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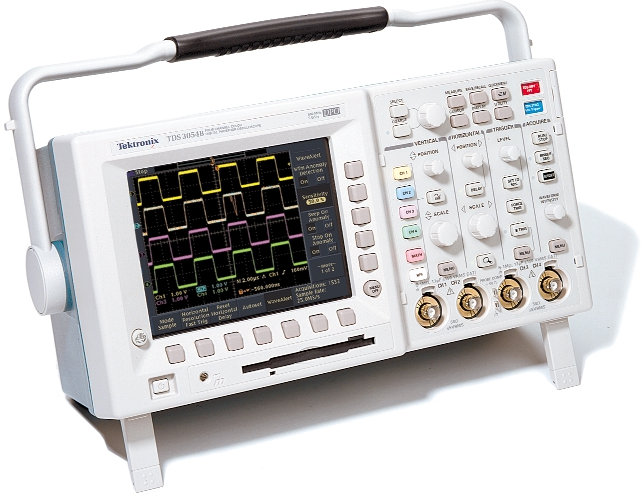
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# Digital Phosphor Oscilloscopes

## TDS3012B • TDS3014B • TDS3032B • TDS3034B • TDS3052B • TDS3054B



## Features & Benefits

- 500 MHz, 300 MHz and 100 MHz Bandwidths
- Sample Rates up to 5 GS/s
- 2 or 4 Channels
- Full VGA Color LCD
- 25 Automatic Measurements
- 9-Bit Vertical Resolution
- Multi-language User Interface
- QuickMenu Graphical User Interface for Easy Operation
- Built-in Ethernet Port
- e*Scope Web-based Remote Control
- WaveAlert Automatic Waveform Anomaly Detection
- Application Modules
  - Advanced Analysis for Detailed Design Analysis
  - Telecommunications Mask Testing
  - FFT
  - Two Video Modules for Testing and Troubleshooting
  - Limit Testing for Rapid Go/No-Go Testing
  - Advanced Triggers including Glitch, Runt and Logic
- Plug-in Printer for Portable Documentation of Results
- TekProbe™ Level II Interface Supports Active, Differential and Current Probes for Automatic Scaling and Units
- Centronics Port Standard for Quick, Convenient Hardcopies
- Built-in Floppy Disk Drive for Easy Storage and Documentation

## Applications

- Telecommunications Manufacturing Test
- Digital Design and Debug
- Video Installation and Service
- Power Supply Design

### The TDS3000B Series of Digital Phosphor Oscilloscopes Provides Unmatched Performance and Portability at an Affordable Price

The TDS3000B Series oscilloscope packs the power of digital phosphor waveform acquisition technology, automatic anomaly detection, web-based remote control and seven application-specific modules into a lightweight, battery-capable design.

#### DPO Technology Provides a New Level of Insight into Complex Signals

Digital phosphor oscilloscopes display, store and analyze in real-time three dimensions of signal information: amplitude, time and distribution of amplitude over time. Fast waveform capture and update rates make it easier to capture and display infrequent waveforms or waveform variations. The intensity graded color display provides information about the frequency of occurrence of signal amplitudes and widths. This helps you locate and characterize waveform anomalies that can be elusive on traditional digital storage oscilloscopes.

#### Enhanced Troubleshooting Ability

WaveAlert waveform anomaly detection speeds your troubleshooting task by helping you find those elusive problems faster. WaveAlert monitors the incoming signals on all channels and will detect and highlight any waveform that deviates from the normal waveform being acquired. Because the TDS3000B oscilloscope can stop acquisition, sound a beep, make a hard copy or save the waveform when it detects an anomaly, you can run tests over long time periods – even unattended – to find those challenging, very infrequent failures.





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### e*Scope Web-based Remote Control

e*Scope means you can control your TDS3000B oscilloscope from anywhere, using the Internet and your PC. Simply connect the TDS3000B oscilloscope to your LAN via its built-in Ethernet port, open a browser window on your PC and enter the TDS3000B oscilloscope's IP address in the Address window. The oscilloscope will respond, allowing you to control it from your browser. Download e*Scope control software to your PC for a graphical interface that displays the TDS3000B oscilloscope screen and front panel controls for easy access.

