

See, Measure, Automate  
at the Touch of a Button

## NEW 2465A/2445A



The 2465A/2445A Option 10, 2465A CT, 2465A DM and 2465A DV comply with IEEE Standard 488-1978 and with Tektronix *Standard Codes and Formats*.

## NEW 2465A CT/ 2465A DM/2465A DV Special Editions

### 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 new productivity enhancing features for fast operation. Increase the probe tip bandwidth to 350 MHz. The result: six new four channel, dual time base oscilloscopes that bring unprecedented efficiency to your design lab, production line or field service site.

### Built on High Performance That Set the Industry Standard

New preamplifier circuits make possible the increased bandwidth—350 MHz in the 2465A, 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 and 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 settings are recorded on film in your waveform photos.

Dual, delaying time bases, each with an independent trigger system, allow for precise measurements on details embedded in complex waveforms.

### Time and Voltage Cursors With CRT Readout for Immediate, Effortless Measurements of Waveform Parameters

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.

And now the cursors can even be applied to delayed sweep displays, improving timing measurement flexibility.

### 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 five integral and 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. As packages, they are offered at a significant savings over the separately ordered measurement options.

The Tek 2465A CT is designed 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. Easily the most powerful portable available.

### New Auto Setup, Instant Recall, Set-Up Sequencing: For Easy Answers Fast!

Now you can 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 quick viewing or advanced parametric characterization. With AUTO-SETUP, users of any experience level 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 of symmetrical waveforms. Input channel selection is also sensed, and display positioning adjusted for up to four waveforms with appropriate scaling.

**Measure Signal Parameters Quickly, With Instant Access to Complex Setups**

For closer examination of your signals and for more specialized setups, such as delayed sweep displays or ones using the extended measurement options, front panel controls are still necessary. But now you only need to create these setups 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. And 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 measurement is a true representation of 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 up, stored and sequenced without a computer. Step through up to 30 of the stored 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 a further 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, stand-alone portable oscilloscope you can implement extensive automated or semiautomated procedures. This 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, too. 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. It also can 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 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.

**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 2467/2465A/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 2467/2465A/2445A scopes make them excellent candidates for installation in large and small test systems. A built-in run time counter assists in recordkeeping for preventative maintenance and calibration. The 2400 Series instruments offer proven reliability and are all backed by Tek's three year warranty.

**A Powerful Yet Portable System**

A GPIB- and DMM-equipped 2467/2465A/2445A, plus a 4041 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 on magnetic tape for later analysis or use in statistical recordkeeping.

**The 2467/2465A/2445A Family—Portable and Rugged**

The 2467/2465A/2445A and Special Editions are easy to carry to any field service site. And when you get there, they perform—even in extreme conditions—with environmental characteristics including a low EMI profile and rugged construction per MIL-T-28800C, Type III, Class 3, Style C.

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  $\Omega$ . To protect against overload while using the internal 50  $\Omega$  terminations, the scopes automatically switch to 1 M $\Omega$  coupling when an overload is detected, and a readout indicates the change.

**The Assurance of Error-Free Operation is Backed by Tek's Three Year Warranty**

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

This, 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 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 09

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

Crystal-Controlled Time Base

0.001% Accuracy

Totalize Up to 9,999,999 Events

Delay-by-Events Triggering Up to a Total of  
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. And 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 allows precise time measurements between two events, each with different characteristics—either 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 microprocessor power-up delay.

Once configured, these measurement set-ups 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, these 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. These advanced triggering capabilities eliminate extraneous signals.

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

And 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.

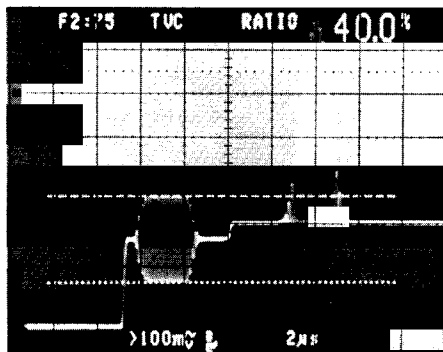
The Counter/Timer/Trigger also is available without the Word Recognizer probe as Option 06.

Specifications begin on page 286.

