Agilent
E5818A LXI Class-B Trigger Box

Data Sheet

Agilent Technologies

Features

- **Remote access to instruments via LAN**
- **IEEE 1588 Time Synchronization**
- **Output trigger at precise timing**
- **Input trigger at precise timing**
- **Peer-to-peer messaging**
- **Supports DHCP Protocol**
- **Built-in Web Access**
- **Battery supported RTC**
- **Multiple Triggering Options**
- **High precision TCXO**
- **Simplifies event correlation**

Introduction

The Agilent E5818A LXI Class-B Trigger Box is a device for handling the IEEE 1588 Precision Time Protocol (PTP) synchronization over the Ethernet and for managing the precision trigger control signals to the legacy instrument that are not compliant with LXI standards. The IEEE 1588 PTP synchronization is performed over the Ethernet by the LXI trigger box.

The E5818 LXI trigger box utilizes LXI and IEEE 1588 to record and control asynchronous events via TTL signal input and output ports.

E5818A Front and Rear Panel Displays

IEEE 1588 Benefits

The E5818 is adopting the IEEE 1588 precision time protocol (PTP) synchronization over the Ethernet network in nanosecond range accuracy with minimal network and local clock computing resources. IEEE 1588 provides synchronization accuracy as it meets current user requirements and future user requirements. It is using multicast communications to synchronize time between modules within a system.

A new IEEE 1588 device on the network listens for the master clock to send out its clock specification. Every device on the network compares its specification to the master. IEEE 1588 works best during asynchronous events and asynchronous control. IEEE 1588 brings a common sense of time to all LXI Class-B and devices.

IEEE 1588 is designed to fill a niche, which is not well served by either of the two dominant protocols, NTP and GPS. IEEE 1588 is designed for local systems that require a very high degree of accuracy which goes beyond what can be provided by NTP. It is also designed for applications that cannot bear the cost of a GPS receiver at each node, or for which GPS signals are inaccessible. [1]

IEEE 1588 can accommodate a wide range of systems and is designed for supporting industrial network protocols.

[1] From John C. Eidson, *Measurement, Control and Communication Using IEEE 1588*.

LXI Class-B Benefits

The E5818A LXI Trigger Box is the world's first LXI Class-B triggering device for precise synchronization of non-LXI Class-B instruments over LAN.

The E5818 provides a new type of synchronization by using the IEEE 1588 standard for a PTP, which enables precise time triggering and stamping of events in the nanosecond range. The new synchronization is crucial, especially in automated test systems that involve multiple distributed devices with asynchronous events.

The E5818 is able to support peer-to-peer messaging and multicast communication which can improve test time, especially when heavy data usage occur between devices.

The E5818 also provides ease of use as it has the built-in web access to communicate E5818 from a supported web browser (Internet Explorer 6.0 or higher or Firefox 2.0 or higher). You can use this web access function to configure and upgrade the E5818 in LAN environment.

Compared to GPIB, LXI, and PXI, the E5818 reduces the overall overhead costs.

Furthermore, the E5818 provides a more cost-effective solution for demanding industries. The E5818 reduces the test system setup time as it uses standard drivers such as IVI drivers, reusing the existing instruments and software, improving the system throughput via LAN and distributed intelligence, reducing the size of the system and building a versatile system to address future needs.

Application

The E5818 is compatible with SCPI and can be configured via a web browser. For greater flexibility, it also comes system-ready with a bundled IVI driver so that users can easily automate measurements and triggers in the programming environment of their choice, such as Agilent VEE, Microsoft Visual Basic, C and LabVIEW.

The robust design of the E5818 trigger box guarantees reliable operations for demanding industries such as aviation, automotive, test and measurement and telecommunication industries.

