

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.

Record File Settings	×
Filename Caption (max 64 chars)	
PDCapture	
Record Filename	
PDCapture.wmc	
Append Timestamp to Filename	Max File Size (MB)
Record File Folder C:\Users\grluser\Documents\GRL-USB-PD-A1	Select Record File Folder
Do not ask again	OK 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.

Setting item	Description
Filename Caption	Specifies the file name of the capture file. (Without the
	extension)
Append the	Append the current time information to the capture file
Timestamp to	Example: Current time 2016 years 11 months 30 days 17 : 12
Filename	minutes 32 seconds. Capture file name "PDCapture_
	<b>20161130-171232</b> .wmc"
Multiple Record File	Sets the operation exceeds the maximum file size, or
	maximum possible capture.
	Unchecked: Capture automatically stops.
	<b>Checked:</b> 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.

#### 7.6 Capture File Setting Details

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 <sup>TM</sup> device freely. Connect / disconnect each USB Type-C <sup>TM</sup> 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

📆 PD	Capture.wmc - G	RL-U	JSB-PD-A1	App															2	-	٥
File	View Record	PD I	Message	Graph CC R	egister	Injectio	n Help														
	i 🖬 🖬 🕨	A         Find         Ctrl+F         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         B         C         C         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D         D <thd< th="">         D         <thd< th=""> <thd< t<="" th=""><th>C 🗠</th><th>0</th><th></th><th></th><th colspan="5"></th><th></th><th></th><th></th><th></th><th></th></thd<></thd<></thd<>			C 🗠	0															
		61 61	Find Prev Find Next	Sh	ift+F3 F3	C	C1	C	C2	VC	ONN										
		G	Auto Scro	u											ζ.						
		T	Display Fi	lter Settings			[														
#	Idle Time	ж	Disable D	isplay Filters		.en[	CH	OS	Power	Data	Cable Plug	Туре		Mes ID	Description						
290 291	18s 166ms 76	C	Column S	ettings		C.P.	DEP	UFP or DFP	Vendor_	Defined Canabilities	0	Discove [1] <fix< td=""><td>er Identify (Requ</td><td>uest) (SVID= 3000[mA1 (U</td><td>FF00h)(Object Posi ISB Suspend)(ExPo</td><td>0s 0s 1</td><td>1ms 70us 21ms 148us</td><td>633 897</td><td></td><td></td><td></td></fix<>	er Identify (Requ	uest) (SVID= 3000[mA1 (U	FF00h)(Object Posi ISB Suspend)(ExPo	0s 0s 1	1ms 70us 21ms 148us	633 897			
292	18s 290ms 51		Font Setti	ngs		ce	DFP		Source	Capabilities	0	[1] <fix< td=""><td>ed&gt; 5000[mV]/3</td><td>3000[mA] (l</td><td>JSB Suspend)(ExPo</td><td>0s</td><td>1ms 73us</td><td>897</td><td></td><td></td><td></td></fix<>	ed> 5000[mV]/3	3000[mA] (l	JSB Suspend)(ExPo	0s	1ms 73us	897			
293	18s 292ms 48	бus	CC2	SOP	Sou	irce	DFP		Source	Capabilities	0	[1] <fix< td=""><td>ed&gt; 5000[mV]/3</td><td>3000[mA] (l</td><td>JSB Suspend)(ExPo</td><td>Os</td><td>1ms 72us</td><td>897</td><td></td><td></td><td></td></fix<>	ed> 5000[mV]/3	3000[mA] (l	JSB Suspend)(ExPo	Os	1ms 72us	897			
294	18s 294ms 45	7us	CC2	SOP'				UFP or DFP	Vendor_	Defined	0	Discove	er Identify (Requ	uest) (SVID=	FF00h)(Object Posi	0s	1ms 74us	633			
295	18s 296ms 16	iOus	CC2	SOP'				UFP or DFP	Vendor_	Defined	0	Discove	er Identify (Requ	uest) (SVID=	FF00h)(Object Posi	0s	1ms 70us	633			
296	18s 297ms 85	7us	CC2	SOP'				UFP or DFP	Vendor_	Defined	0	Discove	er Identify (Requ	uest) (SVID=	FF00h)(Object Posi	0s	1ms 64us	633			
297	18s 419ms 64	Ous	CC2	SOP	Sou	irce	[)FP		Source_	Capabilities	0	[1] <fix< td=""><td>ed&gt; 5000[mV]/3</td><td>3()00[mA] (l</td><td>JSB Suspend)(ExPo</td><td>0s 1.</td><td>21ms 150us</td><td>897</td><td></td><td></td><td></td></fix<>	ed> 5000[mV]/3	3()00[mA] (l	JSB Suspend)(ExPo	0s 1.	21ms 150us	897			
298	18s 421ms 60	4us	CC2	SOP	Sou	irce	DFP		Source_	Capabilities	0	[1] <fix< td=""><td>ed&gt; 5000[mV]/3</td><td>3000[mA] (l</td><td>JSB Suspend)(ExPo</td><td>0s</td><td>1ms 67us</td><td>896</td><td></td><td></td><td></td></fix<>	ed> 5000[mV]/3	3000[mA] (l	JSB Suspend)(ExPo	0s	1ms 67us	896			
299	18s 423ms 57	4us	CC2	SOP	Sou	irce	DFP		Source_	Capabilities	0	[1] <fix< td=""><td>ed&gt; 5000[mV]/3</td><td>3000[mA] (l</td><td>JSB Suspend)(ExPo</td><td>Os</td><td>1ms 74us</td><td>897</td><td></td><td></td><td></td></fix<>	ed> 5000[mV]/3	3000[mA] (l	JSB Suspend)(ExPo	Os	1ms 74us	897			
300	18s 425ms 54	4us	CC2	SOP'				UFP or DFP	Vendor_	Defined	0	Discove	er Identify (Requ	uest) (SVID=	FF00h)(Object Posi	0s	1ms 73us	633			
301	18s 427ms 24	7us	CC2	SOP'				UFP or DFP	Vendor	Defined	0	Discove	er Identify (Requ	uest) (SVID=	FF00h)(Object Posi	Os	1ms 70us	633			
302	18s 428ms 94	5us	CC2	SOP'				UFP or DFP	Vendor	Defined	0	Discove	er Identify (Requ	uest) (SVID=	FF00h)(Object Posi	0s	1ms 65us	633			
303	18s 550ms 71	8us	CC2	SOP	Sou	irce	DFP		Source	Capabilities	0	[1] <fix< td=""><td>ed&gt; 5000[mV]/3</td><td>3000[mA] (l</td><td>JSB Suspend)(ExPo</td><td>Os 1.</td><td>21ms 140us</td><td>897</td><td></td><td></td><td></td></fix<>	ed> 5000[mV]/3	3000[mA] (l	JSB Suspend)(ExPo	Os 1.	21ms 140us	897			
304	18s 552ms 68	2us	CC2	SOP	Sou	irce	DFP		Source_	Capabilities	0	[1] <fix< td=""><td>ed&gt; 5000[mV]/3</td><td>3000[mA] (l</td><td>JSB Suspend)(ExPo</td><td>0s</td><td>1ms 67us</td><td>896</td><td></td><td></td><td></td></fix<>	ed> 5000[mV]/3	3000[mA] (l	JSB Suspend)(ExPo	0s	1ms 67us	896			
305	18s 554ms 65	2us	CC2	SOP	Sou	irce	DFP		Source	Capabilities	0	[1] <fix< td=""><td>ed&gt; 5000[mV]/3</td><td>3000[mA] (l</td><td>JSB Suspend)(ExPo</td><td>0s</td><td>1ms 74us</td><td>897</td><td></td><td></td><td></td></fix<>	ed> 5000[mV]/3	3000[mA] (l	JSB Suspend)(ExPo	0s	1ms 74us	897			

