

# **Granite River Labs**

# Tester Card Port Verification Guide for GRL USB Power Delivery & Data Loopback Volume Tester (GRL-V-UP) Using GRL-V-UP API Test Software



This material is provided as a reference to perform port verification of the tester card for the Granite River Labs (GRL) USB Power Delivery & Data Loopback Volume Tester (GRL-V-UP).

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# **1** Scope of this Verification Guide

This Verification Guide provides the step-by-step procedure to perform port verification of the tester card for the GRL USB Power Delivery & Data Loopback Volume Tester (GRL-V-UP) using the GRL-V-UP API Test software.

For more information on GRL-V-UP, please refer to https://graniteriverlabs.com/grl-v-up/.

For more information on the GRL-V-UP API Test software, please refer to the user documentation in <u>http://graniteriverlabs.com/download-center/</u>.

For purchase orders, licensing questions and concerns, please contact Granite River Labs support at <a href="mailto:support@graniteriverlabs.com">support@graniteriverlabs.com</a>.

# 2 Test/Equipment Requirements



### **GRL-V-UP Hardware Tester**



### For Automated Port Verification:

• **Digital Multimeter** [Note: GRL recommends using the Scientific SMM5000 Series or Keithley DMM6500 Series Digital Multimeter]

### For Manual Port Verification:

• **Digital multimeter** [Note: GRL recommends using a digital multimeter with high accuracy and resolution of 5 1/2 digits or above that has been calibrated.]



#### For Automated Port Verification:

• **DC Power Supply** [Note: GRL recommends using the Keysight E3000 Series or B&K Precision 9130 Series Power Supply]

### For Manual Port Verification:

• **DC Power Supply** [Note: GRL recommends using the Keysight E3000 Series power supply]



# GRL Calibration Kit [See (a) Note: below]



~		
-		-

### **GRL Special EPR (GRL-SPL-EPR) Cable**



# GRL Special (GRL-SPL) Type-C VCONN passthrough test cable (GRL-USB-PD-STC)



#### **VBUS Sense Cable**



### **Banana Connectors**



# **USB Type-A to Type-B Cables**





**Control Computer (laptop or desktop) with the GRL-V-UP API Test software installed** [Note: For more information on the GRL-V-UP API Test software, refer to the user documentation in http://graniteriverlabs.com/download-center/]

(a) Note:

*Make sure Version 3.0 (V3.0) or above of the GRL calibration kit (fixture) is used for port verification (see image below):* 







# 3 Start Up GRL-V-UP API Test Software

On the control computer, launch the GRL-V-UP API Test software. There are four main tabs on the left side of the software screen as follows:

- API
- Graph
- Loopback
- Help

Each of these tabs will display its respective functional screen when selected.

For more information on the GRL-V-UP API Test software, refer to the user documentation in <u>http://graniteriverlabs.com/download-center/</u>.

# 3.1 Connect to the GRL-V-UP Tester

Once the GRL-V-UP tester hardware is connected to the control computer, select the **API** tab to establish connection with the tester:

- 1. In the "V-UP Connection" pane, select the connected GRL-V-UP tester from the **Devices List** drop-down menu. See Figure 3.1 below.
- 2. Click on the **Select** button to establish connection with the selected tester. When connected successfully, the selected tester model will be displayed in the **Selected Device** field. See Figure 3.1 below.

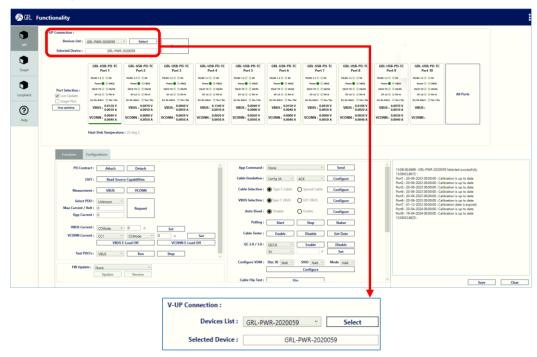


FIGURE 3.1: CONNECT GRL-V-UP API TEST SOFTWARE AND TESTER



Connection with the GRL calibration kit will be established automatically once the tester card port verification process starts. The GRL calibration kit will perform switching of the VBUS voltage, VBUS current and VBUS Sense voltage automatically or the CC1 voltage, CC2 voltage, VCONN current, VBUS voltage, VBUS current and VBUS Sense measurement channels manually.

# 3.2 Access the API Configuration Pane for Port Verification

The API configuration pane contains two tabs: "Functions" allows configuration for USB Power Delivery related API's, firmware update and other functions. "Configurations" allows configuration for additional features such as port verification. See Figure 3.2.

Select the **Configurations** tab to configure and perform automated or manual port verification of the tester card.



**Functions Tab** 



FIGURE 3.2: API CONFIGURATION PANE FOR PORT VERIFICATION

There are six measurement channels for the tester port and their voltage/current ranges are as follows:

- VBUS Voltage : 0 V to 20 V
- VBUS Current : 0 A to 5 A
- VBUS Sense Voltage : 0 V to 20 V
- CC1 Voltage : 0 V to 5 V
- CC2 Voltage : 0 V to 5 V
- VCONN Current : 0 A to 1 A

The "Error" field computes and displays the error percentage with Pass/Fail status using the following formula:

$$Error \% = \frac{Actual \, Value - Measured \, Value}{Actual \, Value} * 100$$



# 4 GRL-V-UP Tester Card Port Verification Procedure

This section describes how to verify the GRL-V-UP tester card port manually or using automation mode.

# 4.1 Manual Port Verification

This section describes how to verify the GRL-V-UP tester card port on the following measurement channels– CC1 voltage, CC2 voltage, VCONN current, VBUS voltage, VBUS current and VBUS Sense.

## 4.1.1 Equipment Requirements

Equipment	Qty.
GRL-V-UP tester hardware	1
DC power supply	1
Digital multimeter	1
GRL calibration kit	1
GRL Special EPR (GRL-SPL-EPR) Cable / GRL Special (GRL-SPL) Type-C VCONN passthrough test cable (GRL-USB-PD-STC)	1
VBUS Sense cable [See (a) Note: below]	1
Banana connectors	4
USB Type-A to Type-B cable	2
Control computer (laptop or desktop) with the GRL-V-UP API Test software installed	1

(a) Note:

The VBUS Sense cable is required if using the GRL Special (GRL-SPL) Type-C VCONN passthrough test cable (GRL-USB-PD-STC).

# 4.1.2 Measurement Configuration

1. Open the GRL-V-UP API Test software and select the **Configurations** tab in the API configuration pane. See Figure 4.1.

