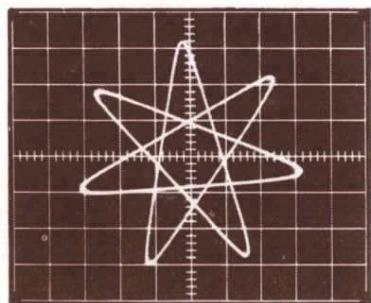


CATHODE-RAY OSCILLOSCOPES

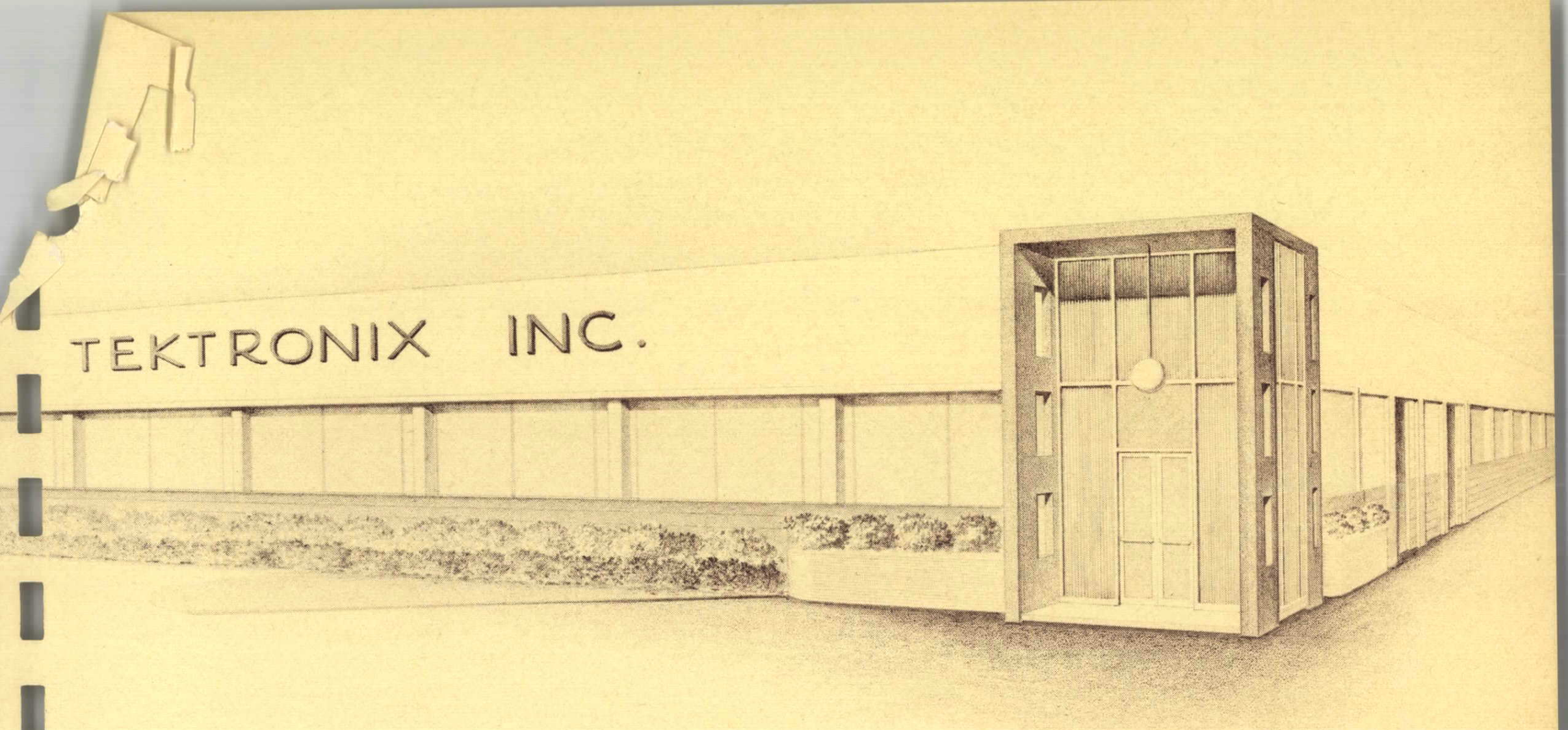
Auxiliary Instruments and Accessories

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.



COVER ILLUSTRATION—Differential input for both vertical and horizontal amplifiers facilitates display of roulette patterns with the new Type 502 (page 71). The seven-point star is formed by two sine waves with a frequency ratio of 3 to 4. Roulette displays can be extremely useful in the measurement of small frequency differences, and are usually easier to interpret than lissajous figures at high ratios.



TEKTRONIX INC.

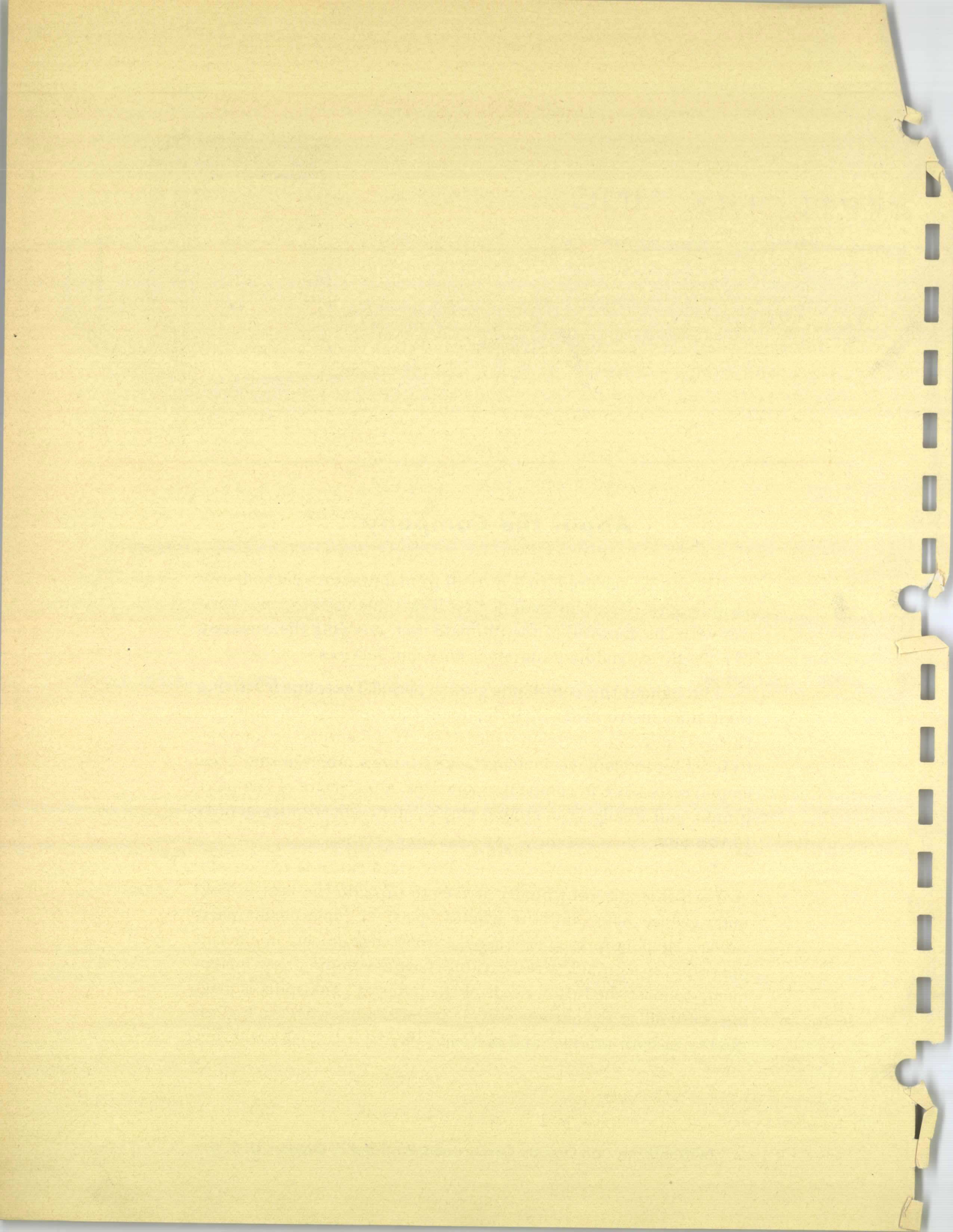
About the Company . . .

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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GENERAL INFORMATION

Terms and Shipment

For domestic orders, placed in accordance with the normal Tektronix marketing practices, our terms are net thirty days. Shipping delay may be prevented by establishing credit at the time of placing your order. When desirable, COD shipments can be arranged. Normally all prices and original quotations are f.o.b. factory.

Unless otherwise specified on your order, shipment will be made via Motor Freight. If another carrier is specified, shipment will be made at full valuation unless your order instructs differently. In case air shipment and full valuation are desired, please specify whether Air Express or Air Freight. Lacking specification, Air Freight and full valuation will be chosen.

Export Orders

To provide our overseas customers with instruments at prices based on eminently fair exchange rates, 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 as a service to our customers. Work is expedited whether or not the instrument is in warranty.

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 transportation paid (via air to meet emergencies, if requested) as soon as possible, usually within 24 hours.

Requests for repairs or replacement parts should include type number and serial number and should be directed to the Tektronix Field Office or Representative in your area. In an emergency, please wire or phone Field Engineering, Tektronix, Inc., Portland, Oregon. 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 your Tektronix Field Office or 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 in production instruments as they are developed in our laboratories. When it is feasible to add such improvements in the field, modification kits are made available 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.

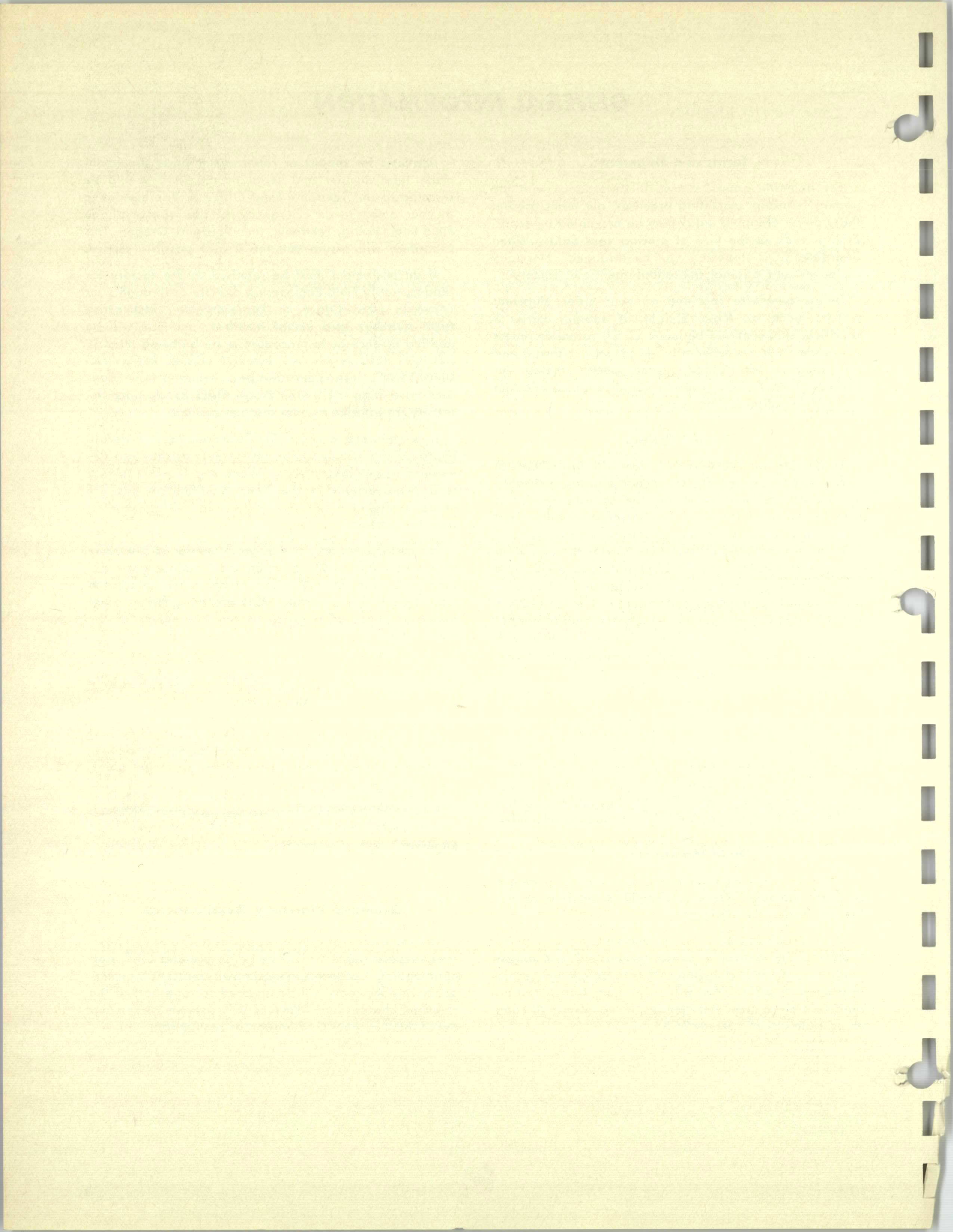
Warranty

All Tektronix instruments are fully guaranteed against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own plant, carry an indefinite warranty.

Any questions with respect to the warranty mentioned above should be taken up with your Tektronix Field Engineer.

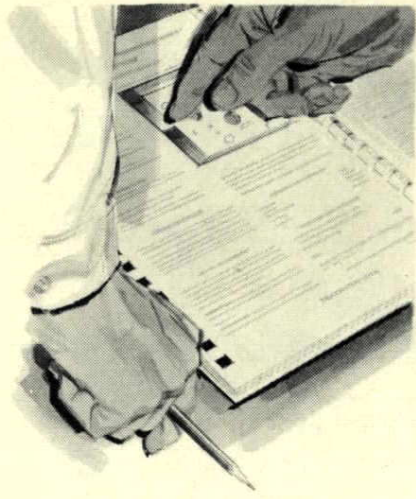
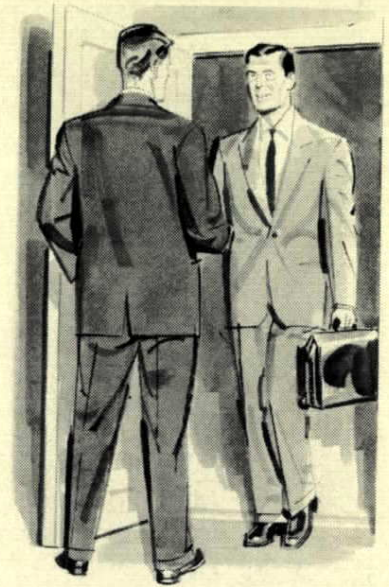
Overseas Warranty Replacements

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.



TEKTRONIX FIELD SERVICES

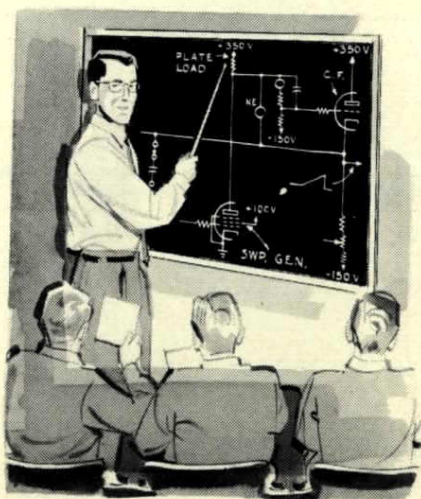
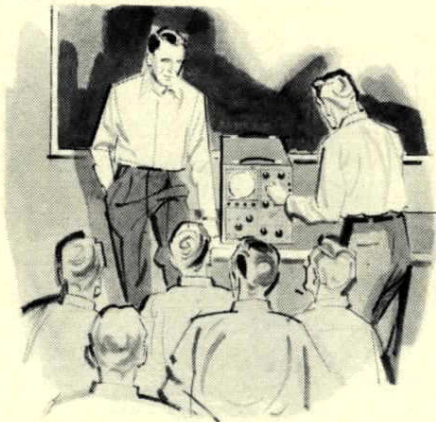
Tektronix Customers are urged to take advantage of the many field services available to them through Tektronix Field-Engineering Offices, Engineering Representatives, and Overseas Engineering Organizations. Some of these services are described below.



Ordering—There are many types of oscilloscopes, each designed for a specific application area. Your Field Engineer can help you select the one best suited to your present and future needs, and he will be happy to arrange a demonstration of the instrument....in your application if you so desire.

If you are a Purchasing Agent or Buyer, your Field Engineer or his secretary can help you with information on prices, terms, shipping estimates, and best method of transportation on instruments, accessories, and replacement parts.

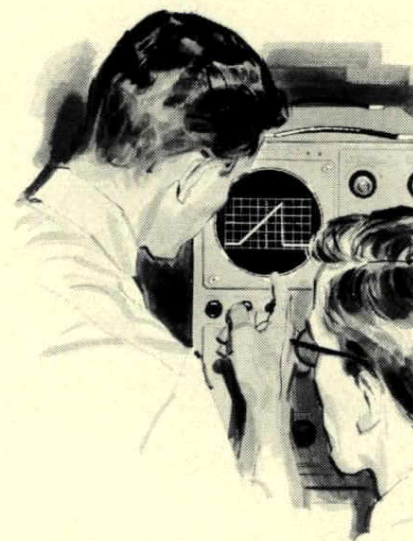
Operation—Your Tektronix Oscilloscope can be most useful to you when you are familiar with all control functions. Your Field Engineer will be glad to demonstrate the use of your instrument in various applications to help you become more familiar with its operation. If your instrument is to be used by several engineers, your Field Engineer will be happy to conduct informal classes on its operation in your laboratory.



Maintenance—Tektronix willingly assumes much of the responsibility for continued efficient operation of the instruments it manufactures. If you should experience a stubborn maintenance problem, your Field Engineer will gladly help you isolate the cause. Often a telephone discussion with him will help you get your instrument back into operation with minimum delay. If yours is a

large laboratory, your Field Engineer can be of service to your maintenance engineers by conducting informal classes on test and calibration procedures, trouble-shooting techniques, and general maintenance.

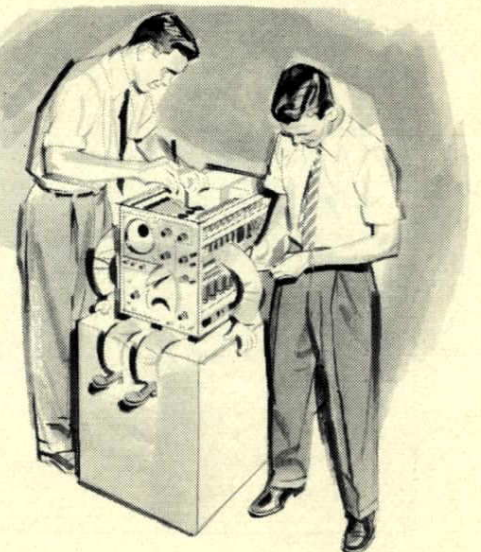
If you are responsible for the maintenance of a large quantity of Tektronix Instruments, ask your Field Engineer about the free factory training course in maintenance and calibration.



Applications—Perhaps the answers you need in a specific application can be obtained faster and easier through use of your Tektronix Oscilloscope. Your Field Engineer can help you find out, and if use of your oscilloscope is indicated, help you with procedures. He may also be able to suggest many time-saving uses for your oscilloscope in routine checks and measurements.

Instrument Reconditioning—An older Tektronix Oscilloscope, properly reconditioned, can give you many additional years of service. Your Field Engineer will gladly explain the advantages and limitations of factory reconditioning, and make the necessary arrangements if you decide in favor of it.

Many major repair and recalibration jobs can be performed at a nearby Field Repair Station. Ask your Field Engineer about this at-cost service to Tektronix customers.



Communications—Your Field Engineer is a valuable communication link between you and the factory. He knows the exact person to contact in each circumstance, and he can reach that person fast and easily. Let him help speed your communications with the factory on any problem related to your Tektronix Instruments.

REFERENCE

MAIN SPECIFICATIONS of TEKTRONIX OSCILLOSCOPES

Oscilloscopes with Plug-In Preamplifiers

	Vertical Frequency Response (with Type 53/54K Unit)	Signal Delay	Calibrated Sweep Range	Sweep Magnifier	Sweep Delay	Accelerating Potential	Price (without plug-in units)	Complete Specifications
TYPE 533	dc to 15 mc	0.2 μ sec	0.02 μ sec/cm to 5 sec/cm	2, 5, 10, 20, 50, 100x	None	10 kv	\$1050	Page 11
TYPE 543	dc to 30 mc						\$1200	Page 26A
TYPE 541 Fast-Rise	dc to 30 mc	0.2 μ sec	0.02 μ sec/cm to 5 sec/cm	5x	None	10 kv	\$1145	Page 23
TYPE 545 Fast-Rise	dc to 30 mc	0.2 μ sec	0.02 μ sec/cm to 5 sec/cm	5x	1 μ sec to 0.1 sec	10 kv	\$1450	Page 27
TYPE 551 Dual-Beam	dc to 25 mc both beams	0.2 μ sec	0.02 μ sec/cm to 5 sec/cm	5x	None	10 kv	\$1725	Page 31

Plug-In Preamplifiers for Type 530-Series,

	Calibrated Deflection Factor	Risetime of Combination — Plugged into Type				
		533	543-541-545	551	531-535-536	532
TYPE 53/54A Wide-Band DC	0.05 v/cm to 20 v/cm	0.025 μ sec	0.018 μ sec	0.02 μ sec	0.035 μ sec	0.07 μ sec
TYPE 53/54B Wide-Band High-Gain	5 mv/cm to 0.05 v/cm	0.035 μ sec	0.03 μ sec	0.035 μ sec	0.04 μ sec	0.07 μ sec
	0.05 v/cm to 20 v/cm	0.025 μ sec	0.018 μ sec	0.02 μ sec	0.035 μ sec	
TYPE 53/54C Dual-Trace DC	0.05 v/cm to 20 v/cm	0.023 μ sec	0.015 μ sec	0.016 μ sec	0.035 μ sec	0.07 μ sec
TYPE 53/54D High-Gain DC Differential	1 mv/cm to 50 v/cm	0.18 μ sec	0.18 μ sec	0.18 μ sec	0.18 μ sec	0.18 μ sec
TYPE 53/54E Low-Level AC Differential	50 μ v/cm to 10 mv/cm	6 μ sec	6 μ sec	6 μ sec	6 μ sec	6 μ sec
TYPE 53/54G Wide-Band DC Differential	0.05 v/cm to 20 v/cm	0.025 μ sec	0.018 μ sec	0.02 μ sec	0.035 μ sec	0.07 μ sec
TYPE 53/54H DC Coupled High-Gain Wide-Band	0.005 v/cm to 20 v/cm	0.031 μ sec	0.023 μ sec	0.025 μ sec	0.037 μ sec	0.07 μ sec
TYPE 53/54K Fast-Rise DC	0.05 v/cm to 20 v/cm	0.023 μ sec	0.012 μ sec	0.014 μ sec	0.031 μ sec	0.07 μ sec
TYPE 53/54L Fast-Rise High-Gain	5 mv/cm to 2 v/cm	0.023 μ sec	0.015 μ sec	0.023 μ sec	0.035 μ sec	0.07 μ sec
	0.05 v/cm to 20 v/cm	0.023 μ sec	0.012 μ sec	0.014 μ sec	0.031 μ sec	

Oscilloscopes without Plug-In Preamplifiers

	Calibrated Deflection Factor	Risetime	Vertical Passband	Calibrated Sweep Range	Sweep Magnifier	Accelerating Potential	Price	Complete Specifications
TYPE 502 Dual-Beam and X-Y Curve Tracer	200 μ v/cm to 1 mv/cm	3.5 μ sec	dc to 100 kc	1 μ sec/cm to 5 sec/cm	2, 5, 10, and 20x	3 kv	\$795	Page 71
	1 mv/cm to 50 mv/cm	1.0 μ sec	dc to 350 kc					
	50 mv/cm to 20 v/cm	0.7 μ sec	dc to 500 kc					
TYPE 517A High-Speed	0.05 v/cm	0.007 μ sec		0.01 μ sec/cm to 20 μ sec/cm		24 kv	\$3500	Page 77
TYPE 524AD Television	0.015 v/cm to 50 v/cm	0.035 μ sec	dc to 10 mc	0.1 μ sec/cm to 0.01 sec/cm	3x and 10x	4 kv	\$1180	Page 83



CHART

for Convenience in Making Preliminary Comparisons

Oscilloscopes with Plug-In Preamplifiers

	Vertical Frequency Response (with Type 53/54K Unit)	Signal Delay	Calibrated Sweep Range	Sweep Magnifier	Sweep Delay	Accelerating Potential	Price (without plug-in units)	Complete Specifications
TYPE 531 General Purpose	dc to 11 mc	0.25 μ sec	0.02 μ sec/cm to 5 sec/cm	5x	None	10 kv	\$995	Page 15
Type 535 General Purpose	dc to 11 mc	0.25 μ sec	0.02 μ sec/cm to 5 sec/cm	5x	1 μ sec to 0.1 sec	10 kv	\$1300	Page 19
Type 536 X-Y Curve Tracer	dc to 11 mc	None	See Type 53/54T Time-Base Gen.		None	4 kv	\$995	Page 35
TYPE 532 General Purpose	dc to 5 mc	None	0.2 μ sec/cm to 5 sec/cm	5x	None	4 kv	\$825	Page 39

Type 540-Series, and Type 550-Series Oscilloscopes

	Passband of Combination — Plugged into Type					Input Capacitance	Price	Complete Specifications
	533	543-541-545	551	531-535-536	532			
	dc to 14 mc	dc to 20 mc	dc to 18 mc	dc to 10 mc	dc to 5 mc	47 μ mf	\$85	Page 50
	2 c to 10 mc	2 c to 12 mc	2 c to 10 mc	2 c to 9 mc	2 c to 5 mc	47 μ mf	\$125	Page 51
	dc to 14 mc	dc to 20 mc	dc to 18 mc	dc to 10 mc	dc to 5 mc			
	dc to 15 mc	dc to 24 mc	dc to 22 mc	dc to 10 mc	dc to 5 mc	20 μ mf	\$250	Page 43
	dc to 2 mc	dc to 2 mc	dc to 2 mc	dc to 2 mc	dc to 2 mc	47 μ mf	\$145	Page 48
	0.06 cycles to 60 kc	0.06 cycles to 60 kc	0.06 cycles to 60 kc	0.06 cycles to 60 kc	0.06 cycles to 60 kc	50 μ mf	\$165	Page 52
	dc to 14 mc	dc to 20 mc	dc to 18 mc	dc to 10 mc	dc to 5 mc	47 μ mf	\$175	Page 49
	dc to 11 mc	dc to 15 mc	dc to 14 mc	dc to 9.5 mc	dc to 5 mc	47 μ mf	\$175	Page 45
	dc to 15 mc	dc to 30 mc	dc to 25 mc	dc to 11 mc	dc to 5 mc	20 μ mf	\$125	Page 46
	3 c to 15 mc	3 c to 24 mc	3 c to 15 mc	3 c to 10 mc	3 c to 5 mc	20 μ mf	\$185	Page 47
	dc to 15 mc	dc to 30 mc	dc to 25 mc	dc to 11 mc	dc to 5 mc			

Oscilloscopes without Plug-In Preamplifiers

	Calibrated Deflection Factor	Risetime	Vertical Passband	Calibrated Sweep Range	Sweep Magnifier	Accelerating Potential	Price	Complete Specifications
TYPE 310 3" Portable	0.01 v/div to 0.1 v/div	0.1 μ sec	2 c to 3.5 mc	0.1 μ sec/div to 0.2 sec/div	5x	1.8 kv	\$595	Page 57
	0.1 v/div to 50 v/div	0.09 μ sec	dc to 4 mc					
TYPE 316 3" Portable	0.01 v/div to 0.1 v/div	0.035 μ sec	2 c to 10 mc	0.2 μ sec/div to 2 sec/div	5x	1.8 kv	\$725	Page 61
	0.1 v/div to 50 v/div	0.035 μ sec	dc to 10 mc					
TYPE 515A 5" Portable	0.05 v/cm to 50 v/cm	0.023 μ sec	dc to 15 mc	0.04 μ sec/cm to 2 sec/cm	5x	4 kv	\$750	Page 65



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

Cardiac Investigation, Diagnosis, Central Nervous System Research, Cortical Research, Neural Activity and Response

- Type 535 Oscilloscope
- Type 536 Oscilloscope
- Type 551 Oscilloscope
- Type 502 Oscilloscope
- Type 532 Oscilloscope
- Type 53/54C Dual-Trace Plug-In Unit
- Type 53/54D Differential High-Gain Plug-In Unit
- Type 53/54E Low-Level Differential Plug-In Unit
- Type 122 Low-Level Preamplifier
- Type 123 Preamplifier

Stimulation

- Type 160-Series Waveform Generators
- Type 360 Cathode-Ray Indicator
- Type 126 Power Supply

CHEMICAL

Analysis and Research, General

- Type 502 Oscilloscope
- Type 532 Oscilloscope
- Type 53/54D Differential High-Gain Plug-In Unit
- Type 53/54E Low-Level Differential Plug-In Unit

Life-Time Testing and Photo-Sensitivity Analysis

- Type 530-Series Oscilloscopes
- Type 540-Series Oscilloscopes
- Type 53/54 Plug-In Units

ELECTRONIC

Circuit Design

- All Tektronix Oscilloscopes
- Type 105 Square-Wave Generator
- Type 130 L,C Meter
- Type 190A Signal Generator
- Type 180A Time-Mark Generator
- Type 181 Time-Mark Generator
- Type 570 Characteristic-Curve Tracer
- Type 575 Transistor-Curve Tracer

Component Testing and Evaluation

- All Tektronix Oscilloscopes
- Type 105 Square-Wave Generator
- Type 180A Time-Mark Generator

- Type 190A Signal Generator
- Type 130 L,C Meter

Computer Design

- Type 530-Series Oscilloscopes
- Type 540-Series Oscilloscopes
- Type 53/54 Plug-In Units
- Type 515A Oscilloscope
- Type 130 L,C Meter
- Type 105 Square-Wave Generator

Computer Servicing

- Type 316 Portable Oscilloscope
- Type 310 Portable Oscilloscope
- Type 515A Oscilloscope
- Type 533 Oscilloscope
- Type 535 Oscilloscope
- Type 53/54B Wide-Band High-Gain Plug-In Unit
- Type 53/54C Dual-Trace Plug-In Unit
- Type 53/54G Wide-Band Differential Plug-In Unit

Delay-Line Testing and Design

- Type 530-Series Oscilloscopes
- Type 540-Series Oscilloscopes
- Type 53/54C Dual-Trace Plug-In Unit
- Type 515A Oscilloscope
- Type 517A High-Speed Pulse Oscilloscope
- Type 180A Time-Mark Generator
- Type 130 L,C Meter

Magnetic Field Investigation

- Type 536 Oscilloscope
- Type 535 Oscilloscope
- Type 53/54B Wide-Band High-Gain Plug-In Unit
- Type 53/54D Differential High-Gain Plug-In Unit
- Type 53/54E Low-Level Differential Plug-In Unit
- Type 53/54G Wide-Band Differential Plug-In Unit

Radar Design and Servicing

- Type 540-Series Oscilloscopes
- Type 551 Oscilloscope
- Type 53/54 Plug-In Units
- Type 180A Time-Mark Generator

Servo Design and Testing

- All Tektronix Oscilloscopes

Sound Equipment Design and Testing

- Type 502 Oscilloscope
- Type 310 Oscilloscope
- Type 105 Square-Wave Generator

APPLICATIONS GUIDE

(Continued)

Transistor and Tube Development

Type 575 Transistor-Curve Tracer
Type 570 Characteristic-Curve Tracer
Type 517A Oscilloscope
Type 515A Oscilloscope
Type 530-Series Oscilloscopes
Type 540-Series Oscilloscopes
Type 53/54G Differential Wide-Band Plug-In Unit
Type 53/54C Dual-Trace Plug-In Unit
Type 53/54R Transistor Rise-Time Testing Unit

TV Station Use

Type 525 Waveform Monitor
Type 524AD Oscilloscope
Type 310 Oscilloscope
Type 316 Oscilloscope
Type 105 Square-Wave Generator
Type 130 L,C Meter

TV Receiver Production Testing

Type 524AD Oscilloscope
Type 105 Square-Wave Generator

GEOPHYSICAL

Equipment Design

All Tektronix Oscilloscopes

Electrical and Mechanical Characteristics of Soils

Type 502 Oscilloscope
Type 532 Oscilloscope
Type 53/54C Dual-Trace Plug-In Unit
Type 53/54D Differential High-Gain Plug-In Unit
Type 53/54E Low-Level Differential Plug-In Unit
Type 122 Low-Level Preampfier

Field Equipment Maintenance

Type 502 Oscilloscope
Type 515A Oscilloscope
Type 310 Portable Oscilloscope
Type 316 Portable Oscilloscope

INDUSTRIAL

Stress and Impact Analysis

Type 502 Oscilloscope
Type 536 Oscilloscope
Type 532 Oscilloscope
Type 53/54 Plug-In Units
Type 122 Low-Level Preampfier

Metal Fracture Investigation

Type 502 Oscilloscope
Type 536 Oscilloscope
Type 531 Oscilloscope
Type 53/54 Plug-In Units

Type 160-Series Waveform Generators
Type 360 Cathode-Ray Indicator

Rotating Machinery Investigations

Type 502 Oscilloscope
Type 532 Oscilloscope
Type 53/54C Dual-Trace Plug-In Unit
Type 53/54D High-Gain Differential Plug-In Unit
Type 53/54E Low-Level Differential Plug-In Unit
Type 121 Wide-Band Preampfier
Type 122 Low-Level Preampfier

Transient Monitor

Type 515A Oscilloscope
Type 535 Oscilloscope
Type 533 Oscilloscope
Type 53/54C Dual-Trace Plug-In Unit

Vibration Analysis

Type 502 Oscilloscope
Type 536 Oscilloscope
Type 532 Oscilloscope
Type 53/54C Dual-Trace Plug-In Unit
Type 53/54D High-Gain Differential Plug-In Unit
Type 53/54E Low-Level Differential Plug-In Unit
Type 122 Low-Level Preampfier

Hydraulic Systems Analysis

Type 502 Oscilloscope
Type 530-Series Oscilloscopes
Type 53/54 Plug-In Units

MISCELLANEOUS SERVICE

Ballistic (weapon and explosive testing)

Type 533 Oscilloscope
Type 535 Oscilloscope
Type 53/54C Dual-Trace Plug-In Unit

Surge Distribution in Transformers

Type 530-Series Oscilloscopes
Type 540-Oscilloscopes
Type 53/54G Wide-Band Differential Plug-In Unit

High Voltage, Surge and Breakdown Testing

Type 517A Oscilloscope
Type 105 Square-Wave Generator
Type 107 Square-Wave Generator
Type 190A Signal Generator

Response of Surge-Measuring Equipment

Type 517A Oscilloscope
Type 540-Series Oscilloscopes
Type 53/54K Fast-Rise DC Plug-In Unit
Type 53/54L Fast-Rise High-Gain Plug-In Unit
Type 53/54H High-Gain DC Plug-In Unit



APPLICATIONS GUIDE

(Continued)

Hydrogen Thyatron Research and Testing

Type 517A Oscilloscope
Type 530-Series Oscilloscopes
Type 540-Series Oscilloscopes
Type 53/54 Plug-In Units

Input-Output Comparison

Type 530-Series Oscilloscopes
Type 53/54C Dual-Trace Plug-In Unit
Type 122 Low-Level Preamplifier

Microwave Generator Modes

Type 530-Series Oscilloscopes
Type 540-Series Oscilloscopes
Type 53/54 Plug-In Units

Missile Check-Out Racks

Type RM30 and RM40-Series Oscilloscopes
Type 53/54 Plug-In Units
Type RM15 Oscilloscope
Type RM16 Oscilloscope

Radioactive Decay Energy Spectrum

Type 541 Oscilloscope
Type 53/54K Fast-Rise Plug-In Unit

Sequence Control

Type 360 Cathode-Ray Indicator

Sonic-Echo Materials Testing

Type 530-Series Oscilloscopes
Type 53/54 Plug-In Units

Telemetry Monitor

Type 360 Cathode-Ray Indicator
Type RM15 Oscilloscope
Type 530-Series Oscilloscopes
Type 53/54C Dual-Trace Plug-In Unit

Time-Shared Microwave Systems

Type 535 Oscilloscope

Type 53/54C Dual-Trace Plug-In Unit

Transducers

Type 502 Oscilloscope
Type 536 Oscilloscope
Type 532 Oscilloscope
Type 53/54 Plug-In Units
Type 122 Low-Level Preamplifier
Type 123 Preamplifier

NUCLEAR

Alpha Particle Detector Amplification

Type 122 Low-Level Preamplifier

Energy Spectrum Indicator

Type 541 Oscilloscope
Type 53/54K Fast-Rise Plug-In Unit

Equipment Design

Type 530-Series Oscilloscopes
Type 540-Series Oscilloscopes
Type 53/54 Plug-In Units
Type 515A Oscilloscope
Type 517A Oscilloscope

PHOTOGRAPHY, OPTICS

Light Intensity and Film Density Measurements, Shutter Speed Accuracy Tests

All Tektronix Oscilloscopes

Sequence Exposure Timing, Shutter Synchroniza- tion Measurements

Type 535 Oscilloscope
Type 545 Oscilloscope
Type 53/54 Plug-In Preamplifiers

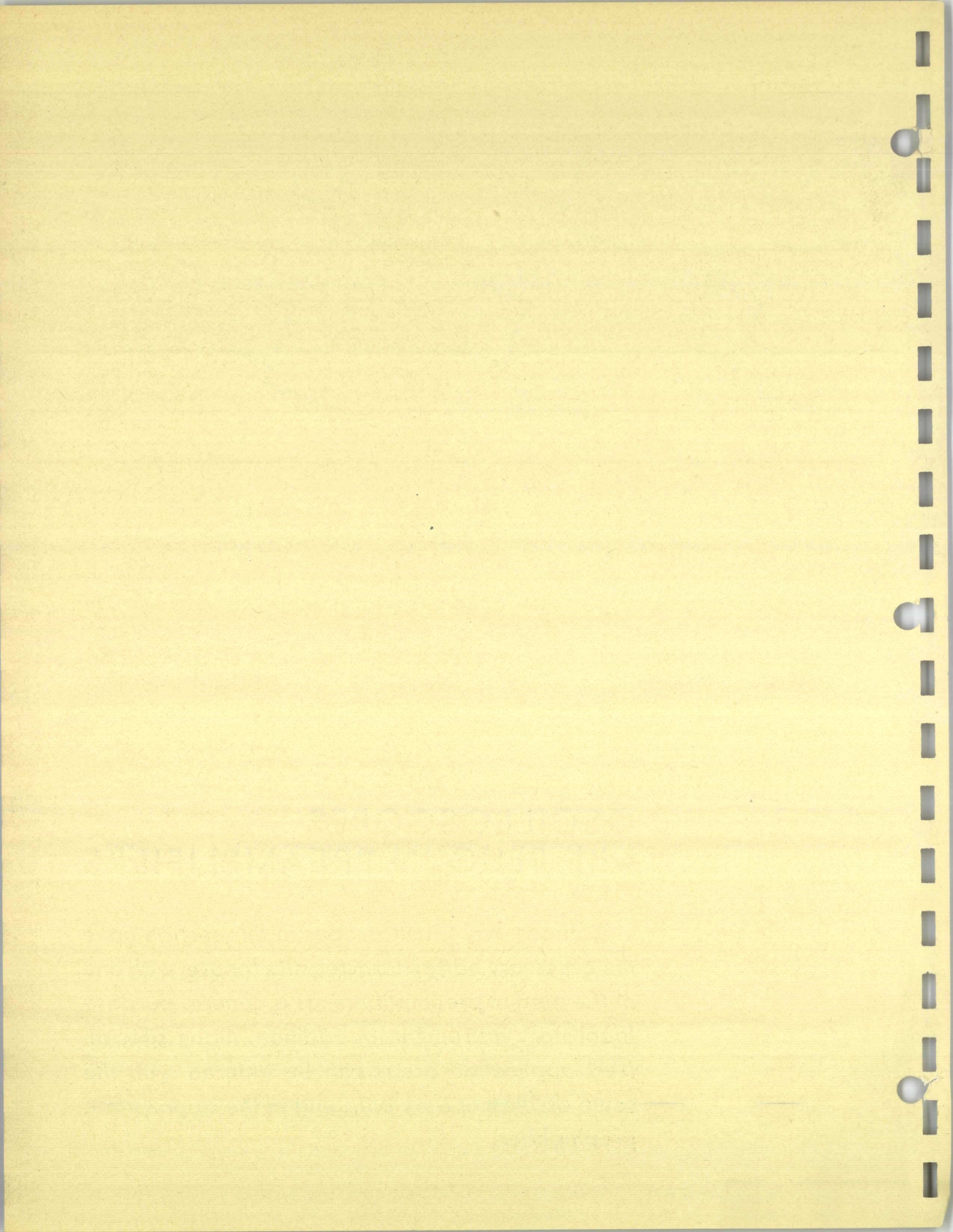
Thermocouple Radiation Measurements, Photo- electric Radiation Measurements

Type 530-Series Oscilloscopes
Type 53/54D Differential High-Gain Plug-In Unit



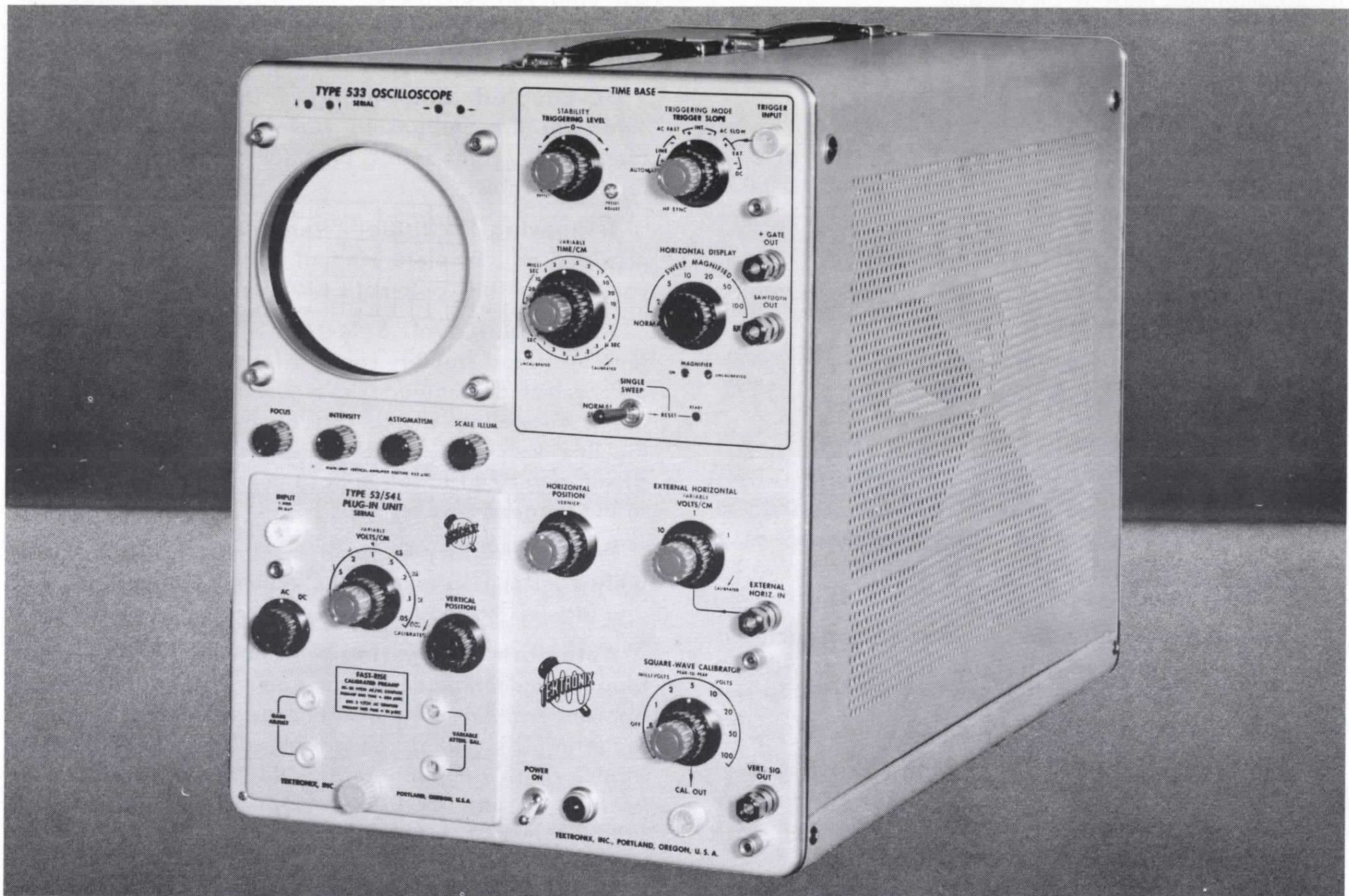
OSCILLOSCOPES with PLUG-IN PREAMPLIFIERS

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 533 CATHODE-RAY OSCILLOSCOPE



Versatility

Nine Available Plug-In Preamplifiers— Wide Band, Dual Trace, Low Level, Differential, and others for specialized applications.

High Performance

DC-to-15 MC Main Vertical Amplifier

Easy Operation

24 Calibrated Direct-Reading Sweep Rates

Sweep Magnification— 2, 5, 10, 20, 50, and 100 Times

Preset Triggering— Eliminates triggering adjustments in most applications.

Single Sweep Operation— Lockout-Reset Circuitry for one-shot recording.

High Writing Rate— 250 cm/ μ sec. 10-kv accelerating potential assures bright trace for operation in single-sweep applications, and with low sweep repetition rates.

GENERAL DESCRIPTION

The Type 533 is a dependable laboratory oscilloscope with special features that make it extremely versatile and easy to operate. The dc-to-15 mc main vertical amplifier provides for a wide range of application coverage through Type 53/54 Plug-In Preamplifiers. Six different degrees of sweep magnification are available. Sweep lockout and high writing rate are combined for best results in one-shot recording.

Operating convenience results from functionally-grouped controls, a single-knob direct-reading sweep selector, and fiddle-free triggering settings. Other useful features are warning lights for uncalibrated sweep-rate and sweep-magnifier settings, beam-position indicators, and built-in blanking for switching transients in dual-trace operation.

VERTICAL-DEFLECTION SYSTEM

DC-Coupled Output Amplifier— The dc-to-15 mc output amplifier is factory adjusted for optimum transient response. Risettime is 0.022 μ sec.

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TYPE 533 OSCILLOSCOPE

The Type 533 vertical deflection system is designed for use with any one of the Type 53/54 Plug-In Pre-amplifiers. In order to operate the Type 533, one of the preamplifiers must be plugged in.

Type 533 passband and risetime with the following plug-in units:

Type 53/54A— DC to 14 mc— 0.025 μ sec.

Type 53/54B— DC to 14 mc— 0.025 μ sec, at 0.05 v/cm to 50 v/cm... 2 cycles to 10 mc— 0.035 μ sec, at 5 mv/cm to 0.05 v/cm.

Type 53/54C— DC to 15 mc— 0.023 μ 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 53/54G— DC to 14 mc— 0.025 μ sec.

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

Type 53/54K— DC to 15 mc— 0.023 μ sec.

Type 53/54L— DC to 15 mc, 0.023 μ sec at 0.05 to 40 v/cm— 3 cycles to 15 mc, 0.023 μ sec at 5 mv/cm to 4 v/cm.

Balanced Delay Network— Ample signal delay is provided by a balanced (push-pull) delay network to permit 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 533. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this circuitry make possible the wide range of 0.02 μ sec/cm to 15 sec/cm.

Calibrated Sweep Rates— Twenty-four direct-reading calibrated sweep rates are provided: 0.1, 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 msec/cm, 0.1, 0.2, 0.5, 1, 2, 5 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.1 μ sec/cm to 15 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%.

Sweep Magnifier— Six degrees of sweep magnification are provided: 2, 5, 10, 20, 50, and 100 times. Any ten centimeters of a magnified sweep can be displayed. When the magnified sweep does not exceed the maximum calibrated rate of 0.02 μ sec/cm, accuracy is within 5% of the displayed portion. An indicator light warns the operator when the maximum calibrated rate is being exceeded.

Single-Sweep Operation— Lockout-reset circuitry provides for one-shot recording. After a single sweep is triggered, the sweep circuit is automatically locked out until manually reset. When reset, the sweep will fire on the next trigger received, then automatically lock out until the operator presses the reset button.

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 Facilities— Versatile triggering circuitry provides for complete manual control, preset stability control, and fully-automatic triggering.

Amplitude-Level Selection— Adjustable amplitude-level and stability controls for triggering the sweep at a selected amplitude level on the triggering waveform. Triggering source can be internal, external, or the line frequency, either ac or dc-coupled. The triggering point can be on either the rising or falling slope of the triggering waveform.

Preset Stability— Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

Automatic Triggering— Automatic level-seeking trigger circuit provides dependable triggering for most applications. One simple setting assures positive sweep-triggering by signals of widely differing amplitudes, shapes, and repetition rates. No trigger control need be touched until a different type of operation is desired. Range of automatic operation is between 60 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the screen.

High-Frequency Sync— Assures a steady display of sine-wave signals up to approximately 30 megacycles. Requires a signal large enough to cause about 2 cm of deflection, or an external signal of about 2 v.

Trigger Requirements— Internal triggering— a signal large enough to cause 2-mm deflection. External triggering— a signal of 0.2 v to 50 v.

Horizontal Input— An external signal can be applied to the horizontal deflection plates through the dc-coupled horizontal amplifier via a front-panel connector. Three calibrated sensitivity steps are provided: 0.1, 1, and 10 v/cm. A variable control provides for continuous adjustment from 0.1 to approximately 100 v/cm. Horizontal amplifier passband is dc to 500 kc. Input impedance is approximately 45 μ m 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 applica-

TYPE 533 OSCILLOSCOPE

tions. A new Tektronix cathode-ray tube is used in the Type 533. It is a 5" flat-faced metallized precision tube with helical post-accelerating anode that provides a full 6-cm x 10-cm viewing area. For best results over the wide sweep range of the Type 533, a P2 phosphor is normally furnished with the instrument.

Dual-Trace Blanking— When the Type 53/54C Dual-Trace Plug-In Unit is used in its chopped mode the switching transients are blanked. Chopping lines between traces are eliminated. (Type 53/54C Units under serial number 14078 will require a minor modification).

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 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.

Access to Interior— Three-piece cabinet design provides easy access to the interior of the instrument. Cabinet sides are held in place by two quick-opening fasteners, and can be removed in a matter of seconds.

Alignment of Cathode-Ray Tube— A molded nylon handle on the crt socket facilitates alignment of the cathode-ray tube.

Beam-Position Indicators— Two pairs of indicator lights show direction of the electron beam when the spot 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.

ELECTRON-TUBE COMPLEMENT

Vertical input amplifiers	2	12BY7A
CF and beam-position amplifiers	2	6BQ7A
Output amplifiers	2	6197
Trigger amplifier		6U8
Trigger CF and vertical signal out		6BQ7A
Sweep generator		12AU6
Sweep generator CF		6BQ7A
Disconnect diode		6AL5
Unblank and holdoff CF		6BQ7A
Trigger inverter		6BQ7A

Horizontal input CF		12AU6
Driver amplifiers	2	6DK6
Output amplifier and CF	2	6BA8
Capacitance driver		6DK6
Positive multivibrator and CF		6BQ7A
Negative multivibrator		12BY7
Sawtooth and gate CF		6BQ7A
External horizontal amplifier		6BQ7A
Trigger shaper		6U8
Cal multivibrator		6U8
Cal output CF		6BQ7A
Dual-trace blanking and trigger amplifier		6U8
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		T64P2

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, 500 watts with Type 53/54C unit plugged in.

Type 533, without plug-in units \$1050

- Includes: 2—P410 probes
 2—A510 binding-post adapters
 1—Test lead (012-031)
 1—F510-5 green filter (378-503)
 1—Instruction manual

Optional Phosphors

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

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Price f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 338 OSCILLOSCOPE

NOTE: A few features mentioned in this manual are not available on the Type 338 Oscilloscope. These features are listed in the "Optional Features" section of this manual.

The Type 338 Oscilloscope is a portable, battery-operated instrument designed for use in the field. It is capable of measuring the amplitude, frequency, and phase of periodic waveforms. The instrument is rugged and reliable, and is suitable for use in a wide variety of environments.

The Type 338 Oscilloscope is equipped with a variety of features, including a built-in speaker, a built-in power supply, and a built-in antenna. It is also capable of measuring the amplitude, frequency, and phase of periodic waveforms. The instrument is rugged and reliable, and is suitable for use in a wide variety of environments.

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TYPE 530-SERIES OSCILLOSCOPES

TYPE 531 CATHODE-RAY OSCILLOSCOPE

Wide Range of Vertical-Amplifier Characteristics

Instant convertibility through interchangeable plug-in preamplifiers.

Excellent Transient Response

Main-unit vertical-amplifier risetime —0.03 μ sec.

Wide Sweep Range

0.02 μ sec/cm to 12 sec/cm.

Versatile Triggering Circuitry

Amplitude-level selection with preset or manual stability control, and fully-automatic triggering.

10-KV Accelerating Potential

Bright display at low repetition rates.
250-cm/ μ sec writing rate.

Horizontal Input Amplifier

6-cm Linear Vertical Deflection

Balanced Delay Network



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. Nine plug-in 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 uses.

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 μ sec is factory adjusted for optimum transient response.

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 μ sec.

Type 53/54B — DC to 10 mc — 0.035 μ sec, at 0.05 v/cm to 50 v/cm . . . 2 cycles to 9 cm—0.04 + sec, at 5 mv/cm to 0.05 v/cm.

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

TYPE 531 OSCILLOSCOPE

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 10 mc — 0.035 μ sec.

Type 53/54H — DC to 9.5 mc — 0.037 μ sec.

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

Type 53/54L — DC to 11 mc, 0.031 μ sec at 0.05 to 40 v/cm — 3 cycles to 10 mc, 0.035 μ sec at 0.005 to 4 v/cm.

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.

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 circuitry make possible the 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 Unblanking—DC coupling is provided for the unblanking waveform, assuring uniform bias on the cathode-ray tube for all sweep times and repetition rates.

Triggering Facilities—Versatile triggering circuitry provides for complete manual control, preset stability control, and fully automatic triggering.

Amplitude-Level Selection—Adjustable amplitude-level and stability controls for triggering the sweep at a selected amplitude level on the triggering waveform. Triggering source can be internal, external, or the line frequency, either ac or dc-coupled. The triggering point can be on either the positive or negative slope of the triggering waveform.

Preset Stability—Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

Automatic Triggering—Automatic level-seeking trigger circuit provides dependable triggering for most applications. One simple setting assures positive sweep-triggering by signals of widely differing amplitudes, shapes, and repetition rates. No trigger control need be touched until a different type of operation is desired. Range of automatic operation is between 60 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the screen.

High-Frequency Sync—Assures a steady display of sine-wave signals up to approximately 30 megacycles. Requires a signal large enough to cause about 2 cm deflection, or an external signal of about 2 v.

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-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 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 5BGP, a Tektronix cathode-ray tube, is used in the Type 531. The 5BGP 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.

TYPE 531 OSCILLOSCOPE

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.

Alignment of Cathode-Ray Tube—Should it become necessary to touch up the alignment of the cathode-ray tube, a molded nylon handle on the crt socket can be reached in a matter of seconds. Release the two quick-opening fasteners on the left cabinet side, and lower the cabinet side out of the way, or remove it completely.

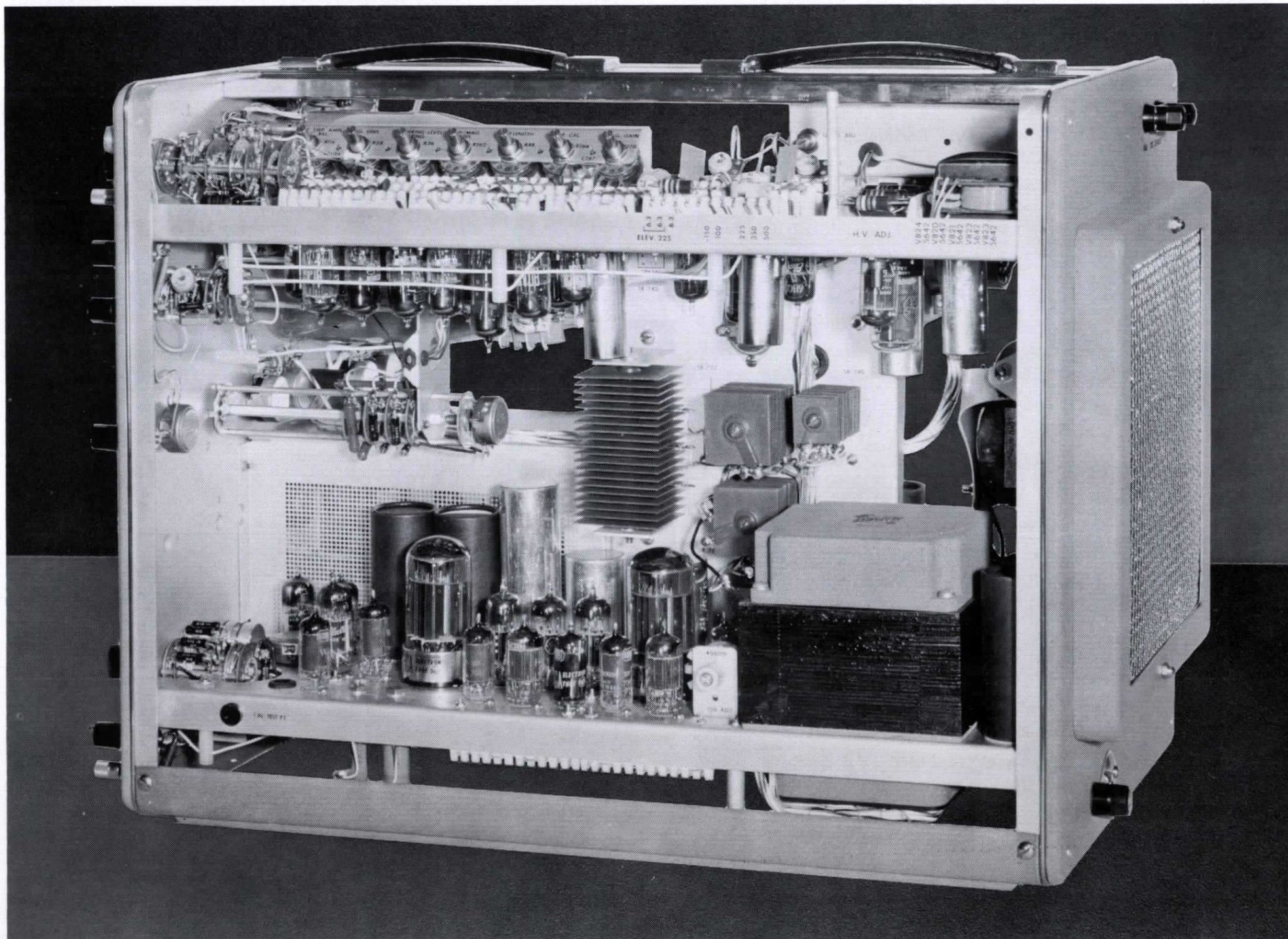
Beam Position Indicators—Two pairs of indicator lights show direction of the electron beam when the spot is not on the screen.

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.

ELECTRON-TUBE COMPLEMENT

Input amplifiers	2	12BY7A
CF and beam-position amplifier	2	6BQ7A
Output amplifiers	2	6197
Trigger amplifier		6U8
Trigger CF and vertical signal out		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
External horizontal amplifier		6BQ7A
Trigger shaper amplifier		6U8
Cal multivibrator		6U8
External horizontal and dc level CF		12AU7



TYPE 531 OSCILLOSCOPE

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	5BGP2

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—Test lead (012-031)
- 1—F510-5 green filter (378-503)
- 1—Instruction manual

Special Models

Type 531-S7, has sweep lockout feature for single-sweep operation. **\$1020**

Since special models require additional manufacturing time, please check with your Tektronix Field Engineer or Representative for exact delivery schedules.

Optional Phosphors

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

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



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.

APPLICATIONS

Here are some of the things you can do with the help of sweep delay, using a Type 535 Oscilloscope and an appropriate Type 53/54 Plug-In Pre-amplifier:

1. Make accurate incremental measurements along a complex waveform.
2. Make accurate phase-angle measurements between two signals up to 1 mc.
3. Display separate channels of a PTM system, determining pulse amplitude and shape under conditions of modulation.
4. Measure pulse-to-pulse interval and amount of jitter on computer signals or any train of pulse signals.
5. Produce a single horizontal sweep upon operating a push-button. This prevents the blurring of a photo-



graph that might be caused by succeeding traces. This operation is useful in:

- a. Photographing recurrent phenomena when succeeding waves are similar but not necessarily identical — for example, in certain biological work or radiation studies.
 - b. Photographing the result of an action initiated by operating the push-button that also starts a single sweep.
6. Produce a single horizontal sweep started by a triggering signal arriving after you have armed the horizontal sweep by means of a push-button. This prevents blurring of a photograph that might be caused by succeeding traces. This operation is useful in such applications as impact and explosion research.
 7. Make accurate time-difference measurements between pulse-in and pulse-out through an amplifying system.
 8. Display any selected individual line of a composite television signal.
 9. Measure time displacement, wave shape, and ampli-

TYPE 535 OSCILLOSCOPE

tude of individual channels in a telemetering system.

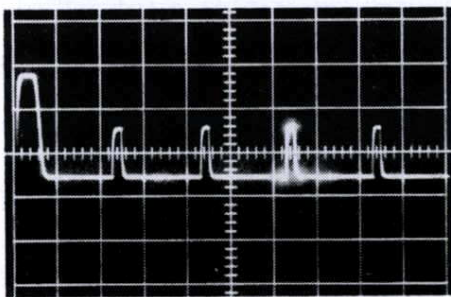
10. Get calibrated sweep magnification up to a practical limit of about 10,000 x.
11. Trigger external equipment at a controllable time after the start of a sweep.
12. Use the delay generator as a rate generator to trigger the sweep or control the repetition rate of external equipment.

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.

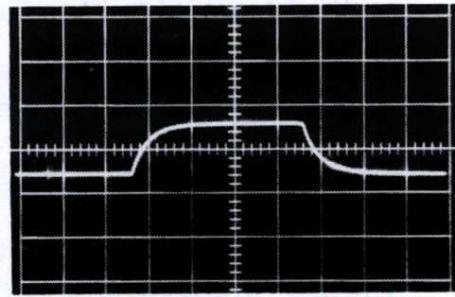
Sweep delay is accomplished in the Type 535 by use of a second sweep called the DELAYING SWEEP. A position on the HORIZONTAL DISPLAY switch provides for displaying the delaying sweep on the cathode-ray-tube screen. When the delaying sweep is displayed on the screen, the main sweep appears upon it as a section of increased brightness. With the signal applied to the delaying sweep, the main sweep can 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



100- μ sec/cm delaying sweep displayed on the screen. The 5- 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.

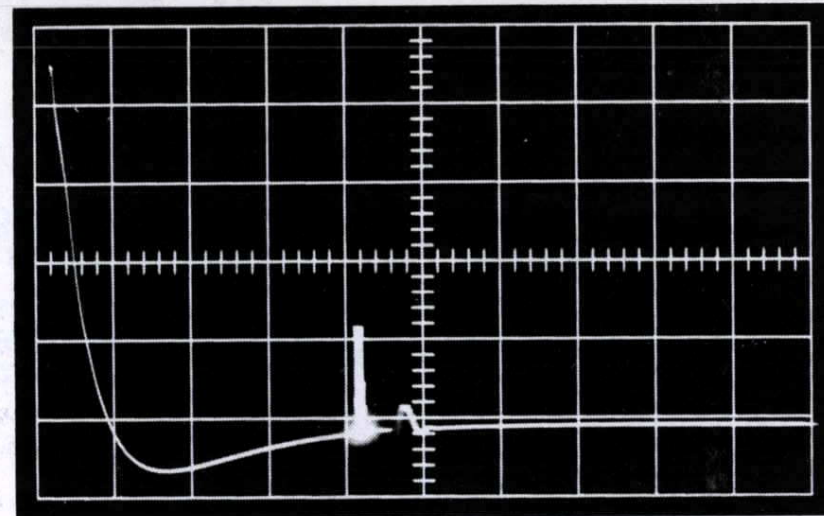
Main Sweep—Delayed



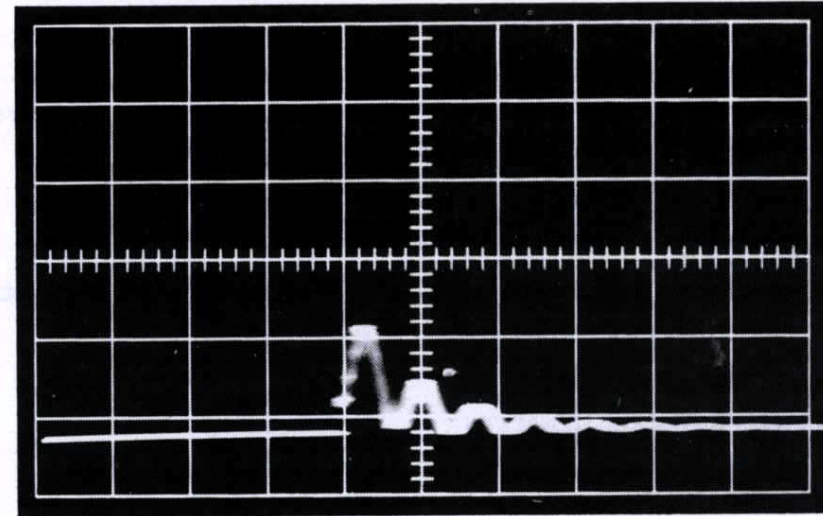
The main sweep returned to the screen, displaying the fourth pulse in the chain on the 5- μ sec/cm time base. The start of the main sweep was delayed 610 μ sec.

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

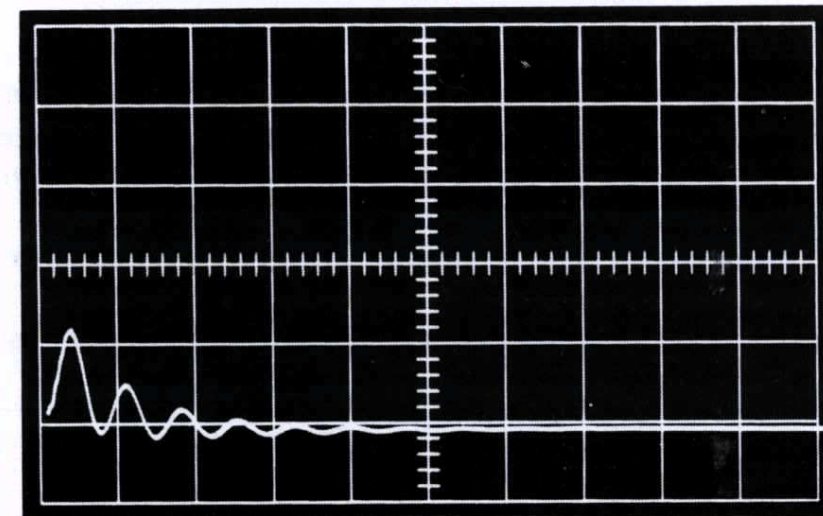
Triggered Operation



Small pulse following a large one displayed on the delaying sweep. The main sweep, running 50-times faster, is operating at the time indicated by the brightened portion of the trace.



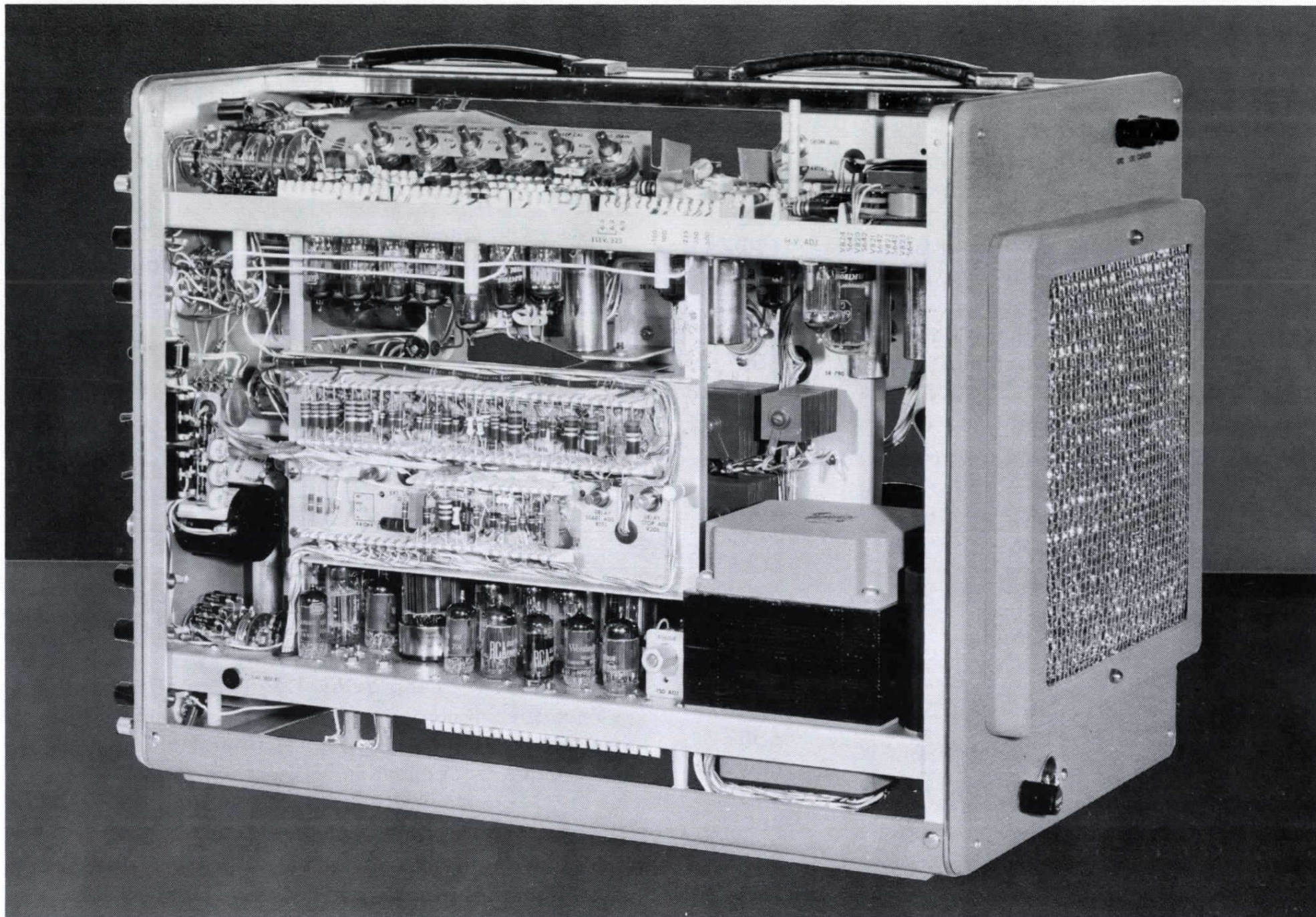
Small pulse displayed on the faster main sweep shows time-jitter on the signal. Main sweep starting time is after the selected period of delay, and before the arrival of the pulse



Main sweep adjusted for triggered operation. The main sweep is now started by the pulse to be observed. All effects of time-jitter on the signal are eliminated in this mode of operation.

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

TYPE 535 OSCILLOSCOPE



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 μmf .

OTHER CHARACTERISTICS

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

TYPE 535 OSCILLOSCOPE

ELECTRON-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		5BGP2

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—Test lead (012-031)
 1—F510-5 green filter (378-503)
 1—Instruction manual

Special Models

Type 535-S1, sweep delay 10 μ sec to 1 sec . . . **\$1325**

Type 535-S2, sweep delay 100 μ sec to 10 sec . **\$1325**

Type 535-S6, sweep delay 1.5 μ sec to 10 sec. **\$1325**

Since special models require additional manufacturing time, please check with your Tektronix Field Engineer or Representative for exact delivery schedules.

