

Specifications and Characteristics



Vertical	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Input channels	1	2	4	1	2	4
	All channels are identical and digitized simultaneously.					
Analog bandwidth, -3 dB flatness	These specifications are valid after a 30-minute warm-up period and ± 2 °C from firmware calibration temperature.					
Full bandwidth *	DC to 5 GHz			DC to 16 GHz		
Middle bandwidth, typical	N/A		DC to 500 MHz	N/A		DC to 500 MHz
Narrow bandwidth, typical	DC to 500 MHz		DC to 100 MHz	DC to 500 MHz		DC to 100 MHz
Passband flatness (full BW)	± 1 dB to 3 GHz			± 1 dB to 5 GHz		
Calculated rise time (Tr), typical	Calculated from the bandwidth: 10% to 90%: calculated from $Tr = 0.35/BW$. 20% to 80%: calculated from $Tr = 0.25/BW$.					
Full bandwidth	10% to 90%: ≤ 70 ps, 20% to 80%: ≤ 50 ps.			10% to 90%: ≤ 21.9 ps, 20% to 80%: ≤ 15.6 ps.		
Middle bandwidth	N/A		10% to 90%: ≤ 700 ps 20% to 80%: ≤ 500 ps	N/A		10% to 90%: ≤ 700 ps 20% to 80%: ≤ 500 ps
Narrow bandwidth	10% to 90%: ≤ 700 ps 20% to 80%: ≤ 500 ps		10% to 90%: ≤ 3.5 ns 20% to 80%: ≤ 2.5 ns	10% to 90%: ≤ 700 ps 20% to 80%: ≤ 500 ps		10% to 90%: ≤ 3.5 ns 20% to 80%: ≤ 2.5 ns
Step response, typical						
Full bandwidth				N/A		
Overshoot	$< 8\%$					
Ringing	$\pm 6\%$ to 3 ns, $\pm 4\%$ from 3 ns to 10 ns, $\pm 3\%$ from 10 ns to 100 ns, $\pm 2\%$ from 100 ns to 400 ns, $\pm 1\%$ after 400 ns.					
Middle bandwidth	N/A			N/A		
Overshoot			$< 6\%$			$< 6\%$
Ringing			$\pm 4\%$ to 10 ns, $\pm 3\%$ from 10 ns to 100 ns, $\pm 2\%$ from 100 ns to 400 ns, $\pm 1\%$ after 400 ns.			$\pm 4\%$ to 10 ns, $\pm 3\%$ from 10 ns to 100 ns, $\pm 2\%$ from 100 ns to 400 ns, $\pm 1\%$ after 400 ns.
Narrow bandwidth						
Overshoot	$< 6\%$		$< 5\%$	$< 6\%$		$< 5\%$
Ringing	$\pm 4\%$ to 10 ns, $\pm 3\%$ from 10 ns to 100 ns, $\pm 2\%$ from 100 ns to 400 ns, $\pm 1\%$ after 400 ns.		$\pm 5\%$ to 20 ns, $\pm 3\%$ from 20 ns to 100 ns, $\pm 2\%$ from 100 ns to 400 ns, $\pm 1\%$ after 400 ns.	$\pm 4\%$ to 10 ns, $\pm 3\%$ from 10 ns to 100 ns, $\pm 2\%$ from 100 ns to 400 ns, $\pm 1\%$ after 400 ns.		$\pm 5\%$ to 20 ns, $\pm 3\%$ from 20 ns to 100 ns, $\pm 2\%$ from 100 ns to 400 ns, $\pm 1\%$ after 400 ns.
RMS noise						
Full bandwidth *	1.8 mV, maximum. 1.6 mV, typical.			2.4 mV, maximum. 2.2 mV, typical.		
Middle bandwidth	N/A		0.8 mV, maximum. 0.65 mV, typical.	N/A		0.8 mV, maximum. 0.65 mV, typical.
Narrow bandwidth	0.8 mV, maximum. 0.65 mV, typical.		0.6 mV, maximum. 0.45 mV, typical.	0.8 mV, maximum. 0.65 mV, typical.		0.8 mV, maximum. 0.65 mV, typical.
Scale factors (sensitivity)	10 mV/div to 250 mV/div. Full scale is 8 vertical divisions. Adjustable in a 10-12.5-15-20-25-30-40-50-60-80-100-125-150-200-250 mV/div sequence. Also adjustable in 1% fine increments or better. With manual or calculator data entry the increment is 0.1 mV/div.					
DC gain accuracy *	$\pm 1.5\%$ of full scale, maximum. $\pm 1\%$ of full scale, typical.		$\pm 1\%$ of full scale, maximum. $\pm 0.5\%$ of full scale, typical.	$\pm 1.5\%$ of full scale, maximum. $\pm 1\%$ of full scale, typical.		$\pm 1\%$ of full scale, maximum. $\pm 0.5\%$ of full scale, typical.

* Specifications marked with (*) are checked in the Performance Verification.

