



CATHODE - RAY OSCILLOSCOPES
AUXILIARY INSTRUMENTS AND ACCESSORIES

CATALOG 15

MARCH 1957



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.

About the Company . . .

Tektronix was organized in 1946 to manufacture cathode-ray oscilloscopes. To an unusual degree, Tektronix oscilloscopes have met with the approval of the ultimate user, enabling the company to grow by expanding its product lines and services.

Throughout this continuing growth period Tektronix is striving to produce instruments with the quality and utility demanded by the fast-moving electronic industry. High employee morale, fostered by an employee-management relations program that gives employees a voice in company operations, a fair share of company profits, and steady year around employment, contributes greatly to this aim.

Realizing the complexity of the modern cathode-ray oscilloscope, Tektronix continually strives to provide the best in field maintenance help, and the utmost speed in replacement parts service. Helping to keep existing Tektronix instruments in efficient operation is as much a responsibility as developing new instruments to meet the future needs of the industry. Tektronix is making every effort to continue serving its customers with the highest quality in both product and service.

Tektronix, Inc., an Oregon Corporation, Portland 7, Oregon, U. S. A.



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REFERENCE CHART

MAIN SPECIFICATIONS of TEKTRONIX OSCILLOSCOPES for Convenience in Making Preliminary Comparisons

Oscilloscopes with Plug-In Preamplifiers

	TYPE 531 General Purpose	TYPE 532 General Purpose	TYPE 535 General Purpose	TYPE 541 Fast-Rise	TYPE 545 Fast-Rise
Vertical Frequency Response (with Type 53/54K Unit)	dc to 11 mc	dc to 5 mc	dc to 11 mc	dc to 30 mc	dc to 30 mc
Calibrated Sweep Range	0.02 μ sec/cm to 5 sec/cm	0.2 μ sec/cm to 5 sec/cm	0.02 μ sec/cm to 5 sec/cm	0.02 μ sec/cm to 5 sec/cm	0.02 μ sec/cm to 5 sec/cm
Sweep Magnifier	5x	5x	5x	5x	5x
Sweep Delay	None	None	1 μ sec to 0.1 sec	None	1 μ sec to 0.1 sec
Accelerating Potential	10 kv	4 kv	10 kv	10 kv	10 kv
Price (without plug-in units)	\$995	\$825	\$1300	\$1145	\$1450
Complete Specifications in Catalog 15	Page 67	Page 79	Page 71	Page 83	Page 87

Plug-In Preamplifiers for Type 530-Series and Type 540-Series Oscilloscopes

	TYPE 53/54A Wide-Band DC	TYPE 53/54B Wide-Band High-Gain	TYPE 53/54C Dual-Trace DC	TYPE 53/54D High-Gain DC Differential	TYPE 53/54E Low-Level AC Differential	TYPE 53/54G Wide-Band DC Differential	TYPE 53/54K Fast-Rise DC
Risetime of Combination — plugged into Types 541, 545	0.018 μ sec	0.018 μ sec	0.015 μ sec	0.18 μ sec	6 μ sec	0.018 μ sec	0.012 μ sec
Types 531, 535	0.035 μ sec	0.035 μ sec	0.035 μ sec	0.18 μ sec	6 μ sec	0.035 μ sec	0.031 μ sec
Type 532	0.07 μ sec	0.07 μ sec	0.07 μ sec	0.18 μ sec	6 μ sec	0.07 μ sec	0.07 μ sec
Passband of Combination—plugged into Types 541, 545	dc to 20 mc	* 2 c to 12 mc dc to 20 mc	dc to 24 mc	dc to 2 mc	0.06 cycles to 60 kc	dc to 20 mc	dc to 30 mc
Types 531, 535	dc to 10 mc	* 2 c to 9 mc dc to 10 mc	dc to 10 mc	dc to 2 mc	0.06 cycles to 60 kc	dc to 10 mc	dc to 11 mc
Type 532	dc to 5 mc	2 c to 5 mc dc to 5 mc	dc to 5 mc	dc to 2 mc	0.06 cycles to 60 kc	dc to 5 mc	dc to 5 mc
Calibrated Deflection Factor ac coupled	0.05 v/cm to 50 v/cm	* 5 mv/cm to 50 v/cm	0.05 v/cm to 50 v/cm	1 mv/cm to 50 v/cm	50 μ v/cm to 10 mv/cm	0.05 v/cm to 50 v/cm	0.05 v/cm to 50 v/cm
dc coupled	0.05 v/cm to 50 v/cm	0.05 v/cm to 50 v/cm	0.05 v/cm to 50 v/cm	1 mv/cm to 50 v/cm		0.05 v/cm to 50 v/cm	0.05 v/cm to 50 v/cm
Input Capacitance	47 μ mf	47 μ mf	20 μ mf	47 μ mf	50 μ mf	47 μ mf	20 μ mf
Price	\$85	\$125	\$275	\$145	\$165	\$175	\$125
Complete Specifications in Catalog 15	Page 91	Page 92	Page 93	Page 94	Page 95	Page 96	Page 97

Oscilloscopes Without Plug-In Preamplifiers

	TYPE 310 3" Portable	TYPE 315D 3" Portable	TYPE 515 5" Portable	TYPE 517A High-Speed	TYPE 524AD Television
Risetime	0.09 μ sec	0.07 μ sec	0.023 μ sec	0.007 μ sec	0.035 μ sec
Vertical Passband					
ac coupled	* 2 c to 3.5 mc	5 c to 5 mc	2 c to 15 mc		2 c to 10 mc
dc coupled	2 c to 4 mc dc to 4 mc	dc to 5 mc	dc to 15 mc		dc to 10 mc
Calibration Deflection Factor					
ac coupled	* 0.01 v/div to 50 v/div	0.01 v/div to 50 v/div	0.1 v/cm to 50 v/cm	0.05 v/cm	0.015 v/cm to 50 v/cm
dc coupled	0.1 v/div to 50 v/div	0.1 v/div to 50 v/div	0.1 v/cm to 50 v/cm		0.15 v/cm to 50 v/cm
Calibrated Sweep Range	0.5 μ sec/div to 0.2 sec/div	0.1 μ sec/div to 5 sec/div	0.04 μ sec/cm to 2 sec/cm	0.01 μ sec/cm to 20 μ sec/cm	0.1 μ sec/cm to 0.01 sec/cm
Sweep Magnifier	5x	5x	5x		3x and 10x
Accelerating Potential	1.8 kv	1.8 kv	4 kv	24 kv	4 kv
Price	\$595	\$770	\$750	\$3500	\$1180
Complete Specifications in Catalog 15	Page 39	Page 43	Page 49	Page 53	Page 57

* An additional ac-coupled amplifier stage is switched in by use of the AC ONLY positions of the sensitivity selector, somewhat restricting the overall high-frequency response.

APPLICATIONS GUIDE

Some of the known applications of Tektronix Instruments are presented here, to help guide you in selecting instruments to fit your needs. Your Tektronix Field Engineer or Representative can be very helpful in this regard. If in doubt, please consult him before ordering. For his location and phone number, please refer to the Field Office page in this catalog.

BIOPHYSICAL-MEDICAL

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Cortical Research

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7700 Series	86
7800 Series	87
7900 Series	88
8000 Series	89
8100 Series	90
8200 Series	91
8300 Series	92
8400 Series	93
8500 Series	94
8600 Series	95
8700 Series	96
8800 Series	97
8900 Series	98
9000 Series	99
9100 Series	100
9200 Series	101
9300 Series	102
9400 Series	103
9500 Series	104
9600 Series	105
9700 Series	106
9800 Series	107
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DESCRIPTION OF CATHODE-RAY-TUBE PHOSPHORS

The catalog description of each oscilloscope gives the kind of phosphor that is normally provided in the crt. In general, your oscilloscope can be provided, on order, with any commercially available phosphor.

Phosphors, other than those of short persistence, may display an initial fluorescence of one color, followed by a phosphorescence of the same or another color. The following table describes some of the phosphors we can provide in your crt. We welcome your inquiries.

PHOSPHOR	FLUORESCENCE	PHOSPHORESCENCE	PERSISTENCE
P1	Green	Green	Medium
P2	Blue-green	Green	Long
P5	Blue		Very short
P7*	Blue-white	Yellow	Long
P11	Blue		Short
P12	Orange	Orange	Medium long
P14*	Purple	Orange	Medium long
P15	Blue-green		Extremely short
P16	Violet and near ultra-violet		Extremely short
P19**	Orange	Orange	Extremely long
P24	Blue		Extremely short

*Double-layer types.

**Readily susceptible to burning.

DESCRIPTION OF BATHING WATER QUALITY

The following table shows the results of the analysis of the water samples collected during the period from 1961 to 1963. The water was analysed for various parameters including pH, temperature, conductivity, total dissolved solids, total suspended solids, total phosphorus, total nitrogen, and various ions. The results are given in the following table. The following table shows the results of the analysis of the water samples collected during the period from 1961 to 1963. The water was analysed for various parameters including pH, temperature, conductivity, total dissolved solids, total suspended solids, total phosphorus, total nitrogen, and various ions. The results are given in the following table.

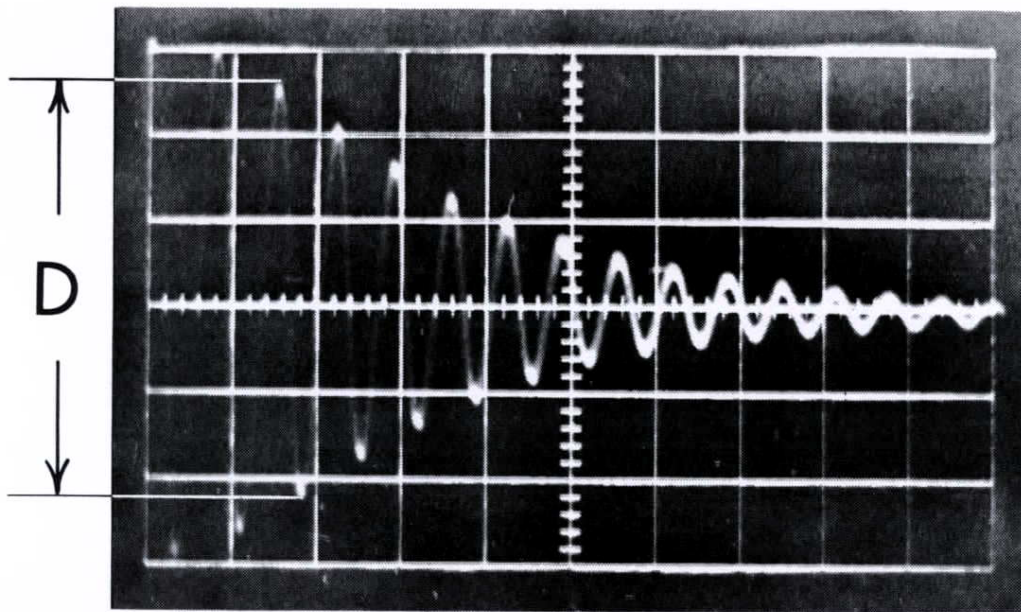
Parameter	1961	1962	1963
pH	7.5	7.8	7.6
Temperature (°C)	18.5	19.2	18.8
Conductivity (µmhos/cm)	150	160	155
Total Dissolved Solids (mg/l)	120	130	125
Total Suspended Solids (mg/l)	5	6	5
Total Phosphorus (mg/l)	0.1	0.1	0.1
Total Nitrogen (mg/l)	0.5	0.5	0.5
Calcium (mg/l)	100	105	100
Magnesium (mg/l)	20	25	20
Sulfate (mg/l)	10	10	10
Chloride (mg/l)	10	10	10

HOW TO CALCULATE WRITING RATE

The writing rate of which an oscilloscope is capable is usually taken to mean the maximum spot speed (usually in centimeters per microsecond) at which a satisfactory photograph can be taken. The result depends not only upon the characteristics and adjustments of the oscilloscope, but also upon the photographic equipment and processes used. The illustration below shows one way in which writing rate can be calculated. There is displayed a single trace of damped sine wave whose frequency is such that the rapidly rising and falling portions of the first cycle or two fail to photograph. The writing-rate capability of the oscilloscope is determined as follows: Starting from the left, find the first rapidly rising or falling portion of the damped sine wave which is photographed in its entirety. Let D represent the vertical distance in centimeters between the peaks which are connected by this portion. If D is three or more times as great as the horizontal distance occupied by one cycle, the writing rate in centimeters per microsecond is given closely by:

$$\text{Maximum writing rate} — 3.14 Df$$

where f is the frequency of the damped wave in megacycles.



Although the writing rate is an important characteristic of the oscilloscope, it does not completely describe the ability of the oscilloscope to present detailed information. It is also important to consider the available resolution in conjunction with screen size. It is convenient to present these latter data in terms of the number of spot widths contained in the length and in the height of the useful graticule area.

HOW TO CALCULATE WRITING RATE

The following is a list of factors which may be used to determine the writing rate of a person. The factors are listed in order of importance, from most important to least important. The factors are: 1. The number of words written per minute. 2. The number of lines written per minute. 3. The number of pages written per minute. 4. The number of words written per hour. 5. The number of lines written per hour. 6. The number of pages written per hour. 7. The number of words written per day. 8. The number of lines written per day. 9. The number of pages written per day. 10. The number of words written per week. 11. The number of lines written per week. 12. The number of pages written per week. 13. The number of words written per month. 14. The number of lines written per month. 15. The number of pages written per month. 16. The number of words written per year. 17. The number of lines written per year. 18. The number of pages written per year.

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THE END OF THE WORLD IS NOT NEAR



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

and Voltage Calibrator



Fixed Frequencies

50 cycles, 1 kc, 100 kc, 1 mc.

High-Frequency Ranges

Risetime—less than 0.02 μ sec.

Output Voltage—5 v maximum in 93-ohm terminated cable.

Low-Frequency Ranges

Risetime—less than 3 μ sec.

Output Voltage—0 to 50 v in 9 calibrated ranges.

GENERAL DESCRIPTION

The Tektronix Type 104A Square-Wave Generator is a convenient source of four fixed square-wave frequencies. Standard frequencies of 50 cycles, 1 kc, 100 kc, and 1 mc are extremely useful for the study of low and high-frequency characteristics of wide-band amplifiers, adjustment of frequency-compensated attenuators, and testing filter networks in the laboratory or on the production line. An extra feature permits the low-frequency output to be used as an accurate voltage calibrator. Frequencies other than those listed can be provided to meet specialized requirements.

CHARACTERISTICS

Risetime—High-frequency square waves have a risetime of less than 0.02 μ sec, making it possible to test amplifiers having passbands up to 20 mc. Risetime of low-frequency square waves is less than 3 μ sec.

High-Frequency Output—The 1-mc and 100-kc outputs are available through a matched 93-ohm cable

terminated by a continuously variable attenuator. Maximum output is 5 v peak-to-peak. Impedance varies from 0 to 93 ohms depending on attenuator setting.

Low-Frequency Output—(Voltage Calibrator) The 50-cycle and 1-kc square-wave outputs are continuously variable in 9 ranges, 5, 15, 50 mv, 0.15, 0.5, 1.5, 5, 15, and 50 volts peak-to-peak. Full-scale calibration is accurate within 3%, control linear within 1% of full scale. Impedance varies from 0 to 10 kilohms depending upon attenuator settings.

For calibrating purposes, the Type 104A can be inserted between a signal source and the oscilloscope. A switch connects either the signal or calibrating waveform to the oscilloscope, permitting accurate amplitude measurement of any portion of the signal waveform.

Synchronizing Signal—An oscilloscope synchronizing waveform is available at a front-panel binding post. Amplitude is 3 v for all frequencies.

Regulated Power Supply—Electronically-regulated dc supplies insure stable operation over power-line variations from 105 to 125 v and current-demand differences.

VACUUM TUBE COMPLEMENT

High-frequency multivibrators	2	6AG7
High-frequency limiter		6AG7
High-frequency output amplifier		6AG7
Low-frequency multivibrator		12AU7
Low-frequency limiter and CF		12AU7
Sync output CF		6J6
Rectifier		5V4
Regulator amplifier		6AU6
Series regulator		6AU5
Voltage reference		OC3

MECHANICAL SPECIFICATIONS

Construction—Self-contained, aluminum-alloy chassis and cabinet.

Finish—Photo-etched anodized front panel, wrinkle-finished cabinet.

Dimensions—14" high, 9" wide, 12" deep.

Weight—22 pounds.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 115 watts.

Price **\$195**

- Includes: 1—P93A attenuator cable
 1—A100 clip-lead adaptor
 2—A510 binding-post adapters
 1—Instruction manual

Currently Available Extras

The Type 104A can be supplied with frequencies other than 50 cycles, 1 kc, 100 kc, and 1 mc at small additional cost.

Prices for selected frequencies are:
 2 in range of 50 cycles to 10 kc. \$20
 2 in range of 50 kc to 1 mc. \$20

Prices f.o.b. Portland, Oregon.



TYPE 105 SQUARE-WAVE GENERATOR

Wide Frequency Range

Risetime

Less than $0.02 \mu\text{sec}$ into a terminated 93-ohm cable. As short as 13 millimicroseconds under suitable conditions.

Frequency Range

25 cycles to 1 mc, continuously variable.

Frequency Meter

Direct reading, accurate within 3% of full scale.

Output Current

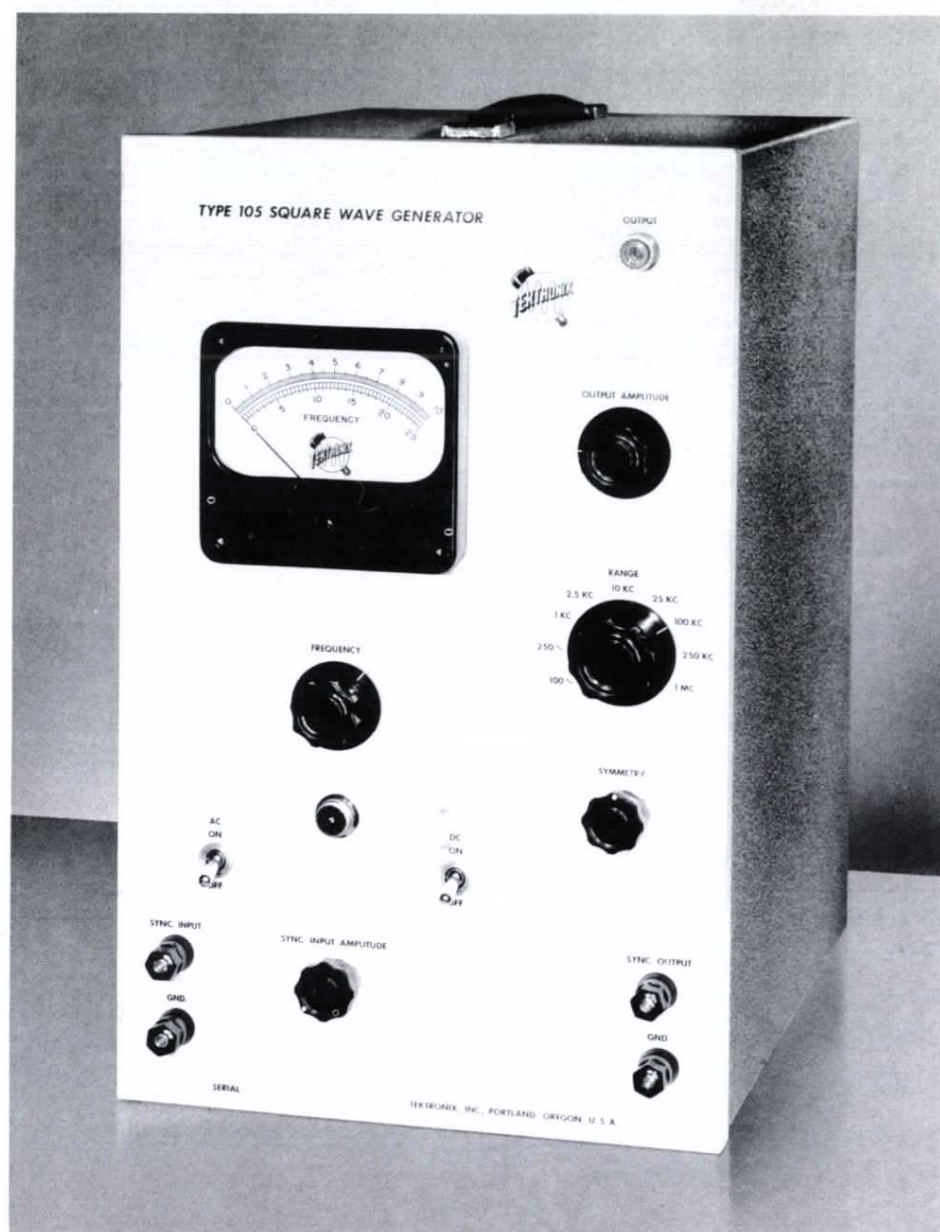
More than 160 ma, peak-to-peak.

GENERAL DESCRIPTION

The Tektronix Type 105 Square-Wave Generator produces square waves with flat horizontal portions, free of overshoot and ringing, over a wide frequency range. Square-wave current greater than 160 ma, peak-to-peak, available at the output terminal, permits a useable voltage swing across very-low impedance loads. Rise-time is less than $0.02 \mu\text{sec}$ into a terminated 93-ohm cable, and is approximately 13 millimicroseconds into a 52-ohm cable terminated at both ends.

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 rise-time 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, making it possible to quickly and accurately test amplifiers, filters, etc., having passbands from a few cycles to 20 mc.

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



CHARACTERISTICS

Frequency Range—The frequency range is 25 cycles to 1 mc, continuously variable, in nine ranges—100, 250 cycles, 1, 2.5, 10, 25, 100, 250 kc, and 1 mc. Frequency is read directly on a meter accurate within 3% of full scale.

Risetime—Less than $0.02 \mu\text{sec}$ into a terminated 93-ohm cable; approximately 18 millimicroseconds when the 93-ohm cable is terminated at both ends; approximately 13 millimicroseconds into a 52-ohm cable terminated at both ends. For higher output voltages larger output impedances can be used, with a corresponding increase in risetime.

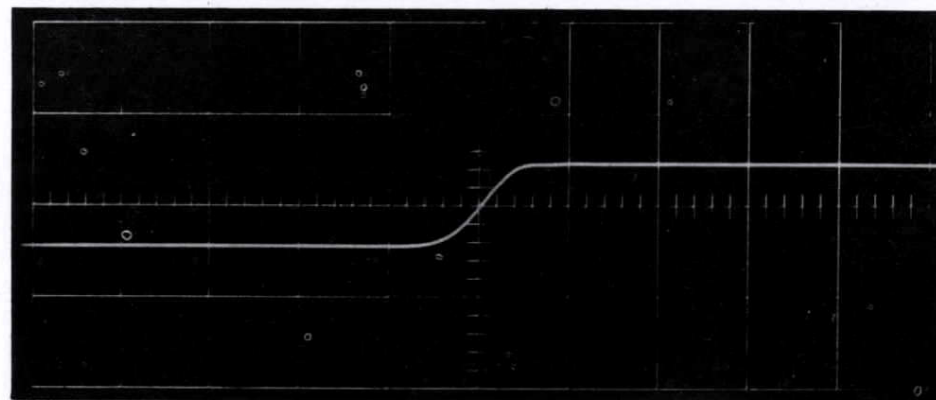


Fig. 1. 13-millimicrosecond risetime of the Type 105 displayed on $0.02 \mu\text{sec/cm}$ sweep. Generator connected to vertical deflection plates of T54P crt, sensitivity 7 v/cm, with 52-ohm cable terminated at both ends.

TYPE 105 SQUARE-WAVE GENERATOR

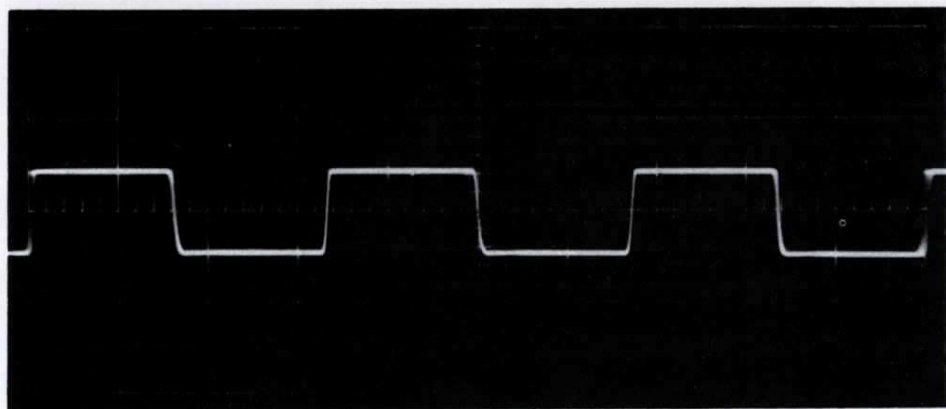


Fig. 2. Sharp leading edge, square corner, and flat top of 1-mc square-wave output of Type 105 displayed on 0.3 μ sec/cm sweep. Other conditions same as in Fig. 1.

Output Amplitude—The output voltage is adjustable from 10 to 100 v across the internal 600-ohm load. The maximum square-wave current available at the output is greater than 160 ma (peak-to-peak). With a 75-ohm terminated output coaxial cable, the maximum voltage available is approximately 12 volts; with a 93-ohm cable, approximately 15 v.

Sync Terminals—Provision is made to furnish an output synchronizing signal whose amplitude is independent of the square-wave output-control setting. A sync-input terminal permits the square wave to be synchronized with a frequency standard.

Regulated Power Supply—Electronically-regulated dc supplies insure stable operation over line variations of 105-125 v, 210-250 v.

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 catching diode		6AL5
Cathode follower voltage regulator		6J6
Meter amplifier		6AL5
Sync output CF		6J6
Voltage reference		5651
Rectifiers	4	5V4G
Regulator amplifiers	2	6AU6
Series regulators	4	6AU5

MECHANICAL SPECIFICATIONS

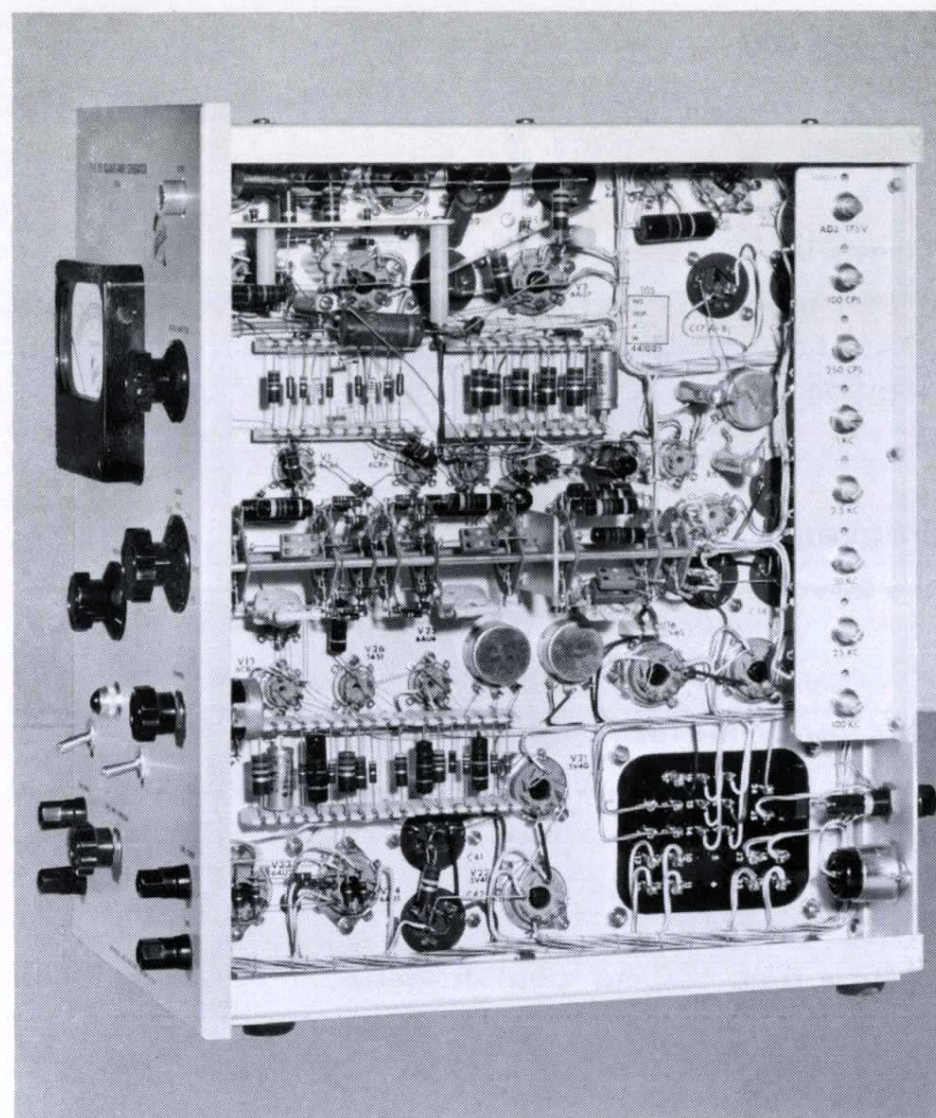
Ventilation—Forced-air ventilation assures safe operating temperature.

Construction—Aluminum-alloy chassis and cabinet.

Finish—Photo-etched anodized front panel, wrinkle-finished cabinet.

Dimensions—16 1/2" high, 10 1/8" wide, 14 7/8" deep.

Weight—35 1/2 pounds.



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

Price \$395

Includes: 1—P93, 93-ohm 42" coaxial cable
1—B93-R, 93-ohm terminating resistor
1—A510 binding-post adapter
1—A100 clip-lead adapter
1—Instruction manual

Currently Available Extras

93-ohm cable and resistor normally furnished. If specified on purchase order, 52-ohm cable and resistor or 75-ohm cable and resistor will be supplied instead of 93-ohm cable and resistor. . . . no extra charge.

Recommended Additional Accessories

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

1—P52, 52-ohm 42" coaxial cable	\$.400
1—B52-R, 52-ohm terminating resistor	8.50
1—B52-L5, 52-ohm "L" pad, 5:1 ratio	8.50
1—B52-T10, 52-ohm "T" pad, 10:1 ratio	11.50

A selection of terminating resistors, pads, and coaxial cables designed to be used with the Type 105 will be found in the Accessory Section of this catalog. Within certain technical limits, special terminating resistors and pads can be supplied upon request.

Prices f.o.b. Portland, Oregon.



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

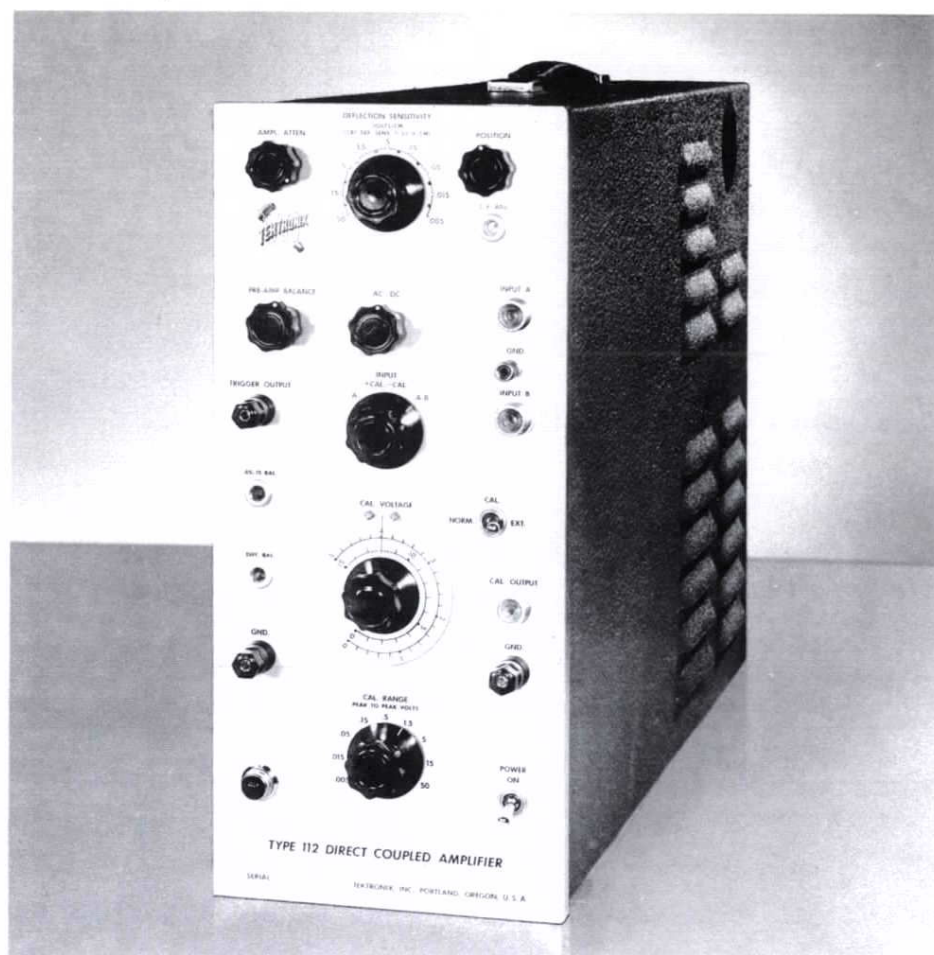
The Type 112 is a dc-coupled differential-input amplifier designed primarily for the amplification of signals to a magnitude suitable for observation on a cathode-ray tube. It is a four-stage balanced push-pull amplifier with the input stage shock mounted. Heaters of the first three stages and all plate 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 to 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 front panel, wrinkle-finished cabinet.
Size—15 1/2" high, 6 1/2" wide, 21 1/2" deep.
Weight—32 pounds.

Price \$495

Includes: 2—P510A attenuator probes
2—W112R output leads (012007)
1—W112B output lead (012008)
2—A510 binding-post adapters
1—Instruction manual

Price f.o.b. Portland, Oregon.

TYPE 121 PREAMPLIFIER

Wide-Band Preamplifier

Voltage Gain

0.01 to 100, continuously variable.

Frequency Response

5 cycles to 12 mc.

Transient Response

Less than 0.03- μ sec risetime.

Maximum Output Voltage

3 v peak-to-peak in terminated 93-ohm cable.

GENERAL DESCRIPTION

The Tektronix Type 121 Wide-Band Preamplifier is a self-contained 3-stage ac-coupled amplifier especially well suited for increasing the sensitivity of the Type 511, 511A, 511AD Oscilloscopes and other applications where a voltage gain up to 100 is desired. Excellent output linearity is achieved on all input signals up to 0.03 v peak-to-peak. All plate circuits are operated on electronically-regulated dc supplies to provide stability against line-voltage fluctuations. To minimize the hum level, dc voltage is supplied to the heaters of the first two amplifier stages. In addition, the first three tubes are located on a shock-mounted chassis to minimize microphonic and drift effects. Cathode-follower output permits wide separation of preamplifier and oscilloscope. Power is available at the front panel for a cathode-follower probe.

CHARACTERISTICS

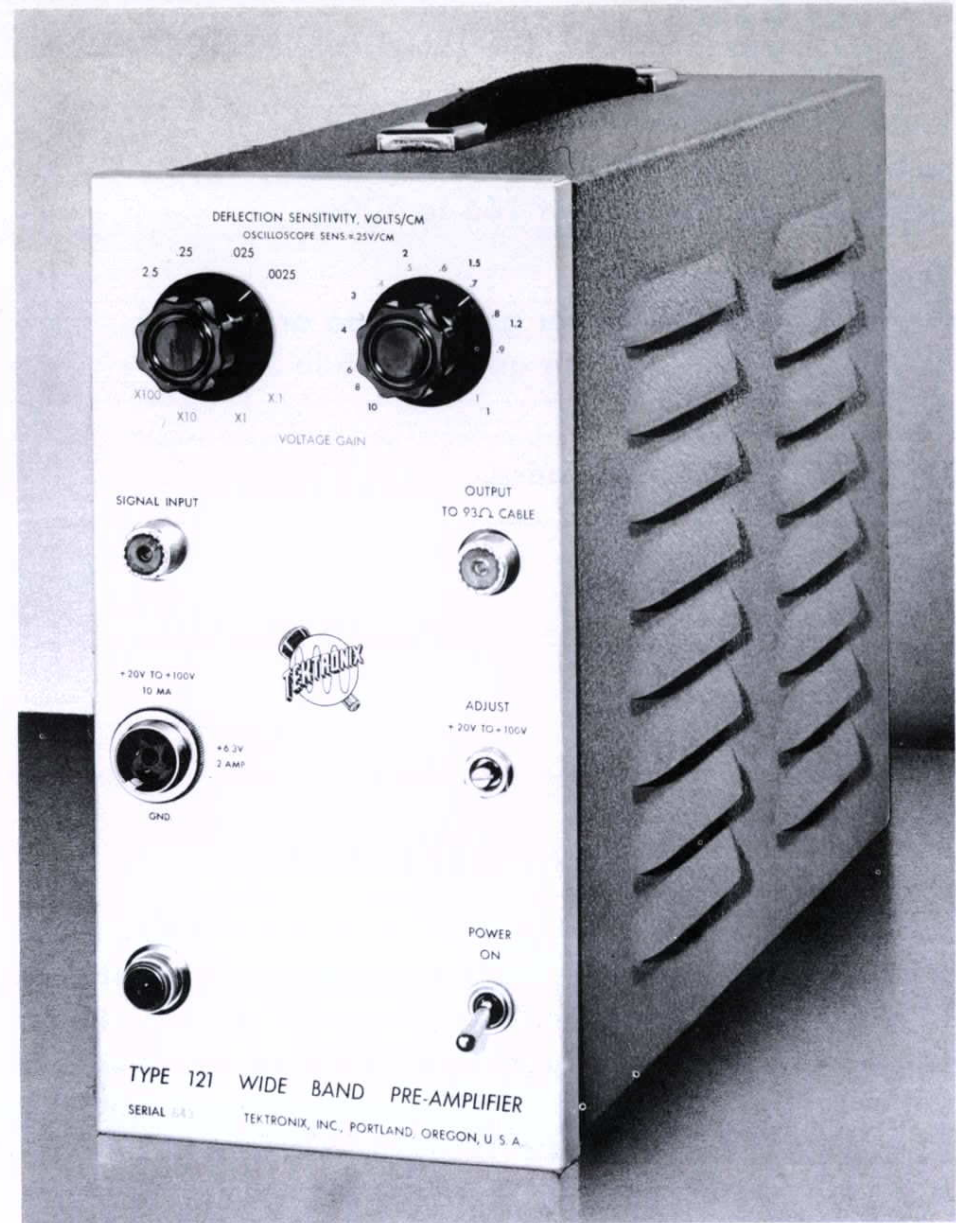
Voltage Gain—Continuously variable from 0.01 to 100 with four fixed calibrated ranges...0.1, 1, 10, and 100. When operated as a preamplifier for an oscilloscope into a deflection sensitivity of 0.25 v/cm, the Type 121 provides a complete range of sensitivity of 2.5 mv/cm to 25 v/cm without the use of oscilloscope attenuators.

Frequency Response—Primary emphasis has been placed on transient response. Risetime is less than 0.03 μ sec; passband is 5 cycles to 12 mc.

Output Voltage—3 v peak-to-peak maximum in a terminated 93-ohm cable, permitting linear amplification of any input signal up to 0.03 v peak-to-peak. Phase inversion in the Type 121 results in the positive portion of the input signal causing a negative deflection at the output terminal. Output is via a cathode follower so a long separation of the preamplifier and oscilloscope, or other instruments, is possible.

Probe Power—20-100 v dc plate and 6.3 dc heater supplies are available at a front-panel connector for cathode-follower probe or special preamplifier use.

Regulated Power Supplies—Electronically-regulated dc supplies insure stable operation over line variations of 105-125 v.



Input Impedance—1 megohm paralleled by approximately 20 μ f.

VACUUM TUBE COMPLEMENT

First and second stage amplifiers	2	6CB6
Cathode follower gain control		6J6
Third stage amplifier		6AH6
Cathode follower output		6J6
Cathode follower voltage regulator		6J6
Rectifier	2	6X4
Voltage reference		5651
Comparator		12AX7
Regulator amplifier		6AU6
Series regulator	2	12B4

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis and cabinet.
Finish—Photo-etched anodized front panel, wrinkle-finished cabinet.
Dimensions—5 $\frac{3}{4}$ " wide, 11 $\frac{1}{4}$ " high, 15" deep.
Weight—18 $\frac{1}{2}$ pounds.
Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 80 watts.

Price \$265

Includes: 1—P93B output cable
 1—Instruction manual

Price f.o.b. Portland, Oregon.

TYPE 122 PREAMPLIFIER

Low-Level Preamplifier

Voltage Gain

High position—approximately 1000.
Low position—approximately 100.

Frequency Response

0.16 cycles to 40 kc maximum.

Noise Level

4 μv rms maximum.

Output Voltage

Maximum 20 v (peak-to-peak).

Input Selection

Single ended or differential.

GENERAL DESCRIPTION

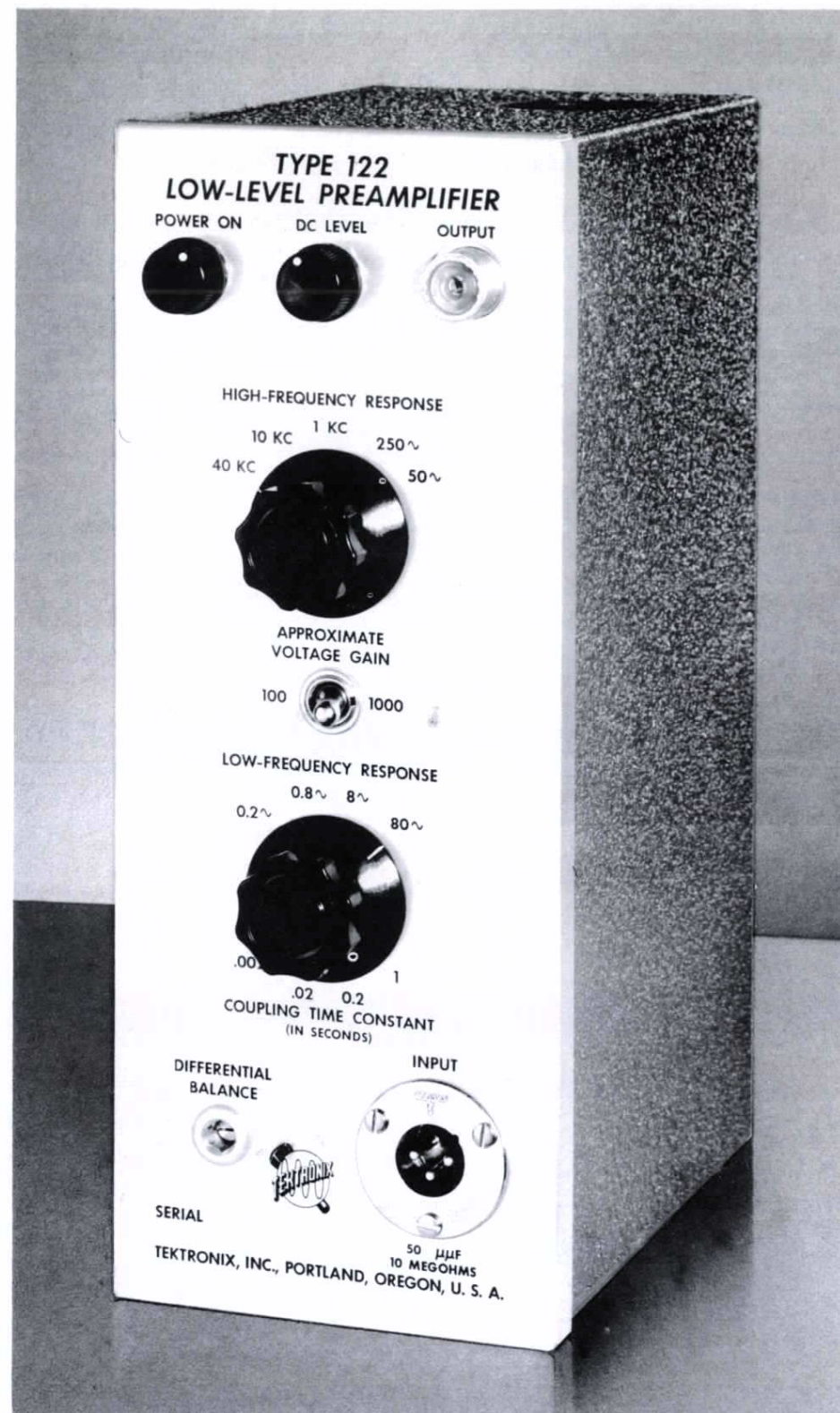
The Tektronix Type 122 Low-Level Preamplifier is a compact 3-stage battery-operated amplifier extending the usefulness of the oscilloscope into the microvolt region. The Type 122 is especially useful in biological research and other applications requiring the amplification of microvolt signals.

The Type 122 can be used with any dc-coupled oscilloscope, increasing its sensitivity by a factor of either 1000 or 100. When used with the Tektronix Type 512 Oscilloscope, sensitivity is increased to 5 $\mu\text{v}/\text{cm}$; with the Tektronix Type 360 Indicator, sensitivity is increased to 50 $\mu\text{v}/\text{cm}$. If the Type 122 is used with an ac-coupled oscilloscope, the overall low-frequency response will be limited to that of the oscilloscope.

Shock mounting, careful bypassing, and use of battery heater and plate-supply voltages reduce microphonics, noise, and hum to a low level.

CHARACTERISTICS

Frequency Response—Maximum passband is 0.16 cycles to 40 kc, with 5 high-frequency 3-db cutoff points . . . 50, 250 cps, 1, 10, and 40 kc; and 4 low-frequency 3-db cutoff points . . . 0.2, 0.8, 8, and 80 cycles. Corresponding low frequency time constants are 1, 0.2, 0.02, and 0.002 seconds. High and low-frequency cutoff points are controlled by separate switches so a variety of frequency response characteristics can be obtained.



Rejection Ratio—80 to 100 db for in-phase signals from 5 cycles to 40 kc; maximum signal input is 10 v.

Voltage Gain—A toggle switch selects either a gain of 100 or 1000.

Signal Output—For a maximum signal input of 0.02 v (peak-to-peak) in high-gain position and 0.2 v (peak-to-peak) in low-gain position, maximum signal output is 20 v peak-to-peak. The output dc level is adjustable to zero for use on dc oscilloscopes. Output is via a cathode follower with impedance approximately 1000 ohms.

Input Impedance—With single-ended input, the impedance is 10 megohms paralleled by approximately 50 $\mu\mu\text{f}$. Impedance for differential input is 20 megohms paralleled by approximately 50 $\mu\mu\text{f}$.

Noise Level—Depending on the setting of the frequency response controls, the noise level is 1 to 4 microvolts rms.

TYPE 122 PREAMPLIFIER

VACUUM TUBE COMPLEMENT

Input amplifier selected 12AX7
 Second stage amplifier selected 12AU7
 Third stage amplifier and CF out selected 12AU7

MECHANICAL SPECIFICATIONS

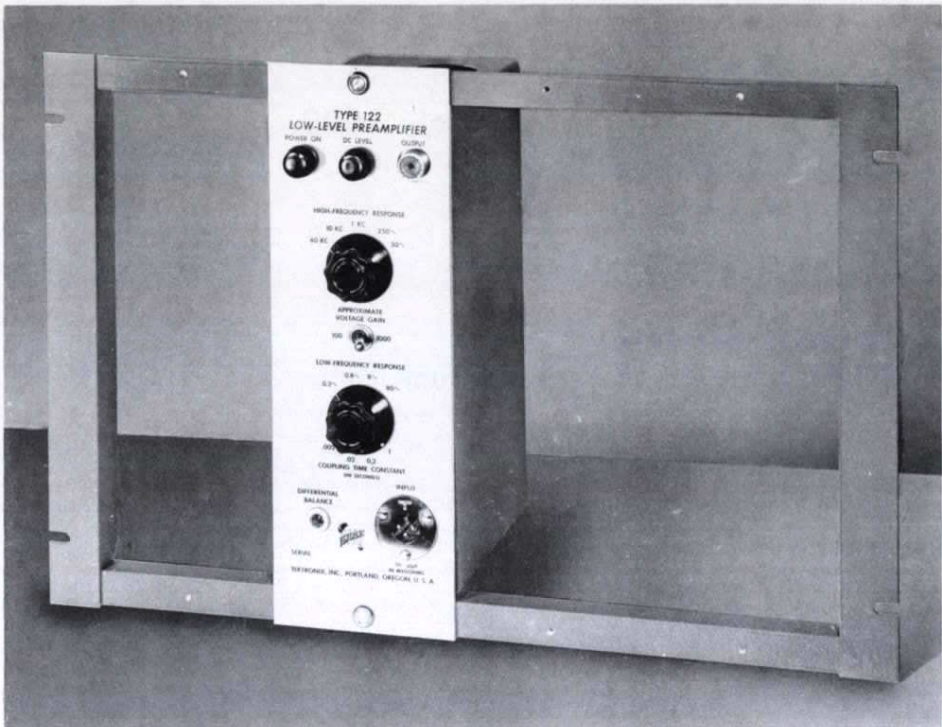
Construction—Aluminum-alloy chassis and cabinet.
 Finish—Photo-etched anodized front panel, wrinkle-finished cabinet.
 Dimensions—10 5/8" high, 4 1/2" wide, 7" deep.
 Weight—5 1/2 pounds.
 Power Requirements—Battery powered through a standard octal plug: +135 v at 5 ma, -90 v at 4 ma, and 6.3 v at 0.9 amp.

Type 122 \$85
 Includes: 1—W122 battery cable (012009)
 1—CON3P input plug
 1—P93 output cable
 1—Instruction manual



Type 122 Rack Mount—fits into standard 19" relay rack. Type 122 mounted horizontally on a panel 1/8" thick, with input connector at left side of panel. Height, 5 1/4".

Type 122 Rack Mount \$90



Type 122 Frame Mount—fits vertically into special adapter frame FA160, or can be mounted in an existing support.

Type 122 Frame Mount \$90

Currently Available Extras

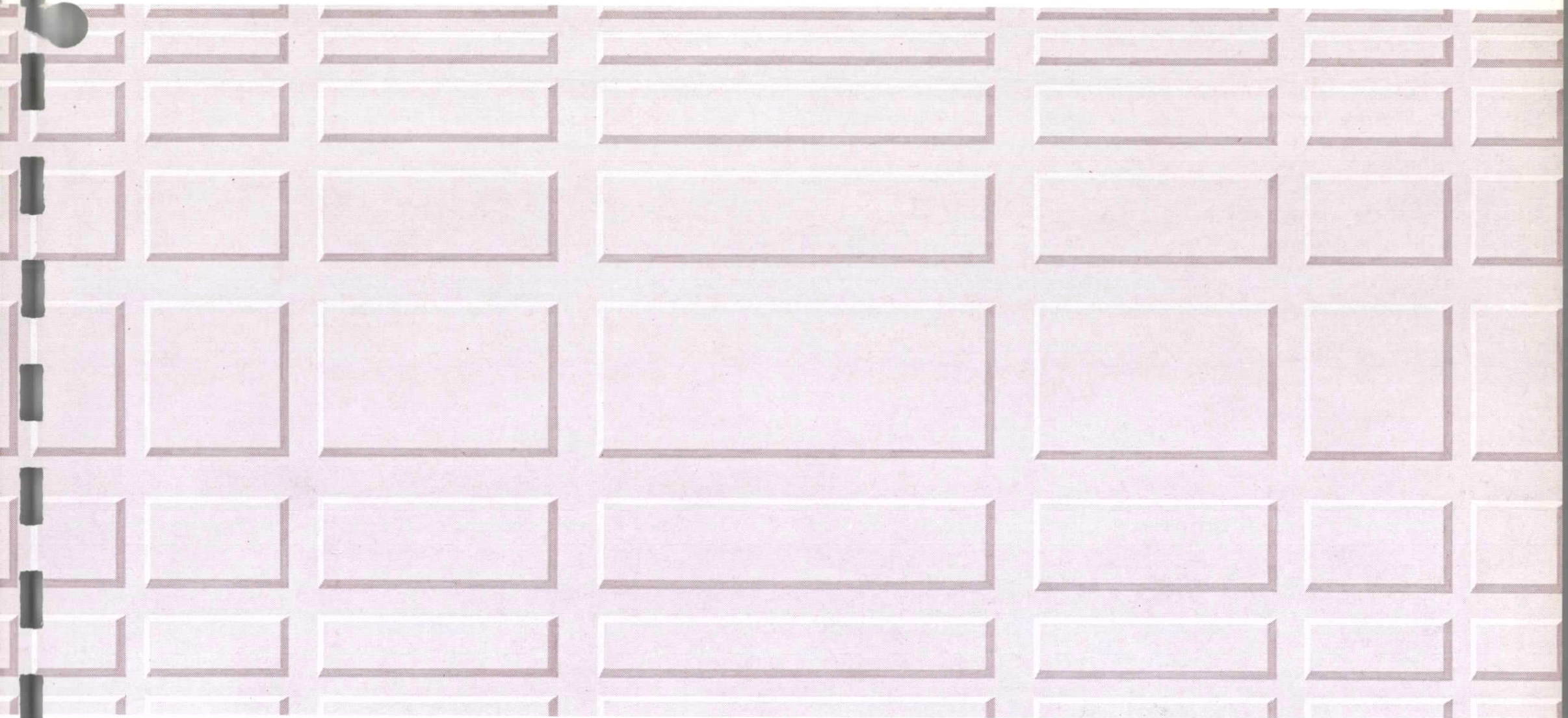
Extra long battery cables, similar to Type W122, can be ordered as special items.

Recommended Additional Accessories

Type FA160 Adapter Frame adapts Type 122 Frame Mount to rack mounting. Mounts in standard rack and holds four of any combination of Type 122 Preampifiers, Type 360 Indicators, and Type 160-Series Units. . . \$5.00

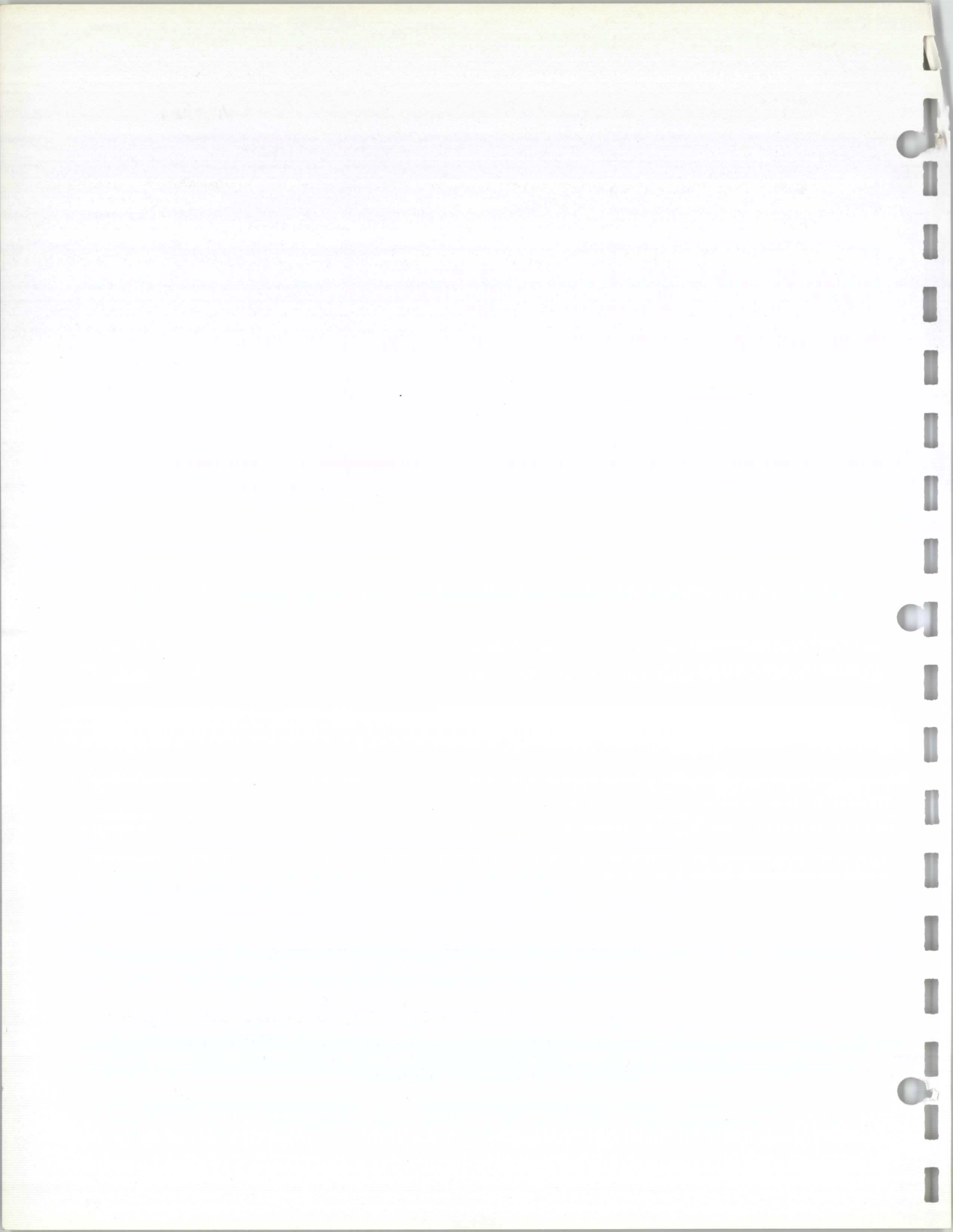
Prices f.o.b. Portland, Oregon.





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 130 L,C METER

Direct-Reading Inductance and Capacitance Meter



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

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.

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.

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

MECHANICAL SPECIFICATIONS

Construction—Aluminum alloy.

Finish—Photo-etched anodized front panel, wrinkle-finished cabinet.

Size—5" wide, 9" high, 8½" deep.

Weight—9 lbs.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 40 watts.

Price **\$195**

Includes: 1—P93C probe (010003)
1—W130R lead (012015)
1—W130B lead (012014)
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, Oregon.

Direct-Reading Inductance and Capacitance Meter

The Type 100 LC Meter is a direct-reading instrument for measuring inductance and capacitance. It is designed for use in the laboratory and field. The meter is accurate to within 1% and has a range of 0.01 to 1000 microhenries for inductance and 0.01 to 1000 microfarads for capacitance. The meter is easy to use and requires no special skills. It is a valuable tool for anyone who works with electrical circuits.

General Description

The meter consists of a single coil which is used for both inductance and capacitance measurements. The coil is wound on a non-magnetic core and is connected to a bridge circuit. The bridge circuit is balanced by a variable capacitor and a variable inductor. The deflection of the coil is measured by a permanent magnet and a scale. The scale is graduated in microhenries and microfarads.

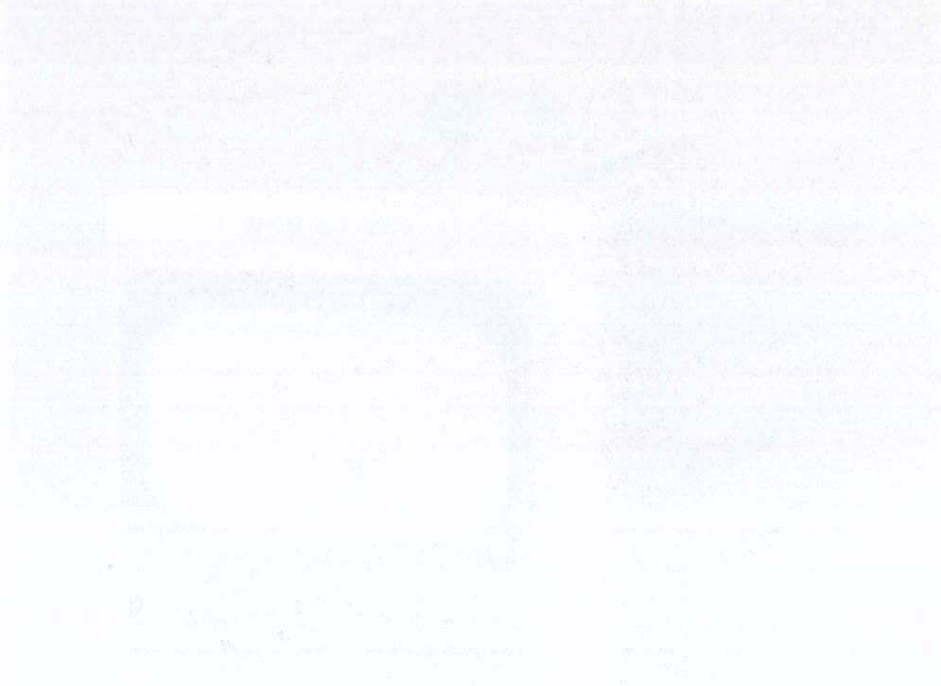


Fig. 1. Bridge circuit of the Type 100 LC Meter.

Operating Instructions

1. Before using the meter, check the range of the coil. The range is marked on the side of the meter.

2. Connect the test coil to the bridge circuit. The test coil is connected to the top and bottom terminals of the bridge.

3. Balance the bridge by adjusting the variable capacitor and the variable inductor. The bridge is balanced when the detector shows zero deflection.

4. Read the value of the test coil from the scale. The scale is graduated in microhenries and microfarads.

5. The meter is accurate to within 1% and has a range of 0.01 to 1000 microhenries for inductance and 0.01 to 1000 microfarads for capacitance.

6. The meter is easy to use and requires no special skills. It is a valuable tool for anyone who works with electrical circuits.

