

## PORTABLE OSCILLOSCOPES SELECTION GUIDE



**PERFORMANCE, PORTABILITY  
AND A HARD-EARNED  
REPUTATION FOR QUALITY.**

**23 portable scopes:  
From 3½ to 30 lbs.  
Nonstorage or storage.  
Bandwidths from 500 kHz to  
350 MHz.**

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

Choose from seven Tek Portable lines. The standard-setting, high-performance 2400 Series. The ultra-rugged 2300 Series. The popularly priced 2200 Series. Tek's super-small 200 Miniscope Series. The compact 300 Series from SONY®/Tektronix®. The high bandwidth and storage capabilities of the 400 Series. Or the multi-purpose, dual-trace T900 family.

### Suggestions for making your best selection.

Compare the characteristics of the Tek portable line, using the selection chart on pages four and five, plus the brief product overviews that follow. For complete technical details, applications assistance, and pricing contact your Tek Sales Representative.

Key performance criteria covered in the chart encompass display technology, vertical and horizontal system characteristics, and triggering. These general considerations warrant a brief explanation:

### Storage or Non-storage.

Most waveform measurements today can be made using traditional nonstorage scope capabilities. But many measurements require, or can benefit by, the unique advantages of storage.

When signals are especially slow, fast but infrequent, or when you need to compare two events, look into a Tektronix storage scope.

There are other situations that call for a storage scope, too, including applications ranging from comparing successive tests against a standard, to enhancing photography.

Only Tek offers so many storage technology options—four distinct types all of which also operate in nonstore mode.

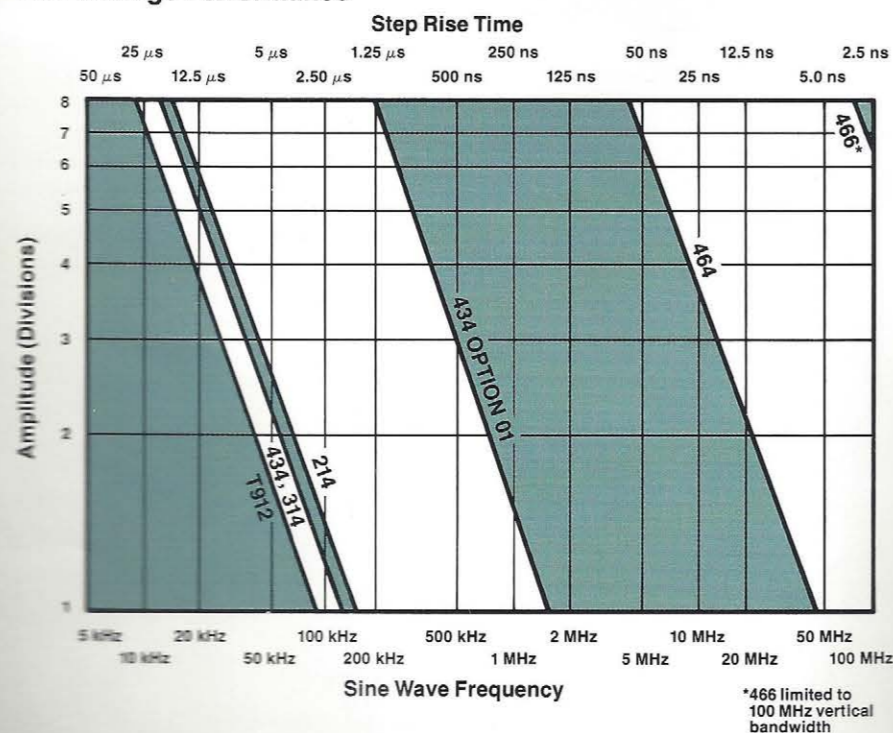
**Digital storage**, which quantifies data and saves it in memory, allows you to display and manipulate stored signals at any time and view pre-trigger events.

**Bistable storage** is the lowest cost CRT storage technology and should be selected if you need to view signals for long periods of time, store non-recurring events, or capture very slow signals over time and view them in a high resolution, bright display.

**Variable persistence storage** is useful in suppressing random signal noise or flicker, comparing changing signals, and for producing high-contrast displays of fast signals that occur at slow periodic rates.

**Fast transfer storage** makes it possible to obtain the highest writing speeds available in storage oscilloscopes.

### CRT Storage Performance



### The vertical system.

In both storage and nonstorage scopes, the appropriate bandwidth and sensitivity ratings will ensure that your scope faithfully reproduces the range and types of signals you want to measure.

**Bandwidth** is the range of frequencies a scope can display with less than a 3 dB loss of amplitude (as compared to a middle frequency). It is measured with a sine wave and only the upper 3 dB point is specified since the low frequency response extends to dc.

**Rise time** specifications help you determine whether the scope is fast enough to accurately display the signals you'll be measuring. The scope rise time you should have depends on the rise times you're measuring and the degree of accuracy you need. For 1% accuracy, pick a scope with a rise time seven times faster than the signal; for 2%, five times faster; for 3%, four times faster. Accuracy continues to decrease with lower ratios of scope to signal rise time; at 1:1, the displayed rise time has a 41% error.

**Vertical channels.** To view

more than one input signal without disturbing connections to your scope, and to compare or measure related signals, you need a multi-trace instrument. Tektronix offers portable scopes with from one to four channels.

**Vertical accuracy** specifications describe the amplifiers of the scope; Tek portables have accuracies as fine as  $\pm 2\%$  for critical amplitude measurements.

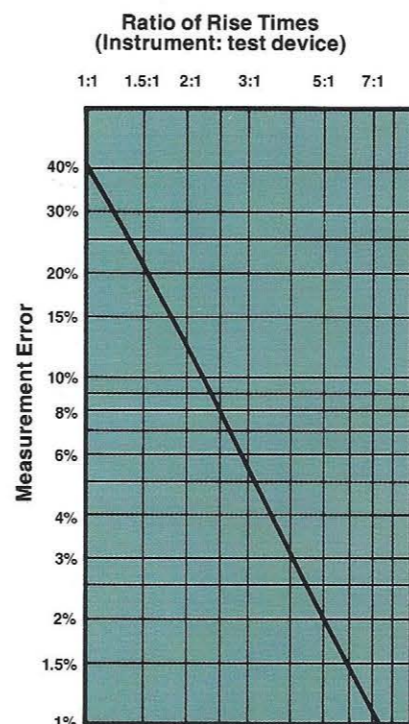
**Sensitivity** defines the input signal level needed to produce a given deflection of the electron beam within the CRT, and helps you determine whether small signals can be displayed with enough amplitude for accurate measurements.

## The horizontal system.

**Sweep speeds.** In many applications you need to see minute differences in time between signal events. The faster the sweeps on your scope, the easier it is to resolve these time differences. Meet your measurement needs with scope sweep speeds as fast as 500 picoseconds/division and horizontal accuracies to  $\pm 1\%$ .

**Delayed sweep** offers the measurement advantage of viewing a portion of a signal in detail at a faster sweep speed. Most Tek portables feature an A sweep and a delayed B sweep. The 2400 Series B sweep can even view the A sweep trigger event.

**Timing measurement accuracy** indicates the minimum possible error you will encounter when making a time measurement between two events. With a basic scope, the best accuracy will equal the horizontal amplifier's accuracy. When the scope is equipped with delayed sweep, your timing measurement accuracy increases. With digital aids—as with the 468, 2236, 2336, 2337, 2445 and 2465—you gain another step in timing accuracy.



Please note that many of the entries for this column in the chart are only representations of the best accuracy possible with that instrument and if space permitted they would be further qualified. Please consult your Tektronix sales representative for information directly applicable to your measurements needs.