Optional Phosphors

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

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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.

Prices f.o.b. factory. (Please refer to **Terms and Shipping, GENERAL INFORMATION** page.)



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 interchangeable plug-in preamplifiers.

Wide Sweep Range

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

Versatile Triggering Circuitry

Amplitude-level selection with preset or manual stability control, and fully-automatic triggering.

10-kv Accelerating Potential

250-cm/ μsec writing rate.

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, pro-

vides a maximum deflection factor of 0.05 v/cm, with 12-millimicrosecond risetime, dc-to-30 mc passband, and 20- μmf input capacitance. (Frequency response is down 3 db $\pm 1/2$ db at 30 mc, 6 db at approximately 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 Preamplifiers. 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 541 OSCILLOSCOPE

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

Type 53/54H — dc to 15 mc, 0.023 μ sec.

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

Type 53/54L — dc to 30 mc, 0.012- μ sec risetime at 0.05 to 40 v/cm. . . 3 cycles to 24 mc, 0.015- μ sec risetime at 0.005 to 4 v/cm.

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 μ 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 μ f at 5x, 5.5 μ f at 20x, and 2.5 μ f at 50x attenuation.

Balanced Delay Network — A signal delay of 0.2 μ sec 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 a sweep range of 0.02 μ sec/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 μ sec/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 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 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 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 Unblinking—The unblinking waveform is dc-coupled to the grid of the cathode-ray tube,

assuring uniform bias for all sweep speeds and repetition rates.

Triggering Facilities—Versatile triggering circuitry provides for complete manual control, preset stability control, and fully automatic triggering.

Amplitude-Level Selection—Adjustable amplitude-level and stability controls for triggering the sweep at a selected amplitude level on the triggering waveform. Trigger source can be internal, external, or the line frequency, either ac or dc-coupled. The triggering point can be on either the positive or negative slope of the triggering waveform.

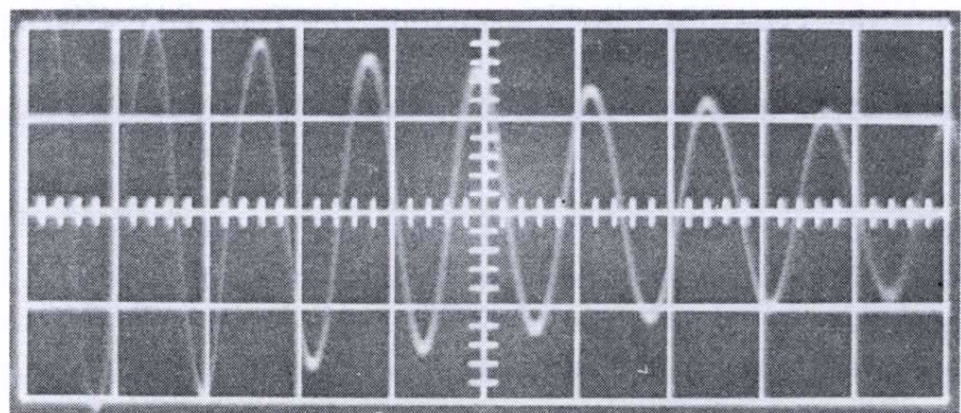
Preset Stability—Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

Automatic Triggering—Automatic level-seeking trigger circuit provides dependable triggering for most applications. One simple setting assures positive sweep-triggering by signals of widely differing amplitudes, shapes, and repetition rates. No trigger controls need be touched until a different type of operation is desired. Range of automatic operation is between 60 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the screen.

High Frequency Sync—Assures a steady display of sine-wave signals up to approximately 30 megacycles. Requires a signal large enough to cause about 2 cm deflection, or an external signal of about 2 v.

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.

Single Sweep Recording



20 megacycle damped oscillation shows 250-cm/ μ sec writing rate of the Type 541 Oscilloscope with a 5BHP11 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.

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

TYPE 541 OSCILLOSCOPE

factor continuously variable from 0.2 v/cm to approximately 15 v/cm. Passband is dc to 240 kc. Input impedance is approximately 40 $\mu\mu\text{f}$ 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 Tektronix Type 5BHP cathode-ray tube. The 5BHP 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.

Alignment of Cathode-Ray Tube—Should it become necessary to touch up the alignment of the cathode-ray tube, a molded nylon handle on the crt socket can be reached in a matter of seconds. Release the two quick-opening fasteners on the left cabinet side, and lower the cabinet side out of the way, or remove it completely.

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 coaxial con-

ductor. 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.

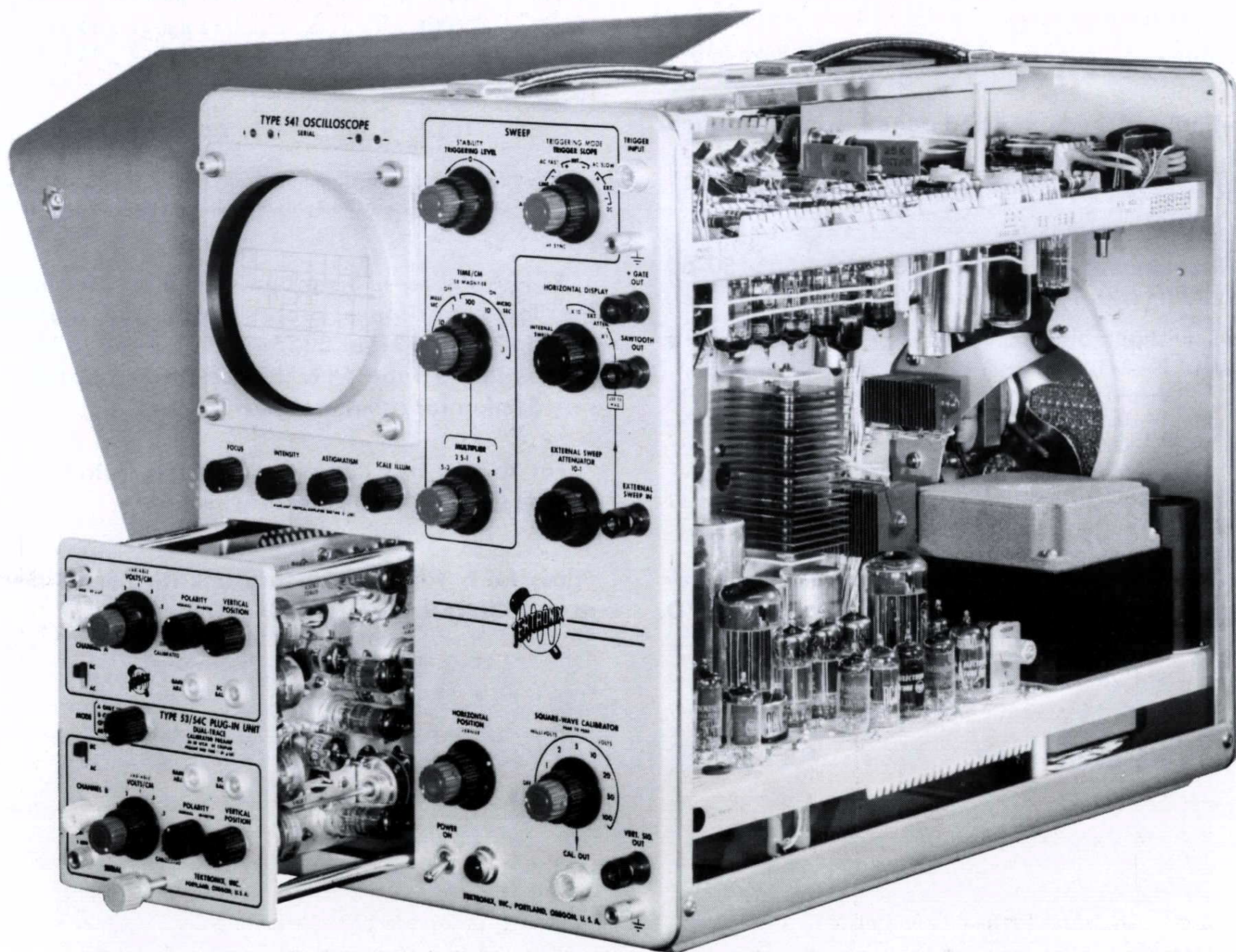
Output Waveforms—A 20-v positive gate voltage of the same duration as the sweep, and a 150-v sweep sawtooth waveform are available at front-panel binding posts via cathode followers. The vertical signal is brought out to a front-panel terminal for external applications.

Beam Position Indicators—Two pairs of indicator lights show the direction of the crt electron beam when the spot 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.

ELECTRON-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



TYPE 541 OSCILLOSCOPE

Trigger amplifier	6BQ7A
Trigger shaper	6U8
Positive multivibrator and multi CF	6BQ7A
Negative multivibrator	12BY7
Unblinking 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	5BHP2

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—Test lead (012-031)
- 1—Green filter (378-514)
- 1—Instruction manual

Special Models

Type 541-S7, has sweep lockout feature for single-sweep operation. **\$1170**

Since special models require additional manufacturing time, please check with your Tektronix Field Engineer or Representative for exact delivery schedules.

Optional Phosphors

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

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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 the Type 541. Please see the Catalog Accessory Section for complete specifications.

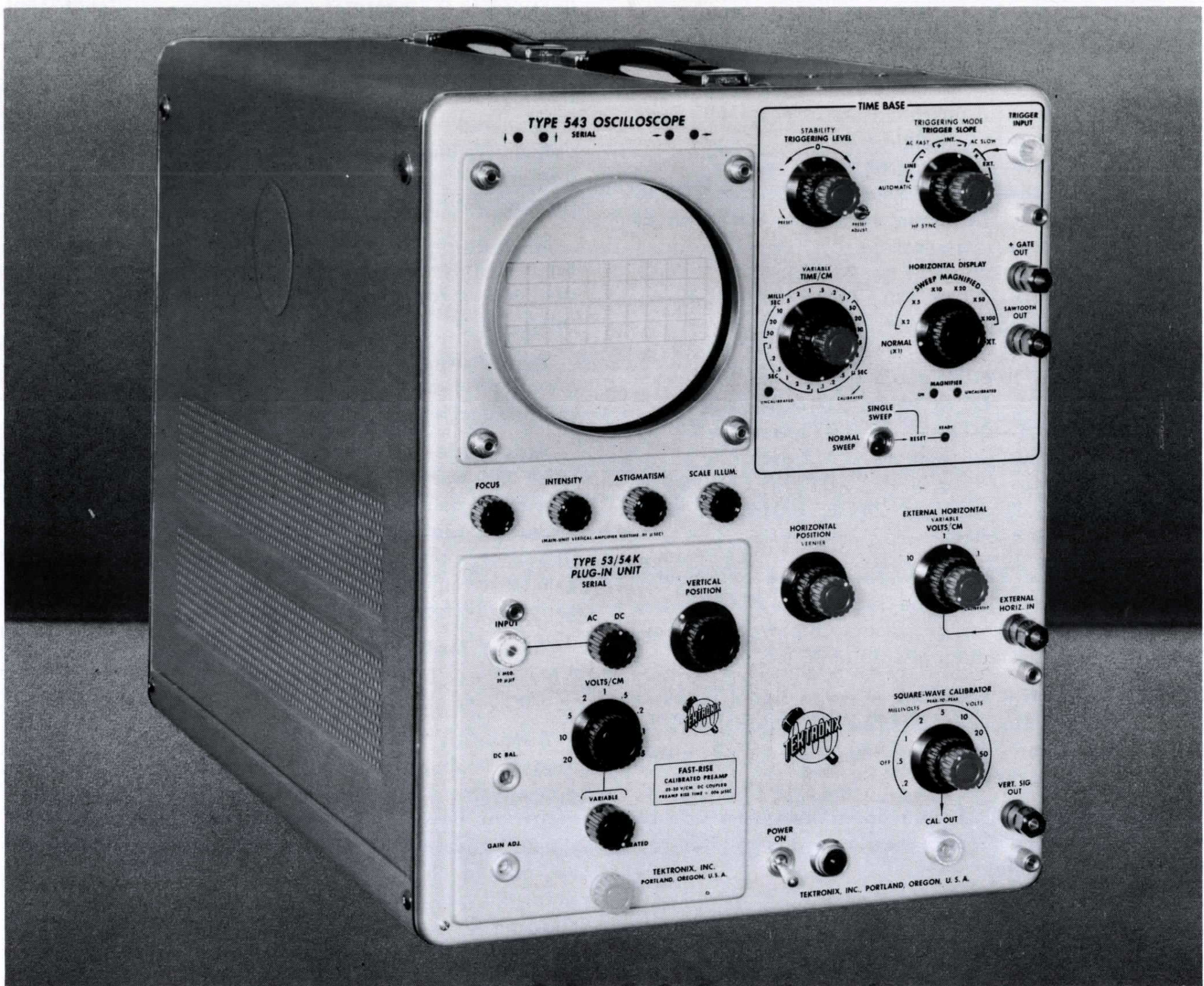
For special test accessories for this instrument, please see the Catalog Test Accessory Section.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 540-SERIES OSCILLOSCOPES

TYPE 543 CATHODE-RAY OSCILLOSCOPE



Versatility

Nine Available Plug-In Preamplifiers—Wide Band, Dual Trace, Low Level, Differential, and others for specialized applications.

High Performance

DC-to-30 MC Vertical Response with Fast-Rise Plug-In Preamplifiers.

Easy Operation

24 Calibrated Direct-Reading Sweep Rates

Sweep Magnification—2, 5, 10, 20, 50, and 100 Times

Preset Triggering—Eliminates triggering adjustments in most applications.

Single Sweep Operation—Lockout-Reset Circuitry for one-shot recording.

High Writing Rate—250 cm/ μ sec. 10-kv accelerating potential assures bright trace for operation in single-sweep applications, and with low sweep repetition rates.

GENERAL DESCRIPTION

The Type 543 is a fast-rise laboratory oscilloscope with new versatility and convenience features. Its applications capabilities extend over the complete range provided by the nine available Type 53/54 Plug-In Preamplifiers and additional special-purpose Plug-In Units. Simplified controls make it easy to operate, and the wide range of sweep magnification and single-sweep lockout feature add to both versatility and operating convenience.

With the exception of the vertical amplifier and cathode-ray tube, the Type 543 is almost identical to the Tektronix Type 533.

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TYPE 543 OSCILLOSCOPE

VERTICAL-DEFLECTION SYSTEM

DC-Coupled Output Amplifier—The Type 543 output amplifier has a risetime of 10 millimicroseconds, and is factory adjusted for optimum transient response. In order to operate the Type 543, one of the Type 53/54 Units must be plugged in.

Type 543 vertical passband and risetime with Type 53/54 Plug-In Preamplifiers:

Type 53/54A—DC to 20 mc, 0.018 μ sec.

Type 53/54B—DC to 20 mc, 0.018 μ sec at 0.05 to 50 v/cm. . . . 2 cycles to 12 mc, 0.03 μ sec at 5 mv/cm to 0.05 v/cm.

Type 53/54C—DC to 24 mc, 0.015 μ 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 30 kc at 50 μ v/cm, increasing to 60 kc at 0.5 mv/cm.

Type 53/54G—DC to 20 mc, 0.018 μ sec.

Type 53/54H—DC to 15 mc, 0.023 μ sec.

Type 53/54K—DC to 30 mc, 0.012 μ sec.

Type 53/54L—DC to 30 mc, 0.012 μ sec at 0.05 to 40 v/cm, 3 cycles to 24 mc, 0.015 μ sec at 5 mv/cm to 4 v/cm.

Probes—Two P410 low-capacitance attenuator probes are supplied with the Type 543. P410 probes introduce no overshoot or ringing, but frequency response is down an additional 1 db at 30 mc.

Balanced Delay Network—Ample signal delay is provided by a balanced (push-pull) delay network to permit 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 543. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this circuitry make possible the wide range of 0.02 μ sec/cm to 15 sec/cm.

Calibrated Sweep Rates—Twenty-four direct-reading calibrated sweep rates are provided: 0.1, 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 msec/cm, 0.1, 0.2, 0.5, 1, 2, 5 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.1 μ sec/cm to 15 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%.

Sweep Magnifier—Six degrees of sweep magnification are provided: 2, 5, 10, 20, 50, and 100 times. Any ten centimeters of a magnified sweep can be dis-

played. When the magnified sweep does not exceed the maximum calibrated rate of 0.02 μ sec/cm, accuracy is within 5% of the displayed portion. An indicator light warns the operator when the maximum calibrated rate is being exceeded.

Single-Sweep Operation—Lockout-reset circuitry provides for one-shot recording. After a single sweep is triggered, the sweep circuit is automatically locked out until manually reset. When reset, the sweep will fire on the next trigger received, then automatically lock out until the operator presses the reset button.

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 Facilities—Versatile triggering circuitry provides for complete manual control, preset stability control, and fully-automatic triggering.

Amplitude-Level Selection—Adjustable amplitude-level and stability controls for triggering the sweep at a selected amplitude level on the triggering waveform. Triggering source can be internal, external, or the line frequency, either ac or dc-coupled. The triggering point can be on either the rising or falling slope of the triggering waveform.

Preset Stability—Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

Automatic Triggering—Automatic level-seeking trigger circuit provides dependable triggering for most applications. One simple setting assures positive sweep-triggering by signals of widely differing amplitudes, shapes, and repetition rates. No trigger control need be touched until a different type of operation is desired. Range of automatic operation is between 60 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the screen.

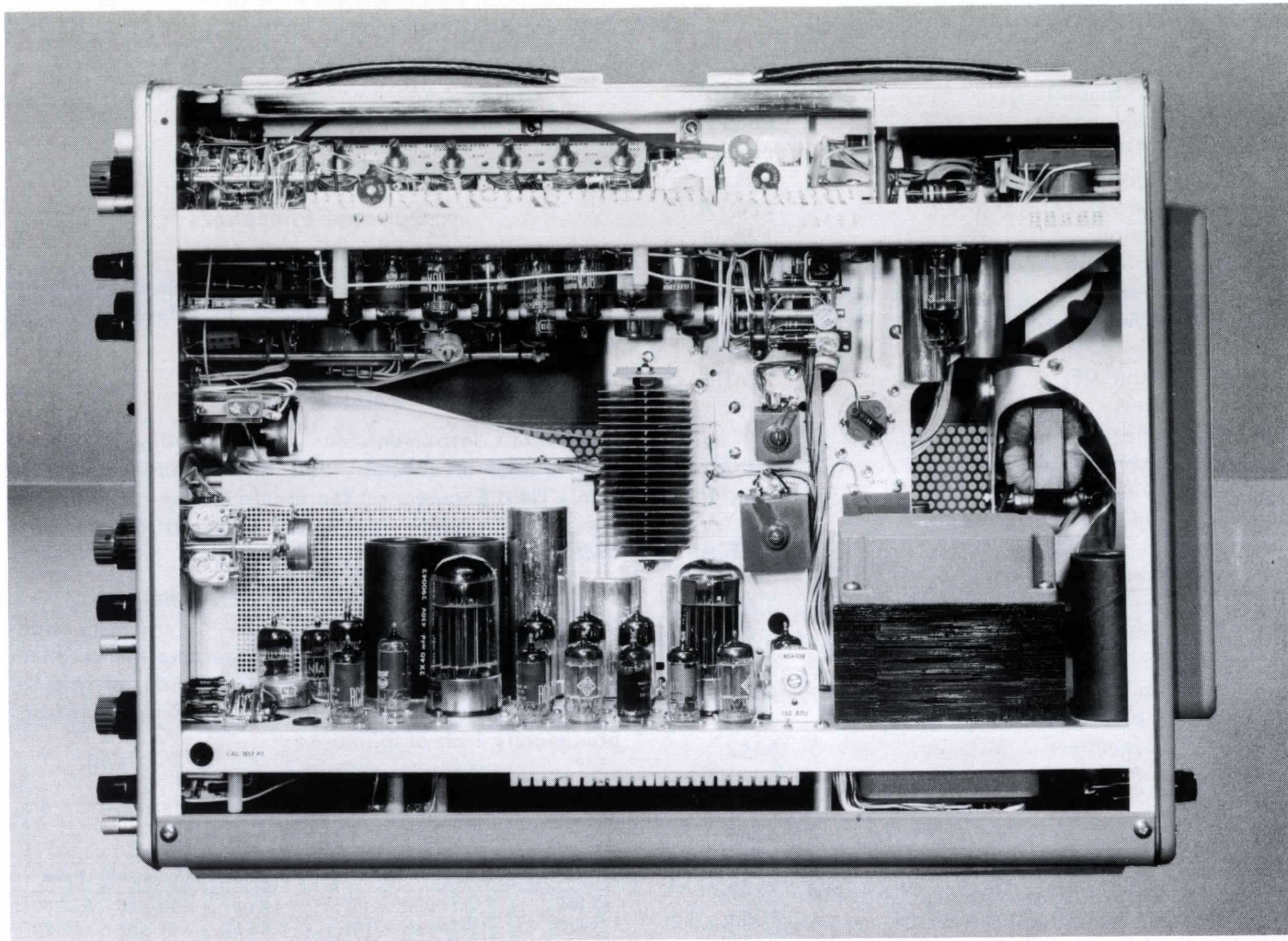
High-Frequency Sync—Assures a steady display of sine-wave signals up to approximately 30 megacycles. Requires a signal large enough to cause about 2 cm of deflection, or an external signal of about 2 v.

Trigger Requirements—Internal triggering—a signal large enough to cause 2-mm deflection. External triggering—a signal of 0.2 v to 50 v.

Horizontal Input—An external signal can be applied to the horizontal deflection plates through the dc-coupled horizontal amplifier via a front-panel connector. Three calibrated sensitivity steps are provided: 0.1, 1, and 10 v/cm. A variable control provides for continuous adjustment from 0.1 to approximately 100 v/cm. Horizontal amplifier passband is dc to 500 kc. Input impedance is approximately 45 μ f paralleled by 1 megohm.



TYPE 543 OSCILLOSCOPE



OTHER CHARACTERISTICS

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates, and in single-sweep applications. A Tektronix manufactured cathode-ray tube is used in the Type 543. It is a 5" flat-faced metallized precision tube with helical post-accelerating anode that provides a 4-cm x 10-cm viewing area. For best results over the wide sweep range of the Type 543, a P2 phosphor is normally furnished with the instrument.

Dual-Trace Blanking—When the Type 53/54C Dual-Trace Plug-In Unit is used in its chopped mode the switching transients are blanked. Chopping lines between traces are eliminated. (Type 53/54C Units under serial number 14078 will require a minor modification.)

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 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.

Access to Interior—Three-piece cabinet design provides easy access to the interior of the instrument. Cabinet sides are held in place by two quick-opening fasteners, and can be removed in a matter of seconds.

Alignment of Cathode-Ray Tube—A molded nylon handle on the crt socket facilitates alignment of the cathode-ray tube.

Beam-Position Indicators—Two pairs of indicator lights show direction of the electron beam when the spot 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.

TYPE 543 OSCILLOSCOPE

ELECTRON-TUBE COMPLEMENT

Vertical input amplifiers	2	12BY7A
Beam-position amplifiers		12AU7
Driver cathode followers	2	6BQ7A
Output amplifiers	12	6DK6
Trigger amplifiers	2	6DK6
Trigger CF and vertical signal out		6BQ7A
Sweep generator		12AU6
Sweep generator CF		6BQ7A
Disconnect diode		6AL5
Unblank and holdoff CF		6BQ7A
Trigger inverter		6BQ7A
Horizontal input CF		12AU6
Driver amplifiers	2	6DK6
Output amplifier and CF	2	6BA8
Capacitance driver		6DK6
Positive multivibrator and CF		6BQ7A
Negative multivibrator		12BY7A
Sawtooth and gate CF		6BQ7A
External horizontal amplifier		6BQ7A
Trigger shaper		6U8
Cal multivibrator		6U8
Cal output CF		6BQ7A
Dual-trace blanking and trigger amplifier		6U8
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		T65P2

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, 530 watts with Type 53/54C Unit plugged in.

Type 543, without plug-in units \$1200

- Includes: 2—P410 probes
 2—A510 binding-post adapters
 1—Test lead (012-031)
 1—Green filter (378-514)
 1—Instruction manual

Optional Phosphors

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

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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
		(Megohms) Resistance	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 capacitance 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 the Type 543. 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. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 540-SERIES OSCILLOSCOPES

TYPE 545 CATHODE-RAY OSCILLOSCOPE with Flexible Sweep Delay

Wide-Range Sweep Delay

1 μ sec to 0.1 sec calibrated, 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.

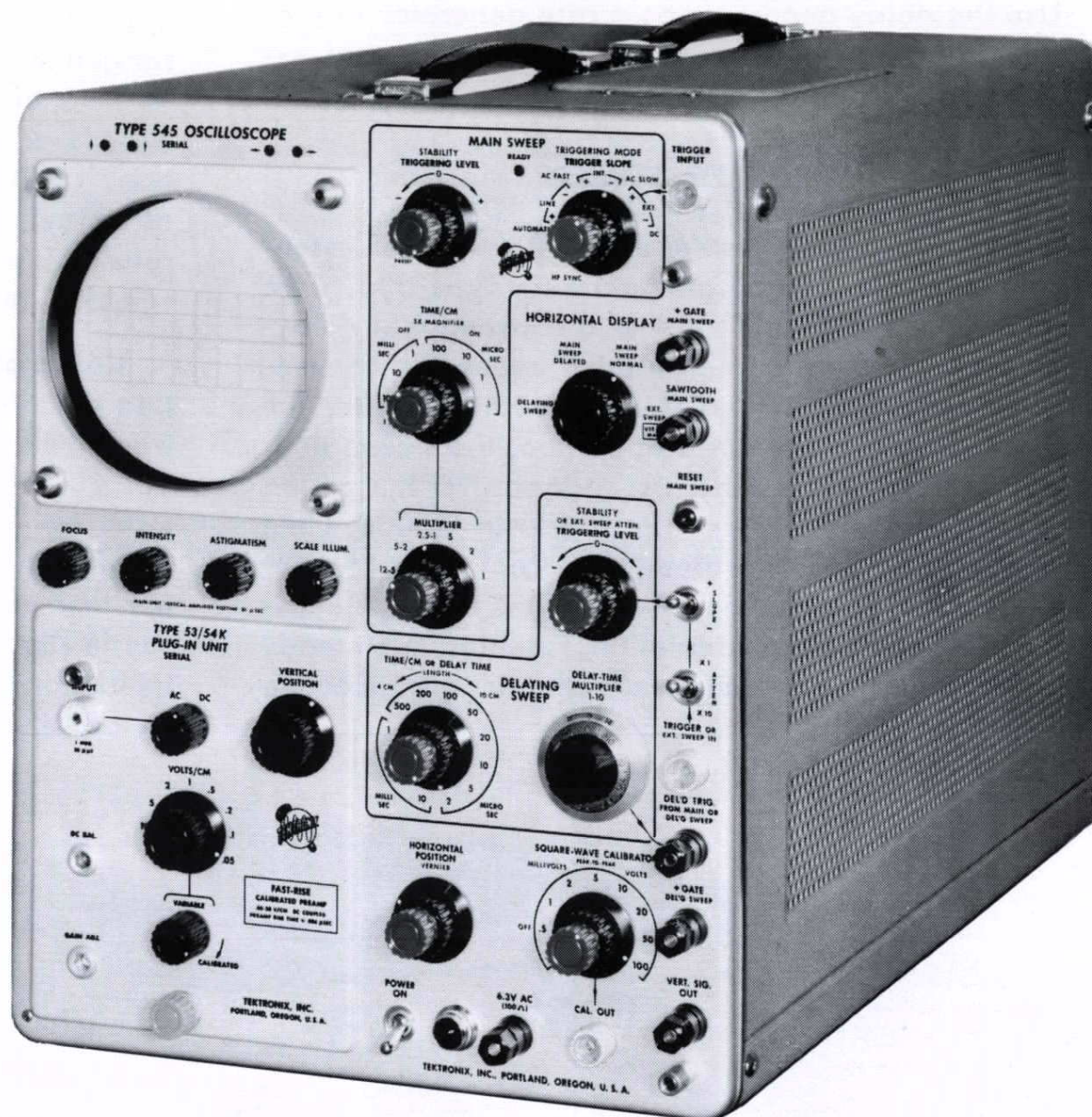
Accurate Calibration

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.

APPLICATIONS

Here are some of the things you can do with the help of sweep delay, using a Type 545 Oscilloscope and an appropriate Type 53/54 Plug-In Pre-amplifier:

1. Make accurate incremental measurements along a complex waveform.
2. Make accurate phase-angle measurements between two signals up to 1 mc.
3. Display separate channels of a PTM system, determining pulse amplitude and shape under conditions of modulation.
4. Measure pulse-to-pulse interval and amount of jitter on computer signals or any train of pulse signals.
5. Produce a single horizontal sweep upon operating

a push-button. This prevents the blurring of a photograph that might be caused by succeeding traces. This operation is useful in:

- a. Photographing recurrent phenomena when succeeding waves are similar but not necessarily identical — for example, in certain biological work or radiation studies.
 - b. Photographing the result of an action initiated by operating the push-button that also starts a single sweep.
6. Produce a single horizontal sweep started by a triggering signal arriving after you have armed the horizontal sweep by means of a push-button. This prevents blurring of a photograph that might be caused by succeeding traces. This operation is useful in such applications as impact and explosion research.
 7. Make accurate time-difference measurements between pulse-in and pulse-out through an amplifying system.
 8. Display any selected individual line of a composite television signal.
 9. Measure time displacement, wave shape, and amplitude of individual channels in a telemetering system.

TYPE 545 OSCILLOSCOPE

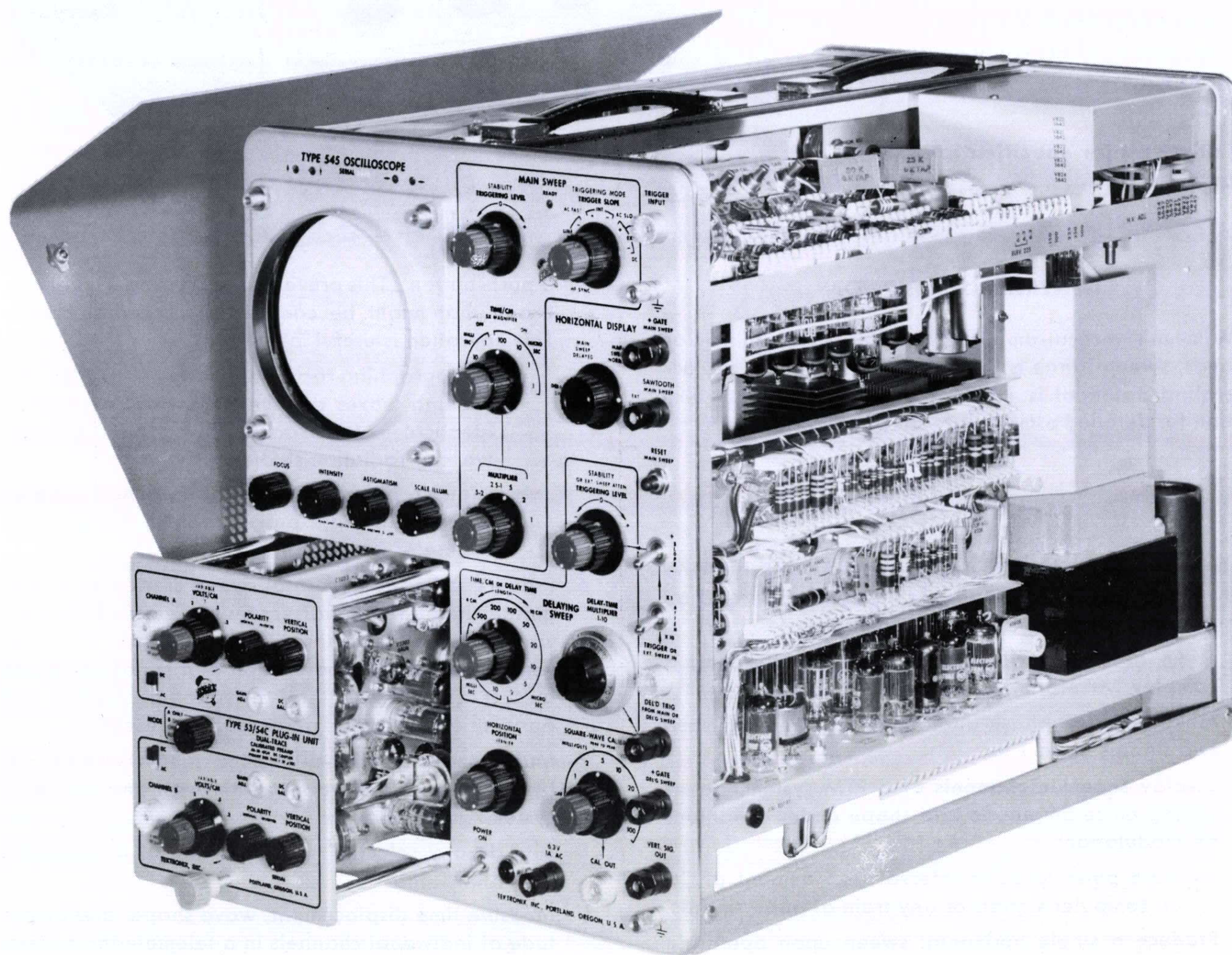
10. Get calibrated sweep magnification up to a practical limit of about 10,000 x.
11. Trigger external equipment at a controllable time after the start of a sweep.
12. Use the delay generator as a rate generator to trigger the sweep or control the repetition rate of external equipment.

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 $\mu\text{sec/cm}$, 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.



TYPE 545 OSCILLOSCOPE

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 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 μ mf.

OTHER CHARACTERISTICS

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

ELECTRON-TUBE COMPLEMENT

Vertical input amplifiers	2	12BY7A
Driver amplifiers	2	6BQ7A
Trigger pickoff amplifiers	2	6DK6

Trigger CF and vert. sig. out CF		6BQ7A
Indicator amplifiers		12AU7
Output amplifiers	12	6DK6
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		5BHP2

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 OSCILLOSCOPE

Type 545, without plug-in units. \$1450

- Includes: 2—P410 probes
 2—A510 binding-post adapters
 1—Test lead (012-031)
 1—Green filter (378-514)
 1—Instruction manual

Special Models

Type 545-S1, sweep delay 10 μ sec to 1 sec. . . \$1475

Type 545-S2, sweep delay 100 μ sec to 10 sec. . \$1475

Type 545-S6, sweep delay 1.5 μ sec to 10 sec. \$1475

Since special models require additional manufacturing time, please check with your Tektronix Field Engineer or Representative for exact delivery schedules.

Optional Phosphors

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

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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 $\mu\mu$ f 19 $\mu\mu$ f	\$10.50
P410	10:1	10	8 $\mu\mu$ f 11 $\mu\mu$ f	10.50
P420	20:1	10	5.5 $\mu\mu$ f 7 $\mu\mu$ f	10.50
P450-L	50:1	10	2.5 $\mu\mu$ f	12.50
P4100	100:1	10	2.5 $\mu\mu$ f 2.5 $\mu\mu$ f	12.50

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

†When connected to instruments with input capacitances up to 50 $\mu\mu$ 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. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 550 SERIES OSCILLOSCOPES

TYPE 551 DUAL-BEAM OSCILLOSCOPE for Fast-Rise Applications

Wide-Band Vertical Amplifiers

Main-unit risetimes — 12 $m\mu\text{sec}$.

Passbands and risetimes with Type 53/54K units—
dc to 25 mc, 0.014 μsec .

Signal-Handling Versatility

All Type 53/54 Plug-In Units can be used in both channels.

0.2- μsec Delay Networks

Wide Sweep Range

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

Single Sweeps

Lockout-reset circuitry.

Complete Triggering

Fully-automatic or amplitude-level selection with pre-set or manual stability control.

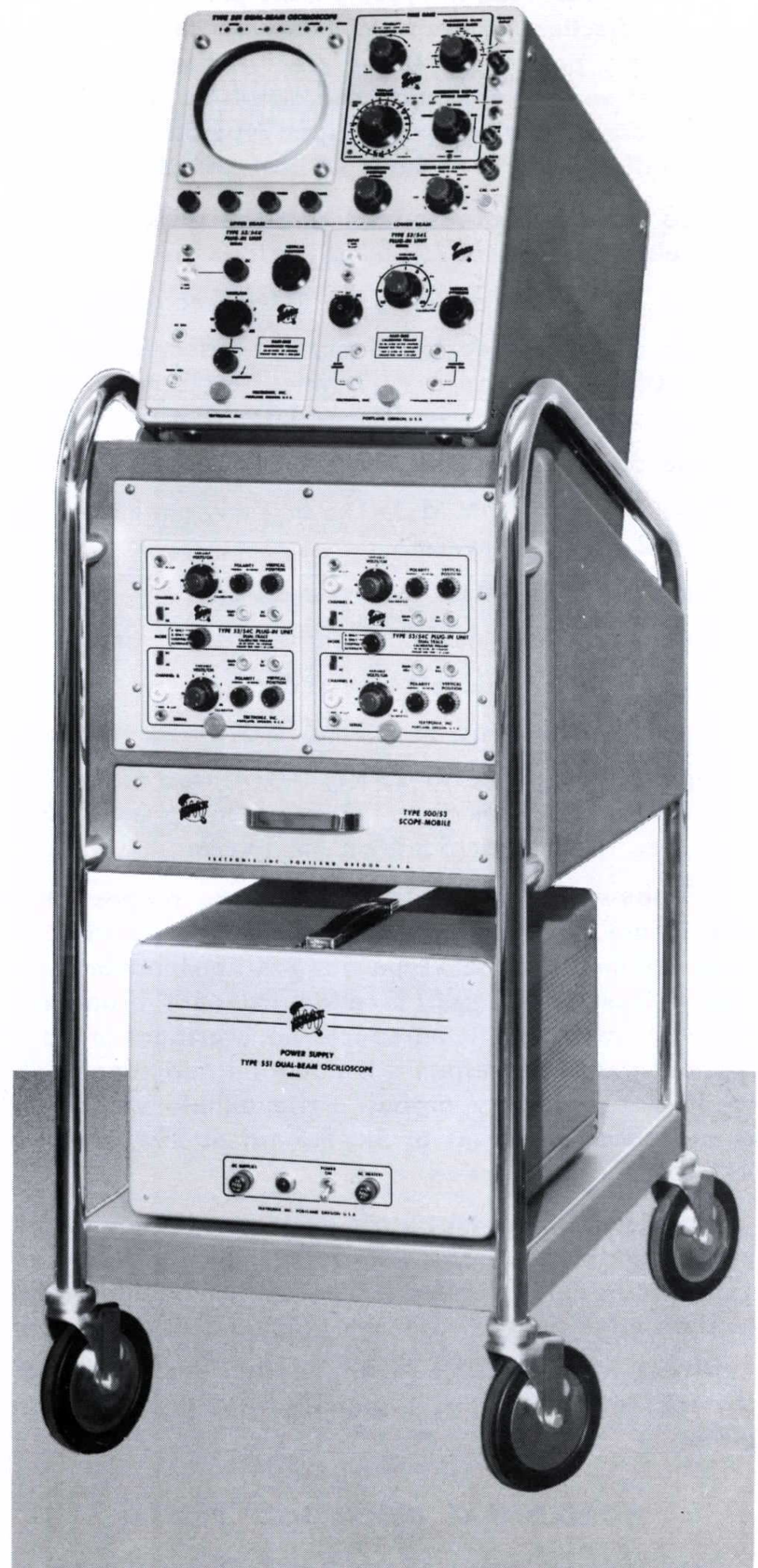
10-kv Accelerating Potential

Brighter display for fast sweeps and low repetition rates

GENERAL DESCRIPTION

The Type 551 uses a new Tektronix two-gun cathode-ray tube with two pairs of vertical-deflection plates. A single pair of horizontal-deflection plates is common to both electron beams. The two wide-band main amplifiers of the Type 551 are designed for Type 53/54 Plug-In Preamplifiers, providing a high degree of signal-handling versatility in both channels. Both electron beams are simultaneously deflected horizontally at any one of many sweep rates provided by an accurately-calibrated time-base generator.

The Type 551 can be used as a single-beam oscilloscope as well as a dual-beam instrument. In addition, a three-channel or four-channel display is available through use of the time-sharing characteristics of Type 53/54C Dual-Trace Plug-In Units in one or both amplifiers. Other available Type 53/54 Plug-In Units extend the working range of the Type 551 into applications requiring high dc-coupled sensitivity, differential input, and narrow-band microvolt sensitivity.



Type 551—as pictured above but without plug-in units—Indicator Unit, Power Supply Unit, Scope-Mobile \$1833

Type 551—Indicator Unit and Power Supply Unit only, without plug-in units \$1725



TYPE 551 OSCILLOSCOPE

VERTICAL DEFLECTION SYSTEMS

Two DC-Coupled Main Amplifiers — Risetime of both main amplifiers is 12 millimicroseconds. A Type 53/54 Preamplifier must be plugged into both channels for instrument operation.

Type 53/54K Plug-In Preamplifiers provide nine calibrated deflection factors from 0.05 v/cm to 20 v/cm at dc-to-25 mc passbands, 0.014- μ sec risetimes. A wide variety of vertical-deflection characteristics is available through use of another of the eight Type 53/54 Plug-In Preamplifiers in one or both vertical channels.

Type 551 vertical-response characteristics for both channels with Type 53/54 Plug-In Units are

Type 53/54A — dc to 18 mc, 0.02- μ sec risetime.

Type 53/54B — dc to 18 mc, 0.02- μ sec risetime at 0.05 to 50 v/cm 2 cycles to 10 mc, 0.035- μ sec risetime at 5 mv/cm to 0.05 v/cm.

Type 53/54C — dc to 22 mc, 0.016- μ sec 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 18 mc, 0.02- μ sec risetime.

Type 53/54H — dc to 14 mc, 0.025 μ sec.

Type 53/54K — dc to 25 mc, 0.014- μ sec risetime.

Type 53/54L — dc to 25 mc, 0.014- μ sec risetime at 0.05 to 50 v/cm 3 cycles to 15 mc, 0.023- μ sec risetime at 5 mv/cm to 4 v/cm.

Probes — Four P410 low-capacitance probes (10x atten.) are supplied with the instrument. Input capacitance of the Type 551-Type 53/54K combination with the P410 probe is 8 $\mu\mu$ f. 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 $\mu\mu$ f at 5x, 5.5 $\mu\mu$ f at 20x, and 2.5 $\mu\mu$ f at 50x attenuation.

Balanced Delay Network — A signal delay of 0.2 μ sec is introduced into each channel by the balanced (push-pull) delay networks. 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

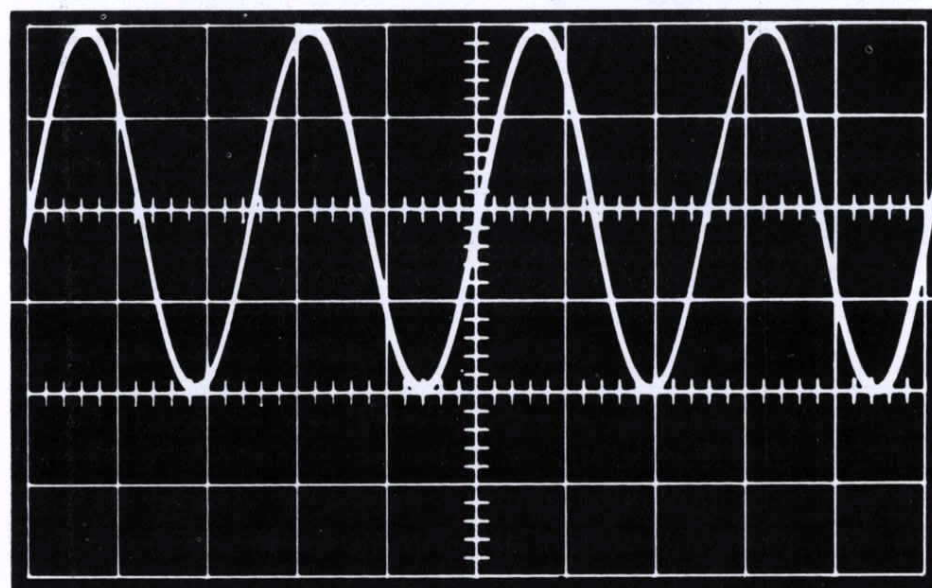
Both electron beams of the Type 551 are simultaneously deflected by the same sweep sawtooth voltage. Sweep generator used in the Type 551 is the Miller runup type. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this circuitry provide an extremely wide sweep range of 0.02 μ sec/cm to 12 sec/cm.

Calibrated Sweep Rates — The Type 551 has single-knob selection of 24 calibrated sweep rates: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 μ sec/cm, 0.1, 0.2, 0.5, 1, 2, and 5 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment of the sweep rate 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%.

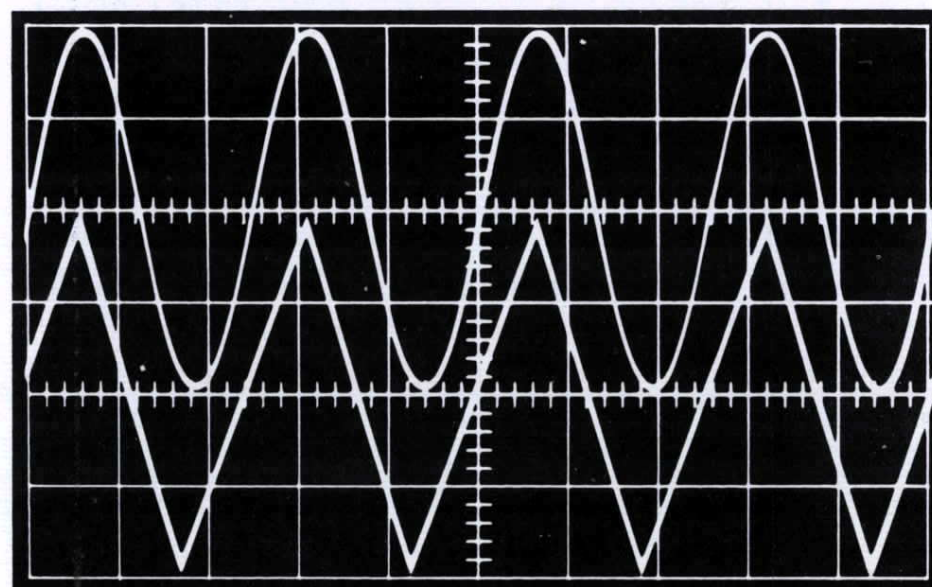
Sweep Magnifier — Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of the display is expanded to the left and right of center to fill the screen. Any one-fifth of the magnified sweep can be displayed on the screen by rotating the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

Single Sweep — The Type 551 has a single-sweep mode of operation. A front-panel RESET pushbutton arms the sweep to fire on the next received trigger. After firing once, the sweep is locked out until rearmed by pressing the RESET pushbutton. The READY light indicates when the sweep is armed to fire on the next received trigger.

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

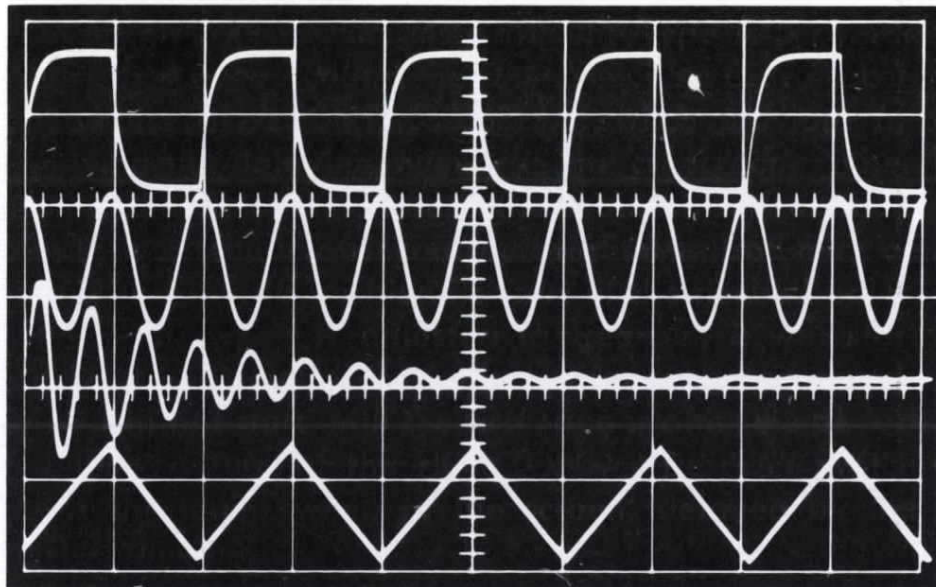


SINGLE-BEAM OPERATION



DUAL-BEAM OPERATION

TYPE 551 OSCILLOSCOPE



**DUAL-BEAM OPERATION WITH
DUAL-TRACE PLUG-IN UNITS**

Triggering Facilities — Versatile triggering circuitry provides for complete manual control, preset stability control, and fully-automatic triggering. The sweep can be triggered internally from either channel.

Amplitude-Level Selection — Adjustable amplitude-level and stability controls for triggering the sweep at a selected amplitude level on the triggering waveform. Trigger source can be internal, external, or the line frequency, either ac or dc coupled. The triggering point can be on either the positive or negative slope of the triggering waveform.

Preset Stability — Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

Automatic Triggering — Automatic level-seeking trigger circuit provides dependable triggering for most applications. One simple setting assures positive sweep-triggering by signals of widely differing amplitudes, shapes, and repetition rates. No trigger controls need be touched until a different type of operation is desired. Range of automatic operation is between 60 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the screen.

High Frequency Sync — Assures a steady display of sine-wave signals up to approximately 30 megacycles. Requires a signal large enough to cause about 2 cm of deflection, or an external signal of about 2 v.

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 de-

flection factor continuously variable from 0.2 v/cm to approximately 15 v/cm. Passband is dc to 240 kc. Input impedance is approximately 40 $\mu\mu\text{f}$ 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 551 uses the Tektronix Type T57P cathode-ray tube. The T57P is a 5" flat-faced metallized precision dual-beam tube with helical post-accelerating anode. It provides a linear 4 cm x 10 cm viewing area, each beam, with at least 2 cm overlap. For best results over the wide sweep range of the Type 551, a P2 screen is normally furnished with the instrument.

Alignment of Cathode-Ray Tube — Should it become necessary to touch up the alignment of the cathode-ray tube, a molded nylon handle on the crt socket can be reached in a matter of seconds. Release the two quick-opening fasteners on the left cabinet side, and lower the cabinet side out of the way, or remove it completely.

Separate Power Supply — A separate unit supplies power to the Type 551 indicator unit through an interconnecting cable. Electronic regulation compensates for line-voltage variations, and for current-demand differences among the plug-in preamplifiers.

Amplitude Calibrator — A square-wave calibration voltage is available through a front-panel coaxial 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 about 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.

Beam Position Indicators — Indicator lights show the direction of each 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.

ELECTRON-TUBE COMPLEMENT

Vertical input amplifiers	4	12BY7A
Driver amplifiers	4	6BQ7A
Trigger pickoff amplifiers	4	6DK6
Trigger CF		6BQ7A
Indicator amplifiers	2	6BQ7A

TYPE 551 OSCILLOSCOPE

Output amplifiers	24	6DK6
Trigger amplifier		6BQ7A
Trigger shaper		6U8
Multivibrator & CF		6BQ7A
Multivibrator		12BY7A
Disconnect diodes		6AL5
Sweep generator		6CL6
Sweep cathode follower		6BQ7A
Holdoff driver and unblanking CF		6BQ7A
Holdoff CF and multivibrator		6BQ7A
Lockout multivibrator		6AU6
Gate and sawtooth out CF		6BQ7A
External horizontal amplifier		6BQ7A
Horizontal input CF		6BQ7A
Horizontal amplifiers		6BQ7A
Horizontal amplifier CF		6BQ7A
Current booster		6CL6
Horizontal position CF and cal. CF		6BQ7A
Calibrator multivibrator		6U8
High voltage oscillator		6AU5
Regulator amplifier		12AU7
High voltage rectifiers	5	5642
Series regulators	5	6080
Series regulators	2	12B4
Regulator amplifiers	5	6AU6
Comparators	2	12AX7
Voltage reference		5651
Cathode-ray tube		T57P2

MECHANICAL SPECIFICATIONS

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

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

Finish — Photo-etched anodized panels, wrinkle-finished cabinets.

Dimensions — Indicator Unit, 24" long, 13" wide, 16 3/4" high. Power Unit, 17 1/2" long, 13" wide, 10" high.

Weight — Indicator Unit, 52 lbs. Power Unit, 46 lbs.

Power Requirements — 105-125 v or 210-250 v 50-60 cycles, 900 watts maximum.

Type 551, without plug-in units \$1725

- Includes: 4—P410 probes
 2—A510 binding-post adapters
 1—Test lead (012-031)
 1—Green filter (378-514)
 1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Optional Phosphors

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

Recommended Additional Accessories

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 551. Please see the Catalog Accessory Section for complete specifications.

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

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.

Type 500/53A Scope-Mobile—A sturdy, mobile support for both Indicator Unit and Power Unit. Two supporting cradles in the front panel accommodate Type 53/54 Plug-In Units. Complete description in Catalog Accessory Section \$108.00

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 $\mu\mu\text{f}$.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 530-SERIES OSCILLOSCOPES

TYPE 536 "X-Y" OSCILLOSCOPE

Identical Deflection Characteristics

Vertical and horizontal risetimes —
0.03 μ sec.
Uniform phase-shift characteristics.

Curve Tracing

The Type 536 is useful for curve tracing with two related varying voltages over a wide frequency range.

Wide Application Range

All Type 53/54 Plug-In Pre-amplifiers can be used with both deflection systems.

General-Purpose Utility

Plug-In Time-Base Generator is available for horizontal deflection in usual oscilloscope applications.



GENERAL DESCRIPTION

The Type 536 is an unusually practical instrument, combining a wide-band "X-Y" oscilloscope with an excellent general-purpose laboratory oscilloscope. Two carefully-designed main amplifiers and a new Tektronix cathode-ray tube with equal X and Y deflection characteristics are the basic components.

With two of the same Type 53/54 wide-band preamplifiers plugged in, the horizontal and vertical deflection systems are almost identical. Relative phase shift is less than one degree to over 14 mc, and, by means of a front-panel control, phase balance can be obtained at any frequency to over 25 mc.

With the new Time-Base Plug-In Unit, Type 53/54T, plugged into the horizontal amplifier, and a Type 53/54 wide-band unit plugged into the vertical amplifier, the Type 536 functions as a general-purpose oscilloscope. It almost matches the performance characteristics of the Tektronix Type 531 in sweep range and triggering facilities, and has the same signal-handling versatility through currently-available Type 53/54 Plug-In Preamplifiers.

APPLICATIONS

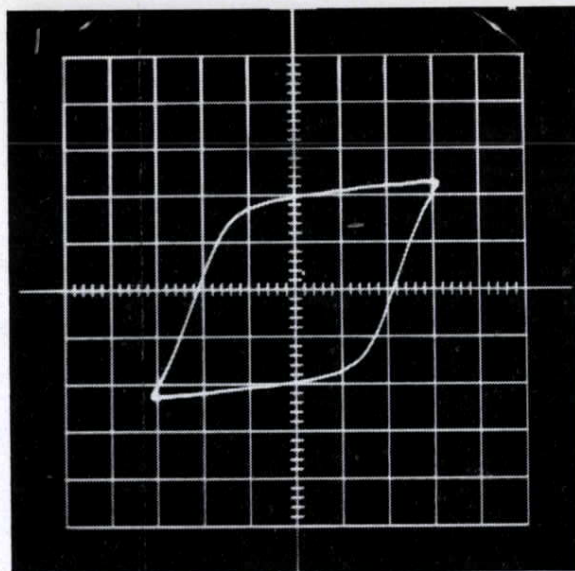
In curve-tracing applications the Type 536 extends the range of familiar techniques to today's higher-frequency

problems. Differential input, a feature that eliminates the need for a common XY terminal, is available in the wide-band Type 53/54G Plug-In Preamplifier. Since differential input is needed for accuracy in many curve-tracing applications, a pair of Type 53/54G Units is recommended for this work.

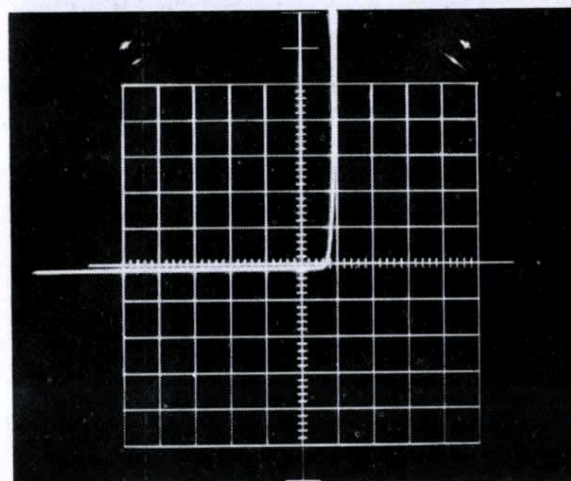
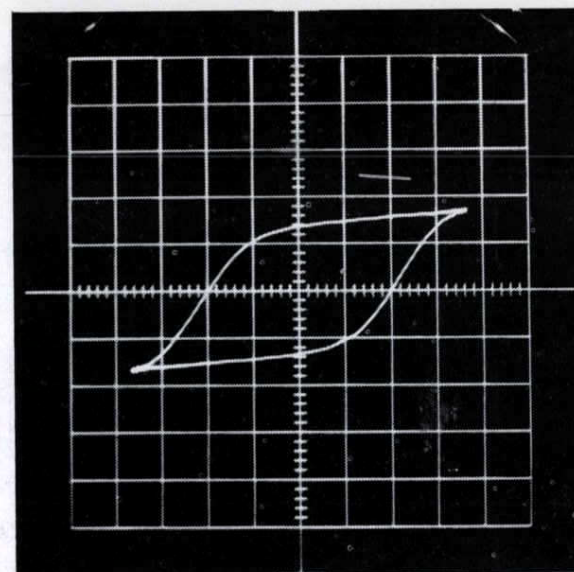
Some applications for a wide-band "X-Y" oscilloscope are

1. Examination of semiconductor diode characteristics—volts vs. amperes plot.
2. Determination of ferromagnetic material characteristics.
3. Linear amplifier distortion measurement.
4. Limiting or expanding-amplifier performance measurements.
5. Displaying pressure vs. volume diagrams.
6. Analyzing amplitude selector type circuits such as Schmitt, diode pick-off, etc.
7. Checking regulated power supply performance.
8. Measurement of voltage coefficient of resistors.

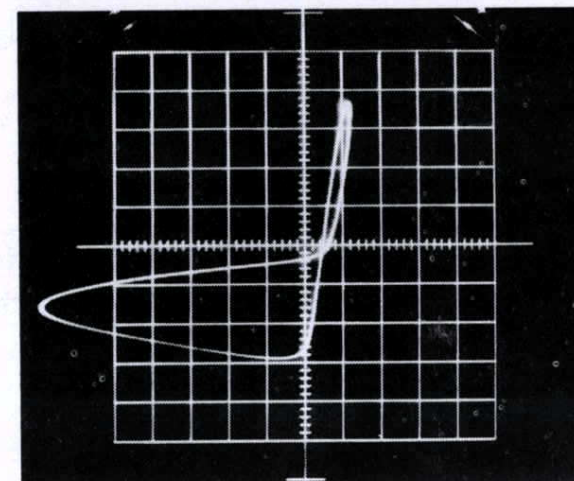
TYPE 536 OSCILLOSCOPE



Ferrite bead characteristics at two different temperatures—left, at 25°C; right, at equilibrium temperature due to self heating. Type 536 with two Type 53/54G Units, driving frequency 1 mc.



High-conduction diffused silicon diode characteristics—left, at 60 cycles; right, at 2 mc. Type 536 with two Type 53/54G Units, horizontal calibration 1 v/div; vertical calibration 100 ma/div; zero current and voltage at center of screen.



9. Performance tests of various modulation systems such as AM, suppressed carrier, FM, PTM, PAM, etc.
10. Performance tests of demodulators for above modulation systems.
11. Determination of various gating circuits characteristics.
12. Function generator — $y = f(x)$.

VERTICAL AND HORIZONTAL DEFLECTION SYSTEMS

Identical Amplifiers—Both main amplifiers have excellent transient response with risetimes of 0.03 μsec . A Type 53/54 Preamplifier must be plugged in to make the vertical-deflection system function. Either a Type 53/54 Preamplifier or a Type 53/54T Time-Base Unit must be plugged in to make the horizontal-deflection system function.

Deflection characteristics with Type 53/54G Units plugged in are:

Passbands—dc to 10 mc.

Risetimes—0.035 μsec .

Deflection factors—0.05 v/div maximum, 9 calibrated

steps from 0.05 v/div to 20 v/div; continuously-variable adjustment between steps.

Relative phase shift—less than one degree to 15 mc, less than two degrees to 17 mc, less than five degrees to 23 mc—provided amplifiers are not overdriven by the input signals.

Amplifier phasing control—phase balance can be obtained at any frequency to over 25 mc provided amplifiers are not overdriven by the input signals.

Deflection capability—five divisions of deflection can be obtained at 20 mc without overdriving the input amplifiers.

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

Type 53/54A—DC to 10 mc, 0.035 μsec .

Type 53/54B—DC to 10 mc, 0.035 μsec at 0.05 v/div to 50 v/div. . . . 2 cycles to 9 mc, 0.04 μsec at 0.005 v/div to 0.05 v/div.

Type 53/54C—DC to 10 mc, 0.035 μsec .

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

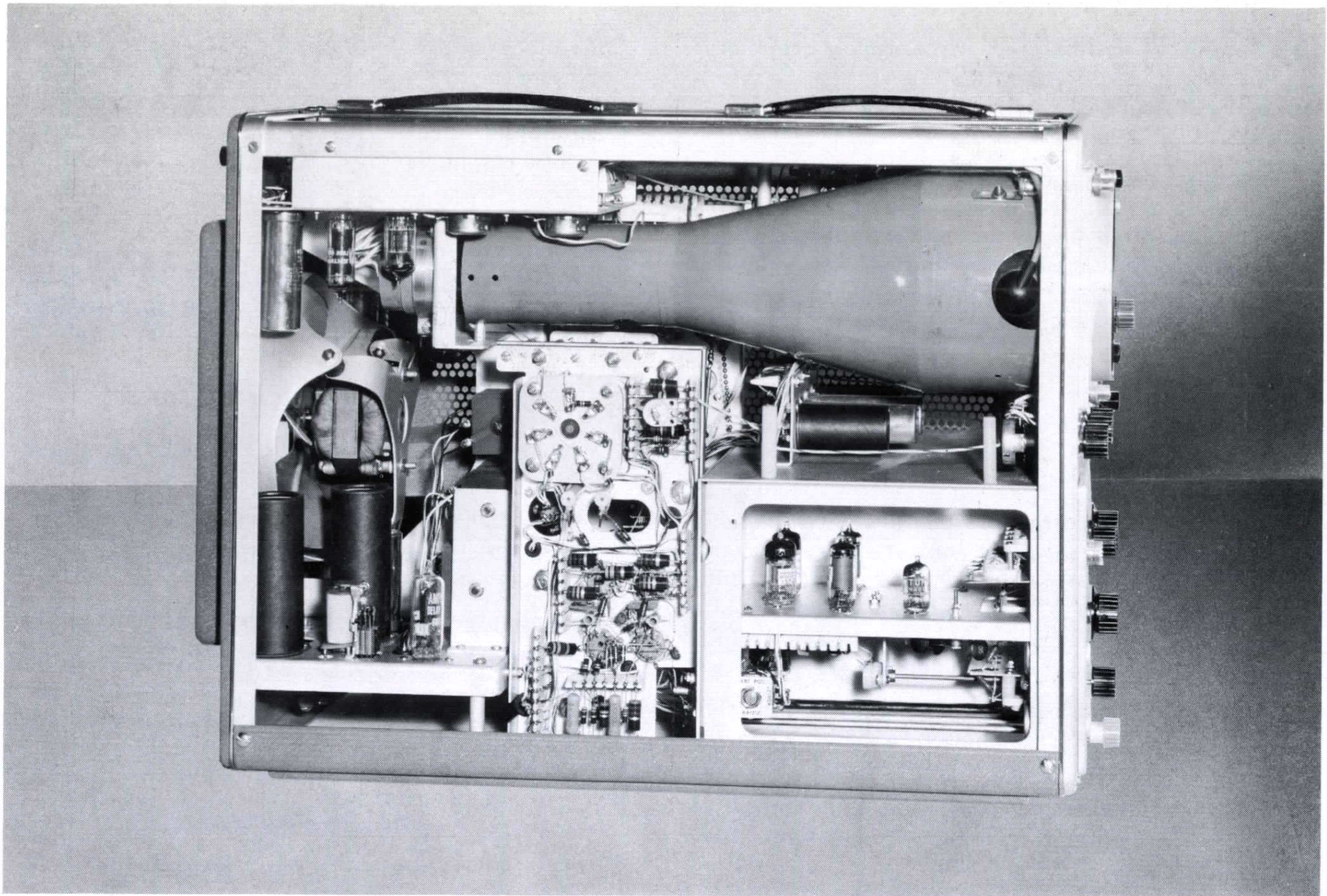
Type 53/54E—0.06 cycles to 60 kc.

Type 53/54G—DC to 10 mc, 0.035 μsec .

Type 53/54H—DC to 9.5 mc, 0.037 μsec .

Type 53/54K—DC to 11 mc, 0.031 μsec .

TYPE 536 OSCILLOSCOPE



Type 53/54L—DC to 11 mc, $0.031 \mu\text{sec}$ at 0.05 to 40 v/div. . . . 3 cycles to 10 mc, $0.035 \mu\text{sec}$ at 0.005 to 4 v/div.

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.

HORIZONTAL DEFLECTION SYSTEM

Time-Base Presentation—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.

Amplitude-Level Selection—With preset or manual stability control.

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—Provided the amplifiers are not overdriven by the input signals, relative phase shift with Type 53/54K Plug-In Preamplifiers is less than 1 degree from dc to 15 mc. Phase-shift balance can be obtained at any frequency to 30 mc with a front-panel AMPLIFIER PHASING control.

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

TYPE 536 OSCILLOSCOPE

(3 1/8" x 3 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.

Alignment of Cathode-Ray Tube—Should it become necessary to touch up the alignment of the cathode-ray tube, a molded nylon handle on the crt socket can be reached in a matter of seconds. Release the two quick-opening fasteners on the left cabinet side, and lower the cabinet side out of the way, or remove it completely.

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 the spot 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 (for 53/54T unit) or external ac or dc-coupling to the crt grid.

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.

ELECTRON-TUBE COMPLEMENT

Vertical input amplifiers	2	12BY7
Cathode followers	2	6BQ7A
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 blue 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—Test lead (012-031)
 - 1—F510-5 green filter (378-503)
 - 1—Instruction manual

Optional Phosphors

P2 phosphor normally furnished.

P1, P7, P11 optional No extra charge

Other phosphors can be furnished on special order.

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Recommended Additional Accessories

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

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 530-SERIES OSCILLOSCOPES

TYPE 532 CATHODE-RAY OSCILLOSCOPE

Designed for Extra Dependability

Wide Sweep Range

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

DC-Coupled Vertical Amplifier

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

Risetime with wide-band plug-in units—0.07 μsec .

Versatile Triggering Circuitry

Amplitude-level selection with preset or manual stability control, and fully-automatic triggering.

Horizontal Input Amplifier

8-cm Linear Vertical Deflection

DC-Coupled Unblanking

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 Preamplifiers. 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.

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

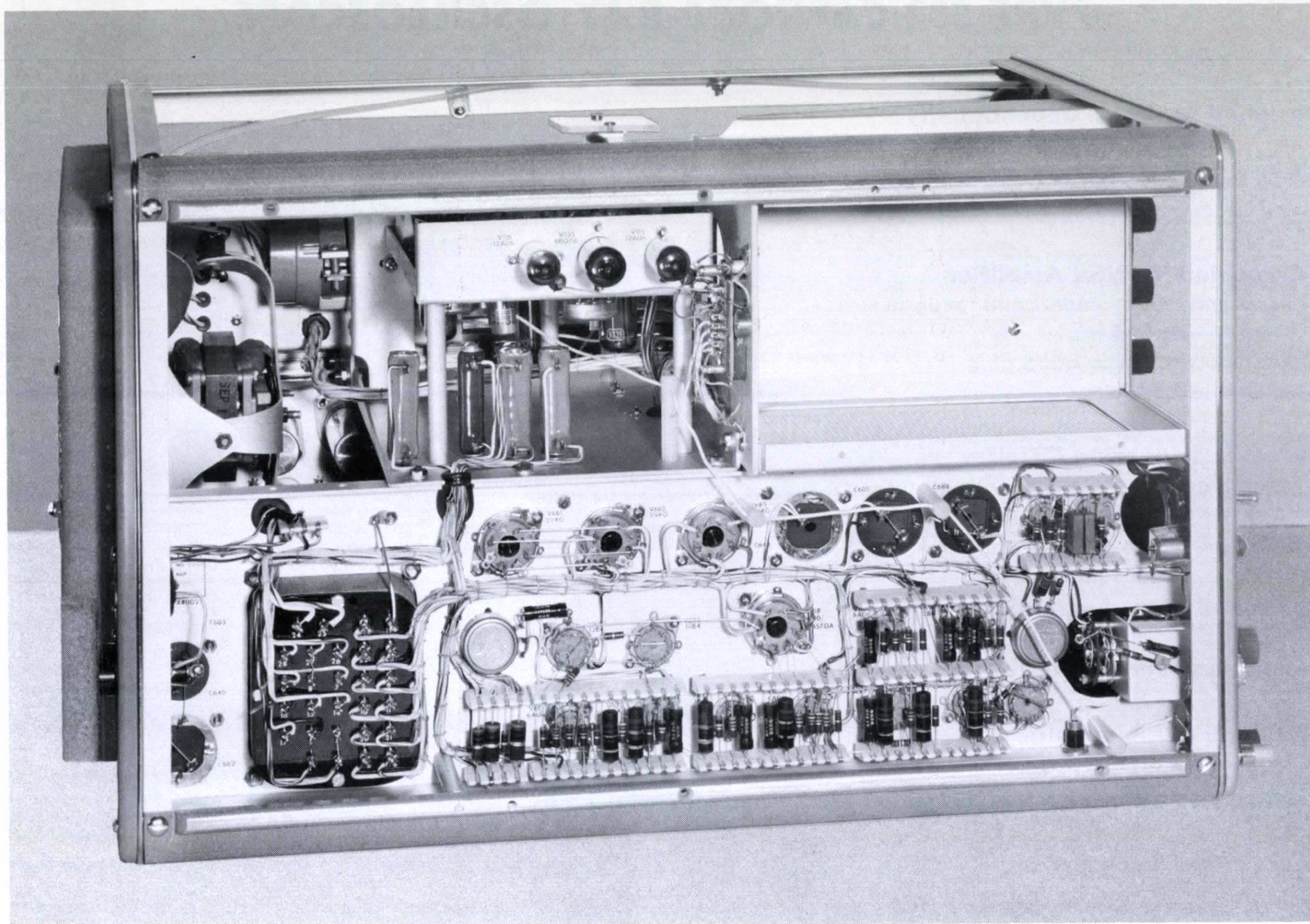
- Type 53/54A—dc to 5 mc, 0.07 μsec .
- Type 53/54B—dc to 5 mc, 0.07 μsec .
- Type 53/54C—dc to 5 mc, 0.07 μsec .
- Type 53/54D—dc to 350 kc at 1 mv/cm, increasing to 2 mc as sensitivity is decreased to 50 mv/cm.
- Type 53/54E—0.06 cycles to 60 kc.
- Type 53/54H—dc to 5 mc, 0.07 μsec .
- Type 53/54K—dc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

TYPE 532 OSCILLOSCOPE



inverse feedback in the timing circuits. Characteristics of the circuitry make possible the wide sweep range of $0.2 \mu\text{sec}/\text{cm}$ to $12 \text{ sec}/\text{cm}$.

Calibrated Sweep Rates—The Type 532 has twenty-one calibrated sweep rates. The main sweep control has seven positions; 1, 10, $100 \mu\text{sec}/\text{cm}$, . . . 1, 10, $100 \text{ msec}/\text{cm}$, . . . 1 sec/cm . Three multiplier switch positions of 1, 2, and 5 for each of the main sweep steps provide a total of 21 calibrated 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.