Specifications

Range: 0.01 to 1000 microhenries for inductance, 0.01 to 1000 microfarads for capacitance.

Accuracy: Within 1%.

Frequency: 50 to 1000 cycles per second.

Power: 100 milliwatts.

Size: 4 1/2" x 3 1/2" x 1 1/2".

Weight: 1.5 pounds.

Price: \$15.00.

Notes

1. The meter is designed for use in the laboratory and field.

2. The meter is accurate to within 1% and has a range of 0.01 to 1000 microhenries for inductance and 0.01 to 1000 microfarads for capacitance.

3. The meter is easy to use and requires no special skills. It is a valuable tool for anyone who works with electrical circuits.

Ordering Information

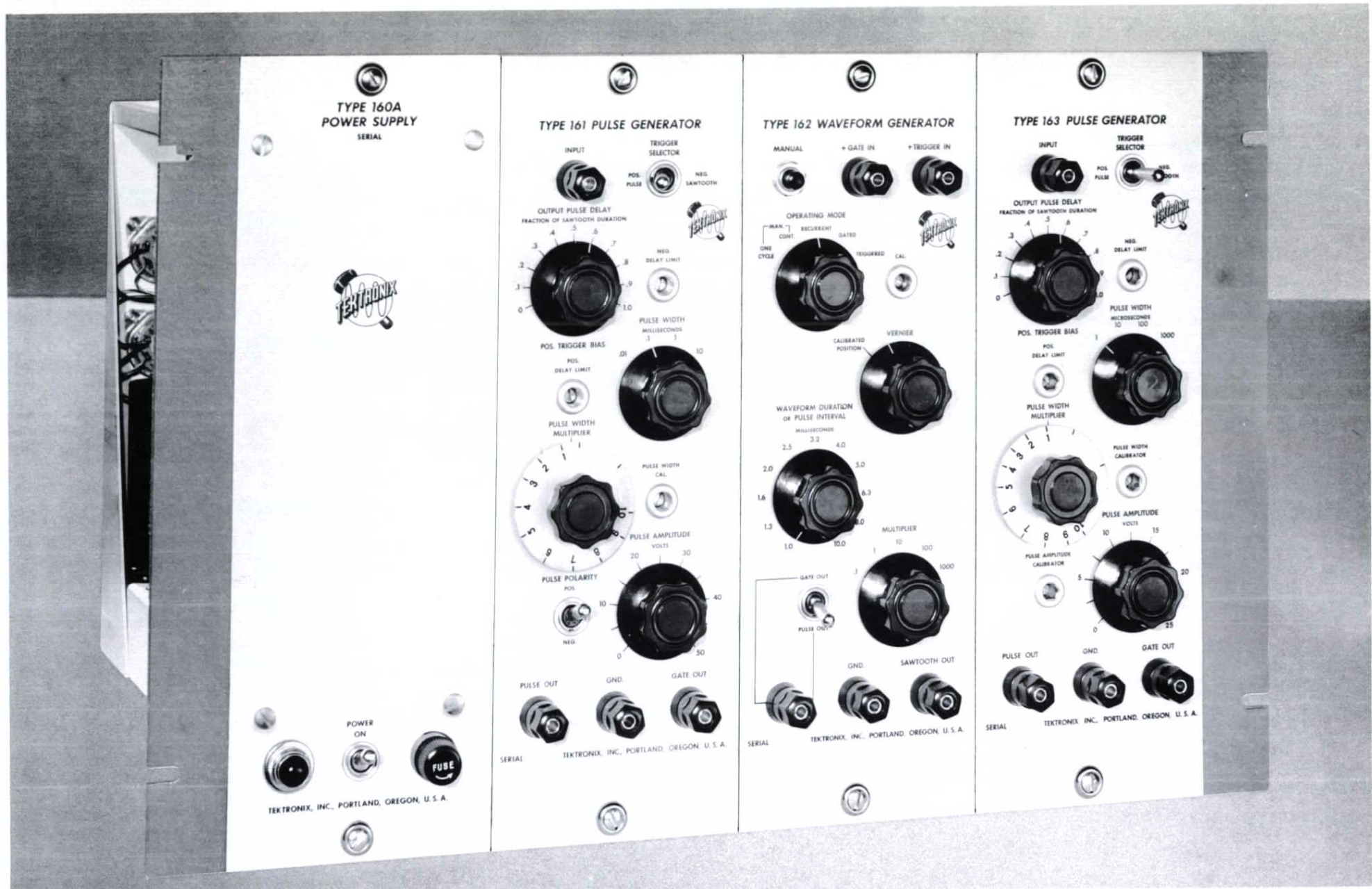
Order the Type 100 LC Meter from the following sources:

General Electric Company, P.O. Box 100, Schenectady, N.Y.

Radio Shack, 1500 Broadway, New York, N.Y.

Electronic Equipment Company, 1000 Broadway, New York, N.Y.

TYPE 160-SERIES WAVEFORM GENERATORS

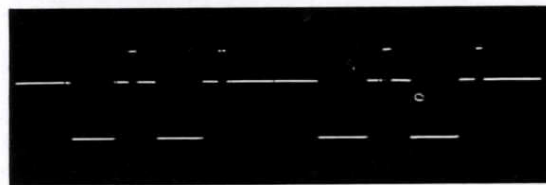
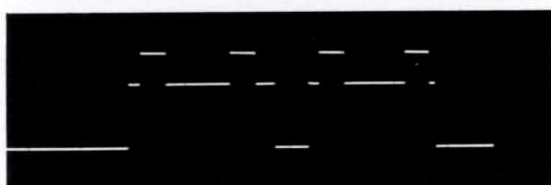
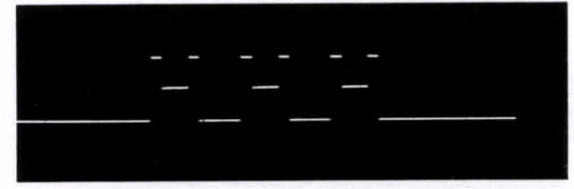
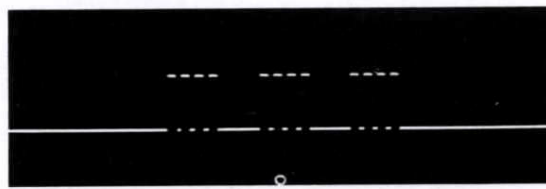
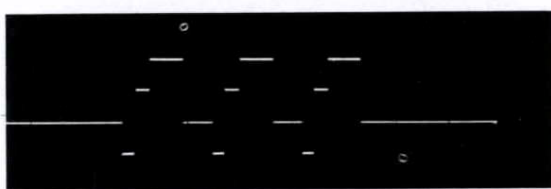


The Tektronix Type 160-Series produces timed pulses of adjustable duration, amplitude and repetition rate, providing a convenient and flexible system of sequence control. By using several instruments together, complex waveform patterns can be obtained. Applications of the Type 160-Series are numerous. . . various combinations are being used for nerve stimulation in neurophysical experiments, timed gating devices for complex equipment, component testing, biophysical and geophysical applications. The Type 360 Indicator unit, described in the oscilloscope section, takes the place of an auxiliary oscilloscope and can be 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 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 a Tektronix accessory, the Type FA160 Mounting 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

TYPE 160-SERIES WAVEFORM GENERATORS

TYPE 160A POWER SUPPLY

ask what current (power) they need - if less than this quote, if more, don't.

Large Load Capacity

- +300 v dc, unregulated.
- +225 v dc, regulated, at 225 milliamps.
- +150 v dc, regulated, at 15 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.

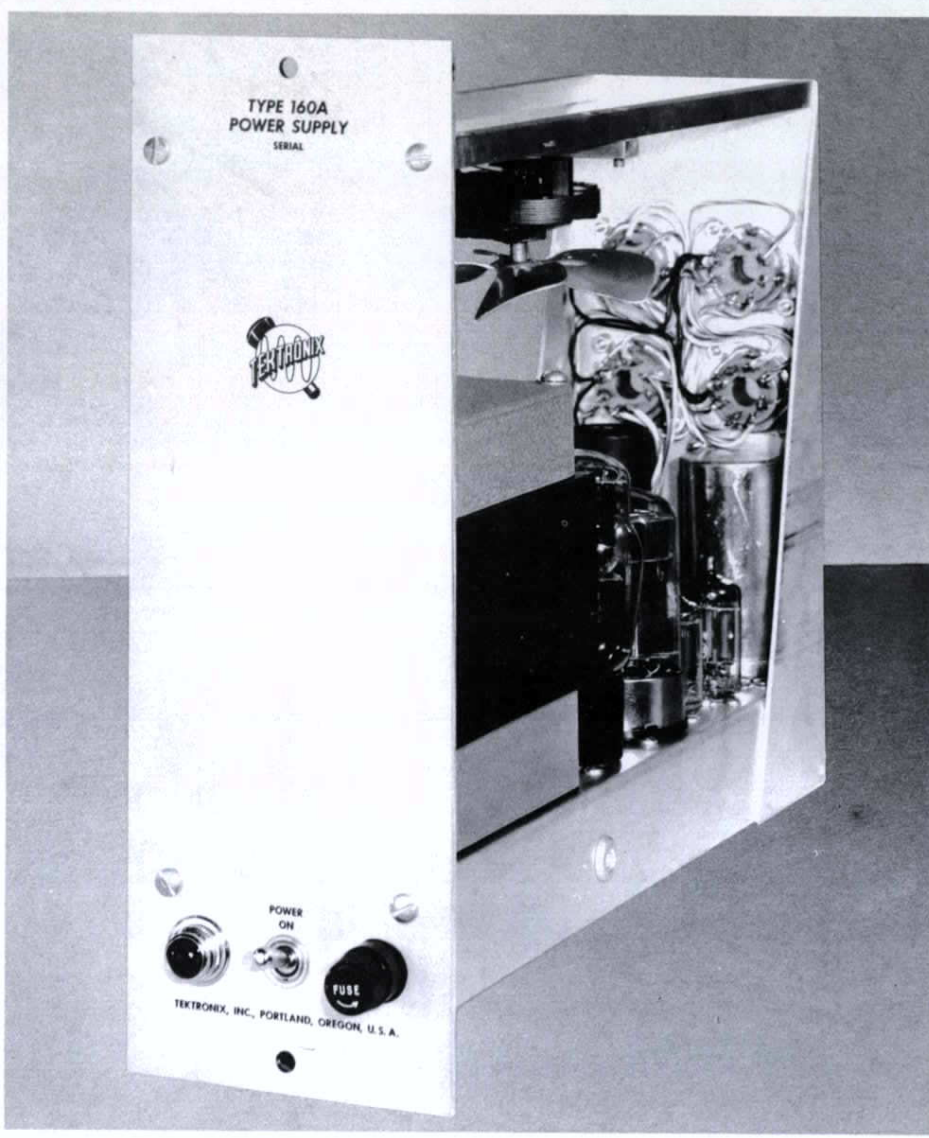
GENERAL DESCRIPTION

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.

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. Two 20-inch 8-conductor inter-unit power cables 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		6AU6
Amplifier and series regulator		6AW8
Series regulator		6080
Series regulator	2	12B4
Amplifier and series regulator		6U8
Voltage reference		5651

MECHANICAL SPECIFICATIONS

- Ventilation—Forced air cooling.
- Mounting—Adaptable to rack mounting by a Tektronix accessory, the Type FA160 Mounting Frame.
- Construction—Aluminum alloy.
- Finish—Photo-etched anodized panel, wrinkle-finished cabinet.
- Dimensions—4 1/8" wide, 12 1/4" high, 13 3/4" deep.
- Weight—21 pounds.
- Power Requirements—105-125 or 210-250 v, 50-60 cycles, 350 watts max.

Price \$140

- Includes: 2—W160-20 connecting cables (012016)
- 1—Set mounting screws and cup washers
- 1—Instruction manual

Price f.o.b. Portland, Oregon.



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 dc at 1.1 amps.

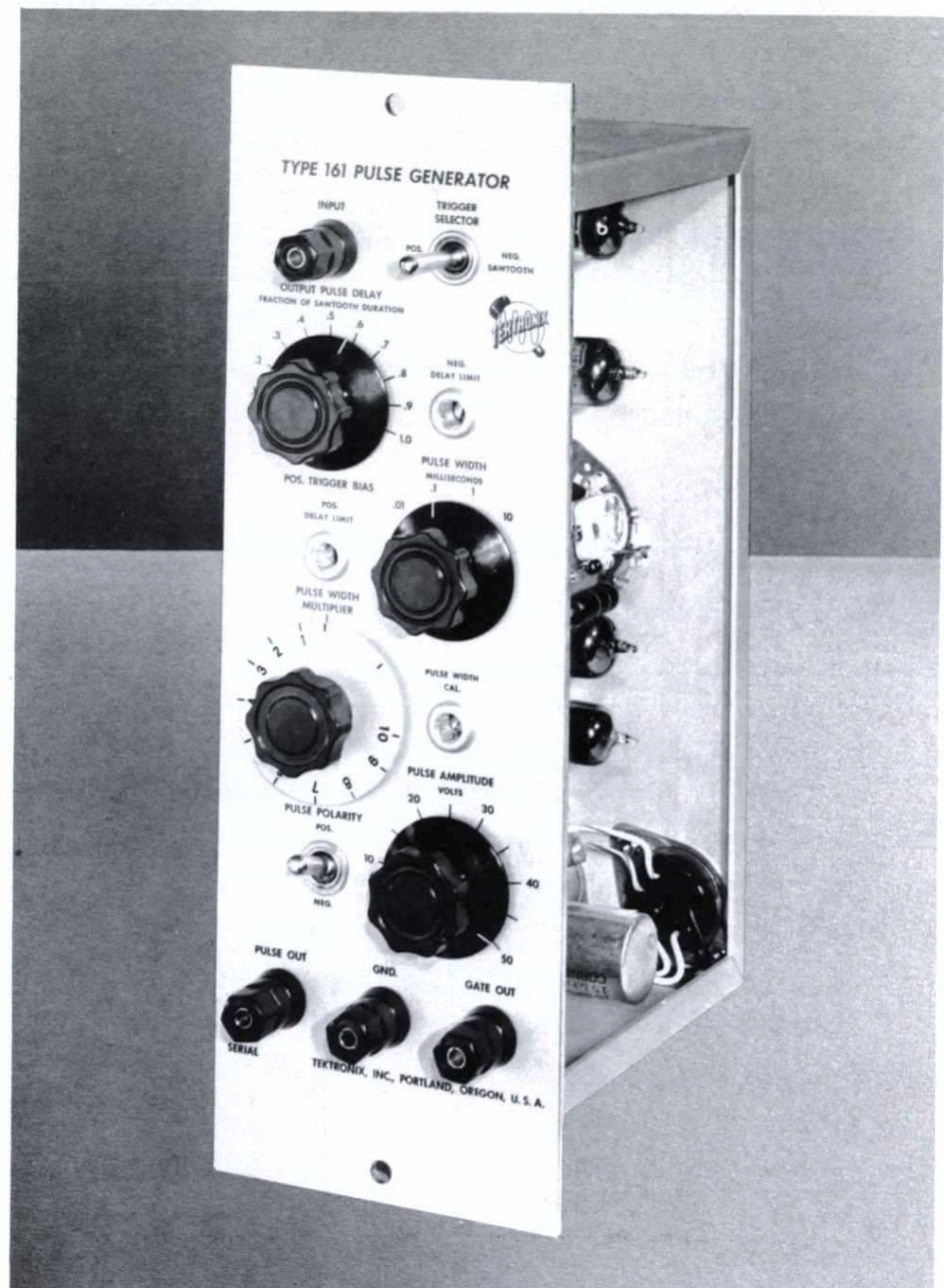
GENERAL DESCRIPTION

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 triggering 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.



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

MECHANICAL SPECIFICATIONS

Mounting—Adaptable to rack mounting by a Tektronix accessory, the Type FA160 Mounting Frame.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, etched chassis.

Dimensions—4 1/8" wide, 12 1/4" high, 7 1/2" deep.

Weight—5 pounds.

Price **\$95**

Includes: 1—W160-10 connecting cable (012017)
1—Set mounting screws and cup washers
1—Instruction manual

Price f.o.b. Portland, Oregon.

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 7 ma.

+150 v dc at 1 ma.

+225 v dc at 28 ma.

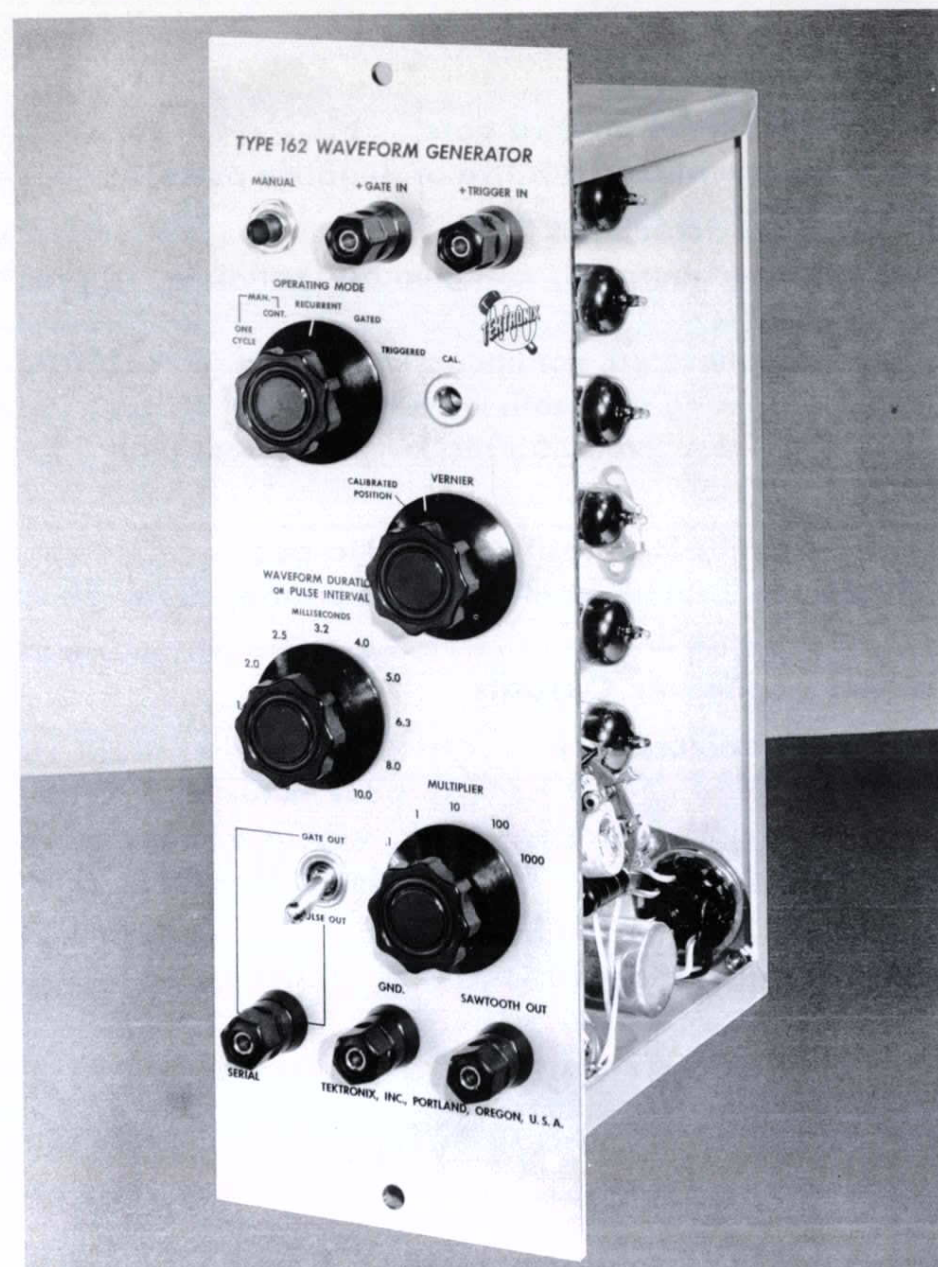
6.3 v dc at 1.7 amps.

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 signal.

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—Adaptable to rack mounting by a Tektronix accessory, the Type FA160 Mounting Frame.

Construction—Aluminum alloy.

Dimensions—4 1/8" wide, 12 1/4" high, 7 1/2" deep.

Finish—Photo-etched anodized panel, etched chassis.

Weight—5 pounds.

Price \$95

Includes: 1—W160-10 connecting cable (012017)
1—Set mounting screws and cup washers
1—Instruction manual

Price f.o.b. Portland, Oregon.



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 μ sec (without load capacitance).
- Decay Time—0.2 μ sec (without load capacitance).
- Overshoot—can be adjusted to zero.
- Duration—calibrated, continuously variable, 1 μ sec to 10,000 μ 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.

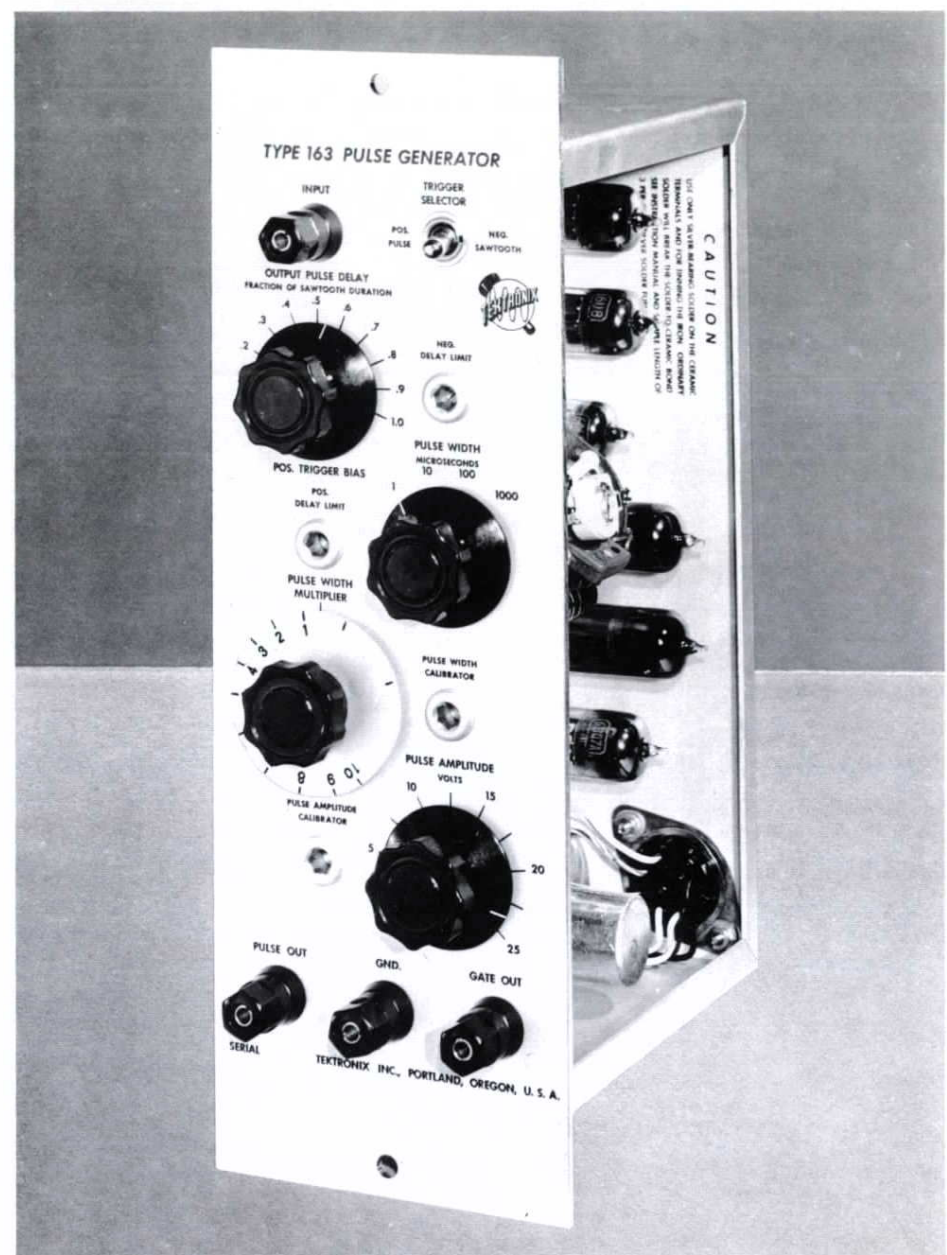
GENERAL DESCRIPTION

The Tektronix Type 163 Pulse Generator produces rectangular pulses of less than 0.2 μ 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- μ 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	6BQ7A

MECHANICAL SPECIFICATIONS

Mounting—Adaptable to rack mounting by a Tektronix accessory, the Type FA160 Mounting Frame.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, etched chassis.

Dimensions—4 1/8" wide, 12 1/4" high, 7 1/2" deep.

Weight—5 pounds.

Price \$95

- Includes: 1—W160-10 connecting cable (012017)
- 1—Set mounting screws and cup washers
- 1—Instruction manual

Recommended Additional Accessories

- Type FA160 Mounting Frame adapts Type 160 Series to rack mounting. Holds four Type 160-Series Units. . \$5.00
- Type FAP160 Blank Panel, 4 1/8" x 12 1/4", covers openings in frame-mounted sets of Type 160-Series instruments \$3.00

Prices f.o.b. Portland, Oregon.



TYPE 180 TIME-MARK GENERATOR

Versatile Timing Source

13 Time-Mark Intervals

Two per decade from 1 μ sec to 1 sec, available separately or in various combinations as a timing comb.

Three Sine-Wave Frequencies

5 mc, 10 mc, and 50 mc.

Six Trigger-Rate Frequencies

1, 10, 100 cycles, 1, 10, 100 kc.

Accuracy Within 0.03%

Stability of 2 ppm available in Type 180-S1.

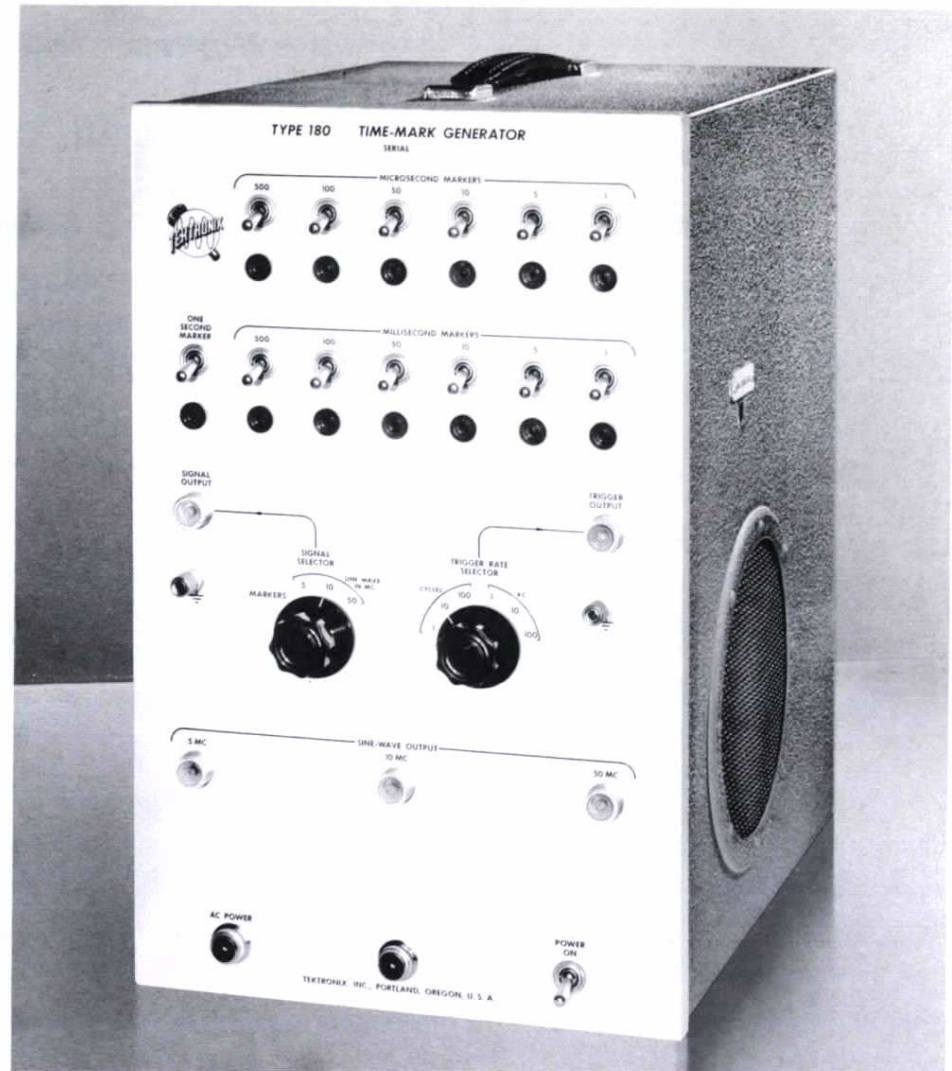
GENERAL DESCRIPTION

The Type 180 Time-Mark Generator is a high-quality source of time markers, sine waves and trigger impulses. Thirteen time markers, 3 sine-wave frequencies and 6 trigger-rate frequencies provide instrument versatility for countless numbers of applications in the laboratory or on the production line. With its frequency accuracy of 0.03%, the Type 180 is an ideal calibrating source for oscilloscope sweeps, oscillators, counters. It can also be used as a time-measuring instrument and as a trigger-rate generator. Markers can be presented separately or mixed into a timing-comb combination. For applications requiring a frequency stability of 2 ppm over a 24-hour period, the Type 180-S1 is available.

CHARACTERISTICS

Time Markers—Time markers occur at intervals of 1, 5, 10, 50, 100, 500 μ sec, 1, 5, 10, 50, 100, 500 milli-sec, and 1 sec. Markers are available separately and simultaneously through pin jacks at 15 to 30 v amplitude, or mixed into a timing combination through a toggle-switch arrangement and available at a coaxial connector at 1 to 3 v.

Sine Waves—The SIGNAL SELECTOR switch connects the sine-wave frequencies of 5 mc, 10 mc or 50 mc to the output connector. Each sine wave is also available at a separate coaxial connector. Output is approximately 3 volts.



Trigger-Rate Generator—Trigger-rate frequencies of 1, 10, 100 cycles, 1, 10, and 100 kc are derived from the dividing multivibrators. Output is through a front-panel coaxial connector.

Stability—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, the Type 180 is available with the crystal mounted in a temperature-stabilized oven. (The Type 180 is then designated Type 180-S1.) Stability is within 2 parts per million over a 24-hour period.

Regulated Power Supply—Electronically-regulated dc supplies insure stable operation over line variations from 105-125 v, 50-60 cycles.

VACUUM TUBE COMPLEMENT

Oscillator and buffer	.....	6U8
Frequency multipliers	..... 3	6AH6
Cathode follower	.....	12AU7
Clamp and clipper diode	.....	6AL5
Amplifier and CF	.....	12AT7
Divider multivibrators	..... 2	12AT7
Divider multivibrators	..... 10	12AU7
Coupling diode and clamp	..... 12	6AL5
Marker cathode follower	..... 3	12AU7
Marker cathode follower	..... 10	6C4

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 50 μ sec	1 v	600 ohms	0.08 μ sec	15 v	400 ohms
100 μ sec to 1 sec	3 v	600 ohms	0.3 μ sec	30 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 (across 52 ohms)
 5, 10, 50 mc 3 v 30 ohms

- Trigger shaper and CF 12AU7
- Rectifier 6X4
- Series regulator 2 6AQ5
- Series regulator 6AS7
- Regulator amplifier 3 6AU6
- Voltage comparator 12AX7
- Voltage reference 5651

Dimensions—10 1/8" wide, 16 1/2" high, 14 7/8" deep.
 Weight—37 pounds.
 Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 330 watts.

Price \$575
 Includes: 2—P93 output cables
 1—A100 clip-lead adapter
 1—Instruction manual

MECHANICAL SPECIFICATIONS

Ventilation—Filtered, forced-air ventilation assures safe operating temperature.
 Construction—Aluminum-alloy chassis and cabinet.
 Finish—Photo-etched anodized front panel, wrinkle-finished cabinet.

Type 180-S1—The 1-mc crystal is mounted in a temperature-stabilized oven. Frequency stability over a 24-hour period is within 2 parts per million.

Price \$625
 Prices f.o.b. Portland, Oregon.



TYPE 181 TIME-MARK GENERATOR

A Portable, Accurate Time-Mark Source

Five Time-Mark Intervals

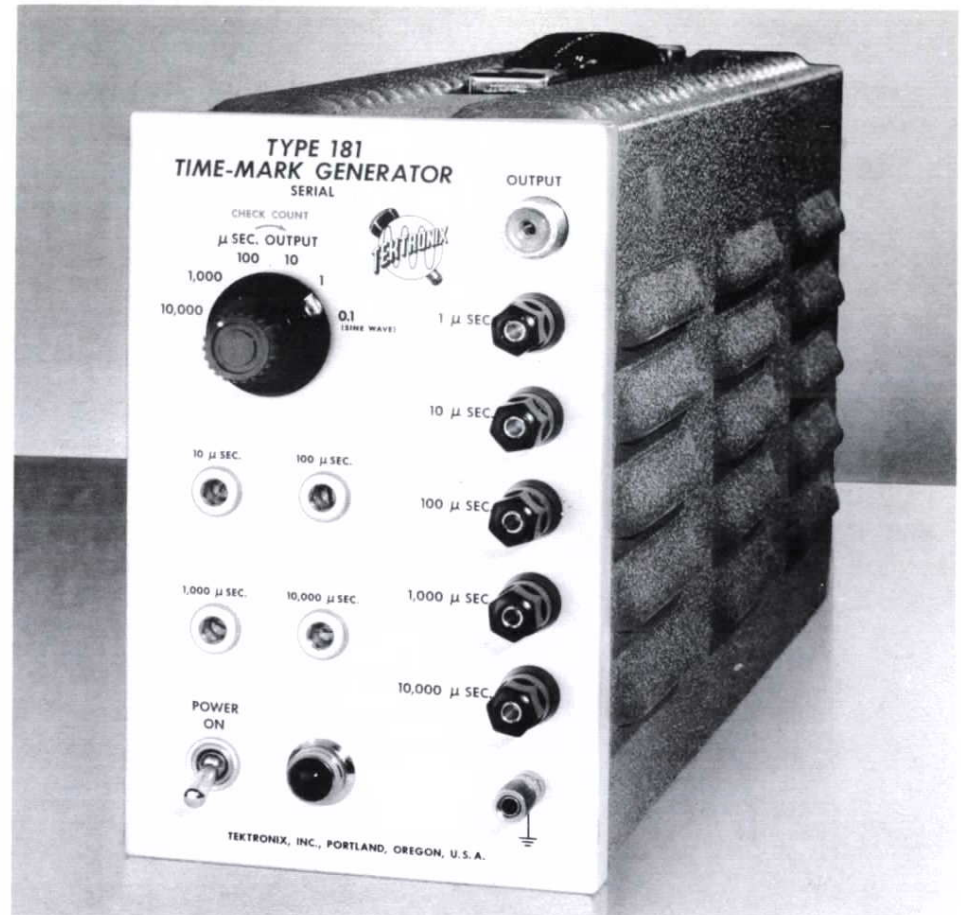
1, 10, 100, 1000, and 10,000 microseconds, plus 10-mc sine wave.

Small Size

8 3/4" high, 5 5/8" wide, 17 1/2" deep.

Low Weight

Only 17 1/2 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 coaxial 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	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, wrinkle-finished cabinet.

Size—8 3/4" high, 5 5/8" wide, 17 1/2" deep.

Weight—17 1/2 pounds.

Type 181 \$225

Includes: 1—P93 output cable
1—W130B lead (012014)
1—W130R lead (012015)
1—Instruction manual

Recommended Additional Accessories

Type CO181A 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, Oregon.

THE 1ST TIME-REAR GENERATOR

A Formula for the Time-Rear Generator

The formula for the time-rear generator is given by the following equation:



The diagram illustrates the components of the time-rear generator, including the main body and the internal circular element.

FIGURE 1

TYPE 190A SIGNAL GENERATOR

Constant-Amplitude Signal Generator



Output Frequency

Continuously variable from 350 kc to 50 mc in 6 ranges. Additional setting at 50 kc, variable over a narrow band. Indication accurate within 2 per cent.

Output Amplitude

Continuously variable from 40 millivolts to 10 volts peak-to-peak in 7 ranges. Amplitude indication accurate within 10% of full scale.

Amplitude Variation

The load resistance should be at least 52 ohms. Load shunt capacitance should not exceed 10 $\mu\mu\text{f}$. The output amplitude varies less than ± 2 per cent from 50 kc to 30 mc; less than ± 5 per cent from 30 mc to 50 mc.

Harmonic Content

Maximum harmonic content is not specified. The harmonic content of a typical instrument will not exceed 5%.

GENERAL DESCRIPTION

The Tektronix Type 190A supplies a constant-amplitude sine-wave signal over the frequency range of 350 kc to 50 mc. In addition, it supplies a 50-kc sine-wave output for reference purposes. Principal application of this instrument is the measurement of high-frequency response and other characteristics of wide-band amplifiers, attenuators, and delay networks.

The Type 190A is housed in an attractive new three-piece cabinet, designed for easy access to the interior of the instrument. All controls are located for maximum operator convenience. The attenuator is a separate unit, connecting to the main unit through a 36" cable.

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

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

MECHANICAL SPECIFICATIONS

Size—9 $\frac{3}{4}$ " wide, 13 $\frac{1}{2}$ " high, 11" deep. Attenuator unit—2 $\frac{5}{8}$ " x 2 $\frac{1}{4}$ " x 2". Connecting cable—36" long. Weight—24 pounds.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, blue wrinkle-finished cabinet.

Power Requirements—105-125 v, or 210-250 v, 50-60 cycles, 100 watts.

Price **\$275**

Includes: 1—Attenuator unit
1—36" connecting cable
1—Instruction manual

Price f.o.b. Portland, Oregon.

General Instructions to Signalmen

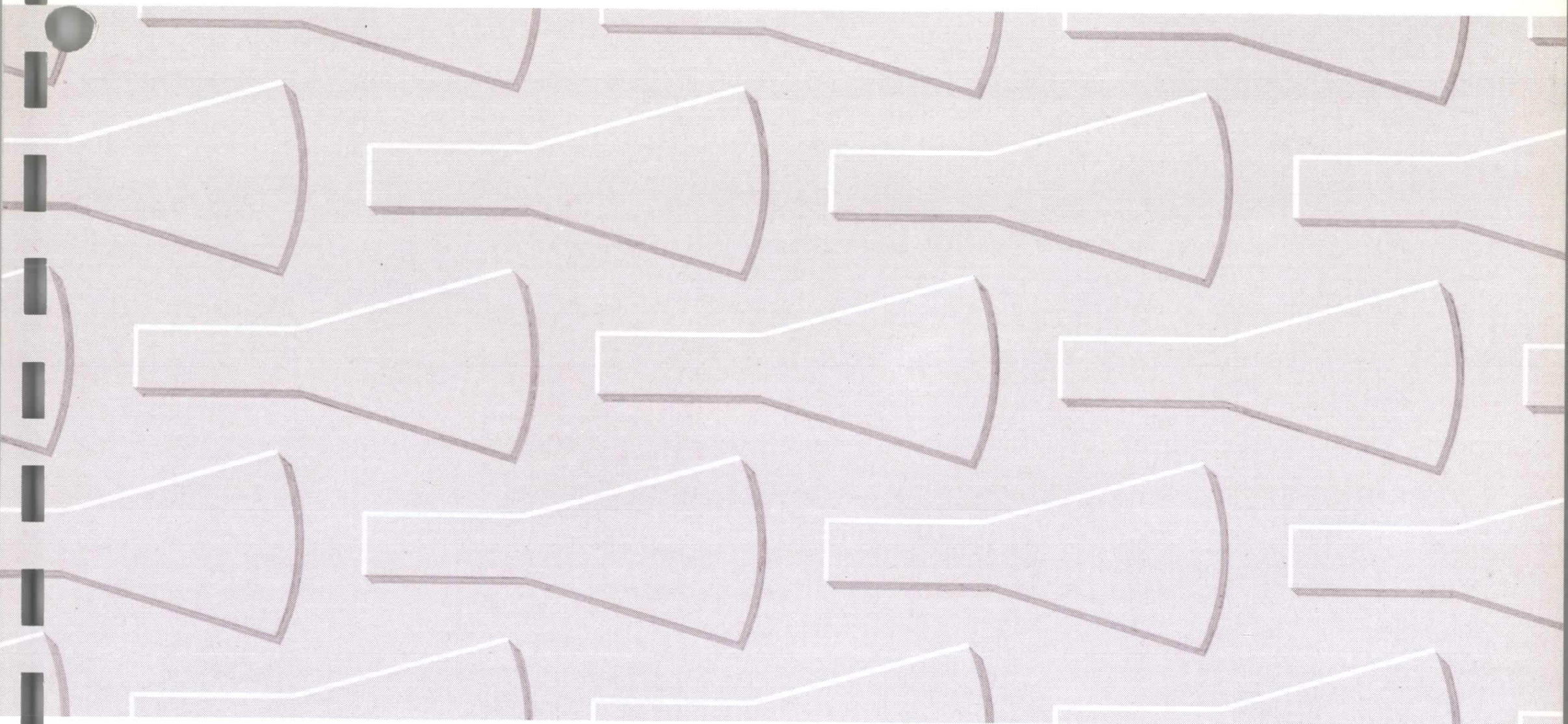
The following instructions are to be observed by all signalmen in the performance of their duties. They are intended to ensure the safety of the railway and the efficient working of the signal system.



1. When a signal is at danger, no train shall be allowed to pass it. 2. When a signal is at danger, the signalman shall not allow any train to pass it until it has been cleared. 3. When a signal is at danger, the signalman shall not allow any train to pass it until it has been cleared.

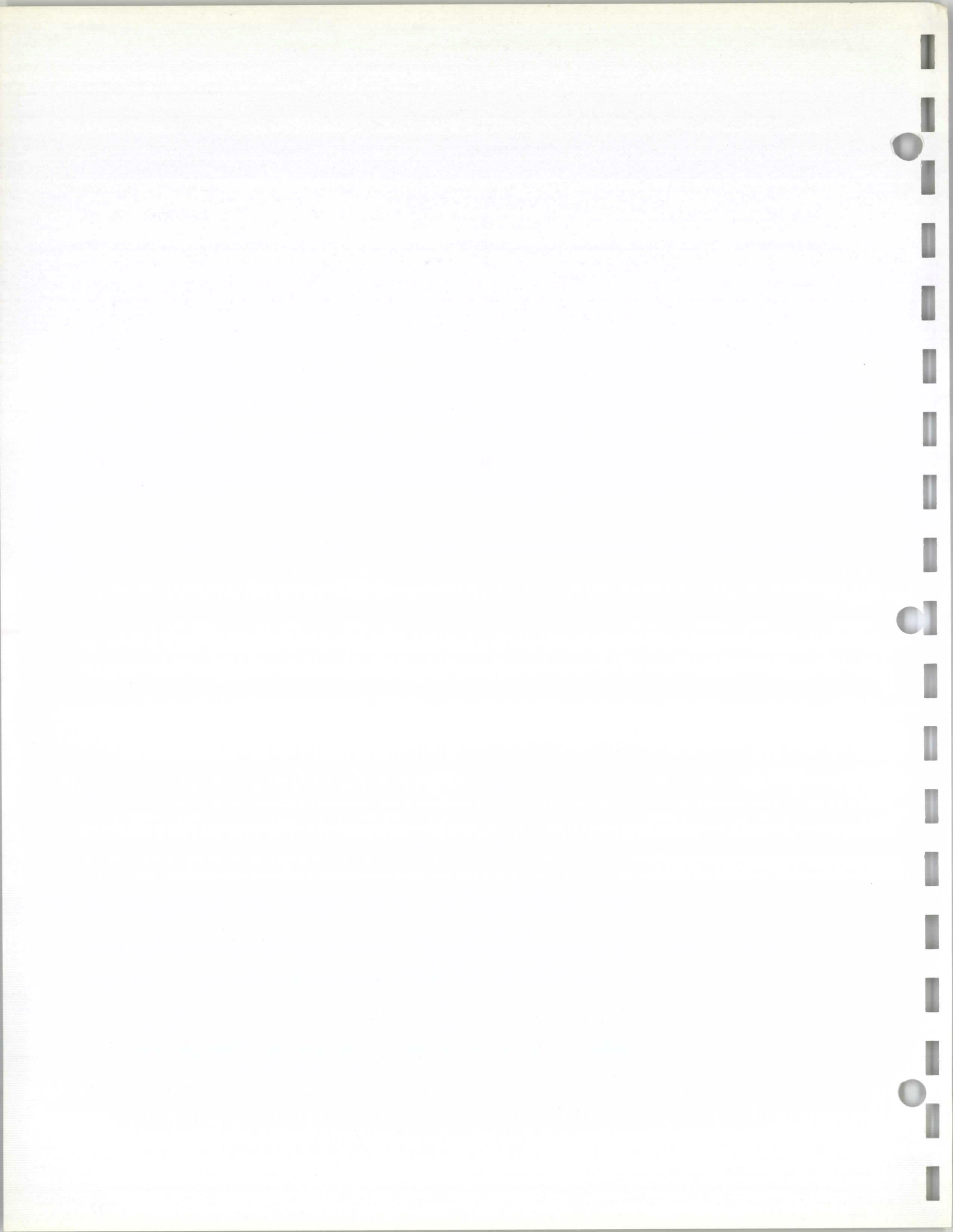
4. When a signal is at danger, the signalman shall not allow any train to pass it until it has been cleared. 5. When a signal is at danger, the signalman shall not allow any train to pass it until it has been cleared.





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 310 OSCILLOSCOPE

DC-Coupled Portable Cathode-Ray Oscilloscope

Designed for Easy Handling

Small—10" x 6¾" x 17".
Weighs only 23½ pounds.

Transient Response

Risetime—0.09 μ sec.

Vertical Sensitivity

Deflection Factor—0.1 v/div, dc to 4 mc.
Deflection Factor—0.01 v/div, 2 cycles to 3.5 mc.

Sweep Range

0.1 μ sec/div to 0.6 sec/div.
18 calibrated sweep rates.

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. Vertical deflection is calibrated in steps 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 VOLTS/DIV control provides three additional calibrated steps of 0.01, 0.02, and 0.05 v/div, at



a frequency response of 2 cycles to 3.5 mc. In addition, a 3-to-1 vernier control provides for continuously-variable adjustment 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.

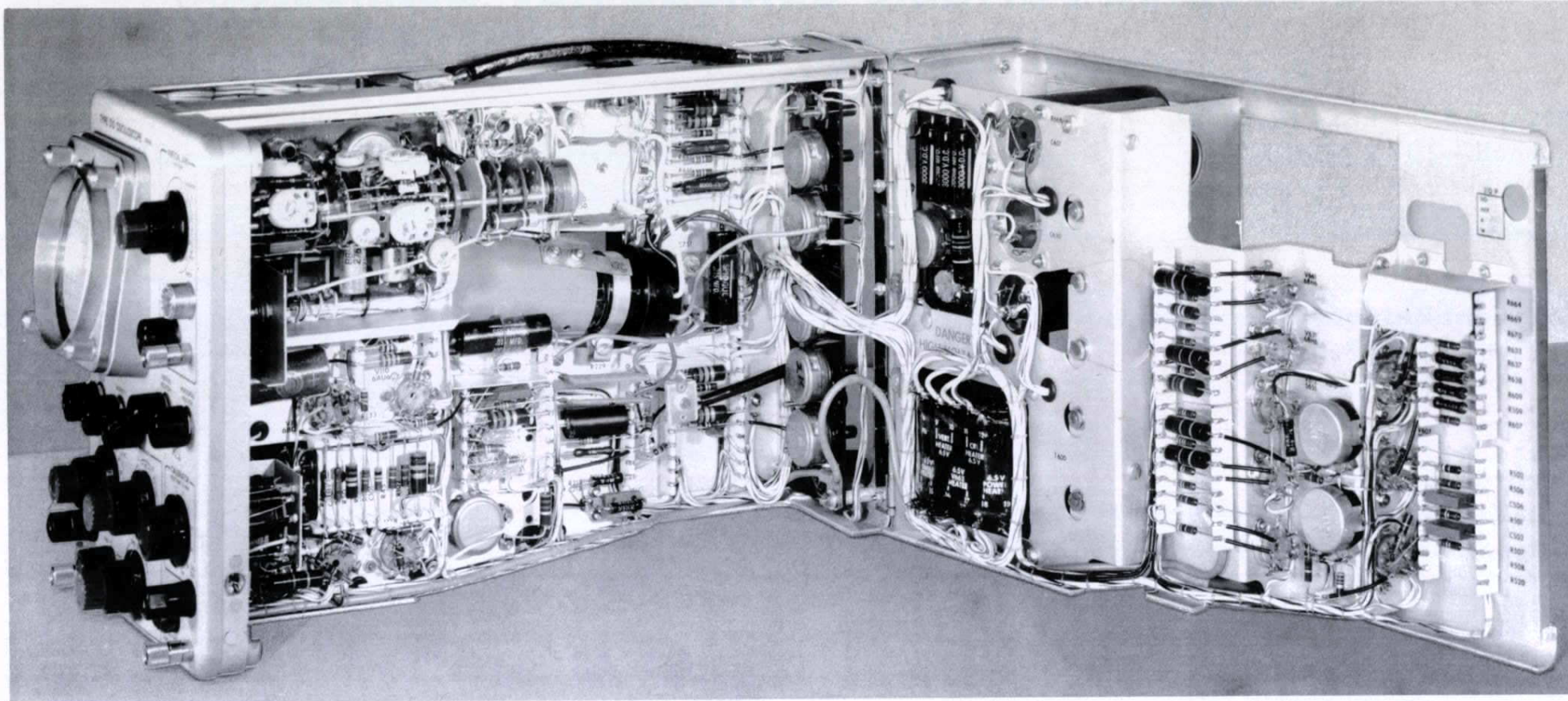
Calibration Accuracy—Internal adjustments are provided for setting the gain of the vertical amplifier. When these adjustments are accurately set with the VOLTS/DIV switch in the 0.1 and 0.01 v/div positions, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that switch position.

Probe—The vertical sensitivity is reduced by a factor of ten by use of the small, insulated, 10x 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—The Type 310 has 18 calibrated sweep rates: 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 μ sec/div, . . . 1, 2, 5, 10, 20, 50 millsec/div, 0.1, 0.2 sec/div. In addition, a vernier (uncalibrated) control provides sweep rates continuously adjustable from 0.5 μ sec/div to 0.6 sec/div. Calibration accuracy of the

TYPE 310 OSCILLOSCOPE



18 fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%.

Sweep Magnifier—Sweep magnification is obtained by increasing the gain of the sweep-output amplifier by a 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 5x magnifier applied to the 0.5- μ sec/div sweep extends the calibrated range to 0.1 μ sec/div. Accuracy is within 3% of the displayed portion of the magnified sweep on all ranges except 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 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, 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 0.2 v to ± 20 v.

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

OTHER CHARACTERISTICS

Voltage Calibrator—A square-wave voltage is available through a front-panel binding post. 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 about 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 between 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-attenuator or sweep-rate control is set in an uncalibrated position.

VACUUM TUBE COMPLEMENT

Vertical preamplifier	.....	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

TYPE 310 OSCILLOSCOPE

Trigger shaper	6U8
Holdoff cathode followers	12AT7
Minus multivibrator	6BH6
Plus multivibrator	6BQ7
Unblanking cathode follower	6BQ7
Disconnect diodes	6AL5
Sweep generator	6AN8
Sweep generator cathode follower	6AN8
Horizontal amplifier cathode follower	6BQ7
Horizontal output amplifier	6BQ7
External horizontal input cathode follower	6BQ7
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, blue wrinkle-finished cabinet.

Dimensions—10" high, 6 3/4" wide, 17 long.

Weight—23 1/2 pounds.

Power Requirements—105-125 v, 60 to 800 cycles, 175 watts.

Type 310 (105-125 v, 60 to 800 cycles) \$595

- Includes: 1—P510A attenuator probe
 1—A510 binding-post adapter
 1—Green filter (378509)
 1—Instruction manual

Type 310-S1—Operates on 105-125 or 210-250 v, 50 to 800 cycles. Weight 25 1/2 pounds.

Price \$595

Currently Available Extras

P2 crt phosphor normally furnished.

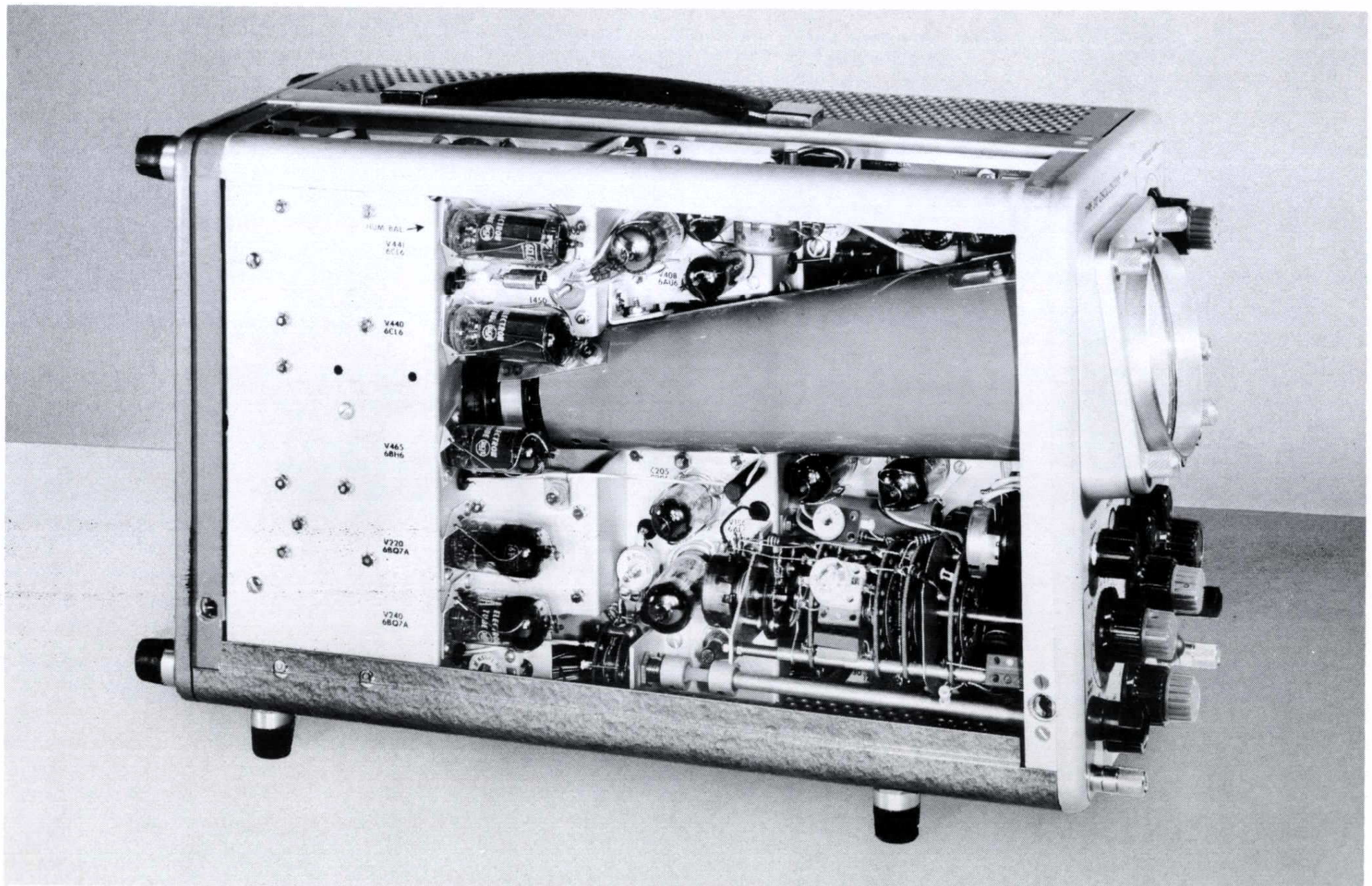
P1, P7, P11 optional. No extra charge

Recommended Additional Accessories

FB 310 Fan Base—Provides filtered forced-air ventilation to assure safe operating temperature when the Type 310 is being used continuously over long periods, or in a hot or limited-ventilation area. The fan base tilts the oscilloscope to a convenient viewing angle. For use on 105-125 v, 60 cycle only. \$25.00

FB 310-S1 Fan Base—For use on 210-250 v, 50 to 60 cycles only \$25.00

Prices f.o.b. Portland, Oregon.



TYPE 315D OSCILLOSCOPE

DC-Coupled Portable Cathode-Ray Oscilloscope

Passband

DC-Coupled—dc to 5 mc.
AC-Coupled—5 cycles to 5 mc.

Transient Response

Risetime—0.07 μ sec

Calibrated Vertical Deflection

DC-Coupled—0.1 v/div to 50 v/div.
AC-Coupled—0.01 v/div to 50 v/div.

Wide Sweep Range

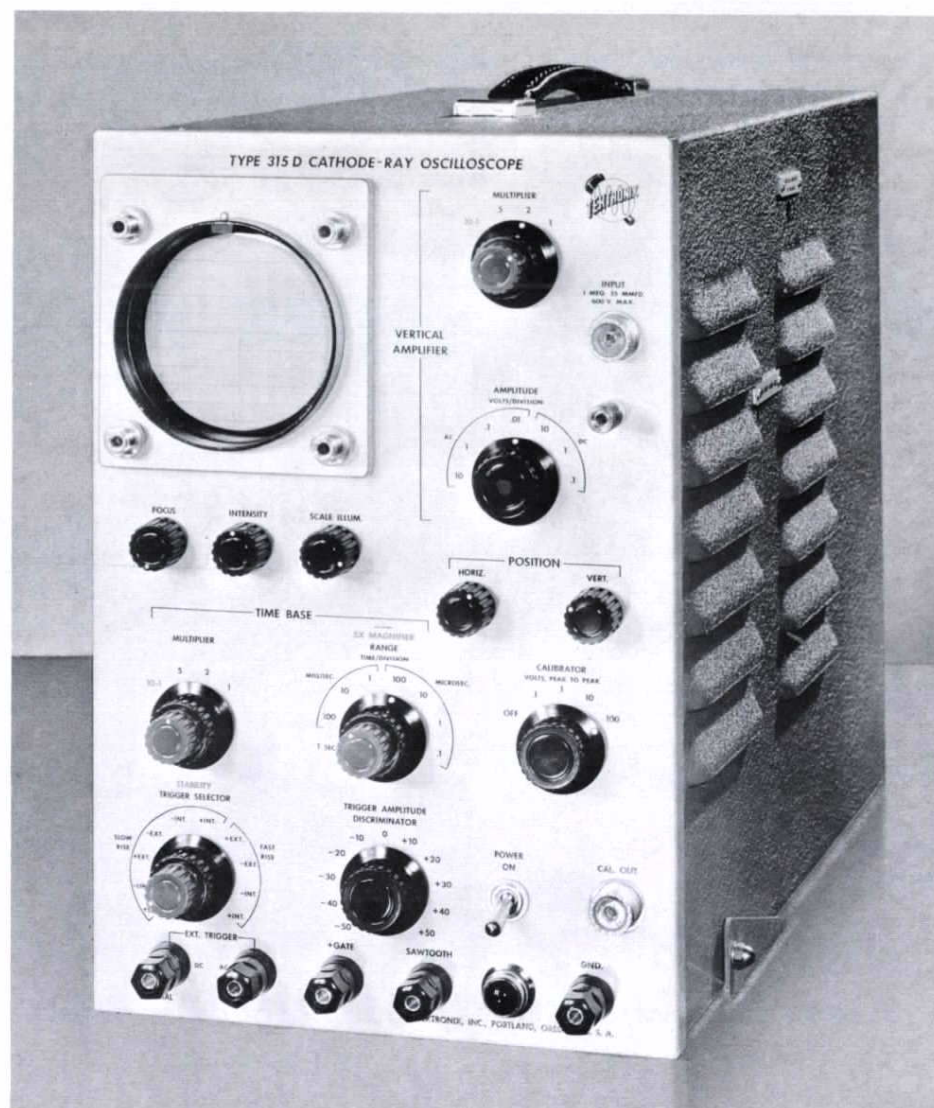
0.1 μ sec/div to 10 sec/div.
24 calibrated sweep rates.

GENERAL DESCRIPTION

The Tektronix Type 315D combines small size with laboratory-oscilloscope capabilities. Wide sweep range adapts it to a great many applications, including those requiring very slow sweeps. Pulse observation is facilitated by the less than 0.07- μ sec risetime of the vertical amplifier, the 0.25- μ sec signal delay, and high-speed sweeps. Vertical deflection and sweep rates are calibrated for accurate amplitude and time readings directly from the screen. A 3" flat-faced cathode-ray tube displays a sharp image of sufficient size for easy interpretation. The Type 315D is an excellent general-purpose laboratory oscilloscope that is easily transported to temporary setups and remote installations.

VERTICAL DEFLECTION SYSTEM

DC-Coupled Vertical Amplifier—A seven-position vertical-input switch covers the calibrated steps of 0.01, 0.1, 1, 10 v/div ac-coupled and 0.1, 1, 10 v/div dc-coupled. AC-coupled passband is 5 cycles to 5 mc, dc-coupled passband is dc to 5 mc. Multipliers of 1, 2, and 5 provide 9 calibrated dc-coupled and 12 calibrated ac-coupled steps. In addition, a 10-to-1 vernier (uncalibrated) control provides for continuously-variable adjustment from 0.01 v/div to 100 v/div. The vertical amplifier is factory adjusted for optimum transient response. Risetime is less than 0.07 μ sec and input impedance is 1 megohm paralleled by approximately 35 μ f.