### Option 06

Counter/Timer/Trigger (CTT)

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



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.

### Option 05

Video Waveform Measurement System

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 kHz to 77 kHz Line Rates

TV Blanking-Level Clamp (Back-Porch)

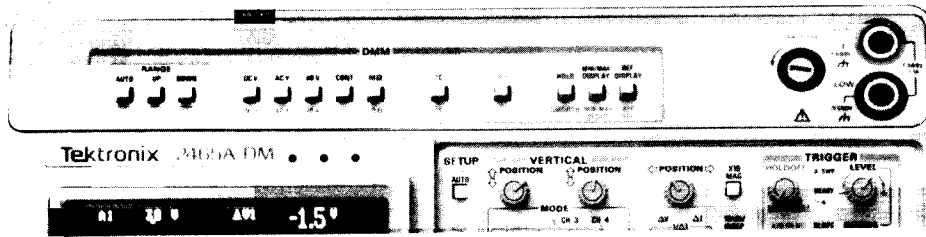
Optimized Vertical Response Comparable  
to High Performance TV Waveform Monitors

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.

Specifications begin on page 287.



**Option 01 Digital Multimeter**

**4 1/2 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°C to +230°C**

**Calibration via Front Panel Without Removing Instrument Covers**

**Convenience Features Include:**

**Set Reference, Hold, Smooth,  
Minimum/Maximum, dBV, and dBm**

The 2467/2465A/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 2467/2465A/2445A into your system (rackmounting 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. It 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 moni-

toring 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.

Specifications begin on page 288.

**Option 10 GPIB Interface**

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 General  
Purpose Interface Bus**

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.

It is possible not only to display scope parameters and settings on the CRT, but also to read them back over the GPIB to the controller.

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.

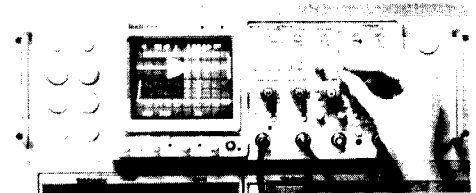
The 2467/2465A/2445A GPIB-message structure conforms to Tektronix *Standard Codes and Formats*, ensuring that all GPIB messages are "human readable" and consistent in format. Selectable message termination characters allow scope use with most types of controllers. The new 2445A and 2465A are compatible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

New 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 it would take 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.

Specifications begin on page 288.



**Option 1R Rackmounting**

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

Specifications begin on page 288.

## 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.

**$\Delta V$  Accuracy** —  $\pm (1.25\% \text{ of reading} + 0.03 \text{ div} + \text{signal aberrations})$ . Basic accuracies apply for temperatures from  $+15^\circ\text{C}$  to  $+35^\circ\text{C}$ . Add  $\pm 2\%$  of reading for temperatures from  $-15^\circ\text{C}$  to  $+15^\circ\text{C}$  and from  $+35^\circ\text{C}$  to  $+55^\circ\text{C}$ . Add 1% of reading when  $50 \Omega$  input coupling is used. Add 1% of Channel 2 reading when inverted. Measured with cursors anywhere on the graticule.

**$\Delta V$  Range** —  $\pm 8$  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 ( $-3 \text{ dB}$ Bandwidth)

Instrument	$+15^\circ\text{C}$ to $+35^\circ\text{C}$	$-15^\circ\text{C}$ to $+15^\circ\text{C}$ $+35^\circ\text{C}$ to $+55^\circ\text{C}$
2467/2465A	350 MHz	300 MHz
2455A	250 MHz	200 MHz
2445A	150 MHz	150 MHz

All responses measured with standard accessory probe or internal  $50 \Omega$  termination.

**Ac Coupled Lower  $-3 \text{ dB}$  Point** — With 1X Probe: 10 Hz or less. With 10X Probe: 1 Hz or less.

**Step Response** — 2467/2465A:  $\leq 1 \text{ ns}$ . 2455A:  $\leq 1.4 \text{ ns}$ . 2445A:  $\leq 2.33 \text{ ns}$ . Rise times calculated from  $t_r = 0.35/\text{BW}$ .

