

CATC™ UPT™

Universal USB Port Tester

User's Manual



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Changes or Modifications

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Chapter 1: Overview

The CATC Universal USB Port Tester (UPT) is both a production tester and a development tool.

- As a production tester, it tests the Universal Serial Bus ports of both USB-capable motherboards and PCs and external USB hubs for proper functionality according to the USB specifications and gives a quick pass/fail indication for the unit under test.
- As a development tool, it provides detailed information that can be used for debug and analysis during the product development process.

Applications

The CATC UPT Universal USB Port Tester provides quick, accurate testing for proper USB device enumeration, data transfers, detection of connection status for full- and low-speed devices, proper operation of USB interrupt circuitry and the various USB status flags, basic hub initialization, and enumeration checks. The tester supports USB host implementations of both the Intel UHCI and OHCI specifications.

The diversity of current USB port implementations requires a USB Port Tester flexible enough to adapt to the requirements of the ports to which it is connected. The introduction of internal hubs on the motherboard presents a mix of possible port configurations that are seen as outputs from the systems. The CATC UPT software automatically detects the port types and uses the correct test cases for root ports and hub downstream ports.

The CATC UPT Tester

- 1 Identifies all root ports.
- 2 Searches for devices connected to the root ports.
- 3 Determines if a device is a USB hub (internal or external).
- 4 Automatically configures the testing for the type of port (root hub or downstream, internal or external hub) connected.
- 5 With all ports identified, starts the test from the first connected port (Channel 1) and continues until all ports are tested.

Program Features

- DOS-based software program verifies functionality of the USB system under test.
- Software supports the use of a USB keyboard for testing legacy-free systems.
- Tests both root hub and downstream hub ports in all configurations.
 - Single host controller root hub ports
 - Up to eight host controllers root hub ports
 - Mixed root hub and downstream hub ports
 - Downstream hub ports only

- Automatically configures software of each channel for testing root hub ports or downstream hub ports.
- Tests Bulk, Interrupt, and Isochronous modes.
- Tests full- and low-speed port operation.
- Can load a port with up to 5 Amps for Hub Overcurrent Protection testing.
- Supports Chapter 9 testing.
- Provides flexible test parameter setup through the use of a text Configuration file.
- Provides both production and development information.
- Supports UHCI and OHCI USB host implementations.
- Displays second-level visual status and test verification via enclosure-mounted LEDs.
- Allows incorporation into customer system test platforms (Custom Integration Service available).
- Provides Intel 8x930 USB controller-based circuitry packaged in a sturdy metal enclosure.
- Complies with the USB 1.1 specification.
- Provides a one-year warranty and hot-line customer support.

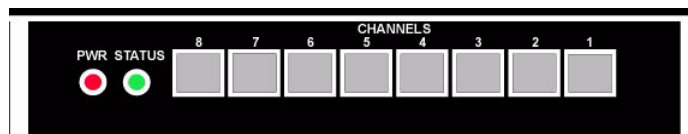
System Components

The DOS-based UPT software runs on the USB host; it communicates with the UPT box via the USB host controller on the motherboard and any USB hub (internal or external) under test. For each port, the UPT software checks for proper operation in both full- and low-speed modes. When all tests are successful, the software declares the unit or hub to be functional. Any failure is both displayed on the screen and saved as a text file. The CATC Chief, Inspector, and Detective USB Bus & Protocol Analyzers can be used to debug and rework units that fail these tests.

The CATC UPT package includes these components:

- a sturdy metal box housing the UPT electronic test circuitry based on the Intel 8x930 USB controller.
- an AC-to-DC converter.
- eight USB cables.
- a diskette with the CATC UPT DOS application program.

The front of the UPT box has eight female B-type USB connectors and two LEDs.



The rear of the UPT box has a +9V DC @ 500mA power connector.



The USB connectors (marked as **CHANNELS 1** through **8**) connect the UPT box to the unit under test. The power connector powers the box from the AC-to-DC power converter. When power is applied, the red LED (marked **PWR**) is illuminated. The green LED (marked **STATUS**) is a status indicator that blinks to indicate that the on-board microcontroller is functioning properly.

Connectors and Cables

All connectors have a limited life (i.e. number of connect/disconnects before failure). When testing multiple units, be sure to **plug and unplug cables at the unit under test side and not at the UPT box**. Forceful or otherwise improper connection and disconnection of USB cables can damage the cables and connectors on the CATC UPT box or the USB system.

Note The CATC Warranty specifically excludes damage caused by product misuse.

There is generally no need to disconnect the B-type USB connectors from the UPT box. There is also no need to power down the UPT box between tests.

Port Testing Configurations

The UPT Program can test both root hub and downstream hub ports in a variety of configurations.

Note Cascaded Hubs are not supported in the CATC UPT.

Figure 1: Motherboard/PC with a Single USB Host Controller

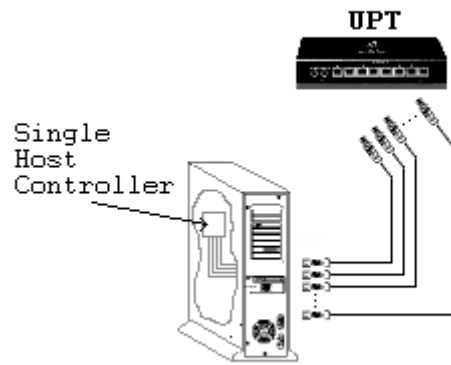


Figure 2: Motherboard/PC with up to eight USB Host Controllers

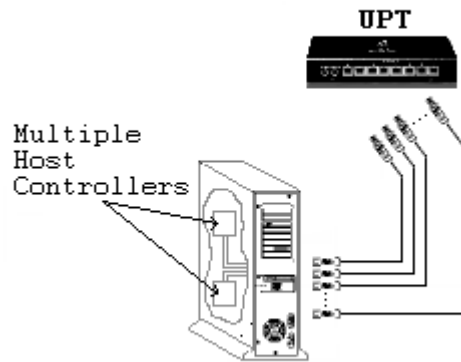


Figure 3: Motherboard/PC with a USB Host Controller and Internal Hub (Mixed Outputs)

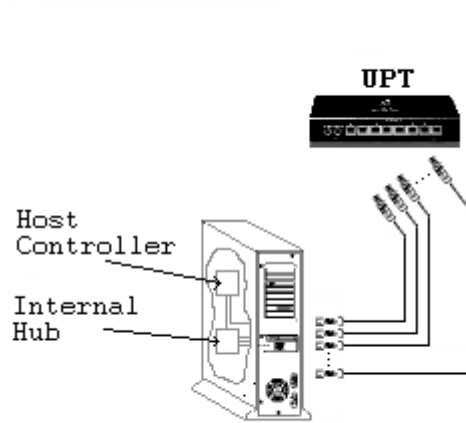


Figure 4: Motherboard/PC with a USB Host Controller and Internal Hub (Hub Outputs Only)