### Triggering.

The flexibility of the trigger system of your scope is an important consideration; particular choices can make your job substantially easier and keep measurement confidence high. Some major choices of triggering modes are:

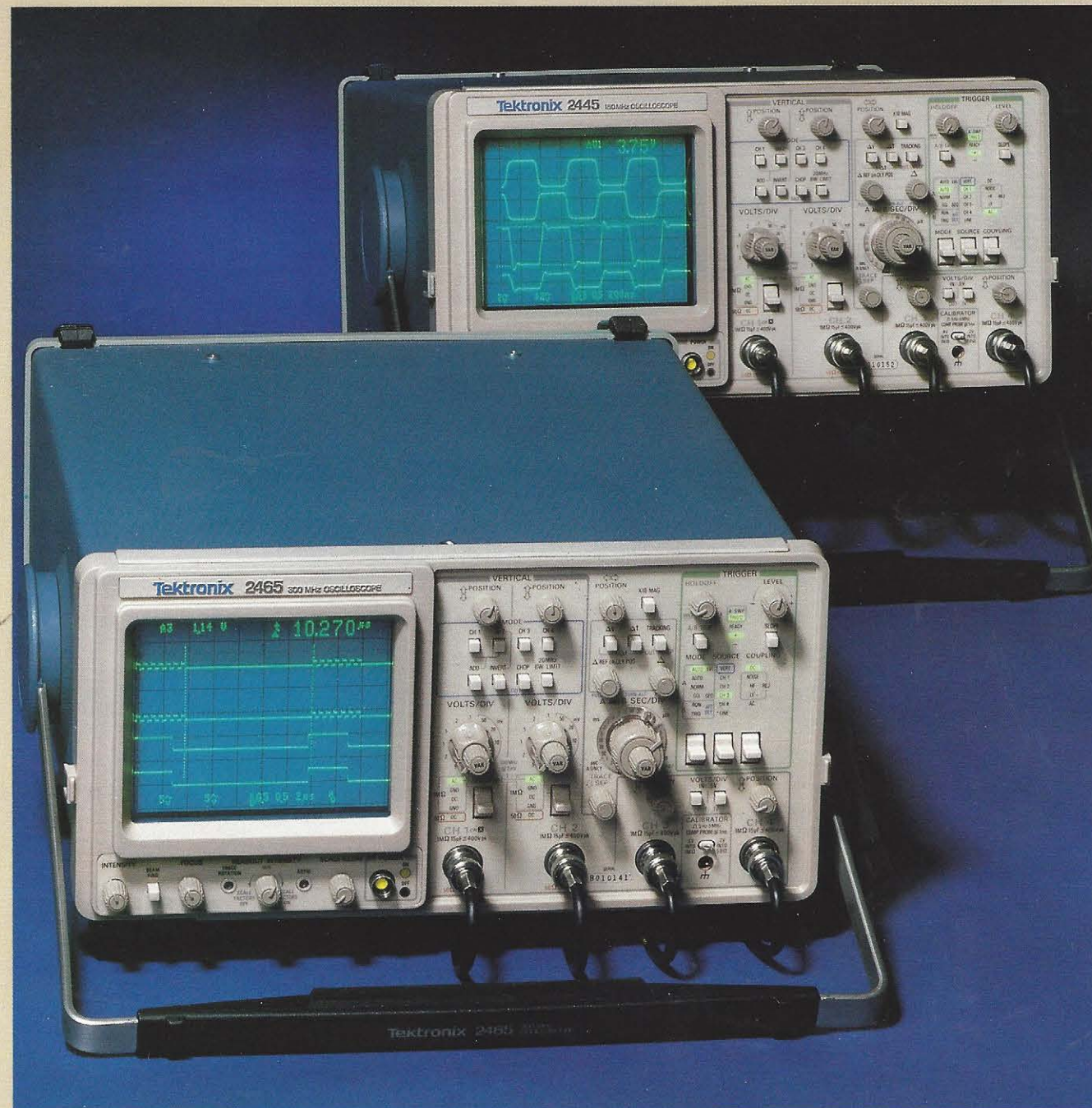
- **Auto Level** triggering of the new 2400 Series provides "hands-off" triggering on signals from 50 Hz to beyond the vertical bandwidth.
- **Peak-to-peak auto triggering** of the 2200 Series delivers quick, convenient triggering with automatic level limits.
- **Alternate triggering** for steady display of unrelated signals with multi-trace scopes.
- **Single sweep operation** is useful for applications such as babysitting a transient pulse, and for CRT photography.
- **TV trigger** is used for synchronization with video signals.

**Trigger sensitivity** specifications show the minimum size signal necessary for stable triggering; in the chart the sensitivity required for triggering at the scope's rated bandwidth is shown for internal triggers and the normal operating mode.

PORTABLE OSCILLOSCOPE KEY SPECIFICATIONS

	TEK SCOPE (B/W, rise time)	VERTICAL CHANNELS				VERTICAL ACCURACY (%)	SENSITIVITY (mV)					FASTEST SWEEP (ns/div)	DELAYED SWEEP	DIFFERENTIAL TIMING MEASUREMENT ACCURACY (%)								TRIGGER SENSITIVITY (INT: div @ BW and Max)				WEIGHT (lbs./kg.)						SPECIAL FEATURES	SEE PG.	
		1	2	3	4		5	4	3	2	1			0.5	1000	100	20	5	1	0.5	5	4	3	2	1	0.5	0.1	.001	1.5	1.0	0.5			0.2
NON-STORAGE	485 350 MHz, 1 ns	2 + Trig View				±2%	5 mV					1 ns	YES	±1%								1.5	Max 0.3				21.0 lb/9.5 kg						Widest bandwidth and fastest writing rate in a portable	12
	2465 300 MHz, 1.17 ns	4				±2%	2 mV					0.5 ns	YES	±0.5%								1.0	Max 0.35				20.5 lb/9.3 kg						CRT readout, cursor measurements, full-featured, Ch 1/Ch 2 delay matching	7
	2445 150 MHz, 2.33 ns	4				±2%	2 mV					1 ns	YES	±0.5%								1.0	Max 0.35				20.5 lb/9.3 kg						CRT readout, cursor measurements, full-featured, Ch 1/Ch 2 delay matching	7
	2337 100 MHz, 3.5 ns	2 + Trig View				±3%	5 mV					5 ns	YES	±0.75%								1.1	Max 0.3				17.5 lb/7.7 kg						Rugged, compact, lightweight, with DMM and Δ-Time LCD readout	9
	2336 100 MHz, 3.5 ns	2 + Trig View				±3%	5 mV					5 ns	YES	±1%								1.1	Max 0.3				17.5 lb/7.7 kg						Rugged, compact, lightweight, with Δ-Time LCD readout	8
	2335 100 MHz, 3.5 ns	2 + Trig View				±3%	5 mV					5 ns	YES	±1%								1.1	Max 0.3				17.0 lb/7.7 kg						Rugged, compact, lightweight	8
	2236 100 MHz, 3.5 ns	2 + Trig View				±2%	2 mV					5 ns	YES	±0.001%								1.5	Max 0.35				16.3 lb/7.4 kg						Integrated 100 MHz counter/timer/DMM	11
	2235 100 MHz, 3.5 ns	2 + Trig View				±2%	2 mV					5 ns	YES	±1%								1.5	Max 0.3				13.5 lb/6.1 kg						100 MHz Performance/Price Standard	11
	2215 60 MHz, 5.8 ns	2				±3%	2 mV					5 ns	YES	±1.5%								1.5	Max 0.4				13.5 lb/6.1 kg						Dual-Trace, Dual-Time Base 60 MHz Performance/Price Standard	10
	2213 60 MHz, 5.8 ns	2				±3%	2 mV					5 ns	YES	±3%								1.5	Max 0.4				13.5 lb/6.1 kg						Dual-Trace 60 MHz Performance/Price Standard	10
	335 35 MHz, 10 ns	2				±3%	1 mV					20 ns	YES	±2%								1.5	Max 0.35				10.3 lb/4.7 kg						Lightweight, high-performance dual-trace, delayed sweep	13
	T922R 15 MHz, 23.3 ns	2				±3%	2 mV					20 ns	NO	±3%								1.5	Max 0.5				20.0 lb/9.1 kg						Rack-mount, switchable front and rear inputs	14
	305 5 MHz, 70 ns	1				±3%	5 mV					100 ns	NO	±3%								0.75	Max 0.3				10.6 lb/4.8 kg						Battery-powered, with DMM	13
	221 5 MHz, 70 ns	1				±3%	5 mV					100 ns	NO	±3%								1.0	Max 0.5				3.5 lb/1.6 kg						Battery-powered, integral probe	14
	213 1 MHz, 350 ns	1				±3%	5 mV					400 ns	NO	±5%								0.5					3.7 lb/1.7 kg						Battery-powered, integral probe with DMM	14
	212 500 kHz, 700 ns	2				±5%	1 mV					1000 ns	NO	±5%								0.2					3.5 lb/1.6 kg						Battery-powered, integral probe, dual channel	14
STORAGE	468 100 MHz, 3.5 ns Digital storage	3 (Inc. Trig View)				±3%	0.5 mV (storage)					2 ns	YES	±0.1% (storage)								1.5	Max 0.3				30.0 lb/12.7 kg						10 MHz Useful Storage Bandwidth	15
	466 100 MHz, 3.5 ns Var. persist. & fast transfer	2 + Trig View				±3%	5 mV					5 ns	YES	±1%								1.5	Max 0.3				26.0 lb/11.8 kg						3000 div/μs stored writing speed	16
	464 100 MHz, 3.5 ns Var. persist. & fast transfer	2 + Trig View				±3%	5 mV					5 ns	YES	±1%								1.5	Max 0.3				26.0 lb/11.8 kg						110 div/μs stored writing speed	16
	434 25 MHz, 14 ns Bistable storage	2				±3%	1 mV					20 ns	NO	±3%								1.0	Max 0.3				20.7 lb/9.4 kg						5000 div/μs with Option 01	16
	314 10 MHz, 35 ns Bistable storage	2				±3%	1 mV					100 ns	NO	±3%								1.0	Max 0.3				10.3 lb/4.7 kg						400 div/μs stored writing speed	17
	T912 10 MHz, 35 ns Bistable storage	2				±3%	2 mV					50 ns	NO	±3%								1.5	Max 0.5				18.0 lb/8.2 kg						250 div/ms stored writing speed	17
	214 500 kHz, 700 ns Bistable storage	2				±5%	1 mV					1000 ns	NO	±5%								0.2					3.5 lb/1.6 kg						500 div/ms stored writing speed	17

