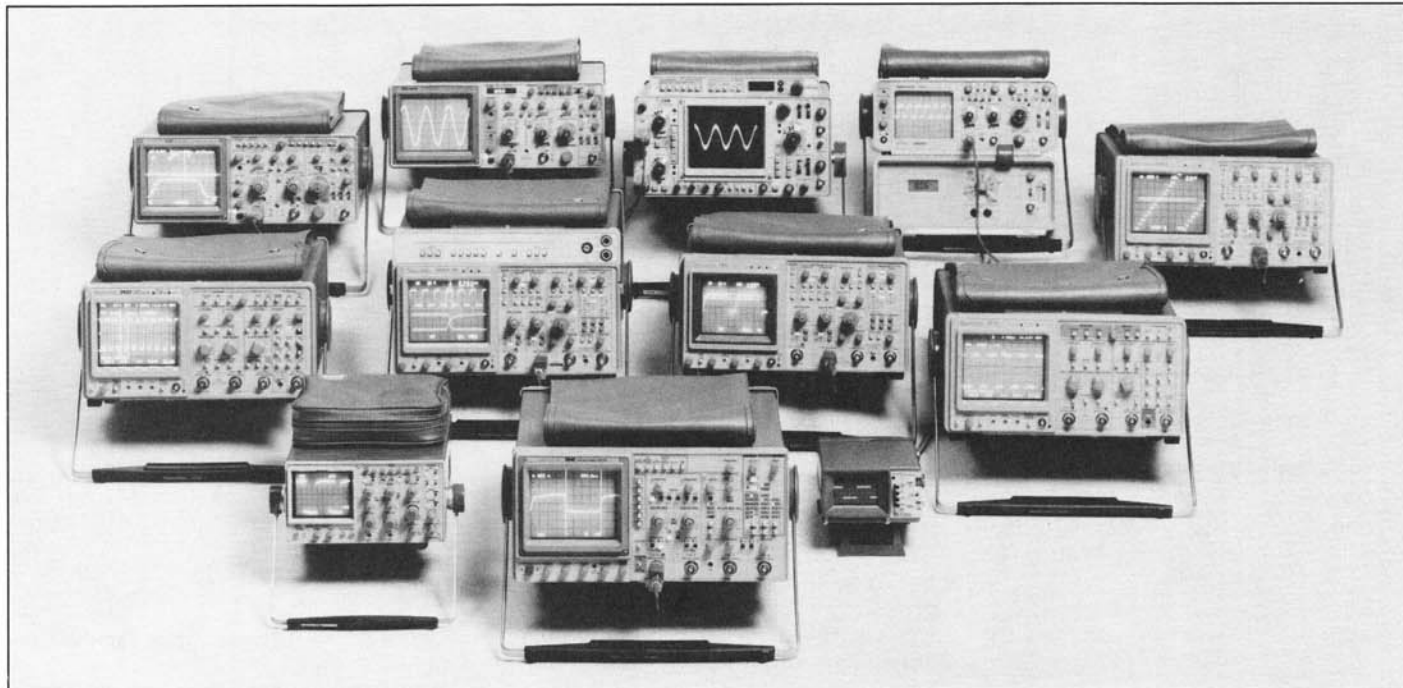


PORTABLE OSCILLOSCOPES



Tektronix offers the widest selection of portable scopes so you'll be able to choose the specific instrument that best suits your needs.

28 portable scopes with many optional features are available with bandwidths from 500 kHz to 350 MHz.



All Portable Oscilloscopes listed in this section are available through the National Marketing Center by calling

toll free 1-800-426-2200 ext. 99. In addition to being able to give you direct order entry, the NMC Sales Engineers are available to offer you immediate technical assistance about product specifications, capabilities, and applications. They can send you literature, discuss available accessories, tell you about payment terms and options, or help you contact your local sales and service office.

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PORTABLE REAL TIME OSCILLOSCOPE SELECTION GUIDE

Product	Bandwidth (MHz)	Sensitivity (mV/div)	Number of Channels	Delayed Sweep	Fastest Sweep (ns/div)	Features	Size mm (in.) HxWxD	Weight kg (lb)	Power Requirements	Prices Begin at
2467	350	2	4	✓	500 ps	4 div/ns visual writing speed, CRT readout, ΔVolts, ΔTime cursors	190x330x467 (7.5x13x18.4)	10.9 (24)	Line (90-132/180-250 V ac, 48-440 Hz)	\$11,900
2465A*1 2465A CT*2 2465A DM*2 2465A DV*2	350	2	4	✓	500 ps	CRT Readout, ΔVolts, ΔTime Cursors	190x338x434 (7.5x13.3x17.1)	10.2 (22.4)	Line (90-132/180-250 V ac, 48-440 Hz)	\$5,550 \$7,150 \$8,400 \$9,200
2455A*1	250	2	4	✓	1	CRT Readout, ΔVolts, ΔTime Cursors	190x338x434 (7.5x13.3x17.1)	10.2 (22.4)	Line (90-132/180-250 V ac, 48-440 Hz)	\$5,350
2445A*1	150	2	4	✓	1	CRT Readout, ΔVolts, ΔTime Cursors	190x338x434 (7.5x13.3x17.1)	10.2 (22.4)	Line (90-132/180-250 V ac, 48-440 Hz)	\$3,590
2335	100	5	2	✓	5	Rugged, compact, lightweight	140 x 270 x 430 (5 x 11 x 17)	7.7 (17)	Line (100-132/200-250 V ac, 48-440 Hz)	\$3,940
2336	100	5	2	✓	5	B Trigger, ΔTime	(140x270x430) (5x11x17)	7.7 (17)	Line (100-132/200-250 V ac, 48-440 Hz)	\$4,270
2336YA	100	5	2	✓	5	B Trigger, ΔTime, elapsed time indicator, extra probes and manual	(140x270x430) (5x11x17)	7.7 (16.5)	Line (100-132/200-250 V ac, 48-440 Hz)	\$4,490
2337	100	5	2	✓	5	B Trigger, ΔTime, DMM	140x270x430 (5x11x17)	7.7 (17)	Line (100-132/100-250 V ac, 48-440 Hz)	\$4,700
2245	100	2	4	✓	2	Full triggering features for both A and B sweeps. CRT Readout of scale factors and delay time.	176x360x445 (7x14.2x17.5)	7.5 (16.5)	Line (90-250 V ac, 48-440 Hz)	\$1,775
2246	100	2	4	✓	2	Full triggering features for both A and B sweeps. CRT Readout of scale factors and delay time. Time/Volts cursors and Δtime function. Voltmeter functions with smart cursors.	176x360x445 (7x14.2x17.5)	7.5 (16.5)	Line (90-250 V ac, 48-440 Hz)	\$2,400
2246 Opt 01	100	2	4	✓	2	Full triggering features for both A and B sweeps. CRT Readout of scale factors and delay time. Time/Volts cursors and ΔTime function. Voltmeter functions with Smart Cursors. Meets MIL SPEC 28800C Type III, Class 3.	176x360x445 (7x14.2x17.5)	7.5 (16.5)	Line (90-250 V ac, 48-440 Hz)	**
2235	100 ³	2	2	✓	5	Dual Time Base, Single Sweep Trigger View, BW Limit	137x360x440 (5.4x14.2x17.3)	6.1 (13.5)	Line (90-250 V ac, 48-440 Hz)	\$1,575
2235 Opt 01	100 ³	2	2	✓	5	Dual Time Base, Single Sweep Trigger View, BW Limit, Scale Illumination, HF/LF Rej Meets MIL SPEC 28800C Type III, Class 3	137x360x440 (5.4x14.2x17.3)	6.1 (13.5)	Line (90-250 V ac, 48-440 Hz)	\$2,195
2236	100 ³	2	2	✓	5	Dual time base with 100 MHz counter, timer, and full-function voltmeter	137x360x440 (5.4x14.2x17.3)	7.4 (16.3)	Line (90-250 V ac, 48-440 Hz)	\$2,795
2225	50	0.5 5 @ 50 MHz	2		5	Alternate magnification, p-p auto X10 vert mag, HF/LF rej single sweep, TV trigger	138x380x438 (5.4x15.0x17.2)	6.6 (14.6)	Line (95-128/185-250 V ac 48-440 Hz)	\$995
305	5	5	2		100	Autoranging DMM battery power	110x240x370 (4.4x9x15)	4.8 (10.6)	Built-in battery, line (90-132/180-264 V ac, 48-440 Hz), or external dc	\$3,060
221	5	5			100	5 MHz hand-held	80x130x230 (3x5x9)	1.6 (3.5)	Built-in battery, line (90-250 V ac, 48-62 Hz)	\$2,715
213	1	20			400	DMM/scope at <4 lb (1.7 kg)	70x130x230 (3x5x9)	1.7 (3.7)	Built-in battery, line (90-136/180-250 V ac, 48-62 Hz), or external dc	\$3,300
212	0.5 (500 kHz)	10	2		1000 (1 μs/div)	Integral 1 MΩ probe	80x130x240 (3x5x10)	1.6 (3.5)	Built-in battery, line (104-126 V ac, 58-62 Hz)	\$2,095

PORTABLE STORAGE OSCILLOSCOPE SELECTION GUIDE

Product	Bandwidth (MHz)	Sensitivity (mV/div)	Dual Trace	Delayed Sweep	Fastest Sweep (ns/div)	Features	Size mm (in.) HxWxD	Weight kg (lb)	Power Requirements	Prices Begin at
2430A	150	2	✓	✓	5	Digital Storage, 100 MS/s with 8-bit resolution and dual-channel acquisition	190x330x479 (7.5x13x18.8)	11.1 (24.4)	Line (90-132/180-250 V ac, 48-440 Hz)	\$8,900
2230	100	2	✓	✓	5	Digital Storage 20 MS/s at 5μs/div and faster	137 x 237 x 440 (5.4 x 9.3 x 17.3)	8.3 (18.0)	Line (90-250 V ac, 48-440 Hz)	\$4,995
466	100	5	✓	✓	5	Fast transfer and variable persistence. 3,000 div/μs stored writing speed at reduced scan	160 x 330 x 550 (6 x 13 x 22)	11.8 (26)	Line (99-132/198-264 V ac, 48-440 Hz) or battery pack	\$8,590
2220	60	2	✓		5	Digital Storage 20 MS/s at 5μs/div and faster	137x237x440 (5.4x9.3x17.3)	8.3 (18.0)	Line (90-250 V ac, 48-440 Hz)	\$2,995
2221										\$3,995
336	50	5	✓	✓	100	Digital Storage 1 MS/s Microprocessor control and menu driven*4	112x237x482 (4.4x9.3x14.6)	5.1 (11.3)	Line (90-132/180-250 V ac, 48-440 Hz)	\$5,470
314	10	1	✓		100	Bistable, Stored viewing time to 4 hr 400 div/ms stored writing speed	110x240x350 (4.4x9x14)	4.7 (10.3)	Line (90-132/180-264 V ac, 48-440 Hz) or external dc	\$4,935
214	0.5 (500 kHz)	10	✓		1000 (1 μs/div)	Bistable, 500 div/μs stored writing speed. Fully self-contained	80x130x240 (3x5x10)	1.6 (3.5)	Built-in battery, line (104-126 V ac, 58-62 Hz)	\$2,865

*1 The 2467, 2445A, 2455A and 2465A offer as options: 4½ digit DMM, 150 MHz Counter/Timer/Trigger, 17-Bit Word Recognizer, TV Trigger and GPIB Interface.

*2 Special Edition 2465A.

*3 The 2235 and 2236 are specified 100 MHz for sensitivities from 5 mV to 5 V/div and 90 MHz in 2 mV.

*4 See specifications in Digitizer section.

*5 Contact your local sales office for information.

PORTABLE SCOPE PRODUCT LITERATURE AND APPLICATION NOTES

Tektronix product literature is readily available from your local Tektronix Sales Office.

For data sheets and product brochures, just ask for literature on the specific instrument. Additional related publications also available are listed below.