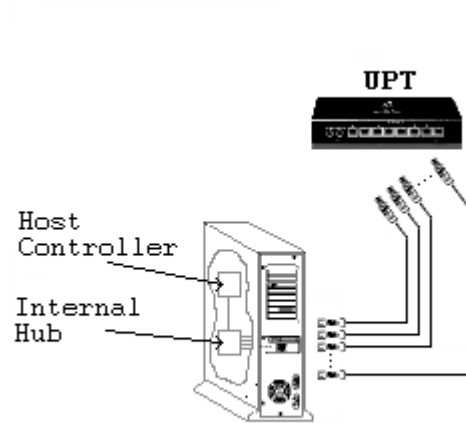


Figure 5: Single External Hub

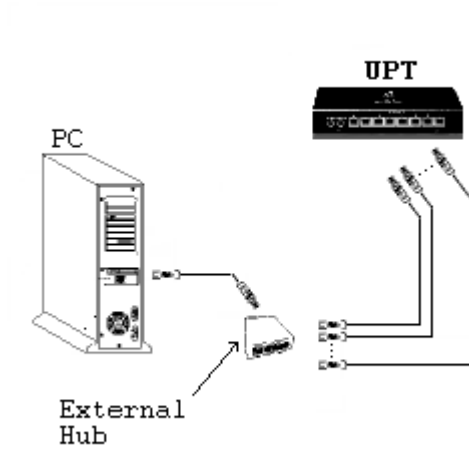


Figure 6: Multiple External Hubs (Root Port Connection Only)

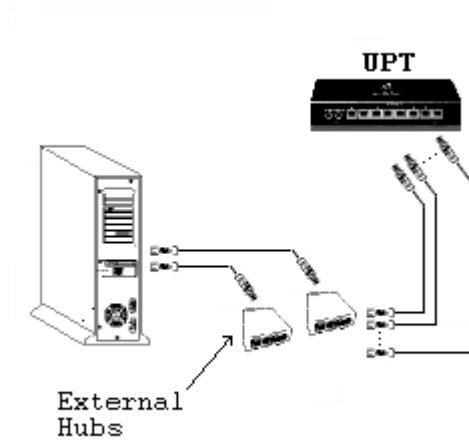


Figure 7: System with a USB Host Controller and External Hub

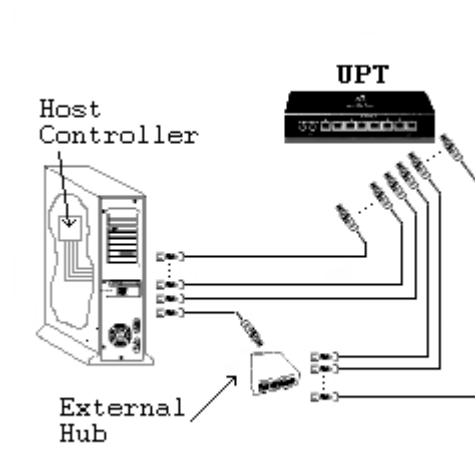
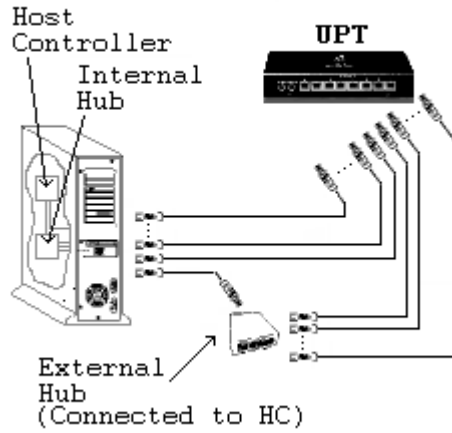


Figure 8: System with USB Host Controller, Internal Hub, & External Hub connected to a Root Port



Chapter 2: Installing the UPT Program

Installing the Hardware

- Step 1** Connect the DC plug of the AC-to-9V DC @ 500mA power converter to the +9V receptacle of the CATC UPT box.
- Step 2** Plug the AC power cable into an outlet.
- Step 3** Connect a USB cable between the USB connector labeled **CHANNEL 1** on the UPT box and a USB port of the unit under test.
- Step 4** If the unit has additional ports, use other USB cables to connect them to the USB connectors labeled **CHANNEL 2**, **CHANNEL 3**, and so forth on the UPT box as needed.
Note: you are not allowed to skip a channel on the UPT box.

The CATC UPT hardware is now ready for operation.

Installing the Software

- Step 1** Make a backup copy of the CATC application diskette.
- Step 2** Create a working directory (i.e. **catc_upt**) on the hard drive of the USB-capable PC to be used for testing.
- Step 3** Copy the contents of the CATC diskette to the working directory.
- Step 4** Check the directory for the CATC UPT software files:
- **upt.exe**: Executable code of the CATC UPT program
 - **upt.cfg**: Configuration file
 - **upthlp.txt**: Text help file
 - **uptflash.ihx**: Firmware HEX File
 - **Version.txt**: Release notes
- Step 5** Add the following line to the CONFIG.SYS file:
stacks=9,512.

Verifying Your USB Setup

With the UPT box **DISCONNECTED**,

- Step 1** Enable Function Key **F9** in the Configuration file (Entry 12).
; DisableFunctionKeys=9
- Step 2** Run the UPT program and wait for the first screen to show up.
- Step 3** Press **F9** to display the Device Connection List screen.
The screen displays the information the program has retrieved about your setup:
- How many USB host controllers and hubs have been found.

- How many USB ports on each host controller and hub have been found.
- The connection between the USB hubs and the USB host controllers

Step 4 Verify your setup with the information on the Device Connection List screen.

Chapter 3: Upgrading the UPT Program

From time to time, as modifications are made to the CATC UPT, it may be desirable to upgrade the software and the firmware.

Upgrading the Software / Firmware

When a new software release is available, it is posted on the Support page of the CATC website at www.catc.com/support.html.

To update the software,

- Step 1** Verify your current software and firmware versions by running **upt /v**.
- Step 2** If the UPT software version or the UPT firmware version on the CATC web site is newer (higher version number), download the new software / firmware to the required destination.
- Step 3** To upgrade the UPT software, just replace the **upt.exe** executable with the new one, and copy the new UPT configuration file (**upt.cfg**) if provided.
- Step 4** To upgrade the UPT firmware, do the following:
copy the new firmware file (**uptflash.ihx**) to the required destination on a USB capable PC. Connect the computer USB port to Channel 1 of the UPT box and then run **upt /f:uptflash.ihx**
The UPT software will load the new firmware into the UPT flash memory via the USB cable.

Chapter 4: Running the UPT Program

The UPT software program (**upt.exe**) is a DOS application and must be run under the DOS operating system.

