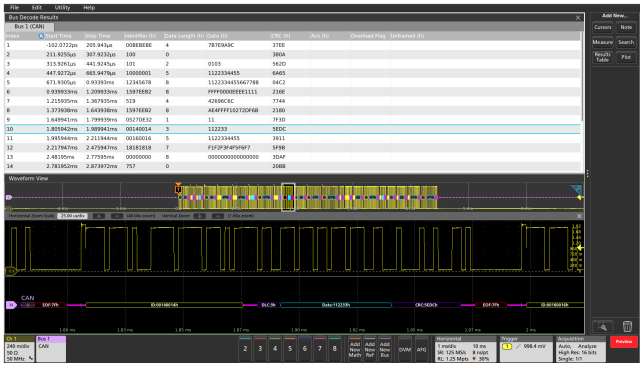
Serial Triggering and Analysis

3 Series MDO, 4/5/6 Series MSO Applications Datasheet



On a serial bus, a single signal often includes address, control, data, and clock information. This can make isolating events of interest difficult. Optional serial applications transform the oscilloscope into a robust tool for debugging serial buses with automatic decode and analysis for I^2C, SPI, CAN, CAN FD, LIN, FlexRay, 100BASE-T1, SENT, RS-232/422/485, UART, USB 2.0 (LS, FS, HS), Ethernet, I3C, SPMI, Spacewire, 8b10b, NRZ, MIL-STD-1553, ARINC`429, I^2S, LJ, RJ, PSI5, DPHY, CPHY, 1-WIRE, and TDM.

Key features

- Automated Serial Decode and Analysis Options for I^2C, SPI, I3C [1], CAN, CAN FD, LIN, FlexRay, SENT[1], RS-232/422/485, UART, USB 2.0, Ethernet[1], SPMI[1], MIL-STD-1553, ARINC`429, I^2S, LJ, RJ, PSI5, DPHY, CPHY, 1-WIRE, and TDM
- Trigger on all the critical elements of a serial bus such as address, data, etc.
- Decode all the critical elements of each message. No more counting 1s and 0s!
- Search through long acquisitions with user-defined criteria to find specific messages
- Event Table shows decoded serial bus activity in a tabular, time-stamped format for quick summary of system activity

Serial Triggering and Analysis Applications

The serial applications support automatic trigger and decode for I^2C, SPI, CAN, CAN FD, LIN, FlexRay, 100BASE-T1, SENT, RS-232/422/485, UART, USB 2.0 (LS, FS, HS), Ethernet, I3C, SPMI, Spacewire, 8b10b, NRZ, MIL-STD-1553, ARINC`429, I^2S, LJ, RJ, PSI5 and TDM buses, making it easier to locate, analyze, and debug events of interest.

Serial triggering

Trigger on packet content such as start of packet, specific addresses, specific data content, unique identifiers, etc. on popular serial interfaces such as I^2C, SPI, CAN, CAN FD, LIN, FlexRay, SENT, RS-232/422/485, UART, USB 2.0, Ethernet, SPMI, MIL-STD-1553, ARINC`429, I^2S, LJ, RJ, PSI5 and TDM.

Bus display

The bus display provides a higher-level, combined view of the individual signals (clock, data, chip enable, and so on) that make up your bus, making it easy to identify where packets begin and end and identifying sub-packet components such as address, data, errors, and so on.

Bus decoding

Tired of having to visually inspect the waveform to count clocks, determine if each bit is a 1 or a 0, combine bits into bytes, and determine the hex value?

Let the oscilloscope with a serial application do it for you! Once you've set up a bus, the oscilloscope decodes each packet on the bus, and displays the value in hex, binary, ASCII, or decimal (certain buses only) in the bus waveform.

Results table

In addition to seeing decoded packet data on the bus waveform itself, you can view all captured packets in a tabular view much like you would see in a software listing. Packets are time stamped and listed consecutively with columns for each component (Address, Data, and so on).

Wave Inspector® search

Serial triggering is very useful for isolating the event of interest, but once you've captured it and need to analyze the surrounding data, what do you do?

In the past, users had to manually scroll through the waveform counting and converting bits and looking for what caused the event. With a serial application, you can enable the oscilloscope to automatically search through the acquired data for user-defined criteria including serial packet content. Each occurrence is highlighted by a search mark. Rapid navigation between marks is as simple as pressing the ← and → arrow buttons on the oscilloscope front panel or the Search badge. The 3 Series MDO uses the arrows in the Search badge to navigate.

[1] Not available for 3 Series MDO.

I^2C characteristics

Table 1: Bus setup options

Characteristic	Description
I^2C Sources (Clock and Data)	Analog channels Digital channels Active Math channels [1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Include R/W in Address	Yes or No
Address/Data Formats Available	Hex Binary

Table 2: Display modes

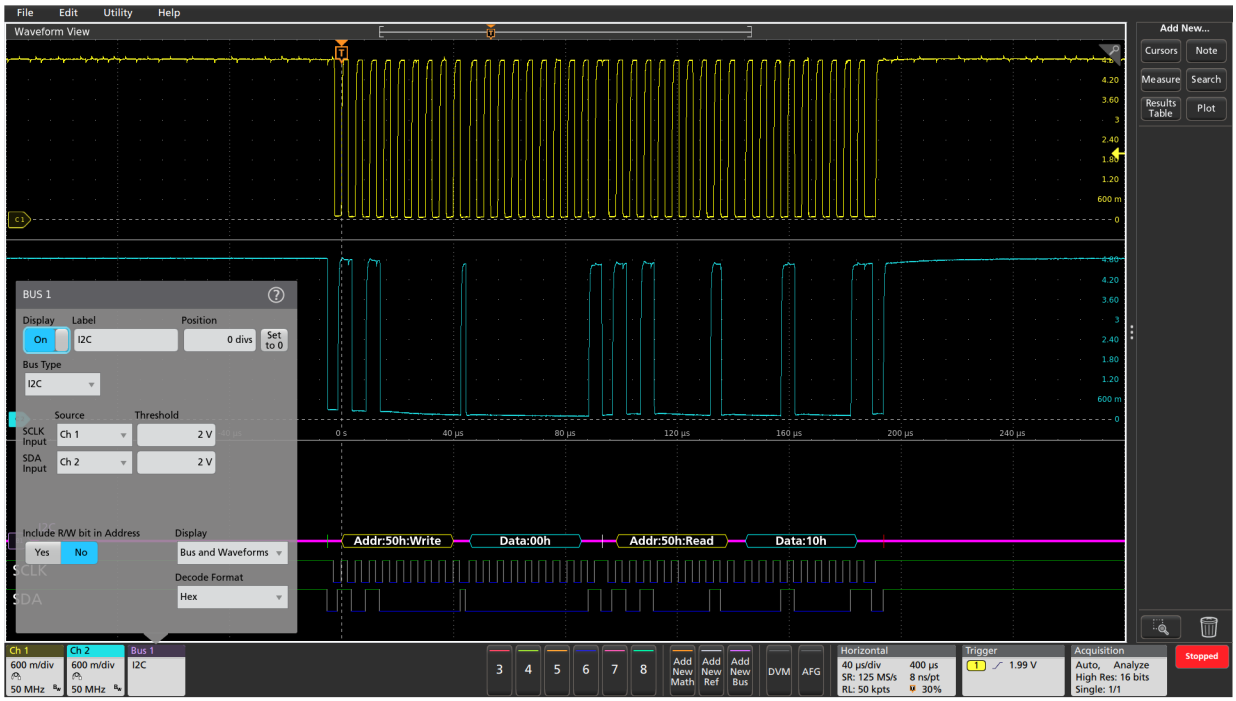
Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table 3: Bus trigger and search options

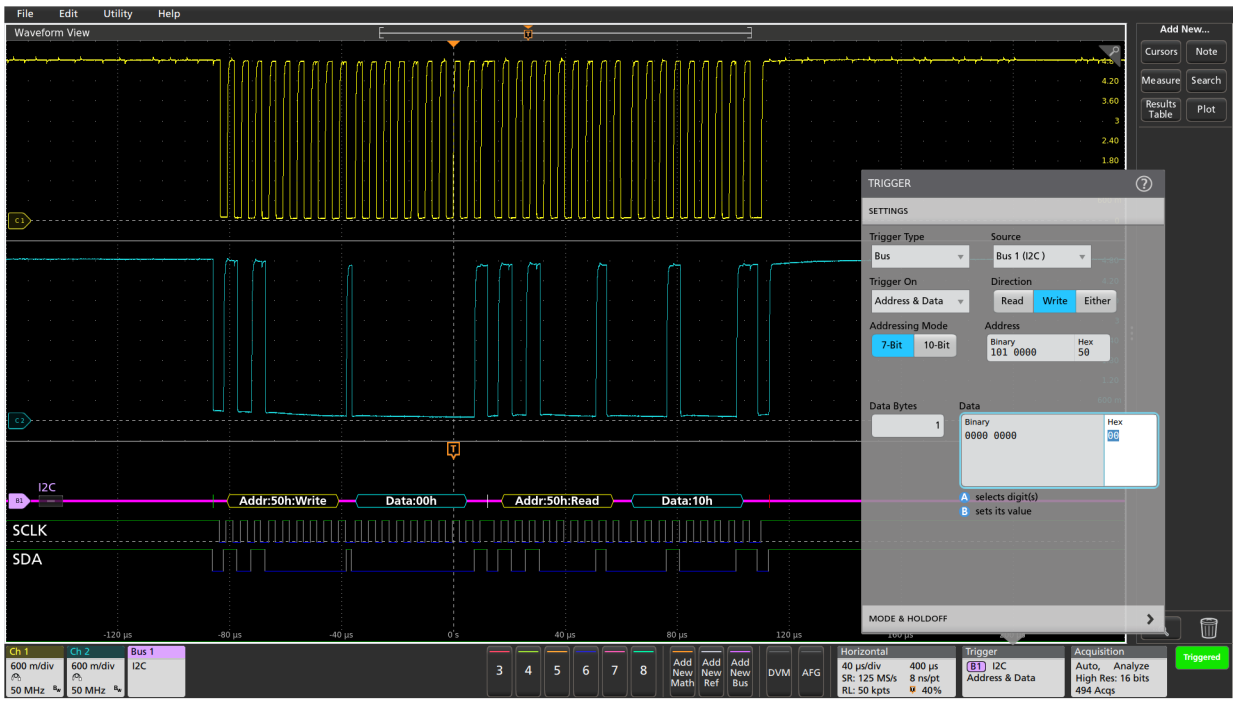
Characteristic	Description
Trigger and/or Search On	Start Repeated Start Stop Missing Ack Address (7 or 10 bit) Data (1-5 bytes) Address and Data

Table 4: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 10 Mb/s (automatic selection)
Decode Display	Start (green bar) Address (yellow packet) Data (cyan packet) Missing Ack (! symbol in red box) Stop (red bar)



Color-coded I²C bus display, using hexadecimal display format.



Triggering on a specific address value on the I²C bus.

SPI characteristics

Table 5: Bus setup options

Characteristic	Description
SPI Sources (Clock, Data, and Slave Select)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Decode Configuration: Framing Clock Slave Select Data Word Size Bit Order	 Slave Select (3-wire SPI), Idle Time (2-wire SPI) Rising or Falling Edge Active High or Active Low Active High or Active Low 4 - 32 bits Most Significant (MS) First, Least Significant (LS) First
Formats Available	Hex Binary

Table 6: Display modes

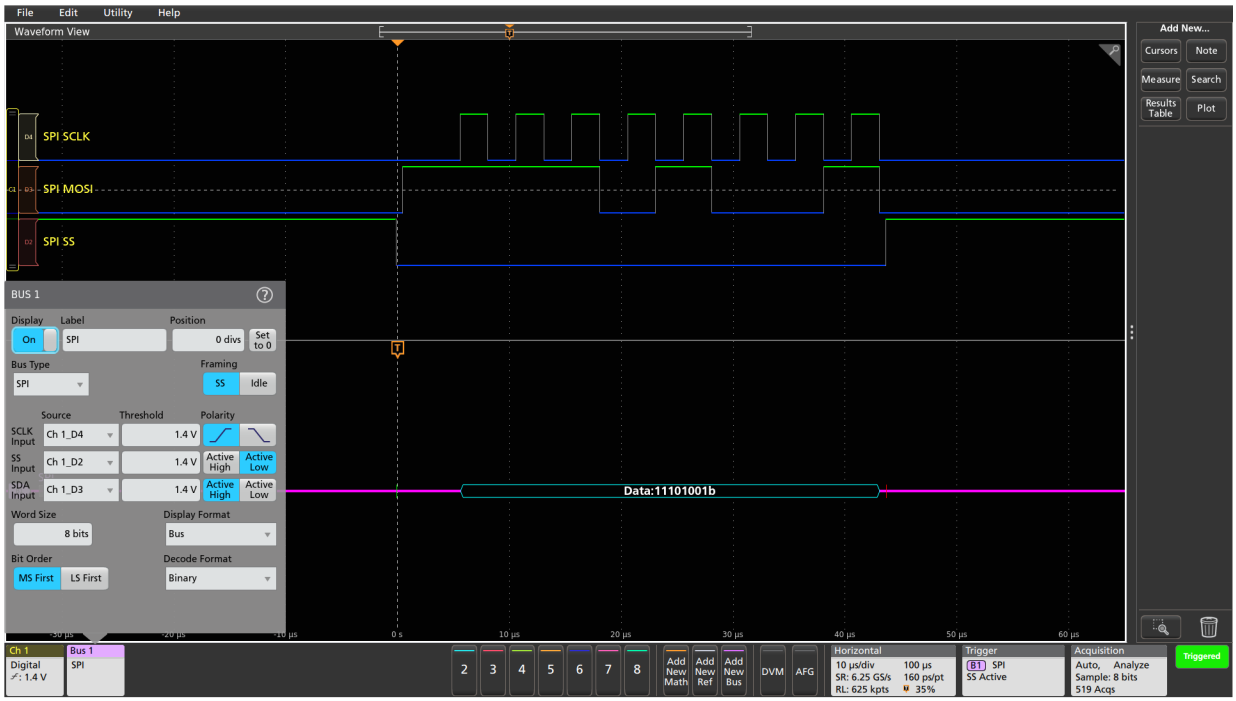
Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table 7: Bus trigger and search options

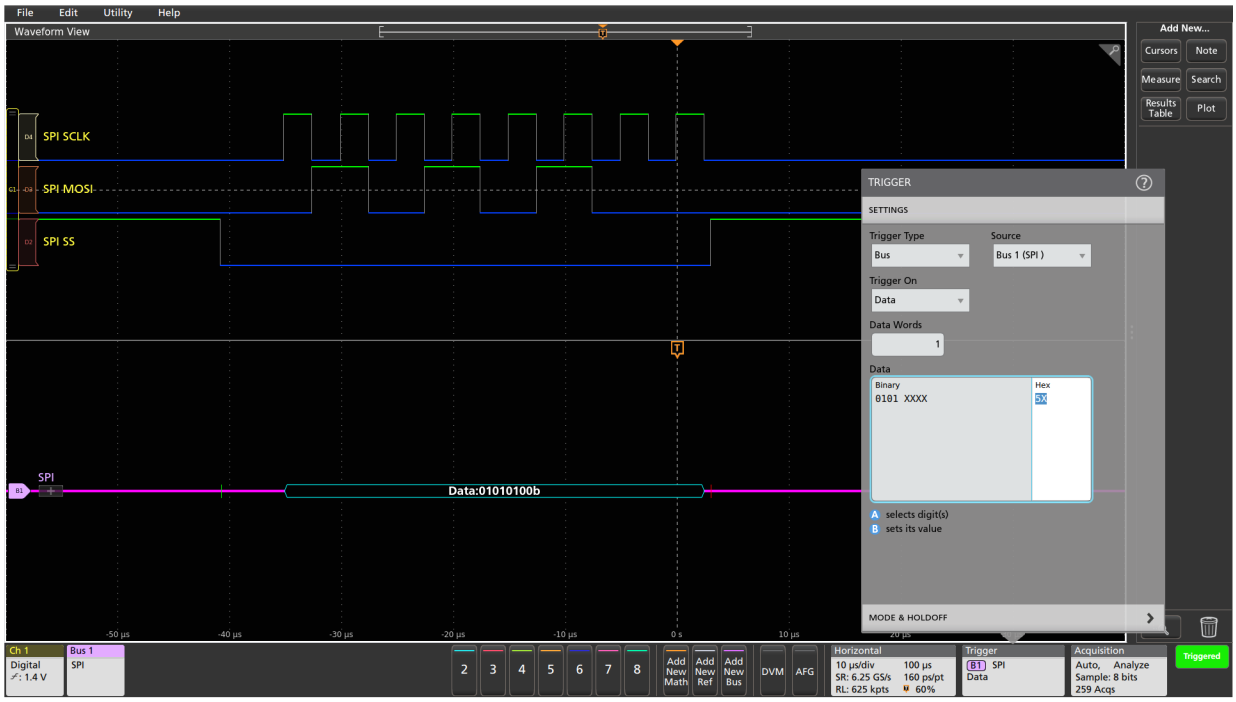
Characteristic	Description
Trigger and/or Search On	SS Active (3-wire SPI) Start of Frame (2-wire SPI) Data (1-16 bytes)

Table 8: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 10 Mb/s (automatic selection)
Decode Display	Start (green bar) Data (cyan packet) Stop (red bar)



SPI bus, captured with digital channels, showing binary display format of the color-coded SPI bus decoding.



Triggering on a specific data value on the SPI bus.

I3C characteristics[1] (Version 1.0)

Table 9: Bus setup options

Characteristic	Description
I3C Sources (Clock and Data)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Speed	High Speed (480 Mb/s) Full Speed (12 Mb/s) Low Speed (1.5 Mb/s)
Recommended Probing	Single-ended
Formats Available	Hex Binary Mixed Hex

Table 10: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

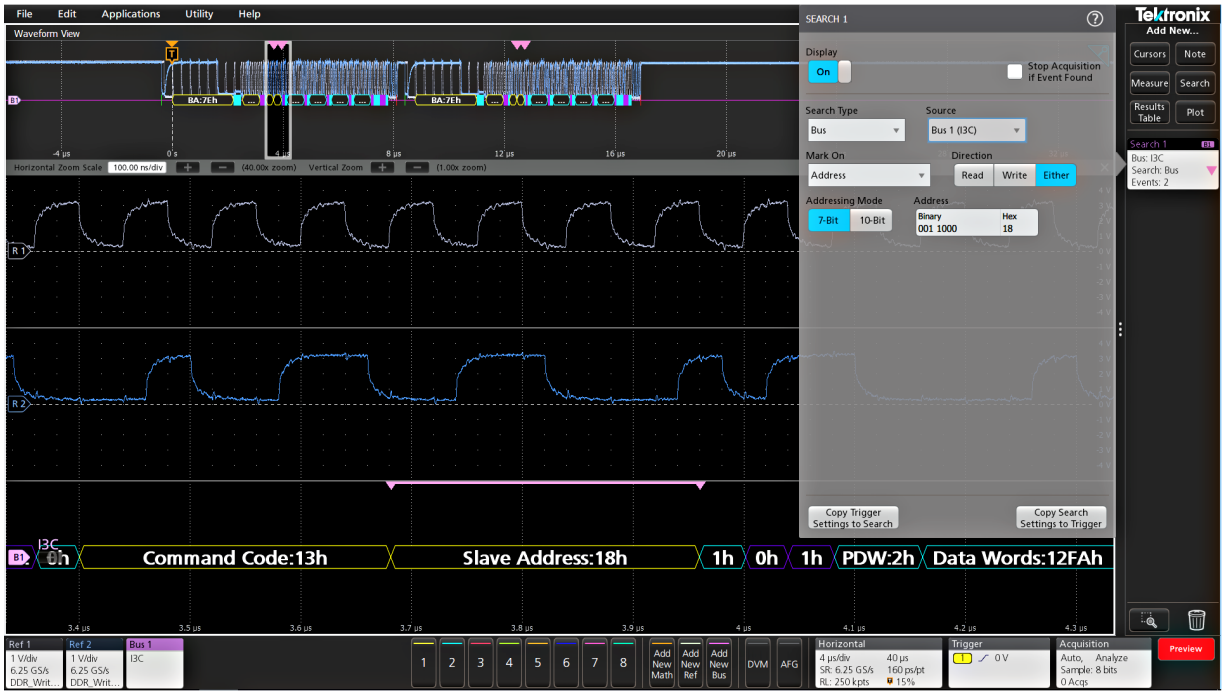
Table 11: Bus search options

Characteristic	Description
Search On	Start Repeated Start Address Data I3C SDR Direct Message I3C SDR Broadcast Message I3C DDR Message Errors Hot-Join Direct Message End Stop HDR Restart HDR Exit

Table 12: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 12.5 Mb/s (automatic selection)
Decode Display	Start (green bar) Address (yellow packet) Commands (cyan packet) Data (cyan packet) Parity (purple packet) Stop (red bar)

The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the I3C bus.



Searching on a specific data pattern on the I3C bus and automatically searching on Sync.

RS-232, RS-422, RS-485, UART characteristics

Table 13: Bus setup options

Characteristic	Description
Sources, RS-232, UART	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Sources, RS-422, RS-485	Analog channels Active Math channels[1] Active Reference channels[1]
Polarity	Normal (RS-232) Inverted (UART, RS-422, RS-485)
Parity	None Odd Even
Recommended Probing, RS-232, UART	Single-ended
Recommended Probing, RS-422, RS-485	Differential
Number of Bits	7 - 9
Formats Available	Hex Binary ASCII Packet View

Table 14: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

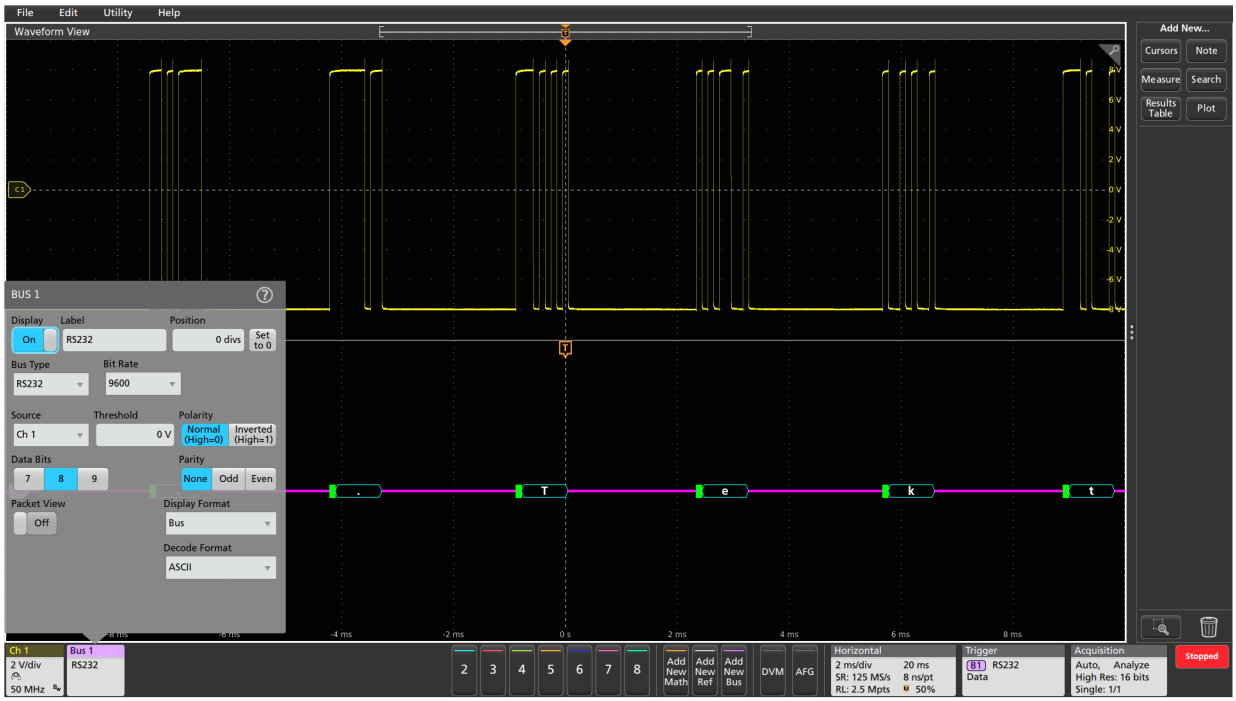
Table continued…

Table 15: Bus trigger and search options

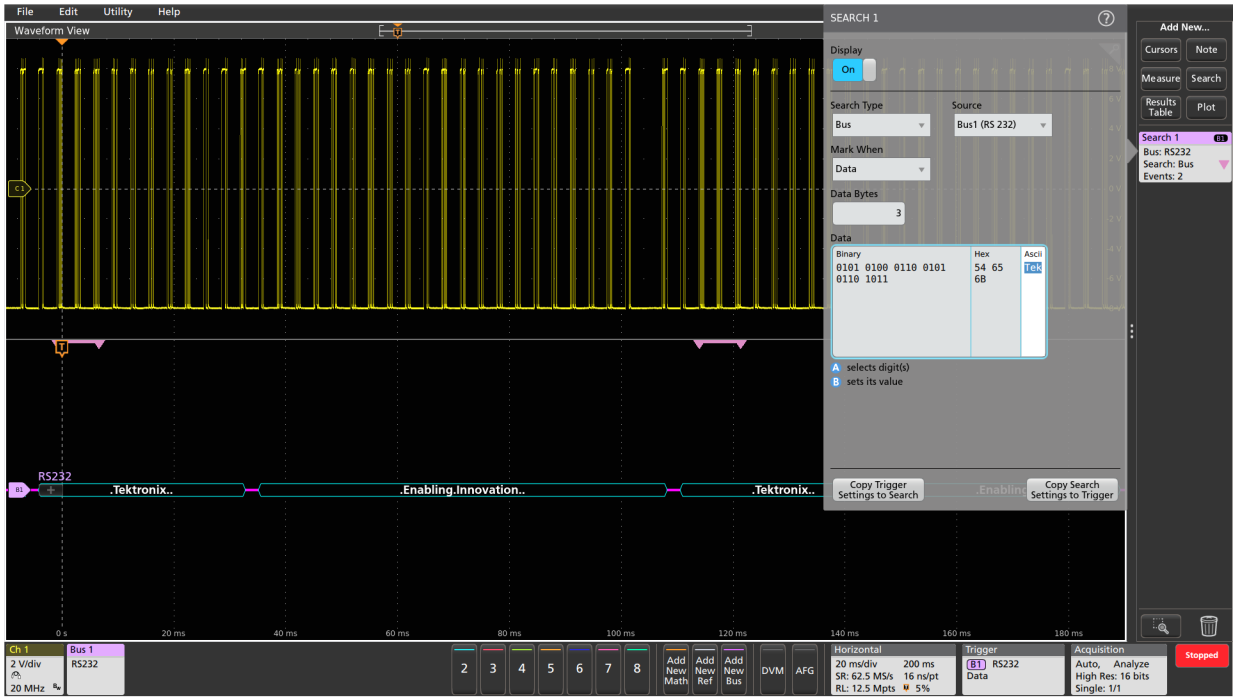
Characteristic	Description
Trigger and/or Search On	Start End of Packet Data (1 - 10 bytes) Parity Error

Table 16: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 15 Mb/s For 3 Series MDO: Up to 10 Mb/s
Bit Rate Selection	300 b/s 1,200 b/s 2,400 b/s 9,600 b/s 19,200 b/s 38,400 b/s 115,200 b/s 921,600 b/s Custom (All but 3 Series MDO: 50 b/s - 15 Mb/s Custom (for 3 Series MDO): 50 b/s - 10 Mb/s
Decode Display	Start (green packet) Data (cyan packet) Parity (purple packet) Parity Error (red packet)



RS-232 bus setup and ASCII display, showing assignment of source signal, digital threshold, and polarity.