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	Desctiption	Width	Show/Hide	^	OK
0	#	Packet Number	50	Show		Contra
1	Idle Time	Idle Time	120	Show		Cance
2	Timestamp	Timestamp	120	Show		Load Def
3	Pkt Len[us]	Packet Length [us]	70	Show		
4	СН	Channel	40	Show		
5	OS	Ordered Set	80	Show		
6	Power	Port Power Role	60	Show		Up
7	Data	Port Data Role	60	Show		Dow
8	Cable Plug	Cable Plug	80	Show		Down
9	Туре	Message Type	150	Show		
10	Mes ID	MessageID	60	Show		Show
11	Description	Description	300	Show		SHOV
	VBUS Vol[V]	VBUS Voltage [V]	70	Hide		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	40	Hide		
	Ex Request Chunk	Extended Request Chunk (Extended	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 (Extende	60	Hide		
	Data Objects or	Data Objects (Extended=0) or Exte	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 <sup>™</sup> 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 <sup>™</sup> 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	The details of the selected PD message would in displayed in the
Message	Detailed PD Message Widow.
Status bar	Of the current PD Try the w C Of the view state.
Voltage and	Captured data VBUS/CC1/CC2 Of the voltage and current chart
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	Performs a variety of operations, such as saving captured data and read.
menu	
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  $^{TM}$  is always displayed regardless of the capture start / stop status.

