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UM2468

User manual

STM32CubeMonitor-UCPD software tool for USB Type-C® power-delivery port management

Introduction

STM32CubeMonitor-UCPD (STM32CubeMonUCPD) is a software tool to configure and monitor the USB Type-C® power-delivery (UCPD) ports on equipped STM32 boards. The configuring part allows the modification of the USB Type-C® power-delivery port default configuration. Checks of power-delivery contract establishment and activity are possible with the monitoring tool.

STM32 CubeMonitor-UCPD

STM32 Cube

1 Features

The main features of the STM32CubeMonitor-UCPD software tool are the following:

- Configures and monitors USB Type-C® power-delivery (UCPD) ports of STMicroelectronics Type-C power delivery boards.
- Sends device policy manager (DPM) messages to the distant USB Type-C® power-delivery port.

This software applies to STM32 Arm®-based microcontrollers.

Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

2 Getting started

2.1 Computer requirements

Supported operating systems and architectures

- Windows® 10 and 11, 64 bits (x64)
- Linux®: Ubuntu® LTS 20.04 and LTS 22.04
- macOS® 13 (Ventura), macOS® 14 (Sonoma)

Note: Windows is a trademark of the Microsoft group of companies.

Linux® is a registered trademark of Linus Torvalds.

Ubuntu® is a registered trademark of Canonical Ltd.

macOS® is a trademark of Apple Inc., registered in the U.S. and other countries and regions.

Software requirements

For Linux®, the installer requires the Java Runtime Environment.

Note: Oracle and Java are registered trademarks of Oracle and/or its affiliates.

2.2 Hardware requirements

- One free USB2 or USB3 host port
- Mini-B or Micro-B cable depending on the target board to access the STM32 ST-LINK
- STMicroelectronics target board with USB Type-C® and firmware latest version (embedding the tracer or the cubemon_ucpd_emb module) as described in the user manual *STM32 TCPM Application* (UM2063), downloaded from STMicroelectronics website *www.st.com*) selecting X-CUBE-USB-PD or built through STM32CubeMX.

2.3 Installing

2.3.1 Installing STM32CubeMonitor-UCPD

The user must have administrator rights on the computer to install the tool.

The steps needed to install the STM32CubeMonitor-UCPD software tool are detailed below (all files can be downloaded from the STMicroelectronics website *www.st.com*):

1. Download SetupSTM32CubeMonitor-UCPD.zip and unzip it in a temporary location.
2. Perform the setup process associated with the environment (x.y.z represents STM32CubeMonitor-UCPD software version):
   - Windows®: launch SetupSTM32CubeMonitor-UCPD-x.y.z.exe and follow the instructions provided.
   - Linux®: launch SetupSTM32CubeMonitor-UCPD-x.y.z.jar and follow the instructions provided.
   - macOS®: launch SetupSTM32CubeMonitor-UCPD-x.y.z.dmg and, into the installer window, drag and drop the *STM32CubeMonitor-UCPD* icon on the *Applications* icon.

If another version of STM32CubeMonitor-UCPD is already installed, the existing version must be uninstalled before installing the new version. Refer to Section 2.4 for more details.

2.3.2 Installing the USB driver for ST-LINK

Note: This section is only applicable to Windows® operating systems.

Follow the steps detailed below to install the USB driver for ST-LINK (all files can be downloaded from the STMicroelectronics website *www.st.com*):

1. Download the USB driver for ST-LINK (STSW-LINK009).
2. Go in the directory `C:\Program Files (x86)\STMicroelectronics\Software\Virtual comport driver` and launch `Win8\dpinst_amd64.exe`.
3. Plug the board with the USB cable. Windows® detects it as an STMicroelectronics ST-LINK Virtual COM port named COMxx.
   Example: COM10.

2.4 Uninstalling STM32CubeMonitor-UCPD

The steps needed to uninstall STM32CubeMonitor-UCPD are detailed below for the various operating systems:

- **Windows®**
  Two possible options are:
  1. Open the Windows® *Control* panel. Select *Programs and Features* to display the list of programs installed on the computer. Right-click on *STM32CubeMonitor-UCPD* from the STMicroelectronics publisher and select the **uninstall** function.
  2. Go to the installation location (for example *C:\Program Files\STMicroelectronics\ STM32CubeUCPD*), go to the *Uninstaller* folder, and launch `uninstaller.jar`.
- **Linux®**
  Go to the STM32CubeMonitor-UCPD installation location (example `$HOME/STMicroelectronics/STM32CubeMonitor-UCPD`), go to the `Uninstaller` folder, and launch `uninstaller.jar`.
- **macOS®**
  Drag and drop the *STM32CubeMonitor-UCPD application* icon onto the *Trash* icon.

2.5 Uninstalling the USB driver for ST-LINK

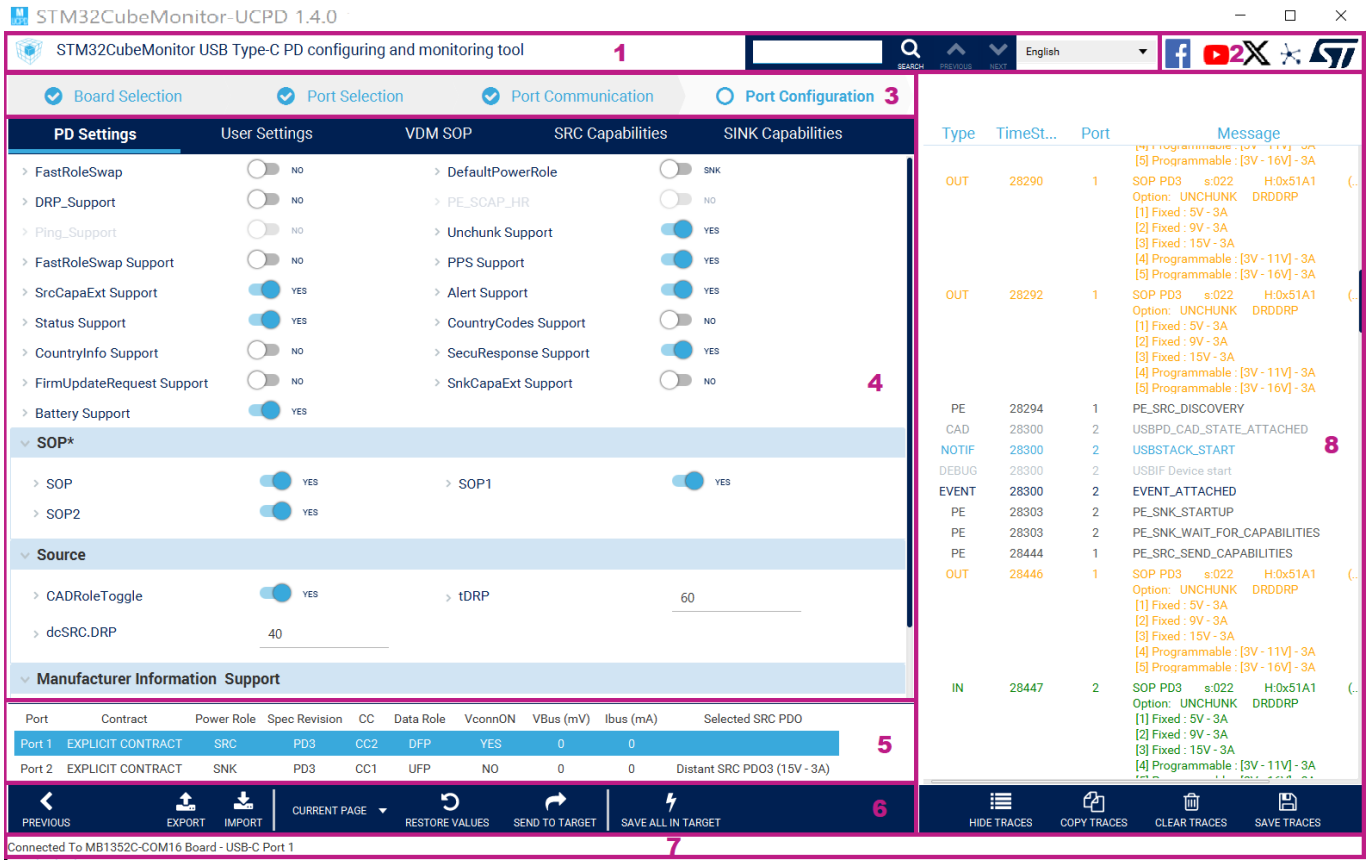
Note: This section is only needed for Windows® operating systems.

Perform the following steps to uninstall the STMicroelectronics USB driver for ST-LINK:

1. Open the Windows® *Control* panel.
2. Select *Programs and Features* to display the list of programs installed on the computer.
3. Right-click on *Windows Driver Package - STMicroelectronics (WinUSB) STLinkWinUSB* from the STMicroelectronics publisher and select the `uninstall` function.

3 Windows structure - main areas

Figure 1. Overview of all panels



The main areas are the following (also shown in Figure 1):

- **Area 1**: *Application Title* panel
- **Area 2**: *Social* panel, linked to STMicroelectronics social networks shown in Figure 2
- **Area 3**: *Ribbon* panel, where the four main states are listed and accessible step after step:
  1. *Board selection*
  2. *Port Selection*
  3. *Port Configuration*
  4. *Port Communication*

  Chevron-right and *chevron-left* buttons in the *Button* panel allow navigation to the previous or next step.
- **Area 4**: *Main* panel content is state-dependent. Refer to Section 4: How to use STM32CubeMonitor-UCPD.
- **Area 5**: *Port Status* panel gives a sum up of each board port. Refer to Section 4.4: *Port Status* information.
- **Area 6**: *Button* panelists the actions.
- **Area 7**: The *Status* bar panel displays the board version and the port selected when relevant.
- **Area 8**: *Traces* panel. Refer to Section 5: Traces information.

Figure 2. **Social network shortcut area**

This area contains five shortcuts to social networks and web pages:

- The Facebook™ icon leads to the official STMicroelectronics Facebook page.
- The YouTube™ icon leads to the official STMicroelectronics YouTube page.
- The X icon leads to the official STMicroelectronics X page.
- The Share icon leads to the ST community website.
- The ST icon leads to the official STMicroelectronics website.

