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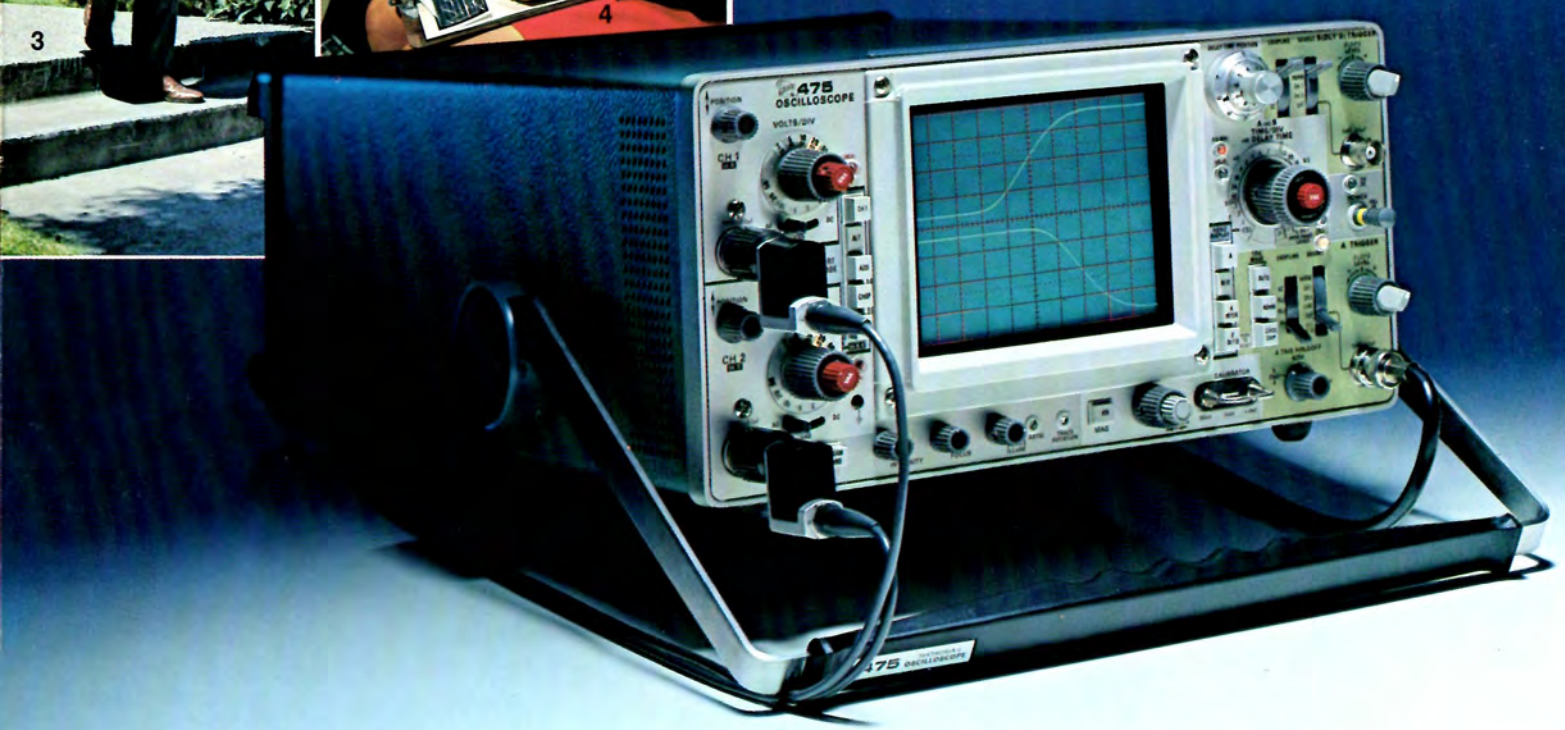
Tektronix, Inc.

