Total Phase Advanced Cable Tester User Manual

This document describes the Advanced Cable Tester web software applications, the Advanced Cable Tester Hardware, and how to use both.

The Advanced Cable Tester provides an easy-to-use web interface that allows for remote operation and logging. Using the Promira platform's connectivity, the Advanced Cable Tester can be operated over USB or over Ethernet. The Advanced Cable Tester can also be configured to operate in a stand-alone mode that does not require a host PC. The LEDs on the device provide straight-forward pass/fail information for the qualification of cables without the need for the graphical interface.

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1 General Overview

1.1 Revision History

Always read the CHANGES.txt file included in the Promira Serial Platform update package for more details

1.1.1 Release 1.13

Version 1.13 FW/1.13 Web - This release provides enhanced speed, removes some eye diagram display issues, fixes other bugs, and adds the USB A to Lightning cable test.

1.1.2 Release 1.11

Version 1.11 FW/1.11 Web - This release provides enhanced behavior, fixes some bugs, adds color coding for resistor detection, and is required for v1.00 adapters.

1.1.3 Release 1.10

Version 1.10 FW/1.10 Web - This is the second release of the advanced cable tester that fixes some errors and includes the use of legacy adapters.

1.1.4 Release 0.90

Version 0.90 - This is the first release of the advanced cable tester.

1.2 General Description

The Advanced Cable Tester is a set of applications for the Promira™ Serial Platform that provides the ability to test USB cables. The Total Phase Advanced Cable Tester - Level 1 Application provides continuity testing, DC resistance measurement, and E-Marker verification. The Total Phase Advanced Cable Tester - Level 2 Application provides additional capabilities to evaluate cable signal integrity at up to 12Gbps. Both application levels use the Advanced Cable Tester Hardware, pictured below.

This document describes the Advanced Cable Tester web software applications, the Advanced Cable Tester Hardware and how to use both.

Figure 1 : ACT Hardware

Figure 2 : ACT System

Primarily targeted at USB cables, the main hardware natively supports testing Type-C-to-Type-C cables. Adapter cards are available to enable testing cables that terminate in USB 3.1 Standard-A, USB 3.1 Micro-B, and Lightning USB2.

Continuity testing checks all pins for continuity, preventing dangerous situations like shorts of VBUS to data signals, VBUS/GND reversal, etc., which could damage devices.

DC Resistance ("DCR") and IR Drop testing confirms that each power pin (VBUS and GND) is capable of carrying the required current to meet the applicable specification. For Type-C cables, each power pin is individually measured, then the cable as a whole is tested.

E-Marker testing reads the data from all E-Markers present on the cable, then validates the advertised data and power capabilities against the actual measured parameters of the cable. Additionally, the values of fields such as Vendor ID, Product ID, Test ID, firmware and hardware versions can be specified by the operator, for easy pass/fail determination of cables through a QA process.

The Advanced Cable Tester provides an easy-to-use web interface that allows for remote operation and logging. Using the Promira platform's connectivity, the Advanced Cable Tester can be operated over USB or over Ethernet. The Advanced Cable Tester can also be configured to operate in a stand-alone mode that does not require a host PC. The LEDs on the device provide straight-forward pass/fail information for the qualification of cables without the need for the graphical interface.

2 Device Specifications

2.1 Hardware Connectors and LED Indicators

Table 1 : Connector Description

Connector	Purpose
Promira platform	Connects to Promira platform via included 40mm 34pin ribbon cable
U	Type-C connector for connecting to one plug of the cable under test. Typically configured as the functional Source when testing Type-C cables.
D	Similar function to the U connector, but typically configured as the functional Sink when testing Type-C cables.

Table 2 : LED Function and Description

	LED	Purpose and Meaning
Advanced Cable Tester LEDs	Data	Indicates data signal integrity is within expected values. Only valid for the Advanced Cable Tester - Level 2 Application. **Off:** Test not performed (Level 1 application) **Green:** Indicates that signal integrity passed. **Red:** Indicates a signal integrity or other data line failure.
	Amps	Indicates power-related test result of the cable. **Green:** Cable shows no power-related failures, and can carry its specified current. **Red:** Power-related failure, such as shorts/opens, out-of-spec IR Drop/DCR, etc.
	Status	**Off:** Not ready or Test in Progress **Green:** Test completed and passed **Red:** Test completed and failed **Blue flashing:** Idle or waiting for cable attachment
	Note	While idle or waiting for cable, the Data or Amps LEDs will illuminate green to indicate an adapter is present, blue to indicate that a USB Type C plug has been detected, or blue-green to indicate that a cable has been detected in the attached adapter, corresponding to the "D"and "U" receptacles.

Promira LEDs	Left	**Blank:** Normal state
	Middle	**Blue flashing:** Test in progress **Off:** Idle
	Right	**Green:** Advanced Cable Tester application running **Blue:** No application running (Promira idle)

2.2 Software Specifications

- Test Profiles: Held in non-volatile storage on the Promira platform

- Test Results: Up to 1000 sets of results are kept in a circular buffer in RAM. Test results are cleared upon power cycle.