Vertical (continued)	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Position range	±4 divisions from center screen					
DC offset range	Adjustable from -1 V to +1 V in 10 mV increments (coarse). Also adjustable in fine increments of 2 mV. With manual or calculator data entry the increment is 0.01 mV for offset between -99.9 and 99.9 mV, and 0.1 mV for offset between -999.9 and 999.9 mV. Referenced to the center of display graticule.					
DC offset accuracy *	±1.5 mV ± 1.5% of offset setting, max ±1 mV ± 1% of offset setting, typical.	±1 mV ± 1% of offset setting, max. ±0.5 mV ± 0.5% of offset setting, typ.		±1.5 mV ± 1.5% of offset setting, max ±1 mV ± 1% of offset setting, typical.		±1 mV ± 1% of offset setting, max. ±0.5 mV ± 0.5% of offset setting, typ.
Operating input voltage	±1 V					
Vertical Zoom and Position	For all input channels, waveform memories, or functions.					
Vertical factor	0.01 to 100.					
Vertical position	±800 division maximum of zoomed waveform.					
Channel-to-channel crosstalk (channel isolation)	≥50 dB (316:1) for input frequency DC to 1 GHz. ≥40 dB (100:1) for input frequency >1 GHz to 3 GHz. ≥36 dB (63:1) for input frequency >3 GHz to ≤5 GHz			≥50 dB (316:1) for input frequency DC to 1 GHz. ≥40 dB (100:1) for input frequency >1 GHz to 3 GHz. ≥36 dB (63:1) for input frequency >3 GHz to ≤16 GHz.		
Delay between channels	N/A	≤ 10 ps typical at full bandwidth, equivalent time.		N/A	≤ 10 ps typical at full bandwidth, equivalent time.	
ADC resolution	12 bits					
Hardware vertical resolution	0.5 mV / LSB without averaging.					
Input impedance *	50 Ω ± 1.5 Ω maximum. 50 Ω ± 1 Ω typical					
Input match	Reflections for 70 ps rise time: 10% or less.			Reflections for 50 ps rise time: 10% or less.		
Input coupling	DC					
Maximum safe input voltage	±2 V (DC + peak AC)					
Input connector	SMA female					
Attenuation	Attenuation factors may be entered to scale the oscilloscope for external attenuators connected to the channel inputs.					
Range	0.0001:1 to 1 000 000:1					
Units	Ratio or dB					
Scale	Volt, Watt, Ampere, or Unknown.					
Horizontal	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Time base	Internal time base common to all input channels.					
Time base range	Full horizontal scale is 10 divisions.					
Real time sampling	10 ns/div to 1000 s/div.					
Random equivalent time sampling	50 ps/div to 5 μs/div.			10 ps/div to 5 μs/div.		
Roll	100 ms/div to 1000 s/div.					
Segmented	Total number of segments: 2 to 1024. Dead time between segments: 3 μs.					
Horizontal zoom and position	For all input channels, waveform memories, or functions					
Horizontal factor	From 1 to 2000.					
Horizontal position	From 0% to 100% non-zoomed waveform.					
Time base clock accuracy	@ 25 °C ± 3 °C					
Frequency	500 MHz					
Initial set tolerance	± 0.5 ppm	± 5 ppm		± 0.5 ppm	± 5 ppm	
Overall frequency stability * (over operating temperature range)	± 2 ppm	± 15 ppm		± 2 ppm	± 15 ppm	
Aging	± 3 ppm	± 7 ppm		± 3 ppm	± 7 ppm	

Horizontal (continued)	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Time base resolution	1.0 ps At random equivalent time sampling			0.2 ps		
Delta time measurement accuracy *	FemtoScope 1000: $\pm (2 \text{ ppm} * \text{reading} + 0.1\% * \text{screen width} + 5 \text{ ps})$. FemtoScope 2000: $\pm (15 \text{ ppm} * \text{reading} + 0.1\% * \text{screen width} + 5 \text{ ps})$. FemtoScope 3000: $\pm (15 \text{ ppm} * \text{reading} + 0.1\% * \text{screen width} + 2 \text{ ps})$.					
Pre-trigger delay	Record length / current sampling rate maximum at zero variable delay time					
Post-trigger delay	0 to 4.28 s. Coarse increment is one horizontal scale division, fine increment is 0.1 horizontal scale divisions, manual or calculator increment is 0.01 horizontal scale divisions.					
Channel deskew range	$\pm 50 \text{ ns}$ range. Coarse increment is 100 ps, fine increment is 10 ps. With manual or calculator data entry the increment is four significant digits or 1 ps.					

Acquisition	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Sampling modes						
Real time	Captures all of the sample points used to reconstruct a waveform during a single trigger event					
Equivalent time	Acquires sample points over several trigger events, requiring the input waveform to be repetitive					
Roll	Acquisition data will be displayed in a rolling fashion starting from the right side of the display and continuing to the left side of the display (while the acquisition is running)					
Segmented	Segmented memory optimizes available memory for data streams that have long dead times between activity. Number of segments: up to 1024. Segments stamped with absolute and delta times.					
Maximum sampling rate						
Real time sampling	500 MS/s per channel simultaneously					
Equivalent time sampling	Up to 1 TS/s or 1.0 ps trigger placement resolution			Up to 5 TS/s or 0.2 ps trigger placement resolution		
Record length						
Real time sampling	50 S/ch to 250 kS/ch for one channel, to 125 kS/ch for two channels, to 50 kS/ch for three and four channels.					
Equivalent time sampling	500 S/ch to 250 kS/ch for one channel, to 125 kS/ch for two channels, to 50 kS/ch for three and four channels.					
Duration at highest sample rate	0.5 ms for one channel, 0.25 ms for two channels, 0.125 ms for three and four channels.					
Acquisition modes						
Sample (normal)	Acquires first sample in decimation interval and displays results without further processing.					
Average	Average value of samples in decimation interval. Number of waveforms for average: 2 to 4096.					
Envelope	Envelope of acquired waveforms. Minimum, Maximum or both Minimum and Maximum values acquired over one or more acquisitions. Number of acquisitions is from 2 to 4096 in $\times 2$ sequence and continuously.					
Peak detect	Largest and smallest sample in decimation interval. Minimum pulse width: $1/(\text{sampling rate})$ or 2 ns @ 50 $\mu\text{s}/\text{div}$ or faster for single channel.					
High resolution	Averages all samples taken during an acquisition interval to create a record point. This average results in a higher-resolution, lower-bandwidth waveform. Resolution can be expanded to 12.5 bits or more, up to 16 bits.					