**Common-Mode Rejection Ratio (Add Mode With Channel 2 Inverted)** — At least 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  $\geq 5 \text{ mV}$ .

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

**Displayed CH 2 Signal Delay With Respect to CH 1 Signal** — Adjustable through a range of at least  $\pm 500 \text{ ps}$ .

**Input Z (1 M $\Omega$ )** — 1 M $\Omega \pm 0.5\%$  shunted by 15 pF,  $\pm 2 \text{ pF}$ . 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  $\Omega$ )** — 50  $\Omega \pm 1\%$ . VSWR (2467/2465A):  $\leq 1.3:1$  from dc to 300 MHz;  $\leq 1.5:1$  from 300 MHz to 350 MHz. VSWR (2455A/2445A):  $\leq 1.3:1$  from dc to nominal bandwidth. Maximum Input Voltage: 5 VRMS, averaged for 1 s;  $\pm 50 \text{ V}$  peak.

**Cascaded Operation** — Deflection Factor: 200  $\mu\text{V}/\text{div} \pm 10\%$ . For 200  $\mu\text{V}/\text{div}$  sensitivity, use 20 MHz bandwidth limit.

### CHANNEL 3 AND CHANNEL 4

**Deflection Factor** — 100 mV/div 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 Channel 1 and Either Channel 3 or Channel 4** —  $\pm 0.5 \text{ ns}$ . Measured at 50% points.

**Input Z** — 1 M $\Omega \pm 1\%$ , shunted by 15 pF  $\pm 3 \text{ pF}$ . 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 MHz to 24 MHz.

**Vertical Signal Delay** — At least 30 ns of sweep is displayed before triggering event is displayed with Sec/div settings  $\geq 10 \text{ ns}/\text{div}$ . At least 10 ns of sweep is displayed before triggering event is displayed with Sec/div settings at 5 ns.

**CHOP Mode Switching Rate** — 2.5 MHz  $\pm 0.2\%$  for sweep speeds ranging from 20  $\mu\text{s}/\text{div}$  to 2  $\mu\text{s}/\text{div}$ . 1 MHz  $\pm 0.2\%$  for 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.

### Timing Accuracy

Parameter	For 100 ms/Div and Faster Settings	
	$+15^\circ\text{C}$ to $+35^\circ\text{C}$	$-15^\circ\text{C}$ to $+15^\circ\text{C}$ $+35^\circ\text{C}$ to $+55^\circ\text{C}$
<b>Unmagnified</b>		
A Sweep <sup>*1</sup>	$\pm (0.7\% \text{ of time interval} + 0.6\% \text{ of full scale})$	$\pm (1.2\% \text{ of time interval} + 0.6\% \text{ of full scale})$
$\Delta T$ Using Cursors <sup>*2</sup>	$\pm (0.5\% \text{ of time interval} + 0.3\% \text{ of full scale})$	$\pm (0.7\% \text{ of time interval} + 0.3\% \text{ of full scale})$
$\Delta T$ Using Sweep Delay <sup>*3</sup>	$\pm (0.3\% \text{ of time interval} + 0.1\% \text{ of full scale})$	$\pm (0.5\% \text{ of time interval} + 0.1\% \text{ of full scale})$
Delay <sup>*4</sup>	$\pm (0.3\% \text{ of delay setting} + 0.6\% \text{ of full scale})$ $+ (0 \text{ to } -25 \text{ ns})$	$\pm (0.5\% \text{ of delay setting} + 0.6\% \text{ of full scale})$ $+ (0 \text{ to } -25 \text{ ns})$
<b>Magnified</b>		
A Sweep <sup>*5</sup>	$\pm (1.2\% \text{ of time interval} + 0.6\% \text{ of full scale})$	$\pm (1.7\% \text{ of time interval} + 0.6\% \text{ of full scale})$
$\Delta T$ Using Cursors <sup>*5</sup>	$\pm (1.0\% \text{ of time interval} + 0.3\% \text{ of full scale})$	$\pm (1.2\% \text{ of time interval} + 0.3\% \text{ of full scale})$

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

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

<sup>\*2</sup> Intervals are measured anywhere on the graticule.

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

<sup>\*4</sup> Delay is from A Sweep trigger point to start of B Sweep.

