
Ellisys USB Explorer 260

Getting Started Guide



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Chapter 1: Starting out

Introduction

The Ellisys USB Explorer 260 is a sophisticated protocol test system for USB traffic monitoring, driver and software stack debugging, protocol compliance verification and performance analysis. The EX260 can reduce your R&D development time by finding issues early and debugging more efficiently, and can improve quality and reliability by verifying compliance to the specifications.

The Ellisys USB Explorer 260 is available in three configurations:

- The **Ellisys USB Explorer 260 Analyzer** includes Ellisys' analysis features with real-time monitoring, hard-disk data streaming, class decoding, traffic statistics, and triggering and filtering.
- The **Ellisys USB Explorer 260 Generator** supplements protocol analysis by emulating USB devices and hosts, and by testing corner cases and recovery mechanisms. Reproducible traffic, timing and error scenarios can be created with a scripting environment. Captured traffic can be replayed to test a particular situation. The Generator supports Inline Error Injection feature to insert programmed errors between a host and device to determine the impact of transmission errors under rare conditions.
- The **Ellisys USB Explorer 260 Duo** is a flexible bundle of two full-featured units that can be used as one analyzer and one generator, two analyzers or two generators depending on your testing requirements. More convenient than having both functions on the same unit, this allows you to better share your test equipment among your R&D team.

Common terms

The following terms are used throughout this manual:

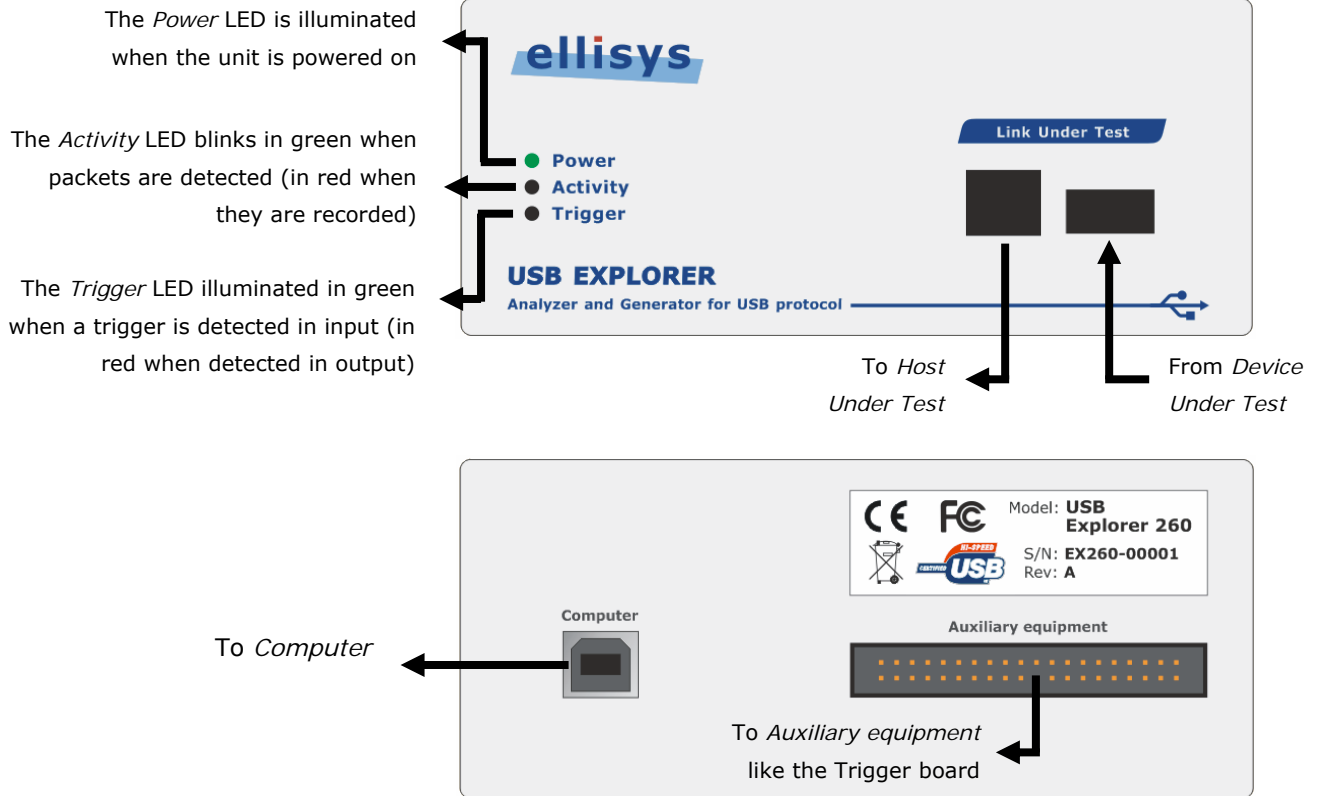
Analysis software The analysis software enables users to record data sent by the analyzer and subsequently displays them in a simple, easy-to-follow format.

