



CATHODE - RAY OSCILLOSCOPES
AUXILIARY INSTRUMENTS AND ACCESSORIES

MARCH 1955

The background features a large, faded watermark of the Tektronix logo, which consists of the word "TEKTRONIX" in a stylized, blocky font, with a circular element above it and a probe-like shape below it.

OUR CONTINUING CREED

is that of serving Tektronix customers with products and policies that are unexcelled in the electronics industry and limited only by the current state of the art.



TEKTRONIX INC.

TEKTRONIX, INC.

was organized as an Oregon Corporation in January 1946 for the purpose of developing and manufacturing cathode-ray oscilloscopes. The owners all had extensive wartime electronic experience, in either military or civilian capacities. All hold active supervisory or engineering positions in the organization.

In reviewing this backlog of experience, a large portion of which pertained to oscilloscopes, it was felt that a valuable contribution could be made in this field. This decision has been strengthened by the passage of time, and by the exceptional response of science and industry to the efforts that have been put forth.

The primary interest of Tektronix is the further development and improvement of the oscilloscope, not only as a "quality observation" device but, increasingly, as an accurate tool capable of precise quantitative measurements of time and amplitude. All present efforts are toward accomplishment of this goal, and all other Tektronix instruments have been developed for the purpose of supplementing and augmenting the operation of the oscilloscope.

TEKTRONIX, INC. • P.O. Box 831, Portland 7, Oregon, U.S.A.

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GENERAL INFORMATION

Terms and Shipment

Our terms are 1% ten days, net thirty days on domestic orders; net thirty days on export orders. Shipping delay may be prevented by establishing credit at time of placing order. When desirable, C.O.D. shipments can be arranged. All prices are f.o.b. Portland (Beaverton), Oregon.

For information relative to discounts on quantity purchases, please contact your nearest Tektronix field office, representative, or distributor.

Although all quotations are for shipment f.o.b. Portland (Beaverton), Oregon, upon request transportation costs can be prepaid and the amount added to the invoice.

Normally, shipments are made by Railway Express or Motor Freight. If shipment by air is desired, please specify Air EXPRESS or Air FREIGHT. Experience has eliminated rail freight as a satisfactory method of surface transportation for electronic instruments.

Export Orders

All orders and inquiries from countries other than the United States should be addressed directly to: Tektronix, Inc., Export Department, P. O. Box 831, Portland 7, Oregon. Cable address: TEKTRONIX.

Delivery

Acceptance of purchase orders is indicated by our acknowledgment, and estimated shipment time is given from date of acknowledged acceptance. Every effort is made to meet the estimated shipment date, but there is the possibility that circumstances beyond our control might make it impossible to meet the quoted schedules.

Field Maintenance

Tektronix Field Maintenance is provided on a non-profit basis, as a service to our customers. Work is expedited whether or not the instrument is in warranty.

Requests for repairs or replacement parts should include type number and serial number and should be directed to our representative or branch office in your area. In an emergency, please wire or phone Field Engineering, Tektronix, Inc., Portland, Oregon, in addition to notifying the local representative. This procedure will assure you the fastest possible service.

If an instrument must be returned to the factory for repairs, notify Field Engineering directly or through the local representative, **indicating type number and serial number**, and you will be notified at once as to procedure to be followed. PLEASE DO NOT RETURN AN INSTRUMENT BEFORE RECEIVING DIRECTIONS. Instruments and parts returned from countries other than the United States *must be accompanied by an invoice* to clear through customs.

It is standard practice for Tektronix to incorporate improvements into production instruments as they are developed in our laboratories. Owners of existing instruments are notified of modifications, and modification kits are made available, when practicable, to those who wish to modernize their own instruments.

For customers who have large quantities of Tektronix instruments and wish to equip their maintenance departments with factory-tested components, integrated kits of parts are available. Kits are designed to cover expected needs of a group of ten instruments of the same type.

Warranty

All Tektronix instruments are fully guaranteed against defective materials and workmanship for one year. Should replacement parts be required, whether at no charge under warranty or at established net prices, they will be shipped from the factory, via air transportation on request, prepaid to any point within continental North America.

Tektronix transformers manufactured in our own plant carry an indefinite warranty. In the event of failure please be sure to contact the nearest Tektronix Field Engineer, Representative or Headquarters.

APPROXIMATE SHIPPING WEIGHTS

| INSTRUMENT TYPE | NET WEIGHT IN POUNDS | DOMESTIC PACKED IN POUNDS | EXPORT PACKED IN POUNDS | EQUIVALENT DIMENSIONAL WEIGHTS IN | | VOLUME IN | |
|--------------------|-------------------------|---------------------------------|-------------------------------|--------------------------------------|-----------|--------------|---------|
| | | | | POUNDS | KILOGRAMS | CU. FT. | CU. IN. |
| 310 | 23½ | 34½ | 56 | 135 | 61.2 | 6 | 9 |
| 315-D | 36 | 47 | 80 | 135 | 61.2 | 6 | 9 |
| 511-A | 53 | 70 | 92 | 135 | 61.2 | 6 | 9 |
| 511-AD | 55 | 72 | 93 | 135 | 61.2 | 6 | 9 |
| 512 | 56 | 73 | 95 | 135 | 61.2 | 6 | 9 |
| 513 | 77 | 95 | 124 | 178 | 80.7 | 8 | 11 |
| 513-D | 79 | 97 | 126 | 178 | 80.7 | 8 | 11 |
| 514-A | 61 | 78 | 112 | 178 | 80.7 | 8 | 11 |
| 514-AD | 62 | 79 | 113 | 178 | 80.7 | 8 | 11 |
| 517 | | | | | | | |
| Indicator Unit | 76 | 103 | 127 | 178 | 80.7 | 8 | 11 |
| Power Supply | 72 | 86 | 105 | 105 | 47.7 | 5 | 3 |
| Scopemobile | 42 | 56 | 67 | 147 | 66.7 | 7 | 4 |
| 524-D | 62 | 80 | 114 | 178 | 80.7 | 8 | 11 |
| Viewing Hood | 1¼ | 4 | 10 | 23 | 10.4 | 1 | 2 |
| 525 | 54 | 72 | 101 | 178 | 80.7 | 8 | 11 |
| 531 (with 53A) | 66 | 83 | 117 | 178 | 80.7 | 8 | 11 |
| 532 (with 53D/54D) | 56 | 73 | 107 | 178 | 80.7 | 8 | 11 |
| 535 (with 53A) | 70½ | 87½ | 120 | 178 | 80.7 | 8 | 11 |
| 53A | 3½ | 12 | 14 | 23 | 10.4 | 1 | 2 |
| 53B | 3½ | 12 | 14 | 23 | 10.4 | 1 | 2 |
| 53C | 5½ | 14 | 16 | 23 | 10.4 | 1 | 2 |
| 53D/54D | 4 | 12½ | 16 | 23 | 10.4 | 1 | 2 |
| 53E/54E | 4½ | 13 | 16 | 23 | 10.4 | 1 | 2 |
| 53G | 4½ | 13 | 16 | 23 | 10.4 | 1 | 2 |
| 541 (with 53K/54K) | 66 | 83 | 117 | 178 | 80.7 | 8 | 11 |
| 545 (with 53K/54K) | 70½ | 87½ | 120 | 178 | 80.7 | 8 | 11 |
| 570 | 67 | 84 | 103 | 178 | 80.7 | 8 | 11 |
| 104-A | 22 | 30 | 53 | 90 | 40.8 | 4 | 6 |
| 105 | 35½ | 47 | 64 | 90 | 40.8 | 4 | 6 |
| 112 | 32 | 49 | 75 | 135 | 61.2 | 6 | 9 |
| 121 | 18½ | 24 | 45 | 90 | 40.8 | 4 | 6 |
| 122 | 5½ | 9 | 16 | 23 | 10.4 | 1 | 2 |
| 124 | 21 | 35 | 62 | 105 | 47.7 | 5 | 3 |
| 130 | 9 | 17 | 44 | 90 | 40.8 | 4 | 6 |
| 160 Series | 22 | 45 | 66 | 135 | 61.2 | 6 | 9 |
| 160 | 12¾ | 27 | 50 | | | | |
| 161 | 3½ | 7 | 14 | | | | |
| 162 | 3½ | 7 | 14 | | | | |
| 163 | 3½ | 7 | 14 | | | | |
| FA-160 | 1¼ | 3 | | | | | |
| 180 | 37 | 49 | 66 | 90 | 40.8 | 4 | 6 |
| 181 | 17½ | 28 | 49 | 135 | 61.2 | 6 | 9 |
| 190 | 24 | 38 | 55 | 90 | 40.8 | 4 | 6 |
| 360 | 9 | 14½ | 32 | 90 | 40.8 | 4 | 6 |
| 500 | 42 | 51 | 63 | 147 | 66.7 | 7 | 4 |



NEW INSTRUMENTS

Field reports relating to present and future instrumentation requirements influence the design of new Tektronix products. This section contains our interpretation of these reports in new instruments currently in production or being readied for early production. Every effort is made to provide the greatest utility to the user, consistent with sound engineering and manufacturing practices.

TYPE 540 SERIES OSCILLOSCOPES

TYPE 541 CATHODE-RAY OSCILLOSCOPE

For Fast-Rise Applications

Excellent Transient Response

Main-unit vertical-amplifier risetime—
10 millimicroseconds.

Wide Range of Vertical-Amplifier Characteristics

Instant convertibility through changing
plug-in preamplifiers.

600,000,000 to 1 Sweep Range

0.02 $\mu\text{sec}/\text{cm}$ to 12 sec/cm.

Versatile Triggering Circuitry

Positive and negative internal and external triggering,
with 30 MC SYNC, amplitude level selection, and
AUTOMATIC TRIGGERING.

10-kv Accelerating Potential

Full 4 cm x 10 cm Linear Deflection

Balanced 0.15 μsec Delay Network

GENERAL DESCRIPTION

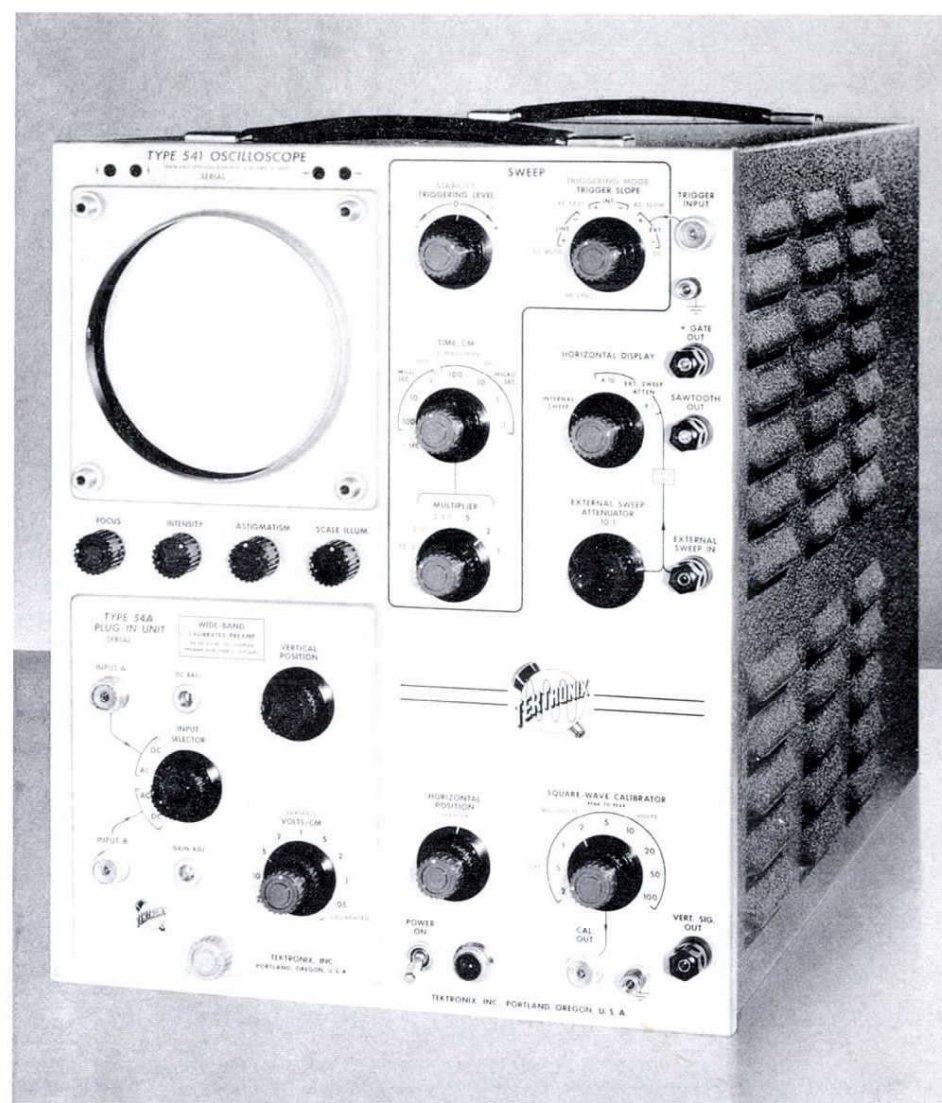
The Tektronix Type 541 is a high-speed laboratory oscilloscope with performance capabilities far above any previous oscilloscope of its size and cost. In combination with the Type 53K/54K Plug-In Unit, the Type 541 offers a vertical-amplifier passband of dc to 30 mc and a risetime of 12 millimicroseconds, opening the way to faster, easier analyses of fast-rising waveforms. Wide sweep range, high accelerating potential, and full four centimeters of vertical deflection fully complement the extended vertical-amplifier range, and the convertibility provided by plug-in preamplifiers adds immensely to its value by making it adaptable to almost all laboratory-oscilloscope applications.

VERTICAL DEFLECTION SYSTEM

DC-Coupled Output Amplifier—The wide-band fast-rise dc-coupled output amplifier has a risetime of 10 millimicroseconds, and is factory adjusted for optimum transient response.

The Type 53K/54K Fast-Rise Plug-in Preamplifier, developed for Type 541 and Type 545 Oscilloscopes, provides a maximum sensitivity of 0.05 v/cm, with 12-millimicrosecond risetime, dc-to-30 mc passband, and 20- μmf input capacitance. (Frequency response is down 3 db $\pm 1/2$ db at 30 mc, 6 db at approximately 45 mc, 12 db at approximately 60 mc.)

The Type 541 vertical deflection system is designed to be used with any of the Type 53/54 or Type 54 Plug-In Preamplifiers. In order to operate the Type 541, one of



the preamplifiers must be plugged in.

Type 541 vertical response with these plug-in units:

Type 53K/54K—dc to 30 mc, 0.012- μsec risetime.

Type 53E/54E—0.06 cycles to 60 kc.

Type 53D/54D—dc to 350 kc at 1 mv/cm, increasing to 2 mc at 50 mv/cm.

Specifications of other plug-in units for use with the Type 541 and Type 545 were not available at the time of this printing, but are probably now available from your Tektronix Field Engineer or Representative.

Probes—Three probes are furnished with the instrument—one P410 low-capacitance probe for use with fast-risetime plug-in units, and two P510A standard probes for use with the other plug-in units. Input capacitance of the Type 541-Type 53K/54K combination with the P410 Probe is 7.5 μmf , maximum sensitivity is 0.5 v/cm. Excellent transient response is retained, as the P410 introduces no overshoot or ringing, but frequency response is down an additional 1 db at 30 mc. Accessory probes are available with input capacitances of 11.5 μmf at 5x attenuation, 4.5 μmf at 20x attenuation, and 2.5 μmf at 50x attenuation.

Balanced Delay Network—A signal delay of 0.15 μsec is introduced by the balanced (push-pull) delay network. Permits observation of the leading edge of the waveform that triggers the sweep.

Direct Input to CRT—An aperture in the side of the cabinet permits direct connection to the deflection plates.

Tektronix, Inc.

TYPE 540 SERIES OSCILLOSCOPES

HORIZONTAL DEFLECTION SYSTEM

The horizontal deflection system of the Type 541 is essentially the same as that of the Tektronix Type 531. Sweep generator used in the Type 541 is the Miller runup type. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this circuitry provide an extremely wide sweep range of 0.02 $\mu\text{sec}/\text{cm}$ to 12 sec/cm .

Calibrated Sweeps—Twenty-four calibrated sweeps are accurate within 3%. The main sweep control has 8 positions—0.1, 1, 10, 100 $\mu\text{sec}/\text{cm}$. . . 1, 10, 100 msec/cm . . . 1 sec/cm . Multiplier positions of 1, 2, and 5 for each main sweep step provide a total of 24 calibrated sweeps. The remaining three positions on the multiplier switch are 1 to 2.5, 2 to 5, and 5 to 12 variable positions, making the sweep time continuously variable from 0.1 $\mu\text{sec}/\text{cm}$ to 12 sec/cm . The 5x magnifier applied to the 0.1 $\mu\text{sec}/\text{cm}$ sweep extends the calibrated range to 0.02 $\mu\text{sec}/\text{cm}$.

Sweep Magnifier—Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of the trace is expanded to the left and right of center to fill the screen. Any one-fifth of the magnified sweep can be displayed on the screen by rotating the HORIZONTAL POSITION control. Accurate 5x magnification is obtained on all ranges.

DC-Coupled Unblanking—The unblanking waveform is dc-coupled to the grid of the cathode-ray tube, assuring uniform bias for all sweep speeds and repetition rates.

Trigger Selection—A concentric control permits triggering from either the positive or negative slopes of internal, external, or line voltage signals; and selection of ac or dc-coupling through the triggering circuits, automatic triggering, or high-frequency sync.

Triggering Level—The amplitude level where triggering occurs is selected with the TRIGGERING LEVEL control. Permits triggering the sweep at a selected level on simple or complex waveforms.

Automatic Triggering—With the control in the AUTO position, the sweep will be triggered by any recurrent incoming signal from 60 cycles to 2 megacycles. Signals differing in frequency, amplitude, and shape can be observed without readjustment of the triggering controls. In the absence of an input signal, the sweep is automatically triggered at approximately a 50-cycle rate, providing a reference trace on the screen.

High-Frequency Sync—When the TRIGGER MODE switch is in the HF SYNC position, the sweep will synchronize with sine-wave signals in the frequency range of about 5 mc to 30 mc.

Trigger Requirements—Internal triggering—a signal large enough to cause 2-mm deflection. External triggering—a signal of 0.05 v to 100 v.

Horizontal Input Amplifier—DC-coupled external connection to the sweep-output amplifier is through a front-panel connector. Combination of a step attenuator and variable attenuator makes the horizontal input sensitivity continuously variable from 0.2 v/cm to 20 v/cm. Passband is dc to 240 kc.

OTHER CHARACTERISTICS

Cathode-Ray Tube—10-kv accelerating potential assures bright displays when using fast sweeps at low repetition rates, and in single-sweep applications. The Type 541 uses the new Tektronix Type T54P cathode-ray tube. The T54P is a 5" flat-faced metallized precision tube with helical post-accelerating anode. It provides a linear 4 cm x 10 cm viewing area. For best results over the wide sweep range of the Type 541, a P2 screen is normally furnished with the instrument.

Regulated Power Supply—Electronic regulation compensates for line-voltage variations between 105 and 125 v, and for current-demand differences among the Plug-In Preamplifiers.

Amplitude Calibrator—A square-wave calibration voltage is available through a front-panel uhf connector. Eighteen fixed voltages—0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 millivolts, 0.2, 0.5, 1, 2, 5, 10, 20, 50 and 100 volts peak-to-peak are provided. Accuracy is within 3%. Square-wave frequency is approximately 1 kc.

Output Waveforms—A positive-gate voltage of the same duration as the sweep and the sweep-sawtooth waveform are available at front-panel binding posts via cathode followers. The vertical signal is brought out to a front-panel terminal for external applications.

Beam Position Indicators—Two pairs of indicator lights show the direction of the crt electron beam when it is not on the screen.

Illuminated Graticule—An edge-lighted graticule is marked in centimeter squares with two-millimeter baseline divisions for convenience in making measurements in time and amplitude. Illumination of the graticule is controlled by a front-panel knob.

VACUUM TUBE COMPLEMENT

| | | |
|--|----|-------|
| Vertical beam-position indicators and input amplifiers | 2 | 6AW8 |
| Driver and internal trigger CF | | 6BQ7A |
| Driver and vertical signal out CF | | 6BQ7A |
| Internal trigger amplifiers | 2 | 6CB6 |
| Distributed output amplifiers | 12 | 6CB6 |
| Calibrator multivibrator | | 6U8 |
| Cal output and horizontal position CF | | 6BQ7A |
| Trigger amplifier | | 6BQ7A |
| Trigger shaper | | 6U8 |
| Positive multivibrator and multi CF | | 6BQ7A |
| Negative multivibrator | | 12BY7 |
| Unblanking and holdoff CF | | 6BQ7A |
| Stability and holdoff CF | | 6BQ7A |
| Sawtooth and gate CF | | 6BQ7A |
| Dual-trace sync amplifier | | 6AU6 |
| Disconnect diodes | | 6AL5 |
| Sweep generator | | 6CL6 |
| Sweep generator CF | | 6BQ7A |
| External horizontal and dc level CF | | 12AU7 |
| External horizontal amplifier | | 6BQ7A |
| Horizontal driver CF | | 6BQ7A |
| Horizontal amplifier and output CF | 2 | 6BQ7A |
| Sweep start compensator | | 6CL6 |
| Voltage reference | | 5651 |
| Comparator amplifiers | 2 | 12AX7 |
| Regulator amplifiers | 5 | 6AU6 |
| Series regulators | 4 | 12B4 |
| Series regulators | 2 | 6080 |
| High-voltage oscillator | | 6AU5 |
| Regulator | | 12AU7 |
| High-voltage rectifiers | 5 | 5642 |
| Cathode-ray tube | | T54P2 |

Tektronix, Inc.

TYPE 540 SERIES OSCILLOSCOPES

MECHANICAL SPECIFICATIONS

Ventilation—Filtered forced-air ventilation maintains safe operating temperatures.

Construction—Electrically-welded aluminum alloy chassis and cabinet.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Dimensions—13" wide, 16" high, 24" long.

Weight—61½ pounds.

Power Requirements—105 to 125 v or 210 to 250 v, 50-60 cycles, 485 watts with Type 53K/54K unit plugged in.

Price **\$1145** (less plug-in preamplifiers)

- Includes: 1—P410 probe
- 2—510A probes
- 2—A510 binding post adapters
- 1—W530B test lead
- 1—F510-5 green filter
- 1—Instruction manual

Currently Available Extras

P2 crt phosphor normally furnished,
P1, P7, P11 optional No extra charge
Several other phosphors can be furnished on special order.

Recommended Additional Accessories

Low Capacitance Accessory Probes—for use with Fast-Rise Plug-In Units. These probes preserve the excellent transient response of the Type 541-Type 53K/54K combination, introducing no overshoot or ringing, but cause an additional frequency-response loss of approximately 1 db at 30 mc.

| Probe | Input Impedance | Maximum Sensitivity | Price |
|-------|--|---------------------|---------|
| P405 | 11.5 μmf , 5 megohms | 0.25 v/cm | \$12.50 |
| P410 | 7.5 μmf , 10 megohms | 0.5 v/cm | 12.50 |
| P420 | 4.5 μmf , 10 megohms | 1 v/cm | 12.50 |
| P450 | 2.5 $\mu\text{mf} \pm 10\%$, 10 megohms | 2.5 v/cm | 12.50 |
| P4100 | 2.5 $\mu\text{mf} \pm 10\%$, 10 megohms | 5 v/cm | 12.50 |

EP53 Plug-In Extension—for making attenuator and transient response adjustments \$5.00

Prices f.o.b. Portland (Beaverton), Oregon

TYPE 545 CATHODE-RAY OSCILLOSCOPE

With Delayed Sweep

Wide-Range Sweep Delay

1 μsec to 0.1 sec, continuously variable.

Two Operating Modes

Conventional Operation—Inherent time-jitter less than 1 part in 20,000.

Triggered Operation—Jitter-free at any magnification, even in the presence of actual signal jitter.

Accurate Calibration

Range accuracy within 2%, incremental accuracy within 0.2% of full scale.

Trigger-Rate Source

10 cycles to 50 kc, continuously variable.

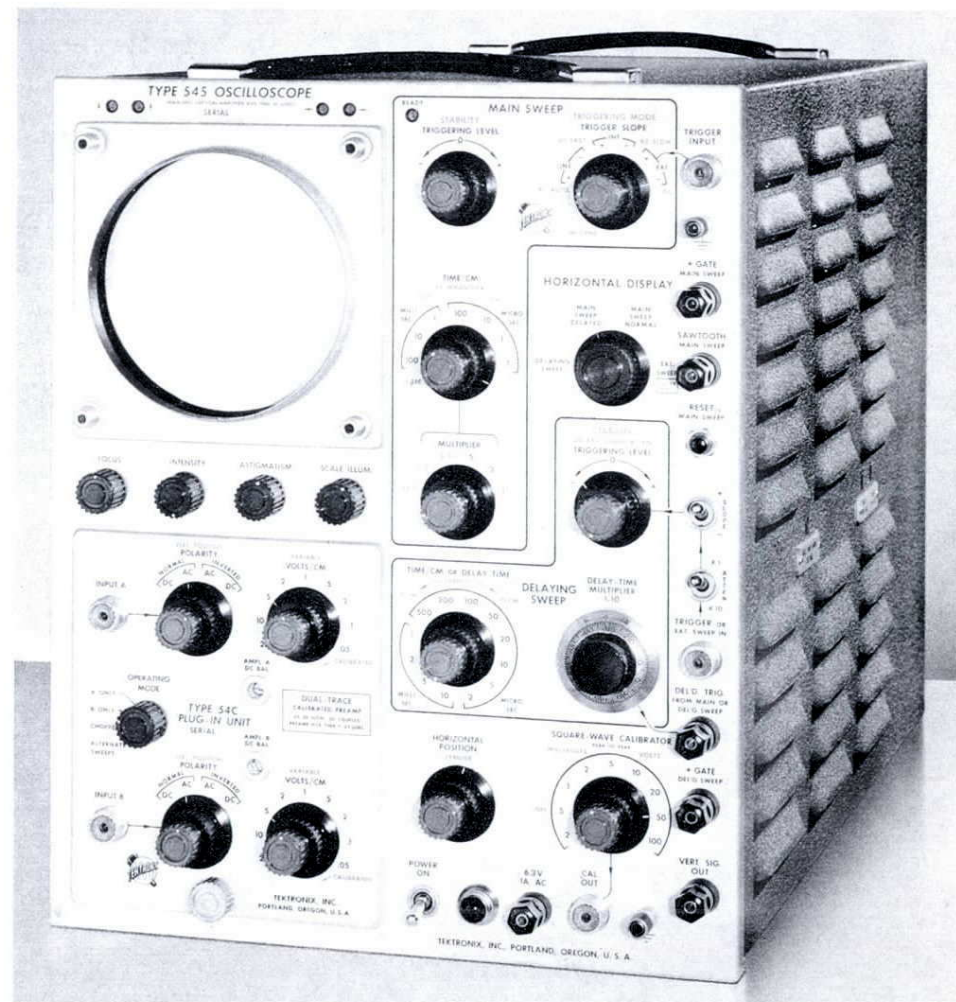
All other major specifications same as Type 541.

GENERAL DESCRIPTION

The Type 545 Cathode-Ray Oscilloscope is essentially the Type 541 plus the Tektronix lockout-reset sweep delay circuitry. All major specifications other than those pertaining to the sweep-delay circuitry are the same. Please refer to the Type 541 section for these specifications.

DELAYED SWEEP

The sweep-delaying system of the Type 545 is essentially the same as that of the Tektronix Type 535. Two modes of operation permit use as a conventional delayed sweep, or as a triggered delayed sweep. In conventional operation, the sweep starts immediately after the period of delay. In triggered operation, the sweep does not start until it receives the first trigger after the period of delay. Time-jitter is less than 1 part in 20,000 when the delayed sweep is operated in the conventional manner. In triggered operation, the delayed sweep is started by the signal under observation, resulting in a steady display even



in the presence of jitter in the incoming signal.

Sweep delay is accomplished in the Type 545 by use of a second sweep called the DELAYING SWEEP. A position on the HORIZONTAL DISPLAY switch provides for displaying the delaying sweep on the crt screen. When viewing the delaying sweep, the main sweep appears upon it as a section of increased brightness, and may be ranged in or out to position its start at the desired point. If the main sweep is adjusted to free-run, it will start exactly at this point. If it is adjusted for triggered operation, it will not start until the first trigger after the period of delay. A turn of the HORIZONTAL DISPLAY SWITCH returns the main sweep to the screen, delayed by the selected amount.

Tektronix, Inc.

TYPE 540 SERIES OSCILLOSCOPES

Calibration — Delay can be read directly from the screen in time/cm or from a calibrated dial in total delay time. A twelve-position switch covers the range of 2 $\mu\text{sec/cm}$ to 10 millisecc/cm. A ten-turn delay-time-multiplier precision potentiometer fills in between steps, making the delay period continuously variable from 1 μsec to 0.1 sec. Range accuracy is within 2% and any range can be adjusted to the accuracy of an external standard. Incremental accuracy is within 0.2% of full scale on all ranges.

Manual Reset—Single sweeps may be initiated by a front-panel button. When the RESET button is pressed, a single sweep results if the main sweep has been adjusted to free-run. When the main sweep is adjusted for triggered operation, pressing the RESET button arms the sweep to fire on the next trigger received. After firing once, the sweep is locked out and will not fire again until rearmed by pressing the RESET button. A front-panel indicator lights when main sweep is reset and ready to accept a trigger. For automatic reset operation, the delaying sweep can be adjusted to rearm the main sweep to fire on the next trigger received.

Trigger-Rate Source—Triggered sweep rates of 10 cycles to 50 kc are obtained by adjusting the duration of the free-running delaying sweep, and using it to trigger the main sweep internally. The 10-cycle to 50-kc rate is continuously variable.

Waveforms Available—A positive gate from the delaying sweep, amplitude approximately 20 v, is available at a front-panel connector. A delayed trigger of approximately 5-v amplitude is also available at the front panel, from either the main sweep or the delaying sweep. The vertical signal is brought out from the main amplifier to a front-panel connector for use in triggering the delaying sweep or other external applications. Peak-to-peak level is about 1.5 v/cm of vertical deflection on the crt screen. For extra convenience, 6.3 v ac at 1 a is available at another front-panel connector.

Trigger Requirements—The delaying sweep requires a trigger from 0.1 v to 100 v fed into its TRIGGER terminal. A switch permits selection of 1x or 10x attenuation and another switch provides for positive or negative trigger polarity.

OTHER CHARACTERISTICS

All other characteristics are identical to those of the Tektronix Type 541 Cathode-Ray Oscilloscope described in the first part of this Type 540 Series section.

VACUUM TUBE COMPLEMENT

| | | |
|--|----|-------|
| Vertical beam position indicators and input amplifiers | 2 | 6AW8 |
| Driver and internal trigger CF | | 6BQ7A |
| Driver and vertical signal out CF | | 6BQ7A |
| Internal trigger amplifiers | 2 | 6CB6 |
| Distributed output amplifiers | 12 | 6CB6 |
| Calibrator multivibrator | | 6U8 |
| Cal output and horizontal position CF | | 6BQ7A |
| Trigger amplifier | | 6BQ7A |
| Trigger shaper | | 6U8 |
| Positive multivibrator and multi CF | | 6BQ7A |
| Negative multivibrator | | 12BY7 |
| Holdoff CF | | 6U8 |
| Delayed trigger amplifier and CF | | 6U8 |

| | | |
|--|---|-------|
| Stability CF and ready indicator | | 6U8 |
| Sawtooth and gate CF | | 6BQ7A |
| Dual-trace sync amplifier | | 6AU6 |
| Disconnect diodes | | 6AL5 |
| Sweep generator | | 6CL6 |
| Sweep generator CF | | 6BQ7A |
| Delaying sweep trigger CF | | 12AU7 |
| Trigger amplifier | | 6BQ7A |
| Trigger shaper and ext sweep CF | | 6U8 |
| Comparator | | 6BQ7A |
| Multivibrator | | 6U8 |
| Multi and gate out CF | | 6BQ7A |
| Disconnect diodes | | 12AL5 |
| Sweep generator | | 12AU6 |
| Sweep generator and holdoff CF | | 6BQ7A |
| Delay pickoff | | 6U8 |
| Trigger shaper | | 6U8 |
| Trigger CF and constant current | | 6U8 |
| Horizontal driver CF | | 6BQ7A |
| Horizontal amplifier and output CF | 2 | 6BQ7A |
| Sweep start compensator | | 6CL6 |
| Voltage reference | | 5651 |
| Comparator amplifiers | 2 | 12AX7 |
| Regulator amplifiers | 5 | 6AU6 |
| Series regulators | 4 | 12B4 |
| Series regulators | 2 | 6080 |
| Unblanking mixer | | 6BQ7A |
| High-voltage oscillator | | 6AU5 |
| Regulator | | 12AU7 |
| High-voltage rectifiers | 5 | 5642 |
| Cathode-ray tube | | T54P2 |

MECHANICAL SPECIFICATIONS

Ventilation—Safe operating temperature is maintained by filtered, forced-air ventilation.

Construction—Electrically-welded aluminum-alloy cabinet and chassis.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Dimensions—24" long, 13" wide, 16" high.

Weight—65 pounds.

Power Requirements—117/234 v, 50-60 cycles, 545 watts with Type 53K/54K unit plugged in.

Price **\$1450** (Less Plug-In Preamplifiers)

- Includes: 1—P410 probe
 2—P510A probes
 2—A510 binding post adapters
 1—W530B test lead
 1—F510-5 green filter
 1—Instruction manual

Currently Available Extras

P2 crt phosphor normally furnished,
 P1, P7, P11 optional No extra charge
 Several other phosphors can be furnished on special order.

Recommended Additional Accessories

Low Capacitance Accessory Probes—for use with Fast-Rise Plug-In Units. These probes preserve the excellent transient response of the Type 545-Type 53K/54K combination, introducing no overshoot or ringing, but cause an additional frequency-response loss of approximately 1 db at 30 mc.

| Probe | Input Impedance | Maximum Sensitivity | Price |
|-------|--|---------------------|---------|
| P405 | 11.5 μmf , 5 megohms | 0.25 v/cm | \$12.50 |
| P410 | 7.5 μmf , 10 megohms | 0.5 v/cm | 12.50 |
| P420 | 4.5 μmf , 10 megohms | 1 v/cm | 12.50 |
| P450 | 2.5 $\mu\text{mf} \pm 10\%$, 10 megohms | 2.5 v/cm | 12.50 |
| P4100 | 2.5 $\mu\text{mf} \pm 10\%$, 10 megohms | 5 v/cm | 12.50 |

EP53 Plug-In Extension—for making attenuator and transient response adjustments \$5.00

Prices f.o.b. Portland (Beaverton), Oregon

Tektronix, Inc.

TYPE 540 SERIES OSCILLOSCOPES

TYPE 53K/54K PLUG-IN UNIT

Fast-Rise DC Preamplifier

Transient Response

With Type 541 and Type 545
Risetime—12 millimicroseconds.

With Type 531 and Type 535
Risetime—0.031 μ sec.

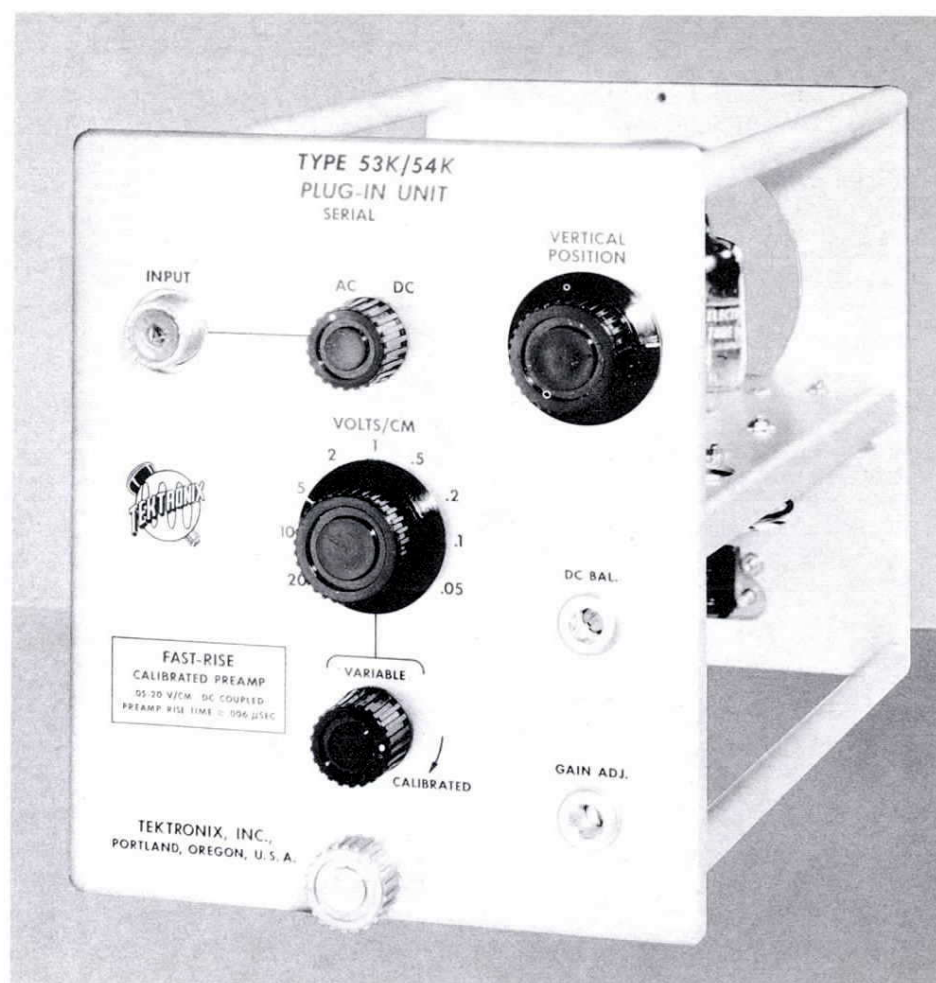
Frequency Response

With Type 541 and Type 545
Passband — DC to 30 mc (down 3 db $\pm 1/2$ db at 30 mc, 6 db at approximately 45 mc, 12 db at approximately 60 mc).

With Type 531 and Type 535
Passband—DC to 11 mc.

Sensitivity

Calibrated—0.05 v/cm to 20 v/cm.



GENERAL DESCRIPTION

The Type 53K/54K Fast-Rise unit provides Type 541 and Type 545 Oscilloscopes with calibrated sensitivity at low input capacitance, taking maximum advantage of the excellent transient response and wide frequency range of their main-unit vertical deflection system. The Type 53K/54K with either the Type 541 or Type 545 makes a 12-millimicrosecond risetime combination, ideal for applications involving fast-rising waveforms. Frequency response is down 3 db $\pm 1/2$ db at 30 mc, 6 db at approximately 45 mc, 12 db at approximately 60 mc. The combined vertical-amplifier system is dc-coupled, and an AC-DC switch provides for insertion of a capacitor to block the dc component of the input signal, limiting the low-frequency response to 2 cycles.

OTHER CHARACTERISTICS

Calibrated Sensitivity—Nine calibrated sensitivity steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, and

20 v/cm. Each step can be adjusted over approximately a 2-to-1 range by means of a variable control.

Input Impedance—The Type 53K/54K input capacitance is 20 μ mf direct. With P400-Series probes it can be reduced to as little as 2.5 μ mf at 50x attenuation, to 11.5 μ mf at 5x attenuation. Direct input impedance of the Type 53K/54K is 1 megohm paralleled by 20 μ mf.

VACUUM TUBE COMPLEMENT

| | |
|--------------------------------------|---------|
| Input cathode followers | 12AT7 |
| Cathode-coupled amplifiers | 2 19X8 |
| Output cathode followers | 2 12AT7 |

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.
Finish—Photo-etched anodized panel.
Weight—3 $\frac{1}{2}$ pounds.

Price—\$125 f.o.b. Portland (Beaverton), Oregon

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

TYPE 532 CATHODE-RAY OSCILLOSCOPE

Designed for Extra Dependability

Wide Sweep Range

0.2 $\mu\text{sec}/\text{cm}$ to 12 sec/cm .

DC-Coupled Vertical Amplifier

Passband with wide-band plug-in units—dc to 5 mc.
Risetime with wide-band plug-in units—0.07 μsec .

Versatile Triggering Circuitry

Amplitude level selection or AUTOMATIC TRIGGERING.

Horizontal Input Amplifier

Sensitivity 0.2 v/cm to 20 v/cm, continuously variable.

DC-Coupled Unblanking

Vertical Beam-Position Indicators

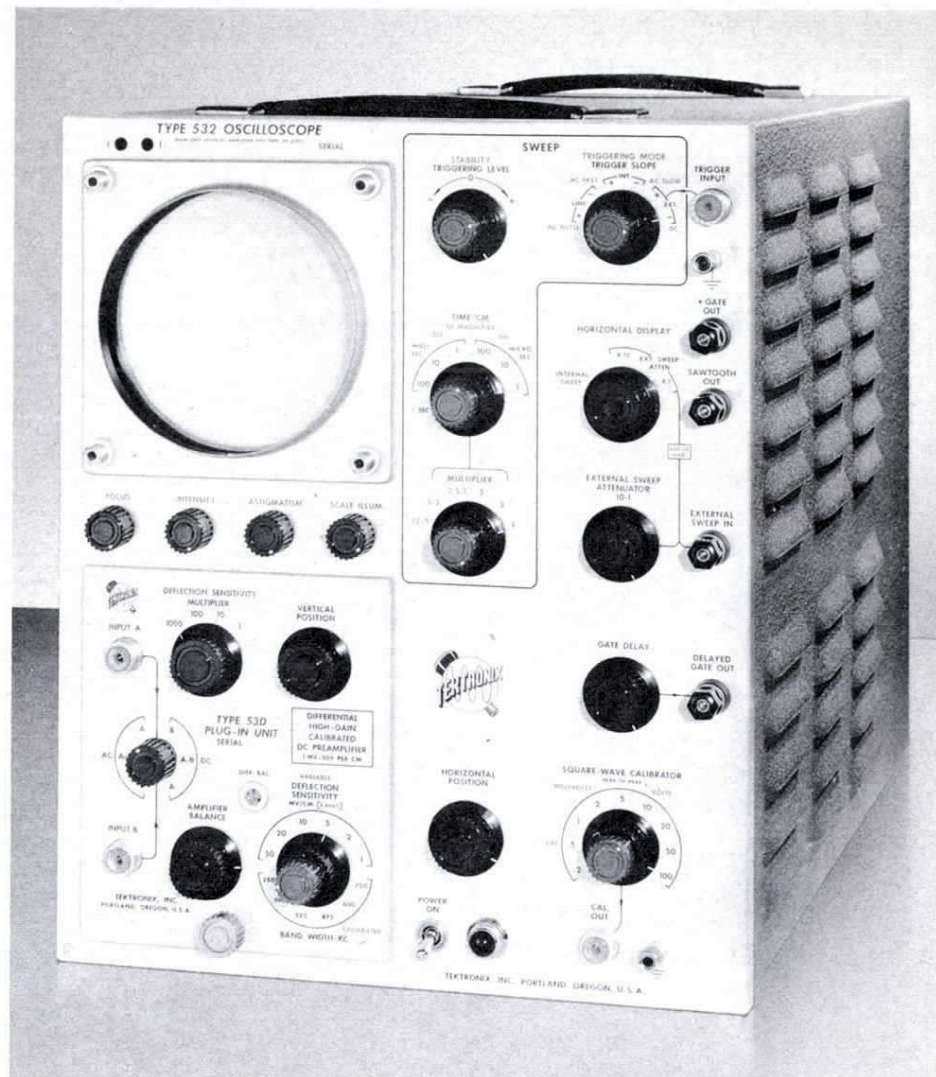
GENERAL DESCRIPTION

The Tektronix Type 532 is a medium-priced laboratory oscilloscope combining the signal-handling versatility provided by plug-in vertical preamplifiers with extra dependability made possible by conservative design. All Type 53 and Type 53/54 plug-in units can be used with the Type 532, only the wide-band units being restricted to 5 mc by the main-unit vertical-amplifier response. The Type 532 has all the precision and stability you expect in Tektronix oscilloscopes. Calibrated controls permit accurate time and amplitude measurements directly from the screen. New Tektronix crt provides 8 centimeters of linear vertical deflection. Wide sweep range and exceptional signal-handling versatility equip the Type 532 for a great many laboratory applications.

VERTICAL DEFLECTION SYSTEM

DC-Coupled Output Amplifier—The vertical amplifier of the Type 532 is designed to be used with any one of the Type 53 or Type 53/54 Plug-In Preamplifiers. The passband of the Type 532 is less than 3db down at 5 mc, adjusted for optimum transient response with the wide-band preamplifier units plugged in. Frequency response of the wide-band units is limited to that of the main-unit vertical amplifier, but the overall response is not materially affected when plug-in units with passbands of 2 mc and lower are used. The main-unit sensitivity is 0.1 v/cm with balanced input.

In order to operate the Type 532, one of the Type 53 or Type 53/54 Units must be plugged in.



Type 532 frequency response and risetime with the following plug-in units:

Type 53A—Passband, DC to 5 mc; Risetime, 0.07 μsec .

Type 53B—Passband, DC to 5 mc; Risetime, 0.07 μsec .

Type 53C—Passband, DC to 5 mc, Risetime, 0.07 μsec .

Type 53D/54D—Passband, DC to 350 kc at 1 mv/cm, increasing to 2 mc as sensitivity is decreased to 50 mv/cm.

Type 53E/54E—Passband, 0.06 cycles to 60 kc.

Type 53G—Passband, DC to 5 mc; Risetime, 0.07 μsec .

Direct Input to CRT—An aperture in the side of the cabinet permits direct connection to the crt deflection plates.

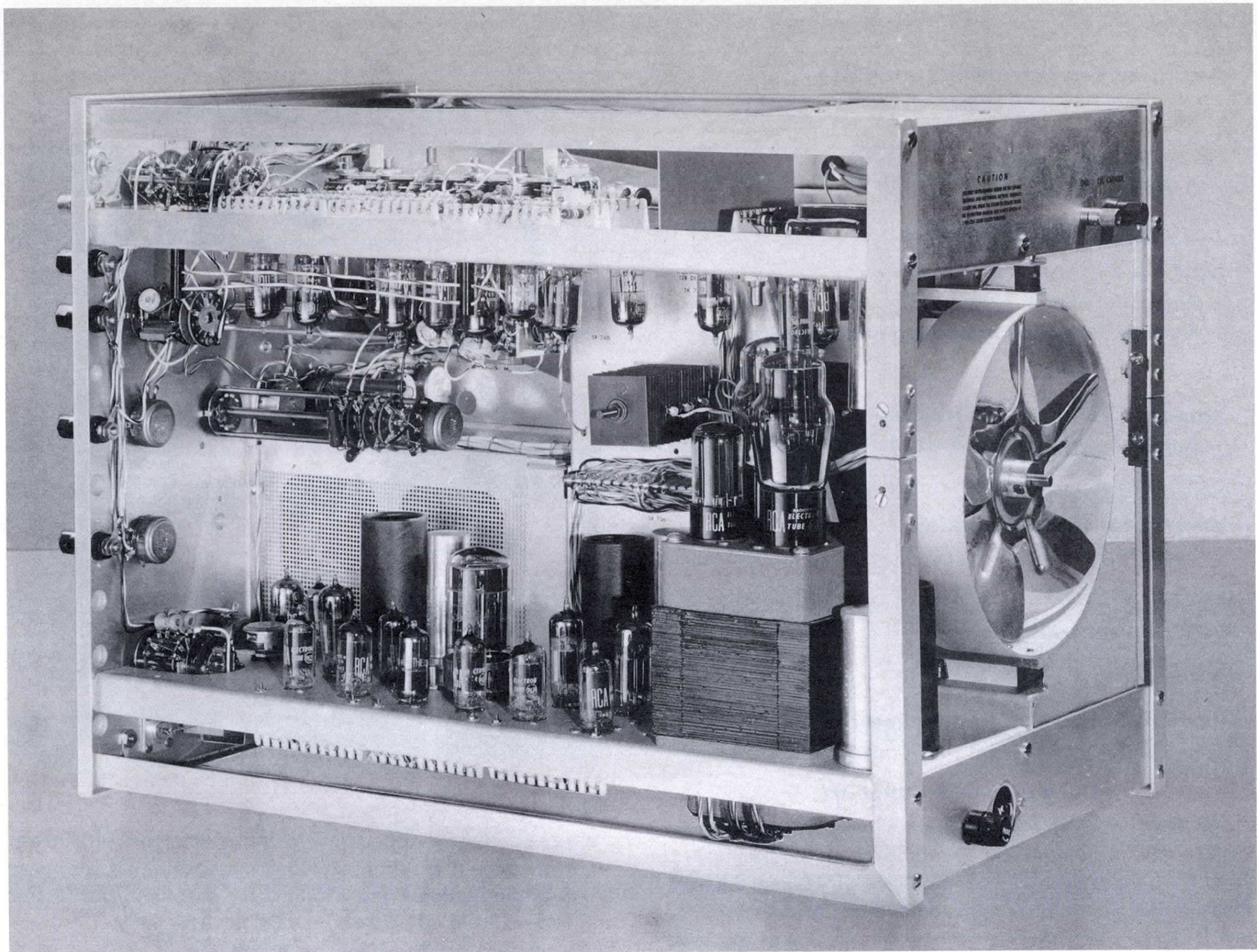
HORIZONTAL DEFLECTION SYSTEM

The sweep generator in the Type 532 is a Miller runup type. Excellent sweep linearity results from use of inverse feedback in the timing circuits. Characteristics of this circuitry make possible the wide sweep range of 0.2 $\mu\text{sec}/\text{cm}$ to 12 sec/cm .

Calibrated Sweeps—Twenty-one calibrated sweeps, accurate within 3%, are available. The main sweep control has seven positions—1, 10, 100 $\mu\text{sec}/\text{cm}$, . . . 1, 10, 100 $\text{milli}\text{sec}/\text{cm}$, . . . 1 sec/cm . Three multiplier switch positions of 1, 2, and 5 for each of the main sweep steps provide a total of 21 calibrated sweeps. The remaining three positions on the multiplier switch of 1 to 2.5, 2 to 5, and 5 to 12 provide continuously variable sweeps from 1 $\mu\text{sec}/\text{cm}$ to 12 sec/cm . The 5-x magnifier applied to the 1 $\mu\text{sec}/\text{cm}$ sweep extends the calibrated sweep range to 0.2 $\mu\text{sec}/\text{cm}$.