Title	Description	Order
Portable Oscilloscope Selection Guide	A helpful aid for choosing the right portable scope for your needs.	38-W-5158-2
2000 Series Warranty Brochure	Describes Tek's 3-year warranty on 2000 Series scopes and 5-year Warranty-Plus Service	81-W-5258
Using the 2336	Pocket Reference Guide	46-W-5732
2245/65, 2445/65 TDR	Application Note	38-W-5221-1
Quick and Easy Phase Measurement	Application Note	38-W-5223-1
Chip CRT and Assembly	Article Reprint	38-W-5312
400 Series Portable CRT Storage Scopes	Describes the 466, 464, and 434 portable storage scopes	40-W-3793-2
336 Brochure	Describes 336	53-W-5426-1
XYZs of Using a Scope	A basic primer that features the 2225 Series	46-W-6428
XYZs Instructor's Aid	Supplement to Primer	46-W-5169-2
XYZs Workbook	Supplement to Primer	46-W-5170-2
Using Delayed Sweep In Measuring Digital Word Trains	Application Note (2246)	41-AX-3349
VITS Analysis for TV Servicing	Application Note	41-AX-4047-1 46-W-5207
Basic Video System Measurements	Describes TV measurements using 2445A/65A Option 05 scopes	38-W-5511
Pulse Parameters	Application Note (2236)	46-W-5205-1
Frequency Measurements	Application Note (2236)	46-W-5206-1
Pulse Ringing and Overshoot	Application Note (2236)	46-W-5209
Swept Frequency Filter and Amplifier	Application Note (2236)	46-W-5210
Power Supply Testing	Application Note (2236)	46-W-5211
General Troubleshooting	Application Note (2236)	46-W-5212
TDR Measurements with a scope	Application Note (2236)	46-W-5215 46-W-5216
Pulse rise Time	Application Note (2236)	46-W-5217-1
Integrating a Scope	Article Reprint	46-W-5337
Portable Storage	Selection Guide	41-W-5546
Your Direct Line to the World's Best Instruments and Technical Expertise	Find out about the Tektronix National Marketing Center and Tek's Service Offices	60-A-4873-1
2245/2246 VITS Analysis for TV Servicing	Application Note	46-W-6311
2225: Setup and Analysis Rise Time Dual Trace & XY Phase Amplitude Period and Frequency	Technique Brief Technique Brief Technique Brief Technique Brief	46-W-6425 46-W-6427 46-W-6424 46-W-6426 46-W-6423
2225 Primer	Concepts	46-W-6428

Title	Description	Order
2225 Instructor's Aid	Supplement to Primer	46-W-6466
2225 Workbook	Supplement to Primer	46-W-6465
2225 Poster	Supplement to Primer	46-W-6430
2215A Primer	Concepts	46-AX-4758-2
2215A Poster	Supplement to Primer	46-TT-528
ABCs of Probes	Primer on signal acquisition probes, applications, specs and selections	60-W-6053
DSO Primer	Concepts	41-W-6051
Waveform Storage using the 2230	Concepts	41-W-6392
Peak Detect Feature of the 2230	Concepts	41-W-6393
Capture of Transient Events with the 2230	Concepts	41-W-6398
Signal Averaging Using the 2230	Concepts	41-W-6570
Scan & Roll Modes for Capturing Slow Events	Concepts	41-W-6570
Single Fiber Muscle Research Using the 2230	Application Note	41-W-6395
2230 Data Acquisition for Process Control	Application Note	41-W-6024
Muscle Fatigue Research Using the 2230	Application Note	41-W-6396
Computer Disk Drive Repair with the 2230	Application Note	41-W-6397
Using the 2230 to Design Zero Defects into the Manufacturing Process	Application Note	41-W-6504
G.E. Medical Diagnostic Instrument Service	Application Note	41-W-6571
DSOs: Take a New Look	Article Report	41-W-6484
New DSO Techniques for Capturing Elusive Glitches	Article Reprint	41-W-6480
Use a DSO to get More and Better Data	Article Reprint	37-W-6251
GPIB Utility Software for 4041	Software Data Sheet	41-W-6486
GPIB Waveform Analysis Software for 4041	Software Data Sheet	41-W-6496
GPIB Utility Software for the IBM PC	Software Data Sheet	41-W-6485
RS-232C Utility Software for IBM PC	Software Data Sheet	41-W-6503
ThinkJet Printer	System Applications	41-W-6497
EPSON Printer	System Applications	41-W-6499
HP-GL Plotter	System Applications	41-W-6501
XY Plotter	System Applications	41-W-6489
2220/2221/2230	Brochure	41-A-6656
2220/2221/2230	Data Sheet	41-W-6657

PORTABLE SCOPE/ACCESSORIES COMPATIBILITY GUIDE

	PROBES**			CAMERAS			CARTS	MISCELLANEOUS ACCESSORIES
	Passive	Active	Current	Single Shot or Low Rep Rate	Stored/Stable or Repetitive	Low Cost		
2430A 2445A 2455A 2465A 2465A DV 2465A CT 2465A DM 2467	P6101A, P6009 P6015 P6133 (2445A, 2430A) P6136 (2467/65A/55A)	P6201 P6202A P6230	P6021/P6022 A6302/AM 503 A6303/AM 503	C-31B Opt 01 016-0269-03 adapter**1	C-30B Opt 01 016-0269-03 adapter**1	C-5C Opt 02 016-0359-01 adapter**1 C-4 122-0894-01	K212	Folding Polarized Viewing Hood 016-0180-00; Collapsible Viewing Hood (Binocular) 016-0566-00; 1105 Power Supply; 1106 Battery Pack; 1107 Dc Inverter Power Supply; Protective Cover 016-0720-00.
2335 2336 2336YA 2337	P6130 P6009 P6063B P6015 P6108A P6101A (2236YA)	P6202A P6201 P6230	P6022 A6302/AM 503 A6303/AM 503 P6021	NA	NA	C-5C Opt 04 016-0359-01 adapter**1 (with flash) C7 Opt 2 016-0359-01 adapter**1	K212	2335 Rack Adapter Kit 016-0468-00.
2245 2246 2220 2230 2235 2236 2225	P6101A P6009 P6130 P6015 P6062B P6230 P6122 P6121 (2236, 2230) P6109 (2245, 2246) P6103 (2225)	P6201 P6202A	P6021 P6022 A6302/AM 503 A6303/AM 503	C-31B Opt 01 016-0269-03 adapter**4	C-31B Opt 01 016-0269-03 adapter**4	C-5C Opt 04 016-0359-01 adapter**1,3 (with flash) C-4 Option 02**4 C-7 Opt 02**4, Opt 03**4 C-5C Opt 02**4	K212	Clear CRT Light Filter 337-2775-01; CRT TV Graticule Custom Mod; Accessories Pouch 016-0677-02; Front Cover 200-2520-00; RM Kit: 016-0466-00 for 2235; 016-0819-00 for 2225; 016-0833-00 for 2235 Opt 01; 016-0015-00 for 2236; RM Kit: F2240R for 2245/2246; P6602 Temperature Probe
466	P6101A P6015 P6105A P6009 P6062B P6130	P6201 P6202A P6230	P6022 A6302/AM 503 A6303/AM 503 P6021	C-31B Opt 01 016-0269-03 adapter**1	C-30B Opt 01 016-0269-03 adapter**2	C-5C Opt 02 016-0359-01 adapter**1 C-4 122-0894-01 adapter**1 C-7 Opt 2 016-0359-01 adaptor**1	K212	Folding Polarized Viewing Hood 016-0180-00; Collapsible Viewing Hood (Binocular) 016-0566-00; Protective Cover 016-0365-00; Mesh Filter 378-0726-01; 1105 Battery Power Supply; Rack Adapter 016-0675-00.
314, 305 336	P6101A P6149A P6148A (336)		P6021, P6022 A6302/AM 503 A6303/AM 503	C-31B Opt 01 016-0327-01 adapter**2	C-30B Opt 01 016-0327-01 adapter**2		NA	Viewing Hood 016-0297-00; Mesh Filter 378-0063-00; 1105 Battery Power Supply; Rain Cover (314, 335) 016-0612-00.

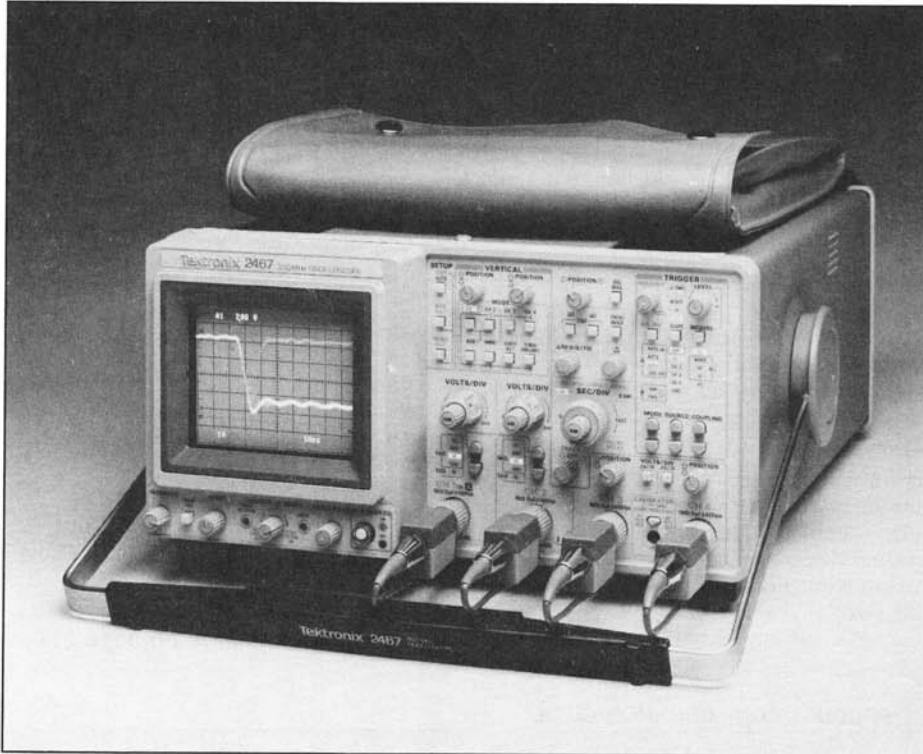
*1 Mounting adapter comes with camera/option listed, others are optional.
*2 Mounting adapter must be ordered in addition to the camera/option listed.
*3 2235 Opt 01 Order C-5C Opt 02 or C7 Opt 03.

*4 Camera listings recommended for 2235 Opt. 01, 2245, and 2246.
*5 Highlighted probes are preferred for typical general purpose use and/or are shipped as included accessory to the instrument.

To order, call your local Tektronix Sales Office, or call Tek's National Marketing Center,
Toll free: 1-800-426-2200, Ext. 99. In Oregon call collect: (503) 627-9000, Ext. 99.

The Standard of Excellence in Portable Oscilloscopes

See, measure, automate at the touch of a button



2467

**GPIB
 IEEE-488**

The 2467 Option 10 complies with IEEE Standard 488-1978 and with Tektronix Standard Codes and Formats.

• 4 ns/Div Visual Writing Speed

Observe faults you couldn't see before. From single-shot, low rep-rate pulses to occasional glitches and fast transients to metastability and jitter in high-repetition rate signals, the Tektronix 2467 instantly reveals events that cannot be displayed or measured by any other portable scope. You now can see high-speed, single-shot phenomena and low-repetition rate analog and digital signals as they occur, at sweep speeds to 500 ps/div without a viewing hood.

At the heart of the 2467's extraordinary capabilities is Tektronix' microchannel-plate (MCP) CRT.

The unique property of an MCP display amplifies the intensity of infrequent signals, yet limits the intensity of signals with high repetition rates. Now see glitches that remain hidden on scopes with conventional CRTs, or are never captured on digital storage scopes because of low trigger probability.

CRT writing speed and intensity superiority results in an instrument able to display everything that happens in your circuit, whether it occurs once or repetitively. The technology that was pioneered by the 1-GHz Tektronix 7104 plug-in oscilloscope is available for a new range of applications in this portable, 350-MHz instrument.

With the 2467 you benefit from the dramatic increase in visual writing speed (VWS) compared to the fastest conventional CRT. The 2467 VWS is 4 div/ns versus 0.04 div/ns for the conventional CRT used in the 2465A. Just being able to see unexpected transients, even when masked by highly repetitive events, makes the critical difference in many design and troubleshooting situations.