Generator software The generator software enables users to write, run and debug generator scripts.

Device Under Test A USB device that is going to be analyzed with the analyzer is called a device under test in this document.

Host Under Test The device under test will be plugged into the Host Under Test through analyzer's Link Under Test connectors. The Host Under Test can be any host including a PC, an embedded computer, a PDA or even a custom piece of equipment acting like a USB host.

Front and back panels of the unit



Chapter 2: Connecting the unit as protocol analyzer

Introduction

The Ellisis USB Explorer 260 Analyzer is a non-intrusive USB protocol analyzer that can connect on any link between any host controller and device.

InterChip USB is supported with an optional analysis probe that connects directly on the USB link between the embedded host and device on a PCB board. Please contact sales@ellisis.com for more information about this option.

The EX260 Analyzer sends data using a High-speed USB 2.0 connection. Although the unit can download analyzed data on a Full-speed USB 1.1 connection, it is strongly recommended that you connect it using a High-speed USB 2.0 port to obtain optimal performance. If you experience any trouble with your analyzer, please ensure it is connected on a High-speed USB 2.0 enabled host controller before contacting our technical support.

The Power LED of the front panel is illuminated in green when the unit is connected on a High-speed USB 2.0 link, and in red when connected on a Full-speed USB 1.1 link.

Connecting the Analyzer to a computer

Configuration with two computers: recommended configuration

The use of two computers is the recommended configuration (see Figure 1). The Host Under Test is ascribed to the Device Under Test, and the analysis computer handles downloads and analyses data coming from the analyzer.

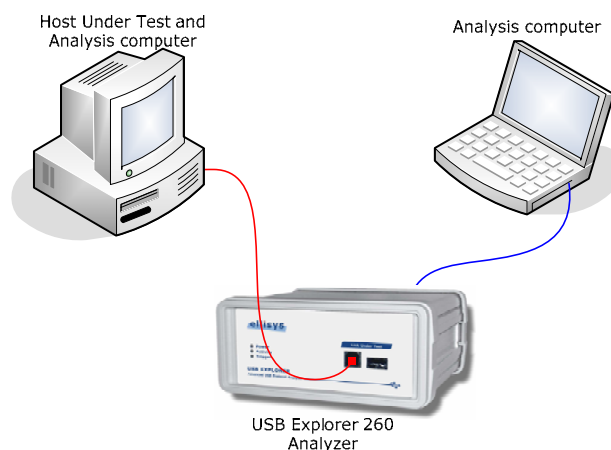


Figure 1 - Configuration with two separate computers

Configuration with only one computer

It is possible to use just one computer for both testing and analysis (see Figure 2), but this may affect the performances of the real-time data monitor and download. You must, however, ensure that **two or more host controllers** are available on the computer. If there is only one host controller on your computer, a CardBus or PCI extension card can be purchased to add a second host controller to an existing computer. Please refer to the chapter on *Troubleshooting* to determine if your computer has two host controllers. The following diagram shows how to use the analyzer with only one computer.

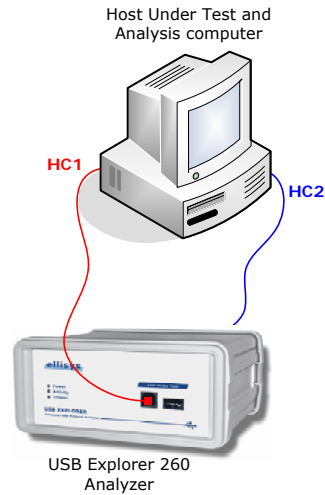


Figure 2 - Configuration with only one computer

Connecting a device under test for analysis

Connecting only one Device Under Test

The most straightforward configuration involves only one device to be analyzed. Figure 3 shows how to properly connect the device under test.

