D9010EMBP

Embedded protocol decode and trigger software for Infiniium oscilloscopes

Introduction

D9010EMBP works on all Infiniium oscilloscopes and includes protocol decode and trigger for USB 1.x and 2.0, eUSB2, USB HSIC, USB-PD, eUSB2, PCI Express Gen1 and Gen2, 10/100 Mbps Ethernet, MDIO, and DisplayPort 2.1 AUX Channel.

KEYSIGHT

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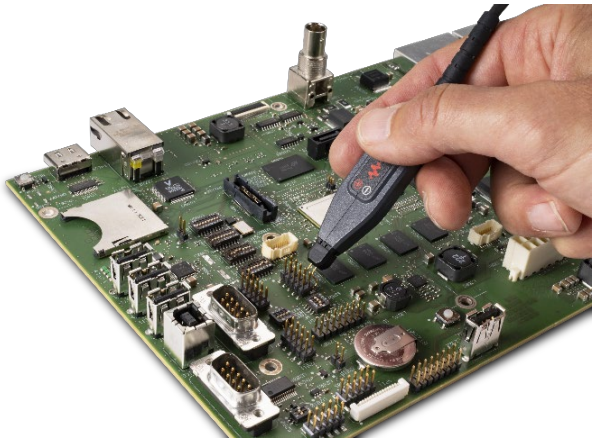
Product Overview

This document is designed to help you understand what is available in D9010EMBP. For assistance in using the software, please reference the latest user's guide, programmer's guides, and online help for Infiniium available on Keysight.com.



Embedded serial bus interfaces are widely used today in electronic designs for communication. In many designs, these serial buses tend to provide content-rich points for debugging and testing. Extend your scope capability with the D9010EMBP embedded serial protocol triggering and decoding application! This application makes it easy to debug and test designs that include embedded serial protocols using Infiniium oscilloscopes. Get access to a rich set of integrated protocol-level triggers specific to each serial bus. When serial triggering is selected, the application enables special real-time triggering hardware inside the scope.

Hardware-based triggering ensures that the scope never misses a trigger event when armed. This hardware takes signals acquired using either scope or digital channels and reconstructs protocol frames. It then inspects these protocol frames against specified protocol-level trigger conditions and triggers when the condition is met.

- Easy access to set up with a dedicated Serial Decode front panel key.
- Set up your scope to show protocol decode in less than 30 seconds with an auto-setup key for every protocol that sets threshold levels, baud rates, sample rate, memory depth, and more.
- Save time and eliminate errors by viewing packets at the protocol level on the physical waveform, or in tabular or graphical format.
- Easy-to-use search and navigate tools allow you to search through long sets of data and find specific packets of interest on the serial bus.
- Segmented memory allows you to capture seconds to days' worth of serial protocol traffic. The scope fills memory in segments as each acquisition sees a trigger condition, using time tags to track time between segments.

USB 2.0 / eUSB2

Low- and full-speed

USB 1.x runs at 1.5 Mbps (low-speed) and 12 Mpbs (full-speed). Decoding for USB 1.x is located in the Protocol Decode menu under USB 2.0, as the 1.x standards were absorbed into USB 2.0 upon its release. Analog and digital channels, as well as waveform memory and math, can be selected as sources for D+ and D-. Single-ended probes must be used for 1.x trigger and decode on analog channels. Users have access to an auto-setup key that will configure the oscilloscope for decoding and triggering. D9010EMBP provides not only decode, but also listing window view, software searching, and trigger on search.

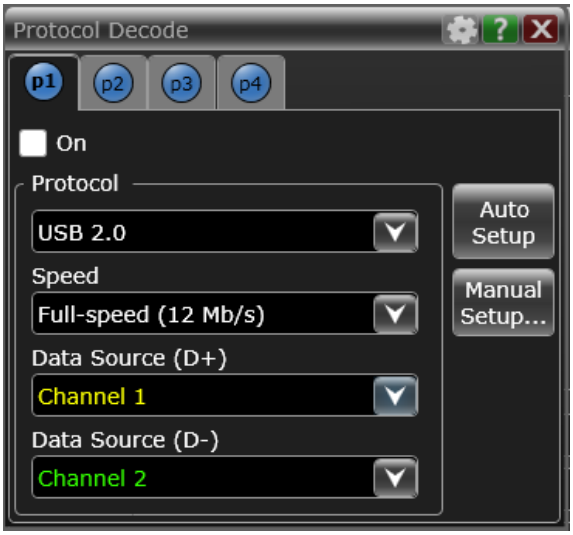


Figure 1. USB full-speed protocol decode setup window.

