



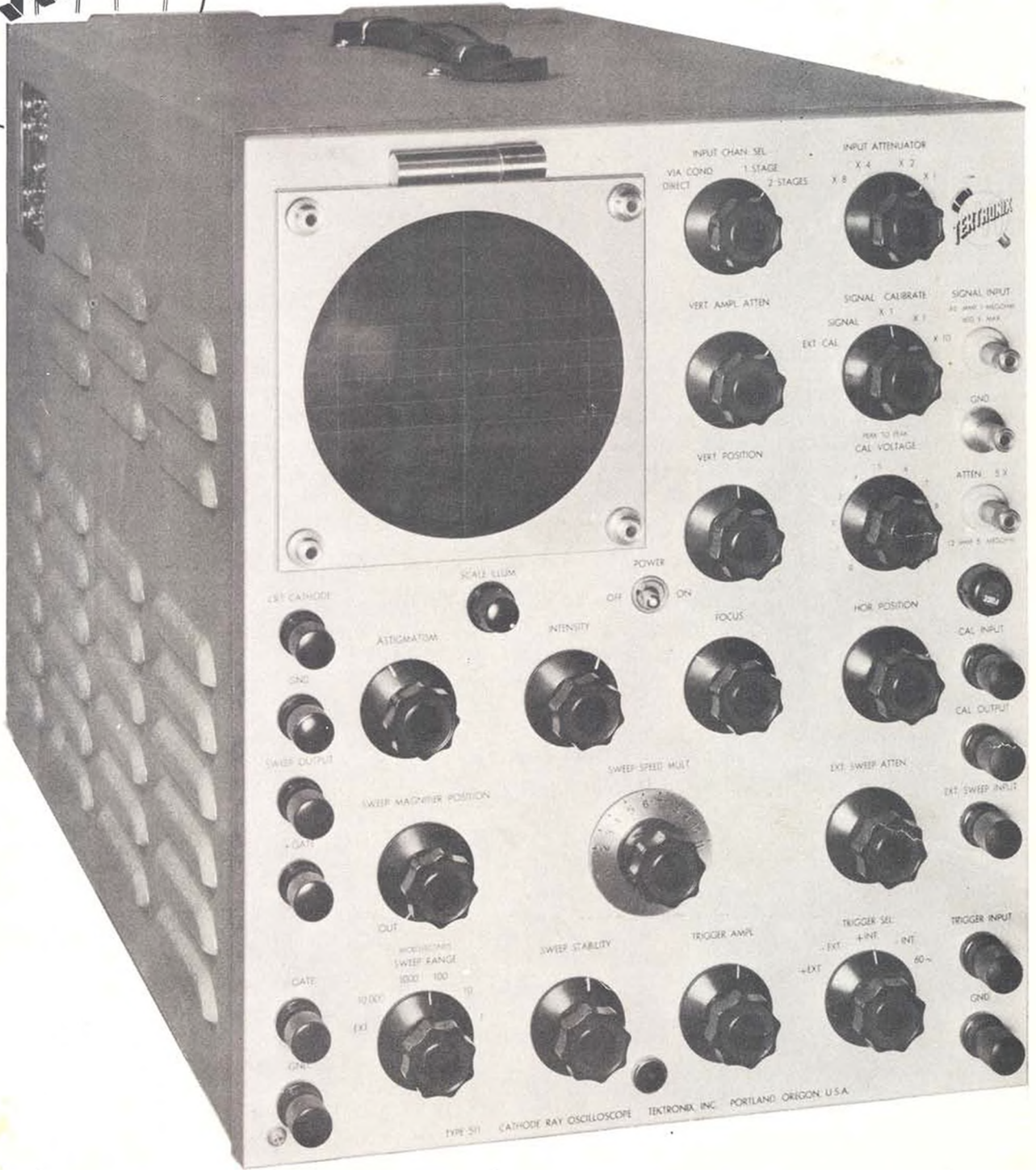
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F1091

TYPE 511

Cathode-Ray Oscilloscope

\$795.00



TEKTRONIX, INC.

