Digital and Mixed Signal Oscilloscopes

DPO/DSA/MSO70000C and D Series Datasheet

Features & Benefits

- Uncompromised Bandwidth – Up to 33 GHz analog bandwidth and rise time as fast as 9 ps enables measurement on the latest high-speed serial standards
- True 33 GHz Real-time Analog Bandwidth on 2 Channels with 33 GHz Models
- Industry-leading Sample Rate and Timing Resolution
  - 100 GS/s on 2 Channels (33, 25, 20, 16, and 12.5 GHz models)
- Four-channel Simultaneous Performance
  - Up to 23 GHz Bandwidth
  - Up to 50 GS/s Real-time Sample Rate
  - Up to 250 Megasample Record Length with MultiView Zoom™ Feature for Quick Navigation
  - Fastest Waveform Capture Rate with >300,000 wfms/s Maximum per Channel
- Superior Signal Integrity and Excellent Signal-to-Noise Ratio – Observe the truest representation of your waveform
- 16 Logic Channels with 80 ps Timing Resolution for Debug of Digital and Analog Signals (MSO70000 Series only)
- Pinpoint® Triggering – Minimize time spent trying to acquire problem signals for efficient troubleshooting and shortened debug time
- Visual Trigger – Precisely qualify triggers and find unique events in complex waveforms
- 6.25 Gb/s Real-time Serial Trigger – Assures triggering on the first instance of a specified NRZ or 8b/10b pattern to allow isolation of pattern-dependent effects
- Search & Mark – Provides waveform or serial bus pattern matching and software triggers for signals of interest
- Automated Serial Triggering and Decode Options for 8b10b Encoded Serial Data, I^2C, SPI, RS-232/422/485/UART, USB 2.0, and MIPI® D-PHY
- P7500 TriMode™ Probing System – Perfectly matched signal connectivity
- Application Support for High-speed Serial Industry Standards, wideband RF, Power Supplies, and Memory – Enables standard-specific certification, measurement automation, and ease of use
- P6780, P6750, and P6717A High-performance 17-channel Logic Probes with Bandwidths up to 2.5 GHz for Connections to Today's Fast Digital Signals (MSO70000 Series only)

Applications

- Design Verification including Signal Integrity, Jitter, and Timing Analysis
- Design Characterization for High-speed, Sophisticated Designs
- Certification Testing of Serial Data Streams for Industry Standards
- Memory Bus Analysis and Debug
- Prototype Turn-on and Power Supply Verification
- Research and Investigation of Transient Phenomena
- Production Testing of Complex Systems
- Spectral Analysis of Transient or Wide-bandwidth RF Signals

Tektronix®

P7500 TriMode probes simplify complex measurement setups.

P6780 Differential Logic probes provide high-bandwidth connections for up to 16 digital signals.

Tools for Your Complete Design Cycle

Tektronix understands that engineers rely on an oscilloscope throughout their design cycle, from prototype turn-on to production testing. The DPO/DSA/MSO70000 Series oscilloscopes' unique capabilities, combined with exceptional signal acquisition performance and analysis, accelerate your measurement tasks.

Unmatched Acquisition and Signal-to-Noise Performance

The superior signal integrity and excellent signal-to-noise ratio of the DPO/DSA/MSO70000 Series ensures confidence in your measurement results.

- High bandwidth, up to 33 GHz, matched across 4 channels
- Bandwidth enhancement eliminates imperfections in frequency response all the way to the probe tip. User-selectable filters for each channel provides magnitude and phase correction for more accurate representation of extremely fast signals. In addition, only Tektronix allows the user to disable the bandwidth enhancement for applications needing the highest measurement throughput
- Simultaneous high sample rate on all channels captures more signal details (transients, imperfections, fast edges)
  - 100 GS/s on 2 channels and 50 GS/s on all analog channels for the 12.5 through 33 GHz models
  - 25 GS/s on all analog channels for the 4, 6, and 8 GHz models
  - 12.5 GS/s on all logic channels in the MSO70000 Series
- Lowest jitter noise floor and highest vertical accuracy provide additional margin in your measurements
- Long record length provides high resolution and extended-duration waveform capture
  - Standard 10 MS per channel on the DPO70000 and MSO70000 Series and 31 MS on the DSA70000 Series
  - Optional up to 125 MS on all four channels for the 4, 6, and 8 GHz models
  - Optional up to 250 MS on all four channels for the 12.5 through 33 GHz models
  - On the MSO70000 Series, the record length of logic channels matches the analog record lengths for uncompromised analog and digital acquisition
  - MultiView Zoom helps you manage long records, compare and analyze multiple waveform segments
- With high signal-to-noise ratio and low internal noise floor, the DPO/DSA/MSO70000 Series enable you to perform precise characterization measurements. When debugging a DUT, a low noise floor and maximum signal fidelity of the measurement instrument allows you to find the smallest anomalies affecting the DUT's performance. For RF signals, a lower noise floor translates into a higher dynamic range, opening the DPO/DSA/MSO70000 Series to a wider range of applications

Widest Range of Probing Solutions – Whether you need to measure 8 Gb/s serial data, fast digital logic, or switching currents from your new power supply design, Tektronix offers a vast array of probing solutions, including active single-ended, differential, logic, high voltage, current, optical, and a wide range of probe and oscilloscope accessories.

Quick Selection Guide

Model	Analog Bandwidth	Analog Sample Rate 2/4 Channels	Standard Memory – Analog + Digital	Analog Channels	Logic Channels
DPO70404C	4 GHz	25 GS/s	10 MS	4	
DSA70404C	4 GHz	25 GS/s	31 MS	4	
MSO70404C	4 GHz	25 GS/s	10 MS	4	16
DPO70604C	6 GHz	25 GS/s	10 MS	4	
DSA70604C	6 GHz	25 GS/s	31 MS	4	
MSO70604C	6 GHz	25 GS/s	10 MS	4	16
DPO70804C	8 GHz	25 GS/s	10 MS	4	
DSA70804C	8 GHz	25 GS/s	31 MS	4	
MSO70804C	8 GHz	25 GS/s	10 MS	4	16
DPO71254C	12.5 GHz	100 GS/s / 50 GS/s	10 MS	4	
DSA71254C	12.5 GHz	100 GS/s / 50 GS/s	31 MS	4	
MSO71254C	12.5 GHz	100 GS/s / 50 GS/s	10 MS	4	16
DPO71604C	16 GHz	100 GS/s / 50 GS/s	10 MS	4	
DSA71604C	16 GHz	100 GS/s / 50 GS/s	31 MS	4	
MSO71604C	16 GHz	100 GS/s / 50 GS/s	10 MS	4	16
DPO72004C	20 GHz	100 GS/s / 50 GS/s	10 MS	4	
DSA72004C	20 GHz	100 GS/s / 50 GS/s	31 MS	4	
MSO72004C	20 GHz	100 GS/s / 50 GS/s	10 MS	4	16
DPO72504D	25 GHz	100 GS/s / 50 GS/s	10 MS	4	
DSA72504D	25 GHz	100 GS/s / 50 GS/s	31 MS	4	
DPO73304D	33 GHz	100 GS/s / 50 GS/s	10 MS	4	
DSA73304D	33 GHz	100 GS/s / 50 GS/s	31 MS	4	

System Turn-on and Verification

From the time a design is first powered up through the initial operational checks, the DPO/DSA/MSO70000 Series provide the features you need.

Uncompromised Four-channel Acquisition

With the industry's lowest noise and up to 50 GS/s sample rate on all four channels the DPO70000 Series ensures that signal integrity checks and timing analysis can be done without worrying about noise and jitter in the scope distorting the measurements. Single-shot bandwidths up to >20 GHz on all four channels ensure that you'll capture your signals of interest without worrying about undersampling when using more than 1 or 2 channels.

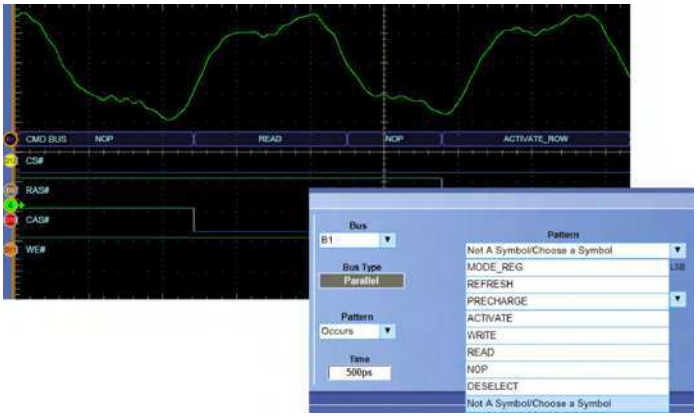
For applications requiring the lowest internal noise and jitter, 100 GS/s performance further reduces noise and jitter and provides additional measurement headroom.

16-channel Digital Acquisition (MSO70000 Series only)

When you have many interfaces to verify, the MSO70000 Series with 4 analog and 16 logic channels enables efficient channel-to-channel timing checks. With timing resolution of 80 ps, the MSO70000 Series' digital acquisition system enables you to make precise timing measurements on as many as 20 channels simultaneously.

iCapture – One Connection for Analog and Digital (MSO70000 Series only)

The number of signals that must be verified can often make the checkout of a design long and involved. By using the iCapture digital-to-analog multiplexer feature, you can easily verify the analog characteristics of any of the 16 signals connected to the MSO70000 Series' digital channels. Using iCapture, you can quickly view the analog characteristics of any input channel. If the signal is working as expected, relegate it to a digital-only view and continue testing other lines.



Symbolic bus formats simplify identifying system states and setting up bus triggers.

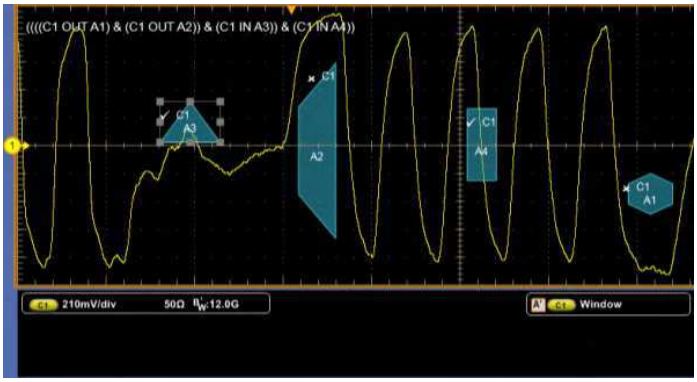
10 ms duration capture of synchronous high-speed and low-speed signals at 25 GS/s.

Bus Decoding and Triggering

Verifying your system operation often requires the ability to see specific system states on a key bus such as the DDR SDRAM interface. The DPO/DSA/MSO70000 Series includes parallel and serial bus decoding that provides deeper insight into the system's behavior. Using the bus triggering capability of the DPO/DSA/MSO70000 Series to isolate the exact state needed or find invalid bus sequences is as easy as defining the bus and choosing the bit pattern or symbolic word that describes the desired state. In addition, serial bus decoding for 8b10b encoded data, I²C, SPI, RS-232/422/485/UART, USB, and MIPI® DSI and CSI2 buses enables you to identify where control and data packets begin and end as well as identify subpacket components such as address, data, CRC, etc.

Deep Record Length Available on All Channels

Longer duration events such as power supply sequencing and system status words can be analyzed without sacrificing timing resolution using the long memory depths available on all four analog channels in the DPO/DSA70000 Series as well as the 16 logic channels of the MSO70000 Series. Optional memory depths up to 125 MS (Option 10XL) on the 4, 6, and 8 GHz models and 250 MS (Option 20XL) on the 12.5 through 33 GHz models are available.



Visual Trigger.

Power supplies can be a critical failure point in any system. Careful testing of the power delivery system's power on sequence can be time consuming. The MSO70000 Series provides independent logic thresholds for each logic channel enabling multiple logic voltages to be set up and observed simultaneously for quick verification of the system's power rails.

Protocol and Serial Pattern Triggering

To verify serial architectures, the serial pattern triggering for NRZ serial data streams with built-in clock recovery in the DPO/DSA/MSO70000 Series allows correlating events across physical and link layers. The instruments can recover the clock signal, identify transitions, and allow you to set the desired encoded words for the serial pattern trigger to capture. This feature comes standard on the DSA70000 Series and is available on the DPO70000 and MSO70000 Series as Option ST6G. For higher bit rate standards like USB 3.0, the 8b10b serial pattern trigger covers data rates up to 6.25 Gb/s.

Pattern lock triggering adds an extra dimension to NRZ serial pattern triggering by enabling the oscilloscope to take synchronized acquisitions of a long serial test pattern with outstanding time base accuracy. Pattern lock triggering can be used to remove random jitter from long serial data patterns. Effects of specific bit transitions can be investigated, and averaging can be used with mask testing. Pattern lock triggering supports up to 6.25 Gb/s NRZ serial data streams and is standard on the DSA70000 Series instruments, or is included as part of Option ST6G on the DPO70000 and MSO70000 Series.

Visual Trigger – Find the Signal of Interest Quickly

Finding the right cycle of a complex bus can require hours of collecting and sorting through thousands of acquisitions for the event of interest. Defining a trigger that isolates the desired event and shows data only when the event occurs speeds up this process. Visual Trigger makes the identification of the desired waveform events quick and easy. Visual Trigger qualifies Tektronix Pinpoint Triggers by scanning through all waveform acquisitions and comparing them to on-screen areas (geometric shapes). With intuitive on-screen controls, up to 8 areas with a choice of shapes can be drawn on-screen and combined in a trigger expression to find only the events needed for verification and analysis.

System Characterization and Margin Testing

When a design is working correctly and the next task is to fully characterize its performance, the DSA70000 Series offers the industry's most comprehensive set of analysis and certification tools, such as math expressions, waveform mask testing, pass/fail testing, event searching, and event marking. Tools for automation reduce the tedium and speed up the process of making hundreds of characterization measurements.

Advanced Waveform Analysis

Full analysis of the power, voltage, and temperature corners of your system under test can be very time consuming. The DPO/DSA/MSO70000 Series offer a wide range of built-in advanced waveform analysis tools.

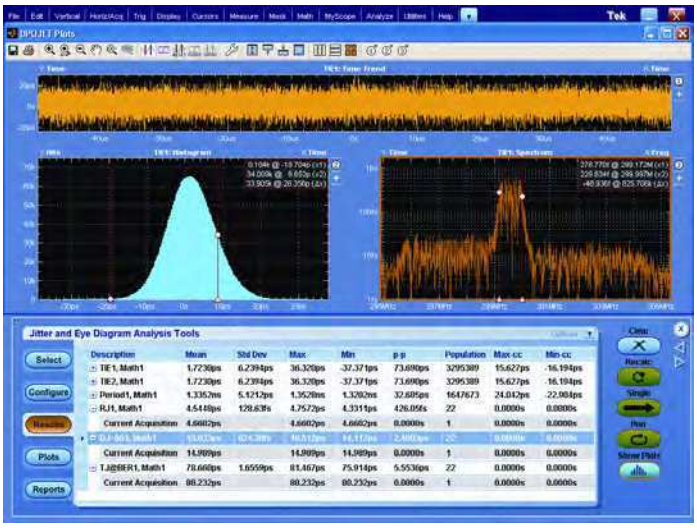
Waveform cursors make it easy to measure trace-to-trace timing characteristics, while cursors that link between YT and XY display modes make it easy to investigate phase relationships and Safe Operating Area violations. Select from 53 automatic measurements using a graphical palette that logically organizes measurements into Amplitude, Time, Histogram, and Communications categories. Gather further insight into your measurement results with statistical data such as mean, min, max, standard deviation, and population.

