

**350  
MHz  
PORTABLE  
OSCILLOSCOPE**



**TEKTRONIX®**

*committed to  
technical excellence*



**...THAT WEIGHS ONLY  
23 POUNDS!**



the TEKTRONIX® 485

# a laboratory oscilloscope with portability

The dual-trace, 350-MHz 485 Oscilloscope is the newest addition to the world's most widely used portables. Many features of earlier TEKTRONIX portables are retained, many others are expanded and a lot of new ones are added. The result is a new product which significantly expands the performance spectrum of portable scopes. Following are some of the features of the 485, an oscilloscope which measures with laboratory precision and carries with small-package ease.

## 350 MHz bandwidth, 1 ns Risetime at 5 mV/Div—

**350-MHz Bandwidth, 1 ns Risetime at 5 mV/Div—** More dual trace high frequency measurement capability at 5 mV/div than any other laboratory-quality scope—portable or cabinet.

**Volts/Div Readout—**A popular feature in new TEK portables. With the 485, any time you use the recommended 10X or 100X probes, LED readout always indicates the correct on-screen deflection factor. No more multiplying attenuation factors and dial settings each time you make a measurement. You'll save valuable time and protect costly equipment and breadboards by avoiding incorrect measurements.



**Vertical Mode Selection—**You have easy-to-understand, easy-to-use fingertip controls for quick operation of the complete range of vertical display modes. You can also use the vertical inputs for X-Y. Just set the vertical mode to X-Y and make calibrated measurements from 5 mV/div to 5 V/div, DC to at least 5 MHz. It's that easy.



**Bandwidth Limit —** Simultaneously suppresses unwanted frequency components above 20 MHz from the trigger circuits and vertical channels.



# A-external trigger



**A-External Trigger**—Just press this button to display the external trigger signal. You can quickly verify your trigger source and check timing reference. Compare this to the time consuming procedure you go through to view an external trigger signal on any other scope.



**Triggering with Fewer Controls**—For full bandwidth triggering you just set the coupling and source switches to the desired position, select the slope and adjust the level. That's all.



**Full Range Internal Trigger Selection**—In Normal, you trigger from the displayed signal. Channel 1 lets you trigger from Channel 1 signal only for applications such as phase and time delay measurements. Channel 2 lets you do all the triggering you do from Channel 1, except you use the Channel 2 signal for reference. All of this without switching probes to get the right reference signal to the right input.



**Applications Oriented Triggering**—You'll use Norm, the minimum hold-off position, for most applications. For other applications the 485 has two more triggering modes. For instance, trigger holdoff allows stable triggering on complex digital words. When measuring low rep-rate, fast-rise pulses using delayed sweep, you want optimum trace intensity. In the B Ends A mode, you end the sweep early to allow triggering at the beginning of the next period. This permits maximum sweep rep-rate AND increases intensity.

# alternate sweep switching



**Alternate Sweep Switching**—These straightforward controls make delayed sweep operation easier than ever before.

Here's the way you make the measurement with the 485. Press A and display the A sweep—press INTEN and select an intensified zone—press ALT. It's easy. And what do you have? You see the intensified waveform and the delayed waveform displayed at the same time. What does this mean? When you move the intensified zone up and down a pulse train, you always know precisely where you are and still see the delayed waveform.