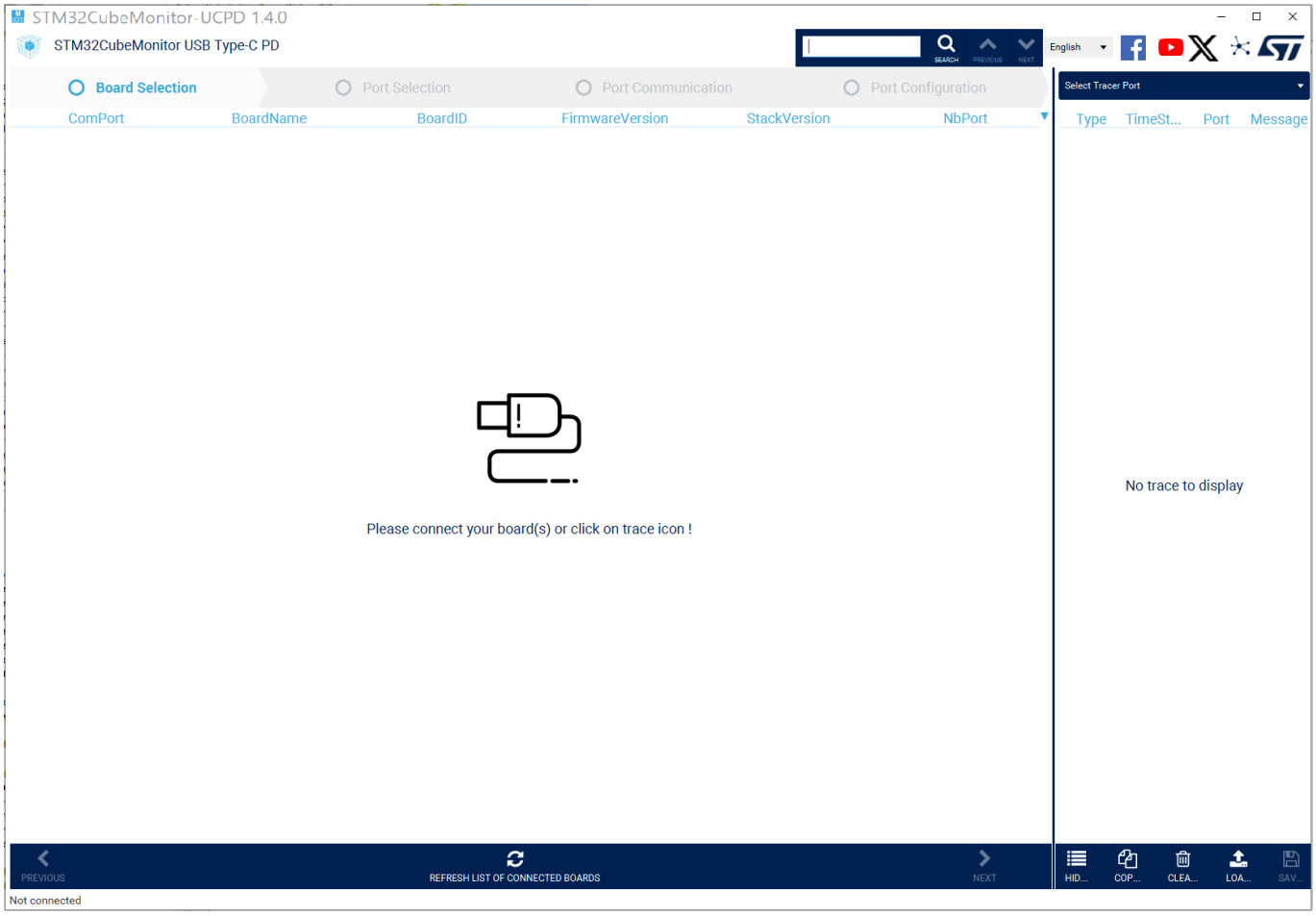
4 How to use STM32CubeMonitor-UCPD

4.1 Board detection and selection

The detection of a board is automatically launched when the application starts.

If there is no board connected via USB to the computer, the application displays an invitation to connect the board as shown in Figure 3.

Figure 3. Invitation to connect the board



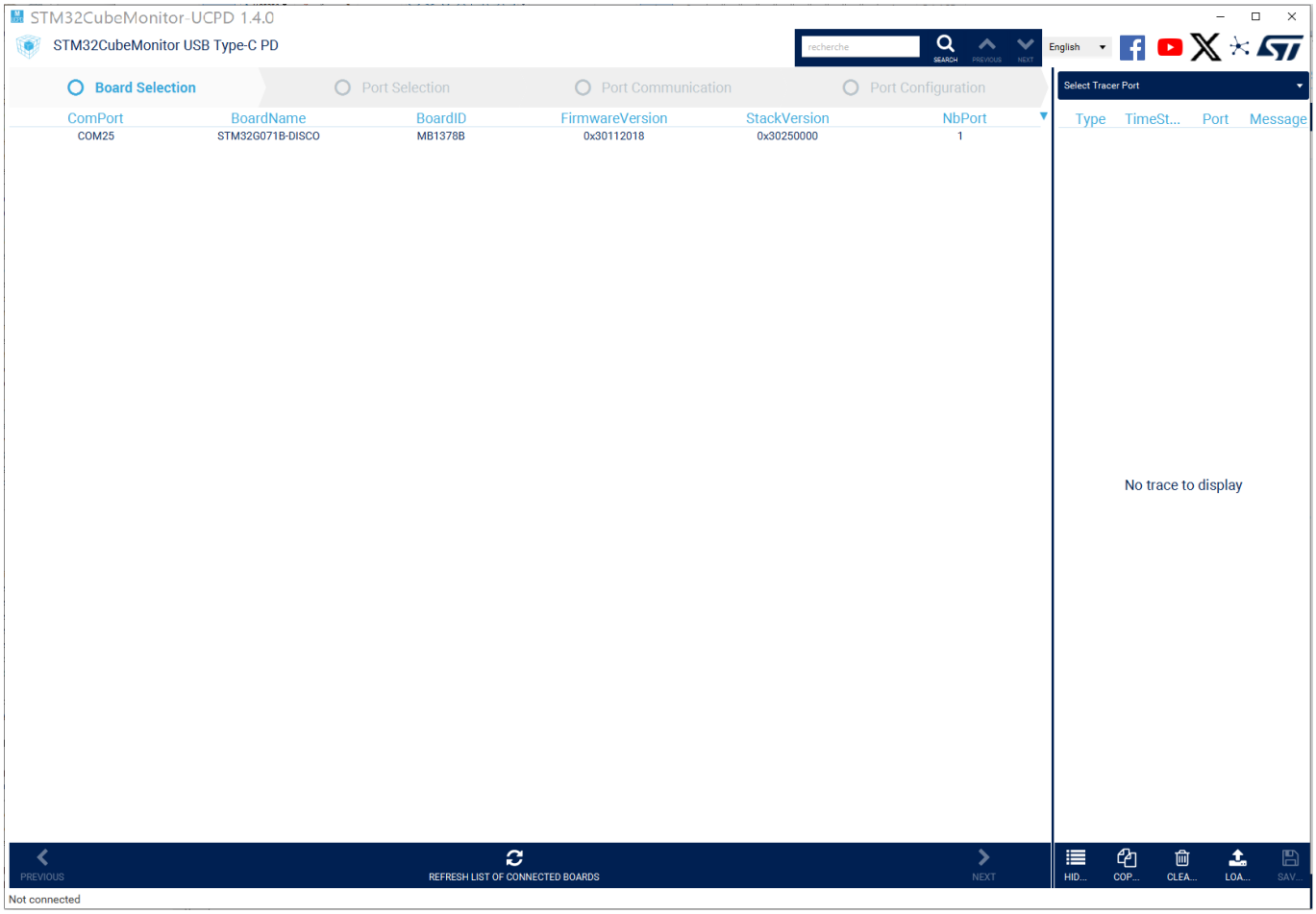
To see a new connected board, click on the button *Refresh list of connected boards*. The application sends a message to all devices, waiting for an appropriate response to distinguish the ST-UCPD GUI-capable boards from the other boards.

An ST-UCPD GUI-capable board is a device that contains a firmware source code to communicate between the STM32CubeMonitor-UCPD application and the device.

Note: If the GUI responder is not activated in the embedded firmware, but the debug trace is available (UART through VCP of the ST-LINK and the compilation switch _TRACE activated), the user might still see the trace in the UCPD monitor by clicking on the Trace button in the bottom-right corner.

All devices identified as ST-UCPD GUI capable are displayed in the *Board Selection* panel as shown in Figure 4.

Figure 4. *Board Selection* window



Parameters for each board are the following:

- Communication port assigned to the device (ComPort)
- Hardware board version
- Power delivery type
- Firmware version
- Stack version
- Number of USB Type-C® ports on the board (NbPort)

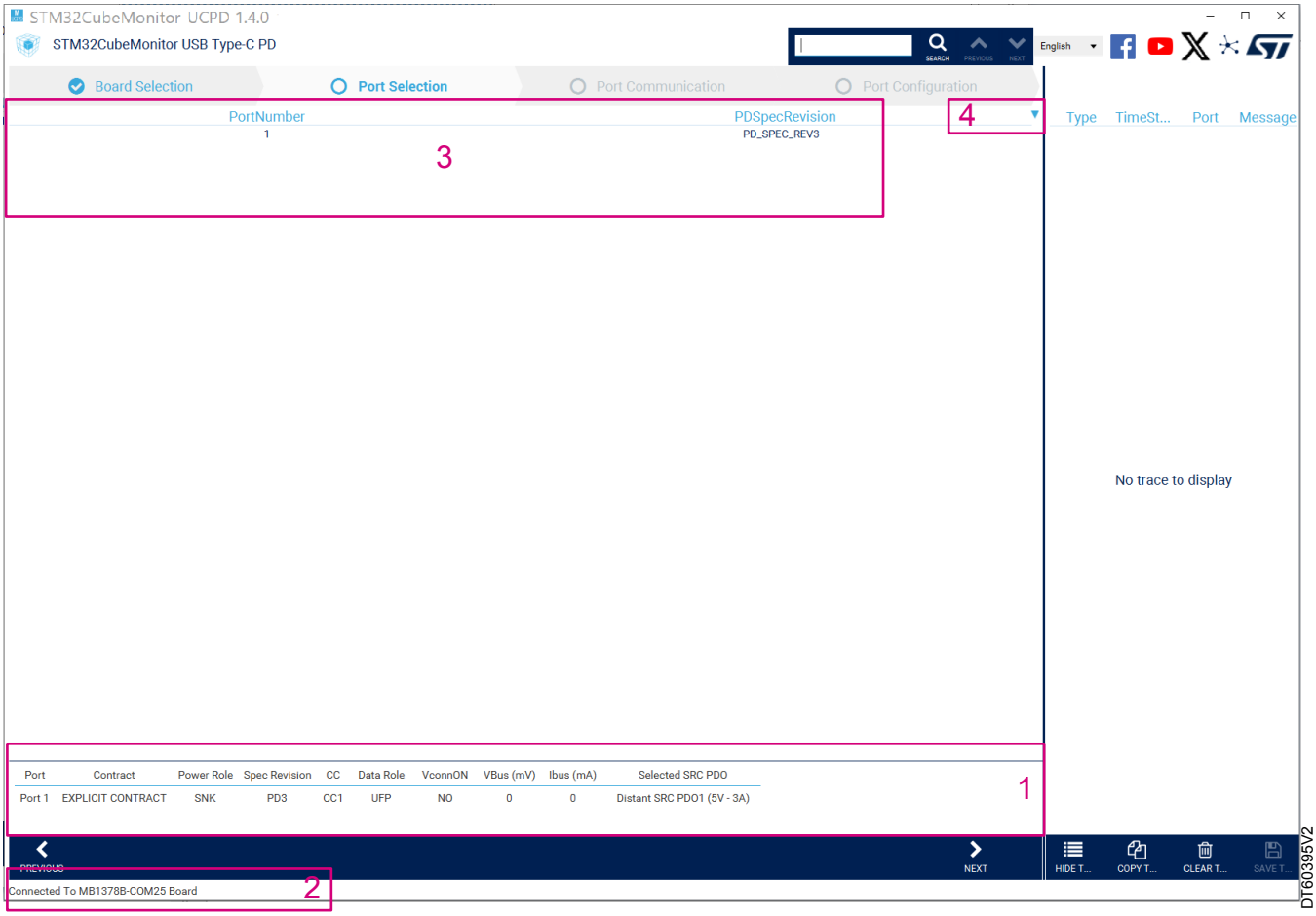
If a board is disconnected, it is removed from the *Board Selection* panel.

To select a board, move the mouse pointer to the corresponding line. The line is grayed out when selected. Then, double-click on the line or click on the chevron-right button. The board is selected and the application window moves to the *Port Selection* window.

4.2 Port selection

When a board is selected, the *Port Selection* window is opened as shown in Figure 5.

