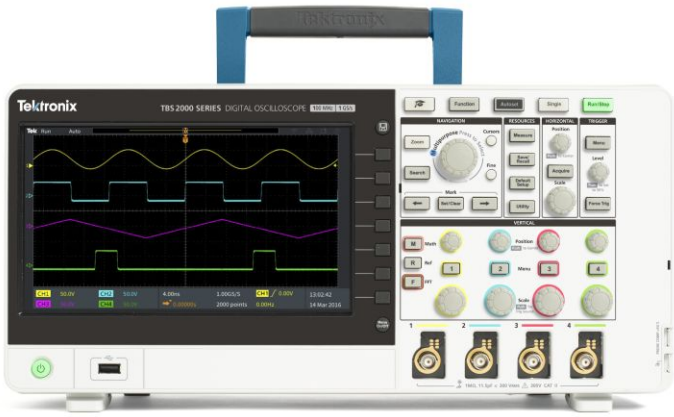
Tektronix

Digital Storage Oscilloscope

TBS2000 Series Datasheet



With a 9-inch WVGA display, 20 million point record length and 1 GS/s sample rate, TBS2000 Series Oscilloscopes capture and display significantly more signal to help you evaluate designs faster. Easily and confidently analyze your signals with new on-waveform cursor readouts and 32 automated measurements, each with informative tips to help you quickly choose the right one. The TekVPI® probe interface works with traditional BNC connections, but also enables wide application coverage with the latest active voltage probes and current probes.

Key performance specifications

- 2 and 4 analog channel models
- 100 and 70 MHz bandwidth models
- Up to 1 GS/s sampling rate
- 20 M record length on all channels
- 5 year warranty

Key features

- 9-inch WVGA color display
- 15 horizontal grids show 50% more signal
- TekVPI probe interface supports active, differential, and current probes with automatic scaling and units
- 32 automated measurements, and FFT function for thorough waveform analysis
- HelpEverywhere provides helpful on-screen tips
- Built-in Scope Intro handbook provides operating instructions and oscilloscope fundamentals
- 2-channel models are highly-portable at 2.62 kg (5.8 lbs)

Connectivity

- USB 2.0 host port on the front panel for quick and easy data storage
- Wi-Fi interface provides wireless communications capability [1] support
- USB 2.0 device port on rear panel for easy connection to a PC
- LXI compliant 10/100BASE-T Ethernet port for remote control over LAN

