

USB Power Delivery Tester PRO

Communication Protocol Guide v1.2

Model PM240

Note: This document is only applicable to the latest firmware release of the USB Power Delivery Tester PRO Model PM240.

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Introduction

This document will demonstrate how to communicate with the Passmark USB Power Delivery Tester PRO. You may need to update device firmware as the information in this document only applies to the latest firmware version and more details about the Passmark USB Power Delivery Tester PRO can be found at the link below,

<https://www.passmark.com.au/products/usb-power-delivery-tester-pro/index.php>

High level languages can access to the Passmark USB Power Delivery Tester PRO using the USB Virtual Com Port. Serial Terminal software like RealTerm can be used to connect to the device com port with Baud Rate 921600, Parity None, 8 Data bits, 1 Stop bits and Hardware Flow Control as None.

The executable file for the example project is located under “Release” directory. To find a short description of all command line options run the executable with -h option. The below screenshot is taken from the USBPDPROConsole application version V1.0.



```
PassMark Software USBPDPROConsole V1.0.0
Usage: C:\My_Files\Dev\PDTester_Pro\USBPD_Pro\Console\Version_1_0_0\Release\USBPDPROConsole.exe [-f] [-d] [-i] [-c] [-p] [-s] [-r] [-v] [-l] [-m] [-n] [-o] [-u] [-w] [-k] [-b] [-g] [-t]
Options:
  -h, --help                Shows this help message
  -f, --find                Finds all the PD Tester PRO devices and their indexes.
  -d, --device              Specifies the PD Tester PRO by COM port number. COMx or "Any"
                           If "Any" is used then the first device detected is selected.
                           Default value if empty: The first detected device will be used.
  -i, --index              Specifies the PD Tester PRO by index.
  -c, --connection         Returns the connection status.
  -p, --profiles            Returns all the profiles supported by DUT connected to sink port.
  -s, --stats              Returns Device status.
  -r, --config              Returns the configuration of the PD Tester PRO.
  -v, --setprofile          Sets a profile for sink port. Index starts from 1.
                           For fixed profile use -v index. For variable voltage profile use: -v index,voltage (mV)
  -l, --load               Sets the sink port current (mA).
  -w, --defload            Sets default load (mA) or "Max" for maximum available current.
  -n, --defvoltage         Sets default voltage (mV).
  -o, --maxload            Sets maximum allowed current (mA). Set to 0 to enable enforce automatic limits.
  -u, --defprofile         Sets default profile by index. Set to 0 to enable auto selection.
                           For variable voltage profile default voltage should also be set.
  -w, --oprcurrent         Sets the operating current in RDO or "Max" for max available current.
  -k, --sinkcap            Sets the capability advertised by the sink. Use: -k voltage(mV),current(mA).
                           Or for no additional capability, use: -k "None".
  -b, --usbconnection      Simulates a physical disconnection or connection of the DUT on Source or Sink port.
                           For disconnecting source port use: -b 0,0. For connecting source port: -b 0,1.
                           For disconnecting sink port use: -b 1,0. For connecting sink port: -b 1,1.
  -e, --setPDsupport       Sets if the PDTesterPRO supports PD profiles.
                           For no PD profiles: -e 0. For PD profiles supported: -e 1.
  -g, --getsrcchargers     Get names of all source port chargers and index of currently set charger.
  -t, --selectsrccharger   Select a source charger by index [0-4] for the source port to emulate.

Return Codes:
  Succeed = 0
  Invalid command line = 1
  No device detected = 2
  Failed to connect = 3
  Invalid profile = 4
  Command is not supported by PD Tester PRO model = 5
  Device firmware update required = 6

Example:
  USBPDPROConsole.exe -d COM2 -v 2
PS C:\My_Files\Dev\PDTester_Pro\USBPD_Pro\Console\Version_1_0_0\Release>
```

Communication Protocol

Communication Format

Following is the frame structure for the commands sent by the host and response received from the tester.

| Header | Length | Command | Data | Checksum | Closing Flag |
|--------|--------|---------|------|----------|--------------|
|--------|--------|---------|------|----------|--------------|

Header: This is a single byte that indicates the beginning of the frame.

Length: This byte indicates the total number of bytes between Length and Checksum.

Command: This byte is used to instruct the tester which operation to perform. For the response packets, this indicates which command's response.

Data [Payload]: Data bytes are the parameters of a command or response. The least significant byte is always sent and received first (LSB First).