RS-232 bus shown in Packet View format, with the Wave Inspector search automatically searching for the data string "Tek".

CAN characteristics (Version 2.0)

Table 17: Bus setup options

Characteristic	Description
Source for CAN_H, CAN_L, Rx, or Tx (single-ended probing)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Source for Diff (differential probing)	Analog channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing: CAN_H, CAN_L, Rx, Tx Diff	Single-ended Differential
Bit Rate Selection: Predefined list of rates Custom	10 kb/s - 1 Mb/s All but 3 Series MDO: 1 kb/s - 1 Mb/s 3 Series MDO: 10 kb/s - 1 Mb/s
Sample Point	All but 3 Series MDO: 0% - 100% of bit period of unit interval 3 Series MDO: 5% - 95% of bit period of unit interval
Formats Available	Mixed Hex Hex Binary Symbolic (.dbc)[1]

Table 18: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table continued…

Table 19: Bus trigger and search options

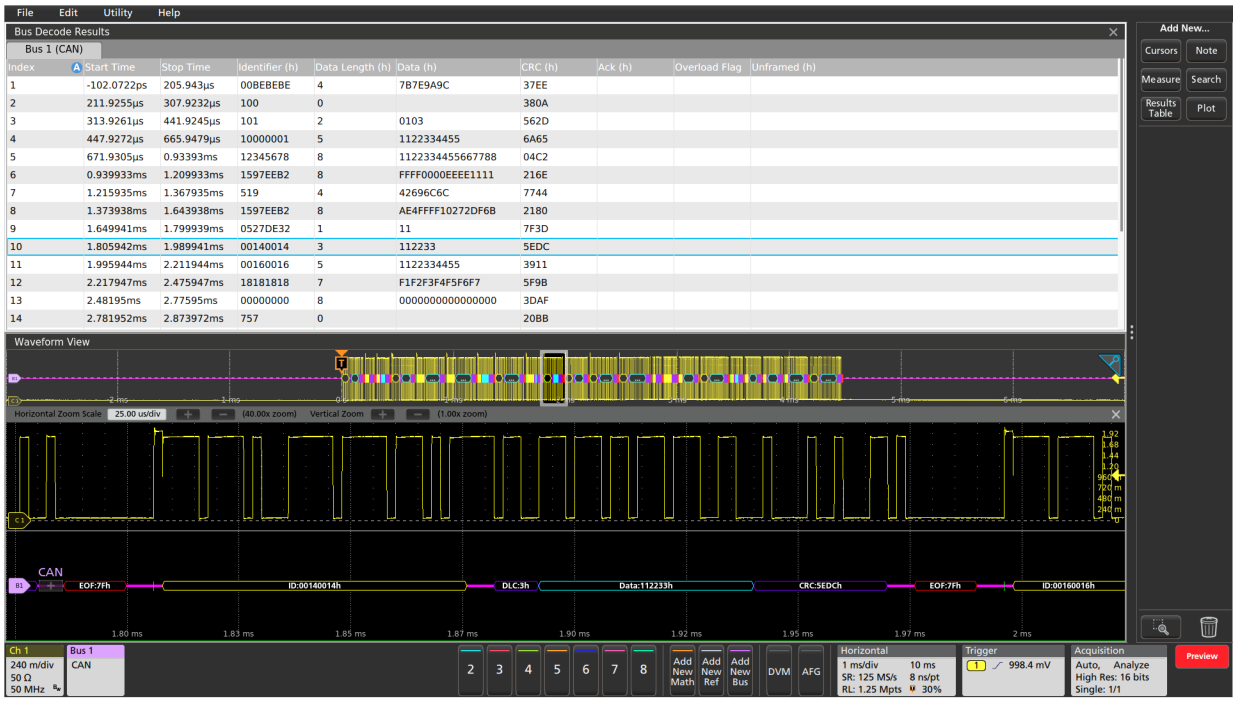
Characteristic	Description
Trigger and/or Search On	Start of Frame Type of Frame (Data, Remote, Error, Overload) Identifier (Standard or Extended) Data (number of bytes 1-8, trigger or search when =, ≠, <, ≤, >, ≥) Identifier and Data EOF Missing Ack Bit Stuff Error

Table 20: Symbolic bus search options

Characteristic	Description
Message	As defined by the .dbc file[1]
Message and Signal	As defined by the .dbc file[1]

Table 21: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 1 Mb/s (automatic selection)
Decode Display	Start of Frame (green bar) Identifier (yellow packet) Data Length Control (purple packet) Data (cyan packet) CRC (purple packet) End of Frame (red bar) Errors (red packet)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the CAN bus.

Triggering on a specific extended Identifier value on the CAN bus.

CAN FD (ISO and non-ISO) characteristics

Table 22: Bus setup options

Characteristic	Description
Source for CAN_H, CAN_L, Rx, or Tx (single-ended probing)	Analog channels Digital channels Active Math channels [1] Active Reference channels[1]
Source for Diff (differential probing)	Analog channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing: CAN_H, CAN_L, Rx, or Tx Diff	Single -ended Differential
Version	ISO non-ISO
SD Bit Rate Selection: Predefined list of rates Custom	10 kb/s - 1 Mb/s All but 3 Series MDO: 50 kb/s - 10 Mb/s 3 Series MDO: 10 kb/s - 1 Mb/s
FD Bit Rate Selection: Predefined list of rates Custom	All but 3 Series MDO: 1 Mb/s - 16 Mb/s 3 Series MDO: 1 Mb/s - 7 Mb/s All but 3 Series MDO: 500 kb/s - 16 Mb/s 3 Series MDO: 500 kb/s - 7 Mb/s
Sample Point	All but 3 Series MDO: 55% - 95% of bit period of unit interval 3 Series MDO: 15% - 95% of bit period of unit interval
Formats Available	Mixed Hex Hex Binary
	Symbolic (.dbc)[1]

Table 23: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table 24: Bus trigger and search options

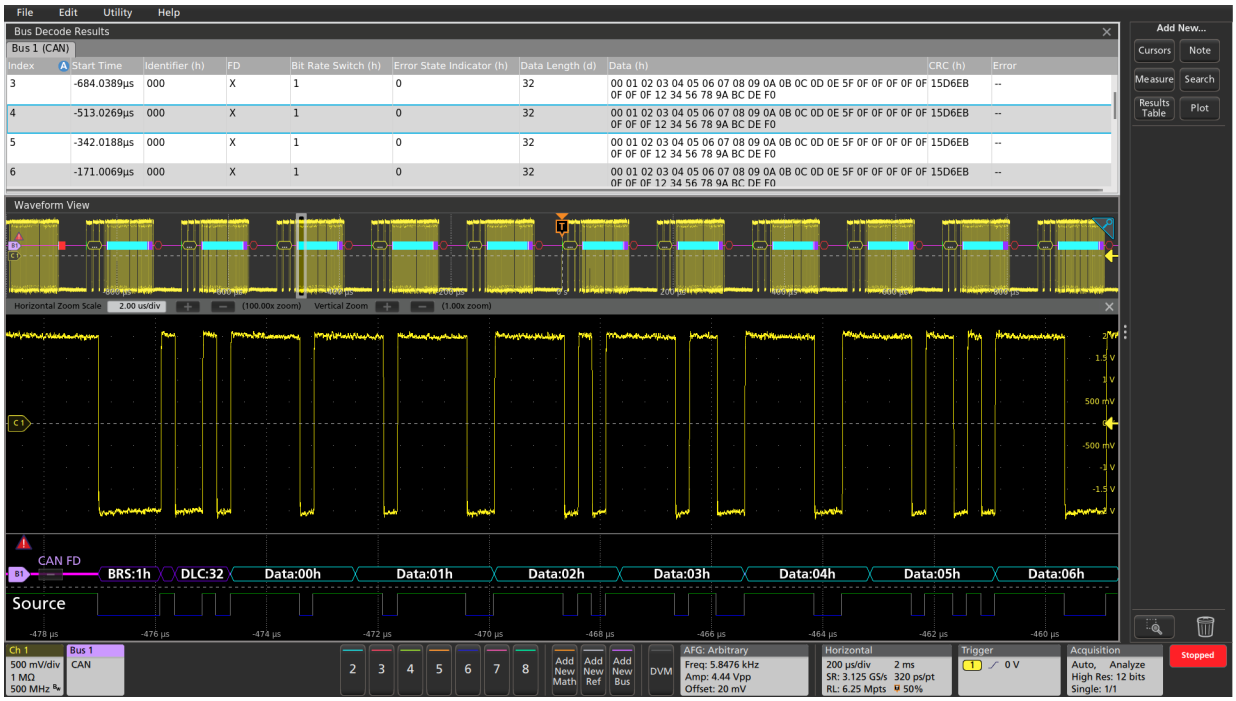
Characteristic	Description
Trigger and/or Search On	Start of Frame Type of Frame (Data, Remote, Error, Overload) FD Bits (Bit Rate Switch bit, Error State Indicator bit) Identifier (Standard or Extended) Data (1-8 bytes, trigger or search when =, ≠, <, ≤, >, ≥) Identifier and Data End of Frame Error (Missing Ack, Bit Stuffing Error, FD Form Error, Any Error)

Table 25: Symbolic bus search options

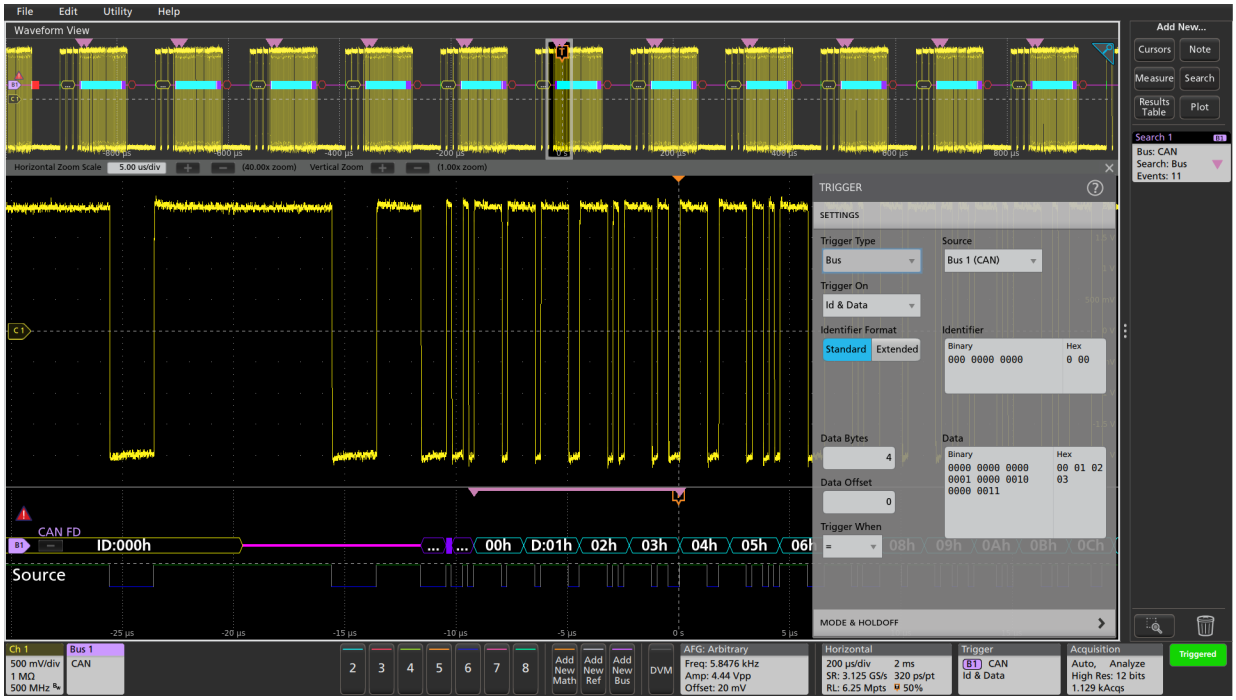
Characteristic	Description
Message	As defined by the .dbc file[1]
Message and Signal	As defined by the .dbc file[1]

Table 26: Bus decode

Characteristic	Description
Decode Display	Start of Frame (green bar) Identifier (yellow packet) Data Length Control (purple packet) Data (cyan packet) CRC (purple packet) End of Frame (red bar) Errors (red packet)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the CAN FD bus.



Triggering on a specific Identifier value and data pattern on the CAN FD bus and automatically searching on the same data pattern.

LIN characteristics (Version 2.0)

Table 27: Bus setup options

Characteristic	Description
LIN Source	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Polarity	Normal Inverted
Bit Rate Selection: Predefined list of rates Custom	1.2 kb/s - 19.2 kb/s All but 3 Series MDO: 1 kb/s - 100 kb/s 3 Series MDO: 800 b/s - 100 kb/s
Sample Point	All but 3 Series MDO: 0% - 100% of bit period of unit interval 3 Series MDO: 10% - 90% of bit period of unit interval
LIN Standard	V 1.x V 2.x Both
Include Parity Bits with ID	Yes No
Formats Available	Hex Binary Mixed

Table 28: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

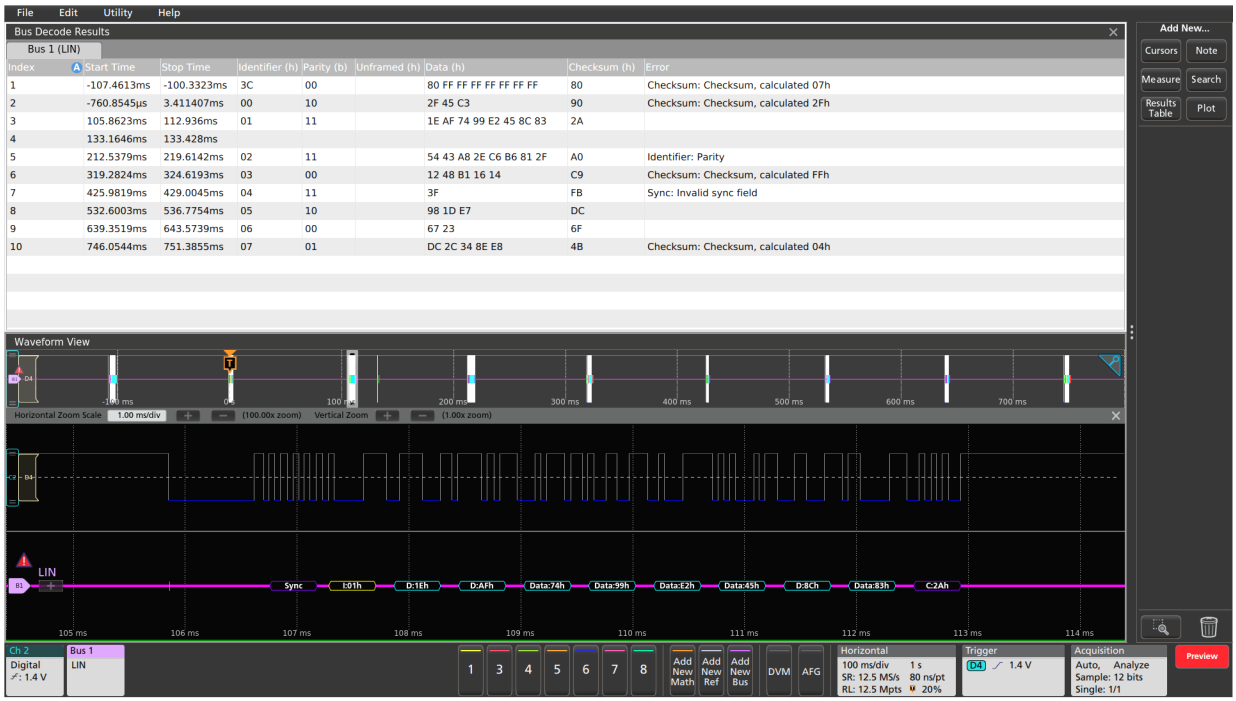
Table 29: Bus trigger and search options

Characteristic	Description
Trigger and/or Search On	Sync Identifier Data (number of bytes 1-8, trigger or search when =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) ID and Data Wakeup Frame Sleep Frame Error (Sync, ID Parity, Checksum)

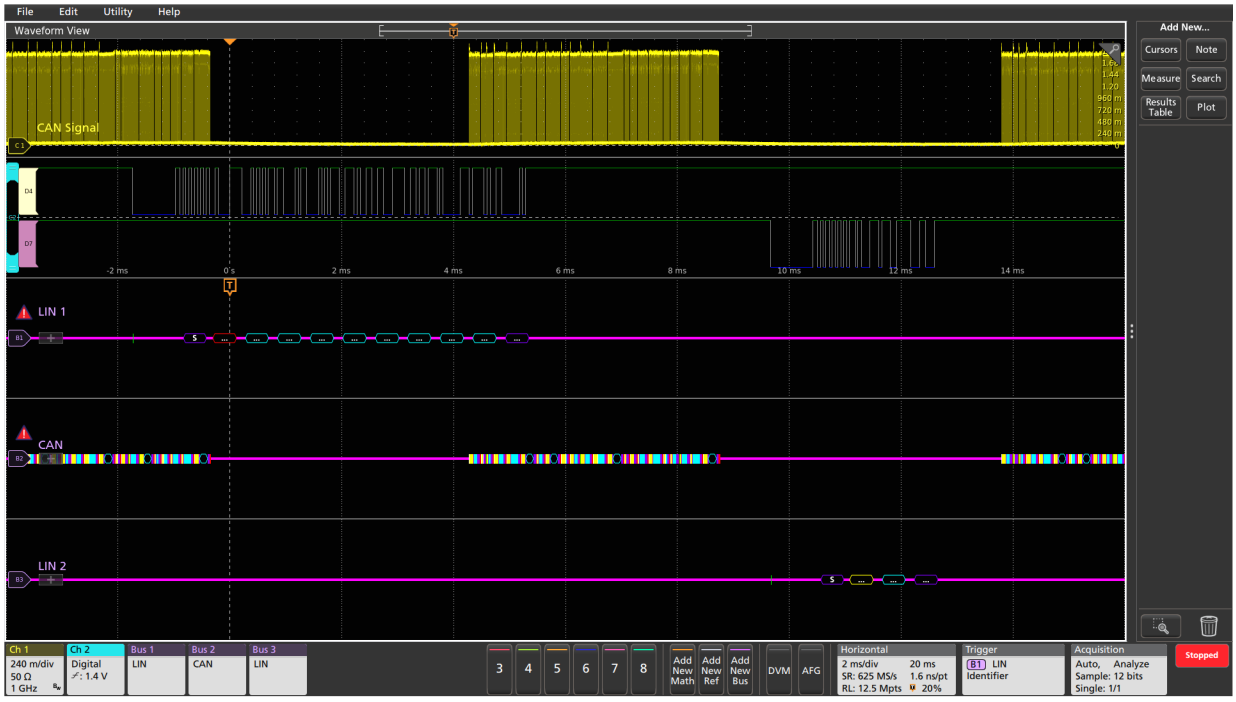
Table 30: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 100 kb/s, by LIN definition up to 20 kb/s (for automated decoding of bus)
Decode Display	Start of Frame (green bar) Sync Identifier (yellow packet) Data (cyan packet) CRC (purple packet) Errors (red packet)

Table continued…



Protocol Decode Results Table provides a time-stamped, tabular view of all captured LIN packets.



Display of multiple LIN and CAN buses, showing timing between the buses.

