

# TEK 60 MHz DUAL TRACE OSCILLOSCOPES



trigger holdoff, TV line and TV field triggering at any sweep speed, and an enhanced auto mode. On the 2215, the dual time base operates in either run after A or trigger after A. The latter permits jitter-free B measurements.

The 2213's single time base delay provides the user with the performance of intensified and delayed sweep operations at a low price. Where dual time base performance is required, the 2215 delivers it with alternate sweep switching. The 2215 can display four traces; vertical channels 1 and 2 at the A sweep rate, and vertical channels 1 and 2, delayed, at the B sweep rate. Both scopes also incorporate new auto-intensity and auto-focus circuits that provide convenient operation over a wide range of sweep speeds.

Low life cycle cost is brought about by the inherent reliability of the new scopes. The parts count and cabling have been greatly reduced as compared to older designs. Even the traditional line transformer and line voltage selector switches have been eliminated, thanks to a new high-efficiency power supply. The advantages of these power supply improvements are that the 2213 and 2215 will operate from mains voltages of 90 to 250 Volts RMS at frequencies from 48 to 62 Hz. Additional reliability also results from superior mechanical design and packaging, soldered-in components, absolute minimum of connectors and very low power consumption.

**NEW**

## 2213/2215

Dc to 60 MHz Bandwidth

Light Weight

Easy to Use

2 mV Sensitivity

Advanced Trigger System

5 ns/div Sweep Speed

Delayed Sweep Measurements

Large, Bright CRT

New 10X Probes Included

A pushbutton beamfinder allows easy scope setups. The scope bezel accepts a TEKTRONIX C-5C Scope Camera with graticule illuminating flash (option 04).

The advanced triggering system features true vertical mode alternate triggering; both the 2213 and 2215 will trigger alternately even with unrelated signals. Other features include variable



Two new 60 MHz, dual trace oscilloscopes from Tektronix offer unprecedented value in both initial and life cycle costs. They are ideal everywhere general purpose scopes are needed.

These oscilloscopes provide unexcelled performance in a small light-weight package; 6.1 kilograms (13.5 lb). With pouch and front cover, only 6.8 kilograms (15 lb).

X-Y operation is simple and easy to use. Both vertical input channels (Ch 1 and Ch 2) can be used through their full range of sensitivity settings. Vertical sensitivities range from 2 mV to 10 V/div. Sweep speeds range from 0.5 seconds per division to 50 nanoseconds per division. A 10X magnification provides 5 nanoseconds per division.

## CHARACTERISTICS

The following electrical characteristics are common to both instruments except where noted:

VERTICAL DEFLECTION  
(2 Identical Channels)

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

0°C to +40°C	+40°C to +50°C
Dc to 60 MHz, 20 mV/div to 10 V/div, 5.8 ns reduced to 50 MHz for 2 mV to 10 mV/div, 7 ns	50 MHz, 7 ns

\*Measured at -3 dB.

**Deflection Factor** — 2 mV/div to 10 V/div  $\pm 3\%$  (+20°C to +30°C) or  $\pm 4\%$  (0°C to +50°C).

1-2-5 sequence. Uncalibrated, continuously variable between steps to at least 25 V/div.

**Display Modes** — Ch 1, Ch 2, Ch 2 ADD (normal and inverted), alternate, chopped —  $\approx 250$  kHz rate, electronically switched.

**CMrr** — Common-mode rejection ratio at least 10:1 at 10 MHz for common-mode signals of 6 divisions or less.

**Input R and C** — 1 M $\Omega$   $\pm 2\%$  paralleled by  $\approx 30$  pF.

**Max Input Voltage** —

Dc coupled	400 V (dc + peak ac) 800 V (p-p ac at 1 kHz or less).
Ac coupled	400 V (dc + peak ac) 800 V (p-p ac at 1 kHz or less).

**Delay Line** — Permits viewing leading edge of displayed waveform.

## HORIZONTAL DEFLECTION

**Time Base A** — (Both 2213 and 2215) — 0.05  $\mu$ s/div to 0.5 s/div (1-2-5 sequence). 10X mag extends max sweep rate to 5 ns/div.

**Time Base B** — (2215 only) — 0.05  $\mu$ s/div to 50 ms/div (1-2-5 sequence). 10X mag extends max sweep rate to 5 ns/div.

**Variable Time Control** — Time Base A (both 2213 and 2215) provides continuously variable uncalibrated sweep rates between steps to at least 1.25 s/div.

**Time Base A (both 2213 and 2215) and B (2215 only) Accuracy, center 8 divisions** —

	+20°C to +30°C	0°C to +50°C
Unmagnified	$\pm 3\%$	$\pm 4\%$
Magnified	$\pm 5\%$	$\pm 6\%$

**Horizontal Display Modes (2213)** — A, A intensified after delay, delayed.

**Horizontal Display Modes (2215)** — A, alternate (A intensified by B and B). B, Electronic switching between intensified and delayed sweep.

## 2213 SWEEP DELAY

**Delay Times** —  $<0.5$   $\mu$ s, 10  $\mu$ s, and 0.2 ms.

**Multiplier** — Increases delay time by 20 to 1 or more.

**Jitter** — 5000 to 1 (0.02%) of maximum available delay time.

## 2215 SWEEP DELAY

**Delay Times** — Continuously variable by means of a 10 to 1 vernier control. Delayed (B) portion is intensified on the main (A) trace.