Calibration Accuracy—Screwdriver adjustments are provided for setting the gain of the vertical amplifier. When these adjustments are accurately set with the VOLTS/DIV switch in the 0.1 and 0.01 v/div positions, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that switch position.

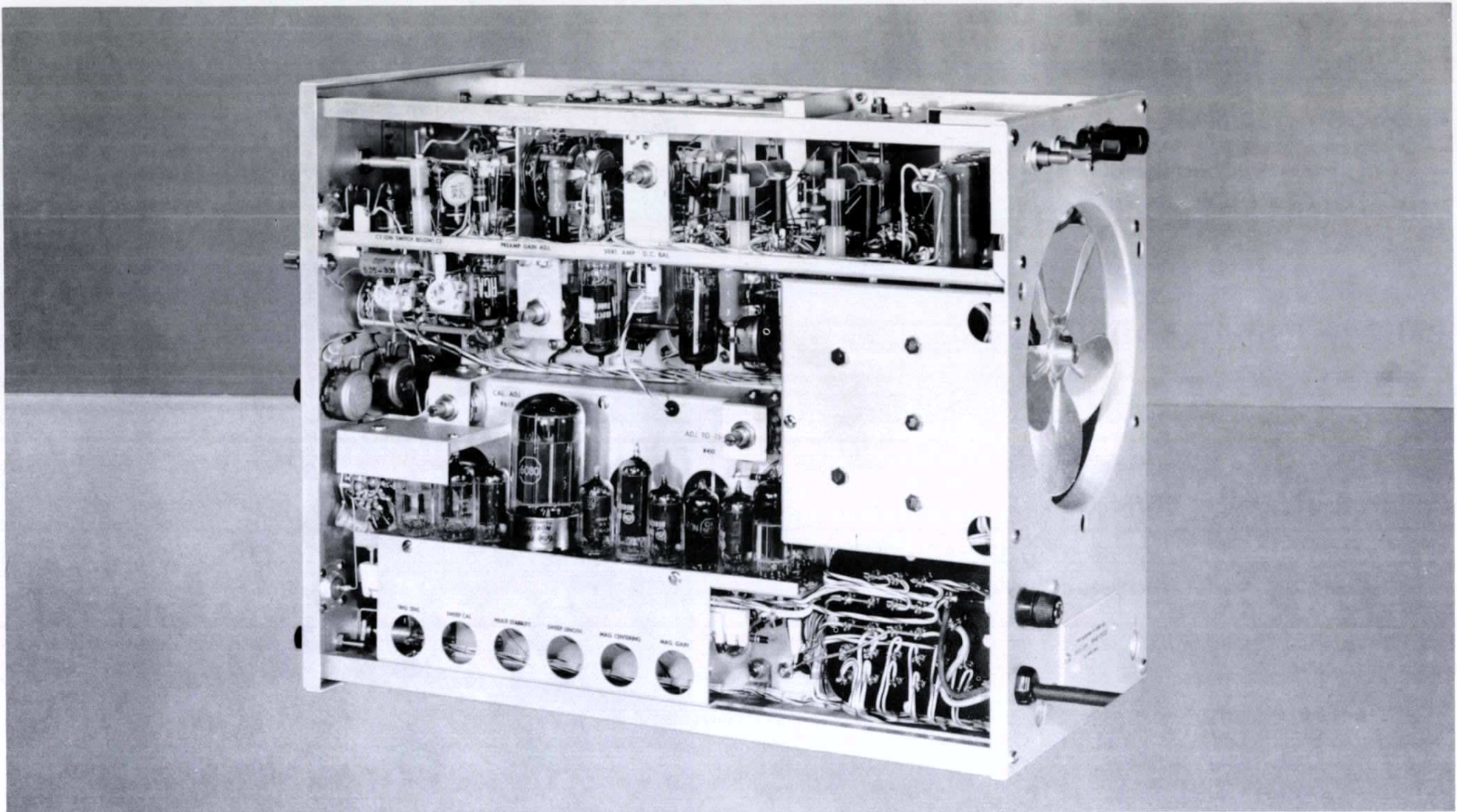
Probe—The vertical sensitivity is reduced by a factor of ten by use of the small, insulated 10x attenuator probe furnished with the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately 13 μ f.

Signal-Delay Network—Delays vertical signal 0.25 μ sec. Permits observation of the waveform that triggers the sweep.

HORIZONTAL DEFLECTION SYSTEM

Wide Sweep Range—The Type 315D has 24 calibrated sweep rates: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 μ sec/div; 1, 2, 5, 10, 20, 50 millsec/div; 0.1, 0.2, 0.5, 1, 2, 5 sec/div. In addition, a vernier (uncalibrated) control provides sweep rates continuously adjustable from 0.1 μ sec/div to 0.6 sec/div. Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%, except for the three fastest and the three slowest sweep rates where accuracy will be within 5%.

TYPE 315D OSCILLOSCOPE



Sweep Magnifier—Sweep magnification is obtained by increasing the gain of the output amplifier by a factor of 5. The center 2-division portion of the trace is expanded to the left and right of center to 10 divisions. The HORIZONTAL POSITION control has sufficient range to display any one-fifth of the magnified sweep. Sweep magnification of 5x is accurate for all settings of the sweep-rate controls slower than 0.5 $\mu\text{sec}/\text{div}$.

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

DC-Coupled Trigger Amplitude Discriminator—The amplitude level on a waveform where triggering occurs is selected by the TRIGGER AMPLITUDE DISCRIMINATOR control. The sweep can be triggered at various levels on simple or complex waveforms. The flexibility of this system permits the sweep to 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 waveform portion to trigger the sweep, either from the signal under observation or from an external source; and use of either a fast or slow-rise waveform for a trigger. Selection of either the positive or negative-going portion of the line-voltage waveform is also available.

Trigger Requirements—Internal triggering—a signal large enough to produce a one-half division deflection. External—a signal of 0.2 v to ± 20 v.

OTHER CHARACTERISTICS

Voltage Calibrator—A square-wave voltage is available through a front-panel coaxial connector. Four fixed voltages—0.1, 1, 10 and 100 volts peak-to-peak are provided. Accuracy is within 3%. Square-wave frequency is approximately 1 kc.

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

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

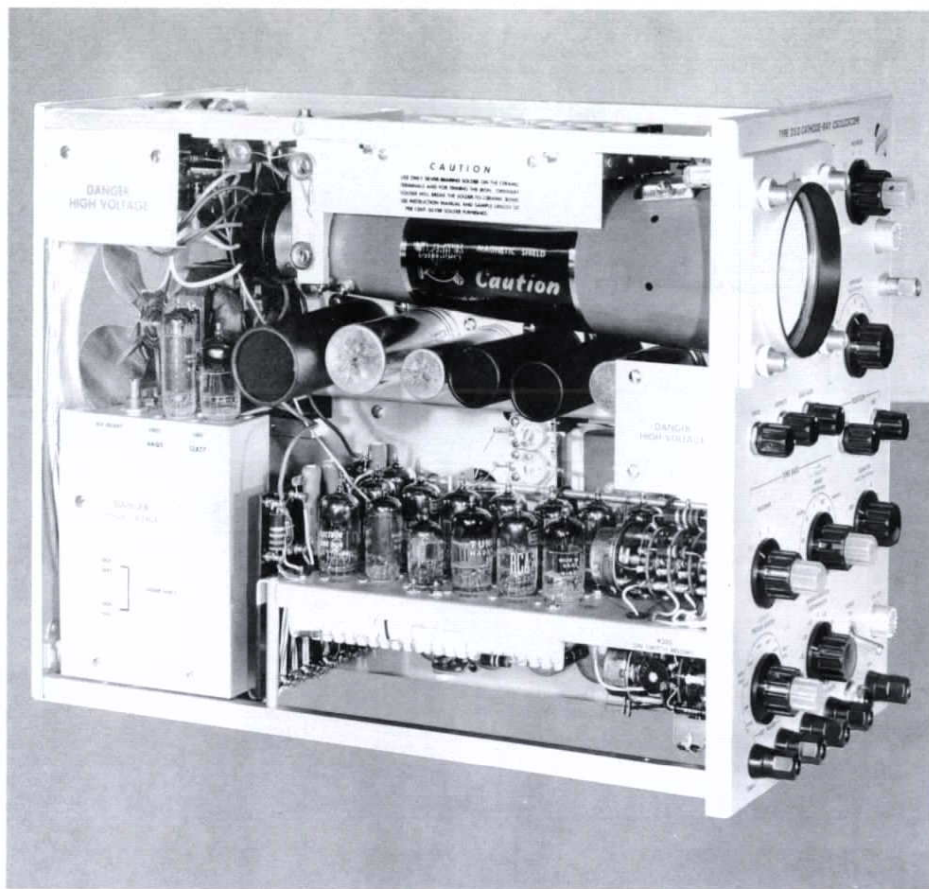
Regulated Power Supply—All dc voltages are electronically regulated to insure stable operation over line variations from 105 to 125 v.

Illuminated Graticule—The edge-lighted graticule has 8 vertical and 10 horizontal quarter-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.

VACUUM TUBE COMPLEMENT

Vertical input preamplifier	6BQ7A
Preamplifier and cathode follower	6BQ7A
Vertical amplifier input	6CL6
Amplifier, delay line driver	6CL6
Cathode followers	6BQ7A
Vertical output amplifiers	4 12BY7
Trigger phase inverter	12AT7

TYPE 315D OSCILLOSCOPE



Trigger shaper multivibrator	6U8
Trigger amplifier	6BQ7A
Trigger CF and holdoff CF	6BQ7A
Clamp diode and trigger holdoff	12AT7
Unblanking CF and buffer CF	6BQ7A
Cascode multivibrators	2 6BQ7A
Multi reverting CF and constant current tube	12AT7
Gate out CF and sweep clamping CF	6U8
Disconnect diodes	6AL5
Sweep generator	6AK6
Sweep out CF and sweep position CF	6BQ7A
Driver CF and sawtooth out CF	6BQ7A
Sweep amplifier and sweep out CF	2 6BQ7A
Cal multivibrator	12AU7
Cal clipper and output CF	12AT7
Voltage reference	5651
Regulator amplifiers	4 6AU6
Series regulators	2 12B4
Series regulator	6AS5
Series regulator	6080
High-voltage oscillator	6AQ5
High-voltage regulator	12AT7
High-voltage rectifiers	2 5642
Cathode-ray tube	3WP2

MECHANICAL SPECIFICATIONS

Construction—Self-contained, chassis and cabinet made of aluminum alloy.

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

Finish—Photo-etched anodized front panel, wrinkle-finished cabinet.

Dimensions—12³/₈" high, 8⁵/₈" wide, 15⁷/₈" deep. Maximum depth including knobs and air filter, 18¹/₄".

Weight—36 pounds.

Power Requirements—105-125 or 210-250 volts, 50-60 cycles, 375 watts. The ability of the Type 315D to operate on power-line frequencies up to 800 cycles is limited only by the type of ventilating fan used. The Type 315D 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 advantage of being quieter and requiring very little maintenance. For operation on power-line frequencies of 50 to 800 cycles, a dc ventilating fan motor and selenium rectifier are used in place of the shaded-pole ac motor. The Type 315D then carries the additional designation of S1. When the Type 315D is ordered for use on power-line frequencies from 50 to 800 cycles (designated Type 315D-S1), it must be stated on the order.

Type 315D Cathode-Ray Oscilloscope—For use on 105-125 or 210-250 v, 50-60 cycles only. . . . **\$770**

Includes: 1—P510A attenuator probe
2—A510 binding-post adapters
1—F310-5 green filter (378505)
1—Instruction manual

Type 315D-S1 Cathode-Ray Oscilloscope—For use on 105-125 or 210-250 v, 50-800 cycles. . . . **\$785**

Type 315D-S2 Cathode-Ray Oscilloscope—For use in PTM systems. Includes a front-panel controlled trigger circuit permitting direct, stable triggering from the sync pulse group 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

Type 315D-S2 **\$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

P2 crt phosphor normally furnished.

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

Recommended Additional Accessories

MU15 Fan Motor Kit—For converting Type 315D for use on 50-800 cycle line frequency (Type 315D-S1). Contains brackets, selenium rectifier, dc fan motor, and fan blade. Price. \$35.00

MS15 Fan Motor Kit—For converting Type 315D-S1 for use on 50-60 cycle line frequency (Type 315D). Contains brackets, ac fan motor and fan blade.

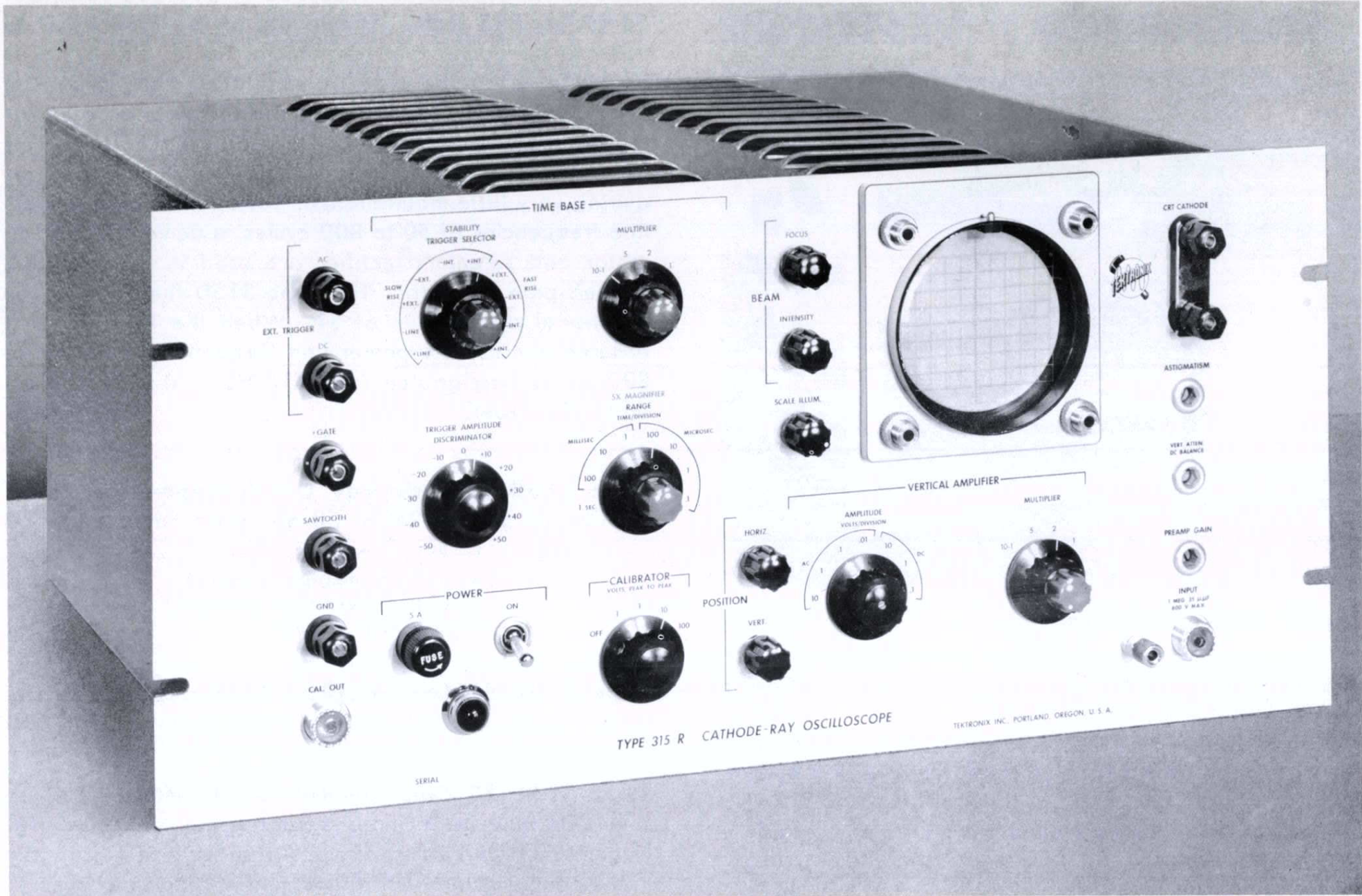
Price \$7.50

Prices f.o.b. Portland, Oregon.



TYPE 315R OSCILLOSCOPE

Rack-Mounting 3-Inch Oscilloscope



The Type 315R is a mechanically rearranged form of the Type 315D, for mounting in five vertical units of a standard 19-inch rack. Dimensions are: 18-31/32" wide, 8-23/32" high, 15-3/4" rack depth, 17" overall depth.

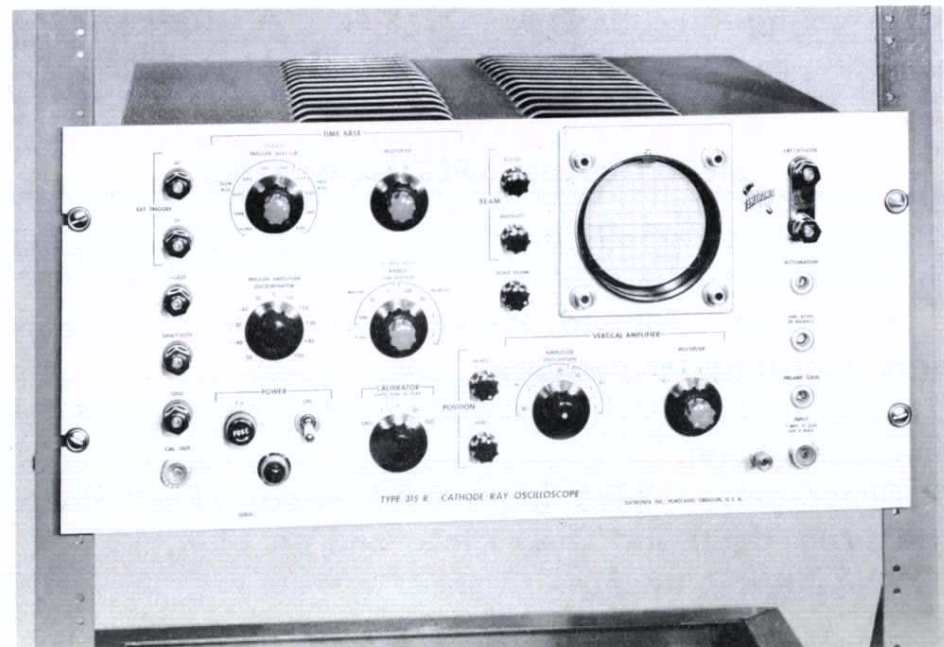
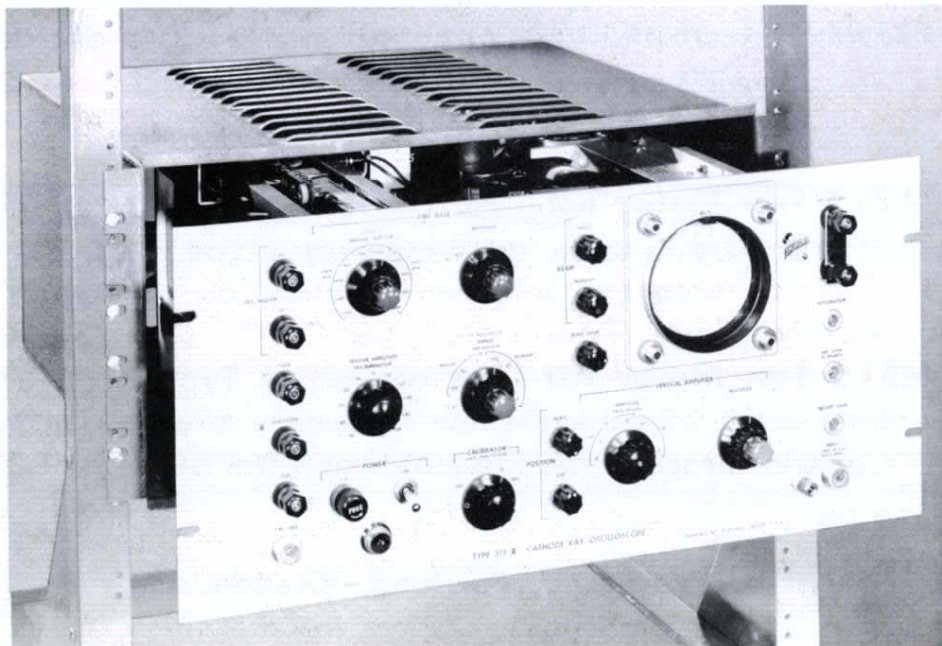
The cabinet of the Type 315R fastens to the rack with four mounting screws on each side. The chassis slides into the cabinet on two horizontal rails, providing firm support over its full length, and permitting easy access for servicing by sliding the chassis partly out of the cabinet. The chassis can be secured in place by four screws

at the front, or by two fasteners at the rear of the instrument.

Rear mounted controls and terminals have been relocated on the front panel. Electrical specifications remain unchanged. All special models of the Type 315D are available in rack-mount form.

Type 315R	\$795
Type 315R-S1	\$810
Type 315R-S2	\$815

Prices f.o.b. Portland, Oregon.



TYPE 360 INDICATOR

Vertical Passband

DC to 500 kc.

Calibrated Vertical Attenuator

Deflection Factor—0.05 v/div.

Waveform Requirements

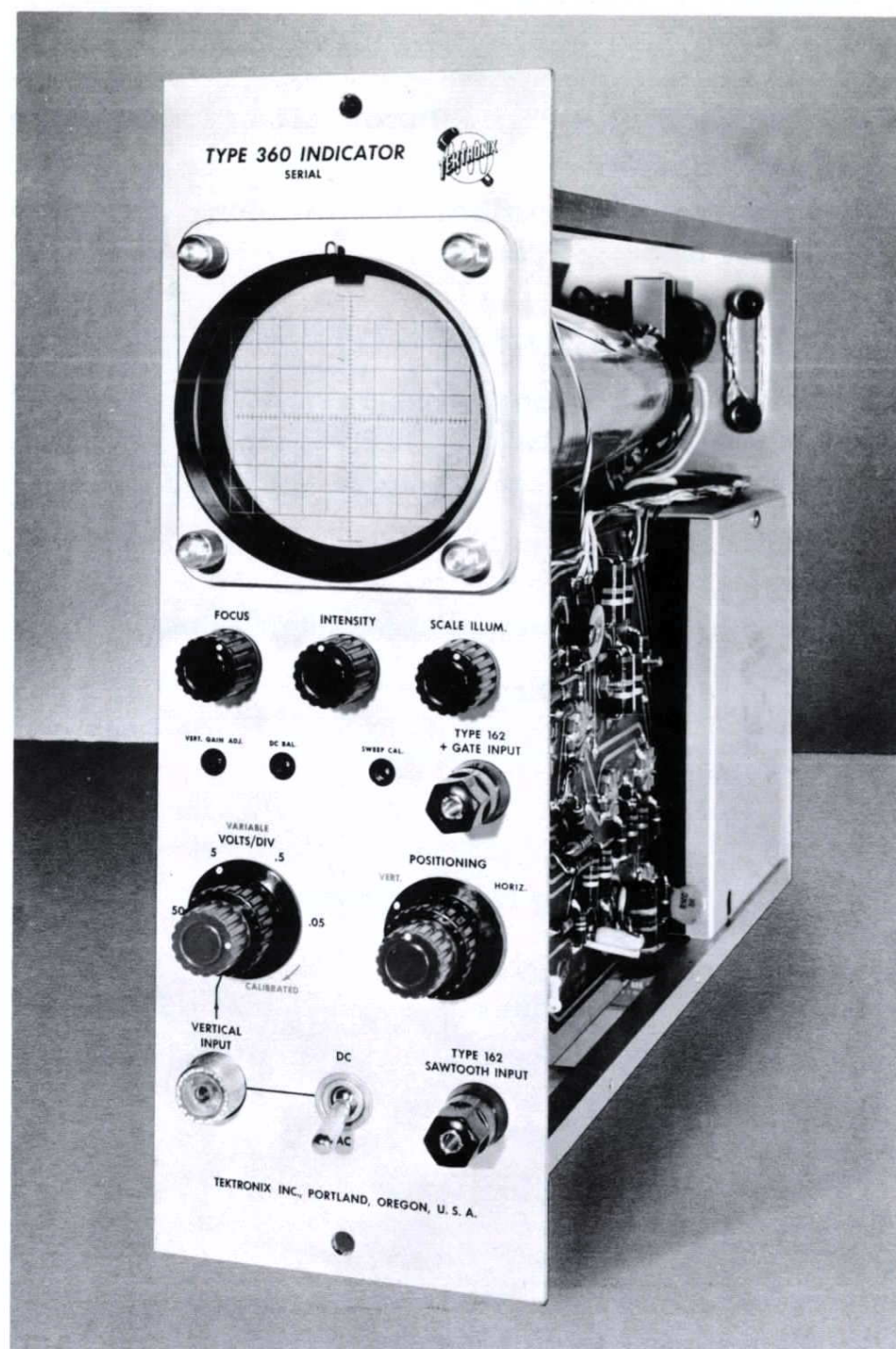
50-v positive unblanking pulse, and a sawtooth of either polarity with amplitude from 110 to 150 v and extreme voltage limits at -90 v and $+170$ v.

Power Requirements

- + 300 v dc unregulated at 20 ma.
- + 225 v dc regulated at 35 ma.
- 170 v dc regulated at 23 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 deflection factor of 0.05 v/div and a calibrated vertical attenuator. It is designed to be powered by a Tektronix Type 160 or Type 160A Power Supply and to receive its sweep and unblanking voltages from a Tektronix Type 162 Waveform Generator or from any Tektronix oscilloscope; 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 a deflection factor of 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 Attenuator—Four positions. .005, 0.5, 5, and 50 v/div. A variable control fills in between steps, making the attenuation continuously variable from 0.05 v/div to 500 v/div.

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

HORIZONTAL DEFLECTION SYSTEM

Input Waveforms—A sawtooth waveform of either polarity can be used to drive the horizontal amplifier. The sawtooth waveform can have an overall amplitude from 110 to 150 v with the extreme voltage limits at -90 v and $+170$ v. A 50-volt positive pulse waveform having the same time duration as the sweep waveform

TYPE 360 INDICATOR

is necessary for unblanking the crt. The Type 162 Waveform Generator, any Tektronix oscilloscope, or any other source of waveforms at the necessary dc levels is required to supply the horizontal deflection system of the Type 360 Indicator.

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 sweeps and repetition rates.

Illuminated Graticule—An edge-lighted graticule is marked in 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

Voltage setting CF and horizontal amplifier 6AN8
Horizontal feedback amplifier 6AU6
High-voltage oscillator 6AQ5
High-voltage regulator 12AT7
High-voltage rectifiers 2 5642
Cathode-ray tube 3WP2

MECHANICAL SPECIFICATIONS

Mounting—Adaptable to rack mounting by a Tektronix accessory, the Type FA160 Mounting Frame.

Construction—Aluminum alloy.

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

Dimensions—4 1/8" wide, 12 1/4" high, 16" deep.

Weight—9 pounds.

Price \$195

Includes: 1—P510A attenuator probe
1—W160-10 connecting cable (012017)
1—Instruction manual

Currently Available Extras

P2 crt phosphor normally furnished.

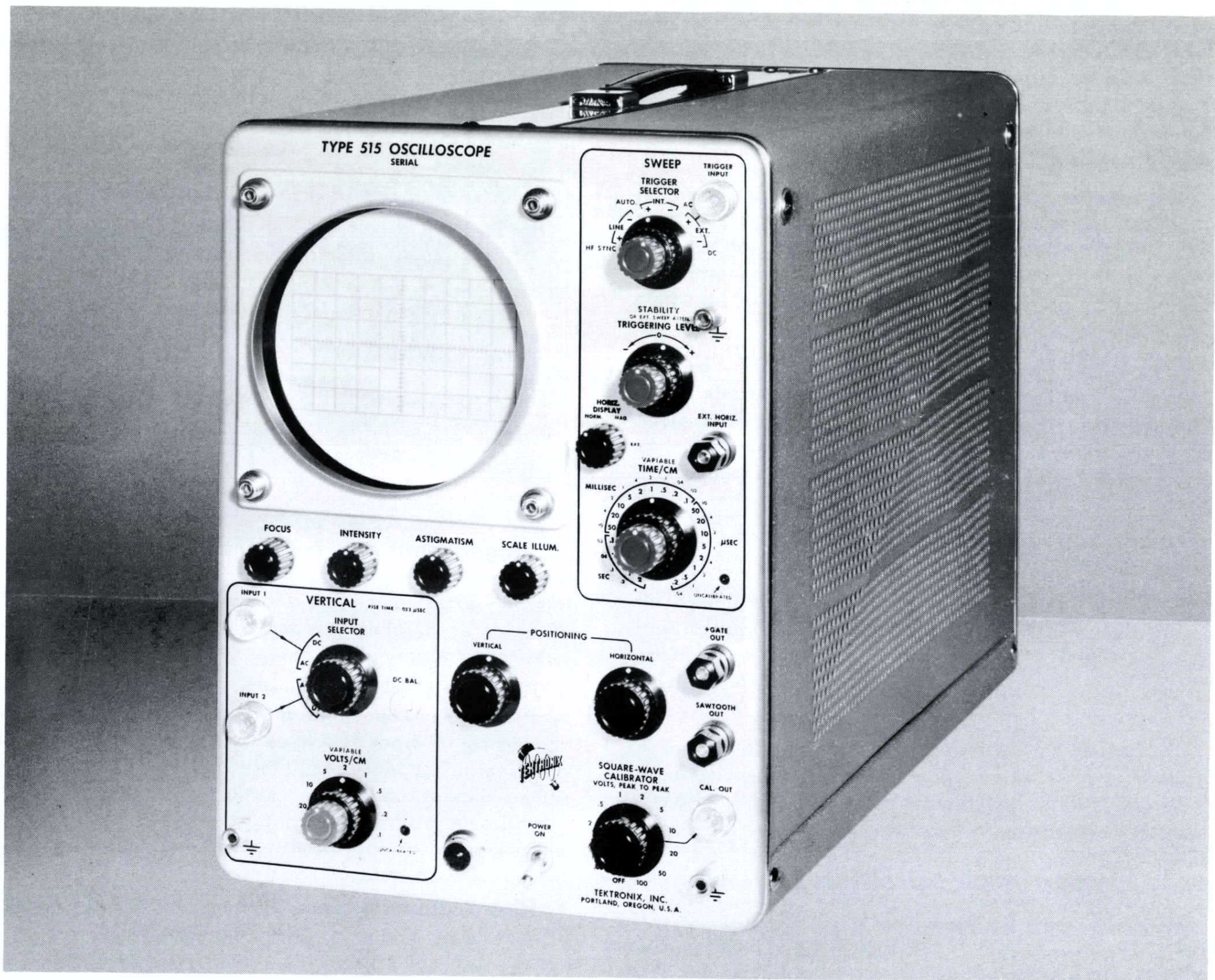
P1, P7, P11 optional. No extra charge

Price f.o.b. Portland, Oregon.



TYPE 515 OSCILLOSCOPE

DC-Coupled General Purpose



Wide Sweep Range

22 calibrated steps from 0.2 $\mu\text{sec}/\text{cm}$ to 2 sec/cm .
0.04 $\mu\text{sec}/\text{cm}$ to 6 sec/cm , continuously variable.
5x magnifier, accurate on all ranges.

Vertical Deflection Factor

9 calibrated steps from 0.1 v/cm to 50 v/cm .
0.1 v/cm to 125 v/cm , continuously variable.

Transient Response—0.023- μsec risetime.

Frequency Response—DC to 15 mc.

Versatile Triggering Circuitry

Internal, external, line . . . ac or dc-coupled, automatic triggering, and high-frequency sync.

Balanced 0.25 μsec Delay Network

GENERAL DESCRIPTION

The Tektronix Type 515 is a dc-coupled general-purpose cathode-ray oscilloscope combining the latest Tektronix oscilloscope circuitry in a compact moderately-priced instrument. Wide sweep range of 0.04 $\mu\text{sec}/\text{cm}$ to 6 sec/cm , dc to 15 mc passband, and vertical deflection factor to 0.1 v/cm qualify the Type 515 for general-purpose laboratory work. Reduced size requires less bench space and permits its use for many field applications.

Other outstanding features include dc-coupled unblanking, a new Tektronix flat-faced 5" cathode-ray tube, and versatile triggering circuitry. Accurate calibration of both sweep and vertical amplifier permits reliable quantitative measurements directly from the screen. Functional panel arrangement and versatile control system makes the Type 515 an easy-to-use oscilloscope for the field and laboratory.

TYPE 515 OSCILLOSCOPE

VERTICAL DEFLECTION SYSTEM

DC-Coupled Vertical Amplifier—The Type 515 vertical passband is dc to 15 mc, risetime is 0.023 μ sec. The vertical attenuator is calibrated in VOLTS/CM of deflection. Nine calibrated steps are provided: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 v/cm. In addition, a vernier (uncalibrated) control provides for continuously-variable adjustment from 0.1 v/cm to 125 v/cm.

Calibration Accuracy—An internal adjustment is provided for setting the gain of the vertical amplifier. When this adjustment is accurately set with the VOLTS/CM switch in the 0.05 v/cm position, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that position.

Two Signal Inputs—Two coaxial signal input connectors with more than 60-db isolation are controlled by a four-position switch. The INPUT SELECTOR switch selects ac or dc-coupling. A blocking capacitor is inserted in the AC positions, limiting the low-frequency response to 2 cycles.

Input Impedance—1 megohm paralleled by approximately 36 μ f.

Probe—The vertical sensitivity is reduced by a factor of 10 by use of a 10x attenuator probe supplied with the instrument. The P410 probe presents an input impedance of 10 megohms paralleled by approximately 10.5 μ f.

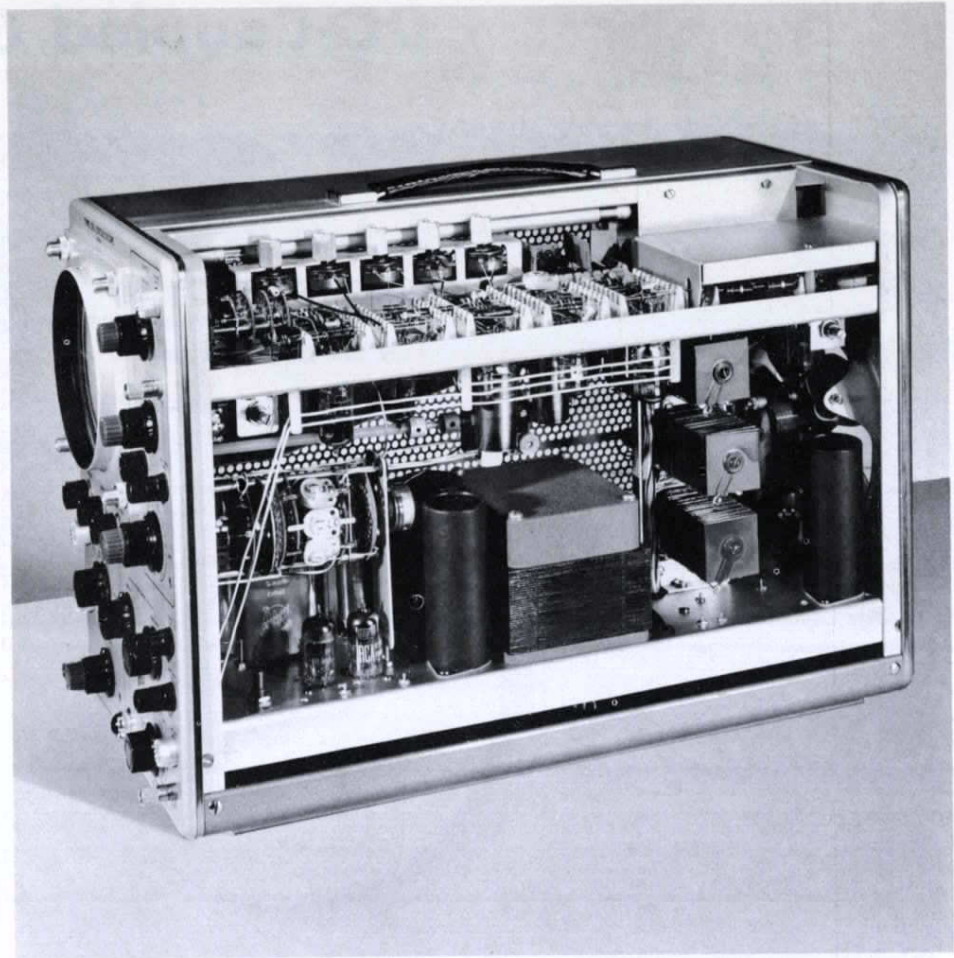
Balanced Delay Network—A signal delay of 0.25 μ sec is introduced by the balanced (push-pull) delay network. Permits observation of the leading edge of the waveform that triggers the sweep.

HORIZONTAL DEFLECTION SYSTEM

Wide Sweep Range—The Type 515 has 22 calibrated sweep rates: 0.2, 0.5, 1, 2, 5, 10, 20, 50 μ sec/cm; 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 millsec/cm; 0.1, 0.2, 0.5, 1, 2 sec/cm. A single 22-position sweep-rate switch is used. In addition, a vernier (uncalibrated) control provides sweep rates continuously adjustable from 0.2 μ sec/cm to 6 sec/cm. Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%.

Sweep Magnifier—When the 5x magnifier is switched in, the center two-centimeter portion of the normal sweep is expanded to left and right of center to fill ten centimeters. The HORIZONTAL POSITION control has sufficient range to display any one-fifth of the magnified sweep. TIME/CM of the magnified sweep is indicated by a second blue-colored figure at each position of the sweep-rate switch. Accuracy is within 5% of the displayed portion of the magnified sweep.

DC-Coupled Unblinking—The unblinking waveform is dc-coupled to the control grid of the crt assuring uniform grid 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 voltage signal; and selection of ac or dc-coupling through the triggering circuits, or automatic triggering.

Automatic Triggering—With the control in 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 SELECTOR switch is in the HF SYNC position, the sweep will synchronize with sine-wave signals in the frequency range of 5 mc to better than 20 mc.

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 0.2 v to 100 v.

Horizontal Input Amplifier—DC-coupled external connection to the sweep amplifier is through a front-panel connector. Deflection factor is 1.4 v/cm. Frequency response is dc to 500 kc.

OTHER CHARACTERISTICS

Voltage Calibrator—A square-wave voltage is available through a front-panel coaxial 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 about 1 kc.

TYPE 515 OSCILLOSCOPE

Cathode-Ray Tube—4-kv accelerating potential is applied to a new Tektronix 5" flat-faced precision tube, T55P, with a helical post-accelerating anode. A P-2 phosphor is normally supplied. Other phosphors are available upon request.

Output Waveforms—A 30-v positive-gate waveform of the same time duration as the sweep, and a 150-v positive-going sweep sawtooth waveform are available at front-panel connectors.

Regulated Power Supply—Electronic regulation compensates for line-voltage variations between 105 and 125 v or 210 and 250 v, 50 to 60 cycles.

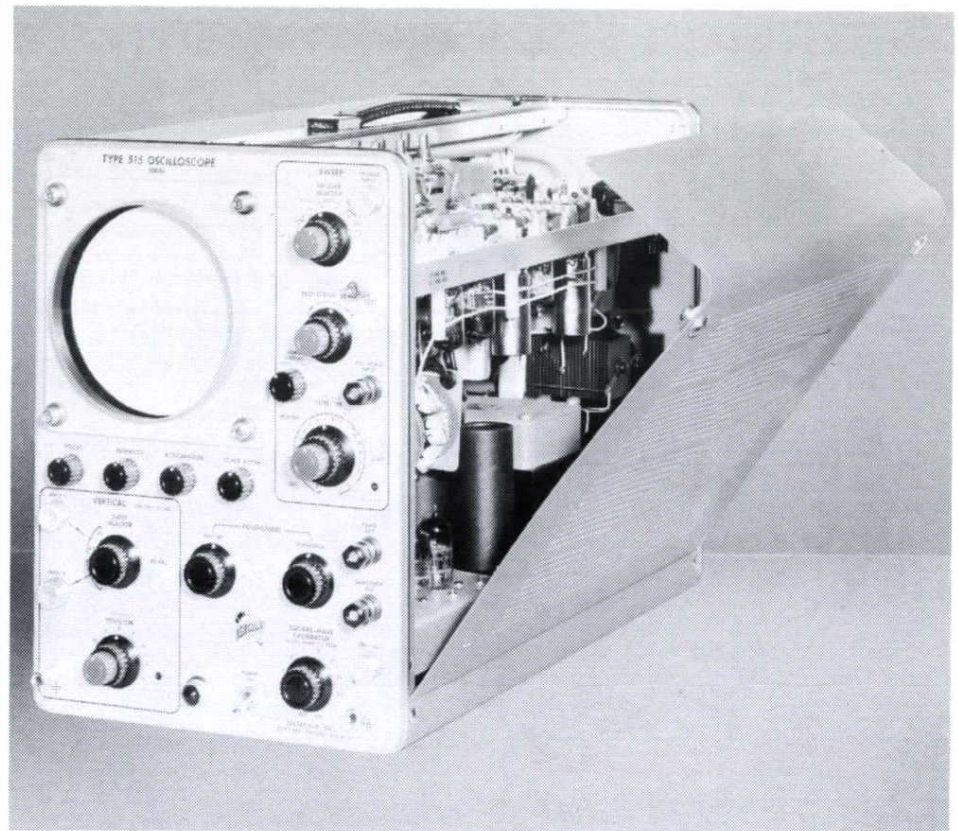
Illuminated Graticule—An edge-lighted graticule is marked in 6 vertical and 10 horizontal centimeter divisions with 2-millimeter baseline divisions. Illumination is controlled by a front-panel knob.

Warning Indicators for Uncalibrated Settings—Separate front-panel neon lights indicate when the vertical-attenuator and sweep-rate controls are in uncalibrated settings.

VACUUM TUBE COMPLEMENT

Vertical input CF	2	6AU6
Input amplifiers	2	12BY7
Amplifier CF		6BQ7A
Output amplifiers	2	6CL6
Internal trigger CF		6BQ7A
Trigger phase inverter		6U8
Regenerative amplifier		6U8
Holdoff cathode followers		12AT7
Minus multivibrator and unblanking CF ...		6AN8
Plus multivibrator and cathode follower ...		6BQ7A
Disconnect diodes		6AL5
Sweep generator and sweep generator CF.		6AN8
Positioning CF and feedback CF		6BQ7A
Sawtooth out CF and +gate out CF		6BQ7A
Horizontal output amplifiers	2	6BQ7A
Calibrator multivibrator		6U8
Calibrator CF		6BQ7A
Voltage reference		5651
Regulator amplifiers	3	6AU6
Series regulator		6080
Series regulator		6AU5
High-voltage oscillator		6AQ5
High-voltage rectifiers	3	5642

High-voltage regulator	12AT7
Cathode-ray tube	T55P2



Easy access to interior is provided by new three-piece cabinet design.

MECHANICAL SPECIFICATIONS

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

Construction—Cabinet and chassis are made of aluminum alloy.

Finish—Photo-etched anodized panel, blue wrinkle-finished cabinet.

Dimensions—9 3/4" wide, 13 1/2" high, 21 1/2" deep.

Weight—40 pounds.

Power Requirements—105 to 125 v or 210 to 250 v, 50-60 cycles, 275 watts.

Price **\$750**

Includes: 1—P410 attenuator probe
2—A510 binding-post adapters
1—F510-5 green filter (378503)
1—Instruction manual

Currently Available Extras

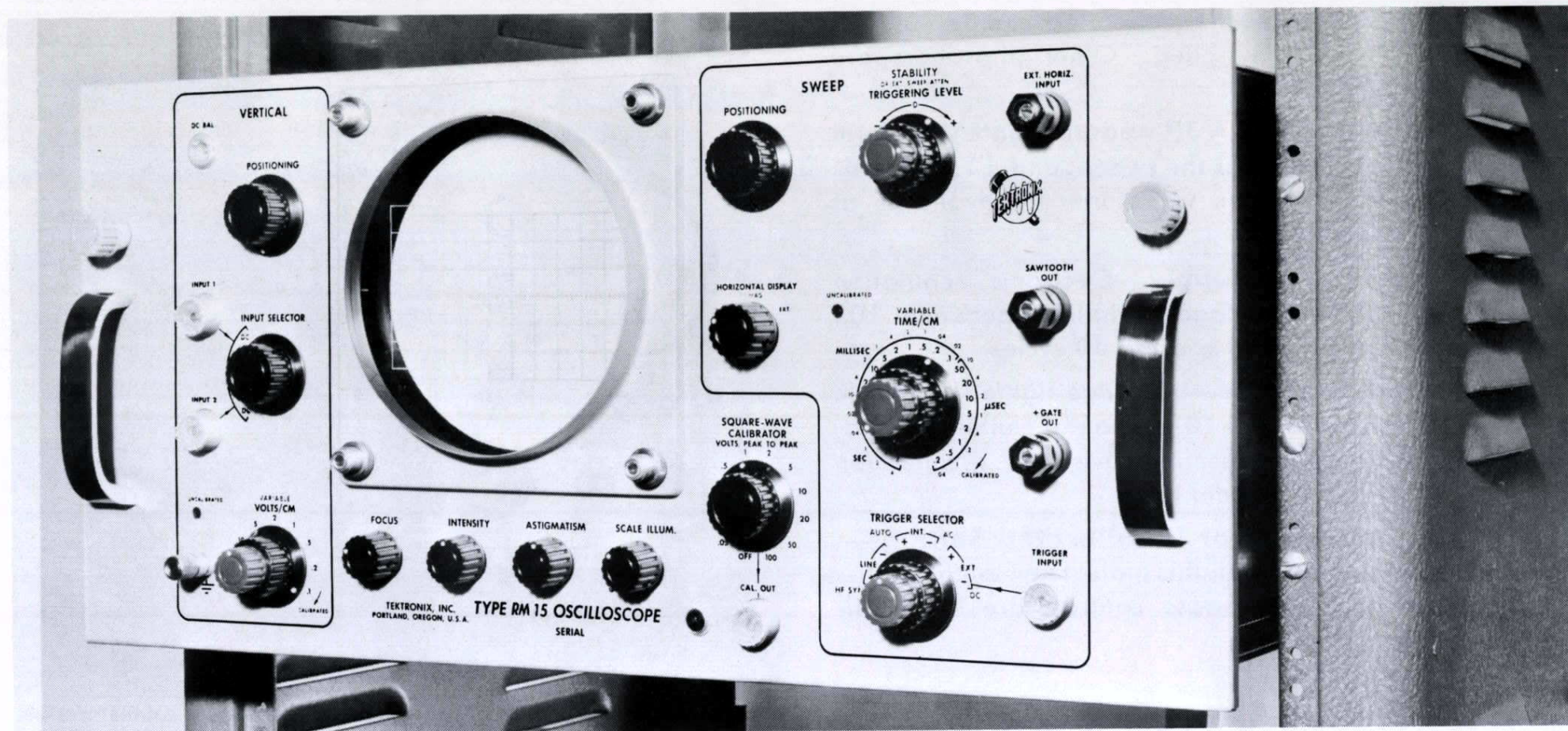
P2 crt phosphor normally furnished.

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

Price f.o.b. Portland, Oregon.

TYPE RM15 OSCILLOSCOPE

Rack-Mounting 5-Inch Oscilloscope



GENERAL DESCRIPTION

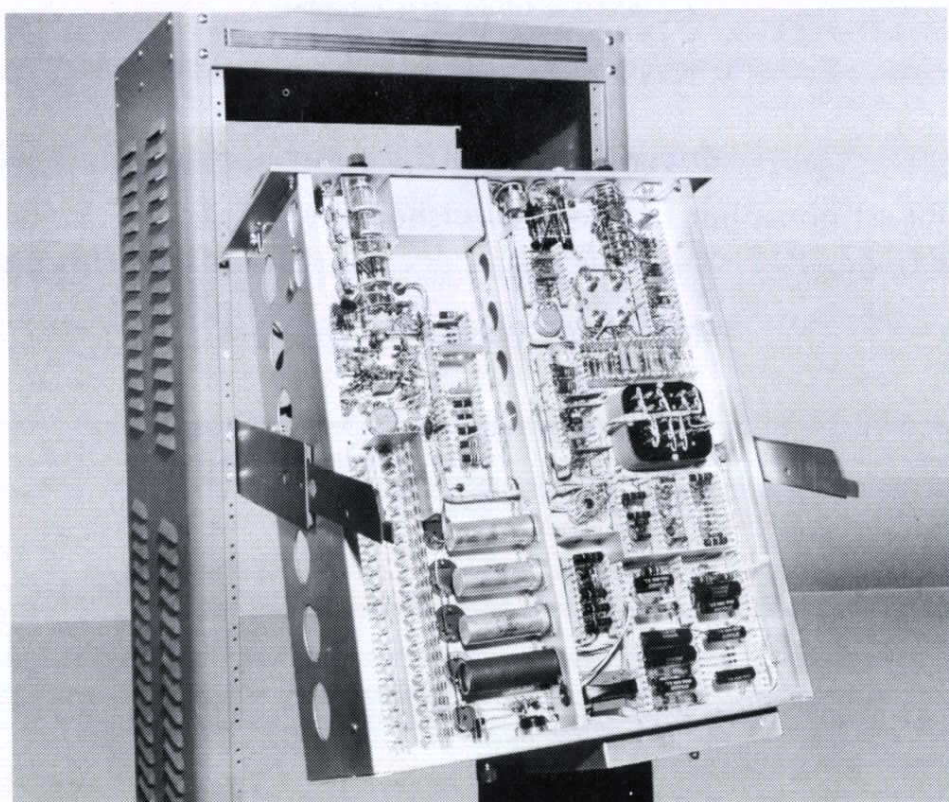
The Type RM15 is a mechanically rearranged Type 515 Oscilloscope, for mounting in a standard 19-inch rack. The instrument mounts to the rack on slide-out tracks. It can be pulled forward, tilted, and locked in any of seven positions for servicing convenience.

OTHER CHARACTERISTICS

Electrical characteristics of the Type RM15 are the same as described for the Tektronix Type 515 Oscilloscope. Controls and terminals are located for maximum convenience in rack-mounted operation.

TENTATIVE SPECIFICATIONS

REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY AUGUST, 1957



MECHANICAL SPECIFICATIONS

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

Construction—Aluminum alloy chassis and two-piece cabinet. Slide-out mounting.

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

Dimensions—8 3/4" high, 19" wide, 23" rack depth, 25" overall depth.

Weight—43 pounds.

Type RM15 **\$825**

- Includes: 1—P410 attenuator probe
2—A510 binding-post adapters
1—F510-5 green filter (378503)
1—Instruction manual

Price f.o.b. Portland, Oregon.

TYPE 517A OSCILLOSCOPE

for High-Speed Pulse Application

Excellent Transient Response

7-millimicrosecond risetime.

Sweep Range

0.01 $\mu\text{sec}/\text{cm}$ to 20 $\mu\text{sec}/\text{cm}$.

Vertical Deflection Factor

0.05 v/cm.

24-kv Accelerating Potential

Writing Rate—1100 cm/ μsec .

Recorded on 35 mm TRI-X film at f1.9 with 4.2 to 1 reduction, developed 26 minutes in D-19 at 68°F. Trace density 0.1 above film fog.

Sweep-Displacement Error

Less than 2% of 8 cm.

Signal-Displacement Error

Less than 2% of 2 cm.

Full 4-cm x 8-cm Deflection

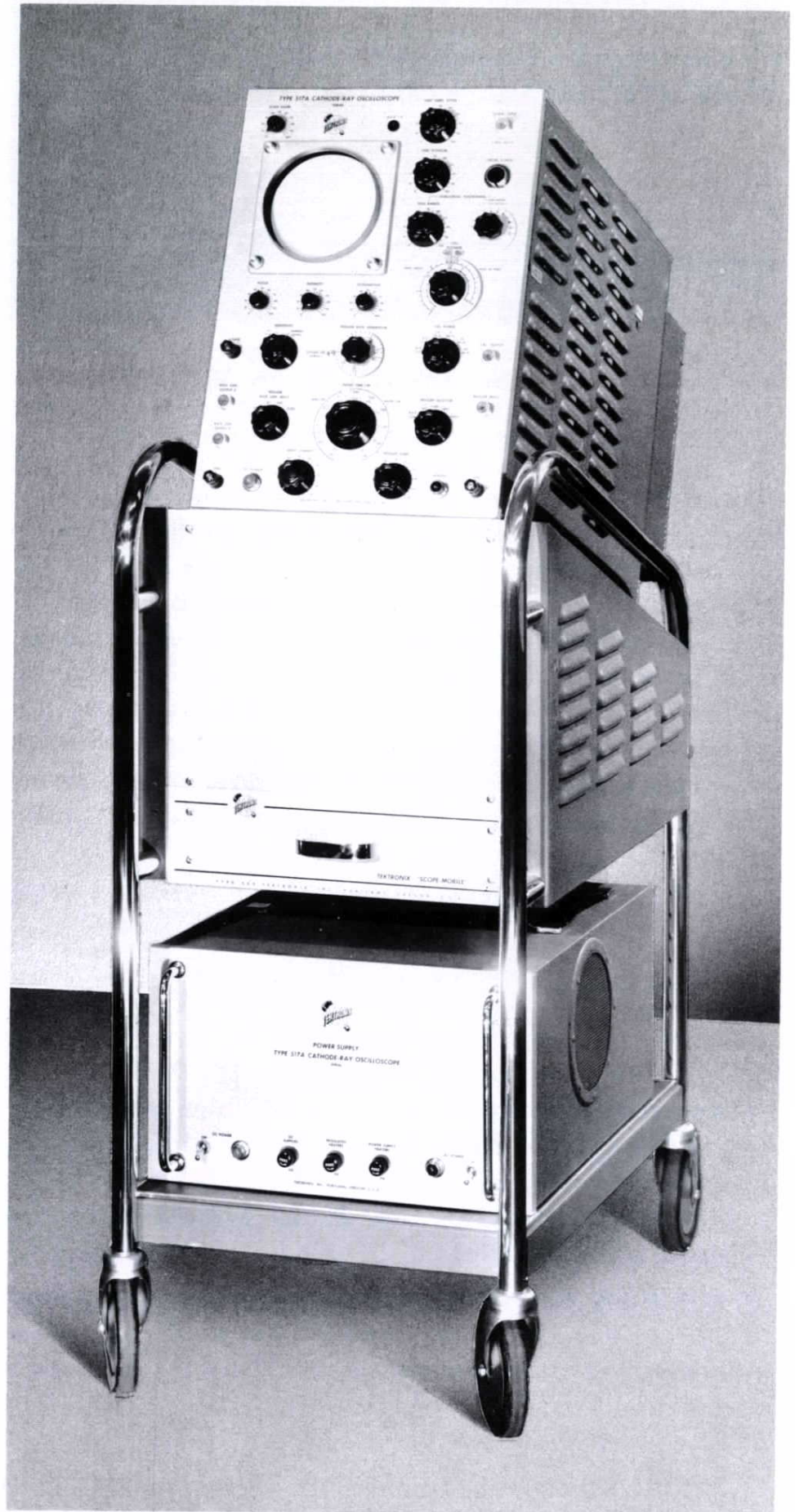
Highly Mobile

Indicator unit and power supply mounted on Scope-Mobile.

GENERAL DESCRIPTION

The Tektronix Type 517A Cathode-Ray Oscilloscope is a wide-band high-voltage instrument for the observation and photographic recording of very-fast-rising waveforms having low duty cycle. With its risetime of 7 millimicroseconds, 24-kv accelerating potential, and high-speed sweeps, the Type 517A is especially well suited to single-sweep applications involving transients of very short duration. Use of the new Tektronix metallized cathode-ray tube, T54PH, increases the maximum vertical deflection to a full 4 cm and improves the linearity of the horizontal sweep. Basic vertical deflection factor of the Type 517A is 0.05 volts/cm.

Both indicator and power-supply units are mounted on a Type 500 Scope-Mobile, making the Type 517A a convenient, mobile unit. If desired, the indicator and power-supply units can be easily removed from the Scope-Mobile for bench use.



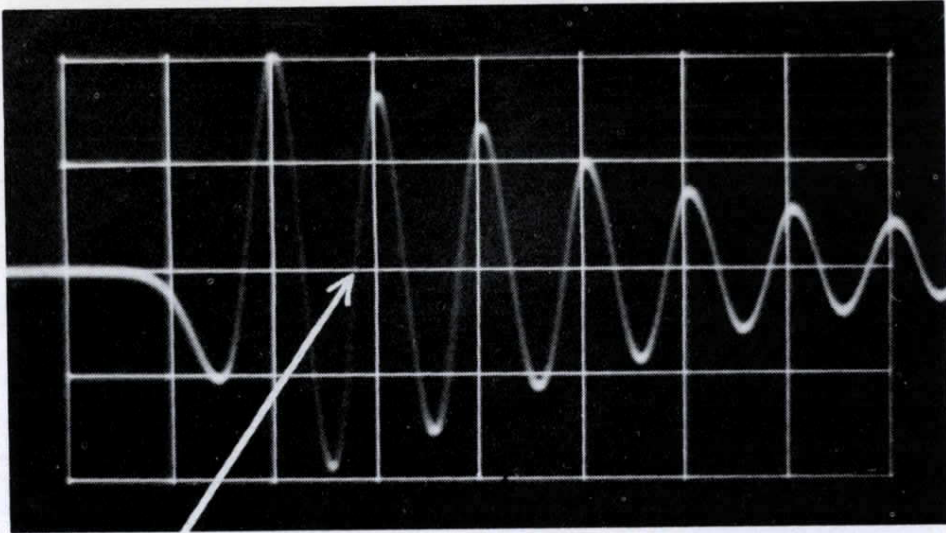
VERTICAL DEFLECTION SYSTEM

Distributed Amplifier—A 5-stage distributed amplifier is used to derive a transient-response risetime of 7 millimicroseconds.

Sensitivity—Basic deflection factor is 0.05 v/cm with 24-kv accelerating potential. An front-panel variable attenuator control can decrease the sensitivity by a factor of 2.

Input—The input of the vertical amplifier is connected through a coaxial connector directly to the 170-ohm first-stage grid line.

TYPE 517A OSCILLOSCOPE



Arrow indicates 1100 cm/ μ sec writing-rate point on 100-mc damped oscillation, displayed on single 0.01 μ sec/cm sweep of Type 517A Oscilloscope with T54P11H crt. Recorded on 35-mm TRI-X film at f1.9 with 4.2 to 1 reduction, developed 26 minutes in D-19 at 68°F.

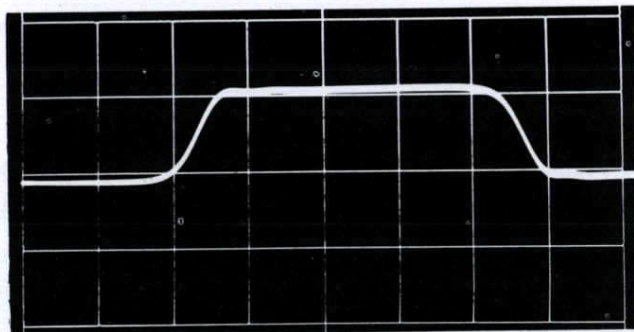
Cathode-Follower Probe—To provide higher input impedances, a cathode-follower probe and three capacitive attenuator heads are supplied with the Type 517A. The input impedance of the probe alone consists of 12 megohms paralleled by approximately 5 μ f. Each attenuator head will present a different input capacitance, decreasing with higher attenuation ratios. Each attenuator head is adjustable over a ten-to-one range by means of a screwdriver adjustment in the nose of the head, making the following deflection factors and attenuator ranges available:

	Deflection Factor of Type 517A at 24-KV Accelerating Potential	Total Attenuation at CRT
Scope Input	0.05 to 0.1 v/cm	1:1 to 2:1
Probe Body Alone	0.1 to 0.2 v/cm	2:1 to 4:1
Probe with Attenuator I	0.2 to 4 v/cm	4:1 to 80:1
Probe with Attenuator II	2 to 40 v/cm	40:1 to 800:1
Probe with Attenuator III	20 to 400 v/cm	400:1 to 8000:1

Step Attenuator—A separate 170-ohm step attenuator is furnished with the Type 517. The attenuator uses 2% precision resistors, and covers the range of 1 to 64 db in 1-db steps. It is rated at 0.25 w. Also furnished is a 170-ohm coaxial cable, 42" long.

Auxiliary Power—A front-panel socket is provided to supply power 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 are available.

Signal Delay—Approximately 65 millimicroseconds of delay cable is incorporated in the vertical amplifier. This delay, along with an inherent 55 millimicroseconds



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

delay in the amplifier, permits the sweep to start before the signal reaches the vertical deflection plates.

Direct Input CRT—An aperture in the side of the cabinet permits direct connection to the crt deflection plates for observation of extremely-fast transients.

