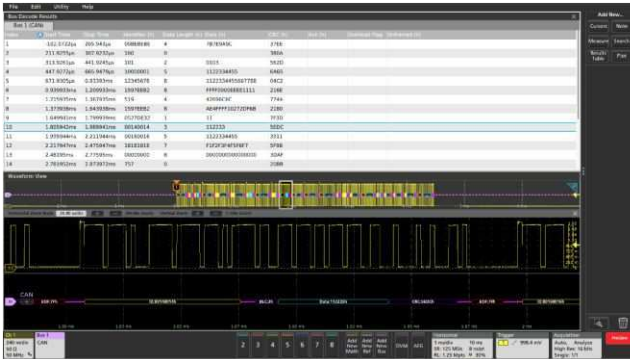# 5 Series MSO Serial Triggering and Analysis Applications

5-SRAERO, 5-SRAUDIO, 5-SRAUTO, 5-SRAUTOSEN, 5-SRCOMP, and 5-SREMBD Datasheet

On a serial bus, a single signal often includes address, control, data, and clock information. This can make isolating events of interest difficult. The serial applications for the 5 Series MSO transform the oscilloscopes into a robust tool for debugging serial buses with automatic trigger and decode for I2C, SPI, CAN, CAN FD, LIN, FlexRay, SENT, RS-232/422/485, UART, MIL-STD-1553, ARINC 429, I2S, LJ, RJ, and TDM.

Key features

- Automated Serial Triggering and Decode Options for I2C, SPI, CAN, CAN FD, LIN, FlexRay, SENT, RS-232/422/485, UART, MIL-STD-1553, ARINC 429, I2S, LJ, RJ, and TDM [1]

- 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 5 Series MSO serial applications support automatic trigger and decode for I2C, SPI, CAN, CAN FD, LIN, FlexRay, SENT, RS-232/422/485, UART, MIL-STD-1553, ARINC 429, I2S, LJ, RJ, 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 I2C, SPI, CAN, CAN FD, LIN, FlexRay, SENT, RS-232/422/485, UART, MIL-STD-1553, ARINC 429, I2S, LJ, RJ, 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 5 Series MSO will decode each packet on the bus, and display the value in hex, binary, or ASCII (RS-232/422/485/UART 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 5 Series MSO 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 → buttons on the oscilloscope front panel.

---

[1] USB 2.0 and Ethernet support information available in separate datasheets

Characteristics

I²C characteristics

Bus setup options

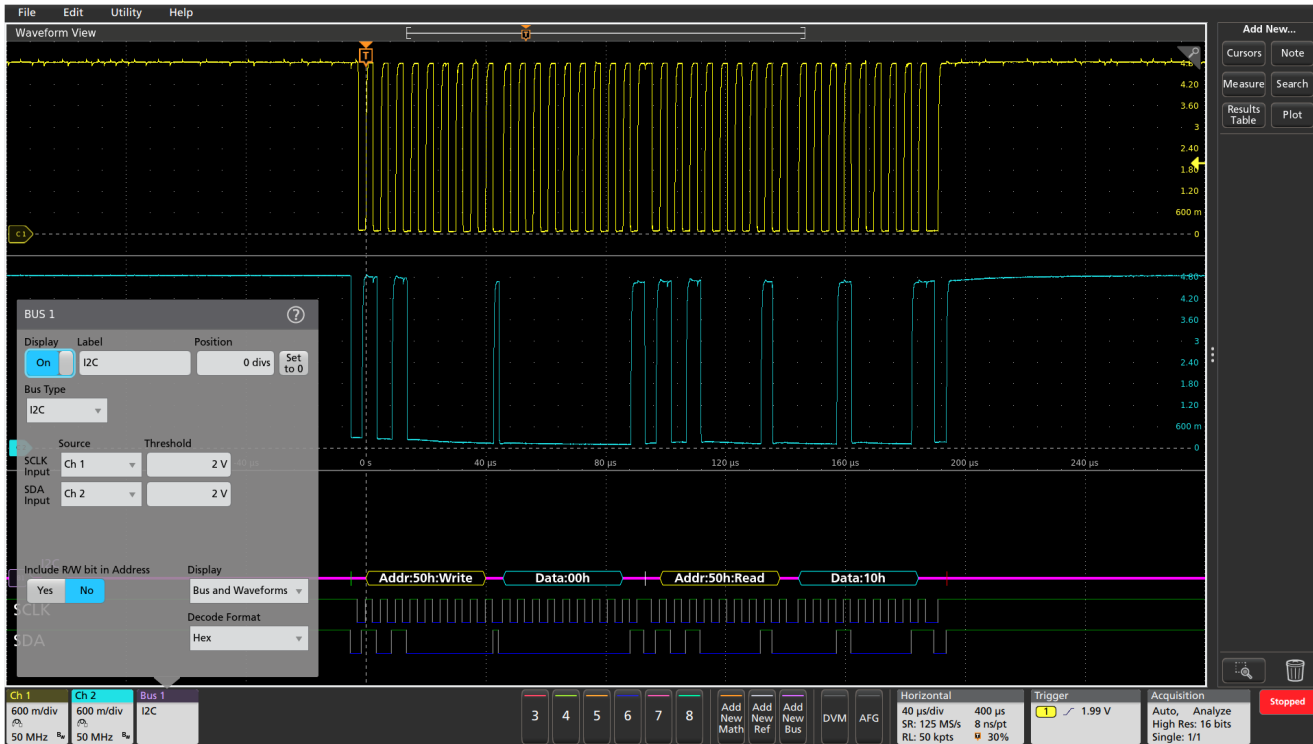| Characteristic	Description
I²C Sources (Clock and Data)	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Include R/W in Address	Yes or No
Address/Data Formats Available	Hex Binary

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

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

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)

www.valuetronics.com

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

Triggering on a specific address value on the I²C bus.

SPI characteristics

Bus setup options

Characteristic	Description
SPI Sources (Clock, Data, and Slave Select)	Analog channels Digital channels Active Math channels Active Reference channels
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

Display modes

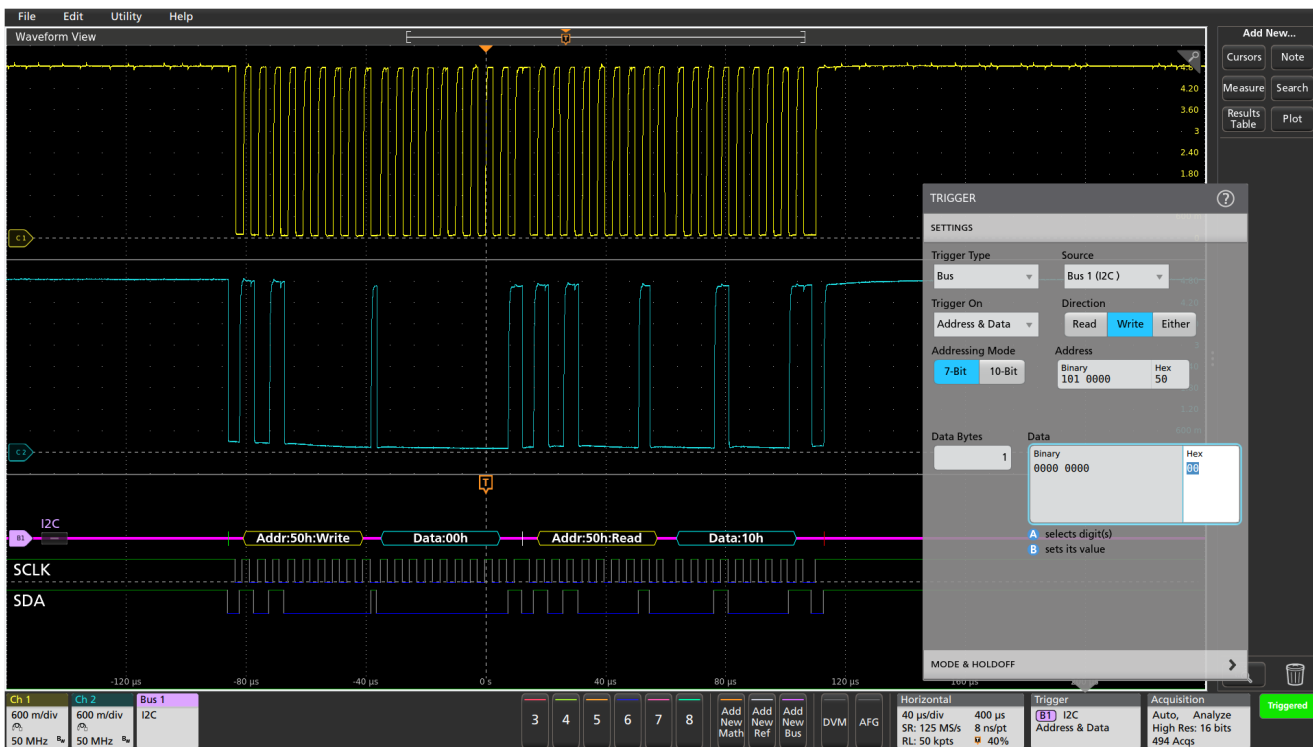| Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

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)

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)

www.valuetronics.com

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.