	VBUS	CC1	CC2	VCONN	
VRd-3.0 (CC2)	20.24 [V]	[V] 00.0	1.69 [V]	0.00 [V]	
10.28 [W]	0.508 [A]	[A] 000.0	[A] 000.0	0.00 [W]	

#### 9.5 PD Message List

		5 1												
	Pkt Len[	Idle Time			Description	Mes ID	Туре	Cable Plug	Data	Power	OS	СН	Timestamp	#
	502	Os 0ms 354us				0	Soft_Reset	UFP or DFP			SOP'	CC2	0s 728ms 765us	12
	502	Os 1ms 49us				0	Soft_Reset	UFP or DFP			SOP'	CC2	0s 730ms 316us	13
	502	Os 1ms 49us				0	Soft_Reset	UFP or DFP			SOP'	CC2	Os 731ms 867us	14
	502	Os 1ms 62us				0	Soft_Reset	UFP or DFP			SOP'	CC2	Os 733ms 431us	15
	502	Os 1ms 137us				2	VCONN_Swap		DFP	Sink	SOP	CC2	0s 735ms 70us	16
	511	Os Oms 54us				2	GoodCRC		UFP	Source	SOP	CC2	0s 735ms 626us	17
	510	Os Oms 56us				4	Reject		UFP	Source	SOP	CC2	0s 736ms 193us	18
	505	Os Oms 72us				4	GoodCRC		DFP	Sink	SOP	CC2	0s 736ms 775us	19
	635	0s 37ms 475us	h)(Object Posi	est) (SVID=FF00	Discover Identify (Reque	3	Vendor_Defined		DFP	Sink	SOP	CC2	0s 774ms 755us	20
	511	Os Oms 55us				3	GoodCRC		UFP	Source	SOP	CC2	0s 775ms 445us	21
	1047	Os Oms 154us	Object Positio	(SVID=FF00h)(C	Discover Identify (ACK) (	5	Vendor_Defined		UFP	Source	SOP	CC2	0s 776ms 110us	22
	505	Os Oms 70us				5	GoodCRC		DFP	Sink	SOP	CC2	0s 777ms 227us	23
	638	Os 3ms 543us	(Object Positi	t) (SVID=FF00h)	Discover SVIDs (Request)	4	Vendor_Defined		DFP	Sink	SOP	CC2	Os 781ms 275us	24
	500	Os Oms 52us				4	GoodCRC		UFP	Source	SOP	CC2	Os 781ms 965us	25
	779	Os 0ms 124us	ject Position=	VID=FF00h)(Ob	Discover SVIDs (ACK) (SV	6	Vendor_Defined		UFP	Source	SOP	CC2	0s 782ms 589us	26
	505	Os Oms 71us				6	GoodCRC		DFP	Sink	SOP	CC2	0s 783ms 439us	27
ASCII	HEX		Description	Value	Field name	Leng	Offset [bits]						acket #0	🖃 Pa
	2C 01		3000 (mA1	12Ch (300)	Maximum Current in 1	10	09					1h	Message Header=316	
												1912Ch	— Data Object [1] = 0A0'	
d	64.00		5000 [mV]	064h (100)	Voltage in 50mV units	10	10.19							
d.	64 00		5000 [mV]	064h (100)	Voltage in 50mV units	10	1019					3C12Ch	- Data Object [2] = 0A0	
d.	64 00 00		5000 [mV]	064h (100) 0h (0)	Voltage in 50mV units Peak Current	10 2	1019 2021					3C12Ch 5412Ch	Data Object [2] = 0A03 Data Object [3] = 0A06	
d.	64 00 00 00		5000 [mV]	064h (100) 0h (0) 0h (0)	Voltage in 50mV units Peak Current Reserved	10 2 2	1019 2021 2223					3C12Ch 5412Ch	Data Object [2] = 0A03 Data Object [3] = 0A06	
d.	64 00 00 00 00		5000 [mV]	064h (100) 0h (0) 0h (0) 0h (0)	Voltage in 50mV units Peak Current Reserved Unchunked Extended	10 2 2 1	1019 2021 2223 24					3C12Ch 5412Ch	Data Object [2] = 0A0 Data Object [3] = 0A06	
d.	64 00 00 00 00 01		5000 [mV]	064h (100) 0h (0) 0h (0) 0h (0) 1h (1)	Voltage in 50mV units Peak Current Reserved Unchunked Extended Dual-Role Data	10 2 2 1 1	1019 2021 2223 24 25					3C12Ch 5412Ch	Data Object [2] = 0A03 Data Object [3] = 0A06	
d.	64 00 00 00 00 01 00		5000 [mV]	064h (100) 0h (0) 0h (0) 0h (0) 1h (1) 0h (0)	Voltage in 50mV units Peak Current Reserved Unchunked Extended Dual-Role Data USB Communications	10 2 2 1 1 1	1019 2021 2223 24 25 26					3C12Ch 5412Ch	Data Object [2] = 0A03 Data Object [3] = 0A06	
d. - - - - - -	64 00 00 00 00 01 00 01 00 01		5000 [mV]	064h (100) 0h (0) 0h (0) 0h (0) 1h (1) 0h (0) 1h (1)	Voltage in 50mV units Peak Current Reserved Unchunked Extended Dual-Role Data USB Communications Unconstrained Powered	10 2 2 1 1 1 1 1	1019 20.21 2223 24 25 26 27					3C12Ch 5412Ch	Data Object [2] = 0A0: Data Object [3] = 0A06	
d.	64 00 00 00 01 00 01 00 01 00		5000 [mV]	064h (100) 0h (0) 0h (0) 0h (0) 1h (1) 0h (0) 1h (1) 0h (0)	Voltage in 50mV units Peak Current Reserved Unchunked Extended Dual-Role Data USB Communications Unconstrained Powered USB Suspend Supported	10 2 2 1 1 1 1 1 1 1	1019 2021 2223 24 25 26 27 28					3C12Ch 5412Ch	Data Object [2] = 0A03 Data Object [3] = 0A06	
d.	64 00 00 00 01 00 01 00 01 00 00		5000 [mV]	064h (100) 0h (0) 0h (0) 1h (1) 0h (0) 1h (1) 0h (0) 0h (0)	Voltage in 50mV units Peak Current Reserved Unchunked Extended Dual-Role Data USB Communications Unconstrained Powered USB Suspend Supported Dual-Role Power	10 2 2 1 1 1 1 1 1 1 1 1	1019 20.21 2223 24 25 26 27 28 29					3C12Ch 5412Ch	Data Object [2] = 0A03 Data Object [3] = 0A06	