2467/2465A/2445A

- 350-MHz Bandwidth (2467, 2465A)
- 1-ns Rise Time (2467, 2465A)
- Auto Setup
- Save and Recall Setups
- Set-Up Sequencing
- On-Screen Trigger-Level Readout
- Volts and Time Cursors With On-Screen Readout
- Cursors After Delay
- 500-MHz Trigger Bandwidth (2467, 2465A)
- Four Independent Channels
- 500 ps/Div Time Base (2467, 2465A)
- Switchable 1 M Ω and 50 Ω Inputs
- 20-ps Time-Interval Resolution
- 2 mV/Div Vertical Sensitivity at 350 MHz

- On-Screen Scale-Factor Readout
- Lightweight and Rugged



DCS01/2467 Digitizing Camera System captures repetitive waveforms and transients from analog scopes according to a scope's CRT visual writing speed (2467: 4 div/ns).

Make single-shot and low-repetition-rate measurements.

Even at 500-ps/div sweep speed, the 2467's 4-div/ns visual writing speed displays the lowest repetition-rate signals, even single shots, in normal room light. Its 350-MHz bandwidth faithfully reproduces your signal's high-frequency details.

Using the trigger-level readout feature, you can set the proper trigger point for your experiment the first time—no more guessing where the trigger point is set. And there's no wasted time and materials repeating the experiment just to properly set the trigger level.

Excellent EMI protection means reliable operation even in the high fields generated by high-power lasers, ESD testing, or NMR equipment.

Find circuit problems in digital systems.

When troubleshooting a digital system, you want to see a fault immediately. In digital circuits, violations of either timing or noise margins can result in faulty operations, such as low-amplitude (runt) pulses, slivers, or metastability. If the margin violations are infrequent, faulty outputs are even less frequent.

A real-time oscilloscope with an MCP-enhanced CRT, such as the Tektronix 2467, can display intermittent variations

as they happen, making them instantly visible, even though they may be masked by thousands of normal traces. Other instruments either cannot display infrequent faults at all or they may take several minutes to build up a display that shows an occasional fault.

With 30-ns pretrigger display, you can examine the inputs to a logic device prior to the output transition. Seeing the inputs when a fault occurs can point to the real problem.

Determine actual noise margins.

With its ability to clearly display transient events in the presence of numerous signals, the 2467 shows designers actual noise margins. Adequate noise margins are essential for reliable system operation. With the 2467, no matter how infrequently noise pulses occur, they are clearly displayed. Even if the noise is asynchronous to the monitored signal, the 2467 will highlight it—so you can see the worst-case noise.

Even if a prototype performs correctly, manufacturing tolerances can induce errors in marginal systems. Correcting marginal circuit conditions not only yields more reliable products but also shortens product design cycles. Crosstalk and other intermittent noises are easily identified and fixed.

Measure random noise and jitter in communication systems.

Eye patterns are often used as a performance measure in a digital communication channel. The use of eye patterns is enhanced by the 2467's high visual writing speed, which permits viewing the worst-case effects of random or erratic noise, jitter and other channel impairments. Also when making eye-pattern measurements, cursors can be applied in either the voltage-ratio or time-ratio mode. Employed in this way, they indicate degradation as a percentage of the normal eye opening, thus simplifying and quantifying the measurement.

Digitize and capture even single-shot events to 350-MHz bandwidth.

Digitize waveforms, store and analyze them on your IBM PC. The DCS01 (Digitizing Camera System) easily and cost-effectively adds digitizing and signal-processing capability to the 2467. The fast working microchannel plate (MCP) CRT allows the capture of transient and repetitive signals at the full 350-MHz bandwidth of the 2467.

For documentation, a C-30 Series oscilloscope camera produces high-contrast photographs of single-shot signals at 500 ps/div using common ISO 3000 film. No special camera or film is required.

Ordering information is on page 314.

PRODUCT CONFIGURATION GUIDE

Configuration	Standard Models				Special Edition Models		
	2467	2465A	2455A	2445A	2465A CT	2465A DM	2465A DV
Bandwidth	350 MHz	350 MHz	250 MHz	150 MHz	350 MHz	350 MHz	350 MHz
GPIB	Option 10	Option 10	Option 10	Option 10	Included	Included	Included
Counter/Timer/Trigger, Word Recognizer	Option 09	Option 09	Option 09	Option 09	Included	Included	Included
DMM		Option 01	Option 01	Option 01		Included	Included
Video Measurement System	Option 05	Option 05	Option 05	Option 05			Included
Counter/Timer/Trigger, No Word Recognizer	Option 06	Option 06	Option 06	Option 06			
Two Additional Probes	Included	Option 22	Option 22	Option 22	Included	Included	Included
Rackmount	Option 1R	Option 1R	Option 1R	Option 1R	Option 1R		
Probe Power	Option 11	Option 11	Option 11				

See, Measure, Automate at the Touch of a Button



2465A/2445A/ 2465A CT/2465A DM/ 2465A DV/2467

Special Editions

GPIB
IEEE-488

The 2465A/2445A Option 10, 2465A CT, 2465A DM and 2465A DV comply with IEEE Standard 488-1987 and with Tektronix Standard Codes and Formats.

The Tek 2467/2465A/2445A family: high-performance capabilities to match your tough assignments.

Start with the standard-setting performance of Tek's top portable analog scopes. Add productivity-enhancing features for fast operation. Provides a probe-tip bandwidth to 350 MHz. The result: six four-channel, dual time-base oscilloscopes that bring unprecedented efficiency to your design lab, production line or field-service site.

Auto setup, instant recall, and set-up sequencing for easy answers fast!

So easy to use that now you simply attach up to four probes to signal points, press Auto-Setup, and within seconds a stable, automatically-triggered display of the probed waveforms appears on screen for viewing or advanced parametric charac-

terization. With Auto-Setup, users of any experience level will gain increased speed and ease of use in making day-to-day waveform observations and measurements.

Digital-design and test personnel are sure to appreciate Tek's proprietary Pulse Mode for viewing narrow pulses in detail. Auto-Setup calculates the duty factor and properly displays either the low-duty-cycle pulse or several cycles or symmetrical waveforms. Also, input channel selection is sensed, and display positioning adjusted for up to four waveforms with appropriate scaling.

Time and voltage cursors.

Use the cursors to obtain quick readouts of voltage, time, frequency, ratio, and phase with no interpretation or CRT linearity errors. Readouts are in units of volts, time, percent, and degrees. The cursors can even be applied to delayed sweep displays, improving timing measurement flexibility.

Tektronix' hybrid preamplifiers make possible a 350 MHz bandwidth—in the 2465A/2467, even at 2 mV/div sensitivity. New probes take the full bandwidth to the probe tip—where you need it.

Timing measurements are possible with 20-ps resolution at sweep speeds to 500 ps/div in the 2467/2465A and to 1 ns/div in the 2445A. Trigger on signals to at least 500 MHz with the 2467/2465A and to at least 250 MHz with the 2445A, which extends the usefulness of each scope well beyond its vertical bandwidth.

Trigger from any one of the four input channels or on four asynchronous signals. Tek's Auto-Level Trigger mode keeps your scope triggered even as the input signal changes. You can choose to trigger at the 10, 50, or 90% level of the signal. On-screen trigger-level readout eliminates trial-and-error triggering, saving you time and frustration.

CRT readout of the vertical scale factors, input coupling, sweep speeds, trigger level and source, and indicators such as Bandwidth Limit and Holdoff give you complete status information at a glance. These readouts are recorded on film in your waveform photos.

Dual, delaying time bases, each with independent trigger systems allow for precise measurements using one or both sweeps.

Tailor your 2467/2465A/2445A for special needs, or choose a specially configured measurement package.

To fit specialized performance requirements, the 2467/2465A/2445A Family offers six integral individual or combinable enhancements: GPIB Interface, Digital Multimeter, Counter/Timer functions with Enhanced Triggering, 17-bit Word Recognition, and Video-Measurement capabilities.

You can also select one of three 2465A Special Editions which, as packages, are preconfigured for a significant savings over separately ordered measurement options.

The 2465A CT is configured especially for use with communications, office and computer-related equipment. The 2465A DM adds a digital multimeter for applications in government/military electronics, avionics, and ATE stations. Finally, there's the fully optioned 2465A DV for even more extensive applications including the design, manufacture, and service of raster-scan devices and high-resolution video equipment. The 2465A DV is easily the most powerful portable available.

With instant access to complex setups measure signal parameters quickly.

For closer examination of your signals and for more specialized setups, such as delayed-sweep displays or applications using the extended-measurement options, front panel controls are still necessary. Now however, you need to create these setups only once. Nonvolatile memory for 30 setups stores *all* front-panel information, including cursor locations and control settings for the extended-measurement options.

The Save/Recall utility is a tremendous time-saver for designers, evaluators, and production-test operators—who need several setups for measurements at multiple test points in a circuit or system. Switching between measurements is fast; just two buttons for a complete setup. Operator attention is focused on answers, not on control adjustments.

Measurements are highly reliable as well as efficient. Vertical and horizontal accuracy are tightly specified for a wide range of environmental conditions. Pulse response is optimized for flatness and speed, so the waveform measured truly represents the signal. With the advanced-feature set, including waveform cursors, the 2467/2465A/2445A Family minimizes errors and maximizes your confidence in measurement results.

Automate repetitive measurement sequences without an external controller.

Now systematic verification procedures for engineering prototypes, final production test, or field service can easily be set, stored, and sequenced without a computer. Step through up to 30 stored test setups in the order you choose. Just press the Step button once for each sequence step. Or plug a foot switch into the rear-panel audio jack for hands-free operation.

As an additional aid, seven-character alphanumeric labels can be stored with each setup. The labels can be test titles or operator prompts for test-point connections. You can protect the saved setups and sequences by write-protecting the memory.

Built-in sequencing and screen-message capabilities are standard throughout the 2467/2465A/2445A Family. With a single, standalone portable oscilloscope, you can implement extensive automated or semi-automated procedures. This feature provides an excellent, price-competitive entry into automated testing. The 2467/2465A/2445A Family offers complete upward mobility from the 2445A through the 2467 and its options.

Add the GPIB option and take advantage of no-controller setup and sequence transfers. Create or modify stored setups on one scope, for example, then update the other scopes in a production test area with a simple transfer procedure.

The GPIB option opens even more possibilities for automating measurement procedures. All front-panel controls on the 2467/2465A/2445A scopes are programmable and can be set up by an external controller, which can also send messages to the operator for semiautomated tests and read back measurement results for storage and analysis.

Personal computers assist hardware development and evaluation taskwork.

For many single-step and multistep tests during product development, characterization, and evaluation, the 2467/2465A/2445A's internal sequencer provides all the automation you need.

Further automation is accomplished by simply linking the scope with a PC, or other controller, via the GPIB. Use this configuration to debug prototypes, efficiently manage experiments, and record measurement results for documentation or analysis.

Test-program software generators such as EZ-TEK 2400 PC are designed so that developing your procedures involves little more than setting the scope's front-panel controls and making selections from a screen menu. *You* don't need to write code.

Decrease a product's time to market by using the same scope/controller system and software throughout the development cycle. Tests that were designed during the engineering phase can be used for evaluation, then adapted for production. Consistency will be maintained in methods and results.

Use oscilloscopes that are ideal for production-test systems.

Configuring 2467/2465A/2445A oscilloscopes for semiautomated operation takes advantage of the strengths of both humans and computers. The controller can record measurement results, make arithmetic-based pass/fail decisions, set the scope for each step of the procedure, and write prompting messages on the CRT. The operator's time is used efficiently to adjust cursors to the signal, compare waveforms against references marked by the controller with the cursors, and decide whether the visual criteria for each test has been met.

Combining the DMM, Video Measurement and CTT options with a 2465A/2445A oscilloscope provides multi-instrument capabilities while reducing rack space, equipment cost, and programming complexity. The self-diagnostic capabilities and self-calibration functions of the 2465A/2445A scopes make them excellent candidates for installation in large and small test systems. A built-in runtime counter assists in record keeping for preventative maintenance and calibration. The 2400 Series instruments offer proven reliability and are all backed by Tek's three-year warranty.

You can use a powerful yet portable system.

A GPIB- and DMM-equipped 2465A/2445A, plus a PC controller are all a service technician needs to carry into the field for maintenance or troubleshooting. The controller leads the technician through the steps of a diagnostic test or calibration procedure. Measurement results are recorded for later analysis or use in statistical record keeping.