Product Specifications

GENERAL REQUIREMENTS	
Minimum System Requirements for Agilent IO Libraries Suite	• Windows 2000/XP/Vista • 450 MHz Pentium II (1 GHz 32-bit is recommended for Vista) • 128 MB RAM (512 MB or greater is recommended for Vista) (OS and Microsoft.NET Framework may require additional resources) • 400 MB free disk space
Minimum System Requirements (Client Computers)	• Available 10BASE-T/100BASE-TX LAN port
Supported Web Browser	• For E5818 web access: Internet Explorer 6.0 or higher, or Firefox 2.0 or higher (Internet Explorer 7.0 is recommended for Vista)
Supported Standards	• VXI-11 Protocol • IEEE-488.2 Compatible • 10BASE-T/100BASE-TX Networks • EIA-232 • LXI Standard Revision 1.1 • IEEE 1588 — 2002
Programming Language	• SCPI Command • IVI-COM • Web Controller
GENERAL CHARACTERISTICS	
Time Stamp Input	Input has TTL compatible logic levels
Time Trigger Output	Output provides TTL compatible logic levels
Periodic Trigger of 1 Pulse Per Second (1PPS)	For synchronization diagnostic use only. Issuing 1 Hz signal at 1 TTL output level (rising edge).
LAN	Allows communication with an external controller
AC Input	**Input Voltage Range:** 100-240 V ±10% @ 47 to 63 Hz **Power:** 25 VA peak (7.5 Watt typical)
Protection Class	Protection Class 1
Connectors	9-pin RS-232 (for debugging purposes), RJ-45 LAN, BNC Connectors
Power Cord	US/Canada: P/N: 8120-1378 (UL Listed, CSA Certified) 10A/250V. All other cord sets: Appropriate foreign country approval associated with cord for per country of use.
Dimensions	**With bumper:** 227.3 mm (W) X 237.4 mm (L) X 59.3 mm (H) **Without bumper:** 212.3 mm (W) X 230.4 mm (L) X 43.25 mm (H)
Weight	3.085 kg
Rack Mount Kit Dimensions	**Full rack:** 242.8 mm (W) X 238.05 mm (L) X 43.25 mm (H) **Half rack:** 27.5 mm (W) X 226.2 mm (L) X 43.25 mm (H)
Non-volatile Memory Battery	Lithium Manganese Dioxide, approximate lifetime 5 years at 25 °C
User Memory Clear	Statement: • All user-configurable data may be erased from the system without trace for security purposes • All LAN configurations can be reset through the LAN Reset button • All Trigger Box configurations are stored in a flash file system and can be deleted. However, once deleted from the system, the user has to restart all the applications manually.
BNC Protection circuit	All BNCs will have its own set of overcurrent protection circuits
Indicators	PWR, LAN, 1588
Safety Compliance	Certified by: IEC 61010-1:2001/EN 61010-1:2001, CAN/CSA-C22.2 No. 61010-1-04, IEC 61326-2002/EN 61326:1997+A1:1998+A3:2003
Warranty	1 year

GENERAL SYSTEM SPECIFICATIONS	
Input Characteristics	
Input Impedance	15M Ohm
Input Threshold:	
Voltage Threshold High	+2.3 V
Voltage Threshold Low	+0.8 V
Minimum Pulse Width	20 ns
Output Characteristics	
Output Impedance	50 Ohm nominal
Output Threshold:	
Output High	1.7 V typical for 50 Ohm load; 4.3 V typical for 1M Ohm load
Output Low	0 V typical for 50 Ohm load; 0 V typical for 1M Ohm load
Output Current	+/–24 µA, max
Square Wave Rise/Fall Time	(10 to 90%) for 50 Ohm load: 0.95 ns min, 1.15 ns max
Internal Timer Resolution	20 ns
TCXO Characteristics	
Frequency	50 MHz
Initial Accuracy	+/–2.0 ppm
Aging Per Year	+/–1.0 ppm
Temperature Stability (0 to 55 °C)	+/–2.5 ppm (–30 to 75%)
1588 Synchronization Accuracy [1]	
1.5 m Ethernet Direct Connection	+/–2 ns mean, 10 ns standard deviation
Via Hirschmann Boundary Clock [2]	+/–3 ns mean, 17 ns standard deviation
Via Switch [3]	+/–12 ns mean, 11 ns standard deviation

[1] The master unit was configured to connect to an external clock source for greater accuracy. The slave unit clock is based on the TCXO. A sync interval for E5818 and boundary clock was set to 1 s. Ethernet connection speed is 100 Mb/s. For E5818 connection using switch and boundary clock, no 1588 traffic was present as the network is isolated. Measurements were taken in room temperature for a duration of 8 hours for each configuration.