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

Bus setup options

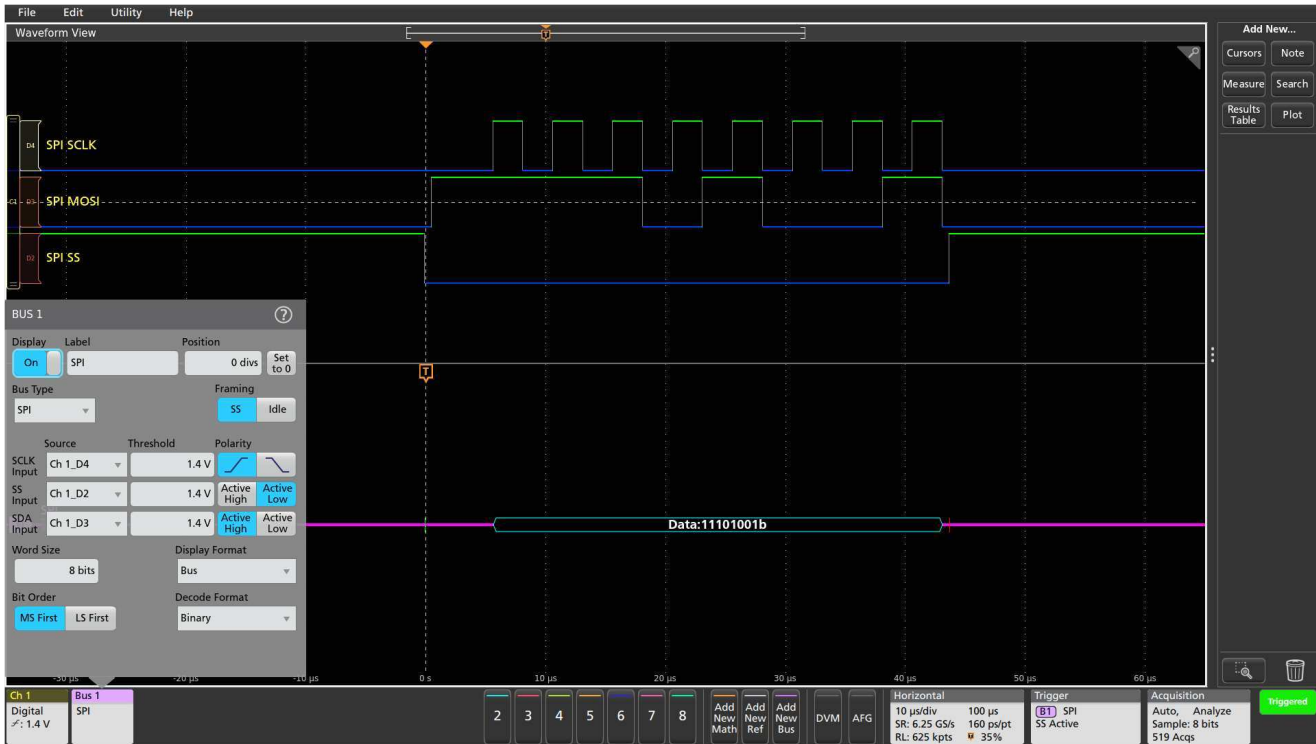| Characteristic	Description
Sources, RS-232, UART	Analog channels Digital channels Active Math channels Active Reference channels
Sources, RS-422, RS-485	Analog channels Active Math channels Active Reference channels
Polarity	Normal (RS-232) Inverted (UART, RS-422, RS-485)
Parity	None Odd Even
Recommended 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

Display modes

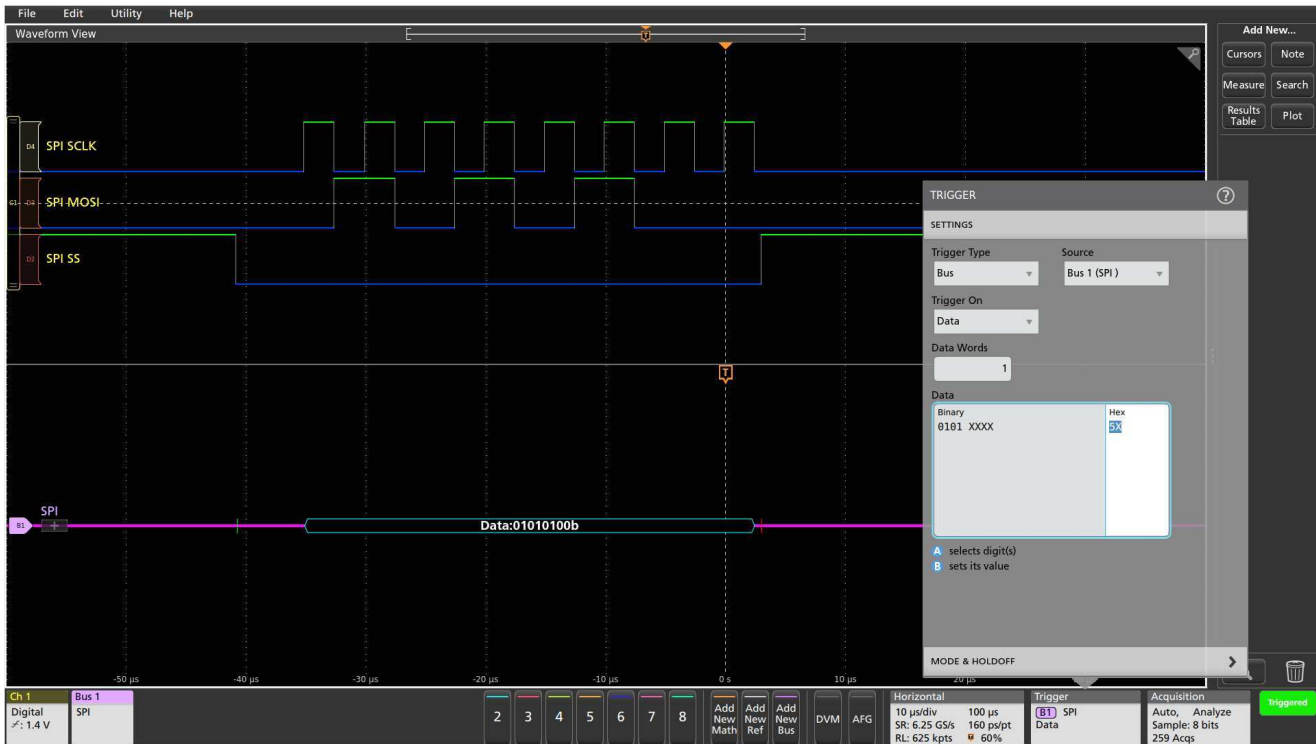| Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

Bus trigger and search options

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

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 15 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 (50 b/s - 15 Mb/s)
Decode Display	Start (green packet) Data (cyan packet) Parity (purple packet) Parity Error (red packet)

