

# Digital Phosphor Oscilloscopes/Digital Serial Analyzers

## DPO/DSA70000 Series Data Sheet



### Features & Benefits

- On All Four Channels Simultaneously
  - 20, 16, 12.5, 8, 6, and 4 GHz Bandwidth Models
  - Up to 50 GS/s Real-Time Sample Rate
  - Up to 200 Megasamples Record Length with MultiView Zoom™ Feature for Quick Navigation
  - Fastest Waveform Capture Rate with >300,000 wfms/s Maximum per Channel
- Digital Serial Analyzer Models with Dedicated Configuration for High-Speed Serial Design and Compliance Testing
- Enhanced Bandwidth to the Probe Tip Extended to Support Multiple Bandwidth Steps for Advanced Signal Integrity.
- Pinpoint® Triggering, with over 1400 Combinations to Address Virtually Any Triggering Situation
- Unique Serial Pattern Triggering up to 3.125 Gbps and 8b/10b Standard Protocol Triggering for Isolation of Pattern-Dependent Effects and NRZ Serial Test Pattern Triggering up to 6.25 Gbps
- Serial Data Analysis and Compliance for PCI Express, Serial ATA, FB-DIMM, SAS, Fiber Channel, IEEE1394b, RapidIO, XAUI, HDMI, DVI, Ethernet, USB 2.0
- High-Speed Serial Data Link Analysis for Transmitter Channel Embed or De-embed and Receiver Equalization Emulation

- Most Popular Jitter, Timing, and Eye-Diagram Analysis Package
- DDR Memory Bus Analysis
- 12.1-in. Largest XGA Touch-Screen Display in the Industry
- Event Search and Mark to Facilitate the Comprehension of Event Relationships
- MyScope® Custom Windows and Right Mouse Click Menus for Exceptional Efficiency
- OpenChoice® Software with Microsoft Windows XP OS Enables Built-In Networking and Extended Analysis

### Applications

- Signal Integrity, Jitter, and Timing Analysis
- Verification, Debug, and Characterization of Sophisticated Designs
- Debugging and Compliance Testing of Serial Data Streams for Telecom and Datacom Industry Standards
- Investigation of Transient Phenomena
- Spectral Analysis

### Unmatched Performance for Greater Insight Into Your Design to Get Your Work Done Faster

The DPO70000 and the DSA70000 Series are the new generation of real-time digital phosphor oscilloscopes and are the industry's best solution to the challenging signal integrity issues faced by designers verifying, characterizing, debugging, and testing sophisticated electronic designs. The specialized DSA70000 Series provides a complete and dedicated solution to address the challenges of high-speed serial designs.

The family features exceptional performance in signal acquisition and analysis, operational simplicity, and unmatched debugging tools to accelerate your day-to-day tasks. The largest screen in the industry and the intuitive user interface provide easy access to the maximum amount of information.

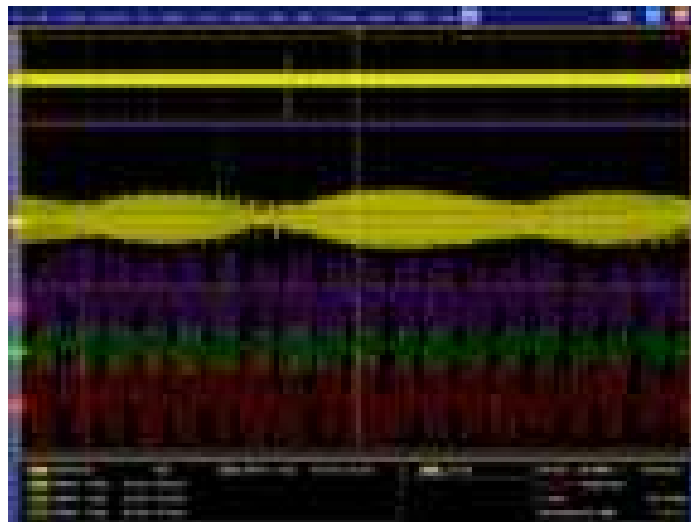
## Unmatched Acquisition Performance

### Signal Fidelity of Tektronix Oscilloscopes Ensures Confidence in Your Measurement Results

- High bandwidth up to 20 GHz matched across 2, 3, or 4 channels and enabled by Tektronix proprietary DSP enhancement. The user-selectable DSP filter on each channel provides magnitude and phase correction plus bandwidth extension to 20 GHz for more accurate representation of extremely fast signals. The DSP filter on each channel can also be switched off to take advantage of true analog bandwidth for applications needing the highest available raw data capture.
- Bandwidth Enhance to the probe tip, extended to support bandwidth steps, gives you an oscilloscope with bandwidth adjustable to capture transitions accurately without excess frequencies and noise.
- High sample rate on all models, on all channels, to capture more signal details (transients, imperfections, fast edges)
  - 50 GS/s on all four channels for the 12.5, 16, and 20 GHz models
  - 25 GS/s on all four channels for the 4, 6, and 8 GHz models
- Lowest jitter noise floor and vertical accuracy for very accurate measurements
- Longest acquisition of the industry to provide more resolution and longer time sequence
  - Standard 10 M samples per channel on the DPO70000 Series and 20 M on the DSA70000 Series
  - Optional up to 100 M samples on all four channels for the 4, 6, and 8 GHz models
  - Optional up to 200 M samples on all four channels for the 12.5, 16, and 20 GHz models
  - Easily manage this deep record length, provide detailed comparison and analysis of multiple waveform segments with the MultiView Zoom™ feature. Automatically scroll through deep records visually, or create a math expression to instantly highlight differences
- Highest-performance probing solutions with bandwidth enhanced to the probe tip for differential and single-ended voltage signals, because accurate design verification depends on high-bandwidth access to critical signals and high-fidelity signal capture



User-selectable bandwidth limiting choices



Zoom in on four areas of interest simultaneously to compare them



Highest-performance P7500 TriMode probes

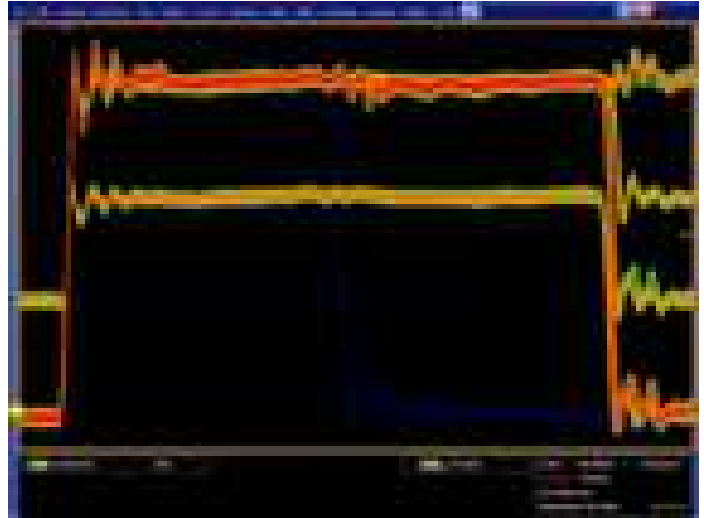
## Accelerate the Debug of Complex Electrical Designs

### FastAcq Acquisition Mode Expedites Debugging by Clearly Showing Imperfections

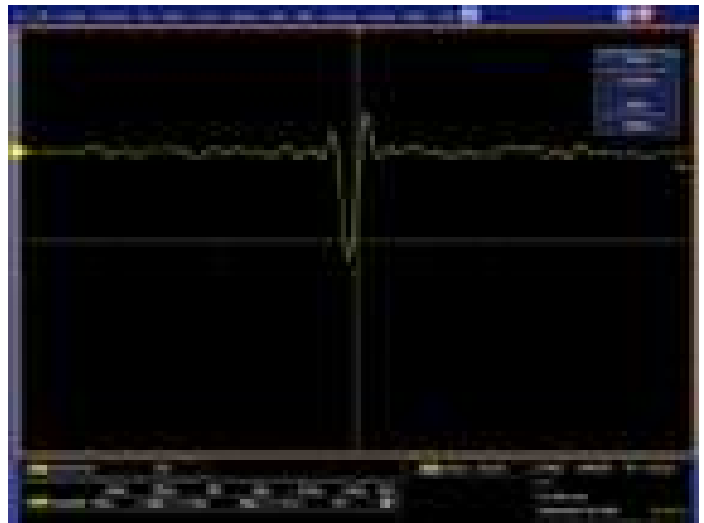
More than just color-grading, FastAcq's proprietary DPX® acquisition technology captures signals at more than 300,000 waveforms per second on all four channels simultaneously, dramatically increasing the probability of discovering infrequent fault events. And with a simple turn of the intensity knob 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 Tektronix oscilloscopes, enabled by DPX technology, can deliver these fast waveform capture rates on a sustained basis — saving minutes, hours, or even days by quickly revealing the nature of faults so sophisticated trigger modes can be applied to isolate them.