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES



Sweep Magnifier—Sweep magnification is obtained by effectively increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of the trace is expanded to 10 cm. Any one-fifth of the magnified sweep can be displayed on the screen by means of the HORIZONTAL POSITION control. Accurate 5-x magnification is obtained on all ranges.

DC-Coupled Unblanking—The unblanking waveform is dc coupled to the grid of the crt to assure uniform unblanking bias for all sweep speeds and repetition rates.

Trigger Selection—A concentric control permits triggering from either the positive or negative slopes of an internal, external, or line signal; and selection of ac or dc coupling through the triggering circuits, or automatic triggering.

Automatic Triggering—With the control in the AUTO position, the sweep will be triggered by any recurrent incoming signal from approximately 60 cycles to approximately 2 mc. Signals differing in frequency, amplitude, and shape can be observed without readjustment of the triggering controls. In the absence of an input signal, the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the crt screen.

Triggering Level—The TRIGGERING LEVEL control selects the amplitude level where triggering occurs. It permits triggering the sweep at a selected level on simple or complex waveforms.

Trigger Requirements—Internal triggering—a signal large enough to cause 2 mm deflection. External triggering—a signal of 0.5 v to 100 v.

Horizontal Input Amplifier—DC-coupled external connection to the sweep amplifier is through a front-panel terminal. Combination of a step attenuator and variable amplifier-gain control makes the horizontal input sensitivity continuously variable from 0.2 v/cm to 20 v/cm. Pass-band is dc to 240 kc.

OTHER CHARACTERISTICS

Cathode-Ray Tube—4-kv accelerating potential is applied to the new Tektronix Type T52P cathode-ray tube. The T52P is a 5" flat-faced precision tube with a helical post-accelerating anode, providing 8 cm of linear vertical deflection. A P-2 phosphor, providing best results over the wide sweep range, is supplied unless another phosphor is requested.

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

Amplitude Calibrator—A square-wave calibration voltage is available through a front-panel uhf connector. Eighteen fixed voltages, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 millivolts, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 volts peak-to-peak are provided. Accuracy is within 3%. Square-wave frequency is approximately 1 kc.

Output Waveforms—Front-panel connectors provide a 100-volt positive-gate voltage of the same duration as the sweep, the positive-going sweep sawtooth waveform, and a positive delayed gate with delay adjustable throughout the period of the sweep.

Regulated Power Supply—Electronic regulation compensates for line-voltage variations between 105 and 125 v or 210 and 250 v, and for current-demand differences among the Type 53 and Type 53/54 Preamplifiers.

Beam Position Indicators—A pair of indicator lights shows the vertical direction of the electron beam when it is not on the screen.

Illuminated Graticule—An edge-lighted graticule is marked in centimeters with two-millimeter baseline divisions for convenience in making time and amplitude measurements. Illumination is controlled by a front-panel control.

VACUUM TUBE COMPLEMENT

| | | |
|---|---|-------|
| Vertical amplifiers | 2 | 12AU6 |
| Cathode followers | | 6BQ7A |
| Vertical output amplifiers | 2 | 6CL6 |
| Beam position amplifiers | | 12AU7 |
| Internal trigger CF | | 6AU6 |
| Trigger amplifier | | 6U8 |
| Trigger shaper | | 6U8 |
| Positive multivibrator and hold-off CF | | 6BQ7A |
| Negative multivibrator | | 6AU6 |
| Sweep generator | | 6AU6 |
| Sweep generator CF and multi CF | | 6BQ7A |
| Disconnect diodes | | 6AL5 |
| Sweep hold-off CF and stability CF | | 6BQ7A |
| Gate out CF and dual-trace trigger amplifier | | 6AN8 |
| Saw-tooth out CF and delayed gate out CF | | 12AU7 |
| Delayed gate pickoff | 2 | 6AU6 |
| External sweep amplifier | | 6BQ7A |
| Cathode follower and sweep output amplifier | | 6BQ7A |
| Sweep output amplifier and + 130 v supply CF | | 6BQ7A |

| | | |
|---|---|-------|
| Calibrator multivibrator and CF | | 6BQ7A |
| Calibrator multivibrator | | 6AU6 |
| Rectifiers | 5 | 5V4 |
| Voltage reference | | 5651 |
| Comparators | 2 | 12AX7 |
| Regulator amplifiers | 4 | 6AU6 |
| Series regulators | 3 | 12B4 |
| Series regulators | | 6080 |
| High-voltage oscillator | | 6AQ5 |
| Shunt regulator and dc comparator | | 12AU7 |
| High-voltage rectifiers | 3 | 5642 |
| Cathode-ray tube | | T52P2 |

MECHANICAL SPECIFICATIONS

Ventilation—Filtered, forced-air ventilation assures safe operating temperature.

Construction—Aluminum-alloy chassis and cabinet.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Dimensions—24" long, 13" wide, 16" high.

Weight—52 pounds.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 475 watts with Type 53D/54D unit plugged in.

Price—\$825 f.o.b. Portland (Beaverton), Oregon

(Less Plug-In Preamplifiers)

- Includes: 2—P510A probes
2—A510 binding post adapters
1—W530-B test lead
1—F510-3 amber filter
1—Instruction manual

Currently Available Extras

P2 phosphor normally furnished.

P1, P7, P11 optional No extra charge

Several other phosphors can be furnished on special order.

Recommended Additional Accessories

EP53 Plug-In Extension—for making attenuator and transient response adjustments \$5

TYPE 530 SERIES OSCILLOSCOPES

PLUG-IN PREAMPLIFIERS

Type 53 Units are factory adjusted for optimum performance in Type 530-Series Oscilloscopes; and Type 54 Units for optimum performance in Type 540-Series Oscilloscopes. Units designated Type 53/54 perform equally well in both Type 530-Series and Type 540-Series Oscilloscopes, requiring no readjustments for use in either series. For performance meeting published specifications always use Type 53 Units with Type 530-Series Oscilloscopes, and Type 54 Units with Type 540-Series Oscilloscopes.

TYPE 53E/54E PLUG-IN UNIT Low-Level Differential AC Preamplifier

Sensitivity

Calibrated—50 microvolts/cm to 10 millivolts/cm.

Continuously variable over the same range.

Frequency Response

0.06 cycles to 30 kc at full gain, increasing to 60 kc at 0.5 mv/cm.

Differential Input

50,000-to-1 rejection ratio for in-phase signals of ± 10 v or less.

GENERAL DESCRIPTION

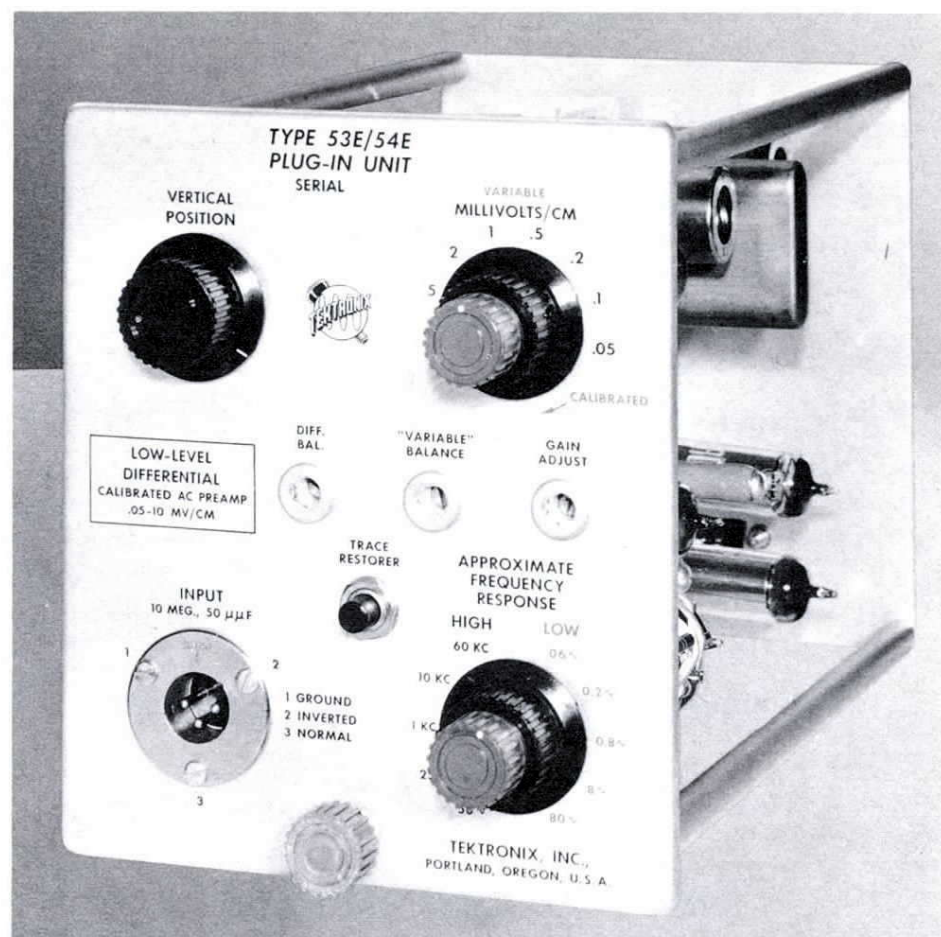
The Type 53E/54E Plug-In Unit provides Type 530-Series and Type 540-Series Oscilloscopes with calibrated vertical sensitivity to 50 microvolts/cm for low-level applications. Maximum combined noise and hum is 5 μ v, rms, with input grids grounded at the input connector. Separate high-frequency and low-frequency response controls permit restricting the bandwidth to further increase the signal-to-noise ratio. A rejection ratio of 50,000 to 1 for in-phase signals can be achieved by careful adjustment of the front-panel differential-balance control. Use of the internal attenuators has a negligible effect on the rejection figure.

OTHER CHARACTERISTICS

Calibrated Sensitivity—Eight calibrated sensitivity steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5 and 10 millivolts/cm. A variable attenuator fills in between steps making the sensitivity continuously variable over the same range.

Calibration Accuracy—When accurately set on any one step, all other steps will be within 3% of the panel reading.

Bandwidth Controls—A five-position switch provides for approximate high-frequency 3-db points of 60, 10, 1, 0.25, and 0.05 kc. Another five-position switch selects the approximate low-frequency 3-db points of 0.06, 0.2,



0.8, 8 and 80 cycles. Restricting the bandwidth to the requirements of the particular application will provide an increase in the signal-to-noise ratio. Input to grids is dc-coupled to provide good rejection at low frequencies.

Trace Restorer—If the trace should be driven from the screen by a large transient, it can be returned to its normal position immediately by pressing the trace restorer button.

Input Impedance—50 μ f paralleled by 10 megohms.

VACUUM TUBE COMPLEMENT

| | |
|---|--------|
| Input amplifiers | 5751 |
| 2nd stage and gain control | 2 5879 |
| 3rd stage and positioning control | 5814 |
| Output CF | 12AT7 |
| Voltage regulators | 2 OB2 |

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

Finish—Photo-etched anodized panel.

Weight—4½ lbs.

Price—\$165 f.o.b. Portland (Beaverton), Oregon.

Includes: 30" two-conductor shielded cable with male input connector.

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

TYPE 53G PLUG-IN UNIT

Differential Wide-Band DC Preamplifier

Common-mode Rejection

100 to 1 at full gain.

Transient Response

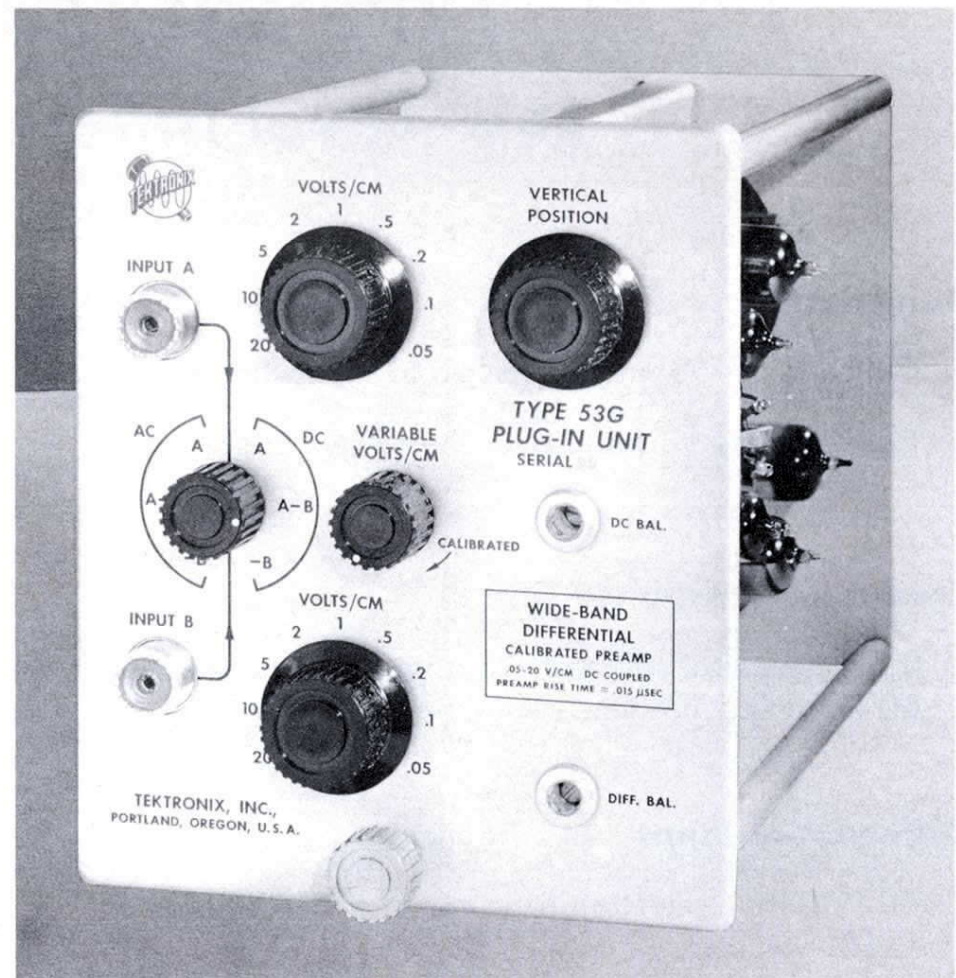
Risetime—0.035 μ sec with Type 531 and Type 535.
Risetime—0.07 μ sec with Type 532.

Frequency Response

Passband—DC to 10 mc with Type 531 and Type 535.
Passband—DC to 5 mc with Type 532.

Sensitivity

Calibrated—0.05 v/cm to 20 v/cm.
Continuously Variable—0.05 v/cm to 50 v/cm.



GENERAL DESCRIPTION

The Type 53G Plug-In Unit equips Type 530-Series Oscilloscopes for wide-band differential-input applications. Common-mode rejection is better than 100 to 1 for the entire passband at full gain . . . better than 300 to 1 at 60 cycles. Independent step attenuators in each input with 80-db isolation permit mixing signals of wide amplitude difference. Either input can be used separately, INPUT B giving a polarity-inverted display.

OTHER CHARACTERISTICS

Input-Selector—A six-position switch provides for use of either input separately, or both together differentially, either ac-coupled or dc-coupled. In the AC positions a blocking capacitor is inserted, limiting the low-frequency response to 2 cycles.

Calibrated Sensitivity—Each of the two attenuators has 9 calibrated positions: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 and 20 v/cm. A variable attenuator fills in between steps making the sensitivity continuously variable from

0.05 v/cm to 50 v/cm. The variable attenuator affects the gain of both inputs at the same time.

Calibration Accuracy—When accurately set on any one step, all other steps will be within 3% of the panel reading.

Input Impedance—45 μ f paralleled by 1 megohm.

VACUUM TUBE COMPLEMENT

| | | |
|-----------------------------|---|-------|
| Input amplifiers | 2 | 12AU6 |
| Cathode followers | | 12AT7 |
| Output amplifiers | | 12AT7 |
| Cathode followers | | 12AT7 |

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.
Finish—Photo-etched anodized panel.
Weight—4½ lbs.

Price—\$175 f.o.b. Portland (Beaverton), Oregon.

Please refer to Type 530-Series Oscilloscopes in the Oscilloscope Section of this catalog for specifications on other Plug-In Units.

Tektronix, Inc.

TYPE 310 OSCILLOSCOPE

DC-Coupled Portable Cathode-Ray Oscilloscope

Designed for Easy Handling

Small—10" x 6³/₄" x 17".
Weighs only 23¹/₂ pounds.

Transient Response

Risetime—0.09 μ sec.

Sensitivity

DC to 4mc—0.1 v/div.
2 cycles to 3.5 mc—0.01 v/div.

Sweep Range

0.1 μ sec/div to 0.6 sec/div.

Versatile Triggering

Internal, external, line . . . ac- or dc-coupled, and
AUTOMATIC TRIGGERING.

GENERAL DESCRIPTION

The Tektronix Type 310 is fully capable of performing much of your laboratory work, yet has the physical characteristics desirable for work away from your bench. It handles easily and fits into tight spots, simplifying field maintenance of complex electronic equipment. The high performance of the Type 310 can help you speed up your field work . . . its low weight and small size can ease your equipment handling problem.

Complete accessibility to tubes and components is maintained by a unique step-chassis construction, hinged at the rear. Accurate calibration and excellent linearity permit reliable quantitative measurements—you read time and amplitude directly from the screen. Functional panel design and versatile control system contribute to operator convenience, making this new oscilloscope an easy-to-use field and laboratory instrument.

VERTICAL DEFLECTION SYSTEM

DC-Coupled Vertical Amplifier—Main amplifier passband is dc to 4 mc at calibrated sensitivities of 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 v/div. Low-frequency response is limited to 2 cycles when the AC-DC switch is in the AC position. An ac-coupled preamplifier switched in by the sensitivity control provides three additional calibrated sensitivities of 0.01, 0.02, and 0.05 v/div, at a



frequency response of 2 cycles to 3.5 mc. A 3-to-1 variable control provides for continuously-variable sensitivity from 0.01 v/div to 150 v/div. Vertical amplifier is factory-adjusted for optimum transient response. Risetime is less than 0.09 μ sec. Input impedance is 1 megohm paralleled by approximately 40 μ f.

Calibration Accuracy—An adjustment is provided for setting the vertical-amplifier gain. When accurately set on any one step, all other steps will be within 2% of the panel reading.

Probe—The vertical sensitivity is reduced by a factor of ten by use of the small, insulated, 10-x attenuator probe furnished with the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately 13 μ f.

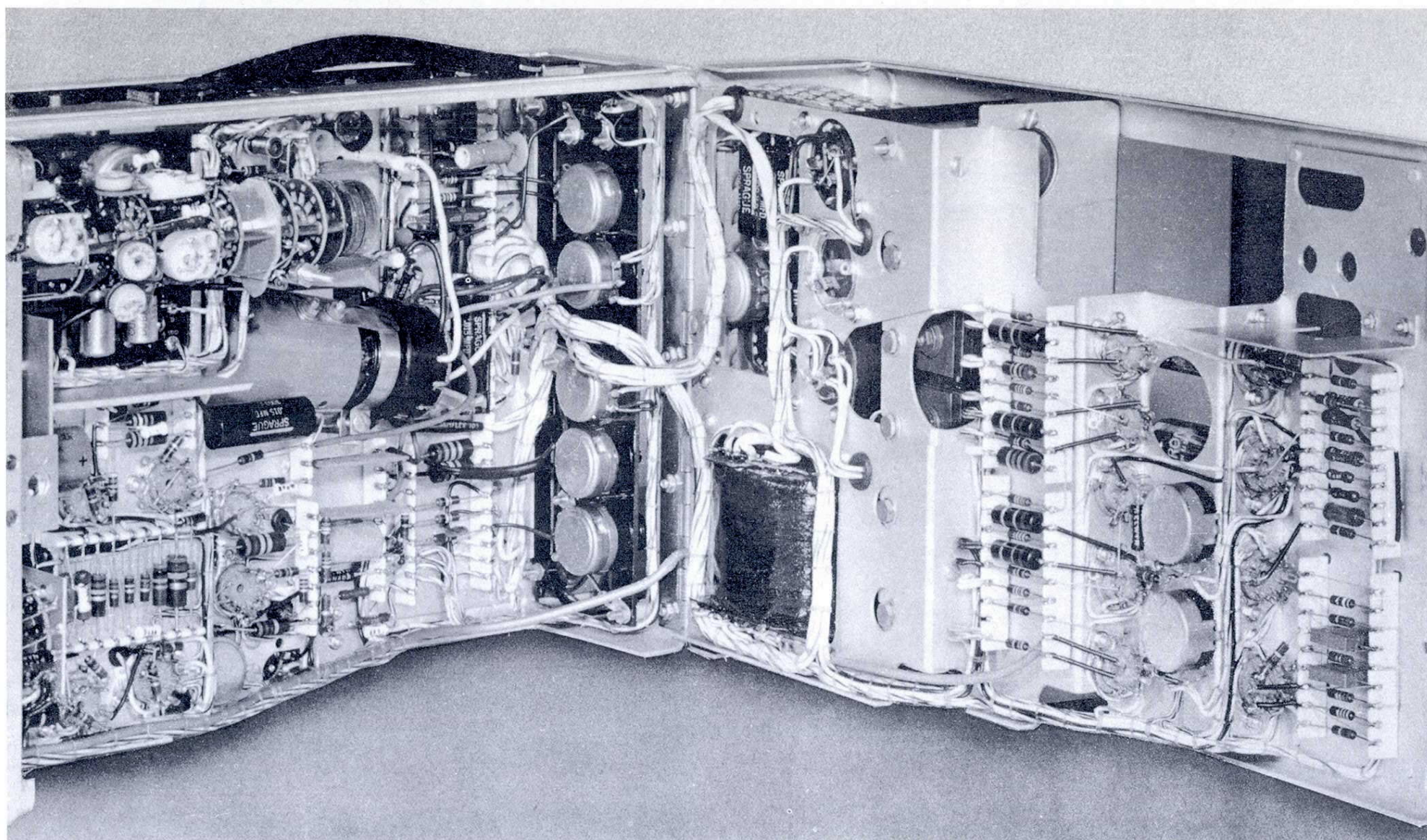
HORIZONTAL DEFLECTION SYSTEM

Wide Sweep Range—18 calibrated, fixed sweeps, accurate within 3%, are provided. Calibrated sweeps are: 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 μ sec/div, . . . 1, 2, 5, 10, 20, 50 msec/div, . . . 0.1, 0.2 sec/div. A variable uncalibrated control provides a continuous sweep range from 0.5 μ sec/div to 0.6 sec/div.

Sweep Magnifier—Sweep magnification is obtained by increasing the gain of the sweep-output amplifier by a

Tektronix, Inc.

TYPE 310 OSCILLOSCOPE



factor of 5. The center 2-division portion of the trace is expanded to 10 divisions. The HORIZONTAL POSITION control has sufficient range to display any one-fifth of the magnified sweep. The 5-x magnifier applied to the 0.5- μ sec/div sweep extends the calibrated range to 0.1 μ sec/div. Accuracy of the 5-x sweep magnifier is within 3% on all ranges except on the 0.5 μ sec/div range where accuracy is within 5%.

DC-Coupled Unblanking—The unblanking waveform is dc-coupled to the control grid of the cathode-ray tube. This assures uniform bias for all sweep speeds and repetition rates.

Automatic Triggering—With the control in the AUTO position, the sweep will be triggered by any recurrent incoming signal from 60 cycles to 2 megacycles. Signals differing in frequency, amplitude, and shape can be observed without readjustment of the triggering controls. In the absence of an input signal, the sweep is automatically triggered at approximately a 50-cycle rate, providing a reference trace on the screen.

Trigger Selection—A coaxial control permits triggering from either the positive or negative slopes of internal, external, or line voltage signals; and selection of ac- or dc-coupling through the triggering circuits, or automatic triggering.

Triggering Level—The TRIGGERING LEVEL control selects the amplitude level where triggering occurs. It permits triggering the sweep at a selected level on simple or complex waveforms.

Trigger Requirements—Internal triggering—a signal large enough to produce a one-half division deflection. External—a signal of 50 mv to ± 20 v.

Horizontal Input—A back-panel terminal permits use of an external signal to drive the horizontal amplifier. Sensitivity is 1.2 v/div.

OTHER FEATURES

Voltage Calibrator—A square-wave voltage is available through a front-panel uhf connector. Eleven fixed voltages—0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 volts peak-to-peak—are provided. Accuracy is within 3%. Square-wave frequency is approximately 1 kc.

Accelerating Potential—1.85-kv accelerating potential, electronically regulated, is applied to the flat-faced 3WP2 cathode-ray tube.

Regulated Power Supply—Electronically-regulated dc supplies insure stable operation over line variations of 105-125 v, 60 to 800 cycles.

Illuminated Graticule—The edge-lighted graticule has 8 vertical and 10 horizontal $\frac{1}{4}$ -inch divisions. Illumination is controlled by a front-panel knob. An appropriate filter is provided to increase contrast when viewing in a brightly-lighted room.

Hinged Chassis—The Type 310 opens up to permit easy accessibility to all tubes and components.

Front-Panel Light—A jewel light indicates when the vertical-sensitivity and sweep-speed controls are set in uncalibrated positions.

Tektronix, Inc.

TYPE 310 OSCILLOSCOPE

VACUUM TUBE COMPLEMENT

| | | |
|--|-----|-------|
| Vertical preamplifier | 2 | 6AU6 |
| Pre-amp cathode follower | | 6BH6 |
| Vertical input amplifier | 2 | 6AU6 |
| Driver cathode follower | | 6BQ7 |
| Vertical output amplifier | 2 | 6CL6 |
| Internal trigger cathode follower | | 6BH6 |
| Trigger amplifier | | 6U8 |
| Trigger shaper | | 6U8 |
| Holdoff cathode followers | | 12AT7 |
| Minus multivibrator | | 6BH6 |
| Plus multivibrator | 1/2 | 6BQ7 |
| Unblanking cathode follower | 1/2 | 6BQ7 |
| Disconnect diodes | | 6AL5 |
| Sweep generator | 1/2 | 6AN8 |
| Sweep generator cathode follower | 1/2 | 6AN8 |
| Horizontal amplifier cathode follower | 1/2 | 12AT7 |
| Horizontal output amplifier | | 6BQ7 |
| External horizontal input cathode follower | 1/2 | 12AT7 |
| Calibrator multivibrator | | 6AN8 |
| Calibrator output cathode follower | | 6BH6 |
| Voltage reference | | 5651 |
| Regulator amplifiers | 3 | 6BH6 |
| Series regulators | 3 | 12B4 |
| High-voltage oscillator | | 6AQ5 |
| High-voltage regulator | | 12AT7 |
| High-voltage rectifiers | 2 | 5642 |
| Cathode-ray tube | | 3WP2 |

MECHANICAL SPECIFICATIONS

Construction—Self-contained, cabinet and chassis made of aluminum alloy. New mechanical techniques improve accessibility to components and tubes.
 Finish—Photo-etched anodized front panel, gray wrinkle cabinet.
 Dimensions—10" high, 6³/₄" wide, 17" long.
 Weight—23¹/₂ pounds.
 Power Requirements—105-125 volts, 60 to 800 cycles, 175 watts.

Type 310 Cathode-Ray Oscilloscope \$595

Includes: 1—P5T0A Attenuator probe
 2—A510 Binding post adaptors
 1—F310-5 Green filter
 1—Instruction manual

Type 310-S1—Operates on 105-125 or 210-250 v, 50 to 800 cycles. Weight 25¹/₂ pounds.

Price \$595

Currently Available Extras

P2 crt phosphor normally furnished.
 P1, P7, P11 optional No extra charge
 Prices f.o.b. Portland (Beaverton), Oregon

TYPE 570 CHARACTERISTIC-CURVE TRACER

Pictures Dynamic Vacuum-Tube Characteristics

Displays Families of Curves on CRT Screen

Four to twelve characteristic curves per family.

Plots All Important Characteristics

Plate current against plate voltage.
Plate current against grid voltage.
Screen current against plate voltage.
Screen current against grid voltage.
Grid current against plate voltage.
Grid current against grid voltage.

Calibrated Controls

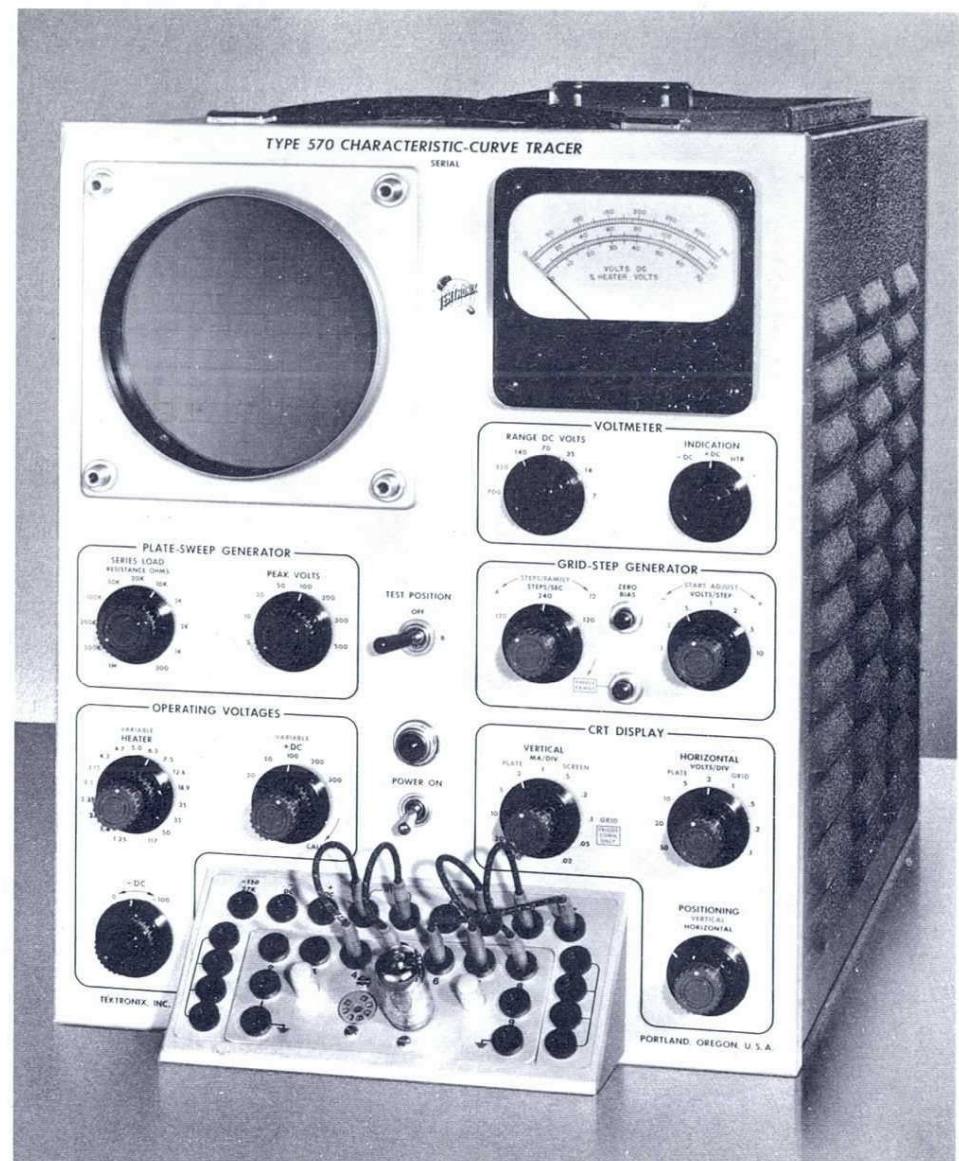
Accurate current and voltage readings directly from the crt screen.

Wide Display Range

11 current ranges from 0.02 ma/div to 50 ma/div.
9 voltage ranges from 0.1 v/div to 50 v/div.
11 series-load resistors from 300 ohms to 1 megohm.
7 grid-step values from 0.1 v/step to 10 v/step.

GENERAL DESCRIPTION

The Tektronix Type 570 Characteristic-Curve Tracer presents an accurate graphic analysis of vacuum-tube characteristics under almost any conceivable operating conditions. Circuit design can now be tailored to more



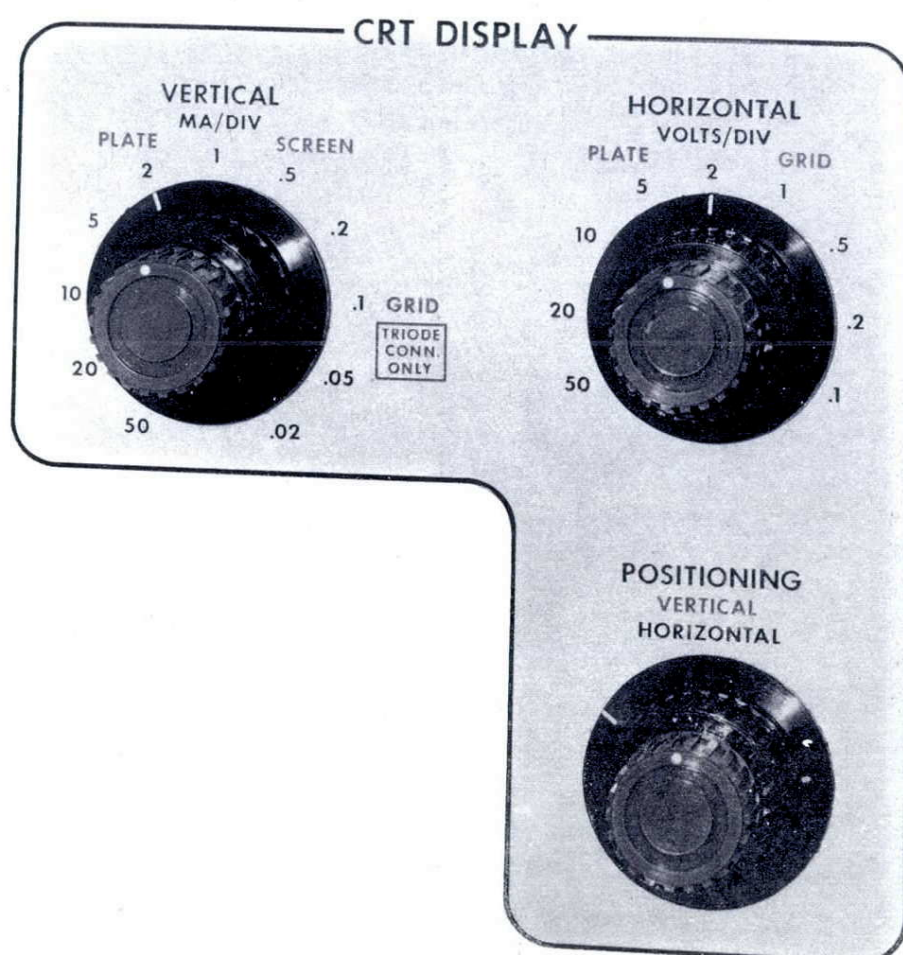
closely fit the operating characteristics of available tubes. Tubes can be selected faster and more accurately for circuits requiring other than average vacuum-tube operating characteristics. Two-socket arrangement with front-panel switching permits rapid comparisons between two tubes, or two sections of the same tube. You can also make rapid comparisons with preselected curves outlined on a crt mask. Patch-cord connector system with socket-adaptor plates gives you complete control of operating-condition setup. Various socket-adaptor plates furnished and wide range of heater voltages available fit the requirements of practically all receiving-type vacuum tubes.

CATHODE-RAY-TUBE DISPLAY

Vertical Axis—Concentric controls provide for selection of plate, screen, or grid current display; and selection of any one of eleven current-per-division values—0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 ma/div. A graticule divides the screen into ten vertical divisions. Calibration accuracy is within 3%, permitting accurate current readings directly from the screen.

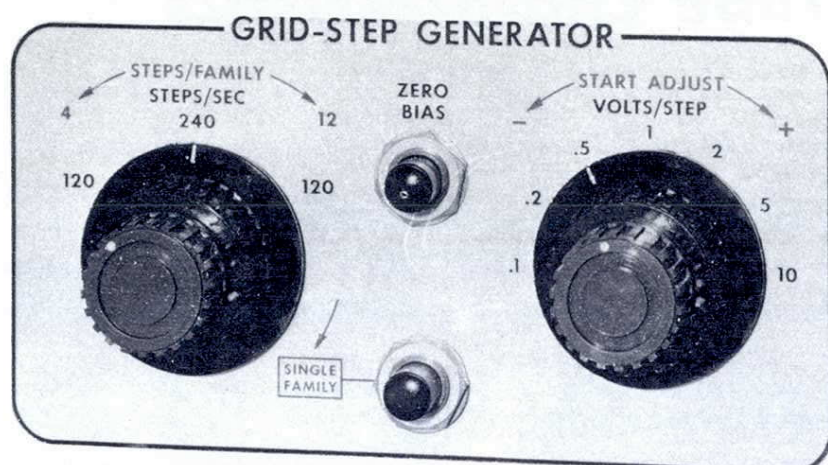
Horizontal Axis—Either plate or grid voltage can be displayed on the horizontal axis, and nine voltage-per-division values are available—0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 v/div. Ten horizontal divisions are scribed on the graticule. Calibration accuracy is within 3%, permitting accurate voltage readings directly from the screen.

Positioning—Concentric controls provide for both vertical and horizontal positioning of the display.



Tektronix, Inc.

TYPE 570 CHARACTERISTIC-CURVE TRACER



GRID-STEP GENERATOR

Family of Curves—A variable control is provided to adjust the number of curves in the display. As few as four and as many as twelve curves can be selected. A single family can be safely displayed with the tube under heavy overload conditions by means of a position on the STEPS/FAMILY control and a push button. With the STEPS/FAMILY control in the single-family position, pressing the button applies the selected conditions to the tube for only a fraction of a second. The STEPS/SEC switch controls the switching-rate of the step generator. A 120- or 240-steps/sec rate can be selected. The extra 120-steps/sec position causes switching to occur at the opposite end of the characteristic curve, for convenience when the area of interest is at either end of the curves displayed.

Bias voltage applied to the grid of the tube under test is impressed in a series of steps to produce the number of curves desired in the display. The voltage difference between steps is selected by a seven-position switch. Calibrated switch positions are: 0.1, 0.2, 0.5, 1, 2, 5, and 10 volts/step, accurate within 3%. Up to 150 ma peak grid current is available. A variable control is provided to adjust the starting point to a positive voltage, zero, or a negative voltage. Pressing the ZERO BIAS push button causes the display of the zero-bias curve only, to use as a reference in adjusting the starting point. The starting point can be adjusted to display two positive-bias curves. In order to prevent damage to the tube under test when positive-bias curves are displayed, the minimum number of curves in the display is limited to four.

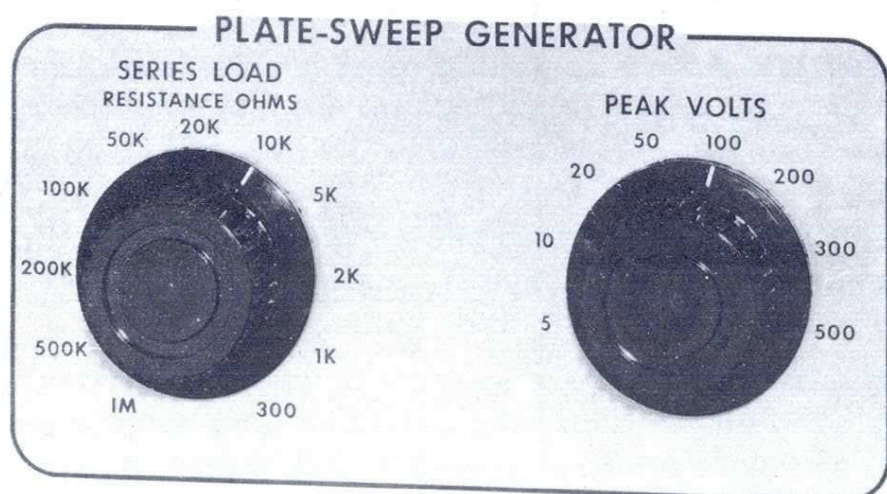


PLATE-SWEEP GENERATOR

An eleven-position switch selects the desired series-load resistance for the plate circuit of the tube under test. Series-load values are: 300 ohms, 1 k, 2 k, 5 k, 10 k, 20 k,

50 k, 100 k, 200 k, 500 k, and 1 megohm. Power-handling capacity of all load resistors is sufficient to dissipate the maximum power available in the plate circuit.

The peak voltage applied to the plate through the series-load resistance is selected by an eight-position switch. Peak voltages are: 5, 10, 20, 50, 100, 200, 300, and 500 volts.

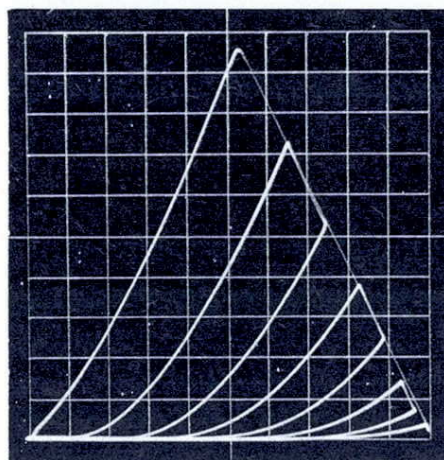


Fig. 1—Plate current plotted against plate voltage for one triode section of a 12AU7. Plate load is 5 k, peak plate-supply voltage is 500 v. Grid voltage is changed 5 v between curves, from -35 v. to zero. Vertical sensitivity is 5 ma/div, horizontal sensitivity 50 v/div. Calibrated controls permit accurate current and voltage readings directly from the screen.

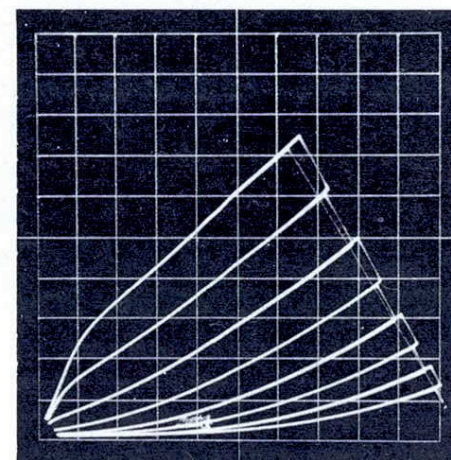
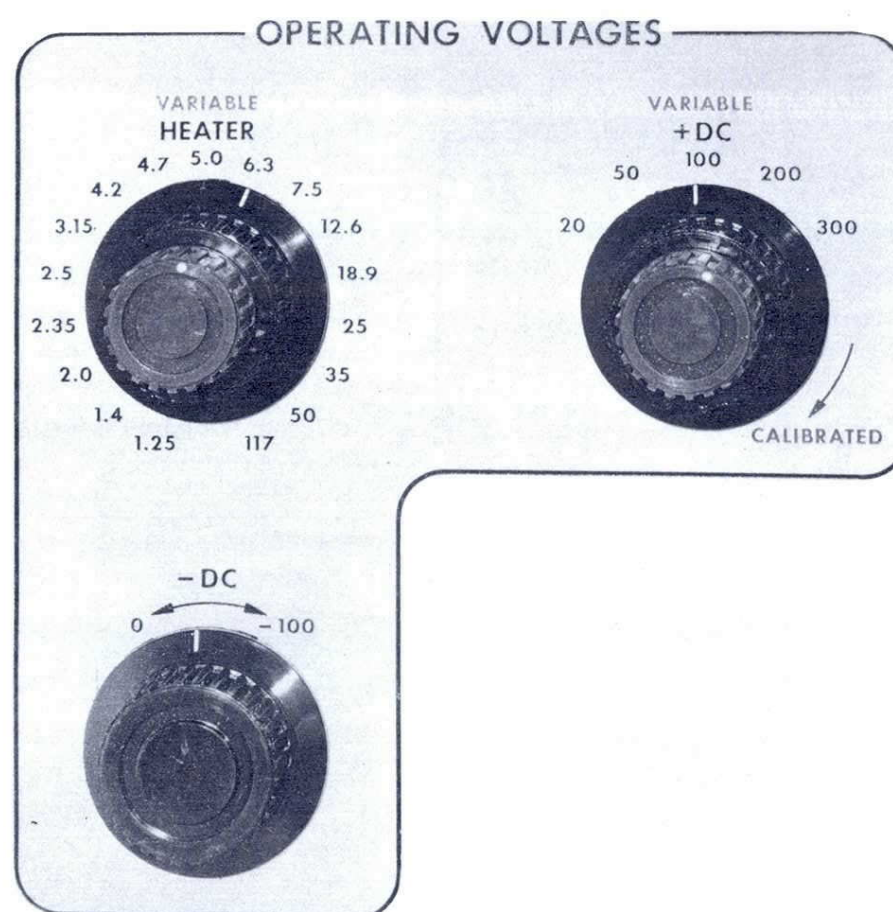


Fig. 2—Same triode section of 12AU7 with only 20-v peak plate supply and sensitivities increased to 0.2 ma/div vertical and 2 v/div horizontal. Grid voltage is changed 2 v between curves, from -14 v to zero. This is essentially a 25-times magnification of the lower left portion of Fig. 1, showing the operating characteristics at low plate-supply voltage.



OPERATING VOLTAGES

Heater voltage is available in 17 fixed steps: 1.25, 1.4, 2.0, 2.35, 2.5, 3.15, 4.2, 4.7, 5.0, 6.3, 7.5, 12.6, 18.9, 25, 35, 50, and 117 volts ac. A control permits adjusting the selected heater voltage approximately $\pm 20\%$ for simulating the effects of low or high line voltage. The variable control provides sufficient spread between steps to supply the proper heater voltage for practically all receiving-type vacuum tubes. Maximum power

TYPE 570 CHARACTERISTIC-CURVE TRACER

available from the heater transformer is 30 watts.

Positive dc voltage is available in five calibrated steps: 20, 50, 100, 200, and 300 volts, accurate within 3%. The positive voltage is also continuously variable from approximately 10 to 300 v. Up to 50 ma steady current is supplied. An adequate reserve is available for higher peak currents.

Negative dc voltage is available, continuously variable from 0 to -100 v. The negative dc supply is capable of delivering up to 1 watt.

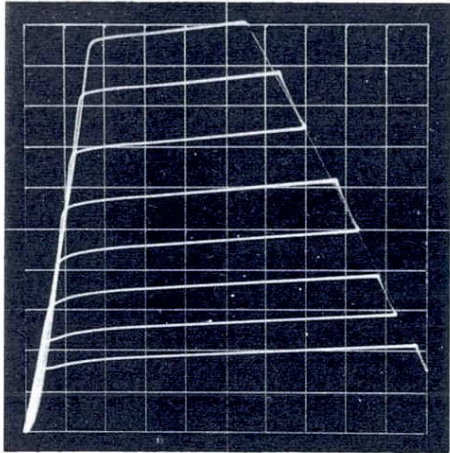


Fig. 3—Typical pentode E_p-I_p curves. Plate load 10 k, peak plate-supply approximately 200 v, grid voltage changing 0.2 v/step from -1 v to +0.4 v, screen voltage 70 v, vertical sensitivity 1 ma/div, horizontal sensitivity 20 v/div.

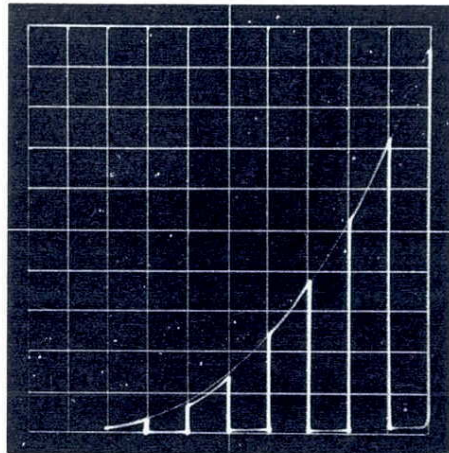


Fig. 4—Typical triode E_g-I_p curves. Plate load 5 k, peak plate-supply voltage 500 v, grid voltage changing 5 v/step from -35 v to zero, vertical sensitivity 5 ma/div, horizontal sensitivity 5 v/div.

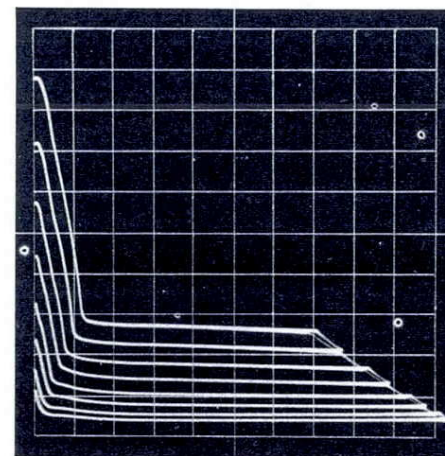
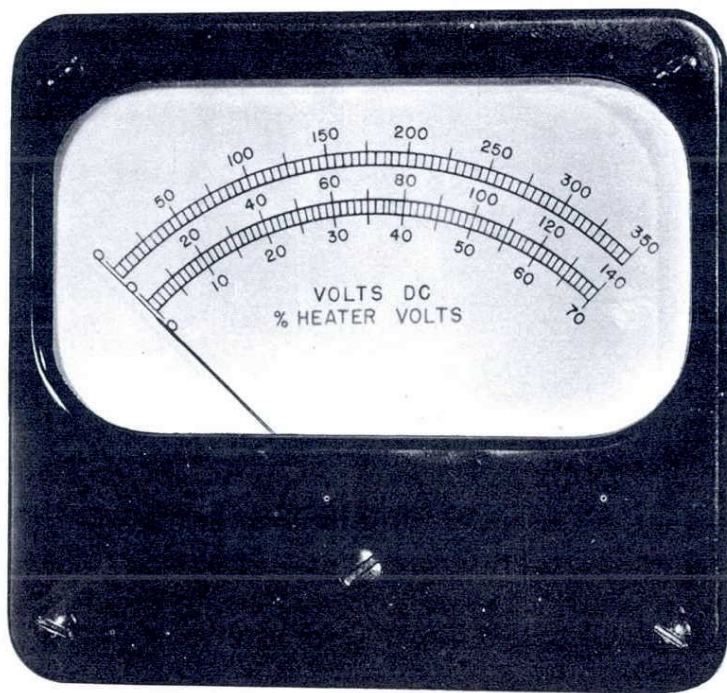


Fig. 5—Typical pentode E_p-I_p curves. Here screen-grid current is plotted against plate voltage. Plate load 10 k, peak plate-supply voltage 200 v, grid voltage changing 0.2 v/step from -1 v to +0.4 v, screen voltage 70 v, vertical sensitivity 1 ma/div, horizontal sensitivity 20 v/div.