HORIZONTAL DEFLECTION SYSTEM

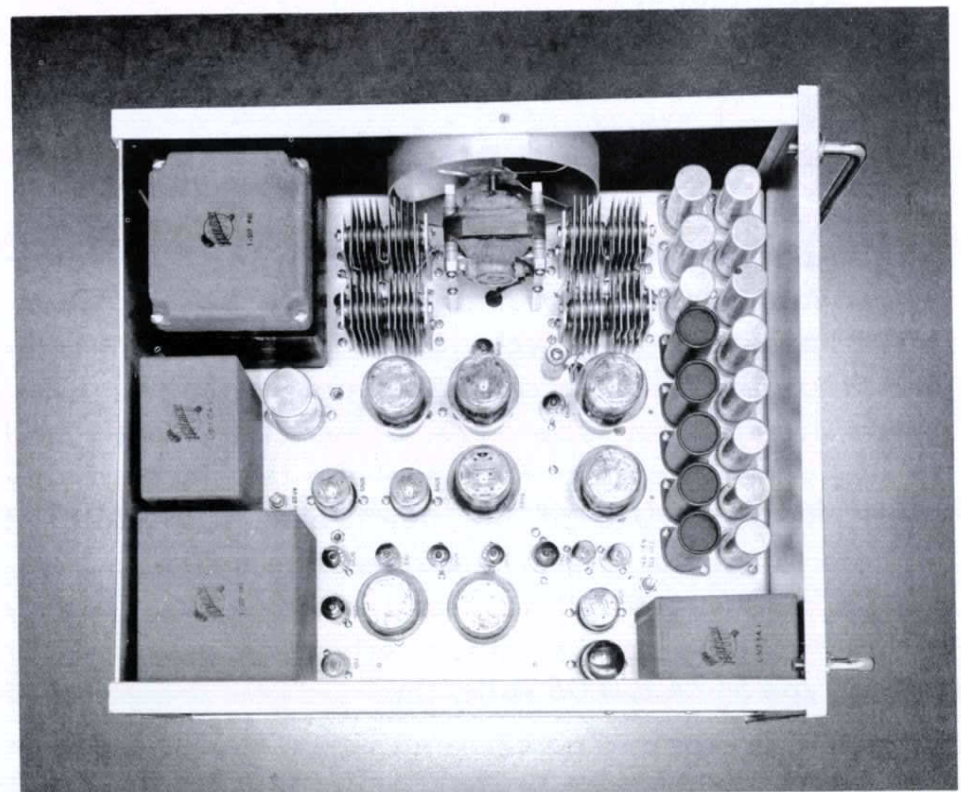
Calibrated Sweep Rates—The basic sweep waveform is generated by a boot-strap circuit with an inverter stage for balanced deflection. Eleven fixed, calibrated sweep rates accurate within 2% . . . 10, 20, 50, 100, 200, 500 millimicrosecond/cm, 1, 2, 5, 10, 20 μ sec/cm are available at 24 kv accelerating potential; and 5, 10, 25, 50, 100, 250 millimicrosecond/cm, 0.5, 1, 2.5, 5, 10 μ sec per cm at 12 kv.

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

Trigger Requirements—The Type 517A uses a distributed amplifier in the trigger circuitry to handle fast-rise trigger signals. An internal trigger giving a 2-mm deflection will trigger the Type 517A. External trigger requirements are 0.3 to 15 v.

Trigger-Rate Generator—Internal trigger-rate generator is continuously variable from 15 to 15,000 cycles in three ranges with accuracy within 5% of full scale. Two cathode-follower outputs are available . . . 20 v at 50 ohms internal impedance and 60 v at 200 ohms internal impedance. Risettime is approximately 0.15 μ sec.

Automatic Duty-Cycle Limiter—The maximum duty cycle of the sweep system is automatically limited to about 15% to avoid exceeding the dissipation limits of some of the sweep circuit components.



POWER SUPPLY

Low Voltage—The low-voltage power supply is separate from the indicator unit, supplying power to it by an

TYPE 517A OSCILLOSCOPE

inter-connecting cable. All dc supplies are electronically regulated and heaters in the indicator unit are regulated by a saturable-reactor method to insure stable operation over line-voltage variations from 105 to 125 v.

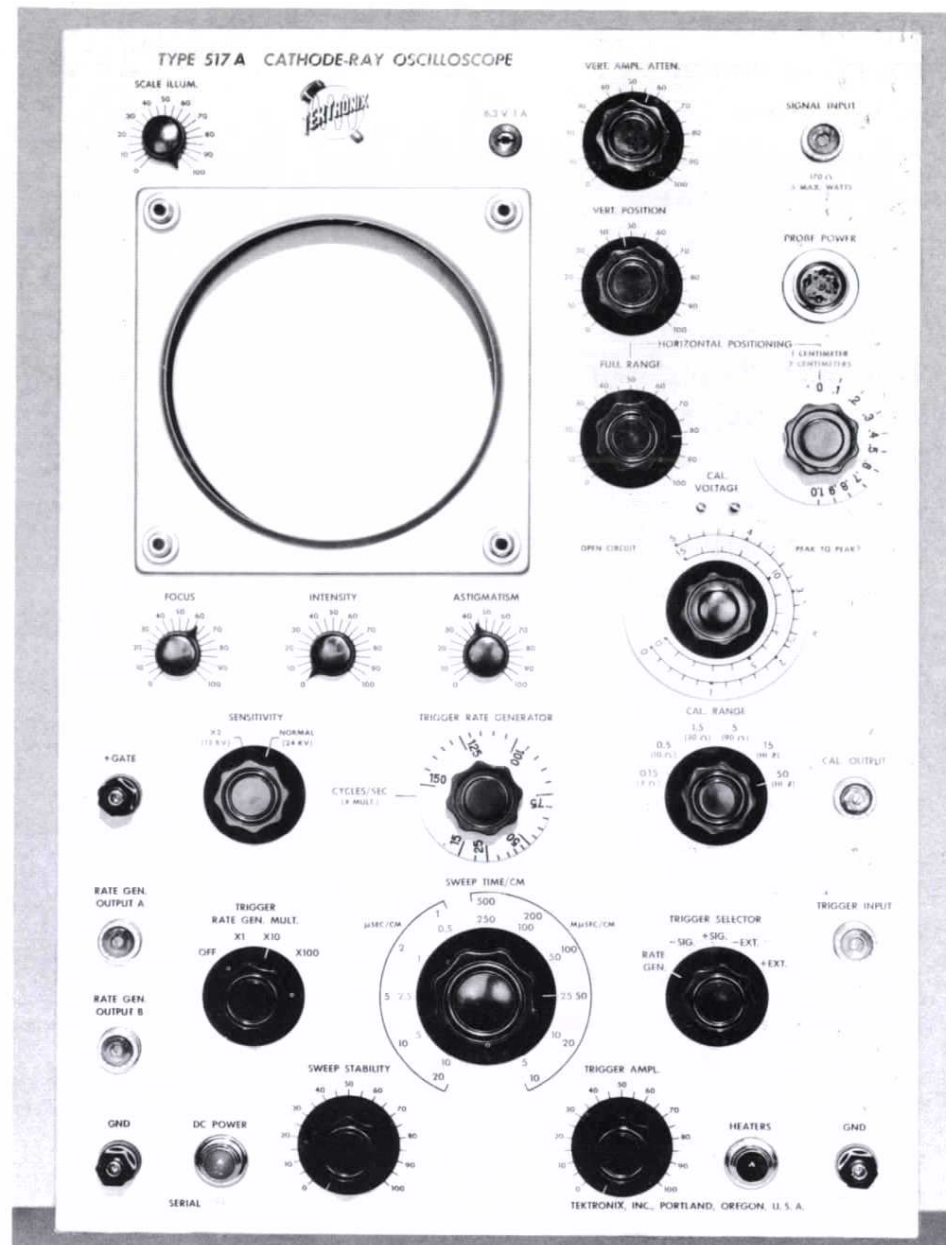
High Voltage—Accelerating potentials for the crt are obtained from an oil-filled oscillator-type supply, all voltages electronically regulated to insure stable operation for both load and line changes. A front-panel switch on the indicator unit changes the accelerating voltage from 24 kv to 12 kv by changing the sampling voltage in the regulator circuit.

OTHER CHARACTERISTICS

Amplitude Calibrator—A pulse-type calibrator is used in the Type 517A and is available at the front-panel through a coaxial connector. The output voltage is continuously variable from 0.15 v to 50 v peak full scale in 6 ranges with accuracy within 4% of full scale. Frequency is approximately 25 kc.

Horizontal-Position Vernier—In addition to the normal horizontal-position control, a vernier control calibrated in millimeters provides accurate measurements over a range of 1 cm (24-kv accelerating potential) for use in measuring risetimes, etc.

Metallized Cathode-Ray Tube—The Type 517A uses a new Tektronix crt, T54PH. The T54PH is a 5" flat-faced metallized precision tube with helical post-accelerating anode. It provides a full 4-cm x 8-cm viewing area



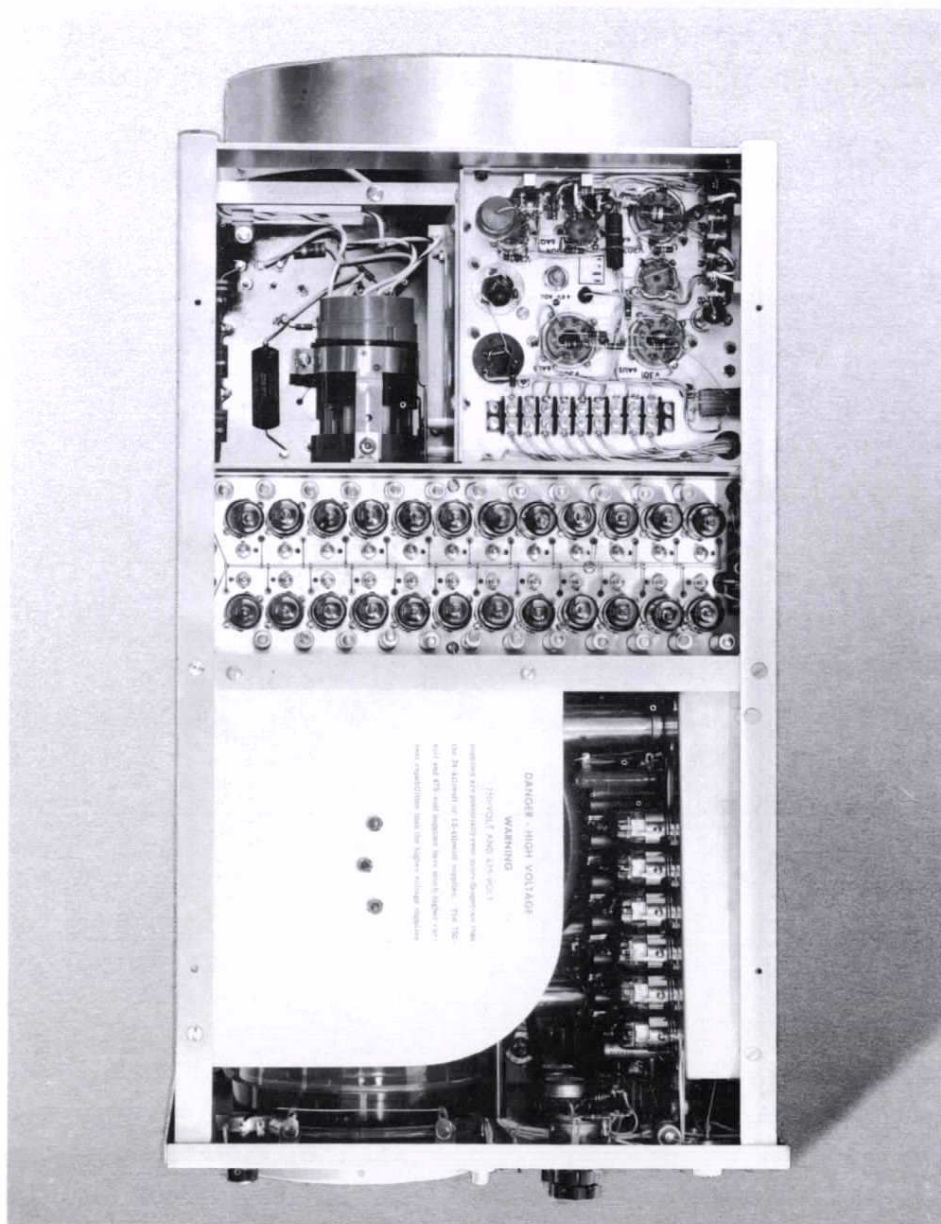
when operated at 24-kv accelerating potential. Position of the high-voltage connector permits bringing the tube face flush with the panel. A P11 phosphor is normally furnished unless otherwise specified.

Output Waveforms—In addition to the two trigger-rate generator outputs and calibrator output, a +GATE waveform of approximately 30 volts amplitude is available. Its duration is approximately equal to the sweep being generated. Risettime is 0.03 μ sec, from a cathode-follower source impedance of 200 ohms.

Illuminated Graticule—An edge-lighted graticule is marked in centimeter squares, 4 vertical and 8 horizontal, for convenience in making time and amplitude measurements. Illumination is controlled by a front-panel knob.

VACUUM TUBE COMPLEMENT

First distributed amplifier	6	6AK5
Second distributed amplifier	6	6AK5
Third distributed amplifier	7	6CB6
Phase inverter stage	3	6CB6
Driver amplifier	12	6CB6
Output amplifier	24	6CB6
Internal trigger coupling		6CB6
Trigger phase-splitter		6J6
Trigger amplifier	6	6AK5
Trigger limiter		6AG7
Trigger switch		6AG7
Coupling diode		6X4



TYPE 517A OSCILLOSCOPE

Multivibrator	2	6AG7
Duty-cycle limiter		6AN8
Sweep clamp	2	6AG7
Bootstrap cathode followers	2	12BH7
Decoupling diode		6X4
Positive sweep out CF		12BH7
Sweep inverter		6AG7
Voltage regulator CF		12AU7
Negative sweep clamp		6AL5
Sweep out dc restorer		6AL5
Unblanking amplifiers	2	6AG7
Voltage regulator CF		6AS5
Unblanking cathode follower		6J6
+ Gate out cathode follower		6J6
Cal multivibrator		12AU7
Clipper		6J6
Cal voltage adjust CF		6J6
Cal out CF		6J6
Trigger rate phantastron generator		6BH6
Trigger coupling and recharging CF		12AU7
Plate catcher		12AU7
Blocking oscillator		12AU7
Output cathode followers	2	12AU7
Astigmatism and probe voltage CF		12AU7
Low-voltage rectifiers	4	6X4
Rectifier		5R4GY
Voltage reference		5651
Comparator		12AX7
Regulator amplifiers	5	6AU6
Series regulators	2	6AU5
Series regulators	6	6AS7
Heater voltage control diode		2AS-15
Heater-regulator amplifier		6AU5
High-voltage rectifiers	5	1X2
High-voltage oscillator		6AU5

Regulator amplifier		12AU7
Series regulator	2	6AU5
High-voltage time delay		6C4
High-voltage rectifier filament oscillator ..		6AQ5
Astigmatism and probe power CF		12AU7
Cathode-ray tube		T54P11H

MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and cabinet.

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

Dimensions—Indicator unit: 18 3/8" high, 13" wide, 27" deep. Power supply unit: 9 5/8" high, 13" wide, 19 3/4" deep.

Weight—Indicator unit: 76 pounds. Power supply unit: 72 pounds. Scope-Mobile: 42 pounds.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 1250 watts.

Type 517A Cathode-Ray Oscilloscope . . . \$3500

- Includes:
- 1—Type 500 Scope-Mobile
 - 1—P170CF cathode-follower probe
 - 1—B170A step attenuator
 - 1—H510 viewing hood
 - 1—BE510 bezel
 - 1—Instruction manual
 - 1—P170 coaxial cable

Currently Available Extras

P11 phosphor normally furnished.

P1, P2, P7 optional. No extra charge

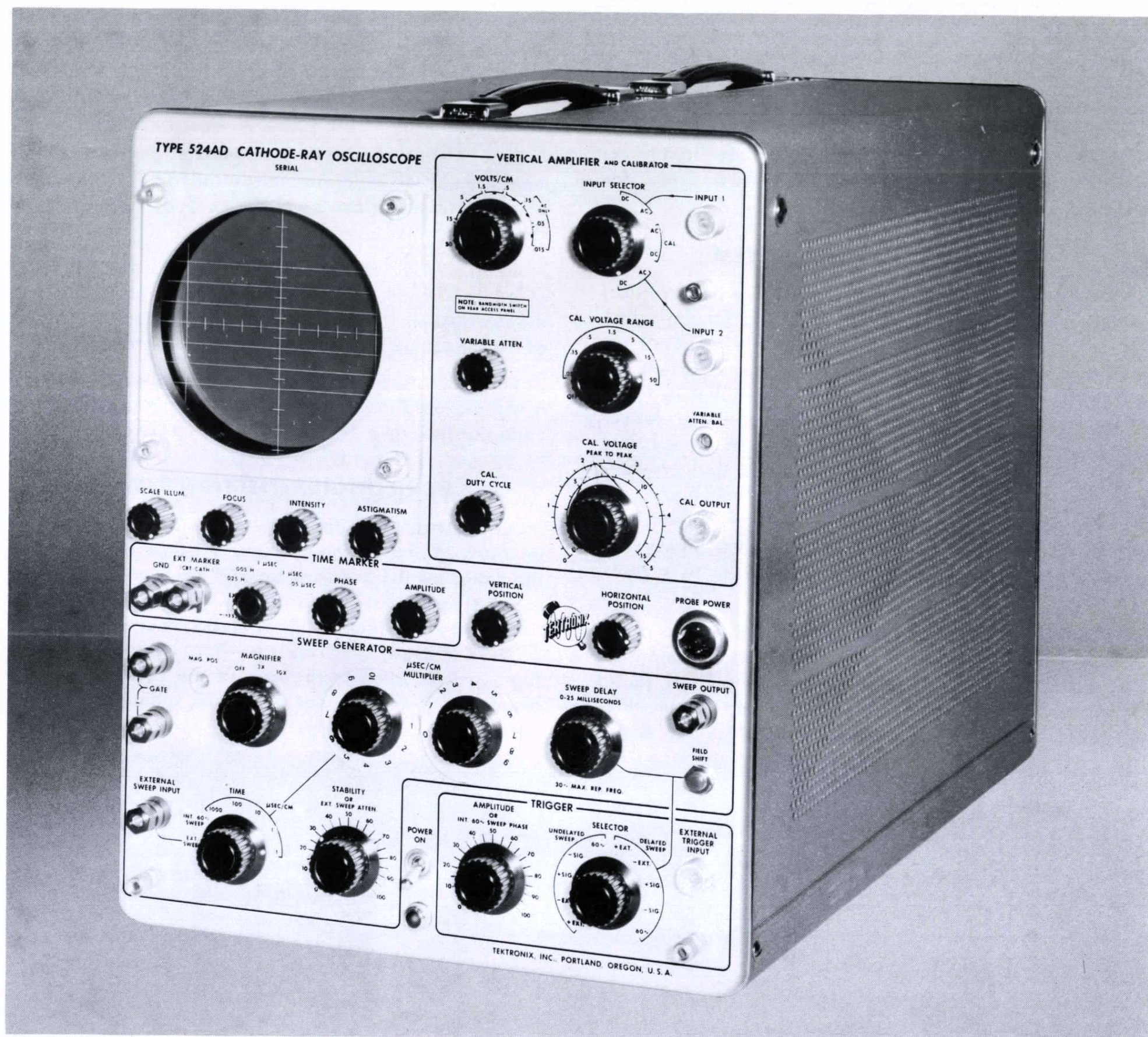
Other phosphors can be furnished on special order.

Price f.o.b. Portland, Oregon.



TYPE 524AD OSCILLOSCOPE

Television Cathode-Ray Oscilloscope



Frequency Response

Normal—dc to 10 mc from 0.15 v/cm to 50 v/cm.
2 cycles to 10 mc from 15 mv/cm to 50 v/cm.
Flat—within 1% from 60 cycles to 5 mc.
IRE—meets IRE standards for level measurements.

Transient Response—0.035- μ sec risetime.

Sweep Range

Continuously variable, 0.1 μ sec/cm to 0.01 sec/cm.

Time Markers

Five markers—0.05 μ sec, 0.1 μ sec, 1.0 μ sec, 200 pips per television line, and 40 pips per television line.

Sweep Delay

Permits detailed observation of any portion of a single television line.

DC-Coupled Unblinking

Variable Duty-Cycle Amplitude Calibrator

New Cabinet Design

GENERAL DESCRIPTION

The Tektronix Type 524AD Oscilloscope is a self-contained instrument with the characteristics desirable for

TYPE 524AD OSCILLOSCOPE

maintenance and adjustment of television transmitter and studio equipment. The Type 524AD will prove itself invaluable in enabling the engineer to observe any portion of the television picture — from complete frames to small portions of individual lines.

Features contributing to the versatility of this oscilloscope include—accurate time markers to facilitate sync-pulse timing, normal response of dc to 10 mc, flat response within 1% from 60 cycles to 5 mc for color-television work, variable-duty-cycle amplitude calibrator, and two steps of sweep magnification, 3x and 10x, for detailed observations.

VERTICAL DEFLECTION SYSTEM

DC-Coupled Vertical Amplifier—The main vertical amplifier has a passband of dc to 10 mc for deflection factors from 0.15 v/cm to 50 v/cm. Low-frequency response is 3 db down at 2 cycles when the AC-DC switch is in the AC position. An ac-coupled preamplifier switched in by the VOLTS/CM control provides additional deflection factors from 0.015 v/cm to 0.15 v/cm. A variable attenuator control fills in between steps and provides continuously variable adjustment from 0.015 v/cm to 50 v/cm. The vertical amplifier is factory adjusted for optimum transient response. Risetime is less than 0.035 μ sec and the input impedance is 1 megohm paralleled by approximately 45 μ mf.

Frequency Response—A switch on the access panel selects the desired bandwidth of the vertical amplifier. The NORMAL position provides a passband of dc to 10 mc. The FLAT position provides a vertical-amplifier response flat within 1% from 60 cycles to 5 mc. About

5% overshoot will occur on extremely sharp waveforms when the switch is in the FLAT position; however, TV signals within the 5 mc passband are not affected. Response of the amplifier meets the IRE standards for level measurements when the access-panel switch is in the IRE position. EXTERNAL position provides ac-coupled external connections to the vertical-deflection plates, bypassing the main vertical amplifier but retaining the function of the vertical-position control.

Two Signal Inputs—Two coaxial connectors with more than 50-db isolation are controlled by a front-panel switch. Each input can be either ac or dc-coupled to the vertical amplifier.

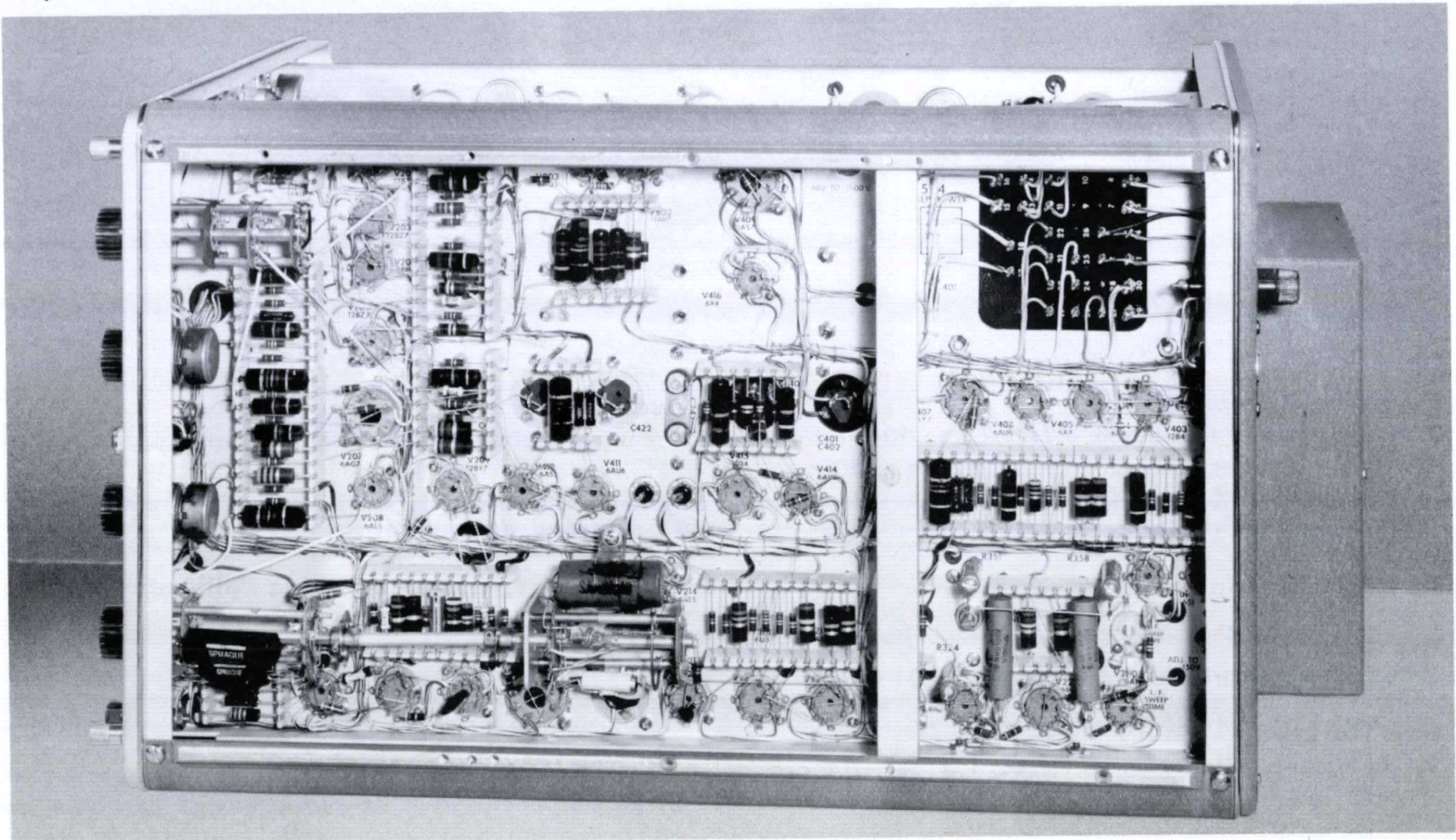
Probe—The vertical sensitivity is reduced by a factor of 10 by use of a 10x attenuator probe supplied with the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately 15 μ mf.

Delay Network—A 0.25 μ sec signal-delay network is incorporated in the vertical amplifier to permit observation of the waveform that triggers the sweep.

HORIZONTAL DEFLECTION SYSTEM

Calibrated Sweeps—The Type 524AD has a continuously variable, linear, triggered time base covering the range of 0.1 μ sec/cm to 0.01 sec/cm in five fixed-range steps. Dual sweep-time multiplier dials cover the range between steps. Calibration accuracy is within 5%.

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.



TYPE 524AD OSCILLOSCOPE

Sweep Delay—Detailed observation of any portion of the television picture is accomplished by continuous sweep delay from 0 to 25 milliseconds. After the desired delay, the sweep is triggered by one of the line sync pulses. The sweep delay is adjustable with a 3-turn potentiometer through about 1½ fields, and operates at the frame rate of 30 cycles so only consecutive lines of one field are observed at any time. A field-shift button permits switching to the corresponding interlaced lines in the other field.

Sweep Magnifier—Sweep magnification is obtained by increasing the drive to the sweep-output amplifier by a factor of either 3 or 10. The center portion of the sweep is expanded equally to left and right of center. The 3-turn horizontal-position control has sufficient range to cover the entire magnified sweep. Accuracy is within 5%.

Trigger Selector—Both normal and delayed sweeps can be triggered by an external signal of either polarity, or internally by either the positive or negative portion of the signal under observation, or by the power-line frequency.

Trigger Requirements—Internal triggering—a signal large enough to produce a one-half centimeter deflection. External—a signal of 0.5 v to 50 v. Composite waveform—a signal large enough to produce a 1.5-centimeter deflection.

OTHER CHARACTERISTICS

Voltage Calibrator—A variable-duty-cycle square-wave calibration voltage is continuously variable from zero to 50 volts in seven ranges. Full-scale calibration is accurate within 3%; variable control is linear within 1% of full scale. Square-wave frequency is approximately 1 kc, but the frequency will vary somewhat as duty cycle is varied to 1% or 99%.

Time-Mark Generator—Time markers are inserted as intensification pips on the crt trace at time intervals of 0.025H, 0.005H, 1.0 μ sec, 0.1 μ sec, and 0.05 μ sec. Since H is 63.5 μ sec, 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 of the same time duration as the sweep, and the sweep sawtooth waveform are available at front-panel connectors.

Line-Indicating Video—When a picture monitor is connected to the coaxial connector at the rear of the cabinet, the picture appearing on the monitor will be brightened during the time of the oscilloscope sweep. This

technique is useful when it is desired to know what portion of the picture is being displayed on the oscilloscope.

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

Cathode-Ray Tube—A flat-faced 5ABP cathode-ray tube with 4-kv electronically-regulated accelerating potential is used in the Type 524AD. A P-1 phosphor is normally supplied although other phosphors are available upon request.

Regulated Power Supply—All dc supplies are electronically regulated to insure stable operation over line variations between 105-125 v or 210-250 v, 50 to 60 cycles.

Illuminated Graticule—An edge-lighted graticule is marked in centimeters. Illumination is controlled by a front-panel knob. A graticule marked for modulation measurements is also supplied with the instrument.

Probe Power Socket—A front-panel socket will provide power for a cathode-follower probe or auxiliary amplifier circuitry. 6.3 v ac at 1 amp and 120 v regulated dc at 15 ma are available at the socket.

VACUUM TUBE COMPLEMENT

Preamplifier	2	6U8
Cathode follower		12AT7
Cathode-coupled amplifier	2	6CL6
Cathode follower		6BQ7A
Driver	2	6CL6
Cathode follower, constant-current triode		6BQ7A
Output amplifier	6	6AG7
Voltage regulator		6AS5
Cal multivibrator		12AU7
Cal clipper amplifier and CF		12AT7
Trigger inverter and clamp diode		6BQ7A
Sync amplifier		12BZ7
Sync separator and coupling diode		12BZ7
Phantastron		6BH6
Trigger delay comparator		12BZ7
Trigger amplifier		6AG7
Coupling diode		6AL5
Negative multivibrator		12BY7
Positive multivibrator		12BY7
Gate amplifier and astigmatism CF		12AU7
Unblanking amplifier		12AT7
Clamp tube		6AG7
DC restorer		6AL5
Cathode follower		12AT7
Decoupling diode and CF		12AT7
Feedback amplifier		6U8
Clamp and CF		12AT7
Sweep-output amplifier	2	6AH6
Sweep-output cathode follower		6BQ7A
Voltage reference		5651

TYPE 524AD OSCILLOSCOPE

Regulator amplifier	4	6AU6
Regulator series tube	2	12B4
Rectifiers	3	6X4
Voltage-comparator amplifier		12AX7
Regulator series tube		6AS7
Regulator series tube		6AS5
Time-mark pulse shaper and CF		6BQ7A
Marker phase multivibrator		6U8
Time-mark oscillator		6AK5
Pulse amplifier		6BQ7A
High-voltage regulator amplifier		12AU7
High-voltage oscillator		6AQ5
High-voltage rectifier	3	5642
Cathode-ray tube		5ABP1

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis and three-piece cabinet.

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

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

Dimensions—25" long, 13" wide, 16 3/4" high.

Weight—61 pounds.

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

Price **\$1180**

Includes: 1—P510A attenuator probe
 2—A510 binding-post adapters
 1—TV RMA style graticule (331009)
 1—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

Type 500 Scope-Mobile \$97.50

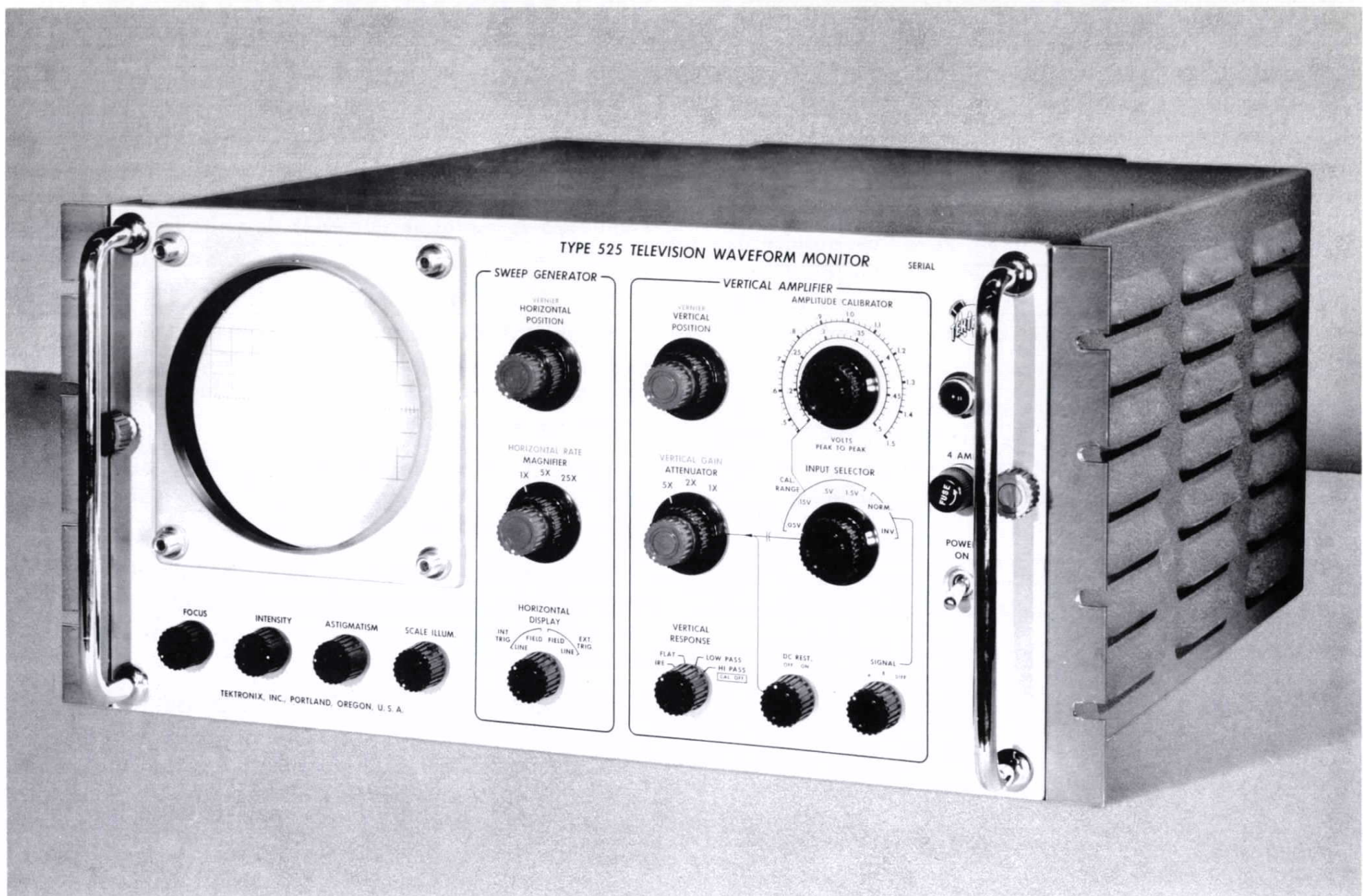
P500CF Cathode-Follower Probe has input impedance of 40 megohms paralleled by 4 $\mu\mu\text{f}$ and gain of 0.8 to 0.85. With 10x attenuator head, input impedance is 10 megohms paralleled by 2 $\mu\mu\text{f}$. Amplitude distortion is less than 3% on unidirectional signals up to 5 v. . \$64.00

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

Prices f.o.b. Portland, Oregon.

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.
- HIGH PASS—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 accu-

rate 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, or differential 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; HIGH PASS, with increase in gain adjustable to 5x, excludes the stair steps but passes the high frequencies for linearity tests.

Sensitivity—The basic deflection factor 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

TYPE 525 TELEVISION WAVEFORM MONITOR

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.

Vertical Input Connectors—All input connectors are located at the rear of the instrument. The vertical deflection system has push-pull input to permit two single-ended signals to be applied to the monitor at the same time. They can be independently selected, rapidly compared, or applied differentially, to cancel out in-phase unwanted signals, by a front-panel switch. Each input is paralleled with another coaxial connector to permit the monitor to bridge or terminate the video circuit. The 75-ohm terminating resistors are supplied with the instrument.

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.

Horizontal Rate, Magnifier—The variable HORIZONTAL RATE control adjusts the sweep-time rate so 2, 3, or 4 lines or fields can be displayed at one time. A three-position switch selects accurate magnification of the sweep by 1x, 5x, or 25x. 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. Accuracy is within 2% of full scale on all ranges. The continuously-adjustable interpolating control is linear within 1%.

Cathode-Ray Tube—The T52P, a Tektronix crt, is used in the Type 525. The T52P 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. P1 phosphor is provided, although other phosphors are available upon request.

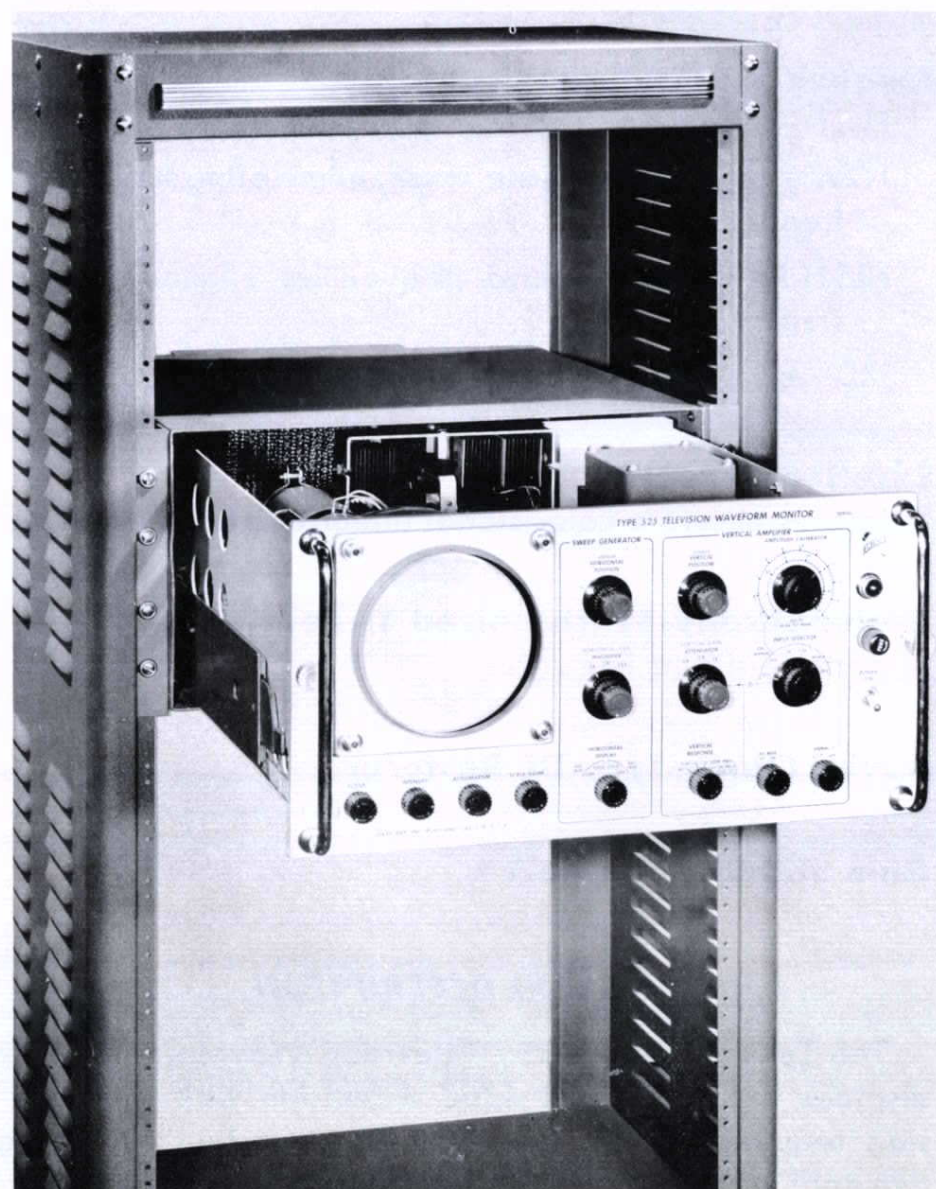
Regulated Power Supply—DC power supplies are regulated to maintain constant dc voltages for changes in load, and for ac input voltages between 105 and 125 volts, or 210 and 250 volts, 50 to 60 cycles.

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.

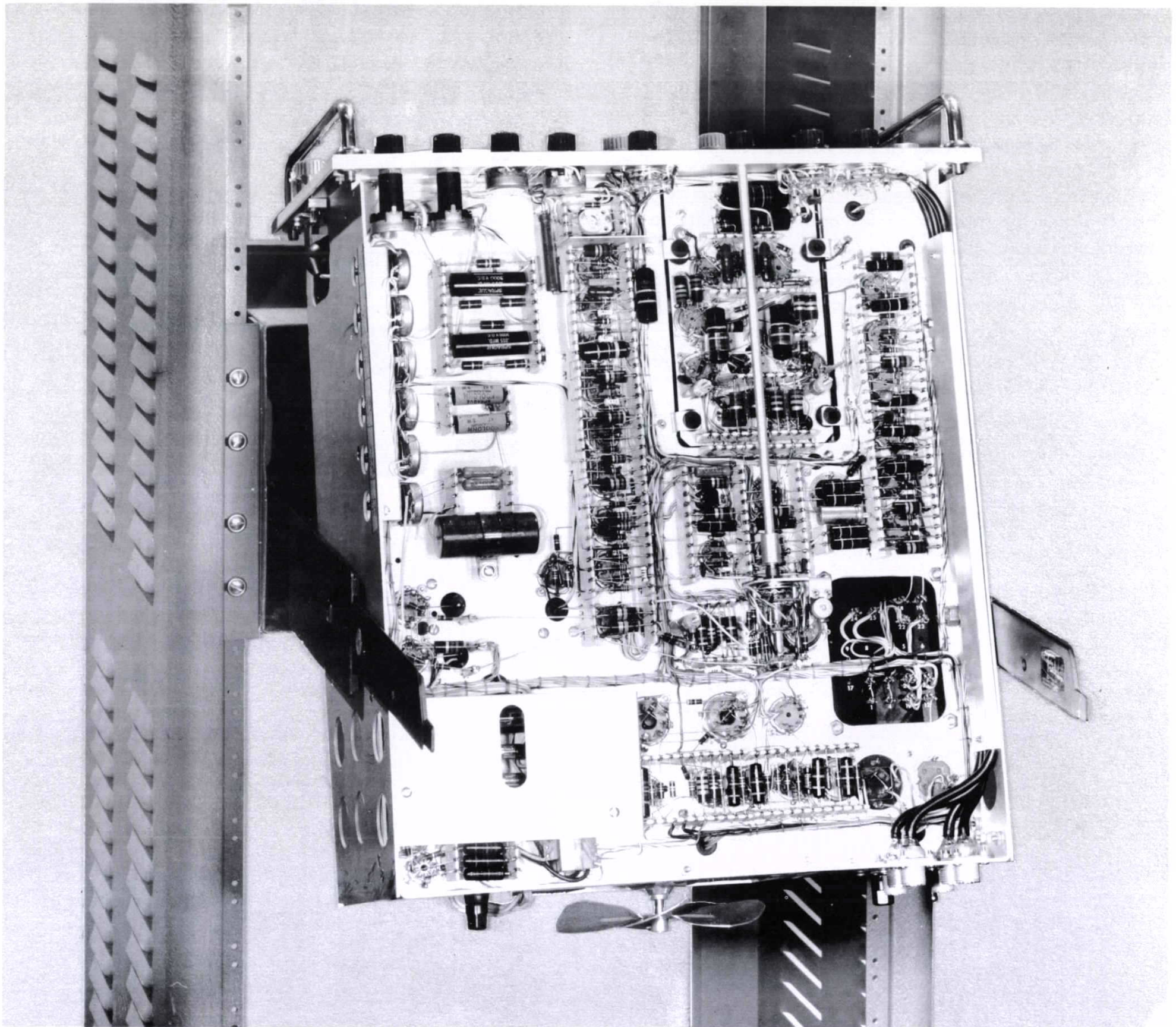
External Time Markers—A binding post, located at the rear of the instrument, is available for applying external time markers to the crt cathode.

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.



TYPE 525 TELEVISION WAVEFORM MONITOR



VACUUM TUBE COMPLEMENT

Vertical input cathode followers	12AT7	Disconnect and clamp diode	6AL5
Vertical phase splitter amplifier	2 6AU6	Clamp diode and unblanking CF	6BQ7A
Cathode followers	6BQ7A	Phantastron sweep generator	6AS6
Preamplifier	2 6CL6	Cathode followers	6BQ7A
Preamplifier output CF	6BQ7A	Sweep amplifier	6BQ7A
Cathode followers	6BQ7A	Cathode followers	6BQ7A
Cathode followers	6BQ7A	Sweep output amplifier	6BQ7A
Keyed-clamp diodes	2 6AL5	Cal multivibrator and CF	6BQ7A
High-pass amplifier	6BQ7A	Cal multivibrator and amplifier	6BQ7A
Cathode followers	6BQ7A	Calibrator clamp and CF	6BQ7A
Output amplifier	2 6CL6	Voltage reference tube	5651
Internal trigger inverter	6U8	Comparator	12AT7
External trigger inverter	6U8	Comparator	6U8
Sync-separator and relay control	6U8	Regulator amplifier and CF	6U8
Keying-pulse pickoff and shaper	6U8	Series regulator	12B4
Keying-pulse shaper and shaper-splitter ..	6BQ7A	Series regulator	6080
		High-voltage oscillator	6AQ5
		Voltage reference CF and regulator	12AU7

TYPE 525 TELEVISION WAVEFORM MONITOR

Comparator 6U8
High-voltage rectifiers 3 5642
Cathode-ray tube T52P1

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.

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, wrinkle-finished cabinet.

Type 525 **\$1050**

Includes: 1—F510-5 green filter (378503)
2—75-ohm termination resistors
1—Instruction manual

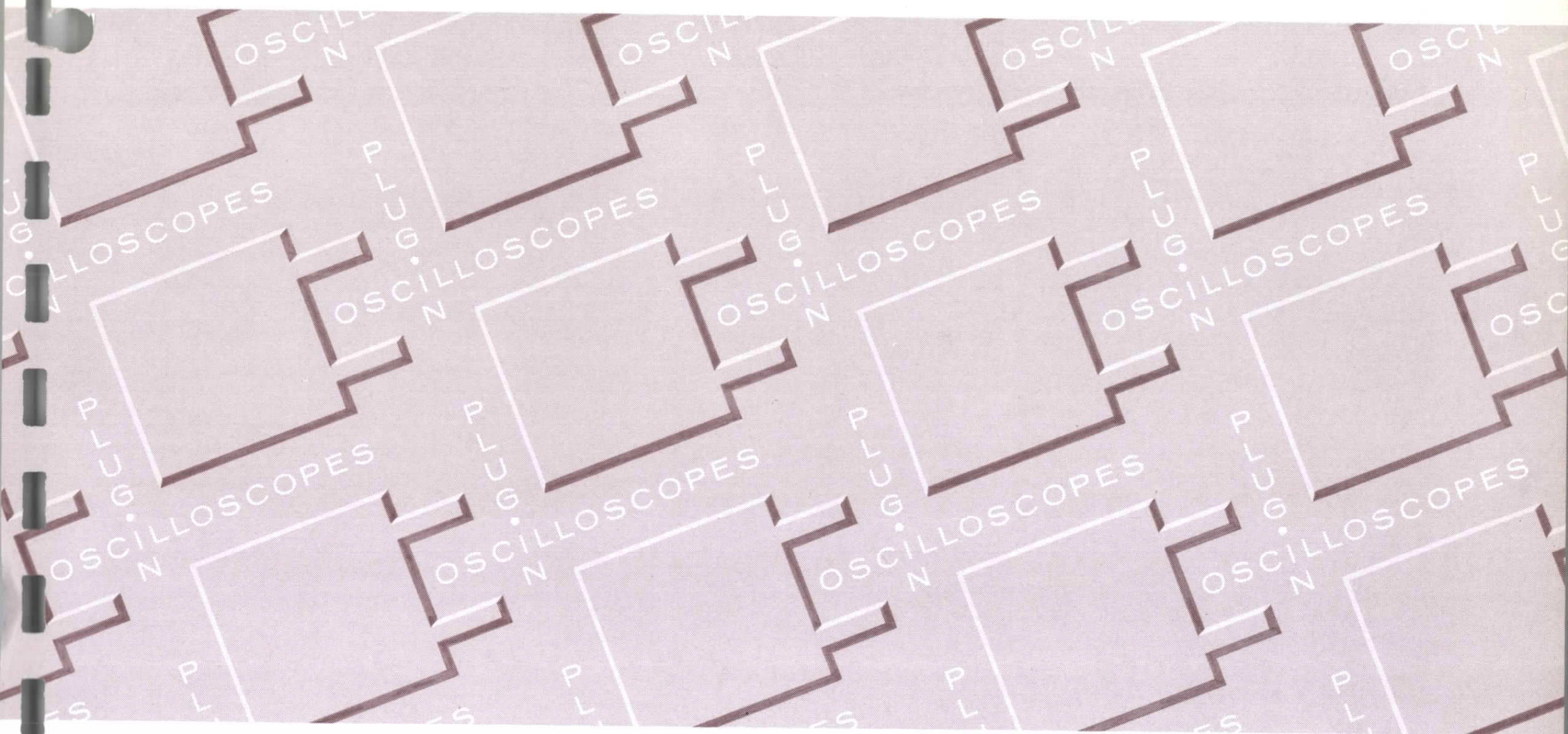
Currently Available Extras

P1 crt phosphor normally furnished.

P7, P11 optional No extra charge

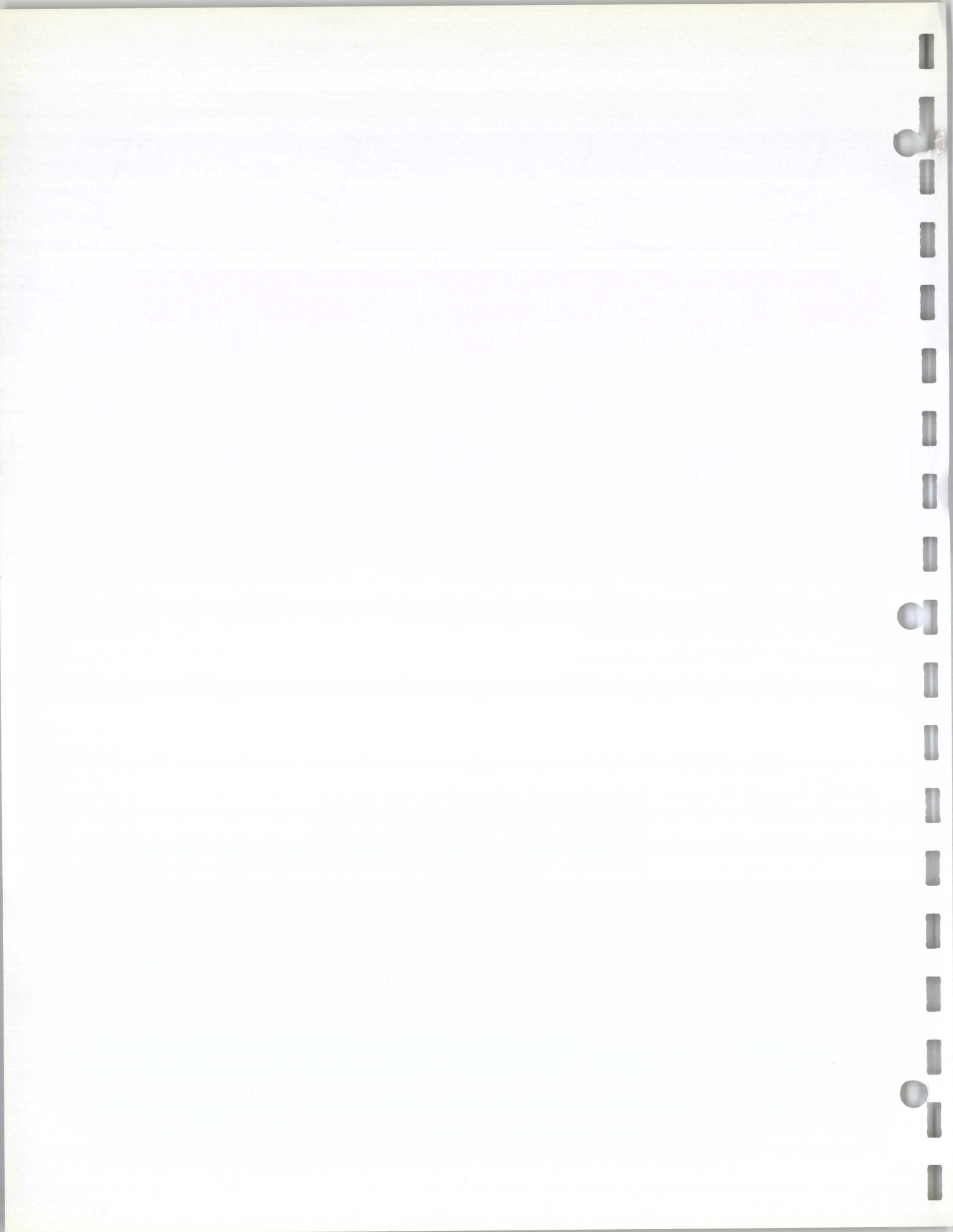
Price f.o.b. Portland, Oregon.





OSCILLOSCOPES with PLUG-IN PREAMPLIFIERS

Cathode-Ray Oscilloscopes in this section have the necessary basic characteristics for use, with one of the plug-in preamplifiers, as a general-purpose laboratory instrument. In addition, many specialized application areas can be entered with the same oscilloscope by plugging in the appropriate preamplifier.



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

6-cm Linear Vertical Deflection

Balanced Delay Network

Automatic Triggering

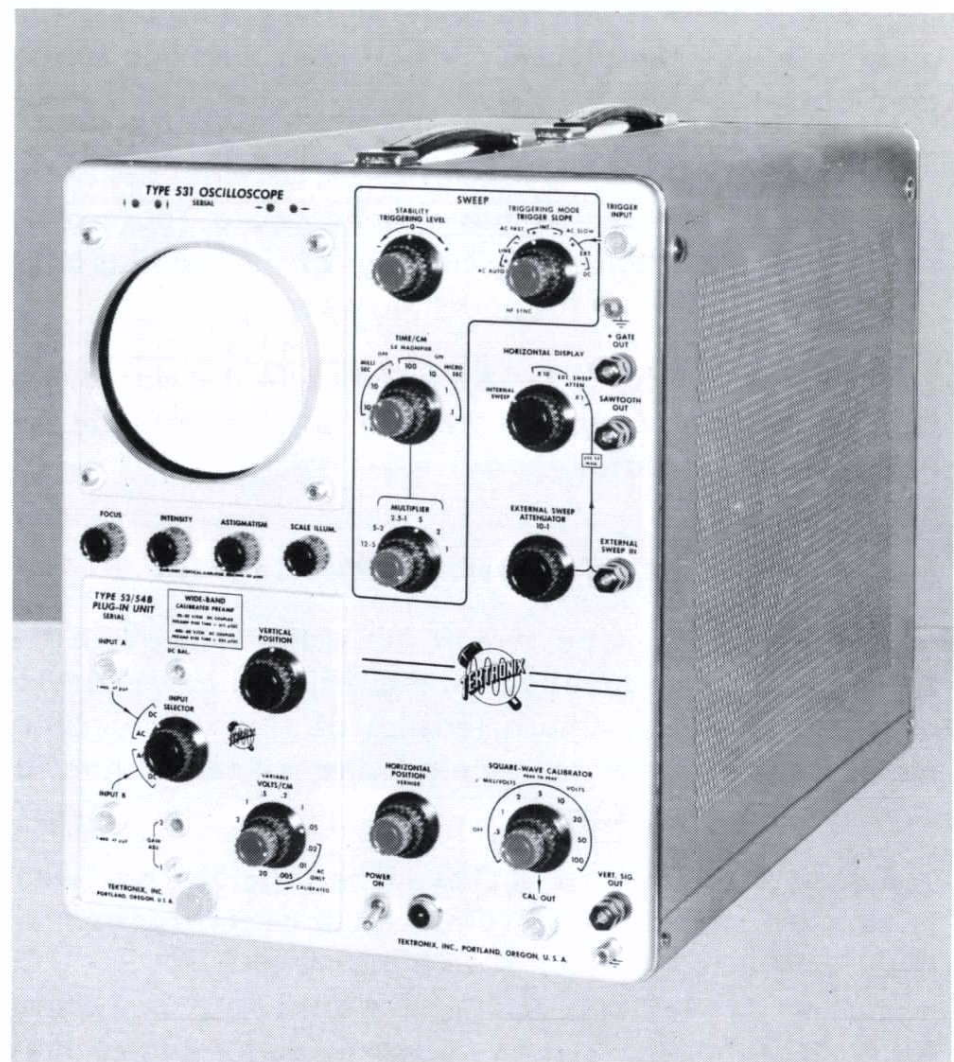
New Cabinet Design

GENERAL DESCRIPTION

The Type 531 is a wide-range laboratory oscilloscope capable of a great many specialized applications, in addition to its extended capabilities as an accurate time and amplitude measuring instrument in the dc-to-10 mc area. Basic specifications in sweep range, accelerating potential, and main vertical amplifier are such that a high degree of versatility is achieved with one of the general-purpose plug-in units. Seven plug-in vertical preamplifiers are available for conversion to possible future requirements.

A very practical initial combination is the Type 531 Oscilloscope with a Type 53/54C Dual-Trace Plug-In Unit. This arrangement covers both dual-trace and single-trace applications with passband requirements from dc to 10 mc at sensitivities as high as 0.05 v/cm . Later, if the need arises, additional plug-in units can be purchased at reasonable cost for wide-band high-gain, millivolt-sensitivity, microvolt-sensitivity, and dc-differential applications.

A new three-piece cabinet design eases access to the interior of the instrument. Either side of the cabinet can be lowered out of the way or quickly removed by merely releasing two quick-opening fasteners. When necessary,



calibration adjustments or tube replacements can be made without disconnecting the instrument or moving it from its operating position.

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 53/54A — DC to 10 mc — $0.035 \mu\text{sec}$.

Type 53/54B — DC to 10 mc — $0.035 \mu\text{sec}$, at 0.05 v/cm to 50 v/cm . . . 5 cycles to 9 mc— $0.04 \mu\text{sec}$, at 5 mv/cm to 0.05 v/cm .

Type 53/54C — DC to 10 mc — $0.035 \mu\text{sec}$.

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

Type 53/54E — 0.06 cycles to 60 kc.

TYPE 530-SERIES OSCILLOSCOPES

Type 53/54G — DC to 10 mc — 0.035 μ sec.

Type 53/54K — DC to 11 mc — 0.031 μ sec.

Please refer to specifications of individual plug-in units for sensitivity and other characteristics. Description of the plug-in units can be found in the catalog immediately following the plug-in oscilloscopes, and in a separate booklet.

Balanced Delay Network—A signal delay of 0.25 μ 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

A 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 μ sec/cm to 12 sec/cm.

Calibrated Sweep Rates—The Type 531 has twenty-four calibrated sweep rates. Main sweep control has eight positions—0.1, 1, 10, 100 μ 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 sweep rates. 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 continuously variable from 0.1 μ sec/cm to 12 sec/cm. Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%. The 5x magnifier applied to the 0.1- μ sec/cm sweep extends the calibrated sweep range to 0.02 μ sec/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 5x magnification is obtained on all ranges.

DC-Coupled Unblinking—DC coupling is provided for the unblinking waveform, assuring uniform bias on the cathode-ray tube for all sweep times and repetition rates.

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

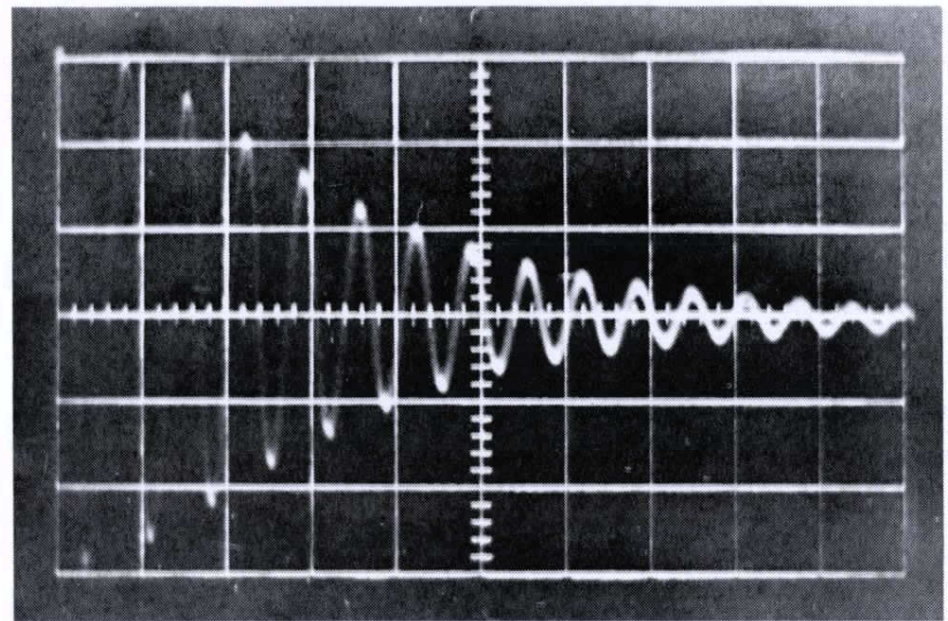
Automatic Triggering—A single switch position provides a convenient triggering arrangement for observation of a variety of signals differing in frequency, amplitude,

and shape. All recurrent signals from 60 cycles to 2 megacycles will automatically trigger the sweep, regardless of the positions of the stability and trigger-level 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. You can still select your trigger source and polarity when using the automatic-triggering mode.

High-Frequency Sync—When the TRIGGERING 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 25 or 30 mc.

