



CATHODE-RAY OSCILLOSCOPES

and associated instruments



Contents

NOTE: For convenience in checking characteristics of Tektronix Instruments and making comparisons between them you will find an expanded Reference Section in the front of this catalog. This section has been divided into four broad categories: (1) Tektronix Oscilloscope characteristics according to passband capabilities, (2) Tektronix Type 560-Series Oscilloscopes and characteristics of their amplifier and time-base plug-in units, (3) Tektronix Type 530A, 540A, 550, and 580-Series Oscilloscope characteristics when used with any of the Letter-Series general and special-purpose Plug-In Units, (4) Tektronix auxiliary instrument characteristics.

Reference Section	2-8
Oscilloscopes by Frequency Response	2-3
Television, Sampling, & Curve-Tracing Oscilloscopes ...	4
Oscilloscopes with 2 and 3-Series Plug-In Units	5
Oscilloscopes with Letter-Series Plug-In Units	6-7
Auxiliary Instruments	8
Descriptions and Specifications	9
Cathode-Ray Tube Phosphor Data	10
Tektronix Field Services	207
Writing Rate Considerations	208
Instrument Dimensions	209
Shipping Weights and Volumes	211
General Information	212
Field Engineering Offices	Inside Back Cover

OSCILLOSCOPES

TYPE		PAGE
310A	DC to 4 MC Portable Oscilloscope	11
317, RM17	DC to 10 MC Oscilloscopes	13
321	Transistorized Portable Oscilloscope	16
360	Indicator Unit	19
502	200 μ v/cm Dual-Beam Oscilloscope	21
503, RM503	DC to 450 KC — X-Y Oscilloscopes	24
504, RM504	DC to 450 KC Oscilloscopes	27
507	Surge-Test Oscilloscope	29
515A, RM15	DC to 15 MC Oscilloscopes	32
516	DC to 15 MC — Dual-Trace Oscilloscope ..	35
517A	High-Speed Oscilloscope	38
519	DC to 1 Gigacycle Oscilloscope	41
524AD	Television Oscilloscope	46
525	Television Waveform Monitor	49
526	Color Television Vectorscope	52

NEW

TYPE		PAGE
527, RM527	Television Waveform Monitors	56
531A, RM31A	DC to 15 MC Oscilloscopes	60
533A, RM33A	DC to 15 MC—100X Magnifier Oscilloscopes	64
535A, RM35A	DC to 15 MC—Sweep Delay Oscilloscopes .	60
536	DC to 10 MC — X-Y Oscilloscope	67
541A, RM41A	DC to 30 MC Oscilloscopes	70
543A, RM43A	DC to 30 MC—100X Magnifier Oscilloscopes	75
545A, RM45A	DC to 30 MC—Sweep Delay Oscilloscopes .	70
551	DC to 25 MC — Dual-Beam Oscilloscope ..	78
555	DC to 30 MC—Sweep Delay — Dual-Beam .	82
561A	Oscilloscope	87
RM561	Oscilloscope	88
565, RM565	Dual-Beam Oscilloscopes	90
567; RM567	Readout Oscilloscopes	94
570	Electron Tube Characteristic Curve Tracer ..	98
575	Transistor Curve Tracer	101
581	DC to 95 MC Oscilloscope	104
585	DC to 95 MC—Sweep Delay Oscilloscope ..	104
661	Sampling Oscilloscope	109
945	Militarized—Sweep Delay Oscilloscope ...	113
MC	Militarized — Dual-Trace Preamplifier	113
ML	Militarized—DC to 30 MC Preamplifier	113

PLUG-IN UNITS

B	Wide-Band, High-Gain Unit	117
CA	Dual-Trace DC Unit	118
D	High-Gain DC Differential Unit	119
E	Low-Level AC Differential Unit	120
G	Wide-Band DC Differential Unit	121
H	Wide-Band, High-Gain DC	122
K	Fast-Rise DC Unit	123
L	Fast-Rise, High-Gain Unit	124
M	Four-Trace DC Unit	125

Contents

TYPE		PAGE	TYPE		PAGE
N	Pulse Sampling Unit	126	113	Delay Cable	161
O	Operational Amplifier Unit	128	122, FM122, RM122	Low-Level Preamplifiers	162
P	Fast-Rise Test Unit	130	123	AC-Coupled Preamplifier	164
Q	Transducer and Strain Gage Unit	131	125, FM125, RM125	Power Supplies	165
R	Transistor-Risetime Unit	133	127	Power Supply	166
S	Diode Recovery Unit	135	130	L-C Meter	168
T	Time-Base Generator	137	132	Power Supply	169
Z	Differential-Comparator Unit	138	133	Power Supply	170
2A60	DC to 1 MC Vertical Amplifier	140	160A	Power Supply	172
2A63	DC to 300 KC Differential Vertical Amplifier	140	161	Pulse Generator	173
2B67	Time-Base Unit	141	162	Waveform Generator	174
3A1	Dual-Trace DC to 10 MC Vertical Amplifier .	141	163	Fast-Rise Pulse Generator	175
3A72	Dual-Trace DC to 650 KC Vertical Amplifier	142	175	High-Current Adapter for Type 575	176
3A75	DC to 4 MC Vertical Amplifier	142	180A	Time-Mark Generator	179
3A74	Four-Trace DC to 2 MC Vertical Amplifier ..	143	181, RM181	Time-Mark Generators	181
3B1, 3B3	Time-Base Units	144	190B	Sine-Wave Generator	183
3S76	Dual-Trace Sampling Unit	145	1121	5 cps to 17 MC Amplifier	184
3T77	Sampling Sweep Unit	146	C-12, C-13, C-19	Trace-Recording Cameras	186
4S1	Dual-Trace Sampling Unit	147			
5T1	Sampling Timing Unit	148			
6R1	Digital Unit	149			
P80	Probe	151			
80	Vertical Unit	151			
81	Plug-In Unit Adapter	152			
82	Dual-Trace Unit	153			
84	Test Unit	154			

AUXILIARY INSTRUMENTS

105	Square-Wave Generator	155
107	Square-Wave Generator	157
109	Pulse Generator	158
110	Pulse Generator & Trigger Takeoff	159
111	Pretrigger Pulse Generator	160

NEW

113	Delay Cable	161
122, FM122, RM122	Low-Level Preamplifiers	162
123	AC-Coupled Preamplifier	164
125, FM125, RM125	Power Supplies	165
127	Power Supply	166
130	L-C Meter	168
132	Power Supply	169
133	Power Supply	170
160A	Power Supply	172
161	Pulse Generator	173
162	Waveform Generator	174
163	Fast-Rise Pulse Generator	175
175	High-Current Adapter for Type 575	176
180A	Time-Mark Generator	179
181, RM181	Time-Mark Generators	181
190B	Sine-Wave Generator	183
1121	5 cps to 17 MC Amplifier	184
C-12, C-13, C-19	Trace-Recording Cameras	186

ACCESSORIES

Accessories for Tektronix Instruments	188-206
Scope Mobile® Carts	188
Probes	
General Purpose	190
Special Purpose	193
Pulse Sampling	196
Pulse Sampling Accessories	201
Terminations, Attenuators, Adapters	202
Plug-In Extensions	203
Cradle Mounts	204
Polarized Viewer, Viewing Hoods	205
Graticules, Light Filters	206

Information in this catalog supersedes all previously published material. Specification and price change privileges reserved.

Reference Chart

Due to the wide range of capabilities of Tektronix Oscilloscopes, some instruments are included at more than one place in the Reference Section. A more complete description can be found in the individual instrument discussion.

For help in selection of the instrument for your particular application, feel free to call your Tektronix Field Engineer.

TEKTRONIX OSCILLOSCOPES (According to Passband Capabilities)										
Instrument	Vertical [‡] Passband	Risetime	Calibrated Deflection Factor	Signal Delay	Sweep Delay Range	Calibrated Sweep Range	Sweep Magnifier	Accel. Potential	Price [†]	Page
Type 519	DC to 1000 MC	0.35 nsec	less than 10 v/cm	Yes	0 to 35 nsec	2 nsec/cm to 1 μ sec/cm	None	24 kv	\$3900	41
Type 661 ^(A)	Equivalent to DC to 1000 MC	0.35 nsec	2 mv/cm to 200 mv/cm	Yes	through 100 nsec	1 nsec/cm to 100 μ sec/cm	2, 5, 10, 20, 50, 100 X	3 kv	\$1150	109
Type 561A ^(B)	Equivalent to DC to 875 MC	0.4 nsec	2 mv/cm to 200 mv/cm	Yes	through 100 nsec	0.2 nsec/cm to 10 μ sec/cm	10X	3.5 kv	\$ 470	87
Type 581 ^(C) Fast-Rise	DC to 95 MC	3.9 nsec	0.1 v/cm	Yes	None	50 nsec/cm to 2 sec/cm	5X	10 kv	\$1425	104
Type 585 ^(C) Fast-Rise		3.9 nsec	0.1 v/cm	Yes	2 μ sec to 10 sec	50 nsec/cm to 2 sec/cm	5X	10 kv	\$1725	104
Type 517A High-Speed		7 nsec	50 mv/cm	Yes	None	10 nsec/cm to 20 μ sec/cm	None	24 kv	\$3500	38
*Type 541A ^(D) Fast-Rise	DC to 30 MC	12 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μ sec/cm to 5 sec/cm	5X	10 kv	\$1225	70
*Type 543A ^(D) Fast-Rise		12 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μ sec/cm to 5 sec/cm	2, 5, 10, 20, 50, 100X	10 kv	\$1300	75
*Type 545A ^(D) Fast-Rise		12 nsec	50 mv/cm to 20 v/cm	Yes	2 μ sec to 10 sec	0.1 μ sec/cm to 5 sec/cm	5X	10 kv	\$1550	70
Type 555 ^(D) Dual-Beam		12 nsec	50 mv/cm to 20 v/cm	Yes	0.1 μ sec to 50 sec	0.1 μ sec/cm to 5 sec/cm	5X	10 kv	\$2650	82
Type 945 ^(E) Military		12 nsec or less	50 mv/cm to 20 v/cm	Yes	2 μ sec to 100 msec	0.1 μ sec/cm to 5 sec/cm	5X	10 kv	\$2850	113
Type 551 ^(D) Dual-Beam	DC to 25 MC	14 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μ sec/cm to 5 sec/cm	5X	10 kv	\$1850	78
*Type 515A	DC to 15 MC	23 nsec	50 mv/cm to 20 v/cm	Yes	None	0.2 μ sec/cm to 2 sec/cm	5X	4 kv	\$ 875	32
Type 516 Dual-Trace		23 nsec	50 mv/cm to 20 v/cm	Yes	None	0.2 μ sec/cm to 2 sec/cm	5X	4 kv	\$1070	35
*Type 531A ^(D)		23 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μ sec/cm to 5 sec/cm	5X	10 kv	\$ 995	60
*Type 533A ^(D)		23 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μ sec/cm to 5 sec/cm	2, 5, 10, 20, 50, 100X	10 kv	\$1125	64
*Type 535A ^(D)		23 nsec	50 mv/cm to 20 v/cm	Yes	2 μ sec to 10 sec	0.1 μ sec/cm to 5 sec/cm	5X	10 kv	\$1400	60

[‡] Frequency Specifications are at 3-db down.

[†] Price does not include Plug-In Units.

* Rack-Mount models are available.

^(A) Specifications include those for Types 4S1 and 5T1 Sampling Units.

^(B) Specifications include those for Types 3S76 and 3T77 Sampling Units.

^(C) Specifications include those for Type 80 Plug-In Unit and Type P80 Probe. New Dual-Trace Type 82 Plug-In Unit extends sensitivity to 10 mv/cm with 4.3 nsec risetime; 4.0 nsec risetime at 100 mv/cm. See page 153.

^(D) Specifications include those for Type K Vertical Preamplifier.

^(E) Specifications include those for Type ML Fast-Rise Vertical Preamplifier.

Reference Chart

TEKTRONIX OSCILLOSCOPES (According to Passband Capabilities)

Instrument	Vertical ‡ Passband	Risetime	Calibrated Deflection Factor	Signal Delay	Sweep Delay Range	Calibrated Sweep Range	Sweep Magnifier	Accel. Potential	Price †	Page
Type 536 ⑥ X-Y Curve Tracer	DC to 11 MC	31 nsec	50 mv/div to 20 v/div	No	None	0.2 μ sec/div to 2 sec/div	5X	4 kv	\$1085	67
*Type 317 Daylight 3" Portable	DC to 10 MC	35 nsec	10 mv/div to 50 v/div	Yes	None	0.2 μ sec/div to 2 sec/div	5X	9 kv	\$ 875	13
Type 561A ⑥ Oscilloscope		35 nsec	10 mv/cm to 10 v/cm	No	0.5 μ sec to 10 sec	0.5 μ sec/cm to 1 sec/cm	5X	3.5 kv	\$ 470	87
Type 321 Transistorized 3" Portable	DC to 5 MC	70 nsec	10 mv/div to 20 v/div	No	None	0.5 μ sec/div to 0.5 sec/div	5X	4 kv	\$ 820	16
Type 310A 3" Portable	DC to 4 MC	0.1 μ sec 90 nsec	10 mv/div to 0.1 v/div 0.1 v/div to 50 v/div	No	None	0.5 μ sec/div to 0.2 sec/div	5X	1.8 kv	\$ 675	11
*Type 565 ⑥ Dual-Beam Oscilloscope		<i>DC to 10 MC w/3A1 (6-cm linear scan)</i>	85 nsec	50 mv/cm to 20 v/cm	No	1 μ sec to 50 sec	1 μ sec/cm to 5 sec/cm	10X	4 kv	\$1400	90
*Type 503 Differential X-Y Curve Tracer	DC to 450 KC	0.75 μ sec	1 mv/cm to 20 v/cm	No	None	1 μ sec/cm to 5 sec/cm	2, 5, 10, 20, and 50X	3 kv	\$ 640	24
*Type 504		0.75 μ sec	5 mv/cm to 20 v/cm	No	None	1 μ sec/cm to 0.5 sec/cm	None	3 kv	\$ 540	27
Type 502 Dual-Beam and X-Y Curve Tracer	DC to 100 KC increasing to DC to 1 MC	3.5 μ sec diminishing to 0.35 μ sec	200 μ v/cm to 20 v/cm	No	None	1 μ sec/cm to 5 sec/cm	2, 5, 10, and 20X	3 kv	\$ 890	21

MILITARIZED INSTRUMENTS

Type 945 Oscilloscope				Yes	2 μ sec/cm to 100 msec/cm	0.1 μ sec/cm to 5 sec/cm	5X	10 kv	\$2850	113
Type MC Dual-Trace Preamp	DC to 24 MC	15 nsec or less	50 mv/cm to 20 v/cm						\$ 475	113
Type ML Fast-Rise Preamp	DC to 30 MC	12 nsec or less	50 mv/cm to 20 v/cm						\$ 425	113

HIGH-VOLTAGE SURGE-TEST OSCILLOSCOPE

Type 507		10 nsec	Approximately 50 v/cm to 500 v/cm	No	None	20 nsec/cm to 50 μ sec/cm	None	24 kv	\$3000	29
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‡ Frequency Specifications are at 3-db down.

† Price does not include Plug-In Units.

* Rack-Mount models are available.

⑥ Specifications include those for Type T Time Base and Type K Vertical Pre-amplifier.

⑦ Specifications include those for Type 3A1 Amplifier and Type 3B3 Time Base.

⑧ Specifications include those for Type 3A75 Amplifier. Type 565 is designed for 2 Amplifier Plug-In Units.

Reference Chart

TELEVISION OSCILLOSCOPES

Instrument	Risetime	Calibrated Deflection Factor	Signal Delay	Vertical Response	Calibrated Sweep Range	Sweep Magnifier	Accel. Potential	Price	Page	
Type 524AD Oscilloscope	35 nsec	15 mv/cm to 50 v/cm	Yes	Normal, Flat, IRE	0.1 μ sec/cm to 0.01 sec/cm	3 and 10X	4 kv	\$1300	46	
Type 525 Waveform Monitor		15 mv/cm with 1X, 2X, 5X step attenuator	No	Flat, Low-Pass, High-Pass, IRE	Field and Line Rates	5 and 25X	4 kv	\$1140	49	
Type 526 Vectorscope	Dual Channel displays, with either vector or linear-sweep presentation of demodulated chroma signal.							4 kv	\$1665	52
*Type 527 Waveform Monitor		0.25 v to 1.6 v for 7 cm	No	Flat, IRE	Field and Line Rates	5 and 25X	4 kv	\$ 925	56	

50- Ω SAMPLING SYSTEMS

Instrument	Risetime	Sensitivity	Signal Delay	Sweep Delay	Equivalent Sweep Time	Samples Per Centimeter	Trigger	Accel. Potential	Price	Page
Type 661 with Types 5T1 and 4S1 Sampling Units	0.35 nsec	2-200 mv/cm 1-2-5 sequence	Yes	through 100 nsec	1 nsec/cm to 100 μ sec/cm	5, 10, 20, 50 or 100 samples/cm	Internal or External	3.0 kv	\$1150 \$ 750 \$1430	109
Type 561A with Types 3S76 and 3T77 Sampling Units	0.4 nsec	2-200 mv/cm 1-2-5 sequence	Yes	through 100 nsec	0.2 nsec/cm to 10 μ sec/cm	10 or 100 samples/cm	Internal or External	3.5 kv	\$ 470 \$1100 \$ 650	87
*Type 567 Readout with Types 3S76 and 3T77 Sampling Units, Type 6R1 Digital Unit	0.4 nsec	2-200 mv/cm 1-2-5 sequence	Yes	through 100 nsec	0.2 nsec/cm to 10 μ sec/cm	10 or 100 samples/cm	Internal or External	3.5 kv	\$ 700 \$1100 \$ 650 \$2500	94
Type N Unit for Oscilloscopes Using Letter-Series Plug-In Units	0.6 nsec	10 mv/cm	No	through 200 nsec	1, 2, 5, and 10 nsec/cm	5, 10, 20, or 50 samples/cm	Requires external trigger in advance of Signal		\$ 625	126

CHARACTERISTIC CURVE TRACERS

Instrument	Vertical Axis	Horizontal Axis	Variable Drive Parameters	Accel. Potential	A-B Comparison Tests	Price	Page
Type 570 presents an accurate graphic analysis of electron-tube characteristics under almost any conceivable operating condition.	20 μ a/div to 50 ma/div 1-2-5 sequence	1 v/div to 50 v/div 1-2-5 sequence	Plate, screen, or grid current vs. plate or grid voltage.	4 kv	Yes	\$1100	98
Type 575 traces characteristic curves for both PNP and NPN transistors and diodes on the face of a crt.	1 μ a/div to 2 a/div 10 mv/div to 0.5 v/div	10 mv/div to 20 v/div 10 mv/div to 0.5 v/div	Collector current & voltage, Base current & voltage.	4 kv	Yes	\$1075	101
Instrument	Collector Supply	Base Supply	Calibrated Display	A-B Comparison Tests	Price	Page	
Type 175 adapts the Type 575 to measurement of high power (NPN and PNP) transistors and diodes. Specifications apply ONLY when used with Type 575 Curve Tracer.	0 to 20 v or 0 to 100 v, or 0 to 100 v with 300- Ω series load resistor.	\pm stepping, 4 to 12 steps per family, either repetitive or single family. 10 current positions—1 ma to 1 amp/step 5 voltage positions—0.02 to 0.5 v/step	Vertical Axis—Collector Current Horizontal Axis—Collector Voltage Base Voltage	Yes	\$1475	176	

* Rack-Mount models are available.

Reference Chart

Type 561A Oscilloscopes use these Plug-In Units.

Type RM561 Oscilloscopes use these Plug-In Units.

Type 565 and Type RM565 Oscilloscopes use Plug-In Units for vertical deflection only.

Type 567 and RM567 Readout Oscilloscopes use Digital and Sampling Units for digital readout. Other Amplifier and Time Base Units can be used without digital readout.

AMPLIFIER UNITS						
Type	Passband (3 db down)	Deflection Factor	Input (ac or dc coupled)	Page	Price	
*2A60 Amplifier	dc — 1 Mc.	50 mv/cm—50 v/cm in 4 steps, variable between steps, uncalibrated.	1 megohm shunted by 47 pf, 600 volts max.	140	\$105	
*2A63 Differential Amplifier 50:1 rejection ratio	dc — 300 kc.	1 mv/cm—20 v/cm, 1-2-5 sequence, variable between steps, uncalibrated.		140	\$130	
3A1 Dual-Trace Amplifier (Identical Channels)	dc — 10 Mc. (each channel).	10 mv/cm—10 v/cm, 1-2-5 sequence, variable between steps, uncalibrated.**		141	\$410	
*3A72 Dual-Trace Amplifier (Identical Channels)	dc — 650 kc (each channel).	10 mv/cm—20 v/cm, 1-2-5 sequence, variable between steps, uncalibrated.		142	\$250	
3A74 Four-Trace Amplifier (Identical Channels)	dc — 2 Mc. (each channel).	20 mv/cm—10 v/cm, 1-2-5 sequence, variable between steps, uncalibrated.		143	\$550	
*3A75 Wide-Band Amplifier	dc — 4 Mc.	50 mv/cm—20 v/cm, 1-2-5 sequence, variable between steps, uncalibrated.		142	\$175	
3S76 Dual-Trace Sampling (use with 3T77)	dc to equivalent 875 Mc. (each channel).	2 mv/cm—200 mv/cm, 1-2-5 sequence, variable between steps, uncalibrated.	50 Ω 2 volts pk-to-pk. max. dc coupled	145	\$1100	
TIME-BASE UNITS						
Type	Sweep Rate	Magnifier	Triggering	Page	Price	
†2B67 Single Sweep	1 μ sec/cm to 5 sec/cm, 1-2-5 sequence. Variable between rates, uncalibrated.	5X	Internal, External, Line; amplitude-level selection; ac or dc-coupled; automatic or free run; \pm slope.	141	\$175	
3B1 Sweep Delay	0.5 μ sec/cm to 1 sec/cm, 1-2-5 sequence (for both normal and delayed sweeps). Variable between rates, uncalibrated.	5X	Internal, External; amplitude-level selection; ac or dc-coupled; automatic (normal sweep only) or free-run; \pm slope.	144	\$475	
3B3 Calibrated Sweep Delay Single Sweep	0.5 μ sec/cm to 1 sec/cm, 1-2-5 sequence (for both normal and delayed sweeps). Variable between rates, uncalibrated. Continuously variable calibrated delay from 0.5 μ sec to 10 sec.	5X	Internal, External; amplitude level selection; ac or dc coupled; \pm slope. Normal sweep has in addition: automatic and line plus single sweep.	144	\$525	
3T77 Sampling Sweep (use with 3S76)	Equivalent sweep rates 0.2 nsec/cm to 10 μ sec/cm, 1-2-5 sequence. Variable between rates, uncalibrated.	10X	Internal or External, \pm slope.	146	\$650	

* Formerly designated by last two digits.

** Provides 6-cm linear scan.

† Same as former Type 67 with addition of single-sweep feature.

Reference

CHARACTERISTICS OF TEKTRONIX OSCILLOSCOPES

OSCILLOSCOPE FEATURES	* Type 531A General Purpose	* Type 533A General Purpose	* Type 535A General Purpose	Type 536 X-Y Curve Tracer
SIGNAL DELAY	Yes			No
CALIBRATED SWEEP RANGE	0.1 μ sec/cm to 5 sec/cm			See Type T Time-Base Generator
SWEEP MAGNIFIER	5X	2, 5, 10, 20, 50, 100X	5X	
SWEEP DELAY	None		2 μ sec to 10 sec	None
ACCELERATING POTENTIAL	10 kv			4 kv
PRICE (WITHOUT PLUG-IN UNITS)	\$995	\$1125	\$1400	\$1085
PAGE NUMBER	60	64	60	67

PLUG-IN UNIT TYPE	DESCRIPTION	PAGE NUMBER	CALIBRATED DEFLECTION FACTOR	RISETIME AND PASSBAND OF OSCILLOSCOPE AND PLUG-IN UNIT	
B	Wide-Band High-Gain Unit	117	5 mv/cm to 20 mv/cm 50 mv/cm to 20 v/cm	35 nsec 2 cps to 10 Mc 25 nsec dc to 14 Mc	40 nsec 2 cps to 9 Mc 35 nsec dc to 10 Mc
C-A	Dual-Trace DC Unit	118	50 mv/cm to 20 v/cm	23 nsec dc to 15 Mc	35 nsec dc to 10 Mc
D	High-Gain DC Differential	119	1 mv/cm to 50 v/cm	0.18 μ sec dc to 300 kc, increasing to 2 Mc	
E	Low-Level AC Differential	120	50 μ v/cm to 10 mv/cm	6 μ sec 0.06 cps to 20 kc, increasing to 60 kc	
G	Wide-Band DC Differential	121	50 mv/cm to 20 v/cm	25 nsec dc to 14 Mc	35 nsec dc to 10 Mc
H	Wide-Band High-Gain DC Unit	122	5 mv/cm to 20 v/cm	31 nsec dc to 11 Mc	37 nsec dc to 9.5 Mc
K	Fast-Rise DC Unit	123	50 mv/cm to 20 v/cm	23 nsec dc to 15 Mc	31 nsec dc to 11 Mc
L	Fast-Rise High-Gain Unit	124	5 mv/cm to 2 v/cm 50 mv/cm to 20 v/cm	23 nsec 3 cps to 15 Mc 23 nsec dc to 15 Mc	35 nsec 3 cps to 10 Mc 31 nsec dc to 11 Mc
M	Four-Trace Unit	125	20 mv/cm to 10 v/cm	25 nsec dc to 14 Mc	35 nsec dc to 10 Mc
N	Pulse-Sampling Unit	126	10 mv/cm	0.6 nsec (corresponding to 600 Mc)	
O	Operational Amplifier Unit	128	50 mv/cm to 20 v/cm	25 nsec dc to 14 Mc	35 nsec dc to 10 Mc
Q	Strain Gage Unit	131	10 μ strain/div to 10,000 μ strain/div	60 μ sec dc to 6 kc	
R	Transistor Risetime Unit	133	0.5 ma/cm to 100 ma/cm	Supplies 5-nsec risetime pulse, 400-ma collector supply, 100-ma bias supply, risetime and passband same as with K Unit.	
S	Semiconductor Diode-Recovery Unit	135	50 mv/cm and 0.5 v/cm	1 to 20 ma forward current, 0 to 2 ma reverse current, risetime and passband same as with K Unit.	
T	Time-Base Generator Unit	137		Generates 22 calibrated sweep rates from 0.2 μ sec/div to 2 sec/div plus 5X magnifier. Triggering facilities include Manual, Automatic, H. F. Sync and either ac or dc coupled.	
Z	Differential-Comparator Unit	138	50 mv/cm to 25 v/cm	35 nsec dc to 10 Mc	40 nsec dc to 9 Mc

* Rack-Mount models are available.

Chart

WITH LETTER SERIES PLUG-IN PREAMPLIFIERS

* Type 541A Fast-Rise	* Type 543A Fast-Rise	* Type 545A Fast-Rise	Type 551 Dual-Beam	Type 555 Dual-Beam	† Type 581	† Type 585	
Yes							
0.1 μ sec/cm to 5 sec/cm				50 nsec/cm to 2 sec/cm			
5X	2, 5, 10, 20 50, 100X	5X					
None	2 μ sec to 10 sec	None	0.1 μ sec to 50 sec	None	2 μ sec to 10 sec		
10 kv							
\$1225	\$1300	\$1550	\$1850	\$2650	\$1425	\$1725	
70	75	70	78	82	104	104	
RISETIME AND PASSBAND OF OSCILLOSCOPE AND PLUG-IN UNIT						PRICE	PLUG-IN UNIT TYPE
30 nsec 2 cps to 12 Mc 18 nsec dc to 20 Mc		30 nsec 2 cps to 12 Mc 20 nsec dc to 18 Mc		30 nsec 2 cps to 12 Mc 18 nsec dc to 20 Mc		\$145	B
15 nsec dc to 24 Mc		16 nsec dc to 22 Mc		15 nsec dc to 24 Mc		\$260	C-A
0.18 μ sec dc to 300 kc, increasing to 2 Mc						\$170	D
6 μ sec 0.06 cps to 20 kc, increasing to 60 kc						\$190	E
18 nsec dc to 20 Mc		20 nsec dc to 18 Mc		18 nsec dc to 20 Mc		\$190	G
23 nsec dc to 15 Mc		25 nsec dc to 14 Mc		23 nsec dc to 15 Mc		\$185	H
12 nsec dc to 30 Mc		14 nsec dc to 25 Mc		12 nsec dc to 30 Mc		\$145	K
15 nsec 3 cps to 24 Mc 12 nsec dc to 30 Mc		16 nsec 3 cps to 22 Mc 14 nsec dc to 25 Mc		15 nsec 3 cps to 24 Mc 12 nsec dc to 30 Mc		\$210	L
17 nsec dc to 20 Mc		18 nsec dc to 19 Mc		17 nsec dc to 20 Mc		\$525	M
0.6 nsec (corresponding to 600 Mc).						\$625	N
14 nsec dc to 25 Mc		16 nsec dc to 22 Mc		14 nsec dc to 25 Mc		\$475	O
Performs precise operations of integration, differentiation, function generation, and linear or nonlinear amplification.							
60 μ sec dc to 6 kc						\$325	Q
Supplies 5-nsec risetime pulse, 400-ma collector supply, 100-ma bias supply, risetime and passband same as with K Unit.						\$325	R
1 to 20 ma forward current, 0 to 2 ma reverse current, risetime and passband same as with K Unit.						\$260	S
Generates 22 calibrated sweep rates from 0.2 μ sec/div to 2 sec/div plus 5X magnifier. Triggering facilities include Manual, Automatic, H. F. Sync and Line, either ac or dc coupled.						\$240	T
27 nsec dc to 13 Mc						\$525	Z

† Uses Letter-Series Plug-In Units with Type 81 Adapter.

Reference Chart

AMPLIFIERS

Instrument	Gain	Frequency Response [‡]	Noise Level	Differential Input	Input Impedance	Output Impedance	Price	Page
*Type 122	100X or 1000X	0.2 cps to 40 kc	1-5 μ v, rms, grounded	Yes	10 megohms paralleled by 50 pf.	1000 ohms	\$ 135	162
Type 123	100X	3 cps to 25 kc	7.5 μ v, rms, or less grounded	No	10 megohms	31 kilohms	\$ 50	164
Type 1121	100X	5 cps to 17 MC 21-nsec risetime	50 μ v or less pk-to-pk, grounded	No	1 megohm paralleled by 22 pf.	93 ohms	\$ 465	184

[‡] Frequency Specifications are at 3-db down.

* Rack-Mount models are available.

INDUCTANCE AND CAPACITANCE METER

Instrument	Ranges	Accuracy	Guard Voltage	Price	Page
Type 130	0 to 3, 10, 30, 100, 300 μ h 0 to 3, 10, 30, 100, 300 μ f	within 3% of full scale	Permits measuring an unknown capacitance while eliminating effects of other capacitances.	\$ 225	168

SQUARE-WAVE GENERATORS

Instrument	Risetime	Frequency Range	Output Voltage	Price	Page
Type 105	13 nsec	25 cps to 1 MC	10 v to 100 v across the internal 600- Ω load	\$ 435	155
Type 107	3 nsec	400 kc to 1 MC	0.1 v to 0.5 v with 52- Ω termination	\$ 190	157

PULSE GENERATORS

Instrument	Frequency	Main Pulse Width	Risetime	Delay	Output		Sync In	Price	Page
					Amplitude	Impedance			
Type 109	275 to 700 cps	0.5 nsec to 300 nsec	<0.25 nsec	None	0 to 50 v	50 Ω	None	\$360	158
Type 110	360 to 720 cps	0.5 nsec to 300 nsec	<0.25 nsec	1 nsec	0 to 50 v	50 Ω	**	\$650	159
Type 111	0 to 100 kc	2 nsec to 0.1 μ sec	0.5 nsec	30 to 250 nsec	\pm 5 v	50 Ω	+5 v**	\$365	160
Type 161	0 to 50 kc	10 μ sec to 0.1 sec	0.5 μ sec	**	0 to \pm 50 v	**	+3 v**	\$130	173
Type 162	0 to 10 kc	100 μ sec to 10 sec	1 μ sec	None	50 v	**	+15 v**	\$130	174
Type 163	0 to 500 kc	1 μ sec to 10 msec	0.2 μ sec	**	0 to +25 v	**	+2 v**	\$130	175

**For a more complete description, please refer to the individual instrument discussion.

TIME-MARK GENERATORS

Instrument	Time-Mark Interval	Sine-Wave Frequency	Accuracy	Stability ^{††}	Price	Page
Type 180A	2 per decade from 1 μ sec to 5 sec, separately or in timing combination.	5 MC, 10 MC, or 50 MC	within 0.001%	3 parts per million for 24 hr. period	\$ 625	179
*Type 181	1 per decade from 1 μ sec to 10 msec.	10 MC	about 0.03%	0.005% per hour	\$ 265	181

* Rack-Mount models are available.

†† All outputs are derived from a 1 MC crystal-controlled oscillator. Type 180A uses temperature-stabilized oven which is also available as accessory for the Type 181, or as MOD110 installed in the instrument. This provides stability of 3 parts per million.

CONSTANT AMPLITUDE SINE-WAVE GENERATOR

Instrument	Output Frequency	Output Amplitude	Harmonic Content	Output Impedance	Price	Page
Type 190B	Continuously variable from 350 kc to 50 MC.	Continuously variable from 40 mv to 10 volts, pk-to-pk.	Typically less than 5%.	Nominally 52 Ω	\$ 330	183

Reference Information

DESCRIPTIONS AND SPECIFICATIONS

All present regular-production Tektronix Instruments and Accessories are listed and described in this catalog. We hope that it contains the right kind and amount of information for you.

The principal Tektronix instrument is the cathode-ray oscilloscope, which is a three-dimensional display device. These three axes are designated: X (time-base or horizontal plane), Y (amplitude or vertical plane), and Z (brightness range of display). The X and Y axes convey precise quantitative information and are usually specified as TIME per division and/or VOLTS per division. The Z axis is usually modulated by blanking or unblanking voltages in order to eliminate retrace time from the presentation. Time markers can also be used to modulate the trace in most Tektronix Oscilloscopes.

Characteristics other than X-axis sweep rates and Y-axis sensitivities are usually not of primary importance in describing the accuracy of the display, but are often pertinent when selecting an oscilloscope for a particular application. While specifications on these other features are less stringent, relative values in areas such as trigger sensitivity, CRT accelerating potential, amplitudes of output waveforms, etc., are quite meaningful.

We have tried to describe all of the more significant features, capabilities, and limitations of Tektronix instruments in a way that will be of the most value to most customers. This cannot be done without knowingly omitting some things meaningful to only a few.

If you have specific questions about any instruments that are not answered here, you should consult your Tektronix Field Engineer or Engineering Representative; he can probably provide a ready answer. Occasionally, however, questions are asked about specific performance limitations that we have never investigated. If the questions are of general interest to many customers, an investigation will be made. However, such questions usually imply a desire to use the instruments in applications for which they are not intended. When such is clearly the case, a special investigation can seldom be justified. The burden of testing or calibrating instruments to assure conformance to such a specification would not be one which we could, with clear conscience, pass on to all customers.

Questions may arise about the exact meaning of such words as "approximately", "typically", and our intent when using them to describe an instrument. For instance, the square-wave voltage calibrators in many Tektronix Oscilloscopes are typically described as having a frequency of approximately 1 kc. The frequency is relatively unimportant. If we specified the acceptable frequency limits, it would be misleading; the primary purpose of the calibrator in most cases is to provide an accurate **voltage** reference, not an accurate **frequency** reference. In other cases, a characteristic might be stated in what seems to be absolute values (for example, + Gate Out). In most instances, the accuracy of the value is unimportant, and the acceptable limits would again be misleading. The availability of the waveform at a front-panel connector is a characteristic of the instrument and does not contribute to the accuracy of X and Y measurements.

Your Tektronix Field Engineer or Overseas Distributor will welcome your discussion on descriptions and specifications of Tektronix Oscilloscopes and associated instrumentation.

PASSBAND AND RISE TIME MEASUREMENTS

Frequency-response quotations are at the 3-db-down points unless otherwise stated.

Equipment for measuring frequency response (passband) must be carefully selected to assure accurate readings. A generator which is correct in amplitude at just the low frequency and high frequency check points could prove misleading. Uniform frequency response measurements require a generator with "flat" output amplitude characteristics over its entire frequency range. Loading placed on the generator must also be considered. High frequency sine-wave generators must usually be terminated to match their output impedance. For oscilloscopes having an upper frequency response in the area from 350 kilocycles through 50 megacycles, Tektronix uses Type 190B Constant Amplitude Sine-Wave Generator to check for high frequency roll-off characteristics.

A characteristic of importance to the pulse-measurement field is risetime. This parameter is generally a good indication of relative passband. In short, faster risetime means greater passband (in the direction of higher frequencies). Several factors must be considered in making risetime measurements. For reasonably accurate readings of risetime, the oscilloscope should be approximately 5 times faster than the signal to be measured. When risetime of the signal approaches risetime of the oscilloscope, the true signal risetime can be computed. Risetime of cascaded signals is calculated by taking the square root of the sum of the squares (of signal and oscilloscope risetimes). For example, a signal with a risetime of one nanosecond viewed on an oscilloscope with a risetime capability of one nanosecond will appear as approximately 1.414 nanoseconds.

In order to measure actual risetime of the oscilloscope, the input pulse should be free of overshoot and ringing, since risetime is generally measured between the 10% and 90% amplitude points on a waveform. Proper termination of the input-pulse source must also be considered. Tektronix uses Type 105 Square-Wave Generator (approximately 13 nsec risetime), Type 107 Square-Wave Generator (less than 3 nsec risetime), or Type 109 Pulse Generator (less than 0.25 nsec risetime) for checking risetime of general purpose oscilloscopes. For faster oscilloscopes, specially constructed generators are employed.

MECHANICAL CONSIDERATIONS

VENTILATION—In general, a standard oscilloscope using 250 watts of power or more will have filtered forced-air cooling.

CLEARANCE—Under normal conditions, at least two inches of unobstructed space around the oscilloscope should be maintained to assure safe operating temperature. Should the chassis temperature become excessive, at typically 120°, a thermal-cutout switch will interrupt the power and keep it off until a safe operating temperature is reached.

CONSTRUCTION—The oscilloscope chassis and cabinet are of aluminum alloy for lightweight durability.

FINISH—The oscilloscope front panel is anodized and the cabinet has blue-vinyl finish.

Reference Information

TEKTRONIX-MANUFACTURED COMPONENTS

When standard commercially-available components do not meet rigid requirements of Tektronix Oscilloscopes and associated instruments, and suppliers cannot fulfill adequately this demand for these specialized components, Tektronix manufactures them.

Some of these special components manufactured by Tektronix for exclusive use in its own equipment include cathode-ray

tubes, transformers, ceramic terminal strips, and etched circuitry—in addition to precision potentiometers, capacitors, wire-wound resistors, inductors, semiconductor and solid-state devices.

Designed compactly for reliability and efficiency these Tektronix-manufactured components incorporate the highest standards of craftsmanship in meeting the special needs of particular instruments.

CATHODE-RAY-TUBE PHOSPHOR DATA

The catalog description of each oscilloscope indicates the phosphor normally supplied. However, for specific applications, you may want to specify another phosphor. The phosphor data chart will help in your selection.

For more specific information regarding the best-suited phosphor for your particular application, please confer with your Tektronix Field Engineer. He will know the factors that must be considered in selection of a phos-

phor for any given application. For example, Type P11 is excellent for waveform photography but due to its short persistence, it is not well suited for applications requiring visual observation of low speed phenomena.

Phosphors are rated in several parameters, such as color of fluorescence or phosphorescence, persistence, etc. The following table describes the more commonly used phosphors.

Phosphor	Fluorescence	Phosphorescence	Relative ^(A) Brightness	Persistence ^(B)	Crystal ^(C) Size	Principal Use	Comments
P1	Green	Green	128	Medium	Fine	Slow Repetition Rate Oscilloscope Displays	Used to keep down flicker apparent at low rep. rates such as 60 cps.
P2	Greenish-Blue	Green	238	Medium *	Coarse	General Purpose Displays	Good compromise for high and low speed applications.
P4	White	White	165	Medium Short	Medium	Television Pictures (Image Displays)	
P7	Greenish-Blue	Yellow	128	Long *	Coarse	Slow Speed Displays	
P11	Blue	Blue	100	Medium Short	Fine	Oscilloscope Photography	High blue light content and small spot size conducive to sharp photographs.
P15	Blueish-Green	Blueish-Green	32	Short	Fine	Moving Film Photography Flying Spot Scanner Displays	Poor for high-speed photography.
P20	Green	Green	250	Medium	Medium	General Purpose Displays	
P31	Green	Green	284	Medium	Fine	Oscilloscope Displays In High Ambient Light	Bright sharp image.

^(A) Taken with a Spectra Brightness Spot Meter, which incorporates a C.I.E. standard eye filter. Representative of 10 kv aluminized screens.

^(B) JEDEC classification (to 10% level).

^(C) FINE = up to 4.9 μ , MEDIUM = 5.0 μ to 9.9 μ , COARSE = 10.0 μ and up.

* Low-level persistence may last for minutes.

UNITS and ABBREVIATIONS used in this Catalog

Unit	Name	Abbreviation	Unit	Name	Abbreviation	Unit	Name	Abbreviation
10 ⁹ cycles	gigacycles	Gc	10 ⁻² meter	centimeter	cm	10 ⁻⁶ farad	microfarad	μ f
10 ⁶ cycles	megacycles	Mc	10 ⁻³ second	millisecond	msec	10 ⁻⁹ second	nanosecond	nsec
10 ⁶ ohms	megohms	meg	10 ⁻³ meter	millimeter	mm	10 ⁻¹² farad	picofarad	pf
10 ³ cycles	kilocycles	kc	10 ⁻⁶ second	microsecond	μ sec	10 ⁻¹² second	picosecond	psec
10 ³ ohms	kilohms	k						



DC-to-4 MC OSCILLOSCOPE Type 310A

Designed for Easy Handling

Small—10 3/8" x 7" x 17 5/8".
Weighs only 23 pounds.

Transient Response

Risetime—90 nsec.

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.

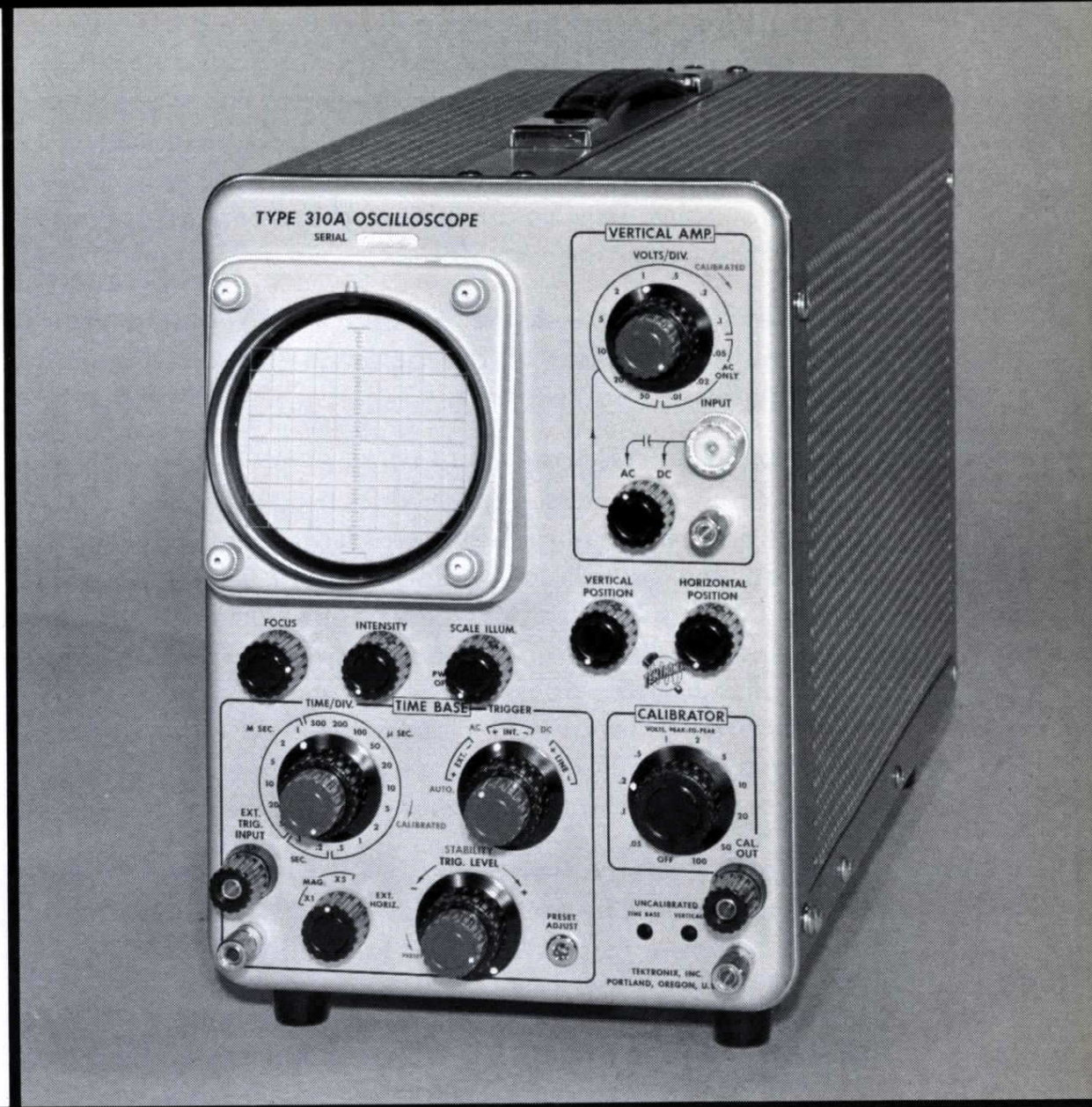
Sweep Range

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

Versatile Triggering

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

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

Frequency specifications are at 3-db down

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. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe. 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 light on the front panel indicates when the control is in the variable (uncalibrated) position. Vertical amplifier is factory-adjusted for optimum transient response. Rise-time is less than 90 nsec. Input impedance is 1 meg-ohm paralleled by approximately 40 pf.

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 pf paralleled by 10 meg-ohms.

HORIZONTAL-DEFLECTION SYSTEM

Wide Sweep Range—The Type 310A has 18 calibrated sweep rates: 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 μ sec/div, . . . 1, 2, 5, 10, 20, 50 msec/div, 0.1, 0.2 sec/div. In addition, a vernier (uncalibrated) control provides sweep rates continuously adjustable from 0.5 μ sec/div to 0.6 sec/div. A 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- μ sec/div sweep extends the calibrated range to 0.1 μ sec/div. Accuracy is within 3% of the displayed portion of the magnified sweep on all ranges except the 0.5 μ sec/div range, where accuracy is within 5%.

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

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

310A

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 ± 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

Amplitude 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 cathode-ray tube. A P31 phosphor is normally supplied.

Regulated Power Supply—Electronically-regulated dc supplies insure stable operation over line-voltage and load variations between 105 and 125 v or 210 and 250 v, 50 to 800 cycles.

Power Requirement—105 v to 125 v or 210 v to 250 v, typically 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. This can be partially compensated for by using the multi-tap primary on the power transformer.

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

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.

Mechanical Specifications—Dimensions are $10\frac{3}{8}$ " high by 7" wide by $17\frac{5}{8}$ " deep. Net weight is 23 pounds. Shipping weight is 36 pounds, approx.

TYPE 310A OSCILLOSCOPE \$675

Each instrument includes: 1—binding-post adapter, 1—10X attenuator probe, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

FAN BASE

A Fan Base is available to provide filtered forced-air ventilation. This will reduce operating temperature when the Type 310A is used continuously for prolonged periods of time or in a hot or limited-ventilation area. For convenience, the Fan Base tilts the oscilloscope to a convenient viewing angle.

For use on 105-125 v, 50 to 60 cps only:

Order Part Number 016-012 \$35

For use on 210-250 v, 50 to 60 cps only:

Order Part Number 016-013 \$35

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





DC-to-10MC—9-KV OSCILLOSCOPE Type 317

DC-COUPLED VERTICAL AMPLIFIER

Passband—dc to 10 mc at 0.1 to 125 v/div.
 Passband—2 cycles to 10 mc at 0.01 to 0.1 v/div.
 Risetime—35 nsec.

WIDE SWEEP RANGE

22 Direct-reading calibrated rates from 0.2 μ sec/div to 2 sec/div.
 5-x Magnifier increases the calibrated sweep rate to 40 nsec/div.
 Continuously variable sweep rates from 40 nsec/div to 6 sec/div.

9-KV ACCELERATING POTENTIAL

Bright trace, even at low sweep-repetition rates.

HIGH RELIABILITY

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.



The Type 317 is an excellent oscilloscope for the daylight 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

Frequency Specifications are at 3-db down

DC-Coupled Vertical Amplifier—Main amplifier passband is dc to 10 mc, risetime is 35 nsec. Vertical deflection is calibrated in steps of 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 v/div. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe. 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 35 nsec. In addition,

a 2 $\frac{1}{2}$ -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.

Input Impedance—1 megohm paralleled by approximately 40 pf.

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

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 pf.

HORIZONTAL-DEFLECTION SYSTEM

Wide Sweep Range—A single knob is used to select any of 22 calibrated sweep rates: 0.2, 0.5, 1, 2, 5, 10, 20, 50 $\mu\text{sec}/\text{div}$, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/div , 0.1, 0.2, 0.5, 1, and 2 sec/div . In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.2 $\mu\text{sec}/\text{div}$ to 6 sec/div . Calibration accuracy of the 22 fixed sweep rates 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 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 Requirement—An internal signal causing deflections of 0.2 major division in AC MODE, 0.3 major division in DC MODE, and 0.5 major division in AUTO MODE, or an external signal of 0.5 v to 20 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.

Under daylight conditions, the trace is easily readable . . . even at low sweep-repetition rates on this portable Type 317.



OTHER CHARACTERISTICS

Calibrator—A square wave calibration 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 P31 phosphor is normally supplied.

Output Waveforms—A 20 v (approx.) positive-gate waveform of the same duration as the sweep, and a 150 v (approx.) positive-going sweep sawtooth waveform are available at front-panel connectors.

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

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 260 watts. Type 317 MOD101 operates on 50 to 400 cps supply, uses dc fan motor.

Unless otherwise specified, the instrument will be shipped wired for operation within the line-voltage range of 105 v to 125 v. 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 decal on the transformer gives complete instructions for changing the operating range.

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.

Mechanical Specifications—Dimensions are 12 3/8" high by 8 5/8" wide by 19 1/2" deep. Net weight is 33 1/4 pounds. Shipping weight is 46 pounds, approx.

TYPE 317 (50 to 60 cps operation) \$875

Each instrument includes: 1—10X attenuator probe, 1—binding-post adapter, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

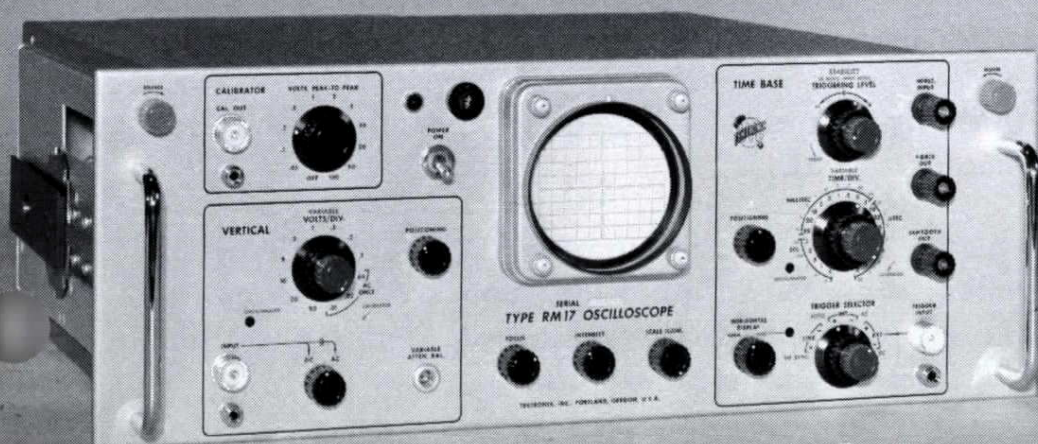
TYPE 317MOD101 (50 to 400 cps operation) ~~\$910~~ \$935.

Each instrument includes: 1—10X attenuator probe, 1—binding-post adapter, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

11-12-62

RACK MOUNT Type RM17

The Type RM17 is a mechanically rearranged Type 317 Oscilloscope for mounting in a standard 19" 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. Electrical characteristics of the instrument are the same as described for the Type 317 Oscilloscope.



Mechanical Specifications—Dimensions are 7" high by 19" wide by 17 5/8" deep. Net weight is 35 pounds. Shipping weight is 67 pounds, approx.

For more mounting information, please refer to the Mounting Dimension page in the catalog.

TYPE RM17 (50 to 60 cps operation) \$950

Each instrument includes: 1—10X attenuator probe, 1—binding-post adapter, 1—green filter, 1—3-conductor power cord, 1—set guide tracks, 2—instruction manuals.

TYPE RM17MOD101 (50 to 400 cps operation) ~~\$985~~ \$1010.

Each instrument includes: 1—10X attenuator probe, 1—binding-post adapter, 1—green filter, 1—3-conductor power cord, 1—set guide tracks, 2—instruction manuals.

11-12-62

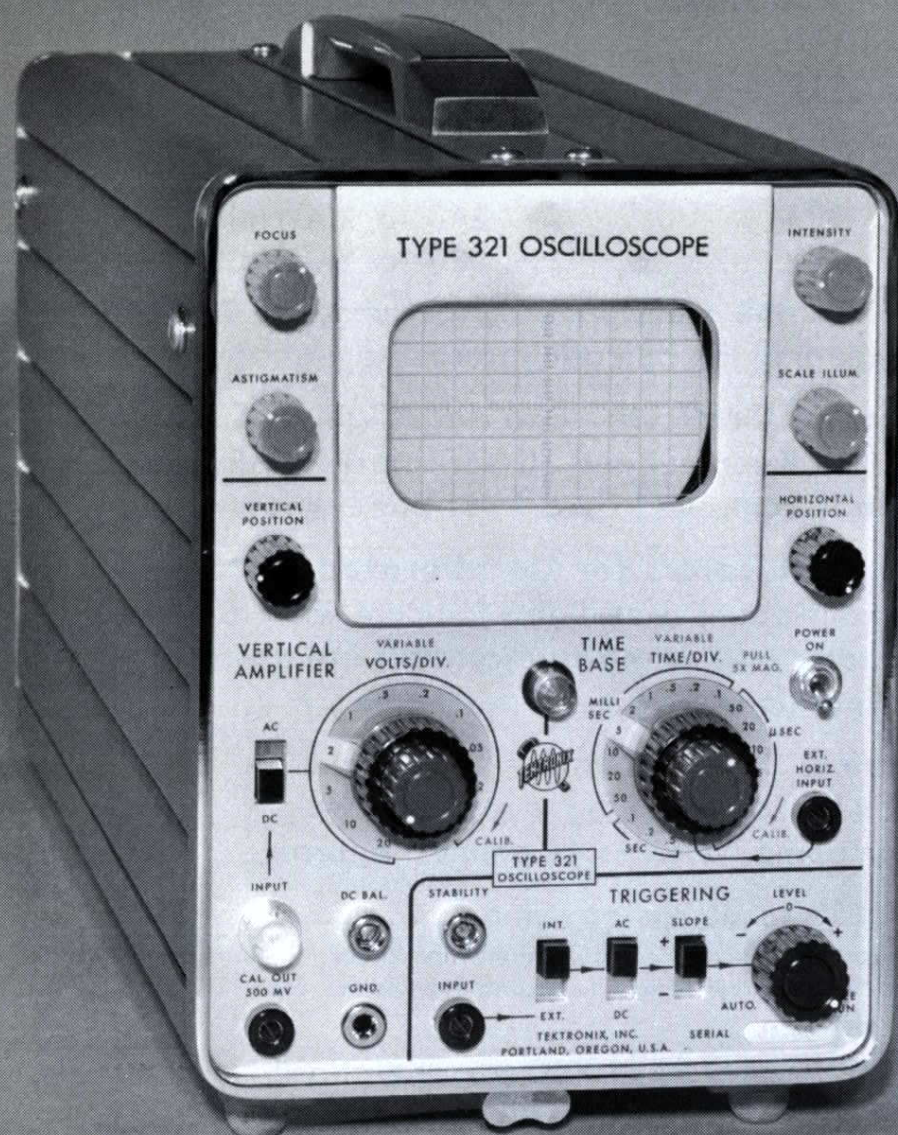
SUPPORTING CRADLES

When the RM17 or RM17MOD101 is mounted in a backless rack, these supporting cradles are necessary for rear-slide support.

Order Part Number 426-064 \$6.50

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 321 PORTABLE TRANSISTOR OSCILLOSCOPE



Designed for Field Work

Operates on AC, DC or self-contained batteries.

Weight: only 13 $\frac{3}{4}$ pounds without batteries.

less than 17 pounds with batteries.

Size: 8 $\frac{3}{4}$ " high by 5 $\frac{3}{4}$ " wide by 16 $\frac{1}{8}$ " deep.

Transient Response

Risetime—0.07 μ sec.

Frequency Response

DC to 5 mc.

Vertical Deflection Factor

11 calibrated steps:

0.01 v/div to 20 v/div.

Continuously variable between steps, and to approximately 50 v/div uncalibrated.

Sweep Range

19 calibrated sweep rates:

0.5 μ sec/div to 0.5 sec/div.

5-x Magnifier extends range to 0.1 μ sec/div.

Sweep time adjustable between steps, and to approximately 2 sec/div uncalibrated.

Versatile Triggering

Type: automatic or amplitude-level selection.

Mode: ac-coupled or dc-coupled.

Slope: plus, from rising slope of trigger, minus, from falling slope of trigger.

Source: internal, from the vertical signal, external, from the triggering signal.

The Tektronix Type 321 Oscilloscope is a high-performance, completely portable instrument. It will operate on its own internally contained batteries, on the dc power systems of airplanes, boats, autos, and trucks, or on any standard ac power system. It is small and light and provides a sharp, bright display on its 3-inch cathode-ray tube.

Small size and low weight make the Type 321 Oscilloscope truly portable. It operates from ten high-current size D flashlight cells, or ten rechargeable size D cells, or 11.5 to 35 volts dc, or 105 to 125 volts or 210 to 250 volts rms, 50 to 800 cycles, single-phase, ac.

Operating temperature range from tests indicates optimum performance and reliability on the self-contained batteries from 32°F to 113°F and at altitudes to 20,000 feet. Accurate calibration and precise linearity assure exact time and amplitude measurements either in the field or in the laboratory. Suitable for applications involving the most modern, complex electronic circuitry, the versatile Type 321 Oscilloscope is dependable, rugged, easy-to-operate.

VERTICAL-DEFLECTION SYSTEM

Frequency specifications are at 3-db down

DC-Coupled Vertical Amplifier—Main vertical passband is dc to 5 mc. Risetime is 0.07 μ sec. Vertical deflection is calibrated in steps of 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 v/div. A vernier control provides for continuously variable adjustment from 0.01 v/div to 50 v/div uncalibrated. In addition, the fully-clockwise position of the VOLTS/DIV switch marked CAL 4 DIV, allows observation of an internally-coupled 40-mv peak-to-peak square-wave signal.

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 fully clockwise position) for four major divisions of signal, the vertical deflection factor for any other switch position will be within 3%.

Input Impedance—1 megohm paralleled by approximately 40 pf.

Probe—The 10-x attenuator probe supplied with the instrument presents an input impedance of 10 megohms paralleled by approximately 12.5 pf, and reduces the vertical sensitivity by a factor of ten.

HORIZONTAL-DEFLECTION SYSTEM

Sweep Range—Sweep time is calibrated in steps of 0.5, 1, 2, 5, 10, 20, and 50 $\mu\text{sec}/\text{div}$. . . 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 msec/div . . . 0.1, 0.2, and 0.5 sec/div . A vernier control provides for continuously variable adjustment from 0.5 $\mu\text{sec}/\text{div}$ to approximately 2 sec/div uncalibrated. Accuracy of the nineteen fixed sweep rates is within 3%.

Sweep Magnifier—The center two-division portion of the displayed waveform can be expanded to ten divisions. The HORIZONTAL POSITION control has sufficient range to cover any one-fifth of the magnified sweep. The 5X MAG 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 4% of the displayed portion of the magnified sweep.

Deflection Blanking—The unblanking waveform is coupled to a separate deflection system in the electron gun of the cathode-ray tube. The system consists of two pairs of cross-connected deflection plates which intercept the beam current, blanking the crt screen during the retrace portion of the sweep. This unique system assures uniform beam current for all sweep speeds and repetition rates. In addition, external blanking can be accomplished by using the crt grid terminal on the back of the oscilloscope.

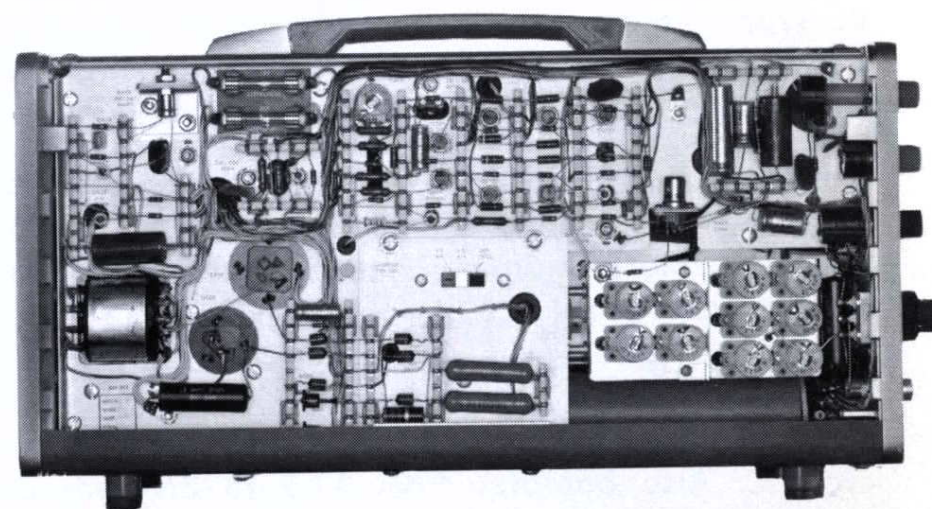
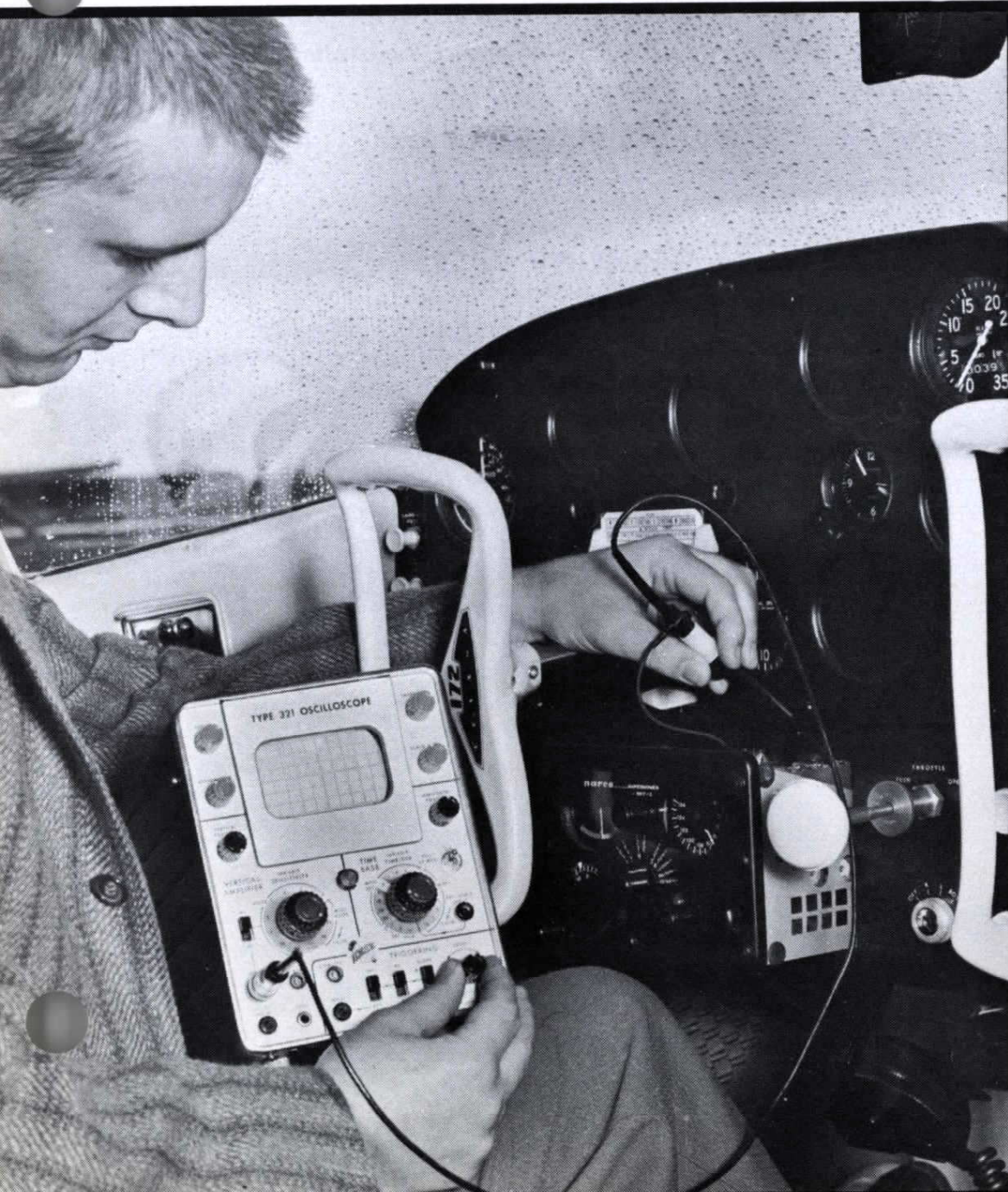
Triggering Facilities—Versatile circuitry provides for complete manual control or fully-automatic triggering.

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 or external, ac-coupled or dc-coupled. Trigger point can occur anywhere on the rising slope or falling slope of the triggering waveform.

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

Trigger Requirements—For internal triggering, a signal large enough to produce one minor division of vertical deflection is required. For external triggering, a signal of 0.5 to 10 volts is necessary.

Horizontal Input—DC-coupled external connection to the sweep amplifier is through a front-panel connector. Bandpass is dc to 1 mc. The horizontal deflection factor is approximately 1.5 volts/div with the 5X MAG on. Input impedance is 100 kilohms paralleled by approximately 20 pf.



OTHER CHARACTERISTICS

Amplitude Calibrator—A 500-mv peak-to-peak square-wave voltage is available through a front-panel connector. In addition, an internally coupled 40-mv peak-to-peak square-wave voltage is available in the fully clockwise position (CAL 4 DIV) of the VOLTS/DIV switch. Accuracy is within 3%. Frequency of the square wave is approximately 2 kc.

Intensity Modulation—The cathode-ray tube display can be intensity modulated by an external signal connected to the crt grid terminal on the back panel of the oscilloscope. A negative signal of approximately 30 volts peak is required to cut off the beam from maximum brightness. Less voltage is required with lower intensity settings.

Cathode-Ray Tube—A Tektronix flat-faced, 3-inch post accelerator cathode-ray tube provides a bright trace and utilizes low heater power. Accelerating potential is 4 kv. Deflection blanking of the beam is used. A P31 phosphor is normally supplied.

Illuminated Graticule—Edge lighting of the graticule is adjusted by the SCALE ILLUM. control when operating from an ac line, only. Display area of the graticule is marked in six vertical and ten horizontal one-fourth inch major divisions. Centerlines are marked in five minor divisions per major division.

Regulated Power Supply—Electronically-regulated dc supply insures stable operation over line variations between 11.5 to 35 volts dc, or 105 to 125 volts or 210 to 250 volts rms, 50 to 800 cycles.

Power Requirements—Operates from ten size D flashlight cells (approximately 1/2 hour continuous operation, more on intermittent operation), or from ten size D rechargeable cells (approximately 3 hours continuous operation with standard cells, approximately 4 1/2 continuous operation with extra-capacity cells, rated at more than 500 complete charge and discharge cycles). Also operates from 11.5 to 35 volts dc, or 105 to 125 volts or 210 to 250 volts, rms single-phase ac. Typical power with 2.5 A.H. Batteries is 20 watts operating, 12 watts charging. For protection, a thermal cutout switch interrupts the power if chassis temperature exceeds 120°F and holds it off until a safe operating temperature is reached.

Battery Charger—An internal switch selects the proper charging circuitry for either type of rechargeable batteries. The battery charger operates as long as the ac power cord is connected to the ac line. For full charge to the batteries, the power switch must be in the OFF position.

The batteries will withstand normal charging current for extended periods of time. However, 16 hours should charge either type of battery.

Mechanical Specifications—Dimensions are 8 3/4" high by 5 3/4" wide by 16 1/8" deep. Net weight is 13 3/4 pounds without batteries, 17 pounds with batteries. Approximate shipping weights are 24 pounds without batteries and 28 pounds with batteries.

TYPE 321 OSCILLOSCOPE (without batteries) . . . \$820

Each instrument includes: 1—10X attenuation probe, 1—3-wire dc power cord, 1—3-wire ac power cord, 1—green filter, 2—instruction manuals.

Set of ten standard rechargeable NiCd (nickel cadmium) cells will operate the Type 321 for approximately 3 hours (approx. 2.5 A.H.).

Order 10—Part No. 146-003, \$3.65 each

Total \$36.50

Set of ten extra-capacity rechargeable NiCd cells will operate the Type 321 for approximately 4.5 hours (approx. 3.5 A.H.).

Order 10—Part No. 146-005, ~~\$5.50~~ ^{\$7.00} each

Total ~~\$55.00~~ ^{\$70.00}

CARRYING CASE

Attractive leather carrying case for the Type 321 provides in-transit protection as well as a convenient accessory storage compartment.

Order Part Number 016-026 \$37

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



INDICATOR UNIT Type 360

Vertical-Deflection System

Frequency Response—dc to 500 kc.

Deflection Factor—

0.05 volts/div to 50 volts/div.

4 calibrated steps.

Continuously variable between steps, and to approximately 500 volts/div.

Maximum Input Voltage—

600 volts (dc plus peak ac).

Horizontal-Deflection System

Waveforms Required—

Positive or negative-going sawtooth, 110 to 150 volts excursion within the limits of -95 volts to $+170$ volts.

Gate, 45 to 75 volts positive same duration as the sawtooth.

Frequency Response—dc to 100 kc.

Power Requirements—

DC Power

$+300$ volts at 20 ma (unregulated)

$+225$ volts at 35 ma (regulated)

-170 volts at 23 ma (regulated)

AC Power

6.3 volts at 3.5 amps.



The Type 360 Indicator Unit in combination with the Type 160-Series Instruments becomes an integral building block in a complex sequence control and monitoring system.

The compact indicator contains a flat-faced, 3-inch cathode-ray tube, accelerating-voltage supply, horizontal amplifier, vertical amplifier and a calibrated vertical attenuator, among other features. It is designed to receive its sweep and unblanking voltages from a Type 162 Waveform Generator.

Several indicators can be driven by a single Type 162 Waveform Generator. The Type 162, an indicator, and a Type 161 Pulse Generator provide a calibrated delayed sawtooth. The indicator used with a Type 122 Preamplifier permits low-level applications and increases the sensitivity of the unit to 50 microvolts per division.

Any source of proper voltage and waveforms can power the indicator. The Type 160A Power Supply is recommended for applications that require a compact rack-mounted combination. In system use, up to 5 Type 360 Indicator Units can operate from a single Type 160A Power Supply.