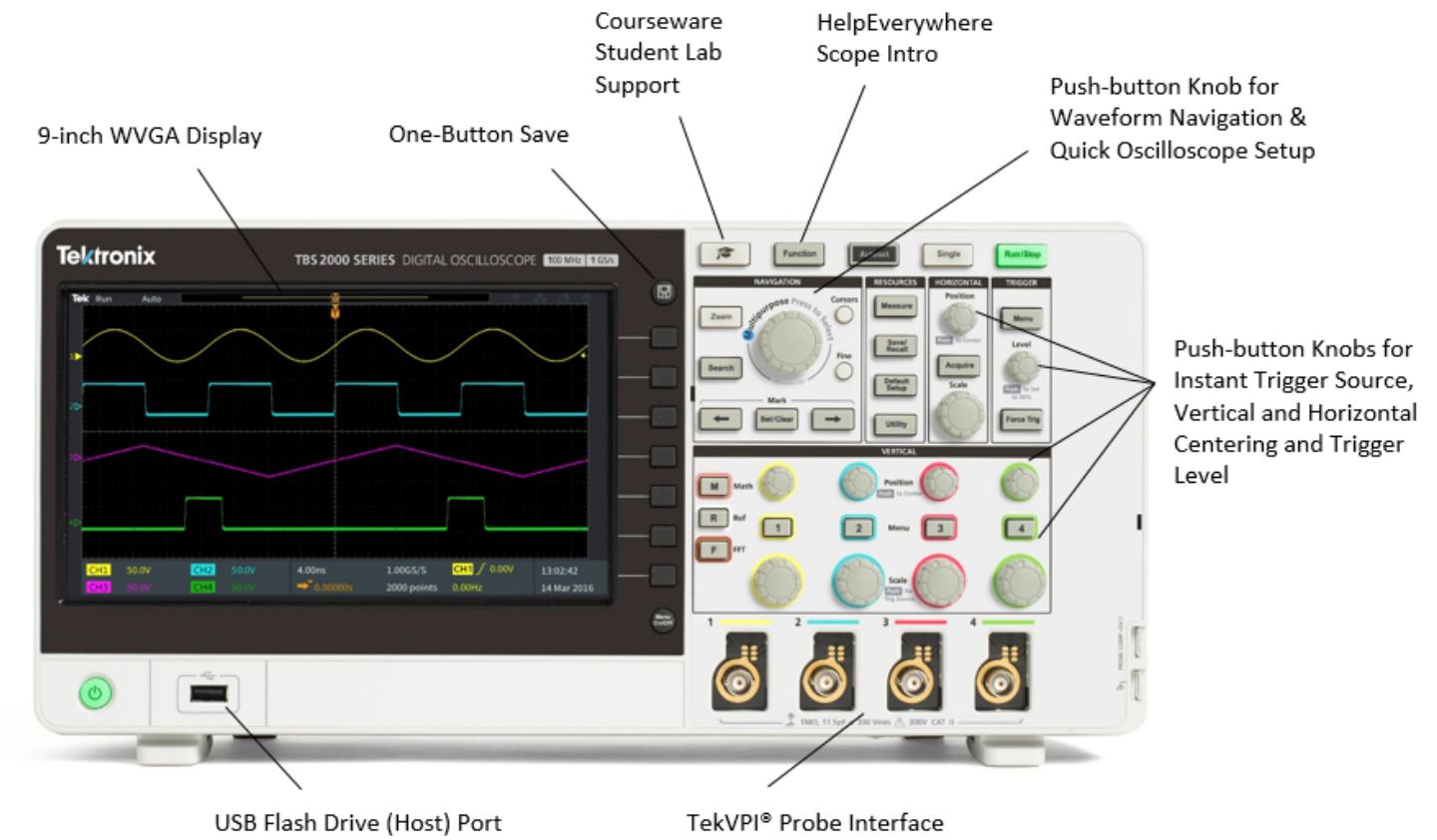
Education

- Courseware function presents lab exercise guidance on the display
- Fully compatible with TekSmartLab lab management software for education

Designed to make your work easier

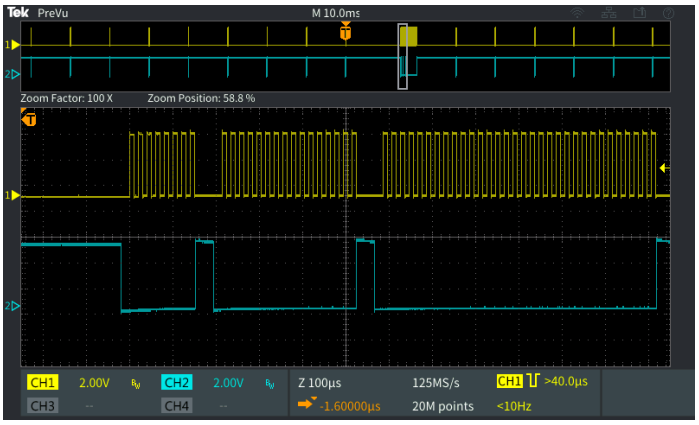
The TBS2000 Series is designed for easy operation and quick hands-on learning. Dedicated controls provide quick access to important settings, so you can evaluate signals faster. Many oscilloscopes provide 8 vertical divisions and 10 horizontal divisions, but the TBS2000 gives you 10 vertical divisions and **15 horizontal divisions**, so you can see more of your signal. The display also offers more room for measurement results and menu information.

[1] A Wi-Fi adapter is available in some countries from Tektronix distributors as an accessory, model TEK-USB-WIFI. See Ordering Information for details.