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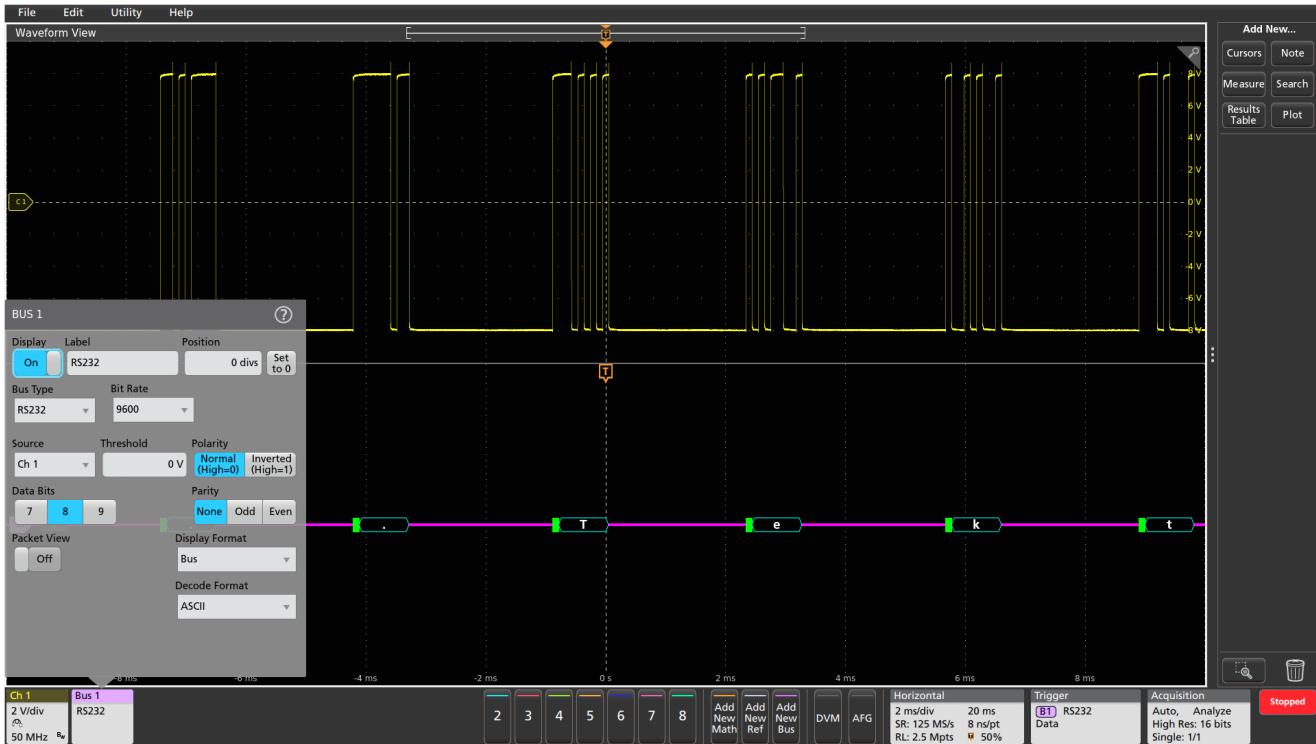
RS-232 bus setup and ASCII display, showing assignment of source signal, digital threshold, and polarity.

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

CAN characteristics

Bus setup options

Characteristic	Description
Source for CAN_H, CAN_L, Rx, or Tx (single-ended probing)	Analog channels Digital channels Active Math channels Active Reference channels
Source for Diff (differential probing)	Analog channels Active Math channels Active Reference channels
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 1 kb/s - 1 Mb/s
Sample Point	0% - 100% of bit period of unit interval
Formats Available	Hex Binary

Display modes

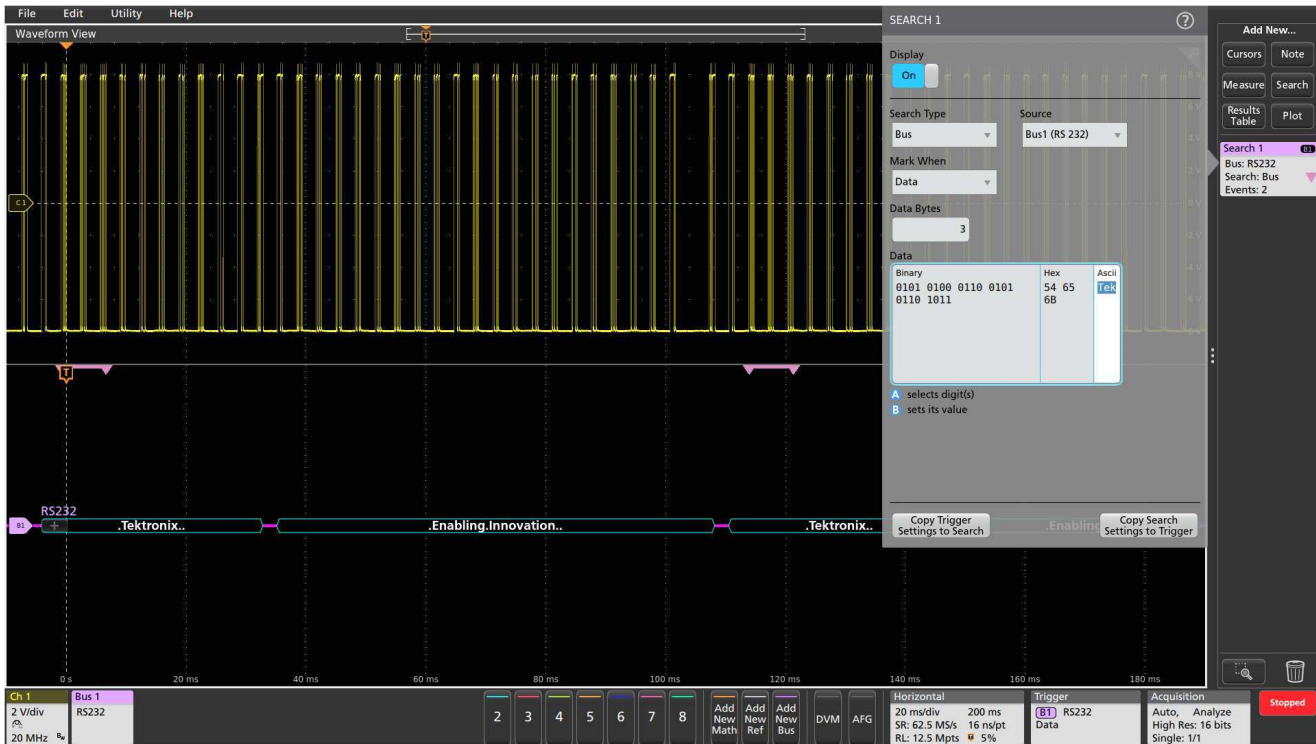| Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

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

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)

www.valuetronics.com

Bus Decode Results — Bus 1 (CAN)

Index	Start Time	Stop Time	Identifier (h)	Data Length (h)	Data (h)	CRC (h)	Ack (h)	Overload Flag	Unframed (h)
1	-102.0722ps	205.943µs	00BEBEBE	4	7B7E9A9C	37EE			
2	211.9255µs	307.9232µs	100	0		380A			
3	313.9261µs	441.9245µs	101	2	0103	562D			
4	447.9272µs	665.9479µs	10000001	5	1122334455	6A65			
5	671.9305µs	0.93393ms	12345678	8	1122334455667788	04C2			
6	0.939933ms	1.209933ms	1597EEB2	8	FFFF0000EEEE1111	216E			
7	1.215935ms	1.367935ms	519	4	42696C6C	7744			
8	1.373938ms	1.643938ms	1597EEB2	8	AE4FFFF10272DF6B	2180			
9	1.649941ms	1.799939ms	0527DE32	1	11	7F3D			
10	1.805942ms	1.989941ms	00140014	3	112233	5EDC			
11	1.995944ms	2.211944ms	00160016	5	1122334455	3911			
12	2.217947ms	2.475947ms	18181818	7	F1F2F3F4F5F6F7	5F9B			
13	2.48195ms	2.77595ms	00000000	8	0000000000000000	3DAF			
14	2.781952ms	2.873972ms	757	0		20BB			

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

Bus setup options

| Characteristic	Description
Source for CAN_H, CAN_L, Rx, or Tx (single-ended probing)	Analog channels Di2gital channels Active Math channels Active Reference channels
Source for Diff (differential probing)	Analog channels Active Math channels Active Reference channels
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 50 kb/s - 10 Mb/s
FD Bit Rate Selection: Predefined list of rates Custom	1 Mb/s - 16 Mb/s 500 kb/s - 16 Mb/s
Sample Point	55% - 95% of bit period of unit interval
Formats Available	Mixed Hex Binary