The below image shows the list of PD messages captured.

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

#	Idle Time	Times	tamp	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.	Os 1ms 70us	633	
291	18s 288ms 547us	CC2	SOP	Source	DFP		Source	Capabilities	0	[1] <fixed> 5000[mV]/3000[mA] (USB Suspend)(ExPo</fixed>	0s 121ms 148us	897	
292	18s 290ms 517us	CC2	SOP	Source	DFP		Source	Capabilities	0	[1] <fixed> 5000[mV]/3000[mA] (USB Suspend)(ExPo</fixed>	Os 1ms 73us	897	
293	18s 292ms 486us	CC2	SOP	Source	DFP		Source	Capabilities	0	[1] <fixed> 5000[mV]/3000[mA] (USB Suspend)(ExPo</fixed>	Os 1ms 72us	897	
294	18s 294ms 457us	CC2	SOP'			UFP or DFP	Vendor	Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi	. Os 1ms 74us	633	
295	18s 296ms 160us	CC2	SOP'			UFP or DFP	Vendor	Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi.	. Os 1ms 70us	633	
296	18s 297ms 857us	CC2	SOP'			UFP or DFP	Vendor	_Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi	. Os 1ms 64us	633	
297	18s 419ms 640us	CC2	SOP	Source	DFP		Source	Capabilities	0	[1] <fixed> 5000[mV]/3000[mA] (USB Suspend)(ExPo</fixed>	0s 121ms 150us	897	
298	18s 421ms 604us	CC2	SOP	Source	DFP		Source	Capabilities	0	[1] <fixed> 5000[mV]/3000[mA] (USB Suspend)(ExPo</fixed>	Os 1ms 67us	896	
299	18s 423ms 574us	CC2	SOP	Source	DFP		Source	Capabilities	0	[1] <fixed> 5000[mV]/3000[mA] (USB Suspend)(ExPo</fixed>	Os 1ms 74us	897	
300	18s 425ms 544us	CC2	SOP'			UFP or DFP	Vendor	_Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi.	. Os 1ms 73us	633	
301	18s 427ms 247us	CC2	SOP'			UFP or DFP	Vendor	Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi.	. Os 1ms 70us	633	
302	18s 428ms 945us	CC2	SOP'			UFP or DFP	Vendor	Defined	0	Discover Identify (Request) (SVID=FF00h)(Object Posi.	. Os 1ms 65us	633	
303	18s 550ms 718us	CC2	SOP	Source	DFP		Source	Capabilities	0	[1] <fixed> 5000[mV]/3000[mA] (USB Suspend)(ExPo</fixed>	0s 121ms 140us	897	
304	18s 552ms 682us	CC2	SOP	Source	OFP		Source	Capabilities	0	[1] <fixed> 5000[mV]/3[00[mA] (USB Suspend)(ExPo</fixed>	Os 1ms 67us	896	
305	185 354ms 652us	112	SOP	Source	DEP		Source	_Capabilities	U	[1] <fixed> 5000[mV]/3000[mA] (05B Suspend)(ExPo</fixed>	Us Ims /4us	897	Ŷ
- Pac	ket #304		Offse	Leng	Field name	e i		Value		Description	HEX	ASCII	
-	Manage 11 and an 11 A	11.	09	10	Maximum	Current in 10m/	A units	12Ch (300)		3000 [mA]	2C 01		
	Data Object [1] = 1801	912Ch	1019	10	Voltage in	50mV units		064h (100)		5000 [mV]	64 00	d.	
1	Data Object [2] = 0002	DIECH	2021	2	Peak Curre	ent		0h (0)		000000	00	2	
	Data Object [3] = COD	C1E3Ch	2223	2	Reserved			0h (0)			00		
			24	1	Unchunke	d Extended Mes	sages S	0h (0)			00		
			25	1	Dual-Role	Data	-	0h (0)			00		
			26	1	USB Com	nunications Can	able	0h (0)			00		
			27	1	Unconstra	ined Powered		1h (1)			01	5	
			28	1	LISE Succe	nd Supported		1h (1)			01	8	
			20	1	Dual Dala	Device		01- (0)			00		
			29		Dual-Role	Power		01 (0)			00	5	
			3031	2	Fixed supp	Ny		0h (0)		Fixed supply (Vmin=Vmax)	00	30	
2.0	and Connect CDU		Device to UC	Poort 1									CAD NUM SCD