1516 S. E. SEVENTH AVENUE

PORTLAND 14, OREGON

GENERAL DESCRIPTION

The Tektronix Type 511 Cathode Ray Oscilloscope is a moderately priced portable unit utilizing a 5" tube. It embodies features previously found only in expensive and cumbersome laboratory type oscilloscopes and synchrosopes.

Its continuously variable triggered sweep circuit synchronizes readily with frequencies as high as 10 megacycles, thus extending oscillographic methods into the broadcast and medium frequency communication bands. The combination of a wide range of triggered sweeps and the excellent transient response of the vertical deflection system, makes possible the observation of a wide variety of pulses and other non-sinusoidal waveshapes.

Both time and amplitude calibration is provided, permitting quantitative measurements.

VERTICAL DEFLECTION SYSTEM

The Type 511 is equipped with a very flexible vertical deflection system capable of amplifying or attenuating, as necessary, a wide range of waveshapes. Some of the more important features are:

1. **INPUT CHANNEL SELECTOR** — Since the best amplifiers have their faults, it is desirable to use the minimum number of stages which will give the necessary gain. To make it convenient to do this a switching system is employed which connects the SIGNAL INPUT binding post to the deflection plates in four ways; directly, via a coupling condenser, or via a one or two stage amplifier. This gives the Type 511 three basic sensitivities: .25, 2.5 and 25 V. per cm. The input impedance of all channels is maintained equal within 1%, making possible the use of the same RC compensated attenuator for any position of the INPUT CHANNEL SELECTOR.

2. **INPUT ATTENUATOR** — An RC compensated attenuator with ratios of 1, 2, 4, and 8 provides sensitivities between those which are made available by the INPUT CHANNEL SELECTOR. Since the attenuator is usable on all positions of the INPUT CHANNEL SELECTOR, sensitivities ranging from .25 to 200 V. per cm. are available. The design of the attenuator is such that its input impedance is the same as that of the oscilloscope alone. Thus, the input impedance of the Type 511 is always the same regardless of the control settings.

3. **WIDEBAND AMPLIFIER** — The vertical amplifiers in the Type 511 are designed to provide optimum transient response consistent with reasonable gain and image size. Both high and low frequency compensation is employed.

The high frequency compensation of each oscilloscope is adjusted by observing a one megacycle square wave having a rise time of .02 microsecond. When the compensation is adjusted to provide the optimum rate of rise without overshoot a very smooth response curve is obtained, being only 3 db down at 10 megacycles with one stage, and 3 db down at 8 megacycles with two stages. (Fig. 1.)

The low frequency compensation of each stage is adjusted to produce the flattest top on a 50 cycle square wave. When properly adjusted, the tops are flat within $\pm 3\%$. (Fig. 2.)

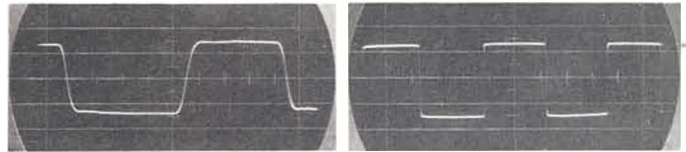


Fig. 1. 1 megacycle square wave. Fig. 2. 60 cycle square wave. Response of 2 Stage Vertical Amplifier.

A cathode follower precedes the output stage to permit the use of a low impedance gain control, thus providing continuously variable attenuation between the steps of the input attenuator.

4. **PROBE** — Since the input impedance of the Type 511 is the same for any position of the controls it is possible to decrease the loading on the circuit under observation by the use of an RC probe. The probe furnished with the instrument increases the input impedance from 1 megohm shunted by 40 mmf to 10 megohms shunted by 11 mmf, introducing an attenuation of ten.