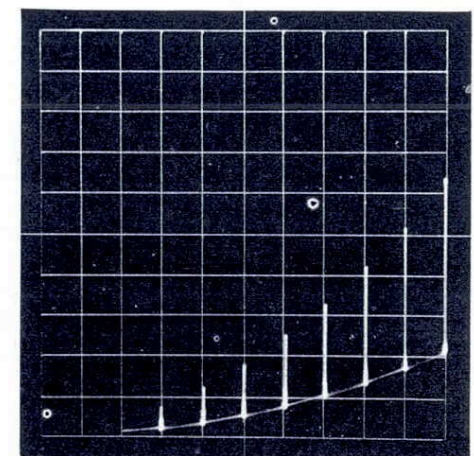
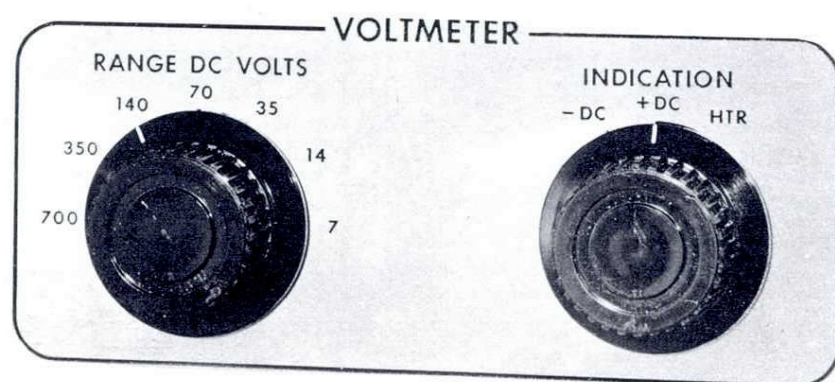


Fig. 6—Typical pentode E_g-I_p curves. Plate load 2 k, peak plate-supply voltage 200 v, grid voltage changing 0.5 v/step from -3.5 to zero, screen voltage 200 v, vertical sensitivity 5 ma/div, horizontal sensitivity 0.5 v/div.



VOLTMETER

The built-in voltmeter indicates the positive and negative operating voltages in seven ranges: 0 to 7, 14, 35, 70, 140, 350, 700 volts, accurate within 2% of full scale. The voltmeter can be switched to show the percent of heater voltage indicated by the heater-voltage selector switch.

ADAPTER PLATES

Eight quick-changing adapter plates are furnished with the Type 570... 2 with octal sockets, 2 with nine-pin miniature sockets, 2 with seven-pin miniature sockets, and 2 with pilot holes only. Plate receptacle holds any two adapter plates at the same time. Small banana jacks connect to each socket terminal. Twenty patch cords with plug-and-socket connectors on both ends are also furnished, making it possible to connect any tube element to any voltage supplied by the instrument.

OTHER FEATURES

Tube-Socket Switching—The TEST POSITION switch in the center of the front panel is used to switch in either of two vacuum tubes during comparison tests. It has an OFF position for changing tubes and for establishing a reference trace on the screen. Control-grid potential drops to -150 v in the off position.

Regulated Power Supply—Electronic voltage regulation is used to compensate for line-voltage changes between 105 and 125 volts or 210 and 250 volts, and for variations in loading. All voltages affecting calibrations are fully regulated. Heater, negative-dc, and peak-plate supplies are unregulated.

Cathode-Ray Tube—A 5ABP cathode-ray tube is used in the Type 570. Accelerating potential is approximately 3 kv. A P1 phosphor is supplied unless a P7 or P11 phosphor is specifically requested.

Illuminated Graticule—The 10 x 10-division graticule is edge-lighted. Illumination control and focus, intensity, and astigmatism controls are accessible through a door in the top of the cabinet.

TYPE 570 CHARACTERISTIC-CURVE TRACER

VACUUM TUBE COMPLEMENT

| | | |
|--|---|-------|
| Split-load phase inverters and shaper amplifiers | 2 | 6AN8 |
| Rectifiers | 2 | 6AL5 |
| Cathode follower and step-control CF | | 12AT7 |
| Clamp and coupling diode | | 6AL5 |
| Grid-step generator | | 6AU6 |
| Step-generator cathode followers | | 12AT7 |
| Step multivibrator | | 6AN8 |
| Disconnect diodes | | 6AL5 |
| Step amplifiers | 2 | 6AU6 |
| Step amplifier | | 12AT7 |
| Cathode follower | | 12AU7 |
| Plate power-supply rectifiers | 2 | 6AX4 |
| Rectifier diodes | | 6AL5 |
| Horizontal-deflection amplifiers | 2 | 6AU6 |
| Horizontal-deflection amplifier CF | | 6BQ7A |
| Horizontal-deflection output amplifiers | | 6BQ7A |
| Vertical-deflection amplifiers | 2 | 6AU6 |
| Vertical-deflection amplifier CF | | 6BQ7A |
| Vertical-deflection output amplifiers | | 6BQ7A |
| Variable dc-supply rectifier | | 6AX5 |
| Fixed dc-supply rectifiers | 3 | 6X4 |
| Regulator amplifiers | 2 | 6AU6 |
| Voltage reference | | 5651 |
| Regulator amplifier and series regulator | | 6AN8 |

| | | |
|--------------------------------------|---|-------|
| Regulator amplifier | | 6AN8 |
| Series regulators | 2 | 12B4 |
| Series regulator | | 6L6GA |
| Variable dc-supply CF | | 12AT7 |
| High-voltage oscillator | | 6AQ5 |
| Regulator amplifier and CF | | 12AU7 |
| High-voltage rectifiers | 2 | 5642 |
| Cathode-ray tube | | 5ABP1 |

MECHANICAL SPECIFICATIONS

Ventilation—Filtered, forced-air ventilation maintains safe operating temperatures.

Construction—Aluminum alloy chassis and cabinet.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Dimensions—16½" high, 13" wide, 24½" deep.

Weight—67 pounds.

Power Requirements—105-125 or 210-250 v, 50 or 60 cycles, 200 watts.

Price—\$925 f.o.b. Portland (Beaverton), Oregon

Includes: 8 adapter plates
20 patch cords

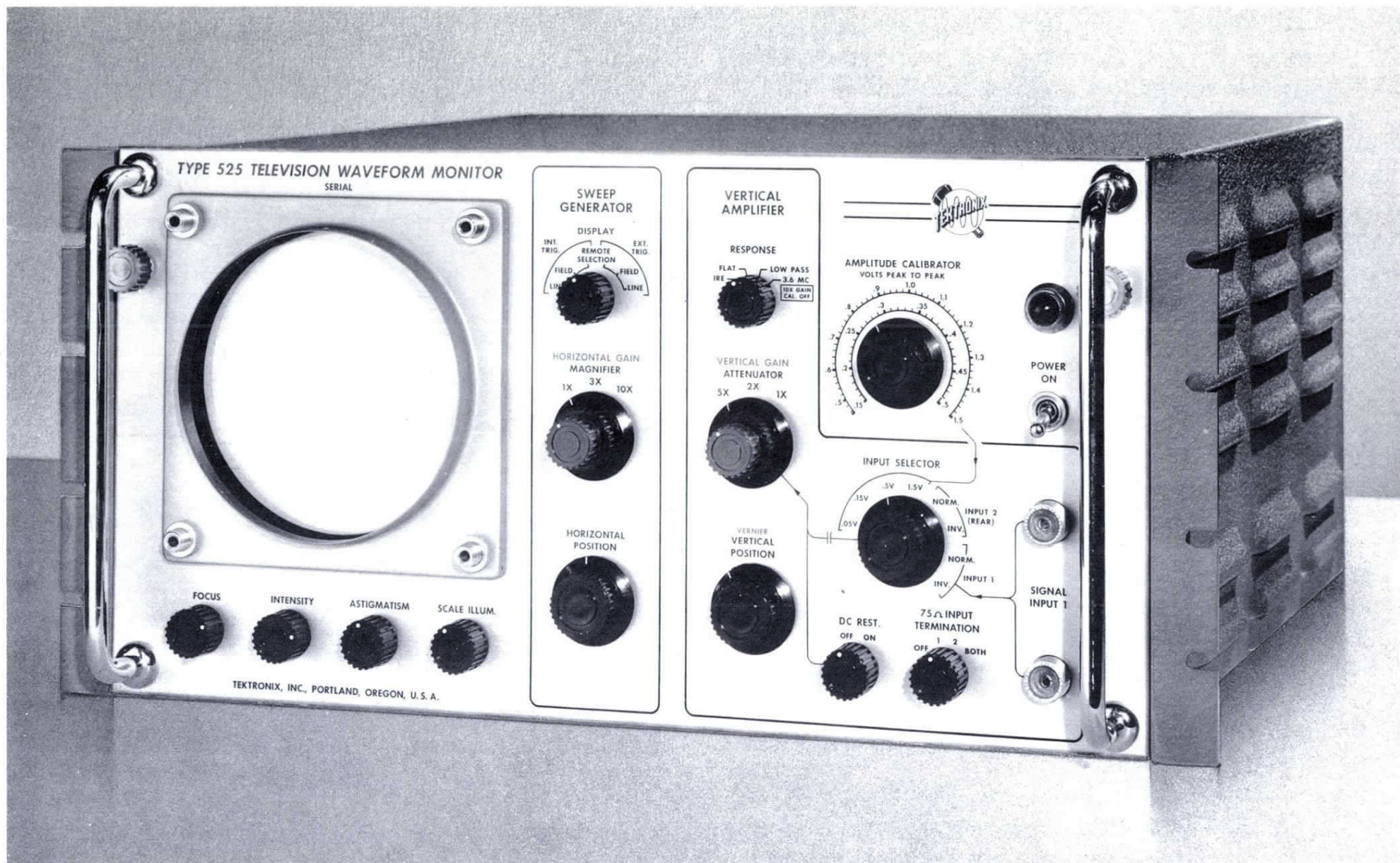
Currently Available Extras

P1 crt phosphor normally furnished.

P7, P11 optional No extra charge

TYPE 525 TELEVISION WAVEFORM MONITOR

for Monochrome and Color Telecasters



Frequency Response

Flat—within 1% between 60 cycles and 5 mc.

Low Pass—passes stair steps, eliminating high frequencies.

3.6 Mc—passes high frequencies, eliminating stair steps.

IRE—meets IRE standards for level measurements.

Excellent Linearity

Insures accurate color signal linearity measurements.

Automatically-Synchronized Sweeps

Both field and line rates.

Keyed Clamp-Type DC Restorer

Gain Stability Within 1%

GENERAL DESCRIPTION

The Tektronix Type 525 Television Waveform Monitor displays the composite video waveform with the precision required for all television broadcasting. Exacting demands of the color-television broadcaster for an accurate display of signal linearity, level, and bandwidth are fulfilled with the Type 525.

Special features of the Type 525: Four vertical-amplifier response characteristics, automatically-synchronized sweeps at line or field rate, bridging or terminating signal inputs, keyed dc restorer, stable gain characteristics. Simplicity of controls aids in easy monitor operation.

VERTICAL DEFLECTION SYSTEM

Frequency Response—A response selector switch selects any one of four characteristics: IRE, with high-frequency cutoff about 2 mc in accordance with IRE standards for level measurements; flat, within 1%, between 60 cycles and 5 mc; low pass, passes the stair steps but eliminates the high frequencies; 3.6 mc, with approximately 10x increase in gain, which excludes the stair steps but passes the high frequencies for linearity tests.

Sensitivity—The basic sensitivity of the vertical amplifier is 0.015 v/cm. A three-step attenuator, 1x, 2x, 5x, and variable gain control can adjust the waveform to fill the graticule.

Stability—Electronic regulation of all dc power, and use of current stabilization in the amplifier, maintains stability and constant gain. Minimum adjustment of the monitor is required after it is once set. Gain stability is within 1% over a ten-hour period.

Linearity—The vertical amplifier linearity is well above the requirements for highly accurate color-television video signal linearity measurements. Signals can be expanded to the equivalent of 35 cm, with any 7 cm accurately displayed on the screen.

DC Restorer—A clamp circuit, keyed by a pulse derived from the sync-separator circuit, restores the dc level of the display to the tip of the sync pulse at each line-frequency pulse. The restorer can be switched in or out as desired.

Tektronix, Inc.

TYPE 525 TELEVISION WAVEFORM MONITOR

Input Connectors—Two UHF coaxial input connectors, paralleled to permit bridging, are available at the rear of the instrument to connect video signals to the vertical-deflection system. Two additional paralleled coaxial connectors are available on the front panel. A front-panel switch connects the vertical-deflection system either to the rear or to the front pair of connectors and provides a choice of either polarity in the display. A second front-panel switch inserts or removes 75-ohm terminations at the connectors so that the monitor can either bridge the video circuit or terminate it. You can connect the monitor permanently into the system at the back panel and still have convenient front-panel access to the monitor for other observations.

HORIZONTAL DEFLECTION SYSTEM

Sync Separator—A sync-separator circuit receives the composite video signal either internally from a point on the vertical amplifier, or through an external-trigger connector located at the rear of the instrument.

Field and Line Speeds—The sweep will synchronize automatically with either line or field pulses. Sweep frequencies correspond to 7875 cycles for line and 30 cycles for field frequencies. A front-panel switch selects one or the other sweep frequency through a relay, or connects an external circuit to the relay coil for remotely selecting one or the other sweep frequency.

Variable Horizontal Gain, Magnifier—A horizontal-gain control adjusts the width of the sweep about a point on the screen selected by the horizontal-positioning control. A three-position switch selects accurate magnification of the sweep by 1x, 3x, or 10x, and the width is set by the variable-gain control. Magnification expands the portion of the sweep that is centered, equally to right and left of screen center.

OTHER CHARACTERISTICS

Amplitude Calibrator—The calibrator provides pulses with a duty cycle of about 75%, and with amplitudes between .015 volts and 1.5 volts, peak-to-peak, continuously adjustable in four ranges, 0.05, 0.15, 0.5, and 1.5 volts. Full scale for each range is accurate within 1%. The continuously-adjustable interpolating control is linear within 1%. Voltages can be set within 2% above half scale and within 3% below half scale on the interpolating dial.

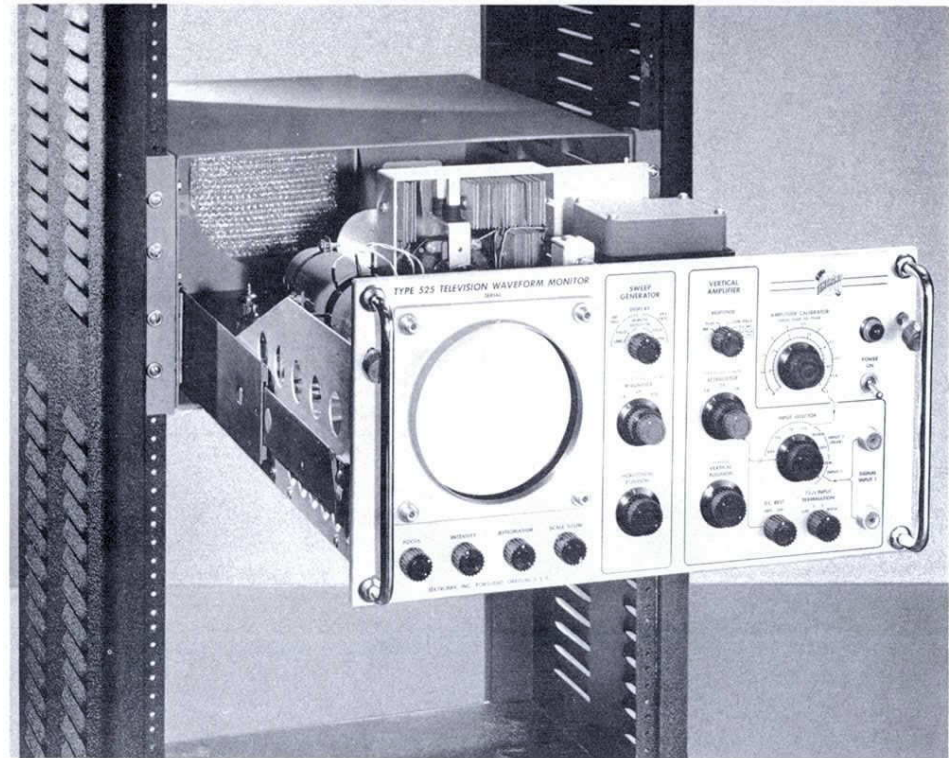
Cathode-Ray Tube—The T52P, a new Tektronix CRT, is used in the Type 525. The 52P is a precision 5" flat-faced tube with a helical post-accelerating anode, providing 8 cm of linear vertical deflection. 4-kv accelerating potential provides a bright trace. A P1 phosphor is provided, although other phosphors are available upon request.

Regulated Power Supply—DC power supplies are regulated to maintain constant dc voltages for changes in load, and for ac input voltages between 105 and 125 volts, or 210 and 250 volts, 50 to 60 cycles.

Illuminated Graticule—An edge-illuminated graticule is marked in percentage, to +100 and -40. Each centimeter division equals 20%. Illumination is controlled by a front-panel knob.

Accessibility—The Type 525 cabinet is designed for standard rack mounting. Chassis is attached to the cabinet with a slide-out mounting that permits it to be tilted vertically, providing easy access to all components.

Internal Adjustments—Internal-adjustment controls, which may require readjustment occasionally, are mounted on the left of the chassis near the front, easily accessible to the operator from his position in front of the instrument by sliding the monitor partly out of the case.

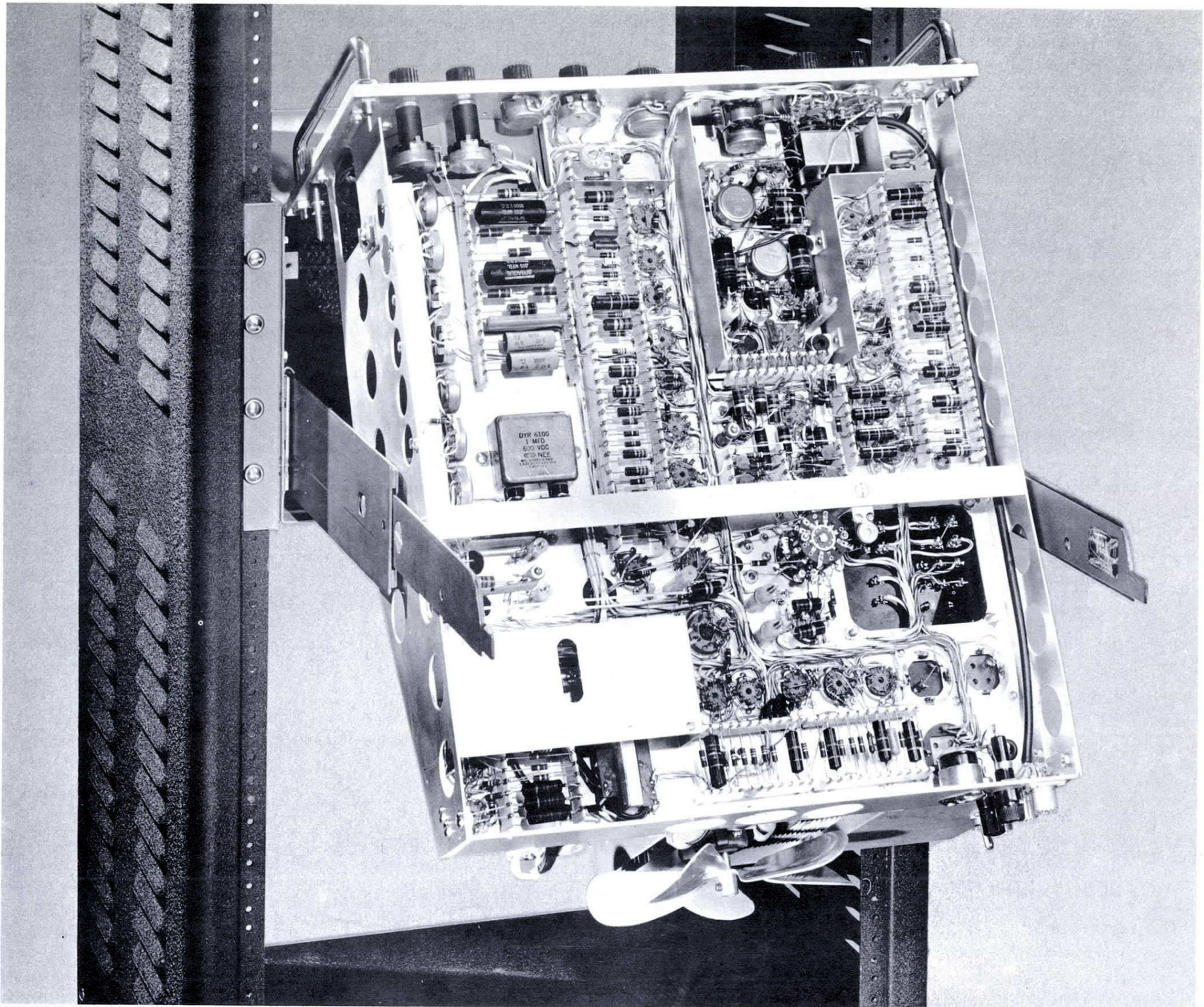


VACUUM TUBE COMPLEMENT

| | | |
|---|---|-------|
| Vertical phase splitter amplifier | 2 | 6AU6 |
| Cathode followers | | 6BQ7A |
| Preamplifier | 2 | 6CL6 |
| Preamplifier output CF | | 6BQ7A |
| Cathode followers | | 6BQ7A |
| Keyed-clamp diodes | 2 | 6AL5 |
| High-pass amplifier | | 6BQ7A |
| Cathode followers | | 6BQ7A |
| Output amplifier | 2 | 6CL6 |
| Internal trigger inverter | | 6U8 |
| External trigger inverter | | 6U8 |
| Sync-separator and relay control | | 6U8 |
| Cathode followers | | 6BQ7A |
| Keying-pulse pickoff and shaper | | 6U8 |
| Keying-pulse shaper and shaper-splitter | | 6U8 |
| Disconnect and clamp diode | | 6AL5 |
| Clamp diode and unblanking CF | | 6BQ7A |
| Phantastron sweep generator | | 6AS6 |
| Cathode followers | | 6BQ7A |
| Sweep amplifier | | 6BQ7A |
| Cathode followers | | 6BQ7A |
| Sweep output amplifier | | 6BQ7A |
| Cal multivibrator and CF | | 6BQ7A |
| Cal multivibrator and amplifier | | 6BQ7A |
| Calibrator clamp and CF | | 6BQ7A |
| Voltage reference tube | | 5651 |
| Comparator | | 12AT7 |
| Comparator | | 6U8 |
| Regulator amplifier and CF | | 6U8 |
| Series regulator | | 12B4 |
| Series regulator | | 6080 |

Tektronix, Inc.

TYPE 525 TELEVISION WAVEFORM MONITOR



| | |
|--|--------|
| High-voltage oscillator | 6AQ5 |
| Voltage reference CF and regulator | 12AU7 |
| Comparator | 6U8 |
| High-voltage rectifiers | 3 5642 |
| Cathode-ray tube | T52P1 |

MECHANICAL SPECIFICATIONS

Mounting—Cabinet designed to mount in a relay rack. Chassis slides forward out of the cabinet and tilts up for convenience in servicing.

Shock Mount—High-gain stages of the vertical amplifier are shock mounted to reduce vacuum-tube microphonics.

Ventilation—Safe operating temperature is maintained by filtered, forced-air ventilation.

Construction—Aluminum alloy cabinet and chassis.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Dimensions — 8-23/32" high, 19" wide, 20 3/4" rack depth, 22 1/4" overall.

Weight—54 pounds.

Power Requirements—105-125 or 210-250 v, 50-60 cycles, 380 watts.

Price—\$900 f.o.b. Portland (Beaverton), Oregon

Includes: 1—F510-5 green filter
1—Instruction manual

\$1050. (see memo 6/21/55)

Currently Available Extras

P1 crt phosphor normally furnished,
P7, P11 optional No extra charge

Tektronix, Inc.

TYPE 360 INDICATOR

Vertical Passband

DC to 500 kc.

Calibrated Vertical Sensitivity

0.05 v/div to 50 v/div.

Waveform Requirements

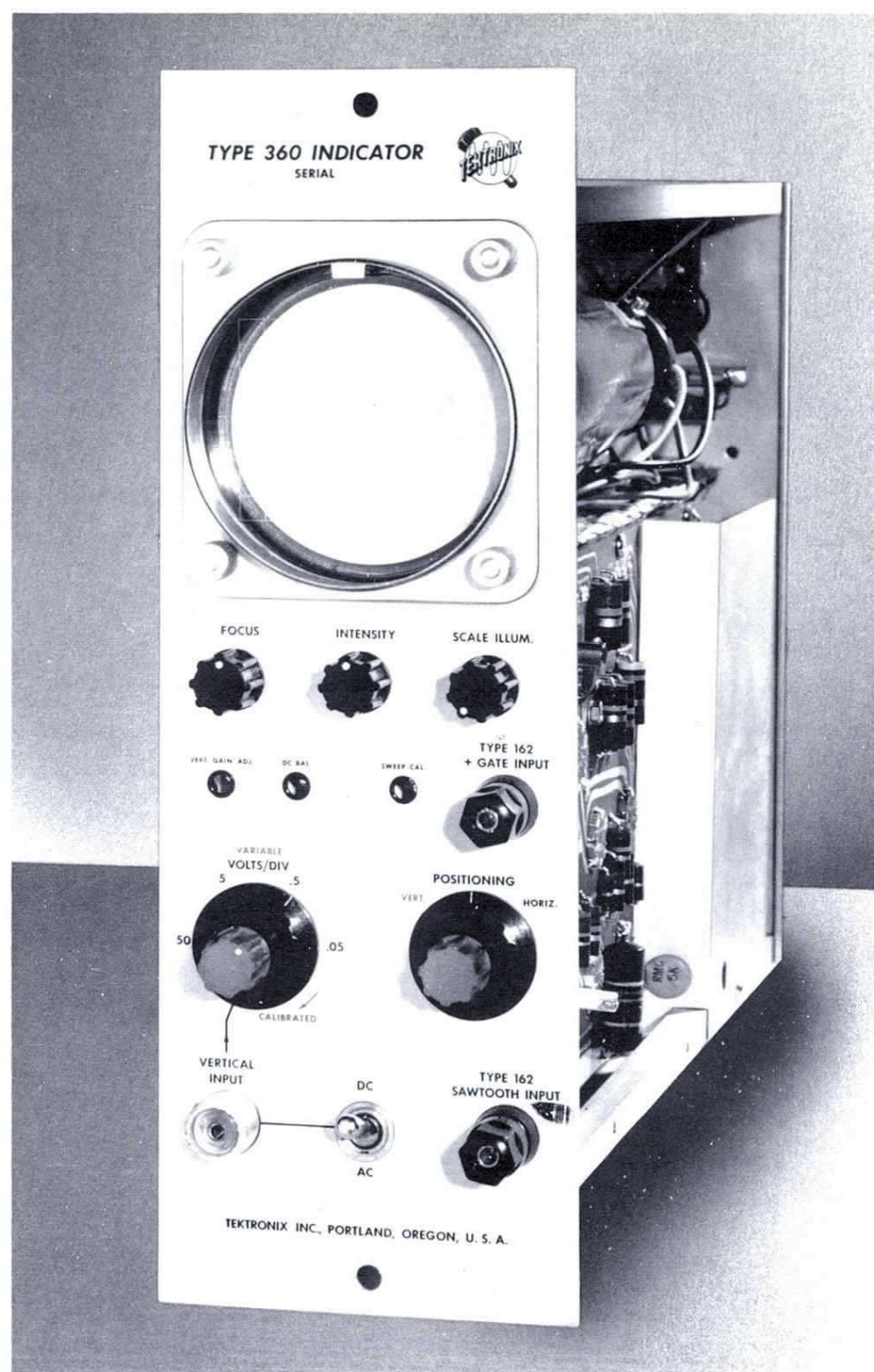
Output waveforms of Tektronix Type 162 . . . 50-v positive unblanking pulse, and 120 to 140 v negative-going sawtooth starting at +150 or +160 v.

Power Requirements

- + 300 v dc unregulated at 20 ma.
- + 225 v dc regulated at 35 ma.
- 170 v dc regulated at 15 ma.
- 6.3 v ac at 3 amps.

GENERAL DESCRIPTION

The Tektronix Type 360 Indicator contains a 3" flat-faced crt, accelerating voltage supply, vertical amplifier with a sensitivity of 0.05 v/div and a calibrated vertical attenuator. It is designed to be powered by a Tektronix Type 160 or 160A Power Supply and to receive its sweep and unblanking voltages from a Tektronix Type 162 Waveform Generator; it can, however, be operated from any source of the proper voltages and waveforms. A Type 360 is well adapted to take the place of a bulkier general purpose oscilloscope in single monitoring applications; or several can be used along with Tektronix Type 160 Units as building blocks in a complex sequence-control and monitoring system. Several Type 360 Indicators can be driven by a single Type 162 Unit, and a simple Type 161-Type 162 hookup provides calibrated sweep delay. For low-level applications a Tektronix Type 122 Preamplifier provides increased sensitivity to 50 microvolts/div. A single Type 160A can supply power to five Type 360 Units. Three Type 360 Units can be powered by a Type 160 (predecessor to Type 160A) Power Supply.



VERTICAL DEFLECTION SYSTEM

DC-Coupled Amplifier—Frequency response of the calibrated vertical amplifier is dc to 500 kc. An AC-DC switch is provided to insert a blocking capacitor in the input when ac-coupling is desired.

Calibrated Sensitivity—Four positions . . . 0.05, 0.5, 5, and 50 v/div. A variable attenuator fills in between steps, making the sensitivity continuously variable from 0.05 v/cm to 500 v/cm.

Signal Input—A front-panel uhf connector is provided for the input signal. Input impedance is 1 megohm paralleled by approximately 40 μ f.

HORIZONTAL DEFLECTION SYSTEM

Input Waveforms—A 50-volt positive unblanking waveform having the same duration as the sweep waveform, and a 120 to 140-volt negative-going sawtooth, starting at +150 to +160 volts, are required to operate the Type 360. The Type 162 Waveform Generator, or any other source of waveforms at the necessary dc levels, is

Tektronix, Inc.

TYPE 360 INDICATOR

required to supply the horizontal deflection system of the Type 360.

Horizontal Calibration—A screwdriver adjustment provides a means of calibrating the sweep.

OTHER CHARACTERISTICS

Cathode-Ray Tube—Accelerating potential of 1.5 kv is supplied to the 3WP crt. A P2 phosphor is normally furnished, but others are available upon request.

DC-Coupled Unblanking—The external unblanking waveform is dc-coupled to the grid of the crt, assuring uniform bias for all sweep speeds and repetition rates.

Illuminated Graticule—An edge-lighted graticule is marked 10-horizontal, 8-vertical quarter-inch divisions. Illumination is controlled by a front-panel knob.

VACUUM TUBE COMPLEMENT

| | | |
|--|---|------|
| Vertical input amplifiers | 2 | 6AU6 |
| Vertical output amplifiers | 2 | 6AU6 |
| Sawtooth CF and voltage setting CF | | 6BQ7 |

| | |
|---|--------|
| Horizontal feedback amplifier | 6AU6 |
| High-voltage oscillator | 6AQ5 |
| High-voltage regulator | 12AT7 |
| High-voltage rectifiers | 2 5642 |

MECHANICAL SPECIFICATIONS

Mounting — Adapted to rack mounting by Tektronix Type FA160 Mounting Frame.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Dimensions—4½" wide, 12¼" high, 16" deep.

Weight—9 pounds.

Price—\$195 f.o.b. Portland (Beaverton), Oregon

Includes: 1—P510A attenuator probe.

1—W160-10 connecting cable.

Currently Available Extras

P2 crt phosphor normally furnished.

P1, P7, P11 optional No extra charge

TYPE 181 TIME-MARK GENERATOR

A Portable, Accurate Time-Mark Source

Five Time-Mark Intervals

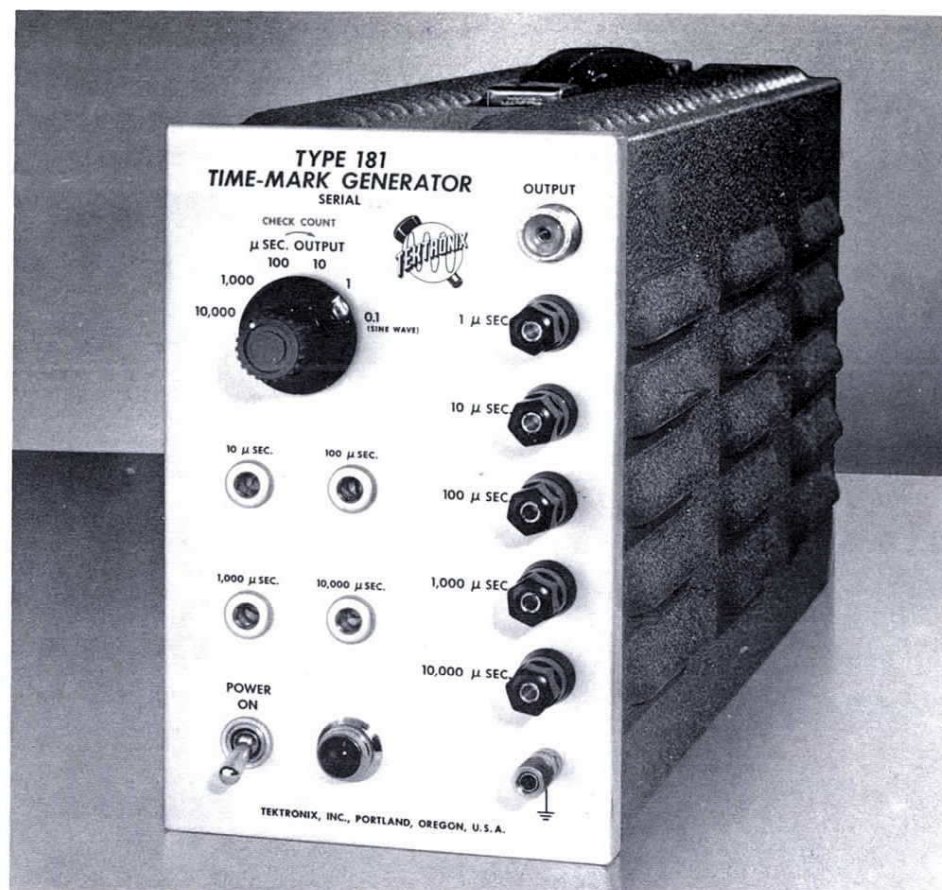
1, 10, 100, 1000, and 10,000 microseconds, plus 10 mc sine wave.

Small Size

8³/₄" high, 5⁵/₈" wide, 17¹/₂" deep.

Low Weight

Only 17¹/₂ pounds.



GENERAL DESCRIPTION

The Type 181 provides accurate markers that can be displayed on an oscilloscope for sweep calibration or comparison time measurements. All six outputs are available at a common coax connector through use of a selector switch. The five time markers are also available separately at front-panel binding posts for convenient utilization as trigger impulses, or for other purposes.

All outputs are derived from a 1-mc crystal-controlled oscillator with a frequency tolerance of about 0.03% and a short time stability, after initial warmup, of about 0.005% per hour. For applications requiring greater stability, a directly interchangeable crystal is available. This plug-in accessory crystal is mounted in a temperature-controlled oven, and provides a stability of 2 parts per million over a 24-hour period.

OTHER CHARACTERISTICS

Nominal Output Values

| Marker | Amplitude | Risetime | Impedance |
|-------------|-----------|-----------|-----------|
| 0.1 μsec | 2 v | sine wave | 150 ohms |
| 1 μsec | 2 v | 0.05 μsec | 80 ohms |
| 10 μsec | 2 v | 0.13 μsec | 80 ohms |
| 100 μsec | 2 v | 0.2 μsec | 80 ohms |
| 1000 μsec | 2 v | 0.4 μsec | 80 ohms |
| 10,000 μsec | 2 v | 0.4 μsec | 80 ohms |

Regulation—DC voltages are electronically regulated.

Power Requirements—105 to 125 or 210 to 250 volts, 50 to 60 cycles, 100 watts.

VACUUM TUBE COMPLEMENT

| | | |
|--|---|-------|
| Oscillator | 4 | 6AU6 |
| Shaper and multiplier | | 6AN8 |
| Buffer and amplifier | | 6AN8 |
| Disconnect and limiting diodes | 4 | 6AL5 |
| Frequency dividers | 4 | 6BQ7A |
| Output CF | 2 | 12AU7 |
| Rectifier | | 6AX5 |
| Rectifier | | 6X4 |
| Voltage reference | | 5651 |
| Regulator amplifiers | 2 | 6AU6 |
| Series regulators | 2 | 12B4 |

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Size—8³/₄" high, 5⁵/₈" wide, 17¹/₂" deep.

Weight—17¹/₂ pounds.

Price **\$225.00**

Includes: 1—P93 output cable
1—Instruction manual
1—W130B lead
1—W130R lead

Recommended Additional Accessories

Type CO181 Crystal-Oven Combination—A 1-mc crystal mounted in a temperature-stabilized oven. Directly interchangeable with standard crystal. Plugs into crystal socket of the Type 181—no wiring changes necessary. Provides a frequency stability of 2 ppm over a 24-hour period. \$27.00

Prices f.o.b. Portland (Beaverton), Oregon.

Tektronix, Inc.



CATHODE-RAY OSCILLOSCOPES

Every Tektronix Oscilloscope is, from its inception, considered to be a specialized extension of the operator's senses. It is engineered to the highest standards of electronic circuit design, and arranged for maximum operator efficiency. Each instrument is built to conform to the distinctive Tektronix "look" as well as to strict standards of instrument design and layout.

TYPE 530 SERIES OSCILLOSCOPES

TYPE 531 CATHODE-RAY OSCILLOSCOPE

Wide Range of Vertical-Amplifier Characteristics

Instant convertibility through changing plug-in preamplifiers.

Excellent Transient Response

Main-unit vertical-amplifier risetime— $0.03 \mu\text{sec}$.

600,000,000 to 1 Sweep Range

$0.02 \mu\text{sec/cm}$ to 12 sec/cm .

10-KV Accelerating Potential

Brighter display at low repetition rates.

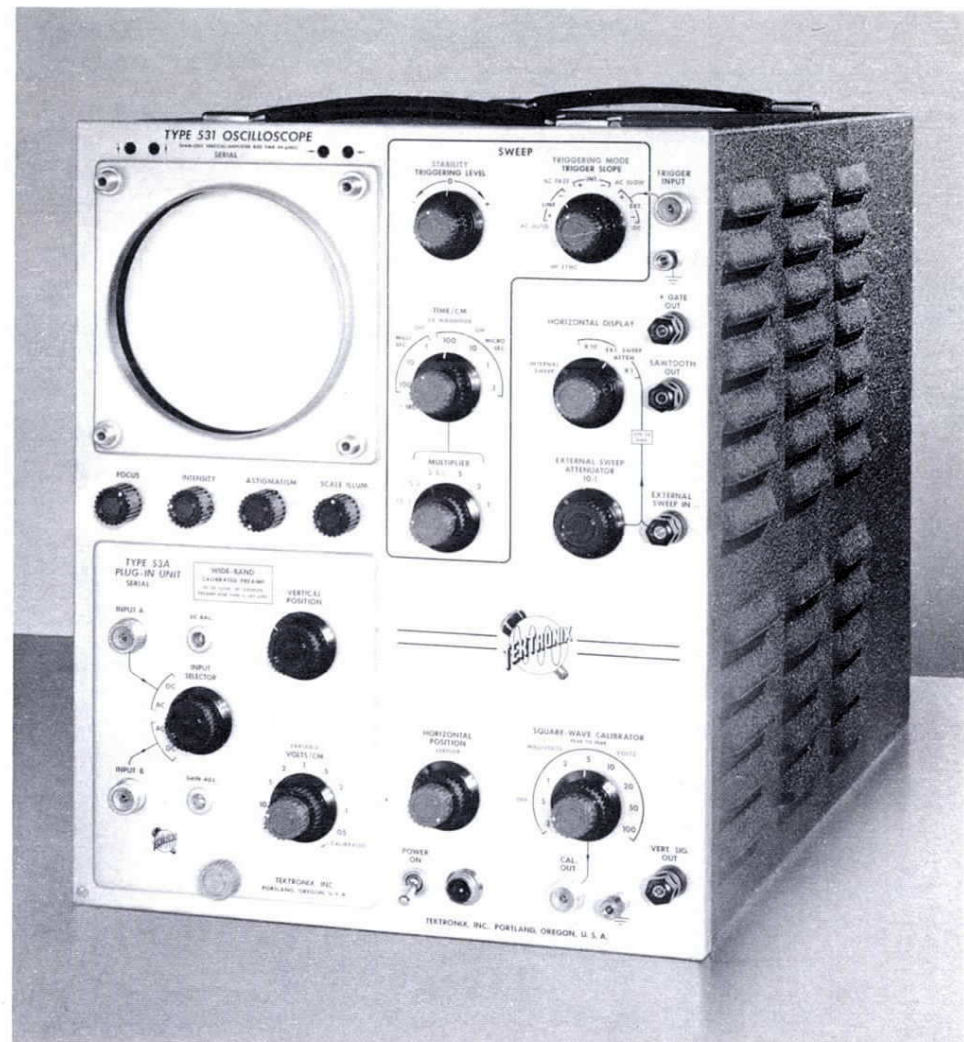
Horizontal Input Amplifier

Sensitivity 0.2 v/cm to 20 v/cm , continuously variable.

DC-Coupled Unblinking

Balanced Delay Network

Beam-Position Indicators



GENERAL DESCRIPTION

The Type 531 basic oscilloscope unit is designed for general purpose laboratory use. With plug-in units, it is capable of handling most laboratory requirements. Many new features make this instrument easier to use than most conventional oscilloscopes. Exceptionally wide sweep range and high accelerating potential extend the working range beyond previous limits. Calibrated controls for accurate time and amplitude measurements, choice of automatic triggering or trigger amplitude selection, and beam position indicators add to the utility of this versatile new oscilloscope.

VERTICAL DEFLECTION SYSTEM

DC-Coupled Output Amplifier—The wide-band dc-coupled output amplifier with risetime of $0.03 \mu\text{sec}$ is factory adjusted for optimum transient response. Cathode followers are used to drive the cathode-ray tube deflection plates.

The Type 531 vertical deflection system is designed for use with any one of the Type 53 or Type 53/54 Plug-In Preamplifiers. In order to operate the Type 531, one of the preamplifiers must be plugged in.

Type 531 passband and risetime with the following plug-in units:

Type 53A—DC to 10 mc — $0.35 \mu\text{sec}$.

Type 53B—DC to 10 mc — $0.035 \mu\text{sec}$, at 0.05 to 50 v/cm . . . 2 cycles to 9 mc — $0.04 \mu\text{sec}$, at 5 mv to 0.05 v/cm .

Type 53C—DC to 8.5 mc — $0.04 \mu\text{sec}$.

Type 53D/54D—DC to 350 kc at 1 mv/cm , increasing to 2 mc at 50 mv/cm .

Type 53E/54E— 0.06 cycles to 60 kc .

Type 53G—DC to 10 mc — $0.035 \mu\text{sec}$.

Type 53K/54K—DC to 11 mc — $0.031 \mu\text{sec}$.

Please refer to specifications of individual plug-in units for sensitivity and other characteristics. Types 53A, 53B, 53C, and 53D/54D are described in this section; Types 53E/54E, 53G, and 53K/54K in the New Instrument section.

Balanced Delay Network—A signal delay of $0.25 \mu\text{sec}$ is provided by the new balanced (push-pull) delay network. Permits observation of the leading edge of the waveform that triggers the sweep.

Direct input to CRT—An aperture in the side of the cabinet permits direct connection to the cathode-ray tube deflection plates.

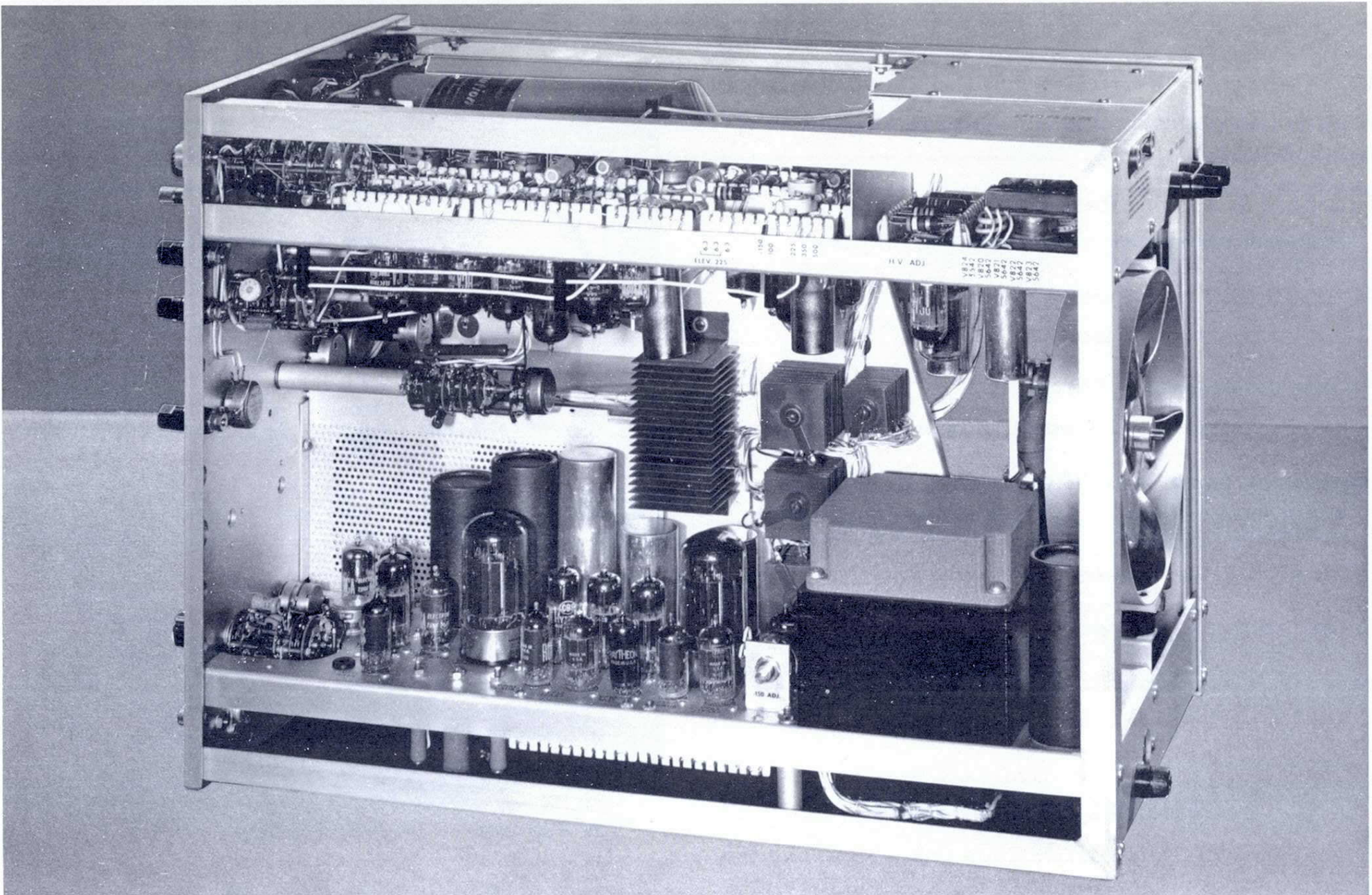
HORIZONTAL DEFLECTION SYSTEM

The new Miller runup type sweep generator is used in the Type 531. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this new circuitry make possible the extremely wide sweep range of $0.02 \mu\text{sec/cm}$ to 12 sec/cm .

Calibrated Sweeps—Twenty-four calibrated sweeps, accurate within 3%, are available. Main sweep control has eight positions— 0.1 , 1 , 10 , $100 \mu\text{sec/cm}$, . . . 1 , 10 , 100 msec/cm , . . . 1 sec/cm . Multiplier positions of 1 , 2 and 5 for each of the main sweep steps provide for a total of 24 calibrated sweeps. The remaining three positions on the multiplier switch are 2.5-to-1, 5-to-2, and 12-to-5 variable positions, making the sweep time continu-

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES



ously variable from $0.1 \mu\text{sec}/\text{cm}$ to $12 \text{ sec}/\text{cm}$. The 5-x magnifier applied to the $0.1\text{-}\mu\text{sec}/\text{cm}$ sweep extends the calibrated sweep range to $0.02 \mu\text{sec}/\text{cm}$.

Sweep Magnifier—Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of the trace is expanded to fill the screen. Any one-fifth of the magnified sweep can be displayed on the screen by rotating the HORIZONTAL POSITION control. Accurate 5-x magnification is obtained on all ranges.

DC-Coupled Unblanking—DC coupling is provided for the unblanking waveform. This assures uniform bias on cathode-ray tube for all sweep times and repetition rates.

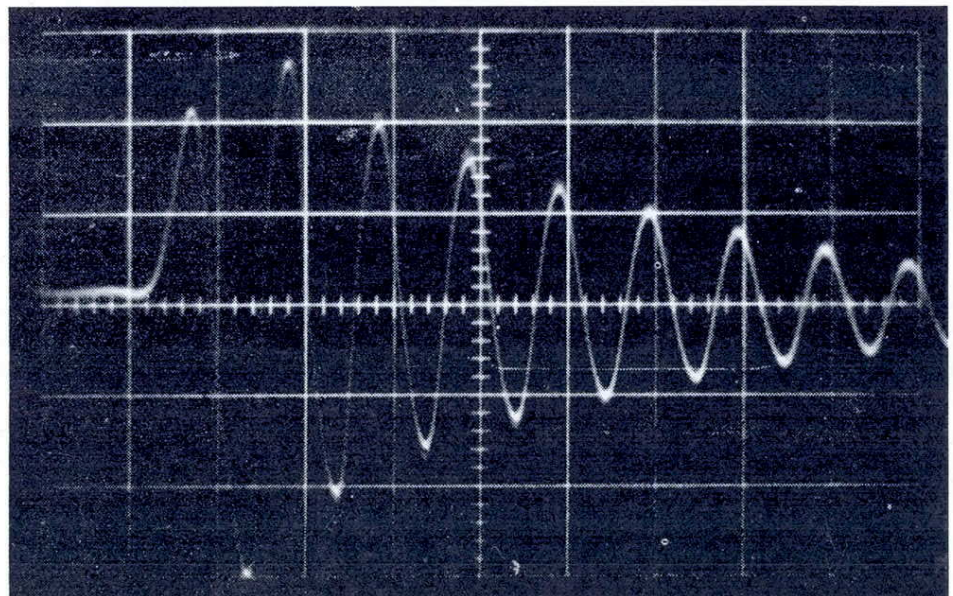
Triggering Level—The amplitude level where triggering occurs may be selected with the TRIGGERING LEVEL control. Permits triggering the sweep at a selected level on simple or complex waveforms.

