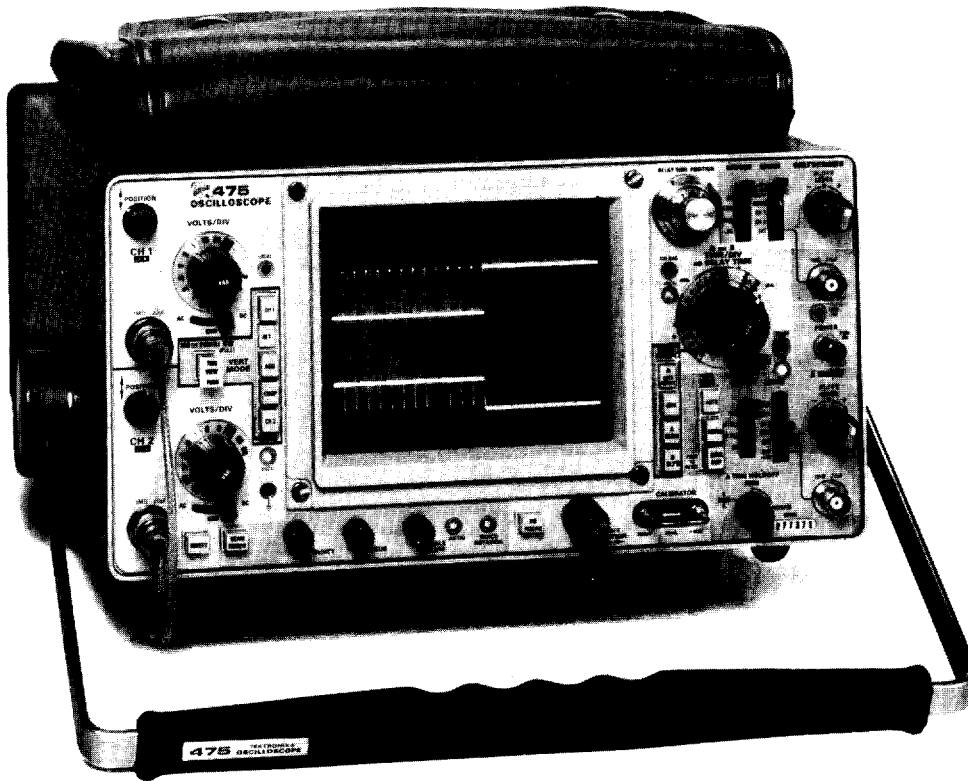


# 250 MHz and 200 MHz Dual Trace Oscilloscopes



## 475/475A

1 ns/div Sweep Rate (475) (475A)  
with X10 Sweep Magnifier

Trigger View

Versatile Trigger Selection

Battery Operation (Optional)

Weights  $\approx$  22.75

Both of these Tektronix Portables feature high performance and light weight for making complex measurements in the field.

1) The 475A provides a 250 MHz bandwidth at 5 mV/div. It features wider bandwidth than the 475, plus a more concise spot size and trace for particular applications.

2) With 200 MHz at 2 mV/div, the 475 features better sensitivity than the 475A. This bandwidth/sensitivity combination is useful in a wide variety of measurements.

Both the 475 and 475A offer 1% (1 ns/div) timing accuracy, which can be critical in servicing computers.

Both oscilloscopes are light, compact, and rugged for portability and durability, yet each contains a large, bright 8 x 10 cm CRT. Operation has been simplified by single-function pushbuttons, control knob design, layout, and color-coordinated front panels.

Determining deflection factors used to be error-prone and costly. Now, it's a problem of the past...readout lights behind knob skirts automatically indicate the proper probe tip deflection factors for recommended 1X and 10X probes.

Measuring with respect to ground is important in many applications. This is controlled at the probe when dc-coupled by simply pressing the small ground reference button on recommended probes.

