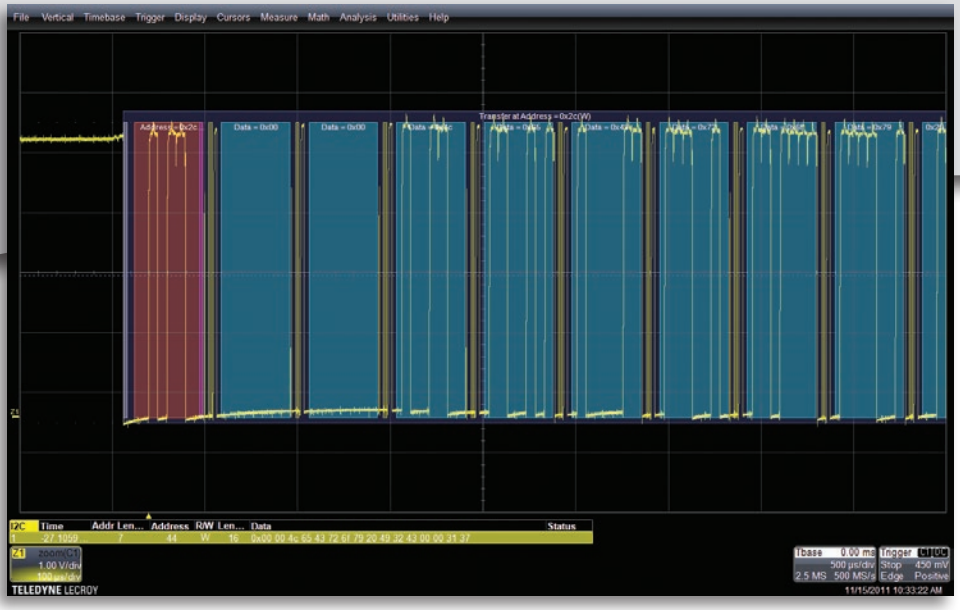
TELEDYNE LECROY
Everywhereyoulook™

I²C, SPI, UART, RS-232 Serial Data Trigger and Decode



Color-coded overlaid protocol decode makes it easy to understand your serial data messages.

Key Features

- **I²C, SPI, UART and RS-232 Trigger and Decode**
- **Color-coded decode overlaid on the waveform is intuitive and easy to read**
- **Powerful and flexible conditional DATA triggering (=, not =, >, >=, <, <=, <>, in range, out of range).**
- **Hex, Binary or ASCII decoding**
- **Decode information expands as the timebase is adjusted or zoomed**
- **Convenient table display with quick "zoom to message" capability**
- **Quick search capability for specific messages**
- **Set an ACK condition (ACK, NO ACK, Don't Care) in all frame trigger setups (I²C)**
- **Decode does not require clock trace to be displayed (I²C, SPI)**
- **Supports UART address (9-bit) Byte triggering**
- **Supports trigger and decode of user defined proprietary protocols based on a UART backbone**

The Most Intuitive Decode

Advanced software algorithms deconstruct the waveform into protocol information, then overlay the decoded data on the waveform. Decode information condenses or expands depending on the timebase/zoom ratio setting, so understanding messages is easy. Various sections of the protocol are color-coded to make it easy to understand, especially for users new to I²C, SPI, UART, and RS-232 serial data. The decode operation is fast—even with long acquisitions. The user can choose to decode into Hex, Binary, or ASCII formats.

Teledyne LeCroy's decode algorithms allow the CLOCK signal to be input to the external channel, which saves valuable channels for other signals. Or, if the CLOCK signal is input to a channel, it can be turned OFF as desired to reduce display clutter.

Powerful Conditional Data Triggering

Completely isolate specific I²C, SPI, UART, or RS-232 message events for better understanding and debug. Use a conditional DATA trigger to select a range of DATA values to trigger on, not just a single DATA value. Oftentimes, I²C utilizes DATA bytes to specify sub-addresses for accessing memory locations in EEPROMs. Conditional DATA trigger allows triggering on a range of DATA bytes that correspond to reads or writes to specific sub-address memory blocks in the EEPROM. It can also aid in monitoring DATA outputs from I²C-based sensors, such as analog-to-digital converters, and triggering when DATA is outside a safe operating range. In both cases, verifying proper operation becomes a simple task. Of course, all the basic I²C and SPI triggering capability you would expect is also included.