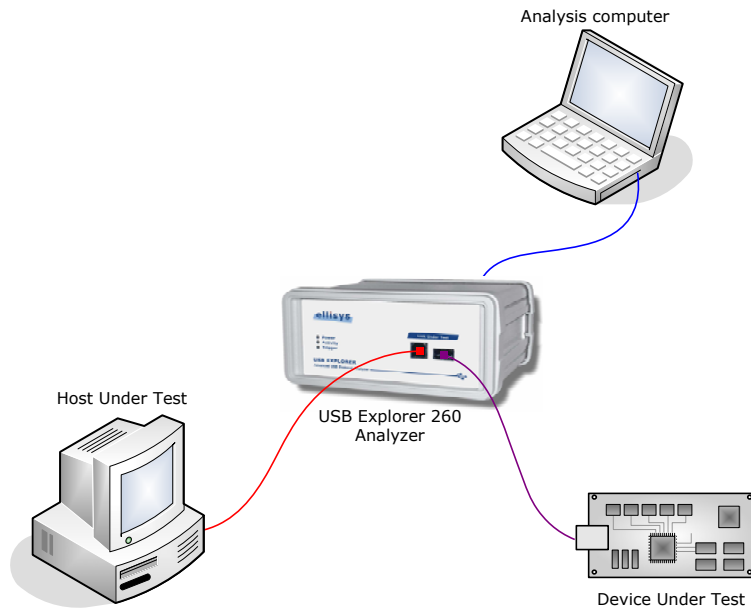


Figure 3 - Connecting only one Device Under Test

To prevent problems which could arise from your cables' length, please follow the following instructions:

- The blue cable must be no longer than 5 meters.
- The total length of the red and purple cables must not exceed 3 meters. A greater length could result in an abnormally high error rate on the bus being analyzed.

Connecting more than one Device Under Test

USB analyzers are able to analyze traffic coming only from devices connected under them. If a device is connected above the analyzer, it will only capture data packets coming from the host. The Figure 4 shows an incorrect connection: the USB mouse is connected 'above' the analyzer.

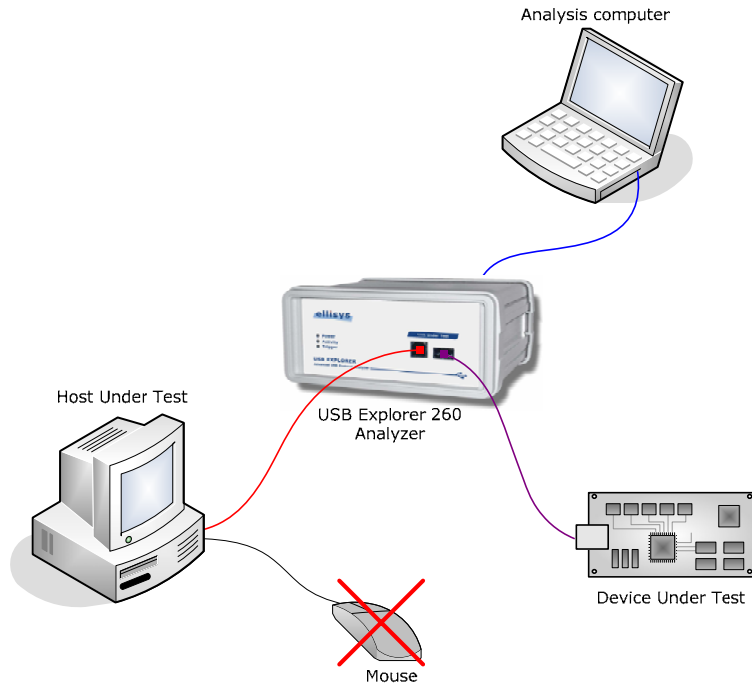


Figure 4 - Wrong connection with more than one DUT

When the analyzer is used to analyze multiple devices, this analysis must necessarily involve a USB hub. In this way, you can ensure that all the devices to be analyzed are, in fact, 'below' the analyzer. You should be aware, however, that the analyzer will record all hub and devices traffic. This won't cause inconvenience because the software's functions can filter out extra traffic very easily. Figure 5 illustrates how to connect correctly several devices under test.