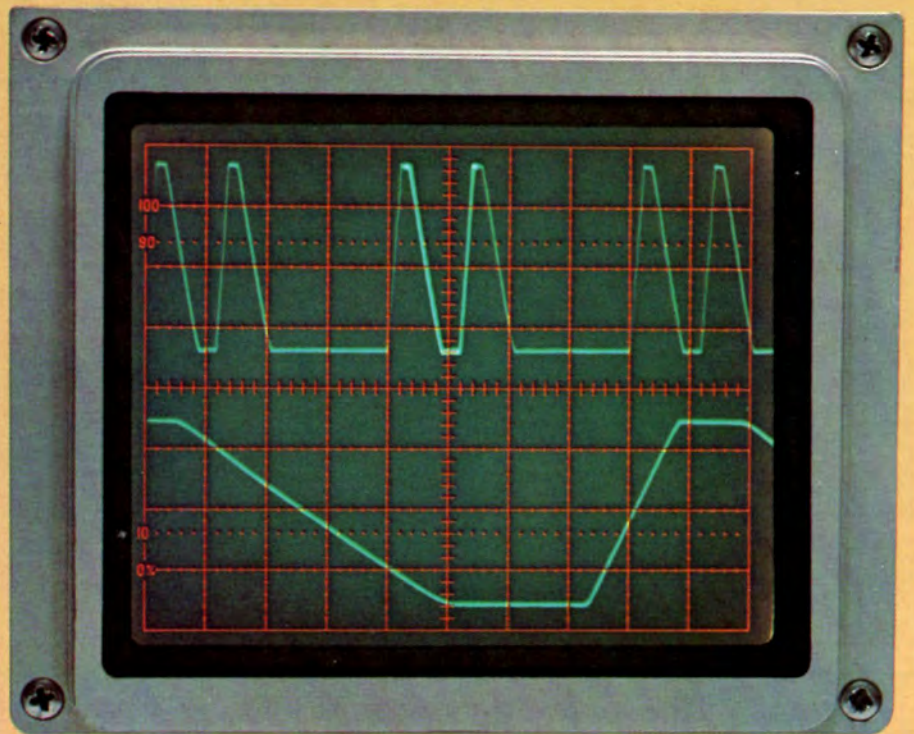
**Alternate Sweep Switching**—The 485 is the only portable that has it.



**Dual Intensity Controls**—Individual intensity controls enhance the alternate sweep feature. When making alternate sweep measurements, you adjust the intensity of each sweep to the level that's best for your applications.

actual—  
size  
CRT

**7.2 Div/ns Writing Speed**—Enough writing speed to photographically record those fast, hard to locate transients. And the extra light output pays off when you measure fast-rise, low rep-rate events in high ambient light.



the  
TEKTRONIX

485

A precision laboratory oscilloscope with portability and unmatched performance characteristics, combined with major new features, provides you with the capability to solve complex measurement problems—in the field and in the lab.

# 485

# specifications

## VERTICAL DEFLECTION (2 Identical Channels)

**Selectable Input Impedance**—50- $\Omega$  and 1-M $\Omega$  impedance are available at a single BNC connector by push button selection. 50  $\Omega$  within 0.5%; VSWR 1.25:1 or less at 5 mV/div and 10 mV/div, 1.15:1 or less from 20 mV/div to 5 V/div at 350 MHz. 1 M $\Omega$  within 1% paralleled by approx 20 pF.

**Bandwidth\* and Rise time**  
from 50- $\Omega$  terminated source, +15°C to +35°C

50 $\Omega$	DC to 350 MHz, 1 ns
1 M $\Omega$	DC to 250 MHz, 1.4 ns

\*Measured at -3 dB. Lower -3 dB point, AC coupled from 50  $\Omega$  source, is 1 kHz or less for 50  $\Omega$  and 10 Hz or less for 1 M $\Omega$ . 20 MHz bandwidth limit selection is provided.

**Deflection Factor**—5 mV/div to 5 V/div in 10 calibrated steps (1-2-5 sequence), accurate within 2%. Uncalibrated, continuously variable between steps and to at least 12.5 V/div. Gain can be recalibrated at the front panel.

**Probe Power**—Two 4-pin connectors at the rear of the instrument provide power suitable for optional active probes.

**Display Modes**—Channel 1; Channel 2 (Normal and Inverted); Alternate; Chopped (Approx 1-MHz rate); Added; X-Y (Channel 1-Y and Channel 2-X).

**Automatic Scale Factor**—Probe tip deflection factors for 10X and 100X coded probes are automatically indicated by three readout lights at the edge of the knob skirts. All lights are off when the channel is not selected for display or when the trace identification control on the probe is depressed.

**50- $\Omega$  Protection**—Internal detection circuitry provides protection by automatically disconnecting excessive signals of up to 100 volts. The "disconnected" condition is indicated, and has manual reset.

### Maximum Input Voltage

50 $\Omega$	Protection disconnect occurs for voltages that exceed approximately: 5 V RMS continuous. 0.1 watt-second for instantaneous voltages of 10 V to 100 V, 50- $\Omega$ source.
1 M $\Omega$	500 V (DC + peak AC) 500 V P-P to 1 kHz

**Selectable Input Coupling**—AC; DC; GND (provides zero reference, precharges coupling capacitor, disconnects 50- $\Omega$  load in 50- $\Omega$  mode).