The 2467/2465A/2445A Family is portable and rugged.

The 2467/2465A/2445A and Special Editions are easy to carry to any field-service site. When you get there, they perform—even in extreme conditions. Environmental characteristics include a low EMI profile and rugged construction.

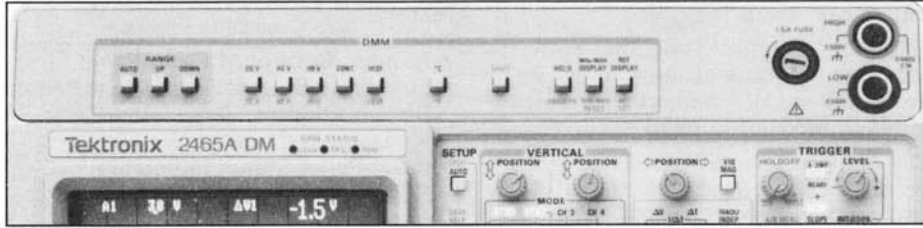
Channels 1 and 2 vertical input couplings can be independently selected as ac, dc, or ground. Or, terminate your circuit outputs and controlled-impedance transmission lines into 50 Ω . To protect against overload while using the internal 50 Ω terminations, the scopes automatically switch to 1 M Ω impedance when an overload is detected, and a readout indicates the change.

Assurance of error-free operation is backed by Tek's three-year instrument warranty.

This warranty includes the CRT and can be easily extended to five years (in most countries) through a variety of optional service plans.

This warranty policy plus Tek quality and proven reliability means you can expect outstanding value and long life from your oscilloscope investment. With new productivity-enhancing features to minimize training and operating time, the 2467/2465A/2445A Oscilloscope Family offers economical solutions to your needs in waveform observation, measurement, and automation; high performance at its affordable best.

Choose From a Complete Range of Options That Extend the Capabilities of the 2467, 2465A, 2455A, and 2445A



- Option 01 Digital Multimeter
- Option 05 Video Waveform Measurement System
- Option 06 Counter/Timer/Trigger (CTT)
- Option 09 CTT with Word Recognizer
- Option 10 GPIB Interface
- Option 1E External Clock
- Option 1R Rackmounting

Digital Multimeter

Option 01

- 4½ Digit Autoranging Digital Multimeter
- True RMS AC Volts From 20 Hz to 100 kHz
- True RMS AC Current From 20 Hz to 10 kHz
- 10 µV Resolution on DC Volts
- Continuity Beeper
- UL Listed, CSA Certified
- Temperature Probe -62 to +230°C
- Calibration via Front Panel Without Removing Instrument Covers
- Convenience Features Include: Set Reference, Hold, Smooth, Minimum/Maximum, dBV, and dBm

The 2465A/2445A's Digital Multimeter (Option 01) makes it possible to measure dc and ac (RMS) volts and current, dBm, dBV, resistance, and temperature at your workbench with no added space requirements. Carry everything you need into the field for maintenance and repair, all in one rugged, portable package. The DMM and scope meet the same tough requirements for environmental conditions including temperature, humidity, and shock. Calibration of the DMM is accomplished from the front panel, without removing any covers. Plug a DMM-equipped 2465A/2445A into your system (rack-mounting is optional as a modified product) to take advantage of its fully-programmable measurements and screen prompts.

Blocks of accumulated measurements can be averaged and smoothed. Minimum and maximum values can also be displayed. Set a reference function if, for example, you need to compare deviations from a

norm. Audible continuity checking is useful for applications in service, production, and design/development. Troubleshoot circuit board hot spots with the temperature probe, which registers temperature variations with 0.1°C or °F resolution.

Combining the DMM and CTT options allows direct measurement of system frequency, period, or time interval while monitoring ac or dc volts, current, or temperature. Use just one instrument to characterize voltage-to-frequency converters and temperature drift of crystal oscillators. Add the GPIB interface for a powerful measurement system to run tests and verification procedures and log measurement results with your controller.

Video Waveform Measurement System

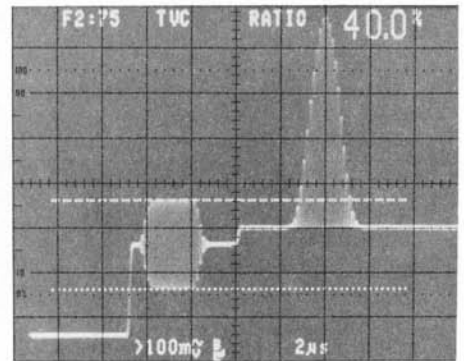
Option 05

- Television Waveform Analysis Capabilities
- Selectable System-M and Nonsystem-M Protocols
- Selectable Triggering on Any Line Within a Field, With Line-Number Readout
- Compatible With Composite Video Having 13.1- to 77-kHz Line Rates
- TV Blanking-Level Clamp (Back-Porch)
- Optimized Vertical Response Comparable to High Performance TV Waveform Monitors

Video measurement capabilities extend the 2467/2465A/2445A's power and versatility to meet the challenges in broadcast and cable television, graphics displays, and raster-scan systems. The Video Waveform Measurement System makes quality measurements convenient during every stage of a product's life cycle: design, production, system calibration, quality assurance, maintenance and service.

With CRT readout of the line number and field selected for triggering, an operator knows precisely what the display represents. Any line can be selected from Field 1, Field 2, or Field 1 alternating with Field 2. The fourth video trigger selection is Lines, which superimposes all the lines in both fields. Systems with up to 1280 lines can be accommodated.

The back-porch clamp locks the video black level to a fixed point, so the display is stable and clean, even when the composite video contains low-frequency hum or when the average picture level changes with ac coupling. Controls are provided for compatibility with a wide variety of system protocols.



This sample waveform and CRT readout show a 2445A's high-fidelity display and measurement of the color subcarrier amplitude on Line 75, Field 2 of an NTSC signal with the television blanking-level clamp (TVC) engaged. The cursor readout of 40% is interpreted as 40 IRE units with appropriate adjustment of the vertical gain.

Counter/Timer/Trigger (CTT)

Option 06

Option 06 provides the Counter/Timer/Trigger without the word recognizer probe. Specifications and included accessories are the same as Option 09. The word recognizer cannot be added to Option 06 after delivery of the oscilloscope (field retrofit kits are not available.)

Counter/Timer/ Trigger (CTT) with Word Recognizer (WR)

Option 09

- Crystal-Controlled Time Base
- 0.001% Accuracy
- Totalize Up to 9,999,999 Events
- Delay-by-Events Triggering up to 4,194,303 Events
- Boolean Logic Triggering on both Digital and Analog Signals
- 17-Bit Word-Recognizer Probe

Option 09 delivers the crystal-controlled timing accuracy and the extra triggering power you need for digital systems. Frequency and period are measured directly from any vertical channel. Time intervals can also be measured by the counter, with ease. The delayed sweep (B sweep) trigger has been expanded to select independent signal sources, slopes, and levels for the beginning and ending of a time interval. This expansion allows precise time measurements between two events, each with different characteristics (using the same or separate channels). This new capability provides for measurement of propagation delay (through a level shifter or an amplifier), as well as rise time, fall time, or processor power-up delay.

Once configured, these measurement setups can be saved in the scope's set-up memory, either to be recalled later or used as part of a sequence. With the CTT, recalled measurements are completely automatic and require no operator intervention.

With the Word Recognizer, any pattern of up to 17 digital bits can act as an input to the counter or as a trigger for the A or B sweep.

Pinpointing the "needle-in-a-haystack" signal in a digital system becomes feasible with the Word Recognizer and Delay-by-Events functions as these advanced triggering capabilities eliminate extraneous signals.

To characterize or "unravel" system, the CTT can measure the frequency or period of recognized words. Also, and it can delay the scope trigger by a selected number of words.

With the Totalize function, you can record the passing of unusual events or verify a burst of events on any vertical input or recognized word.

The Boolean-logic trigger allows triggering on either the logical AND or OR of any two input channels. Logical-OR triggering lets you trigger on either the positive or negative slope of any input signal. This function is known as "bislope triggering" and allows you to catch events reliably—even if you don't know whether the transition will be high-to-low or low-to-high.

The Counter/Timer/Trigger is also available without the Word Recognizer probe as Option 06.

External Clock

Option 1E

The External Frequency Reference option (Option 1E) provides the ability to make frequency measurements with eight-digit resolution. With an external reference signal attached to the rear-panel input connector, the CTT automatically detects the reference signal and makes all frequency measurements relative to the reference. Accuracy is equal to the external reference or one count in the Least Significant Digit of the eight-digit readout, whichever is greater.

Option 1E automatically accepts any one of the following frequencies as the external reference:

- 1.000000 MHz
- 3.579545 MHz (color burst frequency for video)
- 4.4336188 MHz
- 5.000000 MHz
- 10.000000 MHz

GPIB Interface

Option 10

GPIB
IEEE-488

Bus Interface complies with IEEE Standard 488-1978 and with Tektronix *Standard Codes and Formats*.

- Remote Control of Front-Panel
- Functions Selectable at Front Panel: Device Address, Talk/Listen Mode, Message Terminator
- Front-Panel Status Indicators: REM (Remote), SRQ (Service Request), LOCK (Local Lockout)
- Compatible With All Other 2467/2465A/2445A Options
- User-Generated SRQ: To Signal Controller During Program Control
- RQS Control: Optional Enable or Disable of SRQ Reporting

Network the 2467/2465A/2445A with your other equipment on the GPIB.

Option 10 adds the ability to communicate over the IEEE-488 General Purpose Interface Bus. Contents of set-up memory can be transferred between 2467/2465A/2445A units without an external controller. Or use a host controller to assist the oscilloscope operator in performing a series of checks and measurements. Front-panel settings can be remotely set or changed, and the results of cursor, DMM, and CTT measurements communicated back over the bus to the controller, as well as appearing on the scope's CRT.

The ability to display prompting messages (by embedding them in control programs) reduces the chance of operator error at critical points in a test procedure.

The 2467/2465A/2445A GPIB-message structure conforms to Tektronix *Standard Codes and Formats*, ensuring that all GPIB messages are "human readable" and consistent in format. Selectable message termination characters allow scope use with most types of controllers. The new 2445A and 2465A are compatible with programs for their predecessors, the 2445 and 2465.

Tektronix software development packages provide an environment for quickly and easily generating automated and semi-automated test procedures. Not only are they easy for nonprogrammers to use, they substantially reduce the amount of time required to create a test-program using previous programming methods and languages.

TEK EZ-TEST and EZ-TEK 2400 are automatic test program generators designed for use with the Tek 4041 controller. EZ-TEK 2400 PC runs on the IBM PC, XT, and AT. The TEK EZ-TEST generator programs the 4041 to drive a wide variety of GPIB-compatible equipment. Both EZ-TEK 2400 and EZ-TEK 2400 PC are designed for systems that need only the capabilities found in 2467/2465A/2445A oscilloscopes and their options. None of these generators require previous GPIB programming experience since they use simple, multilevel menus to develop sophisticated test programs.

The Tek GPIB User's Resource Utility (GURU II) is a utility package for IBM PCs. It includes a GPIB interface board for the PC, GPIB cable, software and instruction manual.

Rackmounting

Option 1R

The 2467/2465A/2445A instruments are available in standard 19-inch rackmount configuration, complete with slide-out chassis tracks.

CHARACTERISTICS

Characteristics are common to the 2467, 2465A, 2455A, 2445A and 2465A Special Editions except where indicated.

VERTICAL SYSTEM

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

CHANNEL 1 AND CHANNEL 2

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

Deflection Factor Basic Accuracy— $\pm 2\%$ (measured at a volts/div setting with a four- or five-division signal, centered on screen)

ΔV Accuracy— $\pm (1.25\%$ of reading + 0.03 div + signal aberrations). Basic accuracies apply for temperatures from +15 to +35°C. Add $\pm 2\%$ of reading for temperatures from -15 to +15°C and from +35 to +55°C. Add 1% of reading when 50 Ω input coupling is used. Add 1% of Channel 2 reading when inverted (measured with cursors anywhere on the graticule).

ΔV Range— ± 8 times the Volts/div switch setting.

Variable Range—Continuously variable between Volts/div switch settings. Extends deflection factor to at least 12.5 V/div.