Define and apply math expressions to waveform data for on-screen results in terms that you can use. Access common waveform math functions with the touch of a button. Or, for advanced applications, create algebraic expressions consisting of live waveforms, reference waveforms, math functions, measurement values, scalars, and user-adjustable variables with an easy-to-use calculator-style editor.

With deep acquisition memory, margin testing can be done over many cycles and long duration trends in the data can be observed. Plus, data from the oscilloscope can be captured into Microsoft Excel using the unique Excel toolbar, and formatted into custom reports using the Word toolbar provided with the DPO/DSA/MSO70000 Series.

Automated Tools to Increase Measurement Throughput

Ease of use and measurement throughput are key when a large number of measurements must be completed with a performance oscilloscope.

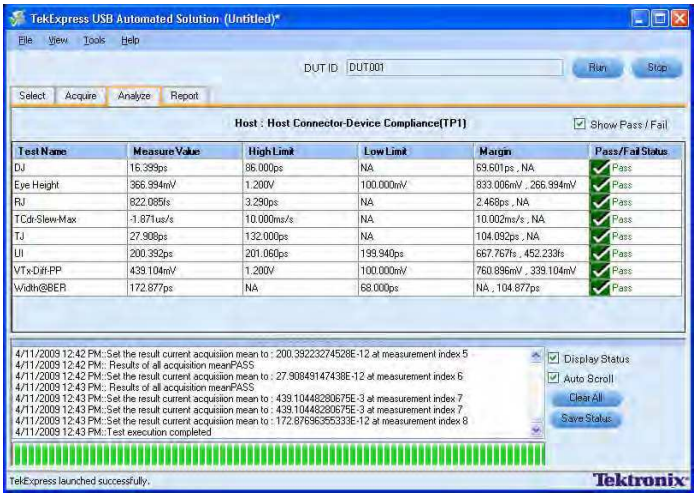


DPOJET Jitter and Eye Diagram Analysis – Simplify identifying signal integrity concerns, jitter, and their related sources with DPOJET software. DPOJET provides the highest sensitivity and accuracy available for real-time oscilloscopes.

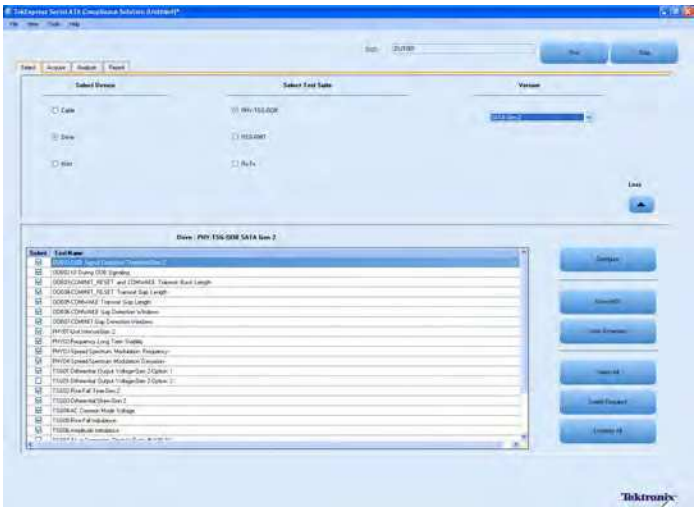
The DSA70000 Series comes standard with the DPOJET Advanced Jitter and Eye Diagram measurement application, providing the tools you need to quickly perform a high volume of measurements and collect statistics. DPOJET Essentials is standard on the DPO70000 and MSO70000 Series with the DPOJET advanced version available as an option. Application-specific measurement packages are also available that extend DPOJET and perform the extensive set of tests required by industry standard groups.

RF and Vector Signal Analysis

When vector signal analysis of RF or baseband signals are needed the optional SignalVu application enables measurements in multiple domains (frequency, time, phase, modulation) simultaneously. SignalVu measurements are fully correlated with the scope's time domain acquisition and triggering. Time domain events, such as commands to a RF subsystem, can be used as trigger events, while the subsystem's RF signal can be seen in the frequency domain.



TekExpress USB 3.0 Automated Test Software (Option USB-TX) – TekExpress USB 3.0 provides an automated, simple, and efficient way to test USB 3.0 transmitter and receiver hosts and devices consistent with the requirements of the SuperSpeed Universal Serial Bus Electrical Compliance Test Specification. The application automates selection of appropriate CTLE and reference channel emulation filters and measurement selections based on device type, test type, test points, and selected probes. In addition, USB-TX leverages DPOJET allowing for debug and advanced characterization of USB 3.0 solutions.



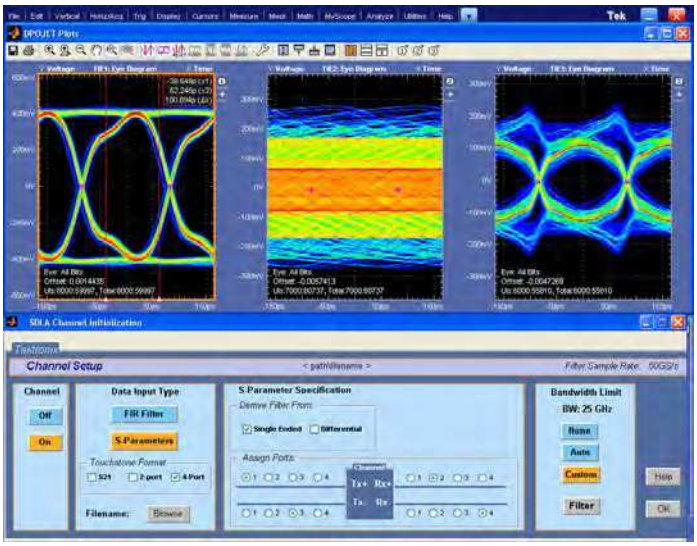
TekExpress SATA Automated Compliance Test Software – Complete support for SATA Gen1 and SATA Gen2 defined test suites for transmitters and receivers. Reduce your compliance test time by approximately 70% with simple, efficient automation of all required test suites with TekExpress software. Also included is auto-recognition of all required test equipment, precise DUT/Host control, and one-button testing.

TekExpress® Software Automation Framework

The TekExpress software automation framework has been developed for automated one-button testing of high-speed serial data standards. Built on top of National Instruments TestStand product, TekExpress efficiently executes the required tests for many serial standards such as SATA, SAS, MIPI® D-PHY, USB 3.0, DisplayPort, and 10GBASE-T Ethernet. Run on an external Windows PC, the TekExpress software orchestrates the instrument setup and control sequences to provide complete test results for complete design validation.

Beyond using the TekExpress framework, custom applications that you develop yourself using application development environments such as MATLAB® can further extend the tool set of the DPO/DSA/MSO70000 Series.

Characterization measurements depend upon accuracy and repeatability. The wide bandwidth and unmatched signal fidelity of the DPO/DSA/MSO70000 analog front end ensures that your signal quality measurements such as rise times are faithful and amplitude correct with flatness of ±0.5 dB.



SDLA - Serial Data Link Analysis (Option SLE and SLA) – Offers the capability to emulate the serial data channel, de-embed a fixture or other network, and add or remove equalization. Option SLA adds processing of waveforms with FFE and DFE equalizations and automatic equalizer training. DPOJET provides advanced measurement and jitter analysis of the resulting waveforms.

Custom Filter and De-embed Capability

Create your own filters or use the filters provided as standard with the DPO/DSA/MSO70000 Series to enhance your ability to isolate or remove a component of your signal (noise or specific harmonics of the signal). These customizable FIR filters can be used to implement signal-processing techniques, such as removing signal pre-emphasis or minimizing the effects of fixtures and cables connected to the device under test. Using the optional Serial Data Link Analysis (SDLA) application, you can gain further insight into serial data links with the capability to emulate the serial data channel from its S-parameters, de-embed a fixture or other network, and add or remove transmitter or receiver equalization (de-emphasis/pre-emphasis).

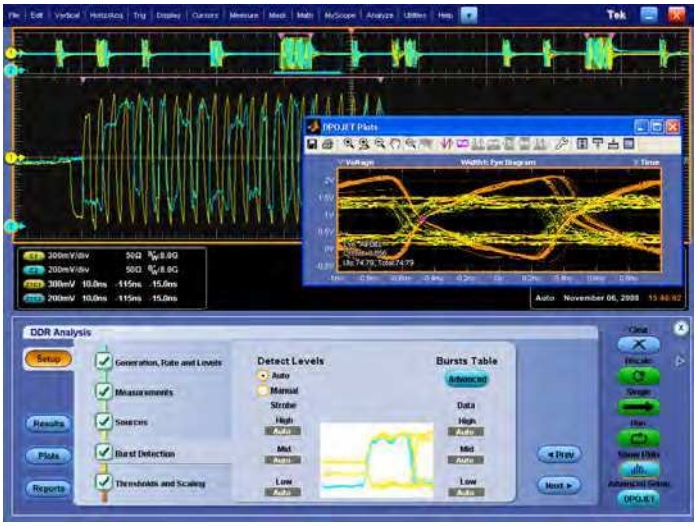
Certification

Before a product can go to market, you often need to complete a series of certification tests on the industry-standard high-speed serial buses in your design. These tests can involve many hours of wrestling with test fixtures, reading certification documents, and collecting sufficient data to validate that your system passes the required tests.

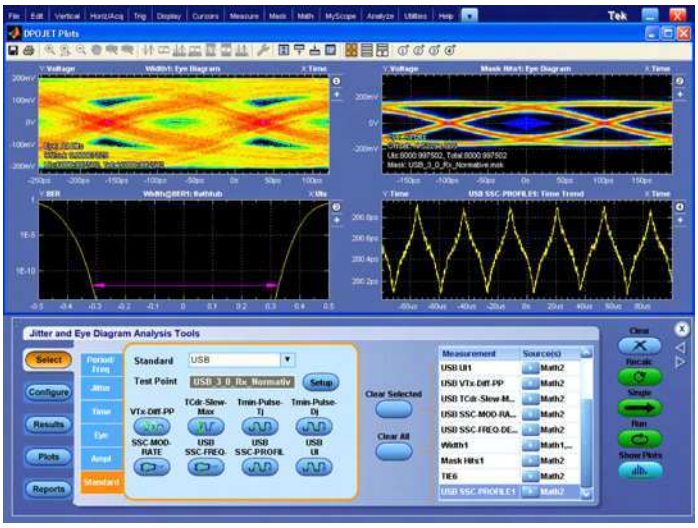
Application-specific Solutions – Enable Standard-specific Certification, Measurement Automation, and Extended Signal Analysis

Accurate, Simple, and Customizable Physical Layer Certification Testing – For designers with industry-standard certification needs, standard-specific compliance and analysis modules that configure the pass/fail waveform mask and measurement limit testing are available as options on the DPO/DSA/MSO70000 Series. Modules are available for PCI Express®, DDR Memory, Serial ATA and SAS, InfiniBand, HDMI, Ethernet, DisplayPort, DVI, UWB, MIPI® D-PHY and M-PHY, Power Supplies, and USB.

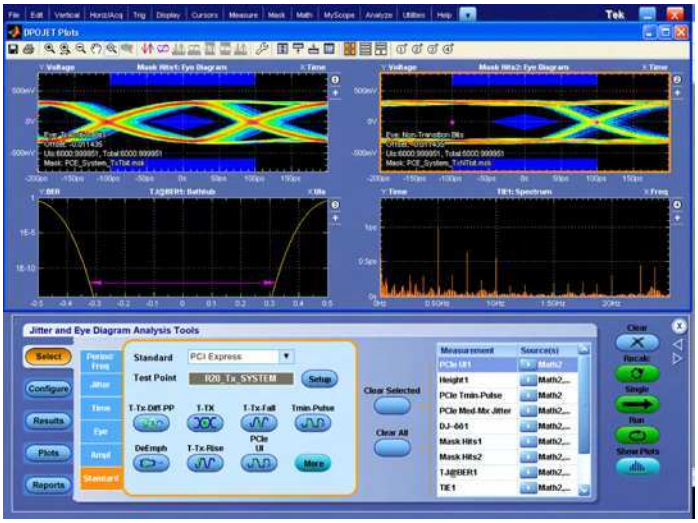
See the following list for highlights of the available application-specific solutions.



DDR Memory Bus Analysis (Option DDRA) – Automatically identify DDR1, LPDDR1, LPDDR2, DDR2, DDR3, and GDDR3 Reads and Writes and makes JEDEC conformance measurements with pass/fail results on all edges in every Read and Write burst. DDRA provides capabilities for measurements of clock, address, and control signals. In addition to enabling conformance testing DDRA with DPOJET is the fastest way to debug complex memory signaling issues. DDRA can also use the Command/Address lines to trigger on specific read/write states when running on the MSO70000 Series Mixed Signal Oscilloscope, which offers 16 channels of digital logic probing.



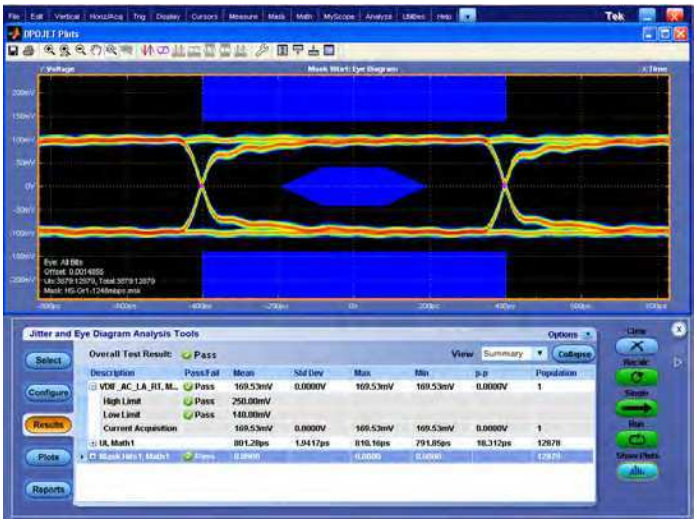
USB 3.0 Transmitter Test Solution (Option USB3) – Perform verification, characterization, and debug of USB 3.0 devices. Measurements are implemented in DPOJET and are compliant to the USB 3.0 specification. For compliance and automation, USB-TX is available.



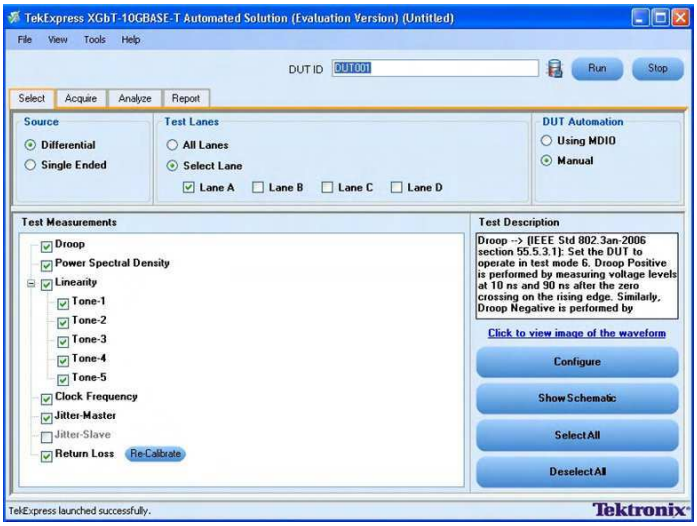
PCI Express Analysis Test Solution (Option PCE3) – Analyze the performance of your PCI Express Rev 1.0, 2.0, or 3.0 (draft spec) design with comprehensive test support. Using DPOJET, Option PCE3 enables tests that conform to PCI-SIG standards.