2.3 Physical Specifications

- DC Characteristics: Power Consumption: 900mA @ 5 V with Promira platform

- Dimensions: W x D x L: 77.5 x 29.2 x 115.6 mm (3.05 x 1.15 x 4.55 in)

- Weight: 125 g (4.41 oz)

- Operating Temperature: 10°35° C (50°95° F) non-condensing

3 Promira Serial Platform Overview

The Promira Serial Platform is a multi-purpose test platform. Total Phase separately licenses many other applications for other types of test and development. This includes Host Adapter and Analysis applications for I2C, SPI, eSPI, etc. The Advanced Cable Tester Applications are just a few possibilities for the platform. Details about the Promira Serial Platform are included in the separate Promira Serial Platform System User Manual (https://www.totalphase.com/support/articles/204227283). A brief overview of essential usage details is included here.

3.1 Basic Connectivity

The basic interface to the Promira Serial Platform is via USB or Ethernet. In either case, the USB micro-B interface is used for power (see below). Communication between the end user platform and the Promira is via TCP/IP over Ethernet-over-USB or via TCP/IP over Ethernet. The Ethernet over USB connection is established using the RNDIS or ECM protocol. In this case, the Promira will act as a DHCP server, provide an IP address t your PC/Mac in the 10.0.0.0/24 range.

When using the physical Ethernet connection, the Promira platform can use a static IP address or act as a DHCP client, depending on network requirements. It is most convenient to use the Promira Utility (https://www.totalphase.com/products/promira-update-utility) software to discover the address that was assigned. The utility software can connect to the Promira via USB or Ethernet connection. The Promira Utility software can also be used to configure a static IP address for the Promria platform (and therefore the Advanced Cable Tester).

3.2 Powering the Promira and ACT

In the case where an Ethernet connection is used, it is necessary to power the Promira platform (and the Advanced Cable Tester) via a USB power adapter with a Micro-B cable. It is essential that this is a high-quality power supply, capable of supplying a minimum of 5V at 1A of current, and with all relevant safety certifications. If a power adapter does not provide enough power, the Promira platform and the Advanced Cable Tester Hardware may not have enough power to operate properly and thus cannot ensure valid testing.

After the Promira platform is configured, the Advaned Cable Tester Application is simply accessed via HTTP from an HTML5-compatible web browser. This could be a mobile

phone, tablet, or most often a PC. Please consult the Quick Start Guide at the end of this manual or on our website at Quick Start Guide (http://www.totalphase.com/support/articles/235050988).

3.3 Update Process

In order to update your Promira databases properly, you *must* follow the below procedure to backup any custom profiles you have created, reset the profile database, and then restore any custom profiles.

The full update sequence is:

1. Start the Promira Utility (v1.35 or later available at Download) and use it put the Promira in firmware update mode:

   a. Click the Promira button.

   b. Find your Promira device in the list. If it doesnt appear yet, wait a little while for it to finish booting and enumerating, then click the button to refresh the list.

   c. Select the Promira which was found, and click OK.

   d. Click the Update License/Firmware button.

2. Copy the new firmware (.pmu file) to the Promiras disk. Typically your PC will notify you that a new disk has been detected, and give you the option to browse it. You may need to manually navigate to it using Finder or Explorer.

3. Eject the USB disk

4. Power-cycle the Promira the firmware will be automatically updated, which will take about a minute to complete, during which time the LEDs will blink blue.

5. Wait for the right-most LED to illuminate green, then login to the Advanced Cable Tester.

6. Open the "Profile Management" screen.
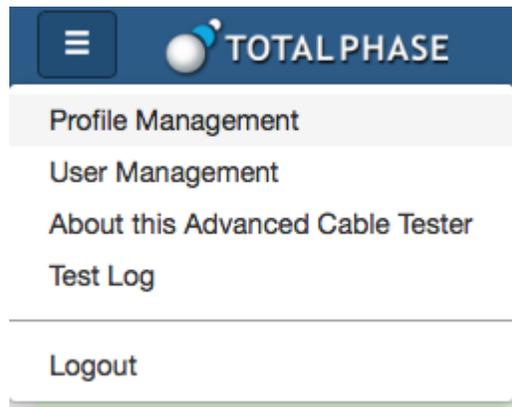
7. Select your first custom profile. (Standard profiles are marked with a *; custom profiles are not marked).
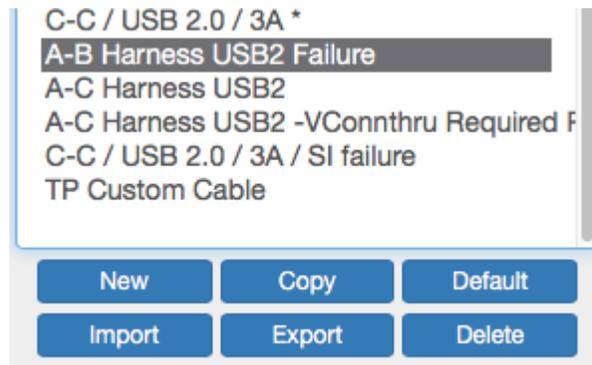
8. Hold down the Shift key on your keyboard and click on the last custom profile. (Be sure youve scrolled to the end of the listbox).
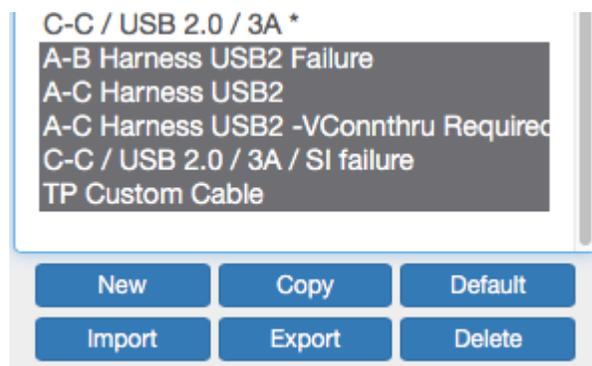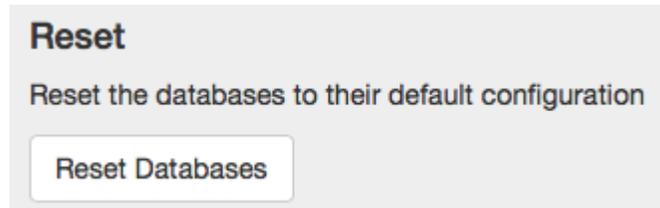

