



**CATHODE - RAY  
OSCILLOSCOPES  
*AND AUXILIARY INSTRUMENTS***

**CATALOG 18**

**MAY 1959**



## **OUR CONTINUING CREED**

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





TEKTRONIX INC.

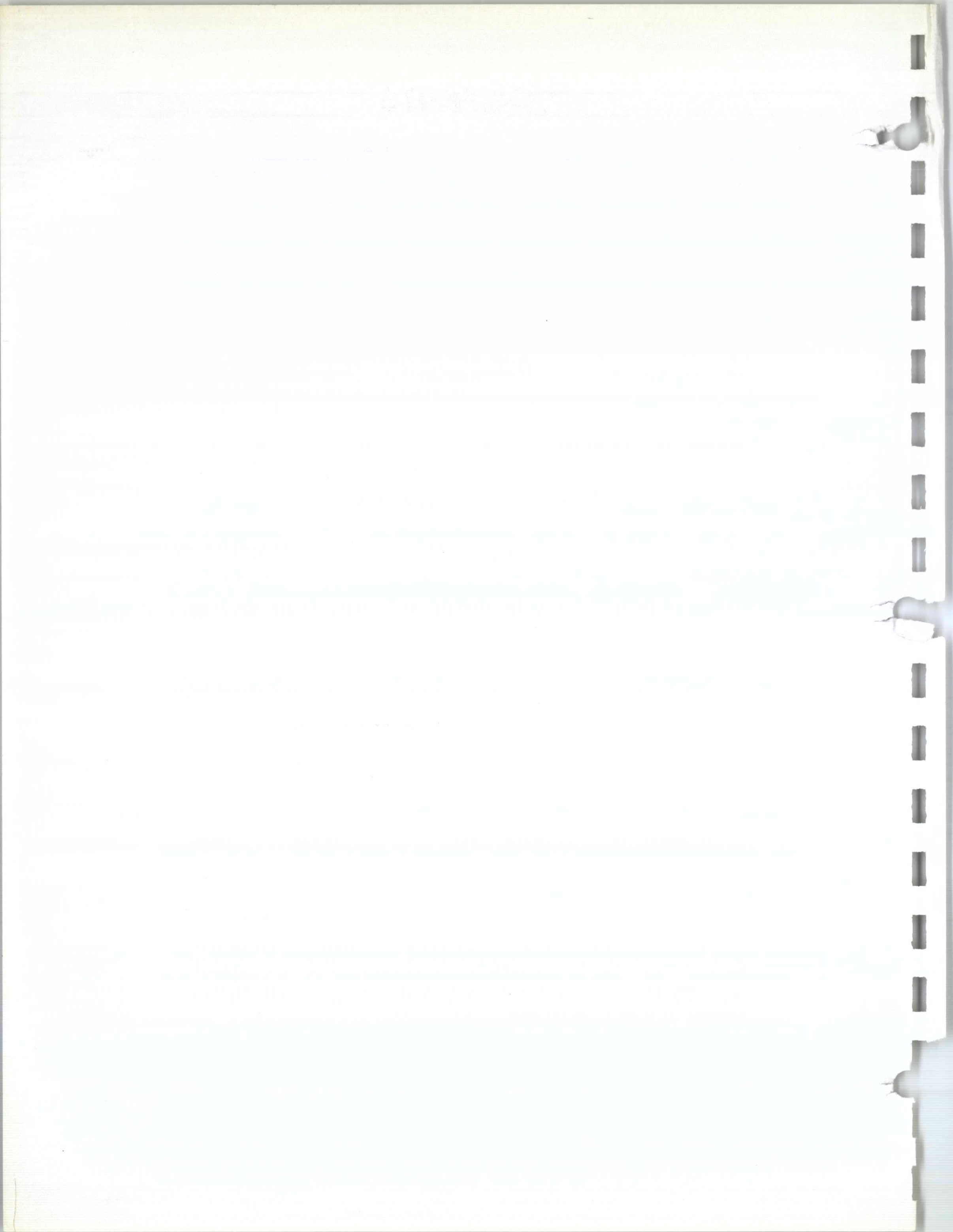
### ***About the Company...***

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

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

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

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





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# 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.

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. 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.



# REFERENCE

## MAIN SPECIFICATIONS of TEKTRONIX OSCILLOSCOPES

### Type 530-Series Oscilloscopes

	Vertical Frequency Response (with Type K Unit)	Signal Delay	Calibrated Sweep Range	Sweep Magnifier	Sweep Delay	Accelerating Potential	Price (without plug-in units)	Complete Specifications
<b>TYPE 531A</b> General Purpose	dc to 15 mc	Yes	0.1 $\mu$ sec/cm to 5 sec/cm	5x	None	10 kv	\$995	Page 13
<b>TYPE 532</b> General Purpose	dc to 5 mc	No	1 $\mu$ sec/cm to 5 sec/cm	5x	None	4 kv	\$875	Page 17
<b>TYPE 533</b> General Purpose	dc to 15 mc	Yes	0.1 $\mu$ sec/cm to 5 sec/cm	2, 5, 10, 20, 50, 100x	None	10 kv	\$1100	Page 21
<b>TYPE 535A</b> General Purpose	dc to 15 mc	Yes	0.1 $\mu$ sec/cm to 5 sec/cm	5x	1 $\mu$ sec to 10 sec	10 kv	\$1400	Page 25
<b>Type 536</b> X-Y Curve Tracer	dc to 11 mc	No	See Type T Time-Base Gen.		None	4 kv	\$1050	Page 29

### Plug-In Preamplifiers for Type 530-Series,

	Calibrated Deflection Factor	Risetime of Combination — Plugged into Type				
		531A, 533, and 535A	532	536	541A, 543, 545A, and 555	551
<b>TYPE A</b> Wide-Band DC	0.05 v/cm to 20 v/cm	0.025 $\mu$ sec	0.07 $\mu$ sec	0.035 $\mu$ sec	0.018 $\mu$ sec	0.02 $\mu$ sec
<b>TYPE B</b> Wide-Band High-Gain	5 mv/cm to 0.05 v/cm	0.035 $\mu$ sec	0.07 $\mu$ sec	0.04 $\mu$ sec	0.03 $\mu$ sec	0.03 $\mu$ sec
	0.05 v/cm to 20 v/cm	0.025 $\mu$ sec		0.035 $\mu$ sec	0.018 $\mu$ sec	0.02 $\mu$ sec
<b>TYPE C-A</b> Dual-Trace DC	0.05 v/cm to 20 v/cm	0.023 $\mu$ sec	0.07 $\mu$ sec	0.035 $\mu$ sec	0.015 $\mu$ sec	0.016 $\mu$ sec
<b>TYPE D</b> High-Gain DC Differential	1 mv/cm to 50 v/cm	0.18 $\mu$ sec	0.18 $\mu$ sec	0.18 $\mu$ sec	0.18 $\mu$ sec	0.18 $\mu$ sec
<b>TYPE E</b> Low-Level AC Differential	50 $\mu$ v/cm to 10 mv/cm	6 $\mu$ sec	6 $\mu$ sec	6 $\mu$ sec	6 $\mu$ sec	6 $\mu$ sec
<b>TYPE G</b> Wide-Band DC Differential	0.05 v/cm to 20 v/cm	0.025 $\mu$ sec	0.07 $\mu$ sec	0.035 $\mu$ sec	0.018 $\mu$ sec	0.02 $\mu$ sec
<b>TYPE H</b> DC Coupled High-Gain Wide-Band	0.005 v/cm to 20 v/cm	0.031 $\mu$ sec	0.07 $\mu$ sec	0.037 $\mu$ sec	0.023 $\mu$ sec	0.025 $\mu$ sec
<b>TYPE K</b> Fast-Rise DC	0.05 v/cm to 20 v/cm	0.023 $\mu$ sec	0.07 $\mu$ sec	0.031 $\mu$ sec	0.012 $\mu$ sec	0.014 $\mu$ sec
<b>TYPE L</b> Fast-Rise High-Gain	5 mv/cm to 2 v/cm	0.023 $\mu$ sec	0.07 $\mu$ sec	0.035 $\mu$ sec	0.015 $\mu$ sec	0.017 $\mu$ sec
	0.05 v/cm to 20 v/cm	0.023 $\mu$ sec		0.031 $\mu$ sec	0.012 $\mu$ sec	0.014 $\mu$ sec



# CHART

for Convenience in Making Preliminary Comparisons

## Type 540-Series, and Type 550-Series Oscilloscopes

		Vertical Frequency Response (with Type K Unit)	Signal Delay	Calibrated Sweep Range	Sweep Magnifier	Sweep Delay	Accelerating Potential	Price (without plug-in units)	Complete Specifications
	TYPE 541A Fast-Rise	dc to 30 mc	Yes	0.1 $\mu$ sec/cm to 5 sec/cm	5x	None	10 kv	\$1200	Page 33
	TYPE 543 Fast-Rise	dc to 30 mc	Yes	0.1 $\mu$ sec/cm to 5 sec/cm	2, 5, 10, 20, 50, 100x	None	10 kv	\$1275	Page 37
	TYPE 545A Fast-Rise	dc to 30 mc	Yes	0.1 $\mu$ sec/cm to 5 sec/cm	5x	1 $\mu$ sec to 10 sec	10 kv	\$1550	Page 41
	TYPE 551 Dual-Beam	dc to 25 mc	Yes	0.1 $\mu$ sec/cm to 5 sec/cm	5x	None	10 kv	\$1800	Page 45
	TYPE 555 Dual-Beam	dc to 30 mc	Yes	0.1 $\mu$ sec/cm to 5 sec/cm	5x	0.5 $\mu$ sec to 50 sec	10 kv	\$2600	Page 49

## Type 540-Series, and Type 550-Series Oscilloscopes

Passband of Combination — Plugged into Type						Input Capacitance	Price	Complete Specifications
531A, 533, and 535A	532	536	541A, 543, 545A, and 555	551				
dc to 14 mc	dc to 5 mc	dc to 10 mc	dc to 20 mc	dc to 18 mc	47 $\mu$ f	\$90	Page 57	
2 c to 10 mc	2 c to 5 mc	2 c to 9 mc	2 c to 12 mc	2 c to 12 mc	47 $\mu$ f	\$135	Page 58	
dc to 14 mc	dc to 5 mc	dc to 10 mc	dc to 20 mc	dc to 18 mc				
dc to 15 mc	dc to 5 mc	dc to 10 mc	dc to 24 mc	dc to 22 mc	20 $\mu$ f	\$250	Page 59	
dc to 2 mc	dc to 2 mc	dc to 2 mc	dc to 2 mc	dc to 2 mc	47 $\mu$ f	\$155	Page 60	
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 $\mu$ f	\$175	Page 61	
dc to 14 mc	dc to 5 mc	dc to 10 mc	dc to 20 mc	dc to 18 mc	47 $\mu$ f	\$185	Page 62	
dc to 11 mc	dc to 5 mc	dc to 9.5 mc	dc to 15 mc	dc to 14 mc	47 $\mu$ f	\$185	Page 63	
dc to 15 mc	dc to 5 mc	dc to 11 mc	dc to 30 mc	dc to 25 mc	20 $\mu$ f	\$135	Page 64	
3 c to 15 mc	3 c to 5 mc	3 c to 10 mc	3 c to 24 mc	3 c to 22 mc	20 $\mu$ f	\$200	Page 65	
dc to 15 mc	dc to 5 mc	dc to 11 mc	dc to 30 mc	dc to 25 mc				





# REFERENCE CHART

(Continued)

## MAIN SPECIFICATIONS of TEKTRONIX OSCILLOSCOPES for Convenience in Making Preliminary Comparisons

### Type 580-Series Oscilloscopes

	Vertical Frequency Response (with Type 80 Unit)	Risetime	Basic Deflection Factor	Signal Delay	Calibrated Sweep Range	Sweep Magnifier	Sweep Delay	Accelerating Potential	Price (without plug-in units)	Complete Specifications
TYPE 581	dc to Approx. 100 mc	3.5 mμsec	0.1 v/cm	Yes	0.01 μsec/cm to 5 sec/cm	5x	None	10 kv	\$1375	Page 104A
TYPE 585	dc to Approx. 100 mc	3.5 mμsec	0.1 v/cm	Yes	0.01 μsec/cm to 5 sec/cm	5x	1 μsec to 10 sec	10 kv	\$1675	Page 104E

### Oscilloscopes without Plug-In Preamplifiers

	Calibrated Deflection Factor	Risetime	Vertical Passband	Signal Delay	Calibrated Sweep Range	Sweep Magnifier	Accelerating Potential	Price	Complete Specifications
TYPE 310A 3" Portable	0.01 v/div to 0.1 v/div	0.1 μsec	2 c to 3.5 mc	No	0.5 μsec/div to 0.2 sec/div	5x	1.8 kv	\$595	Page 73
	0.1 v/div to 50 v/div	0.09 μsec	dc to 4 mc						
TYPE 316 3" Portable	0.01 v/div to 0.1 v/div	0.035 μsec	2 c to 10 mc	Yes	0.2 μsec/div to 2 sec/div	5x	1.8 kv	\$750	Page 77
	0.1 v/div to 50 v/div	0.035 μsec	dc to 10 mc						
TYPE 317 Daylight 3" Portable	0.1 v/div to 0.1 v/div	0.035 μsec	2 c to 10 mc	Yes	0.2 μsec/div to 2 sec/div	5x	9 kv	\$800	Page 81
	0.01 v/div to 50 v/div	0.035 μsec	dc to 10 mc						
TYPE 502 Dual-Beam and X-Y Curve Tracer	200 μv/cm to 20 v/cm	3.5 μsec diminishing to 0.35 μsec	dc to 100 kc increasing to dc to 1 mc	No	1 μsec/cm to 5 sec/cm	2, 5, 10, and 20x	3 kv	\$825	Page 91
TYPE 515A 5" Portable	0.05 v/cm to 20 v/cm	0.023 μsec	dc to 15 mc	Yes	0.2 μsec/cm to 2 sec/cm	5x	4 kv	\$800	Page 85
TYPE 517A High-Speed	0.05 v/cm	0.007 μsec		Yes	0.01 μsec/cm to 20 μsec/cm		24 kv	\$3500	Page 101
TYPE 524AD Television	0.015 v/cm to 50 v/cm	0.035 μsec	dc to 10 mc	Yes	0.1 μsec/cm to 0.01 sec/cm	3x and 10x	4 kv	\$1250	Page 107





# 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 535A Oscilloscope
- Type 536 Oscilloscope
- Type 551 Oscilloscope
- Type 502 Oscilloscope
- Type 532 Oscilloscope
- Type C-A Dual-Trace Plug-In Unit
- Type D Differential High-Gain Plug-In Unit
- Type E 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 D Differential High-Gain Plug-In Unit
- Type E Low-Level Differential Plug-In Unit

### Life-Time Testing and Photo-Sensitivity Analysis

- Type 530-Series Oscilloscopes
- Type 540-Series Oscilloscopes
- Tektronix Plug-In Preamplifiers

## 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 555 Oscilloscope
- Tektronix Plug-In Preamplifiers
- Type 515A Oscilloscope
- Type 130 L,C Meter
- Type 105 Square-Wave Generator

## Computer Servicing

- Type 316 Portable Oscilloscope
- Type 317 Portable Oscilloscope
- Type 310A Portable Oscilloscope
- Type 515A Oscilloscope
- Type 533 Oscilloscope
- Type 535A Oscilloscope
- Type B Wide-Band High-Gain Plug-In Unit
- Type C-A Dual-Trace Plug-In Unit
- Type G Wide-Band Differential Plug-In Unit

## Delay-Line Testing and Design

- Type 530-Series Oscilloscopes
- Type 540-Series Oscilloscopes
- Type 555 Oscilloscope
- Type C-A 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 535A Oscilloscope
- Type B Wide-Band High-Gain Plug-In Unit
- Type D Differential High-Gain Plug-In Unit
- Type E Low-Level Differential Plug-In Unit
- Type G Wide-Band Differential Plug-In Unit

## Radar Design and Servicing

- Type 316 Oscilloscope
- Type 317 Oscilloscope
- Type 515A Oscilloscope
- Type 540-Series Oscilloscopes
- Type 551 Oscilloscope
- Type 555 Oscilloscope
- Tektronix Plug-In Preamplifiers
- Type 180A Time-Mark Generator

## Servo Design and Testing

- All Tektronix Oscilloscopes

## Sound Equipment Design and Testing

- Type 502 Oscilloscope
- Type 310A 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 555 Oscilloscope  
Type G Wide-Band Differential Plug-In Unit  
Type C-A Dual-Trace Plug-In Unit  
Type R Transistor Rise-Time Testing Unit

## TV Station Use

Type 525 Waveform Monitor  
Type 524AD Oscilloscope  
Type 530-Series Oscilloscopes  
Type 540-Series Oscilloscopes  
Type C-A Dual-Trace Plug-In Unit  
Type 310A Oscilloscope  
Type 316 Oscilloscope  
Type 317 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 C-A Dual-Trace Plug-In Unit  
Type D Differential High-Gain Plug-In Unit  
Type E Low-Level Differential Plug-In Unit  
Type 122 Low-Level Preamplifier

### Field Equipment Maintenance

Type 502 Oscilloscope  
Type 515A Oscilloscope  
Type 310A Portable Oscilloscope  
Type 316 Portable Oscilloscope  
Type 317 Portable Oscilloscope

## INDUSTRIAL

### Stress and Impact Analysis

Type 502 Oscilloscope  
Type 536 Oscilloscope  
Type 532 Oscilloscope  
Tektronix Plug-In Preamplifiers  
Type 122 Low-Level Preamplifier

## Metal Fracture Investigation

Type 502 Oscilloscope  
Type 533 Oscilloscope  
Type 535A Oscilloscope  
Type 536 Oscilloscope  
Type 531A Oscilloscope  
Tektronix Plug-In Preamplifiers  
Type 160-Series Waveform Generators  
Type 360 Cathode-Ray Indicator

## Rotating Machinery Investigations

Type 502 Oscilloscope  
Type 532 Oscilloscope  
Type 535A Oscilloscope  
Type C-A Dual-Trace Plug-In Unit  
Type D Differential High-Gain Plug-In Unit  
Type E Low-Level Differential Plug-In Unit  
Type 121 Wide-Band Preamplifier  
Type 122 Low-Level Preamplifier

## Transient Monitor

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

## Vibration Analysis

Type 502 Oscilloscope  
Type 536 Oscilloscope  
Type 532 Oscilloscope  
Type C-A Dual-Trace Plug-In Unit  
Type D Differential High-Gain Plug-In Unit  
Type E Low-Level Differential Plug-In Unit  
Type 122 Low-Level Preamplifier

## Hydraulic Systems Analysis

Type 502 Oscilloscope  
Type 530-Series Oscilloscopes  
Tektronix Plug-In Preamplifiers

## MISCELLANEOUS SERVICE

### Ballistic (weapon and explosive testing)

Type 533 Oscilloscope  
Type 535A Oscilloscope  
Type C-A Dual-Trace Plug-In Unit

### Surge Distribution in Transformers

Type 507 Oscilloscope  
Type 530-Series Oscilloscopes  
Type 540-Series Oscilloscopes  
Type G Wide-Band Differential Plug-In Unit

### High Voltage, Surge and Breakdown Testing

Type 507 Oscilloscope  
Type 517A Oscilloscope  
Type 105 Square-Wave Generator  
Type 107 Square-Wave Generator  
Type 190A Signal Generator



# APPLICATIONS GUIDE

(Continued)

## Response of Surge-Measuring Equipment

Type 507 Oscilloscope  
Type 517A Oscilloscope  
Type 540-Series Oscilloscopes  
Type 555 Oscilloscope  
Type K Fast-Rise DC Plug-In Unit  
Type L Fast-Rise High-Gain Plug-In Unit  
Type H High-Gain DC Plug-In Unit

## Hydrogen Thyatron Research and Testing

Type 517A Oscilloscope  
Type 530-Series Oscilloscopes  
Type 540-Series Oscilloscopes  
Type 555 Oscilloscope  
Tektronix Plug-In Preamplifiers

## Input-Output Comparison

Type 530-Series Oscilloscopes  
Type C-A Dual-Trace Plug-In Unit  
Type 122 Low-Level Preamplifier

## Microwave Generator Modes

Type 530-Series Oscilloscopes  
Type 540-Series Oscilloscopes  
Type 555 Oscilloscope  
Tektronix Plug-In Preamplifiers

## Missile Check-Out Racks

Type RM30 and RM40-Series Oscilloscopes  
Tektronix Plug-In Preamplifiers  
Type RM15 Oscilloscope  
Type RM16 Oscilloscope  
Type RM17 Oscilloscope

## Radioactive Decay Energy Spectrum

Type 541A Oscilloscope  
Type 543 Oscilloscope  
Type K Fast-Rise or Type L Fast-Rise High-Gain Plug-In Units

## Sequence Control

Type 360 Cathode-Ray Indicator

## Sonic-Echo Materials Testing

Type 530-Series Oscilloscopes  
Tektronix Plug-In Preamplifiers

## Telemetry Monitor

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

## Time-Shared Microwave Systems

Type 535A Oscilloscope  
Type C-A Dual-Trace Plug-In Unit

## Transducers

Type 502 Oscilloscope  
Type 536 Oscilloscope  
Type 532 Oscilloscope  
Tektronix Plug-In Preamplifiers  
Type 122 Low-Level Preamplifier  
Type 123 Preamplifier

## NUCLEAR

### Alpha Particle Detector Amplification

Type 122 Low-Level Preamplifier

### Energy Spectrum Indicator

Type 541A Oscilloscope  
Type 543 Oscilloscope  
Type K Fast-Rise or Type L Fast-Rise High-Gain Plug-In Units

### Equipment Design

Type 530-Series Oscilloscopes  
Type 540-Series Oscilloscopes  
Type 555 Oscilloscope  
Tektronix Plug-In Preamplifiers  
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 Synchronization Measurements

Type 535A Oscilloscope  
Type 545A Oscilloscope  
Type 555 Oscilloscope  
Tektronix Plug-In Preamplifiers

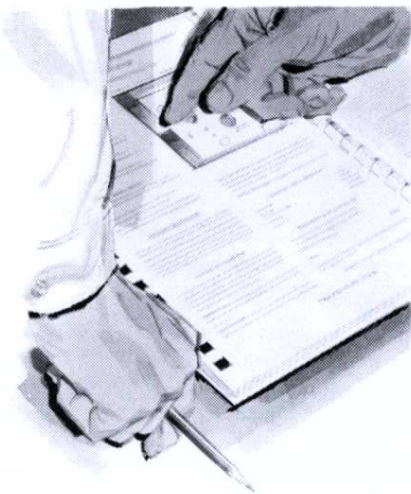
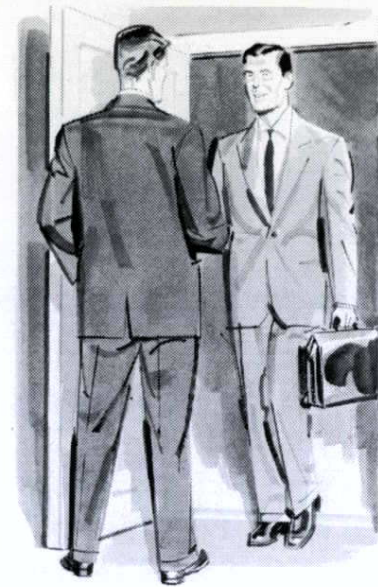
### Thermocouple Radiation Measurements, Photoelectric Radiation Measurements

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



# 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.

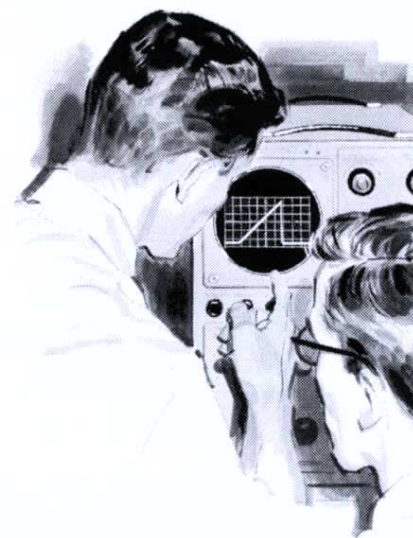


**Ordering**—There are many types of oscilloscopes, each designed for a specific application area. Your Field Engineer can help you select the one best suited to your present and future needs, and he will be happy to arrange a demonstration of the instrument....in your application if you so desire.

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.

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.



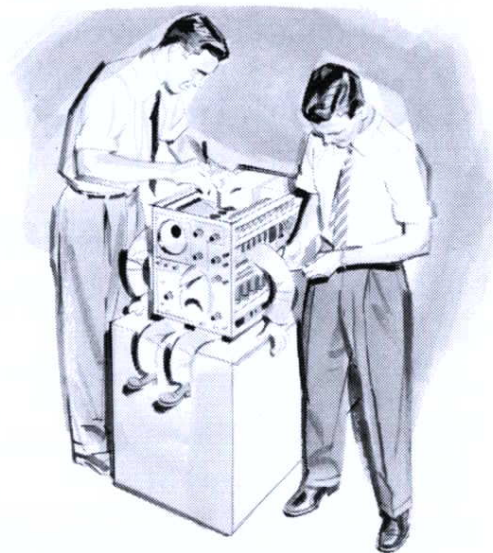
**Applications**—Perhaps the answers you need in a specific application can be obtained faster and easier through use of your Tektronix Oscilloscope. Your Field Engineer can help you find out, and if use of your oscilloscope is indicated, help you with procedures. He may also be able to suggest many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

**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.

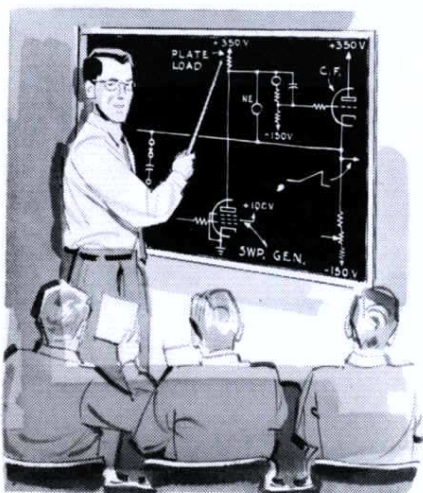


**Instrument Reconditioning**—An older Tektronix Oscilloscope, properly reconditioned, can give you many additional years of service. Your Field Engineer will gladly explain the advantages and limitations of factory reconditioning, and make the necessary arrangements if you decide in favor of it.

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.



**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.



**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.



## 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
P 4*	White	White	Medium
P5	Blue		Very short
P7*	Blue-white	Yellow	Long
P11	Blue		Short
P12	Orange	Orange	Medium long
P 13**	Red	Red	Medium
P14*	Purple	Orange	Medium long
P15	Blue-green		Extremely short
P16	Violet and near ultra-violet		Extremely short
P17*	Green	Green	Long
P19**	Orange	Orange	Extremely long
P 20	Yellow	Yellow	Medium short
P 23*	Yellow	Yellow	Medium
P24	Blue		Extremely short
P 25	Orange	Orange	Medium
P 27	Red	Red	Medium

\*Double-layer types.

\*\*Readily susceptible to burning. Recommended only for aluminized CRTS.

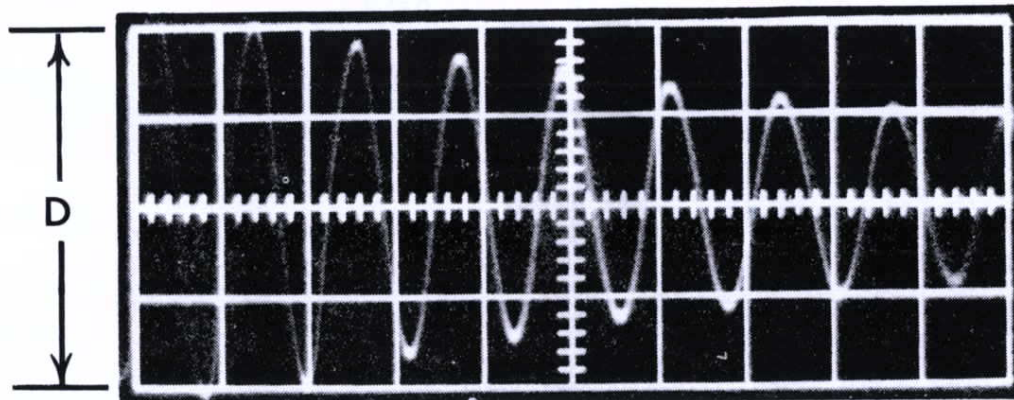


## HOW TO CALCULATE WRITING RATE

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:

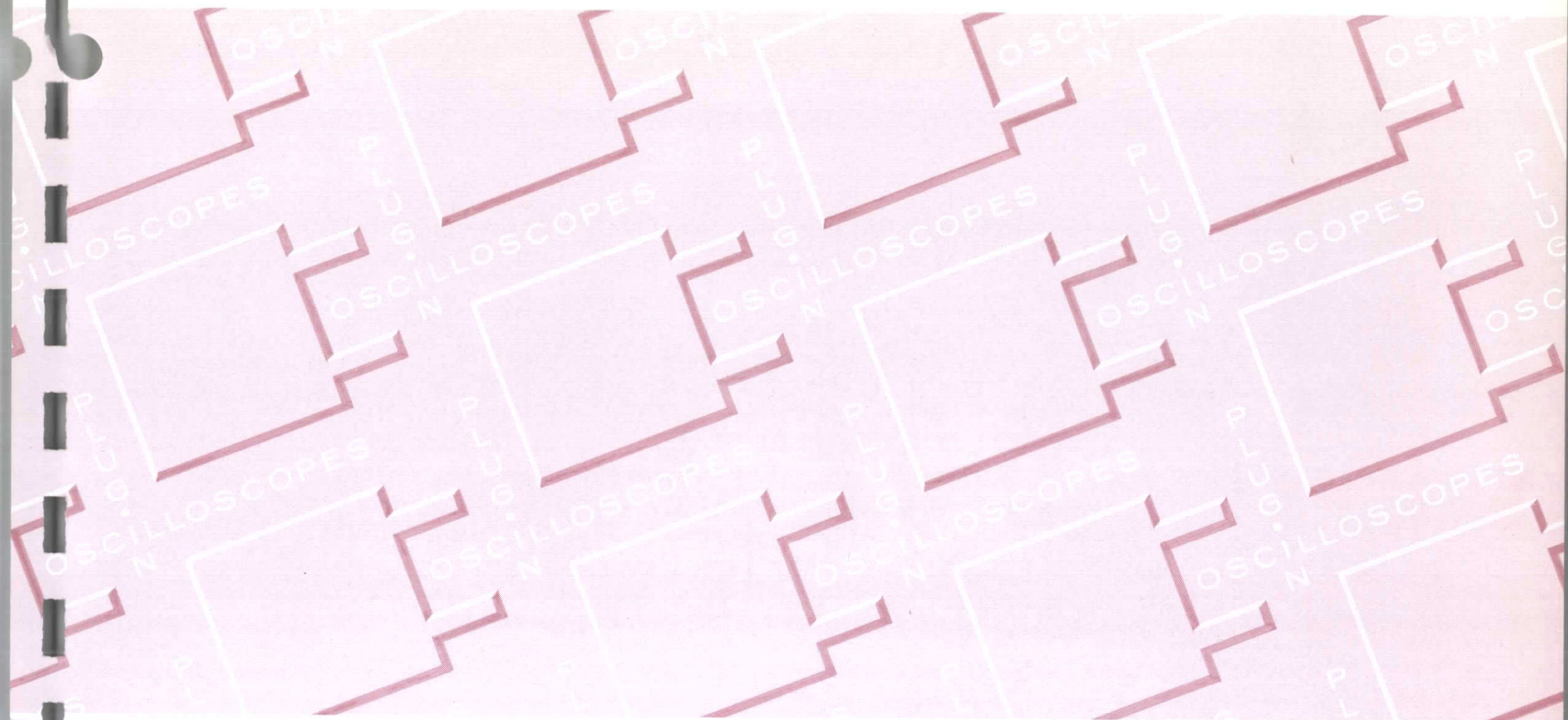
$$\text{Maximum writing rate} = 3.14 Df$$

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



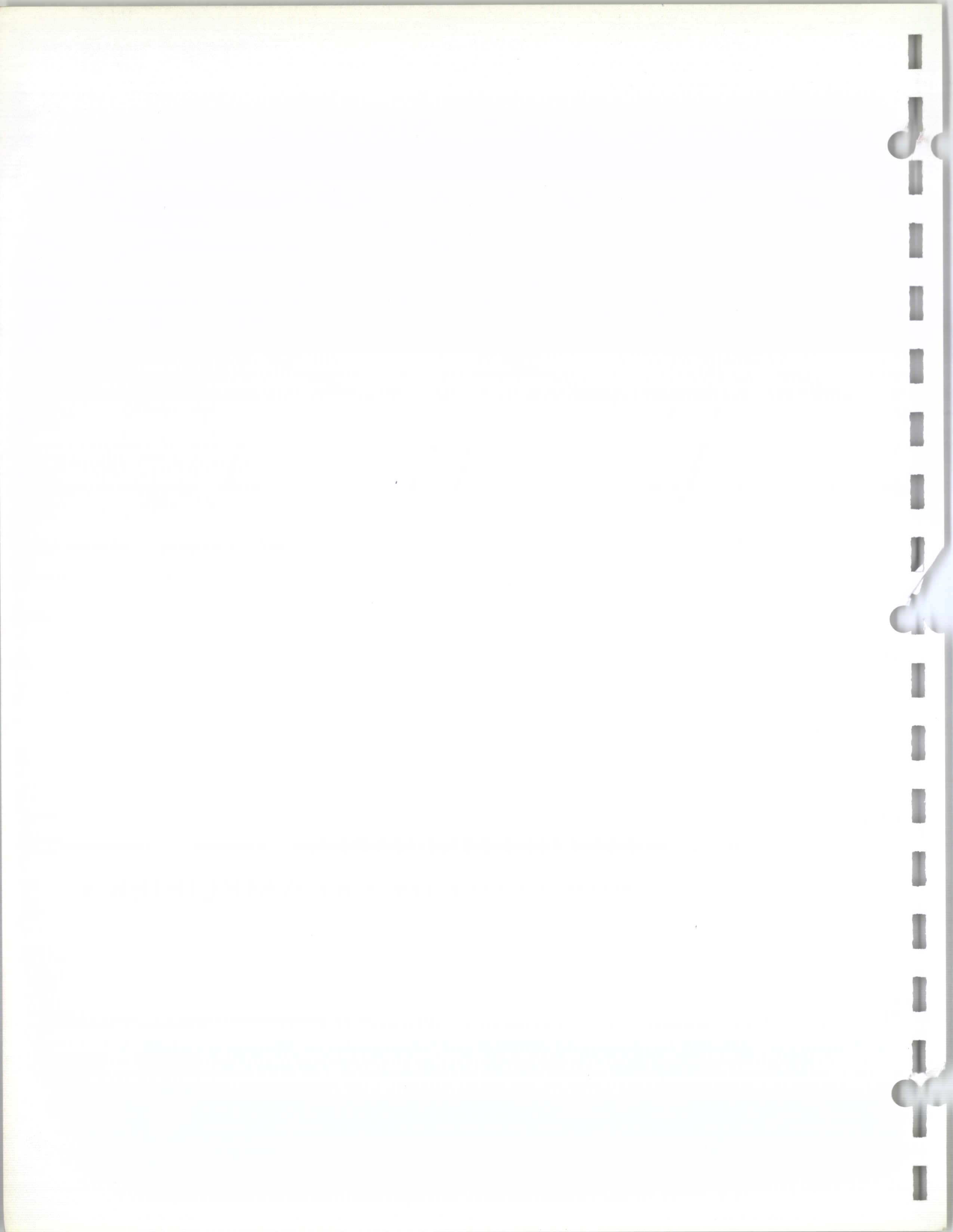
Although the writing rate is an important characteristic of the oscilloscope, it does not completely describe the ability of the oscilloscope to present detailed information. It is also important to consider the available resolution in conjunction with screen size. It is convenient to present these latter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





# OSCILLOSCOPES with PLUG-IN PREAMPLIFIERS







# IMPROVED INSTRUMENT

## TYPE 531A OSCILLOSCOPE

### Easy Operation

Single knob control for Sweep Range, Amplitude Calibrator, and Horizontal Display.

### Increased Vertical Response

Passband and Risetime with Type K unit, dc to 15 mc, 0.023  $\mu$ sec.

### Wide Sweep Range

0.1  $\mu$ sec/cm to 12 sec/cm. 5-x magnifier increases calibrated rate to 0.02  $\mu$ sec/cm.

### Versatile Triggering Circuitry

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

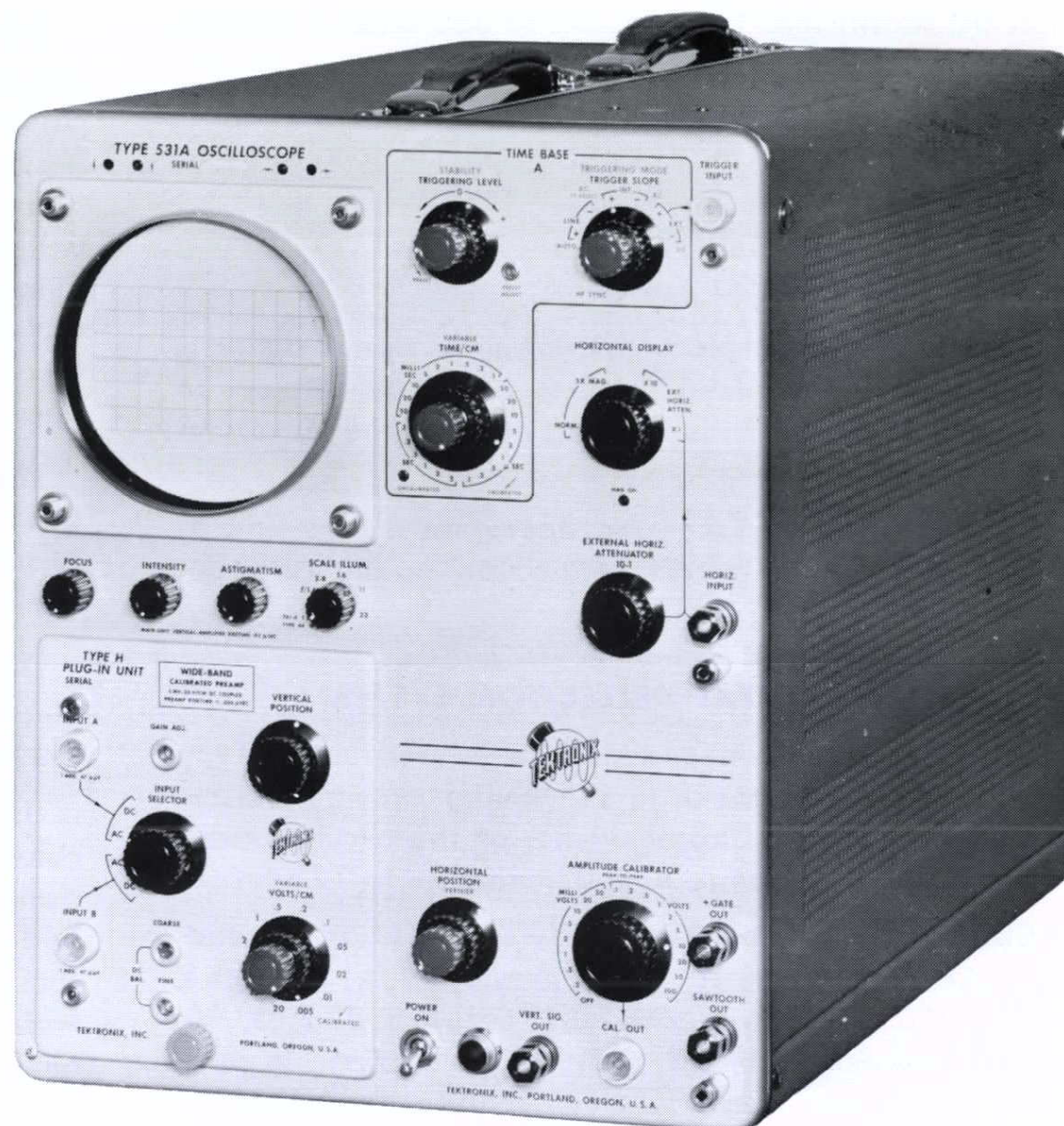
### 10-KV Accelerating Potential

Bright display at low repetition rates.

### Horizontal Input Amplifier

### 6-cm Linear Vertical Deflection

### Balanced Delay Network.



### GENERAL DESCRIPTION

The Type 531A is a wide-range laboratory oscilloscope that is easier to operate, performs better, is even more reliable than its predecessor, the Type 531. Functionally grouped controls with convenient direct-reading single-knob selectors and dependable trigger settings combine to provide easy operation. Greater dependability and longer life have been attained through the use of frame-grid dual triodes and silicon-diode rectifiers. The dc-to-15 mc main vertical amplifier provides for a high degree of versatility through Tektronix Type A to Z Plug-In Preampifiers. Nine plug-in preampifiers are available for conversion to possible future requirements.

A very practical initial combination is the Type 531A Oscilloscope with a Type C-A Dual-Trace Plug-In Unit. This arrangement covers both dual-trace and single-trace applications with passband requirements from dc to 15 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.

### VERTICAL-DEFLECTION SYSTEM

**DC-Coupled Output Amplifier**—The wide-band dc-coupled amplifier with risetime of 0.022  $\mu$ sec is factory adjusted for optimum transient response.

The Type 531A vertical deflection system is designed for use with any one of the Tektronix Type A to Z Plug-In Preampifiers. In order to operate the Type 531A, one of the preampifiers must be plugged in.

### Plug-In Preampifiers

For Wide-Band Applications—

**Type A**—DC to 14 mc, 0.025- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm.

or **Type B**—DC to 14, 0.025- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm—2 cycles to 10 mc, 0.035- $\mu$ sec risetime at 5 mv/cm to 0.05 v/cm.

For maximum frequency response and risetime—

**Type K**—DC to 15 mc, 0.023- $\mu$ sec risetime at 0.05 to 40 v/cm.

or **Type L**—DC to 15 mc, 0.023- $\mu$ sec risetime at 0.05 to 40 v/cm. —3 cycles to 15 mc, 0.023- $\mu$ sec risetime at 5 mv to 4 v/cm.

For dual trace operation—

**Type C-A**—DC to 15 mc, 0.023- $\mu$ sec risetime at 0.05 to 50 v/cm.

For high DC sensitivity—

**Type H**—DC to 11 mc, 0.031- $\mu$ sec risetime at 5 mv/cm to 50 v/cm.



# TYPE 531A OSCILLOSCOPE

For differential input applications—  
Wide band: **Type G**—DC to 14 mc, risetime 0.025  $\mu$ sec at 0.05 to 50 v/cm.

High DC sensitivity: **Type D**—DC to 350 kc at 1 mv/cm, increasing to 2 mc at 50 mv/cm.

For low-level applications—  
**Type E**—0.06 cycles to 20 kc at 50  $\mu$ v/cm, increasing to 60 kc at 0.5 mv/cm.

For transistor risetime checking—  
**Type R**—risetime 0.023  $\mu$ sec.

**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 sweep generator is used in the Type 531A. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of the circuitry make possible the wide range of 0.02  $\mu$ sec/cm to 12 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  $\mu$ 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  $\mu$ sec/cm to 12 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%.

**Sweep Magnifier**—5-x magnifier increases the calibrated sweep time to 0.02  $\mu$ sec/cm. Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of the normal trace is expanded to fill the screen. Any one-fifth of the magnified sweep can be displayed on the screen by rotating the HORIZONTAL POSITION control. Accurate 5-x magnification is obtained on all ranges.

**DC-Coupled Unblanking**—DC coupling is provided for the unblanking waveform, 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 provide 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-coupled 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 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 47  $\mu$ 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 T533P, a Tektronix cathode-ray tube, is used in the Type 531A. The T533P 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. For best results over the wide sweep range of the Type 531A, a P2 phosphor is normally furnished with the instrument.

**Regulated Power Supply**—Electronic regulation compensates for line-voltage variations between 105 and 125 v, and for current-demand differences among the plug-in preamplifiers.

**Amplitude Calibrator**—A square-wave calibration voltage is available through a front-panel coaxial connector. Eighteen direct reading fixed steps—0.2, 0.5, 1, 2, 5, 10, 20, 50 millivolts, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 volts peak-to-peak are provided by the single knob control. 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.



# TYPE 531A OSCILLOSCOPE

**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.

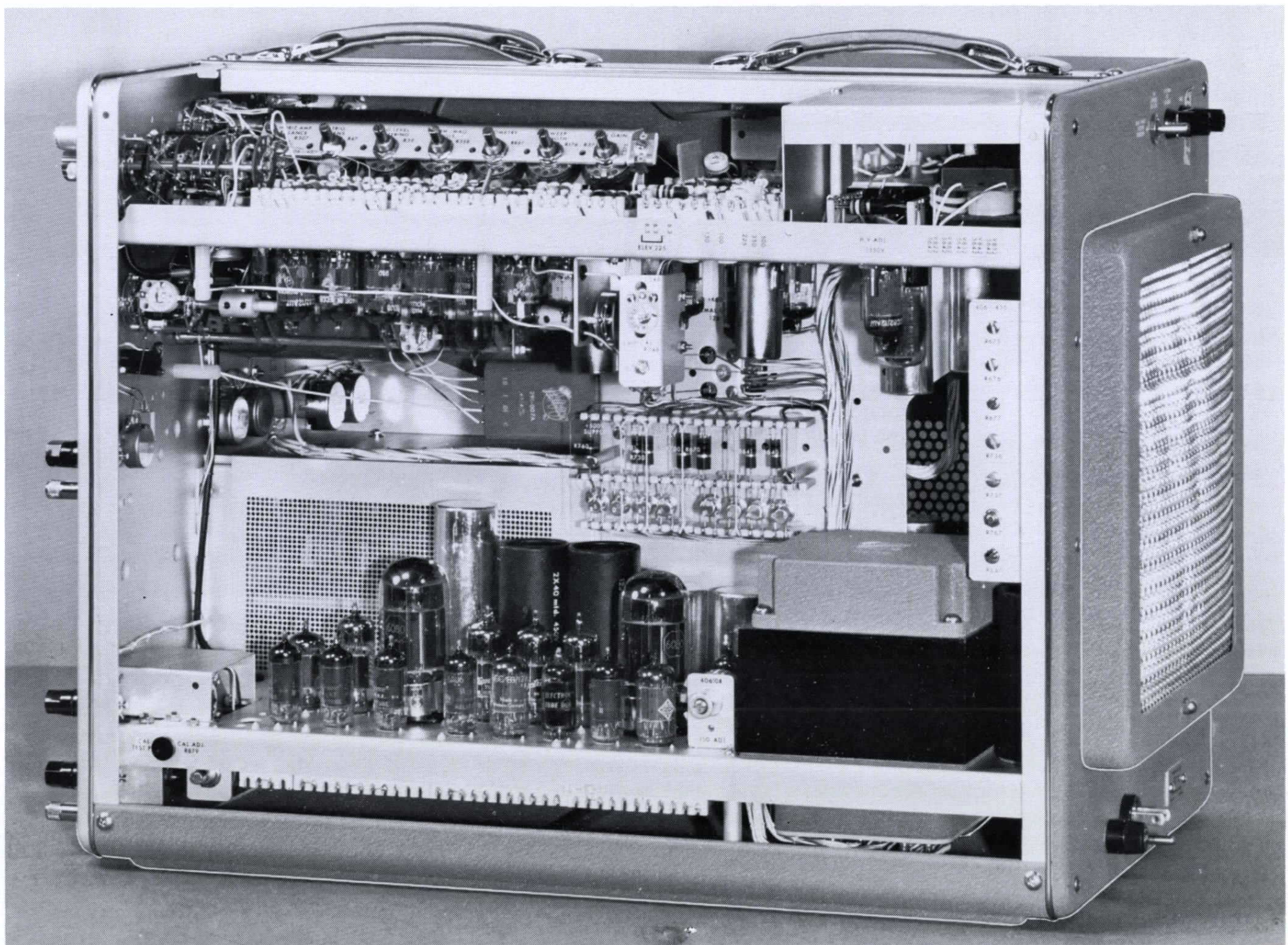
**Beam Position Indicators**—Two pairs of indicator lights show direction of the electron beam when the spot is not on the screen.

**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 TUBES AND SEMICONDUCTORS

Input amplifiers . . . . .	2	12BY7A
CF and beam position amplifiers . . . . .	2	6DJ8
Output amplifiers . . . . .	2	6197

Trigger amplifier . . . . .	6DJ8
Trigger CF and vertical signal out . . . . .	6DJ8
Sweep generator . . . . .	6CL6
Sweep generator CF . . . . .	6DJ8
Unblank and holdoff CF . . . . .	6DJ8
Trigger inverter . . . . .	6DJ8
Calibrator multivibrator and CF . . . . .	12AU7
Calibrator multivibrator . . . . .	6AU6
Horizontal drive CF . . . . .	6DJ8
Horizontal amplifier . . . . .	6DJ8
Horizontal output CF . . . . .	6DJ8
Sawtooth and gate CF . . . . .	6DJ8
External horizontal amplifier . . . . .	6DJ8
Trigger shaper amplifier . . . . .	6DJ8
External horizontal and DC level CF . . . . .	12AU7
Sweep-gating multivibrator . . . . .	12BY7
Sweep-gating multivibrator and CF . . . . .	6DJ8
Sweep start compensator . . . . .	6CL6
Trace blank and dual-trace trigger amplifier . . . . .	6DJ8
Runup on-off diodes . . . . .	6AL5
High-voltage oscillator . . . . .	6AU5
High voltage rectifiers . . . . .	5 5642
Regulator amplifier . . . . .	12AU7
Voltage reference . . . . .	5651





# TYPE 531A OSCILLOSCOPE

Series regulator . . . . .	2	12AX7
Regulator amplifiers . . . . .	5	6AU6
Comparator amplifiers . . . . .	2	6080
Series regulators . . . . .	4	12B4
Rectifiers . . . . .	16	1N1566
Cathode-ray tube . . . . .		T533P2

- 1—Test lead (012-031)
- 1—F510-5 green filter (378-503)
- 1—3-conductor power cord (161-008)
- 1—Instruction manual

## 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, blue 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, 455 watts with Type C-A unit plugged in.

**Type 531A, without plug-in units . . . . . \$995**

- Includes: 2—10-x attenuator probes
- 2—Binding-post adapters (013-004)

## 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.

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





# TYPE 532 OSCILLOSCOPE

## Designed for Extra Dependability

### DC-Coupled Vertical Amplifier

Passband with wide-band plug-in units—dc to 5 mc.  
Risetime with wide-band plug-in units—0.07  $\mu$ sec.

### 8-cm Linear Vertical Deflection

### Wide Sweep Range

0.2  $\mu$ sec/cm to 12 sec/cm.

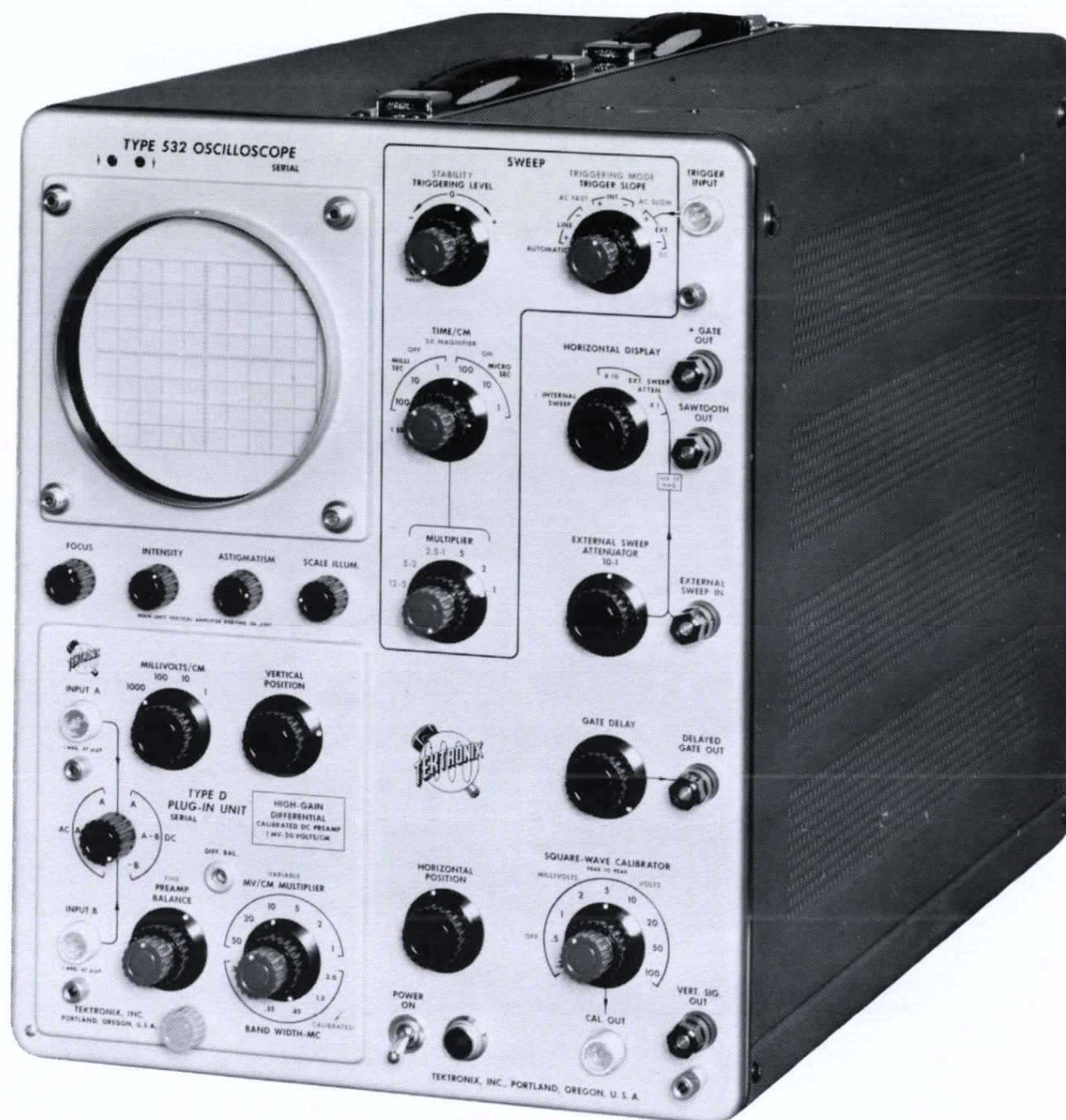
### Versatile Triggering Circuitry

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

### Horizontal Input Amplifier

### Vertical Beam-Position Indicators

### DC-Coupled Unblinking



### 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 531A. 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 Tektronix Type A to Z Plug-In-Preamplifier 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 Tektronix Type A to Z 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 pass-

bands 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 Type A to Z preamplifiers must be plugged in.

### Plug-In Preamplifiers

Type 532 frequency response and risetime is dc to 5 mc, 0.07  $\mu$ sec with the following plug-in units except as noted:

- For general applications—Type A or Type K
- For high gain applications—Type B or Type L
- For high dc gain applications—Type H
- For dual trace applications—Type C-A

For differential applications—Type G, Type D: dc to 350 kc at 1 mv/cm increasing to 2 mc as sensitivity is decreased to 50 mv/cm, and Type E: 0.06 cycles to 60 kc

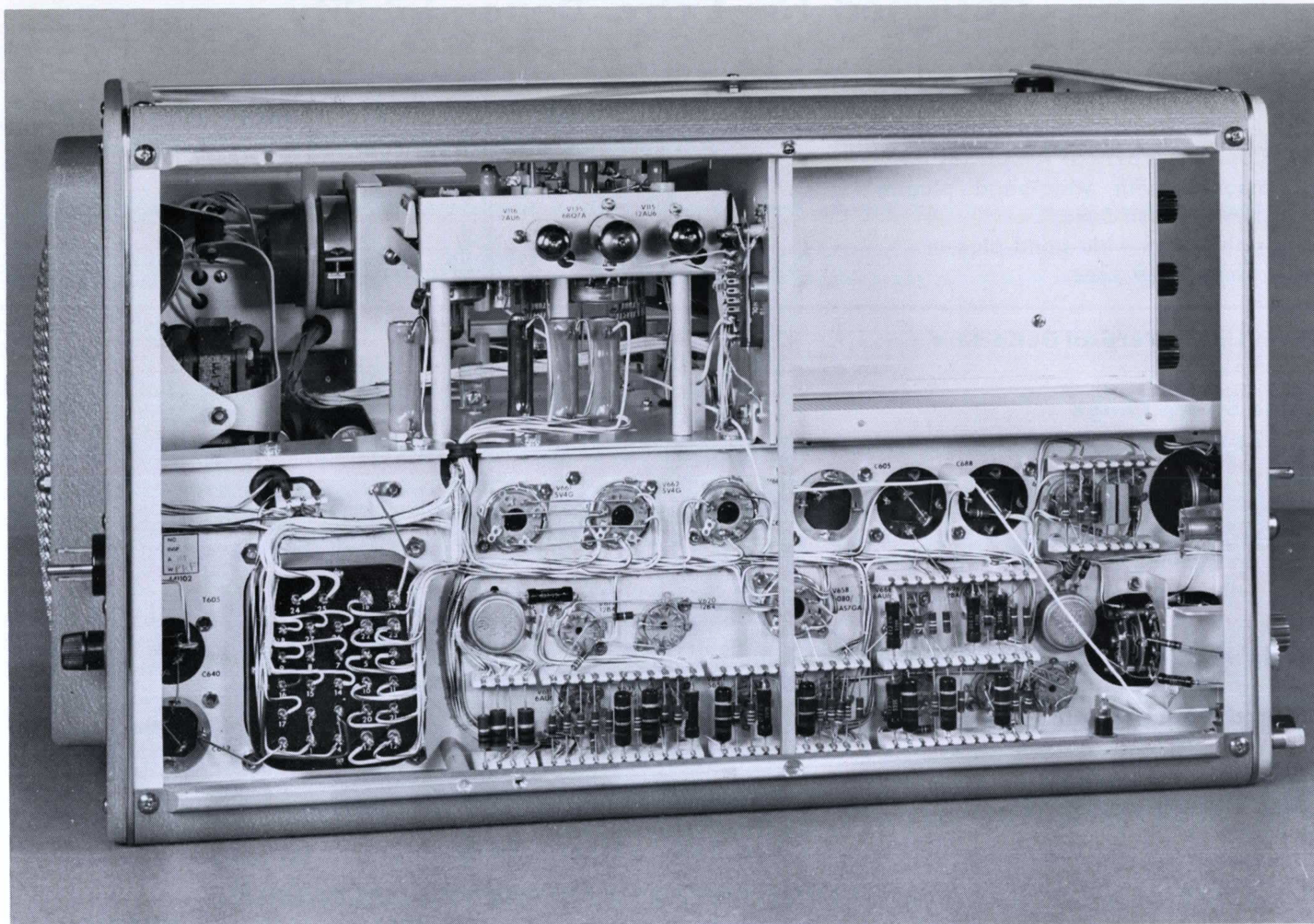
**Direct Input to CRT**—An aperture in the side of the cabinet permits direct connection to the crt deflection plates.

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

**Calibrated Sweep Rates**—The Type 532 has twenty-one calibrated sweep rates. The main sweep control has seven positions; 1, 10,  $100 \mu\text{sec/cm}$ , . . . 1, 10,  $100 \text{ msec/cm}$ , . . . 1  $\text{sec/cm}$ . 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  $1 \mu\text{sec/cm}$  to  $12 \text{ sec/cm}$ . Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%. The 5-x magnifier applied to the  $1 \mu\text{sec/cm}$  sweep extends the calibrated sweep range to  $0.2 \mu\text{sec/cm}$ .

**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 normal 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  $1 \mu\text{sec/cm}$  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 are provided 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-coupled 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 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

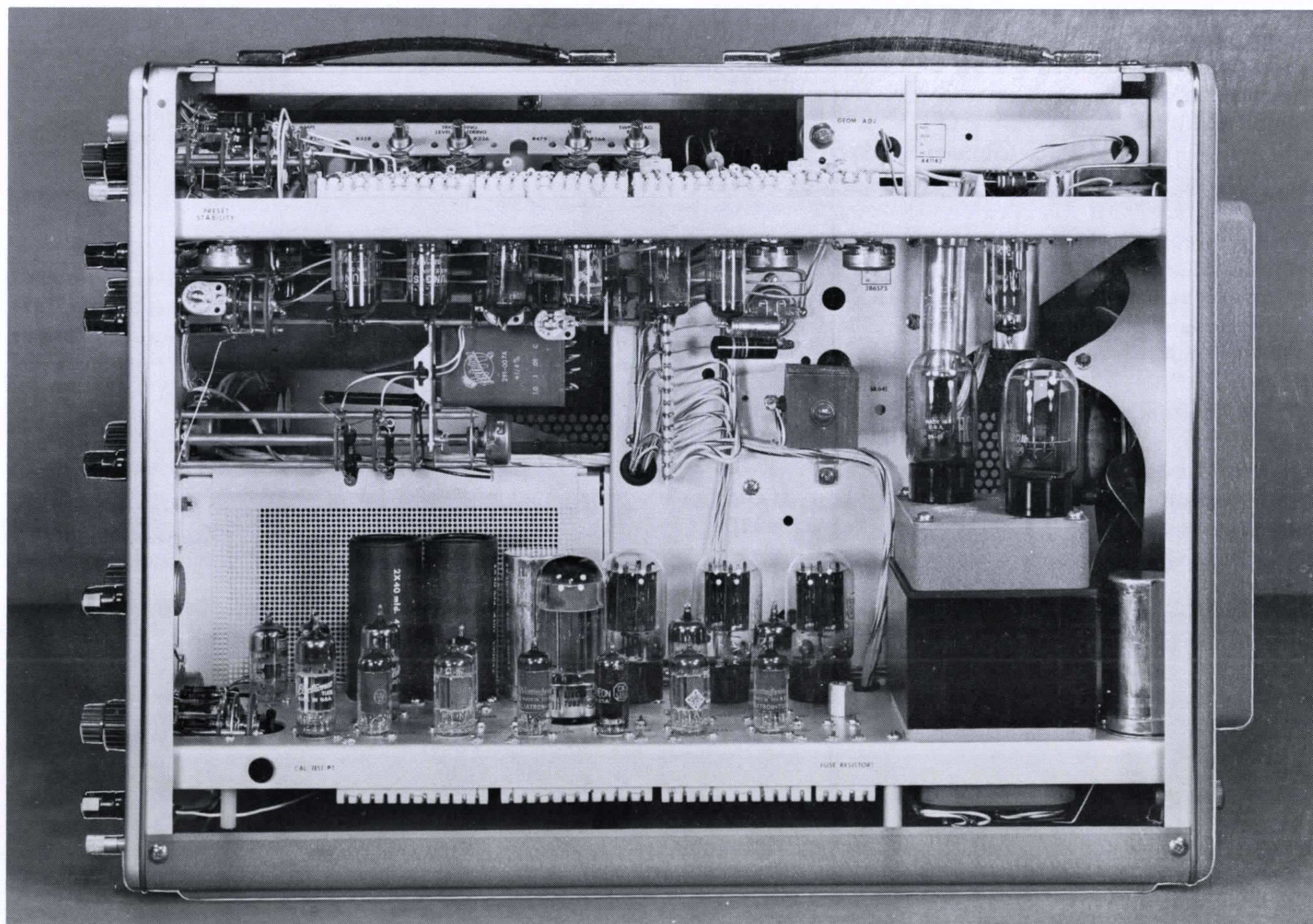
applied to the Tektronix Type 5CAP cathode-ray tube. The 5CAP is a 5" flat-faced precision tube with a helical post-accelerating anode, providing 8 cm of linear vertical deflection. A P-2 phosphor, providing best results over the wide sweep range, is normally supplied. P1, P7, and P11 are available as optional phosphors. Some other phosphors are available on special order.

**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.

**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, 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 . . . . .		5CAP2

## MECHANICAL SPECIFICATIONS

**Ventilation**—Filtered, forced-air ventilation assures 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**—52 pounds.

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

**Type 532, without plug-in units . . . . . \$875**

- Includes: 2—10-x attenuator probes  
 2—Binding-post adapters (013-004)  
 1—Test lead (012-031)  
 1—F510-5 green filter (378-503)  
 1—3-conductor power cord (161-008)  
 1—Instruction manual

## Special Models

**Type 532MOD104**, has sweep lockout feature for single-sweep operation . . . . . **\$900**

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

## 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.

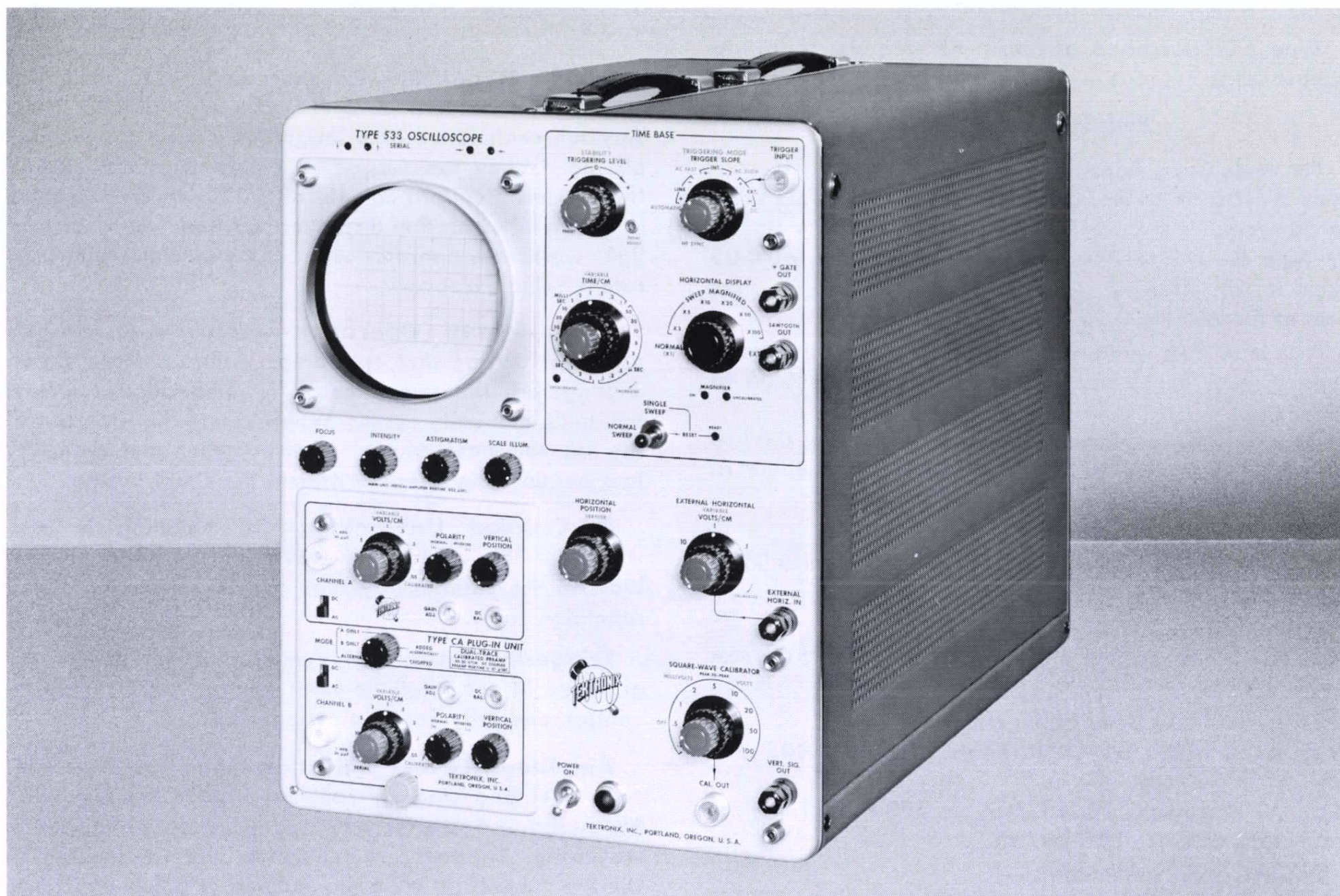
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





# TYPE 533 OSCILLOSCOPE

## TYPE 533 CATHODE-RAY OSCILLOSCOPE



### Easy Operation

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

**Preset Triggering**— Eliminates triggering adjustments in most applications.

**24 Calibrated Direct-Reading Sweep Rates**— Sweep range 0.02  $\mu$ sec/cm to 15 sec/cm.

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

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

### Versatility

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

### High Performance

**DC-to-15 MC Main Vertical Amplifier**

### 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 Tektronix Type A to Z Plug-In Preamplifiers. Six different degrees of sweep magnifications 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  $\mu$ sec.



# TYPE 533 OSCILLOSCOPE

The Type 533 vertical deflection system is designed for use with any one of the Tektronix Type A to Z Plug-In Preamplifiers. 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:

## Plug-In Preamplifiers

For Wide Band Applications—

**Type A**—DC to 14 mc, 0.025- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm.

or **Type B**—DC to 14 mc, 0.025- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm—2 cycles to 10 mc, 0.035- $\mu$ sec risetime at 5 mv/cm to 0.05 v/cm.

For maximum frequency response and risetime—

**Type K**—DC to 15 mc, 0.023- $\mu$ sec risetime at 0.05 to 40 v/cm.

or **Type L**—DC to 15 mc, 0.023- $\mu$ sec risetime at 0.05 to 40 v/cm—3 cycles to 15 mc, 0.023- $\mu$ sec risetime at 5 mv to 4 v/cm.

For dual trace operation—

**Type C-A**—DC to 15 mc, 0.023- $\mu$ sec risetime at 0.05 to 50 v/cm.

For high DC sensitivity—

**Type H**—DC to 11 mc, 0.031- $\mu$ sec risetime at 5 mv/cm to 50 v/cm.

For differential input applications—

Wide band: **Type G**—DC to 14 mc, risetime 0.025  $\mu$ sec at 0.05 to 50 v/cm.

High DC sensitivity: **Type D**—DC to 350 kc at 1 mv/cm, increasing to 2 mc at 50 mv/cm.

For low-level applications—

**Type E**—0.06 cycles to 20 kc at 50  $\mu$ v/cm, increasing to 60 kc at 0.5 mv/cm.

For transistor risetime checking—

**Type R**—0.023- $\mu$ sec risetime

**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 opening 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  $\mu$ 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  $\mu$ 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  $\mu$ sec/cm to 15 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration of the fixed sweeps is 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  $\mu$ 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 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 provide 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-coupled 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.



# TYPE 533 OSCILLOSCOPE

**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  $\mu\mu\text{f}$  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. 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. P1, P7, and P11 phosphors are available as optional phosphors. Some other phosphors are available on special order.

**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.

**Dual-Trace Blanking**—A blanking voltage is available to eliminate switching transients from the display when a dual-trace plug-in unit is operated in its chopped mode. The blanking voltage can be applied to the crt cathode by means of a switch located on the back panel of the instrument. (Type 53/54C Units under serial number 14078 will require a minor modification).

**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	6DJ8
Output amplifiers . . . . .	2	6197
Trigger amplifier . . . . .		6DJ8
Trigger CF and vertical signal out . . . . .		6DJ8
Sweep generator . . . . .		12AU6
Sweep generator CF . . . . .		6DJ8
Disconnect diode . . . . .		6AL5
Unblank and holdoff CF . . . . .		6DJ8
Trigger inverter . . . . .		6DJ8
Holdoff CF & lockout multivibrator . . . . .		6DJ8
Lockout multivibrator . . . . .		6AU6
Horizontal input CF . . . . .		12AU6
Driver amplifiers . . . . .	2	6DK6
Output amplifier and CF . . . . .	2	6BA8
Capacitance driver . . . . .		6DK6
Positive multivibrator and CF . . . . .		6DJ8
Negative multivibrator . . . . .		12BY7
Sawtooth and gate CF . . . . .		6DJ8
External horizontal amplifier . . . . .		6DJ8
Trigger shaper . . . . .		6DJ8
Cal multivibrator . . . . .		6AU6
Cal output CF & multivibrator . . . . .		12AU7
Dual-trace blanking and trigger amplifier . . . . .		6DJ8
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 . . . . .		T533P2

## 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, blue 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 maximum.





# TYPE 533 OSCILLOSCOPE

Type 533, without plug-in units . . . . . \$1100

- Includes: 2—10-x attenuator probes
- 2—Binding-post adapters (013-004)
- 1—Test lead (012-031)
- 1—F510-5 green filter (378-514)
- 1—3-conductor power cord (161-008)
- 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.

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





# IMPROVED INSTRUMENT

## TYPE 535A CATHODE-RAY OSCILLOSCOPE with Flexible Sweep Delay

### Easier Operation

Simplified panel layout.  
Color-correlated controls.

### Two Kinds of Sweep Delay

**Triggered (jitter free)**—delayed sweep is started by signal under observation

**Conventional**—delayed sweep is started by delayed trigger.

### Greater Calibrated Delay Range

1  $\mu$ sec to 10 sec, continuously adjustable (2  $\mu$ sec/cm to 1 sec/cm).

### DC-to-15 MC Vertical Amplifier

All Tektronix Type A to Z Plug-In Pre-amplifiers can be used for signal-handling versatility.

### Two Time-Base Generators

**TIME BASE A**—0.1  $\mu$ sec/cm to 5 sec/cm in 24 calibrated steps, continuously variable from 0.1  $\mu$ sec/cm to 12 sec/cm. 5-x magnifier increases calibrated range to 0.02  $\mu$ sec/cm. Single-sweep provision for one-shot applications.

**TIME BASE B**—Also functions as delay generator. 18 calibrated steps from 2  $\mu$ sec/cm to 1 sec/cm.

### GENERAL DESCRIPTION

The Tektronix Type 535A is a DC-to-15 MC Oscilloscope with a wide range of sweep delay. It is easier to operate and offers higher performance than its predecessor, the Type 535.

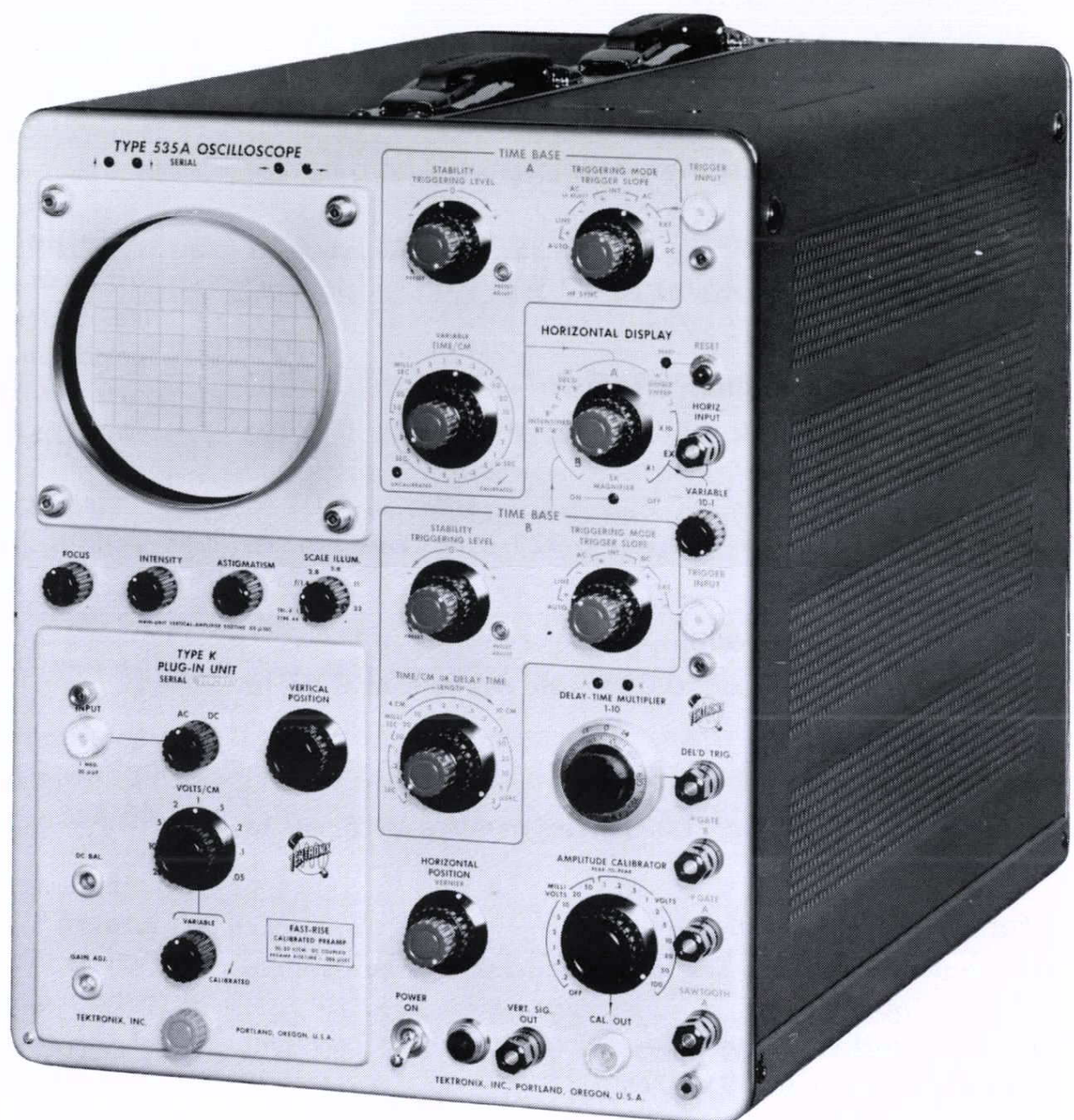
Color-correlated controls contribute greatly to ease of operation. Other contributing factors to easy operation of the Type 535A are simplified panel layout and horizontal display control, single-knob sweep and calibrator controls, and internal triggering for sweep delay.

Greater reliability has been achieved through use of the new frame-grid twin triodes, and a change to silicon diodes in the power supplies. Performance improvement includes an extra 5 mc in vertical response and wider range of sweep delay.

### APPLICATIONS

In addition to the usual applications for a highly versatile DC-to-15 MC Oscilloscope, sweep delay makes it possible to:

1. Make accurate incremental measurements along a complex waveform.



2. Make accurate phase-angle measurements between two signals, up to frequencies of 1 mc.
3. Display separate channels of a PTM system with effects of time jitter removed, 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 pulses.
5. Make accurate time-difference measurements between pulse-in and pulse-out through an amplifying system.
6. Display any selected individual line of a television composite signal.
7. Measure time displacement, wave shape, and amplitude of individual channels in a telemetering system.
8. Utilize calibrated sweep magnification up to the highest practical limit.

Plus many more-specialized applications.

### VERTICAL-DEFLECTION SYSTEM

**DC-Coupled Output Amplifier**—The wide-band dc-coupled amplifier with risetime of 0.022  $\mu$ sec is factory adjusted for optimum transient response.



# TYPE 535A OSCILLOSCOPE

The Type 535A vertical deflection system is designed for use with any one of the Type A to Z Plug-In Preamp-pliers. In order to operate the Type 535A, one of the preamplifiers must be plugged in.

## Plug-In Preamplifiers

For wide-band applications—

**Type A**—DC to 14 mc, 0.025- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm.

or **Type B**—DC to 14 mc, 0.025- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm—2 cycles to 10 mc, 0.035- $\mu$ sec rise-time at 5 mv/cm to 0.05 v/cm.

For maximum frequency response—

**Type K**—DC to 15 mc, 0.023- $\mu$ sec risetime at 0.05 to 40 v/cm.

or **Type L**—DC to 15 mc, 0.023- $\mu$ sec risetime at 0.05 to 40 v/cm—3 cycles to 15 mc, 0.023- $\mu$ sec risetime at 5 mv/cm to 4 v/cm.

For dual-trace operation—

**Type C-A**—DC to 15 mc, 0.023- $\mu$ sec risetime at 0.05 to 50 v/cm.

For high DC sensitivity—

**Type H**—DC to 11 mc, 0.031- $\mu$ sec risetime at 5 mv to 50 v/cm.

For differential-input applications—

Wide band: **Type G**—DC to 14 mc, 0.025- $\mu$ sec risetime at 0.05 to 50 v/cm.

High DC sensitivity: **Type D**—DC to 350 kc at 1mv/cm, increasing to 2 mc at 50 mv/cm.

For low-level applications—

**Type E**—0.06 cycles to 20 kc at 50  $\mu$ v/cm, increasing to 60 kc at 0.5 mv/cm.

For transistor risetime checking—

**Type R**—0.023- $\mu$ sec risetime.

**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 CRT**—An opening in the side of the cabinet permits direct connection to the cathode-ray-tube deflection plates.

## HORIZONTAL-DEFLECTION SYSTEM

The Type 535A has two time-base generators. TIME BASE A is identical to the time-base generator in the Tektronix Type 531A. TIME BASE B functions as a delay generator. The signal to be observed can be displayed on either time base in the following ways: TIME BASE B normal, TIME BASE B with trace brightening during the period that TIME BASE A is running, TIME BASE A delayed by TIME BASE B, TIME BASE A normal, and TIME BASE A single sweep.

**TIME BASE A Calibrated Sweeps**—Twenty-four direct-reading calibrated steps are provided: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50  $\mu$ 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  $\mu$ sec/cm to 12 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration of the fixed sweeps is within 3%.

**Single Sweep**—(TIME BASE A only) A RESET push-button arms the sweep to fire on the next trigger to arrive. After firing once, the sweep is locked out and cannot fire again until rearmed by pressing the RESET button. The READY light indicates when the sweep is armed to fire on the next trigger.

**TIME BASE B Calibrated Sweeps**—Eighteen direct-reading calibrated steps are provided: 2, 5, 10, 20, 50  $\mu$ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, and 1 sec/cm. A sweep-length control adjusts the sweep length from 4 cm to 10 cm for the purpose of changing the sweep repetition rate. Variable sweep repetition rate makes TIME BASE B useful as a repetition-rate generator over the range of 0.1 cycles to 40 kc.

**Sweep Magnifier**—5-x magnifier increases the calibrated sweep time to 0.02  $\mu$ sec/cm. Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of of the normal trace is expanded to fill the screen. Any one-fifth of the magnified sweep can be displayed on the screen by rotating the HORIZONTAL POSITION control. Accurate 5-x magnification is obtained on all ranges, for both time bases.

**DC-Coupled Unblanking**—DC coupling is provided for the unblanking waveforms, 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. Triggering facilities are identical for both time bases, except that TIME BASE A has two additional modes: H.F. SYNC and AC LF (low-frequency) REJECT.

**Amplitude-Level Selection**—Adjustable amplitude-level and stability controls provide 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-coupled 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.



# TYPE 535A OSCILLOSCOPE

**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.

**Low-Frequency Reject**—(TIME BASE A only) Prevents low-frequency components, such as hum, from interfering with stable triggering.

**High-Frequency Sync**—(TIME BASE A only) 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 10 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 47  $\mu\mu\text{f}$  paralleled by 1 megohm.

## SWEEP DELAY

Sweep delay for TIME BASE A over the range of 1  $\mu\text{sec}$  to 10 sec is derived from TIME BASE B by means of a pick-off circuit. A delayed trigger is generated at the pick-off point, which can be adjusted to any point on the sawtooth waveform generated by TIME BASE B. The DELAY-TIME MULTIPLIER, a ten-turn calibrated control, is used in conjunction with the TIME/CM switch for TIME BASE B to select the pick-off point and indicate the amount of delay. Accuracy of the fifteen calibrated time/cm steps from 2  $\mu\text{sec/cm}$  to 0.1 sec/cm is within 1%. Accuracy of the three remaining steps, 0.2, 0.5, and 1 sec/cm, is within 3%. For extreme accuracy any or all steps can be adjusted to an external standard. Incremental accuracy of the ten-turn control is within 0.2%.

**Triggered Operation**—When the triggering controls of TIME BASE A are adjusted so that the delayed trigger from TIME BASE B arms the sweep but does not start it, the next signal to arrive will start the sweep. Thus the delayed sweep is actually started by the signal under observation, resulting in a steady display even when time jitter or time modulation is present in the signal.

**Conventional Operation**—When the triggering controls of TIME BASE A are adjusted to permit the delayed trigger to start the sweep, the delayed sweep starts precisely at the pick-off point, its start delayed the amount of time indicated by the TIME BASE B time/cm switch and the DELAY-TIME MULTIPLIER. Any time modulation or time jitter on the signal will be magnified in proportion to the amount of sweep expansion, however jitter introduced by the delay and pick-off circuitry is less than one part in 20,000, making extremely large magnifications practical.

**Trace Brightening**—When the signal is displayed on TIME BASE B with the HORIZONTAL DISPLAY switch in the "B" INTENSIFIED BY "A" position, the unblanking pulse of TIME BASE A is added to that of TIME BASE B. Therefore the period of operation of TIME BASE A appears as a brightened portion on the display. This trace brightening serves to indicate both the point-in-time relationship between the delayed sweep and the original display, and the degree of magnification that will be achieved when the display is transferred to TIME BASE A.

## 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 T533P, a Tektronix cathode-ray tube, is used in the Type 535A. The T533P 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. For best results over the wide sweep range of the Type 535A, a P2 phosphor is normally furnished with the instrument.

**Regulated Power Supply**—Electronic regulation compensates for line-voltage variations between 105 and 125 v, and for current-demand differences among the plug-in preamplifiers.

**Amplitude Calibrator**—A square-wave calibration voltage is available through a front-panel coaxial connector. Eighteen direct readings fixed steps—0.2, 0.5, 1, 2, 5, 10, 20, 50 millivolts, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 volts peak-to-peak are provided by the single knob control. Accuracy is within 3%. Square-wave frequency is approximately 1 kc.

**Dual-Trace Blanking**—A blanking voltage is available to eliminate switching transients from the display when a dual-trace plug-in unit is operated in its chopped mode. The blanking voltage can be applied to the crt cathode by means of a switch located on the back panel of the instrument. (Type 53/54C Units under serial number 14078 will require a minor modification).

**Output Waveforms**—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-sawtooth waveform are available from TIME BASE A at front-panel binding posts via cathode followers. A 20-v positive gate and the delayed trigger from TIME BASE



# TYPE 535A OSCILLOSCOPE

B are also available at front-panel connectors. 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 TUBES and SEMICONDUCTORS

### Vertical Amplifier

Vertical-input amplifier . . . . .	2	12BY7
CF and beam-position amplifiers . . . . .	2	6DJ8
Output amplifiers . . . . .	2	6197
Trigger amplifiers . . . . .		6DJ8
Trigger CF and vertical-signal out . . . . .		6DJ8

### Time-Base A Generator

Trigger amplifier . . . . .		6DJ8
Trigger shaper . . . . .		6DJ8
Sweep-gating multivibrator and CF . . . . .		6DJ8
Sweep-gating multivibrator . . . . .		12BY7
Unblanking and hold-off CF . . . . .		6DJ8
Sawtooth and gate CF . . . . .		6DJ8
Lockout multivibrator . . . . .		6AU6
Hold-off CF and lockout multivibrator . . . . .		6DJ8
Delay-trigger amplifier . . . . .		6AU6
Clamp . . . . .		T12G
Disconnect diodes . . . . .		6AL5
Miller runup . . . . .		6CL6
Runup CF . . . . .		6DJ8

### Time Base B Generator

Trigger amplifier . . . . .		6DJ8
Trigger shaper . . . . .		6DJ8
Stability CF and hold-off CF . . . . .		6DJ8
Sweep-gating multivibrator and CF . . . . .		6DJ8
Sweep gating multivibrator . . . . .		6AU6
Unblanking CF and gate CF . . . . .		6DJ8
Disconnect diodes . . . . .		12AL5
Miller runup . . . . .		12AU6
Runup CF and hold-off CF . . . . .		6DJ8

### Horizontal Amplifiers and Delay

Input and driver CF . . . . .		6DJ8
Sweep amplifiers and CF . . . . .	2	6DJ8
Current booster . . . . .		6CL6

External-input amplifier . . . . .		6DJ8
Delay trigger . . . . .		6DJ8
Delay pick-off . . . . .	2	6AU6
Delay-trigger CF and current control . . . . .		6DJ8

### Power Supplies

H.V. regulator amplifier . . . . .		12AU7
H.V. oscillator . . . . .		6AU5
H.V. rectifiers . . . . .	5	5642
Comparators . . . . .	2	12AX7
Voltage reference . . . . .		5651
Regulator amplifiers . . . . .	5	6AU6
Series regulators . . . . .	4	12B4
Series regulators . . . . .	2	6080
Rectifiers . . . . .	16	IN1566

### Miscellaneous

Calibrator multivibrator . . . . .		6AU6
Calibrator multivibrator and CF . . . . .		12AU7
Alternate-trace sync amplifier and trace blank . . . . .		6DJ8
Cathode-ray tube . . . . .		T533P2

## 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, blue 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, 550 watts maximum.