Frequency Response (-3 dB Bandwidth)

Instrument	+15 to +35°C	-15 to +15°C +35 to +55°C
	2467/2465A	350 MHz
2455A	250 MHz	200 MHz
2445A	150 MHz	150 MHz

All responses measured with standard accessory probe or internal 50 Ω termination.

AC Coupled Lower -3 dB Point—With 1X Probe: 10 Hz or less. With 10X Probe: 1 Hz or less.

Step Response—2467/2465A: ≤ 1 ns. 2455A: ≤ 1.4 ns. 2445A: ≤ 2.33 ns. (Rise times calculated from $t_r = 0.35/BW$.)

Common-Mode Rejection Ratio (Add Mode With CH 2 Inverted)— $\geq 20:1$ at 50 MHz for common-mode signals of 8 div or less, with Var Volts/div control adjusted for best CMRR at 50 kHz at any Volts/div setting ≥ 5 mV.

Channel Isolation— $\geq 100:1$ attenuation of deselected channel at 100 MHz; $\geq 50:1$ at nominal bandwidth. (Measured with an 8-div input signal and equal Volts/div switch settings on both channels from 2 to 500 mV/div.)

Displayed CH 2 Signal Delay With Respect to CH 1 Signal—Adjustable through a range of at least ± 500 ps.

Input Z (1 M Ω)—1 M Ω $\pm 0.5\%$ shunted by 15 pF, ± 2 pF. Maximum Input Voltage: 400 V (dc+peak ac); 800 V p-p ac at 10 kHz or less, for ac, dc, and ground-coupled signals.

Input Z (50 Ω)—50 Ω $\pm 1\%$. VSWR (2467/2465A): $\leq 1.3:1$ from dc to 300 MHz; $\leq 1.5:1$ from 300 to 350 MHz. VSWR (2455A/2445A): $\leq 1.3:1$ from dc to nominal bandwidth. Maximum Input Voltage: 5 VRMS, averaged for 1 s; ± 50 V peak.

Cascaded Operation—Deflection Factor: 200 μV /div $\pm 10\%$. (For 200 μV /div sensitivity, use 20-MHz bandwidth limit.)

CHANNEL 3 AND CHANNEL 4

Deflection Factor—100 and 500 mV/div $\pm 10\%$
Frequency Response—Same as Channel 1 and Channel 2. (Responses measured only with standard probe.)

Step Response—Same as Channel 1 and Channel 2

Signal Delay Between CH 1 and Either CH 3 or CH 4— ± 0.5 ns. (Measured at 50% points.)

Input Z—1 M Ω $\pm 1\%$, shunted by 15 pF ± 3 pF
Maximum Input Voltage: 400 V (dc+peak ac); 800 V p-p ac at 10 kHz or less.

Channel Isolation— $\geq 50:1$ attenuation of the deselected channel at 100 MHz. (Measured with an 8-div input signal.)

ALL CHANNELS

Low Frequency Linearity—0.1 div or less compression or expansion of a 2 div, center-screen signal when positioned anywhere within the graticule area.

Bandwidth Limiter—Reduces upper 3 dB bandpass to a limit of 13 to 24 MHz.

Vertical Signal Delay— ≥ 30 ns of sweep displayed before triggering event displayed with Sec/div settings ≥ 10 ns/div. ≥ 10 ns of sweep displayed before triggering event displayed with Sec/div settings at 5 ns.

CHOP Mode Switching Rate—2.5 MHz $\pm 0.2\%$ sweep speeds ranging from 20 to 2 μs /div; 1 MHz $\pm 0.2\%$ all other sweep speeds. (The complete display cycle rate equals the CHOP mode switching rate divided by the number of channels displayed. The CHOP mode switching rate is modulated slightly to minimize waveform breaks with repetitive signals.)

HORIZONTAL SYSTEM

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

A Sweep Time Base Range—2467/2465A: 500 ms/div to 5 ns/div in a 1-2-5 sequence of 25 steps. (X10 magnification extends fastest sweep rate to 500 ps/div.) 2455A and 2445A: 500 ms/div to 10 ns/div in a 1-2-5 sequence of 24 steps. (X10 magnification extends fastest sweep rate to 1 ns/div.)

B Sweep Time Base Range—2467/2465A: 50 ms/div to 5 ns/div in a 1-2-5 sequence of 22 steps. (X10 magnification extends fastest sweep rate to 500 ps/div) 2455A/2445A: 50 ms/div to 10 ns/div in a 1-2-5 sequence of 21 steps. (X10 magnification extends fastest sweep rate to 1 ns/div.)

Variable Timing Control—Continuously variable and calibrated between Sec/div settings. Extends slowest A sweep speed to 1.5 s/div. (Affects the A Sec/div setting with the A display mode; affects the B Sec/div setting with INTEN, ALT, and B modes. The VAR control sets one signal cycle to five divisions for RATIO and PHASE measurements with cursors.)

ΔT Readout Resolution—2467/2465A: Either 10 ps or 0.025% of full scale, whichever is greater. 2455A/2445A: Either 20 ps or 0.025% of full scale, whichever is greater

ΔT Range—With Cursors: ±10 times the A Sec/div setting. With Sweep Delay: ±9.95 times the A Sec/div setting.

Sweep Delay Range—0 to 9.95 times the A Sec/div setting, for settings from 500 ms/div to 10 ns/div (2467/2465A) or from 500 ms/div to 20 ns/div (2455A/2445A). With A Sec/div settings of 50 μs and faster, the A Sweep triggering event is observable on the B Sweep with zero delay setting.

Delay Jitter—2467: Within 0.01% (one part or less in 10,000) of maximum available delay, plus 100 ps. 2465A/2455A/2445A: Within 0.004% (one part or less in 25,000) of maximum available delay, plus 50 ps.

Position Control Range—Start of the 1 ms/div sweep can be positioned from right of graticule center to at least 10 divisions left of graticule center. (Some portion of the sweep is always visible with X10 magnification off.)

TRIGGERING

Trigger Sensitivity From CH 1 or CH 2 Source—DC Coupled: 0.35 div. Noise Reject Coupled: ≤1.2 div. HF Reject Coupled: 0.5 div from dc to 30 kHz. LF Reject Coupled: 0.5 div from 80 kHz. AC Coupled: 0.35 div from 60 Hz.

Above 50 MHz: Triggering signal requirement increases to 1.5 div at 500 MHz (for 2467, 2465A, and 2455A) and at 250 MHz (for 2445A) with dc, LF Reject, and ac coupling. For Noise-Reject coupling above 50 MHz, triggering signal requirement increases to 4.5 div at 500 MHz (for 2467, 2465A, and 2455A) and at 250 MHz (for 2445A).

Trigger Sensitivity From ADD Source—2467/2465A/2455A: Add 0.5 div to CH 1 or CH 2 source requirements at 500 MHz.

Trigger Sensitivity From CH 3 or CH 4 Source—2467/2465A/2455A: One-half the CH 1 or CH 2 source requirements.

Trigger Sensitivity From Multiple-Channel Composite Source—2467/2465A/2455A: Add 1.0 div to CH 1 or CH 2 source requirements.

Maximum P-P Signal Rejected by Noise-Reject Coupling Within Vertical Bandwidth—CH 1 or CH 2 Source: ≥0.4 div (with Volts/div settings of 10 mV/div and higher. Maximum noise amplitude rejected is reduced at 2 and 5 mV/div settings). CH 3 or CH 4 Source: ≥0.2 div.

Jitter—2467/2465A: ≤100 ps (with 5 div of 300 MHz at 500 ps/div). 2455A/2445A: ≤100 ps (with 5 div of nominal bandwidth at 1 ns/div).

Level Control Range—CH 1 or CH 2: ±18 ×Volts/div setting; CH 3 or CH 4: ±9 ×Volts/div setting.

Level Readout Basic Accuracy—CH 1 or CH 2 Source: ±[3% of Level setting+3% of p-p signal+0.2 div+0.5 mV+(0.5 mV×probe attenuation factor)]. CH 3 or CH 4 Source: ±[3% of setting+4% of p-p signal+0.1 div+(0.5 mV ×probe attenuation factor)].

Basic accuracies apply from +15 to +35°C and are measured with triggering signals having transition times greater than 20 ns and dc trigger coupling. Add 1.5 mV×probe attenuation factor for temperatures from -15 to +15°C and from +35 to +55°C. Add ±1% of setting from 50 Ω input coupling. Add ±1% of setting with CH 2 Inverted. Add ±0.6 div for CH 1 or CH 2 Source with Noise Reject trigger coupling. Add ±0.3 div for CH 3 or CH 4 Source with Noise Reject trigger coupling.

Maximum Triggering Signal Period

A Sec/div Setting	AUTO LVL Mode	AUTO Mode
<10 ms	≥20 ms	≥80 ms
10 ms to 50 ms	≥4 times A Sec/div	≥16 times A Sec/div
>50 ms	≥200 ms	≥800 ms

X-Y OPERATION

X-Axis Deflection Factor Range, Variable Range, and Accuracy—Same as Channel 1.

X-Axis Bandwidth—DC to 3 MHz.

Input Z—Same as Channel 1.

Phase Difference Between X and Y (With Bandwidth Limiting Off)—≤1° from dc to 1 MHz. ≤3° from 1 to 2 MHz.

X-Axis Low-Frequency Linearity—0.1 div or less compression or expansion of a 2 div, center-screen signal when positioned within the graticule area.

CURSOR AND FRONT-PANEL DISPLAY

Cursor Position Range—ΔVolts: At least the center 7.6 vertical divisions. ΔTime: At least the center 9.6 horizontal divisions.

Z-AXIS INPUT

Sensitivity—DC to 2 MHz: Positive voltage decreases intensity; +2 V blanks a maximum intensity trace. 2 to 20 MHz: +2 V p-p modulates a normal intensity trace.

Input Resistance—9 kΩ ±10%.

Maximum Input Voltage—±25 V peak; 25 V p-p ac at 10 kHz or less.

SIGNAL OUTPUTS

Calibrator—(Measured with the Sec/div setting at 1 ms/div.) Voltage Into 1 MΩ Load: 400 mV±1%. Voltage Into 50Ω Load: 200 mV ±1.5%. Short Circuit Load Current: 8 mA ±1.5%. Repetition Period and Accuracy: Two times the A Sec/div switch setting for settings from 100 ns/div to 100 ms/div ±0.1%, during the sweep time.

Timing Accuracy

For 100 ms/Div and Faster Settings

Parameter	For 100 ms/Div and Faster Settings	
	+15 to +35°C	-15 to +15°C +35 to +55°C
Unmagnified		
A Sweep*1	±(0.7% of time interval +0.6% of full scale)	±(1.2% of time interval +0.6% of full scale)
ΔT Using Cursors*2	±(0.5% of time interval +0.3% of full scale)	±(0.7% of time interval +0.3% of full scale)
ΔT Using Sweep Delay*3	±(0.3% of time interval +0.1% of full scale)	±(0.5% of time interval +0.1% of full scale)
Delay*4	±(0.3% of delay setting +0.6% of full scale +(0 to -25 ns)	±(0.5% of delay setting +0.6% of full scale +(0 to -25 ns)
Magnified		
A Sweep*5	±(1.2% of time interval +0.6% of full scale)	±(1.7% of time interval +0.6% of full scale)
ΔT Using Cursors*5	±(1.0% of time interval +0.3% of full scale)	±(1.2% of time interval +0.3% of full scale)

For the A Sec/div settings of 200 ms and 500 ms, add ±0.5% of time interval or delay setting to preceding specifications.

*1 Intervals are measured on center horizontal graticule line, and 0.6% of full scale is 0.06 division.

*2 Intervals are measured anywhere on the graticule.

*3 Intervals are measured with both delays at 1% or more of full scale from minimum delay (no ? displayed in readout).

*4 Delay is from A Sweep trigger point to start of B Sweep.

*5 Exclude the first 0.5 division after sweep starts (first 0.5% of the full 100 division sweep).

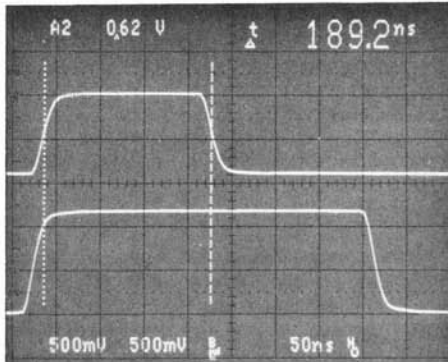
B Sweep Timing Accuracy—Add ±0.3% of time interval to the A Sweep Timing accuracy specifications for Sweep and for ΔT Using Cursors.