FlexRay characteristics (Version 2.0)

Table 31: Bus setup options

Characteristic	Description
Source for Differential Probing (Bdiff)	Analog channels Active Math channels[1] Active Reference channels[1]
Source for Single-ended Probing (BP, BM)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Source for Single-ended Probing (Tx, Rx)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Thresholds: Bdiff BP, BM (analog channels) BP, BM (digital channels) Tx, Rx	 High and Low thresholds High and Low thresholds Single threshold Single threshold
Recommended Probing: Bdiff, BP, BM Tx, Rx	 Differential Single-ended
Channel Type	A B
Bit Rate Selection: Predefined list of rates Custom	 2.5 Mb/s, 5 Mb/s, 10 Mb/s 1 Mb/s - 10 Mb/s
Formats Available	Hex Binary
	Mixed Hex (Decimal: ID, Len, and Count; Hex: Data and CRCs)

Table 32: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table 33: Bus trigger and search options

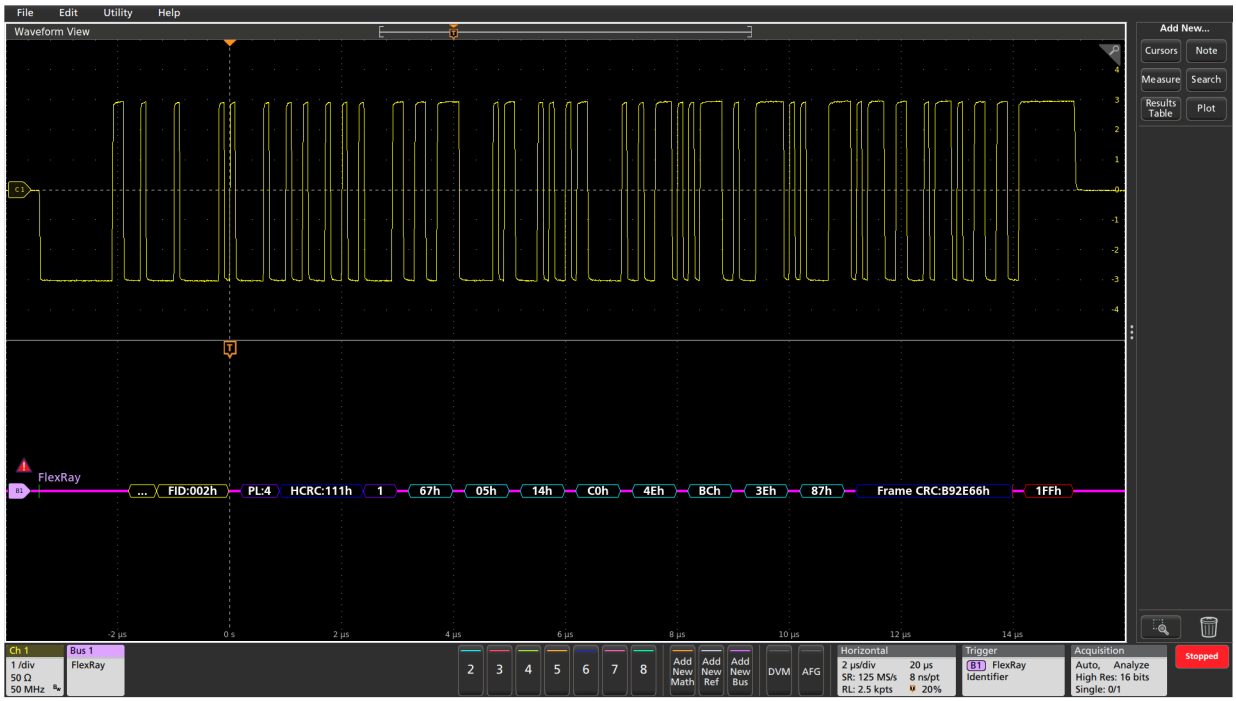
Characteristic	Description
Trigger and/or Search On	Start of Frame Indicator Bits (Normal, Payload, Null, Sync, Startup) Cycle Count (when =, ≠, <, ≤, >, ≥) Header Fields (Indicator Bits, Identifier, Payload Length, Header CRC, and Cycle Count) Identifier (when =, ≠, <, ≤, >, ≥) Data (when =, ≠, <, >, ≤, ≥) Identifier and Data End Of Frame (Static, Dynamic) Error (Header CRC, Trailer CRC, NULL Frame in Static, NULL Frame in Dynamic, Sync Frame in Dynamic, Start Frame No Sync)

Table 34: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 10 Mb/s (for automated decoding of bus)

Table continued…

Characteristic	Description
Decode Display	TTS (purple box) Start (green bracket) Frame ID (yellow box) Payload Length (purple box) Headers (purple box) Cycle Count (yellow box) Data (cyan box) CRC, DTS, CID (purple box) Stop (red bracket)



Decoded FlexRay bus, with the acquisition triggered on a specified identifier value.

Decoded FlexRay bus, with all data values in a specific range marked with pink brackets.

SENT Characteristics[1]

Table 35: Bus setup options

Characteristic	Description
SENT source	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Polarity	Normal Inverted
Clock Tick	1 µs - 300 µs
Tick Tolerance	1% - 30%
Fast Data Channels	1 or 2
Data Nibbles (1 Fast Data Channel)	3, 4, or 6 nibbles
Channel Widths (C1/C2) (2 Fast Data Channels)	12/12, 14/10, or 16/8 bits
Pause Pulse	Yes No
Slow Channel	None Enhanced w/ 4-bit ID Enhanced w/ 8-bit ID Short
Formats Available	Mixed Hex Binary Hex Mixed Decimal

Table 36: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table continued…

Table 37: Bus trigger options

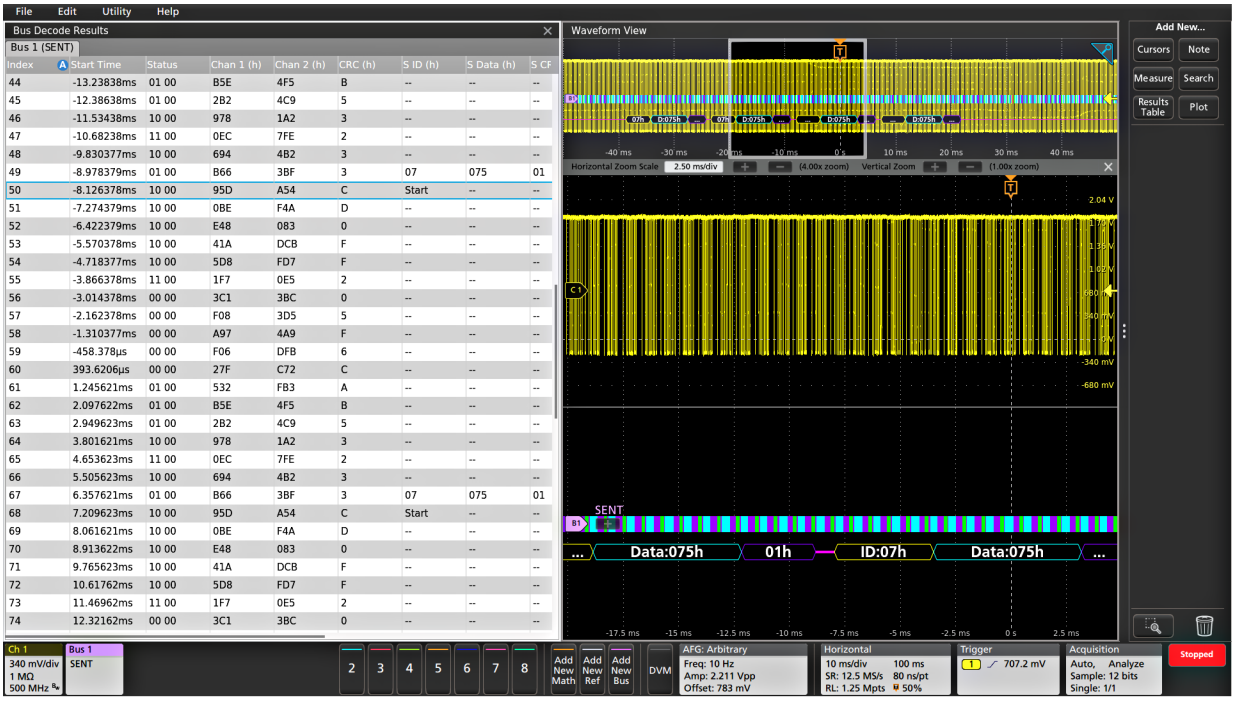
Characteristic	Description
Trigger On	Start of Packet Fast Channel(s) (Status/Communication, Data) Slow Channel (Message ID, Data) CRC Error (Fast channel, Slow channel)

Table 38: Bus search options

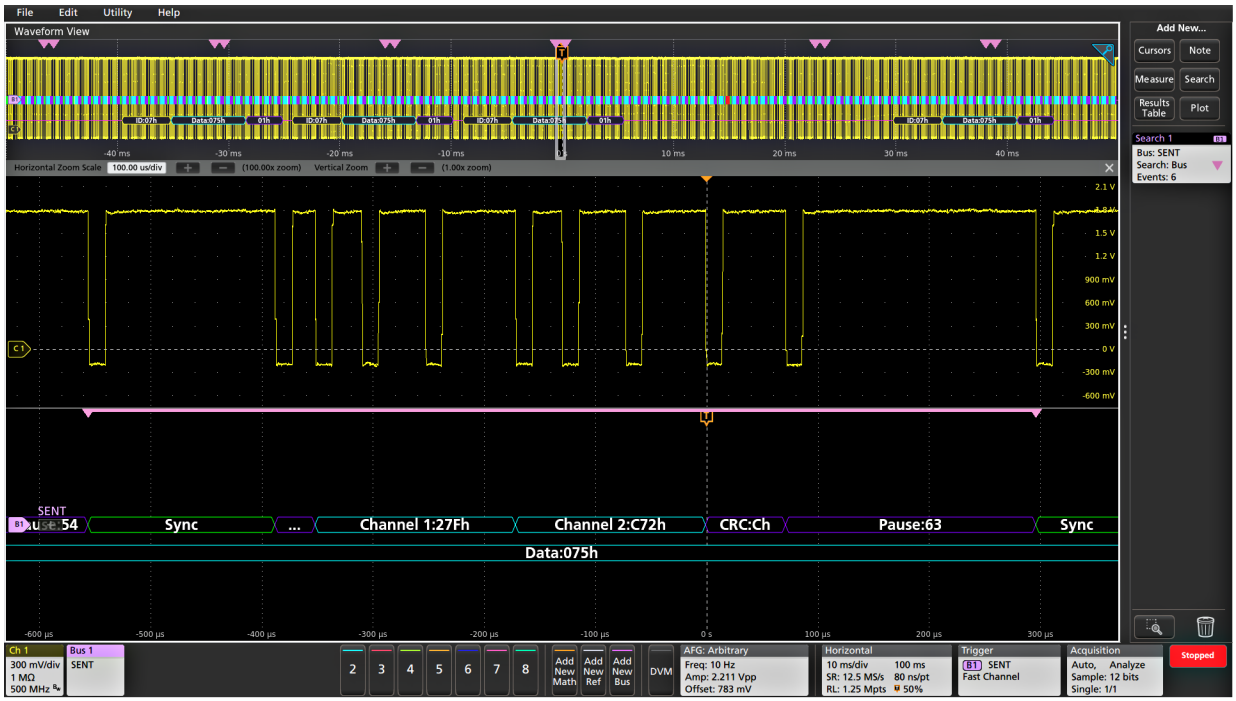
Characteristic	Description
Search On	Start of Packet Fast Channel(s) (Status/Communication, Data) Slow Channel (Message ID, Data) Pause Pulse (Number of Ticks) Error (Frame Length, Fast channel CRC, Slow channel CRC)

Table 39: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 10 Mb/s (for automated decoding of bus)
Decode Display	Sync (green packet) Fast Channel Status (purple packet) Slow Channel Message ID (yellow packet) Data (cyan packet) CRC (purple packet) Pause (purple packet) Errors (red packet)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SENT bus.



Triggering on a specific Fast Channel Status and data pattern on the SENT bus and automatically searching on the same data pattern.

MIL-STD-1553 characteristics

Table 40: Bus setup options

Characteristic	Description
MIL-STD-1553 Source	Analog channels Active Math channels Active Reference channels
Polarity	Normal Inverted
Thresholds	Single-ended: Per-channel thresholds Differential: High and low thresholds
Recommended Probing	Single-ended or differential
Bit Rate	1 Mb/s per the standard
Response Time	2 µs-100 µs
Formats Available	Mixed Hex Mixed ASCII Hex Binary

Table 41: Display modes

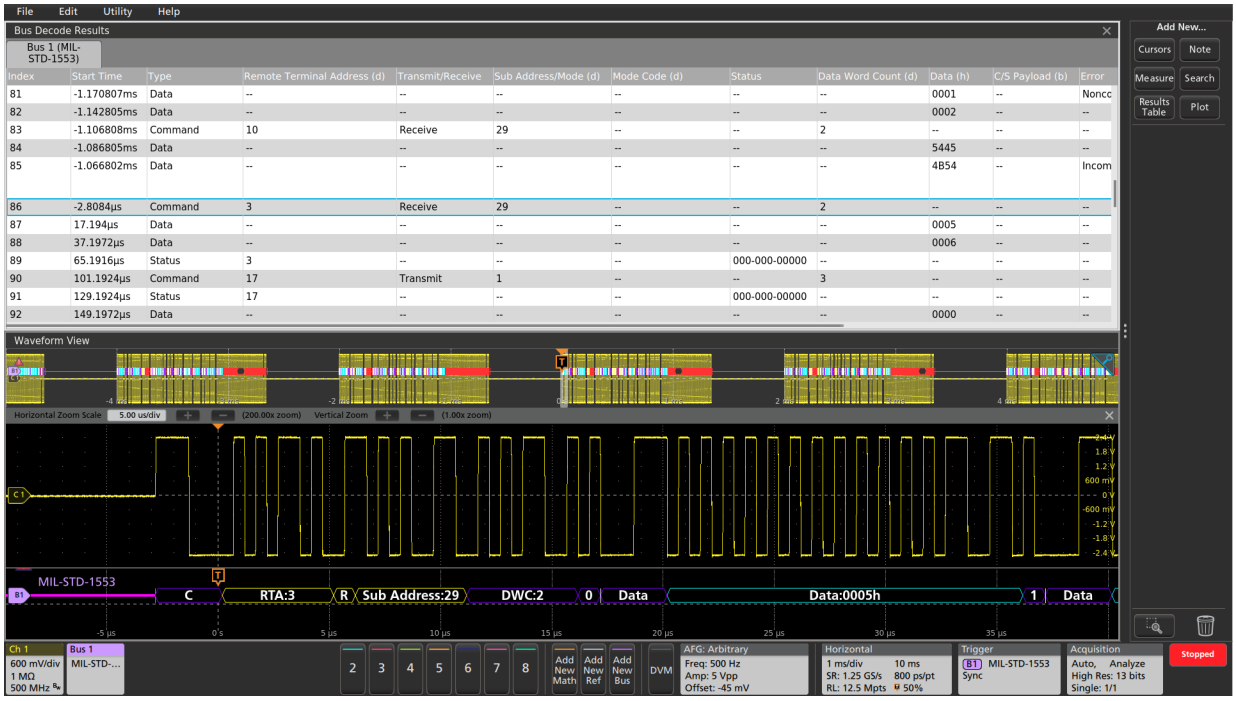
Characteristic	Description
Bus	Bus only
Results Table	Decoded packet data in a tabular view

Table 42: Bus trigger and search options

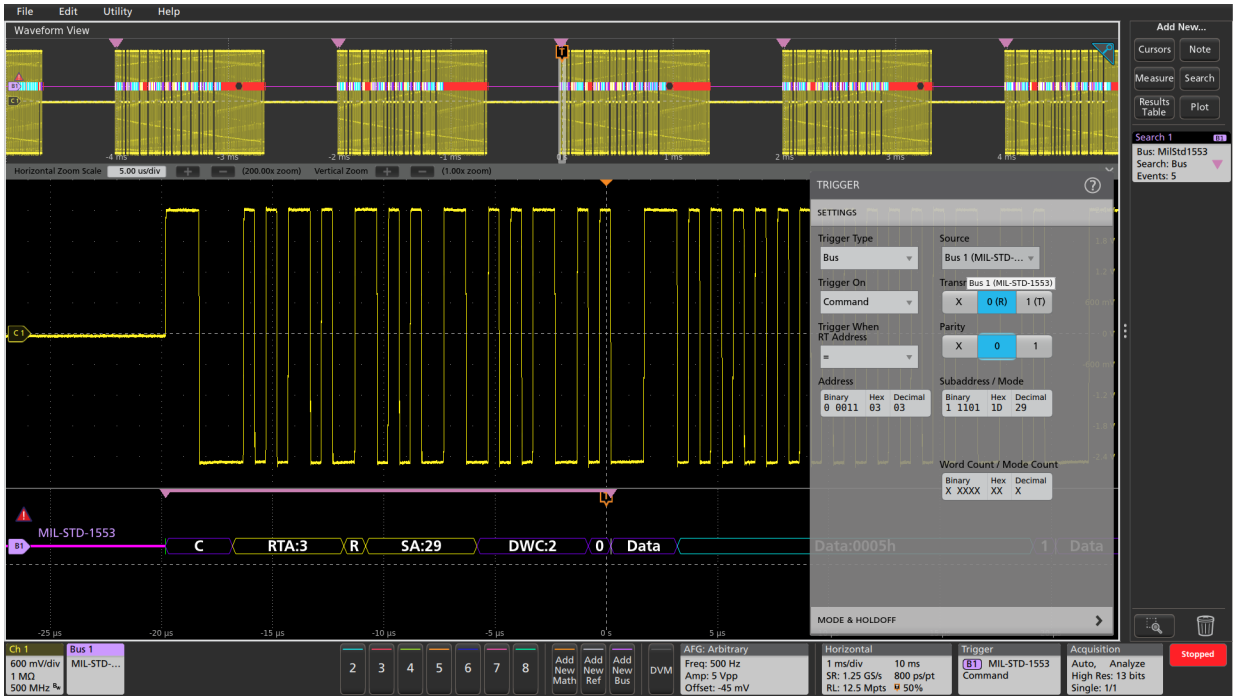
Characteristic	Description
Trigger and/or Search On	Sync Command (Transmit/Receive Bit, Parity, Subaddress / Mode, Word Count / Mode Count, and RT Address =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Status (Parity, Bit 9 - Message Error, Bit 10 - Instrumentation, Bit 11 - Service Request, Bit 15 - Broadcast Command Received, Bit 16 - Busy, Bit 17 - Subsystem Flag, Bit 18 - Dynamic Bus Control Acceptance, Bit 19 - Terminal Flag, and Data =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Data (Parity, and Data =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Time (RT / IMG) (> Maximum, < Minimum, Inside range, Outside Range) Error (Parity Error, Sync Error, Manchester Error (trigger only), Non-contiguous Data)

Table 43: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 1Mb/s (for automated decoding of bus)
Decode Display	Start (green bar) Sync (purple packet with Word Type identified) Address (yellow packet) R/T (purple packet) Word Count (purple packet) Data (cyan packet) Parity (purple packet) Errors (red packet) Stop (red bar)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured MIL-STD-1553 packets.



Triggering on a specific command pattern on the MIL-STD-1553 bus and automatically searching on the same pattern.

ARINC 429 characteristics (ARINC Specs 429 PART 1-17)

Table 44: Bus setup options

Characteristic	Description
ARINC 429 Source	Analog channels Active Math channels Active Reference channels
Signal Type	Differential
Polarity	Normal Inverted
Thresholds	High and low thresholds
Recommended Probing	Differential
Bit Rate Selection: Predefined list of rates Custom	12.5 kb/s, 100 kb/s 10 kb/s - 1 Mb/s
Data Format	Data (19 bits) SDI+Data (21 bits) SDI+Data+SSM (23 bits)
Formats Available	Mixed Hex Hex Binary

Table 45: Display modes

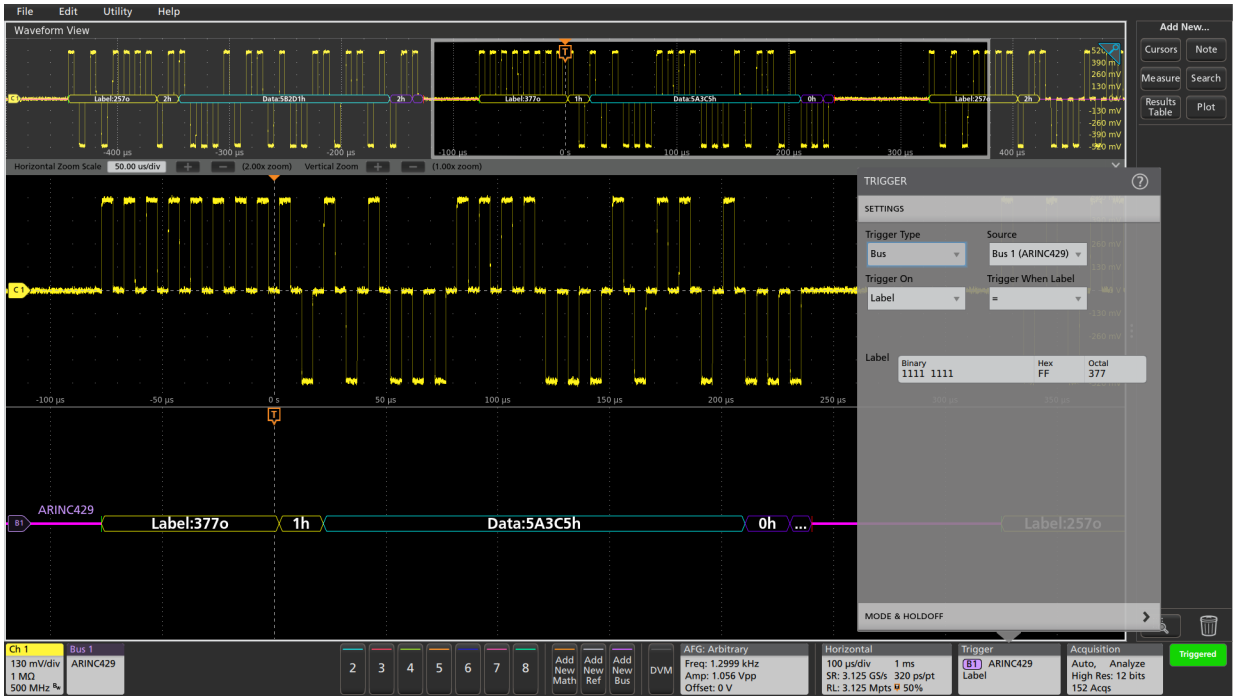
Characteristic	Description
Bus	Bus only
Results Table	Decoded packet data in a tabular view

Table 46: Bus trigger and search options

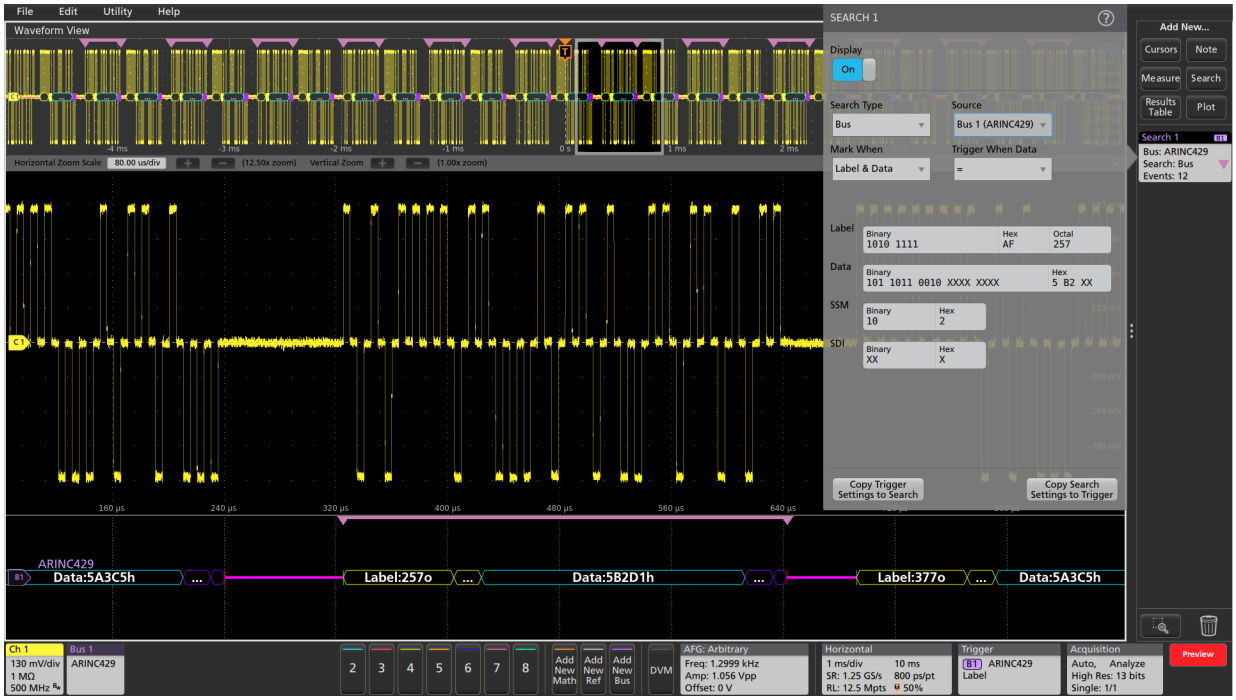
Characteristic	Description
Trigger and/or Search On	Word Start Label (when =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Data (when =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Label and Data (Label value and Data =, ≠, <, ≤, >, ≥, Inside Range, Outside Range) Word End Error (Any Error, Parity Error, Word Error, Gap Error)

Table 47: Bus decode

Characteristic	Description
Decode Display	Start (green bracket) Label (yellow box) Source Destination Identifier (yellow box) Data (cyan box) Sign/Status Matrix (purple box) Parity (purple box) Stop (red bracket) Error (red box)



Decoded ARINC 429 bus, with the acquisition triggered on a specified label value.



Decoded ARINC 429 bus, with all data values in a specific range marked with pink brackets.