9. Click **Export** Export and a ‹filename›.json file will be downloaded to your computer, make sure to save this.
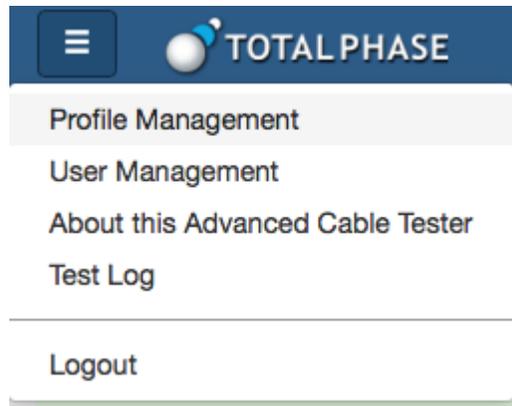
10. Open the About this Advanced Cable Tester screen., and click Reset Databases.
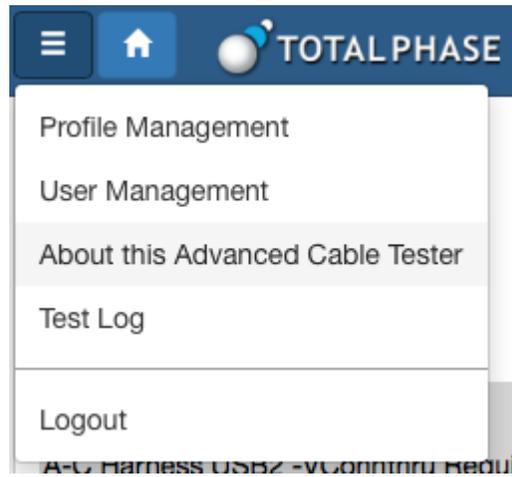
11. Click Reset Databases.

12. Return to the Profile Management screen.

13. Click [Import] Import and re-import your saved custom profiles.

4 User Interface Overview

The Advanced Cable Tester application is accessed via an HTML5 web browser, connecting to the server application hosted on the Promira platform.
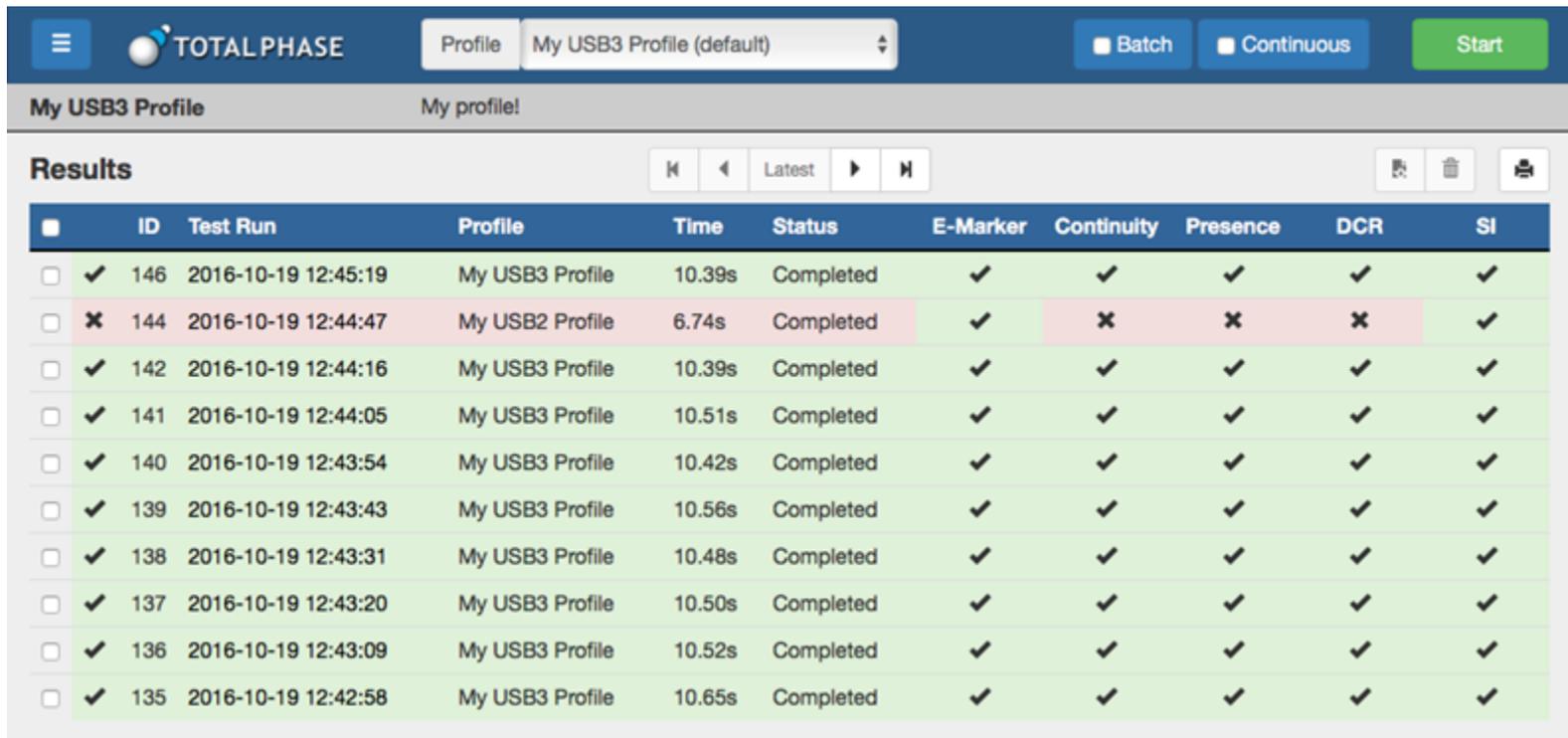
Features:

- **Multi-user:** Multiple users can simultaneously access, view, and control the Advanced Cable Tester.

- **Role-level access:** Different roles are available to limit access to the various features.

- **Responsive design:** Single web interface is compatible with mobile browsers, tablets, and PCs.

- **Preset test profiles:** Standard test profiles are provided for common cable types.

- **Custom test profiles:** Test profiles can be customized for specific test parameter configurations.

- **Batch test mode:** Capable of high-volume testing that auto-starts on cable insertion.

- **Continuous test mode:** Includes single cable burn-in testing.

- **Auto-start:** Advanced Cable Tester is ready for testing after power-up without needing to start a test manually through the web interface.

- **Headless mode:** Advanced Cable Tester can operate without a connection to a host device.

- **Test profiles:** stored on the device. Test profiles can be imported and exported to share between devices.

- **Test results:** stored in volatile memory and are cleared if the power is cycled. Up to 1000 sets of results can be kept. The test results are stored in a circular buffer.

If the results storage is full, then the oldest result set is automatically cleared to make room for the new test result set.

4.1 Main User Interface

The main user interface displays two general sections: The Control section to configure the Advanced Cable Tester, control the active test profile, and initiate testing. The Results section which displays an overview of any available test reports, in addition to allowing you to manage the individual reports.

Figure 3 : *Main User Interface*

The Control section elements are:

Stack (Menu): This drop-down menu provides quick access to the various management features of the Advanced Cable Tester Application: Profile management, User Management, Device Information, Test Log, and Logout. Which features are available will depend on the user's role.

Profile: The Profile menu provides a list of all cable profiles available on the Advanced Cable Tester. When the page is first loaded, the default profile is automatically selected.

Batch: Batch mode is a special testing mode, which only requires the user to click Start once to test a number of cables. Once started, the Advanced Cable Tester will remain active and test cables as they are inserted. The pass/fail status of the cable will be indicated by the LEDs on the Advanced Cable Tester Hardware until the cable is unplugged. The test results will be stored on the device and can be retrieved through the web interface.

Continuous: Continuous mode is a special testing mode which will continuously run tests on a single cable until stopped, with a 500 ms delay between test runs. This test mode is particularly useful for burn-in or environmental testing of cables.

Start: Click to start a test, using the currently selected profile.

The Results section provides a list of the test results available on the Advanced Cable Tester, and a high-level summary of the test outcomes. Clicking on any result will take the user to the detailed test results view. If there are more than 10 reports available, then use the ◀ and ▶ buttons to navigate to the previous or next page, and the ◀◀ and ▶▶ buttons to go to the first or last pages. Additionally, it is possible to download and remove test results by selecting them in the list and clicking on the (download) or (delete selected) buttons. The summary test results shown in the current on-screen list can be printed by clicking on the (print) button. Finally, all stored test results can be downloaded by clicking the (download) button, or deleted by clicking the (delete all) button.

4.2 Test Profiles and Profile Configuration

The Advanced Cable Tester includes an Auto-Detect profile, several preset Type-C profiles, and the ability to create custom profiles. The preset profiles [marked with an * (asterisk)] cannot be modified or deleted; they can be copied and exported.

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etect with SI *
etect *
SS Gen2 / 900mA / SI *
SS Gen1 / 900mA / SI *
SS / 900mA *
USB 2.0 / 500mA / SI *
USB 2.0 / 500mA *
en2 / 3A / SI *
en1 / 3A / SI *
A *
.0 / 3A / SI *
.0 / 3A *
SS Gen2 / 3A / SI *
SS Gen1 / 3A / SI *

| Copy | Default |
| Export | Delete |

Edit Test Profile

Name	Profile Name
Description	Profile Description
Current	Current value (0 to 8191) in mA to use for DCR/IR drop calculations
Connectors	USB Type-C / USB Type-C

DCR

GND	Wire	0 to 32767	mV ▾	Pin	0 to 32767
V_{BUS}	Wire	0 to 32767	mV ▾	Pin	0 to 32767