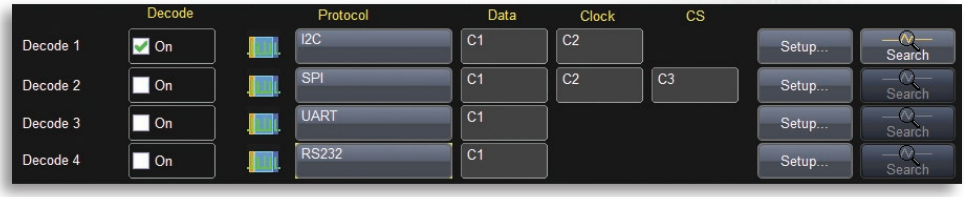
Full UART and RS-232 Capability and Customization

Complete support for any configuration of UART and standard RS-232. Generic UART is commonly used as the backbone for proprietary protocols, and the flexible setup configuration allows definition to meet your exact need.

POWERFUL TRIGGERING, INTUITIVE DECODING

Flexible Triggering

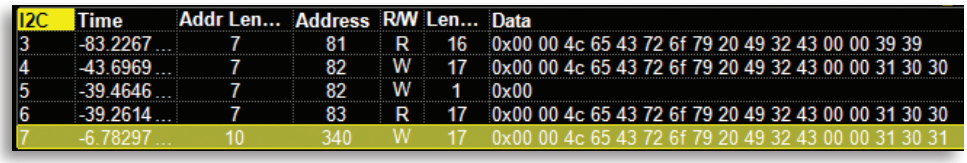
I²C, SPI, and UART all have special use cases and the Teledyne LeCroy Trigger and Decode solutions address these cases. The I²C trigger can be configured for 7 or 10-bit addressing with out without inclusion of the R/W bit. The SPI trigger can be configured for a range of CPOL and CPHA settings as well as the Simplified SPI protocol. With the UART trigger 8 and 9-bit (8+1) formats are supported.



Simultaneously decode up to 4 serial data buses. When using the MSO option on WaveRunner Xi or WaveSurfer Xs the digital inputs D0, D1, D2, etc. can be used as the source for a serial data trigger and decode.

Convenient Table Display Summarizes Results

Turn your oscilloscope into a protocol analyzer with the Table display of protocol information. Custom configure the Table to display only the information you want, and export Table data to an Excel file. Touch a message in the table and automatically zoom for detail. In all cases, the Table never obscures your waveform data.

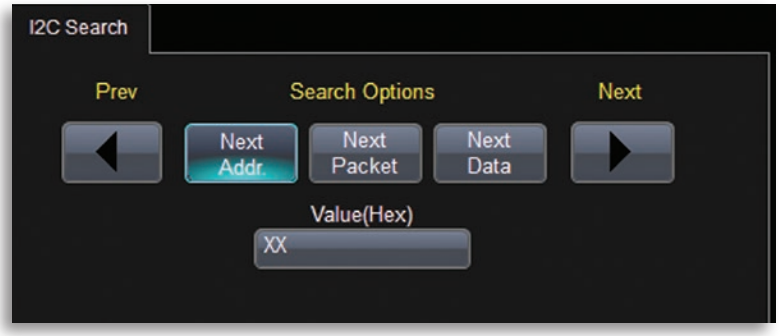


I2C	Time	Addr Len...	Address	R/W	Len...	Data
3	-83.2267 ...	7	81	R	16	0x00 00 4c 65 43 72 6f 79 20 49 32 43 00 00 39 39
4	-43.6969 ...	7	82	W	17	0x00 00 4c 65 43 72 6f 79 20 49 32 43 00 00 31 30 30
5	-39.4646 ...	7	82	W	1	0x00
6	-39.2614 ...	7	83	R	17	0x00 00 4c 65 43 72 6f 79 20 49 32 43 00 00 31 30 30
7	-6.78297 ...	10	340	W	17	0x00 00 4c 65 43 72 6f 79 20 49 32 43 00 00 31 30 31

Display your values in an easy-to-understand table. Touch a row to zoom, or export to Excel with one button push.

Search and Zoom

I²C, SPI, UART, and RS-232 messages can be quickly located by searching on Address (I²C) or DATA (I²C, SPI, UART, RS-232). Pressing an arrow button advances the single zoomed message view one message to the right or left of the current message.