Figure 5. *Port Selection* window



The following details are provided in this window:

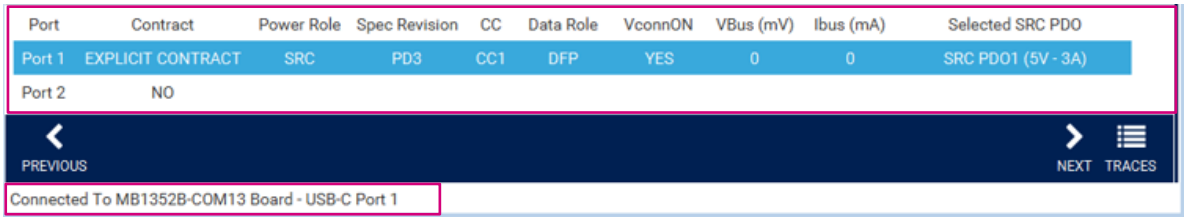
1. *Port Status* information panel. Refer to Section 4.4.2: *Port Status* information-Selected port).
2. The board selected in the previous steps is reported here (*PowerDeliveryType* and *ComPort* board parameters are described in Section 4.1: Board detection and selection).
3. List of USB Type-C® PD available on the selected board (two in this example), with the *PortNumber* written on the board and the PD specification revision supported by the *PDSpecRevision* port.
4. Click on it to select the static parameters to display. Refer to the USB PD standards for further definition of these parameters on the USB website.

Port selection can be performed in zone 1 or 3.

4.3 *Port Selection* action

Figure 6 shows the port parameters. On the *Port Status* panel, the port selected is highlighted in light blue. Refer to the next section for more details. The selected port number is added in the *Status* bar close to the selected board identification.

Figure 6. Port selected: *Port Status* panel, *Button*, and *Status* bars



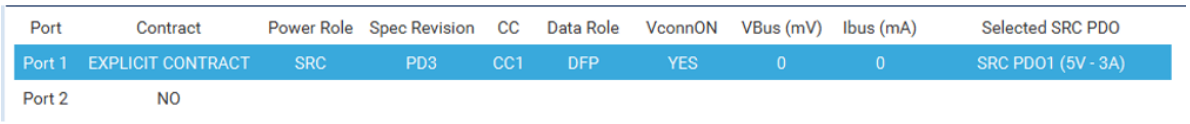
4.4 *Port Status* information

The *Port Status* panel is displayed as soon as a board is selected. This panel is available in the *Port Selection*, *Port Communication*, and *Port Configuration* windows. Refer to Figure 7.

Figure 7. *Port Selection* ribbon

This *Port Status* panel lists all the USB Type-C® with power delivery ports available on the board. Refer to Figure 8.

Figure 8. *Port Status* panel



For each port, the following characteristics are displayed:

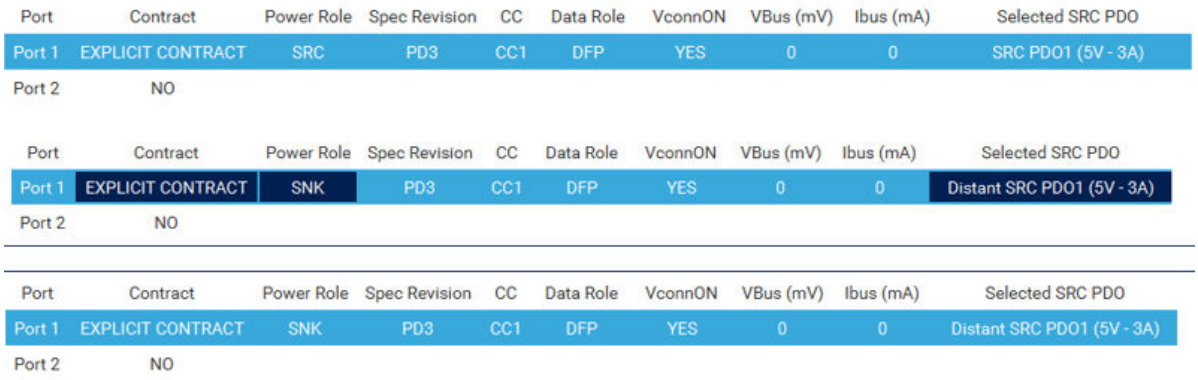
- *Contract*: If this field is not NO, it means that the port established a contract with a distant port and the relevant characteristics of this contract are displayed in the next columns.
- *Power Role*:
  - If this field is SNK, the *Selected SRC PDO* is the PDO selected for the distant port.
  - If this field is SRC, the *Selected SRC PDO* is the PDO selected for the current port.
- *Spec Revision* and *CC, Data Role, VconnON*: characteristics defined in the norm (`http://www.usb.org/developers/powerdelivery`)
- *VBus* and *IBus*: filled as soon as measurements are done. Refer to Section 4.5.2)
- *Selected SRC PDO*: selected PDO
  - If the current port is connected as a source, the *Selected SRC PDO* is its PDO selected which is displayed.
  - If the current port is connected as a sink, the *Selected SRC PDO* is the selected SRC PDO of the distant port on which the port is connected.

When the user double-clicks on a port in the *Port Status* panel, the selected port changes, and information in *Port communication* or port configuration is updated.

4.4.1 *Port Status* information update

When one of the parameters is updated, its value blinks for several seconds to draw attention. Updates can come from a hard-cable disconnection or a message sent that involves the contract cancellation or modification. Refer to Figure 9.

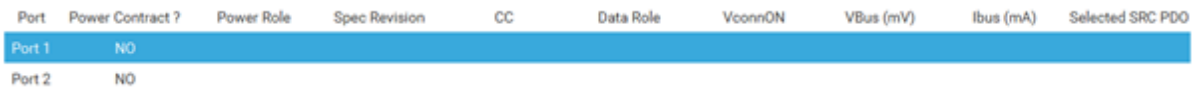
Figure 9. The *Parameter* blinks when the update is done



4.4.2 *Port Status* information-Selected port

As soon as the *Port Communication* or *Port Configuration* window is selected, the *Port Status* panel highlights the selected port in blue, as shown in Figure 10.

Figure 10. Selected port highlighted



4.5 *Port Communication*

Click on the *Port Communication* tab to see specific content, which can be useful only if the selected port is plugged into another device port.

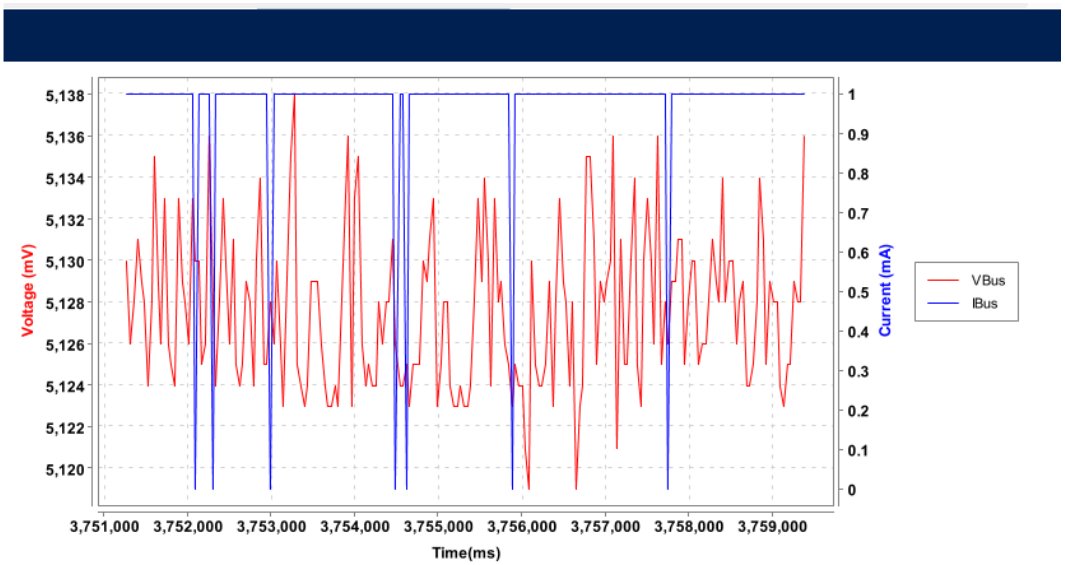
The two following tabs are displayed:

- The *General* tab, including three panels shown in Figure 11:
  - *DISTANT CAPABILITIES*: Capabilities of the distant device port
  - *MEASUREMENT*: Start or stop measures for this connection
  - *MESSAGE SELECTOR*: Messages sent to the distant device port

Figure 11. *General* tab overview

- The *Measurement* tab displays a full-screen view of the measurement graph. Refer to Figure 12).

Figure 12. *Measurement* tab overview



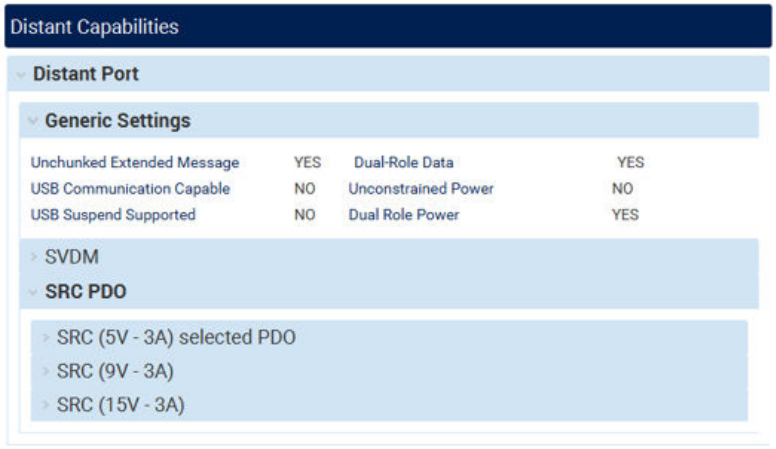
4.5.1 *Distant Capabilities* panel

The *Distant Capabilities* panel contains information coming from the distant port regarding its capabilities (settings, PDO, and VDM), depending on the selected *Power Role*, in a read-only mode.

The PDO used for the current contract is mentioned as the *selected PDO*.

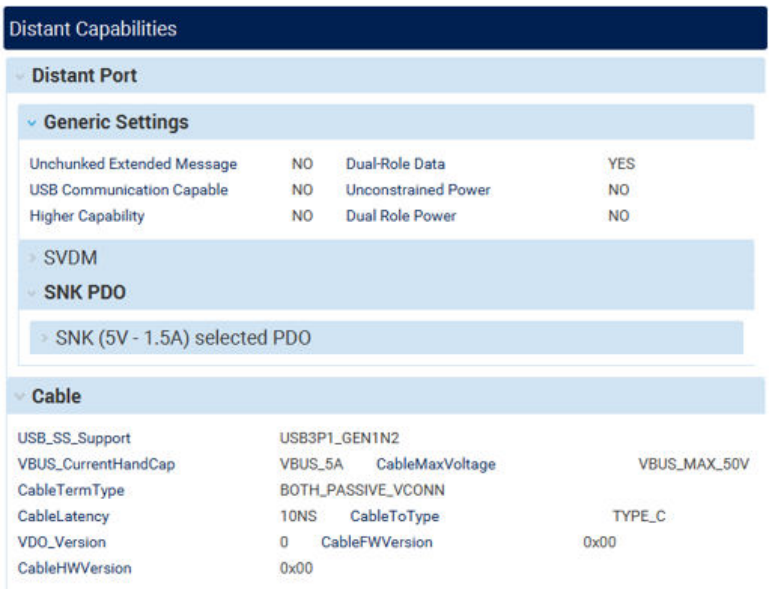
If the port is connected as a sink, the panel displays the source capabilities of the distant port as shown in Figure 13.

Figure 13. SRC capabilities of the distant port



If the port is connected as a source, the panel displays the sink capabilities of the distant port. If an electronic cable is in use, and the information related to it is displayed. Refer to Figure 14.

Figure 14. Sink capabilities of the distant port



Each capability is summarized but the detailed view is available by clicking on the chevron-right as shown in Figure 15.

Figure 15. Distant PDO details

4.5.2 *Measurement* panel

This panel shows a graphical view of the measures, containing the two following controls:

- *Start*/*Stop* button to activate or deactivate the measures
- *Period* to set the period in ms (between 40 and 5000 ms with 40 ms step)

When the measurement period is set to 0, it means that the measurement is not yet launched or is stopped.

The measures are only available when the port is connected. When measures are started but the port is not connected, there is no measurement done.