Trigger	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Trigger sources	Internal Direct or Divided, External Direct or Divided.	Internal Direct, Divided or Clock Recovery. Internal Direct, Divided or Clock Recovery.	Internal Direct, Divided or Clock Recovery. External Direct, Divided or Clock Recovery.	Internal Direct or Divided, External Direct or Divided.	Internal Direct, Divided or Clock Recovery. External Direct, Divided, Clock Recovery or Prescaled	Internal Direct, Divided or Clock Recovery. External Prescaled.
Trigger mode						
Freerun	Triggers automatically but not synchronized to the input in absence of trigger event.					
Normal (triggered)	Requires trigger event for oscilloscope to trigger.					
Single	Software button that triggers only once on a trigger event. Not suitable for random equivalent-time sampling					
Pattern Lock	The oscilloscopes internally generate and lock onto a pattern with $(2^{15})-1$ max length up to maximum specified trigger frequency.					
Eye Line	This mode is used to view averaged eye diagrams as well as a pattern's UIs.					

Trigger (continued)	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Trigger holdoff mode	By Time, Random or by Events					
Trigger holdoff range						
Holdoff by time	Adjustable from 500 ns to 15 s in a 1-2-5-10 sequence or in 4 ns fine increments.					
Random	This mode varies the trigger holdoff from one acquisition to another by randomizing the time value between triggers. The randomized time can be between the values specified in the Min Holdoff and Max Holdoff.					
Internal or External Trigger						
Trigger style						
Edge	Triggers on a rising and falling edge of any source within frequency range DC to 3 GHz.					
Divided	The trigger source is divided before being applied to the trigger system. Maximum trigger frequency 6 GHz					
Division factor	/2	/4		/2	/4	
Clock recovery	N/A	6.5 Mb/s to 5 Gb/s		N/A	6.5 Mb/s to 11.3 Gb/s	
Trigger level range	-1 V to 1 V in 10 mV increments (coarse). Also adjustable in fine increments of 1 mV.					
Trigger bandwidth and sensitivity	Internal and External trigger					
Low sensitivity (Edge trigger)	100 mV p-p DC to 100 MHz. Increasing linearly from 100 mV p-p at 100 MHz to 150 mV p-p at 3 GHz (<i>FemtoScope 1000</i>) and at 3 GHz typical, 2.5 GHz guaranteed (<i>FemtoScope 2000/3000</i>). Pulse Width: 80 ps @ 200 mV p-p typical.					
Low sensitivity (Divided trigger)	100 mV p-p DC to 100 MHz. Increasing linearly from 100 mV p-p at 100 MHz to 200 mV p-p at 6 GHz. Pulse Width: 80 ps @ 200 mV p-p typical.					
High sensitivity (Edge trigger) *	30 mV p-p DC to 100 MHz. Increasing linearly from 30 mV p-p at 100 MHz to 50 mV p-p at 3 GHz (<i>FemtoScope 1000</i>) and at 3 GHz typical, 2.5 GHz guaranteed (<i>FemtoScope 2000/3000</i>). Pulse Width: 80 ps @ 70 mV p-p typical.					
High sensitivity (Divided trigger) *	30 mV p-p DC to 100 MHz. Increasing linearly from 30 mV p-p at 100 MHz to 70 mV p-p at 6 GHz. Pulse Width: 80 ps @ 70 mV p-p typical.					
Edge trigger slope						
Positive	Triggers on rising edge.					
Negative	Triggers on falling edge.					
Bi-slope	Triggers on both edges of the signal.					
RMS trigger jitter *	Measured at 2.5 GHz or 5 Gb/s with optimum triggering level.					
Edge and Divided trigger	1.5 ps + 0.1 ppm of delay typical. 2 ps + 0.1 ppm of delay maximum		1.2 ps + 0.1 ppm of delay, typical. 1.5 ps + 0.1 ppm of delay, maximum		1.5 ps + 0.1 ppm of delay typical. 2 ps + 0.1 ppm of delay maximum	1.2 ps + 0.1 ppm of delay, typical. 1.5 ps + 0.1 ppm of delay, maximum
Clock recovery trigger	2 ps + 1.0% of unit interval + 0.1 ppm of delay, typical. 2.5 ps + 1.0% of unit interval + 0.1 ppm of delay, maximum.					
Direct trigger input impedance *	50 Ω ± 1.5 Ω maximum. 50 Ω ± 1 Ω, typical	N/A		50 Ω ± 1.5 Ω maximum. 50 Ω ± 1 Ω, typical	N/A	
Direct trigger maximum safe input voltage	±3 V (DC+peak AC)		N/A	±3 V (DC+peak AC)		N/A
Direct trigger input coupling	DC		N/A	DC		N/A
Direct trigger input connector	SMA female		N/A	SMA female		N/A
External Prescaled Trigger						
Prescaled trigger input coupling	N/A					
Prescaled trigger bandwidth and sensitivity *	50 Ω, AC coupled, fixed level zero volts					
Prescaled RMS trigger jitter *	200 mV p-p from 1 to 16 GHz (sine wave input)					
Prescaler ratio	1.5 ps delay, 2 ps maximum. For trigger input slope > 5 V/ns.					
Prescaled trigger maximum safe input voltage	Divided by 8, fixed					
Prescaled trigger input connector	±3 V (DC + peak AC)					
	SMA female					