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

DC-Coupled Amplifier—Main vertical passband is dc to 500 kc. Frequency-compensated rc attenuators are switched into the amplifier input circuit by the VOLTS/DIV switch. Two attenuators are used singly or cascaded to produce four calibrated sensitivities in steps of 0.05, 0.5, 5, and 50 volts/div. A vernier control provides for continuously variable adjustment between steps, and to approximately 500 volts/div.

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

AC-DC Switches—A toggle switch is provided to insert or remove coupling capacitor for ac-coupled or dc-coupled operation.

Probe—One low-capacitance probe is supplied with the indicator. It provides an additional ten-times attenuation and reduces the loading on the circuit under test.

Vertical Gain—A screwdriver front-panel adjustment is provided to calibrate the gain of the vertical amplifier.

HORIZONTAL-DEFLECTION SYSTEM

The Type 162 Waveform Generator, any Tektronix oscilloscope that has gate and sweep voltages available at the front panel, or any other source of proper waveforms at the necessary dc levels, is required to supply the waveforms for the horizontal deflection system.

Input Waveforms—The horizontal amplifier will accommodate either a positive-going or a negative-going sawtooth and the total sawtooth excursion and dc level can vary within limits. The minimum sawtooth excursion is about 110 volts, and the excursion must be within the range of -95 volts to $+170$ volts. The maximum practical sawtooth excursion is about 150 volts, and the excursion must be within the range of -90 volts to $+160$ volts. Necessary for unblanking is a 50-volt positive pulse with the same duration as the sweep waveform.

Horizontal Calibration—A screwdriver front-panel adjustment is provided to calibrate the sweep.

OTHER CHARACTERISTICS

Cathode-Ray Tube—A flat-faced, 3-inch cathode-ray tube provides a bright trace. Accelerating potential is 1.5 kv. A ~~P1~~ ^{P2} phosphor is normally supplied.

DC-Coupled Unblanking—The external unblanking waveform, dc-coupled to the grid of the crt, assures uniform bias for all sweep speeds and repetition rates at any setting of the intensity control.

Illuminated Graticule—Edge-lighting of the graticule is adjusted by the SCALE ILLUM. control. Display area of the graticule is marked in eight vertical and ten horizontal one-fourth inch major divisions. Centerlines are further marked in five minor divisions per major division.

Positioning Controls—Separate knobs for vertical and horizontal positioning are provided on concentric controls.

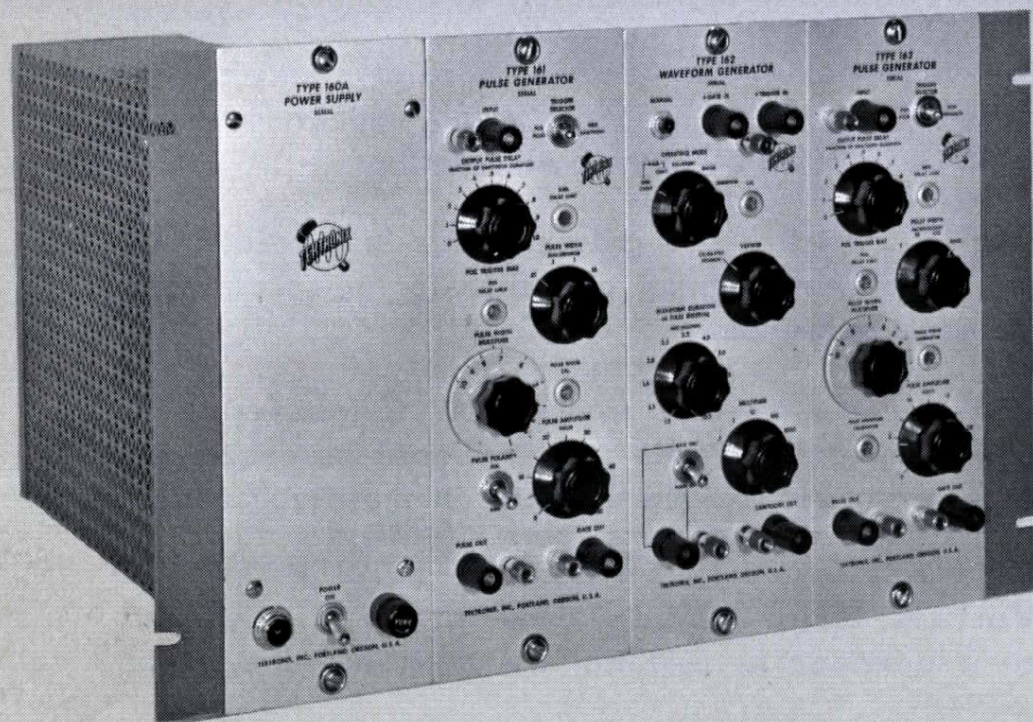
Mounting—The Type 360 Indicator Unit and up to 3 Type 160 Series Instruments can be secured quickly and easily to a Mounting Frame which bolts directly to a standard 19" rack.

Mechanical Specifications—Dimensions are $12\frac{1}{4}$ " high by $4\frac{1}{8}$ " wide by 14" deep. Net weight is 10 pounds. Shipping weight is 19 pounds, approx.

TYPE 360 INDICATOR \$270

Each instrument includes: 1—10X attenuator probe, 1—inter-unit power cable, 1—green filter, 1—set mounting hardware, 2—instruction manuals.

SEQUENCE CONTROL and MONITORING SYSTEM



This system consists of the Tektronix Type 160-Series Instruments. In conjunction with the Type 360 Indicator Unit, the system fits a wide variety of applications, including nerve stimulation, component testing, and data recording.

The Type 360 Indicator Unit and Type 160-Series Instruments can be secured quickly and easily to a Mounting Frame which bolts to a standard 19" rack.

- TYPE 160A POWER SUPPLY \$190
- TYPE 161 PULSE GENERATOR \$130
- TYPE 162 WAVEFORM GENERATOR \$130
- TYPE 163 FAST-RISE PULSE GENERATOR \$130
- MOUNTING FRAME (Order Part Number 014-002) \$5

See appropriate pages for complete information on Type 160-Series Instruments.

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



DUAL-BEAM OSCILLOSCOPE Type 502

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 sec/cm .

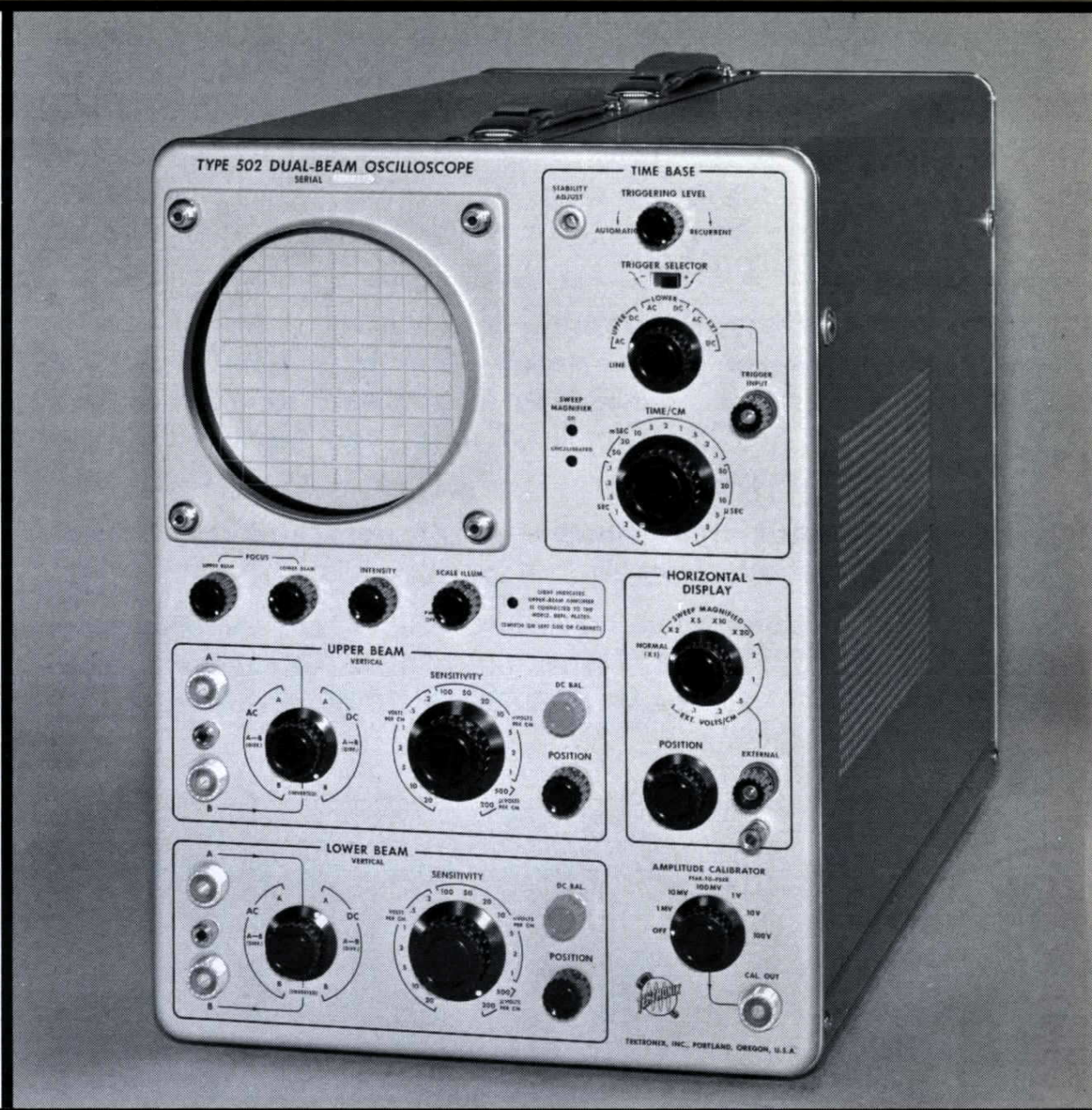
Sweep Magnification—2, 5, 10 and 20 times.

X-Y Curve Tracing with Two Beams

(horizontal-deflection voltage common to both beams, maximum horizontal sensitivity 0.1 v/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.



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.
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

Frequency specifications are at 3-db down.

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 mv/cm , to dc to 400 kc at 50 mv/cm , and dc to 1 mc at 0.2 v/cm . Vertical response at the lower sensitivities varies according to switch position as follows: 0.5 v/cm —dc to 300 kc; 1 v/cm —dc to 500 kc; 2 v/cm —dc to 1 mc; 5 v/cm —dc to 300 kc; 10 v/cm —dc to 500 kc; 20 v/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 mv/cm , 0.2, 0.5, 1, 2, 5, 10 and 20 v/cm . When the upper-beam amplifier is switched to the horizontal-deflection plates, its gain is automatically increased to make the horizontal and vertical sensitivities equal.

Phase Characteristics—When both vertical amplifiers are set at the same sensitivity, the typical phase shift between amplifiers will be within 5 degrees at the specified 3-db point. At one-tenth of the quoted 3-db point for each sensitivity setting, the typical phase shift between amplifiers is less than one degree.

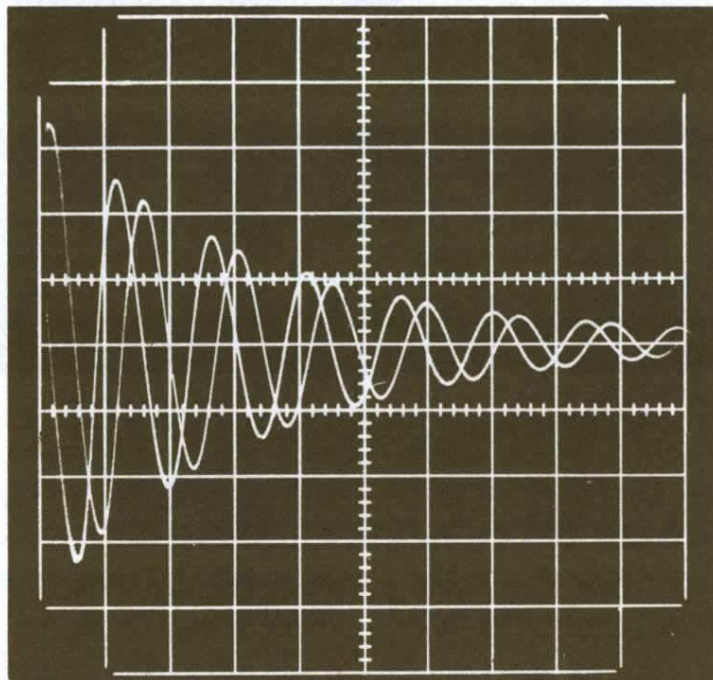
Calibration Accuracy—Internal adjustments are provided for setting the gain of both amplifiers. When accurately set, sensitivities at all positions will be within 3% of the panel readings.

Input Selection—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. Inputs are dc or ac-coupled. When ac-coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

Differential Input—Rejection ratios for differential inputs are approximately 1000 to 1 from 200 $\mu\text{v}/\text{cm}$ to 1 mv/cm , diminishing to 100 to 1 at 0.2 v/cm and 50 to 1 at 5 v/cm . These ratios were measured using a 1-kc square wave.

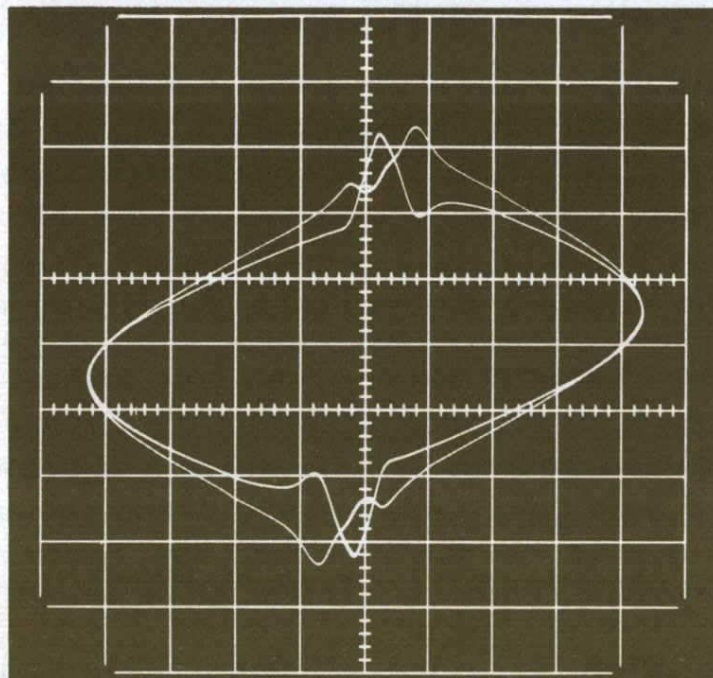
Input Impedances—47 pf paralleled by 1 megohm, both channels.

Probes—Two Tektronix probes are supplied with the Type 502. With these 10-x attenuator probes the input impedance becomes 13 pf paralleled by 10 megohms.



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.

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.

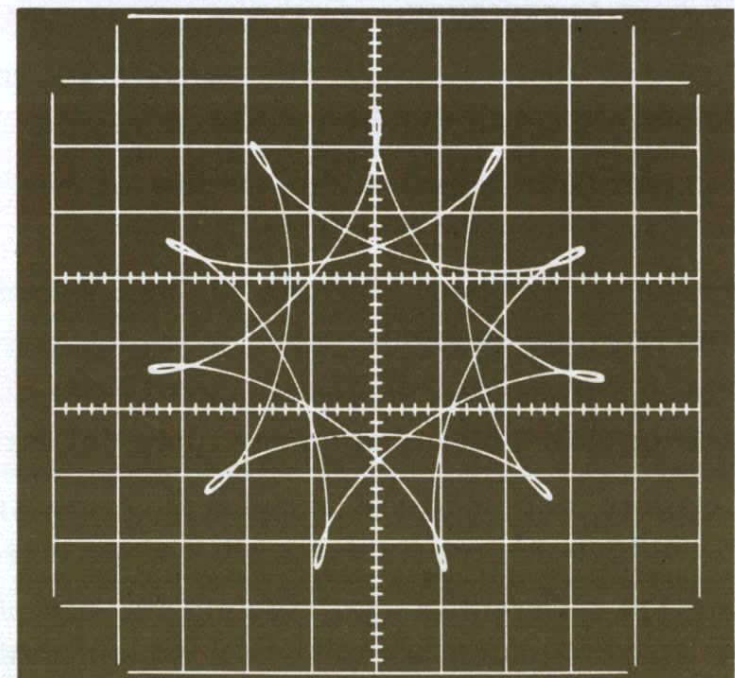
Calibrated Sweeps—A single direct-reading control is used to select any of 21 calibrated sweep rates: 1, 2, 5, 10, 20, 50 $\mu\text{sec}/\text{cm}$, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm , 0.1, 0.2, 0.5, 1, 2 and 5 sec/cm . Calibration accuracy is within 3%.

Sweep Magnifier—Four degrees of sweep magnification are provided: 2, 5, 10 and 20 times. Any 10 cm of the magnified sweep can be displayed. Calibration of the magnified sweep will be accurate at all rates within the maximum calibrated rate of 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. One convenient control selects automatic or recurrent triggering as well as the point on the triggering signal at which the sweep is triggered.

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.



SINGLE-BEAM X-Y CURVE TRACING

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

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 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.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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.

Regulated Power Supplies—Electronic regulation compensates for line-voltage and load variations between 105 and 125 or 210 and 250 v. In addition, the parallel heater supplies to the input stages of both vertical amplifiers are transistor regulated.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 280 watts.

Mechanical Specifications—Dimensions are 15 $\frac{3}{4}$ " high by 11 $\frac{1}{2}$ " wide by 23 $\frac{1}{2}$ " deep. Net weight is 52 $\frac{1}{2}$ pounds. Shipping weight is 77 pounds, approx.

TYPE 502 OSCILLOSCOPE \$890

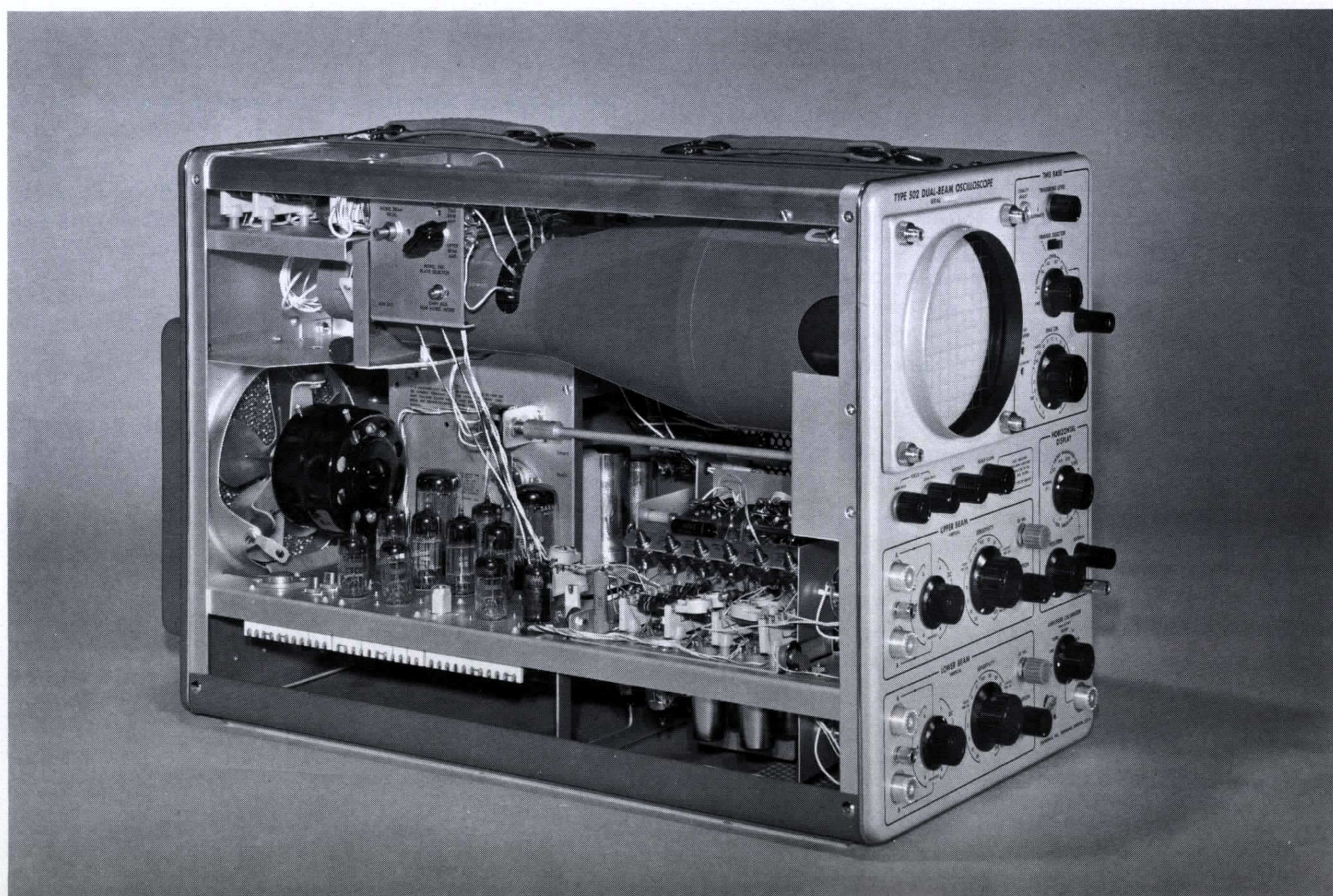
Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

Rack Mount Adapter

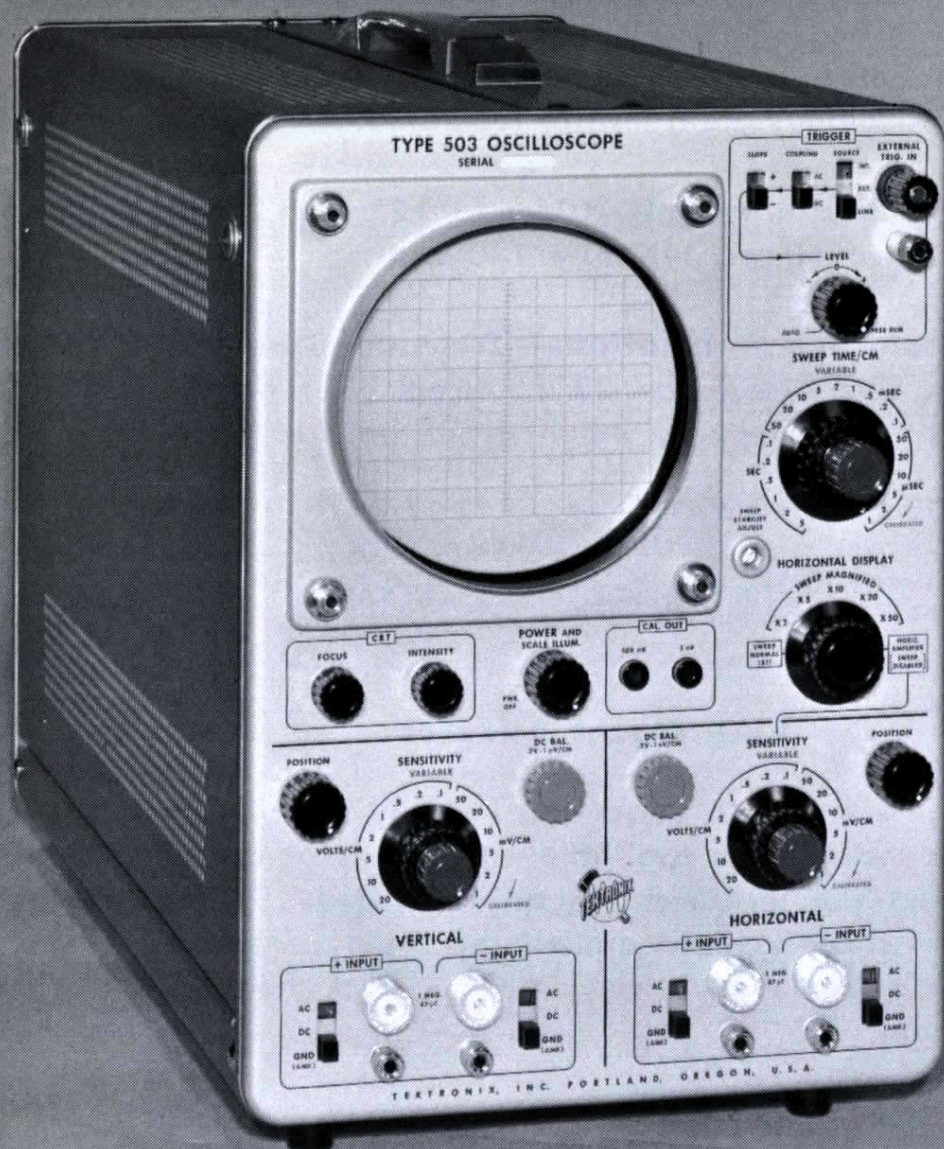
A cradle mount to adapt the Type 502 Oscilloscope for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements 17 $\frac{1}{2}$ ".

Order Part Number 040-278 \$45

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



Type 503 DC-to-450 KC X-Y OSCILLOSCOPE



The Type 503 Oscilloscope incorporates, for the first time, Tektronix standards of precision and reliability in an instrument in the dc-to-450 kc range. Identical vertical and horizontal amplifiers supply an accurate means of plotting curves using the X-Y method of operation. In addition, both amplifiers offer single-ended inputs for conventional operation or differential inputs for cancellation of common-mode signals.

Basic sensitivity is 1 mv/cm. Sweep rates to 1 μ sec/cm combined with the 10-x magnification factor provide dependable sweep rates to 0.1 μ sec/cm. Other features include: functional panel layout, electronically-regulated power supplies, and flexible triggering facilities. High standards of quality and construction combined with advanced design technique make it possible to use a minimum number of tubes for the maximum degree of precision and reliability.

Identical Vertical and Horizontal Amplifiers

Passband—dc to 450 kc.

Vertical Sensitivity—1 mv/cm to 20 v/cm in 14 calibrated steps. 1 mv/cm to 50 v/cm continuously variable (uncalibrated).

Differential input at all sensitivities.

Constant input impedance (1 megohm-47 pf) at all sensitivities—standard 10-x attenuator probe can be used.

Sweep Range

1 μ sec/cm to 5 sec/cm.

21 calibrated sweep rates.

Sweep time continuously variable (uncalibrated) from 1 μ sec/cm to approximately 12 sec/cm.

Sweep Magnification

2, 5, 10, 20, and 50 times.

Amplitude Calibrator

500 mv and 5 mv peak-to-peak square-wave voltages available at front panel.

Regulated Heater Supply

For vertical and horizontal input stages.

HORIZONTAL AND VERTICAL DEFLECTION SYSTEMS

DC-Coupled Amplifiers—Passband is dc to 450 kc (at 3 db down) for both amplifiers. Deflection is calibrated in steps of 1, 2, 5, 10, 20 and 50 mv/cm. . . 0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 volts/cm. A vernier control permits continuous adjustment between the 14 steps, and to about 50 volts/cm uncalibrated.

Calibration Accuracy—Internal adjustments set the gain of each amplifier. When these adjustments are set accurately, the calibration will be within 3% of the indicated switch position.

AC-DC Switches—The switches provide a convenient method of ac or dc-coupling the signal to the input-stage grid, or grounding the grid. When ac-coupled, the low frequency 3-db point is 10 cps direct or 1 cps with 10X Probe.

Relative Phase Shift—Using +INPUT connectors and with both amplifiers at equal sensitivity settings, phase difference between the amplifiers will be no more than one degree up to 100 kc and no more than two degrees up to 450 kc. At unequal sensitivity settings the phase shift will be no more than six degrees up to 50 kc.

Input Impedance—1 megohm paralleled by about 47 pf.

SWEEP GENERATOR

Sweep Range—Sweep time is calibrated in steps of 1, 2, 5, 10, 20, and 50 $\mu\text{sec}/\text{cm}$. . . 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 msec/cm . . . 0.1, 0.2, 0.5, 1, 2, and 5 sec/cm . Calibration accuracy is within 3% of the indicated switch position. A vernier control permits continuous adjustment between the 21 steps, and to over 12 sec/cm , uncalibrated.

Sweep Magnifier—The SWEEP MAGNIFIER control selects five steps of magnification; 2, 5, 10, 20, and 50 times. When the magnifier is switched in, the center portion of the normal sweep is expanded equally to left and right to fill ten centimeters. Size of the portion expanded is determined by the step of magnification selected. The HORIZONTAL POSITION control has sufficient range to display any ten centimeters of the magnified sweep. When the magnified sweep does not exceed the maximum calibrated rate of 0.1 $\mu\text{sec}/\text{cm}$, accuracy is within 5% of the displayed portion.

Deflection Blanking—The unblanking waveform is coupled to a separate deflection system in the electron gun of the cathode-ray tube. The system consists in part of two pairs of cross-connected deflection plates which intercept the beam current, blanking the crt screen except during sweep time. This unique system uses simplified circuitry and at the same time provides improved reliability. It assures uniform beam current for all sweep and repetition rates. In addition, external beam modulation can be accomplished by using the crt grid-input terminal on the back of the oscilloscope.

TRIGGERING FACILITIES

Automatic Triggering—Fully counter-clockwise position of the LEVEL control eliminates triggering readjustments, provides dependable triggering for most applications. One setting assures positive sweep triggering by signals of different amplitudes, shapes, and repetition rates. In the absence of an input signal, automatic triggering of the sweep occurs at about a fifty-cycle rate and provides a convenient reference trace on the crt screen.

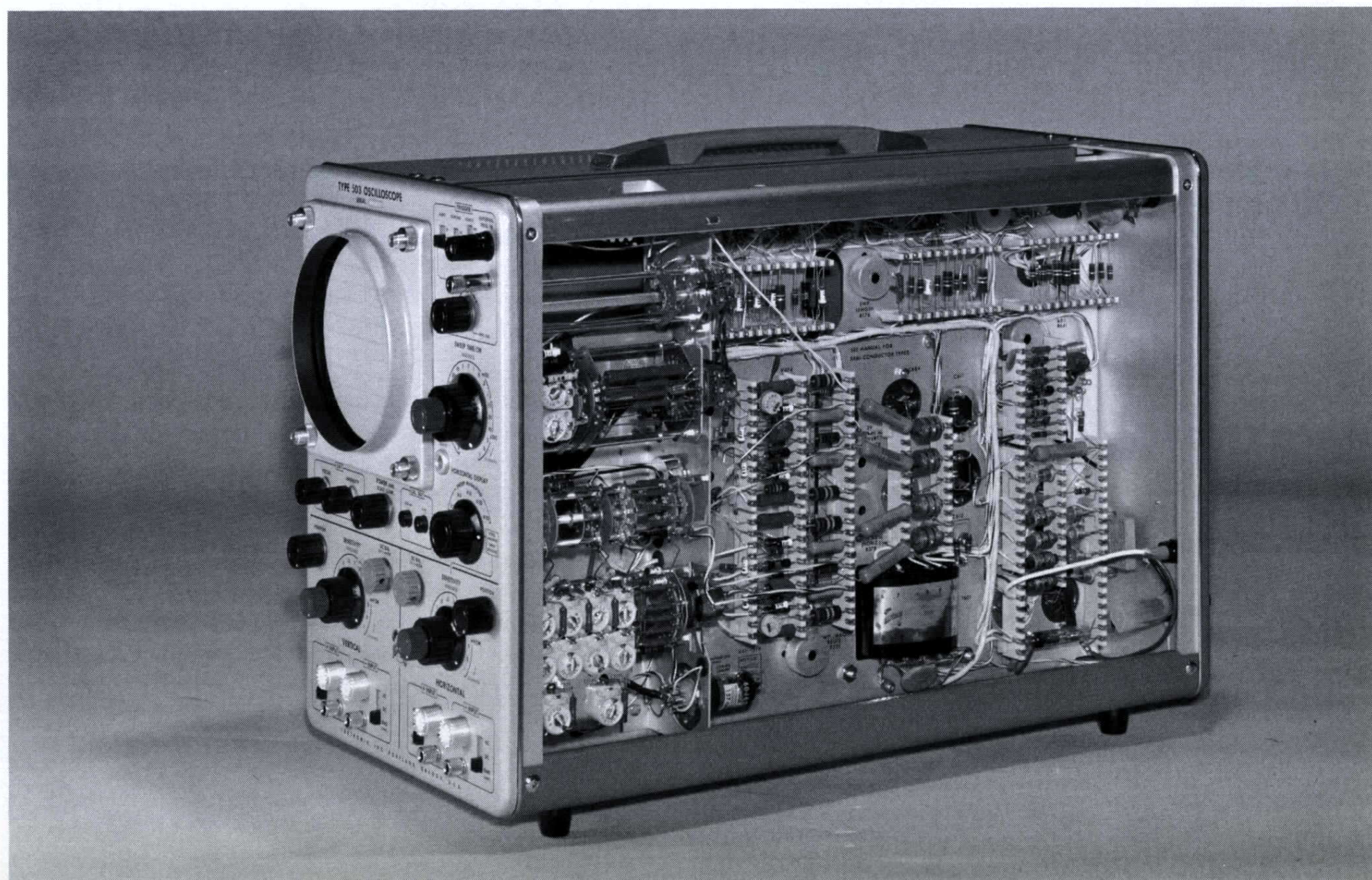
Trigger Requirements—Triggering internally requires a signal large enough to produce one-half centimeter of vertical deflection. Triggering externally requires a signal of at least one-half volt.

Amplitude-Level Selection—Adjustable amplitude-level and slope controls allow sweep triggering at any selected point on the triggering waveform. Trigger source can be internal, external, or from the line frequency, either ac or dc-coupled.

OTHER CHARACTERISTICS

Amplitude Calibrator—Two square-wave calibration voltages are available through front-panel connectors. Peak-to-peak amplitude of these two voltages is 500 millivolts and 5 millivolts. Accuracy is within 3%. Frequency of the square wave is between 300 and 500 cycles.

Intensity Modulation—The crt grid terminal on the back panel of the oscilloscope permits beam-intensity modulation.



503

Cathode-Ray Tube—A Tektronix 5" flat-faced precision cathode-ray tube is used in the Type 503. Accelerating potential is 3 kv. A high-contrast trace easily readable under high ambient light conditions has been achieved with an improved P2 phosphor, normally supplied with the instrument. This phosphor has distinct advantages for oscilloscope photography.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

Graticule—Usable viewing area is marked in eight vertical and ten horizontal one-centimeter divisions. Centerlines are further marked in five minor divisions per centimeter. Convenient control from the SCALE ILLUM. knob provides adjustable edge-lighting for the graticule.

Regulated Power Supplies—Electronically-regulated dc supplies insure stable operation over line fluctuations between 105 and 125 volts or 210 and 250 volts. Line frequency is 50 to 800 cycles. The low-line voltage requirement increases about 10% at 400

cycles and about 15% at 800 cycles. The input stage heaters of the vertical and horizontal amplifiers are supplied with regulated dc.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 800 cps, typically 107 watts at 117 v.

Mechanical Specifications—Dimensions are 14 3/4" high by 9 7/8" wide by 21 5/8" deep. Net weight is 29 1/2 pounds. Shipping weight is 46 pounds, approx.

TYPE 503 OSCILLOSCOPE \$640

Each instrument includes: 2—binding-post adapters, 2—instruction manuals, 1—green filter.

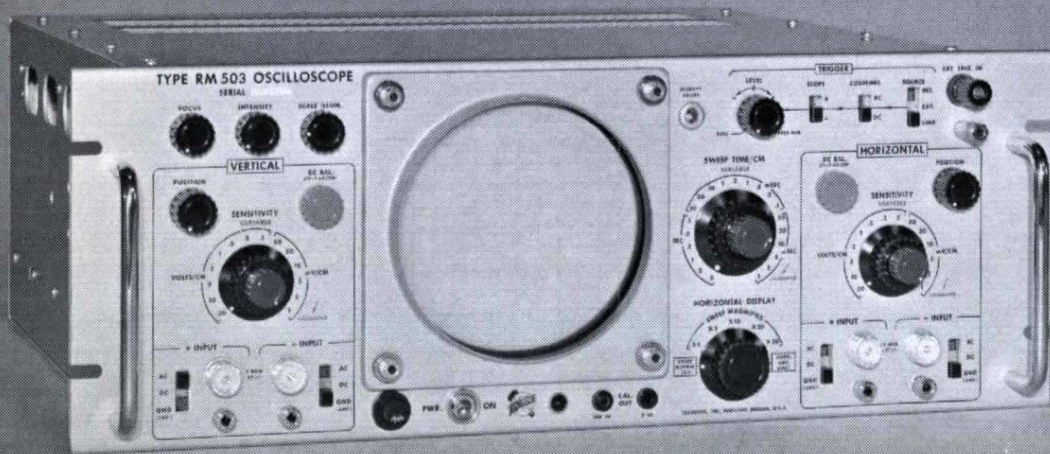
PROBES

Although RC attenuator probes are not included with the Type 503, their use is recommended when minimum loading on the circuit under test is required. The following 42-inch cable length probes are ideally suited for use with this oscilloscope.

Probe	Ratio Atten.	Input Impedance		Voltage Rating	Price
		Resistance	Capacitance		
P6017	10:1	10 meg Ω	14 pf	600 v	\$12.50
P6027	1:1	1 meg Ω	94 pf	600 v	\$12.50
P6002	100:1	9.1 meg	2.8 pf	2000 v	\$21.50

Type RM503 RACK MOUNT

11-12-62
 Rack slides:
 Basic tilt lock (351-051) \$39.25
 Deluxe tilt lock (351-050) \$64.70



The Type RM503 is a mechanically rearranged Type 503 Oscilloscope. It bolts directly to a standard 19" rack, requires only 7" of rack height. Rack Slides are available, but not included with the instrument.

Front-panel controls and connectors are conveniently located for ease of accessibility and simplicity of operation. Electrical characteristics of the RM503 are the same as described for the Type 503 Oscilloscope.

Mechanical Specifications—Dimensions are 7" high by 19" wide by 17" deep. Net weight is 27 pounds. Shipping weight is 52 pounds, approx.

TYPE RM503 OSCILLOSCOPE \$655

Each instrument includes: 1—mounting hardware set, 2—binding-post adapters, 2—instruction manuals, 1—green filter.

U. S. Sales Prices f.o.b. Beaverton, Oregon
 Please refer to Terms and Shipment, General Information page.



DC-to-450 KC OSCILLOSCOPE Type 504

Passband—DC to 450 kc (at 3-db down).

Vertical Sensitivity—5 mv/cm to 20 v/cm in 12 calibrated steps. 5 mv/cm to 50 v/cm continuously variable (uncalibrated).

Single-ended Input

Constant Input Impedance—(1 megohm-47 pf) at all sensitivities, standard 10-x probe can be used.

Sweep Range

1 μ sec/cm to 0.5 sec/cm.

18 calibrated sweep rates.

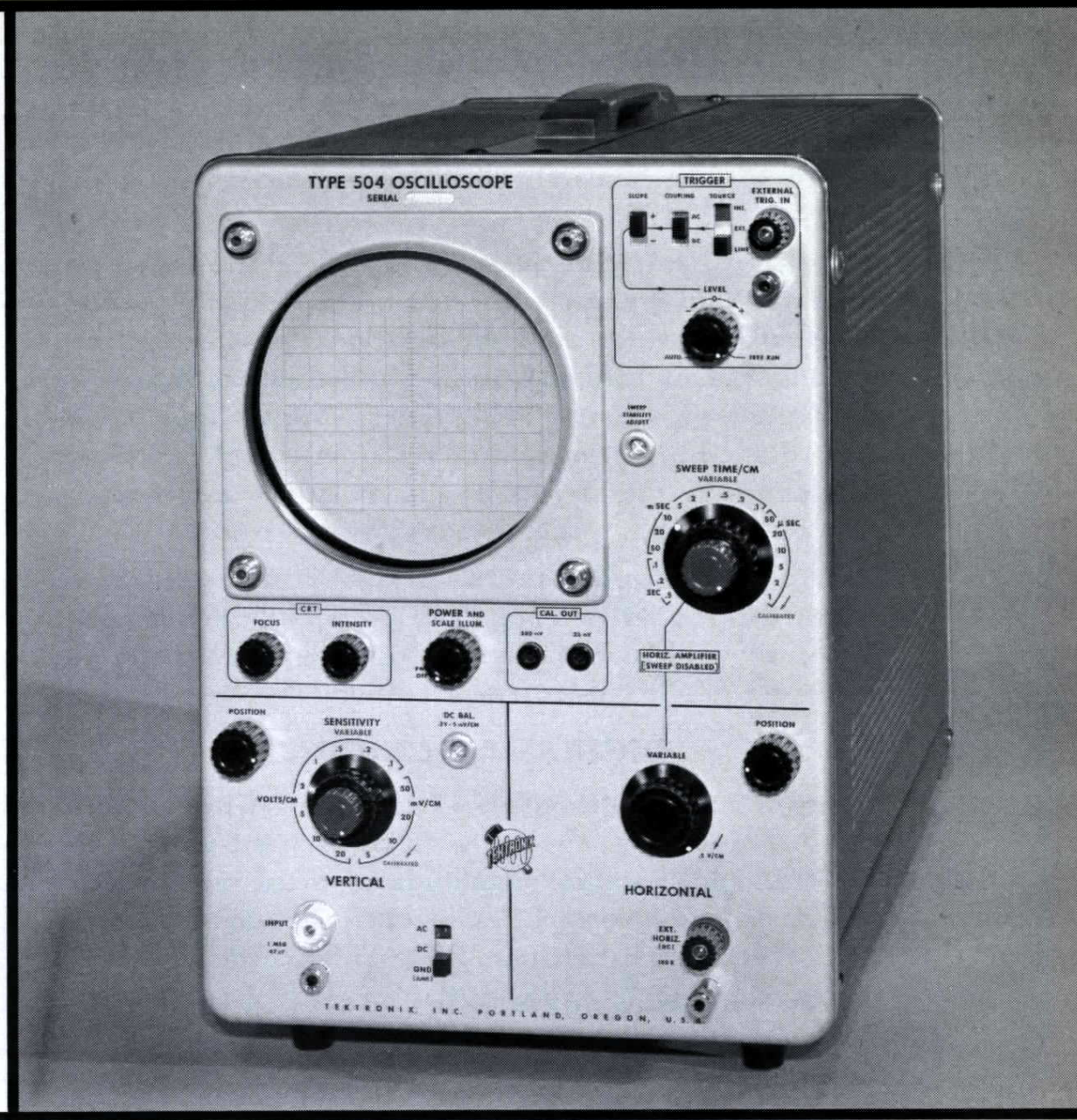
Sweep time adjustable between steps, and to approximately 1.2 sec/cm uncalibrated.

Amplitude Calibrator

500 mv and 25 mv peak-to-peak square-wave voltages available at front panel.

Regulated Heater Supply

Regulated dc supplied to the input stage filaments.



Tektronix standards of precision and reliability are introduced to the low frequency scope field in the Type 504 Oscilloscope. For applications within its dc to 450 kc capabilities, the Type 504 is an accurate dependable instrument at a modest cost. It is equally well adapted for laboratory or classroom. The Type 504's reduced size requires less bench space and suggests its use for many field applications and production-line-testing jobs. Many features not normally found in low-frequency oscilloscopes are included in the Type 504. Some of these are: flexible triggering facilities, 5 mv/cm vertical sensitivity, constant input impedance at all sensitivities, bandpass of dc to 450 kc, deflection blanking, and simple layout with parts easily accessible.

VERTICAL-DEFLECTION SYSTEM

Frequency specifications are at 3-db down

DC-Coupled Amplifier—Passband is dc to 450 kc (at 3 db down). Deflection is calibrated in steps of 5, 10, 20, and 50 mv/cm...0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 volts/cm. A vernier control (uncalibrated) permits continuous adjustment between the 12 steps, and to about 50 volts/cm.

Calibration Accuracy—Internal adjustments set the gain of the vertical amplifier. When these adjustments are set accurately, the calibration will be within 3% of the indicated switch position.

AC-DC Switch—The switch provides a convenient method of ac or dc-coupling the signal to the input-stage grid, or grounding the grid. When ac coupled, the low frequency 3-db point is 10 cps direct or 1 cps with 10X Probe.

Input Impedance—1 megohm paralleled by about 47 pf.

HORIZONTAL-DEFLECTION SYSTEM

Sweep Range—Sweep time is calibrated in steps of 1, 2, 5, 10, 20, and 50 μ sec/cm...0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 msec/cm...0.1, 0.2, 0.5, sec/cm. Calibration accuracy is within 3% of the indicated switch position. A 2.5:1 vernier control permits continuous adjustment between the 18 steps, and to over 1.2 sec/cm, uncalibrated.

Deflection Blanking—The unblanking waveform is coupled to a separate deflection system in the electron gun of the cathode-ray tube. The system consists in part of two pairs of cross-connected deflection plates which intercept the beam current, blanking the crt screen except during sweep time. This unique system uses simplified circuitry and at the same time provides improved reliability. It assures uniform beam current for all sweep and repetition rates. In addition, external beam modulation can be accomplished by using the crt grid-input terminal on the back of the oscilloscope.



TRIGGERING FACILITIES

Amplitude-level Selection—Adjustable amplitude-level and slope controls allow sweep triggering at any selected point on the triggering waveform. Trigger source can be internal, external, or from the line frequency, either ac-coupled or dc-coupled.

Automatic Triggering—Fully counter-clockwise position of the LEVEL control eliminates triggering readjustments, provides dependable triggering for most applications. One setting assures positive sweep triggering by signals of different amplitudes, shapes, and repetition rates. In the absence of an input signal, automatic triggering of the sweep occurs at about a fifty-cycle rate and provides a convenient reference trace.

Trigger Requirements—Triggering internally requires a signal large enough to produce one-half centimeter of vertical deflection. Triggering externally requires a signal of at least one-half volt.

OTHER CHARACTERISTICS

Amplitude Calibrator—Two square-wave calibration voltages are available through front-panel connectors. Peak-to-peak amplitude of these two voltages is 500 millivolts and 25 millivolts. Accuracy is within 3%. Frequency is between 300 and 500 cycles.

Intensity Modulation—The crt grid terminal on the back panel of the oscilloscope permits beam-intensity modulation.

Cathode-Ray Tube—A new Tektronix 5" flat-faced precision cathode-ray tube is used in the Type 504. Accelerating potential is 3 kv. A high-contrast trace easily readable under high ambient light conditions has been achieved with an improved P2 Phosphor normally supplied with the Type 504. This phosphor has distinct advantages for oscilloscope photography.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

Graticule—Usable viewing area is marked in eight vertical and ten horizontal one-centimeter divisions. Centerlines are further marked in five minor divisions per centimeter. The SCALE ILLUM. knob provides adjustable edge-lighting for the graticule.

Regulated Power Supplies—Electronically-regulated dc supplies insure stable operation over line fluctuations between 105 and 125 volts or 210 and 250 volts. Line frequency is 50 to 800 cycles. The low-line voltage requirement increases about 10% at 400 cycles and about 15% at 800 cycles. The input stage heaters are supplied with regulated dc.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 93 watts at 117 v.

Mechanical Specifications—Dimensions are 14 3/4" high by 10" wide by 21 5/8" deep. Net weight is 27 1/4 pounds. Shipping weight is 44 pounds, approx.

TYPE 504 OSCILLOSCOPE \$540

Each instrument includes: 1—binding post adapter, 2—instruction manuals, 1—green filter.

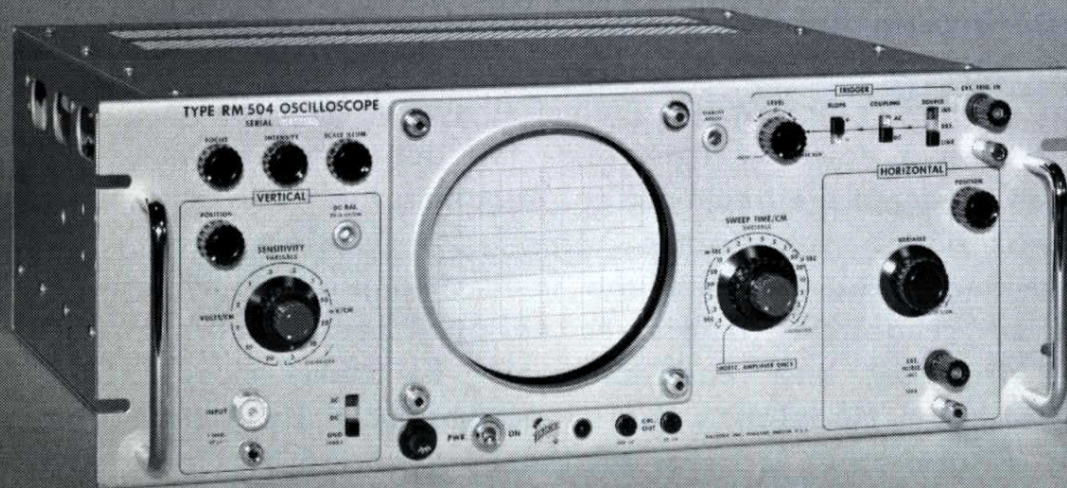
PROBES

Although RC attenuator probes are not included with the Type 504, their use is recommended when minimum loading on the circuit under test is required. The following 42-inch cable length probes are ideally suited for use with this oscilloscope.

Probe	Ratio Atten.	Input Impedance		Voltage Rating	Price
		Resistance	Capacitance		
P6017	10:1	10 meg Ω	14 pf	600 v	\$12.50
P6027	1:1	1 meg Ω	94 pf	600 v	\$12.50
P6002	100:1	9.1 meg	2.8 pf	2000 v	\$21.50

Type RM504 RACK MOUNT

11-12-62
 Rack Slides: * 39.25 (351-051)
 Basic tilt jack * 64.70 (351-050)
 Deluxe " " * 64.70 (351-050)



The Type RM504 is a mechanically rearranged Type 504 Oscilloscope. It bolts directly to a standard 19" rack. Requires only 7" of rack height. Rack slides are available, but not included with the instrument.

Front panel controls and connectors are conveniently located for ease of accessibility and simplicity of operation. Electrical characteristics of the RM504 are the same as described for the Type 504 Oscilloscope.

Mechanical Specifications—Dimensions are 7" high by 19" wide by 17" deep. Net weight is 25 1/2 pounds. Shipping weight is 51 pounds, approx.

TYPE RM504 OSCILLOSCOPE \$550

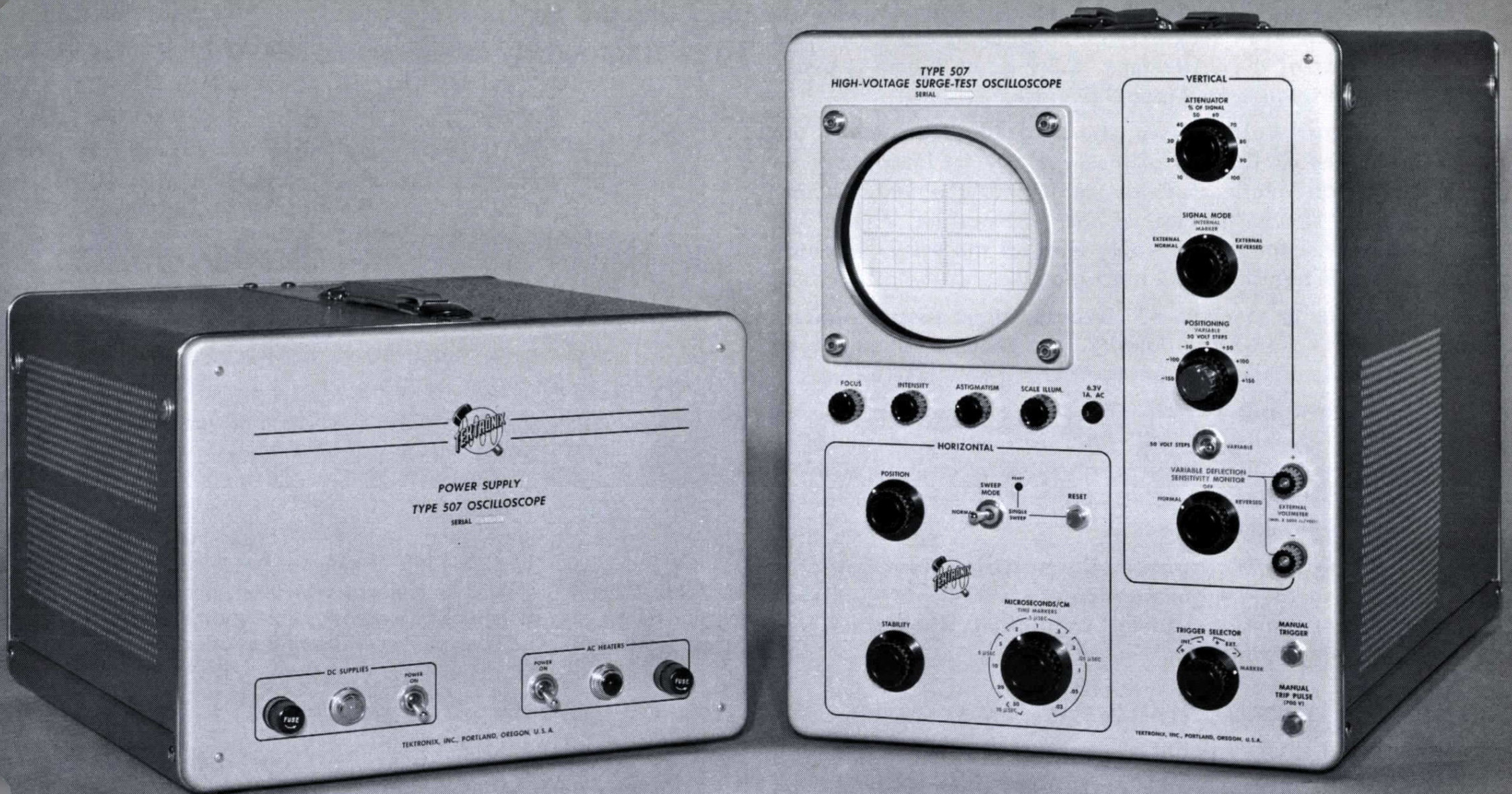
Each instrument includes: 1—mounting hardware set, 2—binding post adapters, 2—instruction manuals, 1—green filter-

U. S. Sales Prices f.o.b. Beaverton, Oregon

Please refer to Terms and Shipment, General Information page.



SURGE-TESTING OSCILLOSCOPE Type 507



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

Calibrated Vertical Positioning

24-kv Accelerating Potential

Risetime—Approximately 10 nsec

Sweep Range—20 nsec/cm to 50 μ sec/cm

6-cm by 10-cm Deflection

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® cart for convenience and mobility.

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

Risetime—A passive damping network inserted in the deflection leads to the crt is adjusted for optimum transient response (without overshoot or ringing) of 10 nsec.

Deflection Factor—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 21-025 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 μ 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 μ sec.

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

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.

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.

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 nano-seconds/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.

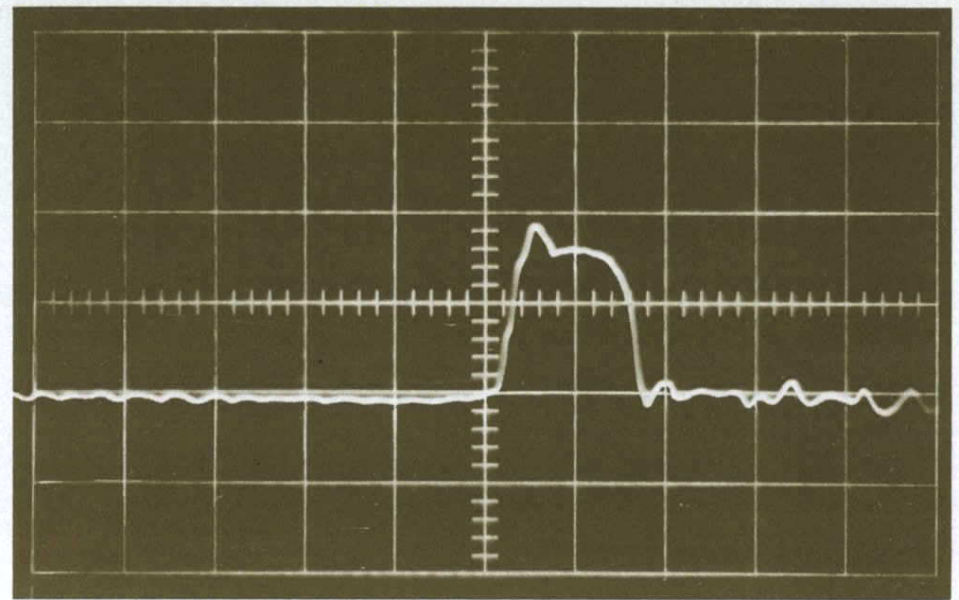
Sweep Mode—When the switch is in the single-sweep position, pressing the RESET button arms the sweep circuit. The sweep then can be triggered internally, by MANUAL TRIGGER, or by an external trigger.

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 and load variations between 105 and 125 v or 210 and 250 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.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 600 watts.



QUALITY CONTROL TEST ON FLASH X-RAY SYSTEM
using x-ray tube with T-F emission cathode.

One-shot waveform depicts one of many photographs recorded—in adjusting for impedance match of high-current T-F emission tube to square-wave pulse of Flash X-Ray System. In testing the System, the Type 507 was used to monitor the output from a 1200 Megawatt Pulser to the x-ray tube. The Tektronix C-12 Camera was used to record critical timing and amplitude measurements of pulses up to 600 kilovolts at 2000 amperes, 0.2-microsecond duration.

OTHER CHARACTERISTICS

Cathode-Ray Tube—The Type 507 uses a 5-inch flat-faced tube. A P11 phosphor is normally furnished.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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 $0.05\text{-}\mu\text{sec}$ time mark is available at sweep speeds from $0.02 \mu\text{sec}/\text{cm}$ to $0.2 \mu\text{sec}/\text{cm}$; $0.5 \mu\text{sec}$, from $0.5 \mu\text{sec}/\text{cm}$ to $2 \mu\text{sec}/\text{cm}$; $5 \mu\text{sec}$, from $5 \mu\text{sec}/\text{cm}$ to $20 \mu\text{sec}/\text{cm}$; and $10 \mu\text{sec}$, at $50 \mu\text{sec}/\text{cm}$. 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 $5 \mu\text{sec}$ width is available at the output connector. Pulse amplitude and width may be affected somewhat by the length of the cable used.

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.

Mechanical Specifications—Dimensions are 16⁷/₈" high by 13¹/₈" wide by 23³/₄" deep for the indicator unit and 10³/₈" high by 13¹/₂" wide by 17³/₈" deep for the power-supply unit. Net weight of the indicator unit is 50³/₄ pounds, and of the power-supply unit is 37¹/₂ pounds. In addition, the Scope-Mobile Cart supplied with each Type 507, weighs 35 pounds, net. Total shipping weight is 172 pounds approx. (with indicator unit weighing 73 pounds approx., with power-supply unit weighing 49 pounds approx., and with the Scope-Mobile Cart weighing 50 pounds approx.).

TYPE 507 OSCILLOSCOPE \$3000

Each instrument includes: 1—Type 500A Scope-Mobile Cart, 1—Power Supply Unit, 1—common buss ground connector, 1—3-conductor power cord, 1—inter-unit power cable, 2—instruction manuals, 1—blue filter.

Rack Mount Adapter

A cradle mount to adapt the Type 507 Oscilloscope and its power supply for rack mounting is available. It consists of two cradles and two masks. The cradles, one each for the indicator and power supply units, support the instruments in any standard 19" relay rack. The two masks fit around the regular instrument panels of the two units. Rack height requirements; Indicator mask 17¹/₂", Power Supply mask 12¹/₄". Tektronix blue vinyl finish.

Order Part Number 040-279 \$85



Scope-Mobile Cart, supplied with each Type 507 Oscilloscope and Power Supply Unit, provides easy moving in your work area.

Tektronix C-12 Camera

Used with a Type 507 Oscilloscope for high-current and high-voltage applications, the Type C-12 Camera enables convenient recording of power-surge measurements—such as high-voltage breakdown tests of power transformers, insulators, allied components. . . pinch-effect studies. . . other experiments in plasma research.

C-12 CAMERA \$465

Includes: f/1.9 lens with 1:0.9 object-to-image ratio, a *Polaroid 3-1/4 by 4-1/4 Camera Back with focus plate, and C-12-25 Camera Frame.

See Camera Section for complete description.

* Registered by Polaroid Corporation

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

GROUND CIRCUIT TRANSIENTS

Due to the physical configurations and electrical parameters of 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.

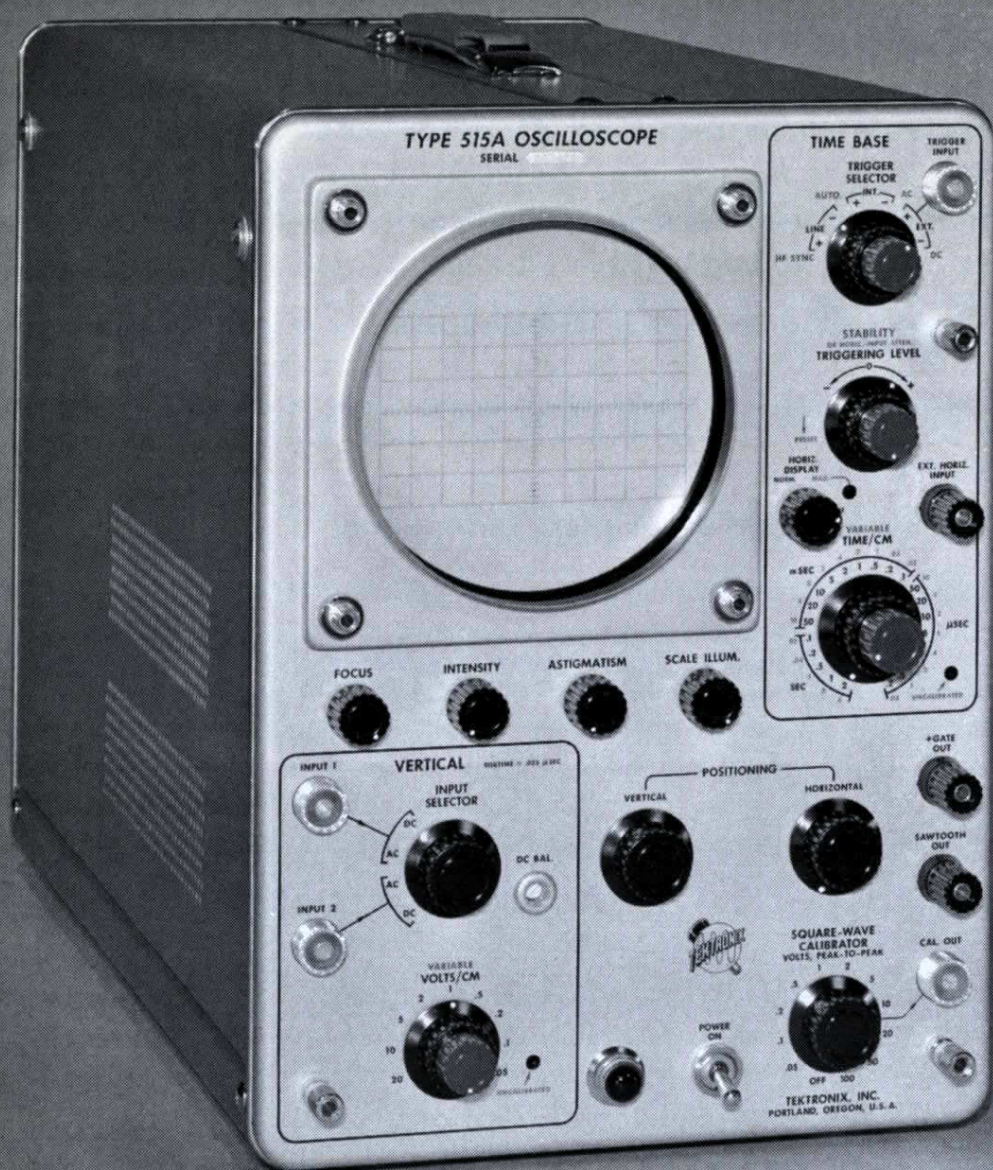
Two undesirable consequences may arise from these ground transients. The oscilloscope power-transformer insulation may be overstressed, causing break-down. Current flow set up through chassis capacity to earth, power source, and any ground conductor connected to the instrument may affect proper operation of sweep circuitry, crt-unblanking circuitry, other circuitry.

The Type 507 has been designed to ensure minimum sensitivity to extraneous disturbances and can withstand a limit of 2000 crest volts to ground for transformer break-down.

However, once the ground-voltage limit is approached in a particular surge-testing apparatus, the engineer must employ means exterior to the Type 507 to reduce the impressed voltages. Techniques in use for isolating the oscilloscope from circulating ground currents range from motor generator sets for power-line isolation to multiple-shielded enclosures that surround the oscilloscope, operator, and 60-cps power generator.

To arrange a demonstration of this specialized oscilloscope in your own application, please call your Tektronix Field Engineer. For, Tektronix fully realizes that instrument performance can be accurately evaluated under conditions of actual use only.

Type 515A DC-to-15MC OSCILLOSCOPE



Frequency Response—DC to 15 mc.

Transient Response—23 nsec risetime.

Vertical Deflection Factor

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

Balanced 0.25 μ sec Delay Network

Wide Sweep Range

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

Versatile Triggering Circuitry

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

The Tektronix Type 515A is a dc-coupled general-purpose cathode-ray oscilloscope combining the latest Tektronix oscilloscope circuitry in a compact instrument. Wide sweep range of 0.04 μ sec/cm to 6 sec/cm, dc to 15 mc passband, and vertical deflection factor to 0.05 v/cm qualify the Type 515A for general-purpose laboratory work and for many field applications.

Accurate calibration of both sweep and vertical amplifiers permit 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.

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

DC-Coupled Vertical Amplifier—The Type 515A vertical passband is dc to 15 mc, risetime is 23 nsec. 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. A front-panel neon light indicates when the control is in the variable (uncalibrated) position.

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. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

Input Impedance—1 megohm paralleled by approximately 36 pf.

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 11.5 pf.

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

HORIZONTAL-DEFLECTION SYSTEM

Wide Sweep Range—The Type 515A has 22 calibrated sweep rates: 0.2, 0.5, 1, 2, 5, 10, 20, 50 $\mu\text{sec}/\text{cm}$; 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 $\text{millisec}/\text{cm}$; 0.1, 0.2, 0.5, 1, 2 sec/cm . A single 22-position sweep-rate switch is used. In addition, a vernier (uncalibrated) control provides sweep rates continuously adjustable from 0.04 $\mu\text{sec}/\text{cm}$ to 6 sec/cm . A front-panel neon light indicates when the control is in the variable (uncalibrated) position. 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 $\mu\text{sec}/\text{cm}$. TIME/CM of the magnified sweep is indicated by a second blue-colored figure at each position of the sweep-rate switch. Accuracy is within 5% of the displayed portion of the magnified sweep. 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.

Trigger Requirements—Internal triggering—a signal large enough to cause 2 mm deflection. External triggering—a signal of 0.5 v to 20 v.

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.

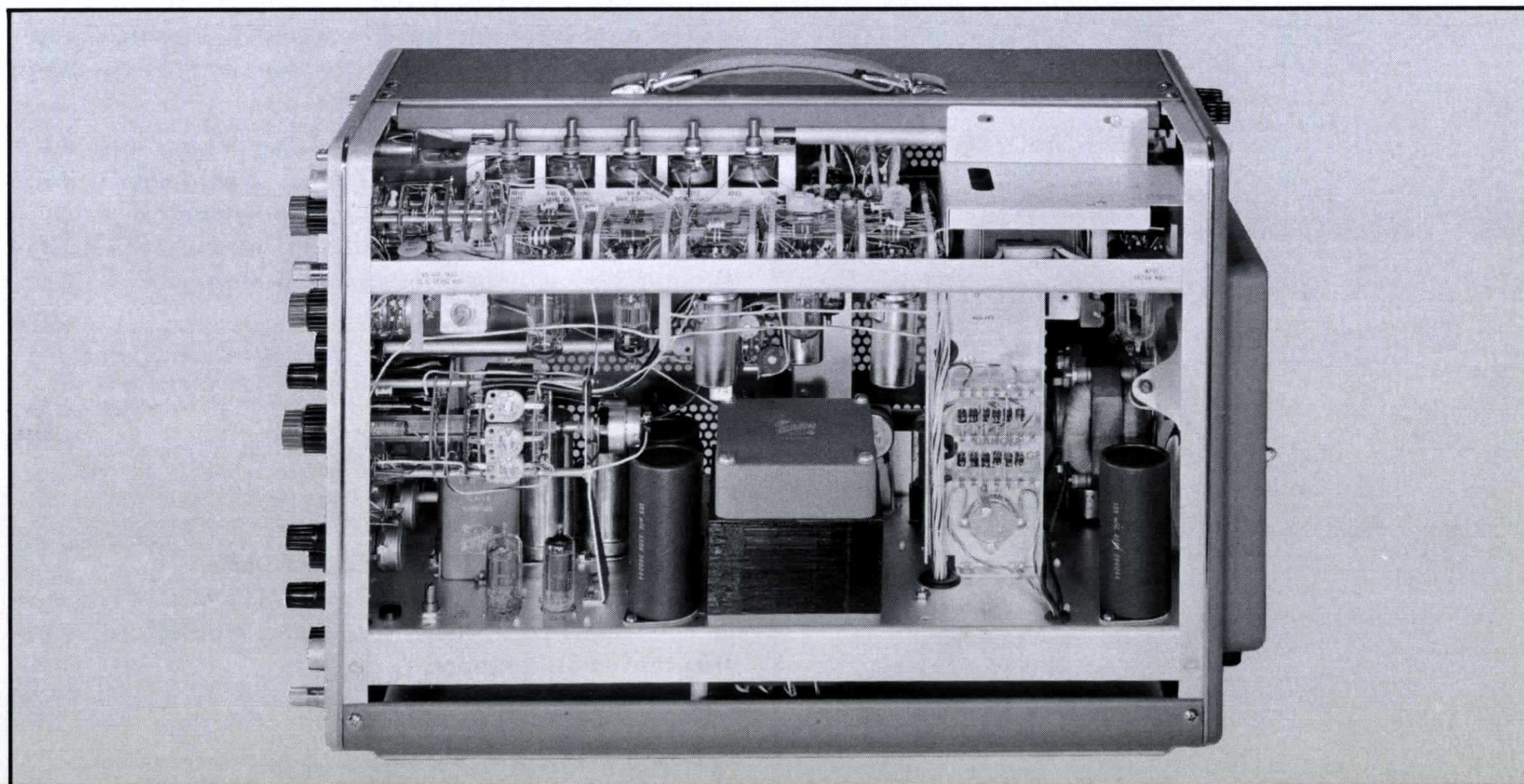
Automatic Triggering—Automatic level-seeking trigger circuit provides dependable triggering for most applications. One simple setting assures positive sweep-triggering by signals of widely differing amplitudes, shapes, and repetition rates. No trigger controls need be touched until a different type of 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 deflection, or an external signal of about 2 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 at maximum sensitivity.

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.



515A

Cathode-Ray Tube—4-kv accelerating potential is applied to a Tektronix 5" flat-faced precision tube with a helical post-accelerating anode. A P31 phosphor is normally supplied.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

Output Waveforms—A 20-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 load differences and line-voltage variations between 105 and 125 v or 210 and 250 v.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 300 watts. Type 515A-MOD101 operates on 50 to 400 cps, uses dc fan motor.

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.

Mechanical Specifications—Dimensions are 14" high by 9 7/8" wide by 21 3/4" deep. Net weight is 42 1/4 pounds. Shipping weight is 63 pounds, approx.