<sup>\*5</sup> Exclude the first 0.5 division after sweep starts (first 0.5% of the full 100 division sweep).

B Sweep Timing Accuracy—Add  $\pm 0.3\%$  of time interval to the A Sweep Timing accuracy specifications for Sweep and for  $\Delta T$  Using Cursors.

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

**$\Delta T$  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.

**$\Delta T$  Range** — With Cursors:  $\pm 10$  times the A Sec/div setting. With Sweep Delay:  $\pm 9.95$  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  $\mu\text{s}$  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 division 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 mV/div 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 times the Volts/div setting. CH 3 or CH 4: ±9 times the 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 x probe attenuation factor)]. CH 3 or CH 4 Source: ±[3% of setting +4% of p-p signal +0.1 div + (0.5 mV x probe attenuation factor)].

Basic accuracies apply from +15°C to +35°C and are measured with triggering signals having transition times greater than 20 ns and dc trigger coupling. Add (1.5 mV x probe attenuation factor) for temperatures from -15°C to +15°C and from +35°C to +55°C. Add ±1% of setting from 50 Ω input coupling. Add ±1% of setting with Channel 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 MHz 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.

**CURTAIN 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** — From Dc to 2 MHz: Positive voltage decreases intensity. +2 V blanks a maximum intensity trace. 2 MHz 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.

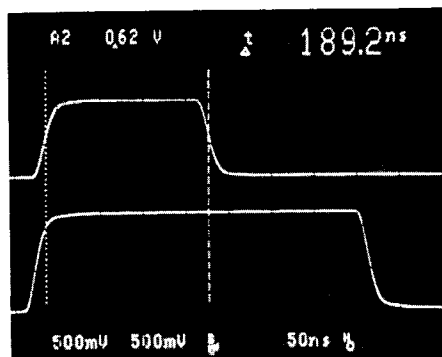
**SIGNAL OUTPUTS**

**Calibrator** — Measured with the Sec/div setting at 1 ms/div. Voltage Into 1 MΩ Load: 400 mV ±1%. Voltage Into 50 Ω 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.

**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 mm x 85 mm. 2465A/2455A/2445A: 80 mm x 100 mm (8 cm x 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 ft-cd. 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 V to 132 V ac. 230 V: 180 V to 250 V ac.

**Line Frequency** — 48 Hz to 440 Hz.

**Maximum Power Consumption** — 120 W (180 V ac) for fully optioned instrument.

**Fuse Rating** — Either 2 A, 250 V, AGC/3AG, fast-blow or 1.6 A, 250 V, 5 x 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, with humidity and temperature requirements defined in paragraphs 3.9.2.2, 3.9.2.3, and 3.9.2.4.

**Ambient Temperature** — Operating: -15°C to +55°C. Nonoperating: -62°C 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 Hz 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°C to +60°C, with operational performance checks at +30°C and +55°C.

**Shock** — Operating and Nonoperating: 50 g's, half-sine, 11 ms duration, three shocks on each face, for a 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.

## PHYSICAL CHARACTERISTICS

Dimensions	2465A/2467		2455A/2445A		Rackmount	
	mm	in	mm	in	mm	in
Width						
With handle	330	13.0	338	13.3	483	19.0
Height						
With feet, pouch	190	7.5	190	7.5	178	7.0
Without pouch	165	6.5	160	6.3		
Depth						
With front cover	467	18.4	434	17.1	419	16.5
handle extended	533	21.0	505	19.9		
Weights <sup>net</sup>	kg	lb	kg	lb	kg	lb
Net						
With accessories and pouch	10.9	24.0	10.2	22.2	4.0 <sup>**</sup>	8.8 <sup>**</sup>
Without accessories and pouch	9.7	21.3	9.3	20.5		
Shipping	14.6	32.1	12.8	28.2	6.3 <sup>**</sup>	13.8 <sup>**</sup>

<sup>\*\*</sup> Weight of conversion kit only. Rear support kit weight is an additional 6.3 kg (13.8 lb).

**Cooling** — Forced air circulation.

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

**Ordering Information** — See page 289.

## CHARACTERISTICS (OPTION 09)

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 $\geq 150$ MHz
CH 3, CH 4	2.0 div	

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

## FREQUENCY

**Range** — Autoranging 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** — Seven digits, updates twice per second or every two periods, whichever is slower.