Variable Timing Accuracy—Add 2% of time interval to Timing Accuracy specifications for sweep when VAR control is out of detent.

CH 2 Signal Out—Voltage: 20 mV/div ±10% into 1 MΩ. 10 mV/div ±10% into 50 Ω. Offset: ±10 mV into 50 Ω after dc balancing within ±5°C of the operating temperature.

A Gate Out and B Gate Out—Voltage: 2.4 V to 5 V positive-going pulse, starting at 0 V to 400 mV. Drive: Supplies 400 μA during HI state; sinks 2 mA during LO state.

CRT READOUT AND WAVEFORM INFORMATION



Your eyes never have to leave the screen to obtain front-panel settings and measurement results. In the CRT example above, the top area of the display provides trigger source, trigger voltage level, and Δtime results. The lower area displays the selected volts/div and seconds/div scale factors and that bandwidth limit and holdoff are activated.

CRT AND DISPLAY FEATURES

Standard CRT—2467: 68×85 mm. 2465A/2455A/2445A: 80×100 mm (8×10 cm). Markings: Eight major div vertically and 10 major div horizontally, with auxiliary markings.

Trace Rotation Range—Adequate to align trace with center horizontal graticule line.

Standard Phosphor—GH (P31).

Visual Writing Speed—(2467) With 20 lux = . Illumination Normal to CRT Faceplate (typical room light): ≥4 div/ns (at maximum INTENSITY control setting). (No more than five bright spots will be visible at maximum INTENSITY control setting. Additional bright spots may be visible after displaying a high intensity trace. These spots will extinguish when INTENSITY control is set to minimum.)

Photographic Writing Speed—(2467) ≥10 div/ns with C-30 Series camera and ISO 3000 film, without prefogging. (A single-shot trace of instrument rise time at 500 ps/div is recorded with high contrast at f/1.9.)

Display Intensity Limitation—(2467) Display intensity is automatically reduced and eventually extinguished after periods of no front panel control activity. The time elapsed before intensity reduction is shortened by high intensity settings and high duty factor/sweep speed/trigger rate combinations. Operating any switch or the Intensity control restores the selected intensity setting.

POWER REQUIREMENTS

Line Voltage Ranges—115 V: 90 to 132 V ac; 230 V: 180 to 250 V ac.

Line Frequency—48 to 440 Hz.

Maximum Power Consumption—120 W (180 V ac) for fully-optional instrument.

Fuse Rating—Either 2 A, 250 V, AGC/3AG, fast-blow or 1.6 A, 250 V, 5×20 mm, quick-acting (Each fuse type requires a different cap.)

Primary Circuit Dielectric Voltage Withstand Test—1500 V rms, 60 Hz, for 10 s without breakdown.

Primary Grounding—Type test to 0.1 Ω maximum. (Routine test to check grounding continuity between chassis ground and protective earth ground.)

ENVIRONMENTAL AND SAFETY

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 3, Style C equipment (humidity and temperature requirements defined in paragraphs 3.9.2.2, 3.9.2.3, and 3.9.2.4).

Ambient Temperature—Operating: -15 to +55°C. Nonoperating: -62 to +85°C.

Altitude—Operating: To 4600 m (15,000 ft). Maximum operating temperature decreases 1°C for each 1,000 ft above 1500 m (5,000 ft). Nonoperating: To 15,000 m (50,000 ft).

Vibration—Operating: 15 minutes along each of three axes at a total displacement of 0.025 inch p-p (4 g's at 55 Hz), with frequency varied from 10 to 55 Hz in one-minute sweeps. Held 10 minutes at each major resonance, or if none existed, held 10 minutes at 55 Hz (75 minutes total test time).

Packaged Transportation Vibration—Meets the limits of the National Safe Transit Association Test Procedure 1A-B-1; excursion of 1 inch p-p at 4.63 Hz (1.1 g) for 30 minutes per Tektronix Standard 062-2858-00.

Humidity—Operating and Nonoperating: Stored at 95% relative humidity for 5 cycles (120 hours) from +30 to +60°C, with operational performance checks at +30 and +55°C.

Shock—Operating and Nonoperating: 50 g's, half-sine, 11-ms duration, three shocks on each face; total of 18 shocks.

Electromagnetic Compatibility—Meets requirements of the following standards: MIL-T-28800C; MIL-STD-461B Part 4 (CE-03 and CS-02), Part 5 (CS-06 and RS-02), and Part 7 (CS-01, RE-02, and RS-03), limited to 1 GHz; VDE 0871 Category B; FCC Rules and Regulations Part 15, Subpart J, Class A; and Tektronix Standard 062-2866-00.

Electrostatic Discharge Susceptibility—Instrument does not change control states with discharges of less than 10 kV. Meets requirements of Tektronix Standard 062-2862-00.

Radiation—Meets requirements of Tektronix Standard 062-1860-00.

Safety—UL listed (UL 1244) and CSA certified (CSA 556B).

Drip Proof—With Cover On: Meets MIL-T-28800C para 4.5.5.5.3.

Transit Drop—Not in Shipping Package: 12-inch drop on each corner and each face (MIL-T-28800C, para 4.5.5.4.2).

Packaged Transportation Drop—Meets the limits of the National Safe Transit Association Test Procedure 1A-B-2; 10 drops of 36 inches per Tektronix Standard 062-2858-00.

Bench Handling—With and Without Cabinet Installed: MIL-STD-810C, Method 516.2, Procedure V (MIL-T-28800C, para 4.5.5.4.3).

Topple—Operating and Cabinet Installed: Set on rear feet and allowed to topple over onto each of four adjacent faces per Tektronix Standard 062-2858-00.

Cooling—Forced air circulation.

Construction—Sheet aluminum-alloy chassis; plastic-laminate front panel; glass-laminate circuit boards.

Ordering Information—See page 314.

PHYSICAL CHARACTERISTICS

	2465A/2467		2455A/2445A		Rackmount	
	mm	in.	mm	in.	mm	in.
Dimensions						
Width w/handle	330	13.0	338	13.3	483	19.0
Height w/feet, pouch	190	7.5	190	7.5	178	7.0
w/o pouch	165	6.5	160	6.3		
Depth w/front cover	467	18.4	434	17.1	419	16.5
handle extended	533	21.0	505	19.9		
Weight ≈	kg	lb	kg	lb	kg	lb
Net w/accessories						
and pouch	10.9	24.0	10.2	22.2	4.0*1	8.8*1
w/o accessories						
and pouch	9.7	21.3	9.3	20.5		
Shipping	14.6	32.1	12.8	28.2	6.3*1	13.8*1

*1 Weight of conversion kit only. Rear support kit weight is an additional 6.3 kg (13.8 lb).

CHARACTERISTICS (OPTION 01)

This option is unavailable for the 2467. The set of characteristics is the same as specified for all other standard 2467/2445A/2465A oscilloscopes and includes the following additions:

All accuracy specifications are stated with an operating temperature range of +18 to +28°C and a relative humidity of 95% or less.

DC VOLTAGE

Ranges—200 mV, 2 V, 20 V, 200 V, 500 V.
Resolution—10 μ V (4½ digits).
Accuracy— $\pm(0.03\%$ of reading +0.01% of full scale). For 500 V range $\pm(0.03\%$ of full scale).
Input Resistance—>100 G Ω on the 200 mV and 2 V ranges, 10 M Ω on the higher ranges. (Resistance can be changed to 10 M Ω on all ranges.)
Normal-Mode Rejection Ratio— \geq 60 dB at 50 and 60 Hz.
Common-Mode Rejection Ratio—100 dB at dc; >80 dB at 50 and 60 Hz with 1 k Ω imbalance.
Maximum Input Voltage—500 V RMS; 700 V peak between inputs and ground.
Response Time—<2 s in Auto, <1 s in Manual.

AC RMS VOLTAGE

Ranges—200 mV, 2 V, 20 V, 200 V, 500 V.
Resolution—10 μ V (4½ digits).
Accuracy— $\pm(\%$ of reading + % of full scale).

Input Frequency	200 mV to 500 V	
	200 V	500 V
20 to 40 Hz	$\pm(0.7\%$ +0.1%)	$\pm(0.7\%$ +0.2%)
40 Hz to 10 kHz	$\pm(0.3\%$ +0.1%)	$\pm(0.3\%$ +0.2%)
10 to 20 kHz	$\pm(0.7\%$ +7%)	$\pm(0.7\%$ +0.2%)
20 to 100 kHz	$\pm(5\%+0.1\%)$	$\pm(5\%+0.2\%)$

Crest Factor— \leq 4 at full scale.
Common-Mode Rejection Ratio— \geq 60 dB at 50 and 60 Hz with 1 k Ω imbalance.
Response Time—<3 s in Auto, <2 s in Manual.
Input Impedance—1 M Ω in parallel with <100 pF.
Maximum Input Voltage—500 V RMS; 700 V peak between inputs and ground, not to exceed 10⁷ V-Hz product.
dBV, dBm—Calculated reading of ac voltage measurements. dBV equals 20 Log (V_{UNK}/1 V). dBm is referenced 1 mW into 600 Ω .

HI Ω RESISTANCE

Ranges—2 k Ω , 20 k Ω , 200 k Ω , 2 M Ω , 20 M Ω .
Accuracy— $\pm(0.1\%$ of reading +0.01% of full scale) for 2 k Ω to 2 M Ω . $\pm(0.4\%$ of reading) for 20 M Ω . Add 2% of reading for each 10% Relative Humidity above 70% when in 2 and 20 M Ω ranges.

Maximum Input Voltage—500 V RMS; 700 V peak.
Full-Scale Voltage—2 V.
Open-Circuit Voltage—<6V
Resolution—0.1 Ω (4½ digits).
Response Time—<2 s in Auto, <1 s in Manual, <5 s in 20 M Ω range.

LO Ω RESISTANCE

Ranges—200 Ω , 2 k Ω , 20 k Ω , 200 k Ω , 2 M Ω .
Accuracy— $\pm(0.1\%$ of reading +0.1% of full scale) for 200 Ω range. Subtract (0.09% of full scale) for 2 to 200 k Ω ranges. Add (0.15% of reading) and subtract (0.09% of full scale) for 2 M Ω range. Add 2% of reading for each 10% Relative Humidity above 70% when in 200 k Ω and 2 M Ω ranges.
Maximum Input Voltage—500 V RMS; 700 V peak.
Full-Scale Voltage—0.2 V.
Open-Circuit Voltage—<6 V.
Resolution—0.01 Ω
Response Time—<2 s in Auto, <1 s in Manual.
Continuity—An audible tone indicates <10 Ω .
Reponse time is \approx 0.1 s.

DC CURRENT

Ranges—100 μ A, 1 mA, 10 mA, 100 mA, 1 A.
Accuracy— $\pm(0.1\%$ of reading +0.02% of full scale).
Burden Voltage—<150 mV up to 100 mA increasing to <500 mV at 1 A.
Resolution—10 nA.
Response Time—<2 s in Auto, <1 s in Manual.

AC (RMS) CURRENT

Ranges—100 μ A, 1 mA, 10 mA, 100 mA, 1 A.
Accuracy— $\pm(0.6\%$ of reading +0.1% of full scale) from 20 Hz to 10 kHz.
Burden Voltage—<150 mV up to 100 mA increasing to <500 mV at 1 A.
Resolution—10 nA.
Response Time—<3 s in Auto, <2 s in Manual.

TEMPERATURE

Range—-62 to +230°C.
Accuracy— $\pm(2\%$ of reading +1.5°C).
Resolution—0.1°C.
Readout—Selectable in either °C or °F.

OTHER CHARACTERISTICS

Reading Rate—Three readings/s nominal except 1.5 readings/s on 20 M Ω range.
Temperature Coefficient— \leq 0.1 \times the accuracy specification/°C from -15 to +18°C and from +28 to +55°C.
GPIB Compatibility for Semiautomatic Measurement Systems—When combined with Option 10, the DMM (Option 01) oscilloscope combination is fully programmable. Complies with Tektronix *Standard Codes and Formats*.

Ordering Information—See page 314.