You can choose from the 1105 or 1106 Battery Packs. Both are small and light weight, and provide a ready solution for making accurate measurements in difficult environments such as conducted emc, ground loops, power line fluctuations or where line power is nonexistent.

Applications for these instruments are widespread. The 475 performs tests and measurements aboard flight test aircraft, in both stationary and portable modes.

## CHARACTERISTICS

All characteristics are common to the 475 and 475A except where indicated.

### VERTICAL DEFLECTION

(2 Identical Channels)

Bandwidth\* and Rise Time — (at all deflection factors from 50  $\Omega$  terminated source)

	-15°C to +40°C	+40°C to +55°C
475	Dc to 200 MHz, 1.8 ns	175 MHz, 2.0 ns
475A	Dc to 250 MHz, 1.4 ns	250 MHz, 1.4 ns

\*Measured at -3 dB, Bandwidth may be limited to approx 20 MHz by bandwidth limit switch.

Lower -3 dB point, ac coupling 1X probe: 10 Hz or less. 10X probe: 1 Hz or less.

### Deflection Factor at BW

475 — 2 mV/div to 5 V/div  
475A — 5 mV/div to 10 V/div

1-2-5 sequence, accurate  $\pm$ 3%. Uncalibrated, continuously variable between steps and to at least 12.5 V/div (475) to at least 25 V/div (475A). In cascade mode sensitivity is approx 400  $\mu$ V/div (475); and approx 2.5 mV/div (475A). Cascaded bandwidth is at least 50 MHz (475/475A) when signal out is terminated in 50  $\Omega$ .

Display Modes — Ch 1; Ch 2 (normal and inverted), alternate, chopped — approx 1 MHz rate), added; X-Y (Ch 1-X, Ch 2-Y).

CMRR — Common-mode rejection ratio at least 20 dB at 50 MHz for common-mode signals of 6 div or less.

Automatic Scale Factor — 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 M $\Omega$   $\pm$ 2% paralleled by approx 20 pF.

### Max 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)

Delay Line — Permits viewing leading edge of displayed waveform.

Probe Power — Connectors provide correct voltages for two optional P6201 FET Probes.

### HORIZONTAL DEFLECTION

Time Base A and B — 0.01  $\mu$ s/div to 0.5 s/div (1-2-5 sequence). X10 mag extends max sweep rate to 1 ns/div.

Variable Time Control — Time Base 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 +55°C
Unmagnified	$\pm$ 1%	$\pm$ 2%
Magnified	$\pm$ 2%	$\pm$ 3%

Horizontal Display Modes — A, mixed sweep, A intensified, B delayed. B ends A for increased intensity in the delayed mode.

Calibrated Mixed Sweep — Displays A sweep for period determined by delay-time position control, then displays B sweep for remainder of horizontal sweep.

### CALIBRATED SWEEP DELAY

#### Delay Time Range

0 to X10 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°C to +35°C
over one or more major dial divisions	$\pm$ 1%
less than one major dial division	$\pm$ 0.01 major dial division

**Jitter** — 1 part or less in 50,000 (0.002%) of X10 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). Lights indicate when sweep is triggered and when single sweep is ready.

**A Trigger Holdoff** — Adjustable control permits a stable presentation of repetitive complex waveforms.

**B Trigger Modes** — B runs after delay time (starts automatically at the end of the delay time) and 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 and B Trigger Sensitivity and Coupling**

Coupling	475		475A		
	To 40 MHz	At 200 MHz	to 40 MHz	At 250 MHz	
Dc	Internal	0.3 div deflection	1.5 div deflection	0.3 div deflection	2.0 div deflection
	External	50 mV	250 mV	50 mV	250 mV
	External ÷ 10	500 mV	2.5 V	500 mV	2.5 V
Ac	Requirements increase below 60 Hz				
Ac Lf Reject	Requirements increase below 50 kHz				
Ac Hf Reject	Requirements increase below 60 Hz and above 50 kHz				

**475 Jitter** — 0.2 ns or less at 200 MHz and 1 ns/div.

**475A Jitter** — 0.2 ns or less at 250 MHz and 1 ns/div.

**A Trigger View** — A spring-loaded pushbutton overrides other vertical controls and displays the external signal used for A sweep triggering. This provides quick verification of the signal and time comparison between a vertical signal and the trigger signal. The deflection factor is approx 50 mV/div (0.5 V/div with external ÷ 10 source).