## THE 2400 SERIES: THE NEW INDUSTRY STANDARD IN PORTABLE SCOPES.



For years the Tek 465B stood as the industry standard for portable scopes. Now, by incorporating state-of-the-art microprocessor design, laser-trimmed hybrid circuitry and innovative conveniences, the Tek 2400 Series is clearly and prominently the new performance and reliability standard.

Accuracy is superb: horizontal at 1%, vertical at 2% and  $\Delta$ -Time to 0.5% using the B sweep. And, that accuracy is not at the expense of ease of use. On screen cursors provide CRT readout measurements of voltage, time, frequency, ratio and phase. CRT readouts also inform you of the scale factor settings, the trigger level voltage and various modes.

Their capabilities are uniquely sophisticated, yet operation is equally simple. Digital readings, simplified trigger operation and illuminated control indicators make

the 2400 Series a pleasure to use.

Tek also designed the new P6131 probe to complement 2400 Series performance: laser-trimmed hybrid circuitry provides you with full bandwidth at the probe tip.

And, like all members of the Tek 2000 Family, the reliability of the 2400 Series is backed by the first three-year warranty in the industry on all labor and parts, including the CRT. Low-cost service options are available that extend this coverage up to five years.

### 2445

The 150 MHz 2445 brings Tek's most advanced scope engineering to bear on applications where the need for timing accuracy, user efficiency and versatility is at its highest. With features like 4 independent channels, auto level "hands off" triggering,  $\Delta$ -Time delay sweep to 0.5% accuracy, triggering frequency to at least 250 MHz, and extensive CRT readouts of front panel settings and waveform parameters, the 2445 is the ideal choice for a wide variety of applications such as mini/micro computer service, communications testing, and other high technology R&D or service requirements.

150 MHz bandwidth.  
4 independent channels.  
1 ns/div sweep speed.  
2 mV/div sensitivity.

$\Delta$ -Volts,  $\Delta$ -Time cursors.

CRT Readout:

- Scale factors
  - Dc trigger level
  - Voltage, Time, Frequency, Phase and Ratio measurements
  - Mode indicators
- B sweep can display the A sweep trigger event.

Trigger sensitivity from 0.35 divisions at 50 MHz to 1.0 division at 250 MHz.

Trigger coupling: dc, ac, HF reject, LF reject, and noise reject.

Ch 1/Ch 2 delay matching control accurately compensates for probe differences.

Switchable inputs: 1 M $\Omega$  and 50  $\Omega$ , with 50  $\Omega$  protection.

$\Delta$ -Time delay sweep accuracy  $\pm$  (0.3% of measurement + 0.1% of full scale).

20:1 CMRR at 50 MHz.

Channel isolation is 100:1 at 100 MHz for channels 1 and 2, 50:1 for channels 3 and 4.

X-axis bandwidth: dc to 3 MHz; phase difference: 1° or less from dc to 1 MHz.

Meets MIL-T-28800, Class 3 environmental standards.

9.3 kg (20.5 lbs).

3 year warranty.

### 2465

The state-of-the-art for portable scope performance and operational simplicity, the 300 MHz 2465 features sweep speeds to 500 ps/div and triggering frequency to at least 500 MHz. It is the uncompromising choice for the widest range of applications of a portable scope including mainframe computer design, large ECL systems, real time control systems and other high technology environments. Waveform cursors and CRT readouts contribute to an unprecedented degree of error-resistance and easy use.

300 MHz bandwidth.  
4 independent channels.  
500 ps/div sweep speed.  
2 mV/div sensitivity.

$\Delta$ -Volts,  $\Delta$ -Time cursors.

CRT Readout:

- Scale factors
  - Dc trigger level
  - Voltage, Time, Frequency, Phase and Ratio measurements
  - Mode indicators
- B sweep can display the A sweep trigger event.

Trigger sensitivity from 0.35 divisions at 50 MHz to 1.0 division at 500 MHz.

Trigger coupling: dc, ac, HF reject, LF reject, and noise reject.

Ch 1/Ch 2 delay matching control accurately compensates for probe differences.

Switchable inputs: 1 M $\Omega$  and 50  $\Omega$ , with 50  $\Omega$  protection.

$\Delta$ -Time delay sweep accuracy  $\pm$  (0.3% of measurement + 0.1% of full scale).

20:1 CMRR at 50 MHz.

Channel isolation is 100:1 at 100 MHz for channels 1 and 2, 50:1 for channels 3 and 4.

X-axis bandwidth: dc to 3 MHz; phase difference: 1° or less from dc to 1 MHz.

Meets MIL-T-28800, Class 3 environmental standards.

9.3 kg (20.5 lbs).

3 year warranty.

## TEK'S TOUGHEST. DEPENDABLE, FIELD SERVICE PORTABLES.

### 2335

Rugged, compact and light-weight for ultra-portability, the 2300 Series is designed and built for on-site field service applications or manufacturing environments where durability is essential. The 100 MHz 2335 is fast and accurate featuring Tek's best electromagnetic interference shielding, 50 g's shock resistance, and a durable, flip-top aluminum case. It meets MIL-T-28800, Class 3 environmental requirements for aerospace and military qualification. And, the 2300 Series scopes offer the lowest life cycle cost of any high performance portable.