Search through long record of decoded data by entering the message or address you are looking for and clicking the right or left search arrows.

	I2Cbus TD	SPIbus TD	UART-RS232bus TD
	Definition		
Protocol Setup	N.A.	Select CPOL, CPHA, DATA = MSB or LSB. Also, may select SIOP or SSPI defaults.	For UART Select BitRate Select # Data Bits (5-9) Select Parity (Odd, Even, None) Select # Stop Bits (1, 1.5, 2) Select Bit Order (MSB or LSB) Select Polarity (IdleLow or IdleHigh) For RS-232 Select BitRate Select # Data Bits (5-8) Select Parity (Odd, Even, None) Select # Stop Bits (1, 1.5, 2)
	Decode Capability		
Format	Hexadecimal, Binary, ASCII	Hexadecimal, Binary, ASCII	Hexadecimal, Binary, or ASCII
Decode Setup	Threshold definition required. Default is to Percent amplitude. Choose to Decode address values including/not including the R/W bit in address value.	Threshold definition required. Default is to Percent amplitude. Select CPOL, CPHA, DATA = MSB or LSB.	Threshold definition required. Default is to Percent amplitude. Select BitRate, # Data Bits, Parity, # Stop Bits, Bit Order, and Polarity (for RS-232, no Bit Order or Polarity setup).
Decode Input			Any analog Channel, Memory, or Math trace.
# of Decode Waveforms	Up to 4 buses may be decoded at one time. Sources can be Channels or Memory Waveforms. In addition, zooms can be displayed (with decoded information).	Up to 4 buses may be decoded at one time. Sources can be Channels or Memory Waveforms. In addition, zooms can be displayed (with decoded information).	Up to 4 buses may be decoded at one time. In addition, zooms can be displayed (with decoded information).
Location	Overlaid over DATA waveform, on Grid	Overlaid over DATA waveform, on Grid	Overlaid over DATA waveform, on Grid. (Note: Use multi-grid if there is more than one decoder ON)
Visual Aid	Color Coding for FRAME, START/ ReSTART bit, ADDR, R/W, DATA, ACK, and STOP bit	Color Coding for FRAME and DATA	Color Coding for Start Bit, Stop Bit, Parity Bit, and DATA. Decode information is intelligently annotated based on timebase setting.
	Trigger Capability		
Format	Hexadecimal or Binary. ADDRESS and DATA can be set up with different formats.	Hexadecimal or Binary	Hexadecimal or Binary
Trigger Setup	Trigger on START, ReSTART, STOP, ADDR, DATA, ADDR+DATA, Data Length, Missing ACK	Trigger on DATA	Trigger on DATA or Parity ERROR
ADDRESS (ID) Condition Setup	Specify one ADDRESS with condition of = 7 or 10-bit ADDRESS supported with full Read, Write, or R/W="Don't Care" selectability on both 7 and 10-bit ADDRESSes Choose to Trigger on address values that include/don't include R/W bit in address value.	N.A.	N.A.
DATA Condition Setup	<=, <, =, >, >=, <>, in range, out of range, don't care.	=	<=, <, =, >, >=, <>, in range, out of range, don't care.