### The Ability to Trigger an Oscilloscope on Events of Interest is Paramount in Complex Signal Debug and Validation

Whether you're trying to find a system error 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 ability to capture very narrow glitches. Pinpoint triggering allows selection of virtually all trigger types on both A and B trigger events. Other trigger systems offer multiple trigger types only on a single event (A event), with delayed trigger (B event) selection limited to edge type triggering and often do not provide a way to reset the trigger sequence if the B event doesn't occur. But Pinpoint triggering provides the full suite of advanced trigger types on both A and B triggers, logic qualification to control when to look for these events, and reset triggering to 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



Maximize the probability of capturing elusive glitches and other infrequent events with FastAcq acquisition mode.



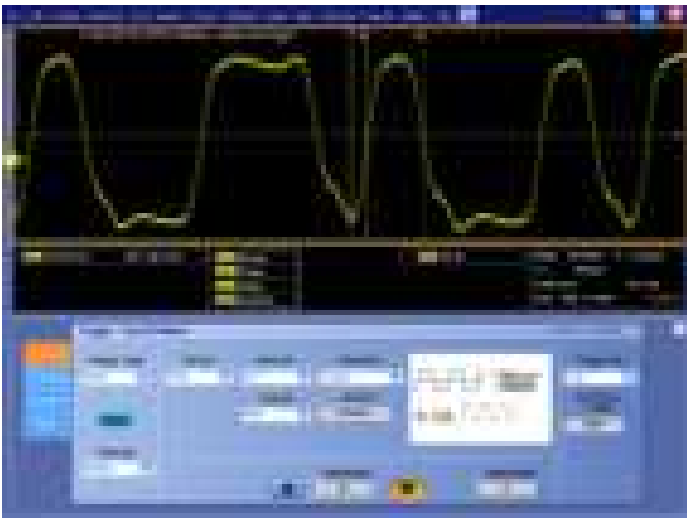
Isolate glitches down to 100-ps wide

oscilloscopes typically offer less than 20 trigger combinations; Pinpoint triggering offers over 1400 combinations, all at full performance.

With Enhanced Triggering, you can choose to compensate for the difference in time there is between the trigger path and the display path and eliminate virtually any trigger jitter at the trigger point. In this mode, the trigger point can be used as a measurement reference.



Isolate only the valid glitches

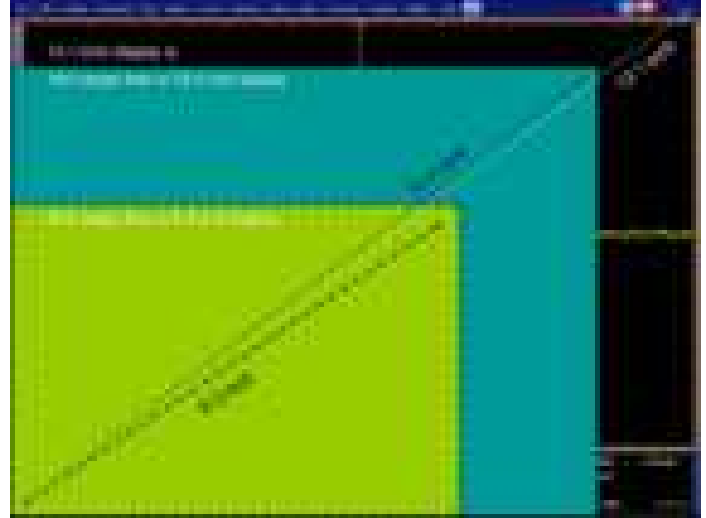


NRZ Pattern Lock Triggering of a 640-bit long serial test pattern SATA 6Gbps

### Protocol and Serial Pattern Triggering

To debug serial architectures, use the serial pattern triggering for NRZ serial data stream with built-in clock recovery and correlate events across physical and link layer. This feature comes standard on the DSA70000 series and is available on DPO70000 models as Opt. PTH. The instrument can recover the clock signal, identify transitions, and allow you to set the desired encoded words for the serial pattern trigger to capture. Opt. PTH and the DSA70000 Series cover serial standards up to 3.125 Gbps.

Pattern Lock Triggering adds a new 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



How does a 12.1-in. display compare to the display size of other oscilloscopes?

data patterns. Effects of specific bit transitions can be investigated, and averaging can be used with mask testing. This feature supports up to 6.25 Gbps NRZ serial data stream and is standard on the DSA70000 instruments, or included as part of Option PTH on the DPO70000 models.

### Large 12.1 inches XGA Display Screen

The DPO/DSA70000 Series have the largest display in the industry with a 12.1" XGA touch screen that gives up to 15% more waveform display than other oscilloscopes of their classes.

10 vertical divisions give you 25% more vertical measurement resolution than other oscilloscopes.

### Unmatched Usability

The TekConnect™ probe interface provides versatility and ease of use enabled by intelligent bidirectional oscilloscope-to-probe communication and maintain signal fidelity.

The DPO/DSA70000 Series instruments contain a comprehensive suite of features, such as a touch screen, shallow menu structures, intuitive graphical icons, knob-per-channel vertical controls, support for right mouse clicks, mouse wheel operation, and intuitive Export/Save/Recall menus.

### Interoperability with Logic Analyzers for Digital Design and Debug

Tektronix' Integrated View (iView™) data display enables digital designers to solve signal integrity challenges and effectively debug and verify their systems more quickly and easily. This integration allows designers to view time-correlated digital and analog data in the same display window, and isolate the analog characteristics of the digital signals that are causing systems failures. No user calibration is required. And, once set up, the iView feature is completely automated.



3 modes of operation of the horizontal time base

## Unmatched Versatility

### Get the Most of Your Oscilloscope by Fully Controlling its Waveform Acquisition and Display Parameters.

You have the choice of three horizontal time base modes of operations. If you are simply doing signal exploration and want to interact with a lively signal, you will use the *Automatic* or interactive default mode that provides you with the liveliest display update rate. If you want a precise measurement and 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. The last mode is called the *Manual* mode because it ensures direct and independent control of the sample rate and record length.

### With the MyScope® Feature, Create Your Own Control Windows With Only the Controls, Features, and Capabilities that You Care About

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



Drag and drop menu items of interest to create the MyScope control window

be far more efficient. Everything you need is found in one control window rather than having to constantly navigate through menu after menu to repeat similar tasks.

### With OpenChoice® Software, Customize Your Test and Measurement System with Familiar Analysis Tools

The analysis and networking features of OpenChoice software add more flexibility to Tektronix' Windows XP 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. Tektronix' implementation 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, serial data, and LAN connections from programs running on the instrument or an external PC. Or, use the Software Developer's Kit (SDK) to help create custom software to automate multistep processes in waveform collection and analysis with Visual BASIC, C, C++, MATLAB, LabVIEW, LabWindows/CVI, and other common Application Development Environments (ADE). Integration of the oscilloscope with external PCs and non-Windows hosts is also supported. In addition, the OpenChoice architecture provides a comprehensive software infrastructure for faster, more versatile operations. Data transfer programs, such as the Excel or Word toolbar are used to simplify analysis and documentation on the Windows desktop or on an external PC.

## More Insight into Your Complex Electrical Design for Characterization and Compliance Testing

Such as a simple math expression, waveform mask testing, a pass/fail compliance test, event searching, event marking, or a custom application that you develop yourself, the DPO/DSA70000 Series offers the industry's most comprehensive set of analysis and compliance tools.

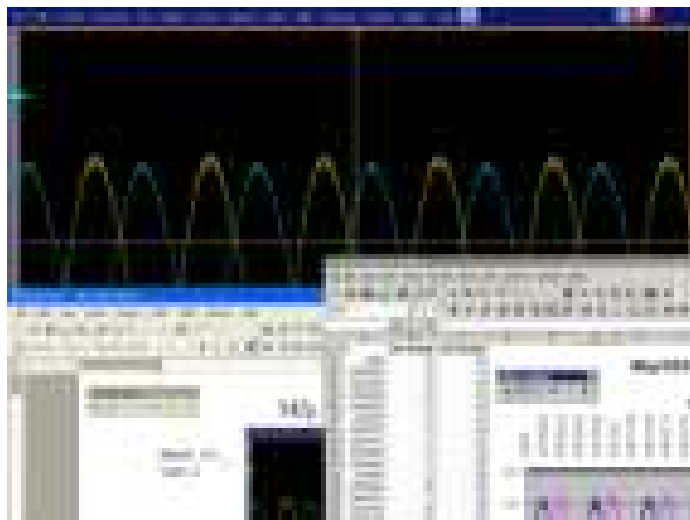
### A Wide Range of Built-In Advanced Waveform Analysis Tools

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, Combination, 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.