**Type 535A, without plug-in units . . . . . \$1400**

Includes: 2—10-x attenuator probes  
2—Binding-post adapters (013-004)  
1—Test lead (012-031)  
1—F510-5 green filter (378-503)  
1—3-conductor power cord (161-008)  
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.

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





# TYPE 536 OSCILLOSCOPE

## TYPE 536 "X-Y" OSCILLOSCOPE

### Identical Deflection Characteristics

Vertical and horizontal risetimes —  
0.03  $\mu$ sec.  
Uniform phase-shift characteristics.

### Curve Tracing

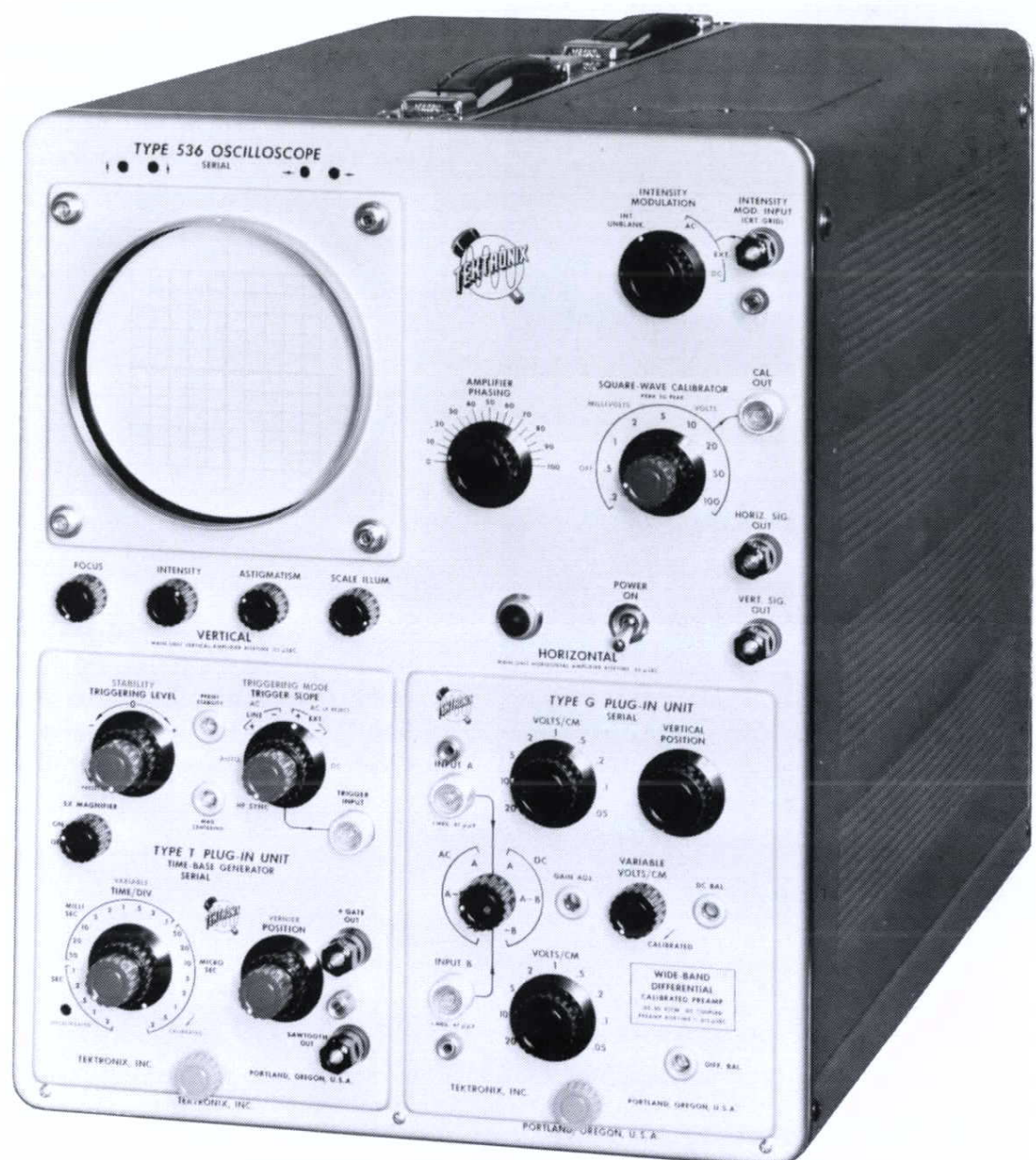
The Type 536 is useful for curve tracing with two related varying voltages over a wide frequency range.

### Wide Application Range

All Type A to Z Plug-In Preamplifiers 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 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 Time-Base Plug-In Unit, Type T, plugged into the horizontal amplifier, and one of the Type A to Z wide-band units 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 Plug-In Preamplifiers.

### APPLICATIONS

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

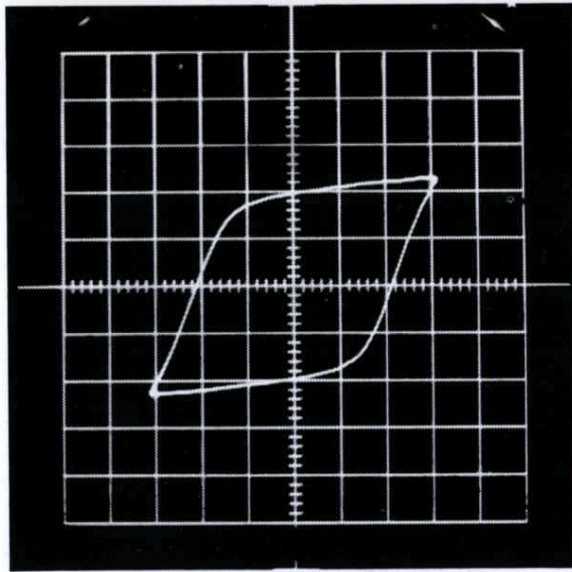
problems. Differential input, a feature that eliminates the need for a common XY terminal, is available in the wide-band Type G Plug-In Preamplifier. Since differential input is needed for accuracy in many curve-tracing applications, a pair of Type G Units is recommended for this work.

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

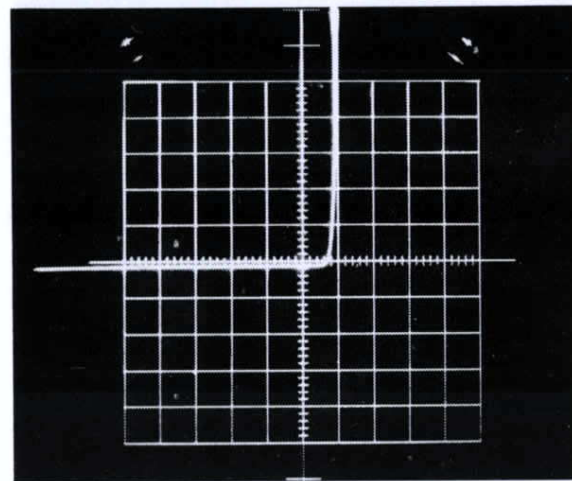
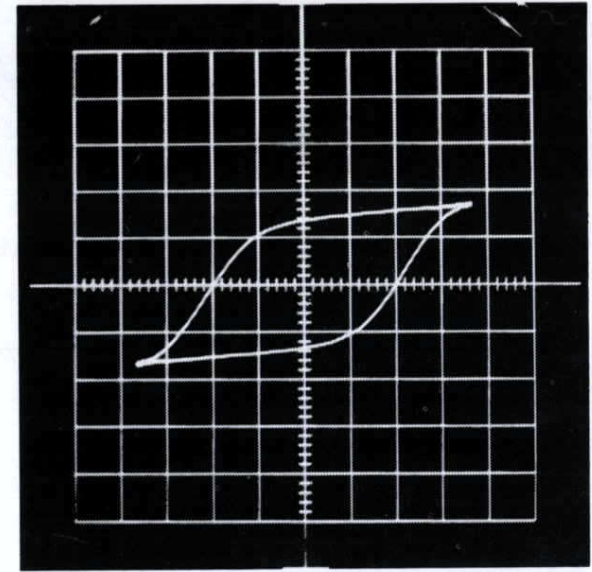
1. Examination of semiconductor diode characteristics—volts vs. amperes plot.
2. Determination of ferromagnetic material characteristics.
3. Linear amplifier distortion measurement.
4. Limiting or expanding-amplifier performance measurements.
5. Displaying pressure vs. volume diagrams.
6. Analyzing amplitude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



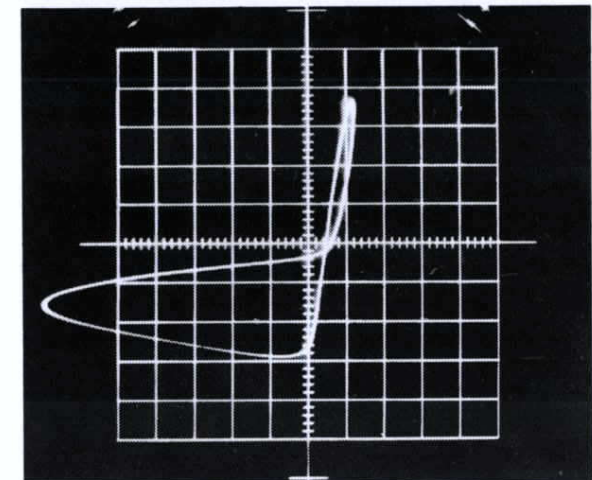
# TYPE 536 OSCILLOSCOPE



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



High-conduction diffused silicon diode characteristics—left, at 60 cycles; right, at 2 mc. Type 536 with two Type G 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  $\mu$ sec. One of the Type A to Z Preamplifiers must be plugged in to make the vertical-deflection system function. Either one of the Type A to Z Preamplifiers or a Type T Time-Base Unit must be plugged in to make the horizontal-deflection system function.

Deflection characteristics with Type G Units plugged in are:

Passbands—dc to 10 mc.

Risetimes—0.035  $\mu$ sec.

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 A—DC to 10 mc, 0.035  $\mu$ sec.

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

Type C-A—DC to 10 mc, 0.035  $\mu$ sec.

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

Type E—0.06 cycles to 60 kc.

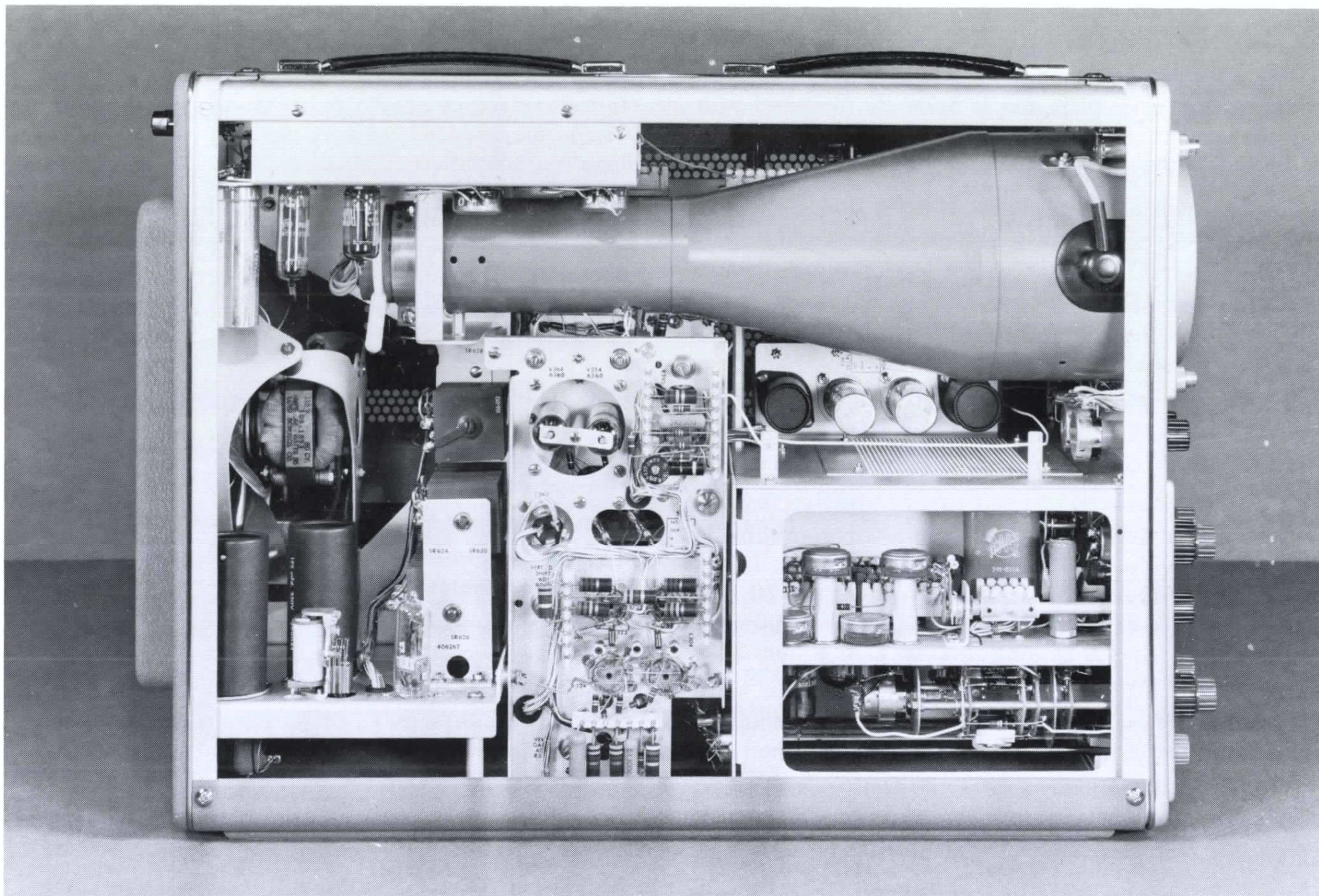
Type G—DC to 10 mc, 0.035  $\mu$ sec.

Type H—DC to 9.5 mc, 0.037  $\mu$ sec.

Type K—DC to 11 mc, 0.031  $\mu$ sec.



# TYPE 536 OSCILLOSCOPE



Type L—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 T Time-Base Generator must be plugged into the horizontal system. Specifications of the Type 536 horizontal-deflection system with the Type T Unit are as follows:

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

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

**Versatile Trigger Selection**—Positive or negative slope, external or line voltage, ac-coupling 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 T 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 A to Z 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 K 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, T536P, is used in the Type 536. Deflection factor is approximately the same for both horizontal and vertical deflection plates. The T536P crt provides a 10-by-10 divi-



# TYPE 536 OSCILLOSCOPE

sion (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.

**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.

**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 T unit) or external ac-coupling 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 . . . . .		T536P2

## 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 K Units plugged in.

**Type 536, without plug-in units . . . . . \$1050**

- Includes: 2—10-x attenuator probes  
 2—Binding-post adapters (013-004)  
 1—Test lead (012-031)  
 1—F510-5 green filter (378-503)  
 1—3-conductor power cord (161-008)  
 1—Instruction manual

## Optional Phosphors

P2 phosphor normally furnished.

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





# IMPROVED INSTRUMENT

## TYPE 541A CATHODE-RAY OSCILLOSCOPE for Fast-Rise Applications

### Easy Operation

Single knob control for Sweep Range, Amplitude Calibrator, and Horizontal Display.

### 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  $\text{sec}/\text{cm}$ .

### 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

### Balanced 0.2 $\mu\text{sec}$ Delay Network



### GENERAL DESCRIPTION

The Type 541A is an improved high-speed laboratory oscilloscope with excellent performance capabilities. Greater dependability and longer life have been attained through the use of frame-grid dual triodes and silicon-diode rectifiers. In combination with the Type K Plug-In Unit, the Type 541A offers a vertical-amplifier passband of dc to 30 mc and a risetime of 12 millimicroseconds. Wide sweep range, high accelerating potential, and full four centimeters of vertical deflection fully complement the extended vertical-amplifier range, and the convertibility provide by plug-in preamplifiers adds immensely to its value.

### 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 K Fast-Rise Plug-In Preamplifier, developed for Type 541A and Type 545A Oscilloscopes, provides a maximum deflection factor of 0.05 v/cm, with 12-

millimicrosecond risetime, dc-to-30 mc passband, and 20- $\mu\text{mf}$  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 541A vertical deflection system is designed to be used with any of the Type A to Z Plug-In Preamplifiers. In order to operate the Type 541A, one of the preamplifiers must be plugged in.

### Plug-In Preamplifiers

For fast-rise applications—

**Type K**—DC to 30 mc, 0.012- $\mu\text{sec}$  risetime at 0.05 v/cm to 40 v/cm,

Or **Type L**—DC to 30 mc, 0.012- $\mu\text{sec}$  risetime at 0.05 v/cm to 40 v/cm—3 cycles to 24 mc, 0.015- $\mu\text{sec}$  risetime at 5 mv/cm to 4 v/cm.

For dual-trace applications—

**Type C-A**—DC to 24 mc, 0.015- $\mu\text{sec}$  risetime at 0.05 v/cm to 50 v/cm.

For high DC sensitivity—

**Type H**—DC to 15 mc, 0.023- $\mu\text{sec}$  risetime at 5 mv/cm to 50 v/cm.



# TYPE 541A OSCILLOSCOPE

For differential input applications—

Wideband: **Type G**—DC to 20 mc, 0.018- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm.

High DC sensitivity: **Type D**—DC to 350 kc at 1 mv/cm, increasing to 2 mc at 50 mv/cm.

Low-Level: **Type E**—0.06 cycles to 20 kc at full gain, increasing to 60 kc at 0.5 mv/cm.

For transistor risetime checking—

**Type R**—0.012- $\mu$ sec risetime.

Type A and B plug-in units can be used with the Type 541A oscilloscope. However, Type K or L units will be preferred by most users because of their superior transient-response characteristics.

**Type A**—DC to 20 mc, 0.018- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm.

**Type B**—DC to 20 mc, 0.018- $\mu$ sec risetime; AC-coupled or DC-coupled—0.05 v/cm to 50 v/cm. 2 cycles to 12 mc, 0.03- $\mu$ sec risetime 5 mv/cm to 0.05 v/cm.

**Probes**—Two low-capacitance probes (10-x atten.) are supplied with the instrument. Input capacitance of the Type 541A-Type K combination with probes is 8  $\mu$ f, maximum deflection factor is 0.5 v/cm. Excellent transient response is retained, as the probes introduce 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  $\mu$ f at 5-x, 5.5  $\mu$ f at 20-x, and 2.5  $\mu$ f at 50-x attenuation.

**Balanced Delay Network**—A signal delay of 0.2  $\mu$ 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 opening in the side of the cabinet permits direct connection to the deflection plates.

## HORIZONTAL DEFLECTION SYSTEM

The horizontal deflection system of the Type 541A is essentially the same as that of the Tektronix Type 531A. Sweep generator used in the Type 541A 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  $\mu$ sec/cm to 12 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  $\mu$ 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  $\mu$ sec/cm to 12 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration of the fixed sweeps is within 3%.

**Sweep Magnifier**—5-x magnifier increases the calibrated sweep time to 0.02  $\mu$ sec/cm. Sweep magnification is obtained by increasing the gain of the sweep

output amplifier by a factor of five. The center 2 cm of the normal 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 5-x 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 provide 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-coupled or dc-coupled. The triggering point can be on either the rising or falling slope of the triggering waveform.

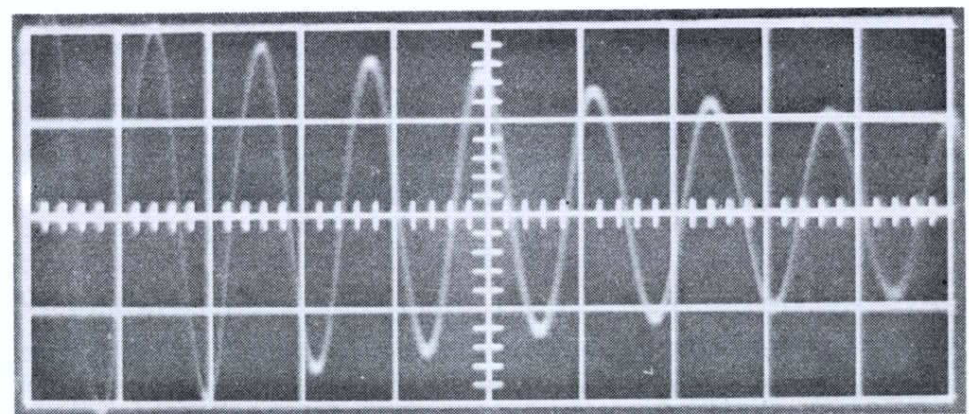
**Preset Stability**—Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

**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 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/ $\mu$ sec writing rate of the Type 541A Oscilloscope with a T543P11 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.



# TYPE 541A OSCILLOSCOPE

**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 47  $\mu\mu\text{f}$  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 541A uses the Tektronix Type T543 cathode-ray tube. The T543 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 541A, a P2 screen is normally furnished with the instrument.

**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.

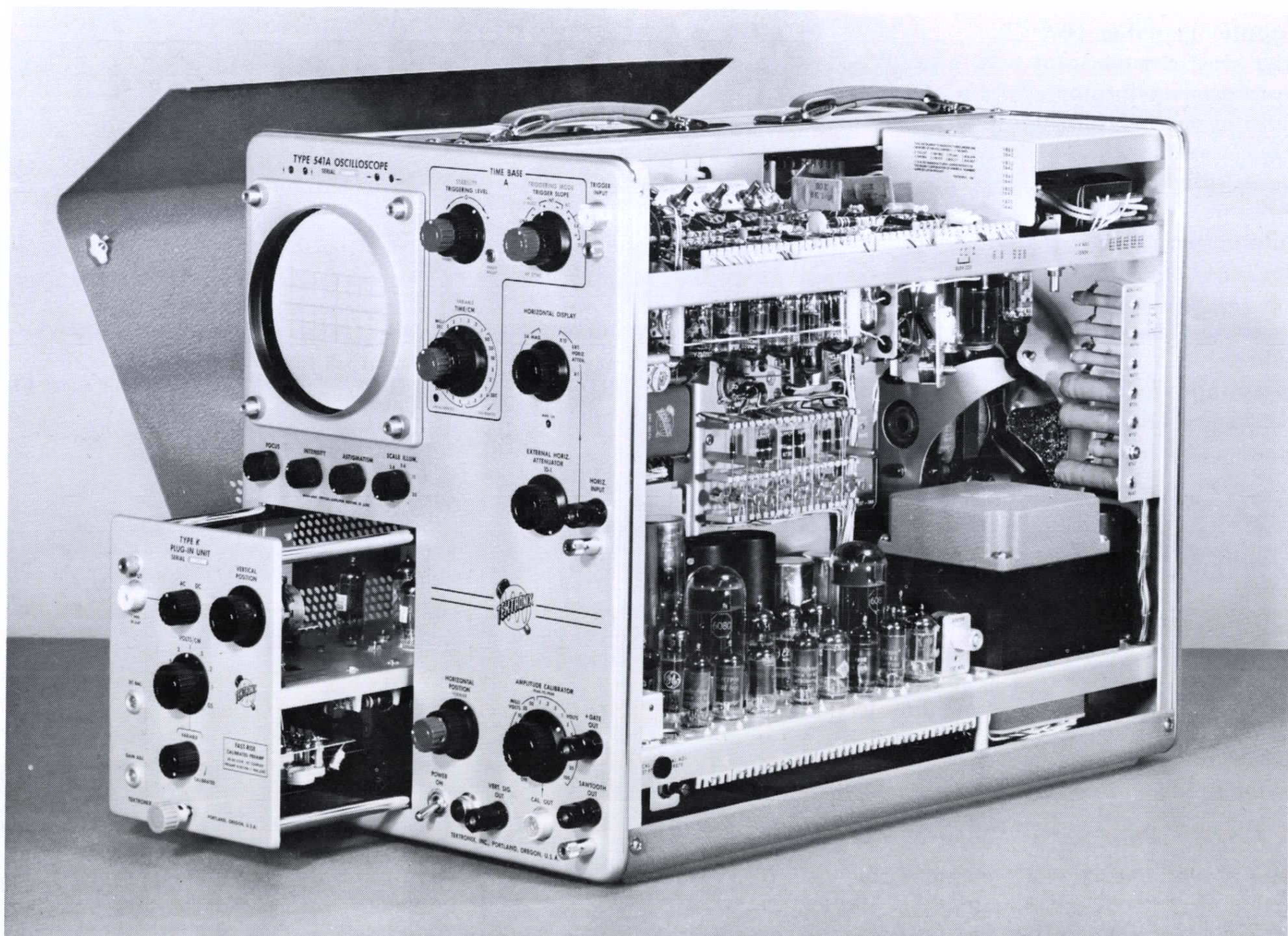
**Regulated Power Supply**—Electronic regulation compensates for line-voltage variations between 105 and 125 v, and for current-demand differences among the plug-in preamplifiers.

**Amplitude Calibrator**—A square-wave calibration voltage is available through a front panel coaxial connector. Eighteen direct readings fixed steps—0.2, 0.5, 1, 2, 5, 10, 20, 50 millivolts, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 volts peak-to-peak are provided by the single knob control. Accuracy is within 3%. Square wave frequency is approximately 1 kc.

**Dual-Trace Blanking**—A blanking voltage is available to eliminate switching transients from the display when a dual-trace plug-in unit is operated in its chopped mode. The blanking voltage can be applied to the crt cathode by means of a switch located on the back panel of the instrument. (Type 53/54C Units under serial number 14078 will require a minor modification).

**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.





# TYPE 541A OSCILLOSCOPE

**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-TUBES AND SEMICONDUCTORS

Vertical input amplifiers . . . . .	2	12BY7A
Beam position amplifiers . . . . .		12AU7
Driver CF . . . . .	2	6DJ8
Output amplifiers . . . . .	12	6DK6
Trigger amplifiers . . . . .	2	6DK6
Trigger CF and vert. sig. out . . . . .		6DJ8
Trigger amplifier . . . . .		6DJ8
Trigger shaper . . . . .		6DJ8
Stability and hold-off CF . . . . .		6DJ8
Hold-off and unblanking CF . . . . .		6DJ8
Sweep-gating multivibrator and CF . . . . .		6DJ8
Sweep-gating multivibrator . . . . .		12BY7
Disconnect diodes . . . . .		6AL5
Gate-out and sawtooth-out CF . . . . .		6DJ8
Dual-trace blanking and trigger amplifiers . . . . .		6DJ8
Sweep generator . . . . .		6CL6
Sweep generator CF . . . . .		6DJ8
External horizontal and dc level CF . . . . .		12AU7
External horizontal amplifier . . . . .		6DJ8
Horizontal input and driver CF. . . . .		6DJ8
Horizontal amplifier and CF . . . . .	2	6DJ8
Sweep start compensator . . . . .		6CL6
Calibrator multivibrator . . . . .		6AU6
Calibrator multivibrator and CF . . . . .		12AU7
Voltage rectifiers . . . . .	16	1N1566
Voltage reference . . . . .		5651
Comparator amplifiers . . . . .	2	12AX7
Regulator amplifiers . . . . .	5	6AU6
Series regulator . . . . .	4	12B4
Series regulators . . . . .	2	6080
High-voltage oscillator . . . . .		6AU5
Regulator . . . . .		12AU7
High-voltage rectifiers . . . . .	5	5642
Cathode-ray tube . . . . .		T543P2

## MECHANICAL SPECIFICATIONS

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

**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**—61 1/2 pounds.

**Power Requirements**—105-125 v or 210-250 v 50-60 cycles, 520 watts maximum.

**Type 541A, without plug-in units . . . . . \$1200**

- Includes: 2—10-x attenuator probes  
 2—Binding-Post adapters (013-004)  
 1—Test lead (012-031)  
 1—Green filter (378-514)  
 1—3-conductor power cord (161-008)  
 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.

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

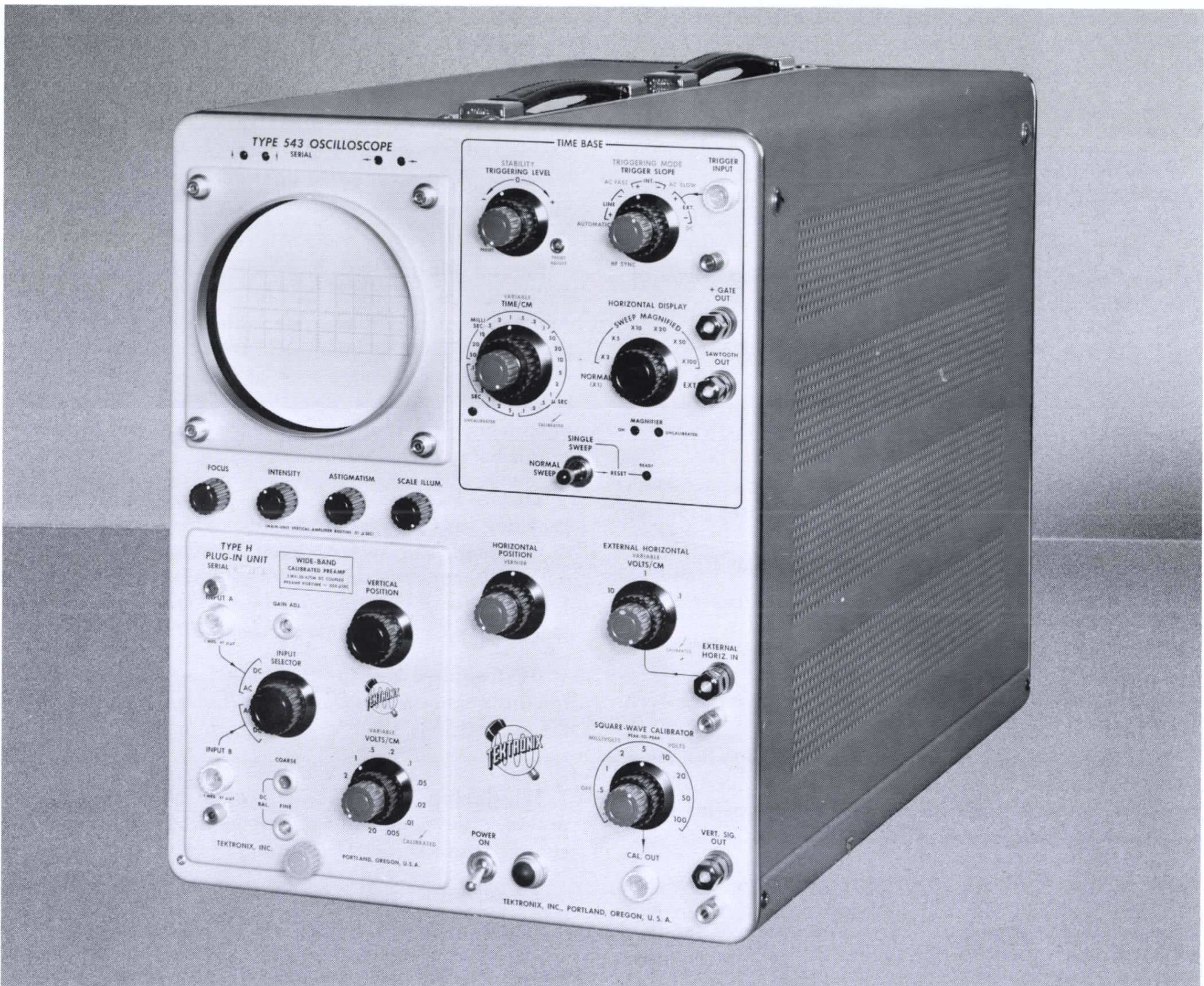
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





# TYPE 543 OSCILLOSCOPE

## TYPE 543 CATHODE-RAY OSCILLOSCOPE



### Easy Operation

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

**Preset Triggering**—Eliminates triggering adjustments in most applications.

**24 Calibrated Direct-Reading Sweep Rates**—Sweep range 0.02  $\mu$ sec/cm to 15 sec/cm.

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

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

### Versatility

**Nine Available Type A to Z Plug-In Preampifiers**—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 Preampifiers.

### 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 Tektronix Type A to Z Plug-In Preampifiers. 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.



# 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 A to Z Plug-In-Preamplifier Units must be plugged in.

### Plug-In Preamplifiers

For maximum frequency response—

**Type K**—DC to 30 mc, 0.012- $\mu$ sec risetime; 0.05 to 40 v/cm.

Or **Type L**—DC to 30 mc, 0.012- $\mu$ sec risetime at 0.05 to 40 v/cm. . . 3 cycles to 24 mc, 0.015- $\mu$ sec risetime at 5 mv/cm to 4 v/cm.

For dual-trace operation—

**Type C-A**—DC to 24 mc, 0.015- $\mu$ sec risetime; 0.05 to 50 v/cm.

For high DC sensitivity—

**Type H**—DC to 15 mc, 0.023- $\mu$ sec risetime; 5 mv/cm to 50 v/cm.

For differential-input applications—

Wide-Band: **Type G**—DC to 20 mc, 0.018- $\mu$ sec risetime; 0.05 to 50 v/cm.

High DC sensitivity: **Type D**—DC to 350 kc at 1 mv/cm, increasing to 2 mc at 50 mv/cm.

For low-level applications—

**Type E**—0.06 cycles to 20 kc at 50  $\mu$ v/cm, increasing to 60 kc at 0.5 mv/cm.

For transistor risetime checking—

**Type R**—0.012- $\mu$ sec risetime.

Type A and B plug-in units can be used with the Type 543 Oscilloscope. However, Type K or L units will be preferred by most users because of their superior transient-response characteristics.

**Type A**—DC to 20 mc, 0.018- $\mu$ sec risetime; 0.05 v/cm to 50 v/cm.

**Type B**—DC to 20 mc, 0.018- $\mu$ sec risetime; AC or DC-coupled—0.05 v/cm to 50 v/cm, AC-coupled only—5 mv/cm to 50 v/cm.

**Probes**—Two low-capacitance 10-x attenuator probes are supplied with the Type 543. 10-x 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 Inputs To CRT**—An opening 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 as-

ures excellent linearity. Characteristics of this circuitry make possible the wide range of 0.02  $\mu$ 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  $\mu$ 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  $\mu$ sec/cm to 15 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration accuracy of the fixed sweeps is 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  $\mu$ 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 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.

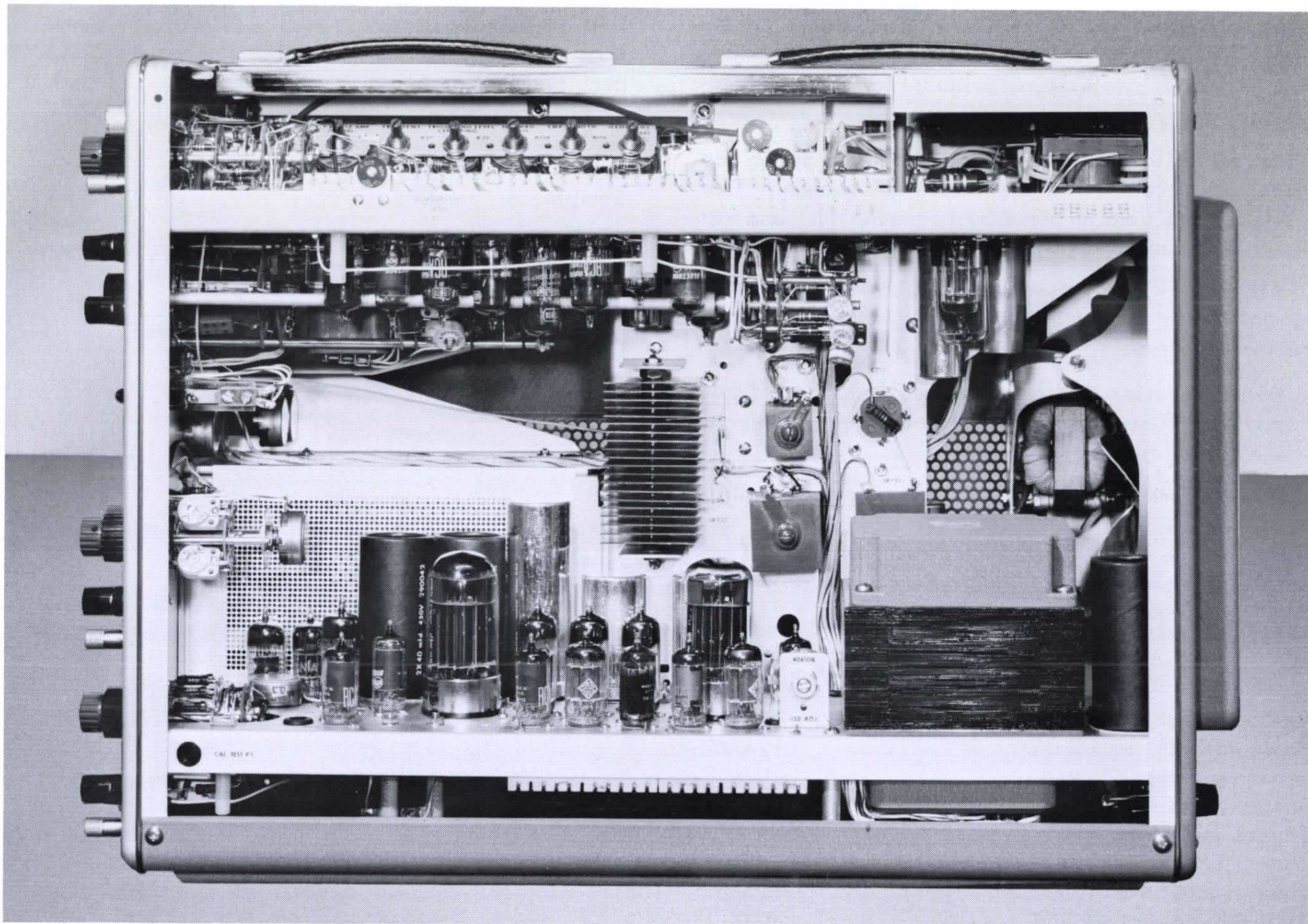
**Amplitude-Level Selection**—Adjustable amplitude-level and stability controls provide for triggering the sweep at a selected amplitude level on the triggering waveform. Triggering source can be internal, external, or the line frequency, either ac-coupled or dc-coupled. The triggering point can be on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



# TYPE 543 OSCILLOSCOPE



**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  $\mu\mu\text{f}$  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. 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. P1, P7, and P11 phosphors are available as optional phosphors. Some other phosphors are available on special order.

**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.

**Dual-Trace Blanking**—A blanking voltage is available to eliminate switching transients from the display when a dual-trace plug-in unit is operated in its chopped mode. The blanking voltage can be applied to the crt cathode by means of a switch located on the back panel of the instrument. (Type 53/54C Units under serial number 14078 will require a minor modification).

**Output Waveforms**—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-saw-



# TYPE 543 OSCILLOSCOPE

tooth 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
Beam-position amplifiers		12AU7
Driver cathode followers		6DJ8
Output amplifiers	12	6DK6
Trigger amplifiers	2	6DK6
Trigger CF and vertical signal out		6DJ8
Sweep generator		12AU6
Sweep generator CF		6DJ8
Disconnect diode		6AL5
Unblank and holdoff CF		6DJ8
Trigger inverter		6DJ8
Holdoff CF & lockout multivibrator		6DJ8
Lockout multivibrator		6AU6
Horizontal input CF		12AU6
Driver amplifiers	2	6DK6
Output amplifier and CF	2	6BA8
Capacitance driver		6DK6
Positive multivibrator and CF		6DJ8
Negative multivibrator		12BY7A
Sawtooth and gate CF		6DJ8
External horizontal amplifier		6DJ8
Trigger shaper		6DJ8
Cal multivibrator		6AU6
Cal output CF & multivibrator		12AU7
Dual-trace blanking and trigger amplifier		6DJ8

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		T543P2

## 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, blue 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 maximum.

**Type 543, without plug-in units** . . . . . **\$1275**

Includes: 2—10-x attenuator probes  
2—Binding-post adapters (013-004)  
1—Test lead (012-031)  
1—Green filter (378-514)  
1—3-conductor power cord (161-008)  
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.)



# IMPROVED INSTRUMENT

## TYPE 545A CATHODE-RAY OSCILLOSCOPE with Flexible Sweep Delay

### Easier Operation

Simplified panel layout.  
Color-correlated controls.

### Two Kinds of Sweep Delay

**Triggered (jitter free)**—delayed sweep is started by signal under observation.

**Conventional**—delayed sweep is started by delayed trigger.

### Greater Calibrated Delay Range

1  $\mu\text{sec}$  to 10 sec, continuously adjustable (2  $\mu\text{sec/cm}$  to 1 sec/cm).

### DC-to-30 MC Main Vertical Amplifier

12-m $\mu\text{sec}$  risetime with Type K Pre-amplifier.

All Tektronix Type A to Z Plug-In Pre-amplifiers can be used for signal-handling versatility.

### Two Time-Base Generators

**TIME BASE A**—0.1  $\mu\text{sec/cm}$  to 5 sec/cm in 24 calibrated steps, continuously variable from 0.1  $\mu\text{sec/cm}$  to 12 sec/cm. 5-x magnifier increases calibrated range to 0.02  $\mu\text{sec/cm}$ . Single-sweep provision for one-shot applications.

**TIME BASE B**—Also functions as delay generator. 18 calibrated steps from 2  $\mu\text{sec/cm}$  to 1 sec/cm.

### GENERAL DESCRIPTION

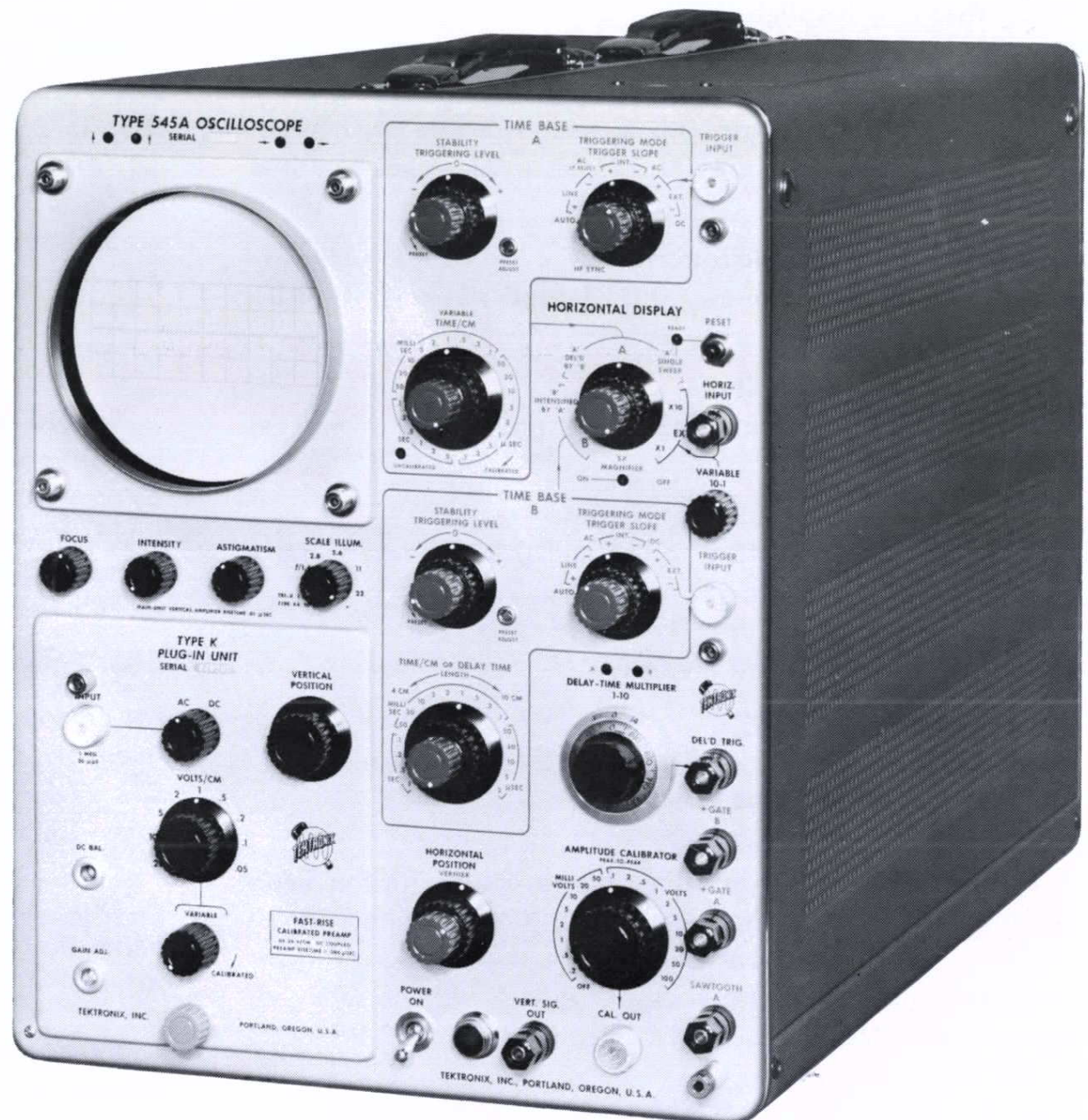
The Type 545A is a versatile laboratory instrument that incorporates features of two popular Tektronix Oscilloscopes. It has both the vertical and horizontal deflection characteristics of the Type 541A, as well as the sweep-delay capabilities of the Type 535A.

In addition to improvements in performance, the Type 545A is easier to operate than its predecessor, the Type 545. Color-correlated controls, single direct-reading controls for sweep time and amplitude calibrator, and internal triggering for sweep delay all contribute to operator convenience. Durability has been improved too, through use of new frame-grid triodes and silicon rectifiers.

### APPLICATIONS

In addition to the usual applications for a highly versatile DC-to-30 MC Oscilloscope, sweep delay makes it possible to:

1. Make accurate incremental measurements along a complex waveform.
2. Make accurate phase-angle measurements between two signals, up to frequencies of 1 mc.



3. Display separate channels of a PTM system, with effects of time jitter removed, determining pulse amplitude and shape under conditions of modulation.
  4. Measure pulse-to-pulse intervals and amount of jitter on computer signals or any train of pulses.
  5. Make accurate time-difference measurements between pulse-in and pulse-out through an amplifying system.
  6. Display any selected individual line of a television composite signal.
  7. Measure time displacement, wave shape, and amplitude of individual channels in a telemetering system.
  8. Utilize calibrated sweep magnification up to the highest practical limit.
- Plus many more-specialized applications.

### VERTICAL-DEFLECTION SYSTEM

**DC-Coupled Output Amplifier**—The fast-rise dc-coupled amplifier with risetime of 10 millimicroseconds is factory adjusted for optimum transient response.

The Type 545A vertical deflection system is designed for use with any one of the Type A to Z Plug-In Pre-



# TYPE 545A OSCILLOSCOPE

amplifiers. In order to operate the Type 545A, one of the preamplifiers must be plugged in.

## Plug-In Preamplifiers

For fast-rise applications—

**Type K**—DC to 30 mc, 0.012- $\mu$ sec risetime at 0.05 v/cm to 40 v/cm.

or **Type L**—DC to 30 mc, 0.012- $\mu$ sec risetime at 0.05 v/cm to 40 v/cm,—3 cycles to 24 mc, 0.015- $\mu$ sec risetime at 5 mv/cm to 4 v/cm.

For dual-trace applications—

**Type C-A**—DC to 24 mc, 0.015- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm.

For high DC sensitivity—

**Type H**—DC to 15 mc, 0.023- $\mu$ sec risetime at 5 mv/cm to 50 v/cm.

For differential input applications—

Wideband: **Type G**—DC to 20 mc, 0.018- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm.

High DC sensitivity: **Type D**—DC to 350 kc at 1 mv/cm, increasing to 2 mc at 50 mv/cm.

Low-Level: **Type E**—0.06 cycles to 20 kc at full gain, increasing to 60 kc at 0.5 mv/cm.

For transistor risetime checking—

**Type R**—0.012- $\mu$ sec risetime.

Type A and B plug-in units can be used with the Type 545A oscilloscope. However, Type K or L units will be preferred by most users because of their superior transient-response characteristics.

**Type A**—DC to 20 mc, 0.018- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm.

**Type B**—DC to 20 mc, 0.018- $\mu$ sec risetime at 0.05 v/cm to 50 v/cm,—2 cycles to 12 mc, 0.03- $\mu$ sec risetime 5 mv/cm to 0.05 v/cm.

**Probes**—Two low-capacitance probes (10-x atten.) are supplied with the instrument. Input capacitance of the Type 545-K combination with probes is 8  $\mu$ mf. Excellent transient response is retained, as the probes introduce 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  $\mu$ mf at 5-x, 5.5  $\mu$ mf at 20-x, and 2.5  $\mu$ mf at 50-x and 100-x attenuation.

**Balanced Delay Network**—A signal delay of 0.2  $\mu$ sec is introduced by a balanced (push-pull) delay network. Signal delay permits observation of the leading edge of the waveform that triggers the sweep.

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

## HORIZONTAL-DEFLECTION SYSTEM

The Type 545A has two time-base generators. TIME BASE A is identical to the time-base generator in the Tektronix Type 541A. TIME BASE B functions as a delay generator. The signal to be observed can be displayed

on either time base in the following ways: TIME BASE B normal, TIME BASE B with trace brightening during the period that TIME BASE A is running, TIME BASE A delayed by TIME BASE B, TIME BASE A normal, and TIME BASE A single sweep.

**TIME BASE A Calibrated Sweeps**—Twenty-four direct-reading calibrated steps are provided: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50  $\mu$ 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  $\mu$ sec/cm to 12 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration of the fixed sweeps is within 3%.

**Single Sweep**—(TIME BASE A only) A RESET push-button arms the sweep to fire on the next trigger to arrive. After firing once, the sweep is locked out and cannot fire again until rearmed by pressing the RESET button. The READY light indicates when the sweep is armed to fire on the next trigger.

**TIME BASE B Calibrated Sweeps**—Eighteen direct-reading calibrated steps are provided: 2, 5, 10, 20, 50  $\mu$ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, and 1 sec/cm. A sweep-length control adjusts the sweep length from 4 cm to 10 cm for the purpose of changing the sweep repetition rate. Variable sweep repetition rate makes TIME BASE B useful as a repetition-rate generator over the range of 0.1 cycles to 40 kc.

**Sweep Magnifier**—5-x magnifier increase the calibrated sweep time to 0.02  $\mu$ sec/cm. Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of the normal trace is expanded to fill the screen. Any one-fifth of the magnified sweep can be displayed on the screen by rotating the HORIZONTAL POSITION control. Accurate 5-x magnification is obtained on all ranges, for both time bases.

**DC-Coupled Unblanking**—DC coupling is provided for the unblanking waveforms, 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. Triggering facilities are identical for both time bases, except that TIME BASE A has two additional modes: H.F. SYNC and AC LF REJECT (low frequency reject).

**Amplitude-Level Selection**—Adjustable amplitude-level and stability controls provide 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-coupled or dc-coupled. The triggering point can be on either the rising or falling slope of the triggering waveform.



# TYPE 545A OSCILLOSCOPE

**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.

**Low-Frequency Reject**—(TIME BASE A only) Prevents low-frequency components, such as hum, from interfering with stable triggering.

**High-Frequency Sync**—(TIME BASE A only) 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 10 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  $47 \mu\mu\text{f}$  paralleled by 1 megohm.

## SWEEP DELAY

Sweep delay for TIME BASE A over the range of 1 sec to 10 sec is derived from TIME BASE B by means of a pick-off circuit. A delayed trigger is generated at the pick-off point, which can be adjusted to any point on the sawtooth waveform generated by TIME BASE B. The DELAY-TIME MULTIPLIER, a ten-turn calibrated control, is used in conjunction with the TIME/CM switch for TIME BASE B to select the pick-off point and indicate the amount of delay. Accuracy of the fifteen calibrated time/cm steps from  $2 \mu\text{sec/cm}$  to 0.1 sec/cm is within 1%. Accuracy of the remaining three steps, 0.2, 0.5, and 1 sec/cm, is within 3%. For extreme accuracy any or all steps can be adjusted to an external standard. Incremental accuracy of the ten-turn calibrated control is within 0.2%.

**Triggered Operation**—When the triggering controls of TIME BASE A are adjusted so that the delayed trigger from TIME BASE B arms the sweep but does not start it, the next signal to arrive will start the sweep.

Thus the delayed sweep is actually started by the signal under observation, resulting in a steady display even when time jitter or time modulation is present in the signal.

**Conventional Operation**—When the triggering controls of TIME BASE A are adjusted to permit the delayed trigger to start the sweep, the delayed sweep starts precisely at the pick-off point, its start delayed the amount of time indicated by the TIME BASE B time/cm switch and the DELAY-TIME MULTIPLIER. Any time modulation or time jitter on the signal will be magnified in proportion to the amount of sweep expansion, however jitter introduced by the delay and pick-off circuitry is less than one part in 20,000, making extremely large magnifications practical.

**Trace Brightening**—When the signal is displayed on TIME BASE B with the HORIZONTAL DISPLAY switch in the "B" INTENSIFIED BY "A" position, the unblanking pulse of TIME BASE A is added to that of TIME BASE B. Therefore the period of operation of TIME BASE A appears as a brightened portion on the display. This trace brightening serves to indicate both the point-in-time relationship between the delayed sweep and the original display, and the degree of magnification that will be achieved when the display is transferred to TIME BASE A.

## 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 T543, a Tektronix cathode-ray tube, is used in the Type 545A. The T543 is a 5" flat-faced metallized precision tube with a helical post-accelerating anode. It provides a full 4-cm x 10-cm viewing area. For best results over the wide sweep range of the Type 545A, a P2 phosphor is normally furnished with the instrument.

**Regulated Power Supply**—Electronic regulation compensates for line-voltage variations between 105 and 125 v, and for current-demand differences among the plug-in preamplifiers.

**Amplitude Calibrator**—A square-wave calibration voltage is available through a front-panel coaxial connector. Eighteen direct reading fixed steps—0.2, 0.5, 1, 2, 5, 10, 20, 50 millivolts, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 volts peak-to-peak are provided by the single knob control. Accuracy is within 3%. Square-wave frequency is approximately 1 kc.

**Dual-Trace Blanking**—A blanking voltage is available to eliminate switching transients from the display when a dual-trace plug-in unit is operated in its chopped mode. The blanking voltage can be applied to the crt cathode by means of a switch located on the back panel of the instrument. (Type 53/54C Units under serial number 14078 will require a minor modification).



# TYPE 545A OSCILLOSCOPE

**Output Waveforms**—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-sawtooth waveform are available from TIME BASE A at front-panel binding posts via cathode followers. A 20-v positive gate and the delayed trigger from TIME BASE B are also available at front-panel connectors. 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 pair 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 TUBES and SEMICONDUCTORS

### Vertical Amplifier

Vertical-input amplifiers	2	12BY7A
Driver amplifiers	2	6DJ8
Trigger-pick-off amplifiers	2	6DK6
Trigger CF and vert. sig. out CF		6DJ8
Indicator amplifiers		12AU7
Output amplifiers	12	6DK6

### Time-Base A Generator

Trigger amplifier	6DJ8
Trigger shaper	6DJ8
Sweep-gating multivibrator and CF	6DJ8
Sweep-gating multivibrator	12BY7
Unblank and hold-off CF	6DJ8
Sawtooth and gate CF	6DJ8
Lockout multivibrator	6AU6
Hold-off CF and lockout multivibrator	6DJ8
Delayed-trigger amplifier	6AU6
Clamp	T12G
Disconnect diodes	6AL5
Miller runup	6CL6
Runup CF	6DJ8

### Time-Base B Generator

Trigger amplifier	6DJ8
Trigger shaper	6DJ8
Stability CF and hold-off CF	6DJ8
Sweep-gating multivibrator and CF	6DJ8
Sweep-gating multivibrator	6AU6
Unblanking CF and gate CF	6DJ8
Disconnect diodes	12AL5
Miller runup	12AU6
Runup CF and hold-off CF	6DJ8

### Horizontal Amplifiers and Delay

Input and driver CF	6DJ8
Sweep amplifiers and CF	2 6DJ8
Current booster	6CL8
External-input amplifier	6DJ8
Delay trigger	6DJ8
Delay pick-off	2 6AU6
Delay-trigger CF and current control	6DJ8

### Power Supplies

H. V. regulator amplifier	12AU7
H. V. oscillator	6AU5
H. V. rectifiers	5 5642
Comparators	2 12AX7
Voltage reference	5651
Regulator amplifiers	5 6AU6
Series regulators	4 12B4
Series regulators	2 6080
Rectifiers	16 IN1566

### Miscellaneous

Calibrator multivibrator	6AU6
Calibrator multivibrator and CF	12AU7
Alternate-tracesync amplifier and trace blank	6DJ8
Cathode-ray tube	T543P2

## 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, blue 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, 600 watts maximum.

**Type 545A, without plug-in units** . . . . . **\$1550**

- Includes:
- 2—10-x attenuator probes
  - 2—Binding-post adapters (013-004)
  - 1—Test lead (012-031)
  - 1—F510-5 green filter (378-514)
  - 1—3-conductor power cord (161-008)
  - 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.

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





# TYPE 551 OSCILLOSCOPE

## DUAL-BEAM OSCILLOSCOPE for Fast-Rise Applications

### Wide-Band Vertical Amplifiers

Main-unit risetimes—12 m $\mu$ sec.  
Passbands and risetimes with Type K units—dc to 25 mc, 0.014  $\mu$ sec.

### Signal-Handling Versatility

All Tektronix Type A to Z Plug-In Preamplifiers can be used in both channels.

### 0.2- $\mu$ sec Delay Networks

### Wide Sweep Range

0.02  $\mu$ 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 Tektronix Type A to Z 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 C-A Dual-Trace Plug-In Units in one or both amplifiers. Other available Type A to Z Plug-In-Preamplifier Units extend the working range of the Type 551 into applications requiring high dc-coupled sensitivity, differential input, and narrow-band microvolt sensitivity.



### VERTICAL-DEFLECTION SYSTEMS

**Two DC-Coupled Main Amplifiers** — Risetime of both main amplifiers is 12 millimicroseconds. A Type A to Z Plug-In Preamplifier must be plugged into both channels for instrument operation.



# TYPE 551 OSCILLOSCOPE

Type K 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- $\mu$ sec risetimes. A wide variety of vertical-deflection characteristics is available through the use of another of the eight Type A to Z Plug-In Preamplifiers in one or both vertical channels.

## Plug-In Preamplifiers

For maximum frequency response—

**Type K**—DC to 25 mc, 0.014- $\mu$ sec risetime; 0.05 to 40 v/cm.

or **Type L**—DC to 25 mc, 0.014- $\mu$ sec risetime; 0.05 to 40 v/cm. . . 3 cycles to 22 mc, 0.017- $\mu$ sec risetime; 5 mv/cm to 4 v/cm.

For dual-trace operation on either or both beams—

**Type C-A**—DC to 22 mc, 0.016- $\mu$ sec risetime; 0.05 to 50 v/cm.

For high DC sensitivity—

**Type H**—DC to 14 mc, 0.025- $\mu$ sec risetime; 0.05 to 50 v/cm.

For differential-input applications—

Wideband: **Type G**—DC to 18 mc, 0.02- $\mu$ sec risetime; 0.05 to 50 v/cm.

High DC sensitivity: **Type D**—DC to 350 kc at 1 mv/cm, increasing to 2 mc at 50 mv/cm.

Low-level: **Type E**—0.06 cycles to 20 kc at 50  $\mu$ v/cm, increasing to 60 kc at 0.5 mv/cm.

For transistor risetime checking—

**Type R**—0.014- $\mu$ sec risetime.

Type A and B plug-in units can be used with the Type 551 Oscilloscope. However Type K or L units will be preferred by most users because of their superior transient-response characteristics.

**Type A**—DC to 18 mc, 0.02- $\mu$ sec risetime; 0.05 to 50 v/cm.

**Type B**—DC to 18 mc, 0.02- $\mu$ sec risetime; 0.05 to 50 v/cm. . . 2 cycles to 12 mc, 0.03- $\mu$ sec risetime; 5 mv/cm to 0.05 v/cm.

**Probes**—Four 10-x atten. low-capacitance probes are supplied with the instrument. Input capacitance of the Type 551-K combination with probes is 8  $\mu$ mf. Excellent transient response is retained, as the probes introduce 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  $\mu$ mf at 5-x, 5.5  $\mu$ mf at 20-x, and 2.5  $\mu$ mf at 50-x attenuation.

**Balanced Delay Network**—A signal delay of 0.2  $\mu$ 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 opening in the side of the cabinet permits direct connection to the deflection plates.

## HORIZONTAL-DEFLECTION SYSTEM

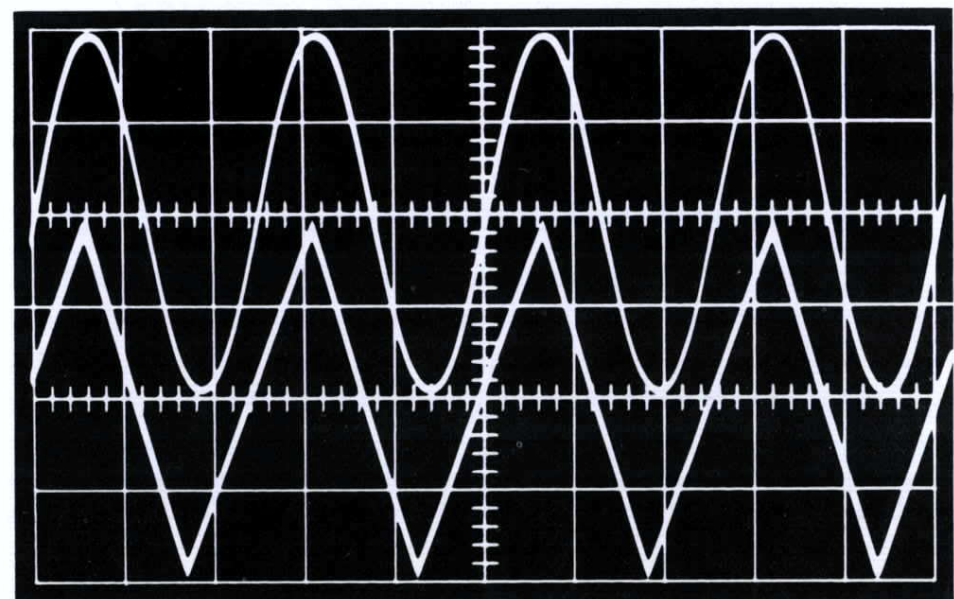
Both electron beams of the Type 551 are simultaneously deflected by the same sweep sawtooth voltage. Sweep generator used in the Type 551 is the Miller runup type. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this circuitry provide an extremely wide sweep range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

**Calibrated Sweeps**—The Type 551 has single-knob selection of 24 calibrated sweeps: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50  $\mu$ sec/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. In addition, a vernier (uncalibrated) control provides for continuous adjustment of the sweep rate from 0.1  $\mu$ sec/cm to 12 sec/cm. Calibration accuracy of the fixed sweeps is within 3%.

**Sweep Magnifier**—5-x magnifier increases the calibrated sweep time to 0.02  $\mu$ sec/cm. Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of the normal 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.

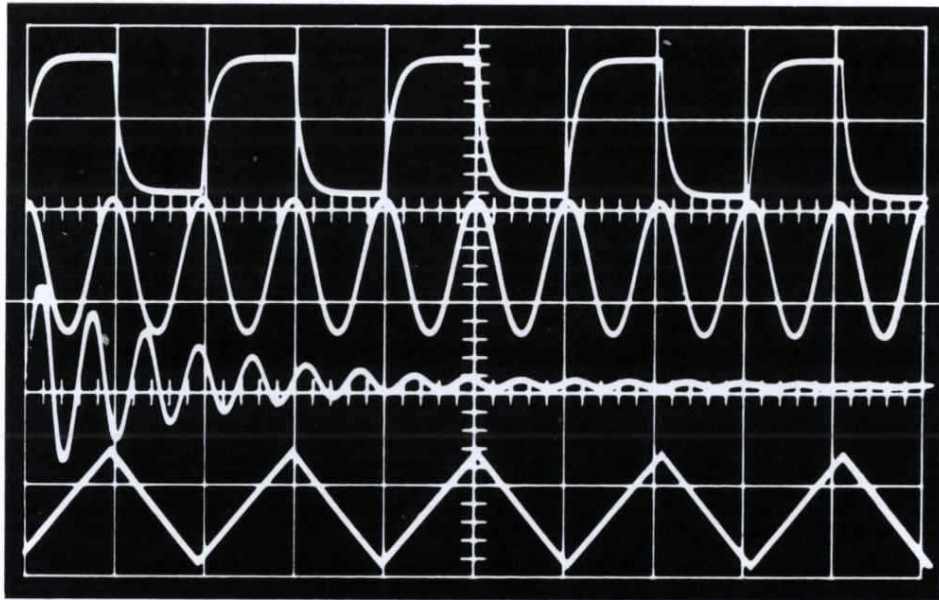
**DC-Coupled Unblinking**—The unblinking waveform is coupled to the grid of the cathode-ray tube, assuring uniform bias for all sweep and repetition rates.



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 are provided 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-coupled 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 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. Attenuator makes the horizontal deflection factor continuously variable from 0.2 v/cm to

approximately 50 v/cm. Passband is dc to approximately 400 kc at maximum sensitivity. Input impedance is approximately 40  $\mu\mu\text{f}$  paralleled by 100 kilohms.

## 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 T551P cathode-ray tube. The T551P 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.

**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.

**Separate Power Supply** — A separate unit supplies power to the Type 551 indicator unit through an inter-unit 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	6DJ8
Trigger-pick-off amplifiers . . . . .	4	6DK6
Trigger CF . . . . .		6DJ8
Indicator amplifiers . . . . .	2	6DJ8



# 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 . . . . .		T551P2

## MECHANICAL SPECIFICATIONS

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

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

Finish—Photo-etched anodized panels, blue 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 . . . . . \$1800**

- Includes: 4—10-x atten. probes  
2—Binding-post adapters (013-004)  
1—Inter-unit cable (012-032)  
1—Test lead (012-031)  
1—Green filter (378-514)  
1—3-conductor power cord (161-010)  
1—Instruction manual

**Type 500A Scope-Mobile . . . . . \$100**  
(as shown with Type 551)

**Type 500/53A Scope-Mobile . . . . . \$110**  
(with plug-in storage cradles)

Complete descriptions of the above Scope-Mobiles will be found in the Accessory section.

## Optional Phosphors

P2 crt phosphor normally furnished.

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

Some 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.

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.)





# NEW INSTRUMENT

## TYPE 555 DUAL-BEAM OSCILLOSCOPE with Sweep Delay

### Independent Electron Beams

Separate vertical and horizontal deflection of both beams.

### Fast-Rise Main Vertical Amplifiers

Passbands—dc to 30 mc with Type K Units.

Risetimes—12 m $\mu$ sec with Type K Units.

Heater supplies regulated for stable operation.

All Tektronix Type A to Z Plug-In Preamplifiers can be used in both vertical channels for signal-handling versatility.

### Wide-Range Time-Base Generators

Either time-base generator can be used to deflect either or both beams.

Sweep ranges—0.1  $\mu$ sec/cm to 12 sec/cm. 5-x magnifiers increase sweep times to 0.02  $\mu$ sec/cm.

### Sweep Delay—Two modes of operation

Triggered—Delayed sweep started by signal under observation.

Conventional—Delayed sweep started by delayed trigger.

Delay range—0.5  $\mu$ sec to 50 sec in 24 calibrated steps, with continuous calibrated adjustment between steps.

### High Writing Rate

10-KV Accelerating potential provides bright traces at low repetition rates and in one-shot application.

### GENERAL DESCRIPTION

The Tektronix Type 555 is essentially two complete fast-rise oscilloscopes with a common dual-gun cathode-ray tube of a new Tektronix design. This new dual-gun cathode-ray tube has two pairs of vertical-deflection plates and two pairs of horizontal-deflection plates. The two fast-rise main amplifiers of the Type 555 are designed for Tektronix Type A to Z Plug-In Preamplifiers, providing a high degree of signal handling versatility in both channels.

Two Plug-In Time-Base Units provide horizontal deflection for both upper and lower beams. In operation the two beams can be deflected simultaneously at either the same sweep rate, or at two different sweep rates, using TIME BASE A for one beam and TIME BASE B for the other beam. Also, the two beams can be deflected simultaneously using either TIME BASE A for both beams or TIME BASE B for both beams. Furthermore, either beam can be used separately, deflected by either TIME BASE A or TIME BASE B. In addition, the start of the sweep sawtooth of TIME BASE B can be accurately delayed over a wide range, with TIME BASE A functioning as the delay generator.



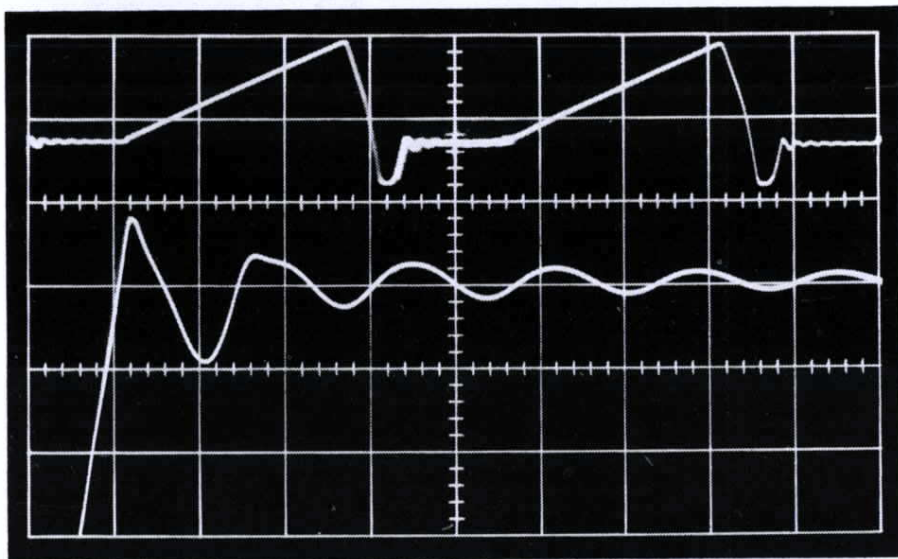
The plug-in feature of the time-base units offers a real advantage in maintenance. By means of a plug-in extension a time-base unit can be operated partially out of its housing, thus facilitating any service that may be required by that unit. The Time-Base Plug-In Extension TEK #013-013 is furnished as an accessory.



# TYPE 555 DUAL-BEAM OSCILLOSCOPE

## APPLICATIONS

The Type 555 is an extremely versatile instrument, capable of all applications for both single-beam and dual-beam oscilloscopes in the dc-to-30 mc category. Nine available Type A to Z Plug-In Preamplifiers provide for many specialized applications, further increasing the instrument's versatility. Applications involving accurate sweep delay are adequately provided for, including means for a steady display of signals with inherent jitter. In addition, the Type 555 is valuable in all applications where it is desirable or necessary to display the same signal simultaneously on two different time bases, as in plasma pinch-effect studies, wind tunnel studies, computer storage research, and investigations in many other fields.



Same signal displayed simultaneously on slow sweep (upper beam) and fast sweep (lower beam) shows both coarse and fine structure of waveform.

## VERTICAL-DEFLECTION SYSTEMS

**Two DC-Coupled Main Amplifiers**—Risetime of both main amplifiers is 10 millimicroseconds. Type A to Z Plug-In Preamplifiers must be plugged into both channels for instrument operation. Tektronix Type K Plug-In Preamplifiers provide nine calibrated deflection factors from 0.05 v/cm to 20 v/cm at dc-to-30 mc passbands. A wide variety of vertical-deflection characteristics is available through the use of other Type A to Z Plug-In Preamplifiers. A three-channel or four-channel display is available through use of the time sharing characteristics of the Type C-A Dual-Trace Plug-In Preamplifier in one or both channels.

### Plug-In Preamplifiers

For maximum frequency response—

**Type K**—DC to 30 mc, 0.012- $\mu$ sec risetime; 0.05 to 40 v/cm.

Or **Type L**—DC to 30 mc, 0.012- $\mu$ sec risetime at 0.05 to 40 v/cm. . . 3 cycles to 24 mc, 0.015- $\mu$ sec risetime at 5 mv/cm to 4 v/cm.

For dual-trace operation on either or both beams—

**Type C-A**—DC to 24 mc, 0.015- $\mu$ sec risetime; 0.05 to 50 v/cm.

For high DC sensitivity—

**Type H**—DC to 15 mc, 0.023- $\mu$ sec risetime; 5 mv/cm to 50 v/cm.

For differential-input applications—

Wide-Band: **Type G**—DC to 20 mc, 0.018- $\mu$ sec risetime; 0.05 to 50 v/cm.

High DC sensitivity: **Type D**—DC to 350 kc at 1 mv/cm, increasing to 2 mc at 50 mv/cm.

For low-level applications—

**Type E**—0.06 cycles to 20 kc at 50  $\mu$ v/cm, increasing to 60 kc at 0.5 mv/cm.

And for transistor risetime checking—

**Type R**—0.012- $\mu$ sec risetime.

Type A and B plug-in units can be used with the Type 555 Oscilloscope. However Type K or L units will be preferred by most users because of their superior transient-response characteristics.

**Type A**—DC to 20 mc, 0.018- $\mu$ sec risetime; 0.05 to 50 v/cm.

**Type B**—DC to 20 mc, 0.018- $\mu$ sec risetime; 0.05 to 50 v/cm. . . 2 cycles to 12 mc, 0.03- $\mu$ sec risetime; 5 mv/cm to 0.05 v/cm.

**Probes**—Four low-capacitance probes (10-x atten.) are supplied with the instrument. Input capacitance of the Type 555-K combination with probes is 8  $\mu$ mf. Excellent transient response is retained, as the probes introduce 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  $\mu$ mf at 5-x, 5.5  $\mu$ mf at 20-x, and 2.5  $\mu$ mf at 50-x and 100-x attenuation.

**Balanced Delay Network**—A signal delay of 0.2  $\mu$ sec is introduced into each channel by the balanced (push-pull) delay networks. Signal delay permits observation of the leading edge of the waveform that triggers the sweep.

## HORIZONTAL-DEFLECTION SYSTEMS

The horizontal deflection systems of the Type 555 are provided with plug-in time-base units. Miller runup type sweep generators are used in the time-base units, with inverse feedback in the timing circuits to assure excellent linearity. Characteristics of these circuits provide the extremely wide sweep ranges of 0.1  $\mu$ sec/cm to 12 sec/cm. Two plug-in time-base units are furnished with the instrument: one Type 21, and one Type 22. When used in the "B" position, sweeps generated by the Type 22 can be delayed a selected amount by a pick-off circuit in the Type 555. The pick-off point can be adjusted to any point along the sawtooth generated by the time-base unit in the "A" position.



# TYPE 555 DUAL-BEAM OSCILLOSCOPE

Either beam can be deflected by either time-base unit, and both beams can be deflected simultaneously by either time-base unit.

**TYPE 21 TIME-BASE PLUG-IN UNIT**—has single knob selection of 24 calibrated sweep rates: 0.1, 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  $\text{msec}/\text{cm}$ , 0.1, 0.2, 0.5, 1, 2, and 5  $\text{sec}/\text{cm}$ . In addition, a vernier (uncalibrated) control provides for continuous adjustment of the sweep rate from 0.1  $\mu\text{sec}/\text{cm}$  to 12  $\text{sec}/\text{cm}$ . 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%.

**Single Sweep**—A 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 button. The READY light indicates when the sweep is armed to fire on the next received trigger.

**Trigger Facilities**—Selective triggering circuitry provides for amplitude-level selection, fully-automatic triggering, and free-running sweeps. Trigger source can be internal from either channel, external, or line frequency, either ac-coupled or dc-coupled.

**Amplitude-Level Selection**—Adjustable amplitude-level control provides for triggering the sweep at a selected amplitude level on either the rising or falling slope of the triggering waveform. This mode of operation also provides for triggering on high-frequency sine waves (up to 15 mc).

**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 to be touched until a different type of operation is desired. Range of automatic operation is between 50 cycles and 2 megacycles, approximately. In the absence of an input signal the sweep is automatically triggered at about a 45 cycle rate, providing a reference trace on the screen.

**Triggering Requirements**—Internal triggering—A signal large enough to cause a 2 mm deflection. External triggering—A signal of 0.2 to 10 v.

**Sweep Magnifier**—5-x magnifier increases the calibrated sweep time to 0.02  $\mu\text{sec}/\text{cm}$ . Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of the normal display is extended 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.

**TYPE 22 TIME BASE UNIT**—Identical to Type 21, with the additional facilities for sweep delay.

**Horizontal-Input Amplifiers**—DC-coupled external connection to the sweep-output amplifiers is through rear-panel connectors. Combination of step attenuators and variable attenuators makes the horizontal deflection factor continuously variable from 0.2 v/cm to approximately 20 v/cm. Passbands are dc to 240 kc. Input impedances are approximately 47  $\mu\mu\text{f}$  paralleled by 1 megohm.

## SWEEP DELAY

TIME BASE A can be used to delay the start of any TIME BASE B sweep. A pick-off circuit in the Type 555 permits starting the TIME BASE B sweep at any point along the sawtooth generated by TIME BASE A. With either a Type 21 or Type 22 Time-Base Unit in the "A" position, a calibrated delay range of 0.5  $\mu\text{sec}$  to 50 sec is available.

**Triggered Operation**—In this mode of operation the start of the delayed sweep is held off until the arrival of the first signal after a selected delay time has elapsed. Because the delayed sweep is actually triggered by the signal under observation, the display is completely jitter-free. A rock-steady display is thus provided for time-modulated pulses and signals with inherent jitter.

**Conventional Operation**—In this mode of operation the start of the delayed sweep is held off until the precise instant the selected amount of delay has elapsed. Any time-modulation or inherent jitter on the signal will be magnified in proportion to the amount of sweep expansion, however, jitter introduced by the delay and pick-off circuitry is less than one part in 20,000, making extremely large magnifications practical with jitter-free signals.

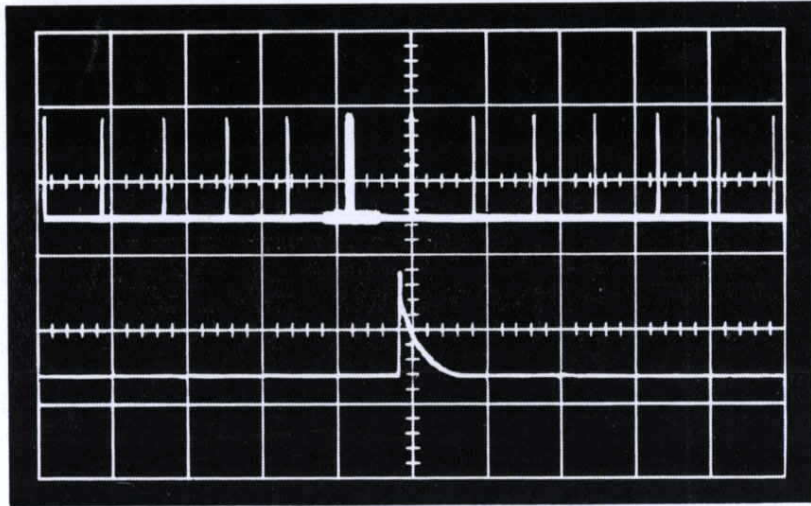
Sweep magnification, up to a practical limit of about 10,000-times, is readily accomplished by introducing the signal into both vertical channels simultaneously, so that it will deflect both beams. The signal is first displayed on either beam, making certain that TIME BASE A is used to deflect that beam at the desired sweep rate. TIME BASE B is then used to deflect the other beam, and is switched to the proper SWEEP FUNCTION position for conventional sweep delay. Operating TIME BASE B at a faster rate than TIME BASE A provides the magnification, with both the original display and the magnified display appearing on the screen. For example, if TIME BASE A is operating at 50  $\mu\text{sec}/\text{cm}$  and TIME BASE B at 1  $\mu\text{sec}/\text{cm}$ , the magnification is 50 times.

**Trace Brightening**—The unblanking pulse of TIME BASE B is added to that of TIME BASE A, so that a portion of the display on the beam deflected by TIME



# TYPE 555 DUAL-BEAM OSCILLOSCOPE

BASE A is brightened. This trace brightening indicates the exact portion appearing on the magnified display, and shows the point-in-time relationship of the magnified display to the original display.



Simultaneous display of pulse chain (upper beam) and sixth pulse on expanded delayed sweep (lower beam). Portion of original display that appears on faster delayed sweep is identified by trace brightening.

**Delay Range**—The calibrated range of sweep delay, 0.5  $\mu$ sec to 50 sec, is derived from the time-base unit in TIME BASE A. The 24 calibrated steps are the same as described for the Type 21 Time-Base Unit. Calibration accuracy is within 3%. A ten-turn precision potentiometer permits accurate delay-time adjustment to any value within the calibrated range of 0.5  $\mu$ sec to 50 sec. Incremental accuracy of this control is within 0.2% on all ranges from 1  $\mu$ sec to 50 sec.

For extreme accuracy, any of the calibrated steps can be adjusted to the accuracy of an external standard.

## OTHER CHARACTERISTICS

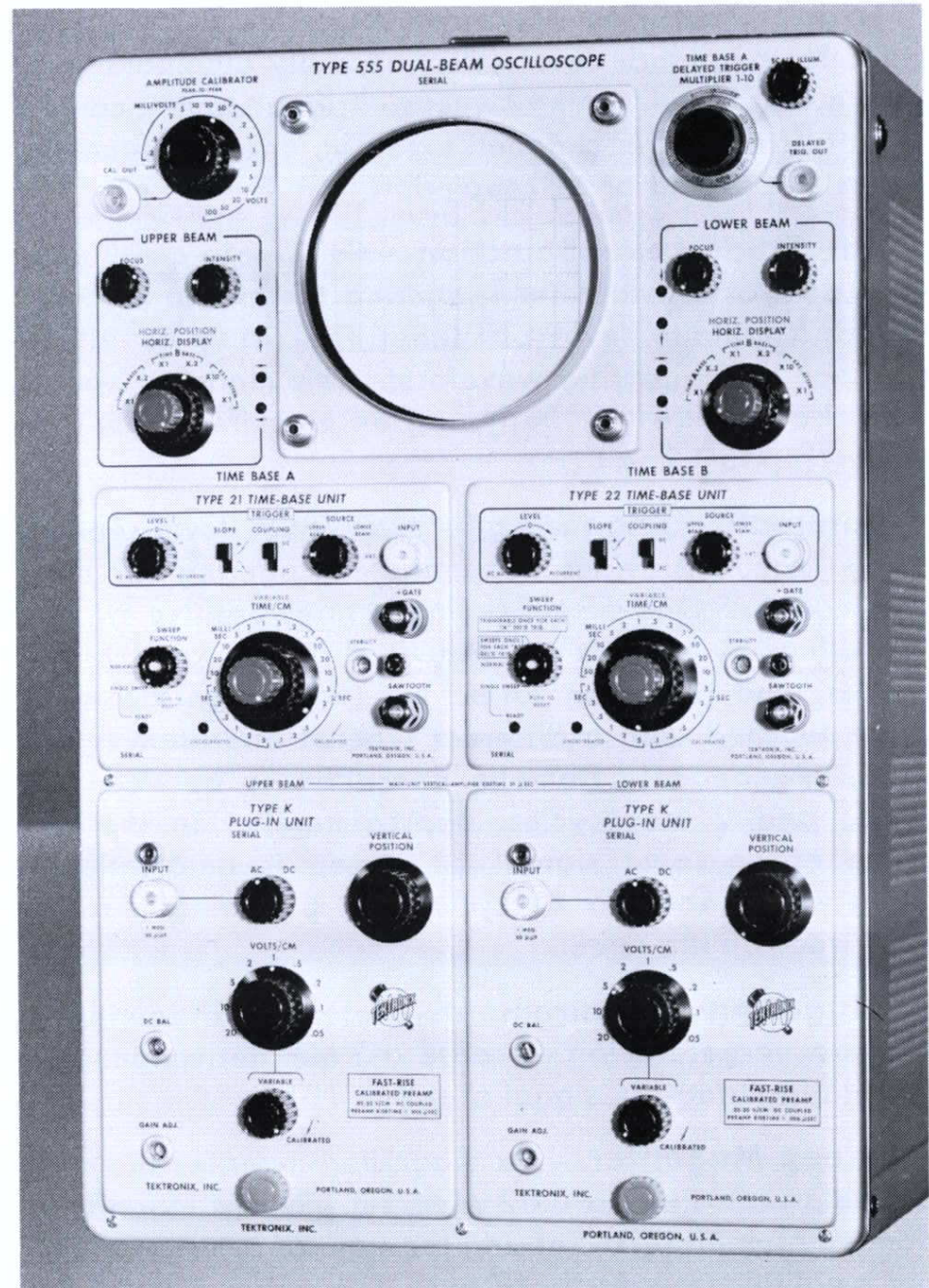
**Cathode-Ray Tube**—10-kv accelerating potential assures bright displays when using fast sweeps at low repetition rates, and single-sweep applications. The Type 555 uses the new Tektronix Type T555P cathode-ray tube. The T555P is a 5" flat-faced metallized precision dual-beam tube with separate vertical and horizontal deflection plates for each beam. It provides a linear 4-cm by 10-cm viewing area, each beam, with at least 2-cm overlap. For best results over the wide sweep ranges of the Type 555, a P2 phosphor is normally furnished with the instrument. P1, P7, and P11 are available as optional phosphors. Some other phosphors are available on special order.

**Regulated DC and Heater Supplies**—A separate unit supplies power to the Type 555 indicator unit through an interconnecting cable. To compensate for line-voltage variations, and for current-demand differences among the plug-in preamplifiers, all dc supplies are electronically regulated. All heaters in the indicator unit and heaters of the amplifiers in the power supply are also regulated for stable operation and longer tube life. Stable operation is insured over line-voltage variations from 105 to 125 v.

**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, 200, 500 millivolts, 1, 2, 5, 10, 20, 50, 100 volts peak-to-peak are provided. Accuracy is within 3%. Square-wave frequency is about 1 kc.

**Dual-Trace Blanking**—A blanking voltage is available to eliminate switching transients from the display when a dual-trace plug-in unit is operated in its chopped mode. The blanking voltage can be applied to the crt cathode by means of a switch located on the back panel of the instrument. (Type 53/54C Units under serial number 14078 will require a minor modification).

**Other Output Waveforms**—A positive gate and a positive-going sawtooth are available through front-panel binding posts from both time base units. Amplitudes are about 20 v. The delayed trigger, amplitude about 5 v, is also available through a front-panel coaxial connector.



**Beam Position Indicators**—Indicator lights show the direction of each electron beam when it is not on the screen.

**Trace Rotation**—A screw-driver adjustment is provided for magnetic rotation of the cathode-ray tube traces for purposes of their horizontal alignment with the graticule lines.



# TYPE 555 DUAL-BEAM OSCILLOSCOPE

**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 TUBES AND SEMICONDUCTORS

### Vertical Amplifiers

Input amplifiers	4	12BY7A
Grid-line drivers	4	6DJ8
Distributed amplifiers	24	6DK6
Trigger-pick-off amplifiers	4	6DK6
Trigger-pick-off CF		6DJ8
Indicator amplifiers	2	6DJ8

### Time-Base Generators

Trigger amplifiers	2	6DJ8
Trigger shapers	2	6DJ8
Sweep-gating multivibrator	2	6DJ8
Sweep-gating multivibrator	2	12BY7A
Miller runup	2	12AU6
Runup CF	2	6DJ8
Runup on-off diodes	2	12AL5
Unblank & gate CF	2	6DJ8
Sawtooth & holdoff CF	2	6DJ8
Holdoff CF & lockout multi	2	6DJ8
Lockout multi	2	6AU6
Delay-trigger amplifier		6AU6
Clamp		T12G

### Horizontal Amplifiers and Delay

Input and driver CF	2	6DJ8
Sweep amplifiers and CF	4	6DJ8
Current boosters	2	6CL6
Delay-trigger shaper		6DJ6
Delay pick-off	2	6AU6
Delay-trigger CF & current control		6DJ8
Unblanking mixer		6AU6
External-input amplifiers	2	6DJ8

### Power Supplies

H.V. Regulator amplifiers	2	12AU7
H.V. Oscillators	2	6CZ5
H.V. Rectifiers	6	5642
Comparators	2	12AX7
Voltage reference		5651
Regulator amplifiers	5	6AU6
Series regulators	5	6080
Series regulators	2	12B4
Heater regulator amplifiers		6CZ5
Heater voltage control		2AS15
Rectifiers	16	1N1566

### Miscellaneous

Calibrator multivibrator		6AU6
Calibrator multivibrator & CF		12AU7
Dual-trace sync. amp. & blanking	2	6DJ8
Cathode-ray tube		T555P2

## MECHANICAL SPECIFICATIONS

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

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

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

**Dimensions**—Indicator Unit: 24" long, 13" wide, 20" high. Power Supply Unit: 17½" long, 13" wide, 10" high.

**Weight**—Indicator Unit: 68 lbs. Power Unit: 45 lbs. Scope-Mobile: 35 lbs.

**Power Requirements**—105-125 v or 210-250 v, 50-60 cycles, 1050 watts maximum.

**Type 555**, without plug-in preamplifiers . . . . **\$2600**

- Includes:
- 1—Type 21 Time-Base Plug-In Unit.
  - 1—Type 22 Time-Base Plug-In Unit.
  - 1—Time-base plug-in extension (013-013)
  - 4—Probes (10-x atten.).
  - 1—Inter-unit cable (012-032).
  - 2—Binding-post adapters (013-004).
  - 1—Test lead (012-031).
  - 1—Green filter (378-514).
  - 1—3-conductor power cord (161-010).
  - 1—Instruction manual.