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

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

R PDC	Capture.wmc - G	RL-USB-PD-A1 App	E.													1000	٥	×
File	View Record	PD Message Grag	oh CC Registe	Injectio	on Help	) )												
	i 🖬 🗖 🔰	Find	Ctrl+F			C: 🕸 📥	0											
		Find Prev	Shift+F3 F3	(	001	C	C2	VC	ONN									
		🔀 Auto Scroll		1									<b>(</b>					
		T Display Filter	Settings															
#	Idle Time	🟋 Disable Displa	y Filters	.en[	CH	OS	Power	Data	Cable Plug	Туре		Mes ID	Description					^
290	18s 166ms 76	Column Settin				UFP or DFP	Vendo	r_Defined	0	Dis	cover Identify (Requ	uest) (SVID:	=FF00h)(Object Posi	Os 1ms 70us	633			
291	18s 288ms 54	Column Settin	93	ce	DFP		Source	Capabilities	s O	[1]-	Fixed> 5000[mV]/3	000[mA] (I	USB Suspend)(ExPo	Os 121ms 148us	897			
292	18s 290ms 51	Font Settings		ce	DFP		Source	Capabilities	s O	[1]-	Fixed> 5000[mV]/3	000[mA] (	USB Suspend)(ExPo	Os 1ms 73us	897			

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.

ind PD Messages				×
CH Ordered ✓ cc1 ✓ S ✓ cc2 ✓ S	d Set SOP SOP' Debug Hard Reset SOP' SOP" Debug Cable Reset SOP"	Power Role	Data Role	Find Direction
Message Type				
Accept Alert Battery_Status Battery_Capabilities BIST Country_Codes Country_Info DR_Swap Firmware_Update_R Firmware_Update_R FR_Swap	Get_Battery_Cap Get_Battery_Status Get_Country_Codes Get_Country_Info Get_PPS_Status Get_PPS_Status Get_Sink_Cap Get_Sink_Cap Get_Source_Cap Request Get_Source_Cap_Extended Response Get_Status GoodCRC	GotoMin Manufacturer_Ir Not_Supported Ping PPS_Status PR_Swap PS_RDY Reject Request	Security_Reque Security_Respo Sink_Capabilitie Soft_Reset Source_Capabil Status VCONN_Swap Vendor_Defined Wait	est onse est onse est onse est onse est onse est onse est of the set of the s
Error Packet No Errors Invalid Packet CRC Error Allow to change all settin	Containing Text			Check All Clear All OK Cancel

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.