High-speed

USB 2.0 runs at 480 Mbps. Analog and digital channels, as well as waveform memory and math, can be selected as sources for D+ and D-. Differential probes must be used for 2.0 trigger and decode on analog channels, and oscilloscopes with 2.5 GHz or greater bandwidth are recommended. Users have access to an auto-setup key that will configure the oscilloscope for decoding and triggering. D9010LSSP provides not only decode, but also listing window view, software searching, and trigger on search.

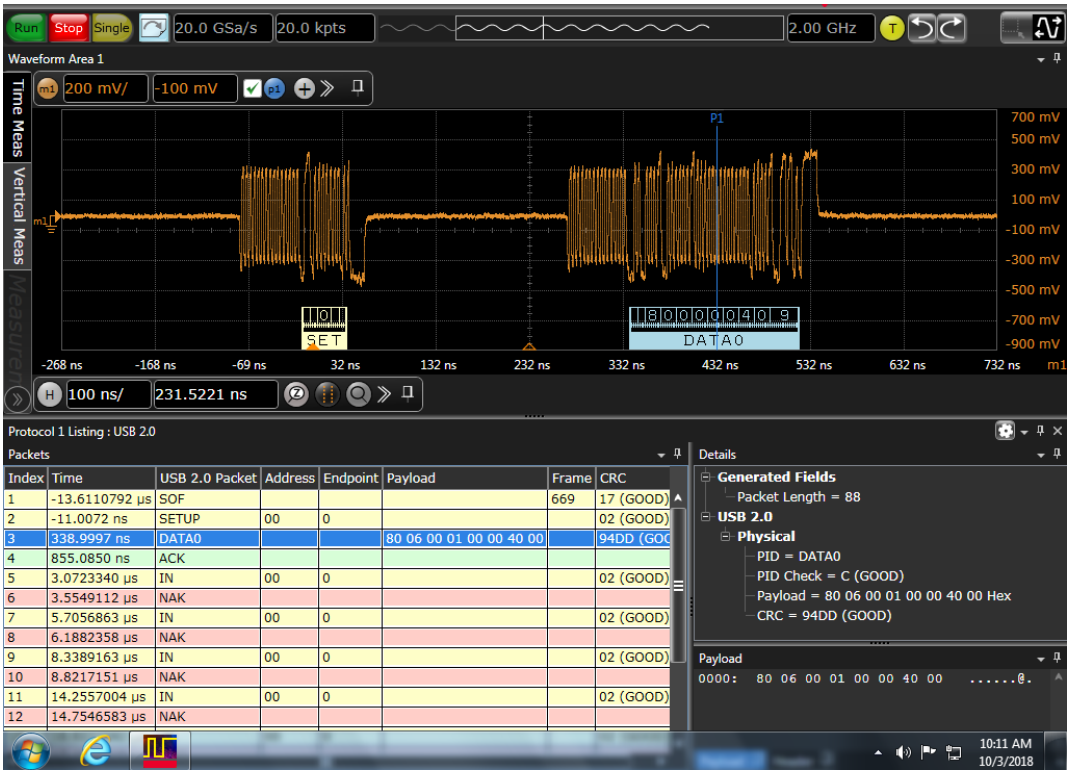


Figure 2. USB high-speed trigger and decode, with protocol lister and detailed packet view.