Display	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Persistence						
Simple	No persistence					
Variable Persistence	Time that each data point is retained on the display. Persistence time can be varied from 100 ms to 20 s.					
Infinite Persistence	In this mode, a waveform sample point is displayed forever.					
Variable Gray Scaling	Five levels of a single color that is varied in saturation and luminosity. Refresh time varied from 1 s to 200 s.					
Infinite Gray Scaling	In this mode, a waveform sample point displayed as five levels of a single color is displayed forever.					
Variable Color Grading	With Color Grading selected, historical timing information is represented by a temperature or spectral color scheme providing "z-axis" information about rapidly changing waveforms. Refresh time varied from 1 to 200 s					
Infinite Color Grading	In this mode, a waveform sample point displayed as a temperature or spectral color is displayed forever.					
Style						
Dots	Displays waveforms without persistence, each new waveform record replaces the previously acquired record for a channel.					
Vector	This function draws a straight line through the data points on the display. Not suited to multi-value signals such as a displayed eye diagram.					
Graticule						
Full Grid, Axes with tick marks, Frame with tick marks, Off (no graticule).						
Format						
Auto	Automatically places, adds or deletes graticules as you select more or fewer waveforms to display.					
Single XT	All waveforms are superimposed and are eight divisions high.					
Dual YT	With two graticules, all waveforms can be four divisions high, displayed separately or superimposed.					
Quad YT	With four graticules, all waveforms can be two divisions high, displayed separately or superimposed. When you select dual or quad screen display, every waveform channel, memory and function can be placed on a specified graticule.					
XY	Displays voltages of two waveforms against each other. The amplitude of the first waveform is plotted on the horizontal X axis and the amplitude of the second waveform is plotted on the vertical Y axis.					
XY + YT	Displays both XY and YT pictures. The YT format appears on the upper part of the screen, and the XY format on the lower part of the screen. The YT format display area is one screen and any displayed waveforms are superimposed.					
XY + 2YT	Displays both YT and XY pictures. The YT format appears on the upper part of the screen, and the XY format on the lower part of the screen. The YT format display area is divided into two equal screens.					
Tandem	Displays graticules to the left and to the right.					
Colors						
You may choose a default color selection, or select your own color set. Different colors are used for displaying selected items: background, channels, functions, waveform memories, FFTs, TDR/TDTs, and histograms.						
Trace annotation						
The instrument gives you the ability to add an identifying label, bearing your own text, to a waveform display. For each waveform, you can create multiple labels and turn them all on or all off. Also, you can position them on the waveform by dragging or by specifying an exact horizontal position.						
Save/Recall	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Management						
Store and recall setups, waveforms and user mask files to any drive on your PC. Storage capacity is limited only by disk space.						
File extensions						
Waveform files: .wfm for binary format, .txt for verbose format (text), .txty for Y values formats (text). Database files: .wdb. Setup files: .set. User mask files: .pcm.						
Operating system						
Microsoft Windows® 7, 8 or 10, 32-bit or 64-bit						
Waveform save/recall						
Up to four waveforms may be stored into the waveform memories (M1 to M4), and then recalled for display.						
Save to/recall from disk						
You can save or recall your acquired waveforms to or from any drive on the PC. To save a waveform, use the standard Windows Save As dialog box. From this dialog box you can create subdirectories and waveform files, or overwrite existing waveform files. You can load, into one of the Waveform Memories, a file with a waveform you have previously saved and then recall it for display.						

Save/Recall (continued)	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Save/recall setups	The instrument can store complete setups in the memory and then recall them.					
Screen image	You can copy a screen image into the clipboard with the following formats: Full Screen, Full Window, Client Part, Invert Client Part, Oscilloscope Screen and Oscilloscope Screen.					
Autoscale	<p>Pressing the Autoscale key automatically adjusts the vertical channels, the horizontal scale factors, and the trigger level for a display appropriate to the signals applied to the inputs.</p> <p>The Autoscale feature requires a repetitive signal with a frequency greater than 100 Hz, duty cycle greater than 0.2%, amplitudes greater than 100 mV p-p. Autoscale is operative only for relatively stable input signals.</p>					
Marker	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Marker type	<p>X-Marker: vertical bars (measure time).</p> <p>Y-Marker: horizontal bars (measure volts).</p> <p>XY-Markers: waveform markers.</p>					
Marker measurements	Absolute, Delta, Volt, Time, Frequency, Slope.					
Marker motion	<p>Independent: both markers can be adjusted independently.</p> <p>Paired: both markers can be adjusted together.</p>					
Ratiometric measurements	Provide ratiometric measurements between measured and reference values. These measurements give results in such ratiometric units as %, dB, and degrees.					
Measure	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Automated measurements	Up to ten simultaneous measurements are supported at the same time.					
Automatic parametric	53 automatic measurements available.					
Amplitude measurements (17)	Maximum, Minimum, Top, Base, Peak-Peak, Amplitude, Middle, Mean, Cycle Mean, DC RMS, Cycle DC RMS, AC RMS, Cycle AC RMS, Positive Overshoot, Negative Overshoot, Area, Cycle Area.					
Timing measurements (18)	Period, Frequency, Positive Width, Negative Width, Rise Time, Fall Time, Positive Duty Cycle, Negative Duty Cycle, Positive Crossing, Negative Crossing, Burst Width, Cycles, Time at Maximum, Time at Minimum, Positive Jitter p-p, Positive Jitter RMS, Negative Jitter p-p, Negative Jitter RMS.					
Inter-signal measurements (13)	Delay (8 options), Phase Deg, Phase Rad, Phase %, Gain, Gain dB.					
FFT measurements (5)	FFT Magnitude, FFT Delta Magnitude, THD, FFT Frequency, FFT Delta Frequency.					
Measurement statistics	Displays current, minimum, maximum, mean and standard deviation on any displayed waveform measurements.					
Method of top-base definition	Histogram, Min/Max, or User-Defined (in absolute voltage).					
Thresholds	Upper, middle and lower horizontal bars settable in percentage, voltage or divisions. Standard thresholds are 10–50–90% or 20–50–80%.					
Margins	Any region of the waveform may be isolated for measurement using left and right margins (vertical bars).					
Measurement mode	Repetitive or Single-shot.					
Counter	Built-in frequency counter					
Source	Internal or External	Internal from any of two channels or External Direct	Internal from any of four channels	Internal or External	Internal from any of two channels, External Direct or External Prescaled.	Internal from any of four channels or External Prescaled.
Resolution	7 digits					
Maximum frequency, guaranteed	6 GHz				Internal or External Direct: 6 GHz. External Prescaled: 16 GHz.	
Measurement	Frequency, period					
Time reference	Internal 250 MHz reference clock					