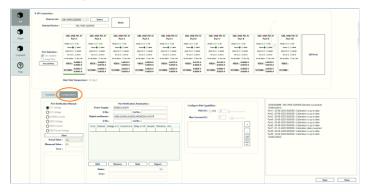


FIGURE 4.1: SELECT CONFIGURATIONS TAB FOR PORT VERIFICATION



2. Select the tester card port(s) that needs to be verified. See example in Figure 4.2 below.

GRL-USB-PD-TC Port 1	GRL-USB-PD-TC Port 2	GRL-USB-PD-TC Port 3	GRL-USB-PD-TC Port 4	GRL-USB-PD-TC Port 5	GRL-USB-PD-TC Port 6	GRL-USB-PD-TC Port 7	GRL-USB-PD-TC Port 8	GRL-USB-PD-TC Port 9	GRL-USB-PD-TC Port 10	
PD/BC 1.2 🔵 🔵 DE	PD/BC 1.2 🔘 🔵 DE	PD/BC 1.2 DE	PD/BC 1.2 DE	PD/BC 1.2  DE	PD/BC 1.2 DE	PD/BC 1.2 DE	PD/BC 1.2 DE	PD/BC 1.2 DE	PD/BC 1.2 🔘 🔵 DE	
Power 🔵 🔵 VBUS	Power C VBUS	Power C VBUS	Power C VBUS	Power C VBUS	Power VBUS	Power C VBUS	Power C VBUS	Power C VBUS	Power 🕘 🔵 VBUS	
EN/D-TX 🔵 🔵 HS/SS	EN/D-TX 🔘 🔘 HS/SS	EN/D-TX C H5/55	EN/D-TX CHS/SS	EN/D-TX 🔘 🔘 HS/SS	EN/D-TX MHS/SS	EN/D-TX 🜑 🜑 HS/SS	EN/D-TX CHS/SS	EN/D-TX CH5/SS	EN/D-TX 🕘 🔘 HS/SS	
DT-LK PD-N	DT-LK C PD-N	DT-LK C PD-N	DT-LK C PD-N	DT-LK C PD-N	DT-LK O PD-N	DT-LK 🔵 🔵 PD-N	DT-LK C PD-N	DT-LK C PD-N	DT-LK 🕘 💭 PD-N	All Ports
rc Re-Advrt 🕘 Yes / No	Src Re-Advrt 🕘 Yes / No	Src Re-Advrt 🔘 Yes / No	Src Re-Advrt 🔘 Yes / No	Src Re-Advrt 🔘 Yes / No	Src Re-Advrt 🕘 Yes / No	Src Re-Advrt 🕘 Yes / No	Src Re-Advrt 🔘 Yes / No	Src Re-Advrt 🔘 Yes / No	Src Re-Advrt 🕘 Yes / No	
VBUS :										
CONN :	VCONN :	VCONN :	VCONN :	VCONN :	VCONN :	VCONN :	VCONN :	VCONN :	VCONN :	

FIGURE 4.2: SELECT TESTER CARD PORT FOR VERIFICATION

3. There are six measurement channels per port (see Figure 4.3) and their voltage/current ranges are as specified in Section 3.2.

Warning: The range for each channel should not be exceeded at any time. Doing so may cause permanent damage to both the GRL calibration kit and tester card.

Port Ver	ification :						
CC1 Voltage							
OCC2 Voltage							
	nt						
OVBUS Voltage							
OVBUS Current							
OVBUS Sense Vo	oltage						
St	art						
Actual Value :	1V	1					
Measured Value :	0 V						
incusarea raiaer		Error :					

FIGURE 4.3: MEASUREMENT CHANNELS FOR MANUAL PORT VERIFICATION

**Actual Value**: This drop-down menu allows the voltage/current level that needs to be verified to be selected based on the selected measurement channel. The selected voltage/current level needs to be set on the power supply as well.

Measured Value: This field displays the measured values of the tester port.

Error: This field computes and displays the error percentage with Pass/Fail status as follows:

$$Error \% = \frac{Actual \, Value - Measured \, Value}{Actual \, Value} * 100$$

The acceptance limits for voltage/current are as follows:

For Voltage: @No Load

$$Error = \begin{cases} 5\%, 0V \le V \le 5V \\ 2\%, 5V < V \le 20V \end{cases}$$

For Current:

 $Error = 2\%, 0A \le A \le 5A$ 



Note: User-defined acceptance limits are also allowed, which the user will need to determine the Pass/Fail status based on the digital multimeter measured values and the GRL-V-UP measured values.

4. Set up the equipment connection and select the measurement channel to perform verification as described in the following sections.

# 4.1.3 Connection Setup for Voltage Measurements

This section describes the connection diagram to set up the equipment and fixture for manual port verification for voltage measurements. Set up the hardware connection as shown in Figure 4.4 below.

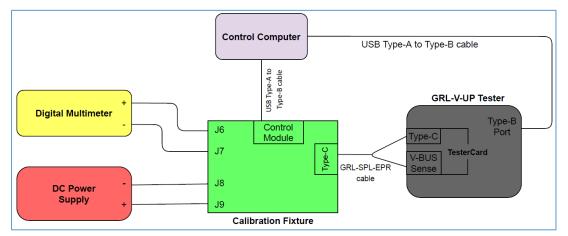


FIGURE 4.4: CONNECTION SETUP FOR GRL-V-UP MANUAL PORT VERIFICATION FOR VOLTAGE MEASUREMENTS

*Note: The connection setup may change according to the measurement channel selected.* 

- 1. Connect the DC power supply to the J8 and J9 terminals of the GRL calibration fixture.
- 2. Connect the digital multimeter (DMM) to the J6 and J7 terminals of the GRL calibration fixture.
- 3. Connect the Control Module of the GRL calibration fixture to the control computer using a USB Type-A to Type-B cable.
- 4. If using the **GRL-SPL-EPR cable**, connect the USB Type-C receptacle of the GRL calibration fixture to both the USB Type-C Port and VBUS Sense connector of the GRL-V-UP tester hardware.
  - Connect the GRL-SPL-EPR cable end with the GRL logo to the calibration fixture. *Note: Make sure to place the GRL logo in the upward position to maintain the same cable orientation between the calibration fixture and tester.*
  - Connect the GRL-SPL-EPR cable thumb screw end to the GRL-V-UP tester card port.
  - Connect the VBUS Sense pin of the GRL-SPL-EPR cable to the VBUS Sense port on the GRL-V-UP tester.



- 5. If using the **GRL-SPL Type-C cable**, connect the USB Type-C receptacle of the GRL calibration fixture to the USB Type-C receptacle of the GRL-V-UP tester. *Note: Make sure to place the GRL logo on the GRL-SPL Type-C cable in the upward position to maintain the same cable orientation between the calibration fixture and tester.* 
  - Connect the VBUS Sense connector of the GRL calibration fixture to the VBUS Sense connector of the GRL-V-UP tester using a VBUS Sense cable.
- 6. Connect the GRL-V-UP tester hardware to the control computer using a USB Type-A to Type-B cable.

## 4.1.4 Procedure for CC1 Voltage Measurement

- 1. Set up the hardware connection as shown in Figure 4.4.
- 2. See Figure 4.5 for the following procedure:
  - i. Select the **CC1 Voltage** channel.

# *Caution: Make sure that the voltage on the power supply is less than 5 V before proceeding to the next step.*

- ii. Click on the **Start** button to start the verification process. A pop-up message will appear to prompt the user to set the voltage on the power supply to ≤ 5 V in order to avoid any permanent damage to the GRL calibration fixture and tester card.
- iii. Set the voltage on the power supply to 0 V and click **OK**.
- iv. Select the voltage level to be verified from the **Actual Value** drop-down menu. Set the same voltage value on the power supply as well.
- v. The **Measured Value** field will display the GRL-V-UP measurement value. The **Error** field will display the error percentage with Pass/Fail status (refer to the acceptance limits as specified above).
- vi. Repeat the above steps for the rest of the voltage levels (1V, 2V, 3V, 4V, 5V) and ensure that all values are within the acceptance limits. When completed, click on the **Stop** button.

Port Verification : © CC1 Voltage © CC2 Voltage © VCONN Current © VBUS Voltage © VBUS Current © VBUS Sense Voltage Start Actual Value : 1V ~ Measured Value : 0 V Error :	Select Actual Value voltage	Port Verification : © CC1 Voltage CC2 Voltage VCONN Current VBUS Voltage VBUS Current VBUS Sense Voltage Stop Actual Value : 1V Measured Value : 1V Error : 2V VOLTAGE RAT 4V SV	Set selected voltage in power supply	Port Verification :         © CC1 Voltage         OC2 Voltage         VCONN Current         VBUS Voltage         VBUS Voltage         VBUS Sense Voltage         Stop         Actual Value :         IV         Weasured Value :         IV         VETOR :         OY40V         Error :         IV         VOLTAGE RANGE < 5.5 V
---	--------------------------------------	---	--	--

FIGURE 4.5: CC1 VOLTAGE CHANNEL VERIFICATION



Note: If the voltage on this measurement channel exceeds 5.5 V, the GRL calibration fixture will terminate the connection between the power supply terminals and the USB Type-C receptacle. The D3 LED (red color) will start blinking on the GRL calibration fixture to indicate over voltage. This will also trigger the following warning message to appear:

WARNIN	G	$\times$
	Voltage out of range on CC line	
		1
	ОК	

## 4.1.5 Procedure for CC2 Voltage Measurement

- 1. Set up the hardware connection as shown in Figure 4.4.
- 2. See Figure 4.6 for the following procedure:
  - i. Select the **CC2 Voltage** channel.