### Flexible Features for Every Application

With its lightweight, compact size and battery pack, the TDS3000B Series oscilloscope can go wherever it is needed. It weighs only 5.2 kilograms, with battery installed.

Use the optional plug-in thermal printer to instantly document your work, even in the field.

You can easily adapt the TDS3000B Series oscilloscope to your needs through optional, easy-to-install application modules. At power-up, the oscilloscope indicates which modules are installed. Currently seven application modules are available for the TDS3000B Series oscilloscope:

- Telecommunications mask testing
- Advanced analysis
- FFT
- Advanced triggering
- Limit testing
- Extended video
- 601 serial digital video

In addition, there are two communication modules available:

- A 10Base-T LAN/RS-232 module
- A GPIB/VGA/RS-232 module

A Centronics port is standard.

## ▶ Applications

### Telecommunications Mask Testing – TDS3TMT

The TDS3000B Series oscilloscope becomes a Pass/Fail test instrument for telecommunications standard compliance testing, when this module is installed.

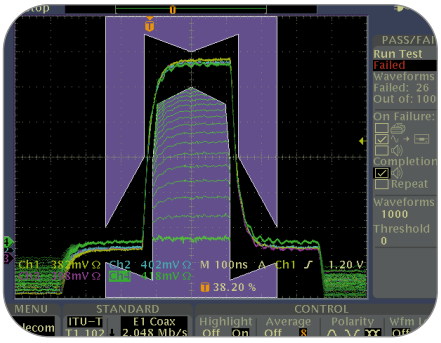
- ITU-T G.703 (DS0, DS1, E1, Clk interface, DS2, E2, E3 and DS3 rates) standards supported
- ANSI T1.102 (DS1, DS1A, DS2, DS3 and STS-1 rates) standards supported
- Perform custom mask editing with WaveStar™ software for oscilloscopes
- Properly terminate your device under test with Communication Signal Adapters
- Use TDS3GV (GPIB) or the built-in Ethernet communication modules to program the TDS3000B Series oscilloscope for automated testing

### Typical Application for the TDS3TMT Module

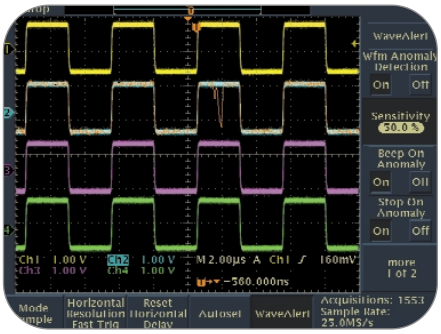
When testing network line cards in manufacturing, one of the most important considerations is throughput. The combination of DPO waveform throughput and hardware assisted mask testing results in breakthrough test speeds for mask testing on single and multiple channel devices. ALT trigger mode enables rapid testing on multiple channels by triggering on all channels sequentially in a single setup.

### Advanced Analysis – TDS3AAM

The TDS3AAM module adds advanced analysis capability to the TDS3000B Series oscilloscope. With it you can define waveforms as arbitrary math expressions – including a variety of mathematical functions plus constants and measurements. The TDS3AAM module also adds Area and Cycle Area measurements, differentiation and integration functions, measurement averaging, and measurement statistics. The FFT capabilities of the TDS3FFT module are also included.




▶ *TDS3000B DPO provides breakthrough test speeds for telecommunications line card testing. The telecom QUICKMENU puts all the commonly used telecom testing functions on a single menu.*




▶ *WaveAlert waveform anomaly detection alerts you to any waveform that deviates from the "normal" input.*

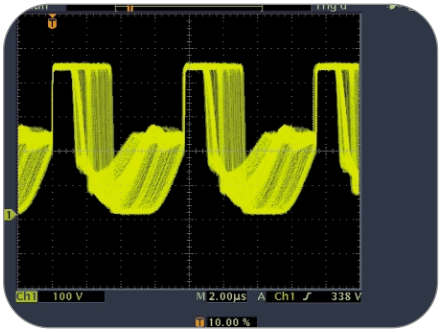
### FFT for Frequency and Harmonic Analysis – TDS3FFT

