Keysight Technologies
USB and HSIC Protocol Triggering and Decode for Infiniium 90000 Series Oscilloscopes

Data Sheet

This application is available in the following license variations.

- Order N5464A for a user-installed license
- Order Option 005 for a factory-installed license with new 90000 Series oscilloscopes
- Order N5435A Option 034 for a server-based license

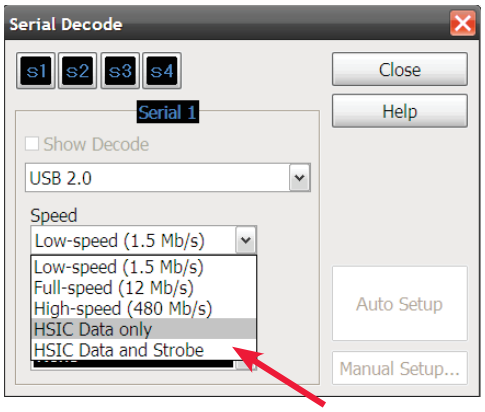
KEYSIGHT TECHNOLOGIES

Easily debug and test designs that include USB protocols using your Infiniium 90000 scope

Serial bus interfaces such as USB (universal serial bus) interfaces are widely used today in electronic designs. In many designs, USB buses can provide a content-rich point for debug and test. However, since USB protocols transfer bits serially, using a traditional oscilloscope has limitations. Manually converting captured 1's and 0's to protocol requires significant effort, can't be done in real-time, and includes potential for human error. In addition, traditional scope triggers are not sufficient for specifying protocol-level conditions.

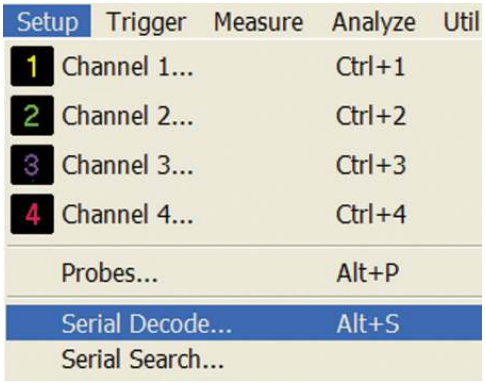
Extend your scope capability with the Keysight Technologies, Inc. USB triggering and decode application. This application makes it easy to debug and test designs that include low, full, or high-speed USB protocols using your Infiniium 90000 scope.

- Set up your scope to show USB protocol decode in less than 30 seconds.
- Get access to a rich set of integrated software-based protocol-level triggers
- Save time and eliminate errors by viewing packets at the protocol level.
- Use time-correlated views to quickly troubleshoot serial protocol problems back to their timing or signal integrity root cause.



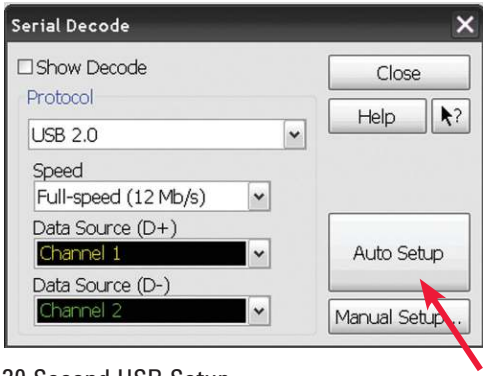
HSIC protocol decode options

Support for High-Speed Inter-Chip (HSIC) is included in the USB protocol triggering and decode software. Acquire both data and strobe or just data to view HSIC decode on the display. If both data and strobe are selected the decode will be based on the strobe timing relative to the data logic levels.



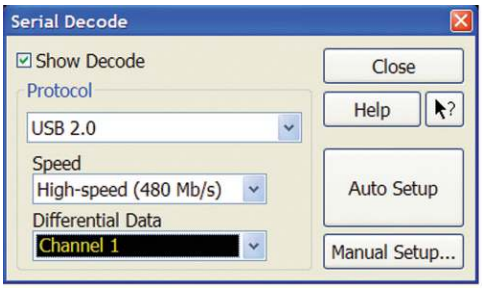
Easy to find

Turn decode on/off in the "Setup" menu. View decode embedded on the waveform display or in the protocol viewer listing window. (See pages 4-5).



30 Second USB Setup

Configure your oscilloscope to display protocol decode in under 30 seconds. Use "Auto Setup" to automatically configure sample rate, memory depth and threshold and trigger levels.