Like other members of the Tek 2000 family, the 2300 Series offers the industry's first three-year warranty on all labor and parts, including the CRT. A variety of maintenance contracts, economically extending this coverage even further, are also available.

100 MHz bandwidth.  
5 ns/div sweep speed.  
5 mV sensitivity (to 2 mV in variable).  
Dual trace.  
Delayed sweep.  
10 volts/meter EMC.  
Pushbutton trigger view.  
Trigger sensitivity from 0.3 divisions at 20 MHz to 1.1 division at 100 MHz.  
Trigger coupling: dc, ac, HF reject and LF reject.

Input R and C: 1 M $\Omega$ , 20 pF.  
10:1 CMRR at 50 MHz.  
Calibrated sweep delay range continuous from 50 ns to at least 5 seconds after start of delaying sweep.  
X-axis bandwidth: dc to 2 MHz; phase difference is 3° or less from dc to 200 kHz.  
Rackmount option available.  
Meets MIL-T-28800, Class 3 environmental standards.  
7.7 kg (17.0 lbs).  
3 year warranty.

### 2336

The 2336 includes all the features, performance and rugged design of the 2335, while adding  $\Delta$ -Time/B-trigger capability with liquid crystal display, in the flip-top cover.

The  $\Delta$ -Time and B trigger capabilities yield differential time measurement accuracies to  $\pm 1\%$  of the reading  $\pm 1$  count, as well as runs after delay and triggered after delay B sweep modes.

100 MHz bandwidth.  
5 ns/div sweep speed.  
5 mV sensitivity (to 2 mV in variable).  
Dual trace.  
Delayed sweep.  
Delta time with LCD direct readout.  
Pushbutton trigger view.  
Trigger sensitivity from 0.3 divisions at 20 MHz to 1.1 division at 100 MHz.  
Trigger coupling: dc, ac, HF reject, and LF reject.  
Trigger jitter 1.0 ns or less at 100 MHz and 5 ns/div.  
Input R and C: 1 M $\Omega$ , 20 pF.  
B trigger sources: Ch 1, Ch 2, composite Ch 1 and Ch 2, external.  
10:1 CMRR at 50 MHz.  
X-axis bandwidth: dc to 2 MHz; phase difference is 3° or less from dc to 200 kHz.  
10 volts/meter EMC.  
Meets MIL-T-28800, Class 3 environmental standards.  
7.9 kg (17.5 lbs).  
3 year warranty.

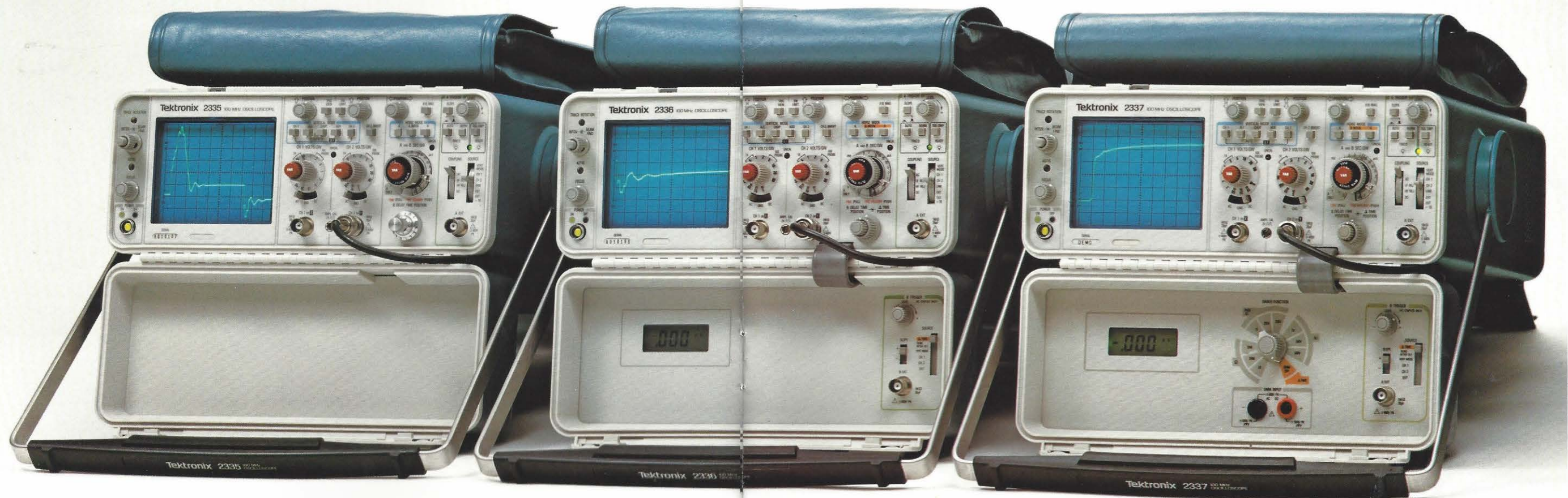
### 2337

The 2337 rounds out the Tek 2300 Series by adding both  $\Delta$ -Time and DMM measurement to its flip-down, stand-up cover. Backlit LCD readout is readable in any lighting condition. All this capability remains extremely portable at 8.9 kg (19.6 lbs) and highly effective in even the most hostile environments, with a specified EMC of 10 volts per meter.

The 2337 DMM measures dc voltage with three scales (to 2 V, 200 V, and 500 V) with accuracy to  $\pm 0.15\%$  of reading  $\pm$  one count. Ac voltage measured to 350 V with an accuracy of  $\pm 3\% \pm 6$  counts; and resistance to 2 M $\Omega$  with a resolution of 0.1  $\Omega$ .

100 MHz bandwidth.  
5 ns/div sweep speed.  
5 mV sensitivity (to 2 mV in variable).  
Dual trace.  
Delayed sweep.  
Delta time/DMM with LCD direct readout.  
Pushbutton trigger view.  
Trigger sensitivity from 0.3 divi-

sions at 20 MHz to 1.1 division at 100 MHz.  
Trigger coupling: dc, ac, HF reject, and LF reject.  
Trigger jitter 1.0 ns or less at 100 MHz and 5 ns/div.  
Input R and C: 1 M $\Omega$ , 20 pF.  
B trigger sources: Ch 1, Ch 2, composite Ch 1 and Ch 2, external.  
10:1 CMRR at 50 MHz.  
X-axis bandwidth: dc to 2 MHz; phase difference is 3° or less from dc to 200 kHz.  
10 volts/meter EMC.  
Meets MIL-T-28800, Class 3 environmental standards.  
8.0 kg (17.6 lbs).  
3 year warranty.



## THE PERFORMANCE/ PRICE STANDARD IN PORTABLE SCOPES.

The 2200 Series ushered in an innovative design concept that substantially lowered the cost of a Tek-quality scope.

Mechanical parts were reduced by 65%, cabling and electrical connectors by 90%, compared to any other instrument in their class. At the same time, fewer parts and connectors have contributed to a new high standard of reliability, serviceability and light weight.

The 100 MHz 2236 is innovative not only in improved reliability, but in enhanced performance: a counter/timer/DMM has been integrated into the scope's vertical, horizontal and trigger systems, resulting in simplified set-up and direct, accurate, digital readouts of waveform measurements.

Like other members of the Tek 2000 family, the 2200 Series offers the industry's first three-year warranty on all labor and parts, including the CRT. A variety of maintenance contracts, economically extending this coverage even further, are also available.

### 2213

The 2213 is a 60 MHz, dual trace oscilloscope offering unprecedented value in both initial and life cycle costs. With single time base delay, the 2213 provides intensified and delayed sweep at a low cost. An ideal choice for general purpose applications, the 2213 is also well-suited for use in education. The 2213 works anywhere in the world, thanks to a high-efficiency power supply that has eliminated the need for line switches, and even made a cooling fan unnecessary.