Audio characteristics

Table 48: Bus setup options

Characteristic	Description
Audio Sources (Bit Clock, Word Select, Data)	Analog channels Digital channels Active Math channels[1] Active Reference channels[1]
Thresholds	Per-channel thresholds
Bit Clock Polarity	Rising Edge Falling Edge
Word Select Polarity	Normal Invert
Data Polarity	Active High Active Low
Word Size	4 - 32 bits
Formats Available	Hex Binary Signed Decimal

Table 49: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

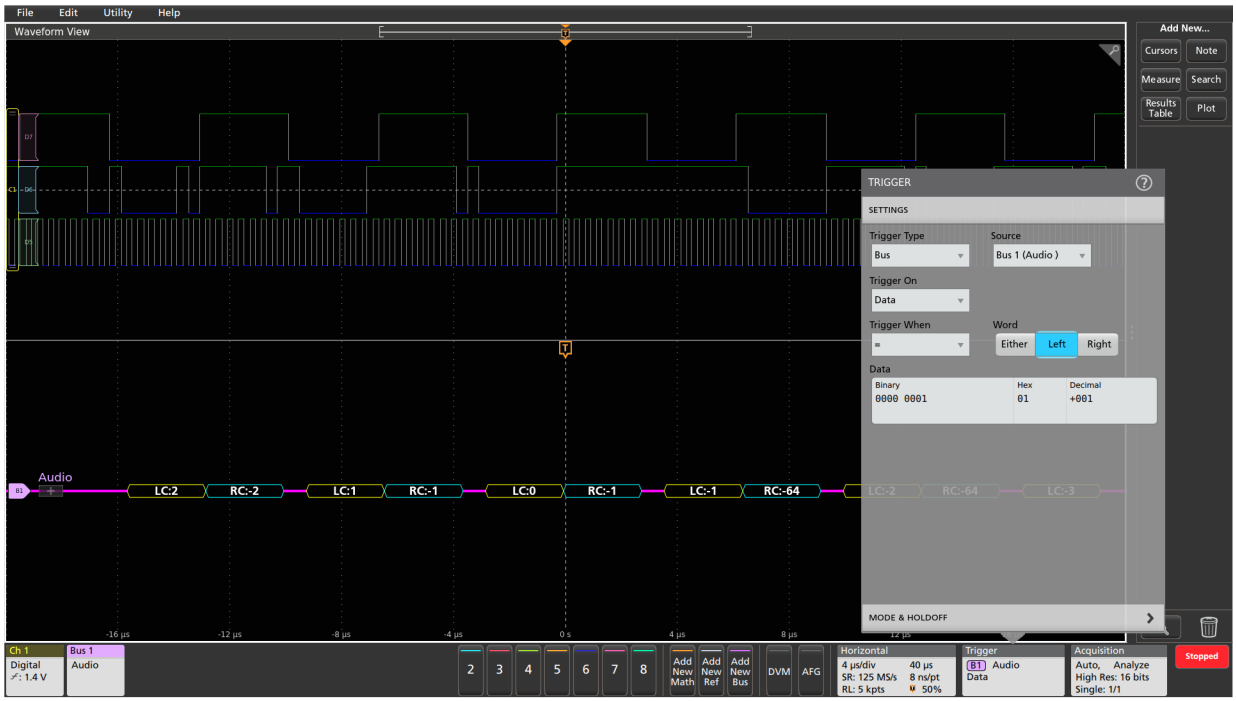
Table continued…

Table 50: Bus trigger and search options

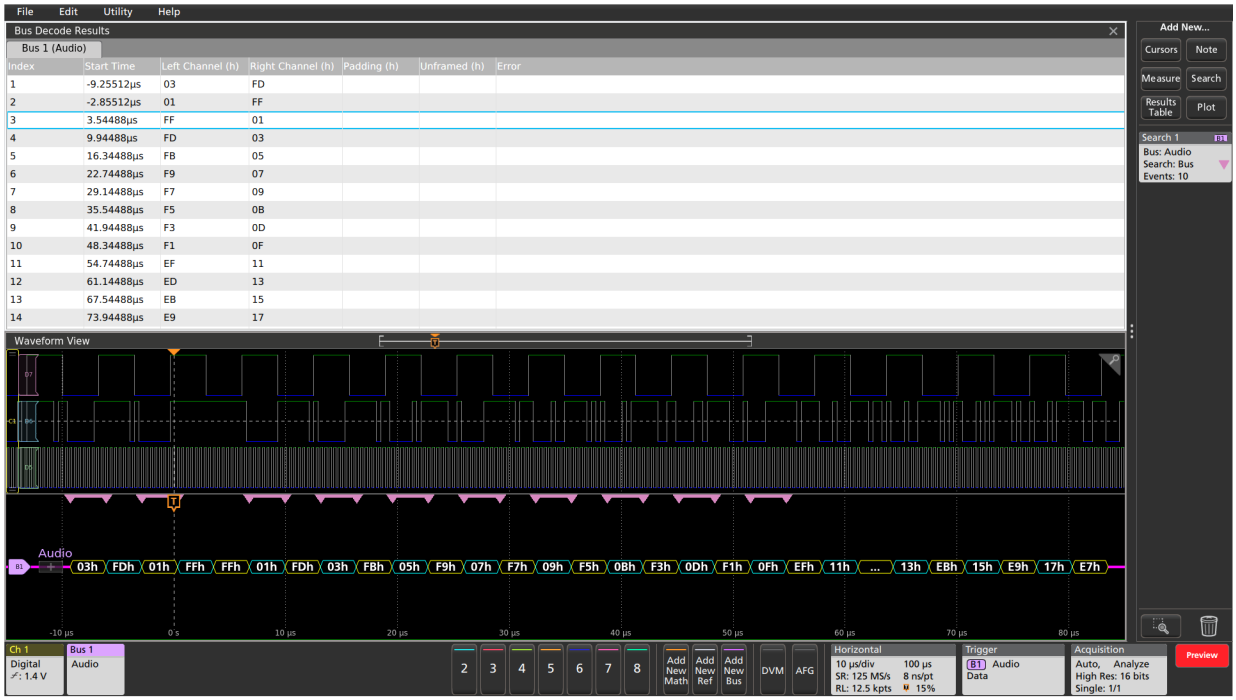
Characteristic	Description
Trigger and/or Search On	Word Select (I^2S, LJ, RJ only) Frame Sync (TDM only) Data (when =, ≠, <, >, ≤, ≥, Inside Range, Outside Range; Left, Right, or Either Word)

Table 51: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	All but 3 Series MDO: Up to 10 Mb/s (for automated decoding of bus) 3 Series MDO: Up to 12.5 Mb/s (for automated decoding of I2S/LJ/RJ bus) 3 Series MDO: Up to 25 Mb/s (for automated decoding of TDM bus)
Decode Display	Left Channel Data (I^2S, LJ, RJ) (yellow box) Right Channel Data (I^2S, LJ, RJ) (cyan box) Channel 1 Data (TDM) (yellow box) Channel 2 - N Data (TDM) (cyan box)



Decoded I²S bus, with data values displayed in signed decimal format, and the MSO triggered on a specific data value.



Decoded I²S bus, with data values displayed in hex and Results Table format, and the Wave Inspector automatic search marking all occurrences of the data values equal to 0X hex.

USB 2.0 Characteristics (Version 2.0)

Table 52: Bus setup options

Characteristic	Description
USB 2.0 Source(s)	Analog channels Digital channels (single-ended) Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Speed	High Speed (480 Mb/s) Full Speed (12 Mb/s) Low Speed (1.5 Mb/s)
Recommended Probing, LS and FS	Single-ended
Recommended Probing, HS	Differential
Formats Available	Mixed Hex Hex Binary Mixed ASCII

Table 53: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table 54: Bus trigger options

Characteristic	Description
Trigger On	Sync Reset Suspend Resume End of Packet Token (address) Packet Data Packet
	Handshake Packet: ACK, NAK, STALL, NYET (HS only) Special Packet: PRE (FS only), ERR, SPLIT, PING, Reserved Error: PID check, CRC5 or CRC16, Bit stuffing (LS and FS only)

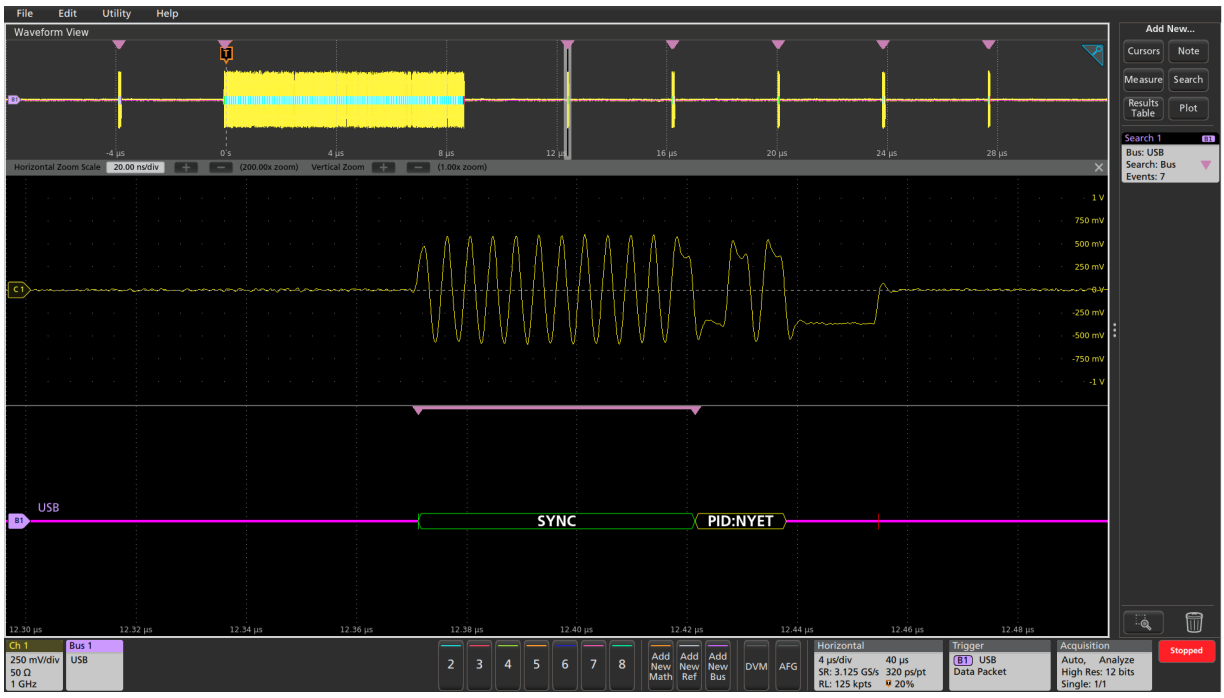
Table 55: Bus Search options

Characteristic	Description
Search On	Sync Reset Suspend Resume End of Packet Token (address) Packet Data Packet Handshake Packet: ACK, NAK, STALL, NYET (HS only) Special Packet: PRE (FS only), ERR, SPLIT, PING, Reserved Error: PID check, CRC5 or CRC16, Bit stuffing (LS and FS only)

Table 56: Bus decode

Characteristic	Description
Decode Display	Start of packet (green bar) Sync (green packet) PID (yellow packet) Token (address) (yellow packet) Data (cyan packet) CRC (purple packet) Error (red packet) End of packet (red bar)

Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the USB bus.



Triggering on a specific data pattern on the USB 2.0 bus and automatically searching on Sync.

Ethernet characteristics[1]

Table 57: Bus setup options

Characteristic	Description
Ethernet Source(s)	Analog channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Speed	10BASE-T 100BASE-TX
Recommended Probing	Differential
Formats Available	Mixed Hex Hex Binary Mixed ASCII

Table 58: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table 59: Bus trigger options

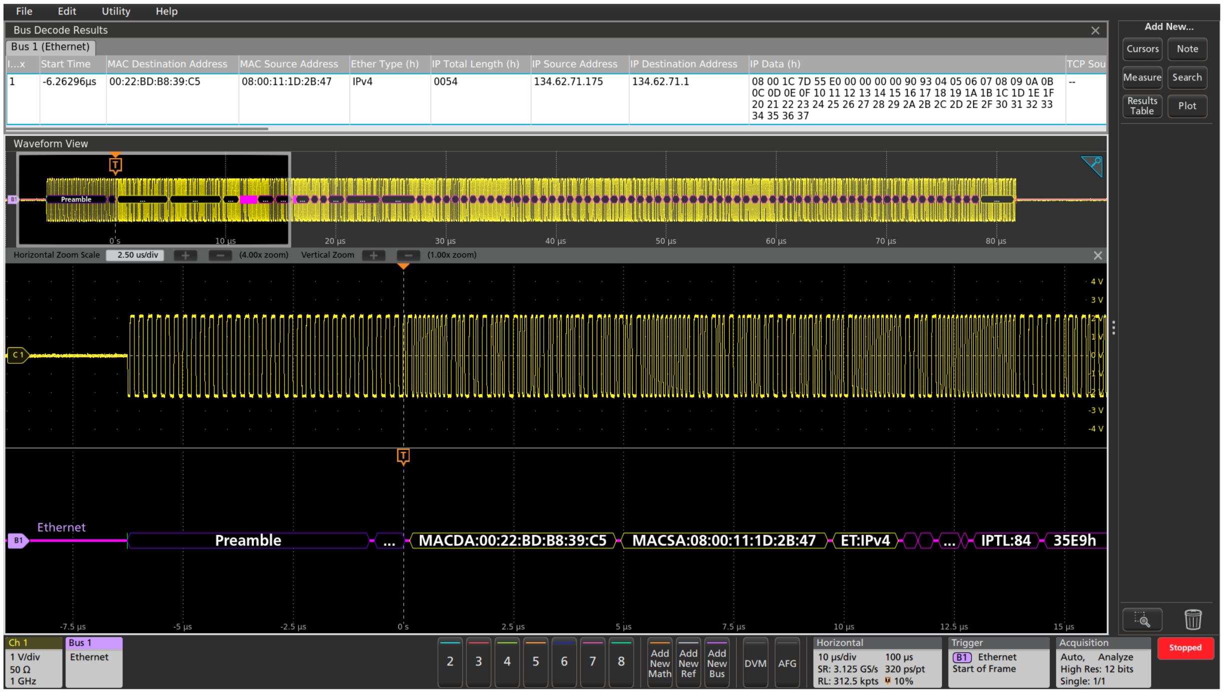
Characteristic	Description
Trigger On	Start Frame Delimiter MAC Addresses Q-Tag Control Information MAC Length/Type IPv4 Header TCP Header MAC Data TCP-IPv4 Client Data Idle End of Packet Frame Check Sequence (CRC) Error

Table 60: Bus search options

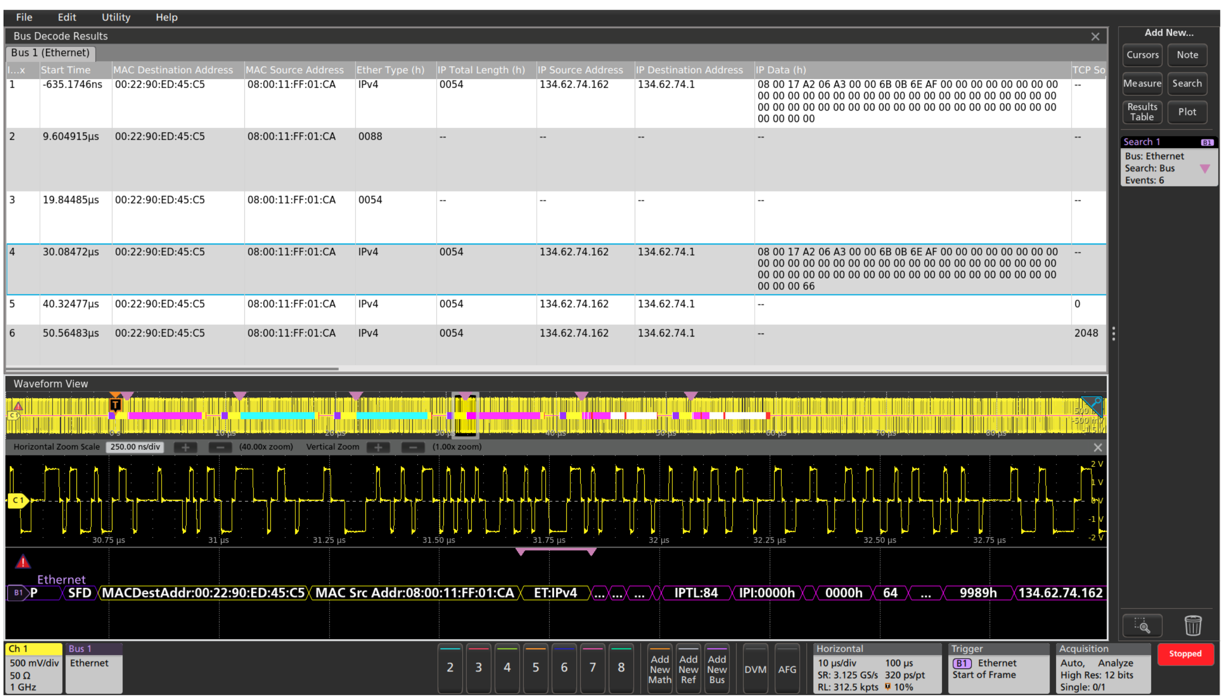
Characteristic	Description
Search On	Start Frame Delimiter MAC Addresses Q-Tag Control Information MAC Length/Type IPv4 Header TCP Header MAC Data TCP-IPv4 Client Data Idle End of Packet Frame Check Sequence (CRC) Error

Table 61: Bus decode

Characteristic	Description
Decode Display	Start of Packet (green bar) Preamble (purple packet) SFD (purple packet) Address (yellow packet) EtherType (yellow packet) IP packet (purple packet) Data (cyan packet) IPv4 packet (pink packet) TCP packet (white packet) Frame Check Sequence (yellow packet) Error (red packet) End of packet (red bar)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the 10BASE-T Ethernet bus



Triggering and automatically searching on the 100BASE-TX Ethernet bus.

SPMI characteristics[1] (Version 2.0)

Table 62: Bus setup options

Characteristic	Description
SPMI Sources (Clock and Data)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Formats Available	Mixed Hex Hex Binary

Table 63: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table 64: Bus trigger options

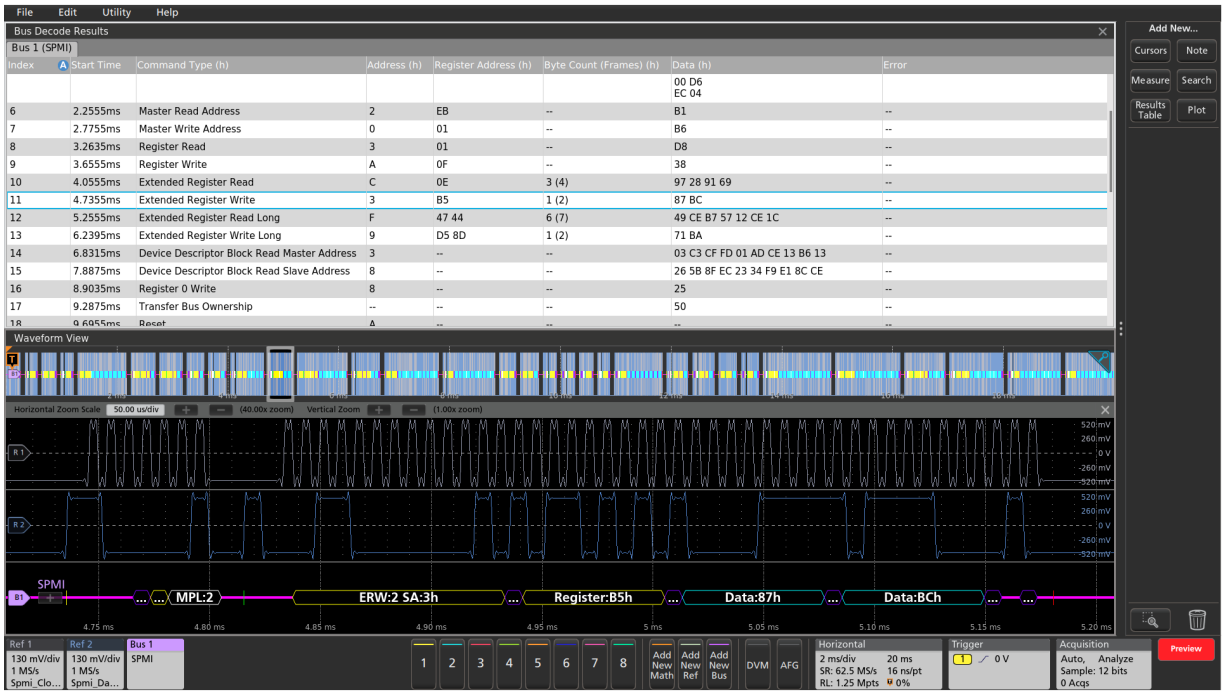
Characteristic	Description
Trigger On	Sequence Start Condition (SSC) Reset Sleep Shutdown Wakeup Authenticate Master Read Master Write Register Read Register Write Extended Register Read Extended Register Write Extended Register Read Long Extended Register Write Long Device Descriptor Block Master Read Device Descriptor Block Slave Read Register 0 Write Transfer Bus Ownership Parity Error

Table 65: Bus search options

Characteristic	Description
Search On	Sequence Start Condition (SSC) Reset Sleep Shutdown Wakeup Authenticate Master Read Master Write Register Read Register Write Extended Register Read Extended Register Write Extended Register Read Long Extended Register Write Long Device Descriptor Block Master Read Device Descriptor Block Slave Read Register 0 Write Transfer Bus Ownership Parity Error

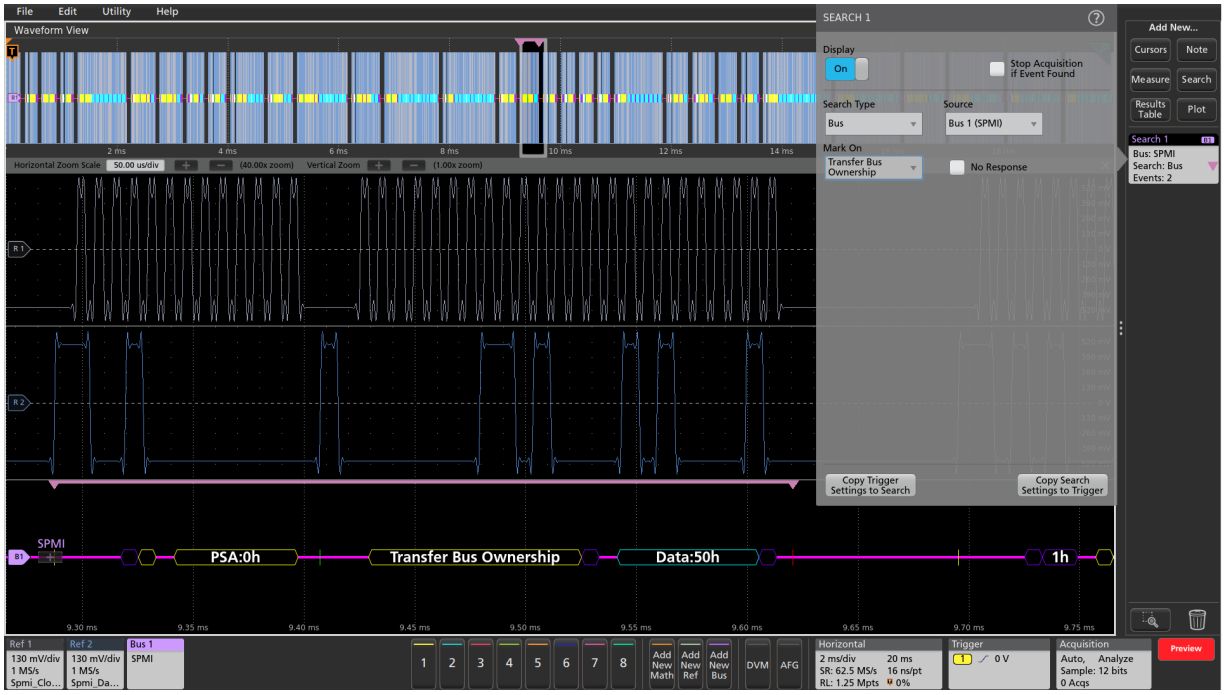
Table 66: Bus decode

Characteristic	Description
Decode Display	Arbitration Start (yellow bar) Connect Bit (purple packet) Master ID (purple packet) Alert Bit (yellow packet) Slave Request Bit (yellow packet) Master Priority Level (gray packet) SSC (green bar) Command Frame, including Byte Count [2] (yellow packet) Address (yellow packet) Data (cyan packet) Parity (purple packet) Ack/Nack (purple packet) Parity error (red packet) End of packet (red bar)



Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SPMI bus.

[2] The actual decimal Byte Count is displayed in Mixed Hex format, but the raw value is shown in Binary and Hex formats.