TYPE 515A OSCILLOSCOPE \$875

Each instrument includes: 1—10X attenuator probe, 2—binding-post adapters, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

TYPE 515AMOD101 OSCILLOSCOPE ~~\$910~~ ^{\$935}

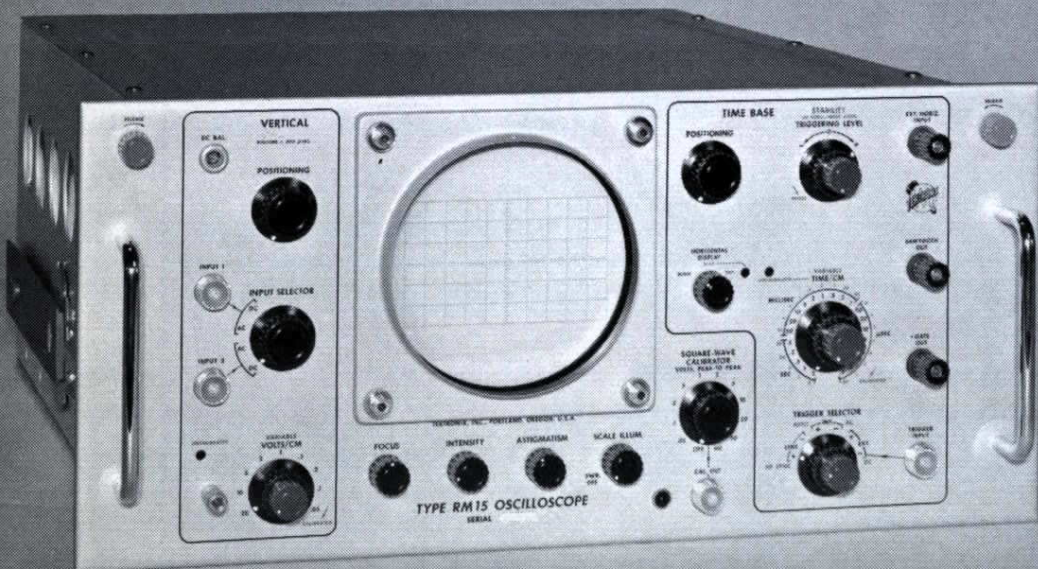
Each instrument includes: 1—10X attenuator probe, 2—binding-post adapters, 1—green filter, 1—3-conductor power cord, 2—instruction manuals. *11-12-62*

FAN MOTOR KIT

A fan motor kit is available for converting a Type 515A Oscilloscope for use on 50 to 400 cps line frequency (Type 515AMOD101). The kit contains brackets, rectifier, and motor.

Order Part Number 040-140 \$40

Type RM15 RACK MOUNT



The Type RM15 is a mechanically rearranged Type 515A Oscilloscope. It mounts in a standard 19-inch rack on slideout tracks. It can be pulled forward, tilted, and locked in any of seven positions for servicing convenience. Except for no Z-axis input, electrical characteristics of the instrument are the same as described for the Type 515A Oscilloscope.

Mechanical Specifications—Dimensions are 8 3/4" high by 19" wide by 22 3/4" deep. Net weight is 46 3/4 pounds. Shipping weight is 80 pounds, approx.

For more mounting information, please refer to the Mounting Dimensions page in the catalog.

TYPE RM15 OSCILLOSCOPE \$950

Each instrument includes: 1—10X attenuator probe, 2—binding-post adapters, 1—green filter, 1—3-conductor power cord, 1—mounting hardware set, 1—pair rails, 2—instruction manuals. *\$1010*

TYPE RM15MOD101 OSCILLOSCOPE ~~\$985~~ ^{\$1010}

Each instrument includes: 1—10X attenuator probe, 2—binding-post adapters, 1—green filter, 1—3-conductor power cord, 1—mounting hardware set, 1—pair rails, 2—instruction manuals. *11-12-62*

SUPPORTING CRADLES

When the Type RM15 or Type RM15MOD101 is used in a backless rack, these supporting cradles are necessary for rear-slide support.

Order Part Number 426-063 \$7.50

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



DC-to-15MC DUAL-TRACE OSCILLOSCOPE Type 516

Two Identical Input Channels

Passband—dc to 15 mc
 Risetime—23 nanoseconds.
 Vertical Sensitivity—0.05 v/div to 20 v/div in 9 calibrated steps. Continuously variable from 0.05 v/div to approximately 50 v/div, uncalibrated.

Four Operating Modes

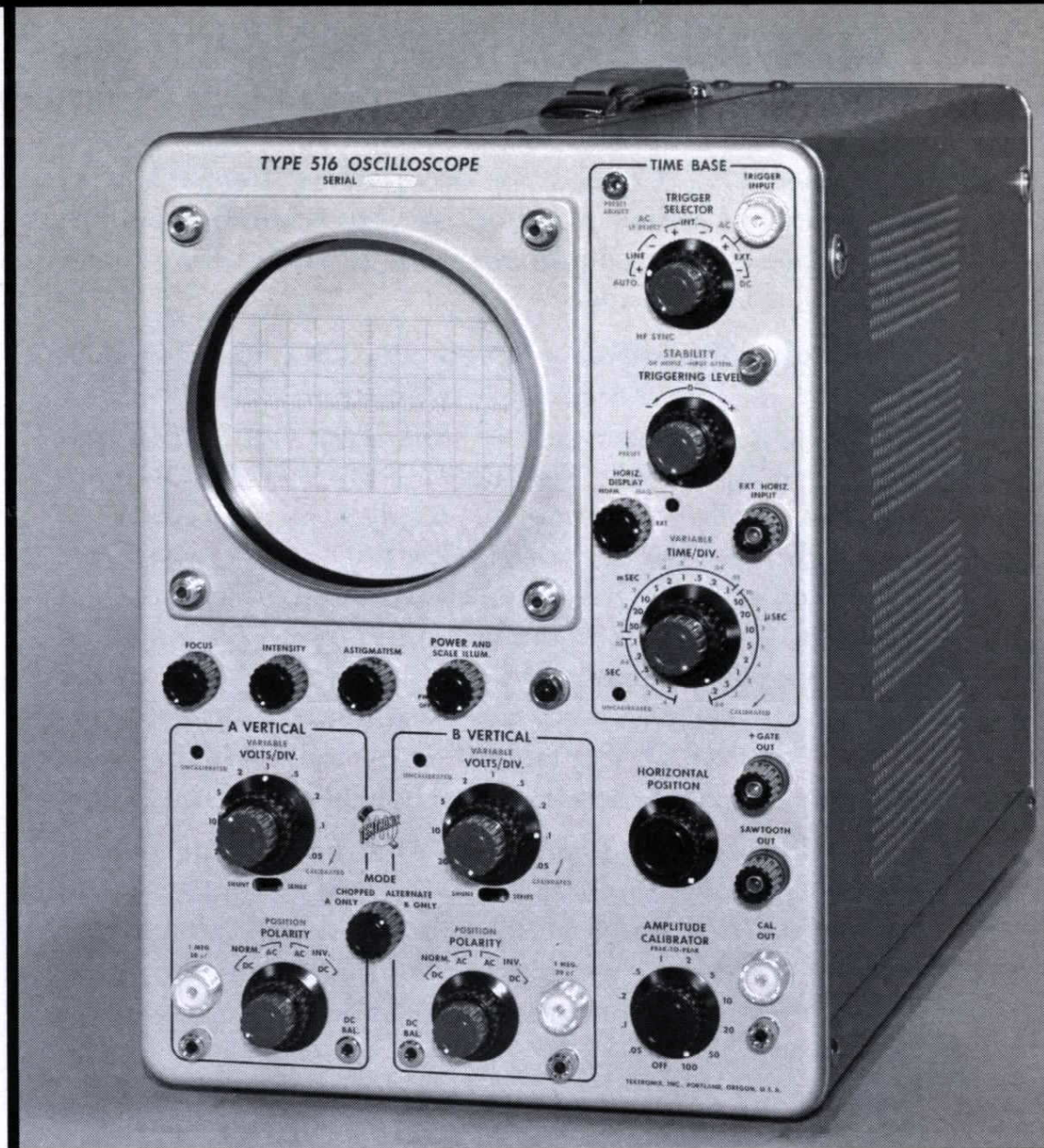
Channel A only.
 Channel B only.
 Chopped—electronic switching at about 150 kc.
 Alternate—electronic switching on alternate sweeps.

Sweep Range

0.2 μ sec/div to 2 sec/div.
 22 calibrated steps.
 Continuously variable from 0.04 μ sec/div to 6 sec/div, uncalibrated.
 5-X magnification.

Trigger System

Automatic or amplitude-level selection (preset or manual).
 Rising or falling slope.
 Internal, external, or line frequency, either ac or dc-coupled.



The Type 516 is a dual-trace, semi-portable instrument ideally suited to bench work applications. Vertical deflection factor is 0.05 v/div for each channel, with four operating modes. Small size and light weight combined with simple operation and reliable performance fit the Type 516 Oscilloscope for many laboratory and field applications.

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

DC-Coupled Vertical Amplifier—Both channels have identical input characteristics. Passband is dc to 15 mc (at 3 db down). Risetime is 23 nsec. Deflection is calibrated in steps of: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 v/div. A vernier control permits continuous adjustments between steps, and to about 50 v/div, uncalibrated.

Calibration Accuracy—Internal adjustments set the gain of each channel. When these adjustments are set accurately the deflection factor will be within 3% of the indicated switch position.

Positioning Control—Each channel has a separate vertical-position control.

Mode Selection—A switch selects one of four operating modes—each channel separately or both channels electronically switched either at a free running rate of about 150 kc or triggered by the oscilloscope sweep.

AC-DC Switches—When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

Polarity Control—Each channel has a separate polarity control (for comparison of signals 180 degrees out of phase).

Input Impedance—1 megohm paralleled by 20 pf.

Signal Delay—A balanced delay network permits observation of the leading edge of the sweep-trigger waveform.

HORIZONTAL-DEFLECTION SYSTEM

Sweep Range—Sweep time is calibrated in steps of 0.2, 0.5, 1, 2, 5, 10, 20, 50 $\mu\text{sec}/\text{div}$. . . 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/div . . . 0.1, 0.2, 0.5, 1, and 2 sec/div . Calibration accuracy is within 3% of the indicated switch position. A vernier control permits continuous adjustment between the 22 steps, and to over 6 sec/div , uncalibrated.

Sweep Magnifier—When the 5-x magnifier is switched in, the center two-division portion of the normal sweep is expanded to left and right of center to fill ten divisions. The HORIZONTAL POSITION control has sufficient range to display any one-fifth of the magnified sweep. Used with the fastest sweep, the magnifier extends the calibrated sweep range to 0.04 $\mu\text{sec}/\text{div}$. TIME/DIV of the magnified sweep is indicated by a second blue-colored figure at each position of the sweep-rate switch. Accuracy is within 5% of the displayed portion of the magnified sweep. A neon lamp lights to indicate when the magnifier is in use.

DC-Coupled Unblanking—The unblanking waveform is dc-coupled to the control grid of the crt. This assures uniform beam current for all sweep speeds and repetition rates at any setting of the intensity control. An external crt cathode terminal permits beam-intensity modulation.

Horizontal Input—A front-panel connector permits dc-coupled external connection to the sweep amplifier. Horizontal deflection factor is 1.4 v/div , and bandpass extends from dc to 500 kc at maximum sensitivity.

TRIGGER FACILITIES

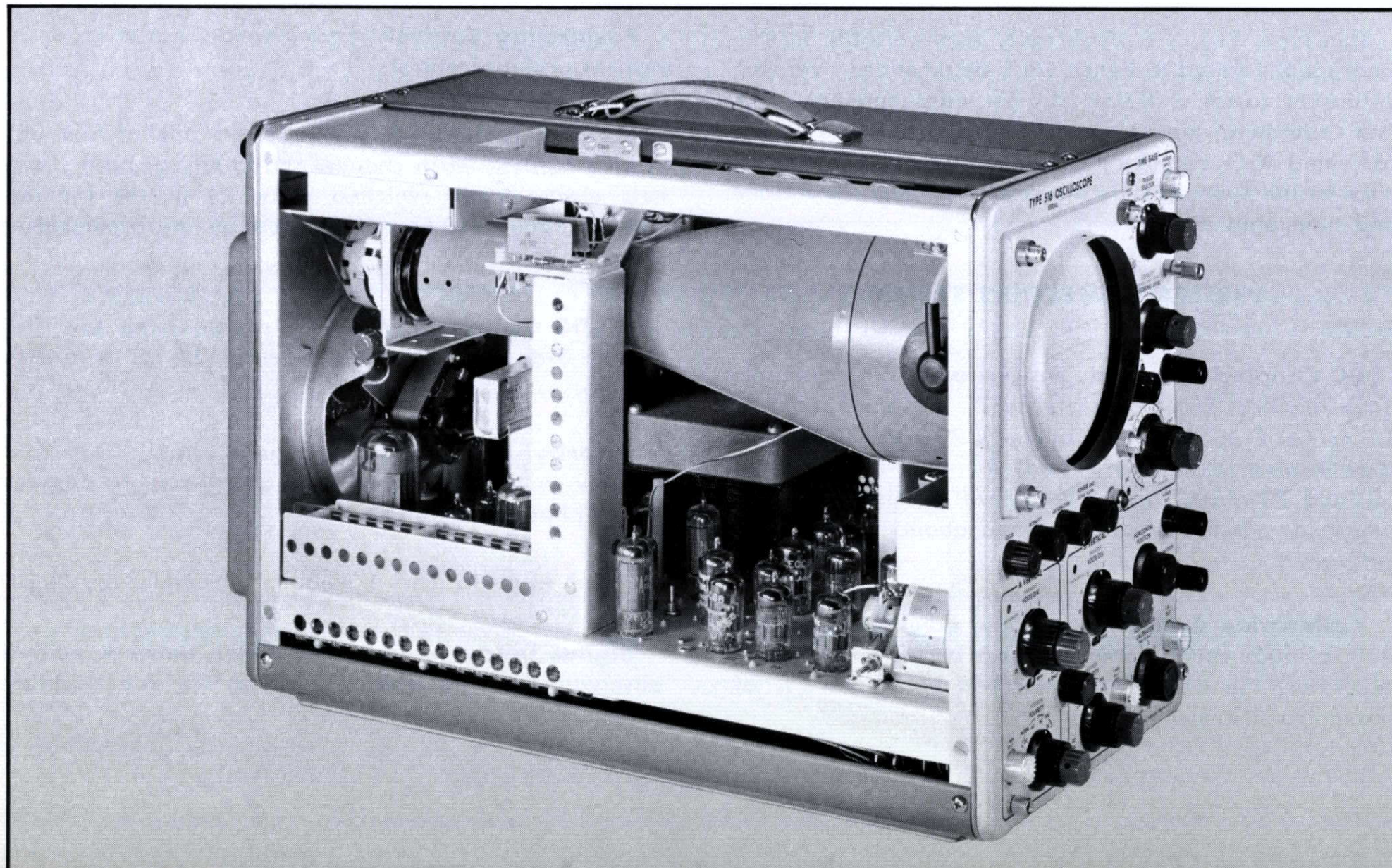
Amplitude-Level Selection—Adjustable amplitude-level and stability controls allow sweep triggering at any selected amplitude level on the triggering waveform. Trigger source can be internal, external, or the line frequency, either ac-coupled or dc-coupled. Trigger point can occur anywhere on the rising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

Preset Stability—The STABILITY control locks at the optimum triggering point and requires no adjustment in the fully counter-clockwise, PRESET position.

Automatic Triggering—Automatic level-seeking trigger circuit eliminates triggering readjustments—provides dependable triggering for most applications. One setting assures positive sweep triggering by signals of widely differing amplitudes, shapes, and repetition rates. Automatic triggering of the sweep occurs at about a fifty-cycle rate in the absence of an input signal, and provides a convenient reference trace on the crt screen.

Trigger Requirements—Triggering internally requires a signal large enough to produce one minor division of vertical deflection. Triggering externally requires a signal of from 0.5 to 25 volts.

High-Frequency Sync—Assures steady display of sine-wave signals to at least 15 megacycles. Requires a signal large enough to cause about 2 div deflection, or an external signal of about 2 volts.



OTHER CHARACTERISTICS

Amplitude Calibrator—Eleven square-wave calibration voltages are available through front-panel connectors. Peak-to-peak amplitude is in steps of 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 volts. Accuracy is within 3%. Frequency of the square-wave is approximately 1 kc.

Tektronix Cathode-Ray Tube—A flat-faced 5-inch cathode-ray tube provides a bright trace. Accelerating potential is 4 kv. A P31 phosphor is normally supplied.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

Dual-Trace Blanking—A blanking voltage is available to eliminate switching transients from the display when the instrument is operated in its chopped mode. The blanking voltage can be supplied to the crt cathode by means of a switch located on the back panel of the instrument.

Graticule—Usable viewing area is marked in six vertical and ten horizontal one-centimeter divisions. Center lines are further marked in five minor divisions per centimeter. Convenient control from the SCALE ILLUM. knob provides adjustable edge-lighting.

Regulated Power Supplies—Electronically-regulated dc supplies insure stable operation over line fluctuations between 105 and 125 volts or 210 and 250 volts.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 300 watts at 117 v. Type 516MOD101 operates on 50 to 400 cps supply, uses dc fan motor.

If requested the instrument will be wired for any of the following nominal line voltages.

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

Output Waveforms—Two output waveforms are available from front-panel connectors. Approximate amplitude of the peak-to-peak voltages are 150 volts from the SAWTOOTH OUT connector and 20 volts from the +GATE OUT connector.

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.

Mechanical Specifications—Dimensions are 14" high by 9 7/8" wide by 21 3/4" deep. Net weight is 44 1/4 pounds. Shipping weight is 63 pounds, approx.

TYPE 516 (50 to 60 cps operation) \$1070

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

TYPE 516MOD101 (50 to 400 cps operation) ~~\$1105~~ ^{#1130}

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

11-12-62

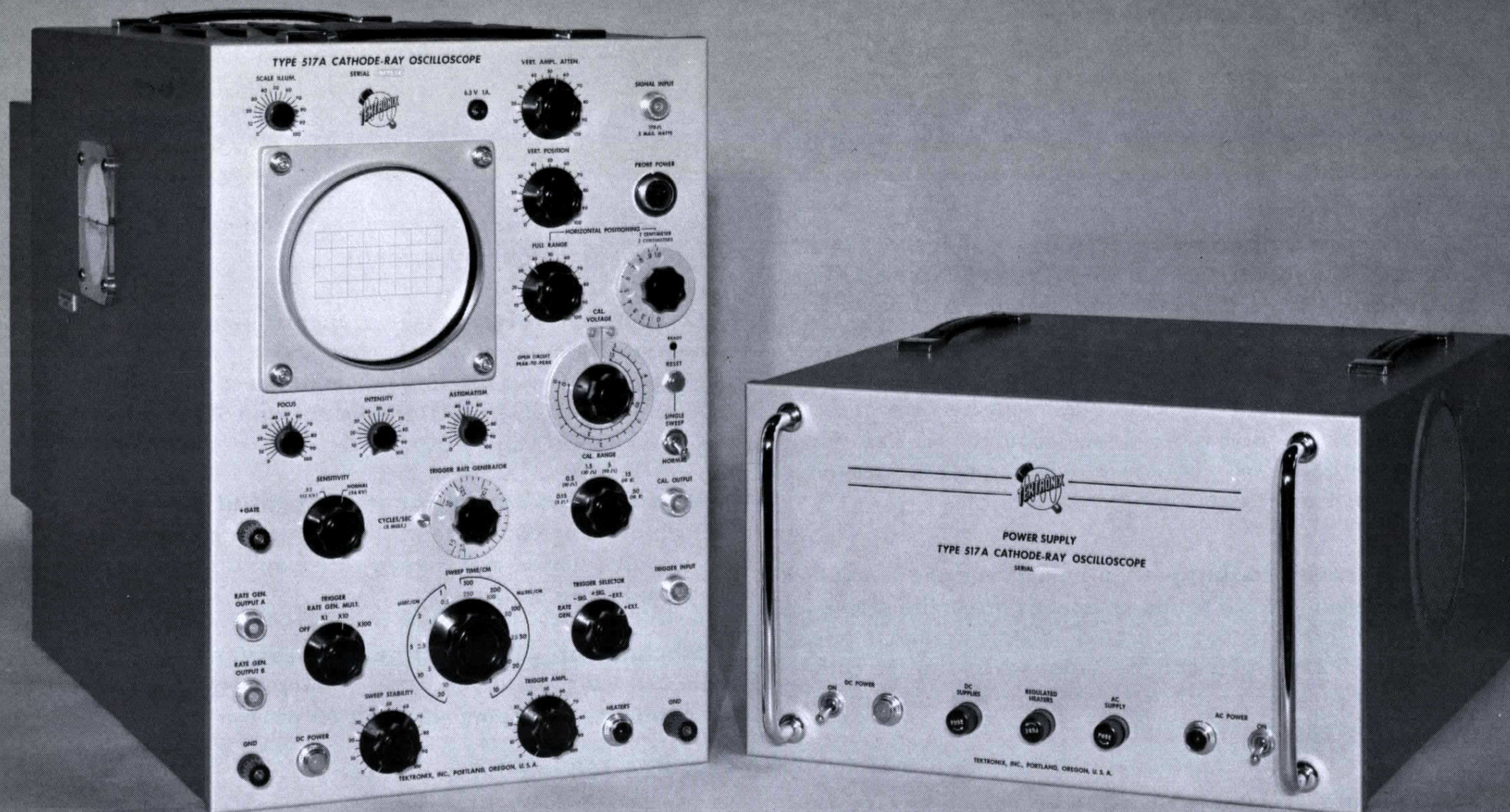
RACK MOUNT ADAPTER

A cradle mount to adapt the Type 516 Oscilloscope for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements 15 1/2".

Order Part Number 040-277 \$45

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 517A HIGH-SPEED OSCILLOSCOPE



Excellent Transient Response

7-nanosecond risetime.

Sweep Range

10 nsec/cm to 20 μ sec/cm.

Single Sweep Operation

Lockout-Rest Circuitry for one shot recording.

Vertical Deflection Factor

0.05 v/cm.

24-kv Accelerating Potential

Writing Rate—1100 cm/ μ 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 cart.

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

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

VERTICAL DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

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

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.

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 pf. 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—with minimum and maximum oscilloscope vertical amplifier attenuation.

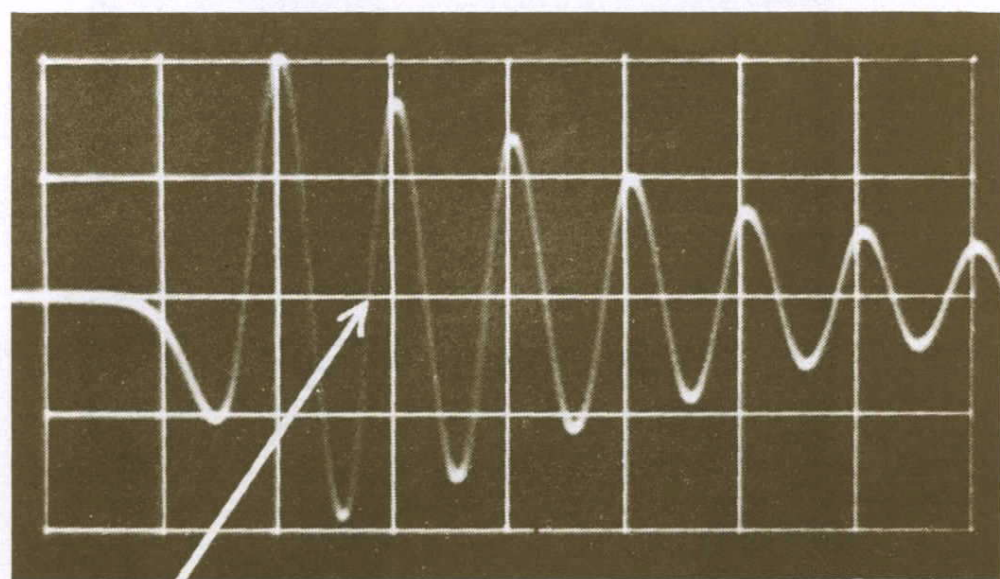
	Deflection Factor of Type 517A at 24-KV Accelerating Potential	Total Attenuation at CRT
Scope Input	0.05 to 0.1 v/cm	1:1 to 2:1
Probe Body Alone	0.1 to 0.2 v/cm	2:1 to 4:1
Probe with Attenuator I	0.2 to 4 v/cm	4:1 to 80:1
Probe with Attenuator II	2 to 40 v/cm	40:1 to 800:1
Probe with Attenuator III	20 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 150 ma and 110 v dc at 9.5 ma are available (in addition to 6.3 v ac at 1 amp at front-panel pin jack).

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



Arrow indicates 1100 cm/ μ sec writing-rate point on 100-mc damped oscillation, displayed on single 10 nsec/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.

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 nsec/cm, 1, 2, 5, 10, 20 μ sec/cm are available at 24 kv accelerating potential; and 5, 10, 25, 50, 100, 250 nsec/cm, 0.5, 1, 2.5, 5, 10 μ sec per cm at 12 kv.

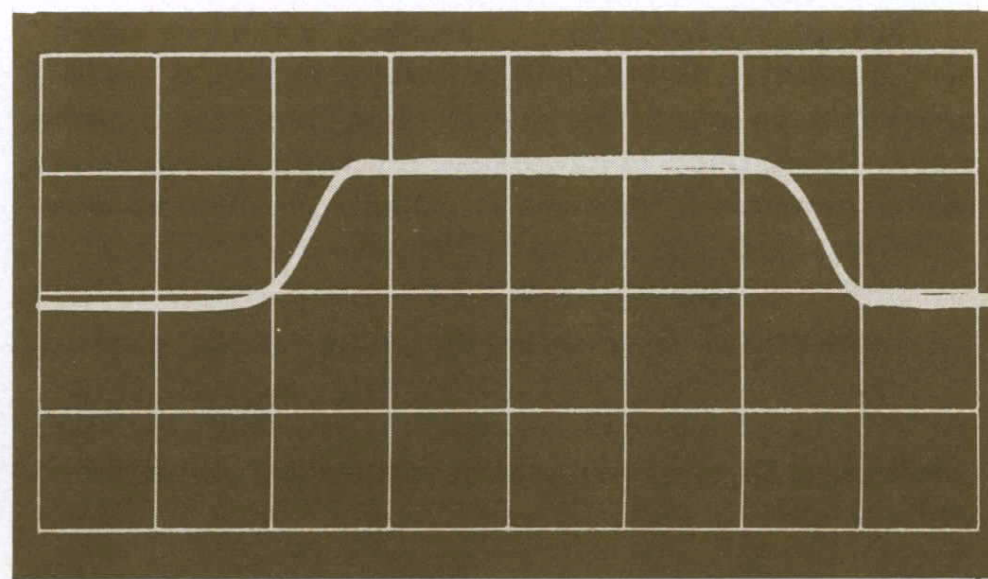
Single-Sweep Operation—Lockout-reset circuitry provides for one shot recording. After a single sweep is triggered, the sweep circuit is automatically locked out until manually reset. When reset, the sweep will fire on the next trigger received, then automatically lock out until the operator presses the 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. Risetime is approximately 0.15 μ sec.

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.



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

517A

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 and load variations between 105 and 125 v or 210 and 215 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.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 1250 watts.

OTHER CHARACTERISTICS

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

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

Metallized Cathode-Ray Tube—The Type 517A uses a 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.

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 30 nsec, 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.

Mechanical Specifications—Dimensions are 18 1/2" high by 13 1/2" wide by 27 1/4" deep for the indicator unit and 10" high by 16 1/4" wide by 20 1/4" deep for the power supply. Net weight is 74 1/2 pounds for the indicator unit, 65 1/2 pounds for the power supply, and 35 pounds for the Scope-Mobile Cart. Shipping weight is 99 pounds approx. for the indicator unit, 79 pounds approx. for the power supply, and 50 pounds approx. for the Scope-Mobile Cart.

TYPE 517A OSCILLOSCOPE \$3500

Each instrument includes: 1—Type 500A Scope-Mobile Cart, 1—Power Supply Unit, 1—P1700CF cathode-follower probe, 1—170-Ω step attenuator, 1—170-Ω coaxial cable, 1—viewing hood, 1—bezel, 1—3-conductor power cord, 1—inter-unit power cord, 2—instruction manuals.

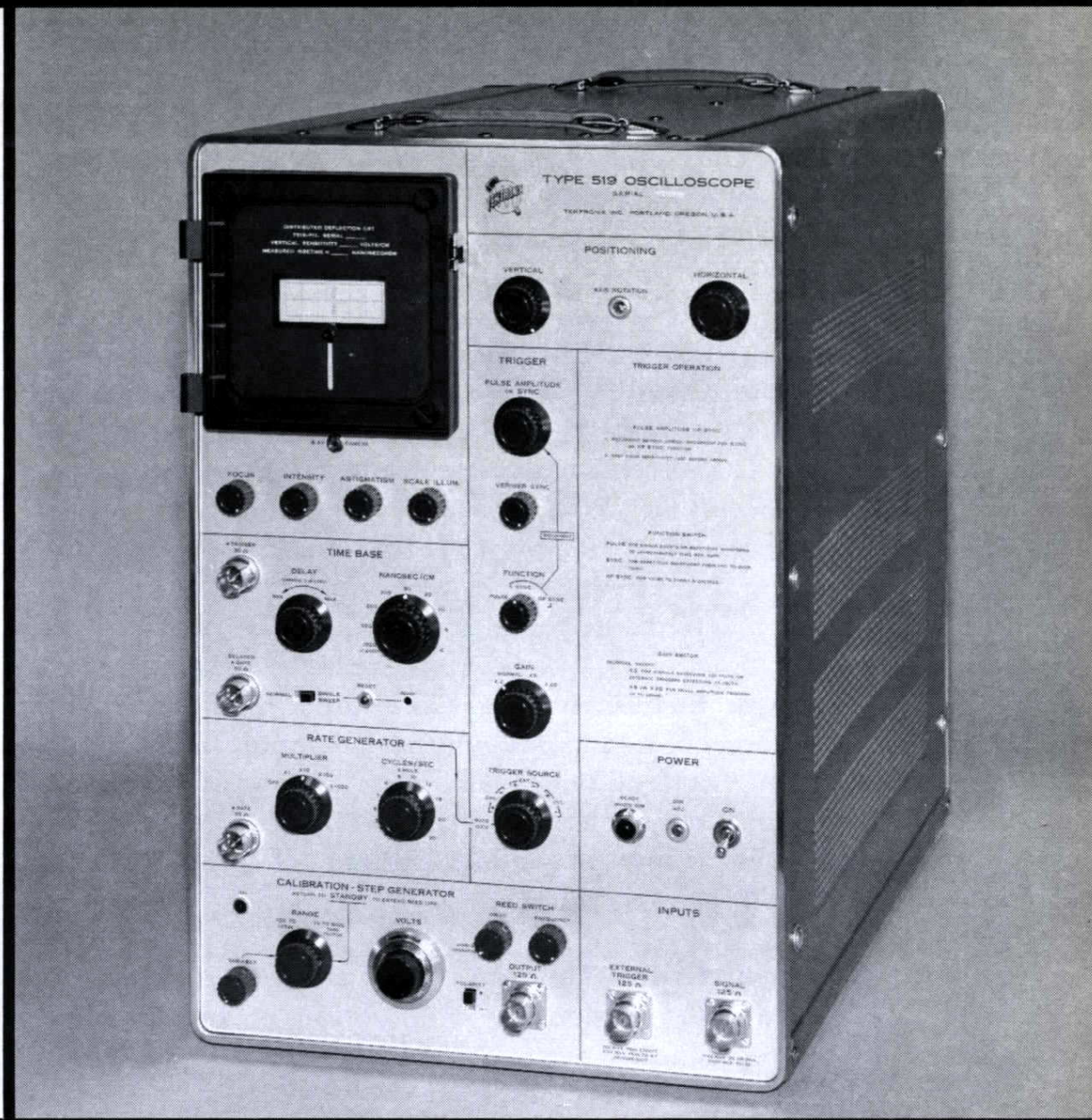
U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





DC-to-1 GIGACYCLE OSCILLOSCOPE Type 519

- Single-unit including delay line
- DC-coupled—less than 3 db down at 1 gigacycle*
- Less than 0.35-nsec risetime
- 125 $\Omega \pm 2\%$ basic input impedance
- Vertical sensitivity better than 10 v/cm
- VSWR 1.25, or less, to 1 gigacycle
- Sensitive wideband trigger system
- Synchronization to over 1 gigacycle
- Distributed-deflection crt
- 24-kv accelerating potential
- 2 x 6 centimeters viewing area
- P11 photographic phosphor
- 9 accurately calibrated sweeps
- Sweep range from 2 nsec to 1 μ sec/cm
- Single-shot photographs at 2 nsec/cm
- Single sweep spot size of 0.004 inches
- Calibration-step generator
- Avalanche transistor rate generator



The Tektronix Type 519 Oscilloscope is a calibrated, high-speed, laboratory instrument designed for observation, measurement, and photographic recording of fractional nanosecond risetimes. A 2 x 6 cm viewing area, coupled with 24-kv accelerating potential, affords bright displays with excellent definition. Performance features include: passband from dc to beyond 1 gigacycle, risetime less than 0.35 nsec, sensitivity less than 10 v/cm, linear sweeps to 2 nsec/cm, sweep delay through 35 nsec, and a wideband trigger system. The single unit houses a fixed signal delay line, a convenient sweep-delay control, a pulse-rate generator, a standard amplitude and waveshape generator, and regulated power supplies and high-voltage supply. Only one connection is necessary for normal operation—signal input.

Combining simple operation with laboratory precision and reliability, the Type 519 ideally suits single-shot or random nuclear events. In addition, the passband permits applications to general measurements where oscilloscope risetime must be faster than signal risetime.

VERTICAL DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

Distributed Deflection System—The signal passes through a trigger-energy take-off, then through a 45 nsec delay cable to the distributed vertical deflection plates of the crt. Passband is dc to 1 gigacycle and risetime is less than 0.35 nsec.

Sensitivity—Vertical deflection factor is less than 10 v/cm. Sensitivity is quickly and accurately checked by means of the CALIBRATION-STEP GENERATOR.

Signal Delay—An internal delay line provides a fixed delay of 45 nsec.

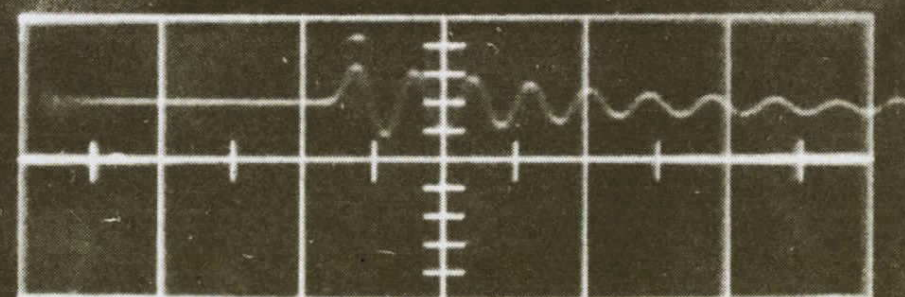
Input—The dc-coupled signal input has an impedance of 125 $\Omega \pm 2\%$. Maximum signal input is ± 15 volts dc or rms, or ± 100 volts pulse. Maximum power input is 1.8 watts.

* 1 gigacycle = 1000 megacycles

SINGLE-SHOT PHOTOGRAPHY

A single-shot exposure was used to take the picture at the right. The display shows a 1 gigacycle damped wave on the fastest rate of the oscilloscope. Picture taken with a Tektronix C19 Camera.

Photograph of a Single 1-Gigacycle Transient



TRIGGERING FACILITIES

Trigger Selection—A front-panel switch permits selection of trigger from the following sources: (1) displayed waveform, (2) externally derived waveform, (3) CALIBRATION-STEP GENERATOR waveform, (4) RATE GENERATOR waveform.

Trigger Function—Three modes of operation are provided: (1) PULSE—Permits choice of a free-running sweep or a stable sweep which can be triggered on random or uniform repetition rates up to approximately 50 mc, (2) SYNC—Permits stable displays of waveforms occurring at a constant repetition rate up to approximately 150 mc, (3) HF SYNC—Permits the sweep to be synchronized with signals from approximately 100 mc to over 1 gigacycle.

Trigger Requirements—Internally, a vertical signal deflection of two trace-widths or more, and 1 nsec duration. Externally, a waveform 20 mv in amplitude and duration of 1 nsec or more. Sweep triggers on either the rising or falling portion of the triggering waveform.

Trigger Gain—Four gain settings of X0.2, NORMAL, X5, and X20 provide for attenuation or amplification of trigger signals.

HORIZONTAL DEFLECTION SYSTEM

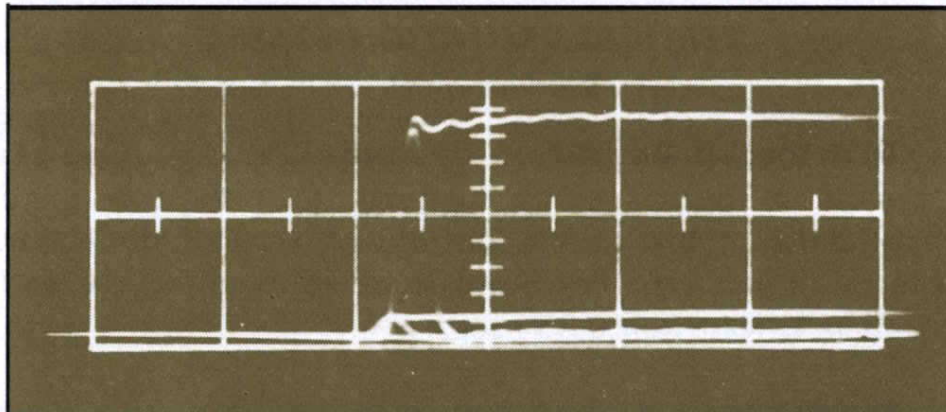
Calibrated Sweep—Nine calibrated rates: 2, 5, 10, 20, 50, 100, 200, 500, and 1000 nsec/cm are provided by a linear, push-pull, time-base generator. Calibrated sweeps are typically within 3% for the 2 nsec/cm position and within 2% for slower rates. For the fastest time-base range, only 2.5 μ sec elapses between sweeps.

Sweep Delay—Provides sweep start delay through 35 nsec, permitting access to transients before and after the main event.

Single Sweep—Permits single-sweep presentation to be obtained. After a single sweep is triggered, the sweep circuit is locked out until the RESET button is pressed; sweep will then fire on the next trigger received.

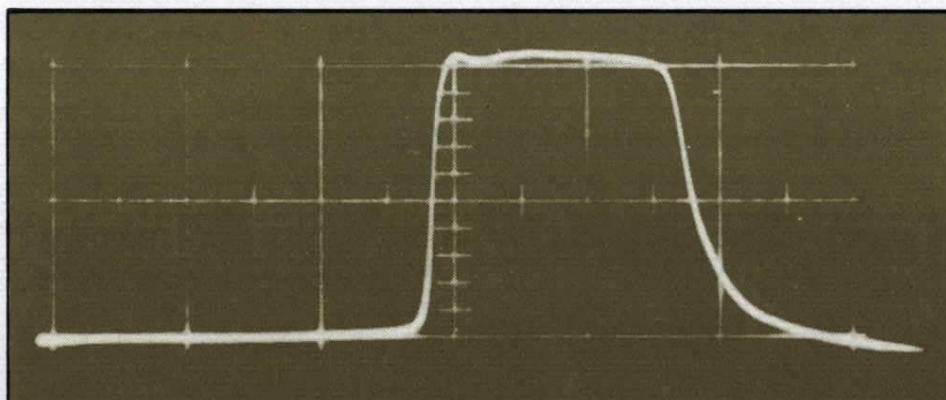
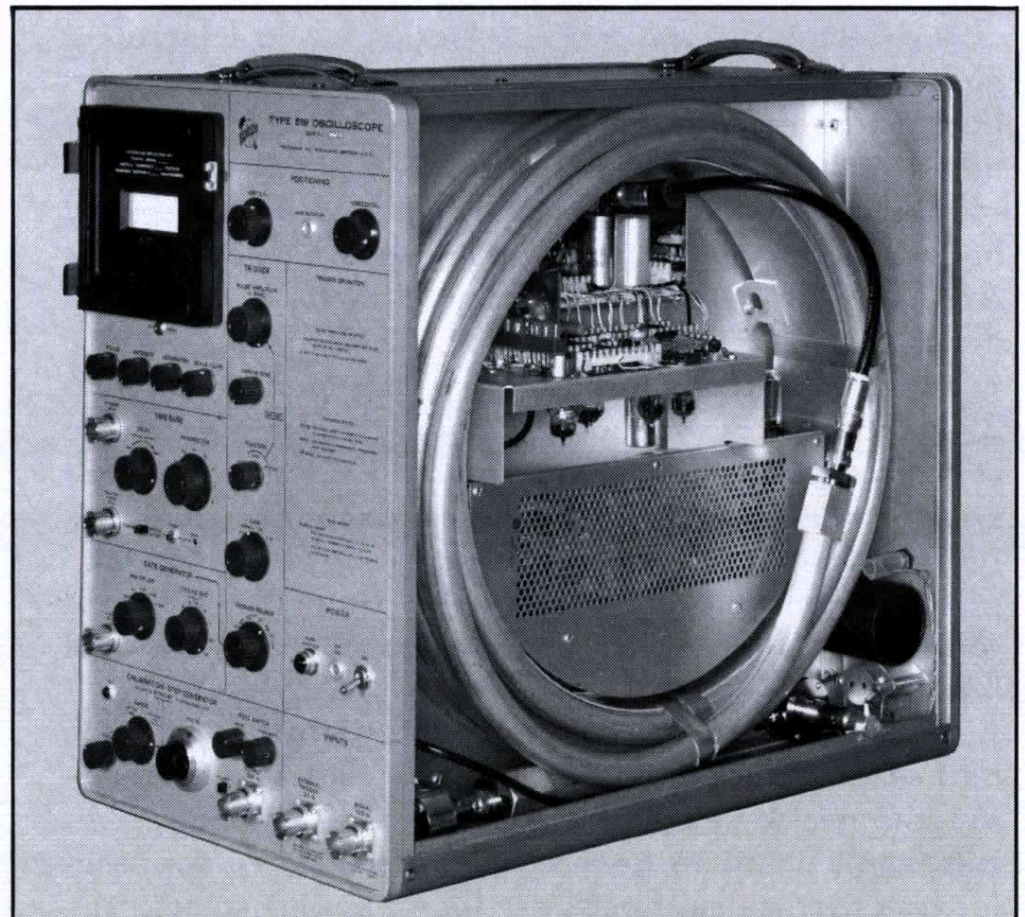
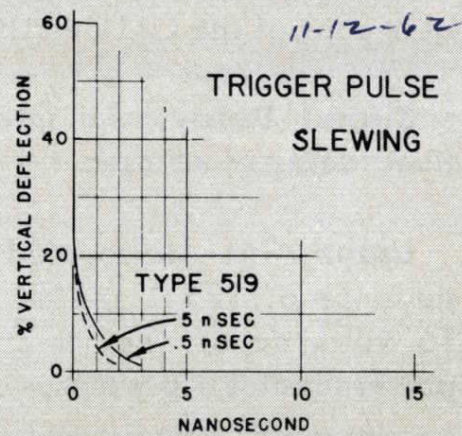
Synchroscope Operation—The output signal from either the +TRIGGER 50 Ω , the DELAYED +GATE, or the +RATE 50 Ω connector can be used to initiate the input waveform.

Rate Generator—Supplies an output pulse of approximately +15 volts, with risetime of less than 0.8 nsec and duration of 10 nsec. Repetition rate is variable between 3 cps and 30 kc. The output impedance is 50 Ω .



Negligible Trigger-Pulse Slewing for Sweep Speed of 5 nsec/cm

High-frequency synchronization permits locking to sine waves or constant-repetition-rates to over 1 gigacycle. Triggering circuits count down from triggers faster than 400 kc.

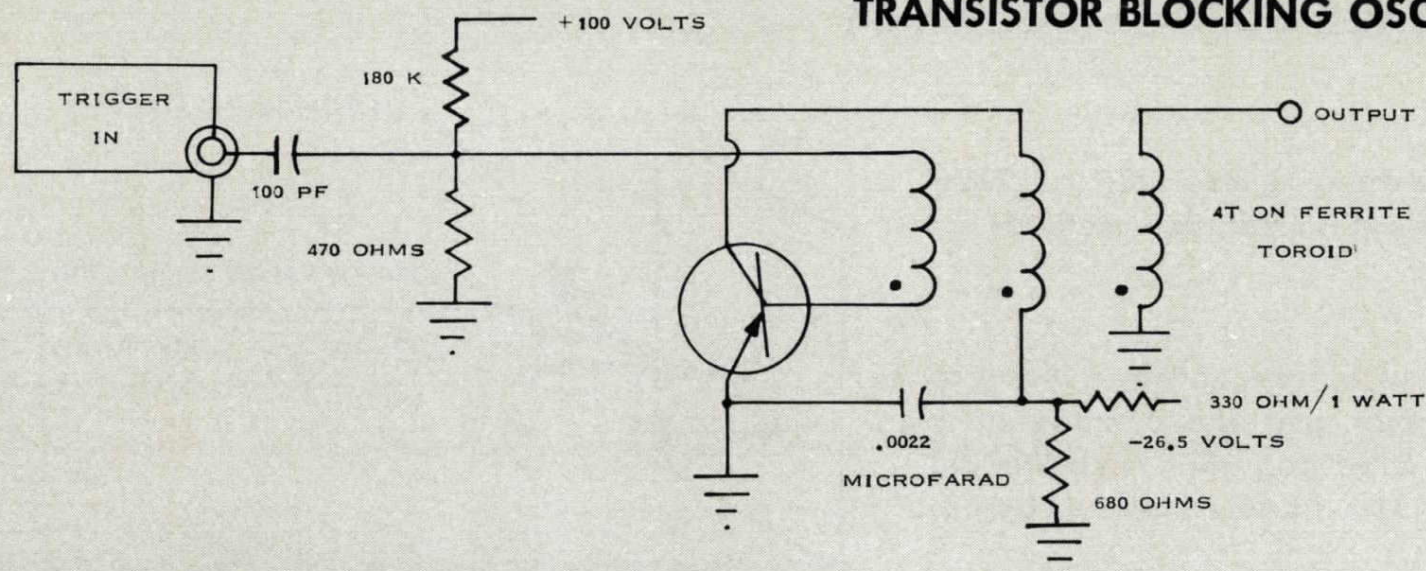


AVALANCHE TRANSISTOR

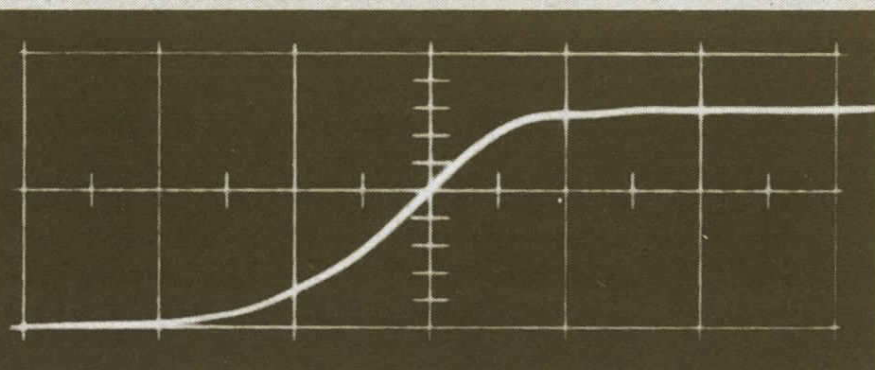
A Type 2N636 transistor in avalanche generates the pulse shown at the left. This pulse is available from the + RATE 50 Ω connector of the RATE GENERATOR on the Type 519.

Pulse of a Transistor in Avalanche, Sweep speed of 5 nsec/cm

TRANSISTOR BLOCKING OSCILLATOR OUTPUT



The transistor circuit illustrated rapidly switches 1 watt into 125 ohms. A ferrite-core transformer, such as the one used under "Circuit Design" on the next page, produces the coupling from collector-to-emitter with proper phase relationship. This type of circuit is employed within the Type 519 to generate power for gating signals.

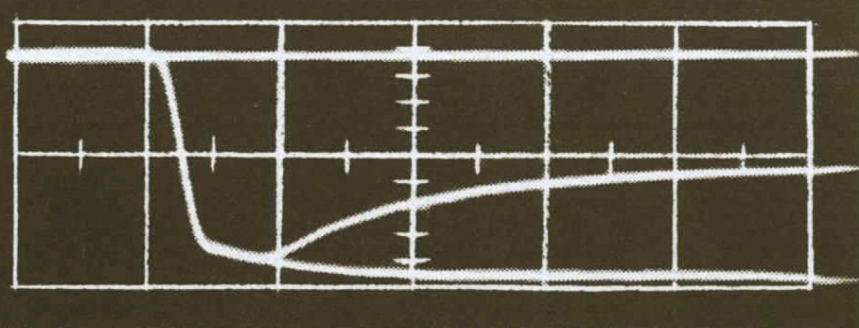


2 nsec/cm

Transistor Blocking Oscillator Output Pulse

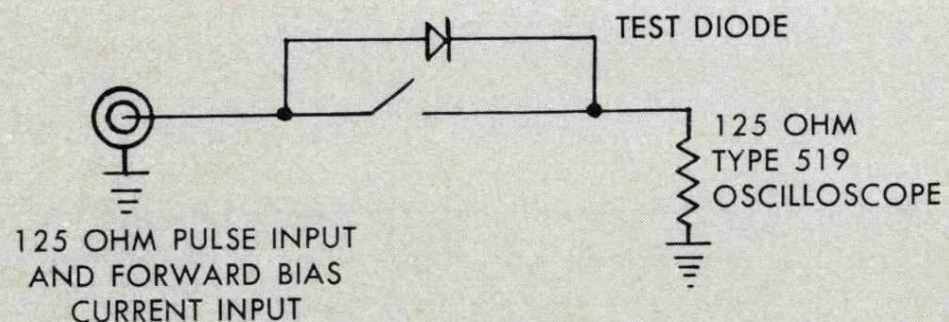
DIODE CHARACTERISTICS

Switching and storage times in fast transistors and diodes can be measured using the outstanding characteristics of the Type 519. In the typical diode recovery-time waveform, the upper trace is a reference trace, the middle trace shows the diode turned on, and the lower trace shows the diode shorted.

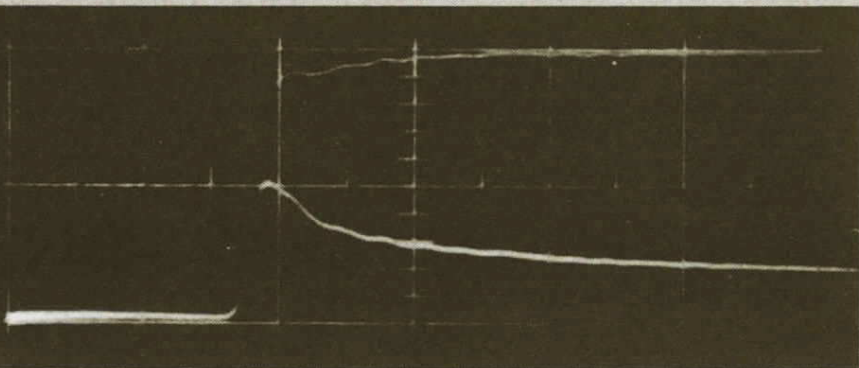


2 nsec/cm

Diode Recovery-Time Characteristics



In the typical diode turn-on waveform, the upper trace is the input pulse alone and the lower trace shows the effect of diode turn-on.



2 nsec/cm

Diode Turn-On Characteristics

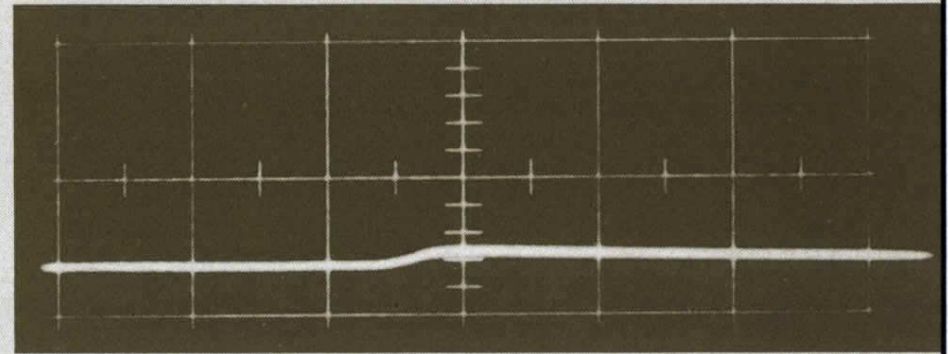
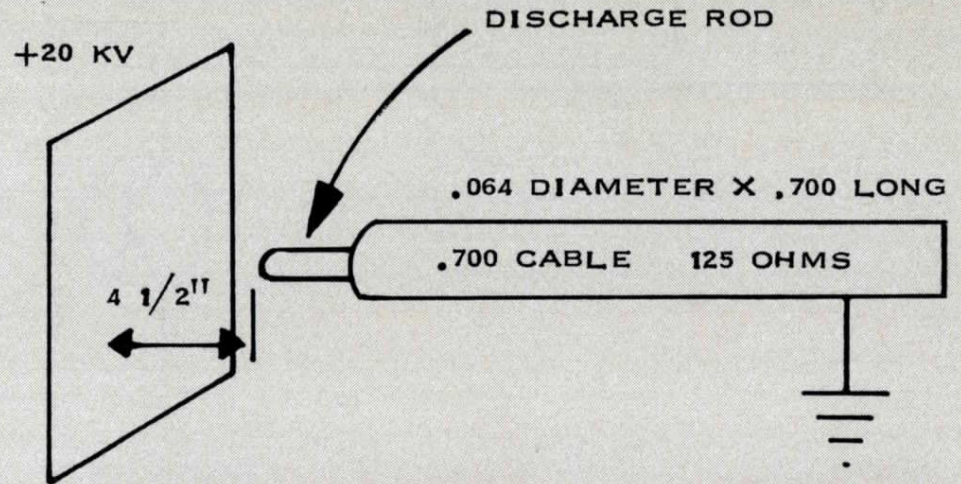
RANDOM HIGH VOLTAGE CORONA DISCHARGE

The random repetition rate was measured as 2300 pps average by the following substitution method:

(1) connect the anode of a semiconductor diode to the + GATE OUT connector and the cathode to a grounded 0.5 microfarad capacitor, then measure the dc produced with the Type 519 triggered by the corona;

(2) switch the oscilloscope triggering to the RATE GENERATOR and select the appropriate rate to produce the same dc output;

(3) read the average signal repetition rate from the CYCLES/SEC and MULTIPLIER controls on the front-panel.

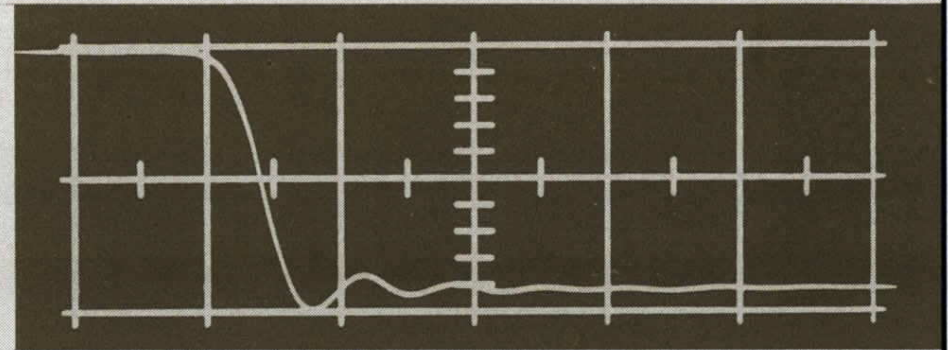


5 nsec/cm

Rapid Rise Produced in Corona Discharge

CIRCUIT DESIGN

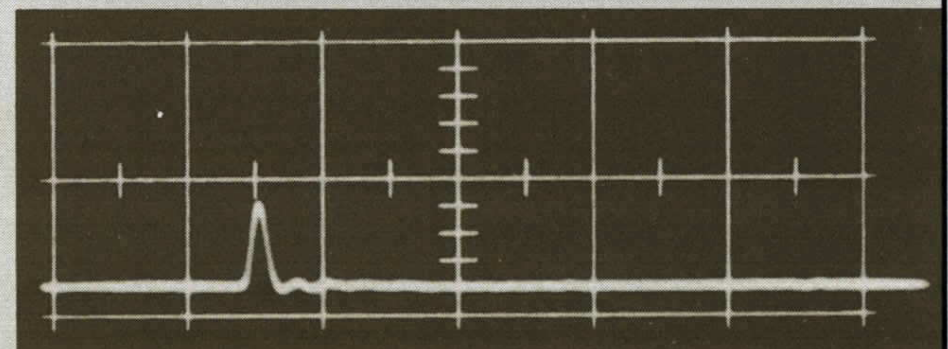
The Type 519 is an invaluable tool for testing active or passive wideband circuits. In the wideband amplifier waveform, little or no correction is necessary for the inherent risetime of the oscilloscope.



5 nsec/cm

Wideband Amplifier Transient Response

Passive network measurements frequently demand the full risetime and bandwidth capabilities of the instrument. The wideband transformer waveform illustrates 1.8 gigacycle ringing in response to a test impulse.



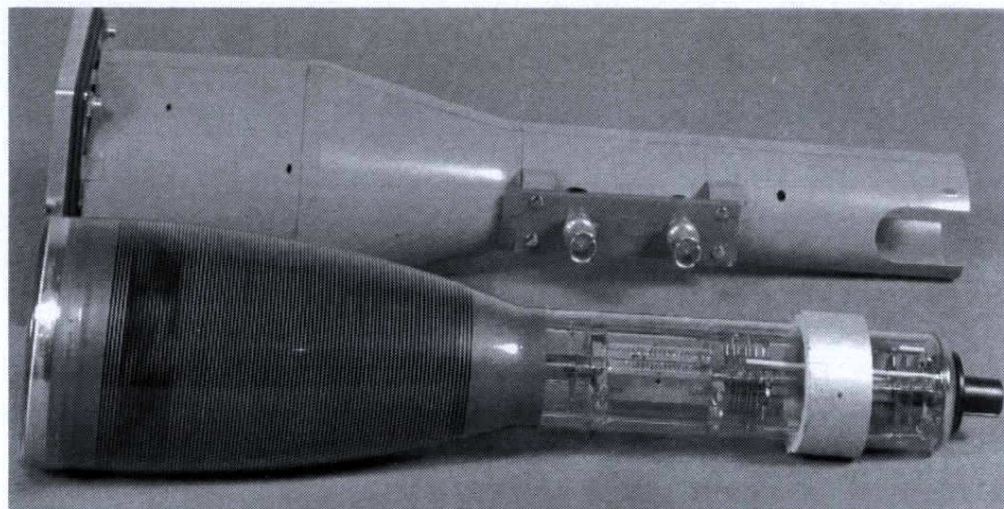
5 nsec/cm

Wideband Transformer Impulse Response

Calibration-Step Generator—A step-waveform of approximately 750 cps, continuously variable and calibrated from 0 to 10 volts into 125 ohms, or 0 to 1 volt into 50 ohms through a T50/T125 adapter, is available at a front-panel 125 ohm connector. Risettime is approximately 0.1 nsec and either positive or negative polarity can be selected. Continuously variable uncalibrated amplitudes of 0 to 50 volts into 125 ohms are also available. The step-waveform can be used to drive a device under test or check the sensitivity and transient response of the oscilloscope itself.

OTHER CHARACTERISTICS

Tektronix Cathode-Ray Tube—A metallized, flat-faced precision tube, with a fine-grain P11 phosphor, provides a spot diameter of 0.004 inch at normal intensity. Accelerating potential is 24 kv. Tube construction completely prevents any possible x-ray hazard. Usable viewing area is 2 x 6 cm. Rotational alignment of trace to graticule is by front-panel screwdriver adjustment.



Distributed-Deflection CRT and Close Fitting Magnetic Shield

Shielded Construction—Electrostatic and electromagnetic shielding minimize disturbance of spot by power transformers and other hum sources.

Graticule—The graticule is accurately marked in 6 horizontal and 2 vertical 1-centimeter divisions. The horizontal centerline markings are 5 millimeters apart, vertical centerline markings are 2 mm apart. Illumination is controlled by a front-panel knob. The graticule drops out of view if desired.

Camera Mounting—Provision is made for quick, convenient mounting of a Tektronix Camera. The Type C-19 Camera is recommended for single-shot photographs. Hinge fittings allow the camera to swing away from the crt screen when not in use.

A 6.3 volt source is available at the front-panel for use with a projected-graticule accessory. When this source is used, the oscilloscope SCALE ILLUM control and graticule lights are automatically disconnected and a virtual-image graticule is projected on the face of the crt. See Camera Section for complete description of C-19 Camera. *Camera must be mounted on bezel supplied with 519.*

Regulated Power Supply—Electronically-regulated dc supplies assure stable operation over line variations between 105 and 125 volts or 210 and 250 volts, 50 to 60 cycles.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 650 watts.

Mechanical Specifications—Dimensions are 22 1/4" high by 14 5/8" wide by 25 1/4" deep. Net weight is 99 3/4 pounds. Shipping weight is 126 pounds, approx.

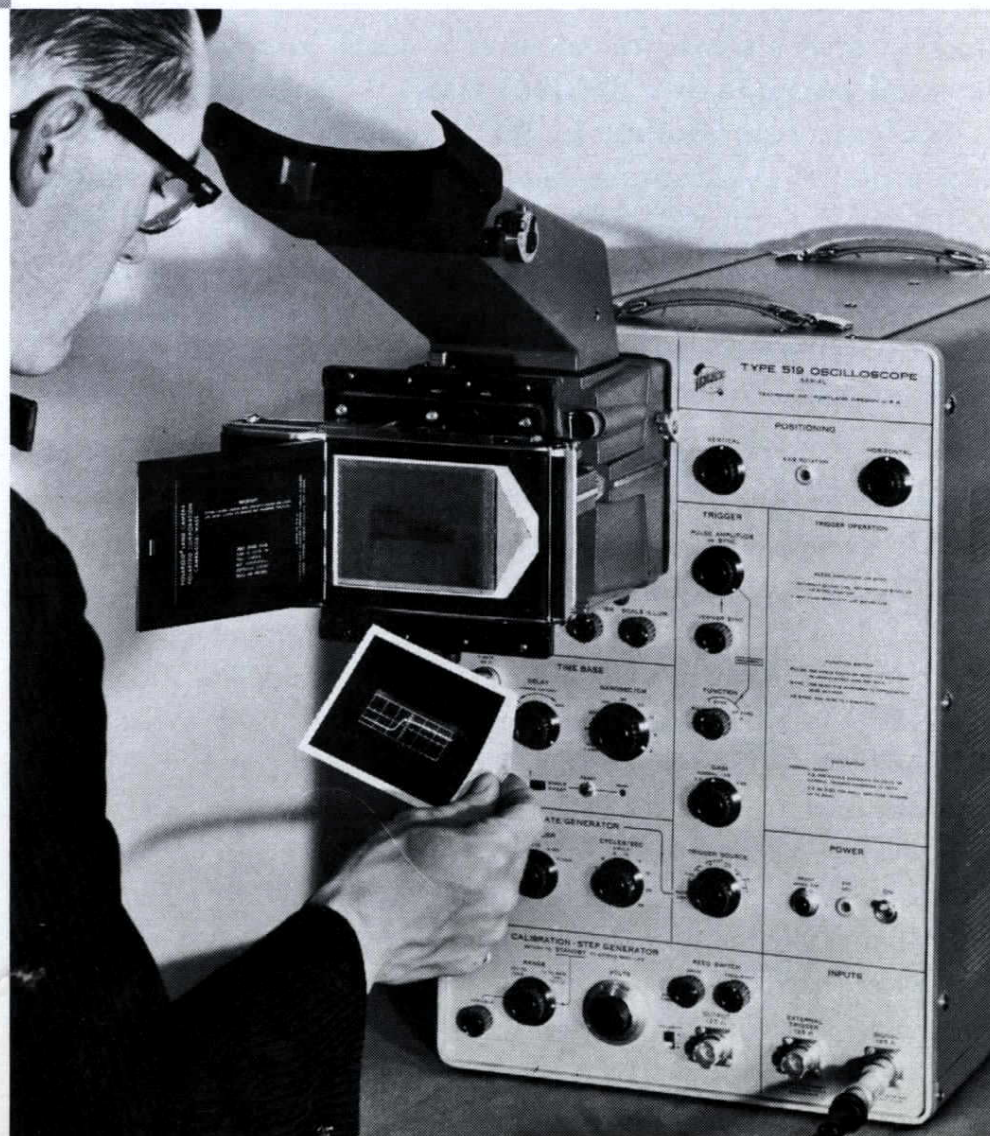
TYPE 519 OSCILLOSCOPE \$3900

Each instrument includes: 1—125-Ω termination, 1—adapter T50/T125, 2—125-Ω insertion units, 1—adapter N50/N125, 1—adapter T50/N125, 1—125-Ω coupling capacitor, 1—125-Ω 1KMC timing standard, 1—125-Ω 1-nsec delay cable, 1—125-Ω 2-nsec delay cable, 1—125-Ω 5-nsec delay cable, 1—125-Ω 10-nsec delay cable, 1—delay line equalizer, 1—double button assembly, 1—panel adapter assembly, 1—125-Ω cable connector, 2—reed switches, 1—viewing hood (includes attached bezel), 1—3-wire power cord, 2—instruction manuals.

OPTIONAL ACCESSORIES

Accessory	Part No.	Price
125-Ω 2:1 attenuator	017-048	\$25
125-Ω 5:1 attenuator	017-049	\$25
125-Ω 10:1 attenuator	017-050	\$25
125-Ω N50/T125 adapter	017-054	\$17.50
125-Ω 90° elbow assembly	017-043	\$15
125-Ω 20-nsec cable	017-511	\$24

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



Type 524AD TELEVISION 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—35 nsec risetime.

Sweep Range

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

Time Markers

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

Sweep Delay

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

DC-Coupled Unblinking

Variable Duty-Cycle Amplitude Calibrator



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

Frequency Specifications are at 3-db down

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. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X probe. 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 35 nsec and the input impedance is 1 megohm paralleled by approximately 45 pf.

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 pf.

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

HORIZONTAL DEFLECTION SYSTEM

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

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

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 $1\frac{1}{2}$ 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. Accuracy is within ~~10%~~ 7%. 11-12-62

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

Amplitude 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, $1.0 \mu\text{sec}$, $0.1 \mu\text{sec}$, and $0.05 \mu\text{sec}$. Since H is $63.5 \mu\text{sec}$, 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.



524AD

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.

4-60 CPS Sweep—A 4-60 cps sweep with variable amplitude and phasing through approximately 150° aids in making bandwidth measurements with a video-sweep generator.

Cathode-Ray Tube—A flat-faced cathode-ray tube with a 4-kv electronically-regulated accelerating potential is used in the Type 524AD. A P1 phosphor is normally supplied.

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.

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

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 500 watts.

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

Mechanical Specifications—Dimensions are 16 3/4" high by 13" wide by 25" deep. Net weight is 61 pounds. Shipping weight is 80 pounds, approx.

TYPE 524AD OSCILLOSCOPE \$1300

Each instrument includes: 1—10X attenuator probe, 2—binding-post adapters, 1—viewing hood, 1—3-conductor power cord, 1—green filter, 2—instruction manuals.

RACK MOUNT ADAPTER

Rack Mount Adapter for the Type 524AD Oscilloscope consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular panel. Rack height requirement is 17 1/2".

Order Part Number 040-281 \$45

SCOPE-MOBILE® CARTS

TYPE 202 SCOPE-MOBILE CART \$85.00

TYPE 204 SCOPE-MOBILE CART \$99.50

TYPE 500A SCOPE-MOBILE CART \$99.50

See Accessory Section for complete information.

CATHODE-FOLLOWER PROBE

The P500CF Cathode-Follower Probe has input impedance of 40 megohms paralleled by 4 pf and gain of 0.8 to 0.85. With 10X attenuator head, input impedance is 10 megohms paralleled by 2 pf. Amplitude distortion is less than 3% on unidirectional signals up to 5 v.

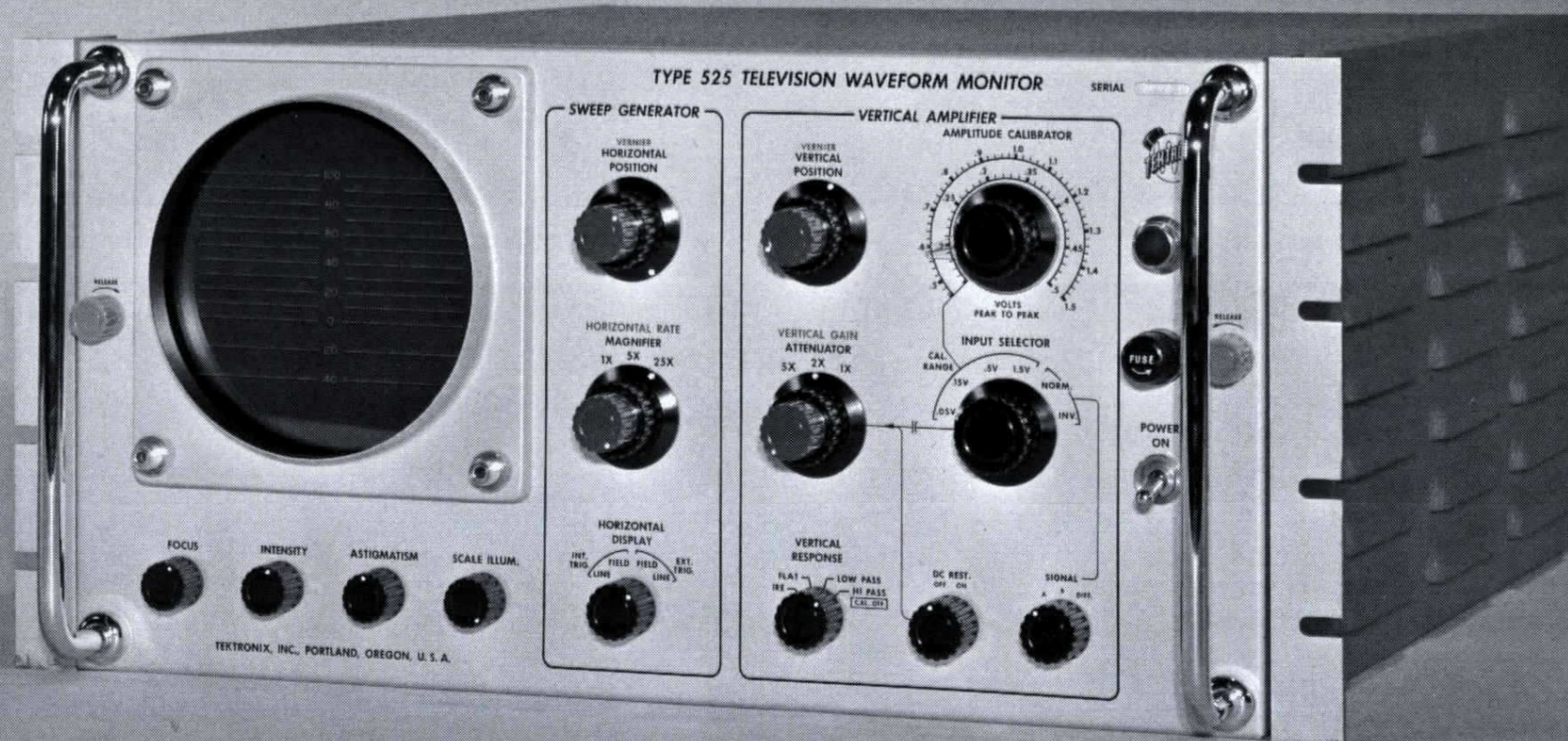
Order Part Number 010-109 \$64

Please refer to Accessory Section for 75-ohm coaxial cables, attenuators, and terminating resistors.

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



TELEVISION WAVEFORM MONITOR Type 525



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 new 1958 Standard 23S-1.