When this module is installed in the TDS3000B Series oscilloscope, the oscilloscope becomes an excellent troubleshooting aid for:

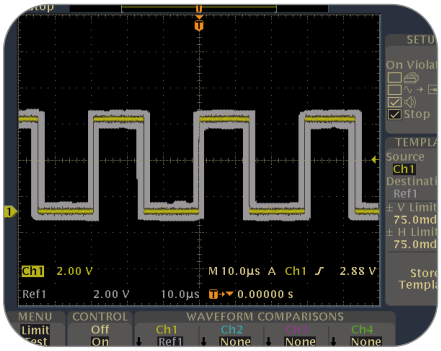
- Testing impulse response of filters and systems
- Measuring harmonic content and distortions in systems
- Identifying and locating noise and interference sources
- Analyzing vibration
- Analyzing harmonics in 50 and 60 Hz power lines



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▶ *DPO technology shows modulation effects on a power supply control loop.*




▶ *The TDS3000B DPO with the TDS3LIM limit testing module is ideal for manufacturing test applications where fast Go/No-Go decisions are required.*

Additionally, the TDS3FFT application module lets you:

- Match the optimum window to the signal you are analyzing with four FFT window choices (Rectangular, Hamming, Hanning and Blackman-Harris)
- Analyze repetitive, single-shot and stored waveforms: display an FFT waveform of any actively-acquired signal, last acquired signal or signal stored in the reference memory
- Set the FFT vertical graticule to either dB or linear RMS
- Show time domain signals and FFT waveforms on the display at the same time. This helps in the quick analysis of circuit or system problems

### Typical Application for the TDS3FFT Module

In the design or analysis of power supplies, it is important to check the harmonics in the power supply's load current. Using the oscilloscope's cursors, you can measure the frequency and magnitude of the individual frequency components.

## Advanced Triggering – TDS3TRG

When this module is installed in the TDS3000B Series oscilloscope, an advanced trigger menu is added to the oscilloscope with additional logic and pulse triggering capability.

### Logic Trigger Features

Logic triggering is extremely useful in the troubleshooting of digital circuits. The oscilloscope is triggered when two signals meet a Boolean trigger condition. This module provides pattern and state logic trigger modes.

### Pattern Trigger

Pattern triggering, useful for digital logic troubleshooting, triggers the oscilloscope when two signals become logically true or false. Basically, the pattern-triggering feature triggers the oscilloscope from the output of a two-input AND, OR, NAND or NOR logic gate. You can specify time constraints and signal threshold levels as part of the triggering condition.

### State Trigger

State triggering, useful for troubleshooting digital logic synchronous state machines, triggers the oscilloscope when a state signal is true or false at the time a clock signal transition is true.

### Pulse Trigger Features

Pulse triggering triggers the oscilloscope when a signal meets a timing or threshold condition. The advanced trigger module provides three pulse trigger modes: pulse width, runt pulse and slew rate.

### Pulse Width (or Glitch)

Pulse Width triggering triggers the oscilloscope when a signal pulse width is less than, greater than, equal to or not equal to a specified pulse width. The pulse width trigger is useful for digital logic troubleshooting.

### Runt Pulse

Runt Pulse triggering triggers the oscilloscope when a signal pulse is less than a specified threshold level. You can also specify runt pulse-width parameters. This trigger is useful for troubleshooting bus-contention problems.

### Slew Rate

Slew Rate triggering triggers the oscilloscope when a signal's slew rate (rise or fall time) is less than, greater than, equal to or not equal to a specified slew rate. This trigger is useful for troubleshooting digital bus transceivers, transmission lines and op-amp circuits.

## Limit Testing – TDS3LIM

The TDS3LIM module offers fast, simple verification that your circuit is operating within its intended parameters – ideal for repetitive testing applications where quick Go/No-Go decisions are required. You can easily create waveform reference templates to compare to your live waveforms. You can also compare any number of input channels with any combination of four references, and select actions for the TDS3000B oscilloscope to take if a waveform strays outside the reference limits: stop acquisition, sound a beep, print a hard copy, or save the waveform to disk.



