

PORTABLE OSCILLOSCOPES

475 200-MHz Dual-Trace Oscilloscope

465 100-MHz Dual-Trace Oscilloscope



475 pictured above is identical in appearance to the 465 (not shown) except the 465 deletes the 0.01 and 0.02 μ s TIME/DIV and 2 mV VOLTS/DIV switch positions.

- 200 MHz at 2 mV/DIV (475)
- 1 nsec/DIV SWEEP RATE (475)
- 100 MHz at 5 mV/DIV (465)
- 5 nsec/DIV SWEEP RATE (465)
- 8 x 10-cm CALIBRATED DISPLAY
- EASY-TO-OPERATE
- TRIGGER VIEW
- AUTOMATIC VOLTS/DIV READOUT
- BANDWIDTH LIMITING
- VERSATILE TRIGGER SELECTION
- BATTERY OPERATION
- DELAYED SWEEP

The need to view and accurately measure complex nanosecond signals on customer locations or in a "field" environment is commonplace and expected. The new 465 and 475 have been specifically designed to be easy to use and meet the high performance and portable demands of these applications.

The exceptionally low-cost of the 465 with 100 MHz at 5 mV/cm and the 475 with 200 MHz at 2 mV/cm represents a price/performance breakthrough for portables and insures top value for the future.

At less than 23 lb the new 465 and 475 portables are light, short and easy to carry (25.3 lb with panel cover and accessories). They use less travel space and are approx 20% lighter than the TEKTRONIX 453A, and 454A, the world's most widely used portables.

Although light weight, small and rugged, the 465 and 475 contain a big, bright, high-resolution CRT. Even in adverse ambient light conditions low rep-rate pulses are easily viewed. With 8 cm vertically and 10 cm horizontally the CRT display covers $\frac{1}{2}$ of the entire front panel. Though the front panel is small in area and dominated by the larger CRT, these versatile portables are easy to use. Operation has been simplified by single-function push buttons, control knob design, layout and color-coordinated front panels.

Troubleshooting circuits and equipment is often more effectively accomplished when using external trigger sources. It is essential that the timing, amplitude and other characteristics of the external trigger waveforms are known. By simply pressing a front panel push button on the 465 or 475, any waveform applied at the A trigger input is instantly displayed, thus eliminating resetting controls and disconnecting leads. This can be a real time saver and convenience when external trigger signals are frequently being used as timing references.

In the past, multi-trace applications or measurements requiring frequent attenuation or probe changes necessitated bothersome and error-prone deflection factor determination. With the 465 and 475, probe tip deflection factors for recommended 1X and 10X probes are automatically indicated by readout lights behind the knob skirts.

Measuring with respect to ground is important in many applications. This is easily accomplished at the probe when DC coupled by simply pressing the small ground reference push button on the probes recommended for 465 and 475 use.

The 465 and 475 can be operated from either a free-standing battery pack or one which attaches directly to the oscilloscope. Both are small and light weight, providing a handy solution for making accurate measurements in difficult environments such as conducted EMI, ground loops, power line fluctuations, or in the absence of line power.



CHARACTERISTICS

All characteristics apply to both the 465 and 475 except where indicated.

VERTICAL DEFLECTION

(2 Identical Channels)

Bandwidth* and Risetime at all deflection factors from 50 Ω terminated source

	-15°C to +40°C	+40°C to +55°C
465	DC to 100 MHz, 3.5 ns	85 MHz, 4.12 ns
475	DC to 200 MHz, 1.75 ns	175 MHz, 2.0 ns

*Measured at -3 dB down. Bandwidth may be limited to approximately 20 MHz by bandwidth limit switch.