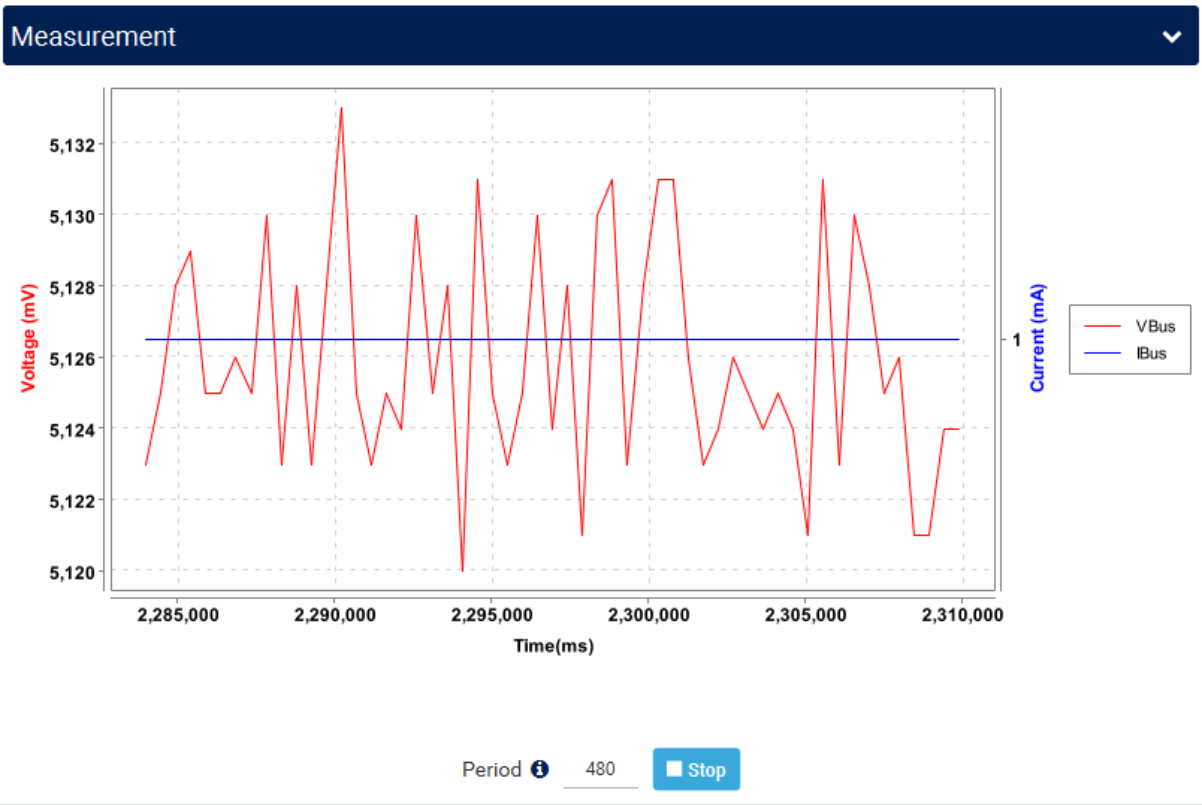
As shown in Figure 16, two different measures are done: the voltage (V_{BUS}) in mV and the current (I_{BUS}) in mA. Current values for I_{BUS} and V_{BUS} are also visible in the *Port Status* panel. Refer to Section 4.4: *Port Status* information.

Figure 16. *Measurement* panel

The steps to follow are detailed below:

1. Select a given period (for example 480 ms).
2. Activate the measurement by clicking on the *Start* button.

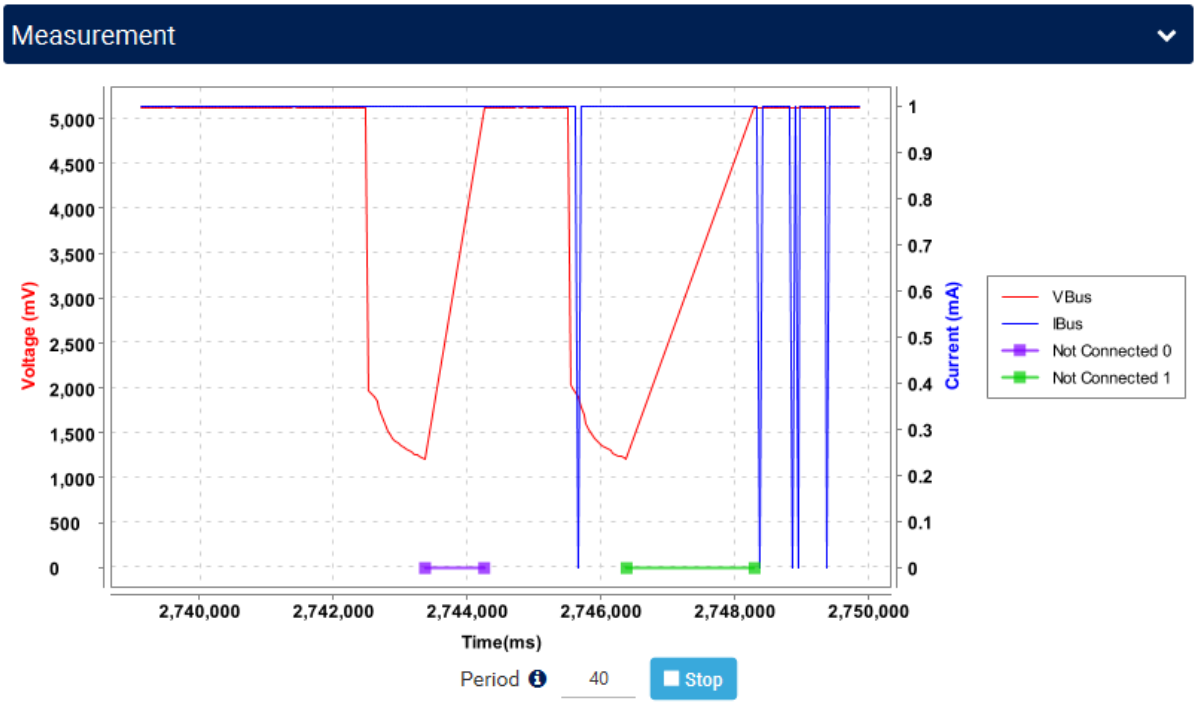
Figure 17. *Measurement* panel registering



3. Deactivate the measurement by clicking on the *Stop* button.

When the cable connecting the remote device is unplugged, a *Not Connected* line appears in the graph. In the example below, two disconnections occur and are visible with the green and purple lines.

Figure 18. *Measurement* panel disconnection



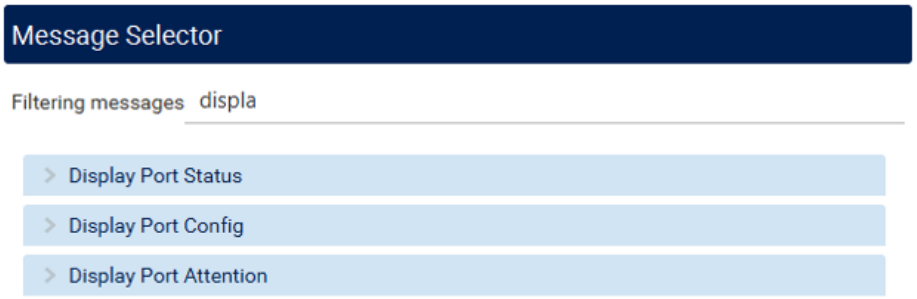
4.5.3 *Message Selector* panel

When a distant port is connected, it is possible to send messages to this distant port. The list of messages is available in the *Message Selector* panel as shown in Figure 19.

Figure 19. *Message Selector* panel

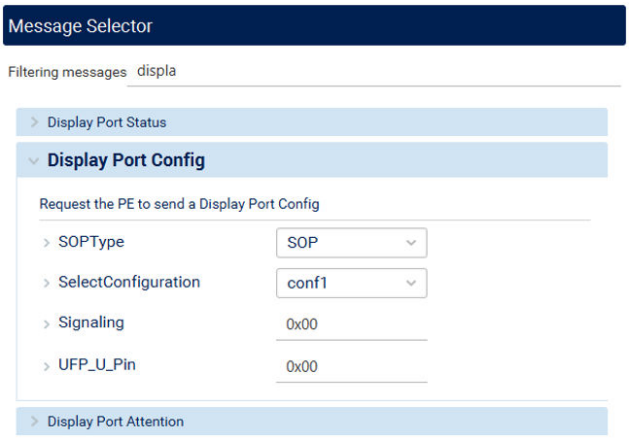
To reduce the number of messages visible, this list can be filtered with the *Filtering messages* field. Refer to the example in Figure 20.

Figure 20. Messages filtering



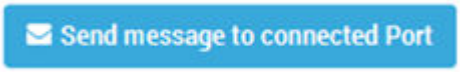
Select the message to send by clicking on it. When a message is selected, additional parameters to fill in are displayed if any. Refer to Figure 21.

Figure 21. Message parameters setting



Send the selected message by clicking on the *Send message to connected Port* button or double-clicking on the message itself. If the message is correctly sent, the *Send message to connected Port* button becomes green for a few seconds.

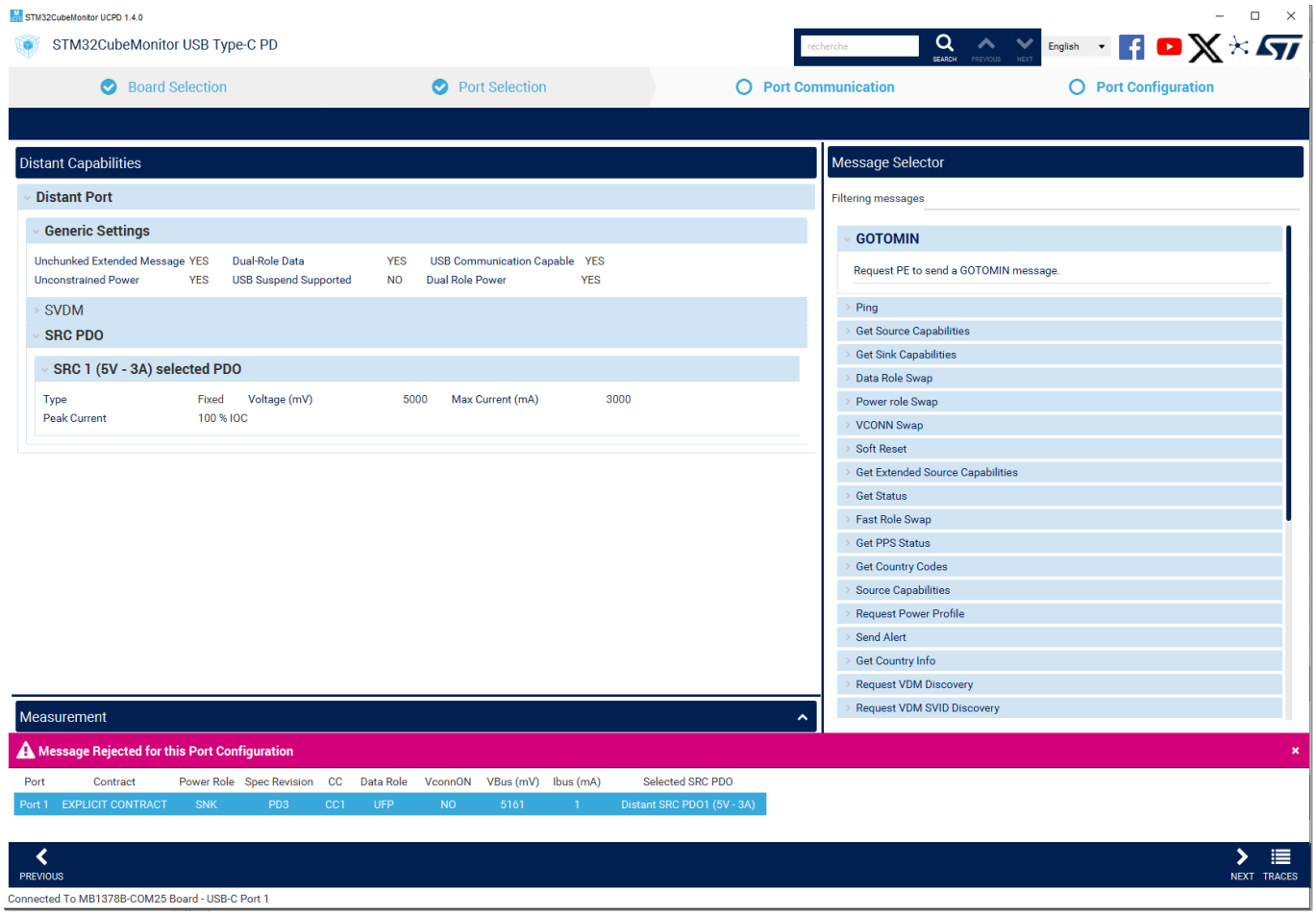
Figure 22. Send message button



Note: A message is considered correctly sent when the firmware considers it, but the attached action can fail. The analysis must be done with the available monitoring panels (such as Measurement, Distant Port Capabilities, Port Status, and Traces).