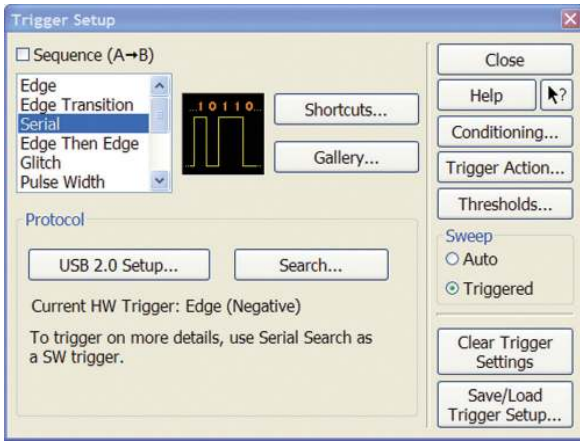
Support for all analog channels

Acquire low and full-speed USB signals using 2 single-ended probes on scope channels. Analog differential channels provide robust signal integrity for high-speed USB protocol analysis.

USB protocol triggering and searching

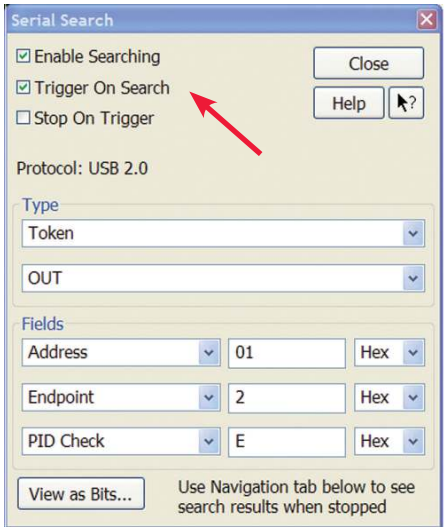
Get access to a rich set of integrated protocol level triggers. The application includes a suite of configurable protocol-level trigger conditions specific to USB. The application uses software-based search triggering when serial triggering is selected.

With software-based protocol triggering, the oscilloscope takes signals acquired using either scope or digital channels and reconstructs protocol frames after each acquisition. It then inspects these protocol frames against specified protocol-level trigger conditions and triggers when the condition is met.



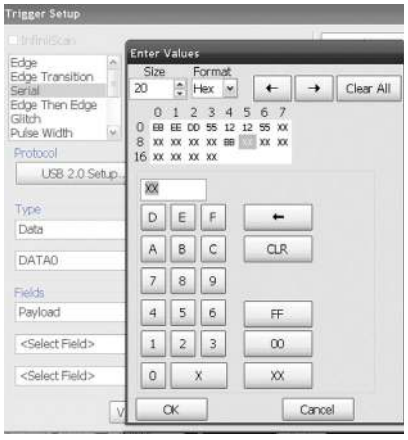
USB Trigger Setup

Quickly access protocol triggering via the scope's trigger menu.



USB Trigger Setup

Choose triggers from a broad range of USB protocol, including token, data, handshakes, special and error types.

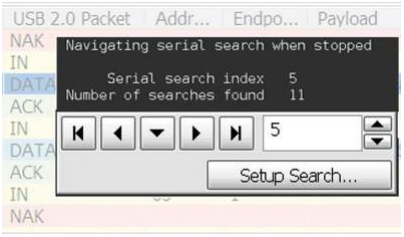


Payload editor

Use the payload editor to specify data values word by word.

Post-acquisition searching

Search acquired protocol listings using a menu that is identical to the trigger menu.



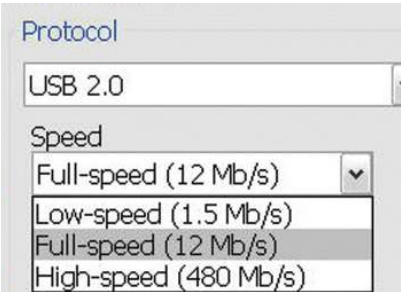
Quickly find occurrences

Quickly move to next occurrence of a specified event.

USB low and full-speed protocol decode

USB full-speed protocol decode with precise time-correlation between waveforms and listing

Keysight's multi-tab protocol viewer includes correlation between the waveforms and the selected packet. The selected packet, highlighted blue row in the listing, is time-correlated with the blue line in the waveform display. Move the blue tracking marker in time through waveforms and the blue bar will automatically track in the packets window. Or, scroll through the packet viewer and highlight a specific packet. The time-correlation tracking marker will move to the associated point in the waveform.



Support for low, full and high-speed USB

USB decode embedded in waveform area

Utilize the oscilloscope waveform area to display decode information. For USB, minor ticks indicate clock transitions and major ticks show the beginning and end of each word in the serial packet.