**Type 500A Scope-Mobile** . . . . . **\$100**  
(as shown with Type 555)

**Type 500/53A Scope-Mobile** . . . . . **\$110**  
(with plug-in storage cradles)

Complete descriptions of the above Scope-Mobiles will be found in the Accessory section.

### 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.

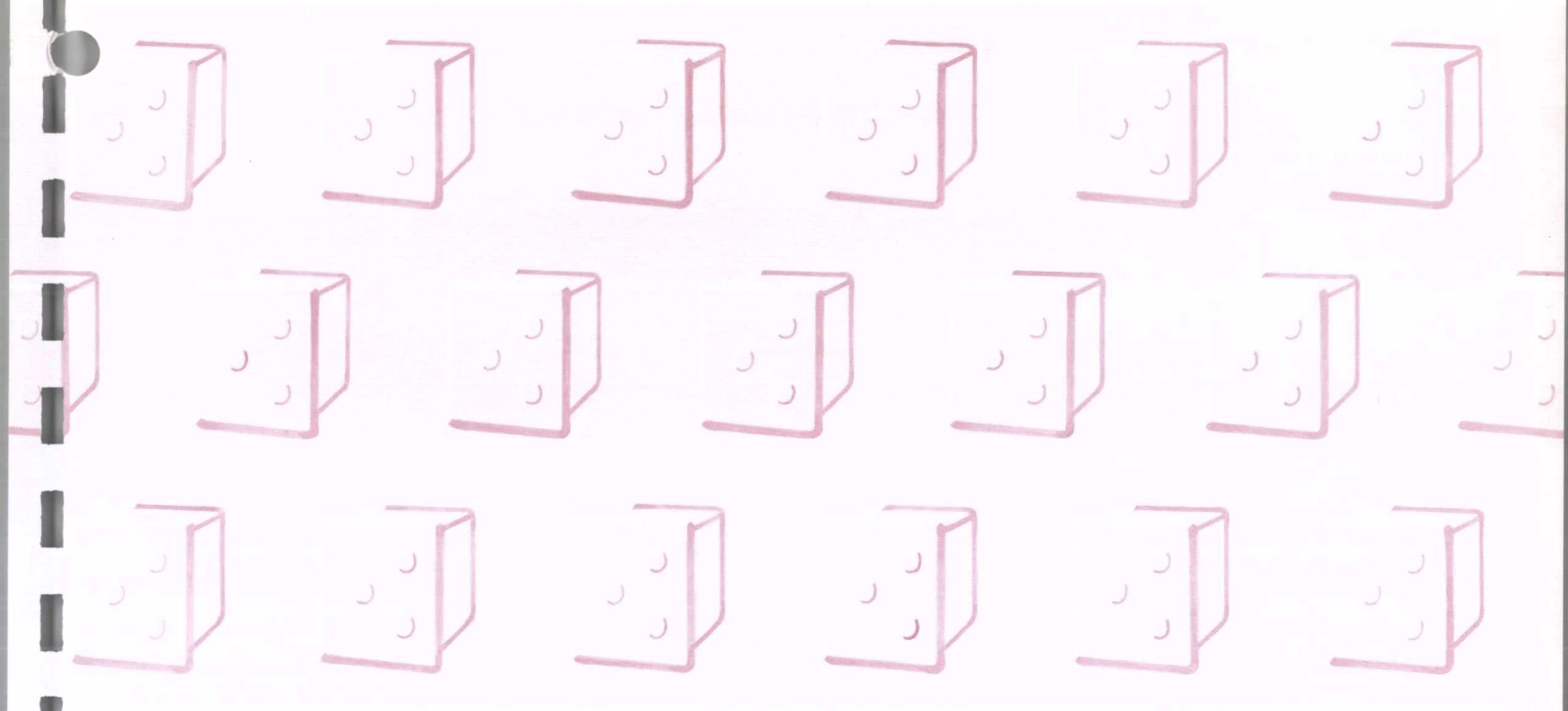
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





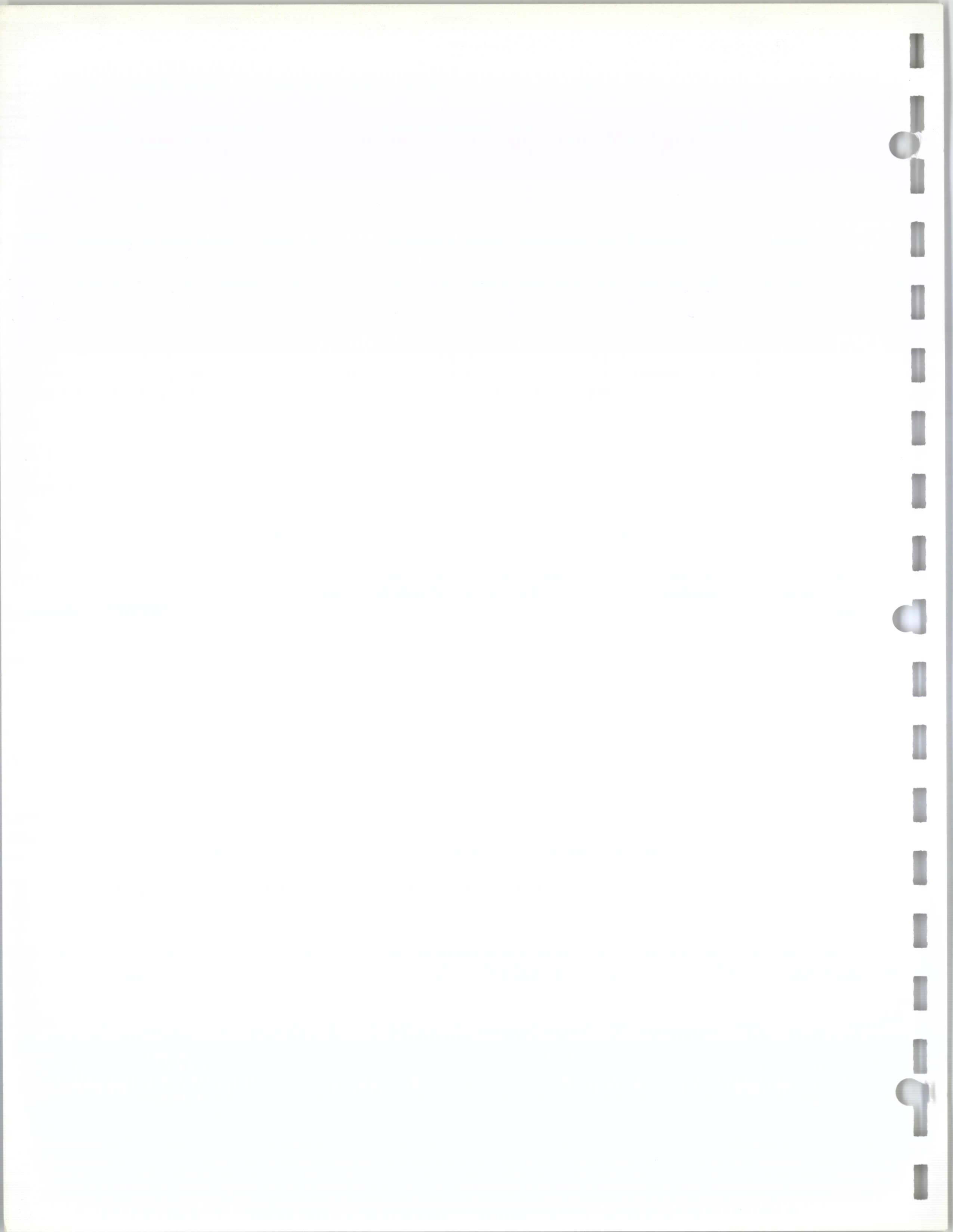






## PLUG-IN PREAMPLIFIERS







# PLUG-IN PREAMPLIFIERS

## TYPE A 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 Types 531A, 533, 535A —  
dc to 14 mc, 0.025  $\mu$ sec.

With Type 536 —  
dc to 10 mc, 0.035  $\mu$ sec.

With Type 532 —  
dc to 5 mc, 0.07  $\mu$ sec.

With Types 541A, 543, 545A, 555 —  
dc to 20 mc, 0.018  $\mu$ sec.

With Type 551 —  
dc to 18 mc, 0.02  $\mu$ sec.

### GENERAL DESCRIPTION

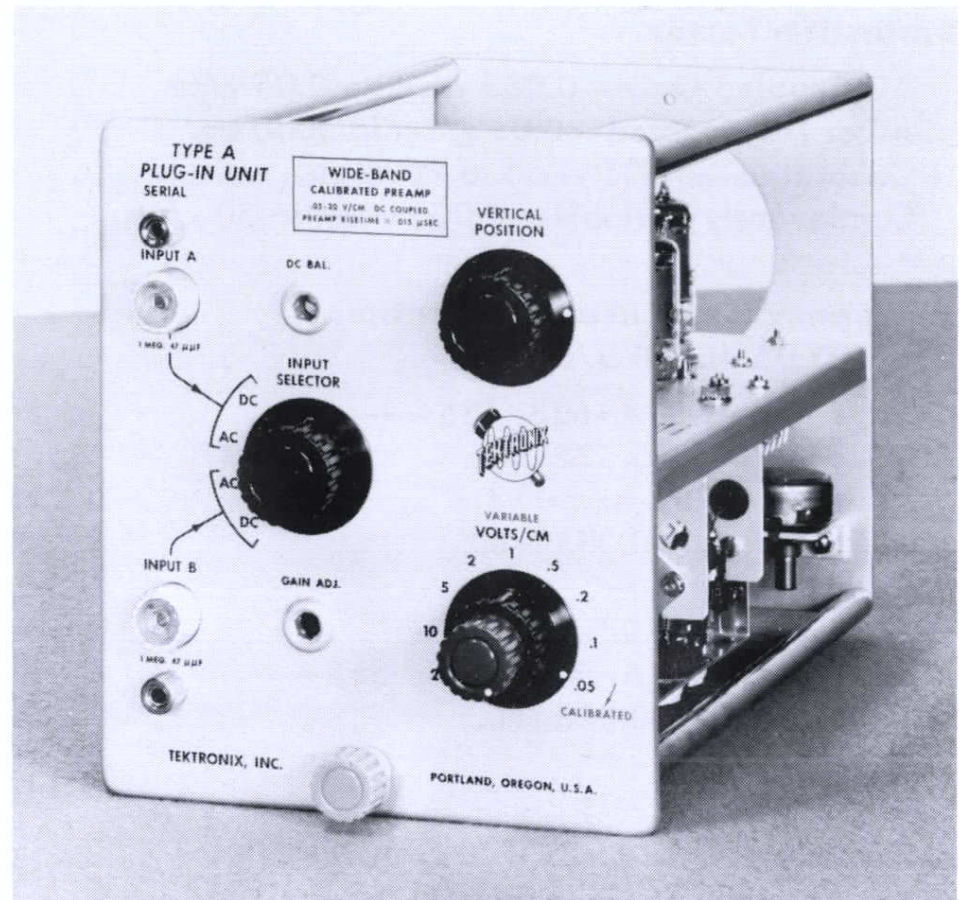
The Type A Plug-In Preamplifier meets the requirements of most wide-band applications. Wide passband, excellent transient response, dc-coupling, and calibrated sensitivity are qualities most users require in an oscilloscope vertical amplifier. The Type A gives all of these qualities to Tektronix Oscilloscopes with the plug-in-pre-amplifier 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  $\mu$ 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** ..... \$90

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 B 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 Types 531A, 533, 535A —  
dc to 14 mc, 0.025  $\mu$ sec.
- With Type 536 —  
dc to 10 mc, 0.035  $\mu$ sec.
- With Type 532 —  
dc to 5 mc, 0.07  $\mu$ sec.
- With Types 541A, 543, 545A, 555 —  
dc to 20 mc, 0.018  $\mu$ sec.
- With Type 551 —  
dc to 18 mc, 0.02  $\mu$ sec.

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

- With Types 531A, 533, 535A —  
2 cycles to 10 mc, 0.035  $\mu$ sec.
- With Type 536 —  
2 cycles to 9 mc, 0.04  $\mu$ sec.
- With Type 532 —  
2 cycles to 5 mc, 0.07  $\mu$ sec.
- With Types 541A, 543, 545A, 555 —  
2 cycles to 12 mc, 0.03  $\mu$ sec.
- With Type 551 —  
2 cycles to 12 mc, 0.03  $\mu$ sec.

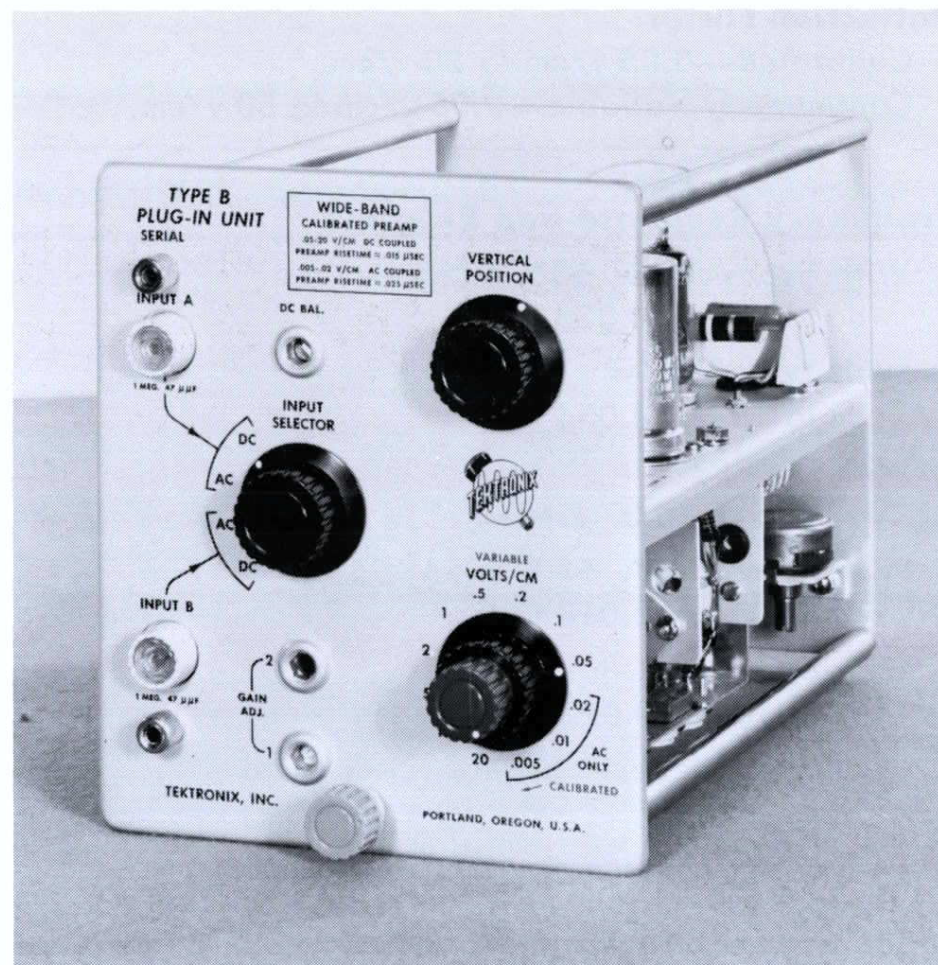
#### GENERAL DESCRIPTION

The Type B Plug-In Unit is essentially the Type A 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 B is identical to the Type A.

#### 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  $\mu$ 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** ..... \$135

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 C-A PLUG-IN UNIT Two-Channel Preamplifier

### Five Operating Modes

- Channel A only.
- Channel B only.
- Electronic switching at 100 kc (chopped).
- Electronic switching on alternate sweeps.
- Both channels combined at output (A ± B).

### Frequency Response and Risetime

- With Types 531A, 533, 535A —  
dc to 15 mc, 0.023 μsec.
- With Type 536 —  
dc to 10 mc, 0.035 μsec.
- With Type 532—  
dc to 5 mc, 0.07 μsec.
- With Types 541A, 543, 545A, 555 —  
dc to 24 mc, 0.015 μsec.
- With Type 551  
dc to 22 mc, 0.016 μsec.

### GENERAL DESCRIPTION

The Tektronix Type C-A Unit contains two identical amplifier channels. Either channel can be operated separately. The two channels can be electronically switched, either at a free-running rate of about 100 kc, or triggered by the oscilloscope sweep. In addition both channels can be combined at the output, adding or subtracting according to the settings of the polarity switches.

When operated A—B or B—A, common-mode rejection is at least 20 to 1 over the entire passband for signals up to 1-v amplitude. Rejection can be improved, especially at low frequencies, by adjusting the vernier attenuator controls and/or the GAIN ADJ. controls. Separate attenuator controls for each channel permit rejection of a common-mode signal of a different amplitude.

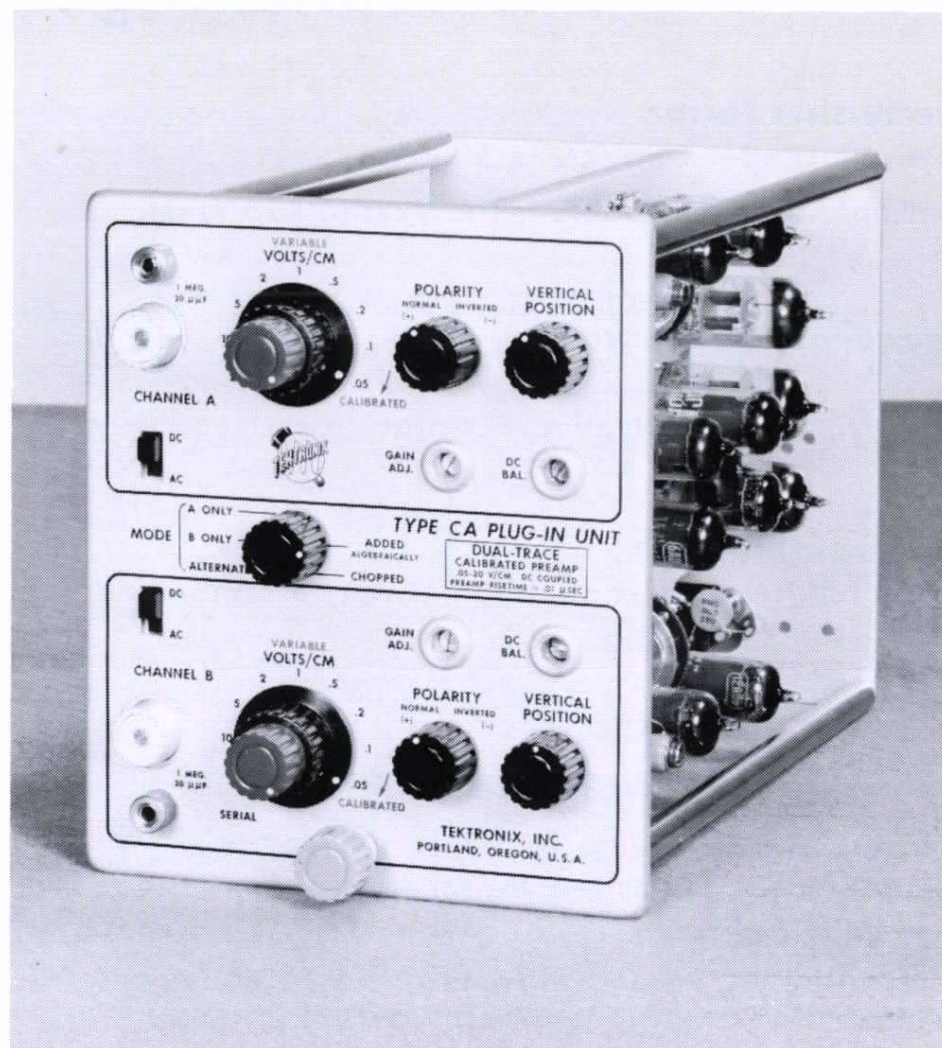
In alternate-sweep, free-running, and single-channel modes of operation the Type C-A is identical to its predecessor, the Type 53/54C Dual-Trace Preamplifier.

### 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 adjustments from 0.05 v/cm to 50 v/cm for each channel.

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

**Calibration Accuracy**—Adjustments are provided for setting the gain of each channel. When accurately set, the vertical deflection factor will be within 3% of the panel reading for all switch positions.



**Operating Mode Selection**—A five-position switch provides for electronic switch operation either triggered or free-running, separate use of either channel, and both channels combined at the output of the unit.

**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 comparisons of signals 180 degrees out of phase, and A—B or A + B mixing.

**Input Impedance**—20 μμf 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

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



# PLUG-IN PREAMPLIFIERS

## TYPE D 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

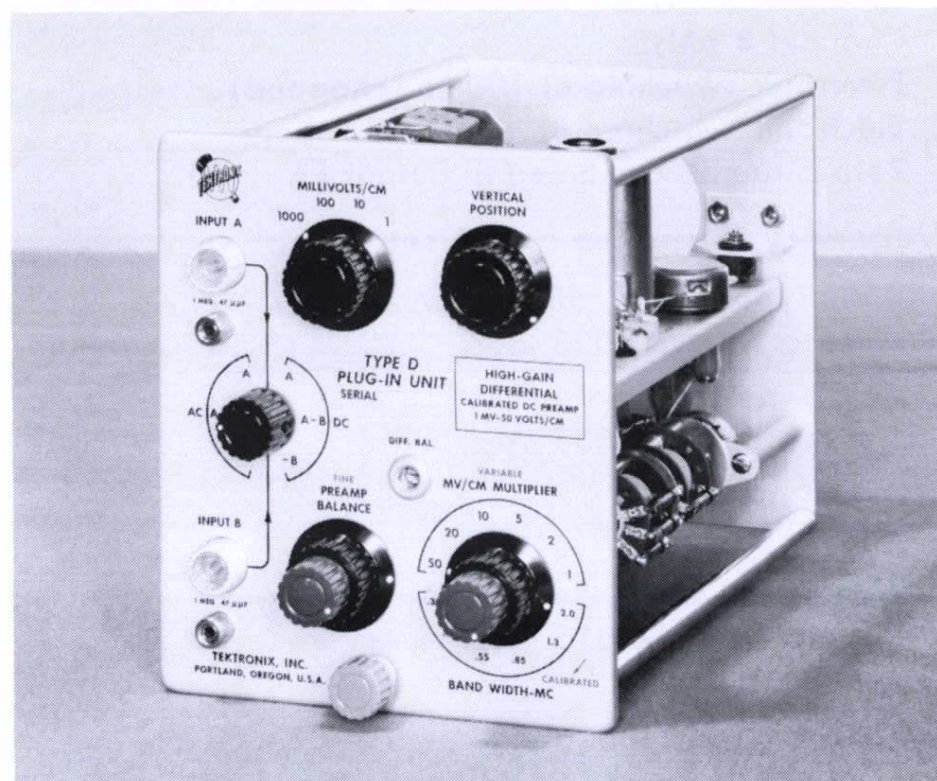
The Type D equips Tektronix Oscilloscopes with the plug-in-preamplifier feature for work requiring dc-coupling at a deflection factor of 1 mv/cm. Differential input with high rejection ratio for in-phase signals permits cancellation of unwanted or interfering signals.

#### 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 D 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 electron tubes in the Type D 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  $\mu\mu\text{f}$  paralleled by 1 megohm.

#### ELECTRON-TUBE COMPLEMENT

Cascode 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** . . . . . **\$155**  
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 E 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 20 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  $\pm 2$  v or less.

#### GENERAL DESCRIPTION

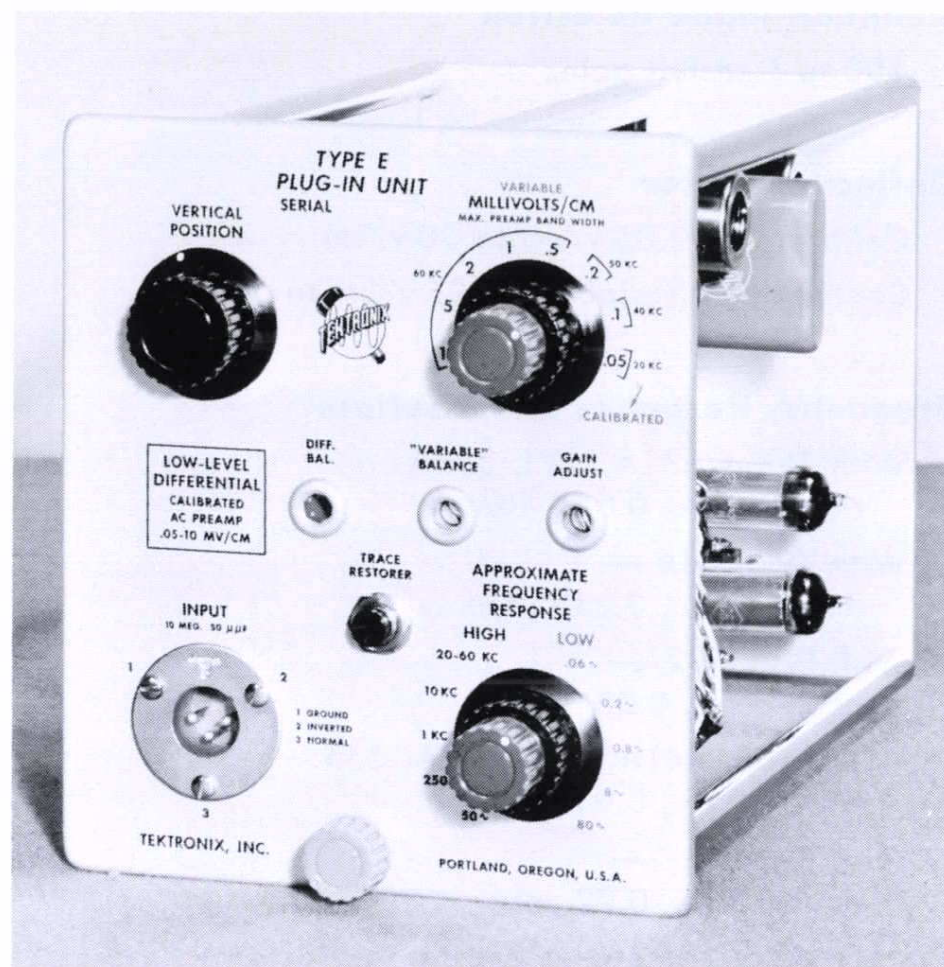
The Type E Plug-In Unit provides Tektronix Oscilloscopes with the plug-in-preamplifier feature with a calibrated vertical deflection factor of 50 microvolts/cm for low-level applications. Maximum combined noise and hum is 5  $\mu$ v, rms, with input grids grounded at the input connector. Separate high-frequency 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  $\mu$ f paralleled by 10 megohms.

#### 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** ..... \$175

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 PREAMPLIFIERS

## TYPE G 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 Types 531A, 533, 535A —  
dc to 14 mc, 0.025  $\mu$ sec.

With Type 536 —  
dc to 10 mc, 0.035  $\mu$ sec.

With Type 532 —  
dc to 5 mc, 0.07  $\mu$ sec.

With Types 541A, 543, 545A, 555 —  
dc to 20 mc, 0.018  $\mu$ sec.

With Type 551 —  
dc to 18 mc, 0.02  $\mu$ sec.

#### GENERAL DESCRIPTION

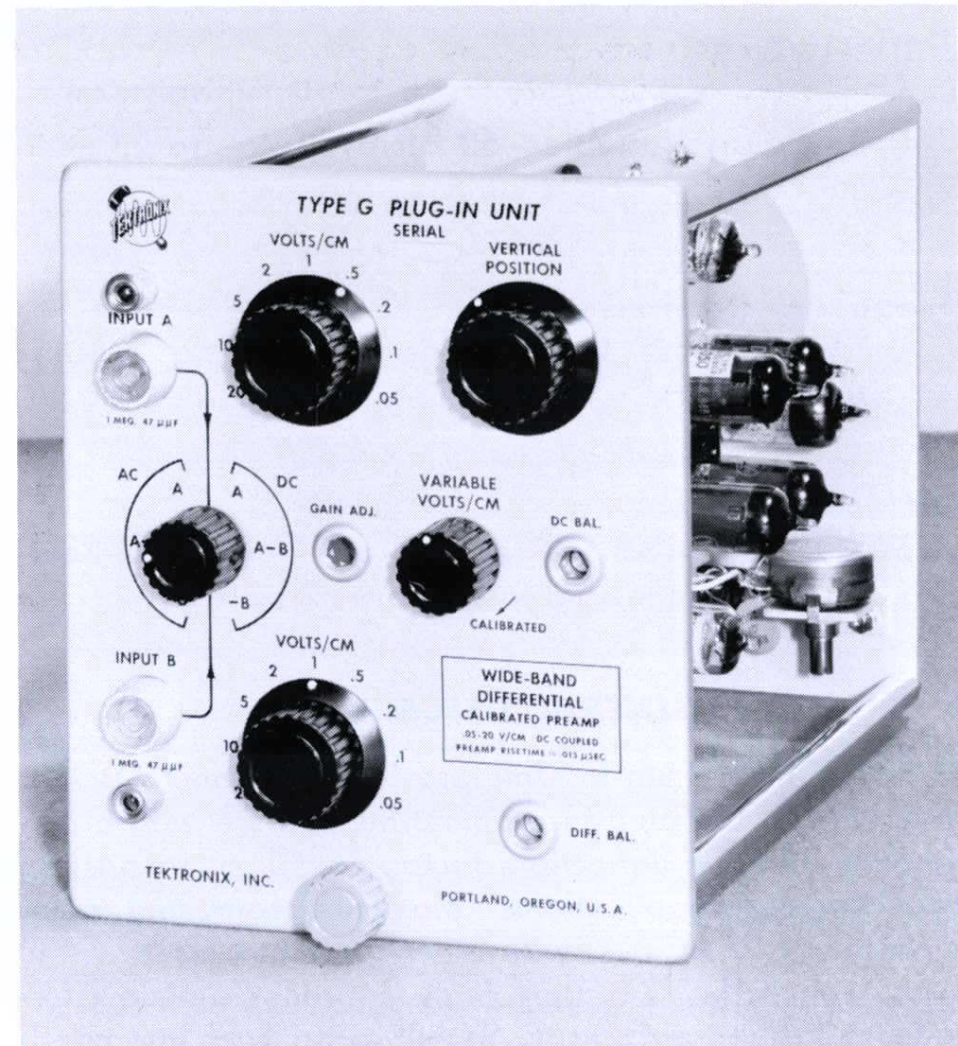
The Type G Plug-In Unit equips Tektronix Oscilloscopes with the plug-in-preamplifier feature for wide-band differential-input applications. Common-mode rejection is better than 100 to 1 for the entire passband at full gain, better than 300 to 1 at 60 cycles. Independent step attenuators in each input 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  $\mu$ 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** . . . . . \$185

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 H 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 Types 531A, 533, 535A —  
 dc to 11 mc, 0.031  $\mu$ sec.  
 With Type 536 —  
 dc to 9.5 mc, 0.037  $\mu$ sec.  
 With Type 532 —  
 dc to 5 mc, 0.07  $\mu$ sec.  
 With Types 541A, 543, 545A, 555 —  
 dc to 15 mc, 0.023  $\mu$ sec.  
 With Type 551 —  
 dc to 14 mc, 0.025  $\mu$ sec.

### GENERAL DESCRIPTION

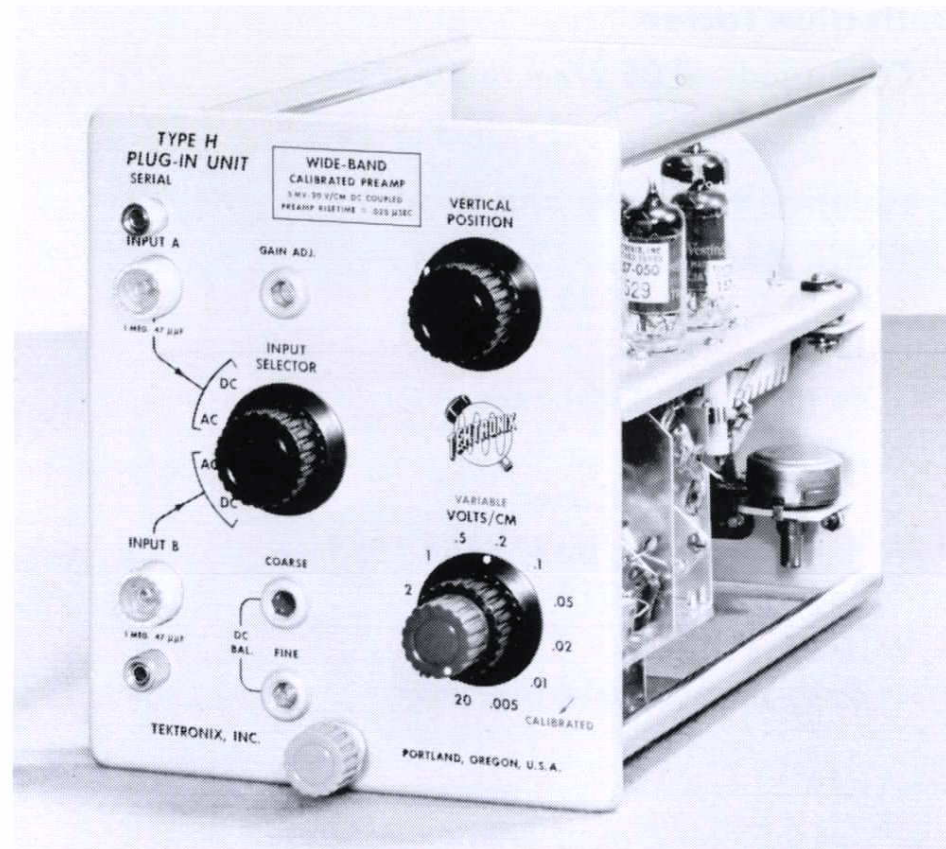
The Type H is a wide-band preamplifier with dc-coupling over its full sensitivity range. It provides a maximum deflection factor of 5 mv/cm, dc-coupled, in Types 530, 540 and 550 Oscilloscopes, with excellent transient-response characteristics.

### 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 coup-



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

**Input Impedance**—47  $\mu$ 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** ..... \$185

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 K PLUG-IN UNIT Fast-Rise DC Preamplifier

### Deflection Factor

Calibrated—0.05 v/cm to 20 v/cm.

### Frequency Response and Risetime

With Types 531A, 533, 535A —  
dc to 15 mc, 0.023  $\mu$ sec.

With Type 536 —  
dc to 11 mc, 0.031  $\mu$ sec.

With Type 532 —  
dc to 5 mc, 0.07  $\mu$ sec.

With Types 541A, 543, 545A, 555 —  
dc to 30 mc, 0.012  $\mu$ sec.

With Type 551 —  
dc to 25 mc, 0.014  $\mu$ sec.

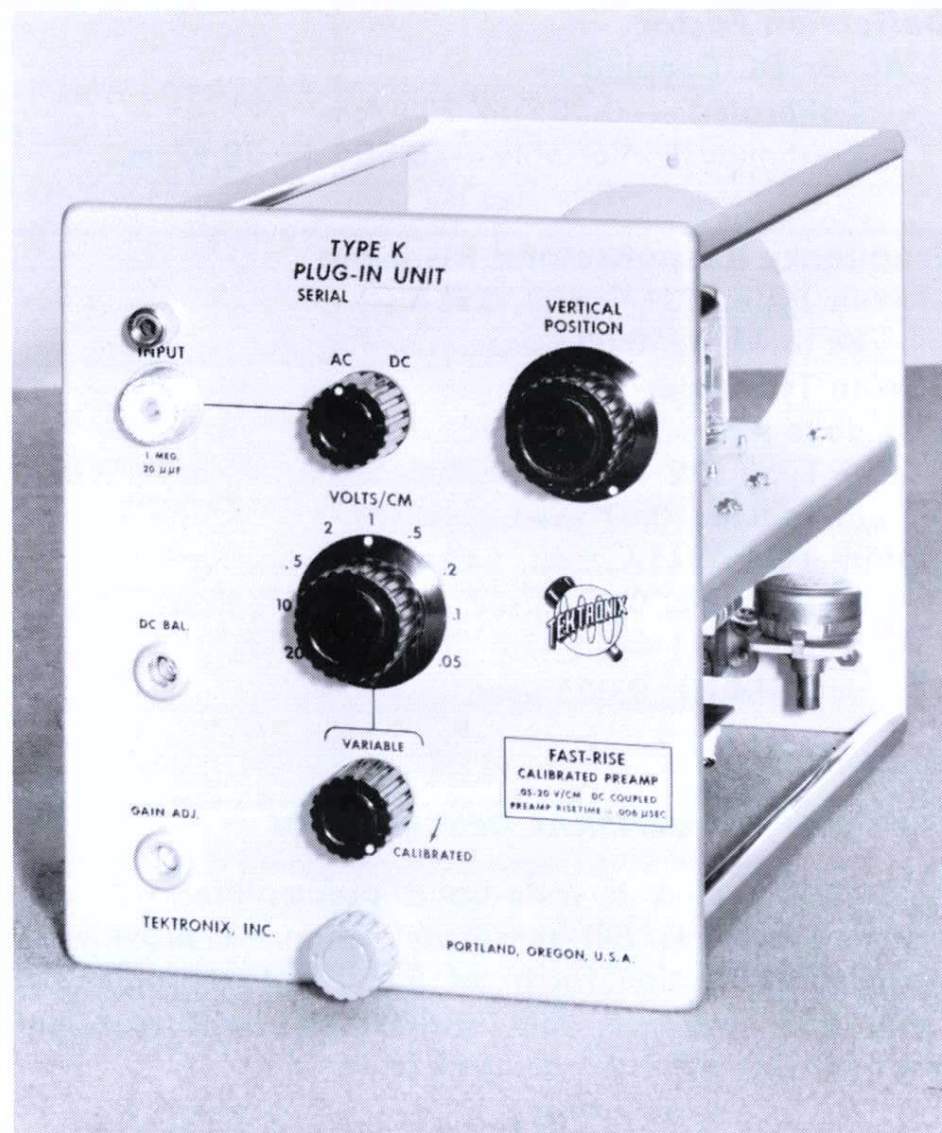
### GENERAL DESCRIPTION

The Type K Fast-Rise Unit provides Types 540 and 550 Series 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 K combined with a fast-rise oscilloscope makes a 12-millisecond 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 K can be used in all Tektronix Oscilloscopes with the plug-in-preamplifier 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 K is 1 megohm paralleled by 20  $\mu$ f. Input impedance with the 10-X attenuator probe, furnished with Tektronix Fast-Rise Oscilloscopes, is 10 megohms paralleled by 8  $\mu$ f. Other Probes, described in the Accessory Section, provide input capacitances from 12  $\mu$ f to 2.5  $\mu$ 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 . . . . . \$135**

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 L 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 Types 531A, 533, 535A — dc to 15 mc, 0.023  $\mu$ sec.
- With Type 536 — dc to 11 mc, 0.031  $\mu$ sec.
- With Type 532 — dc to 5 mc, 0.07  $\mu$ sec.
- With Types 541A, 543, 545A, 555 — dc to 30 mc, 0.012  $\mu$ sec.
- With Type 551 — dc to 25 mc, 0.014  $\mu$ sec.

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

- With Types 531A, 533, 535A — 3 cycles to 15 mc, 0.023  $\mu$ sec.
- With Type 536 — 3 cycles to 10 mc, 0.035  $\mu$ sec.
- With Type 532 — 3 cycles to 5 mc, 0.07  $\mu$ sec.
- With Types 541A, 543, 545A, 555 — 3 cycles to 24 mc, 0.015  $\mu$ sec.
- With Type 551 — 3 cycles to 22 mc, 0.017  $\mu$ sec.

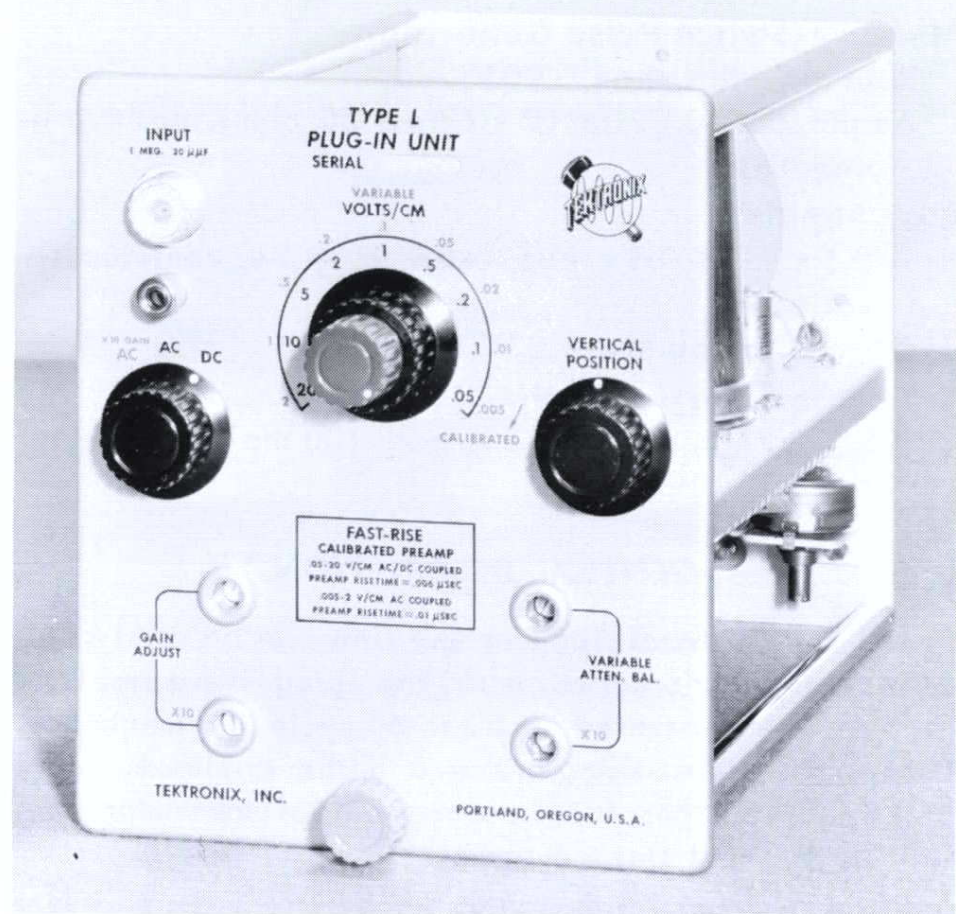
#### GENERAL DESCRIPTION

The Type L Fast-Rise High-Gain Unit is essentially the Type K Plug-In Unit, with an additional amplifier to increase the sensitivity 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 L Unit is identical to the Type K.

#### 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 L Unit is 1 megohm paralleled by 20  $\mu$ f. Input impedance with the 10-X attenuator probe, furnished with Tektronix Fast-Rise Oscilloscopes, is 10 megohms paralleled by 8  $\mu$ f. Other Probes, described in the Accessory Section, provide input capacitances from 12  $\mu$ f to 2.5  $\mu$ 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** ..... **\$200**

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





# PLUG-IN UNITS

## TYPE R 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  $\mu\text{sec}$ .  
Amplitude—0.02 to 10 v across 50 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 R Transistor Rise Time Unit can be used in all Tektronix Oscilloscopes with the plug-in-preamplifier 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 R 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 541A, 543, 545A, 555—0.012  $\mu\text{sec}$
- Type 551—0.014  $\mu\text{sec}$
- Types 531A, 533, 535A—0.023  $\mu\text{sec}$
- Type 536—0.035  $\mu\text{sec}$
- Type 532—0.07  $\mu\text{sec}$  (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 transistor-regulated 10 v dc power supply is chopped by a mercury switch, providing a 120-c/sec test pulse with a risetime of less than 0.005  $\mu\text{sec}$ . The pulse is applied to the transistor under test through a  $\pi$  attenuator with an output impedance of 50 ohms. Sixteen amplitude steps are provided: +0.05, +0.1, +0.2, +0.5, +1, +2, +5, +10v and —0.05, —0.1, —0.2, —0.5, —1, —2, —5, —10v. A vernier (uncalibrated) control fills in between steps.

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



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

**Base Series Resistors**—The base driving resistance can be selected from nine values—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 permits observation of the voltage on the transistor collector or base, through use of external connections. Amplifier sensitivity for these displays is 0.1 v/cm.

**Triggering**—A positive constant-amplitude trigger for the oscilloscope sweep is furnished through a short coaxial cable permanently attached to the Type R Unit. The oscilloscope sweep can be triggered on the rise of the test pulse only, or on both the rise and fall for displaying delay, rise, storage, and fall times simultaneously.

### ELECTRON TUBES & SEMICONDUCTORS

Amplifiers	2	12AU6
Amplifiers		12AT7
Trigger output amplifier	2	12AU6
Trigger output amplifier		12AT7
Regulator amplifier		2N212
Regulator amplifiers	3	2N544
Regulator amplifiers	2	2N270
Series regulators	4	2N307A

### MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

Finish—Photo-etched panel.

Weight—4 1/2 lbs.

**Price** ..... \$300

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



# PLUG-IN UNITS

## TYPE T PLUG-IN UNIT Time-Base Generator

### Wide Sweep Range

Twenty-two calibrated sweep rates from 0.2  $\mu\text{sec}/\text{div}$  to 2 sec/div.

5x magnifier, accurate on all ranges.

### Versatile Triggering

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

### GENERAL DESCRIPTION

The Type T 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 Oscilloscopes with the plug-in-preamplifier feature. The Type T 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 T Unit.

### HORIZONTAL-DEFLECTION SYSTEM

**Calibrated Sweep Rates**—The Type T 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 millisecond/div—0.1, 0.2, 0.5, 1, and 2 sec/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 sec/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 provide 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 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 . . . . . \$235**

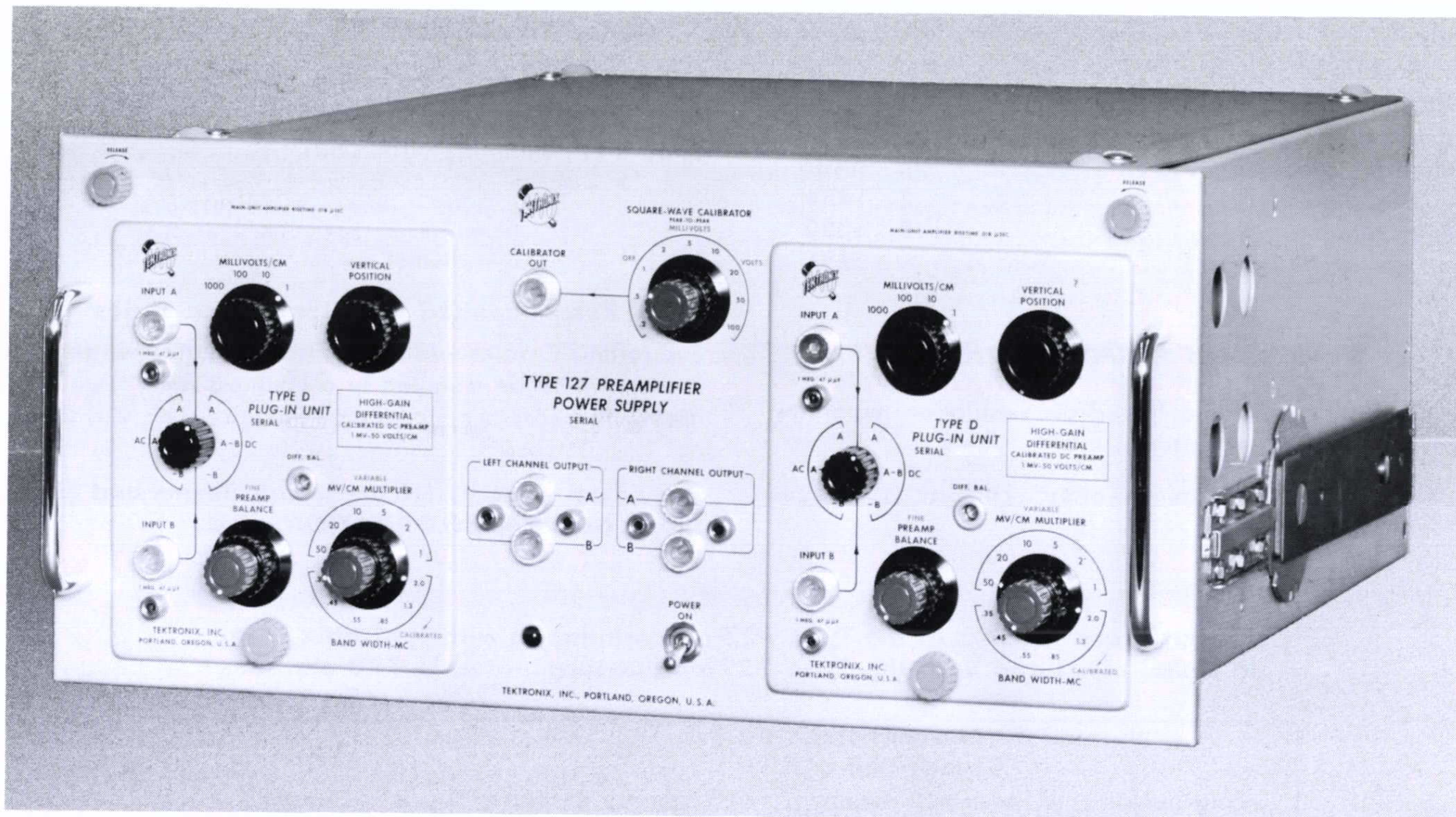
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





# TYPE 127 PREAMPLIFIER POWER SUPPLY

## Rack-Mounting Power Supply for Tektronix Plug-In Preamplifiers



### GENERAL DESCRIPTION

The Tektronix Type 127 supplies proper operating power to one or any combination of two Tektronix Plug-In Preamplifiers. Any Tektronix Plug-In Preamplifiers, 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 can be obtained by employing 2 Type D, E, or G Differential Plug-In Preamplifier Units in the Type 127 in conjunction with an oscilloscope using a Type C-A Dual-Trace Plug-In Unit. The Type 127 also facilitates the use of Tektronix Plug-In Preamplifiers 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  $\pm 0.3$  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 Application**—A Type C-A Dual-Trace Unit in an oscilloscope can be fed by two other Plug-In Units powered by the Type 127 to produce a dual-trace display. A four-trace display results when the Type C-A Unit in an oscilloscope is fed by two Type C-A 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 is possible when two Type C-A Units in the Types 551 or 555 Dual-Beam Oscilloscopes are fed by four Type C-A 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.



# 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

## MECHANICAL SPECIFICATIONS

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

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—170Ω Coaxial cables, 5' long. (012-034)
- 4—170Ω terminating resistors (011-016)
- 1—3-conductor power cord (161-008)
- 1—Instruction manual

## Recommended Additional Accessories

Supporting Cradles—for rear slide support when the instrument is to be mounted in a backless rack. Two cradles with necessary mounting hardware, Tek 426-063A . . . . . 7.50

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

**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
A	2	dc to 15 mc	.023 μsec
B	2	dc to 15 mc	.023 μsec
	20	5 cps to 11 mc	.030 μsec
C-A	2	dc to 17 mc	.020 μsec
D	100	dc to 350 kc at a gain of 100, increasing to 2 mc at a gain of 2	
E	2000	.06 cps to 20 kc at full gain, increasing to 60 kc a gain of 200	
G	2	dc to 15 mc	.023 μsec
H	20	dc to 12 mc	.029 μsec
K	2	dc to 19 mc	.018 μsec
L	2	dc to 19 mc	.018 μsec
	20	3 cps to 17 mc	.020 μsec

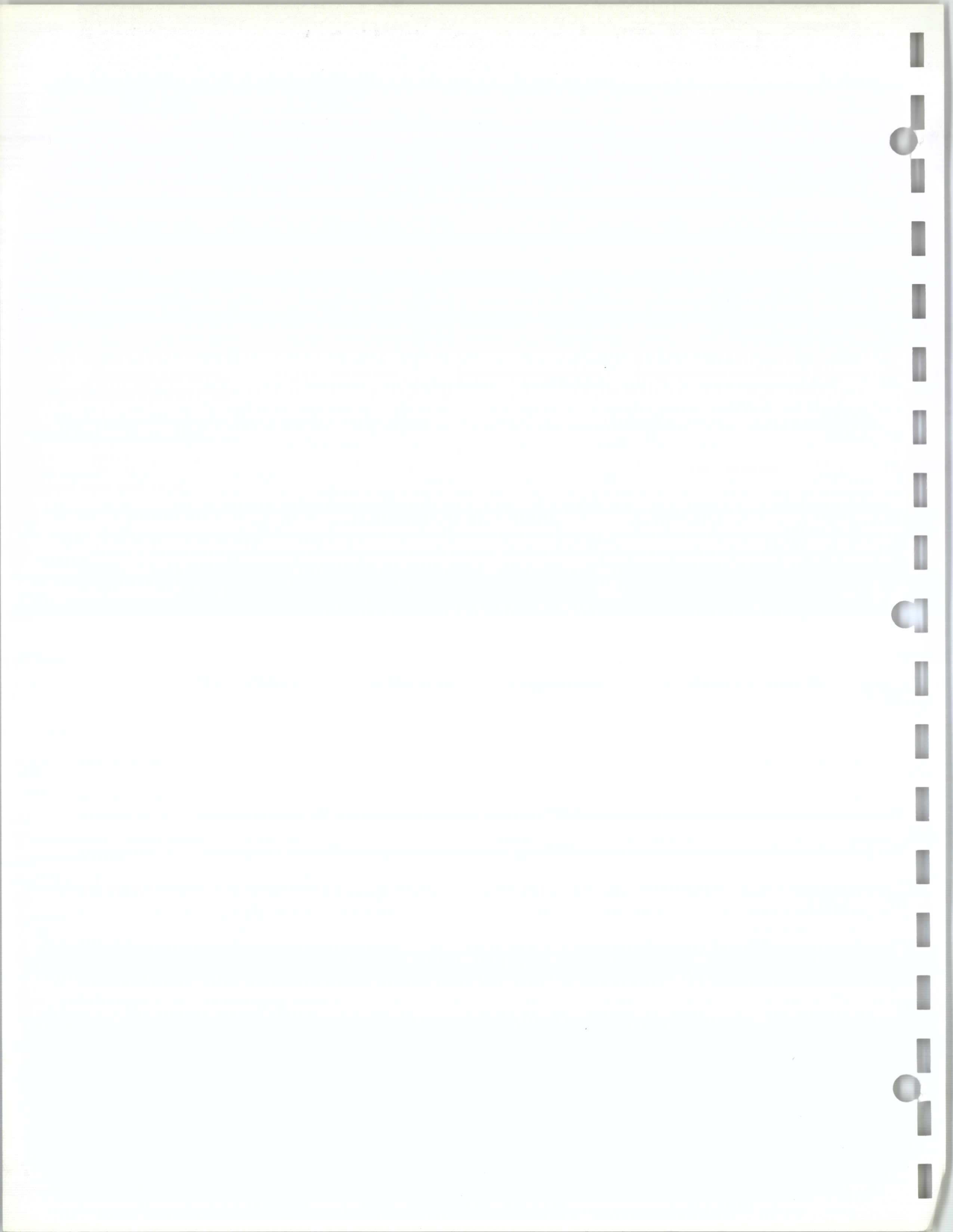






PORTABLE OSCILLOSCOPES







# IMPROVED INSTRUMENT

## TYPE 310A OSCILLOSCOPE 3-Inch DC-Coupled Portable

### Designed for Easy Handling

Small—10" x 6 3/4" x 17".  
Weighs only 23 1/2 pounds.

### Transient Response

Risetime—0.09  $\mu$ sec.

### Frequency Response

DC to 4 mc—0.1 v/div to 125 v/div.  
2 cycles to 3.5 mc—0.01 v/div to  
0.1 v/div.

### Sweep Range

0.1  $\mu$ sec/div to 0.6 sec/div.  
18 calibrated sweep rates.

### Versatile Triggering

Internal, external, line . . . ac-coupled  
or dc-coupled, and automatic trig-  
gering.



### GENERAL DESCRIPTION

The Tektronix Type 310A Oscilloscope is a 3" Portable with new mechanical features. Use of advanced construction techniques has produced a more rugged instrument with greater shock-resistant characteristics. The same desirable degree of compactness of its predecessor the Type 310 has been retained. Longer life and greater reliability have been attained through the use of silicon rectifiers and dual-triodes of an advanced design.

The Type 310A Oscilloscope is an instrument you can take with you—easily, comfortably. Small size and low weight combined with operation on 50 to 800-cycle line frequency make this an ideal instrument for maintenance and calibration of specialized measuring and recording instruments at their point of use. Accurate calibration and excellent linearity assure faithful displays and precise time and amplitude measurements either in the laboratory or in the field. Functional panel design and versatile control systems 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 2.5-to-1 vernier (uncalibrated) control provides for continuously-variable adjustment from 0.01 v/div to 125 v/div. A jewel light on the front panel indicates when the control is in the variable (uncalibrated) position. Vertical amplifier is factory-adjusted for optimum transient response. Risetime is less than 0.09  $\mu$ sec. Input impedance is 1 megohm paralleled by approximately 40  $\mu$ 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.

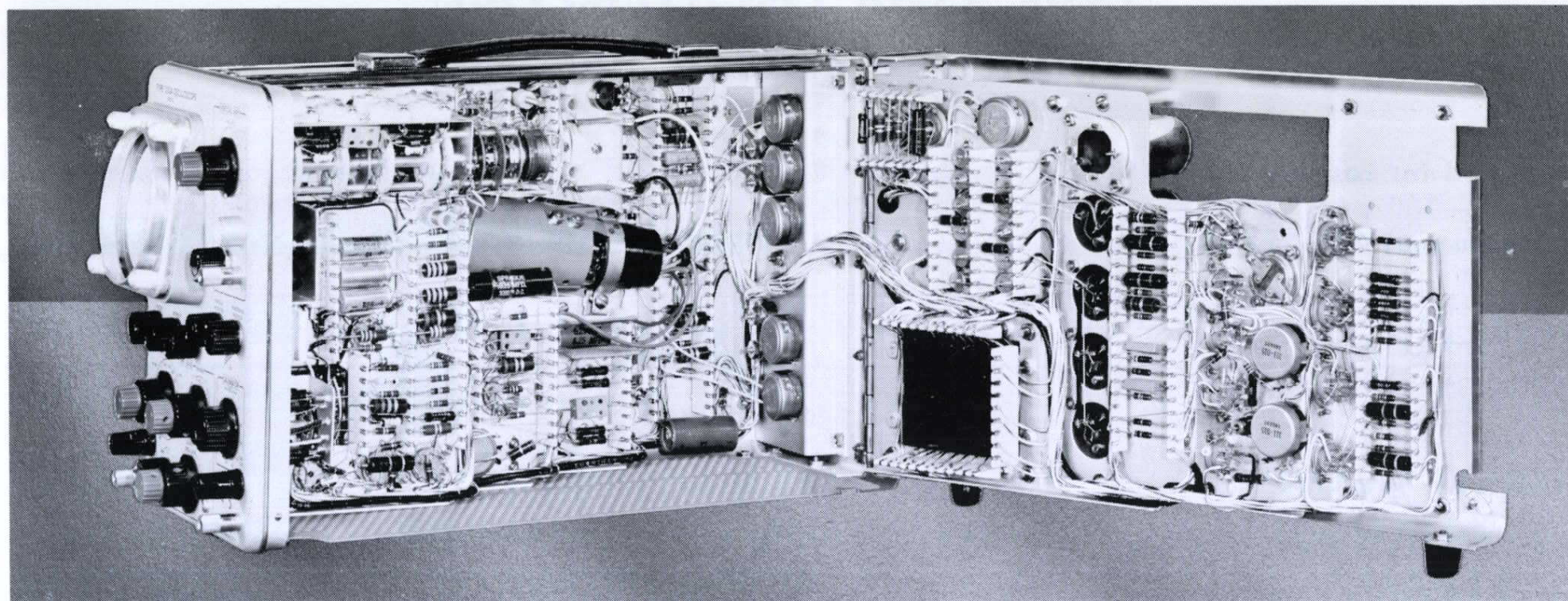
**Probe**—A low-capacitance probe (10-x atten.) is supplied with the instrument. Input capacitance with the probe is approximately 13  $\mu$ f paralleled by 10 megohms.

### HORIZONTAL-DEFLECTION SYSTEM

**Wide Sweep Range**—The Type 310A has 18 calibrated sweep rates: 0.5, 1, 2, 5, 10, 20, 50, 100, 200,



# TYPE 310A OSCILLOSCOPE



500  $\mu\text{sec}/\text{div}$ , . . . 1, 2, 5, 10, 20, 50 millise $\text{c}/\text{div}$ , 0.1, 0.2 sec/div. In addition, a vernier (uncalibrated) control provides sweep rates continuously adjustable from 0.5  $\mu\text{sec}/\text{div}$  to 0.6 sec/div. A jewel light in the front panel indicates when the control is in the variable (uncalibrated) position. Calibration accuracy of the 18 fixed sweeps is 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 normal trace is expanded to 10 divisions. The HORIZONTAL POSITION control has sufficient range to display any one-fifth of the magnified sweep. The 5-x magnifier applied to the 0.5- $\mu\text{sec}/\text{div}$  sweep extends the calibrated range to 0.1  $\mu\text{sec}/\text{div}$ . Accuracy is within 3% of the displayed portion of the magnified sweep on all ranges except the 0.5  $\mu\text{sec}/\text{div}$  range, where accuracy is within 5%.

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

**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 provide 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-coupled 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 controls need be touched until a different type of operation is desired. Range of automatic operation is between 60 cycles and 2 mc, 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 produce a one-half division deflection. External—a signal of 0.2 v to  $\pm 20$  v.

**Horizontal Input**—A back-panel terminal permits use of an external signal to drive the horizontal amplifier. Deflection factor is 1.5 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 3WP cathode-ray tube. A P2 phosphor is normally supplied, but P1, P7, or P11 can be furnished instead if desired. Some other phosphors are available on special order.

**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 310A opens up to permit easy accessibility to all tubes and components.



# TYPE 310A OSCILLOSCOPE

## ELECTRON-TUBES AND SEMICONDUCTORS

Vertical preamplifier .....	6AU6
Preamplifier CF .....	6BH6
Vertical input amplifier .....	2 6AU6
Driver CF .....	6DJ8
Vertical output amplifier .....	2 6CL6
Internal trigger CF .....	6BH6
Calibrator multivibrator and CF .....	12AU7
Calibrator multivibrator .....	6AU6
Trigger amplifier .....	6DJ8
Trigger shaper .....	6DJ8
Sweep multivibrator and CF .....	6DJ8
Sweep multivibrator .....	6AU6
Hold off CF .....	12AT7
Disconnect diodes .....	6AL5
Sweep generator and CF .....	6AN8
Horizontal input CF and output amplifier	6DJ8
External horizontal input CF and	
output amplifier .....	6DJ8
Voltage reference .....	5651
Regulator amplifiers .....	3 6AU6
Series regulators .....	3 12B4
High voltage oscillator .....	6AQ5
High voltage rectifiers .....	2 5642
High voltage regulator .....	12AU7
Voltage rectifiers .....	12 1N1566
Preamp cathode protector .....	TG12
Cathode-ray tube .....	3WPG

## 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<sup>3</sup>/<sub>4</sub>" wide, 17" long.

Weight—23<sup>1</sup>/<sub>2</sub> pounds.

Power Requirements—105 to 125 volts, 175 watts.

The Type 310A 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 310A 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 310A** ..... **\$595**

Includes: 1—10-x attenuator probe  
 1—Binding-post adapter (013-004)  
 1—Green filter (378-509)  
 1—3-conductor power cord (161-008)  
 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 310A 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 310/02 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.)





1. The oscilloscope is a device used for measuring the amplitude and frequency of electrical signals. It consists of a cathode ray tube (CRT) and a control panel. The CRT displays the signal as a trace on a grid. The control panel allows the user to adjust the gain, time base, and other parameters of the oscilloscope.

2. The oscilloscope is used to measure the amplitude and frequency of electrical signals. The amplitude is measured by the vertical deflection of the trace on the CRT. The frequency is measured by the horizontal deflection of the trace on the CRT. The oscilloscope is also used to measure the phase relationship between two signals.

3. The oscilloscope is a very useful tool for troubleshooting electronic circuits. It can be used to identify the cause of a problem in a circuit by measuring the signals at various points. The oscilloscope can also be used to measure the timing of signals in a circuit.

4. The oscilloscope is a very versatile instrument. It can be used to measure signals of many different frequencies and amplitudes. It can also be used to measure signals that are not periodic. The oscilloscope is a very important tool for anyone who works with electronics.

5. The oscilloscope is a very accurate instrument. It can measure signals with a precision of up to 10%. The oscilloscope is also very easy to use. It has a simple control panel and a clear CRT display. The oscilloscope is a very useful tool for anyone who works with electronics.

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# TYPE 316 OSCILLOSCOPE

## Wide-Band 3-Inch DC-Coupled Portable

### Passband

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

### Transient Response

Risetime— 0.035  $\mu$ sec.

### Sweep Range

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

### Triggering

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

### Portability

Size— 8½" wide, 12" high, 19½" overall depth.  
Weight—34 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

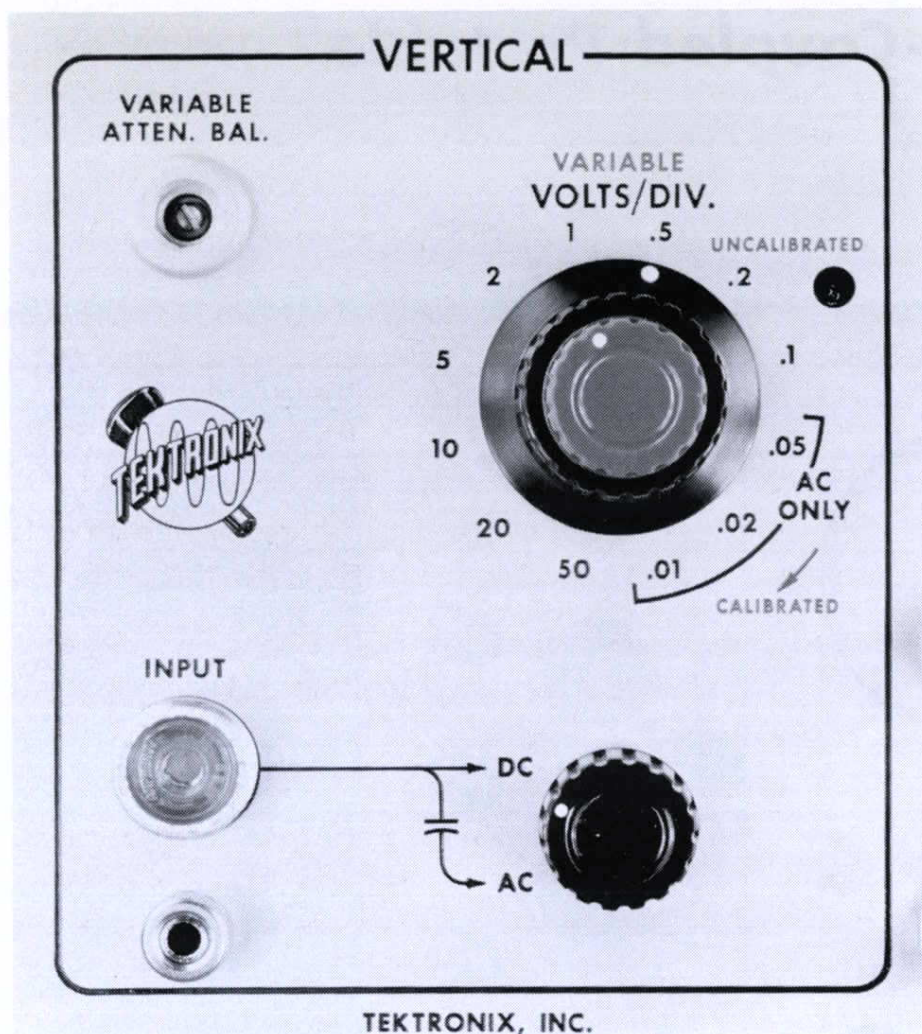
**DC-Coupled Vertical Amplifier**—Main amplifier passband is dc to 10 mc, risetime is 0.035  $\mu$ sec. Vertical deflection is calibrated in steps of 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 v/div. Low-frequency response is 3 db down at 2 cycles when the AC-DC switch is in the AC position. An ac-coupled preamplifier 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  $\mu$ sec. In addition, a 2½-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  $\mu$ 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  $40 \mu\text{f}$ .

**Probe**—The vertical sensitivity of the Type 316 is reduced by a factor of ten by use of the 10-x attenuator probe supplied with the instrument. The Probe presents an input impedance of 10 megohms paralleled by approximately  $13 \mu\text{f}$ .

## 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  $\text{msec}/\text{div}$ , 0.1, 0.2, 0.5, 1, and 2  $\text{sec}/\text{div}$ . In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.2  $\mu\text{sec}/\text{div}$  to 6  $\text{sec}/\text{div}$ . Calibration accuracy of the 22 fixed sweep rates is within 3%.

**Sweep Magnifier**—When the 5-x 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.

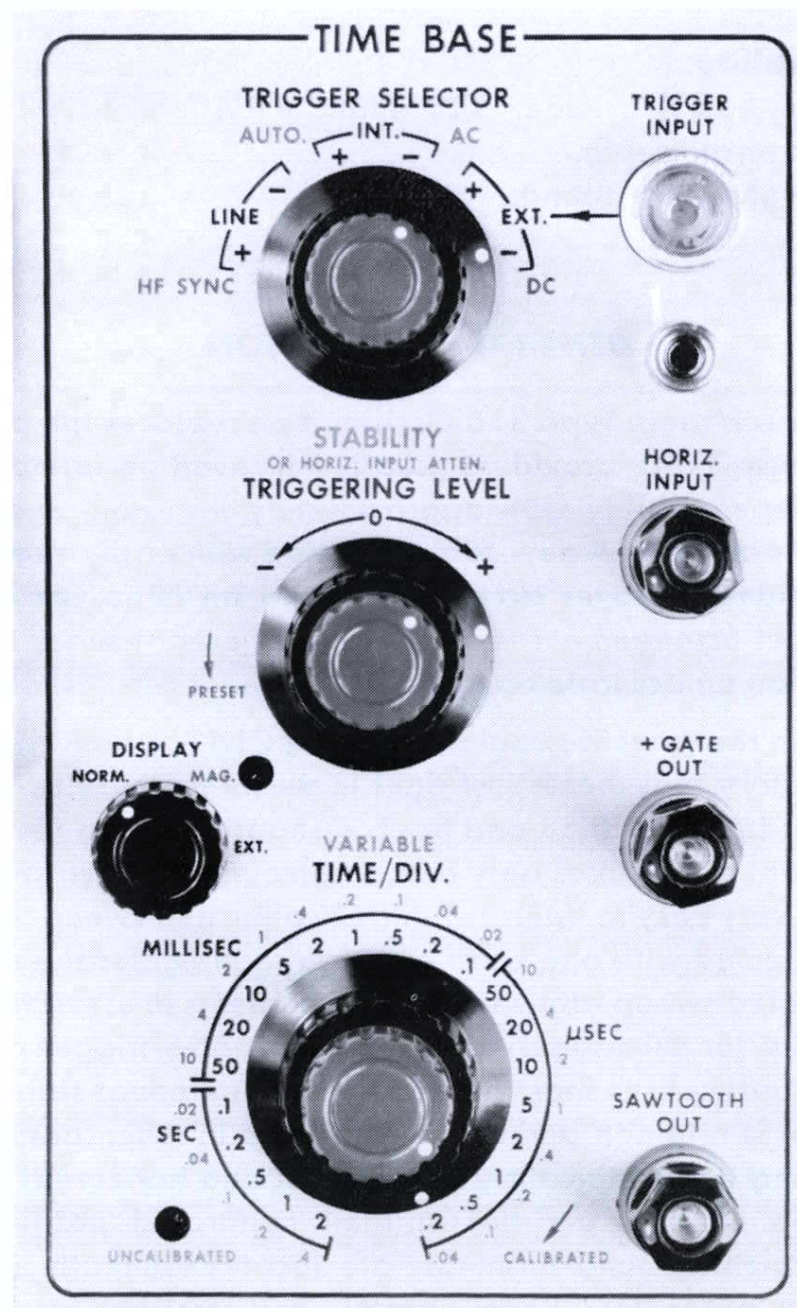
**Triggering Facilities**—Versatile triggering circuitry provides for complete manual control, preset stability control, and fully-automatic triggering.

**Amplitude-Level Selection**—Adjustable amplitude-level and stability controls provide 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-coupled 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 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 P2 phosphor is normally supplied. P1, P7, P11 can be furnished instead if desired. Some other phosphors are available on special order.

**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-pick-off 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	T316P2

## 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**—34 pounds.

**Power Requirements**—105 to 125 v or 210 to 250 v, 50 to 60 cycles, 260 watts. Type 316MOD101 operates on 50 to 400 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) . . . . . **\$750**

**Price, Type 316MOD101** (50 to 400 cycles) **\$785**

Includes: 1—10-x attenuator probe  
1—Binding-post adapter (013-004)  
1—Green filter (378-509)  
1—3-conductor power cord (161-008)  
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 400 cycle line frequency (Type 316MOD101). Contains brackets, rectifier, and fan motor.

040-141 Fan Motor Kit . . . . . \$40.00

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





TYPE 318 ORBITSCOPE

ORBITSCOPE COMPANY, INC. 1000 UNIVERSITY AVENUE, ANN ARBOR, MICHIGAN 48106

Model 318 Orbitscope is a high resolution, wide field of view, electron microscope. It is designed for the study of biological specimens, particularly for the study of the structure of membranes and the organization of macromolecules.

The Orbitscope is a scanning electron microscope (SEM) which uses a secondary electron detector (SED) for imaging. It has a resolution of 10 microns and a field of view of 100 microns. It is capable of operating at 10 kV and 100 pA.

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# NEW INSTRUMENT

## TYPE 317 OSCILLOSCOPE 3-inch Daylight Portable



### DC-COUPLED VERTICAL AMPLIFIER

Passband — DC to 10 MC at 0.1 to 125 v/div.  
Passband — 2 CPS to 10 MC at 0.01 to 0.1 v/div.  
Risetime — 0.035  $\mu$ sec.

### WIDE SWEEP RANGE

22 Direct-reading calibrated rates from 0.2  $\mu$ sec/div to 2 sec/div.  
5-x Magnifier increases the calibrated sweep rate to 0.04  $\mu$ sec/div.  
Continuously variable sweep rates from 0.04  $\mu$ sec/div to 6 sec/div.

### 9-KV ACCELERATING POTENTIAL

Bright trace, even at low sweep-repetition rates.

### HIGH RELIABILITY

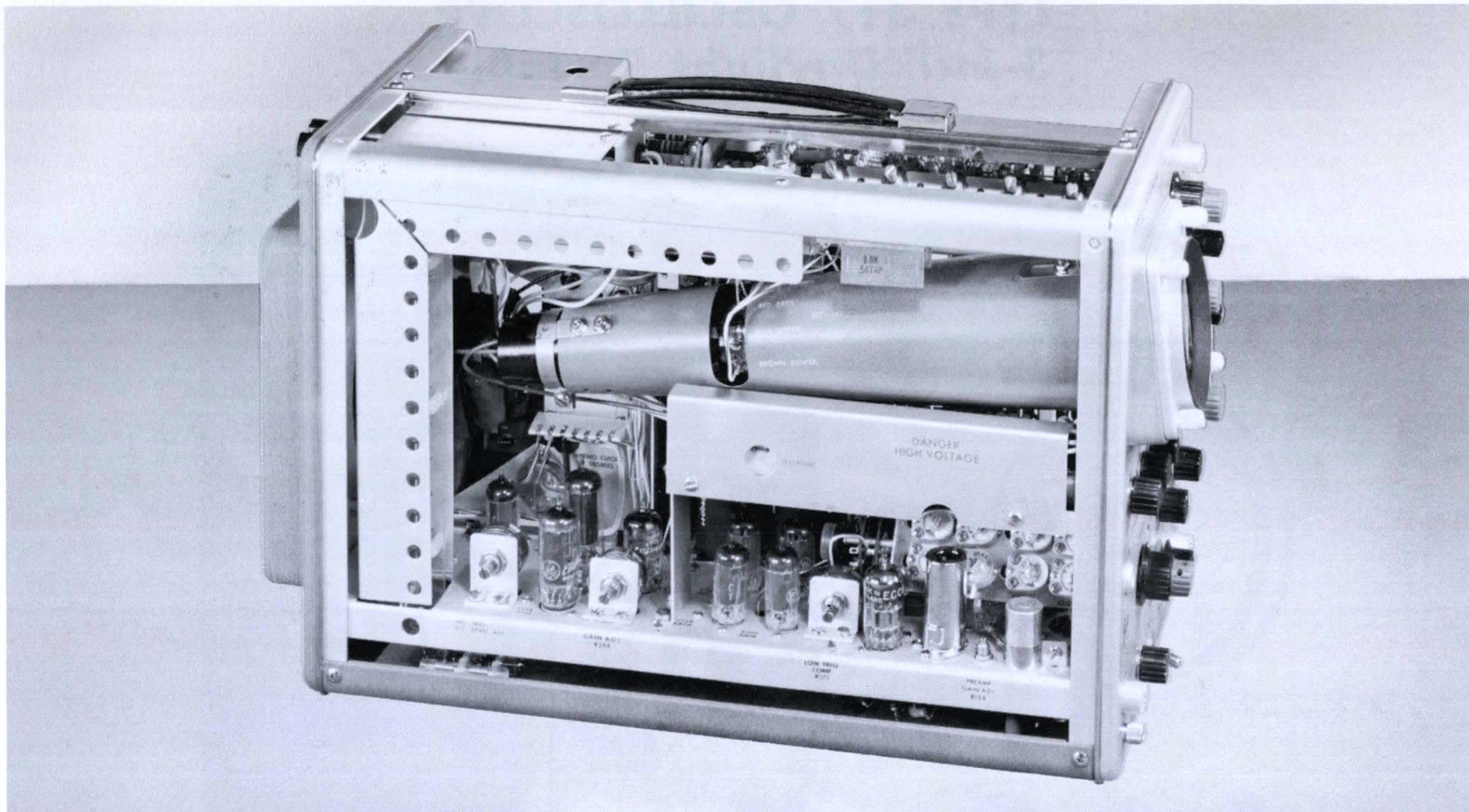
New frame-grid dual triodes insure excellent stability and reliability.

### EASY TRIGGERING

Automatic triggering eliminates readjustment in most applications.  
Preset or manual stability control for complete triggering versatility.



# TYPE 317 OSCILLOSCOPE



## GENERAL DESCRIPTION

The Type 317 is an excellent oscilloscope for the day-light conditions often encountered in the field and at production test stations. Its brilliant trace, provided by 9-kv accelerating potential on a Tektronix 3-inch cathode-ray tube, is easily readable in bright areas... even at low sweep-repetition rates. And its DC-to-10 MC vertical response and wide sweep range easily take care of most of today's complex field and test station applications. Of course, these fine characteristics make it an excellent laboratory oscilloscope, too.

## VERTICAL-DEFLECTION SYSTEM

**DC-Coupled Vertical Amplifier**—Main amplifier passband is dc to 10 mc, risetime is 0.035  $\mu$ 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  $\mu$ sec. In addition, a 2½-to-1 vernier (uncalibrated) control provides for continuous 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  $\mu$ sec is introduced by the balanced delay network. Permits observation of the leading edge of the waveform that triggers the sweep.

**Input Impedance**—1 megohm paralleled by approximately 40  $\mu$ mf.

**Probe**—The vertical sensitivity of the Type 317 is reduced by a factor of ten by use of the 10-x attenuator probe supplied with the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately 13  $\mu$ mf.

## 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  $\mu$ sec/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  $\mu$ sec/div to 6 sec/div. Calibration accuracy of the 22 fixed sweep rates is within 3%.

**Sweep Magnifier**—When the 5-x 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.



# TYPE 317 OSCILLOSCOPE

**DC-Coupled Unblanking**—The unblanking 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 provide 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-coupled 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 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 of about 2 v.

**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 about 1 kc.

**Cathode-Ray Tube**—A new Tektronix flat-faced 3" cathode-ray tube with helical post-accelerating anode is used in the Type 317. Accelerating potential is 9 kv. A P2 phosphor is normally supplied. P1, P7, and P11 are available as optional phosphors. Some other phosphors are available on special order.

**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
Voltage-setting CF and preamplifier CF	6DJ8
Vertical-input CF .....	2 6AU6
Vertical-input amplifiers .....	2 6AU6
Driver CF .....	6DJ8
Vertical-output amplifiers .....	2 6CL6
Trigger-pick-off CF .....	6AU6
Trigger amplifier .....	6DJ8
Trigger multivibrator .....	6DJ8
Sweep-gating multi and CF .....	6DJ8
Sweep-gating multi and unblanking CF	6AN8
Gate-out CF and sawtooth-out CF .....	6DJ8
Miller runup and CF .....	6AN8
Runup on-off diodes .....	6AL5
Hold-off CF and driver .....	6DJ8
Horizontal-input CF and driver .....	6DJ8
Horizontal-output amplifier and CF .....	2 6DJ8
Calibrator multivibrator and CF .....	12AU7
Calibrator multivibrator .....	6AU6
Voltage reference .....	5651
Regulator amplifiers .....	2 6AU6
Difference amplifier and voltage settings CF .....	6AN8
Series regulator .....	6080
Series regulator .....	12B4
Error-signal amplifiers .....	12AU7
High-voltage oscillator .....	6CZ5
High-voltage rectifiers .....	5 5642
Cathode-ray tube .....	T317P2

## 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**—34 pounds.



# TYPE 317 OSCILLOSCOPE

Power Requirements—105 to 125 v or 210 to 250 v, 50 to 60 cycles, 260 watts. Type 317MOD101 operates on 50 to 400 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 317 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 317 (50 to 60 cycles) . . . . . \$800**

**Price, Type 317MOD101 (50 to 400 cycles) \$835**

- Includes: 1—Attenuator probe (10-x)  
1—Binding-post adapter  
1—Green filter (378-509)  
1—3-conductor power cord (161-008)  
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.

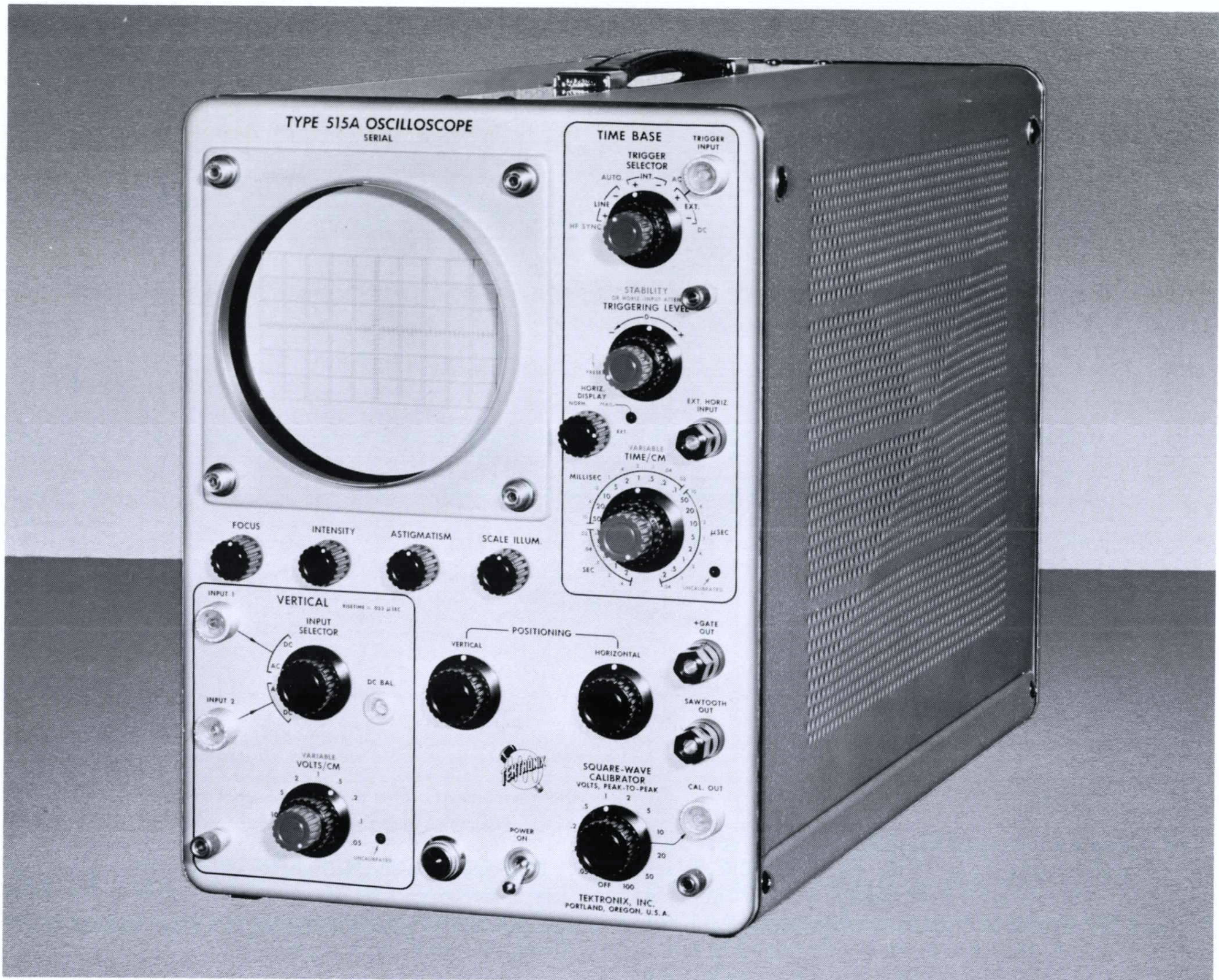
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





# TYPE 515A OSCILLOSCOPE

## DC-Coupled General Purpose



**Frequency Response**—DC to 15 mc.

**Transient Response**—0.023- $\mu$ 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 $\mu$ sec Delay Network**

### **Wide Sweep Range**

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

### **Versatile Triggering Circuitry**

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

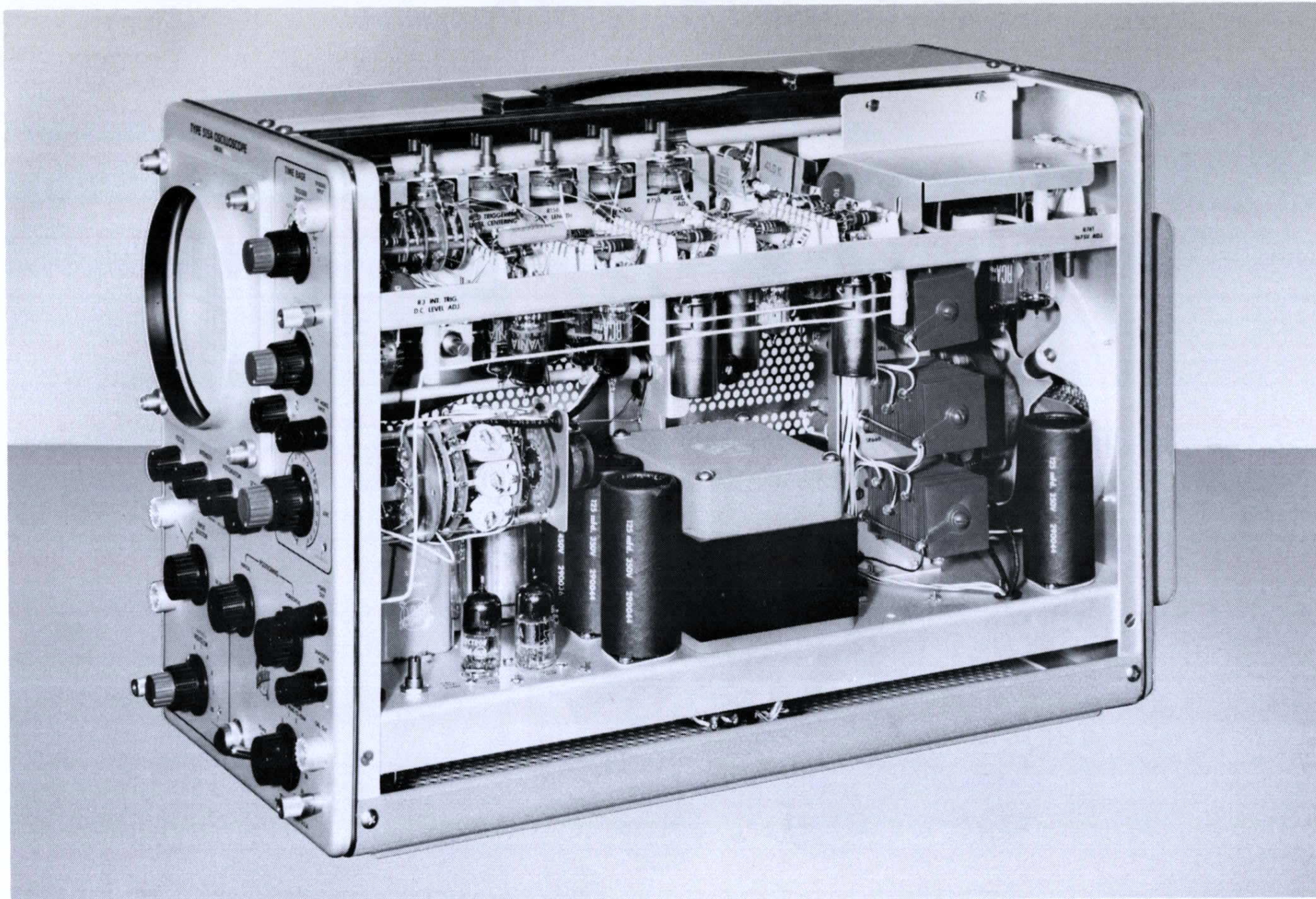
### **GENERAL DESCRIPTION**

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  $\mu$ 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  $0.023 \mu\text{sec}$ . 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-coupling 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  $36 \mu\text{mf}$ .