**Delay Position Range** —  $<0.5$  to more than 10 divisions.

**Delay Dial Accuracy** —  $\pm 1.5\%$  of full scale.

**A/B Sweep Separation** — Control permits main and delayed sweep to be separated by at least 3.5 divisions.

**Jitter** — 10,000 to 1 (0.01%) of maximum available delay time.

## TRIGGERING

**2213 and 2215 A Time Base Trigger Modes** — Normal (sweep runs when triggered), automatic (sweep runs in the absence of a triggering signal and triggers automatically for signals down to 20 Hz), and tv field (with slope set for negative going transitions, and trigger level adjusted close to blanking level, sweep starts at first line of video; use NORMAL for tv line display). LED indicates when sweep is triggered.

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

**Sensitivity** — Auto and Normal Internal: below 2 MHz, signal must be at least 0.4 divisions amplitude; requirements increase above 2 MHz; at 60 MHz, signal must be at least 1.5 divisions amplitude.

**Auto and Normal External** — Up to 2 MHz, trigger signal must be at least 50 mV p-p; requirements increase up to 60 MHz, where signal must be at least 250 mV p-p.

**TV Field** — Composite video must be at least 2 divisions amplitude.

**Level and Slope (NORM Mode)** — Internal: trigger level can be adjusted over the range of amplitudes displayed on the CRT. External, dc coupled: level can be adjusted over a range of at least  $\pm 2$  V, or 4 V p-p. External, dc coupled and attenuated ( $\pm 10$ ): level can be adjusted over a range of at least  $\pm 20$  V, or 40 V p-p.

**External Inputs** — R and C  $\approx 1$  M $\Omega$  paralleled by  $\approx 30$  pF. 400 V (dc + peak ac) or 800 Vac p-p at 1 kHz or less.

## 2215 DELAYED (B) TIMEBASE

**Level and Slope** — Separate slope and level controls for triggering B sweep.

**Sensitivity** — Up to 2 MHz, signal must be at least 0.4 divisions in vertical amplitude; requirements increase up to 60 MHz, where signal must be at least 2 divisions in amplitude.

## X-Y OPERATION

**Full Sensitivity X-Y (Ch 1 Horiz, Ch 2 Vert)** — 2 mV/div to 10 V/div, accurate  $\pm 5\%$ . Bandwidth is dc to at least 2 MHz. Phase difference between amplifiers is  $3^\circ$  or less from dc to 50 kHz.

## DISPLAY

**CRT** — 8 x 10 cm display. Horizontal and vertical center lines further marked in 0.2 cm increments. P31 Phosphor standard. 10 kV accelerating potential, mesh grid, halo suppressed.

**Graticule** — Internal, non-parallax, not illuminated; markings for measurement of rise time.

**Beam Finder** — Compresses trace to within graticule area for ease in locating 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 5 MHz.

## ENVIRONMENTAL CAPABILITIES

**Ambient Temperature** — Operating: 0°C to +50°C. Nonoperating: -55°C to +75°C.

**Altitude** — Operating: to 15,000 ft; max allowable ambient temperature decreased by  $1^\circ\text{C}/1000$  ft from 5000 to 15,000 ft. Nonoperating: to 50,000 ft.

**Vibration** — Operating test samples were subjected to sinusoidal vibration in the X, Y, and Z axis with the frequency varied from 10 Hz to 55 Hz to 10 Hz in one minute sweeps for a duration of 15 minutes per axis and a dwell of 10 minutes at 55 Hz. Total displacement was 0.015 in p-p (2.4 g's at 55 Hz).

**Humidity** — Operating and nonoperating: test samples were subjected to 5 cycles (120 hours) of humidity testing.

**Shock** — Operating and nonoperating: test samples were subjected to 3 shocks, both directions along each axis for a total of 18 shocks. Peak accelerations of each half-sine shock were 30 g's.

## OTHER CHARACTERISTICS

**Probe Adjust Signal** — Squarewave, 0.5 V  $\pm 20\%$ , 1 kHz  $\pm 20\%$ .

**Power Requirements** — 90 to 250 V, 48 to 62 Hz without range switching, 50 watts max at 115 V and 60 Hz.

Cabinet Dimensions	mm	in
Height (with feet and handle)	137	5.4
Width (with handle)	360	14.2
Width (without handle)	237	12.9
Depth (with front cover)	445	17.5
Depth (without front cover)	440	17.3
Depth (with handle extended)	511	20.1
Weights (approx)	kg	lb
Net (with cover accessories, and pouch)	7.6	16.8
Net (without cover accessories, and pouch)	6.1	13.5
Shipping (domestic)	8.2	18

## INCLUDED ACCESSORIES

Two P6120 10X voltage probes (010-6120-00), two IC grabber probe accessories (013-0191-00).

## ORDERING INFORMATION

**2213 Dc to 60 MHz Dual Trace, Single Time Base Oscilloscope with Delayed Sweep** ..... \$1100

**2215 Dc to 60 MHz Dual Trace, Delayed Alternate Time Base Oscilloscope** ..... \$1400

**Power Cords** — Standard: 110 Vac North American plug.

## INTERNATIONAL POWER CORDS &amp; PLUG OPTIONS

**Option A1 Universal Euro 220 V/16A** ..... No Charge  
**Option A2 UK 240 V/13A** ..... No Charge  
**Option A3 Australian 240 V/10A** ..... No Charge  
**Option A4 North American 240 V/15A** ..... No Charge

## OPTIONAL ACCESSORIES

**Front Panel Cover (200-2520-00)** ..... \$5.00  
**Accessory Pouch (016-0677-00)** ..... \$42  
**Pouch and Cover (020-0672-00)** ..... \$47  
**Viewing Hood (016-0566-00)** ..... \$15  
**C-5C Option 04 Scope Camera** ..... \$500  
**Model 200C SCOPE-MOBILE® Cart** ..... \$265  
**Rack Adaptor Kit (016-0466-00)** ..... \$100