Checksum: This byte is used on the host as well as the tester to check the validity of the packet and to trap any data corruption. This is calculated by XORing all the bytes except the Checksum byte.

Closing Flag: This is a single byte that indicates the end of the frame.

Commands

Command Overview

Table below summarizes the command list of USB Power Delivery Tester PRO.

| Command | Description |
|---------|------------------------------------|
| 0x01 | Get Device Info |
| 0x0A | Get Connection Status |
| 0x0B | Get Sink Port Capabilities |
| 0x0C | Get Statistics |
| 0x0D | Change Sink Port Profile / Voltage |
| 0x10 | Set Sink Port Current |
| 0x14 | Set USB Connection |
| 0x30 | Get Source Port Config |
| 0x31 | Set Source Port Config |
| 0x32 | Get Source Charger Name List |
| 0x33 | Select Source Charger |
| 0xE0 | Get Device Config |
| 0xE1 | Set Device Config (Volatile) |
| 0xE2 | Set Device Config (Persistent) |
| 0xE3 | Set Calibration Data |
| 0xE4 | Get Calibration Data |
| 0xE5 | Reset Calibration Data |
| 0xE7 | Set Protocol Analyzer |
| 0xE8 | Run FFT |
| 0xE9 | Get FFT Results |

Get Device Info

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|------|----------|------|
| 0x02 | 0x01 | 0x01 | - | 0x01 | 0x03 |

Response:

| | | |
|------------------|----------------|--|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x11 |
| Command | 1 | 0x01 |
| Hardware Version | 1 | Hardware version |
| Firmware Version | 1 | Firmware version |
| API Version | 1 | API version |
| Device ID | 13 | Device Unique Identifier (12 bytes string) |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example: (in Hex Format)

> Request: 02 01 01 01 03

> Response: 02 11 01 0A 0B 0A 32 30 30 35 31 46 30 37 32 32 32 36 00 69 03

(Hardware Ver 1.0, Firmware Ver: 1.1, API Ver: 1.0, Device ID: 20051F072226)

Get Connection Status

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|------|----------|------|
| 0x02 | 0x01 | 0x0A | - | 0x0A | 0x03 |

Notes: Profile, voltage and current values are only valid if Sink or Source port connection status byte shows Connected.

Response:

| | | |
|-------------------|----------------|--|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x14 |
| Command | 1 | 0x0A |
| Sink Port | | |
| Connection Status | 1 | 0x00: Not Connected 0x01: Connected |
| Profile Index | 1 | Profile Index (index starts from 0) |
| Profile Type | 1 | Selected Profile Type of DUT on Sink Port. See Port Type/Sub-Type Guide Section. |
| Profile Sub Type | 1 | Selected Profile Sub-Type of DUT on Sink Port. See Port Type/Sub-Type Guide Section. |

| | | |
|--------------------|---|--|
| Max Voltage | 2 | Maximum Voltage in millivolts |
| Max Current | 2 | Maximum current in milliamps for the selected profile. |
| Source Port | | |
| Connection Status | 1 | 0x00: Not Connected 0x01: Connected |
| Profile Index | 1 | Profile Index (index starts from 0) |
| Profile Type | 1 | Selected Profile Type of DUT on Source Port. See Port Type/Sub-Type Guide Section. |
| Profile Sub Type | 1 | Selected Profile Sub-Type of DUT on Source Port. See Port Type/Sub-Type Guide Section. |
| Max Voltage | 2 | Maximum Voltage in millivolts |
| Max Current | 2 | Maximum current in milliamps for the selected profile. |
| Requested Current | 2 | Requested current in milliamps for the selected profile. |
| Charger Index | 1 | Index of the charger which the source port emulates. Valid range is 0 to 4. |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example:

> Request: 02 01 0A 0A 03

> Response: 02 14 0A 01 00 06 00 88 13 B8 0B 01 00 06 00 88 13 B8 0B B8 0B 00 AC 03

(Sink Port = Connected, Sink Profile Index = 0, Sink Profile Type = Power Delivery, Sink Profile Sub Type = PD Fix, Sink Requested Voltage = 5000 millivolts, Sink Max Current = 3000mA, Source Port = Connected, Source Profile Index = 0, Source Profile Type = Power Delivery, Source Profile Sub Type = PD Fix, Source Requested Voltage = 5000 millivolts, Source Max Current = 3000mA, Source Requested Current = 3000mA, Source Port Charger Index = 0)

Get Sink Port Capabilities

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|------|----------|------|
| 0x02 | 0x01 | 0x0B | - | 0x0B | 0x03 |

NOTE: The length of the response packet depends on the number of profiles.