Mathematics	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Waveform math	Up to four math waveforms can be defined and displayed using math functions F1 to F4					
Categories and math operators						
Arithmetic (12)	Add, Subtract, Multiply, Divide, Ceil, Floor, Fix, Round, Absolute, Invert, Common, Rescale.					
Algebra (14)	Exponentiation (e), Exponentiation (10), Exponentiation (a), Logarithm (e), Logarithm (10), Logarithm (a), Differentiate, Integrate, Square, Square Root, Cube, Power (a), Inverse, Square Root of the Sum.					
Trigonometry (12)	Sine, Cosine, Tangent, Cotangent, Arcsine, Arc cosine, Arctangent, Arc cotangent, Hyperbolic Sine, Hyperbolic Cosine, Hyperbolic Tangent, Hyperbolic Cotangent.					
FFT (6)	Complex FFT, FFT Magnitude, FFT Phase, FFT Real, FFT Imaginary, Inverse FFT, FFT Group Delay.					
Bit Operator (7)	AND, NAND, OR, NOR, XOR, XNOR, NOT.					
Miscellaneous (4)	Trend, Linear Interpolation, Sin(x)/x Interpolation, Smoothing.					
Formula Editor	You can build math waveforms using the Formula Editor control window.					
FFT						
FFT frequency span	Frequency Span = Sample Rate / 2 = Record Length / (2 × Timebase Range)					
FFT frequency resolution	Frequency Resolution = Sample Rate / Record Length					
FFT windows	The built-in filters (Rectangular, Hamming, Hann, Flattop, Blackman–Harris and Kaiser–Bessel) allow optimization of frequency resolution, transients, and amplitude accuracy.					
FFT measurements	Marker measurements can be made on frequency, delta frequency, magnitude, and delta magnitude. Automated FFT Measurements include: FFT Magnitude, FFT Delta Magnitude, THD, FFT Frequency, and FFT Delta Frequency.					
Histogram	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Histogram axis	Vertical, or Horizontal. Both vertical and horizontal histograms, with periodically updated measurements, allow statistical distributions to be analyzed over any region of the signal.					
Histogram measurement set (15)	Scale, Offset, Hits in Box, Waveforms, Peak Hits, Pk-Pk, Median, Mean, Standard Deviation, Mean ± 1 Std Dev, Mean ± 2 Std Dev, Mean ± 3 Std Dev, Min, Max-Max, Max.					
Histogram window	The histogram window determines which part of the database is used to plot the histogram. You can set the size of the histogram window to be any size that you want within the horizontal and vertical scaling limits of the scope.					
Eye Diagram	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Eye diagram	The oscilloscope can automatically characterize an NRZ and RZ eye pattern. Measurements are based upon statistical analysis of the waveform.					
NRZ measurement set (42)	AC RMS, Area, Bit Rate, Bit Time, Crossing %, Crossing Level, Crossing Time, Cycle Area, Duty Cycle Distortion (%), s), Extinction Ratio (dB, %, ratio), Eye Amplitude, Eye High, Eye High dB, Eye Width (%), s), Fall Time, Frequency, Jitter (p-p, RMS), Max, Mean, Mid, Min, Negative Overshoot, Noise p-p (One, Zero), Noise RMS (One, Zero), One Level, Peak-Peak, Period, Positive Overshoot, Rise Time, RMS, Signal-to-Noise Ratio, Signal-to-Noise Ratio dB, Zero Level.					
RZ measurement set (43)	AC RMS, Area, Bit Rate, Bit Time, Contrast Ratio (dB, %, ratio), Cycle Area, Extinction Ratio (dB, %, ratio), Eye Amplitude, Eye High, Eye High dB, Eye Opening Factor, Eye Width (%), s), Fall Time, Jitter P-p (Fall, Rise), Jitter RMS (Fall, Rise), Max, Mean, Mid, Min, Negative Crossing, Noise P-p (One, Zero), Noise RMS (One, Zero), One Level, Peak-Peak, Positive Crossing, Positive Duty Cycle, Pulse Symmetry, Pulse Width, Rise Time, RMS, Signal-to-Noise, Zero Level.					
Mask Test	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Mask test	Acquired signals are tested for fit outside areas defined by up to eight polygons. Any samples that fall within the polygon boundaries result in test failures. Masks can be loaded from disk, or created automatically or manually.					
Mask creation	You can create the following Mask: Standard predefined Mask, Automask, Mask saved on disk, Create new mask, Edit any mask.					
Standard mask	Standard predefined optical or standard electrical masks can be created.					
SONET/SDH (10)	OC1/STMO (51.84 Mb/s), OC3/STM1 (155.52 Mb/s), OC9/STM3 (466.56 Mb/s), OC12/STM4 (622.08 Mb/s), OC18/STM6 (933.12 Mb/s), OC24/STM8 (1.2442 Gb/s), OC48/STM16 (2.48832 Gb/s), FEC 2666 (2.6666 Gb/s) OC192/STM64 (9.95328 Gb/s), FEC1066 (10.664 Gb/s)					