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%

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

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

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

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

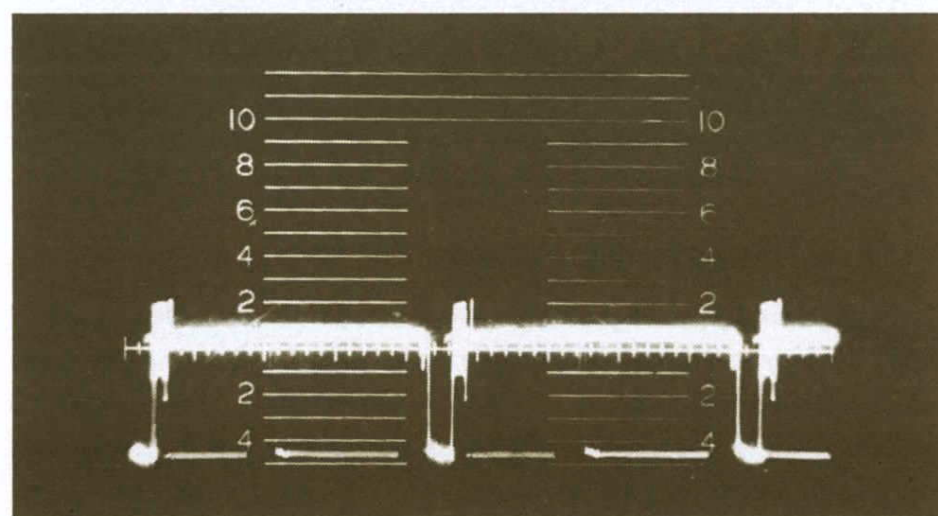


Fig. 1—Horizontal-synch pulse with color burst—Flat vertical response.

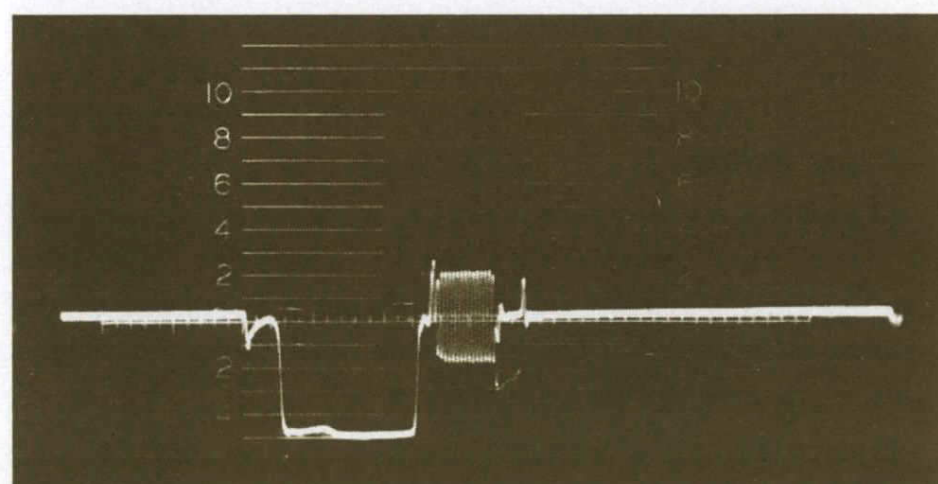


Fig. 2—Same as Fig. 1 with sweep magnified 5 times.

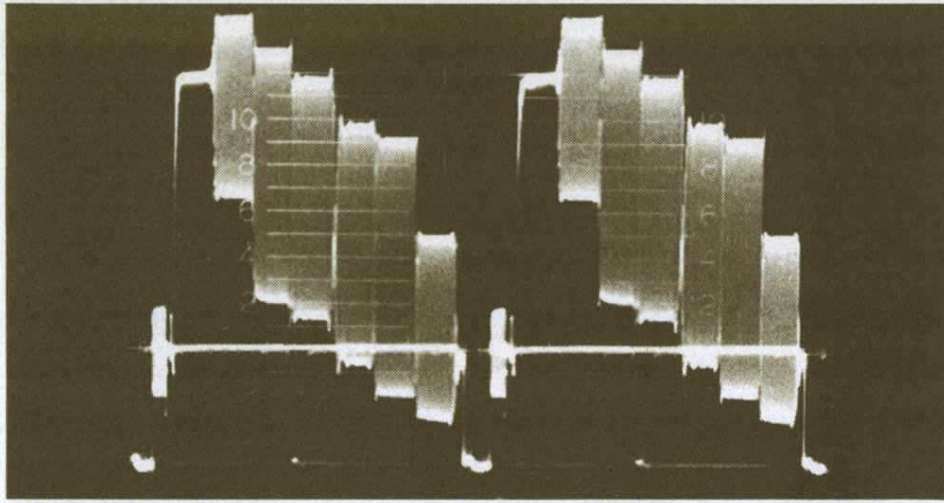


Fig. 3—Color-bar waveform with FLAT vertical response.

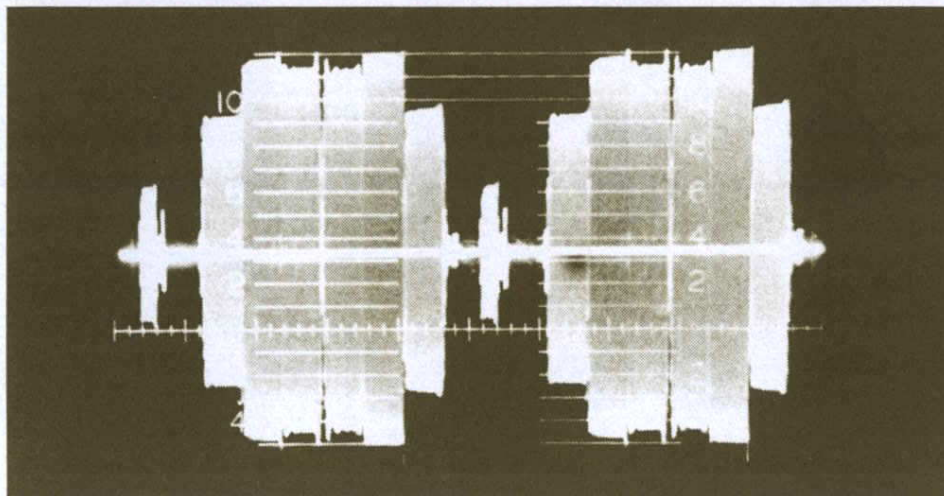


Fig. 5—Fig. 3 waveform with HIGH-PASS response.

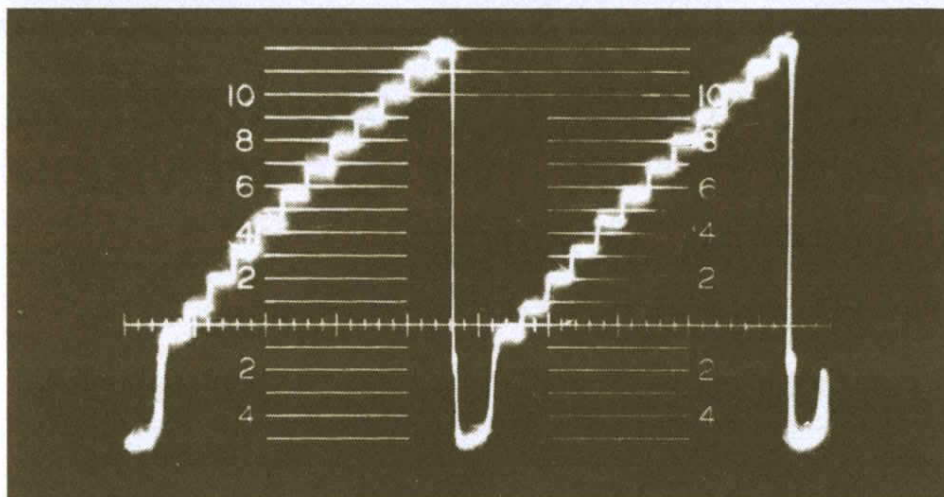


Fig. 7—Same waveform as Fig. 6 with LOW-PASS response.

VERTICAL DEFLECTION SYSTEM

Frequency Response—A response selector switch selects any one of four characteristics: IRE, meets new 1958 Standard 23S-1; 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 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-tele-

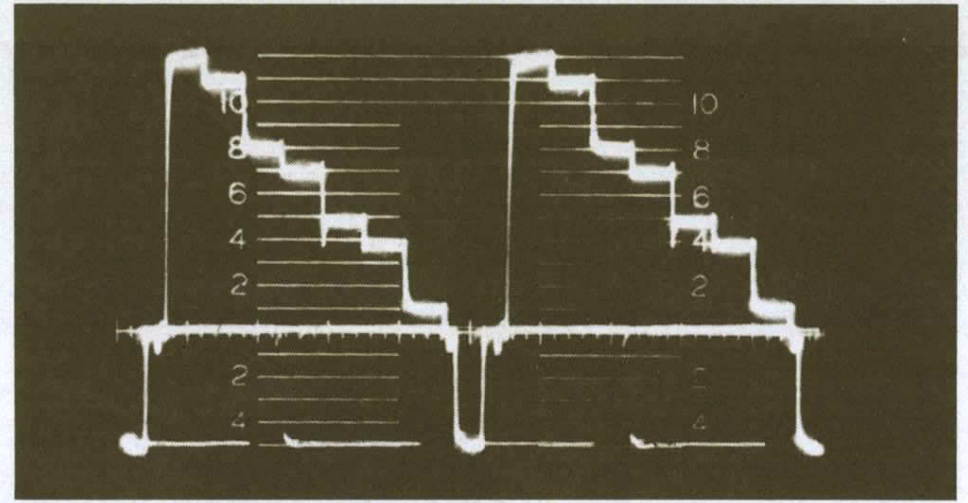


Fig. 4—Same waveform as Fig. 3 with LOW-PASS response.

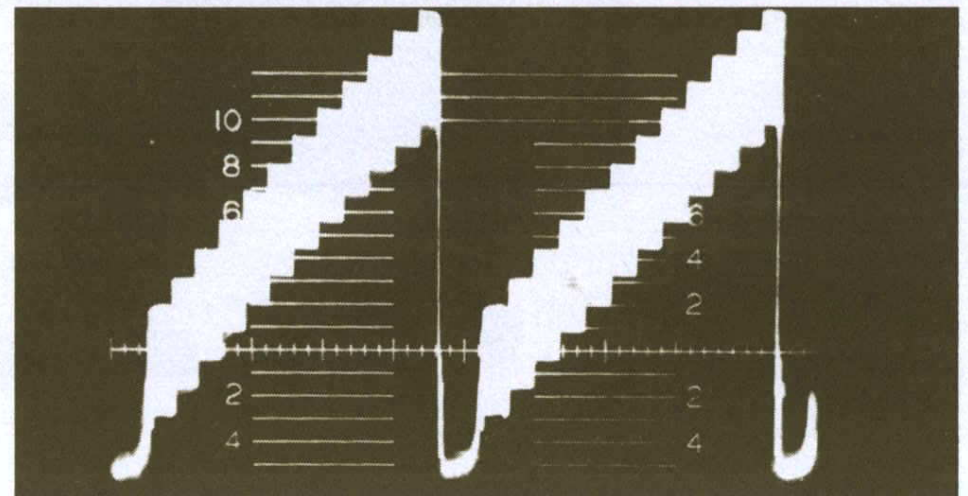


Fig. 6—Staircase with 3.58 mc added—FLAT vertical response.

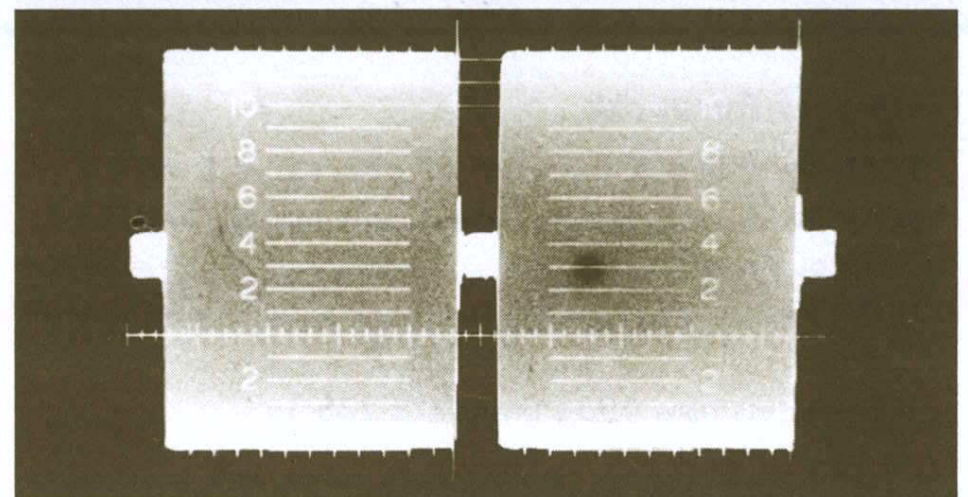


Fig. 8—Fig. 6 waveform with HIGH-PASS response.

vision 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 Tektronix crt used in the Type 525 is a precision 5" flat-faced tube with a helical post-accelerating anode. It provides 8 cm of linear vertical deflection. A 4-kv accelerating potential provides a bright trace. A P1 phosphor is normally supplied.

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.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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

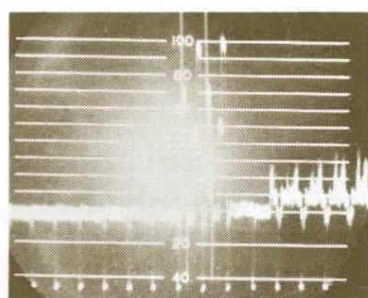


Fig. 9—Two-line test signal displayed at field sweep rate with 25-times sweep magnification. Vertical amplifier is set at FLAT response. (flat from 60 cycles to 5 mc).

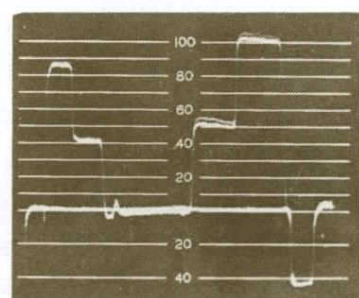


Fig. 10—Same test signal displayed with intensifier turned on. Sweep duration 60 μ sec at line rate, vertical amplifier set at FLAT response.

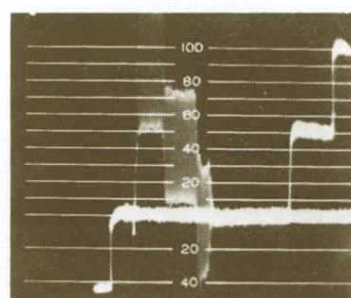


Fig. 11—Same test signal displayed with vertical amplifier switched to LOW PASS response. Sweep duration 70 μ sec at half the line rate.

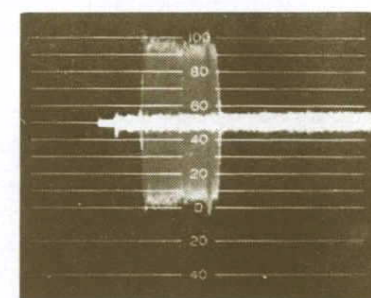


Fig. 12—Cross-modulation check—same test signal displayed with vertical amplifier switched to HIGH PASS response. Shows relative amplifications at three luminance levels.

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 by sliding the monitor partly out of the case.

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.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 380 watts.

Mechanical Specifications—Dimensions are 8 $\frac{3}{4}$ " high by 19" wide by 21" deep. Net weight is 54 $\frac{3}{4}$ pounds. Shipping weight is 78 pounds, approx.

TYPE 525 OSCILLOSCOPE \$1140
Each instrument includes: 1—3-conductor power cord, 2—terminating resistors, 1—green filter, 2—instruction manuals.

Type 525 With Intensifier

This model is equipped with intensifier for vertical-blanking-interval test signal. Additional circuitry provides for displaying the two or three lines of the vertical blanking interval that are used to carry transmission test signals. The cathode-ray tube is unblanked only during the test-signal period. Sweep speed is automatically increased to a maximum sweep duration of approximately 60 μ sec so that a single line of the test signal can be displayed over the full screen width. Sweep repetition rate is consequently increased to 15.75 kc for maximum brightness. The start of the unblanking period is adjustable between 13 and 21 lines after the beginning of the vertical blanking interval; thus including all lines suitable for carrying test signals.

TYPE 525MOD111 OSCILLOSCOPE ~~\$1185~~ ^{#1215}
Each instrument includes: 1—3-conductor power cord, 2—terminating resistors, 1—green filter, 2—instruction manuals.

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

11-12-62

Type 526 COLOR-TELEVISION VECTORSCOPE



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

Phase Resolution—Better than 0.1° 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

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.

PHASE MEASUREMENT

Phase measurements are made by demodulating the chroma signal with a subcarrier signal which can be 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.

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 complementary-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 $\pm 1^\circ$. Resolution is 0.1° at 3.58 mc, or 75 psec. A signal magnifier can be used to expand the vertical deflection approximately 5 times.

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.

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 μ sec of the linear sweep. During the 3- μ 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 compensated for 75-ohm loop-through operation. 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, $C=25$ pf).

External Subcarrier Input—High-impedance compensated loop-through connector for 75-ohm coaxial cable ($R=1$ megohm, $C=20$ pf). 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.

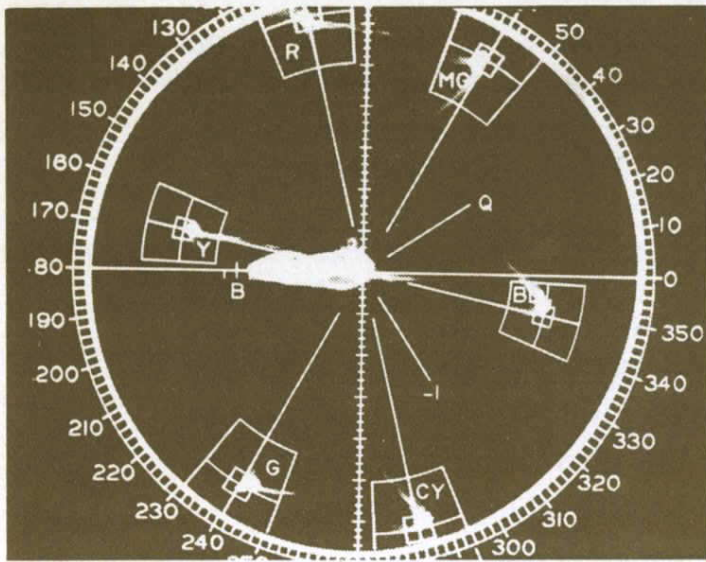


Fig. 1—Vector display of encoder output with 75% saturated color-bar test signal. Test-circle alignment with each other and with scribed graticule circle verifies accuracy of Vectorscope.

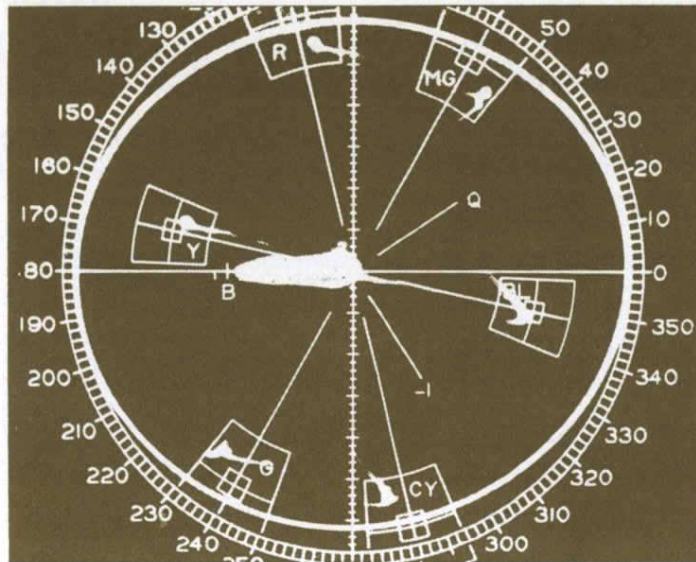


Fig. 2—Same as Fig. 1 except that Vectorscope amplifier-balance control is out of correct adjustment. Test-circle distortion indicates horizontal gain is greater than vertical gain.

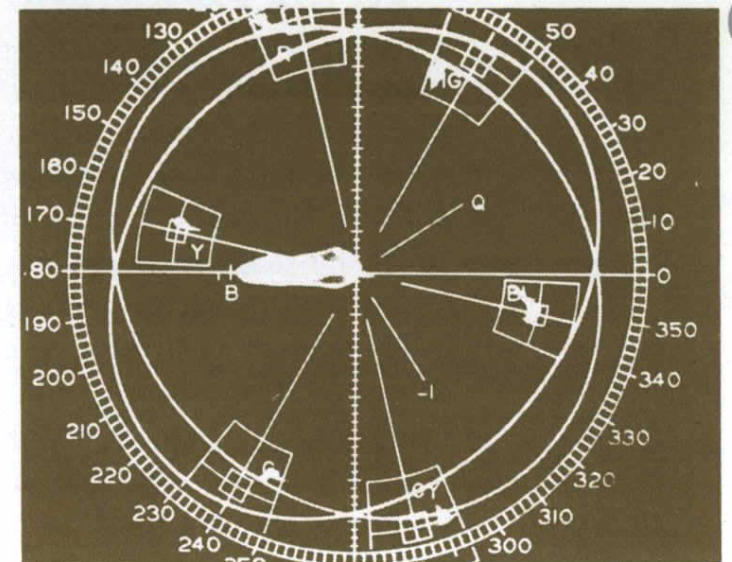


Fig. 3—Same as Fig. 1 except that Vectorscope quadrature control is out of correct adjustment, as indicated by the misalignment of the two test circles. Note red and magenta are displaced in opposite direction to green and cyan.

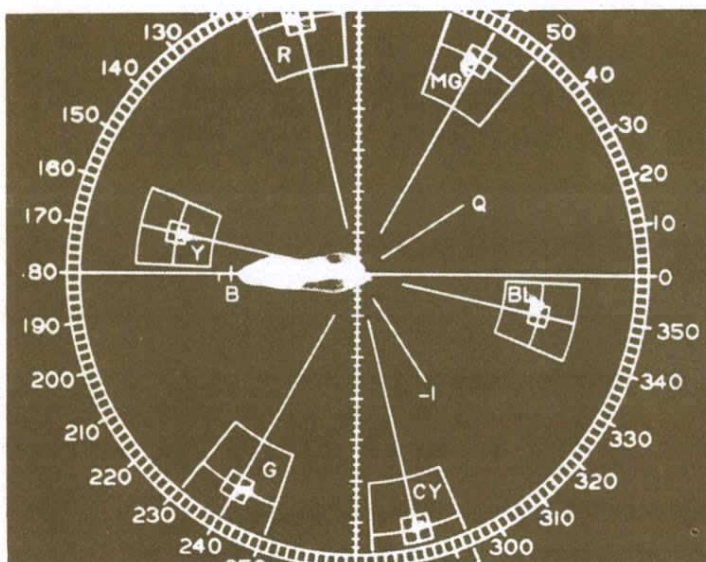


Fig. 4—Output of a well-adjusted encoder displayed on the Vectorscope. The test circle was turned off for this photograph.

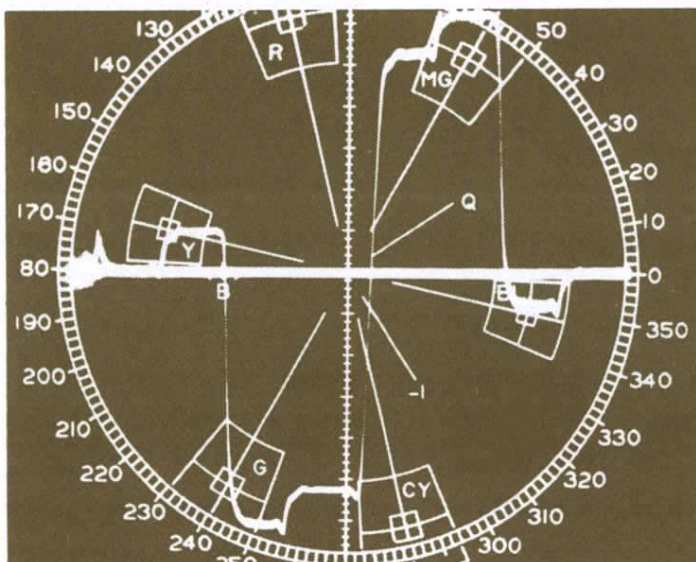


Fig. 5—Demodulated color-bar signal displayed on linear sweep. Burst packet at left end of trace is nulled out, indicating correct phasing of burst at 180°. The signal channel not in use provides a reference trace on the screen at zero signal level.

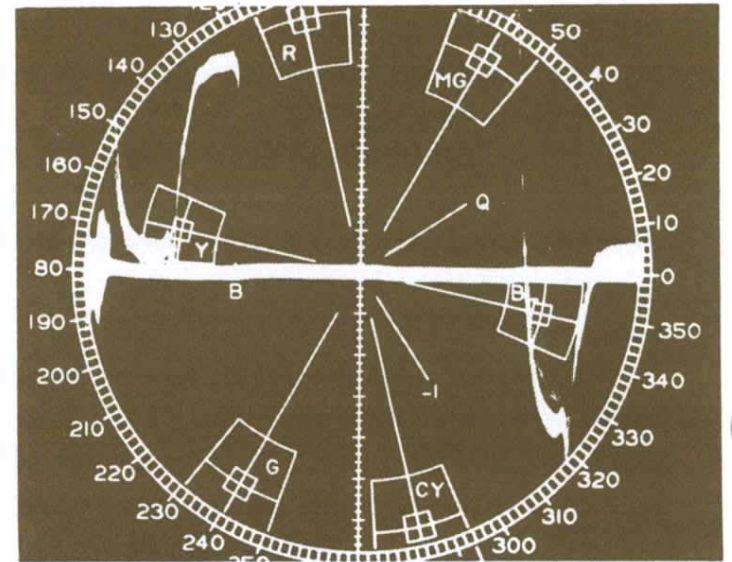


Fig. 6—Same signal as Fig. 5 with Vector vertical magnifier turned on. DC-Coupled system permits detection of subcarrier presence during black and white bars, indicated by departure from zero reference. Need for adjustment of encoder carrier balance is indicated.

Cathode-Ray Tube—The Type 526 uses a 5" flat-faced monoaccelerator tube with similar vertical and horizontal sensitivities, excellent linearity. Accelerating potential is 4 kv. A P1 phosphor is normally supplied.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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 or 210 and 250 volts.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 240 watts.

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—Dimensions are 8 3/4" high by 19" wide by 18" rack depth. Net weight is 45 1/4 pounds. Shipping weight is 75 pounds, approx.

TYPE 526 OSCILLOSCOPE \$1665

Each instrument includes: 3—75-ohm terminations, 1—3-conductor power cord, 1—pair guide rails, 1—green filter, 2—instruction manuals.

SUPPORTING CRADLES

Supporting Cradles—for rear slide support when the instrument is to be mounted in a backless rack. Two cradles with necessary mounting hardware.

Order Part Number 426-063 \$7.50

EXPORT MODEL

The Type 526 MOD 158B is engineered for the C.C.I.R. color subcarrier frequency of 4.4296875 mc/sec. The Precision Phase Shift dial reads directly in degrees at the C.C.I.R. frequency. All other specifications are identical to those for the Type 526.

TYPE 526 MOD 158B OSCILLOSCOPE \$1750

Each instrument includes: 3—75-ohm termination, 1—3-conductor power cord, 1—pair guide rails, 1—green filter, 2—instruction manuals.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

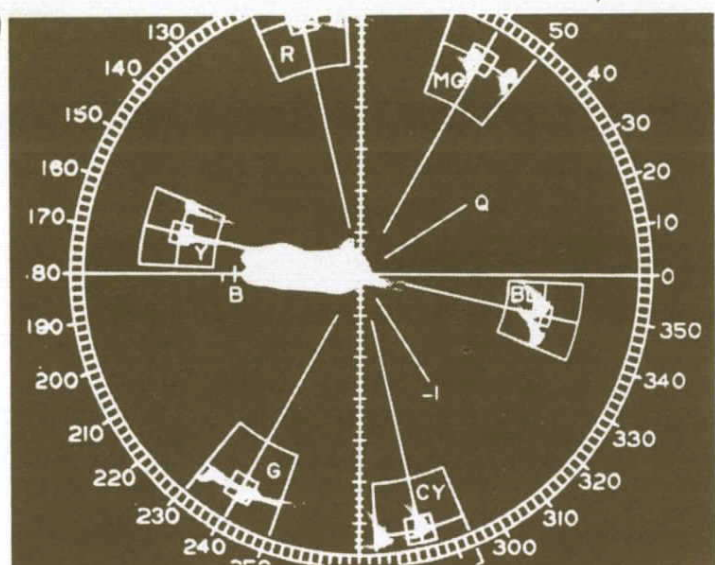


Fig. 7—Dual vector display. Electronic switching of Vectorscope inputs presents signals from two encoders for direct comparison measurements.

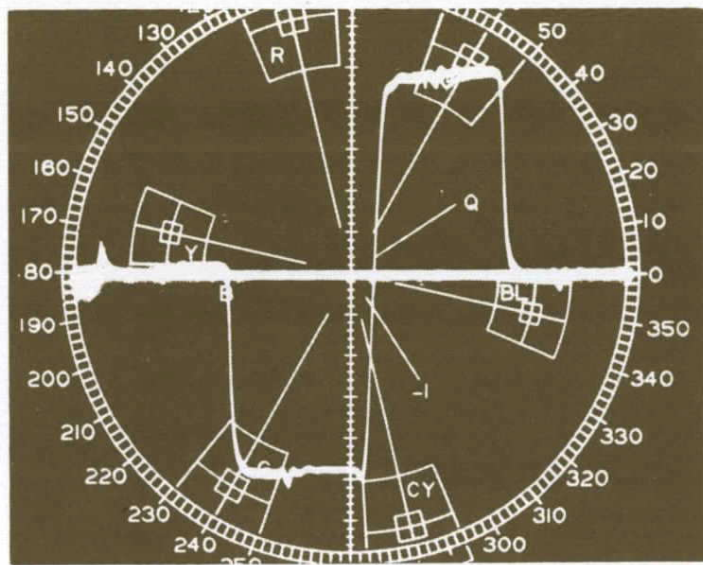


Fig. 8—Line-sweep display of same signals as in Fig. 7. Phase displacement is indicated by difference in amplitude. Note that burst packet from only one encoder is nulled out.

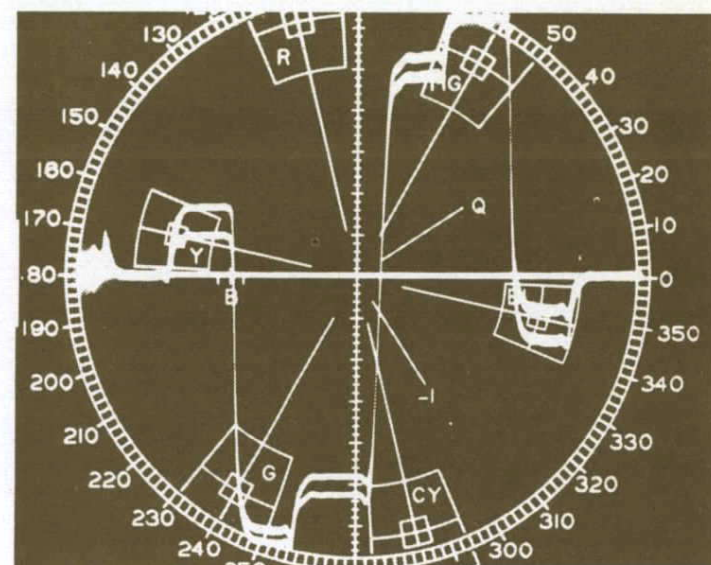


Fig. 9—With blue bar nulled out, its complement, yellow, should also be nulled out. Picture above indicates that either the encoder lacks complementary relationships, or that differential-phase distortion is restored when Y signal is removed, trouble is the latter.

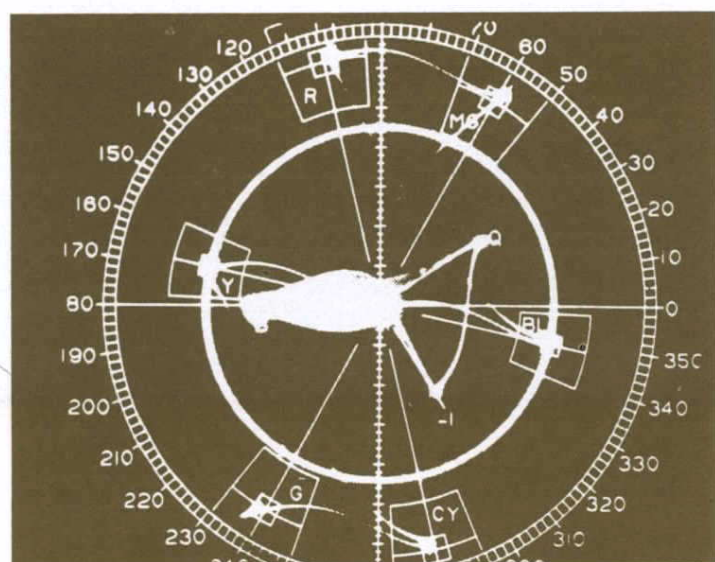


Fig. 10—Test circle adjusted to pass through blue also passes through yellow. If relative amplitudes change as Y signal is switched from off to on, differential-amplitude distortion is present.

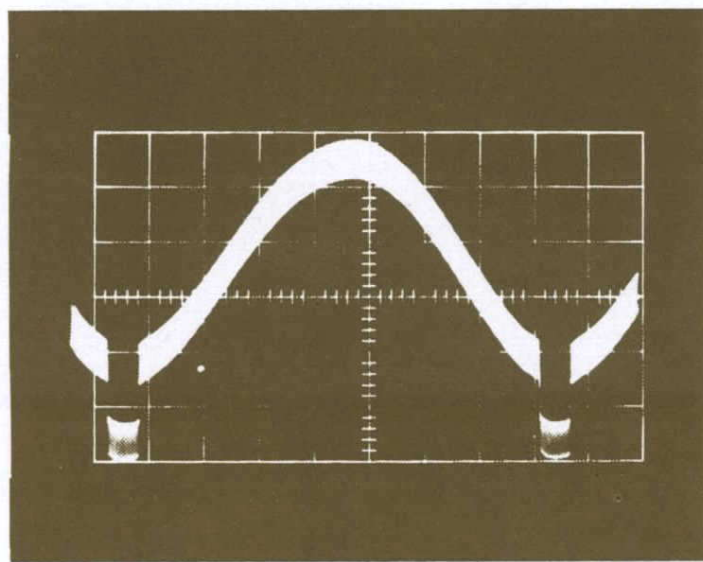


Fig. 11—Oscilloscope display of Bell Kelly Set test signal which is used to measure both differential-phase distortion and differential-amplitude distortion.

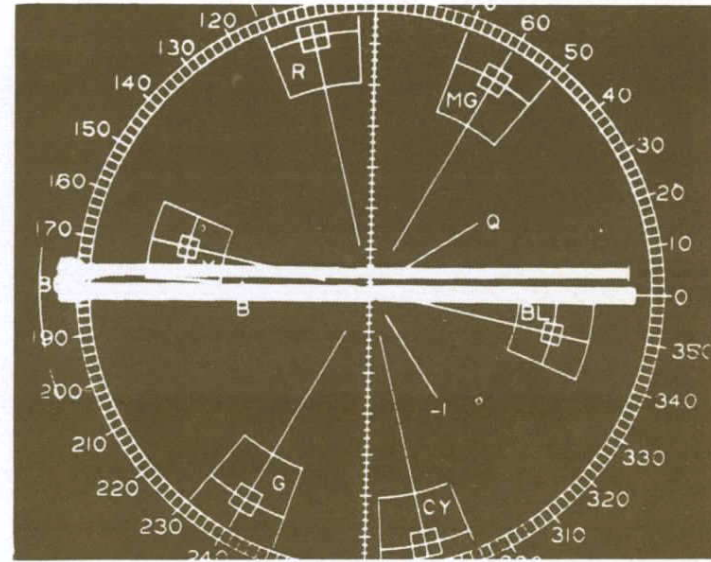


Fig. 12—Line-sweep display of same signal as in Fig. 11 fed directly into Vectorscope, with gain control at maximum and magnifier on. Lower line is reference, upper line is the phase-demodulated 3.58-mc information contained in signal. Lack of differential-phase distortion is evidenced by straight line.

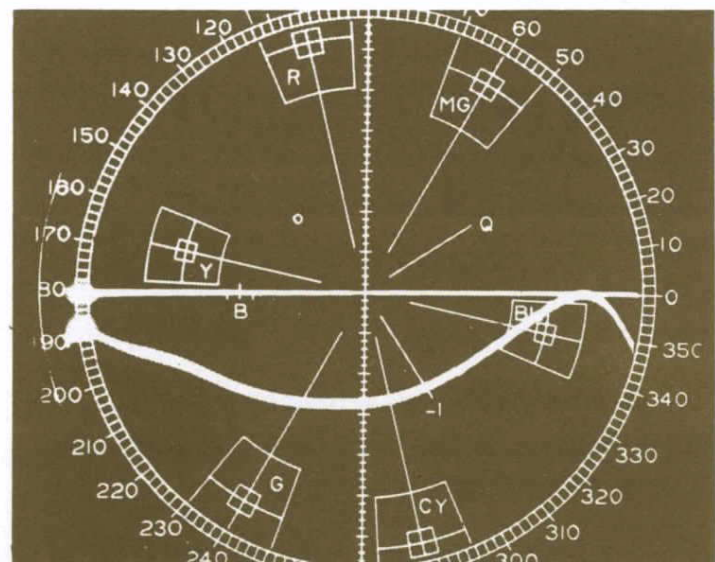


Fig. 13—Same conditions as in Fig. 12 except Bell Kelly Set signal has passed through an amplifier and Vectorscope gain is set at approximately half of maximum with magnifier turned off. Differential-phase distortion contributed by amplifier is measured at 3.1° with the precision phase control of the Type 526.

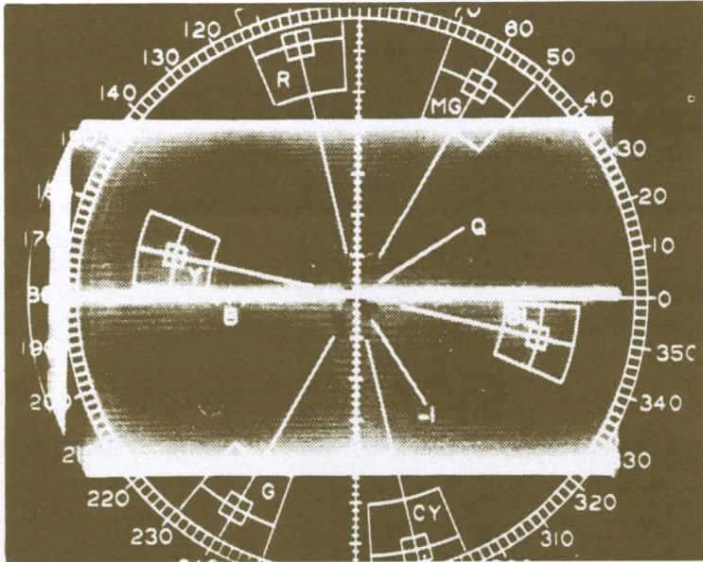


Fig. 14—Vectorscope line-sweep display of Bell Kelly Set signal with asynchronous demodulation (burst-controlled oscillator free running). Gain control is set at approximately half of maximum and magnifier is turned off. Lack of differential-amplitude distortion is evidenced by lack of variation in amplitude.

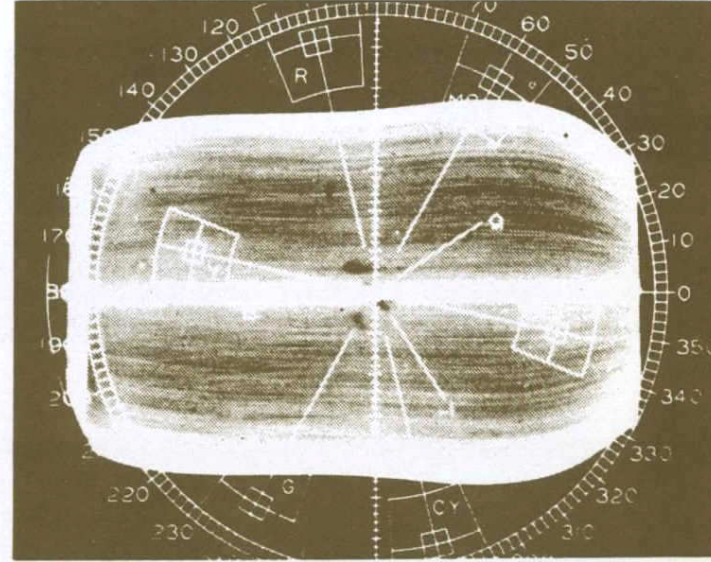
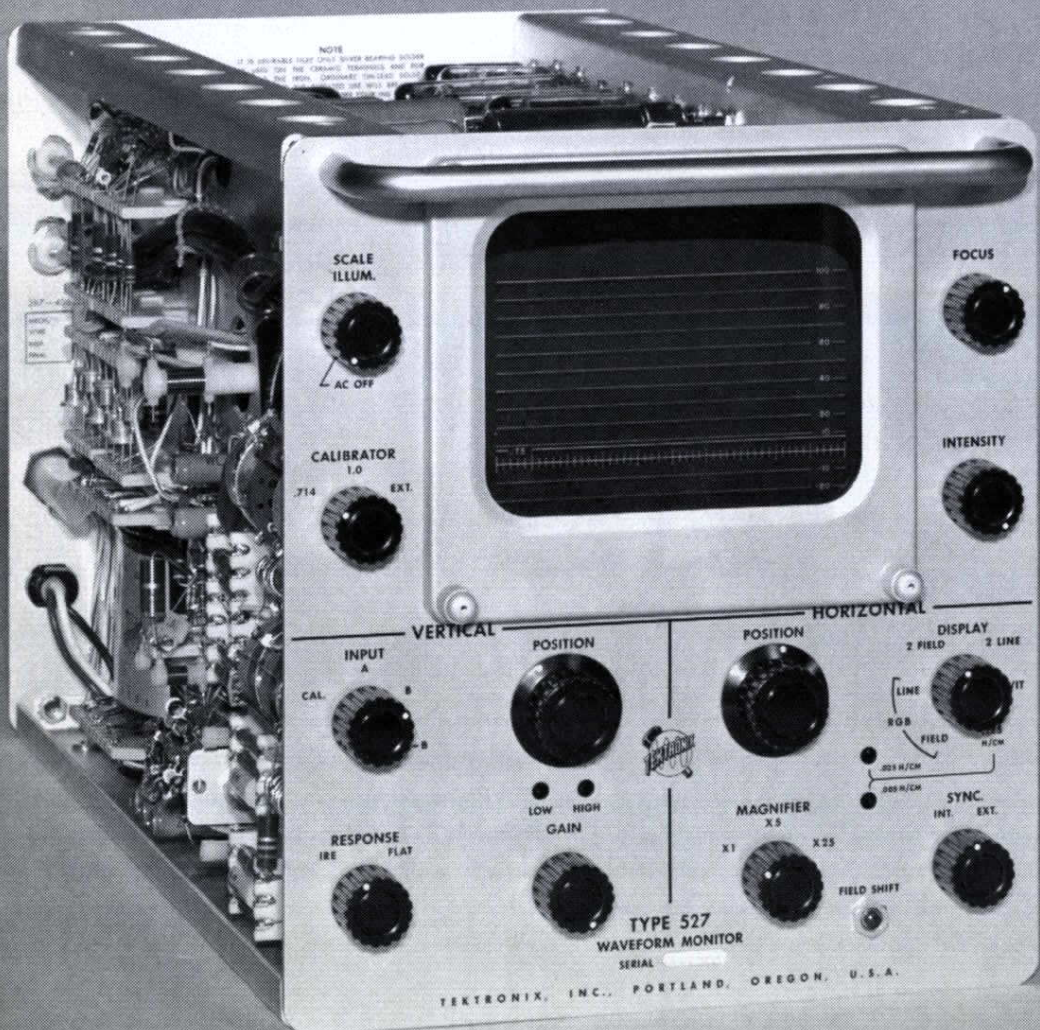
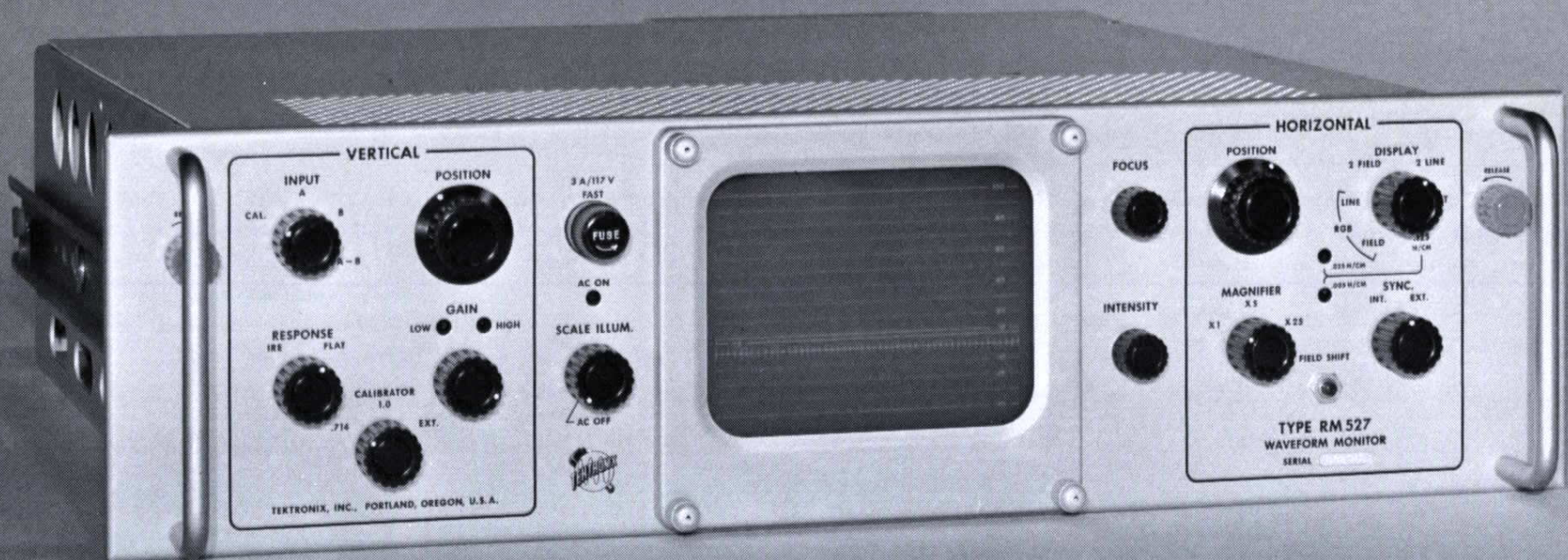


Fig. 15—Same conditions as Fig. 14 except signal has passed through an amplifier. Differential-amplitude distortion contributed by the amplifier is measured at 30% by using maximum amplitude as reference.

Type **527** TELEVISION WAVEFORM MONITOR

RM527



Frequency Response

Flat—within $\pm 1\%$ between 60 cycles and 5 mc.
IRE—new 1958 Standard #23S-1

Calibrated Sweeps

Eliminates need for time-markers.

Backporch DC Restoration

Internal Voltage Calibrator

0.714 v or 1.00 v peak-to-peak.

Space-saving Size

The Type 527 is a compact, easy-to-operate, precision, video-waveform monitor, built to meet the exacting demands of the TV-Broadcaster.

It displays and measures linearity, signal level, and bandwidth of both black-and-white and color television-signal waveforms with a high degree of accuracy and dependability.

A unique space-saving feature of the Type 527 is that two Type 527's, or two RM527's, or one Type 527 and one 8" commercial monitor, mount in a rack-space only 10½" high.

VERTICAL-DEFLECTION SYSTEM

Frequency Response—A response selector switch selects one of two characteristics: Flat, $\pm 1\%$, from 60 cycles to 5 megacycles; IRE, new 1958 Standard #23S-1 (3.58 mc is at -20 db).

Sensitivity—Variable from 0.25 volt, minimum, to 1.6 volts, maximum, for 140 IRE units (7 centimeters of vertical deflection).

Stability—All dc power supplies are electronically regulated to maintain stability and constant gain.

Linearity—Small-signal amplitude linearity of the vertical deflection system is within $\pm 1\%$.

D.C. Restorer—A unique feedback dc-restorer circuit, not a signal clamp, stabilizes the blanking pulse backporch at a constant level on the crt despite changes in signal amplitude or average luminance. The dc-restoration time constant is sufficiently long so hum and tilt in the video signal will be displayed. This circuit eliminates dc drift of the vertical amplifier, making it unusually stable. There is no distortion, clipping, or degradation of the color-burst signal. The presence of the color-burst does not cause the base-line to shift.

Video Input—A four-position switch permits selection of one of four input signals; Calibrator, A, B, or the balanced input A-B.

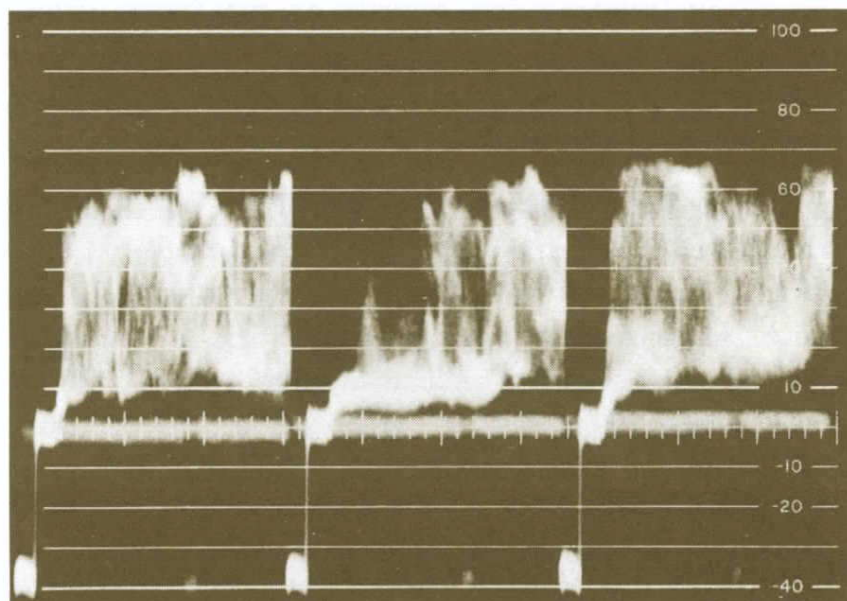
Two bridged 75- Ω compensated signal inputs are provided. Input impedance is never less than 1 megohm. Differential (balanced) input can be used and floating-input operation is possible.

The inputs are designed for high-impedance loop-through operation on 75-ohm lines. In the loop-through mode, the 20-pf input capacitance is inductively compensated for 75-ohm systems. High-impedance bridging mode can be achieved, with an input capacitance of 50 pf.

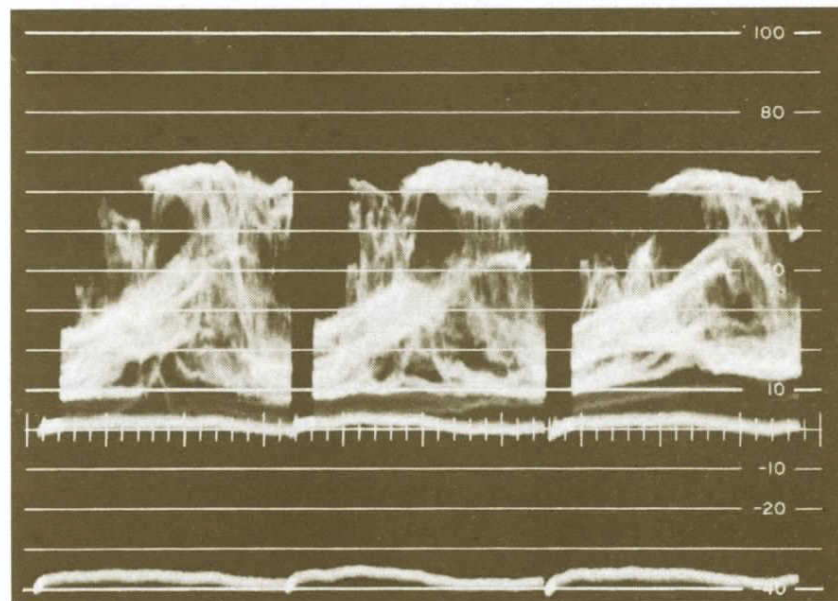
HORIZONTAL-DEFLECTION SYSTEM

Calibrated Sweep—Calibrated sweep speeds of 0.125 H/cm, 0.025 H/cm (with 5-x magnifier), or 0.005 H/cm (with 25-x magnifier), provide a simple and accurate means for measuring the various pulse widths. The triggered "Miller run-down" time base is dc coupled to the crt. The magnifier circuit provides X5 or X25 expansion of any portion of the time base with an accuracy of $\pm 2\%$. Any portion of the TV line can be magnified for detailed study. This accurate sweep rate feature eliminates the need for Z-axis time-marks, with a consequent reduction in instrument complexity.

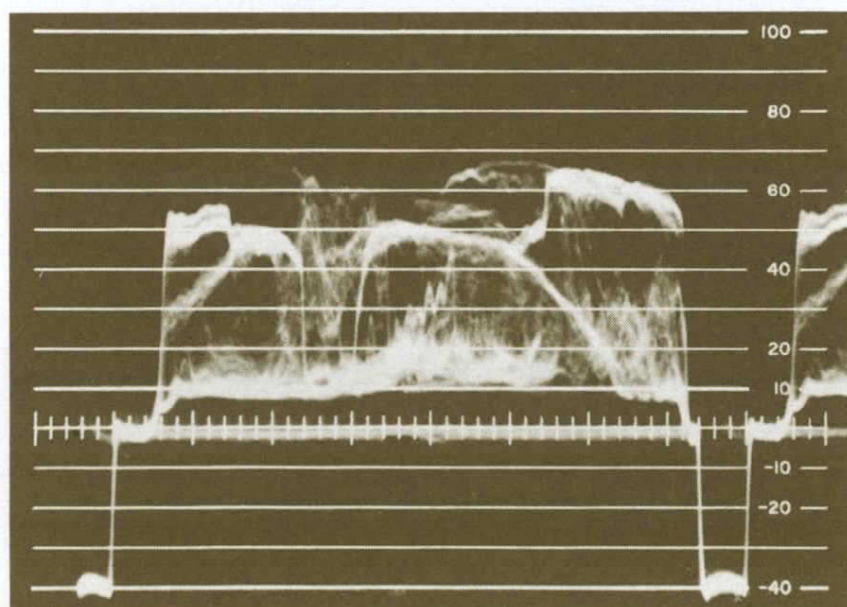
Neon lamps indicate the selected sweep rates when magnifier is used.



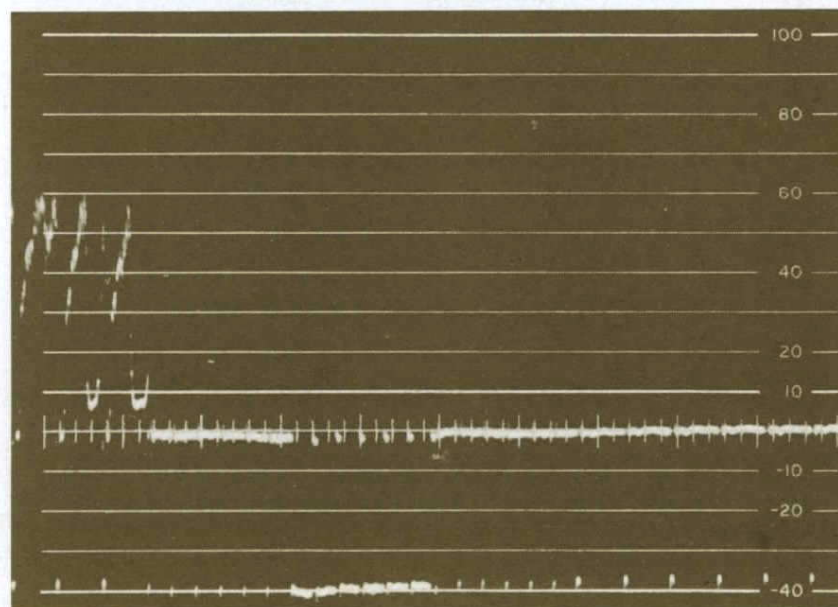
RGB Line position. One line each of the red, green, and blue camera signals from a color processing amplifier.



RGB Field position. One field of red, green, and blue camera signals from a color processing amplifier.



2 Line Display position. Display shows approximately 1-1/3 lines at $\frac{1}{2}$ the line rate. Taken at X1 mag.



2 Field Display position with X25 mag shows details of vertical blanking pulse.

527 RM527

Horizontal Display—A six-position switch permits selection of any one of the following displays:

2 LINE—Displays approximately $1\frac{1}{3}$ lines at $\frac{1}{2}$ the line rate.

2 FIELD—Displays approximately $1\frac{1}{3}$ fields at the frame rate. A Field Shift push-button allows display of odd or even fields.

VIT—Displays, at the field rate, the portion of the vertical blanking pulse which may contain vertical-interfield test signals. The field-rate display will show the $\frac{1}{2}$ -line transposition of horizontal sync pulses due to interlace.

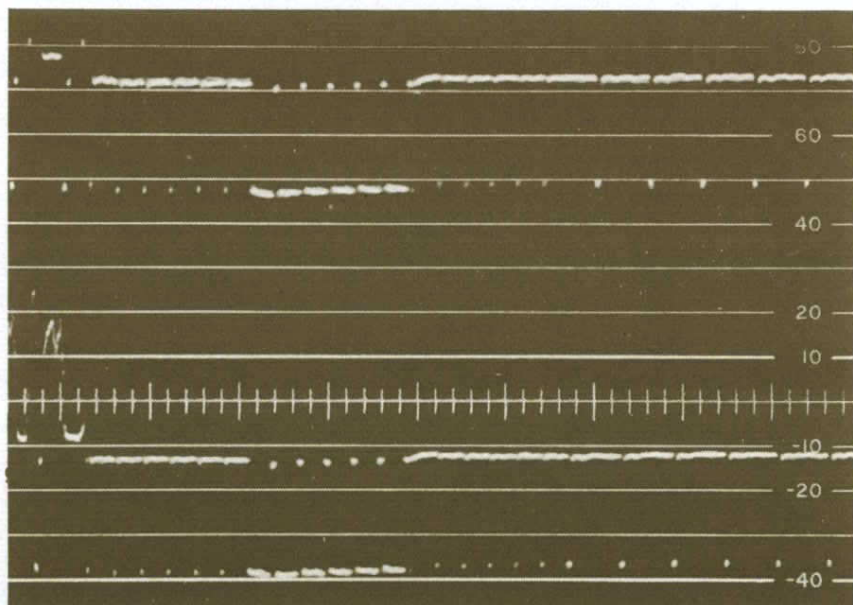
.125 H/CM—When the Display Switch is set to .125 H/CM, one TV line occupies exactly 8.0 cm and is thus self-checking.

RGB LINE and FIELD—The RGB Line or Field positions are used in conjunction with color processing amplifiers which can provide sequential red, green, and blue camera signals to the Type 527 as video input. These signals are switched at the field rate. A 20 cps, 3-step, staircase switching signal of up to 20 volts overall amplitude, from the processing amplifier, is applied to the horizontal amplifier in the Type 527 for displaying RGB signals side-by-side on the crt.

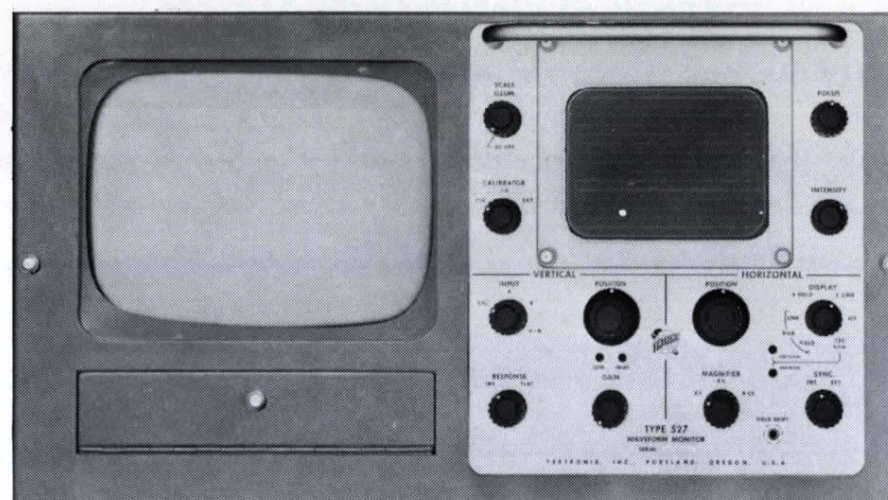
The RGB Field display provides a display at the TV field rate. The RGB Line, a display at the TV line rate. A small portion of the total signal will be missing due to retrace-time considerations.

Sync Separator—The sync separator supplies line-rate or field-rate triggers for the sweep generator from composite video signals.

Internal-External Sync—A front-panel switch allows selection of either internal or external sync sources.



Displays of the odd field and even field vertical blanking pulse at X25 magnification. Pushbutton Field Shift switches the display to alternate field (double exposure).



Type 527 with Commercial Picture Monitor.

OTHER FEATURES

Vertical Amplifier Calibrator—A three-position switch permits choice of a 25-kc square-wave calibration pulse of 0.714 v, or 1.00 v, peak-to-peak, or external calibration input. A temperature-compensated zener diode provides long-term accuracy of $\pm 1\%$ over the normal range of temperatures.

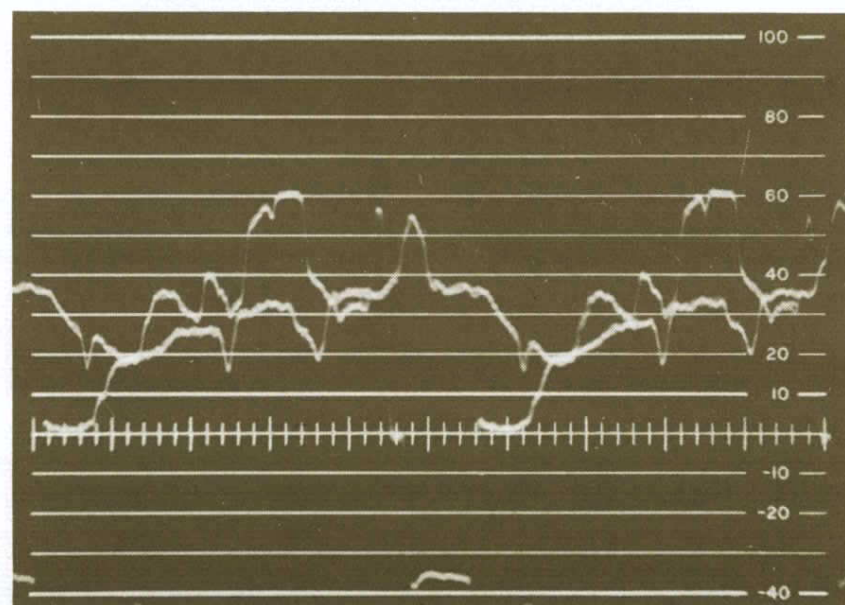
0.714 volt corresponds to 100 IRE units on a 1.00 volt composite video signal. The 1.00 volt level is useful with 1.4 volts composite video signals and 1.00 volt non-composite video signals.

Due to the operation of the dc-restorer circuit, the bottom portion of the internal calibration pulses remain at the same IRE level on the crt as the video blanking pulses.

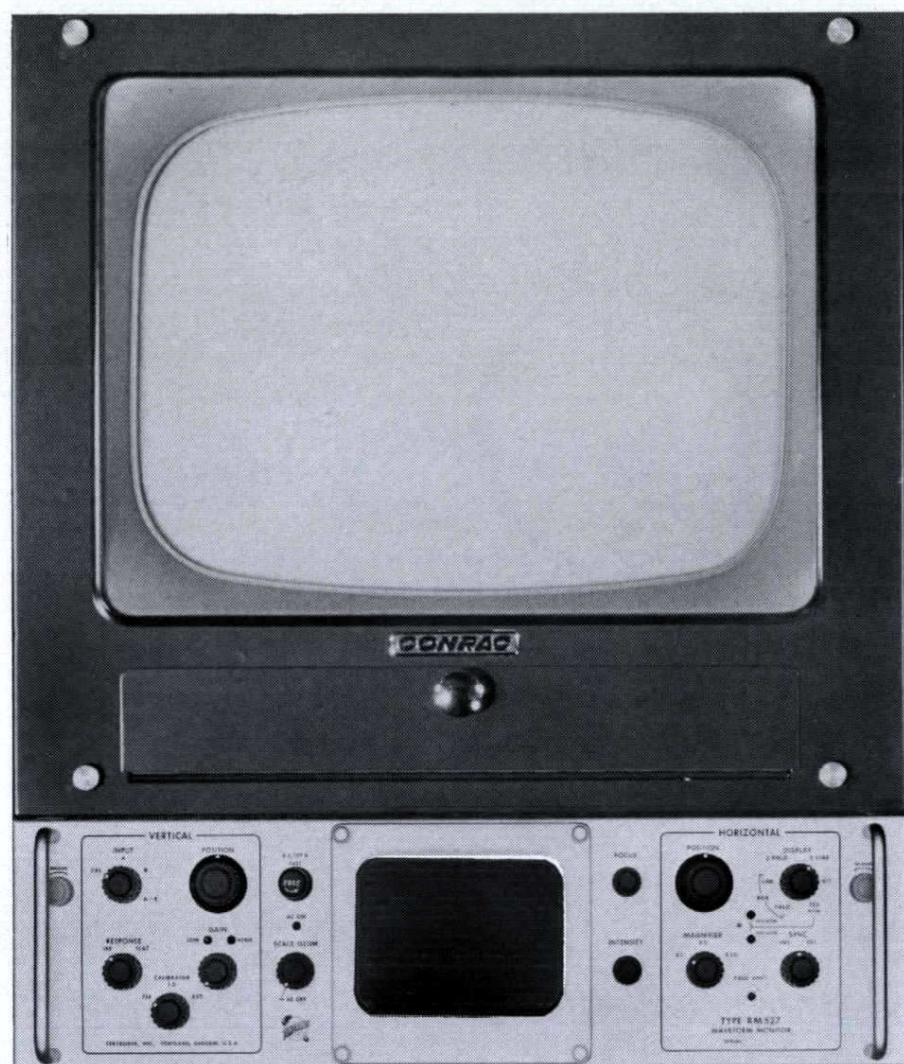
The vertical position control requires no adjustment in checking calibration.

Cathode-Ray Tube—The Tektronix designed and manufactured rectangular 5" (diagonal measure) monoaccelerator crt provides an exceptionally bright display. Accelerating potential is 4 kv. A P1 phosphor is normally supplied. The useful display area is 7 x 10 cm, the same as round 5" crts, while the rectangular shape permits the space-savings realized in these compact instruments.

Illuminated Graticule—A front-panel control adjusts illumination of the edge-lighted graticule.



V.I.T position of Horizontal Display switch. It is possible to range into the top of the picture and examine any one TV line near the top. Note alternate field line displacement of $\frac{1}{2}$ line (X25 mag.)



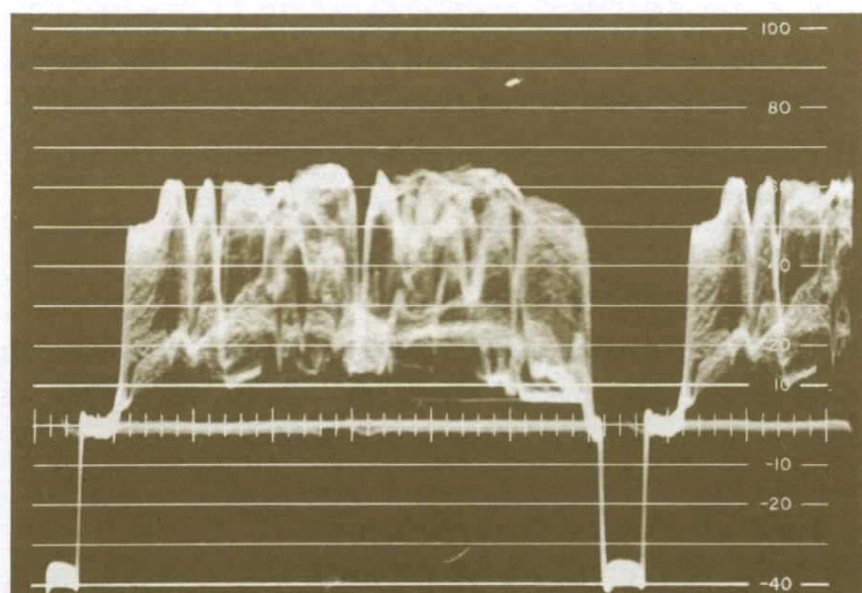
Type RM527 with 14" to 17" Commercial Picture Monitor

DC-Coupled Unblanking—The unblanking signal is dc-coupled to the crt, providing uniform trace brightness of even the slowest time base.

Power Supply—All dc power supplies are electronically regulated to provide stable operation throughout the range of 105-125 volts or 210 to 250 volts, 50 to 60 cycles.

Power Requirement—105 v to 120 v or 210 v to 250 v, 50 to 60 cps, typically 206 watts at 117 v.

Mechanical Specifications—Dimensions are 9 5/8" high by 8 1/2" wide by 20 3/8" deep. Net weight is 31 1/2 pounds. Shipping weight is 53 pounds, approx.



.125 H/CM sweep speed. Sync pulse separation of exactly 8 cm verifies .125 H/CM sweep speed. Precise magnifications of X5 and X25 increase sweep speed to .025 H/CM and .005 H/CM.

TYPE 527 OSCILLOSCOPE \$925

Each instrument includes: 1—green filter, 1—graticule scribed —40 to +100 IRE units 7 1/2%, 2—instruction manuals.

Type RM527

The RM527 is a mechanically rearranged Type 527 for mounting in a standard 19" rack. Electrical characteristics are the same as described for the Type 527.

Mounting—The RM527 is furnished with slide-out tracks. It can be pulled forward and tilted 90° for servicing convenience.

Mechanical Specifications—Dimensions are 5 1/4" high by 18 1/4" deep and fits a standard 19" rack. Net weight is 34 pounds. Shipping weight is 64 pounds, approx.

TYPE RM527 OSCILLOSCOPE \$1000

Each instrument includes: 1—green filter, 1—graticule scribed —40 to +100 IRE units 7 1/2%, 2—instruction manuals.

MOUNTING CRADLES

Two different cradle assemblies for the Type 527, available at extra cost, enable either right or left side mounting of the instrument with a commercial 8" picture monitor in a standard 19" rack. This combination requires only 10 1/2" of rack height. Or two 527's can be mounted side-by-side in the same space. A front mask fits each combination.