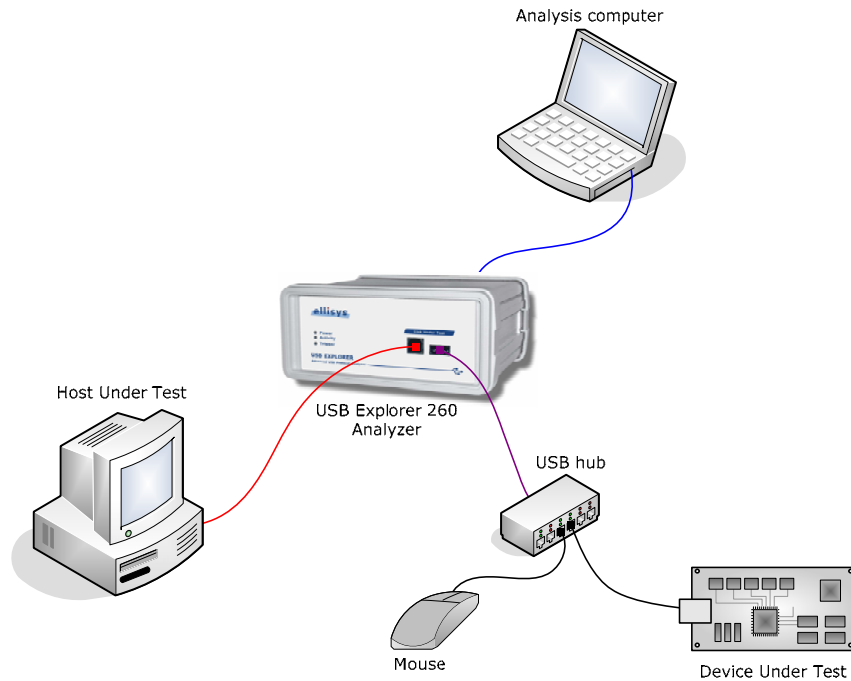


Figure 5 - Correct connection with more than one DUT using a Hub

First data acquisition

Before using the analyzer to make your first data acquisition, ensure that you have successfully completed every step needed to install the software and the drivers.

Follow these steps to proceed with your first data acquisition:

1. Connect the USB analyzer to the analysis computer as demonstrated in the section entitled *Connecting the unit as protocol analyzer*

2. . You must first have successfully installed the analysis software and drivers.
3. Run the analysis software and press keys 'Ctrl+R' (*Start Recording*). Refer to the chapter on *Troubleshooting* if the software indicates that no analyzer is connected.
4. Connect the USB device to be analyzed as discussed in the section entitled *Connecting a device under test* for analysis. For greater safety, first connect a simple commercial device that you can understand easily. The number of valid transactions should increase slowly. You can save data acquisition after it has been recording for a few seconds by clicking the 'Save' button.
5. Congratulations! You have just used the analyzer to record your first data acquisition. You can now read the USB Analysis Software User's Manual to fully benefit from all the available power in the analysis software.

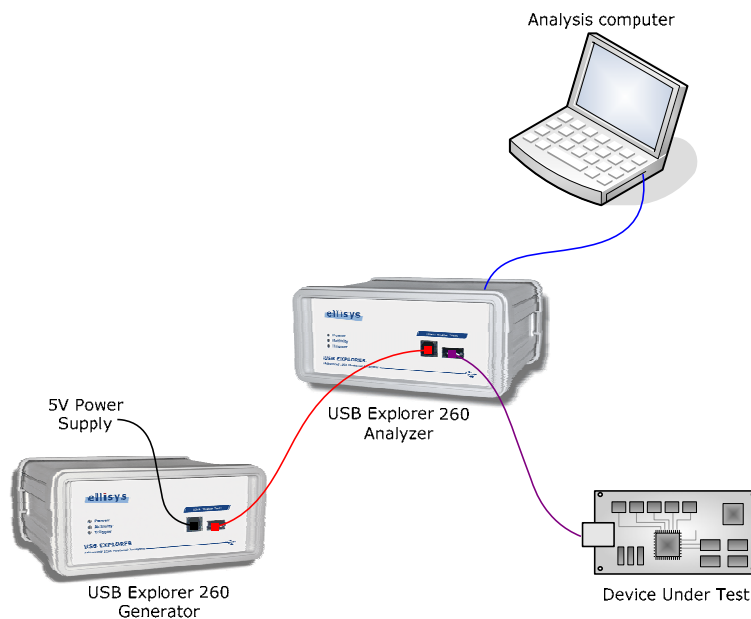
Chapter 3: Connecting the unit as packet generator

Introduction

Depending on the script and the configuration, the Ellisys USB Explorer 260 Generator can emulate a Host controller, a Device or can inject errors on an existing link.

Connecting the Generator as Host

In this setup the Device Under Test must be connected on the A connector of the Generator. An Analyzer can be connected between the Generator and the Device Under Test to debug the link. Please refer to the chapter *Connecting the unit as protocol analyzer* for more information about the analyzer connection. The figure below show the correct connection of a Generator as host, a Device Under Test and an Analyzer.