High-speed inter-chip

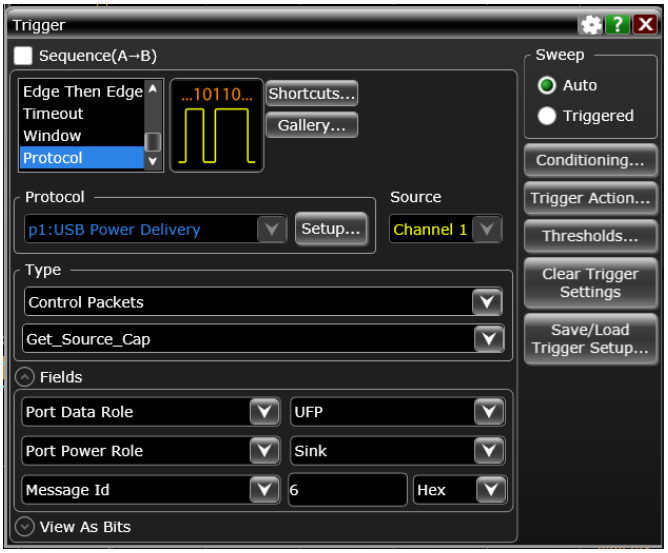
HSIC (also called InterChip USB, IC-USB, or USB-IC) is a low-power variant of the standard physical USB interface that is designed for direct chip-to-chip communications by restricting bus lengths to under 10 cm. In doing so, HSIC uses 50% less power and up to 75% less board area than a traditional USB 2.0 layout. HSIC signals at 1.2 V and 480 Mbps. D9010EMBP is able to trigger and decode HSIC data with or without a strobe signal for clocking.

USB 2.0, eUSB2, and HSIC specifications and characteristics

Data sources (D+ and D-)	Any analog channel Any digital channel (MSO only) Any waveform memory Any waveform math
Supported speeds	Low-speed (1.5 Mbps) Full-speed (12 Mbps) High-speed (480 Mbps) HSIC (480 Mbps)
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Oscilloscope requirements	Keysight recommends an oscilloscope and probe of 2.5 GHz or faster for accurate measurements of the USB 2.0 and HSIC bus.
Probing requirements	Low- and full-speed: single-ended required High-speed: differential required HSIC: High-impedance probes recommended
Trigger options	Tokens: OUT, IN, SOF, SETUP • Can AND with: PID check, address, endpoint, and/or CRC (pick three) Data: DATA0, DATA1, DATA2, MDATA • Can AND with: payload and/or PID check Handshake: ACK, NAK, NYET, STALL • Can AND with: PID check Special: RESERVED, SPLIT, PING, PRE/ERR • Can AND with: RESERVED, PRE/ERR: PID check only PING: PID check, address, endpoint, CRC (pick three) SPLIT: PID check, address, SC (SSPLIT or CSPLIT), port, S (full or low speed), E/U, ET (control, isochronous, bulk, interrupt), CRC (pick three) Errors: Any error, PID error, Bad 5- or 16-bit CRC, glitch (double transition)

USB-PD

The introduction of the USB Type-C connector also introduced the enhanced capabilities of USB-PD. The CC line in the Type-C connector is a single-ended, BMC encoded, 4b/5b signal used for Power Delivery (PD) negotiation. USB-PD is responsible for negotiating power levels, device type, connector orientation, charging infrastructure, and other capabilities like ALT mode. This application includes a suite of configurable protocol-level trigger conditions specific to USB-PD. When serial triggering is selected, the application enables special real-time triggering hardware inside the Infiniium S-Series oscilloscope.



USB-PD specifications and characteristics

CC line sources	Any analog channel Any waveform memory Any waveform math
Probing requirements	Single-ended
Supported protocols	R2.0 V1.0 R3.0 V1.1
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Decode options	Symbol display format: Label, 8-bit, 10-bit
Trigger options	Ordered Sets Control Packets Data Packets Extended Packets Errors Various fields can be ANDed to packet triggers