Presence

SOP'	[select]	SOP"	[select]
CC	[select]	SBU	[select]
V_{CONN}	[select]	V_{CONN} Thru	[select]
DP/DM1	[select]	DP/DM2	[select]
SS TX1	[select]	SS RX1	[select]
SS TX2	[select]	SS RX2	[select]

E-Marker

Product	[select]	Speed	[select]
Current	[select]	Vendor ID	0 to 65535
Product ID	0 to 65535	Test ID	0 to 65535
HW ver	0 to 15	FW ver	0 to 15
V_{BUS} Thru	[select]	Latency	[select]
Term	[select]	SOP"	[select]

Signal Integrity

Lab Mode   Eye Diagrams

High-Speed Data Lines

	Bitrate	518 to 12800	Mbps	HEO	1 to 63	VEO	1

Super-Speed Data Lines

	Bitrate	518 to 12800	Mbps	HEO	1 to 63	VEO	1
	Bitrate	518 to 12800	Mbps	HEO	1 to 63	VEO	1

Save   Cancel

Figure 4 : Profile Management Page

4.3 Default Profiles
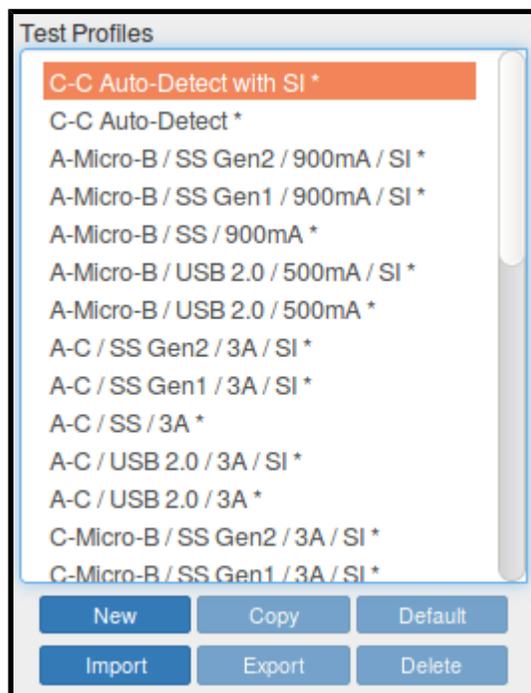
There are several preset profiles. All profiles are provided in both a "with SI" form, valid only for the Advanced Cable Tester - Level 2 Application, which performs signal integrity testing; as well as a simple version, valid for both application levels, which does not perform signal integrity testing.

C-C Auto-Detect: Auto-Detect cable type, based on any inserted adapter cards, E-Marker presence and advertisements, SuperSpeed pair presence, and test accordingly. Cable is tested only for spec compliance, within parameters that are tested by the Advanced Cable Tester. With or without SI.

C-C SS Gen 2 – 5A: Test a Type-C-to-Type-C cable, capable of USB 3.1 Gen 2, and 5A current.

C-C SS Gen 2 – 3A: Test a Type-C-to-Type-C cable, capable of USB 3.1 Gen 2, and 3A current. Note: If E-Marker indicates 5A, this test will fail.

C-C SS Gen 1 – 5A: Test a Type-C-to-Type-C cable, capable of USB 3.1 Gen 1, and 5A current. Note: If E-Marker indicates USB 3.1 Gen 2, this test will fail.

C-C SS Gen 1 – 3A: Test a Type-C-to-Type-C cable, capable of USB 3.1 Gen 1, and 3A current. Note: If E-Marker indicates USB 3.1 Gen 2 or 5A, this test will fail.

C-C USB 2.0 – 5A: Test a Type-C-to-Type-C cable, capable of USB 2.0 only, and 5A current. Note: If E-Marker indicates USB 3.1 is supported, or if any SuperSpeed wire pairs are present, this test will fail.

C-C USB 2.0 – 3A: Test a Type-C-to-Type-C cable, capable of USB 2.0 only, and 3A current. Note: An E-Marker is optional for this profile. If E-Marker is present and indicates USB 3.1 is supported, or E-Marker indicates 5A is supported, or if any SuperSpeed wire pairs are present, this test will fail.

A-µB SS Gen 2 – 900mA: Test a standard A-to-micro B cable, capable of USB 3.1 Gen 2, and 900mA current.

A-µB SS Gen 1 – 900mA: Test a standard A-to-micro B cable, capable of USB 3.1 Gen 1, and 900mA current.

A-µB USB 2.0 – 500mA: Test a standard A-to-micro B cable, capable of USB 2.0, and 500mA current.

A-C SS Gen 2 – 3A: Test a Type-C-to-standard A cable, capable of USB 3.1 Gen 2, and 3A current.

A-C SS Gen 1 – 3A: Test a Type-C-to-standard A cable, capable of USB 3.1 Gen 1, and 3A current.

A-C USB 2.0 – 3A: Test a Type-C-to-standard A cable, capable of USB 2.0, and 3A current.

C-µB SS Gen 2 – 3A: Test a Type-C-to-micro-B cable, capable of USB 3.1 Gen 2, and 3A current.

C-µB SS Gen 1 – 3A: Test a Type-C-to-micro-B cable, capable of USB 3.1 Gen 1, and 3A current.

C-µB USB 2.0 – 3A: Test a Type-C-to-micro-B cable, capable of USB 2.0, and 3A current.