Automatically searching the SPMI bus for the Transfer Bus Ownership command

SpaceWire characteristics

Table 67: Bus setup options

Characteristic	Description
SpaceWire Sources (Strobe and Data)	Analog Channels Digital Channels Active Math Channels Active Reference Channels
Thresholds	Per-Channel Thresholds
Recommended Probing	Differential
Address/Data Formats Available	Hex Binary

Table 68: Display modes

Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

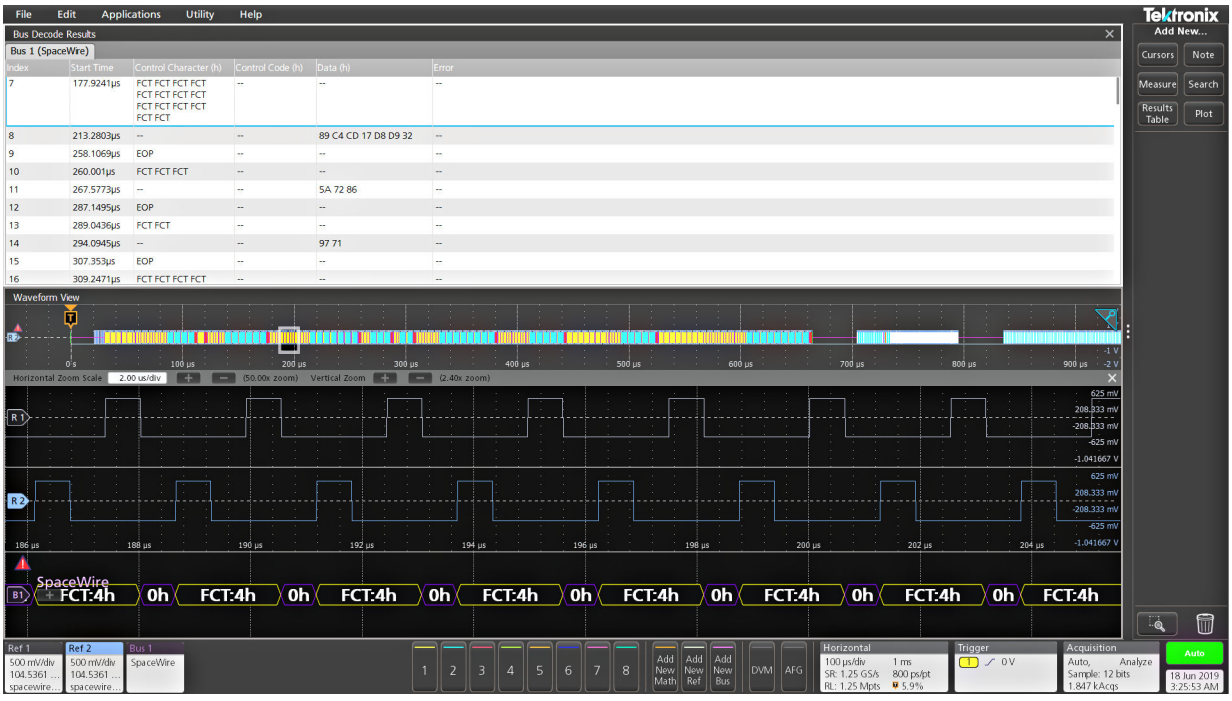
Table 69: Bus search options

Characteristic	Description
Search On	Synchronization Control Code Control Character Data Errors

Table 70: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	2 Mbits/sec to 200 Mbits/sec
Decode Display	Null Control Character Control Code FCT Time-Code Parity Data-Control Flag Data End Of Packet Error End Of Packet Escape Sequence Escape Error Start FCT Start NULL

Searching on a specific data pattern on the SpaceWire bus and automatically searching on Sync.



The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SpaceWire bus.

Automotive Ethernet (100BASE-T1) characteristics (Version BRR V3.2)

Table 71: Bus setup options

Characteristic	Description
Ethernet Source(s)	Analog Channels Active Math Channels Active Reference Channels
Thresholds	Per-channel Thresholds
Speed	100 Mbits/sec
Recommended Probing	Differential
Formats Available	Mixed Hex Hex Binary Mixed ASCII

Table 72: Display modes

Characteristic	Description
Bus	Bus Only
Results Table	Decoded packet data in a tabular view

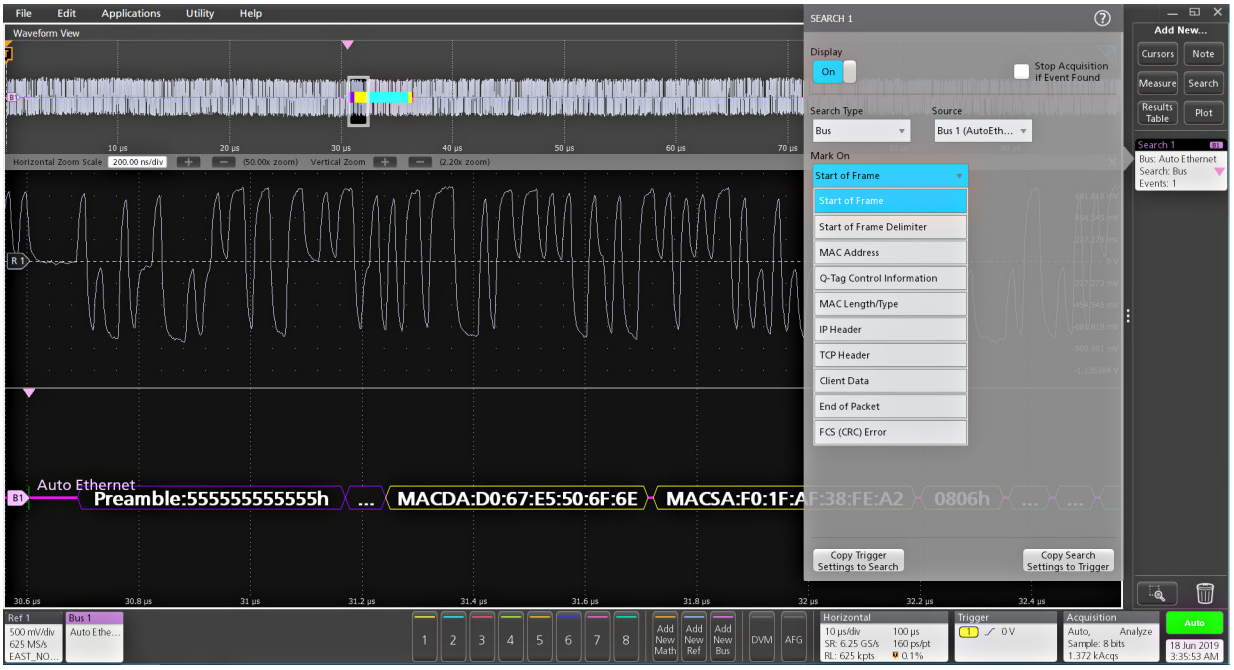
Table 73: Bus search options

Characteristic	Description
Search On	Start of Frame Start of Frame Delimiter MAC Addresses Q-Tag Control Information MAC Length/Type IPv4 Header TCP Header MAC Data TCP-IPv4 Client Data End of Packet Frame Check Sequence (CRC) Error

Table 74: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	100 Mbits/sec
Decode Display	Start of Packet (green bar) Preamble (purple packet) SFD (purple packet) Address (yellow packet) EtherType (yellow packet) IP packet (purple packet) Data (cyan packet) IPv4 packet (pink packet) TCP packet (white packet) Frame Check Sequence (yellow packet) Error (red packet) End of packet (red bar)

The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the Automotive Ethernet (100BASE-T1) bus.



Searching on a specific data pattern on the Automotive Ethernet (100BASE-T1) bus and automatically searching on Start of Frame.

8b10b Characteristics (Line encoding)

Table 75: Bus setup options

Characteristic	Description
8b10b Sources (Strobe and Data)	Analog Channels Digital Channels Active Math Channels Active Reference Channels
Thresholds	Per-Channel Thresholds
Recommended Probing	Differential
Formats Available	Hex Binary Symbolic

Table 76: Display modes

Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table 77: Bus search options

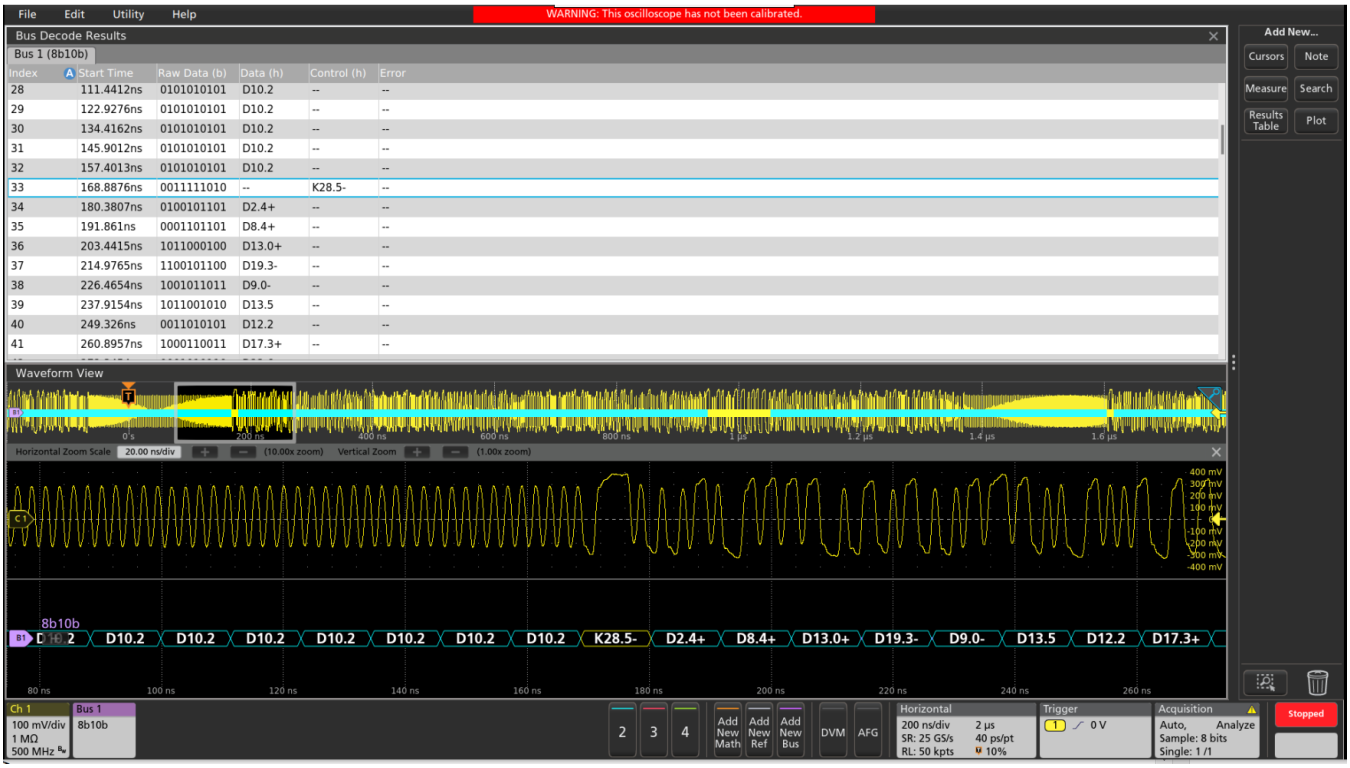
Characteristic	Description
Search On	Symbols [Format:8bit,10bit&symbol] Errors

Table 78: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	1 Tbits/sec
Decode Display	Control Symbol (yellow packet) Data Symbol (cyan packet)
Error Handling	Invalid Symbols Running Disparity (6 bit and 4 bit)

Table continued…

Searching on a specific data symbol in symbol format on a 8b10b bus



The Protocol Decode results table provides time-stamped, tabular view of all captured packets on a 8b10b bus

NRZ Characteristics (Line encoding)

Table 79: Bus setup options

Characteristic	Description
NRZ Source(s)	Analog Channels Digital Channels Active Math Channels Active Reference Channels
Thresholds	Per-channel Thresholds
Recommended Probing	Differential
Bit Order	MSB First LSB First
Polarity	Normal Invert
Formats Available	Hex Binary

Table 80: Display modes

Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms.
Results Table	Decoded packet data in a tabular view

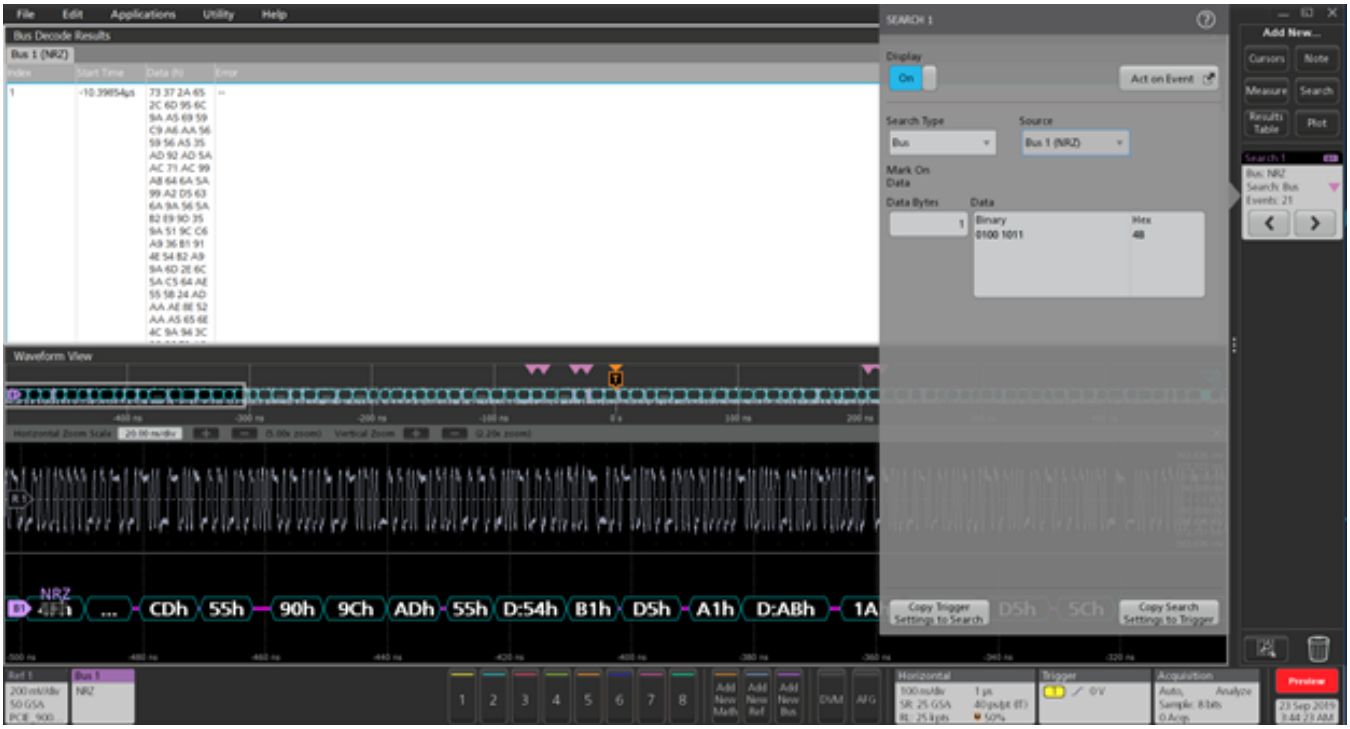
Table continued…

Table 81: Bus search options

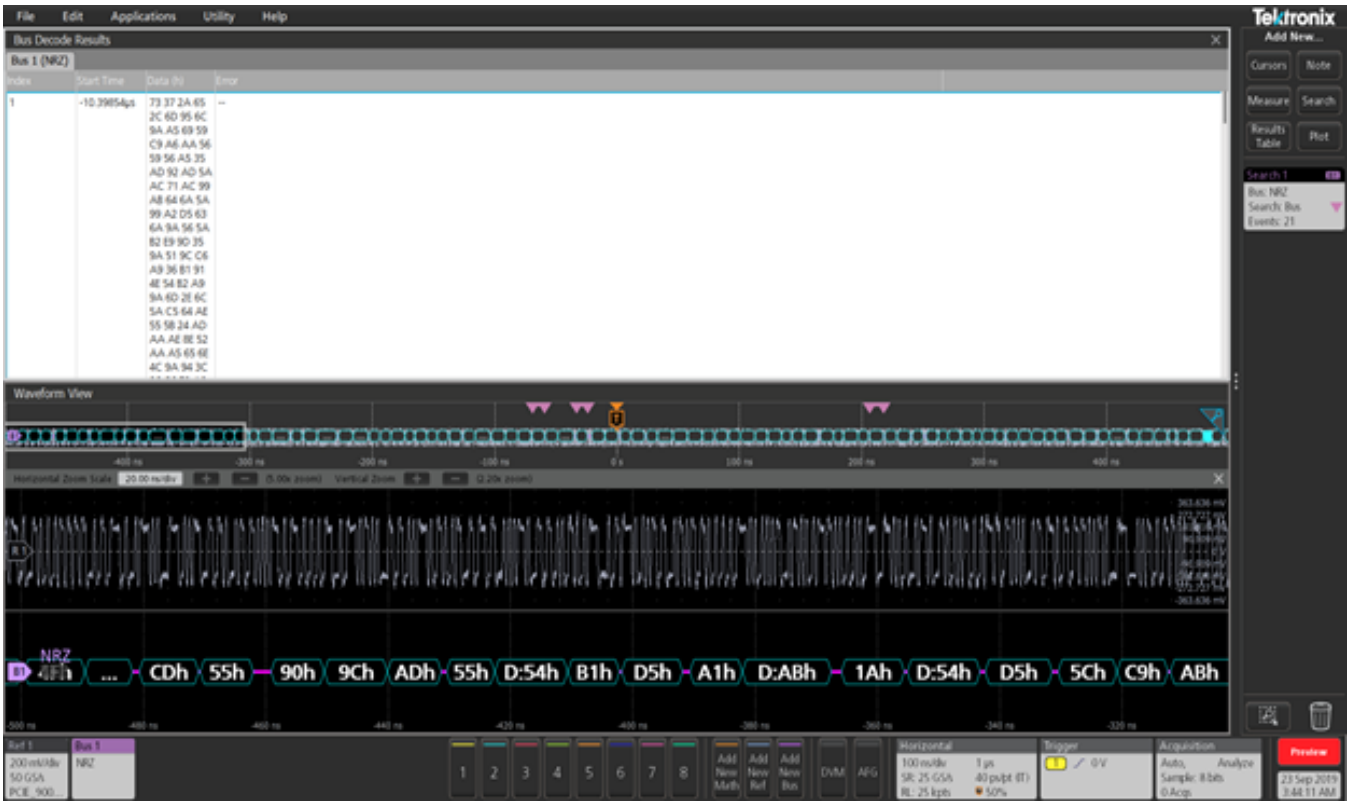
Characteristic	Description
Search On	Data Bytes [Maximum 5]

Table 82: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	1Gbits/sec
Decode Display	Data (cyan packet)



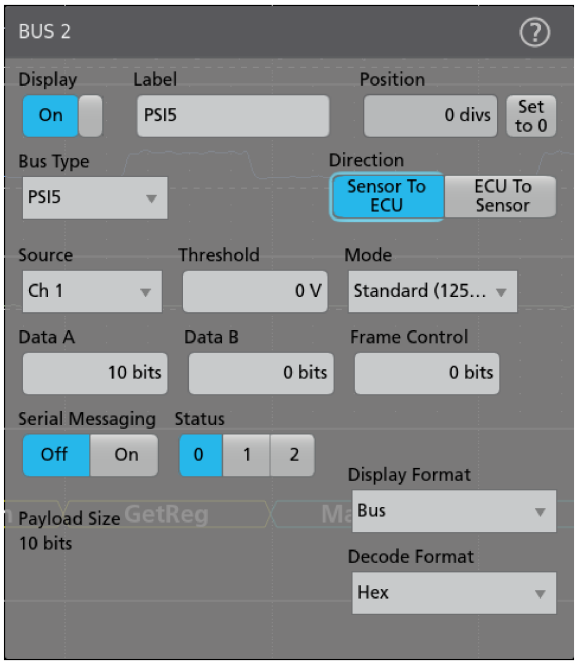
Searching on a specific data symbol in symbol format in the NRZ bus



The Protocol Decode results table provides time-stamped, tabular view of all captured packets on the NRZ bus

PSI5 characteristics (Version 2.1)

PSI5 Sensor to ECU configuration



PSI5 ECU to Sensor configuration

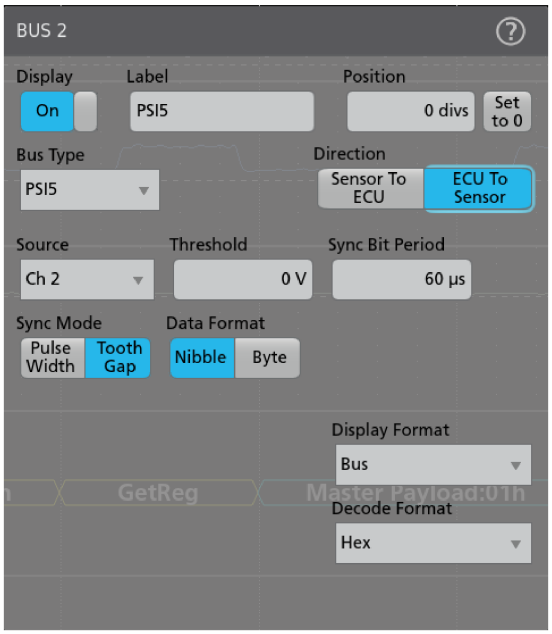


Table 83: Bus setup options

Characteristic	Description	
PSI5 Sources	Analog channels Digital channels Active Math channels Active Reference channels	
Thresholds	Per-channel thresholds	
Recommended Probing	Sensor to ECU	Current probe with minimum current rating of less than 50mA - TCP2020, TCP202A
	ECU to Sensor	Differential Voltage probe - TDP1000, TDP1500, and TAP1500
Direction	ECU to Sensor Sensor to ECU	
Direction - Sensor to ECU	Mode	Slow (83.3 kbps) Standard (125 kbps) Fast (189 kbps)
	Data A	10 - 24 bits
	Data B	0 - 12 bits
	Frame Control	0 - 4 bits
	Status	0 - 3 bits
Direction - ECU to Sensor	Sync Bit Period	1 us to 300 us
	Sync Mode	Pulse Width Tooth Gap
	Data Format	Nibble Byte
Decode Format	Hex Binary Mixed Hex	

Table 84: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous displays bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Table 85: Bus search options

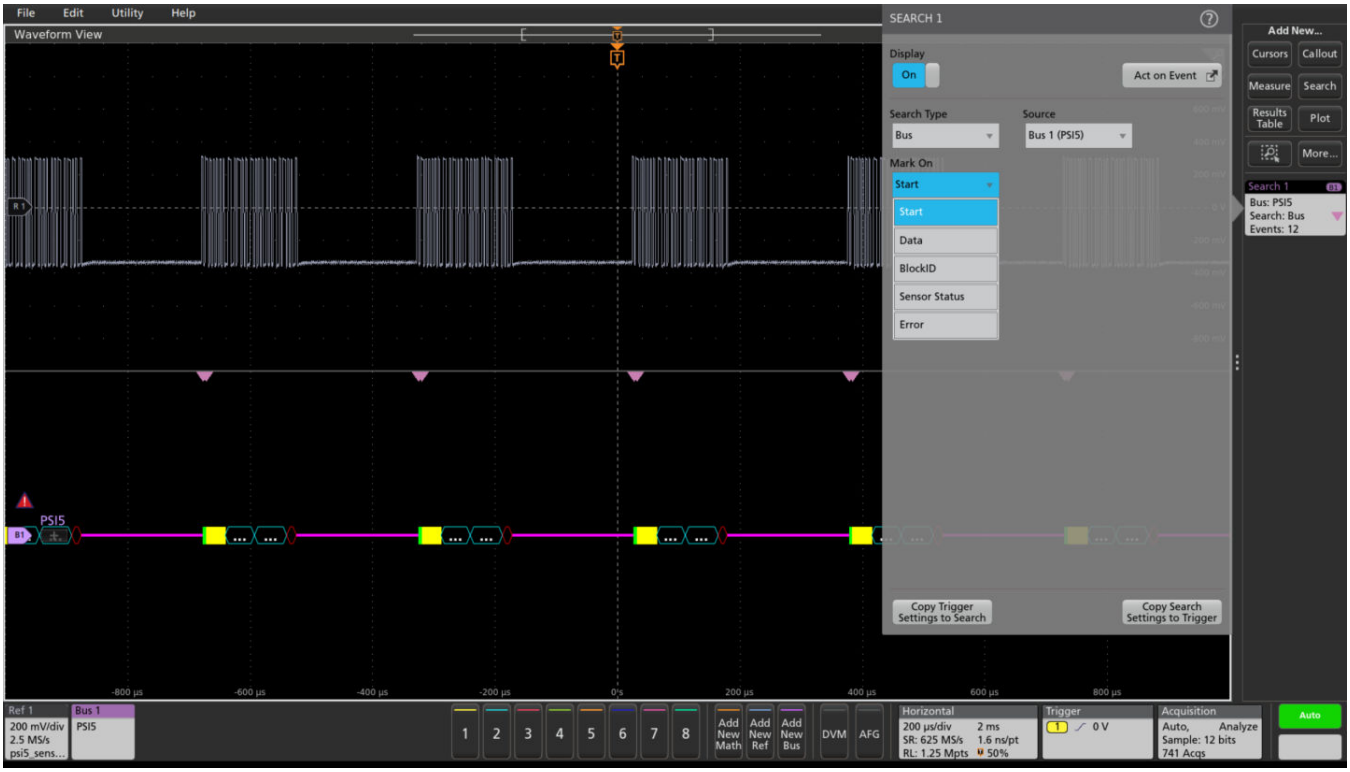
Characteristic	Description	
Mark On	Direction - Sensor to ECU	Start [Start of packet] Status Data [Region B and Region A] Block ID Sensor Status [5 different status] Errors [Parity CRC and any]
	Direction - ECU to Sensor	Start [Start of packet] Status Data [4 or 8 bits] Function Code Sensor Address Register Address CRC Error

Note: Bus Search option is depend on the direction in Bus Configuration.