Triggering Facilities—Versatile triggering circuitry provides for complete manual control, preset stability control, and fully automatic triggering.

Amplitude-Level Selection—Adjustable amplitude-level and stability controls for triggering the sweep at a selected amplitude level on the triggering waveform. Trigger source can be external, internal, or the line frequency, either ac or dc-coupled. The triggering point can be on either the positive or negative slope of the triggering waveform.

Preset Stability—Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

Automatic Triggering—Automatic level-seeking trigger circuit provides dependable triggering for most applications. One simple setting assures positive sweep-triggering by signals of widely differing amplitudes, shapes, and repetition rates. No trigger controls need

TYPE 532 OSCILLOSCOPE

be touched until a different type of operation is desired. Range of automatic operation is between 60 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the screen.

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

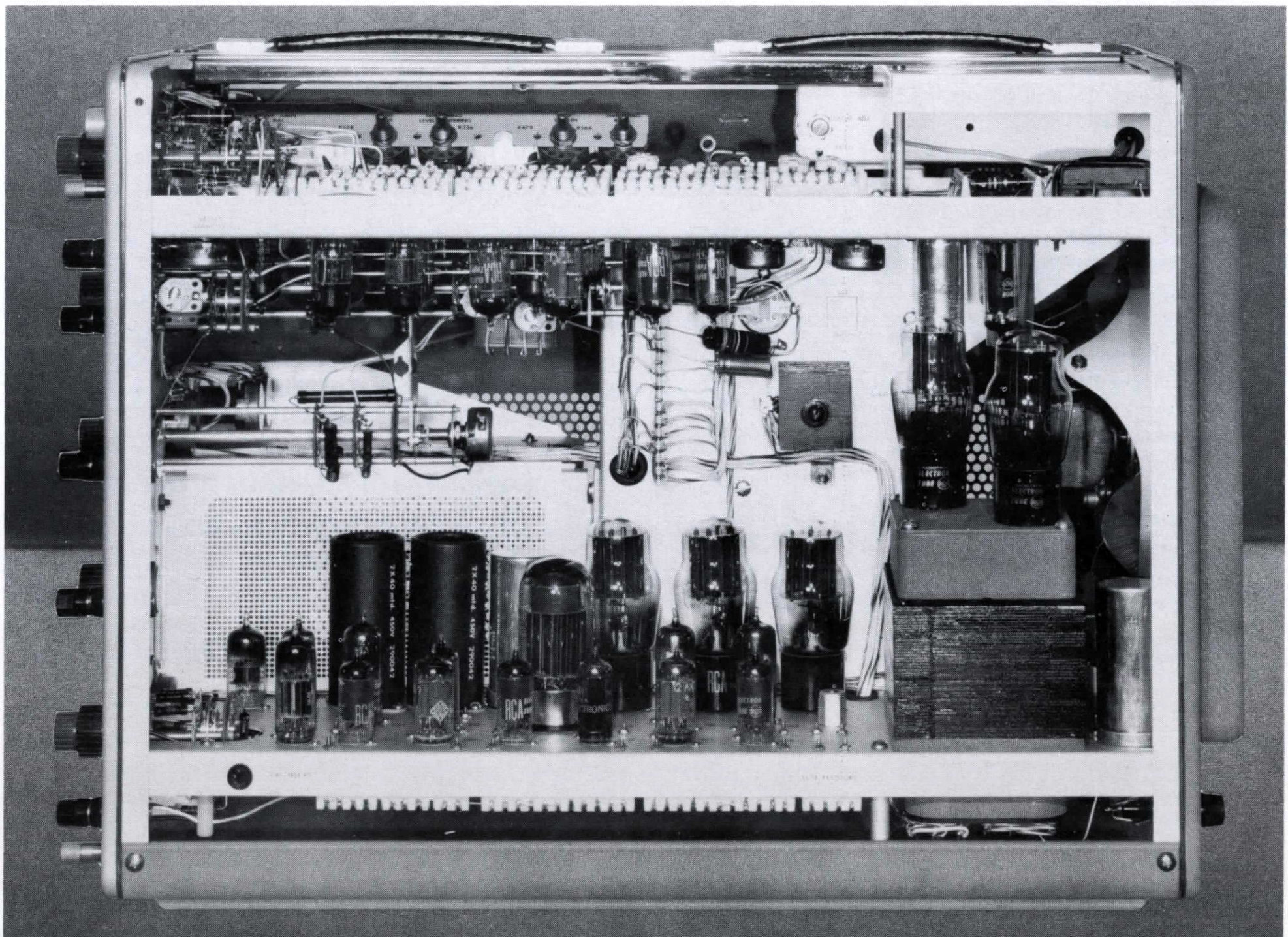
Cathode-Ray Tube—4-kv accelerating potential is

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.

Alignment of Cathode-Ray Tube—Should it become necessary to touch up the alignment of the cathode-ray tube, a molded nylon handle on the crt socket can be reached in a matter of seconds. Release the two quick-opening fasteners on the left cabinet side, and lower the cabinet side out of the way, or remove it completely.

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.



TYPE 532 OSCILLOSCOPE

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 the spot 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.

ELECTRON-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—Test lead (012-031)
1—F510-5 green filter (378-503)
1—Instruction manual

Special Models

Type 532-S7, has sweep lockout feature for single-sweep operation **\$850**

Since special models require additional manufacturing time, please check with your Tektronix Field Engineer or Representative for exact delivery schedules.

Optional Phosphors

P2 phosphor normally furnished.

P1, P7, P11 optional No extra charge

Other phosphors can be furnished on special order.

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Recommended Additional Accessories

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

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



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 and Risetime

With Type 533—

dc to 15 mc, 0.023 μ sec.

With Types 531, 535, 536—

dc to 10 mc, 0.035 μ sec.

With Type 532—

dc to 5 mc, 0.07 μ sec.

With Types 541, 543, 545—

dc to 24 mc, 0.015 μ sec.

With Type 551—

dc to 22 mc, 0.016 μ sec.

GENERAL DESCRIPTION

The Type 53/54C Dual-Trace Preamplifier Unit contains two identical amplifier channels. The two channels can be electronically switched, either triggered by the oscilloscope sweep, or at a free-running rate of about 100 kc. In addition, either channel can be operated separately.

The alternate-sweep mode of operation provides a stationary display of two signals even when they are not related in frequency. Because the two sweeps are identical and time-delay characteristics of the two channels are within 2 m μ sec, time comparisons can be made with a high degree of accuracy.

In the free-running (chopped) mode of operation, switching occurs at a rate of approximately 100 kc, permitting display of two simultaneous transients. Transients of as little as one millisecond duration are well delineated, having about 100 elements in each trace. For many purposes shorter transients can be adequately observed.



OTHER CHARACTERISTICS

Calibrated Sensitivity—The vertical attenuators are calibrated in VOLTS/CM of deflection. Nine calibrated steps are provided for each channel: 0.05, 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.

Calibration Accuracy—An adjustment is 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.

Vertical Position Controls—Separate positioning controls are provided for each 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 can be inverted on either channel for greater accuracy in comparisons of signals 180 degrees out of phase.

PLUG-IN PREAMPLIFIERS

Input Impedance—20 $\mu\mu\text{f}$ paralleled by 1 megohm.

ELECTRON-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—5½ lbs.

Price **\$250**

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

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



PLUG-IN PREAMPLIFIERS

TYPE 53/54H PLUG-IN UNIT DC-Coupled High-Gain Wide-Band Preamplifier

Deflection Factor

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

Frequency Response and Risetime

- With Type 533 —
- dc to 11 mc, 0.031 μ sec.
- With Types 531, 535, 536 —
- dc to 9.5 mc, 0.037 μ sec.
- With Type 532 —
- dc to 5 mc, 0.07 μ sec.
- With Types 541, 543, 545 —
- dc to 15 mc, 0.023 μ sec.
- With Type 551 —
- dc to 14 mc, 0.025 μ sec.

GENERAL DESCRIPTION

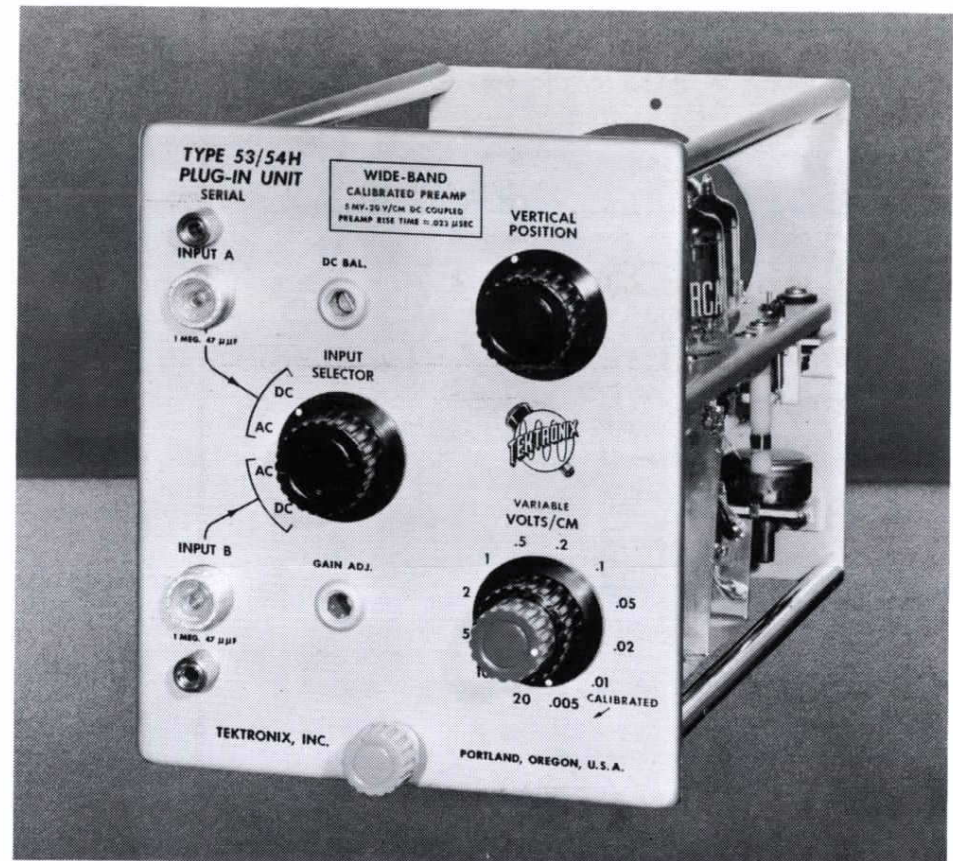
The Type 53/54H is a wide-band preamplifier with dc-coupling over its full sensitivity range. It provides a maximum deflection factor of 5 mv/cm, dc-coupled, in Types 530, 540 and 550 Oscilloscopes, with excellent transient-response characteristics.

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—A front-panel adjustment is provided for setting the gain of the unit. When this adjustment is accurately set with the VOLTS/CM switch in the 0.005 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.

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.



ling 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.

ELECTRON-TUBE COMPLEMENT

1st Amplifiers	2	12AU6
Input CF		12AT7
2nd Amplifiers	2	12AU6
Output CF		12AT7

MECHANICAL SPECIFICATIONS

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

Price \$175

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

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

PLUG-IN PREAMPLIFIERS

TYPE 53/54K PLUG-IN UNIT Fast-Rise DC Preamplifier

Deflection Factor

Calibrated—0.05 v/cm to 20 v/cm.

Frequency Response and Risetime

With Type 533 —

dc to 15 mc, 0.023 μ sec.

With Types 531, 535, 536 —

dc to 11 mc, 0.031 μ sec.

With Type 532 —

dc to 5 mc, 0.07 μ sec.

With Types 541, 543, 545 —

dc to 30 mc, 0.012 μ sec.

With Type 551 —

dc to 25 mc, 0.014 μ sec.

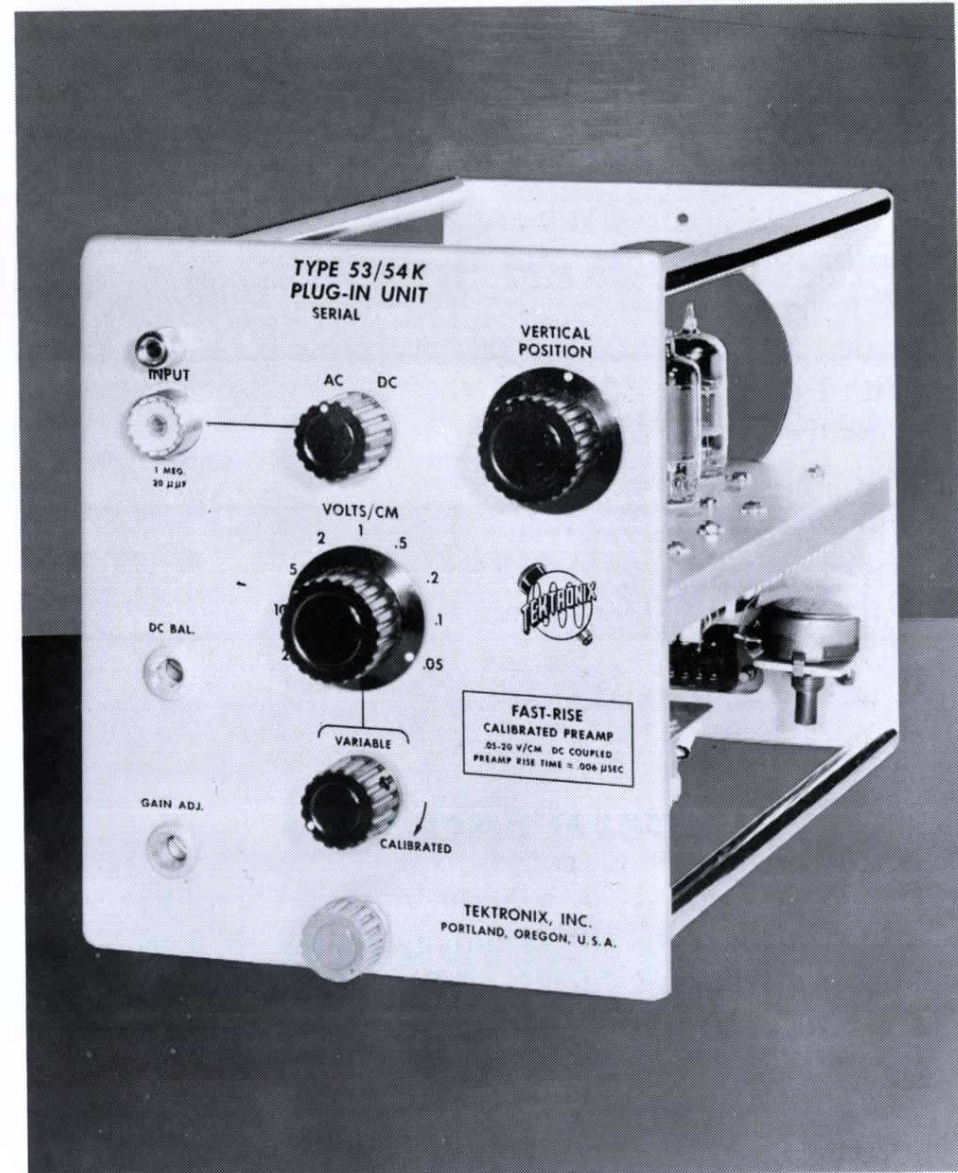
GENERAL DESCRIPTION

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. The Type 53/54K can be used in all Tektronix Oscilloscopes with the plug-in feature.

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 f. Input with the P410 Probe, furnished with Type 541 and Type 545 Oscilloscopes, is 10 megohms paralleled by 8 μ f. Other P400-Series Probes, 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.

ELECTRON-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.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

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.

Frequency Response and Risetime (0.05 to 40 v/cm)

- With Type 533 —
dc to 15 mc, 0.023 μ sec.
- With Types 531, 535, 536 —
dc to 11 mc, 0.031 μ sec.
- With Type 532 —
dc to 5 mc, 0.07 μ sec.
- With Types 541, 543, 545 —
dc to 30 mc, 0.012 μ sec.
- With Type 551 —
dc to 25 mc, 0.014 μ sec.

Frequency Response and Risetime (0.005 to 4 v/cm)

- With Type 533 —
3 cycles to 15 mc, 0.023 μ sec.
- With Types 531, 535, 536 —
3 cycles to 10 mc, 0.035 μ sec.
- With Type 532 —
3 cycles to 5 mc, 0.07 μ sec.
- With Types 541, 543, 545 —
3 cycles to 24 mc, 0.015 μ sec.
- With Type 551 —
3 cycles to 15 mc, 0.023 μ sec.

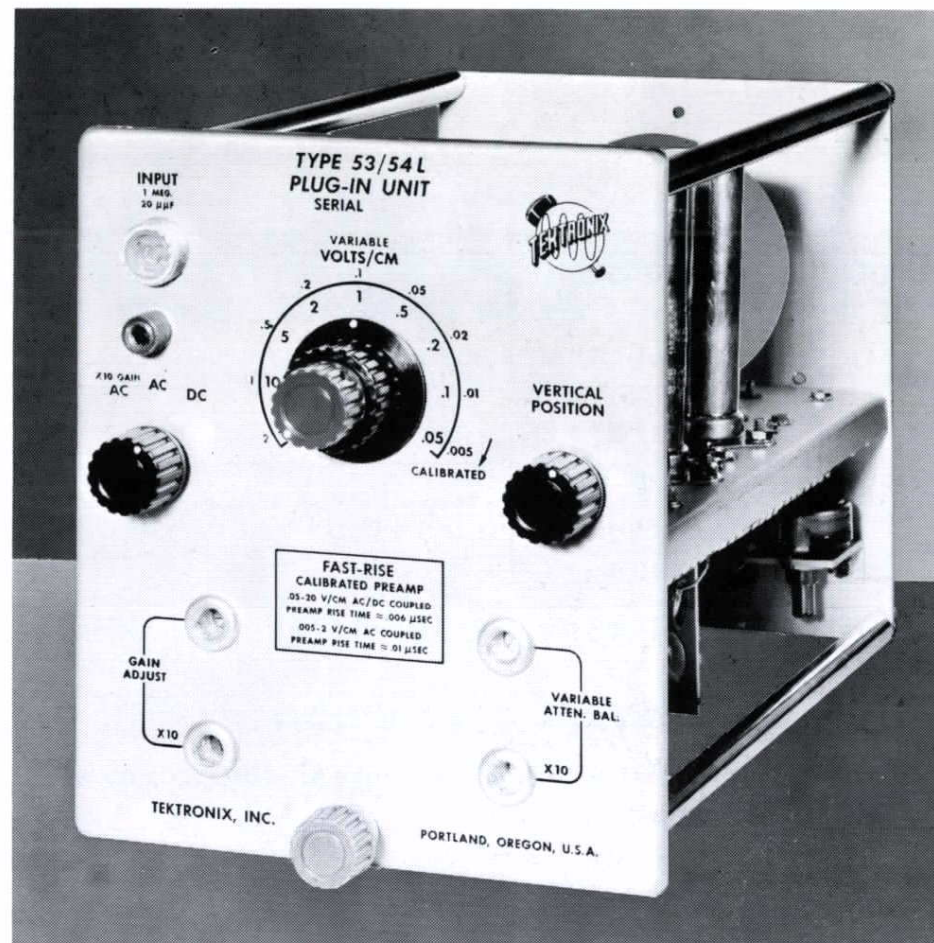
GENERAL DESCRIPTION

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

ELECTRON-TUBE COMPLEMENT

Input cathode follower	6AK5
First amplifier	6AK5
Second amplifier	6AK5
Cathode follower	6AK5
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

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

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

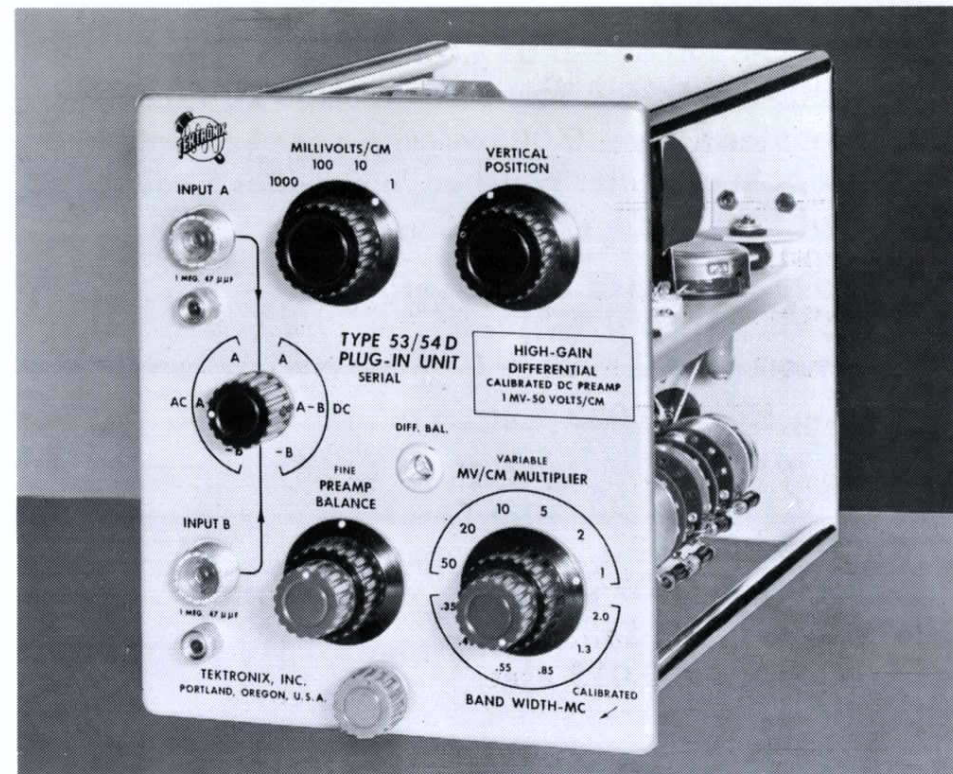
The Type 53/54D equips Tektronix Oscilloscopes with the plug-in feature for work requiring dc-coupling at a deflection factor of 1 mv/cm. Differential input with high rejection ratio for in-phase signals permits cancellation of unwanted or interfering signals.

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.

ELECTRON-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.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



PLUG-IN PREAMPLIFIERS

TYPE 53/54G PLUG-IN UNIT

Differential-Wide-Band DC Preamplifier

Common-mode Rejection

100 to 1 at full gain.

Deflection Factor

Calibrated—0.05 v/cm to 20 v/cm.

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

Frequency Response and Risetime

With Type 533 —

dc to 14 mc, 0.025 μ sec.

With Types 531, 535, 536 —

dc to 10 mc, 0.035 μ sec.

With Type 532 —

dc to 5 mc, 0.07 μ sec.

With Types 541, 543, 545 —

dc to 20 mc, 0.018 μ sec.

With Type 551 —

dc to 18 mc, 0.02 μ sec.

GENERAL DESCRIPTION

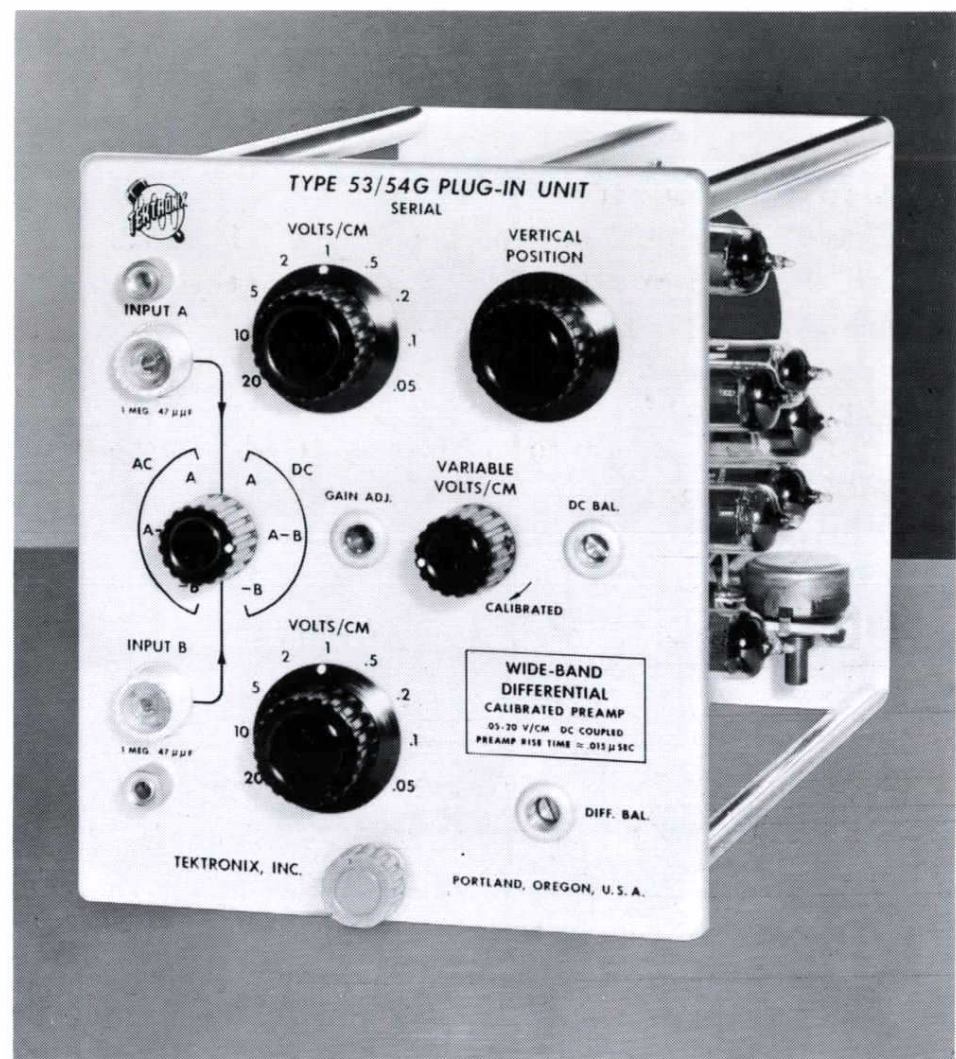
The Type 53/54G Plug-In Unit equips Tektronix Oscilloscopes with the plug-in feature for wide-band differential-input applications. Common-mode rejection is better than 100 to 1 for the entire passband at full gain, better than 300 to 1 at 60 cycles. Independent step attenuators in each input with 80-db 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 f paralleled by 1 megohm.

ELECTRON-TUBE COMPLEMENT

Input cathode followers	2	6AK5
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.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

PLUG-IN PREAMPLIFIERS

TYPE 53/54A PLUG-IN UNIT Wide-Band DC Preamplifier

Deflection Factor

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

Frequency Response and Risetime

With Type 533 —
dc to 14 mc, 0.025 μ sec.
With Types 531, 535, 536 —
dc to 10 mc, 0.035 μ sec.
With Type 532 —
dc to 5 mc, 0.07 μ sec.
With Types 541, 543, 545 —
dc to 20 mc, 0.018 μ sec.
With Type 551 —
dc to 18 mc, 0.02 μ sec.

GENERAL DESCRIPTION

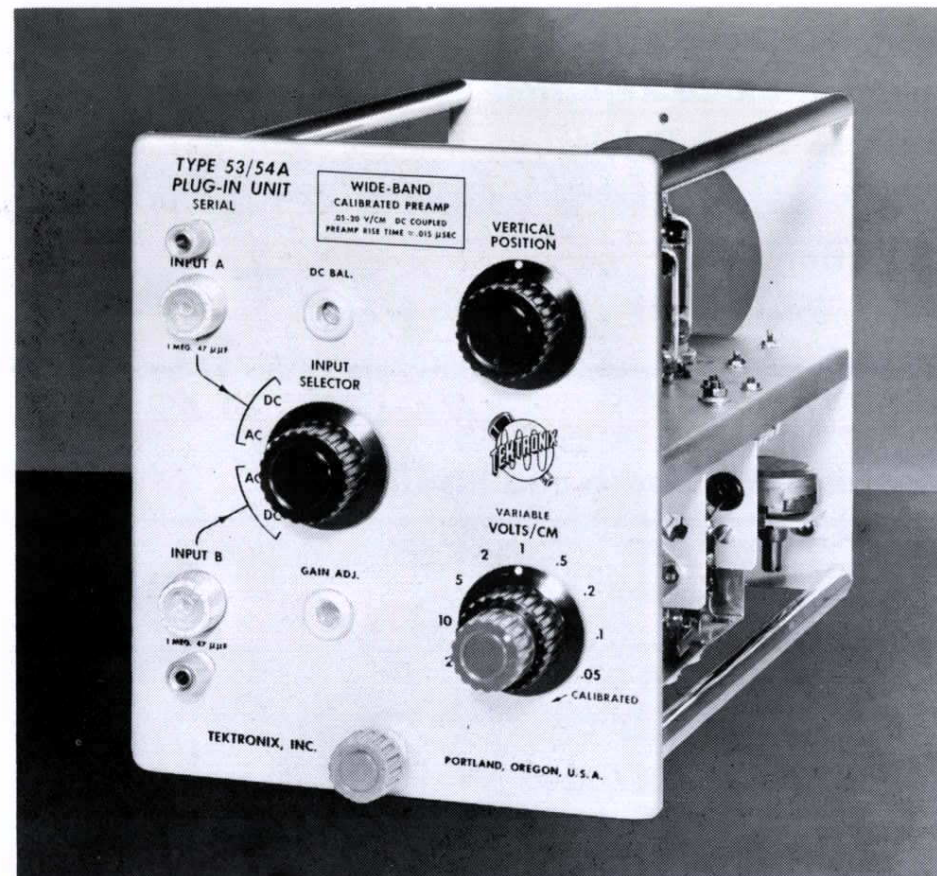
The Type 53/54A Plug-In Preamplifier meets the requirements of most wide-band applications. Wide pass-band, excellent transient response, dc-coupling, and calibrated sensitivity are qualities most users require in an oscilloscope vertical amplifier. The Type 53/54A gives all of these qualities to Tektronix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

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.

ELECTRON-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.

Prices f.o.b. factory. (Please refer to **Terms and Ship-ment, GENERAL INFORMATION** page.)

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 and Risetime (0.05 to 20 v/cm)

With Type 533 —
dc to 14 mc, 0.025 μ sec.
With Types 531, 535, 536 —
dc to 10 mc, 0.035 μ sec.
With Type 532 —
dc to 5 mc, 0.07 μ sec.
With Types 541, 543, 545 —
dc to 20 mc, 0.018 μ sec.
With Type 551 —
dc to 18 mc, 0.02 μ sec.

Frequency Response and Risetime (0.005 to 0.05 v/cm)

With Type 533 —
2 cycles to 10 mc, 0.035 μ sec.
With Types 531, 535, 536 —
2 cycles to 9 mc, 0.04 μ sec.
With Type 532 —
2 cycles to 5 mc, 0.07 μ sec.
With Types 541, 543, 545 —
2 cycles to 12 mc, 0.03 μ sec.
With Type 551 —
2 cycles to 10 mc, 0.035 μ sec.

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. 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.

ELECTRON-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—3 1/2 lbs.

Price **\$125**

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

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

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

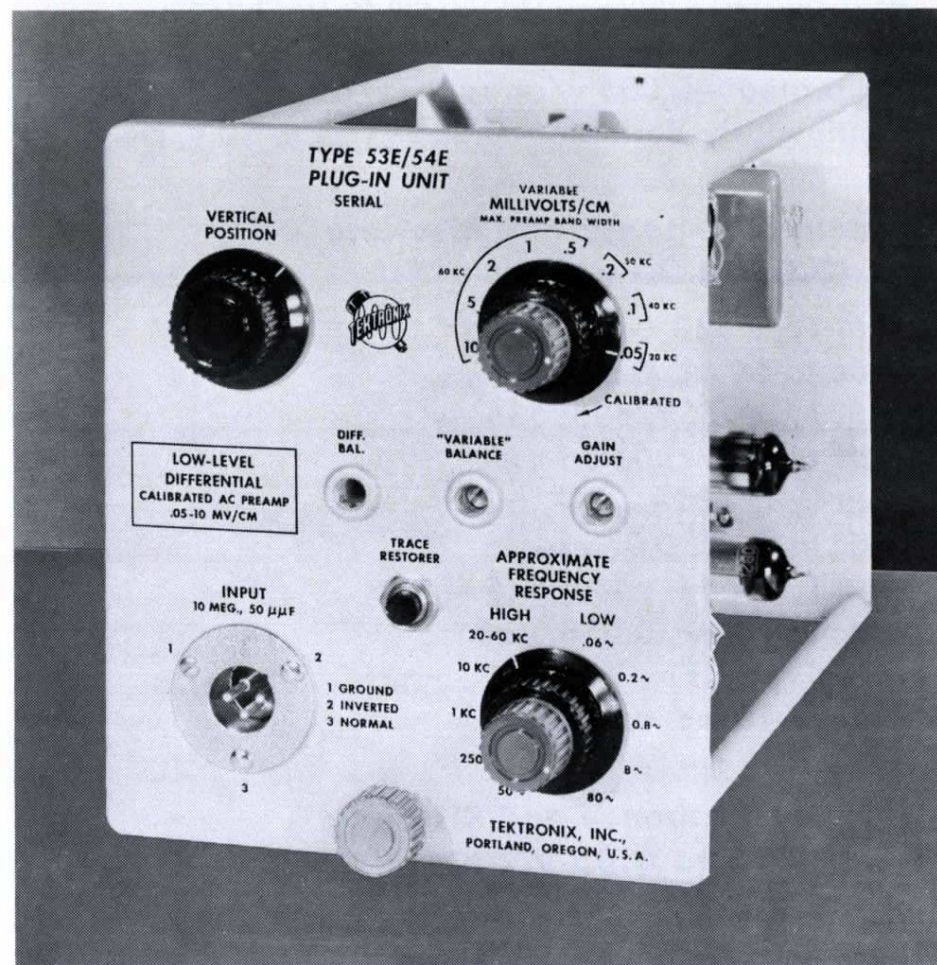
The Type 53/54E Plug-in Unit provides Tektronix Oscilloscopes with the plug-in feature with a calibrated vertical deflection factor of 50 microvolts/cm for low-level applications. Maximum combined noise and hum is 5 μ v, rms, with input grids grounded at the input connector. Separate high-frequency and 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 meg-ohms.

ELECTRON-TUBE COMPLEMENT

Input amplifiers	.....	12AX7
2nd stage and gain control	..... 2	5879
3rd stage and positioning control	.....	12AU7
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.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

PLUG-IN UNITS

TYPE 53/54R TRANSISTOR RISE TIME UNIT

Collector Supply

1 to 15 v continuously variable, positive or negative.
Current Capability—400 ma.

Mercury-Switch Pulse Generator

Risetime less than 0.005 μ sec.
Amplitude—0.04 to 2 v across 10 ohms, positive or negative.

Bias Supply

—0.5 v to +0.5 v and —5 v to +5 v, continuously variable.
Current Capability— \pm 100 ma.

Calibrated Vertical Deflection

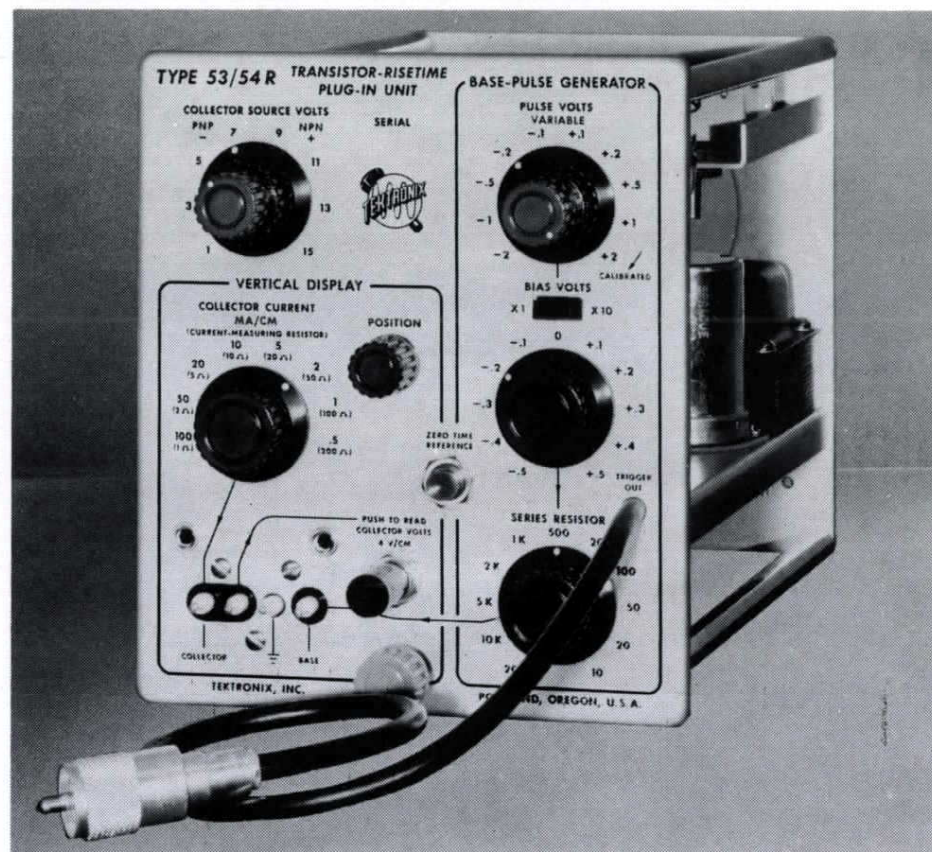
0.5, 1, 2, 5, 10, 20, 50, and 100 ma/cm collector current.

GENERAL DESCRIPTION

The Type 53/54R Transistor Risetime Unit can be used in all Tektronix Oscilloscopes with the plug-in feature when operated on 50 to 60 cycle line frequency. It supplies a fast-rising pulse and the required supply and bias voltages for measurement of transistor rise, fall, delay, and storage times.

Risetime of the pulse supplied by the Type 53/54R is less than 5 millimicroseconds, therefore measurement limitations will depend mainly on the risetime of the oscilloscope used. Overall risetimes with the oscilloscopes are as follows:

Types 541, 543, 545—0.012 μ sec



and —5 v through zero to +5 v. Bias supply is transistor regulated.

Base Series Resistors—The base driving resistance can be selected from eleven values—10, 20, 50, 100, 200, 500 ohms, 1, 2, 5, 10, and 20 kilohms.

Reference Displays—Zero time reference can be displayed by means of a pushbutton. Another pushbutton provides for displaying ground reference, and

TENTATIVE SPECIFICATIONS

REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY MAY, 1958.

Type 551—0.014 μ sec

Type 533—0.023 sec

531, 535, 536—0.035 μ sec

Type 532—0.07 μ sec (The Type 532 and Type 536 have an additional limitation in the lack of signal delay in the main vertical amplifier).

OTHER CHARACTERISTICS

Collector Supply—Positive and negative voltage, 1 v to 15 v continuously adjustable is available from a transistor-regulated supply. Vertical display is calibrated in ma/cm of collector current, 0.5, 1, 2, 5, 10, 20, 50, and 100 ma/cm. Connectors are provided for inserting an external resistor in series with the collector.

Pulse Generator—A mercury switch is used to generate the fast-rising test pulse. Repetition rate is 120 c/sec. Five positive and five negative amplitude ranges are provided—0.1, 0.2, 0.5, 1, and 2 v. Pulse voltage is continuously adjustable between ranges.

Bias Supply—Bias voltage is available for base or emitter in two ranges, —0.5 v through zero to +0.5 v

collector volts at a sensitivity of 4 v/cm.

Triggering—An external positive triggering signal to the oscilloscope is furnished through a cable for operating convenience.

ELECTRON-TUBE COMPLEMENT

Amplifiers	2	12AU6
Amplifiers		12AT7

TRANSISTOR COMPLEMENT

Trigger output amplifier	2N247
Regulator amplifier	2N212
Regulator amplifiers	3 2N247
Regulator amplifiers	2 2N270
Series regulators	3 2N307A

MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

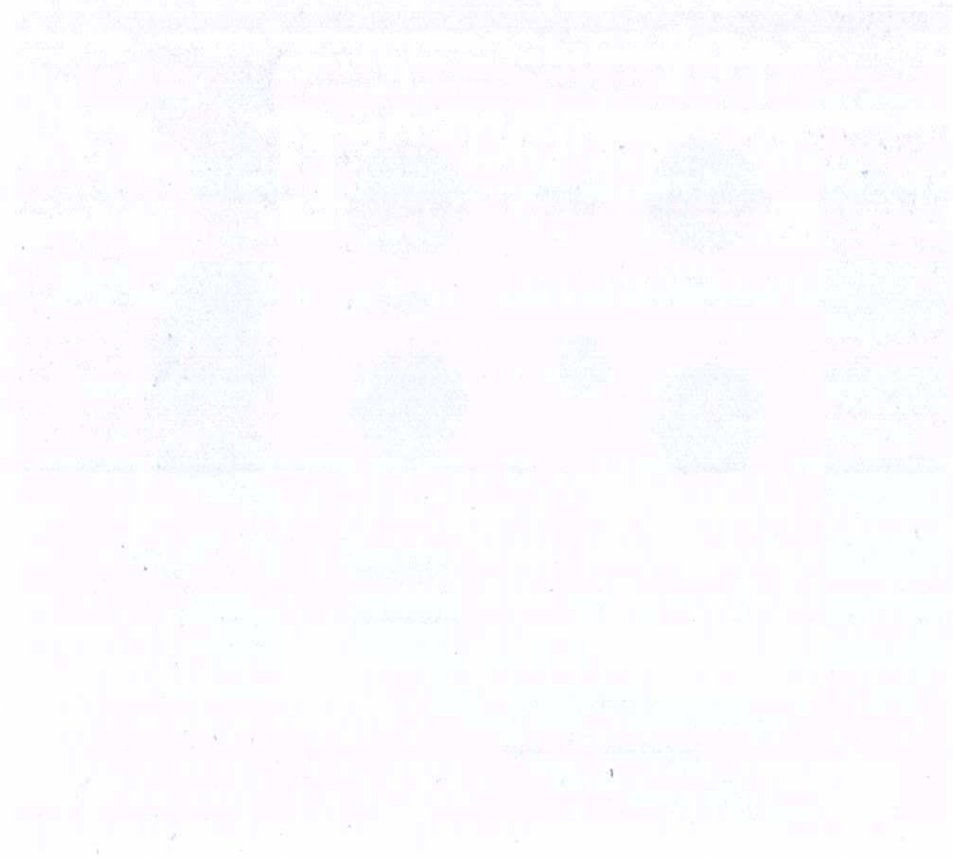
Finish—Photo-etched panel.

Weight—4 1/2 lbs.

Price \$300

Price f.o.b. factory.

TYPE 53/54B TRANSISTOR RESISTIVE UNIT



This unit is designed to provide a constant current source for the base of a transistor. The current is determined by the value of the resistor connected to the base terminal. The emitter terminal is connected to ground, and the collector terminal is connected to the collector of the transistor. The unit is designed to operate from a 5V supply.

The unit is constructed on a printed circuit board and is housed in a standard 9-pin D-sub connector. The connector pins are labeled as follows: Pin 1 is the base terminal, Pin 2 is the emitter terminal, Pin 3 is the collector terminal, and Pin 4 is ground. Pins 5 through 9 are not used.

The unit is designed to be used in a variety of applications, including as a current source for a transistor amplifier, as a biasing network for a transistor oscillator, or as a current source for a transistor switch.

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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.

HORIZONTAL DEFLECTION SYSTEM

Calibrated Sweep Rates—The Type 53/54T Unit has 22 calibrated sweep rates: $0.2, 0.5, 1, 2, 5, 10, 20, 50 \mu\text{sec}/\text{div}$ — $0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 \text{ msec}/\text{div}$ — $0.1, 0.2, 0.5, 1, \text{ and } 2 \text{ sec}/\text{div}$. 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 in, 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. Magnifier increases the calibrated sweep rate to $0.04 \mu\text{sec}/\text{div}$. Accuracy is within 5% of the displayed portion 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.

Triggering Facilities — Versatile triggering circuitry provides for complete manual control, preset stability control, and fully automatic triggering.

Amplitude-Level Selection—Adjustable amplitude-level and stability controls for triggering the sweep at a selected amplitude level on the triggering waveform. Trigger source can be external, line frequency, or the signal under observation by external connection to the oscilloscope VERT. SIG. OUT terminal, either ac or dc-coupled. The triggering point can be on either the rising or falling slope of the triggering waveform.

Preset Stability—Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

Automatic Triggering — Automatic level-seeking trigger circuit provides dependable triggering for most applications with no trigger-control adjustments. Range of automatic operation is between 60 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the screen.

PLUG-IN UNITS

High-Frequency Sync—Assures a steady display of sine-wave signals up to approximately 15 megacycles. Requires a signal large enough to cause about 2 cm of deflection, or an external signal of about 2 v.

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.

ELECTRON-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.

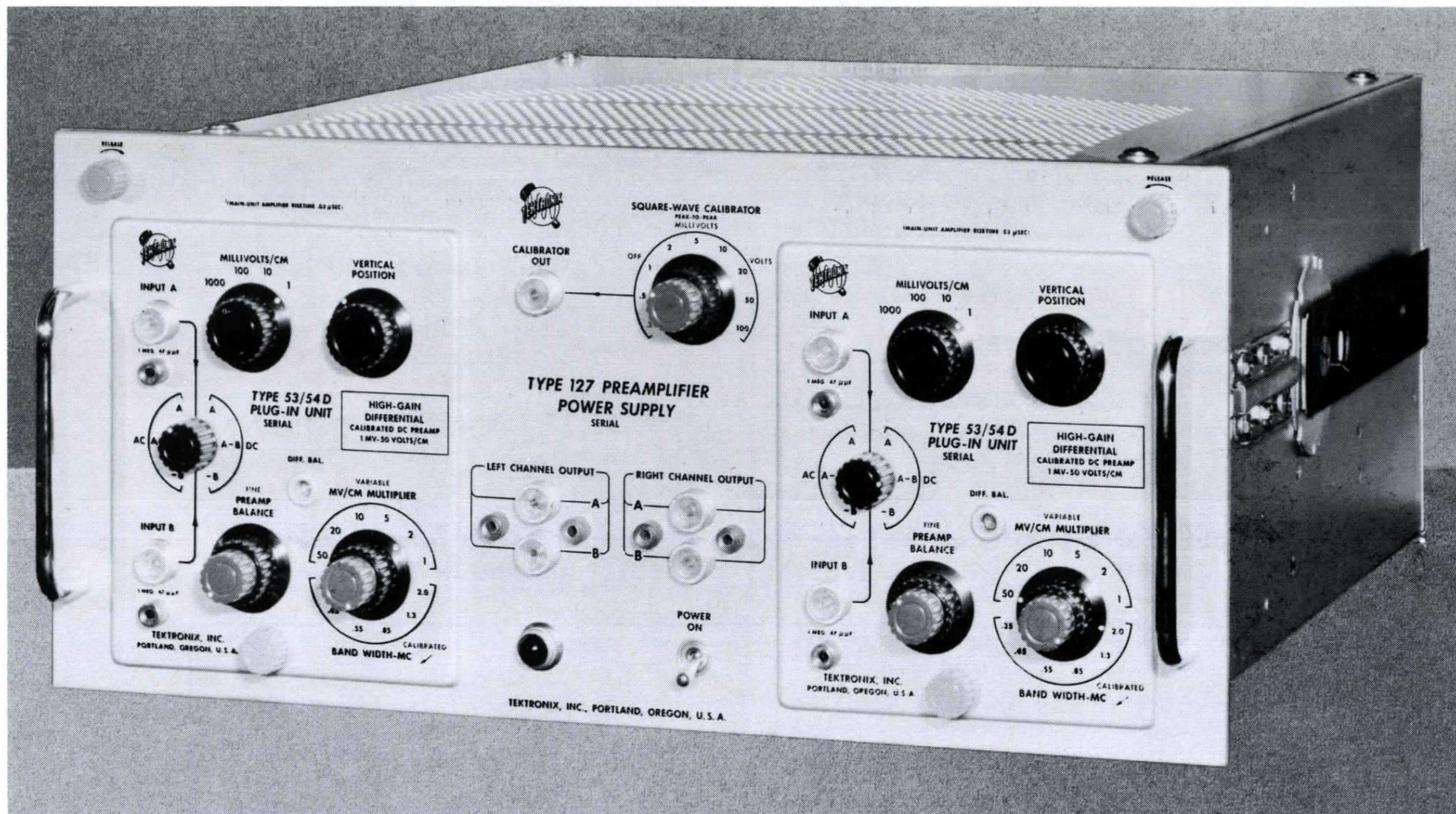
Price \$225

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 127 PREAMPLIFIER POWER SUPPLY

Rack-Mounting Power Supply for Type 53/54 Plug-In Units



GENERAL DESCRIPTION

The Tektronix Type 127 supplies proper operating power to one or any combination of two Tektronix Type 53/54 Plug-In Preamplifiers. Any Type 53/54 Plug-In Units, powered by the Type 127, can be used to further increase the signal-handling versatility of Tektronix oscilloscopes employing Plug-In Preamplifiers. Double-differential dual-trace display may be obtained by employing 2 Type 53/54D, E, or G Differential Plug-In Preamplifier Units in the Type 127 in conjunction with an oscilloscope using a Type 53/54C Dual-Trace Plug-In Unit. The Type 127 also facilitates the use of Type 53/54 Plug-In Units in other applications.

CHARACTERISTICS

Balanced Output—The outputs of Plug-In Units powered by the Type 127 are fed through dc-coupled differential amplifier stages and cathode followers to provide a push-pull signal at the output terminals. Rise-time of the unit is $0.018 \mu\text{sec}$, permitting maximum utilization of the response of Tektronix Type 530-Series Oscilloscopes. Output swing is linear $\pm 3\%$ over a range of ± 0.3 volt. Output dc operating levels are adjustable to ground potential.

Gain—The Type 127 has a gain of one, push-pull. With single-ended output, gain is one-half.

Output Terminals—Each channel has four output terminals, two on the front panel and two at the rear. Terminated 170-ohm output cables are furnished.

Multiple-Trace Applications—A Type 53/54C Dual Trace Unit in an oscilloscope can be fed by two other Type 53/54 Units powered by the Type 127 to produce a dual-trace display. A four-trace display results when the Type 53/54C Unit in an oscilloscope is fed by two Type 53/54C Units powered by the Type 127. Synchronizing pulses for alternate-sweep operation can be introduced through connectors at the rear of the Type 127. An eight-trace display results when two Type 53/54C Units in the Type 551 Dual-Beam Oscilloscope are fed by four Type 53/54C Units powered by two Type 127 Power Supplies.

Electronic Regulation—All dc supply voltages to the Plug-In Units are electronically regulated. A current-sensitive relay switches in a compensating power load when only one preamplifier is plugged into the Type 127.

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

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TYPE 127 PREAMPLIFIER POWER SUPPLY

ELECTRON-TUBE COMPLEMENT

Output amplifiers	4	6CB6
Output cathode followers	4	12AT7
Calibrator		6AU6
Calibrator		6BQ7
Switching amplifiers	2	6U8
Comparators	2	12AX7
Regulator amplifiers	4	6AU6
Series regulators	2	12B4
Series regulators	3	6080
Voltage reference		5651

Construction — Aluminum-alloy chassis. Slide-out mounting to rack.

Finish—Photo-etched anodized panel.

Dimensions—8 3/4" high, 19" wide, 20" rack depth, 21 1/2" overall depth.

Weight—36 pounds.

Power Requirements—105 to 125 v or 210 to 250 v, 50 to 60 cycles, 450 watts maximum.

Type 127, without plug-in units \$525

Includes: 4—170 Ω Coaxial cables, 5' long.
4—170 Ω terminating resistors
1—Instruction manual

MECHANICAL SPECIFICATIONS

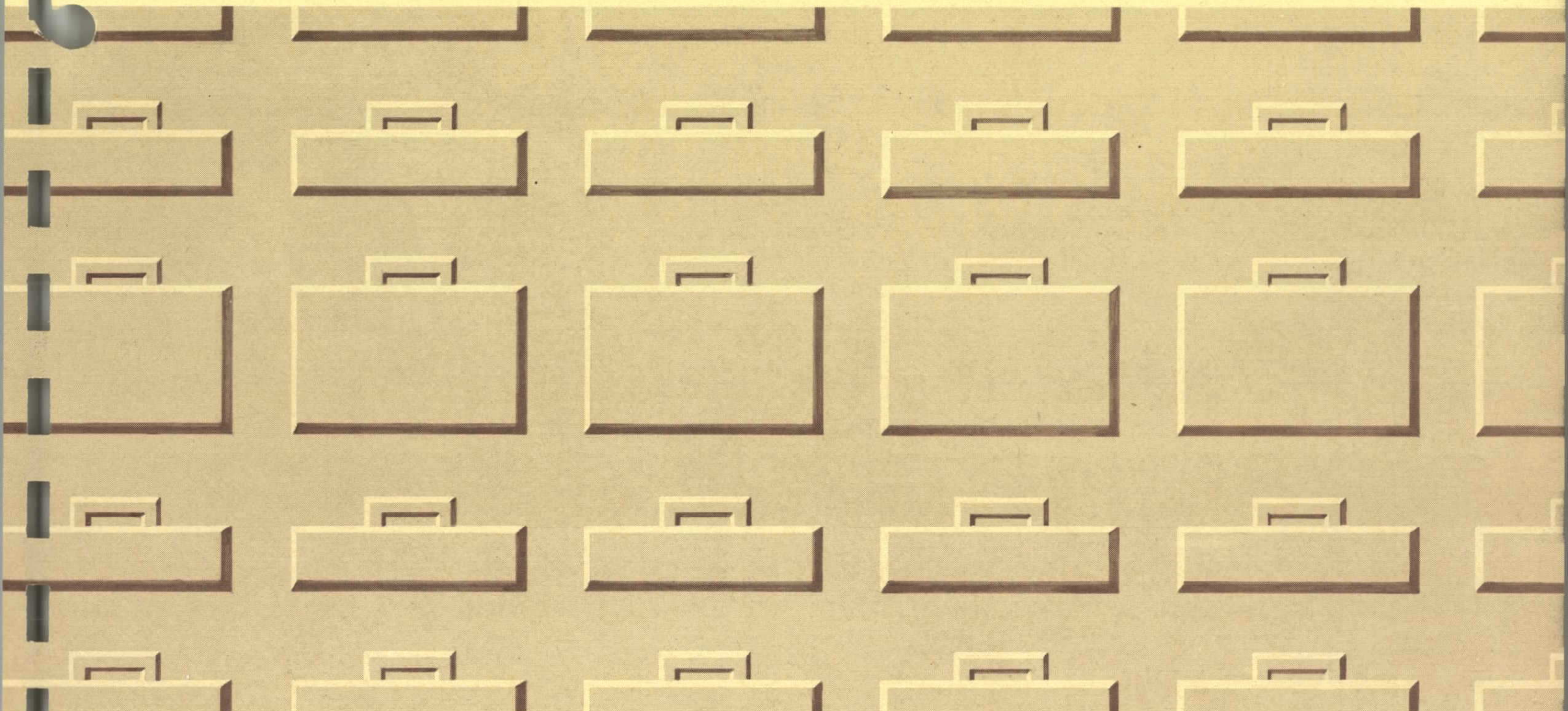
Ventilation—Filtered forced-air ventilation maintains safe operating temperatures.

Prices f.o.b. factory.

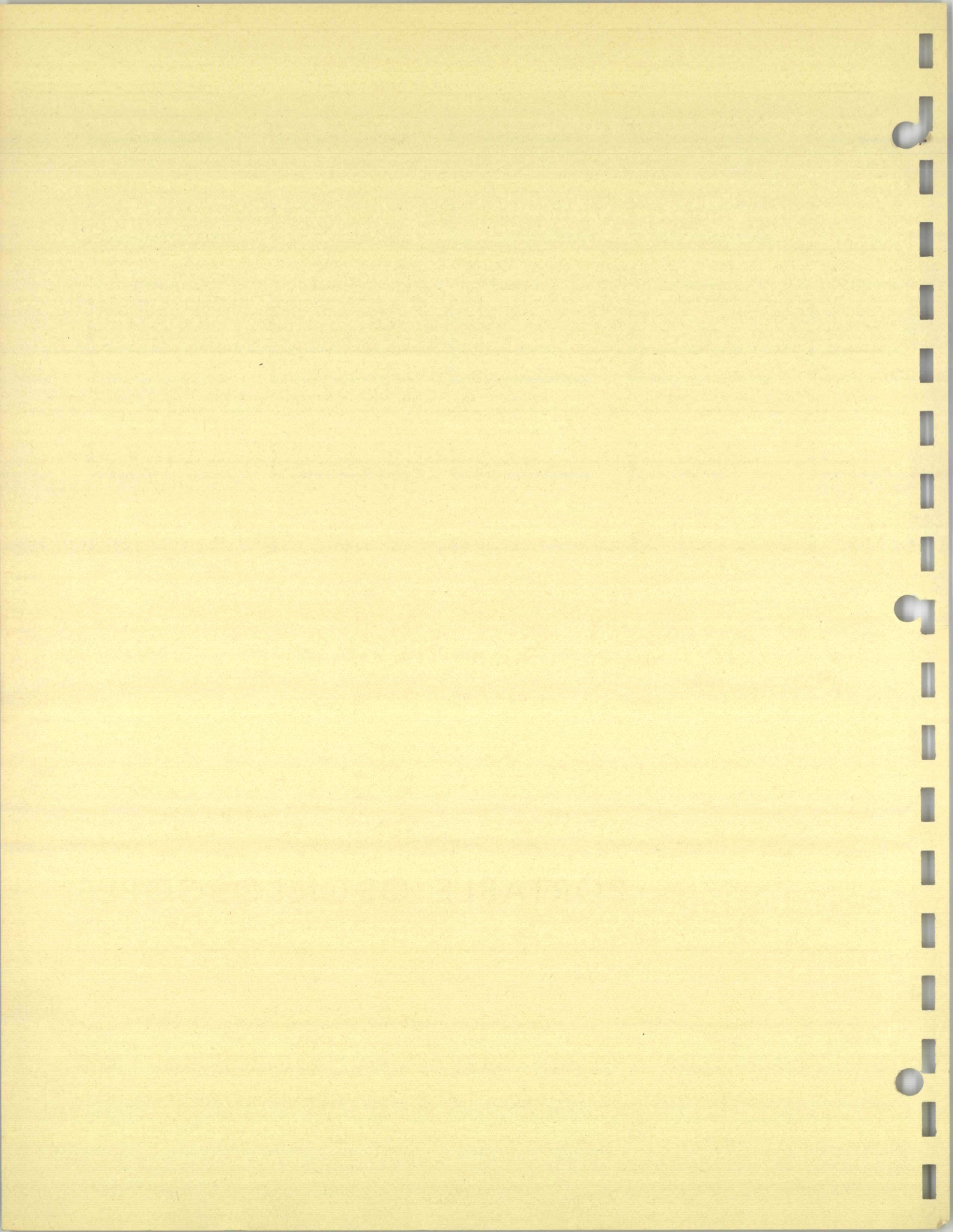
Output characteristics of the Type 127 in combination with Tektronix Plug-In Units, measured with the Type 127 output terminated in 170 ohms.

Plug-In Unit	Maximum Voltage Gain (push-pull output)	Frequency Response	Risetime
53/54A	2	dc to 15 mc	.023 μsec
53/54B	2	dc to 15 mc	.023 μsec
	20	5 cps to 11 mc	.030 μsec
53/54C	2	dc to 17 mc	.020 μsec
53/54D	100	dc to 350 kc at a gain of 100, increasing to 2 mc at a gain of 2	
53/54E	2000	.06 cps to 30 kc at full gain, increasing to 60 kc a gain of 200	
53/54G	2	dc to 15 mc	.023 μsec
53/54H	20	dc to 12 mc	.029 μsec
53/54K	2	dc to 19 mc	.018 μsec
53/54L	2	dc to 19 mc	.018 μsec
	20	3 cps to 17 mc	.020 μsec





PORTABLE OSCILLOSCOPES



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.

Frequency Response

DC to 4 mc—0.1 v/div to 150 v/div.
2 cycles to 3.5 mc—0.01 v/div to 0.1 v/div.

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 Portable 3" Oscilloscope is an instrument you can take with you . . . easily, comfortably. In or out of the laboratory, the Type 310 can be relied upon for faithful displays and accurate time and amplitude measurements. Small size, low weight, and operation on 50 to 800-cycle line frequency make the Type 310 easy to handle, transport, and use in the field. One of the many applications for the Type 310 Portable Oscilloscope is maintenance and calibration of specialized measuring and recording instruments at their point of use.

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.

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.

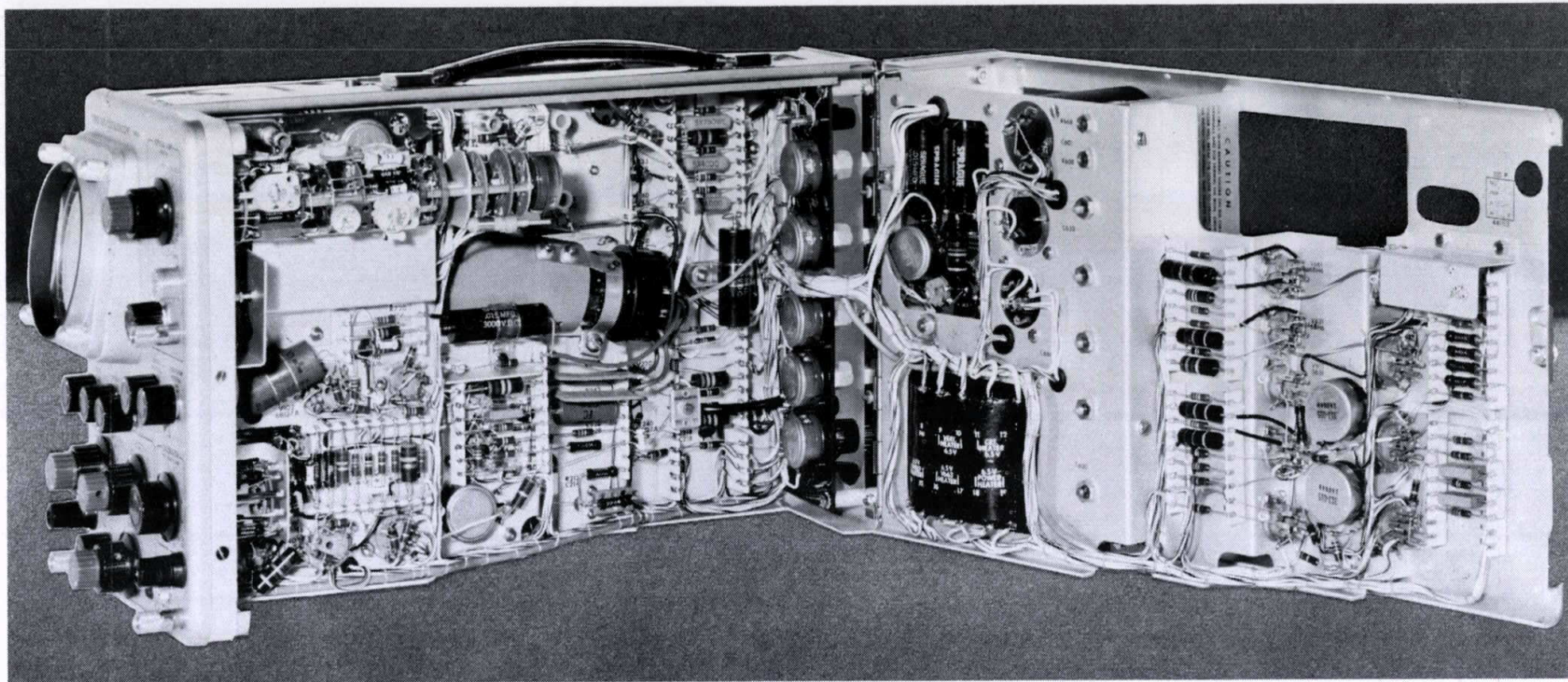
Calibration Accuracy—Internal adjustments are provided for setting the gain of the vertical amplifier. When these adjustments are accurately set with the VOLTS/DIV switch in the 0.1 and 0.01 v/div positions, the vertical deflection factor for any other position of the switch will be within 3% of the 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 msec/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 Unblinking—The unblinking 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 rising or falling slope 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 to 125 v or 210 to 250 v, 50 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.

ELECTRON-TUBE COMPLEMENT

Vertical preamplifier	6AU6
Preamp 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	6AU6
Plus multivibrator	1/2 6BQ7
Unblanking cathode follower	1/2 6BQ7
Disconnect diodes	6AL5
Sweep generator	1/2 6AN8
Sweep generator cathode follower	1/2 6AN8
Horizontal amplifier cathode follower	1/2 6BQ7
Horizontal output amplifier	6BQ7
External horizontal input cathode follower	1/2 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	12AU7
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 to 125 volts, 175 watts.

The Type 310 will operate over the range of 50 to 800 cps, but at 800 cps about 4% greater line voltage is required. Unless otherwise specified, the instrument will be shipped wired for operation within the line-voltage range of 105 to 125 volts. The Type 310 can be ordered wired for operation on several nominal line voltages as follows:

Nominal Line Voltage	Operating Range
(Figures taken at 60 cps)	
110	99 to 117 volts
117	105 to 125 volts
124	111 to 132 volts
220	198 to 235 volts
234	210 to 250 volts
248	223 to 265 volts

A metal decal on the transformer gives complete instructions for changing the operating range.

Type 310\$595

Includes: 1—P510A attenuator probe
1—A510 binding-post adapter
1—Green filter (378-509)
1—Instruction manual

Optional Phosphors

P2 crt phosphor normally furnished.
P1, P7, P11 optional.....No extra charge

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Recommended Additional Accessories

FB 310 Fan Base—Provides filtered forced-air ventilation to reduce 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, 50 to 60 cycles 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. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



PHYSICS DEPARTMENT

PHYSICS 551

LECTURE 1

LECTURE 2

LECTURE 3

LECTURE 4

LECTURE 5

LECTURE 6

LECTURE 7

LECTURE 8

LECTURE 9

LECTURE 10

LECTURE 11

LECTURE 12

LECTURE 13

LECTURE 14

LECTURE 15

LECTURE 16

LECTURE 17

LECTURE 18

LECTURE 19

LECTURE 20

LECTURE 21

LECTURE 22

LECTURE 23

LECTURE 24

LECTURE 25

LECTURE 26

LECTURE 27

LECTURE 28

TYPE 316 OSCILLOSCOPE

Wide-Band DC-Coupled Portable

Passband

DC to 10 mc at 0.1 v/div to 125 v/div.
2 cycles to 10 mc at 0.01 v/div to 0.1 v/div

Transient Response

Risetime— 0.035 μ sec

Sweep Range

22 calibrated sweep rates form 0.2 μ sec/div to 2 sec/div, continuously variable from 0.2 μ sec/div to 6 sec/div. Accurate 5x magnifier increases calibrated rate to 0.04 μ sec/div.

Triggering

Amplitude-level selection with preset or manual stability control, and fully automatic triggering.

Portability

Size— 8 1/2" wide, 12" high, 19 1/2" overall depth.
Weight— 35 pounds.



GENERAL DESCRIPTION

The Tektronix Type 316 Oscilloscope replaces the popular Type 315D, providing greatly improved performance and dependability with approximately the same degree of compactness. A new cabinet design with easily-removable sides improves accessibility, and an improved mechanical arrangement minimizes the effects of shock and vibration on accurate operation.

From the users viewpoint, the Type 316 is a convenient laboratory tool that is just right in performance, size and weight for calibration and trouble-shooting use at remote locations. It requires only a small amount of bench space and is very easy to operate. All 22 calibrated sweep rates are selected with one knob, which also indicates the new calibrated sweep rate when the magnifier is in use. Preset stability for all triggering modes eliminates trigger-control adjustment in most applications, but manual stability control is retained and can be switched in when desired. Warning lights indicate when vertical and horizontal deflection controls are not in their calibrated positions. Convenient ground terminals are located beneath each coaxial connector. Panel controls and terminals are arranged for efficient operation.

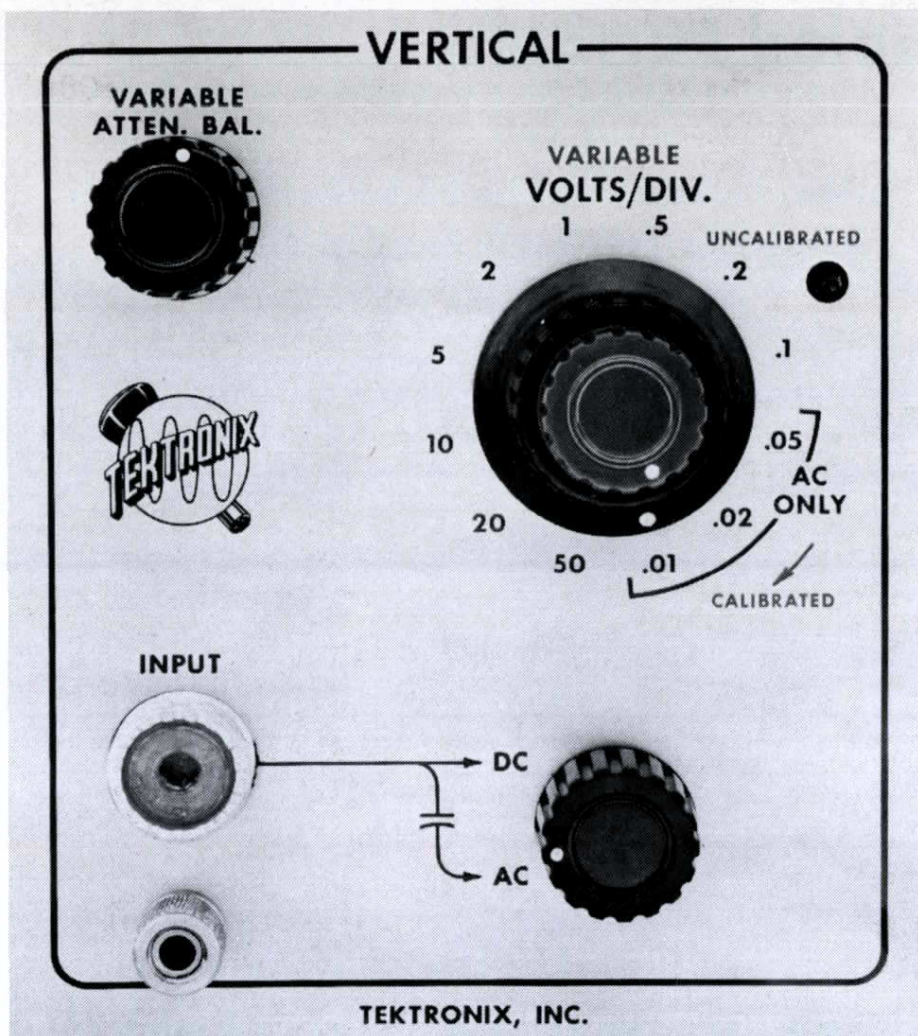
VERTICAL DEFLECTION SYSTEM

DC-Coupled Vertical Amplifier—Main amplifier passband is dc to 10 mc, risetime is 0.035 μ sec. 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 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/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 10 mc, risetime 0.035 μ sec. In addition, a 2 1/2-to-1 vernier (uncalibrated) control provides for continuously-variable adjustment from 0.01 v/div to 125 v/div.

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 v/div 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 position.

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

TYPE 316 OSCILLOSCOPE



Input Impedance—1 megohm paralleled by approximately 40 μf .

Probe—The vertical sensitivity of the Type 316 is reduced by a factor of ten by use of the 10x attenuator probe supplied with the instrument. The P510A Probe presents an input impedance of 10 megohms paralleled by approximately 13 μf .

HORIZONTAL DEFLECTION SYSTEM

Wide Sweep Range—A single knob is used to select any of 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 msec/div , 0.1, 0.2, 0.5, 1, and 2 sec/div . In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.2 $\mu\text{sec}/\text{div}$ to 6 sec/div . Calibration accuracy of the 22 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, calibrated sweep rates are read from the outer ring of numbers circling the TIME/DIV knob. The magnifier expands the normal sweep to fifty divisions, and the HORIZONTAL positioning control has sufficient range to display any ten divisions of the magnified sweep. Calibration accuracy is within 5% of the displayed portion of the magnified sweep.

