



## NEW 2246/2245

Bright, Crisp Display With High Writing Rate  
Four Independent Channels  
100 MHz Bandwidth With 2 ns/Div Time Base  
On-Screen Scale Factor Readouts  
Flexible Triggering  
Auto Level and Auto HF, LF, Noise Reject,  
TV Line and TV Field  
Delayed Sweep  
Control Status Lights  
2% Vertical and Horizontal Accuracy  
2 mV/Div Vertical Sensitivity at Full Bandwidth  
New Specially Designed Probe  
Improved, Rugged Tip  
Hybrid Circuitry for Improved Performance  
Simple, Rugged Construction  
New Labeled Volts Cursors With Ground-  
Referenced Readings and On-Screen  
Readouts

New Hands-Off Voltmeter Measurements  
+Peak and -Peak  
Peak-to-Peak  
Gated Peaks  
Gated Peak-to-Peak  
Dc

New SmartCursors™  
Track Voltmeter Measurements  
Visually Indicate Trigger Level and Ground

Time Measurements With Cursors or  
Alternate Delayed Sweep  $\Delta$ Time

Three Year Warranty—Five Year Option

### TYPICAL APPLICATIONS

Logic Design and Repair  
Communications  
Power Supply Design

See page 277 for available Application Notes.

### Higher Performance, Lower Price

The performance/price ratio for portable oscilloscopes has been substantially upgraded. No other portable scope can offer the range of productivity enhancing features and performance characteristics at a comparably low price than the Tektronix NEW 2245 and 2246.

### Features That Promote Productivity

Four independent channels speed troubleshooting and design tasks by allowing simultaneous observation of multiple test points. Front panel set-ups are simplified by pushbutton activated functions and on-screen scale factor readouts. And with buttons that light up, settings can be verified at a glance.



### More Triggering Flexibility

Hands-free triggering, made possible by the Auto-level mode, automatically places a stable display of almost any waveform on screen. The LF, HF, and Noise Reject modes, together with a 10-to-1 holdoff range, deliver stable triggering on complex waveforms. The built-in TV Line and TV Field triggering capability extends measurements to most video-related applications.

### Performance Plus

The NEW 2245 and 2246 oscilloscopes have low noise vertical systems that produce sharp, bright traces. Their 2 ns time base and 100 MHz bandwidth bring out the details on high speed signals and render measurements with good timing resolution.

Low level signal measurements are easily managed by the 2 mV/div vertical sensitivity, even at full bandwidth, and by trigger sensitivity that extends to 0.25 div at 50 MHz (0.5 div at 100 MHz).

### Voltage Measurements With the Push of a Button

A pushbutton activated measurement system on the 2246 enhances productivity even more. This scope turns out virtually hands-off measurements quickly of +peak, -peak, peak-to-peak, dc, and gated volts, all with convenient on-screen readout of values.

If more visual indication is desired, the unique cursor system can provide feedback showing exactly where on the waveform an automatic measurement is being made. These feedback cursors, when selected, even show ground and trigger level locations.

There is also the ability to use cursors in the conventional manual mode for making point-to-point time and voltage measurements, including time interval measurements between a point on the reference waveform and a point on any of four other displayed waveforms.

### Three Year Warranty

As with all of our high quality 2000 Series Oscilloscopes, the 2245 and 2246 (including the CRT) are covered by the Tektronix three year warranty, making ownership more cost effective than ever.

## CHARACTERISTICS

Characteristics are common to both instruments, except where indicated.

### VERTICAL SYSTEM

**Display Modes** — CH 1, CH 2, CH 3, CH 4, Add (CH 1+CH 2), Invert (CH 2), Alternate and Chopped display switching for all channels, and 20 MHz bandwidth limiting.

### CHANNEL 1 AND CHANNEL 2

**Frequency Response** (—3dB Bandwidth) — 100 MHz for temperatures from 0°C to +35°C. 90 MHz for temperatures from +35°C to +50°C.

**Ac Coupled Lower —3dB Frequency** — 10 Hz or less with 1X probe. 1 Hz or less with standard accessory 10X probe.

**Step Response** —  $\leq 3.5$  ns for temperatures from 0°C to +35°C.  $\leq 3.9$  ns for temperatures from +35°C to +50°C. Rise times calculated from:  $t_r = 0.35/BW$ .