Mask Test (continued)	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Fibre Channel (31)	FC133 Electrical (132.8 Mb/s), FC133 Optical (132.8 Mb/s), FC266 Electrical (265.6 Mb/s), FC266 Optical (265.6 Mb/s), FC531 Electrical (531.35 Mb/s), FC531 Optical (531.35 Mb/s), FC1063 Electrical (1.0625 Gb/s), FC1063 Optical (1.0625 Gb/s), FC1063 Optical PI Rev13 (1.0625 Gb/s), FC1063E Abs Beta Rx.mask (1.0625 Gb/s), FC1063E Abs Beta Tx.mask (1.0625 Gb/s), FC1063E Abs Delta Rx.mask (1.0625 Gb/s), FC1063E Abs Delta Tx.mask (1.0625 Gb/s), FC1063E Abs Gamma Rx.mask (1.0625 Gb/s), FC1063E Abs Gamma Tx.mask (1.0625 Gb/s), FC2125 Optical (2.1231 Gb/s), FC2125 Optical PI Rev13 (2.1231 Gb/s), FC2125E Abs Beta Rx.mask (2.125 Gb/s), FC2125E Abs Beta Tx.mask (2.125 Gb/s), FC2125E Abs Delta Rx.mask (2.125 Gb/s), FC2125E Abs Delta Tx.mask (2.125 Gb/s), FC2125E Abs Gamma Rx.mask (2.125 Gb/s), FC2125E Abs Gamma Tx.mask (2.125 Gb/s). FC4250 Optical PI Rev13 (4.25 Gb/s), FC4250E Abs Beta Rx.mask (4.25 Gb/s), FC4250E Abs Beta Tx.mask (4.25 Gb/s), FC4250E Abs Delta Rx.mask (4.25 Gb/s), FC4250E Abs Delta Tx.mask (4.25 Gb/s), FC4250E Abs Gamma Rx.mask (4.25 Gb/s), FC4250E Abs Gamma Tx.mask (4.25 Gb/s)					
Ethernet (11)	100BASE-BX10 (125 Mb/s), 100BASE-BX/LX10 (125 Mb/s), 1.25 Gb/s 1000Base-CX Absolute TP2 (1.25 Gb/s), 1.25 Gb/s 1000Base-CX Absolute TP3 (1.25 Gb/s), GB Ethernet (1.25 Gb/s), 2XGB Ethernet (2.5 Gb/s), 3.125 Gb/s 10GBase-CX4 Absolute TP2 (3.125 Gb/s). 10Gb Ethernet (9.953 Gb/s), 10GbE 9.953 (9.953 Gb/s), 10Gb Ethernet (10.3125 Gb/s), 10GbE 10.3125 (10.3125 Gb/s).					
Infiniband (16)	2.5G InfiniBand Cable mask (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 1 (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 10 (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 2 (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 3 (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 4 (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 5 (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 6 (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 7 (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 8 (2.5 Gb/s), 2.5G InfiniBand Driver Test Point 9 (2.5 Gb/s), 2.5G InfiniBand Receiver mask (2.5 Gb/s), InfiniBand (2.5 Gb/s). 5.0G InfiniBand Driver Test Point 1 (5 Gb/s), 5.0G InfiniBand Driver Test Point 6 (5 Gb/s), 5.0G InfiniBand Transmitter Pins (5 Gb/s)					
XAUI (4)	3.125 Gb/s XAUI Far End (3.125 Gb/s), 3.125 Gb/s XAUI Far End (3.125 Gb/s), XAUI-E Far (3.125 Gb/s), XAUI-E Near (3.125 Gb/s)					
ITU G.703 (14)	DS1, 100 Ω twisted pair (1.544 Mb/s), 2 Mb 120, 120 Ω twisted pair (2.048 Mb/s), 2 Mb 75, 75 Ω coax (2.048 Mb/s), DS2 110, 110 Ω twisted pair (6.312 Mb/s), DS2 75, 75 Ω coax (6.312 Mb/s), 8 Mb, 75 Ω coax (8.448 Mb/s), 34 Mb, 75 Ω coax (34.368 Mb/s), DS3, 75 Ω coax (44.736 Mb/s), 140 Mb 0, 75 Ω coax (139.264 Mb/s), 140 Mb 1, 75 Ω coax (139.264 Mb/s), 140 Mb 1 Inv, 75 Ω coax (139.264 Mb/s), 155 Mb 0, 75 Ω coax (155.520 Mb/s), 155 Mb 1, 75 Ω coax (155.520 Mb/s), 155 Mb 1 Inv, 75 Ω coax (155.520 Mb/s).					
ANSI T1/102 (7)	DS1, 100 Ω twisted pair, (1.544 Mb/s), DS1C, 100 Ω twisted pair, (3.152 Mb/s), DS2, 110 Ω twisted pair, (6.312 Mb/s), DS3, 75 Ω coax, (44.736 Mb/s), STS1 Eye, 75 Ω coax, (51.84 Mb/s), STS1 Pulse, 75 Ω coax, (51.84 Mb/s), STS3, 75 Ω coax, (155.520 Mb/s)					
RapidIO (9)	RapidIO Serial Level 1, 1.25G Rx (1.25 Gb/s), RapidIO Serial Level 1, 1.25G Tx LR (1.25 Gb/s), RapidIO Serial Level 1, 1.25G Tx SR (1.25 Gb/s), RapidIO Serial Level 1, 2.5G Rx (2.5 Gb/s), RapidIO Serial Level 1, 2.5G Tx LR (2.5 Gb/s), RapidIO Serial Level 1, 2.5G Tx SR (2.5 Gb/s), RapidIO Serial Level 1, 3.125G Rx (3.125 Gb/s), RapidIO Serial Level 1, 3.125G Tx LR (3.125 Gb/s), RapidIO Serial Level 1, 3.125G Tx SR (3.125 Gb/s)					
PCI Express (41)	R1.0a 2.5G Add-in Card Transmitter Non-Transition bit mask (2.5 Gb/s), R1.0a 2.5G Add-in Card Transmitter Transition bit mask (2.5 Gb/s), R1.0a 2.5G Exp.Card Host Non-Transition bit mask (2.5 Gb/s), R1.0a 2.5G Exp.Card Host Transition bit mask (2.5 Gb/s), R1.0a 2.5G Exp.Card Module Non-Transition bit mask (2.5 Gb/s), R1.0a 2.5G Exp.Card Module Transition bit mask (2.5 Gb/s), R1.0a 2.5G Exp.Card Transmitter Non-Transition bit mask (2.5 Gb/s),					

