

Type 549 DC-to-30 MHz STORAGE OSCILLOSCOPE



NEW

- BISTABLE SPLIT-SCREEN STORAGE AND CONVENTIONAL DISPLAYS
- AUTOMATIC ERASE SYSTEM
- 5 cm/ μ s WRITING SPEED
- CALIBRATED SWEEP DELAY
- ACCEPTS LETTER-SERIES AND 1-SERIES PLUG-IN UNITS

CHARACTERISTIC SUMMARY VERTICAL

Vertical deflection characteristics extremely flexible through use of all Letter-Series and 1-Series Plug-In Units.

HORIZONTAL

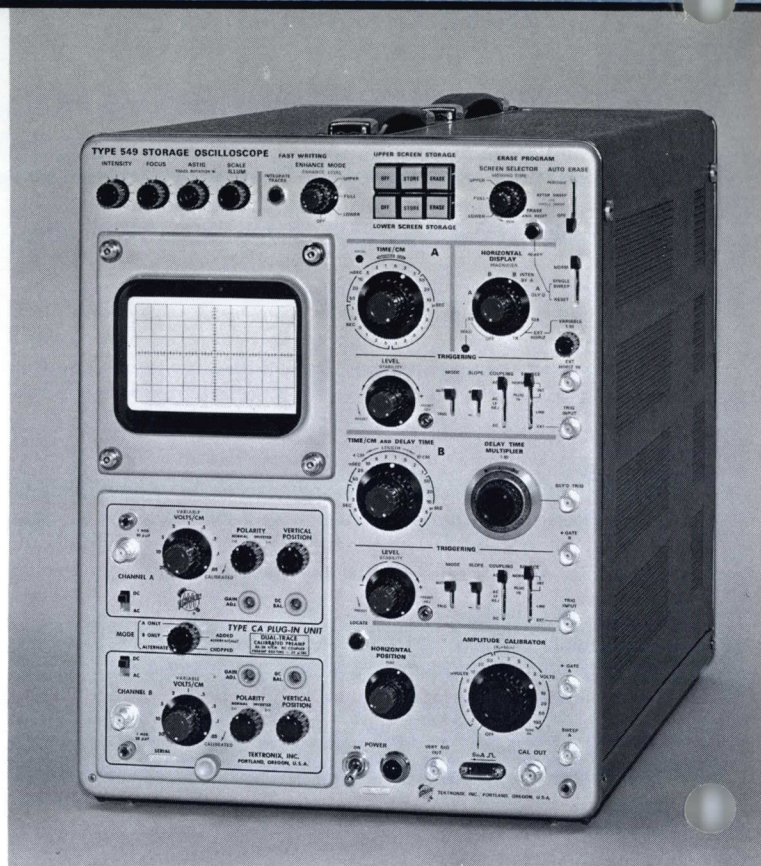
CALIBRATED SWEEP RANGE—0.1 μ s/cm to 5 s/cm.
SWEEP MAGNIFIER—5X, extends sweep range to 0.02 μ s/cm.
TRIGGER REQUIREMENTS—Internal: less than 2-cm deflection to 30 MHz. External: less than 3 V to 30 MHz.
CALIBRATED SWEEP DELAY—1 μ s to 10 s.
EXTERNAL INPUT—0.2 V/cm maximum, DC to 350 kHz.

STORAGE CRT

DISPLAY AREA—6 x 10 cm.
SPLIT SCREEN STORAGE—Store on either upper or lower half of screen with non-storage on other half; store on entire screen; or non-store on entire screen.
LOCATE ZONE—Locate button permits vertical position finding.
STORAGE TIME—Up to one hour.
ERASE TIME—150 ms maximum.
WRITING SPEED—0.5 cm/ μ s. 5 cm/ μ s with enhancement.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V. Source impedance 50 Ω from 0.2 mV to 0.2 V; frequency, 1-kHz squarewave. Front-panel current loop output, 5 mA DC and 5 mA, 1-kHz squarewave output.
POWER REQUIREMENTS—104, 115, 127, or 208, 230, and 254 volts, center value (regulation range $\pm 10\%$), 650 W (approx) maximum.



The Type 549 is a new instrument that extends the exclusive Tektronix split-screen and bistable storage features into research and development applications. The Type 549 offers a high degree of versatility. It accepts all letter-series and 1-series plug-in units covering a multitude of applications including sampling and spectrum analysis. A wide-band vertical system, plus a delaying sweep circuit, insures accurate measurements in both stored and conventional modes of operation.