Full screen USB listing

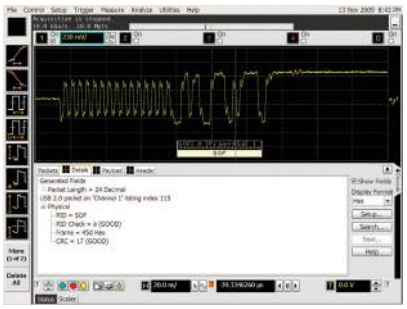
Fill the entire display with compact protocol information using the full screen listing. The protocol viewer window shows the index number, time stamp value, and data content for each serial packet in the list. Scroll though all decoded serial packets to find events of interest or errors in the transmission. Data in the listing window can be saved to a .csv or .txt file for off-line analysis or documentation.

View other signals

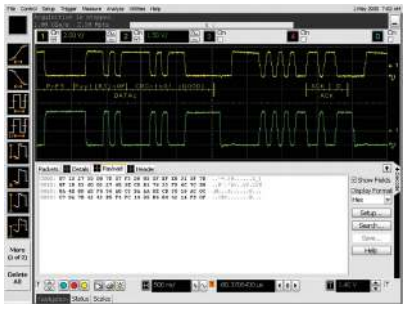
Use scope channels simultaneously view other time-correlated signals.

USB high-speed protocol decode

Quickly move between physical and USB high-speed protocol layer information using the time-correlated tracing marker. Display protocol content using embedded decode in the waveform area. Or, see protocol events in a compact listing format using the industry's first scope based multi-tab protocol viewer. For minor tick marks indicate clock transitions. Major tick markets indicate sections of the USB serial packet.

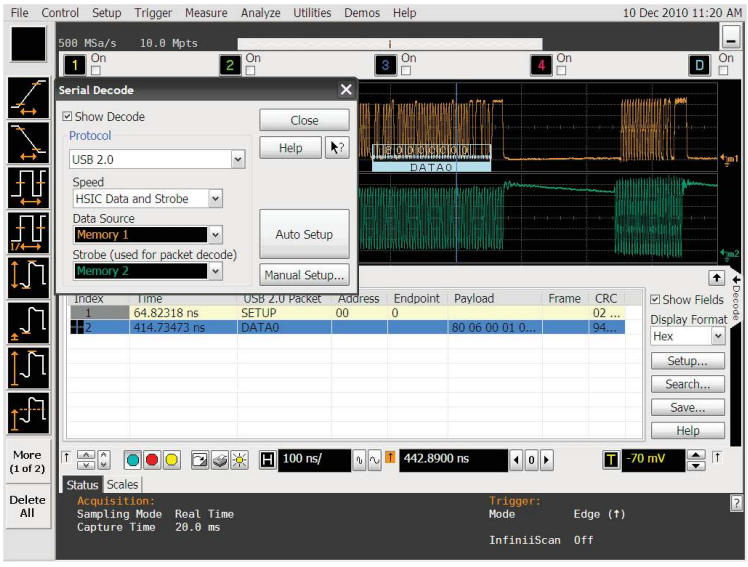


Details tab breaks the packets into easy-to-read textual fields. Hovering shows additional detail.



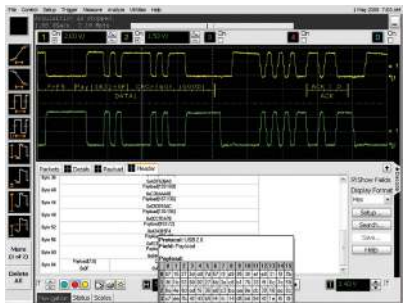
Payload tab shows data carried by the packet in byte-by-byte HEX and ASCII.

High-Speed Inter-Chip (HSIC) protocol decode



HSIC Data and Strobe protocol decode with Strobe used for packet decode

The HSIC decode allows user to decode data by itself or relative to the strobe signal. Data only decode uses the same clock recover method as standard High-Speed USB packets. In both cases all the features and capabilities of the USB protocol decode software, like packet search and viewing tabs, are available.



Header tab shows packets in a data book format. Hovering at any field reveals additional detail.