Ethernet Compliance Test Solution (Option ET3) – Receive full PHY layer support for Ethernet variants 10BASE-T, 100BASE-TX, and 1000BASE-T with the comprehensive, integrated Tektronix Ethernet tool set. Analog verification, automated compliance software, and device characterization solutions are all included.

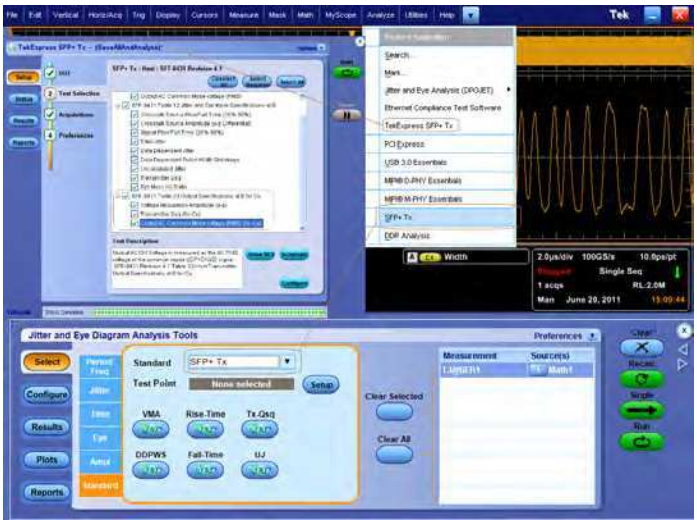
MIPI® D-PHY Characterization and Analysis Solution Solution (Option D-PHY) – Verify to the D-PHY specification by rapidly characterizing and discovering sources of jitter and signal integrity concerns using the fully flexible and customizable test setup. Using DPOJET, Option D-PHY enables transmitter high-speed data-clock timing measurements, along with a full range of electrical characteristics in high-speed or low-power modes.



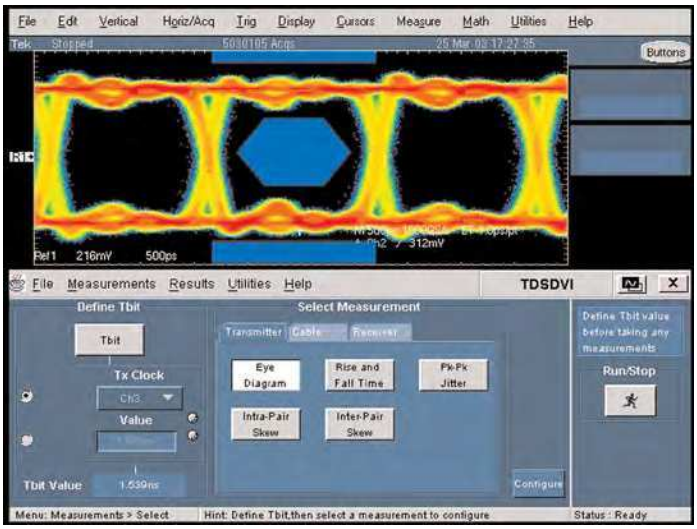
MIPI® M-PHY Debug, Analysis, Characterization and Conformance Test Solution (Option M-PHY) – Verify to the M-PHY specification by rapidly characterizing and discovering sources of jitter and signal integrity concerns. Using DPOJET, Option M-PHY enables transmitter signaling and timing measurements such as differential transmit eye diagrams, rise and fall times, slew rate, amplitude parameters, common mode voltages on each lane for both the large and small amplitude configurations, as well as the terminated and unterminated cases.



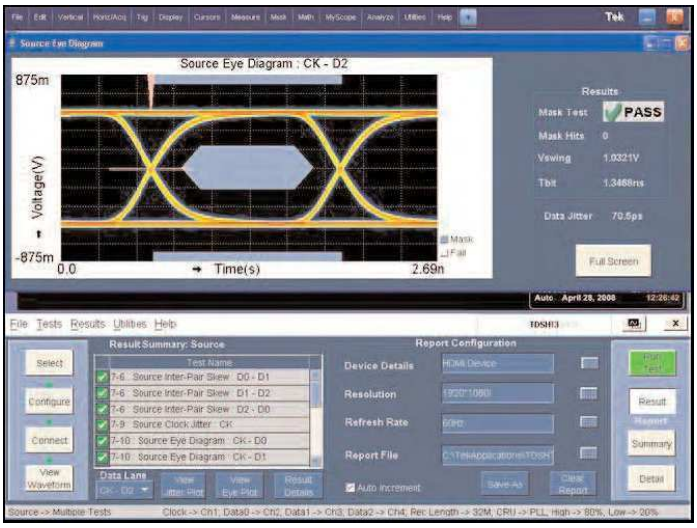
XGbT 10GBASE-T Automated Compliance Software – Quickly perform 10GBASE-T measurements per the IEEE 802.3an-2006 standard including Power Spectral Density (PSD), Power Level, and Linearity, with a simplified instrument configuration. XGbT provides flexible control over test configurations and analysis parameters, enabling more in-depth device characterization.



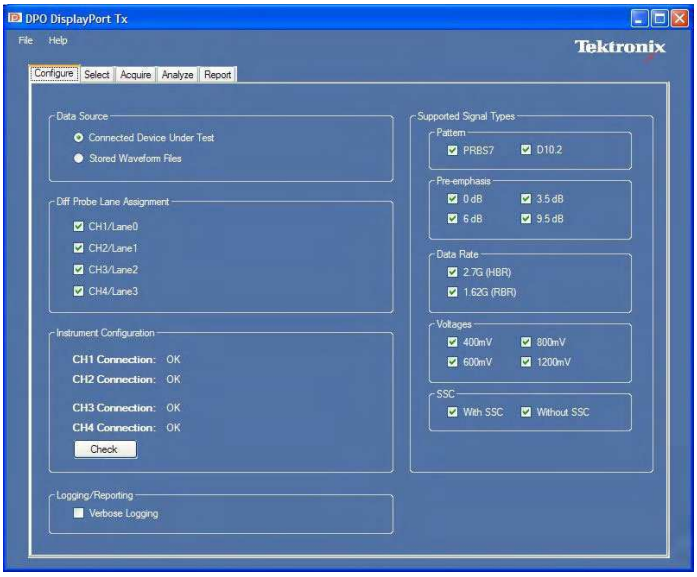
SFF-8431 SFP+ Compliance and Debug Solution (Option SFP-TX) – A comprehensive automated and debug solution for SFF-8431 SFP+ PHY and SFP+ Direct Attach Cable Specifications "10GSFP+CU." This option enables both an automated solution for compliance and a DPOJET plug-in for debug. Test setup and all measurements can be done with a single button click, reducing test time. User-defined mode enables flexible parameter control for characterization and margin analysis.



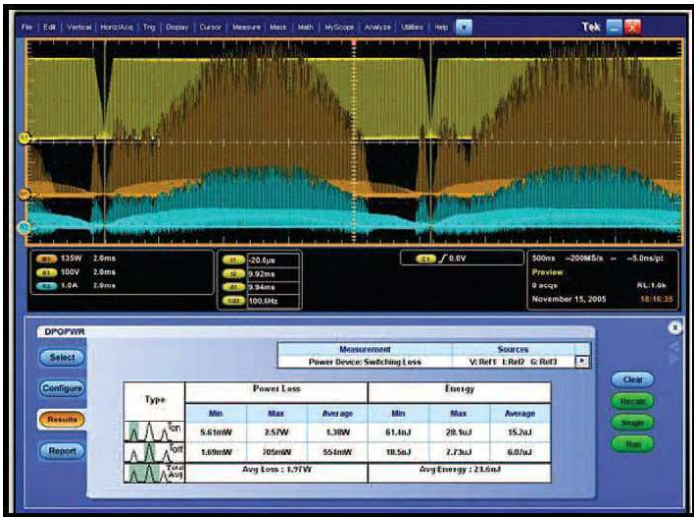
DVI Compliance Test Solution (Option DVI) – Obtain quick and dependable results with the DVI compliance test software. Automated testing based on pass/fail detection dramatically enhances productivity.



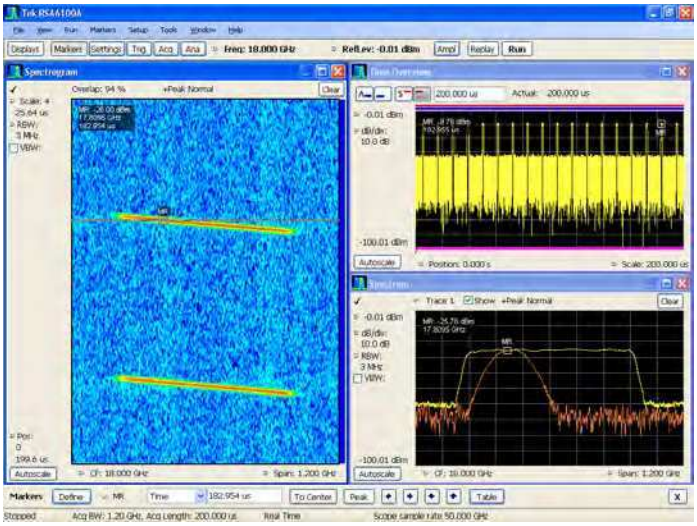
HDMI Compliance Test Solution (Option HT3) – A fast, efficient solution for HDMI compliance measurement challenges, no matter if you are working on a Source, Cable, or Sink solution. This application provides all the HDMI compliance test solutions you need to ensure quality and interoperability.



DisplayPort Compliance Test Solution (Option DSPT) – Supports DisplayPort Compliance Test Standard (CTS) source test with four-line simultaneous testing using the Tektronix P7300SMA Series probes and DisplayPort software. Detailed test reports with waveform plots, pass/fail results, and margin analysis are included.



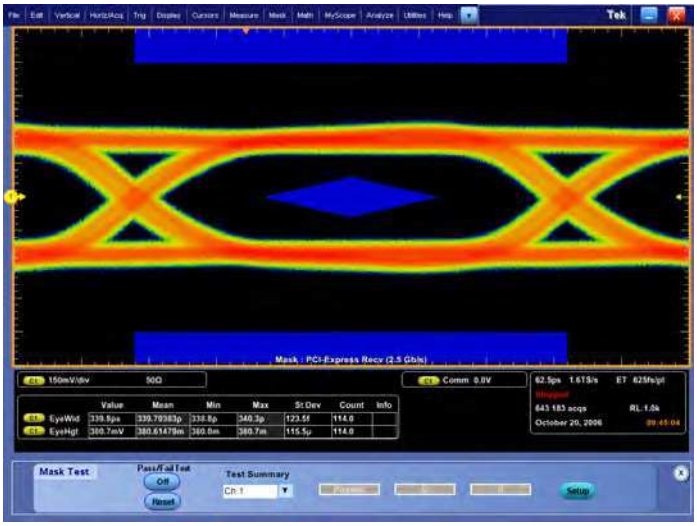
Power Measurement and Analysis Software (Option PWR) – Improve the efficiency of switching power supplies with increased power densities. Measure and analyze power dissipation in power supply switching devices and magnetic components, and generate detailed test reports in customizable formats.



SignalVu® Vector Signal Analysis – Easily verify wide-bandwidth designs such as wideband radar, high data-rate satellite links, or frequency-hopping radios and characterize wideband spectral events. SignalVu combines the functionality of a vector signal analyzer, a spectrum analyzer, and the powerful triggering capabilities of the DPO/DSA/MSO70000 Series – all in a single package.

DSA70000 – A Dedicated Solution Configured for Today's High-speed Serial Design Challenges

The DSA70000 Digital Serial Analyzers are specially configured to address high-speed serial data designs by encapsulating many of the serial domain features needed for high-speed serial verification and characterization. These standard features on the DSA70000 Series are options on the DPO70000 and MSO70000 Series.



Communications Mask Testing.

Serial Pattern Triggering – Real-time serial pattern triggering and protocol decode with built-in clock recovery recovers the clock signal, identifies the transitions, and decodes characters and other protocol data. You can see the 8b/10b bit sequences decoded into their words for convenient analysis, or you can set the desired encoded words for the serial pattern trigger to capture. With pattern lock triggering, the DSA70000 Series can synchronize to long serial test patterns with data rates up to 6.25 Gb/s and remove random jitter.

DPOJET Jitter, Timing, and Eye Diagram Analysis – The DSA70000 Series features the highest-accuracy jitter and timing measurements as well as comprehensive analysis algorithms. Tight timing margins demand stable, low-jitter designs. You can make jitter measurements over contiguous clock cycles on every valid pulse in a single-shot acquisition. Multiple measurements and trend plots quickly show system timing under variable conditions, including Random, Deterministic, and Bounded Uncorrelated Jitter separation.

Communications Mask Testing – Provides a complete portfolio of masks for verifying compliance to serial communications standards. Over 150 masks including the following standards are supported – PCI Express, ITU-T/ANSI T1.102, Ethernet IEEE 802.3, ANSI X3.263, Sonet/SDH, Fibre Channel, InfiniBand, USB, Serial ATA, Serial Attached SCSI, IEEE 1394b, RapidIO, OIF Standards, Open Base Station Architecture Initiative (OBSAI), Common Public Radio Interface (CPRI).

31 MS Record Length – 31 MS on all four channels provides a longer time sequence at high resolution. Optional record lengths up to 125 MS for the 4, 6, and 8 GHz models, 250 MS for the 12.5 through 33 GHz models extend the acquisition time sequence.

With standard features that extend the functionality of the Tektronix DPO70000 Series to address high-speed serial signal analysis and certification, the DSA70000 Series offers a specialized instrument that efficiently addresses your design challenges.

DSA Feature Set in the MSO70000

If you need to combine the functionality of the DSA70000 and the MSO70000 Series, the DSA options for the MSO70000 Series provide the DSA's high-speed serial test features in an MSO (see Option DSAH or DSAU in the Ordering Information section below).

User-selectable Bandwidth Limit Filters

While wide bandwidth is needed to characterize your high-speed serial designs, certification testing can require a specific instrument bandwidth appropriate for the signal's data rate in order to correlate test results between different test labs. The DPO/DSA/MSO70000 Series feature user-selectable bandwidth limiting filters. Using these bandwidth limit filters which range from 500 MHz to 32 GHz, you will ensure that your measurement is done using the bandwidth specified by the industry standard.

Debugging

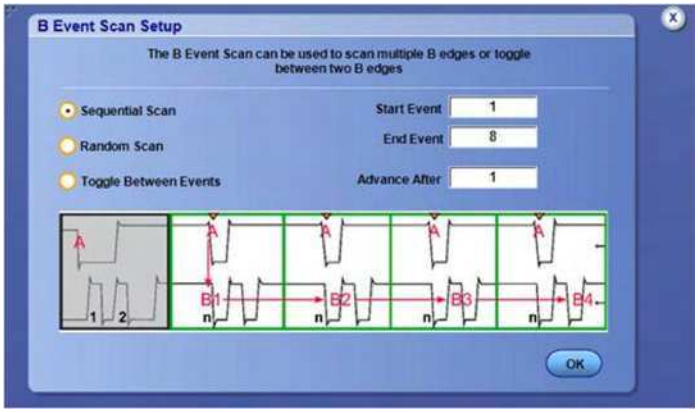
Throughout the design cycle, DPO/DSA/MSO70000 Series oscilloscopes provide the ability to debug malfunctioning subsystems and isolate the cause. Using FastAcq's high waveform capture rate, you can quickly identify signal anomalies that occur intermittently – saving minutes, hours, or even days by quickly revealing the nature of faults so sophisticated trigger modes can be applied to isolate them. Using Pinpoint triggers, infrequent events such as glitches or signal runts caused by bus contention or signal integrity issues can be captured, analyzed, and then eliminated.