[2] Hirschmann MM3-4TX1-RT with PTP precision between 2 modules < 80 ns

[3] DLink - DES1005D switch used

TIME STAMP SYSTEM SPECIFICATIONS	
Time Stamp Latency	62 ns
Time Stamp Input	2 ports
Event Log File	5000 data
Time Stamp Resolution	Min: 100 µs Max: not applicable
Time Stamp Polarity	Rising or Falling Edge
Minimum Pulse Width	20 ns

TIME TRIGGER SYSTEM SPECIFICATIONS	
Time Trigger Latency	67 ns
Trigger Pulse Width	1 µs
Time Trigger Output	2 ports
Event Log File	5000 data
Periodic Trigger	Supported
Programmability	Yes (SW)
Trigger Polarity	Rising or Falling Edge
Trigger Offset	12 hours (max)
Trigger Period	Min: 100 µs Max: 12 hours
MINIMUM TRIGGER PERIOD AND TIMESTAMP RESOLUTION SETTINGS [4]	
TTL1/TTL2 [5]	100 µs
EXT1/EXT2 [5]	400 µs
TTL1/TTL2 + peer-to-peer LAN message [6]	4.5 ms
EXT1/EXT2 + peer-to-peer LAN message [6]	1 ms
TTL(n) + EXT(n), with n ranging from 1 to 2 [7]	200 µs
TTL(n) + EXT(n), with n ranging from 1 to 2 + peer-to-peer LAN message [8]	7 ms
TTL1 + TTL2 + EXT1 + EXT2 [9]	300 µs
TTL1 + TTL2 + EXT1 + EXT2 + peer-to-peer LAN message [10]	14 ms

[4] Test is carried out on a network without P2P LAN messages from other LXI devices besides the device under test. Measurements were taken in room temperature for duration of 12 hours for each configuration. These are the typical values for the setting

[5] A single port, either TTL or EXT of each the E5818, is being exercised

[6] A single port, either TTL or EXT of each the E5818, is being exercised, and peer-to-peer LAN message (WOR) generation upon any event happening

[7] A combination of either two ports of TTL or EXT of the E5818 is being exercised

[8] A combination of either two ports of TTL or EXT of the E5818 is being exercised, and peer-to-peer LAN message (WOR) generation upon any event happening

[9] All four ports of the E5818 are being exercised

[10] All four ports of the E5818 are being exercised, and peer-to-peer LAN message (WOR) generation upon any event happening

EXTERNAL TRIGGER SYSTEM SPECIFICATIONS	
LXI LAN packets	Based on LAN0 to LAN7 or custom event ID with same domain
LAN MESSAGING SYSTEM SPECIFICATIONS	
External Trigger	Based on Time Stamp 0 or Time Stamp 1
TRIGGER OUTPUT RESPONSE TIMES	
Delay from EXT source to TTL Output	300 µs
Delay for Trigger relating to LAN Event source or LAN Event output	Unknown

ENVIRONMENTAL SPECIFICATIONS	
Operating Environment	0 °C to 55 °C — Indoor use, Pollution Degree 2
Installation Category	II (mains input)
Altitude (operating)	2000 m
Operating Humidity	Up to 90% at 40 °C non-condensing
Storage Humidity	Up to 90% at 65 °C non-condensing
Storage Temperature	–40 °C to +70 °C
Operating State	Continuous
Connection to Supply Mains	Detachable cord
Degree of Mobility	Portable (Bench and Cabinet)
SUPPORTED LANGUAGES AND APPLICATIONS	
Applications (with Agilent Intuilink)	Microsoft Excel 97 and 2000 Microsoft Word 97 and 2000 Check the web for latest supported applications
Software Development	Visual Basic 5.0/6.0 Visual C++ 5.0/6.0 Visual Studio Agilent VEE 5.0 or greater BASIC for Windows Visual Studio.NET
SUPPLEMENTARY INFORMATION	
Maximum Number of Simultaneous LXI Peer-to-peer Connections	8
SAFETY	
CE ISM 1-A ICES/NMB-001 CSA® C N10149	

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LXI

www.lxistandard.org
LXI is the LAN-based successor to GPIB, providing faster, more efficient connectivity. Agilent is a founding member of the LXI consortium.

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