Tektronix 465, 475, 475A Series Oscilloscopes Specifications

VERTICAL DEFLECTION (2 IDENTICAL CHANNELS)			
Bandwidth* and Rise Time (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, 4.1 ns
	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	465: 5 mV/div to 5 V/div 475: 2 mV/div to 5 V/div 475A: 5 mV/div to 10 V/div		
1-2-5 sequence, accurate ± 3%. Uncalibrated, continuously variable between steps and to at least 12.5 V/div (465/475) to at least 25 V/div (475A). In cascade mode sensitivity is approx 1 mV/div (465); approx 400 µV/div (475); and approx 2.5 mV/div (475A). Cascaded bandwidth is at least 50 MHz (465/475/475A) when signal out is terminated in 50 Ω.			
Display Modes	Ch 1; Ch 2 (normal and inverted), alternate, chopped (465-approx 250 kHz rate, 475/475A-approx 1 MHz rate), added; X-Y (Ch 1-X, Ch 2-Y)		
CMRR	Common-mode rejection ratio at least 20 dB at 20 MHz (50 MHz for 475/475A) 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 MΩ ± 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 (475/475A 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 (1-2-5 sequence). X10 mag extends max sweep rate to 5 ns/div.		

Time Base B	0.05 µs/div to 50 ms/div (1-2-5 sequence). X10 mag extends max sweep rate to 5 ns/div.
475 / 475A	
Time Base A and B	0.01 µs/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 A (465/475/475A) 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	
	465	**475 / 475A**	**465**	**475 / 475A**
Unmagnified	± 2%	± 1%	± 3%	± 2%
Magnified	± 3%	± 2%	± 4%	± 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	**465:** 0.2 to X10 delay time/div settings of 200/ns to 0.5 s (minimum delay time is 200 ns). **475 / 475A:** 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	± 1%
Less than one major dial division	± 0.01 major dial division

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). 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 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 Sensitivity and Coupling

Coupling		**465**		**475**		**475A**	
		To 25 MHz	At 100 MHz	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	1.5 div deflection	0.3 div deflection	2.0 div deflection
	External	50 mV	150 mV	50 mV	250 mV	50 mV	250 mV
	External ÷10	500 mV	1.5 V	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
465 Jitter	0.5 ns or less at 100 MHz and 5 ns/div
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 their trigger signal.
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 divided by 10.
A Sources	Norm, Ch 1, Ch 2, line, external, and external divided by 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	
465	
Full-sensitivity X-Y (Ch1 Horiz, Ch2 Vert)	5 mV/div to 5 V/div, accurate ± 4%. Bandwidth is dc to at least 4 MHz. Phase difference between amplifiers is 3° or less from dc to 50 kHz.
475, 475A	
Full-sensitivity X-Y (Ch1 Horiz, Ch2 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 option. 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 offscreen 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:** -55°C to +75°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, .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 1/2 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 (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 MW. (475/475A) 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.			
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, 75 watts (465) or 100 watts (475, 475A) max at 115 V and 60 Hz. Operation from 12 or 24 V 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

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