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

## PERIOD

**Range** — Autoranging 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** — Seven digits, updates twice per second or every two periods, whichever is slower.

**Accuracy** — Resolution  $\pm 0.001\%$  of reading over entire temperature range of  $-15^\circ\text{C}$  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) =

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

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

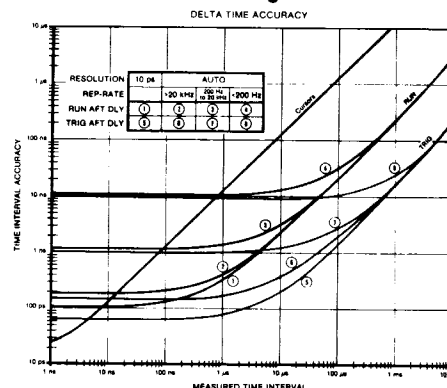
en2 = RMS noise voltage of input signal in divs

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

## $\Delta$ TIME, 1/ $\Delta$ TIME

**TRIG AFT DLY Accuracy** —  $\pm (\text{LSD} + 0.01 \times \text{B Time/div}) + (0.001\% \times \text{A Sec/div} + 0.001\%$  of reading  $+50$  ps). Measured with visually superimposed signal transitions,  $>0.1$  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  $\Delta$ REF and  $\Delta$ B triggers allow visual superposition of any pair of points within the center 80% of transitions having at least 5 div amplitude.

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



Notes: Input Signal is five vertical div with a 2 ns rise time.

Measured times are four horizontal div.

TJE is negligible for Slew Rates  $>0.1$  div/ns.

$\Delta$ Time TRIG AFT DLY assumes visual superposition.

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

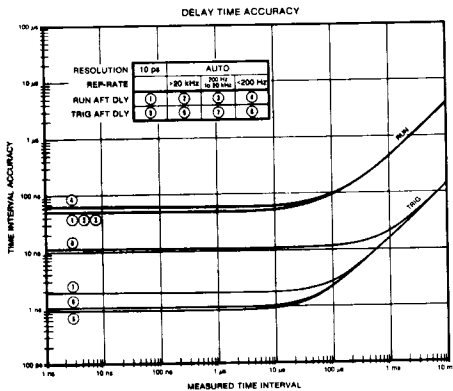
**DELAY TIME**

**TRIG AFT DLY Accuracy** —  $\pm(\text{LSD} + 0.001\%$  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 AFT DLY 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.)

**TRIG AFT DLY and RUN AFT DLY Accuracies Using Word Recognizer on the B Trigger** — Add 100 ns, if using external clock. Add 200 ns, if not using external clock.



Notes: Input Signal is five vertical div with a 2 ns rise time.

Measured times are four horizontal div.

TJE is negligible for Slew Rates  $>0.1 \text{ div/ns}$ .

$\Delta$ Time TRIG AFT DLY assumes visual superposition.

**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 $\mu$ s	10 ps 100 ps 1 ns	10 ps 100 ps 1 ns
10 $\mu$ s to 50 $\mu$ s	10 ps or 100 ps 1 ns	100 ps 1 ns
100 $\mu$ s to 500 $\mu$ s	10 ps to 1 ns	1 ns
1 ms to 5 ms	10 ps to 1 ns	10 ns
10 ms to 50 ms	10 ps to 1 ns	100 ns
100 ms to 500 ms	10 ps to 1 ns	1 $\mu$ s
1 s	10 ps to 1 ns	10 $\mu$ s

**Auto Resolution**

A Sec/Div	Trigger Repetition Rate	LSD
10 ns to 2 $\mu$ s	$>20 \text{ kHz}$	100 ps
10 ns to 2 $\mu$ s	200 Hz to 20 kHz	1 ns
5 $\mu$ s to 200 $\mu$ s	$>200 \text{ Hz}$	1 ns
10 ns to 200 $\mu$ s	$<200 \text{ Hz}$	10 ns
500 $\mu$ s to 5 ms	Any	10 ns
10 ms to 50 ms	Any	100 ns
100 ms to 500 ms	Any	1 $\mu$ s
1 s	Any	10 $\mu$ s

Note: 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** —  $\geq 4 \text{ ns}$ .