USB specifications and characteristics

USB 2.0 supported speeds	Low-speed (1.5 Mb/s) requires single-ended probing, supported by all 9000A and 9000 H-Series bandwidth Full-speed (12 Mb/s) requires single-ended probing, supported by all 9000A and 9000 H-Series bandwidth High-speed (480 Mb/s) (requires differential probing), recommended 2.5 GHz bandwidth or greater models HSIC data only (480 Mb/s) HSIC data and strobe
Probing	Single-ended required for USB low- and full-speed Differential required for USB high-speed (recommended 1.5-GHz 1130A or higher bandwidth) High resistance (1MΩ) required for HSIC strobe (ex: N2796A)
D+ and D- data sources	Analog channels 1, 2, 3, or 4 Any waveform memory For low- or full-speed USB protocol, MSO models can additionally use digital channels D0 to D15
Auto Setup	Automatically configures trigger levels, measurement thresholds, Volts/div, vertical offset, memory depth, sample rate, trigger and holdoff for proper decode and triggering
Probing location requirements	General recommendation: keep cable lengths as short as possible. High-speed (480 Mb/s) differential probing, recommend using cable lengths as short as possible Full-speed (12 Mb/s) single ended probing, must probe signals to be analyzed near the receiver of the transaction (far-end location) HSIC Data (480 Mb/s), must probe signals near the receiver of the transaction (far-end location). Probe impedance is not critical HSIC Strobe (480 Mb/s), must probe signals near the receiver of the transaction (far-end location) and should be probed in same location as HSIC Data. Probe must be high impedance (ex: N2796A) due to weak pull-up on Strobe during electrical idle
Trigger types	Token selections: Any token, OUT, IN, SOF, or SETUP AND-ing of user defined value for up to three of the following PID check, address, endpoint, or CRC Data selections: DATA0, DATA1, DATA2, MDATA AND-ing for user defined value for PID check, payload, and CRC values Handshake selections: Any handshake, ACK, NAK, NYET, STALL User selectable PID check value for handshakes Special selections Any special Reserved with user selectable PID check value Split with AND-ing of three of the following – PID check with user selectable value – Address with user selectable value – SC with choice of SSPLIT or CSPLIT – Port with user defined value – S with choice of full speed or low speed – ET with choice of isochronous, bulk, or interrupt – CRC with user defined value PING: AND-ing of user defined values for three of the following PID check, address, endpoint, CRC PRE/ERR with user defined PID check value Error selections Any error, PID error, bad 5-bit CRC, bad 16-bit CRC.

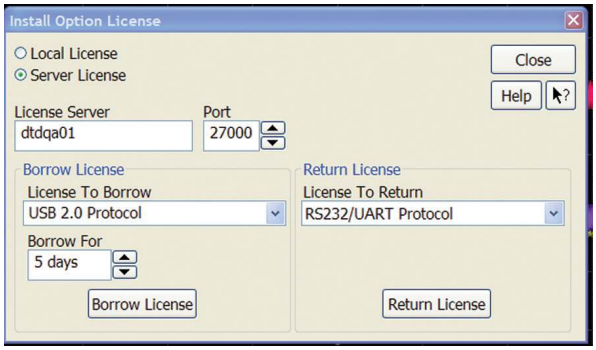
Ordering information

This application is compatible with all 90000 Series oscilloscope models.

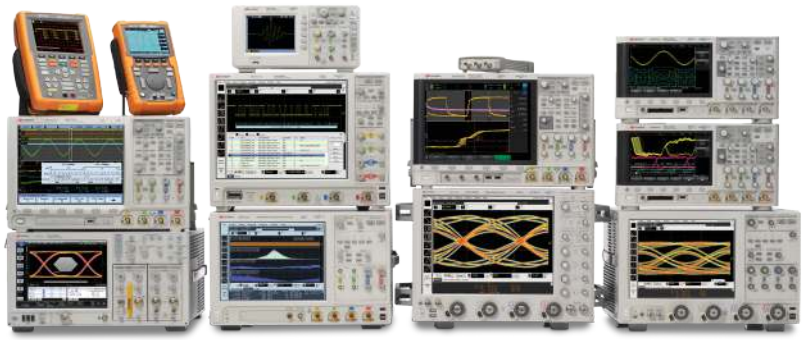
Software applications	Factory-installed node-locked license for new scope purchases	User-installed node-locked license	Server-based license (N5435A option)
USB triggering and decode	005	N5464A	034

Related literature

Publication title	Publication type	Publication number
Infiniium 90000 Series Oscilloscopes	Data Sheet	5989-7819EN
USB Test Compliance for Infiniium Oscilloscopes	Data Sheet	5989-4044EN
U7248A High-Speed Inter-Chip (HSIC) Electrical Test Software for Infiniium Oscilloscopes	Data Sheet	5990-9246EN



Sharing the applications across multiple instruments? Server-based licensing allows you to borrow an application license for a specified period of time.



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