Display modes

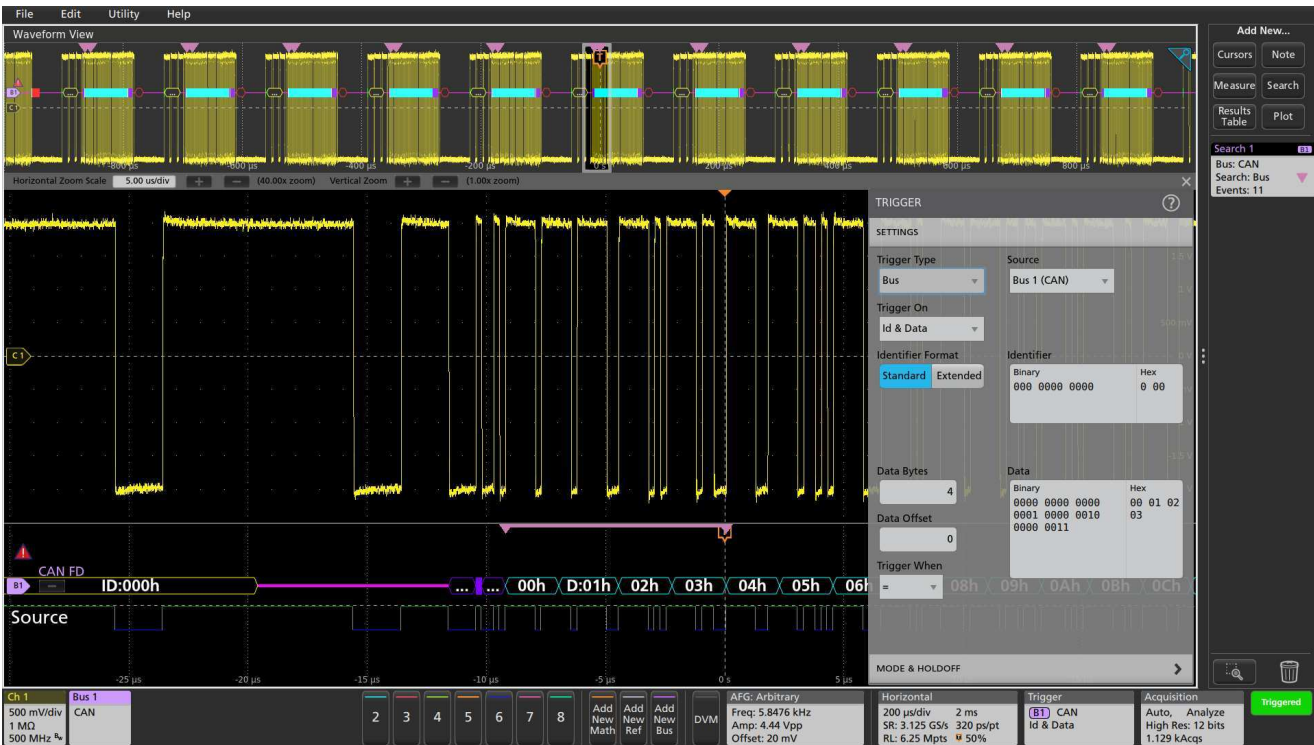| Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

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)

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)

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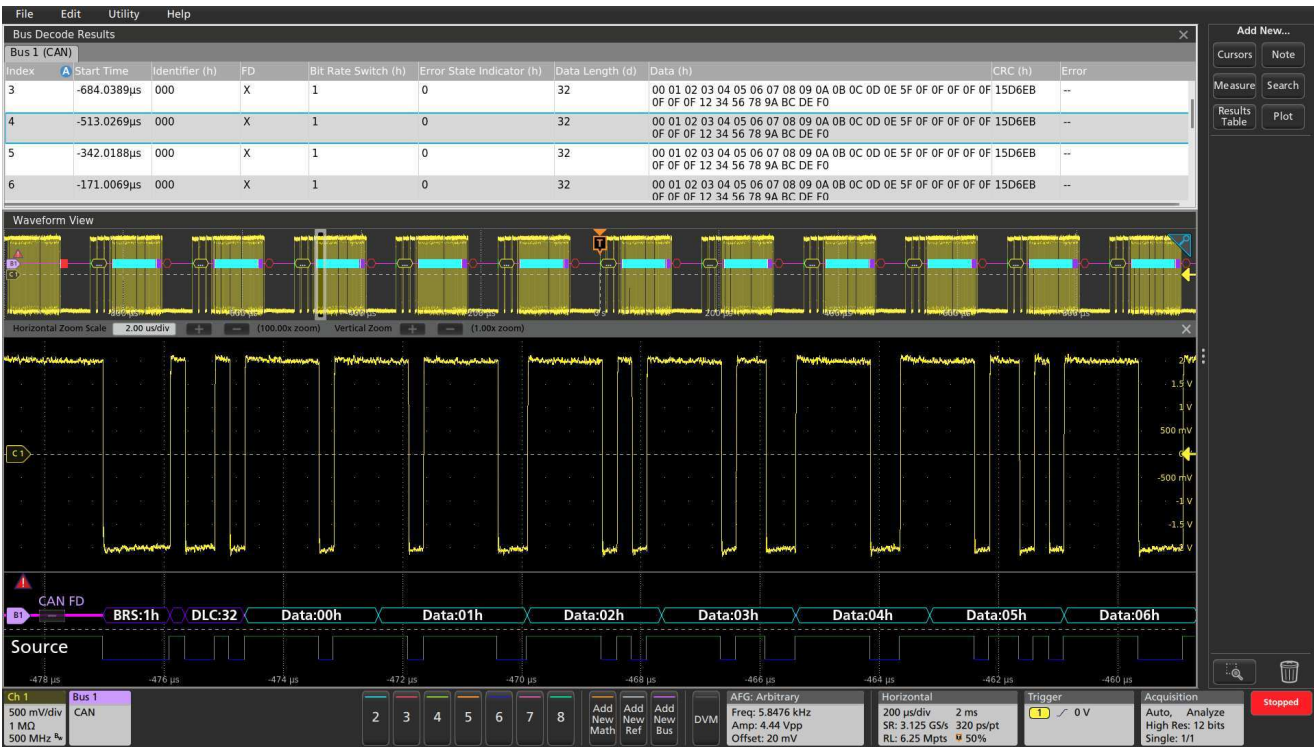
Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the CAN FD bus.

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

www.valuetronics.com

LIN characteristics

Bus setup options

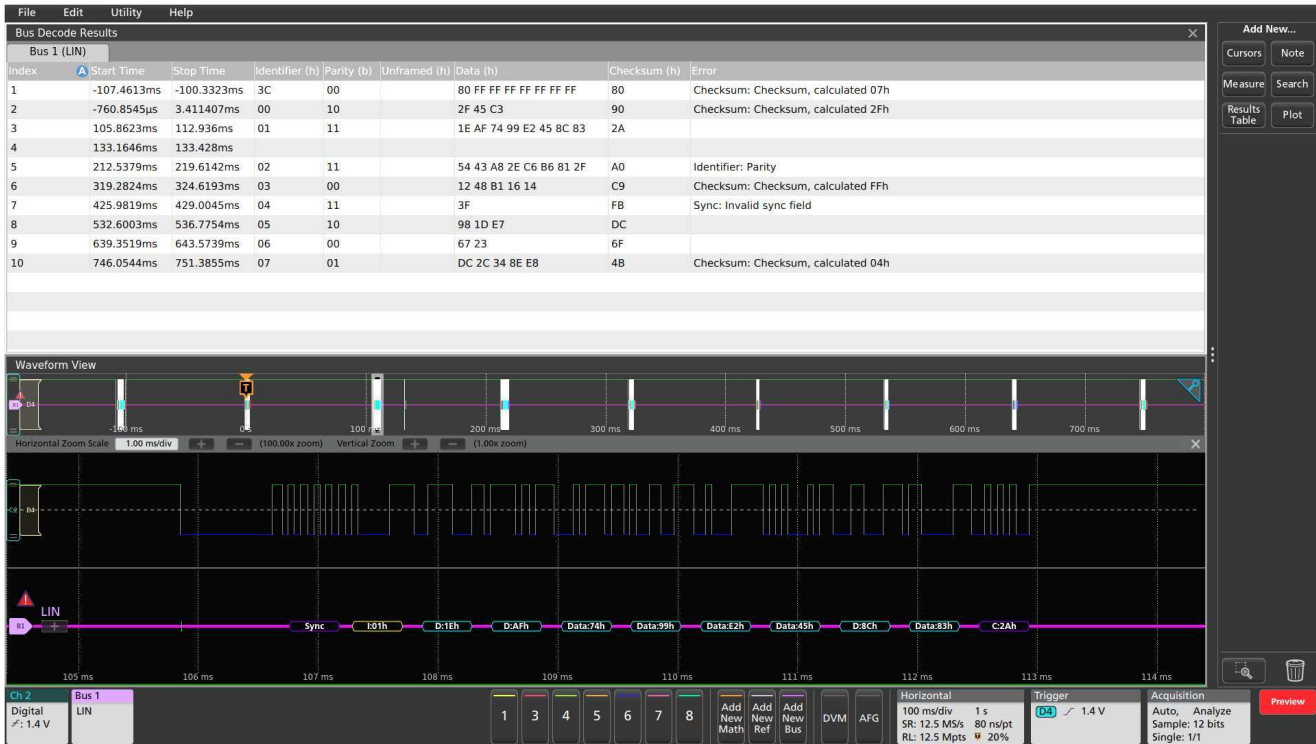| Characteristic	Description
LIN Source	Analog channels Digital channels Active Math channels Active Reference channels
Thresholds	Per-channel thresholds
Recommended Probing	Single-ended
Polarity	Normal Inverted
Bit Rate Selection: Predefined list of rates Custom	1.2 kb/s - 19.2 kb/s 1 kb/s - 100 kb/s
Sample Point	0% - 100% 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