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

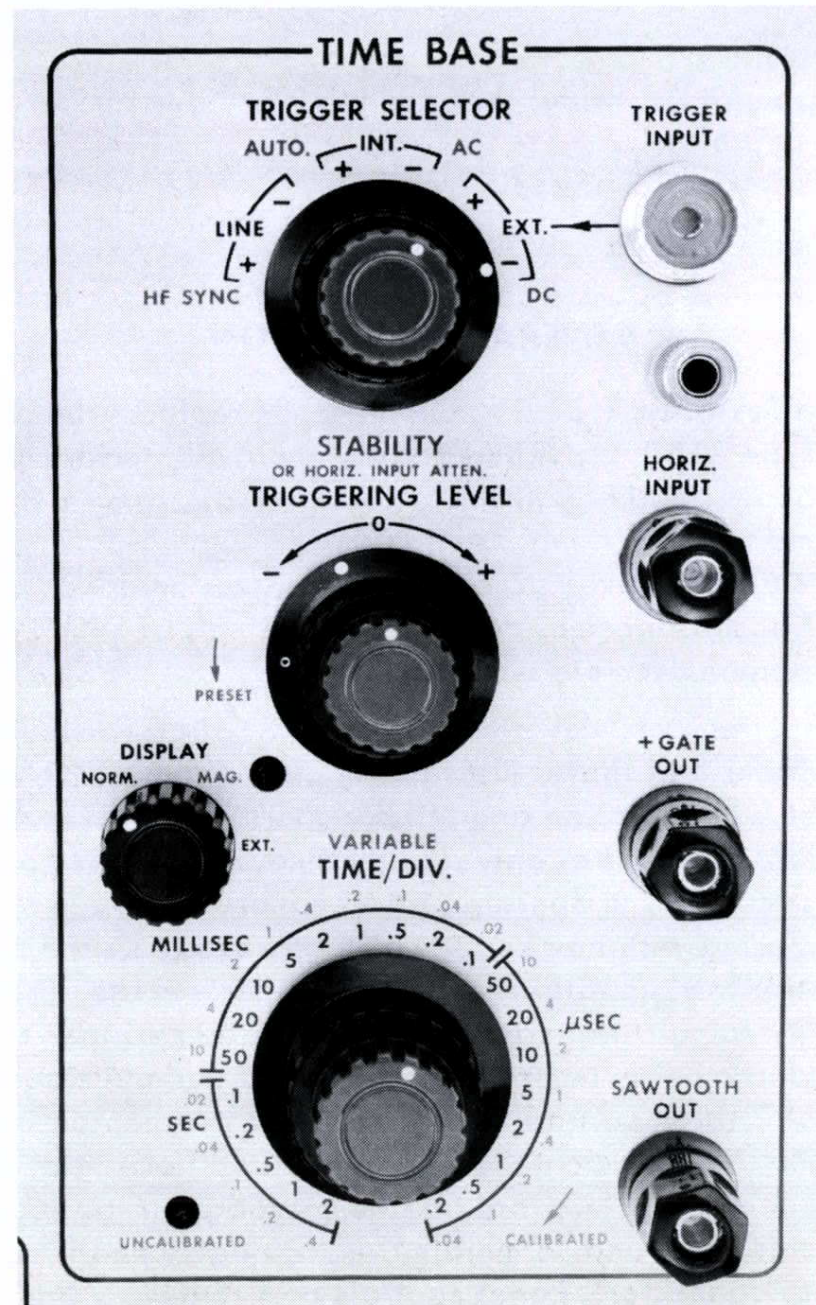
Triggering Facilities—Versatile triggering circuitry provides for complete manual control, preset stability control, and fully automatic triggering.

Amplitude-Level Selection—Adjustable amplitude-level and stability controls for triggering the sweep at a selected amplitude level on the triggering waveform. Trigger source can be internal, external, or the line frequency, either ac or dc-coupled. The triggering point can be on either the positive or negative slope of the triggering waveform.

Preset Stability—Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

Automatic Triggering—Automatic level-seeking trigger circuit provides dependable triggering for most applications. One simple setting assures positive sweep-triggering by signals of widely differing amplitudes, shapes, and repetition rates. No trigger controls need be touched until a different type of operation is desired. Range of automatic operation is between 60 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the screen.

High-Frequency Sync—Assures a steady display of sine-wave signals up to approximately 20 megacycles. Requires a signal large enough to cause about 2 cm of deflection, or an external signal at about 2 v.



TYPE 316 OSCILLOSCOPE

Trigger Requirements—Internal—a signal large enough to cause a one-fifth division deflection. External—a signal of 0.2 v to 50 v.

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

OTHER CHARACTERISTICS

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

Cathode-Ray Tube—A new Tektronix flat-faced 3" cathode-ray tube is used in the Type 316. Accelerating potential is 1.85 kv. A P-2 phosphor is normally supplied. Other phosphors are available on request.

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

Regulated Power Supplies—Electronic regulation compensates for line-voltage variations between 105 and 125 v, or 210 and 250 v.

Illuminated Graticule—The edge-lighted graticule is divided into 8 vertical and 10 horizontal 1/4" 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 not in their calibrated positions.

ELECTRON-TUBE COMPLEMENT

Vertical preamplifier	6CB6
Preamplifier CF and voltage setting CF	6BQ7A
Vertical input CF	2 6AU6
Input amplifiers	2 6AU6
Amplifier CF	6BQ7A
Output amplifiers	2 6CL6
Trigger pickoff CF	6AU6
Calibrator multivibrator	6U8
Calibrator CF	6AU6
Trigger amplifier	6U8
Trigger shaper	6U8
Plus multivibrator and CF	6BQ7A
Minus multivibrator and unblanking CF	6AN8
Gate out CF and sweep out CF	6BQ7A
Disconnect diodes	6AL5
Sweep generator and CF	6AN8
Sweep holdoff CF	12AT7
Sweep amplifier input CF and driver CF	6BQ7A
Sweep output amplifiers and CF	2 6BQ7A
High voltage oscillator	6AQ5
High voltage regulator	12AU7
High voltage rectifiers	2 5642
Voltage reference	5651

Regulator amplifiers	2 6AU6
Series regulator	6AN8
Series regulator	6080
Series regulator	12B4
Cathode-ray tube	T32P2

MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and cabinet.

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

Dimensions—8 1/2" wide, 12" high, 19 1/2" overall depth.

Weight—35 pounds.

Power Requirements—105 to 125 v or 210 to 250 v, 50 to 60 cycles, 260 watts. Type 316-S1 operates on 50 to 800 cycle supply; uses dc fan motor.

Unless otherwise specified, the instrument will be shipped wired for operation within the line-voltage range of 105 to 125 volts. The Type 316 can be ordered wired for operation on several nominal line voltages as follows:

Nominal Line Voltage	Operating Range (Figures taken at 60 cps)
110	99 to 117 volts
117	105 to 125 volts
124	111 to 132 volts
220	198 to 235 volts
234	210 to 250 volts
248	223 to 265 volts

A metal decal on the transformer gives complete instructions for changing the operating range.

Price, Type 316 (50 to 60 cycles) **\$725**

Price, Type 316-S1 (50 to 800 cycles) **\$760**

Includes: 1—P510A attenuator probe
2—A510 binding-post adapters
1—Green filter (378-509)
1—Instruction manual

Optional Phosphors

P2 crt phosphor normally furnished.

P1, P7, P11 optional No extra charge.

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Recommended Additional Accessories

Fan Motor Kit—For converting Type 316 for use on 50 to 800 cycle line frequency (Type 316-S1). Contains brackets, rectifier, and fan motor.

040-141 Fan Motor Kit \$40.00

Prices f.o.b. factory. (Please refer to **Terms and Shipping, GENERAL INFORMATION** page.)



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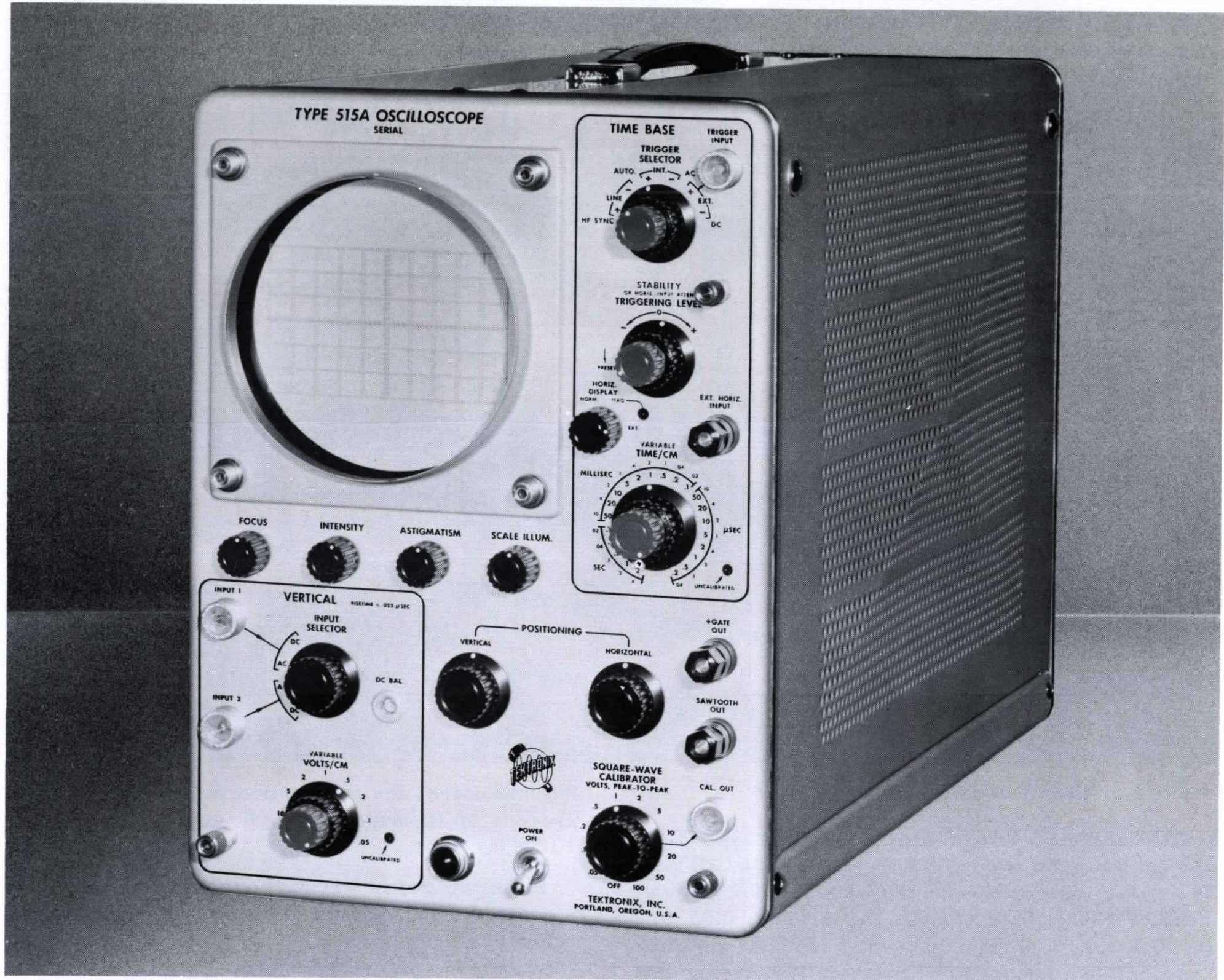
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TYPE 515A OSCILLOSCOPE

DC-Coupled General Purpose



Frequency Response—DC to 15 mc.

Transient Response—0.023- μ sec risetime.

Vertical Deflection Factor

9 calibrated steps from 0.05 v/cm to 20 v/cm.
0.05 v/cm to 50 v/cm, continuously variable.

Balanced 0.25 μ sec Delay Network

Wide Sweep Range

22 calibrated steps from 0.2 μ sec/cm to 2 sec/cm.
0.04 μ sec/cm to 6 sec/cm, continuously variable.
5x magnifier, accurate on all ranges.

Versatile Triggering Circuitry

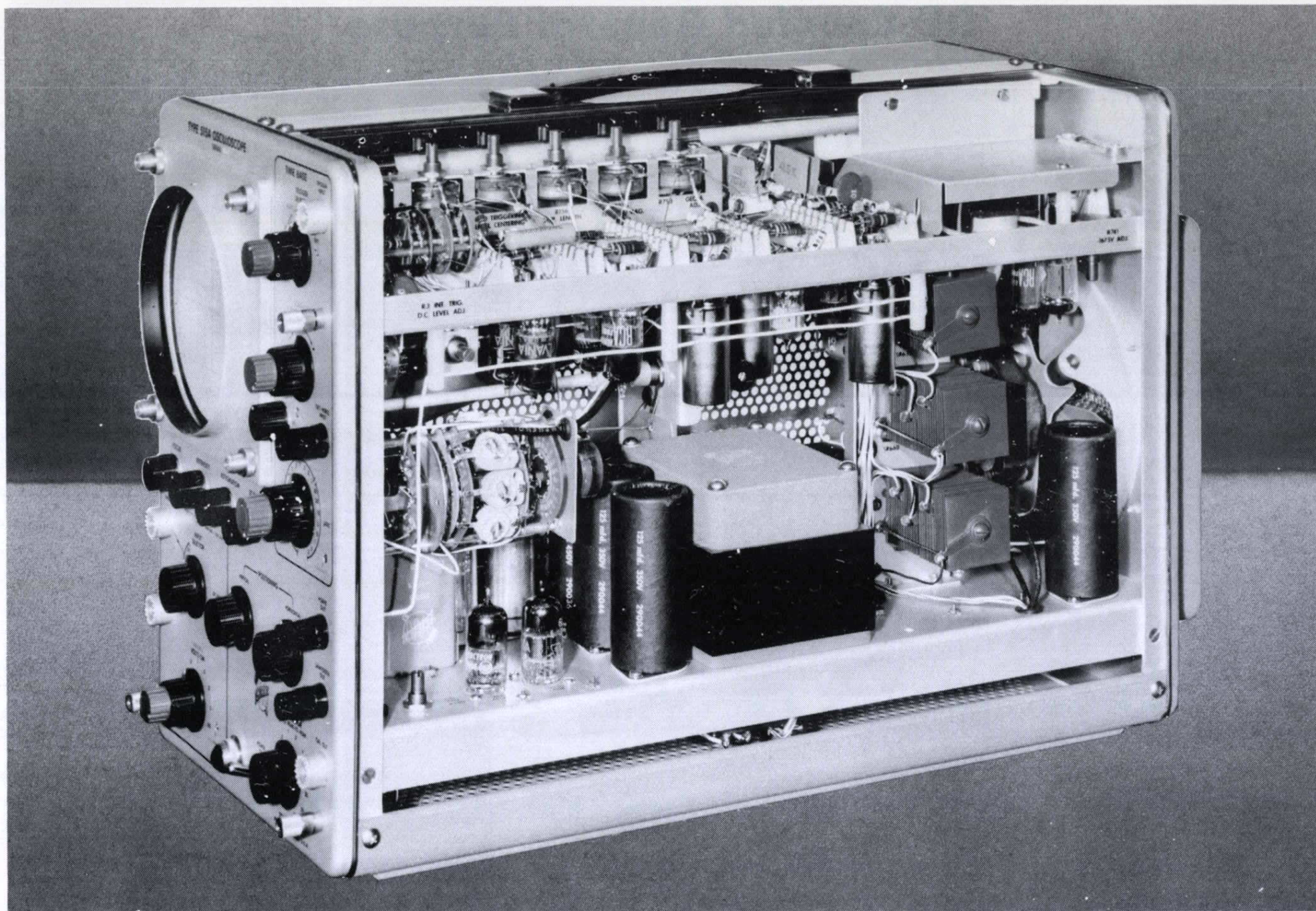
Amplitude-level selection with preset or manual stability control, and fully-automatic triggering.

GENERAL DESCRIPTION

The Tektronix Type 515A 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 μ sec/cm to 6 sec/cm, dc to 15 mc passband, and vertical deflection factor to 0.05 v/cm qualify the Type 515A 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 515A an easy-to-use oscilloscope for the field and laboratory.

TYPE 515A OSCILLOSCOPE



VERTICAL DEFLECTION SYSTEM

DC-Coupled Vertical Amplifier—The Type 515A vertical passband is dc to 15 mc, risetime is 0.023 μsec . 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 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 μf .

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 μf .

Balanced Delay Network—A signal delay of 0.25 μsec 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 515A has 22 calibrated sweep rates: 0.2, 0.5, 1, 2, 5, 10, 20, 50 $\mu\text{sec}/\text{cm}$; 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 millisc/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 0.04 $\mu\text{sec}/\text{cm}$ 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. Magnifier increases the calibrated sweep rate to 0.04 $\mu\text{sec}/\text{cm}$. TIME/CM of the magnified sweep is

TYPE 515A OSCILLOSCOPE

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. An indicator light reminds the operator when the magnifier is in use.

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

Triggering Facilities—Versatile triggering circuitry provides for complete manual control, preset stability control, and fully automatic triggering.

Amplitude-Level Selection—Adjustable amplitude-level and stability controls for triggering the sweep at a selected amplitude level on the triggering waveform. Trigger source can be internal, external, or the line frequency, either ac or dc-coupled. The triggering point can be on either the positive or negative slope of the triggering waveform.

Preset Stability—Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

Automatic Triggering—Automatic level-seeking trigger circuit provides dependable triggering for most applications. One simple setting assures positive sweep-triggering by signals of widely differing amplitudes, shapes, and repetition rates. No trigger controls need be touched until a different type of operation is desired. Range of automatic operation is between 60 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 50-cycle rate, providing a reference trace on the screen.

High-Frequency Sync—Assures a steady display of sine-wave signals up to approximately 25 megacycles. Requires a signal large enough to cause about 2 cm deflection, or an external signal of about 2 v.

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.

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.

Alignment of Cathode-Ray Tube—Should it become necessary to touch up the alignment of the cathode-ray tube, a molded nylon handle on the crt socket can be reached in a matter of seconds. Release the two quick-opening fasteners on the left cabinet side, and lower the cabinet side out of the way, or remove it completely.

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.

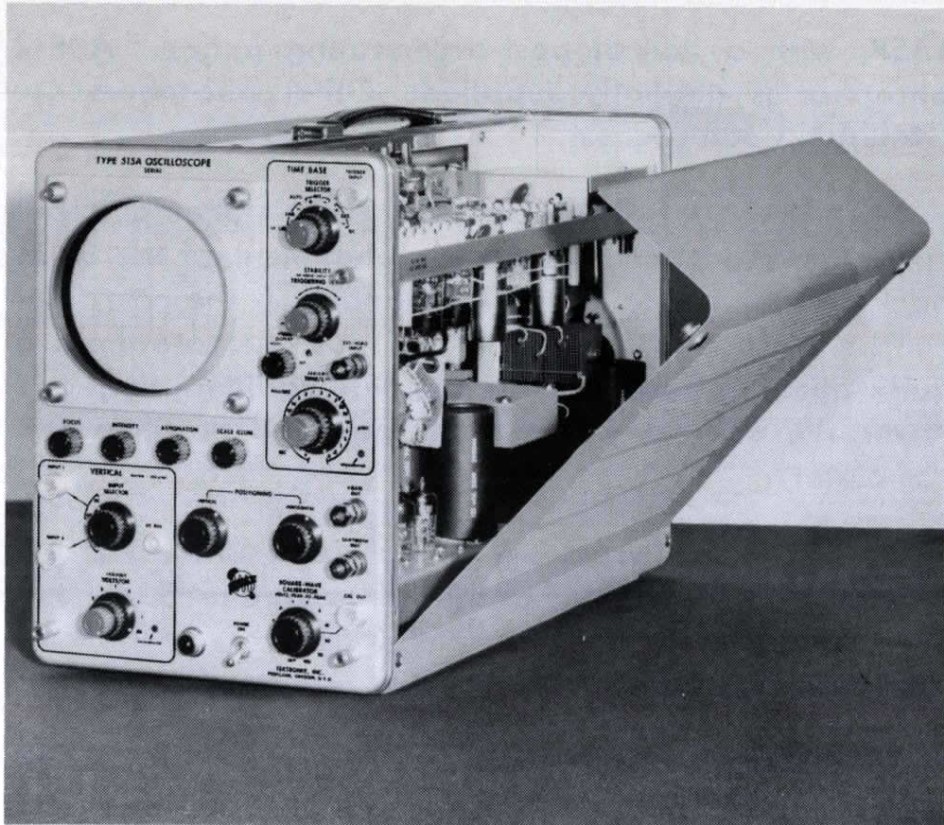
Illuminated Graticule—An edge-lighted graticule is marked in 6 vertical and 10 horizontal centimeter-divisions with 2-millimeter baseline divisions. Illumination is controlled by a front-panel knob.

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

ELECTRON-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

TYPE 515A OSCILLOSCOPE



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. Type 515A-S1 operates on 50 to 800 cycle supply; uses dc fan motor.

Price, Type 515A\$750

Price, Type 515A-S1\$785

Includes: 1—P410 attenuator probe
2—A510 binding-post adapters
1—Green filter (378-514)
1—Instruction manual

Optional Phosphors

P2 crt phosphor normally furnished.

P1, P7, P11 optional.No extra charge

Painted Panels

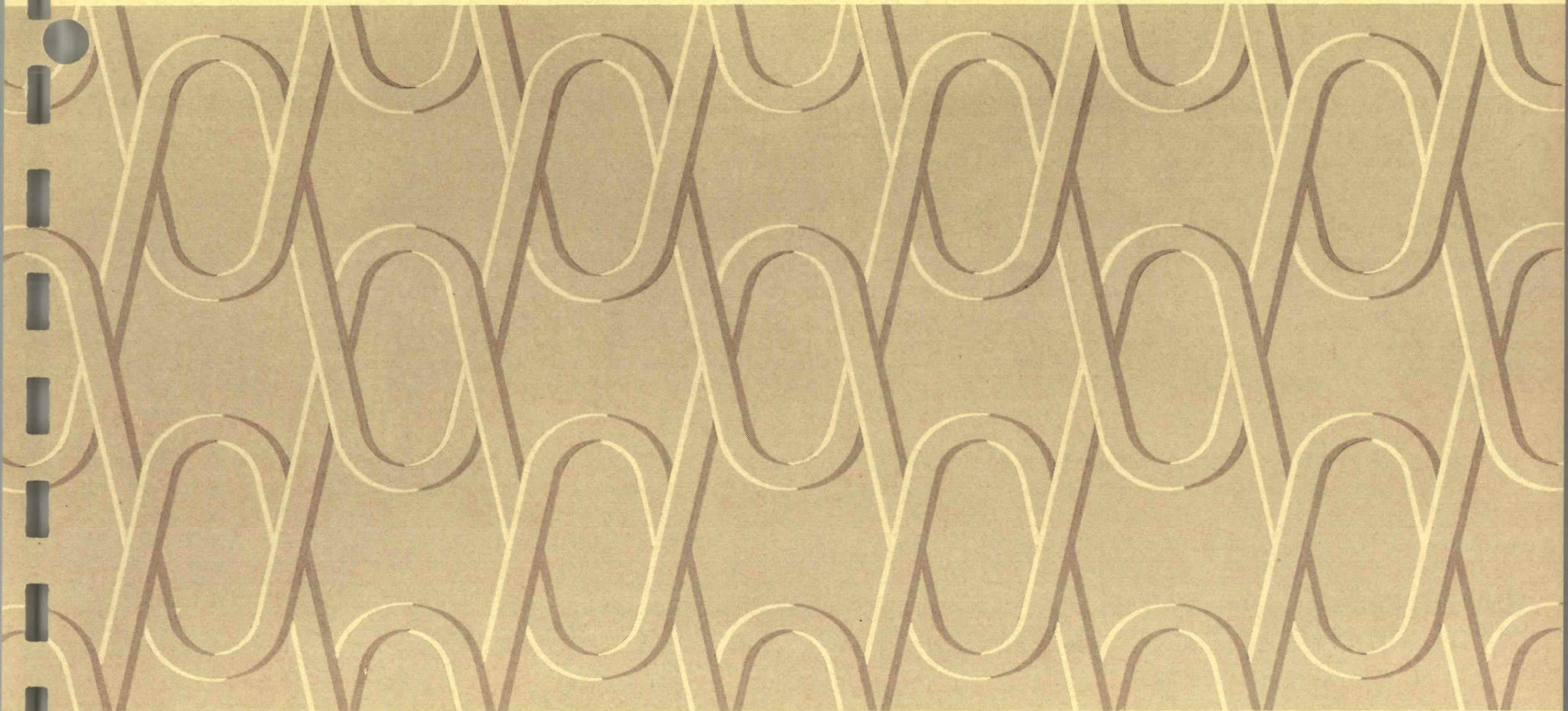
Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Recommended Additional Accessories

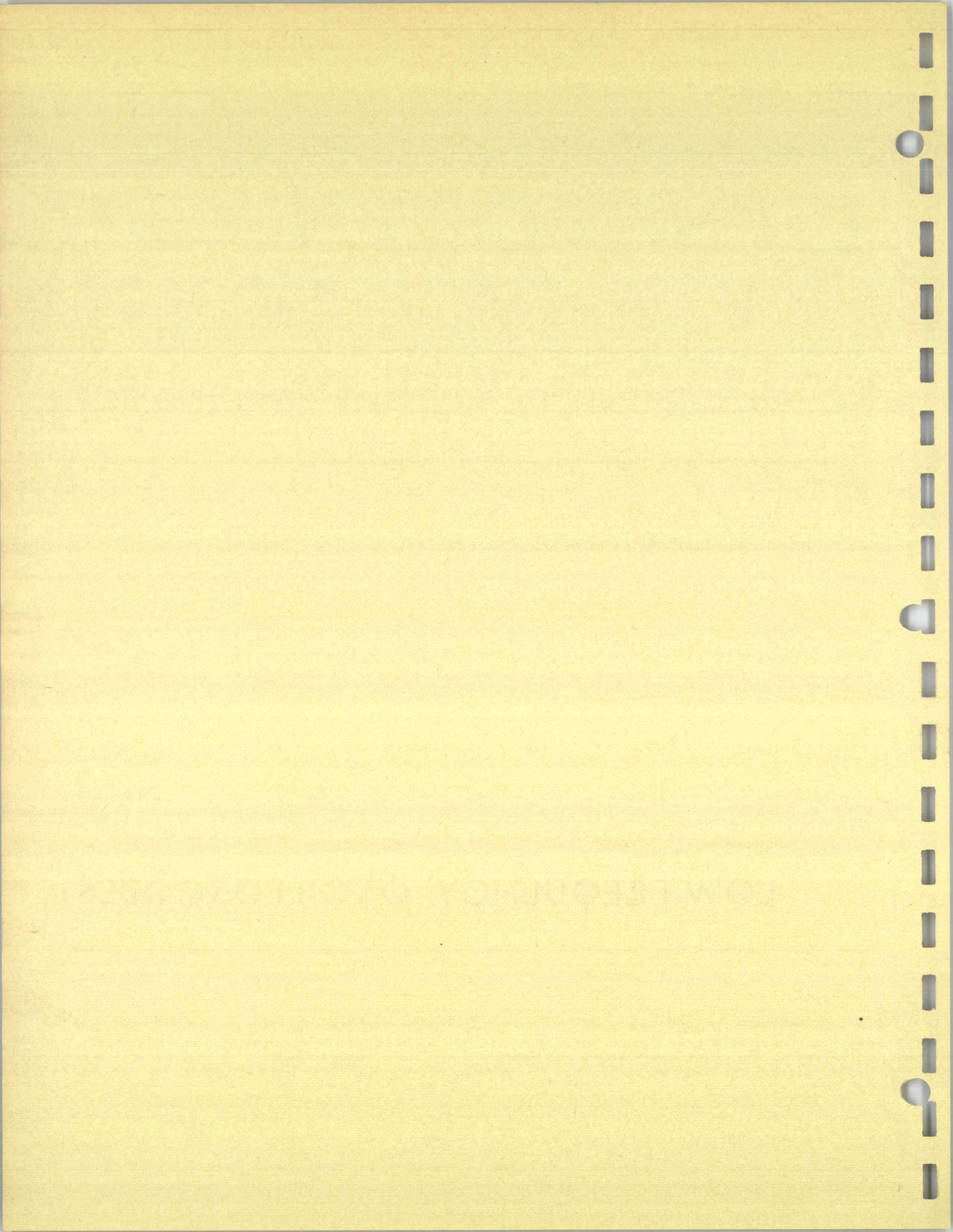
Fan Motor Kit—For converting Type 515A for use on 50 to 800 cycle line frequency (Type 515A-S1). Contains brackets, rectifier, and fan motor.

040-140 Fan Motor Kit\$40.00

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



LOW-FREQUENCY OSCILLOSCOPES



TYPE 502 OSCILLOSCOPE

High-Sensitivity Dual-Beam Oscilloscope

Sensitivity — 200 $\mu\text{v}/\text{cm}$, dc-coupled, both beams.

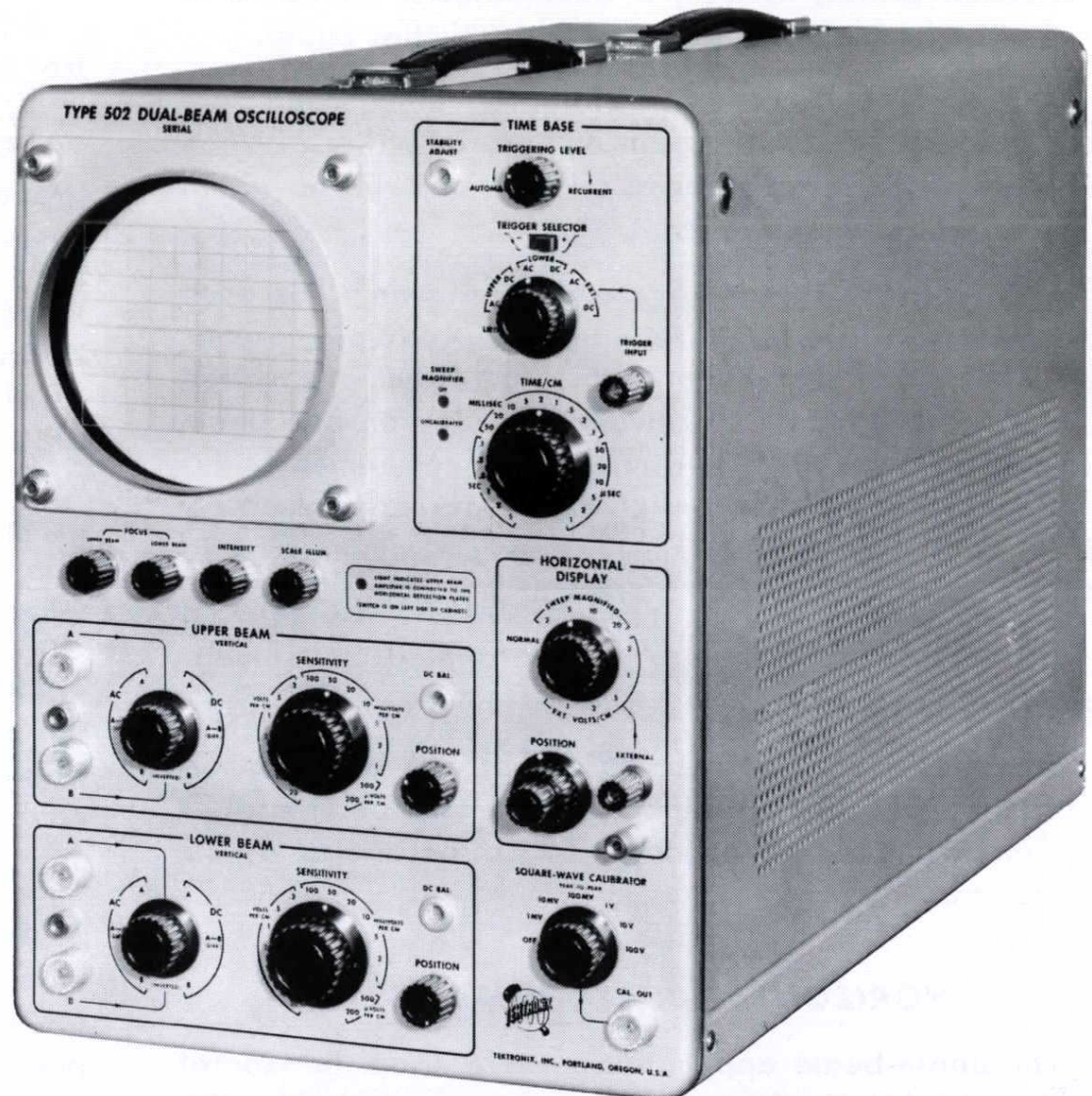
Differential Input—at all sensitivities.

Sweep Magnification—2, 5, 10 and 20 times.

Curve Tracing with Two Beams
(horizontal sensitivity to 0.1 v/cm).

Single-Beam Curve Tracing — at 200 $\mu\text{v}/\text{cm}$, both axes.

Regulated Heater Supplies — input stages of amplifiers have transistor-regulated parallel heater supplies.



TENTATIVE SPECIFICATIONS

... REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY JUNE, 1958.

GENERAL DESCRIPTION

The Tektronix Type 502 combines a number of extremely useful features in one compact oscilloscope. In addition, it offers dual-beam displays on linear time bases with the high sensitivity desired in many industrial and scientific applications, dual-beam X-Y displays at medium sensitivities, and single-beam X-Y displays at high sensitivities.

APPLICATIONS

Here are just a few of the many possible uses for this versatile new oscilloscope:

1. Compare and measure the waveforms at two points in a circuit simultaneously.
2. Compare and measure the outputs of two transducers on the same time base.

3. Display X-Y curves with one or both beams in a variety of applications.
4. Plot one transducer output against another—pressure against volume or temperature for instance.
5. Compare and measure stimulus and reaction, or the outputs of two probes, on the same time base.
6. Use the differential-input feature for cancellation of common-mode signals, and to eliminate the need for a common terminal, in both single and dual displays.
7. Measure phase angles and frequency differences.

VERTICAL-DEFLECTION SYSTEMS

High-Gain DC-Coupled Amplifiers—Both vertical amplifiers have the same characteristics. Passbands are dc to 100 kc at 200 $\mu\text{v}/\text{cm}$, increasing to dc to 350 kc at 1 mv/cm and to dc to 500 kc at 50 mv/cm.

TYPE 502 OSCILLOSCOPE

Sensitivity—Vertical deflection is calibrated in sixteen steps: 200, 500 $\mu\text{v}/\text{cm}$, 1, 2, 5, 10, 20, 50, 100 mv/cm , 0.2, 0.5, 1, 2, 5, 10 and 20 v/cm . When the upper-beam amplifier is switched to the horizontal-deflection plates, its gain is automatically increased to make the horizontal and vertical sensitivities equal.

Calibration Accuracy—Internal adjustments are provided for setting the gain of both amplifiers. When accurately set, sensitivities at all positions will be within 3% of the panel readings.

Differential Input—A six-position switch for each amplifier provides for differential input and single-ended input either normal through the A input or inverted through the B input. An inverted display on one beam is sometimes desirable in comparison measurements. Rejection ratios for differential inputs are approximately 1000 to 1 from 200 $\mu\text{v}/\text{cm}$ to 1 mv/cm , diminishing to 100 to 1 at 0.2 v/cm and 50 to 1 at 5 v/cm .

Input Impedances—47 $\mu\mu\text{f}$ paralleled by 1 megohm, both channels.

Probes—Two Tektronix P510A probes are supplied with the Type 502. With these 10x attenuator probes the input impedance becomes 14 $\mu\mu\text{f}$ paralleled by 10 megohms.

HORIZONTAL-DEFLECTION SYSTEM

For single-beam applications where equal horizontal and vertical-deflection characteristics are desirable, the

advantages of 200 $\mu\text{v}/\text{cm}$ sensitivity and differential input for both horizontal and vertical deflection. A panel light indicates when the upper-beam amplifier is connected to the horizontal-deflection plates.

Calibrated Sweeps—A single direct-reading control is used to select any of 21 calibrated sweep rates: 1, 2, 5, 10, 20, 50 $\mu\text{sec}/\text{cm}$, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm , 0.1, 0.2, 0.5, 1, 2 and 5 sec/cm . Calibration accuracy will typically be within 1%, and in all cases within 3%.

Sweep Magnifier—Four degrees of sweep magnification are provided: 2, 5, 10 and 20 times. Any 10 cm of the magnified sweep can be displayed. Calibration of the magnified sweep will be accurate at all rates within the maximum calibrated rate of 0.5 $\mu\text{sec}/\text{cm}$. Calibration accuracy is within 3% of the displayed portion of the magnified sweep. A warning light indicates when the maximum calibrated rate is being exceeded.

External Input to Horizontal Amplifier—An external signal can be used for horizontal deflection in applications such as curve tracing with both beams. Five calibrated sensitivity steps are provided: 0.1, 0.2, 0.5, 1 and 2 v/cm .

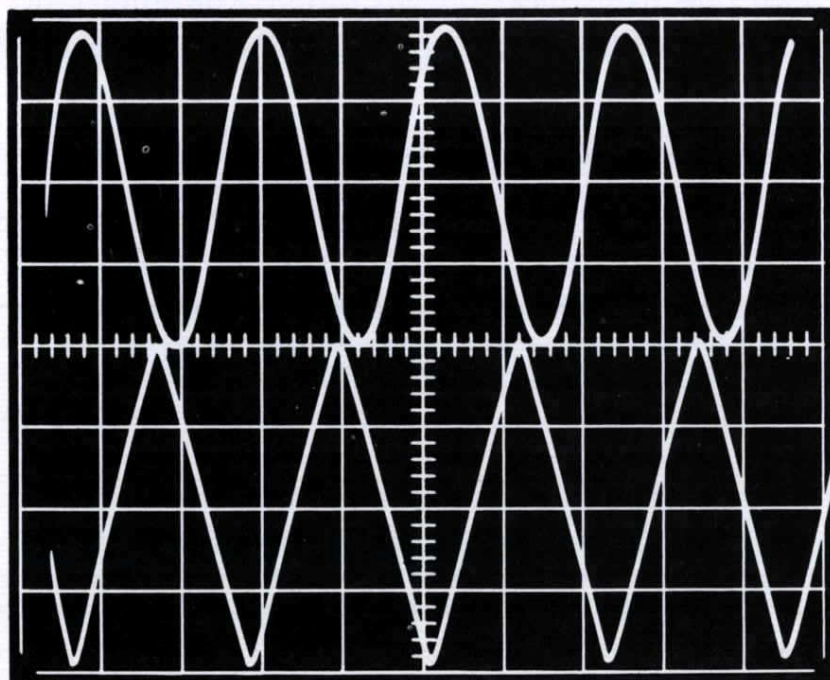
Automatic Triggering—The automatic triggering mode eliminates triggering readjustments and is suitable for most applications. Amplitude-level selection with preset stability is also available. The sweep can be operated free-running when desired.

TENTATIVE SPECIFICATIONS

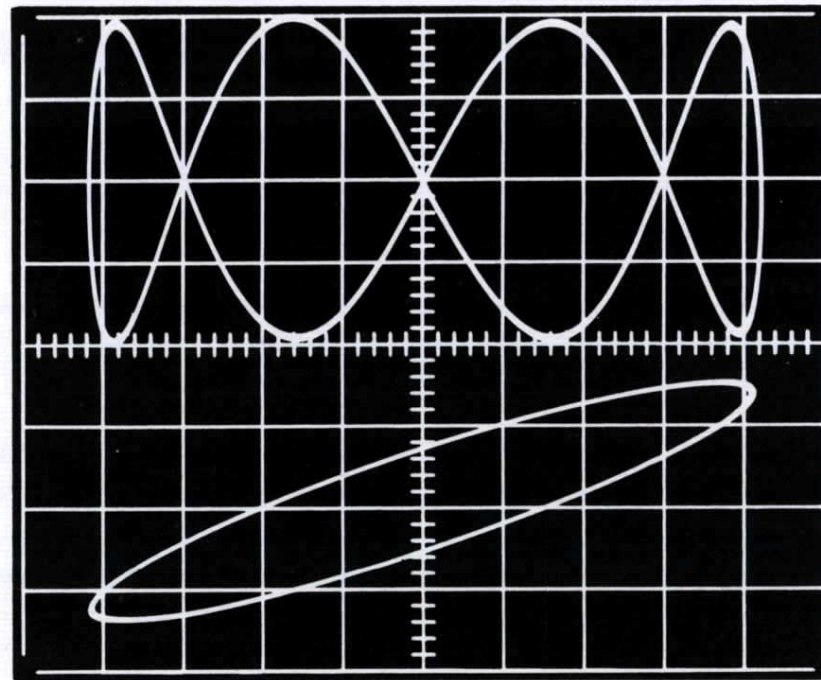
REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY JUNE, 1958.

upper-beam amplifier can be switched to the crt horizontal-deflection plates. This type of operation has the

Trigger Selection—The triggering signal can be selected from either amplifier internally or from an exter-



Dual display on linear time base



Dual display for X-Y curves

TYPE 502 OSCILLOSCOPE

nal source, and can be either ac-coupled or dc-coupled. The sweep can also be triggered internally at the power-line frequency. A switch provides for triggering on either the rising or falling slope of the triggering signal.

Trigger Requirements—Internal triggering—a signal large enough to produce a 2 mm deflection. External triggering—a signal of 0.2 v to 50 v.

OTHER CHARACTERISTICS

Voltage Calibrator—A square-wave voltage is available through a front-panel connector. Six fixed voltage steps are provided: 1, 10, 100 mv, 1, 10 and 100 v peak-to-peak. Accuracy is within 3%. Square-wave frequency is about 1 kc.

Cathode-Ray Tube—A new Tektronix two-gun cathode-ray tube with two pairs of vertical and one pair of horizontal-deflection plates is used in the Type 502. Accelerating potential is 3 kv. Display area for each beam is 8 cm by 10 cm. A P2 phosphor is normally supplied, however, other phosphors are available upon request.

Regulated Power Supplies—Electronic regulation compensates for line-voltage and load variations. In addition, the parallel heater supplies to the input stages of both vertical amplifiers are transistor regulated.

Illuminated Graticule—The edge-lighted graticule is marked in 9 vertical and 10 horizontal one-centimeter

ELECTRON-TUBE COMPLEMENT

Input amplifiers	4	6AU6
Amplifiers	4	6AU6
Output amplifiers	4	5965
Internal trigger amplifiers	2	6AU6
Trigger inverter		6U8
Trigger multivibrator		6U8
Sweep multivibrator	2	6AN8
Disconnect diodes		6AL5
Sweep generator		6U8
Sweep cathode follower		5965
Sweep amplifiers	2	6U8
Calibrator multivibrator		6AN8
Calibrator cathode follower		6AU6
High-voltage oscillator		6CZ5
High-voltage rectifier	2	5642
High-voltage regulator		12AU7
Rectifiers	4	6BW4
Comparator amplifiers	3	6AN8
Series regulators	4	12B4
Voltage reference		5651
Cathode-ray tube		T60P2

TRANSISTOR COMPLEMENT

Heater regulator amplifiers	2	2N109
Heater series regulator		2N301

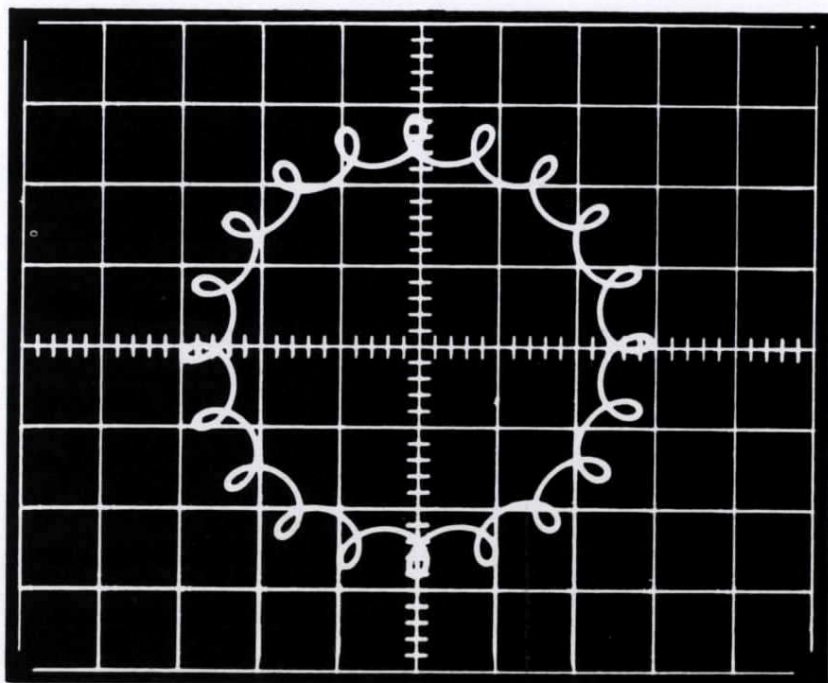
MECHANICAL SPECIFICATIONS

Ventilation—Filtered forced-air ventilation maintains

TENTATIVE SPECIFICATIONS

REGULAR PRODUCTION AND INITIAL SHIPMENT
EXPECTED TO BEGIN APPROXIMATELY JUNE, 1958.

divisions with two-millimeter markings on the baselines. Illumination is controlled by a front-panel knob.



Single-beam X-Y curve tracing

safe operating temperature.

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

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

Dimensions—23 1/2" long, 11 1/4" wide, 15" high.

Weight—55 lbs.

Type 502 \$795

Includes: 2—P510A attenuator probes
2—A510 binding post adapters
1—Green filter (378-514)
1—Instruction manual

Optional Phosphors

P2 crt phosphor normally furnished

P1, P7, P11 optional no extra cost

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

TYPE 502 OSCILLOSCOPE

ELECTRON-TUBE COMPLEMENT

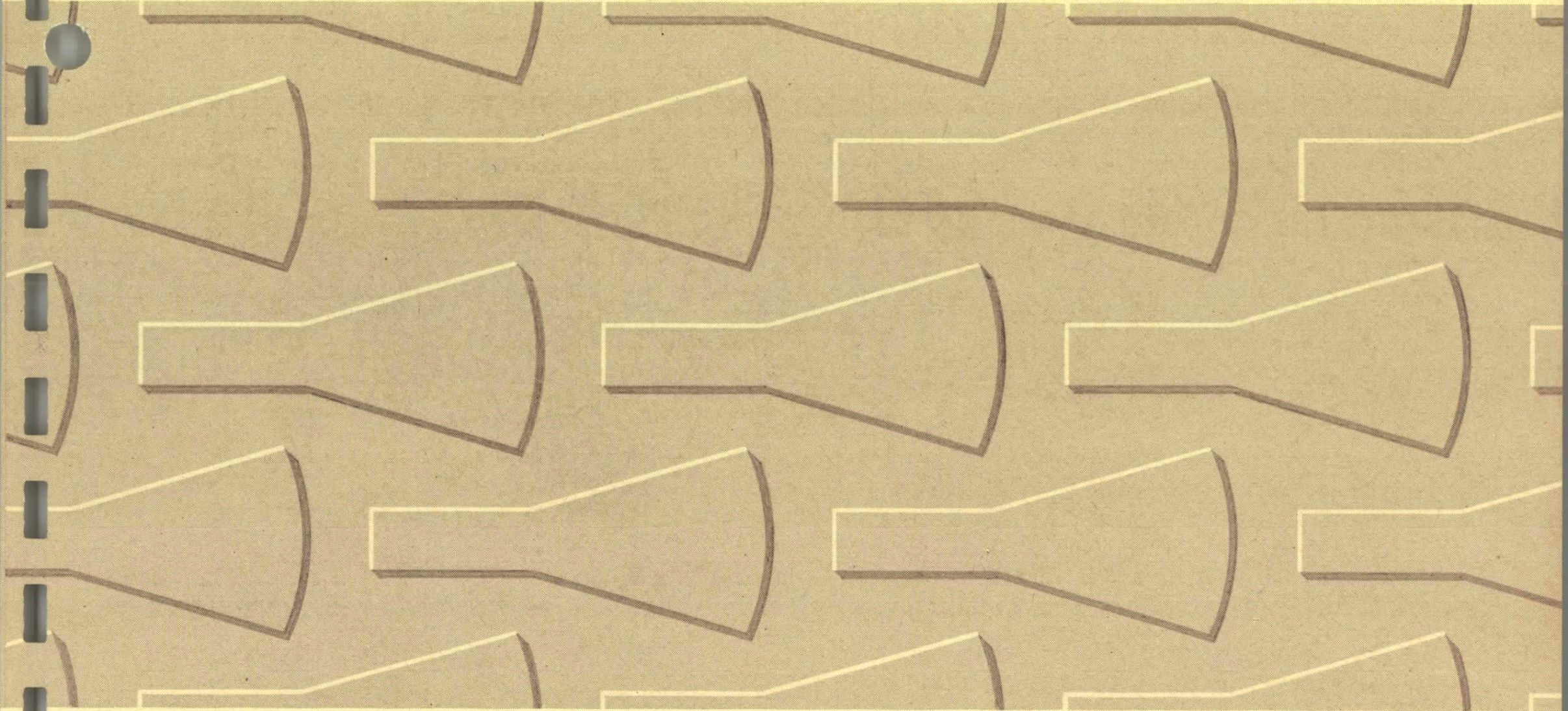
6X4	Power tube
6AR5	Detector, AF amplifier, and sync separator
6AV6	AF amplifier
6BD6	Detector, AF amplifier, and sync separator
6BE6	Detector, AF amplifier, and sync separator
6BE7	Detector, AF amplifier, and sync separator
6BE8	Detector, AF amplifier, and sync separator
6BE9	Detector, AF amplifier, and sync separator
6BE10	Detector, AF amplifier, and sync separator
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6BE44	Detector, AF amplifier, and sync separator
6BE45	Detector, AF amplifier, and sync separator
6BE46	Detector, AF amplifier, and sync separator
6BE47	Detector, AF amplifier, and sync separator
6BE48	Detector, AF amplifier, and sync separator
6BE49	Detector, AF amplifier, and sync separator
6BE50	Detector, AF amplifier, and sync separator

not to be used in any other manner than as specified in the instructions. The use of any other tubes may result in damage to the instrument and void the warranty. The use of any other tubes may also result in poor performance and reduced life of the instrument.

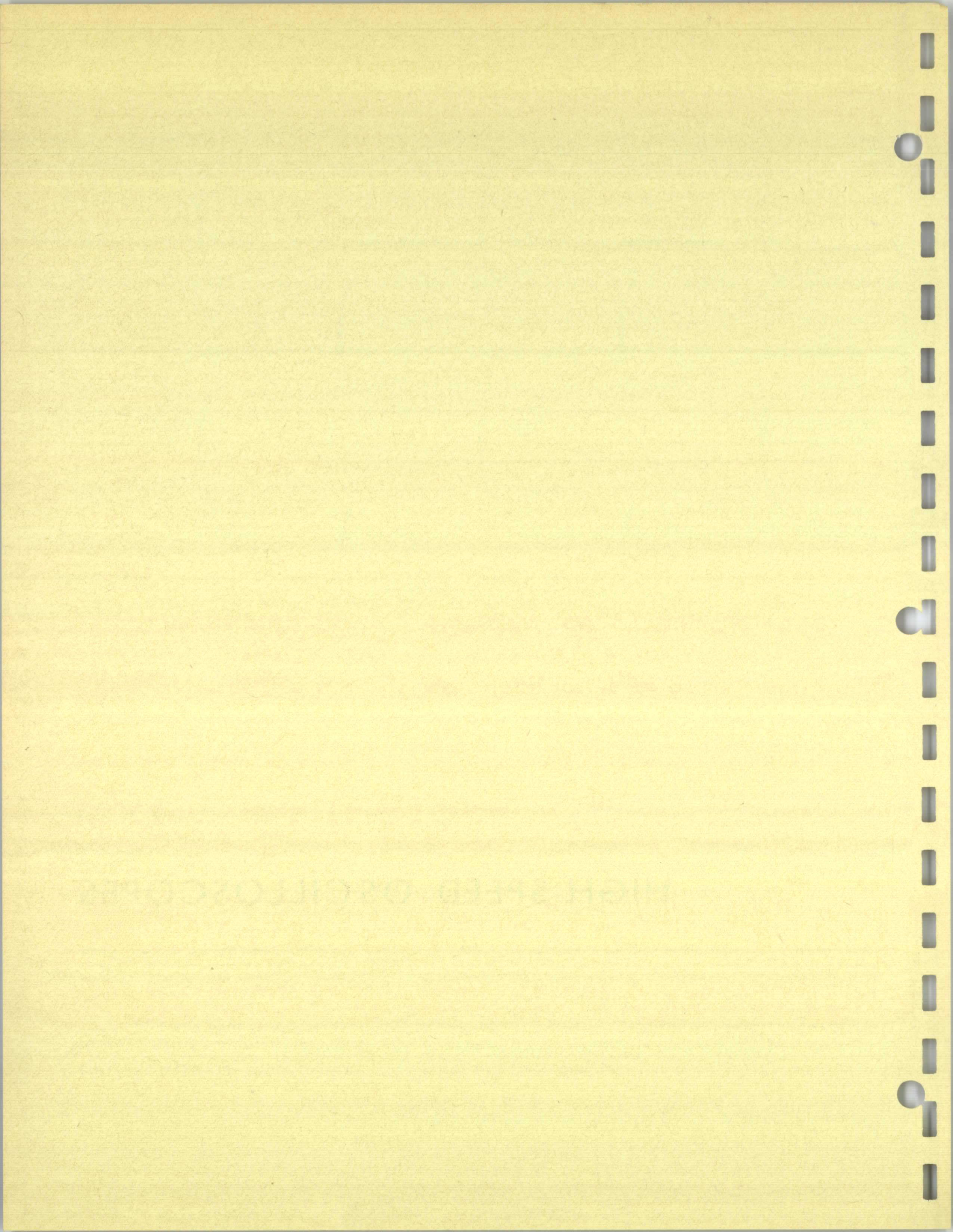
The following table lists the tubes used in the Type 502 Oscilloscope. The tubes are listed in the order in which they are used in the instrument. The tubes are listed in the order in which they are used in the instrument.

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HIGH-SPEED OSCILLOSCOPES



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.



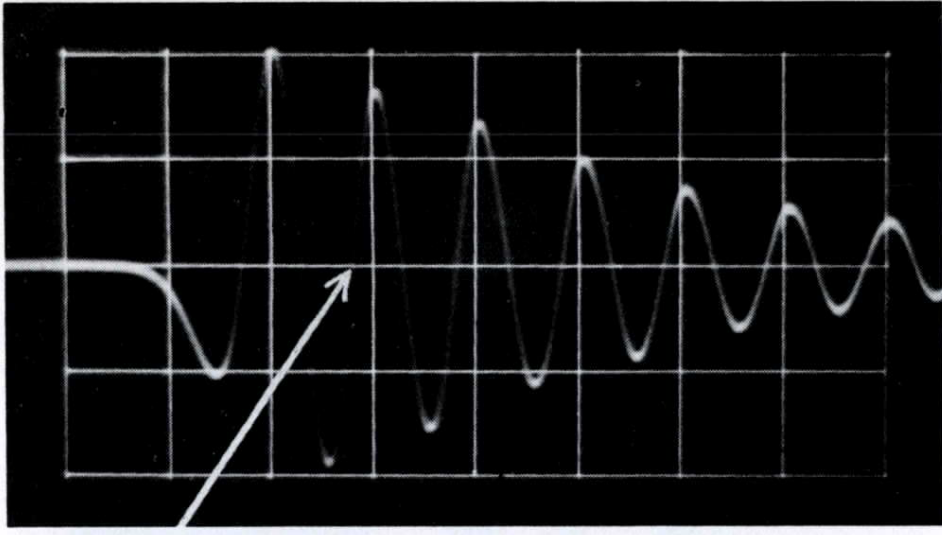
VERTICAL DEFLECTION SYSTEM

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. A front-panel variable-attenuator control is provided to adjust the sensitivity.

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.

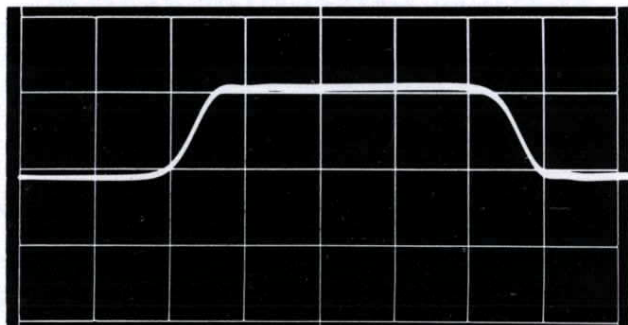
Cathode-Follower Probe—To provide higher input impedances, a cathode-follower probe and three capacitive attenuator heads are supplied with the Type 517A. The input impedance of the probe alone consists of 12 megohms paralleled by approximately 5 μ mf. Each attenuator head will present a different input 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

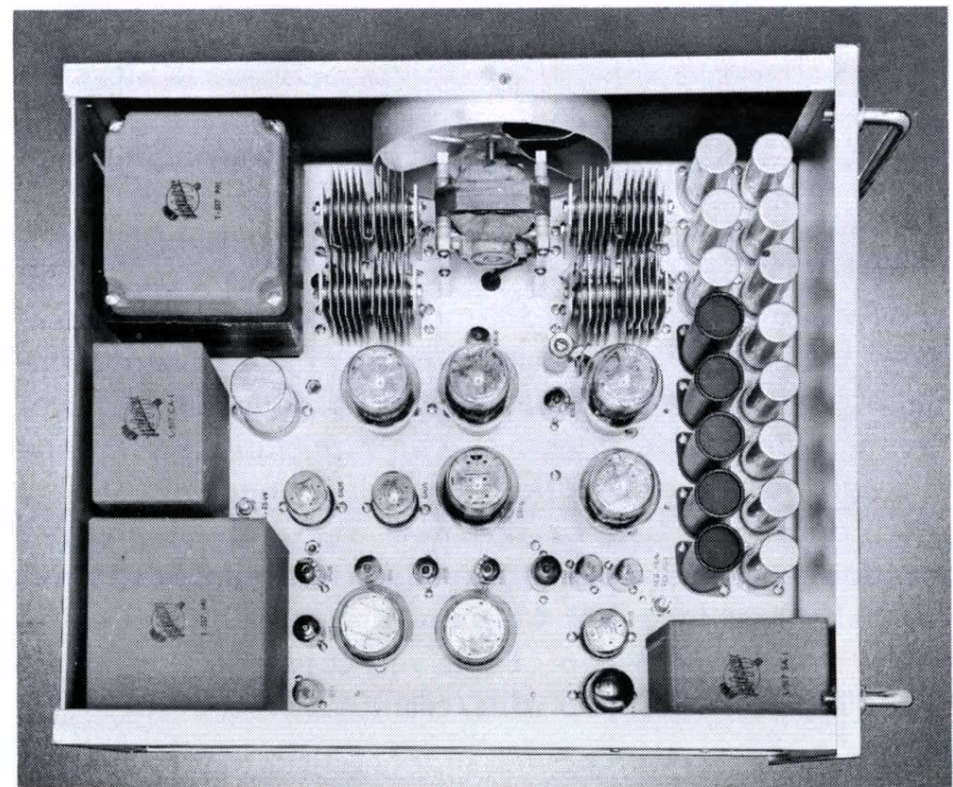
Calibrated Sweep Rates—The basic sweep waveform is generated by a boot-strap circuit with an inverter stage for balanced deflection. Eleven fixed, calibrated sweep rates accurate within 2% . . . 10, 20, 50, 100, 200, 500 millimicrosecond/cm, 1, 2, 5, 10, 20 μ sec/cm are available at 24 kv accelerating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

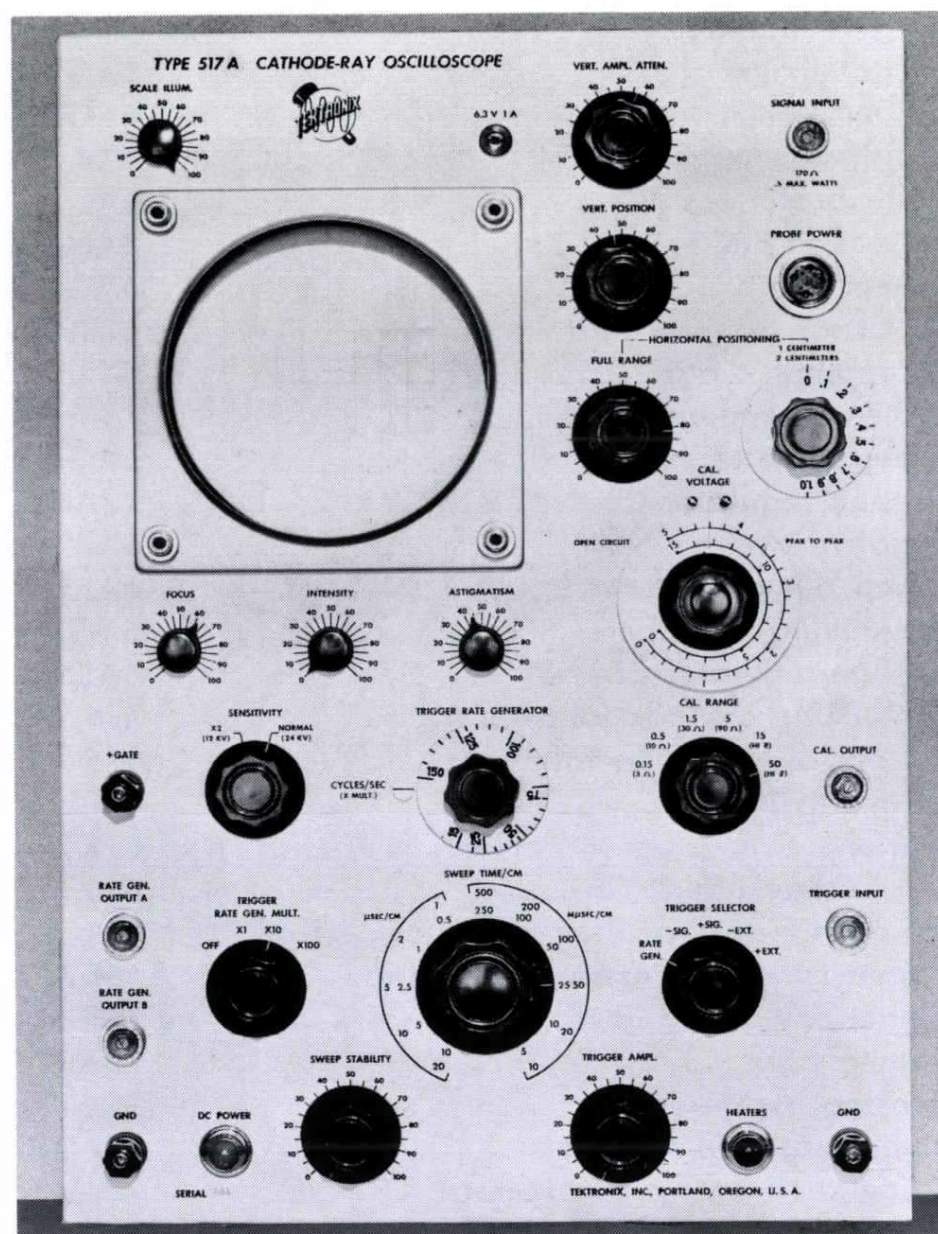
High Voltage—Accelerating potentials for the crt are obtained from an oil-filled oscillator-type supply, all voltages electronically regulated to insure stable operation for both load and line changes. A front-panel switch on the indicator unit changes the accelerating voltage from 24 kv to 12 kv by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

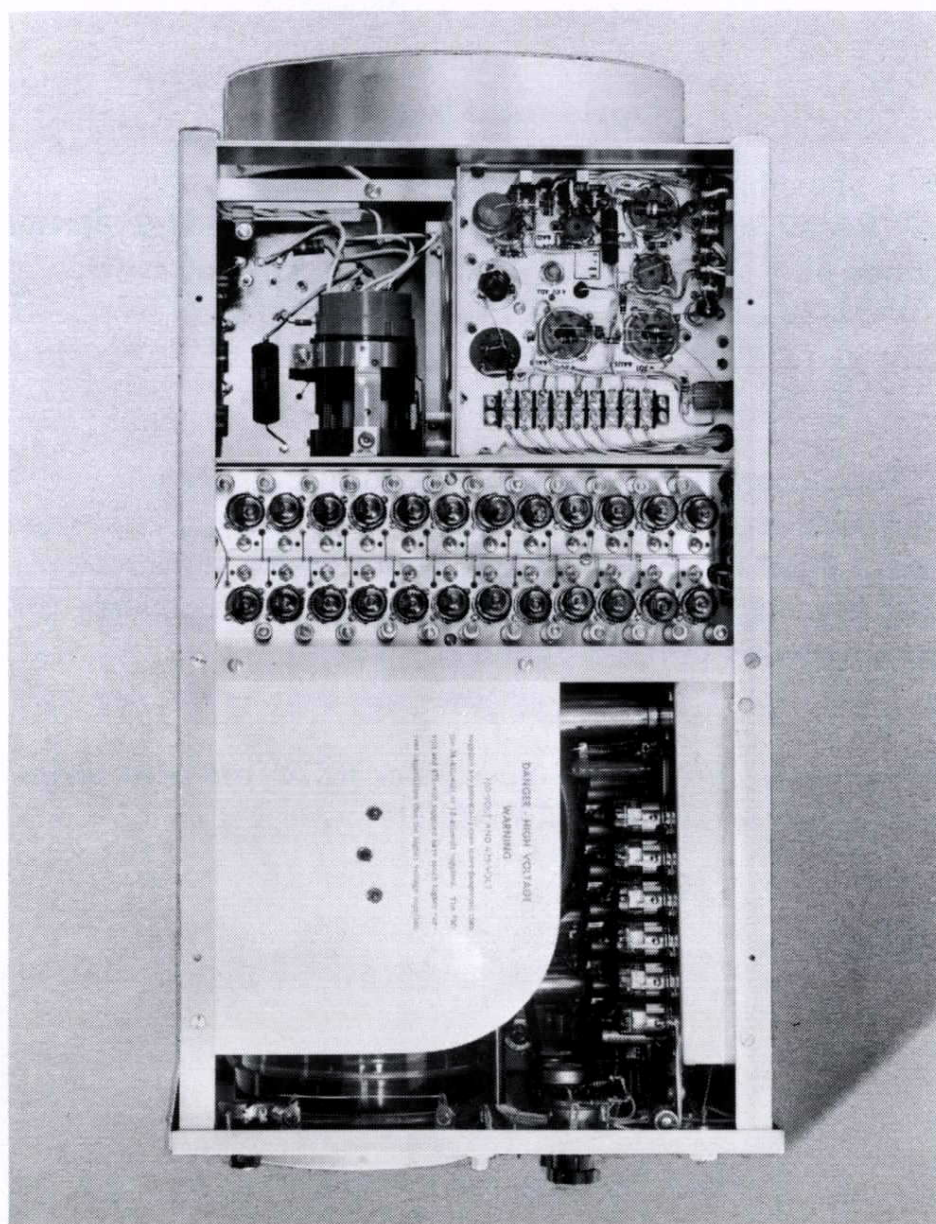
Output Waveforms—In addition to the two trigger-rate generator outputs and calibrator output, a +GATE waveform of approximately 30 volts amplitude is available. Its duration is approximately equal to the sweep being generated. Risetime is 0.03 μ sec, from a cathode-follower source impedance of 200 ohms.

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.

Cathode-Ray Tube Alignment—A molded nylon handle on the crt socket facilitates realignment of the cathode-ray tube.

ELECTRON-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



TYPE 517A OSCILLOSCOPE

Trigger amplifier	6	6AK5
Trigger limiter		6AG7
Trigger switch		6AG7
Coupling diode		6X4
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

Special Models

Type 517A-S1, has sweep lockout feature for single-sweep operation. **\$3536.50**

Since special models require additional manufacturing time, please check with your Tektronix Field Engineer or Representative for exact delivery schedules.

Optional Phosphors

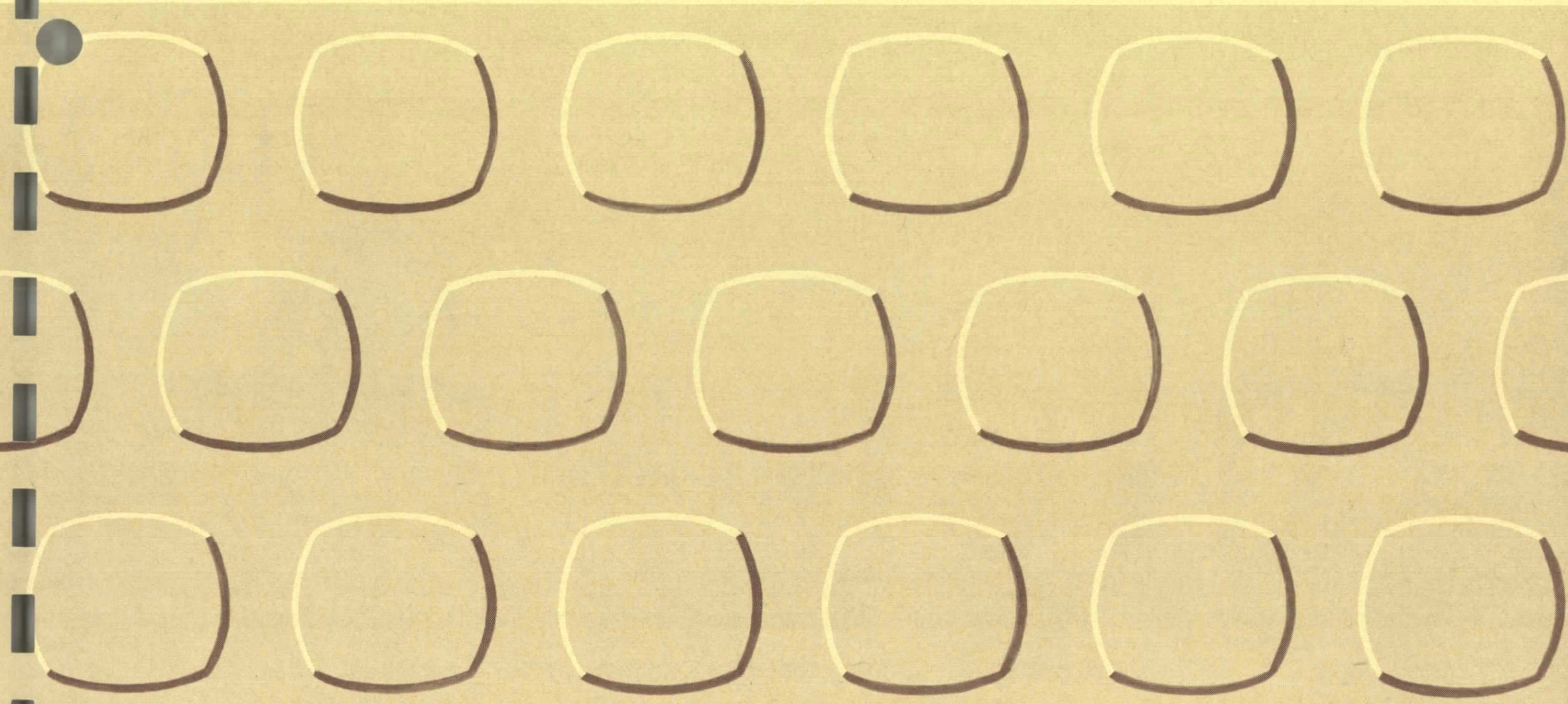
P11 phosphor normally furnished.
P1, P2, P7 optional. No extra charge
Other phosphors can be furnished on special order.