FastAcq – Expedites Debugging by Clearly Showing Imperfections

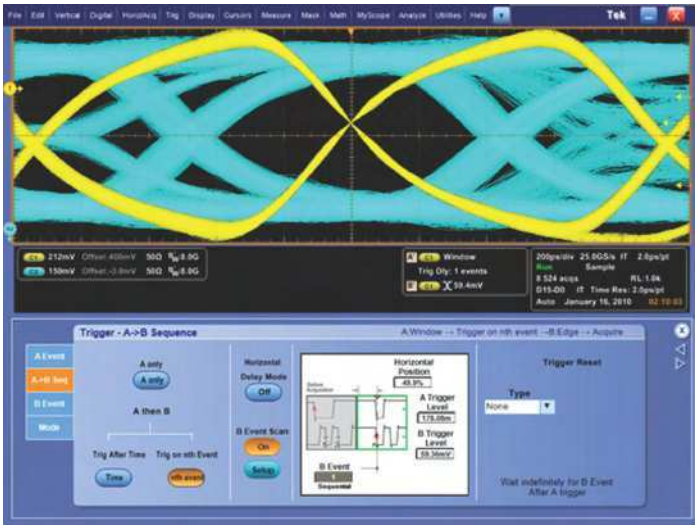
More than just color grading or event scanning, FastAcq's proprietary DPX® acquisition technology captures signals at more than 300,000 waveforms per second on all four channels simultaneously, dramatically increasing the probability of discovering infrequent fault events. And with a simple turn of the intensity knob you can clearly "see a world others don't see", displaying the complete picture of your circuit's operation. Some oscilloscope vendors claim high waveform capture rates for short bursts of time, but only DPO/DSA/MSO70000 Series oscilloscopes, enabled by DPX technology, can deliver these fast waveform capture rates on a sustained basis.

Pinpoint® Trigger

Whether you're trying to find a problem signal or need to isolate a section of a complex signal for further analysis, like a DDR Read or Write burst, Tektronix Pinpoint triggering provides the solution. The Pinpoint trigger system uses Silicon Germanium (SiGe) technology to provide very high trigger sensitivity with very low trigger jitter and the ability to capture very narrow glitches. Pinpoint triggering allows selection of virtually all trigger types on both A and B trigger events delivering the full suite of advanced trigger types for finding sequential trigger events. Pinpoint triggers provide trigger reset capabilities that begin the trigger sequence again after a specified time, state, or transition so that even events in the most complex signals can be captured. Other oscilloscopes typically offer less than 20 trigger combinations; Pinpoint triggering offers over 1400 combinations, all at full performance.



B Event Scan identifies specific events to build an eye diagram.

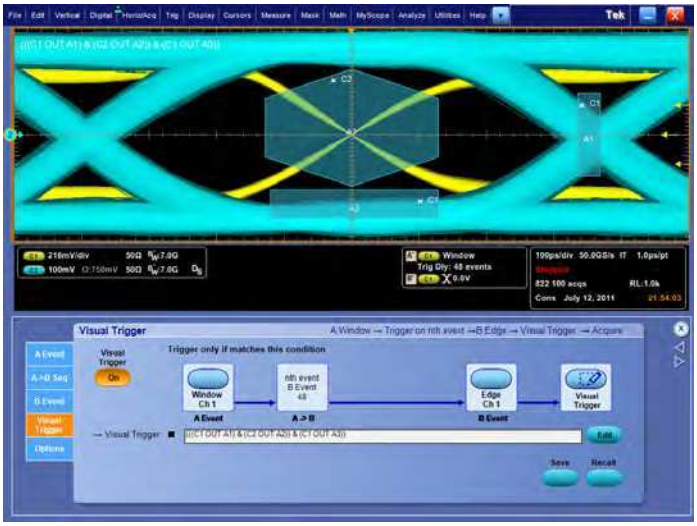


Use B Event Scan trigger on DDR DQS edges used to construct an eye diagram of all bits in a burst.

With Enhanced Triggering, trigger jitter is reduced to <100 fs. With this stability at the trigger point, the trigger point can be used as a measurement reference.

B Scan Event Trigger

Users who wish to create eye diagrams from data bursts synchronized or initiated by an A event will find the B Event Scan trigger function especially useful. B Event Scan is an A to B trigger sequence that will trigger and capture burst event data of interest defined by the B Event setup menu. Captured bits can be scanned in a sequential or randomized fashion, alternatively the trigger can toggle between two successive B trigger events.



Using Visual Trigger to view DDR3 DQ and DQS signals.

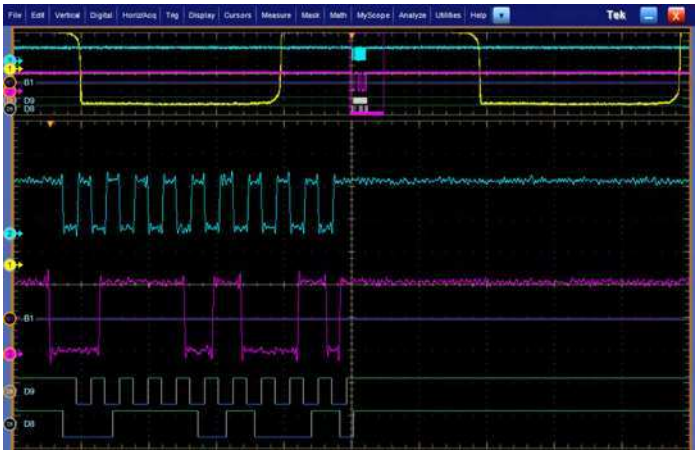
Visual Trigger for Debug

The Visual Trigger option adds an additional dimension to the Pinpoint Triggering system that provides an intuitive method of triggering based on shapes in the oscilloscope's graticule. It enables the user to define shapes on the oscilloscope's display that qualify trigger events for the incoming signals. Areas can be created using a variety of shapes including triangles, rectangles, hexagons, or trapezoids to fit the area to the particular trigger behavior desired. Once shapes are created on the oscilloscope's display, they can be positioned and/or re-sized dynamically while the oscilloscope is in Run mode to create ideal trigger conditions. Visual Trigger can be combined with the Tektronix Pinpoint Trigger system and act as a Boolean logic qualifier for "A" and "B" events.

Visual Trigger can speed up complex debugging situations for high-speed serial signaling with 8 shapes to define a series of ones and zeros. For DDR debugging situations, Visual Trigger can be helpful for accurately capturing bursty read/write traffic. It also can detect patterns in the memory data buses using the dynamic shaping of Visual Trigger to localize the cause of reduced setup and hold margins.

Logic Pattern Triggering

Logic pattern triggering allows logic qualification that controls when to look for faults and ignore events that do not occur during the desired state. On the MSO70000 Series, up to 20-bit wide logic pattern triggering enhances the Pinpoint trigger capabilities by helping you isolate the specific system state and analog events that are causing system failure.



Integrated Logic Channels – Provide time-correlated analog and digital visibility for system debugging.

Digital A then Analog B Triggering (MSO70000 Series only)

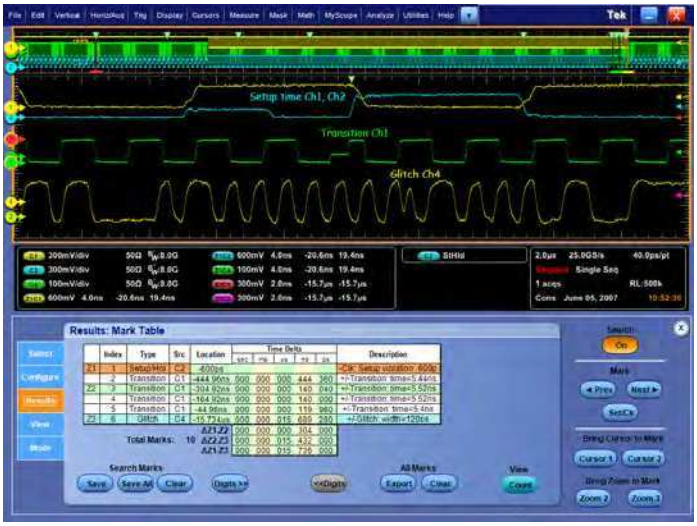
Advanced triggering capabilities include Digital A then Analog B to help you to identify a specific digital pattern or system state and then wait for an analog event such as a runt pulse to trigger the acquisition.

Integrated Logic Channels (MSO70000 Series only)

The MSO70000 Series extends the debug capabilities of a 4-channel oscilloscope with an additional 16 logic channels that can be used to provide system level context when the fault occurs. This context, such as an illegal system state or error, may be the clue that leads to the root cause. When other oscilloscopes require you to use a logic analyzer to see the digital data you need to solve your debugging challenge, the MSO70000 Series can effectively debug and verify many digital timing issues in the system more quickly and easily. With 80 ps timing resolution and channel-to-channel skews of as little as 160 ps, the integrated logic channels allow you to view and measure time-correlated digital and analog data in the same display window.

iCapture (MSO70000 Series only)

When an anomaly is seen on digital lines, iCapture delivers new insight into the analog behavior of the digital signals. With iCapture, you can route any 4 of the 16 logic channels to the MSO70000 Series' analog acquisition system so that these signals can be viewed in finer detail. iCapture's unique multiplexer circuitry provides simultaneous digital and analog views of signals without having to move the logic probe or double probe the circuit.



Advanced Search and Mark – Highlights important events, skips unimportant ones, and navigates between events of interest effortlessly.

FastFrame

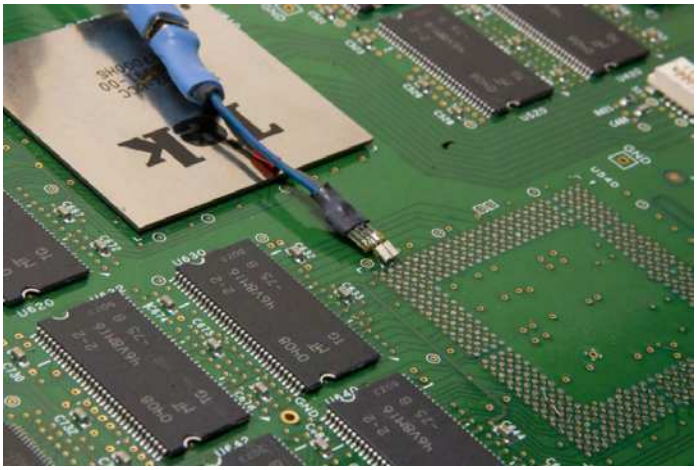
When the key events you are interested in are widely spaced in time, such as bursts of activity on a bus, the FastFrame segmented memory feature on the DPO/DSA/MSO70000 Series enables you to capture the events of interest while conserving acquisition memory. Using multiple trigger events, FastFrame captures and stores short bursts of signals and saves them as frames for later viewing and analysis. On the MSO70000 Series, FastFrame and bus or logic triggering enable you to capture your fastest, bursty signals on the analog channels at the highest sample rate while the logic channel trigger recognizes the bus cycle of interest. Capturing thousands of frames is possible, so long-term trends and changes in the bursting signal can be analyzed.

Advanced Search and Mark

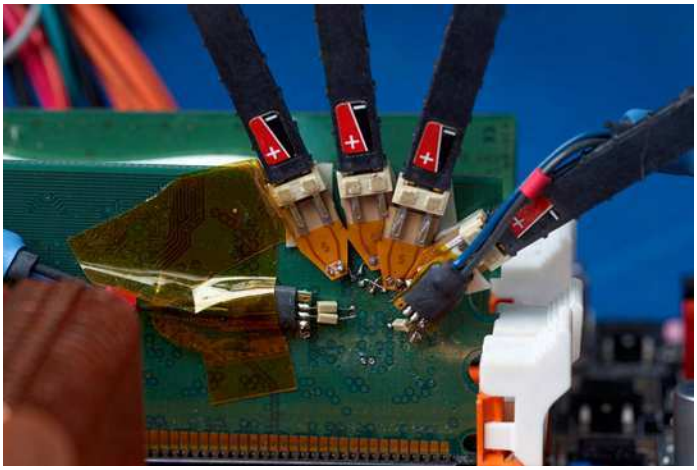
Isolating the key event causing your system failure can often be a tedious task. With the Advanced Event Search and Mark feature standard on the DPO/DSA/MSO70000 Series, examining data and highlighting important events, skipping the unimportant ones, and enhancing the comprehension of event relationships is made easy. With ASM, you'll be able to navigate between the events of interest effortlessly and uncover that rare event you have been trying to find.

Embedded Serial Bus (I²C, SPI, RS-232/422/485/UART, USB) Decoding and Triggering

The DPO/DSA/MSO70000 Series instruments provide integrated support for a broad range of serial buses – I²C, SPI, RS-232/422/485/UART, and USB. This support for up to 16 separate serial buses enables you to monitor or debug subsystems and components, such as frequency synthesizers, D/A converters, and Flash Memory that are controlled or monitored through serial control buses. While monitoring or debugging these serial buses alone is relatively easy, decoding events on the serial bus can also enable more complex system-level debugging. When you experience an issue with a higher-speed serial interface, the clue to what is going wrong may be found by using the serial bus decode feature to observe the data on your I²C, SPI, RS-232/422/485/UART, or USB interface.



The low-cost solder tips available for the P7500 TriMode probes allow quick connection so moving the probe to various solder points is fast and easy.



Solder tip accessories designed for the P6780 differential logic probes provide access to signals on tightly spaced vias and fine-pitched components.

Probing – Analog And Digital

Often the biggest challenge in debugging a system is getting access to the required signals. Tektronix offers a wide array of probing solutions, including the P7500 TriMode probing system with bandwidths that are perfectly matched to the DPO/DSA/MSO70000 Series. The P7500 TriMode probes allow you to switch among differential, single ended, and common-mode measurements without moving the probe from its connection points. The P7500 Series offers probes with performance from 4 GHz to 20 GHz and offers several low-cost solder tips with quick connection features that allow moving the probe to various solder points fast and easy.

On the MSO70000 Series, the P6780 differential, P6750 high-density D-Max®, and P6717A general-purpose logic probes provide connectivity to low-speed and high-speed digital signals with low loading, small size, and a range of accessories for soldering or browsing.

Production Testing

In addition to assisting engineers with design tasks, the DPO/DSA/MSO70000 Series can provide test engineers with the ability to test analog and digital signals with a wide range of clock speeds and data rates. Rackmount options are available for mounting the DPO/DSA/MSO70000 Series into an EIA standard 19 inch (487 mm) rack. An IEEE 488.2 standard GPIB interface is standard on all models.

LXI Class C

Using the LXI Web Interface, you can connect to the DPO/DSA/MSO70000 Series through a standard web browser by simply entering the oscilloscope's IP address in the address bar of the browser. The web interface enables viewing of instrument status and configuration, as well as status and modification of network settings. All web interaction conforms to the LXI Class C specification.

OpenChoice® Analysis Tools

The OpenChoice Software allows you to customize your test and measurement system with familiar analysis tools. The analysis and networking features of the OpenChoice software add more flexibility to Tektronix DPO/DSA/MSO70000 Series oscilloscopes: Using the fast embedded bus, waveform data can be moved directly from acquisition to analysis applications on the Windows desktop at much faster speeds than conventional GPIB transfers.