Response:

| | | |
|---------|----------------|-----------------------------|
| Header | Length (bytes) | 0x02 |
| Length | 1 | Based on number of profiles |
| Command | 1 | 0x0B |

| | | |
|---------------------------------|---------------------|--|
| Number of Power Profiles (Sink) | 2 | Number of power profiles (Max possible 21 profiles) |
| Power Data Objects | 8 bytes per profile | Profile Index (4 bits) Profile Type (4 bits) Profile Sub Type (4 bits) PDO Index (4 bits) Min Voltage (2 bytes) Max Voltage (2 bytes) Max Current (2 bytes) . Next Profile Data Object For the values for Profile Type and Profile Sub Type, See Port Type/Sub-Type Guide Section. |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example:

> Request: 02 01 0B 0B 03

> Respond: 02 4B 0B 09 00 60 00 88 13 88 13 B8 0B 61 10 28 23 28 23 B8 0B 62 20 98 3A 98 3A B8 0B 63 30 20 4E 20 4E 5C 12 78 80 60 6D 60 6D 88 13 79 93 98 3A 60 6D 8C 00 50 02 88 13 88 13 B8 0B 21 15 88 13 88 13 D0 07 32 22 88 13 88 13 DC 05 D4 03

(Num Power Profiles = 9, Profile Index = 0, Profile Type = 6 (PD), Profile Sub Type = 0 (PD-FIX), Min Voltage = 5000mV, Max Voltage = 5000mV, Max Current = 3000mA, Profile Index = 1, Profile Type = 6 (PD), Profile Sub Type = 0 (PD-FIX), Min Voltage = 9000mV, Max Voltage = 9000mV, Max Current = 3000mA, Profile Index = 2, Profile Type = 6 (PD), Profile Sub Type = 0 (PD-FIX), Min Voltage = 15000mV, Max Voltage = 15000mV, Max Current = 3000mA, Profile Index = 3, Profile Type = 6 (PD), Profile Sub Type = 0 (PD-FIX), Min Voltage = 20000mV, Max Voltage = 20000mV, Max Current = 4700mA, Profile Index = 4, Profile Type = 7 (EPR), Profile Sub Type = 0 (EPR-FIX), Min Voltage = 28000mV, Max Voltage = 28000mV, Max Current = 5000mA, Profile Index = 5, Profile Type = 7 (EPR), Profile Sub Type = 3 (EPR-APDO), Min Voltage = 15000mV, Max Voltage = 28000mV, Max Current = 5000mA, Profile Index = 6, Profile Type = 5 (USBC), Profile Sub Type = 2 (USBC-3A), Min Voltage = 5000mV, Max Voltage = 5000mV, Max Current = 3000mA, Profile Index = 7, Profile Type = 2 (PTY), Profile Sub Type = 5 (SAMSUNG), Min Voltage = 5000mV, Max Voltage = 5000mV, Max Current = 2000mA, Profile Index = 8, Profile Type = 3 (BC), Profile Sub Type = 2 (BC-DCP), Min Voltage = 5000mV, Max Voltage = 5000mV, Max Current = 1500mA)

Get Statistics

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|------|----------|------|
| 0x02 | 0x01 | 0x0C | - | 0x0C | 0x03 |

Response:

| | | |
|----------|----------------|---|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x0C |
| Command | 1 | 0x0C |
| Data | 11 | Heatsink Temperature in Celsius (1 byte) Sink Port Voltage in millivolts (2bytes) Source Port Voltage in millivolts (2bytes) Sink Port Set Current in milliamperes (2bytes) Sink Port Current in milliamperes (2bytes) Source/Loopback Port Current in milliamperes (2bytes) |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example:

> Request: 02 01 0c 0c 03

> Response: 02 0C 0C 1B 0A 14 7C 13 00 00 00 00 00 00 6B 03

(Heatsink Temperature = 27, Sink Voltage = 5157 millivolts, Source Voltage = 4998 millivolts, Sink Set Current = 0mA, Sink Current = 0mA, Source/Loopback Current = 0mA.)