# *Caution: Make sure that the voltage on the power supply is less than 5 V before proceeding to the next step.*

- ii. Click on the Start button to start the verification process. A pop-up message will appear to prompt the user to set the voltage on the power supply to ≤ 5 V in order to avoid any permanent damage to the GRL calibration fixture and tester card.
- iii. Set the voltage on the power supply to 0 V and click **OK**.
- iv. Select the voltage level to be verified from the **Actual Value** drop-down menu. Set the same voltage value on the power supply as well.
- v. The **Measured Value** field will display the GRL-V-UP measurement value. The **Error** field will display the error percentage with Pass/Fail status (refer to the acceptance limits as specified above).
- vi. Repeat the above steps for the rest of the voltage levels (1V, 2V, 3V, 4V, 5V) and ensure that all values are within the acceptance limits. When completed, click on the **Stop** button.

Port Verification : OCC1 Voltage OCC2 Voltage VCONN Current			Select Actual	Port Verif OCC1 Voltage OCC2 Voltage OVCONN Current		Set selected voltage	Port Verif CC1 Voltage CC2 Voltage VCONN Current	
VBUS Voltage		WARNING X	Value	OVBUS Voltage		in power	OVBUS Voltage	
OVBUS Current	Start	Please ensure voltage on power supply is <= 5V before	voltage	OVBUS Current		supply	OVBUS Current	
OVBUS Sense Voltage		switching the channel Please ensure voltage on CC line is <= 5 V		OVBUS Sense Vol			OVBUS Sense Vol	tage
				Sta			Sto	p
Start		OK Cancel		Actual Value :	2V ~		Actual Value :	2V ~
Actual Value : 1V ~				Measured Value :	1V			
Measured Value : 0 V				Error :	2V		Measured Value :	1.9750 V
					3V		Error :	1 % - Pass
Error :					4V		VOLTAGE RAI	NGE < 5.5 V
					5V			

FIGURE 4.6: CC2 VOLTAGE CHANNEL VERIFICATION



Note: If the voltage on this measurement channel exceeds 5.5 V, the GRL calibration fixture will terminate the connection between the power supply terminals and the USB Type-C receptacle. The D3 LED (red color) will start blinking on the GRL calibration fixture to indicate over voltage. This will also trigger the following warning message to appear:

WARNIN	IG	$\times$
	Voltage out of range on CC	line
	c	ж (

## 4.1.6 Procedure for VBUS Voltage Measurement

- 1. Set up the hardware connection as shown in Figure 4.4.
- 2. See Figure 4.7 for the following procedure:
  - i. Select the **VBUS Voltage** channel.

# Caution: Make sure that the voltage on the power supply is less than 5 V before proceeding to the next step.

- ii. Click on the Start button to start the verification process. A pop-up message will appear to prompt the user to set the voltage on the power supply to ≤ 5 V in order to avoid any permanent damage to the GRL calibration fixture and tester card.
- iii. Set the voltage on the power supply to 0 V and click **OK**.
- iv. Select the voltage level to be verified from the **Actual Value** drop-down menu. Set the same voltage value on the power supply as well.
- v. The **Measured Value** field will display the GRL-V-UP measurement value. The **Error** field will display the error percentage with Pass/Fail status (refer to the acceptance limits as specified above).
- vi. Repeat the above steps for the rest of the voltage levels (5V, 9V, 12V, 15V, 20V) and ensure that all values are within the acceptance limits. When completed, set the power supply voltage to  $\leq$  5 V and click on the **Stop** button.

Port Verification : OCC1 Voltage OCC2 Voltage VCONN Current VBUS Voltage VBUS Current VBUS Sense Voltage	Start WARNING × Mate sure yotage is less than SV before switching the channel WARNING: On VBUS Votage <= 20 V	Select Actual Value voltage	Port Veril CC1 Voltage CC2 Voltage VCONN Current VBUS Voltage VBUS Current VBUS Sense Vol Sta	tage	Set selected voltage in power supply	Port Veri CC1 Voltage CC2 Voltage VCONN Curren VBUS Voltage VBUS Current VBUS Sense Vo	t
Stop	OK Cancel		Actual Value :	5V ×		Ste	ор
Actual Value : 5V ~		1	Measured Value :	5V		Actual Value :	9V ~
Measured Value : 0 V			Error :	9V		Measured Value :	8.8930 V
				12V		Frror :	1 % - Pass
Error :				15V			
				20V		VOLTAGE RA	NGE < 21 V

FIGURE 4.7: VBUS VOLTAGE CHANNEL VERIFICATION



Note: If the voltage on this measurement channel exceeds 21 V, the GRL calibration fixture will terminate the connection between the power supply terminals and the USB Type-C receptacle. The D3 LED (red color) will start blinking on the GRL calibration fixture to indicate over voltage. This will also trigger the following warning message to appear:

WARNING		×
<u> </u>	Voltage out of range on VBUS line	
	ОК	

# 4.1.7 Procedure for VBUS Sense Voltage Measurement

- 1. Set up the hardware connection as shown in Figure 4.4.
- 2. See Figure 4.8 for the following procedure:
  - i. Select the VBUS Sense Voltage channel.

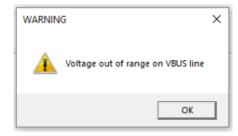
# *Caution: Make sure that the voltage on the power supply is less than 5 V before proceeding to the next step.*

- ii. Click on the Start button to start the verification process. A pop-up message will appear to prompt the user to set the voltage on the power supply to ≤ 5 V in order to avoid any permanent damage to the GRL calibration fixture and tester card.
- iii. Set the voltage on the power supply to 0 V and click **OK**.
- iv. Select the voltage level to be verified from the **Actual Value** drop-down menu. Set the same voltage value on the power supply as well.
- v. The **Measured Value** field will display the GRL-V-UP measurement value. The **Error** field will display the error percentage with Pass/Fail status (refer to the acceptance limits as specified above).
- vi. Repeat the above steps for the rest of the voltage levels (5V, 9V, 12V, 15V, 20V) and ensure that all values are within the acceptance limits. When completed, set the power supply voltage to  $\leq$  5 V and click on the **Stop** button.

FIGURE 4.8: VBUS SENSE VOLTAGE CHANNEL VERIFICATION



Note: If the voltage on this measurement channel exceeds 21 V, the GRL calibration fixture will terminate the connection between the power supply terminals and the USB Type-C receptacle. The D3 LED (red color) will start blinking on the GRL calibration fixture to indicate over voltage. This will also trigger the following warning message to appear:





# 4.1.8 Connection Setup for Current Measurements

This section describes the connection diagram to set up the equipment and fixture for manual port verification for current measurements. Set up the hardware connection as shown in Figure 4.9 below.