**FFT** – To analyze your signal in the spectral domain, use the basic spectral (provides you with the best parameter), or use advanced spectral with the manual time base horizontal mode (to directly control the frequency span, center frequency, and resolution bandwidth).

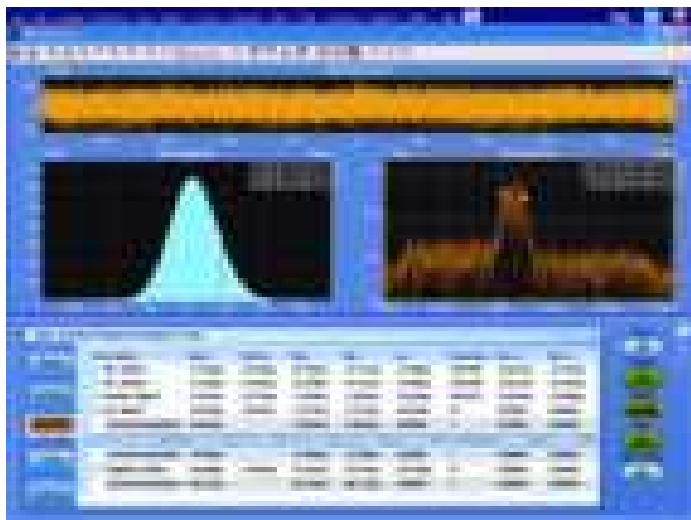
**Filtering** – Enhance your ability to isolate or remove some important component of your signal (noise or specific harmonics of the signal) by creating your own filters, or using the filters provided as standard with the instrument. These customizable FIR filters can be used to implement today's preferred signal-filtering techniques, including to remove the pre-emphasis or to minimize the effects of fixtures and cables connected to the device under test.



Capture data into Microsoft Excel using the unique Excel toolbar, and create custom reports using the Word toolbar



Basic spectral UI control window



Jitter, Timing, and Eye-Diagram Analysis

### A Breadth of Tools to Extend Waveform Analysis Even Further

**Jitter, Timing and Eye-Diagram Analysis (Opt. DJA)** – Tight timing margins associated with today's serial buses demand stable, low jitter designs. DPOJET extends the oscilloscope capability by making jitter, timing, and eye-diagram measurements over contiguous clock and data cycles in a single-shot real-time acquisition. With multiple measurements and a variety of analysis tools including spectral and trend plots, DPOJET quickly shows system timing under variable conditions. It also provides Rj/Dj on signals without a repeating pattern and without requiring a fixed pattern or length. You can get insight into the signal characteristics like SSC profile using the analysis features and perform pass-fail testing using eye diagram masks and limit files for testing against statistical limits using the compliance features.

This tool is available for the DPO70000 and DSA70000 Series as Opt. DJA.

**Advanced Event Search and Mark (Opt. ASM)** – Event Search and Mark will relieve the user from the tedious task of examining data by highlighting important events, skipping the unimportant ones, and enhancing the comprehension of event relationships. You can navigate between the events of interest effortlessly. A basic event (edge-only) search and mark is provided as a standard feature; and support for more advanced event types like transition, setup and hold, or logic pattern, is provided with the ASM option on the DPO70000 Series, standard on the DSA70000.

**Waveform Limit Testing (Opt. LT)** – This feature consists of comparing an acquired waveform to boundaries. These boundaries are typically defined by the user to specify a tolerance band around a reference waveform. If any part of the acquired waveform falls outside the limit, the software returns a failure message and the location of the failure on the waveform.



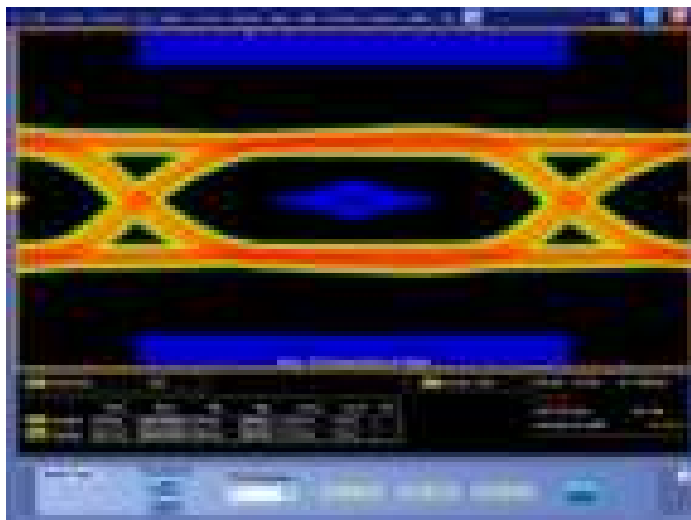
Accelerating the research of specific events in an acquired waveform.

**Communications Mask Testing (Opt. SM)** – This feature provides a complete portfolio of masks for verifying compliance to serial communications standards. It supports 156 Standards Masks.

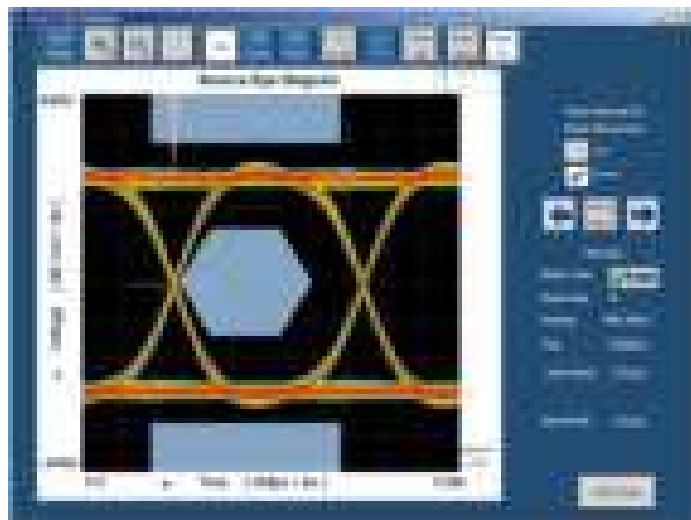
- ITU-T (1.544 Mbps to 155 Mbps)
- ANSI T1.102 (1.544 Mbps to 155 Mbps)
- Ethernet IEEE 802.3, ANSI X3.263 (1.544 Mbps to 3.125 Gbps XAUI)
- Sonet/SDH (51.84 Mbps to 2.4883 Gbps)
- Fiber Channel (133 Mbps to 4.25 Gbps\*1)
- InfiniBand (2.5 Gbps)
- USB (12 Mbps to 480 Mbps)
- Serial ATA (1.5 Gbps, 3 Gbps)
- Serial Attached SCSI (1.5 Gbps, 3 Gbps)
- IEEE 1394b (491.5 Mbps to 1.966 Gbps)
- Rapid I/O (1.25 Gbps to 3.125 Gbps)
- OIF Standards (2.488 Gbps to 3.11 Gbps)
- PCI Express (2.5 Gbps)

\*1 A 4.25 Gbps mask supported using Glitch Trigger. It is standard on the DSA70000 Series, and optional as Opt. MTH on DPO70404, DPO70604, and DPO70804.

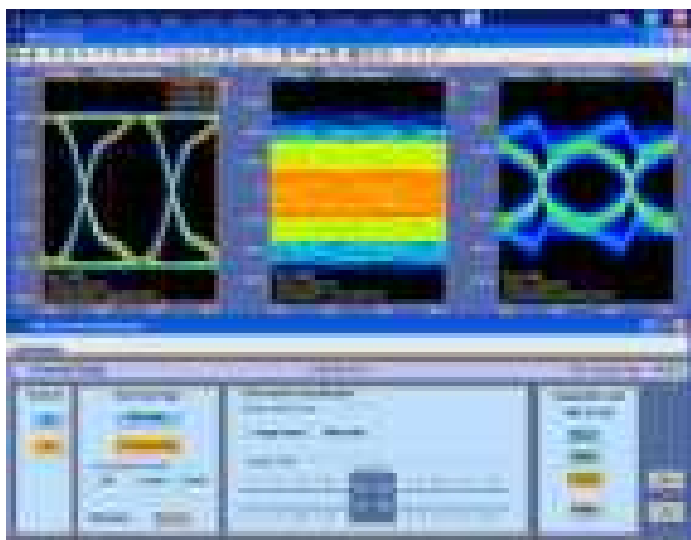




Test eye diagram in equivalent time against the standard mask.