Automatic Triggering—With the TRIGGER MODE switch in the AC AUTO position, the sweep will be triggered by any recurrent incoming signal from 60 cycles to 2 megacycles. Signals differing in frequency, amplitude, and shape can be observed without readjustment of the triggering controls. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the crt screen.

High-Frequency Sync—When the TRIGGER MODE switch is in the HF SYNC position, the sweep will synchronize with sine-wave signals in the frequency range of about 5 mc to about 30 mc.

Trigger Requirements—Internal triggering—a signal large enough to cause 2-mm deflection. External triggering—a signal of 0.5 v to 100 v.

Single-Sweep Recording



10-mc damped oscillation on a single $0.1\text{-}\mu\text{sec}/\text{cm}$ sweep, photographed at $f1.9$ on 35-mm Linagraph Pan. Type 531 Oscilloscope with P11 crt screen. Recorded writing rate— $175 \text{ cm}/\mu\text{sec}$.

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

Trigger Selection—The TRIGGER SELECTOR is a coaxial control. Triggering from either the positive or negative slopes of internal, external, or line voltage signals is selected by the outer knob. The inner knob is used to select the triggering mode—ac, dc, or automatic triggering.

Horizontal Input Amplifier—DC-coupled external connection to the sweep-output amplifier is through a front-panel connector. Combination of a step attenuator and variable attenuator makes the horizontal input sensitivity continuously variable from 0.2 v/cm to 20 v/cm. Passband is dc to 240 kc.

OTHER CHARACTERISTICS

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates, and in single-sweep applications. The T51P, a new Tektronix cathode-ray tube, is used in the Type 531. The T51P is a 5" flat-faced metallized precision tube with a helical post-accelerating anode. It provides a full 6 cm x 10 cm viewing area—50% more vertical deflection than previous high-voltage tubes. For best results over the wide sweep range of the Type 531, a P2 phosphor is normally furnished with the instrument.

Regulated Power Supply—Electronic regulation compensates for line-voltage variations between 105 and 125 v, and for current-demand differences among the Plug-In Preamplifiers.

Amplitude Calibrator—A square-wave calibration voltage is available through a front-panel uhf connector. Eighteen fixed steps—0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 millivolts, 0.2, 0.5, 1, 2, 5, 10, 20, 50 and 100 volts peak-to-peak are provided. Accuracy is within 3%. Square-wave frequency is approximately 1 kc.

Output Waveforms—A positive-gate voltage of the same duration as the sweep and the sweep-sawtooth waveform are available at front-panel binding posts via cathode followers.

Beam Position Indicators—Two pairs of indicator lights shows direction of the electron beam when it is not on the screen.

Illuminated Graticule—An edge-lighted graticule is marked in centimeter squares with two-millimeter baseline divisions for convenience in making time and amplitude measurements. Illumination is controlled by a front-panel knob.

VACUUM TUBE COMPLEMENT

| | | |
|------------------------|---|-------|
| Vertical Amplifiers | 2 | 6CL6 |
| Vertical Amplifier CF | 2 | 6BQ7A |
| Vertical Amplifiers | 2 | 12BY7 |
| Sweep Generator | | 6CL6 |
| Sweep Generator CF | | 6BQ7A |
| Unblank and Holdoff CF | | 6BQ7A |

| | | |
|---------------------------------------|---|-------|
| Trigger Inverter | | 6BQ7A |
| Horizontal Position and Cal Output CF | | 6BQ7A |
| Horizontal Drive CF | | 6BQ7A |
| Horizontal Amplifier | | 6BQ7A |
| Horizontal Output CF | | 6BQ7A |
| Positive Multivibrator and CF | | 6BQ7A |
| Sawtooth and Gate CF | | 6BQ7A |
| Multivibrator CF | | 6BQ7A |
| Internal Trigger CF | | 6BQ7A |
| External Horizontal Amplifier | | 6BQ7A |
| Trigger Shaper Amplifier | | 6U8 |
| Internal Trigger Amplifier | | 6U8 |
| Cal Multivibrator | | 6U8 |
| External Horizontal Amplifier CF | | 12AU7 |
| Negative Multivibrator | | 6CL6 |
| Sweep Start Compensator | | 6CL6 |
| Dual-Trace Trigger Amplifier | | 6AU6 |
| Disconnect Diode | | 6AL5 |
| High-Voltage Oscillator | | 6AU5 |
| High-Voltage Rectifiers | 5 | 5642 |
| Regulator | | 12AU7 |
| Voltage Reference | | 5651 |
| Series Regulators | 2 | 6080 |
| Regulator Amplifiers | 5 | 6AU6 |
| Comparator Amplifiers | 2 | 12AX7 |
| Series Regulators | 4 | 12B4 |
| Cathode-Ray Tube | | T51P2 |

MECHANICAL SPECIFICATIONS

Ventilation—Safe operating temperature is maintained by filtered, forced-air ventilation.

Construction—Electrically-welded aluminum alloy cabinet and chassis.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Dimensions—24" long, 13" wide, 16" high.

Weight—61½ lbs.

Power Requirements—117/234 v, 50-60 cycles, 475 watts with Type 53C unit plugged in.

Price—\$995 f.o.b. Portland (Beaverton), Oregon
(Less Plug-In Preamplifiers)

Includes: 2—P510A probes
2—A510 binding post adapters
1—W530B test lead
1—F510-5 green filter
1—Instruction manual

Currently Available Extras

P2 crt phosphor normally furnished,
P1, P7, P11 optional. No extra charge
Several other phosphors can be furnished on special order.

Recommended Additional Accessories

EP53 Plug-In Extension—for making attenuator and transient response adjustments. \$5

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

TYPE 535 CATHODE-RAY OSCILLOSCOPE with New Delayed Sweep

GENERAL DESCRIPTION

The Type 535 Cathode-Ray Oscilloscope is essentially the Type 531 plus the new Tektronix lockout-reset sweep-delay circuitry. All major specifications other than those pertaining to the sweep-delay circuitry are the same. Please refer to the Type 531 section for these specifications.

WIDE-RANGE SWEEP DELAY

1 μ sec to 0.1 sec, continuously variable.

Conventional Operation

Time-jitter less than 1 part in 20,000.

Triggered Operation

Jitter-free at any magnification, even in the presence of actual signal jitter.

Accurate

Range accuracy within 2%, incremental accuracy within 0.2% of full scale.

Trigger-Rate Source

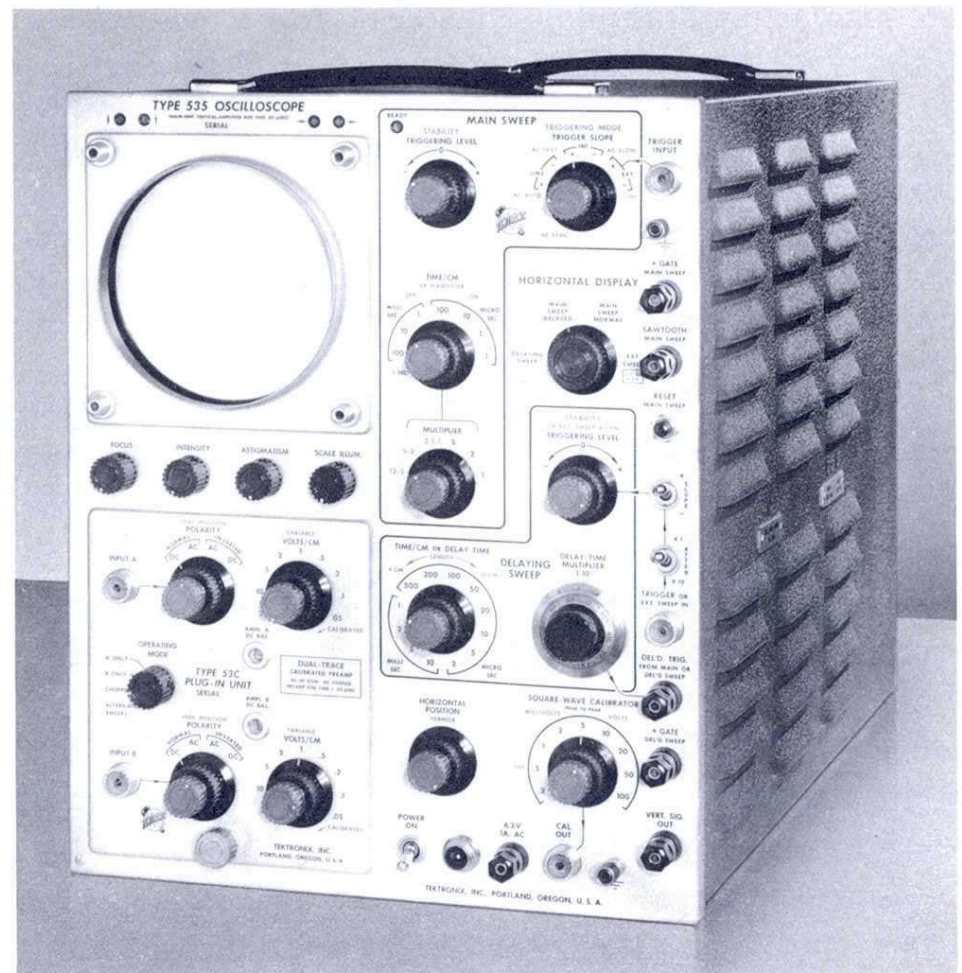
10 cycles to 50 kc, continuously variable.

**ALL OTHER MAJOR SPECIFICATIONS
SAME AS TYPE 531**

DELAYED SWEEP

Two modes of operation permit use as a conventional delayed sweep, or as a triggered delayed sweep. In conventional operation the sweep starts immediately after the period of delay. In triggered operation the sweep does not start until it receives the first signal after the period of delay. Time-jitter is less than 1 part in 20,000 when the delayed sweep is operated in the conventional manner. In triggered operation the delayed sweep is started by the signal under observation, resulting in a steady display even in the presence of jitter in the incoming signal.

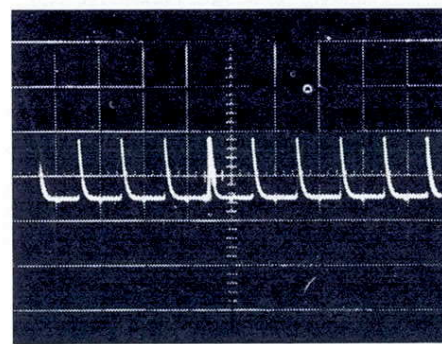
Sweep delay is accomplished in the Type 535 by use of a second sweep called the DELAYING SWEEP. A position on the HORIZONTAL DISPLAY switch provides for displaying the delaying sweep on the cathode-ray tube screen. When the delaying sweep is displayed on the screen, the main sweep appears upon it as a section of increased brightness. With the signal applied to the delaying sweep, the main sweep may be ranged out or in, to position its start at the desired point. If the main sweep is adjusted to free-run, it will start exactly at this point. If it is adjusted for triggered operation, it will not start until the first trigger



following this point is received. A turn of the HORIZONTAL DISPLAY switch returns the main sweep to the screen, delayed by the selected amount.

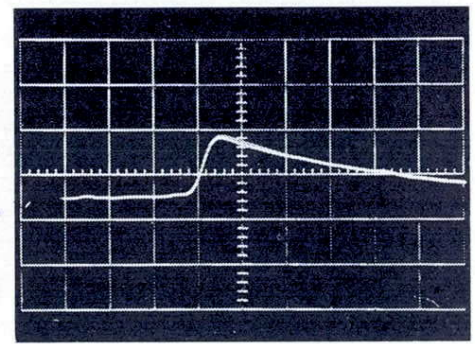
Calibration—Delay is calibrated in time per centimeter. A twelve-position switch covers the range of 2 μ sec/cm to 10 msec/cm. A ten-turn precision potentiometer fills in between steps, making the delay period con-

Delaying Sweep



10- μ sec/cm delaying sweep displayed on the screen. The 0.2- μ sec/cm main sweep appears as a bright area on the delaying sweep, and moves along the trace as the delay is adjusted to the desired amount.

Main Sweep—delayed



The main sweep returned to the screen, displaying the fifth pulse in the chain on the 0.2- μ sec/cm time base. The start of the main sweep was delayed 40 μ sec.

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

tinuously variable from 1 μ sec to 0.1 sec. Range accuracy is within 2% and any range can be adjusted to the accuracy of an external standard. Incremental accuracy is within 0.2% of full scale on all ranges.

Manual Reset—Single sweeps may be initiated by a front-panel button. When the RESET button is pressed, a single sweep results if the main sweep has been adjusted to free-run. When the main sweep is adjusted for triggered operation, pressing the RESET button arms the sweep to fire on the next trigger received. After firing once, the sweep is locked out and will not fire again until rearmed by pressing the RESET button. A front-panel indicator lights when main sweep is reset and ready to accept a trigger.

Trigger-Rate Source—Triggered sweep rates of 10 cycles to 50 kc are obtained by adjusting the duration of the free-running delaying sweep, and using it to trigger the main sweep internally. The 10-cycle to 50-kc rate is continuously variable.

Waveforms Available—A positive gate from the delaying sweep, amplitude approximately 20 v, is available at a front-panel connector. A delayed trigger of approximately 5-v amplitude is also available at the front panel, from either the main sweep or the delaying sweep. The vertical signal is brought out from the main amplifier to a front-panel connector for use in triggering the delaying sweep or other external applications. Peak-to-peak level is about 1.5 v/cm of vertical deflection on the crt screen. For extra convenience, 6.3 v ac at 1 a is available at another front-panel connector.

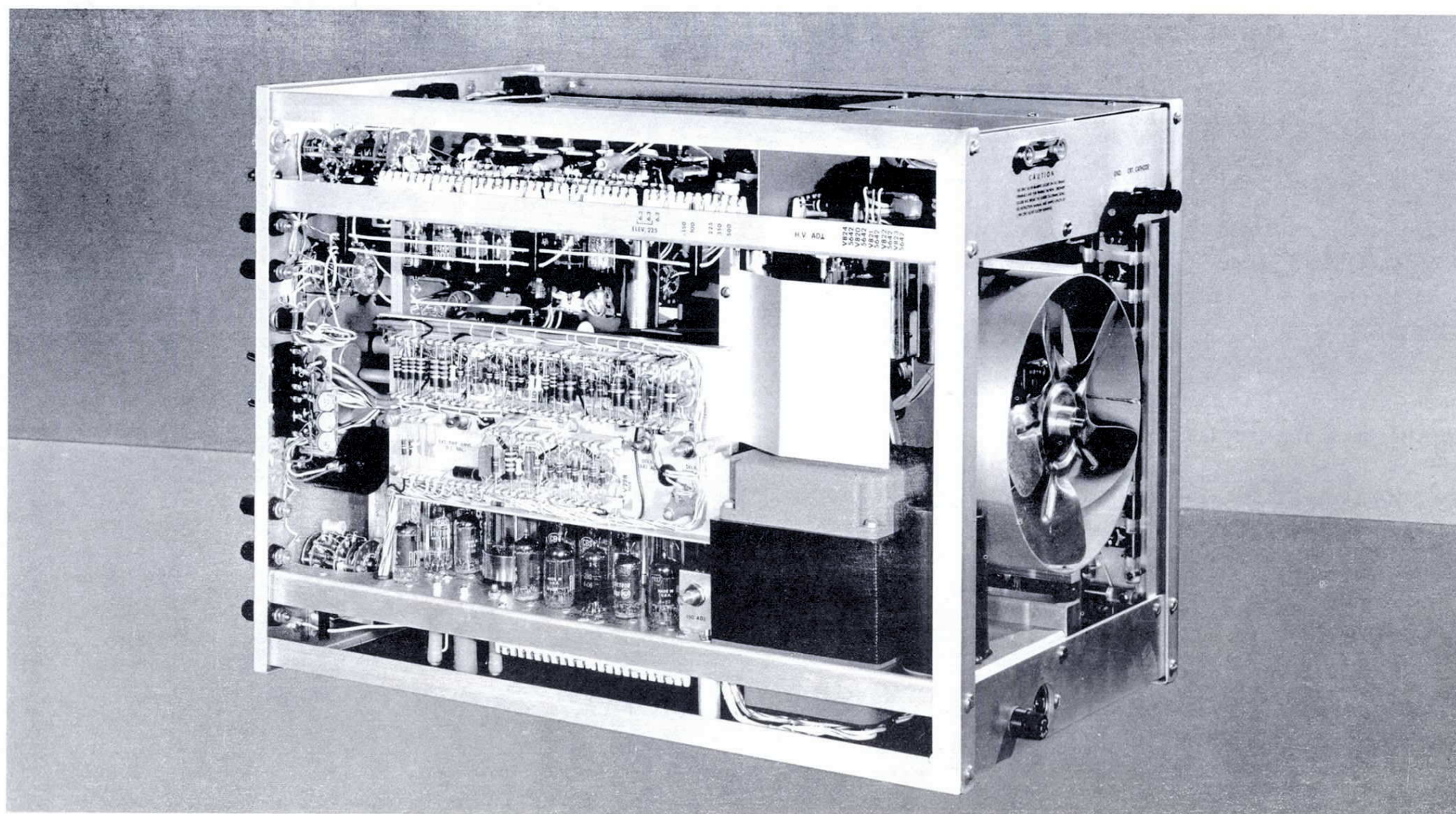
Trigger Requirements—The delaying sweep requires a trigger of from 0.1 v to 100 v fed into its TRIGGER terminal. A switch permits selection of 1-x or 10-x attenuation and another switch provides for positive or negative-trigger polarity.

OTHER CHARACTERISTICS

Horizontal input amplifier passband is dc to 240 kc. All other characteristics are identical to those of the Tektronix Type 531 Cathode-Ray Oscilloscope described in the first part of this Type 530 Series section.

VACUUM TUBE COMPLEMENT

| | | |
|--|---|-------|
| Vertical Amplifiers | 2 | 6CL6 |
| Vertical Amplifier CF | 2 | 6BQ7A |
| Vertical Amplifiers | 2 | 12BY7 |
| Internal Trigger Amplifier | | 6U8 |
| Internal Trigger CF | | 6BQ7A |
| Cal Multivibrator | | 6U8 |
| Horizontal Position and Cal Output CF | | 6BQ7A |
| Trigger Amplifier | | 6BQ7A |
| Trigger Shaper | | 6U8 |
| Positive Multivibrator and Trigger Amplifier | | 6U8 |
| Negative Multivibrator and Clamp | | 6U8 |
| Holdoff CF | | 6BQ7A |
| Positive Multivibrator and CF | | 6BQ7A |
| Negative Multivibrator | | 6CL6 |
| Sawtooth and Gate CF | | 6BQ7A |
| Dual-Trace Trigger Amplifier | | 6AU6 |
| Disconnect Diodes | | 6AL5 |
| Sweep Generator | | 6CL6 |
| Sweep Generator CF | | 6BQ7A |
| Delaying Sweep Generator | | 12AU6 |
| Disconnect Diodes | | 12AL5 |
| Trigger Amplifier | | 6BQ7A |
| Trigger Amplifier CF | | 12AU7 |
| Trigger Shaper | | 6U8 |
| Multivibrator and Gate CF | | 6BQ7A |
| Multivibrator | | 6U8 |
| Sweep Generator and Holdoff CF | | 6BQ7A |
| Comparator | | 6BQ7A |
| Trigger CF and Constant Current | | 6U8 |
| Delay Multivibrator | | 6U8 |
| Comparator | | 6U8 |
| Horizontal Drive CF | | 6BQ7A |



Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

| | |
|-----------------------------------|---------|
| Horizontal Amplifier | 6BQ7A |
| Horizontal Output CF | 6BQ7A |
| Sweep Start Compensator | 6CL6 |
| Unblanking Mixer | 6BQ7A |
| High-Voltage Oscillator | 6AU5 |
| Regulator | 12AU7 |
| High-Voltage Rectifiers | 5 5642 |
| Voltage Reference | 5651 |
| Series Regulators | 2 6080 |
| Regulator Amplifiers | 5 6AU6 |
| Series Regulators | 4 12B4 |
| Comparator Amplifiers | 2 12AX7 |
| Cathode-Ray Tube | T51P2 |

MECHANICAL SPECIFICATIONS

Ventilation—Safe operating temperature is maintained by filtered, forced-air ventilation.

Construction—Electrically-welded aluminum-alloy cabinet and chassis.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Dimensions—24" long, 13" wide, 16" high.

Weight—65 lbs.
Power Requirements—117/234 v, 50-60 cycles, 535 watts with Type 53C unit plugged in.

Price—\$1300 f.o.b. Portland (Beaverton), Oregon
(Less Plug-In Preamplifiers)

- Includes: 2—P510A probes
2—A510 binding post adapters
1—W530B test lead
1—F510-5 green filter
1—Instruction manual

Currently Available Extras

P2 crt phosphor normally furnished,
P1, P7, P11 optional. No extra charge
Several other phosphors can be furnished on special order.

Recommended Additional Accessories

EP53 Plug-In Extension—for making attenuator and transient response adjustments. \$5

PLUG-IN PREAMPLIFIERS

Type 53 Units are factory adjusted for optimum performance in Type 530-Series Oscilloscopes; and Type 54 Units for optimum performance in Type 540-Series Oscilloscopes. Units designated Type 53/54 perform equally well in both Type 530-Series and Type 540-Series Oscilloscopes, requiring no readjustments for use in either series. Although all plug-in units are interchangeable, for performance meeting published specifications Type 54 Units should always be used with Type 540-Series Oscilloscopes.

RACK-MOUNTED STORAGE UNIT FOR 3 PLUG-IN UNITS — \$35. (60 day delivery)

TYPE 53A PLUG-IN UNIT Wide-Band DC Preamplifier

Transient Response

With Type 531 and Type 535—
Risetime—0.035 μ sec.

With Type 532—
Risetime—0.07 μ sec.

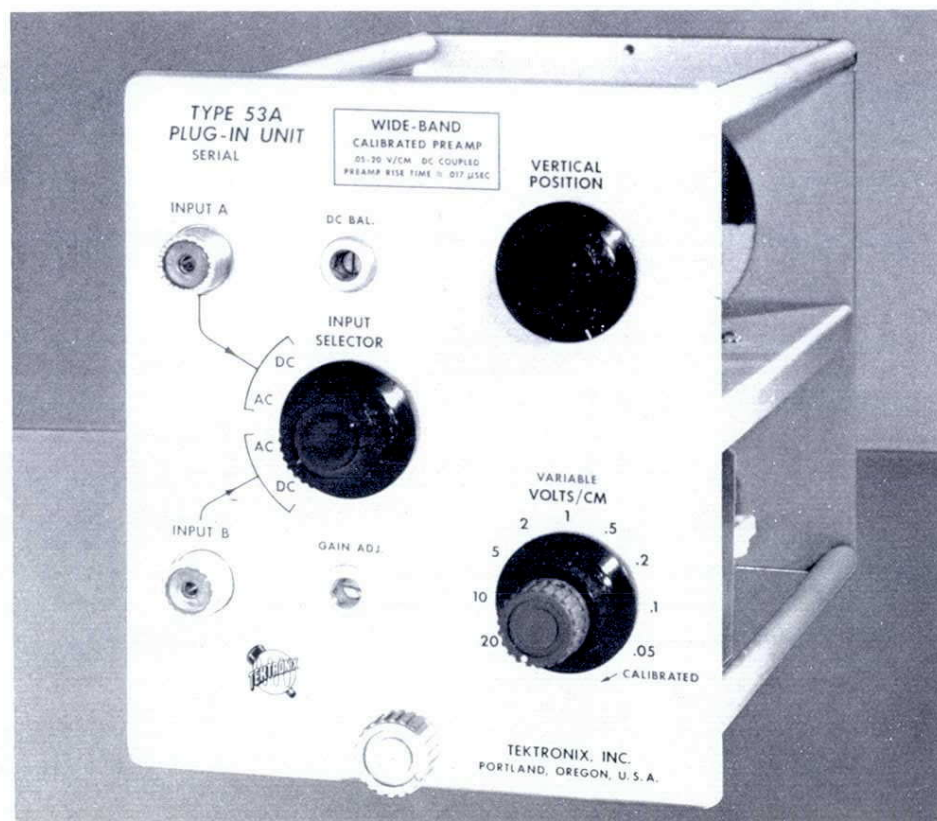
Frequency Response

With Type 531 and Type 535—
Passband—DC to 10 mc.

With Type 532—
Passband—DC to 5 mc.

Sensitivity

Calibrated—0.05 v/cm to 20 v/cm.
Continuously Variable—0.05 v/cm to 50 v/cm.



Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

GENERAL DESCRIPTION

The Type 53A Plug-In Pre-amplifier meets the requirements of most wide-band applications. Wide passband, excellent transient response, dc-coupling, and calibrated sensitivity are qualities most users require in an oscilloscope vertical amplifier. The Type 53A gives all of these qualities to Type 530 Series Oscilloscopes.

OTHER CHARACTERISTICS

Calibrated Sensitivity—Nine calibrated sensitivity steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 v/cm. A variable attenuator fills in between steps, making the sensitivity continuously variable from 0.05 v/cm to 50 v/cm.

Calibration Accuracy—When accurately set on any one step, all other steps will be within 3% of the panel reading.

Two Signal Inputs—Two signal input connectors with

more than 60-db isolation are controlled by a four-position switch. The INPUT SELECTOR provides for ac-coupling or dc-coupling through either input. A blocking capacitor is inserted in the AC positions, limiting the low-frequency response to 2 cycles.

Input Impedance—45 $\mu\mu\text{f}$ paralleled by 1 megohm.

VACUUM TUBE COMPLEMENT

| | | |
|----------------------|---|-------|
| Amplifiers | 2 | 12AU6 |
| Output CF | | 12AT7 |

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.
Finish—Photo-etched anodized panel.
Weight—3½ lbs.

Price—\$85 f.o.b. Portland (Beaverton), Oregon.

TYPE 53B PLUG-IN UNIT Wide-Band High-Gain Pre-amplifier

Sensitivity

- AC-Coupled Only—0.005 v/cm to 0.05 v/cm.
- AC or DC-Coupled—0.05 v/cm to 50 v/cm.
- Calibrated—0.005 v/cm to 20 v/cm.
- Continuously Variable—0.005 v/cm to 50 v/cm.

Frequency Response

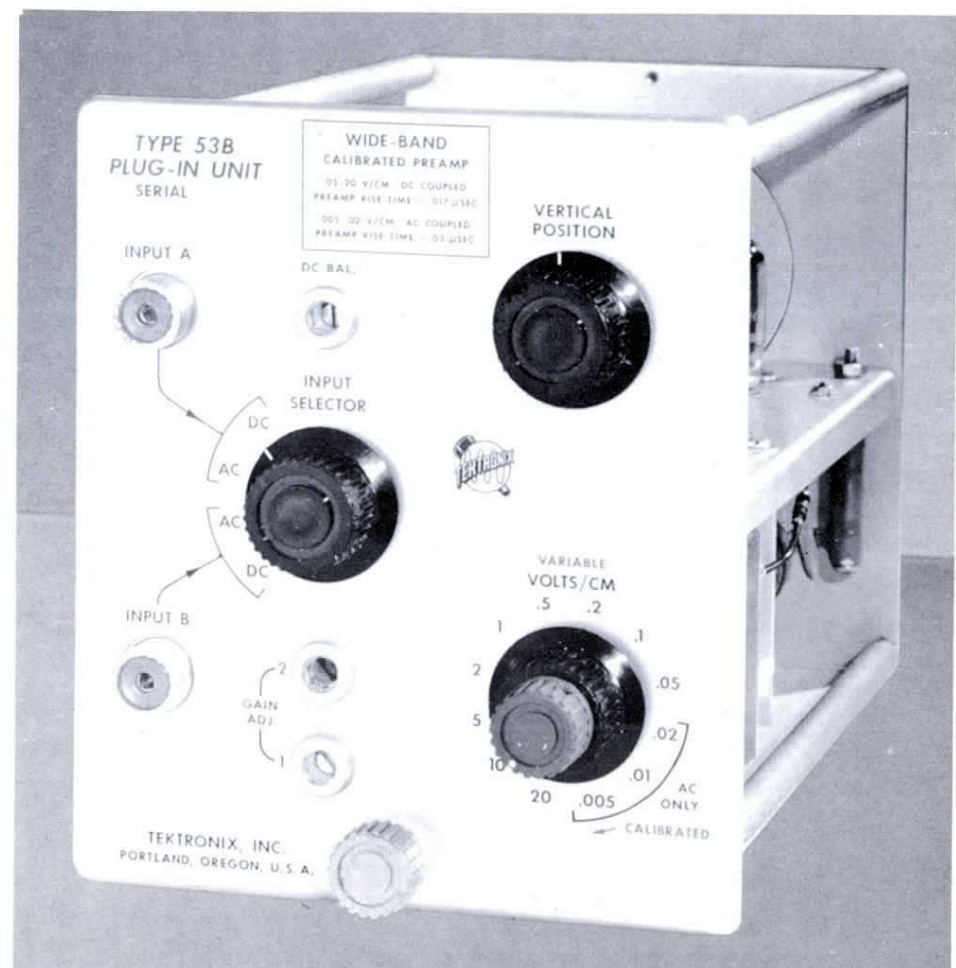
- With Type 531 and Type 535—
0.05 v/cm to 50 v/cm, DC to 10 mc.
0.005 v/cm to 0.5 v/cm, 2 cycles to 9 mc.
- With Type 532—
0.05 v/cm to 50 v/cm, DC to 5 mc.
0.005 v/cm to 0.05 v/cm, 2 cycles to 5 mc.

GENERAL DESCRIPTION

The Type 53B Plug-In Unit is essentially the Type 53A with a preamplifier stage added. Three additional calibrated sensitivity steps, 0.005, 0.01, and 0.02 v/cm are available at slightly reduced frequency response and increased risetime when used with Type 531 and Type 535 Oscilloscopes . . . 2-cycle to 9-mc passband, 0.04- μsec risetime. In all other respects the Type 53B is identical to the Type 53A.

VACUUM TUBE COMPLEMENT

| | |
|----------------------------|-------|
| Preamplifier | 5654 |
| Cathode Follower | 6BQ7A |



| | | |
|----------------------|---|-------|
| Amplifiers | 2 | 12AU6 |
| Output CF | | 12AT7 |

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.
Finish—Photo-etched anodized panel.
Weight—3½ lbs.

Price—\$125 f.o.b. Portland (Beaverton), Oregon.

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

TYPE 53C PLUG-IN UNIT Dual-Trace Preamplifier

Two Identical Channels

Electronic Switching

Triggered—switches on alternate sweeps.
Free-running—at approximately 100 kc.

Calibrated Sensitivity—0.05 v/cm to 20 v/cm.

Frequency Response

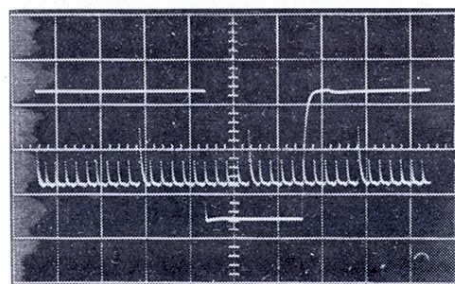
Passband—DC to 8.5 mc with Type 531 and Type 535.
Passband—DC to 5 mc with Type 532.

Transient Response

Risetime—0.04 μ sec with Type 531 and Type 535.
Risetime—0.07 μ sec with Type 532.

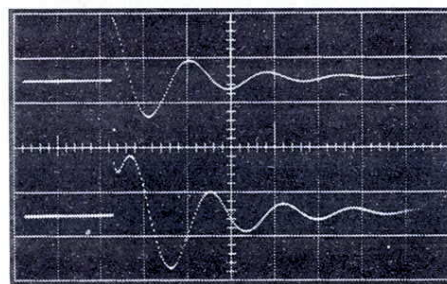
Two operating modes of the Type 53C with a Type 530 Series Oscilloscope are illustrated by the photographs below.

Alternate-Sweep Presentation



Accurate measurement of pulse interval by comparison with timing comb shows alternate-sweep operation. Timing comb consists of 5- μ sec and 50- μ sec markers of the Tektronix Type 180 Time-Mark Generator.

Single-Sweep Presentation

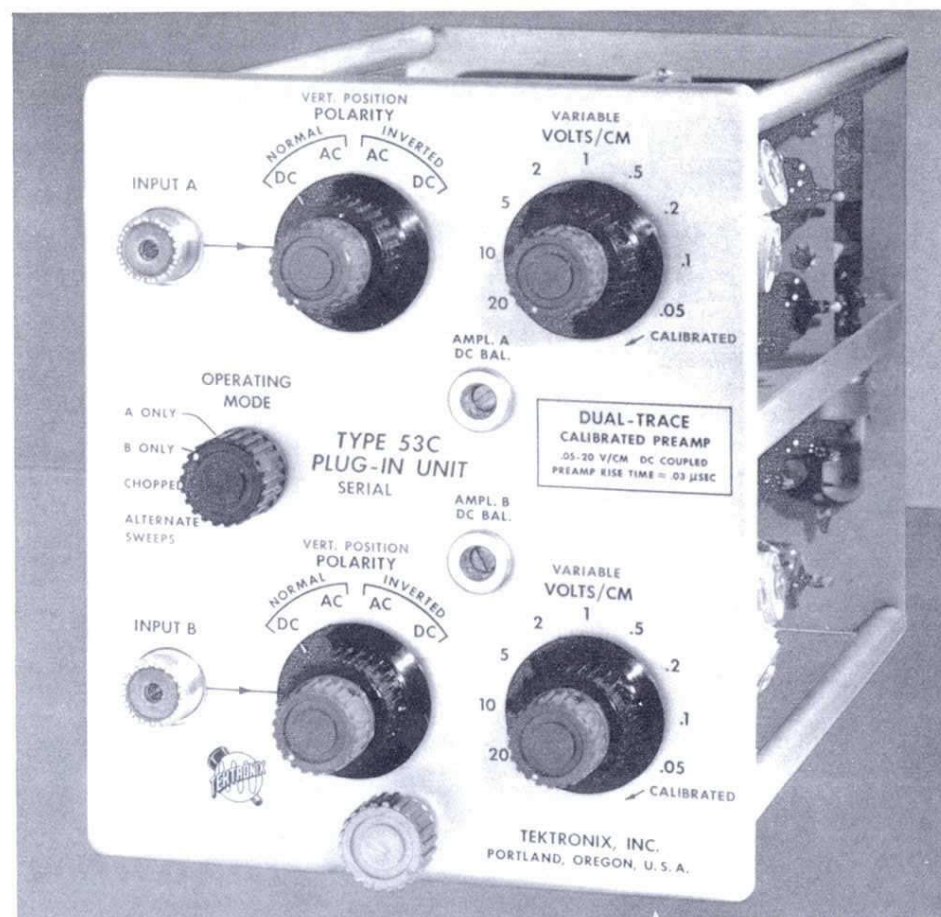


Response of two networks excited by a single pulse shows free-running operation in a one-shot application. A single 200- μ sec/cm sweep is used for this display.

GENERAL DESCRIPTION

The Type 53C Dual-Trace Unit contains two identical amplifier channels that can be electronically switched either by the oscilloscope sweep or at a free-running rate of approximately 100 kc. When amplifier switching is triggered by the oscilloscope sweep, the two signals to be compared appear on alternate sweeps. Because the sweeps are identical, and time-delay characteristics of the two amplifier channels are within 2 m μ sec, time comparisons can be made with a high degree of accuracy.

Stationary display of two signals unrelated in frequency is accomplished by internal triggering of the sweep alternately by the two signals. In free-running operation, switching occurs at a rate of approximately 100 kc, making it possible to view two simultaneous transients. Transients of as little as one millisecond duration are well delineated, having about one hundred elements in each



trace. For many purposes, shorter transients may be adequately observed. Either amplifier channel can be used separately without electronic switching, making the Type 53C also useful in all single-trace applications within its frequency-response and sensitivity capabilities. Maximum flexibility is obtained by providing separate positioning, sensitivity, and polarity inverting controls for each channel.

OTHER CHARACTERISTICS

Calibrated Sensitivity—Nine calibrated sensitivity steps are provided for each channel: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 v/cm. A variable attenuator fills in between steps, making the sensitivity continuously variable from 0.05 v/cm to 50 v/cm.

Calibration Accuracy—When accurately set on any one step, all other steps will be within 3% of the panel reading.

Operating Mode Selection—A four-position switch provides for electronic switch operation either triggered or free-running, and for separate use of either amplifier channel.

Polarity Inversion—Polarity may be inverted on either channel for greater accuracy in comparisons of signals 180 degrees out of phase. A four-position switch for each channel provides for ac or dc coupling, either normal, or polarity inverted. A blocking capacitor is inserted in the AC positions, limiting the low-frequency response to 2 cycles.

Vertical Position Controls—Separate positioning controls are provided for each channel.

Tektronix, Inc.

TYPE 530 SERIES OSCILLOSCOPES

Input Impedance—45 μf paralleled by 1 megohm.

VACUUM TUBE COMPLEMENT

| | | |
|--------------------------|---|-------|
| Input CF | 2 | 12AU7 |
| Amplifiers | 2 | 6BQ7A |
| Amplifiers | 4 | 12AU6 |
| Output CF | | 6BQ7A |
| Coupling Diode | | 6AL5 |

| | |
|-------------------------|-------|
| Multivibrator | 6BQ7A |
| Switching CF | 6BQ7A |

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.
 Finish—Photo-etched anodized panel.
 Weight—5½ lbs.

Price—\$275 f.o.b. Portland (Beaverton), Oregon.

TYPE 53D/54D PLUG-IN UNIT Differential High-Gain DC Preamplifier

Sensitivity

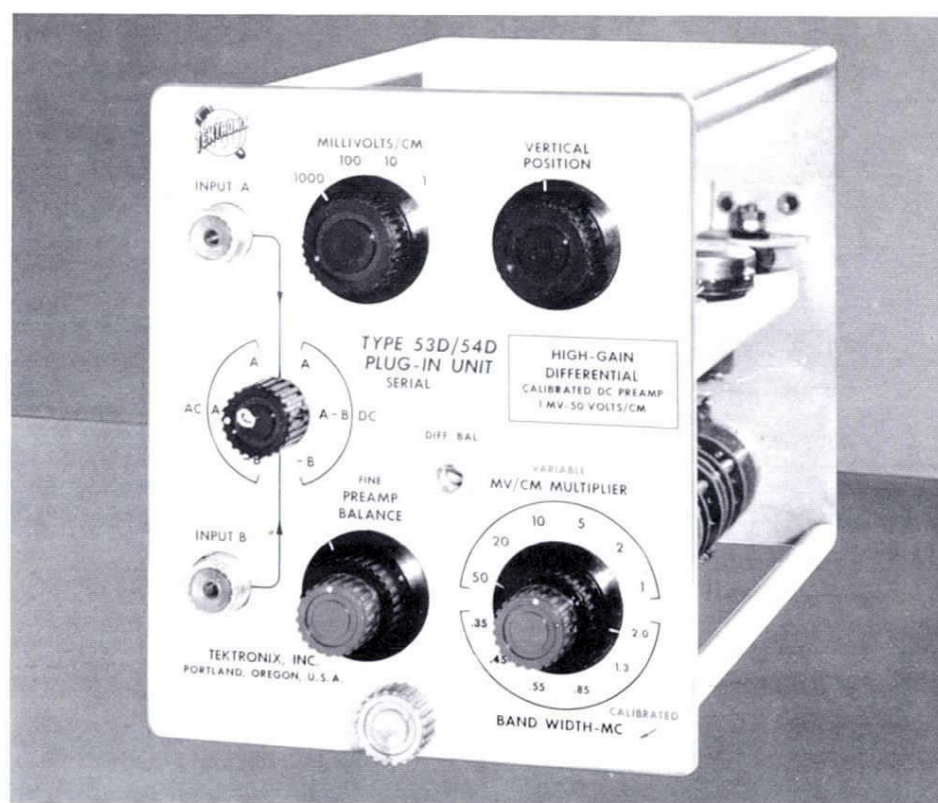
Calibrated—1 mv/cm to 50 v/cm.
 Continuously Variable—1 mv/cm to 125 v/cm.

Frequency Response

DC to 350 kc at 1 mv/cm sensitivity . . . increasing to DC to 2 mc at 50 mv/cm and lower sensitivity.

Differential Input

10,000-to-1 rejection ratio at full gain for in-phase signals.



GENERAL DESCRIPTION

The Type 53D/54D equips Type 530-Series and Type 540-Series Oscilloscopes for work requiring dc-coupling at sensitivities as high as 1 mv/cm. Differential input with high rejection ratio for in-phase signals permits cancellation of unwanted or interfering signals.

OTHER CHARACTERISTICS

Input Selector—A six-position switch provides for use of either input separately, or both together differentially, either ac-coupled or dc-coupled. In the AC positions a blocking capacitor is inserted, limiting the low-frequency response to 2 cycles.

Deflection Sensitivity Controls—The MILLIVOLTS/CM switch has four calibrated positions: 1, 10, 100, and 1000 mv/cm. Because of the stability characteristics of precision resistors available for use in this attenuator, the maximum rejection ratio will not always be attainable except in the 1 mv/cm position. A six-position calibrated switch provides for multiplication by 1, 2, 5, 10, 20, and 50. Approximate 3-db point of amplifier high frequency response for each position is also indicated by this switch. With the MILLIVOLTS/CM switch in the 1 mv/cm position only, a 10,000-to-1 rejection ratio for in-phase signals of 5 v or

less can be achieved at any position of the MV/CM MULTIPLIER switch, by careful adjustment of the differential balance control. The MV/CM MULTIPLIER, by attenuating within the amplifier, reduces drift and increases bandpass in applications that require less than maximum sensitivity. A variable attenuator control provides for continuously variable sensitivity from 1 mv/cm to 125 v/cm.

Calibration Accuracy—When accurately set on any one step, all other steps will be within 3% of the panel reading.

Input Impedance—45 μf paralleled by 1 megohm.

VACUUM TUBE COMPLEMENT

| | | |
|------------------------------|---|-------|
| Cascode Amplifiers | 2 | 5814 |
| Amplifiers | 2 | 5879 |
| Output CF | | 12AU7 |
| Voltage Regulator | | 12AU7 |

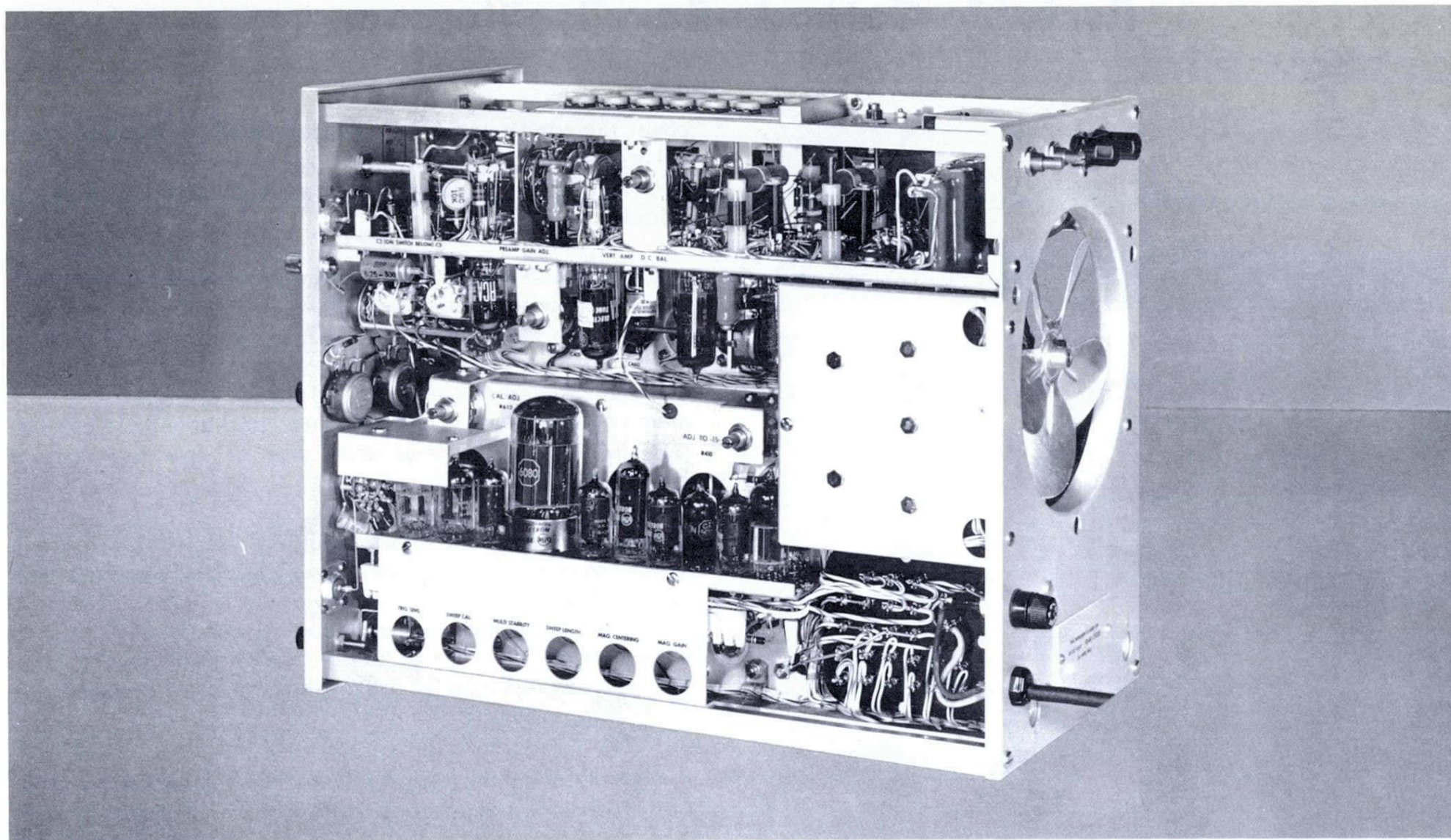
MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.
 Finish—Photo-etched anodized panel.
 Weight—4 lbs.

Price—\$145 f.o.b. Portland (Beaverton), Oregon.

Tektronix, Inc.

TYPE 315-D OSCILLOSCOPE



HORIZONTAL DEFLECTION SYSTEM

An entirely new horizontal deflection system is used in the **Type 315-D**. The time base is generated in a Miller runup circuit. Sawtooth linearity is improved by a constant current charging source to the timing capacitor.

Wide Range—An 8-position range switch and a 1, 2, 5, and 10 to 1 multiplier switch provide 24 calibrated time bases, 3 per decade, from $0.1 \mu\text{sec}/\text{division}$ to 5 sec/division. The 10 to 1 position of the multiplier switch provides a continuously variable uncalibrated time base from approximately $0.1 \mu\text{sec}/\text{division}$ to 10 sec/division.

Sweep Magnifier—The 5x magnifier expands the time base to right and left of center. When the magnifier switch is turned on, a degenerative network in the output amplifier circuit is opened increasing the gain by a factor of five. The HORIZONTAL POSITION control precedes the magnifier circuits and therefore positions for both the magnified and the normal time bases. By means of a screwdriver adjustment the magnification can be accurately set to 5 times, except at sweep times of less than $0.1 \mu\text{sec}/\text{division}$.

• **Direct Coupled Unblanking**—Separate power supplies controlled by a common regulator are provided for the grid and cathode voltages of the cathode-ray tube. The cathode supply maintains a fixed potential. The grid supply is floating and has its positive end connected to the unblanking cathode followers. This provides a dc coupling for the unblanking waveform and assures that when the cathode-ray tube is unblanked its grid bias is uniform regardless of sweep time and repetition rate.

Direct Coupled Trigger Amplitude Discriminator—The amplitude level on a waveform where triggering occurs may be selected by the TRIGGER AMPLITUDE DISCRIMINATOR control. This permits triggering the sweep at various levels on simple or complex waveforms. The degree of flexibility of this system is indicated by the fact that the sweep may be initiated at any point on the positive or negative portion of the negative going slope of a sine wave, as well as any point on the positive going slope.

Trigger Selector—A ten position switch permits selection of the positive or negative going portion of the waveform to trigger the sweep, either internally or by providing the trigger from an external source, and use of either a fast or slow risetime waveform for a trigger. Selection of either the positive or negative going portion of the line voltage waveform is also provided.