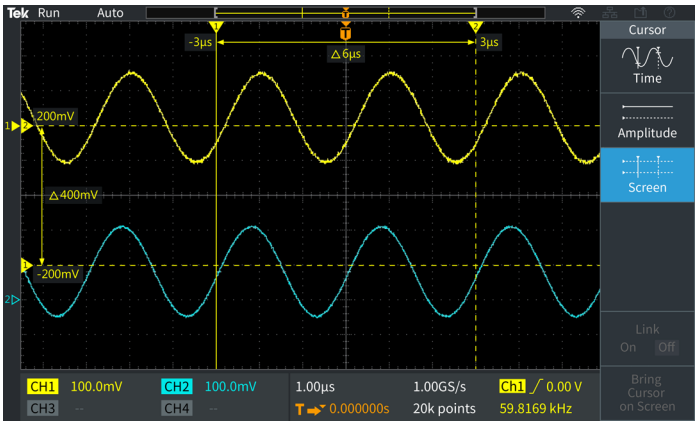


Designed for outstanding waveform visualization and analysis

Long record length with pan and zoom – Record length is selectable, from 2000 samples up to 20 million samples for capturing long time periods. The exceptionally long record length will help you find signal anomalies and verify digital communications. To help navigate long acquisitions, the Zoom function lets you quickly pan through the record and zoom in to see signal details.



In Zoom mode, the upper display gives an overview of up to 20 M points. The detailed zoomed view is shown in the lower display.

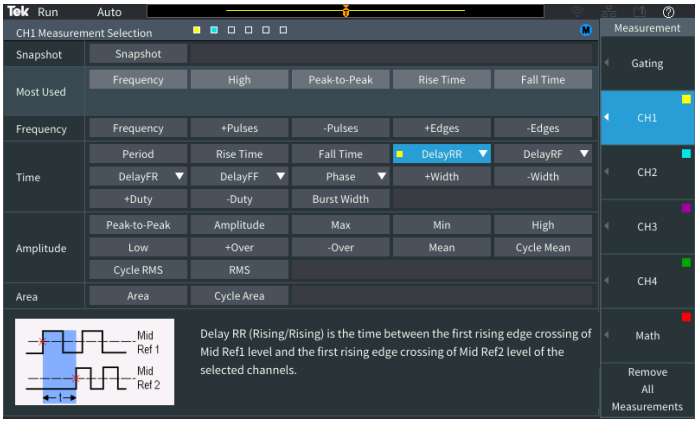


The cursor readouts are presented on the waveform display. Cursors can be used to measure time, amplitude, or both.

Versatile triggering and acquisition modes – The trigger system is designed for troubleshooting today's mixed signal designs. Beyond a basic edge trigger, it also includes pulse width and runt triggering, which are especially useful for troubleshooting digital sections of your designs. Pulse width triggering is perfect for hunting narrow glitches or timeout conditions. You specify a voltage threshold and a width, and the oscilloscope triggers when the pulses are too narrow, too wide, or of a particular duration. Runt triggering is designed to capture signals that are shorter in amplitude than expected. It lets you specify two voltage thresholds and a width. If a pulse amplitude falls between the two thresholds, the oscilloscope will trigger.

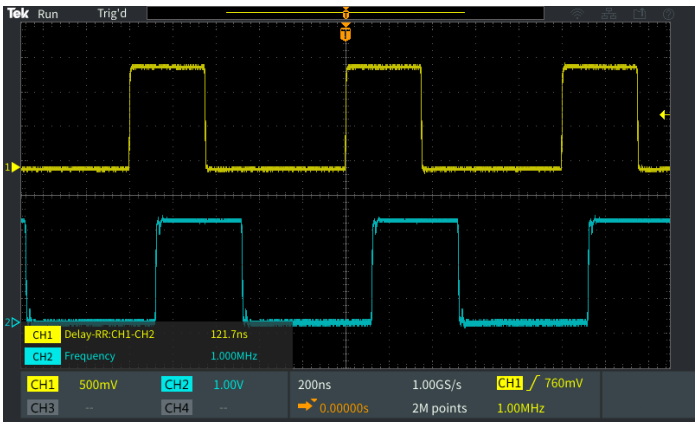
The default acquisition mode is Sample Mode which works well for most applications. However the instrument also offers Peak Detect Mode which is useful for hunting spikes, and Average Mode which can help reduce noise on repetitive signals.

Automated measurements are easier than ever – A comprehensive set of automated measurements enable fast and convenient testing for a wide range of signals and applications.



Measurements are all listed and selected on a single screen.