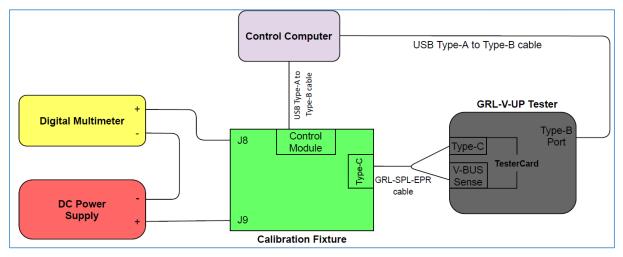


FIGURE 4.9: CONNECTION SETUP FOR GRL-V-UP MANUAL PORT VERIFICATION FOR CURRENT MEASUREMENTS

*Note: The connection setup may change according to the measurement channel selected.* 

- 1. Connect the DC power supply (- terminal) to the digital multimeter (DMM) (- terminal) and power supply (+ terminal) to the J9 terminal of the GRL calibration fixture.
- 2. Connect the DMM (+ terminal) to the J8 terminal of the GRL calibration fixture.
- 3. Connect the Control Module of the GRL calibration fixture to the control computer using a USB Type-A to Type-B cable.
- 4. If using the **GRL-SPL-EPR cable**, connect the USB Type-C receptacle of the GRL calibration fixture to both the USB Type-C Port and VBUS Sense connector of the GRL-V-UP tester hardware.
  - Connect the GRL-SPL-EPR cable end with the GRL logo to the calibration fixture. *Note: Make sure to place the GRL logo in the upward position to maintain the same cable orientation between the calibration fixture and tester.*
  - Connect the GRL-SPL-EPR cable thumb screw end to the GRL-V-UP tester card port.
  - Connect the VBUS Sense pin of the GRL-SPL-EPR cable to the VBUS Sense port on the GRL-V-UP tester.
- 5. If using the **GRL-SPL Type-C cable**, connect the USB Type-C receptacle of the GRL calibration fixture to the USB Type-C receptacle of the GRL-V-UP tester. *Note: Make sure to place the GRL logo on the GRL-SPL Type-C cable in the upward position to maintain the same cable orientation between the calibration fixture and tester.*



- Connect the VBUS Sense connector of the GRL calibration fixture to the VBUS Sense connector of the GRL-V-UP tester using a VBUS Sense cable.
- 6. Connect the GRL-V-UP tester hardware to the control computer using a USB Type-A to Type-B cable.

### 4.1.9 Procedure for VBUS Current Measurement

- 1. Set up the hardware connection as shown in Figure 4.9.
- 2. See Figure 4.10 for the following procedure:
  - i. Select the **VBUS Current** channel.

# *Caution: Make sure that the voltage on the power supply is less than 5 V before proceeding to the next step.*

- ii. Click on the **Start** button to start the verification process. A pop-up message will appear to prompt the user to set the voltage on the power supply to ≤ 5 V in order to avoid any permanent damage to the GRL calibration fixture and tester card.
- iii. Set the voltage on the power supply to 5 V and click **OK**.
- Select the current level to be verified from the Actual Value drop-down menu. The GRL-V-UP tester will draw the requested current automatically from the power supply.
- v. The **Measured Value** field will display the GRL-V-UP measurement value. The **Error** field will display the error percentage with Pass/Fail status (refer to the acceptance limits as specified above).
- vi. Repeat the above steps for the rest of the current levels (1A, 2A, 3A, 4A, 5A) and ensure that all values are within the acceptance limits. When completed, click on the **Stop** button.

Port Verification : OCC1 Voltage OCC2 Voltage OVCONN Current OVBUS Voltage OVBUS Current VBUS Sense Voltage Start Actual Value : 1A Measured Value : 0 V Error :	t MaRNING  WARNING: On VBUS Voltage <= 20 V OK Cancel	Select Actual Value current	Port Verification : OCC1 Voltage OCC2 Voltage VCONN Current VUBUS Voltage VBUS Voltage VBUS Sense Voltage Start Actual Value : Error : 3A 4A SA	Requested current loading by GRL-V-UP	Port Verification :         CC1 Voltage         CC2 Voltage         VCONN Current         VBUS Voltage         Ø VBUS Current         VBUS Sense Voltage         Actual Value :         54         Measured Value :         4.9960 A         Error :       0 % - Pass         CURRENT RANGE < 6 A
--	---	--------------------------------------	---	--	---

FIGURE 4.10: VBUS CURRENT CHANNEL VERIFICATION

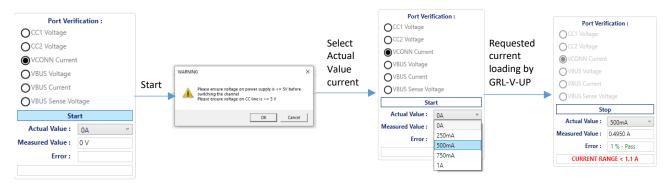


### 4.1.10 Procedure for VCONN Current Measurement

- 1. Set up the hardware connection as shown in Figure 4.9.
- 2. See Figure 4.11 for the following procedure:
  - i. Select the **VCONN Current** channel.

# *Caution: Make sure that the voltage on the power supply is less than 5 V before proceeding to the next step.*

- ii. Click on the **Start** button to start the verification process. A pop-up message will appear to prompt the user to set the voltage on the power supply to ≤ 5 V in order to avoid any permanent damage to the GRL calibration fixture and tester card.
- iii. Set the voltage on the power supply to 5 V and click **OK**.
- iv. Select the current level to be verified from the **Actual Value** drop-down menu. The GRL-V-UP tester will draw the requested current automatically from the power supply.
- v. The **Measured Value** field will display the GRL-V-UP measurement value. The **Error** field will display the error percentage with Pass/Fail status (refer to the acceptance limits as specified above).
- vi. Repeat the above steps for the rest of the current levels (0A, 250mA, 500mA, 750mA, 1A) and ensure that all values are within the acceptance limits. When completed, click on the **Stop** button.



#### FIGURE 4.11: VCONN CURRENT CHANNEL VERIFICATION



# 4.2 Automated Port Verification

### 4.2.1 Equipment Requirements

Equipment	Qty.
GRL-V-UP tester hardware	1
DC power supply	1
Digital multimeter	1
GRL calibration kit	1
GRL Special EPR (GRL-SPL-EPR) Cable / GRL Special (GRL-SPL) Type-C VCONN passthrough test cable (GRL-USB-PD-STC)	1
VBUS Sense cable [See (a) Note: below]	1
Banana connectors	4
USB Type-A to Type-B cable	4
Control computer (laptop or desktop) with the GRL-V-UP API Test software installed	1

(a) Note:

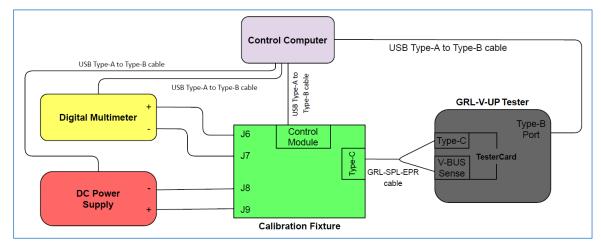
The VBUS Sense cable is required if using the GRL Special (GRL-SPL) Type-C VCONN passthrough test cable (GRL-USB-PD-STC).

(b) Note:

As the DMM, power supply and calibration fixture are connected to the GRL-V-UP tester hardware over USB, the user needs to note the VISA addresses and identification (ID) of the DMM and power supply via their respective I/O software, e.g., the Keysight IO Libraries Suite software.

### 4.2.2 Connection Setup

This section describes the connection diagram to set up the equipment and fixture for automated port verification. Set up the hardware connection as shown in Figure 4.12 below.







Note: The connection setup may change according to the measurement channel selected.

- 1. Connect the DC power supply to the J8 and J9 terminals of the GRL calibration fixture.
- 2. Connect the digital multimeter (DMM) to the J6 and J7 terminals of the GRL calibration fixture.
- 3. Connect the Control Module of the GRL calibration fixture to the control computer using a USB Type-A to Type-B cable.
- 4. If using the **GRL-SPL-EPR cable**, connect the USB Type-C receptacle of the GRL calibration fixture to both the USB Type-C Port and VBUS Sense connector of the GRL-V-UP tester hardware.
  - Connect the GRL-SPL-EPR cable end with the GRL logo to the calibration fixture. *Note: Make sure to place the GRL logo in the upward position to maintain the same cable orientation between the calibration fixture and tester.*
  - Connect the GRL-SPL-EPR cable thumb screw end to the GRL-V-UP tester card port.
  - Connect the VBUS Sense pin of the GRL-SPL-EPR cable to the VBUS Sense port on the GRL-V-UP tester.
- 5. If using the **GRL-SPL Type-C cable**, connect the USB Type-C receptacle of the GRL calibration fixture to the USB Type-C receptacle of the GRL-V-UP tester. *Note: Make sure to place the GRL logo on the GRL-SPL Type-C cable in the upward position to maintain the same cable orientation between the calibration fixture and tester.* 
  - Connect the VBUS Sense connector of the GRL calibration fixture to the VBUS Sense connector of the GRL-V-UP tester using a VBUS Sense cable.
- 6. Connect the GRL-V-UP tester hardware to the control computer using a USB Type-A to Type-B cable.
- 7. Connect the DMM and power supply to the control computer using USB Type-A to Type-B cables.
- 8. If using the Keysight IO Libraries Suite software as the I/O software for the connected equipment (DMM and power supply), download the latest version of the Keysight IO Libraries Suite software from the Keysight website and install on the control PC.
- 9. Open the Keysight IO Libraries Suite application and check for the detected DMM and power supply units as shown in the following example:



Details fo	or Keysig	ht Techn	ologies E36234A	
C	Ø	×		
Check Status	Edit	Remove	Interactive IO Monitor Command BenchVue Web UI Soft Front IO Expert Panel	
			Manufacturer:     Keysight Technologies       Model:     E36234A       Serial Number:     MY61001054       Firmware Version:     1.0.0-1.0.2-1.00	
			VISA Address Aliases SICL Address	
			USB0::0x2A8D::0x3402::MY61001054::0::INSTR USBInstrument7 usb0[10893::13314::MY61001054::0]	
			Installed IVI Drivers 🔕 Update	
			<no drivers="" installed=""></no>	

10. Copy the VISA addresses for the DMM and power supply to be pasted in the Port Verification pane of the GRL-V-UP API Test software.

## 4.2.3 Procedure for VBUS Voltage Measurement

1. In the Automation panel, enter the VISA addresses along with SI and calibration numbers for the power supply and DMM units connected to the GRL-V-UP tester hardware. *Note: The VISA address can be found in the respective I/O software of each equipment as shown in the Keysight IO Libraries Suite example in 4.2.2, Connection Setup.* 

Po	ower Supp	oly:	USBO	::0x1AB1::0x0	E11::DP8C	2249	05633::0:	INSTR	
	SU	No:	DP8C	224905633	Cal No :	223	5903-23		
igital	multimet	ter:	USBO	::0x05E6::0x6	500::04506	029:	0::INSTR		
	SL	No :	45060	029	Cal No :	223	5903-1		1
SI no	Channel	Volta	ge in V	Current in A	Delay in	mS	Sample	Tolorance	Unit
-			· ·	,					
,	Add Status :	]	Remo	we	Start			Report	]

FIGURE 4.13: SET EQUIPMENT VISA ADDRESS AND ID FOR GRL-V-UP AUTOMATED PORT VERIFICATION



- 2. Click on the **Add** button and configure the following parameters:
  - **Channel** This field allows the user to select the test case/measurement to be tested.
  - Voltage in V When testing VBUS voltage or VBUS sense voltage, this field allows the user to add the voltage levels for the respective test.
  - **Current in A** When testing VBUS current, this field allows the user to configure the required current value.
  - **Tolerance in V** The configuration in this field will change according to the measurement type (VBUS voltage, VBUS sense voltage or VBUS current) selected in the 'Channel' field. This field allows the user to set the tolerance level for the pass/fail criteria. The user can increase or decrease the tolerance level as required and the output in percentage will be set in tandem.
  - **Delay in mS** This field allows the user to set the delay value between two samples.
  - **Sample** This field allows the user to set the number of samples to be run in each test step.

Once configured, click on the **Add** button to add the configuration to the list.

*Note: The user can add a single or multiple measurement channels to be run simultaneously during testing.* 

			Power Supply : SI No : al multimeter : SI No :	Port Verification Automation :           USB0::0x1AB1::0x0E11::DP8C224905633:0::INSTR           DP8C224905633         Cal No : [2236903-23]           USB0::0x05E6::0x6500::04506029::0::INSTR           4506029         Cal No : [2236903-1]				R	
		SInc	Channel 1 VBUS Voltage		Current in A	Delay in mS 1000		Tolorance 0.1	Unit V
			2 VBUS Voltage	5	0	1000		0.18	
Add Data Channel : Voltage in V: Current in A: Tolorance in V Delay in mS : Sample :	VBUS Voltage ~ VBUS Voltage VBUS Sens Voltage VBUS Current 2 % 0.1 1000 5		Add Status : Error :	Remove	St	art [	Repo	rt 0 V	
	Add								

FIGURE 4.14: ADD MEASUREMENT CONFIGURATION

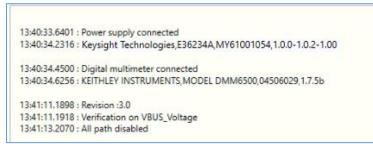
- 3. The user can delete an unwanted measurement configuration by selecting its respective row and click on the **Remove** button.
- 4. Click on the **Start** button to execute the automated port verification test.



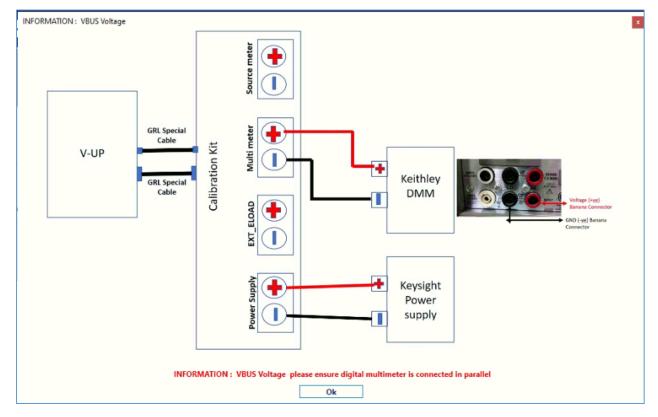
5. When the following screen appears, click **Yes** to proceed with the verification test for the selected tester port.



6. The activity log pane will also display the detected power supply and DMM log.

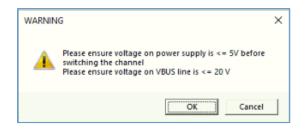


7. The connection diagram for the selected measurement channel will then appear as shown in the example below. Confirm that all devices are properly connected following the diagram and click **Ok** to proceed.





8. The following screen will appear as shown in the example below which requires the user to check the power supply voltage and VBUS line settings. Click **OK** to proceed.



9. Next, the user will need to check that the calibration kit's VBUS switch is turned ON as shown in the example screen below. Click **OK** to proceed.



10. While the port verification test is running, the GRL-V-UP measurement will be indicated in the 'Status' field. In case an error occurs during the test run, it will be indicated in the 'Error' field.

Port Verification Automation :           Power Supply :         USB0:0x1AB1::0x0E11::DP8C:224905633:0:INSTR           SI No :         Dp8C:224905633         Cal No :         2236903-23           Digital multimeter :         US80:0x05565:0x04506029:0:INSTR           SI No :         4506029         Cal No :         2236903-1	Configure Sink Capabilities : PDO (V) :  PPS 9 Max Currrent (A) : 1.43 +	13:40:33.6401 : Power supply connected 13:40:34.2316 : Keysight Technologies,E36234A,MY61001054,1.0.0-1.0.2-1.00 13:40:34.4500 : Digital multimeter connected 13:40:34.6256 : KEITHLEY INSTRUMENTS,MODEL DMM6500,04506029,1.7.5b 13:41:11.1898 : Revision :3.0
Sino         Channel         Voltage in V         Current in A         Delay in mS         Sample         Tolorance         Unit           1         V8US Voltage         5         0         1000         5         0.1         V           2         V8US Voltage         9         0         1000         5         0.18         V	Las Los Los Al	134-11.1018:       Verification on VBUS_Voltage         134-113.2070:       II path disabled         134:200.6579:       Path enabled         134:21.2038:       Iverifying voltage:         134:21.2038:       Reading
Add Remove Stop Report		seesso soor i needenges
Status : 4.9990 V		
Error: 0.1 % - Pass		
VOLTAGE RANGE < 6 V		Save Clear

11. The test report will be automatically generated and displayed once the test is completed, as shown in the example below.