**Probe**—The vertical sensitivity is reduced by a factor of 10 by use of a 10-x attenuator probe supplied with

the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately  $10.5 \mu\text{mf}$ .

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

## HORIZONTAL-DEFLECTION SYSTEM

**Wide Sweep Range**—The Type 515A has 22 calibrated sweep rates: 0.2, 0.5, 1, 2, 5, 10, 20, 50  $\mu\text{sec/cm}$ ; 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 millisecc/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  $0.04 \mu\text{sec/cm}$  to 6 sec/cm. Calibration accuracy of the fixed sweep rates is within 3%.

**Sweep Magnifier**—When the 5-x 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  $0.04 \mu\text{sec/cm}$ . 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 provide 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-coupled 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 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

**Amplitude Calibrator**—A square-wave calibration 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,

5CBP, with a helical post-accelerating anode. A P2 phosphor is normally supplied. P1, P7, or P11 can be furnished instead if desired. Some other phosphors are available on special order.

**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.

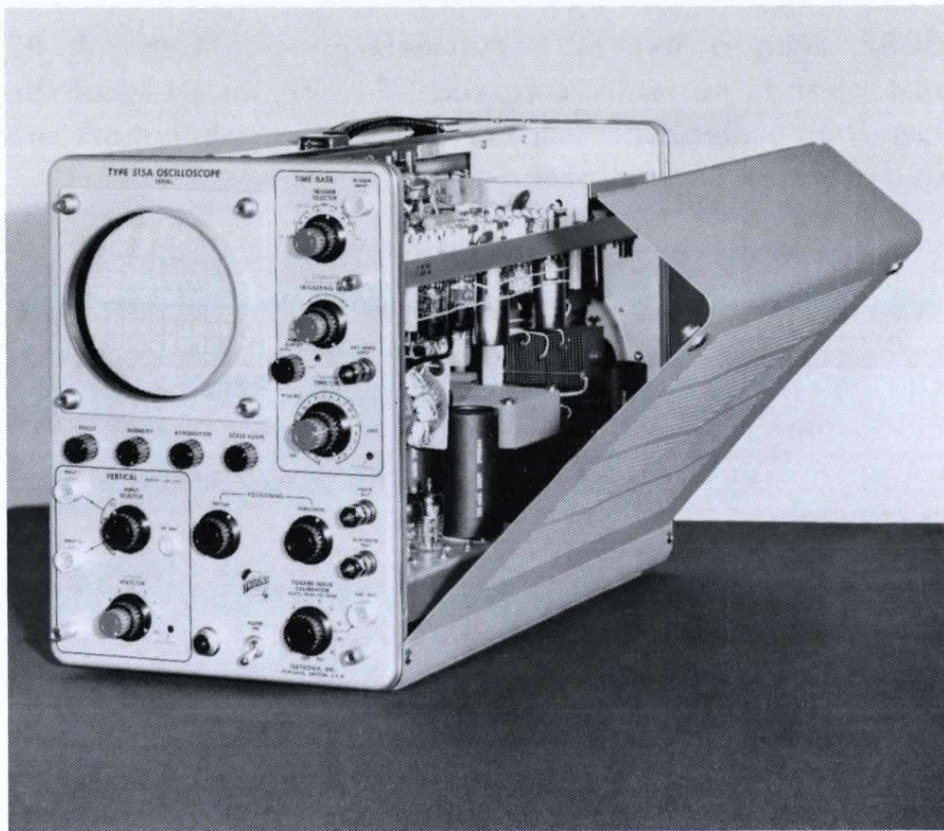
**Warning Indicators for Uncalibrated Settings**—Separate front-panel neon lights indicate when the vertical-attenuator and sweep-rate controls are in uncalibrated settings.

## 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		5CBP2



# 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 515AMOD101 operates on 50 to 400 cycle supply; uses dc fan motor.

**Price, Type 515A** ..... \$800

**Price, Type 515AMOD101** ..... \$835

**Includes:** 1—10-x attenuator probe  
2—Binding-post adapters (013-004)  
1—Green filter (378-514)  
1—3-conductor power cord (161-008)  
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 400 cycle line frequency (Type 515AMOD101). Contains brackets, rectifier, and fan motor.

040-140 Fan Motor Kit .....\$40.00

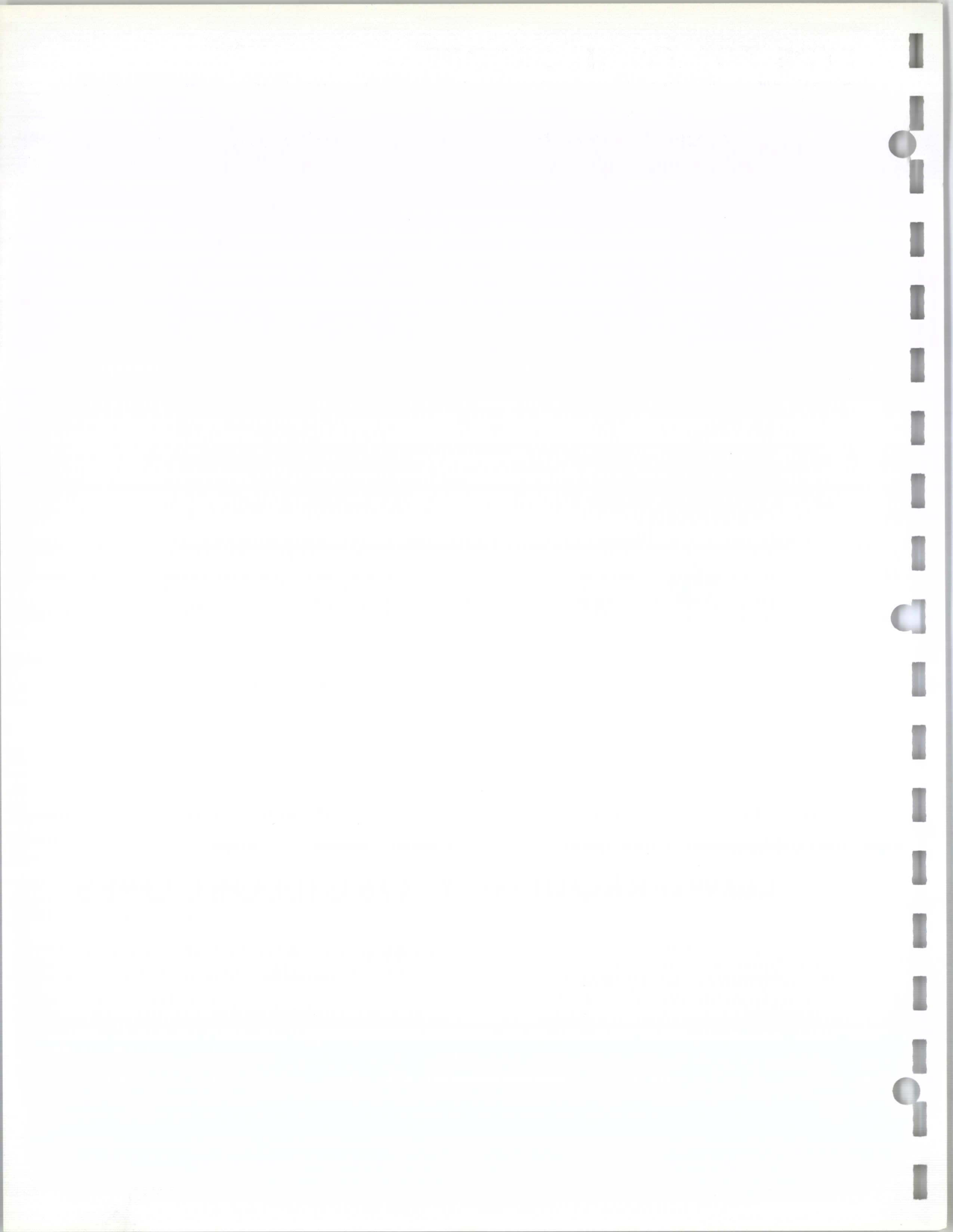
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





**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.

**Calibrated Sweeps**—1  $\mu\text{sec}/\text{cm}$  to 5  $\text{sec}/\text{cm}$ .

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

### **X-Y Curve Tracing with Two Beams**

(horizontal-deflection voltage common to both beams, maximum horizontal sensitivity 0.1  $\text{v}/\text{cm}$ ).

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

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

### **GENERAL DESCRIPTION**

The Tektronix Type 502 combines a number of extremely useful features in one compact oscilloscope. In addition to conventional applications, 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.



# TYPE 502 OSCILLOSCOPE

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 200 kc at 1  $\text{mv}/\text{cm}$ , to dc to 400 kc at 50  $\text{mv}/\text{cm}$ , and dc to 1 mc at 0.2  $\text{v}/\text{cm}$ . Vertical response at the lower sensitivities varies according to switch position as follows: 0.5  $\text{v}/\text{cm}$ —dc to 300 kc; 1  $\text{v}/\text{cm}$ —dc to 500 kc; 2  $\text{v}/\text{cm}$ —dc to 1 mc; 5  $\text{v}/\text{cm}$ —dc to 300 kc; 10  $\text{v}/\text{cm}$ —dc to 500 kc; 20  $\text{v}/\text{cm}$ —dc to 1 mc.

**Sensitivity**—Vertical deflection is calibrated in sixteen steps: 200, 500  $\mu\text{v}/\text{cm}$ , 1, 2, 5, 10, 20, 50, 100  $\text{mv}/\text{cm}$ , 0.2, 0.5, 1, 2, 5, 10 and 20  $\text{v}/\text{cm}$ . 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  $\text{mv}/\text{cm}$ , diminishing to 100 to 1 at 0.2  $\text{v}/\text{cm}$  and 50 to 1 at 5  $\text{v}/\text{cm}$ . These ratios were measured using a 1-kc square wave.

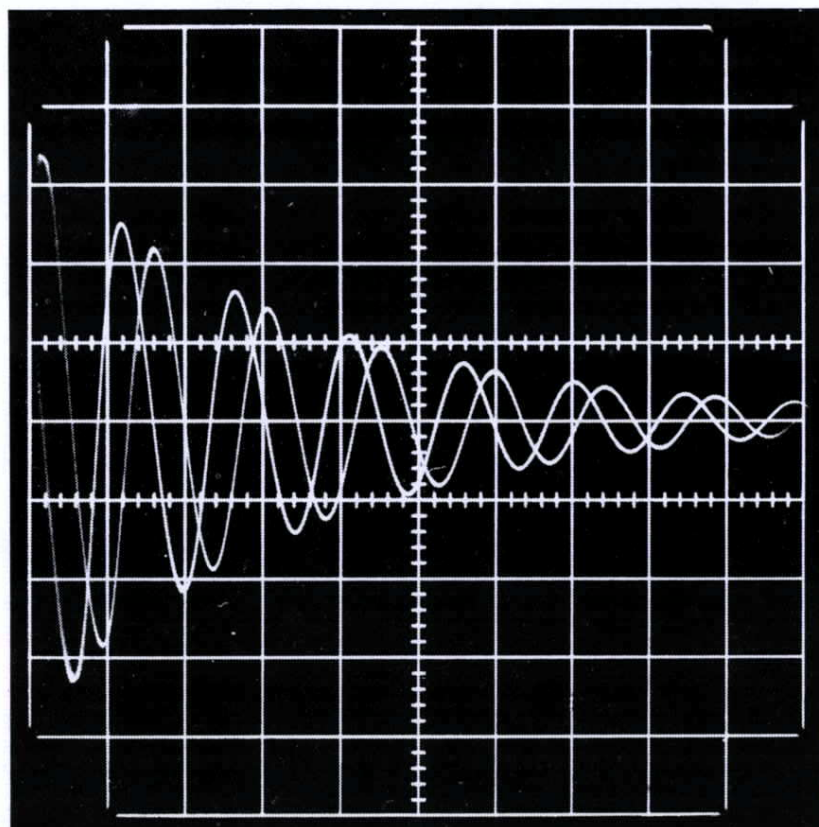
**Input Impedances**—47  $\mu\text{mf}$  paralleled by 1 megohm, both channels.

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

## HORIZONTAL-DEFLECTION SYSTEM

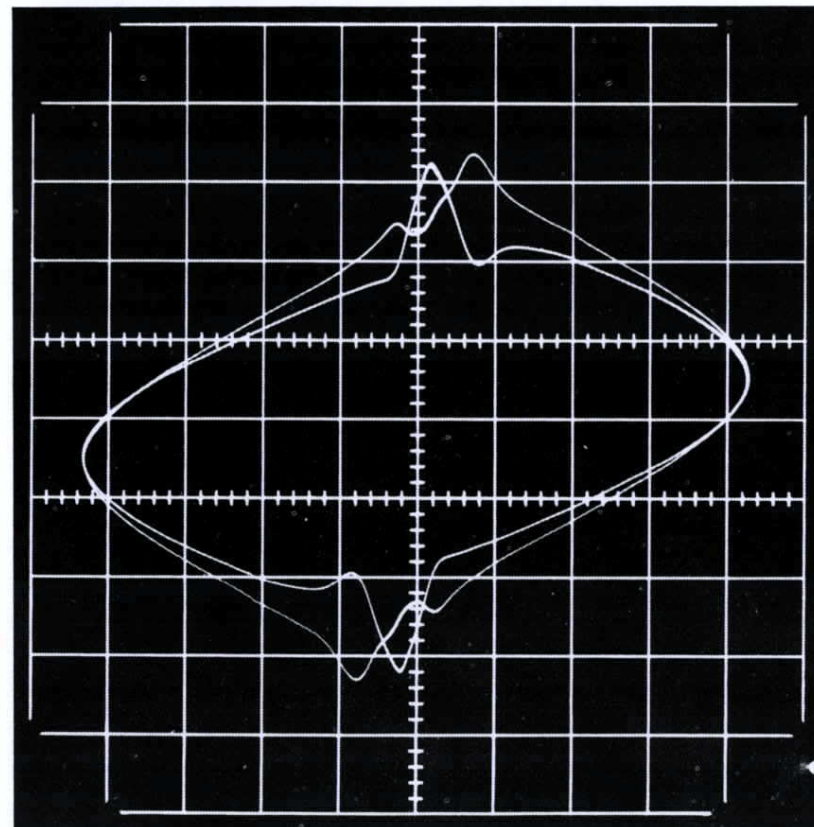
For single-beam applications where equal horizontal and vertical-deflection characteristics are desirable, the upper-beam amplifier can be switched to the crt horizontal-deflection plates. This type of operation has the advantages of 200  $\mu\text{v}/\text{cm}$  sensitivity and differential input for 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  $\text{msec}/\text{cm}$ , 0.1, 0.2, 0.5, 1, 2 and 5  $\text{sec}/\text{cm}$ . Calibration accuracy is within 3%.



**DUAL DISPLAY ON LINEAR TIME BASE**

Comparison of waveforms at two points in a ringing circuit. This kind of display is useful in many types of investigation.

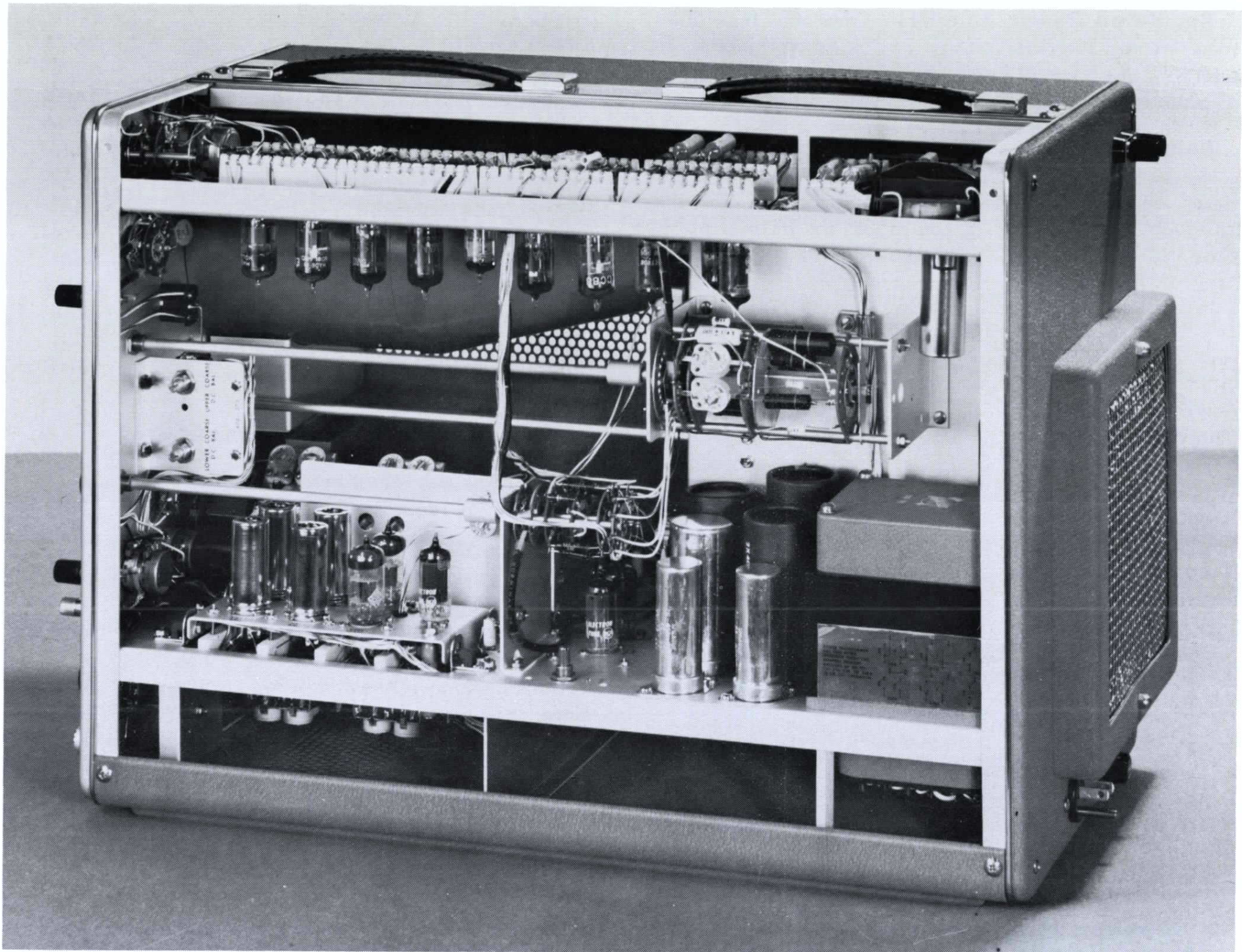


**DUAL-BEAM X-Y CURVE TRACING**

Typical production-test application: display of EI loops of two transformers manufactured under identical conditions.



# TYPE 502 OSCILLOSCOPE



**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  $1 \mu\text{sec}/\text{cm}$ . 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.

**Trigger Selection**—The triggering signal can be selected from either amplifier internally or from an external 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 10 v.

## OTHER CHARACTERISTICS

**Amplitude Calibrator**—A square-wave calibration 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. Both beams overlap in the center 6-cm vertical area. A P2 phosphor is normally supplied, however, P1, P7, and P11 are available instead if desired, and some other phosphors are available on special order.



# TYPE 502 OSCILLOSCOPE

**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 10 vertical and 10 horizontal one-centimeter divisions with two-millimeter markings on the baselines. Illumination is controlled by a front-panel knob.

## ELECTRON-TUBE COMPLEMENT

Input amplifiers	4	6AU6
Amplifiers	4	6AU6
Output amplifiers	4	12AT7
Internal trigger takeoff CF	2	6AU6
Trigger inverter		6DJ8
Trigger multivibrator		6DJ8
Sweep multivibrator and CF	2	6AN8
Disconnect diodes		6AL5
Sweep generator		6AN8

Sweep cathode follower		6DJ8
Sweep amplifiers	2	6AU6
Sweep amplifier		6DJ8
Calibrator multivibrator and CF		6AN8
Calibrator multivibrator		6AU6
High-voltage oscillator		6CZ5
High-voltage rectifier	2	5642
High-voltage regulator		12AU7
Rectifiers		6BW4
Rectifiers	2	5AR4
Comparator amplifiers	3	6AN8
Series regulators	4	12B4
Voltage reference		5651
Cathode-ray tube		T502P2

## TRANSISTOR COMPLEMENT

Heater regulator amplifiers	2	2N214
Heater series regulator		2N307

## MECHANICAL SPECIFICATIONS

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

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

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

**Dimensions**—23½" long, 11¼" wide, 15" high.

**Weight**—55 lbs.

**Power Requirements**—105-125 v or 210-250 v, 50-60 cycles, 280 watts.

**Type 502** ..... \$825

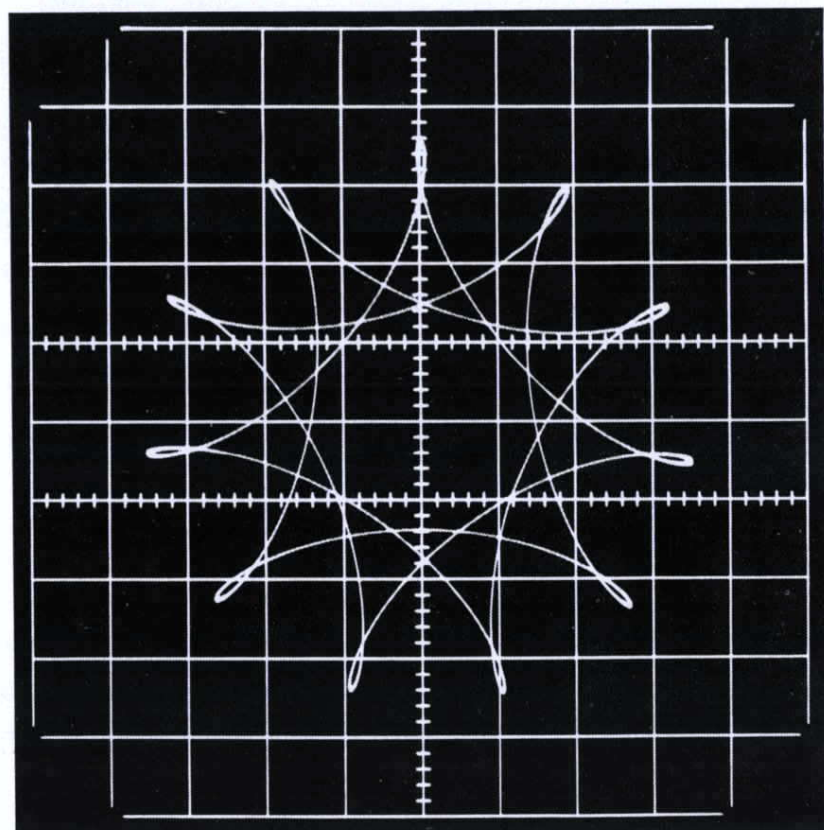
Includes: 2—10-x attenuator probes.  
2—Binding post adapters (013-004)  
1—Green filter (378-503)  
1—3-conductor power cord (161-008)  
1—Instruction manual

## Optional Phosphors

P2 crt phosphor normally furnished.

P1, P7, P11 optional .....no extra cost.

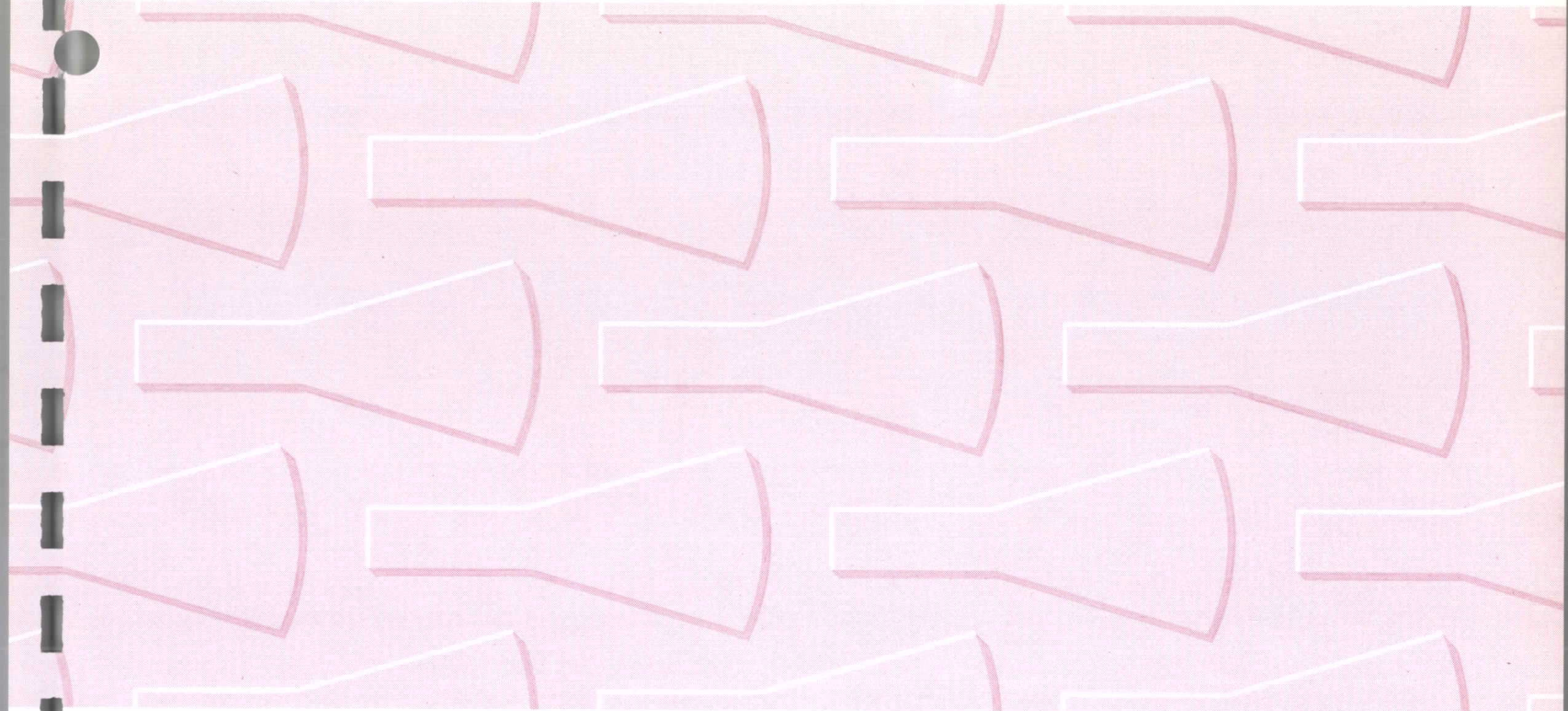
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



### SINGLE-BEAM X-Y CURVE TRACING

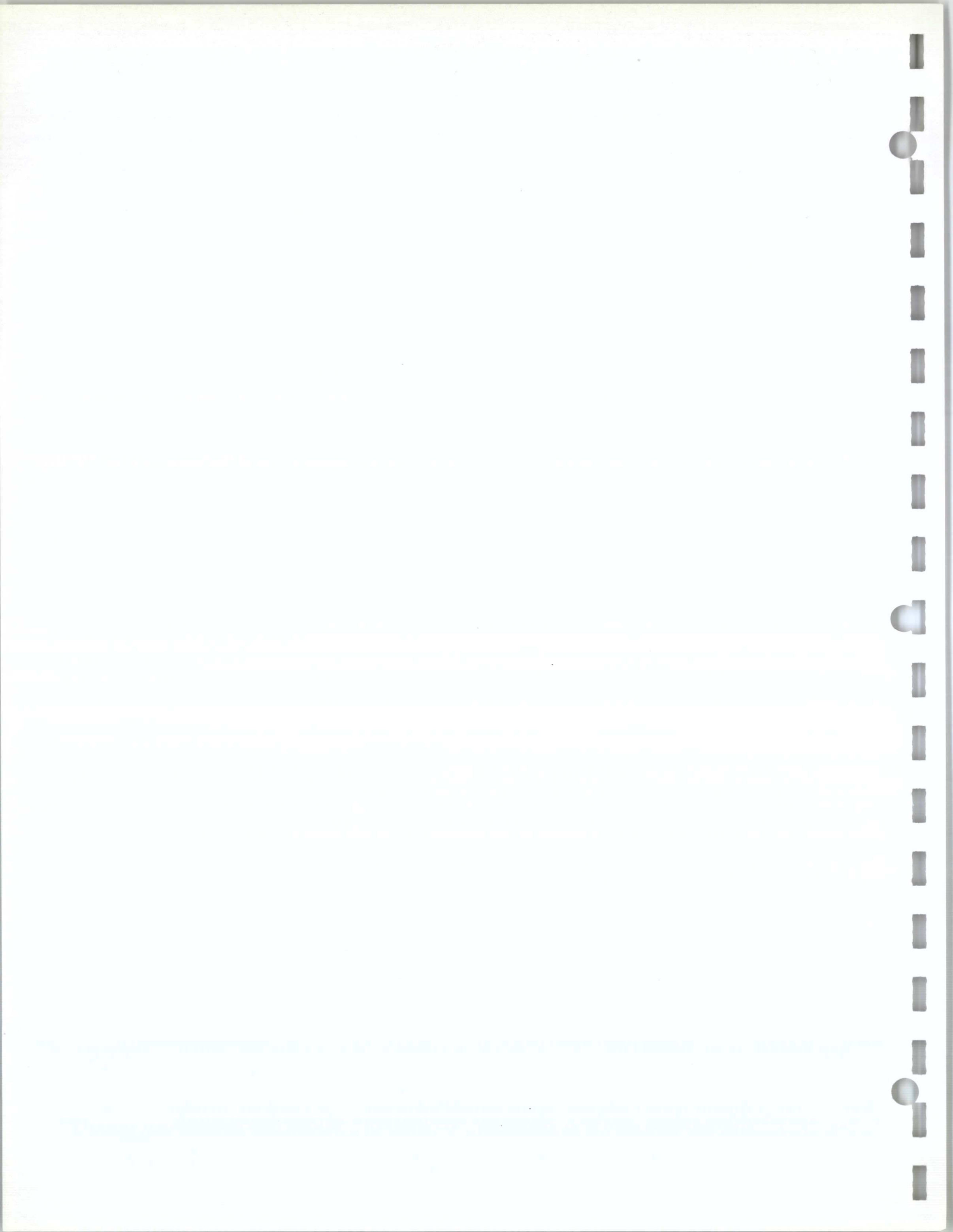
Frequency-comparison application: differential input of both X and Y amplifiers facilitates display of roulette patterns.





# HIGH-SPEED OSCILLOSCOPES







# NEW INSTRUMENT

## TYPE 507 OSCILLOSCOPE for High-Voltage Surge-Testing Applications

**Deflection Factor**—Approximately 50 v/cm to 500 v/cm

**Calibrated Vertical Positioning**

**24-kv Accelerating Potential**

**Risetime**—Approximately 5 millimicroseconds

**Sweep Range**—0.02  $\mu\text{sec}/\text{cm}$  to 50  $\mu\text{sec}/\text{cm}$

**6-cm by 10-cm Deflection**

### GENERAL DESCRIPTION

The Tektronix Type 507 is a specialized oscilloscope, designed primarily for high-voltage surge testing as applied to power transformers, high-voltage insulators, lightning arresters, and their associated design and acceptance tests. Both Indicator Unit and Power Supply are mounted on a Type 500A Scope-Mobile for convenience and mobility.

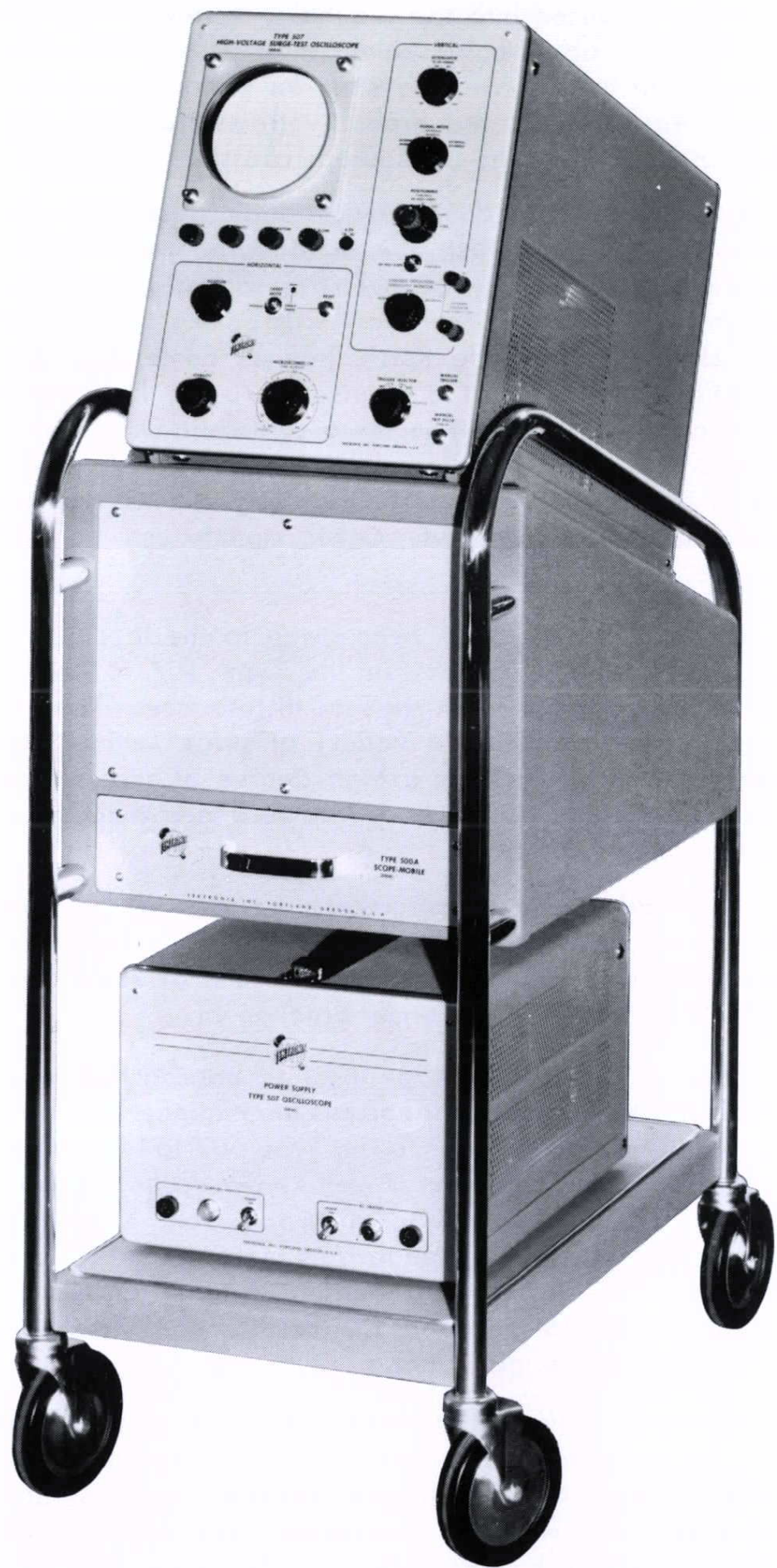
### VERTICAL-DEFLECTION SYSTEM

**Risetime**—A passive damping network inserted in the deflection leads to the crt is adjusted for optimum transient response (without overshoot or ringing) of 5 m $\mu\text{s}$ .

**Deflection Factor**—The Tektronix Type T507P11 crt deflection factor is approximately 50 v/cm.

**Step Attenuator**—The input signal is connected to a series voltage-divider chain of ten equal resistors (normally 7.2 ohms each) mounted on a tap switch. The ratio of signal applied to the deflection plates can be selected by the tap switch from 10% to 100% in 10% steps. The 72-ohm input impedance presented by the divider chain properly terminates Amphenol Type 21-125 coaxial cable. Step attenuator impedances designed to properly terminate other cable impedances as low as 50 ohms can be provided on request. Contact your Tektronix Field Engineer or Representative for information.

The vertical-input system will withstand crest voltages of 3 kv of the standard 1.5 x 40  $\mu\text{sec}$  surge-testing waveform. Voltage-breakdown and heat-dissipation



limitations must be considered before impressing signals greater than 3 kv and/or longer than 40  $\mu\text{sec}$ .

**Vertical Input** —A standard UHF signal-input connector is located on the rear of the instrument.

**Signal Delay**—Two standard UHF connectors are provided on the rear of the Type 507 for insertion of an external length of delay cable into the vertical-input signal circuit. Choice of the appropriate length and type of cable is at the discretion of the user. No delay cable is furnished with the Type 507.



# TYPE 507 OSCILLOSCOPE

**NOTE: Ground Voltage Transients**—Due to the physical configurations and electrical parameters of the apparatus used in surge testing, large voltage transients are often induced into the grounding system. Since the oscilloscope signal-cable shield must be connected to some point in this ground system for potential and current measurements, the ground-voltage transients will be impressed upon the oscilloscope chassis.

Two undesirable consequences may arise from the ground transients: First, the oscilloscope power-transformer insulation may be overstressed, causing breakdown. Second, a current flow will be set up through the chassis capacity to earth, power source, and any ground conductor that is connected to the instrument. Such circulating currents in the oscilloscope chassis may disturb the proper operation of the instrument. Ordinarily the sweep and crt-unblanking circuits will be most noticeably affected. Other circuits can be disturbed also.

Especially attention has been given to the layout and grounding of the circuitry in the Type 507 to ensure minimum sensitivity to extraneous disturbances. The excellent performance in a variety of surge testing laboratories indicates that a high degree of success has been reached in the Type 507 toward accommodating ground disturbances.

As in all practical instruments, however, there must be a limit to the ground voltages which the Type 507 can withstand. Our tests indicate a limit of 2000 crest volts to ground for transformer breakdown.

Once the ground-voltage limit is approached in a particular surge-testing apparatus the engineer will wish to employ means exterior to the Type 507 to reduce the impressed voltages. Several well known techniques are in use for isolating the oscilloscope from circulating ground currents. These range from motor generator sets for power line isolation to multiple shielded enclosures large enough to surround the oscilloscope, operator, and 60-cps power generator.

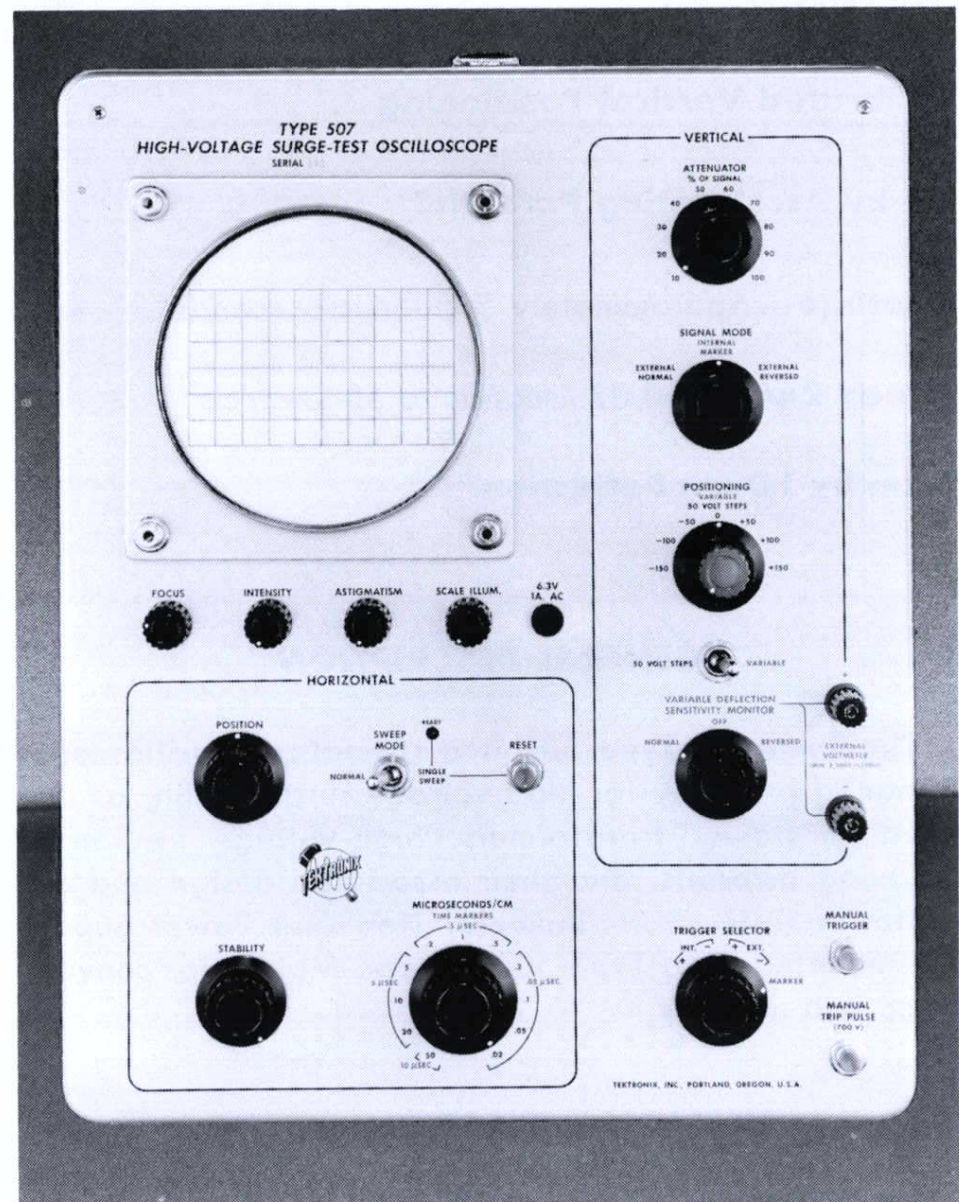
Tektronix fully realizes that instrument performance can be accurately evaluated only under the conditions of actual use. As a specialized instrument the Type 507 represents an important investment. We suggest that the prospective buyer contact his Tektronix Field Engineer or Engineering Representative and arrange for a demonstration. His address is listed in the back pages of this catalog.

**Polarity Switch**—A three-position switch reverses the deflection-plate polarity. The center position is used to apply markers for photographing time references.

**Positioning Switch**—The Type 507 has a seven-step vertical-position switch with 50-v steps of  $-150$  v,  $-100$  v,  $-50$  v,  $0$ ,  $+50$  v,  $+100$  v, and  $+150$  v. A

two-position switch selects either 50-v steps or continuously variable adjustment.

**External Voltmeter Connectors**—Terminals are provided for a high-impedance ( $5000 \Omega/\text{volt}$ ) dc voltmeter, permitting vertical calibration when using the variable positioning.



## HORIZONTAL DEFLECTION SYSTEM

**Calibrated Linear Sweep Rates**—The sweep waveform is generated by a boot-strap circuit and an inverter stage for balanced deflection. Eleven fixed, calibrated sweep rates... 20, 50, 100, 200, 500, millimicroseconds/cm, 1, 2, 5, 10, 20, and 50  $\mu\text{sec}/\text{cm}$  are available.

**Trigger Selection**—A five-position front-panel switch selects a trigger, external or internal of either positive or negative polarity. The marker position is used when time markers are desired.

**Trigger Amplitude**—A signal of 100-v to 3-kv amplitude is required for both internal triggering and triggering with an external signal.

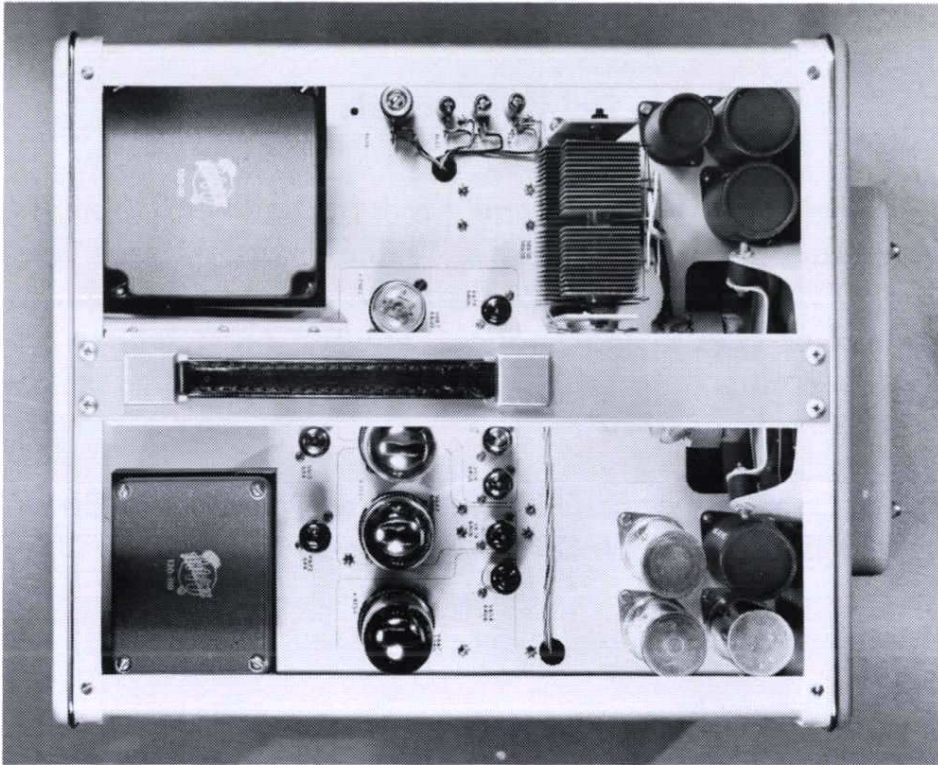
**Sweep Mode**—When the switch is in the single-sweep position, pressing the RESET button arms the sweep circuit. The sweep then can be triggered internally, by MANUAL TRIGGER, or by an external trigger.



# TYPE 507 OSCILLOSCOPE

## POWER SUPPLY

**Low Voltage**—The low-voltage power supply is separate from the indicator unit, supplying power to it by an interconnecting cable. All dc supplies are electronically regulated to ensure stable operation over line-voltage variations from 105 to 125 v.



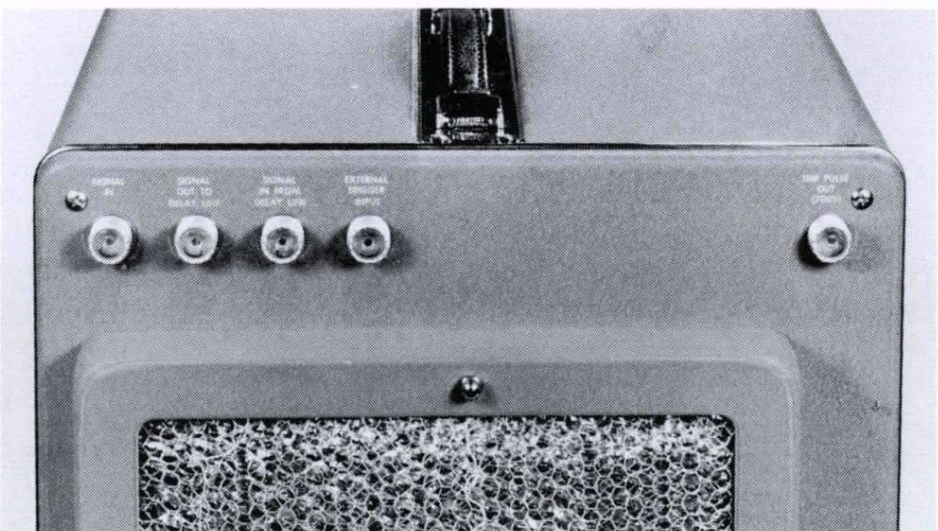
**High Voltage**—Accelerating potentials for the crt are obtained from an oil-filled oscillator-type supply, all voltages electronically regulated to ensure stable operation for both load and line changes.

## OTHER CHARACTERISTICS

**Cathode-Ray Tube**—The Type 507 uses the new Tektronix T507P crt. A P11 phosphor is normally furnished. P1, P2, and P7 are available as optional phosphors. Some other phosphors are available upon request.

**Accelerating Potential**—With its 24-kv accelerating potential and high-speed sweeps, the Type 507 is well suited to single-sweep applications involving transients of very short duration.

**Time Markers**—Markers are available as a function of the MICROSECONDS/CM switch for convenient calibration of the sweep. The 0.05- $\mu$ sec time mark is available at sweep speeds from 0.02  $\mu$ sec/cm to 0.2  $\mu$ sec/cm,



cm, 0.5- $\mu$ sec from 0.5  $\mu$ sec/cm to 2  $\mu$ sec/cm, 5- $\mu$ sec from 5  $\mu$ sec/cm to 20  $\mu$ sec/cm, and 10- $\mu$ sec at 50  $\mu$ sec/cm. These are useful as references when photographing pulses.

**Trip Pulse For Manual Triggering**—This is intended for use in triggering a trip-pulse generator. A pulse of approximately 700-v amplitude and 5- $\mu$ sec width is available at the output connector. Pulse amplitude and width may be affected somewhat by the length of the cable used.

**Connectors**—Standard UHF connectors for Signal In, Signal Out To Delay Line, Signal In From Delay Line, Trip Pulse Out, and External Trigger In are located at the rear of the instrument. 6.3 v ac at 1 amp is available through a front-panel pin jack.

**Illuminated Graticule**—An edge-lighted graticule is marked in centimeter squares, 6 vertical and 10 horizontal, for convenience in making time and amplitude measurements. This graticule is removable. Illumination is controlled by a front-panel knob.

## ELECTRON-TUBE COMPLEMENT

Trigger amplifier	2	6AU6
Trigger limiter		6CL6
Trigger amplifier		6CL6
Trip-pulse generator		2D21
Trigger lockout		2D21
Coupling diode		6X4
Multivibrator	2	6CL6
Duty-cycle limiter		6AN8
Positive gate-out CF		6BQ7A
Voltage setting CF		6AS5
Unblanking amplifier	2	6CL6
Unblanking CF		12BH7
Sweep decoupling diode		6X4
Sweep boot-strap	2	12BH7
Boot-strap CF		12BH7
Sweep clamp	2	6CL6
Marker rate multivibrator		6BQ7A
Trigger CF & voltage setting CF		6BQ7A
Marker generator & amplifier		6AN8
Marker amplifier		6CL6
Clamp diode		6AL5
Voltage-setting CF		12AU7
Negative sweep amplifier		6AG7
DC restorers		6AL5
High-voltage rectifiers	5	1X2
Regulator amplifier		12AU7
High-voltage time delay		6C4
High-voltage filament oscillator		6AQ5
High-voltage oscillator		6AU5
Cathode-ray tube		T507P11
Regulator amplifiers	4	6AU6
Series regulator		6AU5
Low-voltage rectifiers	2	6X4
Voltage reference		5651
Series regulator		6080



# TYPE 507 OSCILLOSCOPE

## MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and cabinet.

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

Dimensions—Indicator unit: 16 $\frac{3}{4}$ " high, 13" wide, 23 $\frac{5}{8}$ " deep. Power supply unit: 10 $\frac{1}{2}$ " high, 13" wide, 17 $\frac{1}{2}$ " deep.

Weight—Indicator unit: 50 pounds. Power supply unit: 39 pounds. Scope-Mobile: 35 pounds.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 600 watts.

**TYPE 507 . . . . . \$3000.**

- Includes: 1—Type 500A Scope-Mobile  
1—Common bus ground connector  
1—3-conductor power cord (161-010)

- 1—Interconnecting power cable (012-032)  
1—Instruction manual

## Optional Phosphors

P11 phosphor normally furnished.

P1, P2, P7 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 517A OSCILLOSCOPE

## for High-Speed Pulse Application

### Excellent Transient Response

7-millimicrosecond risetime.

### Sweep Range

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

### Single Sweep Operation

Lockout-Reset Circuitry for one shot recording

### Vertical Deflection Factor

0.05 v/cm.

### 24-kv Accelerating Potential

Writing Rate—1100 cm/ $\mu\text{sec}$ .

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

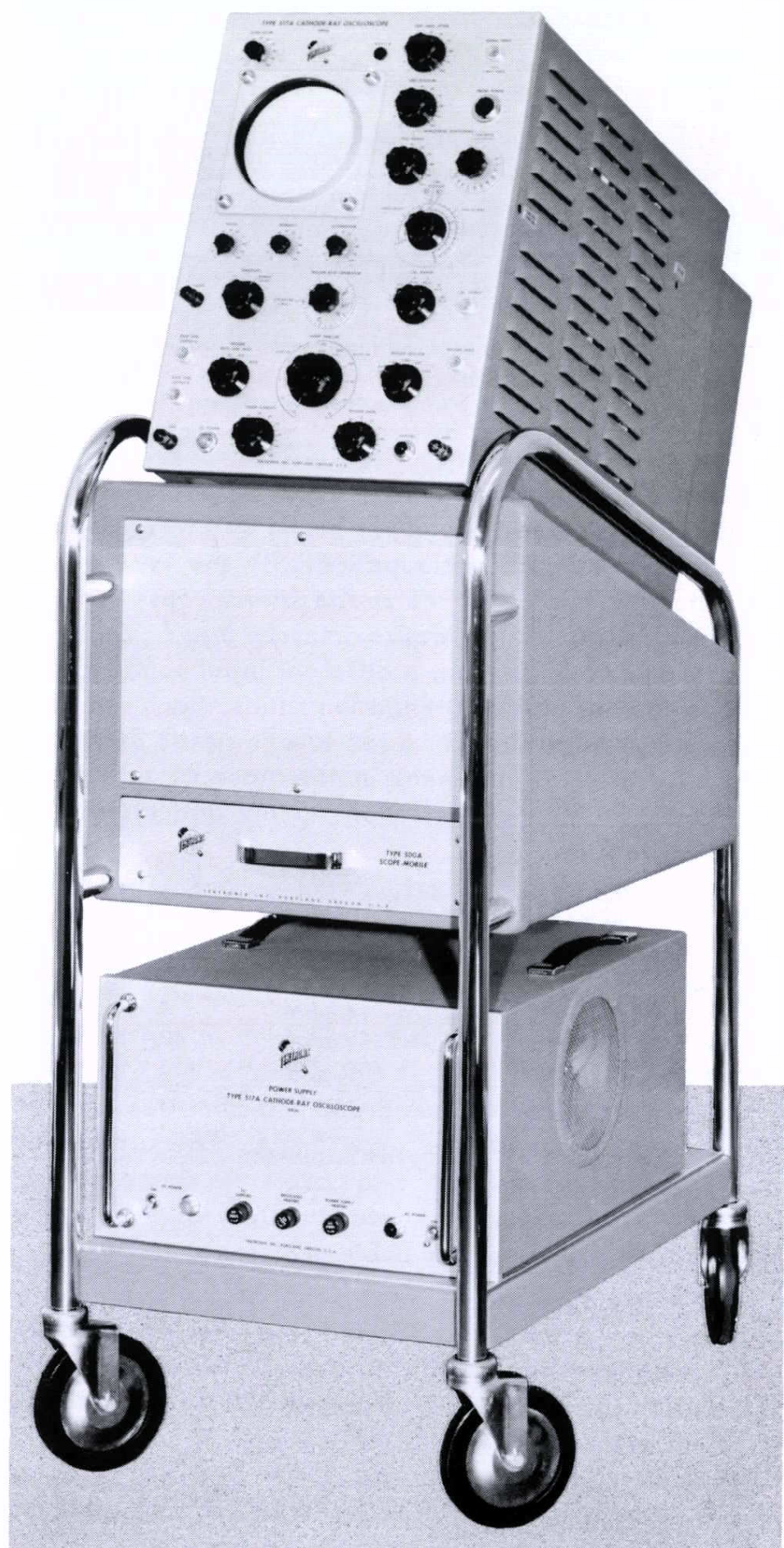
### Highly Mobile

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, T517P, 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.

The 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

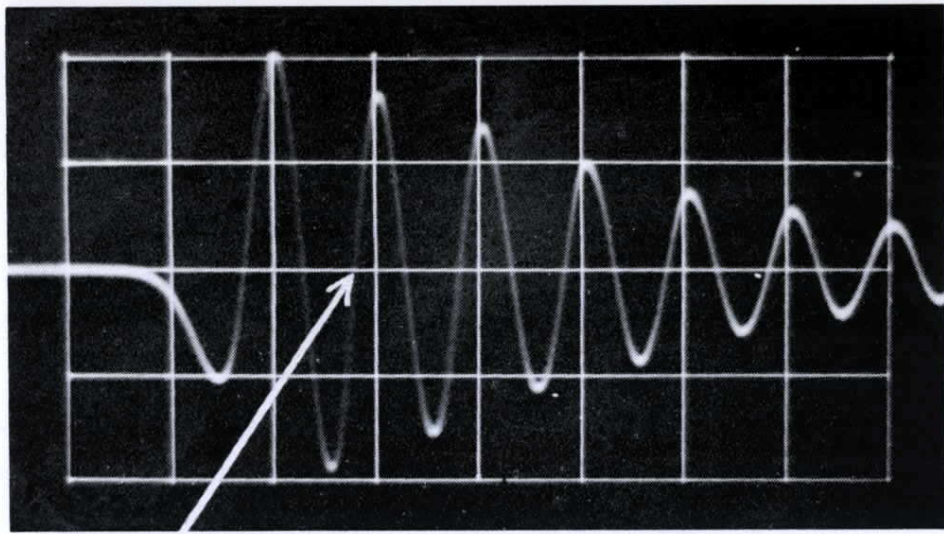
**Distributed Amplifier**—A 5-stage distributed amplifier is used to derive a transient-response risetime of 7 millimicroseconds.

**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/ $\mu$ sec writing-rate point on 100-mc damped oscillation, displayed on single 0.01  $\mu$ sec/cm sweep of Type 517A Oscilloscope with T517P11 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.

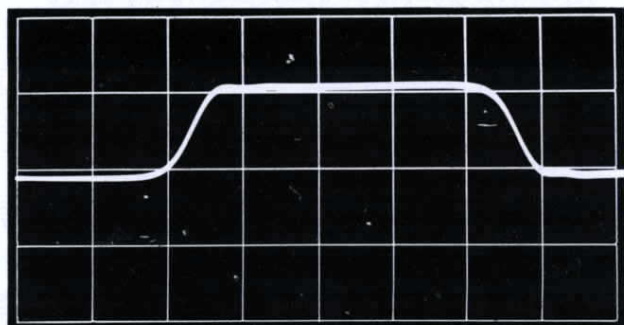
**Cathode-Follower Probe**—To provide higher input impedances, a cathode-follower probe and three capacitive attenuator heads are supplied with the Type 517A. The input impedance of the probe alone consists of 12 megohms paralleled by approximately 5  $\mu$ mf. Each attenuator head will present a different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

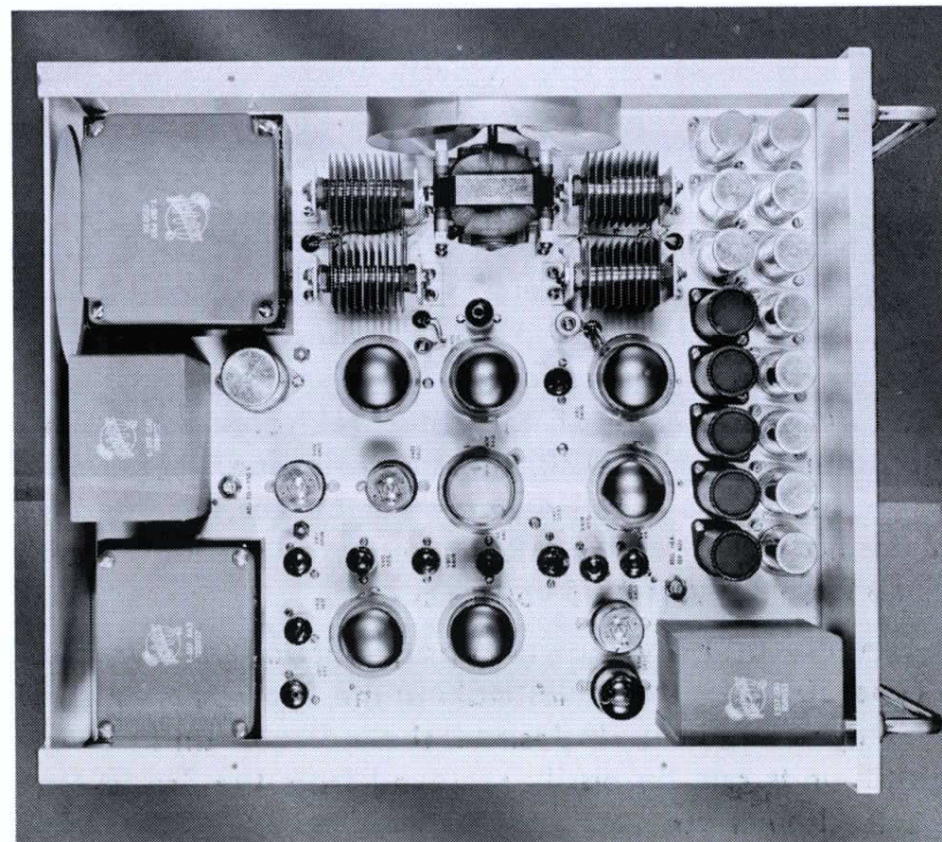
**Calibrated Sweep Rates**—The basic sweep waveform is generated by a boot-strap circuit with an inverter stage for balanced deflection. Eleven fixed, calibrated sweep rates accurate within 2% . . . 10, 20, 50, 100, 200, 500 millimicrosecond/cm, 1, 2, 5, 10, 20  $\mu$ sec/cm are available at 24 kv accelerating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

**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.

**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  $\mu$ sec.





# TYPE 517A OSCILLOSCOPE

**Automatic Duty-Cycle Limiter**—The maximum duty cycle of the sweep system is automatically limited to about 30% to avoid exceeding the dissipation limits of some of the sweep circuit components.

## POWER SUPPLY

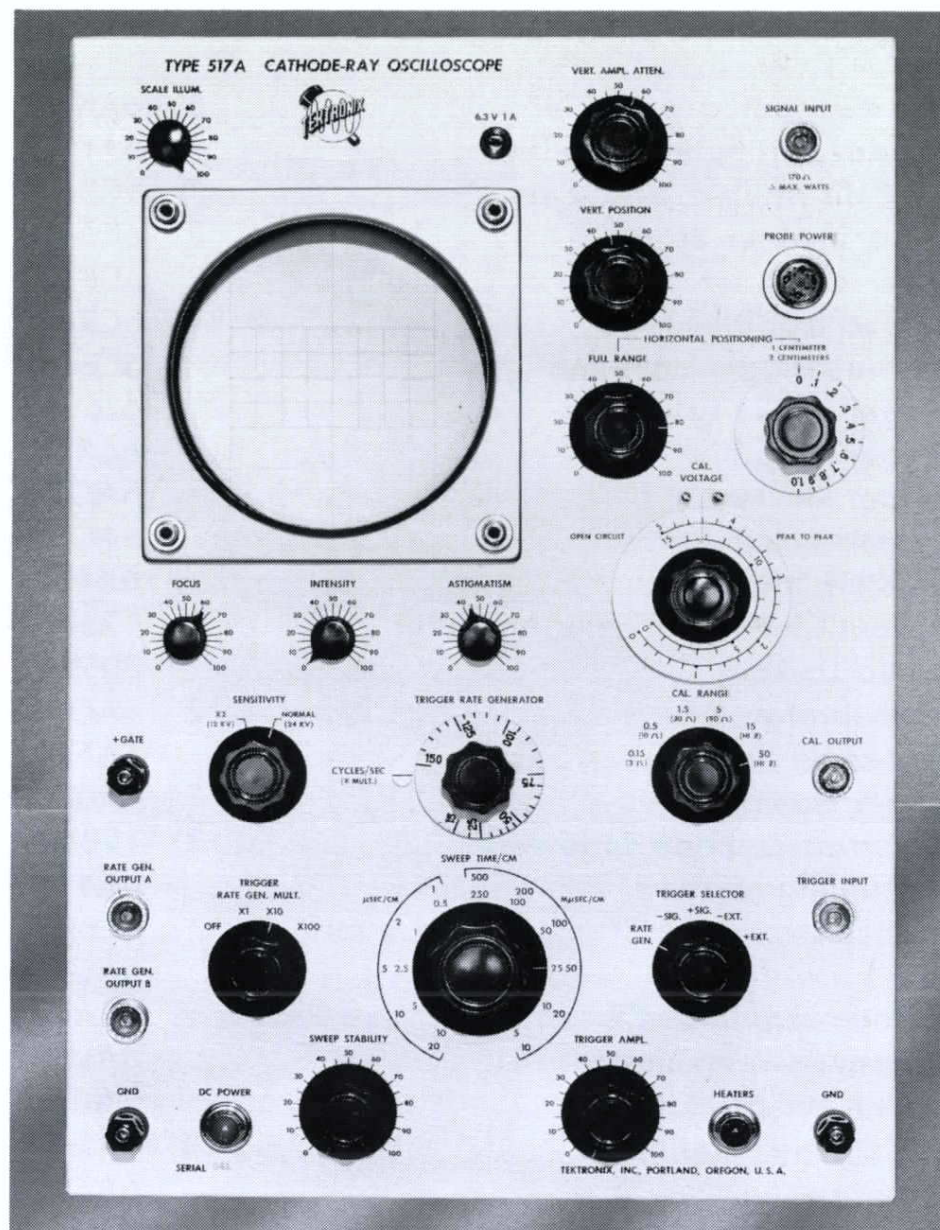
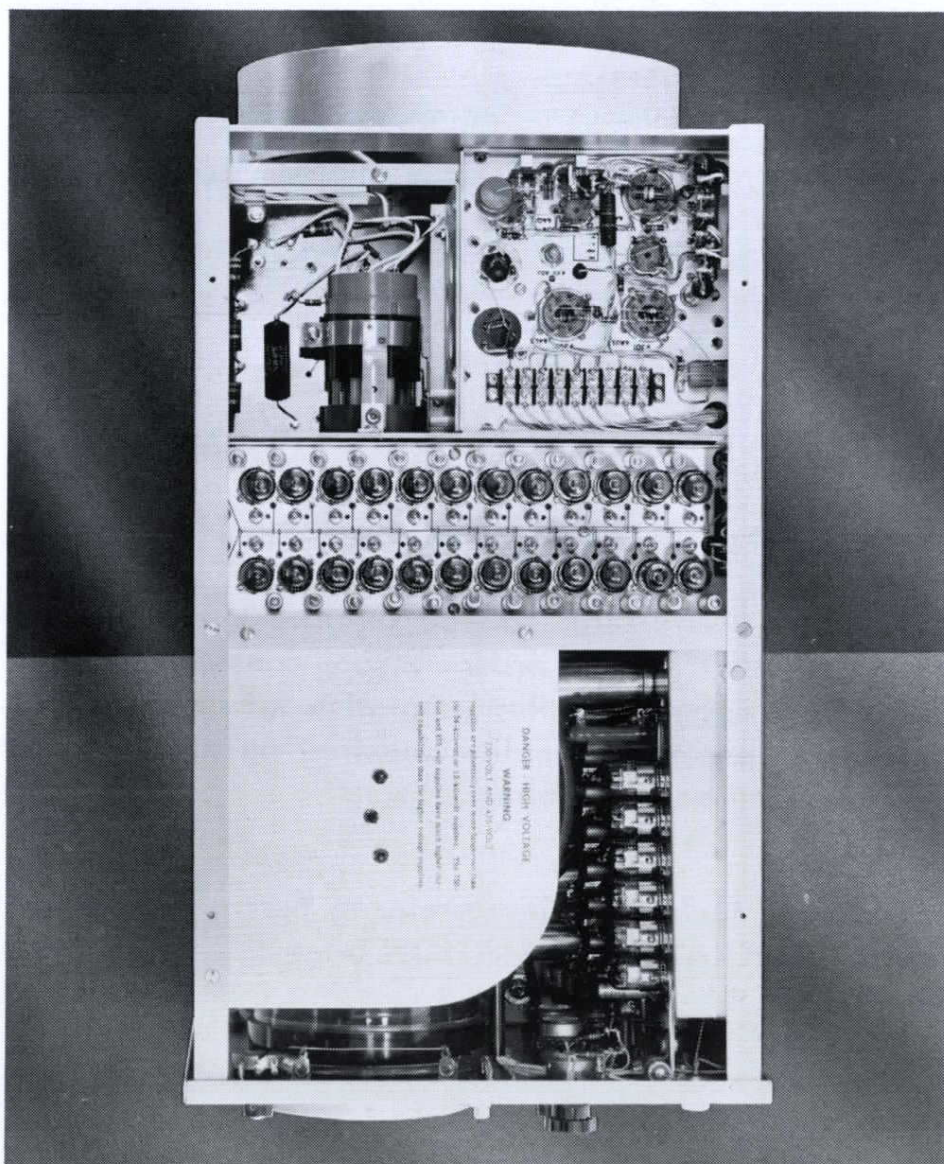
**Low Voltage**—The low-voltage power supply is separate from the indicator unit, supplying power to it by an inter-connecting cable. All dc supplies are electronically regulated and heaters in the indicator unit are regulated by a saturable-reactor method to insure stable operation over line-voltage 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 cali-



brated 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, T517P. The T517P 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. P1, P2, or P7 can be furnished instead if desired. Some other phosphors are available on special order.

**Output Waveforms**—In addition to the two trigger-rate generator outputs and calibrator output, a +GATE waveform of approximately 30 volts amplitude is available. Its duration is approximately equal to the sweep being generated. Risettime is 0.03  $\mu$ 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.



# TYPE 517A OSCILLOSCOPE

## 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
Trigger amplifier	6	6AK5
Trigger limiter		6AG7
Trigger switch		6AG7
Coupling diode		6X4
Lockout CF and Indicator amplifier		12BH7
Sweep Lockout		2D21
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 . . . . . T517P11

## MECHANICAL SPECIFICATIONS

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

Construction—Aluminum-alloy chassis and cabinet.

Finish—Photo-etched anodized panel, blue 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: 35 pounds.

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

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

Includes: 1—Type 500A Scope-Mobile  
1—P170CF cathode-follower probe  
1—B170A step attenuator  
1—P170 coaxial cable  
1—H510 viewing hood  
1—BE510 bezel  
1—3-conductor power cord (161-010)  
1—Interconnecting power cable (012-032)  
1—Instruction manual

## Optional Phosphors

P11 phosphor normally furnished.  
P1, P2, P7 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 Ship-ment, GENERAL INFORMATION** page.)





# NEW INSTRUMENT

## TYPE 581 CATHODE-RAY OSCILLOSCOPE 3.5-Millimicrosecond Risetime

### Fast-Rise Vertical Amplifier

**Passband**—DC to approximately 100 MC.

**Sensitivity**—Basic deflection factor 0.1 v/cm with Type 80 Plug-In Pre-amplifier and P80 Probe.

**Versatility**—Designed for plug-in pre-amplifiers.

### High-Speed Sweeps

**Range**—0.05  $\mu\text{sec/cm}$  to 2 sec/cm in 24 calibrated steps.

**Magnifier**—5-x, extends calibrated range to 0.01  $\mu\text{sec/cm}$ .

**Triggering**—Preset or manual stability control, with amplitude-level selection.

### 10-KV Accelerating Potential

#### GENERAL DESCRIPTION

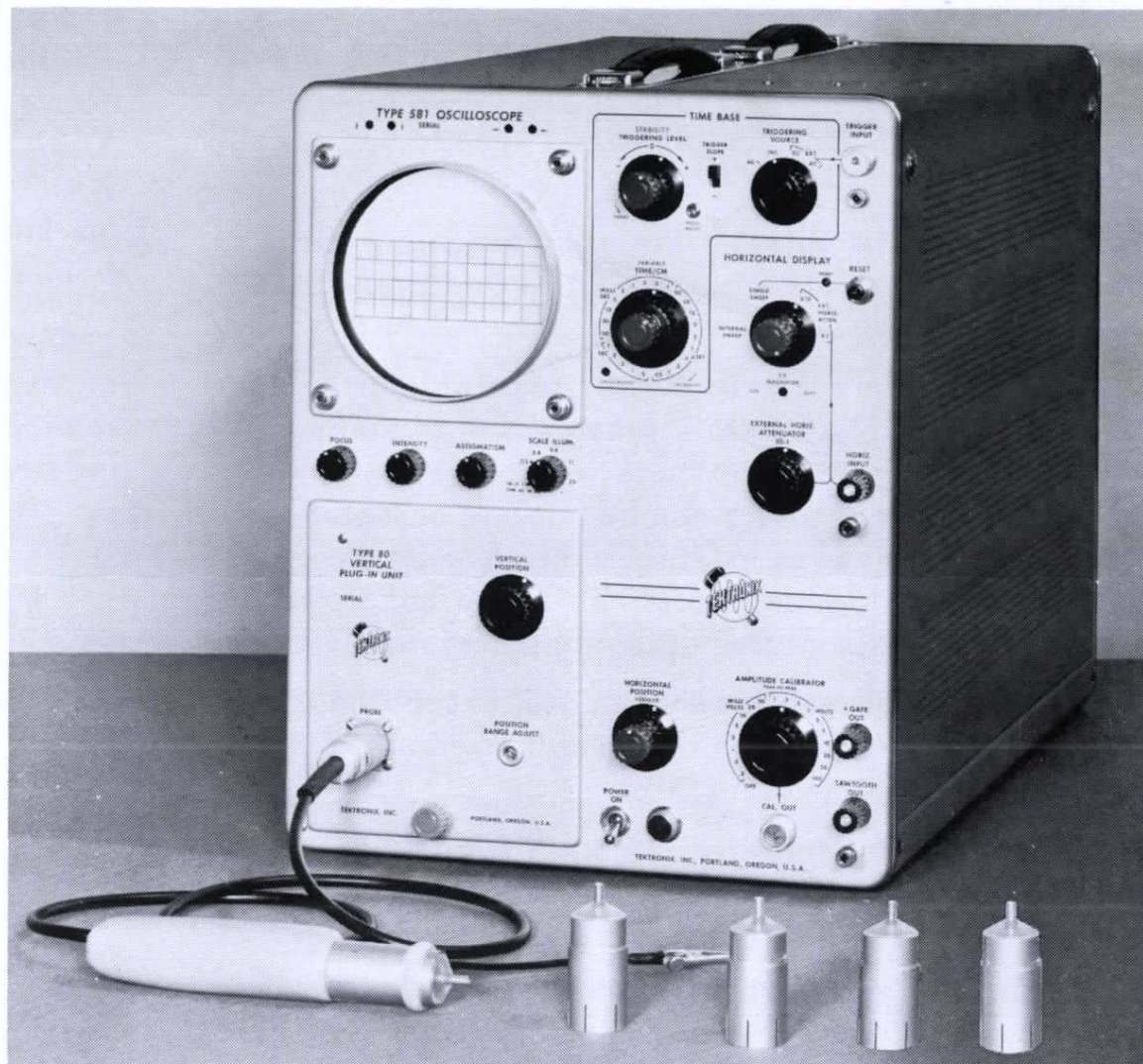
The Tektronix Type 581 is a new laboratory oscilloscope with many of the capabilities needed for rapid advancement of the electronic art. Its 3.5-millimicrosecond risetime, 0.1 v/cm sensitivity, and 0.01  $\mu\text{sec/cm}$  sweep time are excellent features for modern high-speed pulse applications. Although the Type 581 has these unique features, it also has the slow sweeps, versatile triggering, and dc-coupled vertical deflection system needed for most general-purpose laboratory work. Versatility is further improved by the plug-in vertical preamplifier feature.

#### VERTICAL-DEFLECTION SYSTEM

The dc-coupled main vertical amplifier of the Type 581 consists of a two-section distributed amplifier, a balanced, fixed delay line, and a twin-pentode output stage. This system is designed for plug-in preamplifiers, and a preamplifier must be plugged in to operate the Type 581.

#### Plug-In Preamplifier and Probe

The Type 80 Plug-In Preamplifier and Type P80 Probe equip the Type 581 for fast-rise applications at sensitivities up to 0.1 v/cm. Risetime is 3.5 m $\mu\text{sec}$ , passband is dc to approximately 100 mc. Vertical positioning is controlled with a front-panel knob. The probe is a



cathode-anode follower type with an input capacitance of less than 10  $\mu\text{mf}$  and input resistance of 100 kilohms. Five snap-on attenuator heads are supplied with the probe, providing deflection factors of 0.2, 0.5, 1, 2, and 5 v/cm. Approximate input capacitances and resistances are: 5  $\mu\text{mf}$ , 200 kilohms at 0.2 v/cm; 2.5  $\mu\text{mf}$ , 500 kilohms at 0.5 v/cm; 1.5  $\mu\text{mf}$ , 1 megohm at 1 v/cm; 1.5  $\mu\text{mf}$ , 2 megohms at 2 v/cm; 1.5  $\mu\text{mf}$ , 5 megohms at 5 v/cm. Adapters are available for coupling the probe directly to a coaxial cable.

#### HORIZONTAL-DEFLECTION SYSTEM

The sweep generator used in the Type 581 is the Miller runup type, faster but otherwise similar to that used in the Tektronix Type 541. The horizontal amplifier is the same type as that used in the Tektronix Type 541.

**Calibrated Sweep Rates**—Twenty-four direct-reading calibrated sweep rates are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50  $\mu\text{sec/cm}$ , 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, 1, 2 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment between steps and extends the slow sweeps to 5 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration accuracy of the fixed sweeps is within 3%.

**Sweep Magnifier**—5-x magnifier increases the calibrated sweep time to 0.01  $\mu\text{sec/cm}$ . Sweep magnifica-



# TYPE 581 OSCILLOSCOPE

tion is obtained by increasing the gain of the sweep output amplifier by a factor of five. 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.

**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 and preset stability control.

**Amplitude-Level Selection**—Adjustable amplitude-level and stability controls provide for triggering the sweep at a selected amplitude level on the triggering waveform. Trigger source can be internal or the line frequency ac-coupled, or external either ac-coupled 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 adjustment.

**Trigger Requirements**—Internal triggering—a signal large enough to cause a 2-mm deflection. External triggering—a signal of 0.2 v to 20 v.

**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.

**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 approximately 240 kc. Input impedance is approximately 47  $\mu\mu\text{f}$  paralleled by 1 megohm.

## OTHER CHARACTERISTICS

**Cathode-Ray Tube**—The Type 581 uses the Tektronix Type T581 cathode-ray tube. The T581 is a 5" flat-faced metallized lumped-constant traveling-wave 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 581, a P2 screen is normally furnished with the instrument. Accelerating potential is 10 kv.

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

**Regulated Power Supply**—Electronic regulation compensates for line-voltage variations between 105 and 125 v, and for current-demand differences. Regulated dc is supplied to heaters in the plug-in preamplifiers and probe by a transistorized regulator circuit.

**Amplitude Calibrator**—A square-wave calibration voltage is available through a front-panel coaxial connector. Eighteen direct-reading fixed steps—0.2, 0.5, 1, 2, 5, 10, 20, 50 millivolts, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 volts peak-to-peak are provided by the single-knob control. 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.

**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.

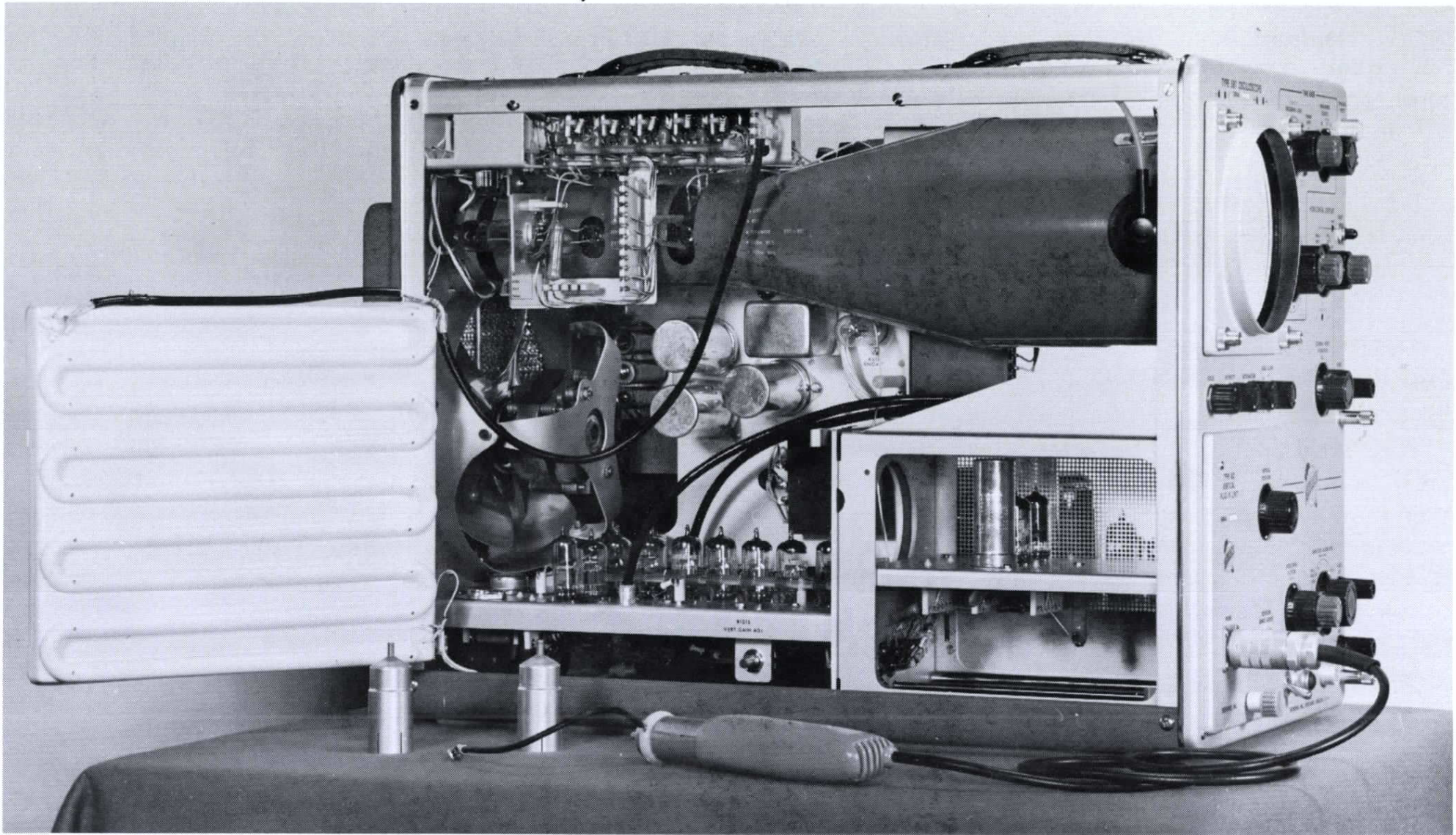
## ELECTRON-TUBES AND SEMICONDUCTORS

Vertical input amplifiers . . . . .	7	6DJ8
Beam position indicator amplifiers . . . . .		6DJ8
Driver amplifiers . . . . .	5	6DJ8
Output amplifier . . . . .		6939
Trigger amplifiers . . . . .	2	6CY5
Trigger CF . . . . .		6DJ8
Trigger amplifiers . . . . .	2	6EW6
Trigger shaper . . . . .		6DJ8
Stability . . . . .		6AU6
Hold-off and unblinking CF . . . . .		6DJ8
Sweep-gating multivibrator and CF . . . . .		6DJ8
Sweep-gating multivibrator . . . . .		6DJ8
Disconnect diodes . . . . .		6AL5
Gate-out and sawtooth-out CF . . . . .		6DJ8
Dual-trace blanking and trigger amplifiers . . . . .		6DJ8
Sweep generator . . . . .		6CL6
Sweep generator CF . . . . .		6DJ8
External horizontal and dc level CF . . . . .		6DJ8
External horizontal amplifier . . . . .		6DJ8
Horizontal input and driver CF . . . . .		6DJ8
Horizontal amplifier and CF . . . . .	2	6DJ8
Sweep start compensator . . . . .		6CL6
Calibrator multivibrator . . . . .		6AU6
Calibrator multivibrator and CF . . . . .		12AU7
Voltage rectifiers . . . . .	16	1N1566
Voltage reference . . . . .		5651
Comparator amplifiers . . . . .	2	12AX7
Regulator amplifiers . . . . .	5	6AU6
Series regulators . . . . .	4	12B4





# TYPE 581 OSCILLOSCOPE



Series regulators .....	2	6080
High-voltage oscillator .....		6AU5
Regulator .....		12AU7
High-voltage rectifiers .....	5	5642
Cathode-ray tube .....		T581P2

#### Type 80 Plug-In Unit

Voltage regulator .....		6AU6
Voltage regulator .....		6DJ8

#### Probe

Cathode-anode follower .....	6688/E180F
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### MECHANICAL SPECIFICATIONS

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

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—61 pounds.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 640 watts maximum.

**Type 581, without plug-in units ..... \$1375**

- Includes: 2—Binding post adapters (013-004)
- 1—Test lead (012-031)
- 1—Green filter (378-514)
- 1—3-conductor power cord (161-008)
- 1—Instruction manual

**Type 80 Plug-In Preamp** ..... **\$50**

Includes: 1—Instruction manual

**Type P80 Probe** ..... **\$100**

Includes: 5 probe attenuator heads—2-x, 5-x, 10-x, 20-x, 50-x.

Note: Both Preamp and probe are necessary to operate the Type 581.

### Recommended Additional Accessories

Probe Adapter—probe to Type BNC connector (013-018) .....	\$5.00
Probe Adapter—probe to Type N connector (013-016) .....	\$4.00
Probe Adapter—probe to Type UHF connector (013-017) .....	\$4.00

### 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.

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





MEMORANDUM FOR THE RECORD

On 10/15/50, the Board of Directors met and discussed the proposed acquisition of the property located at 123 Main Street, New York, New York. The Board has approved the acquisition of the property for a purchase price of \$100,000.00.

The Board has also approved the execution of a purchase agreement with the seller, Mr. John Doe, for the acquisition of the property. The purchase agreement shall be subject to the approval of the Board of Directors.

The Board has further approved the execution of a deed of conveyance for the property, which shall be subject to the approval of the Board of Directors. The deed of conveyance shall be executed by the Board of Directors.

The Board has also approved the execution of a mortgage agreement for the property, which shall be subject to the approval of the Board of Directors. The mortgage agreement shall be executed by the Board of Directors.

The Board has further approved the execution of a lease agreement for the property, which shall be subject to the approval of the Board of Directors. The lease agreement shall be executed by the Board of Directors.

The Board has also approved the execution of a license agreement for the property, which shall be subject to the approval of the Board of Directors. The license agreement shall be executed by the Board of Directors.