OTHER FEATURES

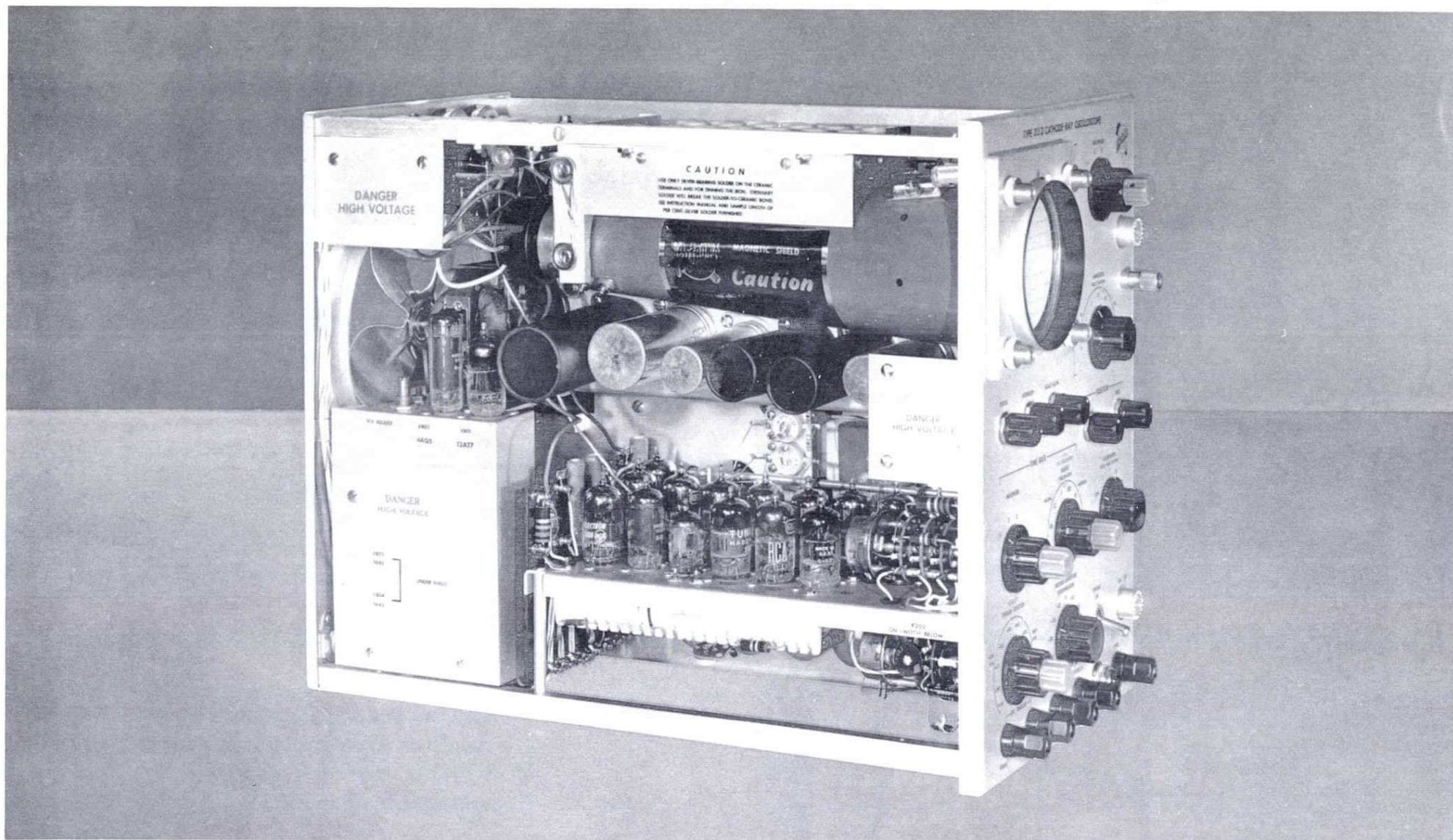
Voltage Calibrator—A square wave voltage is available at four accurate levels—0.1, 1, 10, and 100 volts, peak to peak. The calibrator operates at a frequency of about one kilocycle. This square wave is also useful for aligning the vertical amplifier, attenuator, and probe. It is a suitable signal for checking many types of amplifiers and other equipment.

Output Waveforms—A +GATE voltage of the same duration as the sweep, and the sweep sawtooth waveform are available at the front panel via cathode followers.

Accelerating Potential—A flat-faced cathode-ray tube with 1.8 kv accelerating potential is used in the **Type 315-D**.

Tektronix, Inc.

TYPE 315-D OSCILLOSCOPE



Illuminated Graticule—An edge-lighted graticule marked in quarter inch divisions is provided. Illumination is controlled by a front panel knob. An appropriate color filter is provided to increase contrast when viewing in a brightly lighted room.

Regulated Power Supply—All dc voltages are electronically regulated to insure stable operation over the supply range of 105 v to 125 v. Selenium rectifiers are used throughout the main power supply.

CHARACTERISTICS

Time Base Circuit—Wide range Miller runup type, triggered or recurrent as desired.

Time Bases—24 calibrated: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 microseconds/division, 1, 2, 5, 10, 20, 50, 100, 200, 500 milliseconds/division, 1, 2, 5 seconds/division. Calibration accuracy 3% or better except on 0.1, 0.2, 0.5 μ sec and 1, 2, 5 sec time bases where calibration accuracy is within 5%. Uncalibrated time base continuously variable from approximately 0.1 μ sec/division to 10 sec/division.

Sweep Magnification—5x magnifier expands the sweep to right and left of center.

Vertical Amplifier—Three stage, push-pull output, response dc to 5 mc, 5 cycles to 5 mc when capacitively coupled. Risetime less than 0.07 μ sec.

Vertical Deflection Sensitivity—12 calibrated sensitivity ranges: 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 volts/division. A front panel screwdriver adjust-

ment is provided for setting the vertical amplitude calibration. When set on any one range, all others will fall within 3% of this accuracy. The 0.01, 0.02, 0.05 volts/division ranges capacitively coupled only. Sensitivity continuously variable but uncalibrated from approximately 0.01v/division to 100 v/division.

Calibrating Voltage—Square wave, approximately 1 kc. Four fixed levels: 0.1, 1, 10, 100 volts peak to peak. Calibration accuracy 3% or better.

Construction—Self-contained, cabinet and chassis made of aluminum alloy, removable sub-chassis. Photo-etched front panel.

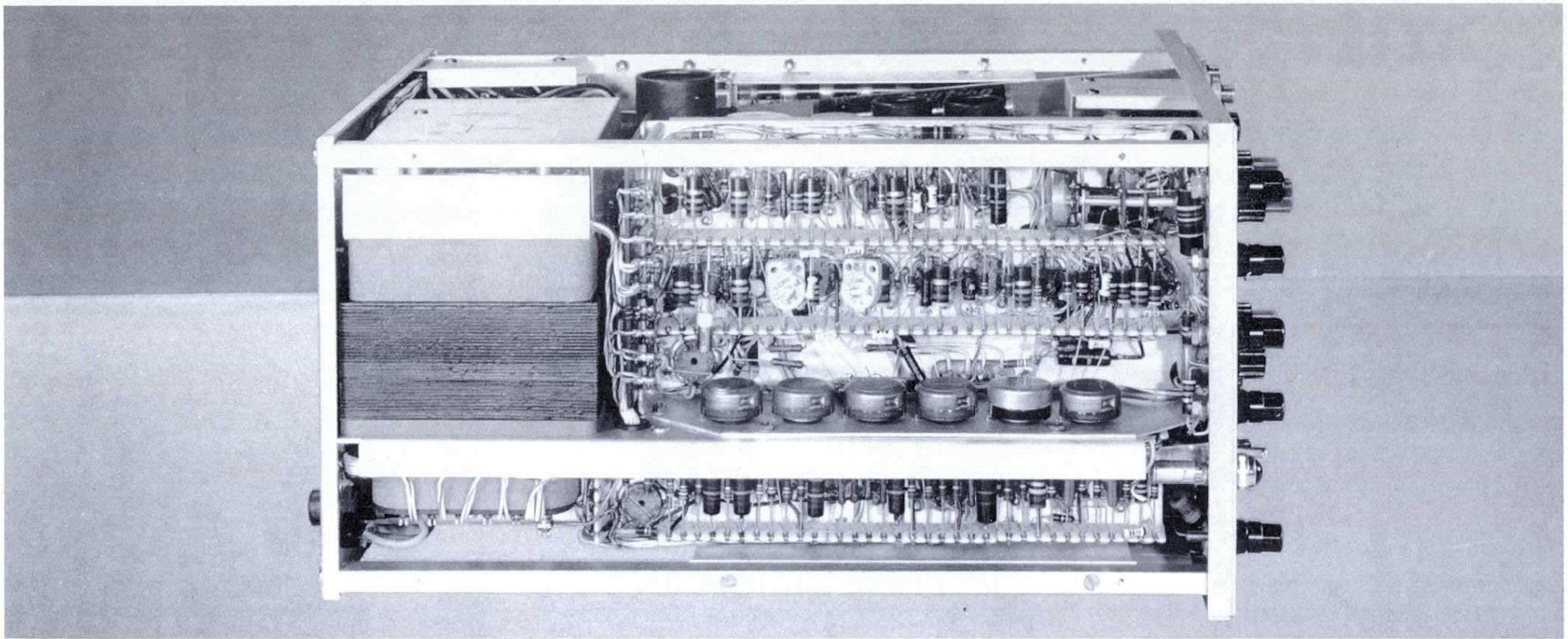
Dimensions—12 $\frac{3}{8}$ " high, 8 $\frac{5}{8}$ " wide, 15 $\frac{7}{8}$ " deep. Maximum depth including knobs and air filter, 18 $\frac{1}{4}$ ".

Weight—36 pounds.

Power Requirements—105-125 or 210-250 volts, 50-60 cycles, 375 watts. The ability of the **Type 315-D** to use power line frequencies from 50 to 800 cycles is limited only by the type of ventilating fan used. Normally the **Type 315-D** is furnished with a shaded-pole ac ventilating fan motor, to be used on 50 to 60 cycle ac only. This fan motor has the advantages of being quieter and requiring very little maintenance. When the **Type 315-D** is ordered for use on power line frequencies from 50 to 800 cycles, it must be so designated on the order. When ordered for use on power line frequencies from 50 to 800 cycles the instrument is furnished with a dc ventilating fan motor and a selenium rectifier.

Tektronix, Inc.

TYPE 315-D OSCILLOSCOPE



VACUUM TUBE COMPLEMENT

| | | |
|--|-----|-------|
| Pre-amp input | | 6BQ7 |
| Pre-amp amplifier | 1/2 | 6BQ7 |
| Pre-amp cathode follower | 1/2 | 6BQ7 |
| Amplifier input | | 6CL6 |
| Amplifier, delay line driver | | 6CL6 |
| Vertical position cathode follower | 1/2 | 6BQ7 |
| Driver cathode follower | 1/2 | 6BQ7 |
| Vertical output amplifier | 4 | 12BY7 |
| DC reference tube | | 5651 |
| -150 regulator amplifier | | 6AU6 |
| -150 v regulator series tube | 2 | 12B4 |
| +100 v regulator amplifier | | 6AU6 |
| +100 v regulator series tube | | 6AS5 |
| +225 v regulator amplifier | | 6AU6 |
| +225 v regulator series tube | 1/2 | 6080 |
| +350 v regulator amplifier | | 6AU6 |
| +350 v regulator series tube | 1/2 | 6080 |
| Cal. multivibrator | | 12AU7 |
| Cal. clipper amplifier | 1/2 | 12AT7 |
| Cal. cathode follower | 1/2 | 12AT7 |
| High voltage oscillator | | 6AQ5 |
| High voltage regulator | | 12AT7 |
| High voltage rectifier | | 5642 |
| Cathode-ray tube bias rectifier | | 5642 |
| Trigger amplitude discriminator—phase inverter | | 12AT7 |
| Trigger shaper multivibrator | | 6U8 |
| Trigger amplifier | | 6BQ7 |
| Hold-off cathode follower | 1/2 | 6BQ7 |
| Clamp diode | 1/2 | 12AT7 |
| Trigger cathode follower | 1/2 | 6BQ7 |
| Hold-off clamp | 1/2 | 12AT7 |
| Unblanking cathode follower | 1/2 | 6BQ7 |
| Buffer cathode follower | 1/2 | 6BQ7 |
| + Gate out cathode follower | 1/2 | 6U8 |
| Cascode multivibrator | 2 | 6BQ7 |
| Multi reverting cathode follower | 1/2 | 12AT7 |
| Sawtooth out cathode follower | 1/2 | 6BQ7 |
| Sweep out cathode follower | 1/2 | 6BQ7 |
| DC feed back diode | 1/2 | 6AL5 |
| Sweep clamp cathode follower | 1/2 | 6U8 |
| Sweep clamp diode | 1/2 | 6AL5 |
| Constant current tube | 1/2 | 12AT7 |
| Miller sweep generator | | 6AK6 |
| Sweep position cathode follower | 1/2 | 6BQ7 |
| Driver cathode follower | 1/2 | 6BQ7 |
| Sweep output amplifier (First side) | 1/2 | 6BQ7 |
| Sweep output cathode follower (First side) | 1/2 | 6BQ7 |
| Sweep output amplifier (Second side) | 1/2 | 6BQ7 |
| Sweep output cathode follower (Second side) | 1/2 | 6BQ7 |
| Cathode-ray Tube | | 3WP2 |

Type 315-D—For use on 105-125 v, 50-60 cycles only—Price \$770.

Includes: 1—P510A Attenuator probe
2—A510 Binding-post adapters
1—F310-5 Green filter
1—Instruction Manual

Type 315-D-S1 — for use on 105-125 or 210-250v, 50 to 800 cycles — Price \$785.

Type 315-S2 — Includes a front panel controlled triggering circuit permitting direct, stable triggering from the sync pulse group of a complete pulse train in a PTM system with these general characteristics:

Rep rate 9 to 17 kc (12 or 24 channels)

Sync group . . . 4 pulses, 0.5 μ sec wide, spaced 0.8 μ sec

Channel pulses 0.5 μ sec wide, spaced 3.85 μ sec

Price \$790

Your inquiries are invited about the availability of this instrument for use with PTM systems having general characteristics differing from the above.

Currently Available Extras

Rack Mounting Add \$25

P2 crt phosphor normally furnished.

P1, P7, P11 optional..... No extra charge

Recommended Additional Accessories

MS 15 Fan Motor Kit — For converting **Type 315-D-S1** for use on fixed supply voltage frequency (50-60 cycles only). Contains bracket, ac ventilating fan motor, and fan blade. Price \$7.50

MU15 Fan Motor Kit—For converting **Type 315-D** for use with various supply voltage frequencies (50-800 cycles). Contains bracket, selenium rectifier, dc ventilating fan motor, and fan blade. Price \$22.50.

Prices f.o.b. Portland (Beaverton), Oregon

Tektronix, Inc.

TYPE 517 OSCILLOSCOPE



GENERAL DESCRIPTION

The TEKTRONIX Type 517 is a wide-band high-voltage cathode-ray oscilloscope designed primarily for the observation and photographic recording of very fast-rising waveforms having low duty cycle.

The use of 24 kv accelerating potential on a metallized cathode-ray tube permits photographic recording of single sweeps at the maximum writing-rate permitted by the vertical amplifier and sweep circuits. Distributed type vertical amplifiers provide a rise-time of 7 milli-microseconds with a maximum sensitivity of .1 v/cm. Both amplitude and time calibrations are provided. Sufficient time delay is incorporated in the vertical amplifier to

permit viewing the leading edge of the waveform which triggers the sweep.

The Type 517 consists of two units, indicator and power supply, mounted on a Scope-Mobile, thus making a very convenient mobile unit. If desired, the units may be lifted off the Scope-Mobile for bench use.

VERTICAL DEFLECTION SYSTEM

Distributed Amplifier — In order to provide sufficient vertical deflection voltage with a rise-time as short as 7 milli-microseconds for a cathode-ray tube using 24 kv accelerating potential, a distributed amplifier is employed. This amplifier consists of 5 distributed stages plus a phase inverter and a trigger tube. The first two stages use six 6AK5 tubes each, next a stage of seven 6CB6 tubes and a phase inverter of three 6CB6 tubes. The signal now goes to a push-pull driver stage having six 6CB6 tubes on a side; and finally to the output stage with twelve 6CB6 tubes on each side.

Input — The input to the vertical amplifier is directly to a 170 ohm grid line, through a UHF type coaxial connector mounted on the front panel.

Probe — In order to provide higher input impedances, a cathode follower input probe, preceded by a capacitive attenuator, is used. By substituting various capacitive attenuators, a wide range of sensitivities and input capacitances can be obtained.

Auxiliary Power — A power supply socket is provided for a cathode follower probe or an auxiliary amplifier stage connected close to the circuit under observation. 6.3 v dc at 1 amp and 120 v regulated dc at 10 ma is available.

Sensitivity — A front panel vertical amplifier attenuator control is provided which decreases the sensitivity of the vertical amplifier from .1 v/cm to .2 v/cm — a range of 2 to 1. Operation of this attenuator does not appreciably affect the characteristics of the vertical amplifier.

Signal Delay — Approximately 60 milli-microseconds of delay cable is incorporated in the signal channel. This delay, along with the inherent delay in the vertical amplifier, permits the sweep to start before the signal reaches the vertical deflection plates.

Amplitude Calibrator — A pulse-type amplitude calibrator is incorporated which provides continuously variable output voltages in six ranges, from .15 v full scale to 50 v full scale, with an accuracy better than 4% of full scale.

Direct Connection to CRT Deflection Plates — It is often desirable to make a low-capacity, low-inductance connection to the deflection plates to permit observation of extremely high speed transients which would be distorted by the amplifier. An aperture in the side of the case permits convenient direct connection to the deflection plates.

HORIZONTAL DEFLECTION SYSTEM

Since many of the fast-rising pulses to be observed are

Tektronix, Inc.

TYPE 517 OSCILLOSCOPE

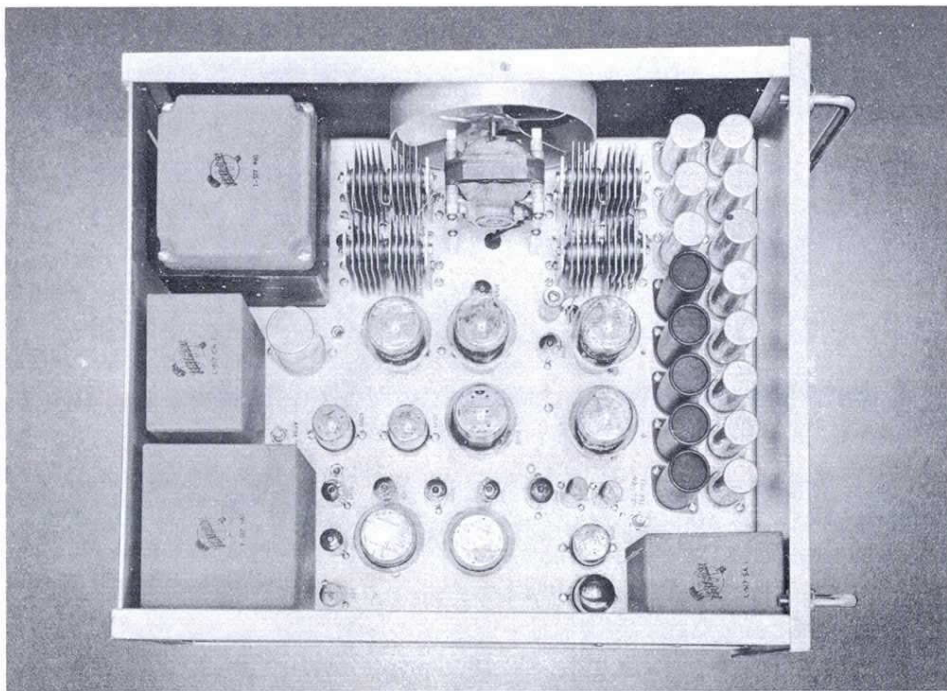
either non-repetitive or non-uniformly spaced, it is essential to have a sweep which can be triggered by the observed pulse itself. The sweep circuit of the **Type 517** can be so triggered.

Triggered Sweep — A linear, triggered sweep is available with eleven fixed, accurately timed sweeps ranging from $.01 \mu\text{sec}/\text{cm}$ to $20 \mu\text{sec}/\text{cm}$ at 24 kv accelerating potential and half these times for 12 kv. The basic sweep waveform is generated by a pentode clamp with a cathode follower boot-strap to maintain the charging current constant throughout the sweep. The waveform is inverted and fed to the opposite deflection plate for balanced deflection.

Trigger Selector — A front panel switch permits the choice of a trigger from an external source of either polarity, an observed signal of either polarity, or an internal trigger-rate generator.

Trigger Amplifier — To enable the **Type 517** to trigger from fast-rising signals of small amplitude, a wide-band, distributed type trigger amplifier is incorporated. Signals of .3 v amplitude, with a rise-time of 1 milli-microsecond, will easily trigger the sweep. When using the observed signal as trigger, any signal giving a deflection of 2 mm is adequate.

Trigger-Rate Generator — A continuously variable trigger-rate generator operating from 15 to 15,000 cps is incorporated. This consists of a calibrated phantastron oscillator controlling a blocking oscillator. Two cathode-follower outputs are provided so that a time delay may be inserted in one output if desired.



POWER SUPPLY

Since the **Type 517** is a quantitative instrument, it is necessary that sweep rates and deflection sensitivities remain constant in spite of line voltage variations. To accomplish this, all critical voltages are electronically controlled. The dc supplies utilize series-regulator tubes controlled by high-gain amplifiers. All heaters in the indicator unit are regulated in rms terms by a saturable-reactor regulator.

The accelerating potentials for the CRT are derived from an oil-filled oscillator-type supply with the CRT gun voltage regulated to compensate for both load and line changes. A panel switch on the indicator unit changes the accel-

erating voltage from approximately 24 kv to approximately 12 kv by changing the point of sampling in the regulator circuit.

Total power consumption for the **Type 517** is approximately 1250 watts at 105-125 or 210-250 v, 60 cycle, single-phase ac.

OTHER FEATURES

Calibrated Horizontal Shift — In addition to the usual full scale horizontal positioning control, a vernier control calibrated in millimeters provides accurate measurements over a range of 1. cm for use in measuring rise-time, etc.

Metallized Cathode Ray Tube — The use of a metallized CRT screen provides two advantages: first, increased brightness; and second, removal of residual charge from previous sweeps. This is very important in single sweep operation, since any residual charge will cause the image to be displaced from its correct position.

Forced Cooling — Because of the high power consumption of the fast sweep and wide-band amplifier circuits, cooling fans are included in both units. The indicator unit has an efficient air filter to remove dust and foreign matter from the cooling air.

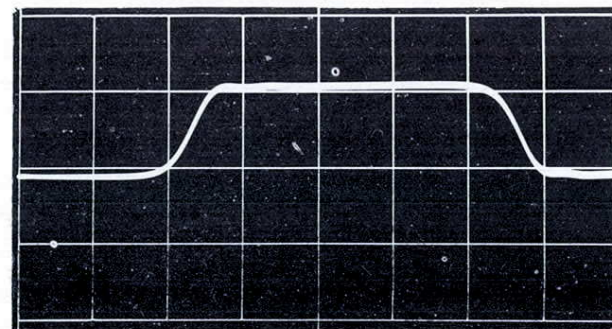
Output Waveforms — Coaxial connectors are provided on the front panel, making available two trigger-rate generator impedances, as well as the calibrator output voltage. A binding post makes available a positive gate waveform of 25 volts amplitude with a duration approximately equal to the sweep being generated, with a rise-time of $.03 \mu\text{sec}$ from a cathode follower source impedance of 200 ohms.

Edge Lighted Graticule — As in all other TEKTRONIX Cathode Ray Oscilloscopes, a specially-designed, edge-lighted, plastic graticule is provided. The illumination on this graticule may be adjusted by a front panel control. Centimeter lines are scribed in both the horizontal and vertical directions to facilitate accurate measurement of amplitude and duration of the waveshapes being observed.

CHARACTERISTICS

Vertical Amplifier — 5 stages of distributed amplification; 4th and 5th stages are push-pull.

Vertical Amplifier Transient Response — Rise time (10% to 90%) is $7 \text{ m}\mu\text{sec}$ ($.007 \mu\text{sec}$). Response is free of ringing and overshoot.



A 45 millimicrosecond pulse, initial risetime one millimicrosecond, displayed with a sweep time of 10 millimicroseconds per centimeter. Note amplifier rise-time and freedom from ringing and overshoot.

Tektronix, Inc.

TYPE 517 OSCILLOSCOPE

Vertical Amplifier Sensitivity — The maximum vertical amplifier sensitivity with a 5XP cathode-ray tube* operated at 24 kv accelerating potential is .1 v/cm without a probe. With a cathode follower probe, the maximum sensitivity is .2 v/cm.

Vertical Amplifier Attenuator — A continuous control with a range of attenuation from 1X to 2X is provided in the vertical amplifier. Fixed plug-on attenuators are provided for use in conjunction with the cathode follower probe. An external step attenuator with a characteristic impedance of 170 ohms and a range of 1 to 64 db in 1 db steps is provided.

Vertical Amplifier Input Impedance — Input impedance direct is 170 ohms resistive. Impedance looking into probe is 12 megohm and 5 μ fd. Higher impedance values can be had depending upon capacitive attenuator used ahead of probe.

Signal Delay — Delay line of RG63U coaxial cable contributes 64 m μ sec delay. This, plus the inherent delay of the distributed vertical amplifier stages, makes an approximate total signal delay of 120 m μ sec. This signal delay permits the sweep to be triggered and under way before the signal is applied to the vertical deflection plates.

Vertical Amplitude Calibrator — Pulse generator operating at about 25 kc available at front panel. Six ranges, 0.15 v to 50 v peak full scale. Continuously variable, accurate within 4% of full scale.

Vertical Amplifier Position Control — With 24 kv accelerating potential, the vertical positioning control moves the trace \pm 2.0 cm from the center line.

Sweep Circuit — Triggered, hard-tube bootstrap type sweep circuit with inverter to produce balanced deflection.

Sweeps — Eleven fixed ranges of 10, 20, 50, 100, 200, 500 m μ sec/cm and 1, 2, 5, 10, 20 μ sec/cm, with a maximum displacement error of 2% for 8 cm sweep length.

Sweep Starting Time — Approximately 70 m μ sec for the average instrument. A total signal delay of approximately 120 m μ sec permits the sweep to be triggered and underway before the signal is applied to the vertical deflection plates.

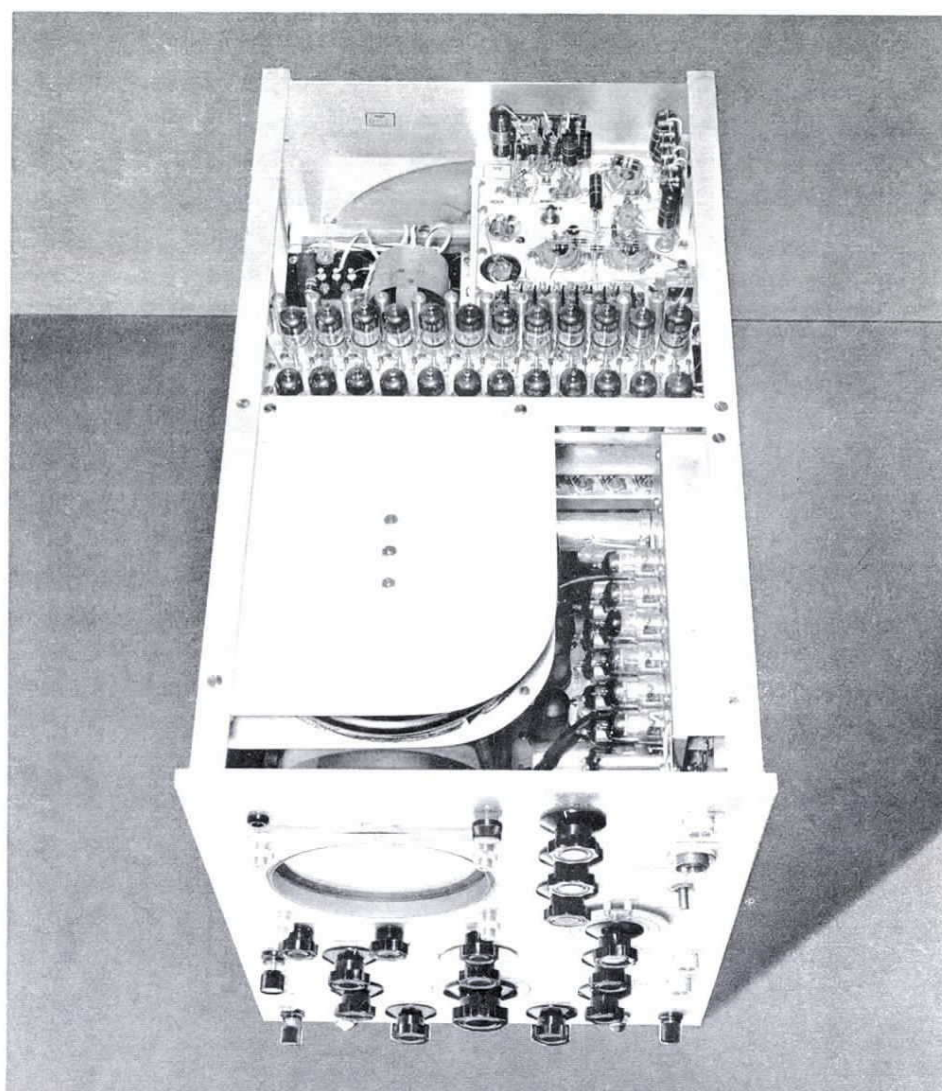
Horizontal Position Control — With 24 kv accelerating potential, the horizontal position control moves the trace approximately 5 cm.

Horizontal Position Vernier — In addition to the normal horizontal positioning control, a vernier control calibrated in millimeters provides accurate measurements over a range of 1 cm for use in measuring rise-time, etc.

Duty Cycle — The approximate limitations on sweep repetition rates for sweep ranges are:

| Sweep Time | Maximum Repetition Rate |
|-----------------|-------------------------|
| 20 μ sec/cm | 1.5 kc |
| 10 μ sec/cm | 3. kc |
| 5 μ sec/cm | 6. kc |
| 2 μ sec/cm | 10. kc |
| 1 μ sec/cm | 20. kc |

*With a nominal tube vertical deflection sensitivity of 30 v/cm.



| Sweep Time | Maximum Repetition Rate |
|--------------------|-------------------------|
| 500 m μ sec/cm | 50. kc |
| 200 m μ sec/cm | 50. kc |
| 100 m μ sec/cm | 50. kc |
| 50 m μ sec/cm | 50. kc |
| 20 m μ sec/cm | 50. kc |
| 10 m μ sec/cm | 80. kc |

Trigger Requirements —

External trigger: .3 - 15 v peak amplitude.
Internal trigger (from signal): 2 mm deflection.

For optimum triggering, the rise time of the trigger source should be as short as possible.

Trigger Rate Generator —

Polarity Positive.
Length 0.4 μ sec.
Rise time 0.15 μ sec.

Output level: 20 v with 50 ohms internal impedance;
60 v with 200 ohms internal impedance.

Repetition rate: 15-15,000 cps variable in three ranges with an accuracy of 5% of full scale.

Cathode Ray Tube — A metallized type 5XP cathode-ray tube with P11 phosphor is furnished with the **Type 517** unless a P1 or P2 phosphor is specified as the optional choice.

Construction — Contained in two separate units of convenient size, normally mounted on a TEKTRONIX Type 500 Scope-Mobile. Cabinets and chassis are made of electrically-welded aluminum alloy. Photo-etched front panels are employed.

Power Requirements — 1250 watts, 105-125 or 210-250v, 50-60 cycles, single-phase ac. Three primary-circuit fuses are provided for protection against sustained over-load conditions.

TYPE 517 OSCILLOSCOPE

Dimensions—

Indicator unit: 12-15/16" wide, 18 3/8" high, 26-15/16" deep.

Power unit: 15-15/16" wide, 9 5/8" high, 19 3/4" deep.

Weight —

Indicator unit: 76 lbs.

Power unit: 72 lbs.

Scope-Mobile: 42 lbs.

TUBE COMPLEMENT

| Circuit Use | Quantity | Type |
|--|----------|-------|
| Vertical Amplifier | | |
| 1st Distributed amplifier | 6 | 6AK5* |
| 2nd Distributed amplifier | 6 | 6AK5* |
| 3rd Distributed amplifier | 7 | 6CB6* |
| Phase inverter stage | 3 | 6CB6* |
| Push-pull distributed driver amplifier | 12 | 6CB6* |
| Push-pull distributed output amplifier | 24 | 6CB6* |
| Internal trigger coupling tube | 1 | 6CB6* |
| Sweep Generator Circuit | | |
| Trigger phase-splitter | 1 | 6J6 |
| 1st Distributed trigger amplifier | 3 | 6AK5* |
| 2nd Distributed trigger amplifier | 3 | 6AK5* |
| Trigger limiter tube | | 6AG7 |
| Trigger switch tube | | 6AG7 |
| Trigger coupling diode | | 6J6 |
| Multivibrator | 2 | 6AG7 |
| Paralleled sweep clamp tubes | 2 | 6AG7 |
| Positive sweep out, cathode follower | | 12BH7 |
| Paralleled bootstrap cathode followers | 2 | 12BH7 |
| Decoupling-diode, bootstrap circuit | | 6X4 |
| Sweep inverter | | 6AG7 |
| Bias, screen, cathode follower voltage-regulator for sweep inverter tube | | 12AU7 |
| Sweep output dc restorer | | 6AL5 |
| Paralleled unblanking amplifier tubes | 2 | 6AG7 |
| Screen cathode follower voltage-regulator for unblanking amplifier tubes | | 6AS5 |
| Unblanking voltage cathode follower output tube | | 6J6 |
| Plus gate output cathode follower | 1 | 6J6 |
| CRT grid bias stabilizers | 4 | NE2* |
| Calibrator Circuit | | |
| Multivibrator | | 12AU7 |
| Clipper | | 6J6 |
| Cathode follower calibrate voltage adj. | | 6J6 |
| Calibrator range output, cathode follower | | 6J6* |
| Trigger Rate Generator | | |
| Phantastron trigger-generator tube | | 6BH6 |
| Recharging cathode follower | 1/2 | 12AU7 |
| Trigger coupling triode | 1/2 | 12AU7 |
| Plate catcher | | 12AU7 |
| Blocking oscillator | | 12AU7 |
| 50 ohm output cathode follower | | 12AU7 |
| 200 ohm output cathode follower | | 12AU7 |

* Selected

Circuit Use

Quantity Type

Astigmatism and Probe Voltage Supply

Astigmatism and probe voltage cathode follower tube 12AU7

CRT High Voltage Supply

Quadrupler rectifiers, +20 kv supply 4 1X2
 Rectifier, -4 kv supply 1X2
 High voltage oscillator tube 6AU5
 Paralleled series-regulator tubes 2 6AU5
 Comparator-amplifier 12AU7
 Oscillator plate voltage time-delay tube 6C4
 High-voltage rectifier-tube filament oscillator 6AQ5

Power Supply, Low Voltages

+750 volt rectifier 6X4
 +750 volt supply series-regulator 6AU5
 Comparator-amplifier, +750 v supply 6AU6
 Rectifier, +475 v supply 5R4GY
 Series-regulator, +475 v supply 6AS7
 Comparator-amplifier, +475 v supply 6AU6
 Full-wave rectifier, +365 v supply 2 6X4
 Paralleled series-regulator, +225 v supply 2 6AS7
 Comparator-amplifier, +225 v supply 6AU6
 Paralleled series-regulator, +150 v supply 3 6AS7
 Comparator-amplifier, +150 v supply, 2nd stage 6AU6
 Comparator-amplifier, +150 v supply, 1st stage 12AX7
 Rectifier, -250 v supply 6X4
 Series-regulator, -250 v supply 6AU5
 Comparator-amplifier, -250 v supply 6AU6
 Voltage reference source 5651
 Heater voltage regulator control diode 2AS-15
 Heater voltage regulator amplifier 6AU5

Cathode-Ray Tube

Cathode-ray tube with optional phosphors of P1, P2, or P11, metallized 1 5XP

Accessories Furnished. The complete Type 517 Oscilloscope consists of the following items:

Indicator unit with 5XP11 metallized cathode-ray tube, unless a P1 or P2 optional phosphor is specified.

Power unit.

Scope-Mobile, Type 500

Inter-unit connecting cable, Type W517

Cathode follower probe, Type P170CF

Step attenuator, Type B170V

AC Power cable, Type COP16-8

Viewing hood, Type H510

170 ohm coaxial input cable.

BE510 Bezel

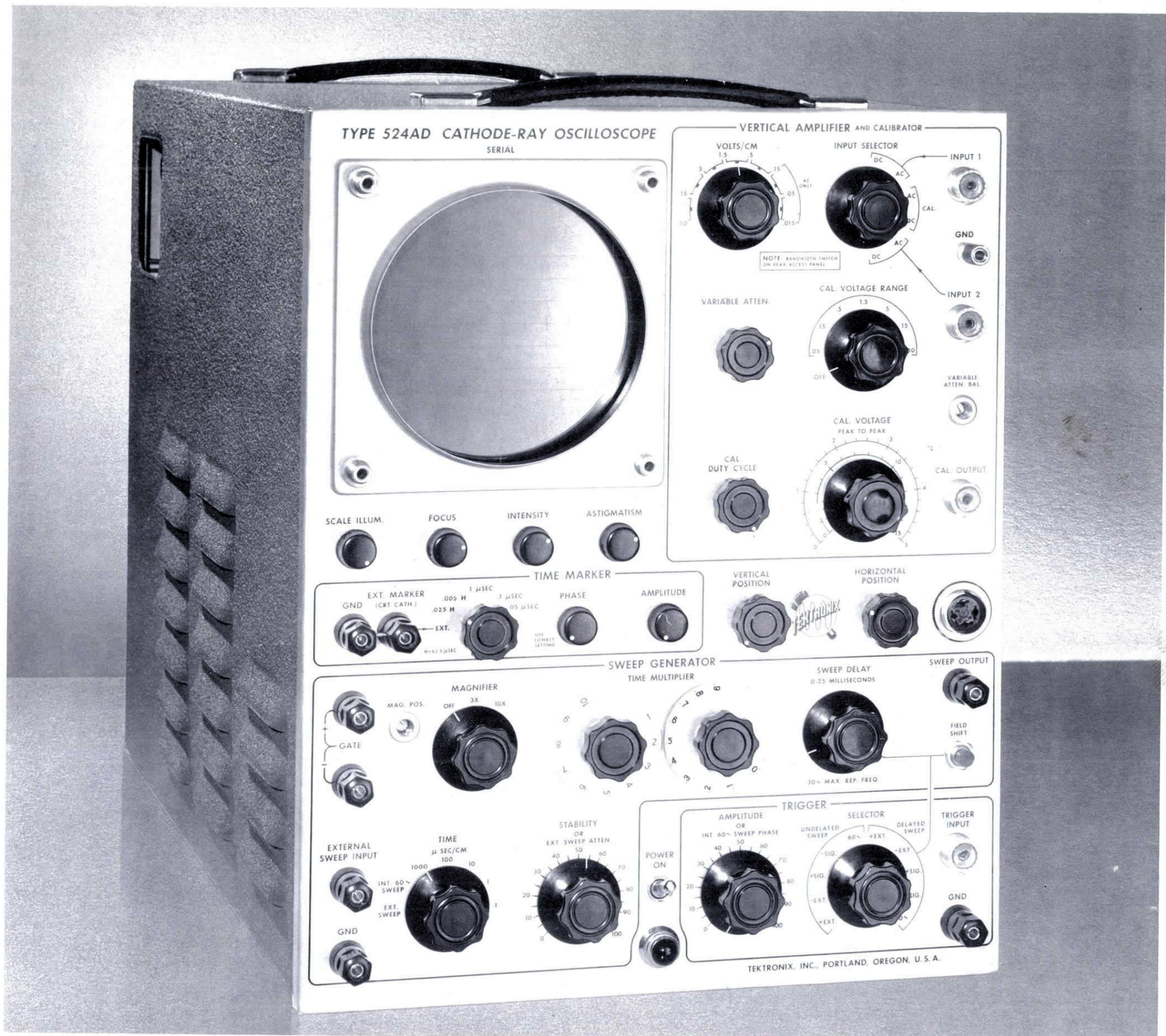
Instruction Manual, Type 517

PRICE \$3500.00

f.o.b. Portland (Beaverton), Oregon

TYPE 524AD OSCILLOSCOPE

Television Cathode-Ray Oscilloscope



GENERAL DESCRIPTION

The Tektronix Type 524AD is a portable, self-contained cathode-ray oscilloscope specifically designed for maintenance and adjustment of television transmitter and studio equipment.

With this oscilloscope, any portion of the television picture can be observed—from complete frames to small portions of individual lines. Any one of the 525 lines in the picture can be located and observed in minute detail. Accurate time markers greatly facilitate sync-pulse timing. The wide-band vertical amplifier is provided with networks that can be switched in to provide a flat response from 60 cycles to 5 mc, and to limit the high frequency re-

sponse to that recommended by the IRE for standardized level measurements.

VERTICAL DEFLECTION SYSTEM

DC-Coupled Amplifier—A 10-megacycle vertical amplifier with a maximum sensitivity of 0.15 v/cm direct coupled and 0.015 v/cm capacitively coupled provides an accurate presentation of the video signal. At sensitivities of 0.15 v/cm or lower the signal is fed into a cathode-coupled gain-control stage, then through the 0.25 μ sec delay network and into the push-pull driver stage. A cathode-follower stage feeds the grid lines of the distributed output stage. For the sensitivity ranges 0.015-0.05 v/cm and 0.05-0.15 v/cm, a capacitively-coupled 2-stage pre-amplifier is switched in.

Tektronix, Inc.

TYPE 524AD OSCILLOSCOPE

Flat Response to 5 mc—Some applications require a vertical-amplifier response flat within 1% from 60 cycles to 5 mc. A switch on the access panel of the Type 524AD inserts special peaking coils in series with the vertical deflection plates of the crt, factory adjusted to provide this response in the main amplifier. When switch is in this position, about 5% overshoot will occur on extremely sharp wavefronts.

IRE Recommended Response — The same access-panel switch can be used to limit the vertical-amplifier response to that recommended by the IRE for television level measurements.

Sensitivity Controls—A seven-position control inserts frequency-compensated attenuators to cover the range of 0.015 v/cm to 50 v/cm. This same control inserts the capacitively-coupled preamplifier in the 0.05-v/cm and 0.015-v/cm positions. The vertical-amplifier attenuator is in the cathode circuit of the gain-control stage. These two controls make the vertical-amplifier sensitivity continuously variable over its entire range.

Direct or Capacitive Coupling — When the dc-coupled feature of the amplifier is not needed, or when it is desirable to observe only the ac components of the signal, the ac-dc switch may be placed in the ac position. In this position a coupling capacitor is inserted in the input circuit to block the dc component of the signal.

Dual Inputs—The 524AD is equipped with two uhf input connectors. Selection of either input is made by the vertical-input selector. This feature offers a convenient method of making a rapid comparison of two separate signals.

Probe—The constant input impedance of the 524AD permits the use of rc input probes. A high impedance probe on a 42" cable is supplied with the instrument. The probe is frequency compensated and has an attenuation of ten times. The input impedance of the probe is 10 megohms paralleled by approximately 14 μmf .

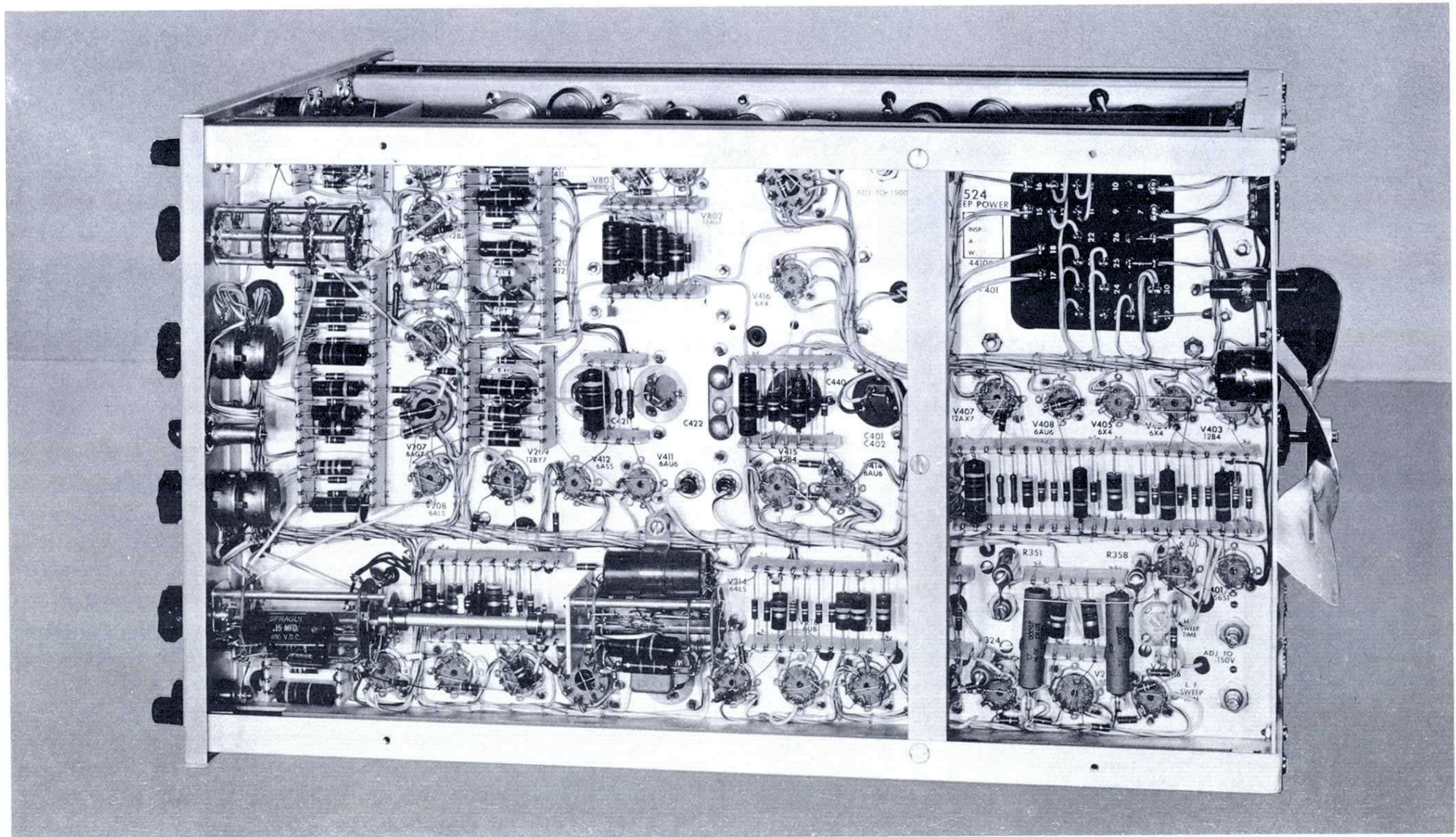
Amplitude Calibrator—A variable-duty-cycle square-wave calibration voltage is provided. This voltage is continuously variable from zero to 50 volts in seven ranges, full-scale calibration accurate within 3%; control linear within 1% of full scale. The duty cycle is variable from 1% to 99%. This permits the duty cycle of the calibrator to be matched with the duty cycle of the observed signal, thus minimizing error in amplitude calibration of an ac-coupled signal due to change in amplifier bias with the duty cycle of the signal.

Access Panel—A panel on the side of the instrument provides a capacitively-coupled connection to the vertical-deflection plates and direct connection to the horizontal-deflection plates, bypassing the vertical and horizontal amplifiers. The vertical-position control remains operative.

HORIZONTAL DEFLECTION SYSTEM

The Type 524AD has a continuously variable, linear, triggered time base covering the range of 0.01 sec/cm to 0.1 $\mu\text{sec/cm}$. A seven-position sweep-time selector switch provides five sweep-time positions, an internal 60-cycle sine-wave sweep, and an external sweep position. Dual sweep-time multiplier dials cover the range between steps. Calibration accuracy is within 5%.

Unblanking—The unblanking circuit used in the Type 524AD assures constant crt beam current at any sweep speed or duty cycle for a given intensity control setting.



Tektronix, Inc.

TYPE 524AD OSCILLOSCOPE

Sweep Delay—To observe individual lines or sync pulses, the sweep must be fast enough to spread out the desired information. By delaying the start of the sweep until the picture has progressed to the desired portion and then triggering the sweep with one of the line sync pulses, any individual portion of the picture may be observed. The sweep delay introduced in the 524AD is adjustable with a 3-turn potentiometer through about one and one-half fields, and operates at the frame rate of 30 cps so that only one interlaced line is observed at any time. A field-shift button permits switching to the corresponding interlaced lines in the other field.

Sweep Magnifier—A magnifier principle has been incorporated in the 524AD that gives either 3- or 10-times magnification of any detail that has been positioned to the center of the screen. With the magnifier on, the operator may explore the entire trace by slowly turning the 3-turn horizontal-position control. The position of any detail with respect to the entire sweep may be determined by turning off the magnifier and observing which part of the trace is centered on the screen.

Trigger Selector—The Type 524AD has a ten-position trigger selector. Both normal and delayed sweeps may be triggered by an external signal of either polarity, by either the positive or negative portion of the signal under observation, or by the power-line frequency.

Recurrent Sweep—A conventional free-running sawtooth sweep may be obtained by adjusting the sweep stability control. This sweep may be easily synchronized with the waveform under observation.

OTHER FEATURES

Time-Mark Generator—Time Markers are inserted as intensification pips on the crt trace at time intervals of 0.025H, 0.005H, 1.0 μsec , 0.1 μsec , and 0.05 μsec . Since H is 63.5 μsec , 0.025H will give 40 pips per television line and 0.005H will give 200 pips per television line. These markers provide a means of accurately timing the sync pulses of a composite signal. Pips spaced at 40 or 200 per television line are useful for adjusting both color and monochrome equipment.

A phasing control permits markers to be positioned on any desired point of the waveform under observation.

Output Waveforms—Positive and negative gate waveforms produced simultaneously with each sweep are provided so that intensification or blanking may be produced in a picture monitor to indicate the portion of the picture under observation. The sweep sawtooth waveform is also available on the front panel.

60-cycle Sweep—A 60-cycle internal sweep with phasing through approximately 150° and variable amplitude is provided to facilitate bandwidth measurements with a video sweep generator.

4-kv Accelerating Potential—A flat-faced cathode-ray tube, type 5ABP1, is used in the 524AD, with 4000-volts regulated accelerating potential.

Grouped Controls—The focus, intensity, and astigmatism controls are conveniently grouped below the crt screen.

Illuminated Graticule—An edge-lighted graticule marked in centimeters is provided. Illumination is controlled by a front-panel knob. An appropriate color filter increases

contrast when viewing in a brightly-lighted room. Also included is a graticule marked for modulation measurement.

Regulated Power Supply—All dc voltages are electronically regulated to insure stable operation over the supply range of 105-125 volts, 50-60 cycles.

CHARACTERISTICS

Sweep Circuit—Hard tube type, triggered or recurrent operation as desired.

Sweeps—Continuously variable, 0.01 sec/cm to 0.1 $\mu\text{sec/cm}$. Calibration accuracy 5%.

Trigger Requirements—0.5 to 50v (peak). Pulses as short as 0.05 μsec . Signal under observation producing 0.5 cm deflection or more. Composite television signal—1 v peak to peak external or 0.05 v to vert. amp.

Sweep Magnification—Magnifier expands the sweep to left and right of center. Either 3-times or 10-times magnification is available except on the 0.1- $\mu\text{sec/cm}$ sweep range.

External Sweep Input—Coupled via 100-k potentiometer, sweep magnifier, and direct-coupled sweep amplifier. Maximum deflection sensitivity, 0.25 v/cm dc or ac peak to peak.

Time Markers—Five markers—0.05 μsec , 0.1 μsec , 1.0 μsec , 200 pips per television line, and 40 pips per television line. Accuracy within 2%.

Time-Marker Phasing—Permits positioning on any desired point of the observed waveform.

Vertical Amplifier—5 stage. 3rd, 4th, and 5th stage direct-coupled push-pull. Distributed output (5th) stage.

AC Vertical-Deflection Sensitivity—Continuously variable from 0.015 v/cm to 50 v/cm, peak to peak.