GRI GRI	GRL-PWR-2020059 - Validation Report - 26-05-2023 13:42:48 quipment details							
Sl.No	Equipment	ID				Serial number	CERT NO	
1	Power supply	Keysight Technologies,E36234A	,MY61001054,1.0.0-1.0.2-1.00			MY59001458	2236903-5	
2	Digital multimeter	KEITHLEY INSTRUMENTS, MODEL	DMM6500,04506029,1.7.5b			4506029	2236903-1	
SI.No	ge Verification for Port1 Set VBUS Voltage in V	V-UP Voltage Measurement in V	V-UP Current Measurement in A	Power supply Voltage in V	Power supply Current in A	DMM Measurement in V	Deviation percentage / Result	
1	5	4.999	0.005	5.01	0.001	5.004	0.1 % - Pass	
2	5	4.998	0.005	5.01	0.001	5.004	0.12 % - Pass	
3	5	4.998	0.004	5.01	0.001	5.004	0.12 % - Pass	
4	5	4.996	0.004	5.01	0.001	5.004	0.16 % - Pass	
5	5	4.999	0.004	5.01	0.001	5.004	0.1 % - Pass	
6	9	8.975	0.005	9	0.117	8.997	0.24 % - Pass	
7	9	8.979	0.006	9	0.114	8.997	0.2 % - Pass	
8	9	8.969	0.003	9	0.113	8.997	0.31 % - Pass	
9	9	8.976	0.004	9	0.113	8.997	0.23 % - Pass	
	9	8.975	0.005		0.113	8.997	0.24 % - Pass	



12. The user can locate test reports from all port verification test runs by selecting the **Help** tab followed by **Port Validation Report** under 'Frequently Accessed Directories'. This will display the directory of all saved reports.

•	Support	File Home Share View					-	×
API	Granite River Labs Support Desk		Move Copy to to t	New item •	Properties	t 🔡 Select none		
7	Email Customer Support	Clipboard	Organise	New	Open	Select		
Graph		· ← → · ↑ 📑 « GRL → V-UP → Re	ports > PortVerification	5 V		Verification		
1	Quick Start Guide	🖈 Quick access	Name	Date modif	fied Typ	e S	ze	
•	C# API Documentation	OneDrive	PortVerification_2023_08_03_16_21_40	08-03-2023		rome HTML Document	26 KB	
opback	C# API Documentation		PortVerification_2023_08_03_16_15_52 PortVerification_2023_08_03_12_49_19	08-03-2023		rome HTML Document	22 KB 91 KB	
- )		This PC	PortVerification_2023_08_03_12_06_43	08-03-2023		rome HTML Document	91 KB	
?	Frequently Accessed Directories	3D Objects	PortVerification_2023_08_03_11_24_01	08-03-2023		rome HTML Document	50 KB	
-		Desktop	PortVerification 2023 08 03 11 20 18	08-03-2023		rome HTML Document	39 KB	
lelp	API Sample Scripts	Documents	PortVerification 2023 07 03 18 01 16	07-03-2023		rome HTML Document	26 KB	
		Downloads	PortVerification_2023_07_03_18_00_23	07-03-2023	06:00 PM Ch	rome HTML Document	26 KB	
7	App Data	Music	PortVerification_2023_07_03_17_59_18	07-03-2023	05:59 PM Ch	rome HTML Document	22 KB	
	ADD Data	E Pictures	PortVerification_2023_07_03_17_58_49	07-03-2023	05:58 PM Ch	rome HTML Document	20 KB	
		Videos	PortVerification_2023_07_03_17_58_22	07-03-2023	05:58 PM Ch	rome HTML Document	23 KB	
	D Software Release Note	Local Disk (C:)	PortVerification_2023_07_03_17_56_27	07-03-2023	05:56 PM Ch	rome HTML Document	56 KB	
		New Volume (E:)	PortVerification_2023_07_03_17_41_34	07-03-2023		rome HTML Document	26 KB	
	Port Validation Report	<ul> <li>ivew volume (E)</li> </ul>	PortVerification_2023_07_03_17_40_51	07-03-2023		rome HTML Document	20 KB	
	port validation Report	Network	<ul> <li>PortVerification_2023_07_03_17_40_37</li> <li>PortVerification_2023_07_03_17_35_38</li> </ul>	07-03-2023	05:40 PM Ch	rome HTML Document	24 KB 48 KB	

13. To perform verification for other GRL-V-UP tester card ports, select the required ports and repeat the above procedure.



## 4.2.4 Procedure for VBUS Sense Voltage Measurement

1. In the Automation panel, enter the VISA addresses along with SI and calibration numbers for the power supply and DMM units connected to the GRL-V-UP tester hardware. *Note: The VISA address can be found in the respective I/O software of each equipment as shown in the Keysight IO Libraries Suite example in 4.2.2, Connection Setup.* 

Power S	upply :	-	CONTRACTOR OF THE OWNER	ion Automati E11::DP8C224	CONTRACTOR OF THE OWNER	INSTR	1	
SI No :		-	DP8C224905633 Cal No: 2236903-23					
igital multi	meter :	USBO	::0x05E6::0x65	00::04506029	:0:INSTR		2	
	SI No :	45060	029	Cal No: 223	6903-1		1	
SI no Chan	nel Volta	age in V	Current in A	Delay in mS	Sample	Tolorance	Unit	
1			ĺ.	1				
Add		Remo	we	Start	]	Report	]	
Add		Remo	we	Start		Report 0 V		

FIGURE 4.15: SET EQUIPMENT VISA ADDRESS AND ID FOR GRL-V-UP AUTOMATED PORT VERIFICATION

- 2. Click on the **Add** button and configure the following parameters:
  - **Channel** This field allows the user to select the test case/measurement to be tested.
  - Voltage in V When testing VBUS voltage or VBUS sense voltage, this field allows the user to add the voltage levels for the respective test.
  - **Current in A** When testing VBUS current, this field allows the user to configure the required current value.
  - **Tolerance in V** The configuration in this field will change according to the measurement type (VBUS voltage, VBUS sense voltage or VBUS current) selected in the 'Channel' field. This field allows the user to set the tolerance level for the pass/fail criteria. The user can increase or decrease the tolerance level as required and the output in percentage will be set in tandem.
  - **Delay in mS** This field allows the user to set the delay value between two samples.
  - **Sample** This field allows the user to set the number of samples to be run in each test step.



Once configured, click on the **Add** button to add the configuration to the list.

*Note: The user can add a single or multiple measurement channels to be run simultaneously during testing.* 

	Add Data						-	
	ridd bard		0000	2 22				
		Channel :	VBUS S					
	Vo	Itage in V:	VBUS Voltage					
	Current in A:			VBUS Sens Voltage				
		VBUS C						
	Tolo	Tolorance in V			0.1			
	De	lay in mS :		10	00			
		Sample :		10.2	5			
			F	\dd				
	SI No :	DP8C224	905633	Cal N	P8C22490563	23		
)igital	multimeter :				506029::0::INS			
	SI No :	4506029		Cal N	o: 2236903-	1		
SI no	Channel		/ Curren	nt in A	Delay in mS	Sample	Tolorance	Unit
1	VBUS Sens Vo		5	0	1000		0.1	V
2	VBUS Sens Vo		9	0	1000	5	0.18	V
	Add	Remove		Sta	art.	Repo	rt	
,	Add	Remove		Sta	art 🗌		rt DV	
		Remove		Sta	ırt			

FIGURE 4.16: ADD MEASUREMENT CONFIGURATION

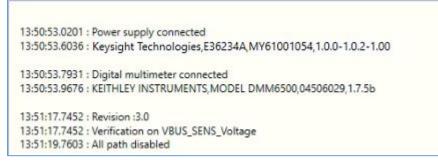
- 3. The user can delete an unwanted measurement configuration by selecting its respective row and click on the **Remove** button.
- 4. Click on the **Start** button to execute the automated port verification test.