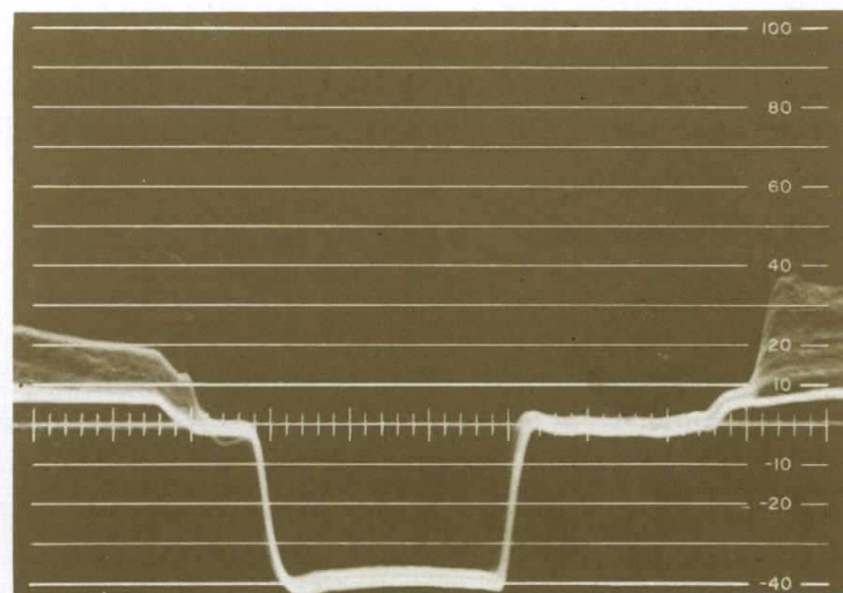
TYPE 527 ACCESSORIES

Description	Part Number	Price
Graticule, non-composite IRE	331-079	\$3.00 \$3.45
Graticule, % video modulation	331-080	\$3.00 \$3.45
Cradle Assembly, left-side mounting oscilloscope	426-133	\$57.50
Cradle Assembly, right-side mounting oscilloscope	426-134	\$57.50
Cradle Assembly, side-by-side mounting oscilloscope	426-135	\$57.50

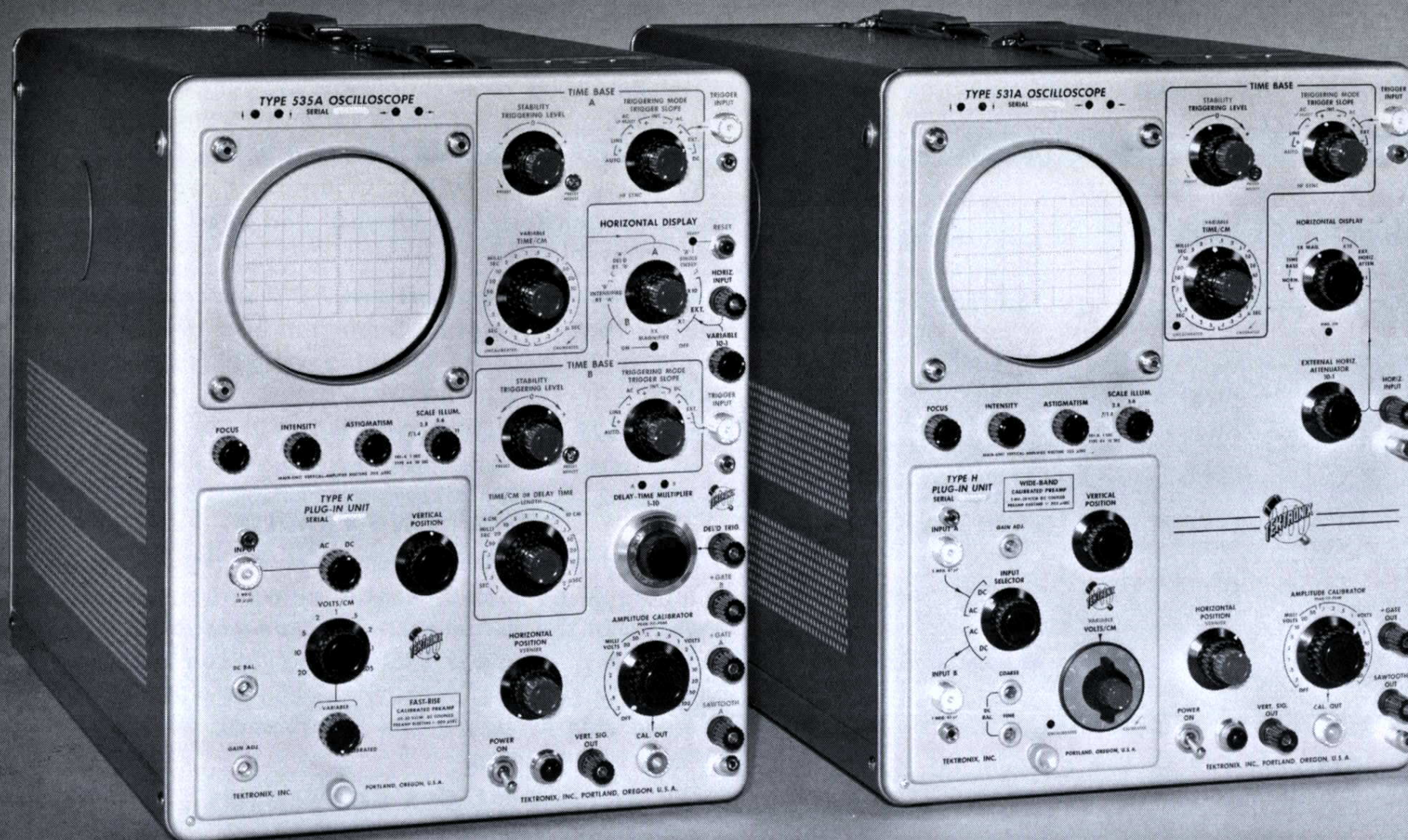
TYPE RM527 ACCESSORIES

Description	Part Number	Price
Graticule, non-composite IRE	331-077	\$3.00 \$3.45
Graticule, % video modulation	331-078	\$3.00 \$3.45

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



5X expansion of .125 H/CM sweep. Frontporch measures 1 cm or .025 H. Sync pulse is 3 cm or .075 H and backporch is 3 cm or .075 H. Simple 1 cm, 3 cm, 3 cm test shows proper sync and blanking pulses and frontporch widths.



Easy Operation

24 Calibrated Direct-Reading Sweep Rates—0.1 μ sec/cm to 5 sec/cm, 1-2-5 sequence.

Preset Triggering—Eliminates triggering adjustments in most applications.

5X Sweep Magnifier—Extends calibrated sweep rate to 20 nsec/cm.

Flexible Sweep Delay—Continuously variable calibrated from 2 μ sec to 10 sec.

High Writing Rate—10-kv accelerating potential.

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

Versatility

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

High Performance

DC-to-15 MC Main Vertical Amplifier

The Tektronix Type 531A and Type 535A are DC-to-15 Mc Oscilloscopes with easy-to-operate functionally-grouped controls, selective triggering facilities, and a high degree of versatility through the use of Tektronix Type A to Z Plug-In Units. Bright displays at low repetition rates, 6-cm linear vertical deflection, and wide sweep range make the Type 531A and Type 535A efficient all-purpose instruments. The Type 535A has all the features of the Type 531A plus a second time-base generator for many specialized applications.

Note: The Type 535A Oscilloscope is similar to the Type 531A Oscilloscope except for the addition of a second time-base generator. Otherwise, both instruments have the same characteristics. In this presentation the information marked by color pertains to the Type 535A Oscilloscope only. All other information, unless designated specifically, concerns both the Type 531A and Type 535A Oscilloscopes.

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

DC-Coupled Output Amplifier—The wide-band dc-coupled amplifier has a risetime of 23 nsec with a Type C-A, K, L, or R Unit plugged in. It is factory adjusted for optimum transient response.

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

For Wide Band Applications—

TYPE B WIDE-BAND UNIT—DC to 14 Mc, 25-nsec risetime at 50 mv/cm to 50 v/cm—2 cps to 10 Mc, 35-nsec risetime at 5 mv/cm to 50 mv/cm.

For Multiple-Trace Operation—

TYPE C-A DUAL-TRACE UNIT—DC to 15 Mc, 23-nsec risetime at 50 mv/cm to 50 v/cm.

TYPE M FOUR-TRACE UNIT—DC to 14 Mc, 25-nsec risetime at 20 mv/cm to 25 v/cm.



For Differential Input Applications—

TYPE D HIGH-GAIN UNIT—DC to 300 kc at 1 mv/cm, increasing to 2 Mc at 50 mv/cm.

TYPE E LOW-LEVEL UNIT—0.06 cps to 20 kc at 50 μ v/cm, increasing to 60 kc at 0.5 mv/cm to 25 mv/cm.

TYPE G WIDE-BAND UNIT—DC to 14 Mc, 25-nsec risetime at 50 mv/cm to 50 v/cm.

For High DC Sensitivity—

TYPE H WIDE-BAND UNIT—DC to 11 Mc, 31-nsec risetime at 5 mv/cm to 50 v/cm.

For Maximum Frequency Response—

TYPE K FAST-RISE UNIT—DC to 15 Mc, 23-nsec risetime at 50 mv/cm to 40 v/cm.

TYPE L FAST-RISE UNIT—DC to 15 Mc, 23-nsec risetime at 50 mv/cm to 40 v/cm—3 cps to 15 Mc, 23-nsec risetime at 5 mv/cm to 4 v/cm.

For Repetitive High-Speed Pulse Applications—

TYPE N SAMPLING UNIT—0.6-nsec risetime (corresponding to approximately 600 Mc).

For Operations of Integration, Differentiation, Function Generation, and Linear or Nonlinear Amplification—

TYPE O OPERATIONAL AMPLIFIER—DC to 14 Mc, 25-nsec risetime at 50 mv/cm to 50 v/cm.

For Transducer and Strain Gage Applications—

TYPE Q UNIT—DC to 6 kc, 60 μ sec risetime at 10 μ strain/div to 10,000 μ strain/div.

For Transistor-Risetime Checking—

TYPE R UNIT—23-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 10 Mc, 35-nsec risetime at 50 mv/cm to 25 v/cm.

APPLICATIONS

In addition to the usual applications for highly versatile DC-to-15 MC Oscilloscopes, 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.

HORIZONTAL-DEFLECTION SYSTEM

A Miller runup sweep generator is used in the Type 531A and Type 535A. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of the circuitry make possible the wide range of 0.02 μ sec/cm to 12 sec/cm.

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.

Calibrated Sweep Rates—Twenty-four direct-reading calibrated sweep rates are provided: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 μ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, 1, 2, 5 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.1 μ sec/cm to 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%.

TIME BASE B Calibrated Sweeps—Eighteen direct-reading calibrated steps are provided: 2, 5, 10, 20, 50 μ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, 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.

Single Sweep—(TIME BASE A only in Type 535A) A RESET pushbutton 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.

Sweep Magnifier—5-x magnifier increases the calibrated sweep time to 0.02 μ 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.

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.

531A

535A

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.

Low-Frequency Reject—(TIME BASE A only in Type 535A) Prevents low-frequency components, such as hum, from interfering with stable triggering.

High Frequency Sync—(TIME BASE A only in Type 535A) 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.

DC-Coupled Unblanking—DC coupling is provided for the unblanking waveforms, assuring uniform bias on the crt for all sweep times and repetition rates.

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 or better at maximum gain. Input impedance is approximately 47 pf paralleled by 1 megohm.

SWEEP DELAY

Sweep delay for TIME BASE A over the range of 2 μ 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 delay steps from 2 μ sec to 0.1 sec is within 1%. Accuracy of the three remaining steps, 0.2, 0.5, and 1 sec 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.

The time jitter in the delayed trigger or delayed sweep will not exceed one part in 20,000 of the maximum available delay interval (where the maximum available delay interval is 10 times the Time/Cm or Delay-Time setting).

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

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.

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates. The Tektronix cathode-ray tube 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 and Type 531A a P2 phosphor is normally furnished.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

531A 535A

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.

Multi-Trace Blanking—A blanking voltage is available to eliminate switching transients from the display when a multiple-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.

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. 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, amplitude is approximately 1.5 v/cm of signal on screen.

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.

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.

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 units.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps; 455 watts maximum for Type 531A, 550 watts maximum for Type 535A.

Mechanical Specifications—Dimensions are 16 7/8" high by 13 1/8" wide by 23 7/8" deep. The 531A net weight is 57 3/4 pounds, shipping weight is 80 pounds, approx. Type 535A net weight is 61 1/2 pounds, shipping weight is 85 pounds, approx.

TYPE 531A, without plug-in units \$995

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

TYPE 535A, without plug-in units \$1400

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

RACK MOUNT Type RM31A RM35A

The Types RM31A and RM35A are mechanically rearranged Types 531A and 535A Oscilloscopes for mounting in a standard 19" rack. The instruments mount to the rack on slide-out tracks. They can be pulled forward, tilted, and locked in any of seven positions for servicing convenience. Electrical characteristics are the same as the Type 531A or 535A Oscilloscopes.

Mechanical Specifications—Dimensions are 14" high by 19" wide by 22 3/4" deep. Type RM31A net weight is 75 pounds, shipping weight is 104 pounds, approx. Type RM35A net weight is 78 1/4 pounds, shipping weight is 108 pounds, approx. For mounting information please refer to the Mounting Dimension page.

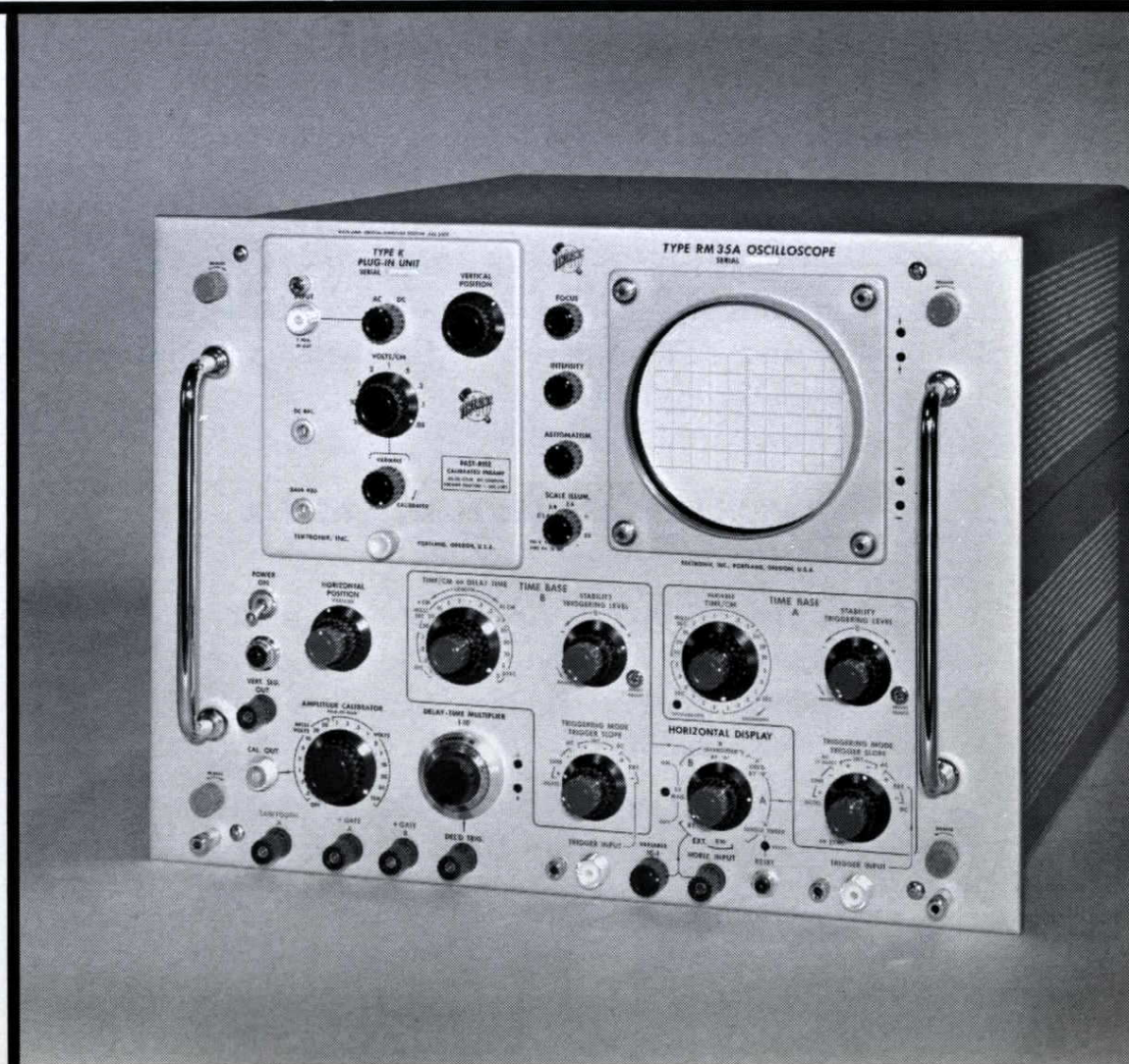
TYPE RM31A, without plug-in units \$1095

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—set mounting hardware, 2—instruction manuals.

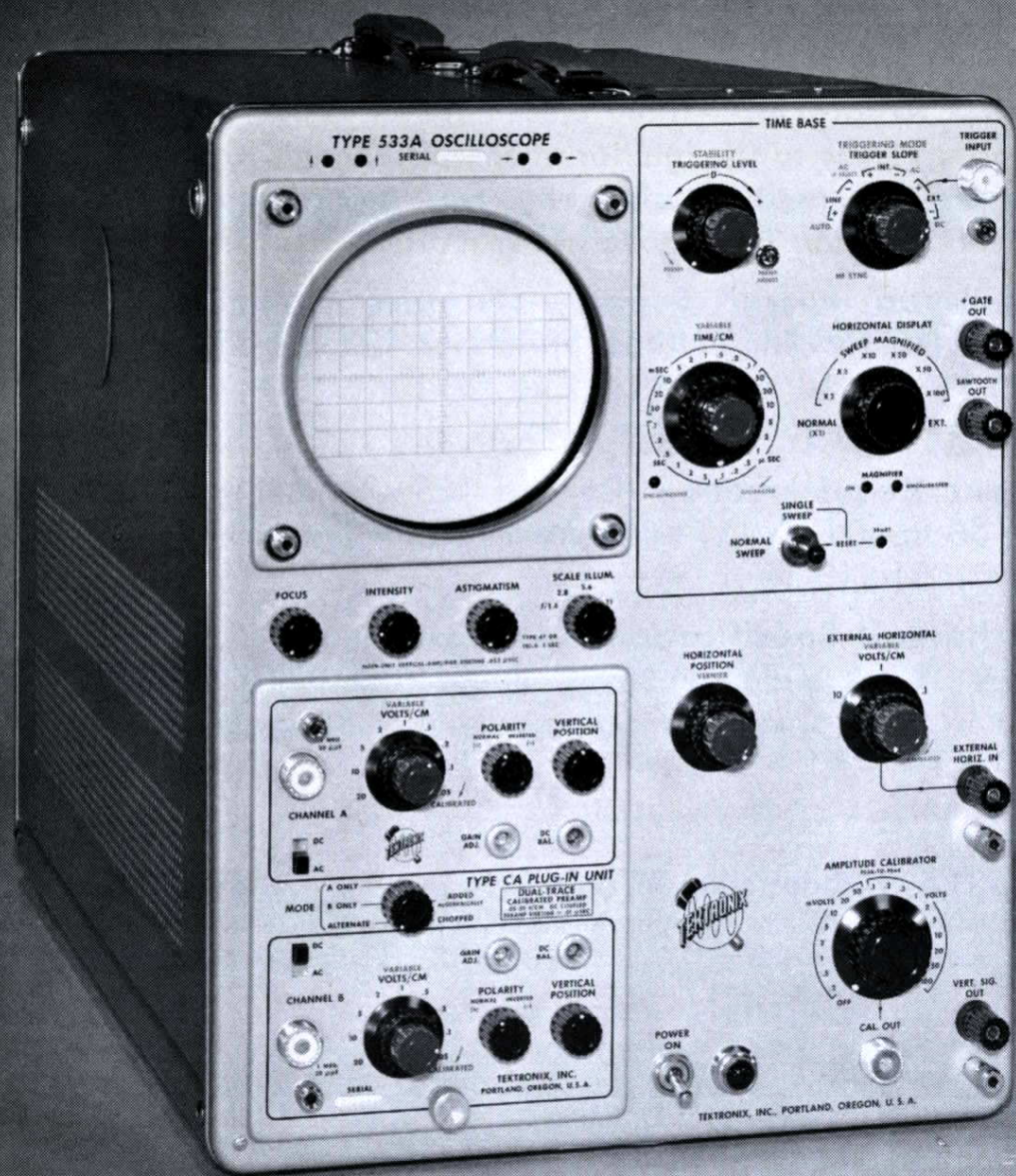
TYPE RM35A, without plug-in units \$1500

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—set mounting hardware, 2—instruction manuals.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



Type 533A DC-to-15MC OSCILLOSCOPE with 100X MAGNIFIER



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—0.1 μ sec/cm to 5 sec/cm, 1-2-5 sequence.

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

Type A to Z Plug-In Preampifiers—Wide Band, Multi-Trace, Low Level, Differential, and others for specialized applications.

High Performance

DC-to-15 MC Main Vertical Amplifier

The Type 533A is a dc-to-15 mc oscilloscope with wide range of application coverage through Tektronix Type A to Z Plug-In Units. 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 multi-trace operation.

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

DC-Coupled Output Amplifier—The dc-to-15 mc output amplifier is factory adjusted for optimum transient response. Risetime is 23 nsec with a Type C-A, K, L, or R Unit plugged in.

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

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

For Wide Band Applications—

TYPE B WIDE-BAND UNIT—DC to 14 Mc, 25-nsec risetime at 50 mv/cm to 50 v/cm—2 cps to 10 Mc, 35-nsec risetime at 5 mv/cm to 50 mv/cm.

For Multiple-Trace Operation—

TYPE C-A DUAL-TRACE UNIT—DC to 15 Mc, 23-nsec risetime at 50 mv/cm to 50 v/cm.

TYPE M FOUR-TRACE UNIT—DC to 14 Mc, 25-nsec risetime at 20 mv/cm to 25 v/cm.

For Differential Input Applications—

TYPE D HIGH-GAIN UNIT—DC to 300 kc at 1 mv/cm, increasing to 2 Mc at 50 mv/cm.

TYPE E LOW-LEVEL UNIT—0.06 cps to 20 kc at 50 μ v/cm, increasing to 60 kc at 0.5 mv/cm to 25 mv/cm.

TYPE G WIDE-BAND UNIT—DC to 14 Mc, 25-nsec risetime at 50 mv/cm to 50 v/cm.

For High DC Sensitivity—

TYPE H WIDE-BAND UNIT—DC to 11 Mc, 31-nsec risetime at 5 mv/cm to 50 v/cm.

For Maximum Frequency Response—

TYPE K FAST-RISE UNIT—DC to 15 Mc, 23-nsec risetime at 50 mv/cm to 40 v/cm.

TYPE L FAST-RISE UNIT—DC to 15 Mc, 23-nsec risetime at 50 mv/cm to 40 v/cm—3 cps to 15 Mc, 23-nsec risetime at 5 mv/cm to 4 v/cm.



For Repetitive High-Speed Pulse Applications—

TYPE N SAMPLING UNIT—0.6 nsec risetime (corresponding to approximately 600 Mc).

For Operations of Integration, Differentiation, Function Generation, and Linear or Nonlinear Amplification—

TYPE O OPERATIONAL AMPLIFIER—DC to 14 Mc, 25-nsec risetime at 50 mv/cm to 50 v/cm.

For Transducer and Strain Gage Applications—

TYPE Q UNIT—DC to 6 kc, 60 μ sec risetime at 10 μ strain/div to 10,000 μ strain/div.

For Transistor-Risetime Checking—

TYPE R UNIT—23-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 10 Mc, 35-nsec risetime at 50 mv/cm to 25 v/cm.

Balanced Delay Network—Ample signal delay is provided by a balanced (push-pull) delay network to permit observation of the leading edge of the waveform that triggers the sweep.

HORIZONTAL-DEFLECTION SYSTEM

A Miller runup type sweep generator is used in the Type 533A. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this circuitry make possible the wide range of 0.02 μ sec/cm to 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 μ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, 1, 2, 5 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.1 μ sec/cm to 12 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 μ sec/cm, accuracy is within 5% of the displayed portion. An indicator light warns the operator when the maximum calibrated rate is being exceeded.

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

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.

Low Frequency Reject—Prevents low-frequency components, such as hum, from interfering with stable triggering.

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 10 v.

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

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 240 kc or better at maximum gain. Input impedance is approximately 45 pf paralleled by 1 megohm.

OTHER CHARACTERISTICS

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.

533A

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates, and in single-sweep applications. The Tektronix cathode-ray tube is a 5" flat-faced metallized precision tube with 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 533A, a P2 phosphor is normally furnished.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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.

Multi-Trace Blanking—A blanking voltage is available to eliminate switching transients from the display when a multiple-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.

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, amplitude is approximately 1.5 v/cm of signal on screen.

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

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.

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.

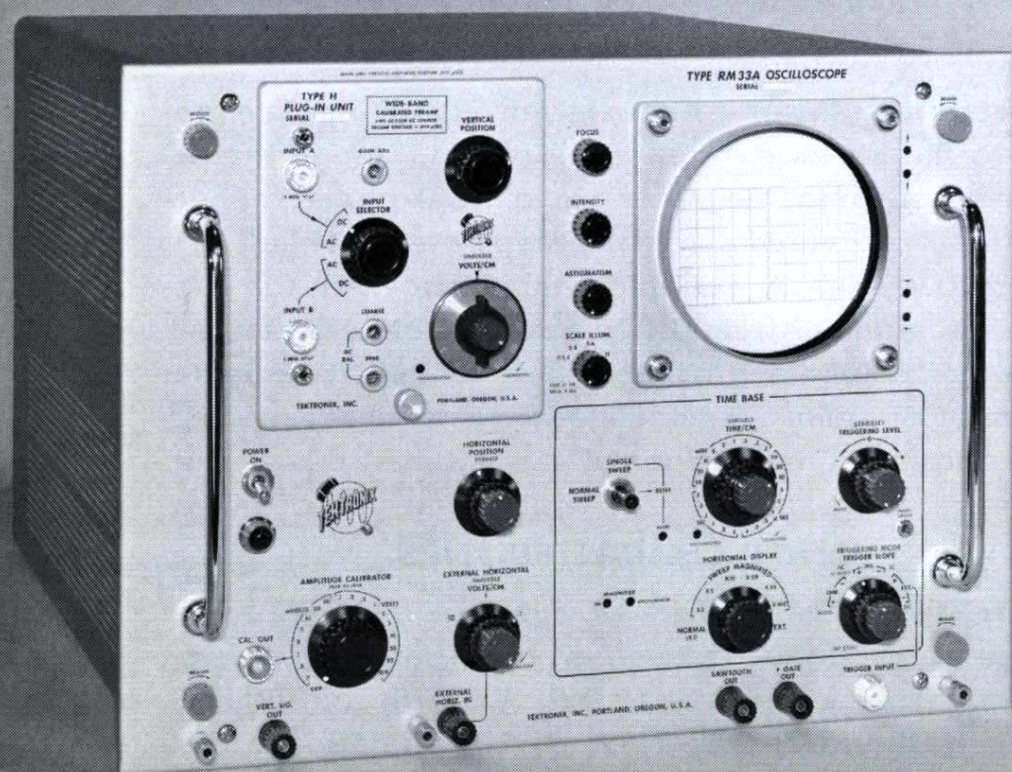
Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 500 watts maximum.

Mechanical Specifications—Dimensions are 16 7/8" high by 13 1/8" wide by 23 7/8" deep. Net weight is 57 3/4 pounds. Shipping weight is 80 pounds, approx.

TYPE 533A, without plug-in units \$1125

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

Type RM33A RACK MOUNT



The Type RM33A is a mechanically rearranged Type 533A Oscilloscope for mounting in a standard 19" 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. Electrical characteristics of the instrument are the same as described for the Type 533A Oscilloscope.

Mechanical Specifications—Dimensions are 14" high by 19" wide by 22 3/4" deep. Net weight is 74 1/2 pounds. Shipping weight is 104 pounds, approx.

For more mounting information, please refer to the Mounting Dimensions page in the catalog.

TYPE RM33A, without plug-in units \$1225

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 1—set mounting hardware, 2—instruction manuals.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



DC-to-10MC X-Y OSCILLOSCOPE Type 536

Identical Deflection Characteristics

Vertical and horizontal risetimes—31 nsec with fast-rise plug-in units.

Uniform phase-shift characteristics.

Curve Tracing

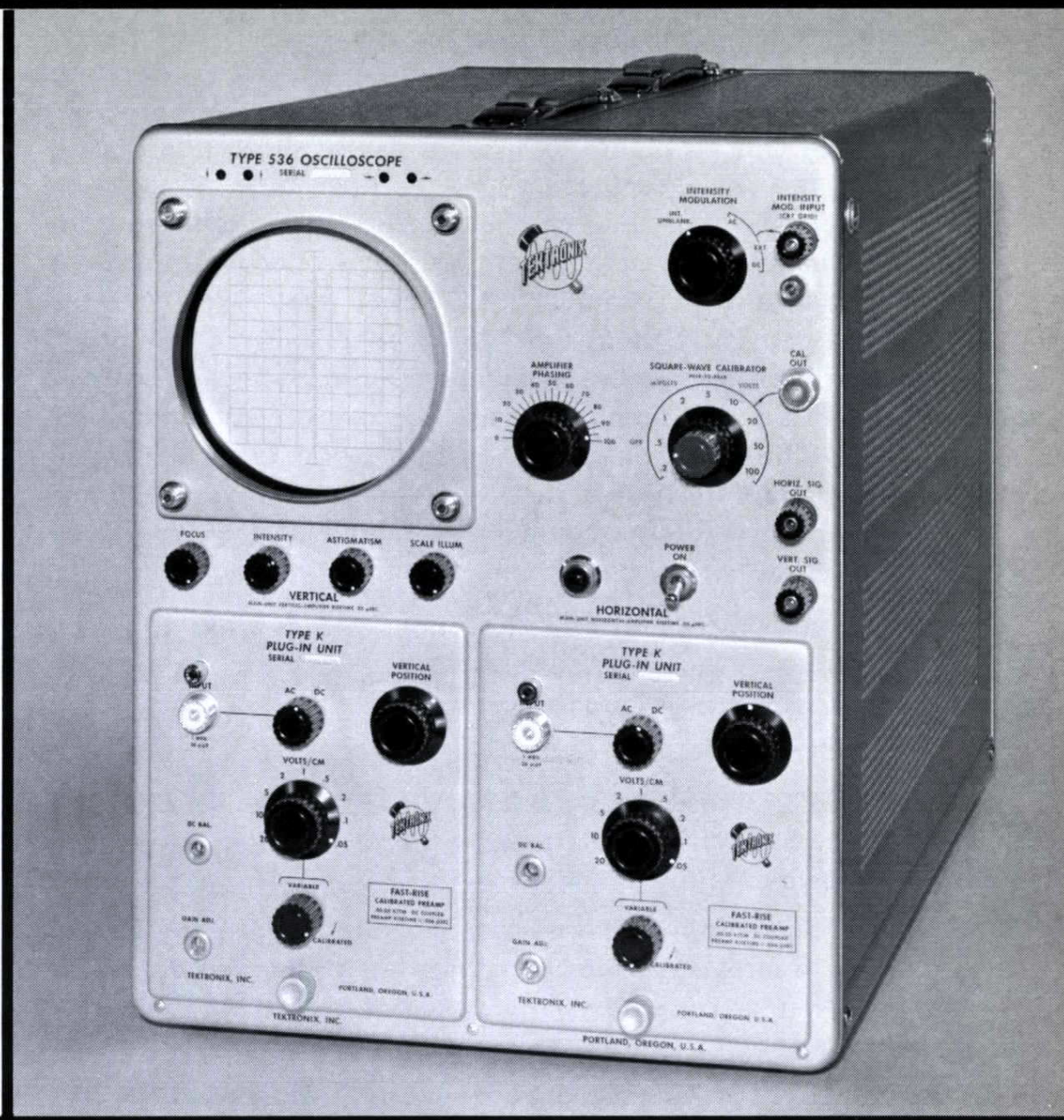
The Type 536 is useful for curve tracing with two related varying voltages over a wide frequency range.

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.



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 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 15 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.

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. A pair of Type G Units provide accuracy needed in many curve-tracing applications.

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

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.
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. Determining gating circuit characteristics.
12. Function generator — $y = f(x)$.

VERTICAL AND HORIZONTAL DEFLECTION SYSTEMS

Frequency Specifications are at 3-db down

All characteristics of the horizontal deflection system are the same as those of the vertical deflection system when the same type of Plug-In Unit is plugged into both systems. Both main amplifiers have excellent transient response with risetimes of 31 nsec with Type K Units plugged in. One of the Type A to Z Units can be plugged into the vertical or the horizontal deflection system. 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.

Type 536 characteristics with Type G Units plugged in are:

Passbands—dc to 10 mc.

Risetimes—35 nsec.

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 other Letter-Series Plug-In Units:

Type B—DC to 10 mc, 35 nsec at 0.05 v/div to 50 v/div. . . . 2 cycles to 9 mc, 0.04 μ sec at 5 mv/div to 0.05 v/div.

Type C-A—DC to 10 mc, 35 nsec.

Type D—DC to 300 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, 35 nsec.

Type H—DC to 9.5 mc, 37 nsec.

Type K—DC to 11 mc, 31 nsec.

Type L—DC to 11 mc, 31 nsec at 0.05 to 40 v/div 3 cycles to 10 mc, 35 nsec at 0.005 to 4 v/div.

Type M—DC to 10 mc, 35 nsec.

For repetitive high-speed pulse applications—

Type N—0.6-nsec risetime (corresponding to approximately 600 mc).

For operations of integration, differentiation, function generation, and linear or nonlinear amplification—
Type O—DC to 10 mc, 35 nsec.

For transducer and strain gage applications—
Type Q—Sensitivity 10 microstrain/div., dc to 6 kc.

For high waveform resolution and precise amplitude measurement applications via the slide-back technique—
Type Z

Please refer to specifications of individual plug-in units for sensitivity and other characteristics.

HORIZONTAL-DEFLECTION SYSTEM

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 μ sec/div to 2 sec/div.

5-x Sweep Magnifier—Increases calibrated sweep rate to 0.04 μ sec/div.

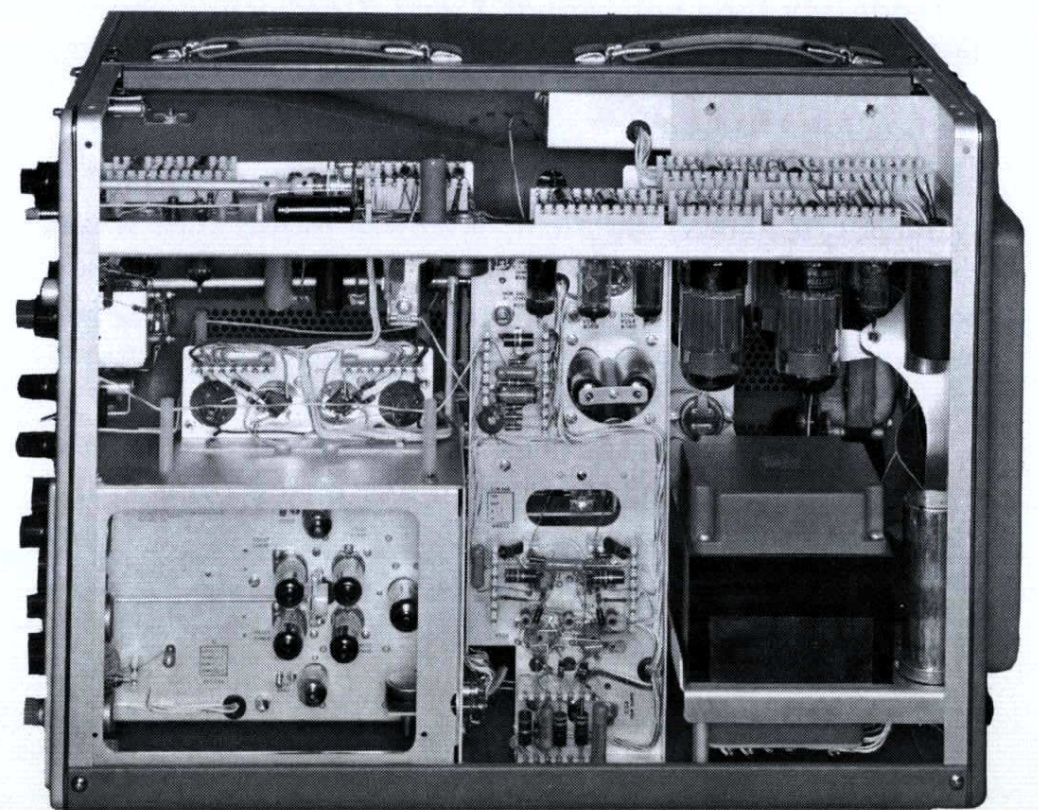
Versatile Trigger Selection—Positive or negative slope, external or line voltage, ac-coupling or dc-coupling through triggering circuits.

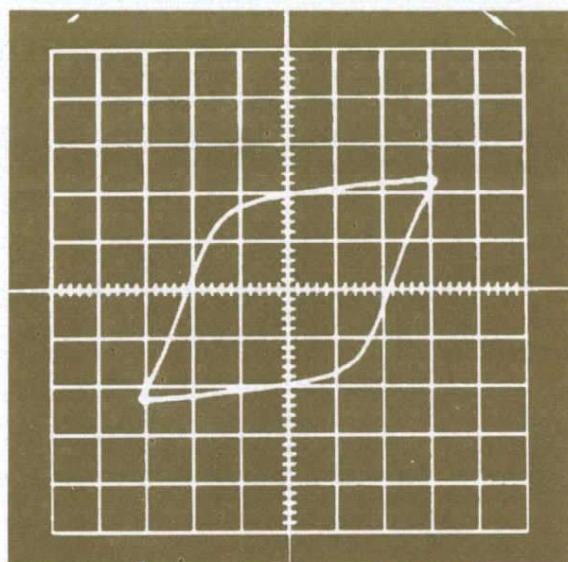
Amplitude-Level Selection—With preset or manual stability control.

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

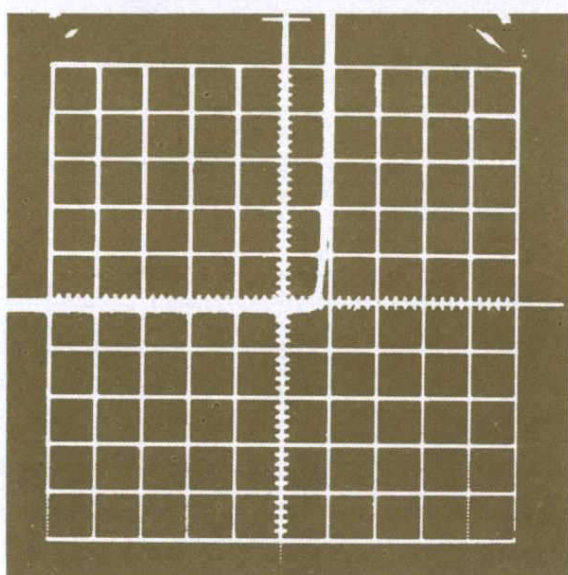
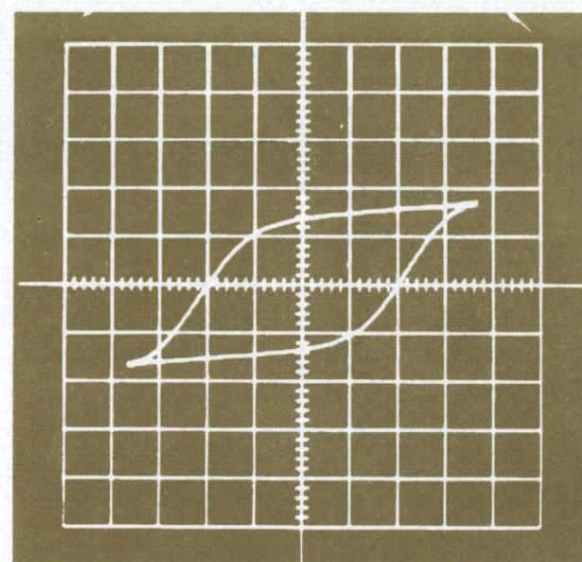
High-Frequency Sync—Synchronizes with sine-wave signals in frequency range of 5 mc to 15 mc.

Please refer to the description of the Type T Time-Base Generator for complete specifications.

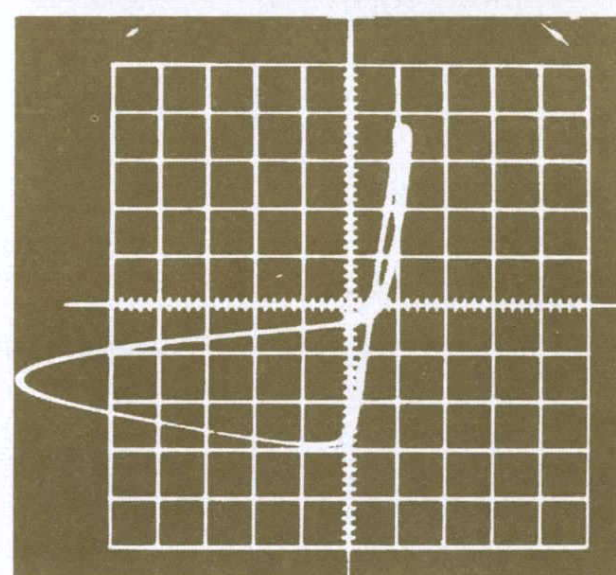




Ferrite bead characteristics at two different temperatures—left, at 25°C; right, at equilibrium temperature due to self heating. Type 536 with two Type G Units, driving frequency 1 mc.



High-condition 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.



OTHER CHARACTERISTICS

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.

Cathode-Ray Tube—A Tektronix cathode-ray tube provides a 10-by-10 division ($3\frac{1}{8}$ " x $3\frac{1}{8}$ ") viewing area. Deflection factor is approximately the same for both horizontal and vertical deflection plates. Accelerating potential is approx. 4 kv. For best results over the wide sweep range, a P31 phosphor is normally supplied.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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. Output signals are dc coupled and are nominally one volt per division of deflection on crt face.

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 grt grid. The visually perceptible input level is typically 1 v. Positive 20 v signal will provide complete "black to white" unblanking.

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.

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.

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 units.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 625 watts with two Type K Units.

Mechanical Specifications—Dimensions are $16\frac{7}{8}$ " high by $13\frac{1}{8}$ " wide by $23\frac{7}{8}$ " deep. Net weight is $55\frac{3}{4}$ pounds. Shipping weight is 78 pounds, approx.

TYPE 536, without plug-in units \$1085

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—phase-measuring graticule, 1—3-conductor power cord, 2—instruction manuals.

Rack Mount Adapter

A cradle mount to adapt the Type 536 Oscilloscope for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements $17\frac{1}{2}$ ".

Order Part Number 040-281 \$45

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type **541A**
545A

DC-to-30MC OSCILLOSCOPES with SWEEP DELAY



Easy Operation

24 CALIBRATED DIRECT-READING SWEEP RATES—0.1 μ sec/cm to 5 sec/cm, 1-2-5 sequence.

PRESET TRIGGERING—Eliminates triggering adjustments in most applications.

5X SWEEP MAGNIFIER—Extends calibrated sweep rate to 20 nsec/cm.

FLEXIBLE SWEEP DELAY—Continuously variable calibrated from 2 μ sec to 10 sec.

HIGH WRITING RATE—10-kv accelerating potential assures bright trace.

SINGLE SWEEP OPERATION—Lockout-Reset Circuitry for one-shot recording.

Versatility

TYPE A to Z PLUG-IN PREAMPLIFIERS—Wide Band, Multi-Trace, Low Level, Differential, and others for specialized applications.

High Performance

DC-TO-30 MC VERTICAL RESPONSE—with Fast-Rise Plug-In Units.

Note: The Type 545A Oscilloscope is similar to the Type 541A Oscilloscope except for the addition of a second time-base generator. Otherwise, both instruments have the same characteristics. In this presentation the information marked by color pertains to the Type 545A Oscilloscope only. All other information, unless designated specifically, concerns both the Type 541A and Type 545A Oscilloscopes.

The Tektronix Type 541A and Type 545A are high-speed DC to 30 Mc laboratory oscilloscopes achieving a high degree of versatility through use of Tektronix A to Z Plug-In Units. This versatility, combined with wide sweep range, high accelerating potential, and long, dependable life, makes the Type 541A and 545A efficient and valuable instruments. The Type 545A has all the features of the Type 541A plus a second time-base generator for many specialized applications.

VERTICAL DEFLECTION SYSTEM

Frequency specifications are at 3-db down

DC-Coupled Output Amplifier—The wide-band fast-rise dc-coupled output amplifier has a risetime of 12 nsec with a Type K, L, or R Unit plugged in. It is factory adjusted for optimum transient response.

The vertical deflection system is designed to be used with any of the Type A to Z Plug-In Units.

The Type K Fast-Rise Plug-In Preamp, developed for Type 541A and Type 545A Oscilloscopes, provides a maximum deflection factor of 0.05 v/cm, with 12-nanosecond risetime, dc-to-30 mc passband, and 20 pf 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.)

PLUG-IN PREAMPLIFIERS

For Wide Band Applications—

TYPE B WIDE-BAND UNIT—DC to 20 Mc, 18-nsec rise-time at 50 mv/cm to 50 v/cm—2 cps to 12 Mc, 30-nsec risetime at 5 mv/cm to 50 mv/cm.

For Multiple-Trace Operation—

TYPE C-A DUAL-TRACE UNIT—DC to 24 Mc, 15-nsec rise-time at 50 mv/cm to 50 v/cm.

TYPE M FOUR-TRACE UNIT—DC to 20 Mc, 17-nsec risetime at 20 mv/cm to 25 v/cm.

For Differential Input Applications—

TYPE D HIGH-GAIN UNIT—DC to 300 kc at 1 mv/cm, increasing to 2 Mc at 50 mv/cm.

TYPE E LOW-LEVEL UNIT—0.06 cps to 20 kc at 50 μ v/cm, increasing to 60 kc at 0.5 mv/cm to 25 mv/cm.

TYPE G WIDE-BAND UNIT—DC to 20 Mc, 18-nsec rise-time at 50 mv/cm to 50 v/cm.

For High DC Sensitivity—

TYPE H WIDE-BAND UNIT—DC to 15 Mc, 23-nsec rise-time at 5 mv/cm to 50 v/cm.

For Maximum Frequency Response—

TYPE K FAST-RISE UNIT—DC to 30 mc, 12-nsec risetime at 50 mv/cm to 40 v/cm.

TYPE L FAST-RISE UNIT—DC to 30 Mc, 12-nsec risetime at 50 mv/cm to 40 v/cm—3 cps to 24 Mc, 15-nsec risetime at 5 mv/cm to 4 v/cm.

For Repetitive High-Speed Pulse Applications—

TYPE N SAMPLING UNIT—0.6-nsec risetime (corresponding to approximately 600 Mc).

For Operations of Integration, Differentiation, Function Generation, and Linear or Nonlinear Amplification—

TYPE O OPERATIONAL AMPLIFIER—DC to 25 Mc, 14-nsec risetime at 50 mv/cm to 50 v/cm.

For Transducer and Strain Gage Applications—

TYPE Q UNIT—DC to 6 kc, 60 μ sec risetime at 10 μ strain/div to 10,000 μ strain/div.

For Transistor-Risetime Checking—

TYPE R UNIT—12-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 Mc, 27-nsec risetime at 50 mv/cm to 24 v/cm.

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.

Balanced Delay Network—A signal delay of 0.2 μ sec is introduced by the balanced (push-pull) delay network. Permits observation of the leading edge of the waveform that triggers the sweep.

HORIZONTAL DEFLECTION SYSTEM

The sweep generator used in the Type 541A and Type 545A is the Miller-runup type. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this circuitry provide a sweep range of 0.02 μ sec/cm to 12 sec/cm.

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.

Calibrated Sweep Rates—Twenty-four direct-reading calibrated sweep rates are provided: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 μ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, 1, 2, 5 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.1 μ sec/cm to 12 sec/cm. An indicator light warns the operator when the sweep is uncalibrated. Calibration of the fixed sweeps is within 3%.

541A 545A

TIME BASE B Calibrated Sweeps—Eighteen direct-reading calibrated steps are provided: 2, 5, 10, 20, 50 $\mu\text{sec}/\text{cm}$, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm , 0.1, 0.2, 0.5, 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.

Single Sweep—(TIME BASE A only in Type 545A) A RESET pushbutton 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.

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 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.

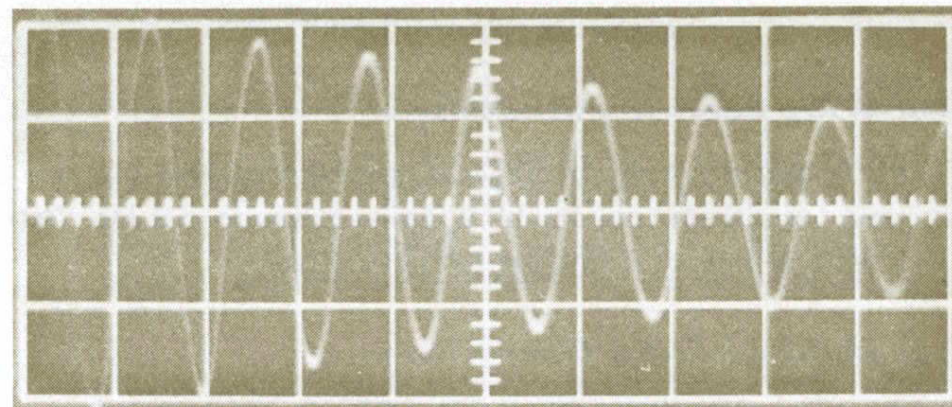
Triggering Facilities—Versatile triggering circuitry provides for complete manual control, preset stability control, and fully-automatic triggering. Triggering facilities are identical for both time bases, except that TIME BASE A has two additional modes: H.F. SYNC and AC LF REJECT (low frequency reject).

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.

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 in Type 545A) Prevents low-frequency components, such as hum, from interfering with stable triggering.



20 megacycle damped oscillation shows 250-cm/ μsec 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.

High-Frequency Sync—(TIME BASE A only in Type 545A) 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.

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

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 or better at maximum gain. Input impedance is approximately 47 pf paralleled by 1 megohm.

SWEEP DELAY

Sweep delay for TIME BASE A over the range of 2 μsec 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 delay steps from 2 μsec to 0.1 sec is within 1%. Accuracy of the remaining three steps, 0.2, 0.5, and 1 sec, 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.

The time jitter in the delayed trigger or delayed sweep will not exceed one part in 20,000 of the maximum available delay interval (where the maximum available delay interval is 10 times the Time/Cm or Delay-Time setting).

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

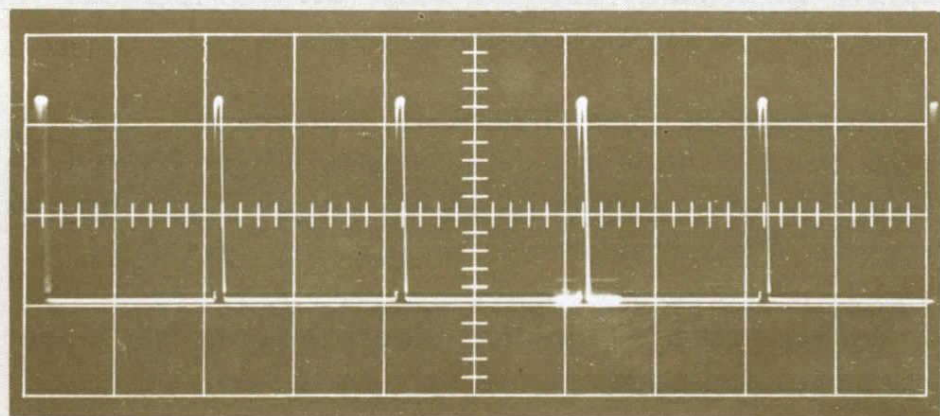
Amplitude Calibrator—A square-wave calibration voltage is available through a front-panel coaxial connector. Eighteen direct reading fixed steps —0.2, 0.5, 1, 2, 5, 10, 20, 50 millivolts, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 volts peak-to-peak are provided by the single knob control. Accuracy is within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

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates. The Tektronix cathode-ray tube 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 541A and Type 545A, a P2 phosphor is normally furnished.

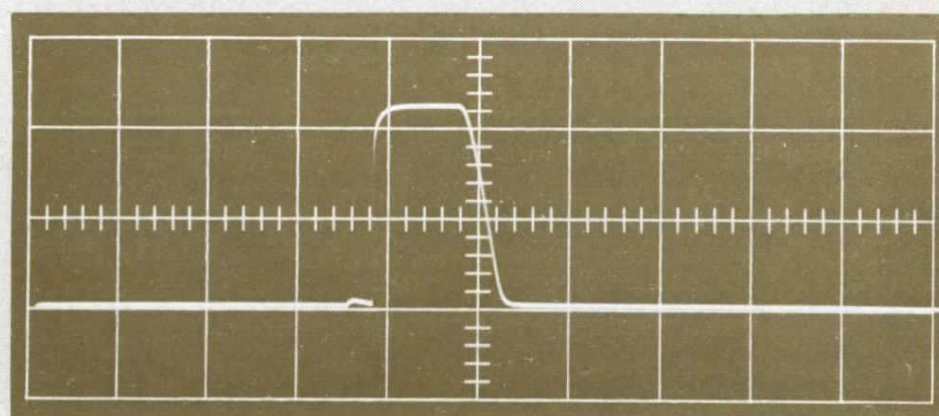
Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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.



Delaying Sweep display of a pulse chain—with the fourth pulse intensified by trace brightening. This brightened area indicates the delayed sweep start and duration. With both the start and duration adjustable, it is possible to include any portion of the displayed waveform in the brightened area.



Delayed Sweep display of the fourth pulse—expanded the full width of the screen. This expanded presentation permits precise incremental measurements along a complex waveform, high magnification of a selected portion of an undelayed sweep, with jitter-free magnification up to 10,000 times.

541A 545A

Multi-Trace Blanking—A blanking voltage is available to eliminate switching transients from the display when a multiple-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.

Output Waveforms—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-saw-tooth waveform are available 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; amplitude is approximately 1.5 v/cm of signal on screen.

Probes—Two low-capacitance probes (10-x atten.) are supplied with the instrument. Input capacitance of the Type 541A-Type K or Type 545A-Type K combination with probes is 11.5 pf, 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.

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

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.

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 units.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps; 520 watts maximum for Type 541A, 600 watts maximum for Type 545A.

Mechanical Specifications—Dimensions are 16 $\frac{7}{8}$ " high by 13 $\frac{1}{8}$ " wide by 23 $\frac{7}{8}$ " deep. Type 541A net weight is 59 pounds, shipping weight is 81 pounds, approx. Type 545A net weight is 63 $\frac{3}{4}$ pounds, shipping weight is 86 pounds, approx.

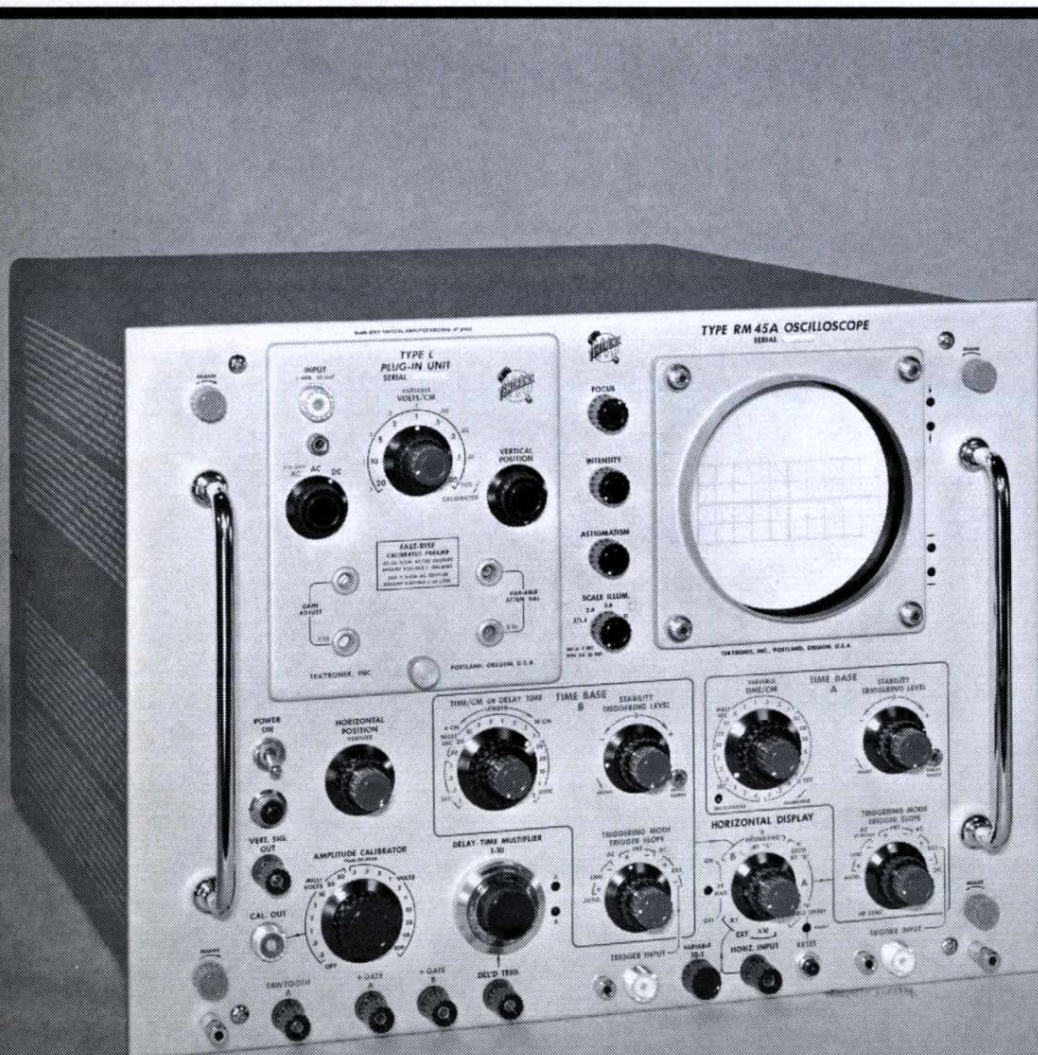
TYPE 541A, without plug-in units \$1225

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

TYPE 545A, without plug-in units \$1550

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

Type RM41A RM45A RACK MOUNT



The Types RM41A and RM45A are mechanically rearranged Types 541A and 545A Oscilloscopes for mounting in a standard 19" rack. The instruments mount to the rack on slide-out tracks. They can be pulled forward, tilted, and locked in any of seven positions for servicing convenience. Electrical characteristics of the instruments are the same as described for the Type 541A or Type 545A Oscilloscopes.

Mechanical Specifications—Dimensions are 14" high by 19" wide by 22 $\frac{3}{4}$ " deep. Type RM41A net weight is 75 $\frac{1}{2}$ pounds, shipping weight is 105 pounds, approx. Type RM45A net weight is 80 pounds, shipping weight is 110 pounds, approx.

For mounting information please refer to the Mounting Dimension page.

TYPE RM41A, without plug-in units \$1325

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—set mounting hardware, 2—instruction manuals.

TYPE RM45A, without plug-in units \$1650

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—set mounting hardware, 2—instruction manuals.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



DC-to-30MC OSCILLOSCOPE Type 543A with 100X MAGNIFIER

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—0.1 μ sec/cm to 5 sec/cm, 1-2-5 sequence.

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

Type A to Z Plug-In Preampifiers—Wide Band, Multi-Trace, Low Level, Differential, and others for specialized applications.

High Performance

DC-to-30 MC Vertical Response—With Fast-Rise Plug-In Units.



The Type 543A is a fast-rise laboratory oscilloscope with application capabilities extending over the complete range provided by the Tektronix Type A to Z Plug-In Units. Simplified controls make it easy to operate. The wide range of sweep magnification and the single-sweep lockout feature add to both versatility and operating convenience.

With the exception of the Vertical Amplifier and Cathode-ray tube, the Type 543A is almost identical to the Tektronix Type 533A.

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

DC-Coupled Output Amplifier—The Type 543A output amplifier has a risetime of 12 nsec with a Type K, L, or R Unit plugged in. It is factory adjusted for optimum transient response.

PLUG-IN PREAMPLIFIERS

For Wide Band Applications—

TYPE B WIDE-BAND UNIT—DC to 20 Mc, 18-nsec risetime at 50 mv/cm to 50 v/cm—2 cps to 12 Mc, 30-nsec risetime at 5 mv/cm to 50 mv/cm.

For Multiple-Trace Operation—

TYPE C-A DUAL-TRACE UNIT—DC to 24 Mc, 15-nsec risetime at 50 mv/cm to 50 v/cm.

TYPE M FOUR-TRACE UNIT—DC to 20 Mc, 17-nsec risetime at 20 mv/cm to 25 v/cm.

For Differential Input Applications—

TYPE D HIGH-GAIN UNIT—DC to 300 kc at 1 mv/cm, increasing to 2 Mc at 50 mv/cm.

TYPE E LOW-LEVEL UNIT—0.06 cps to 20 kc at 50 μ v/cm, increasing to 60 kc at 0.5 mv/cm to 25 mv/cm.

TYPE G WIDE-BAND UNIT—DC to 20 Mc, 18-nsec risetime at 50 mv/cm to 50 v/cm.

For High DC Sensitivity—

TYPE H WIDE-BAND UNIT—DC to 15 Mc, 23-nsec risetime at 5 mv/cm to 50 v/cm.

For Maximum Frequency Response—

TYPE K FAST-RISE UNIT—DC to 30 Mc, 12-nsec risetime at 50 mv/cm to 40 v/cm.

TYPE L FAST-RISE UNIT—DC to 30 Mc, 12-nsec risetime at 50 mv/cm to 40 v/cm—3 cps to 24 Mc, 15-nsec risetime at 5 mv/cm to 4 v/cm.

For Repetitive High-Speed Pulse Applications—

TYPE N SAMPLING UNIT—0.6-nsec risetime (corresponding to approximately 600 Mc).

For Operations of Integration, Differentiation, Function Generation, and Linear or Nonlinear Amplification—

TYPE O OPERATIONAL AMPLIFIER—DC to 25 Mc, 14-nsec risetime at 50 mv/cm to 50 v/cm.

543A

For Transducer and Strain Gage Applications—

TYPE Q UNIT—DC to 6 kc, 60 μ sec risetime at 10 μ strain/div to 10,000 μ strain/div.

For Transistor-Risetime Checking—

TYPE R UNIT—12-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 Mc, 27 nsec risetime at 50 mv/cm to 24 v/cm.

Balanced Delay Network—Ample signal delay is provided by a balanced (push-pull) delay network to permit observation of the leading edge of the waveform that triggers the sweep.

HORIZONTAL-DEFLECTION SYSTEM

A Miller-runup type sweep generator is used in the Type 543A. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this circuitry make possible the wide range of 0.02 μ sec/cm to 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 μ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, 1, 2, 5 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.1 μ sec/cm to 12 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 μ sec/cm, accuracy is within 5% of the displayed portion. An indicator light warns the operator when the maximum calibrated rate is being exceeded.

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

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.

Low Frequency Reject—Prevents low-frequency components, such as hum, from interfering with stable triggering.

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 10 v.

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

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 240 kc or better at maximum gain. Input impedance is approximately 45 pf paralleled by 1 megohm.

OTHER CHARACTERISTICS

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.

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, the T543P___, is used in the Type 543A. 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 543A, 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.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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.

Multi-Trace Blanking—A blanking voltage is available to eliminate switching transients from the display when a multiple-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.

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, amplitude is approximately 1.5 v/cm of signal on screen.

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

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.

Probes—Two low-capacitance 10-x attenuator probes are supplied with the Type 543A. These 10-x probes introduce no overshoot or ringing, but frequency response is down an additional 1 db at 30 mc.

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.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 530 watts maximum.

Mechanical Specifications—Dimensions are 16 7/8" high by 13 1/8" wide by 23 7/8" deep. Net weight is 59 pounds. Shipping weight is 82 pounds, approx.

TYPE 543A, without plug-in units \$1300

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

RACK MOUNT Type RM43A

The Type RM43A is a mechanically rearranged Type 543A Oscilloscope for mounting in a standard 19" 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. Electrical characteristics of the instrument are the same as described for the Type 543A Oscilloscope.

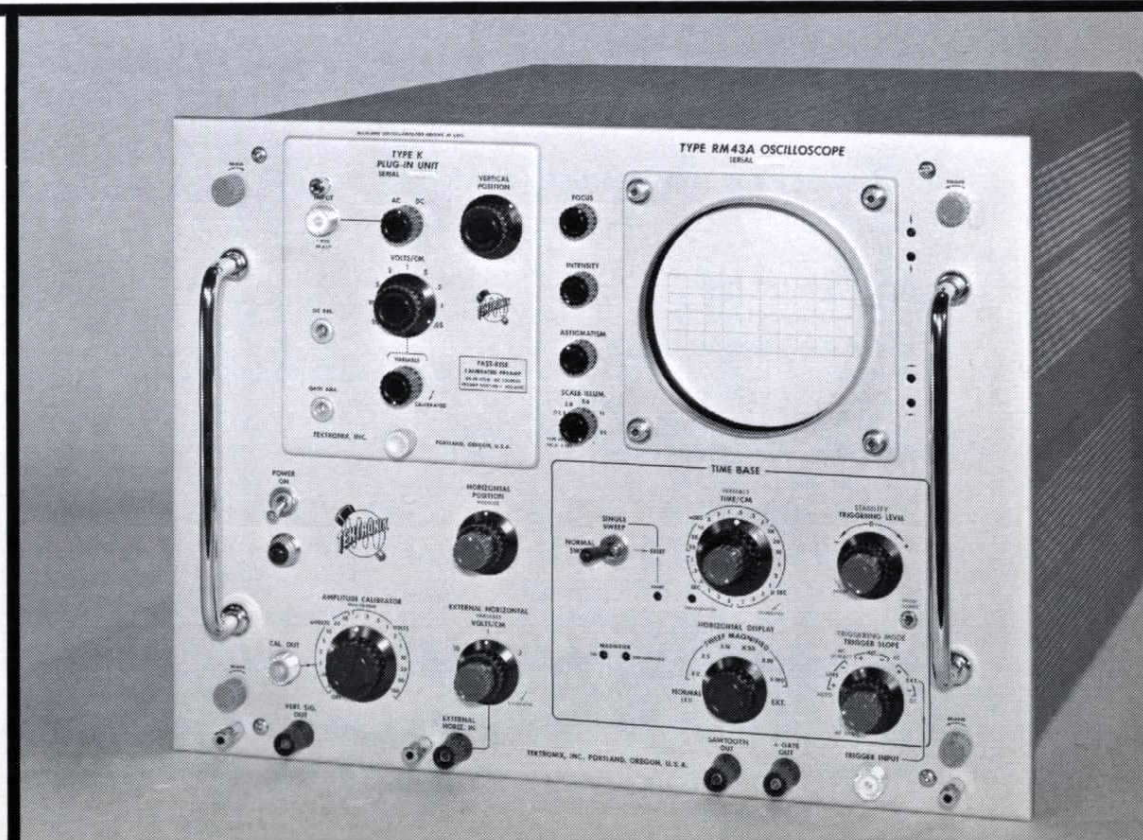
Mechanical Specifications—Dimensions are 14" high by 19" wide by 22 3/4" deep. Net weight is 75 1/2 pounds. Shipping weight is 105 pounds, approx.

For mounting information, please refer to the Mounting Dimension page in the catalog.

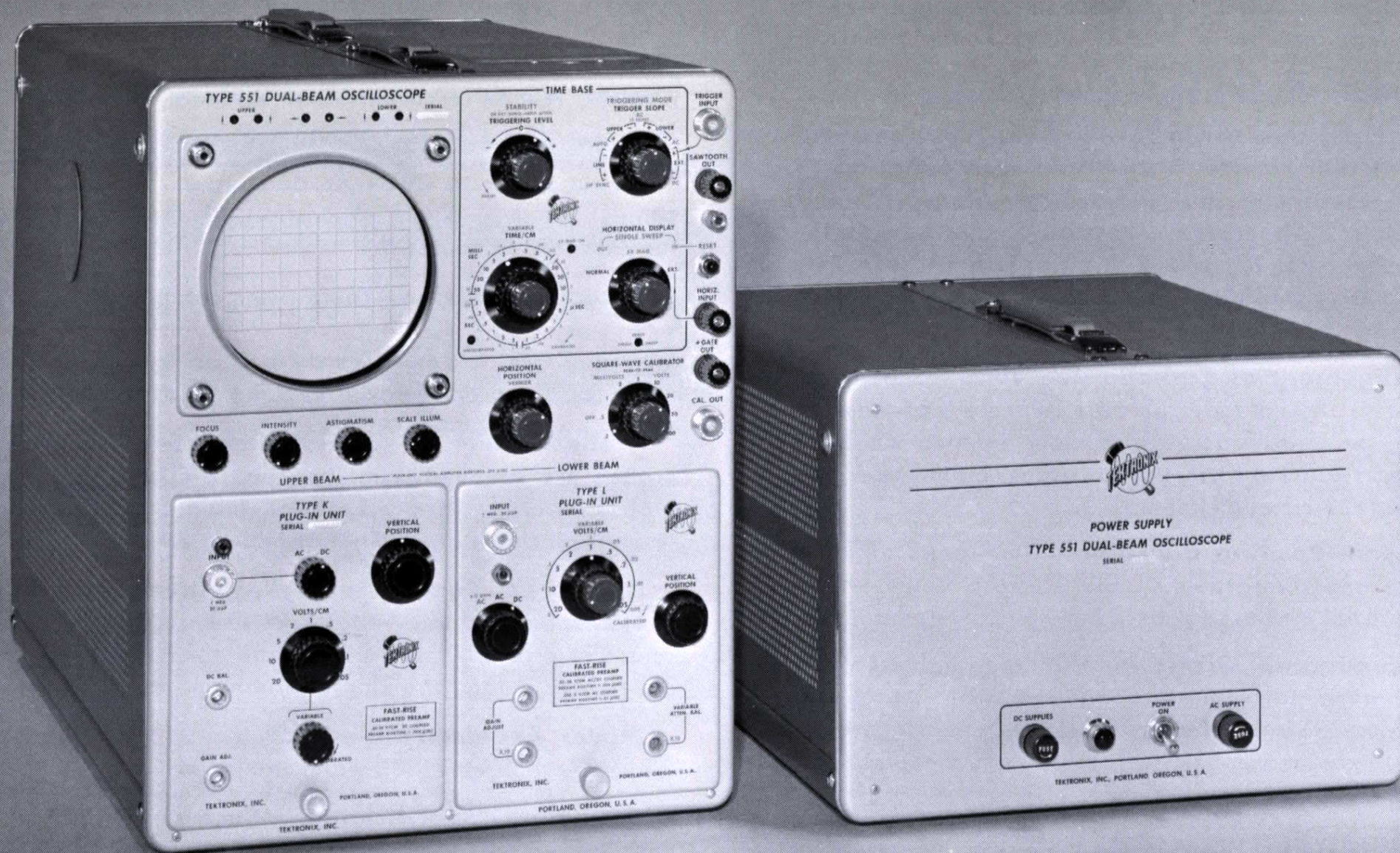
TYPE RM43A, without plug-in units \$1400

Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—set mounting hardware, 2—instruction manuals.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



Type 551 DC-to-25MC DUAL-BEAM OSCILLOSCOPE



Wide-Band Vertical Amplifiers

Passbands and risetimes with fast-rise plug-in units —dc to 25 mc, 14 nsec.

Signal-Handling Versatility

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

0.2- μ sec Delay Networks

Wide Sweep Range

0.02 μ 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.

The Type 551 uses a 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

Frequency specifications are at 3-db down

Two DC-Coupled Main Amplifiers — Risettime of both main amplifiers is 14 nsec with Type K, L, or R Units plugged in. They are factory adjusted for optimum transient response. Any Type A to Z Plug-In Unit can be plugged into both channels for instrument operation.

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, 14-nsec risetimes. A wide variety of vertical-deflection characteristics is available through the use of another of the Type A to Z Plug-In Units in one or both vertical channels.

PLUG-IN PREAMPLIFIERS

For Wide Band Applications—

TYPE B WIDE-BAND UNIT—DC to 18 Mc, 20-nsec risetime at 50 mv/cm to 50 v/cm—2 cps to 12 Mc, 30-nsec risetime at 5 mv/cm to 50 mv/cm.

For Multiple-Trace Operation—

TYPE C-A DUAL-TRACE UNIT—DC to 22 Mc, 16-nsec risetime at 50 mv/cm to 50 v/cm.

TYPE M FOUR-TRACE UNIT—DC to 19 Mc, 18-nsec risetime at 20 mv/cm to 25 v/cm.

For Differential Input Applications—

TYPE D HIGH-GAIN UNIT—DC to 300 kc at 1 mv/cm, increasing to 2 Mc at 50 mv/cm.

TYPE E LOW-LEVEL UNIT—0.06 cps to 20 kc at 50 μ v/cm, increasing to 60 kc at 0.5 mv/cm to 25 mv/cm.