DC Vertical-Deflection Sensitivity—Continuously variable from 0.15 v/cm to 50 v/cm, peak to peak.

Input Impedance—1 megohm shunted by 40 μmf . With probe, 10 megohms shunted by 14 μmf .

Vertical-Amplifier Response—dc to 10 mc (3db down) sensitivity of 0.15 v/cm; 2 cps to 10 mc (3 db down) sensitivity of 0.015 v/cm. Undistorted deflection available —6 cm.

Vertical-Amplifier Transient Response—Rise time (10%-90%) 0.04 μsec .

Signal Delay Network—Provides 0.25 μsec signal delay. Permits observation of the waveform that triggers sweep.

Calibrating Voltage—Variable-duty-cycle square wave. Seven ranges, 0.05 v to 50 v full scale, continuously variable. Full-scale calibrations accurate within 3%; control linear within 1% of full scale. Duty cycle variable from 1% to 99%.

Cathode-Ray Tube—A 5ABP1 cathode-ray tube is furnished with the Type 524AD unless a P7 or P11 phosphor is specified as the optional choice. An accelerating potential of 4 kv is used (+2.5 and -1.5 kv).

Construction—Completely self-contained, cabinet and chassis made of electrically-welded aluminum. Photo-etched front panel.

Dimensions—13" high, 16" wide, 24½" deep.

Weight—61 pounds.

Power Requirements—105-125 or 210-250 volts, 50-60 cycles, 500 watts.

Tektronix, Inc.

TYPE 524AD OSCILLOSCOPE

VACUUM TUBE COMPLEMENT

| | | |
|---|-----|-------|
| Preamplifier | 2 | 6U8 |
| Cathode follower | | 12AT7 |
| Cathode-coupled amplifier | 2 | 6CL6 |
| Driver | 2 | 6CL6 |
| Cathode follower, constant-current triode | 2 | 6BQ7 |
| Output amplifier | 6 | 6AG7 |
| Cathode follower | | 6AS5 |
| Cal. multivibrator | | 12AU7 |
| Cal. clipper amplifier | 1/2 | 12AT7 |
| Cal. cathode follower | 1/2 | 12AT7 |
| Trigger inverter | 1/2 | 6BQ7 |
| Clamp diode | 1/2 | 6BQ7 |
| Sync amplifier | | 12BZ7 |
| Sync separator | 1/2 | 12BZ7 |
| Coupling diode | 1/2 | 12BZ7 |
| Phantastron | | 6BH6 |
| Voltage comparator | | 12BZ7 |
| Trigger amplifier | | 6AG7 |
| Coupling diode | | 6AL5 |
| Negative multivibrator | | 12BY7 |
| Positive multivibrator | | 12BY7 |
| Gate amplifier | 1/2 | 12AU7 |
| Astigmatism cathode follower | 1/2 | 12AU7 |
| Unblanking amplifier | | 12AT7 |
| Clamp tube | | 6AG7 |
| DC restorer | | 6AL5 |
| Cathode follower | | 12AT7 |
| Decoupling diode | 1/2 | 12AT7 |
| Cathode follower | 1/2 | 12AT7 |
| Feedback amplifier | | 6U8 |
| Clamp | 1/2 | 12AT7 |
| Output cathode follower | 1/2 | 12AT7 |
| Sweep-output amplifier | 2 | 6AH6 |
| Sweep-output cathode follower | | 6BQ7 |
| Voltage reference | | 5651 |
| Regulator amplifier | 4 | 6AU6 |
| Regulator series tube | 2 | 12B4 |
| Rectifier | 3 | 6X4 |
| Voltage-comparator amplifier | | 12AX7 |
| Regulator series tube | | 6AS7 |
| Regulator series tube | | 6AS5 |
| Regulator series tube | | 6AQ5 |
| Time-mark pulse shaper | 1/2 | 6BQ7 |

| | | |
|----------------------------|-----|-------|
| Marker phase multivibrator | | 6U8 |
| Oscillator gate | 1/2 | 6BQ7 |
| Time-mark oscillator | | 6AK5 |
| Pulse amplifier | | 6BQ7 |
| Regulator amplifier | | 12AU7 |
| High-voltage oscillator | | 6AQ5 |
| High-voltage rectifier | 3 | 5642 |
| Cathode-ray tube | | 5ABP1 |

Price—\$1,180 f.o.b. Portland (Beaverton), Ore.

- Includes:
- 1—Type P510A Attenuator Probe
 - 2—Type A510 Binding Post Adapters
 - 1—Type GR524TV Graticule
 - 1—Type H510 Viewing Hood
 - 1—Instruction Manual

Currently Available Extras

- Rack Mounting Add \$25
- P1 crt phosphor normally furnished.
- P7, P11 optional No extra charge

Recommended Additional Accessories

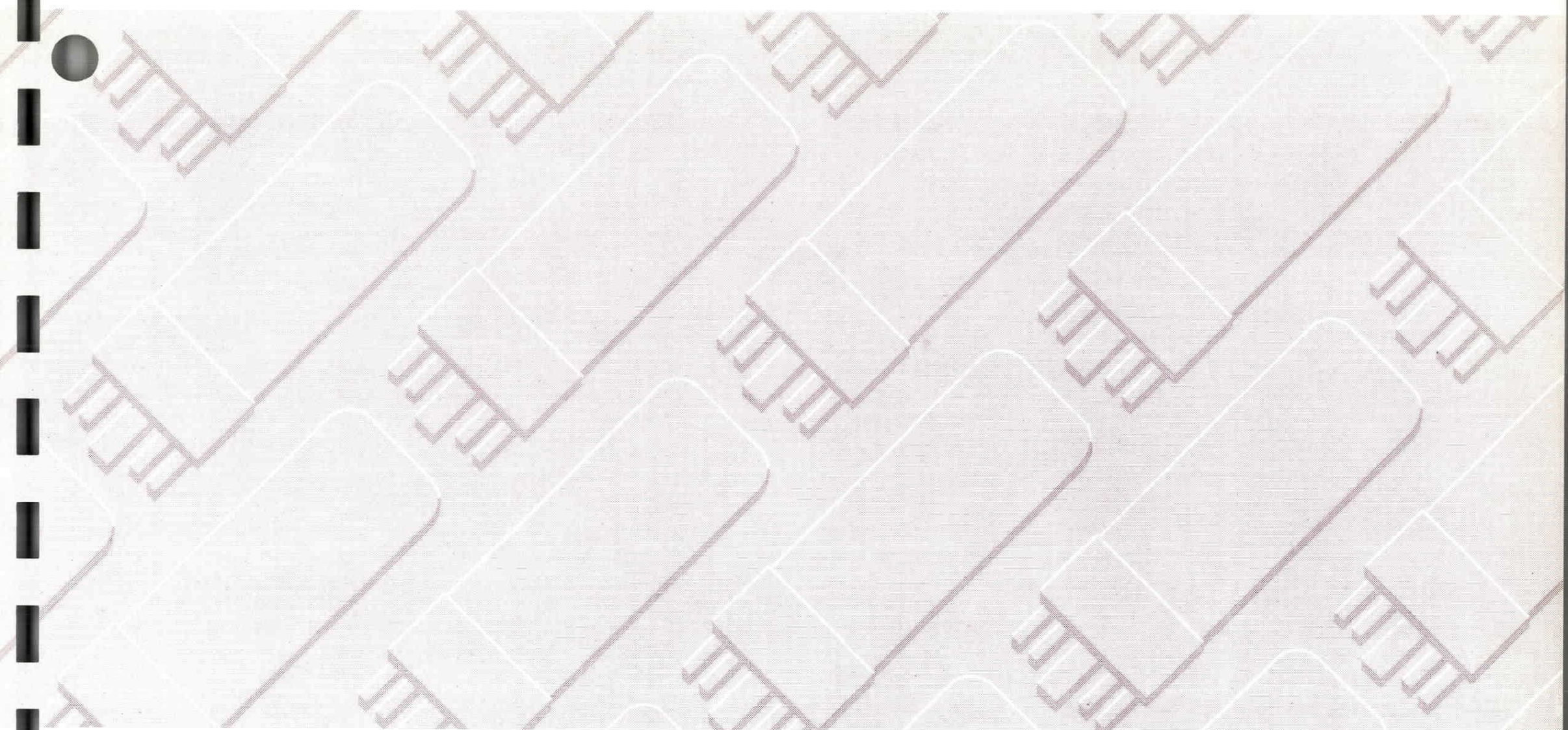
10-105 Cathode-Follower Probe—Presents low input capacitance with minimum attenuation. Input impedance is 40 megohms paralleled by 4 μmf , gain is 0.8 to 0.85. Input to probe is ac-coupled, limiting its low-frequency response to about 5 cycles. Amplitude distortion is less than 3% on unidirectional signals up to 5 volts. 10-x attenuator head is included with probe, and should be used on signals exceeding a few volts to minimize amplitude distortion. With the attenuator head attached the probe input impedance is approximately 10 megohms paralleled by 2 μmf . Probe output level is 11 v positive, making it necessary to use the ac-coupled position of the AC-DC switch at sensitivities from 0.15 v/cm to 50 v/cm. Probe-power output connector is provided on the front panel of the Type 524AD. (Caution—the 6.3 v ac is $\pm 120\text{-v}$ dc above chassis) . . . \$64.00

Type 500 Scope-Mobile \$97.50

See Accessory Section of this catalog for 75-ohm coaxial cables, pads, and terminating resistors.

Probe
→
↓

10-105 also known as P500CF Cathode-Follower Probe. 524AD also have to order Mod. Kit K-524-1021A for \$5.00. to install front-panel probe-power connector. 524-AD is equipped = front panel connector, so no kit is necessary.



AUXILIARY AMPLIFIERS

are designed to expand the area of application of Tektronix oscilloscopes in certain specialized directions. Frequently it is desirable to increase the sensitivity of the oscilloscope amplifier into the mv/cm or μ v/cm region. Other measurements may require that the horizontal deflection circuits have the same order of bandwidth or sensitivity as the vertical circuits.

TYPE 112 AMPLIFIER

DC-Coupled Differential Amplifier

Voltage Gain

0.5 to 5000, continuously variable.

Frequency Response

DC to 2 mc for gain of 166 or less.
DC to 1 mc for gain of 166 to 5000.

Transient Response

Risetime—0.2 μ sec for gain of 166 or less
0.4 μ sec for gain of 166 to 5000.

Output Voltage

150 v at high impedance.
75 v at 8000 ohms.

Calibrating Voltage

5 mv to 50 v full scale, continuously variable.

Time-Marker Input

Trigger Output

GENERAL DESCRIPTION

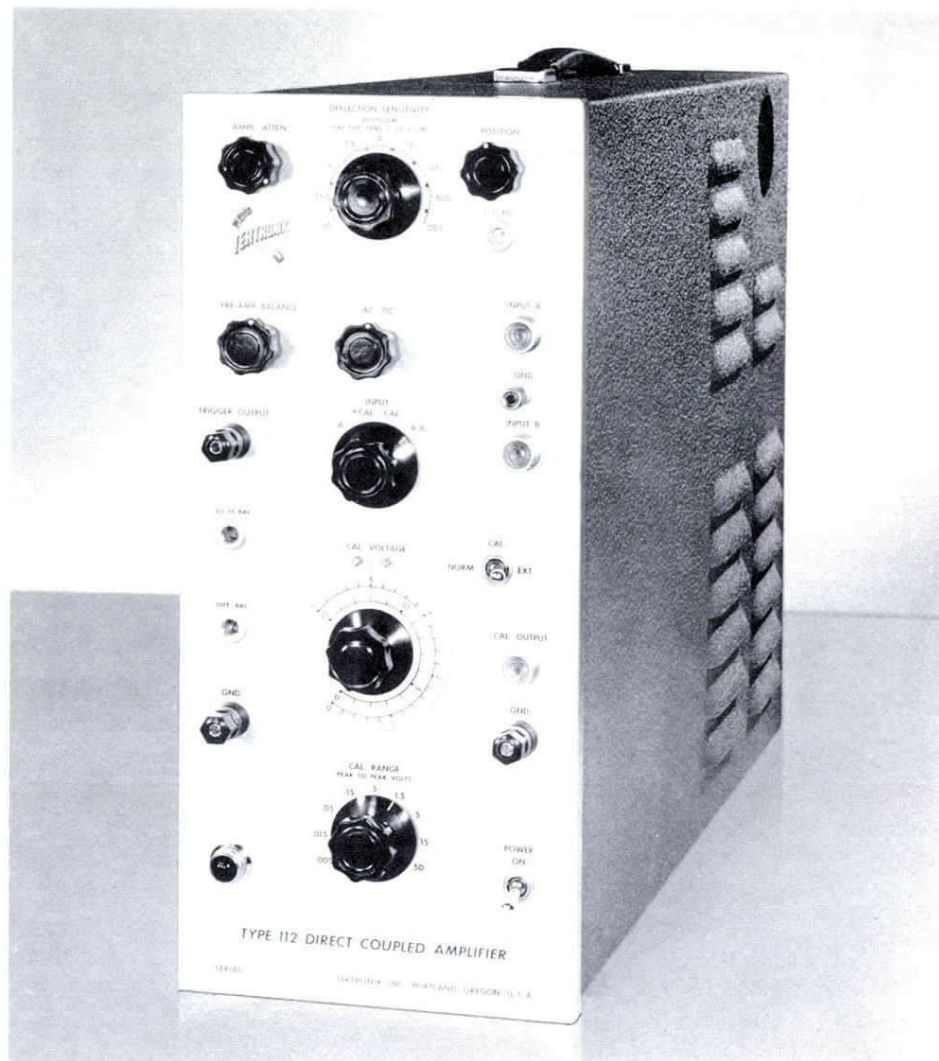
The Type 112 is a dc-coupled differential-input amplifier designed primarily for the amplification of signals to a magnitude suitable for observation on a cathode-ray tube. It is a four-stage balanced push-pull amplifier with the input stage shock mounted. Heaters of the first three stages and all plate circuits are operated on electronically regulated dc supplies to provide stability against line-voltage fluctuations. Choice of single-ended or differential input, either dc-coupled or ac-coupled, provides flexibility of connection to circuits under observation, and often permits rejection of undesired signal pickup.

The Type 112 is especially well adapted for use with Tektronix Type 511, 512, 514, and 524 oscilloscopes. The necessary connections at the crt access panel and trigger input of the oscilloscopes are easy to make. Sensitivity is increased from 5 mv/cm in oscilloscopes in which the crt has a basic deflection factor of 25 v/cm; and to 3 mv/cm where the basic deflection factor is approximately 15 v/cm. Because characteristics of the Type 112 are identical to those of the vertical amplifier of the Tektronix Type 512 oscilloscope, this combination can be used where identical characteristics are needed in both horizontal and vertical axes. For example, for Lissajous presentations.

OTHER CHARACTERISTICS

Deflection Sensitivity—When used with a crt having a basic deflection factor of 25 v/cm, the sensitivity is 5 mv/cm to 50 v/cm in 9 calibrated steps. A potentiometer fills in between steps, making the sensitivity continuously variable.

Input Impedance—1 megohm paralleled by 45 μ mf. With probe, 10 megohms paralleled by 14 μ mf.



Calibrator Accuracy—Full scale calibrations accurate within 3%; control linear within 1% of full scale.

Power Requirements—105 to 125 or 210 to 250 volts, 50 to 60 cycles, 200 watts.

VACUUM TUBE COMPLEMENT

| | | |
|------------------------------------|---|-------|
| Amplifiers | 2 | 5879 |
| Amplifiers | 4 | 12AU6 |
| Amplifiers | 2 | 6AG7 |
| Cathode Followers | 2 | 12AU6 |
| Voltage Regulators | 2 | 12AU7 |
| Marker Amplifier | | 6AU6 |
| Constant-Current Control | 2 | 6CB6 |
| Cal Multivibrator | | 12AU7 |
| Cal Diode and Output CF | | 12AU7 |
| Rectifiers | 3 | 5V4G |
| Voltage Reference | | 5651 |
| Regulator Amplifiers | 2 | 6AU6 |
| Series Regulator | | 6AS7G |

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Size—15½" high, 6½" wide, 21½" deep.

Weight—32 pounds.

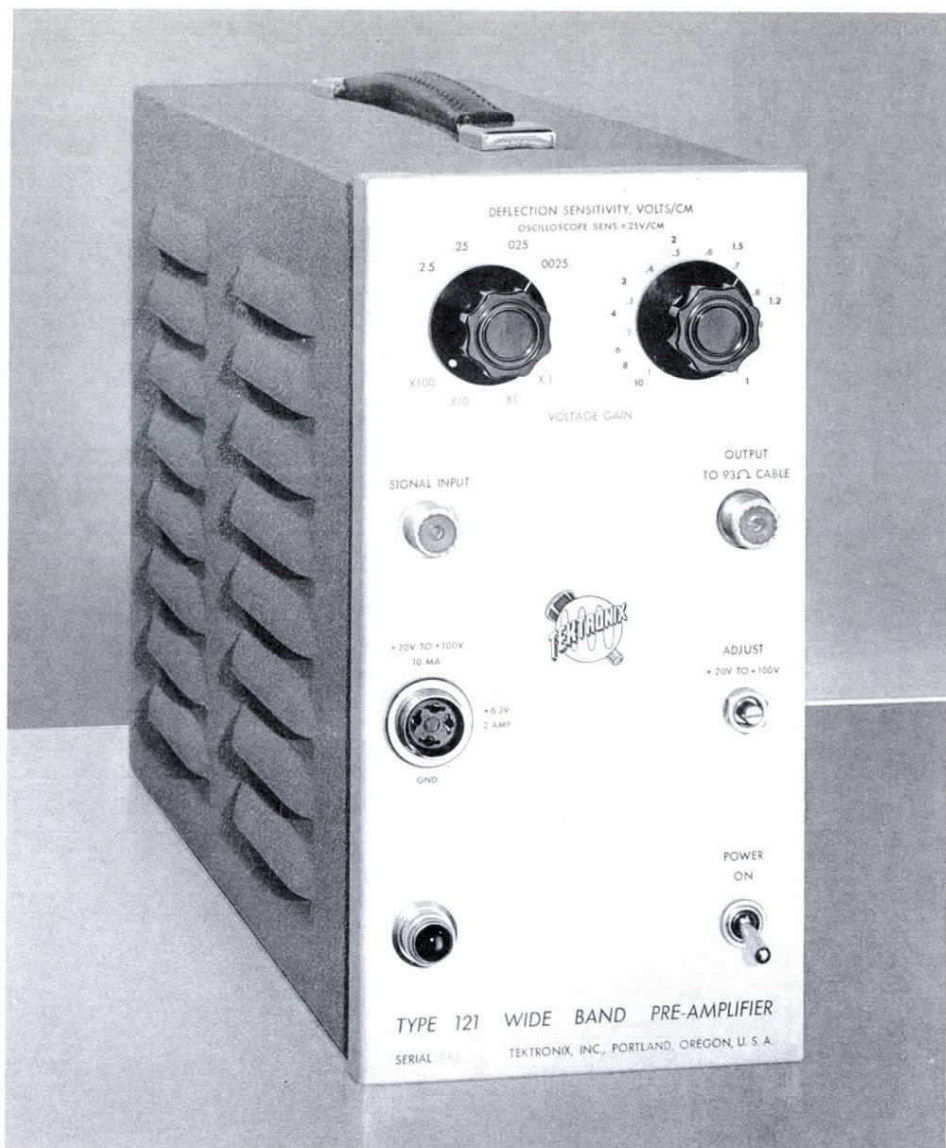
Price—\$495 f.o.b. Portland (Beaverton), Oregon

Includes: 2—P510A Attenuator Probes
2—W112R Output Leads
1—W112B Output Lead
2—A510 Binding-Post Adapters
1—Instruction Manual

Tektronix, Inc.

TYPE 121 PREAMPLIFIER

Wide-Band Preamplifier



Optimum Transient Response Unusual Adaptability

The TEKTRONIX **Type 121 Wide Band Pre-amplifier** is a self-contained three-stage amplifier designed primarily to increase the sensitivity of the Type 511, 511-A, and 511-AD oscilloscopes. A maximum voltage gain of 100 is available, increasing the sensitivity of the oscilloscope to 2.5 mv/cm. A combination of step and continuous attenuators on the TEKTRONIX **Type 121** provides a complete range of sensitivity from 2.5 mv/cm to 25 v/cm without the use of the attenuators on the oscilloscope. Connection between the TEKTRONIX **Type 121** and oscilloscope is via a matched 93-ohm co-axial cable so that the separation of the instruments may be 100 feet or more. As in all TEKTRONIX instruments, primary emphasis has been placed on transient response. A bandwidth in excess of 12 mc preserves the excellent rise time of the oscilloscope.

Careful design results in a high input impedance of 1 meg shunted by 20 mmf, maintained for all positions of the attenuators. When desired, conventional RC probes may be used to increase this impedance at the expense of a reduction of gain. DC plate and heater supplies are available on a front panel power supply socket so that when both high input impedance and high gain are necessary, a cathode follower probe or a special pre-amplifier stage mounted directly on the signal source may conveniently be used.

The self-contained power supply in the TEKTRONIX **Type 121** provides electronically regulated DC for the plates of the tubes and to minimize the hum level, rectified, filtered DC is supplied to the heaters of the first three

tubes as well as the front panel power supply socket. The first, second, and C.F. gain control stages are shock mounted.

SPECIFICATIONS

| | |
|--|---------------------------|
| Voltage Gain | 100 |
| Input Impedance, Direct | 1 meg paralld by 20 mmf |
| Max. Peak Output | ±1 v in 93-ohm cable |
| Band Pass | 5 cps — 12 mc |
| Front Panel Power Supply Socket | 6.3 v DC 20 - 120 v DC |

Power Requirements — 105-125/210-250 volts, 50-60 cycles, 80 watts.

Dimensions

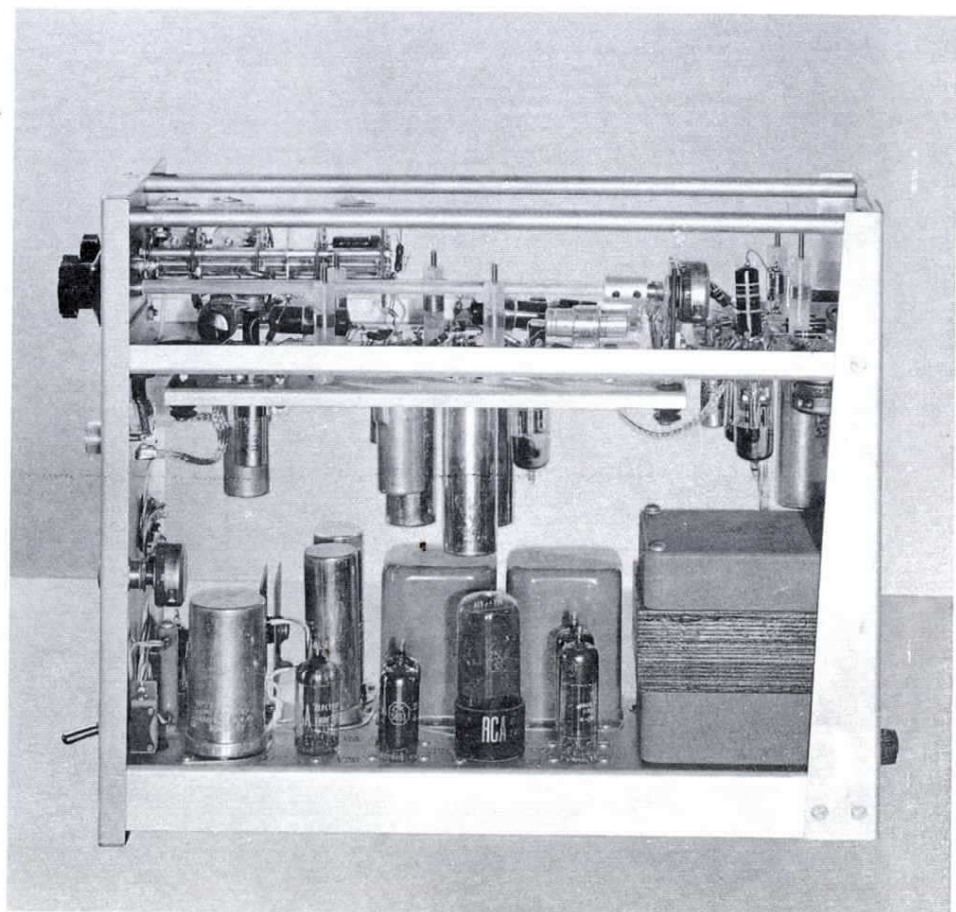
5¾" wide, 11¼" high, 15" deep
Self-contained — Total Weight 18½ lbs.

Vacuum Tube Complement

| | |
|------------------------------------|-------|
| First Stage | 6CB6 |
| Second Stage | 6CB6 |
| C.F. Gain Control | 6J6 |
| Third Stage | 6AH6 |
| C.F. Output | 6J6 |
| C.F. Voltage Regulator | 6J6 |
| Voltage Regulator Comparator | 12AX7 |
| Plate Rectifiers | 2 6X4 |
| Series Voltage Regulator | 25L6 |
| Regulator Amplifier | 6AU6 |
| Voltage Reference | 5651 |

Price \$265 f.o.b. Portland (Beaverton), Oregon

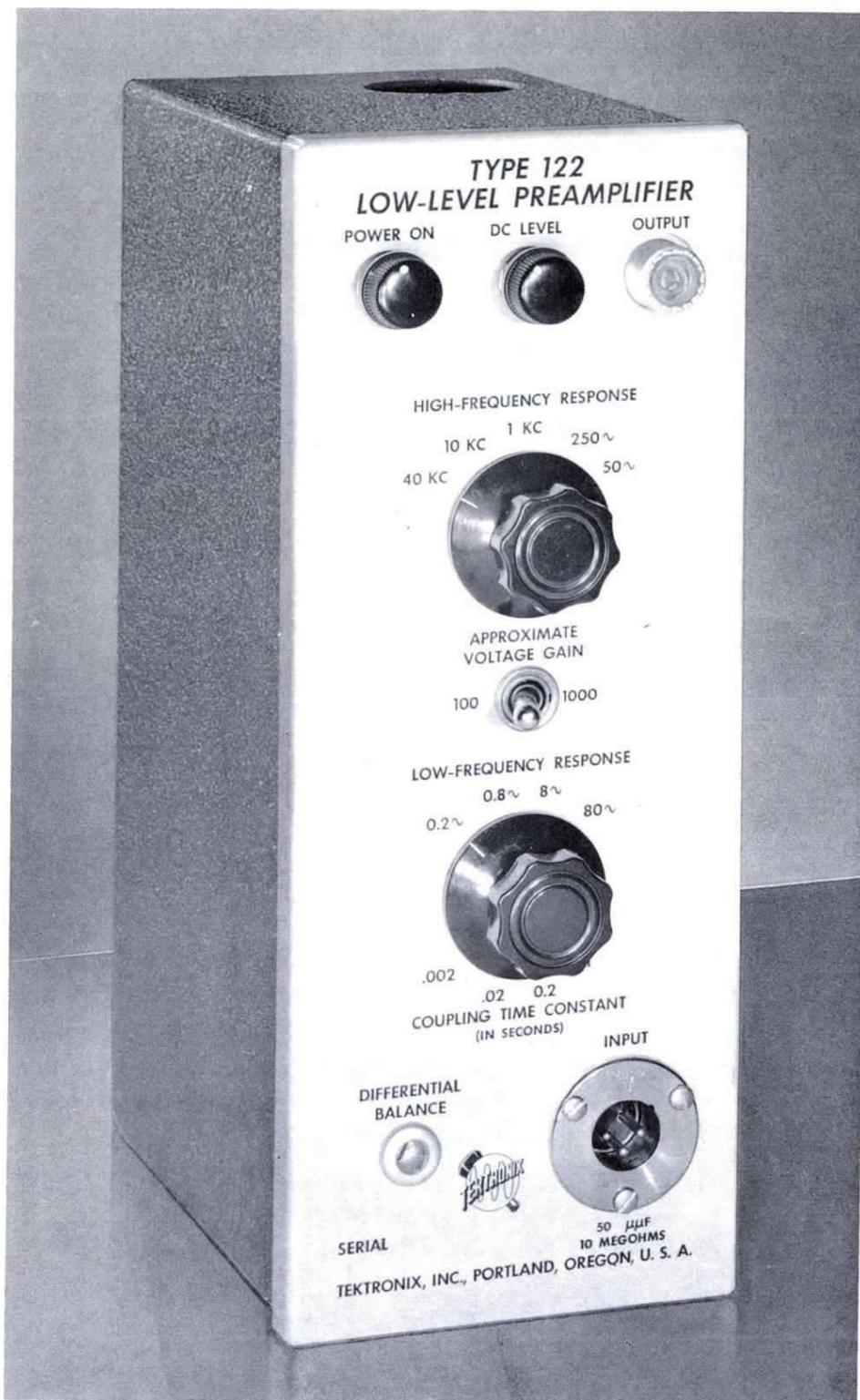
Includes the following: 1—P93B Output Cable
1—Instruction Manual



Tektronix, Inc.

TYPE 122 PREAMPLIFIER

Low-Level Preamplifier



GENERAL DESCRIPTION

The TEKTRONIX Type 122 Pre-amplifier is a compact three-stage, battery operated amplifier designed primarily to extend the sensitivity of the TEKTRONIX Type 512 Oscilloscope into the microvolt region. The maximum voltage gain of 1000 times increases the sensitivity of the Type 512 Oscilloscope to 5 microvolts per centimeter. At maximum gain an input of 0.02 volts peak to peak is permissible.

At maximum bandwidth setting, frequency response is essentially flat between 0.16 cycles and 40 kc. Separate low-frequency and high-frequency controls permit the bandwidth to be reduced to improve the signal-to-noise ratio where reduced bandwidth is permissible.

The first two stages of the Type 122 Amplifier are operated push-pull and are designed especially to have a high degree of balance. With careful setting of the front-panel differential-balance control, an 80- to 100-db rejection ratio can be realized between in-phase and out-of-phase signals applied to the input grids at frequencies above five cycles.

A frequency-compensated attenuator allows the voltage gain to be reduced by a factor of ten, to a gain of about

100 times. At this gain setting, a maximum input of 0.1 volts peak to peak is permissible.

A maximum output of 20 volts peak-to-peak is possible without appreciable deterioration of amplitude linearity at about 1000x gain, and an output of 10 volts at about 100x gain. Shockmounting, careful bypassing, and use of battery heater and plate supply reduce microphonics, noise, and hum to a low level.

A cathode-follower circuit provides a low impedance output of the order of 1000 ohms. An output level control permits operation at ground potential.

APPLICATIONS

Biological research and other applications requiring the amplification of microvolt signals for observation or recording.

CHARACTERISTICS

Frequency Response — 1/6 cps-40 kc.

High Frequency Cutoff,
3 db points 40 kc 10 kc 1 kc 250 cps 50 cps
Low Frequency Cutoff,
3 db points (frequencies-cps) .2 .8 8 80.
(time constants-sec) 1 0.2 .02 .002

Gain — High position, approximately 1000; low position, approximately 100. Rejection ratio for in-phase signals — 80 to 100 db (5 cps-40 kc).

Maximum Output — 20 v (peak-to-peak).

Output Impedance — 1000 ohms approximately (cathode follower).

D. C. Output Level — Adjustable to zero (for use with D.C. oscilloscopes).

Maximum Input Signal — .02v (peak-to-peak) in high gain position; .2v (peak-to-peak) in low gain position.

Input Impedance —
Single Ended 10 meg. paralleled by 50 $\mu\mu\text{f}$ max.
Differential 20 meg. paralleled by 50 $\mu\mu\text{f}$ max.

Noise Level — 1 μvolt to 4 μvolts RMS depending on setting of frequency response controls.

Power Requirements — From batteries through a standard octal plug: -90 v at 4 ma.; +135 v at 5 ma.; 6.3 v at .9 amp.

Vacuum Tube Complement — 1 12AX7 (Specially selected for differential balance). 2 12AU7 (One specially selected for differential balance).

Dimensions — 10 5/8" high; 4 1/2" wide; 7" deep.

Finish — Panel, photo etched aluminum with black lettering; cabinet, grey wrinkle.

Price — \$85.00

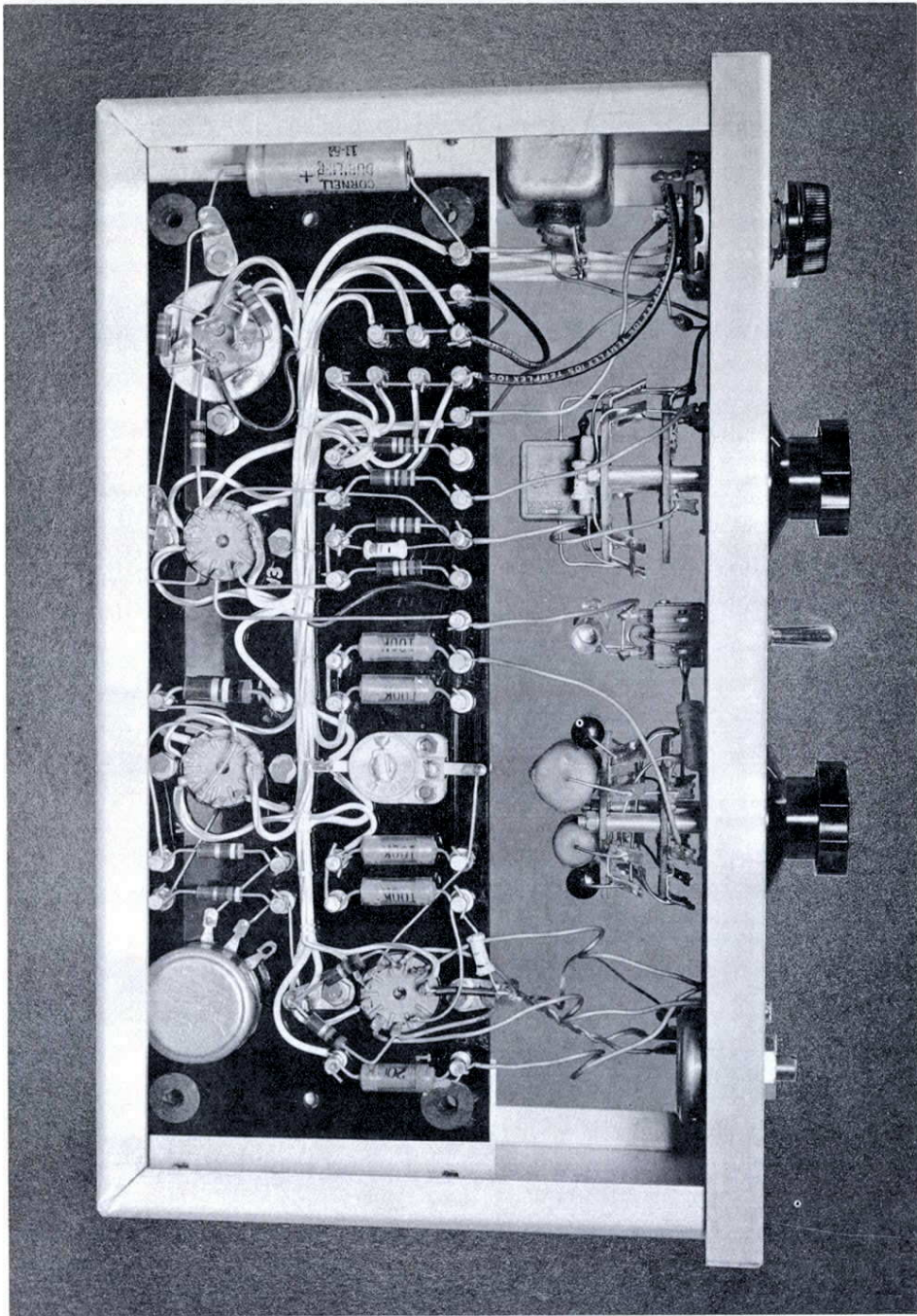
RACK MOUNTED TYPE 122

Mounting Method — The Type 122 is horizontally mounted in a 1/8" thick panel with the input jack at the left end of the panel.

Panel Size — 19" standard relay rack width, 5 1/4" height.

Tektronix, Inc.

TYPE 122 PREAMPLIFIER



Power Input — Battery cable socket is on right end, to rear.

Price — \$90.00

FRAME MOUNTED TYPE 122

Mounting Method — The Type 122 is designed for mounting in a special adapter frame, Type FA160; or it may be fastened to an existing support.

Panel Size — 4 1/8" wide, 12 1/4" high.

Power Input — Battery cable socket is on top, to rear.

Price — \$90.00

Prices f.o.b. Portland (Beaverton), Oregon

Included with the Type 122: 1—W122 Battery Cable
1—CON3P Input Plug
1—P93 Output Cable
1—Instruction Manual

Currently Available Extras

Extra long battery cables, similar to Type W122, may be ordered as special items.

Recommended Additional Accessories

Type FA 160 Adapter Frame \$5.00
Mounts in relay rack. Designed to hold four units—any combination of Type 122, Type 161, Type 162, Type 163. (The Type 160 Power Supply requires the panel space of two units). Outside dimensions—19" (standard relay rack width), 12 1/4" high. Inside dimensions—16 1/2" long, 10 3/8" high.

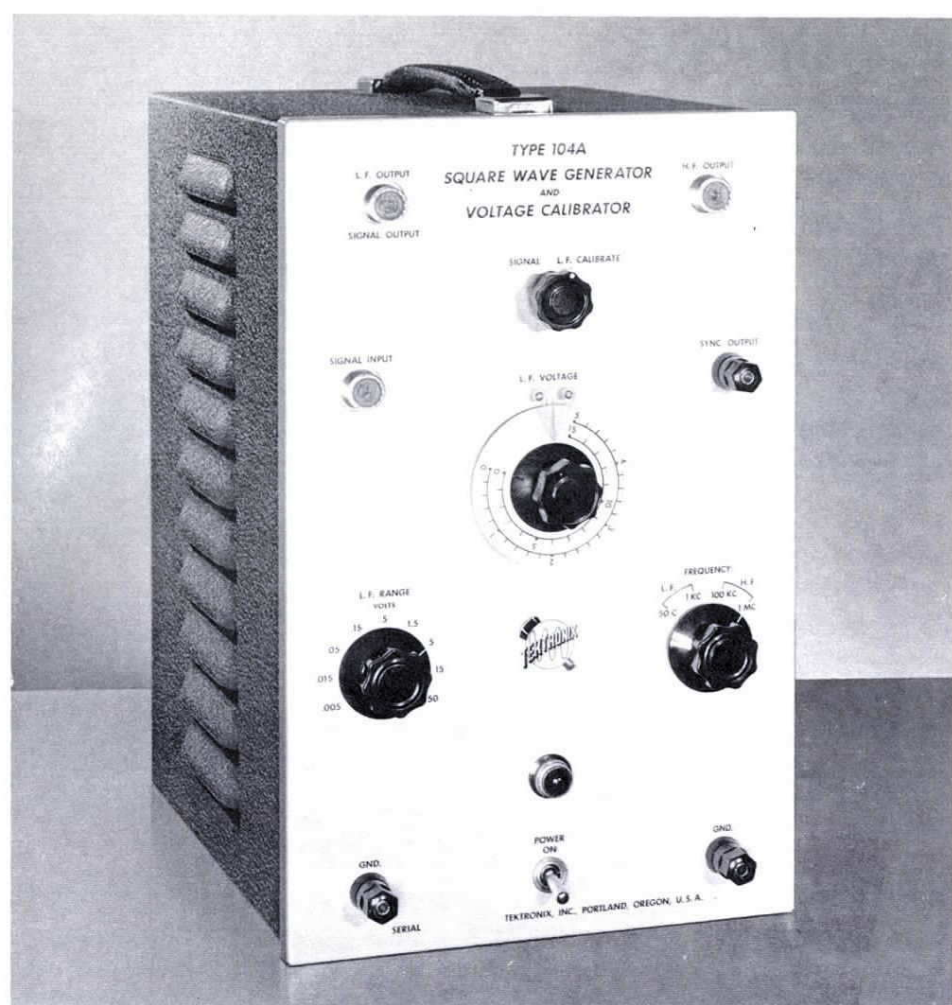


SQUARE WAVE GENERATORS

Square wave testing techniques are recognized as providing one of the most efficient means of determining electronic circuit response. Precise adjustment of frequency compensated attenuator, amplifier and filter circuits is reduced to a simple procedure.

TYPE 104A SQUARE WAVE GENERATOR

& VOLTAGE CALIBRATOR



GENERAL DESCRIPTION

The TEKTRONIX **Type 104-A Square Wave Generator** is an inexpensive generator of precision square waves in the frequency range most commonly used for amplifier response testing. The instrument is similar to its predecessor, the **Type 104**, except that it now includes an accurate voltage calibrator utilizing the two lower frequencies. Improved physical arrangement provides increased usefulness on the test bench. The **Type 104-A** is ordinarily furnished to supply square waves of 50 cps, 1 kc, 100 kc and 1 mc, giving good coverage of the audio and video ranges. By proper choice of these frequencies, the **Type 104-A** permits convenient adjustment of a wide range of amplifier types and accurate observation of their frequency and transient response.

FEATURES

Short Rise Time—As a result of careful design, the two high frequency square waves have a rise time of not more than .02 microsecond without overshoot.

High Frequency Output Available at Low Impedance—The output of the two high frequencies is available through a matched cable terminated by a continuously variable attenuator and provides a signal of at least 5 volts.

Low Frequency Output Available as Calibrating Voltage—Since the rise time is of less consequence at the two lower frequencies, a second multivibrator-limiter circuit provides these signals at a higher impedance, making it possible to obtain the low frequency output via a precision attenuator in 9 ranges of 5 mv to 50 v peak-to-peak. A calibrated wire wound potentiometer permits continuously variable amplitude adjustment for each range, accurate to within 3% of the full scale reading.

Synchronizing Signal—In order to synchronize the oscilloscope being used, a separate binding post supplies a synchronizing signal of at least 3 volts at all settings of attenuator or calibrator controls.

APPLICATIONS

The 50 cycle square wave provides a quick test for the low frequency characteristics of amplifiers. The 1 kc square wave is a convenient signal for quickly and accurately adjusting capacity compensated attenuators. The 100 kc and 1 mc square waves permit convenient adjustment of high frequency compensating networks for video amplifiers.

Provision is made on the two low frequencies for inserting the instrument between a signal source and the oscilloscope. By the turn of a switch, either the signal or the calibrating voltage can be observed, permitting accurate measurement of amplitude of any portion of the signal waveform.

The small size and low cost of the **Type 104-A** extend the square wave testing technique into many fields of production testing.

CHARACTERISTICS

Frequencies—Four fixed: 50 cps, 1 kc, 100 kc, 1 mc.

Impedance—Varies from 0 to 93 ohms for the high frequency output, depending on the attenuator setting. Varies from 0 to 10,000 ohms for the low frequency output, depending upon the calibrator control settings.

Rise Time—.02 μ sec for the high frequency outputs, and 3 μ sec for the low frequency outputs.

Amplitude—Continuously variable from 0 to 5 volts for the high frequency outputs. Continuously variable from 0 to 50 volts, in 9 calibrated ranges, for the low frequency outputs.

Construction—Chassis and cabinet are made of welded aluminum alloy. Front panel is photo etched, satin finished aluminum. Cabinet has baked gray wrinkle finish.

Dimensions—13 1/2" high; 9" wide; 11 1/2" deep.

Weight—22 pounds

Power Requirements—105-125/210-250 volts, 50-60 cycles, approximately 115 watts.

Vacuum Tube Complement—

| | | |
|--|---|-----------|
| High Frequency Multivibrators | 2 | 6AG7 |
| High Frequency Limiter | | 6AG7 |
| High Frequency Output Amplifier | | 6AG7 |
| Low Frequency Multivibrator | | 12AU7 |
| Low Frequency Limiter Diode and Cathode Follower | | 12AU7 |
| Trigger Output Cathode Follower | | 6J6 |
| Power Supply Rectifier | | 5V4G |
| Series Regulator | | 6AU5 |
| Regulator Amplifier | | 6AU6 |
| Voltage Reference | | OC3/VR105 |

Price with listed frequencies \$195.00

Includes: 1—P93A Attenuator cable
1—A100 Clip-lead adapter
2—A510 Binding-post adapters
1—Instruction Manual

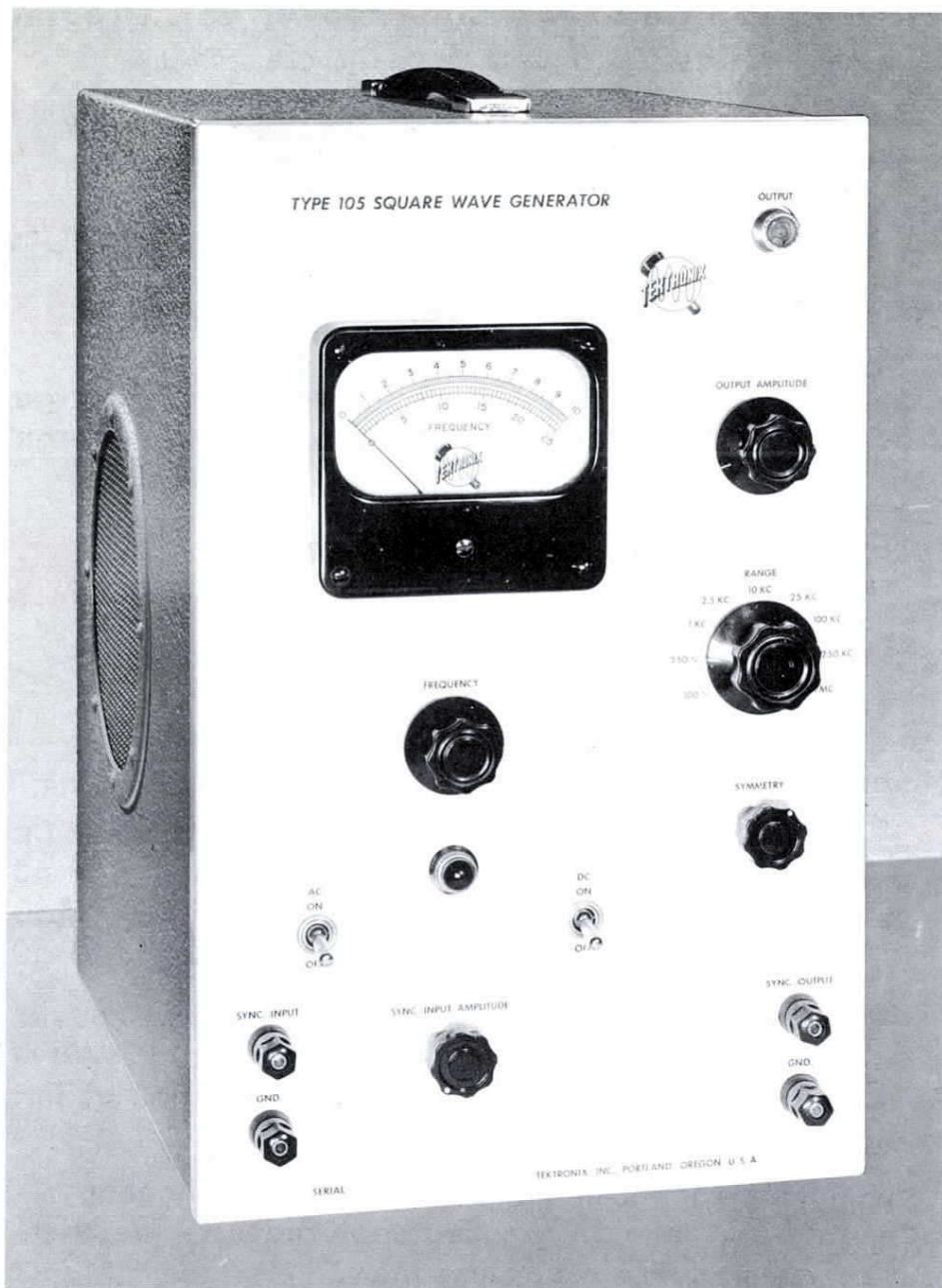
Currently Available Extras

Selected frequencies—
2 in range 50 cycles to 10 kc. \$20
2 in range 50 kc to 1 mc. 20

Prices f.o.b. Portland (Beaverton), Oregon

Tektronix, Inc.

TYPE 105 SQUARE WAVE GENERATOR



Continuously Variable, 25 CPS - 1 MC
Rise Time, .02 Microseconds
Direct Reading Frequency Meter

APPLICATIONS

Testing wide-band amplifiers with a square-wave generator and an oscilloscope is a fast, efficient method both in the laboratory and in the television station. Such characteristics as transient response, bandwidth, and phase shift are quickly revealed. For examination of the high-frequency response a square wave having a risetime faster than that of the amplifier being tested is required. In addition, the test signal must be free of overshoot and ringing. For examination of the low-frequency response a square wave having flat horizontal portions is required.

The TEKTRONIX **Type 105** Square Wave Generator provides a suitable signal for both of these tests. Its frequency range extending continuously from 25 cycles to 1 mc., combined with its risetime of .02 microseconds, makes it possible to quickly and accurately test amplifiers, filters, etc., having pass bands from a few cycles to 20 mc.

For an excellent discussion on the connection between bandwidth and frequency response, composition of risetime and other details associated with square wave testing, see Vol. 18, Radiation Laboratory Series, "Vacuum Tube Amplifiers" (McGraw-Hill).

GENERAL DESCRIPTION

The TEKTRONIX **Type 105** Square Wave Generator consists of a multivibrator frequency generator, having nine ranges in two steps per decade. The signal from the multivibrator is fed through two shaper stages to the output stage which consists of three 6AG7 tubes in parallel. The maximum square wave current available at the output terminals is approximately 160 ma (peak to peak). This gives approximately 12 v in 75-ohm cable or 15 v in 93-ohm cable. Type of output cable furnished with the instrument is optional. (52-ohm, 75-ohm or 93-ohm coaxial cable.) If higher output voltages are needed, correspondingly larger loads may be used with a deterioration of the risetime approximately proportional to the increased load. Maximum available output voltage is 100 v. A panel control permits setting the output amplitude from near zero to the previously mentioned maximums.

For convenience a direct-reading frequency meter is incorporated in the instrument. The range of the frequency meter is changed simultaneously with the range of the multivibrator, providing two scales per decade. The frequency meter is accurate within 3% of full scale.

Provision is made to furnish a synchronizing signal to an oscilloscope. The amplitude of this signal is independent of the output control setting. A sync. input binding post is also provided so that the square wave frequency may be synchronized with a frequency standard.