A new split-screen, bistable CRT offers high contrast displays coupled with unparalleled writing speeds. Each half of the 6 x 10-cm display area can be independently controlled, thus allowing stored or conventional displays on either the upper or lower half. A stored display can then be compared simultaneously with a conventional display. Or, a test or standard signal can be stored on one half of the screen, and compared in detail with successive signals displayed on the other half.

An automatic erase system offers a new convenience to storage oscilloscope users. Through front panel controls, this system can be directed to automatically erase either one, or both halves of the display area after a predetermined viewing time. Automatic circuitry includes a timing circuit which permits viewing time to be varied from 0.5 seconds to 5 seconds with AUTO ERASE selected for either PERIODIC or AFTER-SWEEP operation. Used in conjunction with the SINGLE SWEEP, the "After-Sweep" erase circuit automatically resets the Single-Sweep circuit at the end of the viewing-time interval.

AVAILABLE DISPLAYS

With the wide range of sensitivity and bandwidth of the Type 549, several storage and conventional displays are obtainable. The Type 549, by virtue of a **new** bistable split-screen storage CRT capable of unparalleled writing speeds, extends storage-measuring capability into previously unattainable areas.

SINGLE-TRACE AND MULTI-TRACE

Multi-trace displays are obtained by selecting a Type 1A1, 1A2, CA, or M Amplifier Plug-In Unit. All other 1-Series and Letter-Series Plug-In Units will give single-trace displays. Selection of the Type 1A7, D, E, or G gives differential amplifier operation, while strain gage and other transducer operations are available with the Type O Unit.

SAMPLING DISPLAYS

Sampling displays with risetimes in the sub-nanosecond region are obtained using a Type 1S1 or 1S2 Sampling Unit. The Type 1S1 is a general-purpose sampler with 1 GHz bandwidth, delay line and internal triggering. The Type 1S2 is designed specifically for TDR (time-domain reflectometry) applications, but offers general-purpose sampling with 3.9 GHz bandwidth and built-in triggering.

SPECTRUM ANALYSIS

Spectral displays are obtained using a Type 1L10, 1L20, or 1L30 Spectrum Analyzer Plug-In Unit to cover a frequency range from 1 MHz to 10.5 GHz.

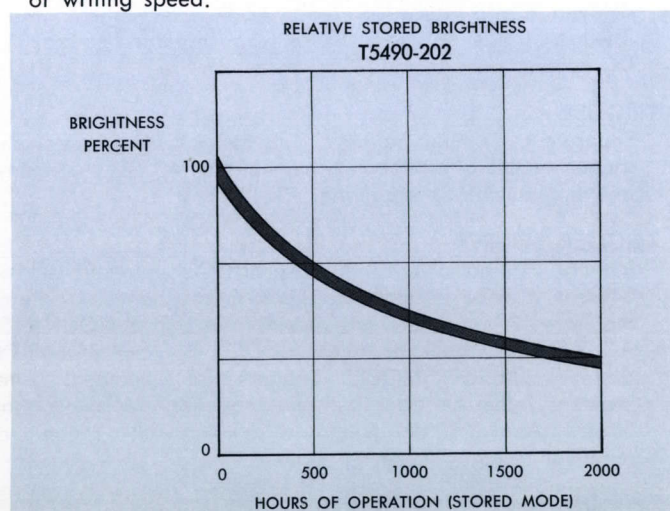
There are decided advantages in using the storage oscilloscope for spectrum analysis. When slow sweep rates are used, it is often difficult to view a complete display; however, by storing the display it can be completely and easily observed.

Signal drift is easily measured using the storage technique. The signal is stored and then as subsequent displays are stored, drift of the signal can be observed. Or, the spectral display can be stored on one half of the screen and simply compared with a similar non-stored display on the other.

STORAGE CHARACTERISTICS

STORAGE CRT

Direct viewing, bistable, split-screen, mono-accelerating with 4-kV accelerating potential and separate non-store "locate zone". External edge-lighted graticule. Tektronix bistable storage offers: 1) Brightness of a stored trace independent of viewing time; 2) Contrast of a stored trace independent of viewing time; and 3) Brightness of a stored trace independent of writing speed.