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

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)

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)

www.valuetronics.com

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.

www.valuetronics.com

FlexRay characteristics

Bus setup options

Characteristic	Description
Source for Differential Probing (Bdiff)	Analog channels Active Math channels Active Reference channels
Source for Single-ended Probing (BP, BM)	Analog channels Digital channels Active Math channels Active Reference channels
Source for Single-ended Probing (Tx, Rx)	Analog channels Digital channels Active Math channels Active Reference channels
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)

Display modes

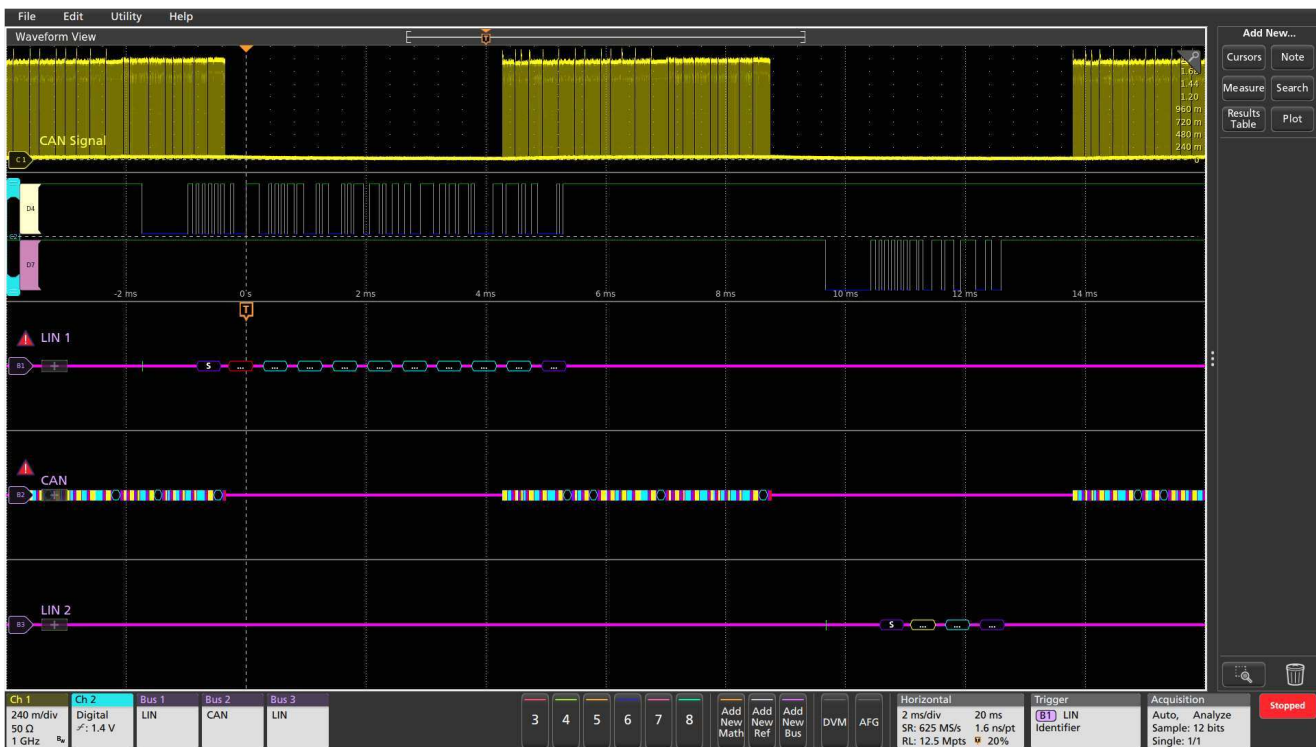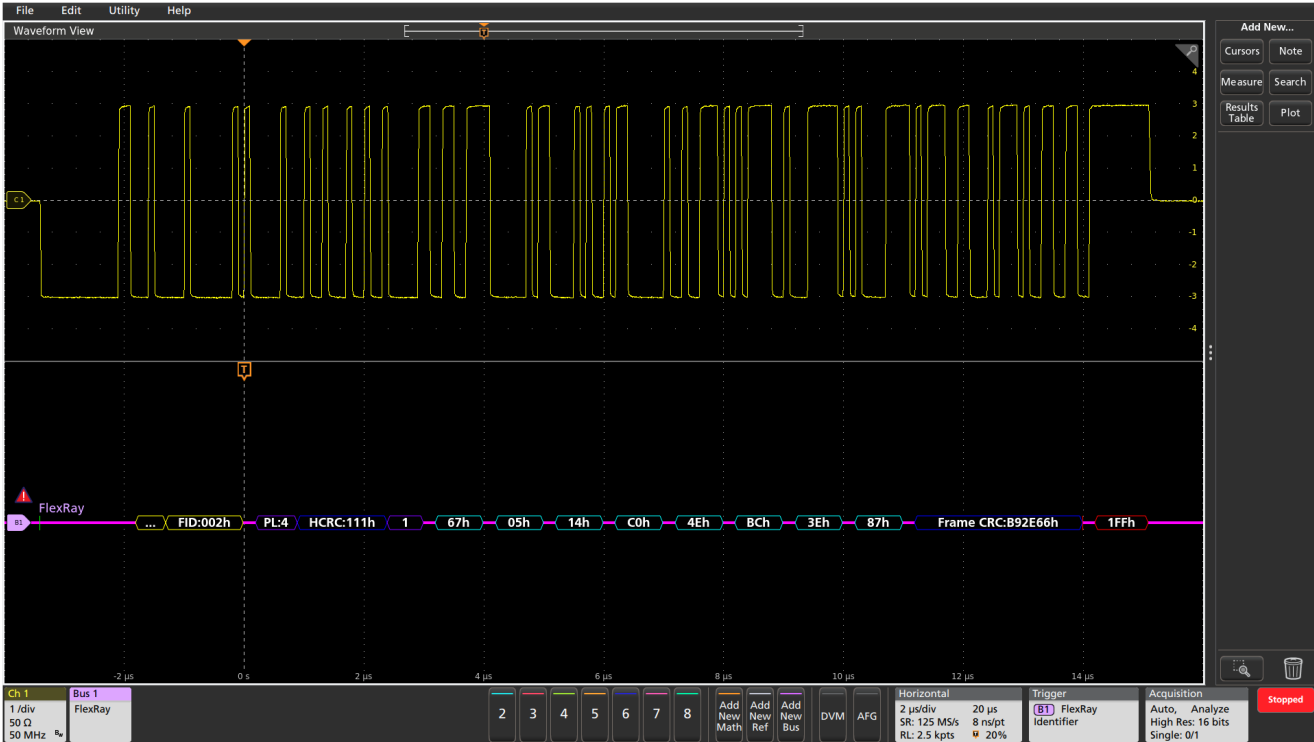| Characteristic	Description
Bus	Bus only
Bus and Waveforms	Simultaneous display of bus and digital waveforms
Results Table	Decoded packet data in a tabular view

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)

Bus decode

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

www.valuetronics.com

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.

www.valuetronics.com

SENT-Characteristics

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

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

Bus trigger options

Characteristic	Description
Trigger On	Start of Packet Fast Channel (Status/Communication, Data) CRC Error

Bus search options

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

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)

www.valuetronics.com

Bus Decode Results

Bus 1 (SENT)