Mask Test (continued)	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
PCI Express (continued)	R1.0a 2.5G Exp.Card Transmitter Transition bit mask (2.5 Gb/s), R1.1 2.5G Add-in Card Transmitter Non-Transition bit mask (2.5 Gb/s), R1.1 2.5G Add-in Card Transmitter Transition bit mask (2.5 Gb/s), R1.1 2.5G Cable Receiver End Non-Transition bit mask (2.5 Gb/s), R1.1 2.5G Cable Receiver End Transition bit mask (2.5 Gb/s), R1.1 2.5G Cable Transmitter End Non-Transition bit mask (2.5 Gb/s), R1.1 2.5G Cable Transmitter End Transition bit mask (2.5 Gb/s), R1.1 2.5G Express Module System Non-Transition bit mask (2.5 Gb/s), R1.1 2.5G Express Module System Transition bit mask (2.5 Gb/s), R1.1 2.5G Express Module Transmitter Path Non-Transition bit mask (2.5 Gb/s), R1.1 2.5G Express Module Transmitter Path Transition bit mask (2.5 Gb/s), R1.1 2.5G Receiver mask (2.5 Gb/s), R1.1 2.5G System Board Transmitter Non-Transition bit mask (2.5 Gb/s), R1.1 2.5G System Board Transmitter Transition bit mask (2.5 Gb/s), R1.1 2.5G Transmitter Non-Transition bit mask (2.5 Gb/s), R1.1 2.5G Transmitter Transition bit mask (2.5 Gb/s)			R2.0 5.0G Add-in Card 35 dB Transmitter Non-Transition bit mask (5 Gb/s), R2.0 5.0G Add-in Card 60 dB Transmitter Non-Transition bit mask (5 Gb/s), 2.0 5.0G Add-in Card 35 dB Transmitter Transition bit mask (5 Gb/s), R2.0 5.0G Add-in Card 60 dB Transmitter Transition bit mask (5 Gb/s), R2.0 5.0G Mobile Transmitter mask (5 Gb/s), R2.0 5.0G Receiver mask (5 Gb/s), R2.0 5.0G System Board Transmitter Non-Transition bit mask (5 Gb/s), R2.0 5.0G System Board Transmitter Transition bit mask (5 Gb/s), R2.0 5.0G Transmitter Non-Transition bit mask (5 Gb/s), R2.0 5.0G Transmitter Transition bit mask (5 Gb/s), R2.1 5.0G Transmitter Non-Transition bit mask (5 Gb/s), R2.1 5.0G Transmitter Transition bit mask (5 Gb/s)		
Serial ATA (24)	Ext Length, 1.5G 250 Cycle, Rx Mask (1.5 Gb/s), Ext Length, 1.5G 250 Cycle, Tx Mask (1.5 Gb/s), Ext Length, 1.5G 5 Cycle, Rx Mask (1.5 Gb/s), Ext Length, 1.5G 5 Cycle, Tx Mask (1.5 Gb/s), Gen1, 1.5G 250 Cycle, Rx Mask (1.5 Gb/s), Gen1, 1.5G 250 Cycle, Tx Mask (1.5 Gb/s), Gen1, 1.5G 5 Cycle, Rx Mask (1.5 Gb/s), Gen1, 1.5G 5 Cycle, Tx Mask (1.5 Gb/s), Gen1m, 1.5G 250 Cycle, Rx Mask (1.5 Gb/s), Gen1m, 1.5G 250 Cycle, Tx Mask (1.5 Gb/s), Gen1m, 1.5G 5 Cycle, Rx Mask (1.5 Gb/s), Gen1m, 1.5G 5 Cycle, Tx Mask (1.5 Gb/s), Ext Length, 3.0G 250 Cycle, Rx Mask (3 Gb/s), Ext Length, 3.0G 250 Cycle, Tx Mask (3 Gb/s), Ext Length, 3.0G 5 Cycle, Rx Mask (3 Gb/s), Ext Length, 3.0G 5 Cycle, Tx Mask (3 Gb/s), Gen1, 3.0G 250 Cycle, Rx Mask (3 Gb/s), Gen1, 3.0G 250 Cycle, Tx Mask (3 Gb/s), Gen1, 3.0G 5 Cycle, Rx Mask (3 Gb/s), Gen1, 3.0G 5 Cycle, Tx Mask (3 Gb/s), Gen1m, 3.0G 250 Cycle, Rx Mask (3 Gb/s), Gen1m, 3.0G 250 Cycle, Tx Mask (3 Gb/s), Gen1m, 3.0G 5 Cycle, Rx Mask (3 Gb/s), Gen1m, 3.0G 5 Cycle, Tx Mask (3 Gb/s).					
Mask margin	Available for industry-standard mask testing					
Automask creation	Masks are created automatically for single-valued voltage signals. Automask specifies both delta X and delta Y tolerances. The failure actions are identical to those of limit testing.					
Data collected during test	Total number of waveforms examined, number of failed samples, number of hits within each polygon boundary					
System requirements	FS1051	FS2052	FS3054	FS1161	FS2162	FS3164
Processor	Pentium-class processor or equivalent					
Memory	4 GB					
Disk space	Software occupies about 50 MB					
Operating system	Windows 7, Windows 8 or Windows 10. 32-bit and 64-bit versions					
PC connection port						
USB	USB 2.0 (high speed). Also compatible with USB 3.0					
LAN	N/A		LAN	N/A		LAN