465 and 475

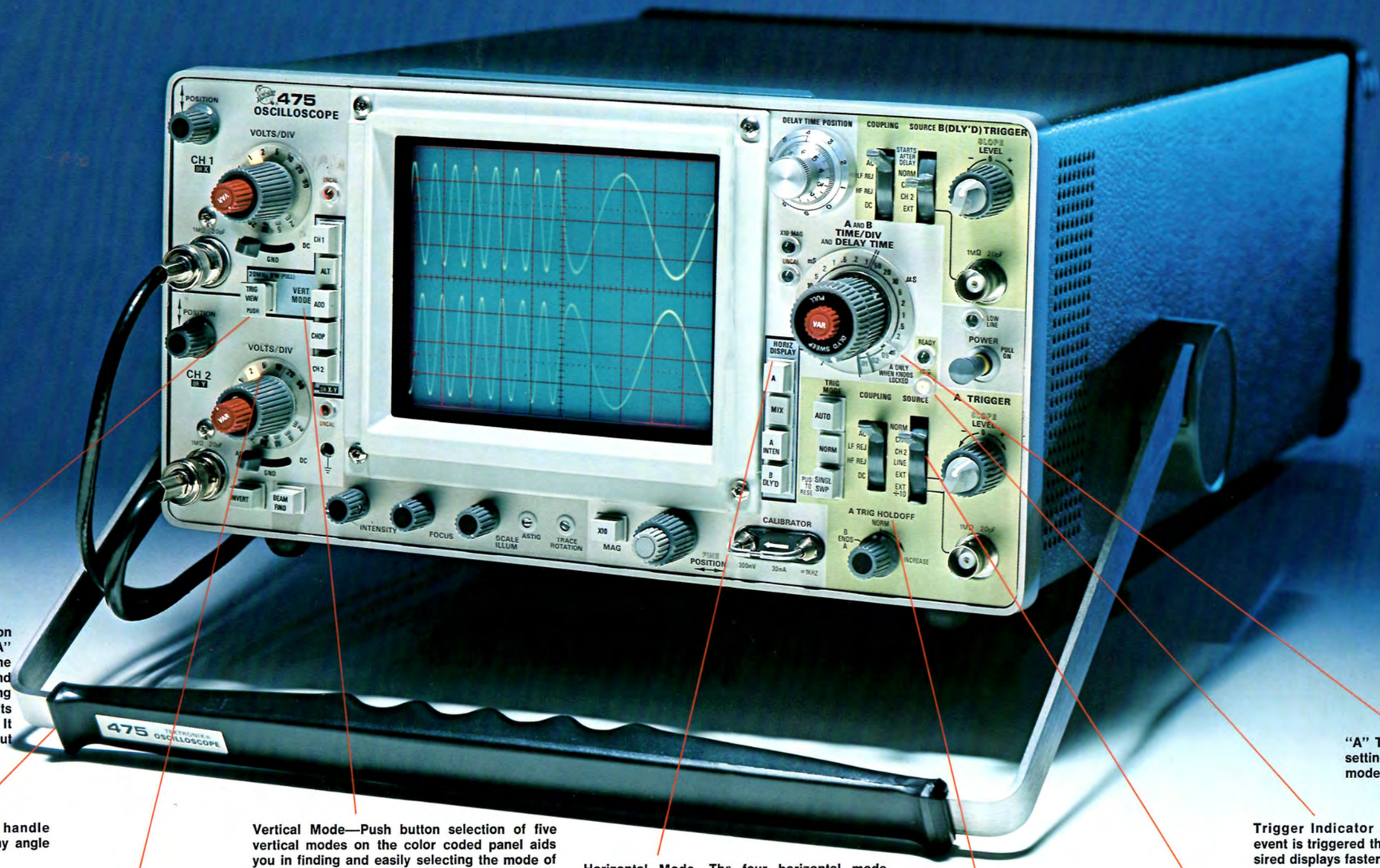
portable oscilloscopes



475—200 MHz @ 2 mV—$2500

465—100 MHz @ 5 mV—$1725

Higher Bandwidth + Better Sensitivity + Faster Sweep Speeds + Larger CRTs + Time Related Trigger Viewing + Many Extra Features + Lower Price = Value Leadership



Trigger View/Bandwidth Limit—A dual function push pull control button that displays the "A" time base trigger from external, internal or line source when pushed. The user can quickly and accurately verify trigger waveforms and timing relationships. The bandwidth limit control limits vertical response to 20 MHz when pulled. It eliminates high-frequency interference without affecting normal performance.

Carrying Handle—The 13-position handle enables positioning of the scope at any angle the user finds convenient.

Volts/Div Readout—Probe tip deflection factors for recommended 1X and 10X probes are automatically indicated. Incorrect measurements from multiplying attenuation factors and dial setting are eliminated.

Vertical Mode—Push button selection of five vertical modes on the color coded panel aids you in finding and easily selecting the mode of your choice.