HDMI compliance testing

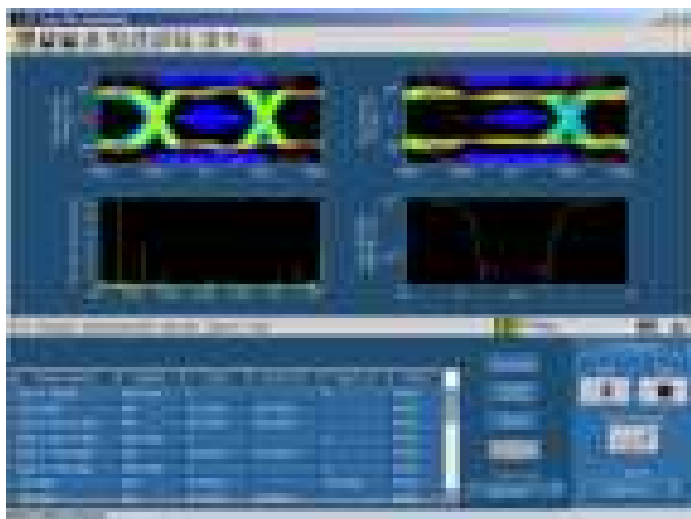


High-Speed Serial Data Link Analysis

**High-Speed Serial Data Link Analysis (Opt. SLE or SLA)** – This application enables designers the most insight into the causes of eye closure. It emulates channel embed/de-embed emulation, supports DFE/FFE equalization algorithms used in receivers, and allows users to mimic the addition/removal of de- or pre-emphasis in the transmitter.

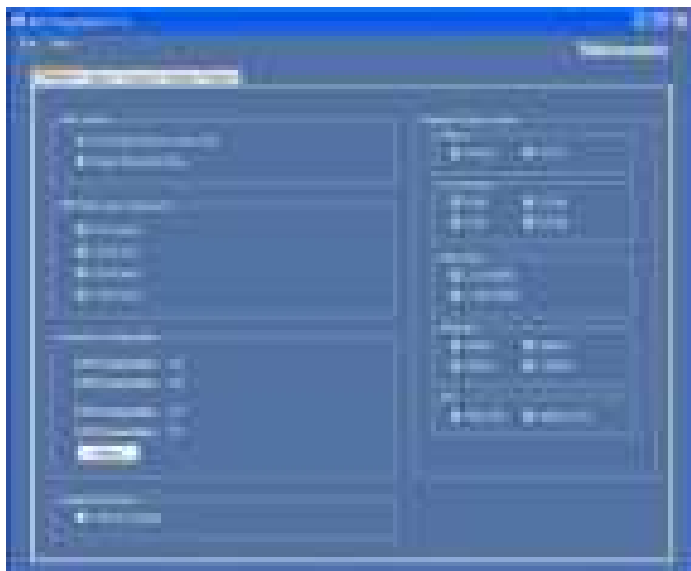
**Serial Data Compliance and Analysis (Opt. RTE)** – Patented Real-Time Eye (RT-Eye® clock recovery and eye-rendering) provides high-speed serial data domain expertise to enable analysis and compliance measurements for testing high-speed serial standards like PCI Express, Serial ATA, SAS, InfiniBand, FB-DIMM, as well as Front Side Bus (FSB), XAUI, Fiber Channel, IEEE 1394b, and RapidIO. It recovers the clock of the serial stream to  $\geq 10$  Gbps and generates very high-precision eye diagrams with an accumulated waveform database. Serial data compliance and analysis comes standard on the DSA70000 Series, and optional on the DPO70404, DPO70604, and DPO70804 as Opt. RTE. The compliance modules for PCI Express, Serial ATA, SAS, InfiniBand, and FB-DIMM are options on both DSA70000 Series and DPO70000 Series (Opt. PCE, SST, IBA, or FBD).

**HDMI Compliance Testing (Opt. HT3)** – Compliance testing: This is your complete solution for HDMI compliance testing, enabling unprecedented efficiency by offering a complete solution of unmatched reliable automation to support the widest range of tests in the industry.



RT-Eye® version 2.0 - PCI Express Rev2 Compliance test





DisplayPort (Opt. DSPT)

**DisplayPort Automated Compliance Testing (Opt. DSPT)** – Option DSPT builds upon the broad measurement capabilities of DPOJET Jitter and Eye-Analysis Tools by adding a test automation executive for DisplayPort source compliance testing. This solution complies with the VESA requirements for PHY test, matching the required tests to the particular capabilities of your source device. After test execution, the software produces a comprehensive report showing all tests performed, measured values, PASS or FAIL against compliance limits and test margins.

**Ultra-Wideband Spectral Analysis and Ultra-Wideband Spectral Analysis Essentials (Opt. UWBE or UWB)** – Ultra-Wideband microwave, optical and electrical signals require more real-time bandwidth than is possible with spectrum analyzer based solutions. Spectral Analysis and Digital Down Conversion of RF data is fast and easy and the down converted frequency span of interest may be exported for further analysis in tools such as RSAVu and MATLAB.

UWB in addition to UWBE adds: With automatic packet, TFC and data rate detection, support for all band groups, Time Frequency Codes and data rates, WiMedia PHY 1.2 analysis provides a complete solution. Rapid visualization, debug, and report generation of the Spectrograms, Power Spectral Density, QPSK/DCM Constellations, EVM-vs-Symbol, EVM-vs-Subcarrier, Common-Phase-Error-vs-Symbol, and Voltage-vs-Time plots and complete measurements are captured and documented for each test condition.

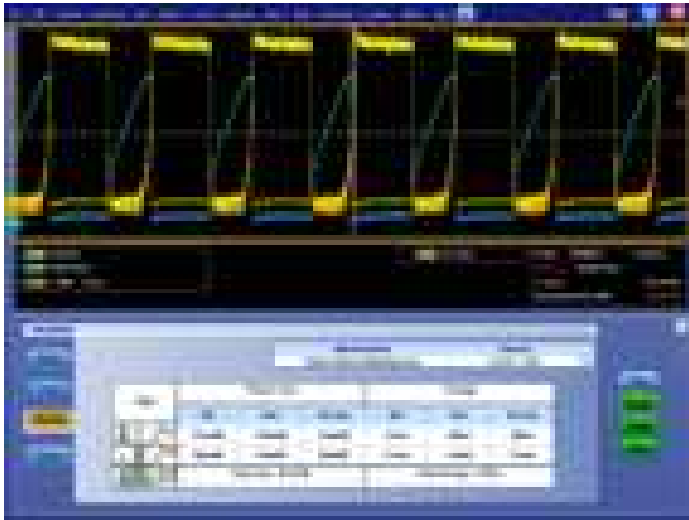


UWB WiMedia analysis and measurements



SignalVu™ enables detailed analysis in multiple domains

**SignalVu™ Vector Signal Analysis (Opt. SVE, SVP, SVM)** – Easily validate wideband designs and characterize wideband spectral events. By combining the signal analysis engine of the RSA6100A real-time spectrum analyzer with that of the industry's widest bandwidth digital oscilloscopes, you can now evaluate complex signals up to 20 GHz without the need of an external down converter. You get the functionality of a vector signal analyzer, a spectrum analyzer, and the powerful trigger capabilities of a digital oscilloscope — all in a single package. Whether your design validation needs include wideband radar, high data rate satellite links, or frequency hopping communications, SignalVu™ vector signal analysis software can speed your time-to-insight by showing you time variant behavior of these wideband signals.



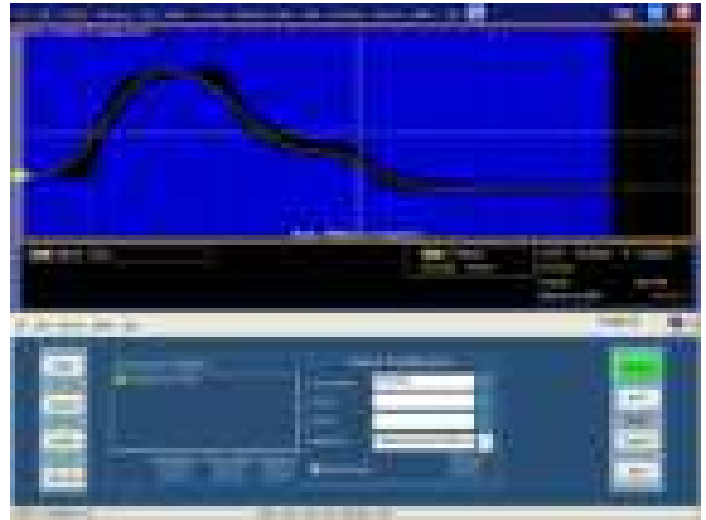
Power measurements and analysis

**Power Measurement and Analysis (Opt. PWR)** – Analyze power dissipation in power supply switching devices and magnetic components, and generate detailed reports in customizable formats. The HiRes acquisition mode delivers greater than 8 bits of vertical resolution on single-shot or repetitive signals at bandwidth up to 125 MHz. The powerful and flexible measurements, math, and math-on-math capabilities make it an ideal solution for performing power measurements, such as voltage, current, instantaneous power and energy, for power device designers.