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## Extended Video – TDS3VID

All TDS3000B Series oscilloscopes come standard with NTSC, PAL and SECAM (all fields or all lines) triggering capability. The TDS3VID application module extends this basic video triggering by adding the following features.

### Video QuickMenu

This Video QuickMenu function allows you to display a bottom and side menu that contains video functions useful for displaying and measuring broadcast standard waveforms, including trigger source, when to trigger, video graticule and video autoset.

### Video Autoset

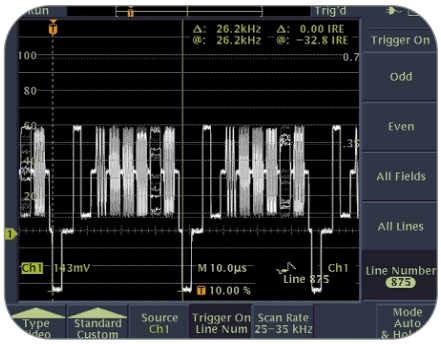
The autoset function automatically adjusts the vertical, horizontal and video trigger settings to display a video waveform triggered on all lines and fields. You can then manually adjust controls to optimize the display. This function is available in the Video QuickMenu and in the Acquire menu.

### Custom Video

The custom video function allows you to specify custom horizontal scan rates in order to trigger on nonbroadcast video waveforms, such as those used by computer monitors and medical equipment displays. This following figure shows the TDS3000B oscilloscope triggering on a scan rate of 26.2 kHz.

### Analog HDTV Features

The TDS3VID and TDS3SDI modules allow you to work with emerging analog HDTV standards. Trigger on a range of HDTV formats – 1080i, 1080p, 720p and 480p. Also use the vectorscope on analog HDTV with graticules for both 100 and 75% color bars.




▶ *Custom video trigger allows the TDS3000B to trigger on standards such as RS343 (26.6 kHz scan rate).*




▶ *Video picture mode with on-screen line select.*

### Line Count Trigger

Sometimes it is necessary to view a single line of the video waveform. For example, the programming information in the NTSC signal is sometimes found on Line 20. Line Count triggering allows you to trigger on any particular line by scrolling through the line numbers and selecting the one you want.

### Field Holdoff

The field holdoff function provides the capability to specify a number of fields to wait before re-enabling triggering. This allows you to trigger on a single field (e.g. field 1 or field 3 of NTSC) instead of both field 1 and field 3.

### Video Graticules

The video graticule function provides the capability for the user to change the standard oscilloscope graticule to either IRE or mV depending on the signal format. Video graticules make it easier to measure and analyze video waveforms.

### Built-in Vectorscope Capabilities

With the TDS3VID module, a TDS3000B Series oscilloscope can function as a vectorscope with built-in graticules for 100% or 75% color bars. It's easy to measure chroma levels, and the oscilloscope's digital phosphor display makes it easy to see any white balance problem.

### Video Picture Mode with On-screen Line Select

The TDS3VID with a TDS3000B oscilloscope gives you fast access to the analog video behind the digital video stream. Check out the monochrome image of the originating camera or other source. Then use the on-screen line select to move quickly to any line in the picture.

## 601 Serial Digital Video – TDS3SDI

When this module is installed in the TDS3000B Series oscilloscope, the oscilloscope becomes a one-tool solution that allows you to trace and identify ITU-R BT.601 video signals, examine their representative analog component and composite waveforms and analyze the bit stream. Features include all the capabilities of the TDS3VID plus:

- Video picture mode with on-screen line select
- Vectorscope (Pb/Pr)
- YPbPr, RGB and YC waveforms