To get the UPT help screen from the DOS prompt run the following command:

upt ?

The help screen shows the following:

CATC USB Port Tester Version n.nn (Build #m).

Copyright (c) CATC 1999

Usage: UPT [/C:filename] [/F:filename] [/V] [?]

Options:

/C:filename -Use the specified configure file to replace the default (UPT.CFG)

/F:filename -Update FLASH memory with the given HEX file

/V: - Show version number of software and firmware

? - Display this help message

To run the application just execute **upt.exe** without any options.

The Program Configuration File

The UPT program can be customized to fit almost any test requirement. The program executes specific test sequences that are defined in the UPT Configuration File (**upt.cfg**). You can instruct the program to skip specific tests or change some test parameters by editing and modifying the UPT configuration text file. If you run the UPT program with the wrong configuration settings the test may fail.

The configuration file has two parts:

- 1 The first part has the different configuration entries that have to be modified as required by the specific test setup.
- 2 The second part includes detailed explanations for all the entries that are in the first part

Lines starting with a semi-colon (;) are interpreted as comments and are not processed by the program. To comment out an entry line, add semicolon (;) on the left side of the line.

Use the comment symbol when you want to use the default setting for a particular parameter. End-of-line comments are references to notes below the Configuration parameters and are ignored by the program.

Note: when an entry is commented out, the software will use a default value for this specific entry.

Example:

; OvercurrentValue=800

The software will use 1500ma for the overcurrent test (default value) instead of the 800ma that was commented out.

If the configuration file does not exist in the working directory, the program uses its default settings (see below).

Default UPT Configuration File

```

;-----
; AutoReturnToDOS=Yes,1000           ; See 1) below
; TypeOfPortsToBeTested=Root         ; See 2) below
; TypeOfUSBHostController=UHCI       ; See 3) below
; NumberOfPorts=1                    ; See 4) below
; EndOfTestSound=Off                 ; See 5) below
; OHCIBaseAddress=D800                ; See 6) below
; TestLog=Statistics                  ; See 7) below
DefaultScreen=Debug                   ; See 8) below
; ConsoleMode=Yes                     ; See 9) below
; UHCIPix4Irq=11                      ; See 10) below
DisableTest=2,3,4,5,6,7,8,9,10,11,12,13 ; See 11) below
DisableFunctionKeys=9                 ; See 12) below
; EmbeddedPorts=2,3                   ; See 13) below
; HubTrafficIndicatorDuration=Yes,200 ; See 14) below
USBLineIdleHigh=3.10                  ; See 15) below
USBLineIdleLow=0.11                   ; See 16) below
USBLineDrivenHigh=3.15                 ; See 17) below
USBLineDrivenLow=0.22                 ; See 18) below
VCCHigh=5.43                           ; See 19) below
VCCLow=5.00                             ; See 20) below
; VCCLoad=700                          ; See 21) below
; OvercurrentValue=1500                 ; See 22) below
; OvercurrentDuration=300              ; See 23) below
; PropagationDuration=200              ; See 24) below
RunTestKey=Space                       ; See 25) below
; PIX3IOSpace                           ; See 26) below
; PIX3IRQ                               ; See 27) below
; PIX3Clock                             ; See 28) below
; USBKeyboardEnabled=Yes                ; See 29) below
PowerSwitchingDelay=30                  ; See 30) below
; AutoOCStartFrom=40                   ; See 31) below
; AutoOCIncreaseBy=1                   ; See 32) below
; AutoOCDelay=50                       ; See 33) below
; BulkLoopCount=10                     ; See 34) below

```


; OvercurrentMode=Global ; See 35) below
; MediaGx=No ; See 36) below
; RootOvercurrentValue=1500 ; See 37) below
; RootOvercurrentDuration=300 ; See 38) below
; ClearScreen=No ; See 39) below

The following describes in detail the different entries of the configuration file:

; 1) Entry Name: AutoReturnToDOS

If specifies Yes, the program will execute the test, wait the specified time (1000ms) and then will automatically return to DOS.

If specified No, the program will stay in the UPT window waiting for the next instruction.

Default: No.

When specified Yes, a valid delay time is from 0 to 32,767ms.

When specified Yes, but with no time, the program will default to a delay of 200ms.

; 2) Entry Name: TypeOfPortsToBeTested

Type of ports to be tested.

Valid data:

All = Test all ports (Root or Hub)

Root = Test root ports only

Hub = Test hub ports only

Default: All

; 3) Entry Name: TypeOfUSBHostController

Type of USB Host Controller to be tested.

Valid data: All = Test all Host Controllers found (OHCI and UHCI)

UHCI = Test UHCI only

OHCI = Test OHCI only

Default: All

; **4) Entry Name: NumberOfPorts**

Number of ports to be tested.

Valid data: Maximum = 8 Minimum = 1

NOTE: The program will force the default if wrong number (<1 or >8) is given.

Default: Up to 8 ports that are found

; **5) Entry Name: EndOfTestSound**

The program plays a sound to signify the end of a test.

Valid data:

On = Enable End-of-Test sound

Off = Disable End-of-Test sound

Default: Off

; **6) Entry Name: OHCIBaseAddress**

OHCI USB Host Controller operational base address (segment in HEX).

NOTE: This is a 4K non-cachable system memory and must be in low memory since this program is a 16 bit application.

This is normally somewhere between 0xC800-0xE000, depending on the system itself.

Default: D000

; **7) Entry Name: TestLog**

The program logs the result of each test in a daily Log file.

The log file is created automatically by the program and is named MMDDYY.UPT where MM is the month, DD the day and YY the year.

The Log file has two parts:

- a.) Statistics - "Total # of Units Tested" shows the total number of units tested, how many passed and how many failed.
- b.) Failure Summary - "Failure Log" provides the time of each failed test and information about the possible reasons for the failure.

When test passes, only Statistics is being updated.

When test fails, Statistics is being updated and a Failure Summary is added.

Valid data:

Full = Log both Statistics and Failure Summary

Statistics = Statistics only, no Failure Summary

None = No Log at all

Default: Full

; **8) Entry Name: DefaultScreen**

The program provides three information screens. You can navigate between the screens by using the appropriate Function keys (F2, F3 and F4). This configuration entry defines the type of screen to be shown at the end of the test. The three screens are:

Basic screen - shows only test results.

Debug screen - shows test results with detailed test information.

Analog screen - shows analog information.

Valid data:

Basic

Debug

Analog

Default: Basic

; 9) Entry Name: ConsoleMode

 Test results are sent to the DOS Console so it can be redirected to a file or to a communication port.

Valid data:

Yes
 No

Default: No

; 10) Entry Name: UHCIPix4Irq

When the USB host controller IRQ is not set by the BIOS (only for Intel PIIX4 chipset), the program reads this entry, uses it as the controller IRQ, and modifies related Host Controller registers.