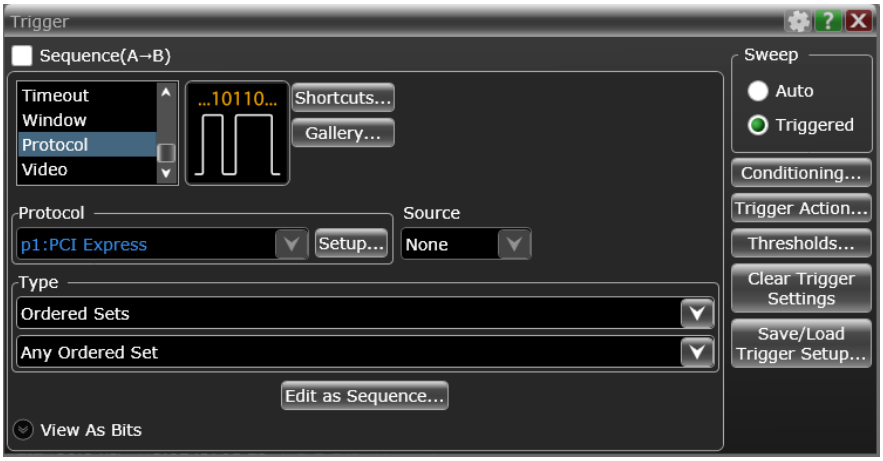
PCI Express

PCI Express interfaces are gaining in popularity outside of the computer industry. PCIe® buses can provide a content-rich point for debugging and testing. Keysight's D9010EMBP provides an economical alternative for low-level PCIe Gen1 and Gen2 debugging.

The application includes a powerful serial search tool that allows you to search for data patterns or search conditions like errors or data packets. The application Includes five "tabs" for easy viewing of the PCIe bus:

- The Details tab breaks the packets into easy-to-read textual fields. Hovering shows additional detail.
- The Payload tab shows data carried by the packet in byte-by-byte HEX and ASCI.
- Header tab shows packets in a data book format. Hovering on any tab reveals additional detail.
- Packets tab that shows full details of each individual packet
- Symbols tab that shows the high-level decoding of the bus

PCIe Gen1 and Gen2 use high data rates, so please take note of the bandwidth and probing requirements below to suit your testing needs.



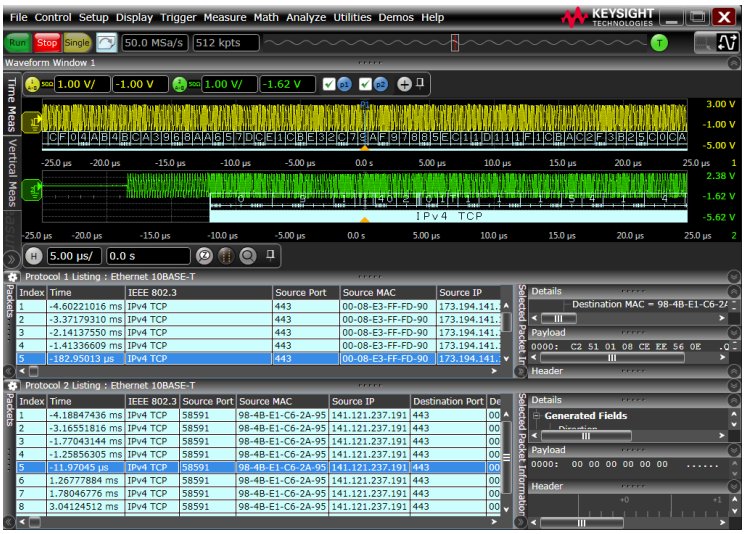
PCI Express specifications and characteristics

PCIe sources (data and clock)	Any analog channel (max 2 for decode) Any waveform memory Any waveform math
Supported speeds	Gen1 (2.5 Gbps) x1 (bi-directional) x4/x8/x16 can be monitored one lane at a time Gen2 (5.0 Gbps) x1 (bi-directional) x4/x8/x16 can be monitored one lane at a time
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Oscilloscope requirements	Gen1: 4 GHz of bandwidth Gen2: 8 GHz of bandwidth
Probing requirements	Gen1: 5 GHz or higher, differential Gen2: 10 GHz or higher, differential
Decode options	Symbol display format: K/D codes, Label, 8-bit, 10-bit Scrambled / unscrambled data symbols Electrical IDLE presence ON/OFF
Trigger options [1]	Ordered sets, training sequences, packets, DLLP packets, TLP packets, 3DW packets, 4DW packets, symbol sequence, errors. Dozens of fields can be ANDed with certain packet types.