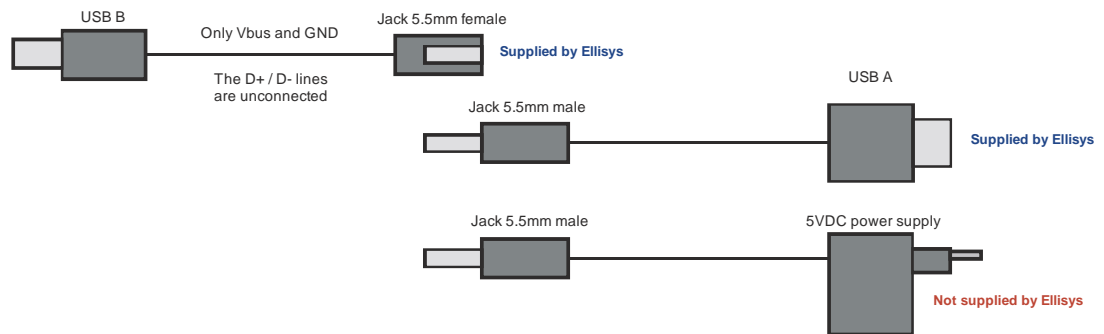


As the Explorer 260 Generator is powered by the USB bus, the power supply for the Device Under Test must be supplied by an external power supply on the B connector of the Generator, as displayed in the figure above.

A cable for powering the Device Under Test is supplied with the Generator. The power cable is a two-part cable:

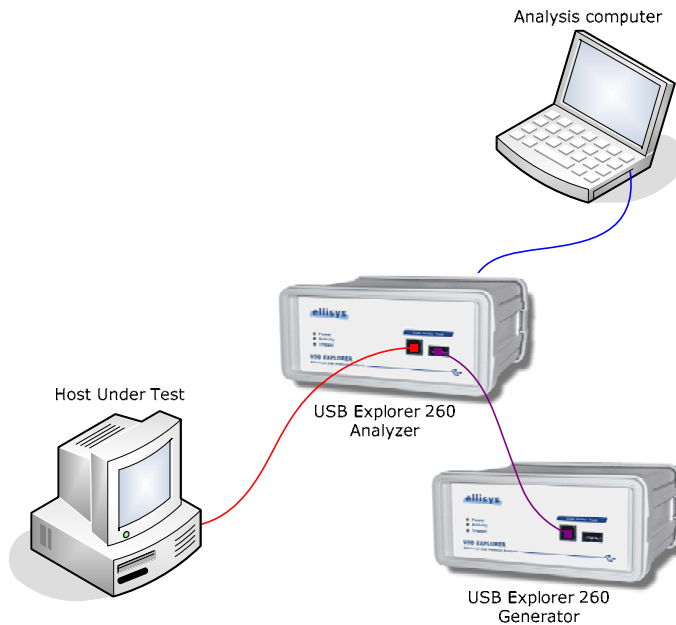
- The first part is a USB B to Jack 5.5 mm female cable. This part must be connected on the B connector of the Generator.
- The second part is a Jack 5.5 mm male to USB A cable. This second part can be connected to the first part and to a standard USB host to supply the 5VDC to the Device Under Test. This is the most convenient when the power supply does not need to be controlled.
- The second part can be replaced by an external 5VDC power supply. This is convenient to control the power supply with the desired voltage. The external power supply is not supplied by Ellisys.

The figure below illustrates the two-parts power cable.