Lower -3 dB point, AC coupling from 50- Ω source

465/475	X1 Probe	10 Hz or less
	X10 Probe	1 Hz or less

Deflection Factor

465—5 mV/div to 5 V/div in 10 calibrated steps**

475—2 mV/div to 5 V/div in 11 calibrated steps**

**1, 2, 5 sequence, accurate within 3%. Uncalibrated, continuously variable between steps and to at least 12.5 V/div.

Display Modes—Channel 1; Channel 2 (normal and inverted); Alternate; Chopped (465—approx 250-kHz rate, 475—approx 1-MHz rate); Added; X-Y (selected by Time/div, CH 1-X, CH 2-Y)

Automatic Scale Factor Readout—Probe tip deflection factors for 1X or 10X coded probes are automatically indicated by two readout lights behind the knob skirts. All lights are off when the channel is not displayed. Ground reference display selectable at probe (when DC coupled).

Input R and C—1 megohm within 2% paralleled by approx 20 pF.

Maximum Input Voltage

DC Coupled	250 V (DC + Peak AC)
	500 V P-P AC at 1 kHz or less
AC Coupled	500 V (DC + Peak AC)
	500 V P-P AC at 1 kHz or less

Signal Output—(465) CH 1 vertical signal is DC to at least 50 MHz -3 dB and approx 25 mV/div terminated into 50 Ω , and approx 50 mV/div terminated into 1 M Ω . (475) CH 2 vertical signal is DC to at least 50 MHz -3 dB and approx 10 mV/div terminated into 50 Ω , and approx 20 mV/div terminated into 1 M Ω .

Delay Line—Permits viewing leading edge of displayed waveform.

Probe Power (for 475 only)—Connectors provide correct voltages for two optional P6201 FET Probes.

HORIZONTAL DEFLECTION

465

Time Base A—0.05 μ s/div to 0.5 s/div in 22 calibrated steps (1-2-5 sequence). X10 MAG extends maximum sweep rate to 5 ns/div.

Time Base B—0.05 μ s/div to 50 ms/div in 19 calibrated steps (1-2-5 sequence). X10 MAG extends maximum sweep rate to 5 ns/div.

475

Time Base A and B—0.01 μ s/div to 0.5 s/div in 24 calibrated steps (1-2-5 sequence). X10 MAG extends maximum sweep rate to 1 ns/div.

Variable Time Control; Time Base A (465/475)—Provides continuously variable uncalibrated sweep rates between steps and to at least 1.25 s/div. Warning light indicates uncalibrated setting.

Time Base A and B Accuracy, full 10 cm

	+20°C to +30°C		-15°C to +20°C +30°C to +55°C	
	465	475	465	475
Unmagnified	$\pm 2\%$	$\pm 1\%$	$\pm 3\%$	$\pm 2\%$
Magnified	$\pm 3\%$	$\pm 2\%$	$\pm 4\%$	$\pm 3\%$

Horizontal Display Modes—A only, Mixed Sweep, A Intensified, B Delayed.

Time Base A Sweep Modes—Auto Trigger (sweep free runs in absence of triggering signal), Normal Trigger, Single Sweep. Lights indicate when sweep is triggered and when single sweep is ready.

Time Base B Sweep Modes—B Starts After Delay Time; B Triggerable after Delay Time from selected source.

Calibrated Mixed Sweep—Displays A sweep for period determined by DELAY-TIME POSITION control, then displays B sweep for remainder of horizontal sweep. Mixed sweep measurements utilize portions of the A and B sweeps. The 465 is accurate to within 2% plus measured A sweep accuracy for the A portion of the display and to within the B accuracy for the B portion of the display. The 475 has a cumulative accuracy of within 3%.

CALIBRATED SWEEP DELAY

Delay Time Range

465—0.2 to 10X Delay Time/Div settings of 200 ns to 0.5 s (minimum delay time is 200 ns).

475—0 to 10X Delay Time/Div settings of 50 ns to 0.5 s (minimum delay time is 50 ns).

Differential Time Measurement Accuracy

Delay Time Setting	+15° to +35°C
over one or more major dial divisions	within 1%
less than one major dial division	within 0.01 major dial divisions

Jitter—1 part or less in 50,000 (0.002%) of 10X the A sweep time/div setting. 1 part in 20,000 when operating from 50 Hz line.

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 30 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.