CHARACTERISTICS (OPTION 05)

The set of characteristics is the same as specified for standard 2467/2445A/2465A oscilloscopes and includes the following additions:

VERTICAL SYSTEM (CHANNEL 1 AND CHANNEL 2)

Frequency Response—Applicable for volt/div settings between 5 mV and 0.2 V with Var volt/div control in calibrated detent and using a 5 div, 50-kHz reference signal from a 50 or 75 Ω system.

Range	With Full BW	With BW Limiting
50 kHz to 5 MHz	$\pm 1\%$	+1%, -4%
>5 to 10 MHz	+1%, -2%	*1
>10 to 30 MHz	+2%, -3%	*1
>30 MHz	*1	*1

*1 Same as basic instrument.

Square wave Flatness—1% p-p for both 60-Hz and 15-kHz square waves, from a 50 or 75 Ω system using a 1.0 V input with a 50 mV/div setting and using a 0.1 V input at 20 mV/div setting. 1.5% p-p using a 0.1 V input with 5 and 10 mV/div settings. Exclude first 50 ns following step transition. For signals with rise times \leq 10 ns, add 2% p-p between 155 and 165 ns after step transition.

Television Blanking-Level Clamp (Back-Porch) 60 Hz Rejection (CH 2 Only)— \geq 18 dB at 60 Hz; with calibrated Volt/div settings between 5 mV and 0.2 V, and a 6 div reference signal.

Television Blanking-Level Clamp (Back-Porch) Reference—Within 1.0 div of ground reference.

TRIGGERING

Sync Separation—Stable sync separation from sync-positive or sync negative composite video on systems with 525 to 1280 lines/frame, 50 or 60 Hz field rate, interlaced or noninterlaced scan.

Trigger Modes—LINES, FLD 1, FLD 2, and ALT (FLD 1-FLD 2).

Input Signal Amplitude for Stable Triggering—CH 1 and CH 2: 1.0 div for composite video and 0.3 div for composite-sync signals (dc+peak video-signal amplitude must be within 18 div of input ground reference).

CH 3 and CH 4: 0.5 div for composite video and 0.25 div for composite-sync signals (dc peak video-signal amplitude must be within 9 div of input ground reference).

GPIB Compatibility for Semiautomatic Measurement Systems—When combined with Option 10, the TV Waveform Measurement Systems (Option 05) oscilloscope combination is fully programmable. Complies with Tektronix *Standard Codes and Formats*.

CHARACTERISTICS (OPTION 06 CTT; OPTION 09 CTT/WR)

The set of characteristics is the same as specified for standard 2467/2445A/2465A oscilloscopes and includes the following additions:

Sensitivity—Signal input requirements for Frequency, Period, Totalize, Delay-by-Events and Logic Trigger.

Input	Displayed Signal	Frequency Range
CH 1, CH 2	1.5 div	DC (0.5 Hz for Frequency and Period) to 50 MHz
CH 3, CH 4	0.75 div	
CH 1, CH 2	4.0 div	50 MHz to ≥ 150 MHz
CH 3, CH 4	2.0 div	

Source—A trigger or word recognizer for Frequency, Period, and Totalize.

FREQUENCY

Range—Autorange over input frequency from 0.5 Hz to 150 MHz.

Resolution— $\pm \left[\text{LSD} + 1.4 \times \frac{\text{TJE}}{N} \times F^2 \right]$

Display—7 digits, updates twice per second or every two periods, whichever is slower.

Accuracy—Resolution $\pm 0.001\%$ of reading over entire temperature range of -15 to $+55^\circ\text{C}$.

PERIOD

Range—Autorange over an input period from 6.666667 ns to 2 s.

Resolution— $\pm \left(\text{LSD} + 1.4 \times \frac{\text{TJE}}{N} \right)$

Display—7 digits (Updates twice per second or every two periods, whichever is slower.)

Accuracy—Resolution $\pm 0.001\%$ of reading over entire temperature range of -15 to $+55^\circ\text{C}$.

ACCURACY AND RESOLUTION DEFINITIONS

F = Input Frequency in Hz

LSD = Least Significant Digit (0.1 ppm of full scale)

TJE = Trigger Jitter Error

N = Number of cycles of measured frequency during measurement interval (0.5 s or 1 period of the input signal, whichever is greater)

TJE (Trigger Jitter Error) =

$$\sqrt{\frac{(\text{en1})^2 + (\text{en2})^2}{\text{Input Slew Rate}}}$$

Where: en1 = RMS noise of vertical system in divisions on screen

en2 = RMS noise voltage of input signal in divisions

Volts/div	en1	
	Trigger Coupling DC and Noise Rej	Trigger Coupling HF Reject
2 mV	0.15 div	0.05 div
5 mV		
to 5 V	0.1 div	0.05 div

ΔTIME , $1/\Delta\text{TIME}$

Trigger After Delay Accuracy— $\pm(\text{LSD} + 0.01 \times \text{B Time/div}) + (0.001\% \times \text{A Sec/div} + 0.001\% \text{ of reading} + 50 \text{ ps})$. Measured with visually superimposed signal transitions, $>0.1 \text{ div/ns}$ trigger-signal slew rates, and with channel-to-channel delay mismatch corrected by the CH 2 DLY match adjustment from the front panel. Independent Slope and Level settings for ΔREF and ΔB triggers allow visual superposition of any pair of points within the center 80% of transitions having at least 5 div amplitude.

Run After Delay Accuracy— $\pm(\text{LSD} + 0.0008 \times \text{A Sec/div}) + (0.01 \times \text{B Time/div} + 83 \text{ ps})$. B Time/div includes 10X mag.

Display Update Rate—Auto resolution, twice per second or every four sweeps, whichever is slower. (Depends on trigger and sweep rates with selectable resolution.)

DELAY TIME

Trigger After Delay Accuracy— $\pm(\text{LSD} + 0.001\% \text{ of reading} + 0.5 \text{ ns} + \text{A trigger-slew error} + \text{B trigger-slew error})$. Add 0.5 ns for dual-channel measurements.

Where: Trigger-slew error equals trigger-level control readout accuracy \div trigger signal slew rate at the trigger point.

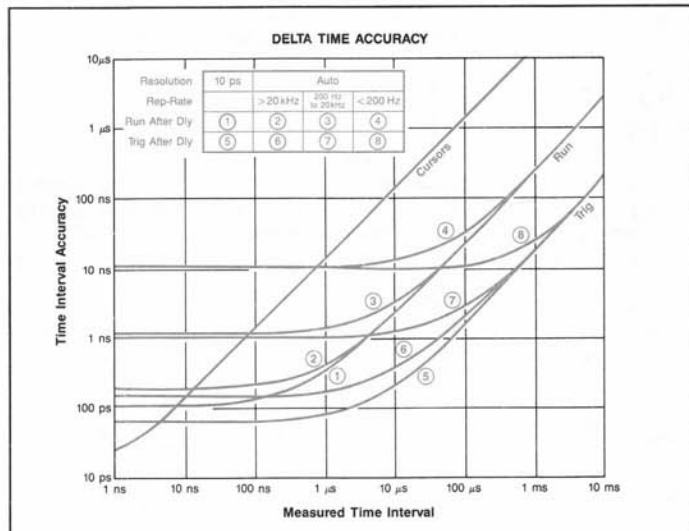
Run After Delay Accuracy— $\pm(\text{LSD} + 0.0012 \times \text{A Sec/div} + 0.03 \times \text{B Time/div} + 50 \text{ ns})$. (B Time/div includes 10X mag.)

Trigger After Delay and Run After Delay Accuracies Using Word Recognizer on the B Trigger—Add 100 ns if using external clock. Add 200 ns if not using external clock.

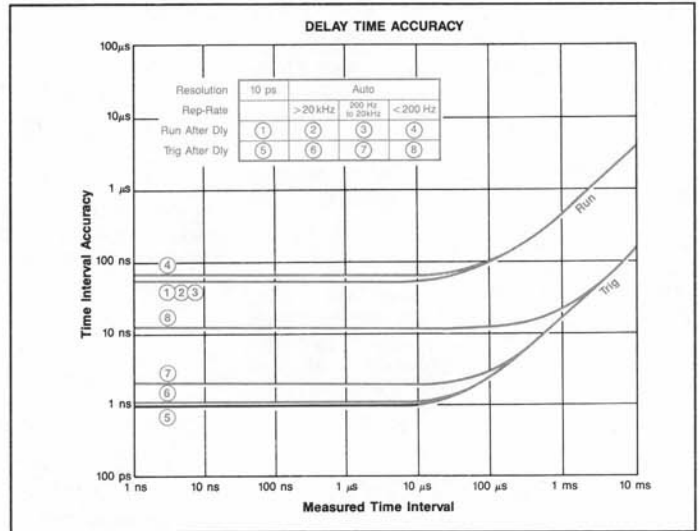
Display Update Rate—Auto, twice per second or once for each sweep, whichever is slower. Depends on trigger and sweep rate for selectable resolution.

Selectable Resolution

A Sec/Div	Selected Resolution	LSD
10 ns to 1 s	AUTO	See Auto Resolution below
10 ns to 5 μs	10 ps 100 ps 1 ns	10 ps 100 ps 1 ns
10 to 50 μs	10 or 100 ps 1 ns	100 ps 1 ns
100 to 500 μs	10 ps to 1 ns	1 ns
1 to 5 ms	10 ps to 1 ns	10 ns
10 to 50 ms	10 ps to 1 ns	100 ns
100 to 500 ms	10 ps to 1 ns	1 μs
1 s	10 ps to 1 ns	10 μs



Input Signal is five vertical div with a 2-ns rise time.
Measured times are four horizontal div.
TJE is negligible for Slew Rates $>0.1 \text{ div/ns}$.
 ΔTime Trigger After Delay assumes visual superposition.



Input Signal is five vertical div with a 2-ns rise time.
Measured times are four horizontal div.
TJE is negligible for Slew Rates $>0.1 \text{ div/ns}$.
 ΔTime Trigger After Delay assumes visual superposition.

Auto Resolution

A Sec/Div	Trigger Repetition Rate	LSD
10 ns to 2 μ s	>20 kHz	100 ps
10 ns to 2 μ s	200 Hz to 20 kHz	1 ns
5 to 200 μ s	>200 Hz	1 ns
10 ns to 200 μ s	<200 Hz	10 ns
500 μ s to 5 ms	Any	10 ns
10 to 50 ms	Any	100 ns
100 to 500 ms	Any	1 μ s
1 s	Any	10 μ s

2445A Sec/div settings range from 20 ns to 1 s.
2465A Sec/div settings range from 10 ns to 500 ms.

TOTALIZE

Maximum Count—To 9,999,999 events.

DELAY BY EVENTS

A or B Sweep—The A trigger or 17-bit word recognizer defines start events. The B trigger or 17-bit word recognizer defines delay events. With A sweep in the delayed-by-events mode, the B sweep is delayable by time.

Maximum Delay Count—Up to 4,194,303.
Minimum Time From Start Event to Any Delay Event— ≥ 4 ns.
Minimum Pulse Width— ≥ 3.3 ns.

LOGIC TRIGGER

Combination Trigger—A sweep can be triggered from logical combinations of A and B triggers (A and B) or (A or B), or the word recognizer. B sweep can be triggered from the word recognizer.
Minimum Time to Satisfy Logic Combinations— ≥ 4 ns.

WORD RECOGNIZER

Input—P6407 Word Recognizer Probe, 17 bits plus clock. (No CRT display from P6407.)

All Inputs	Threshold	Load	Safe Limit
High	<2.0 V	<20 μ A	5.5 V
Low	>0.6 V	>-0.6 mA	-0.5 V

Display Radix—Hexadecimal, octal, binary.
Data Rate—0 to ≥ 20 MHz with clock, 0 to ≥ 10 MHz without clock.

Data Set-Up Time—25 ns.

Data Hold Time—0 ns.

GPIB Compatibility for Semiautomatic Measurement Systems—When combined with Option 10 the CTT/WR (Option 09) Oscilloscope combination is fully programmable. Complies with Tektronix *Standard Codes and Formats*.

Ordering Information—See page 314.

CHARACTERISTICS (OPTION 10)

The set of characteristics is the same as specified for standard 2467/2445A/2465A oscilloscopes and includes the following additions:

Standard Interface Functions Implemented—SH1, AH1, T6, L3, SR1, RLI, DC1, E1 DT0 C0, PP0.

