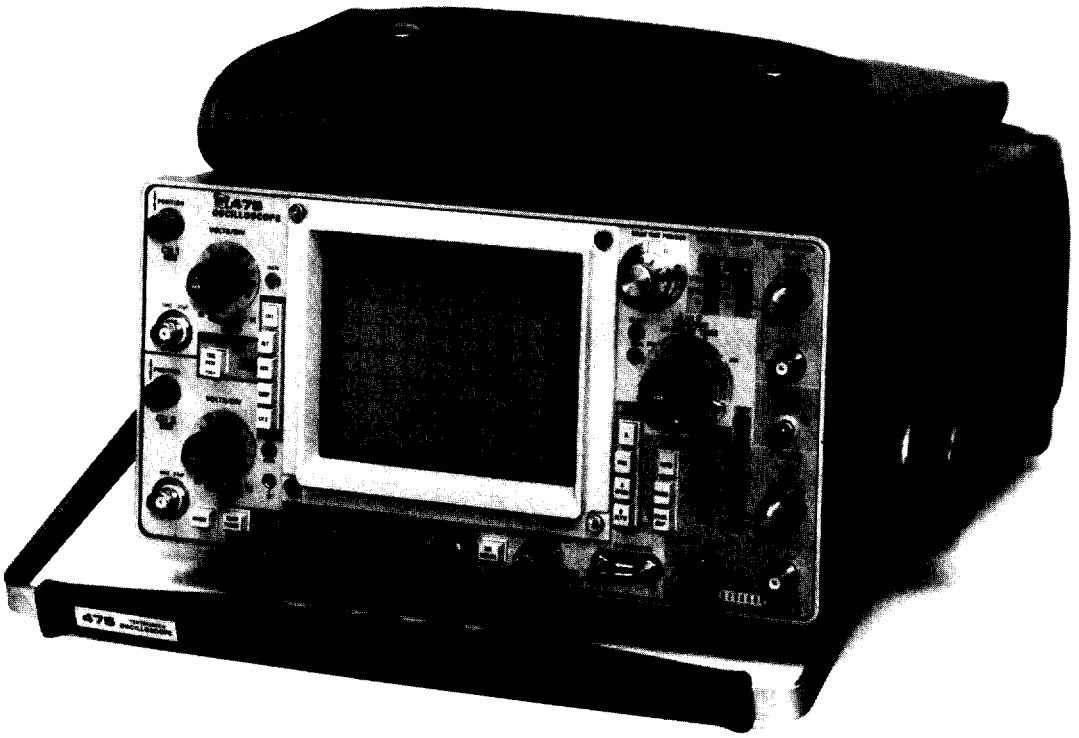


475 pictured above is identical in appearance to the 465 (not shown) except the 465 deletes the 0.01 and 0.02 µs TIME/DIV and 2 mV VOLTS/DIV switch positions.

200 MHz at 2 mV/div (475)	**8 x 10-cm Calibrated Display**	**Bandwidth Limiting**
1 ns/Div Sweep Rate (475)	**Easy-to-Operate**	**Versatile Trigger Selection**
100 MHz at 5 mV/Div (465)	**Trigger View**	**Battery Operation**
5 ns/Div Sweep Rate (465)	**Automatic Volts/Div Readout**	**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 465 and 475 portables are light, short and easy to carry (25.3 lb with panel cover and accessories).

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 ⅓ 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 MΩ. (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 MΩ.

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, full 10 cm

	+20°C to +30°C		−15°C to +20°C +30°C to +55°C	
	465	475	465	475
Unmagnified	±2%	±1%	±3%	±2%
Magnified	±3%	±2%	±4%	±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.

Time Base A and B Trigger Sensitivity

		465		475	
	Trigger Mode	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		0.5 cm with requirements increasing below 50 kHz			
Ac Hf Reject		0.5 cm with requirements increasing below 60 Hz and above 50 kHz			

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

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

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

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 useable 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°C 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. Operation from 12 or 24 V dc is available with Option 7.

	Cabinet		Rackmount	
Dimensions	**in**	**cm**	**in**	**cm**
Height	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

465

Included Accessories—Two 6-ft P6065A 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); ground post (134-0016-01).

475

Included Accessories—Two 6-ft P6075A 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); ground post (134-0016-01).

INSTRUMENT OPTIONS

EMI Environmentalized, Option 4—Includes the features of the 465 and 475; in addition meets electromagnetic interference requirements of MIL-I-6181D over the following frequencies. Power line conducted: 150 kHz to 25 MHz: Radiated (with included mesh filter installed): 150 kHz to 1 GHz.

Tv Sync Separator, Option 5 (465 only)—Option 5 adds a tv sync separator, providing stable sweep triggering from composite video waveforms. With sync separator mode selected, A sweep is automatically triggered at the field rate and tv line rate triggering is added to the signal source selection for sweep B. The sync separator accepts sync-positive or sync-negative video, from Channel 1, Channel 2 or external input. Video signal requirement is 2 divisions internal display or 100 mV external input. Recognition circuits are optimized for 405-525-625 line or 50 or 60 Hz field rate broadcast systems, and are compatible with closed circuit systems up to 1201 line 60 Hz field rate.