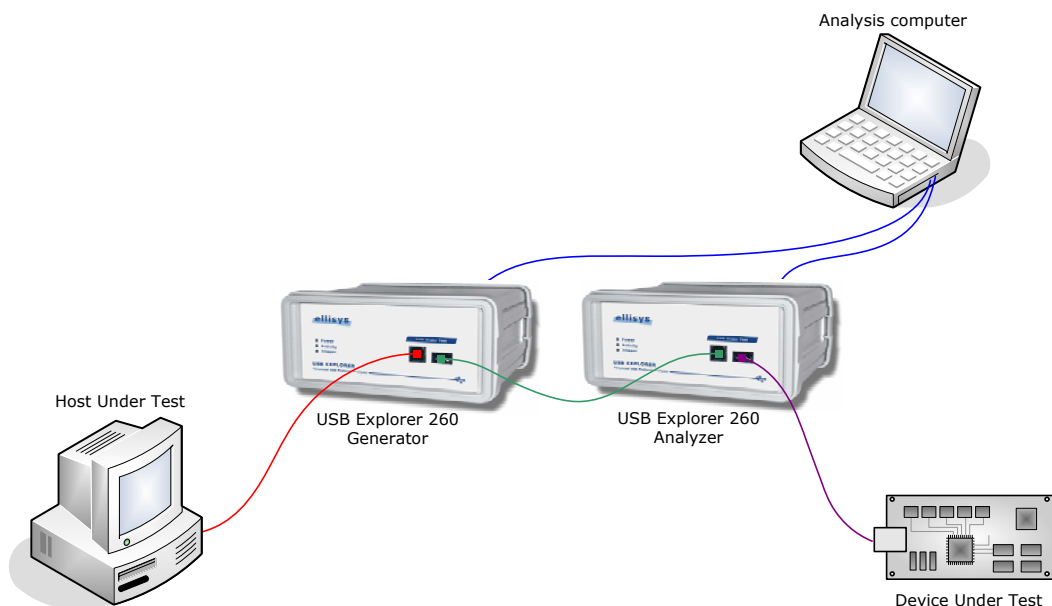
Connecting the Generator as Device

In this setup the Host Under Test must be connected to the Generator on the B connector. An Analyzer can be connected between the Generator and the Host Under Test to debug the link. Please refer to the chapter *Connecting the unit as protocol analyzer* for more information about the analyzer connection. The figure below show the correct connection of a Generator as device, a Host Under Test and an Analyzer.



Connecting the Generator for Inline Error Injection

In this setup the Device Under Test and the Host Under Test must be connected through the Generator. An Analyzer can also be connected between in-line with the Generator to debug the link. Please refer to the chapter *Connecting the unit as protocol analyzer* for more information about the analyzer connection. The figure below show the correct connection of a Host Under Test, a Device Under Test, a Generator for Inline Error Injection and an Analyzer.



Chapter 4: Drivers and software installation

Installing the software and the drivers

The Analyzer and the Generator software are documented in two additional user manuals. These user manuals describe how to install the software & drivers and how to operate the units. The manuals are available on the supplied installation and documentation CD-ROM and on the Ellisys website. Please refer to these manual for more information.

Chapter 5: Frequently Asked Questions

General

What is the Ellisisys USB Explorer 260?

The Ellisisys USB Explorer 260 is an advanced multifunction USB protocol test system capable of:

- analyzing any USB 1.1 or USB 2.0 link, including OTG and IC-USB
- emulating USB hosts and devices
- injecting pre-defined errors for stress testing or error recovery
- verifying the compliance to the USB specification

Is the same hardware able to act either as analyzer or generator?

Yes. Each hardware unit is capable of acting either as a protocol analyzer or packet generator depending on the options purchased.

Analyzer

Which recording speeds can be analyzed by the Ellisisys USB Explorer 260 Analyzer?

The USB Explorer 260 supports recording of Low-speed (1.5 Mbit/s), Full-speed (12 Mbit/s) and High-speed (480 Mbit/s) links. It can record traffic from any USB 2.0 device, including USB OTG devices and InterChip USB. The analyzer automatically detects the appropriate recording speed for an unequalled ease of use.

Which type of configuration do I need to analyze a device?

A computer and a host under test are necessary to analyze a device. The computer may be used as host under test, but two host controllers are necessary in this case: the first to connect the peripheral to be tested and the other to record the data. You must therefore have either:

- A separate computer and host under test, the first for analysis and the other for testing
- One computer with two host controllers. This is the case when an USB 2.0 extension card is used.

To obtain the best performance, we highly recommend the use of two computers.

The analyzer records data using a USB 2.0 connection. Do I need a USB 2.0 host controller?

No. In most cases, the analyzer works just as fine with a high speed connection (480 Mbit/s) than with a full speed one (12 Mbit/s). But you must be aware that a full speed connection may not be adequate if the data flow is too large. If you experience any kind of trouble with the analyzer, please ensure that you are using the recommended configuration.

What is the maximum quantity of data that I can record?

The analyzer uses the host-computer memory to store recorded traffic. Since the Ellisys USB analysis software records data to the central memory (RAM), the maximum amount of data is usually limited to a few hundreds of megabytes. The hard-disk streaming recording mode permits to record a huge amount of data by storing the analyzed data directly on the hard-disk into several consecutive files. This is the preferred mode of recording for debugging intermittent issues that are not catchable by a trigger.

Generator

What is the Ellisys USB Explorer 260 Generator useful for?

The Ellisys USB Explorer 260 Generator supplements protocol analysis by emulating USB devices and hosts, and by testing corner cases and recovery mechanisms. Reproducible traffic, timing and error scenarios can be created with a powerful scripting environment. Captured traffic can be replayed to test a particular situation.

Is the Ellisys 260 Generator able to generate packets interactively?

Yes. The timing constraints of the USB protocol are very straight and no equipment was previously able to generate packets interactively based on received responses, still having a low-level control over the packets, the timings and the errors. The Ellisys generator achieves this by using a specialized processor designed by Ellisys.

Why is the Ellisys 260 Generator so powerful?