Vertical Position Accuracy—CH 1 and CH 2 (Noninverted): $\pm [0.3 \text{ div} + 3\% \text{ of distance (in divisions) from center screen} + 0.5 \text{ mV divided by the Volt/div setting}]$. For -15 to +55°C (excluding +15 to +35°C) add 1.5 mV divided by the Volt/div setting. For CH 2 Inverted add 0.2 div.

CH 3 and CH 4: $\pm [0.7 \text{ div} + 3\% \text{ of distance (in div) from center screen}]$.

Ordering Information—See page 315.

CHARACTERISTICS (OPTION 1E)

FREQUENCY

Range—Autoranging over input frequency from 0.5 Hz to 150 MHz.

Resolution— $\pm \left[\text{LSD} + 1.4 \times \frac{\text{TJE}}{\text{N}} \text{F}^2 \right]$

Display—Seven digits; updates twice per second or every two periods, whichever is slower.

Accuracy—Resolution $\pm [\text{accuracy of reference} \times \text{reading}]$

Definitions:

F—Input frequency in Hz.

LSD—Least Significant Digit (0.1 ppm of full scale).

TJE—Trigger Jitter Error =

$$\sqrt{\frac{(\text{en}1)^2 + (\text{en}2)^2}{\text{Input Slew Rate}}}$$

N—Number of cycles of measured frequent interval (0.5 \times or 1 period of input signal, whichever is greater).

en1—RMS noise of vertical system in divisions on screen.

en2—RMS noise of input signal in divisions.

CHARACTERISTICS (OPTION 1R)

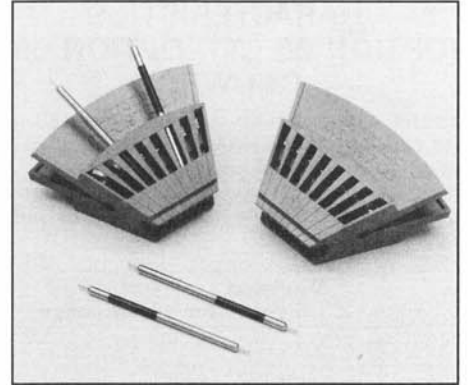
ENVIRONMENTAL

Rackmounting changes the temperature, vibration, and shock capabilities. The rackmounted oscilloscope meets or exceeds the requirements of MIL-T-18800C with respect to Type III, Class 5, Style C equipment, when installed as directed. It also meets or exceeds Tektronix Standard 062-2853-00, Class 5 requirements.

Ambient Temperature—Operating: -15 to +55°C. Measured at the instrument's air inlet, fan exhaust temperature should not exceed +65°C.

Vibration—Operation: Same as standard instrument, except total displacement is 0.015 inch p-p (2.3 g's at 55 Hz).

Shock—Operating and Nonoperating: Same as standard instrument, except shocks are 30 g's.



KLIPKIT makes high speed IC testing easy. For use directly with P6130 family probes or others vis the included signal pins.

ORDERING INFORMATION

2467** 350 MHz Oscilloscope \$11,900

Includes: MCP CRT; four P6136 10X 1.3 m probes with accessories; 2 A, 250 V fuse (159-0021-00); zip lock accessory pouch (016-0537-00); blue plastic CRT filter (378-0199-03); clear plastic CRT filter; snap accessory pouch (016-0692-00); front cover; power cord (161-0104-00); Operator's Manual (070-5854-01).

2465A 350 MHz Oscilloscope \$5,550

Includes: Two P6136 10X 1.3 m probes with accessories (P6136); 2 A, 250 V fuse (159-0021-00); zip lock accessory pouch (016-0537-00); blue plastic CRT filter (378-0199-03); clear plastic CRT filter; snap accessory pouch (016-0692-00); front cover; power cord (161-0104-00); Operator's Manual (070-6014-01).

2455A 250 MHz Oscilloscope \$5,350

Includes: Same as 2465A.

2445A 150 MHz Oscilloscope \$3,590

Includes: Same as 2465A, except two P6133 10X 2 m probes; Option 01, 1.3 m probe

2465A DV 350 MHz Oscilloscope \$9,200

Includes: Same as 2465A, plus DMM (Option 01), TV (Option 05), CTT/WR (Option 09), GPIB (Option 10), and two additional P6136 probes (Option 22). Provides most cost-effective combination of these options.

2465A DM 350 MHz Oscilloscope \$8,400

Includes: Same as 2465A, plus DMM (Option 01), CTT/WR (Option 09), GPIB (Option 10), and two additional P6136 probes (Option 22). Provides most cost effective combination of these options.

2465A CT 350 MHz Oscilloscope \$7,150

Includes: Same as 2465A, plus CTT/WR (Option 09), GPIB (Option 10), and two additional P6136 probes (Option 22). Provides most cost-effective combination of these options.

INSTRUMENT OPTIONS

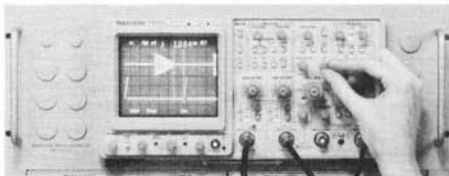
- Option 01***3*4—Digital Multimeter + \$1,500
Includes: Same as standard instruments, plus probe set (012-0941-00); temperature probe (P6602); probe set accessories (020-0087-00).
- Option 05**—TV Waveform Measurement System + \$1,050
Includes: Same as standard instruments, plus CCIR graticule CRT filter (378-0199-04); NTSC graticule CRT filter (378-0199-05); polarized collapsible viewing hood (016-0180-00).
- Option 06**—Counter/Timer/Trigger + \$1,000
Includes: Same as standard instruments, plus 20 grabber tips (206-0222 00); two 10 inch 10 wide comb (012-0747-00).
- Option 09***1*2—Counter/Timer/Trigger and Word Recognizer + \$1,400
Includes: Same as standard instruments, plus a word recognizer probe (010-6407-01); 20 grabber tips (206-0222-00); two 10 inch 10 wide comb (012-0747-00).
- Option 10**—IEEE-488 GPIB Interface + \$900
Includes: Same as standard instruments, plus Instrument Interface Guide.
- Option 1E**—External Clock \$200

MULTIPLE OPTION ALLOWANCE (MOA)

- When a 2467 or 2465A instrument is ordered with more than two of the above options, a special price allowance is applied. This allowance is not applicable to the 2465A DV, 2465A DM, or the 2465A CT.
- Option 2A**—MOA for combining two of the above options. - \$250
- Option 3A**—MOA for combining three of the above options. - \$500
- Option 4A**—MOA for combining four of the above options. - \$750

OTHER INSTRUMENT OPTIONS

- Option B1**—Service manual. (For 2445A/2455A/2465A/2467) Standard manual. + \$50
(For Options/Special Editions) Includes standard manual plus options manual. + \$50
- Option 1R***3—Configure Oscilloscope for Rackmount. + \$320
Includes: Same as bench model instrument (except pouch) plus rackmount hardware and slide-out assemblies.



- Option 1T**—Transit Case. + \$185
- Option 11***1—Rear Panel Probe Power. + \$165
- Option 22** Two additional probes. (2467/2465A/2455A) P6136 probes. + \$265
(2445A) P6133 probes. + \$205

*1 Option 11 may not be ordered with Option 09 or the 2445A.
*2 Option 09 includes Option 06.
*3 Option 1R may not be ordered with Option 01, 2465A DM, or 2465A DV. For rackmounting instruments equipped with Option 01, contact your local Sales Engineer.
*4 Option 01 is not available with the 2467.
NOTE: Options are not retrofittable with field upgrade kits.

INTERNATIONAL POWER PLUG OPTIONS

- Option A1**—Universal Euro 220 V, 50 Hz.
- Option A2**—UK 240 V, 50 Hz.
- Option A3**—Australian 240 V, 50 Hz.
- Option A4**—North American 240 V, 60 Hz.
- Option A5**—Switzerland 220 V, 50 Hz.

WARRANTY-PLUS SERVICE PLANS
See Customer Service Section

- M1**—(2467/2465A/2455A and Special Editions) 2 Calibrations. + \$265
- M1**—(2445A) 2 Calibrations. + \$255
- M2**—(2467) 2 Years Service. + \$370
- M2**—(2455A/2465A and Special Editions) 2 Years Service. + \$270
- M2**—(2445A) 2 Years Service. + \$215
- M3**—(2467) 2 Years Service and 4 Calibrations. + \$845
- M3**—(2465A/2455A and Special Editions) 2 Years Service and 4 Calibrations. + \$695
- M3**—(2445A) 2 Years Service and 4 Calibrations. + \$645
- M4**—(2467/2465A/2455A and Special Editions) 5 Calibrations. + \$670
- M4**—(2445A) 5 Calibrations. + \$660
- M5**—(2467) 9 Calibrations and 2 Years Service. + \$1,495
- M5**—(2465A/2455A and Special Editions) 9 Calibrations and 2 Years Service. + \$1,350
- M5**—(2445A) 9 Calibrations and 2 Years Service. + \$1,295

OPTIONAL ACCESSORIES

- Rackmount Conversion Kit**—Not compatible with Option 01. Order 016-0825-01 \$370
- Probe Power Extender Cable for Rackmount Instrument With Option 11**—Order 020-0104-00 \$490
- Word Recognizer Extender Cable for Rackmount Instrument With Option 09 and 2465A CT**—Order 020-0103-00 \$350
- GPIB Cables**—Double shield, low EMC.
(1 m) Order 012-0991-01 \$140
(2 m) Order 012-0991-00 \$155
(4 m) Order 012-0991-02 \$180
- Viewing Hoods**—
(Polarized Collapsible) Order 016-0180-00 \$60
(Folding Light Shield) Order 016-0592-00 \$14.25
(Folding Binocular) Order 016-0566-00 \$19
- Protective Waterproof Vinyl Cover**—Order 016-0720-00 \$25
- Carrying Case**—Order 016-0792-01 \$360
- Carrying Strap**—Order 346-0199-00 \$17.50
- DC Power**
1105 \$2,090
1106 \$1,580
- DC Inverter**—1107 \$1,140

RECOMMENDED PROBES

- P6133**—10X Passive Probe for use with 2445A. \$115
- P6136**—10X Passive Probe for use with 2467, 2465A, 2455A. \$150

- P6202A**—10X FET Probe. \$715
- P6230**—10X Bias/Offset Probe. \$420
- P6056**—10X, 500Ω Passive Probe for 50 Ω inputs. \$200
- P6057**—100X, 5000 Ω passive probe for 50 Ω input. \$195
- P6602**—Temperature Probe. \$235
- Current Probes**—A6302, A6303, P6021, P6022.

- A6901**—Ground Isolation Monitor \$680
- A6902B Voltage Isolator**—For floating measurements. \$1,885

DIGITIZING CAMERA SYSTEM

- DCS01 Option 2A**—Digitize waveforms from scope screen. \$5,595
- S58DC02**—2467/DCS Interface GPIB Driver. \$295



DCS01 Digitizing Camera System captures repetitive waveforms from analog scopes and transients according to a scope's CRT writing speed (350 MHz for 2467).

RECOMMENDED CAMERAS

- C-30BP Option 01**—General Purpose. \$1,500
- C-5C Option**—02 Low Cost. \$495

RECOMMENDED CART

- K212**—For on-site mobility. \$350

SERVICE MANUALS

- (2467/2465A) Order 070-6019-01 \$50
- (2455A/2445A) Order 070-6017-01 \$50
- (Options) Order 070-5857-00 \$50

SOFTWARE

- EZ-TEK 2400 Test Program Generator**—For instruments with GPIB; used with 4041 controller. Order S49F101 \$250
- EZ-TEK 2400 PC Test Program Generator**—For instruments with GPIB; used with IBM PC/XT/AT and compatibles. Requires GURU hardware. Order S49F103 \$250
- GPIB User's Resource Utility (GURU)**—Includes GPIB-PC interface board, GPIB cable, software, and documentation. Order S3FG100 \$850

TRAINING

Tektronix Instrument Group customer Training offers operation and application training to help you get full value out of your instrumentation investment. See Customer Service Section for information. For further information, or to enroll, call us at 1-800-835-9433 ext. 430. For international orders contact your local Sales Office.