Index	Start Time	Status	Chan 1 (h)	Chan 2 (h)	CRC (h)	S ID (h)	S Data (h)	S CF
44	-13.23838ms	01 00	B5E	4F5	B	--	--	--
45	-12.38638ms	01 00	2B2	4C9	5	--	--	--
46	-11.53438ms	10 00	978	1A2	3	--	--	--
47	-10.68238ms	11 00	0EC	7FE	2	--	--	--
48	-9.830377ms	10 00	694	4B2	3	--	--	--
49	-8.978379ms	01 00	B66	3BF	3	07	075	01
50	-8.126378ms	10 00	95D	A54	C	Start	--	--
51	-7.274379ms	10 00	0BE	F4A	D	--	--	--
52	-6.422379ms	10 00	E48	083	0	--	--	--
53	-5.570378ms	10 00	41A	DCB	F	--	--	--
54	-4.718377ms	10 00	5D8	FD7	F	--	--	--
55	-3.866378ms	11 00	1F7	0E5	2	--	--	--
56	-3.014378ms	00 00	3C1	3BC	0	--	--	--
57	-2.162378ms	00 00	F08	3D5	5	--	--	--
58	-1.310377ms	00 00	A97	4A9	F	--	--	--
59	-458.378µs	00 00	F06	DFB	6	--	--	--
60	393.6206µs	00 00	27F	C72	C	--	--	--
61	1.245621ms	01 00	532	FB3	A	--	--	--
62	2.097622ms	01 00	B5E	4F5	B	--	--	--
63	2.949623ms	01 00	2B2	4C9	5	--	--	--
64	3.801621ms	10 00	978	1A2	3	--	--	--
65	4.653623ms	11 00	0EC	7FE	2	--	--	--
66	5.505623ms	10 00	694	4B2	3	--	--	--
67	6.357621ms	01 00	B66	3BF	3	07	075	01
68	7.209623ms	10 00	95D	A54	C	Start	--	--
69	8.061621ms	10 00	0BE	F4A	D	--	--	--
70	8.913622ms	10 00	E48	083	0	--	--	--
71	9.765623ms	10 00	41A	DCB	F	--	--	--
72	10.61762ms	10 00	5D8	FD7	F	--	--	--
73	11.46962ms	11 00	1F7	0E5	2	--	--	--
74	12.32162ms	00 00	3C1	3BC	0	--	--	--

Protocol Decode Results Table provides a time-stamped, tabular view of all captured packets on the SENT bus.
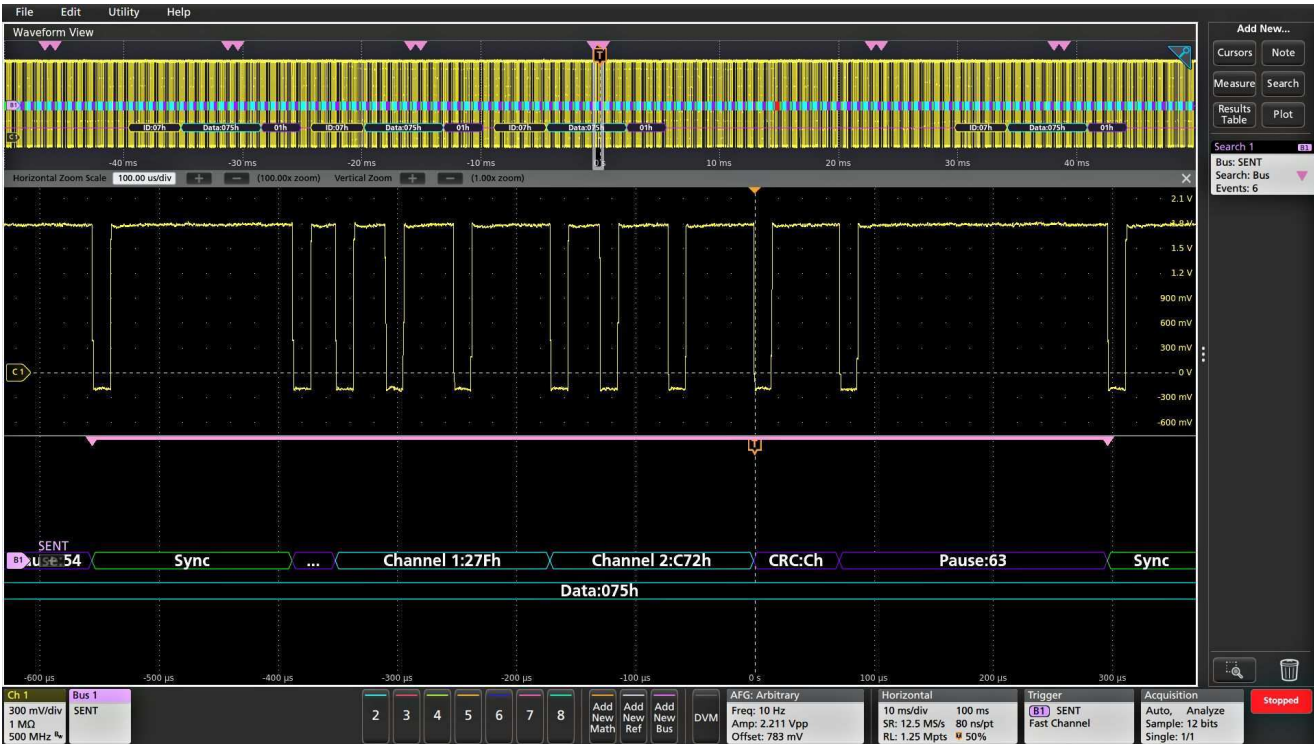
Triggering on a specific Fast Channel Status and data pattern on the SENT bus and automatically searching on the same data pattern.

www.valuetronics.com

MIL-STD-1553 characteristics

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 Binary

Display modes

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

### 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)

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)

www.valuetronics.com

Index	Start Time	Type	Remote Terminal Address (d)	Transmit/Receive	Sub Address/Mode (d)	Mode Code (d)	Status	Data Word Count (d)	Data (h)	C/S Payload (b)	Error
81	-1.170807ms	Data	--	--	--	--	--	--	0001	--	Nonco
82	-1.142805ms	Data	--	--	--	--	--	--	0002	--	--
83	-1.106808ms	Command	10	Receive	29	--	--	2	--	--	--
84	-1.086805ms	Data	--	--	--	--	--	--	5445	--	--
85	-1.066802ms	Data	--	--	--	--	--	--	4B54	--	Incom
86	-2.8084µs	Command	3	Receive	29	--	--	2	--	--	--
87	17.194µs	Data	--	--	--	--	--	--	0005	--	--
88	37.1972µs	Data	--	--	--	--	--	--	0006	--	--
89	65.1916µs	Status	3	--	--	--	000-000-00000	--	--	--	--
90	101.1924µs	Command	17	Transmit	1	--	--	3	--	--	--
91	129.1924µs	Status	17	--	--	--	000-000-00000	--	--	--	--
92	149.1972µs	Data	--	--	--	--	--	--	0000	--	--

Protocol Decode Results Table provides a time-stamped, tabular view of all captured MIL-STD-1553 packets.
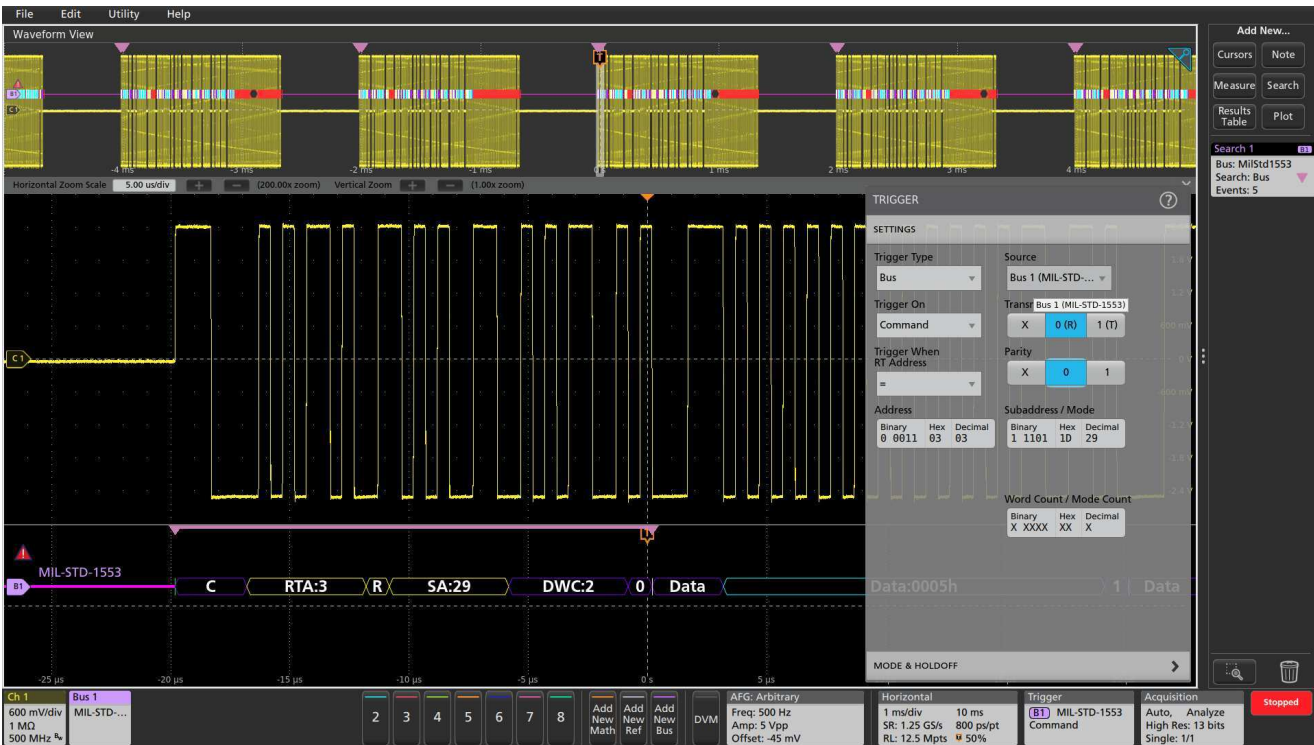
Triggering on a specific command pattern on the MIL-STD-1553 bus and automatically searching on the same pattern.