## HORIZONTAL DEFLECTION

**Time Base A and B**—Calibrated sweep range: 1 ns/div to 0.5 s/div in 27 calibrated steps (1-2-5 sequence). Uncalibrated A continuously variable between steps and to at least 1.25 s/div.

### Time Base A & B Sweep Accuracy

Sweep Rate	+15°C to +35°C	-15°C to +55°C
1 ns/div to 20 ns/div	3%	5%
50 ns/div to 0.1 s/div	2%	4%
0.2 s/div and 0.5 s/div	3%	5%

**A Trigger Holdoff**—Adjustable control permits a stable presentation of repetitive complex waveforms. The control covers at least the time of one full sweep for sweeps faster than 0.2 s/div.

**B Ends A**—The A sweep is reset at the end of the B sweep to allow the fastest possible sweep repetition rate for increased trace intensity in the delayed sweep mode.

**Horizontal Display Modes**—A, Intensified, Alternate, and B (delayed sweep). A only is displayed for A sweep rates of 1, 2 and 5 ns/div.

**Alternate Display Modes**—Allows the B delayed sweep to appear alternately with the intensified A sweep. Trace separation control positions B (delayed) sweep approx 4 div from the A sweep.

## CALIBRATED SWEEP DELAY

**Delay Time Range**—0 to 10 times Delay Time/Div setting of 10 ns/div to 0.5 s/div.

## Differential Delay Time Measurement Accuracy

Delay Time Setting	+15°C to +35°C
10 ns/div and 20 ns/div	2% + 0.4 ns
50 ns/div to 0.1 s/div	0.9% + 0.1% full scale
0.2 s/div and 0.5 s/div	1.9% + 0.1% full scale

Full scale is 10 times the Delay/Div setting.

**Jitter**—1 part or less in 20,000 of 10X the Time/Div setting.

## TRIGGERING A AND B

**A Trigger Modes**—Normal, sweep runs when triggered. Automatic, sweep free-runs in the absence of a triggering signal and for signals below 20 Hz. Single Sweep, sweep runs one time on the first triggering event after the reset selector is pressed.

**B Trigger Modes**—B Runs After Delay Time, starts automatically at the end of the delay time. B Triggerable After Delay Time, runs when triggered. The B (delayed) sweep runs once, in each of these modes, following the A sweep delay time.

### Time Base A & B Trigger Sensitivity

Trigger Mode	To 50 MHz	To 350 MHz
DC	Internal	0.3 div deflection
	External	20 mV
AC	Signals below 16 Hz are attenuated	
AC LF Reject	Signals below 16 kHz are attenuated	
AC HF Reject	Signals below 16 Hz and above 50 kHz are attenuated	

**A External Trigger Display**—A momentary push button selector overrides other vertical controls and displays the external signal being used for A sweep triggering. This provides quick verification of the external signal and time comparison between a vertical signal and the external trigger signal. The deflection factor is approximately 50 mV/div (0.5 V/div with Ext  $\div$  10 source).

**Level and Slope**—Internal, permits selection of triggering at any point on the positive and negative slope of the displayed waveform. External, level is adjustable through at least  $\pm 0.5$  V for either polarity;  $\pm 5$  V for EXT  $\div$  10.

**A Sources**—Internal, line, external, external  $\div$  10.

**B Sources**—B Runs After Delay Time, internal, external, external  $\div$  10.

**External Inputs**—1 M $\Omega$  paralleled by approx 15 pF. Maximum input voltage: 500 V (DC + peak AC), 500 V P-P to 1 kHz.

**Jitter**—0.1 ns or less at 350 MHz and 1 ns/div.

## X-Y OPERATION

**Full Sensitivity X-Y (CH 1-Y, CH 2-X)**—5 mV/div to 5 V/div in 10 calibrated steps (1-2-5 sequence), accurate within 2%. Y-axis bandwidth identical to Channel 1. X-axis bandwidth is DC to at least 5 MHz (-3 dB). Phase difference between amplifiers is 3° or less to 5 MHz.

## CRT

**TEKTRONIX CRT**—4-inch rectangular tube; 8 x 10-div display area, each div is 0.8 cm. Horizontal and vertical centerlines further marked in 0.2-div increments. P31 phosphor normally supplied; P11 optional without extra charge; 21-kV accelerating potential.