DISPLAY AREA

6 x 10-cm split-screen storage area with independent or common control, plus locate zone.

SPLIT-SCREEN STORAGE

Store on either upper or lower half of screen with conventional display on other half; store on entire screen; or, non-store on entire screen. Independent operation of both halves.

STORAGE TIME

Bistable storage yields a stable display for up to one hour. Where applications require maximum writing speed, viewing times of 20 minutes or less are recommended.

ENHANCE MODE

Controls the single sweep storage capabilities of the storage CRT. Through adjustment of ENHANCE LEVEL control, single-trace spot velocities up to 5 cm/ μ s or better can be stored with minimal loss of resolution and contrast.

LOCATE BUTTON (Serves two functions)

STORAGE—When depressed, the beam appears at the left of the CRT screen marking the vertical position of the next sweep. **CONVENTIONAL DISPLAYS**—Permits beam finding of off screen signals.

ERASE TIME

150 ms maximum.

AUTO ERASE SYSTEM

Viewing time before erase continuously variable from 0.5 s to 5 s (approximately).

In the PERIODIC Mode, there is a continuous sequence of storing, viewing time and erasure. This sequence occurs regardless of whether or not a signal is present and is independent of the sweep. In the AFTER SWEEP mode—which is used in conjunction with the SINGLE SWEEP—the sequence of viewing time and erasure is part of a cycle. This cycle occurs in the presence of a signal and begins with the arrival of the signal. The signal initiates a sweep by triggering the Single Sweep circuitry. Viewing time begins as the sweep ends and is followed by erasure. Erasure automatically resets the SINGLE SWEEP readying it for the next signal and thus completes the cycle. The cycle will automatically repeat itself as long as a signal is available.

Manual control available through Erase and Reset button or by Reset position of Single Sweep switch.

REMOTE CONTROL OPERATION

The Type 549 has remote control-operation capabilities using contact closure. A 9-pin connector, located on the rear panel, supplies one ground and 7 inputs (plus one spare) that allows the following functions:

1. Remote erase of upper screen.
2. Remote erase of lower screen.
3. Remote resetting of sweep for single-sweep operation.
4. Remote erase of both halves of the screen and resetting of the sweep.
5. Remote switching from conventional operation to storage operation (independently or commonly) of upper or lower screen halves.
6. Remote interruption of the Auto Erase sequence in order to hold a stored waveform.

Operation of these circuits is achieved by grounding the appropriate pin in the connector.

REMOTE CONTROL UNIT

(Optional accessory, part number 012-0102-00). Performs Remote Erase and Reset functions numbers 1, 2, and 3 above.

VERTICAL PLUG-IN UNITS

(Bandwidth Specifications are at -3 dB.)

PLUG-IN UNIT	DEFLECTION FACTOR	BANDWIDTH	RISETIME
<i>For Wide-Band, Multiple Trace Applications</i>			
1A1 Dual-Trace	50 mV/cm to 50 V/cm	DC to 30 MHz	12 ns
	5 mV/cm	DC to 23 MHz	15 ns
	500 μ V/cm	2 Hz to 14 MHz	26 ns
1A2 Dual-Trace	50 mV/cm to 50 V/cm	DC to 30 MHz	12 ns
CA Dual-Trace	50 mV/cm	DC to 24 MHz	15 ns
	50 V/cm		
M Four-Trace	20 mV/cm to 25 V/cm	DC to 20 MHz	17 ns
<i>For Wide-Band Applications</i>			
B	50 mV/cm to 50 V/cm	DC to 20 MHz	18 ns
	5 mV/cm to 50 mV/cm	2 Hz to 12 MHz	30 ns
K	50 mV/cm to 40 V/cm	DC to 30 MHz	12 ns
L	50 mV/cm to 40 V/cm	DC to 30 MHz	12 ns
	5 mV/cm to 4 V/cm	3 Hz to 24 MHz	15 ns
<i>For Differential Input Applications</i>			
1A7 High-Gain	10 μ V/cm to 10 V/cm	DC to 500 kHz	0.7 μ s
D High-Gain	1 mV/cm	DC to 300 kHz	0.18 μ s
	(to 50 mV/cm)	DC to 2 MHz	
E Low-Level	50 μ V/cm	0.06 Hz to 20 kHz	6 μ s
	(to 10 mV/cm)	(to 60 kHz)	
G Wide-Band	50 mV/cm to 50 V/cm	DC to 20 MHz	18 ns
<i>For High DC Sensitivity Applications</i>			
H Wide-Band	5 mV/cm to 50 V/cm	DC to 15 MHz	23 ns
<i>For Spectrum Analysis</i>			
1L10, 1L20, 1L30 Units cover 1 MHz to 10.5 GHz.			
<i>For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses</i>			
O Operational Amplifier	50 mV/cm to 50 V/cm	DC to 25 MHz	14 ns
<i>For Transducer and Strain Gage Uses</i>			
Q	10 μ strain/div to 10 k μ strain/div	DC to 6 kHz	60 μ s
<i>For Transistor-Risetime Checks</i>			
R	0.5 mA/cm to 100 mA/cm		12 ns
<i>For Diode Recovery Time Measurements</i>			
S	0.05 V/cm and 0.5 V/cm		12 ns
<i>For Precise Amplitude Measurements Via Slide-Back Technique</i>			
W	1 mV/cm to 50 mV/cm	DC-7 MHz to DC-23 MHz	50 ns to 15 ns
Z	50 mV/cm to 50 V/cm	DC to 13 MHz	27 ns
<i>High-Frequency Sampling Applications</i>			
1S1	2 mV/cm to 200 mV/cm	DC to 1 GHz	350 ps
1S2	5 mV/cm to 500 mV/cm	DC to 3.9 GHz	90 ps