Note: If the program reads a valid IRQ number (3-15) from the host controller, this entry is being ignored

Valid data: 3 to 15

Default: N/A

; 11) Entry Name: DisableTest

Disables a specific test or tests.

The UPT program will skip all the tests that are listed under this entry.

- 2 - Port Remote Wakeup
- 3 - Port Suspend/Resume
- 4 - Bulk Transfer
- 5 - ISO Transfer
- 6 - Interrupt Transfer
- 7 - D+/D- Measurement
- 8 - VCC Measurement
- 9 - Hub Generated Remote Wakeup
- 10 - Hub Overcurrent Test
- 11 - Hub Propagation of Remote Wakeup
- 12 - Hub Power Switching (Individual power-switching HUB only)
- 13 - Automatic Hub Overcurrent Test

Valid data: 2 to 13

Default: All tests are enabled

; 12) Entry Name: DisableFunctionKeys

 Disables a specific Function Key used in the UPT software environment.

Function keys and the corresponding number used to disable each key are:

- 2 - to disable F2 - Basic Screen
- 3 - to disable F3 - Debug screen
- 4 - to disable F4 - Analog screen
- 5 - to disable F5 - View Log File
- 6 - to disable F6 - Run Test
- 9 - to disable F9 - Device List
- 10 - to disable F10 - Help

Valid data: 2,3,4,5,6,9,10

Default: F9 (Device list) key is disabled

; 13) Entry Name: EmbeddedPorts

 This entry specifies embedded hub ports that should not be tested.

Valid data: 0 to max port number of the hub

Default: None (no ports are embedded)

; 14) Entry Name: HubTrafficIndicatorDuration

Some hubs have visual display that provides indication about the amount of traffic running through the hub. To enable testing this feature the configuration file allows the user to control the duration of the traffic (in msec) that the application sends to the hub.

Valid data:

- Yes, time in ms, (maximum time allowed = 10,000 msec)
- No

Default: No

If 'YES' is specified but no time is given, default = 200 msec

; 15) Entry Name: USBLineIdleHigh

Upper limit (in Volts) for high states of USB D+ and D- lines during idle time.

Valid data: any

Default: 3.00 Volts

; 16) Entry Name: USBLineIdleLow

Lower limit (in Volts) for the low states of USB D+ and D- lines during idle time.

Valid data: any

Default: 0.10 Volts

; 17) Entry Name: USBLineDrivenHigh

Upper limit (in Volts) for high states of USB D+ and D- lines during driven time (J, K states).

Valid data: any

Default: 3.00 Volts

; 18) Entry Name: USBLineDrivenLow

Lower limit (in Volts) for low states of USB D+ and D- lines during driven time (J, K states).

Valid data: any

Default: 0.1 Volts

; 19) Entry Name: VCCHigh

USB VCC line upper limit (in Volts).

Valid data: any

Default: 5.40 Volts

; **20) Entry Name: VCCLow**

USB VCC line lower limit (in Volts).

Valid data: any

Default: 5.20 Volts

; **21) Entry Name: VCCLoad**

The amount of current (in mA) that the UPT box draws out of the USB VCC line during VCC voltage measurement test.

Valid data: any

Default: 650 mA

; **22) Entry Name: OvercurrentValue**

Current (in mA) that the UPT box draws from the hub downstream port during the overcurrent test.

Valid data: 50-5000

Default: 1500 mA

; **23) Entry Name: OvercurrentDuration**

Duration (in milliseconds) that the UPT box draws the current during the overcurrent test and the time that the UPT application waits before reading the hub port status register.

Valid data: any

Default: 200 msec

; 24) Entry Name: PropagationDuration

Duration (in ms) that the UPT application waits before reading the hub port status register after instructing the UPT box to generate a Remote Wake Up signal.

Valid data: any

Default: 100 msec

; 25) Entry Name: RunTestKey

The keyboard function Key used to run the UPT test within the UPT screen.

Valid data:

F6

Enter

Space

Default: F6

; 26) Entry Name: PIX3IOSpace

The I/O space (in decimal) for Intel PIIX3 USB host controllers only.

Note: Used only if PIIX3 is disabled.

Valid data: See PIIX3 data sheet

Default: 62208 (0xF300)

; 27) Entry Name: PIX3IRQ

IRQ for Intel PIIX3 only.

Note: Used only if PIIX3 is disabled.

Valid data: 3-15

Default: 10

; **28) Entry Name: PIX3Clock**

Clock for Intel PIIX3 only.
Note: Used only if PIIX3 is disabled.

Valid data: See PIIX3 data sheet

Default: 24

; **29) Entry Name: USBKeyboardEnabled**

Enable/Disable USB keyboard support while running UPT program.

Valid data:

Yes = USB keyboard support enabled

No = USB keyboard support disabled

Default: No

; **30) Entry Name: PowerSwitchingDelay**

When testing hubs with power switching capability, the UPT application instructs the hub to shut down the power to the port under test. The UPT application then waits the specified time (in ms) before reading the hub port status register.

Valid data: any

Default: 72 msec

; **31) Entry Name: AutoOCStartFrom**

The UPT application can find the hub's overcurrent trip point. To do that the user has to specify the initial current (in mA), below the trip point, from which the UPT will start increasing the current until the overcurrent event is detected.

Valid data: 10-4000

Default: 10 mA

; 32) Entry Name: AutoOCIncreaseBy

The value of the incremental current (in mA) the UPT adds to the VCC load while trying to detect the over current trip point.

Valid data: 1-1000

Default: 1 mA

; 33) Entry Name: AutoOCDelay

The time (in ms) that the UPT application waits in every current step, waiting for the detection of the overcurrent event. If the overcurrent event doesn't happened in this time interval the UPT will increase the current by "AutoOCIncreaseBy" value and will wait another "AutoOCDelay" period.

Valid data: any

Default: 50 msec

Other configuration related information:

; 34) Entry Name: BulkLoopCount

Support multiple BULK loops.

The BULK loop test will run the specified times and each time will use different random data (256 bytes).

Valid data: 1 - 32767

Default: 1

;35) Entry Name: OvercurrentMode

 Controls the overcurrent test mode.

When Descriptor is specified the software will follow the overcurrent mode given by the Descriptor (Individual or global).

When Global is specified the software will perform global OC test ignoring the descriptor information.

When Individual is specified the software will perform individual OC test ignoring the descriptor information

Valid data: Descriptor - Follow the descriptor overcurrent mode

Global - Run Global overcurrent test

Individual - Run Individual port overcurrent test

Default: Descriptor

;36) Entry Name: MediaGx

 Description:

Instruct the software to use a special delay function when running the software on MediaGx system.