Painted Panels

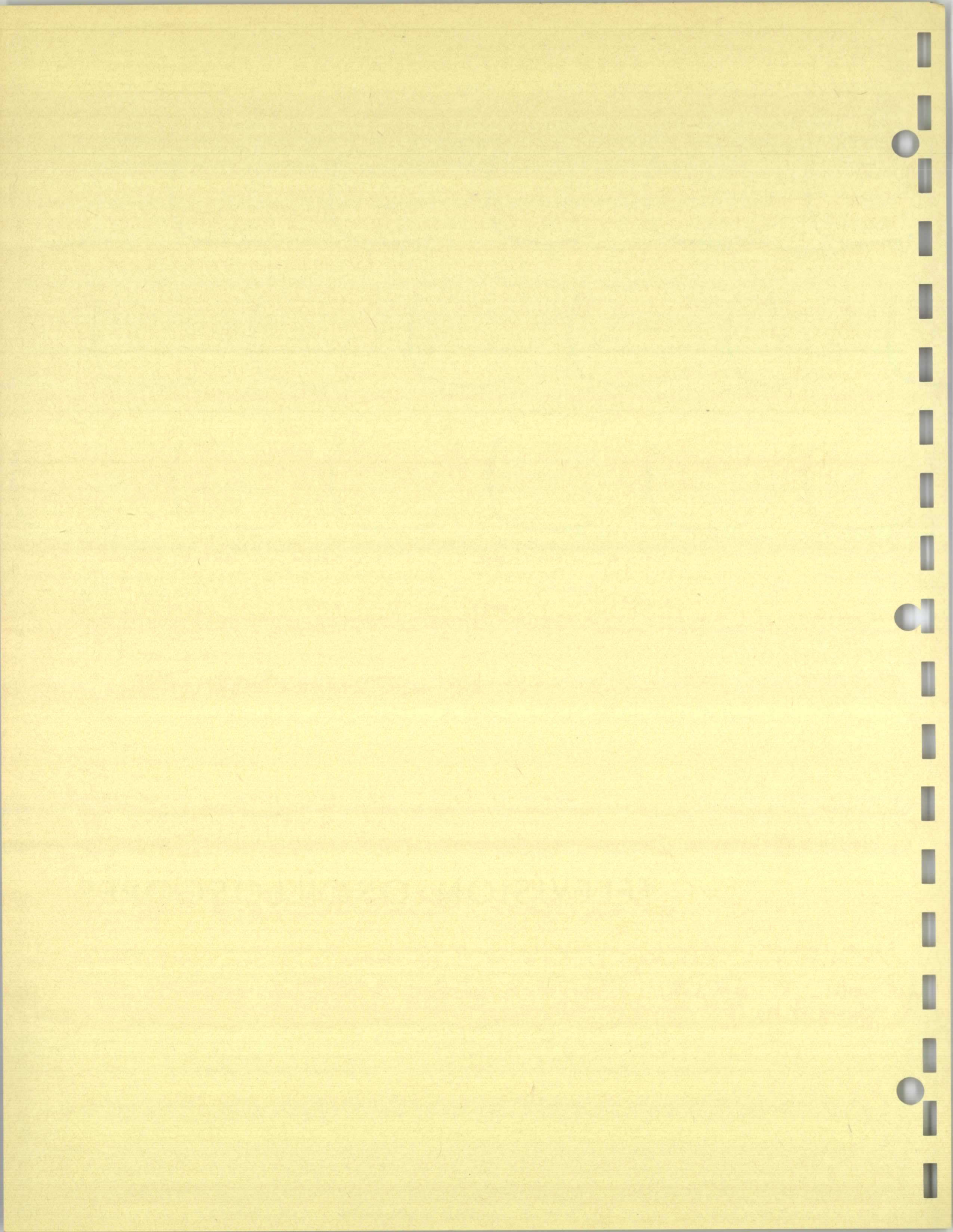
Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



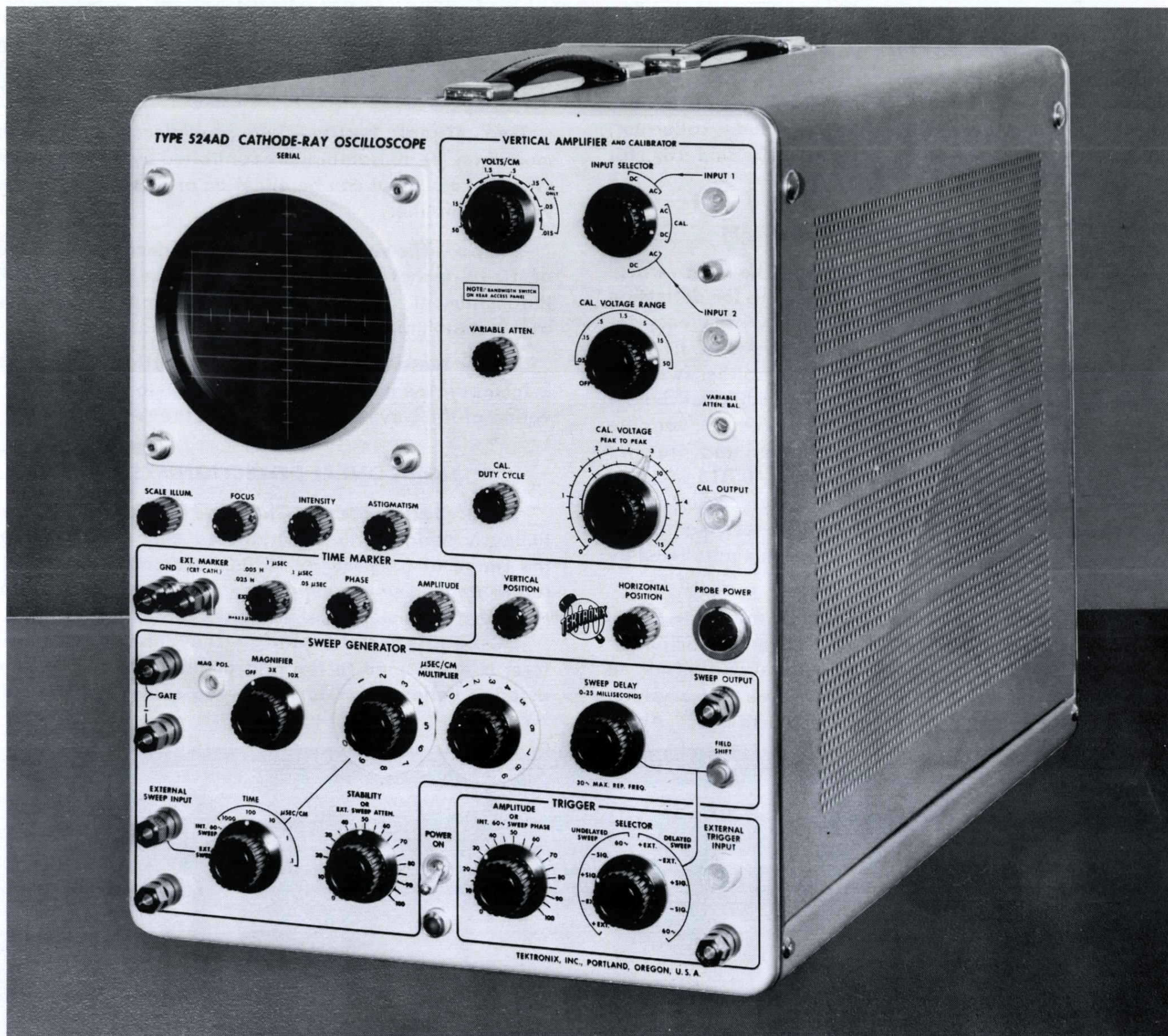


TELEVISION OSCILLOSCOPES



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. Risettime is less than 0.035 μ sec and the input impedance is 1 megohm paralleled by approximately 45 μ f.

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.

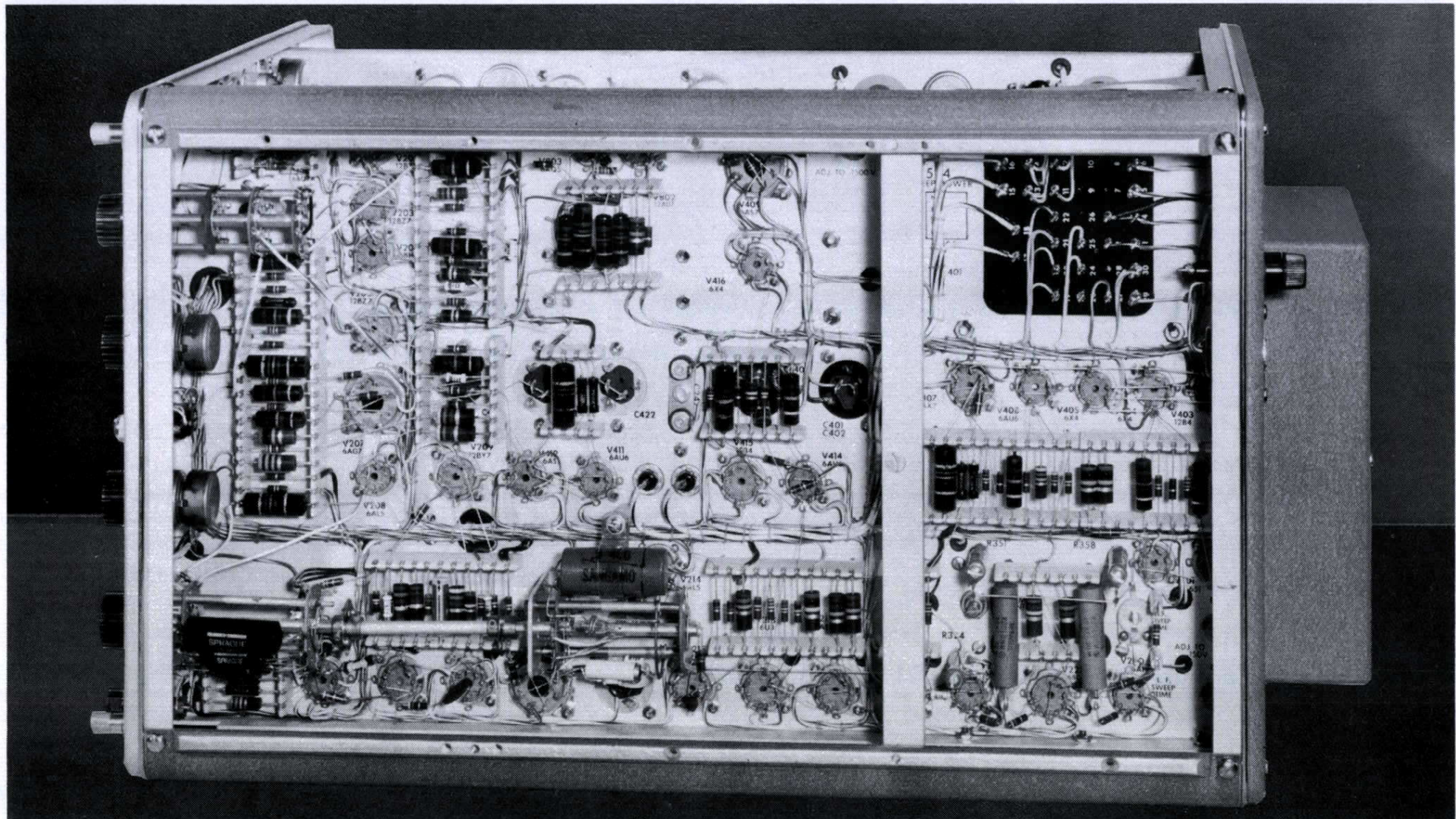
Probe—The vertical sensitivity is reduced by a factor of 10 by use of a 10x attenuator probe supplied with the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately 15 μ f.

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 Unblinking—The unblinking 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.

Alignment of Cathode-Ray Tube—Should it become necessary to touch up the alignment of the cathode-ray tube, a molded nylon handle on the crt socket can be reached in a matter of seconds. Release the two quick-opening fasteners on the left cabinet side, and lower the cabinet side out of the way, or remove it completely.

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.

ELECTRON-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



TYPE 524AD OSCILLOSCOPE

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
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 (331-009)
 1—H510 viewing hood
 1—Instruction manual

Special Models

Rack Mounting Add \$45

Since special models require additional manufacturing time, please check with your Tektronix Field Engineer or Representative for exact delivery schedules.

Optional Phosphors

P1 crt phosphor normally furnished.

P7, P11 optional No extra charge

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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

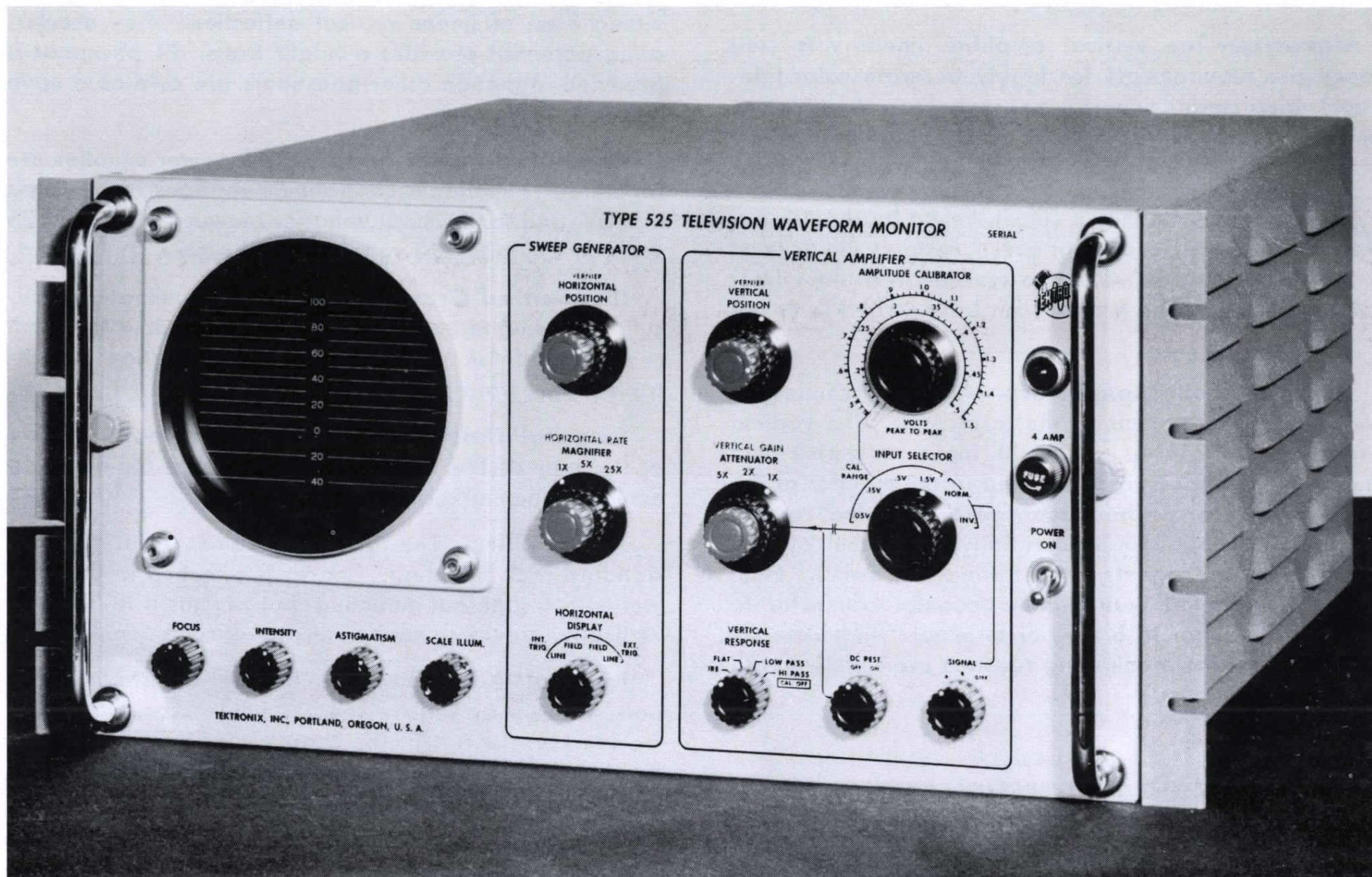
See Accessory Section of this catalog for 75-ohm coaxial cables, pads, and terminating resistors.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



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. External triggering requires a signal of at least 0.5-v amplitude.

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.

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.

ELECTRON-TUBE COMPLEMENT

Vertical input cathode followers		12AT7
Vertical phase splitter amplifier	2	6CB6
Cathode followers		6BQ7A
Preamplifier	2	6CL6
Preamplifier output CF		6BQ7A
Cathode followers		6BQ7A
Cathode followers		6BQ7A
Keyed-clamp diodes	2	6AL5
High-pass amplifier		6BQ7A
Cathode followers		6BQ7A
Output amplifier	2	6CL6
Internal trigger inverter		6U8
External trigger inverter		6U8
Sync-separator and clamp		6U8
Keying-pulse pickoff and shaper		6U8
Keying-pulse shaper and shaper-splitter		6BQ7A
Disconnect and clamp diode		6AL5
Clamp diode and unblanking CF		6BQ7A
Phantastron sweep generator		6AS6
Cathode followers		6BQ7A
Sweep amplifier		6BQ7A
Cathode followers		6BQ7A
Sweep output amplifier		6BQ7A
Cal multivibrator and CF		6BQ7A
Cal multivibrator and amplifier		6BQ7A



TYPICAL COLOR-TV WAVEFORMS AS VIEWED ON THE TYPE 525 TELEVISION WAVEFORM MONITOR

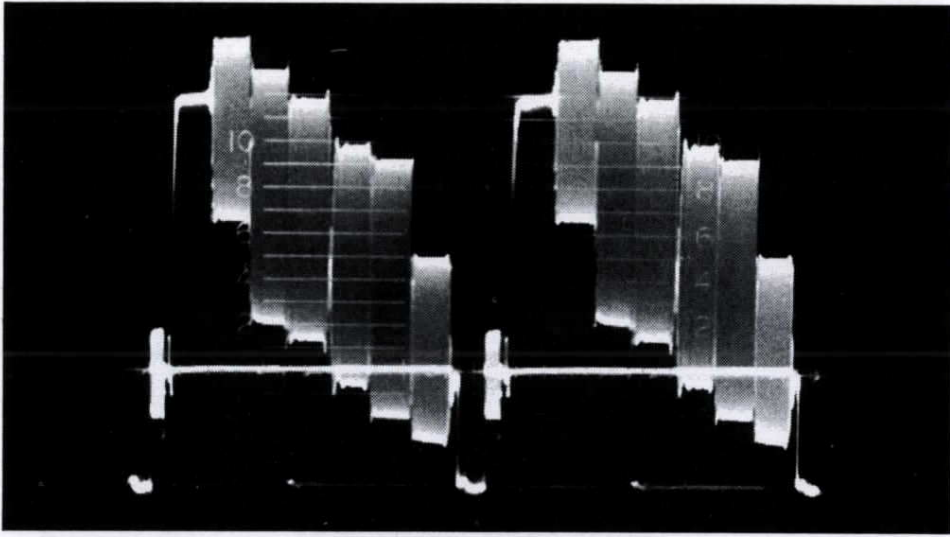


Fig. 1—Color-bar waveform with FLAT vertical response.

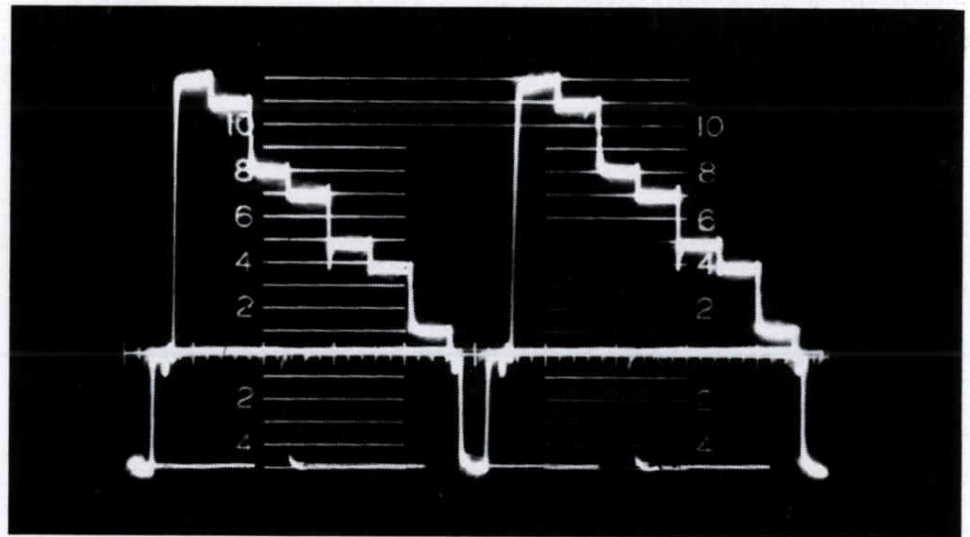


Fig. 2—Same waveform as Fig. 1 with LOW-PASS response.

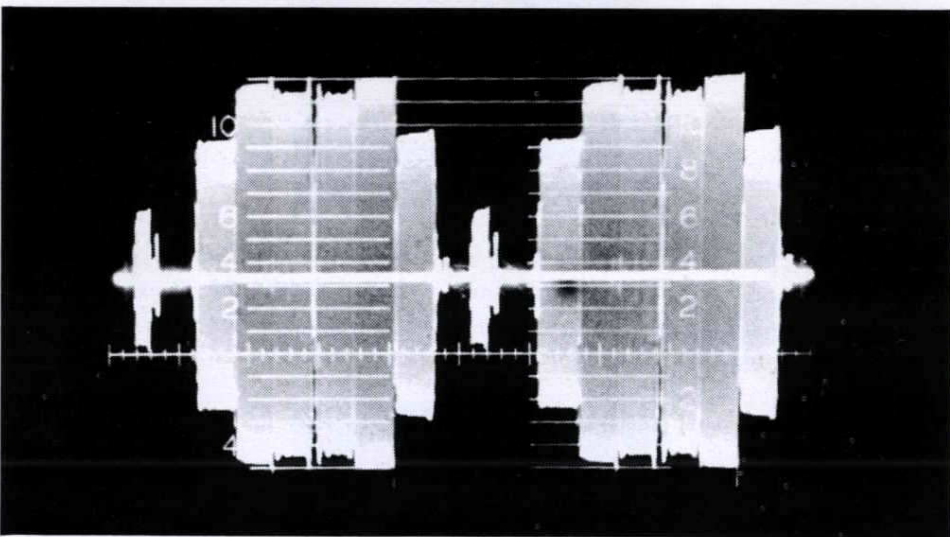


Fig. 3—Fig. 1 waveform with HIGH-PASS response.

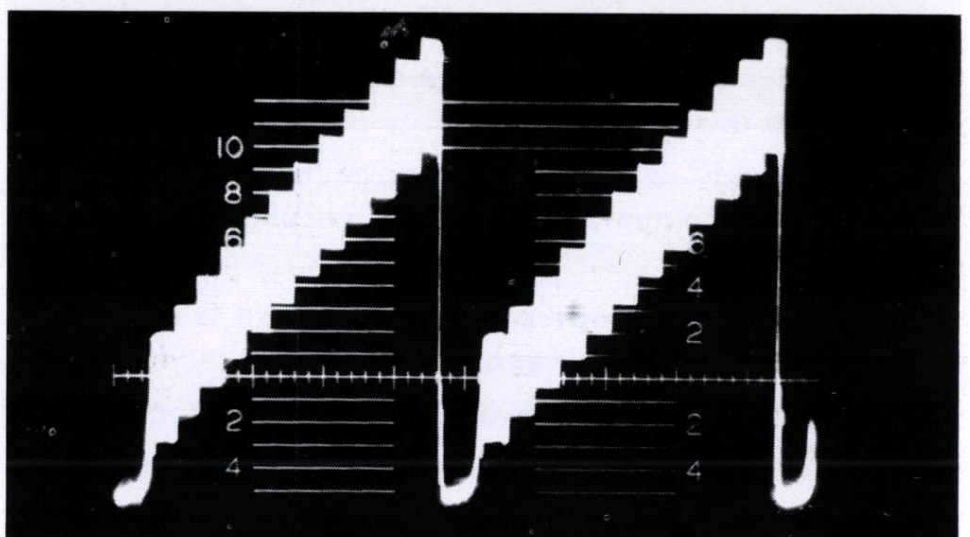


Fig. 4—Staircase with 3.58 mc added—FLAT vertical response.

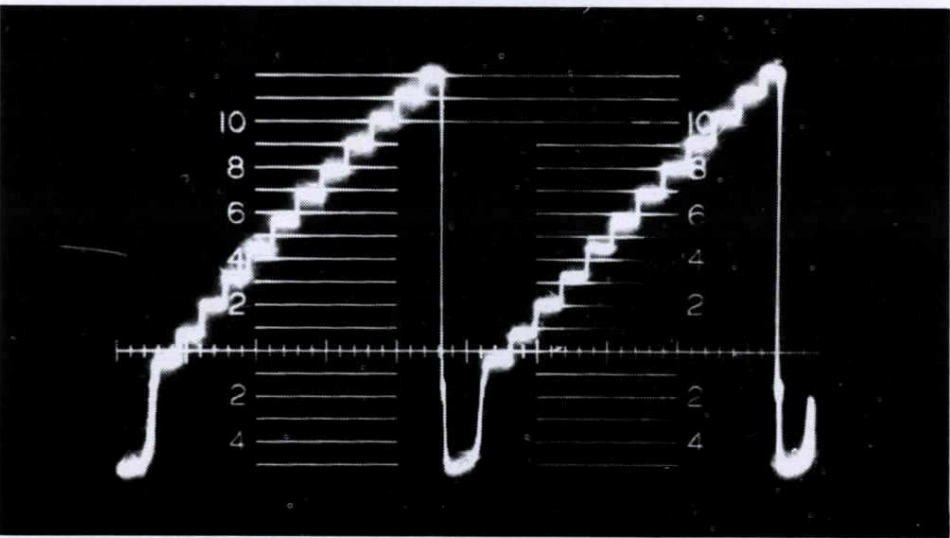


Fig. 5—Same waveform as Fig. 4 with LOW-PASS response.

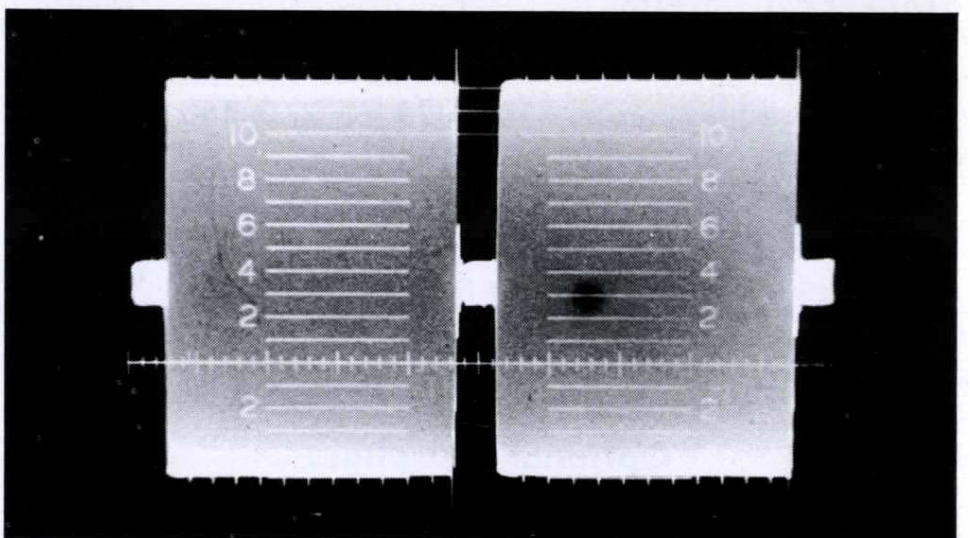


Fig. 6—Fig. 4 waveform with HIGH-PASS response.

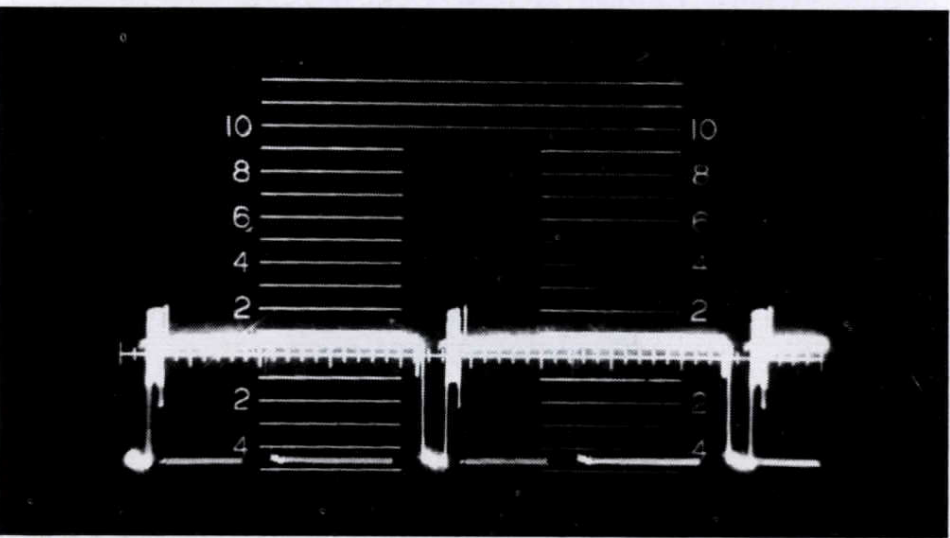


Fig. 7—Horizontal-sync pulse with color burst—FLAT vertical response.

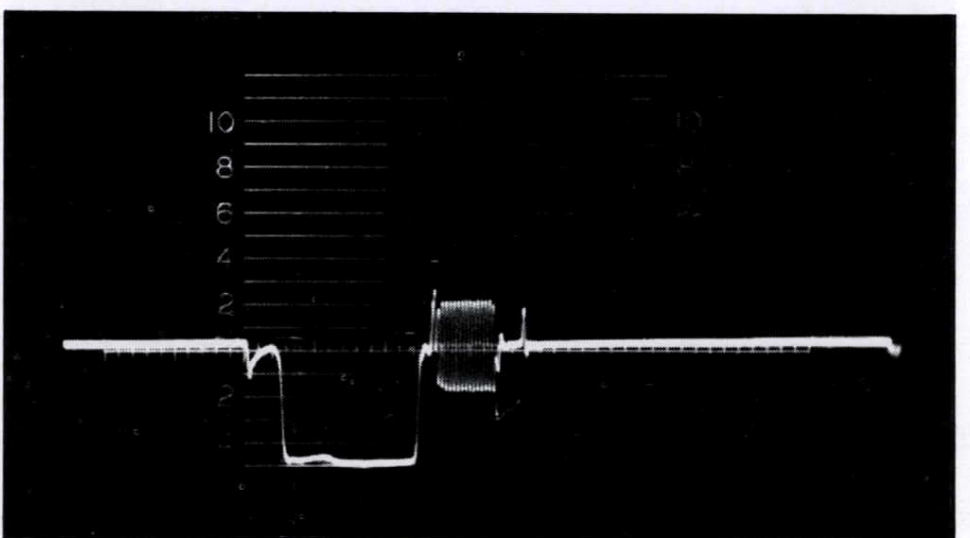


Fig. 8—Same as Fig. 7 with sweep magnified 5 times.

Photos taken through the courtesy of KPTV, Portland, Oregon.

TYPE 525 TELEVISION WAVEFORM MONITOR

Calibrator clamp and CF	6BQ7A
Voltage reference tube	5651
Comparator	12AT7
Comparator	6U8
Regulator amplifier and CF	6U8
Series regulator	12B4
Series regulator	6080
High-voltage oscillator	6AQ5
Voltage reference CF and regulator	12AT7
Comparator	6U8
High-voltage rectifiers	3 5642
Cathode-ray tube	T52P1

MECHANICAL SPECIFICATIONS

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

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

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

Construction—Aluminum-alloy cabinet and chassis.

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

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

Weight—54 pounds.

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

Type 525 **\$1050**

- Includes: 1—F510-5 green filter (378-503)
- 2—75-ohm termination resistors
- 1—Instruction manual

Optional Phosphors

P1 crt phosphor normally furnished.

P7, P11 optional No extra charge

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Special Models

Type 525MOD111—Equipped with intensifier for vertical-blanking-interval test signal. Additional circuitry provides for displaying the two or three lines of the vertical blanking interval that are used to carry transmission test signals. The cathode-ray tube is unblanked

only during the test-signal period. Sweep speed is automatically increased to a maximum sweep duration of approximately 60 μ sec so that a single line of the test signal can be displayed over the full screen width. Sweep repetition rate is consequently increased to 15.75 kc for maximum brightness. The start of the unblanking period is adjustable between 13 and 21 lines after the beginning of the vertical blanking interval; thus including all lines suitable for carrying test signals.

Type 525MOD111 **\$1095.00**

Modification Kit K525-111, for making above modification to existing instruments \$35.00

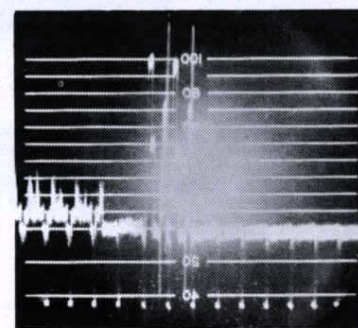


Fig. 9—Two-line test signal displayed at field sweep rate with 25-times sweep magnification. Vertical amplifier is set at FLAT response. (flat from 60 cycles to 5 mc).

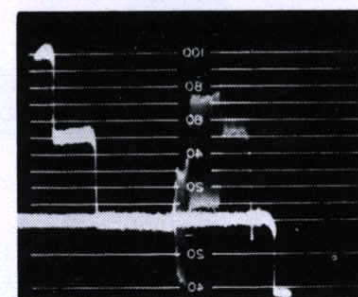


Fig. 10—Same test signal displayed with intensifier turned on. Sweep duration 60 μ sec at line rate, vertical amplifier set at FLAT response.

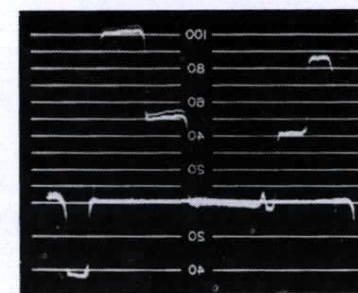


Fig. 11—Same test signal displayed with vertical amplifier switched to LOW PASS response. Sweep duration 70 μ sec at half the line rate.

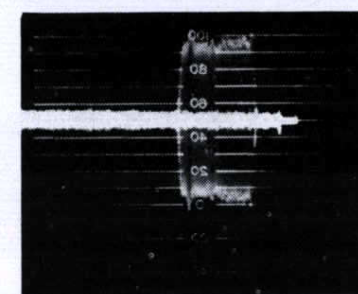
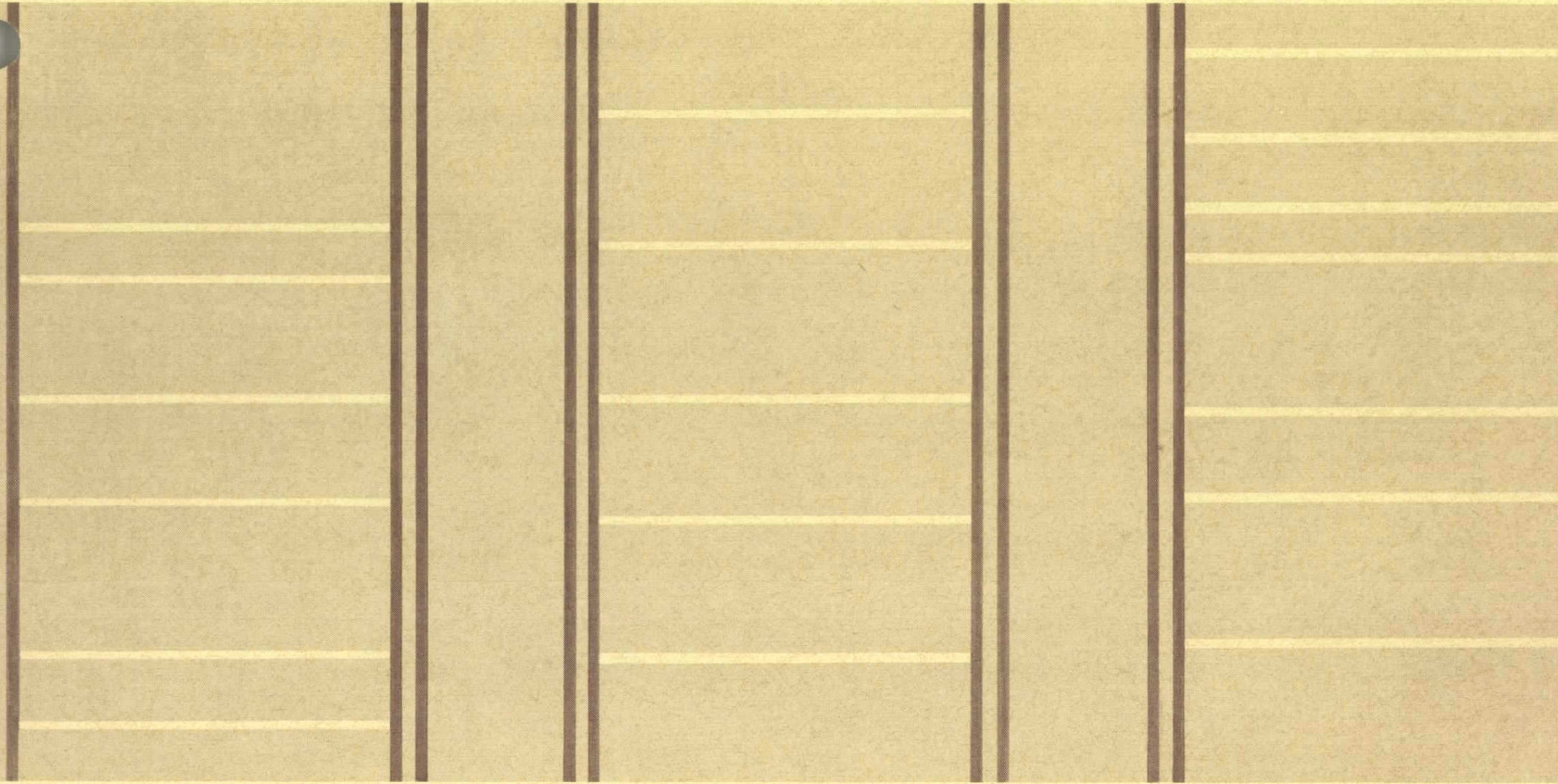
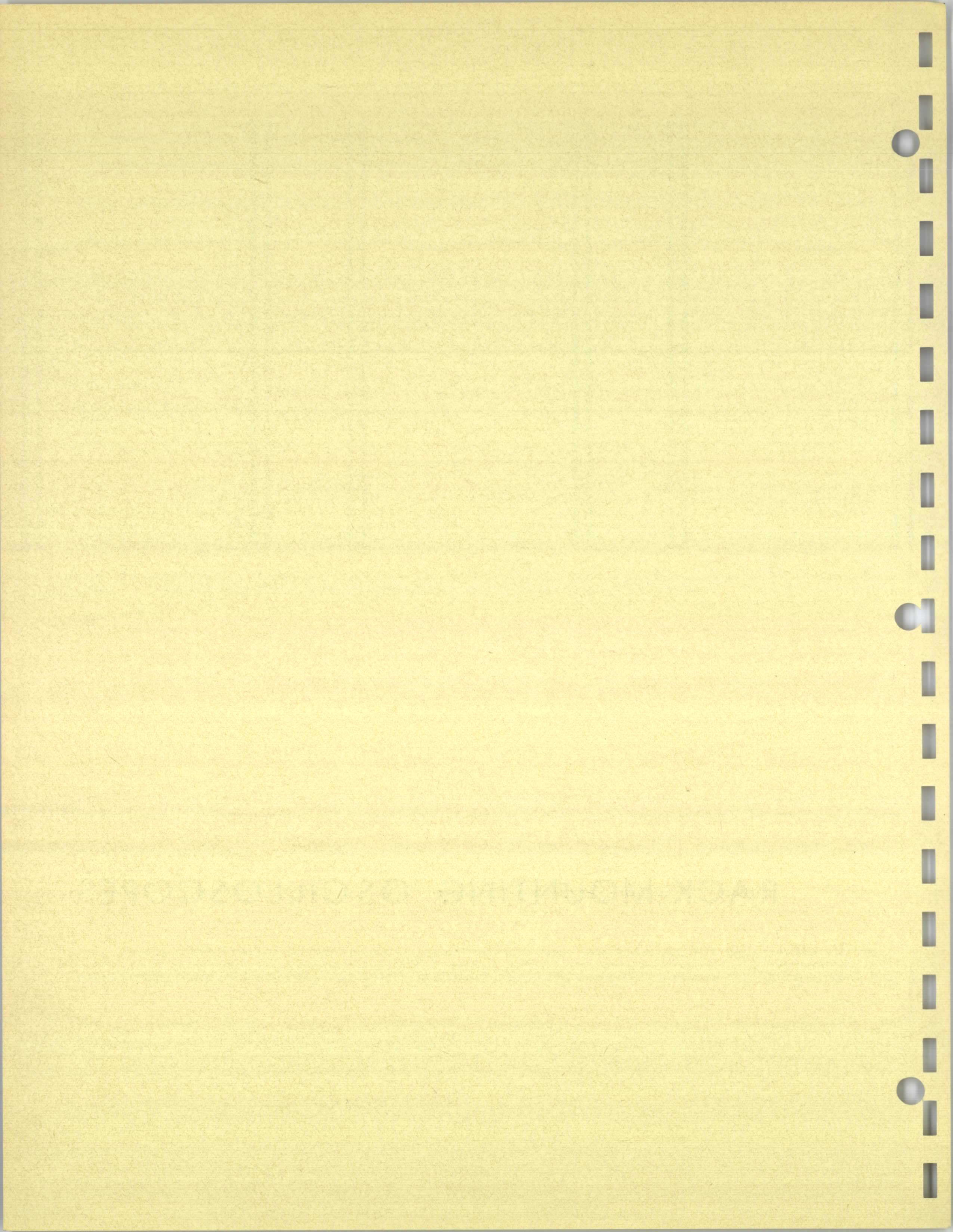


Fig. 12—Cross-modulation check—same test signal displayed with vertical amplifier switched to HIGH PASS response. Shows relative amplifications at the three luminance levels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



RACK-MOUNTING OSCILLOSCOPES



TYPE RM35 OSCILLOSCOPE

RACK-MOUNTING 5-INCH OSCILLOSCOPE With The Tektronix Plug-In Feature

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.

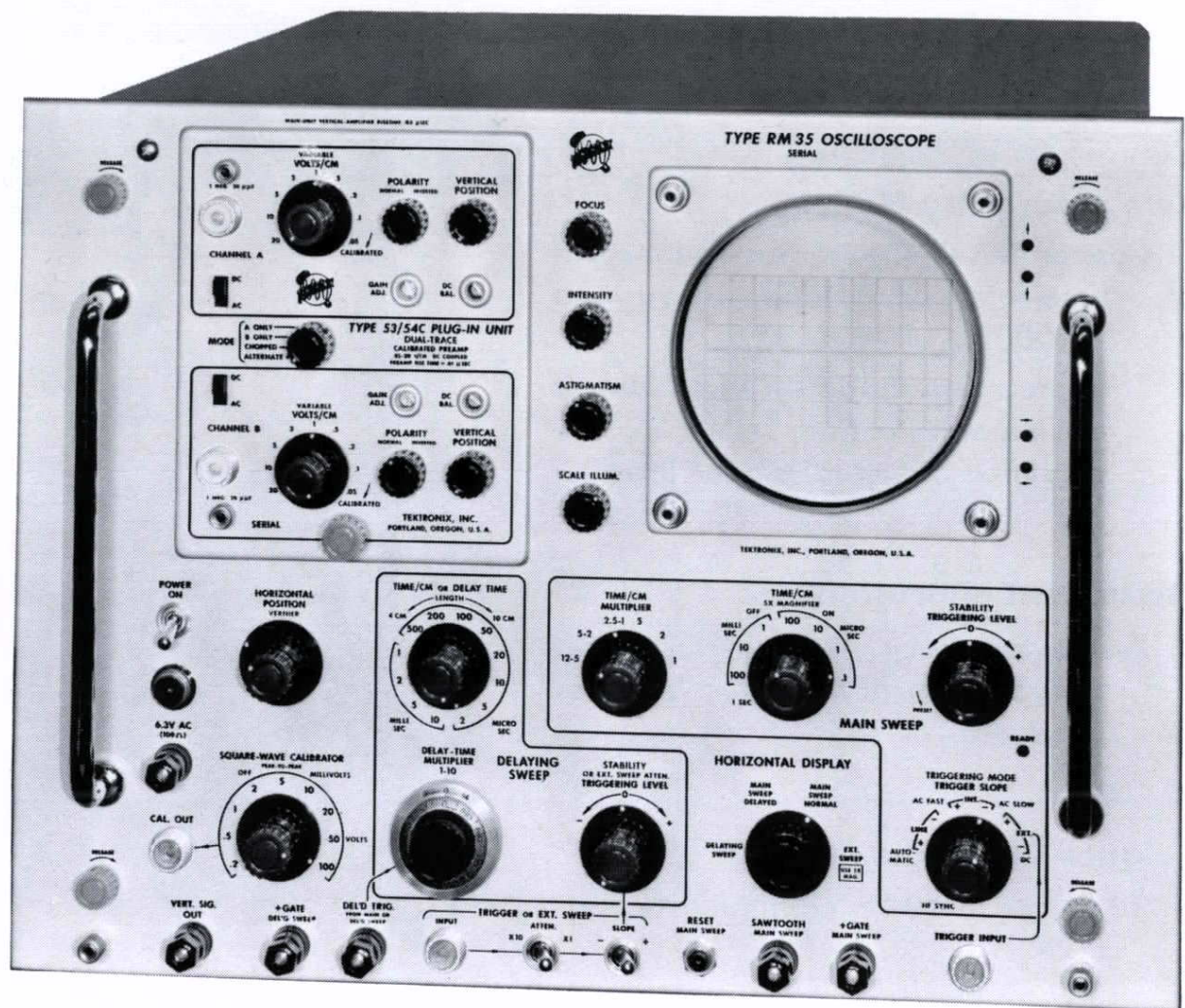
Triggered Operation — Jitter-free at any magnification, even in the presence of actual signal jitter.

Accurate Calibration

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

Trigger Rate Source

10 cycles to 40 kc, continuously variable.



GENERAL DESCRIPTION

The Type RM35 is a mechanically rearranged Type 535 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 RM35 are the same as described for the Tektronix Type 535 Oscilloscope. Controls and terminals are located for maximum convenience in rack-mounted operation.

MECHANICAL SPECIFICATIONS

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

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

Finish—Photo-etched anodized panel, etched aluminum cabinet.

Dimensions—14" high, 19" wide, 22 1/2" rack depth. Please see page 100 for complete dimensions.
Weight—68 pounds.

Type RM35, without plug-in units \$1400

Includes: 2—P510A probes
2—A510 binding post adapters
1—Test lead (012-031)
1—F510-5 green filter (378-503)
1—Instruction manual

Painted Panels

Tektronix instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE RM45 OSCILLOSCOPE

RACK-MOUNTING 5-INCH OSCILLOSCOPE

With The Tektronix Plug-In Feature

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.

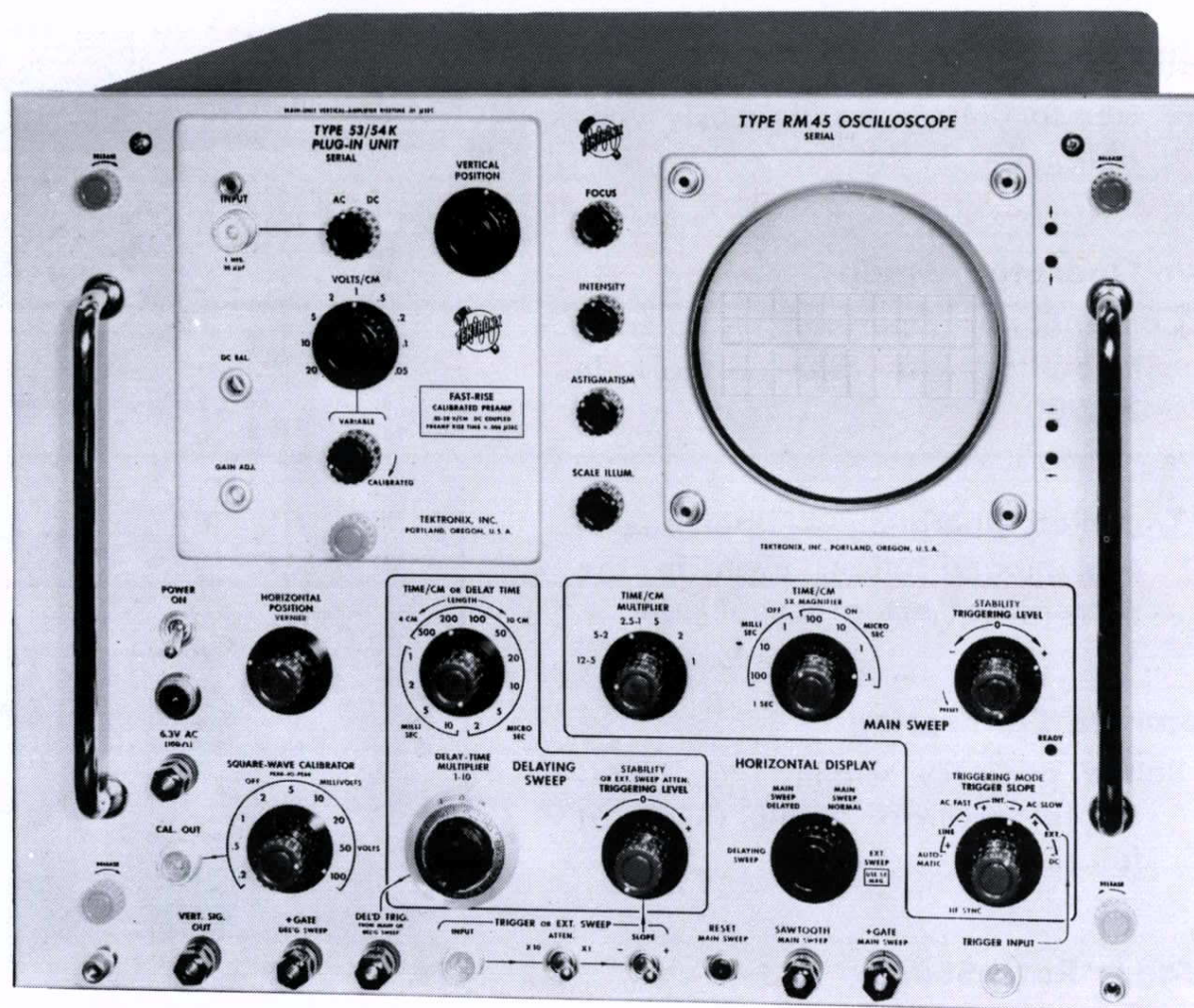
Triggered Operation — Jitter-free at any magnification, even in the presence of actual signal jitter.

Accurate Calibration

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

Trigger Rate Source

10 cycles to 40 kc, continuously variable.



GENERAL DESCRIPTION

The Type RM45 is a mechanically rearranged Type 545 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 RM45 are the same as described for the Tektronix Type 545 Oscilloscope. Controls and terminals are located for maximum convenience in rack-mounted operation.

MECHANICAL SPECIFICATIONS

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

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

Finish—Photo-etched anodized panel, etched aluminum cabinet.

Dimensions—14" high, 19" wide, 22 1/2" rack depth. Please see page 100 for complete dimensions.

Weight—68 pounds.

Type RM45, without plug-in units \$1550

- Includes: 2—P410 probes
- 2—A510 binding-post adapters
- 1—Test lead (012-031)
- 1—Green filter (378-514)
- 1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE RM41 OSCILLOSCOPE

RACK-MOUNTING 5-INCH OSCILLOSCOPE With The Tektronix Plug-In Feature

Excellent Transient Response

Main-unit vertical-amplifier risetime
— 10 millimicroseconds.

Wide Range of Vertical-Amplifier Characteristics

Instant convertability through interchangeable plug-in preamplifiers.

Wide Sweep Range

0.02 μ sec/cm to 12 sec/cm.

Versatile Triggering Circuitry

Amplitude-level selection with preset or manual stability control, and fully-automatic triggering.

10-kv Accelerating Potential

Full 4 cm x 10 cm Linear Deflection



GENERAL DESCRIPTION

The Type RM41 is a mechanically rearranged Type 541 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 RM41 are the same as described for the Tektronix Type 541 Oscilloscope. Controls and terminals are located for maximum convenience in rack-mounted operation.

MECHANICAL SPECIFICATIONS

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

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

Finish—Photo-etched anodized panel, etched aluminum cabinet.

Dimensions—14" high, 19" wide, 22 1/2" rack depth. Please see page 100 for complete dimensions.
Weight—64 1/2 pounds.

Type RM41, without plug-in units \$1245

- Includes: 2—P410 probes
- 2—A510 binding-post adapters
- 1—Test lead (012-031)
- 1—Green filter (378-514)
- 1—Instruction manual

Painted Panels

Tektronix instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE RM31 OSCILLOSCOPE

RACK-MOUNTING 5-INCH OSCILLOSCOPE With The Tektronix Plug-In Feature

Wide Range of Vertical-Amplifier Characteristics

Instant convertibility through interchangeable plug-in preamplifiers.

Excellent Transient Response

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

Wide Sweep Range

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

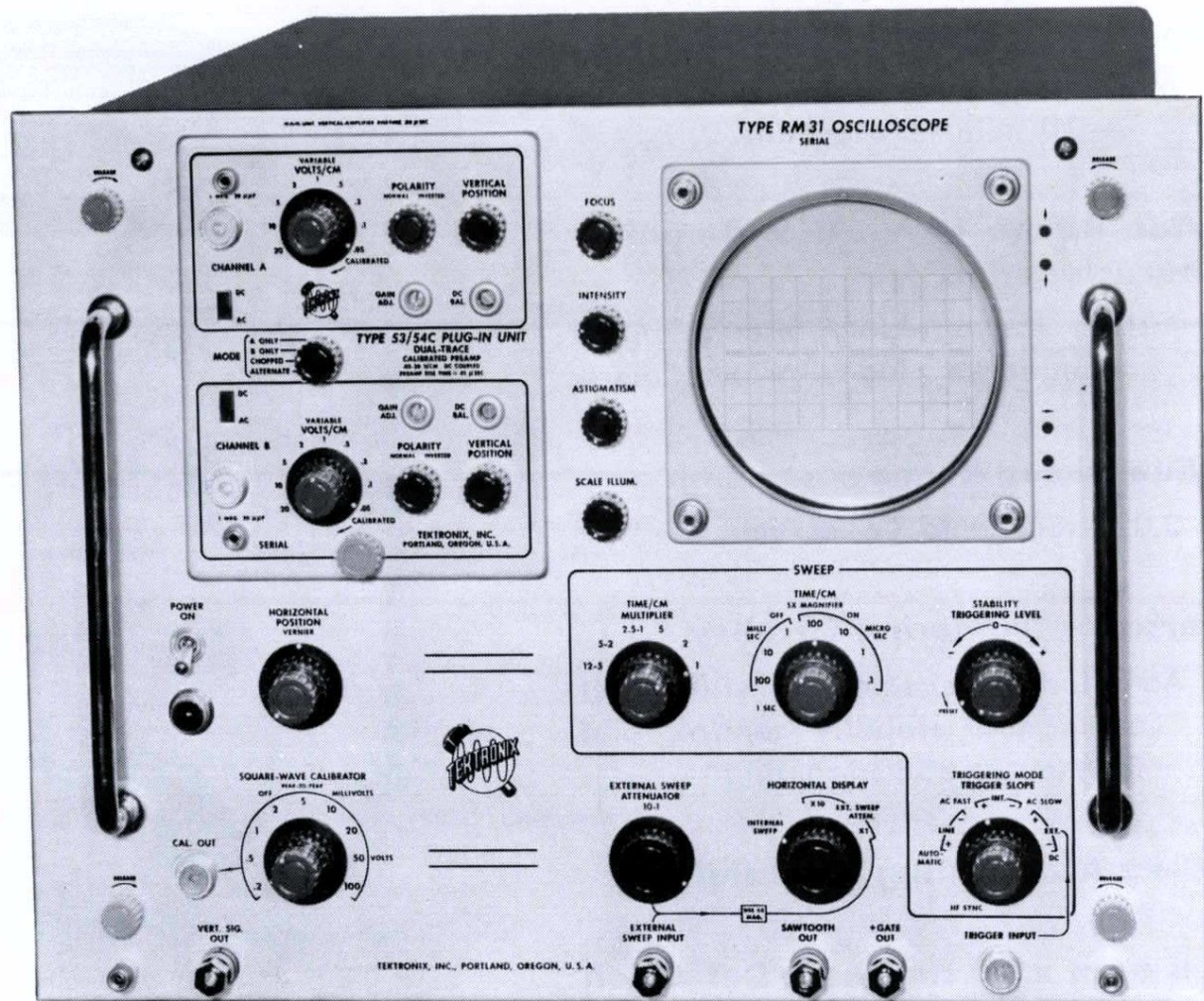
Versatile Triggering Circuitry

Amplitude-level selection with preset or manual stability controls, and fully-automatic triggering.

10-KV Accelerating Potential

Bright display at low repetition rates. $250\text{-cm}/\mu\text{sec}$ writing rate.

6-cm Linear Vertical Deflection



GENERAL DESCRIPTION

The Type RM31 is a mechanically rearranged Type 531 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 RM31 are the same as described for the Tektronix Type 531 Oscilloscope. Controls and terminals are located for maximum convenience in rack-mounted operation.

MECHANICAL SPECIFICATIONS

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

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

Finish—Photo-etched anodized panel, etched aluminum cabinet.

Dimensions—14" high, 19" wide, 22 1/2" rack depth. Please see page 100 for complete dimensions.

Weight—64 1/2 pounds.

Type RM31, without plug-in units \$1095

- Includes: 2—P510A probes
- 2—A510 binding post adapters
- 1—Test lead (012-031)
- 1—F510-5 green filter (378-503)
- 1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

TYPE RM32 OSCILLOSCOPE

RACK-MOUNTING 5-INCH OSCILLOSCOPE With The Tektronix Plug-In Feature

Designed for Extra Dependability

Wide Sweep Range

0.2 μ 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 μ sec.

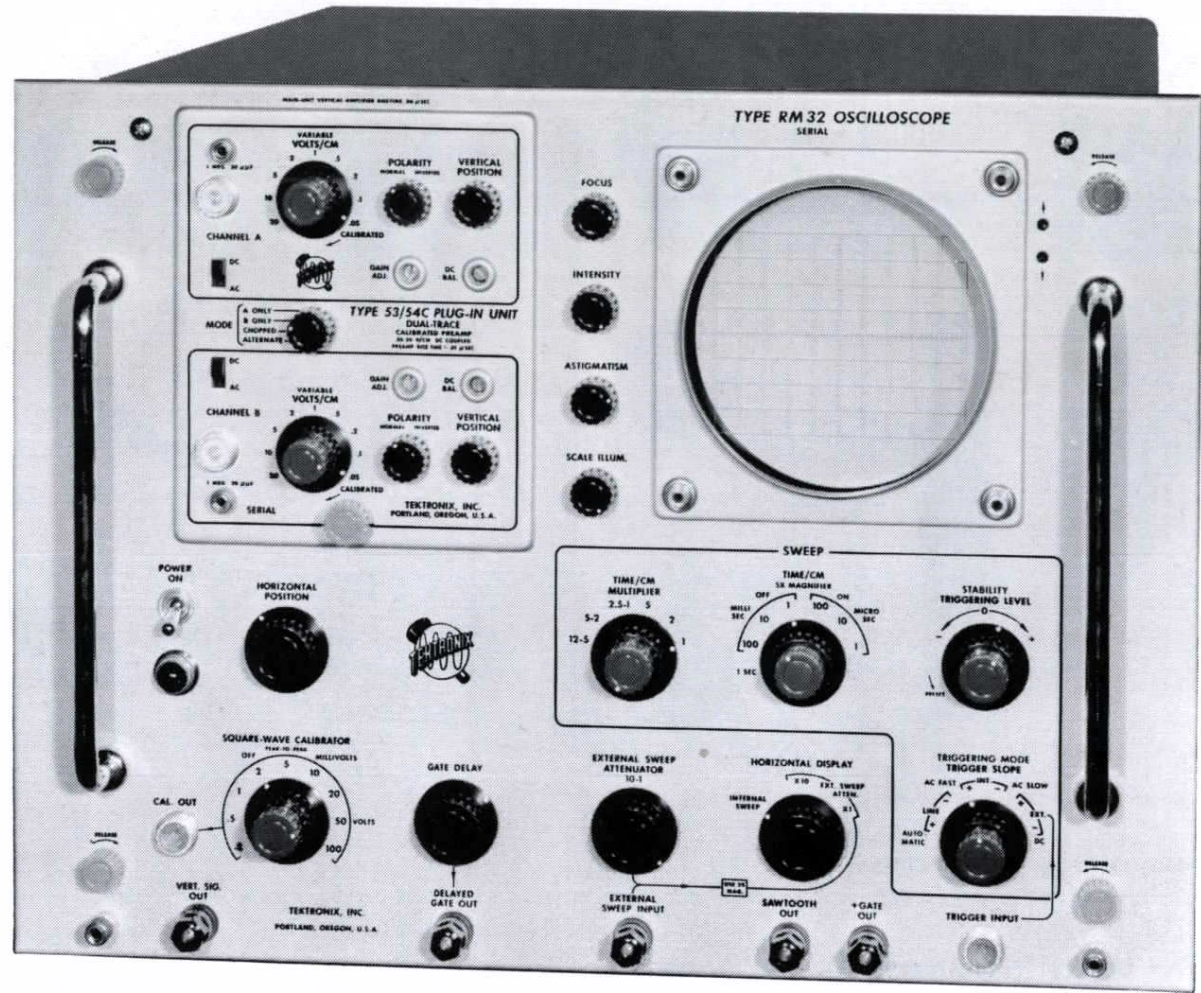
Versatile Triggering Circuitry

Amplitude-level selection with preset or manual stability control, and fully-automatic triggering.

Horizontal Input Amplifier

8-cm Linear Vertical Deflection

DC-Coupled Unblanking



GENERAL DESCRIPTION

The Type RM32 is a mechanically rearranged Type 532 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 RM32 are the same as described for the Tektronix Type 532 Oscilloscope. Controls and terminals are located for maximum convenience in rack-mounted operation.

MECHANICAL SPECIFICATIONS

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

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

Finish—Photo-etched anodized panel, etched aluminum cabinet.

Dimensions—14" high, 19" wide, 22 1/2" rack depth. Please see page 100 for complete dimensions.
Weight—55 pounds.

Type RM32, without plug-in units \$925

- Includes: 2—P510A probes
- 2—A510 binding post adapters
- 1—Test lead (012-031)
- 1—F510-5 green filter (378-503)
- 1—Instruction manual

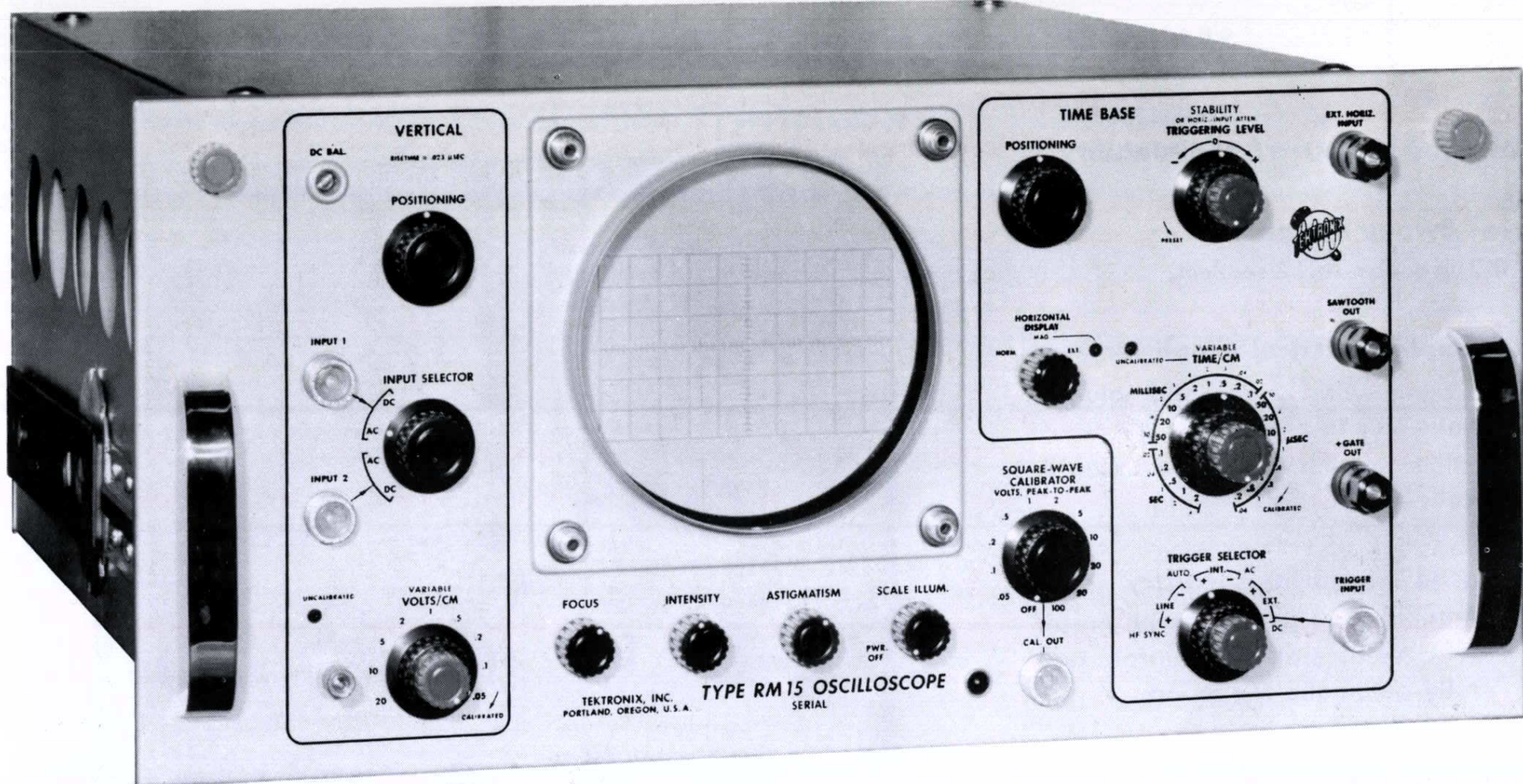
Painted Panels

Tektronix instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

TYPE RM15 OSCILLOSCOPE

Rack-Mounting 5-Inch Oscilloscope



Frequency Response—DC to 15 mc.

Transient Response—0.023- μ sec risetime.

Vertical Deflection Factor

9 calibrated steps from 0.05 v/cm to 20 v/cm.
0.05 v/cm to 50 v/cm, continuously variable.

Sweep Range

22 calibrated steps from 0.2 sec/cm to 2 sec/cm.
0.04 μ sec/cm to 6 sec/cm, continuously variable.
Accurate 5x magnifier increases calibrated rate to
0.04 μ sec/cm.

Triggering

Amplitude-level selection with preset or manual stability control, and fully-automatic triggering.

GENERAL DESCRIPTION

The Type RM15 is a mechanically rearranged Type 515A 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 515A Oscilloscope. Controls and terminals are located for maximum convenience in rack-mounted operation.

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, etched aluminum cabinet.

Dimensions—8 $\frac{3}{4}$ " high, 19" wide, 23" rack depth. Please see page 100 for complete dimensions.

Weight—43 pounds.

Type RM15 (50 to 60 cycle supply) \$825

Type RM15-S1 (50 to 800 cycle supply) \$860

Includes: 1—P410 attenuator probe
2—A510 binding-post adapters
1—Green filter (378-514)
1—Instruction manual

Painted Panels

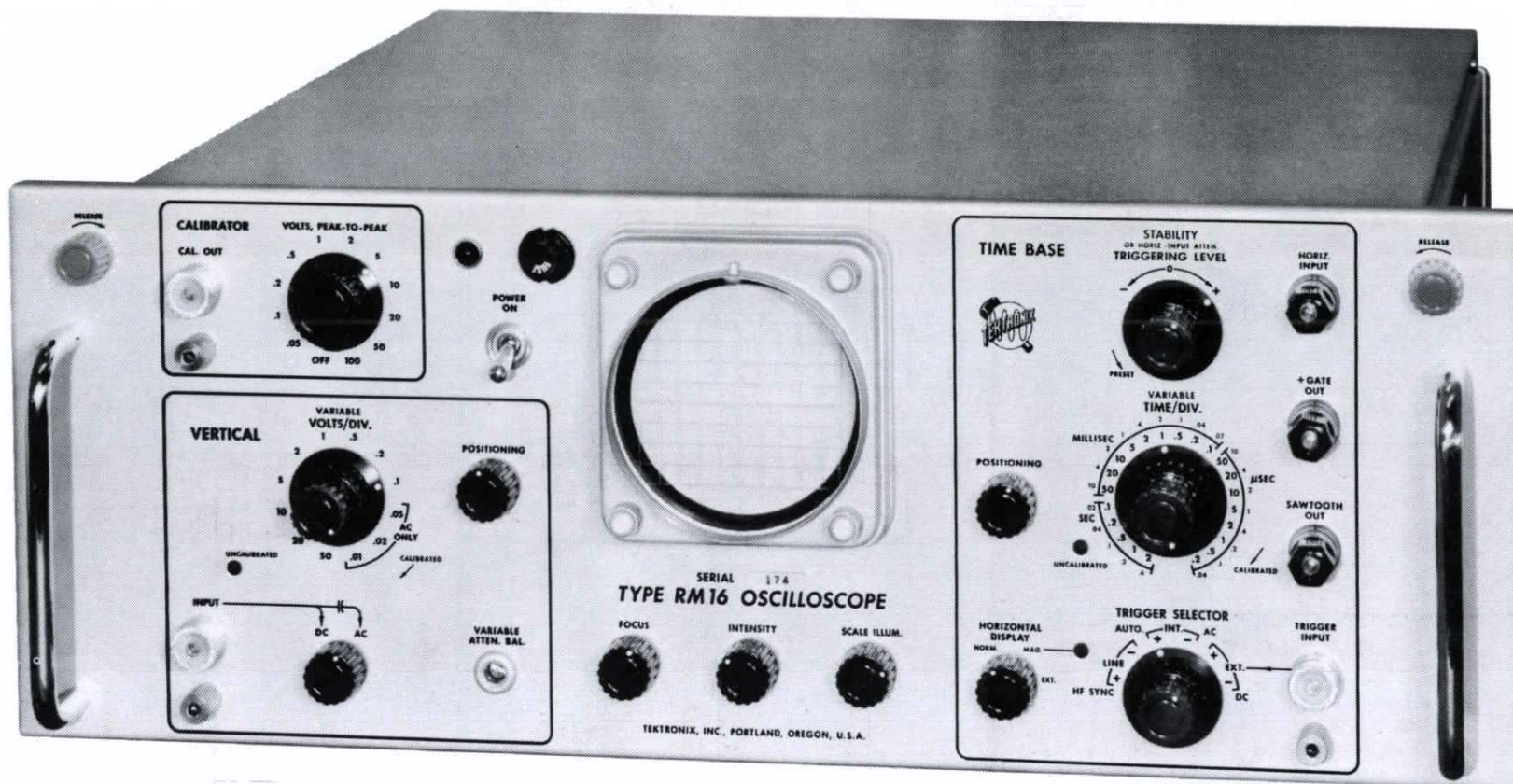
Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE RM16 OSCILLOSCOPE

Rack-Mounting 3-Inch Oscilloscope



Rack height only 7 inches.

Frequency Response

DC to 10 mc at 0.1 v/div to 125 v/div.
2 cycles to 10 mc at 0.01 v/div to 0.1 v/div.

Transient Response

Risetime—0.035 μ sec.

Sweep Range

22 calibrated sweep rates from 0.2 μ sec/div to 2 sec/div, continuously variable from 0.04 μ sec/div to 6 sec/div. Accurate 5x magnifier increases calibrated rate to 0.04 μ sec/div.

Triggering

Amplitude-level selection with preset or manual stability control, and fully-automatic triggering.

GENERAL DESCRIPTION

The Type RM16 is a mechanically rearranged Type 316 Oscilloscope for mounting in a standard 19-inch rack. The instrument mounts to the rack on slide-out tracks. It can be pulled forward and tilted for servicing convenience.

OTHER CHARACTERISTICS

Electrical characteristics of the RM16 are the same as described for the Tektronix Type 316. Please refer to the Type 316 Section for complete electrical specifications. Controls and terminals are located for maximum convenience in rack-mounted operation.

MECHANICAL SPECIFICATIONS

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

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

Finish—Photo-etched anodized panel, etched aluminum cabinet.

Dimensions—19" wide, 7" high, 17 $\frac{5}{8}$ " rack depth. Please see page 100 for complete dimensions.

Weight—Approximately 40 pounds.