R PDC	apture.wmc - GRL-	-USB-PD-A1 App														-	٥	×
File	View Record PE	D Message Graph CCI	Register In	njectio	n Help	2												
	ê 🖬 🗖 🕨 🕅	Find	Ctrl+F	8		a 🔉 🗇 📥	0											
	ی اف 2	Find Prev SP Find Next Auto Scroll	F3	C	C1	C	C2	VC				>	\$					
	٦	Display Filter Settings																
#	Idle Time	Disable Display Filters	1	.en[	CH	OS	Power	Data	Cable Plug	Туре		Mes ID	Description					^
290	18s 166ms 76	Column Settings				UFP or DFP	Vendo	Defined	0	Discove	Identify (Requ	est) (SVID=	F00h)(Object Posi	Os 1ms 70us	633			
291	18s 288ms 54 18s 290ms 51	Font Settings		'ce 'ce	DFP		Source	Capabilities Capabilities	0	[1] <fixe [1]<fixe< td=""><td>d&gt; 5000[mV]/3 d&gt; 5000[mV]/3</td><td>000[mA] (U 000[mA] (U</td><td>SB Suspend)(ExPo SB Suspend)(ExPo</td><td>0s 121ms 148us 0s 1ms 73us</td><td>897</td><td></td><td></td><td></td></fixe<></fixe 	d> 5000[mV]/3 d> 5000[mV]/3	000[mA] (U 000[mA] (U	SB Suspend)(ExPo SB Suspend)(ExPo	0s 121ms 148us 0s 1ms 73us	897			
293	18s 292ms 486u	s CC2 SOP	Sour	rce	DFP		Source	Capabilities	0	[1] <fixe< td=""><td>d&gt; 5000[mV]/3</td><td>000[mA] (U</td><td>SB Suspend)(ExPo</td><td>Os 1ms 72us</td><td>897</td><td></td><td></td><td></td></fixe<>	d> 5000[mV]/3	000[mA] (U	SB Suspend)(ExPo	Os 1ms 72us	897			

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-

M PDCapture.wmc - GRL-USB-PD-A1 App D X File View Record PD Message Graph CC Register Injection Help 🗋 🗃 🖬 📓 🕨 👬 Find Ctrl+F 🚪 🖬 📷 🔐 🛞 🖄 🥝 Shift+F3 CC1 CC2 VCONN Find Next F3 X Auto Scroll Idle Time Display Filter Settings СН Data Cable Plug Mes ID OS Power Туре Description 292 293 294 0s 1ms 73us 0s 1ms 72us 0s 1ms 74us 897 897 633 18s 290ms 51 Column Settings DFP DFP Source\_Capabil 0 [1] 00[mV]/3000[mA] (USB Suspend)(ExPo 18s 292ms 48 18s 294ms 45 [1]<Fixed> 5000[mV]/3000[mA] (USB Suspend)(ExPo... Discover Identify (Request) (SVID=FF00h)(Object Posi. Font Settings UFP or DFP Discover Identify (Request) (SVID=FF00h)(Object Posi... Discover Identify (Request) (SVID=FF00h)(Object Posi... [1]<Fixed> 5000[mV]/3000[mA] (USB Suspend)(ExPo... 18s 297ms 857us 18s 419ms 640us UFP or DFP 296 297 CC2 SOP 0s 1ms 64us 0s 121ms 150us 633 897 Source DFP

#### 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.

Display Filter Settings	s						×
CH CC1 ✓ CC1 ✓ CC2	Ordered Set	SOP' Debug 🛛 Hard SOP'' Debug 🗹 Cabl	d Reset le Reset	Power Role	- Data Rol	e P P	
Message Type							
Accept Accept Alert Battery_Stat Battery_Capt BIST Country_Infc DR_Swap Firmware_Up Firmware_Up Firmware_Up Fr_Swap Fr_Swap	us abilities des o date_Request date_Response	Get_Battery_Ca Get_Battery_Sta Get_Country_Cr Get_Country_In Get_PPS_Status Get_Manufactur Get_Sink_Cap Get_Source_Cap Get_Source_Cap Get_Source_Cap Get_Status Get_Status GoodCRC	p atus doles fo er_Info o p_Extended	GotoMin Manufacturer_1 Not_Supported Ping PPS_Status PR_Swap PS_RDY Reject Reject	info	Security_Request Security_Response Sink_Capabilities Soft_Reset Source_Capabilities Source_Capabilities Status VCONN_Swap VCONN_Swap Vendor_Defined Wait	Extended Check All Message Types Clear All Message Types
Error Packet  No Errors  CRC Error  Allow to change al	t Containin	ng Text hable Text					Check All Clear All OK Cancel