Implementation by Tektronix of industry-standard protocols, such as TekVISA™ interface and ActiveX controls, are included for using and enhancing Windows applications for data analysis and documentation. IVI instrument drivers are included to enable easy communication with the oscilloscope using GPIB, RS-232, and LAN connections from programs running on the instrument or an external PC.

The Application Development Kit (ADK) extends the OpenChoice framework to support custom end-user and third-party application development. ADK documentation describes how to implement the Data Store Public Interface to speed internal transfer of waveform data through user-created data processing algorithms and display the results in real time on the oscilloscope screen. The Data Store Public Interface is >2X faster than traditional GPIB-based data transfer techniques. The Data Store Public Interface is accessible through MathWorks MATLAB or .NET languages such as C# or Visual Basic. Other features of the ADK include a DPOJET plug-in that enables users to add custom measurements to this market-leading timing and jitter analysis tool. The ADK provides comprehensive documentation and coding examples to aid the user in developing their own unique analysis tool kit to quickly capture and analyze their signals.

Research

With industry-leading acquisition speed and signal-to-noise ratio performance, the DPO/DSA/MSO70000 Series can provide researchers with tools that allow them to capture, display, and analyze high-speed and transient signals with unmatched precision.

Full Control of Acquisition and Display Parameters

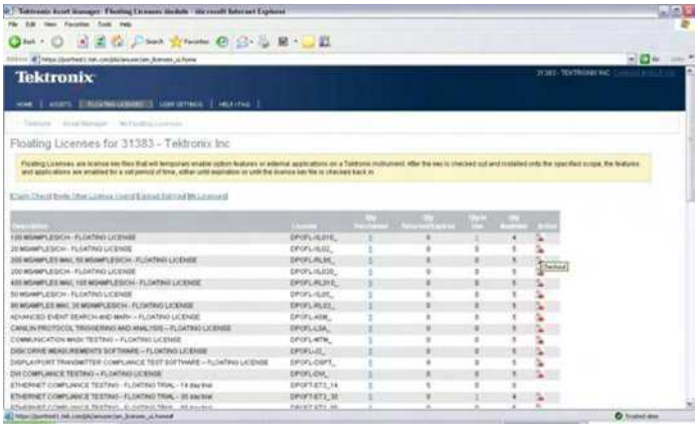
You have full control of the instrument's acquisition modes. Choose the mode you need to do your job the fastest: Automatic, Constant Sample Rate, or Manual settings. When you are doing signal exploration and want a lively signal, the default Automatic mode provides you with the liveliest display update rate. If you want the highest real-time sample rate that will give you the most measurement accuracy, then the Constant Sample Rate mode is for you. It will maintain the highest sample rate and provide the best real-time resolution. Finally the Manual mode ensures direct and independent control of the sample rate and record length for applications requiring specific settings.

TekLink®

When you need to capture a large number of signals simultaneously, TekLink allows you to synchronize multiple DPO/DSA/MSO70000 Series oscilloscopes and acquire more than four analog channels. TekLink enables synchronized capture on up to 4 oscilloscopes with one trigger event.

Document Tools

The OpenChoice architecture provides a comprehensive software infrastructure for faster, more versatile operations. Data transfer utilities, such as the Excel or Word toolbar plug-ins can be used to simplify analysis and documentation on the Windows desktop or on an external PC.



This view in the floating license system identifies the license's current user and location allowing you to easily manage your floating license inventory.

Unmatched Usability

The DPO/DSA/MSO70000 Series instruments excel in usability with a suite of productivity features, such as a touch screen, flat menu structures, intuitive graphical icons, knob-per-channel vertical controls, right clicks, mouse wheel operation, and familiar Windows-based controls.

Remote Desktop

When your oscilloscope is connected to a network, use the Windows Remote Desktop utility to access your oscilloscope from across the lab or across the globe.

MyScope® – Create Your Own Control Windows

Easily create your own personalized "toolbox" of oscilloscope features in a matter of minutes using a simple, visual, drag-and-drop process. Once created, these custom control windows are easily accessed through a dedicated MyScope button and menu selection on the oscilloscope button/menu bar, just like any other control window. You can make an unlimited number of custom control windows, enabling each person who uses the oscilloscope in a shared environment to have their own unique control window. MyScope control windows will benefit all oscilloscope users, eliminating the ramp-up time that many face when returning to the lab after not using an oscilloscope for a while, and enables the power user to be far more efficient. Everything you need is found in one control window rather than navigating through multiple menus to repeat similar tasks.

Option Asset Management: Floating or Fixed

Many Tektronix application solutions and hardware options are enabled with an encrypted license key that is entered through the oscilloscope's Utilities menu. You now have two options. The first option is a fixed license applied to a specific scope serial number and is permanently enabled. A fixed license cannot be moved from one oscilloscope to another.

The second option is a floating license. Floating licenses provide the capability to move a license-key enabled option from one oscilloscope to another. This capability helps users with distributed teams and several Tektronix DPO/DSA/MSO70000, or DPO7000, and MSO/DPO5000 Series oscilloscopes to better manage their assets and deploy applications or other options such as extended memory to the oscilloscope where it is needed.

Managing and deploying floating licenses uses an easy online licensing management system. All floating license management functions are maintained on Tektronix secure servers and no infrastructure or your company IT department involvement is necessary. Simply utilize your myTek account to access, track, and deploy your oscilloscope floating-license enabled options.

Performance You Can Count On

Depend on Tektronix to provide you with performance you can count on. All Tektronix products are backed with industry-leading service and support.

Characteristics

Vertical System

Characteristic	DPO70404C DSA70404C MSO70404C	DPO70604C DSA70604C MSO70604C	DPO70804C DSA70804C MSO70804C	DPO71254C DSA71254C MSO71254C	DPO71604C DSA71604C MSO71604C	DPO72004C DSA72004C MSO72004C	DPO72504D DSA72504D	DPO73304D DSA73304D
Bandwidth (User-selectable DSP enhance)	4 GHz	6 GHz	8 GHz	12.5 GHz	16 GHz	20 GHz	25 GHz (2 Ch) 23 GHz (4 Ch)	33 GHz (2 Ch) 23 GHz (4 Ch)
Hardware Analog Bandwidth (–3 dB)	4 GHz	6 GHz	8 GHz	12.5 GHz	16 GHz (typical)	16 GHz (typical)	25 GHz	33 GHz
Input Channels	4	4	4	4	4	4	4	4
Logic Channels (MSO70000 Series only)	16	16	16	16	16	16		
Rise Time 10% to 90% (Typical)	98 ps	65 ps	49 ps	32 ps	24.5 ps	19 ps	17 ps	13 ps
Rise Time 20% to 80% (Typical)	68 ps	45 ps	34 ps	22 ps	17 ps	14 ps	12 ps	9 ps
Vertical Noise (% of full scale) (Typical)*1	0.28%	0.32%	0.35%	0.36%	0.36%	0.56%	0.58%	0.58%
Bandwidth Limits	Depending on instrument model: 33 GHz to 1 GHz in 1 GHz steps, or 500 MHz Hardware-only bandwidth settings at 33, 25, 20, and 16 GHz							
Channel-to-Channel Isolation (Any two channels at equal vertical scale settings)	DC to 10 GHz: ≥120:1 (41 dB) >10 GHz to 12 GHz: ≥80:1 (38 dB) >12 GHz to 15 GHz: ≥50:1 (34 dB) >15 GHz to 20 GHz: ≥25:1 (28 dB) >20 GHz to 33 GHz: ≥20:1 (26 dB)							
Delay between Any Two Channels (Typical)	≤10 ps for any two channels with equal V/div and coupling settings						<3 ps for any two channels at any gain setting	
DC Gain Accuracy	±2% (of reading)							
Input Coupling	DC (50 Ω), GND							
Input Impedance	50 Ω ±3%, 1 MΩ with TCA-1MEG adapter							
Input Sensitivity								
18 GHz and below	10 mV/div to 500 mV/div (100 mV to 5 V full scale)							
20 GHz and 19 GHz	20 to 500 mV/div (200 mV to 5 V full scale)							
33 GHz and below							6.25 mV/div to 120 mV/div (62.5 mV to 1.2 V full scale)	
Max Input Voltage, 50 Ω*2	<5.0 V_{RMS} for ≥100 mV/div; 1.0 V_{RMS} for <100 mV/div						1.2 V_{RMS}	
Offset Accuracy 10 mV/div – 99.5 mV/div	±(0.35% (offset value-position) + 1.5 mV + 1% of full scale)							
100 mV/div – 500 mV/div.	±(0.35% (offset value-position) + 7.5 mV + 1% of full scale)							
Offset Range	10 mV/div: ±450 mV 20 mV/div: ±400 mV 50 mV/div: ±250 mV 100 mV/div: ±2.0 V 200 mV/div: ±1.5 V 500 mV/div: ±0.0 V						+3.4 V to –3.4 V	
Termination Voltage Range							+3.4 V to –3.4 V	
Passband Flatness (20, 50, 100, 250 mV/div) (Typical)	±0.5 dB to 50% of nominal bandwidth							
Position Range	±5 div							
Vertical Resolution	8 bit (11 bit with averaging)							

*1 50 mV/div, bandwidth filter on, max sample rate.

*2 Also determined by TekConnect accessory.

Logic Channels (MSO70000 Series only)

Characteristic	MSO70404C	MSO70604C	MSO70804C	MSO71254C	MSO71604C	MSO72004C
Input Channels	16					
Trigger Clock/Qualifier Input	1					
Analog Bandwidth						
With P6780 logic probe	2.5 GHz					
With P6750 or P6717A logic probe	1 GHz					
Input Impedance						
With P6780 logic probe	20 kΩ to ground per side or 40 kΩ differential mode ± 2.0%, 0.5 pF					
With P6750 or P6717A logic probe	20 kΩ ± 1.0%, 3 pF					
Vertical Resolution	1 bit					
Threshold Levels	One per channel, independently set					
Threshold Accuracy	±75 mV + 3% of threshold setting					
Threshold Resolution	5 mV					
Logic Threshold Range						
With P6780 logic probe	–2 to +4.5V					
With P6750 or P6717A logic probe	–1.5 to +4.0V					
Minimum Voltage Swing	300 mV_{p-p}					
Maximum Input Voltage	±15 V nondestruct					

Horizontal Time Base System

Characteristic	DPO70404C DSA70404C MSO70404C	DPO70604C DSA70604C MSO70604C	DPO70804C DSA70804C MSO70804C	DPO71254C DSA71254C MSO71254C	DPO71604C DSA71604C MSO71604C	DPO72004C DSA72004C MSO72004C	DPO72504D DSA72504D	DPO73304D DSA73304D
Time Base Range	20 ps/div to 1000 s/div			10 ps/div to 1000 s/div				
Time Resolution (in ET/IT mode)	200 fs			100 fs				
Channel-to-Channel Deskew	Range ±75 ns							
Delta Time Measurement Accuracy RMS over <100 ns Duration; Single Shot; with Signal Rise Time = 1.2 x Scope Rise Time*3	1.48 ps	1.33 ps	1.24 ps	1.23 ps	1.15 ps	1.43 ps	330 fs	347 fs
Jitter Noise Floor (Typical) (With BW bandwidth enhance enabled)	340 fs	300 fs	300 fs	270 fs	270 fs	290 fs	<250 fs	<250 fs
Time Base Accuracy	±1.5 ppm initial accuracy, aging <1 ppm per year							
Time Base Delay Time Range	–5.0 ks to 1.0 ks							
Trigger Jitter (RMS)	1 ps_{RMS} (typical) with enhanced triggering off <100 fs_{RMS} with enhanced triggering on							

*3 100 mV/div, bandwidth filter on, max sample rate.

Acquisition System

Characteristic	DPO70404C DSA70404C MSO70404C	DPO70604C DSA70604C MSO70604C	DPO70804C DSA70804C MSO70804C	DPO71254C DSA71254C MSO71254C	DPO71604C DSA71604C MSO71604C	DPO72004C DSA72004C MSO72004C	DPO72504D DSA72504D	DPO73304D DSA73304D
Sample Rates								
Real-time Mode 1, 2 Channel (Max)						100 GS/s*4		
Real-time Mode 1, 2, 3, or 4 Channel (Max)		25 GS/s				50 GS/s		
ET/IT Mode (Max)		5 TS/s				10 TS/s		
Maximum Record Length per Channel								
With Standard Configuration			10M on all four channels (DPO70000 and MSO70000 Series) 31.25M on all four channels (DSA70000 Series only)					
With Record Length Option 2XL			31.25M on all four channels (DPO70000 and MSO70000 Series)					
With Record Length Option 5XL				62.5M on all four channels				
With Record Length Option 10XL				125M on all four channels				
With Record Length Option 20XL		N/A				250M on all four channels		
Maximum Duration at Highest Real-time Resolution								
Timing Resolution		40 ps (25 GS/s)				10 ps (100 GS/s)		
0.4 ms DPO70000 and MSO70000 Series		0.4 ms DPO70000 and MSO70000 Series 1.25 ms for DSA70000 Series				0.1 ms DPO70000 and MSO70000 Series 0.31 ms for DSA70000 Series		
Max Duration with Option 2XL		1.25 ms (DPO70000 and MSO70000 Series)				0.31 ms (DPO70000 and MSO70000 Series)		
Max Duration with Option 5XL		2.5 ms				0.63 ms		
Max Duration with Option 10XL		5.0 ms				1.3 ms		
Max Duration with Option 20XL		N/A				2.5 ms		

*4 Maximum sample rate is 50 GS/s on digital channels routed to an analog channel through the iCapture analog mux.