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## ▶ Characteristics

### ▶ TDS3000B Series Electrical Characteristics

| | TDS3012B | TDS3014B | TDS3032B | TDS3034B | TDS3052B | TDS3054B |
|---|---|---|---|---|---|---|
| Bandwidth | 100 MHz | 100 MHz | 300 MHz | 300 MHz | 500 MHz | 500 MHz |
| Channels | 2 | 4 | 2 | 4 | 2 | 4 |
| Sample Rate on Each Channel | 1.25 GS/s | 1.25 GS/s | 2.5 GS/s | 2.5 GS/s | 5 GS/s | 5 GS/s |
| Maximum Record Length | 10 K points on all models | | | | | |
| Vertical Resolution | 9-Bits on all models | | | | | |
| Vertical Sensitivity (/div) | 1 mV – 10 V on all models | | | | | |
| Vertical Accuracy | ±2% on all models*1 | | | | | |
| Max Input Voltage (1 MΩ) | 150 $V_{RMS}$ CAT I on all models (300 V CAT II with standard 10X probe) | | | | | |
| Position Range | ± 5 div on all models | | | | | |
| BW Limit | 20 MHz | 20 MHz | 20, 150 MHz | 20, 150 MHz | 20, 150 MHz | 20, 150 MHz |
| Input Coupling | AC, DC, GND on all models | | | | | |
| Input Impedance Selections | 1 MΩ in parallel with 13 pF or 50 Ω | | | | | |
| Time Base Range (/div) | 4 ns – 10 s/div | 4 ns – 10 s/div | 2 ns – 10 s/div | 2 ns – 10 s/div | 1 ns – 10 s/div | 1 ns – 10 s/div |
| Time Base Accuracy | 20 ppm | 20 ppm | 20 ppm | 20 ppm | 20 ppm | 20 ppm |
| Display Monitor | Color LCD | | | | | |

*1 Derated at 0.025%/°C for temperatures above +30°C and below +18°C.

#### Acquisition Modes

DPO – Captures and displays complex waveforms, random events and subtle patterns in actual signal behavior. DPOs are able to provide 3 dimensions of signal information in real-time: amplitude, time and the distribution of amplitude over time.

Peak Detect – High frequency and random glitch capture. Captures glitches as narrow as 1 ns.

WaveAlert™ – Monitors the incoming signals on all channels and alerts the user to any waveform that deviates from the normal waveform being acquired.

Sample – Sample data only.

Envelope – Max/Min values acquired over one or more acquisitions.

Average – Waveform data from 2 to 512 (selectable) acquisitions is averaged.

Single Sequence – Use the Single Sequence button to capture a single triggered acquisition sequence at a time.

#### Trigger System

Main Trigger Modes – Auto (supports Roll Mode for 40 ms/div and slower), Normal.

B Trigger – Trigger after time or events.

Trigger After Time Range – 13.2 ns to 50 s.

Trigger After Events Range – 1 to 9,999,999 events.

External Trigger Input – >1 MΩ in parallel with 17 pF; Max input voltage is 150 $V_{RMS}$.

#### Trigger Types

Edge – Conventional level-driven trigger. Positive or negative slope on any channel. Coupling selections: DC, noise reject, HF reject, LF reject.

Video – Trigger on all lines or individual line, odd/even or all fields or analog HDTV formats (1080i, 1080p, 720p, 480p). See optional TDS3VID and TDS3SDI application modules for extended video triggering and measurement features.

Logic (requires TDS3TRG) – PATTERN: Specifies AND, OR, NAND, NOR when true or false for a specific time.

STATE: Any logic state. Triggerable on rising or falling edge of a clock. Logic triggers can be used on combinations of 2 inputs (not 4).

Pulse (requires TDS3TRG) – WIDTH (or GLITCH): Trigger on pulse width less than, greater than, equal to or not equal to a selectable time limit ranging from 39.6 ns to 50 s.

RUNT: Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again.

SLEW RATE: Trigger on pulse edge rates that are either faster or slower than a set rate. Edges can be rising, falling or either.

Comm (requires TDS3TMT) – provides isolated pulse triggering required to perform DS1/DS3 telecommunications mask testing per ANSI T1.102 standard.

Alternate – Sequentially uses each active channel as a trigger source.



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### Measurement System

**Automatic Waveform Measurements** – Period, Frequency, +Width, –Width, Rise-time, Fall-time, +Duty Cycle, –Duty Cycle, +Overshoot, –Overshoot, High, Low, Max, Min, P-P, Amplitude, Mean, Cycle Mean, RMS, Cycle RMS, Burst Width, Delay, Phase, Area*1, Cycle Area*1.
Display any four measurements from any combination of waveforms.

*1 Requires TDS3AAM module.