60 MHz bandwidth.  
5 ns/div sweep speed.  
2 mV/div sensitivity.  
Dual trace.  
Delayed sweep.  
CMRR of 10:1 at 10 MHz.  
Horizontal operating modes: A, A intensified after delay, delayed.  
Delay times: <0.5  $\mu$ s, 10  $\mu$ s, and 0.2 ms with 20:1 multiplier.  
X-axis bandwidth: 2 MHz; phase difference is 3° from dc to 50 kHz.  
Z-axis input.

Trigger sensitivity from 0.4 division at 2 MHz to 1.5 divisions at 60 MHz.

Triggering features include TV field, alternate channel, and position independent triggering.  
6.1 kg (13.5 lbs).  
3 year warranty.

### 2215

Like the 2213, the 2215 provides excellent performance in a small, lightweight package of just 6.1 kilograms (13.5 lbs). In addition to all the features of the 2213, the 2215 adds dual time base performance with alternate sweep switching. From design to testing,

if you need an accurate scope with a broad range of features at a surprisingly affordable price, look into the 2215.

60 MHz bandwidth.  
5 ns/div sweep speed.  
2 mV/div sensitivity.  
Dual trace.  
Delayed sweep.  
CMRR of 10:1 at 10 MHz.  
Horizontal operating modes: A, alternate (A intensified by B and B), B.  
Delay jitter is 10,000:1 (0.01%) of maximum available delay time.  
X-axis bandwidth: 2 MHz; phase difference is 3° from dc to 50 kHz.  
Z-axis input.  
Trigger sensitivity from 0.4 division at 2 MHz to 1.5 divisions at 60 MHz.  
Triggering features include TV field, alternate channel, and position independent triggering.  
Trigger after delay.  
Calibrated delay time dial.  
Alternate time base.



6.1 kg (13.5 lbs).  
3 year warranty.

### 2235

The 2235 offers the highest value combination of measurement quality and affordability at 100 MHz. Features like rugged design, light weight, easily learned front panel, plus 2% vertical and horizontal accuracy make the 2235 an ideal service scope. For both service and design applications the 2235 offers a low-noise, low-drift, high sensitivity vertical system that improves display quality and makes your measurements easier and more accurate.

In production and test applications, features like the beam finder and separate A and B intensity controls, peak-to-peak auto triggering, and vertical mode triggering make the 2235 easy to use.

100 MHz bandwidth.  
2 channels plus trigger view.



5 ns/div sweep speed.  
2 mV/div sensitivity.  
2% vertical and horizontal accuracy.  
CMRR of 10:1 at 50 MHz.  
20 MHz bandwidth limit on vertical channels and triggering system.  
Input R and C: 1 M $\Omega$ , 20 pF.  
Horizontal operating modes: A, alternate (A intensified by B and B), B.  
Delay jitter is 20,000:1.  
Full sensitivity X-Y measurements with X-axis bandwidth of 3 MHz,  $\pm$ 3% accuracy.  
Chop rate: 500 kHz.  
Differential time measurement accuracy:  $\pm$ 1%.  
Z-axis input useable to 20 MHz.  
Trigger sensitivity from 0.3 division at 10 MHz to 1.5 divisions at 100 MHz.  
Triggering features include P-P auto, TV line, TV field, Normal, Single Sweep and bandwidth-limited modes.  
6.1 kg (13.5 lbs).  
3 year warranty.

### 2236

#### The 2236 100 MHz measurement system with integrated counter/timer/DMM

The first scope to make counter/timer/DMM-type measurements through the scope system, the 2236 makes possible consolidated set-ups and combinations of measurements that have never been possible before. Gated counter measurements, for example, can be made via the B trigger with automatic, digital readout of results. You also get direct digital readout of frequency, period and  $\Delta$ -Time measurements with accuracies to 0.001%. The fluorescent display also provides user prompts to further simplify operation. Its productivity advantages extend from routine service to complex design tasks.

All 2235 features, plus:  
Direct frequency and period measurements from 0.2 Hz to 100 MHz.  
Direct width measurements from 5 ns to 5 seconds.  
Direct totalizing to  $2^{23}$  - 1 events.  
Triggered and non-triggered delay time and  $\Delta$ -Time measurements.  
Frequency and time measurements are auto-ranged and auto-averaged for best resolution.  
100 MHz counter time base yields time resolution to 10 ps and frequency resolution to 10  $\mu$ Hz with averaging.  
 $\pm$ 5000 count DMM measures voltage through Ch 1 input: dc to 0.3%, ac true rms 1.0%, 0.4999 V to 49.99 V (499.9 V with 10X probe) full scale.  
Floating, auto-ranged voltage measurements through side inputs: dc to 0.1%, ac true rms to 1.0%, 0.4999 V to 499.9 V full scale (349.9 V in RMSV).  
Floating, auto-ranged resistance measurements: 0.01  $\Omega$  to 1.99 G $\Omega$  with automatic diode detection.  
Audible continuity test.  
Temperature measurements with optional P6602 probe.  
7.4 kg (16.3 lbs).  
3 year warranty.

## THE FASTEST WRITING SPEED OF ANY PORTABLE SCOPE.

### 485

At 350 MHz and 21 pounds, the 485 is one of the fastest, lightest portable scopes you can find. A long list of features adds versatility and convenience to its impressive specifications.

Viewing and photographing high-speed and low rep-rate signals are the applications the 485 is designed for; with the C-31B camera and 3000 speed film, the 485 offers photographic writing speeds of 1 division per nanosecond (P31 phosphor) or 2 div/ns (P11 phosphor).

And with the 485's autofocus circuit, single-shot photography is

easier; there's no need to refocus if you change the intensity level. Selectable input impedance gives you the capability to measure both high and low impedance points with the same scope and without active probes. Internal detection circuitry protects the 50  $\Omega$  input by automatically disconnecting when the signal exceeds approximately 5 V RMS.

Automatic vertical scale-factor readout is provided by three LEDs located around each attenuator knob for 1X, 10X, and 100X probes.

FET probe power for two active probes is also standard with the 485.

The 485 options and optional accessories include a rackmount

version, EMC modifications, P11 phosphor, a current loop adaptor, and a long list of Tektronix scope accessories.

350 MHz bandwidth.  
2 div/ns photographic writing speed.

1 ns/div sweep speed.

5 mV sensitivity.

Dual trace.

Delayed sweep.

Differential time measurement accuracy to  $\pm(0.5\%$  of measurement  $+0.1\%$  of full scale).

CMRR is 10:1 at 50 MHz.

Horizontal display modes include A, intensified, alternate, B. Delay jitter of less than 20,000:1 of 10X the TIME/DIV setting.

Trigger operating modes include normal, automatic, and single sweep for A sweeps; runs after delay and triggered after delay for B sweeps.

Trigger coupling: dc, ac, HF reject, and LF reject.

Trigger sensitivity from 0.3 division at 50 MHz to 1.5 divisions at 350 MHz.

1 M  $\Omega$  and 50  $\Omega$  selectable input impedance.

Built-in power for FET probes.

External trigger view.

9.5 kg (21 lbs).



## THE ULTRAPORTABLE 300 SERIES FROM SONY/TEKTRONIX

### 335

The portability of the 335 is a big advantage in many digital and analog troubleshooting applications. Features of this 10.5 pound, dual trace scope make it a good choice for many industrial applications. For example, the 1 mV/div (at 25 MHz) vertical sensitivity insures that low level signals from magnetic recording heads, optical read heads, or industrial control transducers can be accurately and easily measured.

35 MHz bandwidth.

20 ns/div sweep speed.

1 mV sensitivity.

Dual trace.

Delayed sweep.

Input R and C: 1 M  $\Omega$ , 24 pF.

Calibrated sweep delay for differential time measurement accuracies to  $\pm 2\%$  over one or more major divisions,  $\pm 0.02\%$  with less than one.