Change Sink Port Profile / Voltage

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|--|---------------------|------|
| 0x02 | 0x04 | 0x0D | Profile Index (1 byte) + Voltage (2bytes) | To be calculated | 0x03 |

NOTE: Profile Indexes starts from 0 and can be optioned by sending “Get Sink Port Capabilities” command.

Response:

| | | |
|----------|----------------|---|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0x0D |
| Data | 1 | Status Byte 0x00: Successful 0x01: Failed |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example - Select Profile #3:

> Request: 02 04 0D 03 20 4E 65 03

> Response: 02 02 0D 00 0E 03

(Status = Successful)

Set Sink Port Current

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|---|------------------|------|
| 0x02 | 0x05 | 0x10 | Current in milliamperes (2 bytes) + Load speed in milliseconds (2 bytes) Valid range is 10ms to 1000ms. | To be calculated | 0x03 |

Response:

| | | |
|----------|----------------|--|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0x10 |
| Data | 1 | Status 0x00: Successful 0x01: Failed |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Set Current 1000mA, with load speed of 200ms (fast default):

> Request: 02 05 10 E8 03 00 C8 37 03

> Response: 02 02 10 00 13 03

(Status = Successful)

Set USB Connection

This command can be used to simulate a physical disconnection or connection of the device under test on sink or source port.

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|---|------------------|------|
| 0x02 | 0x03 | 0x14 | Port Number (1 byte) 0x00: Source 0x01: Sink USB State (1 byte) 0x00: USB Disconnected 0x01: USB Connected | To be calculated | 0x03 |

Response:

| | | |
|----------|----------------|--|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0x14 |
| Data | 1 | Status 0x00: Successful 0x01: Failed |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Disconnect Sink Device Under Test

> Request: 02 03 14 01 00 17 03

> Response: 02 02 14 00 17 03

(Status = Successful)

Get Source Port Config

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|---|------------------|------|
| 0x02 | 0x02 | 0x30 | Charger Index (1 byte). Valid range is 0 to 4. | To be calculated | 0x03 |

NOTE: PD profile data is only valid based on the Number of PD profiles byte.

Response:

| | | |
|----------|----------------|--|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x46 |
| Command | 1 | 0x30 |
| Data | 69 | Source Charger Name (16 bytes) USB-C Sub Type (1 byte) Battery Charging Sub Type (1 byte) Apple Sub Type (1 byte) Number of PD profiles (1 byte) PD profile Data (For PD profiles 0 to 6): Sub Type (1 byte) Min Voltage in millivolts (2 bytes) Max Voltage in millivolts (2 bytes) Max Current in milliamps (2 bytes) |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Get Source Port Config for Charger Index = 0

> Request: 02 02 30 00 33 03

> Response: 02 46 30 44 65 66 61 75 6C 74 00 00 00 00 00 00 00 00 01 02 00 06
00 88 13 88 13 B8 0B 00 28 23 28 23 B8 0B 00 E0 2E E0 2E B8 0B 00 98 3A 98 3A
B8 0B 00 20 4E 20 4E 88 13 01 E4 0C 08 52 88 13 00 00 00 00 00 00 00 8A 03

(Source Charger Name = “Default”, USBC sub type = 1.5A, BC sub type = Samsung 2A + DCP, Apple sub type = None, Number of PD profiles = 6, PD Profile 0: sub type = PD-FIX, min voltage = 5000mV, max voltage = 5000mV, max current = 3000mA, PD Profile 1: sub type = PD-FIX, min voltage = 9000mV, max voltage = 9000mV, max current = 3000mA, PD Profile 2: sub type = PD-FIX, min voltage = 12000mV, max voltage = 12000mV, max current = 3000mA, PD Profile 3: sub type = PD-FIX, min voltage = 15000mV, max voltage = 15000mV, max current = 3000mA, PD Profile 4: sub type = PD-FIX, min voltage = 20000mV, max voltage = 20000mV,

max current = 5000mA, PD Profile 5: sub type = PD-APDO, min voltage = 3300mV, max voltage = 21000mV, max current = 5000mA)

Set Source Port Config (Persistent)

Warning: Performing this operation too many times can burn out the flash memory, as all configuration parameters are written to flash memory after the change operation.