**Thresholds** – Settable in percentage or voltage.

**Gating** – Measurements can be gated using the screen or vertical cursors.

### Waveform Processing

**Deskew** – Channel-to-channel deskew ±10 ns may be manually entered for better timing measurements and more accurate math waveforms.

**Arithmetic Operators** – Add, subtract, multiply, divide.

**Autoset** – Single-button, automatic setup on selected input signal for vertical, horizontal and trigger systems.

### Display Characteristics

**Waveform Style** – Dots, vectors and variable persistence.

**Graticules** – Full, grid, cross-hair, frame, NTSC, PAL, SECAM, vectorscope 100% and 75% color bars (with optional TDS3VID and TDS3SDI video application modules).

**Format** – YT, XY and Gated XYZ (XY with Z-axis blanking available on TDS30X4B only).

### I/O Interface

**Hard Copy Port (standard)** – Centronics-type parallel.

**TDS3GV Communications Module** –
GPIB (IEEE –488.2) Programmability: Full talk/listen modes; Control of all modes, settings and measurements.
VGA: Monitor output for direct display on large VGA-equipped monitors. DB-15 female connector, 31.6 kHz sync rate, EIA RS-343A compliant.
RS-232-C Interface Programmability: Full talk/listen modes; Control of all modes, settings and measurements. Baud Rate up to 38,400. DB-9 male connector.
Programmer Manual: 071-0381-01.

### Hard Copy Capability

**Graphics File Formats** – Interleaf (.img), TIF, PCX (PC Paintbrush), BMP (Microsoft Windows) and Encapsulated Postscript (EPS).

**Printer Formats** – Bubblejet, DPU-3445, Thinkjet, Deskjet, Laserjet, Epson (9- and 24-Pin).

### Environmental and Safety

**Temperature** – +5 to +50°C (operating), –20 to +60°C (nonoperating).

**Humidity** – 20% to 80% RH below 32°C, derate to 30% RH at 45°C (operating), 5% to 90% RH below 41°C, derate to 30% RH at 60°C (nonoperating).

**Altitude** – to 3,000 m (operating), 15,000 m (nonoperating).

**Electromagnetic Compatibility** – Meets or exceeds EN55011 Class A Radiated and Conducted Emissions; EN50082-1; FCC 47 CFR, Part 15, Subpart B, Class A; Australian EMC Framework; Russian GOST EMC regulations.

**Safety** – UL3111-1, CSA1010.1, EN61010-1, IEC61010-1.



▶ ***TDS3BAT –*** *Battery pack being installed. The TDS3000B oscilloscope weighs only 5.2 kilograms with battery pack.*

### Physical Characteristics

| **Instrument Dimensions** | **mm** | **in.** |
|---|---|---|
| Width | 375.0 | 14.8 |
| Height | 176.0 | 6.9 |
| Depth | 149.0 | 5.9 |
| **Weight** | **kg** | **lbs.** |
| Instrument only | 3.2 | 7.0 |
| w/battery | 5.2 | 11.5 |
| **Instrument Shipping Package Dimensions** | **mm** | **in.** |
| Width | 502.0 | 19.8 |
| Height | 375.0 | 14.8 |
| Depth | 369.0 | 14.5 |
| **Rackmount Dimensions** | **mm** | **in.** |
| Width | 484.0 | 19.0 |
| Height | 178.0 | 7.0 |
| Depth | 152.0 | 6.0 |



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▶ ***TDS3PRT –*** *Plug-in printer provides instant, portable documentation of your work.*



▶ *Application module being installed.*

## Instrument Accessories

TDS3TMT – Telecom Mask Testing Application Module.

TDS3AAM – Advanced Analysis Module.

TDS3LIM – Limit Test Module.

TDS3FFT – Fast Fourier Transform Module.

TDS3TRG – Advanced Trigger Application Module.

TDS3VID – Extended Video Application Module.

TDS3SDI – 601 Serial Digital Video Module.

TDS3GV – GPIB, VGA and RS-232 interfaces.

TDS3BAT – Battery pack for up to 2 hours continuous operation without line power.

Note: the instrument must be grounded at all times.