Horizontal operating modes include A, A intensified by B, and B. B sweep either runs or triggers after delay.

Delay jitter of 20,000:1 (0.005%) of X10 the TIME/DIV switch setting.

Normal, automatic and single sweep A trigger operating modes.

Trigger sensitivity from 0.35 divisions at 10 MHz to 1.5 divisions at 35 MHz.



Trigger coupling modes include dc, ac, HF reject, and LF reject. External horizontal input for two XY displays in chopped mode. Z-axis input. AC or DC power operation. Rugged construction. 4.7 kg (10.5 lbs).

### 305

The 305 combines a 5 MHz scope with an integral auto ranging DMM and a built-in rechargeable battery pack. Take the 305 on-site instead of multiple instruments when you are required to make measurements on equipment located in hard to reach places or where power is not readily accessible.

5 MHz bandwidth.

100 ns/div sweep speed.

5 mV sensitivity.

Dual trace.

Input R and C: 1 M  $\Omega$ , 47 pF.

Auto and normal trigger modes.

Trigger sensitivity from 0.3 division at 500 kHz to 0.75 division at 5 MHz.

Z-axis input.

Built-in TTL level triggering.

Battery power.

Integral DMM with dc volts, ac, true rms and resistance.

DMM dc voltage measurement ranges: 2, 20, 200, 1000 V. Accuracy is  $0.1\% \pm 2$  counts.

DMM ac voltage measurement ranges: 2, 20, 200, 700 V. Accuracy is within 0.5% of reading  $\pm 10$  counts, 40 to 500 Hz.

DMM resistance measurement ranges: 2, 20, 200, 2000 k $\Omega$ . Accuracy is  $0.6\% \pm 3$  counts.

Rugged construction.

4.8 kg (10.6 lbs).



## 221

The 221 weighs just 3.5 pounds, measures only 3x5.2x9 inches, and fits easily into a tool box or brief case. This 5 MHz battery-powered portable can be used in a wide assortment of service applications. An integral 1 M $\Omega$  low-capacitance probe minimizes circuit loading.

A single rotary control on the 221 is used for all trigger level and

slope functions. And all controls are side mounted and recessed for protection.

5 MHz bandwidth.  
100 ns/div sweep speed.  
5 mV/div to 100 V/div sensitivity.  
Insulation voltage to 700 V.  
Internal battery pack.  
Integral probe.  
1.6 kg (3.5 lbs).



## 213

The 213 combines a precision 3½ digit digital multimeter and a 1 MHz oscilloscope in a 3.7 pound, 3x5.2x8.9 inch package. Rugged construction, internal batteries, true rms voltage and current measurement make it ideal for on-site service applications.

1 MHz bandwidth.  
400 ns/div sweep speed.  
20 mV sensitivity.

DMM and miniscope in one unit.  
Insulated voltage to 700 V/DMM to 1000 V.  
Dc and ac voltage ranges from 0.1 to 1000 V; resolution is 100  $\mu$ V at 0.1 V full scale.  
Dc and ac current ranges from 0.1 to 1000 mA; resolution is 100 nA at 0.1 mA full scale.  
Resistance ranges from 1 k $\Omega$  to 10 M $\Omega$ ; resolution is 1  $\Omega$  at 1 k $\Omega$  full scale.  
Internal battery pack.  
Integral probes.  
1.7 kg (3.7 lbs).



## 212

Built of impact-resistant plastic and fully self-contained, this miniature portable is perfect for applications in severe environments. Like all 200 Series scopes it permits "floating" measurements since it is double insulated and can be elevated to 700 V (dc + peak ac) above ground when operated from batteries. The 212 weighs just 3.5 pounds, and measures only 3x5.25x9.5 inches.

The 212 features integral probes that are color-coded to the vertical channels to minimize errors. The probes are part of the instrument—you can't forget and leave them behind.

500 KHz bandwidth.  
1  $\mu$ s/div sweep speed.  
1 mV/div to 50 V/div sensitivity.  
Dual trace.  
Insulated voltage to 700 V.  
Internal battery pack.  
Integral probes.  
1.6 kg (3.5 lbs).



## T922R

The T922R is a rackmount, multipurpose, 15 MHz oscilloscope. With switchable front/rear inputs, graticule illumination for photography and three signal outputs, the T922R is often used in production testing and on-site geophysical exploration.

Dc to 15 MHz bandwidth.  
20 ns/div sweep speed.  
2 mV/div sensitivity.

Switchable front and rear signal inputs.  
Single sweep operation.  
Dual trace.  
Trigger modes: Auto, Normal and TV.  
Trigger sensitivity from 0.5 divisions at 5 MHz to 1.5 divisions at 15 MHz.  
X-axis bandwidth to 1 MHz; 5° phase difference dc to 50 kHz.  
Z-axis input.

## TEKTRONIX STORAGE SCOPES

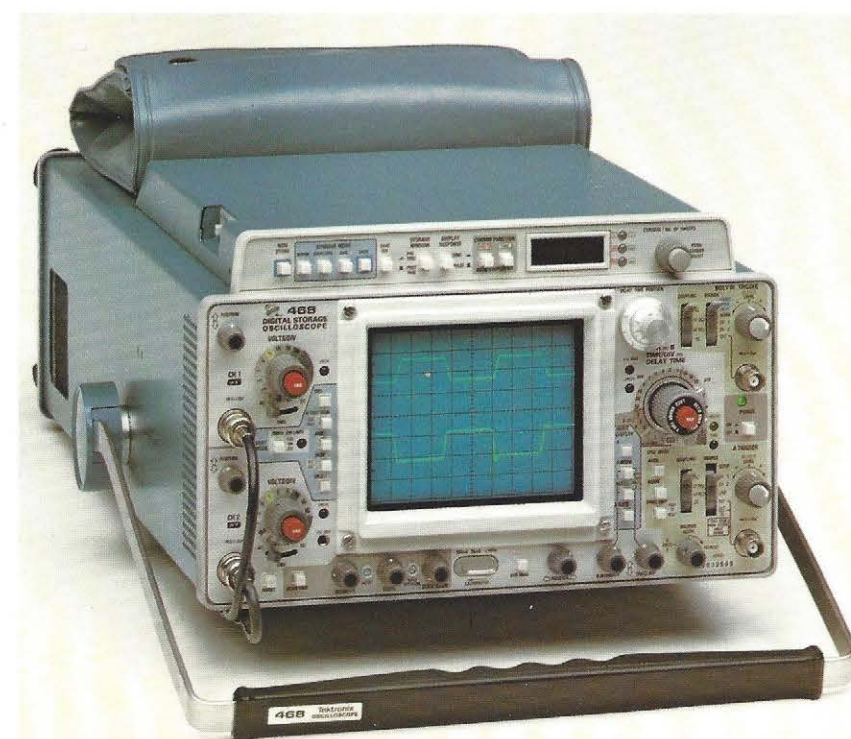
Tektronix stands alone in the variety of storage technologies we make available in portable scopes. Choose from digital or three types of CRT storage (see

general introduction, pp. 2-3) that offer you distinct advantages in acquiring fast single-shot events or a complete picture of a slowly occurring signal. Use storage to maintain a reference signal on the screen for comparison with an incoming signal, or to reduce the time and cost of preparing photographic records.

The Tek digital storage 468 is particularly suitable to help you view pretrigger data, expand or reposition stored traces, or automate measurements by digitizing waveforms for transmission over the

IEEE-488 interface. The 468 is extremely easy to use and offers crisp, clear displays with no fading or blooming of the trace.

Your Tek sales representative can provide you with much more detailed information on storage oscilloscope technology, and help you choose the scope with the best combination of capabilities for your needs.



With the GPIB interface option, the 468 can transmit data to other instruments for logging and to computers for more processing.

Besides the GPIB interface, the 468 offers rackmount, EMC, TV sync separator, and X-Y recorder output options.