Horizontal Mode—The four horizontal mode push buttons are easy to locate on the color coded front panel. It is simple to select or change to the mode of your choice. When the MIX mode is selected you can view an event sequentially at two different sweep rates. Time base "B" is started at the moment of your choice with the DELAY TIME POSITION control.

"A" Trigger Holdoff—Holdoff provides a variable time (as much as two sweep lengths) between the end of "A" sweep and the next acceptable trigger and provides capability to trigger on complex digital words. B ENDS A—allows "A" sweep to be terminated and retriggered in the minimum time following the end of "B" sweep to optimize display brightness.

Single-Point Trigger Selection—With this single cam-actuated switch you can conveniently select versatile trigger reference events from Normal, CH 1, CH 2, Line or Ext Signals.

Trigger Indicator Light—Indicates when the event is triggered thus helping you get your desired displays faster.

"A" Time Base Tab—The user can change the setting of the time base "A" in delaying sweep mode without resetting time base "B".

Cover Photo #1

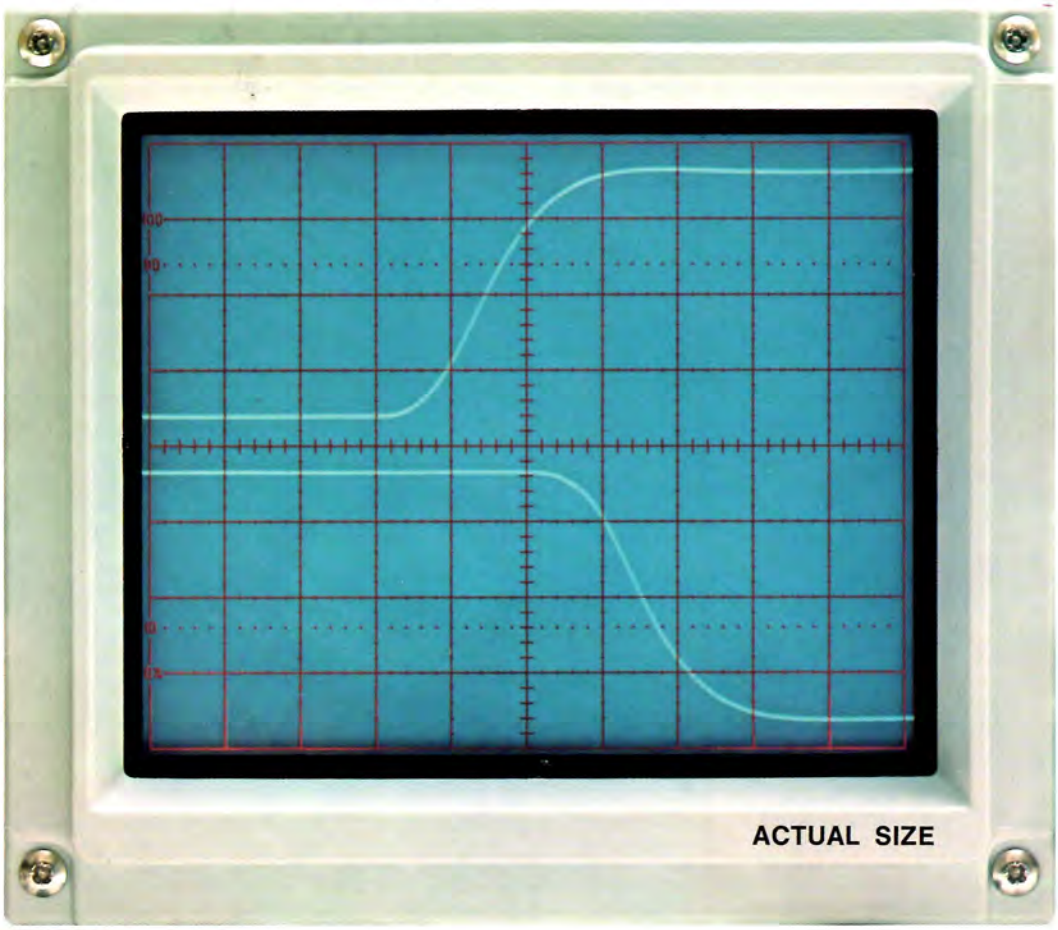
State-of-the-art trigger circuits trigger reliably on low level signals through the bandpass of the scope. Single Point Trigger Source lets you concentrate on your design work rather than on several operation controls. The ability to terminate time base "A" prematurely or extend "A" hold-off prior to retriggering "A" time base helps you optimize trace brightness and view each cycle of repetitive information, even complex digital words.