**Level and Slope** — Internal, permits selection of triggering at any point on the positive or negative slope of the displayed waveform. Level adjustment through at least ± 2 V in external, through at least ± 20 V in external ÷ 10.

**A Sources** — Norm, Ch 1, Ch 2, line, external, and external ÷ 10.

**B Sources** — Starts after delay, norm, Ch 1, Ch 2, and external.

**External Inputs** — R and C approx 1 MΩ paralleled by approx 20 pF. 250 V (dc + peak ac) max input.

**X-Y OPERATION**

**Full-sensitivity X-Y (Ch 1 Horiz, Ch 2 Vert)** — 2 mV/div to 5 V/div (475), 5 mV to 10 V/div (475A) accurate ± 3%. Bandwidth is dc to at least 3 MHz. Phase difference between amplifiers is 1° or less from dc to 1 MHz.

**DISPLAY**

**Crt** — 8 x 10 cm display. Horizontal and vertical centerlines further marked in 0.2 cm increments. P31 Phosphor standard; P11 optional. 18 kV accelerating potential.

**Graticule** — Internal, nonparallax; variable edge lighting; markings for measurement of rise time.

**Beam Finder** — Compresses trace to within graticule area for ease in determining the location of an off-screen signal. A pre-set intensity level provides a constant brightness.

**Z-Axis Input** — Dc coupled, positive-going signal decreases intensity; 5 V p-p signal causes noticeable modulation at normal intensity; dc to 50 MHz.

**ENVIRONMENTAL CAPABILITIES**

**Ambient Temperature** — Operating: -15°C to +55°C. Nonoperating: -62°C to +85°C. Filtered forced air ventilation is provided.

**Altitude** — Operating: to 15,000 ft; max allowable ambient temperature decreased by 1°C/1000 ft from 5000 to 15,000 ft. Nonoperating to 50,000 ft.

**Vibration** — Operating: 15 minutes along each of the three axes, 0.06 cm (0.025 in) p-p displacement (4 g's at 55 Hz) 10 to 55 to 10 Hz in 1 minute cycles.

**Humidity** — Operating and nonoperating: 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).

**Shock** — Operating and nonoperating: 30 g's ½ sine, 11 ms duration, 2 shocks per axis in each direction for a total of 12 shocks.

**OTHER CHARACTERISTICS**

**Amplitude Calibrator**

Output Voltage	0.3 V	1% 0°C to +40°C
Output Current	30 mA	2% +20°C to +30°C
Frequency	Approx 1 kHz	

**Vertical Signal Output** — 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 in 1 MΩ.

**Gate Outputs** — Positive gates from both time bases (approx 5 V).

**Power Requirements** — Quick-change line voltage selector provides six ranges; 110 V, 115 V, 120 V, 220 V, 230 V, and 240 V, each ± 10%. 48 to 440 Hz, or 100 watts max at 115 V and 60 Hz. Operation from 12 or 24V dc is available with Option 07.

Dimensions	Cabinet		Rackmount	
	In	cm	In	cm
Height (w/o pouch)	6.2	15.7	7.0	17.7
Width (with handle)	12.9	32.8	19.0	48.3
Depth (with panel cover)	18.1	46.0	18.0	45.7
Depth (handle extended)	20.3	51.6		
Weights (approx)	lb	kg	lb	kg
Net (without panel cover)	22.8	10.3	29.4	13.3
Net (with panel cover and accessories)	25.3	11.5		
Shipping	37.0	16.7	58.0	26.3

**INCLUDED ACCESSORIES**

Two P6106 10X probes (010-6106-03), blue accessory pouch (016-0594-00), clear pouch (016-0537-00), blue CRT light filter (337-1674-00), clear CRT light filter (337-1674-01), BNC male to ground wire (134-0016-01), two 1½-amp fuses (159-0016-00), one ¾-amp fuse (159-0042-00). Rack models also include mounting hardware and slide out assemblies, do not include accessory pouches.