If the message is not correctly sent, a specific pop-up with a warning or error message appears as shown in Figure 23.

Figure 23. Message-warning information



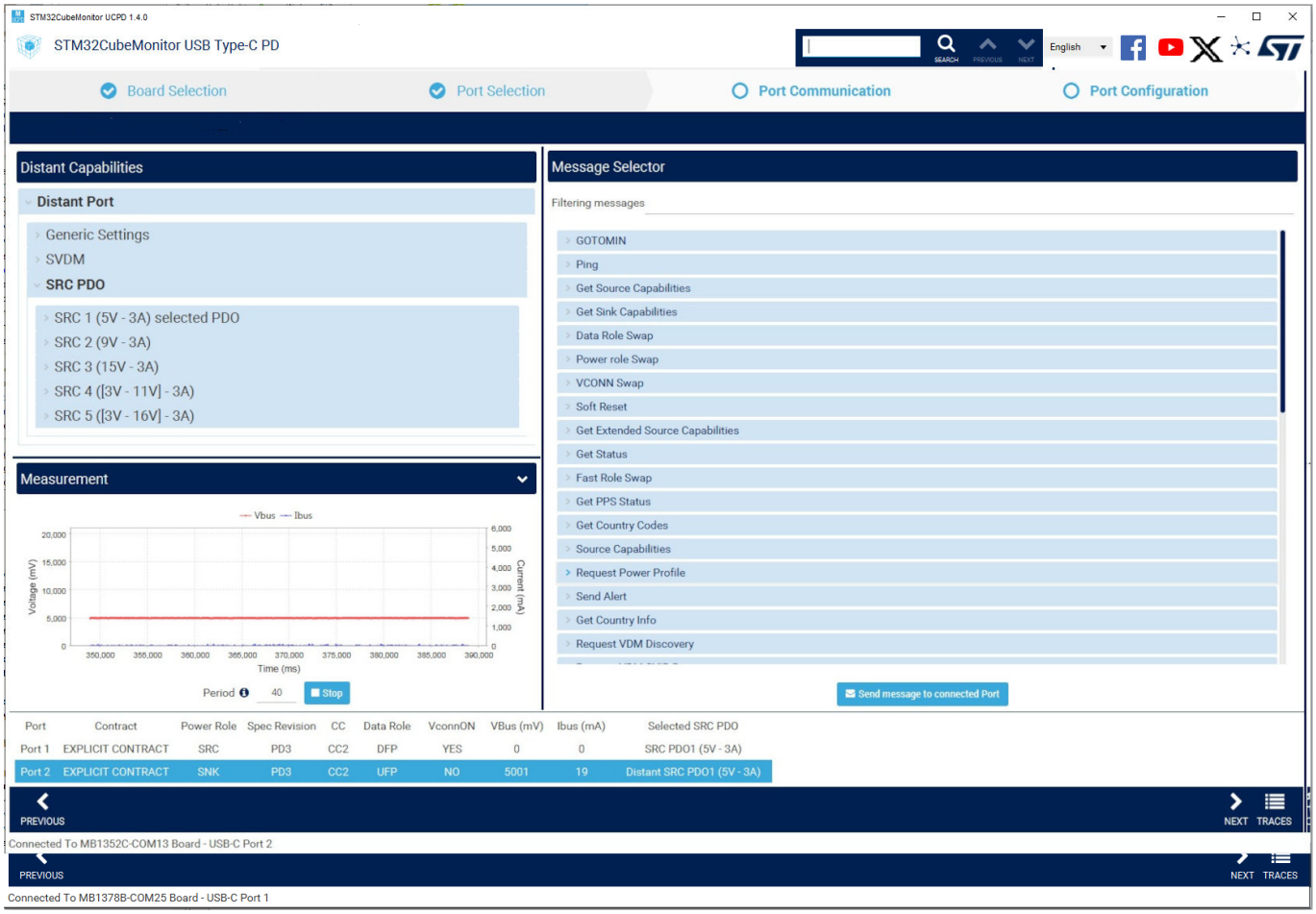
4.5.4 Typical use case with the *General* tab

This typical use case shows actions performed with the *Message Selector* panel and the analysis done with the *Measurement*, *Distant Port Capabilities*, *Port Status*, and *Traces* monitoring panels.

This use case is the selection of a new capability for the current contract.

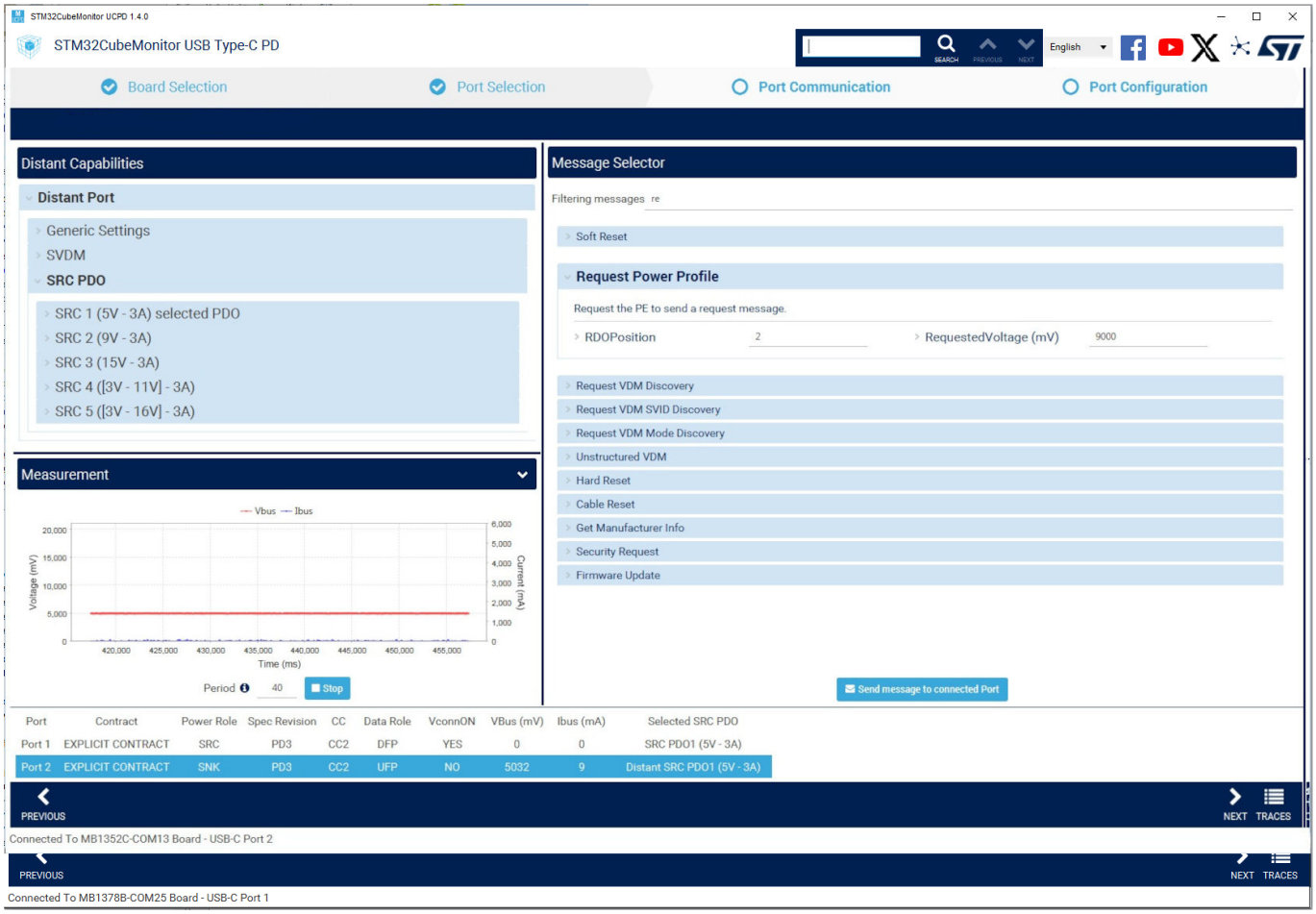
The initial status is *port connected with the selected PDO SRC1*, visible in the *Distant Port Capabilities* panel. The voltage measured in the *Measurement* panel is around 5000 mV.

Figure 24. Overview communication panel



In the *Message Selector* panel, select *Request Power profile*, and fill in the *RDOPosition* and *RequestedVoltage* additional parameters as shown in Figure 25.

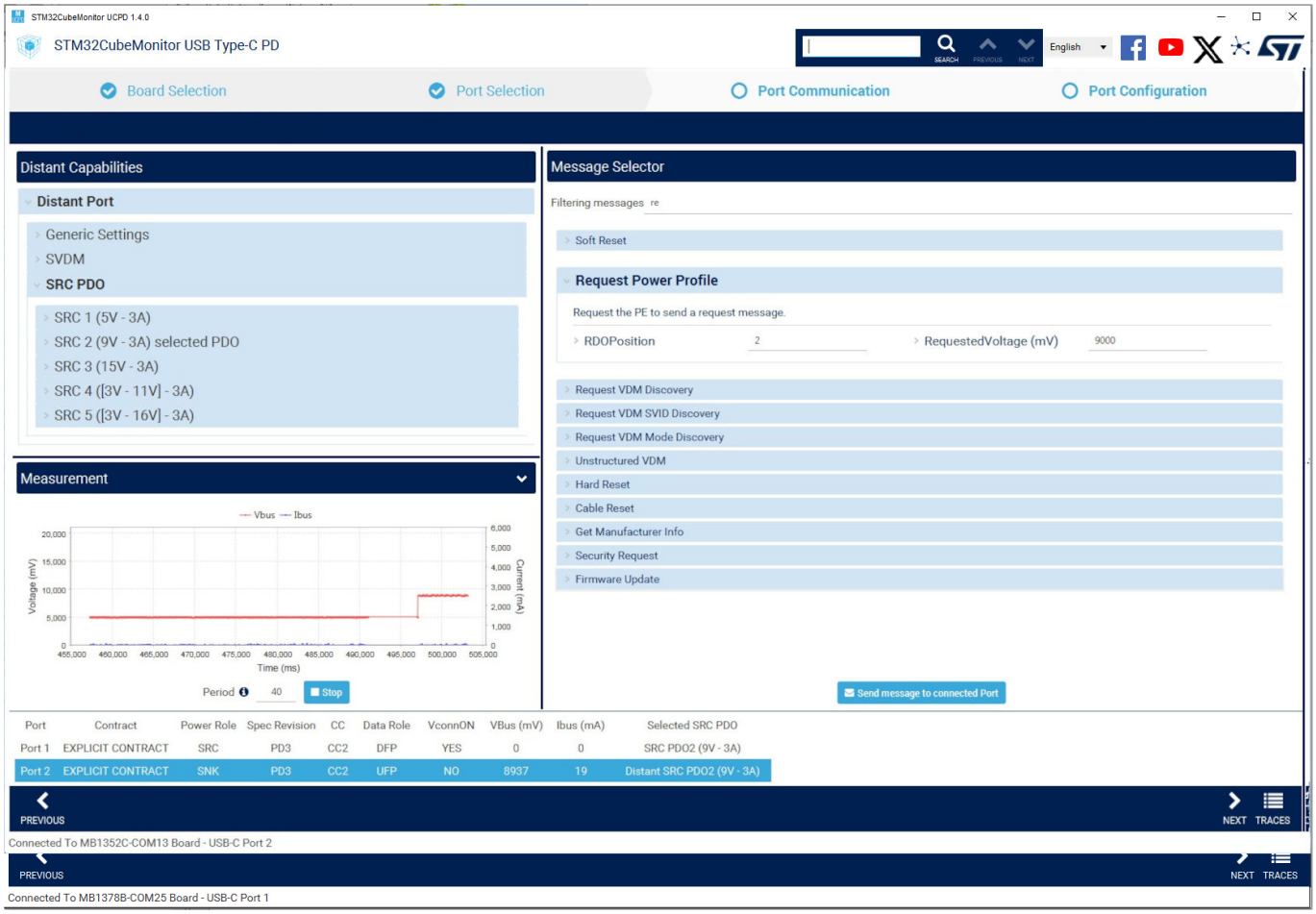
Figure 25. Message selection



As soon as the message is sent, the modifications listed below are visible. Refer to Figure 26:

- The *Selected PDO* in the *Distant Port Capabilities* panel is now SRC2.
- The measured voltage is around 9000 mV in the *Measurement* panel.