TYPE G WIDE-BAND UNIT—DC to 18 Mc, 20-nsec risetime at 50 mv/cm to 50 v/cm.

For High DC Sensitivity—

TYPE H WIDE-BAND UNIT—DC to 14 Mc, 25-nsec risetime at 5 mv/cm to 50 v/cm.

For Maximum Frequency Response—

TYPE K FAST-RISE UNIT—DC to 25 Mc, 14-nsec risetime at 50 mv/cm to 40 v/cm.

TYPE L FAST-RISE UNIT—DC to 25 Mc, 14-nsec risetime at 50 mv/cm to 40 v/cm—3 cps to 22 Mc, 16-nsec risetime at 5 mv/cm to 4 v/cm.

For Repetitive High-Speed Pulse Applications—

TYPE N SAMPLING UNIT—0.6-nsec risetime (corresponding to approximately 600 Mc).

For Operations of Integration, Differentiation, Function Generation, and Linear or Nonlinear Amplification—

TYPE O OPERATIONAL AMPLIFIER—DC to 22 Mc, 16-nsec risetime at 50 mv/cm to 50 v/cm.

For Transducer and Strain Gage Applications—

TYPE Q UNIT—DC to 6 kc, 60 μ sec risetime at 10 μ strain/div to 10,000 μ strain/div.

For Transistor-Risetime Checking—

TYPE R UNIT—14-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 Mc, 27-nsec risetime at 50 mv/cm to 24 v/cm.

Probes—Four 10-x attenuation low-capacitance probes are supplied with the instrument. Input capacitance of the Type 551-K combination with probes is 11.5 pf. 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.

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

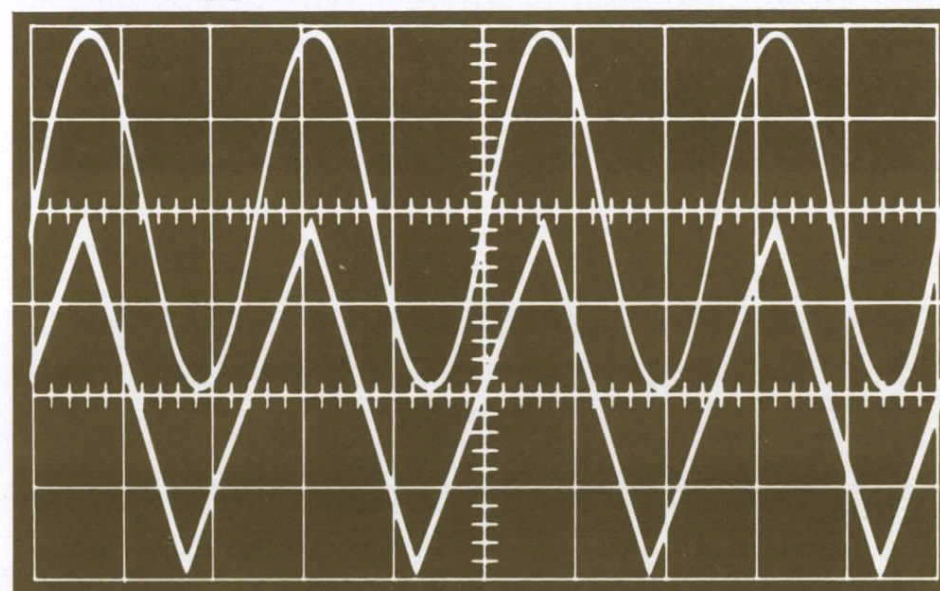
HORIZONTAL-DEFLECTION SYSTEM

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

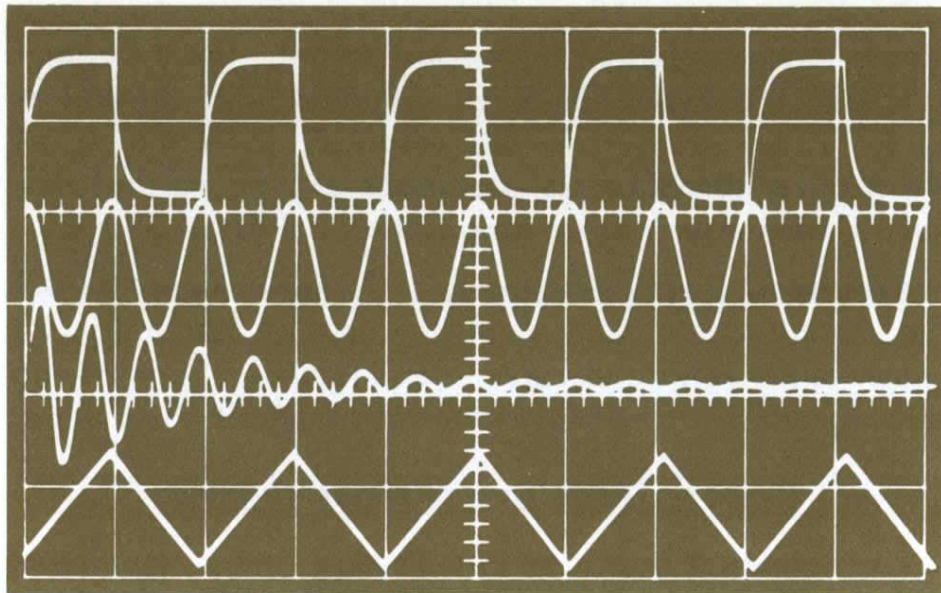
Calibrated Sweeps—The Type 551 has single-knob selection of 24 calibrated sweeps: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 μ sec/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/cm, 0.1, 0.2, 0.5, 1, 2, and 5 sec/cm. In addition, a vernier (uncalibrated) control provides for continuous adjustment of the sweep rate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

Sweep Magnifier—5-x magnifier increases the calibrated sweep time to 0.02 μ 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.



DUAL-BEAM OPERATION



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

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

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.

Low-Frequency Reject — Prevents low-frequency components, such as hum, from interfering with stable triggering.

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 10 v.

Horizontal Input Amplifier—DC-coupled external connection to the sweep-output amplifier is through a front-panel connector. An 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.

OTHER CHARACTERISTICS

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.

Cathode-Ray Tube — 10-kv accelerating potential assures bright displays when using fast sweeps at low repetition rates, and in single-sweep applications. The Tektronix cathode-ray tube 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.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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.

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.

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

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.

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 between 105 and 125 v or 210 and 250 v, and for current-demand differences among the plug-in preamplifiers.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 900 watts maximum.

Mechanical Specifications—Dimensions for Indicator Unit are 16 7/8" high by 13 1/8" wide by 23 7/8" long. Dimensions for the Power Unit are 10 3/8" high by 13 1/2" wide by 17 1/2" long.

Net Indicator Unit weight is 52 1/2 pounds. Shipping weight is 76 pounds, approx. Net Power Unit weight is 44 1/4 pounds. Shipping weight is 53 pounds, approx.

TYPE 551, without plug-in units \$1850

Each instrument includes: 4—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 1—inter-unit cable, 2—instruction manuals.

Rack Mount Adapter

A cradle mount to adapt the Type 551 Oscilloscope and its power supply for rack mounting is available. It consists of two cradles and two masks. The cradles, one each for the indicator and power supply units, support the instruments in any standard 19" relay rack. The two masks fit around the regular instrument panels of the two units. Rack height requirements; Indicator mask 17 1/2", Power Supply mask 12 1/4". Tektronix blue vinyl finish.

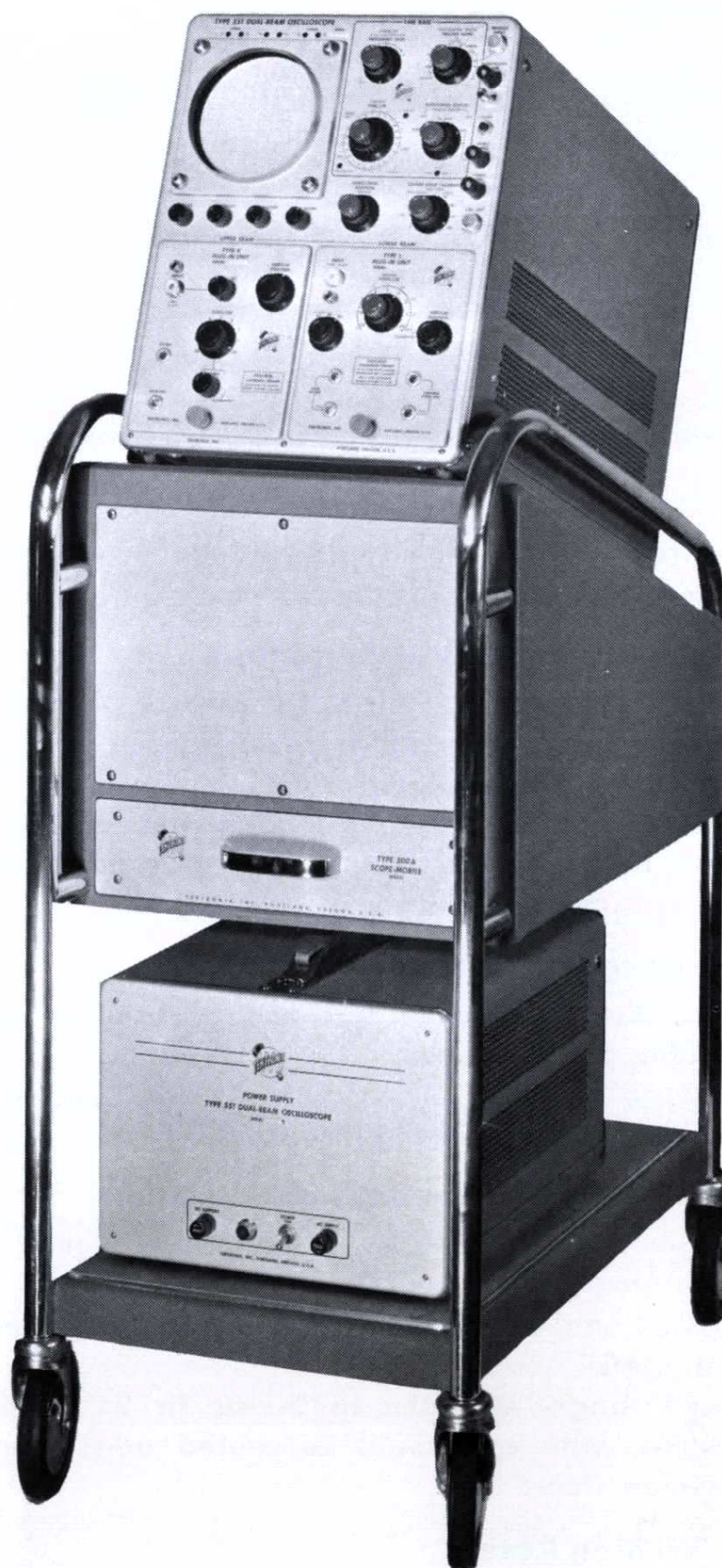
Order Part Number 040-279 \$85

SCOPE-MOBILE® CARTS

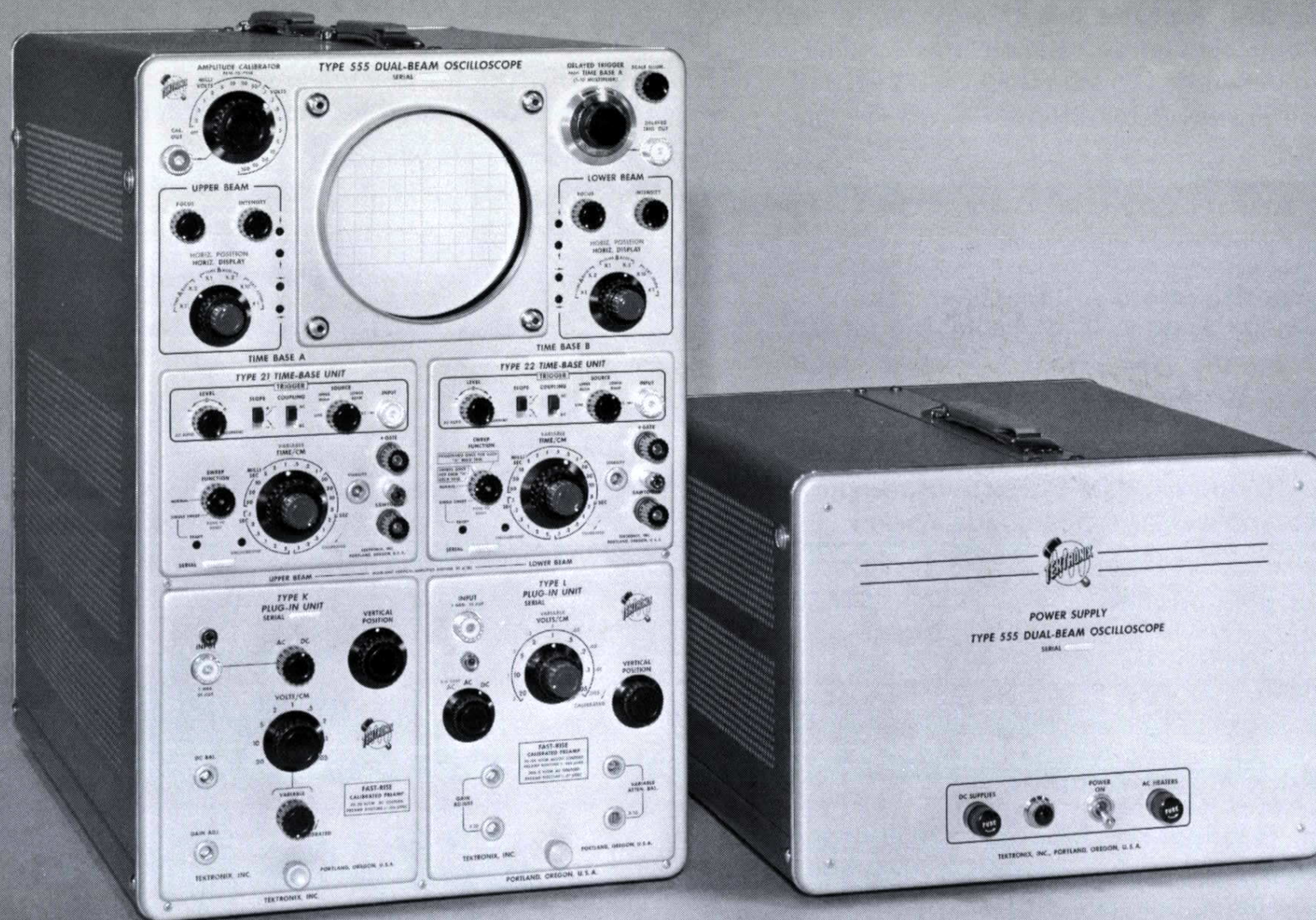
- Type 202 Tilt-Lock Scope-Mobile Cart \$85
- Type 204 Tilt-Lock Scope-Mobile Cart \$99.50
(with storage area for 2 preamplifier units)
- Type 500A Scope-Mobile Cart \$99.50
- Type 500/53A Scope-Mobile Cart \$110
(with storage area for 2 preamplifier units)

See Accessory Section for complete information.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



Type 555 DC-to-30MC 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 fast-rise plug-in units.
Risetimes—12 nsec with fast-rise plug-in units.
Heater supplies regulated for stable operation.
All Tektronix Type A to Z Plug-In Units 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 μ sec/cm to 12 sec/cm. 5-x magnifiers increase sweep times to 0.02 μ 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—0.1 μ 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.

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 Units, 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 supplied with the Type 555, a time-base unit can be operated partially out of its housing, thus facilitating any service that may be required by that unit.

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. Type A to Z Plug-In Units 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.

VERTICAL-DEFLECTION SYSTEMS

Frequency specifications are at 3-db down

Two DC-Coupled Main Amplifiers—Risetime of both main amplifiers is 12 nsec with Type K, L or R units plugged in. They are factory adjusted for optimum transient response. Type A to Z Plug-In Units 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 Units. 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 Wide Band Applications—

TYPE B WIDE-BAND UNIT—DC to 20 Mc, 18-nsec risetime at 50 mv/cm to 50 v/cm—2 cps to 12 Mc, 30-nsec risetime at 5 mv/cm to 50 mv/cm.

For Multiple-Trace Operation—

TYPE C-A DUAL-TRACE UNIT—DC to 24 Mc, 15-nsec risetime at 50 mv/cm to 50 v/cm.

TYPE M FOUR-TRACE UNIT—DC to 20 Mc, 17-nsec risetime at 20 mv/cm to 25 v/cm.

For Differential Input Applications—

TYPE D HIGH-GAIN UNIT—DC to 300 kc at 1 mv/cm, increasing to 2 Mc at 50 mv/cm.

TYPE E LOW-LEVEL UNIT—0.06 cps to 20 kc at 50 μ v/cm, increasing to 60 kc at 0.5 mv/cm to 25 mv/cm.

TYPE G WIDE-BAND UNIT—DC to 20 Mc, 18-nsec risetime at 50 mv/cm to 50 v/cm.

For High DC Sensitivity—

TYPE H WIDE-BAND UNIT—DC to 15 Mc, 23-nsec risetime at 5 mv/cm to 50 v/cm.

For Maximum Frequency Response—

TYPE K FAST-RISE UNIT—DC to 30 Mc, 12-nsec risetime at 50 mv/cm to 40 v/cm.

TYPE L FAST-RISE UNIT—DC to 30 Mc, 12-nsec risetime at 50 mv/cm to 40 v/cm—3 cps to 24 Mc, 15-nsec risetime at 5 mv/cm to 4 v/cm.

For Repetitive High-Speed Pulse Applications—

TYPE N SAMPLING UNIT—0.6-nsec risetime (corresponding to approximately 600 Mc).

For Operations of Integration, Differentiation, Function Generation, and Linear or Nonlinear Amplification—

TYPE O OPERATIONAL AMPLIFIER—DC to 25 Mc, 14-nsec risetime at 50 mv/cm to 50 v/cm.

For Transducer and Strain Gage Applications—

TYPE Q UNIT—DC to 6 kc, 60 μ sec risetime at 10 μ strain/div to 10,000 μ strain/div.

For Transistor-Risetime Checking—

TYPE R UNIT—12-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 Mc, 27-nsec risetime at 50 mv/cm to 24 v/cm.

Probes—Four low-capacitance probes (10-x attenuation) are supplied with the instrument. Input capacitance of the Type 555-K combination with probes is 11.5 pf. 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.

Balanced Delay Network—A signal delay of 0.2 μ 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 μ 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.

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 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 $\mu\text{sec}/\text{cm}$ to 12 sec/cm . An indicator light warns the operator when the sweep is uncalibrated. Calibration accuracy of the fixed sweep rates will typically be within 1% of full scale, and in all cases within 3%.

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 10 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.

Trigger Requirements—For sine wave frequencies up to 2 mc, an internal signal large enough to cause a 2 mm deflection or an external signal of 0.2 v to 10 v will trigger the oscilloscope. Larger amplitudes are required for frequencies above 2 mc, increasing to approximately 2 cm of signal at 10 mc internally. Proportionally larger signals are also required externally.

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 pf 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 0.1 μsec 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.



At Bonneville Power Administration—in one of many continuing studies with their transient analyzer—a System Engineer uses a Tektronix Type 555 Oscilloscope with dual-trace units in both channels to display fast switching transients occurring in each phase of a transmission system. By observing the three switching-transient traces with a timing trace, he can quickly and easily compare magnitudes, phase relationships, transient times, and accurately determine overvoltage characteristics of the system.

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.

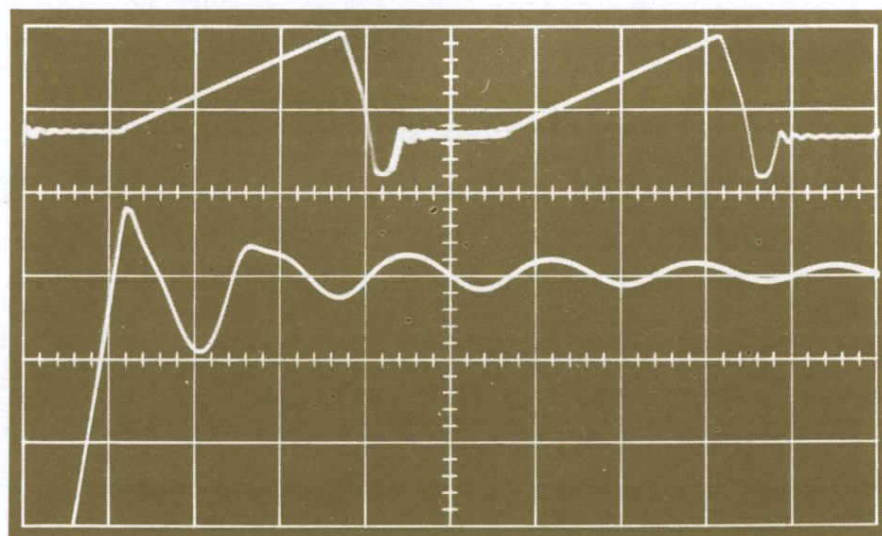
The time jitter in the delayed trigger or delayed sweep will not exceed one part in 20,000 of the maximum available delay interval (where the maximum available delay interval is 10 times the Time/Cm or Delay-Time setting).

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 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.

Delay Range—The calibrated range of sweep delay, $0.1 \mu\text{sec}$ 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 $0.5 \mu\text{sec}$ to 50 sec. Incremental accuracy of this control is within 0.2% on all ranges from $1 \mu\text{sec}$ to 50 sec.

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



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

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 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 supplied.

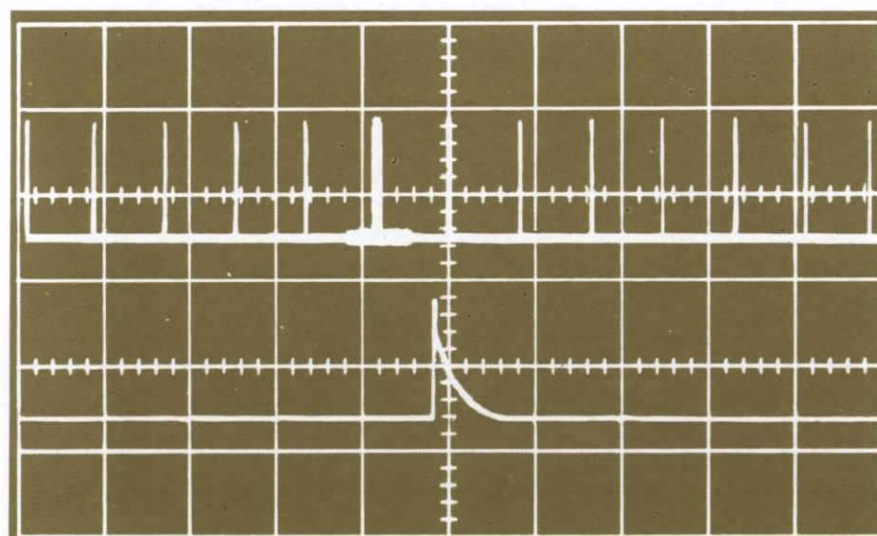
Regulated DC and Heater Supplies—A separate unit supplies power to the Type 555 indicator unit through an interconnecting cable. To compensate for line-voltage variations, and for current-demand differences among the plug-in preamplifiers, all dc supplies are electronically regulated. All heaters in 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 between 105 and 125 v or 210 and 250 v.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 1050 watts maximum.

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 of approximately 20 v and a positive-going sawtooth of approximately 150 v are available through front-panel binding posts from both time base units. The delayed trigger, amplitude about 5 v, is also available through a front-panel coaxial connector.



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.

555

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.

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.

Mechanical Specifications—Dimensions for the indicator unit are 20 1/8" high by 13 1/8" wide by 24" deep. Net weight is 66 pounds. Shipping weight is 93 pounds, approx. Dimensions for the power supply unit are 10 3/8" high by 13 1/2" wide by 17 1/2" deep. Net weight is 51 pounds. Shipping weight is 61 pounds, approx.

TYPE 555, without preamplifier plug-in units . . . \$2600

Each instrument includes: 1—Type 21 Time-Base Plug-In Unit, 1—Power Supply Unit, 1—Type 22 Time-Base Plug-In Unit, 1—Time-Base Plug-In Extension, 4—probes (10X atten), 1—inter-unit cable, 2—binding-post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

*\$2650.
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EXTRA TIME-BASE PLUG-IN UNITS

- Type 21 Time-Base Unit \$275
- Type 22 Time-Base Unit \$285

Scope-Mobile® Carts are available for the Type 555 Oscilloscope and Power Supply Unit to provide easy moving in your work area.



SCOPE-MOBILE® CARTS

- Type 202 Tilt-Lock Scope-Mobile Cart \$85
- Type 204 Tilt-Lock Scope-Mobile Cart \$99.50
(with storage area for 2 preamplifier units)
- Type 500A Scope-Mobile Cart \$99.50
- Type 500/53A Scope-Mobile Cart \$110
(with storage area for 2 preamplifier units)

See Accessory Section for complete information.

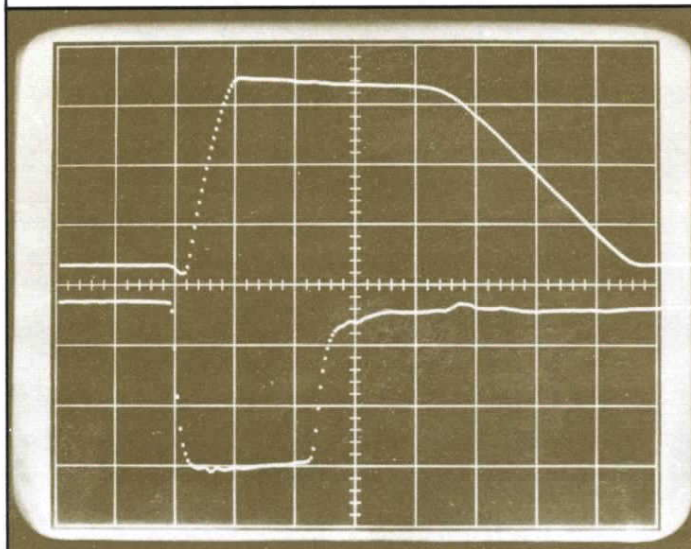
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



OSCILLOSCOPE Type 561A

- RECTANGULAR CERAMIC CRT
- ILLUMINATED INTERNAL GRATICULE
- AMPLIFIER PLUG-IN UNITS
- TIME-BASE PLUG-IN UNITS
- COMPACT SIZE
- SIMPLE, RELIABLE PERFORMANCE

TRANSISTOR SWITCHING-TIME DISPLAY



SWEEP TIME—
10 nsec/cm

UPPER TRACE—
turn-on
and turn-off

LOWER TRACE—
transistor E_c
at turn-on

Note parallax-free display
on new internal illuminated graticule.

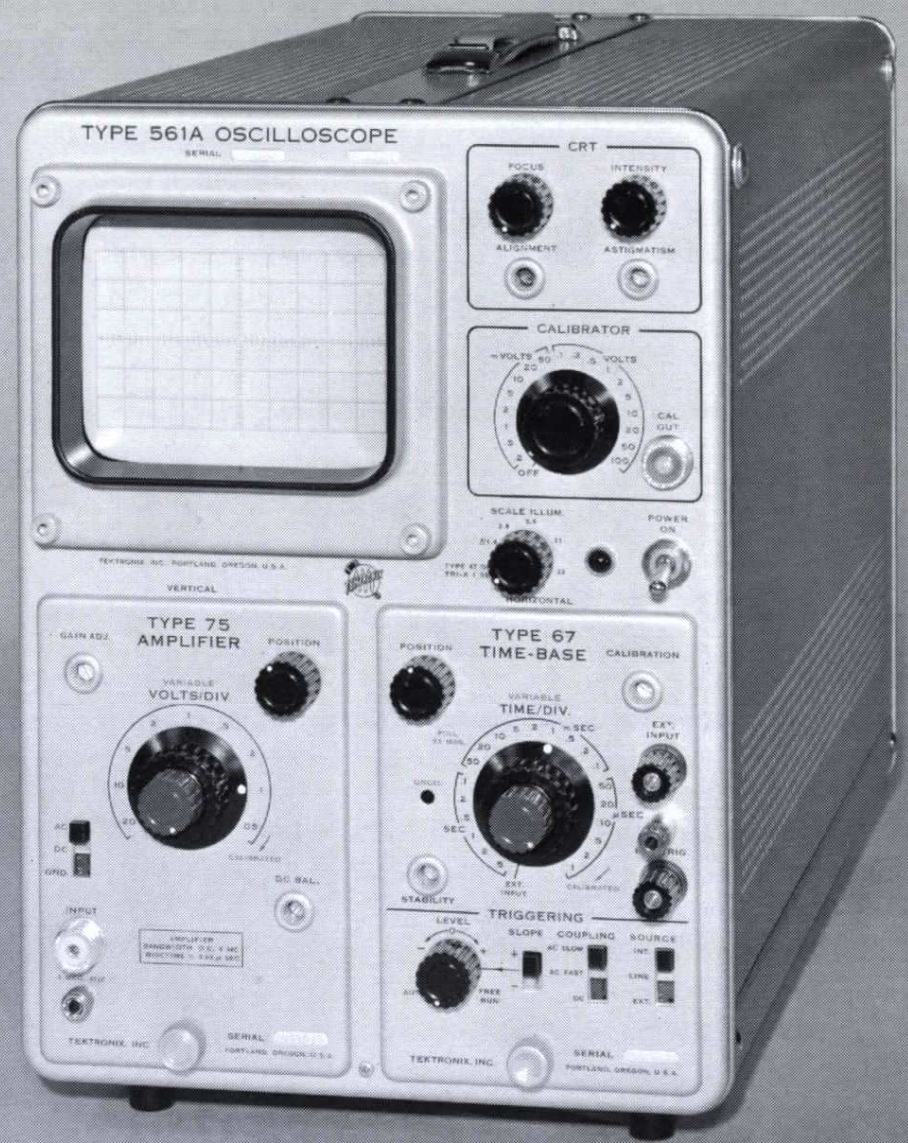
The Type 561A employs a unique 5-inch rectangular "ceramic envelope" cathode-ray tube with the following features:

1. Illuminated "no parallax" internal graticule on a high-quality parallel-ground plate-glass face.
2. Controllable edge-lighting, permitting trace photography with the same convenience as provided by external graticules.
3. Monoaccelerator design and 3.5-KV accelerating potential which provide small spot size for a bright, finely-focused trace.

Other features of this compact new oscilloscope include: Improved regulated power supplies • Regulated dc heater supply • Z-axis input • Amplitude calibrator with 18 steps from 0.2 mv to 100 v • Operation from 105 v to 125 v or 210 v to 250 v, 50 to 400 cps •

A wide range of performance characteristics is provided by available plug-in units—from the simple single-channel Type 2A60 Amplifier to the dual-channel 0.4-nsec-risetime Type 3S76 Sampling Unit. Also, the two latest plug-ins, the Type 3A1 Amplifier Unit and the Type 3B3 Time-Base Unit provide high-sensitivity wide-band dual-trace operation combined with calibrated sweep delay.

X-Y DISPLAYS: Types 2A60, 2A63, 3A72, 3A74 and 3A75 Amplifier Units operate equally well in the vertical and horizontal compartments of the Type 561A, permitting X-Y displays using any combination of these plug-in units.



For medium and high-frequency X-Y operation, use of two units of the same type is recommended. Deflection-plate capacitances of the 561A are carefully standardized to minimize high frequency phase-shift between two plug-ins of the same type when operated X-Y.

MULTIPLE X-Y DISPLAYS: Two Type 3A72 Units in the Type 561A will provide two independent X-Y displays, properly paired; two Type 3A74 Units will provide up to four independent displays, Channel 1 plotted against Channel 1, Channel 2 against Channel 2, etc. (The Type 3A1 Unit does not provide for X-Y pairing, and, due to its 6-cm scan limitation, is not generally recommended for obtaining multiple X-Y displays.)

CHARACTERISTICS

PLUG-IN COMPARTMENTS accept all 2-Series and 3-Series Amplifier and Time-Base Units.

TEKTRONIX CRT is a new flat-faced, "ceramic envelope" tube with internal "no parallax" graticule (on a parallel-ground plate-glass face), controllable edge-lighting, 3.5-KV Monoaccelerator, beam-deflection unblanking. A P31 Phosphor is normally supplied.

DISPLAY CONTROLS on the front-panel include Focus, Intensity, and Scale Illumination (of the 8-cm by 10-cm display area), in addition to adjustments for Astigmatism and Trace Alignment.

Z-AXIS INPUT through a terminal at the rear of the instrument permits external modulation of the crt cathode.

CALIBRATOR has 18 calibrated square-wave voltages available, from 0.2 mv to 100 v, pk-to-pk—approximately 5 μ sec risetime, at line frequency, convenient for time-base calibration. The 0.5 calibrator voltage provides 0.1 volts into 50 ohms, convenient for calibration of sampling units.

561A

AMBIENT TEMPERATURE RANGE for proper operation is approximately 20°F to 120°F. If internal temperature becomes excessive, the power will automatically shut off and remain off until the temperature returns to the proper operating range.

ELECTRONICALLY-REGULATED SUPPLIES furnish all voltages required for proper operation of the Indicator and the plug-in units. Regulated dc-supply operates between 105 v to 125 v or 210 v to 250 v, 50 to 400 cps. . . provides 85 watts for powering the 2-Series and 3-Series Plug-In Units.

Supplies operate normally with or without plug-ins.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v ac, 50 to 400 cps, approximately 210 watts at 117 v and 240 watts maximum at 125 v.

MECHANICAL FEATURES include an aluminum-alloy chassis and three-piece cabinet. Dimensions are 14½" high by 10" wide by 21⅛" deep. Net weight is 28 pounds. Shipping weight is 45 pounds, approx.

TYPE 561A OSCILLOSCOPE (without plug-in units) \$470

Each instrument includes: 1—binding post adapter, 1—power cord, 1—green filter, 2—instruction manuals.

Type RM561 RACK MOUNT

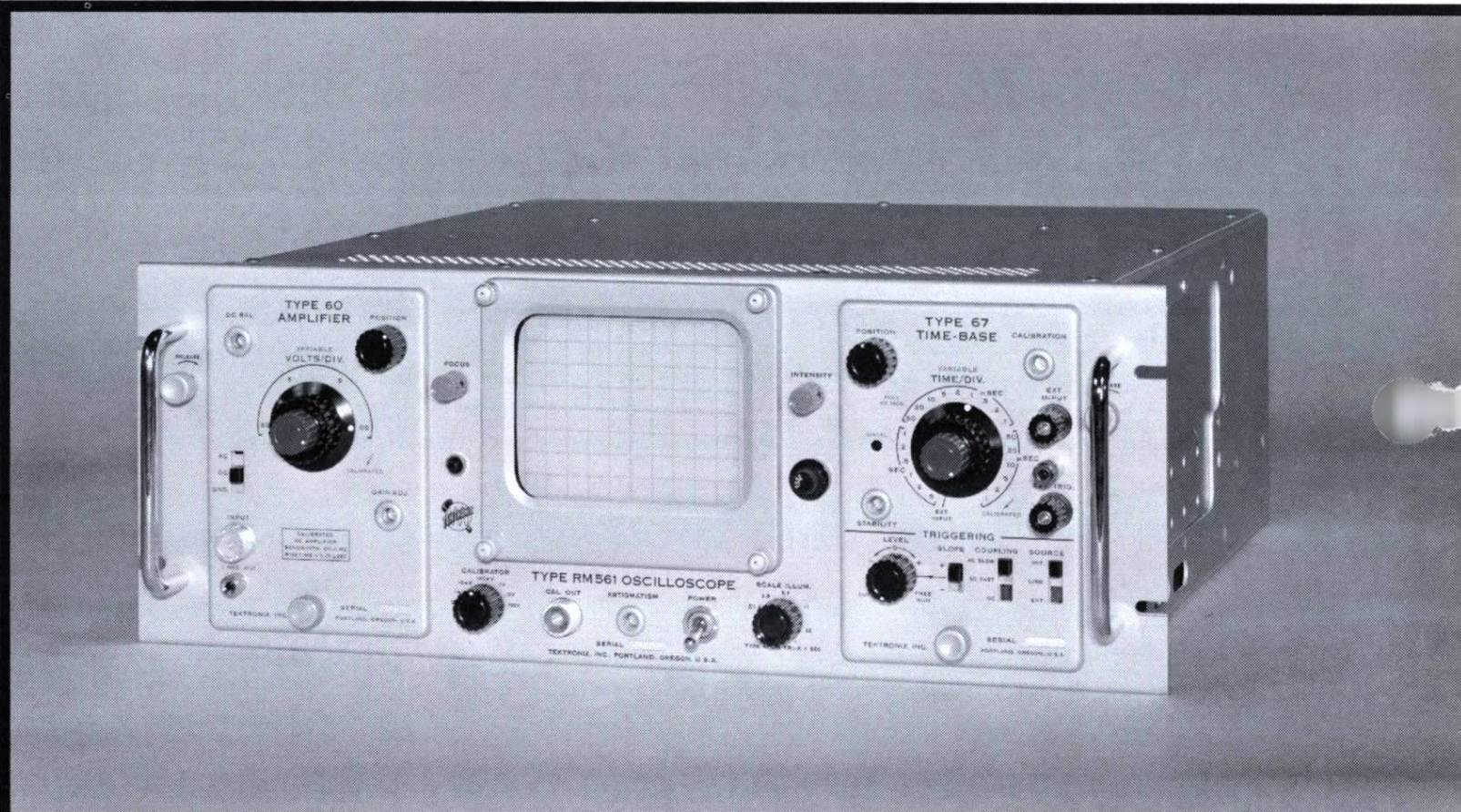
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Rack Slides:
Basic tilt lock (351-051) \$39.25
Deluxe " " (351-050) \$64.70

The Type RM561 is a rack-mount oscilloscope that accepts all 2-Series and 3-Series Amplifier and Time-Base Units except Types 3A1, 3B1, and 3B3. It has the same capabilities for X-Y displays and multiple X-Y displays as the Type 561A Oscilloscope.

Features include a 5-inch rectangular crt, beam-rotator adjustment (that eliminates necessity for removal from the rack when aligning the beam), amplitude calibrator with a range of 1 mv to 100 v, in decade steps, and electronically-regulated power supplies.

Occupying only 7 inches of standard rack height, the Type RM561 bolts directly to the rack, but may be ordered with optional slideout tracks at additional cost. Ask your Tektronix Field Engineer about this option.



CHARACTERISTICS

PLUG-IN COMPARTMENTS accept all 2-Series and 3-Series Amplifier and Time-Base Units except three: the Type 3A1 Dual-Trace Amplifier Unit and the Types 3B1 and 3B3 Time-Base Units.

TEKTRONIX CRT is a 5-inch rectangular, monoaccelerator CRT with external graticule, controllable edge-lighting of 8-cm by 10-cm display area, 3.5-KV accelerating potential, beam-deflection unblanking. A P31 Phosphor is normally supplied.

DISPLAY CONTROLS on the front-panel include Focus, Intensity, and Scale Illumination (of the 8-cm by 10-cm display area), in addition to adjustments for Astigmatism and Trace Alignment.

CALIBRATOR has a range of 1 mv to 100 v in six steps: 1 mv, 10 mv, 100 mv, 1 v, 10 v, and 100 v.

ELECTRONICALLY-REGULATED SUPPLIES furnish all voltages for proper operation of the indicator and the plug-in units. Regulated dc supply operates between 105 v to 125 v or 210 v to 250 v, 50 to 60 cps. . . provides 85 watts for powering the 2-Series and 3-Series Plug-In Units.

Supplies operate normally with or without plug-ins.

AMBIENT TEMPERATURE RANGE for proper operation is approximately 20°F to 120°F. If internal temperature becomes excessive, the power will automatically shut off and remain off until the temperature returns to the proper operating range. The RM561 is fan cooled for optimum reliability in closed racks.

Z-AXIS INPUT through a terminal at the rear of the instrument permits external modulation of the crt grid.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v ac, 50 to 60 cps, approximately 210 watts at 117 v and 240 watts maximum at 125 v.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel. The Type RM561 fits into a standard 19" rack, is 7" high and 18⅜" deep. Net weight is 31 pounds. Shipping weight is 56 pounds, approx.

TYPE RM561 OSCILLOSCOPE (without plug-in units) \$465

Each instrument includes: 1—mounting hardware set, 1—binding post adapter, 1—power cord, 1—green filter, 2—instruction manuals.

For mounting information, please refer to the Mounting Dimensions page in the catalog.

561A

RM561

The Type 561A and RM561 Oscilloscopes accept a wide variety of plug-in units for quick and easy adaptability to many diversified operations, including X-Y applications. The units directly drive the crt deflection plates...house approximately two-thirds of the circuitry—thus provide easy servicing and also minimize "down time" of the instrument.

Type 561A accepts all the plug-in units; Type RM561 accepts all units except Types 3A1, 3B1, and 3B3.

AMPLIFIER UNITS

TYPE	INPUT (ac or dc coupled)	PASSBAND (3-db down)	SENSITIVITY	PRICE
*2A60	1 megohm paralleled by 47 pf, 600 volts max.	dc—1 Mc.	50 mv/cm—50 v/cm, 4 decade steps, with variable control.	\$105
*2A63 (50:1 rejection ratio)		dc—300 kc.	1 mv/cm—20 v/cm, 1-2-5 sequence, with variable control.	\$130
3A1—Dual Trace (Identical Channels)		dc—10 Mc. (each channel).	10 mv/cm—10 v/cm, 1-2-5 sequence, with variable control.	\$410
*3A72—Dual Trace (Identical Channels)		dc—650 kc. (each channel).	10 mv/cm—20 v/cm, 1-2-5 sequence, with variable control. 6 cm Linear scan.	\$250
3A74—Four Trace (Identical Channels)		dc—2 Mc. (each channel).	20 mv/cm—10 v/cm, 1-2-5 sequence, with variable control.	\$550
*3A75—Wide Band		dc—4 Mc.	50 mv/cm—20 v/cm, 1-2-5 sequence, with variable control.	\$175
3S76—Dual Trace Sampling (for use with 3T77)	50 ohms dc-coupled	equivalent dc-to-875 Mc. (0.4-nsec risetime)	2 mv/cm—200 mv/cm, 1-2-5 sequence, with variable control.	\$1100

TIME-BASE UNITS

TYPE	SWEEP FEATURES	TRIGGERING	PRICE
† 2B67	1 μ sec/cm to 5 sec/cm, 1-2-5 sequence, variable between rates. 5X Magnifier. Single Sweep.	Internal, External, Line; Amplitude-Level Selection; AC or DC-Coupling; Automatic or Free-Run; \pm Slope.	\$175
3B1	Normal and Delayed Sweeps—0.5 μ sec/cm to 1 sec/cm, 1-2-5 sequence. 18 calibrated delay settings, 0.5 μ sec to 10 sec, variable between rates uncalibrated.	Internal or External; AC or DC-Coupling; Automatic; \pm Slope. Same features for both Normal and Delayed-Sweep Modes, except automatic.	\$475
3B3	Normal and Delayed Sweeps—0.5 μ sec/cm to 1 sec/cm, 1-2-5 sequence. Continuously variable calibrated delay from 0.5 μ sec to 10 sec. Single Sweep for main sweep.	Internal, External, Line; AC or DC-Coupling; Automatic; \pm Slope; for Normal Sweep Mode. Same features (except no Line or Automatic) for Delayed-Sweep Mode.	\$525
3T77 Sampling Sweep (for use with 3S76)	Equivalent to 0.2 nsec/cm to 10 μ sec/cm, 1-2-5 sequence, variable between rates. 10X Magnifier.	Internal or External \pm Slope.	\$650

* Formerly designated by last two digits.
† Same as former Type 67 with addition of single-sweep feature.

See appropriate catalog pages for complete specifications.

PROBES

RC attenuator probes are not included with the Type 561A or the Type RM561 Oscilloscopes. Tektronix probes are recommended when minimum loading on the circuit is required.

The following 42-inch cable length probes are ideally suited for use with the Types 2A60, 2A63, 3A72, 3A74 and 3A75 Amplifier Units.

Probe	Atten Ratio	Part No.	Input Impedance		Voltage Rating	Price
			Resistance	Capacitance		
P6017	10:1	010-038	10 meg Ω	14 pf	600 v	\$12.50
P6027	1:1	010-070	1 meg Ω	94 pf	600 v	12.50
P6002	100:1	010-024	9.1 meg Ω	2.8 pf	2000 v	21.50

See Accessory Section for complete specifications.

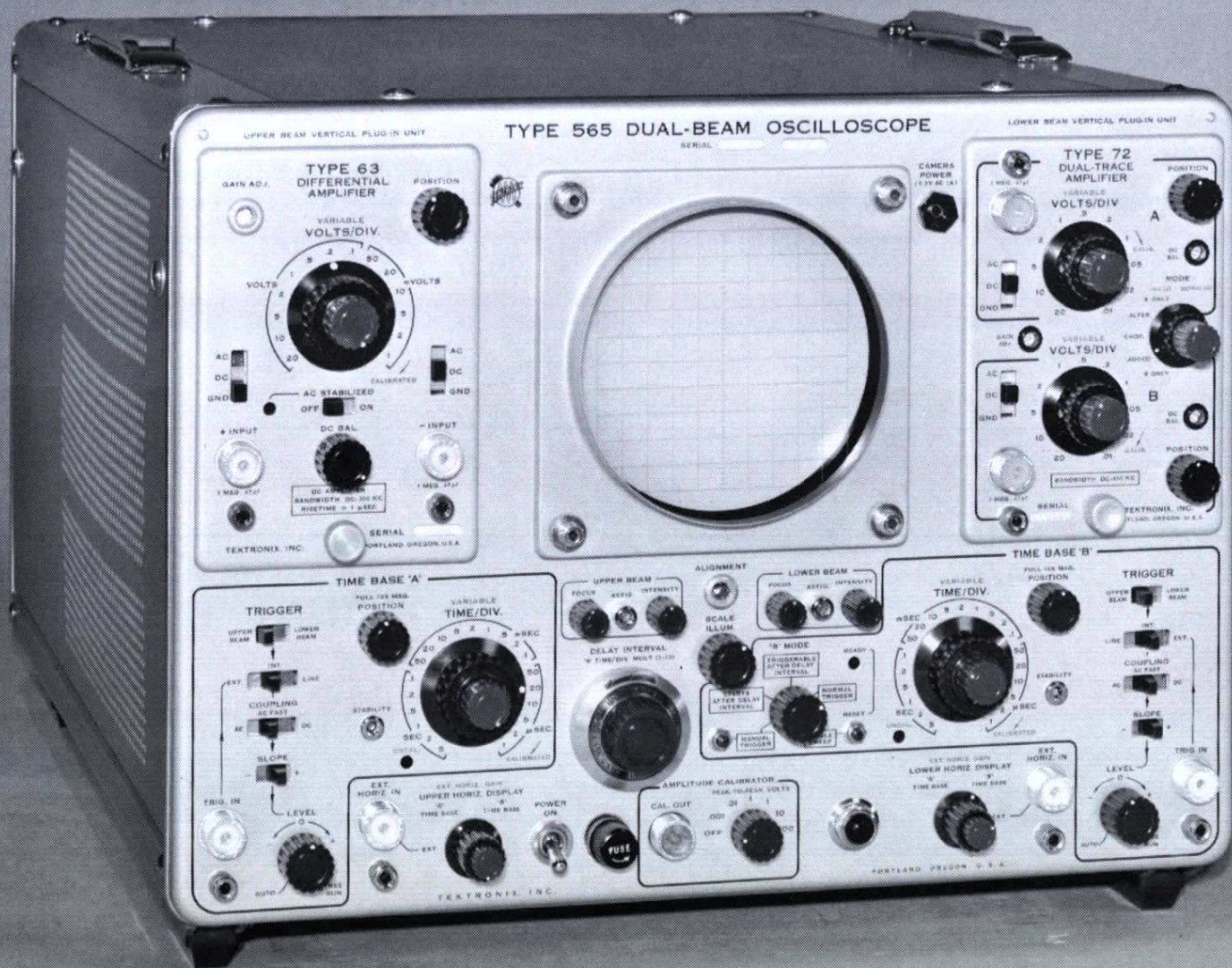
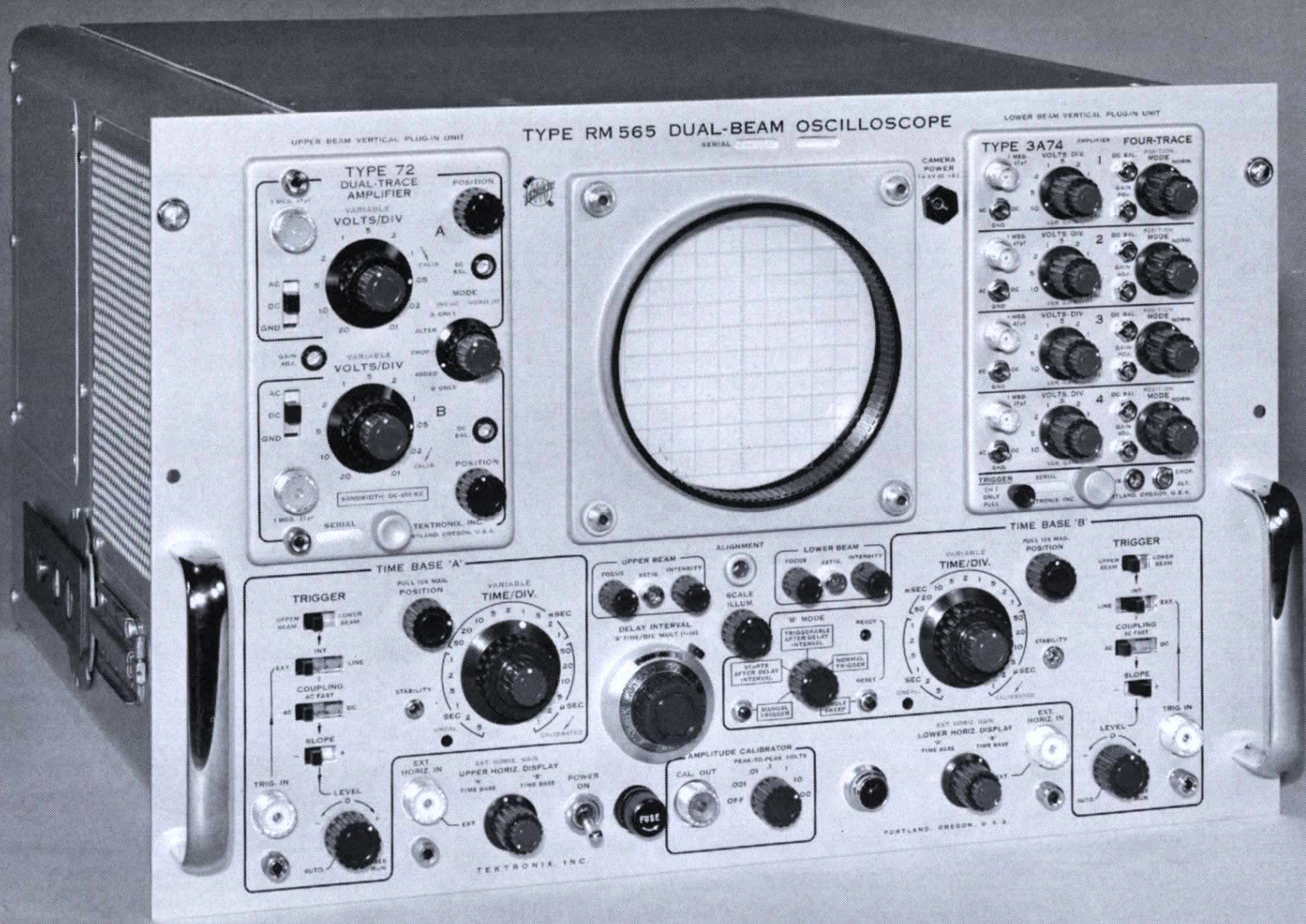
BLANK PLUG-IN CHASSIS

This chassis contains necessary unique mechanical parts for construction of a custom plug-in for Type 560-Series Instruments—including frame, blank front panel, blank chassis, 24-pin connector, latch and small hardware. Instructions are included on permissible power-supply loading and CRT signal requirements. Electrical components are not included.

Order Part Number 040-245 \$15

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type **565** **RM565** DUAL-BEAM OSCILLOSCOPE



- Two Completely Independent Beams
- Two Identical Independent Sweep Systems
- Plug-In Vertical Amplifiers
- Delaying-Sweep Operation
- Single-Sweep Operation
- Rear-Panel Output Connectors

A Type RM565—or cabinet-model counterpart, Type 565—is essentially two single-beam oscilloscopes sharing a common cathode-ray tube, power supply and housing. Each beam has separate vertical and horizontal amplifiers, focus, and intensity controls.

The vertical amplifiers can be any of the 2-Series or 3-Series Plug-In Units listed under Vertical Amplifier Units.

The horizontal amplifiers are built-in and can be driven by either of two identical sweep systems, simultaneously or independently, or from the external input. Front-panel controls permit using "A" sweep as a delaying sweep and "B" as the delayed sweep. In this mode of operation the upper beam is intensified for the duration of the "B" sweep. "B" sweep may also be used for single-sweep operation.

The crt is a round, 5-inch, dual gun, aluminized, mono-accelerator tube with a 4-kv accelerating potential.

Other features include a 1-kc square-wave amplitude calibrator and rear-panel cathode-follower outputs of: Vertical Signals, Horizontal Signals, + Gates, and Delayed Trigger.

ELECTRICAL CHARACTERISTICS

(pertain to circuitry for each of the two beams)

VERTICAL AMPLIFIERS

Characteristics of the two vertical systems depend upon the 2-Series or 3-Series Amplifier Units used. Please refer to the plug-in chart for more information on these vertical amplifier units.

TRIGGER

SENSITIVITY—0.5 volts or 2 minor divisions up to 50 kc, decreasing to 1 volt or 1 cm at 2 Mc.

"AC" coupling time constant— 10^{-2} sec (.01 μ f and 1 meg)

"AC, FAST" coupling time constant— 10^{-4} sec (100 pf and 1 meg)

HORIZONTAL SWEEP GENERATORS

RANGE—1 μ sec/div to 5 sec/div in 21 calibrated steps, 1-2-5 sequence.

ACCURACY—Within 3%.

VARIABLE—Control permits continuous adjustment uncalibrated from 1 μ sec/div to 12 sec/div.

MAGNIFIER—10X Magnifier permits expanding any 1 division portion of the display a full 10 divisions, accuracy within 5%. The magnifier can be used to extend the maximum sweep rate to 0.1 μ sec/div.

HORIZONTAL AMPLIFIERS

SENSITIVITY—Approximately 100 mv/div, continuously adjustable.

INPUT IMPEDANCE—100 kilohms.

PASSBAND—dc-to-350 kc, at maximum sensitivity.

DELAY INTERVAL

RANGE—1 μ sec to 50 sec calibrated and continuously adjustable.

INCREMENTAL ACCURACY—Within 0.5%.

JITTER—1 part in 10,000.

CALIBRATOR

RANGE—1 mv to 100 v pk-to-pk in 6 decade steps, positive-going square wave.

ACCURACY—Within 3%.

FREQUENCY—Approximately 1 kc.

REAR-PANEL OUTPUT CATHODE FOLLOWERS

OUTPUT IMPEDANCE—500 ohms, approximately.

MAXIMUM LOAD CURRENT—2 ma.

VERTICAL OUTPUT—Signal amplitude, dc level, and transient response are dependent upon the vertical plug-in unit used. Signal amplitude, 2 v/div to 4 v/div of display; dc level, ± 20 volts.

HORIZONTAL OUTPUT—Signal amplitude, at least 50 mv/div of display in External position and 0.5 v/div of display in Sweep position; dc level, ± 5 volts.

+ GATE—Pulse height, 20 v minimum; dc level, zero volts.

DELAYED TRIGGER—Fast-rise pulse amplitude, +8 v minimum; decay, 0.5 μ sec; dc level, zero volts.

AUXILIARY POWER PLUG—For powering future accessories.

POWER REQUIREMENT

OPERATION—105 v to 125 v, 50 to 60 cps.

The instrument can be wired for any of the following nominal line voltages.

Nominal Line Voltages	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.

WATTAGE—600 watts maximum (depends upon plug-in combination).

565

RM565

OPERATIONAL FEATURES

(pertain to both sweep systems except as indicated for "B" sweep)

TRIGGER FACILITIES

Trigger selection is accomplished by slide-switch logic. This arrangement allows quick selection and quick visual checks. Sequence is as follows:

1. EXTERNAL, INTERNAL (upper or lower beam), or LINE frequency triggering.
2. COUPLING can be AC, AC FAST, or DC.
3. SLOPE can be + or - for triggering on the positive-going or negative-going portion of the selected waveform.
4. Automatic triggering, level control, free run. The Level control permits triggering on the desired portion of the waveform. At the CCW stop of this control, the trigger is in the Automatic Mode. The sweep free runs at about a 50-cps rate (in the absence of a signal) giving a reference trace but will automatically trigger on incoming trigger signals of a higher frequency. At the CW stop of this control, the sweep free runs.

SWEEP GENERATORS "A" AND "B"

Independent operation of the two generators; delaying sweep operation; single-sweep operation, single control selection of sweep Time/Div in a 1-2-5 sequence, Variable control, light indicating "uncalibrated" sweep, and a 10X Magnifier.

"B" time base mode switch positions: (1) Manual Trigger, (2) Starts After Delay Interval, (3) Triggerable After Delay Interval, (4) Normal Trigger, (5) Single Sweep.

With the "B" time base switch in the "Normal Trigger" position, each sweep operates independently. In the "Starts After Delay Interval" and "Triggerable After Delay Interval" positions, time base "A" operates as a delay timing sweep and time base "B" operates as the delayed sweep. The upper beam is intensified for the duration of the "B" sweep.

The delay interval from 10 μ sec down, is continuously adjustable from one-half centimeter to 10 centimeters of the "A" sweep by a ten-turn helipot and can read accurately from a calibrated dial. Above 10 μ sec, calibrated delay interval is adjustable from one centimeter to 10 centimeters.

In the "Single-Sweep" position, the sweep is armed by pressing a button. A ready light shows that the sweep is ready for the first incoming trigger. Single-sweep operation facilitates photographic recording of waveforms.

HORIZONTAL DISPLAY SWITCH (horizontal amplifier input selector).

Positions include those for external horizontal input, "A" sweep, and "B" sweep. In the external horizontal input position, the horizontal amplifier is connected to the front panel input connector through the Ext Horiz Gain control. In the other two positions, the amplifier is connected to the output of either sweep generator.

The horizontal position is controlled through a backlash potentiometer in which the fine control is adjusted within the large back-lash of the coarse control.

CRT AND DISPLAY FEATURES

CATHODE-RAY TUBE—Round, flat-faced aluminized 5-inch dual-beam tube using 4-kv accelerating potential.

VERTICAL SCAN—8 cm (each beam), overlap of the two beams is 6 cm.

HORIZONTAL SCAN—10 cm.

CONTROLS—Focus, Intensity, and Astigmatism (separate controls for each beam).

INTERNAL CONTRAST CONTROL—for the intensified section of the "A" sweep.

DEFLECTION-AXIS ROTATER—(front panel screw driver adjustment) for electro magnetically rotating the deflection axis to match the graticule lines.

SCALE ILLUMINATION CONTROL—With controllable edge lighting.

PHOSPHOR—P2 is normally supplied. See phosphor chart for others available.

CIRCUIT FEATURES

VERTICAL PLUG-IN AMPLIFIERS—Adapt the dual-beam oscilloscope to a wide range of uses and new circuit developments.

RETRACE BLANKING—dc coupled.

REAR-PANEL SIGNALS—From cathode followers.

Z-AXIS MODULATION—Of ^{both} ~~lower~~ beam grids through rear panel connector. Time constant, 2.2 milliseconds, nominally.

ELECTRONICALLY-REGULATED POWER SUPPLIES.

CHOPPED TRACE BLANKING

MECHANICAL FEATURES

ALUMINUM-ALLOY CHASSIS.

ANODIZED FRONT PANEL.

SNAP-OUT VERTICAL AMPLIFIER SHIELDS.

FORCED-AIR COOLING—With shock mounted fan and plastic dust filter.

RACK-MOUNT MODEL

TYPE RM565—Mounts on tilt-lock slide-out tracks to a standard 19" rack. Dimensions are 12 1/4" high by 19" wide by 22" deep. Net weight is 67 pounds. Shipping weight is 99 pounds, approx.

For more mounting information, please refer to the Mounting Dimension page in the catalog.

TYPE RM565 OSCILLOSCOPE, without plug-in units . \$1500

Each instrument includes: 1—power cord, 2—dual binding-post adapters, 1—test lead, 1—green filter, 1—pair guide rails, 1—set - mounting hardware, 2—instruction manuals.

CABINET MODEL

TYPE 565—Dimensions are 13 1/2" high by 17" wide by 23 3/8" deep. Net weight is 62 pounds. Shipping weight is 92 pounds, approx.

TYPE 565 OSCILLOSCOPE, without plug-in units . . . \$1400

Each instrument includes: 1—power cord, 2—dual binding-post adapters, 1—test lead, 1—green filter, 2—instruction manuals.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

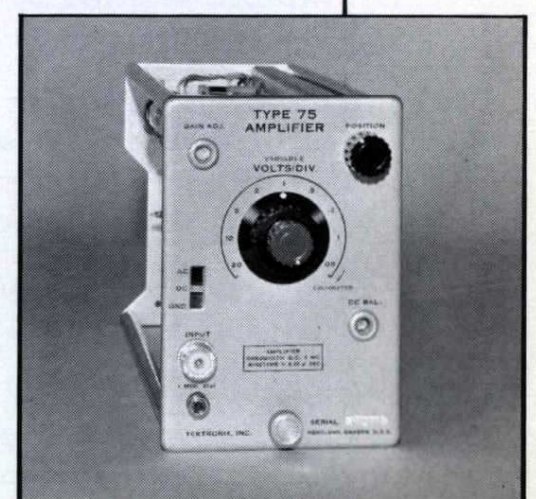
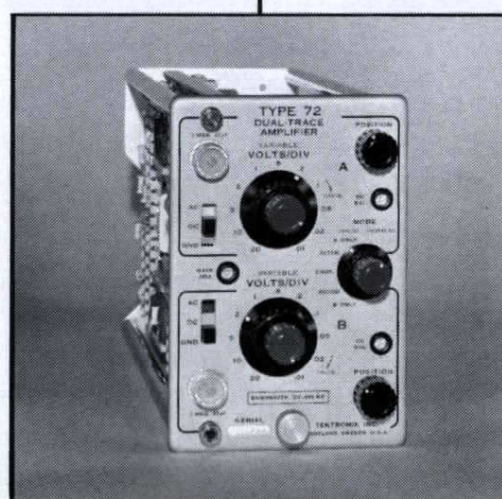
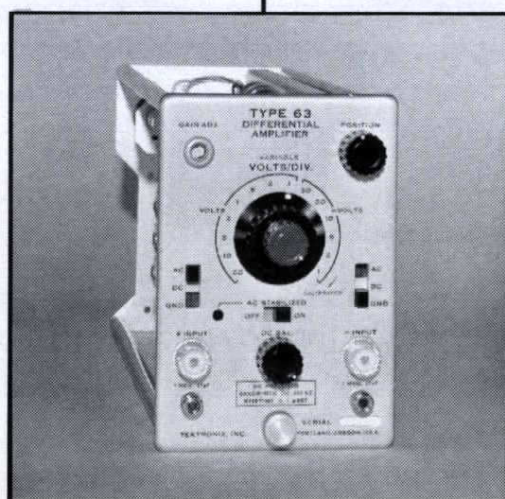
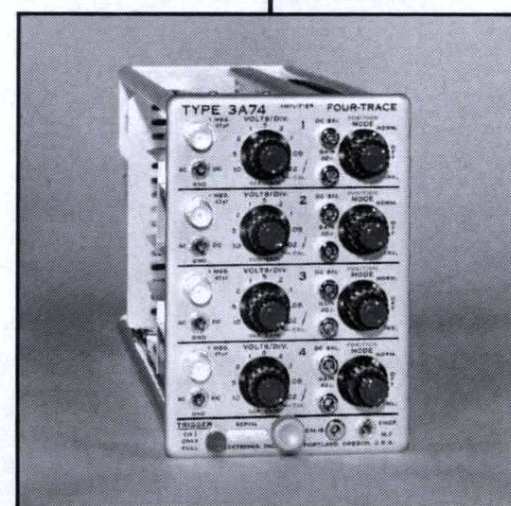
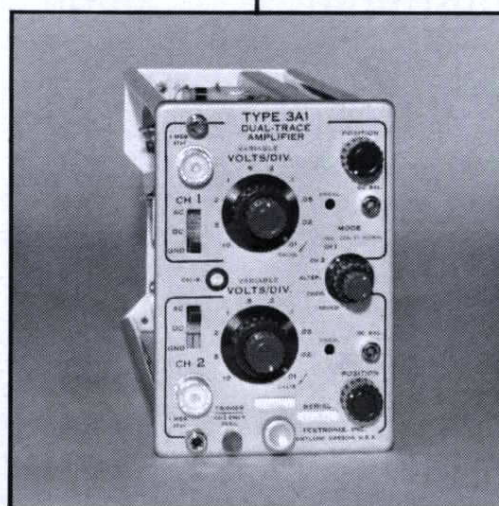
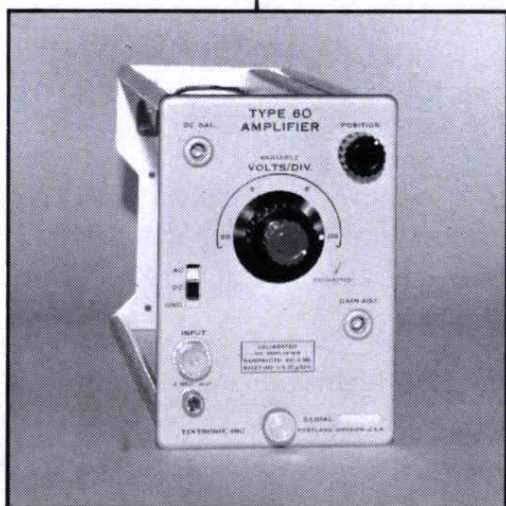
SUPPORTING CRADLES

When the Type RM565 is used in a backless rack, these supporting cradles are necessary for rear-slide support.

Order Part Number 426-165 \$8.50

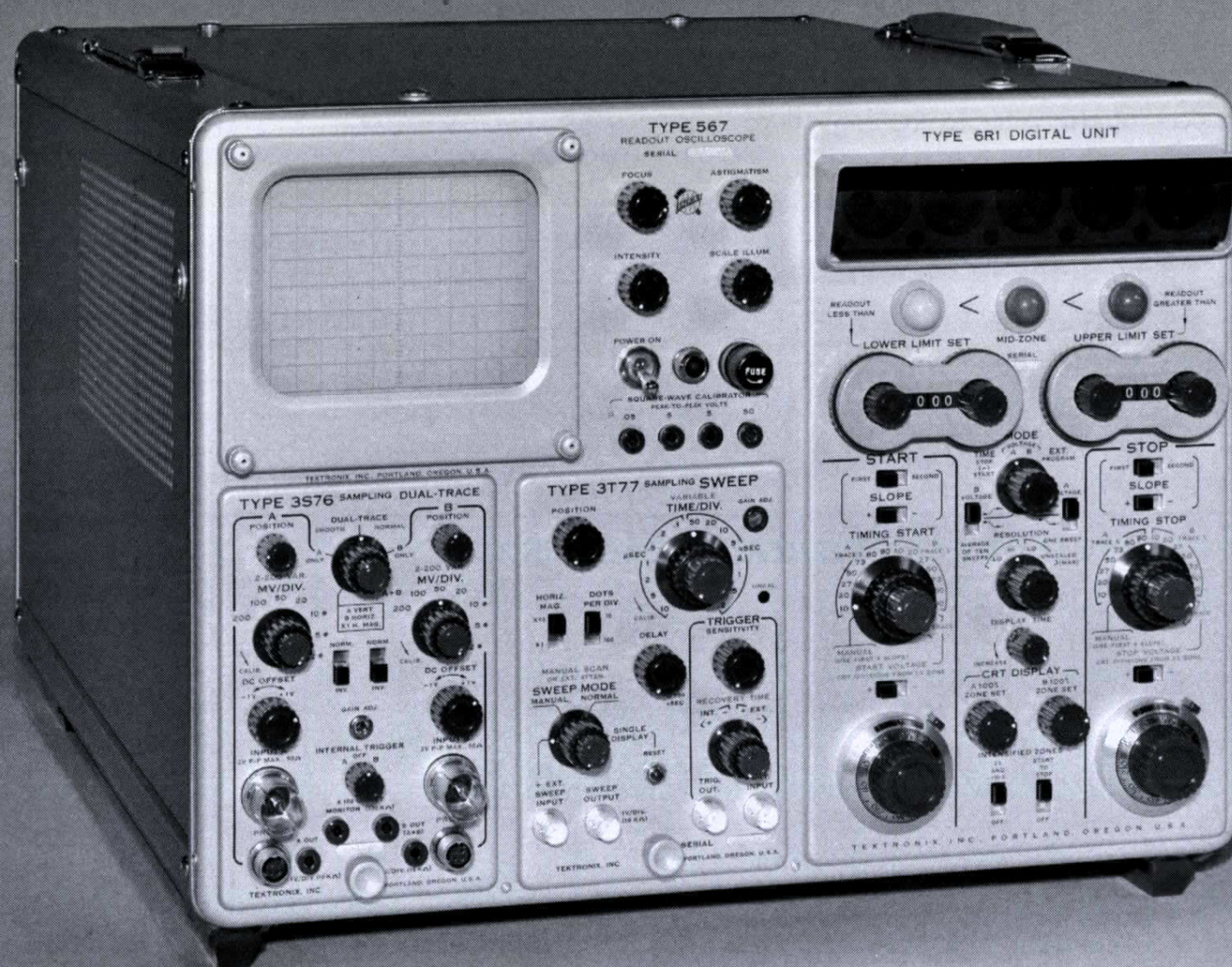
VERTICAL AMPLIFIER UNITS

	2A60 (formerly 60) 1 MC Amplifier	2A63 —(formerly 63) (50:1 rejection ratio) Differential Amplifier	3A1 Dual-Trace Amplifier	3A72 —(formerly 72) Dual-Trace Amplifier (Identical Channels)	3A74 Four-Trace Amplifier	3A75 —(formerly 75) Wide-Band Amplifier
INPUT ac coupled or dc coupled	1 megohm paralleled by 47 pf, 600 volts max.					
PASSBAND (3-db down)	dc—1 Mc	dc—300 kc	dc—10 Mc	dc—650 kc (each channel)	dc—2 Mc (each channel)	dc—4 Mc
SENSITIVITY	50 mv/cm—50 v/ cm, 4 decade steps, with variable control.	1 mv/cm—20 v/cm, 1-2-5 sequence, with variable control.	10 mv/cm—10 v/ cm, (each channel) 1-2-5 sequence, with variable control, 6-cm linear scan.	10 mv/cm—20 v/ cm, 1-2-5 sequence, with variable control.	20 mv/cm—10 v/ cm, (each channel), 1-2-5 sequence, with variable control.	50 mv/cm—20 v/ cm, 1-2-5 sequence, with variable control.
PRICE	\$105	\$130	\$410	\$250	\$550	\$175



PLEASE
REFER
TO
APPROPRIATE
PAGES
FOR
MORE
COMPLETE
SPECIFICATIONS.

Type 567 DIGITAL READOUT OSCILLOSCOPE



DIGITAL READOUT of pulse risetime as fast as 0.4 nsec.

DIGITAL READOUT of pulse amplitudes as small as 2 mv, peak-to-peak.

DIGITAL READOUT of time differences as small as 20 psec up to 100 μ sec.