ARINC 429 characteristics

Bus setup options

Characteristic	Description
ARINC 429 Source	Analog channels Active Math channels Active Reference channels
Signal Type	Single -ended Differential
Polarity	Normal Inverted
Thresholds	Single-ended: Per-channel thresholds Differential: High and low thresholds
Recommended Probing	Single -ended or 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 Binary

Display modes

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

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)

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)

www.valuetronics.com
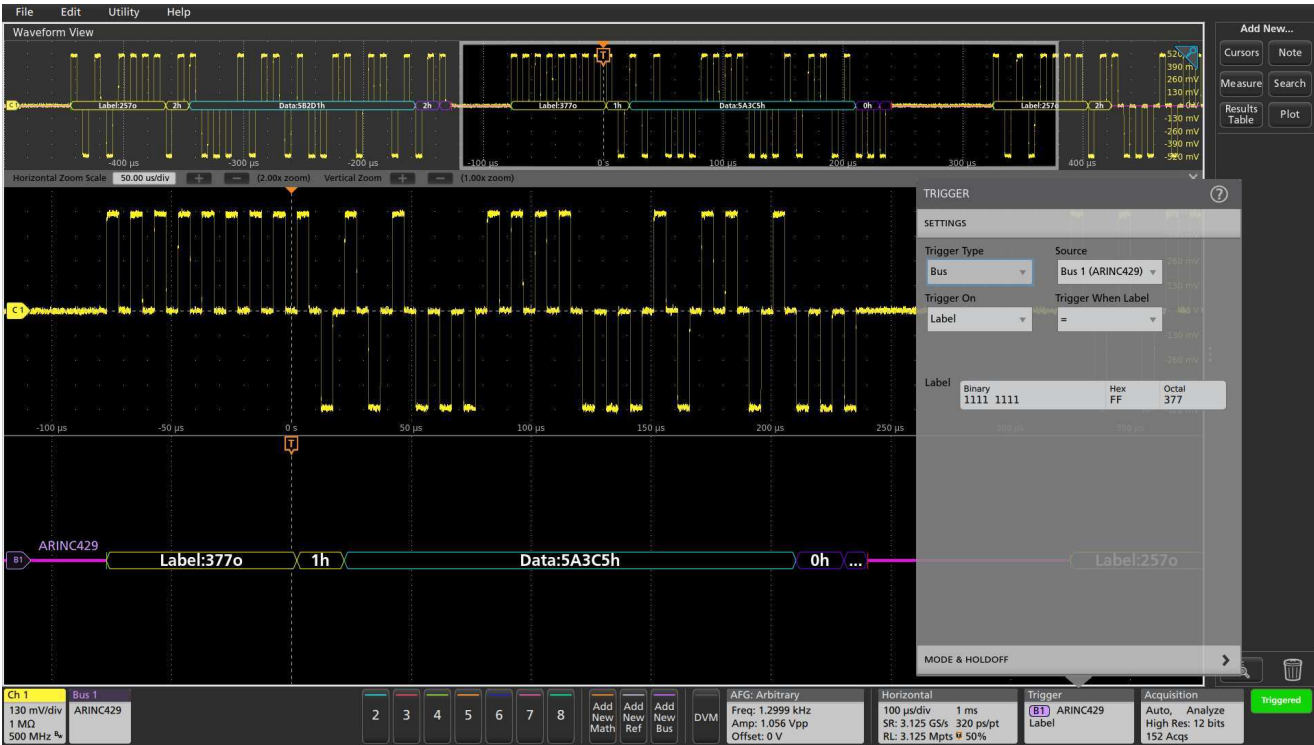
Decoded ARINC 429 bus, with the acquisition triggered on a specified label value.
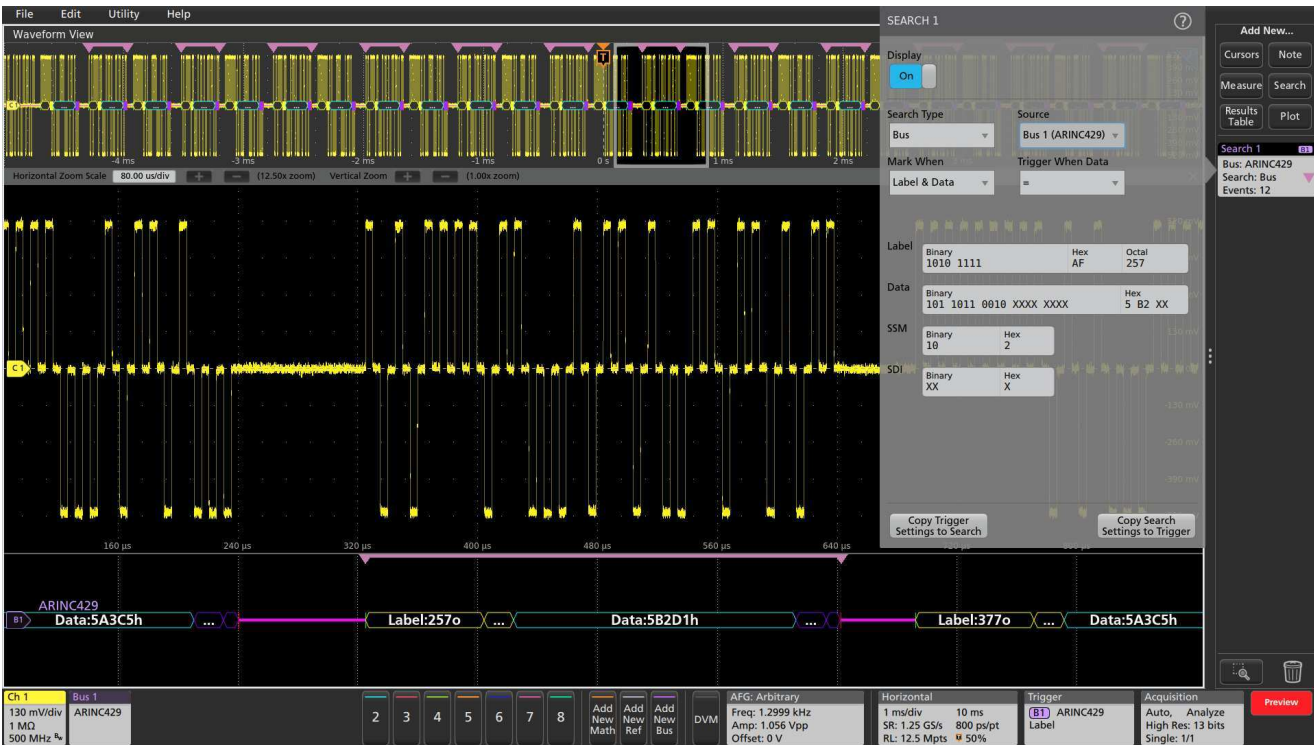
Decoded ARINC 429 bus, with all data values in a specific range marked with pink brackets.