Figure 26. New power contract

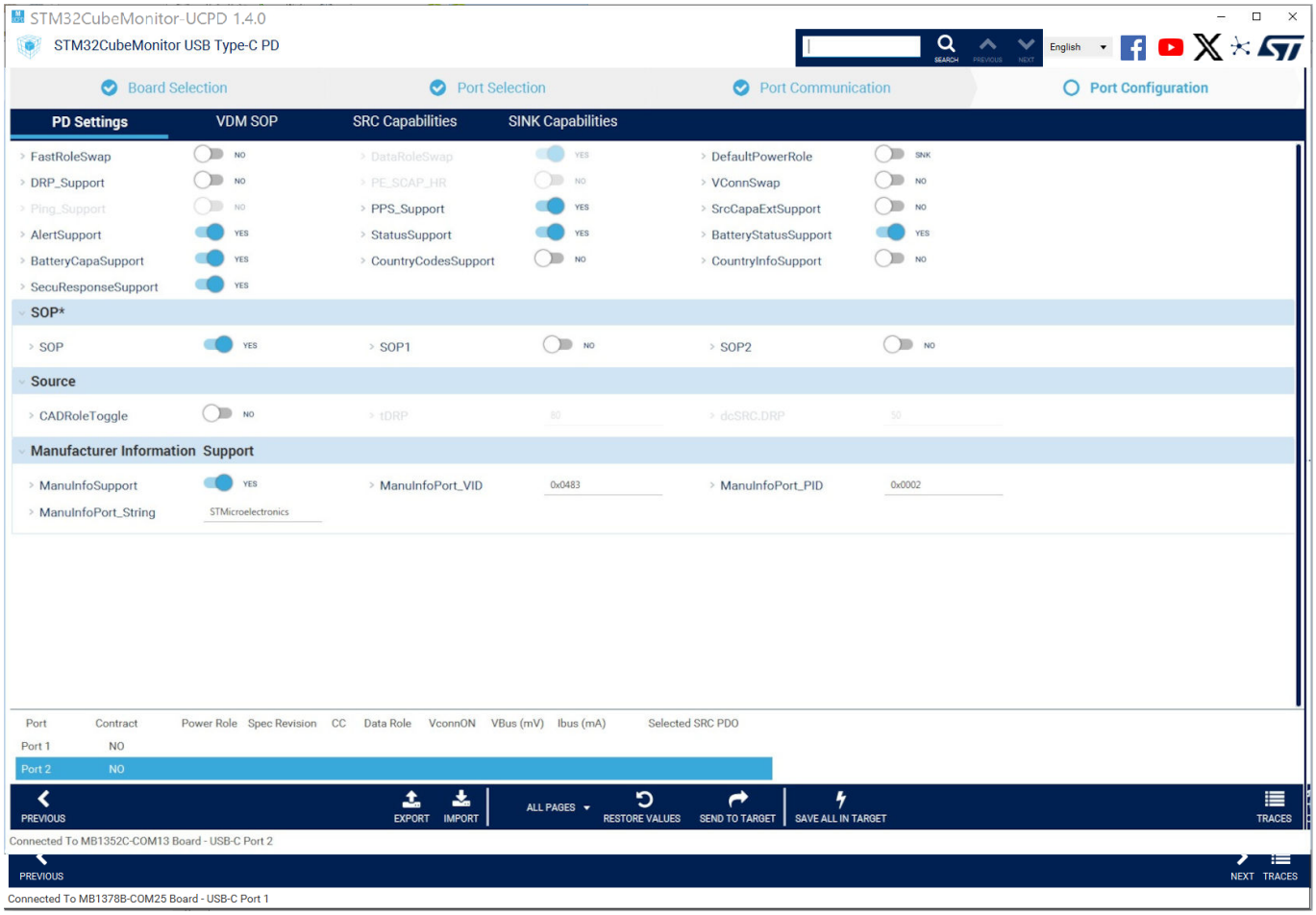


4.6 Port configuration

4.6.1 Overall presentation

The *Port Configuration* window, shown in Figure 27, is used to configure the selected port.

Figure 27. Port configuration window



The *PD Settings* and *VDM SOP* tabs display the configuration parameters of the selected port.
The *SRC capabilities* panel displays the source PDO configured on this port.
The *SINK capabilities* panel displays the sink PDO configured on this port.

4.6.2 Button bar details

The *Button* bar (refer to Figure 28) provides the following actions:

- The *EXPORT* button is used to save the current configuration in a text file.
- The *IMPORT* button is used to upload a saved configuration.
- The *SEND TO TARGET* button saves the parameter modified from the user interface on the board. In this case, the saving is done only in RAM. It means that, after resetting or board disconnection, the updates are lost.
- The *SAVE ALL IN TARGET* button saves the parameter modified from the user interface on the board as the *SEND TO TARGET* button, but this action saves also these updates in the flash memory. It means that, after resetting or board disconnection, the updates are kept.
- The *RESTORE VALUES* button restores the values displayed in the user interface as they are on the board.

Figure 28. *Button* bar

Because the *Port Configuration* window contains four tabs on which parameter updates can be performed, the actions *SAVE IN TARGET*, *SEND TO TARGET*, or *RESTORE VALUES* can be applied to the four tabs (*ALL TABS*) at the same time, or only for the tab (*CURRENT TAB*) displayed in the user interface.

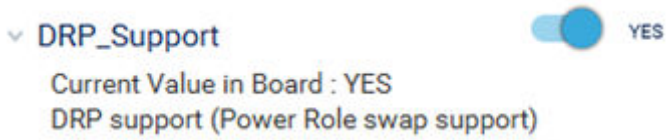
4.6.3 Modify the configuration-Update parameter presentation

The default view is shown in Figure 29.

Figure 29. Default parameter view

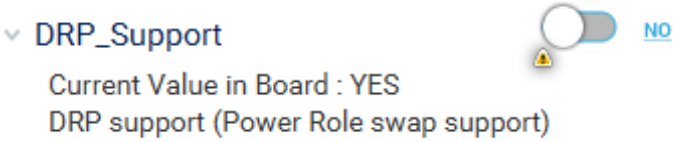
Each parameter has its self-content help. Click on the chevron-right as shown in Figure 30.

Figure 30. Extended parameter view



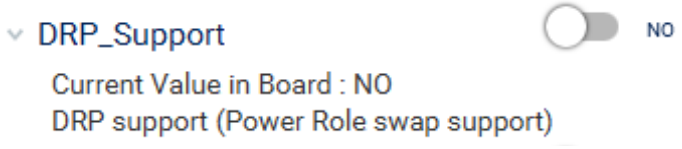
In addition to the signification of the parameter, this area also displays the currently registered value on the board. If the value is changed in the GUI interface, an attention mark is displayed close to the new value, and the onboard value is still visible. Refer to Figure 31.

Figure 31. Parameter modified



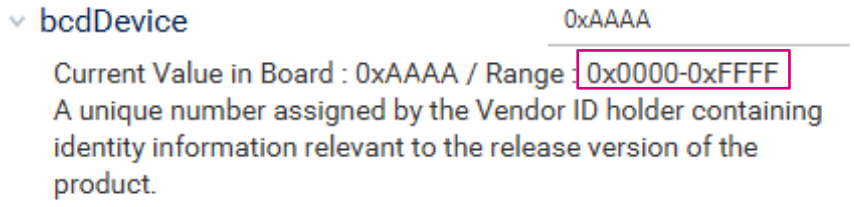
To save the parameter in the board, use the *Send to target* or *Save all in target* button. Refer to Figure 32.

Figure 32. Parameter saved



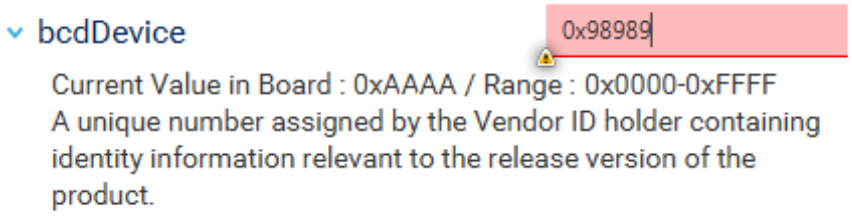
When a value is required, then the range allowed is mentioned in the help. Refer to Figure 33.

Figure 33. Range



The user interface controls the value set with the range. If the value is out of range, then it is highlighted in red.

Figure 34. Value out of range



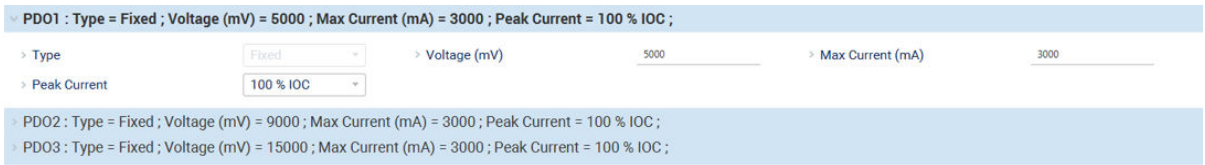
4.6.4 *SRC/SNK capabilities* tabs-PDO management

Source PDO and sink PDO have some generic read-only parameters, which are visible on the top of the panel. On each panel, a sum-up of each PDO is displayed as shown in Figure 35.

Figure 35. Parameters of the PDOs

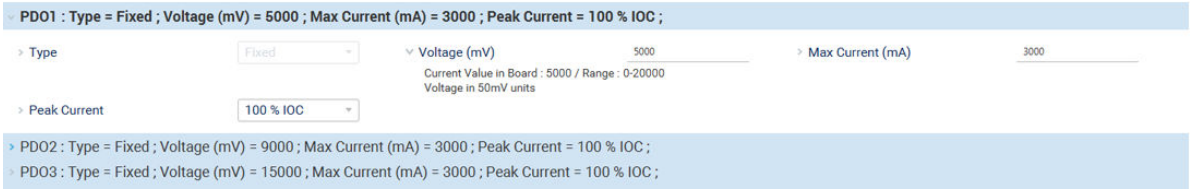
Click on the chevron right of the PDO to see all its parameters. Refer to Figure 36.