The Ellisys 260 Generator contains a specialized processor designed by Ellisys. The specialized processor is able to react fast enough to compute responses adapted depending on the application and the protocol. Standard USB products contain a dedicated hardware managing USB transactions and transfers. For testing purposes, this has the drawback to not let the developer fully define error cases, timings and scenarios. The Ellisys generator permits at the same time to write scripts able to implement high-level protocols, still having a low-level control over the packets, and timings and the errors.

What is Inline Error Injection?

The new error injection features let developers deliberately introduce errors to see how the device under test reacts. This helps increase the robustness of a product -- to test not just a device's compliance with protocol-correct traffic, but its ability to handle and recover from error situations.

I saw a suspect behavior of my device with my Ellisys' analyzer, but I am unable to reproduce the same conditions to verify whether the error is fixed. Can the generator help?

Traces recorded with the 260 Analyzer can be exported from the analysis software to the generator. If your trace contains enough information, you will be able to reproduce the problem using the generator, and verify that you fixed the issue by using the protocol analyzer in conjunction.

Hardware

Is it possible to upgrade the analyzer firmware?

Yes, the analyzer firmware is automatically upgraded with each new USB analysis software release. No user intervention is required. Our newsletter is sent to all subscribers when a new software is released.

Which packets light up the Activity indicator?

DATA packets light up the Activity indicator for around ten milliseconds. In a busy bus case, this indicator blinks rapidly.

Chapter 6: Troubleshooting

Installation

How can I determine if I have two host controllers?

The analysis software will let you know (in the **About** dialogue box) how many host controllers are available on your computer. You can use the Toolbar to access this dialogue box.

I have got one host controller and I'd like to add a second one. How can I achieve this?

Installing a USB extension card is the easiest way to add a host controller to your computer. Furthermore, nowadays most of these extension cards are USB 2.0-compatible, which will enable you to wholly gain from all your analyzer's power. Talk to your local dealer about getting a USB 2.0 host controller card.

I would like to connect the USB analyzer on a EHCI host controller but it seems that it doesn't work. What can I do?

We took note that several EHCI drivers supplied by manufacturers of USB 2.0 add-in cards could cause problem. We strongly recommend the use of the Microsoft EHCI driver. You can find more information on the installation of this driver at:

<http://www.usbman.com/USB%202%20News.htm>

Why can't I run the analysis software installation file?

The analysis software installation file requires Microsoft Windows Installer 2.0 or higher. Updated files are available from the download site:

<http://www.usbexplorer.com/download.php>

Chapter 7: Technical data

Analyzer Characteristics

- Supported specifications: USB 1.0, 1.1, 2.0, OTG and IC-USB (designed for USB 3.0)
- Supported link speeds: 1.5, 12 and 480 Mbit/s with automatic discovery (designed for up to 5 Gbps)
- Timestamp accuracy: 16.67 ns precision
- Low-level errors: detection of bit-stuffing, CRC-5 and CRC-16 errors
- Bus states: detection and measurement of Reset, Suspend, Keep Alive and High-Speed Handshake states

Generator Characteristics

- Supported specifications: USB 1.0, 1.1, 2.0, OTG and IC-USB (designed for USB 3.0)
- Supported specifications: USB 1.0, 1.1, 2.0, OTG and IC-USB (ready for USB 3.0)
- Supported link speeds: 1.5, 12 and 480 Mbit/s
- Supported modes: host, device and inline error injection
- Timing accuracy: 16.67 ns precision

Requirements

- Pentium 4, 1 GHz or compatible processor
- 512 MBytes of RAM
- USB 2.0 EHCI host controller
- 1024 x 768 display resolution with 256 colors
- Windows® 2000 Service Pack 4, Windows® XP Service Pack 1 or higher
- Internet Explorer 5.0 or higher

Specifications

Embedded Memory

- 1 GByte of FIFO memory
- Analyzed data is stored in a highly optimized format
- Analyzed data is downloaded in real time through USB 2.0 High-speed connection

Front-panel Indicators

- Power: analyzer powered on
- Activity: traffic detected
- Trigger: trigger event detected

Connectors

- Link Under Test: USB 1.0, 1.1 and 2.0, OTG and IC-USB, all speeds supported
- Computer: Certified USB 2.0 High-speed
- Auxiliary Equipment: Supports connection of the Trigger board or other extension boards

Power Supply

- No external power supply needed (USB bus powered)
- 500 mA during normal operation
- 500 μ A when suspended

Enclosure

- 150 x 120 x 65 mm (5.9 x 4.7 x 2.5")
- 850 g (1.9 lbs)

Hardware Upgrade

- The decoding engine is automatically updated with each software release (no user intervention required)
- The hardware is designed to support changes in the specification (with hardware upgrades)
- The motherboard supports more than 5 Gbps of throughput

Product Warranty

- Two years warranty

Ellisys reserves itself all rights to change product features and specifications without notice.