Type RM16 (50 to 60 cycle supply) **\$795**
Type RM16-S1 (50 to 800 cycle supply) **\$830**

Includes: 1—P510A attenuator probe
2—A510 binding-post adapters
1—Green filter (378-509)
1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Special Models

Type RS16—A two-unit model of the Type RM16 for racks with limited depth. The power-supply unit has a built-in fan for forced ventilation. The indicator unit requires a minimum of 50 cfm of cooling air from a separate source to prevent overheating when operated continuously. Both units bolt directly to the rack; do not have slide-out mounting. A 60" power cable is furnished. Dimensions are: Indicator Unit—7" high, 19" wide, 11 $\frac{3}{8}$ " deep; Power Supply—7" high, 19" wide, 5 $\frac{1}{2}$ " deep.

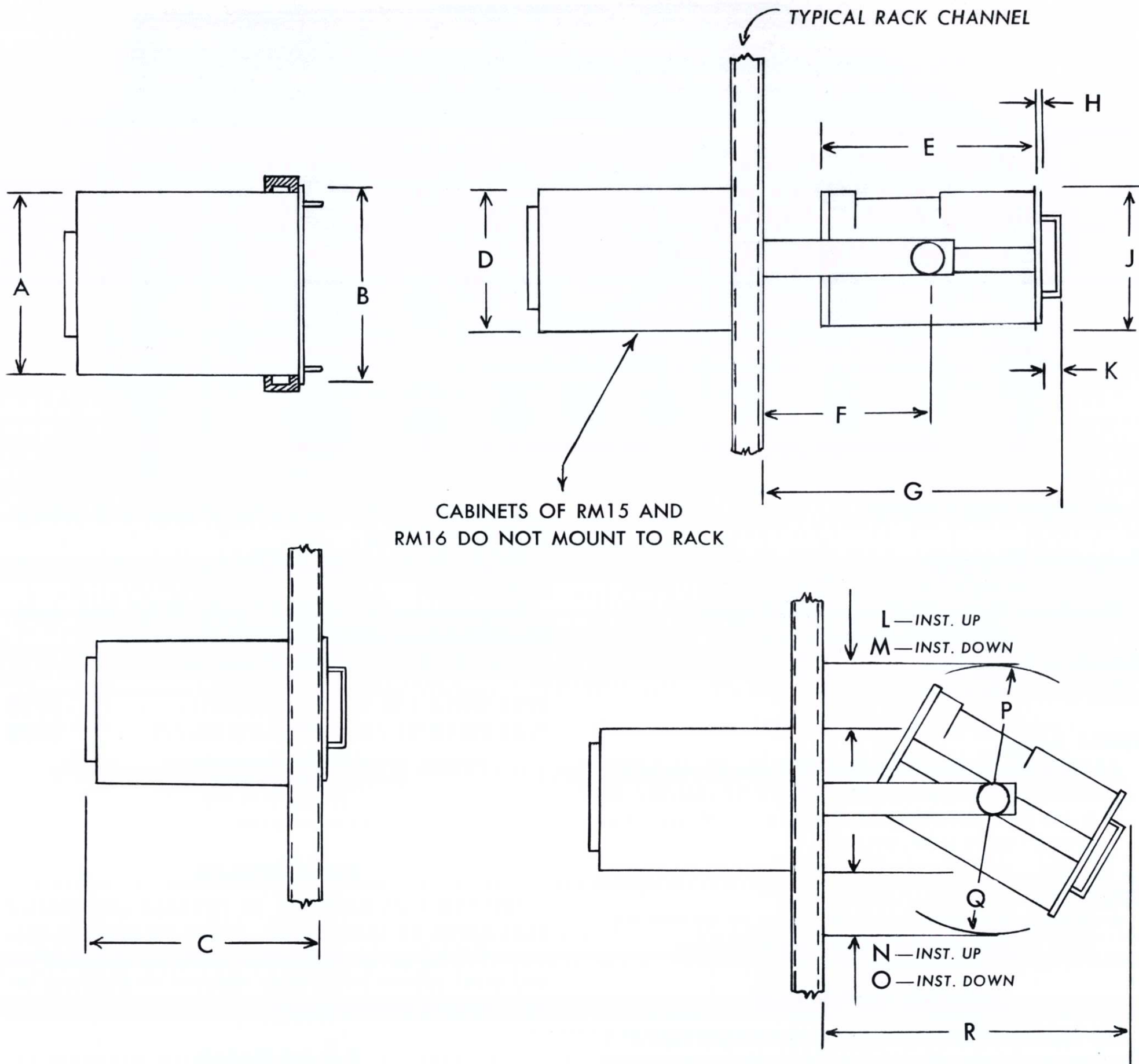
Type RS16 **\$850**

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



MOUNTING DIMENSIONS

for Tektronix RM Oscilloscopes

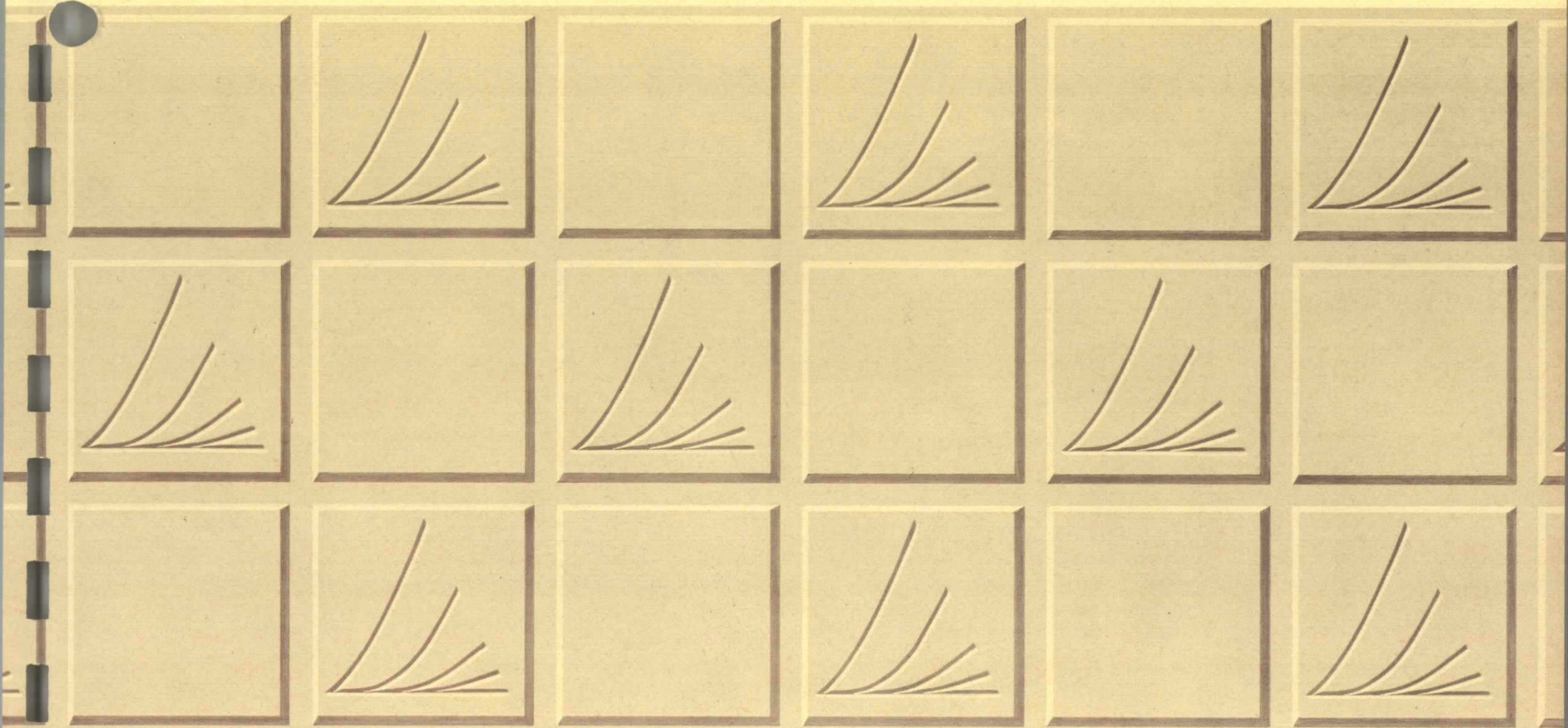


INST.	A	B	C	D	E	F	G	H
RM15	16 ¹¹ / ₁₆	19	22 1/2	8 3/8	21 3/8	*16 5/8	*29 ⁷ / ₁₆	1/4
RM16	16 3/4	19	17 5/8	6 ¹³ / ₁₆	16 ⁹ / ₁₆	*12 ⁹ / ₁₆	*24 ⁹ / ₁₆	1/4
RM30/40	17 1/2	19	22 1/2	13 ¹⁵ / ₁₆	21 1/4	16 3/8	28 ⁵ / ₁₆	5/16

INST.	J	K	L	M	N	O	P	Q	R
RM15	8 ¹¹ / ₁₆	1 1/8	8 ⁹ / ₁₆	6 1/2	6 1/2	8 ⁹ / ₁₆	10 ¹¹ / ₁₆	12 3/4	*29 3/4
RM16	7	1 1/2	8 ¹³ / ₁₆	4 ¹³ / ₁₆	4 ¹³ / ₁₆	8 ¹³ / ₁₆	8 1/4	12 1/4	*25
RM30/40	13 ¹¹ / ₁₆	1 3/4	5 ⁹ / ₁₆	6 1/4	6 1/4	5 ⁹ / ₁₆	13 1/4	12 ⁷ / ₁₆	28 ¹³ / ₁₆

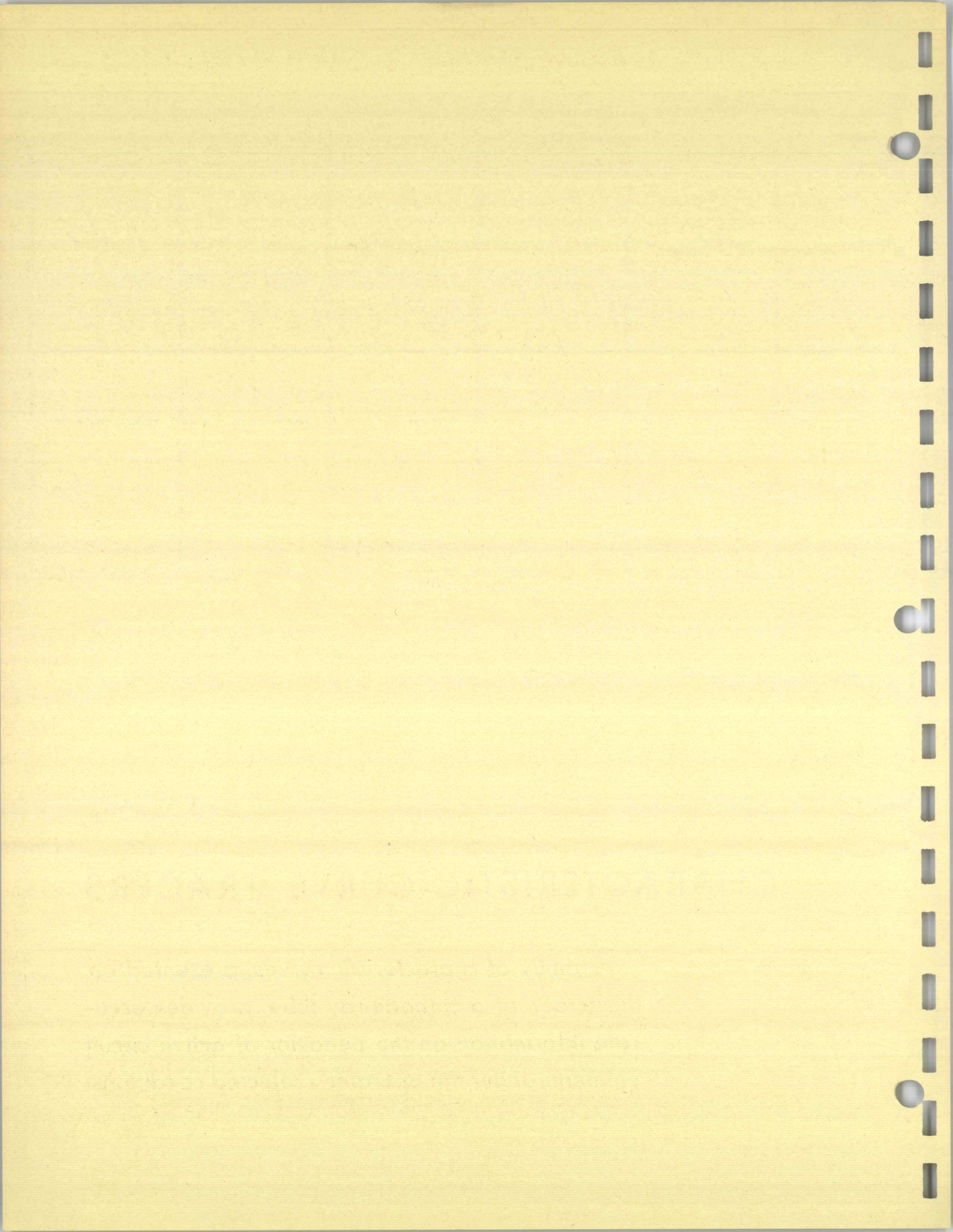
*DIMENSION DETERMINED WITH TRACK MOUNTED ON FRONT OF RACK





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 Electron-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 electron-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 electron-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 electron tubes.

The Type 570 is also an excellent tool for the instructor in electronics, both in the classroom and in the laboratory.

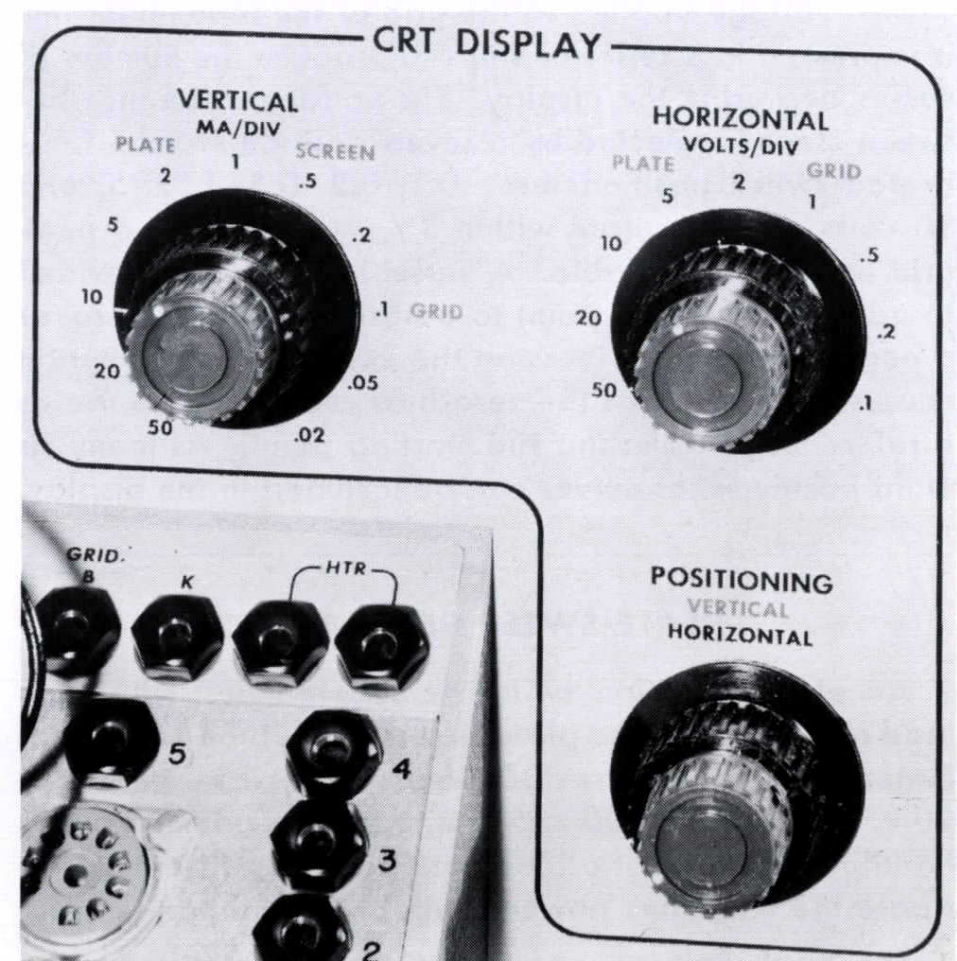
CATHODE-RAY-TUBE DISPLAY

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.

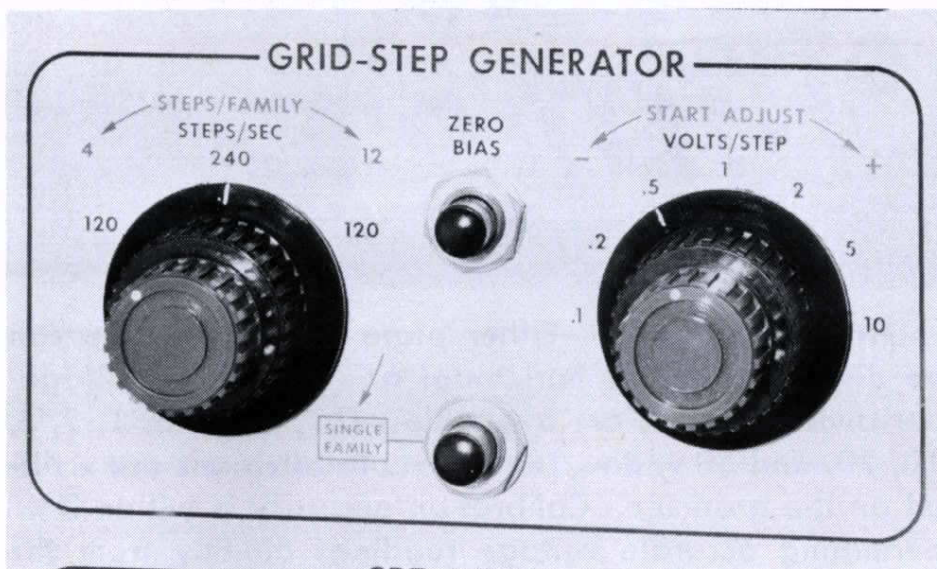


TYPE 570 CHARACTERISTIC-CURVE TRACER

GRID-STEP GENERATOR

Family of Curves—A variable control is provided to adjust the number of curves in the display. As few as four and as many as twelve curves can be selected. A single family can be safely displayed with the tube under heavy overload conditions by means of a position on the STEPS/FAMILY control and a push button. With the STEPS/FAMILY control in the single-family position, pressing the button applies the selected conditions to the tube for only a fraction of 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



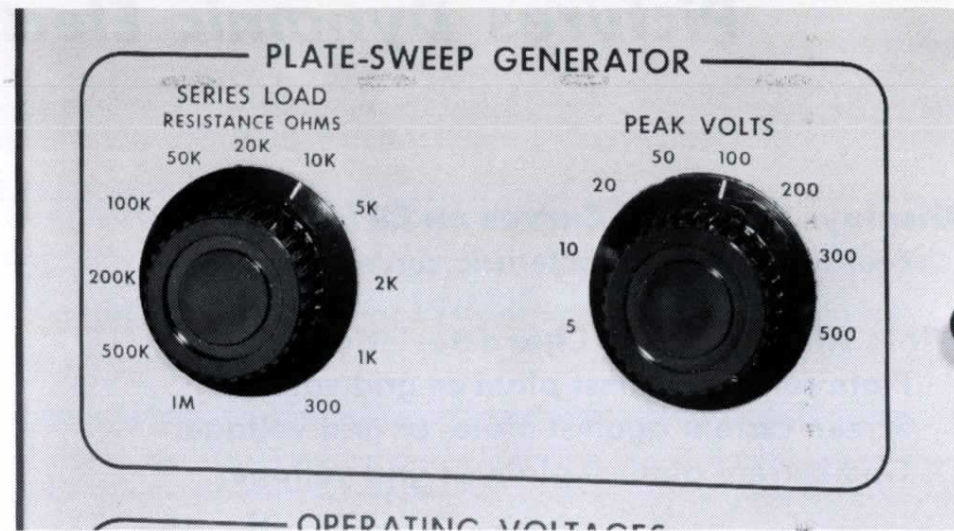
either end of the curves displayed. (When the Type 570 is used with a 50-cycle supply frequency, the step/sec rate will be either 100 or 200.)

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.

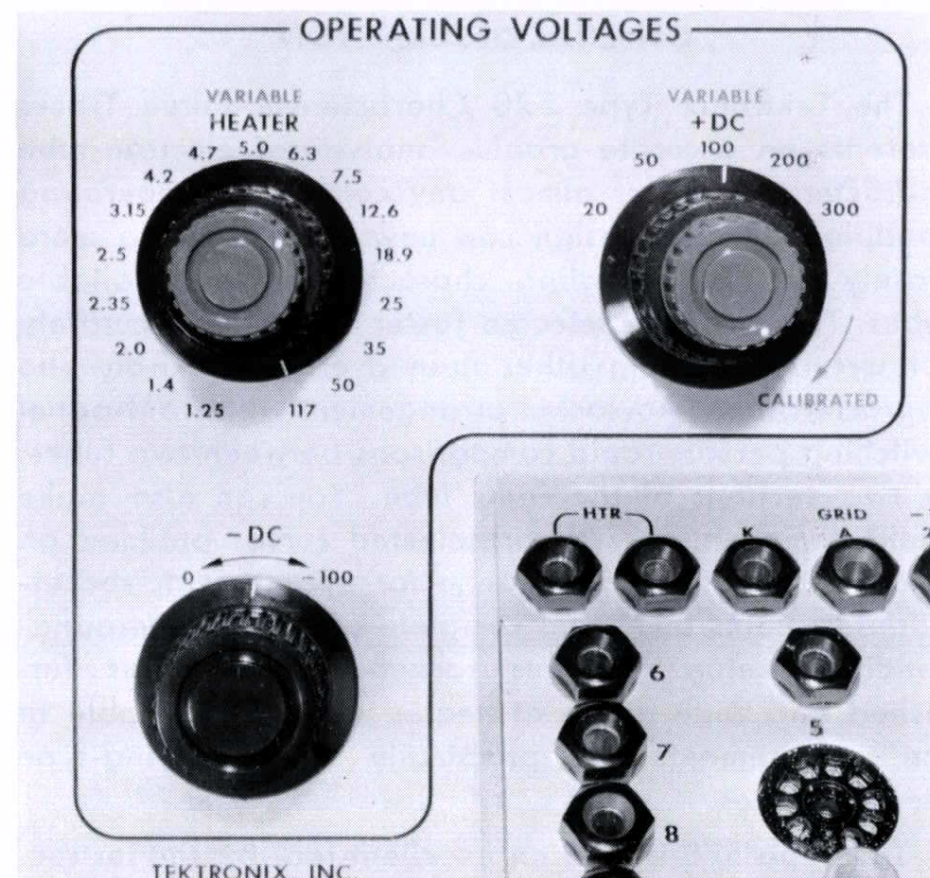
The peak voltage applied to the plate through the



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



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.

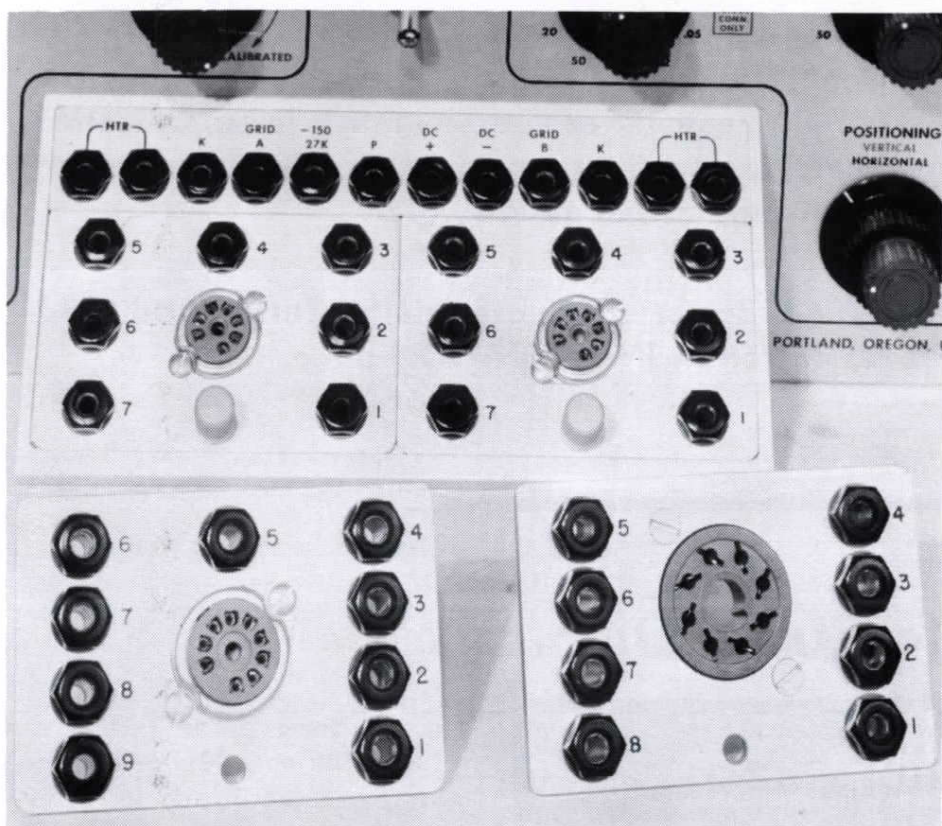
TYPE 570 CHARACTERISTIC-CURVE TRACER

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.

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.

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.

Alignment of Cathode-Ray Tube—Should it become necessary to touch up the alignment of the cathode-ray tube, a molded nylon handle on the crt socket can be reached in a matter of seconds. Release the two quick-opening fasteners on the left cabinet side, and lower the cabinet side out of the way, or remove it completely.

Illuminated Graticule—The 10 x 10-division graticule is edge-lighted. Illumination of the graticule is controlled by a front-panel knob.

ELECTRON-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

TYPE 570 CHARACTERISTIC-CURVE TRACER

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:
- 2—7 pin adapter plates (012-004)
 - 2—8 pin adapter plates (016-005)
 - 2—9 pin adapter plates (016-006)
 - 2—Blank adapter plates (016-007)
 - 5—Double patch cords black 6" (012-023)
 - 5—Double patch cords red 6" (012-024)
 - 2—Suppressor cords 100 Ω 6" (012-025)
 - 2—Suppressor cords 300 Ω 6" (012-026)

- 2—Suppressor cords 1 k Ω 6" (012-027)
- 5—Single patch cords black 6" (012-028)
- 5—Single patch cords red 6" (012-029)
- 5—1/16 amp 3AG Fast-Blo fuses
- 1—6U8
- 1—Instruction manual

Optional Phosphors

P1 crt phosphor normally furnished.

P2, P7, P11 optional No extra charge

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

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.

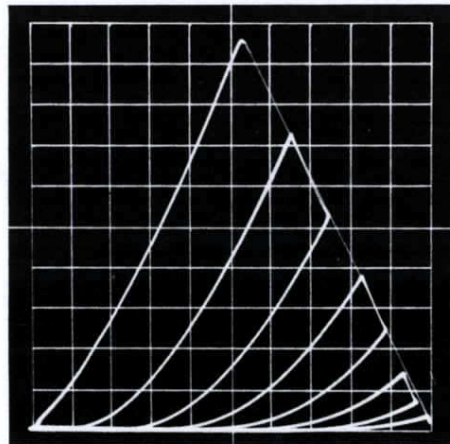


Fig. 2—Same triode section of 12AU7 with only 20-v peak plate supply and sensitivities increased to 0.2 ma/div vertical and 2 v/div horizontal. Grid voltage is changed 2 v between curves, from -14 v to zero. This is essentially a 25-times magnification of the lower left portion of Fig. 1, showing the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

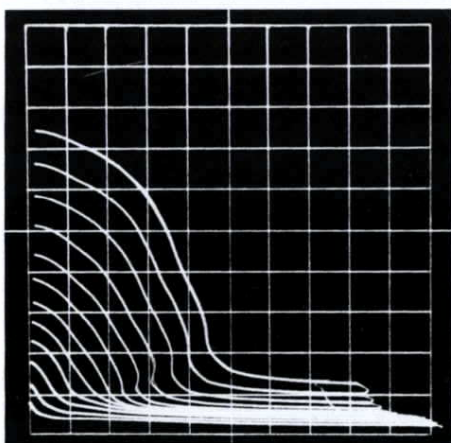
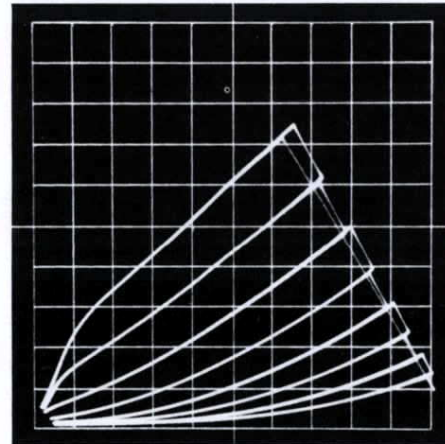


Fig. 3—Screen current plotted against plate voltage with positive grid bias on a 6AQ5. Plate load is 300 ohms, peak plate voltage is 100 v, screen-grid voltage is 100 v, with grid voltage changing 2 v/step from +16 v to below zero. Vertical scale is 10 ma/div, horizontal scale 10 v/div.

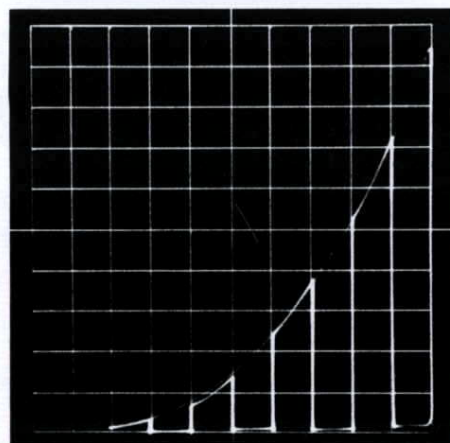


Fig. 4—Typical 12AU7 Eg-1p curves. Plate load 5 k, peak plate-supply voltage 500 v, grid voltage changing 5 v/step from -35 v to zero, vertical sensitivity 5 ma/div, horizontal sensitivity 5 v/div.

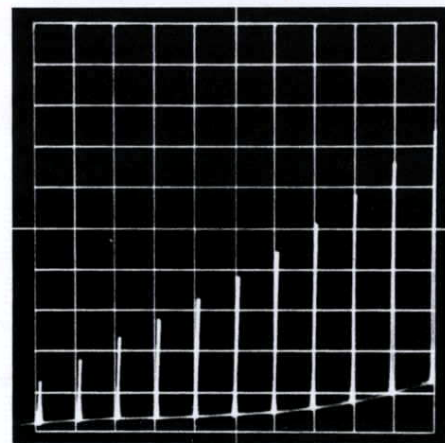


Fig. 5—Another family of curves with positive grid bias. Screen current is plotted against grid voltage. Operating conditions of the 6AQ5 are identical to Fig. 3, except horizontal sensitivity is 2 v/div.

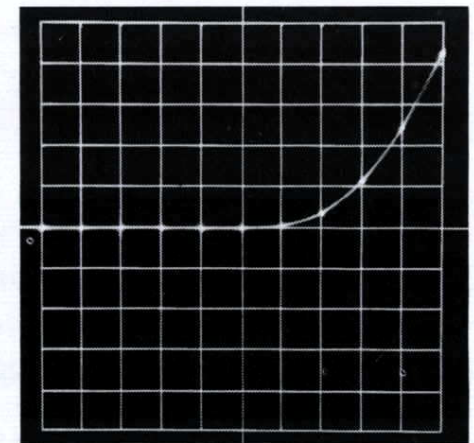


Fig. 6—Typical GERMANIUM DIODE curve. Inherent flexibility of the Type 570 permits accurate evaluation of diode characteristics and detailed examination of any part of the curve. Calibrated scales above are 0.2 v/div horizontal, 0.5 ma/div vertical, with zero points at center of screen.

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, 1 μ a/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—

- Base current
- Collector voltage
- Base voltage
- Base source voltage



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.

Plug-in transistor receptacles are furnished with the Type 575 for convenience in rapid comparison testing. Two receptacles for transistors with long leads, and two receptacles for transistors with pin connectors plug directly into the binding posts on the test panel.

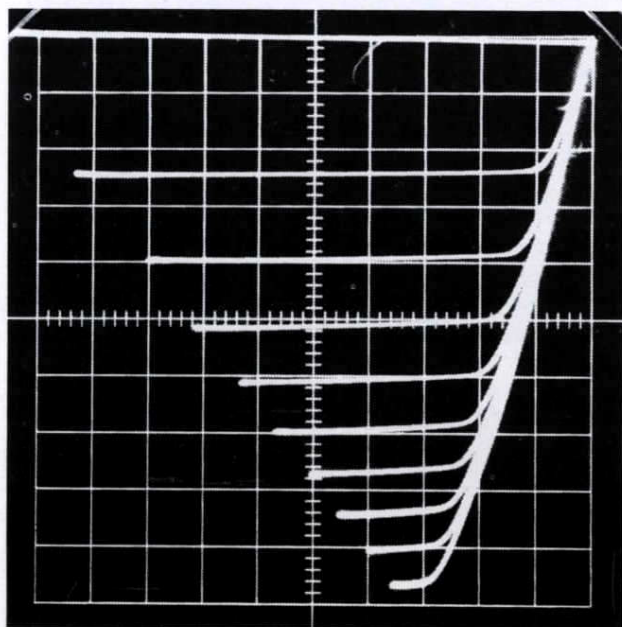


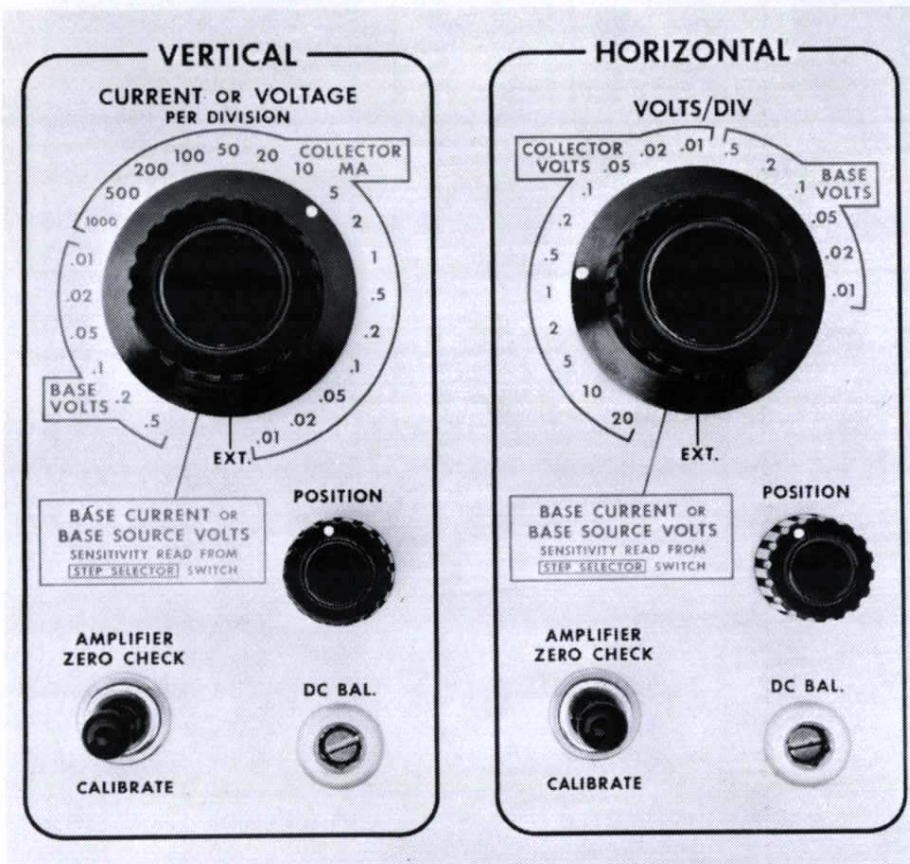
Fig. 1 — PNP Transistor

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.

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 cur-



rent or base source voltage. Calibrated vertical deflection for base current and base source voltage is selected with the STEP SELECTOR switch.

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

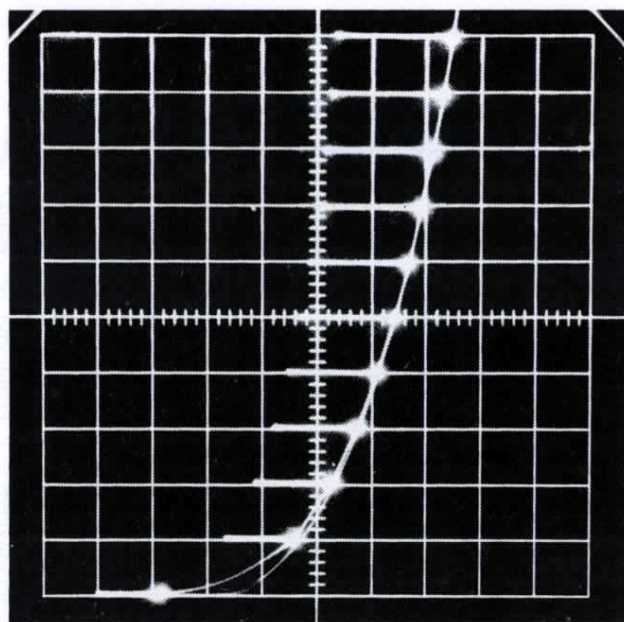


Fig. 2 — NPN Transistor

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.

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 STEP SELECTOR switch.

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

BASE STEP GENERATOR

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 selected. (When the Type 575 is used with a 50-cycle supply frequency, the step/sec rate will be either 100 or 200.) 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.

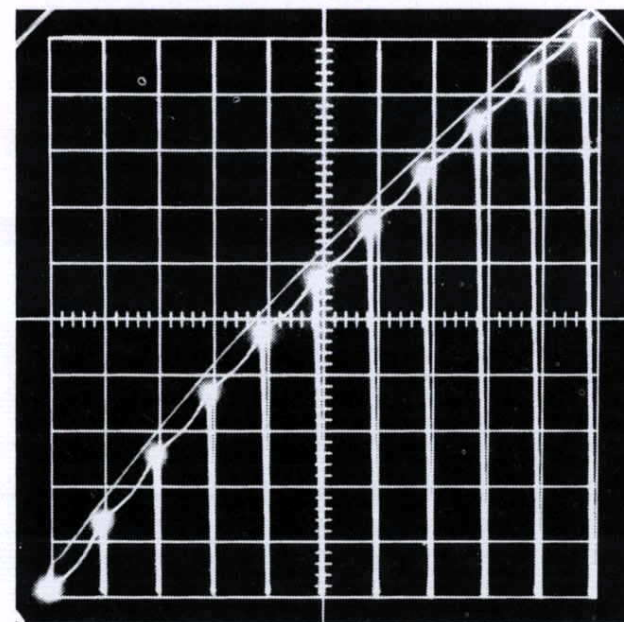
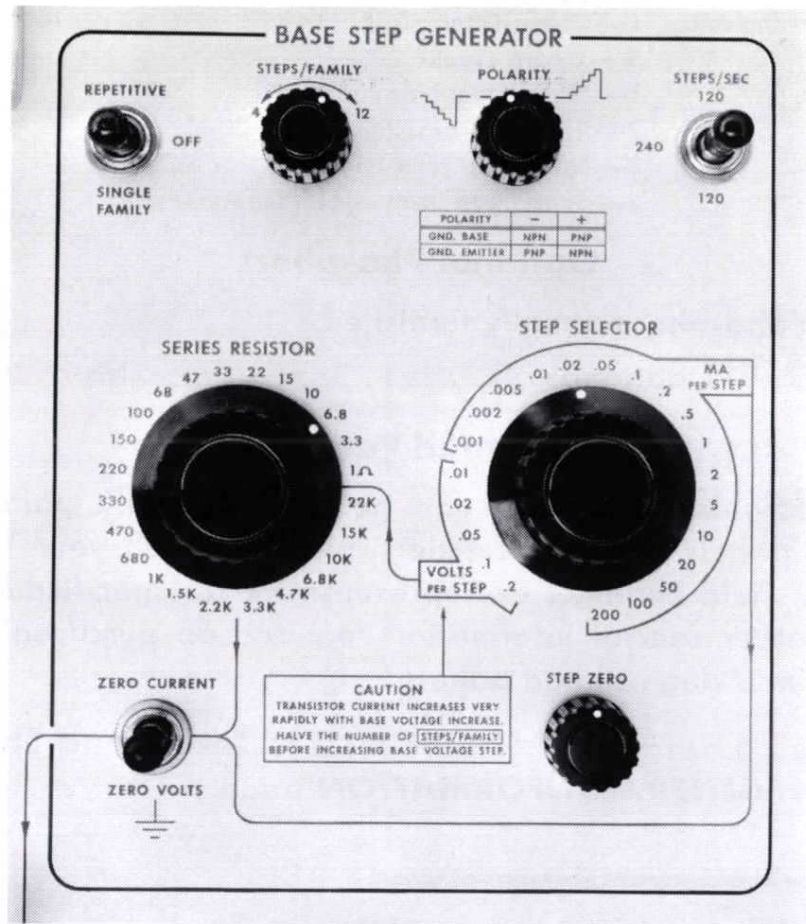


Fig. 3 — NPN Transistor

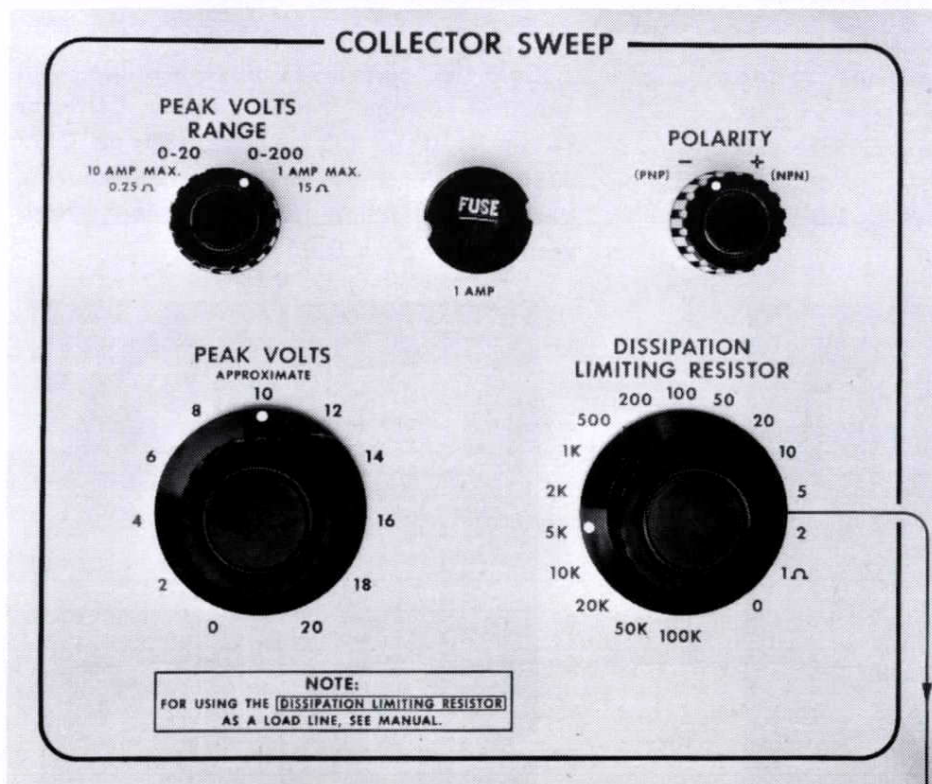
Collector current vs base current with constant-current base steps. Collector sweep is 0 to 1.5 v, base current 0.1 ma/step. Vertical deflection is 5 ma/div collector current, horizontal deflection 0.1 ma/div base current. Incremental and dc current gain can be determined from this display.

TYPE 575 TRANSISTOR-CURVE TRACER



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 100 kilohms can be inserted for limiting collector dissipation.



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.

Alignment of Cathode-Ray Tube—Should it become necessary to touch up the alignment of the cathode-ray tube, a molded nylon handle on the crt socket can be reached in a matter of seconds. Release the two quick-opening fasteners on the left cabinet side, and

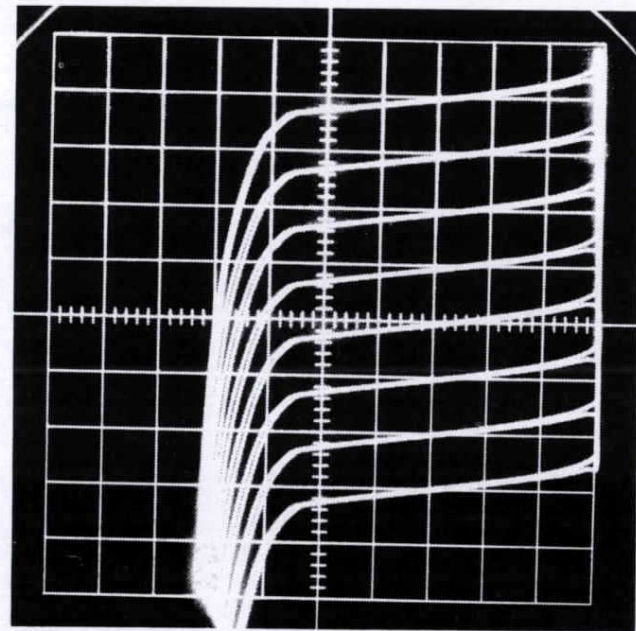


Fig. 4 — PNP Transistor

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.

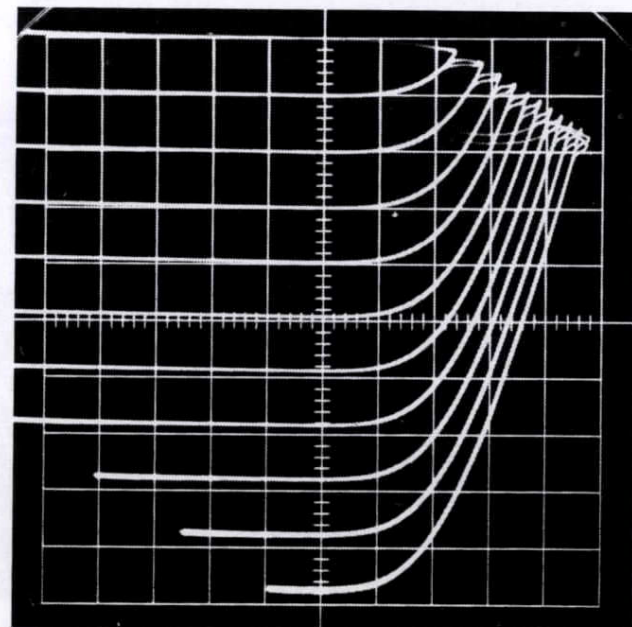


Fig. 5 — PNP Transistor

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

lower the cabinet side out of the way, or remove it completely.

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 65 lbs.

Power Requirements—105 to 125 volts, 60 cycles.

Price \$925

- Includes: 1—Green filter (378-514)
 5—1 amp fuses
 1—Instruction manual
 2—2N407 Transistors (151-003)
 2—Long-lead transistor receptacles
 2—Short-lead transistor receptacles

Optional Phosphors

P1 crt phosphor normally furnished.

P2, P7, P11 optional. No extra charge.

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

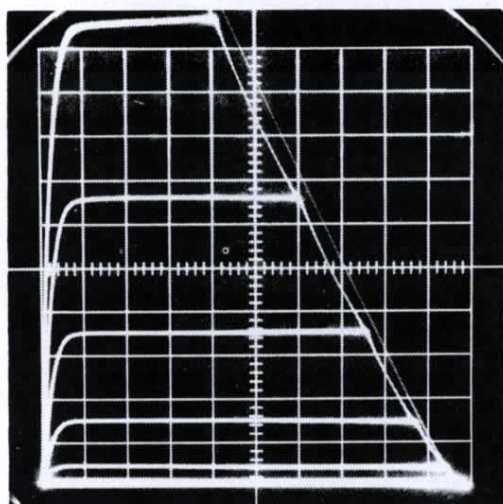


Fig. 6 — NPN Transistor

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.

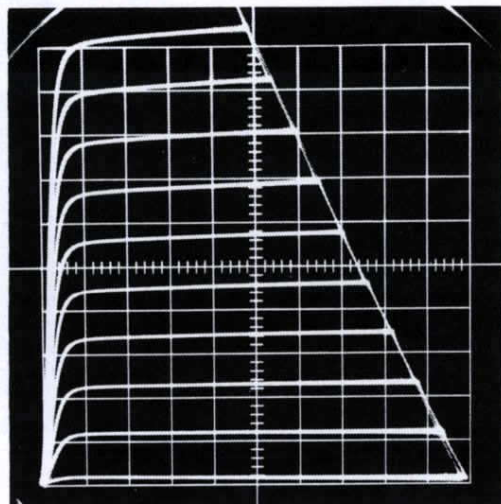


Fig. 8 — NPN Transistor

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.

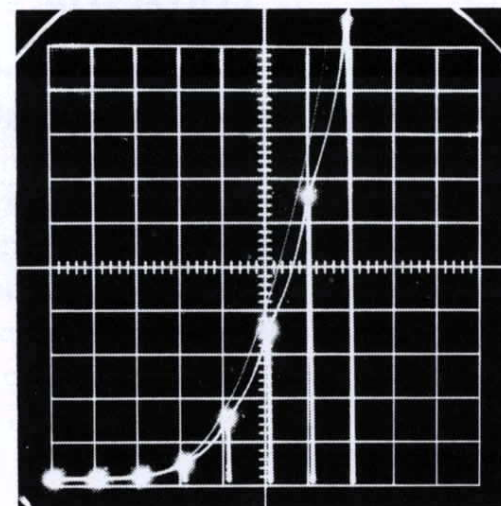


Fig. 10 — NPN Transistor

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.

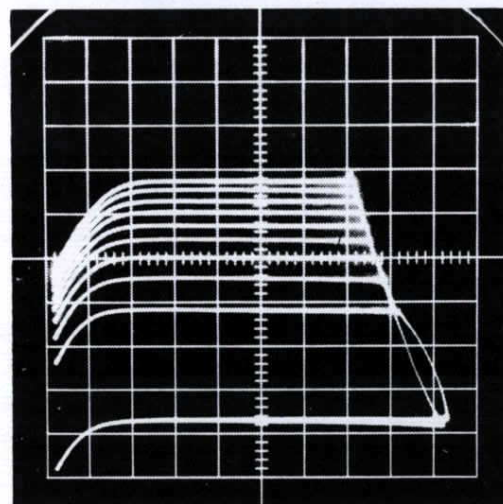


Fig. 7 — NPN Transistor

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.

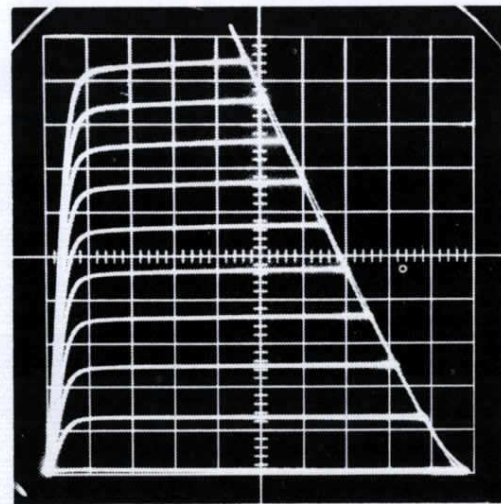


Fig. 9 — NPN Transistor

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

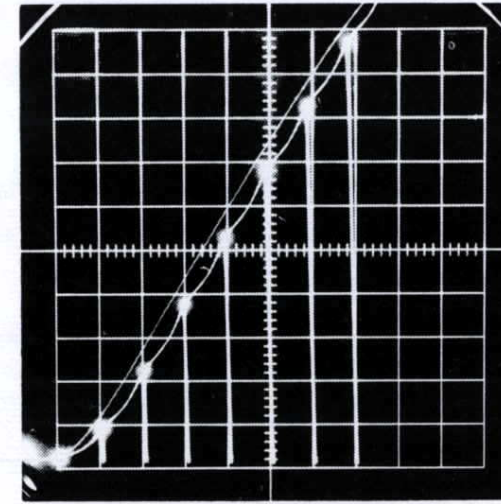
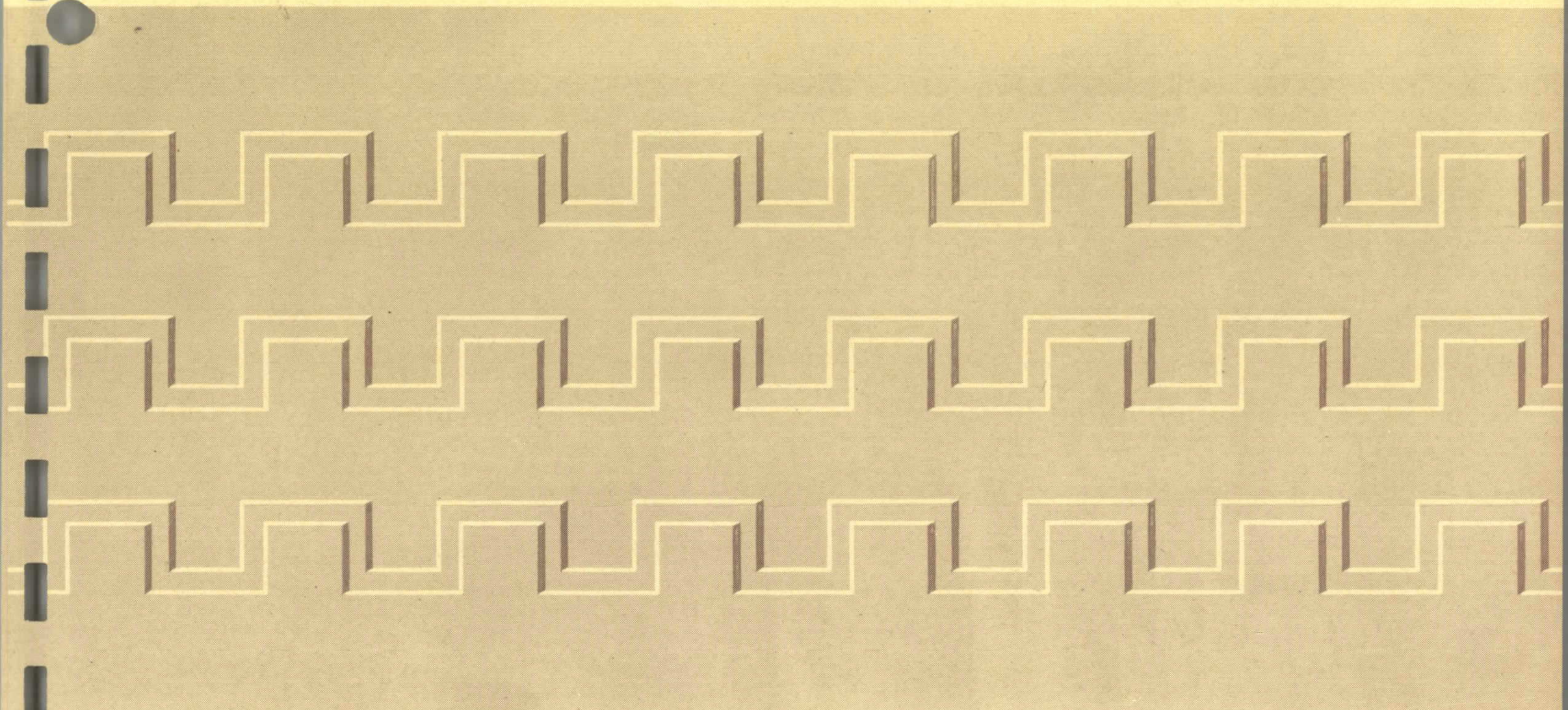


Fig. 11 — NPN Transistor

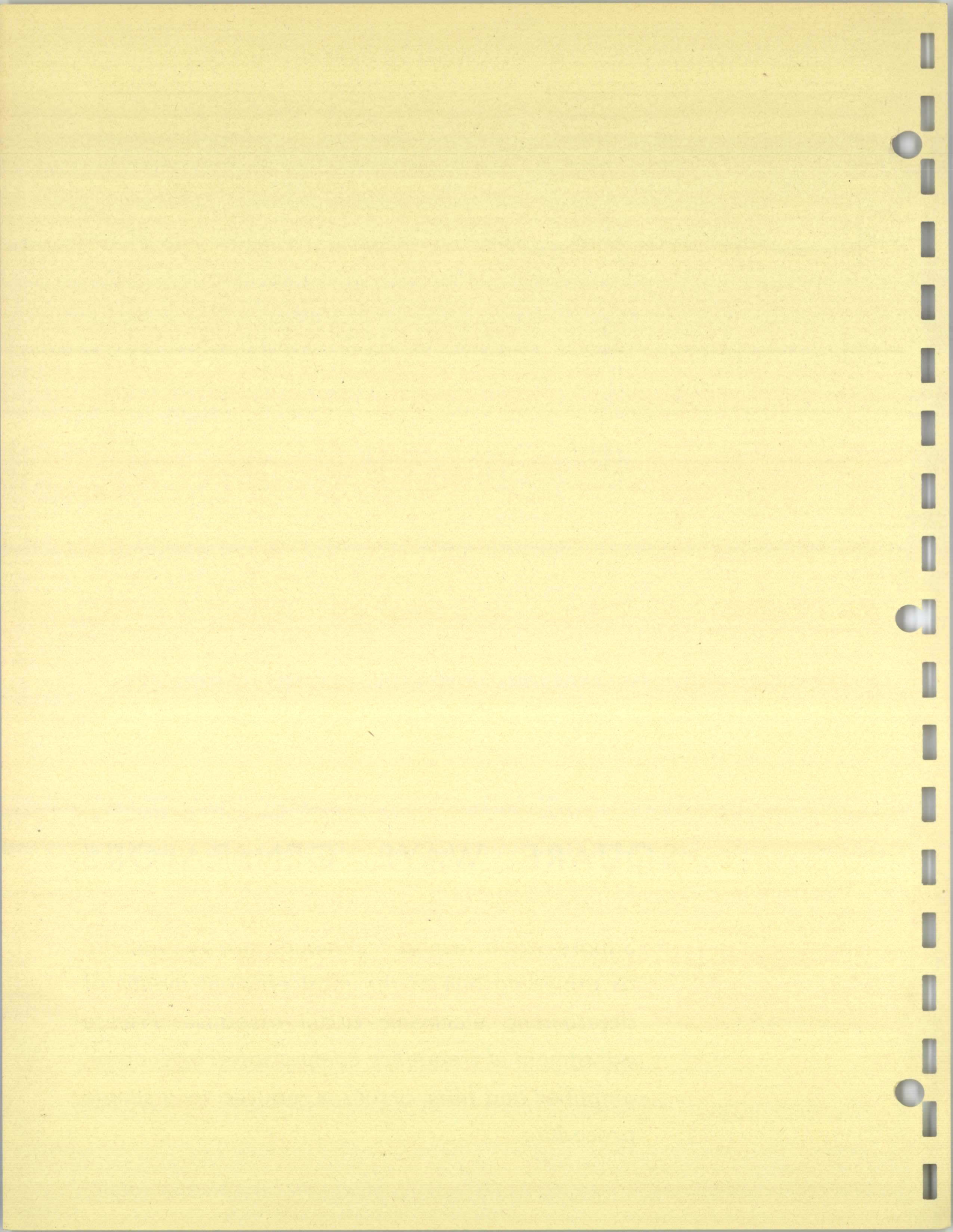
Same as Fig. 10 except base-voltage steps are 0.1 v/step with a 470-ohm source impedance.





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 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.

Maximum Output

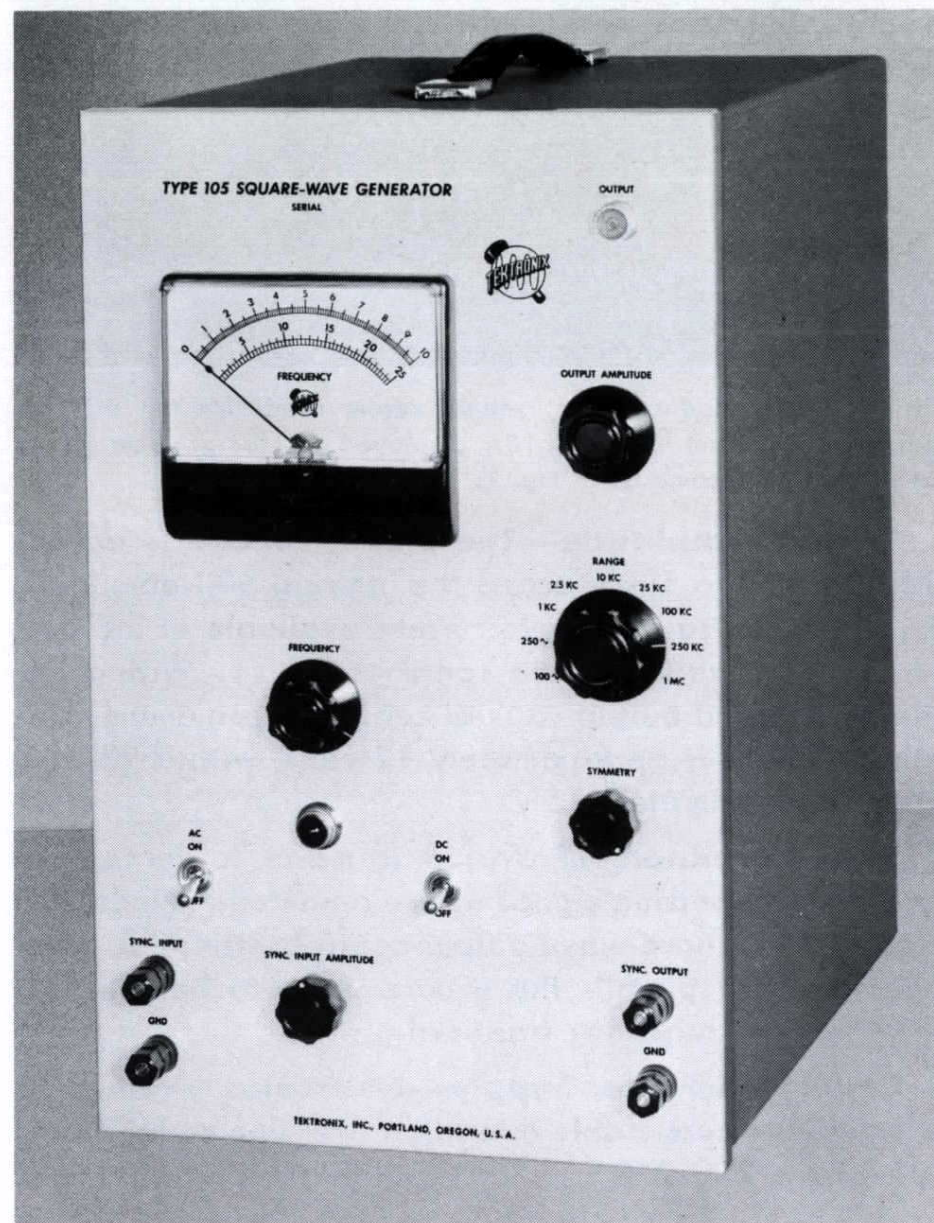
15 v, approximately, into 93-ohm cable. More than 160 ma, peak-to-peak.

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.

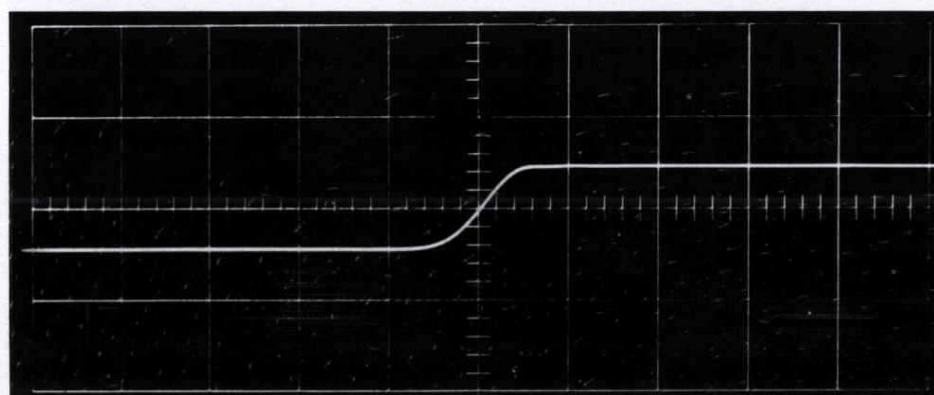


Fig. 1. 13-millimicrosecond risetime of the Type 105 displayed on $0.02 \mu\text{sec}/\text{cm}$ sweep. Generator connected to vertical deflection plates of T54P crt, sensitivity 7 v/cm, with 52-ohm cable terminated at both ends.

TYPE 105 SQUARE-WAVE GENERATOR

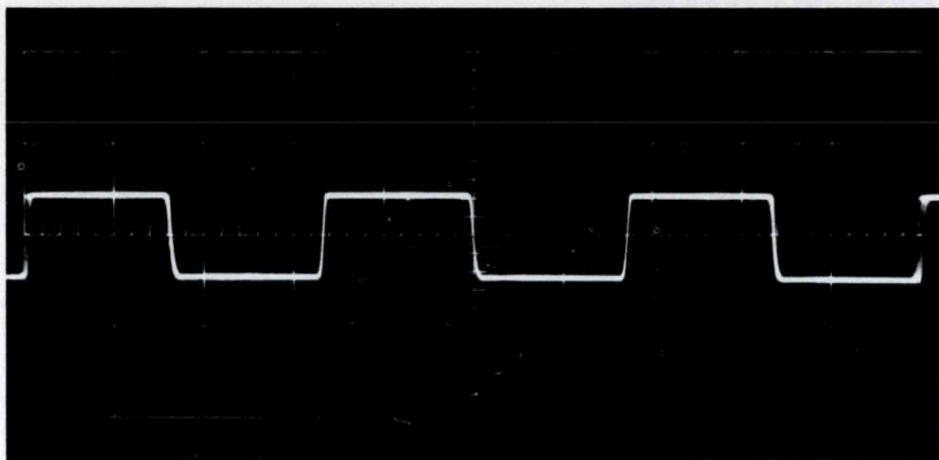


Fig. 2. Sharp leading edge, square corner, and flat top of 1-mc square-wave output of Type 105 displayed on 0.3 μ sec/cm sweep. Other conditions same as in Fig. 1.

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.

ELECTRON-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.

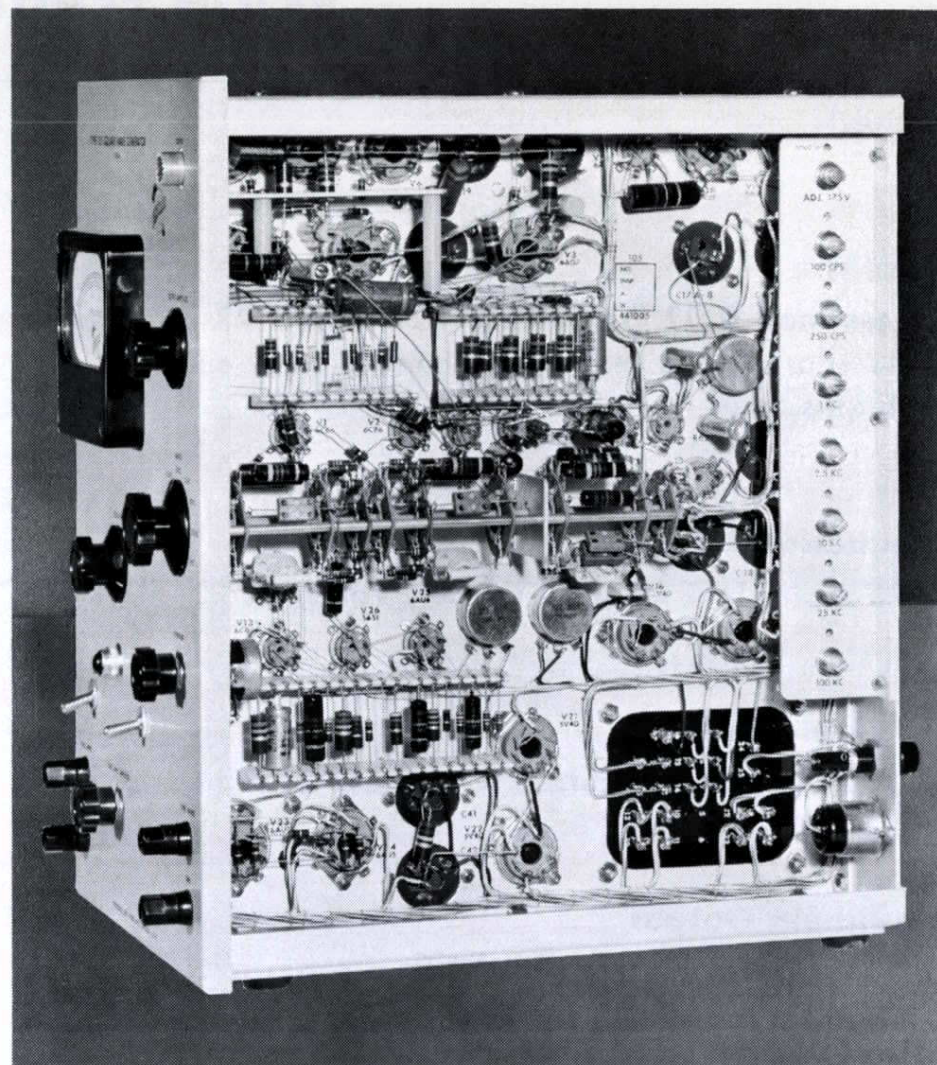
Construction—Aluminum-alloy chassis and cabinet.

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.

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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	..... \$4.00
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. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

TYPE 107 SQUARE-WAVE GENERATOR

3-Millimicrosecond Risetime

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.