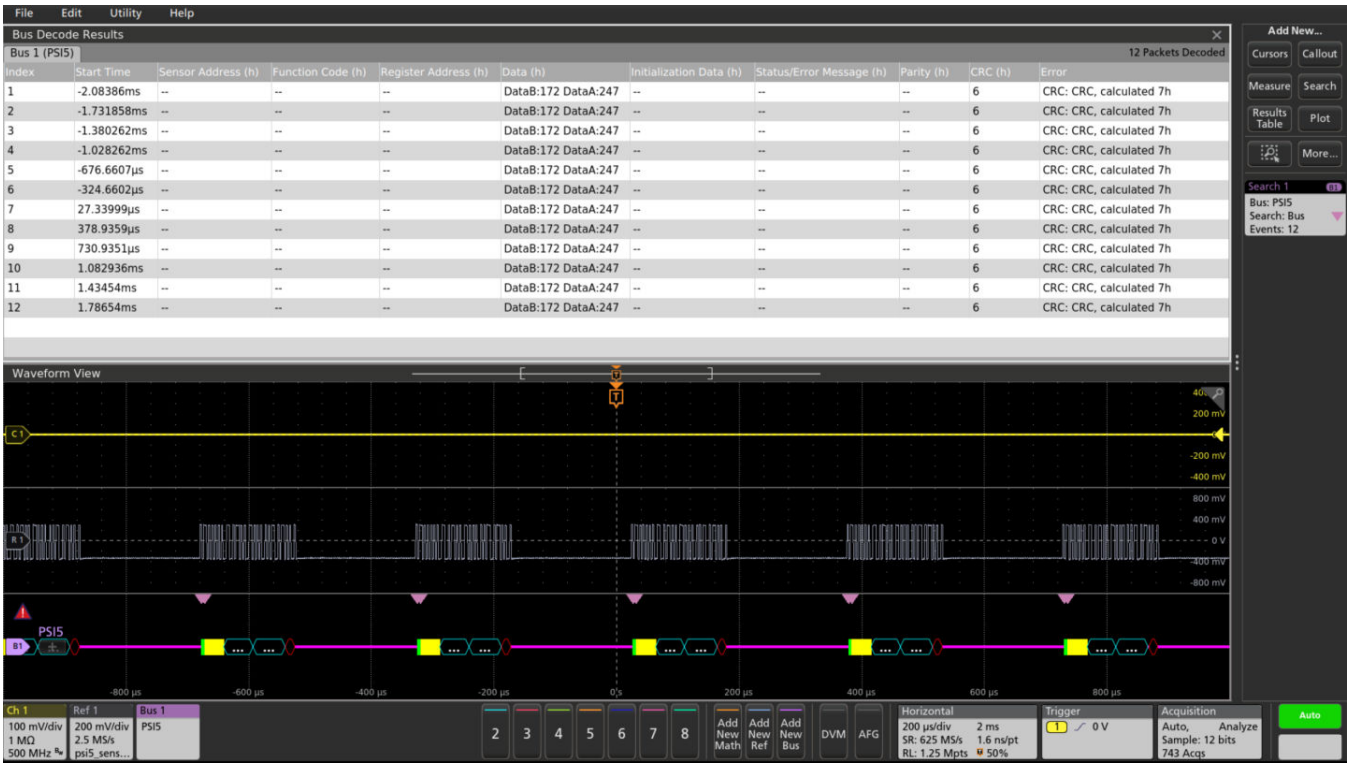
Table 86: Bus decode

Characteristic	Description	
Decode Display	**Direction - Sensor to ECU Packets**	Message Field (Yellow Field) Status (Yellow Field) Frame Control (Yellow Field) Data B (Cyan Field) Data A (Cyan Field) Parity or CRC (Purple Field)
	Direction - ECU to Sensor Packets	Sensor Address (Yellow Field) Function Code (Yellow Field) Register Address (Yellow Field) Data (Cyan Field) CRC (Purple Field)
Error Type		Parity CRC Response Code (Sensor to ECU)

Table continued…



PSI5 Search configuration

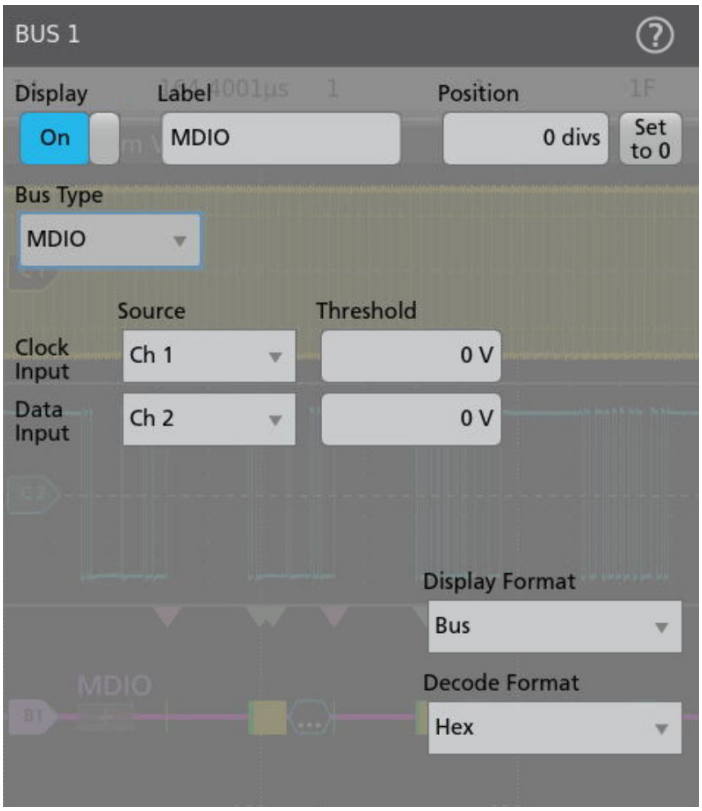


PSI5 Results table

MDIO Characteristics

Table 87: Bus setup options

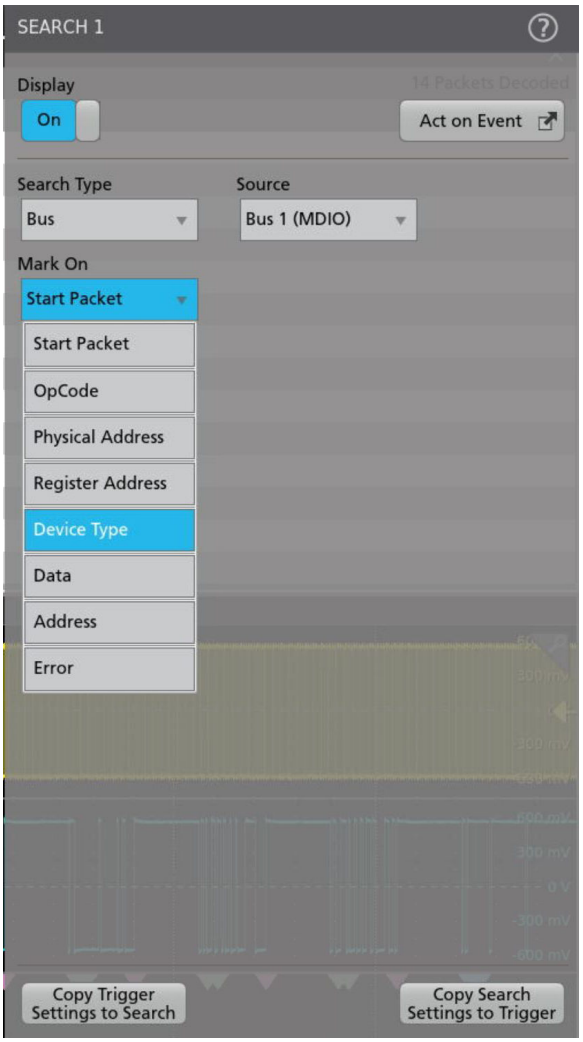
Characteristic	Description
MDIO Sources (Clock, Data)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Pre-channel thresholds
Recommended Probing	Single-ended
Formats Available	Hex Binary Mixed Hex



Bus configuration

Table 88: Bus search options

Characteristic	Description
Search On	Start Packet OpCode Physical Address Register Address Data Error: Any, OpCode Error, Device Type Error



Search configuration

Table 89: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Result Table	Decoded packet data in tabular view

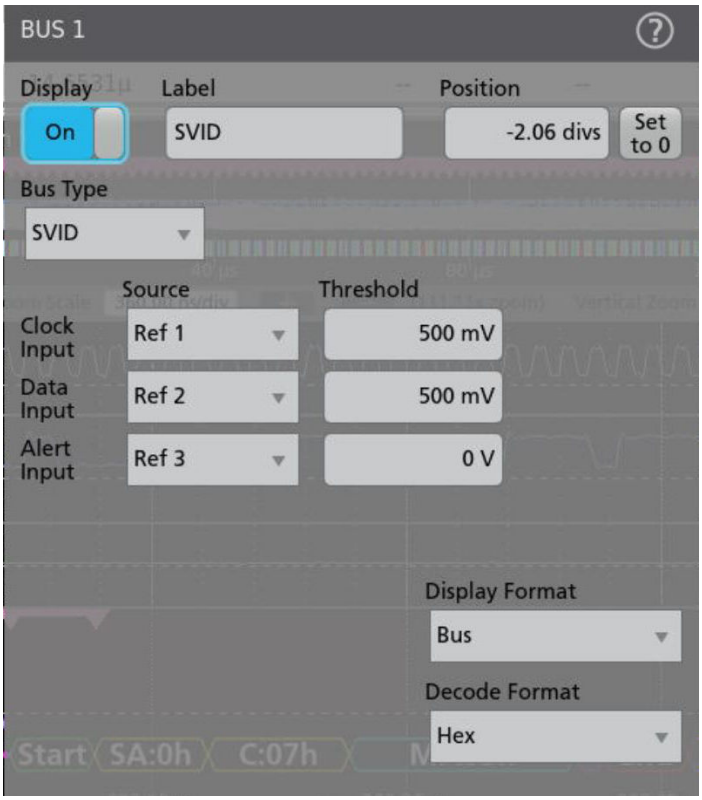
Table 90: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Maximum frequency of up to 2.5 MHz
Decode Display	Start Packet (Green) Clause (Green) OpCode (Yellow) Physical Address (Yellow) Register Address (Yellow) Device Type (Yellow) Data/Address (Cyan) Error: Any, OpCode Error, Device Type Error (Red)

SVID characteristics (Version 1.9)

Table 91: Bus setup options

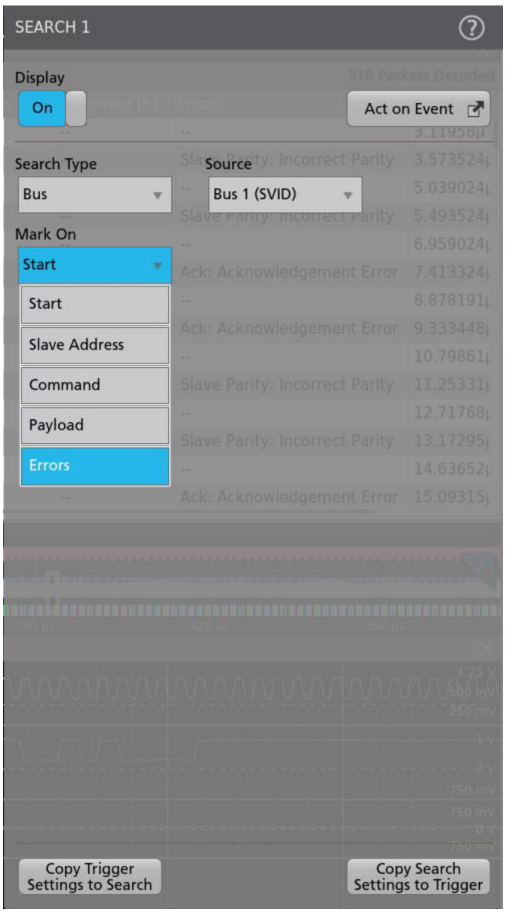
Characteristic	Description
SVID Sources (Clock, Data, Alert)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Pre-channel thresholds
Recommended Probing	Single-ended
Formats Available	Hex Binary Mixed Hex



Bus configuration

Table 92: Bus search options

Characteristic	Description
Search On	Start Slave Address Command Payload: Master, Slave, Either Errors: Any, Missing Ack, Parity End



Search configuration

Table 93: Display modes

Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Result Table	Decoded packet data in tabular view

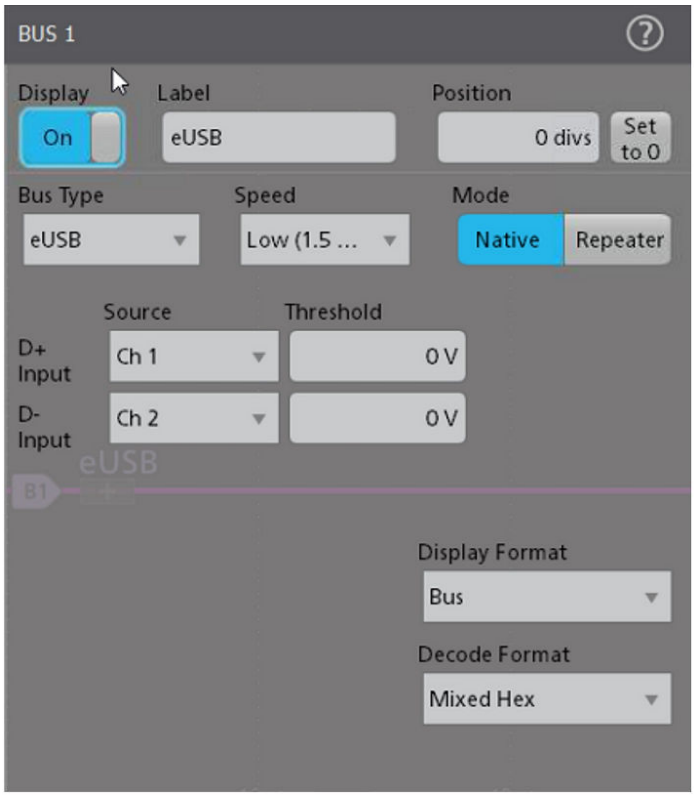
Table 94: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Maximum frequency of 26.25 MHz
Decode Display	Start (Green) Slave Address (Yellow) Command (Yellow) Master Payload (Cyan) Master Parity (Purple) End (Purple) Turnaround (Purple) Ack (Purple) Slave Payload (Cyan) Slave Parity (Purple)

e-USB2 (Version 2.0)

Table 95: Bus setup options

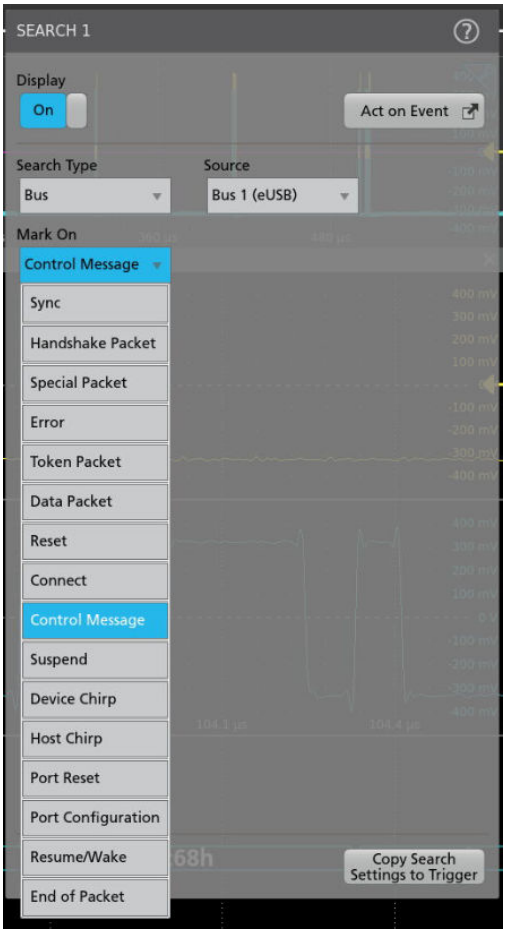
Characteristic	Description
Source(s)	Analog channels Digital channels(single-ended) Active Math channels Active Reference channels
Thresholds	Pre-channel thresholds
Speeds	Speed High Speed (480 Mb/s) Full Speed (12 Mb/s) Low Speed (1.5 Mb/s)
Recommended Probing, HS, LS, and FS	Single-ended [Active Single Ended TAP1500]
Formats Available	Mixed Hex Hex Binary Mixed ASCII



Bus configuration

Table 96: Bus search options

Characteristic	Description
Search On	Characteristic Description Search On Sync Reset Suspend Resume/Wake Connect Control Message Port Reset Port Configuration Device Chirp Host Chirp End of Packet Token (address) Packet Data Packet Handshake Packet: ACK, NAK, STALL, NYET (HS only) Special Packet: PRE (FS only), ERR, SPLIT, PING Reserved Error: PID check, CRC5 or CRC16, Bit stuffing (LS and FS only)



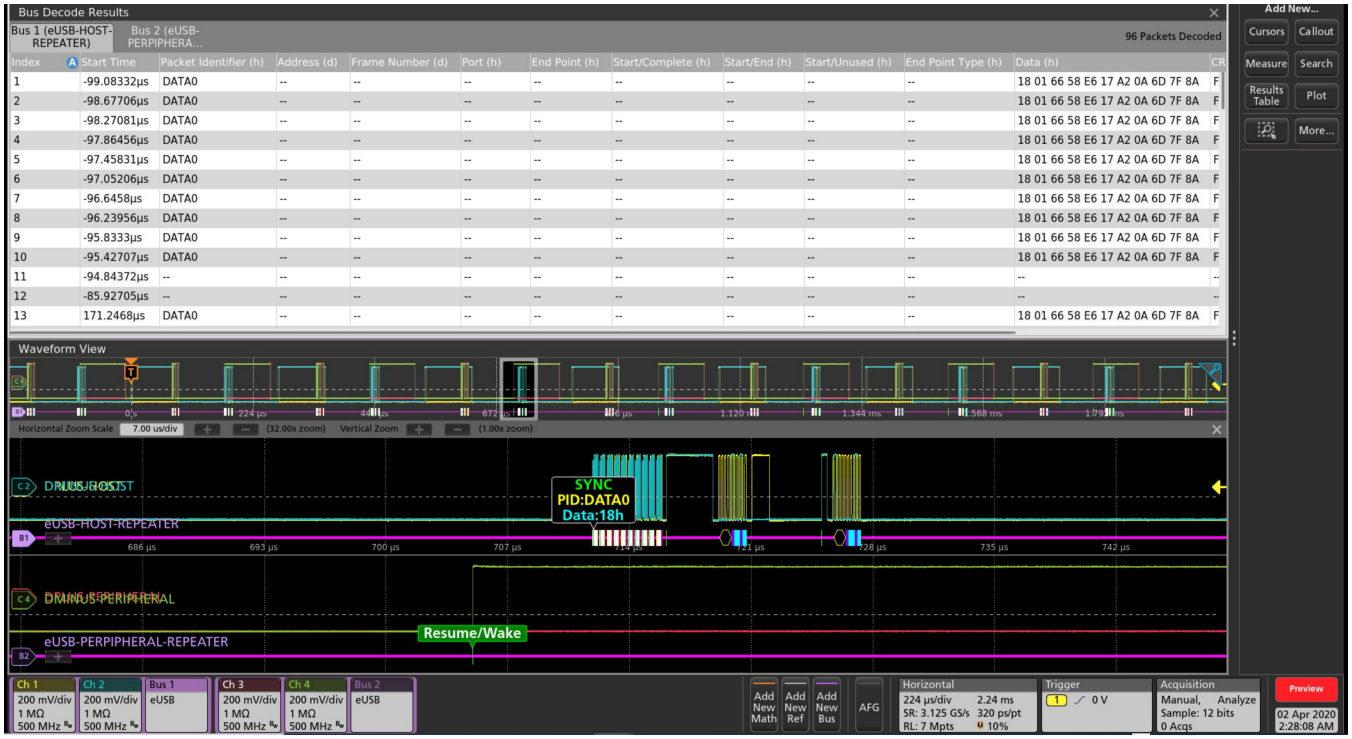
Search configuration

Table 97: Bus decode

Characteristic	Description
Decode Display	Start of packet (green bar) Sync (green packet) PID (yellow packet) Token (address) (yellow packet) Data (cyan packet) CRC (purple packet) Error (red packet) End of packet (red bar) Control Message (Yellow packet) Zeros (Blue packet) Ack (Purple packet) Port Reset (Red Bar) Port Configuration(Green Bar) Connect (Green Bar) Resume/Wake(Green Bar) Device Chirp(Green Bar) Host Chirp (Green Bar) End Of reset(Red Bar)

Table 98: Results & other features

Characteristic	Description
Table view * Depends on the Model	View more than 10000* points
Save	Save Result table as CSV
Sessions	Save sessions of your protocol setup
Simultaneous Buses * Depends on the Model	Load multiple Buses simultaneously*
Upcoming Future addition	Timing Measurements for Protocols
Search Table	Displays the Search hits along with Delta time difference between hits



Results table with decoded waveform

Manchester Characteristics (Line encoding)

Table 99: Bus setup options

Characteristic	Description
Manchester Sources	Analog channels Digital channels(single-ended) Active Math channels Active Reference channels
Bus Setup: Threshold Idle Bits Transition For '0' Tolerance	
Recommended Probing	Differential/Single ended
Formats Available	Hex Binary
Packet View	

Table 100: Bus search options

Characteristic	Description
Search On	Characteristic Description Search On Sync Reset Suspend Resume/Wake Connect Control Message Port Reset Port Configuration Device Chirp Host Chirp End of Packet Token (address) Packet Data Packet Handshake Packet: ACK, NAK, STALL, NYET (HS only) Special Packet: PRE (FS only), ERR, SPLIT, PING Reserved Error: PID check, CRC5 or CRC16, Bit stuffing (LS and FS only)

Table 101: Display modes

Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view with columns containing: Sync Pattern Packet Header Packet Data Packet Trailer Error

Table 102: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	1Gbps
Decode Display	Control Field (yellow packet) Payload Field (cyan packet)
Error Handling	Parity Manchester
Search On	When Packet View is ON Sync Bits Header Data Trailer Errors When Packet View is OFF Data Errors

Table 103: Bus search options

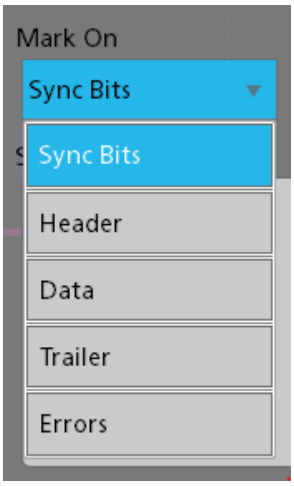
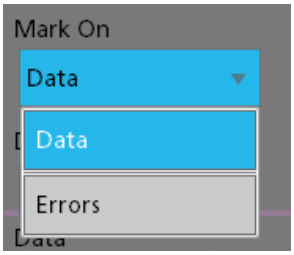
Characteristic	Description	
Search On (Packet View ON)	Sync Bits Header Data Trailer Errors	
Search On (Packet View OFF)	Data Errors	