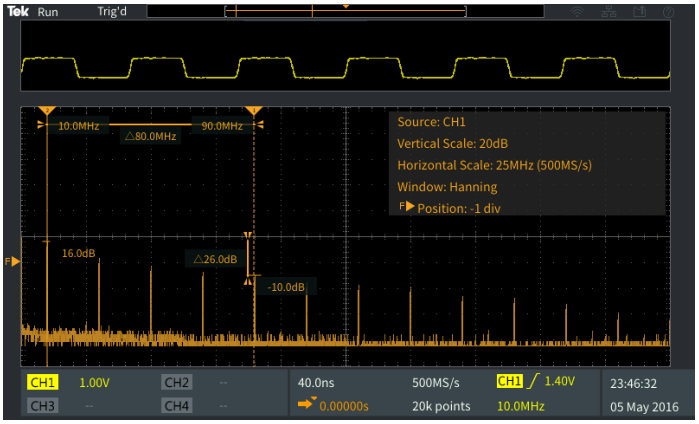
A single measurement selection screen makes it easy to choose from 32 automated measurements without having to hunt through multiple menus. Choose from among your most frequently-used measurements which are tracked at the top of the page, or select from four categories: frequency, time, amplitude, and area. The HelpEverywhere system provides tips for each measurement, making it easier to know which measurement to use and to understand the results.



Measurements are transparent so waveforms are not obscured.

Measurements are color coded by the source, and are presented on a transparent background, so waveforms are not obscured by the readouts.

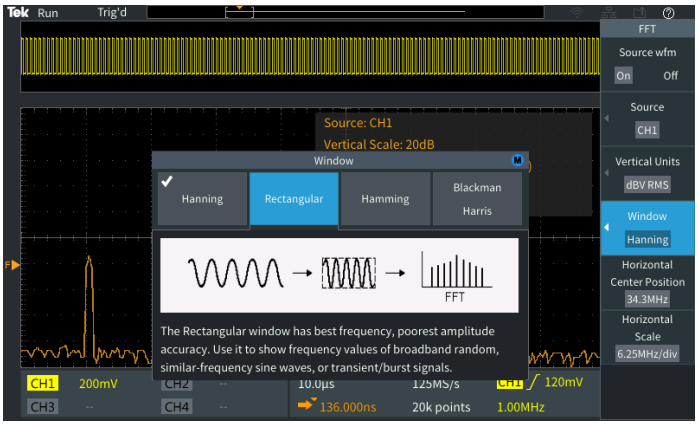
FFT function – You can understand the frequency content of your signals with the FFT function by pressing the dedicated front-panel FFT button. Display only the FFT, or turn on the source waveform display to see both the spectrum and the time domain waveform. A transparent readout shows important settings without blocking the FFT display.



The time domain source waveform can be displayed above the FFT frequency spectrum.

Built-in tips for faster setup

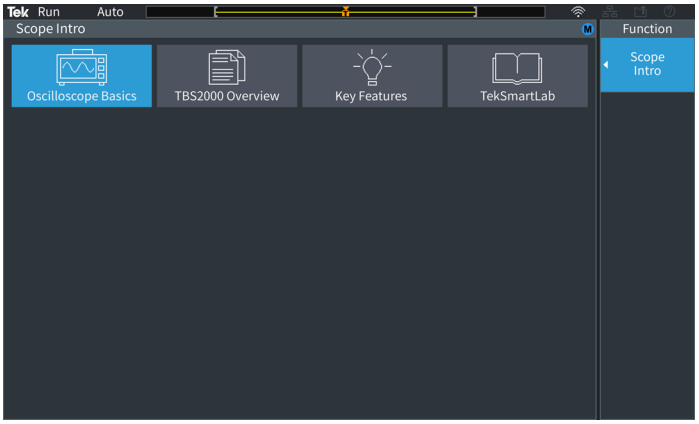
HelpEverywhere is a unique feature on theTBS2000. It shows instant help information as you navigate through key menus. The tips include measurement information, application tips, and general guidance in the form of text and graphics. You can turn tips on and off from the HelpEverywhere menu.