ELECTRON-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

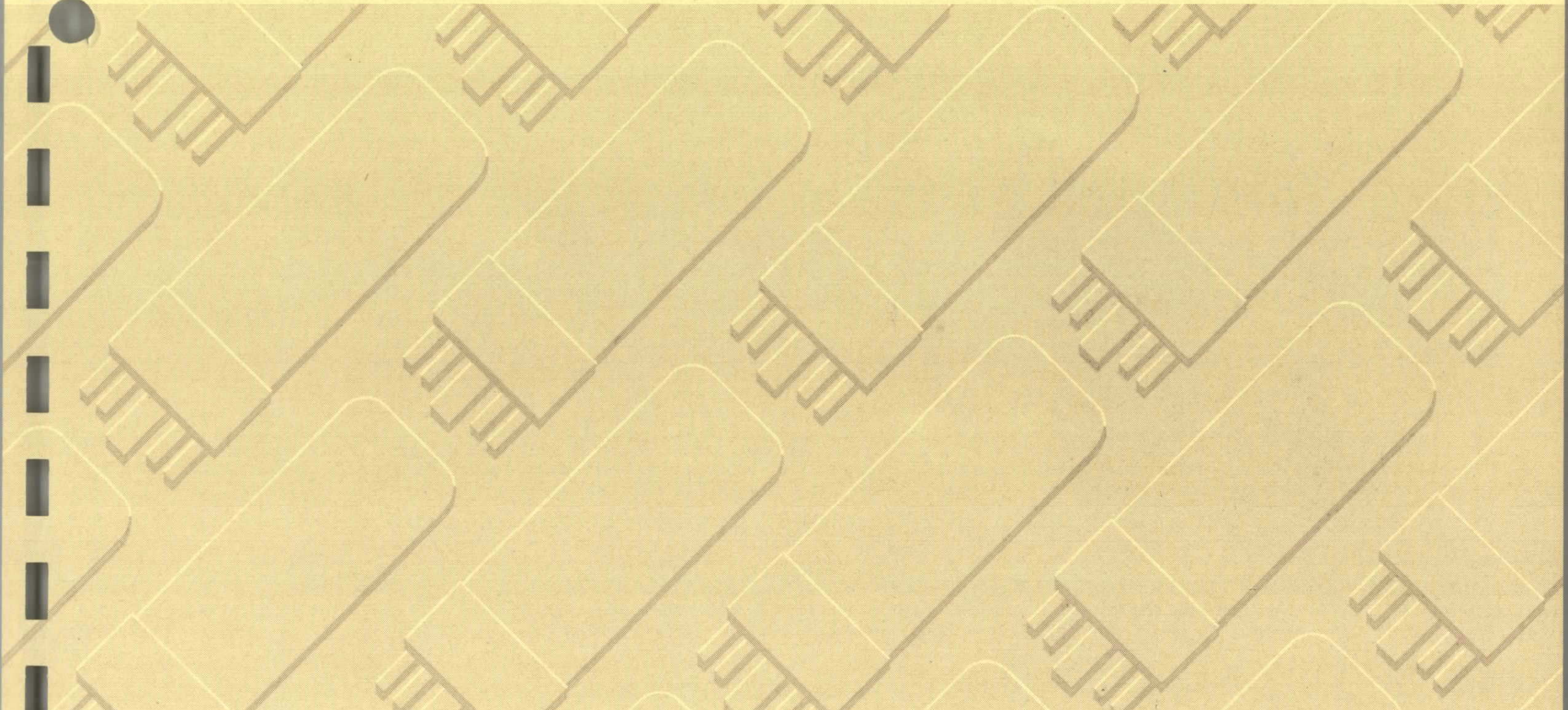
Includes: 1—P52, 52-ohm 42" coaxial cable
1—B52-R, 52-ohm terminating resistor
1—B52-T10, 52-ohm 'T' pad
1—Instruction manual

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

TYPE 107 SQUARE-WAVE GENERATOR

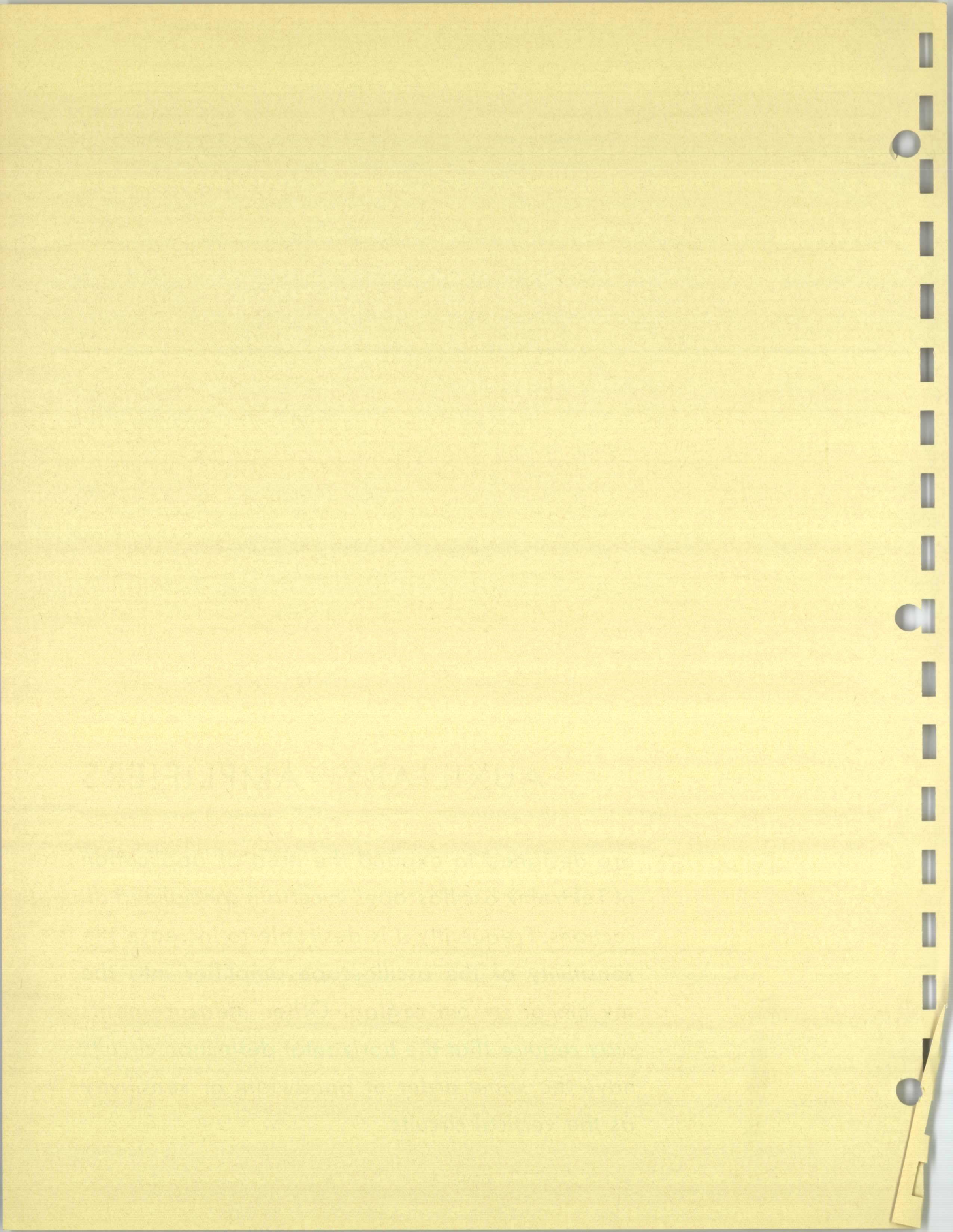
3-Millimicrosecond Rise Time





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

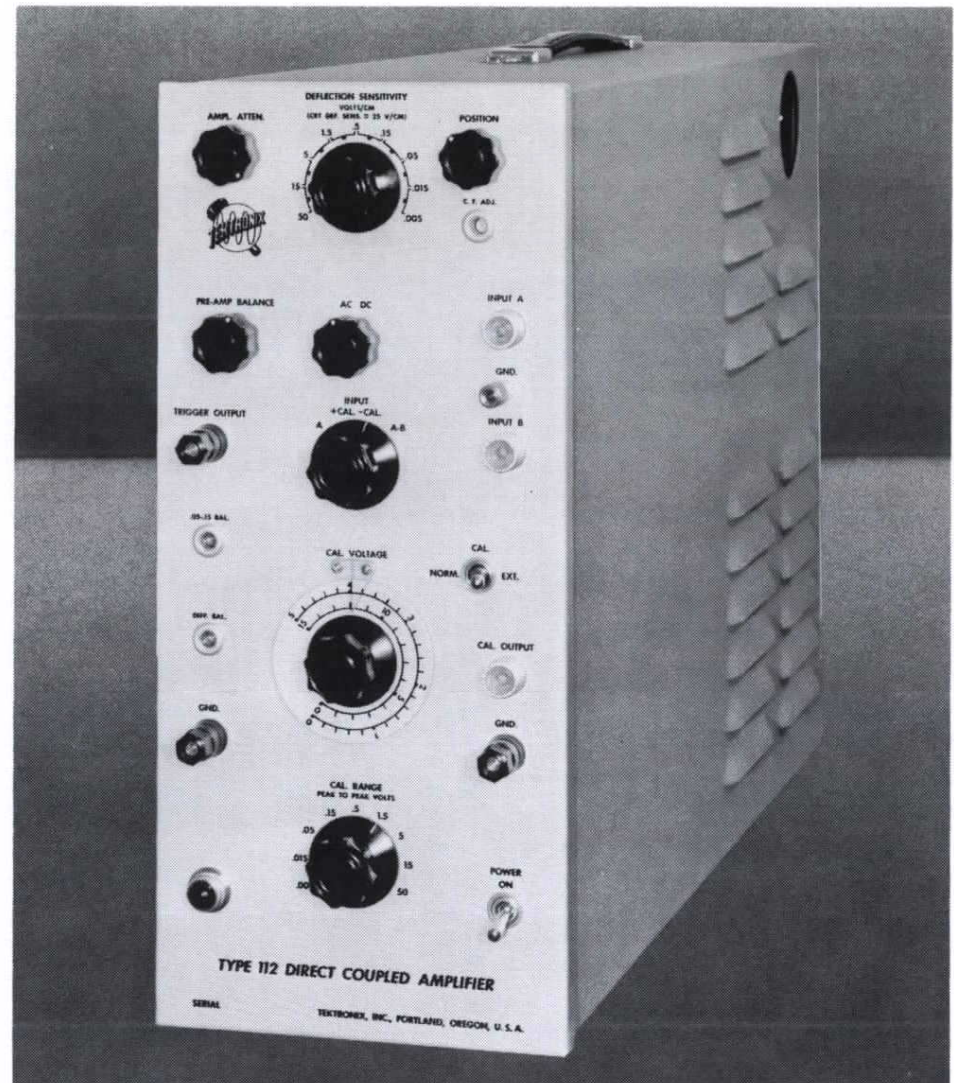
150 v at high impedance.
75 v at 8000 ohms.

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.

OTHER CHARACTERISTICS

Calibrated Attenuator—The step attenuator of the Type 112 is calibrated for use with a cathode-ray tube that has a basic deflection factor of 25 v/cm. Nine calibrated steps are provided: 0.005, 0.015, 0.05, 0.15, 0.5, 1.5, 5, 15, and 50 v/cm. A variable control fills in between steps, making the amplifier gain continuously adjustable from 0.5 to 5000.

Calibrator—Output of the voltage calibrator can be switched directly to the amplifier input. It is also available at a front-panel terminal. Nine voltage ranges are available: 0.005, 0.015, 0.05, 0.15, 0.5, 1.5, 5, 15, and 50 v peak to peak. A variable control fills in between steps. Full-scale accuracy is within 3%, variable control is linear within 1% of full scale.

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

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

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 (012-007)
- 1—W112B output lead (012-008)
- 2—A510 binding-post adapters
- 1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



DE-COPIED BY (enter Amplifier)

UNIT NO. (enter unit number)

DATE (enter date)

BY (enter name)

TESTED AT (enter location)

TESTED BY (enter name)

TESTED ON (enter date)

TESTED FOR (enter purpose)

TESTED TO (enter standard)

TESTED BY (enter name)

TESTED ON (enter date)

TESTED FOR (enter purpose)

TESTED TO (enter standard)

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TESTED FOR (enter purpose)

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

1 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 wide-band oscilloscopes, and for other applications where a voltage gain up to 100 is desired. Excellent output linearity is achieved on all input signals up to 0.01 v peak-to-peak at full gain. 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.

Power is available at the front panel for a cathode-follower probe such as the Tektronix P170CF or P500CF. If the P500CF is to be used, input terminal 4 of the probe-power socket should first be checked to make certain that it is grounded.

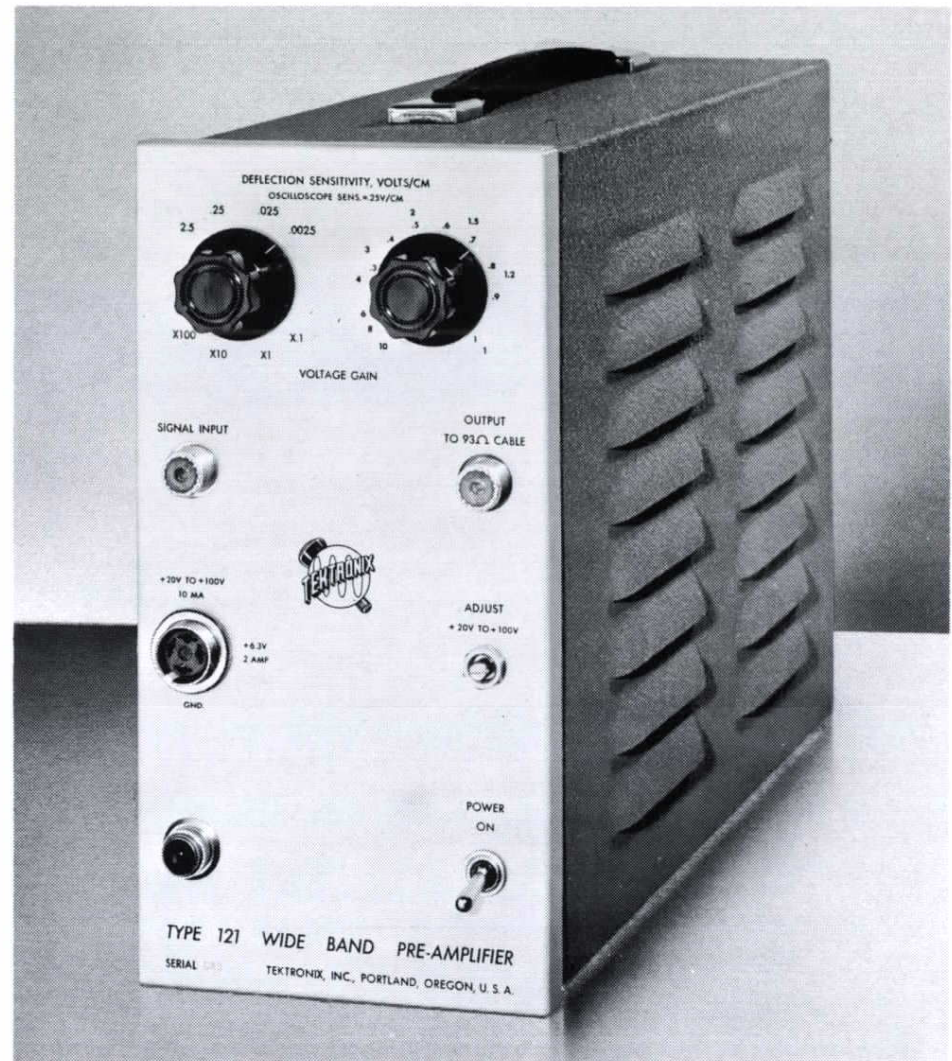
CHARACTERISTICS

Voltage Gain—Continuously variable from 0.01 to 100 with four fixed calibrated ranges...0.1, 1, 10, and 100. Noise level at the output is 5 mv peak-to-peak maximum at full gain, with the input grounded.

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—1 v peak-to-peak maximum in a terminated 93-ohm cable, permitting linear amplification of any input signal up to 0.01 v peak-to-peak at full gain. 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.

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

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



Wils-Bond Preamp/Filter

Wils-Bond
Preamp/Filter

Wils-Bond
Preamp/Filter

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Preamp/Filter

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

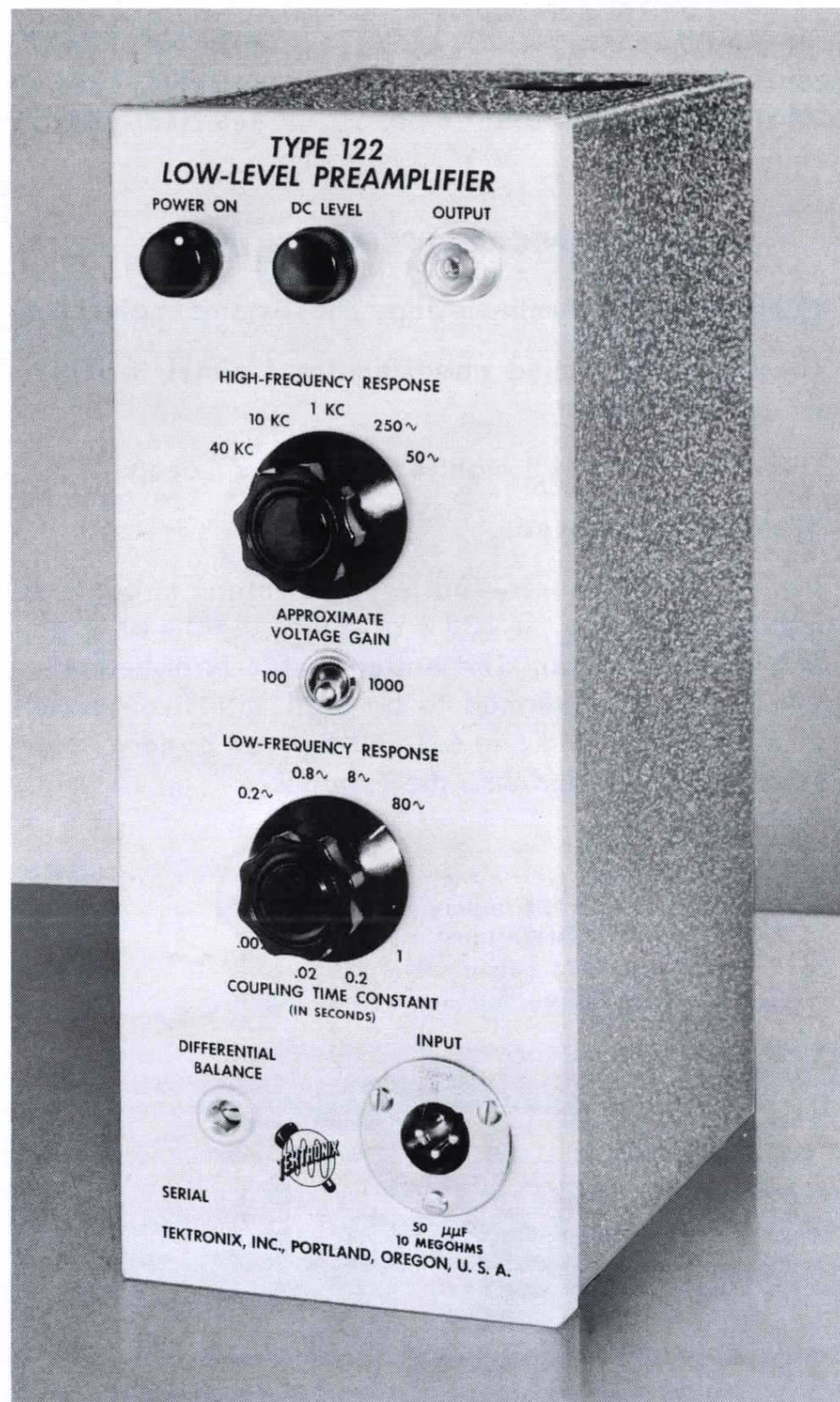
The Tektronix Type 122 Low-Level Preamplifier is a compact 3-stage battery-operated amplifier extending the usefulness of the oscilloscope into the microvolt region. The Type 122 is especially useful in biological research and other applications requiring the amplification of microvolt signals.

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 μf . Impedance for differential input is 20 megohms paralleled by approximately 50 μf .

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

TYPE 122 PREAMPLIFIER

ELECTRON-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. The battery cable furnished with the instrument is designed to be used with five 45-volt dry-cell batteries and one 6.3-volt dry-cell battery. Batteries are not included with the Type 122.

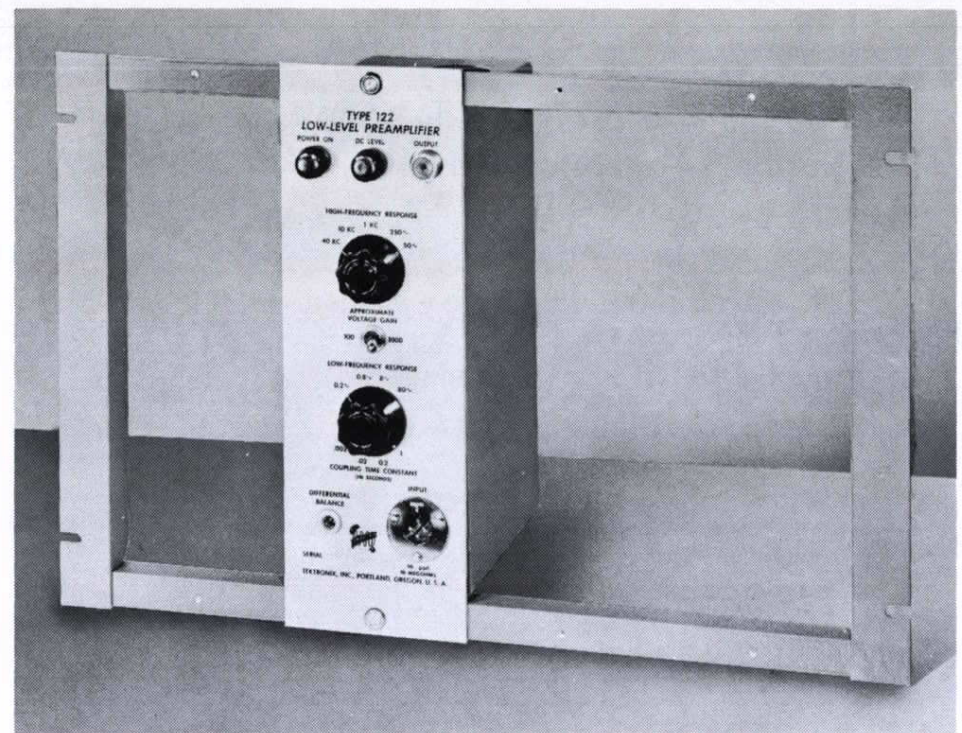
Type 122 \$85

- Includes: 1—W122 battery cable (012-009)
- 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.

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Recommended Additional Accessories

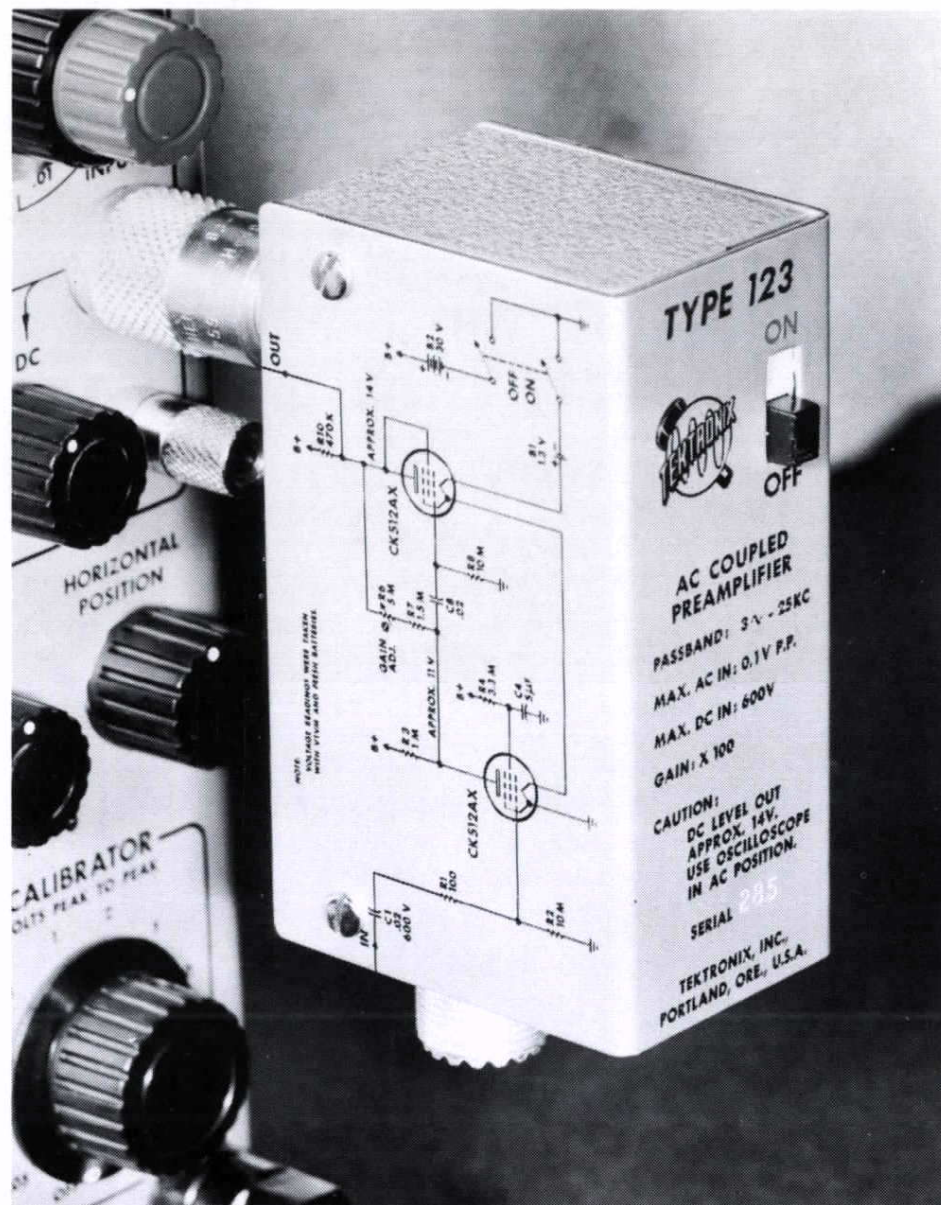
Type FA160 Adapter Frame adapts Type 122 Frame Mount to rack mounting. Mounts in standard rack and holds four of any combination of Type 122 Preamplifiers, Type 360 Indicators, and Type 160-Series Units. . . \$5.00

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 123 PREAMPLIFIER

Miniature Low-Level



Compact

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

Weights 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

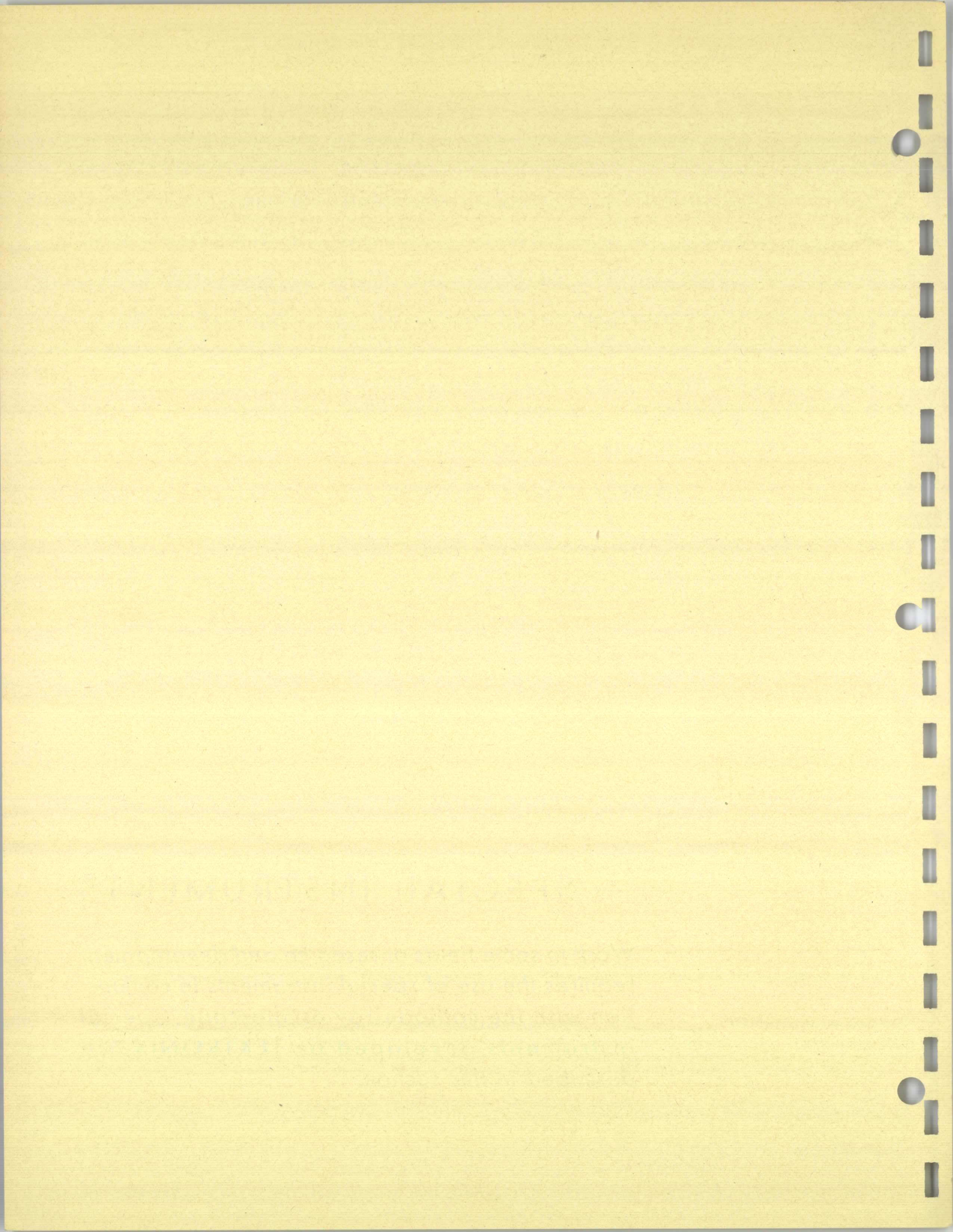
Includes: 1—Mercury cell
1—B battery

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



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.

ELECTRON-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, 8 1/2" deep.

Weight—9 lbs.

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

Price **\$195**

Includes: 1—P93C probe (010-003)
1—W130R lead (012-015)
1—W130B lead (012-014)
1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



1. NAME (Last, First, Middle Initial) _____

2. ADDRESS (Street, City, State, Zip) _____

3. OCCUPATION _____

4. SOCIAL SECURITY NUMBER _____

5. DATE OF BIRTH _____

6. SEX _____

7. RACE _____

8. MARITAL STATUS _____

9. NUMBER OF DEPENDENTS _____

10. EDUCATION _____

11. MILITARY SERVICE _____

12. FOREIGN TRAVEL _____

13. OTHER INFORMATION _____

14. SIGNATURE _____

15. DATE _____

16. OFFICIAL USE _____

17. _____

18. _____

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20. _____

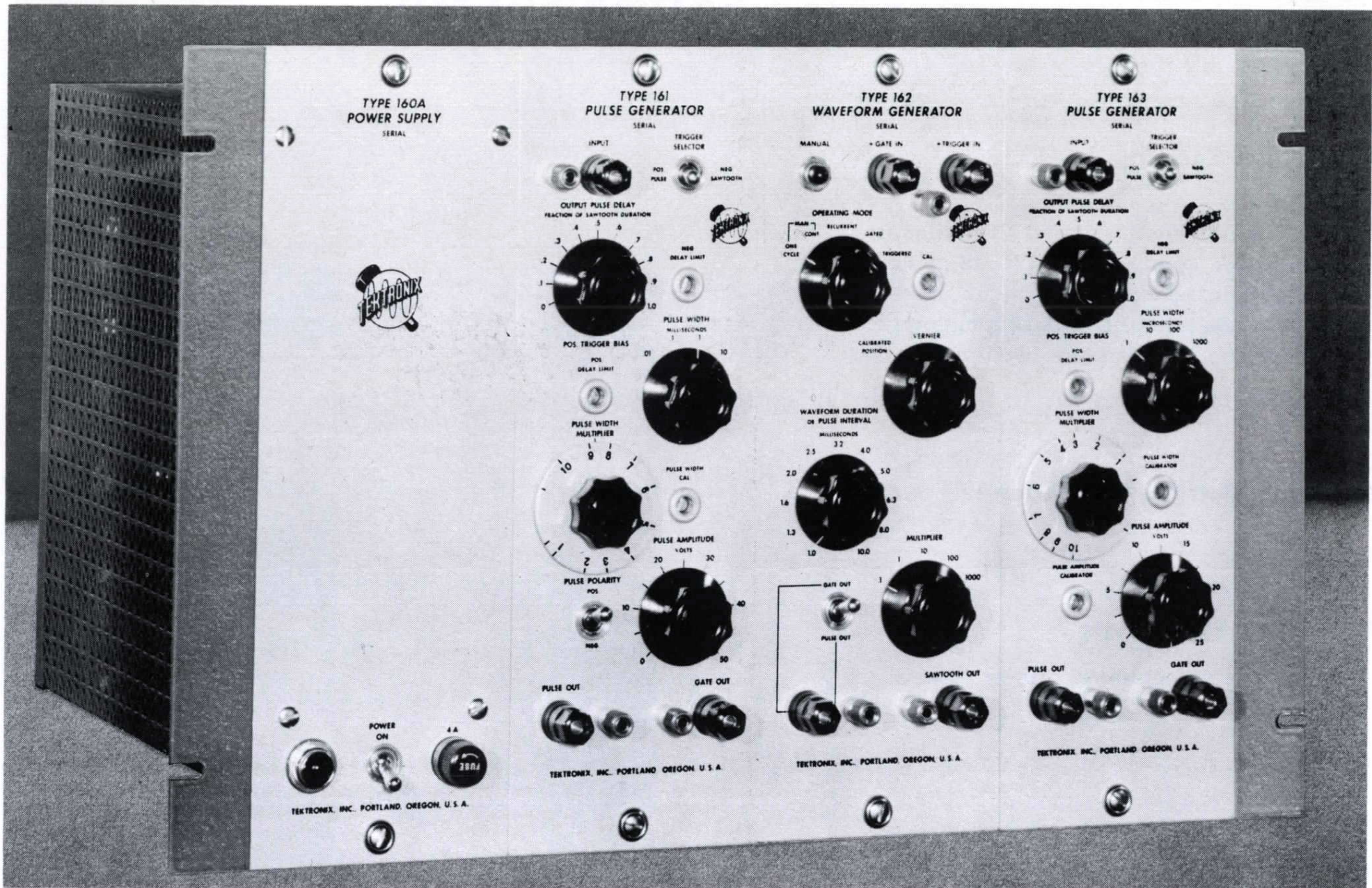
21. _____

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TYPE 160-SERIES WAVEFORM GENERATORS

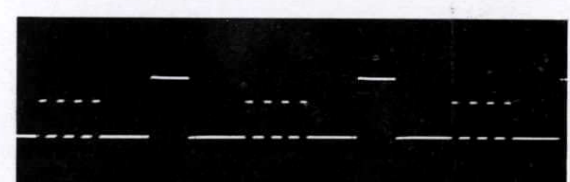
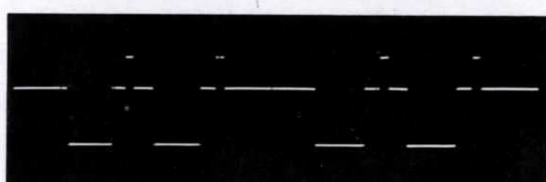
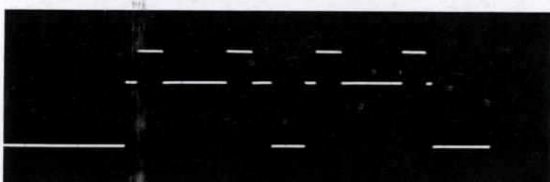
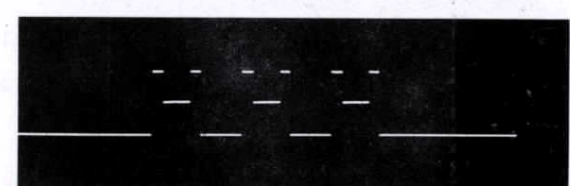
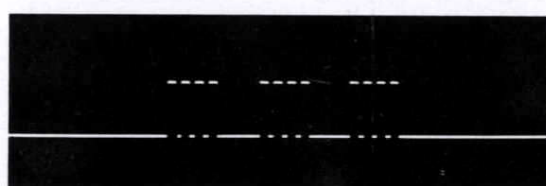
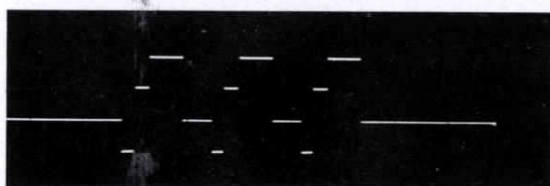


The Tektronix Type 160-Series produces timed pulses of adjustable duration, amplitude and repetition rate, providing a convenient and flexible system of sequence control. By using several instruments together, complex waveform patterns can be obtained. Applications of the Type 160-Series are numerous. . . 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

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.

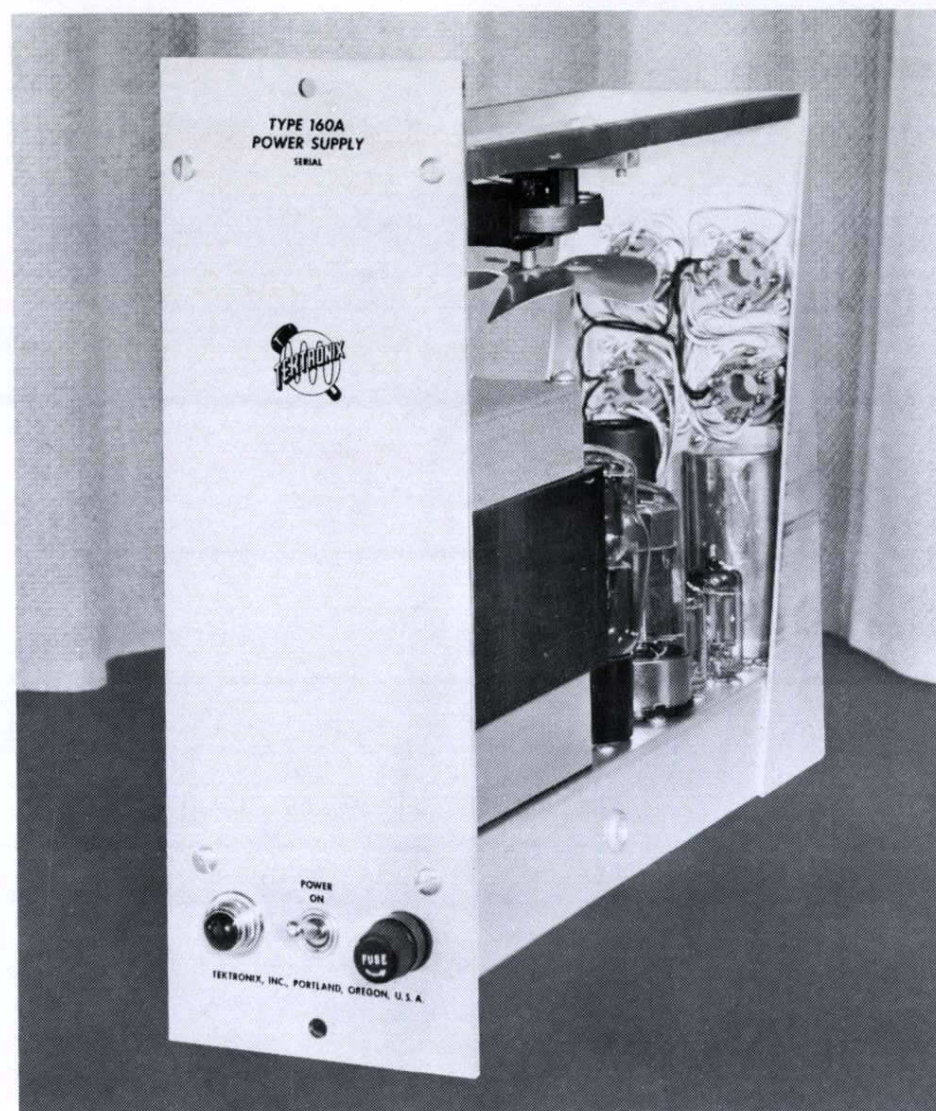
The currents listed above for the + 225 and - 170 volt supplies are available only with series regulator external shunt resistors as provided in the individual units.

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.

ELECTRON-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. For description and price, please see Accessory Section.

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 (012-016)
- 1—Set mounting screws and cup washers
- 1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



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—continuously variable, 0 to 100% of triggering sawtooth waveform.
- Risetime—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, 3-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.

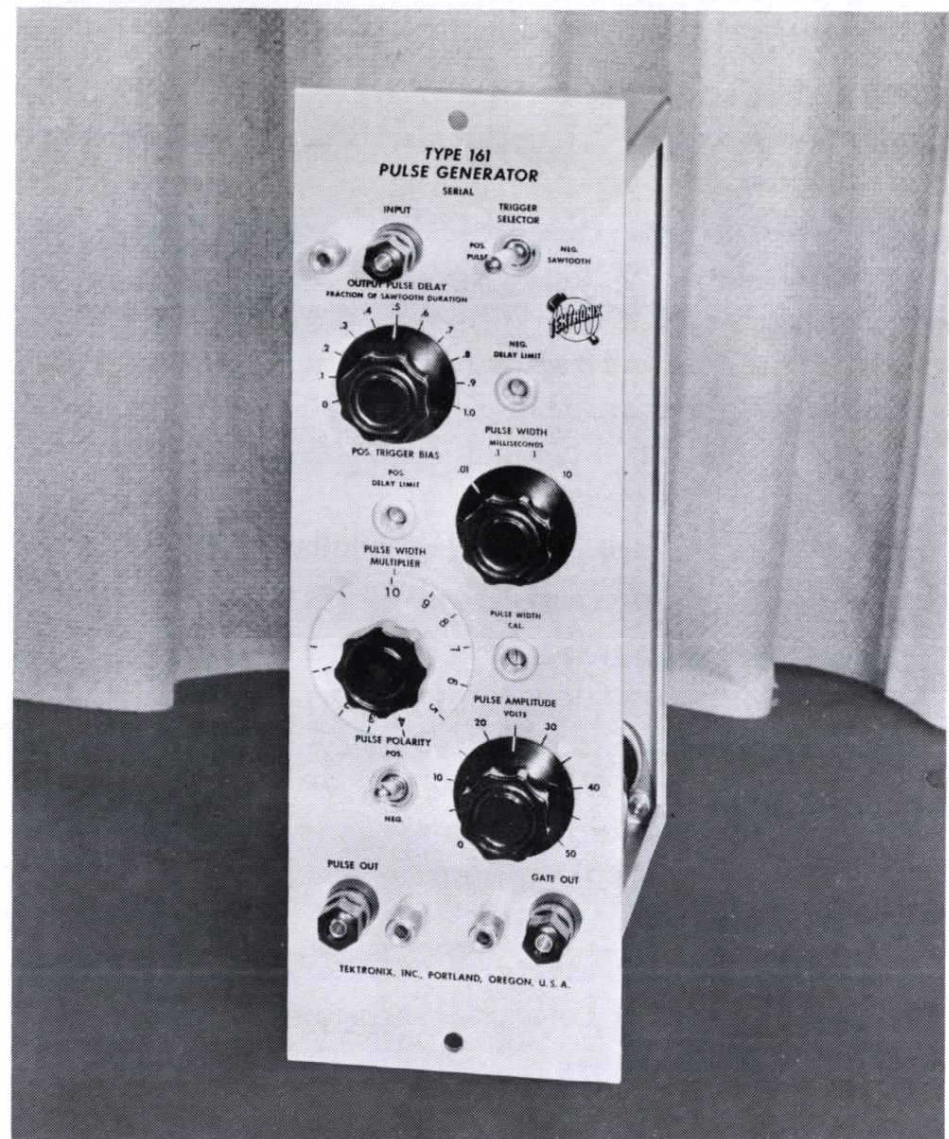
When triggered by a negative-going sawtooth, the time of occurrence of the output pulse and gate can be adjusted to any point throughout the duration of the sawtooth. A calibrated control indicates the output delay as a fraction of the triggering sawtooth duration. Pulse and gate width in milliseconds,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

ELECTRON-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. For description and price, please see Accessory Section.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, etched chassis.

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

Weight—3 1/2 lbs.

Price **\$95**

- Includes: 1—W160-10 connecting cable (012-017)
- 1—Set mounting screws and cup washers
- 1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



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 approximately +20 volts.

Risetime

Pulse—1 μ sec, approximately, minimum.

Cathode-Follower Outputs

Trigger Requirements

Positive pulse—12 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.

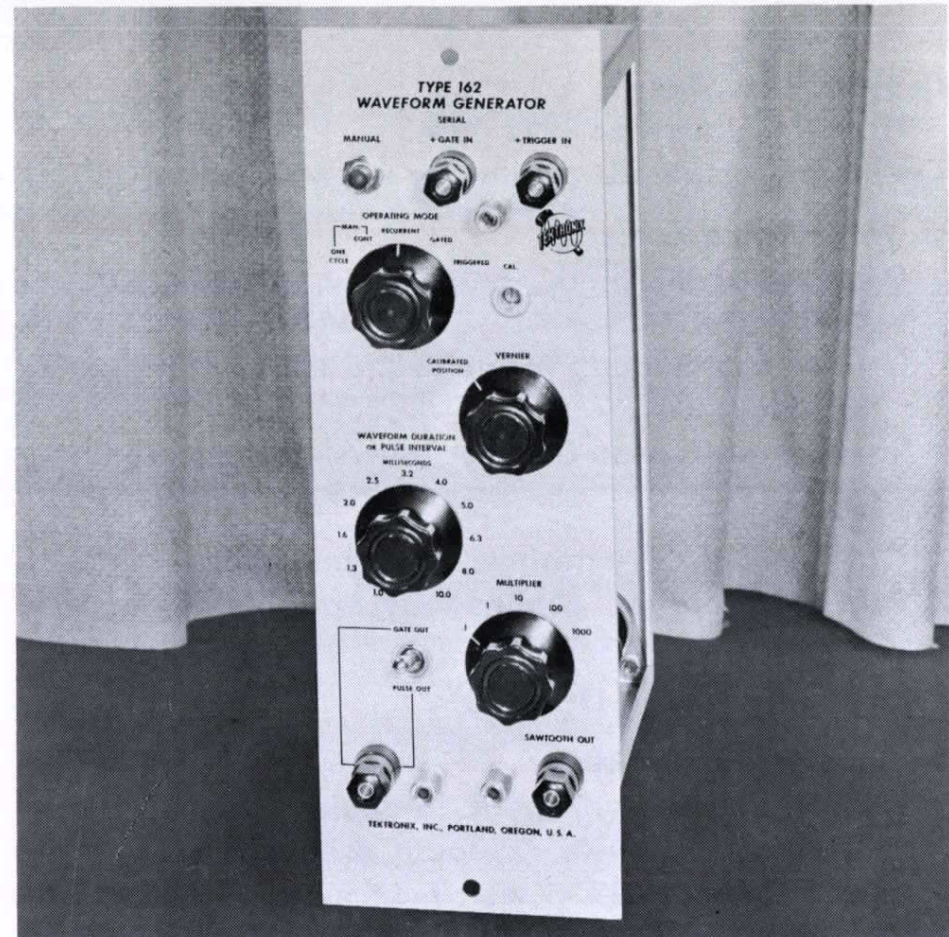
GENERAL DESCRIPTION

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.

ELECTRON-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. For description and price, please see Accessory Section.

Construction—Aluminum alloy.

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

Finish—Photo-etched anodized panel, etched chassis.

Weight—3 1/2 lbs.

Price **\$95**

Includes: 1—W160-10 connecting cable (012-017)
1—Set mounting screws and cup washers
1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

TYPE 160-SERIES WAVEFORM GENERATORS

TYPE 163 FAST-RISE PULSE GENERATOR

Output Waveforms

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

Output Characteristics

Risetime—less than $0.2 \mu\text{sec}$ (without load capacitance).
Decay Time— 0.2 to $0.5 \mu\text{sec}$ (without load capacitance).
Overshoot—can be adjusted to zero.
Duration—calibrated, continuously variable, $1 \mu\text{sec}$ to $10,000 \mu\text{sec}$.
Delay—continuously variable, 0 to 100% of triggering sawtooth duration.

Amplitude

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

Cathode-Follower Output

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

Trigger Requirements

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

Power Requirements

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

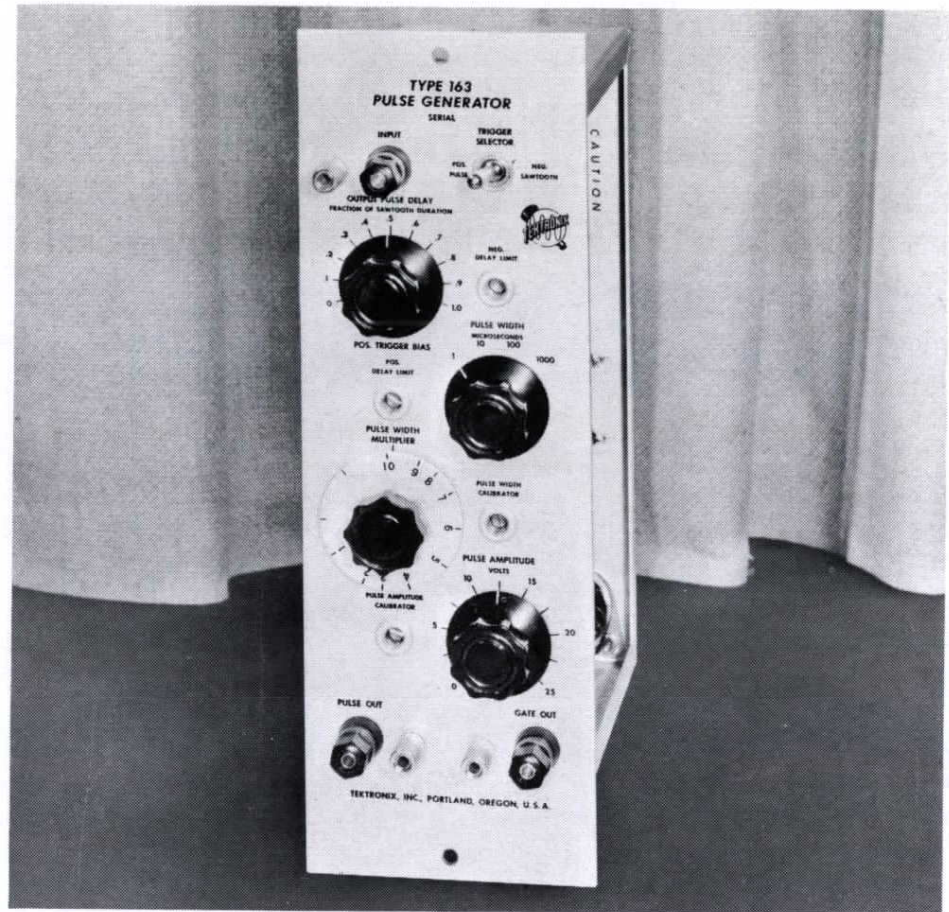
GENERAL DESCRIPTION

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

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

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

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



ELECTRON-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. For description and price, please see Accessory Section.

Construction—Aluminum alloy.

Finish—Photo-etched anodized panel, etched chassis.

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

Weight— $3 \frac{1}{2}$ lbs.

Price \$95

- Includes: 1—W160-10 connecting cable (012-017)
- 1—Set mounting screws and cup washers
- 1—Instruction manual

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 360 INDICATOR

Vertical Passband

DC to 500 kc.

Calibrated Vertical Attenuator

Deflection Factor—0.05 v/div.

Waveform Requirements

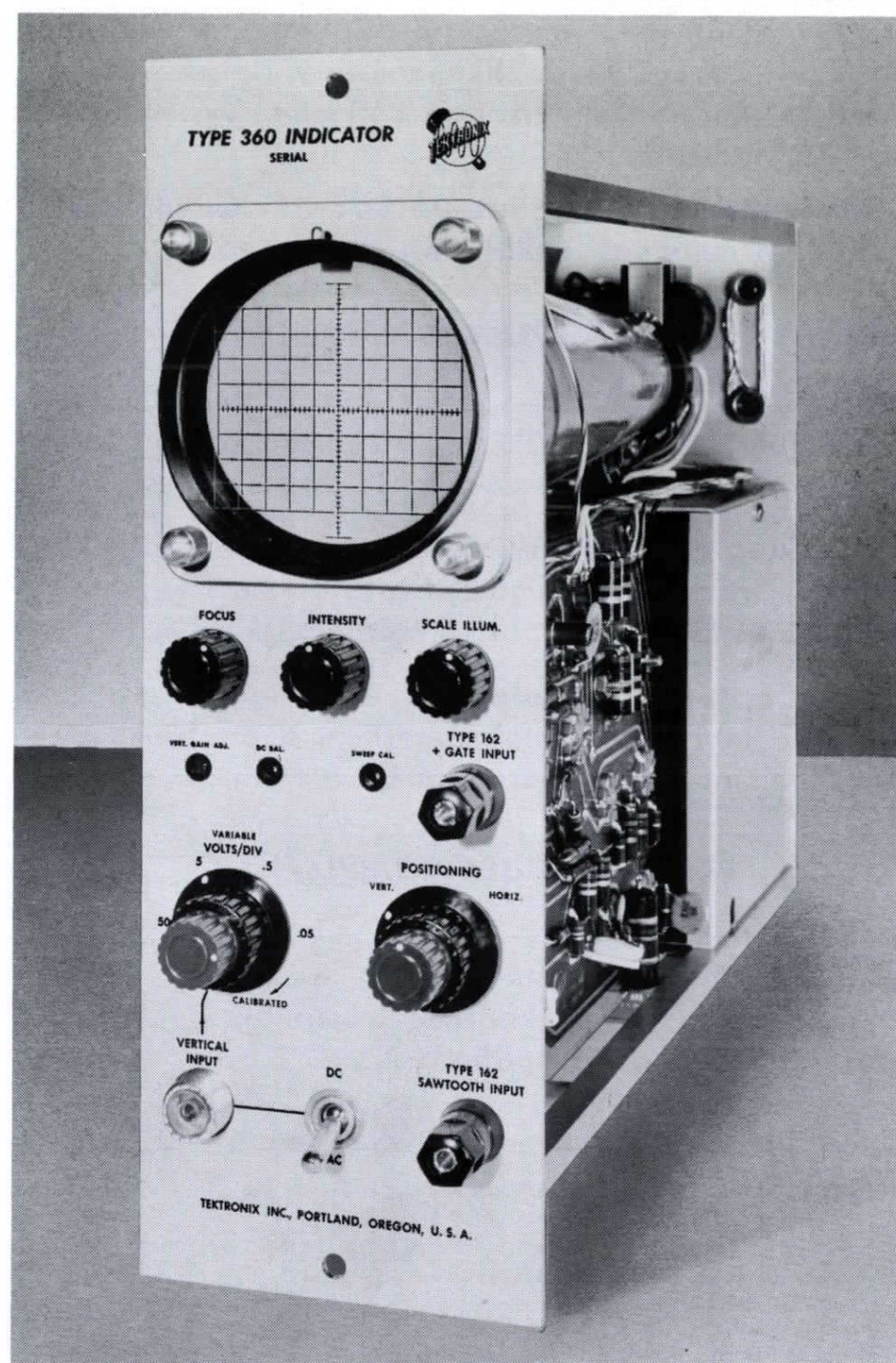
50-v positive unblanking pulse, and a sawtooth of either polarity with amplitude from 110 to 150 v and extreme voltage limits at -90 v and $+170$ v.

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 μ f.

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.

ELECTRON-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. For description and price, please see Accessory Section.

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—W160-20 connecting cable (012-016)
1—Instruction manual

Optional Phosphors

P2 crt phosphor normally furnished.

P1, P7, P11 optional. No extra charge

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



TYPE 126 POWER SUPPLY

for Type 360 Indicator and Type 160-Series Generators

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.

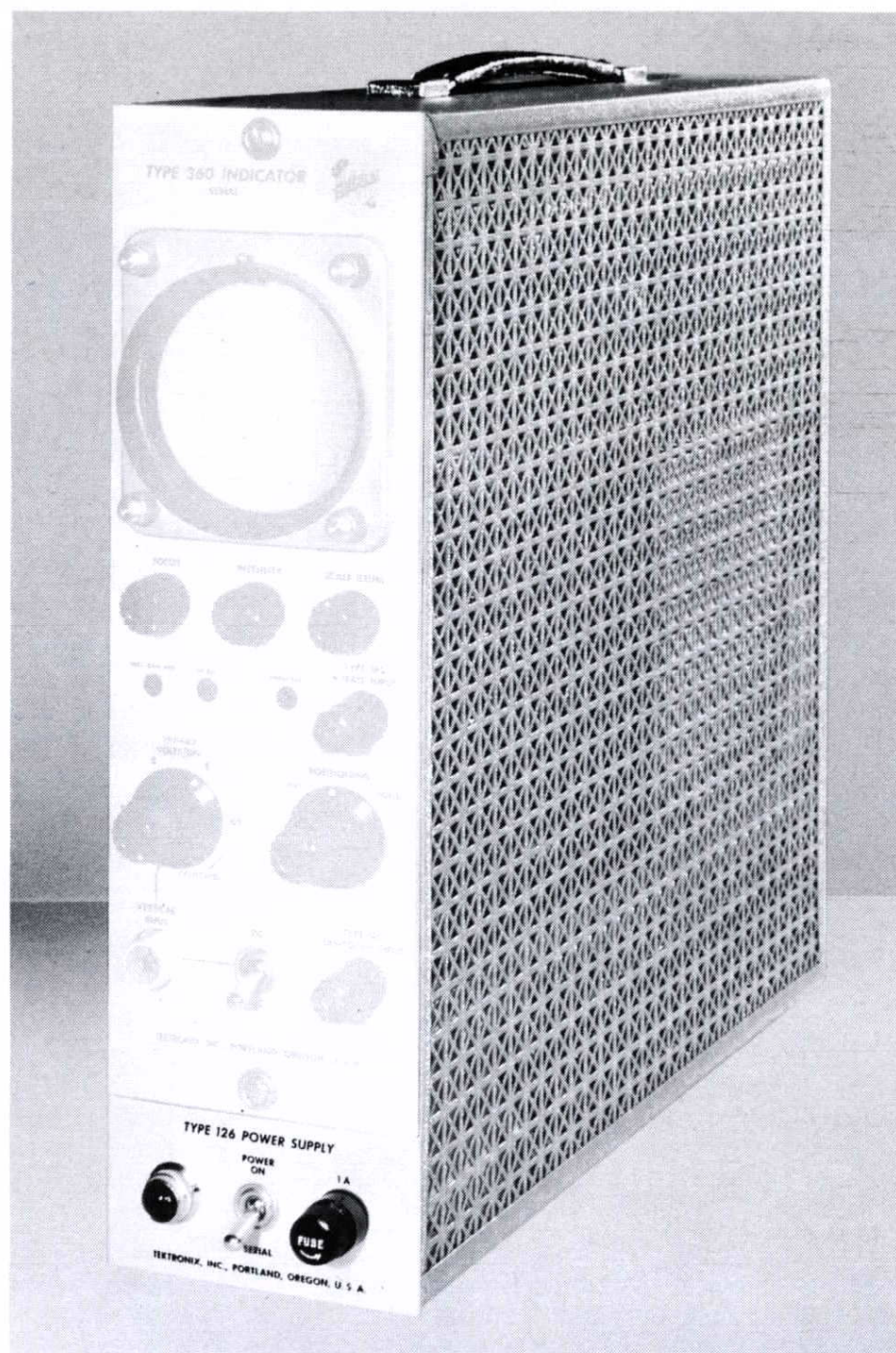
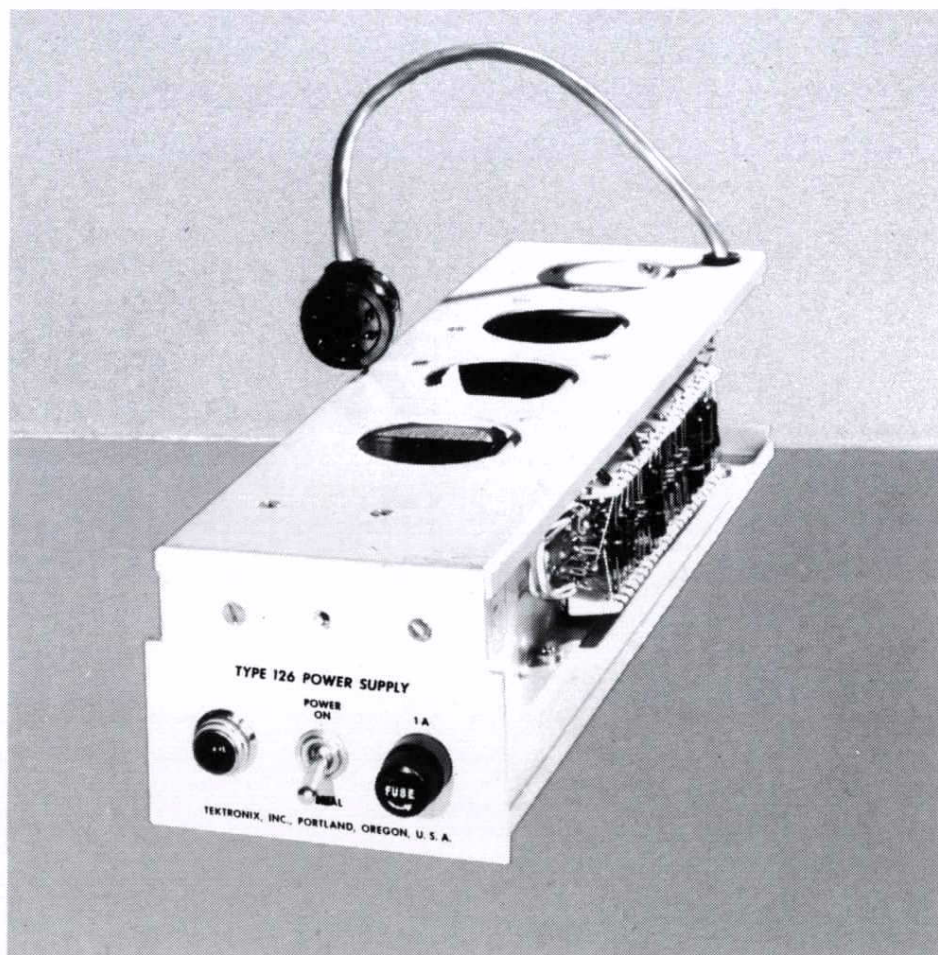
Small — Adds only 2½" in height to Type 360 Indicator.

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.)



ELECTRON-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

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

TYPE 126 POWER SUPPLY

For Type 330 Indicator
and Type 160-Series Generators

1. Connect the positive terminal of the power supply to the positive terminal of the generator.

2. Connect the negative terminal of the power supply to the negative terminal of the generator.

3. Turn the generator on and observe the indicator.

4. If the indicator does not operate, check the connections and the generator.

5. If the indicator still does not operate, consult the generator manufacturer's instructions.

6. Do not attempt to repair the generator or the power supply.

7. If you are unable to solve the problem, contact your nearest authorized service center.

8. This power supply is not to be used for any other purpose.

TYPE 180A TIME-MARK GENERATOR

Versatile Timing Source

14 Time-Mark Intervals

Two per decade from 1 μ sec to 5 sec, available separately or in combinations as a timing comb.

Three Sine-Wave Frequencies

5 mc, 10 mc, and 50 mc.

Six Trigger-Rate Frequencies

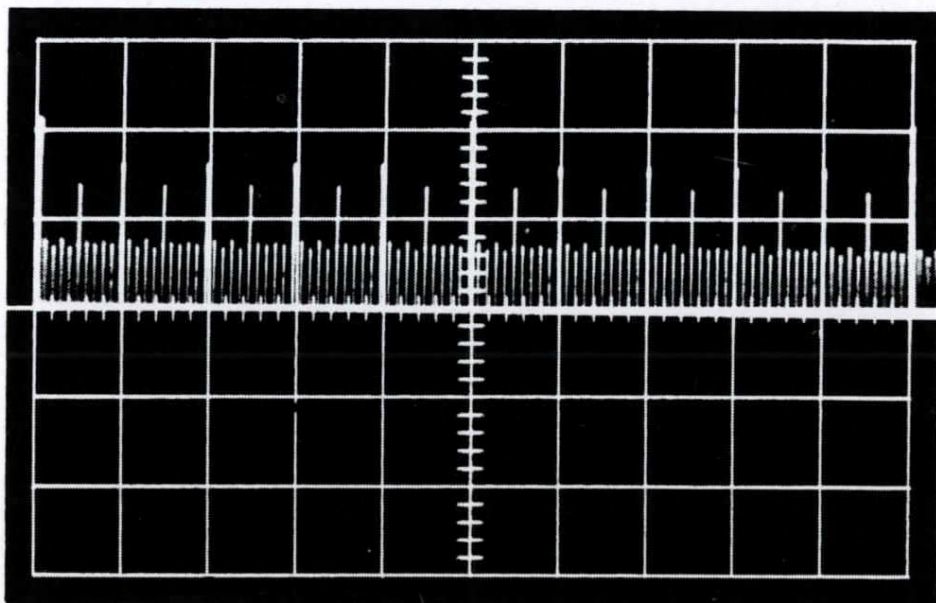
1, 10, 100 cycles, 1, 10, 100 kc.

Accuracy Within 0.03%

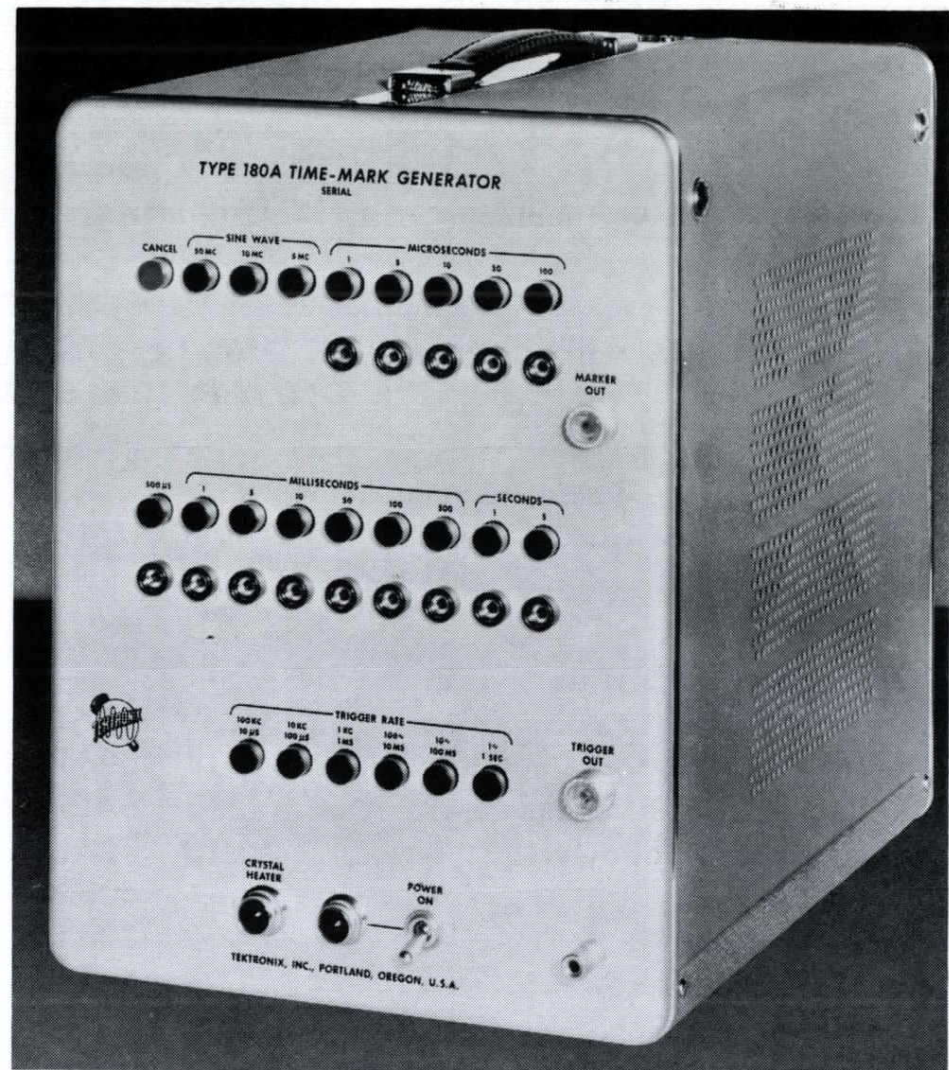
Stability of 2 ppm over a 24-hour period.

GENERAL DESCRIPTION

The Type 180A Time-Mark Generator is a high-quality source of time markers, sine waves and trigger impulses. Fourteen time markers, 3 sine-wave frequencies and 6 trigger-rate frequencies provide instrument versatility for a large number of applications in the laboratory or on the production line. With its frequency accuracy of 0.03% and stability of 2 ppm, the Type 180A 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.



Timing comb formed by a combination of 100, 500 μ sec, 1, and 5 msec markers.



CHARACTERISTICS

Time Markers—Time markers occur at intervals of 1, 5, 10, 50, 100, 500 μ sec, 1, 5, 10, 50, 100, 500 millise-c, 1 sec and 5 sec. Markers are available separately and simultaneously through banana jacks, or mixed into a timing combination through a push-button arrangement and available at a coaxial connector.

Sine Waves—Push-button switches connect the sine-wave frequencies of 5 mc, 10 mc or 50 mc to the output 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%. The 1-mc crystal is mounted in a temperature-stabilized oven. 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.

ELECTRON-TUBE COMPLEMENT

Oscillator and buffer	2	6AN8
Frequency multipliers	3	6DK6

TYPE 180A TIME-MARK GENERATOR

Nominal Voltage, Impedance and Risetime Values

	Open Circuit Voltage	Impedance at Half-Voltage	Risetime	Open Circuit Voltage (jacks)	Impedance
Markers	1 volt minimum	470 Ω at 1 μ second to 3 kilohms at 5 seconds	0.05 μ sec at 1 μ sec to 0.9 μ sec at 5 seconds	6 volts minimum	100 Ω at 1 μ sec to 180 Ω at 5 seconds
Trigger Pulses	1 1/2 volt minimum	82 Ω at 1 cps to 120 Ω at 100 kc	0.07 μ sec at 100 kc to 0.25 μ sec at 1 cps		
Sine Waves	1 1/2 volt minimum across 52-ohms				

Cathode follower	6AN8
Divider multivibrators14	5965
Coupling diode and clamp13	6AL5
Marker cathode follower13	12AU7
Series regulator	6080
Series regulator 2	12B4
Regulator amplifier 2	6AU6
Difference amplifier	6AN8
Voltage reference	5651

Weight—31 pounds.
 Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 240 watts.

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

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and 3-piece cabinet.

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

Dimensions—10" wide, 17" high, 14" deep.



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 μ sec	2 v	sine wave	150 ohms
1 μ sec	2 v	0.05 μ sec	80 ohms
10 μ sec	2 v	0.13 μ sec	80 ohms
100 μ sec	2 v	0.2 μ sec	80 ohms
1000 μ sec	2 v	0.4 μ sec	80 ohms
10,000 μ sec	2 v	0.4 μ sec	80 ohms

Regulation—DC voltages are electronically regulated.

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

ELECTRON-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 (012-014)
1—W130R lead (012-015)
1—Instruction manual

Type 181, with Type CO181A Crystal-Oven Combination installed, **\$245**

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

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. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

TYPE RM181 TIME-MARK GENERATOR

Rack-Mounting Time-Mark Source



GENERAL DESCRIPTION

The Type RM181 is a mechanically rearranged Type 181 Time-Mark Generator for mounting in a standard 19-inch rack. The instrument is fastened to the front of the rack by four screws. It requires only 5 1/4 inches of rack height.

OTHER CHARACTERISTICS

Electrical characteristics of the Type RM181 are the same as described for the Tektronix Type 181 Time-Mark Generator. Outputs are: 1, 10, 100, 1000, 10,000 microseconds, and a 10-mc sine wave.

MECHANICAL SPECIFICATIONS

Construction — Aluminum-alloy chassis.

Finish — Photo-etched anodized panel.

Dimensions — 5 1/4" high, 19" wide, 9 1/4" rack depth (approximately 3" additional required for power cord), 11" overall depth.

Weight — 16 3/4 pounds.