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|---|------------------|------|
| 0x02 | 0x47 | 0x31 | Charger Index (1 byte) Source Charger Name (16 bytes) USBC sub type (1 byte) BC sub type (1 byte) Apple sub type (1 byte) Number of PD profiles (1 byte) PD0 sub type (1 byte) PD0 min voltage (2 bytes) PD0 max voltage (2 bytes) PD0 max current (2 bytes) PD1 sub type (1 byte) PD1 min voltage (2 bytes) PD1 max voltage (2 bytes) PD1 max current (2 bytes) PD2 sub type (1 byte) PD2 min voltage (2 bytes) PD2 max voltage (2 bytes) PD2 max current (2 bytes) PD3 sub type (1 byte) PD3 min voltage (2 bytes) PD3 max voltage (2 bytes) PD3 max current (2 bytes) PD4 sub type (1 byte) PD4 min voltage (2 bytes) PD4 max voltage (2 bytes) PD4 max current (2 bytes) PD5 sub type (1 byte) PD5 min voltage (2 bytes) PD5 max voltage (2 bytes) PD5 max current (2 bytes) PD6 sub type (1 byte) PD6 min voltage (2 bytes) PD6 max voltage (2 bytes) PD6 max current (2 bytes) | To be calculated | 0x03 |

Charger Index: This is the index of the Charger selected. Source port of the PD Tester PRO will emulate to this and will have its profiles.

USBC sub type: Sub type of USBC profile supported.

Apple sub type: Sub type of Apple profile supported.

PD0 sub type: Sub type of the PD profile with index 0.

PD0 min voltage: Minimum voltage supported by the PD profile with index 0.

PD0 max voltage: Maximum voltage supported by the PD profile with index 0.

PD0 max current: Maximum current supported by the PD profile with index 0.

| | | |
|----------|-------------------|--------------------------------|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0x31 |
| Data | 1 | 0x00: Success 0x01: Failure |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

```
> Request: 02 47 31 00 44 65 66 61 75 6C 74 00 00 00 00 00 00 00 00 00 02 00 01
00 88 13 88 13 08 BB 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 CA 03
```

```
> Response: 02 02 31 00 31 03
```

Status: success

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|------|---------------------|------|
| 0x02 | 0x01 | 0x32 | - | To be calculated | 0x03 |

| | | |
|----------|----------------|--|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x52 |
| Command | 1 | 0x32 |
| Data | 81 | Selected Source Charger Index (1 byte) Source Charger 0 Name (16 bytes) Source Charger 1 Name (16 bytes) Source Charger 2 Name (16 bytes) Source Charger 3 Name (16 bytes) Source Charger 4 Name (16 bytes) |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Get Source Charger Name List

> Request: 02 01 32 32 03

> Response: 02 52 32 00 44 65 66 61 75 6C 74 00 00 00 00 00 00 00 00 00 43 68 61 72 67 65 72 20 32 00 00 00 00 00 00 00 00 43 68 61 72 67 65 72 20 33 00 00 00 00 00 00 00 00 43 68 61 72 67 65 72 20 34 00 00 00 00 00 00 00 00 43 68 61 72 67 65 72 20 35 00 00 00 00 00 00 00 2A 03

(Selected Charger Index = 0, Source Charger 0 name = “Default”, Source Charger 1 name = “Charger 2”, Source Charger 2 name = “Charger 3”, Source Charger 3 name = “Charger 4”, Source Charger 4 name = “Charger 5”)

Select Source Charger

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|------------------------|------------------|------|
| 0x02 | 0x02 | 0x33 | Charger Index (1 byte) | To be calculated | 0x03 |

Response:

| | | |
|----------|----------------|--------------------------------|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0x33 |
| Data | 1 | 0x00: Success 0x01: Failure |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Select Source Charger

> Request: 02 02 33 00 30 03

> Response: 02 02 33 00 33 03

Selected Source Charger = 0

Get Device Config

Command

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|----------------------------------|------------------|------|
| 0x02 | 0x02 | 0xE0 | See Configuration Guide Section. | To be calculated | 0x03 |

Response:

| | | |
|----------|--------------------------|----------------------------------|
| Header | Length (bytes) | 0x02 |
| Length | 1 | Depends on the parameter |
| Command | 1 | 0xE0 |
| Data | Depends on the parameter | See Configuration Guide Section. |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Loopback Port:

> Request: 02 02 E0 00 E3 03

> Response: 02 02 E0 01 E2 03

Loopback Port = Enabled

Set Device Config (Volatile)

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------------------------|---------|----------------------------------|------------------|------|
| 0x02 | Depends on the parameter | 0xE1 | See Configuration Guide Section. | To be calculated | 0x03 |

Response:

| | | |
|----------|----------------|--|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0xE1 |
| Data | 1 | Status 0x00: Successful 0x01: Failed |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Enable Loopback Port:

> Request: 02 03 E1 00 01 E2 03

> Response: 02 02 E1 00 E2 03

Status = Successful

Set Device Config (Persistent)

Warning: Performing this operation too many times can burn out the flash memory, as all configuration parameters are written to flash memory after the change operation.