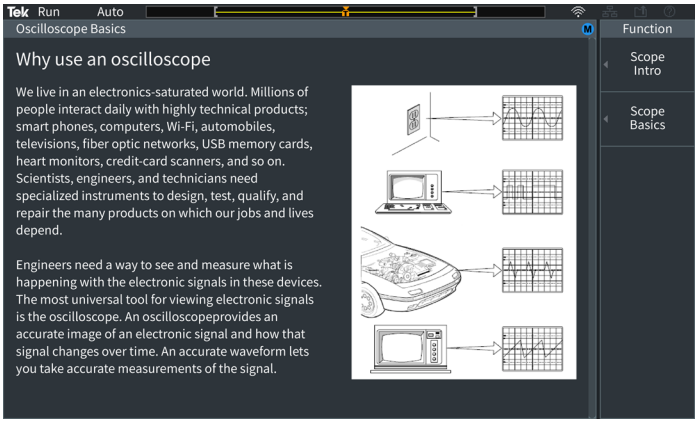


HelpEverywhere tips explain important settings.

On-screen scope fundamentals

Scope Intro is a brief handbook embedded in the TBS2000. Pressing the front panel Function button gives you access to information on oscilloscope basic operations, as well as an overview of the TBS2000 and TekSmartLab Lab Management System for education.





Scope Intro covers basic oscilloscope and TBS2000 usage

First in its class with wireless communications

On the rear of the instrument, you will find several communications ports. The USB device port or LAN port can be used to control the instrument using the fully-documented command set.

Wi-Fi adapters are configured through integrated setup menus and support seamless wireless communications

The TBS2000 is the first oscilloscope in its class to support wireless communication. Plug a Wi-Fi dongle into the USB host port and set the interface for Wi-Fi from the front panel. A Wi-Fi dongle is available as TEK-USB-WIFI. Several off-the-shelf dongles have also been tested and their operation confirmed.

LXI embedded Web page for instrument control – LXI is an industry standard based on LAN connectivity for flexible, reliable, and efficient communication and control. TBS2000 supports LXI Core 2011. The TBS2000 LXI Web page can be accessed by simply typing the instrument IP address into any Web browser.

LXI control screen and waveform display enable remote control over Ethernet

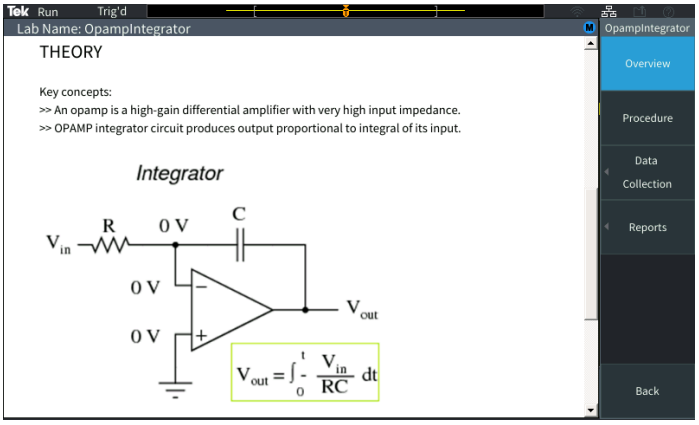
TekVPI® Interface and active probe support

The TekVPI probe interface sets the standard for ease of use in probing. With this interface the TBS2000 Series supports a wide range of the latest voltage and current probes, providing coverage for many applications. These probes are powered by and communicate with the TBS2000 through the interface. Scale factors and status information, such as error conditions, are sent to the instrument for processing and display. This saves you from having to manually set scale factors, calculate offsets, or monitor for open jaw conditions or the need to degauss your current probes.

TekVPI probes communicate scale settings, ranges, and status to the TBS2000.

Innovative new education solutions

The TBS2000 offers distinctive new ways to enable educators to devote more time to teaching circuit concepts instead of lab setup and management.



The Courseware function allows students to see lab information on the instrument display.

The integrated Courseware function allows professors to load lab exercises on the instrument to give students guidance at each station, and provides a structured framework into which students can capture data to incorporate into their reports. Over 100 sample lab exercises are available for download from the Tektronix Courseware Resource Center.