Trigger Requirements—Internal triggering—a signal large enough to cause 2-mm deflection. External triggering—a signal of 0.2 v to 100 v.

Single-Sweep Recording



15-megacycle damped oscillation on single 0.1- μ sec/cm sweep shows 250-cm/ μ sec writing rate of the Type 531 Oscilloscope with a T51P11A crt. Recorded on 35-mm TRI-X film at f1.9 with 4.2 to 1 reduction, developed 26 minutes in D-19 at 68°F.

Trigger Selection—The TRIGGER SELECTOR is a concentric 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, automatic triggering, or high-frequency sync.

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 deflection factor continuously variable from 0.2 v/cm to 20 v/cm. Passband is dc to 240 kc. Input impedance is approximately 40 μ f paralleled by 1 megohm.

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 T51PA, a Tektronix cathode-ray tube, is used in the Type

TYPE 530-SERIES OSCILLOSCOPES

531. The T51PA 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.

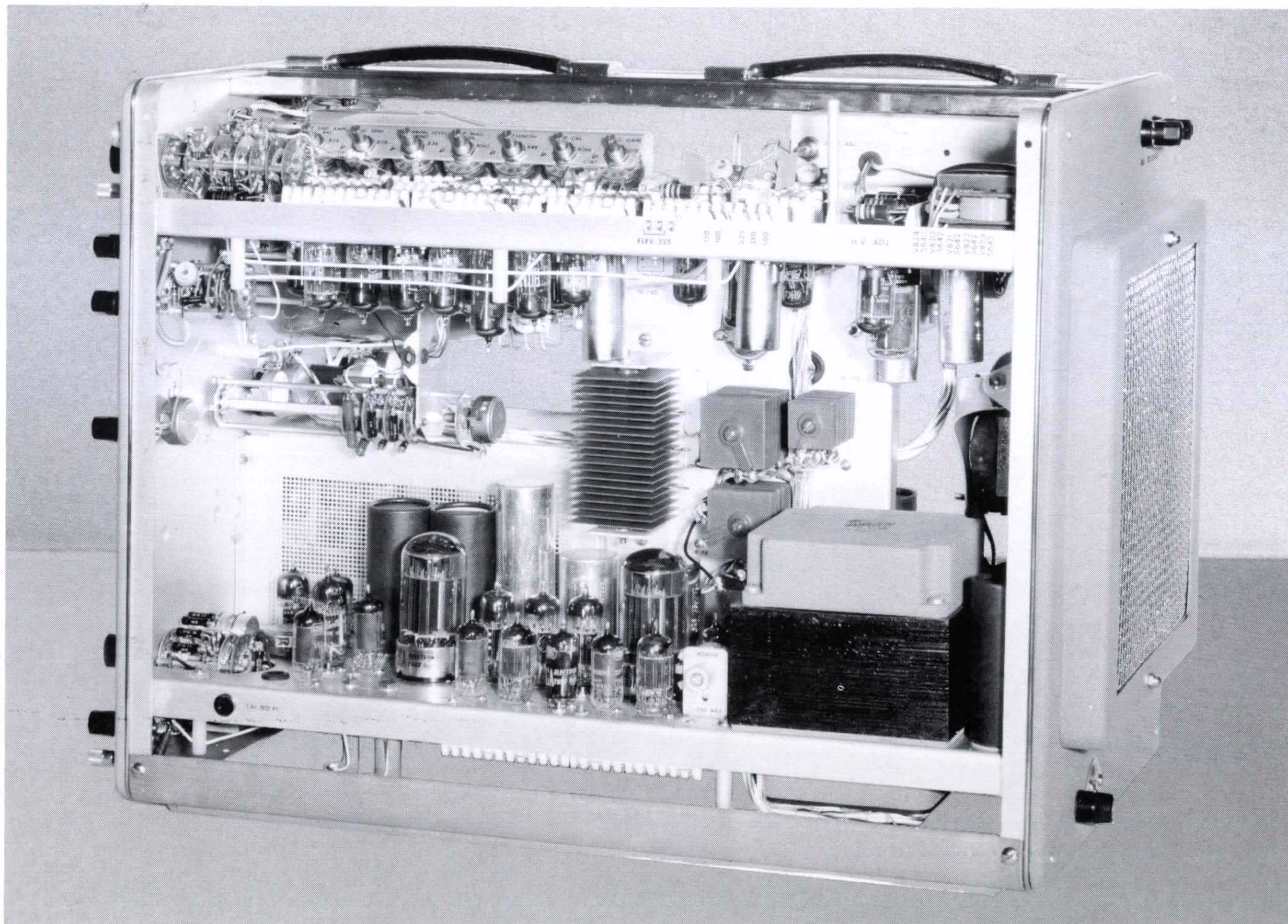
Output Waveforms—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-sawtooth waveform are available at front-panel binding posts via cathode followers. The vertical signal is brought out to a front-panel terminal for external applications.

Beam Position Indicators—Two pairs of indicator lights show 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
Internal trigger amplifier		6U8
Internal trigger CF		6BQ7A
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



TYPE 530-SERIES OSCILLOSCOPES

Internal trigger amplifier	6U8
Cal multivibrator	6U8
External horizontal amplifier CF	12AU7
Negative multivibrator	12BY7
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	T51P2A

MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and three-piece cabinet.

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

Dimensions—24" long, 13" wide, 16 3/4" high.

Weight—61 1/2 pounds.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 490 watts with Type 53/54C unit plugged in.

Type 531, without plug-in units \$995

- Includes:
- 2—P510A probes
 - 2—A510 binding-post adapters
 - 1—W530B test lead (012013)
 - 1—F510-5 green filter (378503)
 - 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

P400-Series Low-Capacitance Probes — For complete specifications please see the Catalog Accessory Section.

For special test accessories for this instrument, please see the Catalog Test Accessory Section.

Price f.o.b. Portland, Oregon.



TYPE 530-SERIES OSCILLOSCOPES

TYPE 535 CATHODE RAY OSCILLOSCOPE with Flexible Sweep Delay

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.

Accuracy

Range accuracy within 1%, incremental accuracy within 0.2% of full scale.

Trigger-Rate Source

10 cycles to 40 kc, continuously variable.

ALL OTHER MAJOR SPECIFICATIONS SAME AS TYPE 531

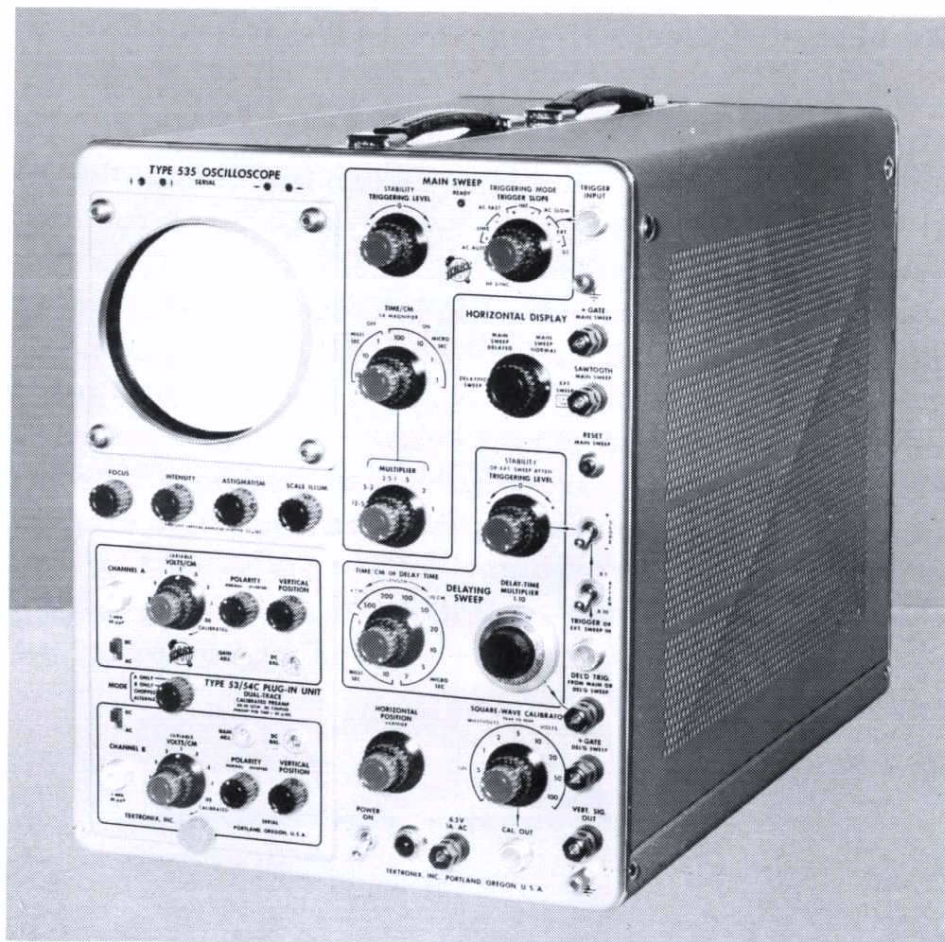
GENERAL DESCRIPTION

Main-unit vertical-amplifier risetime is 0.03 μ sec, sweep range is 0.02 μ sec/cm to 12 sec/cm, accelerating potential is 10 kv. Please refer to Type 531 section for detailed oscilloscope specifications.

DELAYED SWEEP

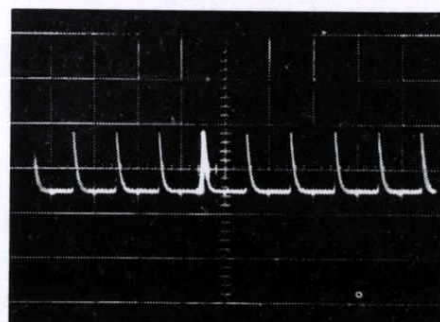
Two modes of operation permit use as a conventional delayed sweep, or as a triggered delayed sweep. In conventional operation the sweep starts immediately after the period of delay. In triggered operation the sweep does not start until it receives the first signal after the period of delay. Time-jitter 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



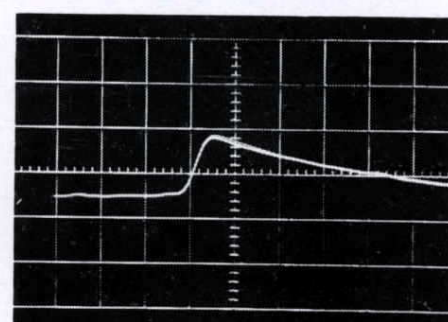
screen, the main sweep appears upon it as a section of increased brightness. With the signal applied to the delaying sweep, the main sweep may be ranged out or in, to position its start at the desired point. If the main sweep is adjusted to free-run, it will start exactly at this point. If it is adjusted for triggered operation, it will not start until the first trigger following this point is received.

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.

TYPE 530-SERIES OSCILLOSCOPES

A turn of the HORIZONTAL DISPLAY switch returns the main sweep to the screen, delayed by the selected amount.

Calibration—A calibrated step control and a ten-turn precision control cover the sweep delay continuously from 1 microsecond to 0.1 second. Twelve steps—2, 5, 10, 20, 50, 100, 200, 500 $\mu\text{sec}/\text{cm}$, 1, 2, 5, and 10 msec/cm —are accurate within 1%. Incremental accuracy of the precision variable control is within 0.2%. Delay time can be read either from the screen in time per centimeter, or from the calibrated controls in total time. For extreme accuracy, any of the twelve steps can be adjusted to the accuracy of an external standard.

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. An electrical signal from a remote location can be used instead of the RESET button to arm the sweep for one-shot operation.

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 40 kc are obtained by adjusting the duration of the free-running delaying sweep, and using it to trigger the main sweep, or to trigger an external device.

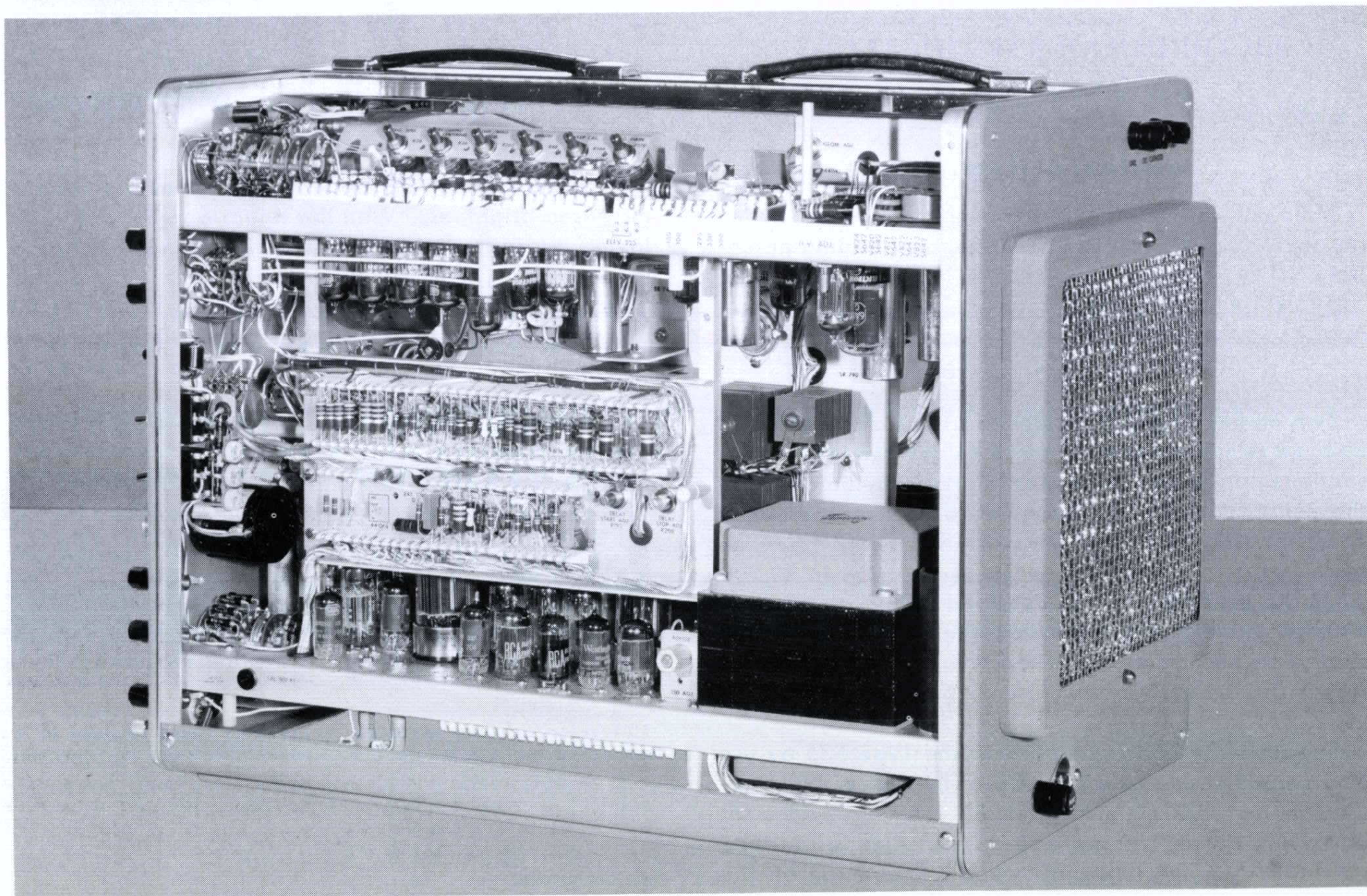
Delayed-Trigger Source—The delayed trigger, amplitude approximately 5 v, is derived from the main sweep or delaying sweep, depending upon the position of the HORIZONTAL DISPLAY switch. The delay is calibrated and is adjustable over the duration of the sweep sawtooth.

Other Available Waveforms—A positive gate from the delaying sweep at approximately 20-v amplitude is available at the front panel. 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 amp 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.

Horizontal Input Amplifier—The horizontal amplifier is the same as that in the Type 531, with the input capacitance standardized at 47 μf .



TYPE 530-SERIES OSCILLOSCOPES

OTHER CHARACTERISTICS

All other characteristics are identical to those of the Tektronix Type 531 Cathode-Ray Oscilloscope described in the preceding pages.

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		12BY7
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
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		T51P2A

MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and three-piece cabinet.

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

Dimensions—24" long, 13" wide, 16 3/4" high.

Weight—65 lbs.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 540 watts with Type 53/54C unit plugged in.

Type 535, without plug-in units.....\$1300

- Includes: 2—P510A probes
 2—A510 binding-post adapters
 1—W530B test lead (012013)
 1—F510-5 green filter (378503)
 1—Instruction manual

Currently Available Extras

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

Recommended Additional Accessories

P400-Series Low-Capacitance Probes — For complete specifications please see the Catalog Accessory Section.

For special test accessories for this instrument, please see the Catalog Test Accessory Section.

Price f.o.b. Portland, Oregon.



TYPE 730-SERIES OSCILLOSCOPES

These oscilloscopes are designed for the measurement of waveforms in the frequency range of 0.1 to 100 MHz. They are available in a variety of models to meet the needs of different applications.

The Type 730-Series Oscilloscopes are designed for the measurement of waveforms in the frequency range of 0.1 to 100 MHz. They are available in a variety of models to meet the needs of different applications.

TYPE 530-SERIES OSCILLOSCOPES

TYPE 536 CATHODE-RAY OSCILLOSCOPE

Wide-Band Identical Amplifiers

Vertical and horizontal amplifier risetime— $0.03 \mu\text{sec}$.

Wide Range of Amplifier Characteristics

Versatility through Plug-In Units.

Linear Deflection

10 divisions vertical and horizontal.

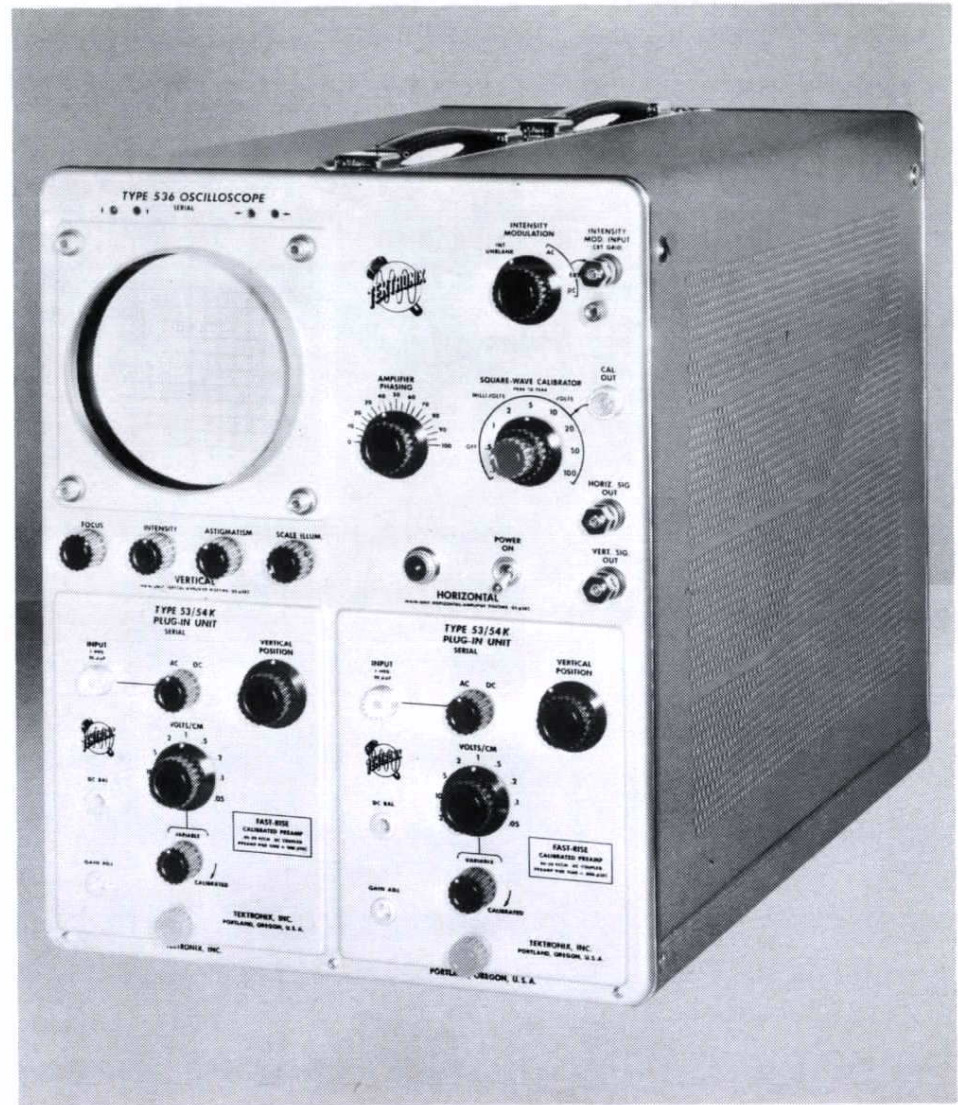
Accurate Phase Measurements

Relative phase shift of amplifiers is within 1 degree.
Front-panel control provides balance at any frequency from dc to 20 mc.

General-Purpose Utility

Plug-In Time-Base Generator available for horizontal deflection.

Beam-Position Indicators



TENTATIVE SPECIFICATIONS

REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY AUGUST, 1957

GENERAL DESCRIPTION

The Type 536 Oscilloscope has identical wide-band amplifiers. Through use of plug-in preamplifiers and wide-range plug-in sweep generator, the Type 536 can be used in the same manner as any wide-band general-purpose oscilloscope. But by using plug-in preamplifiers for both vertical and horizontal deflection systems, the Type 536 Oscilloscope is immediately available for phase-measurement studies requiring extreme accuracies. Phase measurements at frequencies up to 20 mc are possible with this instrument. Characteristics of this basic oscilloscope with its dual-plug-in feature make it adaptable to a wide range of laboratory applications.

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.

Any one of the Type 53 or 53/54 Plug-In Preamplifiers can be used in the vertical amplifier of the Type 536. One of the preamplifiers must be plugged in to make the vertical deflection system function.

Type 536 passband and risetime with the following plug-in units:

Type 53/54A—DC to 10 mc, $0.035 \mu\text{sec}$.

Type 53/54B—DC to 10 mc, $0.035 \mu\text{sec}$ at 0.05 v/div to 50 v/div. . . . 2 cycles to 9 mc, $0.04 \mu\text{sec}$ at 0.005 v/div to 0.05 v/div.

Type 53/54C—DC to 10 mc, $0.035 \mu\text{sec}$.

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

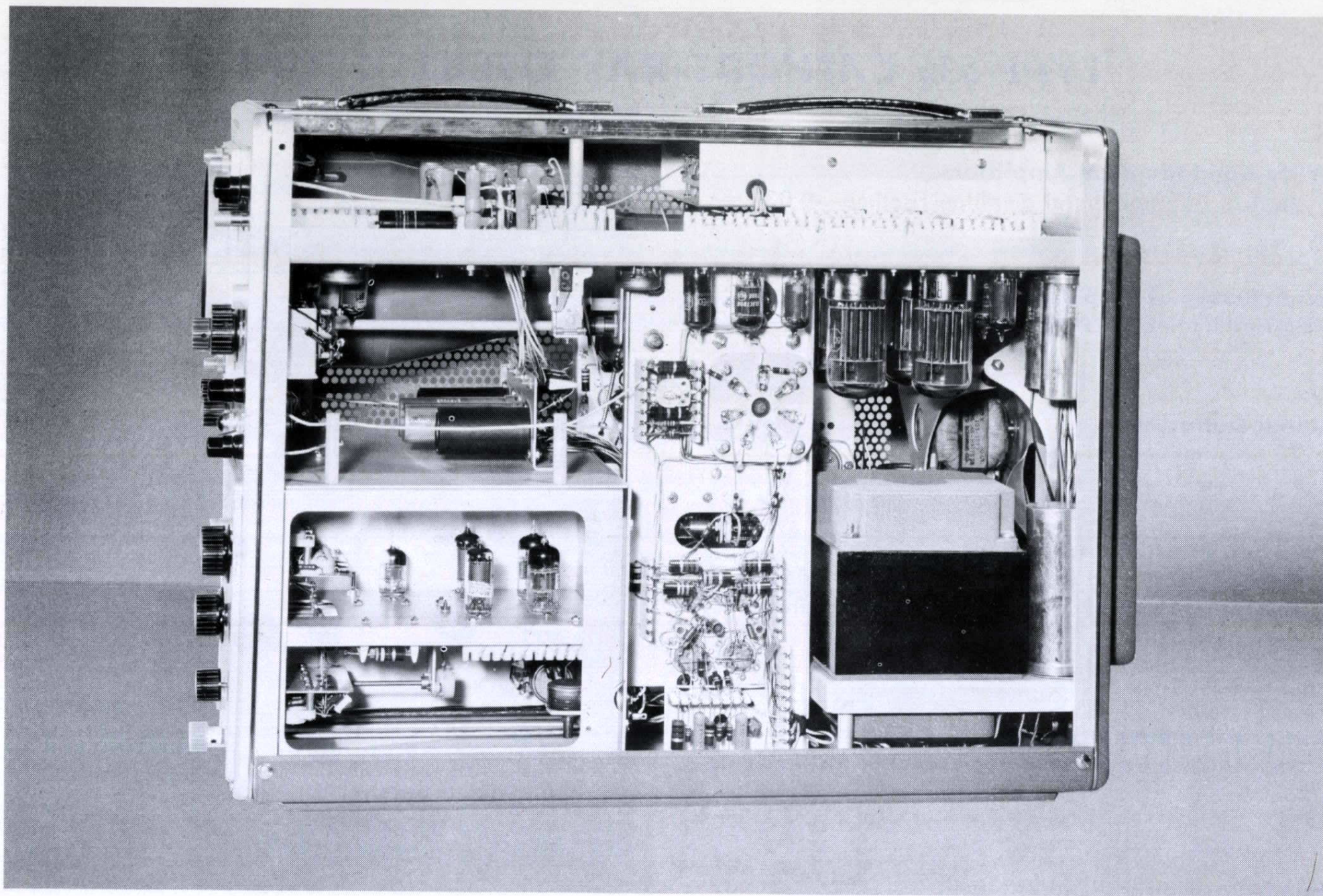
Type 53/54E—0.06 cycles to 60 kc.

Type 53/54G—DC to 10 mc, $0.035 \mu\text{sec}$.

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

Please refer to specifications of individual plug-in units for sensitivity and other characteristics. Descriptions of the plug-in units can be found immediately following the plug-in oscilloscopes.

TYPE 530-SERIES OSCILLOSCOPES



TENTATIVE SPECIFICATIONS

REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY AUGUST, 1957

HORIZONTAL DEFLECTION SYSTEM

DC-Coupled Output Amplifier—The horizontal amplifier system is identical to the vertical amplifier. Rise-time is $0.03 \mu\text{sec}$. For conventional oscilloscope operation, the Type 53/54T Time-Base Generator must be plugged into the horizontal system. Specifications of the Type 536 horizontal deflection system with the Type 53/54T Unit are as follows:

Calibrated Sweep Rates—Twenty-two sweep rates from $0.2 \mu\text{sec/div}$ to 2 sec/div .

5x Sweep Magnifier—Increases calibrated sweep rate to $0.04 \mu\text{sec/div}$.

Versatile Trigger Selection—Positive or negative slope, external or line voltage, ac or dc-coupling through triggering circuits.

Automatic Triggering—Stable triggering regardless of shape, frequency, or amplitude or triggering waveform.

High-Frequency Sync—Synchronizes with sine-wave signals in frequency range of 5 mc to 15 mc.

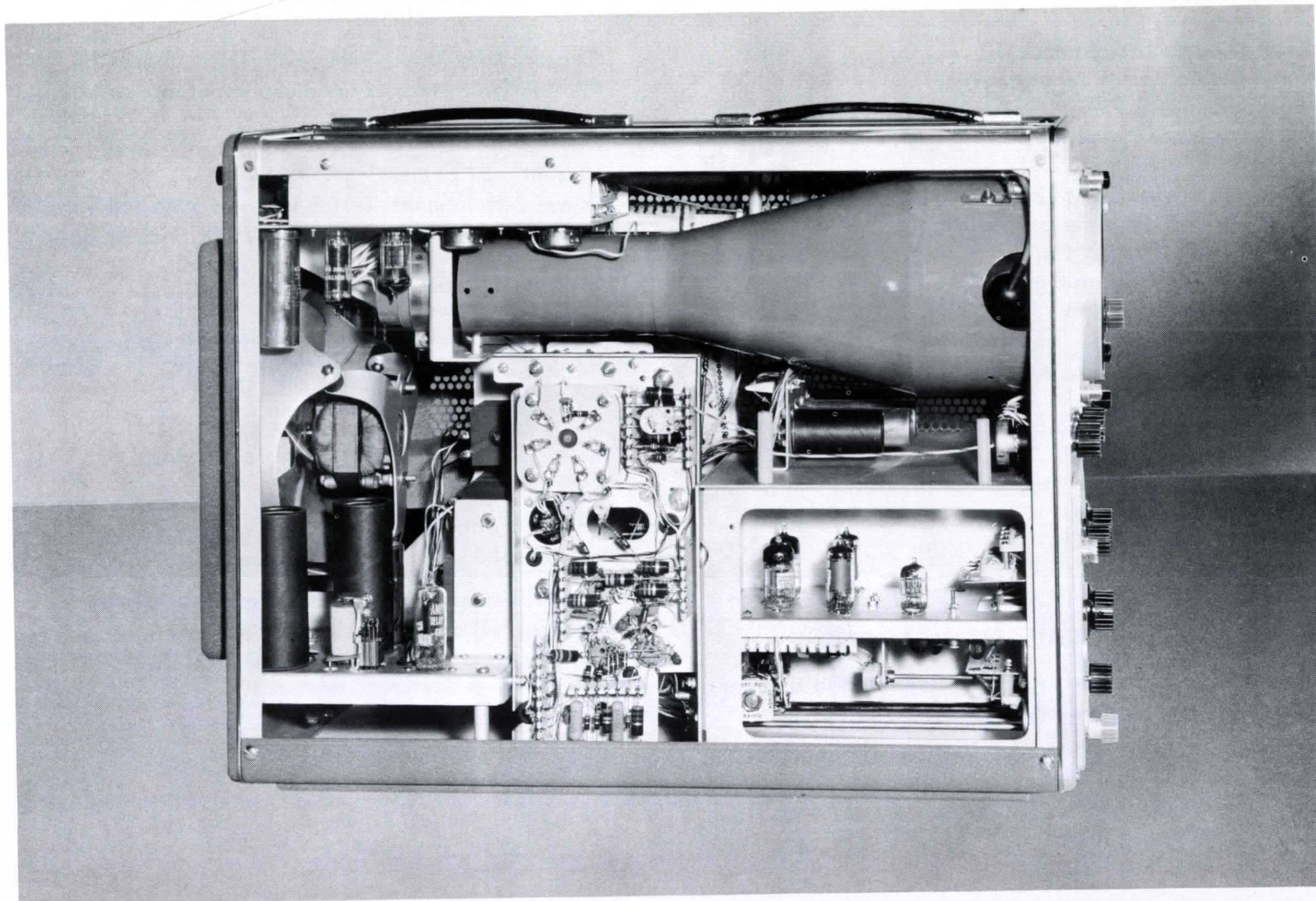
Please refer to specifications of the Type 53/54T Time-Base Generator for complete specifications.

All characteristics of the horizontal deflection system are the same as those of the vertical deflection system when the same type of Plug-In Preamplifier is plugged into both systems. Descriptions of all Type 53/54 Plug-In Units can be found immediately following the plug-in oscilloscope descriptions.

OTHER CHARACTERISTICS

Phasing Adjustments—Relative phase shift of the deflection amplifiers with Type 53/54K Plug-In Preamplifiers is less than 1 degree from dc to 10 mc. Phase-shift balance of both amplifiers can be obtained at any one frequency from dc to 20 mc with a front-panel AMPLIFIER PHASING control.

TYPE 530-SERIES OSCILLOSCOPES



TENTATIVE SPECIFICATIONS

REGULAR PRODUCTION AND INITIAL SHIPMENT
 EXPECTED TO BEGIN APPROXIMATELY AUGUST, 1957

Cathode-Ray Tube—A Tektronix cathode-ray tube, T56P, is used in the Type 536. Deflection factor is approximately the same for both horizontal and vertical deflection plates. The T56P crt provides a 10-by-10 division ($3\frac{1}{8}$ " x $3\frac{1}{8}$ ") viewing area. Accelerating potential is approximately 4 kv. For best results over the wide sweep range, 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 units.

Amplitude Calibrator—A square-wave voltage is available through a front-panel coaxial connector. Eighteen fixed voltage 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.

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

Output Waveforms—The vertical and horizontal signals are brought out to front-panel terminals for external applications.

Intensity Modulation—A front-panel switch selects the desired method of intensity modulation. Internal dc-coupled unblanking or external ac or dc-coupling to the crt grid is possible.

Illuminated Graticule—An edge-lighted graticule is marked in 10 by 10 divisions with one-fifth division baseline markings. Illumination can be adjusted by a front-panel control.

VACUUM TUBE COMPLEMENT

Vertical input amplifiers	2	12BY7
Cathode followers	2	6BQ7A



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TYPE 530-SERIES OSCILLOSCOPES

Vertical output amplifiers	5894
Beam position amplifier and vertical signal out CF	6BQ7A
Horizontal input amplifier 2	12BY7
Cathode followers 2	6BQ7A
Horizontal output amplifiers	5894
Beam position amplifier and horizontal signal out CF	6BQ7A
Calibrator multivibrator and CF	6BQ7A
Calibrator multivibrator	6AU6
Voltage reference	5651
Comparators 2	12AX7
Regulator amplifiers 4	6AU6
Series regulators 4	6080
High-voltage oscillator	6AQ5
Shunt regulator and dc comparator	12AU7
High-voltage rectifiers 3	5642
Intensity modulation CF	6BQ7A
Cathode-ray tube	T56P2

MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and cabinet.
 Finish—Photo-etched anodized panel and wrinkle-finished cabinet.
 Dimensions—24" long, 13" wide, 16 3/4" high.
 Weight—57 pounds.
 Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 625 watts with two Type 53/54K Units plugged in.

Type 536, without plug-in units \$995

- Includes: 2—P510A Probes
 2—A510 binding-post adapters
 1—W530-B test lead (012-013)
 1—F510-5 green filter (378-503)
 1—Instruction manual

Currently Available Extras

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

Recommended Additional Accessories

For special test accessories for this instrument, please see the Test Accessory Section.

Price f.o.b. Portland, Oregon.

TENTATIVE SPECIFICATIONS

. REGULAR PRODUCTION AND INITIAL SHIPMENT
 EXPECTED TO BEGIN APPROXIMATELY AUGUST, 1957



TYPE 530-SERIES OSCILLOSCOPES

TYPE 532 CATHODE-RAY OSCILLOSCOPE

Designed for Extra Dependability

Wide Sweep Range

0.2 $\mu\text{sec/cm}$ 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

8-cm Linear Vertical Deflection

DC-Coupled Unblinking

Vertical Beam-Position Indicators

New Cabinet Design



GENERAL DESCRIPTION

The Tektronix Type 532 is designed for users who do not need the high-speed sweeps, high writing rate, and wide passband of the Type 531. Simplified circuitry eases vacuum-tube loading, lower accelerating potential reduces possibility of screen damage at very-slow sweep speeds and makes possible greater linear vertical deflection. The Type 532 has all the precision and stability you expect in Tektronix oscilloscopes. Signal-handling versatility of the Type 53 and Type 53/54 Plug-In Units is available in the Type 532, within the dc-to-5 mc passband of its main vertical amplifier. It is an instrument that will give lasting satisfaction in the many laboratory applications within its capabilities.

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 Preampifiers. The passband of the Type 532 is less than 3 db 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 deflection factor is 0.1 v/cm with balanced input.

In order to operate the Type 532, one of the preamplifiers must be plugged in.

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

- Type 53/54A—dc to 5 mc, 0.07 μsec .
- Type 53/54B—dc to 5 mc, 0.07 μsec .
- Type 53/54C—dc to 5 mc, 0.07 μsec .
- Type 53/54D—dc to 350 kc at 1 mv/cm, increasing to 2 mc as sensitivity is decreased to 50 mv/cm.
- Type 53/54E—0.06 cycles to 60 kc.
- Type 53/54G—dc to 5 mc, 0.07 μsec .
- Type 53/54K—dc to 5 mc, 0.07 μsec .

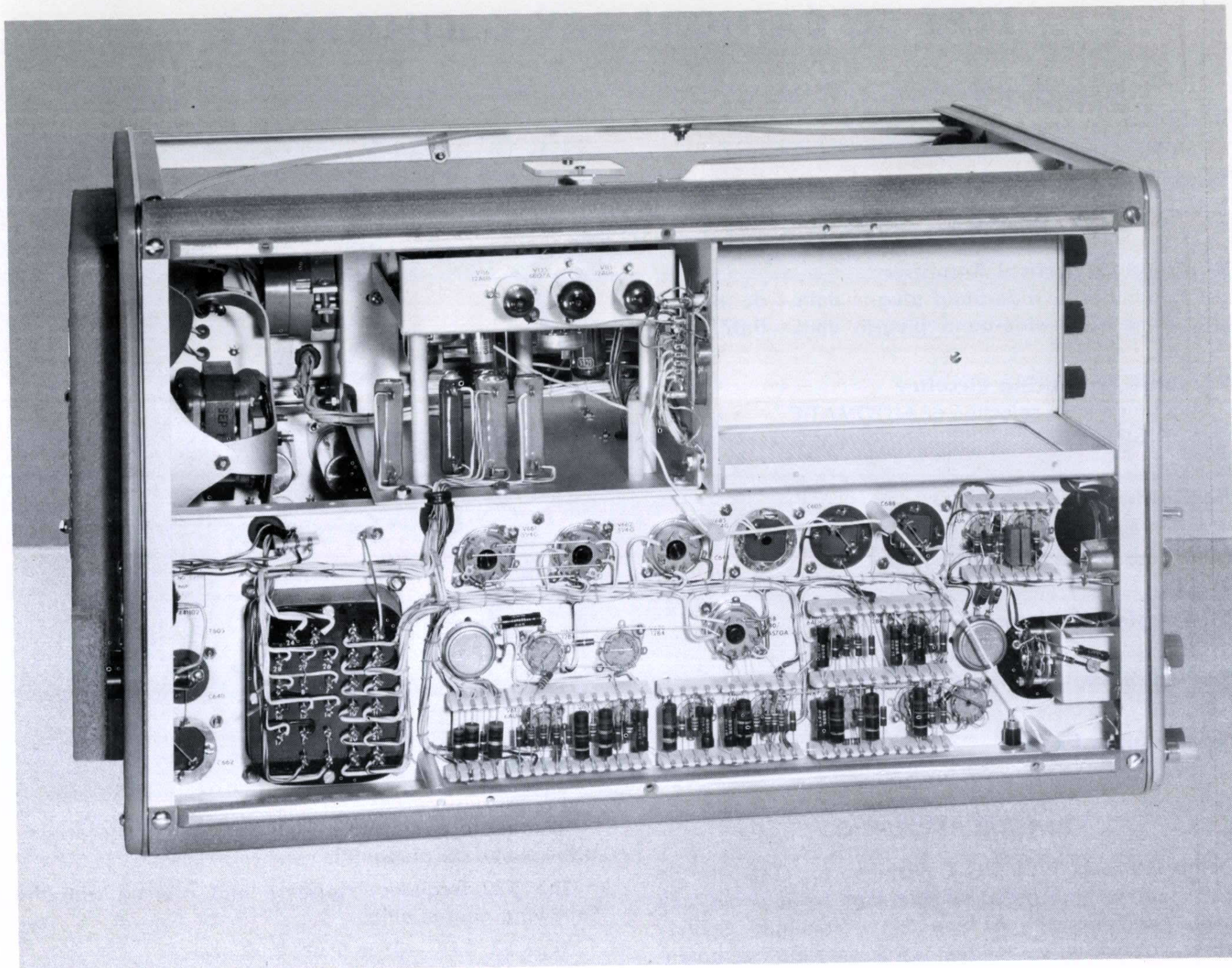
Direct Input to CRT—An aperture in the side of the cabinet permits direct connection to the crt deflection plates.

HORIZONTAL DEFLECTION SYSTEM

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

Calibrated Sweep Rates—The Type 532 has twenty-one calibrated sweep rates. The main sweep control has seven positions; 1, 10, 100 $\mu\text{sec/cm}$, . . . 1, 10, 100 millisecc/cm, . . . 1 sec/cm. Three multiplier switch positions of 1, 2, and 5 for each of the main sweep steps provide a

TYPE 530-SERIES OSCILLOSCOPES



total of 21 calibrated sweep rates. The remaining three positions on the multiplier switch of 1 to 2.5, 2 to 5, and 5 to 12 provide continuously variable sweep rates from $1 \mu\text{sec}/\text{cm}$ to $12 \text{ sec}/\text{cm}$. Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%. The 5x magnifier applied to the $1 \mu\text{sec}/\text{cm}$ sweep extends the calibrated sweep range to $0.2 \mu\text{sec}/\text{cm}$.

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. Accuracy is within 3% except on the $1 \mu\text{sec}/\text{cm}$ range, where accuracy is within 5%.

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—A single switch position provides a convenient triggering arrangement for observation of a variety of signals differing in frequency, amplitude, and shape. All recurrent signals from 60 cycles to 2 megacycles will automatically trigger the sweep, regardless of the position of the trigger-level control. In the absence of an input signal the stability control can be adjusted to automatically trigger the sweep at about a 50-cycle rate, providing a reference trace on the crt screen. You can still select your trigger source and polarity when using the automatic-triggering mode.

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.

TYPE 530-SERIES OSCILLOSCOPES

Trigger Requirements—Internal triggering—a signal large enough to cause 2 mm deflection. External triggering—a signal of 0.2 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 deflection factor continuously variable from 0.2 v/cm to approximately 15 v/cm. Passband is dc to 300 kc. Input impedance is approximately 40 $\mu\mu\text{f}$ paralleled by 1 megohm.

Delayed Gate—A delayed gate voltage of approximately 20 v amplitude is available at the front panel. The amount of delay from the start of the sweep is continuously adjustable throughout the sweep duration.

OTHER CHARACTERISTICS

Cathode-Ray Tube—4-kv accelerating potential is applied to the 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.

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 positive-gate voltage of the same duration at the sweep, the positive-going sweep sawtooth waveform, and a positive delayed gate. The vertical signal is brought out to a front-panel terminal for external applications.

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 Plug-In 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 amplifier and internal trigger CF		6BQ7A

Vertical signal out		6AU6
Trigger amplifier		6U8
Trigger shaper		6U8
Positive multivibrator and CF		6BQ7A
Negative multivibrator		6AU6
Sweep generator		6AU6
Sweep generator CF and hold-off CF		6BQ7A
Disconnect diodes		6AL5
Sweep hold-off CF and stability CF		6BQ7A
Gate out CF and dual-trace trigger amplifier		6AN8
Sawtooth out CF and delayed gate out CF		12AU7
Delayed gate pickoff	2	6AU6
External sweep amplifier		6BQ7A
Cathode follower and driver CF		6BQ7A
Sweep output amplifier		6BQ7A
Calibrator multivibrator and CF		6BQ7A
Calibrator multivibrator		6AU6
Rectifiers	5	5V4
Voltage reference		5651
Comparators	2	12AX7
Regulator amplifiers	4	6AU6
Series regulators	4	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 three-piece cabinet.

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

Dimensions—24" long, 13" wide, 16 3/4" high.

Weight—52 pounds.

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

Type 532, without plug-in units. \$825

- Includes: 2—P510A probes
- 2—A510 binding-post adapters
- 1—W530-B test lead (012013)
- 1—F510-5 green filter (378503)
- 1—Instruction manual

Currently Available Extras

P2 phosphor normally furnished.

P1, P7, P11 optional. No extra charge

Other phosphors can be furnished on special order.

Recommended Additional Accessories

For special test accessories for this instrument, please see the Catalog Test Accessory Section.

Price f.o.b. Portland, Oregon.



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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 $\mu\text{sec/cm}$ 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 0.2 μsec Delay Network

New Cabinet Design

GENERAL DESCRIPTION

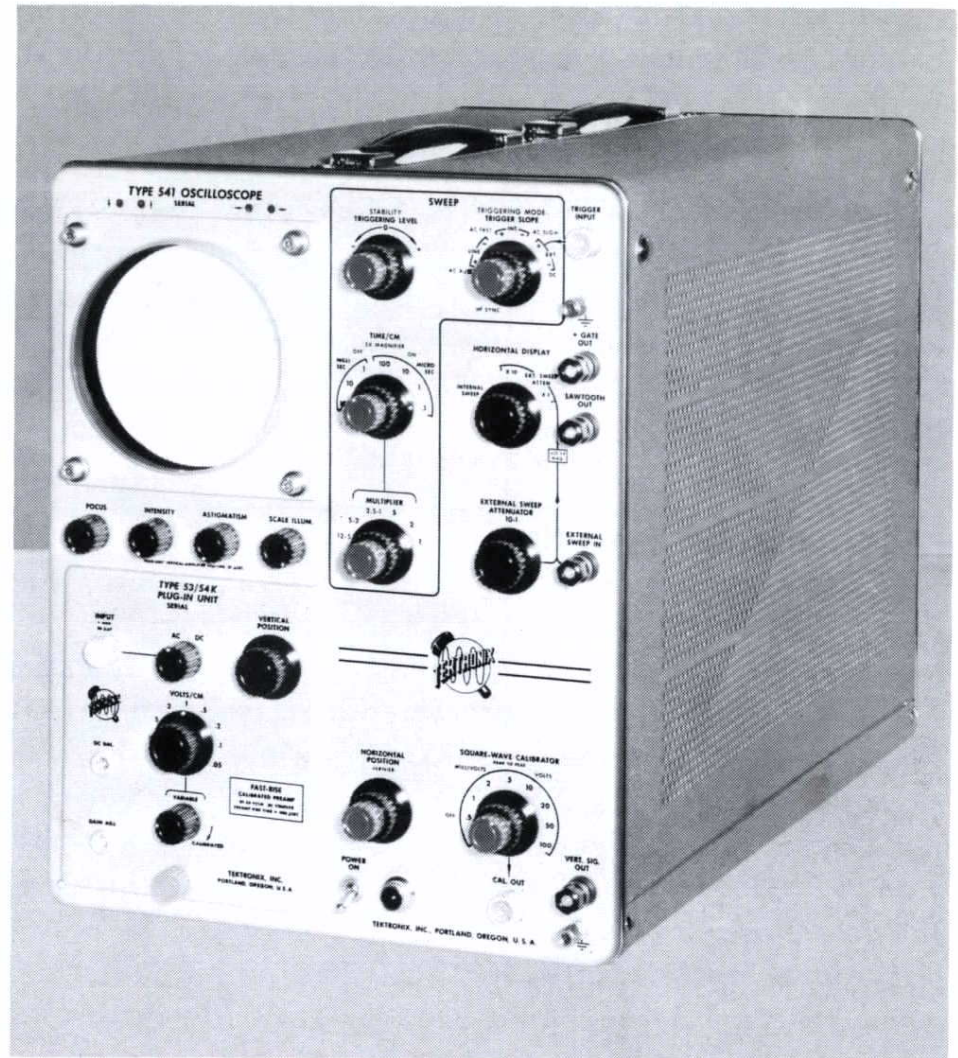
The Tektronix Type 541 is a high-speed laboratory oscilloscope with performance capabilities far above any previous oscilloscope of its size and cost. In combination with the Type 53/54K Plug-In Unit, the Type 541 offers a vertical-amplifier passband of dc to 30 mc and a risetime of 12 millimicroseconds, 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 53/54K Fast-Rise Plug-In Preamplifier, developed for Type 541 and Type 545 Oscilloscopes, provides a maximum deflection factor of 0.05 v/cm, with 12-millimicrosecond risetime, dc-to-30 mc passband, and 20- $\mu\mu\text{f}$ input capacitance. (Frequency response is down 3 db $\pm 1/2$ db at 30 mc, 6 db at approximately 41 mc, 12 db at approximately 55 mc.)

The Type 541 vertical deflection system is designed to be used with any of the Type 53/54 Plug-In Preampli-



fiers. In order to operate the Type 541, one of the preamplifiers must be plugged in.

Type 541 vertical response with the following plug-in units:

Type 53/54A — dc to 20 mc, 0.018- μsec risetime.

Type 53/54B — dc to 20 mc, 0.018- μsec risetime at 0.05 v/cm to 50 v/cm. . . 5 cycles to 12 mc, 0.03- μsec risetime at 5 mv/cm to 0.05 v/cm.

Type 53/54C — dc to 24 mc, 0.015- μsec risetime.

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

Type 53/54E — 0.06 cycles to 60 kc.

Type 53/54G — dc to 20 mc, 0.018- μsec risetime.

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

Probes—Two P410 low-capacitance probes are supplied with the instrument. Input capacitance of the Type 541-Type 53/54K combination with the P410 probe is 8 $\mu\mu\text{f}$, maximum deflection factor 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 12 $\mu\mu\text{f}$ at 5x, 5.5 $\mu\mu\text{f}$ at 20x, and 2.5 $\mu\mu\text{f}$ at 50x attenuation.

TYPE 540-SERIES OSCILLOSCOPES

Balanced Delay Network—A signal delay of 0.2 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.

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 Sweep Rates—The Type 541 has twenty-four calibrated sweep rates. 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 sweep rates. 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 . Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%. 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—A single switch position provides a convenient triggering arrangement for observation of a variety of signals differing in frequency, amplitude, and shape. All recurrent signals from 60 cycles to 2 megacycles will automatically trigger the sweep, regardless of the positions of the stability and trigger-level con-

trols. 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. You can still select your trigger source and polarity when using the automatic-triggering mode.

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 a 2-mm deflection. External triggering—a signal of 0.2 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 deflection factor continuously variable from 0.2 v/cm to approximately 15 v/cm. Passband is dc to 240 kc. Input impedance is approximately 40 μmf paralleled by 1 megohm.

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 20-v positive gate voltage of the same duration as the sweep, and a 150-v 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.

TYPE 540-SERIES OSCILLOSCOPES

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

MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and three-piece cabinet.

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

Dimensions—24" long, 13" wide, 16 3/4" high.

Weight—61 1/2 pounds.

Power Requirements—105-125 v or 210-250 v 50-60 cycles, 520 watts with Type 53/54C Unit plugged in.

Type 541, without plug-in units \$1145

Includes: 2—P410 probes
 2—A510 binding-post adapters
 1—W530B test lead (012013)
 1—F510-5 green filter (378503)
 1—Instruction manual

Currently Available Extras

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

Recommended Additional Accessories

Low Capacitance Accessory Probes—for use with wide-band Plug-In Units. These probes preserve the excellent transient response, introducing no overshoot or ringing, but cause an additional frequency-response loss of approximately 1 db at 30 mc.

Probe	Attenuation Ratio	INPUT IMPEDANCE		Price
		Resistance (Megohms)	Capacitance Minimum* Maximum†	
P405	5:1	5	12 μμf 19 μμf	\$10.50
P410	10:1	10	8 μμf 11 μμf	10.50
P420	20:1	10	5.5 μμf 7 μμf	10.50
P450-L	50:1	10	2.5 μμf	12.50
P4100	100:1	10	2.5 μμf	12.50

*When connected to instruments with 20-μμf input capacitance.

†When connected to instruments with input capacitances up to 50 μμf.

P510A Probe—This probe should be used in place of the low-capacitance probes when the more-sensitive plug-in units—Type 53/54B and Type 53/54D—are used with the Type 541. Please see the Catalog Accessory Section for complete specifications.

For special test accessories for this instrument, please see the Catalog Test Accessory Section.

Prices f.o.b. Portland, Oregon.



TYPE 340 SERIES OPTICAL COPIES

1. The first step in the process is to identify the document to be copied.

2. The document is then placed in the copier and the appropriate settings are selected.

3. The copier then scans the document and creates a digital copy.

4. The digital copy is then stored on a hard drive or other storage device.

5. The digital copy can then be used for a variety of purposes, such as printing or sharing.

6. The copier also has a built-in printer, so you can print a hard copy of the document.

7. The copier is easy to use and has a large touch screen for navigation.

8. The copier is also very quiet and has a compact design.

9. The copier is a great addition to any office or home.

10. The copier is available in a variety of colors and finishes.

11. The copier is a great investment for anyone who needs to copy documents.

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TYPE 540-SERIES OSCILLOSCOPES

TYPE 545 CATHODE-RAY OSCILLOSCOPE with Flexible Sweep Delay

Wide-Range Calibrated Sweep Delay

1 μ sec 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 1%, incremental accuracy within 0.2% of full scale.

Trigger Rate Source

10 cycles to 40 kc, continuously variable.

All other major specifications same as Type 541.

GENERAL DESCRIPTION

Main-unit vertical-amplifier risetime is 10 millimicroseconds, sweep range is 0.02 μ sec/cm to 12 sec/cm, accelerating potential is 10 kv. Please refer to Type 541 section for detailed oscilloscope 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.

Calibration—A calibrated step control and a ten-turn precision control cover the sweep delay continuously from 1 microsecond to 0.1 second. Twelve steps—2, 5, 10, 20, 50, 100, 200, 500 μ sec/cm, 1, 2, 5, and 10 msec/cm—are accurate within 1%. Incremental accuracy of the precision variable control is within 0.2%. Delay time can be read either from the screen in time per centimeter, or from the calibrated controls in total delay time. For extreme accuracy, any of the twelve steps can be adjusted to the accuracy of an external standard.

Manual Reset—Single sweeps can 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. An electrical signal from a remote location can be used instead of the

TYPE 540-SERIES OSCILLOSCOPES

RESET button to arm the sweep for one-shot operation. A front-panel indicator lights when the 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 40 kc are obtained by adjusting the duration of the free-running delaying sweep, and using it to trigger the main sweep internally, or to trigger an external device.

Delayed-Trigger Source—The delayed trigger, amplitude approximately 5 v, is derived from the main sweep or delaying sweep, depending upon the position of the HORIZONTAL DISPLAY switch. The delay is calibrated and is adjustable over the duration of the sweep sawtooth.

Other Available Waveforms—A positive gate from the delaying sweep at approximately 20-v amplitude is available at the front panel. 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 amp 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.

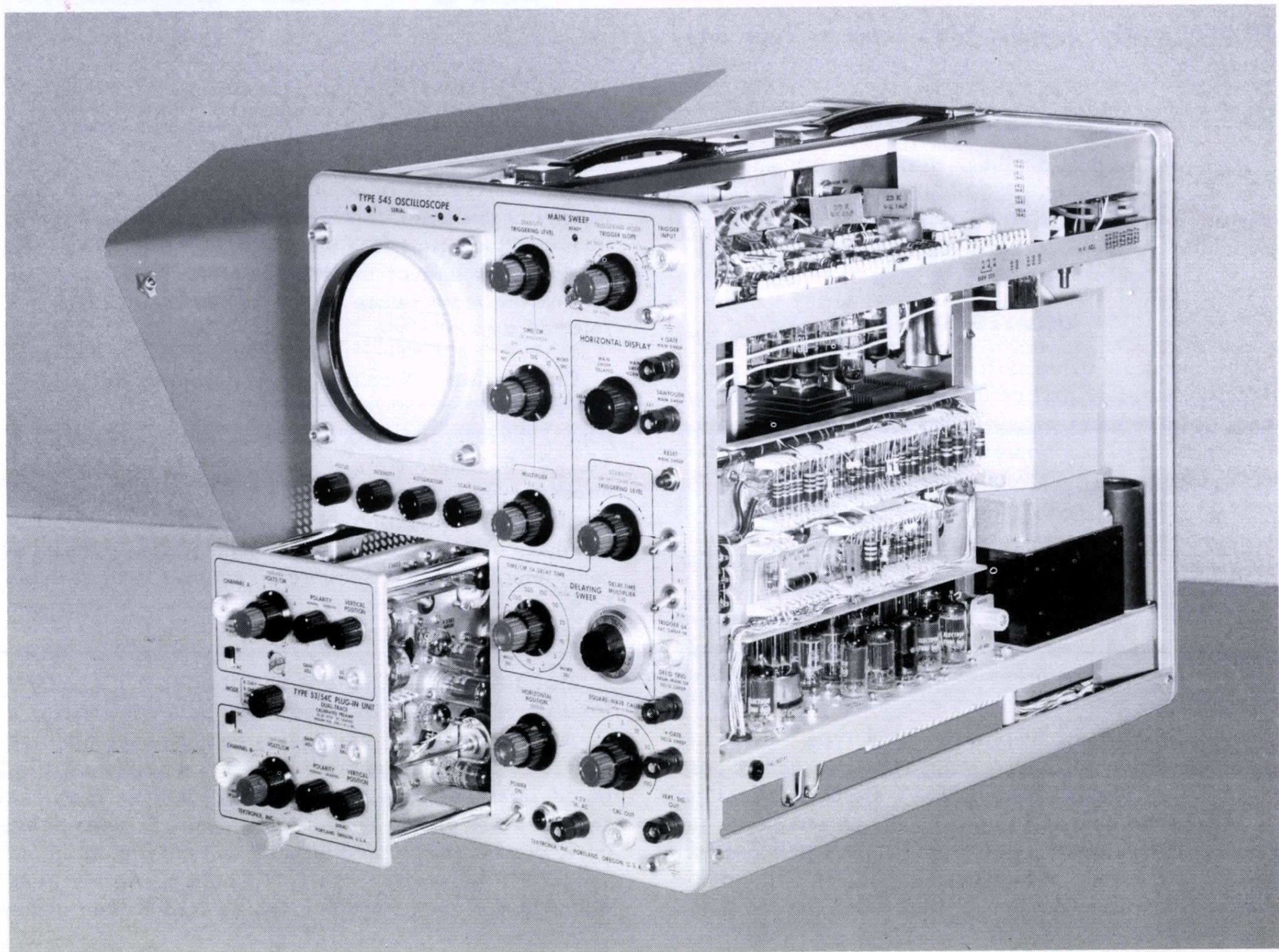
Horizontal Input Amplifier—The horizontal amplifier is the same as that in the Type 541, with the input capacitance standardized at 47 μmf .

OTHER CHARACTERISTICS

All other characteristics are identical to those of the Tektronix Type 541 Cathode-Ray Oscilloscope described in the preceding pages.

VACUUM TUBE COMPLEMENT

Vertical beam-position indicators and input amplifiers	2	6AW8
Driver and vertical trigger CF		6BQ7A



TYPE 540-SERIES OSCILLOSCOPES

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—Aluminum-alloy chassis and three-piece cabinet.

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

Dimensions—24" long, 13" wide, 16 3/4" high.

Weight—65 pounds.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 560 watts with Type 53/54C Unit plugged in.

Type 545, without plug-in units \$1450

- Includes: 2—P410 probes
 2—A510 binding-post adapters
 1—W530B test lead (012013)
 1—F510-5 green filter (378503)
 1—Instruction manual

Currently Available Extras

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

Recommended Additional Accessories

Low Capacitance Accessory Probes—for use with wide-band Plug-In Units. These probes preserve the excellent transient response, introducing no overshoot or ringing, but cause an additional frequency-response loss of approximately 1 db at 30 mc.

Probe	Attenuation Ratio	INPUT IMPEDANCE		Price
		Resistance (Megohms)	Capacitance Minimum* Maximum†	
P405	5:1	5	12 $\mu\mu\text{f}$ 19 $\mu\mu\text{f}$	\$10.50
P410	10:1	10	8 $\mu\mu\text{f}$ 11 $\mu\mu\text{f}$	10.50
P420	20:1	10	5.5 $\mu\mu\text{f}$ 7 $\mu\mu\text{f}$	10.50
P450-L	50:1	10	2.5 $\mu\mu\text{f}$	12.50
P4100	100:1	10	2.5 $\mu\mu\text{f}$ 2.5 $\mu\mu\text{f}$	12.50

*When connected to instruments with 20- $\mu\mu\text{f}$ input capacitance.

†When connected to instruments with input capacitances up to 50 $\mu\mu\text{f}$.

P510A Probe—This probe should be used in place of the low-capacitance probes when the more-sensitive plug-in units—Type 53/54B and Type 53/54D—are used with Type 545. Please see the Catalog Accessory Section for complete specifications.

