

# SATA Link and Data Layer Protocol Trigger and Decode



Comprehensive SATA 1.5 and 3.0 Gb/s trigger and SATA 1.5, 3.0, and 6.0 Gb/s decode speeds debug of embedded systems and provides protocol awareness to your oscilloscope physical layer tool.

## Key Features

- True Hardware Protocol Triggering for efficient debug
- SATA Trigger up to 3 Gb/s with support for:
  - SATA Special Control Symbols
  - SATA Special Primitives
  - FIS Frames
  - Protocol Error Frames
  - Bus Conditions
- SATA Link and Data Layer Decode up to 6 Gb/s
- Color-coded decode overlaid on the waveform is intuitive and easy-to-read
- Decode information expands as the time base is adjusted or zoomed
- Recognizes scrambled or unscrambled data
- Convenient table display with quick “zoom to message” capability
- Quick search capability for specific link layer frames

## SATA Trigger (1.5 and 3 Gb/s) Simplifies Debug of Embedded Systems

Full support is provided for comprehensive SATA triggering (up to 3 Gb/s), including the only SATA Frame Information Structure (FIS) trigger in an oscilloscope. Trigger on a specific FIS Frame with complete setup flexibility over all aspects of the frame structure. Specify a data value in a specific location in the payload field. Support also provided for SATA-specific Symbols, Primitive, Protocol Error and Bus Condition triggering.

## Decode Annotation Complements Physical Layer Views

The SATA link and data layer decode information is annotated on the physical layer waveform. Various sections of the protocol are color-coded to make it easy to understand. Decode annotation information condenses or expands depending on the timebase/zoom ratio setting. Additionally, 8b/10b decode annotation

(a separate option) may also be applied for symbol level debugging. The decode operation is fast—even with long acquisitions.

Combine the SATA Decode Annotation with ProtoSync for a complete picture of physical layer, link layer, and protocol layer views.

## Convenient Table Display and Search

Long oscilloscope acquisition memory provides long capture times of SATA transmissions. Decoded information is conveniently shown in a table format, and specific frame types may be searched for. In addition, table data may be exported as a .csv file.

## Support on Multiple Oscilloscope Platforms

To support the range of users, from SATA 1.5 to 6 Gb/s, the option is available on a wide range of oscilloscope models with real-time bandwidths from 1.5 GHz to 65 GHz.