VERTICAL DEFLECTION SYSTEM

Frequency Specifications are at -3 dB

BANDWIDTH—DC to ≥ 30 MHz*.**RISETIME**— ≤ 12 ns*.**SIGNAL DELAY**—200 ns, approx.**HORIZONTAL DEFLECTION SYSTEM****TIME BASE A**0.1 μ s/cm to 5 s/cm; 24 calibrated steps accurate within $\pm 3\%$, 1-2-5 sequence. Range continuously variable between steps, uncalibrated. (Extends to 12 s/cm, uncalibrated.)**TIME BASE B**2 μ s/cm to 1 s/cm; 18 calibrated steps accurate within $\pm 3\%$, 1-2-5 sequence. No variable time/cm control.**SWEEP DELAY**Calibrated delay range from 1 μ s to 10 s. **ACCURACY:** from 1 μ s to 1 s is $\pm 1\%$ of TIME BASE B sweep accuracy and ± 2 minor dial divisions, plus signal processing time (typically 200 ns depending on signal risetime); within $\pm 3\%$ from 1 s to 10 s. **LINEARITY:** 0.2% of full scale.**SWEEP MAGNIFIER**X5; accuracy, $+2\%$ added to the specified sweep time accuracy, extends Time Base A sweep to 20 ns/cm and Time Base B sweep to 0.4 μ s/cm.**SINGLE SWEEP**

Controls Time Base A in "A" position of Horiz Display switch. Controls Time Base B in "B", "B intensified by A", and "A dly'd" positions. A three-position switch selects normal, single sweep, or reset operation. Reset may be accomplished by the ERASE and RESET button, or by remote control through remote control connector.

EXTERNAL HORIZONTAL INPUT

DC to 350 kHz at minimum deflection factor; 0.2 V/cm in 1X position, or 2 V/cm with 10X attenuation. Continuously variable 10:1 gain control for up to 100X attenuation.

FRONT PANEL OUTPUTSGates from both time bases (0 to at least +20 V). Sawtooth from Time Base A (typically 0 to at least +130 V), and a delayed trigger pulse (at least +5 V). Vertical-Signal-Out Risetime ≤ 1 μ s, deflection factor 1.5 V/displayed cm $\pm 20\%$, DC coupled.**TRIGGER**

Separate but similar trigger circuits for both time bases. The trigger circuits offer complete manual control, preset stability, and fully-automatic triggering.

TRIGGER SOURCEInternal, external or line, either AC or DC coupled. (The Type 549 can also be internally triggered from Channel 1 only of the Type 1A1 or 1A2 Dual-Trace Plug-In Units.) **COUPLING:** AC, AC Low Frequency Reject, or DC. **TRIGGER POLARITY:** \pm slope. **TRIGGER MODES:** Triggered or Automatic. Latter provides reference trace with no input (or inputs less than 50 Hz). Above 50 Hz, time base automatically triggers at repetition rate of incoming signal.

*With Types K, L, 1A1, or 1A2 Plug-In Units.