All DC power supplies are electronically regulated so that uniform operation is obtained at line voltages of 105-125 V. 210-250 V.

| | |
|---|---|
| Frequency Range | 25 cycles to 1 mc |
| Rise Time | .02 microseconds for output load of 100 ohms or less |
| Output Amplitude | 0-100 V. peak to peak across internal 600-ohm load 0-160 ma. available for external load |
| Accuracy of Frequency Indication | $\pm 3\%$ of full scale |
| Sync. Output | 5 Volts |
| Sync. Input | 3 Volts |
| Power Requirements | 105-125, 210-250 V., 50-60 cycles, 250 watts |
| Dimensions | 10 $\frac{1}{8}$ " wide, 16 $\frac{1}{2}$ " high, 14 $\frac{7}{8}$ " deep |
| Weight | 35 $\frac{1}{2}$ pounds |

Vacuum Tube Complement

| | | |
|--|---|------|
| Multivibrator | 2 | 6CB6 |
| Shaper amplifier | | 6AG7 |
| Driver amplifier | 2 | 6AG7 |
| Output amplifier | 3 | 6AG7 |
| Sync input amplifier | | 6CB6 |
| Sync coupling diode | | 6AL5 |
| Meter amplifier | | 6CB6 |
| Limiter and catcher diode | | 6AL5 |
| Cathode follower voltage regulator | | 6J6 |
| Meter diode | | 6AL5 |
| Sync output cathode follower | | 6J6 |
| Fixed power supply rectifiers | 2 | 5V4G |
| Series regulator tubes | 2 | 6AU5 |

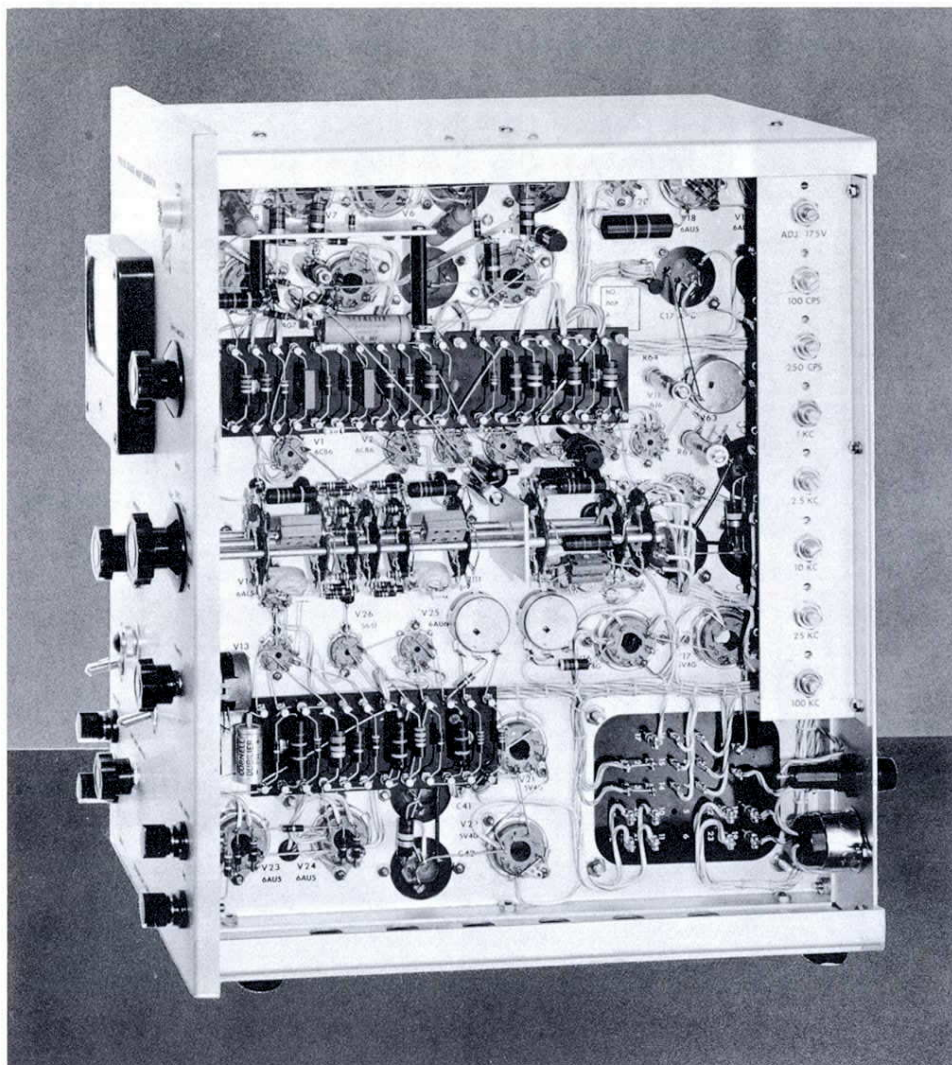
Tektronix, Inc.

TYPE 105 SQUARE WAVE GENERATOR

| | |
|--|--------|
| Regulator amplifier | 6AU6 |
| Voltage reference tube | 5651 |
| Variable power supply rectifiers | 2 5V4G |
| Series regulator tubes | 2 6AU5 |
| Regulator amplifier | 6AU6 |

Price—\$395 f.o.b. Portland (Beaverton), Oregon

Includes the following: 1—P93 42" Coaxial Cable, 93 ohms
1—B93-R Resistor, terminating, 93 ohm
1—A510 Binding Post Adapter
1—A100 Clip Lead Adapter
1—Instruction Manual



Currently Available Extras

93-ohm cable and resistor normally furnished
52-ohm cable and resistor . . optional, no extra charge
75-ohm cable and resistor . . optional, no extra charge

Recommended Additional Accessories

When a Type 105 is used to check the transient response of a Type 513-D Vertical Amplifier, the following accessories should be used to interconnect the two instruments:

- 1—P52 Cable, coaxial, 42", 52 ohms . . . \$ 4.00
- 1—B52R Resistor, terminating, 52 ohms . . . 8.50
- 1—B52-L5 Pad, "L" 5:1 ratio, 52 ohms 8.50
- 1—B52-T10 Pad, "T", 10:1 ratio, 52 ohms . . . 11.50

A selection of terminating resistors, pads, and coaxial cables designed to be used with a Type 105 Square Wave Generator will be found in the Accessory Section of this catalog.

Within certain technical limits, special terminating resistors and pads can be supplied upon request—we invite your correspondence regarding them.



SPECIAL INSTRUMENTS

Work in some fields of research and development requires the use of special instruments in conjunction with the cathode-ray oscilloscope. Special instruments developed by TEKTRONIX are described in this section.

TYPE 124 TELEVISION ADAPTOR

for Triggered Wide-Band Oscilloscopes

Line Selection

Sync separator and delayed trigger circuitry permit triggering the oscilloscope at any selected line of a field.

Field Shift

Push button provides instant shift to corresponding line or lines in opposite field.

Gated Time Markers

Intensity markers of 1 μsec , 0.1 μsec , 0.05 μsec and 0.005 H (200 per television line).

APPLICATIONS

The Type 124 adapts any triggered wide-band oscilloscope to the observation of the television composite video signal. Greatly increases the usefulness of the oscilloscope in television development and maintenance work.

GENERAL DESCRIPTION

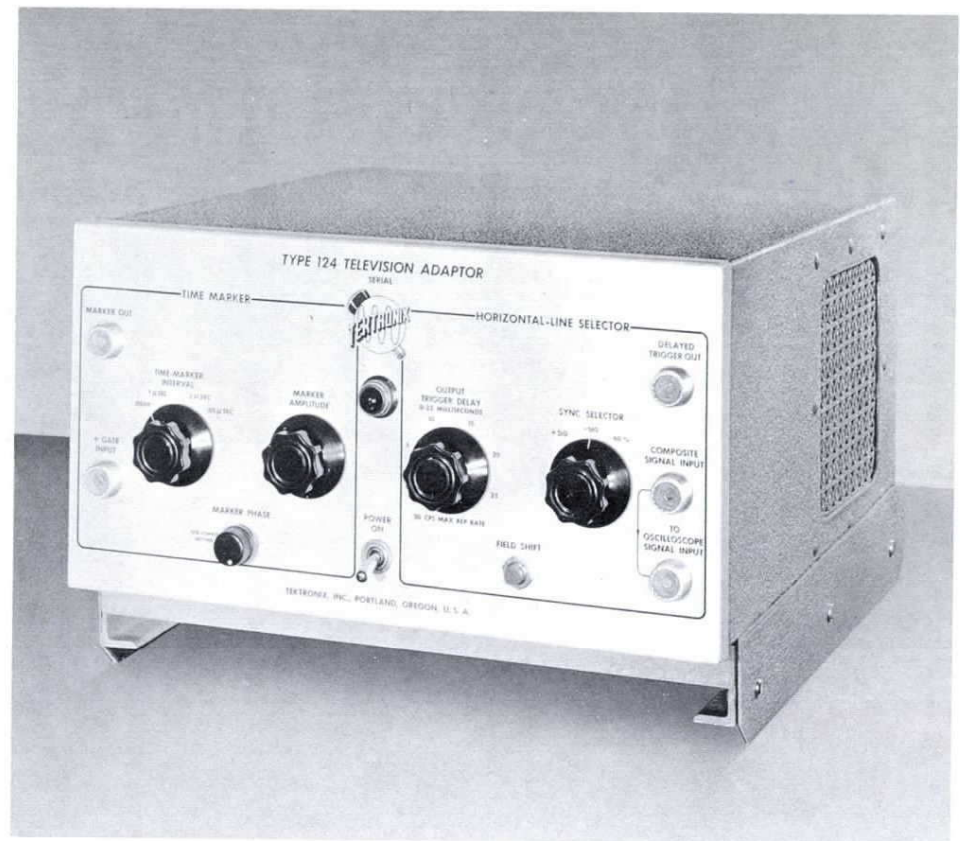
The delayed-trigger output of the Type 124 is continuously variable from zero to 25 milliseconds after receipt of a vertical sync pulse. By adjusting the delay, an oscilloscope can be triggered at the start of any desired line in a field. Panel push button provides instant shift to opposite field. Triggering occurs at half the television vertical rate. Duration of the output pulse is less than 1 μsec , and amplitude is 2 v positive. Triggering may be accomplished by the composite video signal of either polarity, 0.5 v minimum to 20 v maximum, peak to peak, or a 60-cycle sine wave.

The time-marker generator requires a positive gate of 20 v minimum to 50 v maximum, peak to peak. Markers are supplied for the duration of the gate. Time-marker intervals are 1 μsec , 0.1 μsec , 0.05 μsec , and 0.005 H (200 per television line). Amplitude is continuously variable from zero to 30 v. Phase control permits positioning the markers on the trace.

To make use of the time-marker output of the Type 124, the oscilloscope should have a positive gate output and a CRT cathode terminal.

VACUUM TUBE COMPLEMENT

| | |
|--------------------------------|-------|
| Trigger inverter and output CF | 6BQ7A |
| Sync separator and dc restorer | 12BZ7 |
| Phantastron | 6BH6 |
| Trigger coupling diode | 6AL5 |
| Bistable multivibrator | 6U8 |



| | |
|---------------------------------------|--------|
| Cathode-coupled amplifier | 12BZ7 |
| Bistable multivibrator | 12BZ7 |
| Time-marker oscillator | 6AK5 |
| Gating CF and pulse shaping amplifier | 6BQ7A |
| Time-marker output amplifier | 6BQ7A |
| Rectifier | 6AX5 |
| Rectifier | 6X4 |
| Regulator amplifiers | 2 6AU6 |
| Regulator series tubes | 2 12B4 |
| Voltage reference | OA2 |

OTHER CHARACTERISTICS

Ventilation—forced-air cooling.

Mounting frame—provides secure mounting to the top of Tektronix 5" Oscilloscopes.

Connecting cables—the four connecting cables supplied with the Type 124 are designed for use with Tektronix Oscilloscope Types 511, 511A, 513, 514, and 514A. Cable extensions will be necessary in many cases when the Type 124 is used with other triggered wide-band oscilloscopes.

Size—6 $\frac{3}{4}$ " high, 12 $\frac{3}{4}$ " wide, 12 $\frac{1}{2}$ " deep.

Weight—21 lbs.

Construction—aluminum alloy.

Finish—photo-etched anodized panel, baked gray wrinkle cabinet.

Power requirements—117/234 volts, 50-60 cycles, 120 watts.

Price—\$295 f.o.b. Portland (Beaverton), Oregon.

Includes: 1—FM124 Mounting Frame
4—Connecting Cables
1—Instruction Manual

Tektronix, Inc.

TYPE 130 L,C METER

Direct-Reading Inductance and Capacitance Meter



APPLICATIONS

Saves engineering time in circuit development work by providing quick inductance and capacitance readings even while circuit changes are being made. Aids in correct placement of critical components and leads.

Guard circuit produces a voltage of the same amplitude and phase as the voltage at the UNKNOWN terminals, but isolated from the frequency determining portions of the rest of the circuit. This permits separation of the capacitance to be measured from other capacitances and strays. Accurate measurements of direct inter-electrode capacitance in vacuum tubes can be made with ease.

The Type 130 can also be used for component testing, sorting, and color code checking on a production basis.

GENERAL DESCRIPTION

The unknown value to be measured will determine the frequency of the variable oscillator in the Type 130. This frequency is beat against a 140-kc fixed oscillator. The difference frequency is shaped and counted, causing meter deflection proportional to the difference frequency. The direct-reading meter is calibrated in microhenries and micromicrofarads.

Guard Voltage

Permits measuring an unknown capacitance while eliminating the effects of other capacitances from the measurements.

Five Ranges

Microhenries—0 to 3, 10, 30, 100, 300.

Micromicrofarads—0 to 3, 10, 30, 100, 300.

Accuracy

Within 3% of full scale.

Coarse and Fine Zero Adjust

Four-Inch Illuminated Meter

VACUUM TUBE COMPLEMENT

| | |
|--|-------|
| Fixed Oscillator | 6U8 |
| Buffer Amplifier | 6U8 |
| Variable Oscillator | 6U8 |
| Buffer Amplifier | 6U8 |
| Mixer | 6BE6 |
| Bistable Multivibrator | 6U8 |
| Guard Circuit Cathode Follower | 6BH6 |
| CF Clamp and Diode Clamp | 6BQ7A |
| Rectifier | 6X4 |
| Voltage Regulator | OA2 |

OTHER CHARACTERISTICS

Load resistance limits—the following loads will not appreciably alter the indication:

Capacitance, 0.1 megohm shunt.

Inductance, 20 k shunt, 10 ohms series.

A table included in the instruction manual provides corrections for increased loads.

Size—5" wide, 9" high, 8½" deep.

Weight—9 lbs.

Construction—aluminum alloy.

Finish—photo-etched anodized panel, baked gray wrinkle cabinet.

Power requirements—117/234 volts, 50-60 cycles, 40 watts.

Price \$195

Includes: 1—P93C Probe

1—W130R Lead

1—W130B Lead

1—Instruction Manual

Recommended Additional Accessories

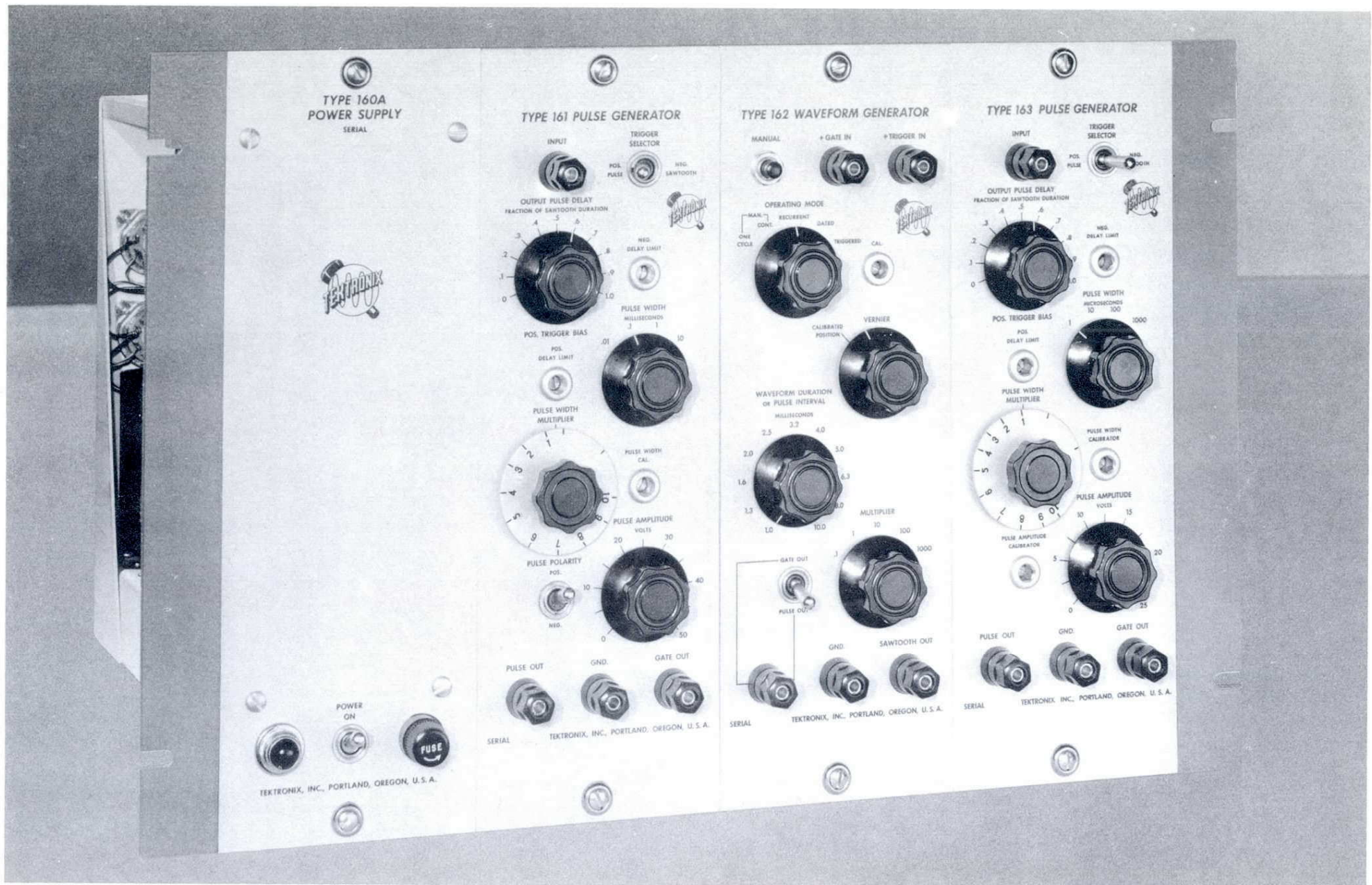
Type F30 Production Test Fixture. Speeds sorting and testing of capacitors and inductors \$3.00

Type S30 Delta Standards, for calibration of Type 130 L,C Meters \$22.00

Prices f.o.b. Portland (Beaverton), Oregon.

Tektronix, Inc.

TYPE 160 SERIES WAVEFORM GENERATORS

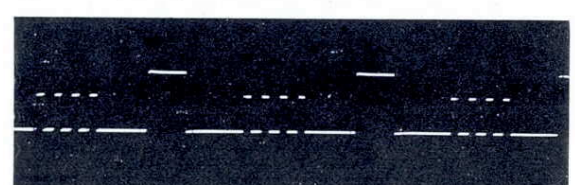
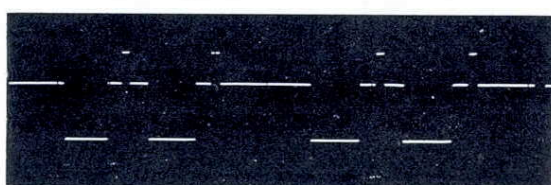
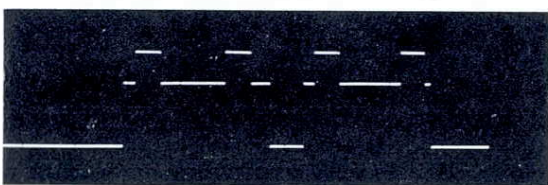
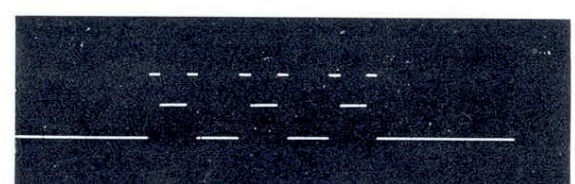
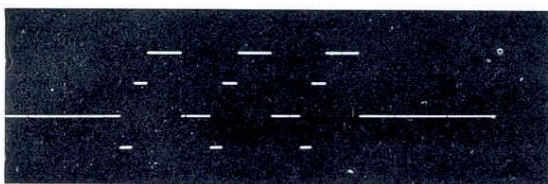


The Tektronix Type 160 Series produces timed pulses of adjustable duration, amplitude, and repetition rate, providing a convenient and flexible system of sequence control. By using several instruments together, complex waveform patterns can be obtained. Applications of the Type 160 Series are numerous . . . various combinations are being used for nerve stimulation in neurophysical experiments, timed gating devices for complex equipment, component testing, biophysical and geophysical applications. The newest addition to the series, Type 360 Indicator unit, described in the NEW INSTRUMENT section, takes the place of an auxiliary oscilloscope and is used to measure the response time and nature of the response

to an electrical pulse generated by the Type 160 series instruments.

The Type 160A Power Supply (replacing the Type 160) will supply power to one Type 360 Indicator unit along with a combination of four to six generators. The Type 161 or Type 163 Pulse Generators can be used to gate one or more Type 162 Waveform Generators, and the Type 162 can be used to trigger several Type 161 or Type 163 Pulse Generators. By using combinations of the generators, a wide variety of waveforms can be produced.

The Type 160 series is adaptable to rack mounting by means of an adapter frame. Any combination of four instruments can be placed in the frame at any one time.



Some of the waveform combinations possible with Tektronix Type 160 Series Waveform Generators.

Tektronix, Inc.

TYPE 160 SERIES WAVEFORM GENERATORS

TYPE 160A POWER SUPPLY

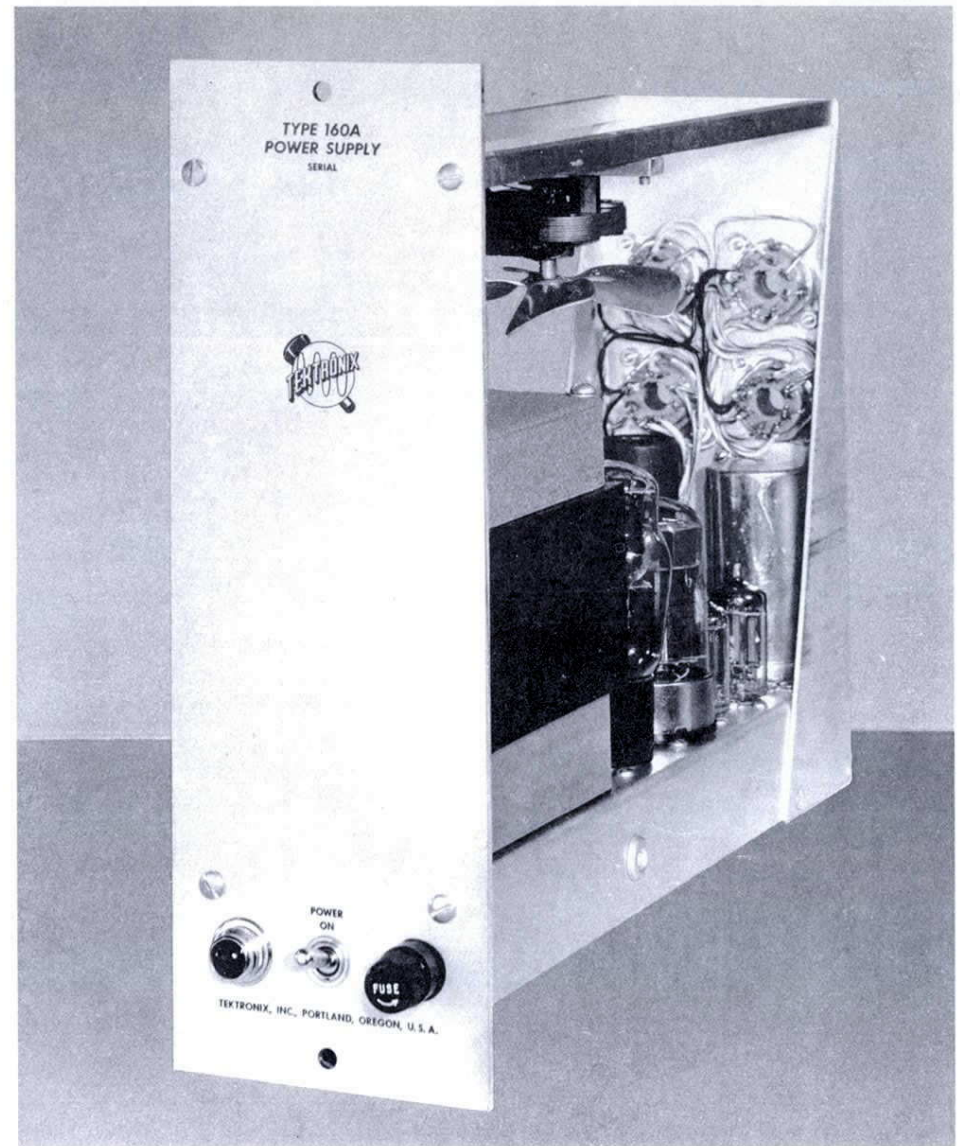
Large Load Capacity

- + 300 v dc, unregulated.
- + 225 v dc, regulated, at 225 milliamps.
- + 150 v dc, regulated, at 5 milliamps.
- + 80 v dc, unregulated.
- 170 v dc, regulated, at 125 milliamps.
- 6.3 v ac, unregulated, at 20 amps.

Electronic Voltage Regulation

Four Output Terminals

Conveniently located at rear of chassis.



GENERAL DESCRIPTION

The Tektronix Type 160A Power Supply provides the required voltages and currents for one Type 360 Indicator unit and a combination of four to six generators. As many as seven Type 161, or seven Type 162, or five Type 163, or five Type 360 units can be supplied by one Type 160A.

The currents listed above for the +225 and -170 volt supplies are available only with series regulator external shunt resistors as provided in the individual units. If the Type 160A is to be used with the maximum number of units, it may be necessary to add shunting resistors to older Types 161 and 163 units.

The output terminals consist of four octal sockets, conveniently located at the rear of the chassis. Each socket is capable of supplying power to two generators. One 10 and one 17-inch 8-conductor inter-unit power cable are supplied.

Electronic voltage regulation compensates for line-voltage variations between 105 and 125 v, and for current-demand differences of generators connected to the power supply.

VACUUM TUBE COMPLEMENT

| | | |
|--|---|-------|
| Rectifiers | 3 | 5V4 |
| Regulator amplifiers | 2 | 6AU6 |
| Amplifier and series regulator | | 12AU7 |
| Series regulator | | 6080 |
| Series regulator | 2 | 12B4 |
| Voltage reference | | 5651 |

MECHANICAL SPECIFICATIONS

Mounting—Adapted to rack mounting by Tektronix Type FA160 Mounting Frame.

Ventilation—Forced air cooling.

Dimensions—4 $\frac{1}{8}$ " wide, 12 $\frac{1}{4}$ " high, 13 $\frac{3}{4}$ " deep.

Weight—21 pounds.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, gray wrinkle cabinet.

Power Requirements—105-125 or 210-250 v, 50-60 cycles, 325 watts max.

Price—\$140 f.o.b. Portland (Beaverton), Oregon

- Includes:
- 1—W160-22 connecting cable.
 - 1—W160-17 connecting cable.
 - 1—Set mounting screws and cup washers.
 - 1—Instruction manual.

Tektronix, Inc.

TYPE 160 SERIES WAVEFORM GENERATORS

TYPE 161 PULSE GENERATOR

Output Waveforms

Fixed-amplitude positive gate.
Variable-amplitude positive or negative pulse.

Output Characteristics

Duration—calibrated, continuously variable, 10 μ sec to 0.1 sec.
Delay—calibrated, continuously variable, 0 to 100% of triggering sawtooth waveform.
Risettime—less than 0.5 μ sec, overshoot less than 5%.

Amplitude

Gate—fixed, 50 v positive, peak-to-peak.
Pulse—calibrated, continuously variable, 0 to 50 v, peak-to-peak.

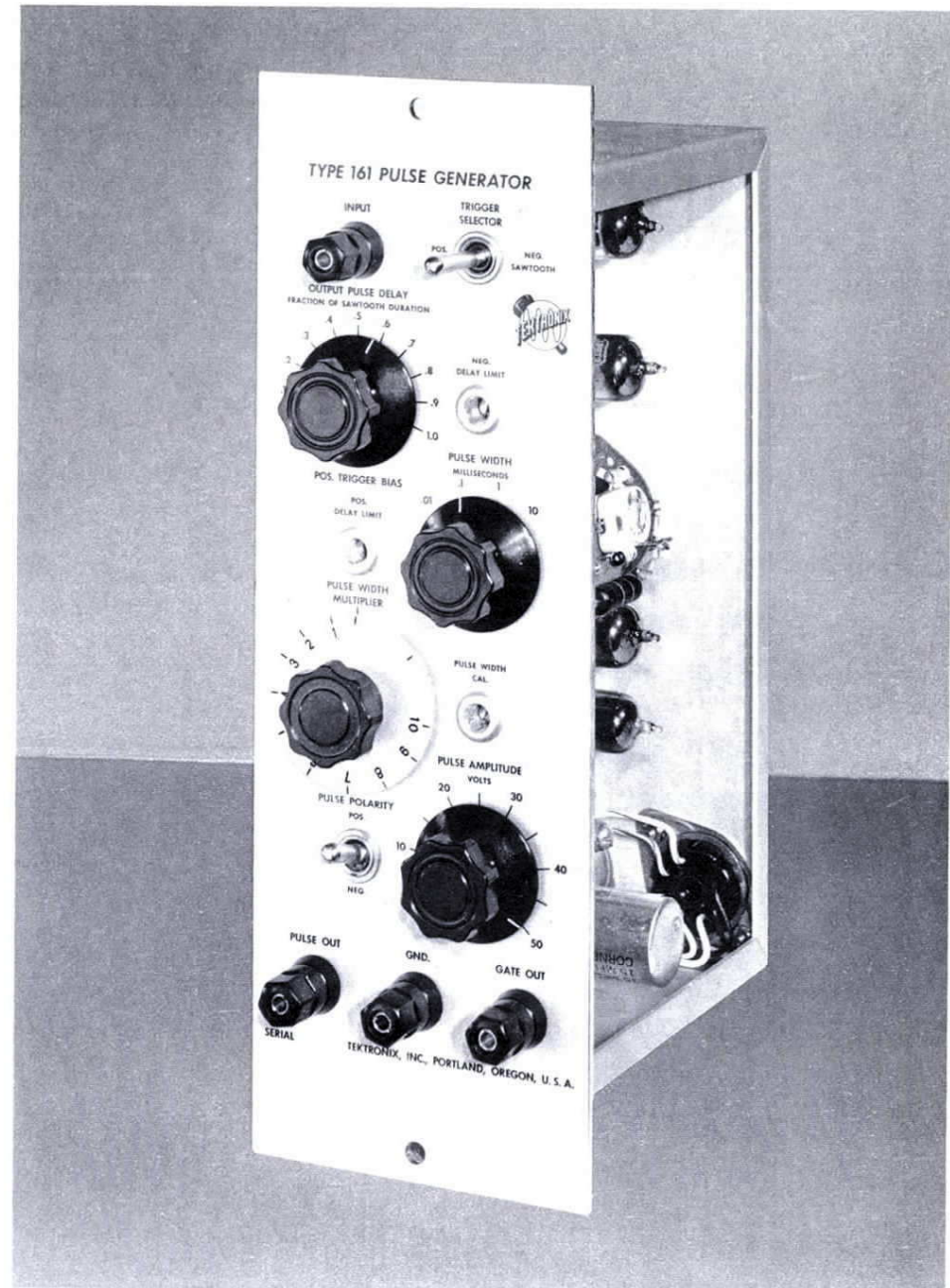
Cathode-Follower Outputs

Trigger Requirements

Positive pulse, 2-volt peak-to-peak minimum. Negative-going positive sawtooth, with a minimum rate of change of 15 v/sec. Maximum repetition rate, 50 kc.

Power Requirements

- 170 v dc at 17 ma.
+ 225 v dc at 22 ma.
6.3 v ac at 1.1 amps.



GENERAL DESCRIPTION

The Tektronix Type 161 Pulse Generator produces calibrated rectangular output pulses of adjustable duration and amplitude when the required trigger voltage is received from an external source. A Tektronix Type 162 Waveform Generator is an excellent source for either the negative-going sawtooth or positive pulse necessary to trigger the Type 161.

When triggered by a negative-going sawtooth, the time of occurrence of the output pulse and gate can be adjusted to any point throughout the duration of the sawtooth. A calibrated control indicates the output delay as a fraction of the triggered sawtooth duration. Pulse and gate width in milliseconds, and pulse amplitude in volts are also indicated by calibrated controls.

When a positive pulse is used to trigger the generator, the same output waveforms are available, and the delay control functions as a triggering-level control.

Voltages necessary to operate the Type 161 can be obtained from a Tektronix Type 160A Power Supply. As many as seven 161 units can be powered by a single Type 160A unit.

MECHANICAL SPECIFICATIONS

Mounting—Adapted to rack mounting by the Tektronix Type FA160 Mounting Frame.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, etched chassis.

Dimensions—4 $\frac{1}{8}$ " wide, 12 $\frac{1}{4}$ " high, 7 $\frac{1}{2}$ " deep.

Weight—5 pounds.

VACUUM TUBE COMPLEMENT

| | |
|--|-------|
| Comparator | 12AU7 |
| Regenerative amplifier | 12AT7 |
| Coupling diode and one-half monostable multivibrator | 12AT7 |
| Second-half multivibrator and positive pulse amplifier | 12AT7 |
| Negative pulse amplifier | 6J6 |

Price—\$95 f.o.b. Portland (Beaverton), Oregon

Includes: 1—W160-10 connecting cable.
1—Set mounting screws and cup washers.
1—Instruction manual.

Tektronix, Inc.

TYPE 160 SERIES WAVEFORM GENERATORS

TYPE 162 WAVEFORM GENERATOR

Output Waveforms

Positive pulse, positive gate, and negative-going sawtooth.

Output Characteristics

Repetition Rate—0.1 cycles to 10 kc for recurrent operation.

Duration—pulse, 10 μ sec to 0.05 sec, gate and sawtooth, 100 μ sec to 10 sec.

Amplitude

Pulse and gate—50 volts positive from ground.

Sawtooth—decreases uniformly with time from +150 volts to +20 volts.

Risetime

Pulse—1 μ sec, approximately, minimum.

Cathode-Follower Outputs

Trigger Requirements

Positive pulse—8 volts peak-to-peak minimum.

Sine wave—6 volts rms, frequency between 5 cycles and 50 kc. At frequencies below 5 cycles, the product of rms voltage times frequency must exceed 10.

Gate—8 volts, peak-to-peak minimum.

Triggering Means

Externally derived electrical pulse or gate, front-panel push button, or automatic recurrent operation.

Power Requirements

—170 v dc at 28 ma.

+225 v dc at 7 ma.

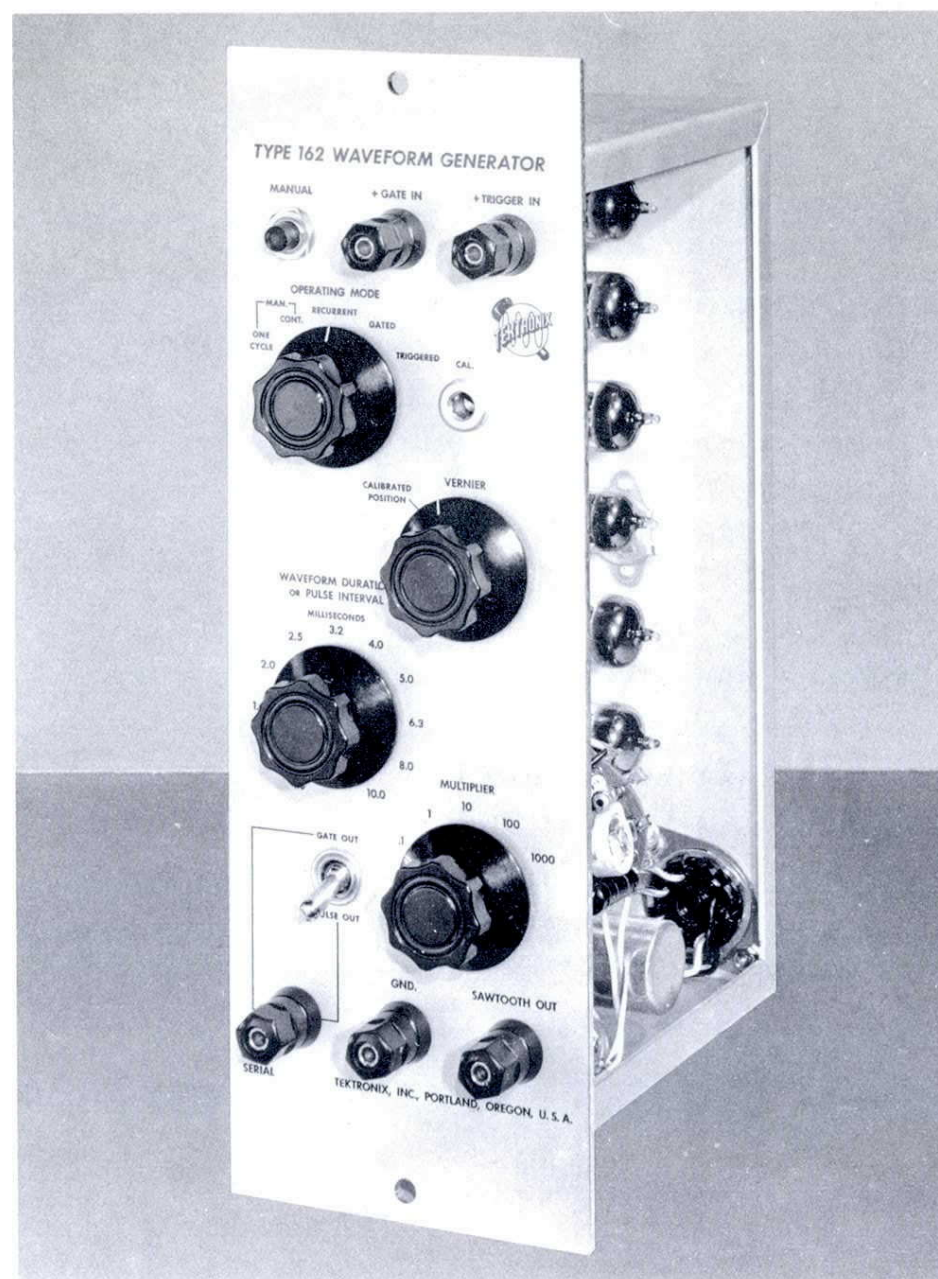
6.3 v ac at 1.7 amps.

GENERAL DESCRIPTION

The Tektronix Type 162 Waveform Generator provides three types of waveforms of adjustable duration and repetition rate: pulse, gate, and sawtooth. Generation of the waveform can be initiated by means of an externally derived electrical impulse, or by front-panel push button. The Tektronix Type 161 or 163 Pulse Generator is an excellent source for the triggering pulse or gate.

The output pulse and gate waveforms have an amplitude of 50 volts with a minimum risetime of approximately one microsecond. The sawtooth waveform is a positive voltage decreasing uniformly from +150 volts to +20 volts. Waveform duration is measured by a calibrated control and the shortest pulse duration is approximately 10 μ sec.

The Type 162 is designed to operate as a delay generator in conjunction with the Type 161 or Type 163 Pulse Generator and to supply a sweep voltage for the Type 360 Indicator unit. It is useful for initiating chains of events electrically, and for controlling the duration of their occurrence and repetition rate. When generating waveforms recurrently it functions as a stable repetition-rate generator.



Voltages necessary to operate the Type 162 can be obtained from a Type 160A Power Supply. As many as seven Type 162 units can be powered by a single Type 160A unit.

VACUUM TUBE COMPLEMENT

| | |
|--|-------|
| Regenerative trigger | 12AU7 |
| Trigger amplifier and one-half multivibrator | 12AU7 |
| Multivibrator and pulse and gate shaper | 12AU7 |
| Phantastron | 6BH6 |
| Pulse and gate amplifier and sawtooth cathode follower | 12AU7 |
| Pulse and gate cathode follower and catching diode | 12AU7 |

MECHANICAL SPECIFICATIONS

Mounting—Adapted to rack mounting by Tektronix Type FA160 Mounting Frame.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, etched chassis.

Dimensions—4 $\frac{1}{8}$ " wide, 12 $\frac{1}{4}$ " high, 7 $\frac{1}{2}$ " deep.

Weight—5 pounds.

Price—\$95 f.o.b. Portland (Beaverton), Oregon

Includes: 1—W160-10 connecting cable.

1—Set mounting screws and cup washers.

1—Instruction manual.

Tektronix, Inc.

TYPE 160 SERIES WAVEFORM GENERATORS

TYPE 163 FAST-RISE PULSE GENERATOR

Output Waveforms

Variable-amplitude positive pulse.
Fixed-amplitude positive gate.

Output Characteristics

Risetime—less than $0.2 \mu\text{sec}$ (without load capacitance).
Decay Time— $0.2 \mu\text{sec}$ (without load capacitance).
Overshoot—can be adjusted to zero.
Duration—calibrated, continuously variable, $1 \mu\text{sec}$ to $10,000 \mu\text{sec}$.
Delay—calibrated, continuously variable, 0 to 100% of triggering sawtooth duration.

Amplitude

Pulse—calibrated, continuously variable, 0 to 25 v, peak to peak.
Gate—fixed, 25 v, peak to peak.

Cathode-Follower Output

Pulse—from arm of variable cathode resistor.
Gate—from top of same resistor.

Trigger Requirements

Positive pulse, 2 v peak to peak minimum.
Negative-going sawtooth; must include dc bias sufficient to keep voltage positive.

Power Requirements

-170 v dc at 26 ma.
+225 v dc at 45 ma.
6.3 v ac at 3.6 amp.

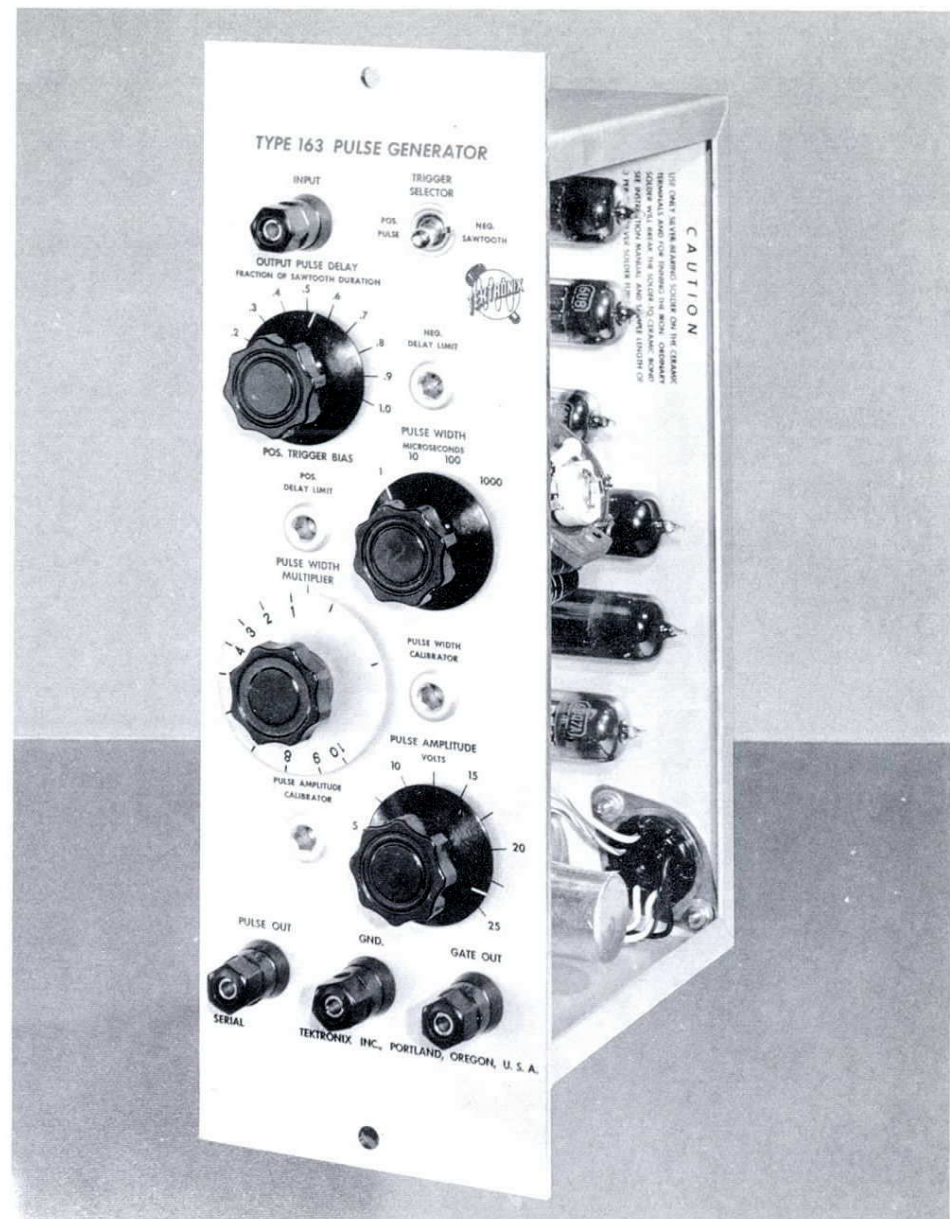
GENERAL DESCRIPTION

The Tektronix Type 163 Pulse Generator produces rectangular pulses of less than $0.2 \mu\text{sec}$ risetime when the required trigger voltage is received from an external source. A Tektronix Type 162 Waveform Generator is an excellent source for either the negative-going sawtooth or positive pulse necessary to trigger the Type 163.

When triggered by a sawtooth voltage the time of occurrence of the output pulse and gate can be adjusted to any point throughout the duration of the sawtooth. Output delay is indicated as a fraction of the triggering sawtooth duration by a calibrated control. Pulse and gate width in microseconds and pulse amplitude in volts may be read directly from calibrated controls.

The Type 163 can be operated up to 50% duty cycle at the minimum time setting on any range. Correspondingly higher duty cycles are obtained at higher multiplier control settings. The maximum repetition rate is 500 kc when a pulse of $1 \mu\text{sec}$ duration is generated.

Voltages necessary to operate the Type 163 may be obtained from a Tektronix Type 160A Power Supply. As many as five Type 163 units can be powered by a single Type 160A unit.



VACUUM TUBE COMPLEMENT

| | |
|---|---------|
| Comparator and pulse amplifier | 6U8 |
| Regenerative trigger amplifier | 6U8 |
| Disconnect diode and charge diode | 6AL5 |
| Monostable multivibrator | 2 12BY7 |
| Output cathode follower | 6BQ7 |

MECHANICAL SPECIFICATIONS

Mounting—Adapted to rack mounting by the Tektronix Type FA160 Mounting Frame.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, etched chassis.

Dimensions— $4\frac{1}{8}$ " wide, $12\frac{1}{4}$ " high, $7\frac{1}{2}$ " deep.

Weight—5 pounds.

Price \$95

Includes: 1—W160-10 Connecting cable.
1—Set mounting screws and cup washers
1—Instruction manual

Recommended Additional Accessories

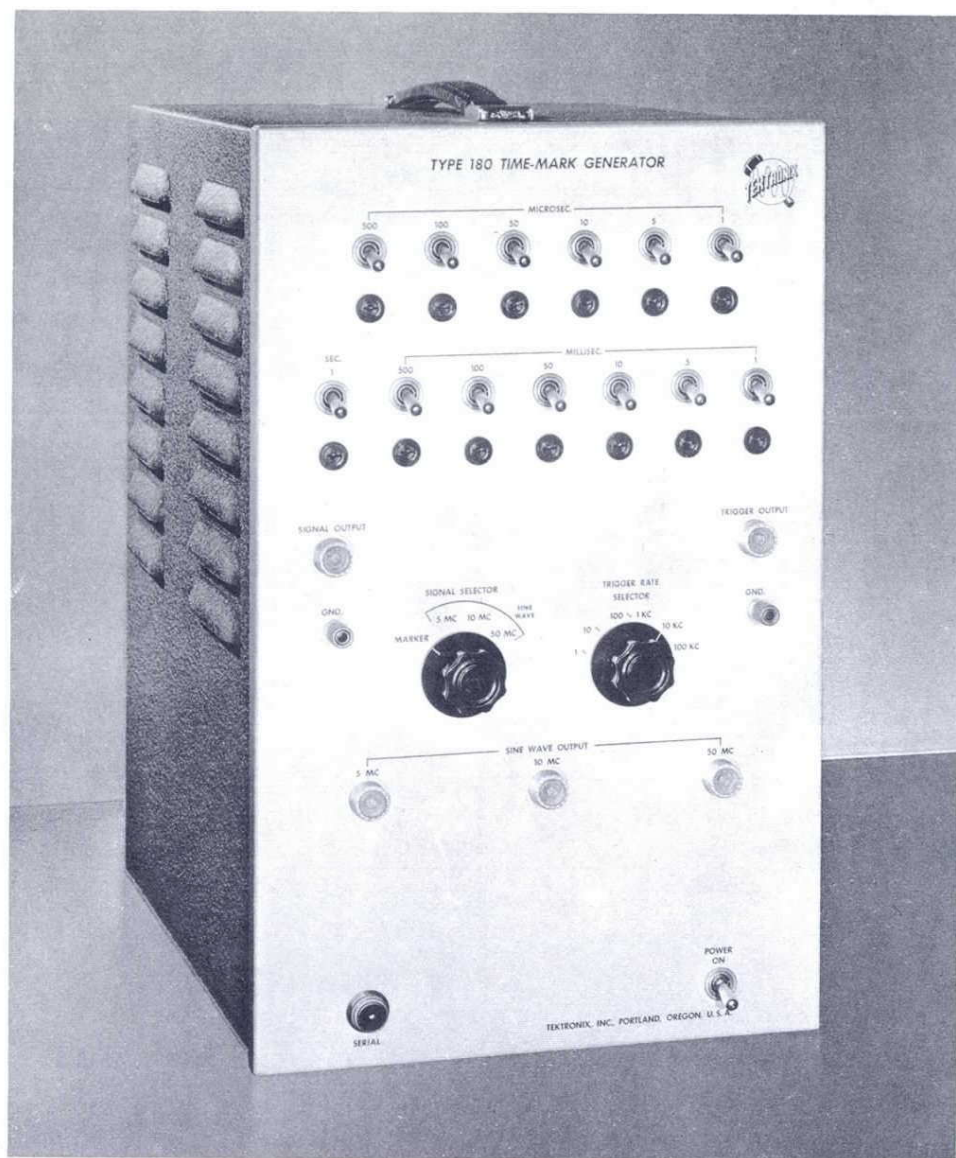
Type FA160 Adapter Frame adapts Type 160 Series to rack mounting. Holds four Type 160-Series Units. \$5.00

Type FAP160 Blank Panel, $4\frac{1}{8}$ " x $12\frac{1}{4}$ ", covers openings in frame-mounted sets of Type 160 Series Instruments. \$3.00

Prices f.o.b. Portland (Beaverton), Oregon.