# SPECIFICATIONS

<b>SATAbus D and TD Specifications</b>	
<b>Definition</b>	
<b>Protocol Setup</b>	Select SATA 1.5, 3, or 6 Gb/s. Selection for source channels. Supports Single (differential probe) or dual (two single-ended probes) input(s) for decoder. Select Detect OOB ON/OFF. Define Host Channel and Device Host. Supports Scrambled/Unscrambled Data.
<b>Decode Capability</b>	
<b>Format</b>	SATA Link and Data Layer Protocol Decode (Hexadecimal or Binary).
<b>Decode Setup</b>	Select SATA 1.5, 3, or 6 Gb/s. Selection for source inputs. Select Detect OOB ON/OFF.
<b>Decode Input</b>	Any analog Channel, Memory or Math trace.
<b># of Decode Waveforms</b>	<b>Up to 4 unique Tx or Rx lanes may be decoded</b> at one time. In addition, zooms can be displayed (with decoded information).
<b>Location</b>	Overlaid on SATA physical layer waveform, on Grid.
<b>Visual Aid</b>	Color Coding for Frame, X_RDYs, WTRMs, Logical Idle, OOB, Speed Negotiation, Electrical Idle, Protocol Error, Unknown Decode information is intelligently annotated based on timebase setting.
<b>Trigger Capability</b>	
<b>Format</b>	Hexadecimal or Binary
<b>Trigger Setup</b>	Trigger on SATA 1.5 and 3 Gb/s Special Control Symbols, SATA Special Primitives, FIS Frames, Error Frames, or Bus Conditions
<b>Special Symbol Setup</b>	Trigger on any one Special "K" or "D" Symbol. Trigger on any inclusive or exclusive group of Special "K" or "D" Symbols. Trigger on any sequential combination of up to four SATA "K" or "D" Symbols. Select Running Disparity +, - or either.
<b>Special Primitive Setup</b>	Trigger on any single Special SATA Primitive, as follows: ALIGN, CONT, DMAT, EOF, HOLD, HOLDA, PMACK, PMNAK, PMREQ_P, PMREQ_S, R_ERR, R_IP, R_OK, R_RDY, SOF, SYNC, UNKNOWN, WTRM, X_RDY. Selection for direction (Device to Host, Host to Device, or Both).
<b>FIS Frame Setup</b>	Trigger on ANY FIS Frame. Trigger on a specific FIS Frame, as follows: Register FIS (Host to Device), Register FIS (Device to Host), DMA Activate FIS (Device to Host), DMA Setup FIS (Bi-Directional), Data FIS (Bi-Directional), BIST Activate FIS (Bi-Directional), PIO Setup FIS (Device to Host), Set Device Bits FIS (Device to Host), Vendor Specific. Additional FIS Frame setup detail is provided for most FIS Frame triggers.
<b>FIS Frame Data Payload Setup</b>	Trigger on a DATA payload with up to 8 DWORDs with up to 32 bytes of data. DATA Condition settable to = or <>. Data byte position/offset settable up to 4095 bytes.
<b>Protocol Error Frame Setup</b>	Trigger on any ORed combination of CRC, FIS Frame Type, FIS Frame Length, FIS Frame Direction, Symbol Violation, Align, STP Invalid State Transition, or Disparity Error Frames.
<b>Bus Condition Setup</b>	Trigger on any ORed combination of Electrical Idle, Electrical Idle OFF, Electrical Burst, COMSAS, COMINIT/RESET, or COMWAKE Bus Conditions.
<b>Trigger Input</b>	Any analog Channel or the EXT input (subject to bandwidth limitations)
<b>Trigger Design</b>	Internal to oscilloscope, settable like any other oscilloscope trigger
<b>Protocol Error Frame Setup</b>	Trigger on any ORed combination of CRC, FIS Frame Type, FIS Frame Length, FIS Frame Direction, Symbol Violation, Align, STP Invalid State Transition, or Disparity Error Frames.
<b>Bus Condition Setup</b>	Trigger on any ORed combination of Electrical Idle, Electrical Idle OFF, Electrical Burst, COMSAS, COMINIT/RESET, COMWAKE, or Bus Conditions.
<b>Trigger Input</b>	Any analog Channel
<b>Trigger Design</b>	Internal to oscilloscope, settable like any other oscilloscope true hardware protocol trigger

# SPECIFICATIONS

<b>Search Capability</b>	
<b>Pattern Search</b>	<p>Search by</p> <p>Any</p> <p>Frame: Any, REG_H2D, REG_D2H, SDB, DMA_ACTIVATE_D2H, DMA_SETUP, BIST_ACTIVATE, PIO_SETUP, DATA, RESERVED, VENDOR_SPECIFIC</p> <p>X_RDYs</p> <p>WTRMs</p> <p>Logical Idle</p> <p>OOB: Any, ComWake, COMRESET/COMINIT, Unknown</p> <p>Speed Negotiation</p> <p>Electrical Idle</p> <p>Protocol Error: Any, Missing SOF, Missing EOF, Extra SOF, Payload Size Greater than 2048, Payload Size 0, CRC Error, Unknown FISType, Excessive payload for FIST Type, Unexpected R_IP inside frame, Unexpected R_OK inside frame, Unexpected R_RDY inside frame, Unexpected X_RDY inside frame, Missing expected 2 primitive prior CONT, Missing expected wtrm after EOF, Insufficient bytes in DWord, 8b/10b result-Data and Symbolic Length Not Matched, 8b/10b result-Length not matched with Symbolic Length, 8b/10b result-Length not matched with Data Length</p> <p>Unknown</p>
<b>Other</b>	
<b>Compatible With...</b>	<p>TD (Trigger &amp; Decode) Option fully compatible with WaveRunner 6 Zi Series.</p> <p>D (Decode) Option fully compatible with WaveRunner Xi/Xi-A, 6000 Series; WavePro 7 Zi/Zi-A, 7000 Series; WaveMaster 8 Zi/Zi-A, 8000 Series and LabMaster 9 Zi-A and 10 Zi oscilloscopes. Bandwidth of oscilloscope must be equal to bit rate with a minimum oscilloscope sample rate of 4x the bit rate.</p>