Logic Channels (MSO70000 Series only)

Characteristic	MSO70404C	MSO70604C	MSO70804C	MSO71254C	MSO71604C	MSO72004C
Sample Rate – All Channels (Max)	12.5 GS/s					
Timing Resolution	80 ps					
Displayed Channel-to-Channel Timing Uncertainty	<160 ps					
Maximum Record Length per Channel	125M on all channels (Option 10XL)			250M on all channels (Option 20XL)		
Minimum Detectable Pulse Width	<400 ps					
Maximum Number of Buses	16					
Number of Channels per Bus	Up to 24 (16 logic, 4 analog, 4 math)					

Acquisition Modes

Mode	Description
Averaging	From 2 to 10,000 waveforms can be included in an average waveform
Envelope	From 1 to 2×10^9 waveforms included in min-max envelope
FastAcq	FastAcq optimizes the instrument for analysis of dynamic signals and capture of infrequent events
Maximum FastAcq Waveform Capture Rate	>300,000 wfms/s on all 4 channels simultaneously
FastFrame™	Acquisition memory divided into segments; maximum trigger rate >310,000 waveforms per second. Time of arrival recorded with each event. Frame finder tool helps to visually identify transients
Hi-Res	Real-time boxcar averaging reduces random noise and increases resolution
Peak Detect	Captures and displays narrow glitches at all real-time sampling rates. Glitch widths: 1 ns at ≤125 MS/s; 1/sample rate at ≥250 MS/s
Roll Mode	Scrolls sequential waveform points across the display in a right-to-left rolling motion. Works at sample rates up to 10 MS/s with a maximum record length of 40 MS
Sample	Acquires and displays sampled values
Waveform Database	Accumulates waveform data providing a three-dimensional array of amplitude, time, and counts

Pinpoint® Trigger System

Sensitivity	DPO and MSO Models	DSA Models
Internal DC Coupled	4% of full scale from DC to 50 MHz 10% of full scale at 4 GHz 20% of full scale at 8 GHz 50% of full scale at 11 GHz	
External (Auxiliary Input) 50 Ω	250 mV from DC to 50 MHz, increasing to 350 mV at 1.0 GHz	
Trigger Characteristics		
A Event and Delayed B Event Trigger Types	Edge, Glitch, Runt, Width, Transition Time, Timeout, Pattern, State, Setup/Hold, Window – all except Edge, Pattern, and State can be Logic State qualified by up to two channels	
Main Trigger Modes	Auto, Normal, and Single	
Trigger Sequences	Main, Delayed by Time, Delayed by Events, Reset by Time, Reset by State, Reset by Transition. All sequences can include a separate horizontal delay after the trigger event to position the acquisition window in time	
Trigger Coupling	DC, AC (attenuates <100 Hz) HF Rej (attenuates >20 kHz) LF Rej (attenuates <200 kHz) Noise Reject (reduces sensitivity)	
Trigger Holdoff Range	250 ns min to 12 s max	
Trigger Level Range Internal	±120% of full scale from center of screen	
Clock Recovery System	Requires Option ST6G or Option MTH	Standard
Clock Recovery Phase Locked Loop Bandwidth	Fixed at FBaud/1600	
Clock Recovery Jitter (RMS)	<0.25% bit period + 2 ps_{RMS} for PRBS data patterns <0.25% bit period + 1.5 ps_{RMS} for repeating "0011" data pattern	
Minimum Signal Amplitude needed for Clock Recovery	1 div_{p-p} up to 1.25 Gbaud 1.5 div_{p-p} above 1.25 Gbaud	
Tracking/Acquisition Range	±2% of requested baud	
Clock Recovery Frequency Range	1.5 MBaud to 3.125 GBaud	
Clock Output	Recovered clock available for use with a BERT, along with regenerated data	
Serial Pattern Trigger	Requires Option ST6G	Standard
	Up to 64 bit serial word recognizer, bits specified in binary (high, low, don't care) or hex format. Trigger on NRZ-encoded data up to 1.25 GBaud	
	Trigger on 8b/10b-encoded data at following rates: 1.25 to 1.65, 2.0 to 3.25, 3.5 to 5.2, and 5.3 to 6.25 GBaud (40 bits)	
8b10b Max Baud Rate	Requires Option ST6G	Standard
	6.25 GBaud	
Pattern Length	1-4 valid, 10-bit characters	
Alignment Character	K28.5 (either disparity)	
Communications-related Triggers	Requires Option MTH	Standard
	Support for AMI, HDB3, BnZS, CMI, MLT3, and NRZ encoded communications signals. Select among isolated positive or negative one, zero pulse form, or eye patterns as applicable to the standard	
Logic Pattern Trigger (MSO70000 Series)		
Threshold Range (when using MSO Logic Probes)		
P6780	–2 to +4.5 V	
P6717A/P6750	–1.5 to +4 V	
Threshold Accuracy	±100 mV + 3% of threshold setting	
Bus Trigger Maximum Toggle Rate		
I^2C, SPI, RS-232/422/485/UART	10 Mb/s	
USB	Low-speed, full-speed	
Enhanced Triggering	User-selectable; enhanced triggering corrects the difference in timing between the trigger path and the acquired data path (supports all Pinpoint trigger types on both A- and B-Events except pattern trigger); Not available in FastAcq mode	
Line	Trigger on power line signal. Level fixed at 0 V	
Visual Trigger	Requires Option VET	
Max Number of Areas	8	
Area Shapes	Rectangle, Triangle, Trapezoid, Hexagon	
Compatibility	Visual Trigger qualification is compatible with all trigger types and all trigger sequences	

Trigger Types

Trigger	Analog Channels	MSO Logic Channels	Description
Comm	X		Support for AMI, HDB3, BnZS, CMI, MLT3, and NRZ encoded signals. Standard feature on the DSA70000 Series, provided as part of Option MTH on the DPO70000 and MSO70000 Series
Bus	X	X	Trigger on a parallel or serial bus when the specific bus value is found
I²C	X	X	Trigger on Start, Repeated Start, Stop, Missing ACK, Address (7 or 10 bit), Data, or Address and Data
SPI	X	X	Trigger on SS or data
RS-232/422/485/UART	X	X	Trigger on Start Bit, End of Packet, Data, and Parity Error
USB	X	X	Low-speed or Full-speed: Trigger on Sync, Reset, Suspend, Resume, End of Packet, Token (Address) Packet, Data Packet, Handshake Packet, Special Packet, Error
Edge	X	X	Positive or negative slope on any channel or front-panel auxiliary input. Coupling includes DC, AC, noise reject, HF reject, and LF reject
B Event Scan	X		B Event Scan is an A to B trigger sequence that will trigger and capture burst event data of interest as defined in the B Event Scan setup menu. Captured bits can be scanned in a sequential or randomized fashion, and alternatively the trigger can toggle between two successive B trigger events. Eye diagrams can be constructed with burst data acquired as a result of scanning B Event
Glitch	X	X	Trigger on or reject glitches of positive, negative, or either polarity. Minimum glitch width is 150 ps (typical) with rearm time of 300 ps
Pattern	X	X	Trigger when pattern goes false or stays true for specified period of time. Pattern (AND, OR, NAND, NOR) specified for four input channels (and 16 logic channels on the MSO70000 Series) defined as high, low, or don't care
Runt	X		Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Event can be time- or logic-qualified
Serial Pattern	X		Trigger on NRZ-encoded data up to 6.25 Gbaud; above 1.25 Gbaud requires 8b/10b encoded data. Extended with pattern lock triggering to capture repeated acquisitions of long serial test patterns up to 6.25 Gb/s
Setup/Hold	X		Trigger on violations of both setup time and hold time between clock and data present on any two input channels
State	X	X	Any logical pattern of channels (1, 2, 3) (and 16 logic channels on the MSO70000 Series) clocked by edge on channel 4. Trigger on rising or falling clock edge
Timeout	X	X	Trigger on an event which remains high, low, or either, for a specified time period. Selectable from 300 ps
Transition	X		Trigger on pulse edge rates that are faster or slower than specified. Slope may be positive, negative, or either
Trigger Delay by Events	X	X	1 to 2 billion events
Trigger Delay by Time	X	X	3.2 ns to 3 million seconds
Visual Trigger	X		Trigger when the Visual Trigger expression is satisfied
Width	X	X	Trigger on width of positive or negative pulse either within or out of selectable time limits (down to 150 ps)
Window	X		Trigger on an event that enters or exits a window defined by two user-adjustable thresholds. Event can be time or logic qualified

Search and Mark Events

Search for glitches or runts, as well as transition rate, pulse width, setup and hold, timeout, window violations, or find any logic or state pattern on any number of channels. Any events found matching the search criteria are marked and placed in the Event table. The search can use positive/negative slopes or both on any channels.

Search DDR Read or Write bursts with Option DDRA.

The Event table summarizes all found events. All events are time stamped in reference to trigger position. Users can choose to stop acquisitions when an event is found.

Waveform Analysis

Waveform Measurements

Measurement	Description
Automatic Measurements	53, of which 8 can be displayed on-screen at any one time; measurement statistics, user-definable reference levels, measurement within gates isolating the specific occurrence within an acquisition to measure
Amplitude Related	Amplitude, High, Low, Maximum, Minimum, Peak-to-Peak, Mean, Cycle Mean, RMS, Cycle RMS, Positive Overshoot, Negative Overshoot
Combination	Area, Cycle Area, Phase, Burst Width
Eye-pattern Related	Extinction Ratio (absolute, %, dB), Eye Height, Eye Width, Eye Top, Eye Base, Crossing %, Jitter (p-p, RMS, 6sigma), Noise (p-p, RMS), Signal/Noise Ratio, Cycle Distortion, Q-Factor
Histogram Related	Waveform Count, Hits in Box, Peak Hits, Median, Maximum, Minimum, Peak-to-Peak, Mean (μ), Standard Deviation (sigma), μ+1sigma, μ+2sigma, μ+3sigma
Time Related	Rise Time, Fall Time, Positive Width, Negative Width, Positive Duty Cycle, Negative Duty Cycle, Period, Frequency, Delay

Bus Decoding

Characteristic	Description
Parallel	Data from selected channels is grouped as a parallel, multichannel bus and displayed as a single bus value. Display can be binary, hexadecimal, or symbolic formats
I²C	SCLK and SDA channels are displayed as a bus per the Inter-Integrated Circuit specification
SPI	MOSI, MISO, SCLK, and SS channels are displayed as a bus per the Serial Peripheral Interface specification
RS-232/422/485/UART	Channel is displayed as a bus
USB	Channels are displayed as a bus per the USB specification
MIPI® D-PHY	DSI or CSI2 channels are displayed as a bus per the MIPI standard
8b10b Encoded	Control and data characters are displayed as a bus

Waveform Processing/Math

Measurement	Description
Algebraic Expressions	Define extensive algebraic expressions including Waveforms, Scalars, User-adjustable Variables, and Results of Parametric Measurements e.g. (Integral (CH1 – Mean(CH1)) × 1.414 × VAR1)
Arithmetic	Add, Subtract, Multiply, Divide Waveforms and Scalars
Filtering Functions	User-definable filters. Users specify a file containing the coefficients of the filter. Several example filter files are provided
Frequency Domain Functions	Spectral Magnitude and Phase, Real and Imaginary Spectra
Mask Function	Generates a Waveform Database pixel map from a sample waveform. Sample count can be defined
Math Functions	Average, Invert, Integrate, Differentiate, Square Root, Exponential, Log 10, Log e, Abs, Ceiling, Floor, Min, Max, Sin, Cos, Tan, ASin, ACos, ATan, Sinh, Cosh, Tanh
Relational	Boolean result of comparison >, <, ≥, ≤, ==, !=
Vertical Units	Magnitude: Linear, dB, dBm Phase: Degrees, radians, group delay IRE and mV units
Window Functions	Rectangular, Hamming, Hanning, Kaiser-Bessel, Blackman-Harris, Gaussian, Flattop2, Tek Exponential

Display, Computer, I/O

Display

Characteristic	Description
Color Palettes	Normal, Green, Gray, Temperature, Spectral, and User-defined
Display Format	YT, XY, XYZ
Display Resolution	XGA 1024 horizontal x 768 vertical pixels
Display Size	Diagonal: 307.3 mm (12.1 in.)
Display Type	Liquid-crystal active-matrix color display
Horizontal Divisions	10
Vertical Divisions	10
Waveform Styles	Vectors, Dots, Variable Persistance, Infinite Persistance

Computer System and Peripherals

Characteristic	Description
Operating System	Microsoft Windows 7 Ultimate – 64 bit OS
CPU	Intel Core 2 Duo Processor, 3 GHz
PC System Memory	8 GB
Hard Disk Drive	Rear-panel, removable hard disk drive, 160 GB capacity
Optional Solid State Drive (Option SSD)	Removable, 160 GB capacity (SSD is standard on 25 and 33 GHz models)
CD/DVD Drive	Front-panel CD-R/W, DVD-R drive
Mouse	Optical wheel mouse, USB interface
Keyboard	USB interface

Input/Output Ports

Front Panel

Port	Description
Aux Trigger Input	See trigger specifications
DC Probe Calibration Output	BNC connector, ±10 V DC for DC probe calibration (signal available only during probe calibration)
Fast Edge Output	SMA connector provides fast edge signal. 1 kHz ±20%; 810 mV (base to top) ±20% into ≥10 kΩ load; 440 mV ±20% into a 50 Ω load
Recovered Clock	SMA connector, ≤1.25 Gb/s, Output swing ≥130 mV_{p-p} into 50 Ω at 1.25 Gb/s. Requires Option ST6G or Option MTH to enable on DPO70000 and MSO70000 Series, standard on DSA70000 Series
Recovered Data	SMA connector, ≤1.25 Gb/s, Output swing of 1010 repeating pattern 200 mV into 50 Ω at 1.25 Gb/s. Requires Option ST6G or Option MTH to enable on DPO70000 and MSO70000 Series, standard on DSA70000 Series
USB 2.0 Ports	Allows connection of USB keyboard, mouse, or storage device
LAN eXtensions for Instrumentation (LXI)	
Class	LXI Class C
Version	1.3

Rear Panel

Port	Description
Audio Ports	Miniature phone jacks for stereo microphone input and stereo line output
Aux Trigger Output	BNC connector, 0 to 3 V; default output is A-Event Trigger low true
External Time Base Reference In	BNC connector; allows time base system to phase lock to external 10/100 MHz reference. Optimized (by using a software switch) for either a highly stable clock or tracking mode
GPIB Port	IEEE 488.2 standard
Keyboard Port	PS/2 compatible
LAN Port	RJ-45 connector, supports 10BASE-T, 100BASE-T, and 1000BASE-T
Mouse Port	PS/2 compatible
eSATA port	External SATA interface for eSATA storage devices
Power	100 to 240 V_{RMS}, ±10%, 50/60 Hz; 115 V_{RMS} ±10%, <870 W, 400 Hz; CAT II, <1100 VA typical
DVI-I Video Port	Connect to show the oscilloscope display, including live waveforms on an external monitor or projector. The primary Windows desktop can also be displayed on an external monitor using these ports. Alternatively, the DVI-I port can be configured to show the secondary Windows desktop (also called extended desktop or dual-monitor display) DVI connector, female. DVI to VGA 15-pin D-sub connector adapter provided
Serial Port	Two DB-9 COM1 ports
TekLink®	Synchronizes triggers from multiple Tektronix oscilloscopes together to allow simultaneous acquisition of more than four channels
Time Base Reference Out	BNC connector; provides TTL-compatible output of internal 10 MHz reference oscillator
USB 2.0 Ports	Five on 25 and 33 GHz models, four on all others.. Allow connection of USB keyboard, mouse, or storage devices

Physical Characteristics

Dimensions

Benchtop Configuration

Dimension	mm	in.
Height	298	11.74
Width	451	17.75
Depth	489.97	19.29
Weight	**kg**	**lb.**
Net	24	53
Shipping	34	67

Rackmount Configuration

Dimension	mm	in.
Height	311	12.25
Width	480.1	18.9
Depth (from rack mounting ear to back of instrument)	546.1	21.5
Weight	**kg**	**lb.**
Net	22	59
Kit	2.7	6

Mechanical

Cooling – Required Clearance	mm	in.
Top	0	0
Bottom	0	0
Left Side	76	3
Right Side	76	3
Front	0	0
Rear	0	0

Environmental

Characteristic	Description
Temperature	
Operating	5 °C to +45 °C
Nonoperating	–20 °C to +60 °C
Humidity	
Operating	8% to 80% relative humidity (RH) at up to 32 °C Above +32 °C up to +45 °C; as limited by a 29.4 °C wet bulb temperature
Nonoperating	5% to 95% relative humidity (RH) Above +32 °C up to +60 °C; as limited by a 29.4 °C wet bulb temperature
Altitude	
Operating	3,000 m (9,843 ft.)
Nonoperating	12,000 m (39,370 ft.)
Regulatory	
Electromagnetic Compatibility	2004/108/EC; EN 61326-2-1:2006
Certifications	UL 61010-1, CSA 61010-1-04, LVD 2006/95/EC, EN61010-1, IEC 61010-1

Ordering Information

Models

Model	Description
MSO70404C	4 GHz Mixed Signal Oscilloscope
MSO70604C	6 GHz Mixed Signal Oscilloscope
MSO70804C	8 GHz Mixed Signal Oscilloscope
MSO71254C	12.5 GHz Mixed Signal Oscilloscope
MSO71604C	16 GHz Mixed Signal Oscilloscope
MSO72004C	20 GHz Mixed Signal Oscilloscope
DPO70404C	4 GHz Digital Phosphor Oscilloscope
DPO70604C	6 GHz Digital Phosphor Oscilloscope
DPO70804C	8 GHz Digital Phosphor Oscilloscope
DPO71254C	12.5 GHz Digital Phosphor Oscilloscope
DPO71604C	16 GHz Digital Phosphor Oscilloscope
DPO72004C	20 GHz Digital Phosphor Oscilloscope
DPO72504D	25 GHz Digital Phosphor Oscilloscope
DPO73304D	33 GHz Digital Phosphor Oscilloscope
DSA70404C	4 GHz Digital Serial Analyzer
DSA70604C	6 GHz Digital Serial Analyzer
DSA70804C	8 GHz Digital Serial Analyzer
DSA71254C	12.5 GHz Digital Serial Analyzer
DSA71604C	16 GHz Digital Serial Analyzer
DSA72004C	20 GHz Digital Serial Analyzer
DSA72504D	25 GHz Digital Serial Analyzer
DSA73304D	33 GHz Digital Serial Analyzer

All Models Include: Accessory pouch, front cover, mouse, keyboard, quick start user manual (071-173x-xx), (4) TekConnect® to 2.92 mm adapters (TCA-292MM) and (1) TekConnect-to-BNC adapter (TCA-BNC), DVI to VGA adapter, static protection wrist strap, DPO/DSA/MSO70000 Series product software CD/DVD-ROM, performance verification procedure PDF file, GPIB programmer's reference (on product software CD/DVD-ROM), calibration certificate documenting NIST traceability, Z 540-1 compliance and ISO9001, power cord, one-year warranty.