Plus, the 468 is a real-time sampling digital scope, which means you can capture single-shot events as they happen. There's no need to acquire multiple copies of the signal to build up the data until you can use it.

Digital storage.  
100 MHz real-time bandwidth.  
10 MHz digital storage bandwidth.  
2 ns/div sweep speed.  
5 mV sensitivity.  
Envelope mode for babysitting and glitch catching.  
Dual trace.  
Delayed sweep.  
X10 vertical and X100 horizontal magnification in storage mode.  
2 to 256 sweep signal averaging.  
Voltage and time measurement cursors.

Ground reference display.  
Automatic scale factor.  
Electronically switched external A trigger view.  
Pre-trigger viewing of data.  
Automatic  $\pm 1/2$  sample interval correction for digital trigger uncertainty.  
Storage time base accuracy: 0.1% for full 10 cm.  
13.6 kg (30 lbs).  
GPIB option.

## 468

The 468 high performance portable scope offers 100 MHz real-time bandwidth and is capable of accurately storing and displaying 10 MHz single shot events. The exclusive Tek ENVELOPE mode, unlimited storage time, expandable, repositionable stored traces, SAVE REFERENCE memory, pre-trigger viewing and trigger jitter correction make the 468 the most versatile digital storage scope available today.

For instance, you can use the ENVELOPE mode to monitor changing signals, find missing pulses, catch glitches, babysit intermittent conditions, and detect aliasing.

Another Tektronix exclusive is dual display reconstruction techniques. Push a button for either sine or pulse interpolation between data points. Both make waveforms easier to read than the dot displays typical of most digital scopes.

Signal averaging is also standard with the 468. Depending on the number of sweeps you average, you can increase measurement resolution—and accuracy—by a factor of up to 16.

## CRT STORAGE

### 466/464

The 466 at 3000 div/ $\mu$ s is the fastest portable storage scope. Light weight, and the ability to use optional, external dc power, makes the 466 useful for virtually all field



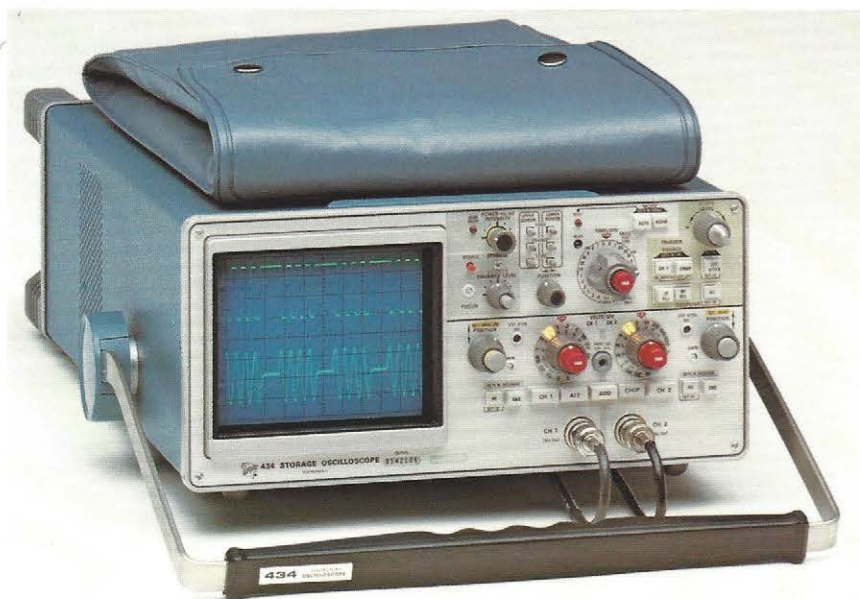
measurement applications. The 1106 Battery Pack is also useful in isolating the scope from noisy or intermittent power sources.

With the exception of stored writing speed, the lower cost 464 is identical in performance and features to the 466. The 464 offers 110 div/ $\mu$ s.

Variable persistence and fast transfer storage.  
3000 div/ $\mu$ s stored writing speed (466).  
110 div/ $\mu$ s stored writing speed (464).  
100 MHz real-time bandwidth.  
5 mV sensitivity.  
Dual trace.  
Delayed sweep.  
5 ns/div sweep speed.  
Push button trigger view.  
DM 44 Differential-Time/DMM  
Option available: 1% timing measurements with 3½-digit display; 2% frequency measurements; 0.1% dc voltage measurements; 0.3% resistance measurements; and temperature measurements from -55 to 150°C.  
Other options include EMC modification and TV sync separator.  
11.8 kg (26.0 lbs).

### 434

A bistable storage oscilloscope with a 25 MHz bandwidth, the 434 offers the versatility of split-screen storage. The entire screen or both halves may be used in



either store or non-store modes, and they are separately erasable. Option 01 offers you a stored writing speed of 5000 div/ms.

Split-screen bistable storage.  
25 MHz bandwidth.  
20 ns/div sweep speed.  
10 mV sensitivity.  
400 div/ms stored writing speed.  
5000 div/ms writing speed with Option 01.  
Dual trace.  
LOCATE beam control for photography applications.  
Automatic scale factor.  
X50 horizontal magnifier.  
Trigger sensitivity from 0.3 divisions at 5 MHz to 1.0 division at 25 MHz.  
Trigger modes: normal, auto, and single sweep.  
Trigger coupling includes dc, ac, HF reject, LF reject.  
Z-axis input.  
9.4 kg (20.8 lbs).

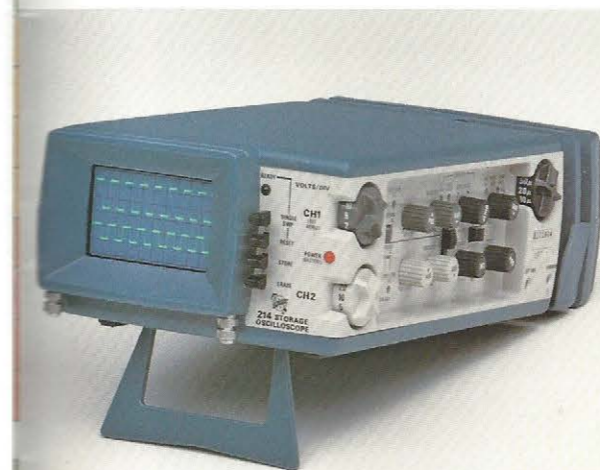


### 314

The 10.5 pound, bistable storage 314 Oscilloscope provides 1 mV/div sensitivity at 10 MHz, 400 div/ms stored writing speed, and a 4 hour viewing time. With long-term storage, you can use the 314 to monitor signal lines where undesired transients are suspected. Other features include the integrate mode to increase the intensity of the stored trace, auto erase, and side-mounted probes.

Bistable storage.  
10 MHz bandwidth.  
100 ns/div sweep speed.  
1 mV sensitivity.

400 div/ms stored writing speed.  
Dual trace.  
4 hour viewing time.  
Trigger sensitivity from 0.3 divisions at 1 MHz to 1.0 division at 10 MHz.  
Trigger modes: normal, auto, and single sweep.  
Trigger coupling includes dc, ac, and LF reject.  
Two simultaneous XY displays: dc to 200 Hz.  
Z-axis input.  
Ac or dc power operation.  
4.7 kg (10.5 lbs).



### 214

The 214 weighs only 3.5 pounds, and measures just 3x5x9.5 inches. Its signal acquisition capabilities include bandwidth to 500 kHz with deflection factors from 1 mV/div to 50 V/div. Stored writing speed can be enhanced to at least 500 div/ms. Like all 200 Series scopes, the 214 features ruggedness, internal battery and an integral probe.

Bistable storage.  
500 kHz bandwidth.  
1  $\mu$ s/div sweep speed.  
1 mV/div to 50 V/div sensitivity.