1. There are extreme levels of sub-level trigger options and abilities. Contact Keysight if you want to verify that D9010EMBP has the exact trigger you may need.

10/100 Mbps Ethernet

The application makes it easy to debug and test Ethernet designs on your Infiniium Series oscilloscope. Debugging Ethernet signals is as simple as clicking the “Auto Setup” button and capturing Ethernet protocol data, and decoding packets can be done in less than 30 seconds. The “Auto Setup” button automatically configures the sample rate, memory depth, threshold, and trigger levels. As pictured here, you can also display bidirectional serial data from the transmitter (yellow) and receiver (green) at the same time with time-correlated data. Decoded packets are shown below the waveforms and in the decode listings windows.



Ethernet specifications and characteristics

Data sources	Any analog channel Any waveform memory Any waveform math
Supported protocols	10BASE-T and 100BASE-TX IPv4 and IPv6 UDP and TCP
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Oscilloscope requirements	Any Infiniium Series oscilloscope, > 500 MHz
Probing requirements	Differential, > 500 MHz
Decode options	Symbol display format (100BASE-TX): Label, 8-bit, 10-bit Electrical IDLE presence (100BASE-TX): ON/OFF
Trigger options [1]	Any packet, ARP, IPv4, IPv4 ICMP, IPv6, IPv6 ICMP, IPv6 extension headers, 802.1Q, 802.ad, ethernet packet, symbol sequence, errors. Many can be ANDed with up to three various fields.

1. There are extreme levels of sub-level trigger options and abilities. Contact Keysight if you want to verify that D9010EMBP has the exact trigger you may need.

Management Data Input/Output (MDIO)

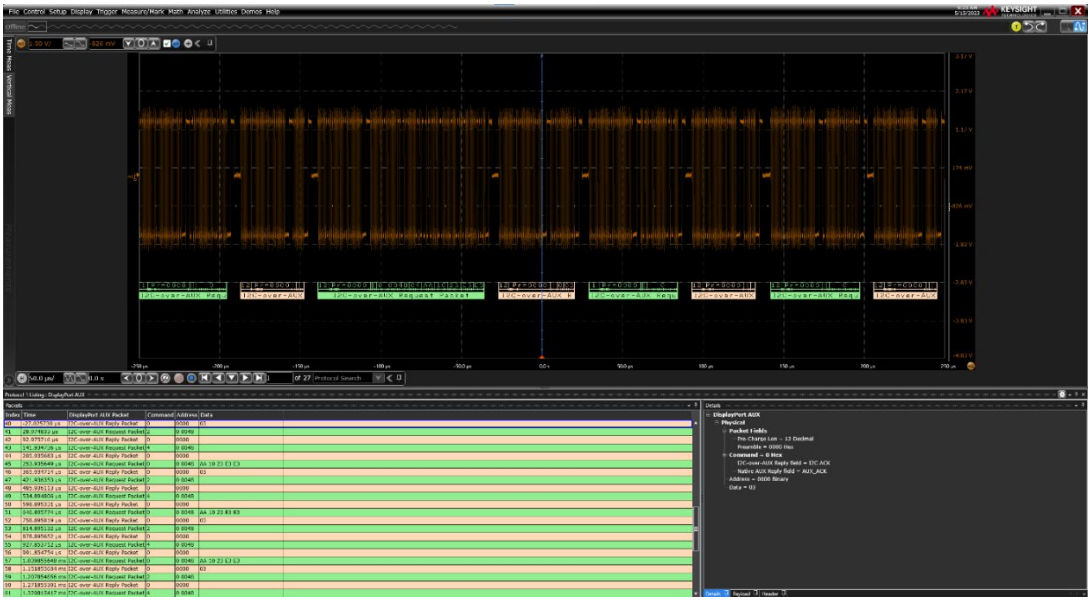
The Management Data Input/Output (MDIO) protocol, a widely adopted standard in network and communication systems, plays a pivotal role in the configuration and monitoring of Ethernet PHY devices. This software solution for decoding MDIO protocols is designed to facilitate the accurate interpretation and analysis of data exchanges between network components. By offering a robust and user-friendly interface, the software empowers engineers and technicians to seamlessly decode, visualize, and troubleshoot MDIO transactions. Infiniium Series oscilloscopes support real-time hardware triggering of MDIO buses and display decoded information time-correlated to the waveform. The MDIO decoder will decode both Clause 22 and Clause 45 of the 802.3 spec.