**Photographic Writing Speed**—At least 4 div/ns with standard P31 phosphor and at least 7.2 div/ns with optional P11 phosphor using the TEKTRONIX C-31-R Camera and Polaroid\* 10,000 ASA film.

**Auto Focus**—Automatically maintains beam focus for all intensity settings.

**Graticule**—Internal, no parallax; variable edge lighting; markings for measurement of risetime. Graticule is dark with illumination off.

**Beam Finder**—Limits display within graticule area.

**External Z-Axis**—Risetime  $\approx$  15 ns. Input R  $\approx$  500  $\Omega$ . +0.2 V (DC to 20 MHz) blanks trace of average intensity. +2 V (DC to 2 MHz) blanks maximum intensity trace.

**Beam Current Limit**—Automatically limits the average beam current to protect the CRT phosphor.

\*Registered Trademark Polaroid Corporation

## ENVIRONMENTAL CAPABILITIES

**Ambient Temperature**—Operating: -15°C to +55°C. Filtered forced air ventilation is provided. Storage: -35°C to +75°C.

**Altitude**—Operating: to 15,000 feet; maximum allowable ambient temperature decreased by 1°C/1000 feet from 5,000 to 15,000 feet. Nonoperating: to 50,000 feet.

**Vibration**—Operating: 15 minutes along each of the three axis, 0.025 inch peak-to-peak displacement (4 g's at 55 Hz) 10 to 55 to 10 Hz in 1-minute cycles.

**Shock**—Operating and nonoperating: 30 g's, 1/2 sine, 11-ms duration, 2 shocks per axis in each direction for a total of 12 shocks.

**Humidity**—Operating and storage: 5 cycles (120 hours) to 95% relative humidity referenced to MIL-E-16400F (par 4.5.9 through 4.5.9.5.1, class 4).

## OTHER CHARACTERISTICS

**Two-Frequency, Fast-Rise Calibrator**—Output resistance is 450  $\Omega$  with a risetime (positive slope) into 50  $\Omega$  of 1 ns or less. 1-kHz duty cycle 49.8% to 50.2%. Amplitude is 5 V within 0.5% open circuit and 0.5 V within 1% into 50  $\Omega$  ( $\pm 0.5\%$ ). Optional BNC accessory current loop provides 50 mA within 1%. Selectable repetition rates are 1 kHz and 1 MHz within 0.25%. Specifications apply over +15°C to +35°C range.

**A Sweep Output and A and B Gate Outputs.**

**Power Requirements**—120 V and 240 V nominal, 48 to 440 Hz.

### 485 Dimensions and Weights

Height	6-9/16 in
Width	12 in
Depth 18 1/2 in, with handle extended	20-5/8 in
Net Weight 20 1/2 lb, with accessories	23 lb
Domestic Shipping Weight	$\approx$ 35 lb
Export Packed Weight	$\approx$ 49 lb

**Included Standard Accessories**—50- $\Omega$  18-inch BNC cable (012-0076-00); two BNC jack posts (012-0092-00); 50- $\Omega$  terminator (011-0049-01); accessory pouch (016-0535-00); instruction manual; operator's handbook.

485 OSCILLOSCOPE	\$4200
485-1 OSCILLOSCOPE, without A EXT TRIG Display	\$4100
485-2 OSCILLOSCOPE, without A EXT TRIG Display and with 50- $\Omega$ input only instead of selectable input impedance	\$3850

Battery and external DC power capability to power this and other instruments will be available in a stand-alone package.

## PROBES

Probes are not supplied with the 485 and should be ordered separately, according to the application.

### Probes—

P6056 10X 500- $\Omega$ Probe Package, for use with 50- $\Omega$ systems, order 010-6056-03—6 ft.	
010-6056-05—9 ft.	\$45
P6057 100X 5-k $\Omega$ Probe Package, for use with 50- $\Omega$ systems, order 010-6057-03—6 ft.	
010-6057-05—9 ft.	\$45
P6053A 10X 10-M $\Omega$ Probe Package, for use with 1-M $\Omega$ systems, order 010-6053-01—3.5 ft.	
010-6053-03—6 ft.	
010-6053-05—9 ft.	\$55

Contact your Field Engineer for further information on these or active probes.

Information in this publication supersedes all previously published material. Specification and price change privileges reserved. Revised from 1972 New Products Catalog.





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technical excellence*

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