Note: Please specify quick-start user manual language and power plug when ordering.

Options

Instrument Options

Option	DPO70000	DSA70000	MSO70000	Description
Record Length Options				
Opt. 2XL	X	Standard	X	31.25 MS/Ch
Opt. 5XL	X	X	X	62.5 MS/Ch
Opt. 10XL	X	X	X	125 MS/Ch
Opt. 20XL*[11]	X	X	X	250 MS/Ch
Storage Options				
Opt. SSD*[19]	X	X	X	Additional Removable Disk – Solid State Drive
MSO70000 Digital Signal Analyzer Options				
Opt. DSAH			X, for MSO70404C, MSO70604C, or MSO70804C	MSO Digital Serial Analysis Bundle, includes Opt. 2XL, DJA, MTH, and ST6G
Opt. DSAU			X, for MSO71254C, MSO71604C, or MSO72004C	MSO Digital Serial Analysis Bundle, includes Opt. 2XL, DJA, MTH, and ST6G
Trigger and Search Options				
Opt. LT	X	X	X	Waveform Limit Testing
Opt. MTH	X	Standard	X	Mask testing for Serial Standards. Includes hardware clock recovery for up to 3.125 Gb/s
Opt. ST6G	X	Standard	X	Protocol Triggering and Decoding for 8b/10b-encoded Serial Signals up to 6.25 Gb/s. Includes hardware clock recovery and pattern lock triggering
Advanced Analysis Options				
Opt. D-PHY*[12]	X	X	X	MIPI® D-PHY Essentials – Characterization and Analysis Solution
Opt. DDRA*[12]	X	X	X	DDR Memory Bus Analysis
Opt. DJA	X	Standard	X	DPOJET Jitter and Eye Diagram Analysis
Opt. DP12*[21]	X	X	X	DisplayPort 1.2 Source Test Automation Software
Opt. DVI	X	X	X	DVI Compliance Test Solution
Opt. ERRDT*[16]	X	X	X	Frame and Bit Error Rate Detector for High-speed Serial Standards (Available through the programmable interface only)
Opt. ET3*[5]	X	X	X	Ethernet Compliance Test Software
Opt. HT3	X	X	X	HDMI Compliance Test Software
Opt. HT3DS	X	X	X	HDMI Direct Synthesis for HDMI 1.4
Opt. M-PHY*[12]	X	X	X	MIPI® M-PHY Essentials – Characterization and Analysis Solution
Opt. PCE3*[12]	X	X	X	PCI Express Gen3 Essentials
Opt. PWR*[9]	X	X	X	Power Measurement and Analysis Software
Opt. QPI*[12]	X	X	X	Intel® Quick Path Interconnect Test Automation Software
Opt. SFP-TX*[12, 20]	X	X	X	SFP+ Compliance and Debug Solution
Opt. SFP-WDP*[20, 27]	X	X	X	SFP+ Compliance and Debug Solution with TWDPc Measurements
Opt. SLA	X	X	X	Serial Data Link Analysis Advanced (with Equalization)
Opt. SLE	X	X	X	Serial Data Link Analysis Essentials (no Equalization)
Opt. SR-COMP	X	X	X	Computer Serial Triggering and Analysis (RS-232/422/485/UART)
Opt. SR-CUST	X	X	X	Custom Serial Analysis Kit for Developers
Opt. SR-DPHY	X	X	X	MIPI® D-PHY (DSI / CSI2) Serial Analysis
Opt. SR-EMBD	X	X	Standard	Embedded Serial Triggering and Analysis (I^2C, SPI)
Opt. SR-USB	X	X	X	USB Serial Triggering and Analysis
Opt. SVE	X	X	X	SignalVu® Essentials – Vector Signal Analysis Software
Opt. SVM*[13]	X	X	X	General Purpose Modulation Analysis
Opt. SVO*[13]	X	X	X	Flexible OFDM Analysis
Opt. SVP*[13]	X	X	X	Advanced Signal Analysis (including pulse measurements)
Opt. SVT*[13]	X	X	X	Frequency and Phase Settling Time Measurements
Opt. TBT-TX*[8, 12, 20]	X	X	X	Thunderbolt Transmitter Characterization, Debug, and Compliance Testing

Option	DPO70000	DSA70000	MSO70000	Description
Opt. UHS2*7	X	X	X	UHS-II-Host-Tx and UHS-II-Device-Tx Measurements
Opt. USB*6	X	X	X	USB 2.0 Compliance Test Software
Opt. USB3*12, 14	X	X	X	USB 3.0 Compliance and Analysis Software
Opt. VET	X	X	X	Visual Trigger
Floating Option Licenses				
Floating licenses offer an alternative method to manage your Tektronix asset. Floating licenses allow license-key enabled options to be easily moved among all your DPO/DSA/MSO70000, DPO7000, and MSO/DPO5000 Series oscilloscopes. Floating licenses are available for the license-key enabled options listed below. Check www.tek.com/products/oscilloscopes/floatinglicenses for additional information about floating license options.				
DPOFL-ASM	X	X*18	X	Advanced Event Search and Mark
DPOFL-D-PHY*12	X	X	X	MIPI® D-PHY Essentials – Characterization and Analysis Solution
DPOFL-DDRA*12	X	X	X	DDR Memory Bus Analysis
DPOFL-DJA	X	X*18	X	Jitter and Eye Analysis Tools – Advanced (DPOJET)
DPOFL-DSA	X	X*18	X	Digital Serial Analysis Bundle
DPOFL-DSPT*14, 15	X	X	X	DisplayPort Transmitter Compliance Test Software
DPOFL-DVI	X	X	X	DVI Compliance Testing
DPOFL-ERRDT*16	X	X	X	Frame and Bit Error Rate Detector for High-speed Serial Standards
DPOFL-ET3*5	X	X	X	Ethernet Compliance Testing
DPOFL-HT3	X	X	X	HDMI Compliance Testing
DPOFL-HT3DS	X	X	X	HDMI Direct Synthesis for HDMI 1.4
DPOFL-LT	X	X	X	Waveform Limit Testing
DPOFL-MPHY	X	X	X	MIPI® M-PHY Essentials – Characterization and Analysis Solution
DPOFL-MTH	X	X*18	X	Mask Testing, includes Hardware Clock Recovery
DPOFL-PCE3*12	X	X	X	PCI Express Gen3 Essentials
DPOFL-PTD	X	X*18	X	Protocol Trigger and Decode for 8b/10b
DPOFL-PTM-H	X	X	X	Serial Protocol Trigger and Decode up to 6.25 Gb/s
DPOFL-PWR*9	X	X	X	Power Measurement and Analysis
DPOFL-QPI*12	X	X	X	Intel® Quick Path Interconnect Test Automation Software
DPOFL-SFP-TX*12, 20	X	X	X	SFP+ Compliance and Debug Solution
DPOFL-SFP-WDP*20, 27	X	X	X	SFP+ Compliance and Debug Solution with TWDPc Measurements
DPOFL-SLA	X	X	X	Serial Data Link Analysis – Advanced (includes Equalization)
DPOFL-SLE	X	X	X	Serial Data Link Analysis – Essentials (no Equalization)
DPOFL-SR-COMP	X	X	X	Computer Serial Triggering and Analysis (RS-232/422/485/UART)
DPOFL-SR-DPHY	X	X	X	MIPI® D-PHY (DSI / CSI2) Serial Analysis
DPOFL-SR-EMBD	X	X	X	Embedded Serial Triggering and Analysis (I^2C, SPI)
DPOFL-SR-USB	X	X	X	USB Serial Triggering and Analysis
DPOFL-ST6G	X	X*18	X	8b/10b Serial Protocol Trigger and Decode up to 6.25 Gb/s
DPOFL-STU		X		Upgrade from 3.125 Gb/s to 6.25 Gb/s 8b/10b Serial Protocol Trigger and Decode
DPOFL-SVE	X	X	X	SignalVu Essentials – Vector Signal Analysis Software
DPOFL-SVM*13	X	X	X	SignalVu General Purpose Modulation Analysis
DPOFL-SVO*13	X	X	X	Flexible OFDM Analysis
DPOFL-SVP*13	X	X	X	SignalVu Pulse – Advanced Signal Analysis Software
DPOFL-SVT*13	X	X	X	Settling Time Measurements – Frequency and Phase
DPOFL-TBT-TX*8, 12, 20	X	X	X	Thunderbolt Transmitter Characterization, Debug, and Compliance Testing
DPOFL-UHS2*7	X	X	X	UHS-II-Host-Tx and UHS-II-Device-Tx Measurements
DPOFL-USB*6	X	X	X	USB 2.0 Compliance Testing
DPOFL-USB3*12, 14	X	X	X	USB 3.0 Essentials
DPOFL-VET	X	X	X	Visual Trigger
DPOFL-XL02	X	X*18	X	Extended record length – 31.25M Samples/Ch
DPOFL-XL05	X	X	X	Extended record length – 62.5M Samples/Ch
DPOFL-XL010	X	X	X	Extended record length – 125M Samples/Ch
DPOFL-XL020*11	X	X	X	Extended record length – 250M Samples/Ch

Option	DPO70000	DSA70000	MSO70000	Description
TekExpress® Application Framework				
TEKEXP	X	X	X	TekExpress Automation Framework
Opt. D-PHYTX	X	X	X	D-PHY Automated Solution
Opt. DIIVA	X	X	X	DiiVA Automation Solution
Opt. DP-SINK	X	X	X	DisplayPort Sink Compliance Automation Software
Opt. HEAC	X	X	X	HEAC Automated Solution
Opt. SAS-RSG	X	X	X	Stand-alone SAS Receiver Measurements
Opt. SAS-RXTX	X	X	X	Stand-alone SAS Channel Measurements
Opt. SAS-TSG	X	X	X	Stand-alone SAS Transmitter Measurements
Opt. SAS-DHB	X	X	X	Stand-alone SAS Bundled Solution
Opt. SATA-TSG	X	X	X	SATA PHY/TSG/OOB Transmitter Tests for TekExpress
Opt. SATA-RSG	X	X	X	SATA RSG/RMT Receiver Tests for TekExpress
Opt. SATA-RXTX	X	X	X	SATA Rx/Tx Channel Tests for TekExpress
Opt. SATA-DHB	X	X	X	SATA TekExpress SW Bundle (TSG, RSG, RXTX for Hosts or Devices)
Opt. SATA-SI	X	X	X	SATA SI Cable Tests for TekExpress
Opt. USB-RMT	X	X	X	TekExpress Automated USB 3.0 Receiver Solution
Opt. USB-TX*[12, 14]	X	X	X	TekExpress Automated USB 3.0 Solution
Opt. XGbT	X	X	X	10GBASE-T Automated Solution

*[5] Requires Ethernet Test Fixture.

*[6] Requires TDSUSBF (USB Test Fixture).

*[7] For models of bandwidth ≥6 GHz only.

*[8] Requires Opt. 2XL or higher.

*[9] At least Opt. 2XL and a TCA-1MEG TekConnect 1 MΩ buffer amplifier are recommended for use.

*[10] Requires Opt. RTE.

*[11] For models of bandwidth ≥12.5 GHz only.

*[12] Requires Opt. DJA.

*[13] Requires Opt. SVE.

*[14] For models of bandwidth ≥8 GHz only.

*[15] Requires Opt. DJA and 5XL.

*[16] Requires Opt. ST6G.

*[17] Requires Opt. MTH.

*[18] This option is standard on DSA70000 models. A floating license is compatible, but not required.

*[19] Replaces conventional removable drive. Standard on 25 and 33 GHz models.

*[20] For models of bandwidth ≥16 GHz only.

*[21] Requires Opt. ASM and DJA.

*[27] Requires Opt. SFP-TX.