HORIZONTAL DEFLECTION SYSTEM

One of the most important features of the Type 511 is its very versatile sweep system. The sweep generator used employs a commercial adaptation of widely used radar circuits. A brief description of its more important points follows:

1. **TRIGGERED SWEEP** — A continuously variable, linear, triggered sweep, covering the range of 1/10 second to one microsecond, is available for the first time in a moderately priced oscilloscope. With this type sweep, the beam is cut off in its normal rest position at the left side of the screen until it is turned on and released by an external trigger signal or by the wave-shape under observation. It then moves across the screen at a speed determined by the setting of the SWEEP RANGE and SWEEP SPEED MULTIPLIER controls. At the end of the sweep, the beam is cut off and rapidly returned to the left side of the screen to await another trigger. This type circuit enables the operator to vary the sweep speed without upsetting the synchronism as is inevitable with a conventional sawtooth or recurrent sweep.

The use of a wide band trigger amplifier permits the sweep to be readily synchronized with sine waves of frequencies as high as 10 megacycles or pulses as short as .05 microsecond. Fig. 3 illustrates the excellent linearity of even the fastest sweep and the ability to observe high frequency signals. When triggered by a sharp pulse, the sweep is started and the cathode ray tube is unblanked in less than .1 microsecond.

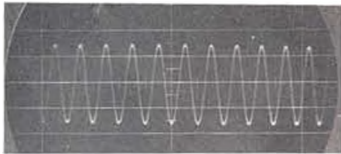


Fig. 3. 10 megacycle sine wave.

2. **RECURRENT SWEEP** — If it is desirable to have a sweep without the necessity of providing a trigger, a conventional sawtooth sweep may be obtained merely by readjusting the SWEEP STABILITY control.

3. **SINGLE TRACE SWEEP** — The triggered sweep in the Type 511 inherently provides for single sweep operation. Single sweeps can be triggered either by pulses or by a mechanical switch in series with a three-volt battery.

4. **TRIGGER SELECTOR** — The TRIGGER SELECTOR switch enables the sweep to be started by either positive or negative triggers from an external source, from the signal via the vertical amplifier, or from the 60 cycle line voltage.

5. **CALIBRATED SWEEP SPEEDS** — The time in microseconds for the sweep to cross the ruled portion of the graticule can be determined to within 10% by multiplying the SWEEP RANGE setting by the reading of the SWEEP SPEED MULTIPLIER dial.

6. **SWEEP SPEED MAGNIFIER** — A control on the panel allows any selected 20% of the sweep to be amplified five times and thus expanded to cover the entire trace. (Figs. 4, 5.) This is especially useful in examining widely spaced waveshapes such as television sync. pulses.



Fig. 4. Sweep magnifier off.



Fig. 5. Sweep magnifier on.

20 Microsecond Pulse.

7. **EXTERNAL SWEEP** — The EXTERNAL SWEEP INPUT binding post is connected to the horizontal deflection plates via the EXTERNAL SWEEP ATTENUATOR and a one stage push-pull amplifier. The entire system is DC coupled, permitting the use of very slow sweeps.

VOLTAGE CALIBRATION

A 60 cycle sine wave calibrating voltage is provided to measure the amplitude of the waveshapes under observation. This is continuously variable, by means of a calibrated potentiometer, from 100 millivolts to 100 volts peak to peak, in three ranges.

ILLUMINATED GRATICULE

An illuminated graticule aids in the measurement of amplitude and duration of waveshapes being observed. By edge lighting the graticule, fine red lines are visible, which do not obscure the tube trace. A green filter is provided to increase the contrast of the trace when viewed in brightly lighted rooms.

DEFLECTION PLATE CONNECTIONS

Although a signal can be supplied directly to the deflection plates from the front panel, a side panel is provided in the cabinet which allows direct connection to all the plates with low capacity and short leads.

OUTPUT WAVESHAPES

The sweep sawtooth, and positive and negative square wave gate pulses, having the same duration as the sweep, are available on the front panel.

CRT CATHODE CONNECTION (Z Axis)

A binding post is provided on the panel for the purpose of receiving blanking pulses or brightness time markers, etc.

CONSTRUCTION

The Type 511 is constructed of the highest quality materials throughout. The three chassis, metal framework, case and front panel are all made of light, strong, electrically welded, aluminum alloys. As can be seen in Fig. 6 the various chassis are supported in a frame making possible a compact instrument with all components readily accessible.