**Deflection Factor Range** — 2 mV/div to 5 V/div in a 1-2-5 sequence of 11 steps.

**Maximum Error** —  $\pm 2\%$  for temperatures from +15°C to +35°C. Add  $\pm 1\%$  for temperatures from 0°C to +15°C and from +35°C to +50°C.

**Variable Range** — Continuously variable between VOLTS/DIV step settings. Increases step setting by at least 2.5 V/div.

**Uncalibrated Indicators** — A > symbol appears on-screen when deflection factor is between calibrated VOLTS/DIV step settings.

**Channel Isolation** — 50 dB or more attenuation of deselected channel at 10 MHz. 34 dB or more at 100 MHz. Measured with an eight div input signal and equal VOLTS/DIV settings on both channels from 2 mV/div to 0.5 V/div.

**Channel 2 Signal Delay With Respect to Channel 1** — <100 ps difference.

**Input Characteristics** — 1 M $\Omega$   $\pm 0.15\%$  shunted by 20 pF  $\pm 0.5$  pF. Maximum Input Voltage: 400 V (dc + peak ac); 800 V ac p-p at 10 kHz or less.

**Common Mode Rejection Ratio (ADD Mode With Channel 2 Inverted)** — At least 10:1 at 50 MHz. For common-mode signals of eight div or less and with VAR VOLTS/DIV control adjusted for best CMRR at 50 kHz at any VOLTS/DIV setting.

**Trace Drift** — Between VOLTS/DIV Step Settings: 0.2 div or less. With VAR VOLTS/DIV Rotated Between Extremes: 1 div or less. Inverting Channel 2: 1 div or less. Between GND and Dc Input Coupling: <0.5 mV for temperatures from 0°C to +35°C. <2 mV for temperatures from +35°C to +50°C.

**Position Range** — At least  $\pm 11$  div from graticule center.

### CHANNEL 3 AND CHANNEL 4

**Frequency Response** — Same as Channel 1 and Channel 2.

**Step Response** — Same as Channel 1 and Channel 2.

**Deflection Factor** — Settings: 0.1 V/div and 0.5 V/div.

**Maximum Error** — Same as Channel 1 and Channel 2.

**Channel Isolation** — 34 dB or more attenuation of deselected channel at 100 MHz. Measured with an eight div input signal.

**Channel 4 Signal Delay With Respect to Channel 3** — <100 ps difference.

**Input Characteristics** — 1 M $\Omega$   $\pm 1\%$  shunted by 2 pF  $\pm 0.5$  pF. Maximum Input Voltage: 400 V (dc + peak ac); 800 V p-p ac at 10 kHz or less.

**Trace Shift** — Between VOLTS/DIV Settings: 1 div or less.

**Position Range** — Same as Channel 1 and Channel 2.

### ALL CHANNELS

**Low Frequency Linearity** — 0.06 div or less compression or expansion of a 2 div, center-screen signal when positioned anywhere within the graticule area.

**Bandwidth Limiter** — Reduces upper —3dB bandpass to a limit of 17 MHz to 23 MHz.

**Trace Separation Range** —  $\pm 4$  div.

**Chop Mode Switching Rate** — 625 kHz  $\pm 10\%$ .

**Channel 3 or Channel 4 Signal Delay With Respect to Either Channel 1 or Channel 2** — <200 ps difference.

### HORIZONTAL SYSTEM

**Display Modes** — A (main sweep), A ALTernate with B (delayed sweep), and B. In X-Y mode, Channel 1 provides X-axis (horizontal) deflection.

**A Sweep Time Base Range** — 0.5 s/div to 20 ns/div in a 1-2-5 sequence of 24 steps. X10 magnification extends fastest sweep rate to 2 ns/div.

**B Sweep Time Base Range** — 5 ms/div to 20 ns/div in a 1-2-5 sequence of 21 steps. X10 magnification extends fastest sweep rate to 2 ns/div.

**Variable Timing Range** — Continuously variable between SEC/DIV calibrated step settings. Extends slowest A sweep and B sweep speeds by a factor of at least 2.5 times. Affects the A SEC/DIV setting with the A display mode; affects the B SEC/DIV setting with the ALT and B modes.

**A Sweep Timing Accuracy** — Applies over the center eight div. Excludes the first 0.25 div of the magnified sweep and sweep beyond the 100th magnified div.