User Manual Options

Option	Description
Opt. L0	English manual
Opt. L1	French manual
Opt. L3	German manual
Opt. L5	Japanese manual
Opt. L7	Simple Chinese manual
Opt. L8	Standard Chinese manual
Opt. L9	Korean manual
Opt. L10	Russian manual
Opt. L99	No manual

Power Plug Options

Option	Description
Opt. A0	US plug, 115 V, 60 Hz
Opt. A1	Euro plug, 220 V, 50 Hz
Opt. A2	UK plug, 240 V, 50 Hz
Opt. A3	Australian plug, 240 V, 50 Hz
Opt. A5	Swiss plug, 220 V, 50 Hz
Opt. A6	Japanese plug, 100 V, 110/120 V, 60 Hz
Opt. A10	China plug, 50 Hz
Opt. A11	India plug, 50 Hz
Opt. A12	Brazilian plug, 60 Hz
Opt. A99	No power cord

Service Options

Option	Description
Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. G3	Complete Care 3 Years (includes loaner, scheduled calibration and more)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration and more)
Opt. R3	Repair Service 3 Years
Opt. R5	Repair Service 5 Years
Opt. IF	Upgrade Installation Service

Recommended Accessories

Probes

Probe	Description
P7520	20 GHz TriMode™ probe
P7516	16 GHz TriMode probe
P7513A	13 GHz TriMode probe
P7313SMA	13 GHz TekConnect® differential SMA probe
P7508	8 GHz TriMode probe
P7380SMA	8 GHz TekConnect differential SMA probe
P7506	6 GHz TriMode probe
P7504	4 GHz TriMode probe
P6780	Differential Input Logic probe
P6750	D-Max Technology Logic Probe
P6717A	General-purpose Logic probe
P6251	DC to 1 GHz, 42 V, differential probe (requires TCA-BNC adapter)
P6250	DC to 500 MHz, 42 V, differential probe (requires TCA-BNC adapter)
TCPA300/TCPA400 Series	Current measurement systems
P5200/P5205/P5210	High-voltage differential probes
067-0484-xx	Analog Probe Calibration and Deskew Fixture (4 GHz)
067-1586-xx	Analog Probe Deskew Fixture (>4 GHz)
067-1686-xx	Power Deskew Fixture

Adapters

Adapter	Description
TCA-1MEG	TekConnect high-impedance buffer amplifier. Includes P6139A passive probe
TCA-292MM	TekConnect to 2.92 mm adapter
TCA-292D	TekConnect to 2.92 mm adapter (33 GHz bandwidth)
TCA-BNC	TekConnect to BNC adapter
TCA-N	TekConnect to N adapter
TCA-SMA	TekConnect to SMA adapter
TCA-VPI50	50 Ω TekVPI to TekConnect adapter
TCA75	8 GHz precision TekConnect 75 Ω to 50 Ω adapter with 75 Ω BNC input connector

Cables

Cable	Order Number
TekLink Cable	174-5019-xx
TekLink 4-port Hub	TL704H
GPIB Cable (1 m)	012-0991-xx
GPIB Cable (2 m)	012-0991-xx
6 dB Attenuator, Coax, 40 GHz	011-0152-xx
Torque Wrench, 2.92 mm, SMA (8 in-lbs.)	003-1929-xx
Microwave, RF Cable Assembly (40 GHz, 18 in., 2.92 mm connectors)	174-6134-xx

P6780 Logic Probe Standard Accessories

Accessory	Order Number
D-Max Probe Footprint to Square Pin Header Adapter	NEX-P6960PIN
Mictor to Square Pin Header Adapter	NEX-HD2HEADER
Deskew Fixture Logic Probes	067-2083-xx
Standard Adapter	020-3035-xx
Wide Body Adapter	020-3036-xx
25°/55° Holder	020-3032-00
Heat Strip Wire (4.57 m)	020-3021-00
Hand Browsing Adapter	202-3031-xx
Flex Adapter	020-3033-xx
Lead Set Ground	020-3038-xx
Probe Grouper (including header pins)	020-3042-xx
Ferrite Beads	020-3034-xx
Wire Tubing (4.57 m)	020-3037-xx

P6717A Logic Probe Standard Accessories

Accessory	Order Number
D-Max Probe Footprint to Square Pin Header Adapter	NEX-P6960PIN
Mictor to Square Pin Header Adapter	NEX-HD2HEADER
Deskew Fixture Logic Probes	067-2083-xx
Extension Ground Tip	206-0559-xx
Probe Tip	131-5638-xx
IC Grabber	206-0569-xx
Probe Grouper	352-1115-xx
Lead Sets	196-3501-xx
Ground Lead Sets	196-3497-xx

Transit Case (carbon fiber)

Accessories

Accessory	Order Number
Memory Testing	
DDR3 x4/x8 Solder Chip Interposer	NEX-DDR3MP78BSC
DDR3 x4/x8 Socket Chip Interposer	NEX-DDR3MP78BSCSK
DDR3 x16 Solder Chip Interposer	NEX-DDR3MP96BSC
DDR3 x16 Socket Chip Interposer	NEX-DDR3MP96BSCSK
DDR2 x4/x8 Solder Chip Interposer	NEX-DDR2MP60BSC
DDR2 x4/x8 Socket Chip Interposer	NEX-DDR2MP60BSCSK
DDR2 x16 Solder Chip Interposer	NEX-DDR2MP84BSC
DDR2 x16 Socket Chip Interposer	NEX-DDR2MP84BSCSK
Instrumented DIMM for DDR3	Order Scope NEXVu card for UDIMM Raw Card E. (Contact http://www.nexustechnology.com)
System Test	
Test Fixture for Use with Opt. USB	TDSUSBF
10GBASE-T Fixture for Use with Option XGbT Software	TF-XGbT
Ethernet Test Fixture	Order through Crescent Heart Software (http://www.c-h-s.com)
Crescent Heart Software; Serial ATA ZP test fixture set for Host, Device, and Cable testing	TF-SATA-SET-IV-ZP
Crescent Heart Software; eSATA ZP test fixture set for Host, Device, and Cable testing	TF-ESATA-SET-IV-ZP
HEAC TPA-KIT consists of: Main Board; Plug A-type board; Plug C-type board; 2 × TDR board with A Receptacle; 2 × TDR board with C Receptacle	TF-HEAC-TPA-KIT
HDMI Type C Fixture Set for Rx/Tx	TF-HDMI-TPA-S/STX
Keithley Instruments RF/Microwave switch system, 32 channel, unterminated, Americas power cord	S46-6666-A-AMER
Keithley Instruments RF/Microwave switch system, 32 channel, unterminated, Asia-Pacific power cord	S46-6666-A-ASIAP
Keithley Instruments RF/Microwave switch system, 32 channel, unterminated, Europe/Africa power cords	S46-6666-A-EURAF
USB 3.0 A/B Fixture/Cable Kit	TF-USB3-AB-KIT
USB 3.0 A Plug Fixture	TF-USB3-A-P
USB 3.0 A Receptacle Fixture Kit	TF-USB3-A-R
USB 3.0 B Receptacle Fixture Kit	TF-USB3-B-R
10/100/1000BASE-T Advanced Test Package (consists of test fixture PCB set, RJ45 interconnect cable, and 1000BASE-T jitter test channel cable)	TF-GBE-ATP
10/100/1000BASE-T Basic Test Package (consists of test fixture PCB set and RJ45 interconnect cable)	TF-GBE-BTP
103 meter 1000BASE-T jitter test channel cable	TF-GBE-JTC
Short (4 inch (0.1 meter)) RJ45 interconnect cable	TF-GBE-SIC
Test fixtures that complement the use of the TekEXP-XGbT solution	TF-XGbT
Other	
Oscilloscope Cart	K4000
Rackmount Kit	016-1985-xx
Service Manual	071-1740-xx
Spare HDD for DPO/DSA/MSO70000 Series	065-0864-xx
Transit Case (metal frame, wood panels) Weight Empty: 58 lb. (26.3 kg) Weight w/ Scope: ~115 lb. (52 kg)	016-2039-00
Transit Case (carbon fiber) Weight Empty: 40.5 lb. (18.4 kg) Weight w/ Scope: ~95 lb. (43 kg)	016-2043-00

Upgrade Options

The DPO/DSA/MSO70000 Series instruments can be easily upgraded after initial time of purchase.

To upgrade an existing DPO/DSA/MSO70000, order DPO-UP and an option listed below. For example, DPO-UP DDRA.

Option	Description
Memory	
Upgrade record length on a DPO70000 or MSO70000 Series from:	
XL02	Standard Configuration to Option 2XL Configuration
XL05	Standard Configuration to Option 5XL Configuration
XL010	Standard Configuration to Option 10XL Configuration
XL020*[11]	Standard Configuration to Option 20XL Configuration
Upgrade record length on a DPO70000, DSA70000, or MSO70000 Series from:	
XL25	Option 2XL Configuration to Option 5XL Configuration
XL210	Option 2XL Configuration to Option 10XL Configuration
XL220*[11]	Option 2XL Configuration to Option 20XL Configuration
XL510	Opt. 5XL Configuration to Opt. 10XL Configuration
XL520*[11]	Opt. 5XL Configuration to Opt. 20XL Configuration
XL1020*[11]	Opt. 10XL Configuration to Opt. 20XL Configuration
Trigger and Search	
Upgrade DPO70000, DSA70000, or MSO70000 Series with:	
LT	Waveform Limit Testing
MTH	Mask testing for Serial Standards with Hardware Clock Recovery
ST6G	Protocol Triggering and Decoding for 8b/10b-encoded Serial Signals (Up to 6.25 Gb/s)
STU	Increase Protocol Triggering and Decoding from 3.125 Gb/s to 6.25 Gb/s
Advanced Analysis	
Upgrade DPO70000, DSA70000, or MSO70000 Series with:	
ASM	Advanced Event Search and Mark
CP2*[17, 26]	ANSI/ITU Telecom Pulse Compliance Testing Software
D-PHY*[12]	MIPI® D-PHY Characterization and Analysis Solution
DDRA*[21]	Upgrade to Option DDRA
DJAH*[23]	DPOJET Jitter and Eye Diagram Analysis (Upgrade for DPO70404 - DPO70804 or MSO70404 - MSO70804 models)
DJAU*[11]	DPOJET Jitter and Eye Diagram Analysis (Upgrade for DPO71254 - DPO73304 or MSO71254 - MSO72004 models)
DSAH*[23]	Digital Serial Analysis Bundle (Upgrade for DPO/MSO70404 - DPO/MSO70804 models)
DSAU*[11]	MSO Digital Serial Analysis Bundle (Upgrade for DPO71254 - DPO73304 or MSO71254 - MSO72004 models)
DSPT*[14, 15]	DisplayPort Compliance Test Solution
DVI	DVI Compliance Test Solution
EQ*[22]	Equalization to upgrade from Option SLE to Option SLA
ERRDTH*[16, 23]	Frame and Bit Error Rate Detector (Upgrade for DPO70404 - DPO70804, DSA70404 - DSA70804, or MSO70404 - MSO70804 models)
ERRDTU*[11, 16]	Frame and Bit Error Rate Detector (Upgrade for DPO71254 - DPO72004, DSA71254 - DSA72004, or MSO71254 - MSO72004 models)

Option	Description
ET3	Ethernet Compliance Test Software
FBD*[10, 26]	FB-DIMM Memory Bus Analysis
HT3	HDMI Compliance Test Software
HT3DS	HDMI Direct Synthesis for HDMI 1.4
IBA*[10, 26]	InfiniBand Compliance Module for RT-Eye Analysis Software
J2*[26]	TDSDDM2 Disk-drive Analysis Software
JA3*[26]	TDSJIT3 Advanced Jitter and Timing Measurements Software
M-PHY*[12]	MIPI® M-PHY Characterization and Analysis Solution
PCE3*[12]	PCI Express Gen3 Essentials
PTD	Protocol Decoding for 8b/10b-encoded Serial Signals
PWR	Power Measurement and Analysis Software
QPI*[12]	Intel® Quick Path Interconnect 1.1 Test Automation
RJUP	Upgrade DSA70000 Series with RT-Eye Serial Data Compliance and Analysis Software
RTE*[26]	RT-Eye Serial Data Compliance and Analysis Software
SFP-TX*[12, 20]	SFP+ Compliance and Debug Solution
SFP-WDP*[20, 27]	SFP+ Compliance and Debug Solution with TWDPc Measurements
SLA	Serial Data Link Analysis Advanced (with Equalization)
SLE	Serial Data Link Analysis Essentials (No Equalization)
SR-COMP	Computer Serial Triggering and Analysis (RS-232/422/485/UART)
SR-CUST	Custom Serial Analysis Kit for Developers
SR-DPHY	MIPI® D-PHY (DSI / CSI2) Serial Analysis
SR-EMBD	Embedded Serial Triggering and Analysis (I^2C, SPI)
SR-USB	USB Serial Triggering and Analysis
SSD	Additional Removable Disk – Solid State Drive
SST*[10, 26]	SATA and SAS Analysis Software Module for RT-Eye Analysis Software
SVEH*[23]	SignalVu Essentials – Vector Signal Analysis Software
SVEU*[11]	SignalVu Essentials – Vector Signal Analysis Software
SVM*[25]	General Purpose Modulation Analysis. Requires Option SVE
SVO*[25]	Flexible OFDM Analysis
SVP*[25]	Advanced Pulsed Signal Analysis including Measurements. Requires Option SVE
SVT*[25]	Frequency and Phase Settling Time Measurements. Requires Opt. SVE
TBT-TX*[8, 12, 20]	Thunderbolt Transmitter Characterization, Debug, and Compliance Testing
UHS2*[7]	UHS-II-Host-Tx and UHS-II-Device-Tx Measurements
USB	USB 2.0 Compliance Test Software
USB3*[12, 14]	USB 3.0 Compliance and Analysis Software
UWB*[26]	Ultra-Wideband Spectral Analysis (includes WiMedia Alliance PHY interf. testing)
VETH*[23]	Visual Trigger
VETU*[11]	Visual Trigger
VNM*[24]	TDSVNM CAN and LIN Timing and Protocol Decode (Triggering not included)

Option	Description
Other	
IF	Upgrade Installation Service

*7 For models of bandwidth ≥6 GHz only.

*8 Requires Opt. 2XL or higher.

*10 Requires Opt. RTE.

*11 For models of bandwidth ≥12.5 GHz only.

*12 Requires Opt. DJA.

*14 For models of bandwidth ≥8 GHz only.

*15 Requires Opt. DJA and 5XL.

*16 Requires Opt. ST6G.

*17 Requires Opt. MTH.

*20 For models of bandwidth ≥16 GHz only.

*21 Requires Opt. ASM and DJA.

*22 Requires Opt. SLE.

*23 For models of bandwidth ≤8 GHz only.

*24 CAN/LIN trigger module available – Order ATM1 through Crescent Heart Software.

*25 Requires Opt. SVE, SVEH, or SVEU.

*26 Only compatible with Windows XP based scopes.

*27 Requires Opt. SFP-TX.

Instrument Bandwidth Upgrades

The analog bandwidth of the DPO/DSA/MSO70000 Series instruments can be easily upgraded after initial time of purchase. To upgrade your instrument's bandwidth, order one of the products listed below.

Current Bandwidth	Bandwidth After Upgrade	Model Number
DPO70000B and DSA70000B Series		
4 GHz	6 GHz	BWU4T6
4 GHz	8 GHz	BWU4T8
4 GHz	12.5 GHz	BWU4T12
4 GHz	16 GHz	BWU4T16
4 GHz	20 GHz	BWU4T20
6 GHz	8 GHz	BWU6T8
6 GHz	12.5 GHz	BWU6T12
6 GHz	16 GHz	BWU6T16
6 GHz	20 GHz	BWU6T20
8 GHz	12.5 GHz	BWU8T12
8 GHz	16 GHz	BWU8T16
8 GHz	20 GHz	BWU8T20
12.5 GHz	16 GHz	BWU12T16
12.5 GHz	20 GHz	BWU12T20
16 GHz	20 GHz	BWU16T20
DPO70000C and DSA70000C Series		
4 GHz	6 GHz	CBWU4T6
4 GHz	8 GHz	CBWU4T8
4 GHz	12.5 GHz	CBWU4T12
4 GHz	16 GHz	CBWU4T16
4 GHz	20 GHz	CBWU4T20
6 GHz	8 GHz	CBWU6T8
6 GHz	12.5 GHz	CBWU6T12
6 GHz	16 GHz	CBWU6T16
6 GHz	20 GHz	CBWU6T20
8 GHz	12.5 GHz	CBWU8T12
8 GHz	16 GHz	CBWU8T16
8 GHz	20 GHz	CBWU8T20
12.5 GHz	16 GHz	CBWU12T16
12.5 GHz	20 GHz	CBWU12T20
16 GHz	20 GHz	CBWU16T20
MSO70000 and MSO70000C Series		
4 GHz	6 GHz	MBWU4T6
4 GHz	8 GHz	MBWU4T8
4 GHz	12.5 GHz	MBWU4T12
4 GHz	16 GHz	MBWU4T16
4 GHz	20 GHz	MBWU4T20
6 GHz	8 GHz	MBWU6T8
6 GHz	12.5 GHz	MBWU6T12
6 GHz	16 GHz	MBWU6T16
6 GHz	20 GHz	MBWU6T20
8 GHz	12.5 GHz	MBWU8T12
8 GHz	16 GHz	MBWU8T16
8 GHz	20 GHz	MBWU8T20
12.5 GHz	16 GHz	MBWU12T16
12.5 GHz	20 GHz	MBWU12T20
16 GHz	20 GHz	MBWU16T20
DPO70000D and DSA70000D Series		
25 GHz	33 GHz	DBWU25T33

CE

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.

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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.tektronix.com**

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