# NEW INSTRUMENT

## TYPE 585 CATHODE-RAY OSCILLOSCOPE 3.5-Millimicrosecond Risetime, Sweep Delay

### Fast-Rise Vertical Amplifier

**Passband**—DC to approximately 100 MC.

**Sensitivity**—Basic deflection factor 0.1 v/cm with Type 80 Plug-In Preampfier and P80 Probe.

**Versatility**—Designed for plug-in pre-amplifiers.

### Sweep Delay

**Triggered (jitter free)**—delayed sweep is started by signal under observation.

**Conventional**—delayed sweep is started by delayed trigger.

**Range**—1  $\mu$ sec to 10 sec, continuously adjustable (2  $\mu$ sec/cm to 1 sec/cm).

### Two Time-Base Generators

**TIME BASE A**—0.05  $\mu$ sec/cm to 2 sec/cm in 24 calibrated steps, continuously variable from 0.05  $\mu$ sec/cm to 5 sec/cm. 5-x magnifier increases calibrated range to 0.01  $\mu$ sec/cm. Single-sweep provision for one-shot applications.

**TIME BASE B**—Also functions as delay generator. 18 calibrated steps from 2  $\mu$ sec/cm to 1 sec/cm.

### 10-KV Accelerating Potential

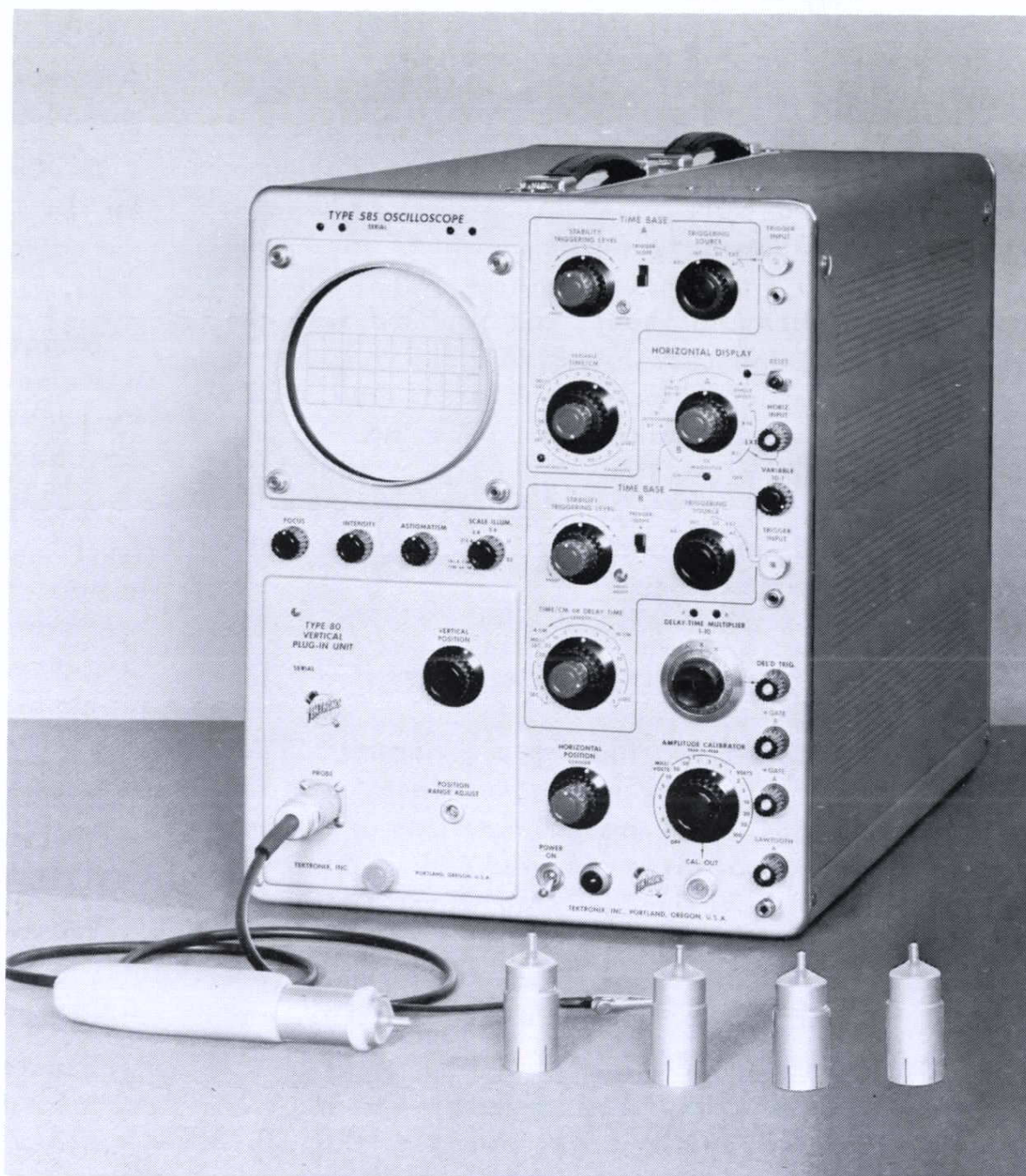
### GENERAL DESCRIPTION

The Type 585 has a second time-base generator which also functions as a sweep-delay generator, but it is otherwise similar to the Tektronix Type 581. In addition to the applications covered by the Type 581 (high-speed pulse, and most general-purpose laboratory work) the Type 585 is especially suited to applications involving sweep delay. The unusual versatility of this new oscilloscope is enhanced by the simplicity of operation fostered by functional panel layout and color-correlated controls.

### APPLICATIONS

In addition to the usual applications for a versatile DC-to-100 MC oscilloscope, sweep delay makes it possible to:

1. Make accurate incremental measurements along a complex waveform.
2. Display separate channels of a PTM system, with effects of time jitter removed, determining pulse



amplitude and shape under conditions of modulation.

3. Measure pulse-to-pulse intervals and amount of jitter on computer signals or any train of pulses.
  4. Make accurate time-difference measurements between pulse-in and pulse-out through an amplifying system.
  5. Display any selected individual line of a television composite signal.
  6. Measure time displacement, wave shape, and amplitude of individual channels in a telemetering system.
  7. Utilize effective calibrated sweep magnification up to the highest practical limit.
- Plus many more-specialized applications.

### VERTICAL-DEFLECTION SYSTEM

The dc-coupled main vertical amplifier of the Type 585 consists of a two-section distributed amplifier, a balanced, fixed delay line, and a twin-pentode output



# TYPE 585 OSCILLOSCOPE

stage. This system is designed for plug-in preamplifiers, and a preamplifier must be plugged in to operate the Type 585.

## Plug-In Preamplifier and Probe

The Type 80 Plug-In Preamplifier and Type P80 Probe equip the Type 585 for fast-rise applications at sensitivities up to 0.1 v/cm. Risetime is 3.5 m $\mu$ sec, passband is dc to approximately 100 mc. Vertical positioning is controlled with a front-panel knob. The probe is a cathode-anode follower type with an input capacitance of less than 10  $\mu\mu$ f and input resistance of 100 kilohms. Five snap-on attenuator heads are supplied with the probe, providing deflection factors of 0.2, 0.5, 1, 2, and 5 v/cm. Approximate input capacitances and resistances are: 5  $\mu\mu$ f, 200 kilohms at 0.2 v/cm; 2.5  $\mu\mu$ f, 500 kilohms at 0.5 v/cm; 1.5  $\mu\mu$ f, 1 megohm at 1 v/cm; 1.5  $\mu\mu$ f, 2 megohms at 2 v/cm; 1.5  $\mu\mu$ f, 5 megohms at 5 v/cm. Adapters are available for coupling the probe directly to a coaxial cable.

## HORIZONTAL-DEFLECTION SYSTEM

The Type 585 has two time-base generators. TIME BASE A is identical to the time-base generator in the Tektronix Type 581. TIME BASE B functions as a delay generator. The signal to be observed can be displayed on either time base in the following ways: TIME BASE B normal, TIME BASE B with trace brightening during the period that TIME BASE A is running, TIME BASE A delayed by TIME BASE B, TIME BASE A normal, and TIME BASE A single sweep.

**TIME BASE A Calibrated Sweeps**—Twenty-four direct-reading calibrated steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50  $\mu$ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, 1, 2 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment between steps and extends the slow sweeps to 5 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration accuracy of the fixed sweeps is within 3%.

**Single Sweep**—(TIME BASE A only) A RESET push button arms the sweep to fire on the next trigger to arrive. After firing once, the sweep is locked out and cannot fire again until rearmed by pressing the RESET button. The READY light indicates when the sweep is armed to fire on the next trigger.

**TIME BASE B Calibrated Sweeps**—Eighteen direct-reading calibrated steps are provided: 2, 5, 10, 20, 50  $\mu$ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, and 1 sec/cm. A sweep-length control adjusts the sweep length from 4 cm to 10 cm for the purpose of changing the sweep repetition rate. Variable sweep repetition rate makes TIME BASE B useful as a repetition-rate generator over the range of 0.1 cycles to 40 kc.

**Sweep Magnifier**—5-x magnifier increases the calibrated sweep time to 0.01  $\mu$ sec/cm. Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. Any one-fifth of the magnified sweep can be displayed on the screen by rotating the HORIZONTAL POSITION control. 5-x magnification is obtained on all ranges, for both time bases. Accuracy is within 5% of the displayed portion of the magnified sweep.

**DC-Coupled Unblanking**—DC coupling is provided for the unblanking waveforms, 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 and preset stability control. Triggering facilities are the same for both time bases.

**Amplitude-Level Selection**—Adjustable amplitude-level and stability controls provide for triggering the sweep at a selected amplitude level on the triggering waveform. Trigger source can be internal or the line frequency ac-coupled, or external either ac-coupled 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 adjustment.

**Trigger Requirements**—Internal triggering—a signal large enough to cause a 2-mm deflection. External triggering—a signal of 0.2 v to 20 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 approximately 240 kc. Input impedance is approximately 47  $\mu\mu$ f paralleled by 1 megohm.

## SWEEP DELAY

Sweep delay for TIME BASE A over the range of 1  $\mu$ -sec to 10 sec is derived from TIME BASE B by means of a pick-off circuit. A delayed trigger is generated at the pick-off point, which can be adjusted to any point on the sawtooth waveform generated by TIME BASE B. The DELAY-TIME MULTIPLIER, a ten-turn calibrated control, is used in conjunction with the TIME/CM switch for TIME BASE B to select the pick-off point and indicate the amount of delay. Accuracy of the fifteen calibrated time/cm steps from 2  $\mu$ sec/cm to 0.1 sec/cm is within 1%. Accuracy of the remaining three steps, 0.2, 0.5, and 1 sec/cm, is within 3%. For extreme accuracy any of the steps can be adjusted to an external standard. Incremental accuracy of the ten-turn calibrated control is within 0.2%.



# TYPE 585 OSCILLOSCOPE

**Triggered Operation**—When the triggering controls of TIME BASE A are adjusted so that the delayed trigger from TIME BASE B arms the sweep but does not start it, the next signal to arrive will start the sweep. Thus the delayed sweep is actually started by the signal under observation, resulting in a steady display even when time jitter or time modulation is present in the signal.

**Conventional Operation**—When the triggering controls of TIME BASE A are adjusted to permit the delayed trigger to start the sweep, the delayed sweep starts precisely at the pick-off point, its start delayed the amount of time indicated by the TIME BASE B time/cm switch and the DELAY-TIME MULTIPLIER. Any time modulation or time jitter on the signal will be magnified in proportion to the amount of sweep expansion, however jitter introduced by the delay and pick-off circuitry is less than one part in 20,000, making extremely large magnifications practical.

**Trace Brightening**—When the signal is displayed on TIME BASE B with the HORIZONTAL DISPLAY switch in the "B" INTENSIFIED BY "A" position, the unblanking pulse of TIME BASE A is added to that of TIME BASE B. Therefore the period of operation of TIME BASE A appears as a brightened portion on the display. This trace brightening serves to indicate both the point-in-time relationship between the delayed sweep and the original display, and the degree of magnification that will be achieved when the display is transferred to TIME BASE A.

## OTHER CHARACTERISTICS

**Cathode-Ray Tube**—The Type 585 uses the Tektronix Type T581 cathode-ray tube. The T581 is a 5" flat-faced metallized lumped-constant traveling-wave 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 585, a P2 screen is normally furnished with the instrument. Accelerating potential is 10 kv.

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

**Regulated Power Supply**—Electronic regulation compensates for line-voltage variations between 105 and 125 v, and for current-demand differences. Regulated dc is supplied to heaters in the plug-in preamplifier and probe by a transistorized regulator circuit.

**Amplitude Calibrator**—A square-wave calibration voltage is available through a front-panel coaxial connector. Eighteen direct-reading fixed steps—0.2, 0.5, 1, 2, 5, 10, 20, 50 millivolts, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 volts peak-to-peak are provided by the single-knob control. 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 from TIME BASE A at front-panel binding posts via cathode followers. A 20-v positive gate voltage from TIME BASE B and a delayed trigger are also available at front-panel connectors.

**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 TUBES AND SEMICONDUCTORS

### Vertical Amplifier

Vertical input amplifiers . . . . .	7	6DJ8
Beam Position indicator amplifiers . . . . .		6DJ8
Driver amplifiers . . . . .	5	6DJ8
Output amplifier . . . . .		6939
Trigger amplifiers . . . . .	2	6CY5
Trigger CF . . . . .		6DJ8

### Time-Base A Generator

Trigger amplifier . . . . .	2	6EW6
Trigger shaper . . . . .	2	6DJ8
Sweep-gating multivibrator and CF . . . . .		6DJ8
Sweep-gating multivibrator . . . . .		6DJ8
Unblank and hold-off CF . . . . .		6DJ8
Sawtooth and gate CF . . . . .		6DJ8
Lockout multivibrator . . . . .		6AU6
Hold-off CF and lockout multivibrator . . . . .		6DJ8
Delayed-trigger amplifier . . . . .		6AU6
Disconnect diodes . . . . .		6AL5
Miller runup . . . . .		6CL6
Runup CF . . . . .		6DJ8

### Time-Base B Generator

Trigger amplifier . . . . .		6DJ8
Trigger shaper . . . . .		6DJ8
Stability CF and hold-off CF . . . . .		6DJ8
Sweep-gating multivibrator and CF . . . . .		6DJ8
Sweep-gating multivibrator . . . . .		6AU6
Unblanking CF and gate CF . . . . .		6DJ8
Disconnect diodes . . . . .		12AL5
Miller runup . . . . .		12AU6
Runup CF and hold-off CF . . . . .		6DJ8

### Horizontal Amplifiers and Delay

Input and driver CF . . . . .		6DJ8
Sweep amplifiers and CF . . . . .	2	6DJ8
Current booster . . . . .		6CL8





# TYPE 585 OSCILLOSCOPE

External-input amplifier .....	6DJ8
Delay trigger .....	6DJ8
Delay pick-off .....	2 6AU6
Delay-trigger CF and current control ....	6DJ8

### Power Supplies

H.V. regulator amplifier .....	12AU7
H.V. oscillator .....	6AU5
H.V. rectifiers .....	5 5642
Comparators .....	2 12AX7
Voltage reference .....	5651
Regulator amplifiers .....	5 6AU6
Series regulators .....	4 12B4
Series regulators .....	2 6080
Rectifiers .....	16 1N1566

### Miscellaneous

Calibrator multivibrator .....	6AU6
Calibrator multivibrator and CF .....	12AU7
Alternate-trace sync amplifier and trace blank .....	6DJ8
Cathode-ray tube .....	T581P2

### Type 80 Plug-In Unit

Voltage regulator .....	6AU6
Voltage regulator .....	6DJ8

### Probe

Cathode-anode follower .....	6688/E180F
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## MECHANICAL SPECIFICATIONS

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

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—65 pounds.

Power Requirements—105-125 v or 210-250 v, 50-60 cycles, 725 watts maximum.

**Type 585, without plug-in units ..... \$1675**

- Includes: 2—Binding-post adapters (013-004)
- 1—Test lead (012-031)
- 1—Green filter (378-514)
- 1—Instruction manual
- 1—3-conductor power cord (161-008)

**Type 80 Plug-In Preampifier ..... \$50**

Includes: 1—Instruction manual

**Type P80 Probe ..... \$100**

Includes: 5 probe attenuator heads—2-x, 5-x, 10-x, 20-x, 50-x.

Note: Both Preampifier and Probe are necessary to operate the Type 585.

## Recommended Additional Accessories

Probe Adapter—probe to Type BNC connector (013-018) ..... \$5.00

Probe Adapter—probe to Type N connector (013-016) ..... \$4.00

Probe Adapter—probe to Type UHF connector (013-017) ..... \$4.00

## 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.

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

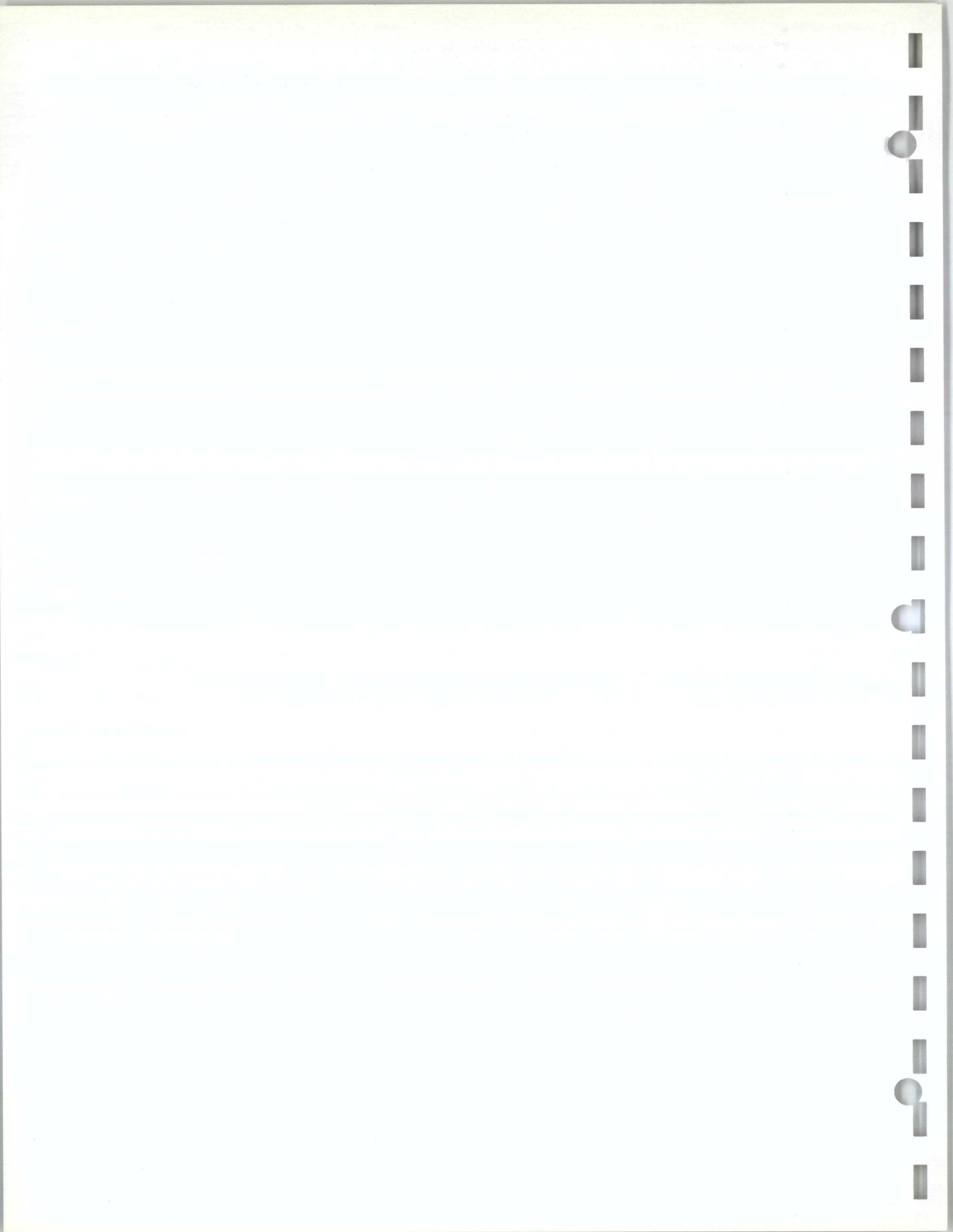






TELEVISION OSCILLOSCOPES

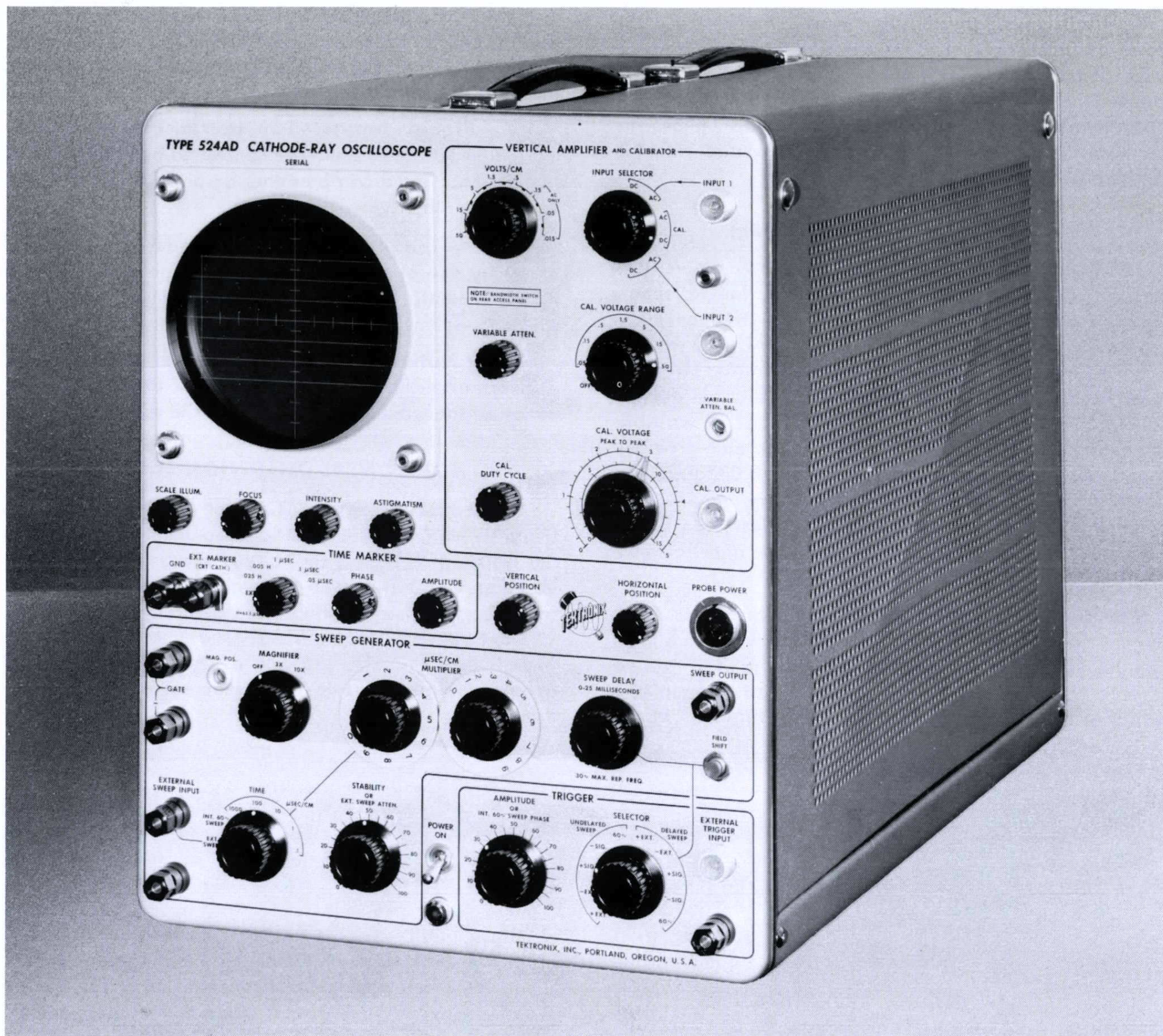






# TYPE 524AD OSCILLOSCOPE

## 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- $\mu$ sec risetime.

### Sweep Range

Continuously variable, 0.1  $\mu$ sec/cm to 0.01 sec/cm.

### Time Markers

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

### Sweep Delay

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

### DC-Coupled Unblinking

### Variable Duty-Cycle Amplitude Calibrator

### New Cabinet Design

### GENERAL DESCRIPTION

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



# TYPE 524AD OSCILLOSCOPE

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

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

## VERTICAL DEFLECTION SYSTEM

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

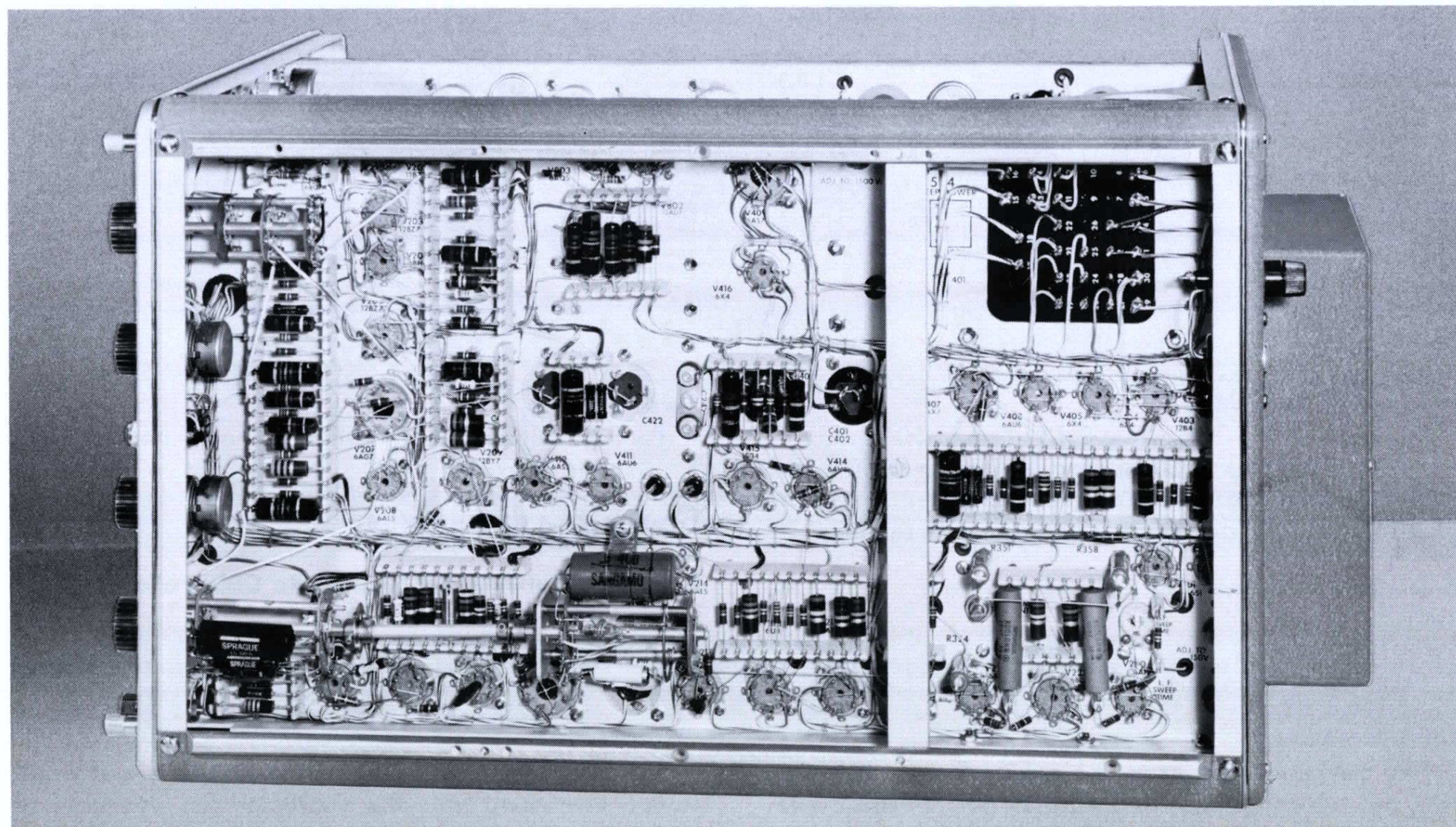
**Probe**—The vertical sensitivity is reduced by a factor of 10 by use of a 10x attenuator probe supplied with the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately 15  $\mu$ f.

**Delay Network**—A 0.25  $\mu$ 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  $\mu$ 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 normal 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  $\mu$ sec, 0.1  $\mu$ sec, and 0.05  $\mu$ sec. Since H is 63.5  $\mu$ 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, blue 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 .....** \$1250

Includes: 1—10X attenuator probe  
 2—Binding-post adapters (013-004)  
 1—TV RMA style graticule (331-009)  
 1—Viewing hood (016-001)  
 3-conductor power cord (161-008)  
 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 500A Scope-Mobile ..... \$100.00

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

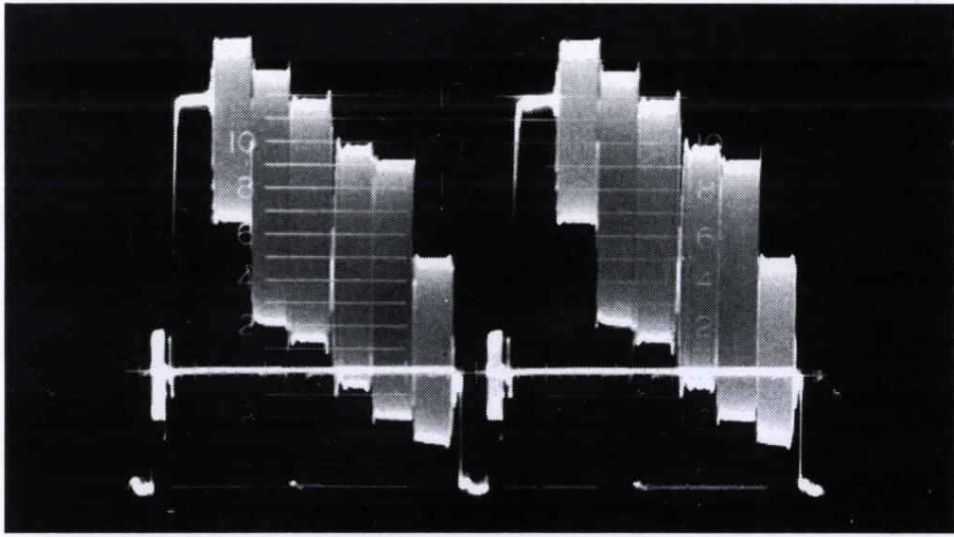


Fig. 1—Color-bar waveform with FLAT vertical response.

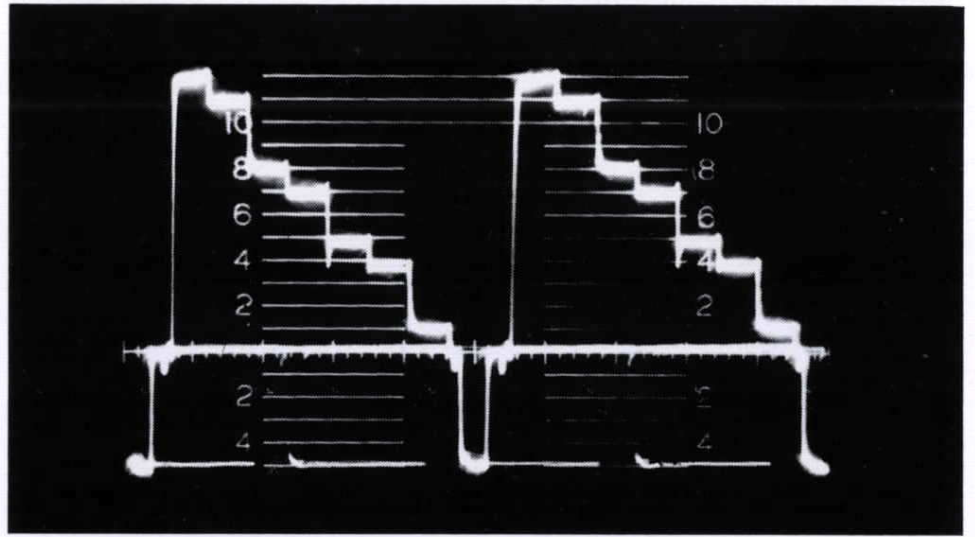


Fig. 2—Same waveform as Fig. 1 with LOW-PASS response.

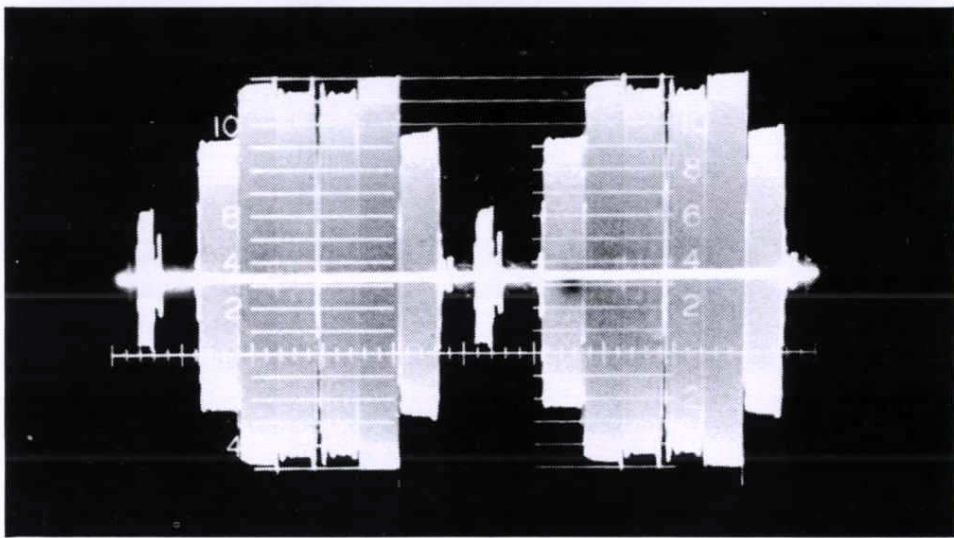


Fig. 3—Fig. 1 waveform with HIGH-PASS response.

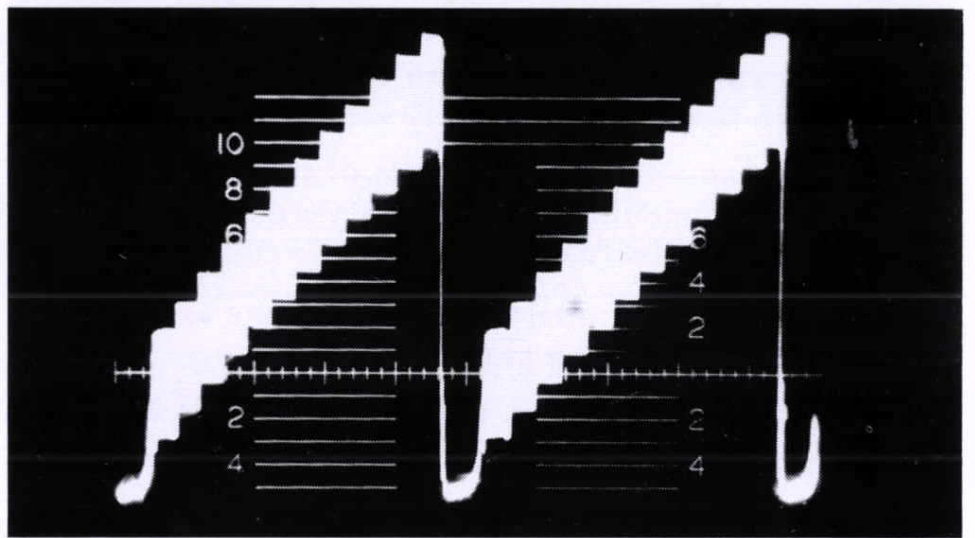


Fig. 4—Staircase with 3.58 mc added—FLAT vertical response.

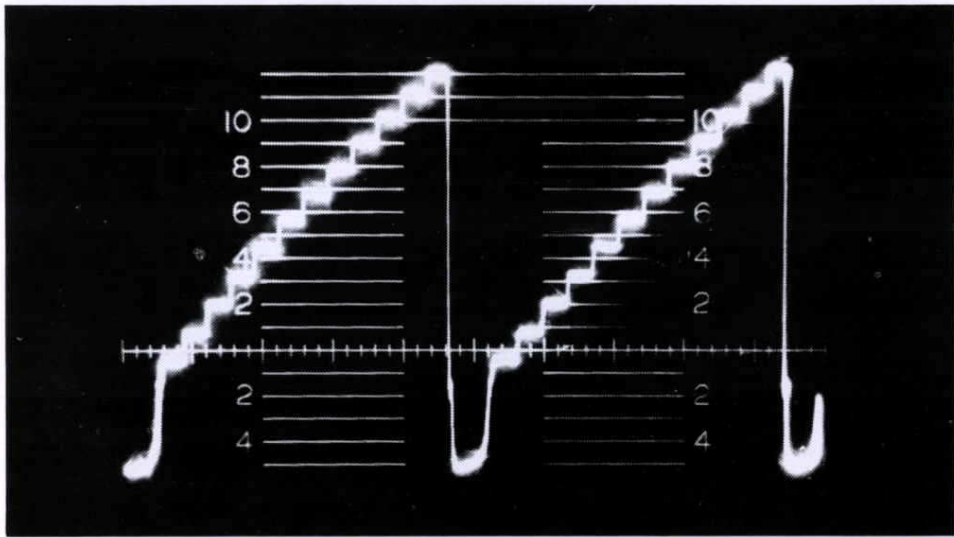


Fig. 5—Same waveform as Fig. 4 with LOW-PASS response.

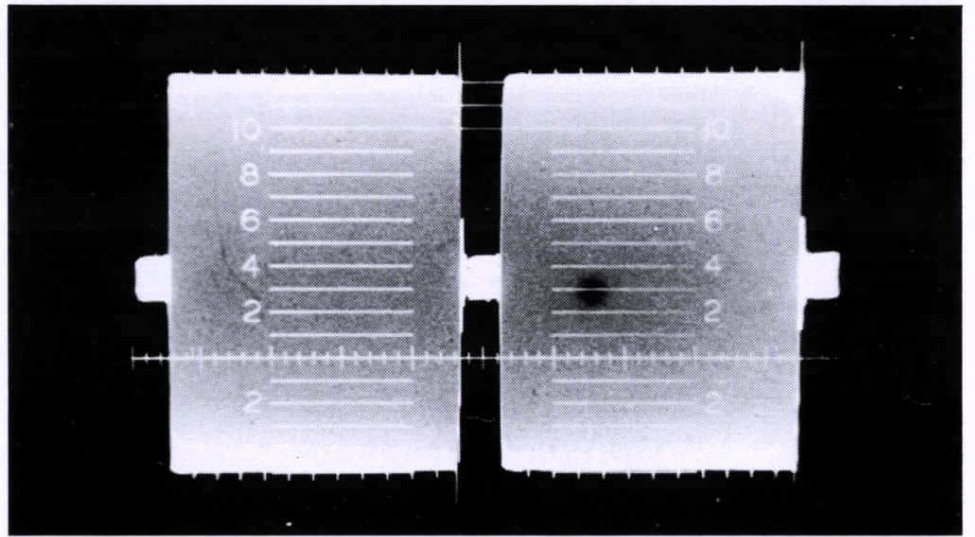


Fig. 6—Fig. 4 waveform with HIGH-PASS response.

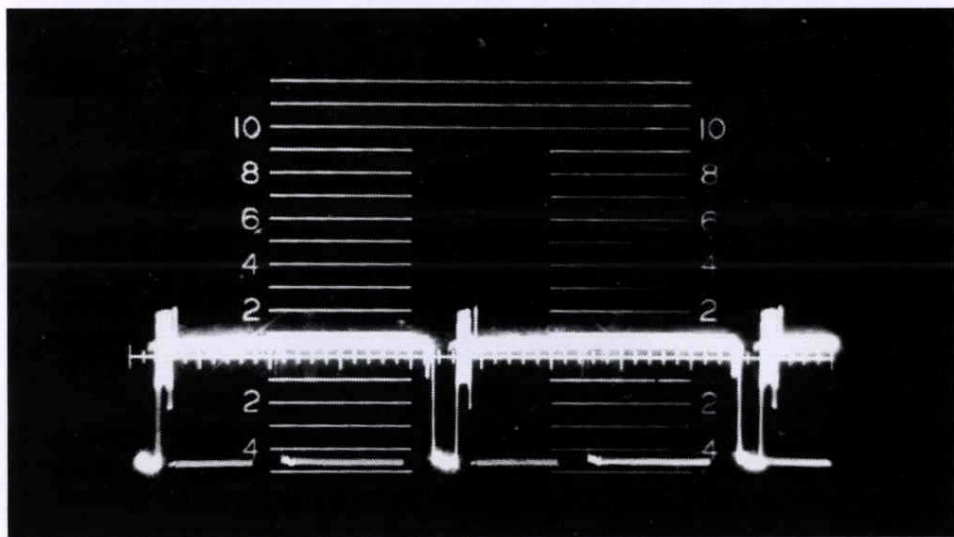


Fig. 7—Horizontal-sync pulse with color burst—FLAT vertical response.

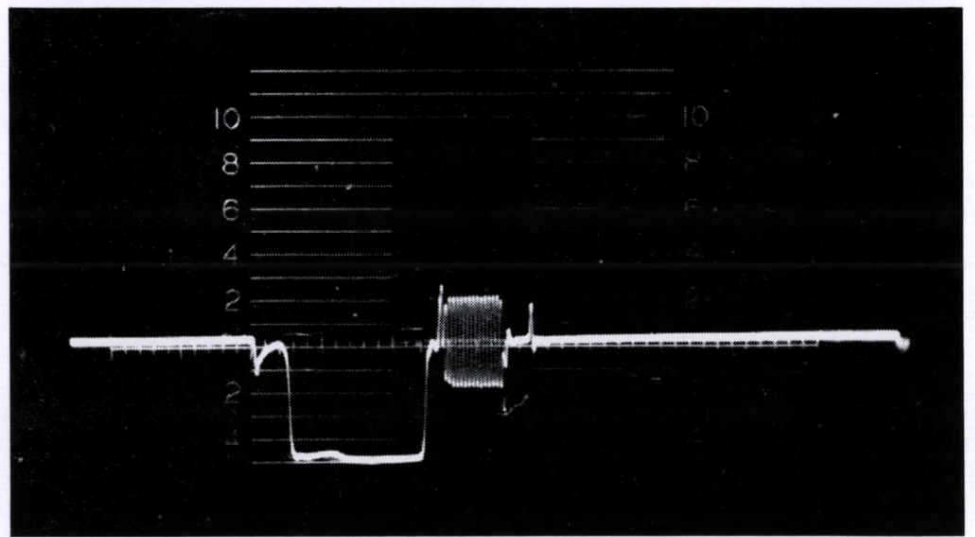


Fig. 8—Same as Fig. 7 with sweep magnified 5 times.

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

only during the test-signal period. Sweep speed is automatically increased to a maximum sweep duration of approximately 60  $\mu$ 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 .....** \$1145

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

## 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, blue 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 .....** \$1100

- 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

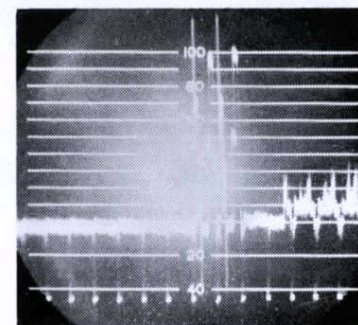


Fig. 9—Two-line test signal displayed at field sweep rate with 25-times sweep magnification. Vertical amplifier is set at FLAT response. (flat from 60 cycles to 5 mc).

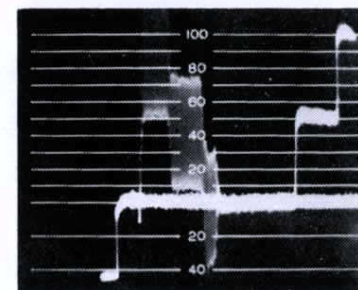


Fig. 10—Same test signal displayed with intensifier turned on. Sweep duration 60  $\mu$ sec at line rate, vertical amplifier set at FLAT response.

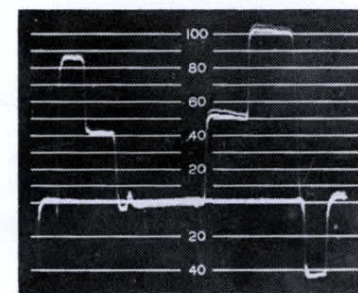


Fig. 11—Same test signal displayed with vertical amplifier switched to LOW PASS response. Sweep duration 70  $\mu$ sec at half the line rate.

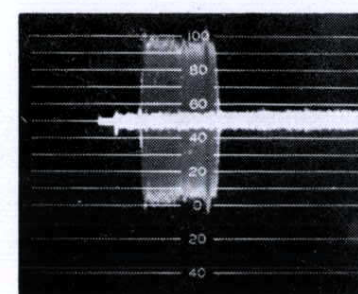


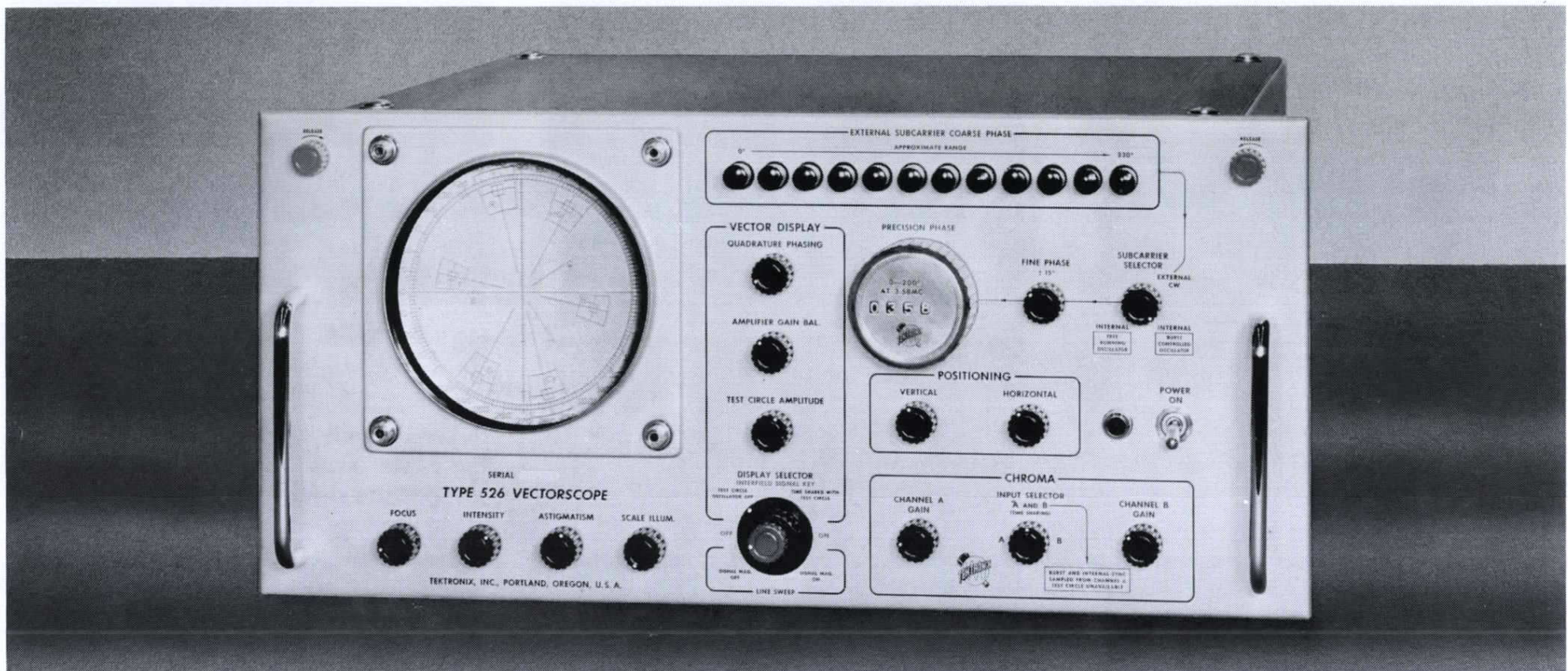
Fig. 12—Cross-modulation check—same test signal displayed with vertical amplifier switched to HIGH PASS response. Shows relative amplifications at the three luminance levels.

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



# NEW INSTRUMENT

## TYPE 526 VECTORSCOPE for the N.T.S.C. Color-Television Signal



**Phase Accuracy**— $\pm 1.5^\circ$  by vector presentation,  $\pm 1^\circ$  by null technique.

**Phase Resolution**—Better than  $0.1^\circ$  at 3.58 mc.

**Saturation Measurements**— $\pm 2\%$  on graticule, closer when comparing two signals.

**Interfield Signal Key**—Permits easy display of test signals during vertical blanking time.

**Linear Time Base**—Operates at line rate, synchronized by horizontal sync pulse.

**Burst Brightening**—Positive identification of burst packet.

**Push-Pull Synchronous Demodulators**—DC-Coupled to crt.

**Self-Checking Circuitry**

**Subcarrier Regenerator**

### GENERAL DESCRIPTION

The Tektronix Type 526 Vectorscope greatly reduces the time and effort involved in making extremely-accurate relative phase and amplitude measurements of chrominance information in the N.T.S.C. color signal. Electronically-switched dual signal channels facilitate matching equipment such as encoders, cameras, etc.

The Type 526 presents either a vector display of the demodulated chroma signal, or a display of the demodulated chroma signal on a linear time base. DC-Coupled signal circuits permit monitoring program signals as well as industry test signals such as 75% saturated color bars, interfield test signals, linearity stair step, and the Bell Kelly Set tests for differential phase and amplitude. A built-in subcarrier regenerator facilitates operation remote from the subcarrier source.

### VECTOR PRESENTATION

The vector presentation is a graphic display for operational measurements with a color-bar, interfield-test signal, other industry test signals, or with program material. Signal circuits are dc-coupled, preventing changes in chroma signal composition from affecting the positioning of the display.

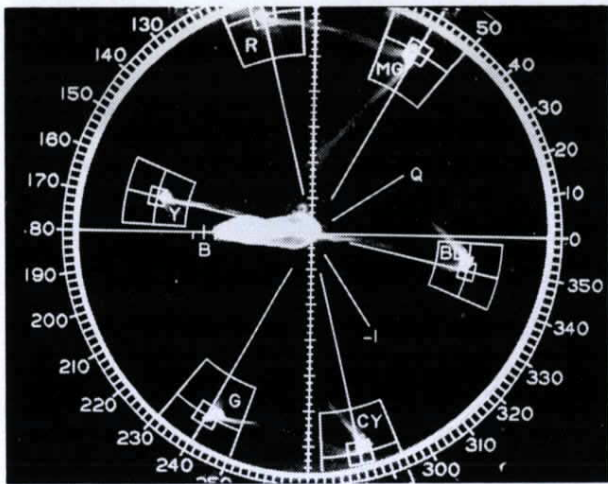
Through a time sharing arrangement, the signal from an internal 3.59-mc test oscillator can be fed through the signal circuits. This signal will form a circle of controllable amplitude when quadrature-phasing and amplifier-gain-balance controls are properly adjusted, and will match the circle inscribed on the graticule when positioning and test-circle-amplitude controls are properly adjusted. A test circle matched with the graticule circle verifies the accuracy of the vector display. The test circle can also be used to verify the accuracy of the complimentary-color relationships. Phase measurements accurate within  $\pm 1.5^\circ$  can be made using the vector display. Accuracy of saturation measurements will be within  $\pm 2\%$  on graticule, closer when comparing two signals.

### LINEAR-SWEEP PRESENTATION

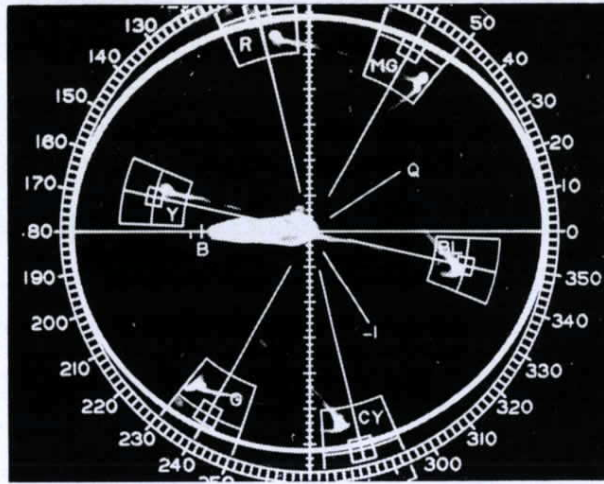
Phase measurements are simplified by displaying the demodulated chroma signals vertically on a linear horizontal sweep, which is terminated by the horizontal sync pulse and restarts just prior to the burst packet. Using the null technique, differential phase can be measured with an accuracy of  $\pm 0.5^\circ$ . Resolution is  $0.1^\circ$  at 3.58 mc, or 75  $\mu\text{sec}$ . A signal magnifier can be used to expand the vertical deflection approximately 5 times.



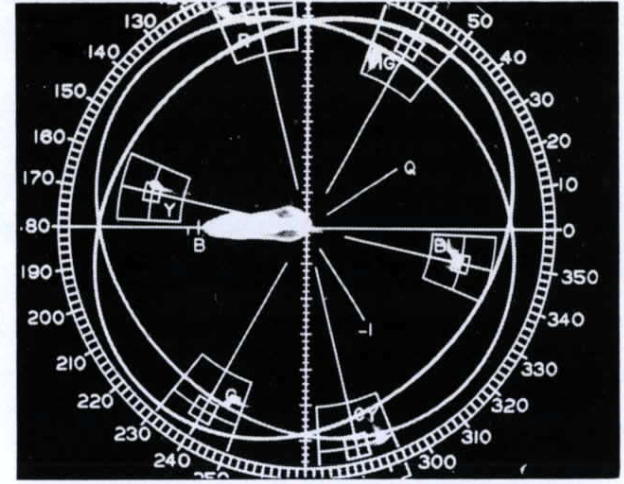
# TYPE 526 VECTORSCOPE



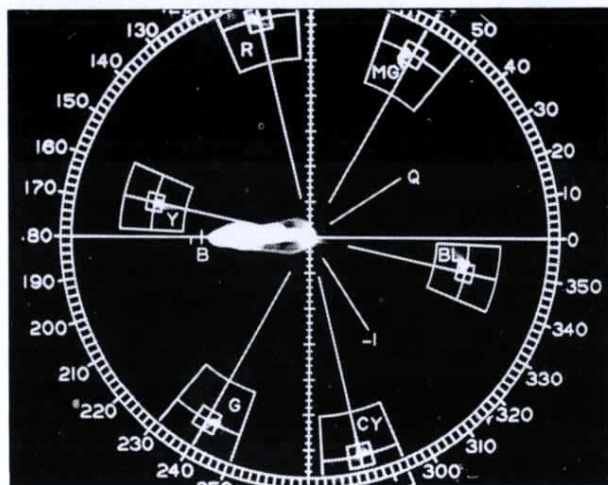
**Fig. 1**—Vector display of encoder output with 75%-saturated color-bar test signal. Test-circle alignment with each other and with scribed graticule circle verifies accuracy of Vectorscope.



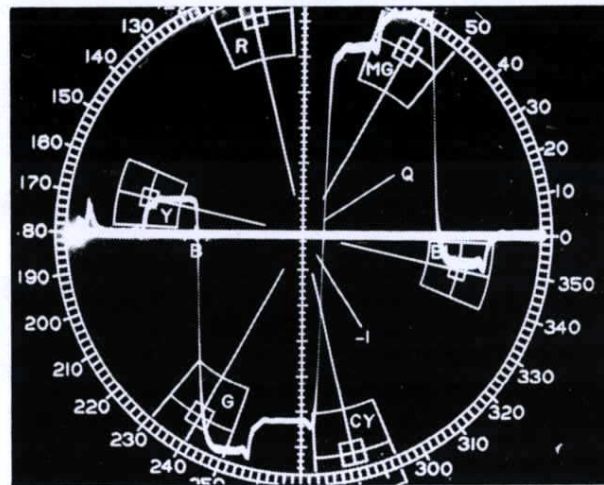
**Fig. 2**—Same as Fig. 1 except that Vectorscope amplifier-balance control is out of correct adjustment. Test-circle distortion indicates horizontal gain is greater than vertical gain.



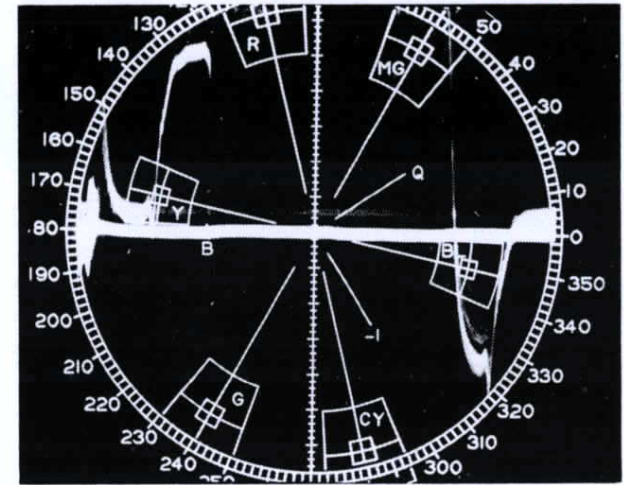
**Fig. 3**—Same as Fig. 1 except that Vectorscope quadrature control is out of correct adjustment, as indicated by the misalignment of the two test circles. Note red and magenta are displaced in opposite direction to green and cyan.



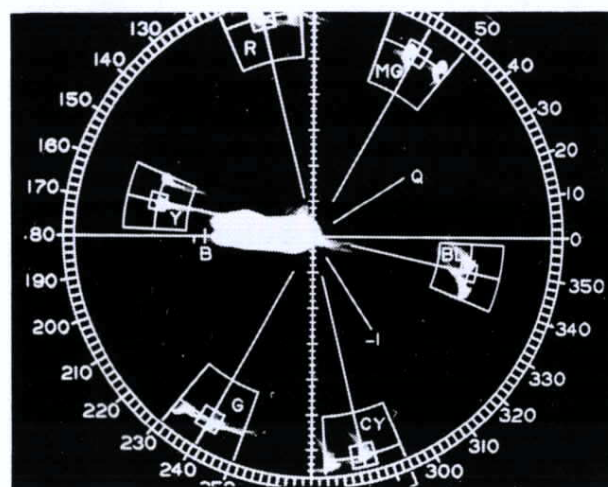
**Fig. 4**—Output of a well-adjusted encoder displayed on the Vectorscope. The test circle was turned off for this photograph.



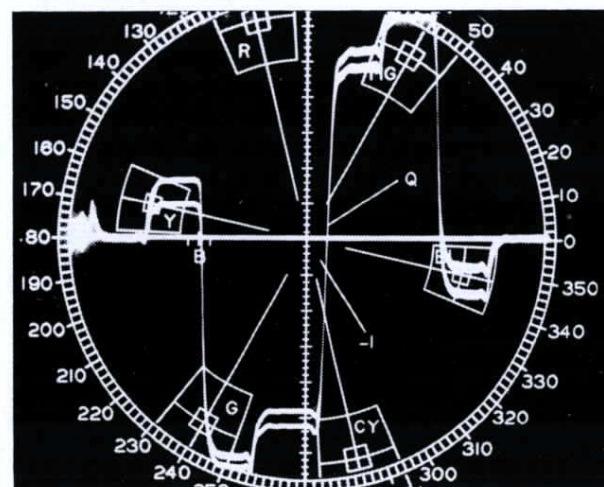
**Fig. 5**—Demodulated color-bar signal displayed on linear sweep. Burst packet at left end of trace is nulled out, indicating correct phasing of burst at 180°. The signal channel not in use provides a reference trace on the screen at zero signal level.



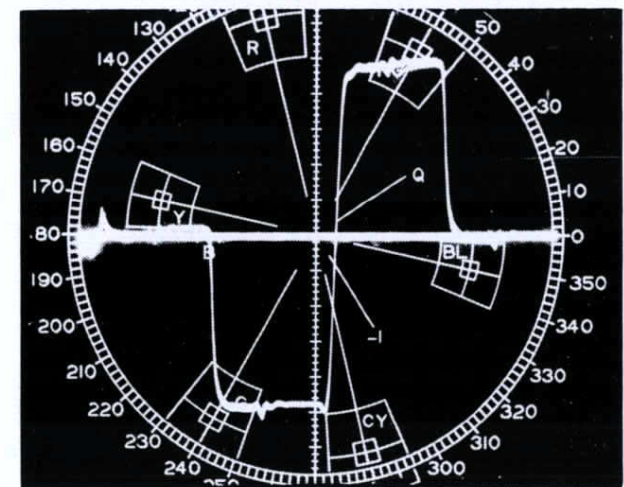
**Fig. 6**—Same signal as Fig. 5 with Vectorscope vertical magnifier turned on. DC-Coupled system permits detection of subcarrier presence during black and white bars, indicated by departure from zero reference. Need for adjustment of encoder carrier balance is indicated.



**Fig. 7**—Dual vector display. Electronic switching of Vectorscope inputs presents signals from two encoders for direct comparison measurements.



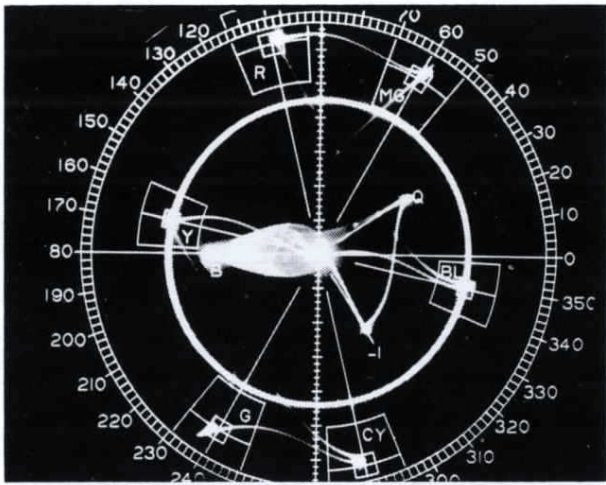
**Fig. 8**—Line-sweep display of same signals as in Fig. 7. Phase displacement is indicated by difference in amplitude. Note that burst packet from only one encoder is nulled out.



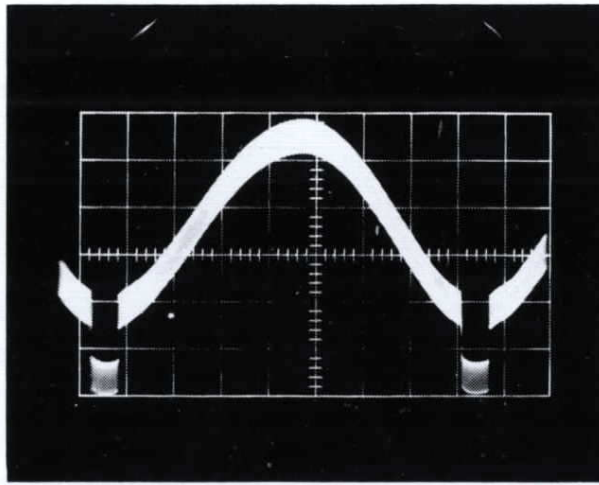
**Fig. 9**—With blue bar nulled out, its complement, yellow, should also be nulled out. Picture above indicates that either the encoder lacks complimentary relationships, or that differential-phase distortion is present. If complimentary relationship is restored when Y signal is removed, trouble is the latter.



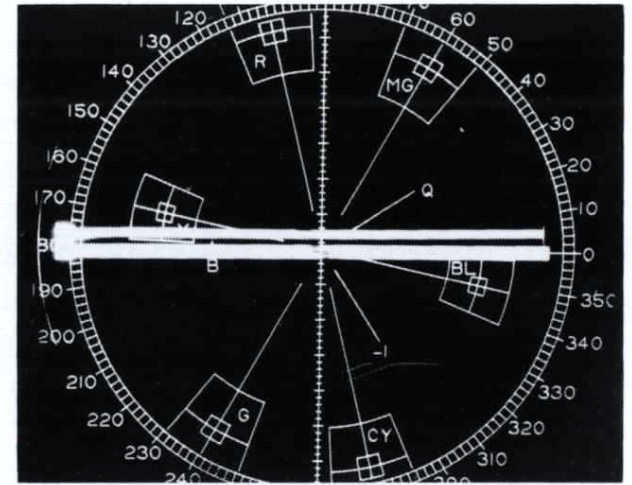
# TYPE 526 VECTORSCOPE



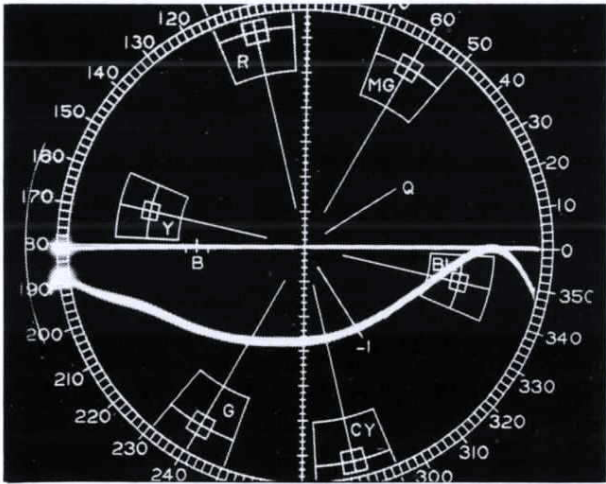
**Fig. 10**—Test circle adjusted to pass through blue also passes through yellow. If relative amplitudes change as Y signal is switched from off to on, differential-amplitude distortion is present.



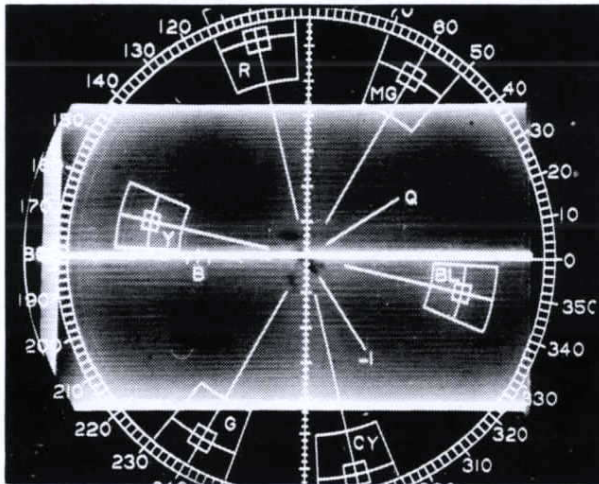
**Fig. 11**—Oscilloscope display of Bell Kelly Set test signal which is used to measure both differential-phase distortion and differential-amplitude distortion.



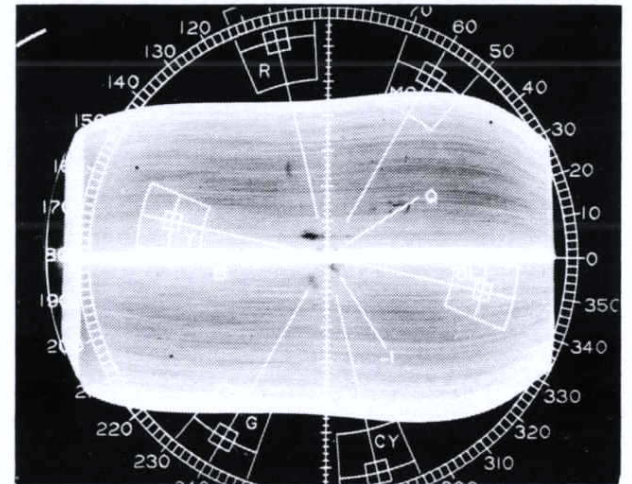
**Fig. 12**—Line-sweep display of same signal fed directly into Vectorscope, with gain control at maximum and magnifier on. Lower line is reference, upper line is the phase-demodulated 3.58-mc information contained in signal. Lack of differential-phase distortion is evidenced by straight line.



**Fig. 13**—Same conditions as in Fig. 12 except Bell Kelly Set signal has passed through an amplifier and Vectorscope gain is set at approximately half of maximum with magnifier turned off. Differential-phase distortion contributed by amplifier is measured at  $3.1^\circ$  with the precision phase control of the Type 526.



**Fig. 14**—Vectorscope line-sweep display of Bell Kelly Set signal with asynchronous demodulation (burst-controlled oscillator free running). Gain control is set at approximately half of maximum and magnifier is turned off. Lack of differential-amplitude distortion is evidenced by lack of variation in amplitude.



**Fig. 15**—Same conditions as Fig. 14 except signal has passed through an amplifier. Differential-amplitude distortion contributed by the amplifier is measured at 30% using maximum amplitude as reference.

## DUAL DISPLAYS

Two input channels, each with its own gain control, are electronically switched at about a 500-cycle rate permitting the display of two different signals simultaneously for direct comparison.

When using the vector display, an internally generated reference signal (test circle) can be fed into either channel A or B to calibrate the instrument, or both channel A and channel B signals can be displayed together for comparison measurements. The signal into a portion of the broadcast plant can be compared directly with the signal out to measure any phase and/or amplitude distortion contributed by the equipment. The independent gain controls of each channel of the Vectorscope produce virtually no phase-shift effects, and have a range of over 40 db. Also, the outputs of any

two portions of the broadcast plant can be directly compared for matching purposes.

Either signal channel can be turned off while the other remains in use, providing a zero reference point in the form of a sharply defined spot in the center of the display. Any drift in the Vectorscope circuits will affect the position of the spot and is therefore easily detected and corrected.

When using the linear-sweep display, turning off one channel while the other remains in use provides a zero reference line against which signals can be nulled. This technique eliminates the possibility of measurement errors due to parallax.

## PHASE MEASUREMENT

Phase measurements are made by demodulating the chroma signal with a subcarrier signal which can be



# TYPE 526 VECTORSCOPE

shifted in phase relative to burst phase in the signal. High accuracy is obtained with the 20-turn precision calibrated phase shifter. This control is a two-speed illuminated dial with direct readout in degrees and tenths of degrees. It has a range of 0° to 200°, and the 180° point can be verified within the instrument. Random phase shifts in the subcarrier signal due to cable length can be cancelled out with a push-button operated phase-shift network covering 0° to 330° in twelve steps. A fine-phase control ( $\pm 20^\circ$ ) provides for variable adjustment between steps, and fine phase adjustment when using the burst-controlled oscillator.

## INTERFIELD-SIGNAL KEY

When the INTERFIELD SIGNAL KEY Switch is in the ON position, the cathode-ray tube is gated on only during the 3 or 4 lines occupied by the interfield signal. Video clutter is thus eliminated from the display.

## BURST BRIGHTENING

The burst amplifier in the burst-controlled oscillator circuit is keyed on during the first 3  $\mu$ sec of the linear sweep. During the 3- $\mu$ sec interval the crt trace is brightened for positive identification of the burst packet. Trace brightening during the burst-sampling interval also facilitates adjustment of burst-amplifier gating.

## OTHER CHARACTERISTICS

**DC-Coupled Signal Circuits**—DC-Coupling from the push-pull synchronous demodulators to the cathode-ray tube prevents changes in chroma signal composition from affecting the positioning of the display, making possible the detection and measurement of color carrier present during blanking time. Carrier-balance corrections can be made even while on the air, because the vector display shows the direction and magnitude of the required adjustments.

**Video Inputs**—Channel A and channel B inputs are designed for high-impedance loop-through operation and are compensated for 75-ohm line impedance ( $R=3.3$  megohms,  $C=10 \mu\mu\text{f}$ ). Input stages are cathode followers. Sufficient gain is provided to allow use of a compensated probe rather than loop-through input.

Composite video, sync negative, 1.0-volt peak-to-peak permits internal synchronization, eliminating the need for a signal at the sync input connector. When using external sync, channels A and B can receive non-composite video or chroma.

**Sync Input**—1.0-volt sync-negative composite video or negative-going composite sync, 3.5 v to 8 v, can be used. If the interfield-signal keying feature is not required, horizontal-drive pulses can be used to synchronize the Type 526. Input is high-impedance loop-through type, compensated for 75-ohm line impedance ( $R=1$  megohm,  $C=25 \mu\mu\text{f}$ ).

**External Subcarrier Input**—High-impedance compensated loop-through connector for 75-ohm coaxial

cable ( $R=1$  megohm,  $C=20 \mu\mu\text{f}$ ). Input has buffer-amplifier stage and requires a signal level of 2 volts peak-to-peak minimum.

**Vertical Signal Output**—The demodulated vertical signal is available at a binding post, dc-coupled, for feeding remote indicators.

**Trace Intensification Input**—A jack (PL-55) is provided for external trace-brightening pulses. Internal blanking circuitry is disconnected when an external signal is being applied. Signal required for trace brightening is an ac-coupled positive-going 20-volt pulse, which can be obtained from the + GATE terminal of any Tektronix Oscilloscope that is being triggered by the vertical-signal output of the Type 526. This type of trace brightening is useful for determining the time limits over which a phase shift is occurring.

**Cathode-Ray Tube**—A special Tektronix cathode-ray tube, the T526, is used in the Type 526. It is a 5" flat-faced monoaccelerator tube with similar vertical and horizontal sensitivities, excellent linearity. Accelerating potential is 4 kv. A P1 phosphor is normally furnished, with P2, P7, and P11 as optional phosphors. Some other phosphors can be furnished on special order.

**Regulated Power Supplies**—The self-contained low-voltage and crt-high-voltage power supplies are electronically regulated against changes in load and line-voltage fluctuations between 105 and 125 volts.

**Accessibility**—The Type 526 is designed for standard rack mounting. Chassis attaches to rack with slide-out mounting that permits it to be tilted vertically, providing easy access to all components.

## MECHANICAL SPECIFICATIONS

**Mounting**—Chassis mounts directly to standard rack on slide-out rails.

**Ventilation**—Self-contained fan provides ample filtered cooling air to keep the instrument at a safe operating temperature.

**Construction**—Aluminum-alloy chassis and cabinet.

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

**Dimensions**—8  $\frac{5}{8}$ " high, 19" wide, 18  $\frac{1}{2}$ " rack depth.

**Weight**—45 lbs.

**Power Requirements**—105 to 125 v or 210 to 250 v, 50 to 60 cycles, 340 watts.

**Type 526** ..... \$1800

Includes: 3—75-ohm Terminations  
1—3-conductor power cord  
1—Instruction manual.

## EXPORT MODELS

The Type 526 can be ordered factory-tuned for any subcarrier frequency between 3.5 mc and 4.5 mc. Interpolation of phase-measurement values obtained from precision delay-line control may be necessary in some cases, but instrument accuracy will not be affected.

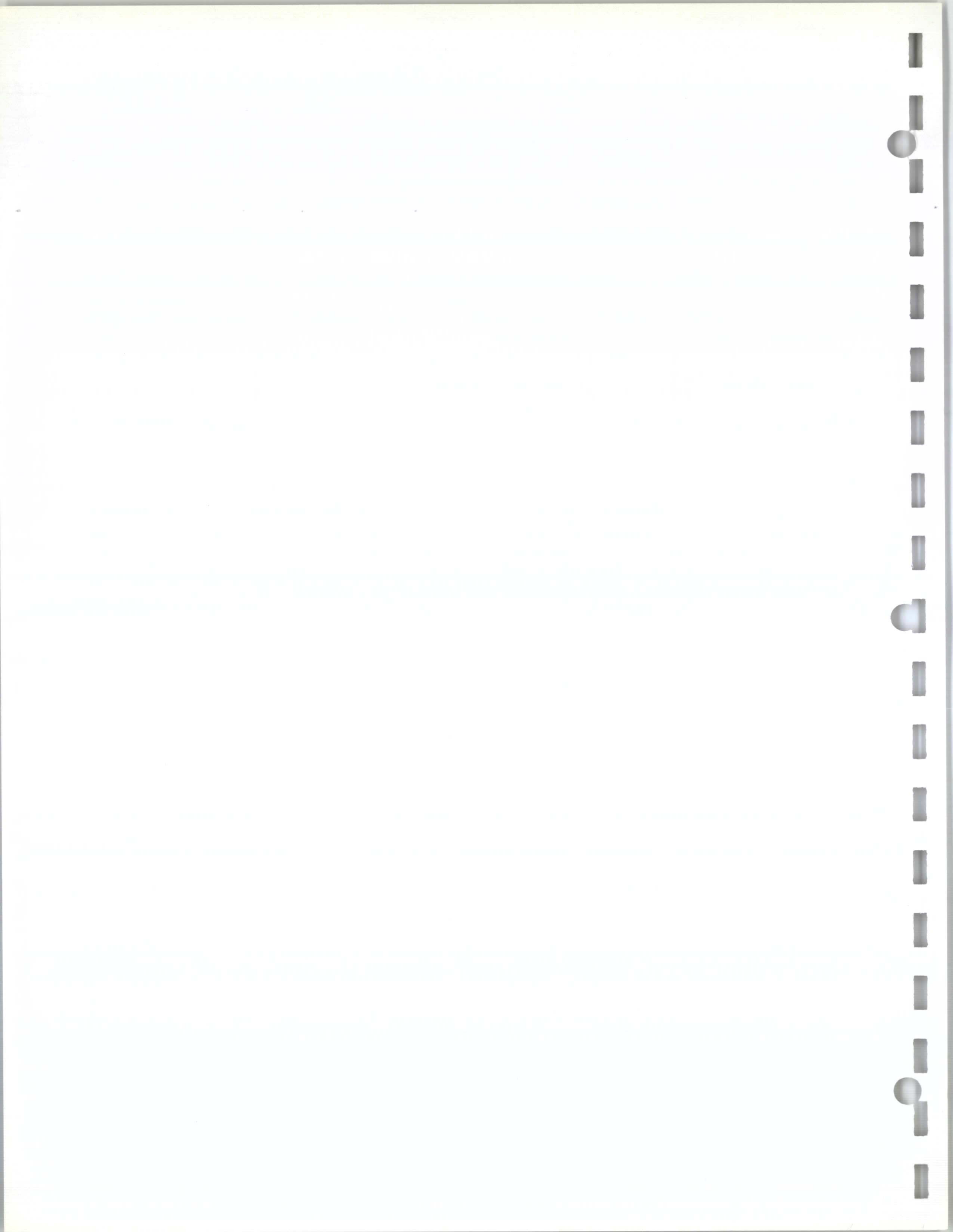
Price f.o.b. factory





RACK-MOUNTING OSCILLOSCOPES

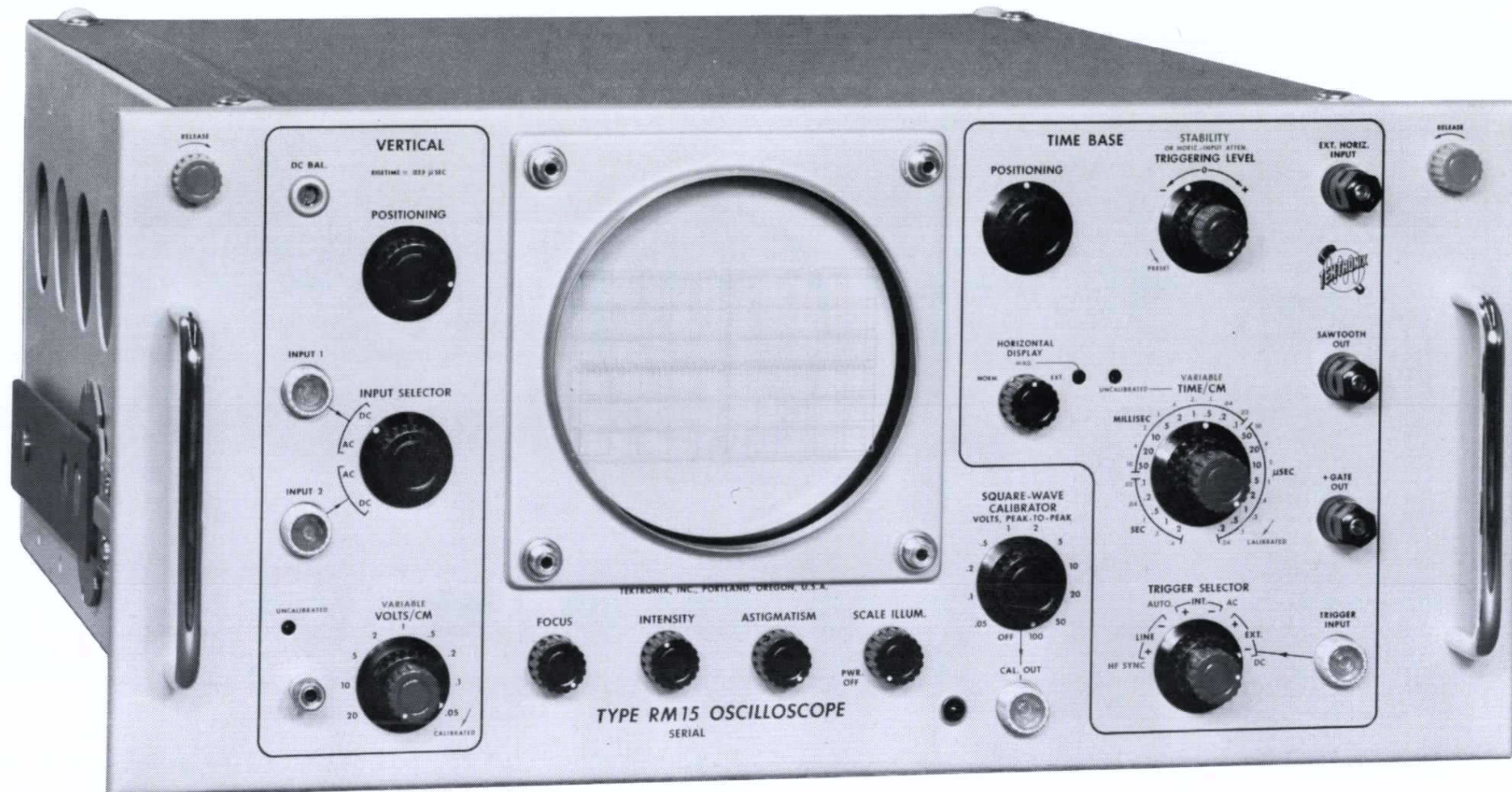






# TYPE RM15 OSCILLOSCOPE

## Rack-Mounting 5-Inch Oscilloscope



**Frequency Response**—DC to 15 mc.

**Transient Response**—0.023- $\mu$ 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  $\mu$ sec/cm to 2 sec/cm.  
0.2  $\mu$ sec/cm to 6 sec/cm, continuously variable.  
Accurate 5-x magnifier increases calibrated rate to 0.04  $\mu$ 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. Please refer to the Type 515A 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**—8 3/4" high, 19" wide, 23" rack depth. Please see page 132 for complete dimensions.

**Weight**—43 pounds.

**Type RM15** (50 to 60 cycle supply) . . . . . **\$875**

**Type RM15MOD101** (50 to 400 cycle supply) **\$910**

- Includes:
- 1—Probe (10-x atten.)
  - 2—Binding-post adapters (013-004)
  - 1—Green filter (378-514)
  - 1—3-conductor power cord (161-008)
  - 1—Set, mounting hardware
  - 1—Pair, guide rails (351-006)
  - 1—Instruction manual

**Recommended Additional Accessories**

**Supporting Cradles**—for rear slide support when the instrument is to be mounted in a backless rack. Two cradles with necessary mounting hardware, Tek 426-063  
Price . . . . . 7.50

**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.

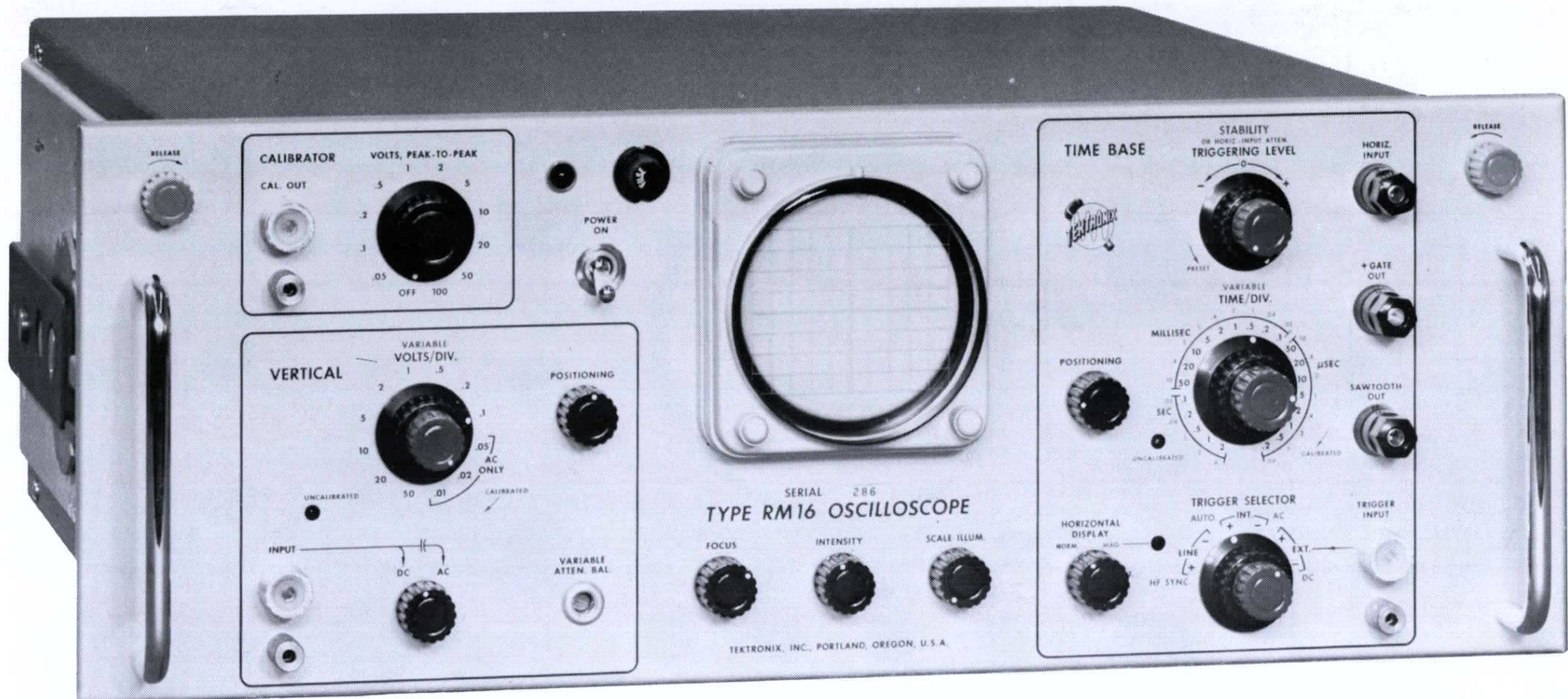
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





# 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  $\mu$ sec.

### Sweep Range

22 calibrated sweep rates from 0.2  $\mu$ sec/div to 2 sec/div, continuously variable from 0.2  $\mu$ sec/div to 6 sec/div. Accurate 5-x magnifier increases calibrated rate to 0.04  $\mu$ 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 Type 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 132 for complete dimensions.

Weight—44 pounds.