Table continued…

Table 104: Results & other features

Characteristic	Description
Table view * Depends on the Model	View more than 10000* points
Save	Save Result table as CSV
Results Table	Sessions
Simultaneous Buses * Depends on the Model	Load multiple Buses simultaneously*
Upcoming Future addition	Timing Measurements for Protocols
Search Table	Displays the Search hits along with Delta time difference between hits

DPHY(DSI2.0/CSI2.0) Characteristics (Version 2.0)

Table 105: Bus setup options

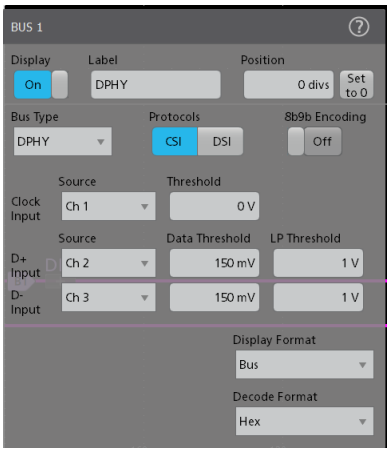
Characteristic	Description
DPHY Sources	Analog channels Math channels Active Reference channels
Salient Features	Decode capability in for CSI/DSI protocols. Decode capability for Escape mode. Decode capability for High speed burst mode. Decode capability for 8b9b line encoding in LPDT and HS mode. Search capability for SoT/EoT Search capability for long and short packets Search capability for Escape mode Search capability for Errors like ECC, CRC, and Any
Bus Setup	
Recommended Probing	Clock – Single Ended/Differential Data – Single Ended Single ended probe: No. of probes: 3 (D+ and D- by default) Differential probe: No. of probes: Not supported
8b9b encoding mode	Select line encoding in LPDT and HS mode.
Formats Available	Hex Binary Mixed Hex

Table 106: Display modes

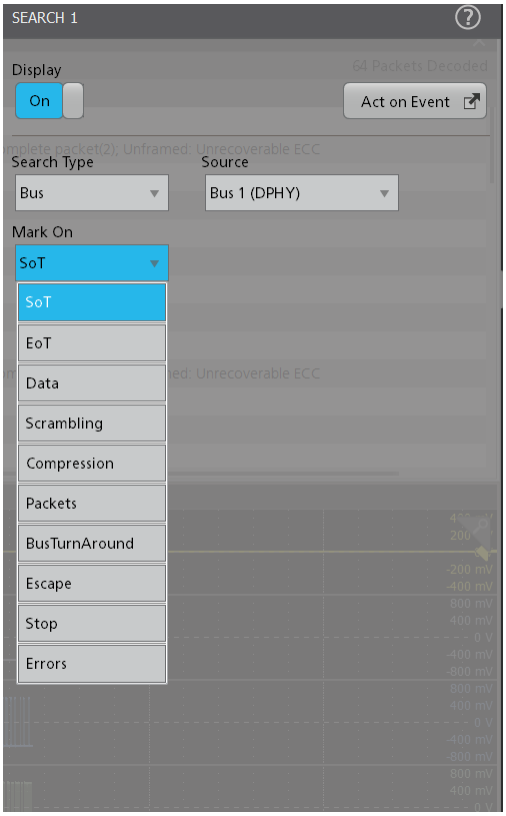
Characteristic	Description
Bus	Bus Only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Result Table	Decoded packet data in a tabular view with columns containing: Mode Data Type Virtual Identifier ECC Data CRC End Error

Table 107: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	2.5 Gbps
Decode Display	Control Field (yellow) ECC/CRC (Green) Pixel Fields (Red,Green,Blue,Yellow) Data Symbol (cyan) Raw Fields (Cyan)
Error Handling	ECC CRC SOT Sync

Table 108: Bus search options

Characteristic	Description
Search On (CSI/DSI)	SoT – It searches SoT of each transmission in HS mode EoT – It searches EoT of each transmission in HS mode. Data – Data search (HS/LP) Scrambling – Search for scrambling mode command Compression – Search for Compression mode command. **Packets – Searches for Short and long packets Escape – Search for Escape entry mode STOP – Search for Escape mode exit Errors – Search for CRC and ECC errors. **Can select from the list of standard packet names



Bus search options

Table 109: Result & other features

Characteristic	Description
Table view * Depends on the Model	View more than 10000* points
Save	Save Result table as CSV
Sessions	Save sessions of your protocol setup
Simultaneous Buses * Depends on the Model	Load multiple Buses simultaneously*
Upcoming Future addition	Timing Measurements for Protocols
Search Table	Displays the Search hits along with Delta time difference between hits

SDLC Characteristics (Version GA27-3093-3)

Table 110: Bus setup options

Characteristic	Description
SDLC Source(s)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Pre-channel thresholds
Recommended Probing	Differential
Modulo	8 [8-bit Control Word] 128 [16-bit Control Word]
Encoding	Discrete Transmission [NRZ] Invert On Zero [Inverted NRZi]
Formats Available	Hex Binary Mixed Hex

Table 111: Display modes

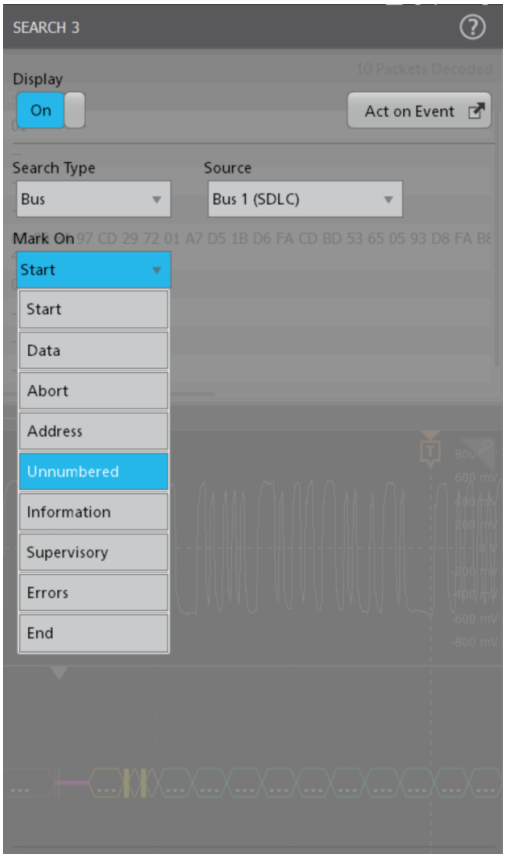
Characteristic	Description
Bus	Bus Only
Result Table	Decoded packet data in a tabular view

Table 112: Bus decode

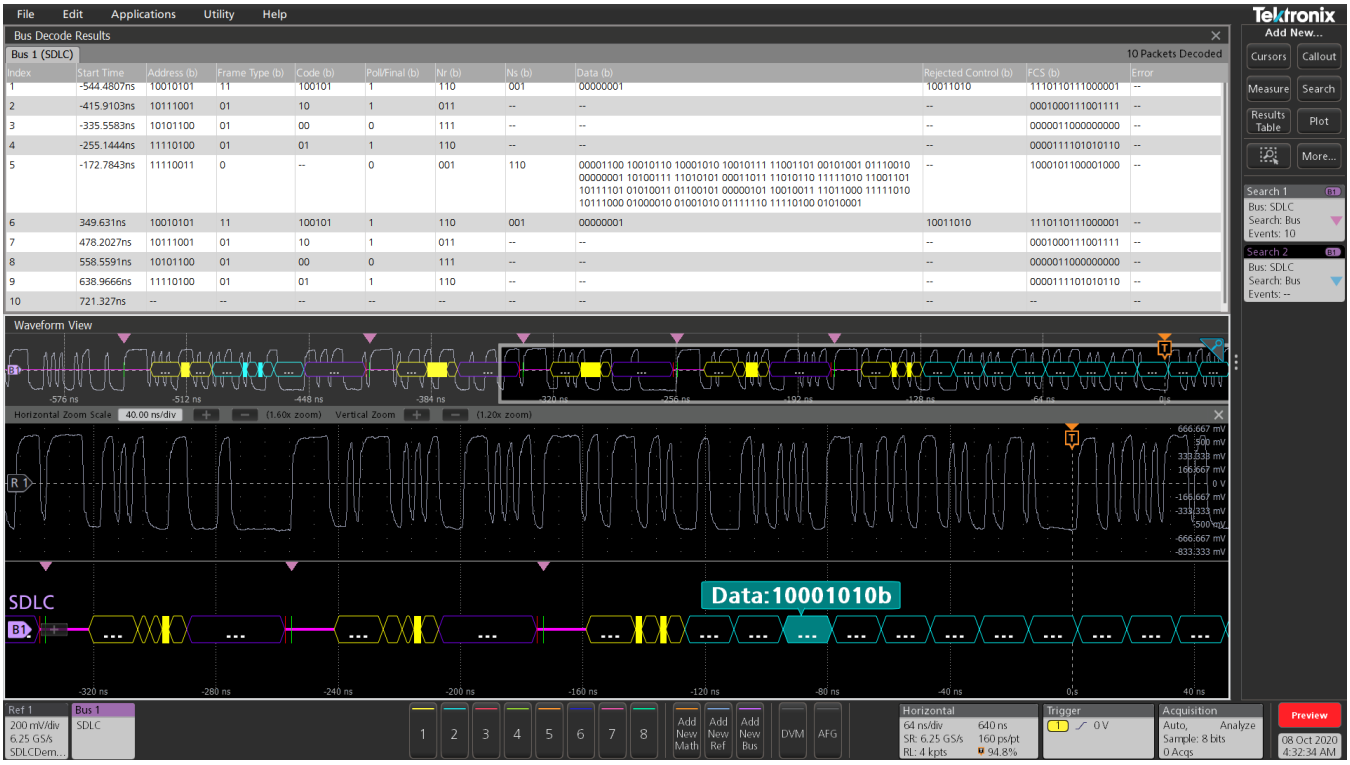
Characteristic	Description
Maximum Clock/Data Rate	1 Gbits/sec
Decode Display	Start (green vertical line) Address (yellow field) Frame Type (yellow field) Code (yellow field) Ns(yellow field) [Sequence number sent] Nr(yellow field) [Sequence number received] Poll/Final (yellow field) Data(cyan field) FCS(purple field) Abort (red vertical line)
Error handling	FCS [Frame Check Sequence Errors]

Table 113: Bus search options

Characteristic	Description
Search On	Start [Searches for Start event] Data [Searches for Payload Data] Abort [Searches for Abort] Address Broadcast [Broadcast Packets] No Station [Packets not pertaining to secondary] Station [Valid Station Address] Unnumbered Commands [Searches for Primary Commands] Responses [Searches for Secondary Responses] Both Information [Searches for information frames] Supervisory [Searches for different receiver status] Receive Frame Ready Receive Frame Not Ready Reject frame Errors FCS [Searches for Frame Check Sequence errorrs] Out of Numeric Order [Searches for this frame] Stop



Bus search options



The Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SDLC bus.

Searching on a station address on the SDLC bus.

CPHY Characteristics (Version 2.0)

Table 114: Bus setup options

Characteristic	Description
CPHY Sources	Analog channels Digital channels Math channels Active reference channels
Salient Features	Decode capability in for CSI/DSI protocols. Decode capability for Escape mode. Decode capability for High speed burst mode. Decode capability for Word/Symbol Mode. Decode capability in single ended and differential mode Search capability for SoT/EoT Search capability for long and short packets Search capability for Escape mode Search capability for CRC Errors Search capability on Pixel value and Pixel number in CSI/DSI packet search
Sub Type	CSI DSI Word (16 Bit data word decode) Symbol (Symbol level decode of cphy data)
Signal Type	Single Ended: No. of probes: 3 Differential: No. of probes: 5 Minimum BW of probe: As minimum bitrate of HS is set to 4 Mbps, almost all probe should work. But considering the general CPHY HS speed is about 1 GHz and speed can vary depending on customer, the probe need to based on what speed the end customer want to test.
Formats Available	Hex Binary Mixed Hex
Bit Rate	Specifies the data rate in High Speed Mode

Table 115: Display modes

Characteristic	Description
Bus	Bus Only
Result Table	Decoded packet data in a tabular view with columns containing: Mode Data Type Virtual Identifier PHCCRC Data CRC Symbols End Error

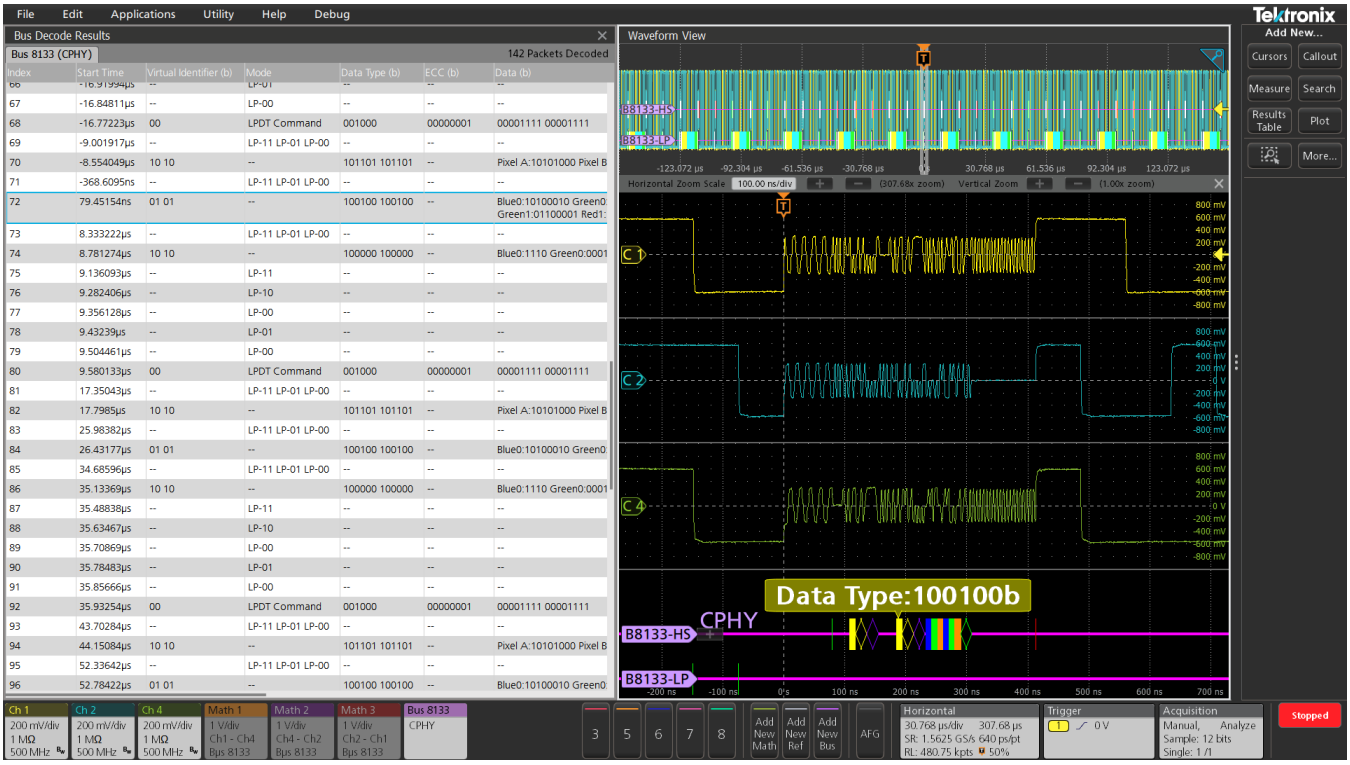
Table 116: Bus decode

Characteristic	Description
Maximum Clock/Data Rate	10 Gbps
Decode Display	Control Field (yellow) ECC/CRC (Green) Pixel Fields (Red, Green, Blue, Yellow) Data Symbol (cyan) Raw Fields (Cyan) Word and Symbol Decode (cyan)
Error Handling	PHCRC CRC SOT Sync
Sub type	CSI (CSI packet decode) DSI (DSI packet decode in HS/LP) Word (16 bit word decode) Symbol Decode

Table 117: Bus search options

Characteristic	Description
Search On (CSI/DSI)	SoT – Searches SoT of each transmission in HS mode EoT – Searches EoT of each transmission in HS mode. Data – Data search (HS/LP) Scrambling – Search for scrambling mode command Compression – Search for Compression mode command.

Characteristic	Description
	**Packets – Searches for Short and long packets Escape – Search for Escape entry mode Errors – Search for CRC and PHCRC errors. **Can select from the list of standard packet names
Word / Symbols Decode	Search for Words/Symbols respectively



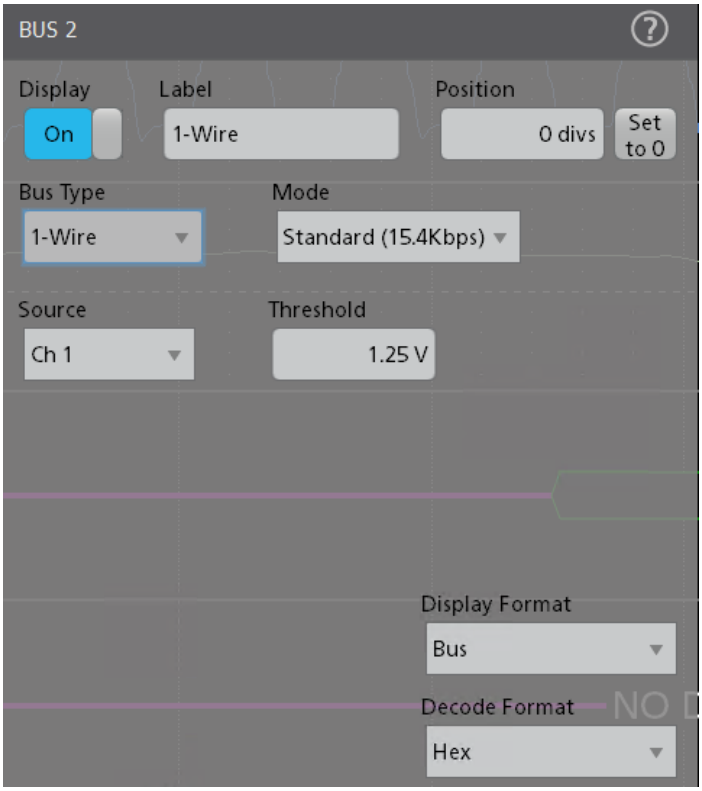
The protocol decode results table provides a time-stamped, tabular view of all captured pixel packets on the CPHY bus

CPHY search results display

ONEWIRE Characteristics

Table 118: Bus setup options

Characteristic	Description
1-WIRE Sources	Analog channels Digital Channels Active Math channels Active Reference channels
Salient Features	Decode capability in for 1-WIRE protocol. Decode capability for Standard mode. Decode capability for Overdrive mode. Search capability for Reset, Presence events Search capability for Command, Data Search capability for different ROM packets such as Read/Match/Skip/Search ROM and Alarm based on the Standard or Overdrive mode chosen. Search capability for CRC Error
Formats Available	Hex Binary Mixed Hex
Mode	Specifies the mode of operation – Standard (15.4 kbits/s) or Overdrive (125 kbits/s).



Bus setup

Table 119: Display modes

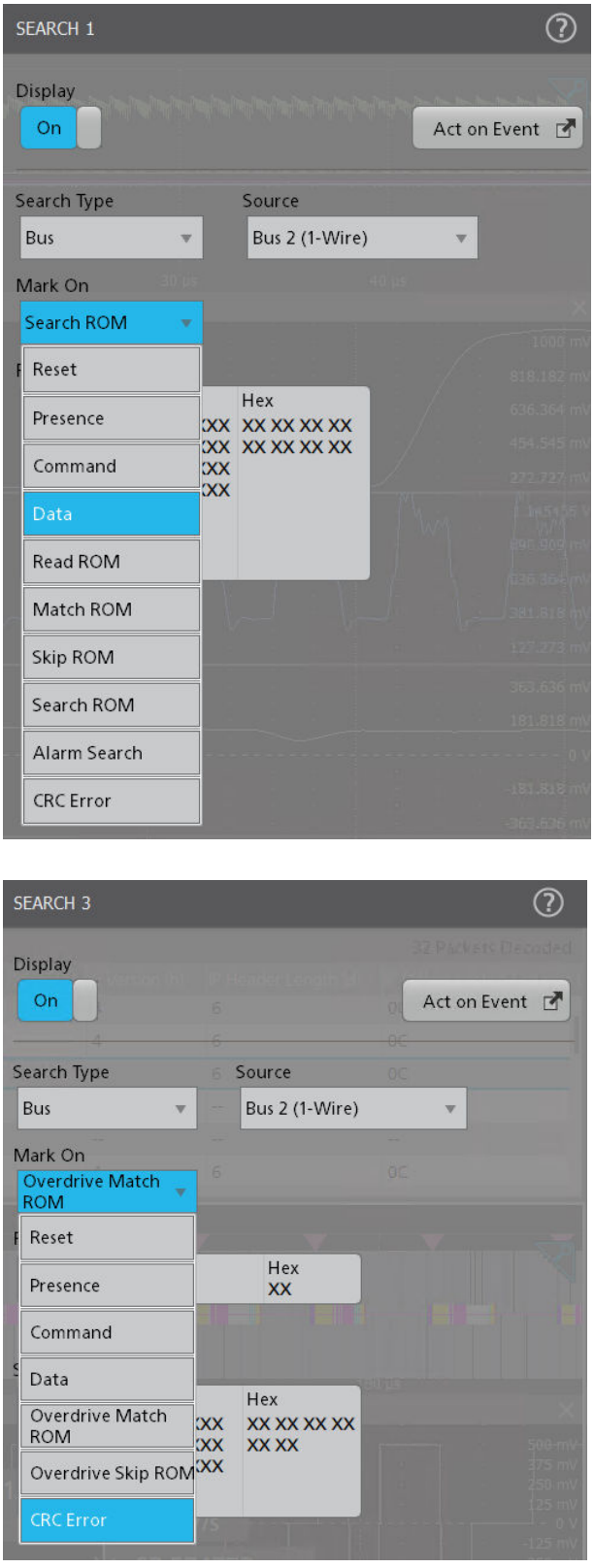
Characteristic	Description
Bus	Bus Only
Result Table	Decoded packet data in a tabular view with columns containing: Initialization ROM Command ROM Code CRC Command Data Error

Table 120: Bus decode

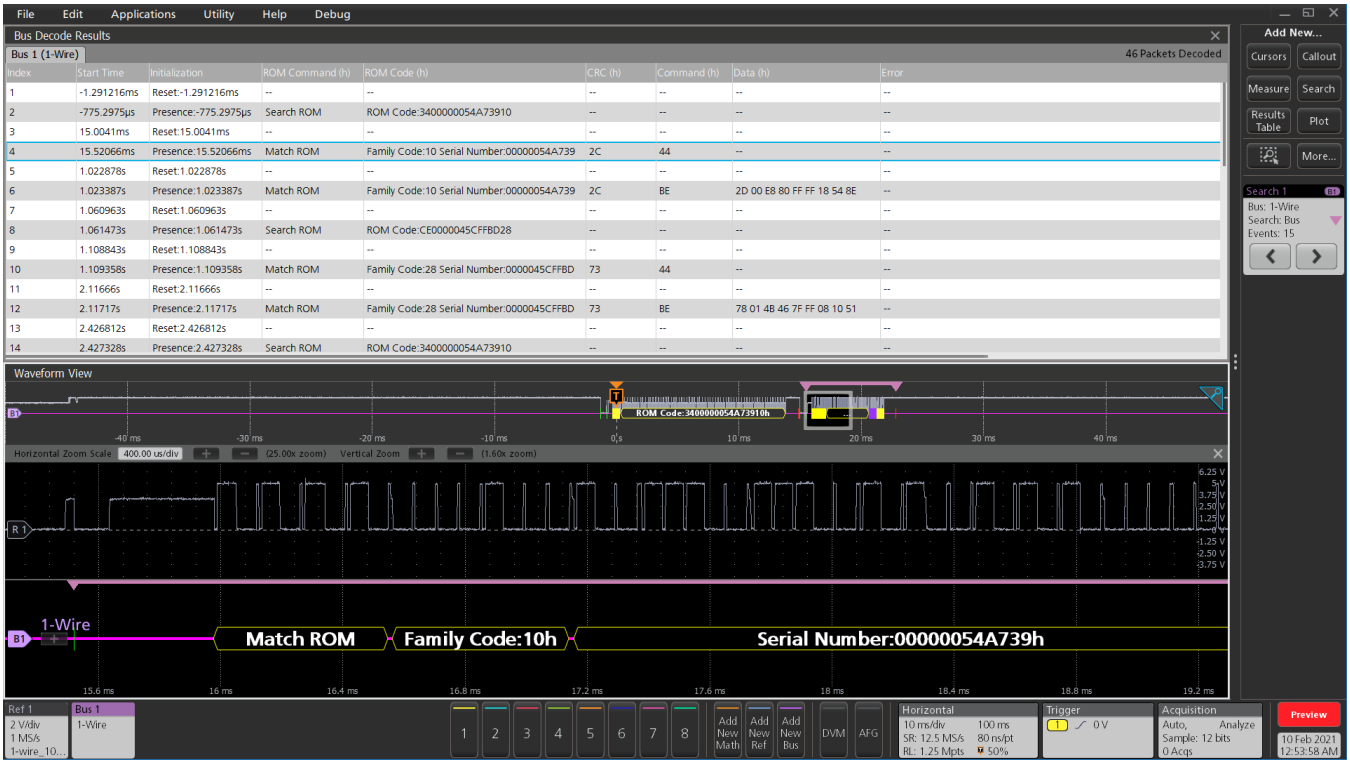
Characteristic	Description
Decode Display	ROM Command/ROM Code/ Command (yellow) CRC (purple) Reset/Presence event (Green) End event (Red)
Error Handling	CRC