#### 9.9 PD Message-Font Setting

GR. PD	Capture.wmc - (	GRL-USE	B-PD-A1	Арр															 ٥	×
File	View Record	PD M	essage	Graph CC Reg	ister Inje	ction I	lelp													
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		が F が F	ind Prev	Shift	F3	CC			VC	ONN				<i>•</i>						
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#	Idle Time	Т 🗶 🛛	Disable Di	isplay Filters	er	[ C	H OS	Power	Data	Cable Plug	Туре		Mes ID	Description						^
290	18s 166ms 7	ε .					UFP or DFF	Vendo	Defined	0	Disco	ver Identify (Red	quest) (SVID:	FF00h)(Object Posi	0s 1	ms 70us	633			
291	18s 288ms 5	2	Column Se	ettings	ce	DFF		Source	Capabilitie	5 0	[1] <e< td=""><td>ixed&gt; 5000[mV]</td><td>/3000[mA1 (</td><td>USB Suspend)(ExPo</td><td>0s 12</td><td>1ms 148us</td><td>897</td><td></td><td></td><td></td></e<>	ixed> 5000[mV]	/3000[mA1 (	USB Suspend)(ExPo	0s 12	1ms 148us	897			
292	18s 290ms 5	1 F	ont Setti	ngs	ce	DFF	6	Source	Capabilitie	s 0	[1] <f< td=""><td>ixed&gt; 5000[mV]</td><td>/3000[mA1 (</td><td>USB Suspend)(ExPo</td><td>0s 1</td><td>ms 73us</td><td>897</td><td></td><td></td><td></td></f<>	ixed> 5000[mV]	/3000[mA1 (	USB Suspend)(ExPo	0s 1	ms 73us	897			
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294	18s 294ms 4	57us	CC2	SOP'			UFP or DFF	Vendo	Defined	0	Disco	ver Identify (Red	quest) (SVID:	=FF00h)(Object Posi	0s 1	ms 74us	633			
295	18s 296ms 1	60us	CC2	SOP'			UFP or DFF	Vendo	Defined	0	Disco	ver Identify (Red	quiest) (SVID:	=FF00h)(Object Posi	0s 1	ms 70us	633			
296	18s 297ms 8	57us	CC2	SOP'			UFP or DFF	> Vendo	Defined	0	Disco	ver Identify (Red	quest) (SVID:	=FF00h)(Object Posi	0s 1	ms 64us	633			
297	18s 419ms 6	40us	CC2	SOP	Source	()FF	C.	Source	Capabilitie	s 0	[1] <f< td=""><td>xed&gt; 5000[mV].</td><td>/3000[mA] (</td><td>USB Suspend)(ExPo</td><td>Os 12</td><td>1ms 150us</td><td>897</td><td>10</td><td></td><td></td></f<>	xed> 5000[mV].	/3000[mA] (	USB Suspend)(ExPo	Os 12	1ms 150us	897	10		
298	18s 421ms 6	04us	CC2	SOP	Source	DFF		Source	Capabilitie	s O	[1] <f< td=""><td>ixed&gt; 5000[mV].</td><td>/3000[mA] (</td><td>USB Suspend)(ExPo</td><td>0s 1</td><td>ms 67us</td><td>896</td><td></td><td></td><td></td></f<>	ixed> 5000[mV].	/3000[mA] (	USB Suspend)(ExPo	0s 1	ms 67us	896			
299	18s 423ms 5	74us	CC2	SOP	Source	DFF	6 Internet	Source	Capabilitie	s O	[1] <f< td=""><td>ixed&gt; 5000[mV].</td><td>/3000[mA] (</td><td>USB Suspend)(ExPo</td><td>0s 1</td><td>ms 74us</td><td>897</td><td></td><td></td><td></td></f<>	ixed> 5000[mV].	/3000[mA] (	USB Suspend)(ExPo	0s 1	ms 74us	897			
300	18s 425ms 5	44us	CC2	SOP'			UFP or DFF	Vendo	Defined	0	Disco	ver Identify (Red	quiest) (SVID:	=FF00h)(Object Posi	0s 1	ms 73us	633			
301	18s 427ms 2	47us	CC2	SOP'			UFP or DFF	Vendo	Defined	0	Disco	ver Identify (Red	quest) (SVID:	=FF00h)(Object Posi	0s 1	ms 70us	633			
302	18s 428ms 9	45us	CC2	SOP'			UFP or DFF	Vendor	Defined	0	Disco	ver Identify (Red	quest) (SVID:	=FF00h)(Object Posi	Os 1	ms 65us	633			
303	18s 550ms 7	18us	CC2	SOP	Source	()FF	C	Source	Capabilitie	s 0	[1] <f< td=""><td>ixed&gt; 5000[mV]</td><td>/3000[mA] (</td><td>USB Suspend)(ExPo</td><td>Os 12</td><td>1ms 140us</td><td>897</td><td></td><td></td><td>_</td></f<>	ixed> 5000[mV]	/3000[mA] (	USB Suspend)(ExPo	Os 12	1ms 140us	897			_
304	18s 552ms 6	82us	CC2	SOP	Source	DFF		Source	Capabilitie	s 0	[1] <f< td=""><td>ixed&gt; 5000[mV].</td><td>/3000[mA] (</td><td>USB Suspend)(ExPo</td><td>0s 1</td><td>ms 67us</td><td>896</td><td></td><td></td><td></td></f<>	ixed> 5000[mV].	/3000[mA] (	USB Suspend)(ExPo	0s 1	ms 67us	896			
305	18s 554ms 6	52us	CC2	SOP	Source	DFF	6	Source	Capabilitie	s O	[1] <f< td=""><td>ixed&gt; 5000[mV].</td><td>/3000[mA] (</td><td>USB Suspend)(ExPo</td><td>0s 1</td><td>ms 74us</td><td>897</td><td></td><td></td><td>~</td></f<>	ixed> 5000[mV].	/3000[mA] (	USB Suspend)(ExPo	0s 1	ms 74us	897			~