The TBS2000 can be easily integrated into the TekSmartLab System. Together they enable educators to preset a lab full of instruments with a few mouse-clicks, and allow lab instructors to track every student's progress from one central workstation.

Performance you can count on

Tektronix has industry-leading service and support, and every TBS2000 series oscilloscope is backed with a standard 5-year warranty.

Specifications

All specifications are guaranteed unless noted otherwise. All specifications apply to all models unless noted otherwise.

Model overview

	TBS2072	TBS2102	TBS2074	TBS2104
Analog channels	2	2	4	4
Bandwidth	70 MHz	100 MHz	70 MHz	100 MHz
Sample rate	1 GS/s	1 GS/s	1 GS/s	1 GS/s
Record length	20 M points	20 M points	20 M points	20 M points

Vertical system analog channels

Hardware bandwidth limits	20 MHz
Input coupling	DC, AC, or GND
Input impedance	1 MΩ ± 2 %, 11.5 pF ± 2.5 pF
Input sensitivity range	2 mV/Div to 5 V/Div
Vertical resolution	8 bits
Maximum input voltage, 1 MΩ	300 V RMS with peaks ≤ ±450 V
Acquisition modes	
Sample	Acquire sampled values.
Peak Detect	Captures glitches as narrow as 3.5 ns at all sweep speeds.
Average	From 2 to 512 waveforms included in average.
Hi-Res	Averages multiple sample of one acquisition interval into one waveform point.
Roll	Scrolls waveforms right to left across the screen at sweep speeds slower than or equal to 40 ms/div (400 ms/div at 20M record length).
Math modes	
All units:	Ch 1 - Ch 2
	Ch 2 - Ch 1
	Ch 1 + Ch 2
	Ch 1 X Ch 2
	FFT
4 channel units:	Ch 3 - Ch 4
	Ch 3 + Ch 4
	Ch 4 - Ch 3
	Ch 3 X Ch 4
DC balance	± (1 mV +0.1 div)
DC gain accuracy	± 3% 10 mV/div through 5 V/div-
	± 4% typical 2 mV/div and 5 mV/div

Vertical system analog channels

DC voltage measurement accuracy average mode

Average of 16 waveforms	±((DC Gain Accuracy) X |reading - (offset - position)| + Offset Accuracy + 0.11 div + 1 mV)
Delta Volts between any two averages of ≥16 waveforms acquired with the same oscilloscope setup and ambient conditions	±(DC Gain Accuracy X |reading| + 0.08 div + 1.4 mV)

Vertical position range ± 5 divisions

Vertical offset ranges

Volts/Div setting	Offset range, 1 MΩ
2 mV/div to 200 mV/div	± 0.8 V
> 200 mV/div to 5 V/div	± 20 V

Analog bandwidth, DC coupled

100 MHz models:	DC to ≥100 MHz for 2 mV/div through 5 V/div.
70 MHz models:	DC to ≥70 MHz for 2 mV/div through 5 V/div.

Common mode rejection ratio (CMRR), typical 100:1 at 60 Hz, reducing to 10:1 with 50 MHz sine wave with equal Volts/div and coupling settings on each channel.

Channel-to-channel isolation

TBS2072, TBS2074	TBS2102, TBS2104
≥100:1 at ≤70 MHz	≥100:1 at ≤100 MHz

Horizontal system analog channels

Maximum duration of time captured at highest sample rate (all channels) 40 ms

Time base range 2 ns/div to 100 sec/div

Time-base delay time range -15 divisions to 5000 s

Deskew range ±100 ns

Time base accuracy ±25 ppm over any ≥1 ms interval

Trigger system

Trigger modes Auto, Normal, and Single

Trigger holdoff range 20 ns to 8 s

Trigger types

Edge	Positive or negative slope on any channel. Coupling includes DC, HF reject, LF reject, and noise reject.
Pulse width	Trigger on width of positive or negative pulses that are >, <, =, or ≠ a specified period of time.
Runt	Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again.

Trigger coupling analog channels DC, Noise Reject, High Freq Reject, Low Freq Reject.

Trigger system

Sensitivity, edge–type trigger, DC coupled

Trigger Source	Sensitivity
Analog inputs	0.4 division from DC to 50 MHz
	0.6 divisions >50 MHz to 100 MHz

Trigger level ranges Input channels: ± 4.90 divisions from center screen

Data storage

Nonvolatile memory retention time, typical No time limit for Front Panel Settings, saved waveforms, setups, and calibration constants.