. . . the value leaders

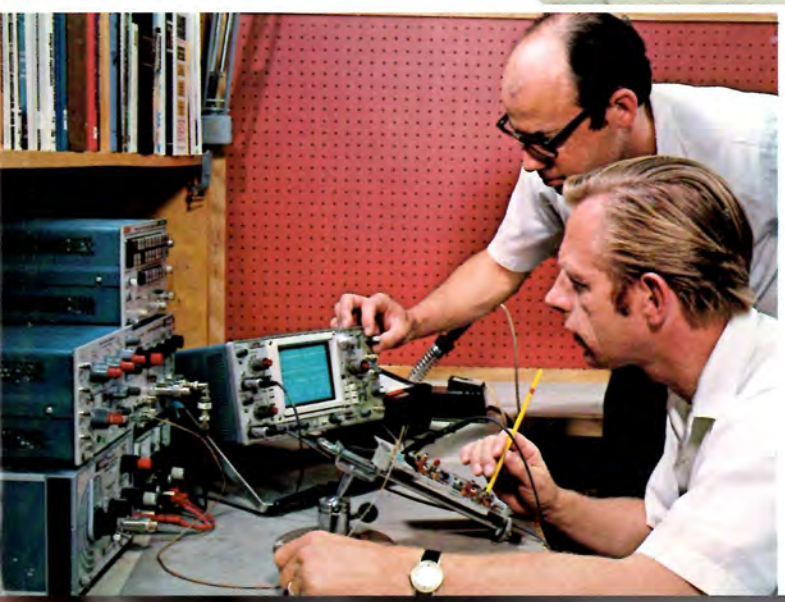
The high-performance, easy-to-use, low-cost 465 and 475 give you field service portability with TEKTRONIX high-quality laboratory accuracy for an unprecedented value. The 475 contains the highest gain-bandwidth factor now available in a general-purpose portable oscilloscope (DC to at least 200 MHz with 1.75 ns risetime at 2 mV/div.) The 465 offers performance and features which help you make more measurements at a lower cost than ever before (DC to at least 100 MHz with 3.5 ns risetime at 5 mV/div.)

Both the 465 and 475 have many extra user aids carefully thought out for operational ease and flexibility, such as; TRIGGER VIEW, PROBE GROUND PUSH BUTTON, SINGLE POINT TRIGGER SELECTION, MIXED SWEEP MODE, BEAM FINDER, VARIABLE TRIGGER HOLDOFF, VERSATILE BATTERY OPERATION, and many more.

The big 8 x 10-cm CRT display is the largest to be found in any high-performance, general-purpose portable oscilloscope. It enables you to easily view fast changing complex events. High accelerating potential of 18,000 volts ensures a bright display of low repetition rate signals even in high ambient light environments. The fast 1 ns/cm sweep speed and big CRT enable you to readily make time difference measurements of a nanosecond or even less. Good spot size, CRT geometry and focus control combine to allow 15-line-per-centimeter resolution giving you laboratory precision and accuracy for measuring fast-changing, complex waveforms.



ACTUAL SIZE



The 465 and 475 are ideal oscilloscopes for design engineers. Their compactness conserves valuable bench space. Their advanced trigger circuits are straightforward to operate and let you trigger on practically any event.

Their high resolution CRT's, coupled with plenty of bandpass, excellent vertical response and the fastest sweeps available in general purpose portable scopes give you laboratory accuracy and precision for your measurement anywhere. Their light weight and battery operation helps you verify and test your circuits in nearly any environment at your bench or the site where your design must ultimately perform. Also, the easy-to-view CRT enhances simultaneous viewing with colleagues for design verification or with larger groups for instruction.

Cover Photo #2

There are situations at your engineering bench or service site when a SCOPE-MOBILE® is the best place for your 465 or 475. The TEKTRONIX SCOPE-MOBILE with friction lock, tilts through approximately 160° of vertical position. It will always be handy whether you must observe the CRT display from above, below or straight on.

The six-foot P6065 and P6075 probes with a handy ground reference button in each probe, in conjunction with the big bright display, makes it possible for you to do a lot of fast testing without returning to the scope panel.