Included Accessories—Two 6-32 adapters (103-0051-01); interchangeable light filter/tv graticule (NTSC) (337-1674-02); interchangeable light filter/tv graticule (CCIR) (337-1674-03); OPTION 5 instruction book insert.

External Dc Operation, Option 7—In addition to the standard ac line operation, Option 7 permits the 465 and 475 to be powered from a 12 V dc or a 24 V dc source. For battery operation, Option 7 makes these scopes compatible with the 1106 Battery Pack.

ORDERING INFORMATION

1995

465 Oscilloscope ..... ~~$1925~~
475 Oscilloscope ..... ~~$2650~~ 2800
R465 Oscilloscope **$1900**
R475 Oscilloscope **$2725**
465 DM40 Oscilloscope/multimeter **$2215**
465 DM43 Oscilloscope/multimeter with temp **$2300**
475 DM40 Oscilloscope/multimeter **$3040**
475 DM43 Oscilloscope/multimeter with temp **$3125**

(See pages 145 and 146 for details on DM40 and DM43)

INSTRUMENT OPTIONS

Option 4 Emi Environmental ..... **Add $ 75**
Option 5 TV Sync Separator (465 only) ..... **Add $100**
Option 7 Ext Dc Operation ..... **Add $ 75**
Option 78 P11 Phosphor ..... **No Charge**

Note: Option 7 cannot be ordered along with DM40 and DM43.

OPTIONAL ACCESSORIES

Probes: P6201 1X FET (475 only); P6042 dc to 50 MHz Current Probe; P6063A Switchable 1X-10X (475 only); P6062A Switchable 1X-10X (465 only). See accessories section for ordering information.

C-30A-P Option 1 Compact Camera—f/1.9 lens, 0.8 magnification, Polaroid Land Pack Film back for 3000-speed film (includes Adapter Frame/Corrector Lens 016-0301-00),
order C-30A-P Option 1 ..... **$570**

Camera Adapter and Corrector Lens—Adapts C-30A to 465 or 475,
order 016-0301-00 ..... **$ 42**

Option 7 Modification Kit—Converts existing 465 or 475's to the Option 7 version. For 465's with serial No. below B042244,
order 040-0650-00 ..... **$150**

For 475's with serial No. below B061174,
order 040-0665-00 ..... **$150**

For 465's or 475's with serial No. above those listed,
order 040-0666-00 ..... **$150**

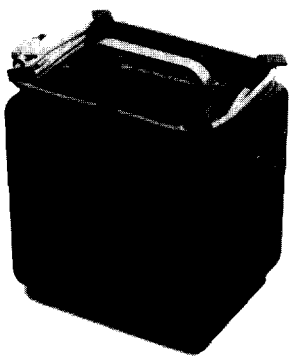
Protective Cover—Waterproof, blue vinyl,
order 016-0554-00 ..... **$ 11**

Folding Polarized Viewing Hood—Order 016-0180-00 .... **$ 15**

Mesh Filter—Improves contrast and emi filtering,
order 378-0726-01 ..... **$ 16**

SCOPE-MOBILE® Cart—Occupies less than 18 inches aisle space, has storage area in base **order 200** **$125**

1105 BATTERY POWER SUPPLY



The 1105 is a rugged, portable power supply suitable for powering portable oscilloscopes or other instruments in the field.

Frequency—Square wave, 60 Hz within 10%.

Amplitude—Approx 108 V peak, operating from 24 V dc external or 22 V internal charge. Approx 137.5 V peak, operating from 28 V dc external or 30 V internal charge.

Amplitude (Option 1)—Approx 216 V peak, from 24 V dc external or 22 V internal charge. Approx 275 V peak, operating from 30 V dc external or 28 V internal charge.

Charging Power Source—100 to 132 V ac, 48 to 440 Hz (or internal connections expand range). Option 1—200 to 264 V ac, 48 to 440 Hz (or internal connections expand range).

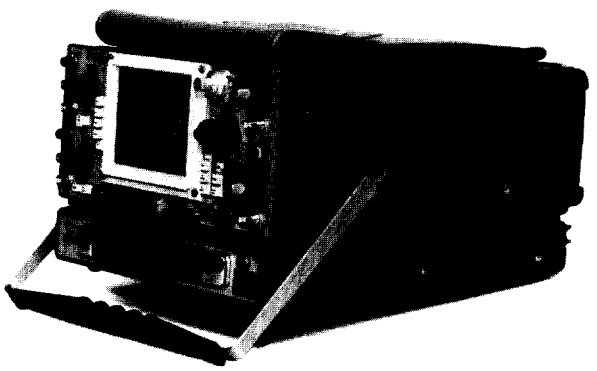
Battery Operating Time—Approx 140 watt-hours.

Recommended Max Output Current—0.9 amp.

ORDERING INFORMATION

1105 Battery Power Supply **$525**
Option 1, 230 V Operation ..... **No Charge**

1106 BATTERY PACK



The 1106 is a convenient, snap-on battery power supply for TEKTRONIX 464, 465, 466, or 475 Option 7 Oscilloscopes.

Output Power—22 to 24 V dc; 140 watt-hours from full charge.

Charging Power Source—90 to 132 V ac, 50 to 400 Hz; or 180 to 264 V ac, 50 to 400 Hz.

Charging Time—14 to 16 hours.

Order 1106 Battery Pack **$275**