Range	Unmagnified	Magnified
+15°C to +35°C	$\pm 2\%$	$\pm 3\%$
0°C to +15°C		
+35°C to +50°C	$\pm 3\%$	$\pm 4\%$

**Linearity** —  $\pm 5\%$  over any two of the center eight div, or both unmagnified and magnified displays.

**Delay Time** — Range: <0.1 div to >9.9 div of the A sweep. Maximum value does not exceed end of the A sweep. Jitter: 1:20,000 p-p (0.005%) viewed over two seconds.

**$\Delta$ Time** — (2246) Range: 0 to >10 div to right of the delay time setting, but does not exceed end of the A sweep. Accuracy:  $\pm (0.5\% \text{ of reading} + 1\% \text{ of one A sweep div} + 20 \text{ ns})$ .

### TRIGGERING

Trigger Sensitivity from CH 1, CH 2, CH 3, CH 2 Source.

**Dc Coupled** — 0.35 div or greater triggers from dc to 50 MHz, increasing to 1 div at 150 MHz.

**Noise Reject Coupled** — 0.8 div or more triggers; 0.5 div or less does not trigger.

**HF Reject Coupled** — 0.35 div or greater triggers from dc to 50 kHz; 0.25 div or less does not trigger above 500 kHz.

**LF Reject Coupled** — 0.35 div or greater triggers from 100 kHz to 50 MHz; 0.35 div or greater does not trigger from dc to 10 kHz.

**Ac Coupled** — 0.35 div or greater triggers from 50 Hz and 50 MHz; 0.35 div or less does not trigger from dc to 5 Hz.

For dc, LF Reject, and ac coupling above 50 MHz, triggering signal requirement increases to 1.0 div at 150 MHz.



**Trigger Sensitivity From TV Line or TV Field Source** — 0.5 div or less of composite sync achieves stable display.

**Lowest Usable Frequency With Auto Level Function** — 10 Hz.

**Level Control Range** —  $\pm 20$  div referenced to the selected source.

**Level Readout Accuracy** —  $\pm (0.3\% \text{ of reading} + 0.1 \text{ div})$ .

**Variable Holdoff Range** — Increases the A sweep holdoff time by at least a factor of 10.

## X-Y OPERATION

**Deflection Factors** — Same as Vertical System, with VAR VOLTS/DIV in calibrated detent.

## Maximum Error

Range	Y-Axis	X-Axis
+15°C to +35°C	$\pm 2\%$	$\pm 3\%$
0°C to +15°C		
+35°C to +50°C	$\pm 3\%$	$\pm 4\%$

**X-Axis — 3dB Bandwidth** — 3 MHz or more.

**Phase Difference Between X and Y** —  $\leq 3^\circ$  for dc coupled signals from dc to 50 kHz with bandwidth limiter off.

## CURSOR AND FRONT PANEL DISPLAY

**Controls** — Separate A Intensity, B Intensity, Readout Intensity, Focus, Beam Finder, Trace Rotation, and Scale Illumination.

**CRT** — 8 x 10 cm internal graticule. Markings: 8 major div vertically and 10 major div horizontally, with auxiliary markings.

**Standard Phosphor** — GH (P31).

**Y-Axis Orthogonality** —  $\leq 0.1$  div over eight vertical div; no adjustment.

## Cursor Functions — (2246)

Function	Accuracy
SEC; 1/SEC; PHASE; $\Delta$ TIME; $\Delta$ 1/TIME; $\Delta$ PHASE	$\pm (0.5\% \text{ of reading} + 0.02 \text{ horizontal div})$
VOLTS; GND VOLTS	$\pm (0.5\% \text{ of reading} + 0.02 \text{ vertical div} + \text{HF display errors})$

Function	Position Accuracy *1
Track Measurement, Trig Level, Ground	$\pm 0.05$ vertical div

\*1 Cursor position on waveform vs readout displayed value.