Cover Photo #3

At 25 lbs. the 465 and 475 are self contained, ready to travel and ready to make measurements on arrival.

The accessories are carried in a pouch which fits on top of the instrument. It is large enough so you can readily insert and carry all the accessories. The front cover functions as a CRT, panel and knob protector. The low profile, only 7.5 inches including accessory pouch and feet, enables you to carry the 465 and 475 naturally, close to your body. The short carrying length, only 20.3 inches from bottom of scope to top of handles, makes them easier to carry in comfort without bumping stairs or curbs.

Cover Photo #4

Permanent recordings of device test data, product parameters, circuit operation or systems performance are easily recorded using the C-30A Option 1 Camera. The C-30A Camera conveniently swings out of the way while you obtain the exact waveforms you wish recorded for documentation, communication, or your lab records.

The high writing rate CRT lets you record fast, single shot events without wasting time or film.

A TV sync separator circuit option can be ordered on the 465 permitting stable internal triggering from displayed composite video or composite sync waveforms.

With a risetime of 1.75 ns and sweep speeds up to 1 ns/cm the 475 is well suited for designing and servicing of ECL circuitry in computer mainframes, systems and fast peripherals.

The 465 with a risetime of 3.5 ns and sweep speeds to 5 ns/cm is ideal for TTL and DTL circuitry measurements.

The front panel functional operation of the 465 and 475 are exactly the same. It is not necessary to spend valuable training time or money, or put up with operational mistakes and inconveniences as you switch from using one to the other.

The 465 and 475 introduce a new look in portable scopes. The CRT is located near the center of the front panel. The vertical controls are located to the left while the horizontal controls are on the right and the display controls are immediately below the CRT. This functional division of the front panel simplifies 465 and 475 training and operation. Operation is further enhanced by push button operations, control knob design, color coordinated front panels, unique cam-actuated lever switches, and a lot of front panel human engineering.

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 lightweight making it convenient to get accurate measurements in difficult environments.

TEKTRONIX®

P. O. BOX 500 · BEAVERTON, OREGON 97005 · Phone: (Area Code 503) 644-0161 · Telex: 36-0485
Cable: TEKTRONIX · OVERSEAS DISTRIBUTORS IN OVER 40 COUNTRIES
TEKTRONIX FIELD OFFICES in principal cities throughout the world. Consult Telephone Directory

465/475 specifications

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, 0°C to +40°C

465—DC to at least 100 MHz, 3.5 ns or less. 50 MHz cascaded at approx 1 mV/div.

475—DC to at least 200 MHz, 1.75 ns or less. 50 MHz cascaded at approx 400 μV/div.

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

Signal Output—CH 1 vertical signal is DC to at least 50 MHz −3 dB and approx 25 mV/div when terminated in 50 Ω, and approx 50 mV/div terminated into 1 megohm.

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 μs/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 μs/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 μs/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 (465/475)

	−20°C to −30°C	−15°C to +55°C
Unmagnified	±2%	±3%
Magnified	±3%	±4%

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. 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.

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.

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.

Time Base A and B Trigger Sensitivity

Trigger Mode		465		475	
		To 25 MHz	At 100 MHz	To 40 MHz	At 200 MHz
DC	Internal	0.3 cm deflection	1.5 cm deflection	0.3 cm deflection	1.5 cm deflection
	External	50 mV	150 mV	50 mV	250 mV
	External — 10	500 mV	1.5 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			

465 Jitter— 0.5 ns or less at 100 MHz and 5 ns/div. (X10 Mag on)

475 Jitter— 0.2 ns or less at 200 MHz and 1 ns/div. (X10 Mag on)

A Trigger View—A momentary push button selector overrides other vertical controls and displays the signal being 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 approximately 50 mV/div (0.5 V/div with Ext ÷ 10 source).

Level and Slope—Internal, permits selection of triggering at any point on the positive or negative slope of the displayed waveform.

Time Base Trigger Sources—A: Norm, Channel 1, Channel 2, Line, External and External ÷ 10. B: Starts After Delay, Norm, CH 1, CH 2, and External. Level adjustment through at least ±2 Volts in External, through at least ±20 Volts in External ÷ 10.

External Inputs—R and C approx 1 MΩ paralleled by approx 20 pF. 250 V (DC + peak AC) maximum input.