Real-Time clock A programmable clock providing time in years, months, days, hours, minutes, and seconds.

Waveform measurements

Cursors Time, amplitude and screen.

Automated measurements 32, of which up to six can be displayed on-screen at any one time. Measurements include: Period, Frequency, Rise Time, Fall Time, Positive Duty Cycle, Negative Duty Cycle, Positive Pulse Width, Negative Pulse Width, Burst Width, Phase, Positive Overshoot, Negative Overshoot, Peak to Peak, Amplitude, High, Low, Max, Min, Mean, Cycle Mean, RMS, Cycle RMS, Positive Pulse Count, Negative Pulse Count, Rising Edge Count, Falling Edge Count, Area, Cycle Area, Delay FR, Delay FF, Delay FR, and Delay RR.

Gating Isolate the specific occurrence within an acquisition to take measurements on, using either the screen, between waveform cursors or full record length.

Waveform math

Arithmetic Add, subtract, and multiply waveforms.

FFT Spectral magnitude. Set FFT Vertical Scale to Linear RMS or dBV RMS, and FFT Window to Rectangular, Hamming, Hanning, or Blackman-Harris.

Remote control software

LXI web page LXI Core 2011. Built-in web page enables remote control of horizontal and vertical scale, trigger settings, and measurements. Allows waveform and image save to USB flash drive.

Display system

Display type 9 inch (228 mm) wide format liquid crystal TFT color display.

Display resolution 800 horizontal by 480 vertical displayed pixels (WVGA).

Waveform styles Vectors, Variable Persistence, and Infinite Persistence.

Graticules Grid, None.

Format YT and XY.

Input output ports

USB 2.0 high-speed host port	Supports USB mass storage devices, Wi-Fi dongle, One port available on rear panel and one on front panel.
USB 2.0 high-speed device port	
Device port	Rear-panel connector allows for communication/control of oscilloscope through USBTMC or GPIB with a TEK-USB-488.
Compatible USB-WIFI dongles	TBS2xxx USBWIFI option TEK-USB-WIFI accessory TP-LINK TL-WN823N, NETGEAR WNA1000M, WNA3100M
LAN port (Ethernet)	RJ-45 connector, supports 10/100BASE-T.
Probe compensator	
Amplitude	5 V
Frequency	1 kHz
Kensington-style lock	Rear-panel security slot connects to standard Kensington-style lock.

Power source

Power source voltage	100 to 240 V_{AC} RMS ±10%
Power source frequency	45 Hz to 65 Hz (90 to 264 V) 360 Hz to 440 Hz (100 to 132 V)
Power consumption	80 W maximum

Physical characteristics

Dimensions	
TBS2xx2:	Height: 174.9 mm (6.89 in) Width: 372.4 mm (14.66 in) Depth: 103.3 mm (4.07 in)
TBS2xx4:	Height: 201.5mm (7.93 in) Width: 412.8 mm (16.25 in) Depth: 128.1 mm (5.04 in)
Weight	
TBS2xx2:	2.62 kg (5.8 lbs.), standalone instrument. 5.1 kg (11.2 lbs.), when packaged for domestic shipment.
TBS2xx4:	4.17 kg (9.2 lbs.), stand-alone instrument. 7 kg (15.4 lbs.), when packaged for domestic shipment.
Cooling clearance	50 mm (2 in) required on left side and rear of instrument.

EMC, environment, and safety

Temperature	
Operating:	0 °C to +50 °C (+32 ºF to 122 ºF)
Nonoperating:	-40 °C to +71 °C (-40 ºF to 160 ºF)
Humidity	
Operating:	High: +30 °C to +50 °C, 5% to 60% relative humidity
	Low: 0 °C to +30 °C, 5% to 95% relative humidity
Nonoperating:	High: +30 °C to +55 °C, 5% to 60% relative humidity
	Low: 0 °C to +30 °C 5% to 95% relative humidity
Altitude	
Operating:	Up to 3,000 meters (9,842 feet).
Non-Operating:	Up to 12,000 meters (39,370 feet).
Regulatory	
Electromagnetic compatibility	EC Council Directive 2004/108/EC
Safety	UL61010-1:2004; CAN/CSA-C22.2 No. 61010.1: 2004; EN61010-1:2001; complies with the Low Voltage Directive 2004/108/EC for Product Safety.