**Minimum Pulse Width** —  $\geq 3.3 \text{ ns}$ .

**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** —  $\geq 4 \text{ ns}$ .

**WORD RECOGNIZER**

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

All Inputs	Threshold	Load	Safe Limit
High	$<2.0 \text{ V}$	$<20 \mu\text{A}$	5.5 V
Low	$>0.6 \text{ V}$	$>-0.6 \text{ mA}$	-0.5 V

**Display Radix** — Hexadecimal, octal, binary.

**Data Rate** — 0 MHz to  $\geq 20 \text{ MHz}$  with clock, 0 MHz to  $\geq 10 \text{ MHz}$  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 289.

**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  $\Omega$  or 75  $\Omega$  system.

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

\*\* Same as basic instrument.

**Squarewave Flatness** — 1% p-p for both 60 Hz and 15 kHz squarewaves, from a 50  $\Omega$  or 75  $\Omega$  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 mV/div and 10 mV/div settings. Exclude first 50 ns following step transition. For signals with rise times  $<10 \text{ ns}$ , add 2% p-p between 155 ns and 165 ns after step transition.

**Television Blanking-Level Clamp (Back-Porch) 60 Hz Rejection (Channel 2 Only)** —  $\geq 18 \text{ dB}$  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 Hz 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** — Channel 1 and Channel 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).

Channel 3 and Channel 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*.

**Ordering Information** — See page 289.



**CHARACTERISTICS (OPTION 01)**

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

All accuracy specifications are stated with an operating temperature range of +18°C 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  $\mu$ V (4 1/2 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 $\Omega$  on the 200 mV and 2 V ranges, 10 M $\Omega$  on the higher ranges. Resistance can be changed to 10 M $\Omega$  on all ranges.

**Normal-Mode Rejection Ratio** —  $>$ 60 dB at 50 Hz and 60 Hz.

**Common-Mode Rejection Ratio** — 100 dB at dc;  $>$ 80 dB at 50 Hz and 60 Hz with 1 k $\Omega$  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  $\mu$ V (4 1/2 digits).

**Accuracy** —  $\pm$ (% of reading + % of full scale).

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

**Crest Factor** —  $<$ 4 at full scale.

**Common-Mode Rejection Ratio** —  $>$ 60 dB at 50 Hz and 60 Hz with 1 k $\Omega$  imbalance.

**Response Time** —  $<$ 3 s in Auto,  $<$ 2 s in Manual.

**Input Impedance** — 1 M $\Omega$  in parallel with  $<$ 100 pF.

**Maximum Input Voltage** — 500 V RMS; 700 V peak between inputs and ground, not to exceed 10<sup>7</sup> V-Hz product.

**dBV, dBm** — Calculated reading of ac voltage measurements. dBV equals 20 Log ( $V_{\text{unsk}}/1 \text{ V}$ ). dBm is referenced 1 mW into 600  $\Omega$ .

**HI  $\Omega$  RESISTANCE**

**Ranges** — 2 k $\Omega$ , 20 k $\Omega$ , 200 k $\Omega$ , 2 M $\Omega$ , 20 M $\Omega$ .

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

**Maximum Input Voltage** — 500 V RMS; 700 V peak.

**Full Scale Voltage** — 2 V.

**Open Circuit Voltage** —  $<$ 6 V.

**Resolution** — 0.1  $\Omega$  (4 1/2 digits).

**Response Time** —  $<$ 2 s in Auto,  $<$ 1 s in Manual.  $<$ 5 s in 20 M $\Omega$  range.

**LO  $\Omega$  RESISTANCE**

**Ranges** — 200  $\Omega$ , 2 k $\Omega$ , 20 k $\Omega$ , 200 k $\Omega$ , 2 M $\Omega$ .

**Accuracy** —  $\pm$ (0.1% of reading + 0.1% of full scale) for 200  $\Omega$  range. Subtract (0.09% of full scale) for 2 k $\Omega$  to 200 k $\Omega$  ranges. Add (0.15% of reading) and subtract (0.09% of full scale) for 2 M $\Omega$  range. Add 2% of reading for each 10% Relative Humidity above 70% when in 200 k $\Omega$  and 2 M $\Omega$  ranges.