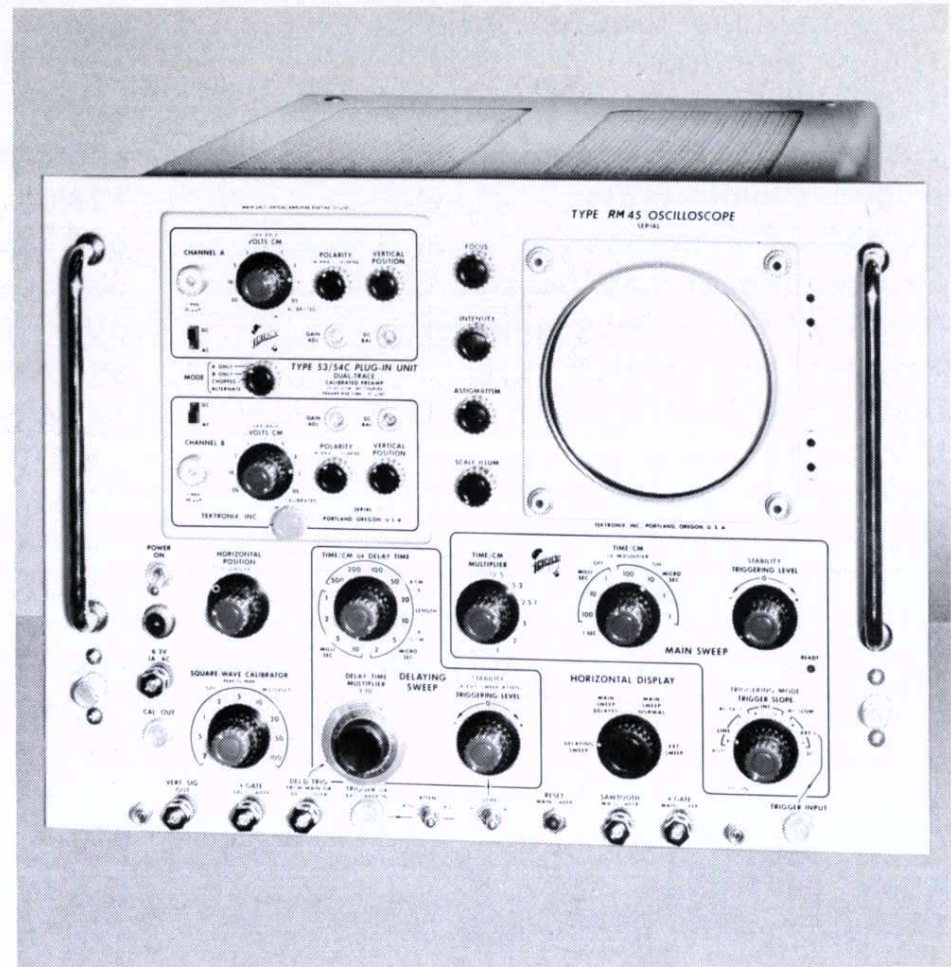
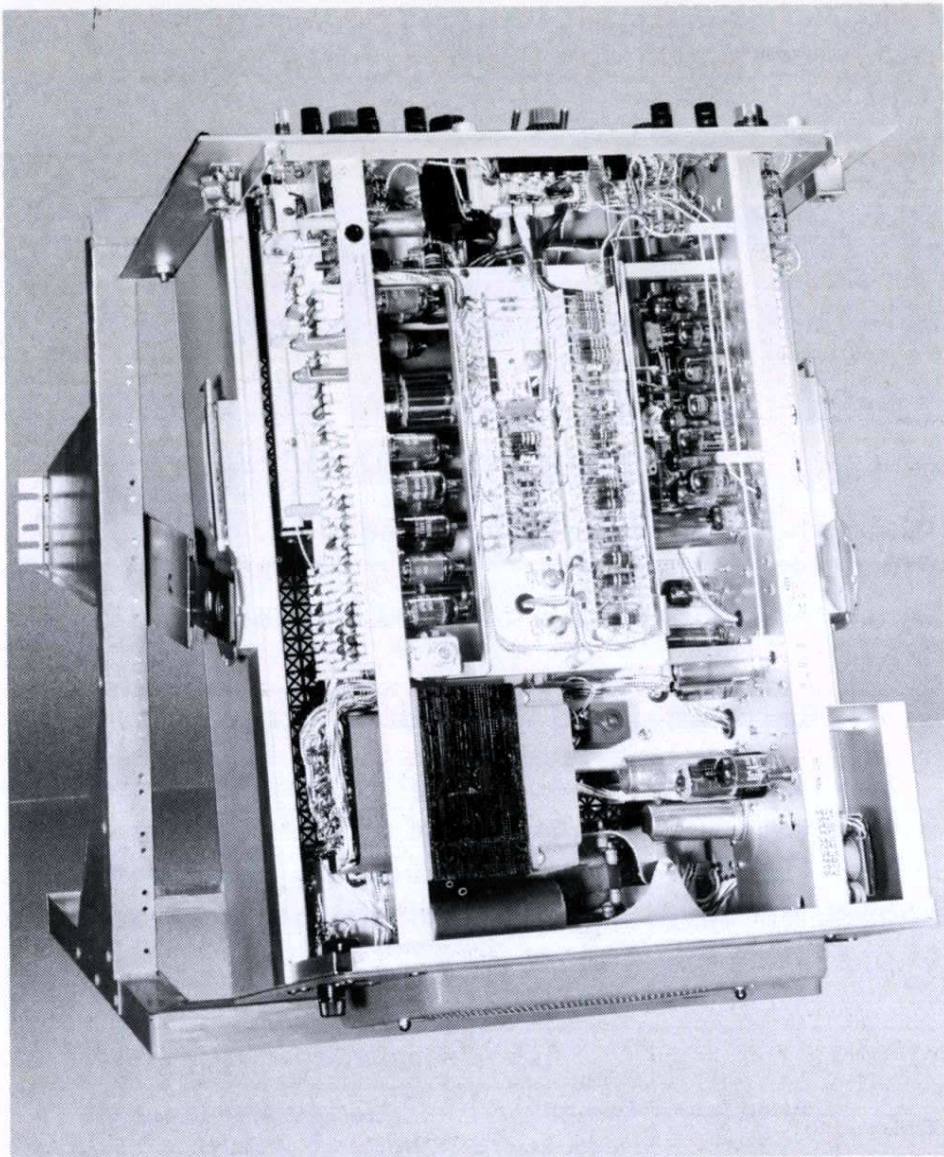
For special test accessories for this instrument, please see the Catalog Test Accessory Section.

Prices f.o.b. Portland, Oregon.



TYPES RM30 & RM40-SERIES OSCILLOSCOPES

Rack-Mounting Type 530-Series and Type 540-Series Oscilloscopes



Construction—Aluminum alloy chassis and two-piece cabinet. Slide-out mounting.
Finish—Photo-etched anodized panel, wrinkle-finished cabinet.

TENTATIVE SPECIFICATIONS

REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY OCTOBER, 1957

GENERAL DESCRIPTION

Types RM31, RM35, RM32, RM41, RM45 Oscilloscopes are mechanically rearranged Types 531, 535, 532, 541, 545 Oscilloscopes for mounting in a standard 19-inch rack. The instrument mounts to the rack on slide-out tracks. It can be pulled forward, tilted, and locked in any of seven positions for servicing convenience.

OTHER CHARACTERISTICS

Electrical characteristics of the rack-mounting models of Type 530 and 540-Series Oscilloscopes are the same as described for the standard models of these Tektronix Oscilloscopes. Controls and terminals are located for maximum convenience in rack-mounted operation.

MECHANICAL SPECIFICATIONS

The following mechanical specifications apply to Type RM31, Type RM35, Type RM32, Type RM41, and Type RM45 Oscilloscopes.

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

Dimensions—14" high, 19" wide, 22 1/2" rack depth, 24" overall depth.

Weight—Types RM31 and RM41, 64 1/2 pounds.
Types RM35 and RM45, 68 pounds.
Type RM32, 55 pounds.

Type RM31	.....	\$1095
Type RM35	.....	\$1400
Type RM32	.....	\$ 925
Includes:	2—P510A probes	
	2—A510 binding-post adapters	
	1—W530B test lead (012013)	
	1—F510-5 green filter (378503)	
	1—Instruction manual	
Type RM41	.....	\$1245
Type RM45	.....	\$1550
Includes:	2—P410 probes	
	2—A510 binding-post adapters	
	1—W530B test lead (012013)	
	1—F510-5 green filter (378503)	
	1—Instruction manual	

Prices f.o.b. Portland, Oregon.

PLUG-IN PREAMPLIFIERS

TYPE 53/54A 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.
- With Type 541 and Type 545—
Risetime—0.018 μ sec.

Frequency Response

- With Type 531 and Type 535—
Passband—DC to 10 mc.
- With Type 532—
Passband—DC to 5 mc.
- With Type 541 and Type 545—
Passband—DC to 20 mc.

Deflection Factor

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

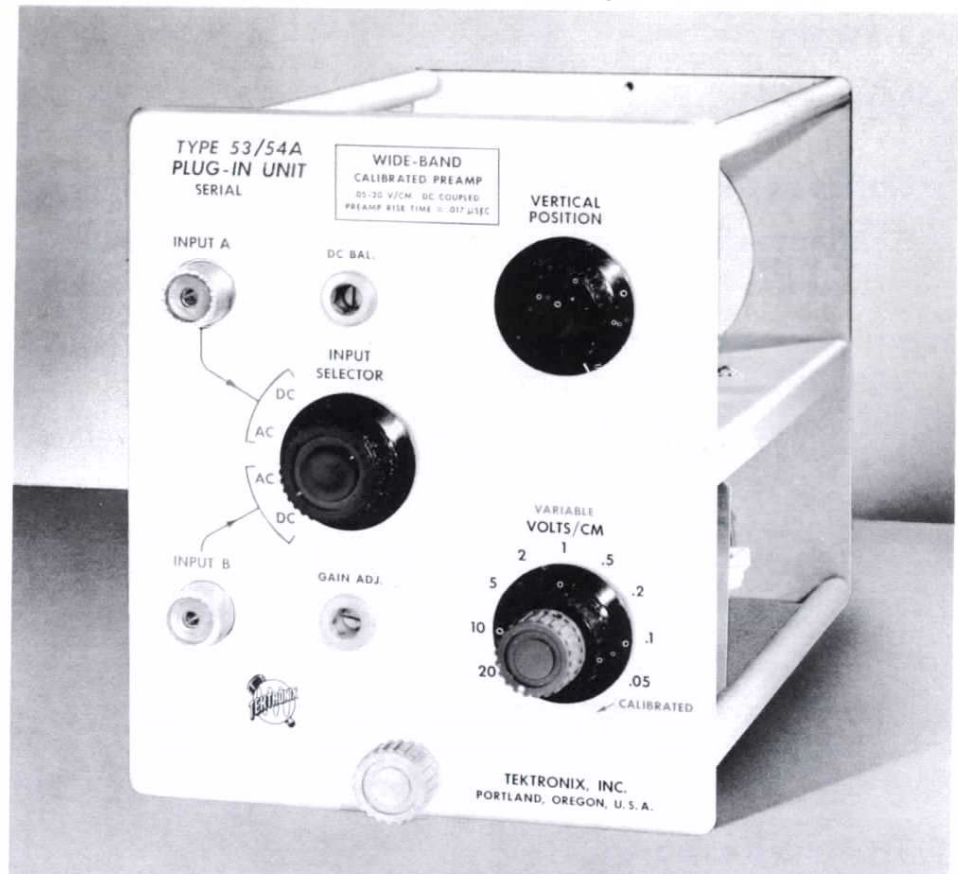
GENERAL DESCRIPTION

The Type 53/54A Plug-In Preamplifier meets the requirements of most wide-band applications. Wide pass-band, excellent transient response, dc-coupling, and calibrated sensitivity are qualities most users require in an oscilloscope vertical amplifier. The Type 53/54A gives all of these qualities to Type 530 and Type 540-Series Oscilloscopes.

OTHER CHARACTERISTICS

Calibrated Sensitivity—The vertical attenuator is calibrated in VOLTS/CM of deflection. Nine calibrated steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 v/cm. In addition, a vernier (uncalibrated) control provides for continuously-variable adjustment from 0.05 v/cm to 50 v/cm.

Calibration Accuracy—An adjustment is provided for setting the gain of the unit. When this adjustment is accurately set with the VOLTS/CM switch in the 0.05 v/cm position, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that position.



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 3 db down at 2 cycles.

Input Impedance—47 μ f paralleled by 1 megohm.

VACUUM TUBE COMPLEMENT

Input CF	12AU6
Amplifiers	2 12AU6
Output CF	12AT7

MECHANICAL SPECIFICATIONS

- Construction—Aluminum-alloy chassis.
- Finish—Photo-etched panel.
- Weight—3 1/2 lbs.

Price \$85

For low-capacitance accessory probes, please see the Catalog Accessory Section.

Price f.o.b. Portland, Oregon

PLUG-IN PREAMPLIFIERS

TYPE 53/54B PLUG-IN UNIT Wide-Band High-Gain Preamplifier

Deflection Factor

- 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 0.05 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.
- With Type 541 and 545—
 - 0.05 v/cm to 50 v/cm, DC to 20 mc.
 - 0.005 v/cm to 0.05 v/cm, 2 cycles to 12 mc.

Transient Response

- With Type 531 and Type 535—
 - 0.05 v/cm to 50 v/cm, 0.035- μ sec risetime.
 - 0.005 v/cm to 0.05 v/cm, 0.04- μ sec risetime.
- With Type 532—
 - 0.07- μ sec risetime for all sensitivities.
- With Type 541 and Type 545—
 - 0.05 v/cm to 50 v/cm, 0.018- μ sec risetime.
 - 0.005 v/cm to 0.05 v/cm, 0.03- μ sec risetime.

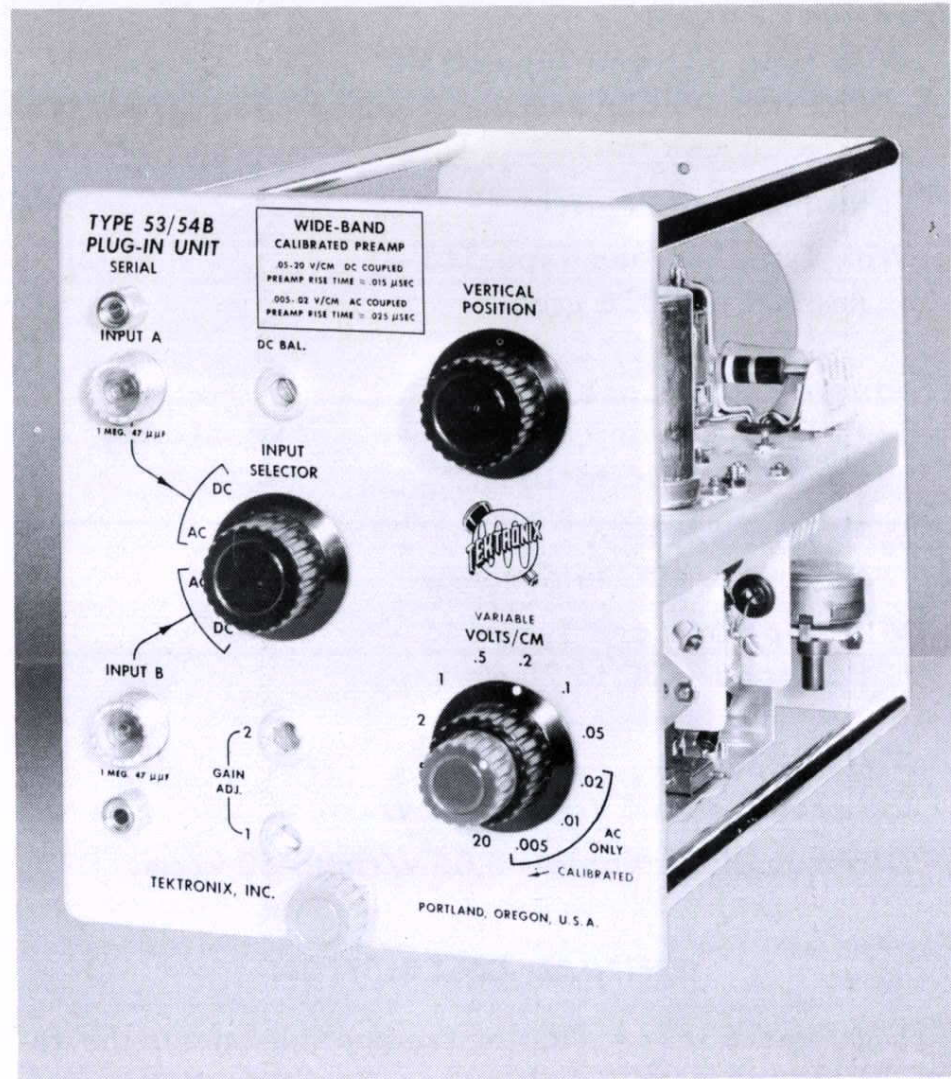
GENERAL DESCRIPTION

The Type 53/54B Plug-In Unit is essentially the Type 53/54A with a preamplifier stage added. Three additional calibrated deflection factors, 0.005, 0.01, and 0.02 v/cm are available at slightly reduced frequency response and increased risetime when used with Type 531, 535, 541, 545 Oscilloscopes. In all other specifications the Type 53/54B is identical to the Type 53/54A.

OTHER CHARACTERISTICS

Calibrated Sensitivity—The vertical attenuator is calibrated in VOLTS/CM of deflection. Twelve calibrated steps are provided: 0.005, 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 and 20 v/cm. In addition, a vernier (uncalibrated) control provides for continuously-variable adjustment from 0.005 v/cm to 50 v/cm.

Calibration Accuracy—Two adjustments are provided for setting the gain of the unit. When these adjustments are accurately set with the VOLTS/CM switch in the 0.005 v/cm and 0.05 v/cm positions, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that position.



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 coupling capacitor is inserted in the AC positions, limiting the low-frequency response to 3 db down at 2 cycles.

Input Impedance—47 μ f paralleled by 1 megohm.

VACUUM TUBE COMPLEMENT

Preamplifier	5654
Input CF	12AU6
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

For low-capacitance accessory probes, please see the Catalog Accessory Section.

Price f.o.b. Portland, Oregon

PLUG-IN PREAMPLIFIERS

TYPE 53/54C PLUG-IN UNIT Dual-Trace Preamplifier

Two Identical Channels

Electronic Switching

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

Deflection Factor

Calibrated—0.05 v/cm to 20 v/cm.

Frequency Response

Passband—DC to 10 mc with Type 531 and Type 535.
Passband—DC to 5 mc with Type 532.
Passband—DC to 24 mc with Type 541 and Type 545.
(3 db \pm 1/2 db down at 24 mc).

Transient Response

Risetime—0.035 μ sec with Type 531 and Type 535.
Risetime—0.07 μ sec with Type 532.
Risetime—0.015 μ sec with Type 541 and Type 545.

GENERAL DESCRIPTION

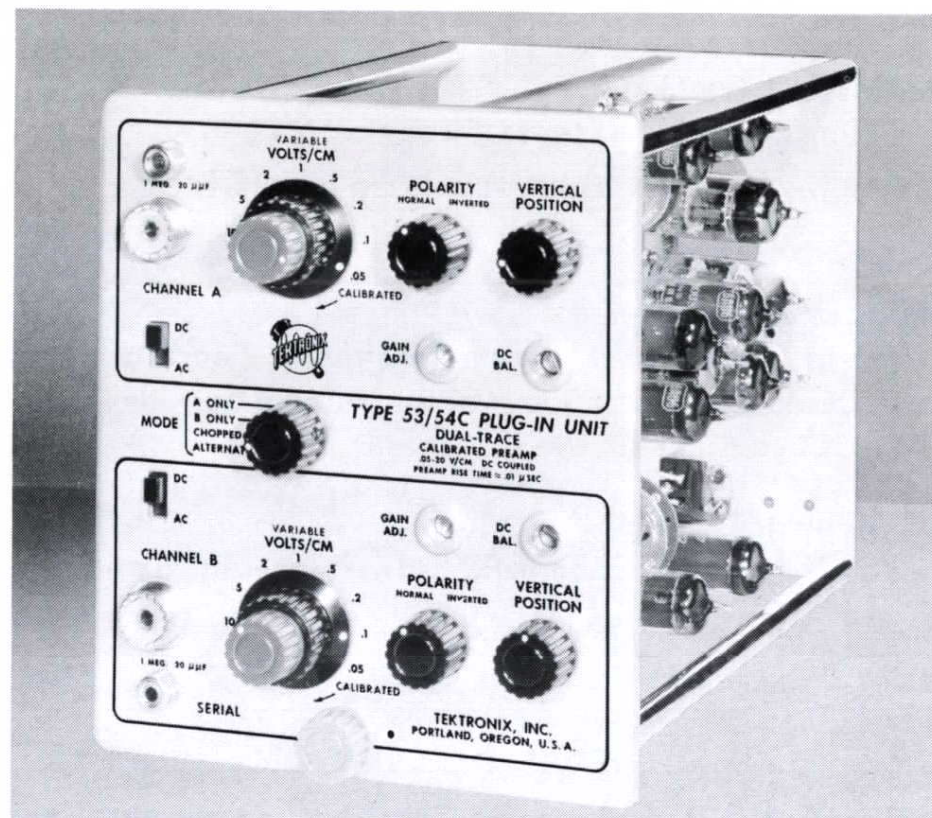
The Type 53/54C Dual-Trace Unit contains two identical amplifier channels that can be electronically switched either by the oscilloscope sweep or at a free-running rate of approximately 100 kc. When switching is triggered by the oscilloscope sweep, the two signals to be compared appear on alternate sweeps. 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 53/54C 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—The vertical attenuators are calibrated in VOLTS/CM of deflection. Nine calibrated steps are provided for each channel: .05, 0.1, 0.2, 0.5, 1, 2, 5, 10 and 20 v/cm. In addition, vernier (uncalibrated) controls provide for continuously-variable adjustment from 0.05 v/cm to 50 v/cm for each channel.

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



Calibration Accuracy—Adjustments are provided for setting the gain of each channel. When this adjustment is accurately set with the VOLTS/CM switch in the 0.05 v/cm position, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that position.

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

AC-DC Switches—A coupling capacitor is inserted in the AC positions, limiting the low-frequency response to 3 db down at 2 cycles.

Polarity Inversion—Polarity may be inverted on either channel for greater accuracy in comparisons of signals 180 degrees out of phase.

Input Impedance—20 μ f paralleled by 1 megohm.

VACUUM TUBE COMPLEMENT

Input CF	2	6AK5
Amplifiers	4	12AU6
Switching amplifiers	4	6AU6
Output CF		12AT7
Coupling diode		6AL5
Multivibrator		12AT7
Multivibrator waveform shaper		12AT7
Switching CF		12AT7

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

Finish—Photo-etched anodized panel.

Weight—5 1/2 lbs.

Price **\$275**
For low-capacitance accessory probes, please see the Catalog Accessory Section.

Price f.o.b. Portland, Oregon

PLUG-IN PREAMPLIFIERS

TYPE 53/54D PLUG-IN UNIT

Differential High-Gain DC Preamplifier

Deflection Factor

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 between in-phase and out-of-phase signals.

GENERAL DESCRIPTION

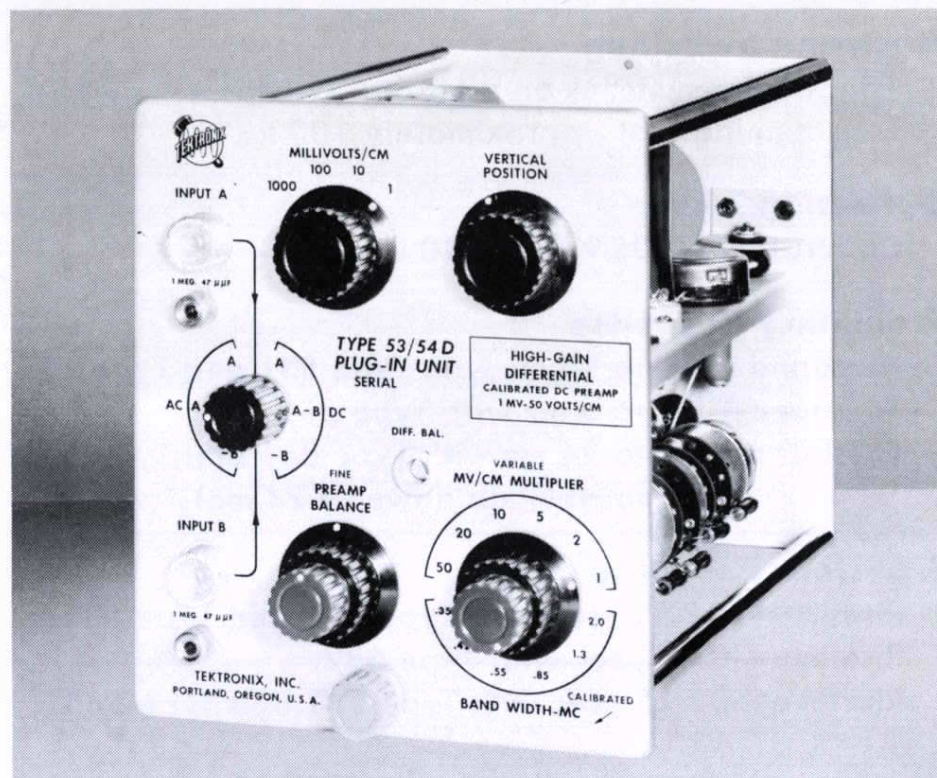
The Type 53/54D equips Type 530-Series and Type 540-Series Oscilloscopes for work requiring dc-coupling at a deflection factor of 1 mv/cm. Differential input with high rejection ratio for in-phase signals permits cancellation of unwanted or interfering signals.

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 coupling capacitor is inserted, limiting the low-frequency response to 3 db down at 2 cycles.

Differential Input — In the A-minus-B position of the input selector switch, the Type 53/54D operates as a differential amplifier whose output is proportional to the difference between signals applied to input A and input B. The differential feature is useful in making voltage measurements between two above-ground points, and for cancelling in-phase signals such as hum pickup in connecting leads. By careful adjustment of the differential-balance control, 10,000-to-1 rejection ratio for in-phase signals up to 20 kc can be achieved at all positions of the MV/CM MULTIPLIER switch.

Deflection Sensitivity Controls — The MILLIVOLTS/CM switch has four calibrated positions: 1, 10, 100, and 1000 mv/cm. A MV/CM MULTIPLIER 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. The MV/CM MULTIPLIER, by attenuating within the amplifier, reduces drift and increases bandpass in applications that require less than maximum sensitivity. A vernier



(uncalibrated) control provides for continuously-variable adjustment from 1 mv/cm to 125 v/cm.

Regulated Heater Voltage — Heaters of all vacuum tubes in the Type 53/54D are operated from the regulated dc voltage supplies in the main oscilloscope unit.

Calibration Accuracy—An adjustment is provided for setting the gain of the unit. When this adjustment is accurately set with the MILLIVOLTS/CM switch in the 1 mv/cm position and the MV/CM MULTIPLIER in the 50 mv/cm position, the vertical deflection factor for any other position of the switches will be within 3% of the panel reading for that position.

Stability — Normal drift is from 2 to 5 mv/hr.

Input Impedance—47 μmf paralleled by 1 megohm.

VACUUM TUBE COMPLEMENT

Cascade amplifiers	2	12AU7
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
For low-capacitance accessory probes, please see the Catalog Accessory Section.

Price f.o.b. Portland, Oregon

PLUG-IN PREAMPLIFIERS

TYPE 53/54E PLUG-IN UNIT

Low-Level Differential AC Preamplifier

Deflection Factor

Calibrated—50 microvolts/cm to 10 millivolts/cm.
Continuously Variable—50 microvolts/cm to 25 millivolts/cm.

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 between in-phase and out-of-phase signals up to 1 kc of ± 2 v or less.

GENERAL DESCRIPTION

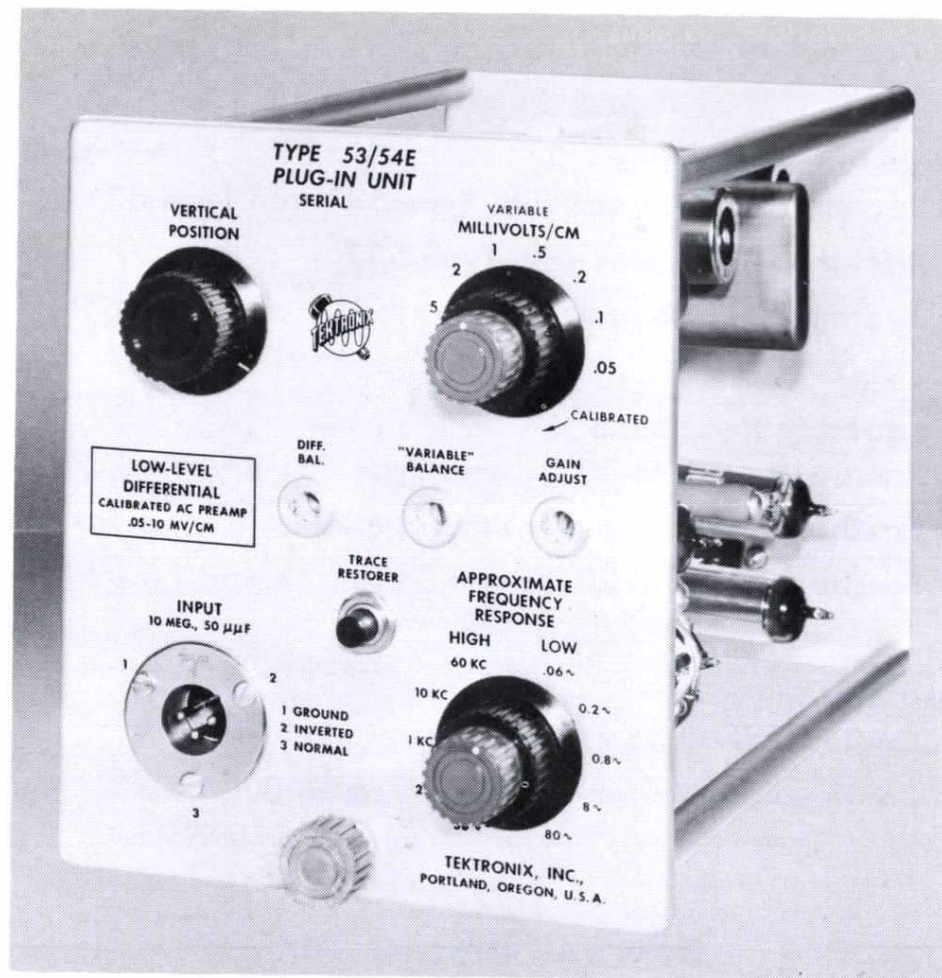
The Type 53/54E Plug-In Unit provides Type 530-Series and Type 540-Series Oscilloscope with a calibrated vertical deflection factor of 50 microvolts/cm for low-level applications. Maximum combined noise and hum is 5 μ v, rms, with input grids grounded at the input connector. Separate high-frequency and 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 up to 1 kc 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—The vertical attenuator is calibrated in MILLIVOLTS/CM of deflection. Eight calibrated steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5 and 10 millivolts/cm. In addition, a vernier (uncalibrated) control provides for continuously-variable adjustment from 50 microvolts/cm to 25 millivolts/cm.

Calibration Accuracy—An adjustment is provided for setting the gain of the unit. When this adjustment is accurately set with the MILLIVOLTS/CM switch in the 5 millivolts/cm position, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that position.

Bandwidth Control—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	12AU7
Voltage regulators	2 OB2

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

Finish—Photo-etched anodized panel.

Weight—4 1/2 lbs.

Price \$165

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

Price f.o.b. Portland, Oregon



PLUG-IN PREAMPLIFIERS

TYPE 53/54G 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.

Risetime—0.018 μ sec with Type 541 and Type 545.

Frequency Response

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

Passband—DC to 5 mc with Type 532.

Passband—DC to 20 mc with Type 541 and Type 545.

Deflection Factor

Calibrated—0.05 v/cm to 20 v/cm.

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

GENERAL DESCRIPTION

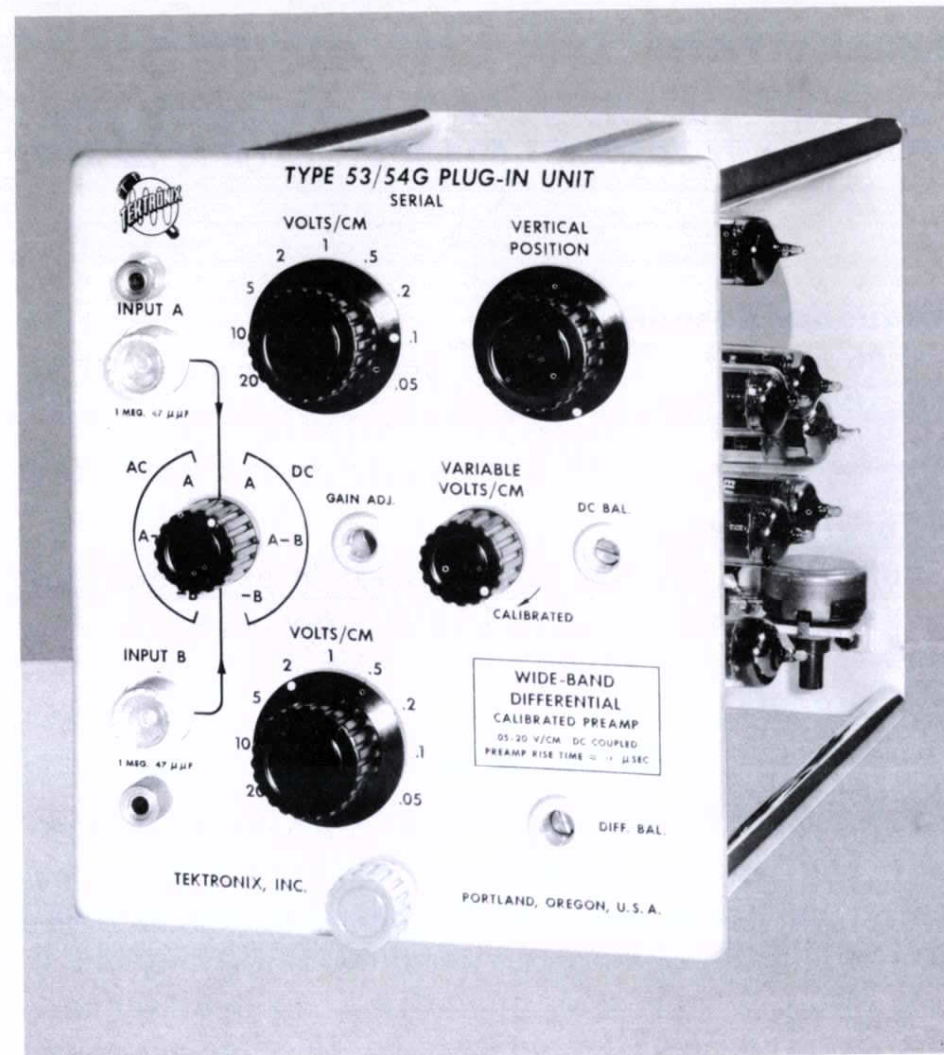
The Type 53/54G Plug-In Unit equips Type 530 and Type 540-Series Oscilloscopes for wide-band differential-input applications. Common-mode rejection is better than 100 to 1 for the entire passband at full gain. . . better than 300 to 1 at 60 cycles. Independent step attenuators in each input with 80-db 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 coupling capacitor is inserted, limiting the low-frequency response to 3 db down at 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 adjustment 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—An adjustment is provided for setting the gain of the unit. When this adjustment is ac-



curately set with the VOLTS/CM switch in the 0.05 v/cm position, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that position.

Input Impedance—47 μ μ f paralleled by 1 megohm.

VACUUM TUBE COMPLEMENT

Input cathode followers	2	6BH6
Input amplifiers	2	12AU6
Output amplifiers	2	12AU6
Cathode followers		12AT7

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

Finish—Photo-etched anodized panel.

Weight—4 1/2 lbs.

Price \$175

For low-capacitance accessory probes, please see the Catalog Accessory Section.

Price f.o.b. Portland, Oregon

PLUG-IN PREAMPLIFIERS

TYPE 53/54K 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.
- With Type 532
Risetime—0.07 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 41 mc, 12 db at approximately 55 mc).
- With Type 531 and Type 535
Passband—DC to 11 mc.
- With Type 532
Passband—DC to 5 mc.

Deflection Factor

- Calibrated—0.05 v/cm to 20 v/cm.

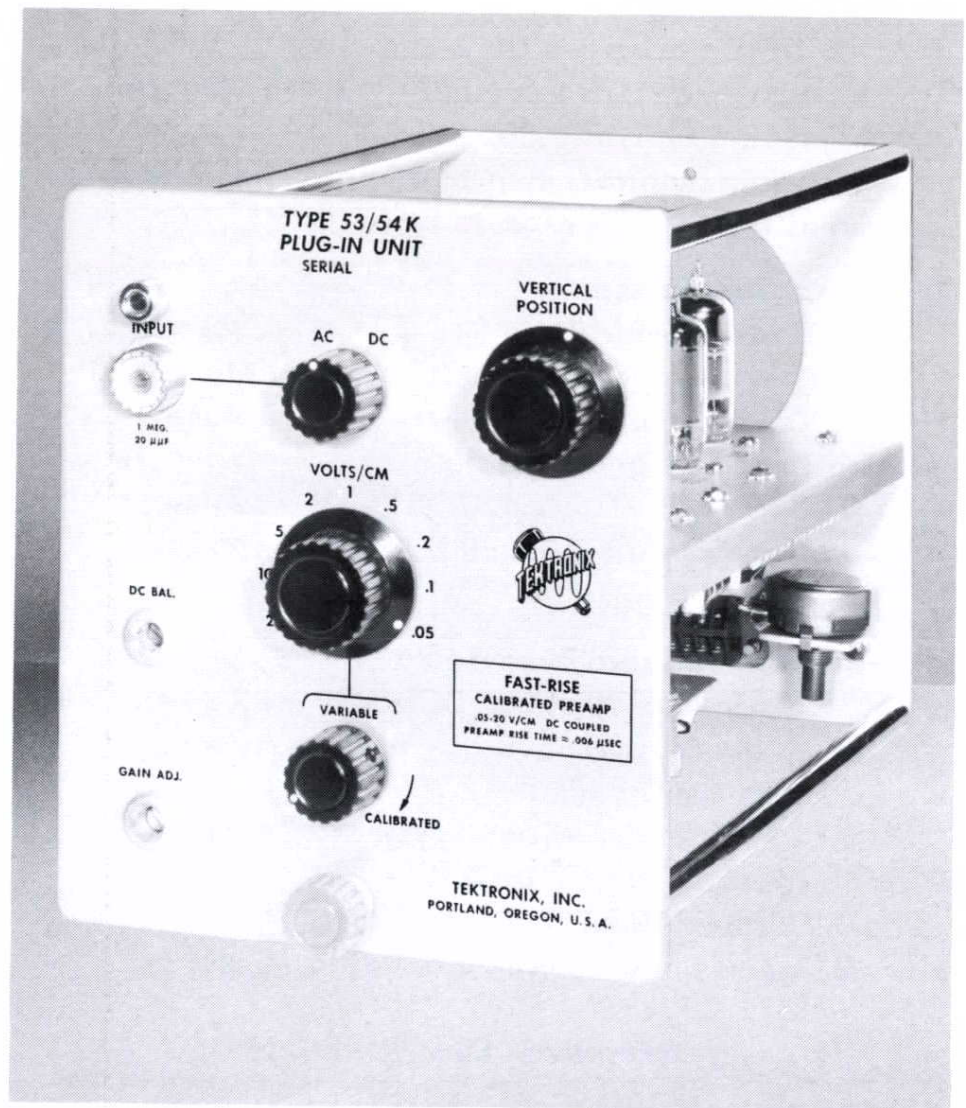
GENERAL DESCRIPTION

The Type 53/54K 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 the oscilloscope vertical-deflection system. The Type 53/54K 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 41 mc, 12 db at approximately 55 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 3 db down at 2 cycles.

OTHER CHARACTERISTICS

Calibrated Sensitivity—The vertical attenuator is calibrated in VOLTS/CM of deflection. Nine calibrated steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 and 20 v/cm. In addition, a vernier (uncalibrated) control provides for variable adjustment over a 2-to-1 range on each step.

Calibration Accuracy—An adjustment is provided for setting the gain of the unit. When this adjustment is accurately set with the VOLTS/CM switch in the 0.05 v/cm



position, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that position.

Input Impedance—Direct input impedance of the Type 53/54K is 1 megohm paralleled by 20 μ mf. Input with the P410 Probe, furnished with Type 541 and Type 545 Oscilloscopes, is 10 megohms paralleled by 8 μ mf. Other P400-Series Probes, described in the Accessory Section, provide input capacitances from 12 μ mf to 2.5 μ mf, at attenuation ratios from 5 to 1 up to 100 to 1.

VACUUM TUBE COMPLEMENT

Input cathode follower	6AK5
Cathode-coupled amplifiers	2 12AU6
Output cathode followers	2 12AT7

MECHANICAL SPECIFICATIONS

- Construction—Aluminum-alloy chassis.
- Finish—Photo-etched panel.
- Weight—3 1/2 lbs.

Price \$125

For low-capacitance accessory probes, please see the Catalog Accessory Section.

Price f.o.b. Portland, Oregon



PLUG-IN PREAMPLIFIERS

TYPE 53/54L PLUG-IN UNIT Fast-Rise High-Gain Preamplifier

Deflection Factor

AC or DC-Coupled—0.05 v/cm.
9 calibrated steps from 0.05 v/cm to 20 v/cm.
AC-Coupled Only—0.005 v/cm.
10x gain amplifier switched in provides 9 calibrated steps from 0.005 v/cm to 2 v/cm.

Transient Response

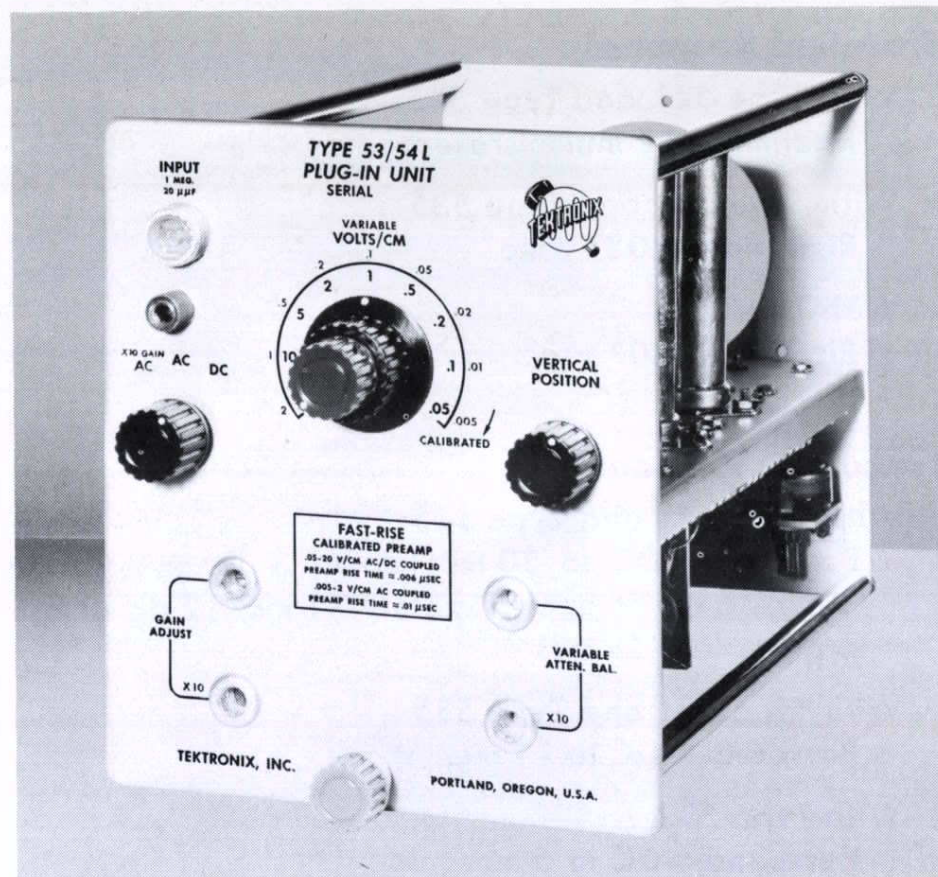
With Type 541 and Type 545
0.05 v/cm to 40 v/cm, 0.012- μ sec risetime.
0.005 v/cm to 4 v/cm, 0.015- μ sec risetime.
With Type 531 and Type 535
0.05 v/cm to 40 v/cm, 0.031- μ sec risetime.
0.005 v/cm to 4 v/cm, 0.035- μ sec risetime.

Frequency Response

With Type 541 and Type 545
0.05 v/cm to 40 v/cm, DC to 30 mc (down 3 db $\pm 1/2$ db at 30 mc, 6 db at approximately 41 mc, 12 db at approximately 55 mc.)
0.005 v/cm to 4 v/cm, 3 cycles to 24 mc.
With Type 531 and Type 535
0.05 cm to 40 v/cm, DC to 11 mc.
0.005 v/cm to 4 v/cm, 3 cycles to 10 mc.

GENERAL DESCRIPTION

The Type 53/54L Fast-Rise High-Gain Unit is essentially the Type 53/54K Plug-In Unit, with an additional ampli-



adjustments are accurately set with the VOLTS/CM switch in the 0.05 v/cm position, the vertical deflection factor for any other position of the switch will be within 3% of the panel reading for that switch position.

Input Impedance—Direct input impedance of the Type 53/54L Unit is 1 megohm paralleled by 20 μ f. Input impedance with the P410 probe, furnished with

TENTATIVE SPECIFICATIONS

REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY JULY, 1957

fier to increase the sensitivity of Tektronix Type 540-Series Oscilloscopes by a factor of 10 for fast-rise applications.

A front-panel switch connects the ac-coupled amplifier into the circuit, increasing the deflection factor to 0.005 v/cm. Slightly reduced frequency response and increased risetime when used with Type 531, 535, 541, 545 Oscilloscopes results when the additional amplifier is switched into the circuit. In all other respects, the Type 53/54L Unit is identical to the Type 53/54K.

OTHER CHARACTERISTICS

Calibrated Deflection Factor—Nine steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 v/cm. When the additional amplifier stage is switched in, the steps are changed to 0.005, 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, and 2 v/cm. In addition, a vernier (uncalibrated) control provides for variable adjustment over a 2-to-1 range on each step.

Calibration Accuracy—Front-panel adjustments are provided for setting the gain of the unit. When these

Type 541 and Type 545 Oscilloscopes, is 10 megohms paralleled by 8 μ f. Other P400-Series Probes, as described in the Accessory Section, provide input capacitances from 12 μ f to 2.5 μ f, at attenuation ratios from 5 to 1 up to 100 to 1.

VACUUM TUBE COMPLEMENT

Input cathode follower	5654
First amplifier	5654
Second amplifier	5654
Cathode follower	5654
Cathode-coupled amplifiers 2	12AU6
Output cathode followers 2	12AT7

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.
Finish—Photo-etched panel.
Weight—4 1/2 pounds.

Price \$185

Price f.o.b. Portland, Oregon.



PLUG-IN UNITS

TYPE 53/54T PLUG-IN UNIT Time-Base Generator

Wide Sweep Range

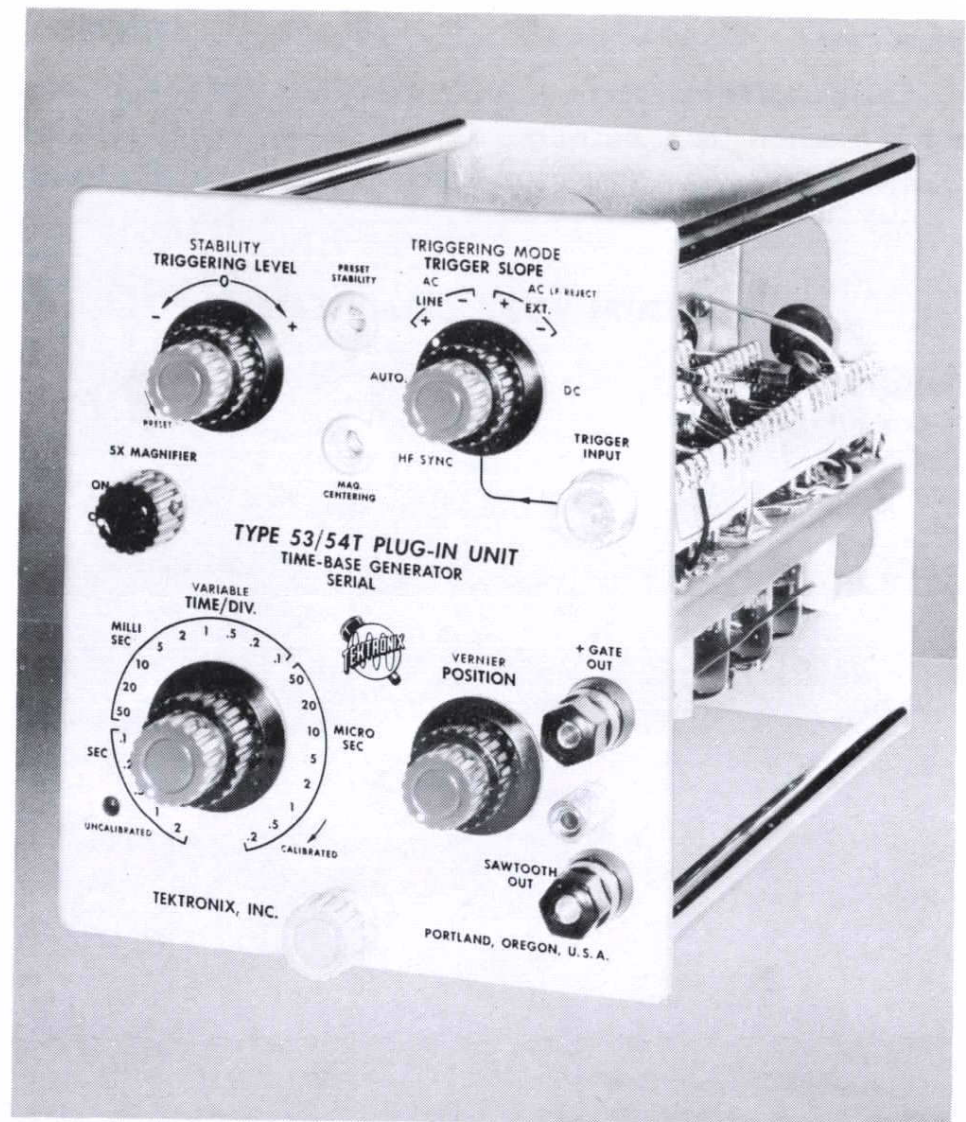
Twenty-two calibrated sweep rates from $0.2 \mu\text{sec}/\text{div}$ to $2 \text{ sec}/\text{div}$.
5x magnifier, accurate on all ranges.

Versatile Triggering

Line, external, ac or dc-coupled, automatic triggering, high-frequency sync.

GENERAL DESCRIPTION

The Type 53/54T Time-Base Generator Plug-In Unit is intended to provide sawtooth sweep voltages to drive the horizontal-deflection system in the Type 536 Cathode-Ray Oscilloscope. This plug-in unit can also be used in the vertical-deflection system of any of the Tektronix 530 or 540-Series Oscilloscopes. The Type 53/54T Unit provides the Type 536 with a wide range of sweep rates for use in the usual oscilloscope applications. Trigger shaping and dc-coupled unblanking circuits are included in the Type 53/54T Unit.



TENTATIVE SPECIFICATIONS

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HORIZONTAL DEFLECTION SYSTEM

Calibrated Sweep Rates—The Type 53/54T Unit has 22 calibrated sweep rates: $0.2, 0.5, 1, 2, 5, 10, 20, 50 \mu\text{sec}/\text{div}$ — $0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 \text{ millsec}/\text{div}$ — $0.1, 0.2, 0.5, 1, \text{ and } 2 \text{ sec}/\text{div}$. A single 22-position switch is used. In addition, a vernier (uncalibrated) control provides continuously variable sweep rates from $0.2 \mu\text{sec}/\text{div}$ to $6 \text{ sec}/\text{div}$. Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases will be within 3%.

Sweep Magnifier—When the 5x magnifier is switched on, the center two-division portion of the normal sweep is expanded to the left and right of center to fill ten divisions. The POSITION control has sufficient range to display any one-fifth of the magnified sweep.

DC-Coupled Unblanking—When the unit is plugged into the Type 536 Oscilloscope horizontal amplifier, the unblanking waveform is dc-coupled to the control grid of the crt. Uniform bias is assured for all sweep and repetition rates.

Trigger Selection—A concentric control permits triggering from either the positive or negative slopes of an external or line voltage signal, selection of ac or dc-coupling through the triggering circuits, or automatic triggering. Triggering by the signal under observation can also be accomplished by an external connection from the oscilloscope VERT. SIGNAL OUT connector to the Type 53/54T TRIGGER INPUT connector.

Automatic Triggering—With the control in AUTO position, the sweep will be triggered by recurrent incoming signals from 60 cycles to 2 mc. Signals differing in frequency, amplitude, and shape can be observed without readjustment of the triggering or stability 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 SELECTOR switch is in the HF SYNC position, the sweep will synchronize with sine-wave signals in the frequency range of 5 mc to better than 15 mc.

PLUG-IN UNITS

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—A signal of 0.2 v to 50 v is required.

Output Waveforms—A 30-v positive-gate waveform of the same time duration as the sweep, and a 150-v positive-going sawtooth waveform are available at front-panel connectors.

VACUUM TUBE COMPLEMENT

Trigger amplifier	6U8
Trigger shaper	6U8

Multivibrator and cathode follower	6BQ7A
Multivibrator and + gate out CF	6U8
Channel-selecting pulse amplifier and sawtooth out CF	6U8
Disconnect diodes	6AL5
Hold-off driver and hold-off CF	6BQ7A
Sawtooth generator and cathode follower .	6AU8

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

Finish—Photo-etched panel.

Weight—5 pounds.

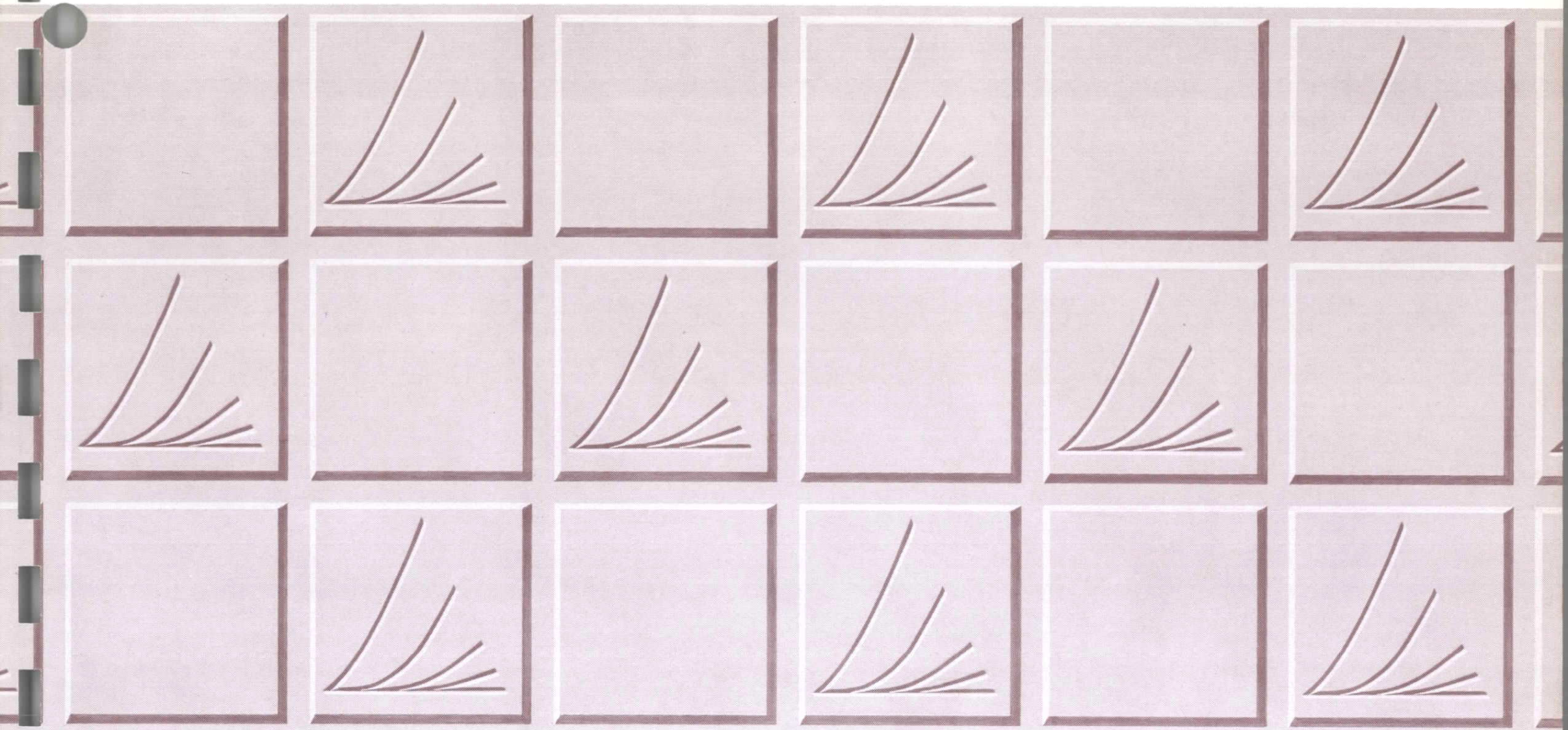
Price **\$225**

Price f.o.b. Portland, Oregon.

TENTATIVE SPECIFICATIONS

..... REGULAR PRODUCTION AND INITIAL SHIPMENT
 EXPECTED TO BEGIN APPROXIMATELY AUGUST, 1957





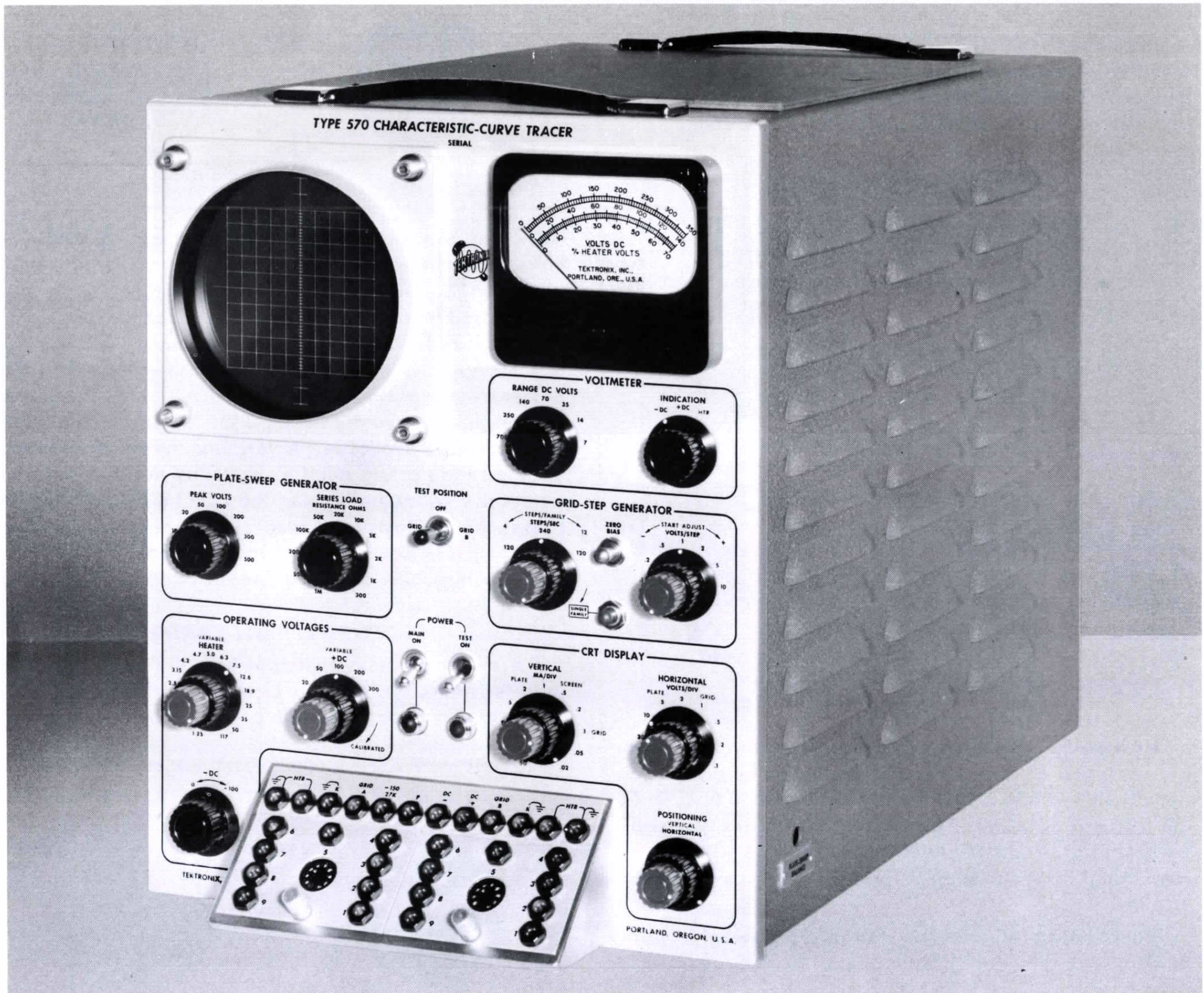
CHARACTERISTIC-CURVE TRACERS

A family of characteristic curves, presented on the screen of a cathode-ray tube, provides accurate information on the behavior of active circuit elements under the operator's selected conditions.



TYPE 570 CHARACTERISTIC-CURVE TRACER

Pictures Dynamic Vacuum-Tube Characteristics



Displays Family of Curves on CRT Screen

Four to twelve characteristic curves per family.

Plots All Important Characteristics

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

Positive-Bias Curves

Plots up to 8 positive-bias curves per family.

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.