Valid data: No - The system is not MediaGx. Use the standard Borland delay function

Yes - The system is MediaGx. Use a special delay function in the UPT software

Default: No

;37) Entry Name: RootOvercurrentValue

 ; Description:

; Current in mA during draw current for OHCI root port over-current test.

;

; Valid data: 50-5000

;

; Default: 1500

;

;38) Entry Name: RootOvercurrentDuration

 ; Description:

; Duration in ms during draw current for OHCI root port Over-current test.

;

; Valid data: 0 - 10,000 msec

;

; Default: 200

```

;-----
; 39) Entry Name: ClearScreen
;-----
; Description:
; Instruct the software to display or clear the screen after the UPT
; software returns to the DOS shell.
;
; Valid data: Yes, No
;
; Default: Yes

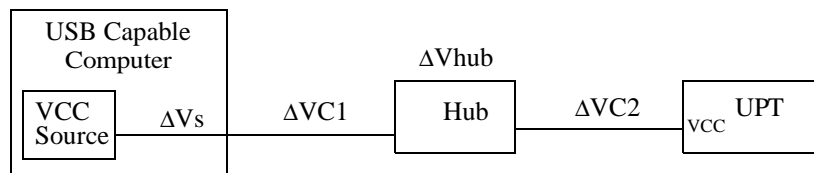
```

Measurement of the USB VCC Line

The UPT hardware includes an analog to digital converter circuit (A/D) that measures the voltage of the USB data and power lines. The USB VCC line measurement is done while the UPT box is drawing current from the VCC line by connecting a controllable load to it.

In case of a bus powered hub, the VCC power source is in the computer (VCC source). The VCC line runs in the USB cables from the computer to the hub up-stream port and from the hub down-stream port to the UPT box.

The higher the current that the UPT draws from the VCC line the higher will be the voltage drop between the computer and the UPT A/D circuitry.



$$VCC = VCC \text{ Source} - \Delta V_s - \Delta VC1 - \Delta V_{\text{hub}} - \Delta VC2$$

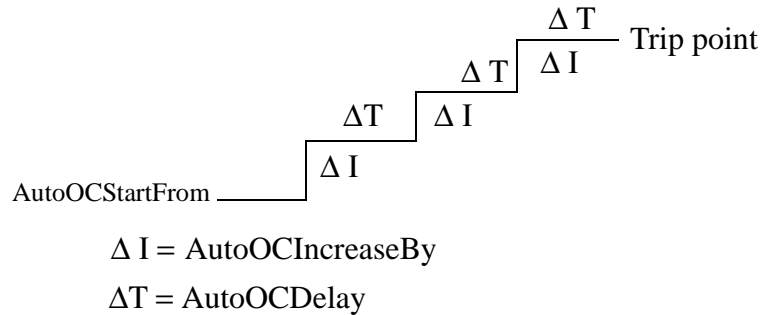
Because of the above, it is important to define the VccHigh and the VccLow in conjunction with the VccLoad value.

Auto detect of the Hub's Overcurrent Trip point

The UPT provides an integrated utility that when enabled finds the overcurrent trip point of the hub. To detect the overcurrent trip point the UPT loads the VCC line with the current that is specified by the "AutoOCStartFrom" entry in the configuration file. The UPT application is waiting "AutoOCDelay" milliseconds and then checks for the overcurrent indication.

If not found the UPT application increases the load current by "AutoOCIncreaseBy" mA and again waits "AutoOCDelay" ms before it checks for the overcurrent indication.

This procedure is continued until the load current trips the overcurrent detection circuitry of the hub. The UPT application displays this value along the other test results on the Analog screen.



Setting the PIIX4 Interrupt Line Number

In some computers, the BIOS does not set the PIIX4 interrupt line and the USB host controller interrupt line remains disabled. The UPT software allows you to set the PIIX4 interrupt line number using Entry 10: **UHCIPix4Irq=n** in the Configuration file, where n is the IRQ number of the USB host controller (in the range 3-15).

If the IRQ setting is set by the BIOS, the UHCIPix4Irq entry is not required.

When directed to, the UPT software reads the Interrupt Line Register contents (function 2).

- If a valid interrupt line number (3-15) is found it uses this interrupt number even if the UHCIPix4Irq entry specifies a different IRQ number.
- If an invalid interrupt value is found (not 3-15), the driver alerts the user with a screen message stating that an invalid interrupt number was found, and requests the use of the UHCIPix4Irq entry to specify a valid IRQ value.

You can ignore the UHCIPix4Irq option when a valid IRQ number is detected in order to use the same software configuration to run the UPT tester on different systems.

When the UHCIPix4Irq option is used, the driver writes the specified IRQ number to both the Interrupt Line Register and the PIRQD Route Control Register (function 0) and clears the Interrupt Routing Enable bit of the latter.

Embedded Ports

The CATC UPT Tester is autoconfigured to detect and identify all root and hub ports, but it cannot automatically identify embedded ports. Therefore, during a test, the program interprets an unidentified embedded port as a bad port. In order for the program to work correctly, you must identify the embedded ports for the program using Entry 13: **EmbeddedPorts** in the Configuration file. Use the **F9** screen (Device List Screen) to help identify embedded ports.

Note A port number is dictated by the device being tested and not by the CATC UPT program. Thus the on-screen port number may differ from the actual port number on the device itself.

Using the Function Keys

The Function Keys are located across the bottom of the on-screen display and allow easy movement among the various UPT Program screens.

Table 1: Function Keys

Function Key	Description
F1 - Exit	Can be used to quit the program at any time. If the program quits in the middle of a test, that test is not logged.
F2 - Basic Screen	Switches to Basic Screen.
F3 - Debug Screen	Switches to Debug Screen.
F4 - Analog Screen	Switches to Analog Screen.
F5 - View Log File	If the last test failed, shows the log message for the test.
F6 - Run Program Enter Space	At any time, restarts the program without going back to the DOS prompt and reloading the UPT program. F6 is disabled while viewing a Log file or Help message. Use the Configuration file to change the active key to Enter or Space (Entry 25: RunTestKey).
F9	Switches to Device List Screen.
F10 - Help	Shows the on-line help message.

Note Function Keys can be disabled from Configuration file (Entry 12: **DisableFunctionKeys**).

Using the Command Line Options

Four command line options can be used when starting the program from the DOS prompt.

Table 2: Command Line Options

Option	Description
[/c:filename]	Uses a specific Configuration file to replace the default (upt.cfg).
[/f:filename]	Updates FLASH memory with the given HEX file.
[/v]	Displays the version number of the UPT software and firmware.
[?]	Displays a help message on the command line options.

Note Command Format Usage: **upt** [/c:filename] [/f:filename] [/v] [?]

Verifying Host Controller and Hub Test Status

Step 1 In the Configuration file, disable all test cases (Entry 11: **DisableTest**).