**Type RM16** (50 to 60 cycle supply) . . . . . **\$825**

**Type RM16MOD101** (50 to 400 cycle supply) **\$860**

- Includes: 1—Probe (10-x atten.)  
1—Binding-post adapter (013-004)  
1—Green filter (378-509)  
1—3-conductor power cord (161-008)  
1—Set, mounting hardware  
1—Pair, guide rails (351-017)  
1—Instruction manual

### Recommended Additional Accessories

Supporting Cradles—for rear slide support when the instrument is to be mounted in a backless rack. Two cradles with necessary mounting hardware, Tek 426-064  
Price . . . . . 6.50

### 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.

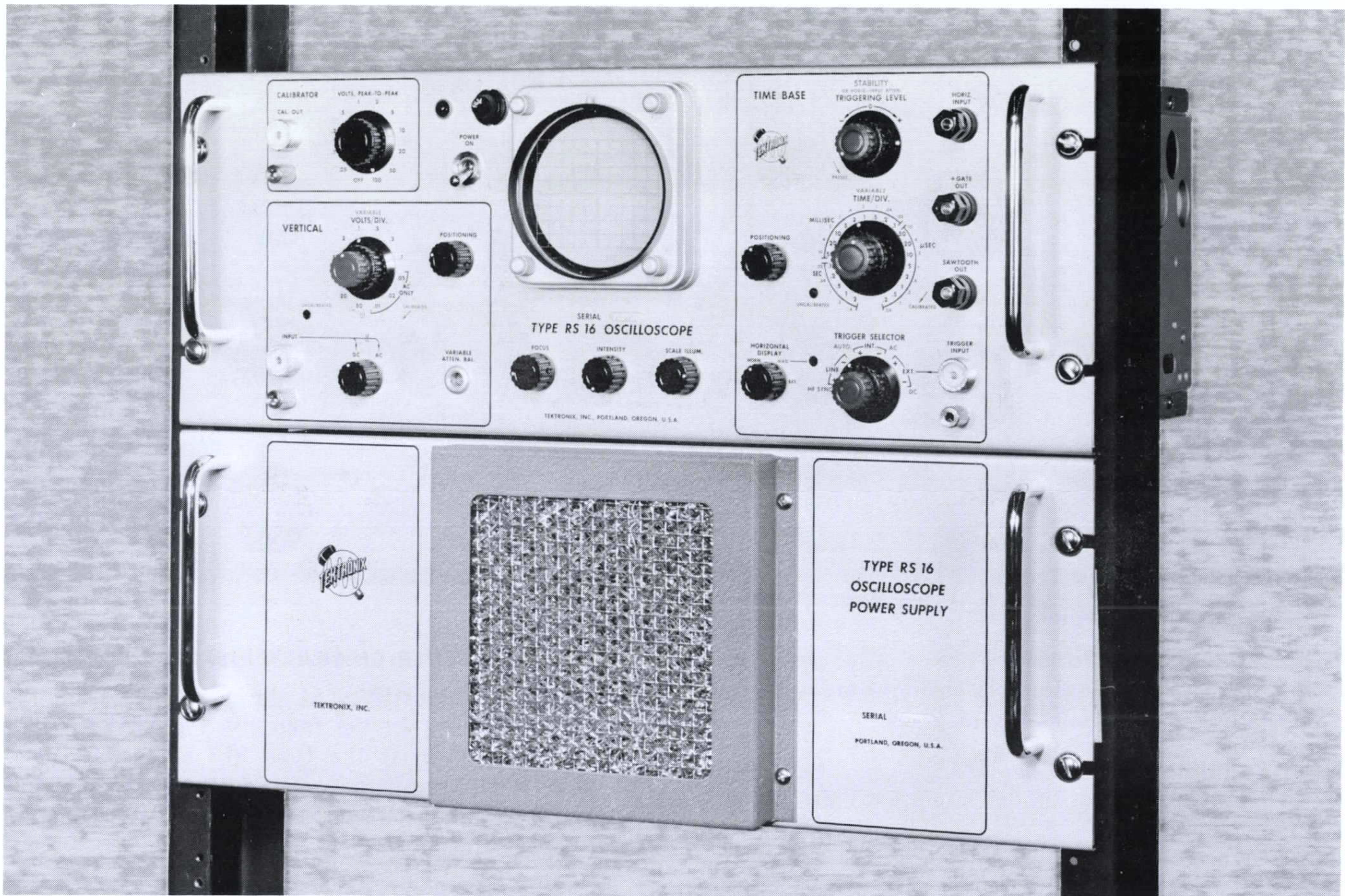
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





# TYPE RS16 OSCILLOSCOPE

## Special Model Rack-Mounting 3 Inch Oscilloscope



**Rack Depth Only 11 3/8 Inches**

**Electrical Characteristics the Same as RM16**

### GENERAL DESCRIPTION

The Type RS16 is a two unit model of the Type RM16 for racks with limited depth. The power-supply unit has a built-in fan for forced-air 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" inter-unit power cable is furnished.

### OTHER CHARACTERISTICS

Electrical characteristics of the RS16 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

Electrical characteristics of the Type RS16 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.

Construction—Aluminum chassis and cabinets.

Finish—Photo-etched anodized panels, etched aluminum cabinets.

Dimensions—Indicator unit—7" high, 19" wide, 11 3/8" deep; Power Supply—7" high, 19" wide, 5 1/2" deep.

Weight—Indicator unit 20 pounds; Power Supply 18 pounds.

**Type RS16 . . . . . \$875**

- Includes:
- 1—Probe (10-x atten.)
  - 1—Binding-post adapter (013-004)
  - 1—Green filter (378-509)
  - 1—3-conductor power cord (161-008)
  - 1—Inter-unit power cord (012-035)
  - 1—Set, mounting hardware
  - 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.)





# NEW INSTRUMENT

## TYPE RM17 Rack-Mounting Daylight Oscilloscope



### 9-KV Accelerating Potential

Bright trace—Easily readable in bright areas. . . even at low sweep repetition rates.

### High Reliability

New frame-grid dual triodes insure excellent stability and reliability.

### DC-Coupled Vertical Amplifier

Passband—DC to 10 MC at 0.1 to 125 v/div.

Passband—2 CPS to 10 MC at 0.01 to 0.1 v/div.

Risetime—0.035  $\mu$ sec.

### Wide Sweep Range

22 Direct-reading calibrated sweep rates from 0.2  $\mu$ sec/div to 2 sec/div.

5-x Magnifier increases the calibrated sweep rates to 0.04  $\mu$ sec/div.

Continuously variable sweep rates from 0.04  $\mu$ sec/div to 6 sec/div.

### Easy Triggering

Automatic triggering eliminates readjustment in most applications.

Preset or manual stability control for complete triggering versatility.

### GENERAL DESCRIPTION

The Type RM17 is a mechanically rearranged Type 317 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 RM17 are the same as described for the Tektronix Type 317 Oscilloscope. Please refer to the Type 317 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 two-piece cabinet. Slide-out mounting.

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

Dimensions—7" high, 19" wide, 17 $\frac{5}{8}$ " rack depth. Please see page 132 for complete dimensions.

Weight—40 pounds.

**Type RM17** (50 to 60 cycles) . . . . . **\$875**

**Type RM17MOD101** (50 to 400 cycles) . . . . . **910**

Includes: 1—Probe (10-x atten.)  
1—Binding-post adapter (013-004)  
1—Green filter (378-509)  
1—3-conductor power cord (161-008)  
1—Pair, guide rails (351-017)  
1—Set, mounting hardware  
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.)





# IMPROVED INSTRUMENT

## TYPE RM31A RACK-MOUNTING OSCILLOSCOPE

### Easy Operation

Single knob control for Sweep Range, Amplitude Calibrator, and Horizontal Display.

### Increased Vertical Response

Passband and Risettime with Type K unit, dc to 15 mc, 0.023  $\mu$ sec.

### Wide Sweep Range

0.1  $\mu$ sec/cm to 12 sec/cm. 5-x magnifier increases calibrated rate to 0.02  $\mu$ sec/cm.

### Versatile Triggering Circuitry

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

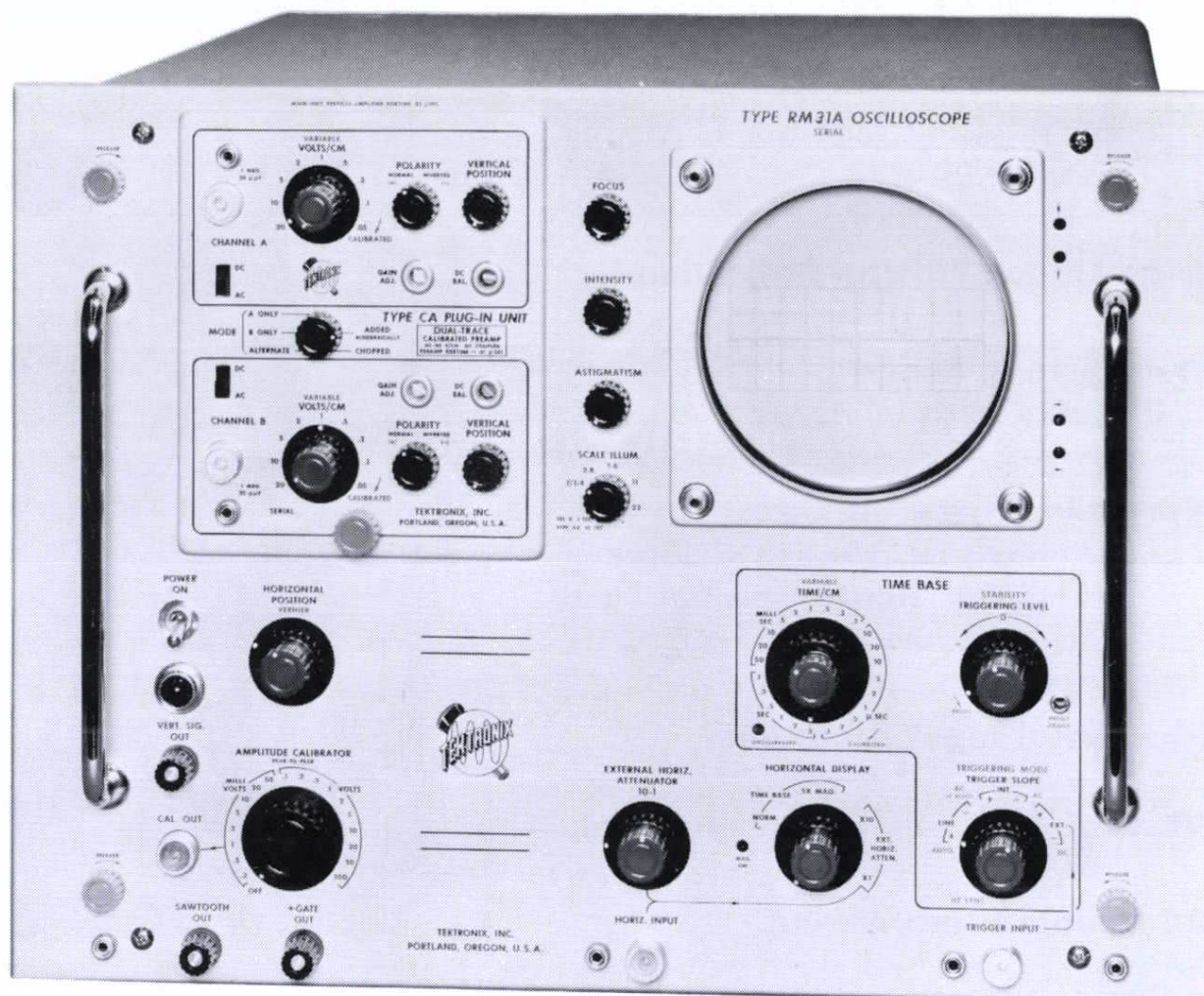
### 10-KV Accelerating Potential

Bright display at low repetition rates.

### Horizontal Input Amplifier

### 6-cm Linear Vertical Deflection

### Balanced Delay Network.



### GENERAL DESCRIPTION

The Type RM31A is a mechanically rearranged Type 531A 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 RM31A are the same as described for the Tektronix Type 531A Oscilloscope. Please refer to the Type 531A 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, blue wrinkle-finished cabinet.

Dimensions—14" high, 19" wide, 22 1/2" rack depth. Please see page 132 for complete dimensions.

Weight—80 pounds.

**Type RM31A, without plug-in units . . . . . \$1095**

- Includes: 2—Probes (10-x atten.)
- 2—Binding-post adapters (013-004)
- 1—Test lead (012-031)
- 1—F510-5 green filter (378-503)
- 1—3-conductor power cord (161-008)
- 1—Set, mounting hardware
- 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

### Designed for Extra Dependability

#### DC-Coupled Vertical Amplifier

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

Risetime with wide-band plug-in units—0.07  $\mu$ sec.

#### 8-cm Linear Vertical Deflection

#### Wide Sweep Range

0.2  $\mu$ sec/cm to 12 sec/cm.

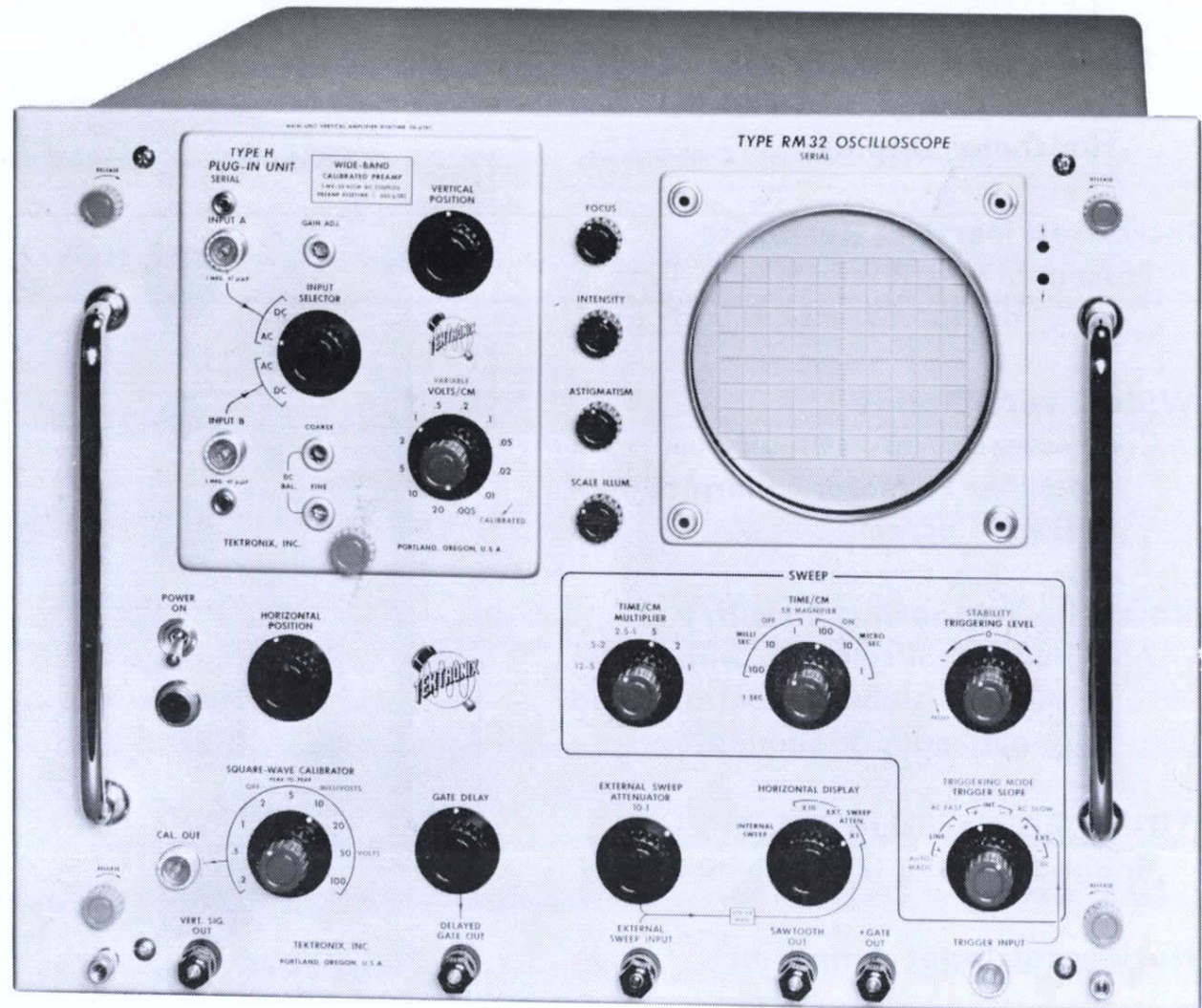
#### Versatile Triggering Circuitry

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

#### Horizontal Input Amplifier

#### Vertical Beam-Position Indicators

#### DC-Coupled Unblinking



### 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. Please refer to the Type 532 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, blue wrinkle-finished cabinet.

Dimensions—14" high, 19" wide, 22 1/2" rack depth. Please see page 132 for complete dimensions.

Weight—70 pounds.

**Type RM32, without plug-in units . . . . . \$975**

- Includes: 2—Probes (10-x atten.)
- 2—Binding post adapters (013-004)
- 1—Test lead (012-031)
- 1—F510-5 green filter (378-503)
- 1—3-conductor power cord (161-008)
- 1—Set, mounting hardware
- 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.)





# NEW INSTRUMENT

## TYPE RM33 RACK-MOUNTING OSCILLOSCOPE

### Easy Operation

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

**Preset Triggering**—Eliminates triggering adjustments in most applications.

**24 Calibrated Direct-Reading Sweep Rates**—Sweep range 0.02  $\mu$ sec/cm to 15 sec/cm.

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

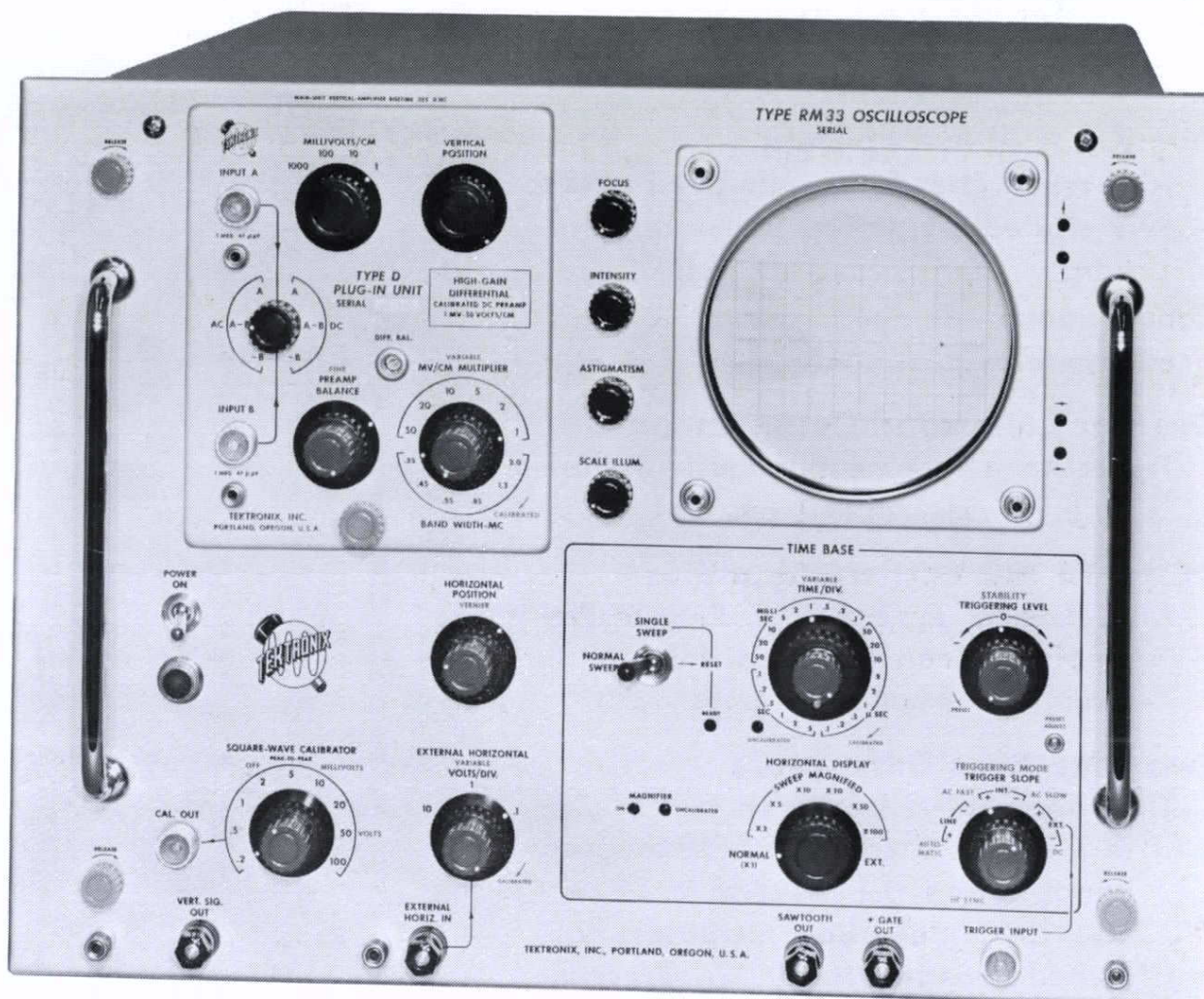
**High Writing Rate**—10-kv accelerating potential assures bright trace for operation in single-sweep applications, and with low sweep repetition rates.

### 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



### GENERAL DESCRIPTION

The RM33 is a mechanically rearranged Type 533 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 RM33 are the same as described for the Tektronix Type 533 Oscilloscope. Please refer to the Type 533 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, and blue wrinkle-finished cabinet.

**Dimensions**—19" wide, 14" high, 22 1/2" rack depth. Please see page 132 for complete dimensions.

**Weight**—80 Pounds.

**Type RM33, without plug-in units . . . . . \$1200**

- Includes: 2—Probe (10-x atten.)
- 2—Binding-post adapters (013-004)
- 1—Test lead (012-031)
- 1—Green filter (378-514)
- 1—3-conductor power cord (161-008)
- 1—Set, mounting hardware
- 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.)





# IMPROVED INSTRUMENT

## TYPE RM35A RACK-MOUNTING OSCILLOSCOPE

### Easier Operation

Simplified panel layout.  
Color-correlated controls.

### Two Kinds of Sweep Delay

**Triggered (jitter free)**—delayed sweep is started by signal under observation.

**Conventional**—delayed sweep is started by delayed trigger.

### Greater Calibrated Delay Range

1  $\mu$ sec to 10 sec, continuously adjustable (2  $\mu$ sec/cm to 1 sec/cm).

### DC-to-15 MC Vertical Amplifier

All Tektronix Type A to Z Plug-In Pre-amplifiers can be used for signal-handling versatility.

### Two Time-Base Generators

**TIME BASE A**—0.1  $\mu$ sec/cm to 5 sec/cm in 24 calibrated steps, continuously variable from 0.1  $\mu$ sec/cm to 12 sec/cm. 5-x magnifier increases calibrated range to 0.02  $\mu$ sec/cm. Single-sweep provision for one-shot applications.

**TIME BASE B**—Also functions as delay generator. 18 calibrated steps from 2  $\mu$ sec/cm to 1 sec/cm.

### GENERAL DESCRIPTION

The Type RM35A is a mechanically rearranged Type 535A 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

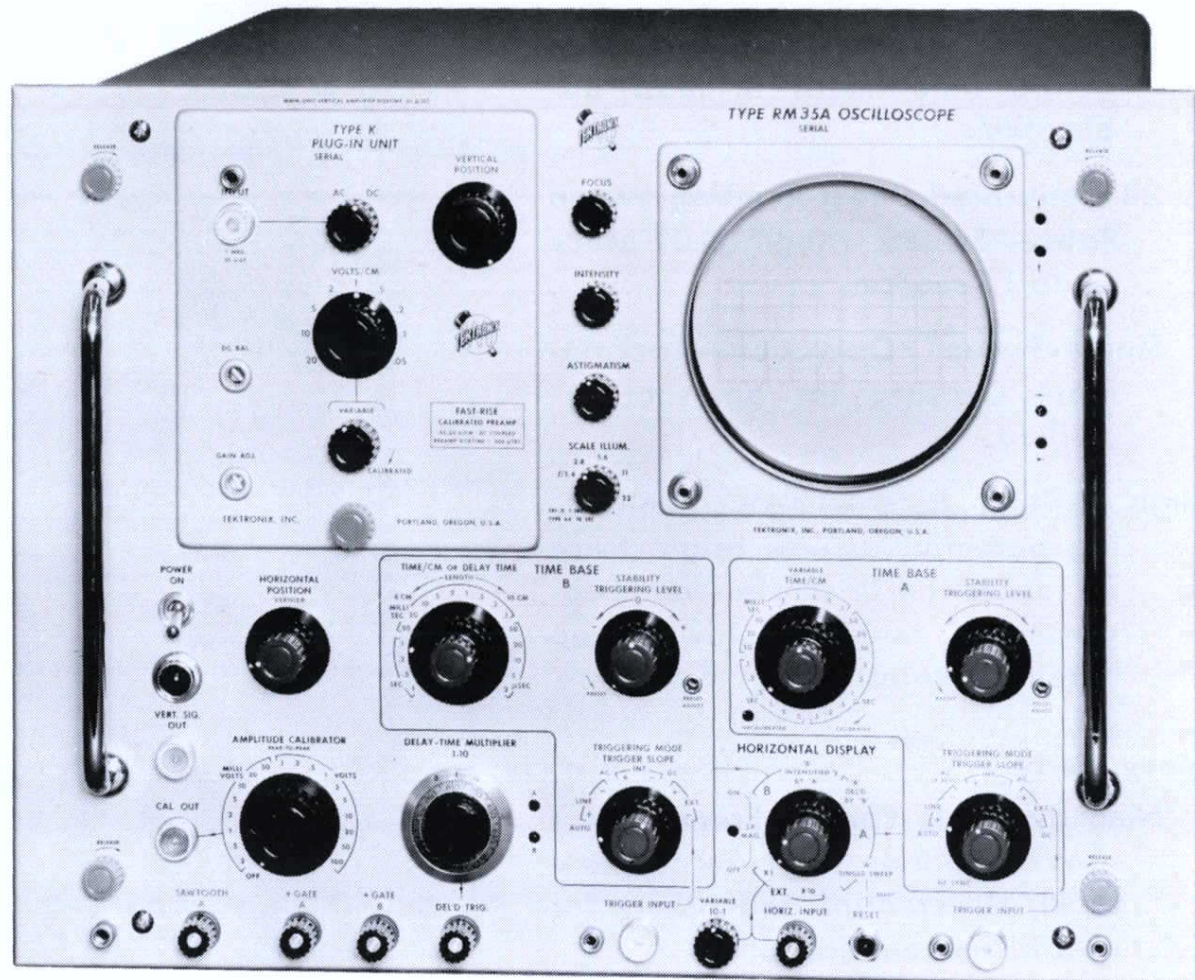
Electrical characteristics of the Type RM35A are the same as described for the Tektronix Type 535A Oscilloscope. Please refer to the Type 535A Section for complete electrical specifications. Controls and terminals are located for maximum convenience in rack-mounted operation.

### 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, blue wrinkle-finished cabinet.



Dimensions—14" high, 19" wide, 22 1/2" rack depth.  
Please see page 132 for complete dimensions.  
Weight—84 pounds.

**Type RM35A, without plug-in units . . . . . \$1500**

- Includes: 2—Probes (10-x atten.)
- 2—Binding-post adapters (013-004)
- 1—Test lead (012-031)
- 1—F510-5 green filter (378-503)
- 1—3-conductor power cord (161-008)
- 1—Set, mounting hardware
- 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 Ship-ment, GENERAL INFORMATION** page.)





# IMPROVED INSTRUMENT

## TYPE RM41A RACK-MOUNTING OSCILLOSCOPE

### Easy Operation

Single knob control for Sweep Range, Amplitude Calibrator, and Horizontal Display.

### 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  $\text{sec}/\text{cm}$ .

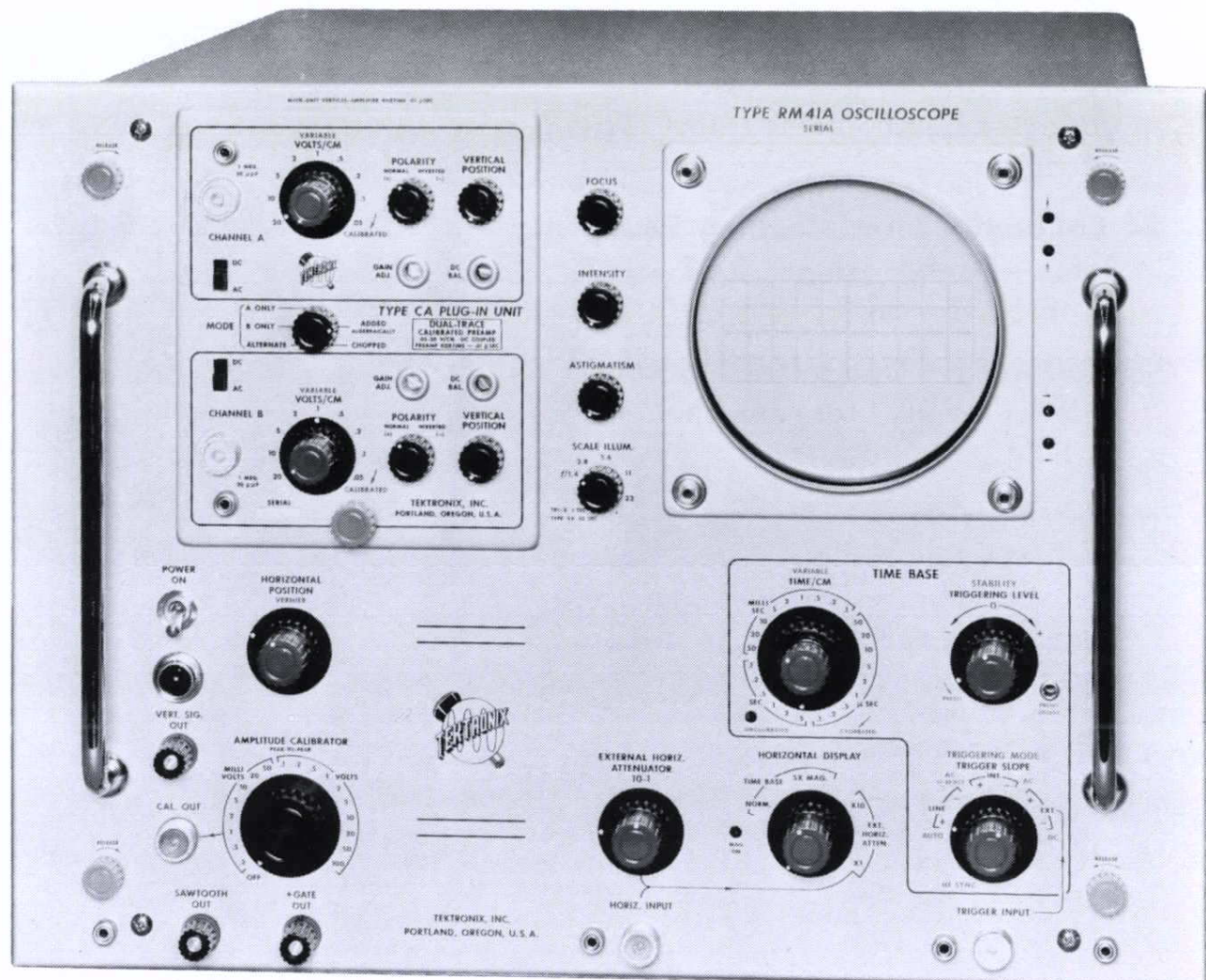
### Versatile Triggering Circuitry

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

### Balanced 0.2 $\mu\text{sec}$ Delay Network



### GENERAL DESCRIPTION

The Type RM41A is a mechanically rearranged Type 541A 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 RM41A are the same as described for the Tektronix Type 541A Oscilloscope. Please refer to the Type 541A 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, blue wrinkle-finished cabinet.

Dimensions—14" high, 19" wide, 22½" rack depth. Please see page 132 for complete dimensions.

Weight—80 pounds.

**Type RM41A, without plug-in units . . . . . \$1300**

- Includes: 2—Probes (10-x atten.)
- 2—Binding-post adapters (013-004)
- 1—Test lead (012-031)
- 1—Green filter (378-514)
- 1—3-conductor power cord (161-008)
- 1—Set, mounting hardware
- 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.)





# NEW INSTRUMENT

## TYPE RM43 RACK-MOUNTING OSCILLOSCOPE

### Easy Operation

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

**Preset Triggering**—Eliminates triggering adjustments in most applications.

**24 Calibrated Direct-Reading Sweep Rates**—Sweep range 0.02  $\mu$ sec/cm to 15 sec/cm.

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

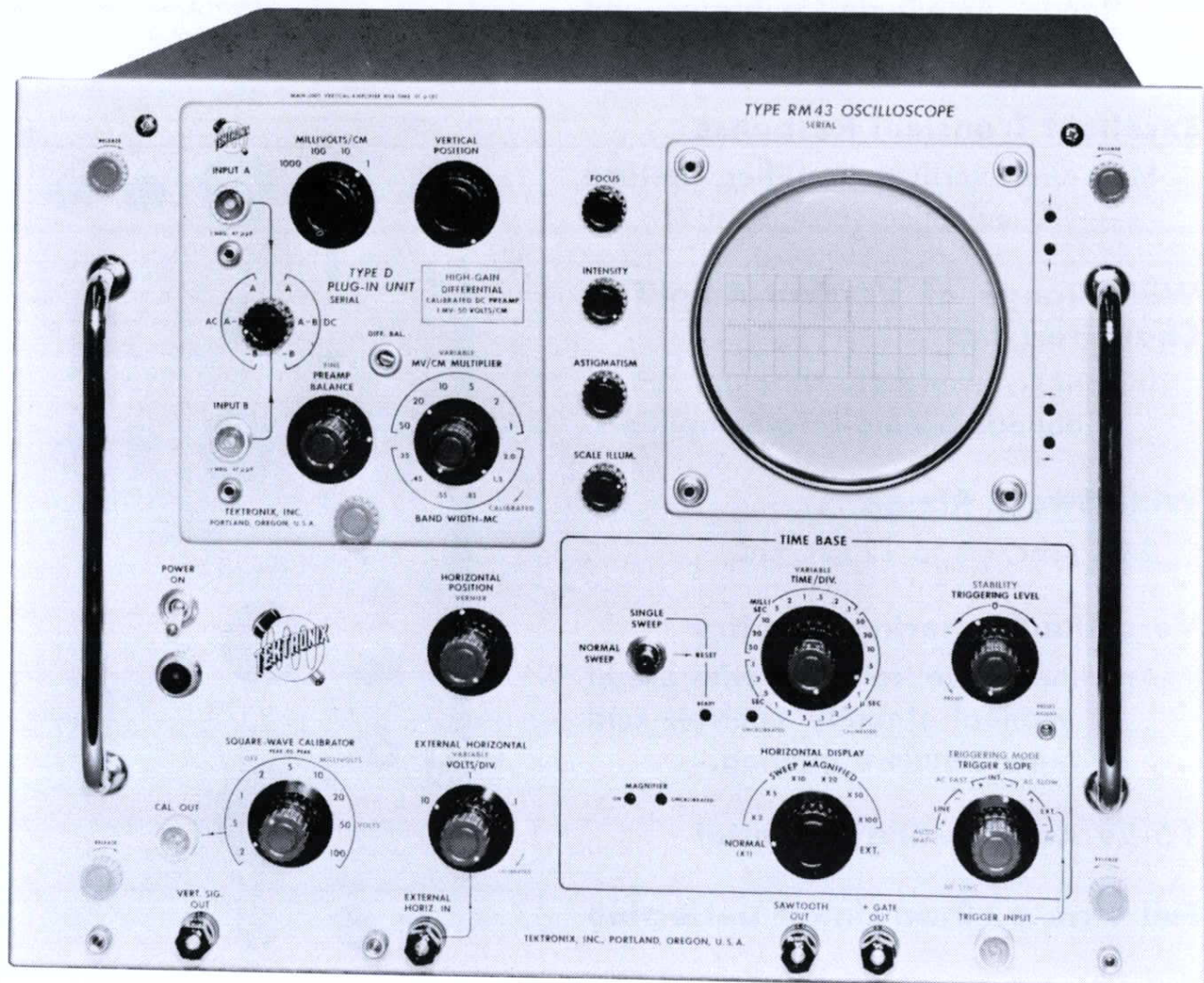
**High Writing Rate**—10-kv accelerating potential assures bright trace for operation in single-sweep applications, and with low sweep repetition rates.

### Versatility

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

### High Performance

DC-to-30 MC Main Vertical Amplifier



### GENERAL DESCRIPTION

The RM43 is a mechanically rearranged Type 543 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 RM43 are the same as described for the Tektronix Type 543 Oscilloscope. Please refer to the Type 543 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, and blue wrinkle-finished cabinet.

**Dimensions**—19" wide, 14" high, 22½" rack depth. Please see page 132 for complete dimensions.

**Weight**—80 pounds.

**Type RM43, without plug-in units . . . . . \$1375**

- Includes:
- 2—Probe (10-x atten.)
  - 2—Binding-post adapters (013-004)
  - 1—Test lead (012-031)
  - 1—Green filter (378-514)
  - 1—3-conductor power cord (161-008)
  - 1—Set, mounting hardware
  - 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.)





# IMPROVED INSTRUMENT

## TYPE RM45A RACK-MOUNTING OSCILLOSCOPE

### Easier Operation

Simplified panel layout.  
Color-correlated controls.

### Two Kinds of Sweep Delay

**Triggered (jitter free)**—delayed sweep is started by signal under observation.

**Conventional**—delayed sweep is started by delayed trigger.

### Greater Calibrated Delay Range

1  $\mu\text{sec}$  to 10 sec, continuously adjustable (2  $\mu\text{sec}/\text{cm}$  to 1 sec/cm).

### DC-to-30 MC Main Vertical Amplifier

12-m $\mu\text{sec}$  risetime with Type K Pre-amplifier.

All Tektronix Type A to Z Plug-In Pre-amplifiers can be used for signal-handling versatility.

### Two Time-Base Generators

**TIME BASE A**—0.1  $\mu\text{sec}/\text{cm}$  to 5 sec/cm in 24 calibrated steps, continuously variable from 0.1  $\mu\text{sec}/\text{cm}$  to 12 sec/cm. 5-x magnifier increases calibrated range to 0.02  $\mu\text{sec}/\text{cm}$ . Single-sweep provision for one-shot applications.

**TIME BASE B**—Also functions as delay generator. 18 calibrated steps from 2  $\mu\text{sec}/\text{cm}$  to 1 sec/cm.

### GENERAL DESCRIPTION

The Type RM45A is a mechanically rearranged Type 545A 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.

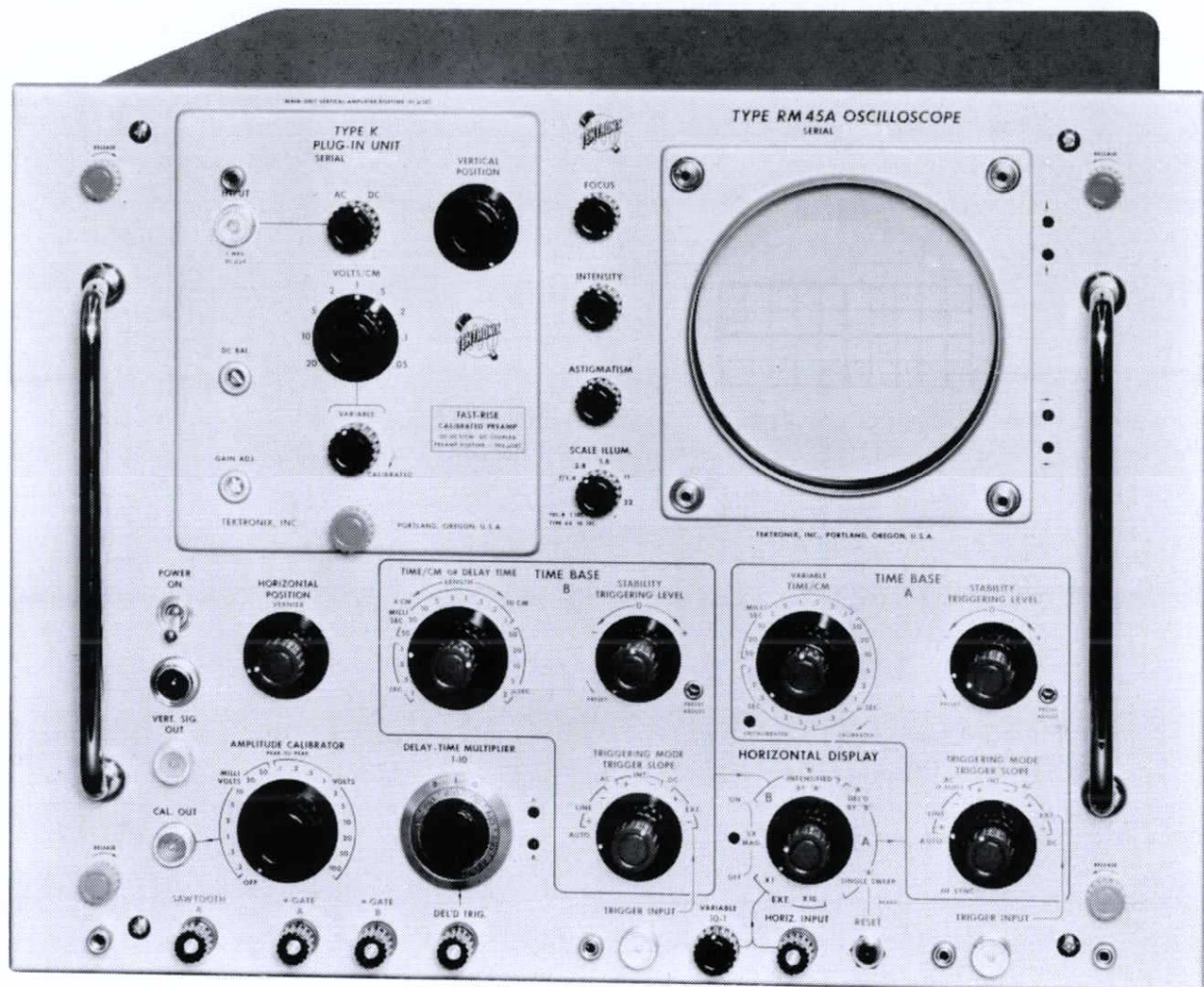
### OTHER CHARACTERISTICS

Electrical characteristics of the Type RM45A are the same as described for the Tektronix Type 545A Oscilloscope. Please refer to the Type 545A 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, blue wrinkle-finished cabinet.

**Dimensions**—14" high, 19" wide, 22 1/2" rack depth. Please see page 132 for complete dimensions.

**Weight**—84 pounds.

**Type RM45A, without plug-in units . . . . . \$1650**

Includes: 2—Probes (10-x atten.)  
2—Binding-post adapters (013-004)  
1—Test lead (012-031)  
1—Green filter (378-514)  
1—3-conductor power cord (161-008)  
1—Set, mounting hardware  
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.

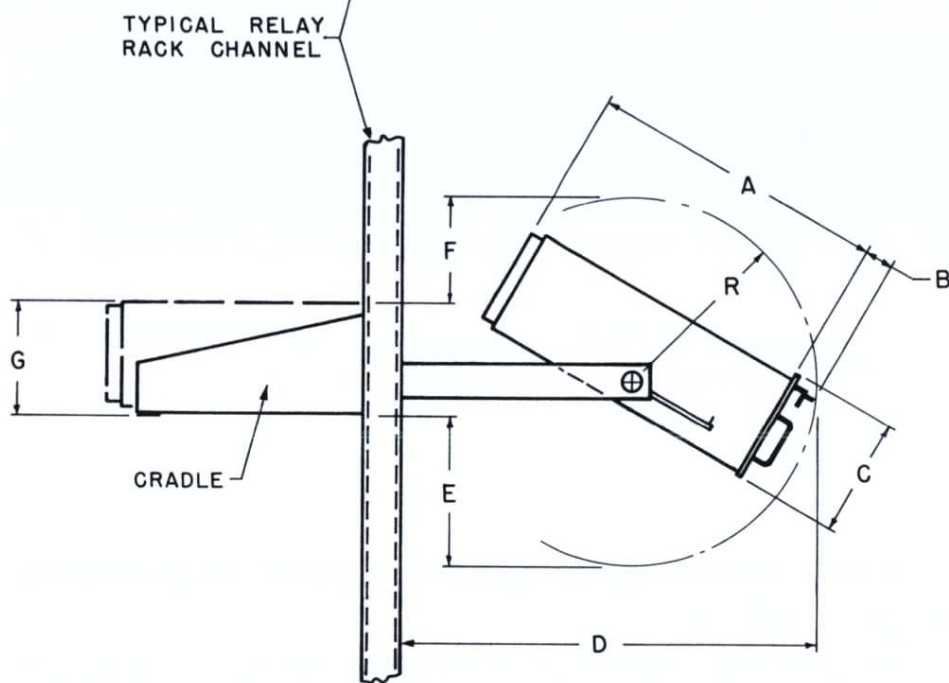
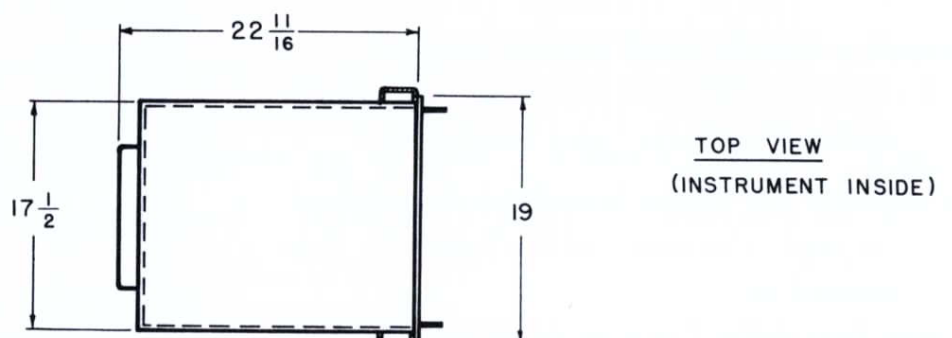
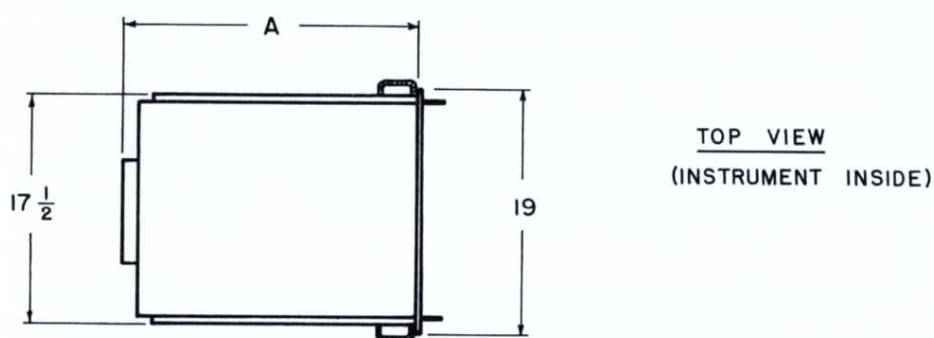
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)



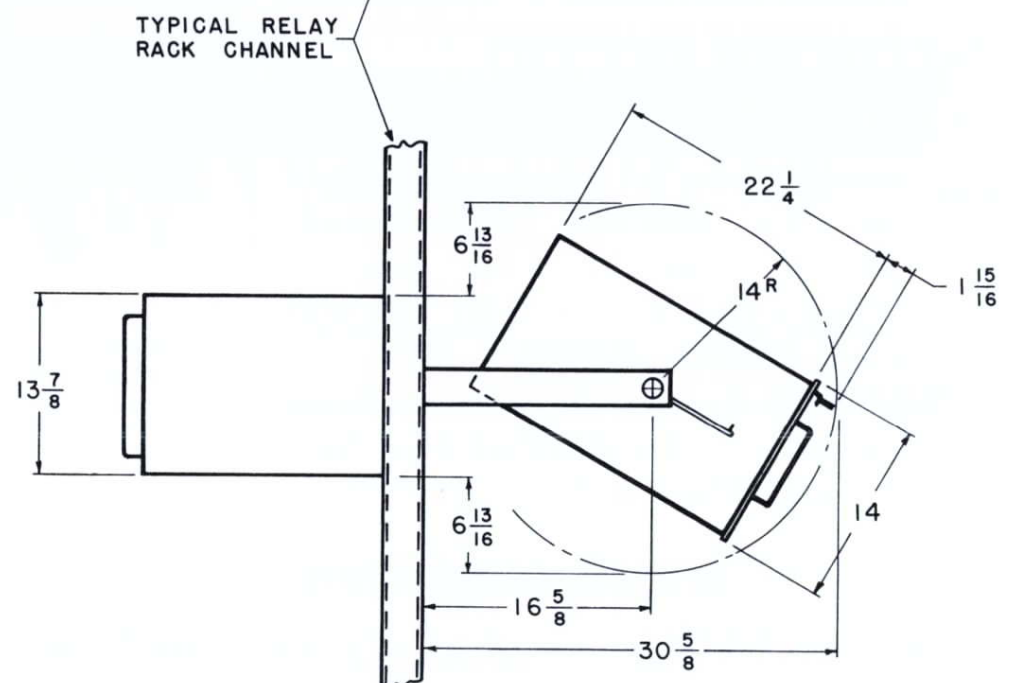
# MOUNTING DIMENSIONS

TEKTRONIX RM INSTRUMENTS

RM 30/40 OSCILLOSCOPES



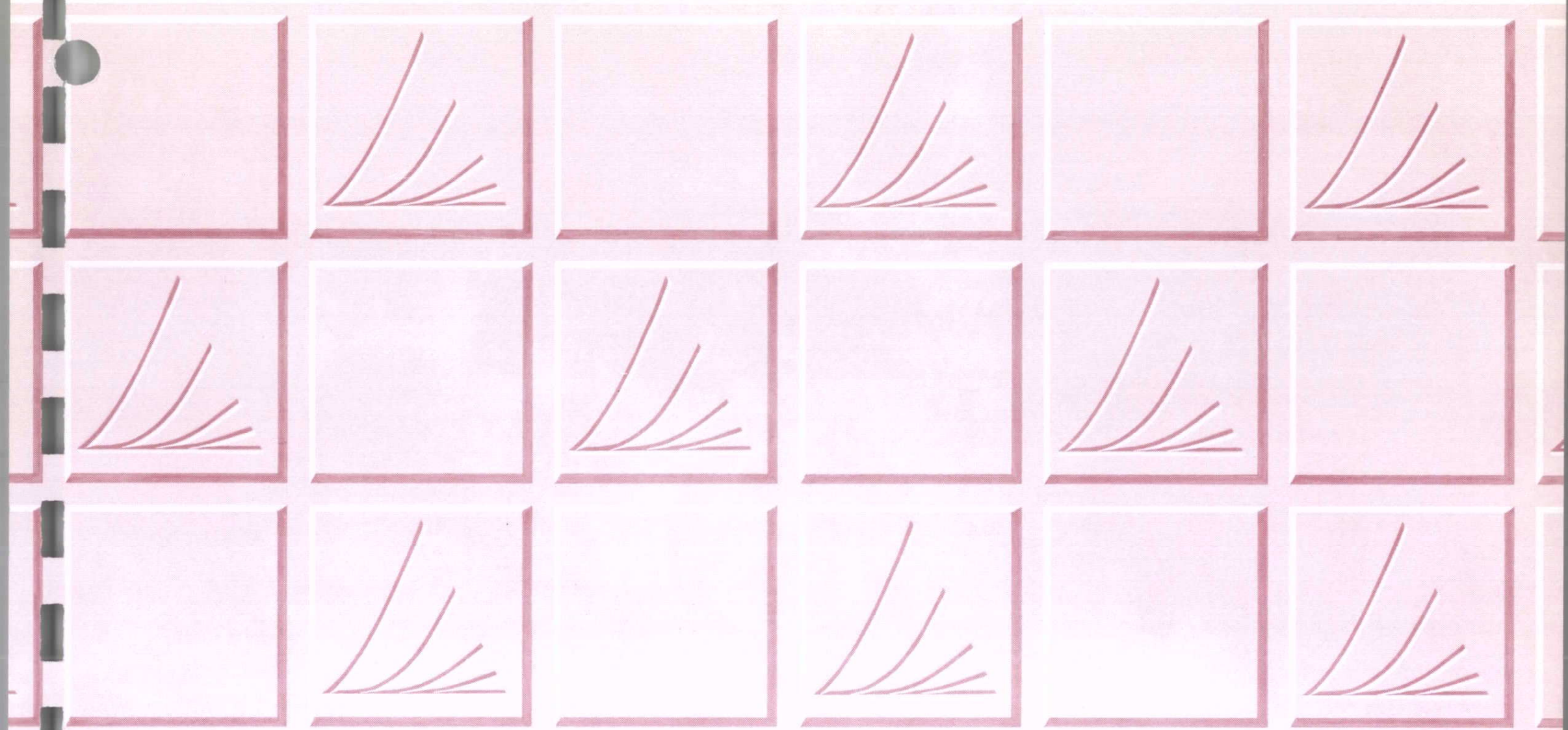
SIDE VIEW  
(INSTRUMENT OUTSIDE AND PARTLY ROTATED)



SIDE VIEW  
(INSTRUMENT OUTSIDE AND PARTLY ROTATED)

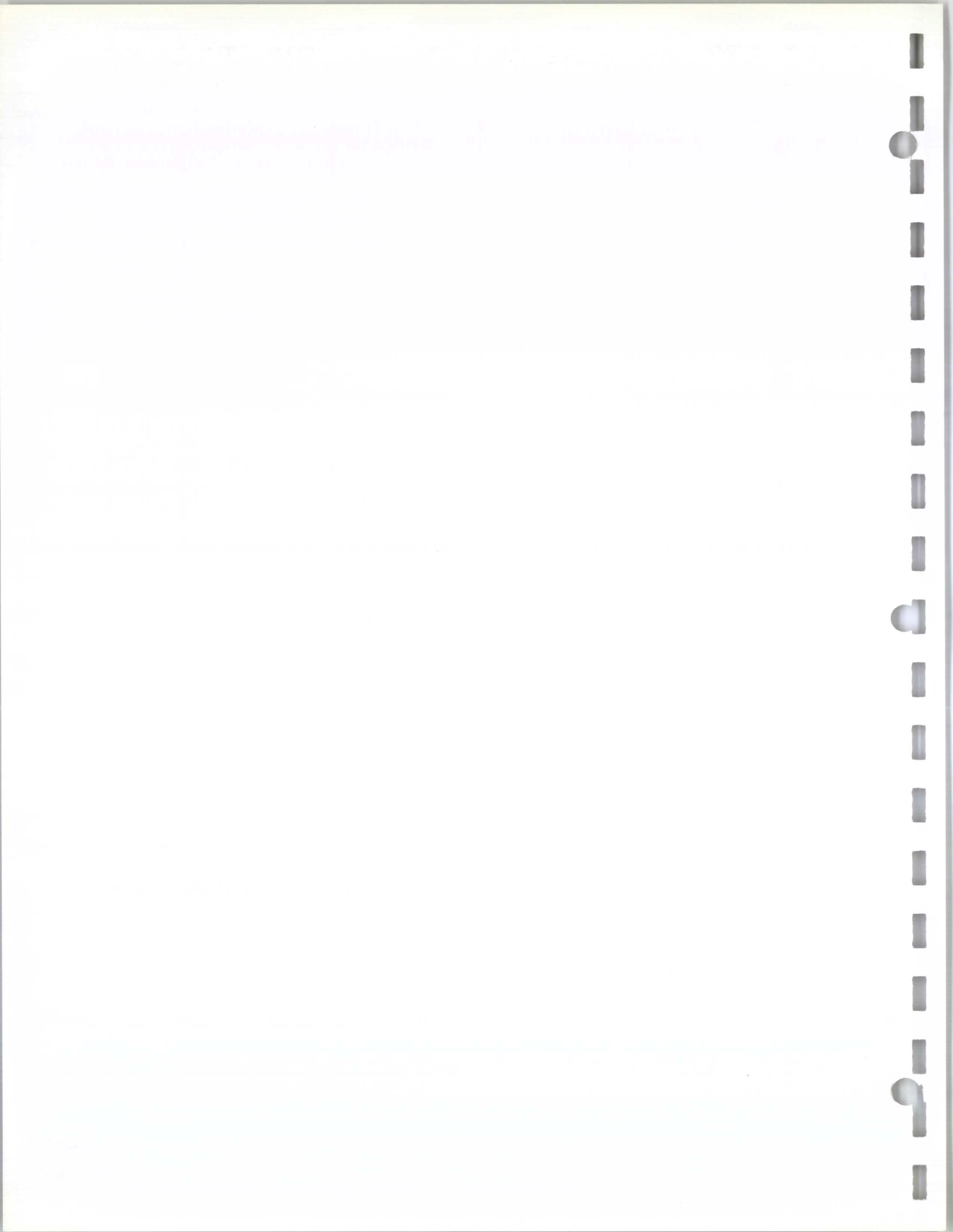
INST.	A	B	C	D	E	F	G	R
RM15	22 <sup>5</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	8 <sup>3</sup> / <sub>4</sub>	30 <sup>1</sup> / <sub>4</sub>	10 <sup>3</sup> / <sub>8</sub>	8 <sup>3</sup> / <sub>8</sub>	9 <sup>1</sup> / <sub>16</sub>	13 <sup>3</sup> / <sub>4</sub>
RM16	17 <sup>7</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>4</sub>	7	21 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>8</sub>	7 <sup>7</sup> / <sub>16</sub>	12 <sup>3</sup> / <sub>8</sub>
RM17	17 <sup>7</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>4</sub>	7	21 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>8</sub>	7 <sup>7</sup> / <sub>16</sub>	12 <sup>3</sup> / <sub>8</sub>
127	21 <sup>1</sup> / <sub>2</sub>	1 <sup>3</sup> / <sub>4</sub>	8 <sup>3</sup> / <sub>4</sub>	29 <sup>1</sup> / <sub>4</sub>	9 <sup>5</sup> / <sub>8</sub>	5 <sup>7</sup> / <sub>8</sub>	9 <sup>1</sup> / <sub>16</sub>	12 <sup>3</sup> / <sub>4</sub>





## CHARACTERISTIC-CURVE TRACERS







# 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.  
(up to 12 negative-bias curves)

### 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.

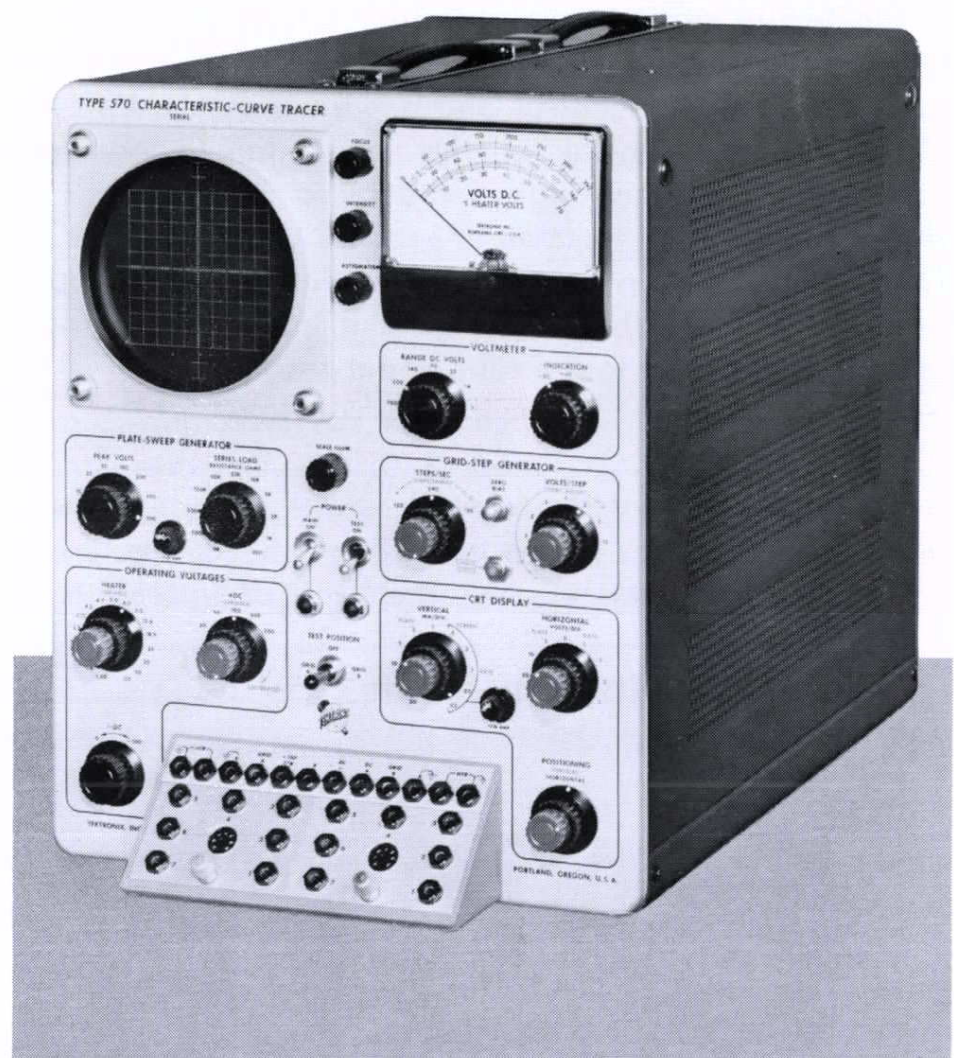
## GENERAL DESCRIPTION

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.

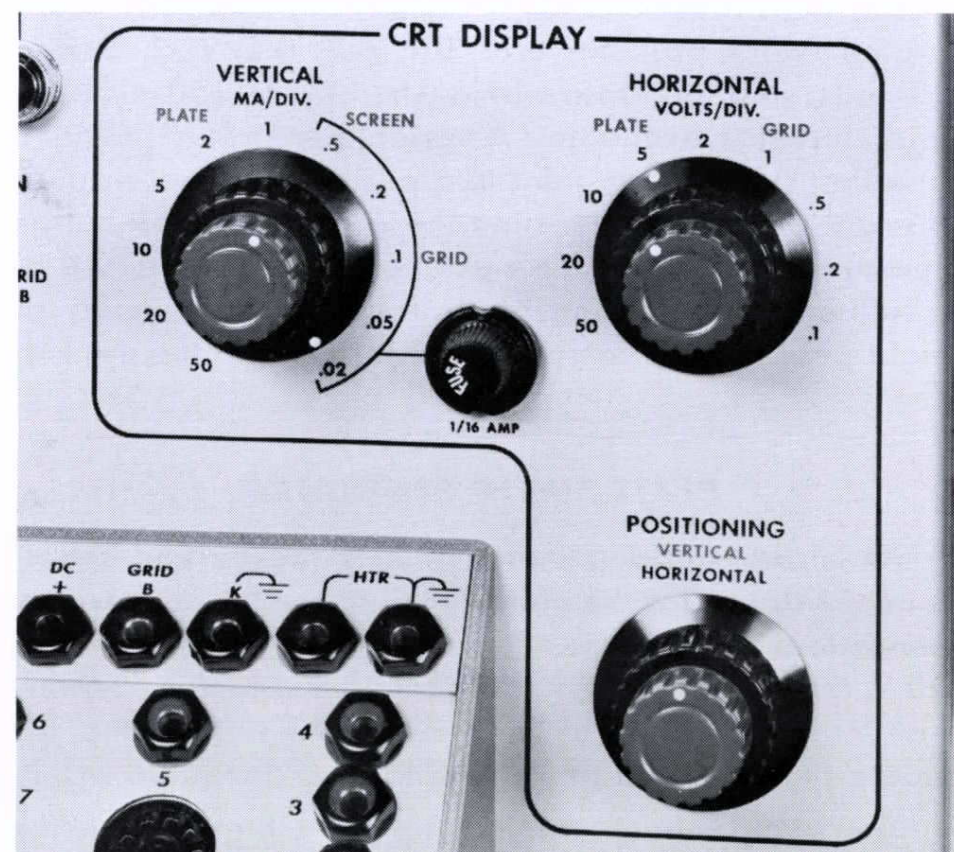
## CATHODE-RAY-TUBE DISPLAY

**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.



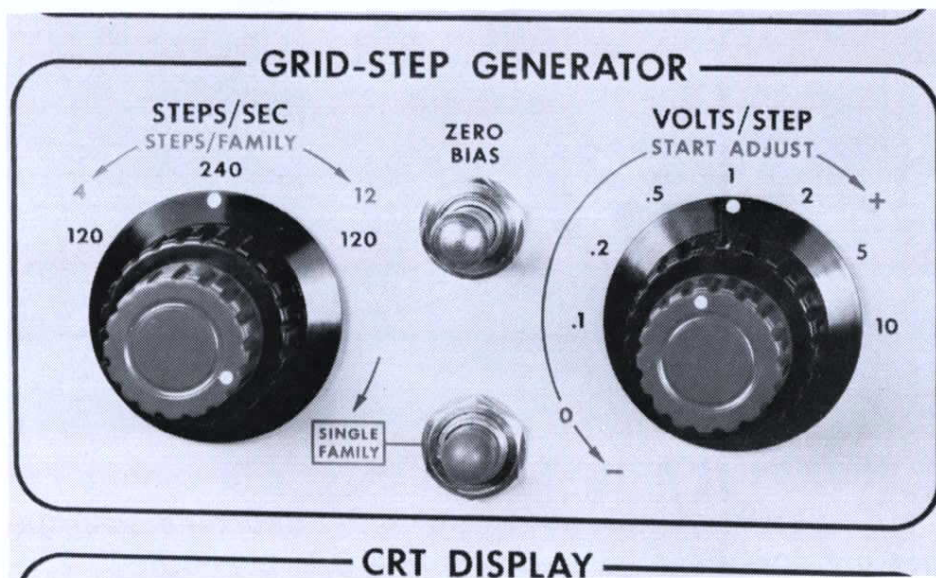


# TYPE 570 CHARACTERISTIC-CURVE TRACER

## 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



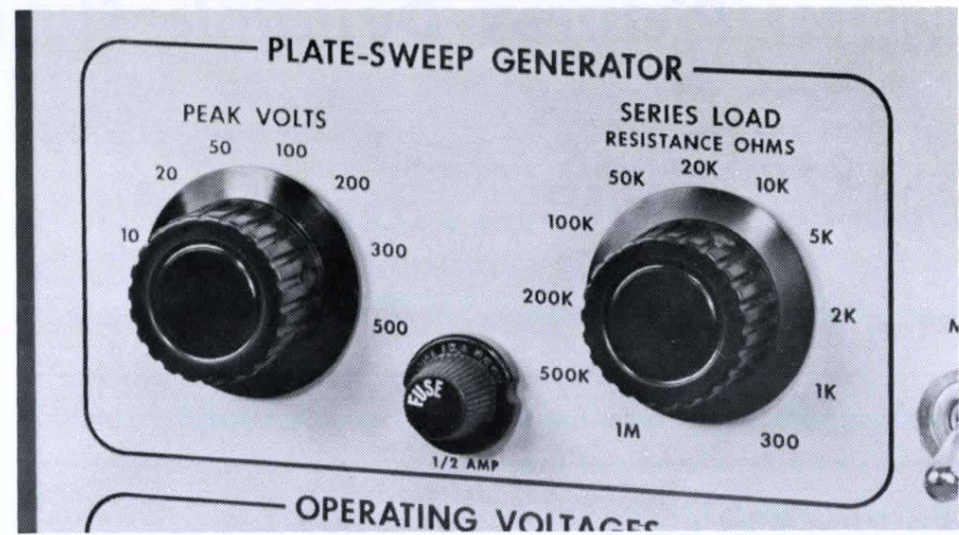
either end of the curves displayed. (When the Type 570 is used with a 50-cycle supply frequency, the step/sec rate will be either 100 or 200.)

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.

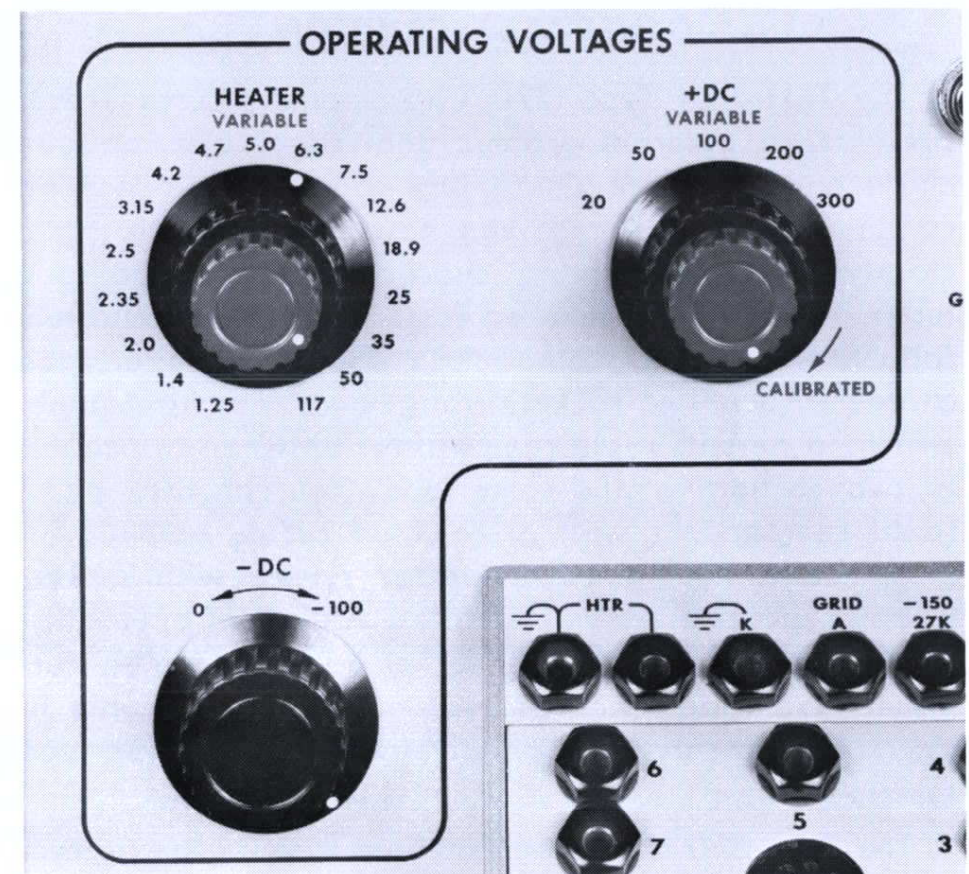
The peak voltage applied to the plate through the



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.



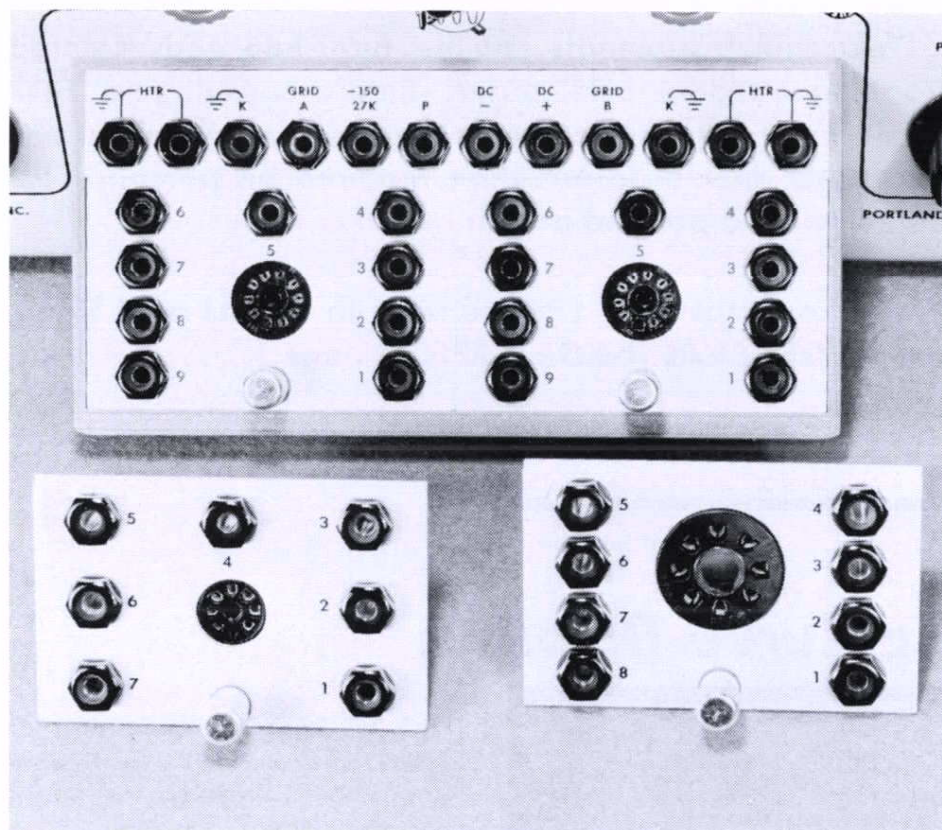
# TYPE 570 CHARACTERISTIC-CURVE TRACER

## 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 5CAP cathode-ray tube is used in the Type 570. Accelerating potential is approximately 4 kv. P1 phosphor is normally supplied. P2, P7, or P11 can be furnished instead if desired. Some other phosphors are available on special order.

**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		5CAP1



# 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, blue 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** ..... \$995

- Includes:
- 2—7 pin adapter plates (016-004)
  - 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  $\Omega$  6" (012-025)
  - 2—Suppressor cords 300  $\Omega$  6" (012-026)

- 2—Suppressor cords 1 k 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
- 5—1/2 amp 3AG Fast-Blo fuses
- 1—6U8
- 1—3-conductor power cord (161-008)
- 1—Instruction manual

## Optional Phosphors

P1 crt phosphor normally furnished.

P2, P7, P11 optional ..... No extra charge

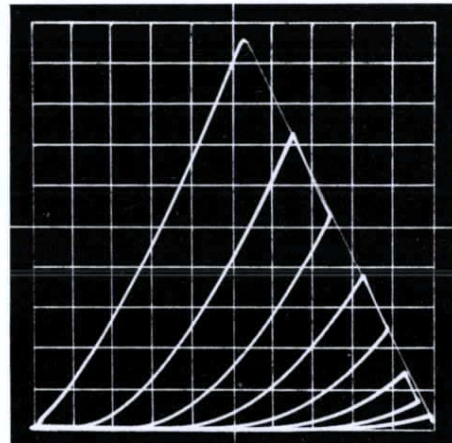
## Painted Panels

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.

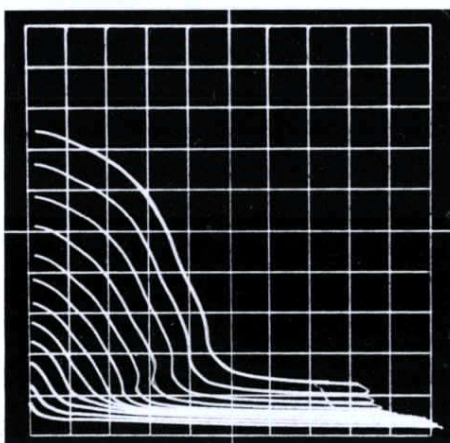
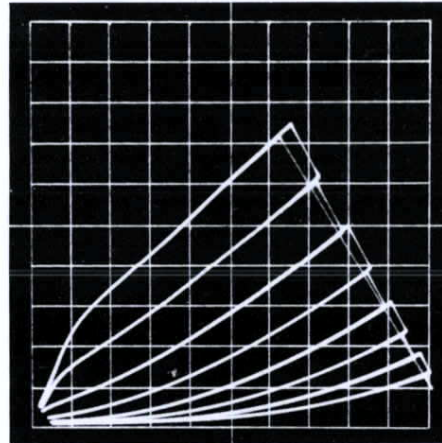
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)

## Type 570 Characteristic-Curve Displays

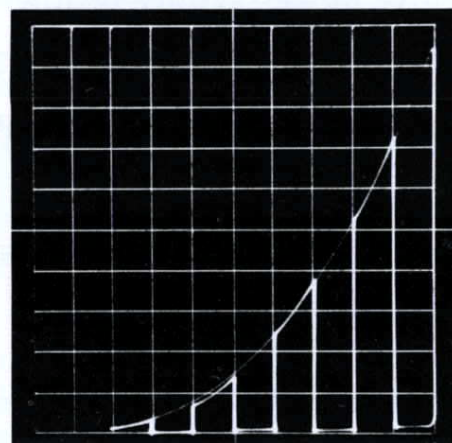
**Fig. 1**—Plate current plotted against plate voltage for one triode section of a 12AU7. Plate load is 5 k, peak plate-supply voltage is 500 v. Grid voltage is changed 5 v between curves, from -35 v to zero. Vertical sensitivity is 5 ma/div, horizontal sensitivity 50 v/div. Calibrated controls permit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



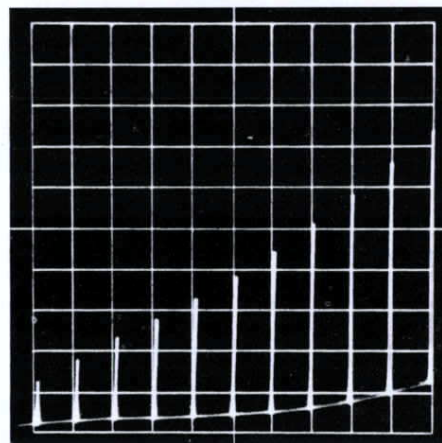
**Fig. 2**—Same triode section of 12AU7 with only 20-v peak plate supply and sensitivities increased to 0.2 ma/div vertical and 2 v/div horizontal. Grid voltage is changed 2 v between curves, from -14 v to zero. This is essentially a 25-times magnification of the lower left portion of Fig. 1, showing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



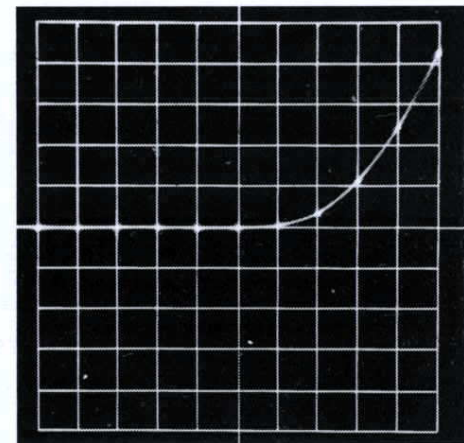
**Fig. 3**—Screen current plotted against plate voltage with positive grid bias on a 6AQ5. Plate load is 300 ohms, peak plate voltage is 100 v, screen-grid voltage is 100 v, with grid voltage changing 2 v/step from +16 v to below zero. Vertical scale is 10 ma/div, horizontal scale 10 v/div.



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



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



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



# TYPE 575 TRANSISTOR-CURVE TRACER

## Displays PNP and NPN Characteristics

### 20-AMPERE COLLECTOR DISPLAYS

(10 ampere average supply current).

### 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  $\mu$ 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.

### CATHODE-RAY-TUBE DISPLAY

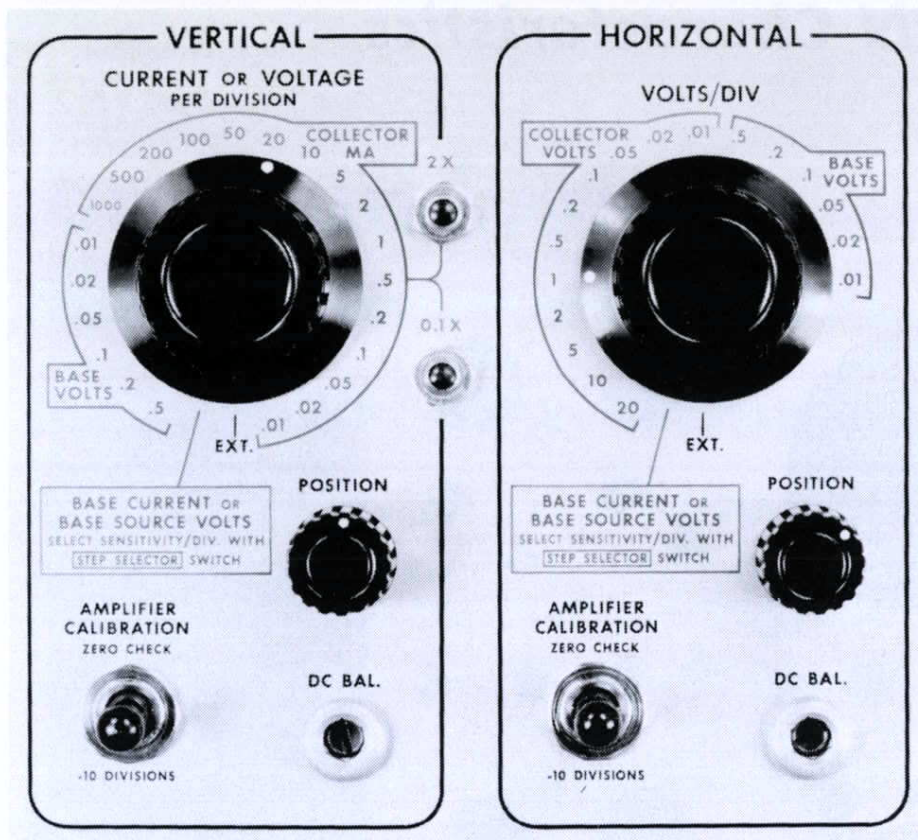
**Vertical Axis**—A 24-position switch provides for selection of collector current, base voltage, base current, or base source voltage. Calibrated vertical deflection in current-per-division for collector current is selected from sixteen of the switch positions, 0.01 ma/div to 1000 ma/div. Pushbuttons are provided for multiplying each current step by 2 and dividing by 10, increasing the current range to 0.001 to 2000 ma/div. Calibrated vertical deflection in volts-per-division for base voltage is selected from six other positions of the switch, 0.01 v/div to 0.5 v/div. Another position of the switch provides for vertical deflection by base current or base source voltage. Calibrated vertical deflection for base current and base source voltage is selected with the STEP SELECTOR switch.

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

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



# TYPE 575 TRANSISTOR-CURVE TRACER



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.

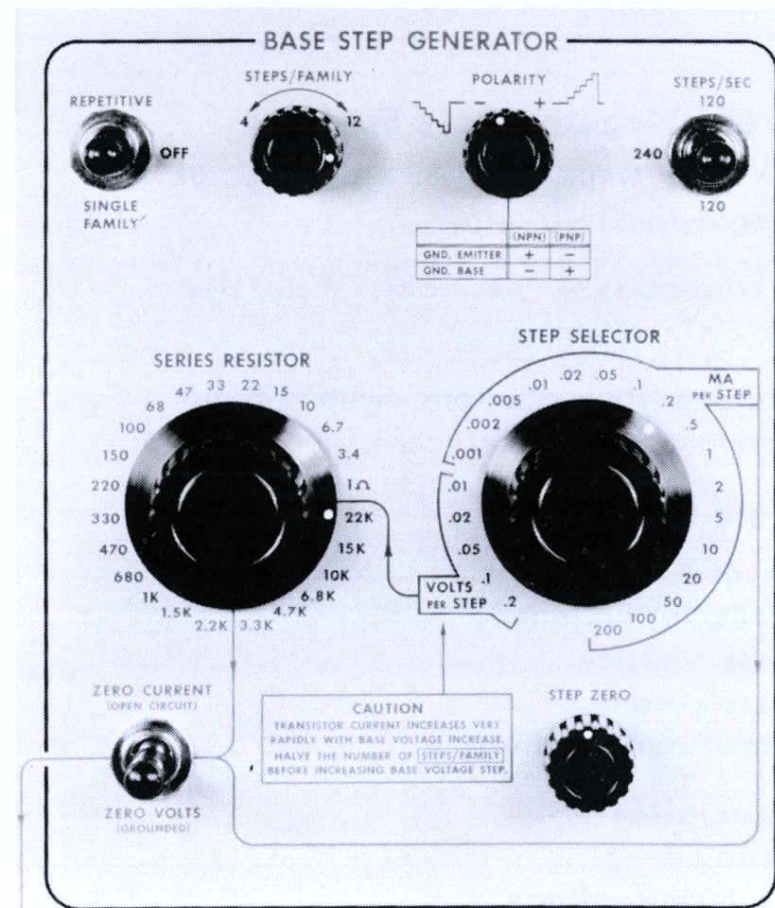
A horizontal-position control and an amplifier-zero-check switch are provided.

## 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.



## COLLECTOR SWEEP

The collector supply of the Type 575 consists of a variable transformer driving a power transformer whose secondary is tapped to give an output voltage of 0-20 volts or 0-200 volts. This output is full-wave rectified using germanium rectifiers in parallel or series depending upon the output-voltage range. The collector-supply primary is protected by a circuit breaker, set to trip

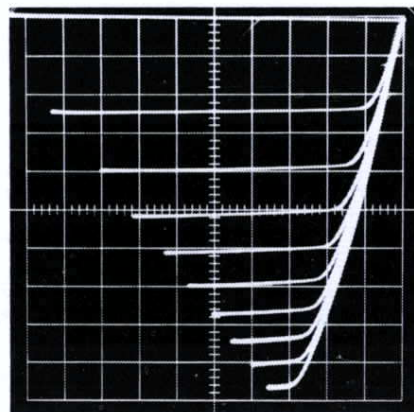


Fig. 1 — PNP Transistor

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.

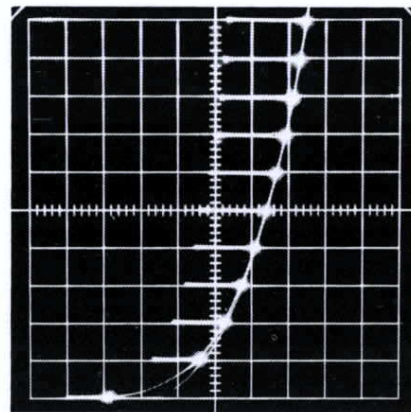


Fig. 2 — NPN Transistor

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

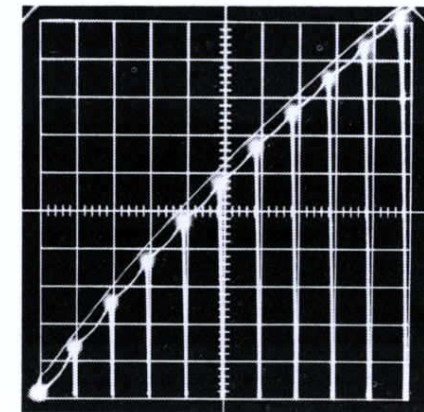


Fig. 3 — NPN Transistor

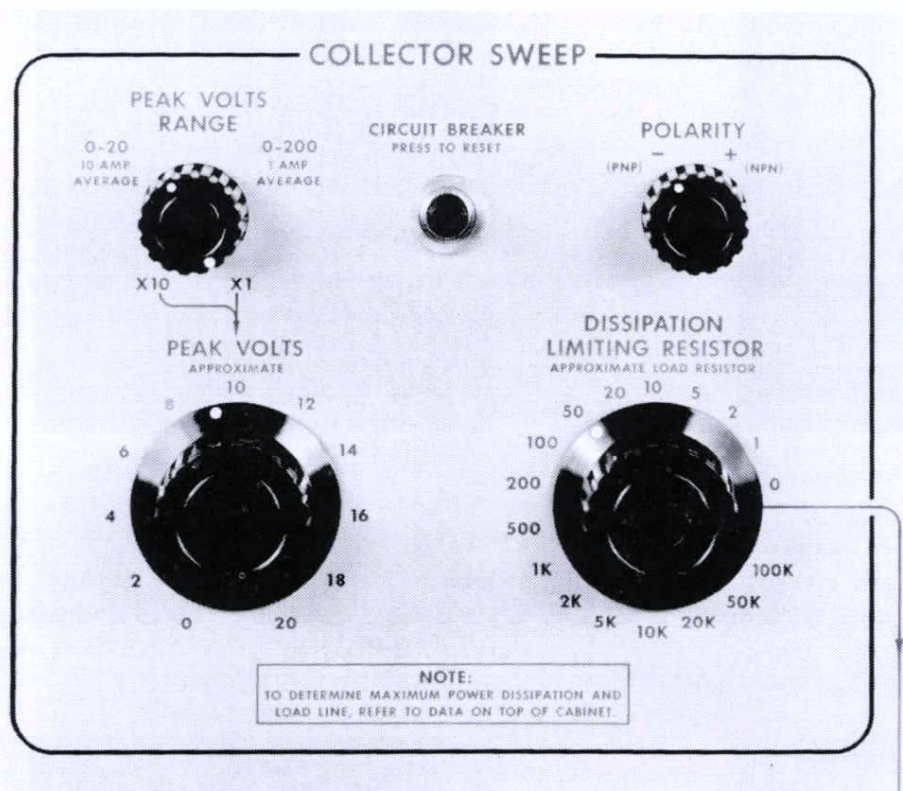
Collector current vs base current with constant-current base steps. Collector sweep is 0 to 1.5 v, base current 0.1 ma/step. Vertical deflection is 5 ma/div collector current, horizontal deflection 0.1 ma/div base current. Incremental and dc current gain can be determined from this display.