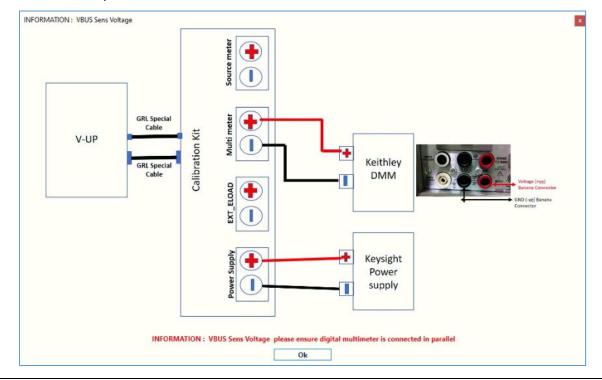
5. When the following screen appears, click **Yes** to proceed with the verification test for the selected tester port.



6. The activity log pane will also display the detected power supply and DMM log.

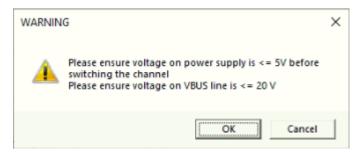


7. The connection diagram for the VBUS sense voltage measurement will then appear as shown in the example below. Confirm that all devices are properly connected following the diagram and click **Ok** to proceed.

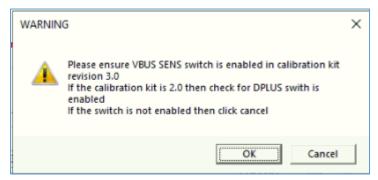




8. The following screen will appear as shown in the example below which requires the user to check the power supply voltage and VBUS line settings. Click **OK** to proceed.



9. Next, the user will need to check that the VBUS SENSE switch of calibration kit revision 3.0 is turned ON as shown in the example screen below. If revision 2.0 of the calibration kit is being used, then check that the DPLUS switch on the kit is turned ON. Once done, click **OK** to proceed.



10. While the port verification test is running, the GRL-V-UP measurement will be indicated in the 'Status' field. In case an error occurs during the test run, it will be indicated in the 'Error' field.

Power Supply :	Port Verification Automation : USB0:0x1AB1:0x0E11::DP8C224905633::0::INSTR	Configure Sink Capablities :	13:53:58:3978 : Power supply connected 13:53:58:9777 : Keysight Technologies,E36234A,MY61001054,1.0.0-1.0.2-1.00
SI No : Digital multimeter : SI No :	DP8C224905633         Cal No :         2236903-23           US80:0x0556:0x6500:04506029:0::INSTR         4506029         Cal No :         2236903-1	PD0 (V) : □ PPS 9 Max Currrent (A) : 1.43	13:53:59.1537 ; Digital multimeter connected 13:53:59.2432 ; KEITH-LEY INSTRUMENTS, MODEL DMM6500,04506029,1.7.5b 13:54:03.0465 ; Revision : 3.0
Si no Channel 1 VBUS Sens Vo 2 VBUS Sens Vo Add Status : Error :	Voltage in V         Current in A         Delay in mS         Sample         Tolorance         Unit           5         0         1000         5         0.1         V           9         0         1000         5         0.18         V           9         0         1000         5         0.18         V           0         0         1000         5         0.18         V	+ - Los Foo Car AL	135403.0465 : Verification on VBUS SENS_Voltage 135405.0467 : All path disabled 1354:18.1405 : Path enabled 1354:18.7434 : Verifying voltage : 5 V 1354:18.0543 : Foeding- 1354:20.0623 : Reading_ 1354:20.0543 : Reading_ 1354:20.849 : Reading_ 1354:20.849 : Reading_ 1354:20.238 : Sequence Disabled 1354:26.0539 : Path enabled 1354:37.2362 : Verifying voltage : 9 V
	VOLTAGE RANGE < 6 V		Save Clear

11. The test report will be automatically generated and displayed once the test is completed, as shown in the example below.



GRL-PWR-2020059 - Validation Report - 26-05-2023 13:54:57								
Sl.No	Equipment	ID				Serial number	CERT NO	
1	Power supply	Keysight Technologies,E36234A	,MY61001054,1.0.0-1.0.2-1.00			MY59001458	2236903-5	
2	Digital multimeter	KEITHLEY INSTRUMENTS, MODEL	DMM6500,04506029,1.7.5b			4506029	2236903-1	
VBUS Sens V	erification for Port1 Set VBUS Sens Voltage in	n V V-UP Voltage Measurement in V	V-UP Current Measurement in A	Power supply Voltage in V	Power supply Current in A	DMM Measurement in V	Deviation percentage / Result	
1	5	4.989	0.004	5.01	0.001	5.004	0.3 % - Pass	
2	5	4.987	0.004	5.01	0.001	5.004	0.34 % - Pass	
3	5	4.986	0.005	5.01	0.001	5.004	0.36 % - Pass	
4	5	4.991	0.006	5.01	0.001	5.004	0.26 % - Pass	
5	5	4.992	0.006	5.01	0.001	5.004	0.24 % - Pass	
6	9	8.973	0.006	9	0.113	8.997	0.27 % - Pass	
7	9	8.981	0.006	9	0.113	8.997	0.18 % - Pass	
8	9	8.974	0.005	9	0.113	8.997	0.26 % - Pass	
9	9	8.975	0.006	9	0.112	8.997	0.24 % - Pass	
10	9	8.979	0.005	9	0.112	8.997	0.2 % - Pass	

12. The user can locate test reports from all port verification test runs by selecting the **Help** tab followed by **Port Validation Report** under 'Frequently Accessed Directories'. This will display the directory of all saved reports.

	Support	File Home Share View					-	×
API	Granite River Labs Support Desk	Pinto Quick Copy Paste Porto	Move Conv Delete Rename New	New item ▼ Easy access ▼	Properties	Select all Select none		
	Email Customer Support	access Paste shortcut Clipboard	Organise	New	Open	Select		
Graph		← → ·	eports > PortVerification	5 4	© Search PortVerit	ication		
	Quick Start Guide		Name	Date modifi	0		ze	
<b>J</b>	•	🖈 Quick access	PortVerification_2023_08_03_16_21_40	08-03-2023	04:21 PM Chrom	HTML Document	26 KB	
opback	C# API Documentation	<ul> <li>OneDrive</li> </ul>	PortVerification_2023_08_03_16_15_52	08-03-2023	04:15 PM Chrom	e HTML Document	22 KB	
	•	This PC	PortVerification_2023_08_03_12_49_19	08-03-2023	12:49 PM Chrom	HTML Document	91 KB	
2	Frequently Accessed Directories	3 3D Objects	PortVerification_2023_08_03_12_06_43	08-03-2023		e HTML Document	91 KB	
?	inequeinity Accessed Directories		PortVerification_2023_08_03_11_24_01	08-03-2023	11:24 AM Chrom	HTML Document	50 KB	
	API Sample Scripts	Desktop	PortVerification_2023_08_03_11_20_18	08-03-2023		e HTML Document	39 KB	
	API Sample Scripts	Documents	PortVerification_2023_07_03_18_01_16	07-03-2023		e HTML Document	26 KB	
		- Downloads	PortVerification_2023_07_03_18_00_23	07-03-2023		e HTML Document	26 KB	
	App Data	Music	PortVerification_2023_07_03_17_59_18	07-03-2023		HTML Document	22 KB	
		E Pictures	PortVerification_2023_07_03_17_58_49	07-03-2023		e HTML Document e HTML Document	20 KB 23 KB	
	Software Release Note	Videos	<ul> <li>PortVerification_2023_07_03_17_58_22</li> <li>PortVerification 2023 07 03 17 56 27</li> </ul>	07-03-2023		HTML Document	23 KB 56 KB	
	Software Release Note	Local Disk (C:)	PortVerification 2023 07 03 17 41 34	07-03-2023		HTML Document	26 KB	
		- New Volume (E:)	PortVerification_2023_07_03_17_40_51	07-03-2023		HTML Document	20 KB	
	Port Validation Report		PortVerification_2023_07_03_17_40_37	07-03-2023		HTML Document	20 KB	
		ight Network	PortVerification_2023_07_03_17_35_38	07-03-2023		HTML Document	48 KB	

13. To perform verification for other GRL-V-UP tester card ports, select the required ports and repeat the above procedure.