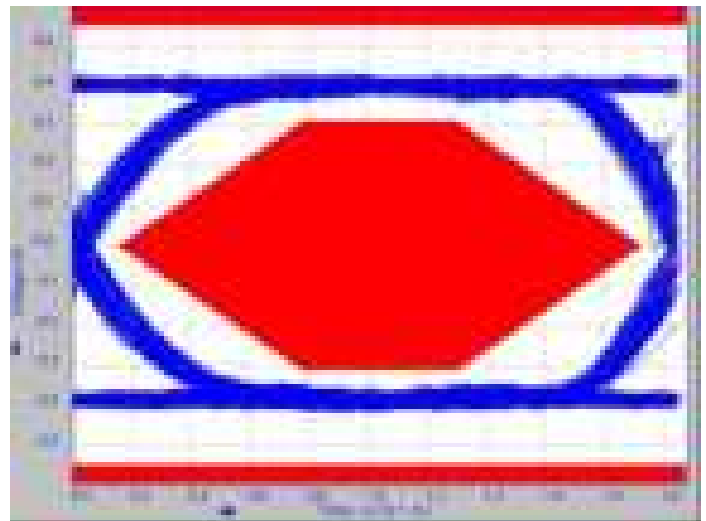
**Ethernet Compliance Testing (Opt. ET3)** – Provides compliance testing for 10/100/1000Base-T signals.

**DVI Compliance Testing (Opt. DVI)** – Provides Digital Visual Interface physical layer validation and compliance testing with automated eye diagram generation and parametric testing.

**USB Compliance Testing (Opt. USB)** – Provides compliance testing for USB 2.0 signals.



Ethernet compliance testing

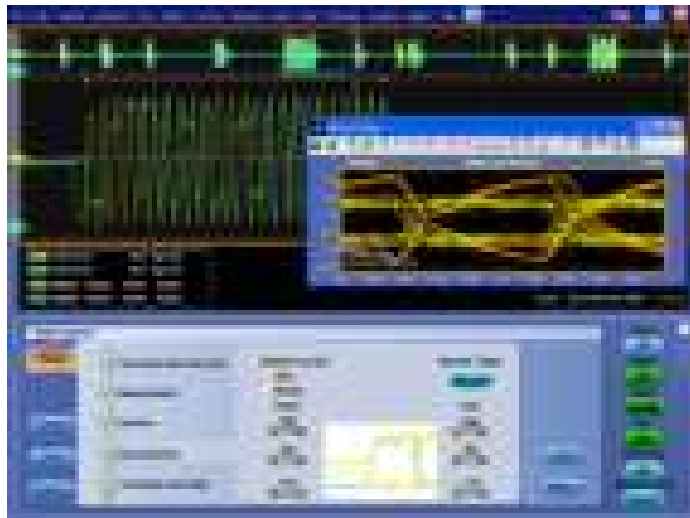


USB compliance testing

**DDR Memory System Analysis (Option DDRA) –**

The Option DDRA includes a DDR Wizard to speed test setup and execution for a wide selection of current and custom DDR standards and speeds. DDRA accelerates the analysis, validation, and JEDEC conformance testing of memory systems based on DDR1, DDR2, DDR3, and DDR derivative technologies, like LPDDR and GDDR3. DDRA supports the common data rates plus custom data rates up to and beyond 1600 MT/s. JEDEC-conforming pass/fail tests and report generation are included.

In addition to PinPoint® triggers suitable for DDR read/write identification, DDRA now adds advanced search algorithms to automatically detect signal details like transfer rate, voltage levels of data, strobe, clocks, and chip-select signals. DDRA then marks every occurrence of read and/or write bursts in the acquired waveform. Search and mark tools allow stepping through each burst and then, based on search criteria, to generate eye diagrams and perform JEDEC standard measurements using DPOJET Advanced Jitter and Eye-Analysis Tools.



Identify and separate all DDR read from write bursts.

## DSA70000 Series

### **For Developing with Today's High-Speed Serial Standards, the DSA70000 Digital Serial Analyzer is Your Uncompromised High-Performance, Dedicated Solution to Efficiently Address Your Design Challenges**

The DSA70000 Series is a new generation of real-time digital serial analyzers based on the same advanced technology as the DPO70000 real-time digital phosphor oscilloscopes. As high-speed serial technology becomes more pervasive, more designers are looking for easy to use, complete, and dedicated solutions for verifying, characterizing, debugging, and testing sophisticated high-speed serial designs. The DSA70000 Series is specifically targeted to address the challenging high-speed serial design issues faced by designers, by encapsulating extended high-speed serial data domain expertise. It inherits exceptional signal acquisition performance, operational simplicity, and unmatched debugging tools from the DPO70000 Series, to accelerate your day-to-day tasks. It also features the extended analysis tools that enable high-speed serial signal analysis and compliance measurements in a specialized instrument.

The DSA70000 Series Analyzers provides the signal fidelity of Tektronix oscilloscopes to ensure confidence in your measurement results: high sample rate on all models, on all channels, to capture more signal details (transients, imperfections, fast edges), 25 GS/s on all four channels for the 4, 6, and 8 GHz models, 50 GS/s on all four channels for the 12.5, 16, and 20 GHz models, bandwidth enhancement as well as best low jitter noise floor and vertical accuracy for very accurate measurements.

The DSA70000 Series provides the longest acquisition of the industry to provide more resolution and longer time sequence—a standard 20 M on the DSA Series, or an optional up to 100 M samples on all four channels for the 4, 6, and 8 GHz models, 200 M samples on all four channels for the 12.5, 16, and 20 GHz models. Easily manage this deep record length and provide detailed comparison and analysis of multiple waveform segments with the MultiView Zoom™ feature.

The DSA70000 analyzers share the DPX technology of the DPO70000 and can deliver high waveform capture rate at more than 300,000 waveforms per second. The DSA70000 Series capture these intermittent fault events that can break a design with the FastAcq acquisition mode. With Pinpoint® triggering, the DSA70000 series is also equipped to isolate a section of a complex signal for further analysis.

To debug serial architectures, the DSA70000 Series features the NRZ serial pattern triggering and protocol decode with built-in clock recovery. It recovers the clock signal, identifies the transitions, and decodes characters and other protocol data. You can see the captured bit sequences decoded into their words for convenient analysis (for 8b/10b and other encoded serial data streams), or you can set the desired encoded words for the serial pattern trigger to capture. Lastly, you can synchronize long serial test pattern acquisitions up to 6.25 Gbps to remove random jitter. The DSA70000 Series covers serial standards up to 3.125 Gbps.

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 from every valid pulse in a single-shot acquisition. Multiple measurements and trend plots quickly show system timing under variable conditions. It also includes Random Jitter and Deterministic Jitter separation as well as Total Jitter measurement at Bit Error Ratio to 10<sup>-18</sup>.

Communications Mask Testing provides a complete portfolio of masks for verifying compliance to serial communications standards. It supports 156 Standards Masks – ITU-T (1.544 Mbps to 155 Mbps)/ANSI T1.102 (1.544 Mbps to 155 Mbps); Ethernet IEEE 802.3; ANSI X3.263 (1.544 Mbps to 3.125 Gbps XAUI); Sonet/SDH (51.84 Mbps to 2.4883 Gbps); Fiber Channel (133 Mbps to 4.25 Gbps\*1). InfiniBand (2.5 Gbps); USB (12 Mbps to 480 Mbps); Serial ATA (1.5 Gbps, 3 Gbps); Serial Attached SCSI (1.5 Gbps, 3.0 Gbps); IEEE 1394b (491.5 Mbps to 1.966 Gbps); Rapid I/O (1.25 Gbps to 3.125 Gbps); OIF Standards (2.488 Gbps to 3.11 Gbps); PCI Express (2.5 Gbps).

Accurate, Simple, and Customizable Physical Layer Testing on High-Speed Serial Standards. When designing to industry standards, analog validation and compliance testing (Front Side Bus, PCI Express, FB-DIMM, Serial ATA, Serial Attached SCSI, Fiber Channel, XAUI, IEEE1394b, RapidIO) is critical to ensure device interoperability. Patented Real-Time (RT-Eye®) clock recovery and Eye Rendering provides standard specific clock recovery, high-precision eye diagrams for transition and nontransition bits and accurate jitter measurements, and de-emphasis measurements. Standard-specific compliance and analysis modules that configure the pass/fail waveform mask and measurement limit testing are also available as an option for PCI Express (Option PCE), for Serial ATA and SAS (Option SST), for FB-DIMM (Fully Buffered - Dual Inline Memory Module) (Option FBD), or InfiniBand (Option IBA)

\*1 A 4.25 Gbps mask supported using Glitch Trigger. It is standard on the DSA70000 Series, and optional as Opt. MTH on DPO70404, DPO70604, and DPO70804.