A-Lightning USB2: Test a USB A-to-Lightning cable, per MFi specifications.

4.4 Profile Management Actions

When a profile is selected in the list, its settings are automatically loaded. Changes must be saved by clicking the Save button at the bottom. Selecting another profile before clicking the Save button will result in changes being lost.

The method for selecting multiple profiles for Download or Delete is browser-dependent, but typically on Windows/Linux a range is selected by holding down Shift before clicking on the second extent of the range, or by holding Control and clicking each individual item; or on Mac OS X using Shift to select a range, and Command to select individual items.

New: Create a new profile with blank fields.

Copy: Create a copy of the currently selected profile. Use this to clone one of the preset profiles, to create your own derivative.

Export: Export the selected profile as a JSON file. Multiple profiles can be exported at once.

Delete: Delete the selected profile, after displaying a confirmation dialog. Multiple profiles can be deleted at once.

Default: Set the selected profile as the default, automatically selected when the application starts.

Import: Import a previously Exported profile(s) from a JSON file.

4.5 Profile Options

Name: This is the profile name, shown in the list of profiles. This will be displayed in the test results.

Description: Verbose text describing the profile purpose. This will be displayed in the test results and is a useful place to put descriptive information for users of the Advanced Cable Tester and consumers of the test reports.

Current: Current value in milliAmps to use for DCR/IR drop calculations. When computing the IR drop for VBUS/GND, it's necessary to factor in the current. Depending on the cable type, a default will be used: 3000mA for unmarked Type-C, 3000mA or

5000mA for E-Marked Type-C, 900mA for USB 3.1 cables terminating in an A or B connector, and 500mA for USB 2.0 cables terminating in an A or B connector.

Connectors: This section has three drop-down selections for choosing the connectors on the cable to be tested. No particular order is required for the selection as the ACT automatically verifies that the selected connectors are available on the two ports of the ACT. For example, if you select Type-C and Standard A, the ACT will verify that one and only one Standard A Adapter is inserted into the ACT when the test begins execution. If the ACT configuration does not match the selection at the start of a test, the test will abort and the message "Invalid Profile" will be presented in the results summary.

DCR: This configures the parameters for the DC resistance (DCR) measurement for the cable, on the GND and VBUS lines. Both follow a similar pattern: If the checkbox is selected, then the parameter is validated against measured values; if not selected, then the results are reported but will not cause a failure.

> **GND / Wire:** Maximum resistance or IR drop for the GND wire through the cable. If units are set to mV then this is taken as Maximum IR drop; if units are set to "mOh", then this is taken as Maximum DC resistance in milliohms.

> **GND / Pin:** Maximum DC resistance for any GND pin, measured between the Advanced Cable Tester and the paddle card, in milliohms.

> **VBUS / Wire:** Maximum resistance or IR drop for the VBUS wire through the cable. If units are set to mV then this is taken as Maximum IR drop; If units are set to "mOhm", then this is taken as Maximum DC resistance in milliohms.

> **VBUS / Pin:** Maximum DC resistance for any VBUS pin, measured between the ACT and the paddle card, in milliohms.

Presence: All items in this section follow a common pattern: If Required is checked, then the items presence must match the Presence option.

> **SOP' & SOP'':** Checks for presence of a corresponding E-Marker in the cable. Any present E-Marker must be valid, match cable parameters, etc.

> **CC:** Presence of the CC wire through the USB cable. For Type-C cables, this is a fundamental requirement; this test is recommended as Present / Required for Type-C-to-Type-C cables.

> **SBU:** Presence of SBU1/SBU2 wires through the cable. These two wires are required for Full-Featured Type-C cables.

VCONN: Presence of the VCONN pulldown in the cable plug.

VCONN Thru: Presence of the VCONN wire through the cable. A cable that has this is not Type-C compliant. This test is recommended as Absent / Required.

DP/DM1: Presence of the USB2 wire pair, also known as D+/D-. These wires are required for all Type-C cables. This test is recommended as Present / Required.

DP/DM2: Presence of a second USB2 wire pair, also known as D+/D-. These wires are prohibited for Type-C cables. This test is recommended as Absent / Required.

SS TX1 / SS TX2 / SS RX1 / SS RX2: Presence of each of the four SuperSpeed wire pairs: SSTX1, SSTX2, SSRX1, SSRX2. These wire pairs are required for Full-Featured Type-C cables.

E-Marker: This section defines E-Marker parameter validation. If an E-Marker is present in the cable, then the identity VDOs are read, and compared to the parameters specified here. If the checkbox for a given item is checked, then the associated parameter must match.

Product: Product type as specified in the ID Header VDO. Can be either Passive Cable or Active Cable.

Speed: USB SuperSpeed Signaling Support as specified in the Cable VDO. Can be USB 2.0 only, USB 3.1 Gen 1, or USB 3.1 Gen 1 and Gen 2.

Current: VBUS Current Handling Capability as specified in the Cable VDO. Can be either 3A or 5A.

Vendor ID: USB Vendor ID as specified in the ID Header VDO.

Vendor Name: Vendor Name as specified in the USB.org and the linux.org vendor lists.

Product ID: USB Product ID as specified in the Product VDO.

Test ID: USB Test ID (XID) as specified in the Cert Stat VDO.

HW Ver: Hardware Version as specified in the Cable VDO.