## EXTERNAL Z-AXIS INPUT

**Active Region Lower Threshold** —  $\leq 1.8$  V.

**Signal Required to Blank Sweep-Related Trace** —  $\geq 3.8$  V.

**Input Resistance to Ground** — 10 k $\Omega$   $\pm 10\%$ .

**Maximum Input Voltage** — 30 V (dc + peak ac) or  $\leq 30$  V ac p-p at 1 kHz.

## CALIBRATOR OUTPUT

**Voltage Into 1 M $\Omega$  Load** — 0.5 V  $\pm 2\%$ .

**Repetition Range** — 1 kHz  $\pm 10\%$ .

**Overshoot** —  $\leq 0.1\%$ .

## POWER REQUIREMENTS

**Line Voltage Range** — 90 V to 250 V.

**Line Frequency** — 48 Hz to 445 Hz.

**Fuse Rating** — 2 A, 250 V, slow-blow.

**Maximum Power Consumption** — 80 W (110 V ac):

## ENVIRONMENTAL

Environmental requirements qualify the electrical and mechanical specifications. When not rack-mounted, the instrument meets the environmental requirements of MIL-T-28800C for Type III, Class 5, Style D equipment.

**Ambient Temperature** — Operating: 0°C to +50°C. Nonoperating: -50°C to -75°C.

**Altitude** — Operating: To 4500 m (15,000 ft). Maximum operating temperature decreases 1°C for each 300 (1,000 ft) above 1500 m (5000 ft). Nonoperating: to 15 250 m (50,000 ft).

**Vibration** — Operating: 15 minutes along each of three axes, 0.015 inch p-p displacement. 10 Hz to 55 Hz in one minute sweeps. Held for 10 minutes at 55 Hz (2.4 g's at 55 Hz).

**Humidity** — Operating and Nonoperating: 95%, five cycles (120 hours) referenced to MIL-T-28800C, Paragraph 4.5.5.1.2.2 for Type III, Class 5.

**Shock** — Operating and Nonoperating: 30 g, half sine, 11 ms duration; three shocks on each face, for a total of 18 shocks.

**Bench Handling Test** — 4 inch drop per Tektronix Standard 062-2858-00.

**Transportation Drop and Vibration** — Meets the limits of Tektronix Standard 062-2858-00.

## PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width, With handle	361	14.2
Height		
With feet and pouch	177	7.0
Without pouch	164	6.4
Depth		
With front cover	445	17.5
With handle extended	519	20.4
Weight	kg	lb
Net		
With accessories and pouch	8.9	19.6
Without accessories and pouch	7.9	17.4

## 2246 With Voltmeter

**Dc Volts** — Accuracy:  $\pm (0.3\% \text{ of reading} + 0.02 \text{ div})$ . Normal Mode Rejection Ratio:  $> 50$  dB at 50 Hz and 60 Hz.

**+Peak and -Peak Volts** — Accuracy:  $\pm (2\% \text{ of reading} + 0.1 \text{ div})$  for signals from 20 Hz to 30 MHz. -3dB at 100 MHz. Gated Region Minimum Width:  $\leq (0.2 \text{ div} + 50 \text{ ns})$ .

**P-P Volts** — Accuracy:  $\pm (2\% \text{ of reading} + 0.1 \text{ div})$  for signals from 20 Hz to 30 MHz. -3 dB from 30 MHz to 100 MHz. Gated Region Minimum Width:  $\leq (0.2 \text{ div} + 50 \text{ ns})$ .

## ORDERING INFORMATION

**2245 100 MHz Oscilloscope \$1,875**

**Includes:** Two 10X, 1.5 m probes with accessories (P6109 Opt 01); clear accessories pouch with ziploc fastener (016-0537-00); blue plastic CRT filter (337-2775-00); 2A, 250 V fuse (159-0023-00); operator manual (070-6083-00); user reference guide (070-6082-00).

**2246 100 MHz Oscilloscope with Voltmeter,  $\Delta$ Time, and SmartCursors\* \$2,400**

**Includes:** Same as 2245.

## OPTIONS

<b>Option 02</b> — Protective front panel cover and accessory pouch.	<b>+\$47</b>
<b>Option 1C</b> — C-5C Option 02 Camera.	<b>+\$465</b>
<b>Option 1K</b> — K212 Portable Instrument Cart.	<b>+\$330</b>
<b>Option 1T</b> — Transit Case.	<b>+\$185</b>
<b>Option 22</b> — Two additional P6109 probes.	<b>+\$130</b>
<b>Option 23</b> — Two 1X/10X P6062B, 6 ft probes.	<b>+\$350</b>

## INTERNATIONAL POWER PLUG OPTIONS

<b>Option A1</b> — Universal Euro 220 V, 50 Hz.
<b>Option A2</b> — UK 240 V, 50 Hz.
<b>Option A3</b> — Australian 240 V, 50 Hz.
<b>Option A4</b> — North American 240 V, 60 Hz.
<b>Option A5</b> — Switzerland 220 V, 50 Hz.