Satin finished aluminum with photo etched lettering is used for the front panel. A light gray baked wrinkle finish is used on the cabinet.

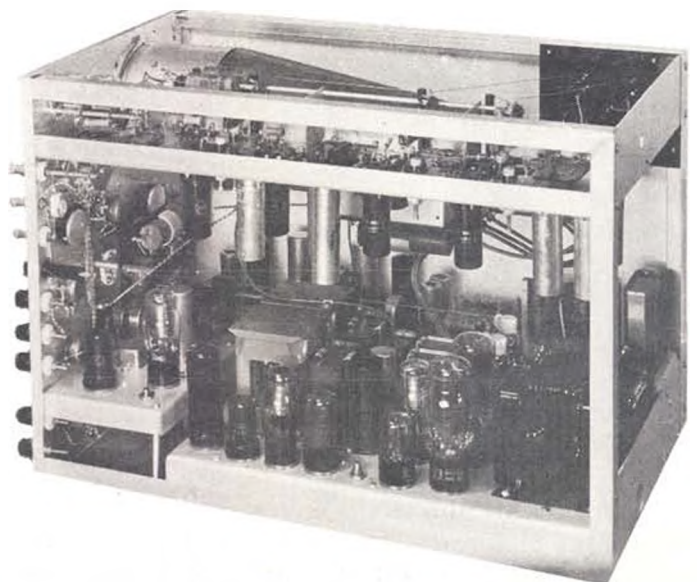


Fig. 6. Interior, compact and all parts readily accessible.

CHARACTERISTICS

SIGNALS OBSERVABLE — Sine waves, 10 cycles to 10 mc. Pulses, .1 microsecond to 1/50 sec.

SWEEP CIRCUIT — Hard tube type, either triggered or recurrent as desired.

SWEEP SPEEDS — Continuously variable, .1 sec. to 1 microsecond for a sweep length of 10 cm.

TRIGGER REQUIREMENTS — .5 to 50 V. (peak) sine wave, or pulse as short as .05 microsecond of either polarity.

SWEEP LAG — .1 microsecond, max.

SWEEP MAGNIFICATION — 5 times indicated sweep speed.

EXTERNAL SWEEP INPUT — DC coupled via 100 K. pot. and sweep amplifier. Maximum deflection sensitivity, 3 V per cm DC or peak to peak AC.

INPUT ATTENUATOR RATIOS—2, 4 and 8. An additional 5 and 10 times available by use of ATTEN 5X binding post and PROBE respectively.

VERTICAL DEFLECTION SENSITIVITY—
(peak to peak).

Without amplifier, 27 V. per cm.

With 1 stage, 2.7 V. per cm.

With 2 stages, .27 V. per cm.

INPUT IMPEDANCE — 1 meg. shunted by 40 mmf. ATTEN 5X binding post, 5 meg. shunted by 12 mmf. PROBE, 10 meg. shunted by 11 mmf.

VERTICAL AMPLIFIER BANDWIDTH—

(3 db down from 1 mc response)

1 stage, 5 cps to 10 mc.

2 stages, 5 cps to 8 mc.

VERTICAL AMPLIFIER TRANSIENT RESPONSE—

Rise time (10% to 90%):

1 stage, .04 microsecond;

2 stages, .05 microsecond.

CALIBRATING VOLTAGE — Line frequency (50-60 cps). Three ranges, 0-1, 0-10 and 0-100 V. peak to peak. Accuracy $\pm 5\%$ of full scale.

WAVEFORMS AVAILABLE — Sweep sawtooth, positive and negative gates, 30 V. peak.

CRT CATHODE CONNECTION — Via .1 mfd condenser, $RC = .012$ sec.

CATHODE RAY TUBE — 5CP1A, 3 kv accelerating voltage.

POWER REQUIREMENTS — 105-125 volts, 50-60 cycles, 180 watts.

WEIGHT — 65 pounds.

DIMENSIONS — 15½" high, 12½" wide, 21½" deep.

TEKTRONIX, INC.

MANUFACTURERS OF

CATHODE-RAY OSCILLOSCOPES & VIDEO TEST EQUIPMENT

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