FW Ver: Firmware Version as specified in the Cable VDO.

VBUS Thru: VBUS Through Cable, either Yes or No, as specified in the Cable VDO.

Latency: Cable Latency, as specified in the Cable VDO.

Term: Cable Termination, as specified in the Cable VDO.

SOP DP: True if the emitter indicates an SOP" controller is present, as specified in the Cable VDO.

Signal Integrity: Parameters for signal integrity testing. These can be configured when using the Advanced Cable Tester - Level 1 Application, but tests can only be run when using the Advanced Cable Tester - Level 2 Application.

Lab Mode: When Lab mode is not enabled, the Advanced Cable Tester will test for data reception only where reception expected, which results in faster test times. When lab mode is enabled, the Advanced Cable Tester will test signal integrity on all possible combinations of wires. If cable is mis-wired, additional debug information may be available by checking this box.

Eye Diagrams: Enables capture and storage of the eye diagram data.

For each test option, **Frequency** controls at what rate to test. Test frequencies can be selected between 518Mbps and 12Gbps. Not all test frequencies are available, if an unavailable frequency is selected, the next highest available rate (or the maximum) will automatically be chosen. The actual frequency used in signal integrity testing will be returned in the results.

HEO and **VEO** set the minimum horizontal (HEO) and vertical (VEO) eye openings. Both are specified only in internal units. It is recommended to start with one of the standard profiles, and then fine-tune this by loosening (lowering) or tightening (raising) the value as necessary.

High-Speed Data Lines: If checked, enables signal integrity analysis of the USB2 DP/DM wire pair at the specified rate, with HEO and VEO validation as specified.

SuperSpeed Data Lines: If checked, enables signal integrity analysis of all four SuperSpeed USB wire pairs at the specified rate, with HEO and VEO validation as specified.

4.6 About This Advanced Cable Tester

This page describes the status of the Advanced Cable Tester and the associated adapters (if installed). Additionally, this page provides a support utility and the "Reset Databases" function for the ACT.

5 Test Specification

5.1 Test Coverage

The Advanced Cable Tester contains several types of analysis circuitry for testing the different types of pins. With the exception of the lower-speed USB2 pins, a given pin type is not tested by multiple analysis circuits. The tests have been carefully selected to provide test coverage, while not increasing system cost of impacting accuracy.

Pin Groups

<u>VBUS, GND:</u> Tested using power pin tester.

<u>CC, VCONN:</u> Tested using a Type-C port controller.

<u>SSTX1, SSTX2, SSRX1, SSRX2:</u> Tested using signal integrity circuit.

<u>SBU1, SBU2, SHIELD:</u> Tested using simple digital testing.

<u>USB2 D+/D- pair:</u> Tested using both digital tester *and* signal integrity circuit.

5.2 Test Sequence

The Advanced Cable Tester uses multiple phases to test the cables that are put under test. The phases are generally measurement of the various cable parameters followed by evaluation of the results for pass/fail criteria established by the selected profile and the specifications of the USB Type-C Specification. The first phase is a safety test stage where the cable is evaluated for shorts and mis-wires that are deemed to be safety issues; the second phase measures all the parameters of the cable; and the final phase takes all of the measured parameters and evaluates them against the requirements for the cable under test. At the completion of the third phase, the web interface is updated with the result and the information is available for further use by the end-user.

5.2.1 Test Phases

Test Phase 1

1. The first phase encompasses the Safety Test part of the test sequence. The following items are checked during this phase.

2. VBus to Ground Short

3. CC/VCONN to Ground Short

4. VBus to CC/VCONN Short

Test Phase 2

1. Shorts between all other pins

2. Continuity of defined and present pins

3. Mis-wires of defined and present pins

4. DC resistance of each of the Ground pins at both the "U" and "D" side of the cable

5. Total DC resistance of the Ground connection through the cable

6. DC resistance of each of the VBus pins at both the "U" and "D" side of the cable

7. Total DC resistance of the VBus connection through the cable

8. E-Marker detection and read out

   a. From the "U" side of the cable (SOP' and SOP")

   b. From the "D" side of the cable (SOP' and SOP")

9. Differentiate Pair continuity check

10. (Optional) Signal Integrity measurement

Test Phase 3

1. Compare the results from the above testing with the requirements of the profile used and USB Type-C specifications.

2. Set the LEDs on the Advanced Cable Tester device per the pass/fail results.

3. Report to the web browser the results of the test.

5.3 Detailed Test information

5.3.1 DCR Resistance Tests

The Advanced Cable Tester utilizes a small current to measure the DC resistance of the various parts of the cable. The individual pin test relies upon the fact that each end of the cable has at least two of the four defined pins used for each of VBus or Ground. The total cable DC resistance test relies on the presence of at least one good pin connection on each end of the cable for the VBus and the Ground connection. If there are not sufficient connections for the above tests, the Advanced Cable Tester reports back "no connection" in the test results. It will report back as much information as it can discern from the available connections.

NOTE: The Advanced Cable Tester does not use the maximum specificed current per the USB Type-C Specification for the levels of 1.5 A, 3 A, or 5 A for legacy to Type-C or Type-C to Type-C cables.