## WARRANTY-PLUS SERVICE PLANS SEE PAGE 497

<b>M1</b> — (2245) 2 Calibrations.	<b>+\$145</b>
<b>M1</b> — (2246) 2 Calibrations.	<b>+\$160</b>
<b>M2</b> — (2245) 2 Years Service.	<b>+\$175</b>
<b>M2</b> — (2246) 2 Years Service.	<b>+\$185</b>
<b>M3</b> — (2245) 2 Years Service and 4 Calibrations.	<b>+\$290</b>
<b>M3</b> — (2246) 2 Years Service and 4 Calibrations.	<b>+\$320</b>
<b>M4</b> — (2245) 5 Calibrations.	<b>+\$385</b>
<b>M4</b> — (2246) 5 Calibrations.	<b>+\$410</b>
<b>M5</b> — (2245) 9 Calibrations + 2 Years Service.	<b>+\$1,005</b>
<b>M5</b> — (2246) 9 Calibrations + 2 Years Service.	<b>+\$1,095</b>

## OPTIONAL ACCESSORIES

<b>Service Manual</b> (2245/2246) Order 070-6081-00	<b>\$25</b>
<b>Front Panel Cover</b> — Order 200-3232-00	<b>\$5.00</b>
<b>Accessory Pouch</b> — Order 016-0857-00	<b>\$15</b>
<b>Accessory Pouch and Cover*2</b> Order 016-0848-00	<b>\$15</b>
<b>Protective Waterproof Vinyl Cover</b> — Order 016-0848-00	<b>\$15</b>
<b>Viewing Hoods</b> — (Collapsible) Order 016-0592-00	<b>\$14</b>
(Binocular) Order 016-0566-00	<b>\$18.75</b>
(Polarized) Order 016-0180-00	<b>\$50</b>
<b>Clear Implosion Shield</b> — Order 337-2775-01.	<b>+\$1.95</b>
<b>Carrying Strap</b> — Order 346-0199-00	<b>\$17</b>
<b>Carrying Case</b> — Order 016-0792-01*1	<b>\$355</b>
<b>Clear Graticule Filter</b> — Order 337-2775-01	<b>\$1.95</b>
<b>1107 Mounting Kit</b> — Order 016-0785-00	<b>\$50</b>
<b>1107 DC Inverter</b> — See page 307.	<b>\$525</b>
<b>1106 Battery Pack</b> — See page 306.	<b>\$1,265</b>
<b>1105 Power Supply</b> — See page 306.	<b>\$1,690</b>

\*1 Recommend use with front panel cover (200-2520-00).

\*2 To order, contact your local Tektronix Sales Office.

## RECOMMENDED PROBES

See Probe Section for additional probes, page 464.



The P6062B allows switching between 1X and 10X attenuation. Readout display changes with attenuation switching. See page 470.

<b>P6109</b> — 10X Probe.	<b>\$58</b>
<b>P6062B</b> — 1X-10X Probe.	<b>\$175</b>
<b>P6008</b> — Environmental Probe.	<b>\$240</b>
<b>P6009</b> — High Voltage Probe.	<b>\$195</b>
<b>P6202A</b> — Active Probe.	<b>\$680</b>
<b>1101A</b> — Active Probe Power Supply.	<b>\$425</b>
<b>A6302</b> — Current Probe.	<b>\$565</b>
<b>A6303</b> — Current Probe.	<b>\$1,070</b>
<b>AM 503</b> — Current Probe Amplifier.	<b>\$1,125</b>
<b>A6901 Ground Isolation Monitor</b> — See page 478. Order A6901	<b>\$650</b>
<b>A6902B Isolator</b> — See page 479.	<b>\$1,795</b>

## RECOMMENDED CAMERAS

<b>C-5C Option 02</b> — See page 445.	<b>\$465</b>
<b>C-7 Option 03</b> — See page 448.	<b>\$565</b>
<b>C-4</b> — See page 446.	<b>\$370</b>

## RECOMMENDED CART

<b>K212</b> — For on-site mobility. See page 461.	<b>\$330</b>
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