Figure 36. Detailed parameters of a PDO



Click on the chevron right of the PDO parameter to get the help, range, and value on the board. Refer to Figure 37.

Figure 37. PDO parameter: Help, range, and value on the board

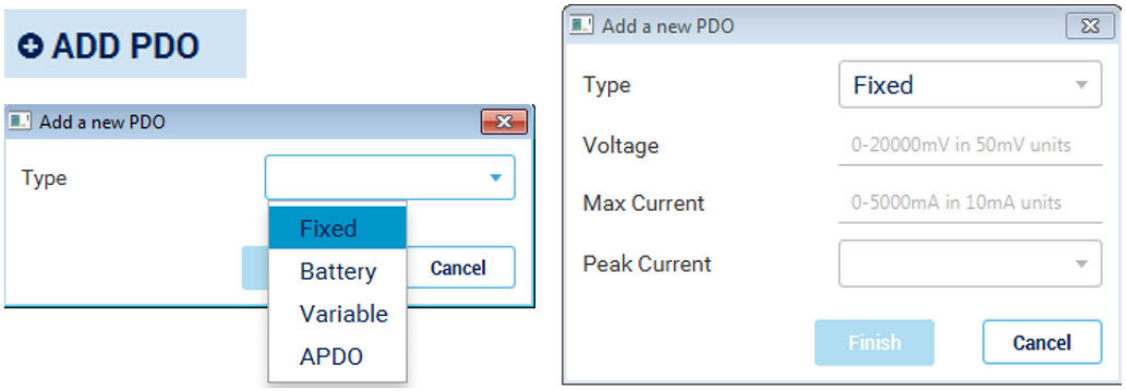


4.6.5 Add a PDO

The first step to adding a PDO is to define its type in one of the two following ways:

- From a picklist as shown in Figure 38

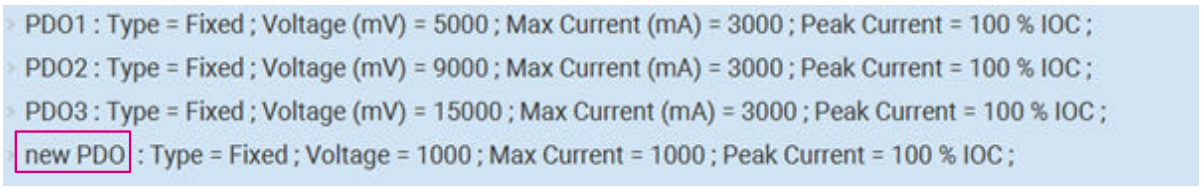
Figure 38. Add a new fixed PDO



- With a value to choose from a predefined range.

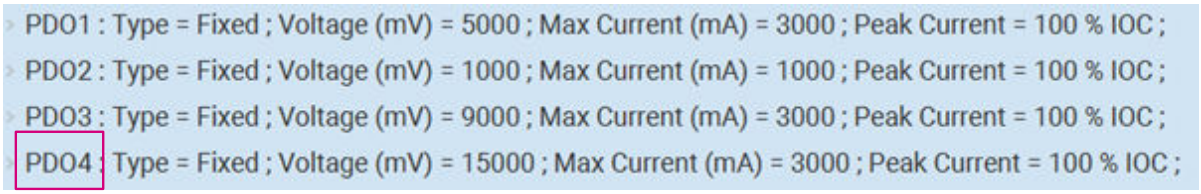
When the new PDO is created, it appears as a *new PDO* up to the sending to the target. Refer to Figure 39.

Figure 39. New PDO created (not saved yet)



After saving, the new PDO is integrated into the numbered list as shown in Figure 40.

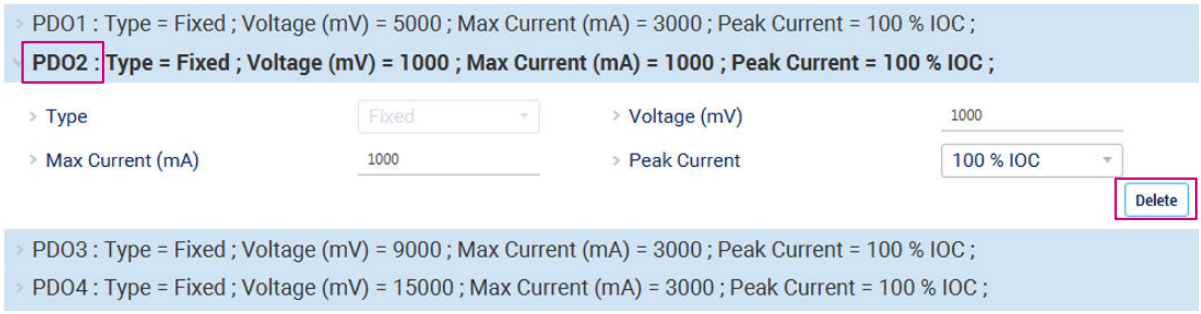
Figure 40. New PDO saved



4.6.6 Delete a PDO

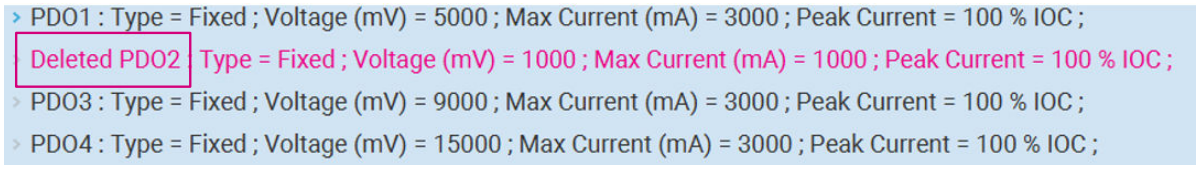
View details of the PDO to delete and click on the *Delete* button as shown in Figure 41.

Figure 41. Select the PDO to delete



The deleted PDO appears in red up to the sending to the target. Refer to Figure 42).

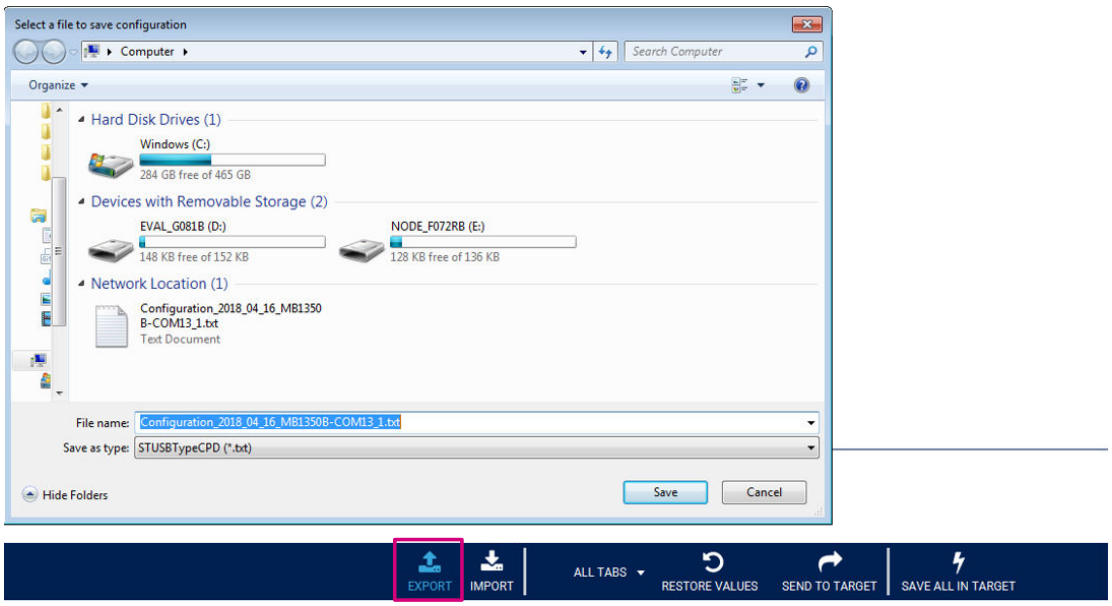
Figure 42. PDO to delete selected



4.6.7 Configuration saving

The tool proposes to save the selected port configuration for further needs. The *EXPORT* button allows this saving in a text file with a predefined name and location, which can be updated. Refer to Figure 43.

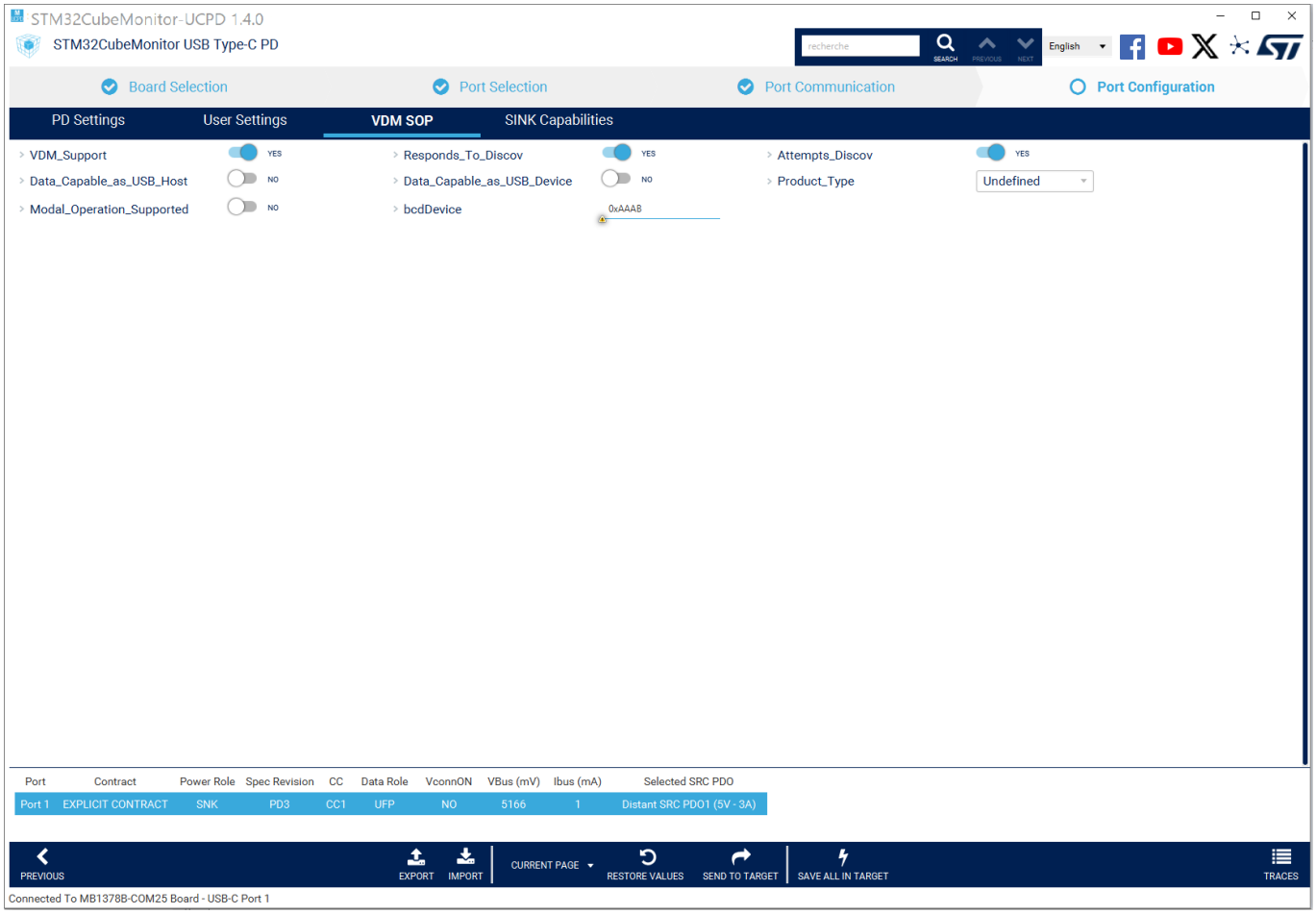
Figure 43. Export the configuration of a port



The *IMPORT* button allows the saved configuration to be loaded only in the user interface.