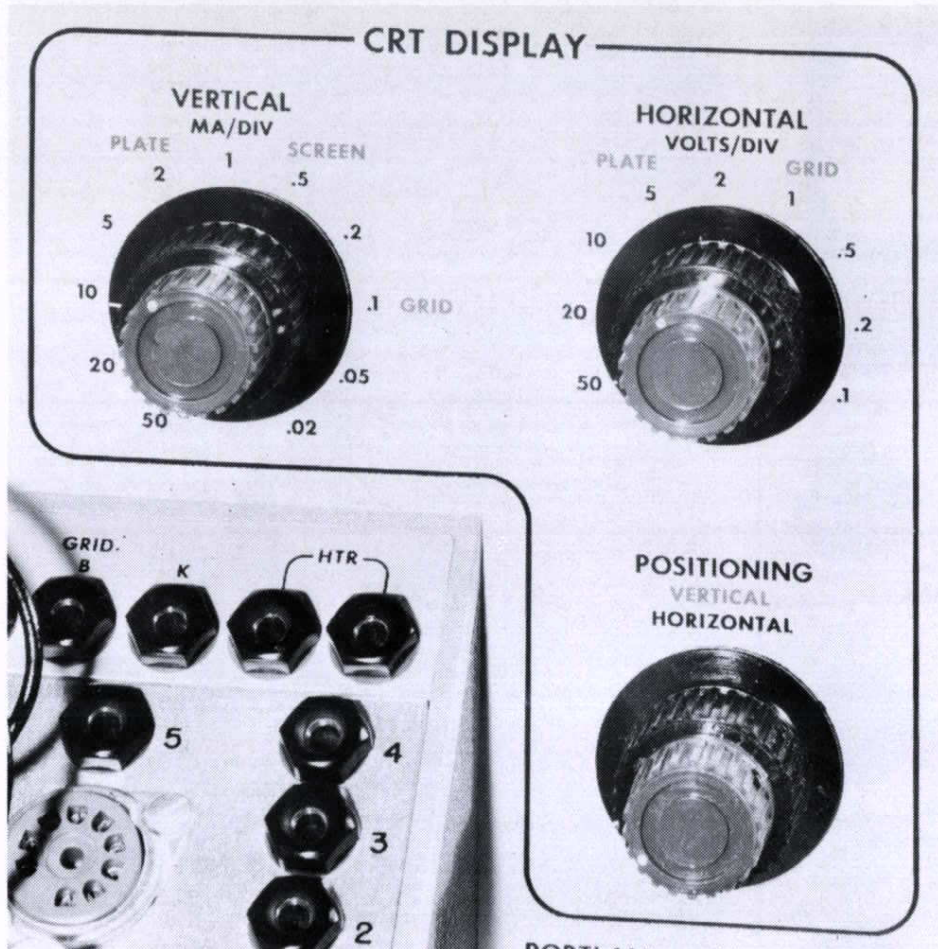
GENERAL DESCRIPTION

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 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.

TYPE 570 CHARACTERISTIC-CURVE TRACER

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.

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 second. Use of the SINGLE FAMILY push button permits observation or photography of tube characteristics under unusual conditions without danger of damage to the tube under test.

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

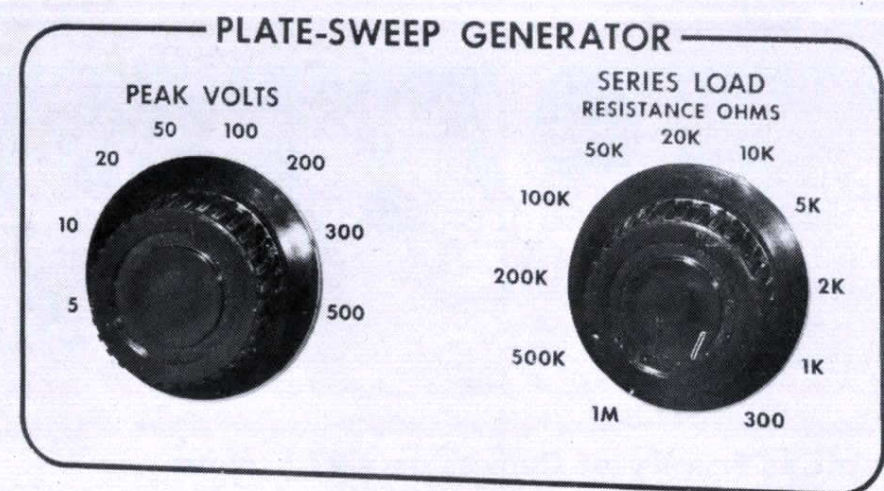


curve, for convenience when the area of interest is at either end of the curves displayed.

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. As many as eight positive-bias curves can be included in the display.

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,



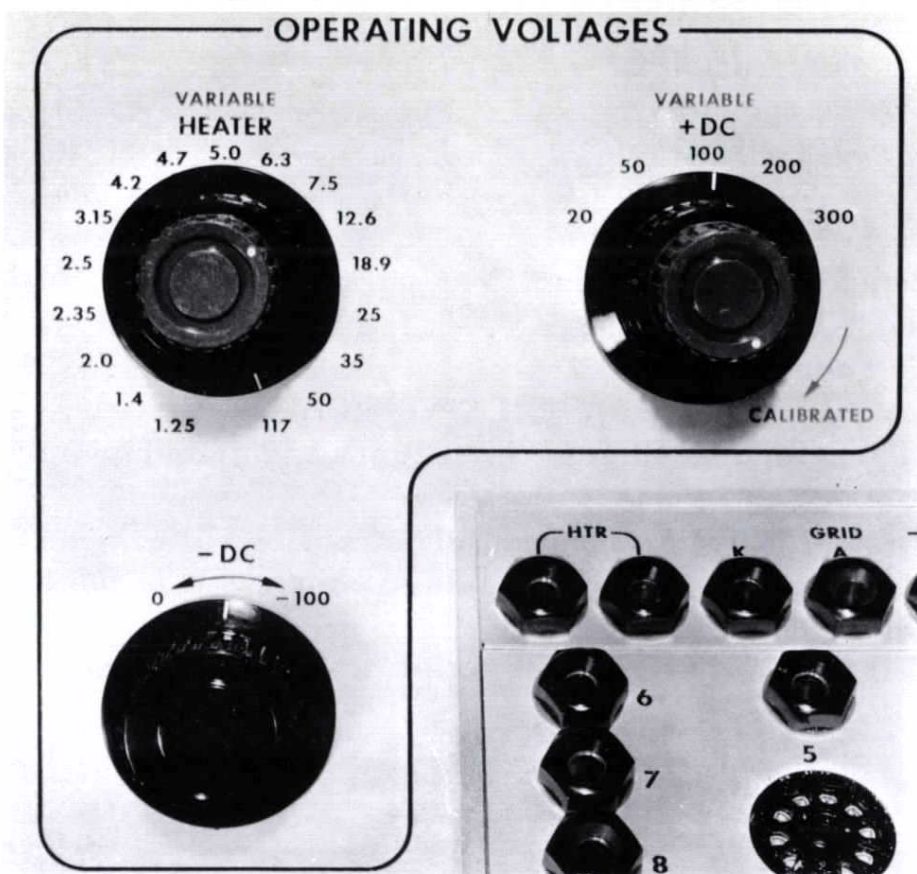
20 k, 50 k, 100 k, 200 k, 500 k, and 1 megohm. Power-handling capacity of all load resistors is sufficient to dissipate the maximum power available in the plate circuit.

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.

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

TYPE 570 CHARACTERISTIC-CURVE TRACER



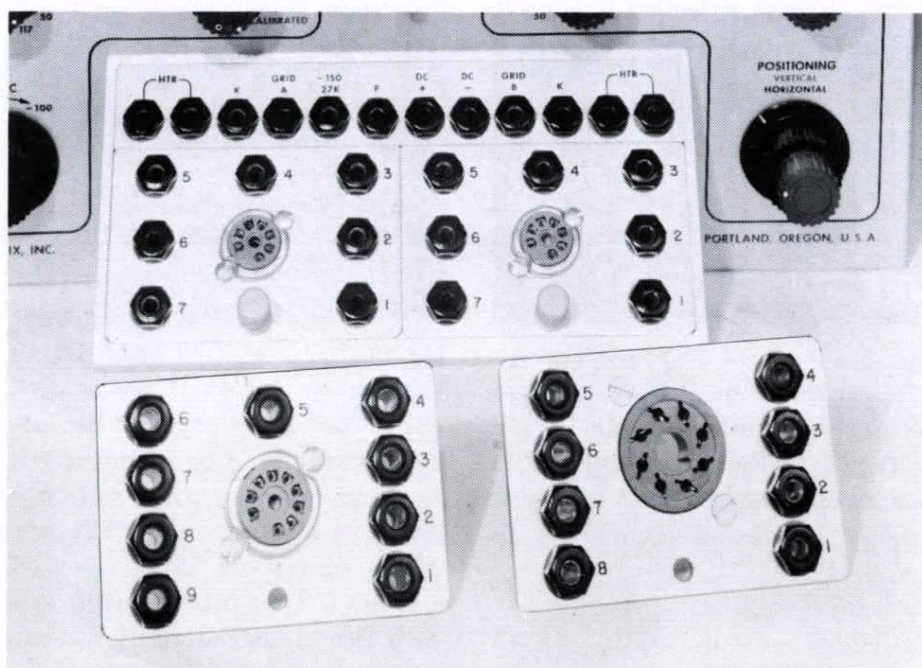
between steps to supply the proper heater voltage for practically all receiving-type vacuum tubes. Maximum power available from the heater transformer is 30 watts.

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.

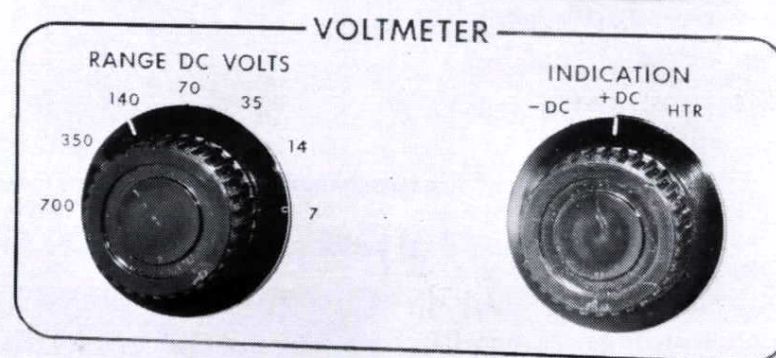
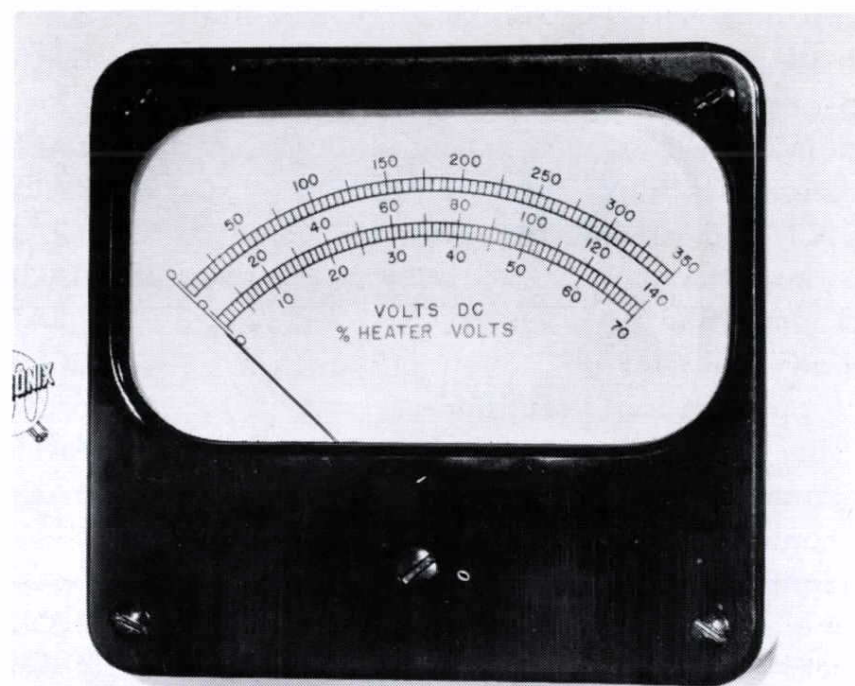
ADAPTER PLATES

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. Three types of patch cords are also furnished, making it possible to connect any tube element to any voltage supplied by the instrument.



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. The voltmeter can be switched to show the percent of heater voltage indicated by the heater-voltage selector switch.



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.

Safety Switch—The extremely flexible operational-setup facility of the Type 570 requires that potentially dangerous voltages be present at the patch panel. All voltages to the patch panel can be removed by a front panel switch for safety and convenience while changing the operation setup. A jewel light indicates when power is present at the patch panel.

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 Tektronix T52P cathode-ray tube is used in the Type 570. Accelerating potential is approximately 4 kv. P1 phosphor is supplied unless another phosphor is specifically requested.

Illuminated Graticule—The 10 x 10-division graticule is edge-lighted. Illumination control, and focus, in-

TYPE 570 CHARACTERISTIC-CURVE TRACER

tensity, and astigmatism controls are accessible through a door in the top of the cabinet.

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 CF and voltage regulator CF		12AX7
Step amplifiers	2	6AU6
Step amplifier		12AT7
Cathode follower		6CL6
Plate power-supply rectifiers	2	6AX4
Rectifier diodes		6AL5
Horizontal-deflection amplifiers	2	6AU6
Horizontal-deflection amplifier CF	2	6AU6
Horizontal-deflection output amplifiers		6BQ7A
Vertical-deflection amplifiers	2	6AU6
Vertical-deflection output amplifiers		6BQ7A
Variable dc-supply rectifier		6AX5
Fixed dc-supply rectifier	4	6X4
Regulator amplifiers	2	6AU6
Voltage reference		5651

Regulator amplifier and series regulator	6AN8
Regulator amplifier	6AN8
Series regulators	2 12B4
Series regulator	6CD6GA
Variable dc-supply CF	12AT7
High-voltage oscillator	6AQ5
Regulator amplifier and CF	12AU7
High-voltage rectifiers	2 5642
Cathode-ray tube	T52P1

MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and cabinet.

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

Dimensions—16 1/2" high, 13" wide, 24 1/2" deep.

Weight—75 pounds.

Power Requirements—105-125 or 210-250 v, 50 or 60 cycles, 400 watts maximum, 300 watts standby.

Price \$925

- Includes: 8—Adapter plates
- 5—1/16 amp 3AG Fast-Blo fuses
- 26—Patch cords
- 1—Instruction manual

Currently Available Extras

P1 crt phosphor normally furnished.

P2, P7, P11 optional No extra charge

Price f.o.b. Portland, Oregon.

Type 570 Characteristic-Curve Displays

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.

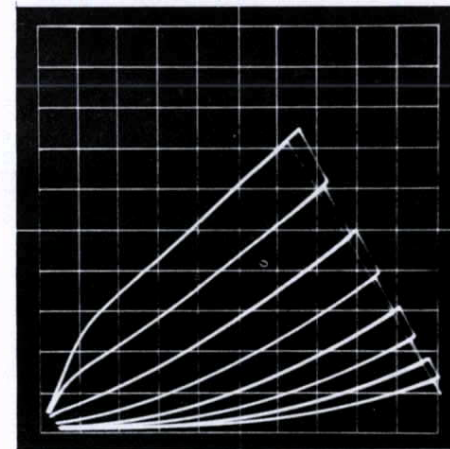
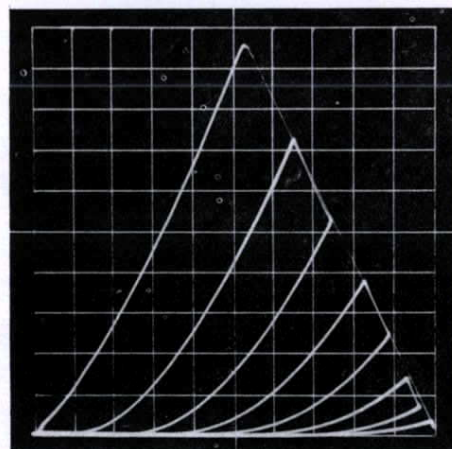


Fig. 2—Same triode section of 12AU7 with only 20-v peak plate supply and sensitivities increased to 0.2 ma/div vertical and 2 v/div horizontal. Grid voltage is changed 2 v between curves, from -14 v to zero. This is essentially a 25-times magnification of the lower left portion of Fig. 1, showing the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

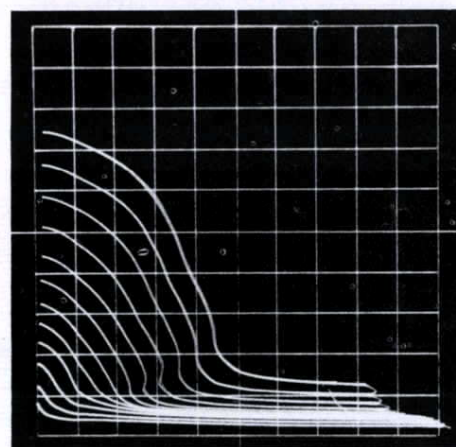


Fig. 3—Screen current plotted against plate voltage with positive grid bias on a 6AQ5. Plate load is 300 ohms, peak plate voltage is 100 v, screen-grid voltage is 100 v, with grid voltage changing 2 v/step from +16 v to below zero. Vertical scale is 10 ma/div, horizontal scale 10 v/div.

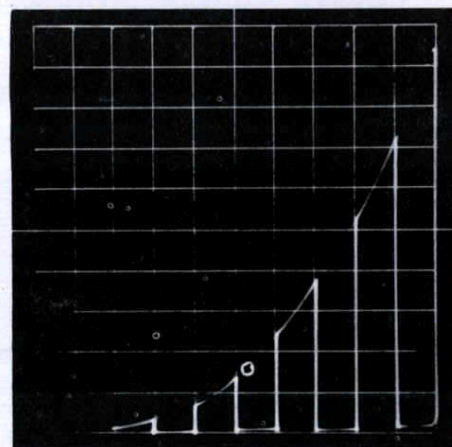


Fig. 4—Typical 12AU7 Eg-Ip curves. Plate load 5 k, peak plate-supply voltage 500 v, grid voltage changing 5 v/step from -35 v to zero, vertical sensitivity 5 ma/div, horizontal sensitivity 5 v/div.

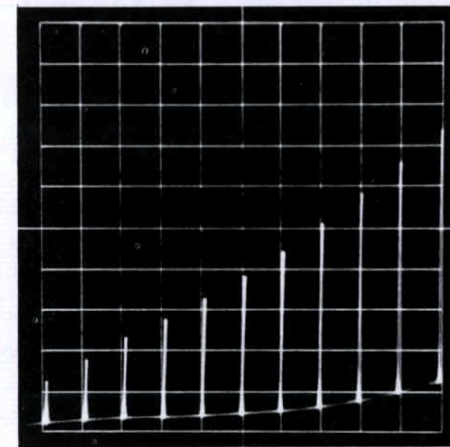


Fig. 5—Another family of curves with positive grid bias. Screen current is plotted against grid voltage. Operating conditions of the 6AQ5 are identical to Fig 3, except horizontal sensitivity is 2 v/div.

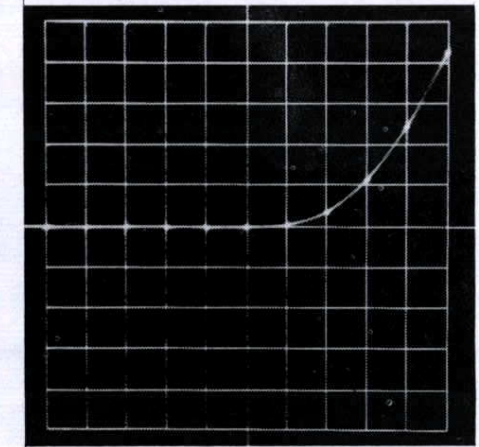


Fig. 6—Typical GERMANIUM DIODE curve. Inherent flexibility of the Type 570 permits accurate evaluation of diode characteristics and detailed examination of any part of the curve. Calibrated scales above are 0.2 v/div horizontal, 0.5 ma/div vertical, with zero points at center of screen.



TYPE 575 TRANSISTOR-CURVE TRACER

Displays PNP and NPN Characteristics

10-AMPERE COLLECTOR SUPPLY

2.4-AMPERE BASE SUPPLY

Positive or Negative Collector Sweep

Collector supply—0 to 20 v, 10 amperes.
—0 to 200 v, 1 ampere.

Positive or Negative Base Stepping

4 to 12 steps/family, repetitive or single family display.
17 current/step positions, 0.001 ma/step to
200 ma/step.
5 voltage/step positions, with 24 different driving
resistances.

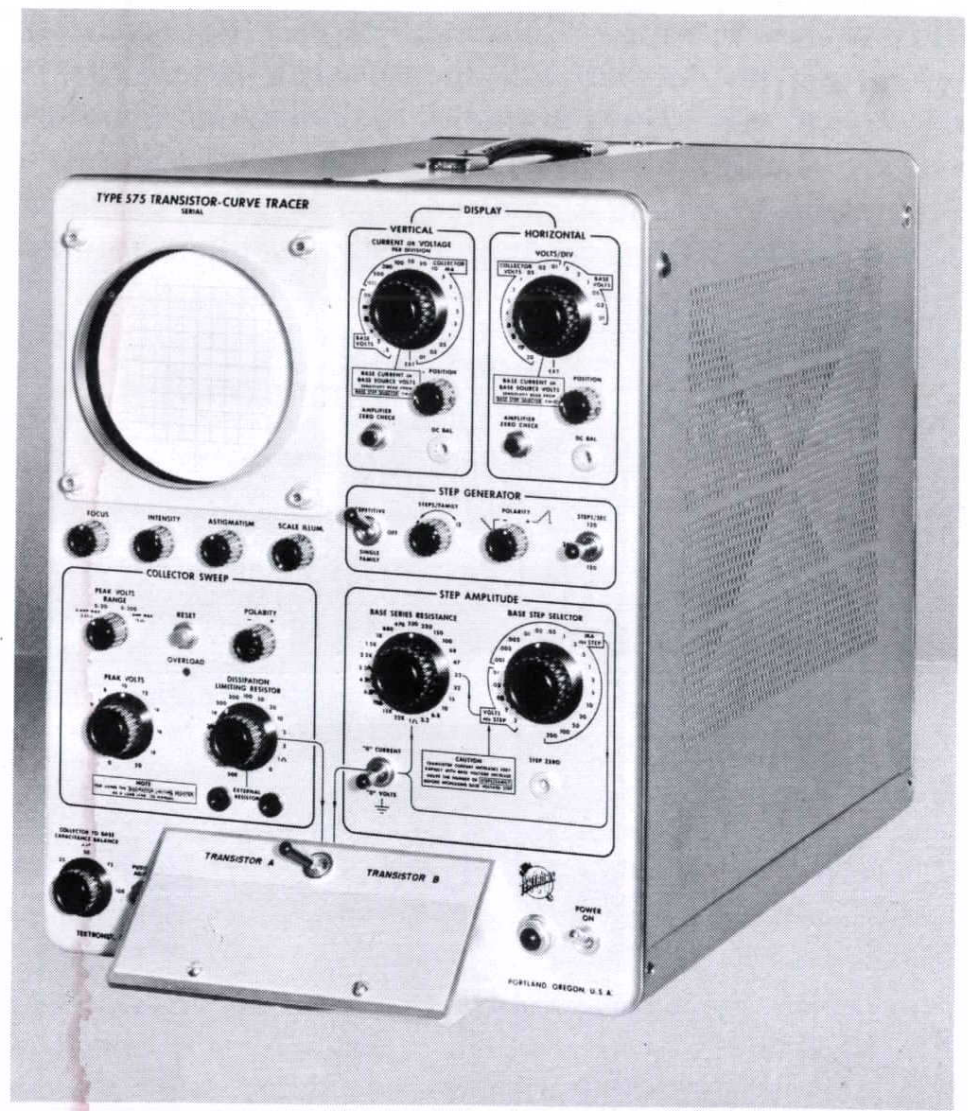
Calibrated Display

Vertical Axis—

Collector current
Base voltage
Base current
Base source voltage

Horizontal Axis—

Collector voltage
Base voltage
Base current
Base source voltage



TENTATIVE SPECIFICATIONS

REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY OCTOBER, 1957

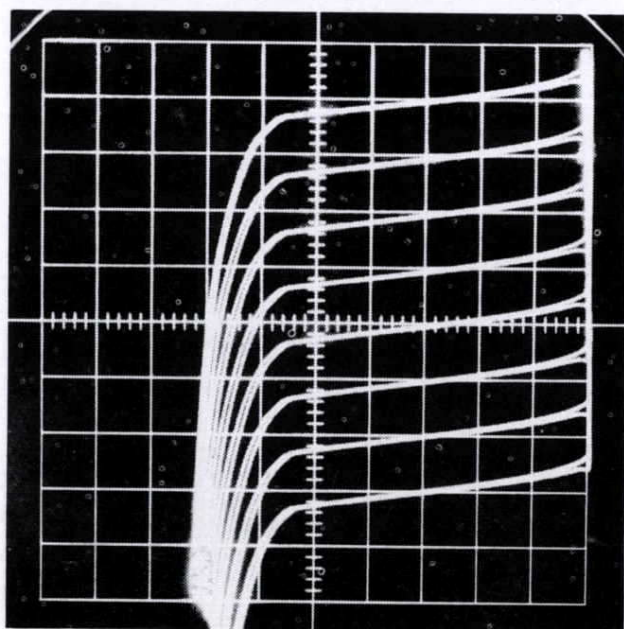


Fig. 1 — PNP Transistor

Collector current vs collector voltage with base grounded and constant-current emitter steps. Collector sweep is 0 to 120 v through a 5 k load resistor, emitter current 1 ma/step. Vertical deflection is 1 ma/div, horizontal deflection 10 v/div.

GENERAL DESCRIPTION

The Tektronix Type 575 traces characteristic curves for both PNP and NPN transistors on the face of a cathode-ray tube. Equal steps of current, or equal steps of voltage, are applied to the transistor input. The voltage applied to the collector is swept from zero to a selected value on each input step. Seven different transistor characteristics are accurately plotted for examination and measurement. Vertical deflection is calibrated for collector current, base voltage, base current, and base source voltage. Horizontal deflection is calibrated for collector voltage, base voltage, base current, and base source voltage. The number of steps per family is adjustable from 4 to 12, and the step/sec rate is 120 or 240. A repetitive display or a single family can be presented. Dissipation limiting resistors can be switched into the collector supply circuit. When equal steps of voltage are in use, series resistors can be switched into the step output circuit.

TYPE 575 TRANSISTOR-CURVE TRACER

CATHODE-RAY-TUBE DISPLAY

Vertical Axis—A 24-position switch provides for selection of collector current, base voltage, base current, or base source voltage. Calibrated vertical deflection in current-per-division for collector current is selected from sixteen of the switch positions, 0.01 ma/div to 1000 ma/div. Calibrated vertical deflection in volts-per-division for base voltage is selected from six other positions of the switch, 0.01 v/div to 0.5 v/div. Another position

of the switch provides for vertical deflection by base current or base source voltage. Calibrated vertical deflection for base current and base source voltage is selected with the BASE STEP SELECTOR switch.

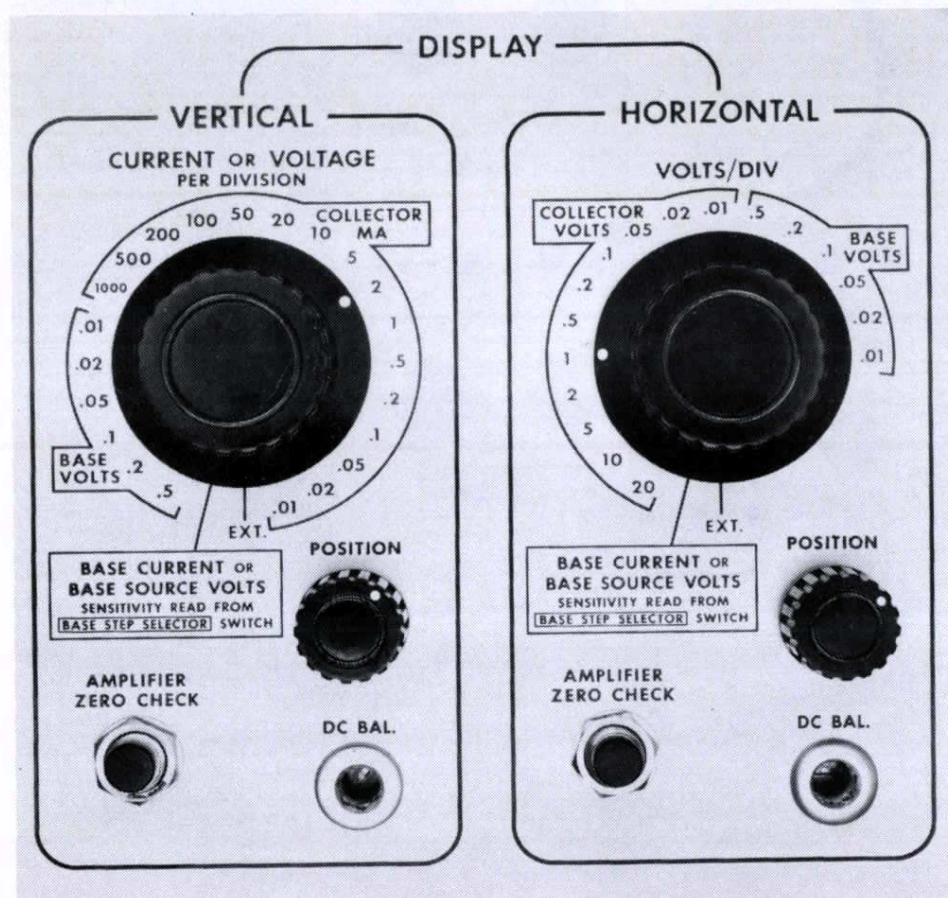
A vertical-position control and an amplifier-zero-check pushbutton are provided.

Horizontal Axis—A 19-position switch provides for selection of base voltage, collector voltage, base current, or base source voltage. Calibrated horizontal deflection in volts-per-division for base voltage is selected from six switch positions, 0.01 v/div to 0.5 v/div. Calibrated deflection for collector voltage is selected from eleven other positions, 0.01 v/div to 20 v/div. Another switch position provides for horizontal deflection by base current or base source voltage. Calibrated horizontal deflection for base current and base source voltage is selected with the BASE STEP SELECTOR switch.

A horizontal-position control and an amplifier-zero-check pushbutton are provided.

STEP GENERATOR and STEP AMPLITUDE

The Type 575 step generator produces input steps of constant current from 0.001 ma/step to 200 ma/step, and input steps of constant voltage from 0.01 v/step to 0.2 v/step with a source impedance of one ohm. A polarity switch provides for stepping the input in either the positive or negative direction. The number of steps per family is adjustable from 4 to 12, and a repetitive or single-family display can be presented. Either a 120-steps/sec or 240-steps/sec repetition rate can be select-



TENTATIVE SPECIFICATIONS

... REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY OCTOBER, 1957

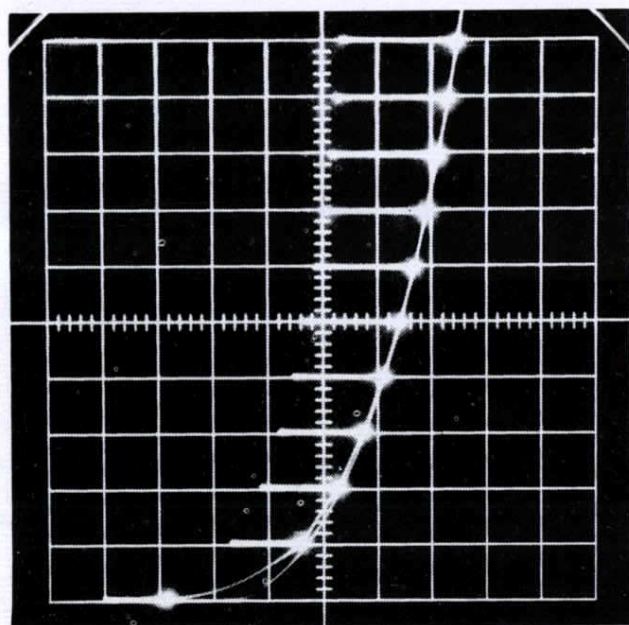


Fig. 2 — NPN Transistor

Base current vs base voltage with constant-current base steps. Collector sweep is 0 to 1 v, base current 0.1 ma/step. Vertical deflection is 0.1 ma/div, horizontal deflection 0.05 v/div. Dots represent equal increments of base current. Dynamic base impedance can be determined from this display.

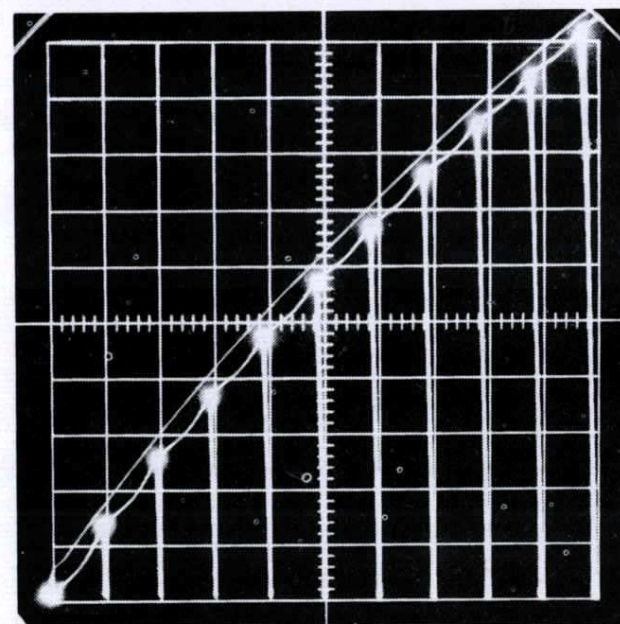
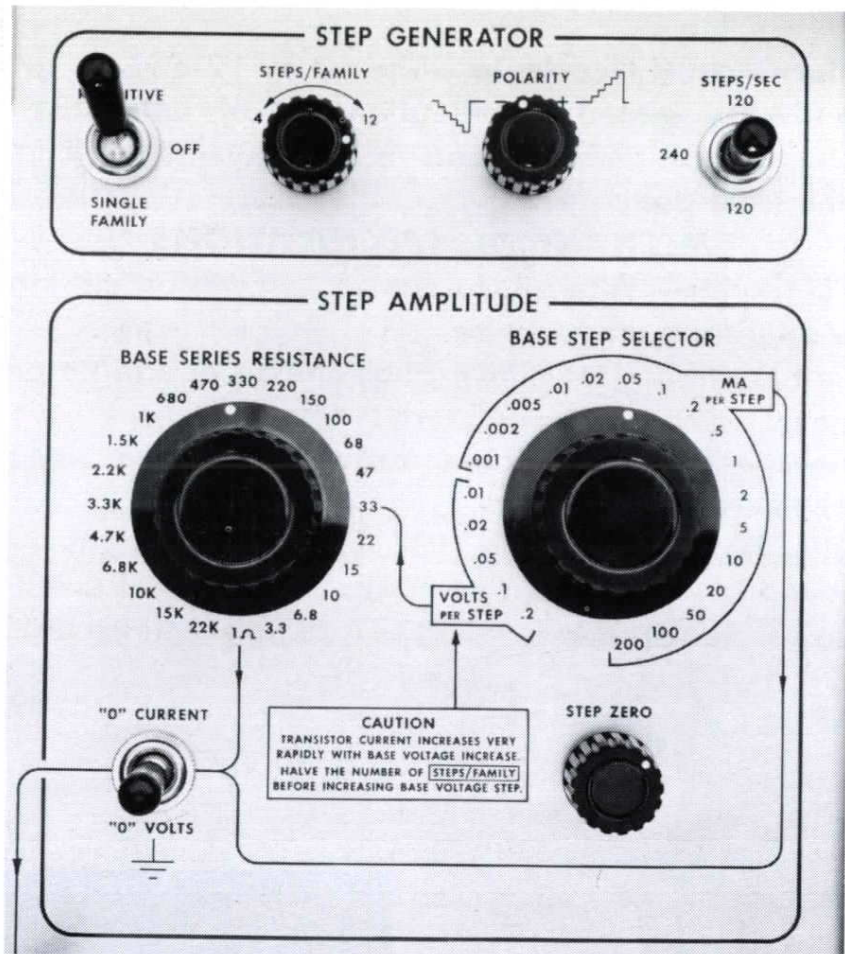


Fig. 3 — NPN Transistor

Collector current vs base current with constant-current base steps. Collector sweep is 0 to 1.5 v, base current 0.1 ma/step. Vertical deflection is 5 ma/div collector current, horizontal deflection 0.1 ma/div base current. Incremental and dc current gain can be determined from this display.

TYPE 575 TRANSISTOR-CURVE TRACER

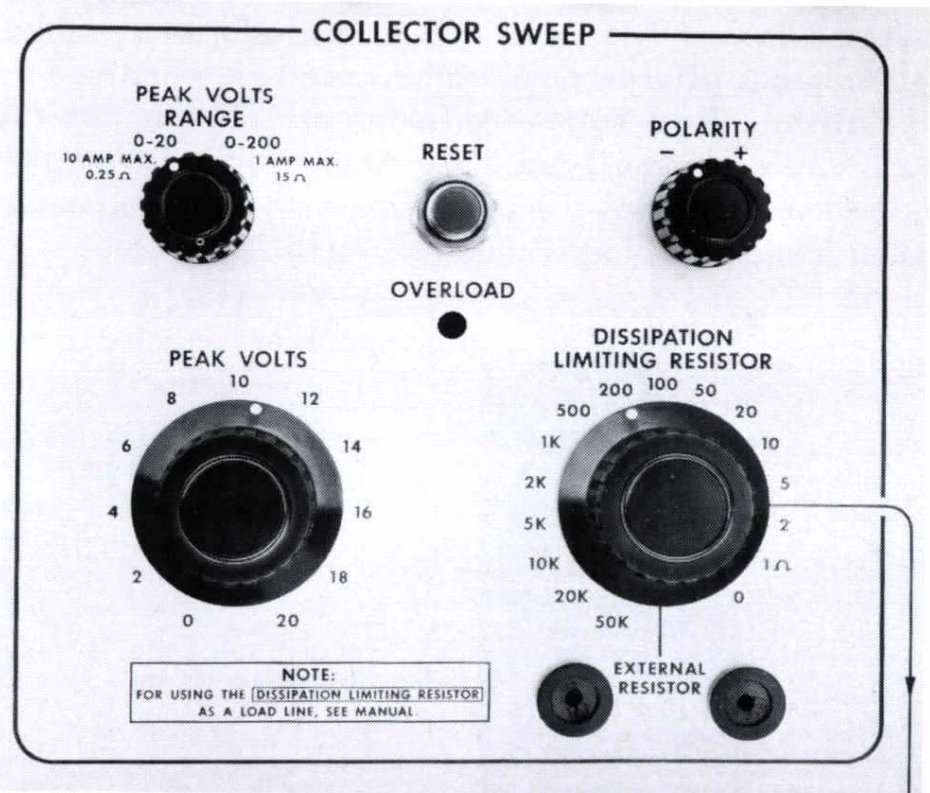


ed. A switch is provided for grounding the transistor input for a zero voltage reference check, and opening the transistor input for a zero current reference check. The starting point of input current or voltage steps can be adjusted with the STEP ZERO control.

When constant-voltage input steps are in use a resistance is inserted in series with the one-ohm source impedance of the step generator. This driving resistance can be selected from 23 values, 3.3 ohms to 22 kilohms.

COLLECTOR SWEEP

The voltage applied to the collector is swept to a selected value on each input current or voltage step. A polarity switch provides for sweeping the collector voltage in either the positive or negative direction. Peak collector voltage is continuously adjustable from zero to 20 v, and from zero to 200 v. Maximum current is 10 amperes on the 0-to-20 v range, 1 ampere on the 0-to-200 v range. Any of fifteen load resistors from 0.35 ohm to 50 kilohms can be inserted for limiting collector dissipation.



TENTATIVE SPECIFICATIONS

... REGULAR PRODUCTION AND INITIAL SHIPMENT EXPECTED TO BEGIN APPROXIMATELY OCTOBER, 1957

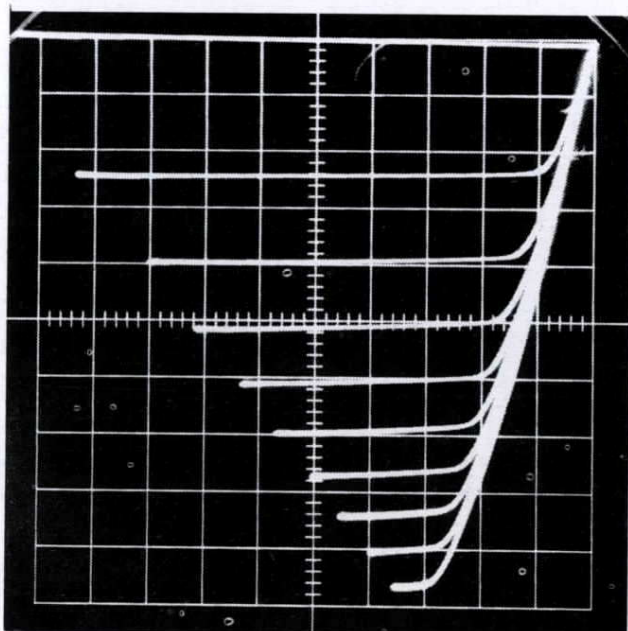


Fig. 4 — PNP Transistor

Collector current vs collector voltage with constant-current base steps. Collector sweep is 0 to 5 v with a 0.25-ohm load, base current is 50 ma/step. Vertical deflection is 1000 ma/div, horizontal deflection 0.5 v/div.

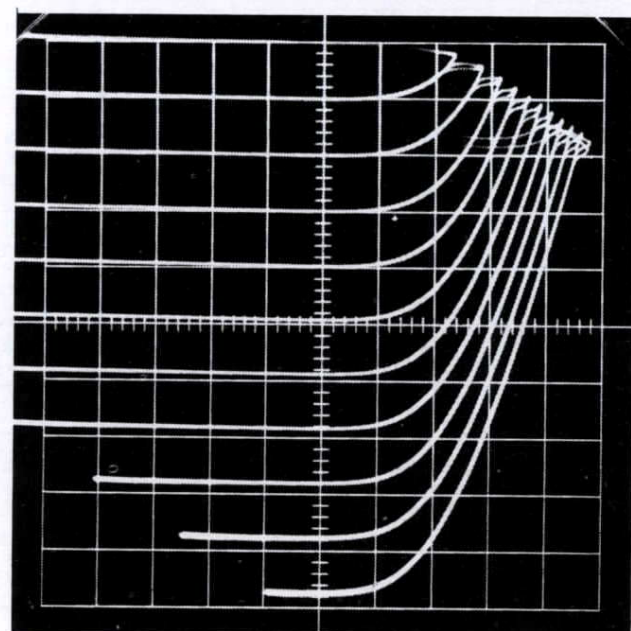


Fig. 5 — PNP Transistor

Collector current vs collector voltage with base grounded and constant-current emitter steps. Collector sweep is 0 to 1.5 v, emitter current 200 ma/step. Vertical deflection is 200 ma/div, horizontal deflection 0.1 v/div.

TYPE 575 TRANSISTOR-CURVE TRACER

Provision is also made for substitution of an external resistor.

OTHER FEATURES

Input Selection—A switch is provided for changing the test conditions from the common-emitter to the common-base configuration.

Comparison Tests—Two transistors can be rapidly compared by switching the test conditions from one to the other.

Regulated Power Supply—Electronic voltage regulation is used to compensate for line-voltage changes between 105 and 125 volts, and for variations in loading. All voltages affecting calibrations are fully regulated.

Cathode-Ray Tube—A Tektronix T52P cathode-ray tube is used in the Type 575. Accelerating potential is approximately 4 kv. P1 phosphor is supplied unless another phosphor is specifically requested.

Illuminated Graticule—The 10 by 10-division graticule is edge-lighted. Illumination control, and focus, intensity, and astigmatism controls are conveniently located on the front panel.

MECHANICAL SPECIFICATIONS

Ventilation—Filtered, forced air circulation maintains safe operating temperature.

Construction—Aluminum-alloy chassis and three-piece cabinet.

Finish—Photo-etched anodized panel, blue wrinkle-finished cabinet.

Dimensions—24" long, 13" wide, 16 3/4" high.

Weight—Approximately 70 lbs.

Power Requirements—105 to 125 volts, 60 cycles.

Price \$925

Price f.o.b. Portland, Oregon.

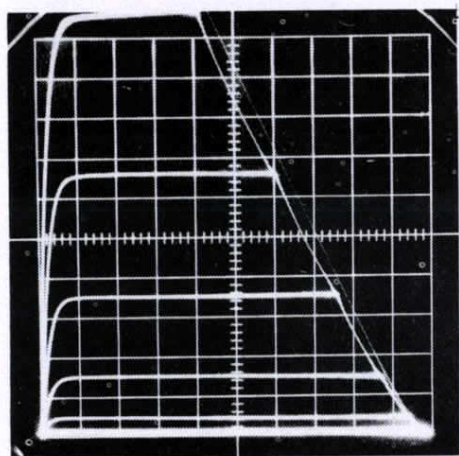


Fig. 6 — NPN Transistor
Collector current vs collector voltage with constant-voltage base steps. Collector sweep is 0 to 2 v, base voltage 0.02 v/step, vertical deflection is 5 ma/div, horizontal deflection 0.2 v/div.

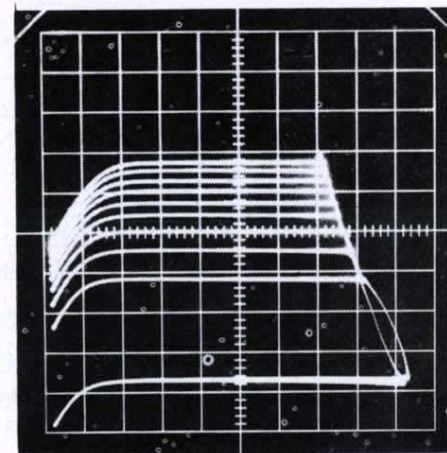


Fig. 7 — NPN Transistor
Base voltage vs collector voltage with constant-current base steps. Collector sweep is 0 to 1 v, base current 0.1 ma/step. Vertical deflection is 0.05 v/div base voltage, horizontal deflection 0.1 v/div collector voltage.

TENTATIVE SPECIFICATIONS

..... REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY OCTOBER, 1957

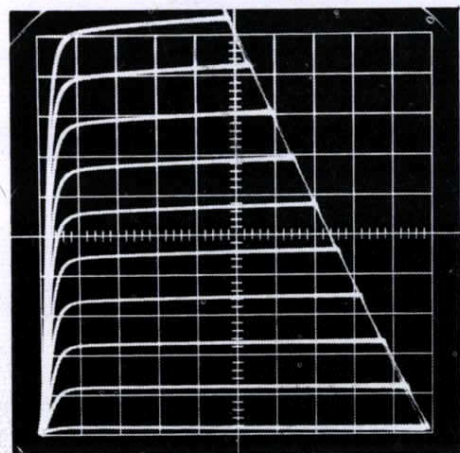


Fig. 8 — NPN Transistor
Collector current vs collector voltage with constant-current base steps. Collector sweep is 0 to 2 v, base current 0.01 ma/step. Vertical deflection is 0.5 ma/div, horizontal deflection 0.2 v/div.

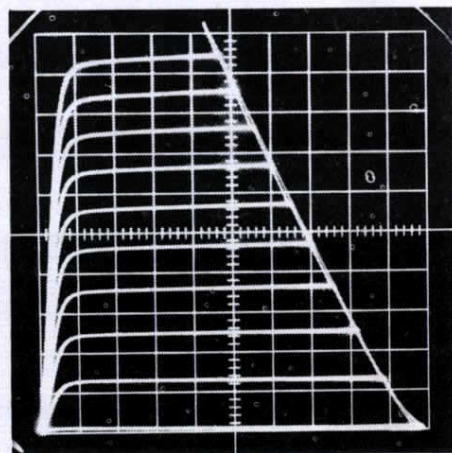


Fig. 9 — NPN Transistor
Same as Fig 8 except base-current steps are 0.1 ma/step and vertical deflection is 5 ma/div.

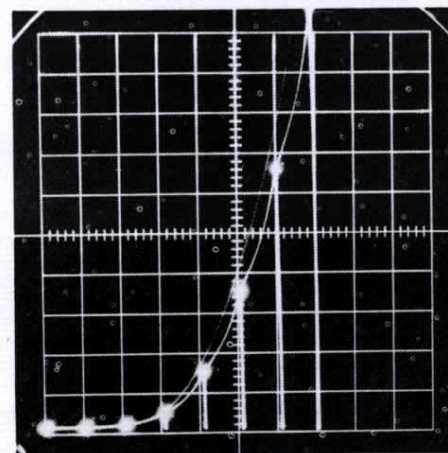


Fig. 10 — NPN Transistor
Collector current vs base voltage with constant-voltage base steps. Collector sweep is 0 to 1.5 v, base voltage 0.05 v/step with a 1-ohm source impedance. Vertical deflection is 0.5 ma/div, horizontal deflection 0.05 v/div.

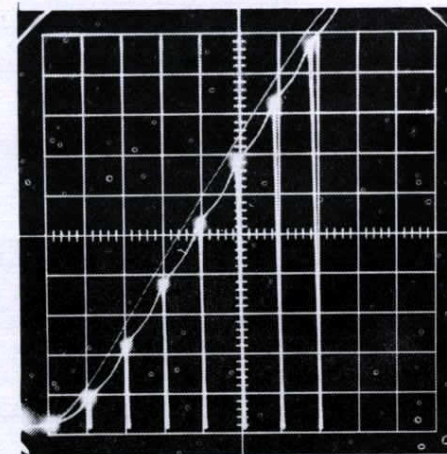
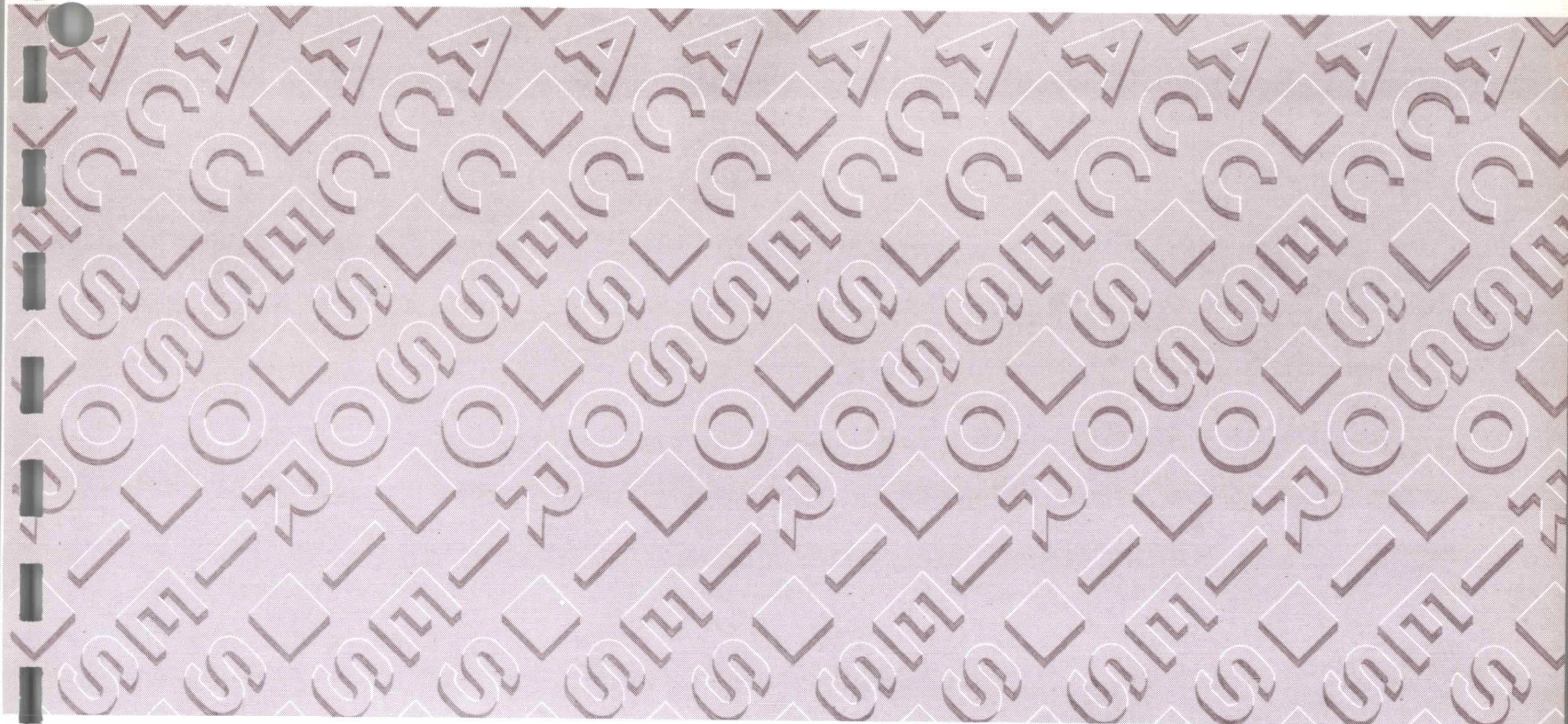


Fig. 11 — NPN Transistor
Same as Fig. 10 except base-voltage steps are 0.1 v/step with a 470-ohm source impedance.



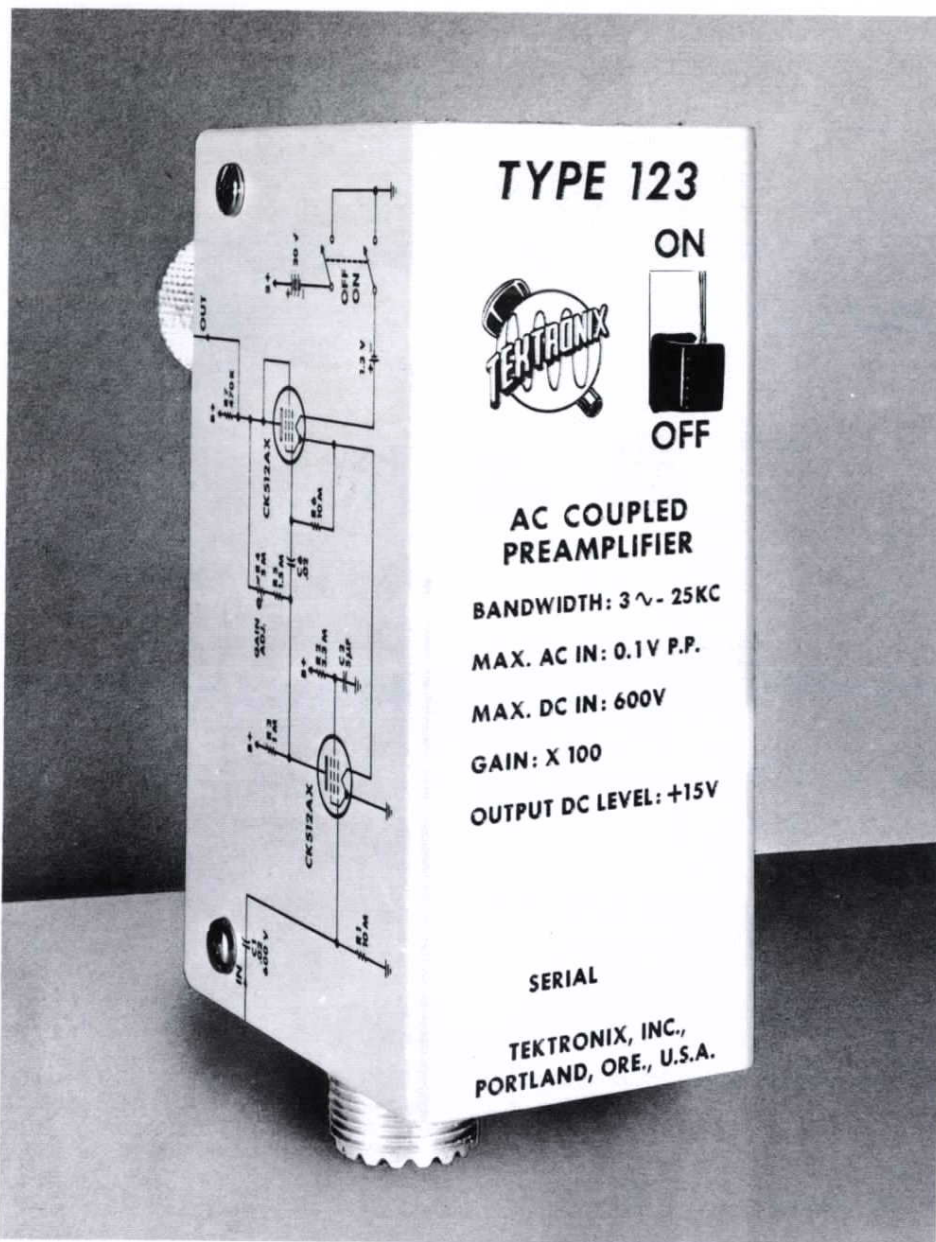
ACCESSORIES

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 123 PREAMPLIFIER



Compact

3 5/8" high, 1 1/2" wide, 2-3/16" deep.

Weighs only 10 ounces.

Voltage Gain

Accurately set at 100 times.

Passband

Within 2% from 15 cycles to 6 kc.
Within 3 db from 3 cycles to 25 kc.

Maximum Input Signal

0.1 v peak-to-peak.

Hum-Free Low-Level Amplification

Powered by miniature batteries.

GENERAL DESCRIPTION

The Tektronix Type 123 Preamplifier is a compact, light-weight, battery-operated amplifier for use in applications where a gain of 100 without additional hum signal is desired. Passband is 3 cycles to 25 kc. Etched

wiring, miniature tubes and small batteries are combined in a unit about the size of 2 king-size cigarette packages. Where reduced high-frequency response is permissible, ground-loop hum pickup can be virtually eliminated by mounting the Type 123 close to the circuit under observation. Coaxial connectors permit the Type 123 to be connected directly to an oscilloscope or other instrument, and at reduced high-frequency response, in a connecting cable, or even for use as a probe. Shock-mounted chassis reduces the effects of microphonics, shift, and drift.

Applications of the Type 123 are confined to the audio range; for example, observing hum levels, transducer pre-amplifier, and other low-level applications where a gain of 100 is desired.

CHARACTERISTICS

Voltage Gain—Gain is 100, adjustable with screw-driver calibration control.

Passband—Within 3 db from 3 cycles to 25 kc. Within 2% from 15 cycles to 6 kc.

Battery Powered—A small mercury cell supplies the filament voltage and a miniature 30 v battery is the source of plate voltage. Life of the mercury cell is approximately 100 hours. Low plate current, 75 microamps, assures plate-supply battery life of more than 100 hours.

Noise Level—The maximum noise level with the input grounded is less than 7.5 microvolts, rms.

Output Signal Level—DC level of output is approximately +15 v.

Maximum Input Signal—Maximum input signal for linear amplification is 0.1 v, peak-to-peak.

Input Impedance—10 megohms.

Effective Output Impedance—31 kilohms.

Vacuum Tube Complement—Two Type 512AX sub-miniature filament-type pentodes.

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy cover and etched-wiring chassis.

Finish—Photo-etched anodized front panel.

Dimensions—3 5/8" high, 4 1/8" including coaxial connector; 1 1/2" wide; 2-3/16" deep, 3 3/4" including coaxial connector.

Weight—10 ounces.

Power Requirements—One 1.345 v mercury cell and one 30 v miniature battery, included with the instrument.

Price \$50

Includes: 1—Mercury cell
1—B battery

Price f.o.b. Portland, Oregon.



ACCESSORIES

Operational Accessories TYPE 124 TELEVISION ADAPTOR

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 μ sec, 0.1 μ sec, 0.05 μ sec 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

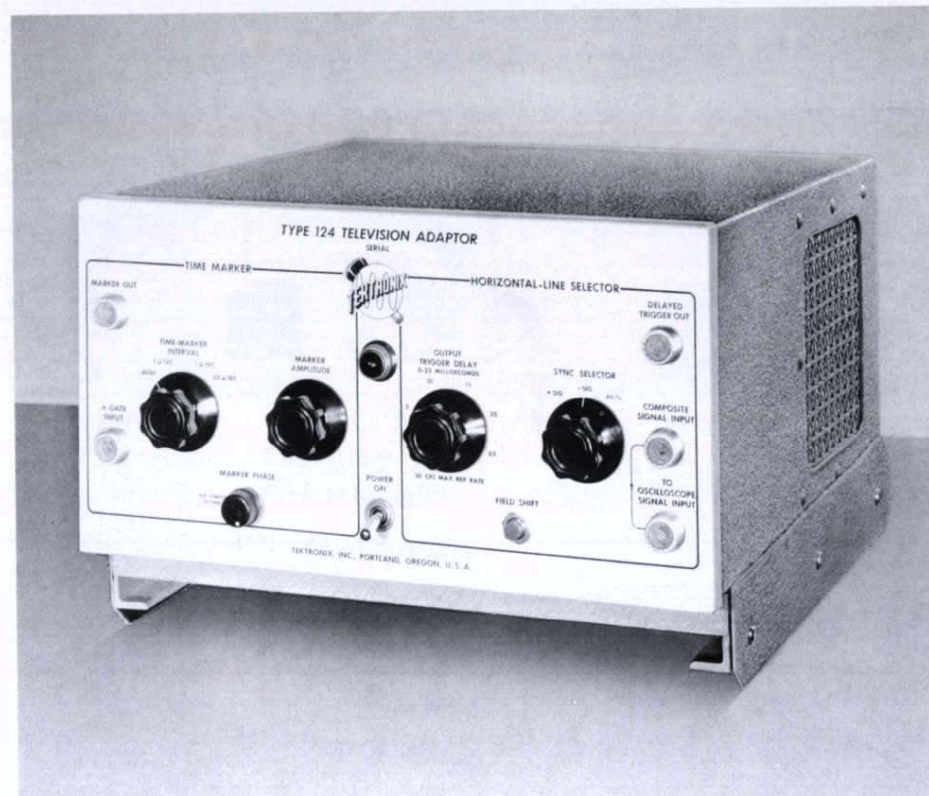
The delayed-trigger output of the Type 124 is continuously variable from zero to 25 milliseconds after receipt of a vertical sync pulse. By adjusting the delay, an oscilloscope can be triggered at the start of any desired line in a field. Panel push button provides instant shift to opposite field. Triggering occurs at half the television vertical rate. Duration of the output pulse is less than 1 μ sec, 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 μ sec, 0.1 μ sec, 0.05 μ sec, 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

MECHANICAL SPECIFICATIONS

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 3/4" high, 12 3/4" wide, 12 1/2" deep.