Command:

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------------------------|---------|----------------------------------|------------------|------|
| 0x02 | Depends on the parameter | 0xE2 | See Configuration Guide Section. | To be calculated | 0x03 |

Response:

| | | |
|---------|----------------|----------------------------|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0xE2 |
| Data | 1 | Status 0x00: Successful |

| | | |
|----------|---|------------------|
| | | 0x01: Failed |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Enable Loopback Port:

> Request: 02 03 E2 00 01 E1 03

> Response: 02 02 E2 00 E1 03

Status = Successful

Set Calibration Data

Command

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|--|------------------|------|
| 0x02 | 0x0C | 0xE3 | Channel (1 byte): 0 : Source VBUS 1 : Source current 2 : Sink VBUS 3 : Sink current Year (1 byte) Month (1 byte) Applied 1 (2 bytes) Measured 1 (2 bytes) Applied 2 (2 bytes) Measured 2 (2 bytes) | To be calculated | 0x03 |

Response:

| | | |
|----------|----------------|--------------------------------|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0xE3 |
| Data | 1 | 0x00: Success 0x01: Failure |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Set Calibration data for Sink VBUS:

> Request: 02 0C E3 02 18 0A 88 13 24 13 20 4E BC 4D C0 03

Channel = Sink VBUS, Year = 24, Month = 10, Applied 1 = 5000, Measured 1 = 4900, Applied 2 = 20000, Measured 2 = 19900

> Response: 02 02 E3 00 E3 03

Get Calibration Data

Command

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|---|------------------|------|
| 0x02 | 0x02 | 0xE4 | Channel (1 byte): 0 : Source VBUS 1 : Source current 2 : Sink VBUS 3 : Sink current | To be calculated | 0x03 |

Response:

| | | |
|----------|----------------|---|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x0C |
| Command | 1 | 0xE4 |
| Data | 11 | Calibrated status (1 byte) Year (1 byte) Month (1 byte) Applied 1 (2 bytes) Measured 1 (2 bytes) Applied 2 (2 bytes) Measured 2 (2 bytes) |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Get Calibration data for Sink VBUS:

> Request: 02 02 E4 02 E6 03

> Response: 02 0C E4 01 18 0A 88 13 24 13 20 4E BC 4D F3 03

Channel = Sink VBUS, Year = 24, Month = 10, Applied 1 = 5000, Measured 1 = 4900, Applied 2 = 20000, Measured 2 = 19900

Reset Calibration Data

Command

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|---|------------------|------|
| 0x02 | 0x02 | 0xE5 | Channel (1 byte): 0 : Source VBUS 1 : Source current 2 : Sink VBUS 3 : Sink current | To be calculated | 0x03 |

Response:

| | | |
|----------|----------------|--------------------------------|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0xE5 |
| Data | 1 | 0x00: Success 0x01: Failure |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Reset Calibration data for Sink VBUS:

> Request: 02 02 E5 02 E7 03

> Response: 02 02 E5 00 E5 03

Status = Success

Set Protocol Analyzer

Command

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|-------------------------------|------------------|------|
| 0x02 | 0x02 | 0xE7 | Enable: 0x01 Disable: 0x00 | To be calculated | 0x03 |

Response:

| | | |
|----------|----------------|--------------------------------|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0xE7 |
| Data | 1 | 0x00: Success 0x01: Failure |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Enable PD Analyzer:

> Request: 02 02 E7 01 E6 03

> Response: 02 02 E7 00 E7 03

Status = Success

Run FFT

This command is used to start and stop FFT test on the device. This is required to reconfigure the ADCs before FFT points can be retrieved.

Command

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|---------------------------|------------------|------|
| 0x02 | 0x02 | 0xE8 | Start: 0x01 Stop: 0x00 | To be calculated | 0x03 |

Response:

| | | |
|----------|----------------|--------------------------------|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x02 |
| Command | 1 | 0xE8 |
| Data | 1 | 0x00: Success 0x01: Failure |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Example – Start FFT:

> Request: 02 02 E8 01 E9 03

> Response: 02 02 E8 00 E8 03

Status = Success

Get FFT Results

This command is used to retrieve the latest FFT amplitudes (in dB) which can be used to plot on the FFT graph. Recommend minimum interval is 1 second between consecutive commands.