Table 121: Bus search options

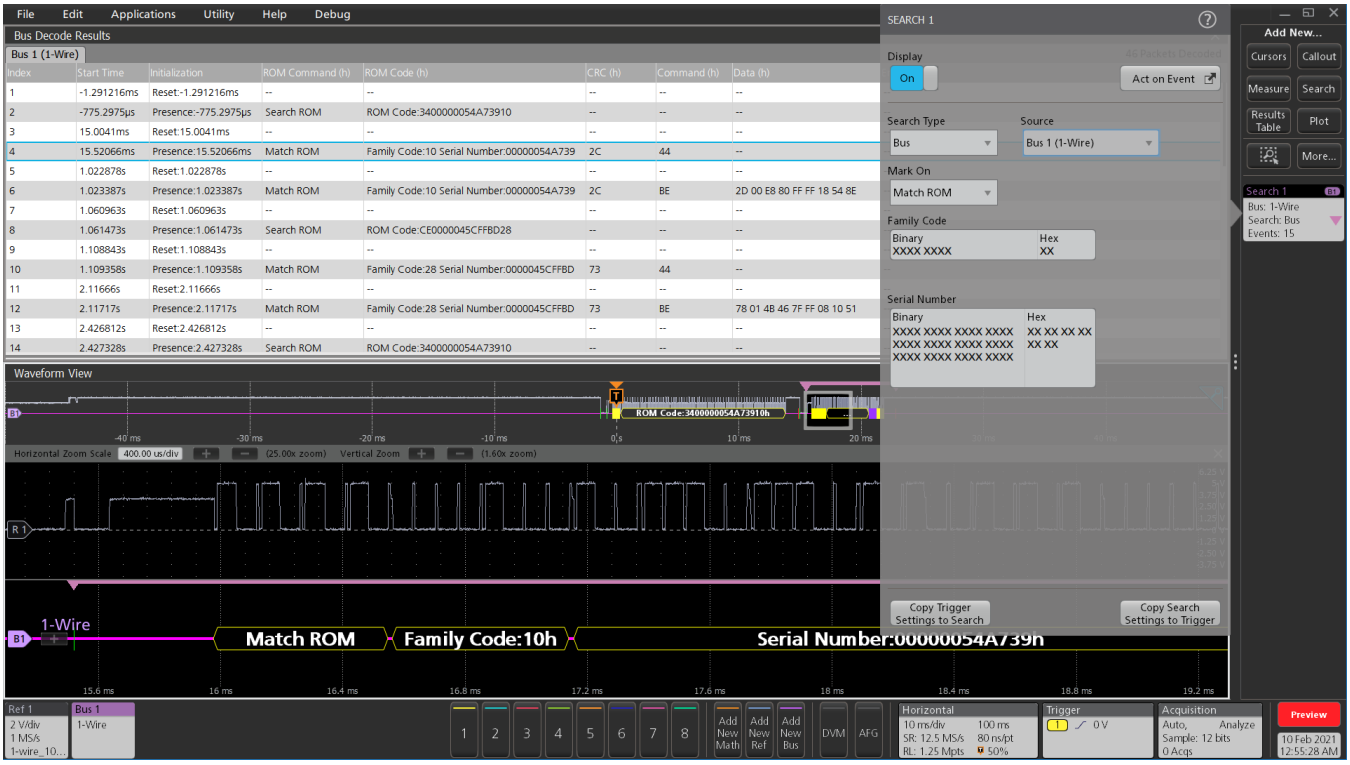
Characteristic	Description
Search On 1-WIRE	Reset – Searches for the Reset event. Reset is the default trigger on condition. Presence – Searches for the Presence event. Command – Searches for Command. Data – Searches for the Data. Read ROM – Searches for the Family code and Serial number of Read ROM. Match ROM – Searches for the Family code and Serial number of Match ROM. Overdrive Match ROM – Searches for the Family code and Serial number of Match ROM. Skip ROM – Searches for Skip ROM packet. Overdrive Skip ROM – Searches for the Overdrive Skip ROM packet. Search ROM – Searches for the ROM code. Alarm Search – Searches for the Alarm packet. CRC Error specifies the search condition as CRC Error.



Search on 1-WIRE



The protocol decode results table provides a time-stamped, tabular view of all captured pixel packets on the 1-WIRE bus.



Searching on a MATCH ROM packet with Family Code and Serial Number on the 1-WIRE bus.

Ordering information

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Serial Decode	Description	4 Series MSO	5 Series MSO	6 Series MSO
4-RL-1	Record length enhancement to 62.5 million sample points	✔	✖	✖
5-RL-125M	Record length enhancement to 125 million sample points	✖	✔	✖
6-RL-2	Record length enhancement to 250 million sample points	✖	✖	✔
SRAUDIO	Audio Serial Triggering and Analysis (I2S, LI, RJ, TDM). Enables triggering on packet-level information on serial audio buses	✔	✔	✔
SRAUTO	Automotive Serial Triggering and Analysis (CAN, CAN FD, LIN, FlexRay). Enables triggering on packet-level information on CAN/CAN FD/LIN/FelxRay	✔	✔	✔
SRNET	Ethernet Serial Triggering and Analysis (10BASE-T, 100BASE-T). Enables decoding and analysis on Ethernet buses.	✔	✔	✔
SRI3C	I3C Serial Decoding and Analysis. Enables decoding and searching on packet-level information on MPI I3C	✔	✔	✔
SRNRZ	NRZ Serial Decoding and Analysis. Supports NRZ with normal and inverted polarity with Bit order (MSB or LSB first)	✔	✔	✔
SRPM	Power Management Serial Triggering and Analysis. Enables triggering on packet-level information on SPMI buses	✔	✔	✔
SRUSB2	USB 2.0 Serial Triggering and Analysis (LS, FS, HS). Enables triggering on packet-level information on USB 2.0 buses	✔	✔	✔
SRMDIO	MDIO Protocol Decoder and Search. Extensive search options.	✔	✔	✔
SRSVID	SVID Protocol Decider and Search. Supports version rev.1.92. Extensive search options	✔	✔	✔
SR8B10B	8B10B Serial Decoding and Analysis. Finds and displays parity error if found in 4-bit or 6-bit for the 10-bit symbol in 8b10b	✖	✔	✔
1 Year License		4-PRO-MILGOV-1Y	5-PRO-MILGOV-1Y	6-PRO-MILGOV-1Y
Perpetual		4-PRO-MILGOV-PER	5-PRO-MILGOV-PER	6-PRO-MILGOV-PER

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Serial Decode	Description	4 Series MSO	5 Series MSO	6 Series MSO
4-RL-1	Record length enhancement to 62.5 million sample points	✔	✖	✖
5-Rl-125M	Record length enhancement to 125 million sample points	✖	✔	✖
6-RL-2	Record length enhancement to 250 million sample points	✖	✖	✔
SRAERO	Aerospace Serial Triggering and Analysis (MIL-STD-1553, ARINC429). Enables triggering on packet-level information	✔	✔	✔
SRSPACEWIRE	SpaceWire serial analysis. Enables decoding and analysis on SpaceWire buses.	✔	✔	✔
MTM		✔	✔	✔
SRNRZ	NRZ Serial Decoding and Analysis. Supports NRZ with normal and inverted polarity with Bit order (MSB or LSB first)	✖	✔	✔
DJA	Jitter Analysis Package including TIE, Eye diagram, Histogram and other advanced analysis measurements.	✔	✔	✔
1 Year License		4-PRO-MILGOV-1Y	5-PRO-MILGOV-1Y	6-PRO-MILGOV-1Y
Perpetual		4-PRO-MILGOV-PER	5-PRO-MILGOV-PER	6-PRO-MILGOV-PER

To add to an instrument at purchase

Serial bus type	3 Series MDO Option	4 Series MSO Option	5 Series MSO Option	6 Series MSO Option	Description
MIL-STD-1553, ARINC 429	3-SRAERO	4-SRAERO	5-SRAERO	6-SRAERO	Aerospace Serial Triggering and Analysis (MIL-STD-1553, ARINC 429). Enables triggering on packet-level information on MIL-STD-1553 and ARINC 429 buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
I^2S, LJ, RJ, TDM	3-SRAUDIO	4-SRAUDIO	5-SRAUDIO	6-SRAUDIO	Audio Serial Triggering and Analysis (I^2S, LJ, RJ, TDM). Enables triggering on packet-level information on serial audio buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
8b10b	N/A	N/A	5-SR8B10B	5-SR8B10B	8B10B Serial Decoding and Analysis. Enables decoding and searching the packet-level information on buses with analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information. Finds and displays parity error if found in 4-bit or 6-bit for the 10-bit symbol in 8b10b.

Table continued…

Serial bus type	3 Series MDO Option	4 Series MSO Option	5 Series MSO Option	6 Series MSO Option	Description
NRZ	N/A	4-SRNRZ	5-SRNRZ	6-SRNRZ	NRZ Serial Decoding and Analysis. Enables decoding and searching the packet-level information on buses with analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information. Variants like NRZ-I, NRZ-M, NRZ-S, and NRZ-C are not supported currently. Supports only NRZ with normal and inverted polarity with Bit Order (MSB or LSB First).
CAN, CAN FD, LIN, FlexRay	3-SRAUTO	4-SRAUTO	5-SRAUTO	6-SRAUTO	Automotive Serial Triggering and Analysis (CAN, CAN FD, LIN, FlexRay). Enables triggering on packet-level information on CAN/CAN FD/LIN/FlexRay buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
Automotive 100BASE-T1	N/A	N/A	5-SRAUTOEN1	6-SRAUTOEN1	100BASE-T1 Automotive Ethernet serial analysis.
SENT	N/A	4-SRAUTOSEN	5-SRAUTOSEN	6-SRAUTOSEN	Automotive Sensor Serial Triggering and Analysis (SENT). Enables triggering on packet-level information on SENT buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
RS-232/422/485, UART	3-SRCOMP	4-SRCOMP	5-SRCOMP	6-SRCOMP	Computer Serial Triggering and Analysis (RS-232, RS-422, RS-485, UART). Enables triggering on packet-level information on RS-232/422/485 and UART buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
I^2C, SPI	3-SREMBD	4-SREMBD	5-SREMBD	6-SREMBD	Embedded Serial Triggering and Analysis (I^2C, SPI). Enables triggering on packet-level information on I^2C and SPI buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
Ethernet	N/A	4-SRENET	5-SRENET	6-SRENET	Ethernet Serial Triggering and Analysis (10BASE-T, 100BASE-T). Enables triggering on packet-level information on Ethernet buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
I3C	N/A	4-SRI3C	5-SRI3C	6-SRI3C	I3C Serial Decoding and Analysis. Enables decoding and searching on packet-level information on MIPI I3C buses with analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.

Table continued…

Serial bus type	3 Series MDO Option	4 Series MSO Option	5 Series MSO Option	6 Series MSO Option	Description
SPMI	N/A	4-SRPM	5-SRPM	6-SRPM	Power Management Serial Triggering and Analysis (SPMI). Enables triggering on packet-level information on SPMI buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
Spacewire	N/A	4-SRSPACEWIRE	5-SRSPACEWIRE	6-SRSPACEWIRE	Spacewire serial analysis. Enables decoding and analysis on Spacewire buses.
USB 2.0	3-SRUSB2	4-SRUSB2	5-SRUSB2	6-SRUSB2	USB 2.0 Serial Triggering and Analysis (LS, FS, HS). Enables triggering on packet-level information on USB 2.0 buses as well as analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
Serial options bundle	3-BND	N/A	N/A	N/A	Adds all serial analysis options and the power analysis option available for an instrument.
PSI5	N/A	4-SRPSI5	5-SRPSI5	6-SRPSI5	PSI5 Serial Decoding (v1.3 and 2.1) and analysis. Enables decoding and Search Packet level information with analytical tools such as digital views of the signal, bus views, packet decoding, search tools, and packet decode tables with time stamp information.
MDIO	N/A	4-SRMDIO	5-SRMDIO	6-SRMDIO	MDIO Protocol Decoder and Search, No Hardware Trigger; Node locked
SVID	N/A	4-SRSVID	5-SRSVID	6-SRSVID	SVID Protocol Decoder and Search, No Hardware Trigger; Node locked
e-USB2	N/A	4-SREUSB2	5-SREUSB2	6-SREUSB2	eUSB2 Protocol Decoder and Search; Node locked
DPHY	N/A	N/A	5- SRDPY	6- SRDPY	DPHY CSI/DSI (DSI2.0 /CSI2.0 protocols decoder. Supports HS data transmission burst, and escape mode functionality. Data transmission can be with 8-bit raw data or using 8b9b encoded symbol
MANCHESTER	N/A	4-SRMANCH	5-SRMANCH	6-SRMANCH	Supports Generic Manchester decode. Decode of packets as per packet structure defined. Decode of Errors like Sync, Parity, Manchester
SDLC		4-SRSDLC	5-SRSDLC	6-SRSDLC	SDLC decoder and Search. Extensive search options on captured waveforms like unnumbered , Supervisory, address etc
CPHY 1.2	N/A	N/A	5-SRCPHY	6-SRCPHY	MIPI C-PHY CSI/DSI Protocol Decoder and Search
1-Wire	N/A	4-SRONEWIRE	5-SRONEWIRE	6-SRONEWIRE	1-Wire Protocol Decoder and search

To upgrade an already purchased instrument

Serial bus [3]	3 Series MDO Node-Locked License [4]	4 Series MSO Node-Locked/ Floating License	5 Series MSO Node-Locked/ Floating License	6 Series MSO Node-Locked/ Floating License
MIL-STD-1553, ARINC 429	SUP3 SRAERO	SUP4-SRAERO SUP4-SRAERO-FL	SUP5-SRAERO SUP5-SRAERO-FL	SUP6-SRAERO SUP6-SRAERO-FL
I^2S, LJ, RJ, TDM	SUP3 SRAUDIO	SUP4-SRAUDIO SUP4-SRAUDIO-FL	SUP5-SRAUDIO SUP5-SRAUDIO-FL	SUP6-SRAUDIO SUP6-SRAUDIO-FL
CAN, CAN FD, LIN, FlexRay	SUP3 SRAUTO	SUP4-SRAUTO SUP4-SRAUTO-FL	SUP5-SRAUTO SUP5-SRAUTO-FL	SUP6-SRAUTO SUP6-SRAUTO-FL
8B10B	N/A	N/A	SUP5-SR8B10B SUP5-SR8B10B-FL	SUP6-SR8B10B SUP6-SR8B10B-FL
NRZ	N/A	SUP4-SRNRZ SUP4-SRNRZ-FL	SUP5-SRNRZ SUP5-SRNRZ-FL	SUP6-SRNRZ SUP6-SRNRZ-FL
100BASE-T1 Automotive Ethernet	N/A	N/A	SUP5-SRAUTOEN1 SUP5-SRAUTOEN1-FL	SUP6-SRAUTOEN1 SUP6-SRAUTOEN1-FL
SENT	N/A	SUP4-SRAUTOSEN SUP4-SRAUTOSEN-FL	SUP5-SRAUTOSEN SUP5-SRAUTOSEN-FL	SUP6-SRAUTOSEN SUP6-SRAUTOSEN-FL
RS-232/422/485, UART	SUP3 SRCOMP	SUP4-SRCOMP SUP4-SRCOMP-FL	SUP5-SRCOMP SUP5-SRCOMP-FL	SUP6-SRCOMP SUP6-SRCOMP-FL
I^2C, SPI	SUP3 SREMBD	SUP4-SREMBD SUP4-SREMBD-FL	SUP5-SREMBD SUP5-SREMBD-FL	SUP6-SREMBD SUP6-SREMBD-FL
Ethernet	N/A	SUP4-SRENET SUP4-SRENET-FL	SUP5-SRENET SUP5-SRENET-FL	SUP6-SRENET SUP6-SRENET-FL
I3C	N/A	SUP4-SRI3C SUP4-SRI3C-FL	SUP5-SRI3C SUP5-SRI3C-FL	SUP6-SRI3C SUP6-SRI3C-FL
SPMI	N/A	SUP4-SRPM SUP4-SRPM-FL	SUP5-SRPM SUP5-SRPM-FL	SUP6-SRPM SUP6-SRPM-FL
Spacewire	N/A	SUP4-SRSPACEWIRE SUP4-SRSPACEWIRE	SUP5-SRSPACEWIRE SUP5-SRSPACEWIRE-FL	SUP6-SRSPACEWIRE SUP6-SRSPACEWIRE-FL
USB 2.0	SUP3 SRUSB2	SUP4-SRUSB2 SUP4-SRUSB2-FL	SUP5-SRUSB2 SUP5-SRUSB2-FL	SUP6-SRUSB2 SUP6-SRUSB2-FL
Serial analysis bundle [5]	SUP3 BND	N/A	N/A	N/A

Table continued…

[3] Software is supplied with the instrument firmware. Always download and install the latest version of the firmware. Option documentation is part of the application Help.

[4] 3 Series MDO option license names do not have a dash in the option number.

[5] All serial bus and power analysis options that are available for an instrument.

Serial bus [3]	3 Series MDO Node-Locked License [4]	4 Series MSO Node-Locked/ Floating License	5 Series MSO Node-Locked/ Floating License	6 Series MSO Node-Locked/ Floating License
PSI5	N/A	SUP4-SRPSI5 SUP4-SRPSI5-FL	SUP5-SRPSI5 SUP5-SRPSI5-FL	SUP6-SRPSI5 SUP6-SRPSI5-FL
MDIO	N/A	SUP4-SRMDIO SUP4-SRMDIO-FL	SUP5-SRMDIO SUP5-SRMDIO-FL	SUP6-SRMDIO SUP6-SRMDIO-FL
SVID	N/A	SUP4-SRSVID SUP4-SRSVID-FL	SUP5-SRSVID SUP5-SRSVID-FL	SUP6-SRSVID SUP6-SRSVID-FL
e-USB2	N/A	SUP4-SREUSB2 SUP4-SREUSB2-FL	SUP5-SREUSB2 SUP5-SREUSB2-FL	SUP6-SREUSB2 SUP6-SREUSB2-FL
DPHY	N/A	N/A	SUP5-SRDPHY SUP5-SRDPHY -FL	SUP6-SRDPHY SUP6-SRDPHY-FL
MANCHESTER	N/A	SUP4-SRMANCH SUP4-SRMANCH-FL	SUP5-SRMANCH SUP5-SRMANCH-FL	SUP6- SRMANCH SUP6-SRMANCH -FL
SDLC	N/A	SUP4-SRSDLC SUP4- SRSDLC -FL	SUP5- SRSDLC SUP5- SRSDLC -FL	SUP6- SRSDLC SUP6- SRSDLC -FL
CPHY 1.2	N/A	SUP5-SRCPHY	SUP6-SRCPHY	MIPI C-PHY CSI/DSI Protocol Decoder and Search
1-Wire	SUP4-SRONEWIRE	SUP5-SRONEWIRE	SUP6-SRONEWIRE	1-Wire Protocol Decoder and search

Recommended probes

Please refer to *www.tek.com/probes* for further information on the recommended models of probes and any necessary probe adapters.

Partner Products Ordering information

Brief Description of Partner

To add to an instrument at purchase (Supports Windows Option)

Serial bus type	Minimum Bandwidth	Recommended Probes	5 Series MSO Option	6 Series/6B Series MSO Option	Description
PGY-eMMC (Windows Option Only)	2 GHz	Standard probes of MSO5/6 series	PGY-eMMC	PGY-eMMC	eMMC and SD (UHS-I) electrical measurements and Protocol decoding. software conforms to eMMC version 4.41,4.51,5.0, 5.1 specification. Supports Boot, SDR, DDR, HS200 and HS400 mode for electrical measurement and protocol Decode
PGY-SDIO(Windows Option Only)	2 GHz	Standard probes of MSO5/6 series	PGY-I2C	PGY-I2C	I2C Electrical Validation and Protocol decode SW

Table continued…

[3] Software is supplied with the instrument firmware. Always download and install the latest version of the firmware. Option documentation is part of the application Help.

[4] 3 Series MDO option license names do not have a dash in the option number.

Serial bus type	Minimum Bandwidth	Recommended Probes	5 Series MSO Option	6 Series/6B Series MSO Option	Description
PGY-QSPI(Windows Option Only)	500 MHz	Standard probes of MSO5/6 series	PGY-SPI	PGY-SPI	Electrical measurements compliance testing and protocol decoding as specified in QSPI specification. Supports Single and Dual Transfer rate (STR/DTR), electrical measurements and compliance testing for Ext SPI, Dual SPI and Quad SPI. Supports Triggering on command index and on S# falling edge. Supports Analog and Digital Channels of Tektronix MSO Series

Reference Selling of List of protocols supported on MSO series (please note: Windows only)

Serial bus type	Minimum Bandwidth	Recommended Probes	Ordering	5 Series MSO Option	6 Series/6B Series MSO Option	Description
RFFE	500 MHz	Standard probes of MSO5/6 series	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-RFFE	PGY-RFFE	RFFE Protocol Trigger & Decode Analysis Software. PGY-RFFE utilizes the hardware based real-time RFFE protocol aware trigger, protocol analysis of long acquisition record length up to 125MB to provide superior RFFE Protocol Analysis result at press of button.
I2S	500 MHx and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-I2S	PGY-I2S	I2S Electrical, Audio and Protocol Testing SW
I2C	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-I2C	PGY-I2C	I2C Electrical Validation and Protocol decode SW
SPI	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-SPI	PGY-SPI	SPI Electrical Validation and Protocol decode SW
I3C	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-I3C	PGY-I3C	I3C Electrical Validation, Protocol trigger and Decode software
JTAG	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-JTAG	PGY-JTAG	JTAG Protocol decode Software
ONFI	4 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-ONFI	PGY-ONFI	ONFI Electrical Timing Analysis Sw
SPMI	500 MHz and above	standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-SPMI	PGY-SPMI	SPMI Protocol Decode Software

Table continued…

Serial bus type	Minimum Bandwidth	Recommended Probes	Ordering	5 Series MSO Option	6 Series/6B Series MSO Option	Description
MPHY	16 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-UPRO PGY-LLI PGY-UFS(needs PGY-UPRO)	PGY-UPRO PGY-LLI PGY-UFS(needs PGY-UPRO)	MIPI MPHY -UniPro/LLI/UFS Protocol Decode Sw
USB 2.0	2 GHz	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-USB	PGY-USB	USB 2.0 Protocol Decode Sw
USB-PD	500 MHz and above	Standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-PD	PGY-PD	USB PD (CC) Protocol Analysis Sw
UART	500 MHz and above	Standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-UART	PGY-UART	UART Electrical Validation and Protocol Decode Software
KX/KR	12 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-NEGO	PGY-NEGO	KX/KR DME and Line Training Analysis Sw
100Base-T1	2 GHz and above	Standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-100Base T1	PGY-100Base T1	100 Base-T1 Protocol Decode Sw
SVID	500 MHz and above	Standard probes	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-SVID	PGY-SVID	SVID Protocol Decode Sw
USB3 Gen 1	23 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-USB3 Gen1	PGY-USB3 Gen1	USB3 Gen 1 5 Gbps Protocol Decode Sw
USB3 Gen 2	23 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-USB3 Gen1	PGY-USB3 Gen1	USB3 Gen 2 Protocol Decode Sw
8B10B	4 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-8B10B	PGY-8B10B	8B10B Protocol Decode Sw
1000T1-LT	4 GHz and above	Contact Prodigy	Reference Selling. Contact: *contact@prodigytechno.com*	PGY-1000T1-LT	PGY-1000T1-LT	1000BaseT1 Line Training Decode Software

Terms and Conditions Lead time of 2-3 Weeks ARO.

Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

Product Area Assessed: The planning, design/development and manufacture of electronic Test and Measurement instruments.

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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit *www.tek.com*.

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