## Characteristics

### Vertical System

DPO/DSA Models	70404	70604	70804	71254	71604	72004
Input Channels	4	4	4	4	4	4
Bandwidth (user selectable DSP enhance)	4 GHz	6 GHz	8 GHz	12.5 GHz	16 GHz	2 settings: 20 GHz and 18 GHz
Rise Time 10% to 90% (typical)	93 ps	62 ps	47 ps	34.3 ps	27.5 ps	22.5 ps
Rise Time 20% to 80% (typical)	65 ps	43 ps	33 ps	23 ps	21 ps	17 ps
Hardware Analog Bandwidth (-3 dB)	4 GHz	6 GHz	8 GHz	12.5 GHz	16 GHz (typical)	16 GHz (typical)
DC Gain Accuracy	±2% (of reading)					
Bandwidth Limits	Depending on instrument model: 19 GHz, 18 GHz, 17 GHz, 16 GHz, 15 GHz, 14 GHz, 13 GHz, 12 GHz, 11 GHz, 10 GHz, 9 GHz, 8 GHz, 7 GHz, 6 GHz, 5 GHz, 4 GHz, 3 GHz, 2 GHz, 1 GHz, or 500 MHz					
Input Coupling	DC (50 Ω), GND					
Input Impedance	50 Ω ±1.5%, 1 MΩ with TCA-1MEG adapter					
Input Sensitivity	10 mV/div to 1 V/div (100 mV to 10 V full scale)					
18 GHz and below	20 to 99.5 mV/div and 200 mV/div to 1 V/div					
20 GHz and 19 GHz						
Vertical Resolution	8 bit (11 bit with averaging)					
Max Input Voltage, 50 Ω	< 5.5 V <sub>RMS</sub> for ≥1 V full scale; also determined by TekConnect accessory					
Position Range	±5 div					
Offset Range	10 mV/div: ±450 mV 20 mV/div: ±400 mV 50 mV/div: ±250 mV 100 mV/div: ±4.5 V 200 mV/div: ±4.0 V 500 mV/div: ±2.5 V 1.0 V/div: 0					
Offset Accuracy	10 mV/div – 99.5 mV/div: ± (0.35% (offset value-position) + 1.5 mV + 1% of full scale) 100 mV/div – 1 V/div: ± (0.35% (offset value-position) + 15 mV + 1% of full scale)					
Delay between any two channels (typical)	≤100 ps for any two channels with equal V/div and coupling settings ≤50 ps with BW enhance enabled (BW+)					
Channel-to-channel Isolation (Any Two Channels at Equal Vertical Scale Settings)	≥120:1 (for input frequency 0 to 10 GHz) ≥80:1 (for input frequency >10 GHz to 12 GHz) ≥50:1 (for input frequency >12 GHz to 15 GHz) ≥25:1 (for input frequency >15 GHz)					

### Time Base System

DPO/DSA Models	70404	70604	70804	71254	71604	72004
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		
Time Base Delay	-5.0 ks to 1.0 ks					
Time Range						
Channel-to-channel Deskew	Range ±75 ns					
Delta Time Measurement Accuracy (typical) Over <100 ns duration; single shot; with signal rise time = 1.2X scope rise time	888 fs	695 fs	611 fs	504 fs	482 fs	525 fs
Trigger Jitter (RMS)	1 ps <sub>RMS</sub> (typical) with enhanced triggering OFF <100 fs <sub>RMS</sub> with enhanced triggering ON					
Jitter Noise Floor(typical) (With BW+ bandwidth enhance enabled)	450 fs	450 fs	450 fs	300 fs	300 fs	400 fs
Time Base Accuracy	±1.5 ppm initial accuracy, aging <1 ppm per year					

**Acquisition System**

DPO/DSA Models	70404 / 70604 / 70804	71254 / 71604 / 72004
<b>Sample Rates</b>		
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
<b>Maximum Record Length per Channel</b>		
With Standard Configuration	10 M on all four channels (DPO70000 Series only) 20 M on all four channels (DSA70000 Series only)	
With Record Length Opt. 2XL	20 M on all four channels (DPO70000 Series only)	
With Record Length Opt. 5XL	50 M on all four channels	
With Record Length Opt. 10XL	100 M on all four channels	
With Record Length Opt. 20XL	N/A	200 M on all four channels

**Maximum Duration at Highest Real-Time Resolution**

DPO/DSA Models	70404 / 70604 / 70804	71254 / 71604 / 72004
Resolution	40 ps (25 GS/s)	20 ps (50 GS/s)
Max Duration with Standard Memory	0.4 ms DPO70000 Series; 0.8 ms for DSA70000 Series	0.2 ms DPO70000 Series; 0.4 ms for DSA70000 Series
Max Duration with Opt. 2XL	0.8 ms (DPO70000 Series only)	0.4 ms (DPO70000 Series only)
Max Duration with Opt. 5XL	2.0 ms	1.0 ms
Max Duration with Opt. 10XL	4.0 ms	2.0 ms
Max Duration with Opt. 20XL	N/A	4.0 ms

**Acquisition Modes**

Mode	Description
FastAcq Acquisition Mode	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
Waveform Database	Accumulate waveform database providing three-dimensional array of amplitude, time, and counts
Sample	Acquire sampled values
Peak Detect	Captures narrow glitches at all real-time sampling rates: 1 ns at $\leq 125$ MS/s; 1/sample rate at $\geq 250$ MS/s
Averaging	From 2 to 10,000 waveforms included in average
Envelope	From 1 to $2 \times 10^9$ waveforms included in min-max envelope
Hi-Res	Real-time boxcar averaging reduces random noise and increases resolution
FastFrame™ Acquisition	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.
Roll Mode	Up to 10 MS/s with a maximum record length of 40 M

## Pinpoint® Trigger System

DPO Models		DSA Models
70404 / 70604 / 70804 / 71254 / 71604 / 72004		70404 / 70604 / 70804 / 71254 / 71604 / 72004
<b>Sensitivity</b>		
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.	
<b>Trigger Characteristics</b>		
A Event and Delayed B Event Trigger Types	Edge, Glitch, Runt, Width, Transition Time, Time-out, 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	
Enhanced Triggering	User-selectable; it corrects the difference in timing between the trigger path and the acquired data path (it supports all Pinpoint trigger types on both A- and B-Events except pattern trigger and not available in FastAcq).	
Trigger Sequences	Main, Delayed by Time, Delayed by Events, Reset by Time, Reset by State, Reset by Transition. All sequences can include separate horizontal delay after the trigger event to position the acquisition window in time.	
Communications-related Triggers	<b>Requires Opt. MTH</b>	<b>Standard</b>
	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.	
Serial Pattern Trigger	<b>Requires Opt. PTH</b>	<b>Standard</b>
	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 from 1.25 to 3.125 GBaud (40 bits)	
Clock Recovery System	<b>Requires Opt. PTH or Opt. MTH</b>	<b>Standard</b>
Clock Recovery Phase Locked Loop Bandwidth	Fixed at FBaud/1600	
Frequency Range	1.5 MBaud to 3.125 GBaud	
Clock Recovery Jitter (RMS)	<0.25% bit period + 2 ps <sub>RMS</sub> for PRBS data patterns <0.25% bit period + 1.5 ps <sub>RMS</sub> for repeating "0011" data pattern	
Tracking/Acquisition Range	±2% of requested baud	
Minimum Signal Amplitude needed for Clock Recovery	1 div <sub>p-p</sub> up to 1.25 Gbaud 1.5 div <sub>p-p</sub> above 1.25 Gbaud	
Trigger Level Range Internal	±120% of full scale from center of screen	
AUX Trigger	TekConnect interface: ±5 V	
Line	Fixed at 0 V	
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 Modes**

Mode	Description
Edge	Positive or negative slope on any channel or front panel auxiliary input. Coupling includes DC, AC, noise reject, HF reject, and LF reject.
Glitch	Trigger on or reject glitches of positive, negative, or either polarity. Minimum glitch width is down to 150 ps (typical) with rearm time of 300 ps
Width	Trigger on width of positive or negative pulse either within or out of selectable time limits (down to 150 ps).
Runt	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.
Time-out	Trigger on an event which remains high, low, or either, for a specified time period. Selectable from 300 ps.
Transition	Trigger on pulse edge rates that are faster or slower than specified. Slope may be positive, negative, or either.
Setup/Hold	Trigger on violations of both setup time and hold time between clock and data present on any two input channels.
Pattern	Trigger when pattern goes false or stays true for specified period of time. Pattern (AND, OR, NAND, NOR) specified for four input channels defined as high, low, or don't care.
State	Any logical pattern of channels (1, 2, 3) clocked by edge on channel 4. Trigger on rising or falling clock edge.
Window	Trigger on an event that enters or exits a window defined by two user-adjustable thresholds. Event can be time- or logic-qualified.
Trigger Delay by Time	3.2 ns to 3 Ms
Trigger Delay by Events	1 to 2 G events
Comm	Standard feature on the DSA70000, provided as part of Opt. MTH on the DPO70000 Series. Support for AMI, HDB3, BnZS, CMI, MLT3 and NRZ encoded signals.
Serial Pattern	Trigger on NRZ-encoded data up to 3.125 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 Gbps.