Command

| Header | Length | Command | Data | Checksum | Flag |
|--------|--------|---------|------|----------|------|
| 0x02 | 0x01 | 0xE9 | - | 0xE9 | 0x03 |

An array of 570 amplitudes (dB) are send in 30 packets with each packet having 19 amplitudes. Each index represents a frequency of 1757.8125 KHz. So the FFT is plotted across 0 - 569 points representing 0Hz - 1MHz
 $(569 * 1757.8125 = 1000195.3125\text{Hz})$

Response: (Total 30 packets)

| | | |
|----------|----------------|---|
| Header | Length (bytes) | 0x02 |
| Length | 1 | 0x27 |
| Command | 1 | 0xE9 |
| Data | 38 | Amplitudes in dB [19], starting with index = 0. |
| Checksum | 1 | To be calculated |
| Flag | 1 | 0x03 |

Configuration Guide

Configuration Overview

These are device configuration parameters. If not specified, these are by default applicable to Sink port on the device.

| Parameter | Description |
|--------------------------|--|
| Loopback Port | Connect loopback port to power and data lines from device under test on sink port. When Loopback mode is enabled, the PD messages will be forwarded between sink and loopback port. |
| Set Max Current Limit | This is to modify the current limit and not stored in persistent memory. "CurrentLimitType" can be 0 (Enforce limits), 1 (Allow 20% overcurrent) and 2 (Force limit). When Force limit is selected, additional 2 bytes of "MaxCurrent" in milliamperes should be sent. |
| Max SDP Current | The maximum current for standard downstream ports can be defined by this option. |
| Upstream VBUS Estimation | When enabled, the displayed voltage is the upstream voltage from the device under test (estimated based on set cable resistance). When disabled, displayed voltage is voltage measured downstream at test unit. |
| Cable Resistance | Resistance of the cable connecting the device under test to the test unit. Used for estimating the upstream voltage from the device under test. |
| Default Profile Index | The initial profile index selected when the device under test is connected. In "Auto mode", selects best matching profile to the |

| | |
|--|--|
| | default voltage. |
| Default Voltage | The initial voltage set when the device under test is connected. |
| Default Current | The initial current set when the device under test is connected. |
| Operating Current | The value advertised by the test unit as the maximum current it will accept. If not required, set to “Max”. See Section 6.4.2.8 <i>Operating Current</i> from the <i>USB Power Delivery Specification Revision 3.1</i> for more details. |
| Sink Capability | The second capability of the sink advertised, alongside the first which is always 5V, 5A. If not required, set to “None”. This value is used when replying to a “Get Sink Capabilities” message, see Section 6.4.3.1 <i>Sink Capabilities Message</i> from the <i>USB Power Delivery Specification Revision 3.1</i> for more details |
| Profile Limit PD | This is used to enable or disable the PD profile detection during the detection step. If disabled, the device will appear to not support the Power Delivery Protocol. |
| Profile Limit EPR | This is used to enable or disable the EPR profile detection during the detection step. If disabled, the device will appear to not support the Extended Power Range Protocol. |
| Profile Limit BC | This is used to enable or disable the BC profile detection during the detection step. If disabled, the device will appear to not support the Battery Charging Protocol. |
| Profile Limit QC | This is used to enable or disable the QC profile detection during the detection step. If disabled, the device will appear to not support the Quick Charge Protocol. |
| Profile Limit PPS | This is used to enable or disable the PPS profile detection during the detection step. If disabled, the device will appear to not support the Programmable Power Supply Protocol. |
| Apply Defaults on Source Capability Change | This is used to enable setting the defaults (Profile index, Voltage and Current) on any source capability change. |
| Dial Load Speed | This is used to set the load change speed, when the rotary dial is used to increase or decrease the load on sink port. Valid range of “LoadSpeed” in milliseconds is 20ms to 1000ms. Default is 200ms (fast). |
| USBC Max Current | The maximum current for USBC default ports can be defined by this option. |