Calibrator Output	FemtoScope 3000 only
Output mode	DC, 1 kHz square, Meander with frequency from 15.266 Hz to 500 kHz.
Output DC level	Adjustable from -1 V to +1 V into 50 Ω. Coarse increment: 50 mV, fine increment: 1 mV.
Output DC level accuracy	± 1 mV ± 0.5% of output DC level
Output impedance	50 Ω nominal
Rise/Fall time	150 ns, typical
Output connectors	SMA female

Trigger Output	FemtoScope 1051	FemtoScope 3054	FemtoScope 1161	FemtoScope 3164
Timing	Positive transition equivalent to acquisition trigger point.			
Low level	(-0.2 ± 0.1) V. Measured into 50 Ω.			
Amplitude	(900 ± 200) mV. Measured into 50 Ω.			
Rise time	10% to 90%: ≤ 0.45 ns. 20% to 80%: ≤ 0.3 ns.			
RMS jitter	2 ps or less.			
Output delay	(4 ± 1) ns			
Output coupling	DC-coupled			
Output connectors	SMA female			

Recovered Data Output	FemtoScope 2052	FemtoScope 3054	FemtoScope 2162	FemtoScope 3164
Data Rate	6.5 Mb/s to 5 Gb/s		6.5 Mb/s to 11.3 Gb/s	
Eye amplitude	250 mV p-p typical			
Eye rise/fall time	20%–80%: 70 ps, typical. Measured at 5-GHz channel.		20%–80%: 50 ps, typical. Measured at 16-GHz channel	
RMS jitter	2 ps +1% of UI, typical			
Output coupling	AC-coupled			
Output connections	SMA female			

Recovered Clock Output	FemtoScope 2052	FemtoScope 3054	FemtoScope 2162	FemtoScope 3164
Output frequency	Half rate clock output, 3.25 MHz to 2.5 GHz		Half rate clock output, 3.25 MHz to 5.65 GHz	
Output amplitude	250 mV p-p, typical			
Output coupling	AC-coupled			
Output connectors	SMA female			

General	FemtoScope 1000	FemtoScope 2000	FemtoScope 3000
Power requirements			
Power supply voltage	+12 V ± 5%		
Power supply current	1.3 A max	1.8 A max	2.7 A max
Protection	Auto shutdown on excess or reverse voltage		
AC-DC adaptor	Universal adaptor supplied		
Physical characteristics			
Dimensions			
Width	113.9 mm	160 mm	244 mm
Height	33.5 mm w/o feet, 41.8 mm with feet	50 mm w/o feet, 54 mm with feet	64 mm
Depth	162 mm (w/o connectors), 187 mm (with connectors)	210 mm (w/o connectors), 225 mm (with connectors)	233 mm
Net weight	370 g	790 g	1.52 kg
Environmental conditions			
Temperature	Normal: +5°C to +40°C. For quoted accuracy: +15°C to +25°C. Storage: -20°C to +50°C.		
Humidity	Operating: Up to 85 % relative humidity at +25°C. Storage: Up to 95 % relative humidity		

Our partners



www.picotech.com

Pico Technology is a UK-based manufacturer of high-precision PC-based oscilloscopes and automotive diagnostics equipment, founded in 1991. The product range includes the PicoScope line of PC-based oscilloscopes, data loggers, automotive equipment, and most recently, handheld USB-based oscilloscopes.

Since their inception in 1991, Pico Tech has been researching and developing PC-based oscilloscopes, when the market standard was analogue storage oscilloscopes. Pico Technology is one of two European scope manufacturers, and competes in the low to middle end of the instrumentation market.

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www.prist.ru

The Prist company was established in 1994 and has been developing fast since then. During these years the company has grown into one of the biggest Russian suppliers of devices for electrical measurements, radio measurements and the measurement of environmental parameters.

Today Prist has more than 80 highly qualified employees with offices in Moscow, Saint- Petersburg, Ekaterinburg and lots of partners-distributors throughout Russia, Belorussia and Kazakhstan.

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Since 2004, ACQUITEK has been selling electronic systems and equipment related to data acquisition, Test and Measurement, and Time Frequency. Acquitek also provides the services associated with this equipment through specialized partners (Integration, Software Development, Mechanical Design and After-Sales Service)

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Signal Solutions is a relatively young company but with highly experienced employees. It focuses on RF/Microwave, Fiber Optics, EMC and Shielding technology. All engineers have long experience from the industry.

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This information is subject to change without notice.

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FemtoScope 1000/2000/3000 Data Sheet. v1.2.

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