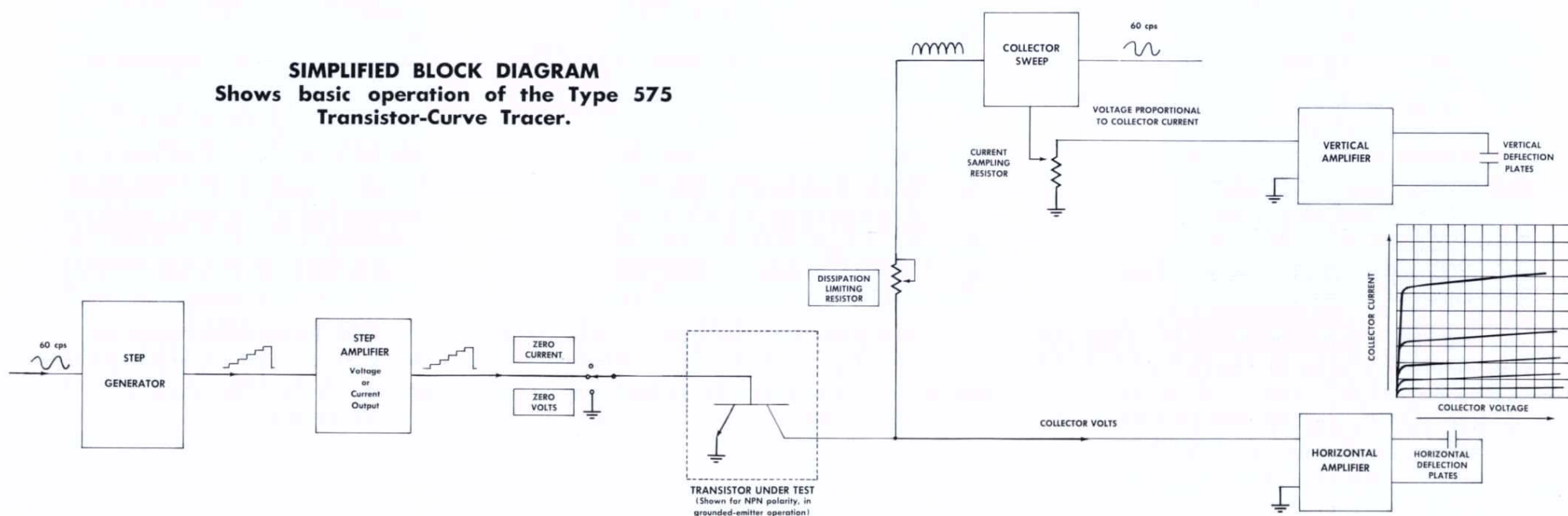
# TYPE 575 TRANSISTOR-CURVE TRACER

within 30 seconds at 1.2 ampere rms current but to hold on a rms current of 1 ampere. The turns ratio of the transformer for the 20-v range is such that a maximum peak current of 15 amperes is available with 1 ampere rms in the primary. Because the current pulses for transistors are not sinusoidal nor of constant amplitude, and their duty cycle is dependent upon the characteristics of the device being tested, it is difficult to say what maximum collector-current curves can be plotted. Generally, a family of collector-current curves can be plotted to 20 amperes or more when the transistors have a beta of 8 or greater. When checking diodes the waveform of the current pulses is such that a curve of about 15 amperes maximum can be drawn.

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 average 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.



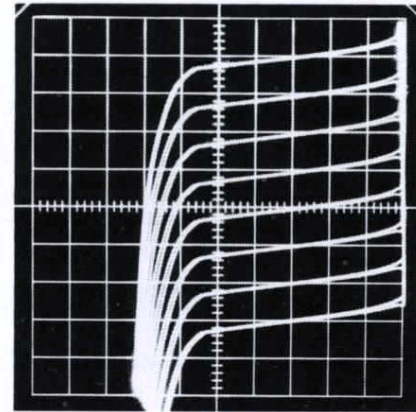
**SIMPLIFIED BLOCK DIAGRAM**  
Shows basic operation of the Type 575 Transistor-Curve Tracer.



## OTHER FEATURES

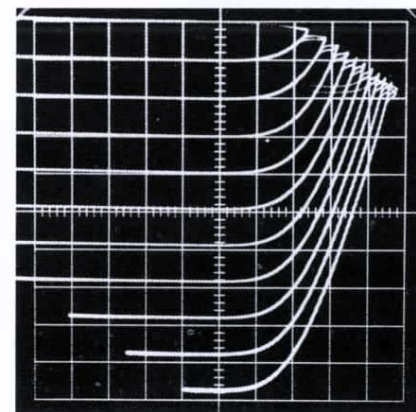
**Input Selection**—A switch is provided for changing the test conditions from the common-emitter to the common-base configuration.

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



**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

**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 5CAP cathode-ray tube is used in the Type 575. Accelerating potential is approximately 4 kv. P1 phosphor is normally supplied. P2, P7, or P11 can be furnished instead if desired. Some other phosphors are available on special order.

**Illuminated Graticule**—The 10 by 10-division graticule is edge-lighted. Illumination, 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**—105-125 or 210-250 volts, 50-60 cycles, 410 watts maximum, 220 watts standby.

**Price** ..... **\$975**

- Includes: 1—Green filter (378-514)  
 2—2N407 Transistors (151-003)  
 2—Long-lead transistor receptacles  
 2—Short-lead transistor receptacles  
 1—3-conductor power cord (161-008)  
 1—Instruction manual

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

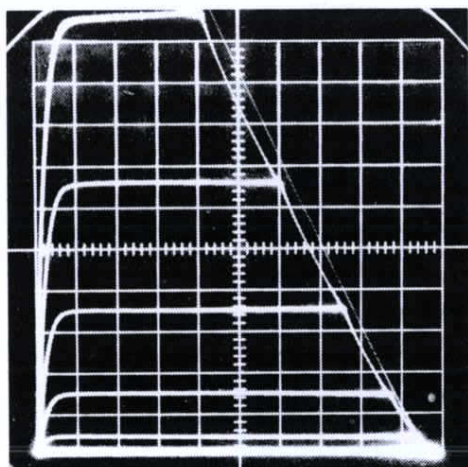


Fig. 6 — NPN Transistor

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.

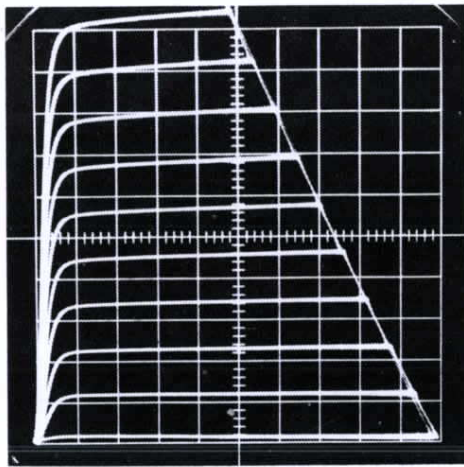


Fig. 8 — NPN Transistor

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.

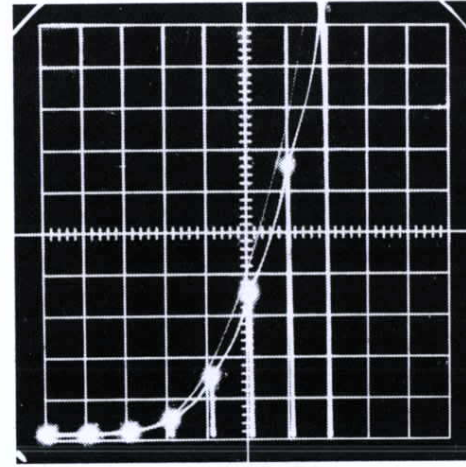


Fig. 10 — NPN Transistor

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.

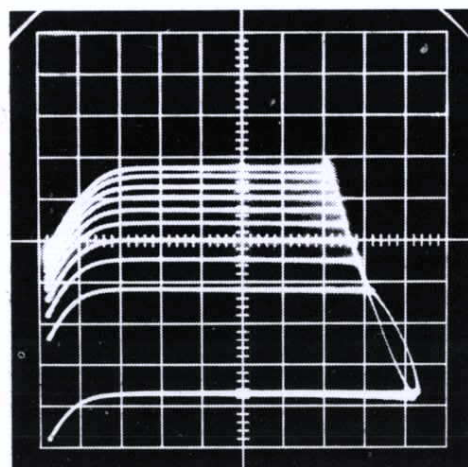


Fig. 7 — NPN Transistor

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.

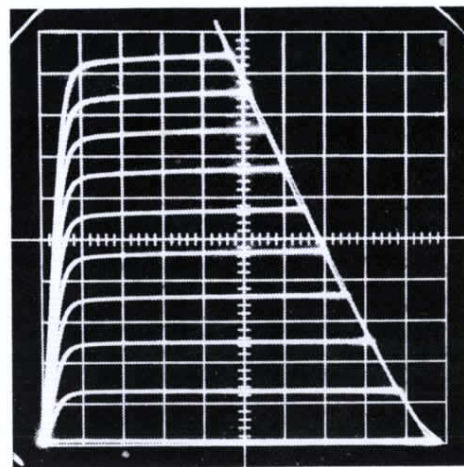


Fig. 9 — NPN Transistor

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

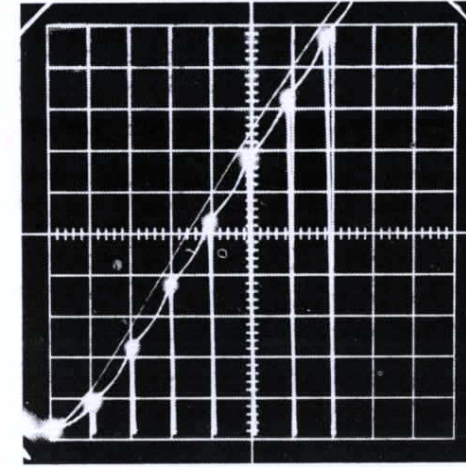


Fig. 11 — NPN Transistor

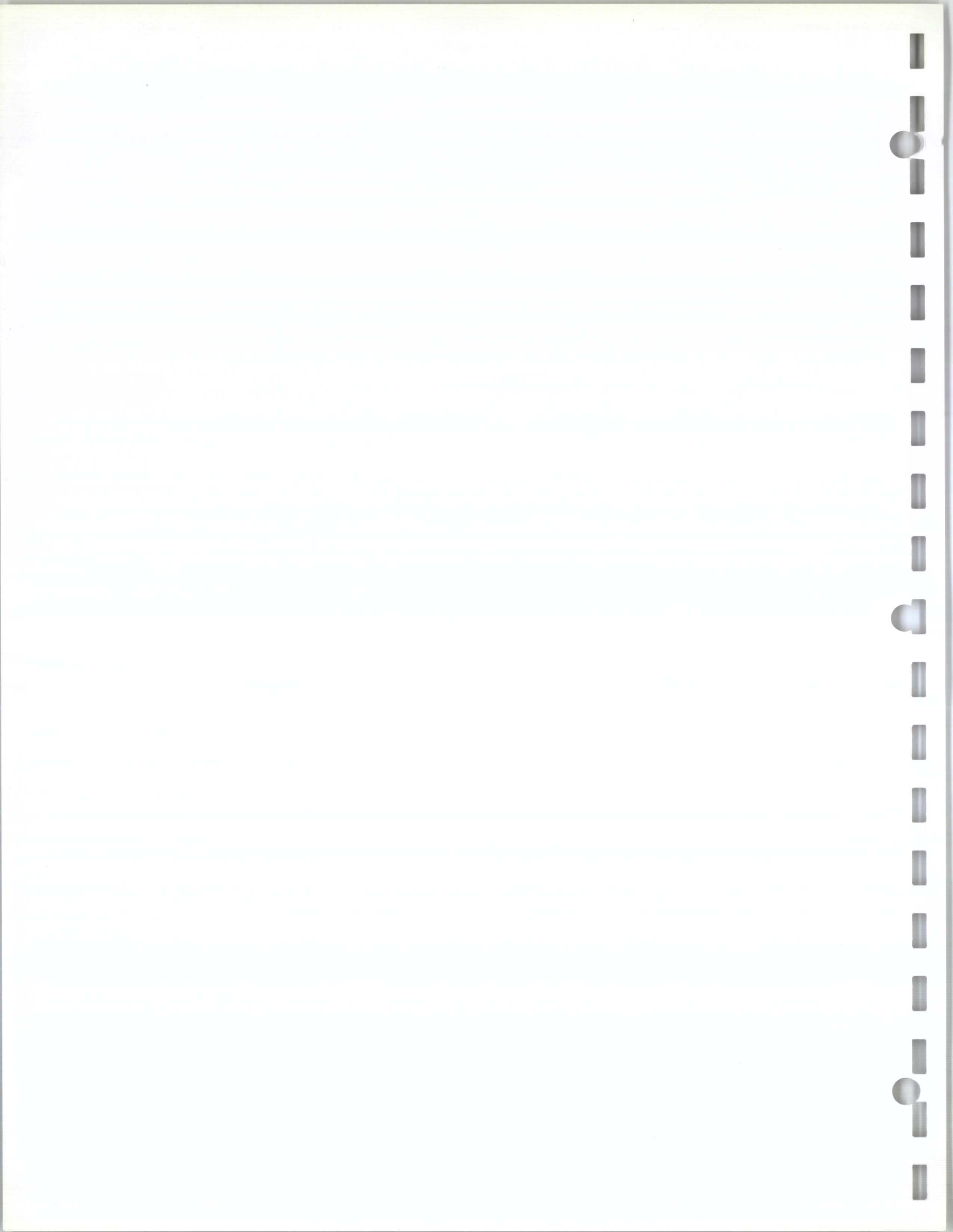
Same as Fig. 10 except base-voltage steps are 0.1 v/step with a 470-ohm source impedance.





SQUARE WAVE GENERATORS







# 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

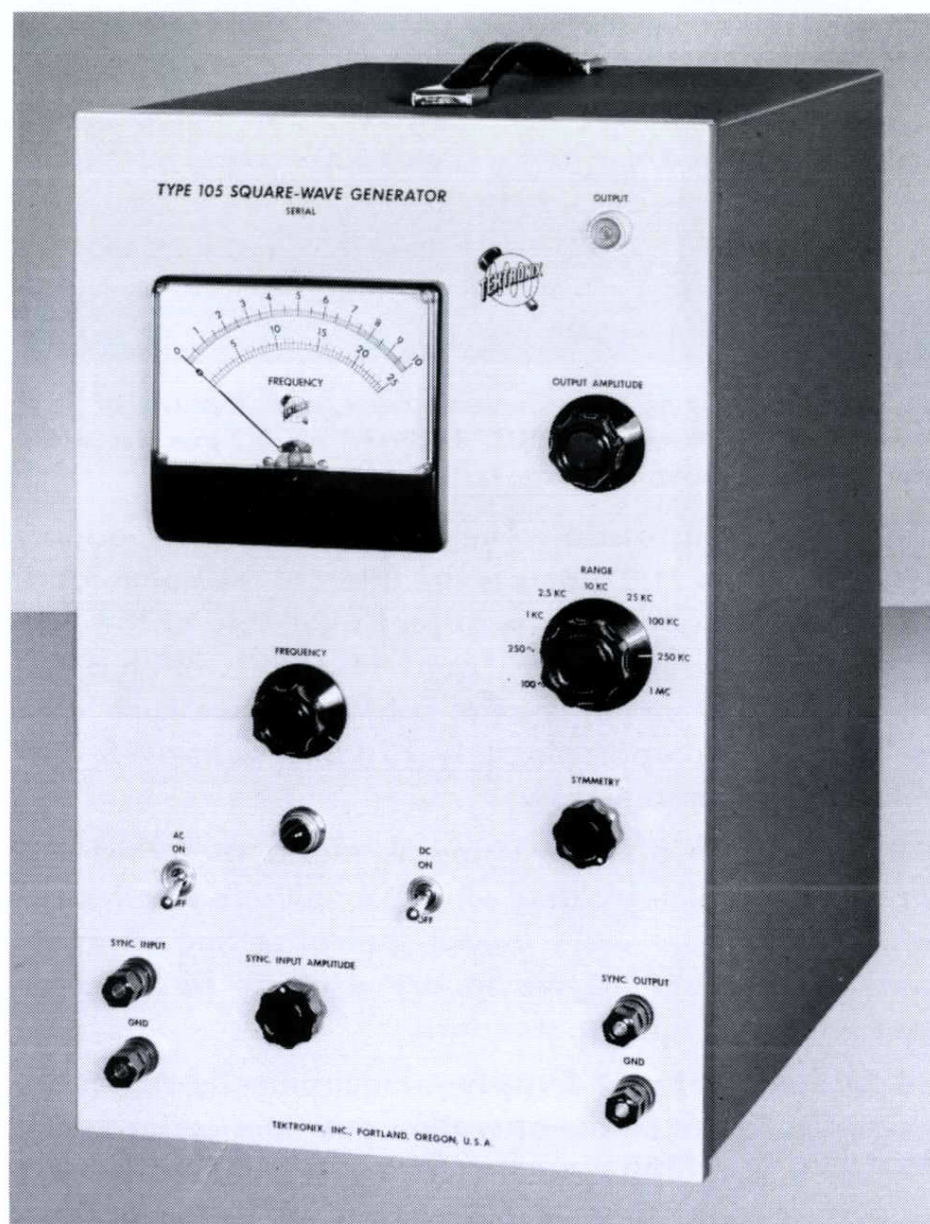
15 v, approximately, into 93-ohm cable. More than 160 ma, peak-to-peak.

## 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.

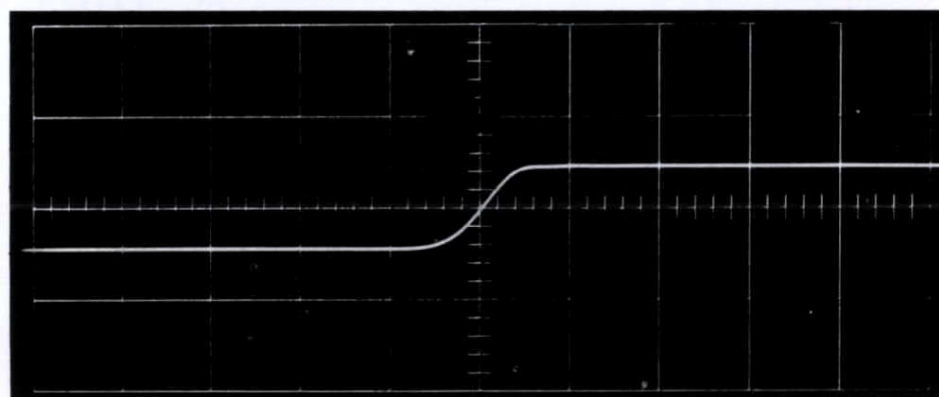


Fig. 1. 13-millimicrosecond risetime of the Type 105 displayed on  $0.02 \mu\text{sec/cm}$  sweep. Generator connected to vertical deflection plates of T54P crt, sensitivity 7 v/cm, with 52-ohm cable terminated at both ends.



# TYPE 105 SQUARE-WAVE GENERATOR

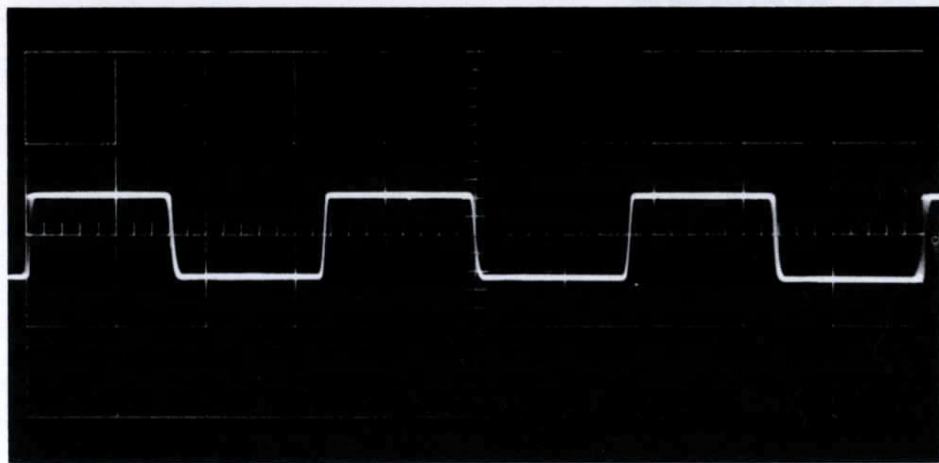


Fig. 2. Sharp leading edge, square corner, and flat top of 1- $\mu$ c square-wave output of Type 105 displayed on 0.3  $\mu$ sec/cm sweep. Other conditions same as in Fig. 1.

**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.

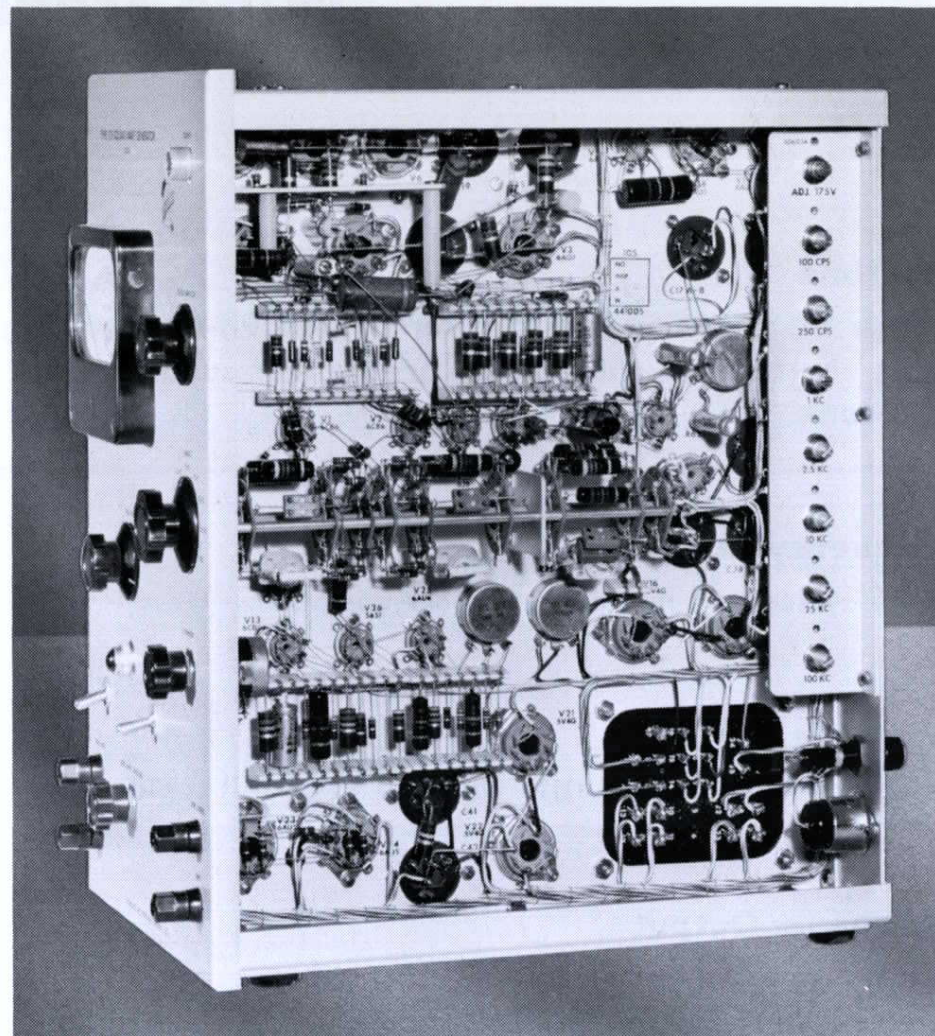
**Construction**—Aluminum-alloy chassis and cabinet.

**Finish**—Photo-etched anodized front panel, blue 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—Binding-post adapter (013-004)
- 1—3-conductor power cord (161-008)
- 1—Clip-lead adapter (013-003)
- 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 Type 540-Series and Type 550-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 and Type 550-Series Oscilloscopes with the Type 53/54K or Type K Plug-In Preamplifier have a combination risetime of 14 millimicroseconds or better. 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 and Type 550-Series Oscilloscopes and Tektronix 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** ..... \$175

Includes: 1—P52, 52-ohm 42" coaxial cable  
1—B52-R, 52-ohm terminating resistor  
1—3-conductor power cord (161-008)  
1—Instruction manual

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

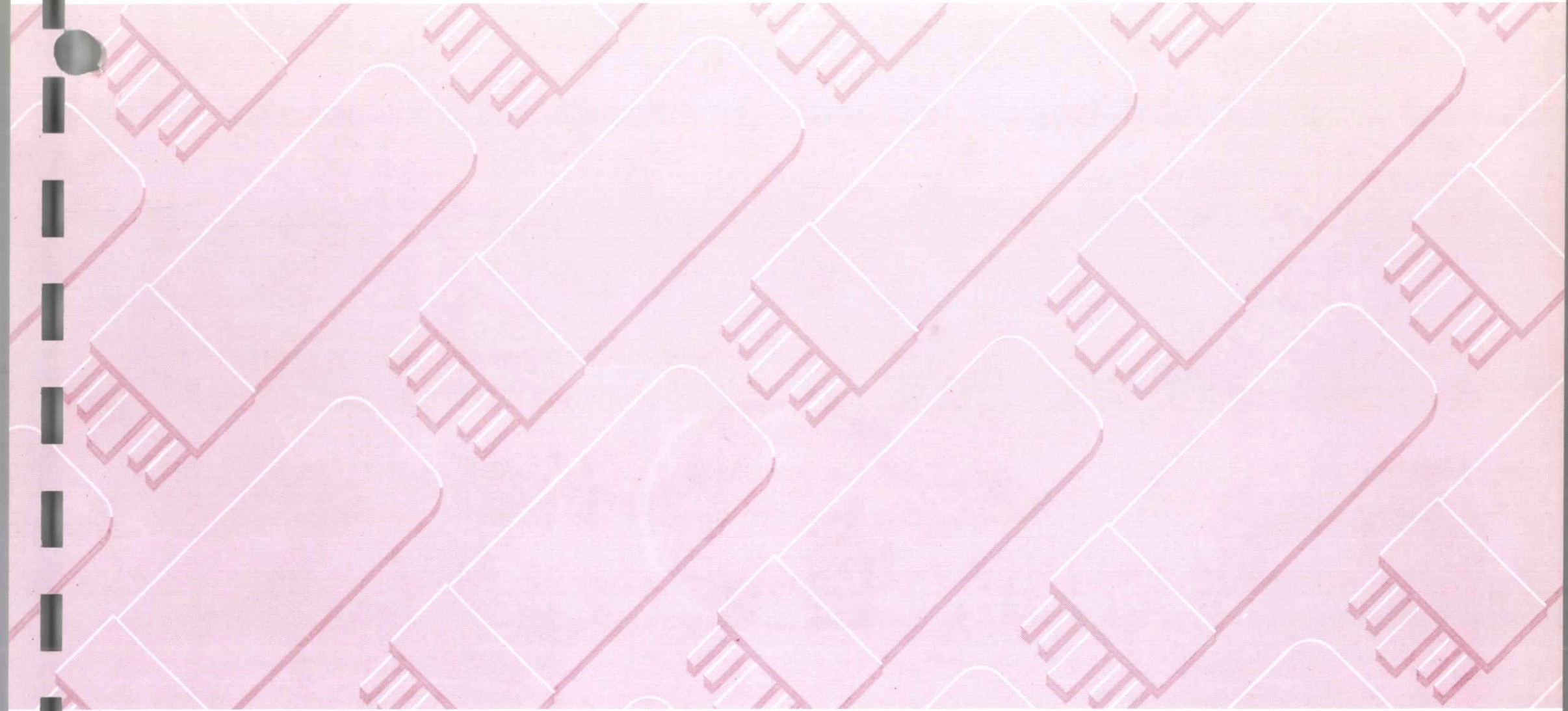


# TYPE III SQUARE-WAVE GENERATOR

J. William Raymond, Raleigh, N.C.

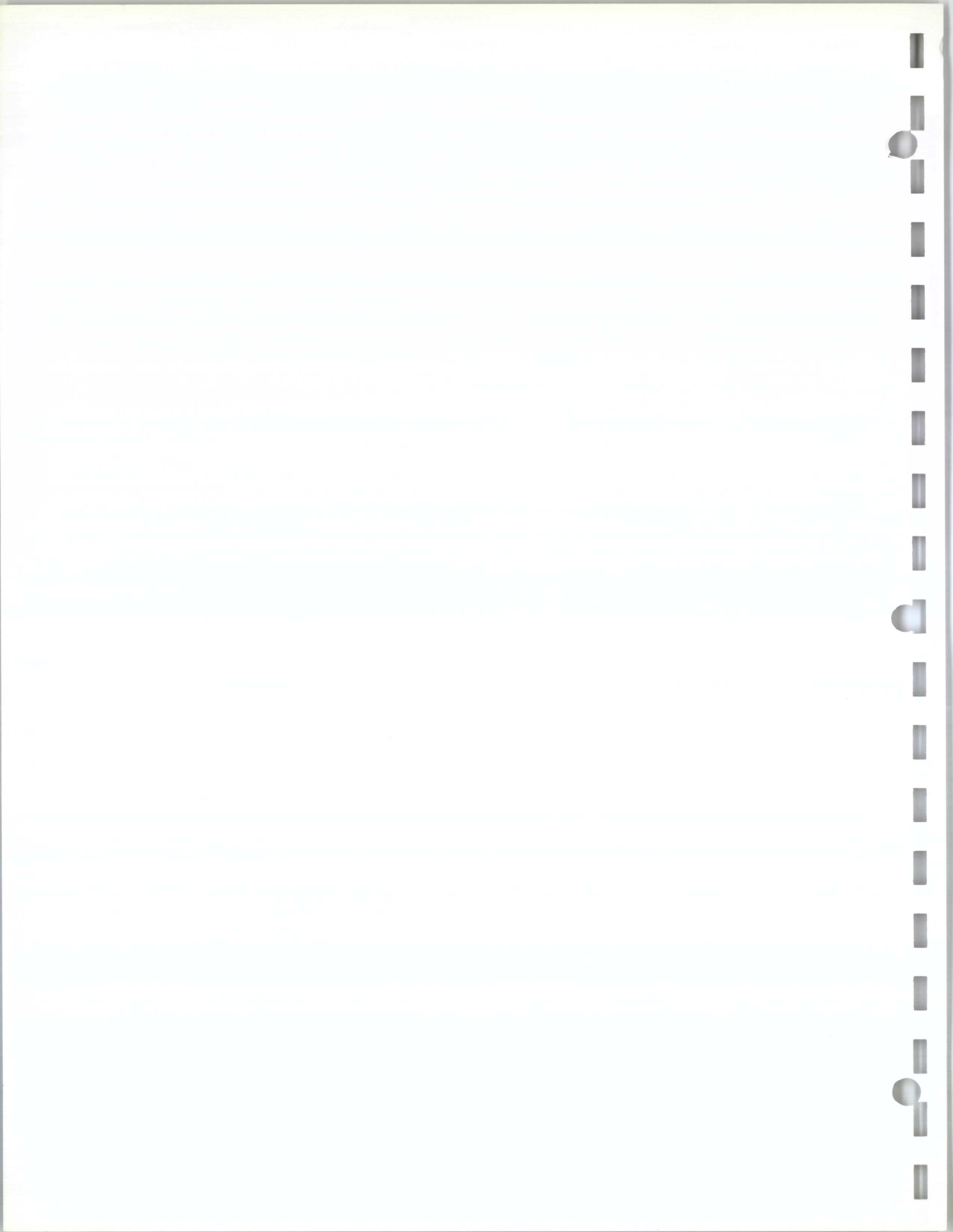
The following text is extremely faint and illegible due to the quality of the scan. It appears to be a technical document or report, likely containing a description of the square-wave generator and its characteristics. The text is organized into several paragraphs and possibly includes a table or figure, but the details are not discernible.





## AUXILIARY AMPLIFIERS











Wide Band Preamplifier

1. This preamplifier is designed to provide a wide bandwidth of 100 Hz to 100 kHz with a gain of 100. It is suitable for use with a variety of transducers and sensors.

2. The input impedance is 100 kΩ and the output impedance is 100 Ω. The input is protected against short circuits and open circuits.

3. The preamplifier is powered by a single 12V DC supply. The quiescent current is 10 mA and the maximum current is 20 mA.

4. The preamplifier is housed in a standard 9-pin D-sub connector. The pin connections are as follows:

Pin 1: Input (+)

Pin 2: Input (-)

Pin 3: Output

Pin 4: Ground

Pin 5: Ground

Pin 6: Ground

Pin 7: Ground

Pin 8: Ground

Pin 9: Ground

5. The preamplifier is suitable for use in a variety of applications, including signal conditioning, data acquisition, and instrumentation.

6. The preamplifier is available in a variety of packages, including through-hole and surface-mount.

7. The preamplifier is available in a variety of gain settings, including 10, 100, and 1000.

8. The preamplifier is available in a variety of bandwidths, including 100 Hz to 100 kHz, 100 Hz to 10 kHz, and 100 Hz to 1 kHz.

9. The preamplifier is available in a variety of input impedances, including 100 kΩ, 10 kΩ, and 1 kΩ.

10. The preamplifier is available in a variety of output impedances, including 100 Ω, 10 Ω, and 1 Ω.

11. The preamplifier is available in a variety of supply voltages, including 12V, 5V, and 3V.

12. The preamplifier is available in a variety of quiescent currents, including 10 mA, 5 mA, and 2 mA.

13. The preamplifier is available in a variety of maximum currents, including 20 mA, 10 mA, and 5 mA.

14. The preamplifier is available in a variety of connector types, including D-sub, BNC, and SMA.

15. The preamplifier is available in a variety of package sizes, including 9-pin, 15-pin, and 25-pin.

16. The preamplifier is available in a variety of package materials, including plastic and metal.

17. The preamplifier is available in a variety of package finishes, including tin, gold, and silver.

18. The preamplifier is available in a variety of package orientations, including upright and inverted.

19. The preamplifier is available in a variety of package types, including DIP, SOIC, and QFN.



# 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  $\mu\text{v}$  rms maximum.

### Output Voltage

Maximum 20 v (peak-to-peak).

### Input Selection

Single ended or differential.

### GENERAL DESCRIPTION

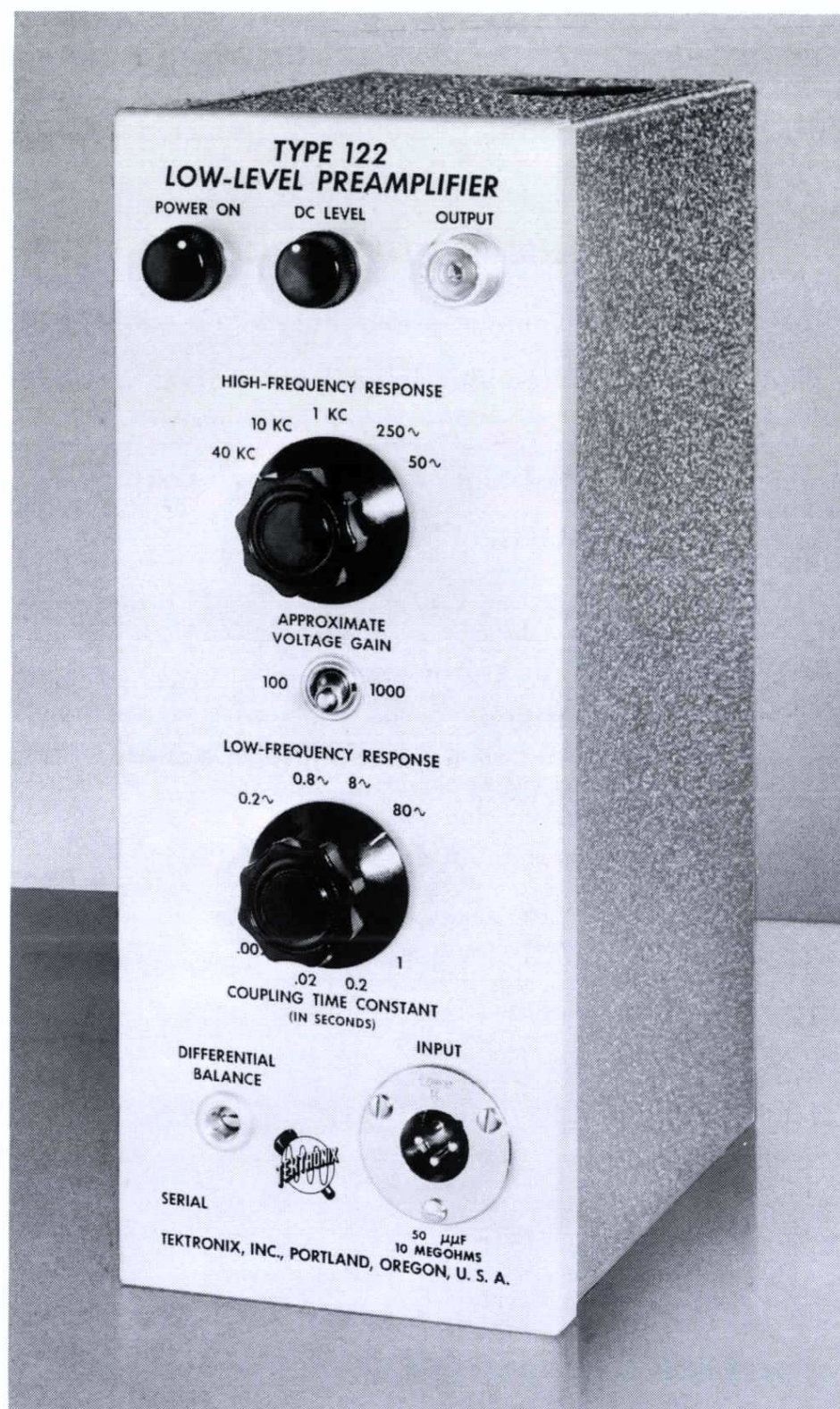
The Tektronix Type 122 Low-Level Preamplifier is a compact 3-stage battery-operated amplifier extending the usefulness of the oscilloscope into the microvolt region. The Type 122 is especially useful in biological research and other applications requiring the amplification of microvolt signals.

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

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

### CHARACTERISTICS

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



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

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

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

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

**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

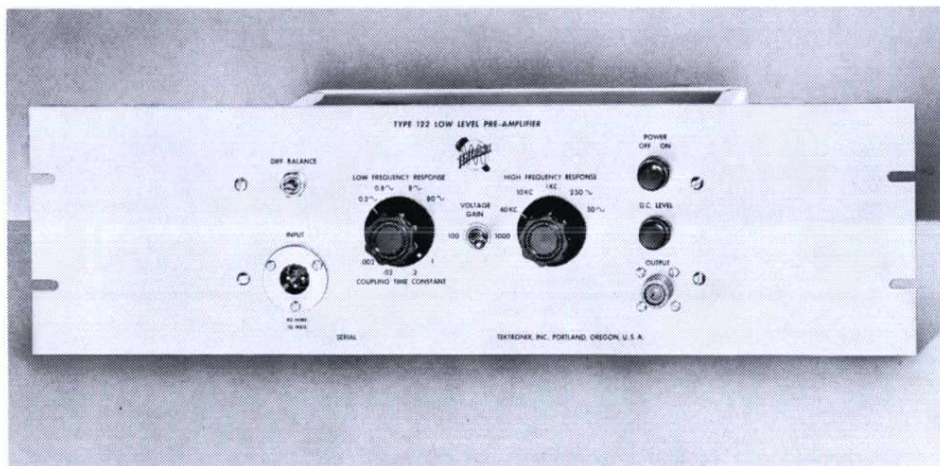
## ELECTRON-TUBE COMPLEMENT

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

## MECHANICAL SPECIFICATIONS

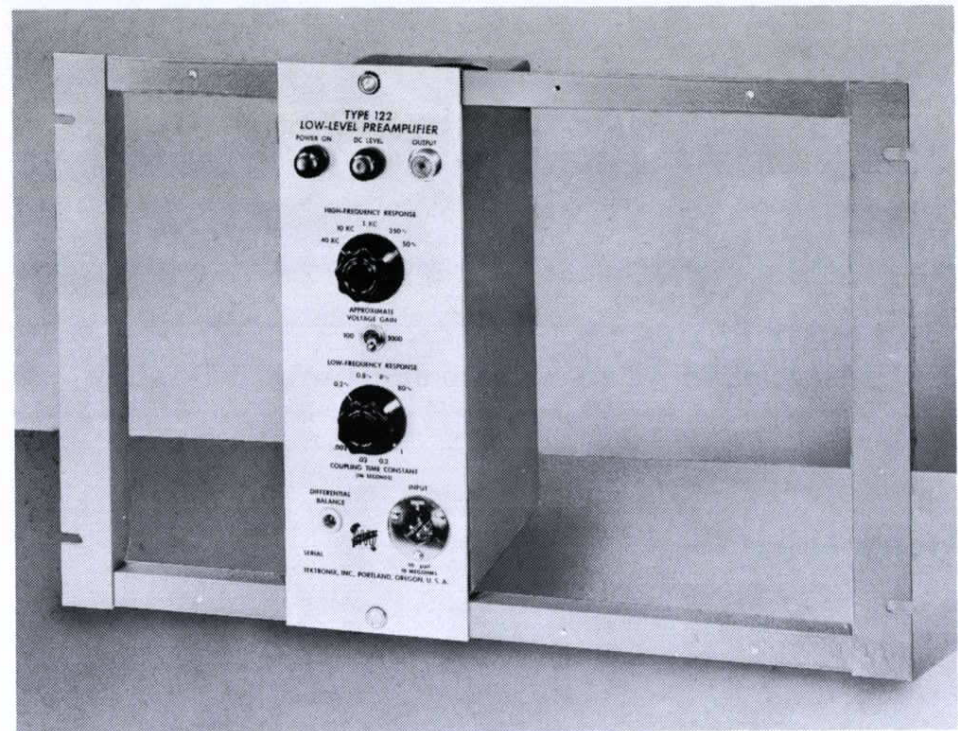
Construction—Aluminum-alloy chassis and cabinet.  
 Finish—Photo-etched anodized front panel, wrinkle-finished cabinet.  
 Dimensions—10 5/8" high, 4 1/2" wide, 7" deep.  
 Weight—5 1/2 pounds.  
 Power Requirements—Battery powered through a standard octal plug: +135 v at 5 ma, -90 v at 4 ma, and 6.3 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 storage battery. Batteries are not included with the Type 122.

**Type 122 . . . . . \$125**  
 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 . . . . . \$130**



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

**Type 122 Frame Mount . . . . . \$130**

## 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

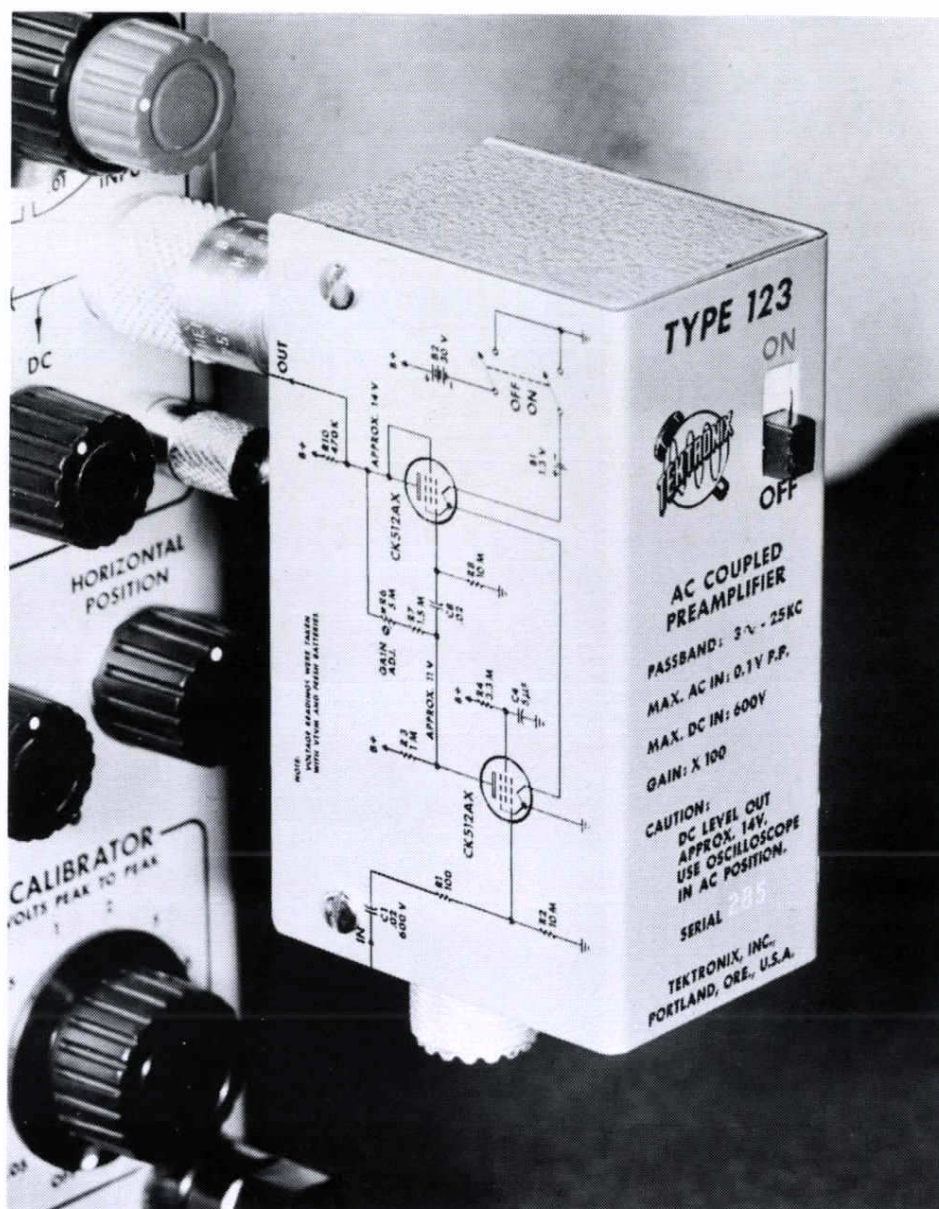
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





# TYPE 123 PREAMPLIFIER

## Miniature Low-Level



### Compact

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

### Weighs only 10 ounces.

### Voltage Gain

Accurately set at 100 times.

### Passband

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

### Maximum Input Signal

0.1 v peak-to-peak.

### Hum-Free Low-Level Amplification

Powered by miniature batteries.

### GENERAL DESCRIPTION

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

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

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

### CHARACTERISTICS

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

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

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

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

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

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

**Input Impedance**—10 megohms.

**Effective Output Impedance**—31 kilohms.

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

### MECHANICAL SPECIFICATIONS

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

**Finish**—Photo-etched anodized front panel.

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

**Weight**—10 ounces.

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

**Price** . . . . . \$50

Includes: 1—Mercury cell  
1—B battery

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





Administrative Information

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MEMORANDUM

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ADMINISTRATIVE INFORMATION

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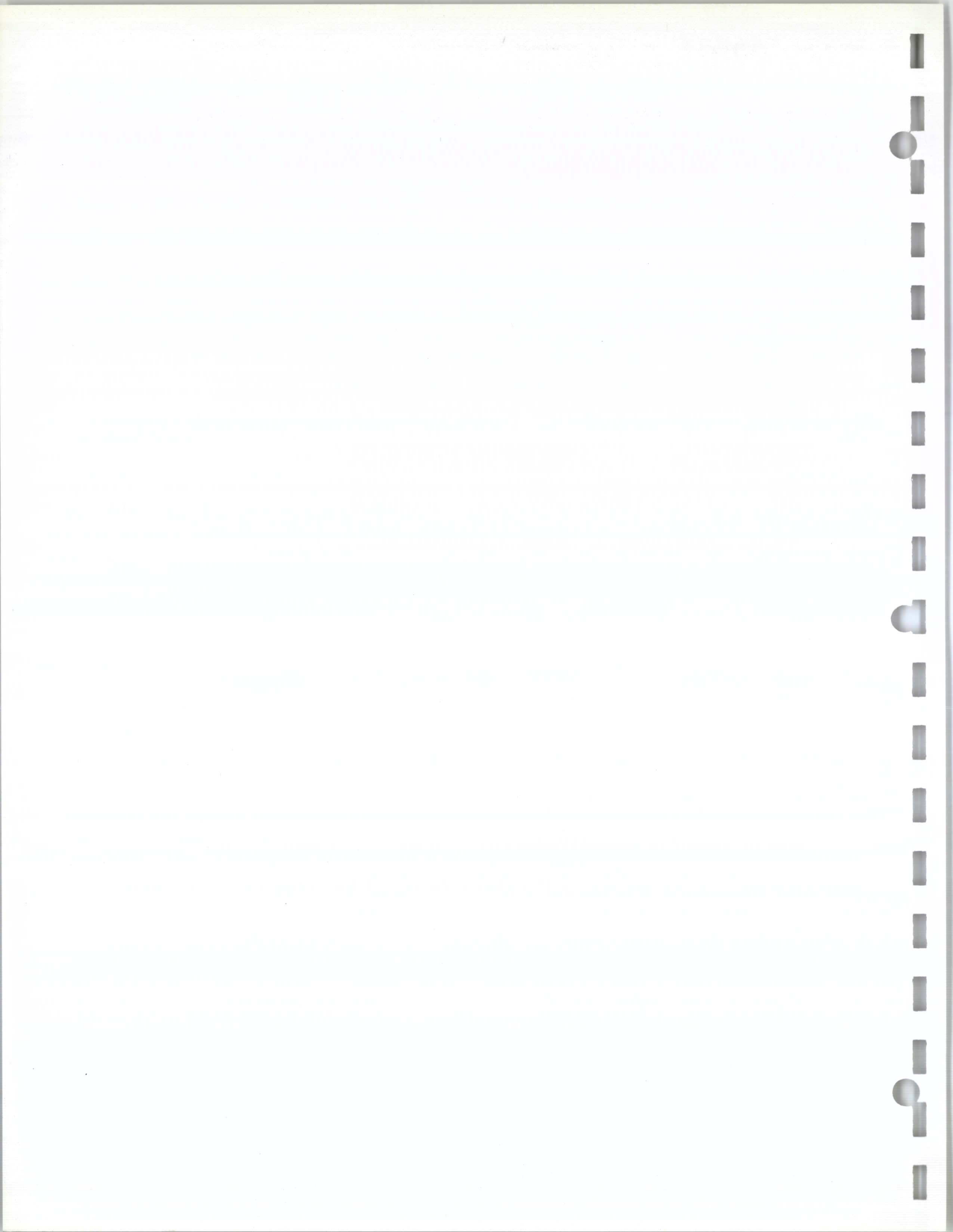






SPECIAL INSTRUMENTS







# 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

### 4 1/2" 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.

Small actual and stray capacitances have very little effect on inductance measurements made with the Type 130. For instance, the meter reading will be affected less than 1% on inductance measurements where the actual and stray capacitances are as great as 50  $\mu\mu\text{f}$ .

**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 greater 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, blue wrinkle-finished cabinet.

Size—7" wide, 10 1/2" high, 10 3/4" deep.

Weight—9 lbs.

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

**Price** ..... **\$200**

Includes: 1—P93C probe (010-003)  
 1—W130R lead (012-015)  
 1—3-conductor power cord (161-008)  
 1—W130B lead (012-014)  
 1—Instruction manual

### Recommended Additional Accessories

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

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

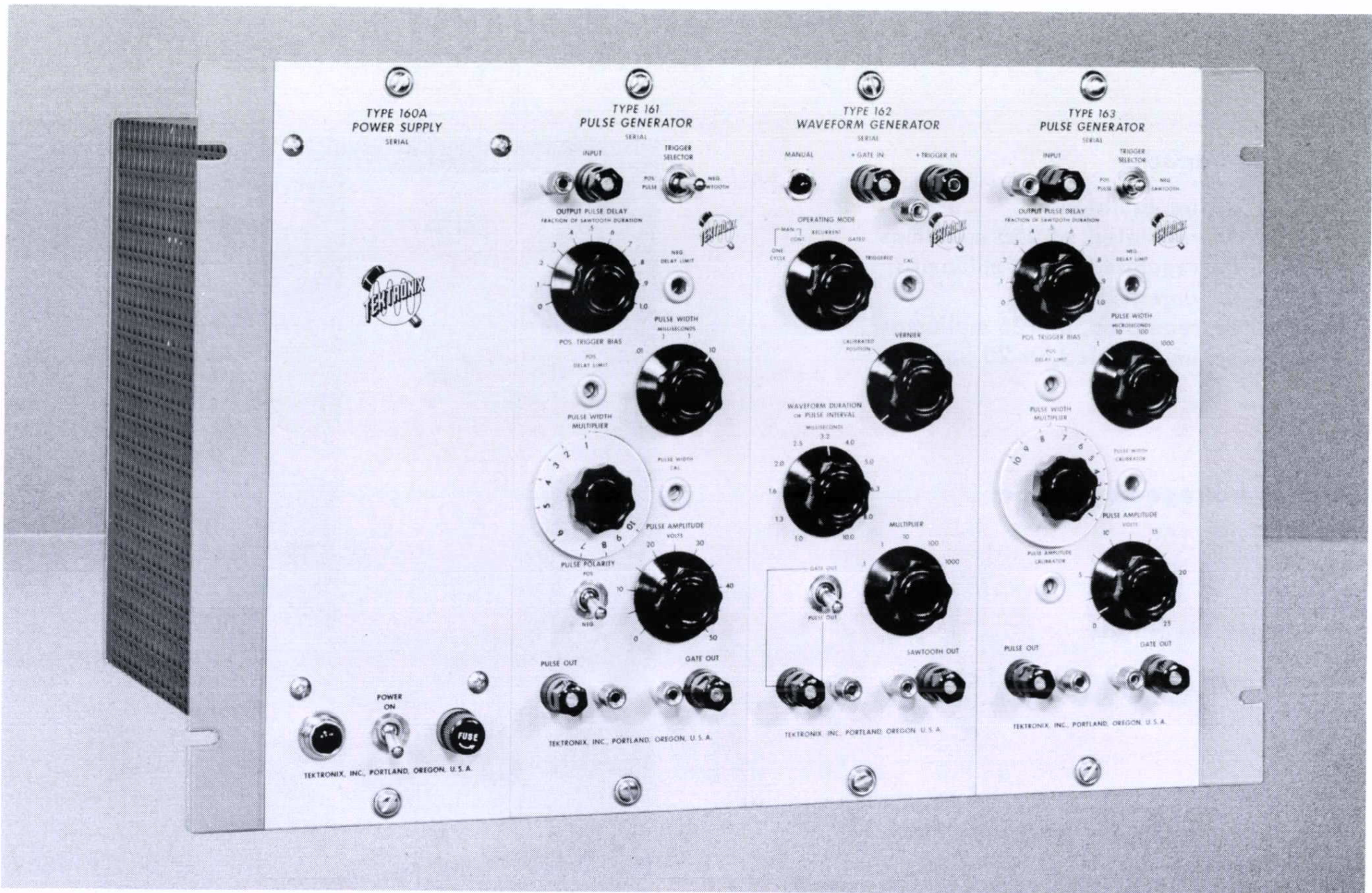
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)







# TYPE 160-SERIES WAVEFORM GENERATORS

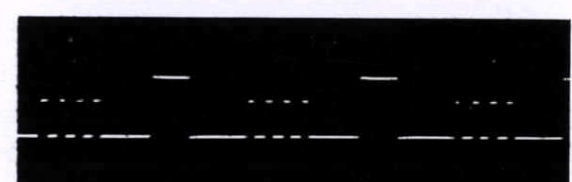
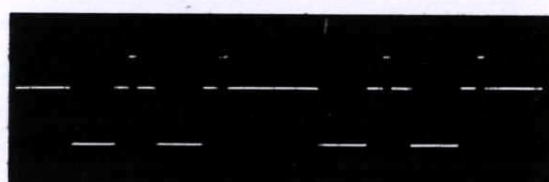
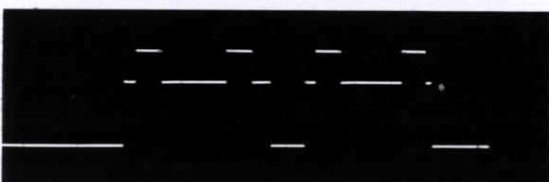
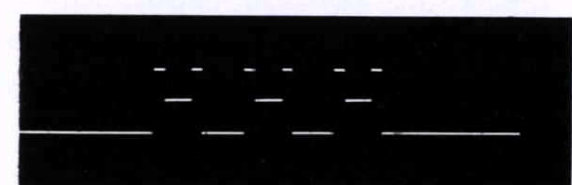
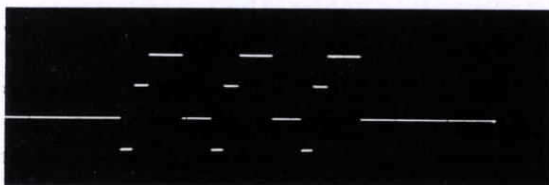


The Tektronix Type 160-Series produces timed pulses of adjustable duration, amplitude and repetition rate, providing a convenient and flexible system of sequence control. By using several instruments together, complex waveform patterns can be obtained. Applications of the Type 160-Series are numerous.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

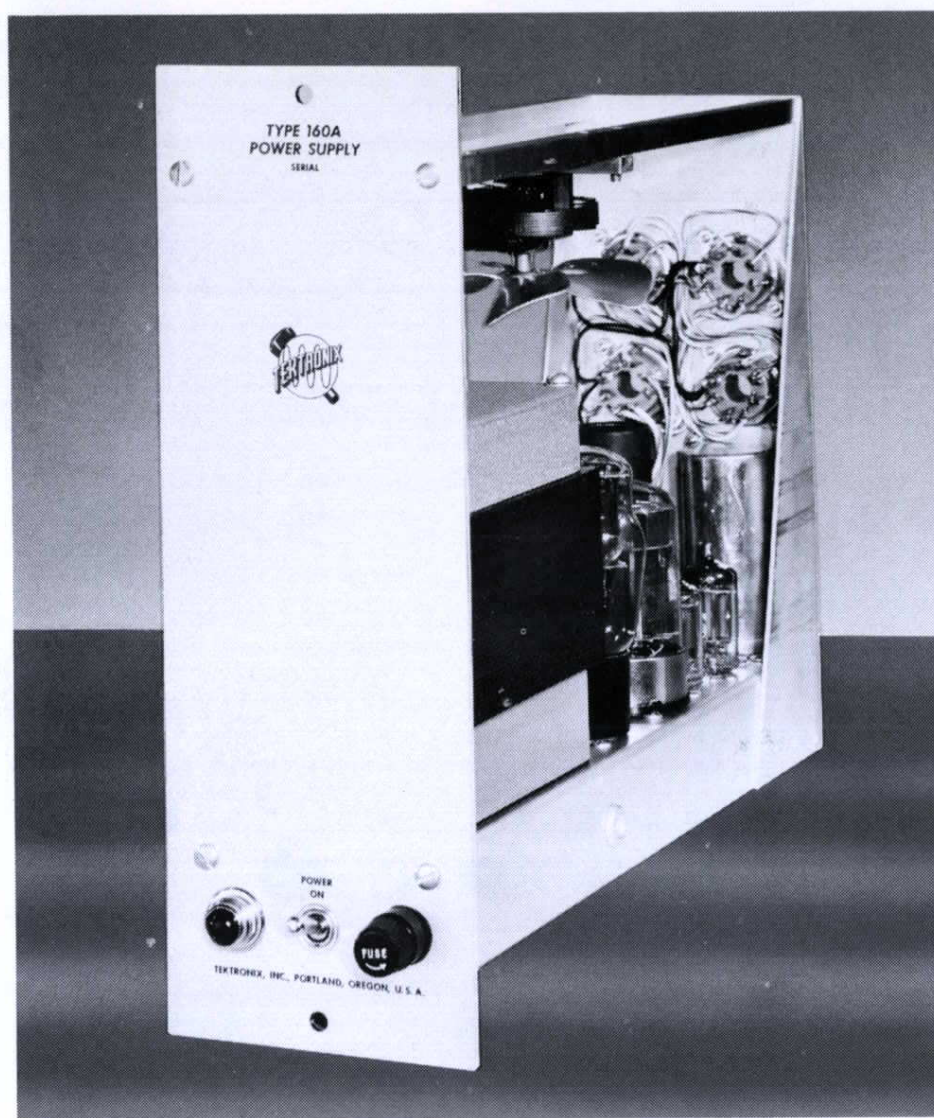
The currents listed above for the + 225 and - 170 volt supplies are available only with series regulator external shunt resistors as provided in the individual units.

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
Amplifier . . . . .		6AU6
Amplifier and series regulator . . . . .		6AW8
Series regulator . . . . .		6080
Series regulator . . . . .	2	12B4
Amplifier and cathode follower . . . . .		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, blue 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 . . . . . \$175**

- Includes: 2—W160-20 connecting cables (012-016)
- 1—Set mounting screws and cup washers
- 1—3-conductor power cord (161-008)
- 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  $\mu$ sec to 0.1 sec.
- Delay—continuously variable, 0 to 100% of triggering sawtooth waveform.
- Risetime—less than 0.5  $\mu$ 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 ac at 1.1 amps.

### GENERAL DESCRIPTION

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

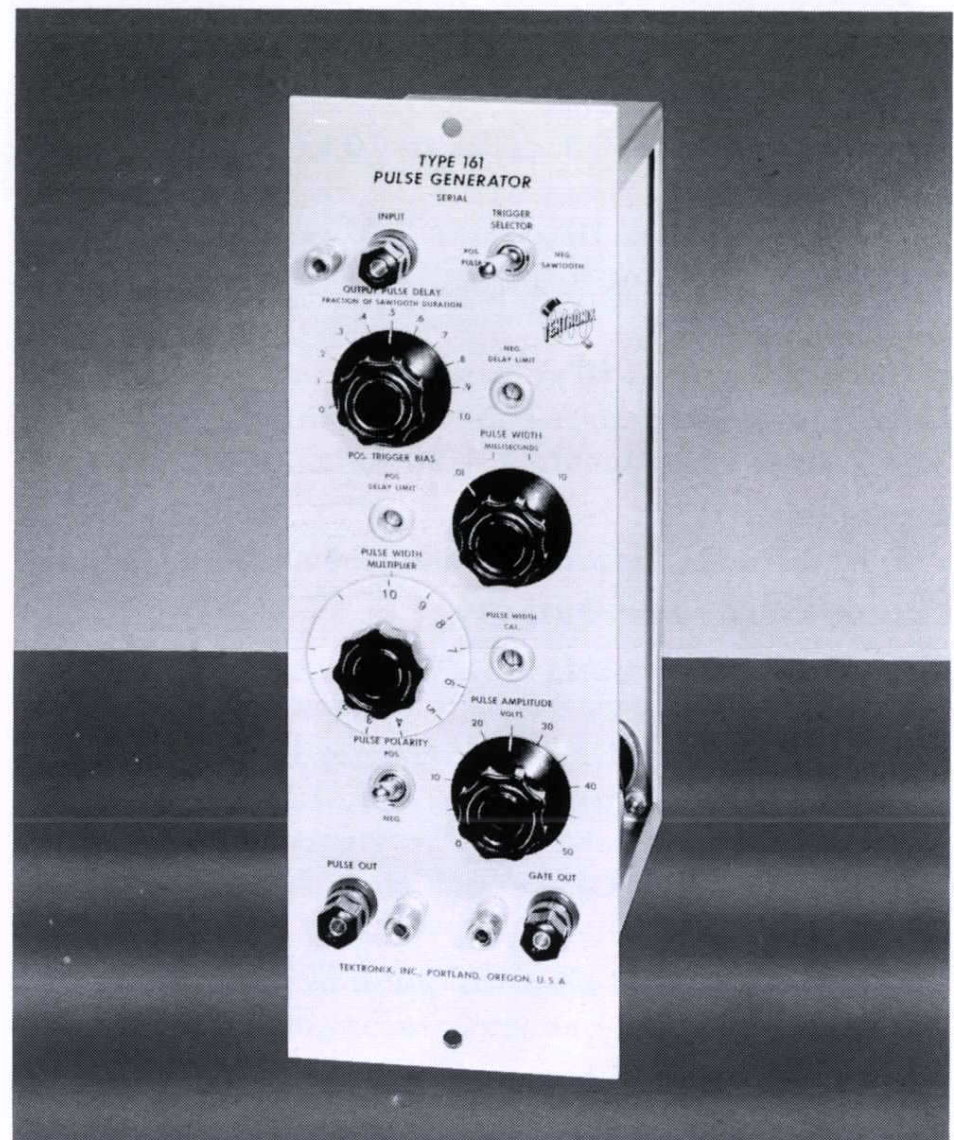
When triggered by a negative-going sawtooth, the time of occurrence of the output pulse and gate can be adjusted to any point throughout the duration of the sawtooth. A calibrated control indicates the output delay as a fraction of the triggering sawtooth duration. Pulse and gate width in milliseconds, 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 . . . . . \$125**

- 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 positive sawtooth.

### Output Characteristics

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

Duration—pulse, 10  $\mu$ sec to 0.05 sec, gate and sawtooth, 100  $\mu$ 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  $\mu$ 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 ac at 1.7 amps.

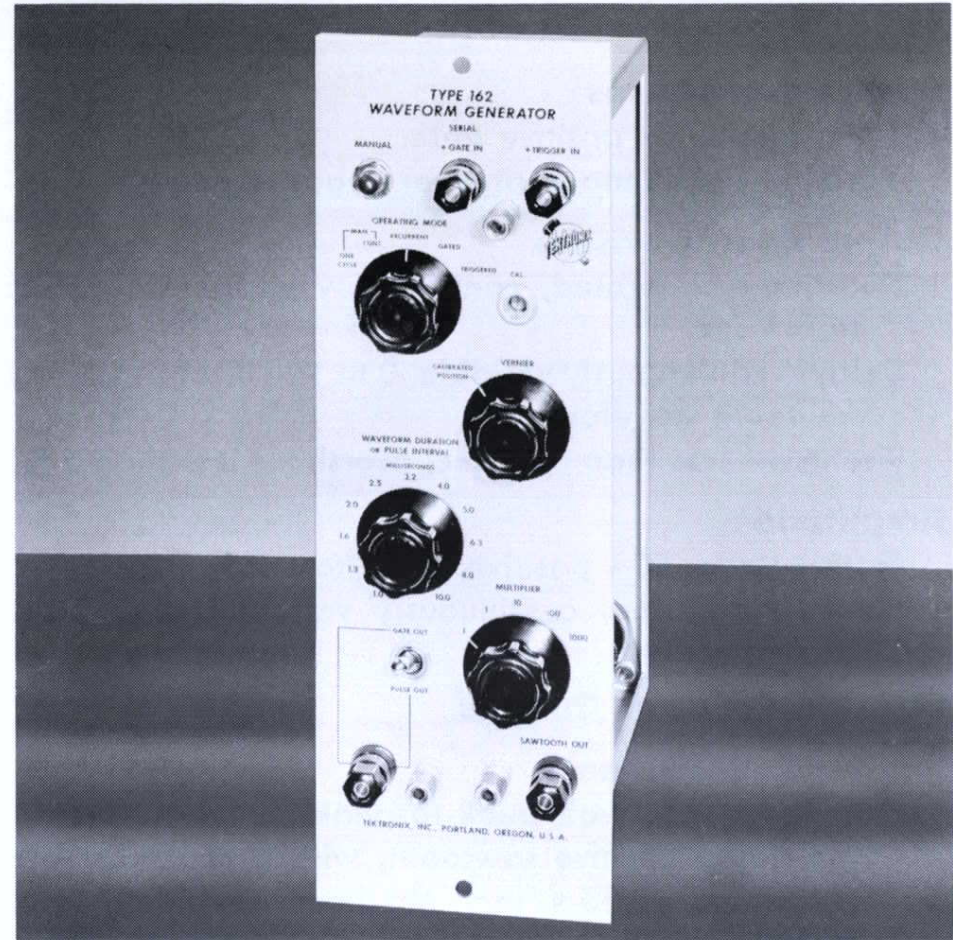
### GENERAL DESCRIPTION

The Tektronix Type 162 Waveform Generator provides three types of positive waveforms of adjustable duration and repetition rate: pulse, gate and negative-going 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  $\mu$ 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** ..... **\$125**

- 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  $\mu$ sec (without load capacitance).
- Decay Time—0.2 to 0.5  $\mu$ sec (without load capacitance).
- Overshoot—can be adjusted to zero.
- Duration—calibrated, continuously variable, 1  $\mu$ sec to 10,000  $\mu$ 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.

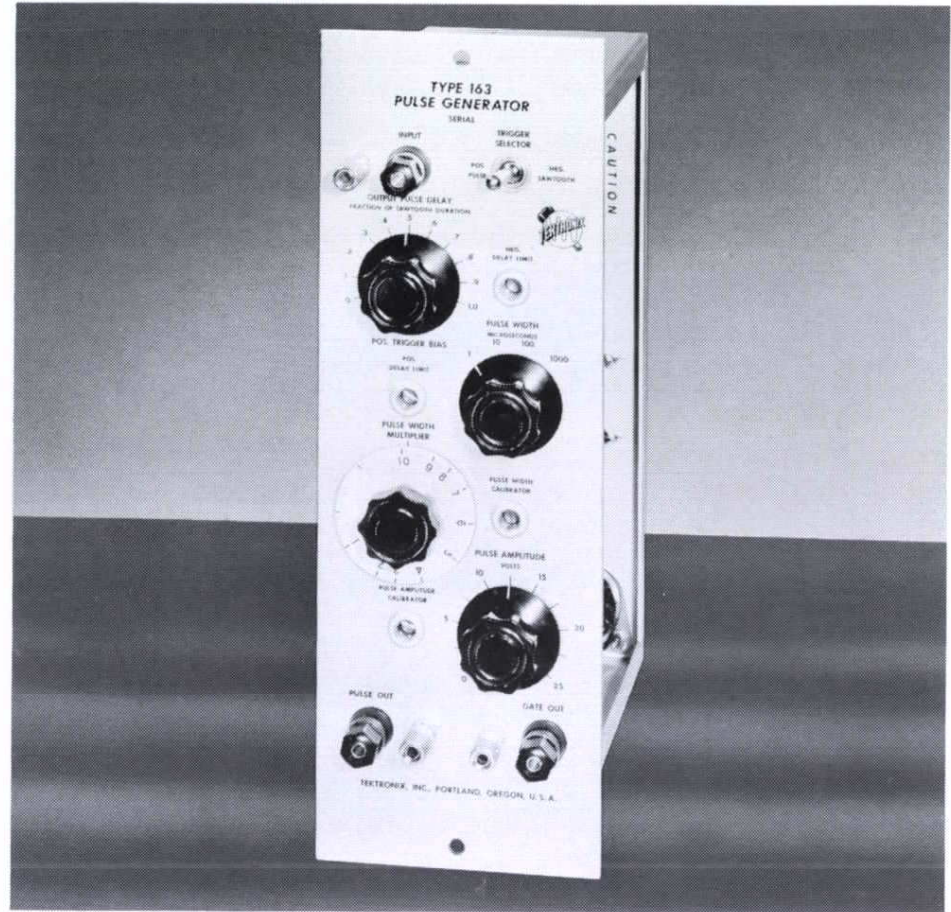
### GENERAL DESCRIPTION

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

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

The Type 163 can be operated up to 50% duty cycle at the minimum time setting on any range. Correspondingly higher duty cycles are obtained at higher multiplier control settings. The maximum repetition rate is 500 kc when a pulse of 1- $\mu$ 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 1/8" wide, 12 1/4" high, 7 1/2" deep.

Weight—3 1/2 lbs.

**Price . . . . . \$125**

- 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 1/8" x 12 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 100-SERIES WAVEFORM GENERATORS

TYPE 103 FAST-RISE PULSE GENERATOR

TYPE 103 FAST-RISE PULSE GENERATOR  
The Type 103 Fast-Rise Pulse Generator is a constant-current source which provides a fast-rising pulse of current to a load. The pulse is generated by a constant-current source which is switched on and off by a pulse generator. The pulse generator is a constant-current source which provides a fast-rising pulse of current to a load. The pulse is generated by a constant-current source which is switched on and off by a pulse generator.

The pulse generator is a constant-current source which provides a fast-rising pulse of current to a load. The pulse is generated by a constant-current source which is switched on and off by a pulse generator. The pulse generator is a constant-current source which provides a fast-rising pulse of current to a load. The pulse is generated by a constant-current source which is switched on and off by a pulse generator.

The pulse generator is a constant-current source which provides a fast-rising pulse of current to a load. The pulse is generated by a constant-current source which is switched on and off by a pulse generator. The pulse generator is a constant-current source which provides a fast-rising pulse of current to a load. The pulse is generated by a constant-current source which is switched on and off by a pulse generator.

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# TYPE 360 INDICATOR

## Vertical Passband

DC to 500 kc.

## Calibrated Vertical Attenuator

Deflection Factor—0.05 v/div.

## Waveform Requirements

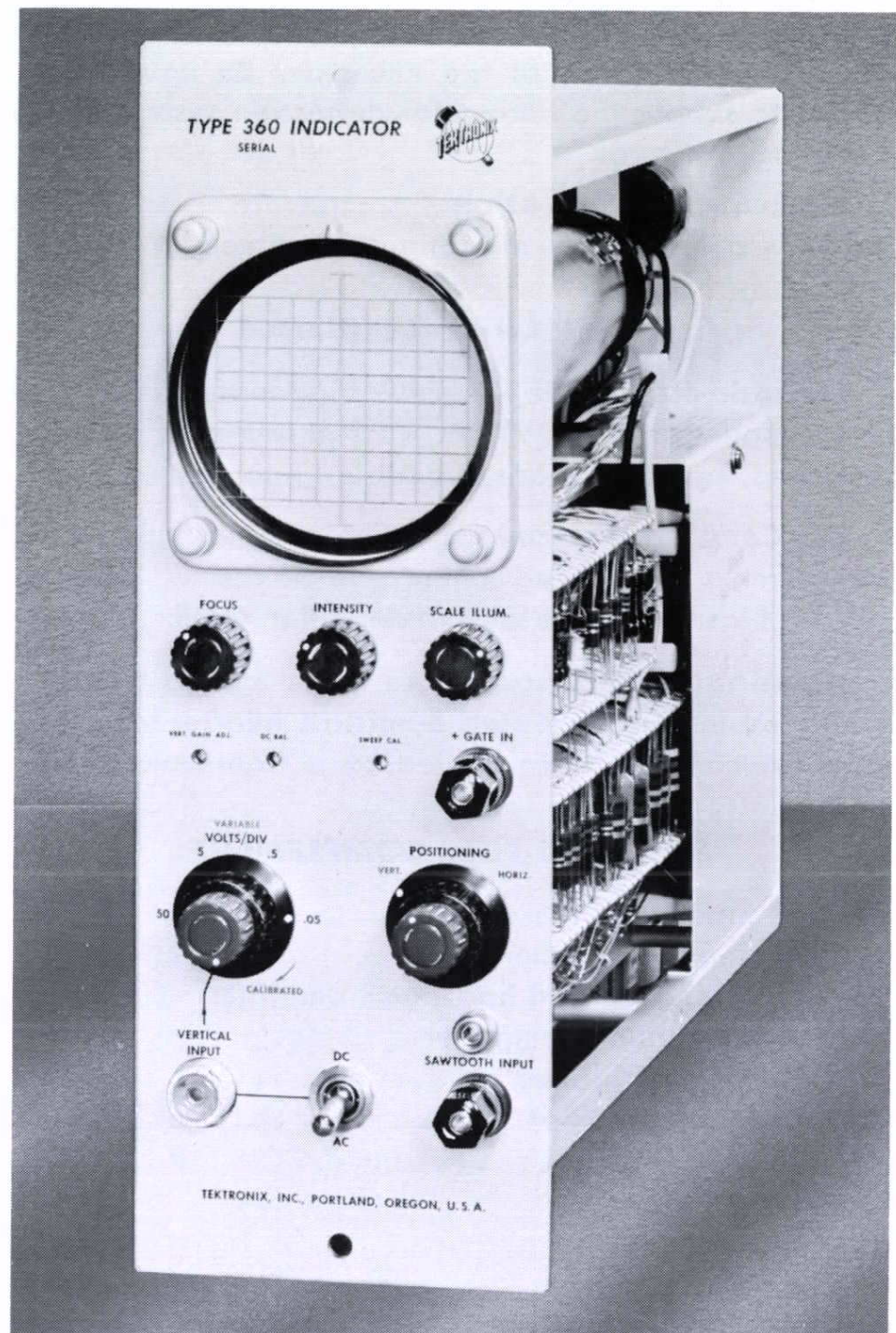
50-v positive unblanking pulse, and a sawtooth of either polarity with amplitude from 110 to 150 v and extreme voltage limits at  $-90$  v and  $+170$  v.

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

## 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 1.8 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, blue wrinkle-finished cabinet.

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

**Weight**—9 pounds.

**Price** . . . . . **\$250**

- Includes: 1—10X 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

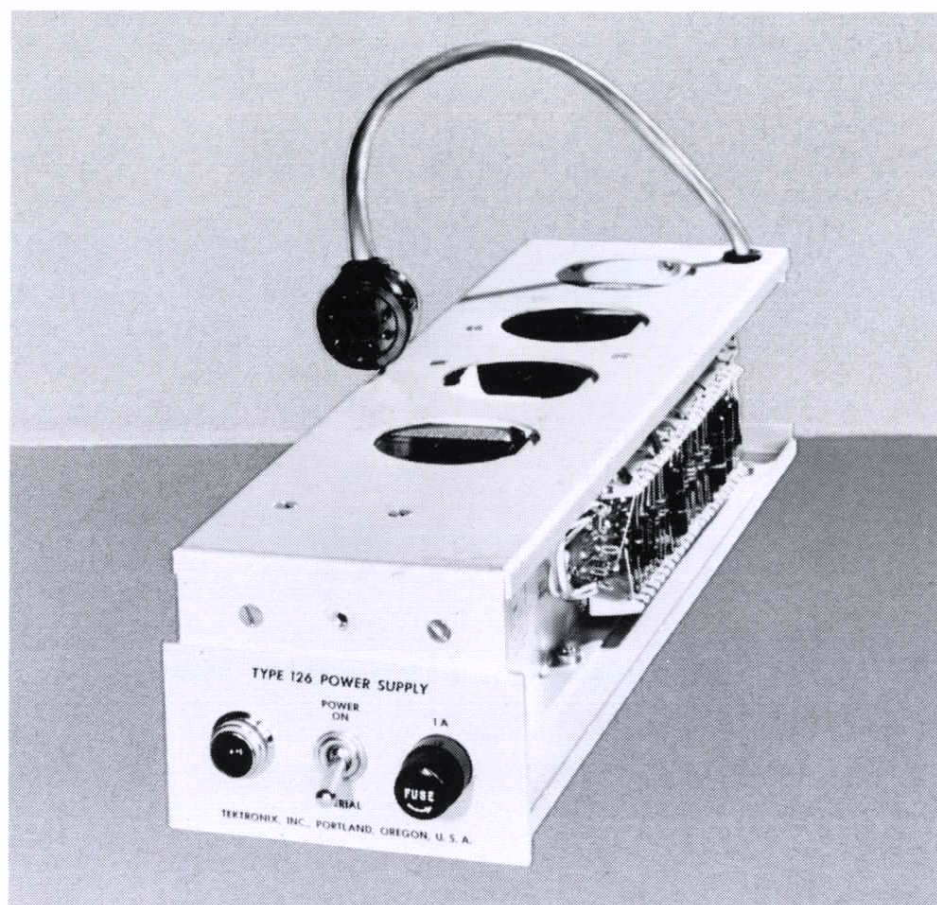
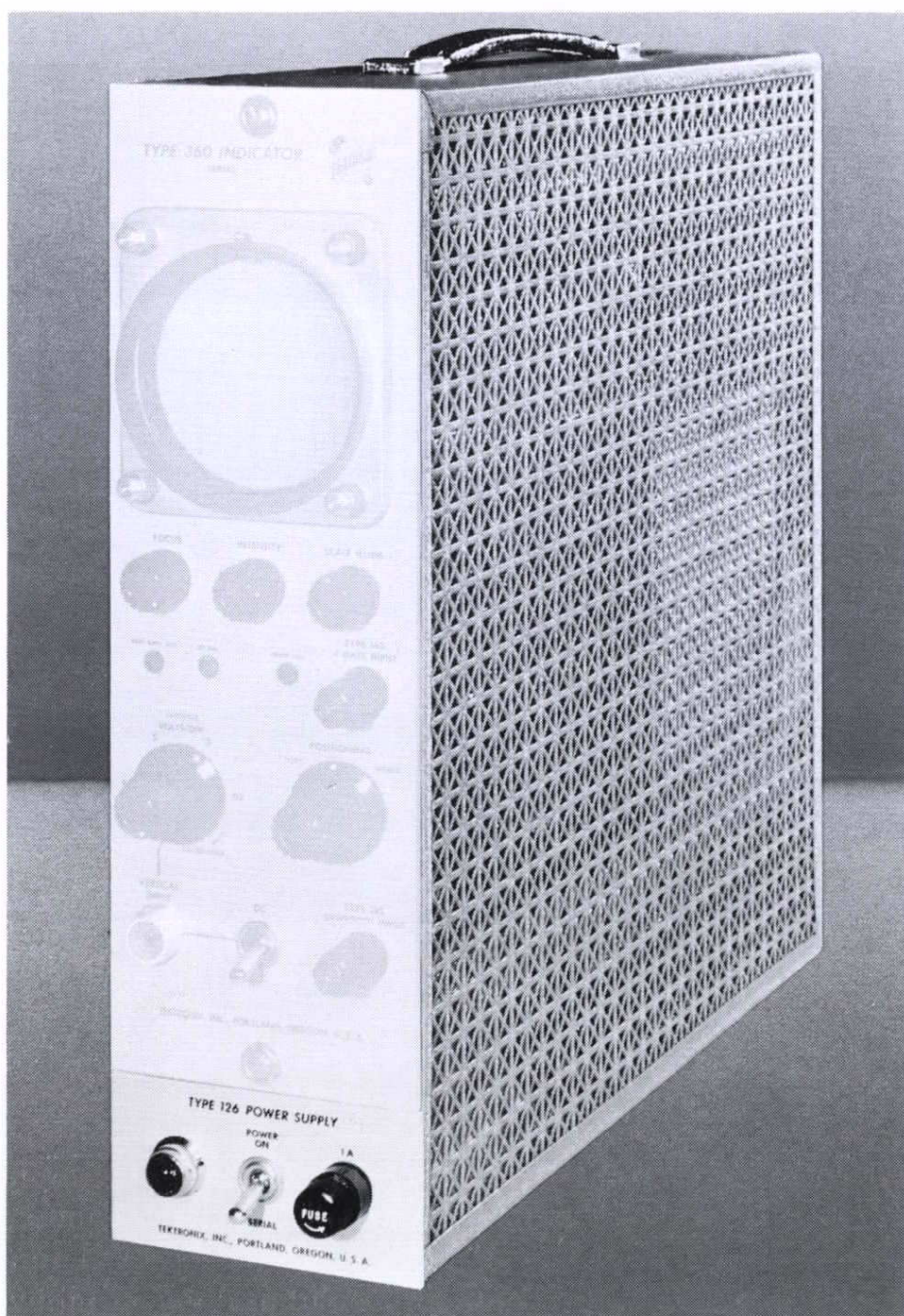
- + 300 v dc, unregulated.
- + 225 v dc, regulated, 45 ma maximum.
- + 150 v dc, regulated, 5 ma maximum.
- 170 v dc, regulated, 30 ma maximum.
- 6.3 v ac, unregulated, 4 amps maximum.

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

### Electronic Voltage Regulation

#### GENERAL DESCRIPTION

The Tektronix Type 126 Power Supply supplies the required voltages and currents necessary to power one



Type 360 Indicator or any one of the Type 160-Series Waveform Generators. The Type 126 mounts beneath the unit to be powered, and includes a cabinet to house both the Type 126 and the powered unit.

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

#### 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 120 POWER SUPPLY

for Type 350 Indicator  
and Type 150 Paper Recorder



1951  
The following is a list of the parts  
and their quantities required for the  
assembly of this power supply.



# TYPE 180A TIME-MARK GENERATOR

## Versatile Timing Source

### 14 Time-Mark Intervals

Two per decade from 1  $\mu$ 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

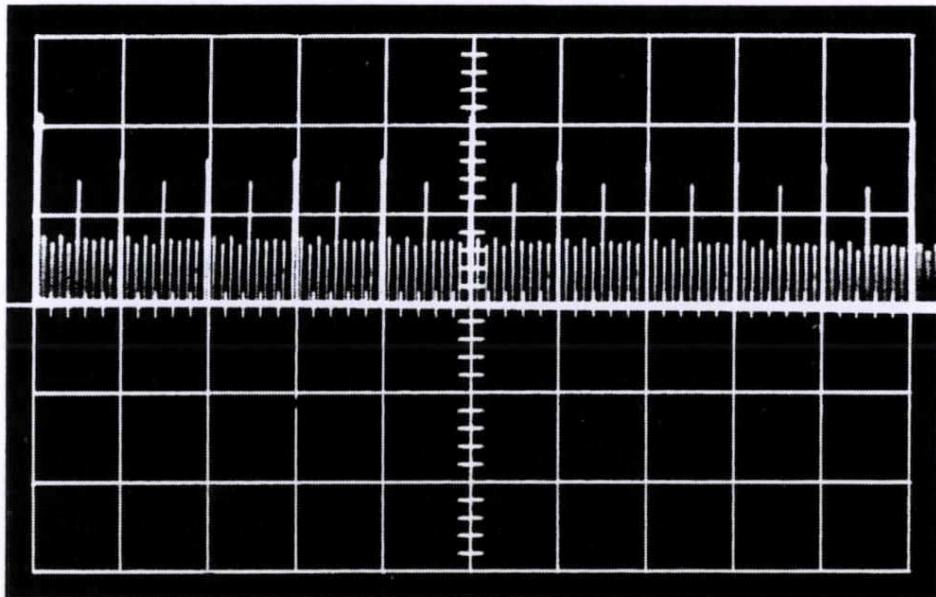
1, 10, 100 cycles, 1, 10, 100 kc.

### Accuracy Within 0.03%

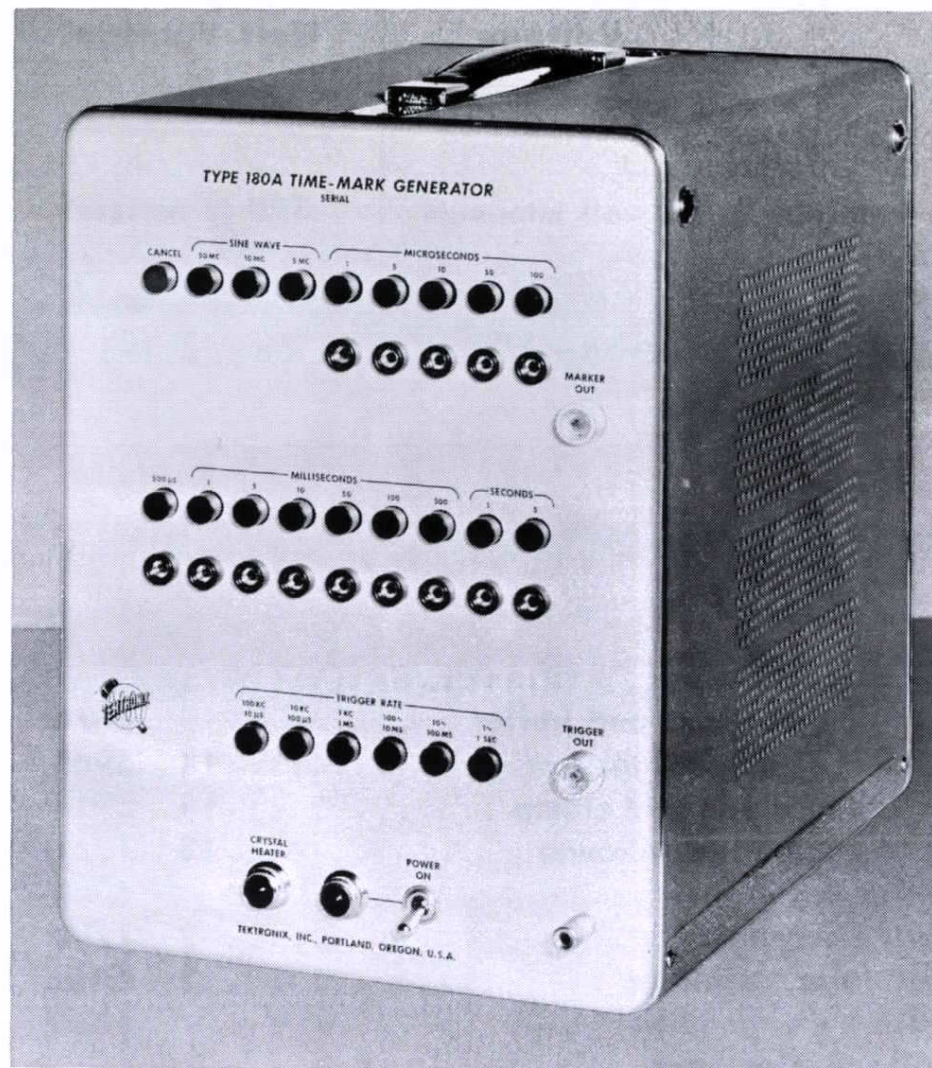
Stability of 2 ppm over a 24-hour period.

### 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, and 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  $\mu$ sec, 1, and 5 msec markers.