Ordering information

Models

TBS2072	70 MHz, 1 GS/s, 20 M record length, 2-channel digital storage oscilloscope
TBS2102	100 MHz, 1 GS/s, 20 M record length, 2-channel digital storage oscilloscope
TBS2074	70 MHz, 1 GS/s, 20 M record length, 4-channel digital storage oscilloscope
TBS2104	100 MHz, 1 GS/s, 20 M record length, 4-channel digital storage oscilloscope

Standard accessories

Probes

TPP0100	100 MHz, 10x passive probe (one per analog channel)

Accessories

063-4568-xx	Documentation CD
071-3445-xx	Installation and safety manual
077-1149-xx	Programmer manual, available on documentation CD and on Tek Web
-	Power cord
-	Calibration certificate documenting traceability to National Metrology Institute(s) and ISO9001 quality system registration

Warranty Five-year warranty covering all parts and labor, excluding probes.

Recommended accessories

Probes Tektronix offers over 100 different probes to meet your application needs. For a comprehensive listing of available probes, please visit www.tektronix.com/probes.

P5100A	2.5 kV, 500 MHz, 100X high-voltage passive probe
TDP0500	500 MHz TekVPI ® differential voltage probe with ±42 V differential input voltage
THDP0200	±1.5 kV 200 MHz high-voltage differential probe
THDP0100	±6 kV 100 MHz high-voltage differential probe
TAP1500	1.5 GHz TekVPI ® active voltage probe
TCP0020	50 MHz TekVPI ® 20 Ampere AC/DC current probe
TCP0030A	120 MHz TekVPI ® 30 Ampere AC/DC current probe
TCP0150	20 MHz TekVPI ® 150 Ampere AC/DC current probe
TCP2020	50 MHz BNC 20 Ampere AC/DC current probe
P5202A	100 MHz, 640 V High Voltage differential probe
P5205A	100 MHz, 1.3 kV High Voltage differential probe
P5210A	50 MHz, 5.6 kV High Voltage differential probe

Accessories

TPA-BNC	TekVPI ® to TekProbe ® BNC adapter
ACD2000	Soft transit case, for TBS2072 and TBS2102
ACD4000B	Soft transit case, for TBS2074 and TBS2104
TEK-DPG	TekVPI ® Deskew pulse generator signal source
067-1686-XX	Power measurement deskew and calibration fixture
TEK-USB-WIFI	USB Wi-Fi ² dongle for TBS2000 series only
TEK-USB-488	GPIB-to-USB adapter

Instrument options

TBS2XXX USBWIFI [2]	USB Wi-Fi dongle for TBS2000 series only
TBS2XXX P2221	Replaces standard probes with P2221 probes (200 MHz passive voltage probes with 1x/10x attenuation)

Power plug

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A4	North America power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 50/60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A12	Brazil power plug (60 Hz)
Opt. A99	No power cord

Language options

Opt. L0	English front panel overlay
Opt. L1	French front panel overlay
Opt. L2	Italian front panel overlay
Opt. L3	German front panel overlay
Opt. L4	Spanish front panel overlay
Opt. L5	Japanese front panel overlay
Opt. L6	Portuguese front panel overlay
Opt. L7	Simplified Chinese front panel overlay
Opt. L8	Traditional Chinese front panel overlay
Opt. L9	Korean front panel overlay
Opt. L10	Russian front panel overlay
Opt. L99	No manual

Language options include translated front-panel overlay only, manuals with different language are available on Tek web.

Service options

Opt. D1	Calibration Data Report

2 Certified to comply with CE, FCC and IC regulations. Available in Australia, Canada, China, EU Region, New Zealand, and United States. For other compatible Wi-Fi adapters, see Compatible USB-WIFI dongles under Input output ports specifications.

Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

Product Area Assessed: The planning, design/development and manufacture of electronic Test and Measurement instruments.

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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tek.com.

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