Type RM181 **\$250**

Includes: 1—P93 output cable
1—W130B lead (012-014)
1—W130R lead (012-015)
1—Set mounting hardware
1—Instruction manual

Type RM181, with Type CO181A Crystal-Oven Combination installed, **\$270**

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 RM181 — no wiring changes necessary. Provides a frequency stability of 2 ppm over a 24-hour period **\$27.00**

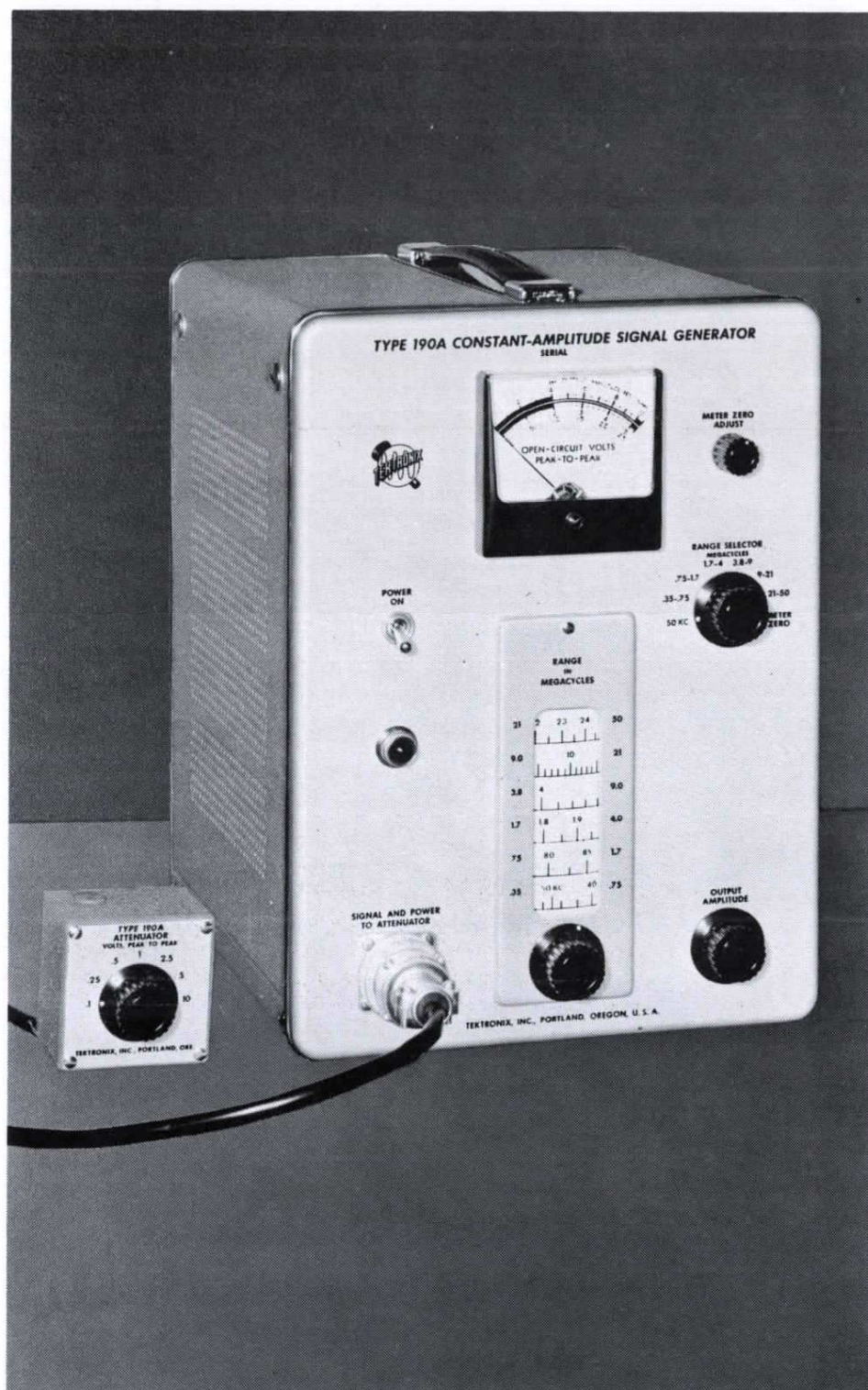
Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

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.

ELECTRON-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

Painted Panels

Tektronix Instruments can be furnished with painted front panels on special order. Please consult your Tektronix Field Engineer or Representative for specifications and other special information required on purchase orders involving painted panels.

Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

THE SIGNAL GENERATOR

7 contacts (Amplitude Signal Generator)



SCOPE-MOBILES

Type 500/53A



The Tektronix Type 500/53A 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. The front panel has two supporting cradles to accommodate Type 53 and Type 53/54 Plug-In Units. 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 35 pounds. Dimensions are 18½" wide, 39" high and 30" deep.

Type 500/53A \$108.00

Type 53A Scope-Mobile Panel — for Type 500A Scope-Mobiles. Converts the Type 500A to a Type 500/53A by replacing the standard blank panel. 014-005 10.50

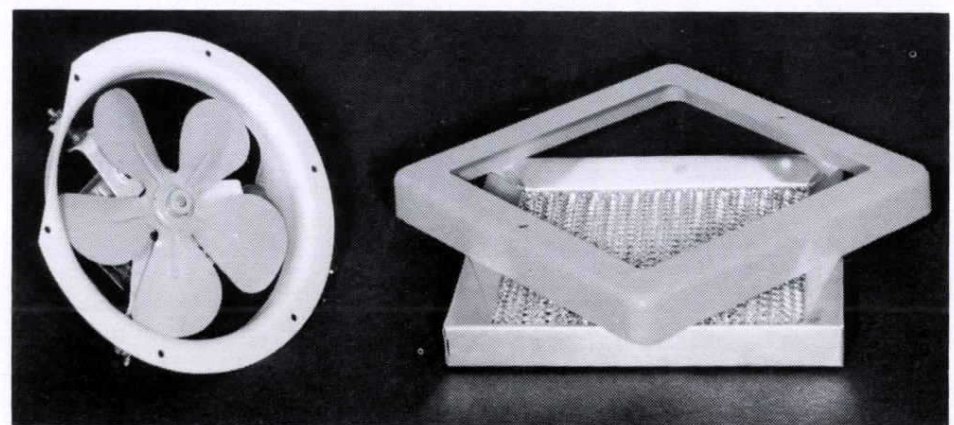
Type 53 Scope-Mobile Panel — For Type 500 Scope-Mobiles only. Converts the earlier Type 500 model to a Type 500/53 by replacing the standard blank panel. 014-004 10.50

Type 500A



The Tektronix Type 500A Scope-Mobile is identical to the Type 500/53A, except for the front panel. Auxiliary equipment can be mounted behind the blank front panel, but it will usually be necessary to provide forced-air ventilation for the equipment compartment. A fan kit, 040-161, is recommended for this purpose.

Type 500A 97.50



Scope-Mobile Fan Kit — for forced-air ventilation of the equipment compartment of the Type 500A Scope-Mobile. Contains motor, blade, filter, and mounting hardware. 040-161 15.00

Prices f.o.b. factory.

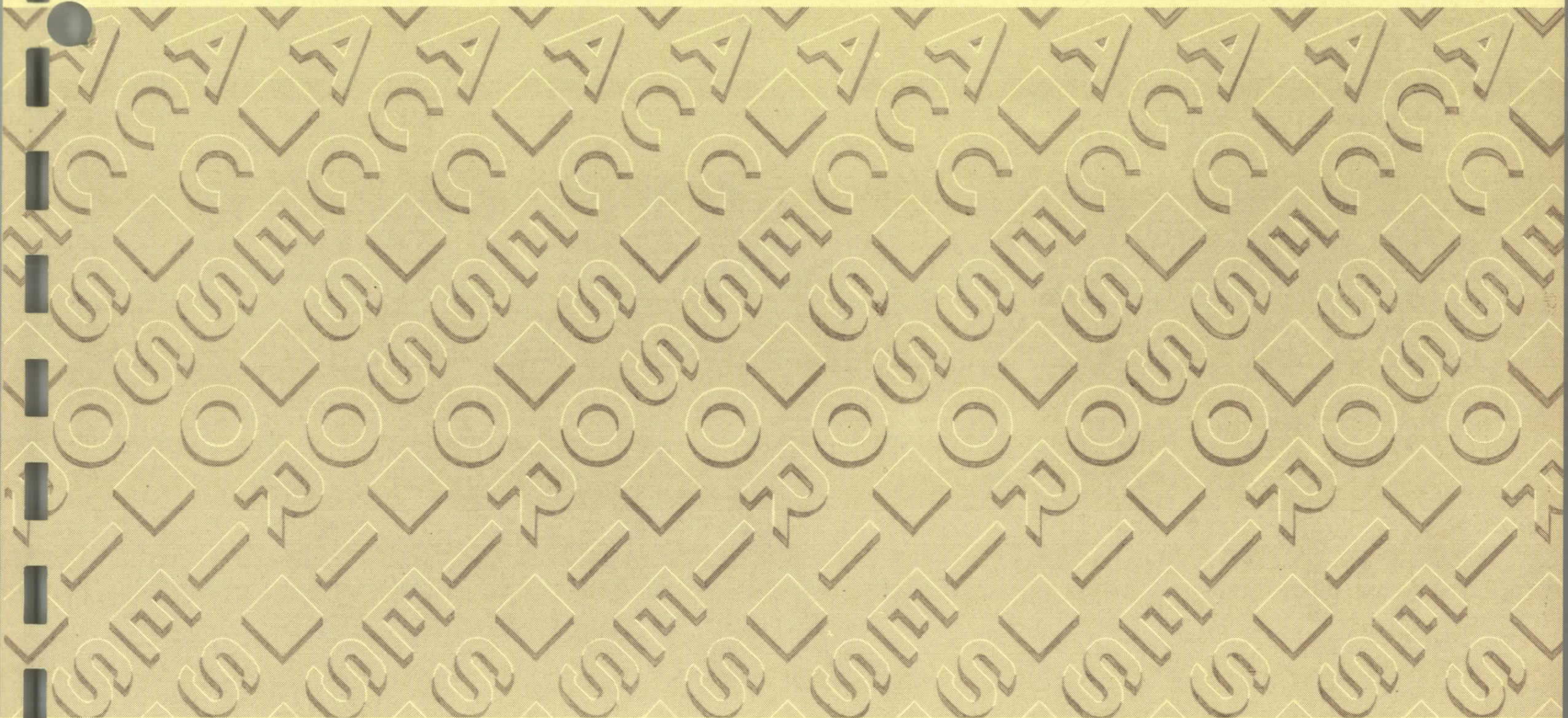


2004-MOJLES

Type 200A

Type 200-23A





ACCESSORIES

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

ACCEPTED

These are the terms of the contract
agreed upon by the parties
and shall be binding on all
parties to the contract.

MODIFICATION KITS

Type 531 and Type 541 Oscilloscopes

K531 Sweep Lockout. Single-sweep lockout reset feature for one-shot recording. 040-118 **\$25.00**

Type 532 Oscilloscopes

K532 Sweep Lockout. Same as for Type 531 and 541. 040-147 **\$25.00**

Type 531 and Type 535 Oscilloscopes

K531/535. Preset Stability. Eliminates trigger-control readjustments in most applications. For Type 531 serial numbers 101 through 607, for Type 535 serial numbers 101 through 1074. 040-149 **\$18.50**

K530/K540-1. Preset Stability. For Type 531 serial numbers 608 through 5453, for Type 535 serial numbers 1075 through 5469. 040-152 **\$5.00**

K530/K540-2. Preset Stability. For Type 531 serial numbers 5454 through 6019, for Type 535 serial numbers 5470 through 6044. 040-153 **\$4.50**

K530/K540-3. Preset Stability. For Type 531 serial numbers 6020 through 6710, for Type 535 serial numbers 6045 through 7552. 040-154 **\$2.50**

K531/535 HF SYNC. Improves operation of HF SYNC triggering mode. For Type 531 serial numbers 101 through 651, for Type 535 serial numbers 101 through 1207. 040-150 **\$1.50**

Type 541 and Type 545 Oscilloscopes

K530/K540-1. Preset Stability. Eliminates trigger-control readjustments in most applications. For Type 541 serial numbers 101 through 5253, for Type 545 serial numbers 101 through 5550. 040-152 **\$5.00**

K530/K540-2. Preset Stability. For Type 541 serial numbers 5254 through 5414, for Type 545 serial numbers 5551 through 5945. 040-153 **\$4.50**

K530/K540-3. Preset Stability. For Type 541 serial numbers 5415 through 5942, for Type 545 serial numbers 5946 through 7400. 040-154 **\$2.50**

Type 517 Oscilloscopes

K517-593. Increases reliability of boot-strap circuitry and simplifies maintenance. For serial numbers 101 through 560. 040-053 **No Charge**

K517-1127-1. Cathode-ray tube change to a T54PH. Increases vertical sensitivity to 0.05 v/cm, increases vertical deflection to 4 cm, improves focus and sweep linearity. Includes T54P11H cathode-ray tube. For serial numbers 101 through 925 except 921. 040-108 **\$120.00**

K517-1127-2. Limits sweep duty cycle to 15% to avoid overloading sweep circuits. For serial numbers 101 through 925 except 921. 040-107 **\$10.00**

Type 524 Oscilloscopes

K524-1010. Improved high-voltage supply. For serial numbers 101 through 1429. 040-058 **\$40.00**

K524-579. Installation of 7" fan increases reliability. For serial numbers 101 through 789. 040-060 **\$18.00**

K524-705. Reduces ripple in power supply. For serial numbers 101 through 820. 040-090 **No Charge**

K524-717. Prevents parasitic oscillations in vertical amplifier. For serial numbers 101 through 859. 040-091 ..
..... **No Charge**

K524-1021A. Front-panel power receptacle for P500CF cathode-follower probe. For serial numbers 101 through 1842. 040-059 **\$5.00**

K524-748-1. Relocates selenium rectifiers in airstream for improved reliability. Includes thermal cut-out. For serial numbers 101 through 902. 040-055 **\$17.00**

K524-748-2. Same as above. For serial numbers 903 through 1069. 040-056 **\$17.00**

K524-805. Converts vertical-amplifier response to flat within $\pm 1\%$ to 5 mc. Includes new access panel. For serial numbers 101 through 1399. 040-057 **\$6.50**

For a complete list of available modification kits, please call your Field Engineer or Representative.



MODIFICATION KITS

1. The first step is to identify the modification kit that is required for the specific application. This is done by consulting the manufacturer's literature and the application engineer.

2. The second step is to obtain the modification kit from the manufacturer. This is done by placing an order with the manufacturer and providing the necessary information.

3. The third step is to install the modification kit on the equipment. This is done by following the instructions provided in the manufacturer's literature.

4. The fourth step is to test the equipment to ensure that the modification kit is installed correctly and that the equipment is operating properly.

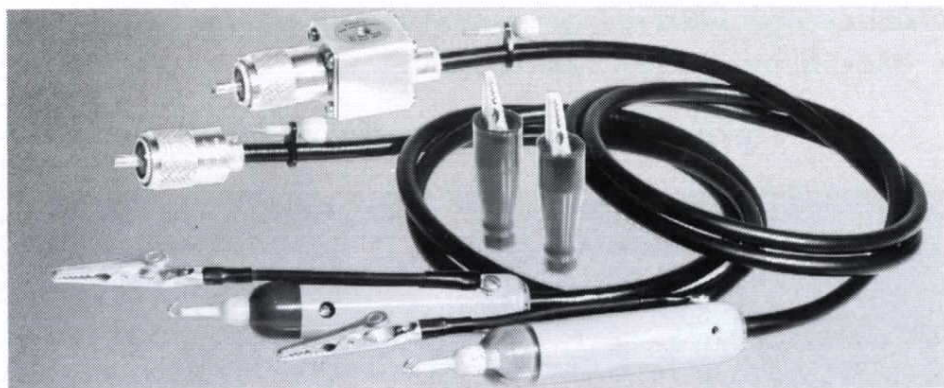
5. The fifth step is to maintain the equipment to ensure that the modification kit continues to operate properly. This is done by following the manufacturer's maintenance instructions.

6. The sixth step is to replace the modification kit when it becomes worn or damaged. This is done by following the manufacturer's instructions for replacement.

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. 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

P400-SERIES PROBE SPECIFICATIONS

Probe	Ratio Atten.	INPUT IMPEDANCE		DB Loss at 30 MC	Voltage Rating (max.)
		Resist. (Meg Ω)	Capacitance Minimum* Maximum†		
P405	5:1	5	12 $\mu\mu\text{f}$ 19 $\mu\mu\text{f}$	1-2	600
P410	10:1	10	8 $\mu\mu\text{f}$ 11 $\mu\mu\text{f}$	1	600
P420	20:1	10	5.5 $\mu\mu\text{f}$ 7 $\mu\mu\text{f}$	1	600
P450	50:1	10	3.5 $\mu\mu\text{f}$ 3.5 $\mu\mu\text{f}$	1	1000
P450-L	50:1	10	2.5 $\mu\mu\text{f}$	1	1000
P4100	100:1	10	2.5 $\mu\mu\text{f}$ 2.5 $\mu\mu\text{f}$	1	1000

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

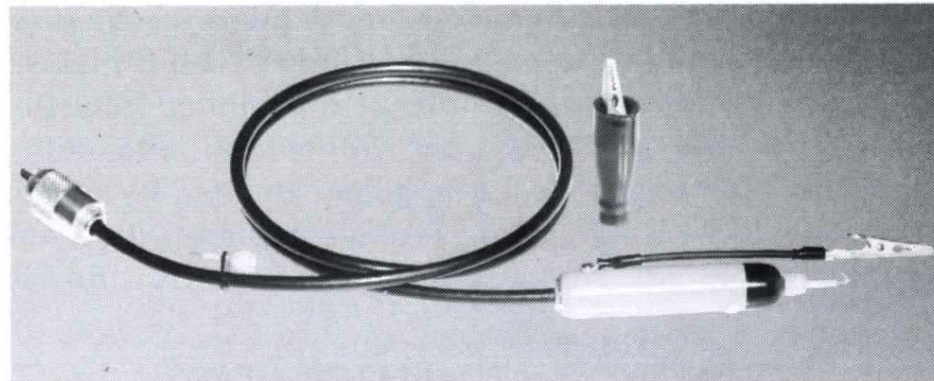
†When connected to instruments with input capacitances up to 50 $\mu\mu\text{f}$.

P400-Series Probes with Long Cables—Input capacitance and insertion loss are affected by cable length. With cables up to 12' in length, insertion loss is less than 3 db at 20 mc, and overshoot is less than 1%.

P400-SERIES PROBES with 8' CABLES

Probe	INPUT CAPACITANCE		Tek Number	Price
	Minimum	Maximum		
P405	21 $\mu\mu\text{f}$	30 $\mu\mu\text{f}$	010-013	\$12.50
P410	12 $\mu\mu\text{f}$	15 $\mu\mu\text{f}$	010-014	12.50
P420	8 $\mu\mu\text{f}$	9 $\mu\mu\text{f}$	010-015	12.50
P450	4 $\mu\mu\text{f}$	4 $\mu\mu\text{f}$	010-016	14.50
P450-L	3 $\mu\mu\text{f}$		010-017	14.50
P4100	3 $\mu\mu\text{f}$	3 $\mu\mu\text{f}$	010-018	14.50

Prices for P400-Series Probes with other cable lengths available on request.



P510A Attenuator Probe provides an attenuation of ten times when used with Tektronix oscilloscopes and amplifiers. The P510A is small and streamlined, and presents an input impedance of 10 megohms paralleled by 14 $\mu\mu\text{f}$. 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 maximum.

P510A 8.50

P510A PROBES WITH LONG CABLES

P510A probe cables ring at a period that depends on the cable length and, to a lesser degree, on the input capacitance of the oscilloscope used. Each particular cable length will be satisfactory only when zero transmission of the oscilloscope does not extend to a frequency that includes the resonant frequency of the probe. This difficulty has been eliminated in the P400-Series Probes.

P510A with 6' cable, Tek 010-004 9.00

P510A with 8' cable, Tek 010-005 9.50

Prices for P510A Probes with other cable lengths available on request.



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

Prices f.o.b. factory.



ACCESSORIES

Operational Accessories

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

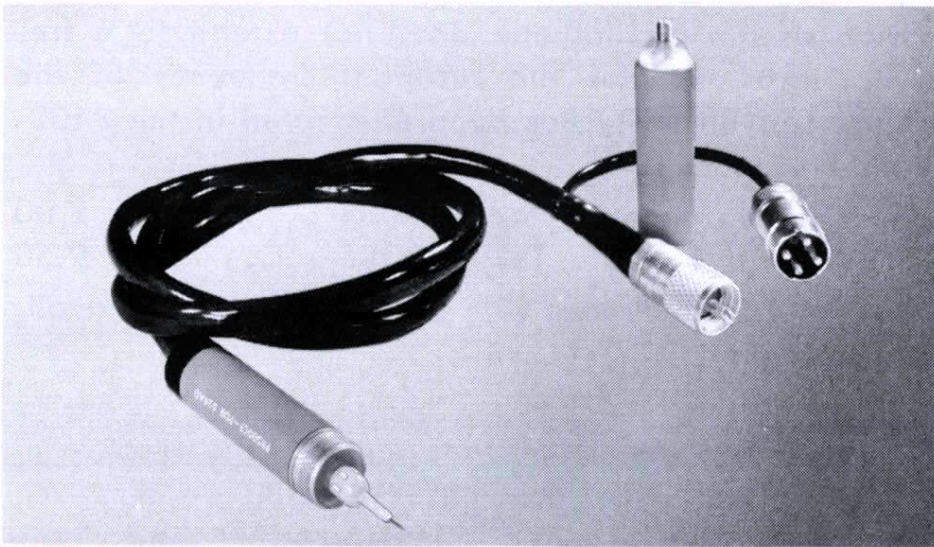
PAX-I Attenuator Head for P170CF, attenuation can be varied between 4 times and 40 times. 11.00

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



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

TYPE 128 PROBE POWER SUPPLY



Type 128 Probe Power Supply for P500CF and P170CF cathode-follower probes. The Type 128 supplies the necessary plate and filament voltages for one or two probes, making it possible to use the cathode-follower probes with oscilloscopes not equipped with a probe-power outlet.

DC Output Voltages:

- + 120 v regulated, at 25 ma
- + 6.3 v unregulated, at 150 ma
- + 6.3 v unregulated, at 150 ma

When a P170CF probe is to be used with an instrument other than the Tektronix Type 517, a 170-ohm terminating resistor is required. The B170R Terminating Resistor is recommended for this purpose.

Ripple—Ripple on the 120 v supply is not more than 5 mv peak-to-peak, and not more than 75 mv peak-to-peak on the 6.3 v supplies.

Power Requirements—105 to 125 v or 210 to 250 v, 50 to 60 cycles, 25 watts using two P500CF probes.

Dimensions—4 3/4" wide, 7 3/4" high, 9" overall depth.

Weight—6 lbs.

Type 128, Tek 015-006 \$95.00

Probe Power-Cable Extension—a 24" 3-conductor power-cable extension for Tektronix cathode-follower probes. Permits wider separation of the probe power source from the instrument signal input.

012-030 \$5.00

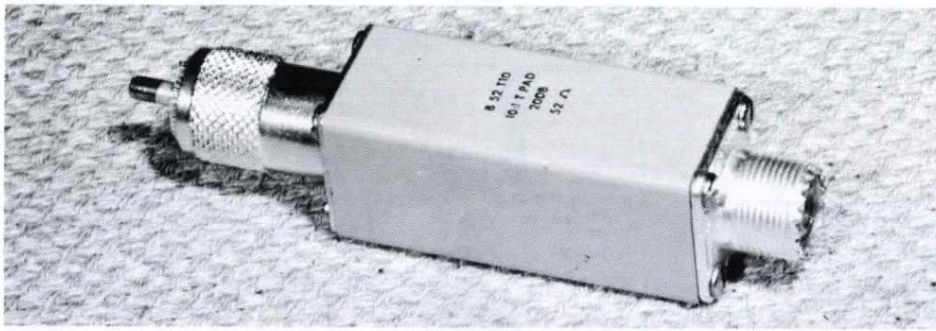
Prices f.o.b. factory.



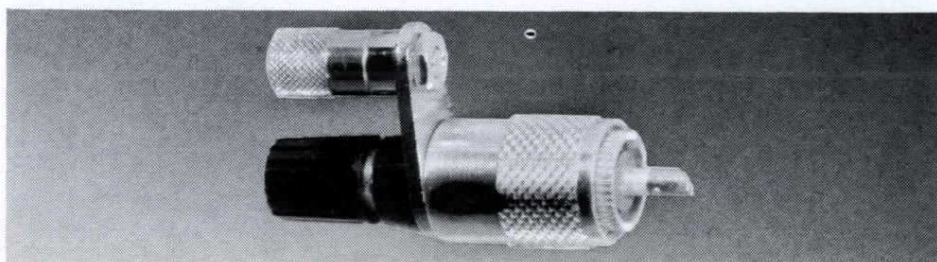
ACCESSORIES

Operational Accessories

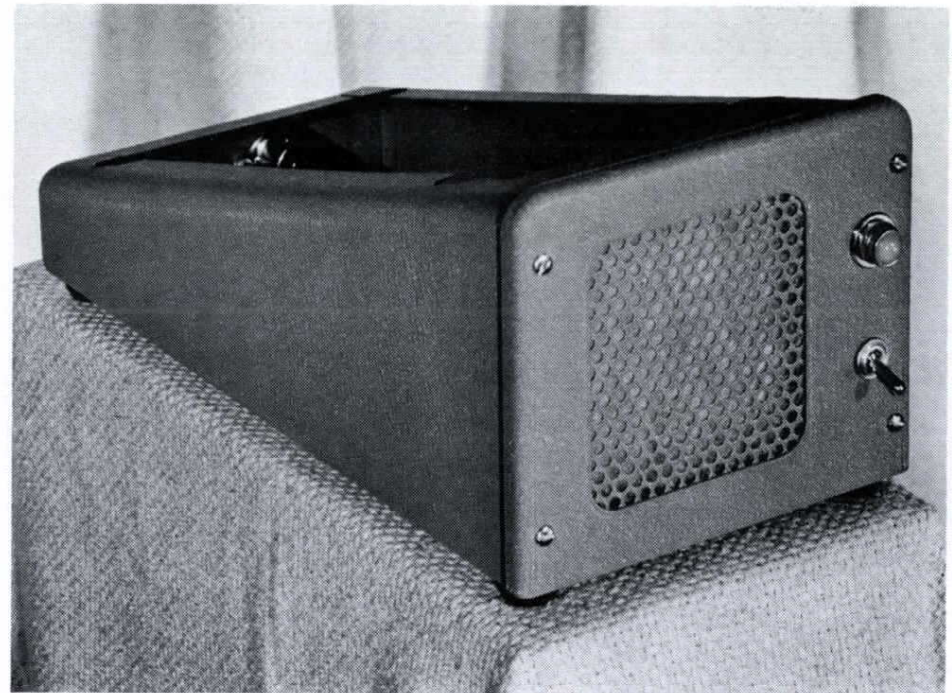
TERMINATIONS, PADS, ATTENUATORS



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
011-023	75-ohm terminating resistor for Type 525, 0.5 w	4.00
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

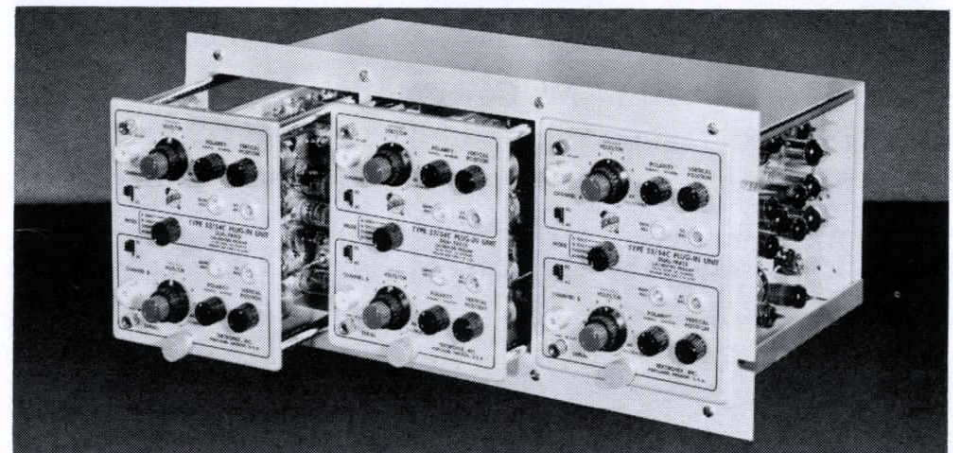


Binding Post Adapter with ground terminal, $\frac{3}{4}$ " spacing. Tek no. 013-009.....\$3.00

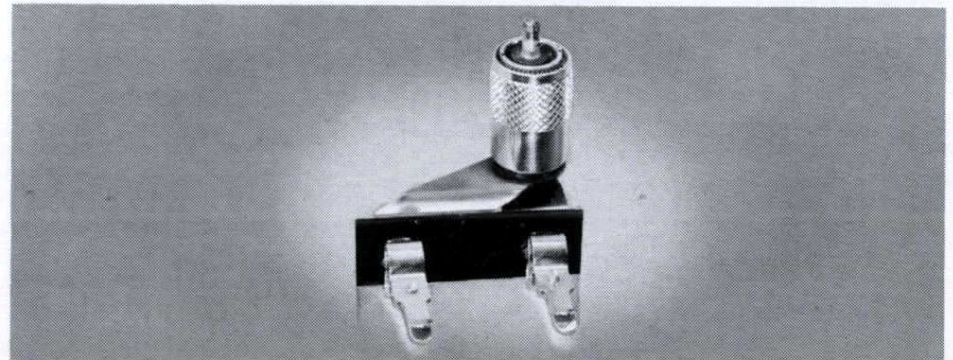


FB 310 Fan Base—for Type 310 Oscilloscope. Provides filtered, forced-air ventilation to assure safe operating temperature when the Type 310 Oscilloscope is being used continuously over long periods, or in hot or limited-ventilation areas. The fan base tilts the oscilloscope to a convenient viewing angle.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



53/54 Storage Frame Cabinet—Mounts in standard rack, holds three Type 53/54 Plug-In Units. Dimensions: 19" wide, 8 $\frac{3}{4}$ " high, 9 $\frac{3}{8}$ " deep. Tek no. 437-031. Price, without plug-in units25.00

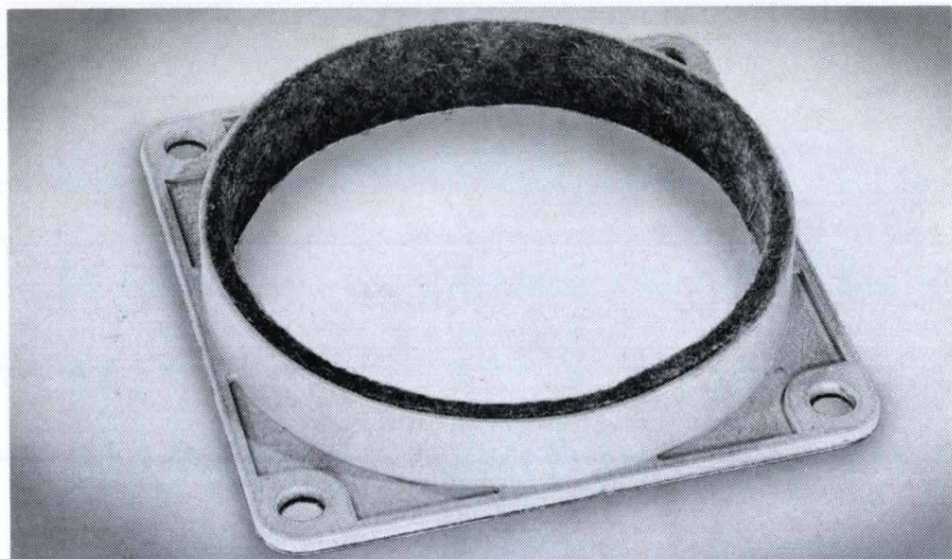


F30 Production Test Fixture, for use with the Type 130 L,C Meter. Speeds sorting and testing of capacitors and inductors 3.00

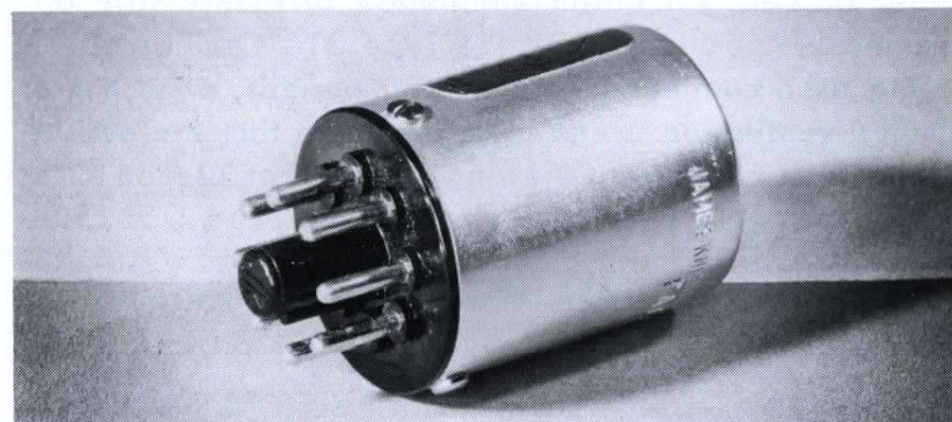
Prices f.o.b. factory.

ACCESSORIES

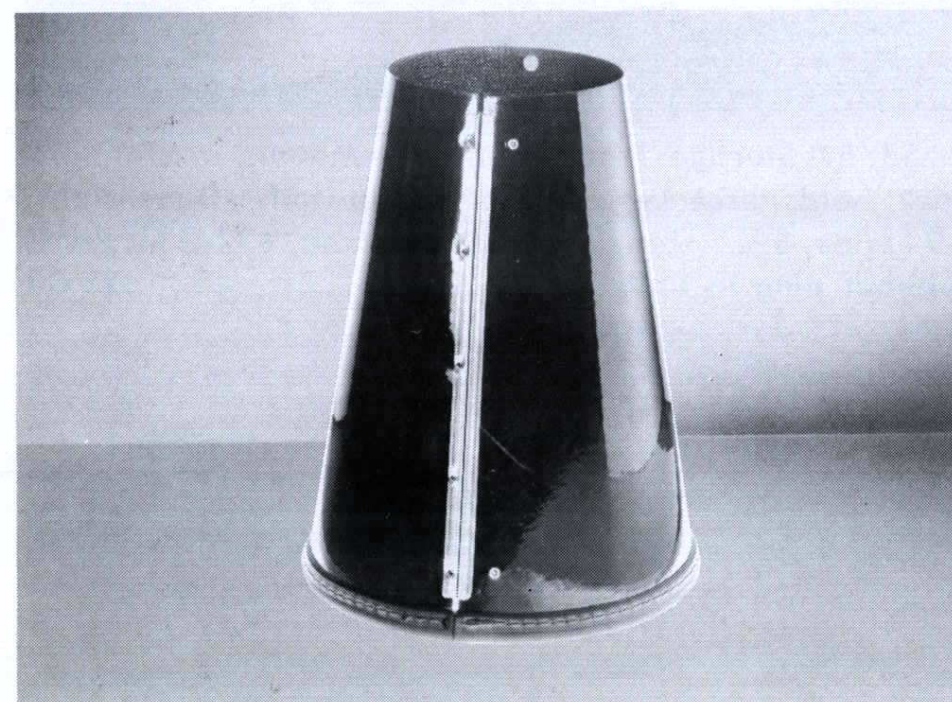
Operational Accessories



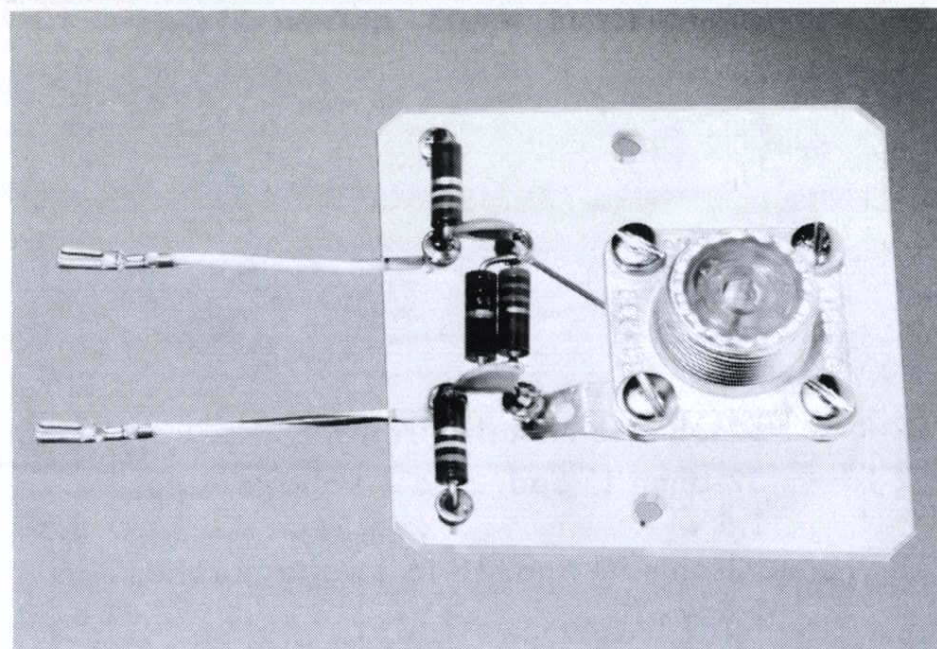
BE510 Bezel, for mounting camera on Tektronix 5" oscilloscopes. Dimensions— $5\frac{7}{8}$ " square; ring $\frac{7}{8}$ " deep, diameter $5\frac{5}{8}$ " outside, $5\frac{1}{8}$ " inside. Die-cast construction, wrinkle finish, felt lined. 4.50



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



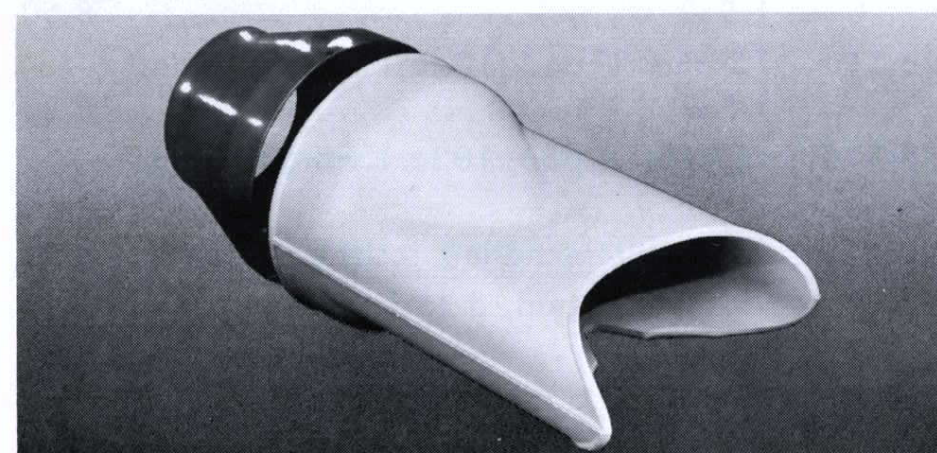
HC 310 Collapsible Viewing Hood, for Tektronix 3" Oscilloscopes. It is made of black acrylic plastic with handy fastening arrangement. Tek no. 016-010. .3.50



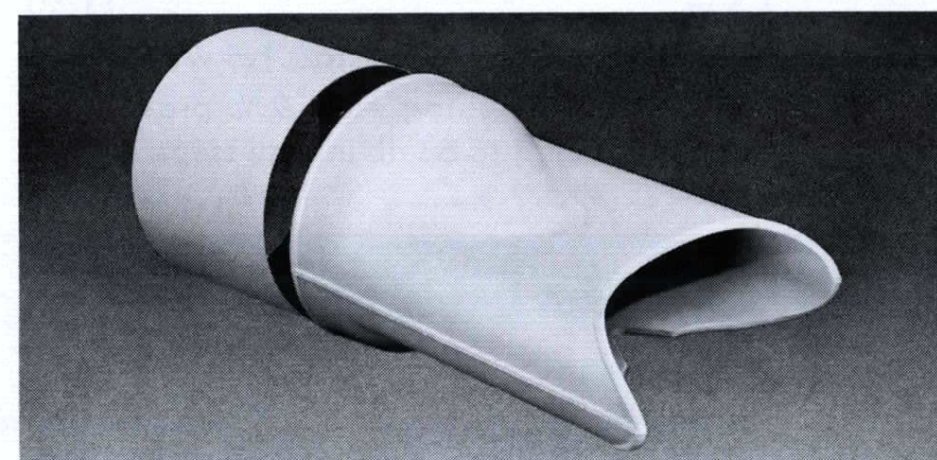
DP 52 Deflection Plate Connector, for Type 530 and 540-Series Oscilloscopes. A convenient means of making a connection directly to the cathode-ray tube vertical-deflection plates. Function of the vertical positioning control is retained. The connector is designed for use with a 52-ohm cable.

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



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

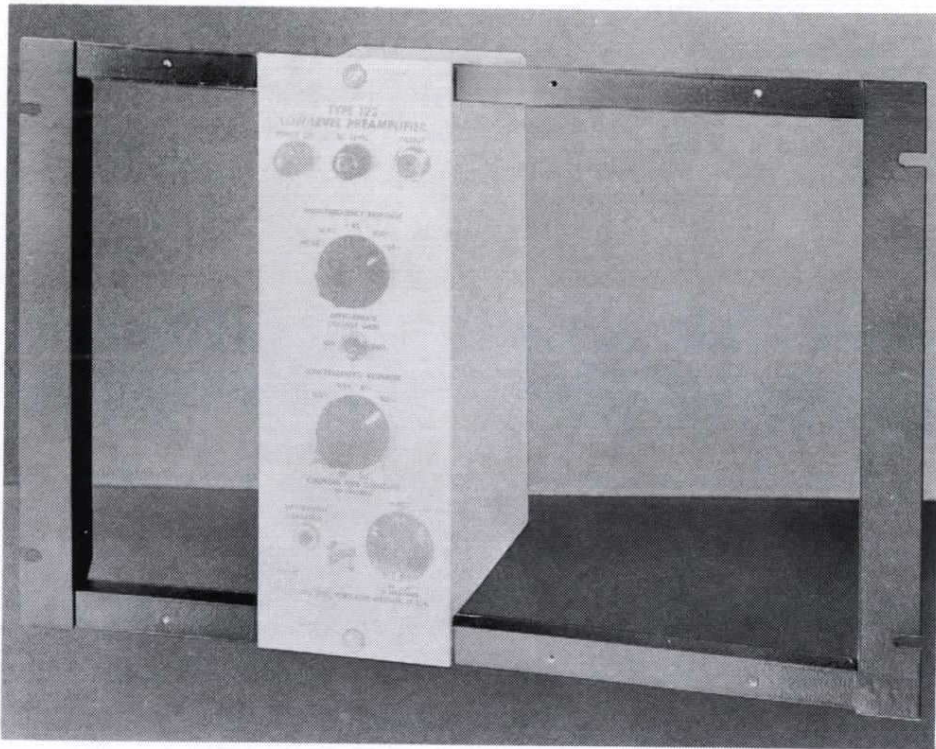


H510 Viewing Hood, for Tektronix 5" Oscilloscopes. Includes molded rubber eye-piece and aluminum light shield 4.50

Prices f.o.b. factory.

ACCESSORIES

Operational Accessories

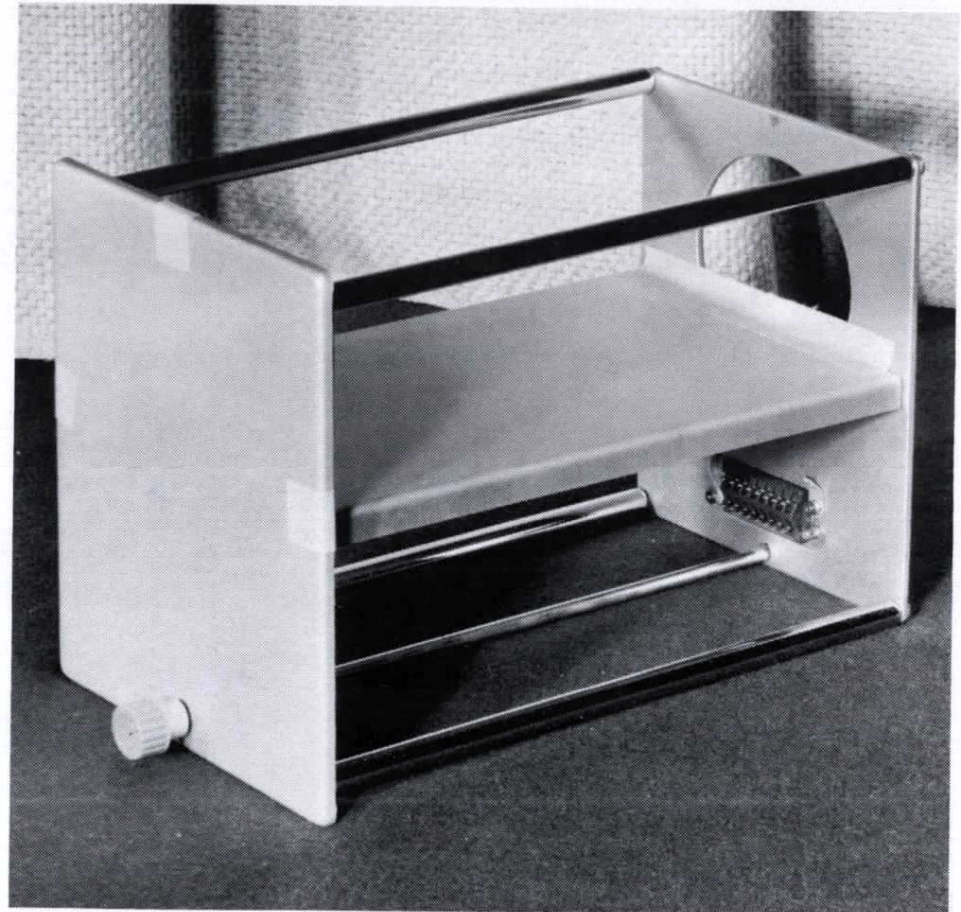


FA160 Mounting frame. Holds four of any combination of Type 122, Type 360, and Type 160-Series units. Mounts to standard instrument rack 5.00

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



040-065 Blank Plug-in Skeleton 15.00

MISCELLANEOUS

- A100 Adapter, clip lead. 2.00
- A510 Adapter, binding post. 2.00

Prices f.o.b. factory.



Operational Accessories

939 - Control output cable (2) other variants

940 - Control output cable (2) other variants

941 - Control output cable (2) other variants

942 - Control output cable (2) other variants

943 - Control output cable (2) other variants

944 - Control output cable (2) other variants

945 - Control output cable (2) other variants

946 - Control output cable (2) other variants

947 - Control output cable (2) other variants

948 - Control output cable (2) other variants

949 - Control output cable (2) other variants

ACCESSORIES

Test Accessories Plug-In Test Unit

GENERAL DESCRIPTION

The Type 53/54P is a special-purpose test unit for Tektronix convertible oscilloscopes. You plug it in instead of a plug-in preamplifier, and use the step function it generates to adjust the oscilloscope main vertical amplifier and delay network. By this procedure you can standardize the transient response of a number of like oscilloscopes. A Type 53/54 Plug-In Preamplifier will exhibit identical transient-response characteristics in like oscilloscopes that have been standardized with the Type 53/54P.

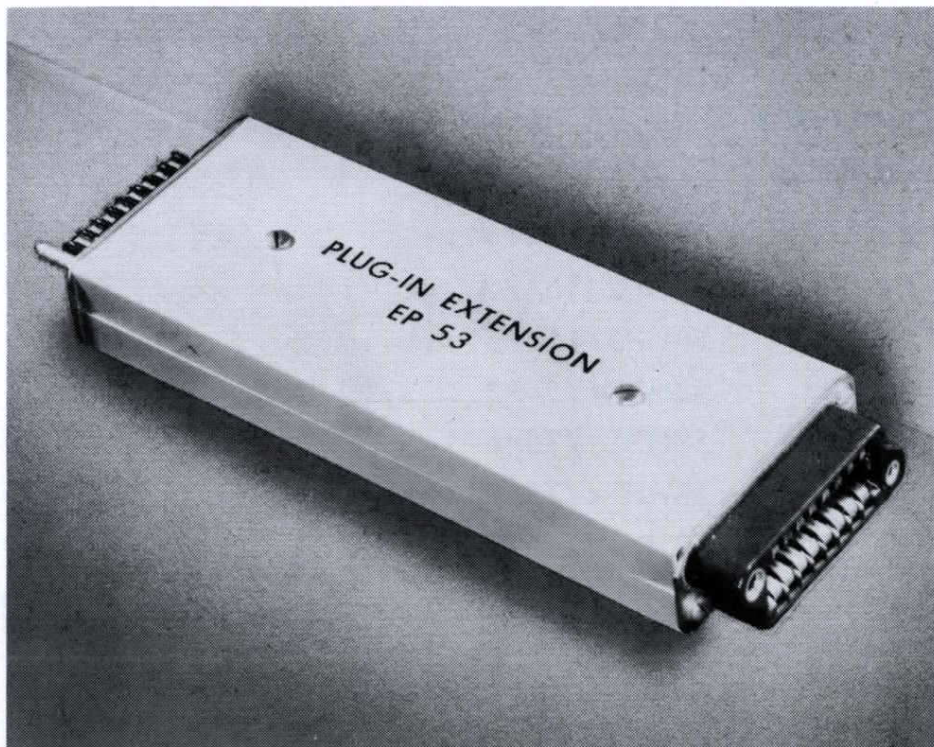
OTHER CHARACTERISTICS

Risetime of the step function generated by the Type 53/54P is less than 4 millimicroseconds. Polarity can be either positive or negative, and amplitude is continuously adjustable from 0 to 3 major graticule divisions. Repetition rate is 240/sec.

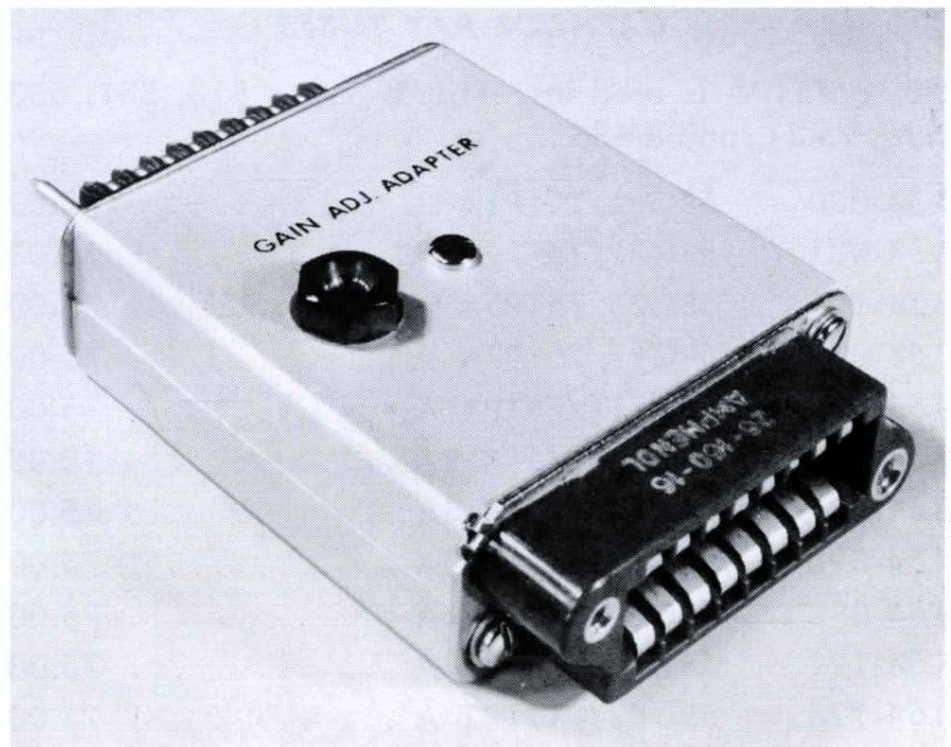
MECHANICAL SPECIFICATIONS

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

Price \$60



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

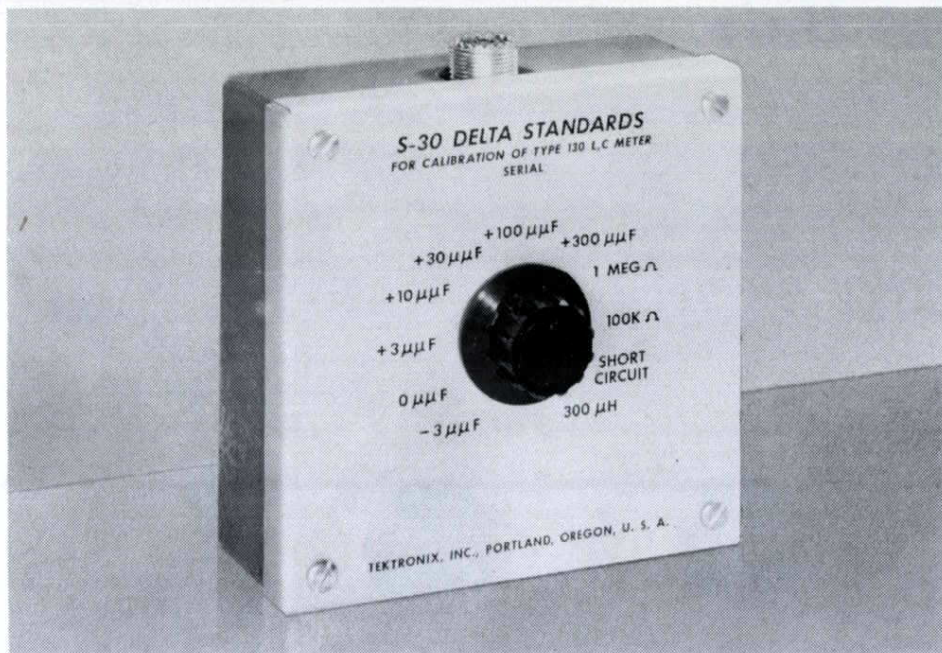


013-005 (EP53A) Gain Set Adapter—Permits an external calibrating signal to bypass the plug-in preamplifier, for calibrating the sensitivity of the main amplifier of Type 530 and 540-Series Oscilloscopes. 5.00

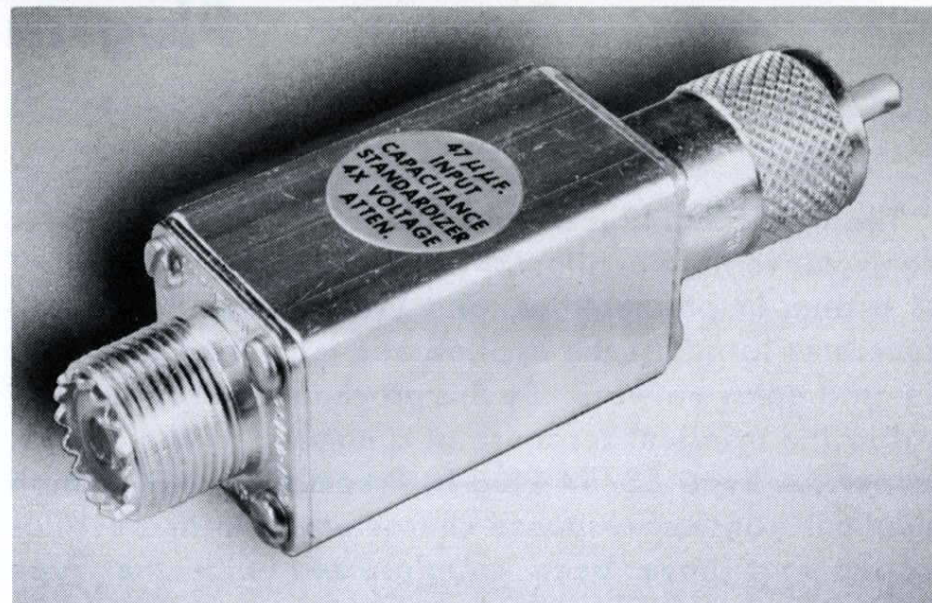
Prices f.o.b. factory.

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 ranges22.00



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 μ f. With this accessory the input capacitance of each preamplifier can be standardized to 47 μ f, eliminating the necessity for probe readjustment when used with different plug-in preamplifiers11.50

011-022 (CS 20) Input Capacitance Standardizer—Similar to 011-021 (CS 47), for use with the Types 53/54C, 53/54K and 53/54L Plug-In Preamplifiers having 20 μ f input capacitance11.50

Prices f.o.b. factory.

Replacement Parts

CATHODE-RAY TUBES

5BGP/T51PA is used in Tektronix Types 513, 531, 533, 535, RM31, and RM35

154-080	5BGP1/T51P1A	75.00
154-081	5BGP2/T51P2A	75.00
154-123	5BGP5/T51P5A	75.00
154-082	5BGP7/T51P7A	75.00
154-083	5BGP11/T51P11A	75.00
154-101	5BGP12/T51P12A	75.00
154-117	5BGP14/T51P14A	75.00
154-096	5BGP15/T51P15A	75.00
154-092	5BGP16/T51P16A	75.00
154-121	5BGP19/T51P19A	75.00
154-124	5BGP24/T51P24A	75.00

T52P is used in Tektronix Types 525, 532, RM32, 570, and 575

154-093	T52P1	50.00
154-097	T52P2	50.00
154-102	T52P7	50.00

154-103	T52P11	50.00
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5BHP/T54P is used in Tektronix Types 541, 545, RM41, and RM45

154-106	5BHP1/T54P1	100.00
154-098	5BHP2/T54P2	100.00
154-111	5BHP5/T54P5	100.00
154-104	5BHP7/T54P7	100.00
154-099	5BHP11/T54P11	100.00
154-110	5BHP14/T54P14	100.00
154-122	5BHP15/T54P15	100.00
154-118	5BHP16/T54P16	100.00

T54PH is used in Tektronix Type 517A

154-107	T54P1H	110.00
154-109	T54P2H	110.00
154-108	T54P7H	110.00
154-105	T54P11H	110.00
154-115	T54P15H	110.00
154-128	T54P16H	110.00



ACCESSORIES

T55P is used in Tektronix Types 515 and RM15

154-125	T55P1	60.00
154-120	T55P2	60.00
154-126	T55P7	60.00
154-127	T55P11	60.00

T56P is used in Tektronix Type 536

154-140	T56P1	60.00
154-133	T56P2	60.00
154-135	T56P7	60.00
154-136	T56P11	60.00

T32P is used in Tektronix Types 316 and RM16 (Replaces T31P with minor circuit changes)

154-154	T32P1	40.00
154-155	T32P2	40.00
154-156	T32P7	40.00
154-157	T32P11	40.00
154-158	T32P16	40.00
154-159	T32P24	40.00

GRATICULES

386-395	Unruled, for Type 310, 316, and 360..	1.00
386-312	Unruled, for Type 315.....	1.00
386-326	Unruled, fits Types 511A, 512, 513, 514, 514A, 524D, 524AD, 531 and 535	1.00
386-451	Unruled, for Types 515, 515A, 541, 545, 517A	1.00
331-027	Quarter-inch divisions, 8 divisions vertically, 10 horizontally, for Type 310, 316 and 360	1.50
331-005	Quarter-inch divisions, 8 divisions vertically, 10 horizontally, for Type 315...	1.50
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
331-037	Graticule 5", 6 cm vertically, 10 cm horizontally, for Type 515, 515A	1.50

331-008	Centimeter ruling, 4 cm vertically, 8 horizontally, for Type 517 with 5XP crt	9.50
331-033	Adjustable reference, 4 cm vertically, 8 horizontally for Type 517A and Type 517 with T54P CRT	1.50
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
331-034	Centimeter ruling, 4 centimeters vertically, 10 horizontally, for Types 541 and 545.....	1.50
331-028	Division ruling, 10 divisions vertically, 10 horizontally, for Types 536, 570 and 575	1.50
331-045	Centimeter ruling, 6 centimeters vertically, 10 horizontally, for Type 551..	1.50

CATHODE-RAY-TUBE LIGHT FILTERS

378-511	3" Amber (for Type 310, 316 and 360)	.50
378-509	3" Green (for Type 310, 316 and 360)	.50
378-510	3" Blue (for Type 310, 316 and 360) .	.50
378-512	3" Yellow (for Types 310, 316 & 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
378-508	3" Yellow (for Type 315D) .....	.50
378-501	(F510-3) 5" Amber, fits Types 511A, 512, 513, 514, 514A, 524D, 524AD, 531, and 535 .....	.90
378-502	5" Yellow, fits Types 511A, 512, 513, 514, 514A, 524D, 524AD, 531, and 535 .....	.90
378-503	(F510-5) 5" Green, fits Types 511A, 512, 513, 514, 514A, 524D, 524AD, 531, and 535 .....	.90
378-504	(F510-6) 5" Blue, fits Types 511A, 512, 513, 514, 514A, 524D, 524AD, 531, and 535 .....	.90
378-514	5" Green, adjustable, for Types 515, 515A, 517A, 541, 545 .....	.90
378-515	5" Blue, adjustable, for Types 515, 515A, 517A, 541, 545 .....	.90
378-516	5" Amber, adjustable, for Types 515, 515A, 517A, 541, 545 .....	.90



ACCESSORIES

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
012-022 Shielded cable for Type 53/54E, 30" long	3.00
012-013 (W530B) 16" Black test lead for Type 530 and 540-Series Oscilloscopes	1.00
012-031 (PC-18R) 18" Red test lead for Type 530 and 540-Series Oscilloscopes	1.50

ADAPTER PLATES (for Type 570)

016-004 7 pin with jacks installed	4.00
016-005 8 pin with jacks installed	4.00
016-006 9 pin with jacks installed	4.00
016-007 Blank with jacks included	2.50

PATCH CORDS (for Type 570)

012-023 Double Patch Cord, Black 6" (banana plug & jack combination both ends)	1.25
012-024 Double Patch Cord, Red 6" (banana plug & jack combination both ends)	1.25
012-025 Suppressor Cord, 100 Ω , 6" (banana plug both ends)	1.50
012-026 Suppressor Cord, 300 Ω , 6" (banana plug both ends)	1.50
012-027 Suppressor Cord, 1 k, 6" (banana plug both ends)	1.50
012-028 Single Patch Cord, Black 6"	1.00
012-029 Single Patch Cord, Red 6"	1.00

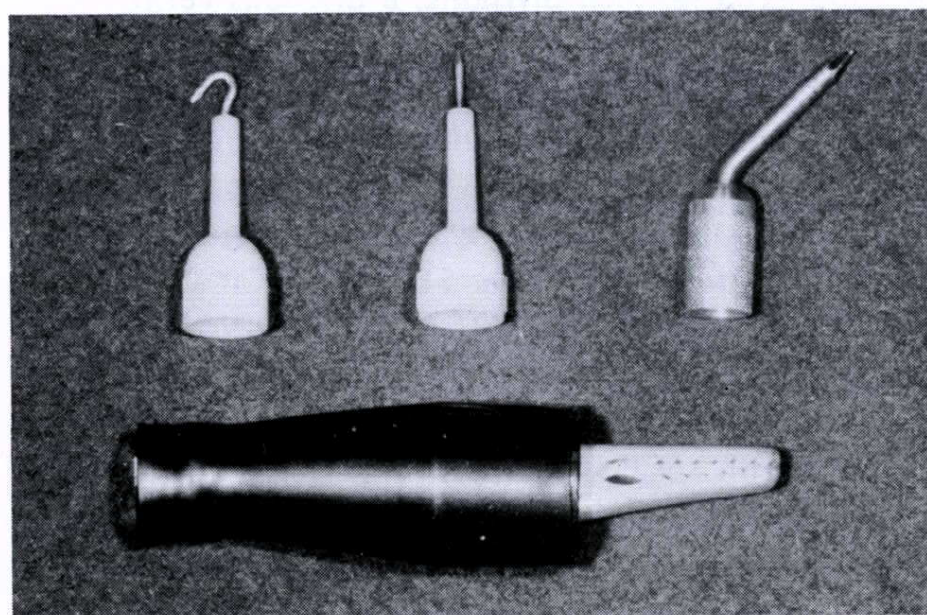
AIR FILTERS

378-008 Spun glass, disposable 5 1/4 x 5 1/4 x 1 for FB 310 Fan Base . . . . .	.25
378-002 Aluminum, 7 x 7 x 1 for Type 315D	1.20
378-015 Aluminum 7 x 7 x 1 for Type 316 and 180A	1.85
378-017 Aluminum 6 1/2 x 6 1/2 x 1 for Type RM16	1.85
378-004 Aluminum, 11 7/8 x 11 7/8 x 1 for Type 513	2.00
378-003 Aluminum, 8 x 8 x 1 for Types 514, 524, 525	1.50
378-010 Aluminum, 8 x 8 x 1 for Types 515, 515A	1.50
378-016 Aluminum 7 x 7 x 1 for Type RM15 . . .	1.85
378-011A Aluminum, 10 x 10 x 1 for Types 530 and 540-Series, 551, 570 and 575 . . .	1.75
378-009 Spun glass filter with back-up screens, 10 x 10 x 3/4, disposable, for Type 530-540 series	1.75
378-012 Spun glass filter only for above	1.00

ATTENUATOR HEADS

010-301 PAX-1 Attenuator Head for P170CF, attenuation can be varied between 4 times and 40 times	11.00
010-302 PAX-2 Attenuator Head for P170CF, attenuation can be varied between 20 times and 200 times	11.00
010-303 PAX-3 Attenuator Head for P170CF, attenuation can be varied between 200 times and 2000 times	11.00

PROBE TIPS



206-008 Tek tip, Hook Shank . . . . .	.25
206-009 Tek tip, Straight Shank . . . . .	.25
206-011 Pin Jack Probe Tip, Bent Shank (fits 0.082" pin jacks) . . . . .	.25
344-005 Alligator Clip Assembly . . . . .	.40



ACCESSORIES

MISCELLANEOUS

011-018 Attenuator unit, for Type 190	19.00
011-024 Attenuator unit, for Type 190A	22.00
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
107	1.75
112	1.50
121	1.50
122	1.50
124	1.75
126	1.50
128	1.50
130	1.50
160 or 160A	1.50
161	1.50
162	1.50
163	1.50
180 or 180A	2.00
181	1.75
190A	1.50
310	3.50
315D	4.00
316, RM16 or RH16	4.50
360	1.75
502	4.00
507	4.00
511A or 511AD	2.75

512	2.75
513 or 513D	2.75
514 or 514D	2.75
514A or 514AD	3.00
515 or 515A	4.00
RM15	4.50
517 or 517A	4.50
524D or 524AD	5.00
525	4.50
531 or RM31	4.50
532 or RM32	4.50
533	4.50
535 or RM35	5.00
536	4.50
537	4.50
541 or RM41	4.50
543	4.50
545 or RM45	5.00
547	4.50
551	4.50
53A or 53/54A	1.50
53B or 53/54B	1.50
53C or 53/54C	1.50
53/54D	1.50
53/54E	1.50
53G or 53/54G	1.50
53/54H	1.50
53/54K	1.50
53/54L	1.50
53/54P	1.50
53/54T	1.50
570	4.50
575	5.00



APPROXIMATE SHIPPING WEIGHTS

INSTRUMENT TYPE	NET WEIGHT IN POUNDS	DOMESTIC PACKED IN POUNDS	EXPORT PACKED		VOLUME IN CU. FT.
			WEIGHT IN POUNDS	KILOGRAMS	
105	35½	49	65	29	5
107	12	19	44	20	4
112	32	49	75	34	7
121	18½	24	45	20	4
122	5½	9	16	7	1
126	10½	25	43	19	5
128	6	13	16	7	1
130	9	17	38	17	4
160 Series					
160A	21	27	50	22	4
161	3½	7	14	6	1
162	3½	7	14	6	1
163	3½	7	14	6	1
360	9	17	32	15	4
FA-160	1¼	3			
180A	31	43	60	27	5
181	17½	24	49	22	7
RM181	18	33	54	24	6
190A	24	36	55	25	5
310	23½	30	50	23	4
316	35	42	64	29	4
RM16	35½	79	107	49	9
502	55	79	98	44	8
515A	40	58	76	34	5
RM15	43	85	113	51	9
517A	190	242	299	135	21
524AD	61	80	103	47	8
Viewing Hood	1¼	3	11	5	1
525	54	86	115	52	9
531	61½	80	101	46	8
RM31	78	96	116	52	10
532	52	73	95	43	8
RM32	71	89	109	50	10
535	65	85	105	48	8
RM35	81	100	120	54	10
536	57	83	98	44	8
541	61½	80	101	46	8
RM41	78	96	116	52	10
545	65	85	105	48	8
RM45	81	100	120	54	10
551	96	120	140	63	13
53/54A	3½	10	14	6	1
53/54B	3½	10	14	6	1
53/54C	5½	12	16	7	1
53/54D	4	11	15	7	1
53/54E	4½	12	16	7	1
53/54G	4½	12	16	7	1
53/54H	3½	10	14	6	1
53/54K	3½	10	14	6	1
53/54L	4½	12	16	7	1
53/54P	3½	10	14	6	1
53/54R	4½	12	16	7	1
53/54T	5	12	16	7	1
570	75	96	116	53	8
575	70	84	105	48	8
500A	35	53	62	28	7
500/53A	35	53	62	28	7

25
12



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.

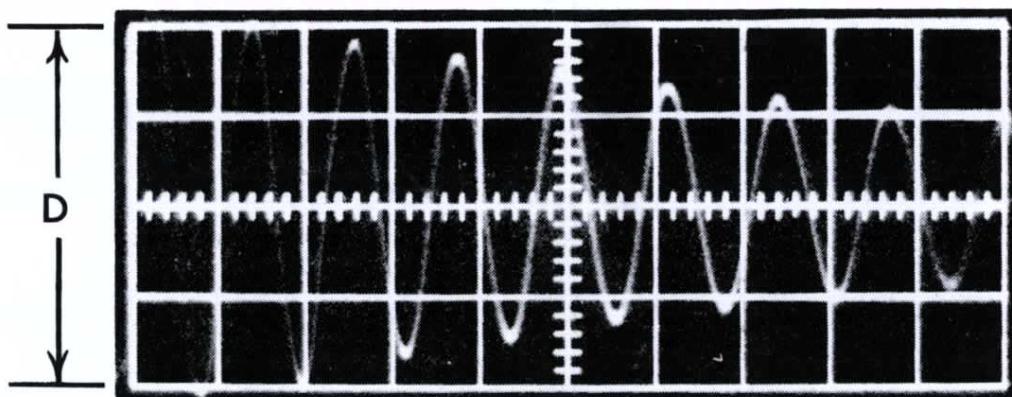
**Readily susceptible to burning.

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.

Tektronix, Inc., P. O. Box 831, Portland 7, Oregon

Telephone: **CYpress 2-2611**

TWX—PD 311

Cable: TEKTRONIX

AN OREGON CORPORATION

Tektronix Field Engineering Offices

ALBUQUERQUE*	Tektronix, Inc., 127C Jefferson St. N. E., Albuquerque, New Mexico TWX: AQ 96 ALpine 6-1279
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BOSTON*	Tektronix, Inc., 18 Austin St., Newtonville 60, Massachusetts TWX: NEWTON MASS 940 LAsell 7-2212
CHICAGO*	Tektronix, Inc., 7514 W. North Ave., Elmwood Park 35, Illinois TWX: RIVER GROVE ILL 1395 GLadstone 6-7930
CLEVELAND	Tektronix, Inc., 3353 Edgecliff Terrace, Cleveland 11, Ohio TWX: CV 352 CLearwater 2-2121 Detroit Area: ENterprise 7121 Pittsburg Area: ZEnith 0212
DALLAS*	Tektronix, Inc., 6211 Denton Drive, P. O. Box 35104, Dallas 35, Texas TWX: DL 264 FLeeewood 2-4087, 2-7655
DAYTON	Tektronix, Inc., 3898 Linden Ave., Room 212, Dayton 32, Ohio TWX: DY 363 CLearwater 4-1774
ENDICOTT*	Tektronix, Inc., 3214 Watson Blvd., Endwell, New York TWX: ENDICOTT NY 290 ENdicott 8-5291
HOUSTON	Tektronix, Inc., 2605 Westgrove Lane, Houston 6, Texas MOhawk 7-8301, 7-8302
KANSAS CITY	Tektronix, Inc., 5920 Nall, Mission, Kansas RAndolph 2-6522, 2-6523 St. Louis Area: ENterprise 6510
LOS ANGELES AREA	
East L. A.	Tektronix, Inc., 5441 East Beverly Blvd., East Los Angeles 22, California TWX: MTB 7762 RAYmond 3-9408, 3-9409
West L. A.*	Tektronix, Inc., 11681 San Vicente Blvd., West Los Angeles 49, California BRadshaw 2-1563 TWX: WEST LOS ANGELES CAL 6698 GRanite 3-1105
MINNEAPOLIS	Tektronix, Inc., 3100 W. Lake Street, Minneapolis 16, Minnesota TWX: MP 983 WAlnut 7-9559
NEW YORK CITY AREA***	
New York City and Long Island served by:	
	Tektronix, Inc., 840 Willis Avenue, Albertson, L. I., New York TWX: G CY NY 1416 Plioneer 7-4830
Westchester County, Western Connecticut, Hudson River Valley served by:	
	Tektronix, Inc., 49 Pondfield Road, Bronxville 8, New York TWX: BRONXVILLE NY 1207 DEerfield 7-3771
Northern New Jersey served by:	
	Tektronix, Inc., 412 Chestnut Street, Union, New Jersey TWX: UNVL 82 MURdock 8-2222
PALO ALTO*	Tektronix, Inc., 701 Welch Road, Palo Alto, California TWX: PALO ALTO CAL 112 DAVenport 6-8500
PHILADELPHIA*	Tektronix, Inc., 7709 Ogontz Ave., Philadelphia 50, Pennsylvania TWX: PH 930 WAverly 4-5678
PHOENIX	Tektronix, Inc., 2415 E. McDowell Road, Phoenix, Arizona TWX: PX 52 BRidge 5-9762
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