Tektronix, Inc.

TYPE 180 TIME-MARK GENERATOR



The Type 180 Time-Mark Generator is a precision laboratory instrument of high quality design and construction. The Type 180 generates time markers of 1, 5, 10, 50, 100, 500 microseconds, — 1, 5, 10, 50, 100, 500 milliseconds, — 1 second; sine waves of 5 mc, 10 mc, 50 mc, trigger rates of 1, 10, 100 cycles, 1, 10, 100 kilocycles. A crystal-controlled oscillator operating at one megacycle controls all outputs. The 1-mc frequency is accurate within 0.03%.

The 1 μ sec markers are formed by a clipper, differentiating network, and biased cathode follower. 5 μ sec to 1 sec markers are generated in a chain of triggered multi-vibrator circuits and each is shaped in a differentiating network and biased cathode follower. Markers are mixed

in a resistive circuit so that marker amplitudes are added together forming a distinctive timing comb. Markers selected by the trigger rate switch are fed to a shaper and cathode follower to form the trigger output. The sine wave outputs are formed by three frequency-multiplier circuits.

A four-position switch is used to select the signal output — markers, 5-mc sine wave, 10-mc sine wave, or 50-mc sine wave. Individual switches are used to form any combination of markers desired. The markers are also available separately and simultaneously through individual pin jacks, and each sine wave frequency is available at a separate connector. A six-position switch is used to select the trigger repetition rate desired.

A Type 180 can be very helpful in the laboratory. You can use it to calibrate oscilloscope time bases; to calibrate audio, supersonic, and rf oscillators; to calibrate counters; as a time measuring instrument (calibrating points from 10 $m\mu$ sec to 1 sec); as a repetition rate generator.

Regulation

All dc voltages electronically regulated.

Accuracy

Within 0.03%.

Construction

Aluminum alloy chassis and cabinet. Hinged sub-chassis. Photo-etched aluminum panel with anodized finish. Gray wrinkle finished cabinet.

Power Requirements

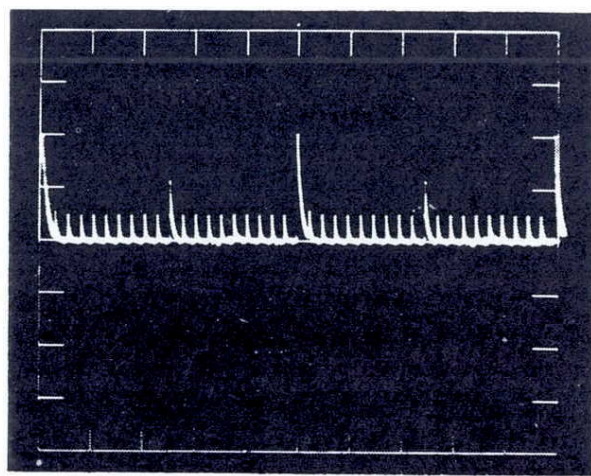
105-125 v or 210-250 v, 50-60 cycles — 330 watts.

Dimensions

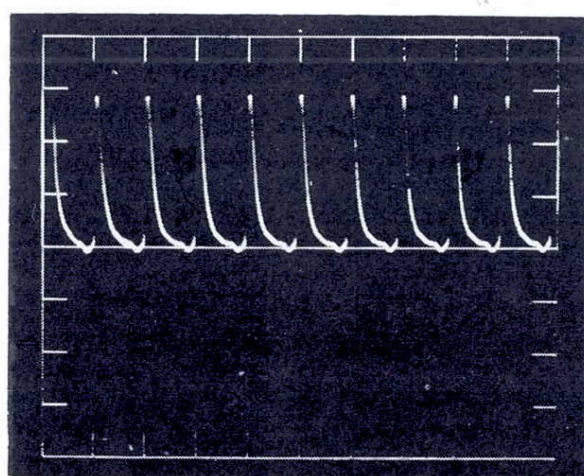
10 $\frac{1}{8}$ " wide, 16 $\frac{1}{2}$ " high, 14 $\frac{7}{8}$ " deep.

Weight

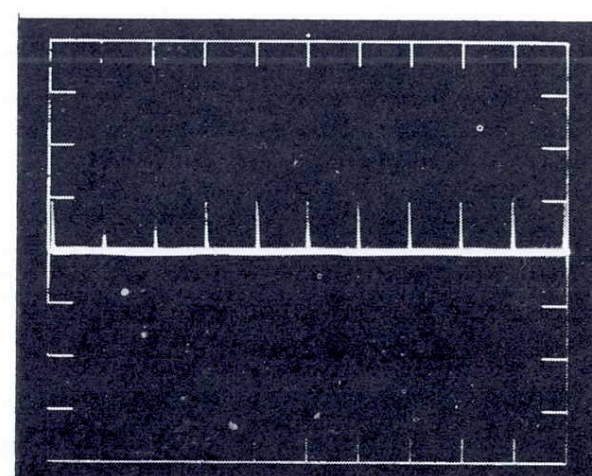
37 lbs.



Timing comb



1- μ sec Marker



1-msec Marker

Timing comb consists of 5- μ sec, 50- μ sec, and 100- μ sec markers. A Tektronix Type 315-D Oscilloscope was used for these photographs.

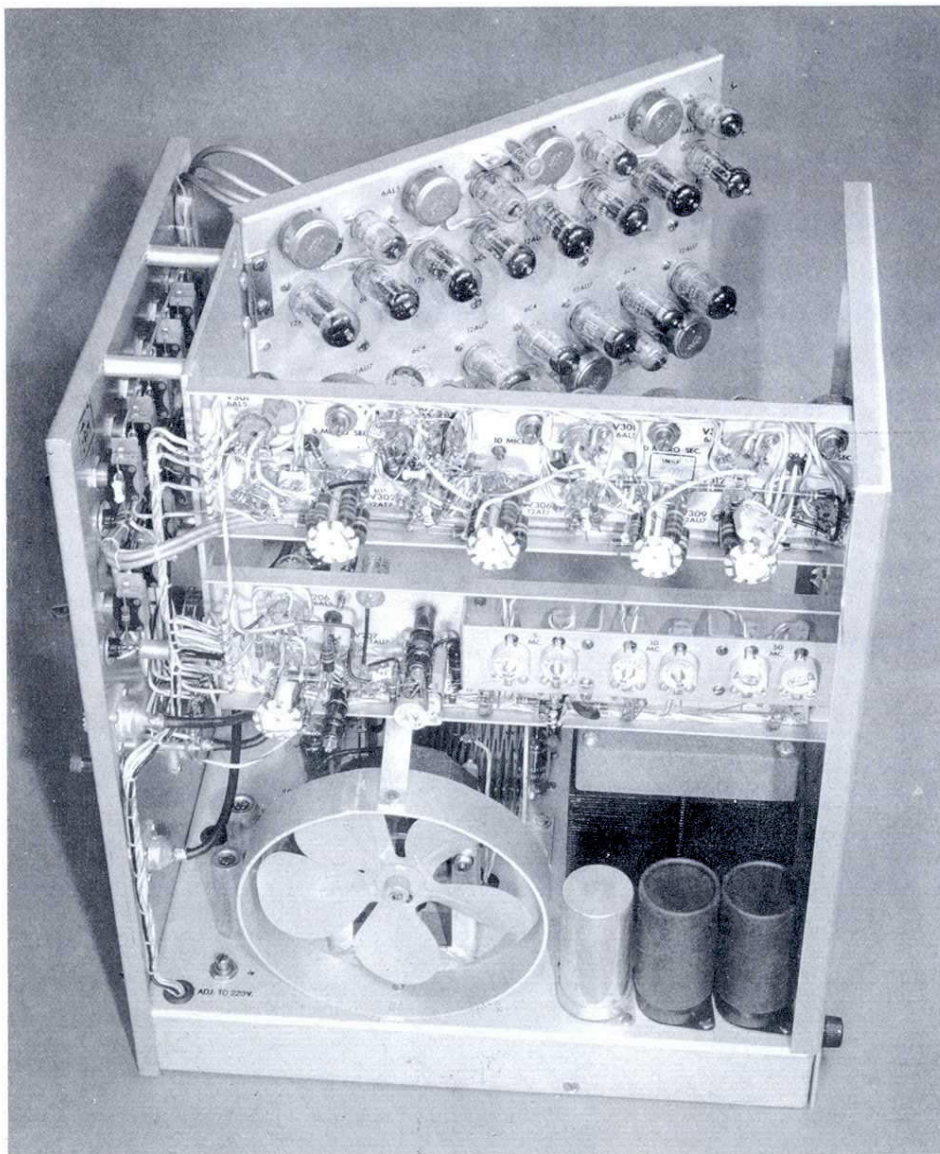
Tektronix, Inc.

TYPE 180 TIME-MARK GENERATOR

CHARACTERISTICS

Nominal Voltage, Impedance, and Risetime Values

| AT SIGNAL OUTPUT | | | AT PIN JACKS | | |
|-------------------------------------|-------------------------|-----------|----------------|-----------|-----------|
| Marker | Amplitude | Impedance | Risetime | Amplitude | Impedance |
| 1 μ sec | 1 v | 300 ohms | 0.04 μ sec | 20 v | 400 ohms |
| 5 μ sec to 10 μ sec | 1 v | 600 ohms | 0.08 μ sec | 25 v | 400 ohms |
| 50 μ sec | 1.5 v | 600 ohms | 0.08 μ sec | 25 v | 400 ohms |
| 100 μ sec to 1 sec | 3 v | 600 ohms | 0.3 μ sec | 50 v | 600 ohms |
| Trigger Pulses 1, 10, 100 cycles | | | | | |
| 1, 10, kc | 9 v | 200 ohms | 0.2 μ sec | | |
| 100 kc | 3 v | 200 ohms | 0.2 μ sec | | |
| Sine Waves 5, 10, 50 mc | (across 52 ohms) 4 v | 30 ohms | | | |



VACUUM TUBE COMPLEMENT

| | | |
|---------------------------------|---|-------|
| Oscillator and buffer | | 6U8 |
| Frequency Multiplier | 3 | 6AH6 |
| Cathode Follower | | 12AU7 |

| | | |
|---|----|-------|
| Clamp and Clipper Diode | | 6AL5 |
| Amplifier and Cathode Follower | | 12AT7 |
| Divider Multivibrator | 2 | 12AT7 |
| Divider Multivibrator | 10 | 12AU7 |
| Coupling Diode and Clamp | 12 | 6AL5 |
| Marker Cathode Follower | 3 | 12AU7 |
| Marker Cathode Follower | 10 | 6C4 |
| Trigger Shaper and Cathode Follower | | 12AU7 |
| Rectifier | | 6X4 |
| Series Regulator | 2 | 6AQ5 |
| Series Regulator | | 6AS7 |
| Regulator Amplifier | 3 | 6AU6 |
| Voltage Comparator | | 12AX7 |
| Voltage Reference | | 5651 |

Price — \$575 f.o.b. Portland (Beaverton), Oregon

Included with the Type 180: 2 — P93 Output Cables
1 — A100 Clip Lead Adapter
1 — Instruction Manual

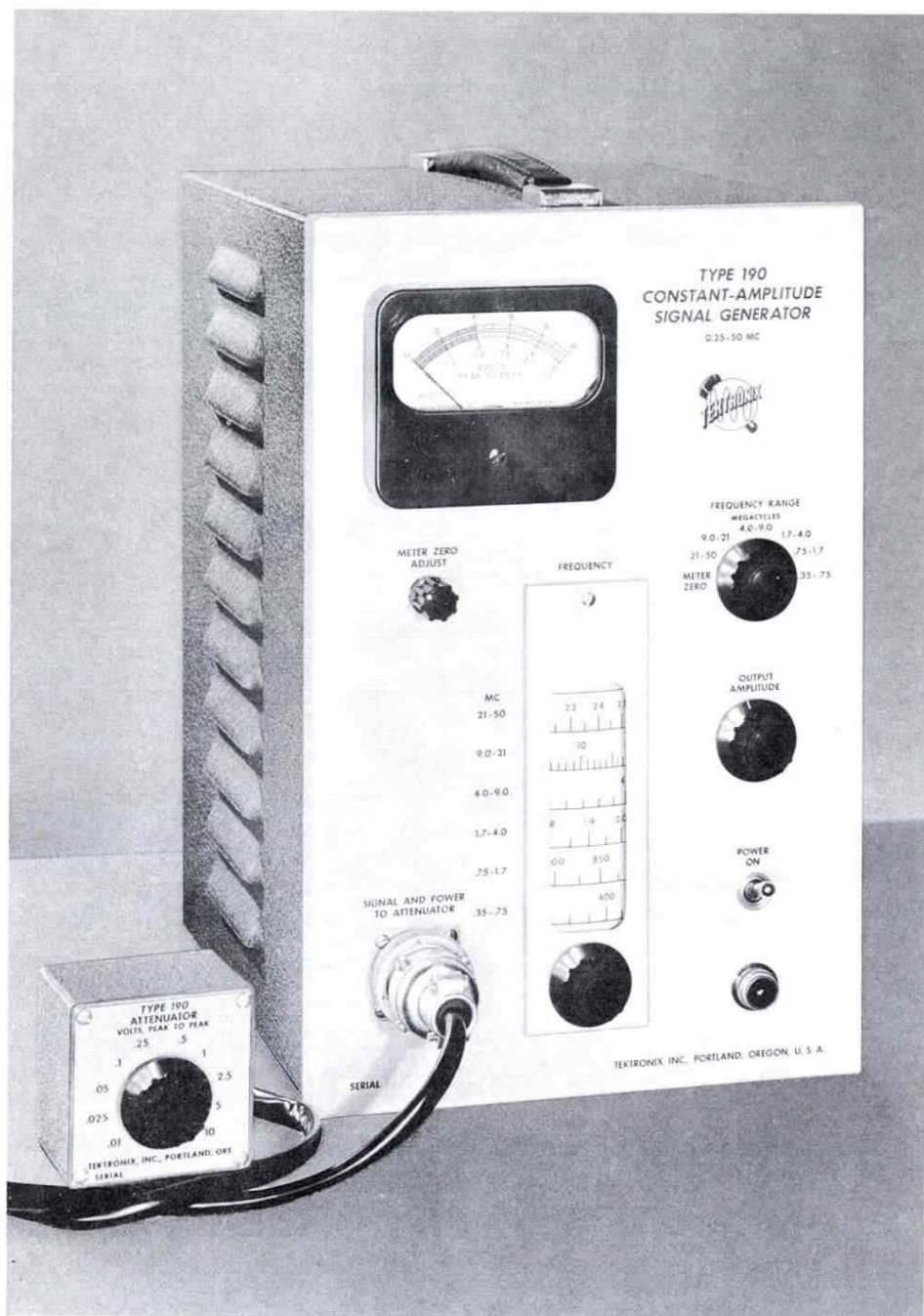
Type 180-S1 — The same Time-Mark Generator with the 1-mc frequency controlled by a James Knights Type H-17 crystal in a Type JKO-2 temperature stabilized oven. Frequency stability over a twenty-four hour period is within two parts per million. The 1-mc frequency is adjustable within ± 50 cycles.

Price — \$625 f.o.b. Portland (Beaverton), Oregon

Tektronix, Inc.

TYPE 190 SIGNAL GENERATOR

Constant-Amplitude Signal Generator



GENERAL DESCRIPTION

The Tektronix Type 190 Constant-Amplitude Signal Generator is designed to supply sine waves of constant amplitude for checking the high-frequency response of video amplifiers.

The Type 190 consists of two units and a 36" interconnecting cable. The larger unit contains the power supply, oscillator, and the amplitude indicating circuitry. The smaller unit contains the output attenuator and amplitude-sampling full-wave rectifier.

Peak-to-peak level of the output signal at the attenuator is indicated on the amplitude meter. Output is maintained at a constant level by the control voltage fed back from the sampling full-wave rectifier in the attenuator unit. This control signal varies the oscillator plate voltage through an electronic regulator circuit.

Output Frequency

Continuously variable from 350 kc to 50 mc in 6 ranges. Frequency indication accurate within 2%.

Output Amplitude

Continuously variable from 4 millivolts to 10 volts peak to peak in 10 ranges. Amplitude indication accurate within 10% of full scale.

Amplitude Variation

Output amplitude varies less than 2% from 350 kc to 30 mc; less than 4% from 30 mc to 50 mc.

Distortion

At attenuator settings of 5 volts or lower, less than 5% total harmonic content, and less than 3% above 2 mc.

Output Impedance

52 ohms.

VACUUM-TUBE COMPLEMENT

| | |
|--------------------------------|--------|
| Oscillator | 6C4 |
| Meter Amplifier | 12AU7 |
| Compensating diode | 6AL5 |
| Sampling diode | 6AZ5 |
| Voltage regulator | OB2 |
| Regulator amplifiers | 2 6AU6 |
| Series regulator | 12AU7 |
| Power rectifier | 5Y3G |

OTHER CHARACTERISTICS

Size—8½" wide, 13½" high, 11" deep.

Attenuator unit—2⅝" x 2¼" x 2".

Connecting cable—36" long.

Weight—24 pounds.

Construction—aluminum alloy.

Finish—Photo-etched anodized panel, baked gray wrinkle cabinet.

Power Requirements—117/234 volts, 50-60 cycles, 100 watts.

Price—\$275 f.o.b. Portland (Beaverton), Oregon.

Includes: 1—Attenuator Unit
1—36" Connecting Cable
1—Instruction Manual

Tektronix, Inc.



ACCESSORIES

These accessories are designed to expand the applicability of Tektronix Oscilloscopes in order that a greater benefit might accrue to the user.

ACCESSORIES

Operational Accessories

TYPE 500 SCOPE-MOBILE



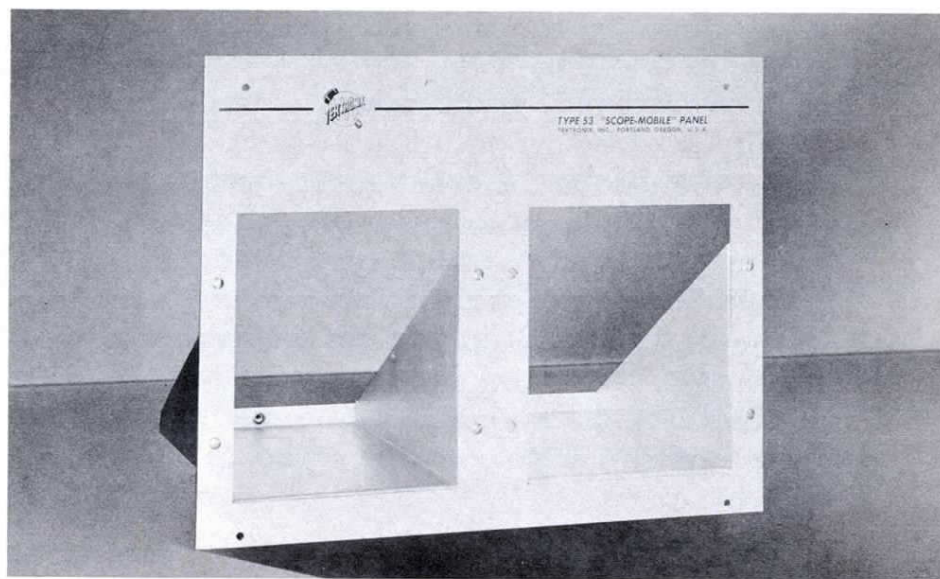
The Tektronix Type 500 Scope-Mobile has been especially designed to accommodate Tektronix 5" Cathode-Ray Oscilloscopes. It provides a sturdy yet mobile and therefore highly useful support for the Oscilloscope. Convenient and easy observation of the CRT face is achieved by a 20° tilt back.

A blank panel, 11"x15", fronting a mounting space of approximately 1½ cubic feet allows for auxiliary built-in

equipment as an aid in meeting specialized requirements. This space is fully ventilated by means of louvres. A power input connector and three convenience outlets appear at the back.

A drawer is provided for the handy storage of cords, probes, instruction books, small tools, etc. For quietness and ease of operation the drawer, 15"x15"x3" in size, is felt lined and operates in roller bearing support runners. An open shelf, 17"x24" in size and topped with battle-ship linoleum, is located at the bottom of the unit.

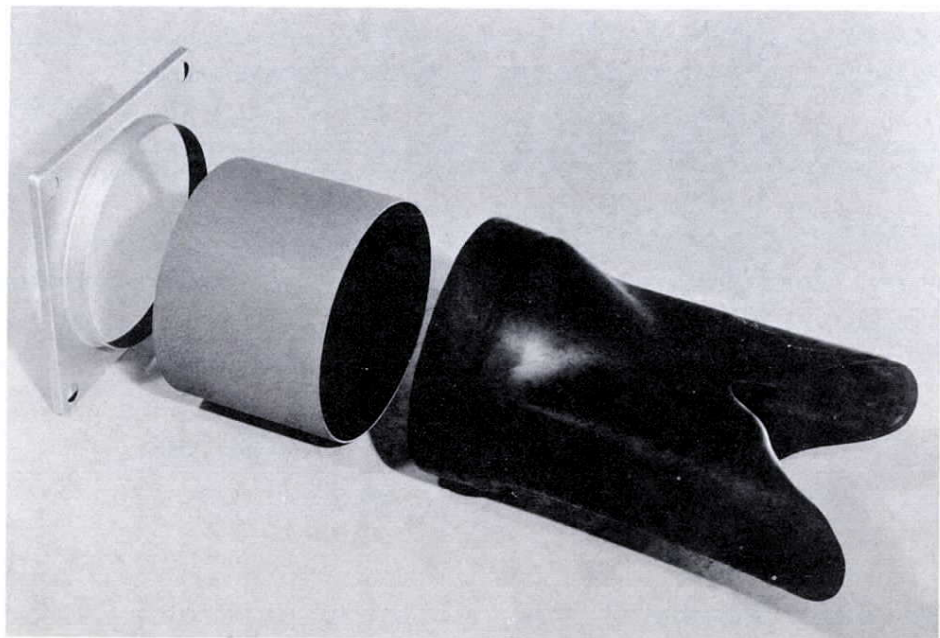
Total weight of the Scope-Mobile is approximately 42 pounds and clearance dimensions are 18½" wide, 39" high and 30" deep 97.50



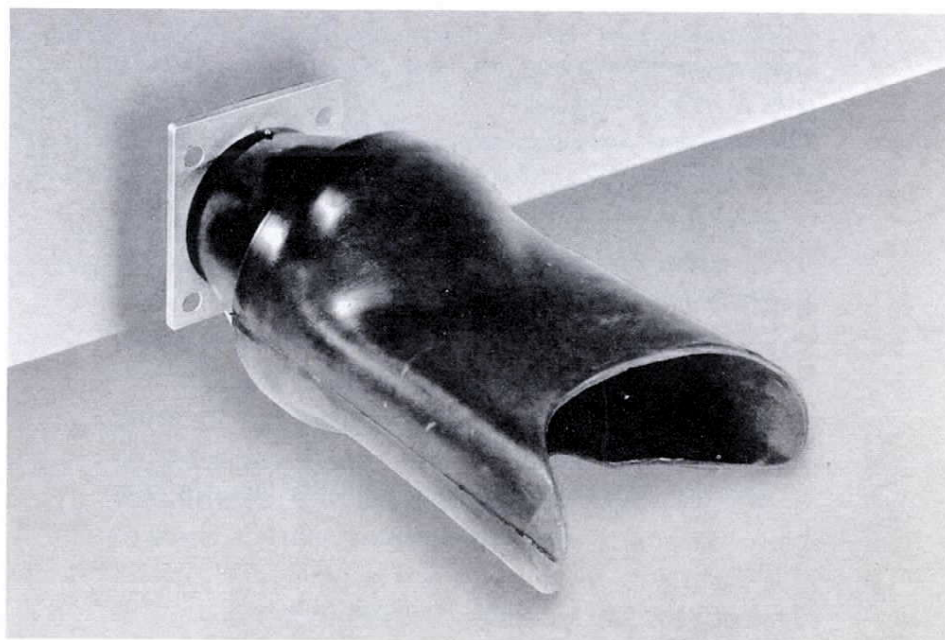
Type 53 Scope-Mobile Panel—replaces standard blank panel in the Scope-Mobile. It has two supporting cradles designed to accommodate the Type 53 Plug-In Preamplifiers used with Type 530 Series Oscilloscopes 10.50

RACK MOUNTED STORAGE UNIT FOR 3 PLUG-IN UNITS - \$35. (60 day delivery)

VIEWING HOODS



H510 Viewing Hood, for Tektronix 5" Oscilloscopes. Includes rubber eye-piece and aluminum light shield 4.50



H310 Viewing Hood, for Tektronix 3" Oscilloscopes. Includes rubber eye-piece and spun-aluminum light shield 4.50

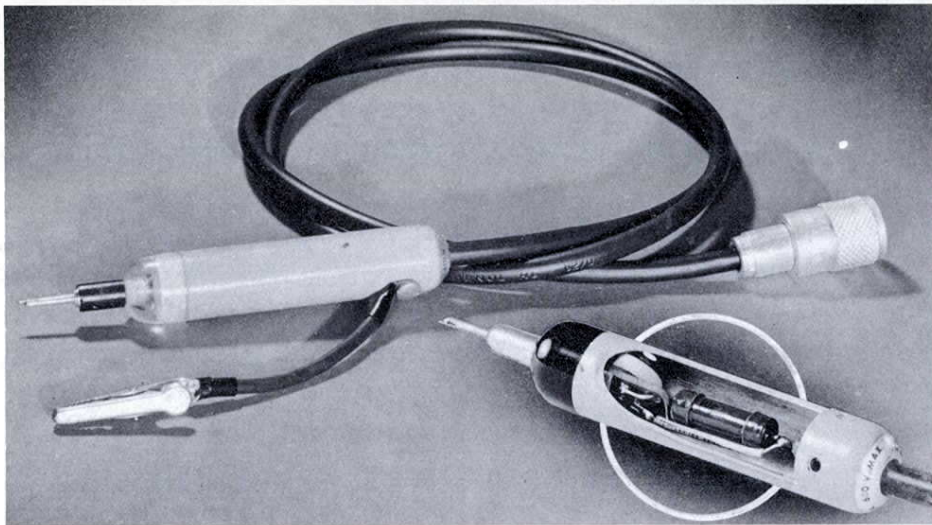
Prices f.o.b. Portland (Beaverton), Oregon

Tektronix, Inc.

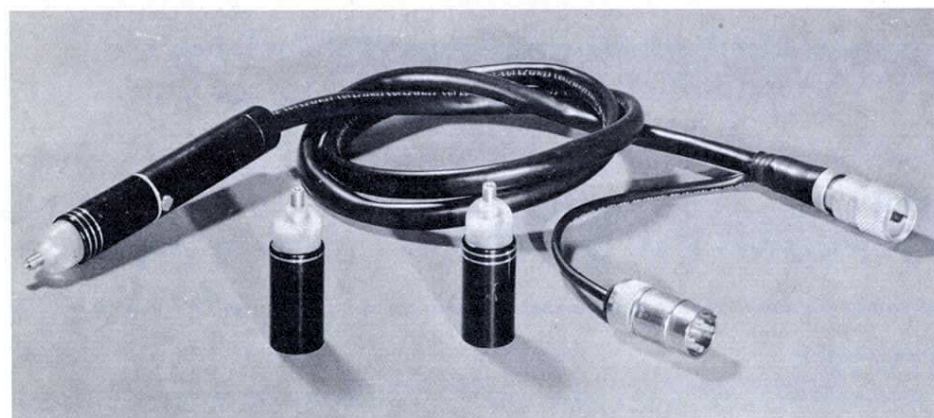
ACCESSORIES

Operational Accessories

PROBES



P510A Attenuator Probe provides an attenuation of ten times when used with Tektronix oscilloscopes and amplifiers. The P510A is small and streamlined, and presents an input impedance of 10 megohms paralleled by 14 μmf . The probe is completely insulated—made of high-impact-strength fiberglass-reinforced alkyd—and has an internal brass shield. Two interchangeable tips are furnished—a Klipzon tip and an alligator clip assembly. A ground clip is attached to the probe body. Probe has a 42" coaxial cable with uhf connector, and is rated at 600v peak-to-peak. 8.50
 Replacement Klipzon tips40
 Replacement alligator tips40

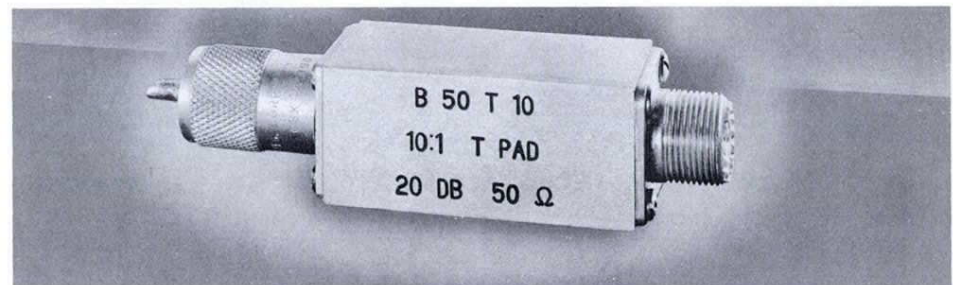


P170CF Cathode Follower Probe complete with 3 attenuator Heads. 86.00
 This probe was developed for use with Type 517 oscilloscope. The cathode-follower tube is a 5718 triode whose cathode load is the 170-ohm termination of the preamplifier grid line in Type 517. Plate and heater voltages for this tube are provided at a four-terminal socket on the panel of the oscilloscope. The signal is attenuated by 2 times when using P170CF. The input impedance of the probe will depend on the attenuator head being used, also since transit time in the cathode-follower tube is involved, it will decrease appreciably at the higher frequencies. When the probe is used without an attenuator head, the input looks like 12 megohms, shunted by 5 μmf into the grid of the 5718.

PAX-I Attenuator Head for P170CF 11.00
 Attenuation may be varied between 4 times and 40 times.
PAX-II Attenuator Head for P170CF 11.00
 Attenuation may be varied between 20 times and 200 times.
PAX-III Attenuator Head for P170CF 11.00
 Attenuation may be varied between 200 times and 2000 times.
 P170CF may be used with Type 513 oscilloscope, but low frequency response will suffer somewhat, depending on the attenuator head being used. It is necessary to terminate the 170-ohm cable at the oscilloscope input. B170R terminating resistor is designed for this. (See below.) A rectifier kit, KP170CF, is recommended for installation in Type 513 to rectify the 6.3 volt heater supply.

KP170CF DC Filament Kit for P170CF 4.50

TERMINATIONS, PADS, ATTENUATORS



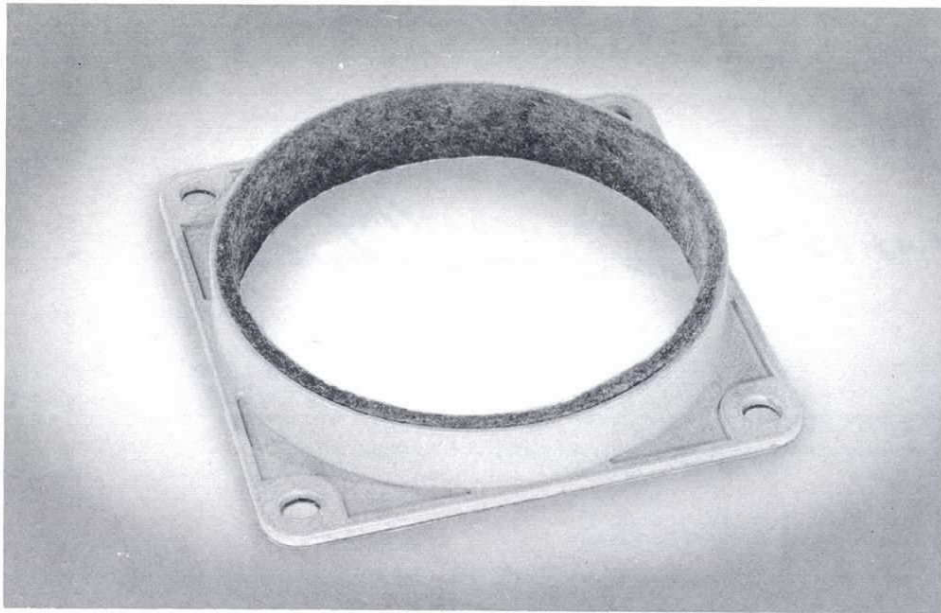
B52-R 52-ohm terminating resistor, 1.5w 8.50
B52-L5 52-ohm 'L' pad, 5 to 1 voltage ratio, 1.5w 8.50
B52-L10 52-ohm 'L' pad, 10 to 1 voltage ratio, 1.5w 8.50
B52-75L Minimum-loss pad, 52 ohms to 75 ohms 11.50
B52-170L Minimum-loss pad, 52 ohms to 170 ohms 11.50
B52-T10 52-ohm 'T' pad, 10 to 1 voltage ratio, 1.5w 11.50
B75-R 75-ohm terminating resistor, 1.5w 8.50
B75-L5 75-ohm 'L' pad, 5 to 1 voltage ratio, 1.5w 8.50
B75-L10 75-ohm 'L' pad, 10 to 1 voltage ratio, 1.5w 8.50
B75-T10 75-ohm 'T' pad, 10 to 1 voltage ratio, 1.5w 11.50
B93-R 93-ohm terminating resistor, 1.5w 8.50
B93-L5 93-ohm 'L' pad, 5 to 1 voltage ratio, 1.5w 8.50
B93-L10 93-ohm 'L' pad, 10 to 1 voltage ratio, 1.5w 8.50
B93-52L Minimum-loss pad, 93 ohms to 52 ohms, 1.5w 11.50
B93-T10 93-ohm 'T' pad, 10 to 1 voltage ratio, 1.5w 11.50
B170-R 170-ohm terminating resistor, 1.5w . . . 8.50
B170-V 170-ohm attenuator, 1 to 64 db in 1 db steps, 0.25w 45.00

Prices f.o.b. Portland (Beaverton), Oregon

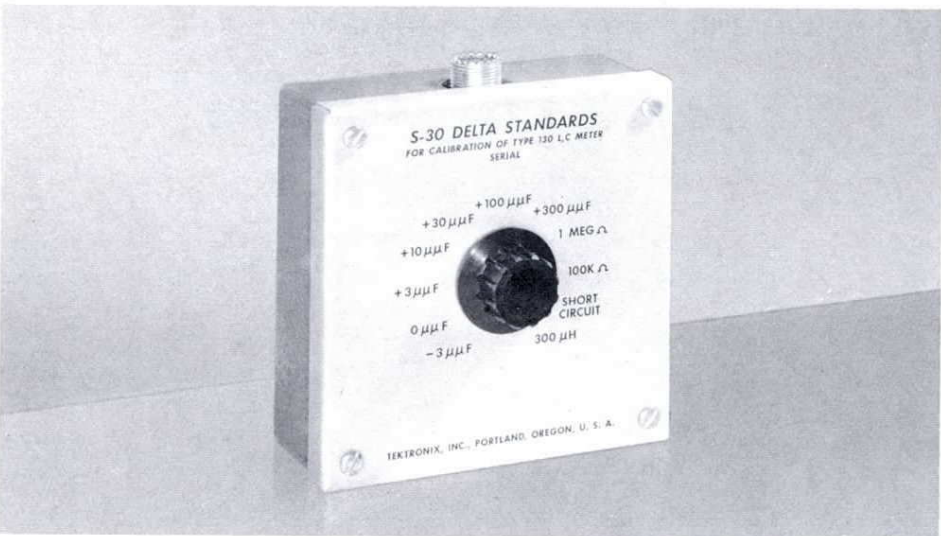
Tektronix, Inc.

ACCESSORIES

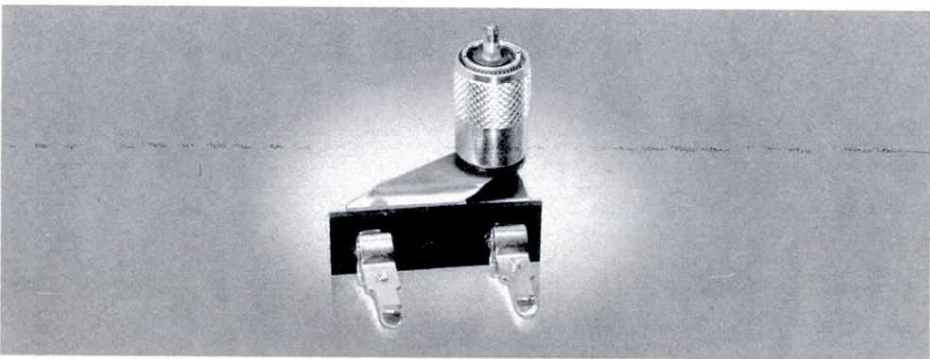
Operational Accessories



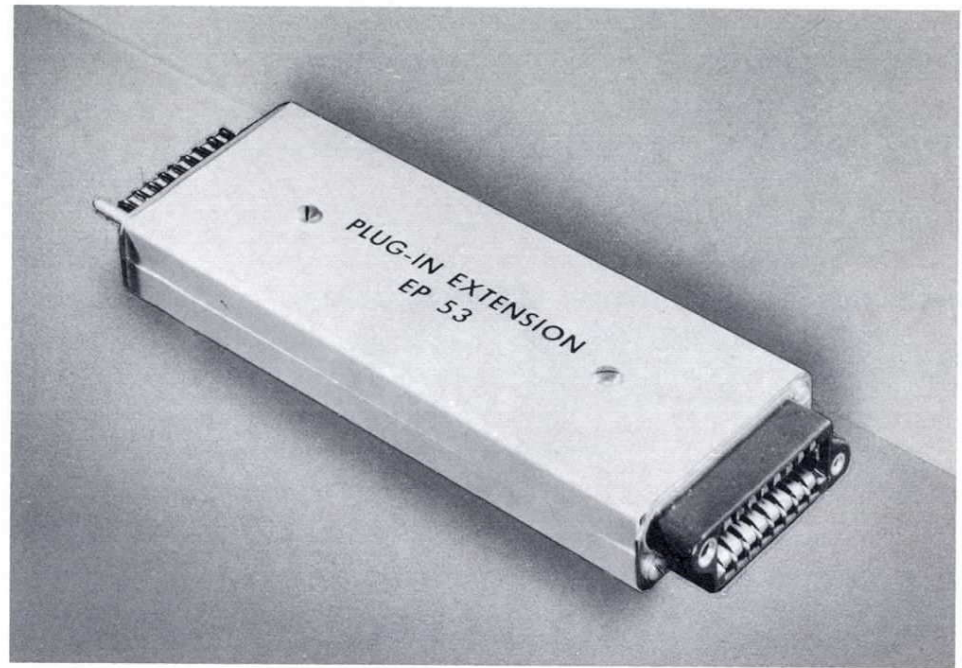
BE510 Bezel, for mounting camera on Tektronix 5" Oscilloscopes. Dimensions—5⁷/₈" square; ring ⁷/₈" deep, diameter 5⁵/₈" outside, 5¹/₈" inside. Die-cast construction, gray wrinkle finish, felt lined 4.50



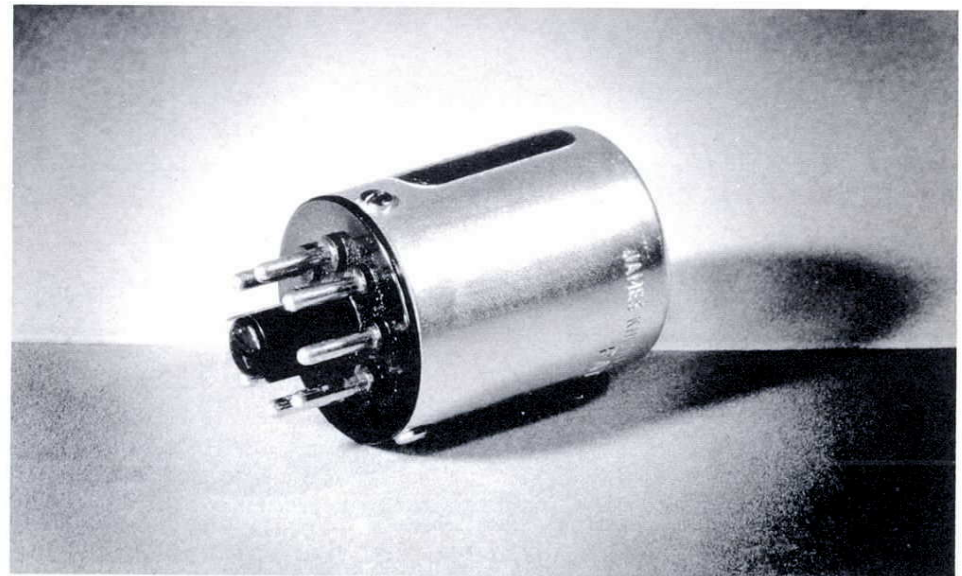
S30 Delta Standards, for calibration of the Type 130 L,C Meter. The unit provides accurately adjusted steps of capacitance and inductance, selected by a rotary selector switch. Values of the capacitance steps correspond to the full-scale adjustments required on the five scales of the Type 130. Two resistors of identical manufacture and similar capacitance, values of 1 megohm and 0.1 megohm, are provided for the resistance compensation adjustment. A 300- μ h standard permits proper adjustments of the inductance ranges 22.00



F30 Production Test Fixture, for use with the Type 130 L,C Meter. Speeds sorting and testing of capacitors and inductors 3.00



EP53 Plug-in Extension—Allows the plug-in pre-amplifier unit for the Type 530 Series oscilloscope to be operated partially out of its housing. A convenient accessory in making attenuator and transient response adjustments 5.00



CO181 Crystal-Oven Combination—A 1-mc crystal mounted in a temperature-stabilized oven. Directly interchangeable with standard crystal. Plugs into crystal socket of the Type 181—no wiring changes necessary. Provides a frequency stability of 2ppm over a 24-hour period 27.00

COAXIAL CABLES

| | | |
|------|---|-------|
| P52 | Coaxial Cable, 52 ohms nominal impedance, 42" long | 4.00 |
| P75 | Coaxial Cable, 75 ohms nominal impedance, 42" long | 4.00 |
| P93 | Coaxial Cable, 93 ohms nominal impedance, 42" long | 4.00 |
| P93A | Coaxial output cable, 93 ohms, terminated at end with variable attenuator, 42" long | 13.50 |
| P93B | Coaxial output cable, 93 ohms, terminated at end with ¹ / ₂ -watt 93-ohm resistor, 42" long | 5.00 |
| P170 | Coaxial cable 170 ohms nominal impedance, 42" long | 9.50 |

Prices f.o.b. Portland (Beaverton), Oregon

Tektronix, Inc.

ACCESSORIES

Operational Accessories

DELAY NETWORKS

| | | |
|---------|---|-------|
| 1-D-25 | Delay network, .25 μ sec delay, for Type 511 | 50.00 |
| 1-AD-25 | Delay network, .25 μ sec delay, for Type 511A | 50.00 |
| 3-D-25 | Delay network, .25 μ sec delay, for Type 513 | 65.00 |
| 4-D-25 | Delay network, .25 μ sec delay, for Type 514 | 50.00 |

MISCELLANEOUS

| | | |
|-------|---|-------------|
| A100 | Adapter, clip lead | 2.50 |
| A510 | Adapter, binding post | 1.88 |
| FA160 | Frame, mounting, for Type 122 and Type 160 series units | 5.00 |
| | <i>FA160 FRAME MOUNTING FOR 160 SERIES UNITS.</i> | <i>3.00</i> |

Prices f.o.b. Portland (Beaverton), Oregon

Replacement Accessories

GRATICULES

| | | |
|----------|--|------|
| GR 300 | Unruled; fits Type 315 | .50 |
| GR 315 | Quarter-inch ruling, 8 spaces vertically, 10 horizontally | 1.00 |
| GR 510 | Unruled; fits Types 511A, 512, 513, 514, 514A, 524D, 524AD | 1.00 |
| GR 511 | Centimeter ruling; 4 centimeters vertically, 10 horizontally, for Types 511A and 514 with 5CP CRT | 1.50 |
| GR 512 | Centimeter ruling; 6 centimeters vertically, 10 horizontally, for Type 512 with 5CP CRT, Types 514A, 524A, 524AD and Type 511A with 5ABP CRT | 1.50 |
| GR 8 | Centimeter ruling; 8 centimeters vertically, 10 horizontally, for Type 512 with 5ABP CRT | 1.50 |
| GR 513 | Centimeter ruling; 4 centimeters vertically, 8 horizontally; for Type 513 | 1.50 |
| GR 517 | Centimeter ruling; 4 centimeters vertically, 8 horizontally; for Type 517 only | 9.50 |
| GR 524TV | RMA Style ruling for percentage measurements, for Type 524D and 524AD | 1.50 |
| GR 535 | Centimeter ruling; 6 centimeters vertically, 10 horizontally; for Types 531 and 535 | 1.50 |

CATHODE-RAY TUBE LIGHT FILTERS

| | | |
|--------|------------|-----|
| F310-3 | (3" amber) | .50 |
| F310-5 | (3" green) | .50 |
| F310-6 | (3" blue) | .50 |
| F510-3 | (5" amber) | .90 |
| F510-5 | (5" green) | .90 |
| F510-6 | (5" blue) | .90 |

AC POWER CORDS

| | | |
|---------|---------------------|------|
| COP16-8 | (#16 wire, 8' long) | 2.40 |
| COP18-1 | (#18 wire, 1' long) | .85 |
| COP18-8 | (#18 wire, 8' long) | 1.50 |

MISCELLANEOUS

| | | |
|-----------------------|--------------|-------|
| Attenuator Unit | for Type 190 | 19.00 |
| P93C Probe | for Type 130 | 2.00 |
| FM 124 Mounting Frame | for Type 124 | 5.00 |

SPECIAL CORDS AND LEADS

| | | |
|-------|---|------|
| W112R | (Red output lead for 112) | 1.00 |
| W112B | (Black output lead for 112) | 1.00 |
| W122 | (Battery power lead for 122) | 7.50 |
| W160L | (17" inter-unit Power cable for 160 series) | 2.00 |
| W160S | (10" inter-unit Power cable for 160 series) | 2.00 |
| W517 | (Inter-unit Power cable for 517) | 9.50 |

INSTRUCTION MANUALS

| | |
|---------------|------|
| 104A | 1.50 |
| 105 | 1.75 |
| 112 | 1.50 |
| 121 | 1.50 |
| 122 | 1.50 |
| 124 | 1.75 |
| 130 | 1.50 |
| 160 or 160A | 1.50 |
| 161 | 1.50 |
| 162 | 1.50 |
| 163 | 1.50 |
| 180 | 2.00 |
| 181 | 1.75 |
| 190 | 1.50 |
| 310 | 3.50 |
| 315D | 4.00 |
| 360 | 1.75 |
| 511A or 511AD | 2.75 |
| 512 | 2.75 |
| 513 or 513D | 2.75 |
| 514 or 514D | 2.75 |
| 514A or 514AD | 3.00 |
| 517 | 4.50 |
| 524D or 524AD | 5.00 |
| 525 | 4.50 |
| 531 | 4.50 |
| 532 | 4.50 |
| 533 | 4.50 |
| 535 | 5.00 |
| 53A | 1.50 |
| 53B | 1.50 |
| 53C | 1.50 |
| 53D | 1.50 |
| 53E | 1.50 |
| 53G | 1.50 |
| 570 | 4.50 |

Tektronix, Inc.

AN OREGON CORPORATION

Main Office and Factory—Sunset Highway and Barnes Road

Mailing Address—P. O. Box 831, Portland 7, Oregon

Phone—CYpress 2-2611

Cable—TEKTRONIX

TEKTRONIX FIELD ENGINEERING OFFICES

| | | |
|--------------|---|-------------------|
| BALTIMORE | Tektronix, Inc., 8118 Harford Road, Baltimore 14, Maryland | Northfield 5-2600 |
| | Washington Area Phone | Enterprise 1-6023 |
| BOSTON | Tektronix, Inc., 18 Austin St., Newtonville 60, Massachusetts | LAstell 7-2212 |
| CHICAGO | Tektronix, Inc., 7514 W. North Ave., Elmwood Park 35, Illinois | Gladstone 6-7930 |
| CLEVELAND | Tektronix, Inc., 3353 Edgely Terrace, Cleveland 11, Ohio | Clearwater 2-2121 |
| | Dayton Area: Enterprise 7121 Detroit Area: Enterprise 7121 Pittsburgh Area: Zenith 0212 | |
| NEW YORK | Tektronix, Inc., 49 Pondfield Road, Bronxville 8, New York | DEerfield 7-3771 |
| PHILADELPHIA | Tektronix, Inc., 7709 Ogontz Ave., Philadelphia 38, Pennsylvania | WAverly 4-5678 |
| SYRACUSE | Tektronix, Inc., 313 Nottingham Road, Syracuse 10, New York | Phone: 72-3339 |

TEKTRONIX ENGINEERING REPRESENTATIVES

| | | |
|---------------|---|-------------------|
| ALBUQUERQUE | Neely Enterprises, 107 Washington St. S. E., Albuquerque, New Mexico | Phone: 5-5586 |
| ATLANTA | Bivins & Caldwell, 267 East Paces Ferry Road, N. E., Atlanta, Georgia | CHerokee 7522 |
| DALLAS | M. F. Klicpera Company, P. O. Box 4117, Sta. A, Dallas 8, Texas | FEderal 0992 |
| DENVER | Hytronic Measurement Associates, 446 Broadway, Denver 3, Colorado | SHerman 4-2241 |
| FORT MYERS | Arthur Lynch & Associates, P. O. Box 466, Fort Myers, Florida | Fort Myers 5-6762 |
| HIGH POINT | Bivins & Caldwell, Security Bank Bldg., High Point, North Carolina | Phone: 3672 |
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