**ORDERING INFORMATION**

<b>475 Oscilloscope</b> .....	<b>\$3910</b>
<b>475A Oscilloscope</b> .....	<b>\$4350</b>
<b>R475 Rackmount Oscilloscope</b> .....	<b>\$4070</b>
<b>R475A Rackmount Oscilloscope</b> .....	<b>\$5005</b>
<b>475 DM 44 DM 44 info on page 155</b> . . .	<b>\$4405</b>
<b>475A DM 44 (order 475A 44)</b> .....	<b>\$4845</b>

**INSTRUMENT OPTIONS**

<b>Option 01 delete temperature probe on DM 44</b> .....	<b>Sub \$75</b>
<b>Option 04 Emc Modification</b> .....	<b>Add \$135</b>
<b>Option 07 Ext Dc Operation</b> .....	<b>Add \$210</b>
<b>Option 07 cannot be ordered with DM 44.</b>	
<b>Option 78 P11 Phosphor</b> .....	<b>Add \$35</b>

Modification kits for field conversion of existing 475s or 475As to Option 04, Option 07, or DM 44 equipped scopes are available. These are typically more expensive than when the option is ordered with the instrument. Contact your Tektronix Field Engineer, Distributor, or Representative for information.

**OPTIONAL ACCESSORIES**

Probe Type	Attenuation	Input Impedance	Bandwidth* with	
			475	475A
P6063B 6 ft	1X	1 MΩ 105 pF	6 MHz	6 MHz
	Switchable 10X	10 MΩ 14 pF	145 MHz	160 MHz
P6202 FET Probe 2 Meter	10X	10 MΩ 2 pF	185 MHz	220 MHz
	100X Head	10 MΩ 2 pF	185 MHz	220 MHz
	Ac Head	10 MΩ 4 pF	185 MHz	220 MHz
Current Probe	Calibration	Insertion Impedance	Bandwidth with	
P6022 5 ft	1 mA/mV 10 mA/mV (Selectable)	0.03 Ω @ 1 MHz In- creasing to 0.2 Ω @ 120 MHz	125 MHz	160 MHz

\*Bandwidths are measured at the upper -3 dB and apply only to the cable length shown. Generally shorter cable lengths increase bandwidth, longer ones decrease bandwidth.

**Folding Polarized Viewing Hood** —  
Order 016-0180-00 .....

**Collapsible Viewing Hood** — Binocular —  
Order 016-0566-00 .....

**Protective Cover** — Waterproof, blue vinyl  
Order 016-0554-00 .....

**Mesh Filter** — Improves contrast and emc filtering  
Order 378-0726-01 .....

**SCOPE-MOBILE® Cart** — Occupies less than 18 in. aisle space, has storage area in base.  
Order 200C .....

**1106 Battery Pack** (for use with Option 07) .....

**1105 Battery Power Supply** .....

**Rack Adapter** (not for use with DM 44) —  
Order 016-0556-00 .....

**RECOMMENDED CAMERA**

**C-30BP Option 01 General Purpose Compact Camera** Includes 016-0301-01 mounting adapter/corrector lens.  
Order C-30BP Option 01 .....

For further information see Camera section.

Tektronix offers maintenance training classes on instruments in the 400 Series and multi-media training packages on Digital Counter and Meter Concepts and Basic Oscilloscope Maintenance Concepts. For further training information, contact your local Field Office or request a copy of the Tektronix Customer Training Catalog on the return card at the back of this catalog.