MDIO specifications and characteristics

Data sources	Any analog channel Any waveform memory Any waveform math
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Oscilloscope requirements	Any Infiniium Series oscilloscope, > 500 MHz
Trigger options	Any Frame, Read PHYAD, Write PHYAD, Address PRTAD, Read PRTAD, Write PRTAD, Post-Read Inc addr PRTAD, Frame, and Errors

DisplayPort 2.1 Aux Channel (AUX_CH)

The communication over the Auxiliary Channel (AUX CH) is critical for a successful DisplayPort link bring-up and product interoperability. The DisplayPort physical interface consists of a Main Link, up to 4 high-speed differential, unidirectional pairs, Hot-Plug Detect (HPD) — used by the DP Sink to signal its presence to the DP Source — and the AUX CH. The AUX CH uses a modified version of the Manchester-II encoding running at 1 Mbps to establish a bidirectional, request-response communication channel between the DP Source and the DP Sink to advertise capabilities and negotiate the link bandwidth (number of high-speed lanes and data rate) and DP Source drive settings.



DP-AUX specification and characteristics

Data sources	Any analog channel Any waveform memory Any waveform math
Probing requirements	Differential
Supported speed	1 Mbps
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Trigger options	Any packet, Aux Write/Read Request, I2C Write/Read Request, I2C Write Status Update Request, Aux Write/Read Acknowledged, Aux Write Not-Acknowledged, Aux Deferred, I2C Write/Read Acknowledged, I2C Write/Read Not-Acknowledged, I2C Deferred, errors

Ordering Information

Required hardware

Model	Compatibility
D9010EMBP	Infiniium 9000, S-Series, EXR-Series, MXR-Series, 90000, V-Series, Z-Series, UXR-Series

Flexible software licenses and KeysightCare Software Support Subscriptions

Keysight offers a variety of flexible licensing options to fit your needs and budget. Choose your license term and license type.

License terms

Perpetual – Perpetual licenses can be used indefinitely.

Subscription – Subscription licenses can be used through the term of the license only.

License types

Node-locked – License can be used on one specified instrument/computer.

Transportable – License can be used on one instrument/computer at a time but may be transferred to another using Keysight Software Manager (internet connection required).

USB Portable – License can be used on one instrument/computer at a time but may be transferred to another using a certified USB dongle (available for additional purchase with Keysight part number SW1000-D10).

Floating (single site) – Networked instruments/computers can access a license from a server one at a time. Multiple licenses can be purchased for concurrent usage.

KeysightCare Software Support Subscriptions

Perpetual licenses are sold with a 12 (default) and up to 60-month software support subscription with a user-selected start and end date. Support subscriptions can be renewed for a fee after that.

Subscription licenses include a software support subscription through the term of the license, from 3 to 36 months, with a user-selected start date.

Selecting your license

Step 1. Choose your software product (e.g. D9020ASIA)

Step 2. Choose your license term: perpetual or subscription.

Step 3. Choose your license type: node-locked, transportable, USB portable, or floating.

Step 4: Depending on the license term, choose your support subscription duration.

Example

If you selected:	Your quote will look like this:	
D9020ASIA Node-locked Perpetual license	Part number D9020ASIA SW1000-LIC-01 SW1000-SUP-01	Description Advanced Signal Integrity Software (EQ, InfiniiSimAdv, Crosstalk) Node-locked perpetual license Node-locked KeysightCare software support subscription with user-selected start and end dates
D9020ASIA Transportable Subscription 6-month license	Part number D9020ASIA SW1000-SUB-01	Description Advanced Signal Integrity Software (EQ, InfiniiSimAdv, Crosstalk) 6-months, transportable subscription license

To configure your product and request a quote:

http://www.keysight.com/find/software

Contact your Keysight representative or authorized partner for more information or to place an order:

www.keysight.com/find/contactus