# ORDERING INFORMATION

## Product Description Product Code

### SATA Trigger and Decode Options

SATA Trigger and Decode Annotation Option for WaveRunner 6 Zi Oscilloscopes Supports SATA Gen1 and 2	WR6Zi-SATABus TD
SATA Decode Annotation Option for WaveRunner Xi/Xi-A Oscilloscopes Supports SATA Gen1	WRXi-SATABus D
SATA Decode Annotation Option for WavePro 7 Zi/Zi-A Oscilloscopes Supports SATA Gen1, 2, and 3	WPZi-SATABus D
SATA Decode Annotation Option for WaveMaster 8 Zi/Zi-A Series Oscilloscopes Supports SATA Gen1, 2, and 3	WM8Zi-SATABus D
SATA Decode Annotation Option for LabMaster 9 Zi-A Series Oscilloscopes Supports SATA Gen1, 2, and 3	LM9Zi-SATABus D
SATA Decode Annotation Option for LabMaster 10 Zi Series Oscilloscopes Supports SATA Gen1, 2, and 3	LM10Zi-SATABus D

### Additional Products

8b/10b Trigger and Decode Annotation Option for WaveRunner 6 Zi Oscilloscopes	WR6Zi-80B-8B10B TD
8b/10b Decode Annotation Option for WaveRunner Xi/Xi-A Oscilloscopes	WRXi-8B10B D
8b/10b Decode Annotation Option for WavePro 7 Zi/Zi-A Oscilloscopes	WPZi-8B10B D
8b/10b Decode Annotation Option for WaveMaster 8 Zi/Zi-A Oscilloscopes	WM8Zi-8B10B D
8b/10b Decode Annotation Option for LabMaster 9 Zi-A Oscilloscopes	LM9Zi-8B10B D
8b/10b Decode Annotation Option for LabMaster 10 Zi Oscilloscopes	LM10Zi-8B10B D
Decode Annotation and Protocol Analyzer Synchronization Software Option for WaveRunner 6 Zi	WR6Zi-ProtoSync
Decode Annotation and Protocol Analyzer Synchronization Software Option for WaveRunner Xi/Xi-A	WRXi-ProtoSync
Decode Annotation and Protocol Analyzer Synchronization Software Option for WavePro 7 Zi/Zi-A	WPZi-ProtoSync
Decode Annotation and Protocol Analyzer Synchronization Software Option for WaveMaster 8 Zi/Zi-A	WM8Zi-ProtoSync
Decode Annotation and Protocol Analyzer Synchronization Software Option for LabMaster 9 Zi-A	LM9Zi-ProtoSync
Decode Annotation and Protocol Analyzer Synchronization Software Option for LabMaster 10 Zi	LM10Zi-ProtoSync

## Product Description Product Code

### Recommended Probe Accessories

1.5 GHz, 1.0 pF, 1 MΩ Active Differential Probe	ZD1500
WaveLink 4 GHz 2.5 Vp-p Differential Amplifier Small Tip Module	D410-PS
WaveLink 4 GHz 5 Vp-p Differential Amplifier Small Tip Module	D420-PS
WaveLink 6 GHz 2.5 Vp-p Differential Amplifier Small Tip Module	D610-PS
WaveLink 6 GHz, 5 Vp-p Differential Amplifier Small Tip Module	D620-PS

### 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



1-800-5-LeCroy  
teledynelecroy.com

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