X-Y OPERATION

465

Full-sensitivity X-Y (CH 1 Horiz, CH 2 Vert)— 5 mV/div to 5 V/div in 10 calibrated steps, accurate within 4%. Bandwidth is DC to at least 4 MHz. Phase difference between amplifiers is 3° or less from DC to 50 kHz.

475

Full-sensitivity X-Y (CH 1 Horiz, CH 2 Vert)—2 mV/div to 5 V/div in 11 calibrated steps, accurate within 3%. Bandwidth is DC to at least 1 MHz. Phase difference between amplifiers is 1° or less from DC to 1 MHz.

CRT

TEKTRONIX CRT— 5 inch rectangular tube; 8 x 10 cm display area. Horizontal and vertical centerlines further marked in 0.2-cm increments. P31 phosphor normally supplied; P11 optional without extra charge. 18-kV accelerating potential.

Z-axis input—DC-coupled to CRT cathode; noticeable modulation at normal intensity with 5 V or more peak-to-peak signal; DC to 50 MHz usable frequency range.

Graticule—Internal, nonparallax; variable edge lighting; markings for measurement of risetime.

Beam Finder—Compresses trace to within graticule area for ease in determining the location or relative magnitude of an off-screen signal regardless of settings of vertical and horizontal position controls. A preset intensity level provides a constant brightness.

ENVIRONMENTAL CAPABILITIES

Ambient Temperature—Operating: −15°C to −55°C. Storage: −55°C to −75°C. Filtered forced air ventilation is provided.

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 axes, 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, ½ sine, 11-ms duration. 2 shocks per axis in each direction for a total of 12 shocks.

Electromagnetic Interference (OPTION 4 only)—Meets interference requirements of MIL-I-6181D, power line conducted, 150 kHz to 25 MHz. Radiated (with included mesh filter installed), 150 kHz to 1 GHz.

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

OTHER CHARACTERISTICS

Amplitude Calibrator

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

Signal Outputs—Positive gates from both time bases (approx 5 V), and a vertical signal output from one channel.

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, 75 watts (465) or 100 watts (475) maximum at 115 V and 60 Hz. Battery and external DC power capability to power the 465 and 475 is available. Contact your TEKTRONIX Field Engineer or Representative for further information.

Dimensions and Weights

Height	6.2 in	15.7 cm
Width (with handle)	12.9 in	32.8 cm
Depth (with panel cover)	18.1 in	46.0 cm
Depth (handle extended)	20.3 in	51.6 cm
Net Weight (w/o panel cover)	22.8 lb	10.3 kg
Net Weight (with panel cover and accessories)	25.3 lb	11.5 kg
Domestic Shipping Weight	≈32.7 lb	≈14.8 kg
Export Packed Weight	≈48.0 lb	≈21.8 kg

465

Included Accessories—Two 6 ft. P6065 Probes with accessories (010-6065-03); accessory pouch (016-0535-02); blue CRT light filter (337-1674-00); clear CRT light filter (337-1674-01).

475

Included Accessories—Two 6 ft. P6075 Probes with accessories (010-6075-03); accessory pouch (016-0535-02); blue CRT light filter (337-1674-00); clear CRT light filter (337-1674-01).

ORDERING INFORMATION

465 OSCILLOSCOPE $1725
475 OSCILLOSCOPE $2500

EMI ENVIRONMENTALIZED, OPTION 4

Order 465 OPTION 4 OSCILLOSCOPE $1800
Order 475 OPTION 4 OSCILLOSCOPE $2575

TV SYNC SEPARATOR, OPTION 5 (465 ONLY)

Order 465 OPTION 5 OSCILLOSCOPE $1825

OPTIONAL ACCESSORIES

Probes

P6201 1X FET Probe Package (for 475 only), order 010-6201-01 ..... $375

P6048 10X Probe Package, order 010-0215-00 ..... $65

C-30A Compact Camera—f/1.9 lens, magnification variable from 1.5 to 0.7, Polaroid Land* Pack-Film back for 3000-speed film, order C-30A-P $525

Camera Adaptor—Adapts C-30A to 465 or 475, order 016-0301-00 ..... $35

Folding Polarized Viewing Hood—order 016-0180-00 ..... $ 9

Mesh Filter—Improves contrast and EMI filtering, order 378-0726-01 ..... $15

SCOPE-MOBILE® Cart—Occupies less than 18 inches aisle space, has storage area in base, order 200-1B $120

*Registered Trademark Polaroid Corporation

U.S. Sales Prices FOB Beaverton, Oregon