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

Font			×
Eont: Segoe UI Segoe UI Emoji Segoe UI Emoji SHOWCARD GOTHI Sitka Banner	Font style: Regular Regular /talic Semibold Semibold Italic Bold v	Size: 9 10 11 12 14 16 18	OK Cancel
Effects          Strikeout         Underline         Color:	Sample AaBbYyZz		
Black ~	Script: Western	~	

### 9.10 File Export Operation

PDCapture.wr	mc - GRL-USB-PD-A1 A	pp												<u></u>	٥
File View Re	cord PD Message G	raph	CC Register Injectio	n Hel	p										
New	Ctrl+N	14	Y 🗶 🔀 🛯		C 🛛 🖄	0									
Gpen Save	Ctrl+O Ctrl+S	BUS	C		C	C2	VC				<				
1 C:\Users\	\PDCapture.wmc	np	Pkt Len[	СН	OS	Power	Data	Cable Plug	Туре	Mes ID	Description				
Stitch Reco	ord Files	OP'			UFP or DFP	Vendo	_Defined	0	Dis	cover Identify (Request) (SVID:	=FF00h)(Object Posi	Os 1ms 70us	633		
		OP	Source	DFP		Source	_Capabilities	0	[1]	<fixed> 5000[mV]/3000[mA] (</fixed>	USB Suspend)(ExPo	0s 121ms 148us	897		
EXIL	105 000	OP	Source	DFP		Source	_Capabilities	0	[1]	<fixed> 5000[mV]/3000[mA] (</fixed>	USB Suspend)(ExPo	Os 1ms 73us	897		
293 18s 292	2ms 486us CC2	SOP	Source	DFP		Source	_Capabilities	0	[1]	<fixed> 5000[mV]/3000[mA] (</fixed>	USB Suspend)(ExPo	Os 1ms 72us	897		

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

OMarker Marker X ( 0s 0ms 0us)	O Voltage / Current	О ммс
© Capture End O Packet Number 308 O Marker Marker O ( 0s 0ms 0us)	PD Message Options	Voltage / Current Options VBUS Voltage VBUS Current VBUS Wattage CC1 Voltage CC1 Current CC2 Voltage CC2 Current

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.

From	Export Items	Export Type
Capture Top Packet Number 0 Marker Marker X ( 0s 0ms 0us)	PD Messages     Voltage / Current     Both	● csv ○ wmc
© Capture End ○ Packet Number 308 ○ Marker Marker O ( 0s 0ms 0us) ✓	PD Message Options	Voltage / Current Options VBUS Voltage VBUS Current VBUS Wattage CC1 Voltage CC1 Current CC2 Voltage CC2 Current
port File Name \Users\grluser\Documents\GRL-USB-PD-A1\PDCapture_export.	abort	File

#### 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.



END\_OF\_DOCUMENT