This leaves only the basic tests:

- Control Transfer
- USB Interrupt on Completion of a successful USB Transfer
- Device Connect and Disconnect Detection.

Step 2 Run the basic tests.

If these tests pass, the USB Host Controller or Hubs under test are OK for further tests.

If these tests fail, do not continue until the reason is found.

Note Some UPT tests are straightforward (i.e. Bulk Loopback Test and Interrupt Loopback Test), while others are more complicated (i.e. Suspend/Resume Test and Hub Overcurrent Test). CATC recommends that you try to understand each test case before beginning the testing. If there is a failure, understanding the configuration can be helpful in discovering the reason for the failure. You can enable one test at a time or enable only the test or tests that failed.

If there is a test failure,

Step 3 View the Test Log.

If the Failure message is clear,

Step 4 Follow the instructions given and continue your debug.

If the Failure message is not clear and you need technical support from CATC,

Step 5 Send the Log File and the Device List file (**uptdev.lst**) to CATC.

Chapter 5: Reading the UPT Screens

Operation Screens

The UPT Program supports three Operation screens:

- The **Basic Screen** is used for production line testing.
- The **Debug Screen** is used for development and debugging.
- The **Analog Screen** is used for analog testing.

UPT tests can be run only from one of the Operation screens.

Note The Basic Screen is the default screen. The Debug Screen or the Analog Screen can be selected as the default screen using the Configuration file (Entry 8: **DefaultScreen**).

Basic Screen

```

CATC USB Port Tester - [Basic Screen]                               Version 1.00 Build 1
=====
      CH   Type   Port   Result
-----
      1   Root    2     Passed
      2   Hub     2     Passed
      3   Hub     4     Passed
      4   Hub     3     Passed

-----
                        Test: Passed

-----
Summary for the day: Passed=20   Failed=47
=====
F1-Exit  F2-Basic Screen  F3-Debug Screen  F4-Analog Screen  F5-View Log File
F6-Run   F9-Device List    F10-Help

```

The Basic Screen displays

- Test results for each port.
 - If a port passes a test, **Passed** is displayed in green next to the port number.
 - If a port fails a test, **Failed** is displayed in red next to the port number.
- Overall test result for the unit.
 - If all ports pass, **Passed** flashes in green at the bottom of the screen to indicate that the unit under test passed.
 - If any single port fails, **Failed** flashes in red at the bottom of the screen to indicate that the unit under test failed.
- Statistics for all testing taking place during the day.

- The **Summary for the day** at the bottom of the screen displays the total number of units that have passed and failed for the day.

Debug Screen

```

CATC USB Port Tester - [Debug Screen]                               Version 1.00 Build 1
-----
CH Port  SPEED  CON DIS IOC CTL BLK INT ISO PSR RW  UOL UCC HRW PRW OC  PSW AOC
-----
1  R-2   FS   OK OK OK OK OK N/A OK OK OK  Dis Dis N/A N/A N/A Dis Dis
   LS   OK OK OK OK OK N/A OK N/A Dis Dis N/A N/A N/A Dis Dis
2  H-2   FS   OK OK OK OK OK N/A OK OK OK  Dis Dis N/A N/A N/A Dis Dis
   LS   OK OK OK OK OK N/A OK N/A Dis Dis Dis Dis Dis Dis Dis Dis
3  H-4   FS   OK OK OK OK OK N/A OK OK OK  Dis Dis Dis Dis Dis Dis Dis Dis
   LS   OK OK OK OK OK N/A OK N/A Dis Dis Dis Dis Dis Dis Dis Dis
4  H-3   FS   OK OK OK OK OK N/A OK OK OK  Dis Dis Dis Dis Dis Dis Dis Dis
   LS   OK OK OK OK OK N/A OK N/A Dis Dis Dis Dis Dis Dis Dis Dis

-----
Test: Passed
-----
F1-Exit  F2-Basic Screen  F3-Debug Screen  F4-Analog Screen  F5-View Log File
F6-Run                                     F9-Device List  F10-Help
    
```

The Debug Screen shows the results by port for each test performed.

Table 3: Test Case Abbreviations

Abbreviation	Test Case
CON	device CONNecTion
DIS	device DISConnecTion
IOC	INterrupt On Completion
CTL	CONTroL transfer
BLK	BuLK transfer
INT	INTerrupt transfer
ISO	ISOchronous transfer
PSR	Port Suspend/Resume
RW	Remote Wakeup
VOL	VOLtage measurement
VCC	VCC measurement
HRW	Hub-generated Remote Wakeup (Hub port only)
PRW	Propagation of Remote Wakeup (Hub port only)
OC	OverCurrent (Hub port only)
PSW	Power SWitch (Hub port only)
AOC	Automatic OverCurrent (Hub port only)

Note Test cases can be disabled in the Configuration file (Entry 11: **DisableTest**).

Table 4: Test Case Results

Code	Text Color	Meaning
OK	Green	Passed
Bad	Red	Failed
Dis	Blue	Disabled
N/A	Yellow	Not applicable
---	Brown	Not tested due to previous test failure

Note Press **F10** for on-screen definitions of the test case abbreviations shown across the top of the Debug Screen.

Analog Screen

```

CATC USB Port Tester - [Analog Screen]                               Version 1.00 Build 1
-----
      Idle State      Driven State      VCC      Overcurrent
      (>3.10U,<0.11U) (>3.15U,<0.22U) >5.00U  Per-port  Global  Auto
      High/Low      High/Low      <5.43U  ( 40mS, 2000mA) (A)
-----
1  Root  1  FS  3.54/0.01  3.33/0.07  5.10  N/A  N/A  N/A
      LS  3.51/0.00  3.37/0.11  5.12  N/A  N/A  N/A
2  Hub  2  FS  3.55/0.01  3.25/0.08  5.08  No Trip 3.8
      LS  3.51/0.00  3.29/0.12  5.08  No Trip 3.8
3  Hub  3  FS  3.55/0.01  3.25/0.08  5.06  No Trip 3.7
      LS  3.52/0.00  3.29/0.12  5.06  No Trip 3.7
4  Hub  4  FS  3.55/0.01  3.25/0.08  5.02  No Trip 3.7
      LS  3.52/0.00  3.28/0.12  5.03  No Trip 3.7
-----
F1-Exit  F2-Basic Screen  F3-Debug Screen  F4-Analog Screen  F5-View Log File
F6-Run   F9-Device List  F10-Help

```

The Analog Screen shows analog data for D+/D- and VCC and the result of Hub Overcurrent test.

- If D+/D- and VCC data are within the range specified in Configuration file, results are displayed in green.
- If D+/D- and VCC data are not within the specified range, results are displayed in red.
- If the program fails to read the data due to a previously failed test or a bad device, --- is displayed in brown.