**Search and Mark Events**

Event	Description
Basic	Mark any events and document waveforms. Search positive, negative slopes or both on any channels. 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.
Advanced	Search glitches or runts, as well as transition rate, pulse width, setup and hold, time-out, window violations, or find any logic or state pattern on any number of channels. Search DDR read or write bursts with Opt. DDRA.

**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 take measurements on.
Amplitude Related	Amplitude, High, Low, Maximum, Minimum, Peak-to-Peak, Mean, Cycle Mean, RMS, Cycle RMS, Positive Overshoot, Negative Overshoot
Time Related	Rise Time, Fall Time, Positive Width, Negative Width, Positive Duty Cycle, Negative Duty Cycle, Period, Frequency, Delay
Combination	Area, Cycle Area, Phase, Burst Width
Histogram Related	Waveform Count, Hits in Box, Peak Hits, Median, Maximum, Minimum, Peak-to-Peak, Mean ( $\mu$ ), Standard Deviation ( $\sigma$ ), $\mu+1\sigma$ , $\mu+2\sigma$ , $\mu+3\sigma$
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

**Waveform Processing/Math**

Processing Type	Description
Arithmetic	Add, Subtract, Multiply, Divide Waveforms and Scalars
Algebraic Expressions	Define extensive algebraic expressions including Waveforms, Scalars, User-adjustable Variables and Results of Parametric Measurements e.g. $(\text{Integral}(\text{CH.1} - \text{Mean}(\text{CH.1})) \times 1.414 \times \text{VAR1})$
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 $>$ , $<$ , $\geq$ , $\leq$ , $==$ , $!=$
Frequency Domain Functions	Spectral Magnitude and Phase, Real and Imaginary Spectra
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
Waveform Definition	As an arbitrary math expression
Filtering Functions	User-definable filters. Users specify a file containing the coefficients of the filter. Several filter files provided.
Mask Function	A function that generates a Waveform Database pixmap from a sample waveform. Sample count can be defined.

**Display Characteristics**

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

**Computer System and Peripherals**

Item	Description
Operating System	Windows XP
CPU	Intel Pentium 4, 3.4-GHz processor
PC System Memory	2 GB
Hard Disk Drive	Rear-panel, removable hard disk drive, 80 GB capacity
CD-R/W Drive	Front-panel CD-R/W drive with CD creation software application
DVD Drive	Read only
Mouse	Optical wheel mouse, USB interface
Keyboard	USB interface

**Input/Output Ports****Front Panel**

Port	Description
Aux Trigger Input	See trigger specifications
Recovered Clock	SMA connector, $\leq 1.25$ Gbps, Output swing $\geq 130$ mV <sub>p-p</sub> into 50 $\Omega$ at 1.25 Gbps. Requires Opt. PTH or Opt. MTH to enable on DPO70000, standard on DSA70000.
Recovered Data	SMA connector, $\leq 1.25$ Gbps, Output swing of 1010 repeating pattern 200 mV into 50 $\Omega$ at 1.25 Gbps. Requires Opt. PTH or Opt. MTH to enable on DPO70000, standard on DSA70000.
DC Probe Calibration Output	BNC connector, $\pm 10$ V DC for DC probe calibration. (Signal available only during probe calibration.)
Fast Edge Output	SMA connector provides fast edge signal. 1 kHz $\pm 20\%$ ; 810 mV (base to top) $\pm 20\%$ into $\geq 10$ k $\Omega$ load; 440 mV $\pm 20\%$ into a 50 $\Omega$ load.
AUX Trigger Output	BNC connector, provides a TTL-compatible, polarity-switchable pulse when the oscilloscope triggers.
USB 2.0 Port	One in front, four on back. Allows connection or disconnection of USB keyboard, mouse, or storage device while oscilloscope is on.

**Rear Panel**

Port	Description
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.
Time Base Reference Out	BNC connector; provides TTL-compatible output of internal 10 MHz reference oscillator
AUX Trigger Output	BNC connector, 0 to 3 V; default output is A-Event Trigger low true
Parallel Port	IEEE 1284, DB-25 connector
Audio Ports	Miniature phone jacks for stereo microphone input and stereo line output.
USB 2.0 Ports	Four in back. Allow connection or disconnection of USB keyboard, mouse, or storage device while oscilloscope power is on.
Keyboard Port	PS/2 compatible
Mouse Port	PS/2 compatible
LAN Port	RJ-45 connector, supports 10Base-T, 100Base-T, and 1000Base-T
Serial Port	DB-9 COM1 port
Windows Video Port	15 pin D-sub connector on the rear panel; connects a second monitor to use dual-monitor display mode allowing analysis results and plots to be viewed along with the oscilloscope display. Video is DDC2B compliant.
GPIO Port	IEEE 488.2 standard
Scope XGA Video Port	15 pin D-sub connector on the rear panel, video is IBM XGA compatible. Connects 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 this port.
TekLink™	Proprietary interface for connecting multiple Tektronix instruments
Power	100 to 240 V <sub>RMS</sub> , $\pm 10\%$ , 50/60 Hz; 115 V <sub>RMS</sub> $\pm 10\%$ , <870 Watts, 400 Hz; CAT II, <1100 VA typical

**Physical Characteristics**

Dimensions	mm	in.
<b>Benchtop Configuration</b>		
Height	298	11.74
Width	451	17.75
Depth	489.97	19.29
<b>Weight</b>	<b>kg</b>	<b>lbs.</b>
Net	20	44
Shipping	34	75
<b>Rackmount Configuration</b>		
	<b>mm</b>	<b>in.</b>
Height	311	12.25
Width	480.1	18.9
Depth (from rack mounting ear to back of instrument)	546.1	21.5
<b>Weight</b>	<b>kg</b>	<b>lbs.</b>
Net	20	44
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**

<b>Temperature</b>	
Operating	5 °C to +45 °C
Nonoperating	–20 °C to +60 °C
<b>Humidity</b>	
Operating	8% to 80% relative humidity (RH) at up to 32 °C. 5% to 45% RH above +32 °C up to +45 °C
Nonoperating	5% to 95% relative humidity (RH). Upper limit derated to 45% RH above +30 °C up to +60 °C
<b>Altitude</b>	
Operating	10,000 ft. (3,048 m)
Nonoperating	40,000 ft. (12,190 m)
<b>Regulatory</b>	
Electromagnetic Compatibility	93/68/EEC; EN61326:1997 +A1 1998+A2:2000
Certifications	UL 3111-1, CSA1010.1, ISO11469, EN61010-1, IEC 61010-1

**Ordering Information**

Model	Description
DPO70404	4 GHz Digital Phosphor Oscilloscope
DPO70604	6 GHz Digital Phosphor Oscilloscope
DPO70804	8 GHz Digital Phosphor Oscilloscope
DPO71254	12.5 GHz Digital Phosphor Oscilloscope
DPO71604	16 GHz Digital Phosphor Oscilloscope
DPO72004	20 GHz Digital Phosphor Oscilloscope
DSA70404	4 GHz Digital Serial Analyzer
DSA70604	6 GHz Digital Serial Analyzer
DSA70804	8 GHz Digital Serial Analyzer
DSA71254	12.5 GHz Digital Serial Analyzer
DSA71604	16 GHz Digital Serial Analyzer
DSA72004	20 GHz Digital Serial Analyzer

**All Models Include:** Accessory pouch, front cover, mouse, keyboard, quick start user manual (071-173x-xx), probe calibration and deskew fixture, DPO70000 Series product software CD/DVD-ROM, DPO70000 Series operating system restoration CD/DVD-ROM, Optional applications 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.