TDS3PRT – The TDS3PRT plug-in printer adds easy, portable documentation capability to your TDS3000B or TDS3000 oscilloscope. Just plug it into the back of your oscilloscope and press Hard Copy to get a print of your screen. The printer works where your TDS3000B works – even when operating on battery power.

Note: With TDS3000 series, printer does not operate on battery power.

016-1907-00 – 5-roll pack of paper for TDS3PRT plug-in thermal printer.

TDS3CHG – Fast charger for battery pack.

AC3000 – Soft case for carrying instrument.

HCTDS32 – Hard plastic case for carrying instrument.

RM3000 – Rackmount kit.

Service Manual (TDS3000B Series) – English Only (071-0972-00).

TDS3GV Programmers Manual – English Only (071-0381-01).

WaveStar™ Software for Oscilloscopes – Windows 95/98/NT 4.0 Application.

VocalLink™ – Voice Control Software.

### Probes

ADA400A – 100x, 10x, 1x, 0.1x High gain differential amplifier.

P6243 – 1 GHz, ≤1 pF input C 10x active probe.

P5205 – 1.3 kV, 100 MHz high voltage differential probe.

P5210 – 5.6 kV, 50 MHz high voltage differential probe.

P5100 – 2.5 kV, 100x high voltage passive probe.

TCP202 – 15 A, DC + Peak AC 50 MHz AC/DC current probe.

## ▶ Ordering Information

**TDS3012B, TDS3014B, TDS3032B, TDS3034B, TDS3052B, TDS3054B**

### Standard Accessories

Probes: 2 each P3010 10x passive probes (TDS3012B), 4 each P3010 10x passive probes (TDS3014B), 2 each P6139A 10x passive probes (TDS3032B and TDS3052B), 4 each P6139A 10x passive probes (TDS3034B and TDS3054B).

Documentation: Reference manuals, CD with user manuals in 11 languages, Programmer's Manual and Application Module Manuals, front panel overlay for non-English languages.

Application Modules:

TDS3FFT, TDS3TRG.

Power Cord.

Accessory Tray.

Protective Front Cover: has holder for user manual and/or 3.5 in. floppy disks.

NIST-Traceable Certificate of Calibration.

### Warranty Information

Three year warranty covering all labor and parts, excluding probes.

### International Power Plugs

Standard – US (161-0104-00).

Opt. A1 – Universal Euro 220 V, 50 Hz (161-0104-06).

Opt. A2 – United Kingdom 240 V, 50 Hz (161-0104-07).

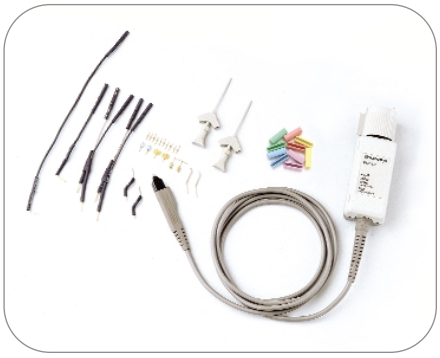
Opt. A3 – Australia 240 V, 50 Hz (161-0104-05).

Opt. A5 – Switzerland 220 V, 50 Hz (161-0167-00).

Opt. A6 – Japan 3 to 2 wire adapter (013-0310-00).



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- Active, Differential, Passive and Current Probes. A dependable probe is essential to completing your test system because even the most advanced oscilloscope can only be as precise as the data that goes into it. Tektronix probes are expressly designed for your oscilloscope, with identical quality standards and built-in compatibility for optimum performance. Choose a probe that's right for your TDS3000B oscilloscope and for your application: a P6243 1 GHz active; P5202 and P5210 high voltage differential; P5100 high voltage passive; or TCP202 current probe.



- VocalLink™ Voice Control Software. Probing today's circuits with their dense packaging and extremely fine pitch parts requires precise probe placement and the use of both hands, making it a challenge to maintain probe contact while operating the oscilloscope. VocalLink software frees your visual attention to focus on making solid probe contact with your test signals to ensure accurate, repeatable measurements. Choose from multiple languages for both on-screen operating menus and voice recognition.

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Updated January 24, 2002

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01/02 HB/PG 3GW-12482-7



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