The differences between the current configuration and the configuration loaded are highlighted in the user interface as shown in Figure 44.

Figure 44. Modified parameter after importing a configuration file



To set effectively the configuration imported in the board, use the *SEND TO TARGET* or *SAVE ALL IN TARGET* button.

5 Traces information

The tool displays debug information on a dedicated *Debug* panel.

There are five types of debugging information listed below:

- Type-C event (EVENT)
- Power-delivery notification traces (NOTIF)
- Traces of messages sent to the distant device (OUT)
- Traces of messages received from the distant device (IN)
- Debug traces (DEBUG)

5.1 Message contents

Message-type contents are described in the user manual *STM32 TCPM Application* (UM2063).

5.2 *Traces* panel

The *Traces* panel, shown in Figure 45, includes the following four columns:

1. Type of the message (*EVENT*, *NOTIF*, *OUT*, *IN*, or *DEBUG*)
2. Timestamp of the message. The timestamp is the current hardware value in milliseconds since the boot of the hardware platform.
3. USB Type-C® port number of the message
4. Content of the message

Figure 45. *Traces* panel

5.3 *Traces* panel functionality

This panel offers functionalities to select, copy, clear, or save traces. It can also be done using the mouse, keyboard controls (Ctrl-V), or *Copy Traces*, *Clear Traces*, and *Save Traces* buttons. Selections can be copied (Ctrl-V) to the usual text editors.

The panel can be also hidden if needed by clicking on *Hide Traces*.

5.4 Read saved traces file

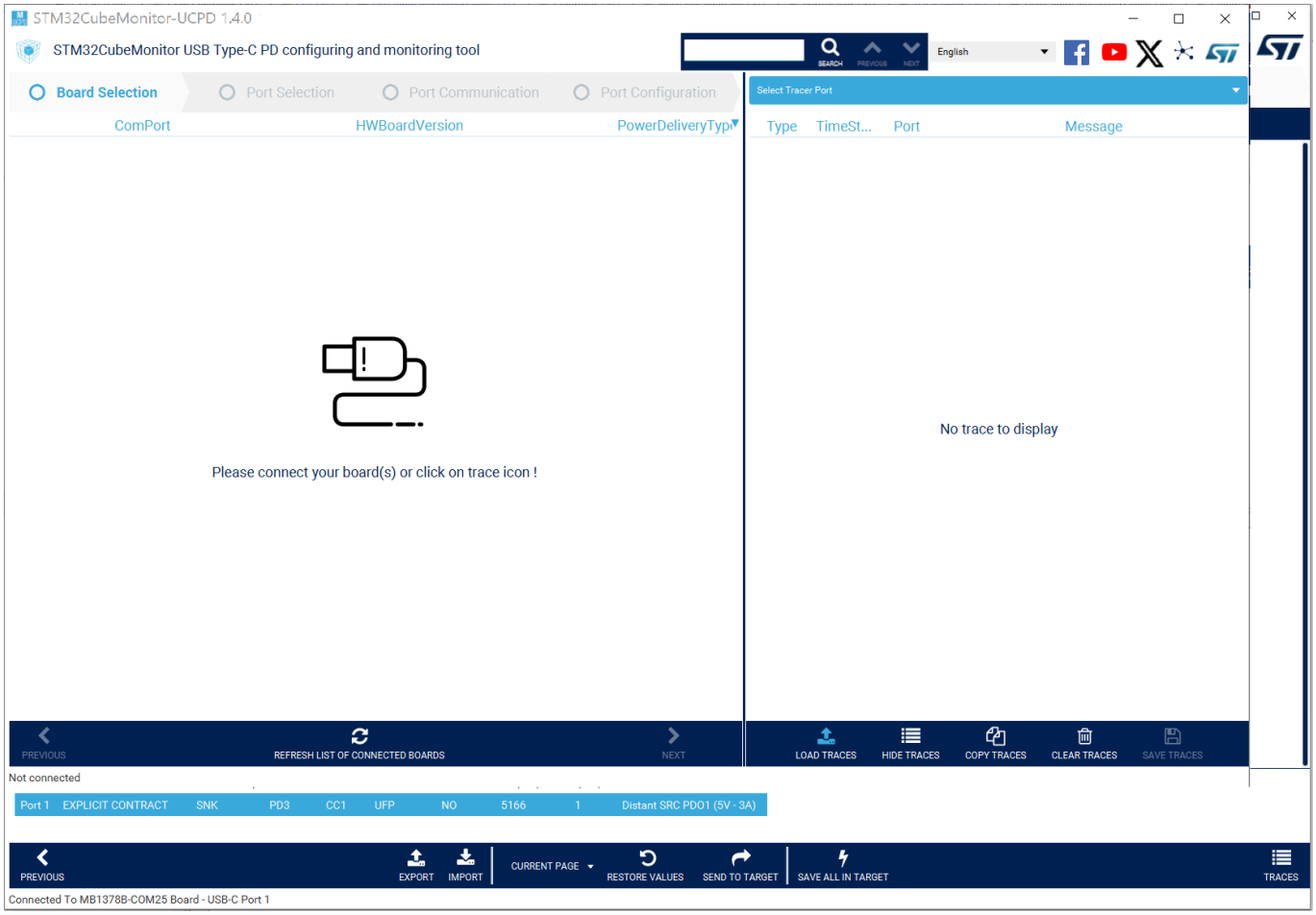
As soon as the user saves a trace in a directory, the tool uses this directory for all file operations, such as opening or saving a trace.

The user must save the first traces manually in a specific directory and relaunch the tool. After that, the tool uses this directory for all file operations, such as opening or saving a trace. Each time the user connects to the board, a new `.cpd` file is created by default on the directory.

When installing a new version of the tool, the user must repeat the process of saving the first trace manually in a specific directory. Relaunch the tool saves by default the traces in the same directory.

When the tool is not connected to any board, the *Traces* panel proposes a *Load Traces* button to read a `.cpd` file formerly saved in the application folder.

Figure 46. *Load Traces* button

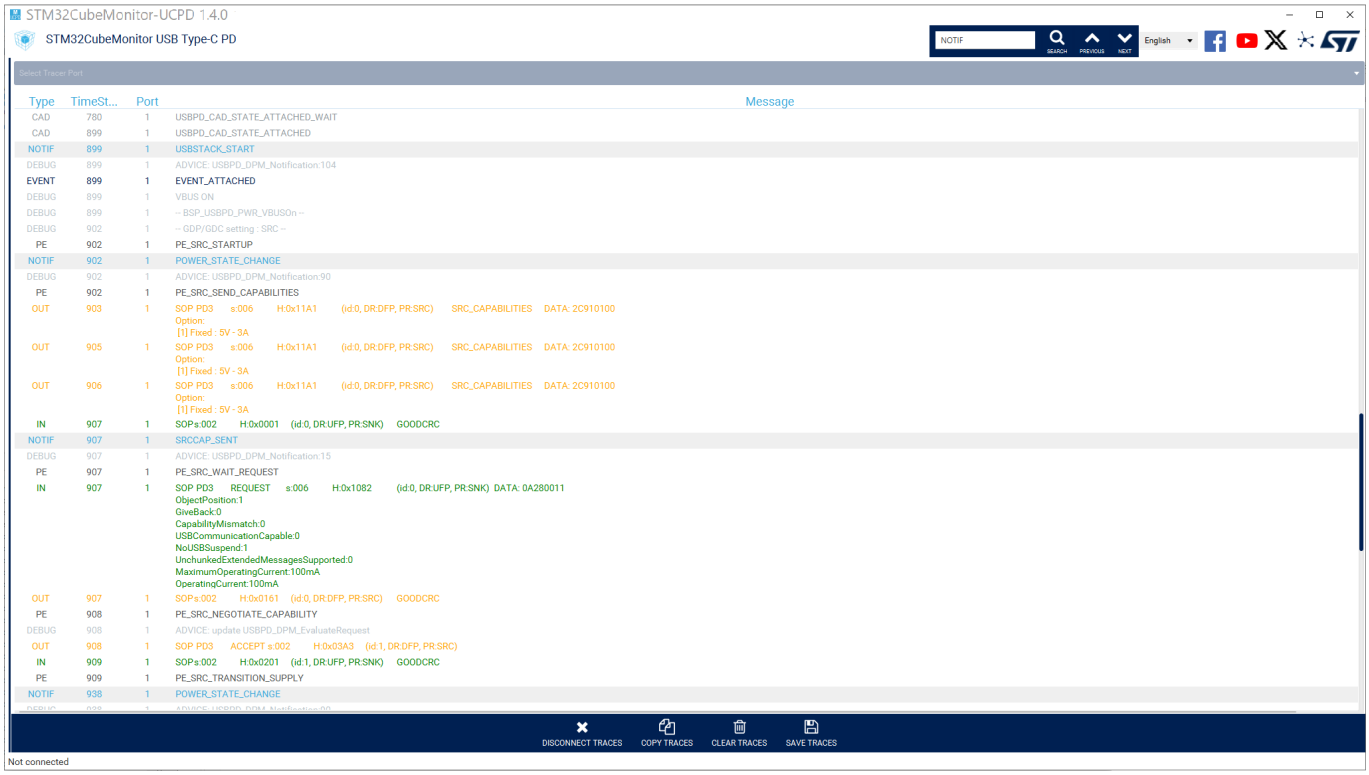


5.5 Search in *Trace*

Figure 47. Look for a text in the trace

By entering a text in the text area, the user locates all entries of this text into the entire trace.

Figure 48. Find messages in the trace



In the example shown in Figure 48, the user is searching entries of NOTIF messages in the trace. After entering NOTIF in the text area and clicking the *Search* button, NOTIF messages are highlighted all along the trace. Clicking on the previous or next button, the user navigates to each occurrence of the entry.

6 Troubleshooting

6.1 Board not detected

If the board is not detected after clicking on the *Refresh list of connected boards*: Unplug the board, plug it again and have a new click on the *Refresh* button.

Note: If the GUI responder is not activated in the embedded firmware but the debug trace is available (UART through VCP of the ST-LINK and the compilation switch _TRACE activated), the user might still see the trace in the UCPD monitor by clicking on the Trace button in the bottom-right corner.

7 Support material

7.1 Hardware

STM32 Nucleo pack for USB Type-C® and any board embedding power delivery https://www.st.com/en/applications/connectivity/usb-type-c-and-power-delivery.html.

7.2 Software

X-CUBE-USB-PD is STM32 USB power-delivery firmware with the tracer and the cubemon_ucpd_emb modules on their latest version (as described in the user manual *STM32 TPM application* (UM2063), available from *www.st.com*, or built through STM32CubeMX) or any new power delivery firmware from STM32G0, G4, L5 MCU Package.

For more information, refer to the USB power-delivery overview wiki page https://wiki.st.com/stm32mcu/wiki/USB_Power_Delivery_overview.

Revision history

Table 1. **Document revision history**

Date	Revision	Changes
15-Nov-2018	1	Initial release.
1-Sep-2020	2	Updated: • *Section 2.1 Computer requirements* • *Section 2.3.2 Installing the USB driver for ST-LINK*
18-Nov-2021	3	Updated: • *Figure 1*, *Figure 44*, *Figure 45*, and *Section 5.3 Traces panel functionality* with the *Save Traces* feature and button
26-May-2023	4	Updated • *Section 5.4: Read saved traces file* • *Figure 1*, *Figure 3* to *Figure 5*, *Figure 11*, *Figure 22* to *Figure 26*, and *Figure 43* Added: • *Section 5.5: Search in Trace* • *Figure 46* and *Figure 47*
14-Nov-2024	5	Updated: • Section 2.1: Computer requirements • Global screenshot update with refreshed social network shortcut area Added: • Figure 18. *Measurement* panel disconnection

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