## 4.2.5 Procedure for VBUS Current Measurement

1. In the Automation panel, enter the VISA addresses along with SI and calibration numbers for the power supply and DMM units connected to the GRL-V-UP tester hardware. *Note: The VISA address can be found in the respective I/O software of each equipment as shown in the Keysight IO Libraries Suite example in 4.2.2, Connection Setup.* 

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	SIN	lo: 4	1506029	)	Cal No	: 223	6903-1		
SI no	Channel	Voltage	in V C	urrent in A	Delay i	in mS	Sample	Tolorance	Unit
			1		1				
A	Add	]R	emove		Start			Report	]
A	Status :	)R	emove		Start		] []	Report 0 V	]
A	1005152	)R	emove		Start		] []	cipero.	

FIGURE 4.17: SET EQUIPMENT VISA ADDRESS AND ID FOR GRL-V-UP AUTOMATED PORT VERIFICATION

- 2. Click on the **Add** button and configure the following parameters:
  - **Channel** This field allows the user to select the test case/measurement to be tested.
  - Voltage in V When testing VBUS current, this field allows the user to add the voltage levels for the respective test.
  - **Current in A** When testing VBUS current, this field allows the user to configure the required current value.
  - **Tolerance in A** The configuration in this field will change according to the measurement type (VBUS voltage, VBUS sense voltage or VBUS current) selected in the 'Channel' field. This field allows the user to set the tolerance level for the pass/fail criteria. The user can increase or decrease the tolerance level as required and the output in percentage will be set in tandem.
  - **Delay in mS** This field allows the user to set the delay value between two samples.



• **Sample** — This field allows the user to set the number of samples to be run in each test step.

Once configured, click on the **Add** button to add the configuration to the list.

*Note: The user can add a single or multiple measurement channels to be run simultaneously during testing.* 

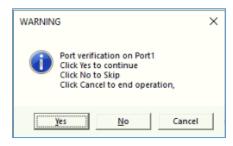
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Pow	er Supply :	Port USB0::0x1			utomatio P8C22490		3::0::INST	R		
	SI No :	DP8C224	905633	Cal N	o: 2236	903-	-23			
Digital m	ultimeter :	USB0::0x0	5E6::0x6	500::04	506029:0	):INS	STR			
	SI No :	4506029		Cal N	lo: 2236	903-	1			
SI no C		Voltage in V	Curren	t in A	Delay in	mS	-		Unit	
	BUS Current		5	1		000		0.02	A	
2 V	BUS Current	9		1	1	000	5	0.02	A	H
Ad	ld Status : Error :	Remove		St	art		Repoi	rt D V		

FIGURE 4.18: ADD MEASUREMENT CONFIGURATION

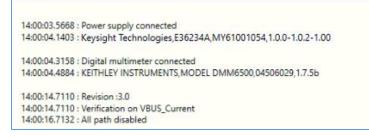
3. The user can delete an unwanted measurement configuration by selecting its respective row and click on the **Remove** button.



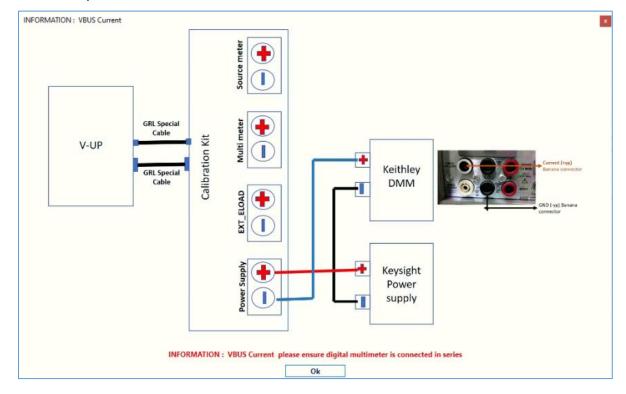
- 4. Click on the Start button to execute the automated port verification test.
- 5. When the following screen appears, click **Yes** to proceed with the verification test for the selected tester port.



6. The activity log pane will also display the detected power supply and DMM log.



7. The connection diagram for the VBUS current measurement will then appear as shown in the example below. Confirm that all devices are properly connected following the diagram and click **Ok** to proceed.





8. The following screen will appear as shown in the example below which requires the user to check the power supply voltage and VBUS line settings. Click **OK** to proceed.



9. Next, the user will need to check that the calibration kit's VBUS switch is turned ON as shown in the example screen below. Click **OK** to proceed.



10. While the port verification test is running, the GRL-V-UP measurement will be indicated in the 'Status' field. In case an error occurs during the test run, it will be indicated in the 'Error' field.

Power Supply : USB0::0x1AB SI No : DP8C224905	Call No:         2236903-12           Call No:         2236903-23           Call No:         2236903-12	Configure Sink Capabilities : PDO (V) : _ PPS 9 Max Currrent (A) : 1.43	14:00:04.1403 : Keysight Technologies,E36234A,MY61001054,1:0.0-1:0.2-1:00 14:00:04.3158 : Digital multimeter connected 14:00:04.4884 : KEITHLEY INSTRUMENTS,MODEL DMM6500,04506029,1:7:5b 14:00:14.7110 : Revision :3.0 14:00:14.7110 : Verification on VBUS_Current 14:00:16:7132 : All part disabled
SI no Channel Voltage in V 0 1 VBUS Current 5 2 VBUS Current 9	Current in A         Delay in mS         Sample         Tolorance         Unit           1         1000         5         0.02         A           1         1000         5         0.02         A           1         1000         5         0.02         A	Lead Control of Contro	1400507737 Path enabled 1400514631 Sequence enabled 1400514631 Sequence enabled 1400574631 Sequence enabled 1400575477 Reading 14010575407 Reading 1401056749 Reading 1401058749 Reading 1401138042 Sequence Disabled 140114.4670 Sequence Disabled 140114.4670 Sequence enabled 14011714578 Verifying current : 1 A 140115.1980 Sequence enabled 1401172057 Reading
Status :	0.9980 A		
Error :	0.22 % - Pass		
	CURRENT RANGE < 6 A		Save Clear

11. The test report will be automatically generated and displayed once the test is completed, as shown in the example below.

GRL-PWR-2020059 - Validation Report - 26-05-2023 14:01:40								
Sl.No	Equipment	ID				Serial number	CERT NO	
1	Power supply	Keysight Technologies,E36234A	,MY61001054,1.0.0-1.0.2-1.00			MY59001458	2236903-5	
2	Digital multimeter	KEITHLEY INSTRUMENTS, MODEL	DMM6500,04506029,1.7.5b			4506029	2236903-1	
VBUS Curre	nt Verification for Port	V-UP Voltage Measurement in V	V-UP Current Measurement in A	Power supply Voltage in V	Power supply Current in A	DMM Measurement in A	Deviation percentage / Result	
1	1	4.791	0.996	5.01	0.994	0.9956	0.04 % - Pass	
2	1	4.791	0.996	5.01	0.994	0.9957	0.03 % - Pass	
3	1	4.791	0.998	5.01	0.994	0.9957	0.23 % - Pass	
4	1	4.79	0.998	5.01	0.995	0.9958	0.22 % - Pass	
5	1	4.79	0.998	5.01	0.994	0.9958	0.22 % - Pass	
6	1	8.772	0.998	9	0.996	0.9972	0.08 % - Pass	
7	1	8.781	0.999	9	0.996	0.9972	0.18 % - Pass	
8	1	8.774	0.998	9	0.996	0.9972	0.08 % - Pass	
9	1	8.776	0.997	9	0.996	0.9973	0.03 % - Pass	
*								



12. The user can locate test reports from all port verification test runs by selecting the **Help** tab followed by **Port Validation Report** under 'Frequently Accessed Directories'. This will display the directory of all saved reports.

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