Up to 500 div/ms stored writing speed.  
Dual trace.  
Probes color keyed to vertical channels.  
Trigger sensitivity to 0.2 divisions at 500 kHz.  
Automatic and normal trigger modes; single control for level and slope.  
Internal battery pack.  
Integral probes.  
1.6 kg (3.5 lbs).



### T912

The T912 Storage Oscilloscope is well suited for a wide range of applications in education and industry. As a training aid in basic electricity and electronics courses, the storage feature is highly useful in creating visual representations of electrical signals.

The T912 has numerous industrial applications, where it can be used to compare input vs. feedback signals in servo-mechanisms for shock and vibration analysis, and countless other transducer-aided measurements.

Bistable storage.  
10 MHz real-time bandwidth.  
250 cm/ms stored writing speed.  
10 V to 2 mV/div sensitivity.  
Differential input option.  
50 ns/div sweep speed.  
Trigger sensitivity from 0.5 division at 5 MHz to 1.5 divisions at 10 MHz.  
Trigger modes: normal, auto, and single sweep.  
XY displays: dc to 1 MHz; 5° phase difference at 50 kHz.  
Z-axis input.  
7.9 kg (17.5 lbs).

TEK PORTABLES ACCESSORIES  
PROVIDE THE STRONGEST LINK  
BETWEEN YOUR INSTRUMENTS  
AND THE OUTSIDE WORLD.

Because Tek instruments are designed for users who place a premium on the quality and reliability of results, we support every link in the measurement chain.

Tek's engineering ensures that all accessories are designed to complement their respective instruments as completely as possible. At the same time, no Tek instrument is introduced until the essential accessories, documen-

tation and service support are in-place and performance-proved. The following chart is a brief and by no means comprehensive survey of accessories available for Tek portables. For a more complete listing of tools, from attenuators and terminators to isolators and cables, talk to your Tek sales representative or in the U.S.A. call the Tektronix National Marketing Center at 1-800-426-2200, Ext. 98. In Oregon, call collect (503) 627-9000 Ext. 98.



PORTABLE SCOPE ACCESSORIES

PROBES				CAMERAS		CART	MISCELLANEOUS ACCESSORIES
Passive	Active	Current	Single Shot or Low Rep Rate	Stored/Stable or Repetition	Low Cost		
2400 SERIES							
2445 2465	P6131	P6201 P6202A	P6021 P6022 A6302/AM 503 A6303/AM 503	C31B with 016-0269-03 adaptor	C-30B Opt 01 with 016-0269-03 adaptor	C-5C with 016-0359-01 adaptor	200C Protective cover, waterproof, Blue Vinyl-016-0720-00; Probe Package (for channels 3 & 4) 010-6131-01; Rackmount conversion kit-016-0691-00; Rear support kit (for rackmounted inst.) 016-0096-00; Polarized Collapsible Viewing Hood-016-0180-00; Folding Viewing Hood, Light-shielding-016-0592-00; Collapsible Viewing Hood, Binocular-016-0566-00; Carrying Strap-346-0058-00.
2300 SERIES							
2335 2336 2337	P6108 P6122 P6130	P6201 P6202A	P6021 P6022 A6302/AM 503 A6303/AM 503	NA	NA	C-5C with 016-0357-01 adaptor	200C 2335 Rack Adaptor Kit 016-0468-00.
2200 SERIES							
2213 2215 2235 2236	P6122 P6121 (2236) P6130	P6201 P6202A	P6021 P6022 A6302/AM 503 A6303/AM 503	NA	NA	C-5C Opt 04 includes 016-0359-01 adaptor and flash	200C Front panel cover and accessory pouch-020-0672-00; Front panel cover-200-2520-00; Accessory pouch-016-0677-00; Viewing Hood-016-0566-00; Carrying Strap-346-0058-00; Carrying Case-016-0566-00; Rack Adaptor Kit (2213/2215/2235)-016-0466-00; 2236 Rack Adaptor Kit-016-0015-00; CRT TV Graticule-035-0175-00; CRT Light Filter (clear)-337-2775-02; 2236 only: Tektronix P6602 Temp. Probe-010-6602-00.
400 SERIES							
485	P6101 P6106 P6056 P6057	P6063B P6015 P6009 P6048 P6130	P6201 P6202	P6021 P6022 A6302/AM 503 A6303/AM 503	C-31B with 016-0306-01 adaptor	C-30B with 016-0306-01 adaptor	NA 200C Folding Viewing Hood-016-0274-00 & 016-0082-00; 1105 Battery Power Supply Rain Cover-016-0554-00; Rack Adaptor 016-0558-00.
468	P6101 P6105 P6062B	P6015 P6009 P6048 P6130	P6201 P6202	P6021 P6022 A6302/AM 503 A6303/AM 503	C-31B with 016-0269-03 adaptor	C-30B Opt 01 with 016-0269-03 adaptor	C-5C with 016-0359-01 adaptor 200C Viewing Hood (Binocular)-016-0566-00; Folding Polarized Viewing Hood-016-0180-00, 1105 or 1106 Battery Power Supply Mesh Filter-378-0726-01. Rack Adaptor (468) 016-0675-00.
465M UVSM 425	P6101 P6104	P6015 P6009 P6130	P6201 P6202	P6022 P6021 A6302/AM 503 A6303/AM 503	C-31B with 016-0269-03 adaptor	C30B Opt 01 with 016-0269-03 adaptor	C-5C with 016-0359-01 adaptor 200C Folding Polarized Viewing Hood-016-0180-00. Mesh Filter-378-0726-01; 1105 Battery Power Supply; Rack Adaptor-040-0825-01.
466 464	P6101 P6105 P6062B	P6015 P6009 P6130	P6202 P6201	P6021 P6022 A6302/AM 503 A6303/AM 503	C-31B with 016-0269-03 adaptor	C-30B Opt 01 with 016-0269-03 adaptor	C-5C with 016-0359-01 adaptor 200C 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 Adaptor-016-0675-00.
434	P6101 P6108 P6009	P6015 P6120	P6021 P6022 A6302/AM 503 A6303/AM 503	C-31B with 016-0269-03 adaptor	C-30B Opt 01 with 016-0269-03 adaptor	C-5C Opt 02 with 016-0359-01 adaptor (handheld)	200C Folding Polarized Viewing Hood-016-0180-00; Mesh Filter-378-0682-00. 1105 Battery Power Supply; Rack Adaptor-016-0272-00.
300 SERIES							
314 305 335	P6101 P6149A		P6021 P6022 A6302/AM 503 A6303/AM 503	C-31B with 016-0327-01 adaptor	C-30B with 016-0327-01 adaptor	NA	NA Viewing Hood-016-0297-00; Mesh Filter-378-0063-00. 1105 Battery Power Supply; Rain Cover (314, 335) 016-0612-00.
200 SERIES							
212 213 214 221	NA	NA	NA	NA	NA	NA	NA Alligator Clip Kit-015-0231-00; Probe Tip to BNC Panel Connector-013-0084-01; Probe Tip to BNC Cable Connector-013-0096-00; Power Cable Adaptor Assembly-161-0077-01; 10X Attenuator Package-010-0378-01; Viewing Hood-016-0199-01; Carrying Strap-346-0104-00; Carrying Case-016-0512-00.
T900 SERIES							
T912	P6101 P6108 P6062B	P6015 P6120 P6007	P6021 P6022 A6302/AM 503 A6303/AM 503	NA	NA	C-5C Opt 03 with 016-0358-01 adaptor	NA Protective Cover-016-0340-00; Dust/Rain Jacket-016-0361-00.
T922R	P6101 P6108 P6062B	P6015 P6120 P6007	P6021 P6022 A6302/AM 503 A6303/AM 503	C-51 with 016-0249-04 adaptor	C-53 with 016-0249-04 adaptor	C-5C Opt. 01 with 016-0357-01 adaptor	NA Viewing Hood-016-0377-00.

For further information, contact:


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