Audio characteristics

Bus setup options

Characteristic	Description
Audio Sources (Bit Clock, Word Select, Data)	Analog channels Digital channels Active Math channels Active Reference channels
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

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

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)

Bus decode

Characteristic	Description
Maximum Clock/Data Rate	Up to 10 Mb/s (for automated decoding of 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)
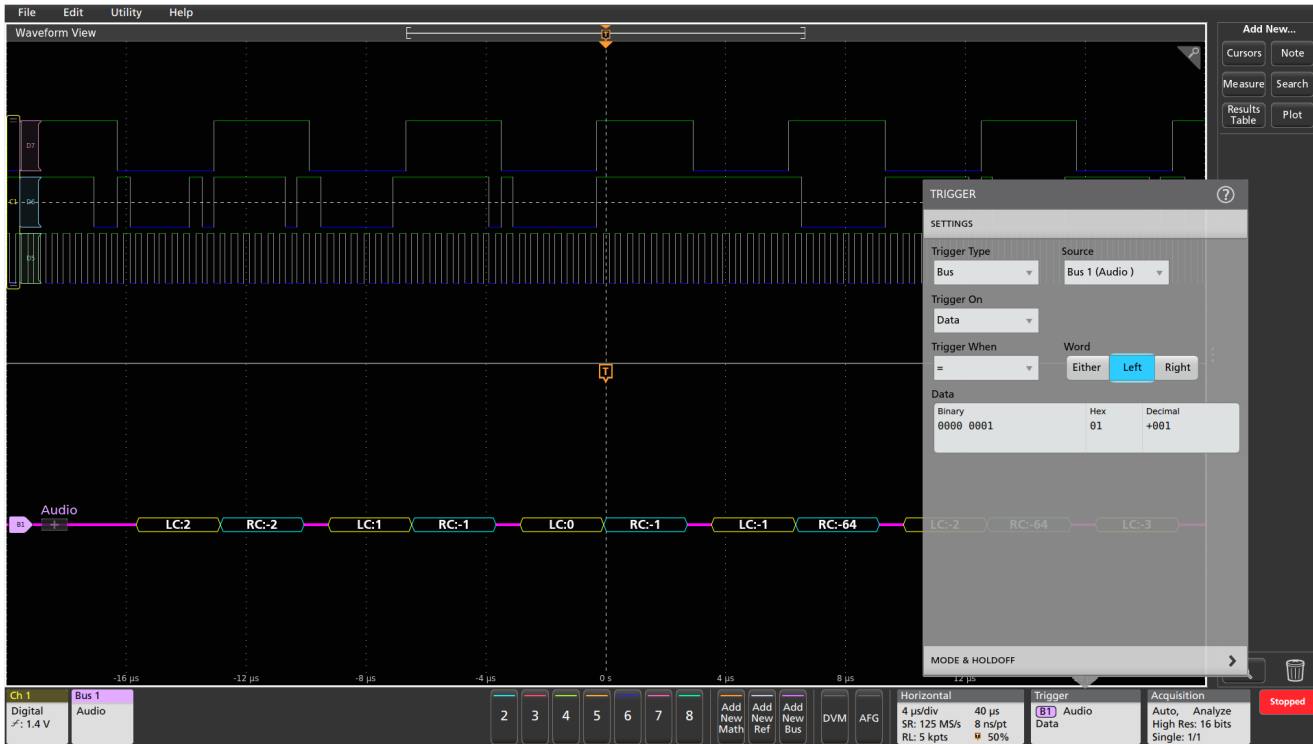
Decoded I²S bus, with data values displayed in signed decimal format, and the MSO triggered on a specific data value.
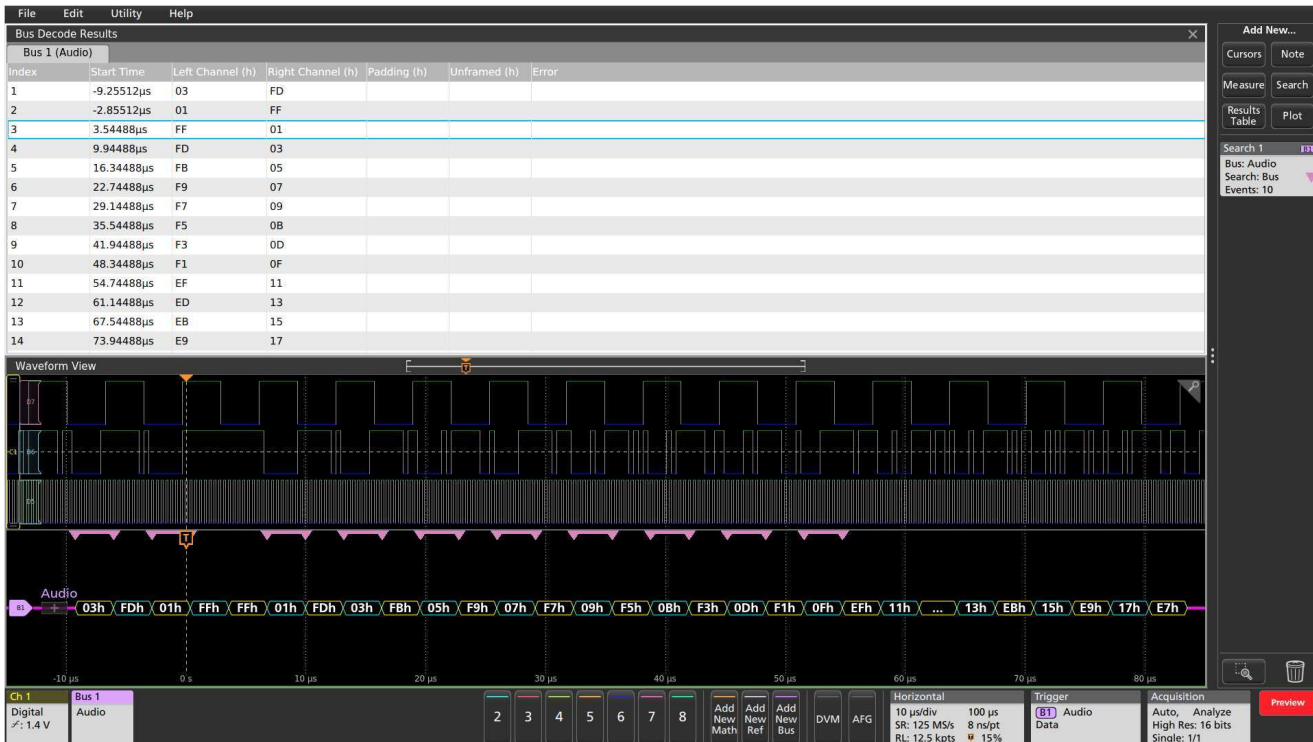
Decoded I²S bus, with data values displayed in hex and Results Table format, and the Wave Inspector automatic search marking all occurrences of the data values equal to 0X hex.

Ordering information

To add to an instrument at purchase

Serial bus	5 Series MSO Option [2]	Description
I ^{2}C, SPI	5-SREMBD	Embedded Serial Triggering and Analysis (I^{2}C, SPI). Enables triggering on packet-level information on I^{2}C 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.
CAN, CAN FD, LIN, FlexRay	5-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.
SENT	5-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	5-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.
MIL-STD-1553, ARINC 429	5-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^{2}S, LJ, RJ, TDM	5-SRAUDIO	Audio Serial Triggering and Analysis (I^{2}S, 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.

To upgrade an existing 5 Series MSO

Serial bus [3]	Order Node-Locked License	Order Floating License
I^{2}C, SPI	SUP5-SREMBD	SUP5-SREMBD-FL
CAN, CAN FD, LIN, FlexRay	SUP5-SRAUTO	SUP5-SRAUTO-FL
SENT	SUP5-SRAUTOSEN	SUP5-SRAUTOSEN-FL
RS-232/422/485, UART	SUP5-SRCOMP	SUP5-SRCOMP-FL
MIL-STD-1553, ARINC 429	SUP5-SRAERO	SUP5-SRAERO-FL
I^{2}S, LJ, RJ, TDM	SUP5-SRAUDIO	SUP5-SRAUDIO-FL

Recommended probes

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

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.

---

[2] USB 2.0 and Ethernet options also available.

[3] Software is supplied with the 5 Series MSO instrument firmware. User documentation is part of the oscilloscope documentation.

www.valuetronics.com

ASEAN / Australasia (65) 6356 3900
Belgium 00800 2255 4835*
Central East Europe and the Baltics +41 52 675 3777
Finland +41 52 675 3777
Hong Kong 400 820 5835
Japan 81 (3) 6714 3086
Middle East, Asia, and North Africa +41 52 675 3777
People's Republic of China 400 820 5835
Republic of Korea +822 6917 5084, 822 6917 5080
Spain 00800 2255 4835*
Taiwan 886 (2) 2656 6688

Austria 00800 2255 4835*
Brazil +55 (11) 3759 7627
Central Europe & Greece +41 52 675 3777
France 00800 2255 4835*
India 000 800 650 1835
Luxembourg +41 52 675 3777
The Netherlands 00800 2255 4835*
Poland +41 52 675 3777
Russia & CIS +7 (495) 6647564
Sweden 00800 2255 4835*
United Kingdom & Ireland 00800 2255 4835*

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
Canada 1 800 833 9200
Denmark +45 80 88 1401
Germany 00800 2255 4835*
Italy 00800 2255 4835*
Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90
Norway 800 16098
Portugal 80 08 12370
South Africa +41 52 675 3777
Switzerland 00800 2255 4835*
USA 1 800 833 9200

* European toll-free number. If not accessible, call: +41 52 675 3777

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.

14 Mar 2018   61W-61101-2

www.tek.com/5SeriesMSO

Tektronix®