With digital and sampling units in a Type 567 you can:

1. Read, digitally, time differences as small as 20 psec up to 100 μ sec—displayed-pulse risetimes as fast as 0.4 nsec—pulse amplitudes as small as 2 mv, pk-pk.
2. Control start and stop time of measurements on each input signal or between either input signal through automatic timing systems.
3. Measure time intervals between selected percentage points (10, 20, 27, 50, 73, 80, 90) on one or both dual-trace waveforms—thus eliminate the need to manually "line-up" the display.
4. Initiate and/or stop time-interval measurements by means of continuously-variable calibrated amplitude-discriminators or by any combination of percentage, amplitude, polarity—first or second pulse crossing.
5. Readout peak amplitude between 0% and 100% points on the displayed waveform.
6. Set 0% and 100% zones that automatically normalize themselves with changes in amplitude or vertical position, or time measurements independent of dc position or pulse amplitude.
7. Select and intensify measurement points on the display for easy cross-reference with the digital information.
8. Preset the digital comparators for automatic readings of three categories: (1) less than lower limit preset, (2) greater than upper limit preset, (3) mid-zone, through upper and lower limits.
9. Readout, in up to four digit resolution, the actual measurement. Decimal point and class of indication (nsec, μ sec, msec, mv, v) are automatically presented when time/div, amplitude/div, or program is changed.
10. Use external program control such as punch-tapes or stepping relays for automatic sequential operation in automatic-test systems—systems check-out—component testing—micro-circuit testing.
11. Provide digital and go/no-go outputs to printers, summary punches, etc.
12. Make rapid production or laboratory tests of transistor switching-time characteristics—of width comparison between two pulses—of time and amplitude between two selected points.
13. Trigger internally from either vertical input, as well as externally.

HOW THE TYPE 567 READOUT OSCILLOSCOPE MEASURES TIME

SAMPLING PROCESS

With each repetition of a signal, the circuit measures one point (sample) at a time a little later than the last sample. This process of advancing the sampling time in fixed increments is called strobing. A reconstructed signal, much slower than the original signal, is reproduced on the crt as an amplitude vs. time, point-to-point graph.

EQUIVALENT TIME BASE CLOCK

The equivalent time between each sample depends upon the number of samples per centimeter and the sweep time per centimeter. For instance, 1 nsec/cm and 100 samples/cm = 10 psec/sample. By counting the number of samples between two selected portions of a waveform, the time between these portions can be measured.

AUTOMATIC REFERENCE ZONES

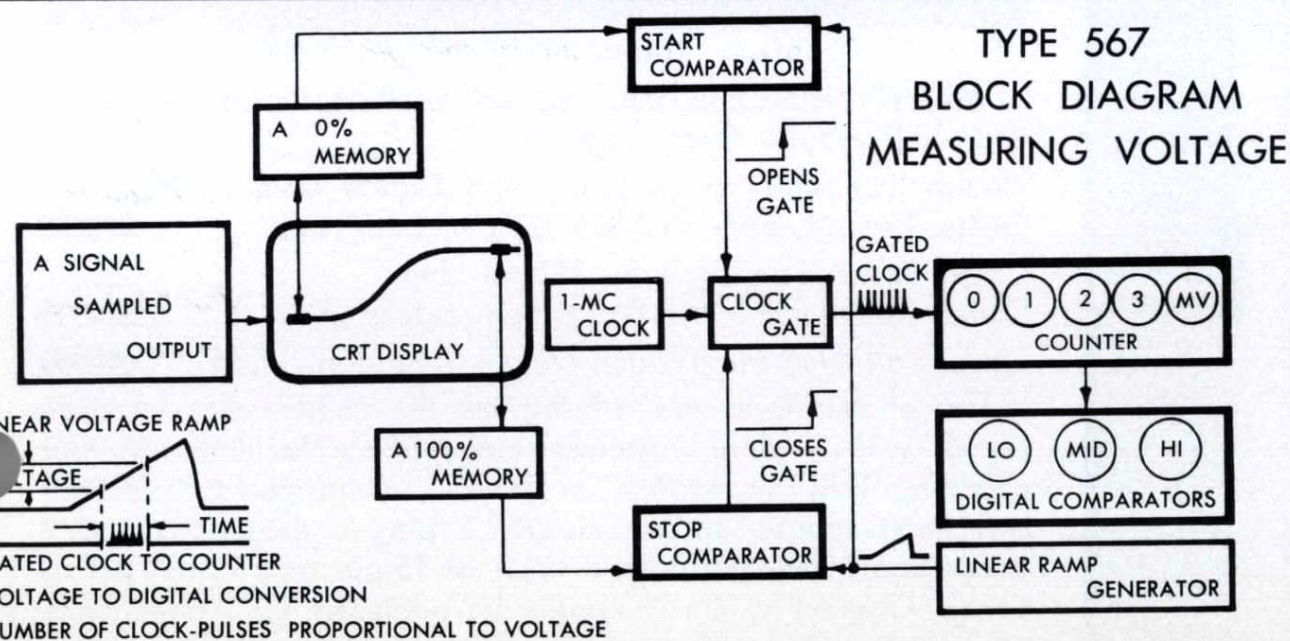
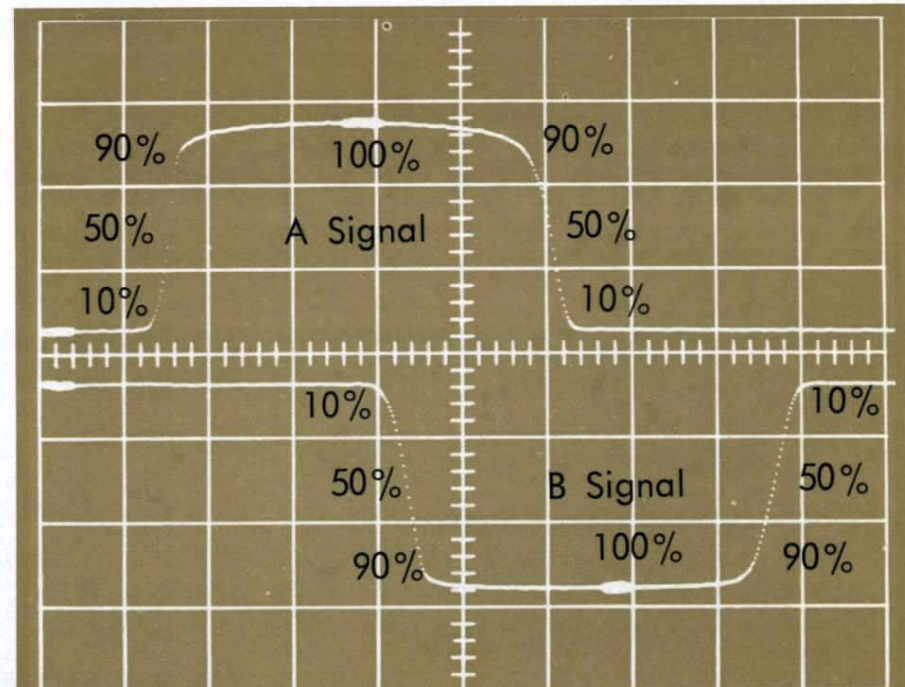
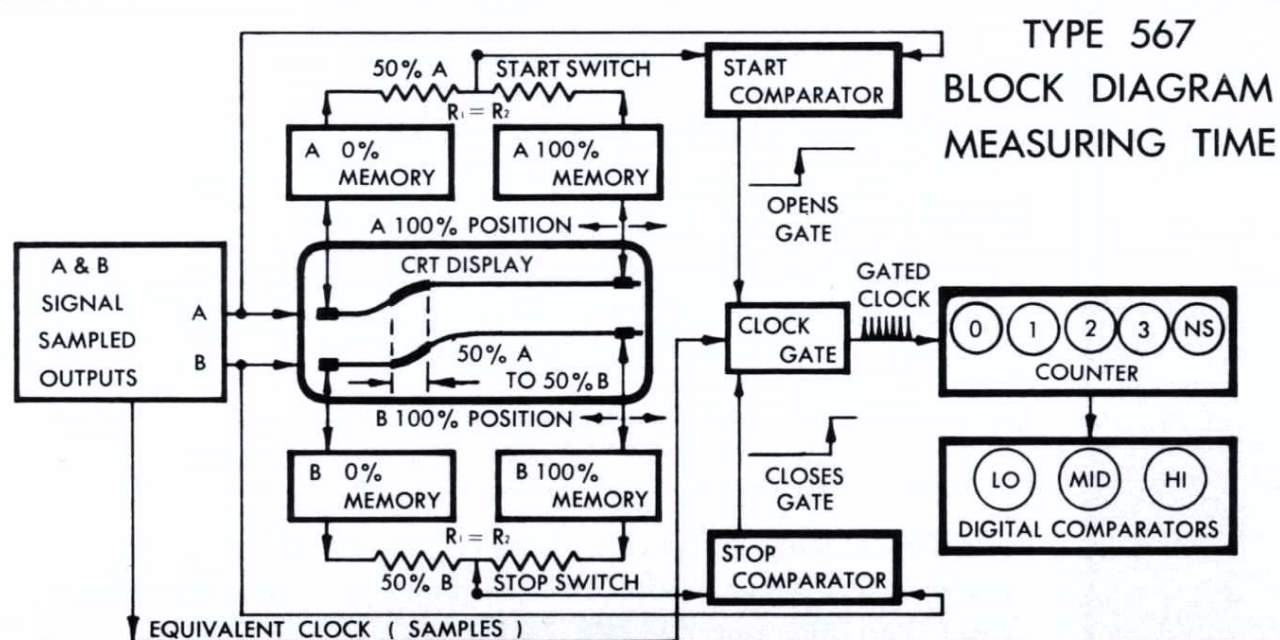
Two intensified zones on each trace indicate 0% and 100% zones. The 0% zone is fixed at the start of the trace. The 100% zone can be positioned at any point on the display the user may want to designate as 100% amplitude. After the first sweep, the amplitudes corresponding to the four zones are stored in memory circuits. Changes in amplitude, vertical position, or waveform automatically re-establish new 0% and 100% memory amplitudes.

START-STOP SYSTEM

In a typical measurement, voltage divider taps between the 0% and 100% memory outputs are set for start and stop timing at selected percentage points such as 10, 20, 27, 50, 73, 80, and 90% of either waveform. The selected percentage reference levels are then compared against the sampled input waveform on the second sweep. Coincidence of the waveform amplitudes with the selected percentage reference amplitudes is sensed by comparators which open and close the clock gate to the digital counter. The crt display can be intensified for the duration of the measured interval as a reference check. The number of clock pulses are read out digitally in nanoseconds, microseconds, or milliseconds, with decimal points included.

HOW IT MEASURES VOLTAGE

Start and stop comparators gate 1-mc clock pulses for the period of time that a linear ramp voltage is at values between the 0% and 100% amplitudes. The number of clock pulses is proportional to the voltage between the selected measurement points. Readout is in millivolts and volts, with decimal points included.



DUAL-TRACE DISPLAY SHOWING TYPICAL MEASUREMENT

MEASUREMENT	6R1 PROGRAM	
	Start	Stop
Risetime A	+10% A	+90% A
Falltime A	-90% A	-10% A
Risetime B	-10% B	-90% B
Falltime B	+90% B	+10% B
Delay A to B	+10% A	-10% B
Storage A to B	-90% A	+90% B
Turn on A to B	+10% A	-90% B
Turn off A to B	-90% A	+10% B
Width A	+50% A	-50% A
Width B	-50% B	+50% B

567

READOUT OSCILLOSCOPE



The Tektronix Readout Oscilloscope utilizes a Type 6R1 Digital Unit and Type 3S76 and 3T77 Sampling Units—and with these plug-ins installed presents a conventional display on its crt simultaneously with digital data on the Type 6R1. The Type 567 will operate without the digital unit—for presentation of sampling displays on the 5-inch crt, as well as other analog displays using 2-Series or 3-Series Plug-In Units.

AMPLITUDE CALIBRATOR is at line frequency and has 4 calibrated pk-to-pk square wave voltages of 0.05 v, 0.5 v, 5 v, and 50 v available at front panel.

DC-VOLTAGE SUPPLIES are electronically regulated to compensate for widely varying line conditions. Separate regulated heater supply is provided.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v, 50 to 60 cps, (approximately 405 watts with Type 3S76, 3T77, 6R1 Units). A thermal cutout switch prevents overheating of the instrument.

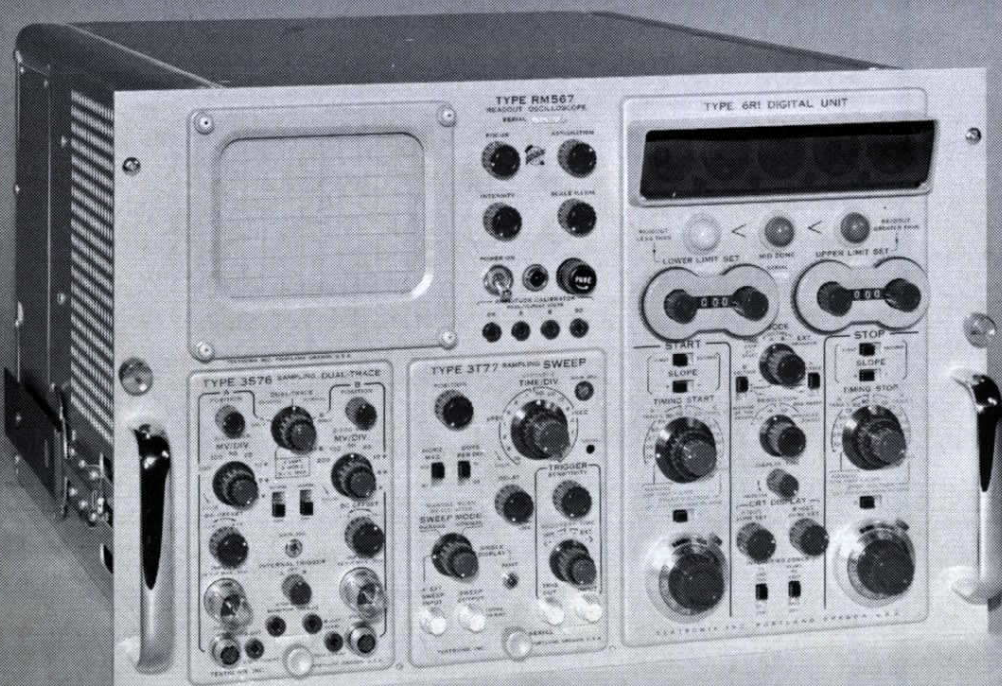
CATHODE-RAY TUBE is a 5-inch rectangular crt using 3.5-kv accelerating potential. A P2 phosphor is normally supplied.

ILLUMINATED GRATICULE has controlled edge-lighting and is marked in 8 vertical and 10 horizontal cm divisions.

MECHANICAL SPECIFICATIONS: Dimensions are 13⁵/₈" high by 17" wide by 23" deep. Net weight is 49 pounds. Shipping weight is 79 pounds, approx.

TYPE 567, without plug-in units \$700
Each instrument includes: 1—power cord, 1—green filter, 2—instruction manuals.

Type RM567 RACK MOUNT



The Type RM567 Readout Oscilloscope is electrically identical to the Type 567 but adapted to rack mounting in a standard 19-inch rack. The instrument mounts to the rack on slide-out tracks. For more mounting information, please refer to the Mounting Dimension page in the catalog.

MECHANICAL SPECIFICATIONS: Dimensions are 12¹/₄" high by 19" wide by 22" deep. Net weight is 50¹/₂ pounds. Shipping weight is 84 pounds, approx.

TYPE RM567, without plug-in units \$800
Each instrument includes: 1—power cord, 1—green filter, 2—instruction manuals, 1—pair guide rails.

SUPPORTING CRADLES: When Type RM567 is used in a backless rack, these cradles are necessary for rear slide support. Order Part Number 426-~~125~~ 165 \$8.50

See accessories p. 203

MAINTENANCE of the Type 567 or RM567 and the plug-in units will require these items:

- Plug-In Extension for Sampling and Digital Units. *\$23.00*
- Order Part Number 012-066 (24-pin extension) ~~\$22.00~~
- Circuit-Board Extensions for Digital Unit
- Order Part Number 012-067 (15-pin extension) *\$20.00* ~~\$17.00~~
- Order Part Number 012-068 (20-pin extension) *\$25.00* ~~\$20.00~~

The above items are offered for the convenience of companies with in-plant instrument-maintenance facilities. If your company has this facility, or if you intend performing your own maintenance, please include 2 plug-in extensions and 2 circuit-board extensions (one each of 15-pin and 20-pin extensions). One set of 4 will usually be adequate for maintenance of several instruments.

11-12-62

PLUG-IN UNITS

TYPE 6R1 DIGITAL UNIT \$2500

INTERNAL INPUT—from horizontal and vertical plug-in units. **IN-LINE READOUTS**—with up-to-4 digit decimal units of actual measurement. **MEASUREMENT-REFERENCE ZONE**—from fixed zero to 100% zone positionable over the sweep range. . . for each trace. **AUTOMATIC NORMALIZATION**—for establishing pulse amplitude or time measurements independent of dc position or pulse amplitude. **ZONE-INTENSITY MARKERS**—for indicating the position of the reference zone in relation to the waveform and also the actual start-to-stop interval . . . for each trace. **AUTOMATIC START-TIMING AND STOP TIMING SYSTEMS**—for controlling start and stop . . . on any of 7 calibrated % steps on either trace . . . or any combination of percentage, amplitude, polarity, first or second pulse slope or input channels A or B. **MANUAL TIMING**—for setting the start-timing and stop-timing at selected points on the displayed waveforms. **DISPLAY-TIME CONTROL**—for varying amount of display time needed to take readings or operate associated equipment. **PRESET-LIMIT SELECTOR**—for setting the upper and lower limits of the readout digits. **LIMIT-SELECTOR INDICATORS**—for designating measurements occurring *below, in, or above* the present preset-limit range. **PROVISION FOR EXTERNAL PROGRAMMING**—for sequencing automatically between various measurement programs.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

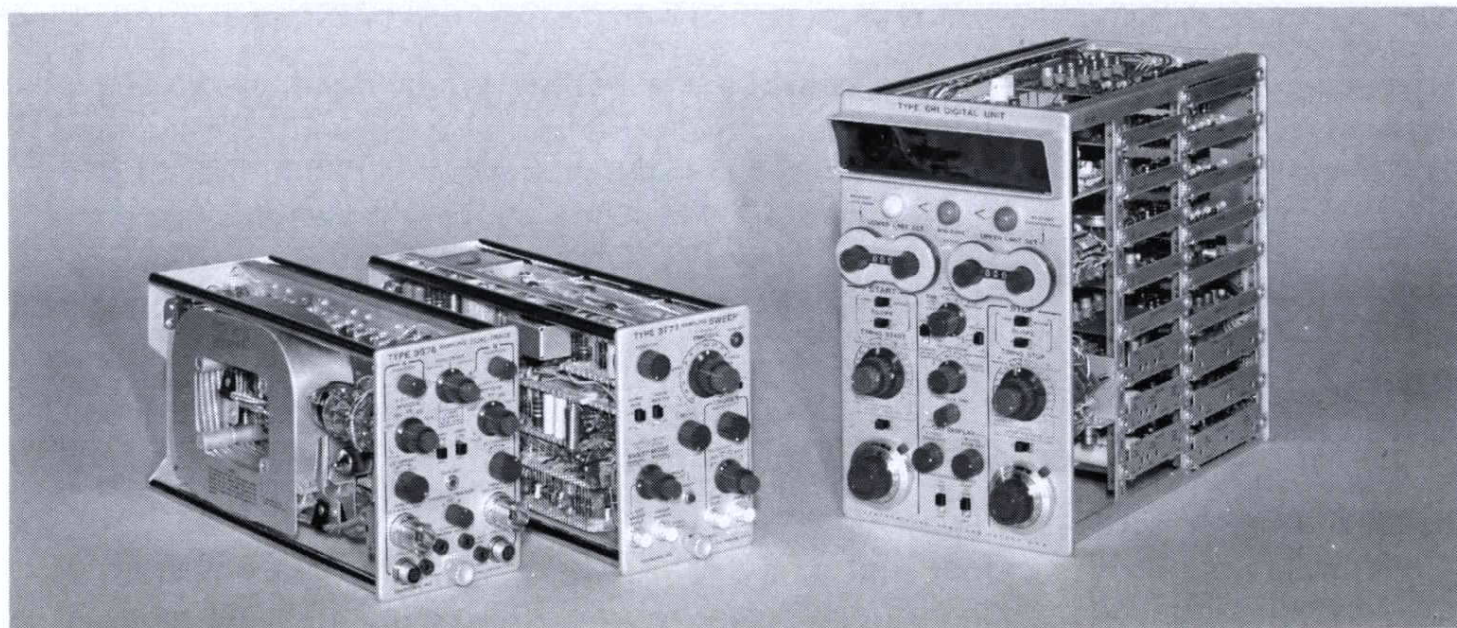
TYPE 3S76 SAMPLING DUAL-TRACE UNIT \$1100

IDENTICAL CHANNELS WITH INDEPENDENT CONTROLS—for positioning, dc-offsetting, attenuating, and inverting input signals as desired.

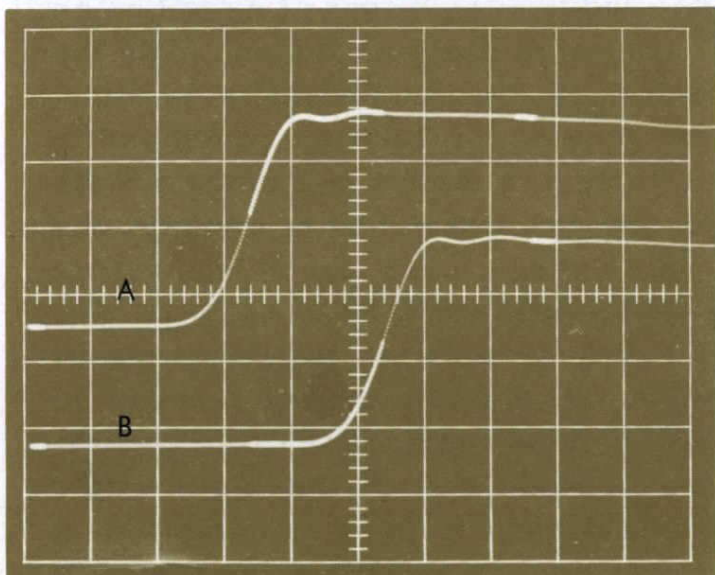
RISETIME—0.4 nanosecond or less. **CALIBRATED SENSITIVITY**—from 2 mv/div to 200 mv/div in 7 steps, also continuously variable between steps uncalibrated. **NOISE**—less than 2 mv peak-to-peak (referred to input). **OPERATING MODES**—either channel separately, dual-trace, algebraic additions, differential output (with common mode rejection ratio approximately 50:1), X-Y display (A vertical, B horizontal). **DC-OFFSET VOLTAGE**—for measuring mv signals in the presence of a substantial dc component (offset voltage monitorable at front panel). **INTERNAL TRIGGERING**—built-in delay lines and trigger takeoffs internally connected to Sampling Sweep Unit. Sweep Unit receives a nominal one-fifth amplitude signal from trigger takeoff.

TYPE 3T77 SAMPLING SWEEP UNIT \$650

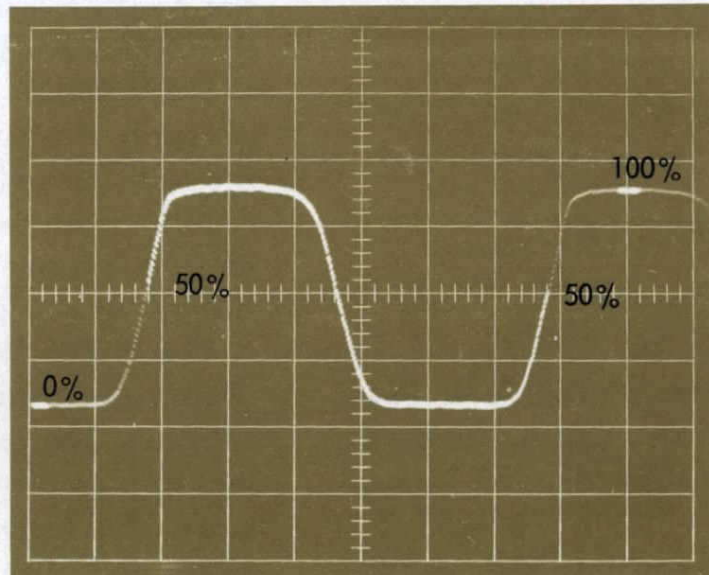
CALIBRATED SWEEP RANGE—for equivalent sweep times from 10 μ sec/div to 0.2 nsec/div in 15 steps, also continuously variable uncalibrated from 10 μ sec/div to 0.07 nsec/div. **10X HORIZONTAL MAGNIFIER**. **SINGLE-DISPLAY PROVISION**. **10 OR 100 SAMPLES-PER-DIVISION**. **SWEEP DELAY THROUGH 100 NANoseconds**. **MANUAL CONTROL OF SCANNING FUNCTION**—for XY or YT Recorders. **INTERNAL OR EXTERNAL TRIGGERING**—either positive or negative, 10 mv sensitivity. (Internal 50 mv signal in Type 3S76 results in 10 mv at 3T77.)



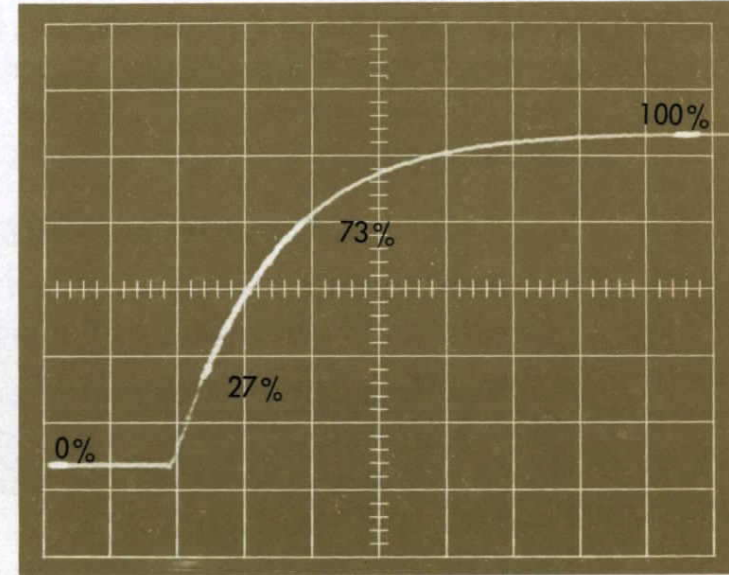
PLEASE REFER
TO
PAGES
145, 146
and 149
FOR
FURTHER
INFORMATION.



DELAY-TIME INTERVAL MEASUREMENT
Start: +50% A Trace Stop: +50% B Trace



PERIOD (1 CYCLE) MEASUREMENT
Start: +50% A Trace Stop: +50% A Trace
1st crossing 2nd crossing



TIME-CONSTANT MEASUREMENT
Start (from) Stop (to)
+27% A Trace + 73% A Trace

Type 570 ELECTRON-TUBE-CURVE TRACER



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

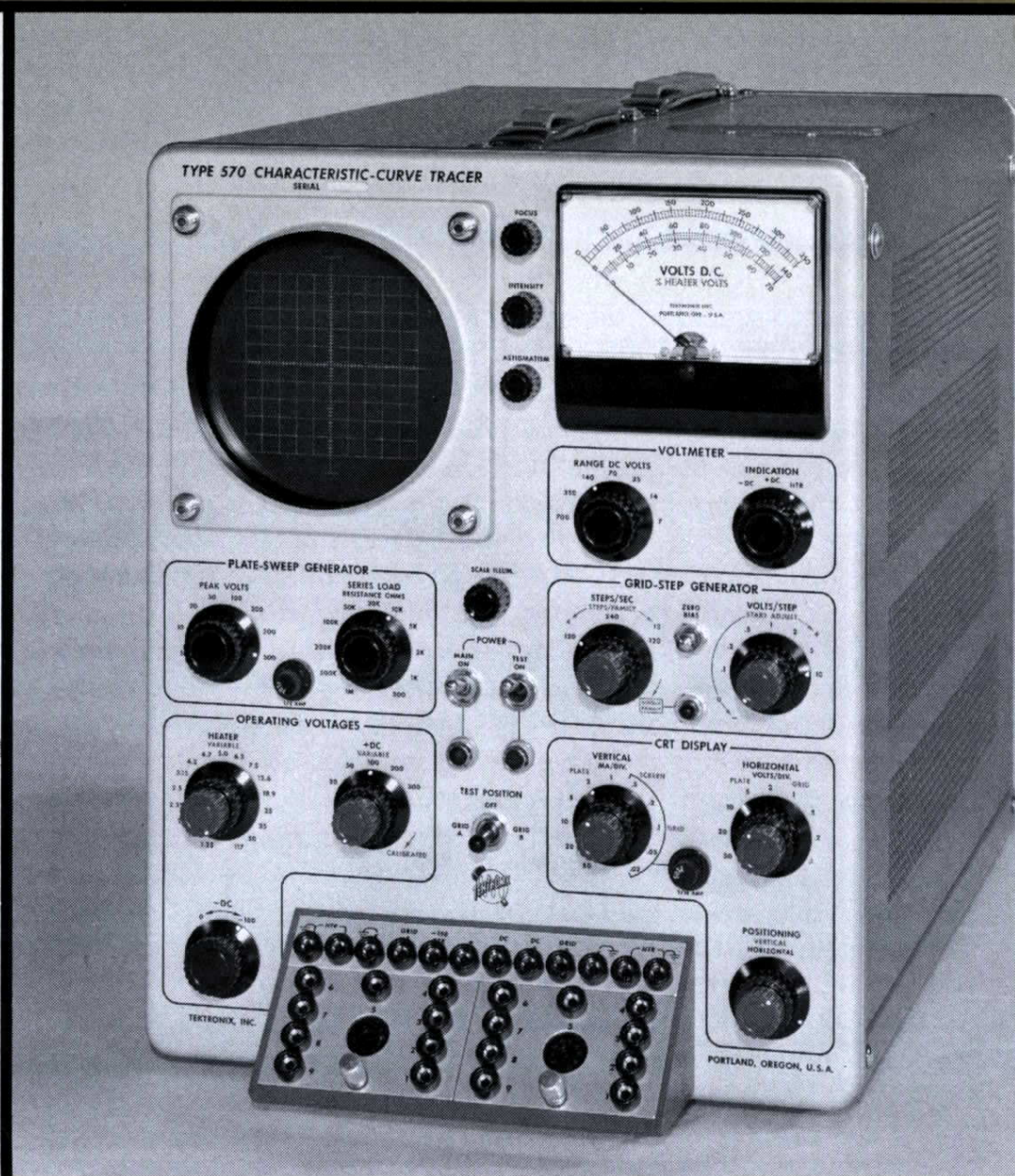
Plots up to 8 positive-bias curves per family.
(up to 12 negative-bias curves)

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.



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. Rapid comparisons can be made with preselected curves outlined on a crt mask. Patch-cord connector system with socket-adaptor plates enables complete control of operating-condition setup.

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

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

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.

ADAPTER PLATES

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

VOLTMETER

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

OTHER FEATURES

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

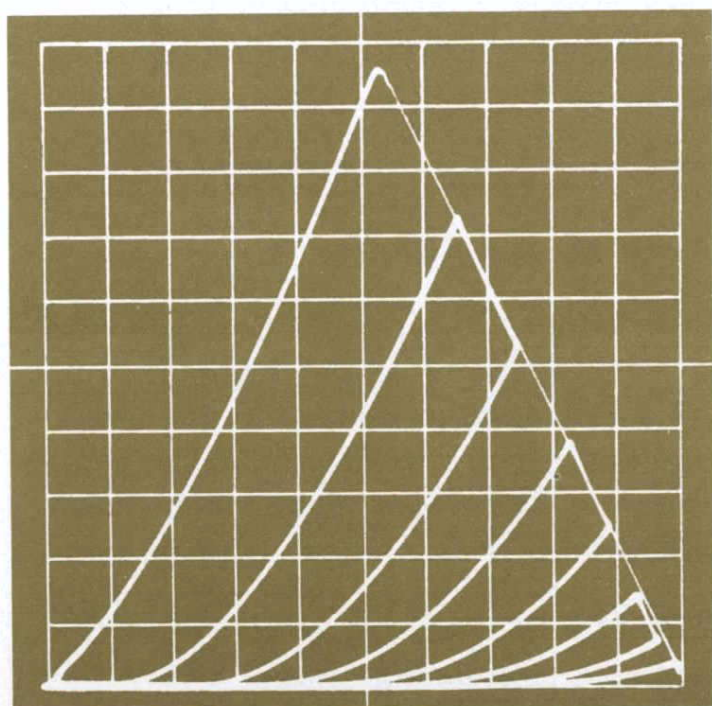


Fig. 1—Plate current plotted against plate voltage for one triode section of a 12AU7. Plate load is 5 k, peak plate-supply voltage is 500 v. Grid voltage is changed 5 v between curves, from -35 v to zero. Vertical sensitivity is 5 ma/div, horizontal sensitivity 50 v/div. Calibrated controls permit accurate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

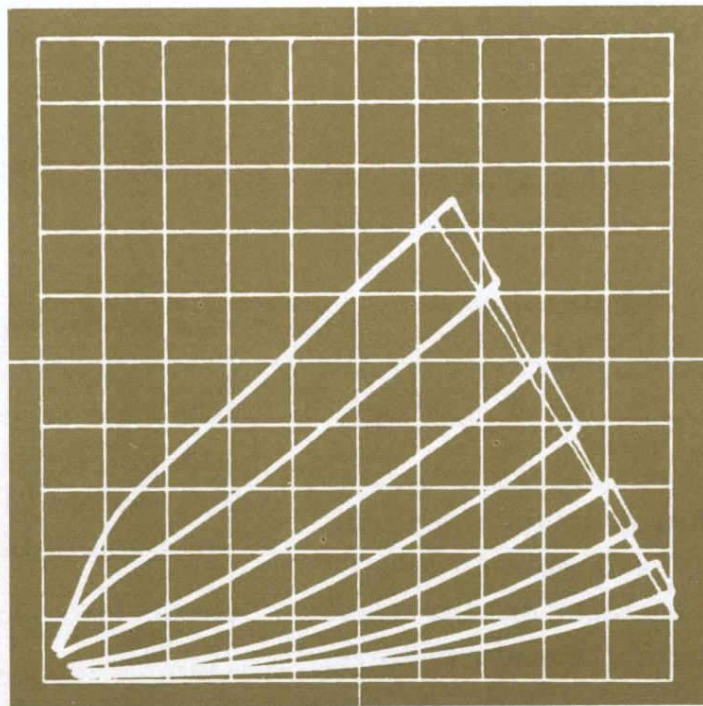


Fig. 2.—Same triode section of 12AU7 with only 20-v peak plate supply and sensitivities increased to 0.2 ma/div vertical and 2 v/div horizontal. Grid voltage is changed 2 v between curves, from -14 v to zero. This is essentially a 25-times magnification of the lower left portion of Fig. 1, showing the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

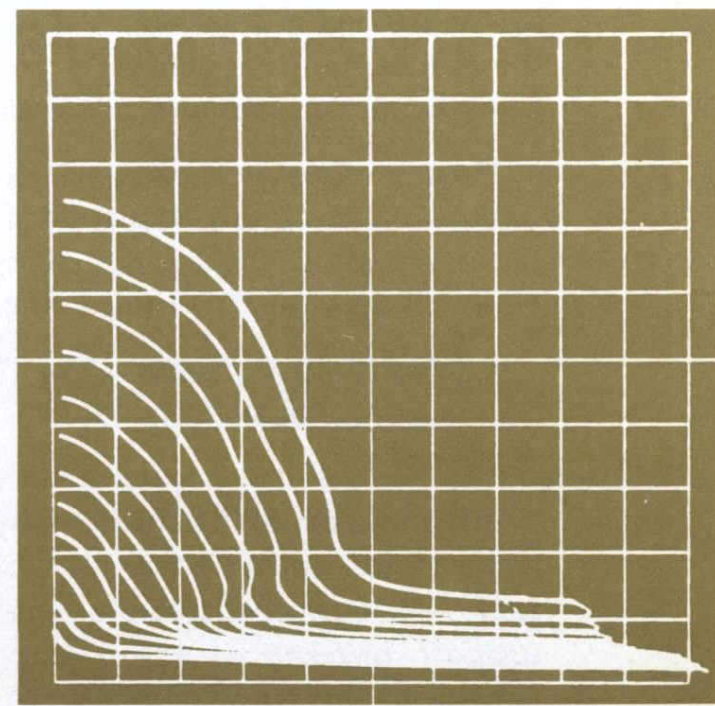


Fig. 3—Screen current plotted against plate voltage with positive grid bias on a 6AQ5. Plate load is 300 ohms, peak plate voltage is 100 v, screen-grid voltage is 100 v, with grid voltage changing 2 v/step from $+16$ v to below zero. Vertical scale is 10 ma/div, horizontal scale is 10 v/div.

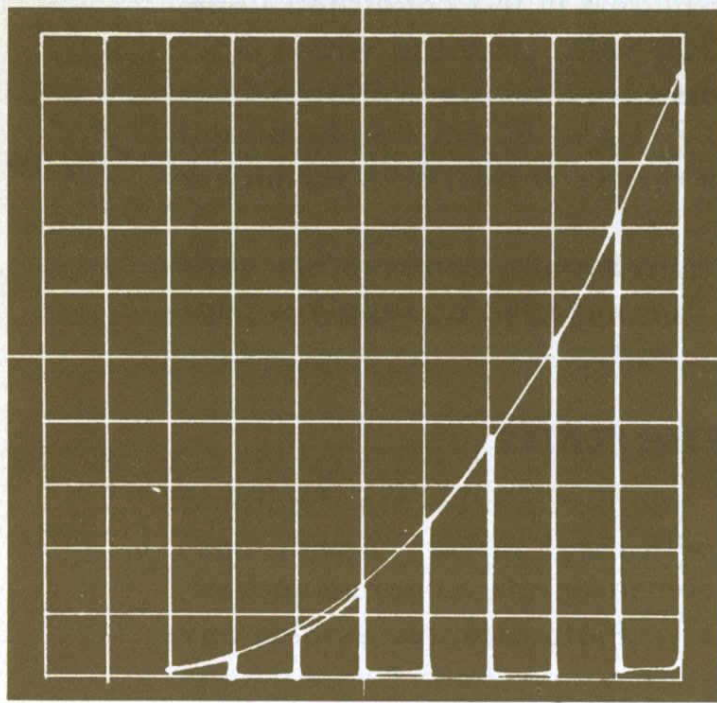


Fig. 4—Typical 12AU7 Eg-Ip curves. Plate load 5 k, peak plate-supply voltage 500 v, grid voltage changing 5 v/step from -35 v to zero, vertical sensitivity 5 ma/div, horizontal sensitivity 5 v/div.

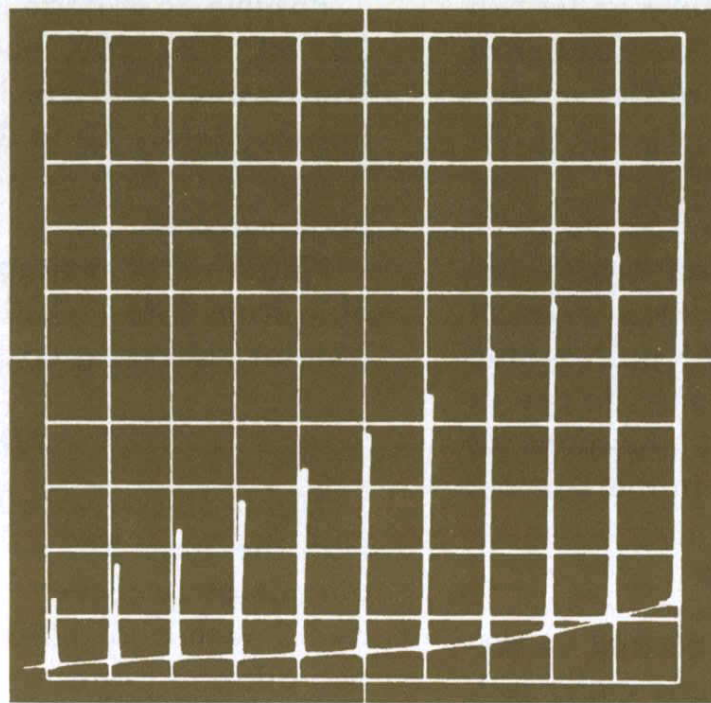


Fig. 5—Another family of curves with positive grid bias. Screen current is plotted against grid voltage. Operating conditions of the 6AQ5 are identical to Fig. 3, except horizontal sensitivity is 2 v/div.

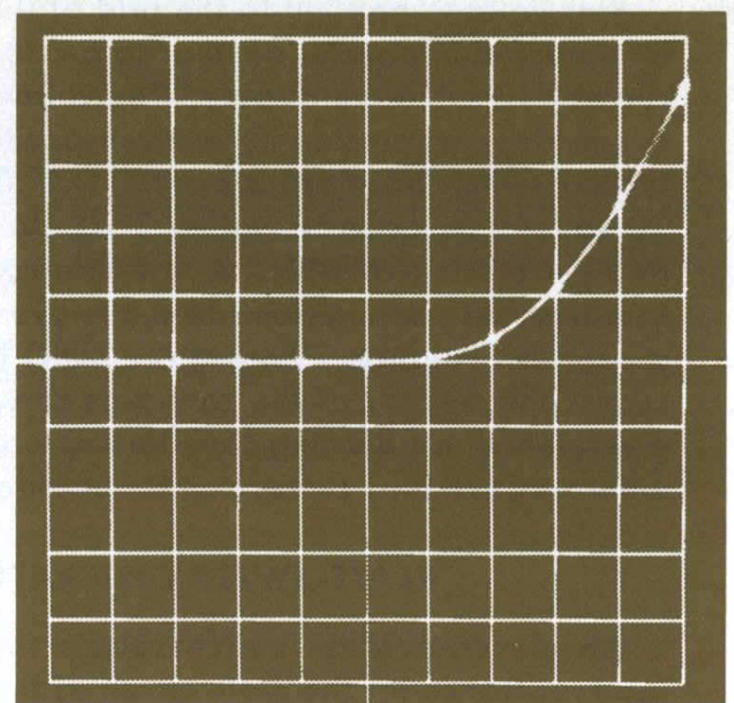


Fig. 6—Typical GERMANIUM DIODE curve. Inherent flexibility of the Type 570 permits accurate evaluation of diode characteristics and detailed examination of any part of the curve. Calibrated scales above are 0.2 v/div horizontal, 0.5 ma/div vertical, with zero points at center of screen.

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.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 400 watts maximum, 300 watts standby. Note: For 50 cps supply, the switching rate will be either 100 steps/sec or 200 steps/sec.

Cathode-Ray Tube—The Tektronix crt uses 4-kv accelerating potential. A P1 phosphor is normally supplied.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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

Mechanical Specifications—Dimensions are 17" high by 13 1/8" wide by 23 1/4" deep. Net weight is 74 3/4 pounds. Shipping weight is 96 pounds, approx.

TYPE 570 CURVE TRACER \$1100

Each instrument includes: 2—7 pin adapter plates, 2—8 pin adapter plates, 2—9 pin adapter plates, 2—blank adapter plates, 5—double patch cords, black 6", 5—double patch cord, red 6", 2—suppressor cords, 100 Ω , 6", 2—suppressor cords, 300 Ω , 6", 2—suppressor cords, 1 k Ω , 6", 5—single patch cords, black 6", 5—single patch cords, red 6", 5—1/16-amp 3AG Fast-Blo fuses, 5—1/2-amp 3AG Fast-Blo fuses, 1—6U8 electron tube, 1—3-conductor power cord, 1—green filter, 2—instruction manuals.

Rack Mount Adapter

A cradle mount to adapt the Type 570 Characteristic-Curve Tracer for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements 17 1/2".

Order Part No. 040-281 \$45

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



TRANSISTOR-CURVE TRACER Type 575

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 μ a/step to 200 ma/step.
5 voltage/step positions, with 24 different driving resistances.

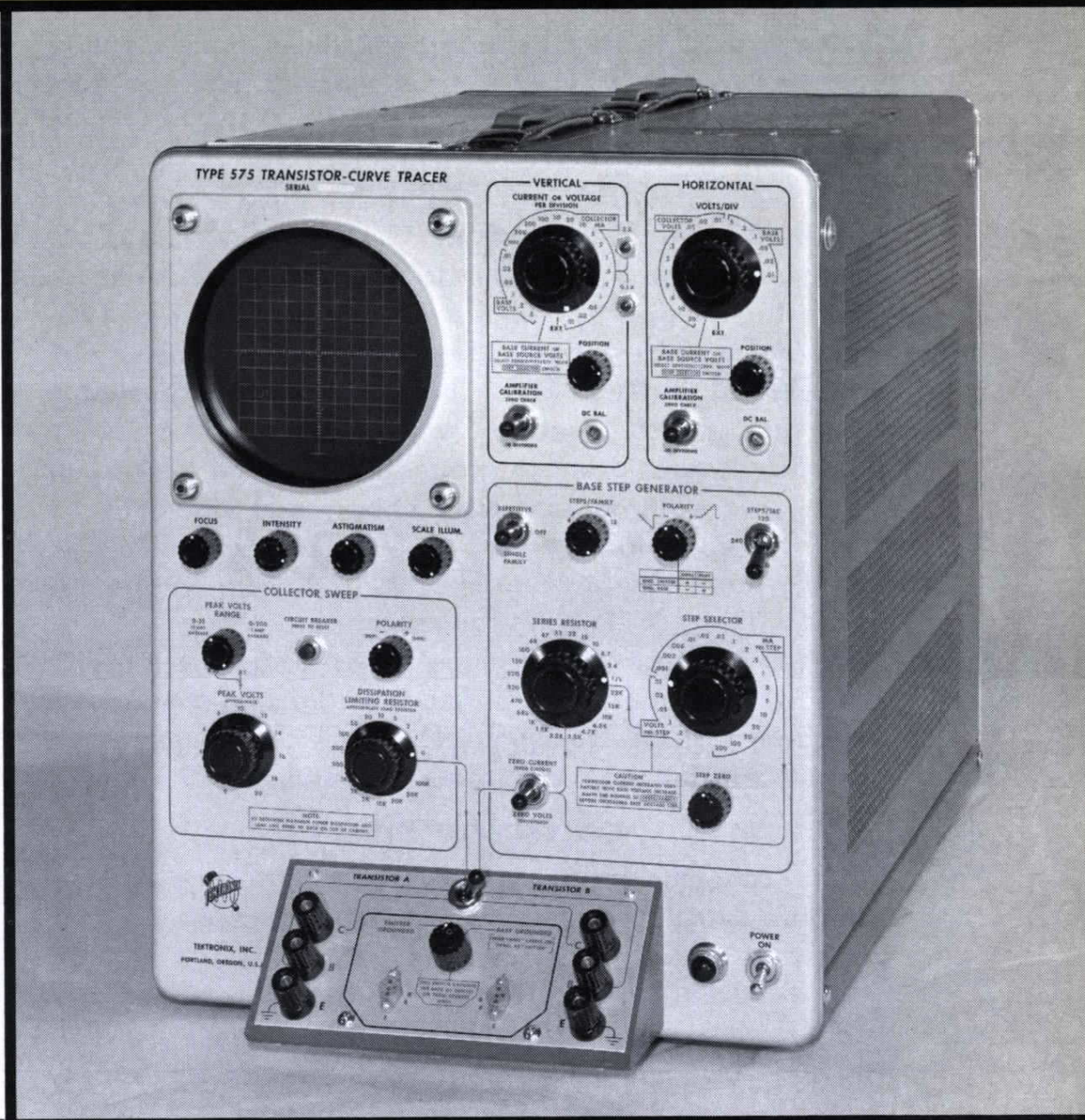
Calibrated Display

Vertical Axis—

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

Horizontal Axis—

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



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 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 can be inserted in series with the one-ohm source impedance of the step generator. This driving resistance can be selected from 23 values, 3.4 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 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 sixteen limiting resistances from 1.0 ohm to 100 kilohms can be selected for limiting collector dissipation.

OTHER FEATURES

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

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

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

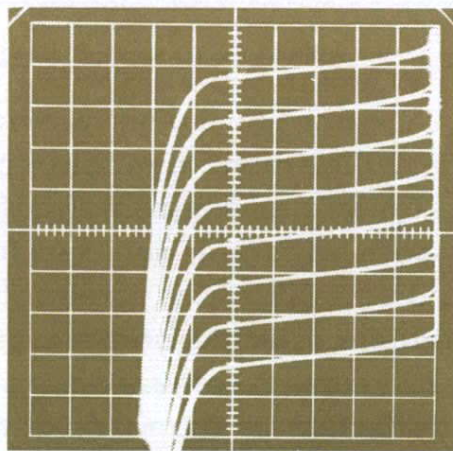
Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 410 watts maximum, 220 watts standby.

Note: When the Type 575 is used with a 50-cps supply frequency, the step/sec rate will be either 100 or 200.

Cathode-Ray Tube—The Tektronix crt uses 4-kv accelerating potential. A P1 phosphor is normally supplied.

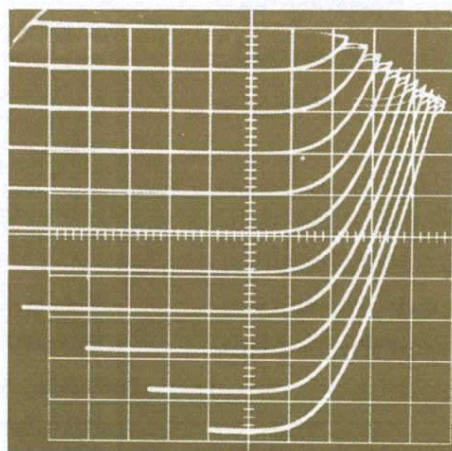
Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

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



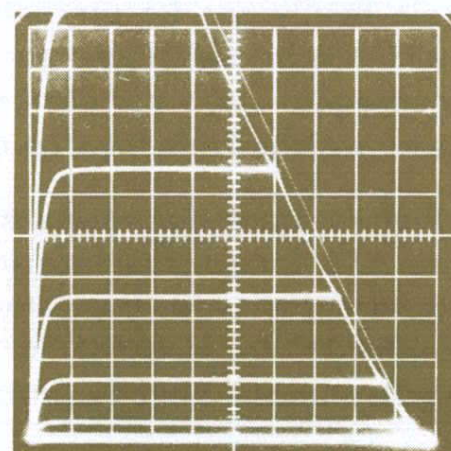
PNP TRANSISTOR

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.



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.



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.

Mechanical Specifications—Dimensions are 16 7/8" high by 13 1/8" wide by 23 3/8" deep. Net weight is 66 pounds. Shipping weight is 87 pounds, approx.

TYPE 575 TRANSISTOR CURVE-TRACER \$1075

Each instrument includes: 1—green filter, 2—2N1381 test transistors, 2—long-lead transistor receptacles, 2—short-lead transistor receptacles, 1—3-conductor power cord, 2—instruction manuals.

INCREASED COLLECTOR SUPPLY

Although similar to the Type 575 Transistor Curve-Tracer, a special model, Type 575 MOD122C, provides much higher diode breakdown test voltage (variable from zero to 1500 volts, maximum short circuit current of 1 milliamperere) and also much higher Collector Supply (up to 400 volts, at 0.5 ampere).

TYPE 575 MOD122C \$1325

Each instrument includes: 1—green filter, 2—2N1381 test transistors, 2—long-lead transistor receptacles, 2—short-lead transistor receptacles, 1—3-conductor power cord, 2—instruction manuals.

Rack Mount Adapter

A cradle mount to adapt the Type 575 Transistor-Curve Tracer for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements 17 1/2".

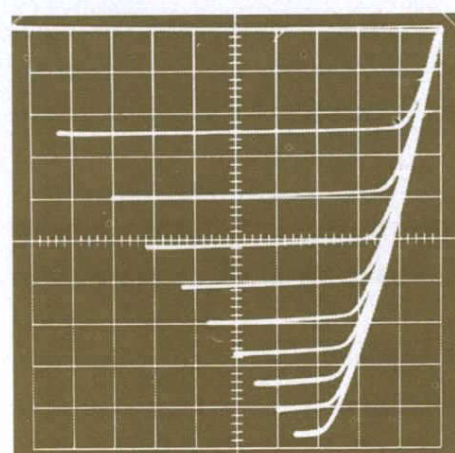
Order Part No. 040-281 \$45

HIGH CURRENT ADAPTER

Designed to extend the capabilities of the Type 575 Transistor Curve-Tracer, the Type 175 enables measurement of high-powered semiconductor devices which exceed the current capabilities of a Type 575. Not intended for separate use, the Type 175 depends upon circuitry and crt of a Type 575. See appropriate pages for complete information on the Type 175 Instrument.

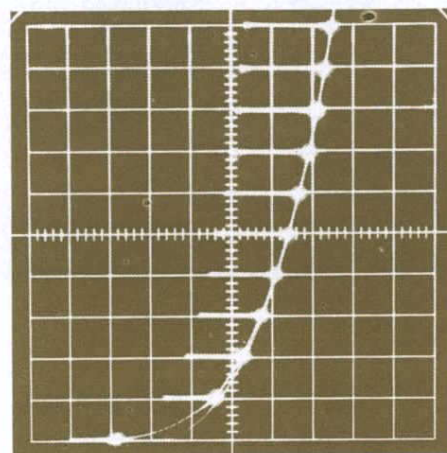
TYPE 175 ADAPTER \$1475

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



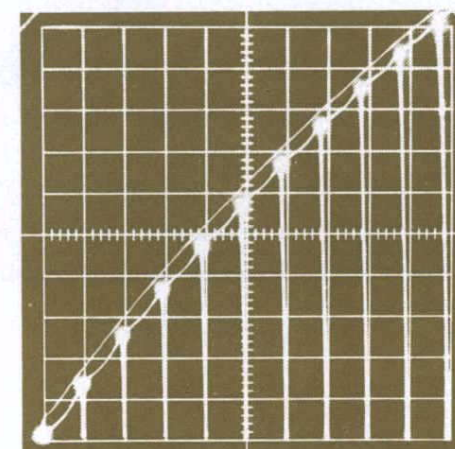
PNP TRANSISTOR

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.



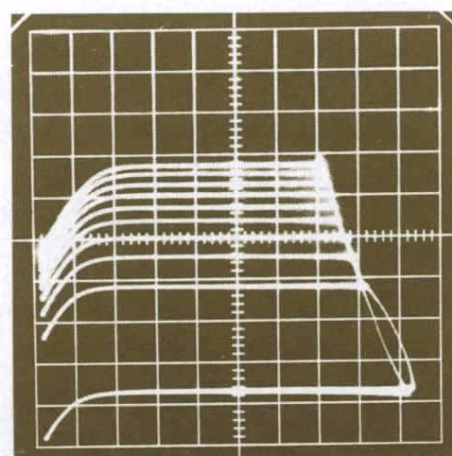
NPN TRANSISTOR

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.



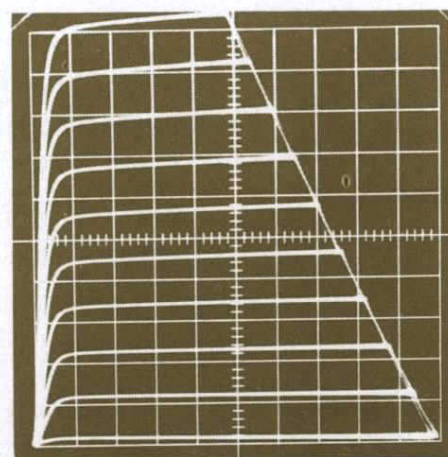
NPN TRANSISTOR

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.



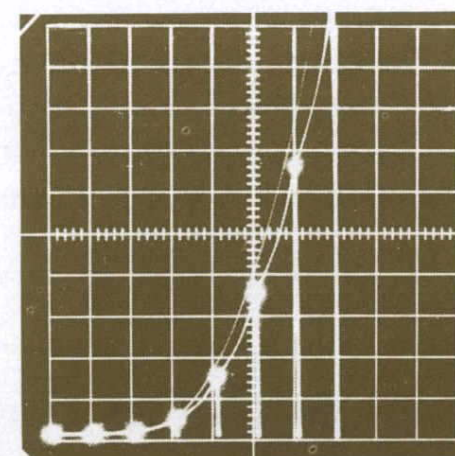
NPN TRANSISTOR

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.



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.



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.

Type $\frac{581}{585}$ DC-to-95MC OSCILLOSCOPE with SWEEP DELAY



The Tektronix Type 581 and Type 585 Oscilloscopes are dependable laboratory instruments with many of the capabilities needed for rapid advancement of the electronic art. Features included for high speed pulse applications are 3.7 nsec risetime, 0.1 v/cm sensitivity, and 10 nsec/cm sweep time. The Type 585 has all the features of the Type 581 plus a second time-base generator which can be used for sweep delay applications.

In addition, the new Type 82 Plug-In Unit adds dual-trace facility to these oscilloscopes. Also, with a Type 81 Adapter, these oscilloscopes will accept any Tektronix Type A to Z Plug-In Unit for a wide variety of general-purpose and special-purpose applications.

NOTE: The Type 585 Oscilloscope is similar to the Type 581 Oscilloscope except for addition of a second time-base generator. Otherwise, both instruments have the same characteristics. **In this presentation, the information marked by color pertains to the Type 585 Oscilloscope only.** All other information, unless designated specifically, concerns both the Type 581 and Type 585 Oscilloscopes.

CHARACTERISTICS

Fast-Rise Vertical Amplifier—

PASSBAND—dc to about 95 mc (at 3 db down).

SENSITIVITY—basic deflection factor is 0.1 volt/cm (with Type 80 Plug-In Unit and Type P80 Probe).

VERSATILITY—designed for plug-in preamplifiers (with Type 81 Plug-In Adapter, present Tektronix "A" to "Z" Plug-In Units can be used without loss of pass-band or sensitivity).

High-Speed Sweeps—

RANGE—50 nsec/cm to 2 sec/cm in 24 calibrated steps. A vernier control (uncalibrated) permits continuously variable adjustment between steps and to over 5 sec/cm. Calibrated accuracy is typical within 1%, and in all cases within 3%, of the indicated sweep rate.

MAGNIFICATION—5-X Magnifier extends calibrated range to 10 nsec/cm.

TRIGGERING—Adaptable circuitry provides for amplitude-level selection with preset or manual stability control. Triggering signal source can be internal, external, or line frequency: rising or falling slope. External source can be dc-coupled. Triggering capability extends to 100 Mc or more.

SINGLE SWEEP OPERATION—Lockout-reset circuitry permits one-shot recording.



Flexible Sweep Delay— *Relate only to 585*

RANGE—Sweep delay is continuously variable from 2 microseconds to over 10 seconds. Actual delay steps are within 1% of the indicated delay, from 2 μ sec/cm to 0.1 sec/cm, and within 3%, from 0.2 sec/cm to 1 sec/cm. Incremental delay accuracy is within 0.2%.

JITTER—1 part in 20,000.

OPERATION—In triggered operation, the signal under observation starts the delayed sweep. In conventional operation, a delayed trigger starts the delayed sweep.

Applications

In addition to the usual applications of a dc-to-95 mc general-purpose oscilloscope, the addition of sweep delay enables the user 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. Determine accurate time-difference measurements between pulse-in and pulse-out through an amplifying system.
5. Select any individual line of a television composite signal.
6. Show 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.

VERTICAL-DEFLECTION SYSTEM

Risetime and Passband—Characteristics depend upon the probe and plug-in unit used with the Type 581 and Type 585 Oscilloscopes. The chart designates these characteristics.

Type 581 and Type 585 Oscilloscopes used with:	Risetime		Passband at 3 db, approx.
	nominally	always less than	
Type 80 Plug-In Unit, P80 Probe	3.7 nsec	3.9 nsec	95 Mc
*Type 82 Dual-Trace Plug-In Unit	at 100 mv/cm		
	4.0 nsec	4.2 nsec	85 Mc
	at 10 mv/cm		
	4.3 nsec	4.5 nsec	80 Mc

* The risetime of a Type 580-Series Oscilloscope, Type 82 Plug-In Unit, and P6008 Probe at an overall sensitivity of 1 v/cm is approx. 5 nsec.

Type 81 Plug-In Adapter—The Type 81 equips the Type 580-Series Oscilloscopes to accept any Tektronix Type A to Z Plug-In Unit, for pulse-sampling applications...transistor risetime testing...semiconductor-diode-recovery-time studies...strain gage and other transducer measurements...differential-comparator displays...multiple-trace work, as well as many other general purpose applications.

DC-Coupled Output Amplifier—The main vertical amplifier consists of a two-stage distributed amplifier, a balanced, fixed delay line, and a twin-pentode output stage.

Balanced Delay Network—A push-pull network provides ample signal delay. This delay permits observation of the leading edge of the sweep-triggering waveform.

HORIZONTAL-DEFLECTION SYSTEM

The Type 585 has two time-base generators, Time Base A and Time Base B. Time Base A is identical to the Miller-runup type Time Base sweep generator in the Type 581. Time Base B functions as a delay generator or as a conventional sweep generator. The signal to be observed can be displayed in the following ways: Time Base B normal, Time Base B with trace brightening during the period that Time Base A runs, Time Base A delayed by Time Base B, Time Base A normal and Time Base A single sweep.

Single Sweep Operation—(TIME BASE A only in Type 585). Lockout reset circuitry permits one-shot recording. The RESET button controls operation of the single sweep. With the stability control fully clockwise, a single sweep runs immediately each time the RESET button is pressed. With the time base set for triggered operation, the single sweep does not occur when the RESET button is pressed until a proper trigger signal occurs. Instead the READY lamp lights. When a proper trigger signal occurs, the single sweep runs, the READY light goes out. Each time the RESET button is pressed, the procedure is repeated.

Sweep Range—(TIME BASE A). Sweep time is calibrated in steps of 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 μ sec/cm...0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 msec/cm...0.1, 0.2, 0.5, 1, and 2 sec/cm. A vernier control provides for continuous adjustment between the 24 steps, and to over 5 sec/cm, uncalibrated. Calibrated accuracy is typically within 1%, and in all cases within 3%, of the indicated sweep rate.

Sweep Magnifier—When the 5-X Magnifier is used, the center two-centimeter portion of the displayed waveform is expanded to ten centimeters. The HORIZONTAL POSITION control has sufficient range to cover any one-fifth of the magnified sweep. The magnifier applied to the 0.05 $\mu\text{sec}/\text{cm}$ sweep extends the calibrated range to 0.01 $\mu\text{sec}/\text{cm}$. Accuracy of the displayed portion of the magnified sweep is within 5% of the figured sweep rate. The 5-X Magnifier operates on all ranges for both time bases.

Sweep Range—(TIME BASE B). Sweep time is calibrated in steps of 2, 5, 10, 20, and 50 $\mu\text{sec}/\text{cm}$ 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 msec/cm. . . . 0.1, 0.2, 0.5, and 1 sec/cm. A control is capable of changing the sweep repetition rate by adjusting the sweep length from 4 to 10 centimeters. This variable length control enables use of Time Base B as a repetition-rate generator over the range of 0.1 cps to 40 kc.

The 5-X MAGNIFIER used with Time Base B extends the fastest sweep speed to 0.4 $\mu\text{sec}/\text{cm}$. It operates on all ranges.

Horizontal-Input Amplifier—The dc-coupled external connection to the sweep-output amplifier is through a front-panel connector. Passband is dc to approximately 240 kc. Combination of a step attenuator and variable attenuator makes the horizontal deflection factor continuously variable from 0.2 v/cm to over 15 v/cm. Input impedance is 1 megohm paralleled by approximately 47 pf.

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

TRIGGERING FACILITIES

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 line frequency. Internal and line frequency source are ac-coupled only; external source can be ac or dc-coupled. Trigger point can occur anywhere on the rising or falling slope of the triggering waveform.

Preset Stability—The STABILITY control is locked at the optimum triggering point and requires no adjustment in the fully counterclockwise, PRESET, position.

Trigger Requirements—For internal triggering a signal producing 4 mm of vertical deflection is required from 15 cps to 10 Mc. . . 1.5 cm from 10 to 30 Mc. . . 2.5 cm from 30 to 50 Mc. . . 4.0 cm from 50 to 100 Mc. External triggering can be accomplished with signals of 0.2 v to 30 v pk-to-pk. A larger signal may be used, but the TRIGGERING LEVEL control operates only over a -15 to $+15$ v range.

Time Base B—Internal triggering requires 4 mm of crt display through 500 kc, increasing to 2 cm crt display at 4 Mc. External requirements are ± 0.4 v through 500 kc, increasing to 1 v at 1 Mc, and 2.5 v at 2 Mc.

SWEEP DELAY

Start of the sweep of Time Base A can be delayed for a period of from 2 microseconds to 10 seconds after application of the triggering waveform. This is accomplished through simultaneous use of both time bases. Sweep delay for Time Base A is derived from Time Base B via a pickoff circuit. A delayed trigger is generated at the pickoff point, which can be adjusted to any point on the sawtooth waveform (generated by Time Base B). Thus, when using the delayed sweep feature of the Type 585, Time Base B provides accurate time delay while Time Base A presents normal sweep at the end of the delay period. Duration of the sweep delay is controlled by the TIME/CM OR DELAY TIME switch and the DELAY-TIME MULTIPLIER. The settings of the two controls are multiplied together to obtain the actual delay time.

Accuracy of the 15 calibrated delay steps from 2 μsec to 0.1 sec is within 1% of the indicated delay. Accuracy of the remaining three calibrated steps of 0.2, 0.5, and 1 sec is within 3% of the indicated delay. Incremental accuracy of the ten-turn precision DELAY-TIME MULTIPLIER is within 0.2% of the indicated setting.

Triggered Operation—When the triggering controls of TIME BASE A are adjusted so that the delayed trigger from TIME BASE B readies 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. This allows a steady display even with time jitter or time modulation 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. The start is delayed the amount of time indicated by the settings of the TIME/CM OR DELAY TIME switch and the DELAY-TIME MULTIPLIER. Time modulation or time jitter on the signal will be magnified in proportion to the amount of sweep expansion. However, the time jitter in the delayed trigger or delayed sweep will not exceed one part in 20,000 of the maximum available delay interval (where the maximum available delay interval is 10 times the TIME/CM or DELAY-TIME setting).

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 indicates 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

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 and 50 millivolts. . . 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 and 100 volts peak-to-peak are provided by a single-knob control. Accuracy of the square-wave peak-to-peak amplitude is within 3% of the indicated calibration voltage. Square-wave frequency is approximately 1 kc.

Cathode-Ray Tube—The Tektronix, flat-faced, 5-inch, precision cathode-ray tube is a metallized, lumped-constant traveling-wave tube with helical post-accelerating anode. It provides a linear 4-cm x 10-cm viewing area. Accelerating potential is 10 kv. A P31 phosphor is normally supplied.

Alignment of Cathode-Ray Tube—Should adjustment of the cathode-ray tube alignment become necessary, an easily accessible knob, located on the rear support bracket of the crt, provides smooth positive control of the crt alignment.

Indicator Lamps—Four beam-position indicator lamps marked with arrows are located above the crt screen. If the beam is positioned horizontally or vertically away from the center of the graticule, either on or off the screen, the appropriate beam-position indicator lamp will light.

Separate indicator lamps also light to designate magnified displays and uncalibrated settings of the sweep-rate controls.

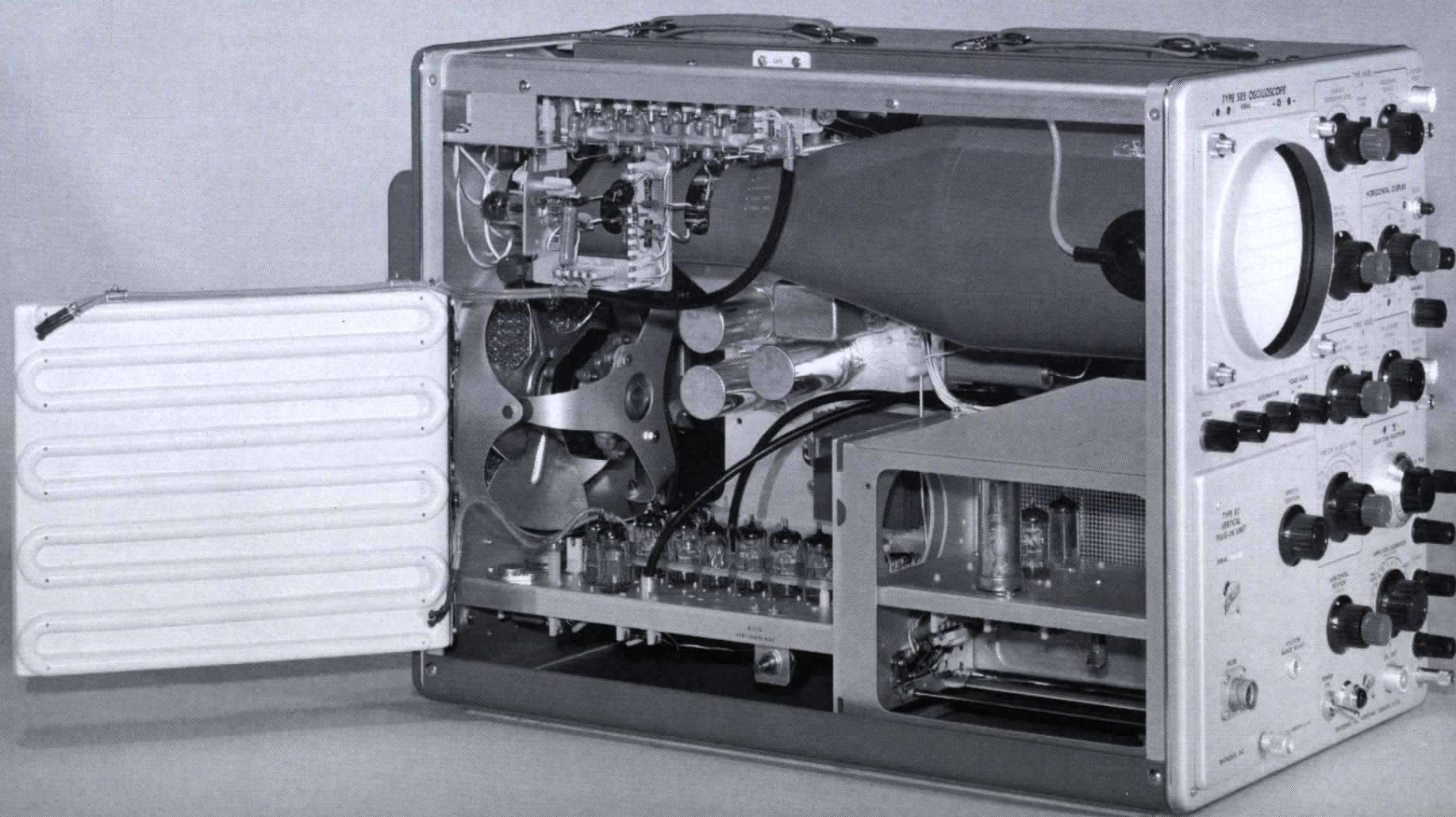
Illuminated Graticule—Edge lighting of the graticule is adjusted by the SCALE ILLUM. control. Display area of the graticule is marked in four vertical and ten horizontal one-centimeter major divisions. Centerlines are further marked in five minor divisions per major division.

Output Waveforms—Two output waveforms are available from front-panel connectors via cathode followers. Approximate amplitude of the peak-to-peak voltages are 150 volts from the SAWTOOTH connector and 20 volts from the +GATE connector (of same duration as the sweep).

Two other output waveforms are available from front-panel connectors. Approximate amplitude of the delayed trigger pulse (occurring at the end of the delay period) is 5 volts, and of the positive gate (+GATE B, of the same duration as sweep B) is 20 volts.

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.

Thermal Protection—For protection, a thermal cut-out switch interrupts the power if chassis temperature becomes excessive, and holds it off until a safe operating temperature is reached.



581 585

Regulated Power Supply—Electronically-regulated dc supply insures stable operation over line variations between 105 and 125 volts or 210 and 250 volts, 50 to 60 cycles.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps; 560 watts maximum for Type 581, 630 watts maximum for Type 585 (Type 84 Test Unit set for high load).

Mechanical Specifications—Dimensions are 16 $\frac{7}{8}$ " high by 13 $\frac{1}{8}$ " wide by 23 $\frac{7}{8}$ " deep. Type 581 net weight is 63 $\frac{1}{2}$ pounds, shipping weight is 85 pounds, approx. Type 585 net weight is 67 pounds, shipping weight is 85 pounds, approx.