**Maximum Input Voltage** — 500 V RMS; 700 V peak.

**Full Scale Voltage** — 0.2 V.

**Open Circuit Voltage** —  $<$ 6 V.

**Resolution** — 0.01  $\Omega$

**Response Time** —  $<$ 2 s in Auto;  $<$ 1 s in Manual.

**Continuity** — An audible tone indicates  $<$ 10  $\Omega$ . Reponse time is  $\approx$ 0.1 s.

**DC CURRENT**

**Ranges** — 100  $\mu$ 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  $\mu$ 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** —  $-62^\circ\text{C}$  to  $+230^\circ\text{C}$ .

**Accuracy** —  $\pm$ (2% of reading + 1.5°C).

**Resolution** — 0.1°.

**Readout** — Selectable in either °C or °F.

**OTHER CHARACTERISTICS**

**Reading Rate** — Three readings/s nominal except 1.5 readings/s on 20 M $\Omega$  range.

**Temperature Coefficient** —  $<$ 0.1 x the accuracy specification/°C from  $-15^\circ\text{C}$  to  $+18^\circ\text{C}$  and from  $+28^\circ\text{C}$  to  $+55^\circ\text{C}$ .

**GP/IB 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 289.

**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, RL1, DC1, E1 DT0 C0, PP0.

**Vertical Position Accuracy**

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

**Channel 3 and Channel 4:**  $\pm$ [0.7 div + 3% of distance (in div) from center screen].

**Ordering Information** — See page 289.

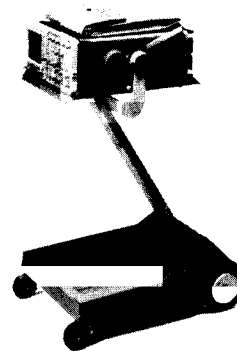
**CHARACTERISTICS (OPTION 1R)  
ENVIRONMENTAL**

Rackmounting changes the temperature, vibration, and shock capabilities. The rackmounted oscilloscope meets or exceeds the requirements of MIL-T-28800C 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.

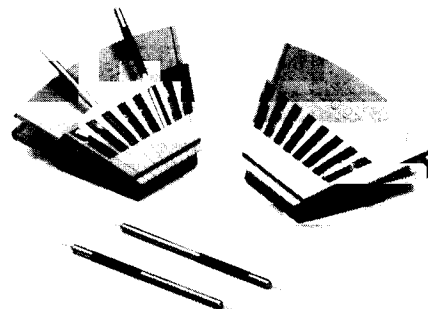
**Ambient Temperature** — Operating:  $-15^\circ\text{C}$  to  $+55^\circ\text{C}$ . Measured at the instrument's air inlet, fan exhaust temperature should not exceed  $+65^\circ\text{C}$ .

**Vibration** — Operating: 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.



K1212 Portable Instrument Cart. See page 461.



KLIPKIT makes high speed IC testing easy. For use directly with P6130 family probes or others via the included signal pins. See page 472.

**ORDERING INFORMATION**

**2467\*4 350 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 manual (070-5854-00).

**2465A 350 MHz Oscilloscope \$5,350**  
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 manual (070-6014-00).

**2455A 250 MHz Oscilloscope \$5,150**  
Includes: Same as 2465A.

**2445A 150 MHz Oscilloscope \$3,590**  
Includes: Same as 2465A, except two P6133 10X 2 m probes (P6133).

**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\*\*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 (378-0199-01); NTSC graticule CRT filter (378-0199-02); 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\*\*\*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.