continues

SPECIFICATIONS AND ORDERING INFORMATION

	I2Cbus TD	SPIbus TD	UART-RS232bus TD
DATA Setup	Hexadecimal: # Data Bytes = 0 to 12. Data can be defined by nibble. Binary: Any combination of 0,1, or X for 1-96 bits. Data pattern can be set to start on any byte in a 2048-byte window (EEPROM mode only).	Hexadecimal: # Data Bytes = 0 to 12. Data can be defined by nibble. Binary: Any combination of 0,1, or X for 1-96 bits. Triggers on that data pattern in a specified location.	Hexadecimal: # Data Bytes = 0 to 12. Data can be defined by nibble. Binary: Any combination of 0,1, or X for 1-96 bits. May specify particular data position anywhere in a 2048 byte sequence.
ACK Condition Setup	For any ADDR, ADDR+DATA, ADDR+DATA LENGTH, or EEPROM frame setup, select an ACK Condition of ACK, NO ACK, and DON'T CARE.	N.A.	N.A.
Bit Rates	Full range over I^2C specification for Standard, Fast, Fast-Mode Plus, and High-speed modes. Auto-detected	Any. Auto-detected	Any from 300 b/s to 10 Mb/s (User settable)
Trigger Input	Any analog Channel or the EXT input. Clock may be input to EXT to conserve available analog Channels.	Any analog Channel or the EXT input. Clock or Slave Select may be input to EXT to conserve available analog Channels.	Any analog Channel or the EXT input.
Trigger Design	Internal to oscilloscope, settable like any other oscilloscope trigger	Internal to oscilloscope, settable like any other oscilloscope trigger	Internal to oscilloscope, settable like any other oscilloscope trigger.
	Search Capability		
Pattern Search	Search by ADDRESS or DATA in Hexadecimal format	Search by ADDRESS or DATA in Hexadecimal format	Search by DATA in Hexadecimal formats, or for Next ERROR.
	Other		
Compatible With	TD (Trigger & Decode) Option compatible with all WaveMaster 8Zi/Zi-A, WavePro 7Zi/Zi-A, WaveRunner 6Zi, WaveRunner® Xi and WaveSurfer® Xs	TD (Trigger & Decode) Option compatible with all WaveMaster® 8 Zi/Zi-A, WavePro® 7 Zi/Zi-A, WaveRunner® 6Zi, WaveRunner® Xi and WaveSurfer® Xs	TD (Trigger & Decode) Option compatible with all WaveMaster® 8 Zi/Zi-A, WavePro® 7 Zi/Zi-A, WaveRunner® 6Zi, WaveRunner Xi and WaveSurfer Xs

Ordering Information

Product Description	Product Code
I^2C Trigger and Decode Option for WaveRunner Xi	WRXi-I2Cbus TD
I^2C Trigger and Decode Option for WaveRunner 6Zi	WR6Zi-I2Cbus TD
I^2C Trigger and Decode Option for WavePro Zi/Zi-A	WPZi-I2Cbus TD
I^2C Trigger and Decode Option for WaveSurfer MXs-B	WSXs-I2Cbus TD
I^2C Trigger and Decode Option for WaveMaster 8Zi/Zi-A	WM8Zi-I2Cbus TD
SPI Trigger and Decode Option for WaveRunner Xi	WRXi-SPIbus TD
SPI Trigger and Decode Option for WaveRunner 6Zi	WR6Zi-SPIbus TD
SPI Trigger and Decode Option for WavePro Zi/Zi-A	WPZi-SPIbus TD
SPI Trigger and Decode Option for WaveSurfer MXs-B	WSXs-SPIbus TD
SPI Trigger and Decode Option for WaveMaster 8Zi/Zi-A	WM8Zi-SPIbus TD
UART and RS-232 Trigger and Decode Option for WaveRunner Xi	WRXi-UART-RS232bus TD
UART and RS-232 Trigger and Decode Option for WaveRunner 6Zi	WR6Zi-UART-RS232bus TD
UART and RS-232 Trigger and Decode Option for WavePro Zi/Zi-A	WPZi-UART-RS232bus TD
UART and RS-232 Trigger and Decode Option for WaveSurfer MXs-B	WSXs-UART-RS232bus TD
UART and RS-232 Trigger and Decode Option for WaveMaster 8Zi/Zi-A	WM8Zi-UART-RS232bus TD

Product Description	Product Code
Related Products	
PROTObus MAG Serial Debug Toolkit for WaveRunner Xi/Xi-A	WRXi-PROTObus MAG
PROTObus MAG Serial Debug Toolkit for WaveRunner 6Zi	WR6Zi-PROTObus MAG
PROTObus MAG Serial Debug Toolkit for WavePro 7 Zi/Zi-A	WPZi-PROTObus MAG
PROTObus MAG Serial Debug Toolkit for WaveMaster 8 Zi/Zi-A	WM8Zi-PROTO-bus MAG

Customer Service

Teledyne LeCroy oscilloscopes and probes are designed, built, and tested to ensure high reliability. In the unlikely event you experience difficulties, our digital oscilloscopes are fully warranted for three years, and our probes are warranted for one year.

This warranty includes: • No charge for return shipping • Long-term 7-year support • Upgrade to latest software at no charge

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1-800-5-LeCroy
teledynelecroy.com

Local sales offices are located throughout the world.
Visit our website to find the most convenient location.