Weight—21 lbs.

Construction—aluminum alloy.

Finish—photo-etched anodized panel, wrinkle-finished cabinet.

Power requirements—105-125 v or 210-250 v, 50-60 cycles, 120 watts.

Price **\$295**

Includes: 1—FM124 Mounting frame (014003)
4—Connecting cables
1—Instruction manual

Price f.o.b. Portland, Oregon.

ACCESSORIES

Operational Accessories TYPE 126 POWER SUPPLY

Output Voltages

- + 300 v dc, unregulated.
- + 225 v dc, regulated, 45 ma maximum.
- + 150 v dc, regulated, 5 ma maximum.
- 170 v dc, regulated, 30 ma maximum.
- 6.3 v ac, unregulated, 4 amps maximum.

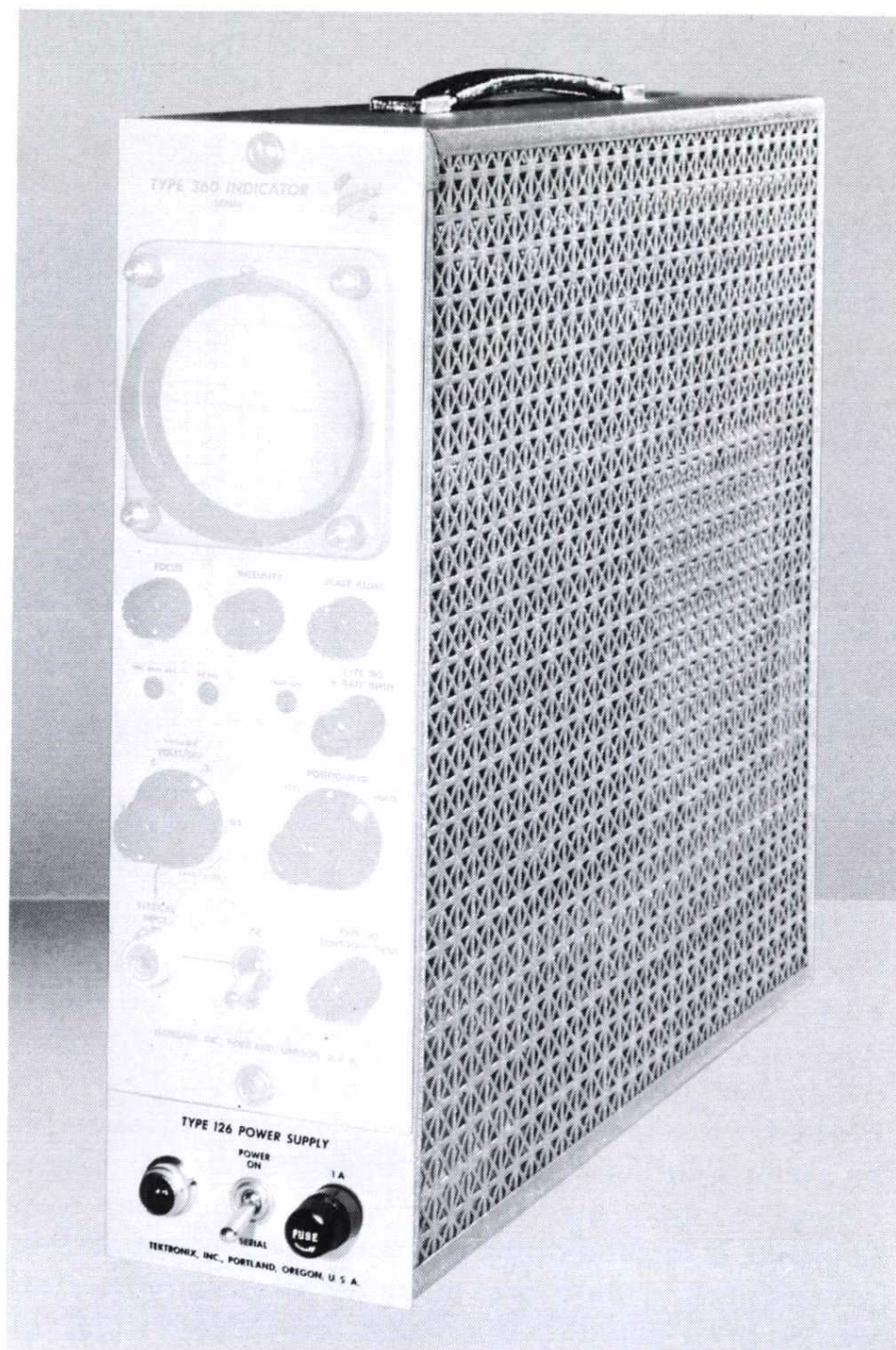
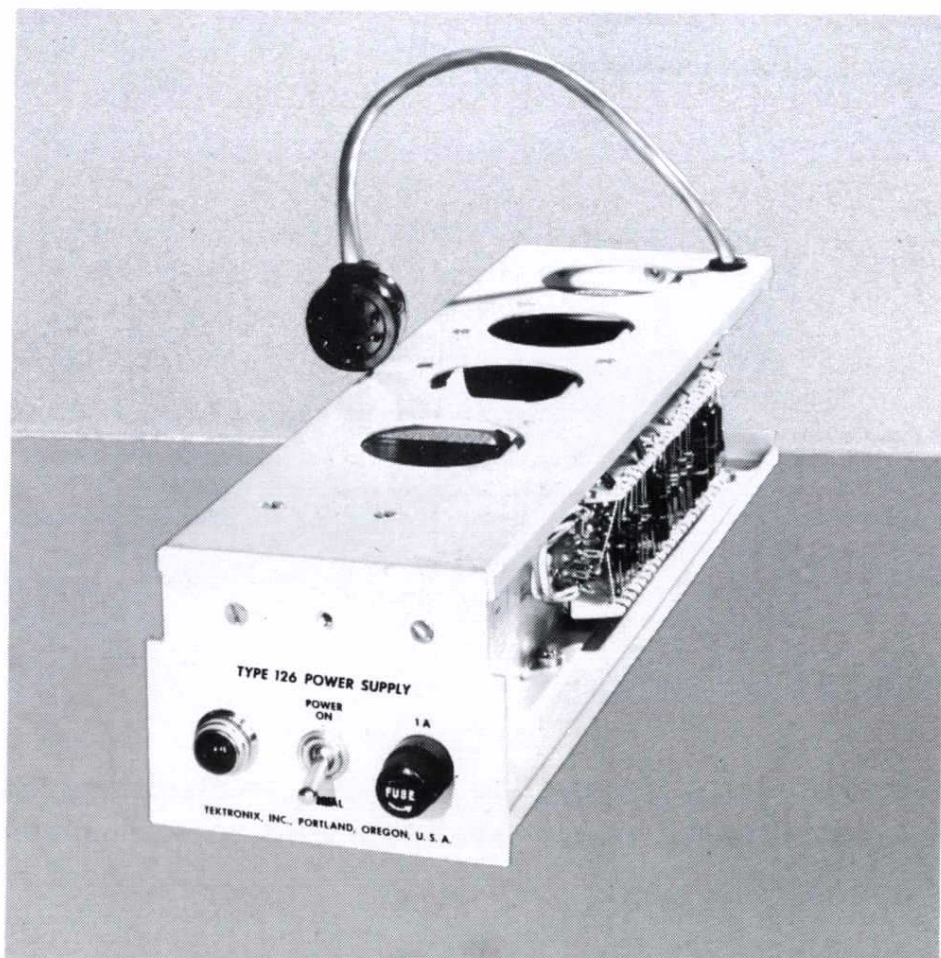
Small — Adds only 2 1/2" in height to Type 360 Indicator.

Electronic Voltage Regulation

GENERAL DESCRIPTION

The Tektronix Type 126 Power Supply supplies the required voltages and currents necessary to power one Type 360 Indicator or any one of the Type 160-Series Waveform Generators. The Type 126 mounts beneath the unit to be powered, and includes a cabinet to house both the Type 126 and the powered unit.

A Type 126 Power Supply combined with a Type 360 Indicator makes a practical, compact slave unit for any Tektronix oscilloscope. (The oscilloscope has the necessary sweep sawtooth and unblanking pulse for the Type 360 Indicator available at front-panel connectors.)



VACUUM TUBE COMPLEMENT

Rectifiers	2	6BW4
Regulator amplifier		6AU6
Regulator amplifier and voltage regulator CF		6AN8
Series regulators	2	12B4
Voltage reference		5651

MECHANICAL SPECIFICATIONS

Construction — Aluminum alloy.

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

Dimensions — 4 1/8" wide, 15 1/2" deep, cabinet height 14 3/4".

Weight — 10 1/2 pounds.

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

Price **\$100**

Includes: 1—Instruction manual

Price f.o.b. Portland, Oregon.

ACCESSORIES

Operational Accessories

SCOPE-MOBILE



The Tektronix Type 500 Scope-Mobile is a sturdy, mobile support for Tektronix 5" Oscilloscopes. Convenient observation of the crt face is achieved by a 20-degree backward tilt of the top surface. Auxiliary equipment can be mounted in the enclosed vented space behind the blank front panel. A drawer, felt-lined and operating on roller bearings, provides handy storage for probes, cables, manuals, etc. An open shelf, topped with tough linoleum, is located at the bottom. Power input and three convenience outlets are mounted at the rear. Total weight is 42 pounds. Dimensions are 18½" wide, 39" high and 30" deep. \$97.50



The Tektronix Type 500/53 Scope-Mobile is the Type 500 with a Type 53 Scope-Mobile front-panel installed. This front-panel has two supporting cradles to accommodate the Type 53 and 53/54 Plug-In Preamplifiers used in the Type 530 and Type 540-Series Oscilloscopes. In all other characteristics the Type 500/53 is identical to the Type 500. 108.00

Type 53 Scope-Mobile Panel — converts the Type 500 into a Type 500/53 Scope-Mobile by replacing the standard blank panel. 10.50

VIEWING HOODS



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



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

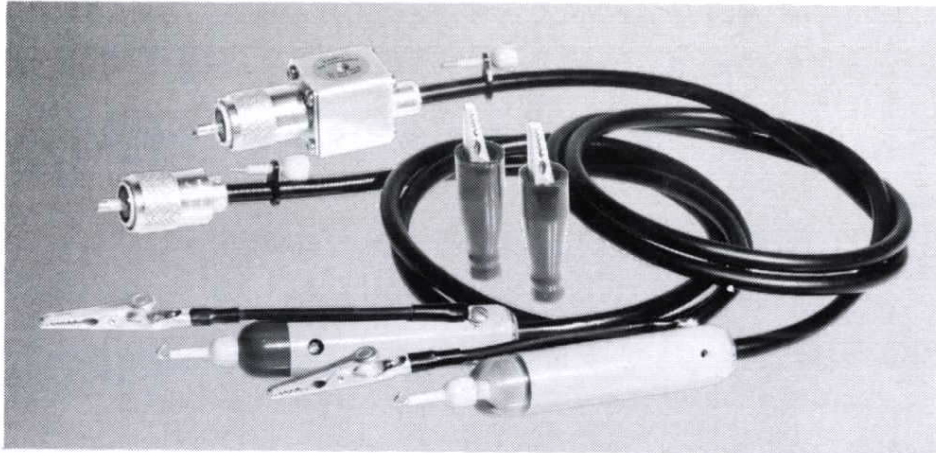
Prices f.o.b. Portland, Oregon.



ACCESSORIES

Operational Accessories

PROBES



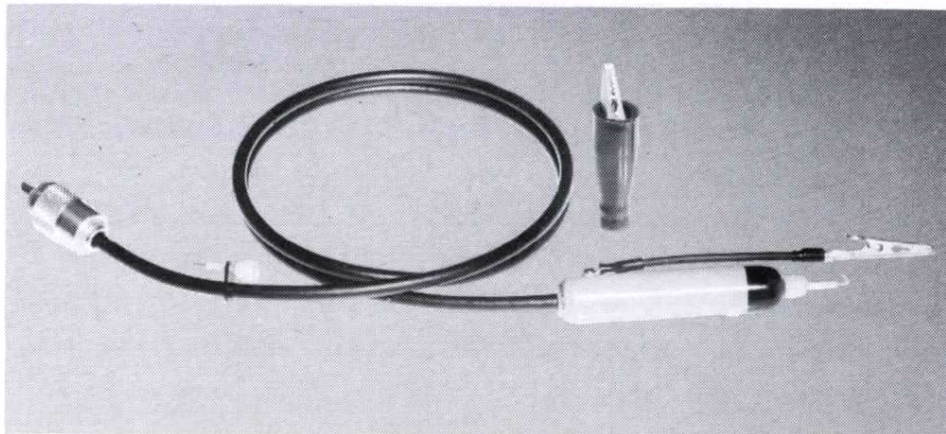
P400-Series Low-Capacitance Probes—This series of low-capacitance probes preserves the transient response of Tektronix fast-rise instruments. The P400-Series probes are free of overshoot and ringing and have relatively uniform high-frequency response. With exception of the P450-L, these probes can be used on other instruments having input capacitances from 20 to 50 $\mu\mu\text{f}$. General physical characteristics of the P400-Series probe are identical to the P510A probe. Color-coding of the plastic nose indicates attenuation ratio. Probes have 42" cable with coaxial connector and are rated at 600 v peak-to-peak. Two interchangeable Tektips—a straight tip and a hooked tip—each adding less than 0.5 $\mu\mu\text{f}$ to the input capacitance, and an alligator clip assembly are supplied with the probes.

- P405, P410, P420 10.50
- P450, P450-L, P4100 12.50
- Replacement Tektips, each25

P400-SERIES PROBE SPECIFICATION

Probe	Attenuation Ratio	INPUT IMPEDANCE		DB Loss at 30 MC
		Resistance (Megohms)	Capacitance Minimum* Maximum†	
P405	5:1	5	12 $\mu\mu\text{f}$ 19 $\mu\mu\text{f}$	1-2
P410	10:1	10	8 $\mu\mu\text{f}$ 11 $\mu\mu\text{f}$	1
P420	20:1	10	5.5 $\mu\mu\text{f}$ 7 $\mu\mu\text{f}$	1
P450	50:1	10	3.5 $\mu\mu\text{f}$ 3.5 $\mu\mu\text{f}$	1
P450-L	50:1	10	2.5 $\mu\mu\text{f}$	1
P4100	100:1	10	2.5 $\mu\mu\text{f}$ 2.5 $\mu\mu\text{f}$	1

*When connected to instruments with 20- $\mu\mu\text{f}$ input capacitance.
 †When connected to instruments with input capacitances up to 50 $\mu\mu\text{f}$.



P510A Attenuator Probe provides an attenuation of ten times when used with Tektronix oscilloscopes and amplifiers. The P510A is small and streamlined, and pre-

sents an input impedance of 10 megohms paralleled by 14 $\mu\mu\text{f}$. The probe is completely insulated — made of high-impact-strength fiberglass-reinforced alkyd — and has an internal brass shield. Two interchangeable Tektips—a straight tip and a hooked tip, and an alligator clip assembly are furnished. Probe has a 42" cable with coaxial connector, and is rated at 600 v peak-to-peak.

- P510A 8.50



P170CF Cathode Follower Probe was developed for use with the 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 the 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 the 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 $\mu\mu\text{f}$. The probe cable is 42" long. Probe complete with 3 attenuator heads 86.00

REPLACEMENT ATTENUATOR HEADS

- PAX-I Attenuator Head for P170CF, attenuation can be varied between 4 times and 40 times. 11.00
- PAX-II Attenuator Head for P170CF, attenuation can be varied between 20 times and 200 times. 11.00
- PAX-III Attenuator Head for P170CF, attenuation can be varied between 200 times and 2000 times. 11.00

P170CF can be used with the 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 terminations.) A rectifier kit, KP170CF, is recommended for installation in Type 513 to rectify the 6.3 volt heater supply.

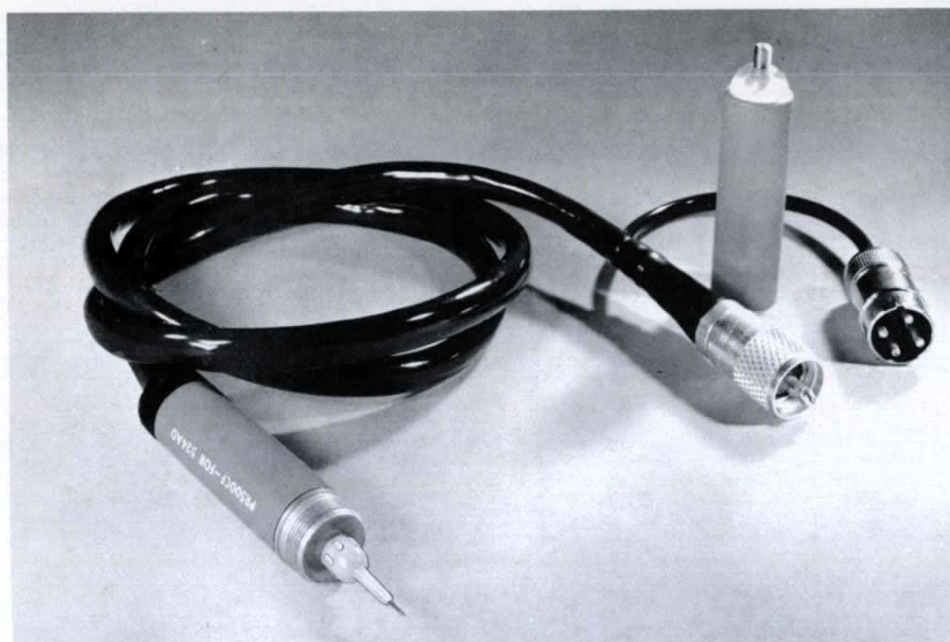
- KP170CF DC Filament Kit for Type 513. 4.50

Prices f.o.b. Portland, Oregon.



ACCESSORIES

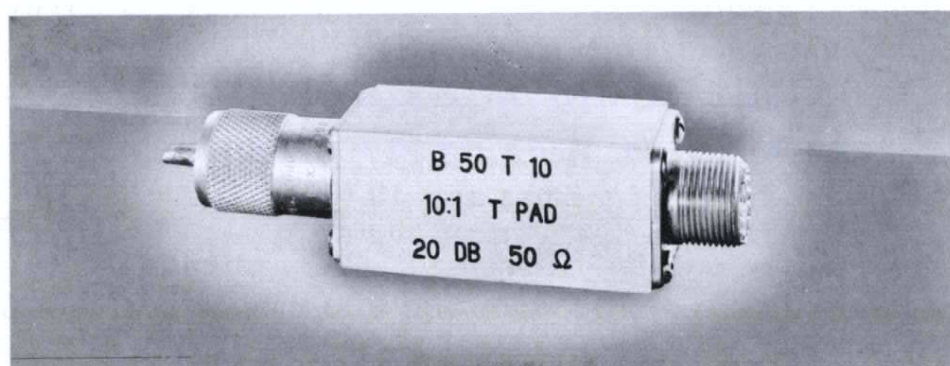
Operational Accessories



P500CF Cathode-Follower Probe—For use with Types 524D and 524AD Oscilloscopes. Presents low capacitance with minimum attenuation. Input impedance is 40 megohms paralleled by $4 \mu\mu\text{f}$, gain 0.8 to 0.85. Input to probe is ac-coupled, limiting its low-frequency response to 5 cycles. Amplitude distortion is less than 3% on unidirectional signals up to 5 volts. 10x 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 $2 \mu\mu\text{f}$. Probe output level is 11 v positive, making it necessary to use the ac-coupled position of the oscilloscope AC-DC switch. Probe cable is 42" long. 64.00

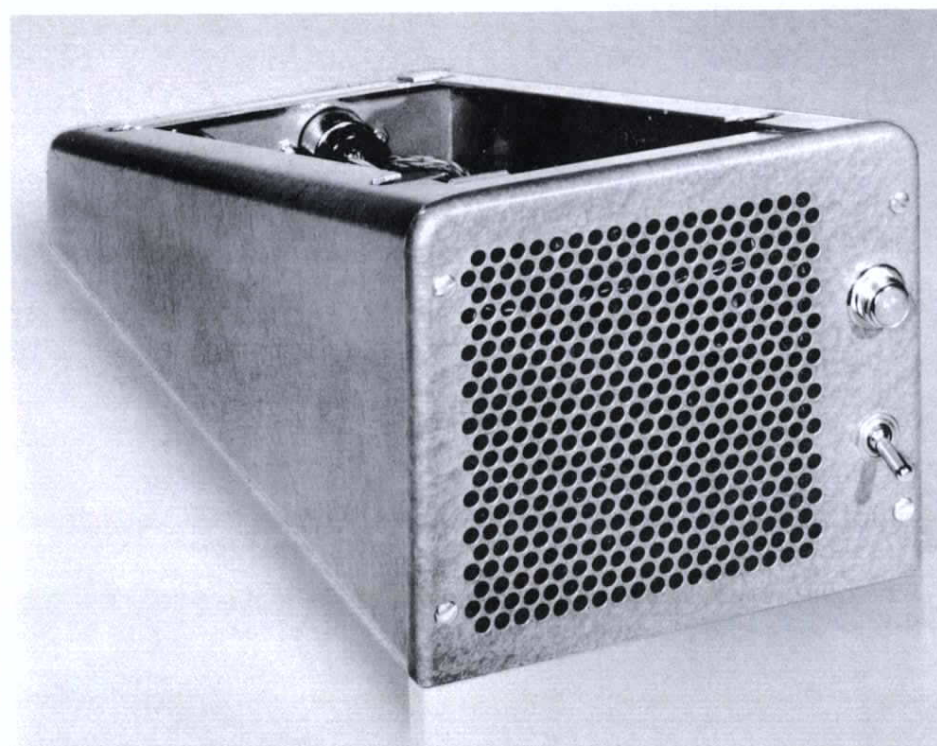
A modification kit is available to equip the Type 524D Oscilloscope with a front-panel probe-power connector. Modification Kit K524-1021A. 5.00

TERMINATIONS, PADS, ATTENUATORS



B52-R	52-ohm terminating resistor, 1.5 w. . .	8.50
B52-L5	52-ohm 'L' pad, 5 to 1 voltage ratio, 1.5 w	8.50
B52-L10	52-ohm 'L' pad, 10 to 1 voltage ratio, 1.5 w	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, 1.5 w	11.50
B75-R	75-ohm terminating resistor, 1.5 w. . .	8.50
B75-L5	75-ohm 'L' pad, 5 to 1 voltage ratio, 1.5 w	8.50
B75-L10	75-ohm 'L' pad, 10 to 1 voltage ratio, 1.5 w	8.50
B75-T10	75-ohm 'T' pad, 10 to 1 voltage ratio, 1.5 w	11.50
B93-R	93-ohm terminating resistor, 1.5 w. . .	8.50
B93-L5	93-ohm 'L' pad, 5 to 1 voltage ratio, 1.5 w	8.50
B93-L10	93-ohm 'L' pad, 10 to 1 voltage ratio, 1.5 w	8.50
B93-52L	Minimum-loss pad, 93 ohms to 52 ohms, 1.5 w.	11.50
B93-T10	93-ohm 'T' pad, 10 to 1 voltage ratio, 1.5 w	11.50
B170-R	170-ohm terminating resistor, 1.5 w. . .	8.50
B170-A	170-ohm π -attenuator, using 2% precision resistors, 1 to 64 db in 1 db steps, 0.25 w	45.00



FB 310 Fan Base—for Type 310 Oscilloscope. Provides filtered, forced-air ventilation to assure safe operating temperature when the Type 310 Oscilloscope is being used continuously over long periods, or in hot or limited-ventilation areas. The fan base tilts the oscilloscope to a convenient viewing angle. For use on 105-125 v, 60 cycle only. 25.00

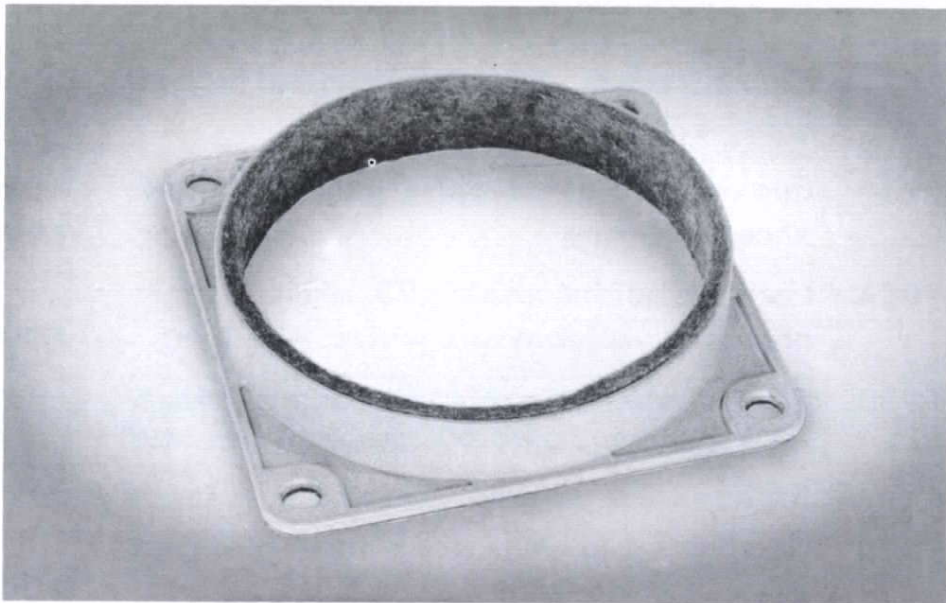
FB 310-S1 Fan Base—for use on 210-250 v, 50 to 60 cycles only. 25.00

Prices f.o.b. Portland, Oregon.

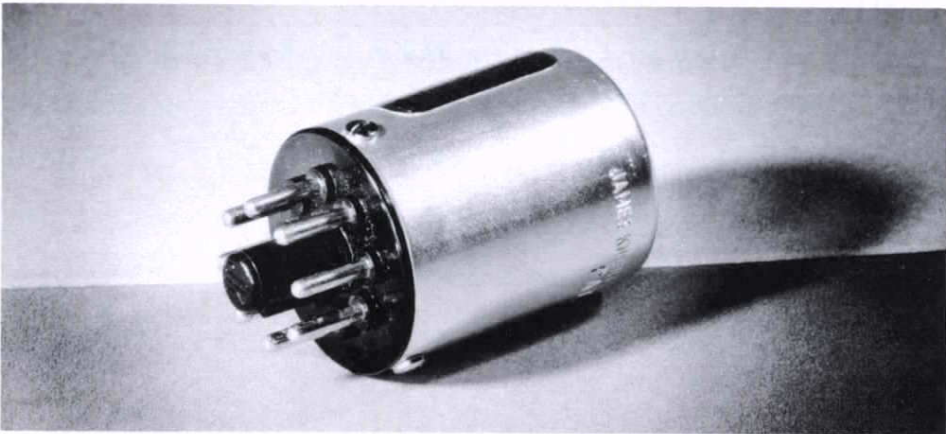


ACCESSORIES

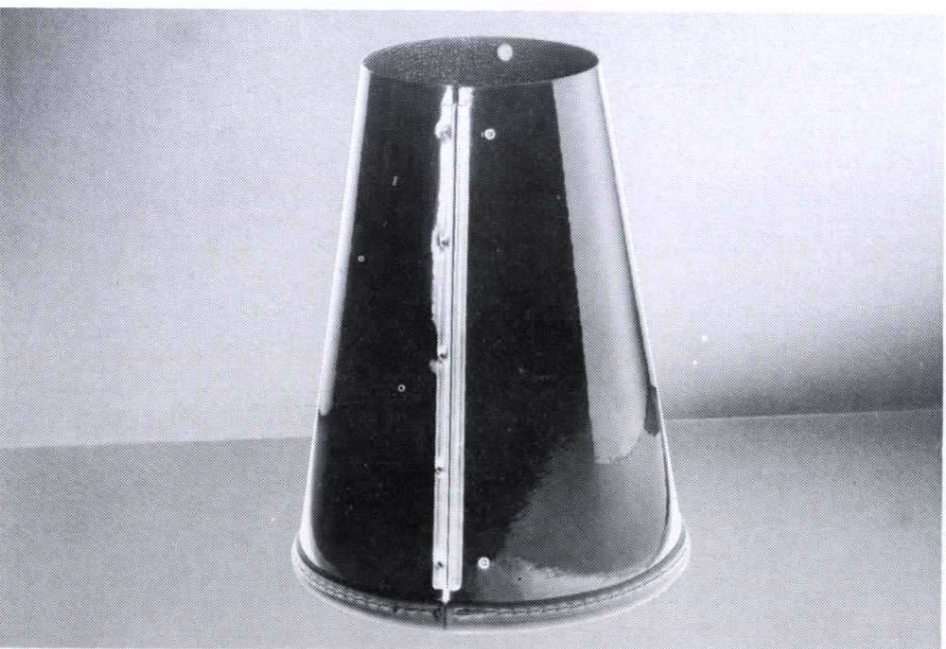
Operational Accessories



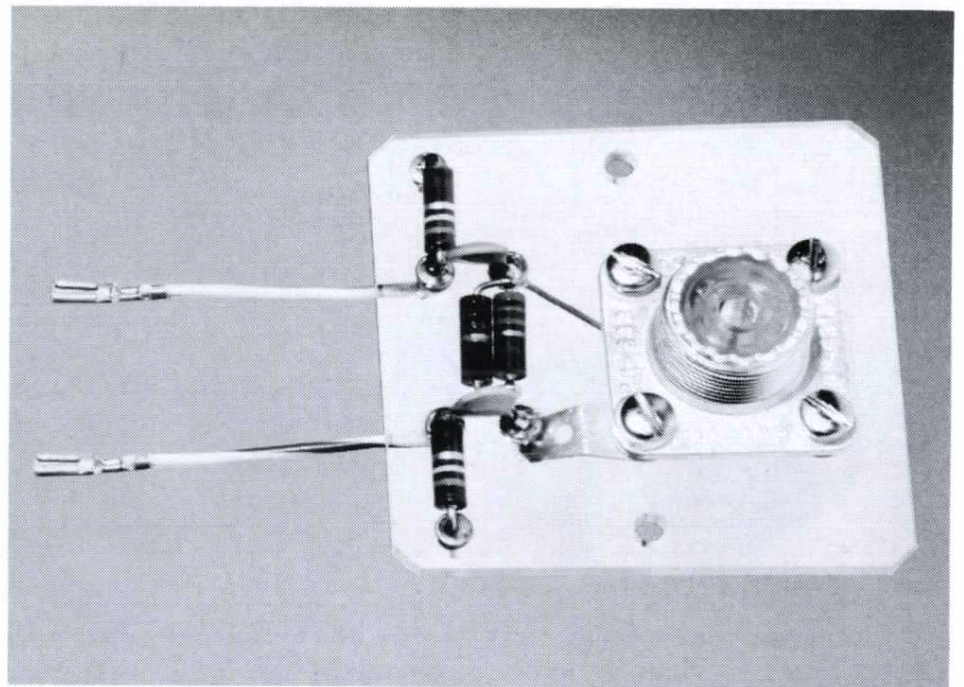
BE510 Bezel, for mounting camera on Tektronix 5" oscilloscopes. Dimensions— $5\frac{7}{8}$ " square; ring $\frac{7}{8}$ " deep, diameter $5\frac{5}{8}$ " outside, $5\frac{1}{8}$ " inside. Die-cast construction, wrinkle finish, felt lined. 4.50



CO181A 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



HC 310 Collapsible Viewing Hood, for Tektronix 3" Oscilloscopes. It is made of black acrylic plastic with handy fastening arrangement. Will fit into side pocket of Type 310 carrying case. Tek no. 016-010 3.50



DP 52 Deflection Plate Connector, for Type 530 and 540-Series Oscilloscopes. A convenient means of making a connection directly to the cathode-ray tube vertical-deflection plates. Function of the vertical positioning control is still retained. The connector is designed for use with a 52-ohm cable.

For instruments with serial numbers below 5001,
Tek no. 013-006 5.00
For instruments with serial numbers 5001 and above,
Tek no. 013-007 5.00

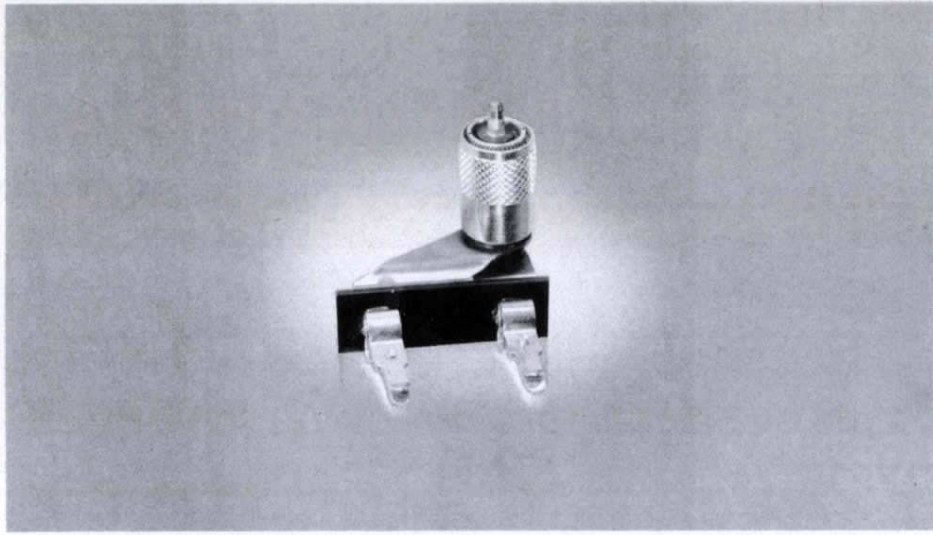


CC 310 Canvas Carrying Case, for Tektronix Type 310 Oscilloscope. The case has a zipper fastener along the top and one end. The other end is padded for extra protection for knobs and cathode-ray tube. A side pocket holds probes, power cords, etc. Color is forest green with olive-drab carrying straps. Tek no. 253-541 12.00

Prices f.o.b. Portland, Oregon.

ACCESSORIES

Operational Accessories



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

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 with variable attenuator, 42" long . . 13.50
- P93B Coaxial output cable, 93 ohms, terminated with 1/2-watt 93-ohm resistor, 42" long 5.00
- P170 Coaxial cable, 170 ohms nominal impedance, 42" long 9.50

MISCELLANEOUS

- A100 Adapter, clip lead 2.00
- A510 Adapter, binding post 2.00
- FA160 Frame, mounting, for Type 122 and Type 160-Series units 5.00

Prices f.o.b. Portland, Oregon.



ACCESSORIES

Test Accessories

Type 107 Square-Wave Generator

Risetime

Less than 3 millimicroseconds into a terminated 52-ohm cable.

Frequency Range

Approximately 400 kc to 1 mc, uncalibrated.

Output Voltage

0.1 to 0.5 v, approximately, when cable is terminated in 52 ohms.

GENERAL DESCRIPTION

The Tektronix Type 107 Square-Wave Generator is basically intended as a Test Accessory for the Type 540-Series Oscilloscopes. For examination of high-frequency response, a square wave having a risetime faster than that of the amplifier being tested is necessary. The Type 540-Series Oscilloscopes with the Type 53/54K Plug-In Preamplifier have a combination risetime of 12 millimicroseconds. The Type 107, with its risetime of 3 millimicroseconds, provides a suitable square wave for checking and adjusting the high-frequency response of the Type 540-Series Oscilloscopes and Type 53/54 Wide-Band Preamplifiers.

CHARACTERISTICS

Risetime—Less than 3 millimicroseconds when the output 52-ohm cable is terminated.

Frequency Range—A front-panel control varies the frequency over an uncalibrated range of approximately 400 kc to 1 mc.

Output Voltage—When the output cable is terminated the output voltage range is approximately 0.1 v to 0.5 v. If the cable is not terminated, the voltage range is 0.2 v to 1 v.

Output Trigger—An output trigger signal is available at a coaxial connector at the rear of the instrument.



Waveform—Special design consideration has been placed on the shape of the positive portion of the waveform. Therefore, only this portion should be used in transient response testing.

VACUUM TUBE COMPLEMENT

Multivibrator	6BQ7A
Amplifier	12BY7
Shaper amplifier	12BY7
Driver amplifier	12BY7
Output amplifier	6AU6
Rectifiers	2 6BW4
Output voltage regulator	OA2

MECHANICAL SPECIFICATIONS

Ventilation—Forced-air ventilation assures safe operating temperature.

Construction—Aluminum-alloy chassis and cabinet.

Finish—Photo-etched panel, wrinkle-finished cabinet.

Dimensions—11" long, 6 3/4" wide, 10 1/2" high.

Weight—13 pounds.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 100 watts.

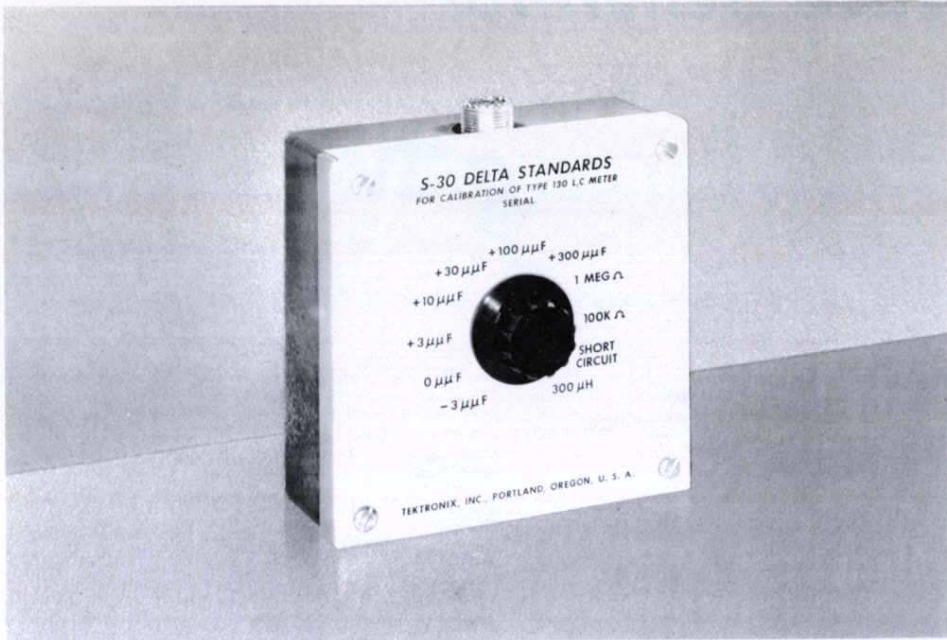
Price \$165

Includes: 1—P52, 52-ohm 42" coaxial cable
 1—B52-R, 52-ohm terminating resistor
 1—B52-T10, 52-ohm 'T' pad
 1—Instruction manual

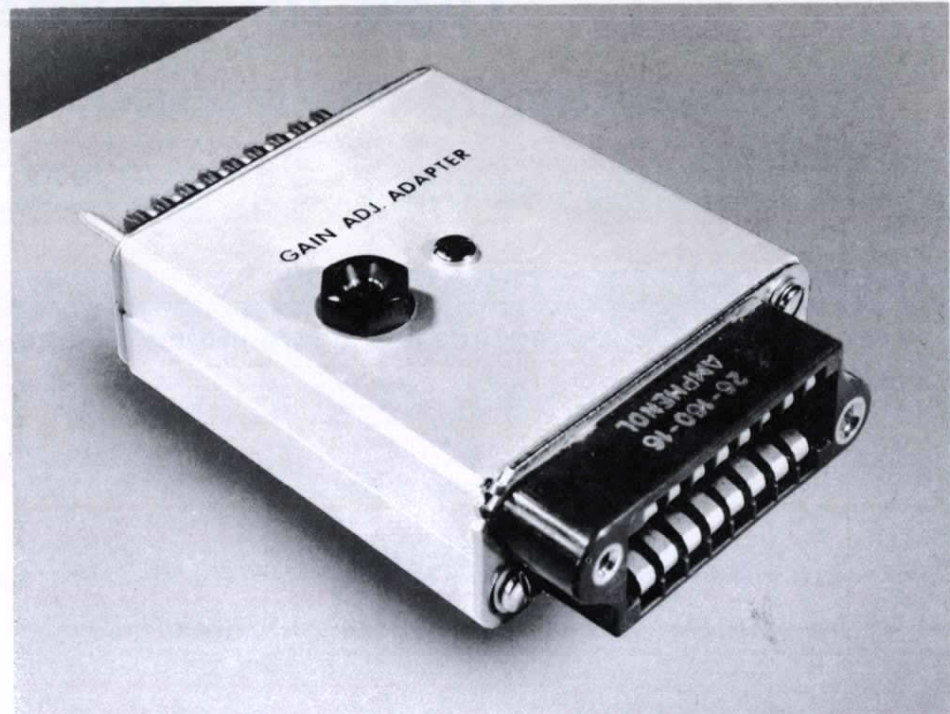
Price f.o.b. Portland, Oregon.

ACCESSORIES

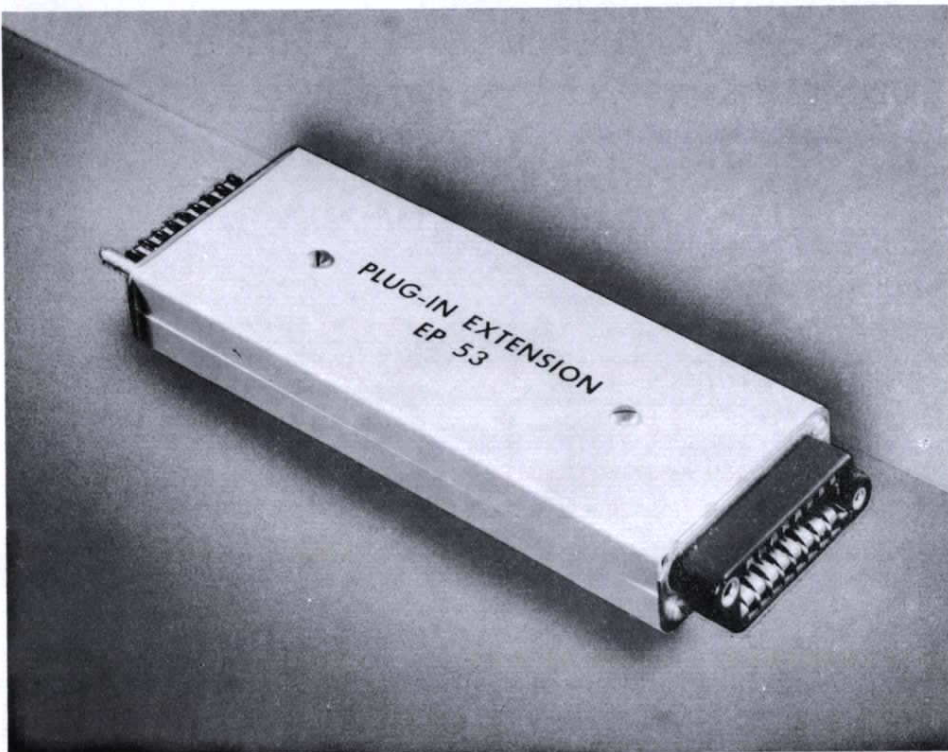
Test Accessories



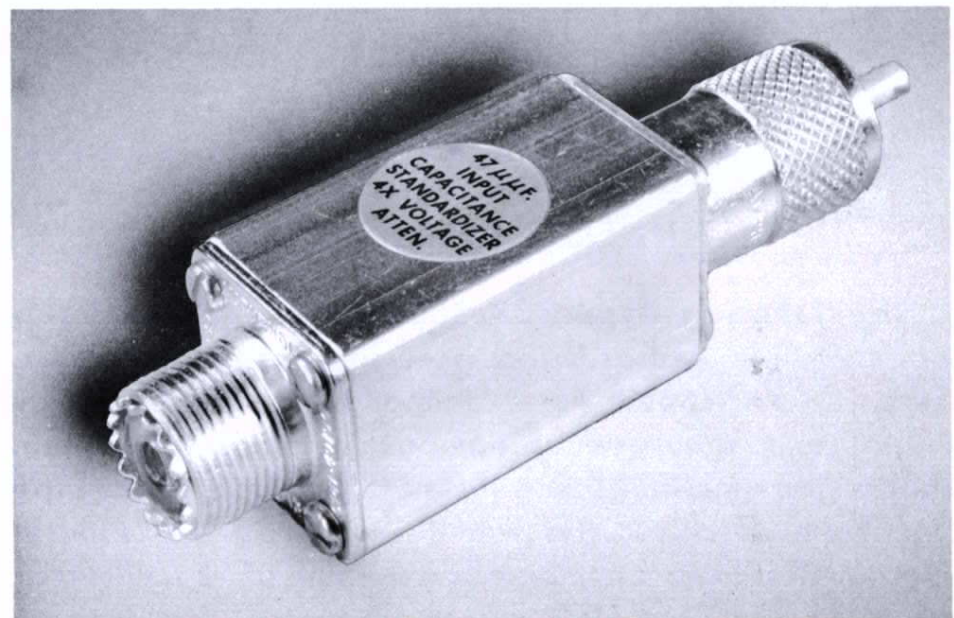
015-001 (S30) Delta Standards, for calibration of the Type 130 L,C Meter. The unit provides accurately adjusted steps of capacitance and inductance, selected by a rotary selector switch. Values of the capacitance steps correspond to the full-scale adjustments required on the five scales of the Type 130. 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



013-005 (EP53A) Gain Set Adapter—Permits an external calibrating signal to bypass the plug-in preamplifier, for calibrating the sensitivity of the main amplifier of Type 530 and 540-Series Oscilloscopes. 5.00



013-002 (EP53) Plug-in Extension — Allows the plug-in preamplifier unit for the Type 530 and Type 540-Series Oscilloscopes to be operated partially out of its housing. 5.00



011-021 (CS 47) Input Capacitance Standardizer—For use with Type 53 and Type 53/54 Plug-In Preamplifiers having an input capacitance of 47 $\mu\mu$ f. With this accessory the input capacitance of each preamplifier can be standardized to 47 $\mu\mu$ f, eliminating the necessity for probe readjustment when used with different plug-in preamplifiers 11.50

011-022 (CS 20) Input Capacitance Standardizer—Similar to 011-021 (CS 47), for use with the Type 53/54C and Type 53/54K Plug-In Preamplifiers having 20 $\mu\mu$ f input capacitance 11.50

Prices f.o.b. Portland, Oregon

ACCESSORIES

Replacement Parts

GRATICULES

386-395	Unruled, for Type 310.....	1.00
386-312	Unruled, for Type 315.....	1.00
331-027	Quarter-inch divisions, 8 divisions vertically, 10 horizontally, for Type 310 and 360	1.50
331-005	Quarter-inch divisions, 8 divisions vertically, 10 horizontally, for Type 315....	1.50
386-326	Unruled, fits Types 511A, 512, 513, 514, 514A, 524D, 524AD.....	1.00
331-023	Centimeter ruling, 4 centimeters vertically, 10 horizontally, for Types 511A with 5CP CRT.....	1.50
331-024	Centimeter ruling, 4 vertically, 10 horizontally, for Type 514 with 5CP CRT, 513 with T51PA CRT.....	1.50
331-006	Centimeter ruling, 6 centimeters vertically, 10 horizontally, for Type 512 with 5CP CRT, Types 514A, 524D, 524AD and Type 511A with 5ABP CRT	1.50
331-010	Centimeter ruling, 8 centimeters vertically, 10 horizontally, for Type 512 with 5ABP CRT.....	1.50
331-007	Centimeter ruling, 4 centimeters vertically, 8 horizontally, for Type 513 with 5XP CRT	1.50
331-008	Centimeter ruling, 4 centimeters vertically, 8 horizontally, for Type 517....	9.50
331-009	TV RMA style ruling for percentage measurements, for Types 524D and 524AD	1.50
331-035	Ruling in percentages, -40 to +100, for Type 525.....	1.50
331-026	Centimeter ruling, 8 centimeter vertically, 10 horizontally, for Type 532....	1.50
331-016	Centimeter ruling, 6 centimeters vertically, 10 horizontally, for Types 531 and 535.....	1.50
331-025	Centimeter ruling, 4 centimeters vertically, 10 horizontally, for Types 541 and 545.....	1.50
331-028	Division ruling, 10 divisions vertically, 10 horizontally, for Type 570.....	1.50

CATHODE-RAY-TUBE LIGHT FILTERS

378-511	3" Amber (for Type 310 and 360)....	.50
378-509	3" Green (for Type 310 and 360)....	.50
378-510	3" Blue (for Type 310 and 360)....	.50
378-506	3" Amber (for Type 315D).....	.50

378-505	3" Green (for Type 315D).....	.50
378-507	3" Blue (for Type 315D).....	.50
378-501	(F510-3) 5" Amber.....	.90
378-503	(F510-5) 5" Green.....	.90
378-504	(F510-6) 5" Blue.....	.90

AC POWER CORDS

161-004	(COP 16-8) No. 16 wire, 8' long....	2.40
161-003	(COP 18-1) No. 18 wire, 1' long....	.85
161-001	(COP 18-8) No. 18 wire, 8' long....	1.50
161-007	(COP 18-8) Right angle.....	1.50

SPECIAL CORDS AND LEADS

012-007	(W112R) Red output lead for Type 112	1.00
012-008	(W112B) Black output lead for Type 112	1.00
012-009	(W122) Battery power lead for Type 122	7.50
012-014	(W130B) Black output lead for Type 130	1.00
012-015	(W130R) Red output lead for Type 130	1.00
012-016	(W160-20) 20" inter-unit power cable for Type 160-Series.....	2.00
012-017	(W160-10) 10" inter-unit power cable for Type 160-Series.....	2.00
012-012	(W517) Inter-unit power cable for Type 517.....	9.50
012-013	(W530B) Black test lead for Types 530 and 540-Series Oscilloscopes.....	1.00

MISCELLANEOUS

011-018	Attenuator unit, for Type 190A.....	19.00
010-003	P93C Probe, for Type 130.....	2.00
014-003	FM 124 Mounting frame, for Type 124.	5.00

INSTRUCTION MANUALS

104A	.....	1.50
105	.....	1.75
112	.....	1.50
121	.....	1.50
122	.....	1.50
124	.....	1.75
126	.....	1.50
130	.....	1.50
160 or 160A	.....	1.50



ACCESSORIES

Replacement Parts

INSTRUCTION MANUALS					
161	.....	1.50	517 or 517A.....	4.50	
162	.....	1.50	524D or 524AD.....	5.00	
163	.....	1.50	525	.....	4.50
180	.....	2.00	531	.....	4.50
181	.....	1.75	532	.....	4.50
190A	.....	1.50	535	.....	5.00
310	.....	3.50	541	.....	4.50
315D	.....	4.00	545	.....	5.00
360	.....	1.75	53A or 53/54A.....	1.50	
511A or 511AD.....	2.75	53B or 53/54B.....	1.50		
512	.....	2.75	53C or 53/54C.....	1.50	
513 or 513D.....	2.75	53/54D	.....	1.50	
514 or 514D.....	2.75	53/54E	.....	1.50	
514A or 514AD.....	3.00	53G or 53/54G.....	1.50		
515	.....	4.00	53/54K	.....	1.50
			570	.....	4.50



GENERAL INFORMATION

Terms and Shipment

Our terms are 1% ten days, net thirty days on domestic orders; on overseas orders terms are net letter of credit or advance payment. 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, 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, 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

To provide our overseas customers with instruments at published catalog prices, assistance in ordering, and most important, service after receipt of their instruments, Tektronix has established authorized distributors in many overseas countries. To take advantage of these services, available **ONLY** through your **AUTHORIZED TEKTRONIX DISTRIBUTOR**, and to eliminate the necessity of paying a premium for our instruments, please direct all inquiries and orders to the **TEKTRONIX DISTRIBUTOR** in your country. Customers in a country not presently served by an authorized Tektronix distributor are asked to send all inquiries and orders directly to Tektronix, Inc., Portland, Oregon.

Delivery

Acceptance of purchase orders is indicated by our acknowledgement, 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 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, notify us promptly, including sufficient details to identify the required parts. We will ship them prepaid (via air to meet emergencies, if requested) as soon as possible, usually within 24 hours.

Tektronix transformers, manufactured in our own plant, carry an indefinite warranty.

Overseas Warranty Replacements

The same general warranty policies above apply; however, surface shipment will be made prepaid C.I.F. port of unloading. Customers requesting air shipment for emergency replacements will be invoiced for one-half of the shipment charges and Tektronix will assume the remainder of these charges C.I.F. airport of destination.

APPROXIMATE SHIPPING WEIGHTS

INSTRUMENT TYPE	NET WEIGHT IN POUNDS	DOMESTIC PACKED IN POUNDS	EXPORT PACKED		VOLUME IN CU. FT.
			WEIGHT IN POUNDS	WEIGHT IN KILOGRAMS	
104A	22	32	53	24	5
105	35½	49	65	30	5
112	32	49	75	51	7
121	18½	24	45	20	4
122	5½	9	16	7	1
130	9	17	38	17	4
160 Series.....	33	56	74	34	7
160A	21	28	50	22	4
161	3½	7	14	6	1
162	3½	7	14	6	1
163	3½	7	14	6	1
FA-160	1¼	3			
180	37	49	66	30	5
181	17½	24	49	22	7
190A	24	35	55	25	5
310	23½	30	49	22	4
315D	36	47	65	30	4
360	9	17	32	15	4
515	40	66	88	40	7
517A					
Indicator Unit ...	76	101	127	58	9
Power Supply ...	72	83	105	48	5
Scopemobile	42	62	67	30	7
524AD	61	84	117	53	8
Viewing Hood ...	1¼	4	11	5	1
525	54	86	101	46	9
531	61½	80	105	48	8
532	52	73	94	43	8
535	65	85	110	50	8
541	61½	80	103	47	8
545	65	85	111	50	1
53/54A	3½	10	12	5	1
53/54B	3½	10	12	5	1
53/54C	5½	12	14	6	1
53/54D	4	11	14	6	1
53/54E	4½	12	14	6	1
53/54G	4½	12	14	6	1
53/54K	3½	10	12	5	1
570	75	96	116	53	8
124	21	32	58	26	5
500	42	53	62	28	7



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 • TWX—PD311 • Cable—TEKTRONIX

Tektronix Field Engineering Offices

ALBUQUERQUE	Tektronix, Inc., 127C Jefferson St., N. E., Albuquerque, New Mexico	Phone: 6-1279
BALTIMORE*	Tektronix, Inc., 8118 Harford Rd., Baltimore 14, Maryland	TWX—BOULEVARD MARYLAND 535..NORthfield 5-2600
	Washington Area Phone	ENterprise 1-6023
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	Detroit Area: ENterprise 7121	Pittsburg Area: ZEnith 0212
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		Fleetwood 2-7655
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	TWX—WEST LOS ANGELES CAL 6698	GRanite 3-1105
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NEW YORK*	Tektronix, Inc., 49 Pondfield Road, Bronxville 8, New York	TWX—BRONXVILLE NY 1207 ..DEerfield 7-3771
PHILADELPHIA	Tektronix, Inc., 7709 Ogontz Ave., Philadelphia 50, Pennsylvania	TWX—PH 930.....WAvrly 4-5678
PHOENIX	Tektronix, Inc., 2415 E. McDowell Road, Phoenix, Arizona	BRidge 5-9762
SAN FRANCISCO*	Tektronix, Inc., 1436 El Camino Real, Menlo Park, California	TWX—PALO ALTO 112.....DAvenport 2-5590
SYRACUSE*	Tektronix, Inc., 313 Nottingham Road, Syracuse 10, New York	TWX—SS 423.....Phone: 72-3339
TORONTO	Tektronix, Inc., 3 Finch Ave., East, Willowdale, Ontario, Canada	Toronto, BAldwin 5-1138
UNION*	Tektronix, Inc., 412 Chestnut Street, Union, New Jersey	TWX—UNVL 82 ..MURdock 8-2222

* REPAIR CENTERS

Tektronix Engineering Representatives

ATLANTA	Bivins & Caldwell, 3133 Maple Drive, N. E., Atlanta 5, Georgia	CEdar 3-7522
DENVER	Hytronic Measurements, Inc., 1295 South Bannock Street, Denver 23, Colorado	PEarl 3-3701
FORT MYERS	Arthur Lynch & Associates, 35 W. Northshore Ave., Fort Myers, Florida	EDison 4-4431
HIGH POINT	Bivins & Caldwell, Security Bank Bldg., High Point, North Carolina	TWX—HIGH POINT NC 454.....Phone: 3672
PORTLAND	Hawthorne Electronics, 700 S. E. Hawthorne Blvd., Portland 14, Oregon	BElmont 4-9375
SEATTLE	Hawthorne Electronics, 107 Administration Bldg., Boeing Field, Seattle, Washington	MOhawk 3962

Tektronix Overseas Distributors

ADELAIDE	Electronic Industries Imports Pty. Ltd., 90 Grote St., Adelaide, S.A., Australia	LA 4468/9
BERLIN	Rohde & Schwarz Vertriebs, GmbH, Berlin W30, Augsburgstrasse 33, West Germany	91 27 62
BOMBAY	Electronic Enterprises, 46, Karani Building, Opp. Cama Baug., New Charni Road, Bombay 4, India	75376
BRISBANE	Electronic Industries Imports Pty. Ltd., 52 Bowen St., Brisbane, Qld., Australia	B 7161
BRUXELLES	Regulation-Mesure, S.P.R.L. 22, rue Saint-Hubert, Bruxelles, Belgium	70. 79. 89
HANNOVER	Rohde & Schwarz Vertriebs, GmbH, Hannover, Schillerstrasse 23, West Germany	2 33 80
HELSINKI	Into O/Y, 11 Meritullinkatu, Helsinki, Finland	62 14 25, 35 125
ISRAEL	Landseas Products Corp., 48 West 48th Street, New York 36, New York	Columbus 5-8323
	Landseas Eastern Co., P.O. Box 2554, Tel Aviv, Israel	
JOHANNESBURG	Protea Holdings, Ltd., 42, Faraday Street, Wemmer, Johannesburg, Union of South Africa	33-4762/3
KARLSRUHE	Rohde & Schwarz Vertriebs, GmbH, Karlsruhe, Kriegstrasse 39, West Germany	25202
KOBENHAVN	Tage Olsen A/S, Centrumgaarden, Room 133, 6D, Vesterbrogade, Kobenhavn V, Denmark	Palae 1369, Palae 1343
KOLN	Rohde & Schwarz Vertriebs, GmbH, Koln, Habsburger-Ring 2-12, West Germany	215341
LONDON	Livingston Laboratories Ltd., Retcar Street, London N.19, England	Archway 6251
MELBOURNE	Electronic Industries Imports Pty. Ltd., 139-143 Bouverie St., Carlton, N. 3, Melbourne, Australia	FJ 4161
MUNCHEN	Rohde & Schwarz Vertriebs, GmbH, Munchen 9, Auerfeldstrasse 22, West Germany	4 46 38
OSLO	Eugen Nilsson, Mollergaten 8, Oslo, Norway	33 14 28, 33 27 62
PARIS	Maurice I. Parisier & Co., 1860 Broadway, New York 23, New York	Circle 5-5701
	Relations Techniques Intercontinentales, 145, Avenue Malakoff, Paris 16, France	Passy 08-36, Kleber 54-82
PERTH	Electronic Industries Imports Pty. Ltd., 68 Railway Pde., West Perth, W.A., Perth, Australia	BA 9686
RIO DE JANEIRO	Empresa Comercial Importadora Limitada, Rua Araujo Porto Alegre, 70-8°, Rio De Janeiro, Brazil	42-9460
ROMA	CESA-Elettronica, 20 via Tevere, Roma, Italy	846.592, 865.722
's-GRAVENHAGE	C. N. Rood, Weteringkade 37, 's-Gravenhage, Netherlands	771920
STOCKHOLM	Erik Ferner AB, Bjornsonsgatan 197, Bromma, Stockholm, Sweden	37 42 77, 37 77 00
SYDNEY	Electronic Industries Imports Pty. Ltd., 713 Parramatta Rd., Leichhardt, NSW, Sydney, Australia	LM 3311
TOKYO	Midoriya Electric Co., Ltd., 3-4 Chome, Ginzaishi, Chuo-Ku, Tokyo, Japan	(56) 1786 7415 7416 7439 5396 8282
ZURICH	Omni Ray AG, Dufourstrasse 56, Zurich 8, Switzerland	(051) 34-44-30

Other OVERSEAS areas please write or cable directly to the Export Department, Portland, Oregon, U.S.A.

3/57

Printed in U. S. A.

STATE OF CALIFORNIA

THE OFFICE OF THE ATTORNEY GENERAL

Department of Justice

San Francisco, California

February 10, 1954

Dear Sirs: Reference is made to your letter of the 8th instant.

The State of California is not a party to the contract in question.

Very truly yours,

Attorney General

State of California

San Francisco, California

Enclosed for you are two copies of the contract in question.

Very truly yours,

Attorney General

State of California

San Francisco, California

Enclosed for you are two copies of the contract in question.

Very truly yours,

Attorney General

State of California

San Francisco, California

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State of California

San Francisco, California

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Very truly yours,

Attorney General

State of California

San Francisco, California