Saving Operation Screens as Text Files

You can save data from any of the Operation screens in text files. However, you can save only the data from whichever of the Operation screens is currently set as the default screen. You can change the default screen in the Configuration file using Entry 8: **DefaultScreen**.

To save the output from an Operation screen as a text file,

Step 1 In the Configuration file, set Entry 9: **ConsoleMode** to **Yes**.

Step 2 At the DOS prompt, run the program, redirecting the output to a text file.

You can give the text file any name and extension you want. For example, if you enter **upt>data.txt**, you save the output to a file named **data.txt**.

Note The program beeps when the test has completed.

If you have turned on Entry 1: **AutoReturnToDOS** in the Configuration file, you are automatically returned to the DOS prompt after the test has completed.

If you have not turned on **AutoReturnToDOS**,

Step 3 Press any key to return to the DOS prompt after the test has completed.

Information Screens

The Program supports three Information screens:

- The **Log File Screen** provides detailed information about the results of the last test.
- The **Device List Screen** provides detailed information about USB host controllers, hubs, devices, and connections.
- The **Help Screen** provides on-screen help information.

Log File Screen

```

CATC USB Port Tester - [Log View Screen]                               Version 1.00 Build 1
-----
12:43:31 Unit #2
Port(s) passed: None
Port failed Test case Failure Code
-----
FS R-2      8 Voltage UCC out of range          0
              Ucc read 5.1 < UccLow 5.2
LS R-2      7 D+/D- USB Idle/Driven out of range 0
              Driven D- read 0.11 > UsbLineDrivenLow 0.1
              8 Voltage UCC out of range          0
              Ucc read 5.11 < UccLow 5.2
FS H-2      8 Voltage UCC out of range          0
              Ucc read 5.08 < UccLow 5.2
              10 Hub OC Did not trip on hub overcurrent 1
LS H-2      7 D+/D- USB Idle/Driven out of range 0
              Driven D- read 0.11 > UsbLineDrivenLow 0.1
-----
F1-Exit F2-Basic Screen F3-Debug Screen F4-Analog Screen F5-View Log File
F6-Run  F9-Device List F10-Help

```

The Log File Screen provides detailed information about the test results indicated on the Debug Screen.

- If there have been no failed tests, the Log File Screen displays the summary section at the top of the screen.
- If there have been test failures, the Log File Screen displays the details for the most recent failure.

Note Once on the Log File Screen, you can scroll up and down the page at will.

Log File Screen Failed Test Data

- Type of port
- Port Number
- Speed (Full Speed or Low Speed) at which failure occurred
- Test Case Name
- Parameter that failed
- Failure Code
- Suggestion for possible fix of the problem

Binary Log File

The UPT software has an option for generating a binary log file of the test results. This log file can then be used for post-processing the test results.

To generate a binary log file, run the UPT software with a **/b** option as follows:

UPT.exe /b:[filename]

where **[filename]** is a filename you provide.

If no filename is supplied, the software will use **uptbin.log** as default file name.

The following is a description of structure of the log file:

The log file consists of 20 bytes long records. Each record provides information about a single test sequence. The information describes the nature of the test, and the test results.

Bytes 0-1:

Test sequence #. This is number of units tested so far (for a given date).

Byte 2:

Test sequence index.

Example:

0 for first port to be tested in FS.

1 for first port to be tested in LS

2 for second port to be tested in FS.

3 for second port to be tested in LS

etc...

Byte 3:

Bit 7:1=FS,0=LS

6:1=Root 0=Hub

5-3:Root/Hub # (0 for single Hub or Host Controller)

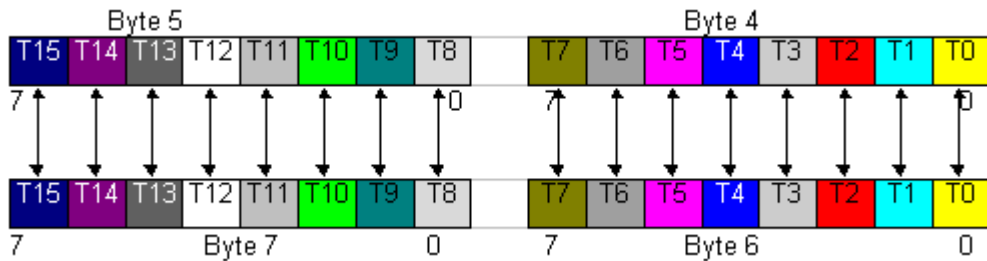
2-0:Port #

Bytes 4-7:

The test bits labeled *T0* through *T15* in Bytes 4, 5, 6, and 7 report the results of the following sixteen tests:

Test #	Description
T0	Connect
T1	Disconnect
T2	Interrupt on completion
T3	Control Transfer
T4	Bulk Transfer
T5	Interrupt transfer
T6	ISO transfer
T7	Port suspend/resume
T8	Remote wakeup
T9	Voltage measurement
T10	VCC measurement
T11	Hub remote wakeup
T12	Propagation of remote wakeup
T13	Over-current
T14	Power switching
T15	Automatic over-current

Test bits are paired (for example, T15 from Byte 5 is paired with T15 from Byte 7) as shown in the following illustration:



Each pair of test bits reports a test status. For example, bit T0 from Byte 4 plus bit T0 from Byte 6 report the results of a Connect status test. To interpret these results, consult the following tables:

Test bit from Bytes 4 & 5	Test bit from Bytes 6 & 7	Result
0	0	Tested and Passed

Test bit from Bytes 4 & 5	Test bit from Bytes 6 & 7	Result
0	1	Tested and Failed

Test bit from Bytes 4 & 5	Test bit from Bytes 6 & 7	Result
1	0	Disabled or N/A

Test bit from Bytes 4 & 5	Test bit from Bytes 6 & 7	Result
1	1	Not tested

Interpreting the Results

- Step 1: Look at a bit in the top row (for example the bit returned for T11 in Byte 5).
 Step 2: Look at the bit directly below it in the bottom row (e.g, the bit in T11 in Byte 7).
 Step 3: Interpret results using the above tables.

Example:

If bit T11 on the top row reads "0," and bit T11 on the bottom row also reads "0," then the test results are "Tested and Passed."

Byte 8-9: Idle high in mV (FFFF if not tested or skipped or failed)

Example: 0CF8

Byte 10-11: Idle low in mV (FFFF if not tested or skipped or failed)

Example: 0046

Byte 12-13: Driven high in mV (FFFF if not tested or skipped or failed)

Example: 0CEE

Byte 14-15: Driven low in mV (FFFF if not tested or skipped or failed)

- Total number of downstream ports
- Root port it is connected to
- Assigned USB address
- Class code
- SubClass code
- Speed (FS or LS)
- For all other devices:
 - Vendor ID
 - Device ID
 - Root or HUB port it is connected to
 - Assigned USB address
 - Class code
 - SubClass code
 - Speed.