Configuration Commands

| Parameter | Data Bytes | | Example Set Command Data |
|-----------------------|------------|---|--|
| | Read | Set / Response data from read | |
| Loopback Port | 0x00 | Disable: 0x00 0x00 Enable: 0x00 0x01 | |
| Set Max Current Limit | 0x01 | 0x01 <i>CurrentLimitType</i> (1 Bytes) <i>MaxCurrent</i> in milliamperes (2 Bytes) | Force current limit to 1000mA 0x01 0x02 0x03 0xE8 |
| Max SDP Current | 0x02 | 0x02 <i>MaxCurrent</i> in milliamperes (2 Bytes) | Set maximum current to 900mA |

| | | | |
|--|------|---|---|
| | | | 0x02 0x84 0x03 |
| Upstream VBUS Estimation | 0x03 | Disable: 0x03 0x00 Enable: 0x03 0x01 | |
| Cable Resistance | 0x04 | 0x04 <i>CableResistance</i> in ohms (2 Bytes) | Set cable resistance to 80 ohms: 0x04 0x50 0x00 |
| Default Profile Index | 0x05 | 0x05 <i>DefaultProfileIndex</i> (1 Byte) Or for Auto mode: 0x05 0xFF | Set default profile index to 2: 0x05 0x02 |
| Default Voltage | 0x06 | 0x06 <i>DefaultVoltage</i> in millivolts (2 Bytes) | Set default voltage to 2000mV: 0x06 0xD0 0x07 |
| Default Current | 0x07 | 0x07 <i>DefaultCurrent</i> in milliamperes (2 Bytes) | Set default current to 1500mA: 0x07 0xDC 0x05 |
| Operating Current | 0x08 | 0x08 <i>MaxOperatingCurrent</i> in milliamperes (2 Bytes) Or for Max: 0x08 0xFF 0xFF | Set maximum operating current to 1500mA: 0x08 0xDC 0x05 |
| Sink Capability | 0x09 | 0x09 <i>Voltage</i> in millivolts (2 Bytes) <i>Current</i> in milliamperes (2 Bytes) Or for None: 0x09 0xFF 0xFF 0xFF 0xFF | Set sink capability to 15V, 3A: 0x09 0x98 0x3A 0xB8 0x0B |
| Profile Limit PD | 0x0A | Disable: 0x0A 0x00 Enable: 0x0A 0xFF | |
| Profile Limit EPR | 0x0B | Disable: 0x0B 0x00 Enable: 0x0B 0xFF | |
| Profile Limit BC | 0x0C | Disable: 0x0C 0x00 Enable: 0x0C 0xFF | |
| Profile Limit QC | 0x0D | Disable: 0x0D 0x00 Enable: 0x0D 0xFF | |
| Profile Limit PPS | 0x17 | Disable: 0x17 0x00 Enable: 0x17 0xFF | |
| Apply Defaults on Source Capability Change | 0x20 | Disable: 0x20 0x00 Enable: 0x20 0x01 | |
| Dial Load Speed | 0x21 | 0x21 <i>LoadSpeed</i> in milliseconds (2 Bytes) | Set dial load speed to 200ms: 0x21 0x00 0xC8 |
| USBC Max Current | 0x22 | 0x22 <i>MaxCurrent</i> in milliamperes (2 Bytes) | Set maximum current to 900mA 0x02 0x84 0x03 |

Port Type/Sub-Type Guide

Port Types

0x00: Unknown
 0x01: Legacy
 0x02: Proprietary Charger (PTY)
 0x03: Battery Charging (BC)
 0x04: Quick Charge (QC)
 0x05: USB-C (without PD support)
 0x06: Power Delivery (SPR)
 0x07: EPR (with PD support)

Port Sub-Types

| Profile Type | Profile Sub Type | | | | | |
|--------------|------------------|-----------|------------|------------|----------|------------|
| | 0x00 | 0x01 | 0x02 | 0x03 | 0x04 | 0x05 |
| 0x00 | Unknown | | | | | |
| 0x01 | Legacy | | | | | |
| 0x02 | Apple 0.5A | Apple 1A | Apple 2.1A | Apple 2.4A | Apple 3A | Samsung 2A |
| 0x03 | BC-SDP | BC-CDP | BC-DCP | | | |
| 0x04 | QC1 | QC2 | QC3 | | | |
| 0x05 | USBC 0.5A | USBC 1.5A | USBC 3A | | | |
| 0x06 | PD-FIX | PD-BAT | PD-VAR | PD-PPS | | |
| 0x07 | EPR-FIX | EPR-BAT | EPR-CAR | EPR-AVS | | |