Chapter 8: Limited Warranty Terms and Conditions

Coverage

Ellisys warrants to the original customer of its products that its products are free from defects in material and workmanship for the warranty period. Subject to the conditions and limitations set forth below, Ellisys will, at its option, either repair or replace any part of its products that prove defective by reason of improper workmanship or materials. Repaired parts or replacement products will be provided by Ellisys on an exchange basis, and will be either new or refurbished to be functionally equivalent to new. If Ellisys is unable to repair or replace the product, it will refund the current value of the product at the time the warranty claim is made. In no event shall Ellisys' liability exceed the original purchase price of product.

Excluded Products and Problems

This limited warranty does not cover any damage to this product that results from improper installation, accident, abuse, misuse, natural disaster, insufficient or excessive electrical supply, abnormal mechanical or environmental conditions, or any unauthorized disassembly, repair, or modification. This limited warranty also does not apply to any product on which the original identification information has been altered, obliterated or removed, has not been handled or packaged correctly, or has been sold as second-hand. This limited warranty only applies to the original customer of the product for so long as the original customer owns the product. This limited warranty is non-transferable.

This limited warranty covers only repair, replacement or refund for defective Ellisys products, as provided above. Ellisys is not liable for, and does not cover under warranty, any loss of data or any costs associated with determining the source of system problems or removing, servicing or installing Ellisys products.

Obtaining Warranty Service

To obtain warranty service, you may return a defective product to the authorized Ellisys dealer or distributor from which you purchased the Ellisys product. Please confirm the terms of your dealer's or distributor's return policies prior to returning the product. Typically, you must include product identification information, including model number and serial number with a detailed description of the problem you are experiencing. You must also include proof of the date of original retail purchase as evidence that the product is within the applicable warranty period.

The returned product will become the property of Ellisys. Repaired or replacement product will be shipped at Ellisys' expense. Repaired or replacement product will continue to be covered by this limited warranty for the remainder of the original warranty or 90 days, whichever is longer.

Limitations

THE FOREGOING IS THE COMPLETE WARRANTY FOR ELLISYS PRODUCTS AND SUPERSEDES ALL OTHER WARRANTIES AND REPRESENTATIONS, WHETHER ORAL OR WRITTEN. EXCEPT AS EXPRESSLY SET FORTH ABOVE, NO OTHER WARRANTIES ARE MADE WITH RESPECT TO ELLISYS PRODUCTS AND ELLISYS EXPRESSLY DISCLAIMS ALL WARRANTIES NOT STATED HEREIN, INCLUDING, TO THE EXTENT PERMITTED BY APPLICABLE LAW, ANY WARRANTY THAT MAY EXIST UNDER NATIONAL, STATE, PROVINCIAL OR LOCAL LAW INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, ARE LIMITED TO THE PERIODS OF TIME SET FORTH ABOVE. SOME STATES OR OTHER JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES OR LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

ELLISYS PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT EQUIPMENT OR FOR APPLICATIONS IN WHICH THE FAILURE OR MALFUNCTION OF THE PRODUCTS WOULD CREATE A SITUATION IN WHICH PERSONAL INJURY OR DEATH IS LIKELY TO OCCUR. ELLISYS SHALL NOT BE LIABLE FOR THE DEATH OF ANY PERSON OR ANY LOSS, INJURY OR DAMAGE TO PERSONS OR PROPERTY BY USE OF PRODUCTS USED IN APPLICATIONS INCLUDING, BUT NOT LIMITED TO, MILITARY OR MILITARY-RELATED EQUIPMENT, TRAFFIC CONTROL EQUIPMENT, DISASTER PREVENTION SYSTEMS AND MEDICAL OR MEDICAL-RELATED EQUIPMENT.

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Severability

If any provision or any portion of any provision contained in these terms is held to be invalid, illegal or unenforceable by a court of competent jurisdiction, then the remaining provisions, and if a portion of any provision is unenforceable, then the remaining portion of such provision shall, nevertheless, remain in full force and effect. The parties undertake to negotiate in good faith with a view to replace such invalid, illegal or unenforceable provision or part thereof with another provision not so invalid, illegal or unenforceable with the same or similar effect, and further agree to be bound by the mutually agreed substitute provision.

Warranty Period

The warranty begins on the date of purchase and covers a period of two (2) years.

Governing Law

These conditions and terms shall be governed by and construed in accordance with the law of Switzerland.

Jurisdiction; Venue

The parties consent to the exclusive personal jurisdiction of, and venue in, the District Court of Geneva, Switzerland.