5.3.2 Signal Integrity

Each requested test (HS USB and however many SS USB tests are specified) are performed sequentially by iterating through the specified test rates. The default cases for USB cables are 500 MBps (HS), 5 GBps, and 10 GBps (SS). The user can set the test rates between 518 MBps and 12.8 GBps for both types of wires via the interface. If a test is requested on a particular pair that does not support or is missing the correct connection, the tester will try multiple times to look for a transmitted signal. If no lock of the transmitted signal is received this process will slow down the overall test time. There are two modes for operation of the signal integrity test. The "Lab Mode" switch enables/disables the ability to look at all possible combinations for the SS pair rourting. It does not affect the HS pair test. When disabled (default) the device only looks for the signals at the USB Type-C specification locations (i.e., U end TX1, at D end RX1 or RX2 depending on cable orientation). If it is enabled it will look at all possible locations. The results are returned as unitless measures HEO and VEO. The HEO is the Horizontal Eye opening, and is a value from 0 to 63 with each unit representing 1/64 of the UI. The VEO is the Vertical Eye opening, which is a value from 0 to 150 representing the vertical opening of the recovered eye diagram. Each of these values re measured at the respective horizontal and vertical centers of the UI. The HEO and the VEO are the values used for pass/fail criteria.

Eye diagrams are the complete UI results for each test. They are returned in the results page for visual inspection but not used for pass/fail criteria.

5.3.3 Digital Pins

For the digital pins, which are defined as: SBU1, SBU2, DP1/DM1, and DP2/DM2 a simple continuity test is used to verify presence or absence. This test will fail if the lines are AC coupled between the Up and the Down port of the ACT. The test consists of applying a voltage at one end of the cable and measuring the incoming signal at the far end of the cable. The inputs are weakly pulled to the rail to prevent any false readings from a floating conductor. (NOTE: The DP/DM pairs are also tested with high-speed signal when the Signal Integrity option is purchased.)

5.3.4 E-Marker

The E-marker reading is achieved by sending a USB Power Delivery compliant query to the cable when VConn is supplied. The ACT sends a SOP' and SOP" message from both the Up and the Down ports so as to verify presence of any content from both ends of the cable. In the case of a Type-C to Legacy cable, the messages are only sent from the Type-C end. All retrieved data from the cable is displayed in the results page. The read of the CC is not dependent on Ra presence.

5.3.5 Shield

The shield of the cable is tested in different ways depending on the type of cable under test. For a cable a simple detection first determines if the shield is connected to ground at either end of the cable. If it is, no further testing is undertaken as it is indiscernable from the ground circuits. If the shield is not connected to the cable ground, the shield continuity is checked with a simple continuity test as used above for the digital pins.

6 Appendix A: Quick Start Guide

6.1 Introduction

Promira™ Serial Platform with Advanced Cable Tester application is used to test next generation USB Type-C™ cables. This article will get you up and testing USB Type-C cables using a USB connection, the Promira Utility, and a web browser.

6.2 Setting up the Promira™ Serial Platform with Advanced Cable Tester application

1. Connect the Advanced Cable Tester Hardware to the Promira platform, using the 34-Pin: 34-Pin Header Cable 40mm as shown below.

2. Connect the Promira platform to your PC using a USB Standard-A to Micro-B cable.

3. Follow the instructions in Section 5.2 – Connectivity of the Promira platform system user manual to configure Ethernet over USB interface.

4. Download and unzip the latest version of Promira Utility for your OS. (?)

5. Start the Promira Utility and use it to connect to your Promira by clicking the Promira button in the upper-left corner of the utility window.

    a. Click the [Promira] Promira button.
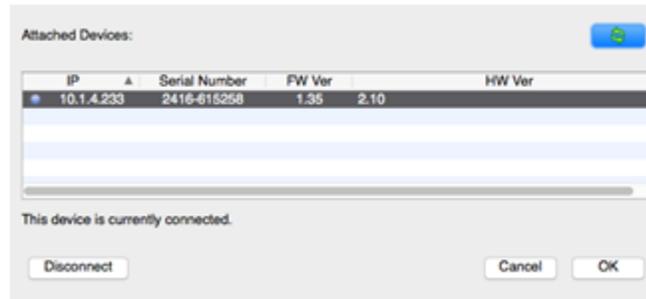
    b. Find your Promira device in the list.

If it doesn't appear yet, wait a little while for it to finish booting and enumerating, then click the 🔄 button to refresh the list.

    c. Select the Promira device which was found, and click OK.

6. In order to start the Advanced Cable Tester application on the Promira platform you must enable it as the "Auto Start App:" by clicking on the pulldown.

    a. Choose "com.totalphase.promact_cab" in the list, and click Apply.

    b. Note the IP address shown in the window. This is the address of the device that you will need below in the process.

    c. Power-cycle the Promira by unplugging the USB cable, and plugging it back in.

    d. Wait for the Promira platform's right LED to go from RED to BLUE and finally to GREEN.

6.3 Testing USB Type-C™ Cables

1. Open a web browser, and navigate to http://⟨ip-address-from-above⟩/
For example, assuming the IP shown was 10.1.4.233, then the URL would be
`http://10.1.4.233/`

2. Login using the default credentials:
   Username: `admin`
   Password: `ChangeMe`

3. Insert a USB Type-C cable into the "U" and "D" ports on the Advanced Cable Tester Hardware.

4. Click "Start Test"

5. The cable will be tested, and results summary will be shown on the screen.

6. To see the detailed results, click on the results line that you are interested in viewing.

7 Legal / Contact

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