### CHARACTERISTICS

**Time Markers**—Time markers occur at intervals of 1, 5, 10, 50, 100, 500  $\mu$ sec, 1, 5, 10, 50, 100, 500 millisecond, 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 Cathode follower . . . . .	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
<b>Markers</b>	3 volt minimum	390 $\Omega$ or less	varies from 0.05 $\mu$ sec at 1 $\mu$ sec to 1 $\mu$ sec at 5 seconds	25 volts minimum	390 $\Omega$ at 1 $\mu$ sec to 680 $\Omega$ at 5 seconds
<b>Trigger Pulses</b>	6 volt minimum	56 $\Omega$ or less	0.07 $\mu$ sec at 100 kc to 0.25 $\mu$ sec at 1 cps		
<b>Sine Waves</b>	3 volt minimum across 52-ohms				

Cathode follower and buffer . . . . .	6AN8
Divider multivibrators . . . . .14	5965
Coupling diode and clamp . . . . .13	6AL5
Marker cathode follower . . . . .13	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—Clip-lead adapter (013-003)  
 1—3-conductor power cord (161-008)  
 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, blue wrinkle-finished cabinet.

Dimensions—10" wide, 14" high, 17" 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 after initial warmup, a short time stability of about 0.005% per hour. For applications requiring greater stability, a directly interchangeable crystal is available as an accessory. This plug-in 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 $\mu$ sec	2 v	sine wave	150 ohms
1 $\mu$ sec	2 v	0.05 $\mu$ sec	80 ohms
10 $\mu$ sec	2 v	0.13 $\mu$ sec	80 ohms
100 $\mu$ sec	2 v	0.2 $\mu$ sec	80 ohms
1000 $\mu$ sec	2 v	0.4 $\mu$ sec	80 ohms
10,000 $\mu$ sec	2 v	0.4 $\mu$ 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, blue wrinkle-finished cabinet.

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

Weight—17 1/2 pounds.

**Type 181** ..... \$240

Includes: 1—P93 output cable  
1—W130B lead (012-014)  
1—W130R lead (012-015)  
1—3-conductor power cord (161-008)  
1—Instruction manual

**Type 181**, with Type CO181A Crystal-Oven Combination installed, ..... \$260

### 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 5¼ 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 — 5¼" high, 19" wide, 9¼" rack depth (approximately 3" additional required for power cord), 11" overall depth.  
 Weight — 16¾ pounds.

**Type RM181 . . . . . \$265**

- Includes: 1—P93 output cable
- 1—W130B lead (012-014)
- 1—W130R lead (012-015)
- 1—Set mounting hardware
- 1—3-conductor power cord (161-008)
- 1—Instruction manual

**Type RM181, with Type CO181A Crystal-Oven Combination installed, . . . . . \$285**

### 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.

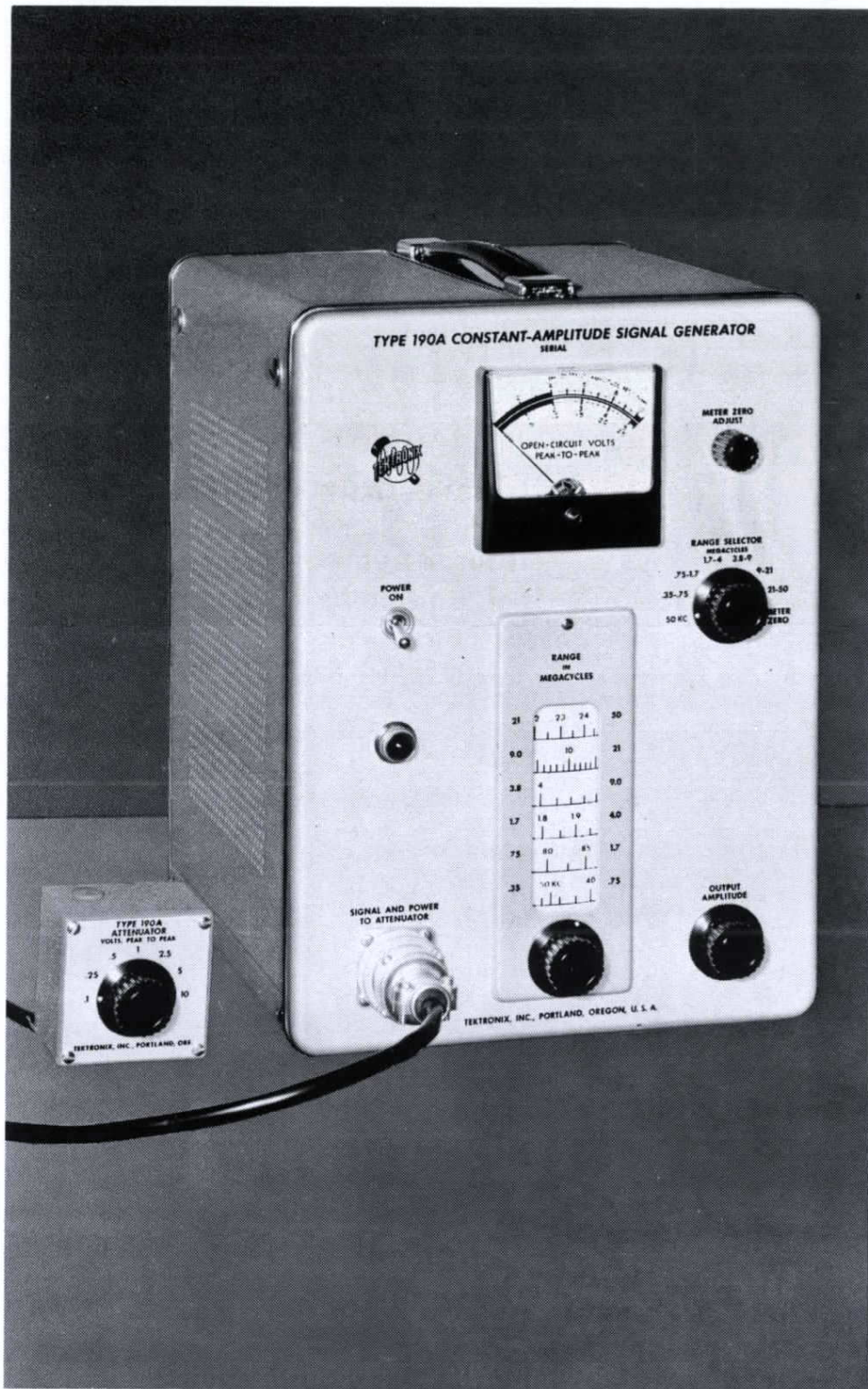
Prices f.o.b. factory. (Please refer to **Terms and Shipment, GENERAL INFORMATION** page.)





# 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  $\mu\text{mf}$ . The output amplitude varies less than  $\pm 2$  per cent from 50 kc to 30 mc; less than  $\pm 5$  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 ..... \$300

Includes: 1—Attenuator unit  
1—36" connecting cable  
1—3-conductor power cord (161-008)  
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 190A SIGNAL GENERATOR

Operating Instructions

Model 190A Signal Generator

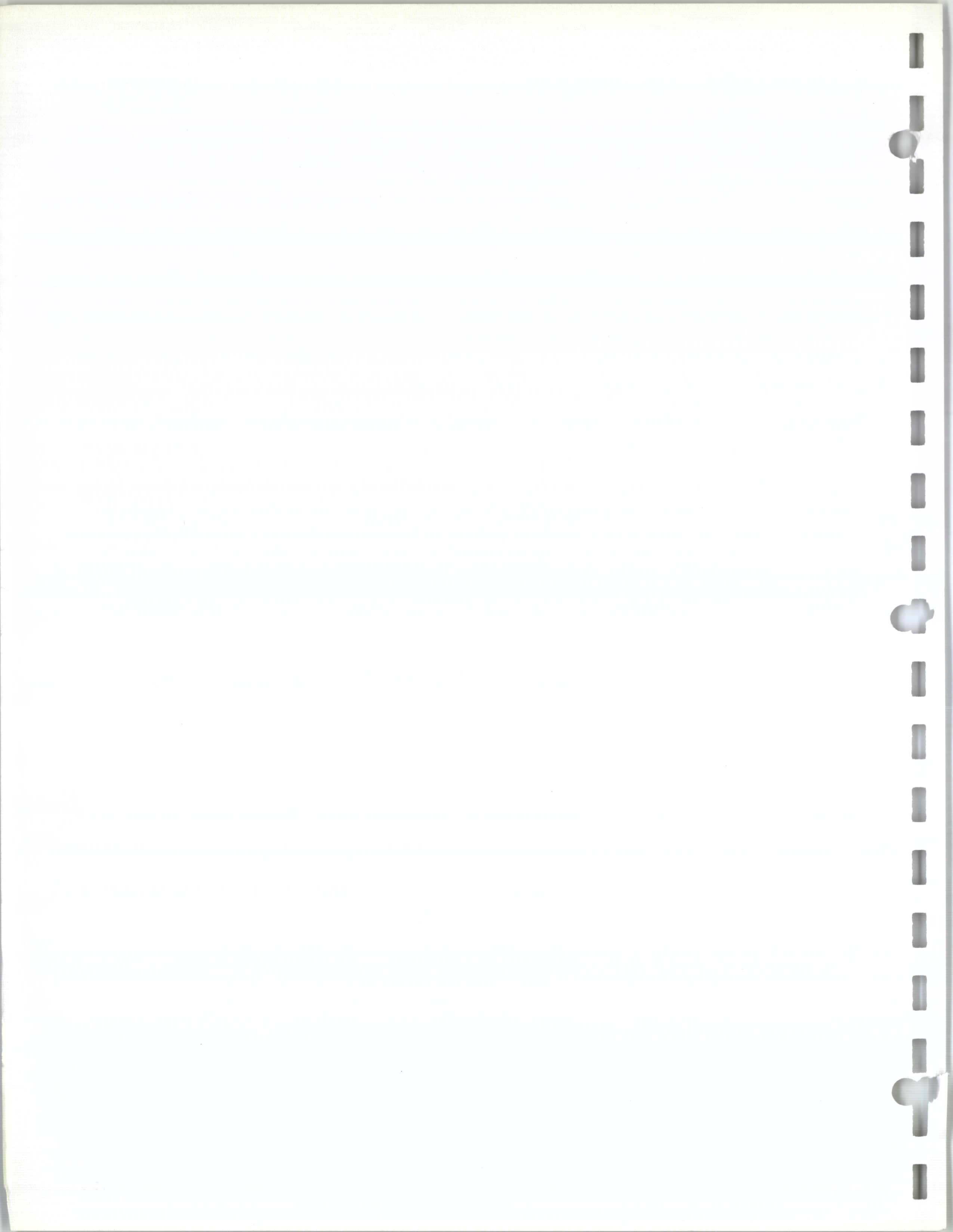






**ACCESSORIES**







# MOBILE OSCILLOSCOPE TABLES

## 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 Tektronix Preamplifier Plug-In units. A drawer, felt-lined and operating on roller bearings, provides handy storage for probes, cables, manuals etc. An open shelf, 14 5/8" wide, 12 1/2" high, and 23 5/8" deep, 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 18 1/2" wide, 39" high and 30" deep.

Includes: 1—3-conductor power cord (161-014)

**Type 500/53A . . . . . \$110.00**

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 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 in a space 13 3/4" wide, and 8 1/2" high for the first 5 1/2" of depth and tapering in height from this point, on a 20 degree angle to a minimum height of 2 1/2" at a depth of 19 1/2". It will usually be necessary to provide forced-air ventilation for the equipment compartment. A fan kit, 040-161, is recommended for this purpose.

Includes: 1—3-conductor power cord (161-014)

**Type 500A . . . . . \$100.00**

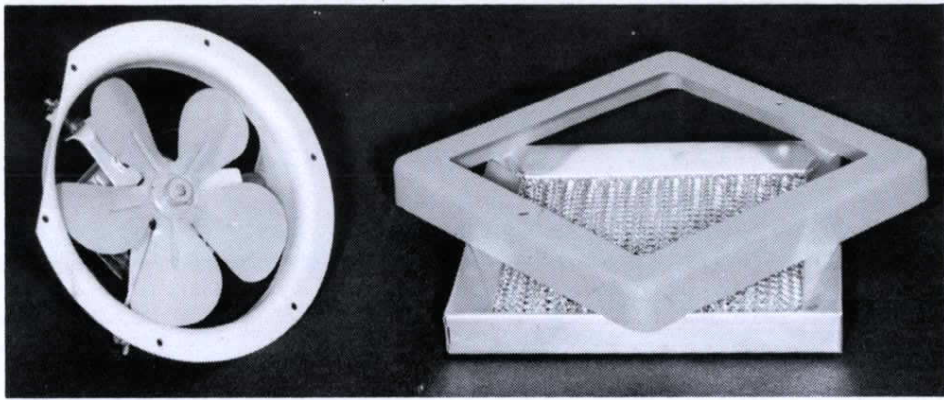
Type 53 Scope-Mobile Panel — For Type 500 Scope-Mobiles only. Converts the earlier Type 500 model to a Type 500/53 by replacing the standard blank panel.

014-004 . . . . . 10.50





# MOBILE OSCILLOSCOPE TABLES



Scope-Mobile Fan Kit — for forced-air ventilation of the equipment compartment of the Type 500A Scope-Mobile. Contains motor, 5" blade, filter, and mounting hardware. 040-161 . . . . . 15.00

## Scope-Mobile Trays For Type 500A and 500/53A Scope-Mobiles

Two sizes available. When installed on a Type 500A or 500/53A scope-mobile, each size furnishes a secure positioning mount for a type of Tektronix oscilloscope, smaller in size than those for which the Scope-Mobile was originally designed. Trays are installed with 2 self-tapping screws. Requires drilling of two #36 holes.

**436-017**-for Type 515A Oscilloscopes . . . . . **Price**

**436-016**-for Type 502 Oscilloscope . . . . . **Price**





# MODIFICATION KITS

## Type 112 Amplifiers

**040-030** (Formerly K112-618-S1) Improves pre-amplifier stability and simplifies tube replacement. For Type 112 serial numbers 101 through 123 . . . . **\$8.80**

**040-031** (Formerly K112-618-S2) Same kit as above. For Type 112 serial numbers 124 through 453 . . . . . **\$8.80**

## Type 180 Time-Mark Generators

**040-002** (Formerly K180-438 & 444) Improves stability of high-frequency dividers, 100-kc trigger performance and marker phasing. For Type 180 serial numbers 101 through 163 . . . . . **\$7.50**

**040-003** (Formerly K180-553-1) Improves oscillator performance and permits precise frequency setting of crystal oscillator when zero-beating against a standard-frequency source. For Type 180 serial numbers 108 through 138 . . . . . **\$7.15**

**040-004** (Formerly K180-553-2) Same kit as above. For Type 180 serial numbers 139 through 163 . . . . . **\$7.15**

**040-005** (Formerly K180-553-3) Same kit as above. For serial numbers 164 through 293, except serial numbers 174, 192, 220, 253, 258, 261, 264, 266, 270, 273, 274, 276, 292, 294 and 299 . . . . . **\$7.15**

**040-006** (Formerly K180-1046) Further improves high-frequency divider stability. For serial numbers 294 through 637. This modification kit will apply if Type 180 uses 6U8 oscillator tube; it can be made on serial numbers below 294 if the two preceding mods are first installed . . . . . **No charge**

## Type 310 Oscilloscopes

**040-195** Replaces the selenium type rectifier used in the Type 310 with a silicon type offering more reliability and longer life . . . . . **Price on request**

## Type 316 Oscilloscopes

**040-151** Replaces 2 resistors in high-voltage supply circuit in order to change focus voltage for T32P crt; for serial numbers 101 through 269 with T31P crts . . . . . **No charge**

## Type 515 Oscilloscopes

**040-172** Permits automatic triggering, independent of the setting of the front panel stability control. All serial numbers. . . . . **\$20.00**

**040-173** Increases sensitivity of the vertical amplifier from 0.1 v/cm to 0.05 v/cm. All serial numbers . . . . . **\$35.00**

## Type 517 and 517A Oscilloscopes

**040-053** (Formerly K517-593) Increases reliability of bootstrap circuitry and simplifies maintenance. For serial numbers 101 through 560 . . . . . **No Charge**

**040-180** (Formerly K517-1127-1) Cathode-ray tube change to 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 . . . . . **\$120.00**

**040-107** (Formerly K517-1127-2) Limits sweep duty cycle to 15% to avoid overloading sweep circuits. For serial numbers 101 through 925 except 921 . . **\$10.00**

**040-165** Offers temperature protection to both the Indicator and Power Supply Units, especially when operating under high ambient temperature conditions. For serial numbers 101 through 1724 . . . . . **\$45.00**

## Type 524D and 524AD Oscilloscopes

**040-058** (Formerly K524-1010) Improved high-voltage supply. For serial numbers 101 through 1429 . . . . . **\$40.00**

**040-060** (Formerly K524-579) Installation of 7" fan increases reliability. For serial numbers 101 through 789 . . . . . **\$18.00**

**040-090** (Formerly K524-705) Reduces ripple in power supply. For serial numbers 101 through 820 . . . . . **No Charge**

**040-091** (Formerly K524-717) Prevents parasitic oscillations in vertical amplifier. For serial numbers 101 through 850 . . . . . **No Charge**

**040-059** (Formerly K524-1021A) Front-panel power receptacle for P500CF cathode-follower probe. For serial numbers 101 through 1842 . . . . . **\$5.00**

**040-177** Replaces the selenium type rectifier used in the Type 524 with a silicon type offering more reliability and longer life. When ordering kits for serial numbers below 1069 please specify if Modification Kit K524-748, which relocates the selenium rectifiers, has been installed . . . . . **\$22.00**

**040-057** (Formerly K524-805) Converts vertical-amplifier response to flat within 1% to 5 mc. Includes new access panel. For serial numbers 101 through 1399 . . . . . **\$6.50**

## Type 525 Oscilloscopes

**040-171** Permits observation of the Vertical Inter-field Test Signal. For all serial numbers except Type 525Mod111 instruments . . . . . **\$35.00**

## Type 531 and Type 541 Oscilloscopes

**040-118** (Formerly K531 Sweep Lockout) Single-sweep lockout reset feature for one-shot recording . . . . . **\$25.00**

## Type 532 Oscilloscopes

**040-147** (Formerly K532 Sweep Lockout) Same as for Type 531 and 541 . . . . . **\$25.00**





# MODIFICATION KITS

**040-158** Preset stability—Provides a way for easy sweep stability setting. For serial numbers 101 through 5665 ..... **\$12.00**

## Type 531 and Type 535 Oscilloscopes

**040-149** (Formerly 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 ..... **\$18.50**

**040-152** (Formerly K530/K540-2) Preset stability. For Type 531 serial numbers 608 through 5453, for Type 535 serial numbers 1075 through 5469 ..... **\$5.00**

**040-153** (Formerly K530/K540-2) Preset stability. For Type 531 serial numbers 5454 through 6019, for Type 535 serial numbers 5470 through 6044 .. **\$4.50**

**040-154** (Formerly K530/540-3) Preset stability. For Type 531 serial numbers 6020 through 6710, for Type 535 serial numbers 6045 through 7552 .. **\$2.50**

**040-150** (Formerly 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 ..... **\$1.50**

**040-159** Maximum intensity modification to decrease the possibility of burning the crt phosphor by installing an auxiliary intensity control to limit the front panel maximum intensity setting. For Type 531 and Type 535 all serial numbers ..... **\$5.00**

**040-061** (Formerly K531-1099; K535-1100) Improvement of time-delay reliability by rewiring the circuit. For Type 531 serial numbers 101 through 765; Type 535 serial numbers 101 through 1282 ..... **No charge**

**040-085** (Formerly K531-1105; K535-1107) Further improvement of time-delay circuitry by installation of a new relay. For Type 531 serial numbers 101 through 1280; Type 535 serial numbers 101 through 1703 ..... **\$8.50**

**040-097** (Formerly K531-1055; K535-1056) Improvement in driver amplifier circuitry. Recommended in applications where minimum gain variations in respect to line-voltage changes are required. For Type 531 serial numbers 101 through 592; Type 535 serial numbers 101 through 1058 ..... **\$70.00**

**040-160** Adds blanking to CRT cathode to eliminate switching transients when using Type 53C, Type 53/54 C, or Type C-A plug-in unit. For Type 531 serial numbers 101 through 593; Type 535 serial numbers 101 through 1059 ..... **\$15.00**

## Type 543 Oscilloscopes

**040-191** Improves reliability of 6DK6 tubes in distributed amplifier and provides better stability of the vertical amplifier. For serial numbers 101 through 181 ..... **\$1.80**

## Type 541 and Type 545 Oscilloscopes

**040-152** (Formerly 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 ..... **\$5.00**

**040-153** (Formerly K530/K540-2) Preset stability. For Type 541 serial numbers 5254 through 5414, for Type 545 serial numbers 5551 through 5945 ..... **\$4.50**

**040-154** (Formerly K530/K540-3) Preset stability. For Type 541 serial numbers 5415 through 5942, for Type 545 serial numbers 5946 through 7400 .. **\$2.50**

**040-159** Maximum intensity modification to decrease the possibility of burning the crt phosphor by installing an auxiliary intensity control to limit the front panel maximum intensity setting. For Type 541 and Type 545 all serial numbers ..... **\$5.00**

**040-191** Improves reliability of 6DK6 tubes in distributed amplifier and provides better stability of the vertical amplifier. For Type 541 serial numbers 6474 through 7078, Type RM41 serial numbers 101 through 149, Type 545 serial numbers 9292 through 11692, and Type RM45 serial numbers 101 through 291 .... **\$1.80**

**040-176** Replaces 10 kv high voltage transformer with a 12 kv transformer for greater intensity at fastest sweep speeds which will give a higher writing rate. For Type 541 and Type 545 instruments, all serial numbers ..... **\$15.00**

## Type 551 Oscilloscopes

**040-191** Improves reliability of 6DK6 tubes in distributed amplifier and provides better stability of the vertical amplifier. For Type 551 serial numbers 101 through 291. Two kits required ..... **\$1.80**

## Type 500A and Type 500/53A Scopemobile

**040-161** Fan motor assembly provides forced-air ventilation to the equipment compartments of the Type 500A and Type 500/53A Scopemobiles .... **\$15.00**

**040-186** Converts the early Type 500 or Type 500/53 Scopemobile to a three wire power receptacle ..... **\$8.50**

The following 3-wire power cords are available but are not included in the 040-186 modification kit:

8' 16 gauge Tek No. 161-010 ..... **\$1.75**

20" 16 gauge Tek No. 161-014 ..... **\$1.25**

## Type P410 and Type P510A Probes

**040-180** Universal Probe Repair Kit for Tektronix P410 and P510A Probes contains a quantity of the electrical and mechanical parts that are most subject to failure. Instructions are included to facilitate repair procedures ..... **\$8.50**

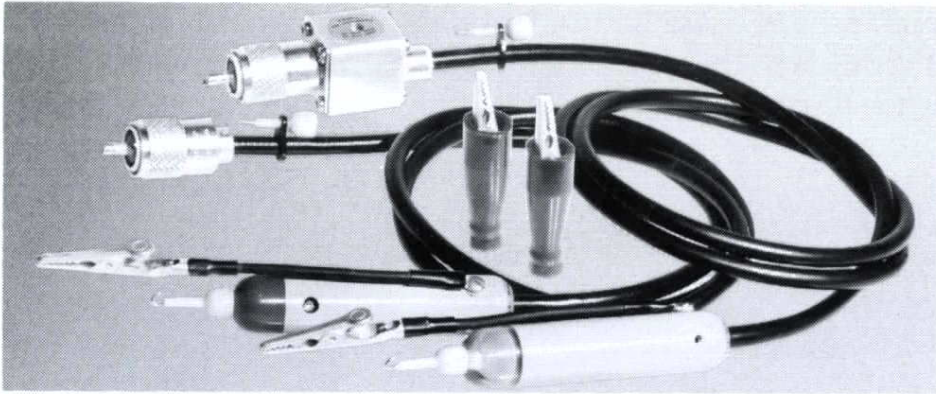
**For a complete list of available modification kits, please call your Field Engineer or Representative.**



# 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 $\Omega$ )	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.

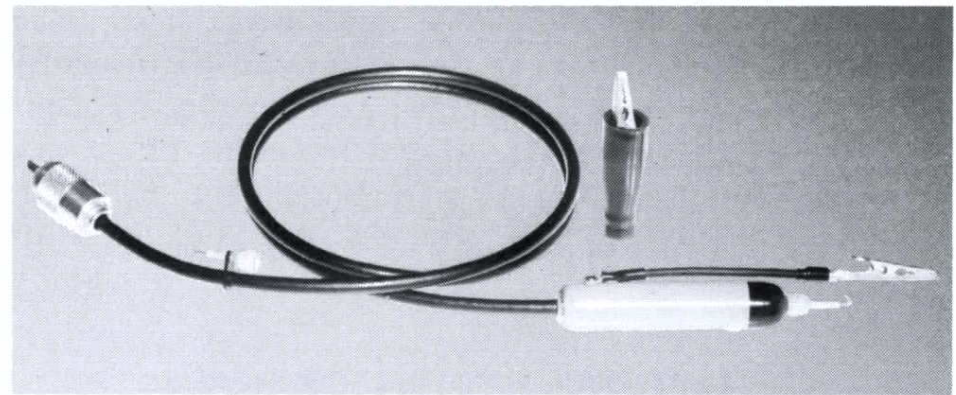
†When connected to instruments with input capacitances up to 50  $\mu\mu\text{f}$ .

**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

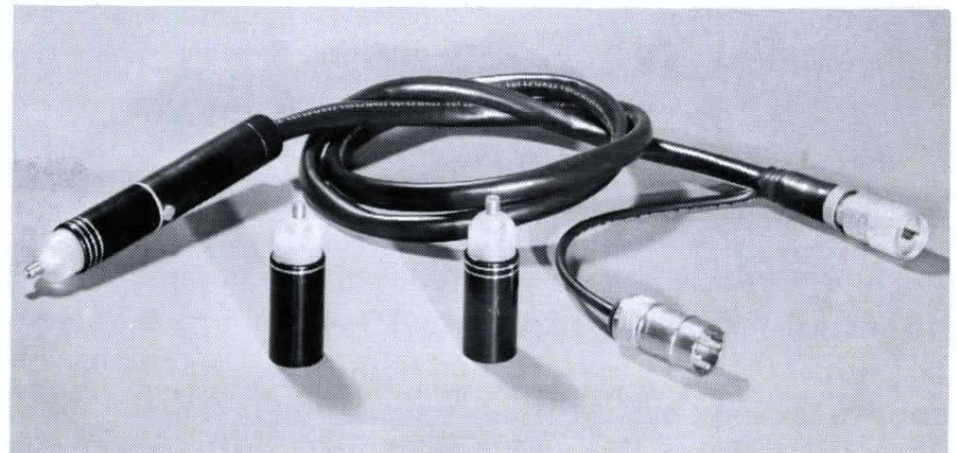
#### P510A PROBES WITH LONG CABLES

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  $\mu\text{f}$ . The probe cable is 42" long. Probe complete with 3 attenuator heads . . . . . \$86.00

### REPLACEMENT ATTENUATOR HEADS

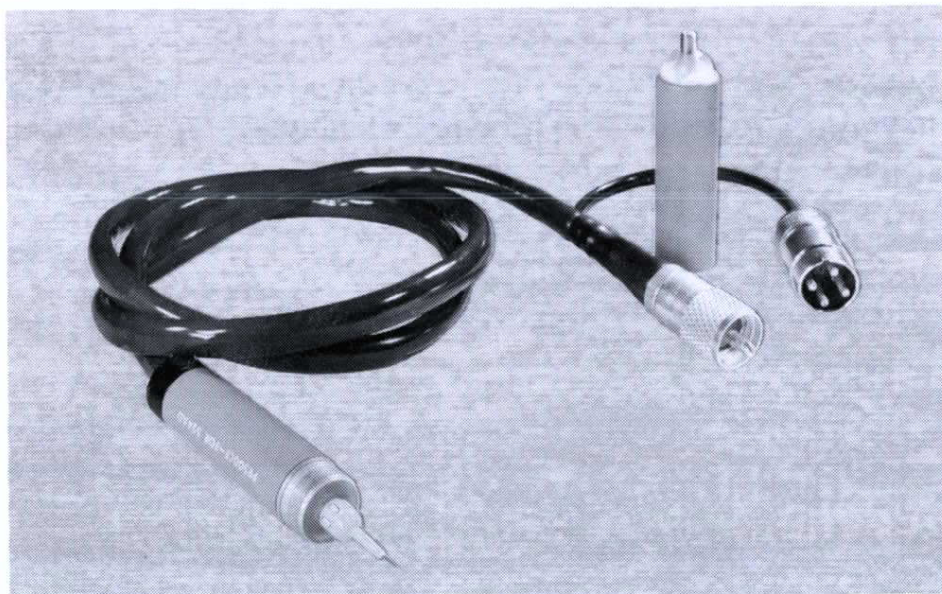
PAX-I Attenuator Head for P170CF, attenuation can be varied between 4 times and 40 times . . . . . \$11.00

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

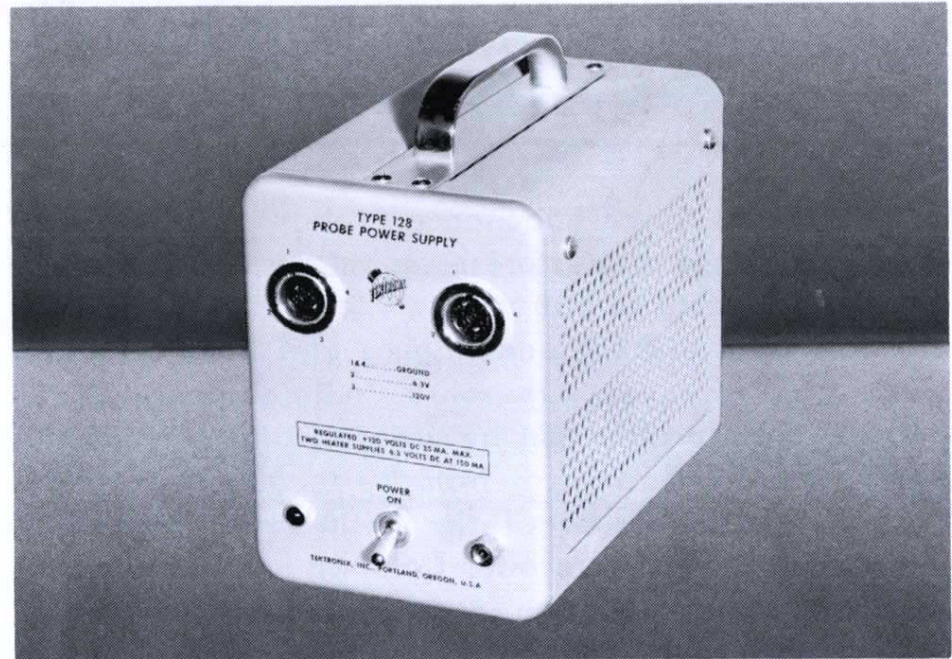


**P500CF Cathode-Follower Probe**—Presents low capacitance with minimum attenuation. Input impedance is 40 megohms paralleled by 4  $\mu\text{f}$ , gain 0.8 to 0.85. Input to probe is ac-coupled, limiting its low-frequency response to 5 cycles. Amplitude distortion is less than 3% on unidirectional signals 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  $\mu\text{f}$ . 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 connector to power the P500CF Probe.

040-059 . . . . . \$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

Two +6.3 v unregulated, at 150 ma

The two cathode-follower probe connections have separate +6.3 v dc voltage supplies.

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.

Includes: 1—3-conductor power cord.

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

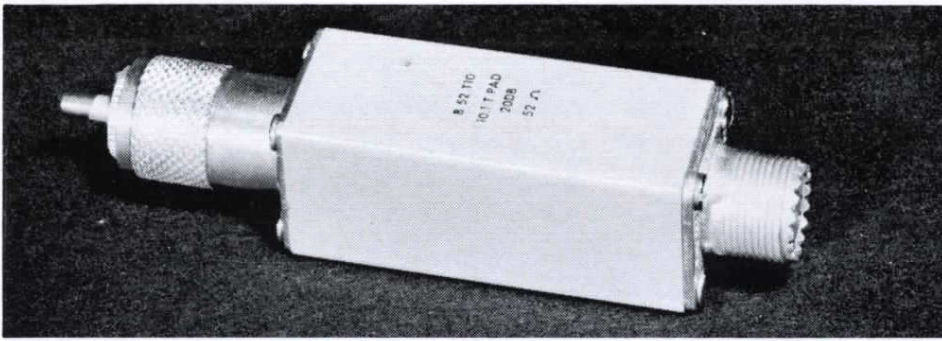
Prices f.o.b. factory.



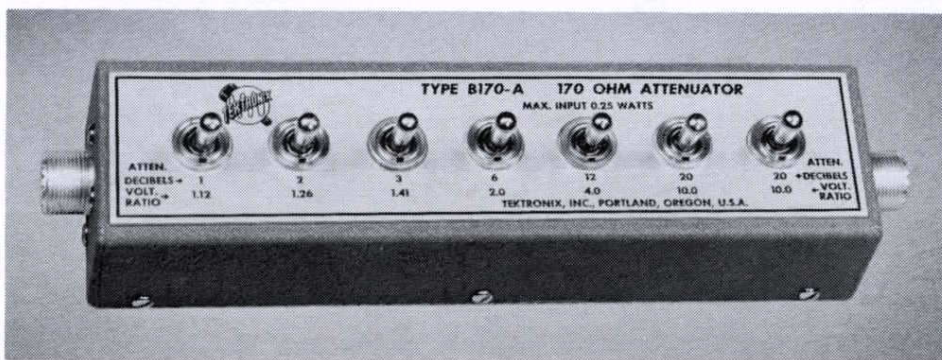
# ACCESSORIES

## 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



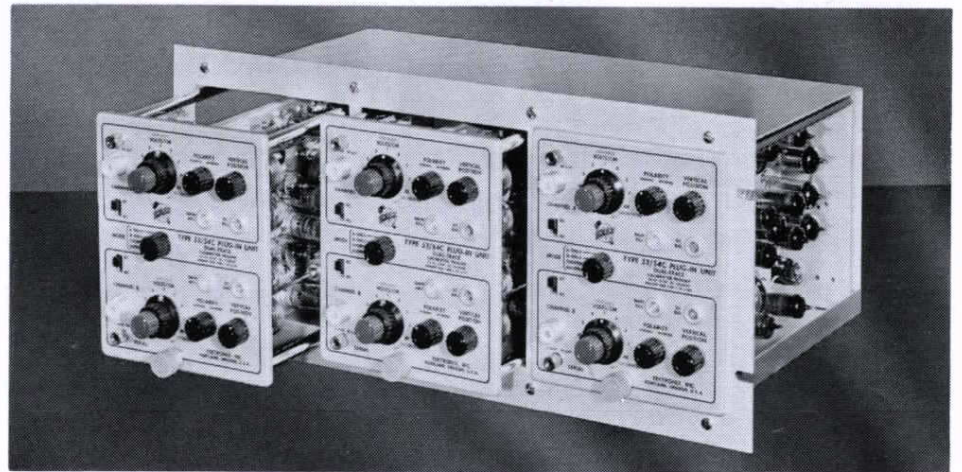
B170-A 170-ohm  $\pi$ -attenuator, using 2% precision resistors, 1 to 64 db in 1 db steps, 0.25 w .....

Prices f.o.b. factory.

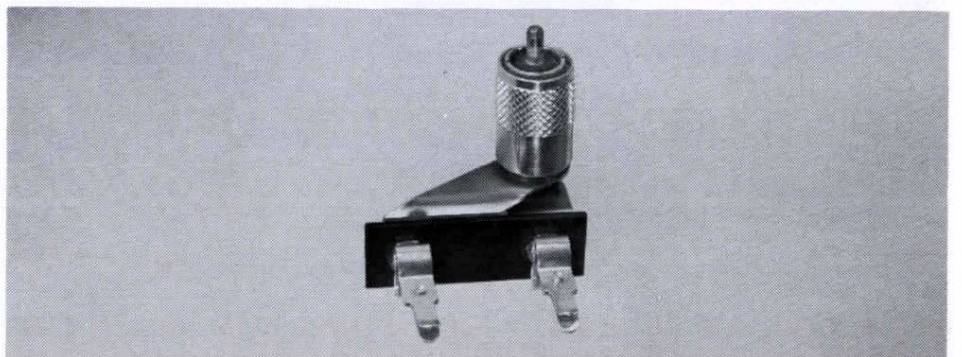


016-012 Fan Base for Type 310, and Type 310A Oscilloscopes. Provides filtered, forced-air ventilation to assure safe operating temperature when the Type 310 or Type 310A Oscilloscope is being used continuously over long periods, or in hot or limited ventilation areas. The fan base tilts the oscilloscope to a convenient viewing angle. For use on 105-125 v, 50 to 60 cycle only .....

016-013 Fan Base Same as above except it is for use on 210-250 v, 50 to 60 cycles only .....



437-031 Plug-In Preamplifier Storage Cabinet—Mounts in standard rack, holds three Tektronix Plug-In Preamplifiers. Dimensions: 19" wide, 8 3/4" high, 9 3/8" deep. Price, without plug-in units .....



013-001 Production Test Fixture, for use with the Type 130 L,C Meter. Speeds sorting and testing of capacitors and inductors .....

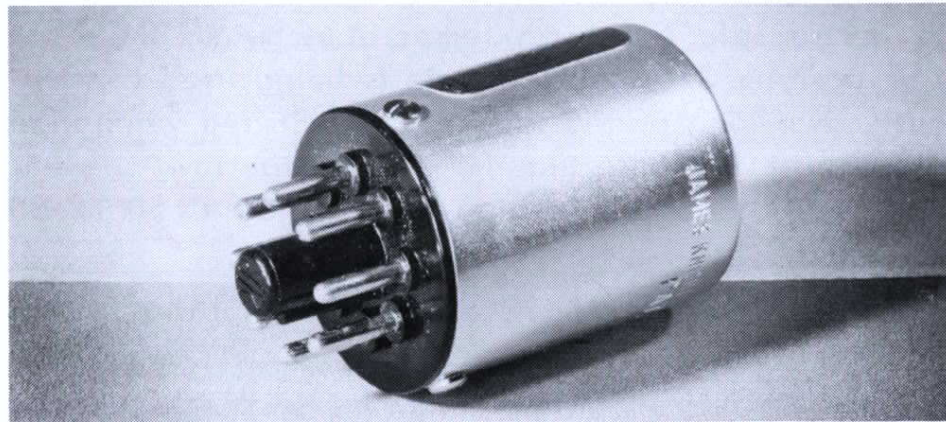


# ACCESSORIES

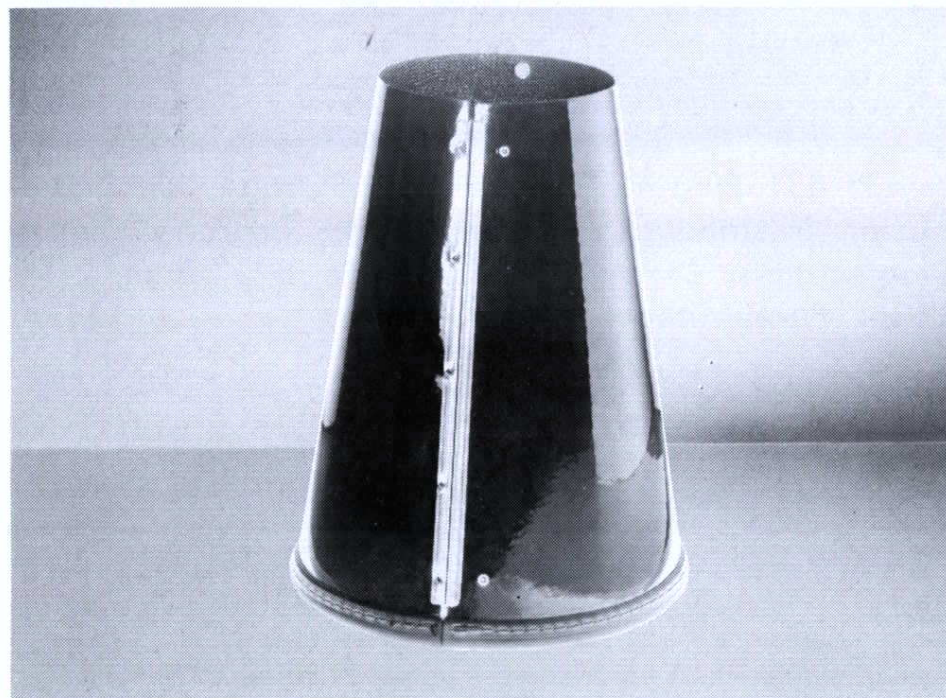
## Operational Accessories



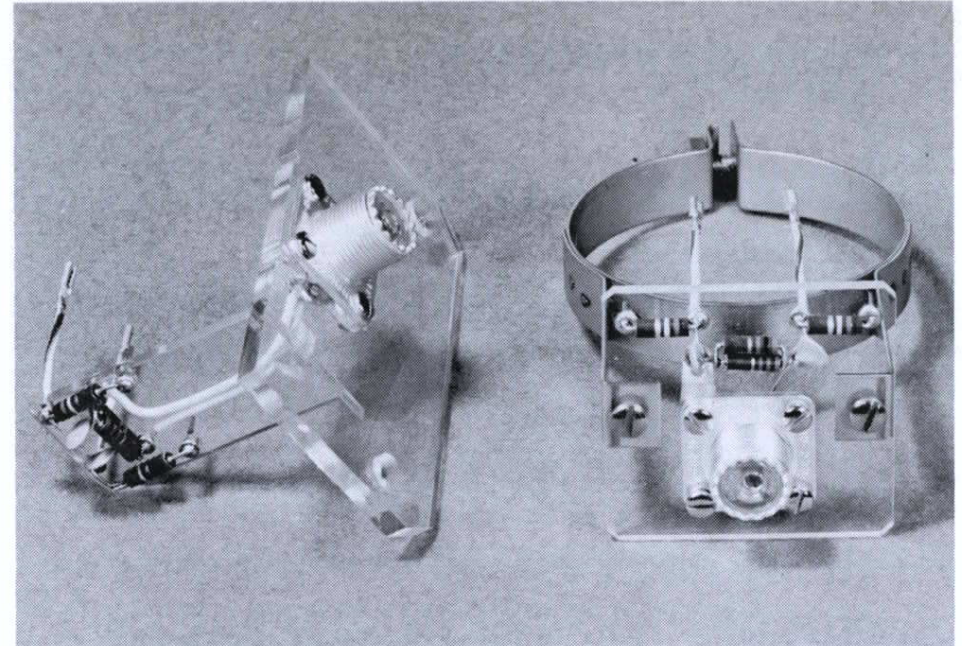
BE510 Bezel, for mounting camera on Tektronix 5" oscilloscopes. Dimensions—5 7/8" square; ring 7/8" deep, diameter 5 5/8" outside, 5 1/8" inside. Die-cast construction, wrinkle finish, felt lined. . . . . 4.50



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

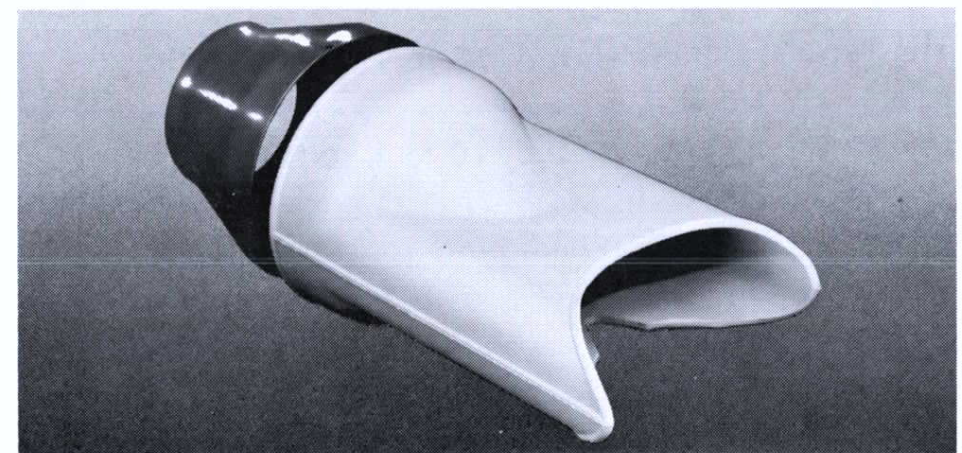


HC 310 Collapsible Viewing Hood, for Tektronix 3" Oscilloscopes. It is made of black acrylic plastic with handy fastening arrangement. Tek no. 016-010. .3.50

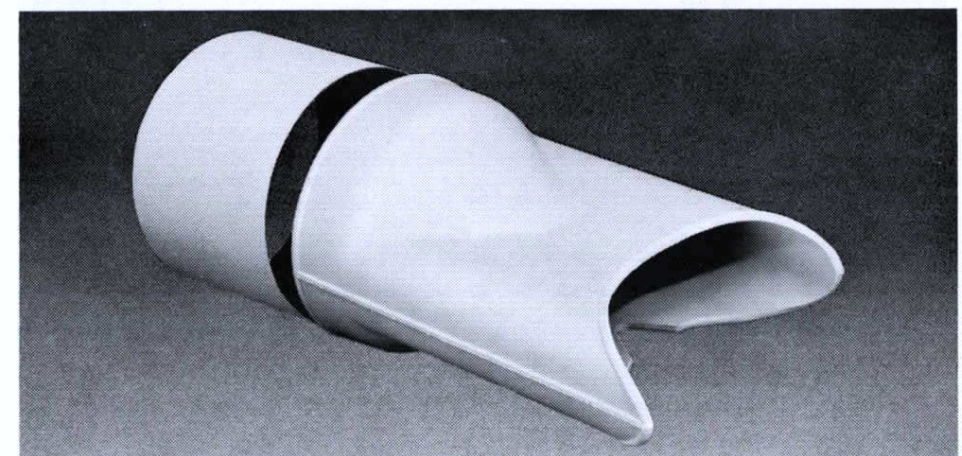


Deflection Plate Connector, for Type 530, 540, 530A, and 540A-Series Oscilloscopes. A convenient means of making a connection directly to the cathode-ray tube vertical deflection plates. Function of the vertical positioning control is retained. The connector is designed for use with a 52-ohm cable.

For instruments with serial numbers below 5001,  
013-006 . . . . . 5.00  
For instruments with serial numbers 5001 and above,  
013-007 . . . . . 5.00



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



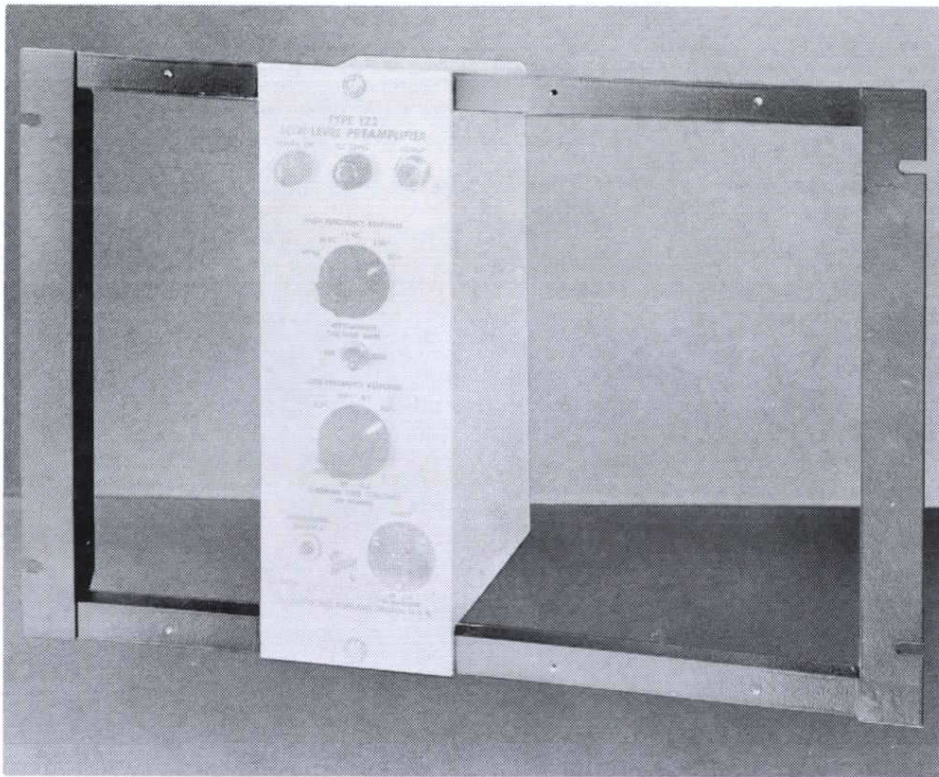
H510 Viewing Hood, for Tektronix 5" Oscilloscopes. Includes molded rubber eye-piece and aluminum light shield . . . . . 4.50

Prices f.o.b. factory.

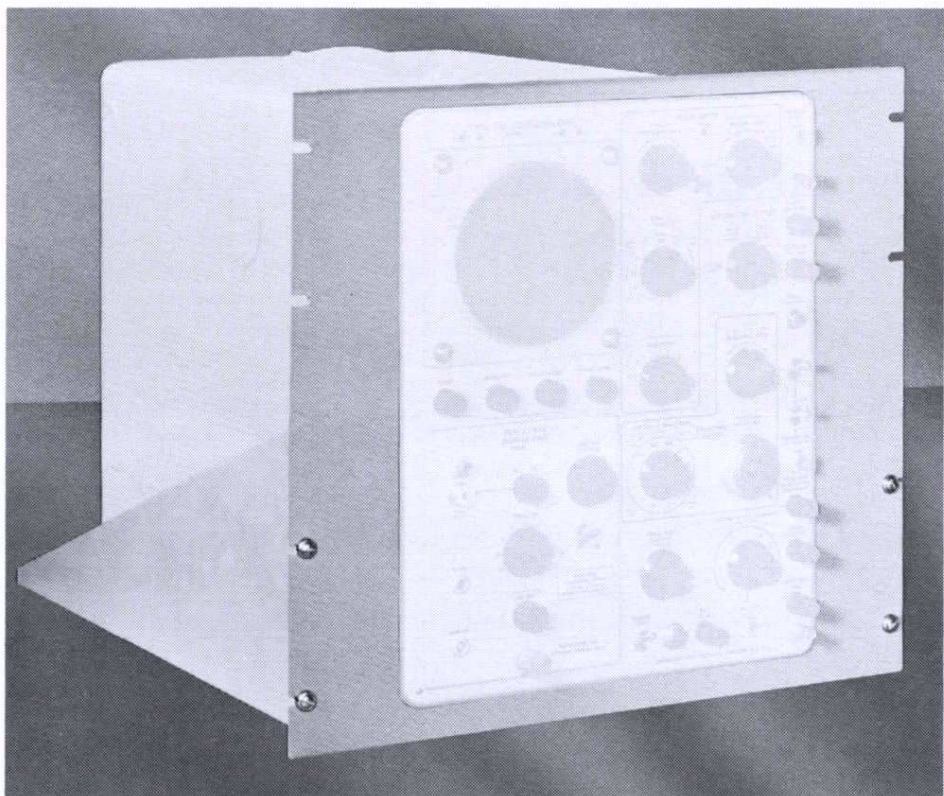


# ACCESSORIES

## 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



Cradle-mount for rack mounting cabinet-type oscilloscopes. Each cradle-mount consists of a cradle (or "shelf") to support the instrument in any standard 19" relay rack, and a mask to fit over the regular instrument panel. Tek blue wrinkle finish.

040-182 For Type 524, Type-530 series and Type-540 series instruments all serial numbers above 5000 (1 mask, 1 cradle) . . . . . \$45.00

040-183 For Type 507 and Type 551 instruments (2 masks, 2 cradles) . . . . . \$85.00

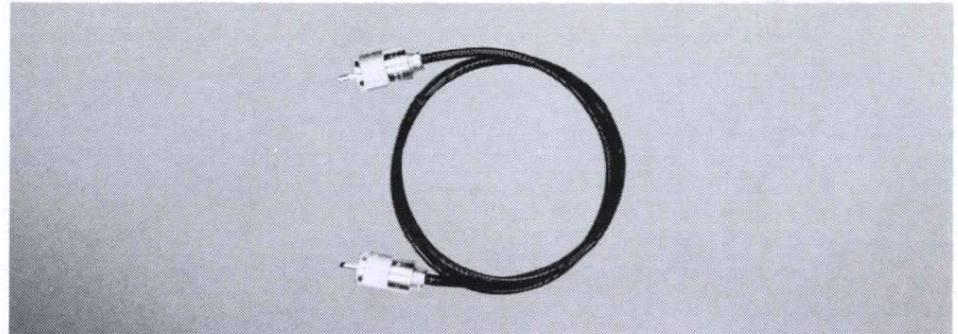
040-193 For Type 180A, Type 190A and Type 515A instruments (1 mask, 1 cradle) . . . . . \$45.00

040-194 For Type 502 instruments (1 mask, 1 cradle) . . . . . \$45.00

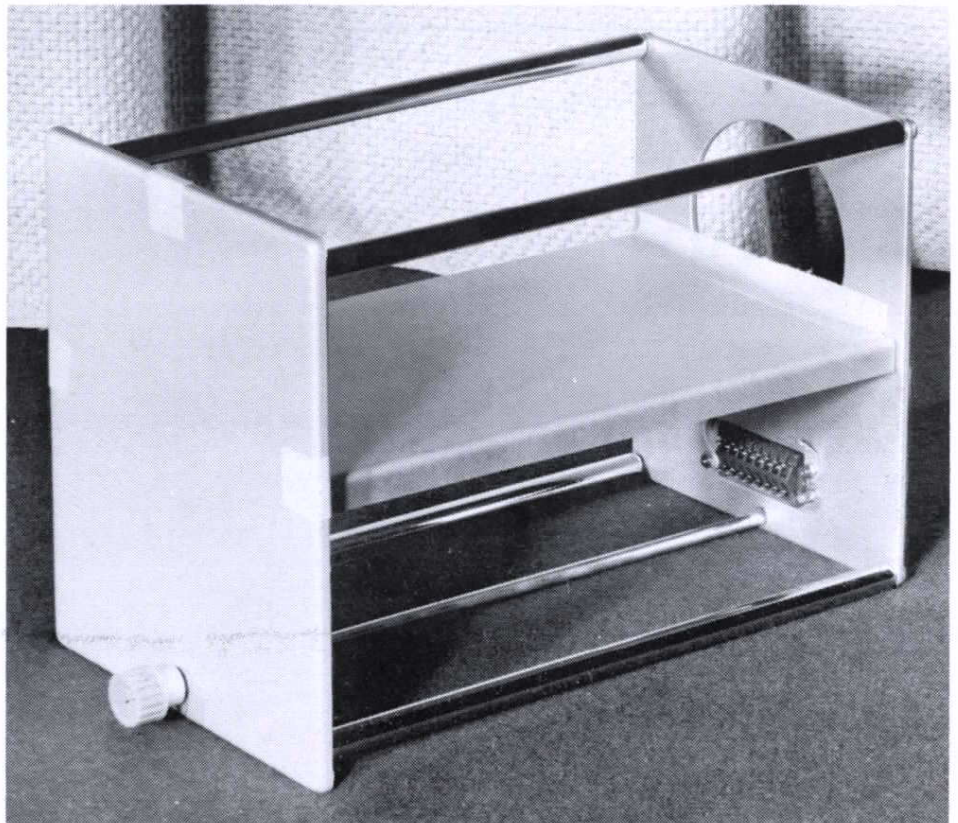
Prices f.o.b. factory.

### COAXIAL CABLES

- P52 Coaxial cable, 52 ohms nominal impedance, 42" long . . . . . \$4.00
- P75 Coaxial cable, 75 ohms nominal impedance, 42" long . . . . . 4.00

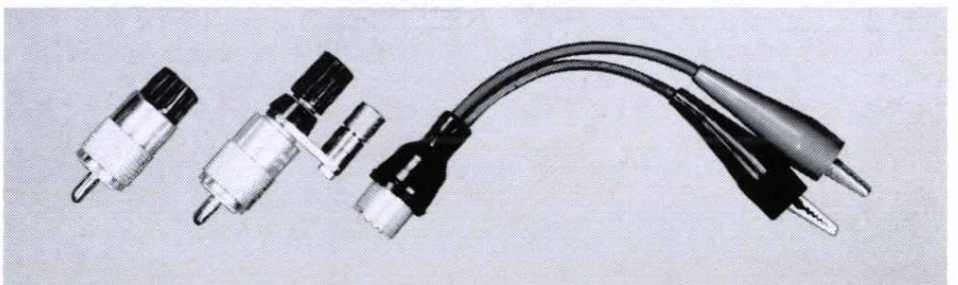


- P93 Coaxial cable, 93 ohms nominal impedance, 42" long . . . . . \$4.00
- P93A Coaxial output cable, 93 ohms, 42" long, terminated with variable attenuator 13.50
- P93B Coaxial output cable, 93 ohms, 42" long, terminated with 1/2-watt 93-ohm resistor 5.00
- P170 Coaxial cable, 170 ohms nominal impedance, 42" long . . . . . 9.50



040-065 Blank Plug-in Skeleton . . . . . \$15.00

### MISCELLANEOUS



- 013-003 Adapter, binding post . . . . . \$2.00
- 013-004 Adapter, binding post . . . . . 2.00
- 013-009 Binding Post Adapter with ground terminal, 3/4" spacing . . . . . \$3.00





Geographical Abstracts

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1968



# ACCESSORIES

## Test Accessories

### Type P Plug-In Test Unit

#### GENERAL DESCRIPTION

The Type P 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 A to Z Plug-In Preamplifier will exhibit identical transient-response characteristics in like oscilloscopes that have been standardized with the Type P.

#### OTHER CHARACTERISTICS

Risetime of the step function generated by the Type P 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.

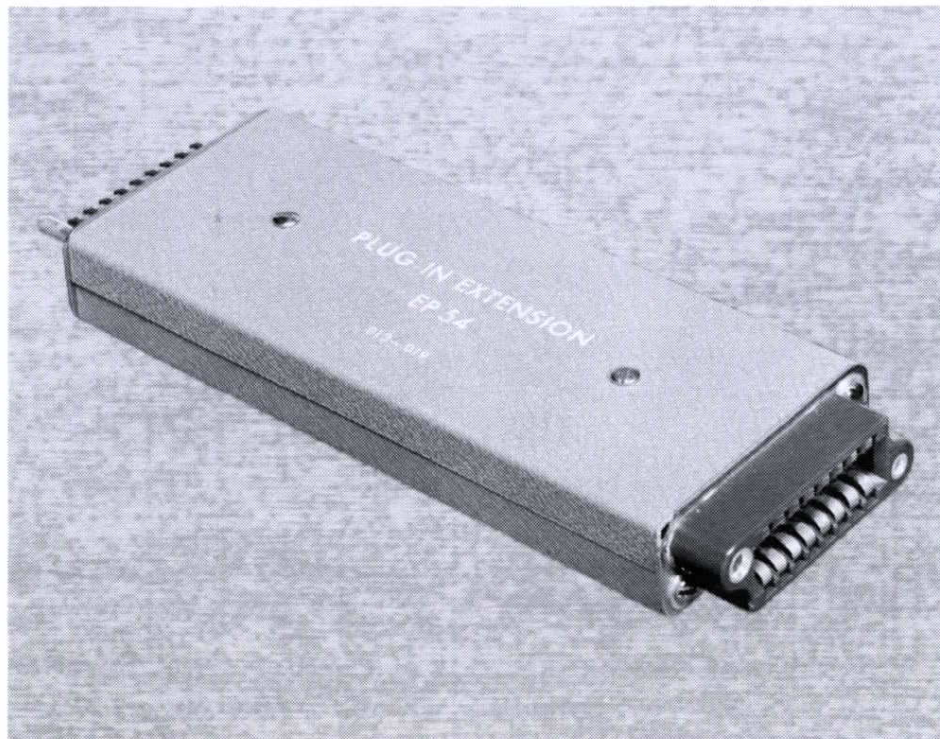
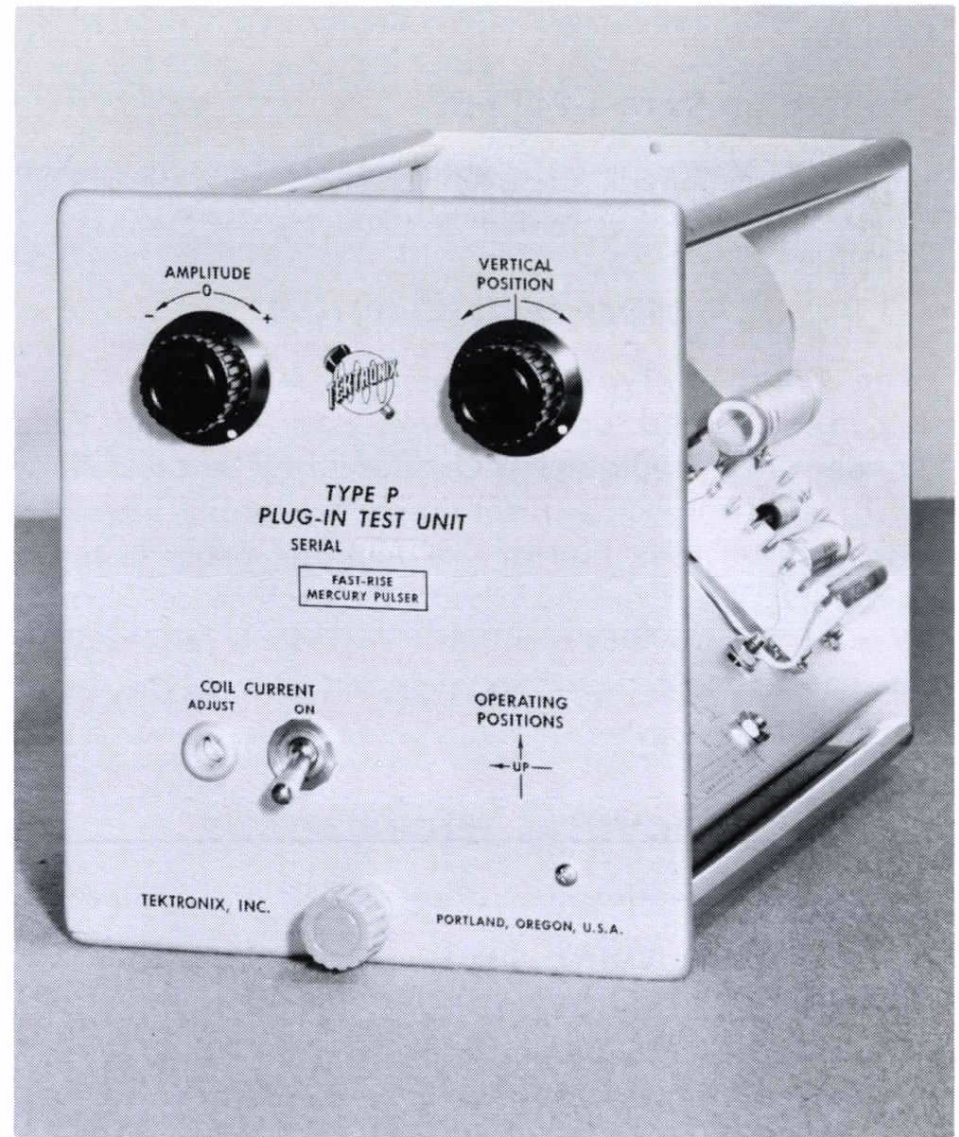
#### MECHANICAL SPECIFICATIONS

Construction—Aluminum-alloy chassis.

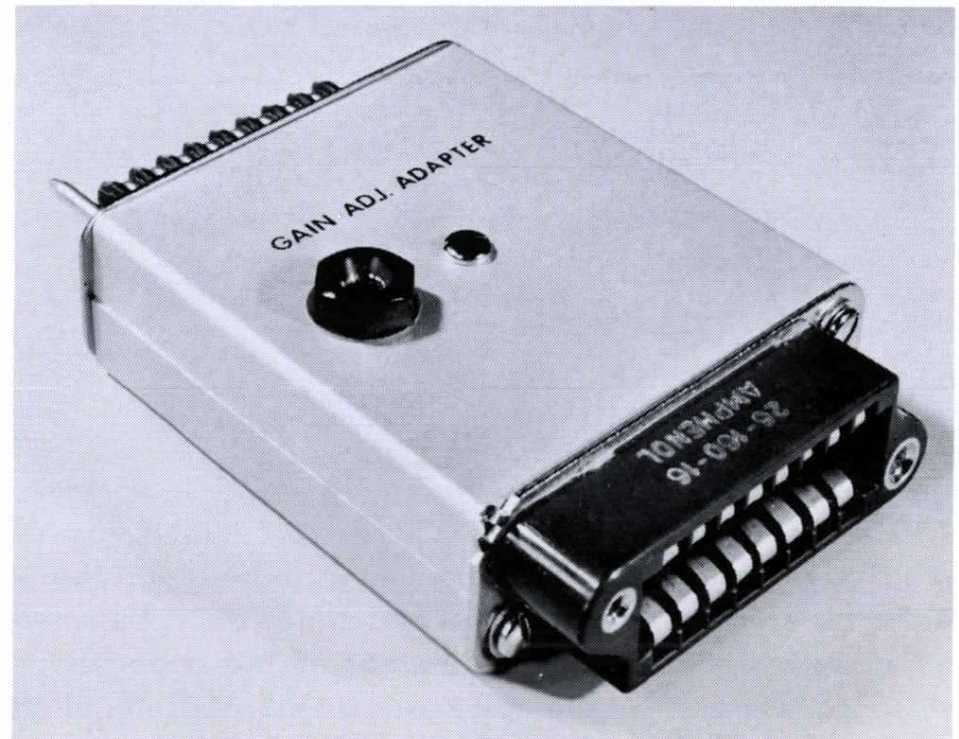
Finish—Photo-etched panel.

Weight—3 1/2 pounds.

Price ..... \$60



013-019 (EP54) Plug-in Extension—Allows the plug-in preamplifier unit for the Type 530, 540, 550, and 580-Series Oscilloscopes to be operated partially out of its housing ..... 8.50



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

### Type 108 Fast-Rise Mercury Pulser

**Risetime**—1 millimicrosecond into a terminated 52-ohm line.

**Repetition Rate**—240 pps.

**Output Voltage**—10 volts, approximately, when cable is terminated in 52 ohms.

#### GENERAL DESCRIPTION

The Tektronix Type 108 Fast-Rise Mercury Pulser is basically intended as a Test Accessory for the Type 517, and 517A High-Speed Oscilloscopes. For examination of high-frequency response, a waveform having a risetime faster than that of the amplifier being tested is necessary. The Type 108, with its risetime of 1 millimicrosecond, provides a suitable waveform for checking and adjusting the high-frequency response of the Types 517 and 517A.

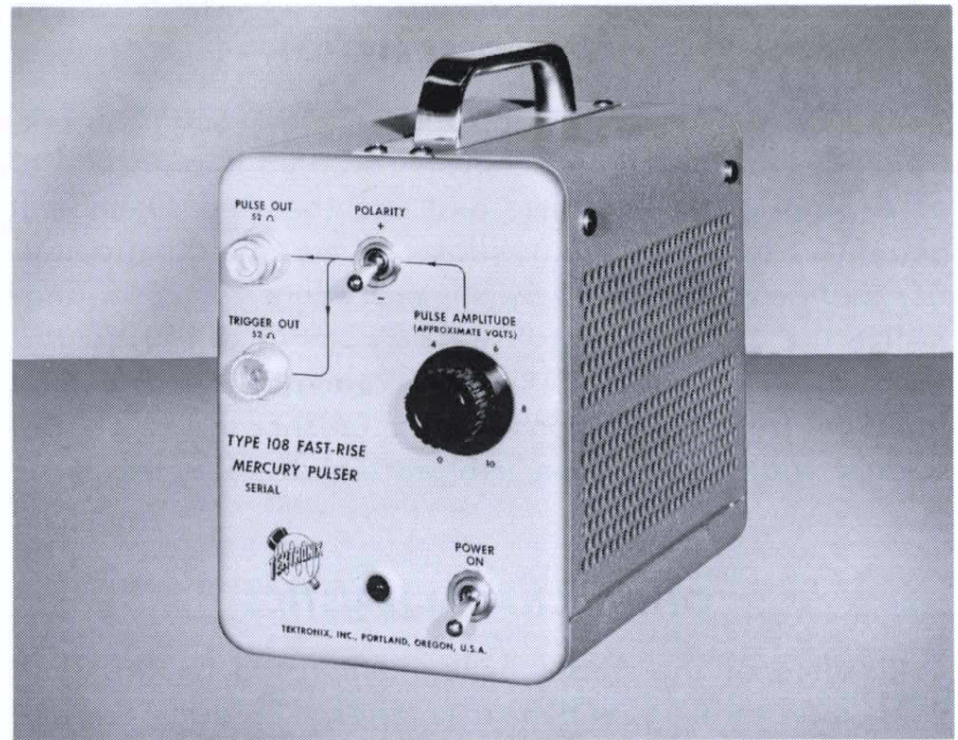
#### MECHANICAL SPECIFICATIONS

**Construction**—Aluminum alloy chassis and cabinet.

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

**Dimensions**—9 1/4" long, 5" wide, 7 3/4" high.

**Weight**—5 pounds.



**Power Requirements**—105-125 v 50-60 cycle, 19 watts.

**Price** ..... \$125

Includes: 1—Cable (012-033)  
1—Cable (012-001)  
1—T-Pad (10:1, 52 to 170 Ω)

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



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-μh standard permits proper adjustments of the inductance ranges .....22.00

Prices f.o.b. factory.



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

011-022 (CS 20) Input Capacitance Standardizer—Similar to 011-021 (CS 47), for use with the Types C-A, K and L Plug-In Preamplifiers having 20 μμf input capacitance ..... 11.50



# ACCESSORIES

## Replacement Parts

### CATHODE-RAY TUBES

**5BGP is used in Tektronix Types 513, 531, 535, RM31 and RM35**

154-080	5BGP1	.....	\$75.00
154-081	5BGP2	.....	75.00
154-082	5BGP7	.....	75.00
154-083	5BGP11	.....	75.00

**5CAP is used in Tektronix Types 525, 532, RM32, 570 and 575**

154-093	5CAP1	.....	\$50.00
154-097	5CAP2	.....	50.00
154-102	5CAP7	.....	50.00
154-103	5CAP11	.....	50.00

**5BHP is used in Tektronix Types 541, 545, RM41 and RM45**

154-106	5BHP1	.....	\$100.00
154-098	5BHP2	.....	100.00
154-104	5BHP7	.....	100.00
154-099	5BHP11	.....	100.00

**5CBP is used in Tektronix Types 515A and RM15**

154-125	5CBP1	.....	\$60.00
154-120	5CBP2	.....	60.00
154-126	5CBP7	.....	60.00
154-127	5CBP11	.....	60.00

**T316 (T32) is used in the Tektronix Types 316 and RM16**

(Replaces T31 with minor circuit changes)

154-154	T316P1	.....	\$40.00
154-155	T316P2	.....	40.00
154-156	T316P7	.....	40.00
154-157	T316P11	.....	40.00

**T317 (T33) is used in the Tektronix Types 317 and RM17**

154-216	T317P1	.....	Price on request
154-196	T317P2	.....	Price on request
154-217	T317P7	.....	Price on request
154-218	T317P11	.....	Price on request

**T502 (T60) is used in the Tektronix Type 502**

154-172	T502P1	.....	\$150.00
154-144	T502P2	.....	150.00

154-170	T502P7	.....	150.00
154-173	T502P11	.....	150.00

**T507 (T53) is used in Tektronix Type 507**

154-137	T507P11	.....	Price on request
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**T517 (T54-H) is used in Tektronix Type 517A**

154-107	T517P1	.....	\$110.00
154-109	T517P2	.....	110.00
154-108	T517P7	.....	110.00
154-105	T517P11	.....	110.00

**T533 (T64) is used in Tektronix Types 531A, RM31A, 533, RM33, 535A and RM35A.**

154-178	T533P1	.....	\$90.00
154-165	T533P2	.....	90.00
154-179	T533P7	.....	90.00
154-180	T533P11	.....	90.00

**T536 (T56) is used in Tektronix Type 536**

154-140	T536P1	.....	\$60.00
154-133	T536P2	.....	60.00
154-135	T536P7	.....	60.00
154-136	T536P11	.....	60.00

**T543 (T65) is used in Tektronix Types 541A, RM41A, 543, RM43, 545A and RM45A.**

154-181	T543P1	.....	\$110.00
154-175	T543P2	.....	110.00
154-182	T543P7	.....	110.00
154-183	T543P11	.....	110.00

**T551 (T57) is used in Tektronix Type 551**

154-186	T551P1	.....	Price on request
154-160	T551P2	.....	Price on request
154-189	T551P7	.....	Price on request
154-143	T551P11	.....	Price on request

**T555 (T59) is used in Tektronix Type 555**

154-219	T555P1	.....	Price on request
154-199	T555P2	.....	Price on request
154-220	T555P7	.....	Price on request
154-221	T555P11	.....	Price on request





# ACCESSORIES

## Replacement Parts

T581 is used in Tektronix Types 581 and 585

154-228	T581P1	Price on request
154-224	T581P2	Price on request
154-229	T581P7	Price on request
154-230	T581P11	Price on request

### GRATICULES

386-395	Unruled, for Types 310, 310A, 316, 317 and 360	\$1.00
386-312	Unruled, for Types 315 and 315D	1.00
386-326	Unruled, for Types 502, 507, 511A, 512, 513, 514, 514A, 524D, 524AD, 531, 531A, 532, 535, 535A, 536, 570 and 575	1.00
386-451	Unruled, for Types 515, 515A, 517A, 533, 541, 541A, 543, 545, 545A, 551, 555, 581 and 585	1.00
331-027	Quarter-inch divisions, 8 divisions vertically, 10 horizontally, for Types 310, 310A, and 360	1.50
331-042	Quarter-inch divisions, 8 divisions vertically, 10 horizontally, for Types 316 and 317	1.50
331-005	Quarter-inch divisions, 8 divisions vertically, 10 horizontally, for Types 315 and 315D	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
331-047	Centimeter ruling, 10 cm vertically, 10 cm horizontally, for Type 502	1.50
331-037	Centimeter ruling, 6 cm vertically, 10 cm horizontally, for Types 515, 515A, and 533	1.50
331-008	Centimeter ruling, 4 cm vertically, 8 horizontally, for Type 517 with 5XP crt	1.50

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 cm vertically, 10 cm horizontally, for Type 532	1.50
331-016	Centimeter ruling, 6 cm vertically, 10 cm horizontally, for Types 507, 531, 531A, 535, and 535A	1.50
331-034	Centimeter ruling, 4 cm vertically, 10 horizontally, for Types 541, 541A, 543, 545, 545A, and 585	1.50
331-028	Division ruling, 10 divisions vertically, 10 horizontally, for Types 536, 570 and 575	1.50
331-045	Centimeter ruling, 6 cm vertically, 10 cm horizontally, for Types 551 and 555	1.50

### CATHODE-RAY-TUBE LIGHT FILTERS

For Types 310, 310A, 316, 317, and 360.

378-511	3" Amber	.50
378-509	3" Green	.50
378-510	3" Blue	.50
378-512	3" Yellow	.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

For Types 502, 507, 511A, 512, 513, 514, 514A, 524D, 524AD, 531, 531A, 532, 535, 535A, 536, 570, and 575.

378-501	5" Amber	.90
378-502	5" Yellow	.90
378-503	5" Green	.90
378-504	5" Blue	.90

For Types 515, 515A, 517A, 533, 541, 541A, 543, 545, 545A, 551, 555, 581 and 585.

378-514	5" Green	.90
378-515	5" Blue	.90
378-516	5" Amber	.90





# ACCESSORIES

## Replacement Parts

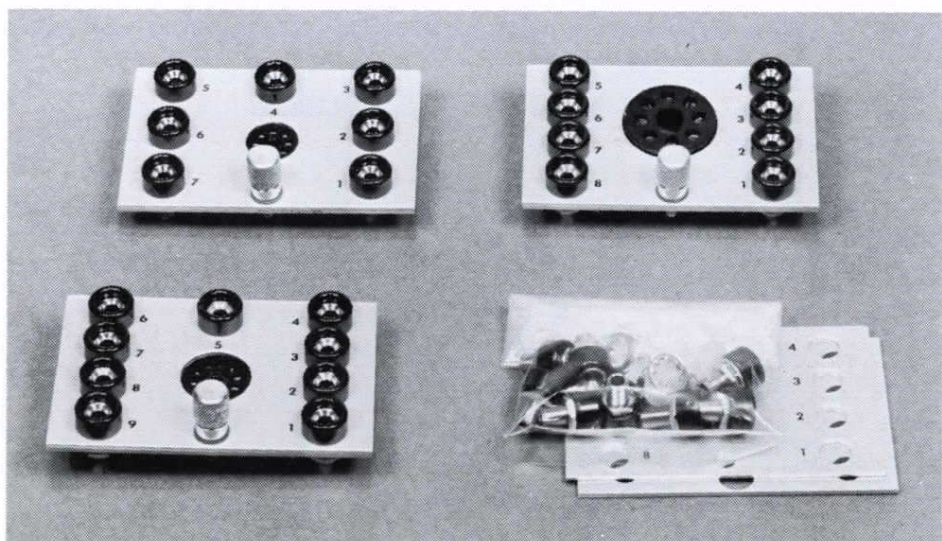
### AC POWER CORDS

161-001	2-conductor No. 18 wire 8' long	.....	\$1.25
161-003	2-conductor No. 18 wire 15" long	.....	.85
161-007	2-conductor No. 18 wire 8' long with right angle female plug	.....	1.25
161-004	2-conductor No. 16 wire 8' long	.....	1.75
161-008	3-conductor No. 18 wire 8' long	.....	1.50
161-014	3-conductor No. 16 wire 20" long	.....	1.25
161-010	3-conductor No. 15 wire 8' long	.....	1.75

### 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 or Type E, 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
012-034	170 $\Omega$ 5' long coaxial cable for type 127	5.00

### ADAPTER PLATES (for Type 570)

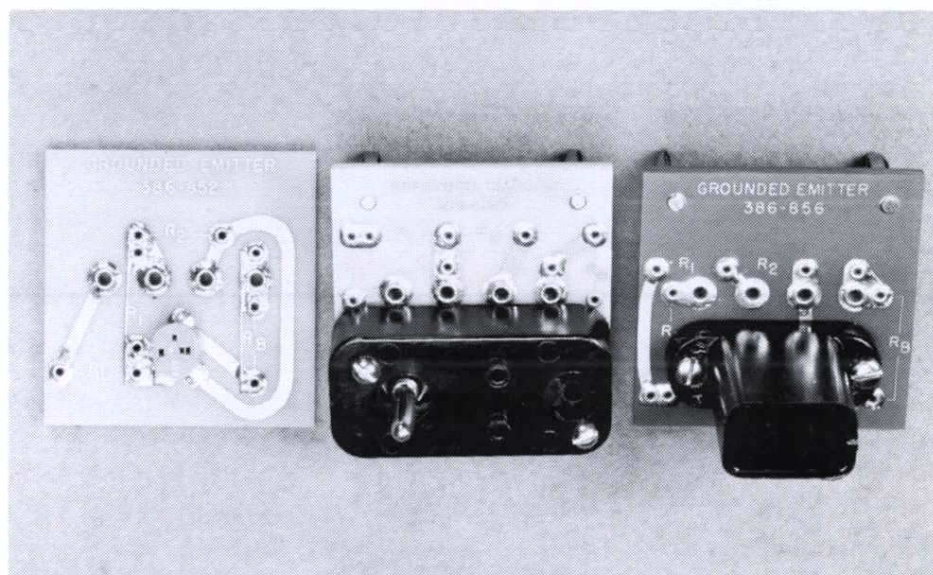


016-004	7 pin with jacks installed	.....	4.00
016-005	8 pin with jacks installed	.....	4.00
016-006	9 pin with jacks installed	.....	4.00
016-007	Blank with jacks included	.....	2.50

(For Type R Transistor Risetime Unit)

Since each transistor type will require different values of collector load resistor, base or emitter driving resistors, and voltage dividing resistors, these are not supplied with the adapter plates.

If large quantities of different types of transistors are to be checked, it is desirable to have a separate plate wired for each type.



Short lead, 3-wire small transistor

386-852	grounded emitter transistor socket	.....	\$1.50
386-853	grounded base transistor socket	.....	1.50

Small power transistor, T0-3 type package.

386-854	grounded emitter power transistor socket	.....	2.50
386-855	grounded base power transistor socket	.....	2.50

Long lead, 3-wire small transistor

386-856	grounded emitter adapter	.....	2.50
386-857	grounded base adapter	.....	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 $\Omega$ , 6 (banana plug both ends)	.....	1.50
012-026	Suppressor Cord, 300 $\Omega$ , 6 (banana plug both ends)	.....	1.50

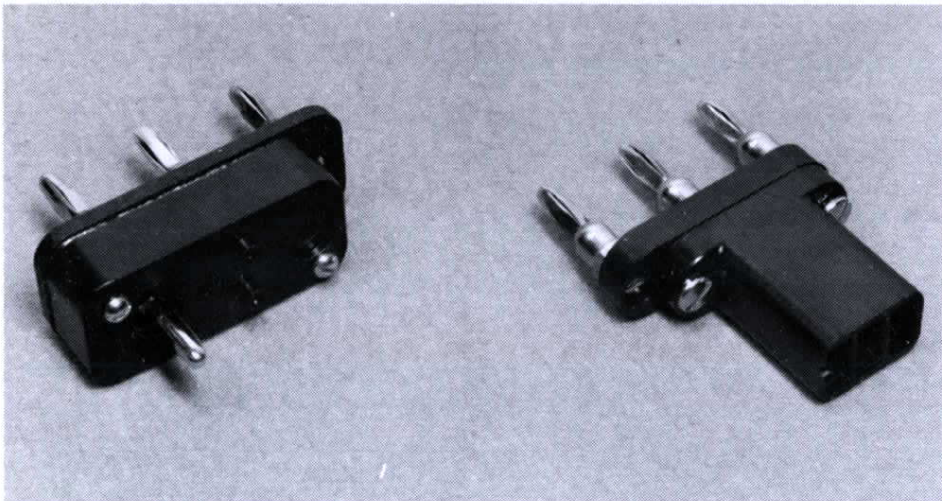


# ACCESSORIES

## Replacement Parts

- 012-027 Suppressor Cord, 1 k, 6 ..... 1.50  
(banana plug both ends)
- 012-028 Single Patch Cord, Black 6 ..... 1.00
- 012-029 Single Patch Cord, Red 6 ..... 1.00

### TRANSISTOR RECEPTACLES (for Type 575)



- 013-010 Transistor adapter for transistors with wire leads ..... 4.25
- 013-012 Transistor adapter for transistors with short pin leads ..... 3.50

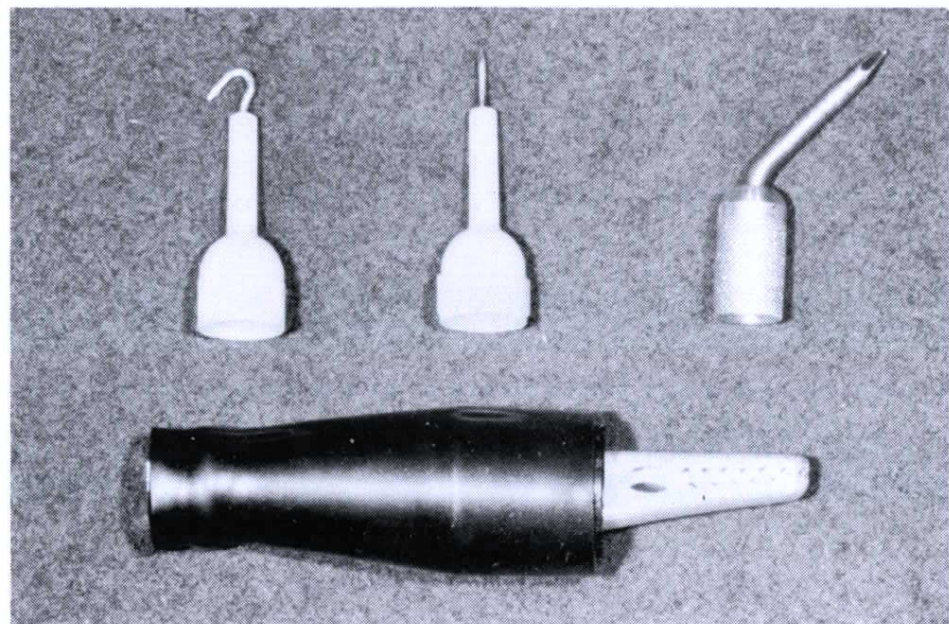
### AIR FILTERS

- 378-001 Aluminum, 11 7/8 x 11 7/8 x 2 for Type 517 and 517A ..... 4.00
- 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 Types 316, 317 and 180A ..... 1.85
- 378-017 Aluminum, 6 1/2 x 6 1/2 x 1 for Types RM16, RS16 and RM17 ..... 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 and 525 ..... 1.50
- 378-010 Aluminum, 8 x 8 x 1 for Types 502, 515 and 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, 555, 570, 575, 581 and 585 ..... 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

### 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





# ACCESSORIES

## Replacement Parts

127 .....	\$2.00	524 or 524AD .....	5.00
128 .....	1.50	525 .....	4.50
130 .....	1.30	531 or RM31 .....	4.50
160 or 160A .....	1.50	532 or RM32 .....	4.50
161 .....	1.50	533 .....	4.50
162 .....	1.50	535 or RM35 .....	5.00
163 .....	1.50	536 .....	4.50
180 or 180A .....	2.00	541 or RM41 .....	4.50
181 .....	1.75	543 .....	4.50
190A .....	1.50	545 or RM45 .....	5.00
310 or 310A .....	3.50	551 .....	4.50
315D .....	4.00	53/54A or A .....	1.50
316, RM16 or RS16 .....	4.50	53/54B or B .....	1.50
317 or RM17 .....	4.50	53/54C or C-A .....	1.50
360 .....	1.75	53/54D or D .....	1.50
502 .....	4.50	53/54E or E .....	1.50
507 .....	4.00	53/54G or G .....	1.50
511A or 511AD .....	2.75	53/54H or H .....	1.50
512 .....	2.75	53/54K or K .....	1.50
513 or 513D .....	2.75	53/54L or L .....	1.50
514 or 514D .....	2.75	53/54P or P .....	1.50
514A or 514AD .....	3.00	R .....	2.00
515 or 515A .....	4.00	53/54T or T .....	1.50
RM15 .....	4.50	570 .....	4.50
517 or 517A .....	4.50	575 .....	5.00



REPLACEMENT PARTS





## APPROXIMATE SHIPPING WEIGHTS

INSTRUMENT TYPE	NET WEIGHT IN POUNDS	DOMESTIC PACKED IN POUNDS	EXPORT PACKED		VOLUME IN CU. FT.
			WEIGHT IN POUNDS	KILOGRAMS	
105	35 1/2	49	63	29	5
107	12	19	38	20	4
112	35	49	79	34	7
121	18 1/2	24	43	20	4
122	5 1/2	9	16	7	1
126	20	30	50	19	5
127	36	75	105	48	9
128	6	13	16	7	1
130	9	17	34	17	4
160 Series					
160A	21	27	50	22	4
161	3 1/2	7	14	6	1
162	3 1/2	7	14	6	1
163	3 1/2	7	14	6	1
360	9	17	32	15	4
FA-160	1 1/4	3			
180A	31	43	60	27	5
181	17 1/2	24	42	22	7
RM181	18	33	54	24	6
190A	24	36	55	25	5
310 and 310A	23 1/2	30	50	23	4
316	34	42	55	25	4
317	34	42	55	25	4
RM16	44	79	107	49	9
502	55	79	98	44	8
515A	40	58	76	34	6
RM15	43	85	113	51	9
517A	190	242	299	135	21
524AD	61	80	100	46	8
Viewing Hood	1 1/4	3	11	5	1
525	54	86	115	52	9
531 and 531A	61 1/2	80	101	46	8
RM31 and RM31A	78	96	116	52	10
532	52	73	95	43	8
RM32	71	89	109	50	10
533	61	80	100	46	8
RM33	78	96	116	52	10
535 and 535A	65	85	105	48	8
RM35 and RM35A	81	100	120	54	10
536	57	83	98	44	8
541 and 541A	61 1/2	80	101	46	8
RM41 and RM41A	78	96	116	52	10
543	61	80	100	46	8
RM43	78	96	116	52	10
545 and 545A	65	85	105	48	8
RM45 and RM45A	81	100	120	54	10
551	96	120	140	63	13
A	3 1/2	10	14	6	1
B	3 1/2	10	14	6	1
C-A	5 1/2	12	16	7	1
D	4	11	15	7	1
E	4 1/2	12	16	7	1
G	4 1/2	12	16	7	1
H	3 1/2	10	14	6	1
K	3 1/2	10	14	6	1
L	4 1/2	12	16	7	1
P	3 1/2	10	14	6	1
R	4 1/2	12	16	7	1
T	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





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AN OREGON CORPORATION

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<b>BOSTON*</b>	Tektronix, Inc., 18 Austin St., Newtonville 60, Massachusetts TWX: NEWTON MASS 940 ..... LAsell 7-2212
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