Note If this screen is enabled, the program generates a file named **uptdev.lst** to save the information.

Help Screen

The Help Screen provides assistance with various Program features:

- Introduction
- Motherboard and PC Testing
- Stand-Alone Hub Testing

To display a Help message from within the UPT Program, press **F10**.

Appendix

Test Times

Overall Time Required for Testing

The total amount of time required for a test depends on several variables:

- Number of ports to be tested
- Number of test cases enabled
- Type of test
- Type of unit under test

For example, the Hub Overcurrent Test for the same amount of current drawn and the same amount of time waited may detect a hub overcurrent on one hub but not on another. Many parameters in the Configuration file affect the length of a test.

Saving Test Time during Production

Step 1 Disable **F9** (Entry 12: **DisableFunctionKeys**).

Step 2 Disable the Automatic Hub OverCurrent test (AOC) in the Configuration file (Entry 11: **DisableTest**).

Note After you have used **F9** to shorten Production test time, **F9** is reserved **for Debug use only**.

Test Case Descriptions

Basic Test

- For Host Controllers:
 - Searches for all USB host controllers based on PCI device class code.
For UHCI: 0xC0300
For OHCI: 0xC3010
 - Initializes the host controllers and enumerates all connected devices.
- For Hubs:
 - Searches for and initializes hubs.
 - Powers on all ports.
 - Detects any devices connected to a hub.
- Test results are displayed on the Debug Screen under **CON/DIS/IOC/CTL**.

- Related Configuration file entries:
 - TypeOfPortsToBeTested
 - TypeOfUSBHostController
 - OHCIBaseAddress
 - UHCIPix4Irq

Bulk Data Loopback Test

- Test Procedure:
 - Sends out 256 bytes random data.
 - Reads it back.
 - Matches the data.
- Test results are displayed on the Debug Screen under **BLK**.
- Related Configuration file entry:
 - DisableTest 4

Interrupt Data Loopback Test (Low Speed Only)

- Test Procedure:
 - Sends out 16 bytes of random data.
 - Reads it back.
 - Matches the data.
- Test results are displayed on the Debug Screen under **INT**.
- Related Configuration file entry:
 - DisableTest 6

ISO Data Loopback Test (Low Speed Only)

- Test Procedure:
 - Sends out 256 bytes of random data.
 - Reads it back.
 - Matches the data.
- Test results are displayed on the Debug Screen under **ISO**.
- Related Configuration file entry:
 - DisableTest 5

Port Suspend/Resume Test

- Test Procedure:
 - Sets port under test to Suspend mode.
 - Waits 30 ms.
 - Sets port under test to Resume mode.
 - Reads and verifies the number of Suspend/Resumes detected during the test.
- Test results are displayed on the Debug Screen under **PSR**.
- Related Configuration file entry:
 - DisableTest 3

Port Remote Wakeup Detection Test

- Test Procedure:
 - Sets UPT to Remote Wakeup mode.
 - For a Root port, sets host controller to Global Suspend mode.
 - For a hub port, sets port to Suspend mode.
 - Waits for UPT to generate Remote Wakeup.
 - Verifies that the event occurred.
- Test results are displayed on the Debug Screen under **RW**.
- Related Configuration file entry:
 - DisableTest 2

D+/D- Measurement Test:

- Test Procedure:
 - Suspends the port under test.
 - Resumes the port under test.
 - Reads the D+/D- during both Suspend and Resume.
- Test results are displayed on the Debug Screen under **VOL**.
- Related Configuration file entries:
 - DisableTest 7
 - USBLineIdleHigh
 - USBLineIdleLow
 - USBLineDrivenHigh
 - USBLineDrivenLow

VCC Measurement Test

- Test Procedure:
 - Draws amount of current specified in the Configuration file (Entry 21: **VCCLoad**).
 - Reads the VCC.
- Test results are displayed on the Debug Screen under **VCC**.
- Related Configuration file entries:
 - DisableTest 8
 - VCCHigh
 - VCCLow
 - VCCLoad

Hub Generated Remote Wakeup Test

- Test Procedure:
 - Sets host controller to Global Suspend mode.
 - UPT generates a Resume event and expects the hub to detect it.
 - Sets host controller to Resume mode.
- Test results are displayed on the Debug Screen under **HRW**.
- Related Configuration file entry:
 - DisableTest 9

Hub Propagation of Remote Wakeup Test

- Test Procedure:
 - Connects UPT to a port other than the port under test.
 - Sets host controller to Suspend mode.
 - Waits for the **PropagationDuration** specified in the Configuration file (Entry 24).
 - The port under test generates a Resume signal and verifies that the connected port received the Propagated Resume Signal from the Hub.
- Test results are displayed on the Debug Screen under **PRW**.
- Related Configuration file entries:
 - DisableTest 11
 - PropagationDuration

Hub OverCurrent Test (Hubs with Global OC or Individual Protection)

- Test Procedure:
 - Draws amount of current specified in Configuration file (OvercurrentValue).

- Waits for a period of time specified in Configuration file (OvercurrentDuration) before verifying that overcurrent occurred.
- Test results are displayed on the Debug Screen under **OC**.
- Related Configuration file entries:
 - DisableTest 10
 - OverCurrentValue
 - OvercurrentDuration

Hub Power Switching Test (Hub with Individual Port Power Switching)

- Test Procedure:
 - Sets power to OFF for the port under test.
 - Waits the amount of time specified in the Configuration file (Entry 30: **PowerSwitchingDelay**).
 - Verifies there is no power on powered-off port.
 - Sets power to ON and verifies it.
- Test results are displayed on the Debug Screen under **PSW**.
- Related Configuration file entries:
 - DisableTest 12
 - PowerSwitchingDelay

Hub Automatic OverCurrent Test

- Test Procedure:
 - UPT draws current in increasing amounts (starts from AutoOCStartFrom, delays by AutoOCDelay, and increases by AutoOCIncreaseBy) until it detects an overcurrent or reaches the limit.
 - If OC happens, UPT reports the current value.
- Test results are displayed on the Debug Screen under **AOC**.
- Related Configuration file entries:
 - DisableTest 13
 - AutoOCStartFrom
 - AutoOCIncreaseBy
 - AutoOCDelay

Note Run this test once to generate an OverCurrent value. Then use that value in the Configuration file setting to modify the OvercurrentValue for the Hub Overcurrent Test.

Contacting CATC

Type of Service	Contact
Call for technical support...	US and Canada: 1 (800) 909-2282 Worldwide: 1 (408) 727-6600
Fax your questions...	Worldwide: 1 (408) 727-6622
Write a letter...	Computer Access Technology Corp. Customer Support 2403 Walsh Avenue Santa Clara, CA 95051-1302
Send e-mail...	support@CATC.com
Visit CATC's web site...	http://www.CATC.com/

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