**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**

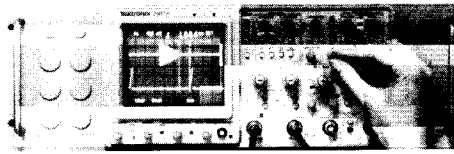
**Option 3A — MOA for combining three of the above options. -\$500**

**Option 4A — MOA for combining four of the above options. -\$750**

**OTHER INSTRUMENT OPTIONS**

**Option B1 — Service manual. +\$50**  
(For 2445A/2455A/2465A/2467) Standard manual.  
(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. +\$340**

**Option 11\*1 — Rear Panel Probe Power. +\$185**

**Option 22 — Two additional probes. +\$285**  
(2467/2465A/2455A) P6136 probes.  
(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 OPTIONS**

**Option A0 — 115 V, 60 Hz, US plug.**

**Option A1 — 220 V, 50 Hz, Universal Euro plug.**

**Option A2 — 240 V, 50 Hz, UK plug.**

**Option A3 — 240 V, 50 Hz, Australian plug.**

**Option A4 — 240 V, 60 Hz, North American plug.**

**Option A5 — 220 V, 50 Hz, Switzerland plug.**

**WARRANTY-PLUS SERVICE PLANS**

SEE PAGE 497

**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 + 2 Years Service. +\$1,495**

**M5 — (2465A/2455A and Special Editions) 9 Calibrations + 2 Years Service. +\$1,350**

**M5 — (2445A) 9 Calibrations + 2 Years Service. +\$1,295**

**OPTIONAL ACCESSORIES**

**Rackmount Conversion Kit — Not compatible with Option 01. Order 016-0825-01 \$365**

**Probe Power Extender Cable for Rackmount Instrument With Option 11 — Order 020-0104-00 \$475**

**Word Recognizer Extender Cable for Rackmount Instrument With Option 09 and 2465A CT — Order 020-0103-00 \$335**

**GPIB Cables — Double shield, low EMC.**

(1 m) Order 012-0991-01 \$135

(2 m) Order 012-0991-00 \$150

(4 m) Order 012-0991-02 \$175

**Viewing Hoods — \$50**

(Polarized Collapsible) Order 016-0180-00 \$50

(Folding Light Shield) Order 016-0592-00 \$14

(Folding Binocular) Order 016-0566-00 \$18.75

**Protective Waterproof Vinyl Cover — \$24**

Order 016-0720-00 \$24

**Carrying Case — Order 016-0792-01 \$355**

**Carrying Strap — Order 346-0199-00 \$17**

**Dc Power — For more information, see page 306.**

(1105) \$1,690

(1106) \$1,265

**Dc Inverter — 1107. For more information, see page 307. \$525**

**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. \$680**

**P6230 — 10X Bias/Offset Probe. \$395**

**P6057 — 100X, 5000 Ω passive probe for 50 Ω input. \$190**

**P6602 — Temperature Probe. \$225**

**Current Probes — A6302, A6303, P6021, P6022. See pages 483 and 482 respectively.**

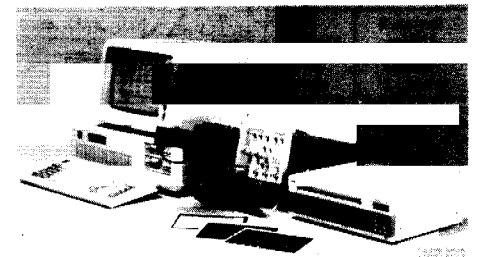
**A6901 Ground Isolation Monitor — See page 478 for complete description. \$650**

**A6902B Voltage Isolator — For floating measurements; see page 479 for complete description. \$1,795**

**DIGITIZING CAMERA SYSTEM**

**DCS01 Option 2A — Digitize waveforms from scope screen. \$5,395**

See page 353 for complete description.



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. See page 450. \$1,524**

**C-5C Option 02 — Low Cost. See page 445. \$465**

**RECOMMENDED CART**

**K212 — For on-site mobility. See page 461. \$330**

**SERVICE MANUALS**

(2467/2465A) Order 070-6019-00 \$50

(2455A/2445A) Order 070-6017-00 \$50

(Options) Order 070-5857-00 \$25

**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 021-0396-00 \$595**

Additional accessories begin on page 439.

**TRAINING**

For each 2467/2445A/2465A oscilloscope purchased, one operation and application training seat, applicable to the product, will be made available to the purchaser at 50% of the normal fee. Other restrictions apply. Workshop content is on pages 195-196. For further information, or to enroll, call 1-800-225-7802. For international orders, contact your local Sales Office.



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