(4) TekConnect® to 2.92 mm adapters (TCA-292MM) and (1) Tekconnect to BNC adapter (TCA-BNC)

## Options

### Instrument Options

#### Record Length Options for DPO70000 Series

Opt. 2XL	20 MSamples/ch
Opt. 5XL	50 MSamples/ch
Opt. 10XL	100 MSamples/ch
Opt. 20XL* <sup>9</sup>	200 MSamples/ch

#### Record Length Options for DSA70000 Series

Opt. 5XL	50 MSamples/ch
Opt. 10XL	100 MSamples/ch
Opt. 20X* <sup>9</sup>	200 MSamples/ch

#### Software Options for DPO70000 Series

Opt. PTH	Protocol Triggering and Decoding for 8b/10b-encoded Serial Signals up to 3.125 Gbps. Includes hardware clock recovery and pattern lock triggering.
Opt. MTH	Mask testing for Serial Standards up to 4.25 Gbps. Includes hardware clock recovery.
Opt. ASM	Advanced Event Search and Mark

#### Software Options for DPO70000 Series and DSA70000 Series

Opt. LT	Waveform Limit Testing
Opt. DDRA* <sup>10</sup>	DDR Memory Bus Analysis
Opt. DJA	DPOJET Jitter and Eye Diagram Analysis
Opt. ET3* <sup>2</sup>	Ethernet Compliance Test Software
Opt. USB* <sup>3</sup>	USB 2.0 Compliance Test Software only
Opt. PWR* <sup>4</sup>	Power Measurement and Analysis Software
Opt. HT3	HDMI Compliance Test Software
Opt. DSPT	DisplayPort Compliance Test Solution
Opt. DVI	DVI Compliance Test Solution
Opt. PCE* <sup>5</sup>	PCI Express™ Compliance Module for RT-Eye Serial Data Compliance and Analysis Software
Opt. SST* <sup>5</sup>	SATA and SAS Analysis Software Module for RT-Eye Serial Data Compliance and Analysis Software
Opt. FBD* <sup>5</sup>	FB-DIMM Compliance Module for RT-Eye Serial Data Compliance and Analysis Software
Opt. IBA* <sup>5</sup>	InfiniBand Compliance Module for RT-Eye Serial Data Compliance and Analysis Software
Opt. UWB	Ultra-Wideband Spectral Analysis
Opt. UWBE	Ultra-Wideband Spectral Analysis Essentials
Opt. SVE	SignalVu™ Essentials – Vector Signal Analysis Software
Opt. SVP* <sup>11</sup>	Advanced Signal Analysis (including pulse measurements). Requires option SVE.
Opt. SVM* <sup>11</sup>	General Purpose Modulation Analysis. Requires option SVE.
Opt. SLE	Serial Data Link Analysis Essentials (no Equalization).
Opt. SLA	Serial Data Link Analysis Advanced (with Equalization).

\*<sup>2</sup> Requires Ethernet Test Fixture.

\*<sup>3</sup> Requires TDSUSB (USB Test Fixture).

\*<sup>4</sup> At least Opt. 2XL and a TCA-1MEG TekConnect 1 MΩ buffer amplifier are recommended for use.

\*<sup>5</sup> Requires Opt. RTE on DPO70000 Series.

\*<sup>9</sup> For models of bandwidth >= 12.5 GHz only

\*<sup>10</sup> Requires DJA and ASM

\*<sup>11</sup> Requires Opt. SVE, SVEH, or SVEU

### User Manual Options

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

### Power Plug Options

Option	Description
Opt. A0	North America
Opt. A1	Universal European Union
Opt. A2	UK
Opt. A3	Australia
Opt. A5	Switzerland
Opt. A6	Japan
Opt. A10	China
Opt. A11	India
Opt. A99	No power cord

### Service Options

Option	Description
Opt. CA1	Provides a single calibration event or coverage for the designated calibration interval, whichever comes first
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. R3	Repair Service 3 Years
Opt. R5	Repair Service 5 Years

## Recommended Accessories

### Probes

Probe	Description
P7520	20 GHz TriMode™ probe
P7516	16 GHz TriMode™ probe
P7513	13 GHz TriMode™ probe
P7313	13 GHz Z-Active™ differential probe
P7313SMA	13 GHz TekConnect® differential SMA probe
P7380A	8 GHz Z-Active™ differential probe
P7380SMA	8 GHz TekConnect differential SMA probe
P7360A	6 GHz Z-Active™ differential probe
P7340A	4 GHz Z-Active™ differential probe
P6251	DC to 1 GHz, 42V, Differential Probe (requires TCA-BNC adapter)
P6250	DC to 500 MHz, 42V, Differential Probe (requires TCA-BNC adapter)
TCPA300/TCPA400	Series current measurement systems
P5200/P5205/P5210	High-voltage differential probes

### Adapters

Adapter	Description
TCA-292MM	TekConnect to 2.92 mm connectors
TCA-SMA	TekConnect-to-SMA adapter
TCA-N	TekConnect-to-N adapter
TCA-BNC	TekConnect-to-BNC adapter
TCA75	4 GHz precision TekConnect 75 $\Omega$ to 50 $\Omega$ adapter with 75 $\Omega$ BNC input connector
TCA-1MEG	TekConnect high-impedance buffer amplifier. Includes P6139A passive probe

### Cables

Cable	Order
GPIB Cable (1 m)	012-0991-01
GPIB Cable (2 m)	012-0991-00
RS-232 Cable	012-1298-00
Centronics Cable	012-1214-00

### Accessories

Accessory	Order
Service Manual	071-1740-xx
Instrumented DIMM for DDR3	Order Scope NEXVu card for UDIMM Raw Card E. (Contact <a href="http://www.nexustechology.com">http://www.nexustechology.com</a> )
Transit Case	016-1977-00
Rackmount Kit	016-1985-00
Oscilloscope Cart	K4000
TDSUSB	Test fixture for use with Opt. USB
Probe Calibration and Deskew Fixture (4 GHz)	067-0484-xx
Probe Deskew Fixture (>4 GHz)	067-1586-xx
Power Deskew Fixture	067-1686-xx
Ethernet Test Fixture	Order through Crescent Heart Software ( <a href="http://www.c-h-s.com">http://www.c-h-s.com</a> )

## Instrument Upgrades

To upgrade your DPO70000 Series Oscilloscope or your DSA70000 Series Serial Analyzer, order DPO7UP and option as noted.

Option	Description
<b>To upgrade record length on DPO70000 Series from:</b>	
XL02*6	Standard configuration to Opt. 2XL configuration
XL25*6	Opt. 2XL configuration to Opt. 5XL configuration
XL210*6	Opt. 2XL configuration to Opt. 10XL configuration
XL220*9*6	Opt. 2XL configuration to Opt. 20XL configuration (only available on instruments of bandwidth >= 12.5 GHz)
<b>To upgrade record length from standard configuration to:</b>	
XL05	Opt. 5XL configuration
XL010	Opt. 10XL configuration
XL020*9	Opt. 20XL configuration (only available on instruments of bandwidth >= 12.5 GHz)
<b>To upgrade record length on DPO70000 Series or DSA70000 Series from:</b>	
XL510	Opt. 5XL configuration to Opt. 10XL configuration
XL520*9	Opt. 5XL configuration to Opt. 20XL configuration (only available on instruments of bandwidth >= 12.5 GHz)
XL1020*9	Opt. 10XL configuration to Opt. 20XL configuration (only available on instruments of bandwidth >= 12.5 GHz)
<b>To upgrade:</b>	
DDRA*10	DPO70000 or DSA70000 Series with Opt. DDRA
DJAH	DPO70404, 70604, 70804 with Opt. DJA
DJAU	DPO71254, 71604, 72004 with Opt. DJA
DJUP	DSA70000 with Opt. DJA
<b>To upgrade DPO70000 Series or DSA70000 Series with:</b>	
DVI	Opt. DVI
SST*5	Opt. SST
ET3	Opt. ET3
LT	Opt. LT
USB	Opt. USB
PWR	Opt. PWR
PCE*5	Opt. PCE

IBA*5	Opt. IBA
FBD*5	Opt. FBD
UWB	Opt. UWB
UWBE	Opt. UWBE
HT3	Opt. HT3
SLE	Opt. SLE
SLA	Opt. SLA
EQ*14	From Opt SLE to Opt. SLA

### To upgrade DPO70000 Series with:

ASM	Opt. ASM
MTH*6	Opt. MTH
PTH*6	Opt. PTH

### To upgrade DPO70000 Series or DSA70000 Series with:

CP2*7	TDSCPM2 ANSI/ITU Telecom pulse compliance testing software (requires Opt. MTH on DPO70000 Series)
J2	TDSDDM2 disk-drive analysis software
VNM*8	TDSVNM CAN and LIN Timing and Protocol Decode (no CAN triggering included)
SVEH*12	Opt. SVE
SVEU*13	Opt. SVE
SVP*11	Opt. SVP
SVM*11	Opt. SVM

\*5 Requires Opt. RTE on DPO70000 Series.

\*6 DPO70000 only.

\*7 Requires Opt. MTH on DPO70000 Series

\*8 Requires ATM1 CAN/LIN trigger module - Order through Crescent Heart Software

\*9 For models of bandwidth >= 12.5 GHz only

\*10 Requires DJA and ASM

\*11 Requires Opt. SVE, SVEH, or SVEU

\*12 DPO/DSA70404, DPO/DSA70604, DPO/DSA 70804 only

\*13 DPO/DSA71254, DPO/DSA71604, DPO/DSA72004 only

\*14 Request Opt. SLE



Product(s) are manufactured in ISO registered facilities.

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