TYPE 581, without plug-in units \$1425
Each instrument includes: 2—binding post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

TYPE 585, without plug-in units \$1725
Each instrument includes: 2—binding post adapters, 1—test lead, 1—green filter, 1—3-conductor power cord, 2—instruction manuals.

Please refer to the appropriate page for complete specifications of the following instruments that are used with the Type 581 and Type 585 Oscilloscopes, as well as the Letter-Series Plug-In Units that extend applications into general and special-purpose fields.

TYPE 80 Plug-In Unit	\$50
TYPE P80 Probe	150. ⁰⁰ \$99.50
TYPE 81 Plug-In Adapter	\$135
Type 82 Dual-Trace Plug-In Unit	\$650
Type 84 Plug-In Test Unit	\$195

Plug-In Extension—Six inches long and allows a Type 80, 82, or 84 Plug-In Unit to be serviced while partially removed from the oscilloscope.
Order Part Number 013-055 \$14.50

Rack Mount Adapter

A cradle mount to adapt the Type 581 or Type 585 Oscilloscopes for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements 17 $\frac{1}{2}$ ".

Order Part Number 040-281 \$45
U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



PULSE-SAMPLING OSCILLOSCOPE Type 661

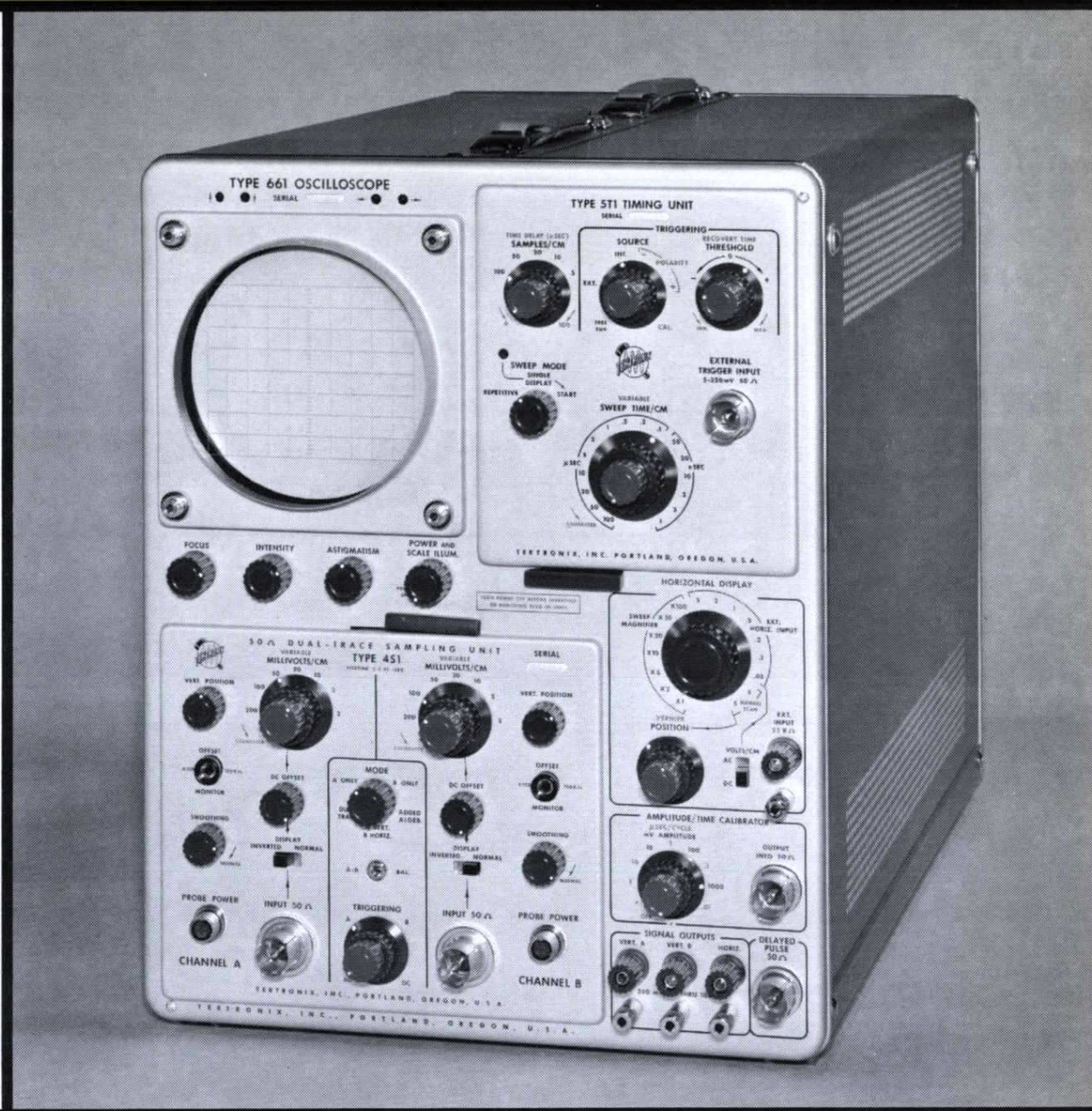
**16 CALIBRATED EQUIVALENT SWEEP RATES
FROM 1 NSEC/CM TO 100 μ .SEC/CM**

TIME-MEASUREMENT RANGE EXTENDS TO 1 MSEC

2X TO 100X MAGNIFICATION

DELAYED-PULSE OUTPUT

AMPLITUDE-TIME CALIBRATOR



VERTICAL AND TIMING PLUG-IN UNITS are necessary for operation.

The vertical system plug-in compartment accepts a 4-series unit.

The horizontal system plug-in compartment accepts a 5-series unit.

CATHODE-RAY TUBE is a 5" flat-faced tube with 8 by 10 cm viewing area. Accelerating potential is 2.7 kv. A P2 phosphor is normally supplied.

HORIZONTAL DISPLAY CONTROLS include those for positioning, scanning, sweep magnification, and external horizontal input.

HORIZONTAL POSITION controls provide either coarse or fine adjustment—shift of display over 10-cm unmagnified or 1000-cm fully magnified.

FAST or **SLOW MANUAL SCAN** permits detailed analysis of any portion of the display. This mode of operation facilitates driving external recorders.

SWEEP MAGNIFICATION of 1X, 2X, 5X, 10X, 20X, 50X, and 100X, symmetrical about the screen center, reduces the number of dots/cm and keeps time/dot uniform.

EXTERNAL HORIZONTAL INPUT permits externally scanning the sampled display. Sensitivity positions in 7 steps from 50 mv/cm to 5 v/cm, 1-2-5 sequence (into 25-K impedance) are ac or dc-coupled. Time per centimeter remains calibrated.

The Type 661 is a compact, complete, sampling-type oscilloscope that covers a wide range of fast-signal applications when used with appropriate signal and sweep plug-in units. Used with Types 4S1 and 5T1 Units, the Type 661 becomes a dual-trace instrument that operates much like a conventional oscilloscope, with such features as built-in signal delay, 0.35-nsec risetime, and calibrated equivalent sweep times as fast as 1 nsec/cm.

Extending many of the usual oscilloscope operating conveniences to the gigacycle region, the Type 661 can be used with 50-ohm inputs, or with passive probes or cathode-follower probes to meet most of the general-purpose-measurement demands in repetitive-signal applications.

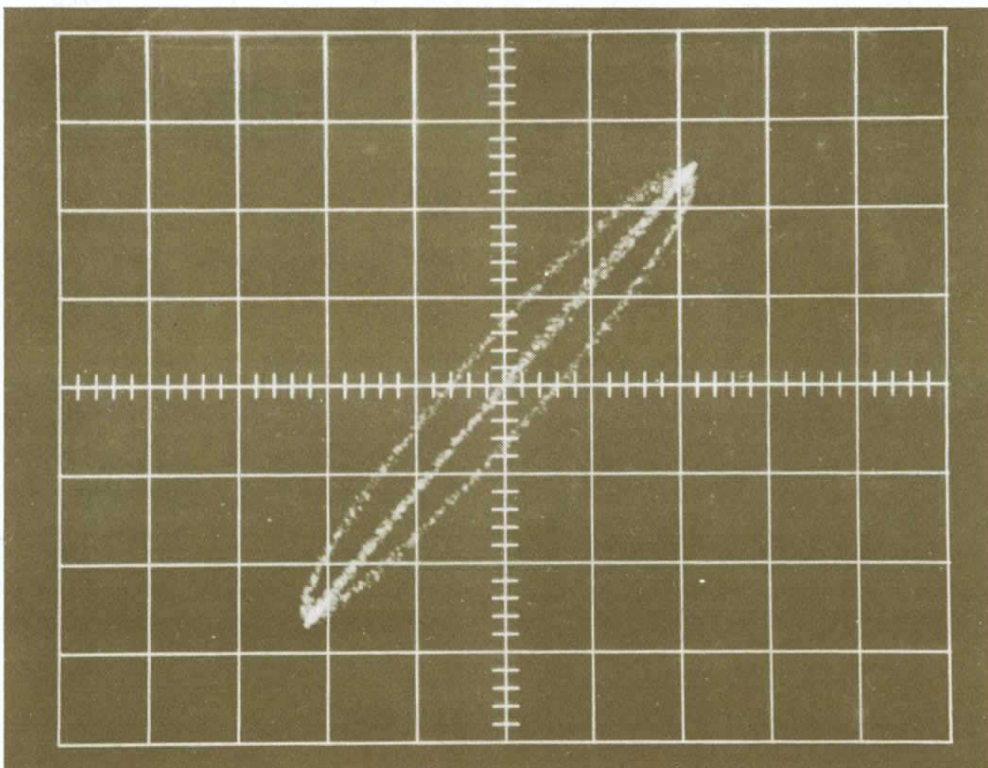
661

AMPLITUDE/TIME CALIBRATOR provides sinusoidal signals for checking vertical sensitivity and sweep rates.

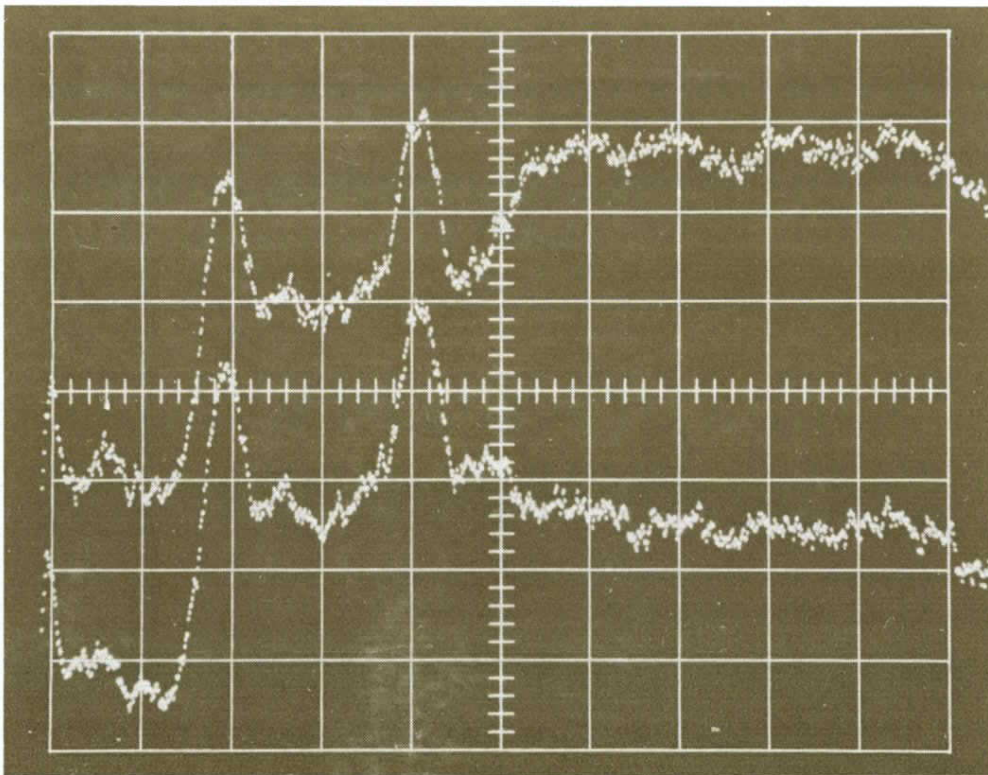
AMPLITUDE CALIBRATION accuracy, with a 50-ohm load, at 1000 mv, 100 mv, 10 mv, and 1 mv is within 2%, 4%, 5%, and 6% respectively in the 10 $\mu\text{sec}/\text{cycle}$, 1 $\mu\text{sec}/\text{cycle}$, and 0.1 $\mu\text{sec}/\text{cycle}$ positions; and within 8%, 9%, 10%, and 11% respectively in the 0.01 $\mu\text{sec}/\text{cycle}$ position.

TIME CALIBRATION accuracy, with a 50-ohm load, at 10 $\mu\text{sec}/\text{cycle}$, 1 $\mu\text{sec}/\text{cycle}$, and 0.1 $\mu\text{sec}/\text{cycle}$ is within 0.2%, and at 0.01 $\mu\text{sec}/\text{cycle}$, is within 2%.

TYPICAL APPLICATIONS



2 gigacycle sine-wave driving inputs to 4S1 show X-Y capability. Diagonal line shows in-phase characteristics. Ellipse is caused by insertion of 8 millimeters of air-line to one input, resulting in approximately 20 degrees of phase-shift. Resolution below one degree is possible.



Reflectometer system showing 0.1%/cm voltage reflection resolution. Scale is 1.0 mv/cm vertically and 1.0 nsec/cm horizontally. Large positive pips are due to connector impedance errors. Differences in the two waveforms following the large pips are due to differences in terminating T pads.

DELAYED-PULSE AND SIGNAL OUTPUTS add to flexibility of the instrument.

DELAYED PULSE 50-ohm output permits the Type 661 (with 4S1 and 5T1 Units) to serve as a rate generator to trigger external circuitry. Delayed pulses occur each time the display is sampled. Pulses occur nominally 50 nsec after the sweep starts, with an amplitude of at least 350 mv and risetime of less than 0.2 nsec.

SIGNAL OUTPUTS include those for Vertical A, Vertical B, and Horizontal Outputs through an impedance of 10 kilohms, at an amplitude of 200 mv/cm referred to the crt display. Also a connector at the rear is provided for future digital readout devices.

BEAM-POSITION INDICATORS show position of the crt beam when away from the center-screen area.

ILLUMINATED GRATICULE has controlled edge lighting and is accurately scribed in 8 vertical and 10 horizontal cm divisions, with 2-mm baseline divisions.

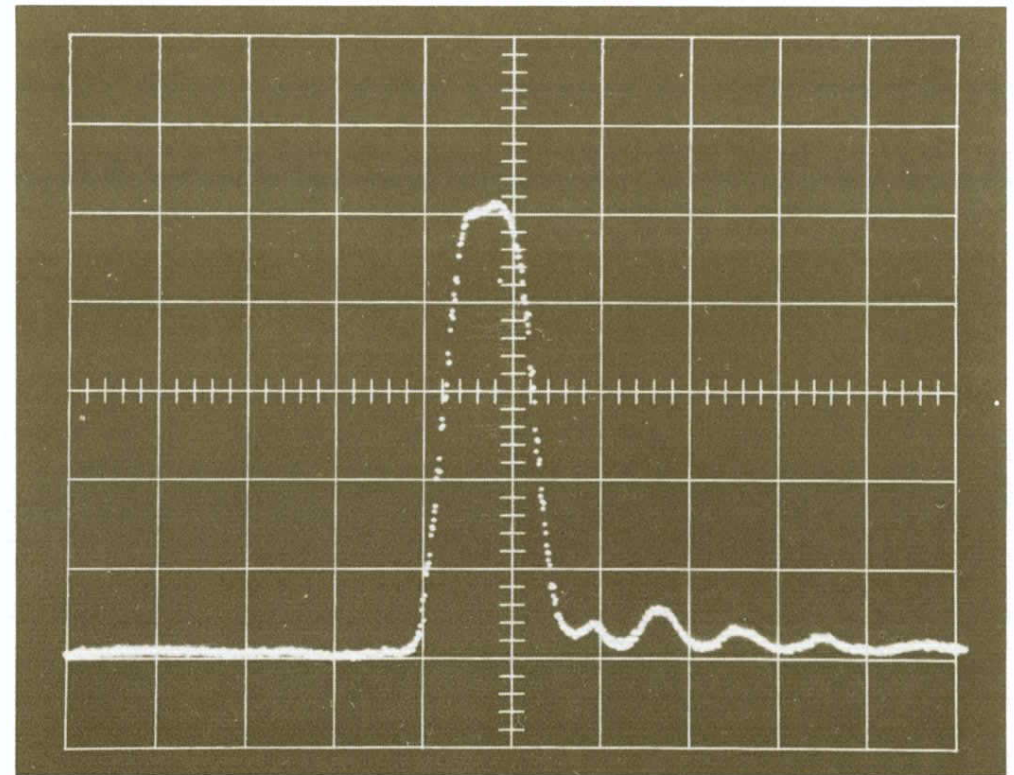
ELECTRONICALLY-REGULATED POWER SUPPLIES, temperature isolated, provide adequate power for stable operation of the oscilloscope with plug-in units. Thermal cutout interrupts the power if chassis temperature becomes excessive. Line voltage changes within operating range causes imperceptible changes in the display.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically ~~400~~ ⁴⁵⁰ watts.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel. Dimensions are 16⁷/₈" high by 13¹/₈" wide by 23³/₄" deep. Net weight is 49¹/₂ pounds. Shipping weight is 69 pounds, approx. 11-12-62

TYPE 661 OSCILLOSCOPE, without plug-in units . . . \$1150

Each instrument includes: 1—polarizing light filter, 1—power cord, 2—instruction manuals.



A 1.0 nsec wide pulse illustrates the internal-triggering capability of 661/4S1/5T1 system. Time base = 1 nsec/cm, amplitude scale = 10 mv/cm. Display is shown unsmoothed. Note very small amount of time jitter.

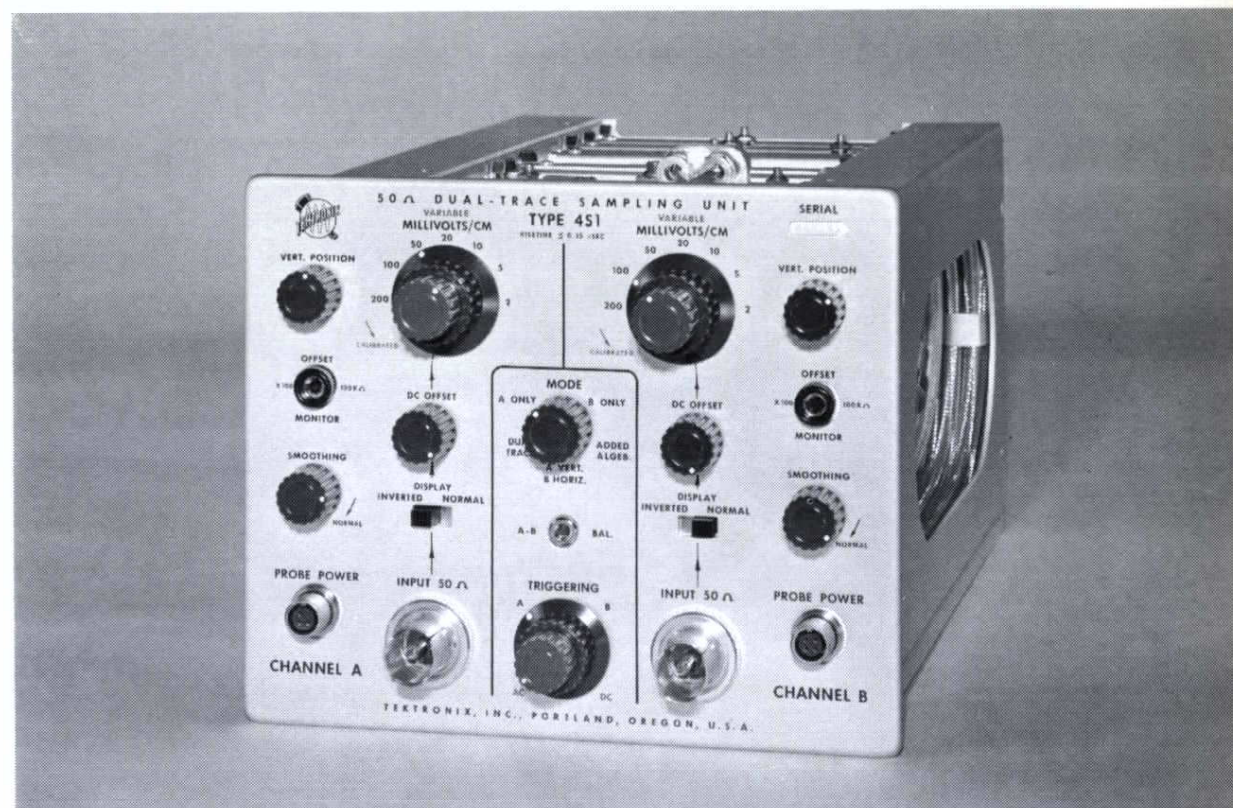
SAMPLING PLUG-IN UNITS

The TYPE 4S1 DUAL-TRACE PLUG-IN UNIT is a general-purpose unit. Risetime is 350 psec or less. Sensitivity is in 7 calibrated steps from 2 mv/cm to 200 mv/cm.

The Type 4S1 has capabilities for display of A only, B only, $\pm A \pm B$, dual-trace, and a Tektronix Sampling Oscilloscope innovation, an X-Y type display, of A-vertically and B-horizontally—for observing hysteresis loops, phase shift, similar displays. SEPARATE internal trigger take-offs, delay lines, and terminations permit triggering on either A or B input signals. The trigger take-offs deliver to the timing unit a signal approximately $\frac{1}{8}$ the input amplitude.

TYPE 4S1 DUAL-TRACE UNIT \$1430

Each plug-in includes: 2—10X, 50- Ω attenuators, 2—5-nsec, 50- Ω cables, 2—instruction manuals.

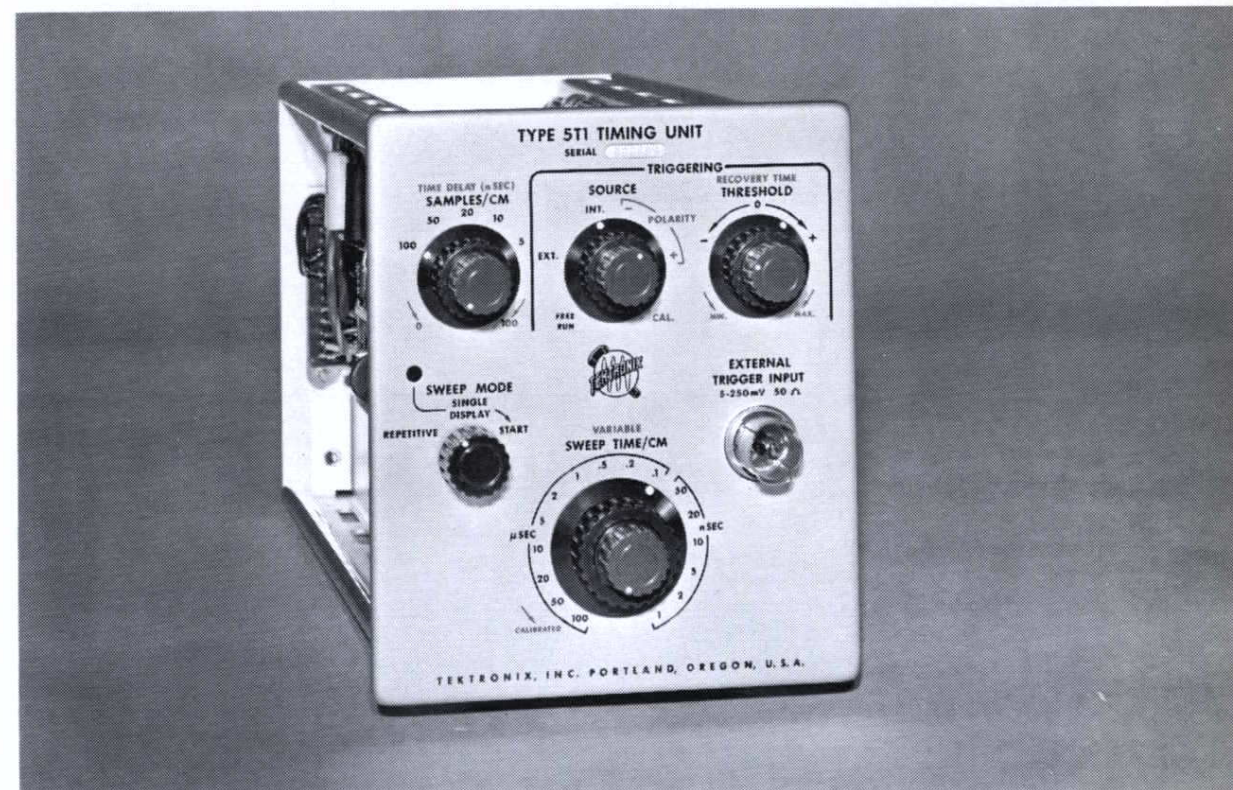


The TYPE 5T1 TIMING PLUG-IN UNIT provides flexible triggering and generates the time base. Trigger sensitivity is 5 mv, at the timing unit, for pulses 2 nsec or wider. Triggers larger than 250 mv can be accommodated with external attenuators. External input is ac coupled, approximately 3-db down at 300 kc (sine-wave) at the low end. Minimum rate of rise for pulse triggering is approximately 100 mv/nsec at 50 cps or greater repetition rate.

Time-base range covers an equivalent sweep rate from 100 μ sec/cm to 1 nsec/cm in 16 calibrated rates (to 10 psec/cm with full horizontal magnification of the Type 661). Continuous adjustment is possible between rates uncalibrated and to approximately 0.33 nsec/cm. Accuracy of the samples per centimeter is within 2%.

TYPE 5T1 TIMING UNIT \$750

Each plug-in includes: 2—10X, 50- Ω attenuators, 1—10-nsec, 50- Ω cable, 2—instruction manuals.



SEE PAGES 147-148 FOR COMPLETE SPECIFICATIONS.

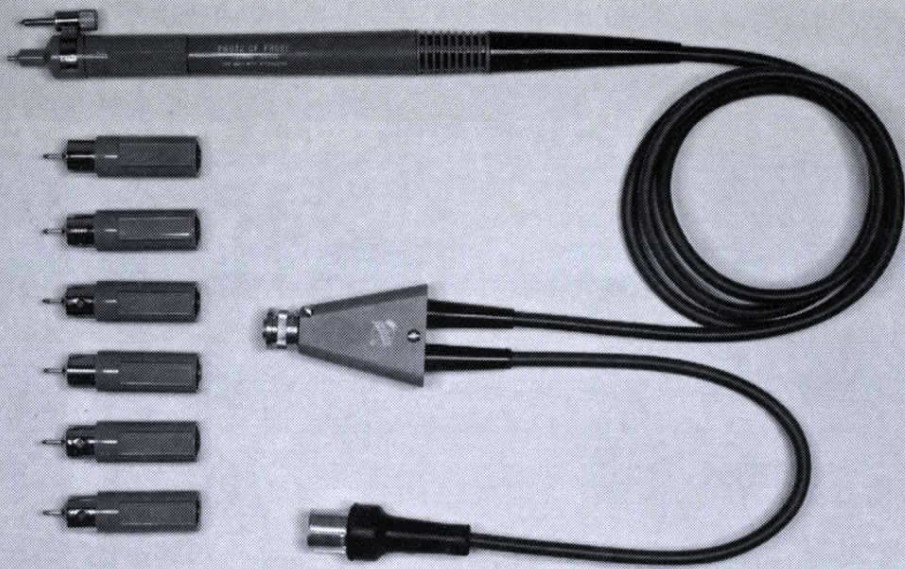
SEE NEXT PAGE FOR PROBES.

MAINTENANCE

of the Type 661 and its plug-in units will require these items:

Plug-In Extension for Dual-Trace and Timing Units Order Part Number 012-064 (24-pin extension)	\$23.00
Circuit-Board Extension for Dual-Trace Unit Order Part Number 012-069 (22-pin extension)	\$17.50
Coaxial Cable for Coupling Trigger Signals Order Part Number 012-070	\$ 9.75

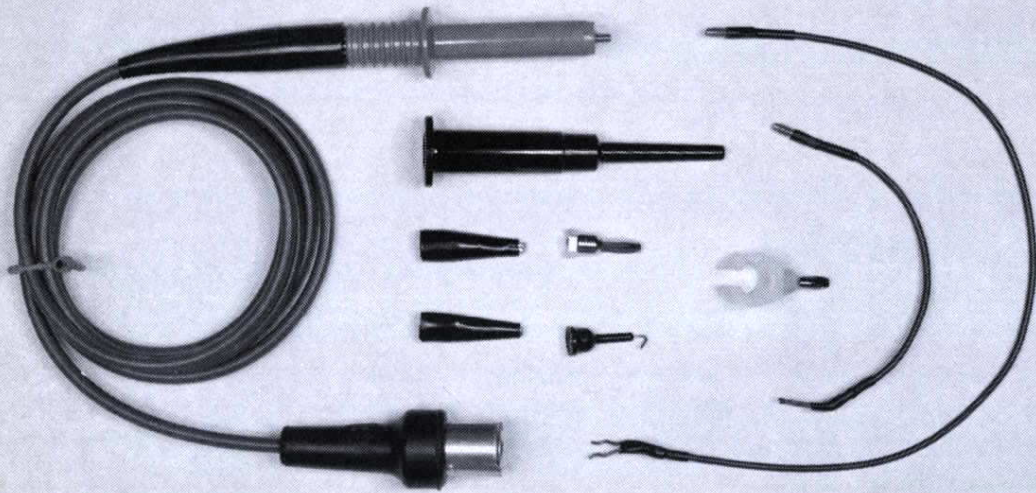
These items are offered for the convenience of companies with in-plant instrument-maintenance facilities. If your company has this facility, or you intend performing your own maintenance, please include 2 plug-in extensions (one each for the dual-trace and timing units), 1 circuit-board extension, and 2 coaxial trigger cables with your initial instrument order. One set of 5 will usually be adequate for maintenance of several instruments.



PROBES

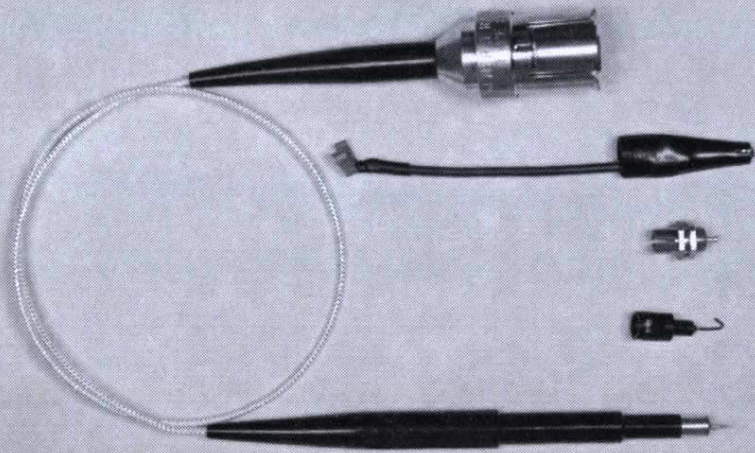
The TYPE P6032 CATHODE-FOLLOWER PROBE is a high-impedance, dc-coupled probe with an attenuation range of 10X to 1000X, in a 1-2-5 sequence, with 7 plug-in attenuator heads and a capacitor-coupler head. Maximum output is ± 150 mv. Risetime is typically 0.55 nsec with 4S1. Static capacitance is 3.6 to 1.3 pf. Static resistance is 10 megohms.

Order Part Number 010-108 \$160



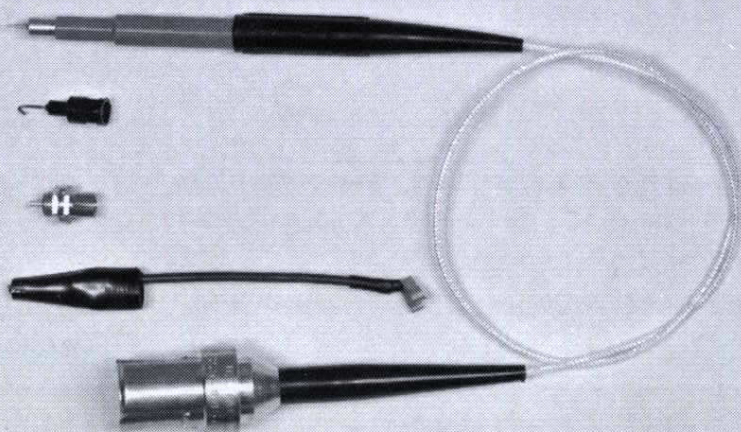
The TYPE P6033 TRIGGER PROBE can be used in applications requiring external signals for triggering units with a 50-ohm external trigger input, such as the Type 5T1. Attenuation of the Type P6033 is 10:1 from 1.5 Mc to 300 Mc and 17:1 from dc-to-100 kc terminated into 50 ohms (attenuation has a maximum point of 50:1 at 350 kc). Impedance is 1200 ohms paralleled by approximately 2 pf at 250 Mc and 870 ohms at dc, when terminated into 50 ohms. Risetime is 1.2 nsec or less. Probe voltage rating is 15 volts dc or rms, dc coupled; 400 v dc or 15 v rms, ac coupled.

Order Part Number 010-100 \$35



The TYPE P6034 MINIATURE PASSIVE PROBE (10X attenuation) is designed for use with Tektronix plug-ins such as 4S1 and 3S76. Input resistance is 500 ohms at dc and approximately 300 ohms at 1.0 gigacycle. Input capacitance is 0.7 pf \pm 0.1 pf at 1.0 Mc to 1.0 gc. Risetime of the probe is less than 100 picoseconds. Ringing and overshoot is 2% or less on pulses from 25 ohm source.

Order Part Number 010-110 \$35



The TYPE P6035 MINIATURE PASSIVE PROBE (100X attenuation) is designed for use with Tektronix plug-ins such as 4S1 and 3S76. Input resistance is 5000 ohms at dc and approximately 1500 ohms at 1.0 gigacycle. Input capacitance is 0.6 pf \pm 0.1 pf at 1.0 Mc to 1.0 gc. Risetime of the probe is less than 200 picoseconds. Ringing and overshoot is 2% or less on pulses from 25 ohm source.

11-12-82

Order Part Number 010-111 \$35

SEE ACCESSORY SECTION FOR COMPLETE PROBE DESCRIPTION.

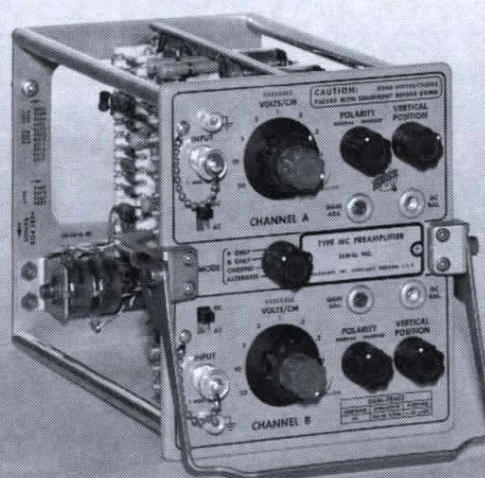
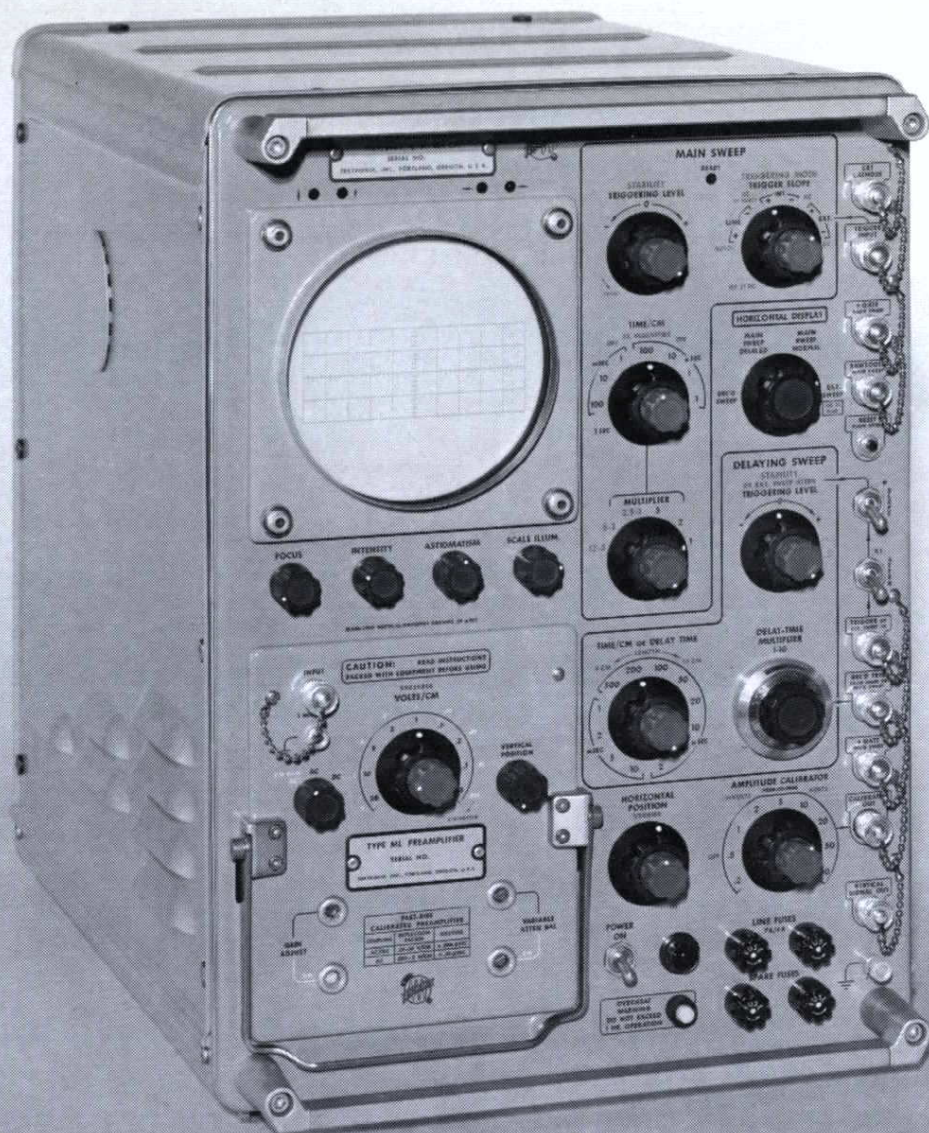
U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



MILITARIZED

OSCILLOSCOPE DUAL-TRACE PREAMPLIFIER FAST-RISE PREAMPLIFIER

Types 945 MC ML



EXTREME-ENVIRONMENT ACCURACY

EXPERIENCE PROVEN CIRCUITRY

MECHANICAL RUGGEDNESS

ELECTRICAL RELIABILITY

DESIGN FEATURES

- Ruggedized structure to withstand vibration and shock.*
- Forced-air cooling with carefully chosen components and materials to assure reliable operation at extreme temperatures and humidity.*
- Finish engineered to provide corrosion resistance to humidity, fungus, and salt spray.*
- Rain-sealed cabinet for weather protection.*
- Cabinet louver screening, crt faceplate shielding and line filter prevents radio interference.*
- Transistorized fan-motor power supply enables operation from 50 to 400 cycles.*
- MIL-E-1 vacuum tubes, except crt, high voltage rectifiers, and vertical-output distributed amplifier.*
- Components meet or exceed MIL specifications.*
- Tektronix manufactured parts meet or exceed environmental test requirements.*
- Power-supply transformer hermetically sealed, Grade 1, Class R, MIL-T-27.*
- Encapsulated high-voltage power supply.*
- Regulated heaters in vertical amplifier.*
- Front and rear panel covers for "in transit" protection and convenient accessory storage.*
- Front and rear combination panel-guards and handles provide protection and carrying ease.*
- Military styled control knobs.*
- BNC type signal connectors.*
- Over-heat warning lamp.*

ENVIRONMENTAL SPECIFICATIONS

Tektronix militarized instruments will operate with accuracy and reliability in severe environments and will survive extreme shipping and storage conditions. Even greater reliability is realized under normal conditions.

The following summary indicates the environmental capabilities of the Type 945 Oscilloscope, MC, and ML Plug-In Units.

Complete specifications are available through your Tektronix Field Engineer.

Temperature	-40°C to +55°C/71°C -65°C to +85°C	(operating) (storage)
Humidity	10 days, 95% RH +18°C to +65°C	(storage)
Fungus	28 days	(storage)
Vibration	5 G's, 55 cps, 0.030" pk-to-pk	(operating)
Shock	400 lb. drop hammer	(operating)
Altitude	20,000 ft. 50,000 ft.	(operating) (storage)
Radio Interference	14 kc to 1000 Mc	(operating)
Salt Atmosphere	100 hrs.	(finishes)
Rain	5 min. drip test	(storage)

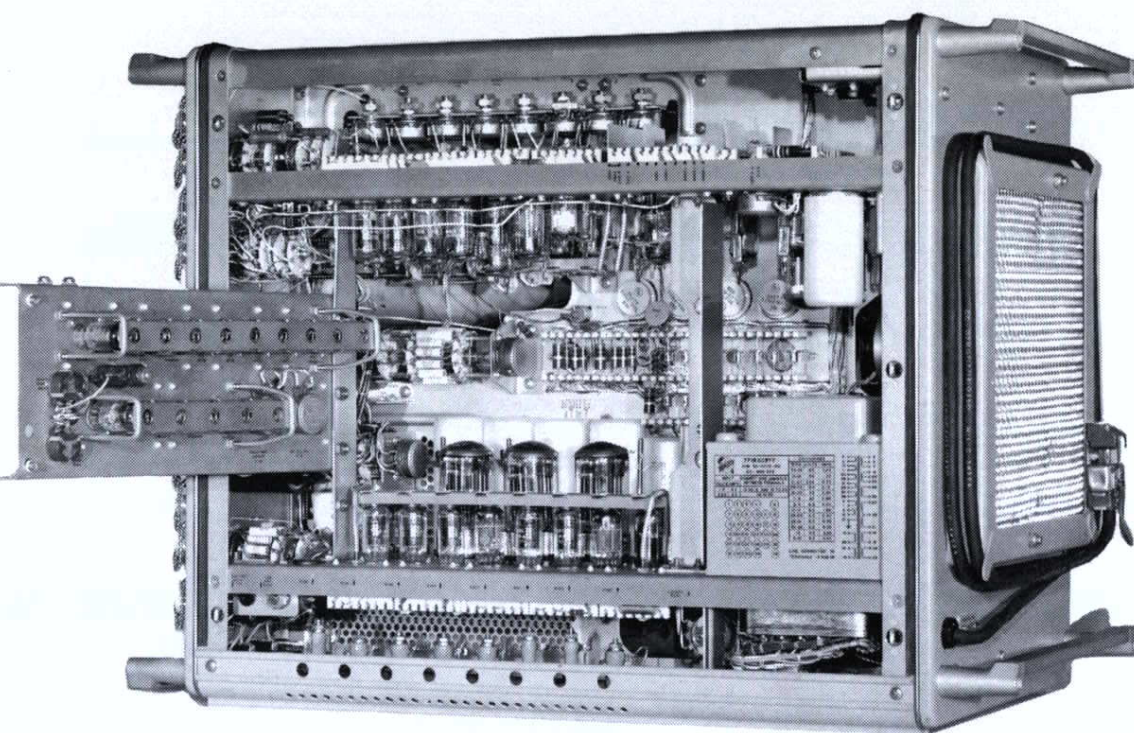
945 MC ML

The Tektronix Type 945 Oscilloscope, Type ML Fast-Rise, High-Gain Preamplifier, and Type MC Dual-Trace Preamplifier are militarized versions of the Type 545 Oscilloscope, Type L Plug-In Unit, and Type 53/54C Plug-In Unit. The Type P6945 probes supplied with the Type 945 are electrically equivalent to the Tektronix Type P6003 probes. These instruments are designed to meet MIL-T-945A environmental specifications and are manufactured to most MIL-T-945A parts, materials and process specifications. (Where a deviation exists, the intent of the specifications is met by performing to the required environmental test). The Tektronix electrical-environmental specifications describe the capabilities of the Type 945 Oscilloscope and militarized plug-in units.

MIL-T-21200 and MIL-E-16400 are general specifications similar to MIL-T-945A. Many portions of these specifications are applicable to the Type 945 Oscilloscope, Type MC, and Type ML Plug-In Units.

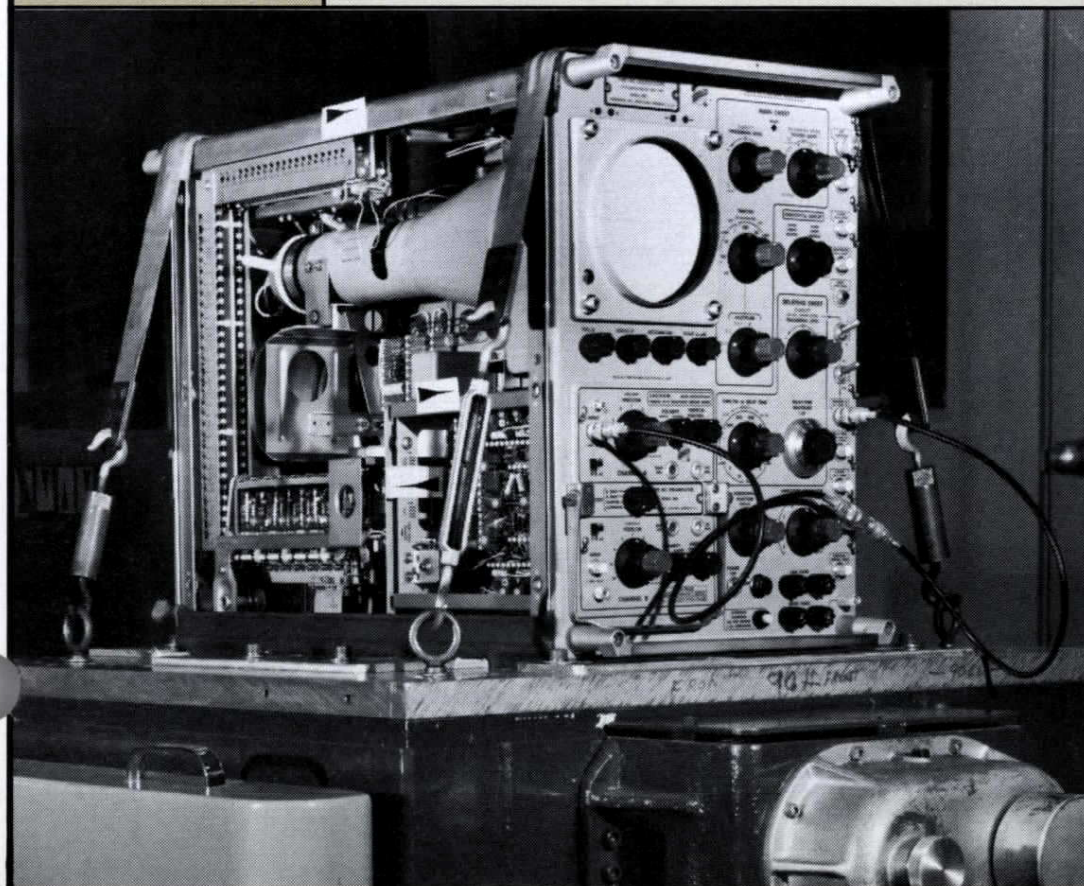
As a result of designing to military requirements many Military Standard components have been used. Other areas of design have dictated special parts either from the environmental aspect or improved reliability standpoint.

In addition to the 2 militarized plug-in units, any Tektronix Type A to Z Plug-In Unit can be used in the Type 945. This feature extends the signal-handling versatility of the Type 945 during operation in normal environments.



Characteristics	Requirements		
	VERTICAL DEFLECTION		
	Type MC Dual Channel Plug-In Preamplifier	Type ML Fast-Rise Preamplifier	
		AC or DC-Coupled	10X Gain AC
Frequency Response	DC to 24 Mc, $\frac{+3}{-0}$ Mc	DC-Coupled—dc to 30 Mc, $\frac{+3}{-0}$ Mc AC-Coupled—5 cps to 30 Mc, $\frac{+3}{-0}$ Mc	5 cps to 24 Mc, $\frac{+3}{-0}$ Mc
Low-Frequency Response	DC-Coupled—No greater than 2.5% down from 1 kc to dc. AC-Coupled—No greater than 10% down from 1 kc to 5 cps.	DC-Coupled—No greater than 2.5% down from 1 kc to dc. AC-Coupled—No greater than 10% down from 1 kc to 5 cps.	No greater than 30% rise from 100 cps to 5 cps (when adjusted for 5% droop with 50 cps squarewave).
High-Frequency Response	No greater than 30% (3 db) down from 50 kc to 24 Mc at 0.05 v/cm.	No greater than 30% (3 db) down from 50 kc to 30 Mc at 0.05 v/cm.	No greater than 30% (3 db) down from 50 kc to 24 Mc at 0.005 v/cm.
Risetime	15 nsec or less, at 0.05 v/cm.	12 nsec or less, at 0.05 v/cm.	15 nsec or less, at 0.005 v/cm.
Deflection Factor Range	0.05 v/cm to 20 v/cm in nine steps, 1-2-5 sequence. 2.5 to 1 variable control permits uncalibrated attenuation between steps and to 50 v/cm.		0.005 v/cm to 2.0 v/cm in nine steps, 1-2-5 sequence. 2.5 to 1 variable control permits uncalibrated attenuation between steps and to 5.0 v/cm.
Attenuator Accuracy	$\pm 3\%$ from -20°C to $+55^{\circ}\text{C}$, $\pm 5\%$ from -40°C to -20°C , $\pm 5\%$ after Vibration and Shock Tests.		
Input Impedance	1 megohm $\pm 5\%$, 20 pf $\pm 5\%$.		
Operating Modes	Channel A, Channel B, Chopped, Alternate		

Characteristics	Requirements	Characteristics	Requirements
HORIZONTAL DEFLECTION		VARIABLE TIME DELAY	
MAIN SWEEP			
Time/cm Range	0.02 μ sec/cm to 12 sec/cm. 0.1 μ sec/cm to 5 sec/cm in 24 calibrated steps; 1-2-5 sequence. Uncalibrated vernier extends range to 12 sec/cm.	Delay Time Range	1 μ sec to 100 msec. 2 μ sec to 10 msec in 12 calibrated steps; 1-2-5 sequence. Calibrated 10 turn vernier/multiplier extends range to 1 μ sec and 100 msec.
Accuracy	$\pm 3\%$ -20°C to $+55^{\circ}\text{C}$. $\pm 5\%$ -40°C to $+71^{\circ}\text{C}$. $\pm 5\%$ Vibration and Shock	Accuracy	$\pm 1\%$ -20°C to $+55^{\circ}\text{C}$. $\pm 2\%$ from -20°C to 0°C on 2, 5, 10 msec/cm only. $\pm 3\%$ -40°C to $+71^{\circ}\text{C}$. Incremental 0.2%, 0°C to $+71^{\circ}\text{C}$ at 500 μ sec. 0.3% from -40°C to 0°C .
Sweep Expansion	X5 $\pm 3\%$ -20°C to $+55^{\circ}\text{C}$, $\pm 5\%$ -40°C to $+71^{\circ}\text{C}$. Extends range to 0.02 μ sec/cm.	HORIZONTAL AMPLIFIER	
Trigger Level	External AC, AC LF reject, DC, & AUTO. ± 0.5 v to ± 50 v. Internal AC & AC LF reject, 2 mm or less. DC & AUTO, 5 mm or less. HF sync 30 Mc or greater, (2 cm deflection and 2 mm maximum horizontal jitter).	External Input	DC coupled
DELAYING SWEEP		Deflection Factor	Continuously variable from 0.2 v/cm or less to 10 v/cm or greater with 5X magnifier on.
Time/cm Range	2 μ sec/cm to 10 msec/cm in 12 calibrated steps; 1-2-5 sequence.	Frequency Response	DC to 1 Mc at maximum gain; high frequency response, no greater than 30% (3 db) down from 1 kc; low frequency response, no greater than 3% down from 1 kc to dc.
Accuracy	$\pm 3\%$ -20°C to $+55^{\circ}\text{C}$. $\pm 5\%$ -40°C to $+71^{\circ}\text{C}$. $\pm 5\%$ Vibration and Shock.	AMPLITUDE CALIBRATOR	
Trigger Level	± 1 v to ± 50 v.	Voltage Range	0.2 mv to 100 v pk-to-pk
Jitter	1/20,000 at 1 msec/cm, (5 mm at X1000 expansion using Delay Time Multiplier and Main Sweep Display).	Accuracy	$\pm 2\%$ -40°C to $+55^{\circ}\text{C}$. $\pm 4\%$ $+55^{\circ}\text{C}$ to $+71^{\circ}\text{C}$.
Sweep Length	Continuously variable from 4 cm $\frac{+0.5}{-1}$ cm to 10 cm $\frac{+1}{-0}$ cm.	POWER SOURCE	
		Regulation	115/230 v $\pm 10\%$, 1 ϕ , 50 to 400 cps $\pm 10\%$, 700 watts maximum. At voltage limits 103.5 and 126.5 no greater than the following change from 115 v line will be observed: Deflection Factor $\pm 1.5\%$ (Type MC at 0.05 v/cm.) $\pm 1\%$ (Type ML at 0.05 v/cm and 0.005 v/cm.) Amplitude calibrator $\pm 0.5\%$ at 100 v. Time Base $\pm 0.75\%$ (Main and Delaying Sweep at 1 msec/cm.)
		OTHER CHARACTERISTICS	
		CRT	T945P2
		Accelerating Potential	10 kv
		Useful Scan	4 x 10 cm
		Power Cable	Permanently attached three-wire cord terminated with MIL-C-3767/4 plug (2 or 3 prong).
		Connectors	All input and output jacks are BNC type.



The Type 945 undergoing a routine vibration test.

The Tektronix Type 945 Oscilloscope and Types MC and ML Preamplifiers are 100% vibration tested as a regular quality control procedure. This nondeteriorating test assures uniform mechanical integrity of each instrument. It finds random defects that might otherwise give trouble after the shipping environment. This is only one of the many manufacturing steps that serve to build-in quality and reliability.

945 MC ML

MECHANICAL FEATURES include ruggedized construction, cabinet painted with military light gray enamel per MIL-F-14072, matching photoetched front panel.

Dimensions are 18.1" high by 13.4" wide by 25.3" deep without panel covers; 18.4" high by 13.8" wide by 27.6" deep with panel covers.

Type 945 net weight is 80 pounds. Shipping weight is 117 pounds, approx. Front and rear panel covers with accessories weight 14 pounds. Shipping weight is 19 pounds, approx.

TYPE 945, without plug-in units \$2850

Each instrument includes:

- 2—10X attenuator Type P6945 probes with tips, holders, and gnd. leads
- 2—coax cables, RG58C/U, 50 Ω , 24", BNC
- 2—binding post adapters, UG 1090/U, (special), BNC
- 1—green light filter
- 1—instruction manual

TYPE MC Preamplifier \$475

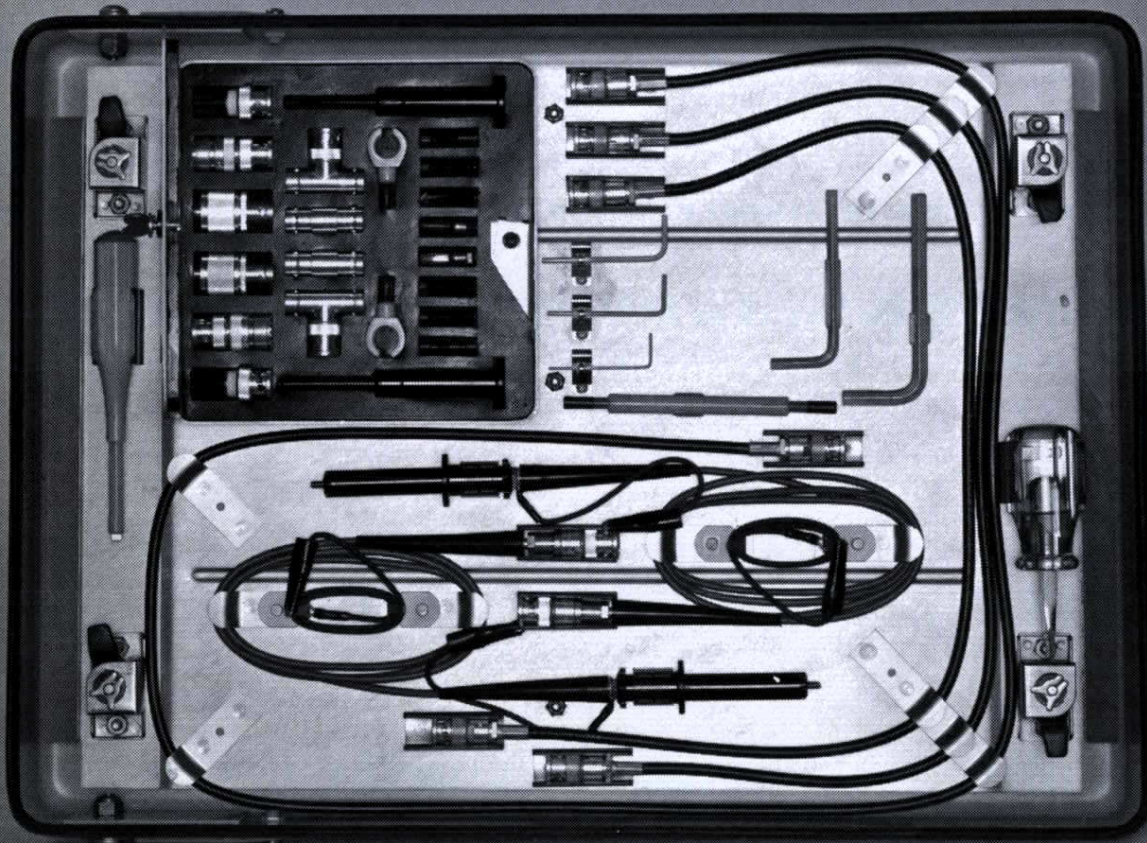
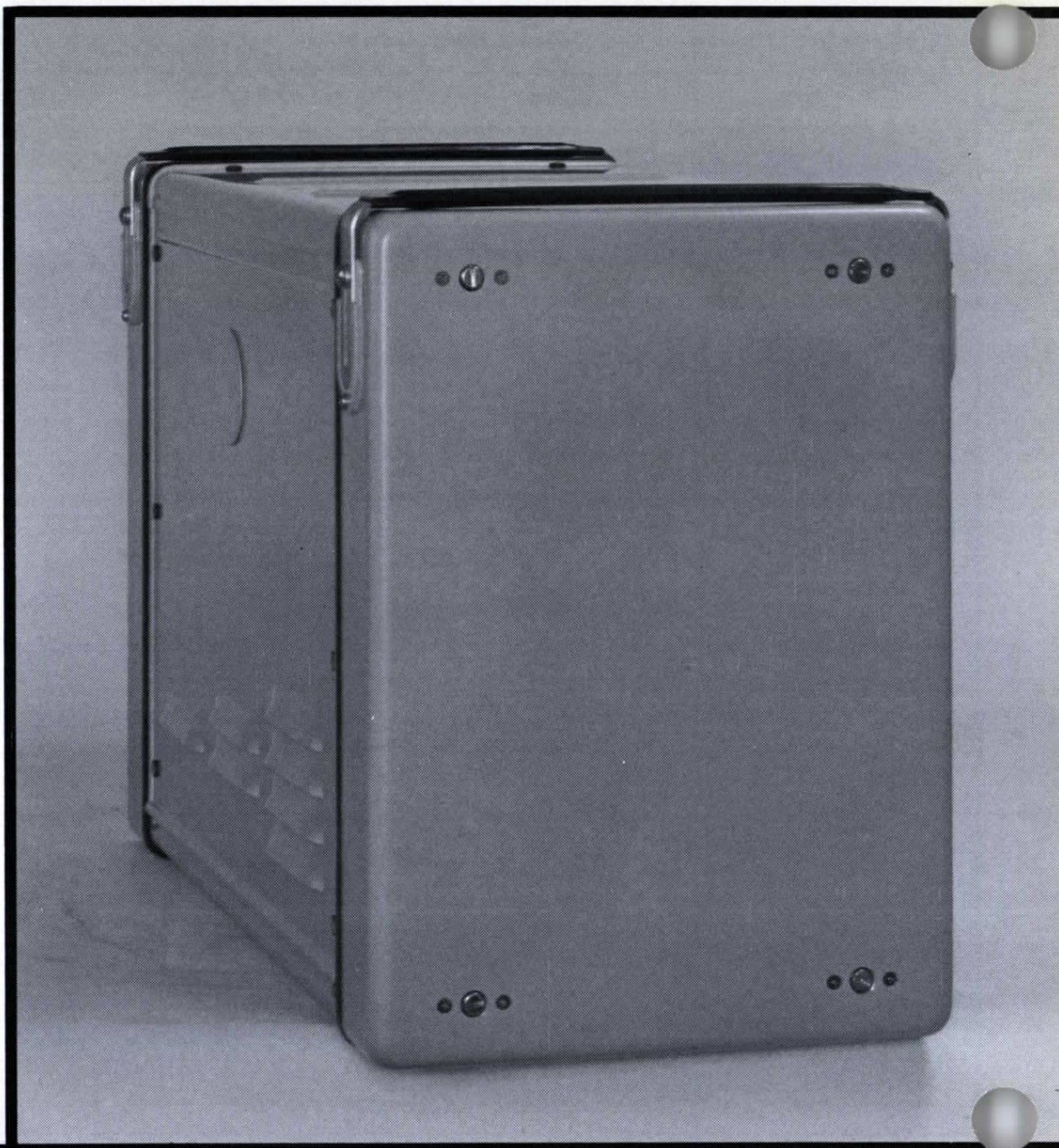
Each unit includes: 1—instruction manual.

Net weight is 5.0 pounds. Shipping weight is 9 pounds, approx.

TYPE ML Preamplifier \$425

Each unit includes: 1—instruction manual.

Net weight is 4.8 pounds. Shipping weight is 9 pounds, approx.



OPTIONAL PANEL COVERS

Front and rear panel covers provide complete "in transit" protection and convenient storage for both standard and additional accessories and instruction manual.

Front and rear panel covers (without standard accessories listed above) include additional accessories as follows:

- 1—coax cable, RG58C/U, 50 Ω , 48", BNC
- 2—adapters, conn., UG 273/U, BNC jack, UHF plug
- 2—adapters, conn., UG 274/U, BNC, tee
- 2—adapters, conn., UG 914/U, straight BNC
- 2—adapters, conn., UG 255/U, BNC plug, UHF jack
- 2—alignment tools
- 1—screwdriver
- 5—Allen Key wrenches—one each #4, #8, $\frac{3}{32}$, $\frac{3}{16}$, $\frac{1}{4}$.

Order Part Number 70-4003-00 \$150

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



WIDE-BAND HIGH-GAIN UNIT Type B

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)

- Frequency specifications are at 3-db down
- With Types 531A, 533A, 535A—dc to 14 mc, 25 nsec.
- With Types 536—dc to 10 mc, 35 nsec.
- With Types 541A, 543A, 545A, 555, *581, *585—dc to 20 mc, 18 nsec.
- With Type 551—dc to 18 mc, 20 nsec.

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

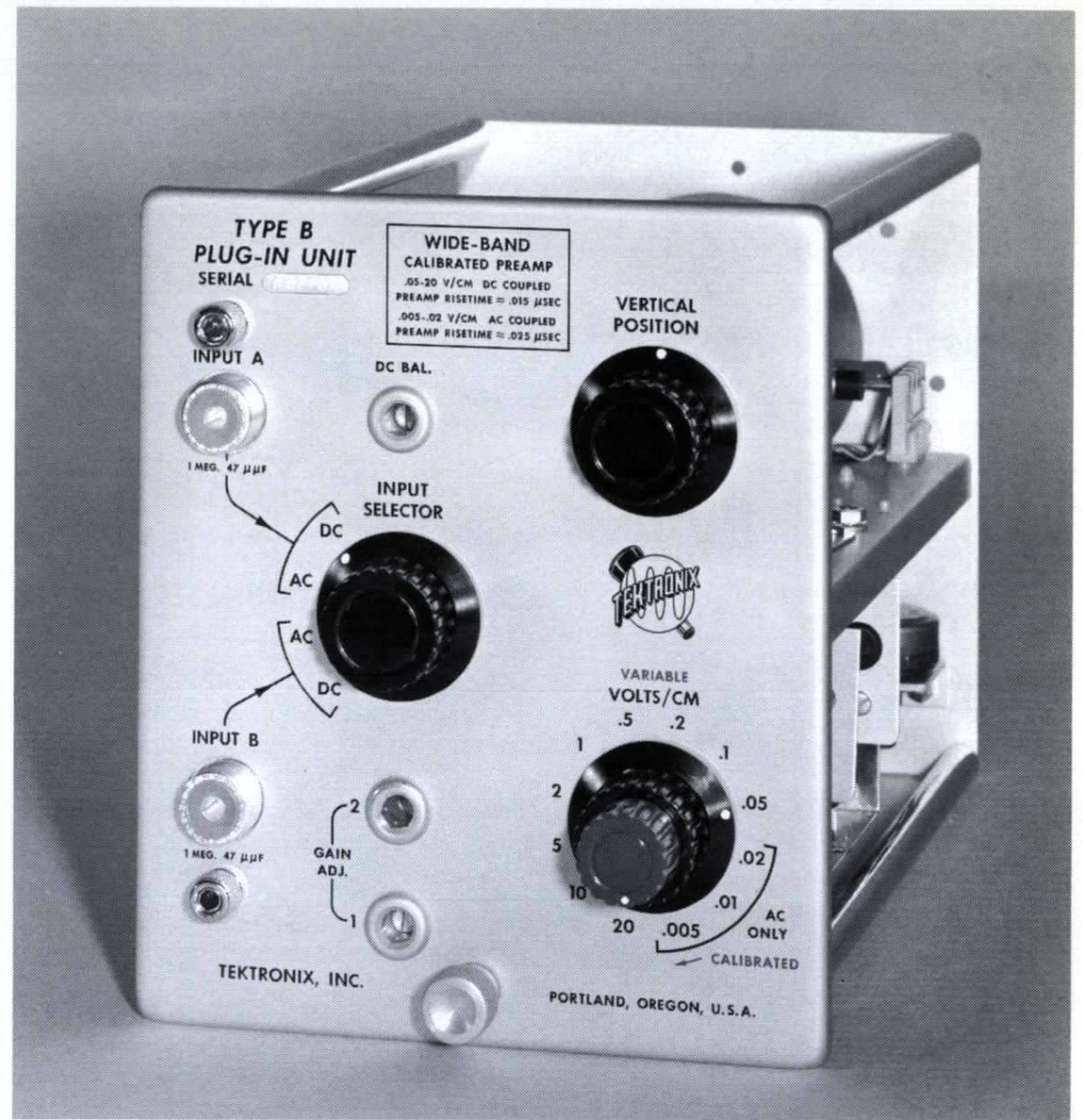
- Frequency specifications are at 3-db down
- With Types 531A, 533A, 535A—2 cycles to 10 mc, 35 nsec.
- With Type 536—2 cycles to 9 mc, 40 nsec.
- With Types 541A, 543A, 545A, 555, *581, *585—2 cycles to 12 mc, 30 nsec.
- With Type 551—2 cycles to 12 mc, 30 nsec.

The Type B Plug-In Preampifier 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 B gives all of these qualities to Tektronix Type 530, 540, 550 and *580 Series Oscilloscopes.

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.

* A Type 81 Adapter is required for use with Types 581 and 585.



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 0.05 v/cm and 0.005 v/cm positions, the vertical deflection factor for any other position of the switch will be within 3% of the panel 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. When ac coupled, the low-frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

Input Impedance—1 megohm paralleled by approximately 47 pf.

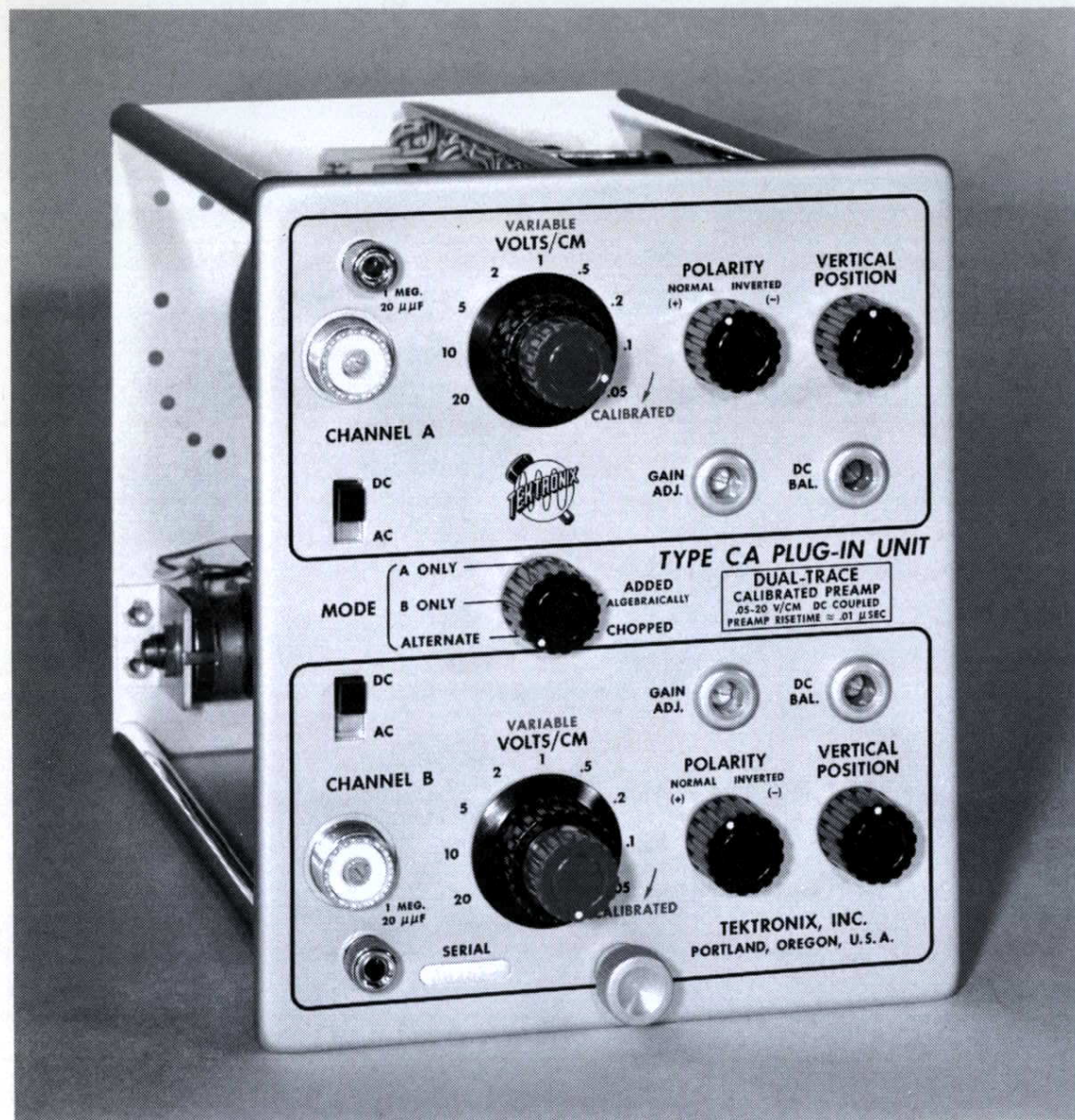
Weight: Net—4 pounds
Shipping—8 pounds approx.

TYPE B PLUG-IN UNIT \$145
Each instrument includes: 2—instruction manuals.

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

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type C-A DUAL-TRACE DC UNIT



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 ($A \pm B$).

Frequency Response and Risetime

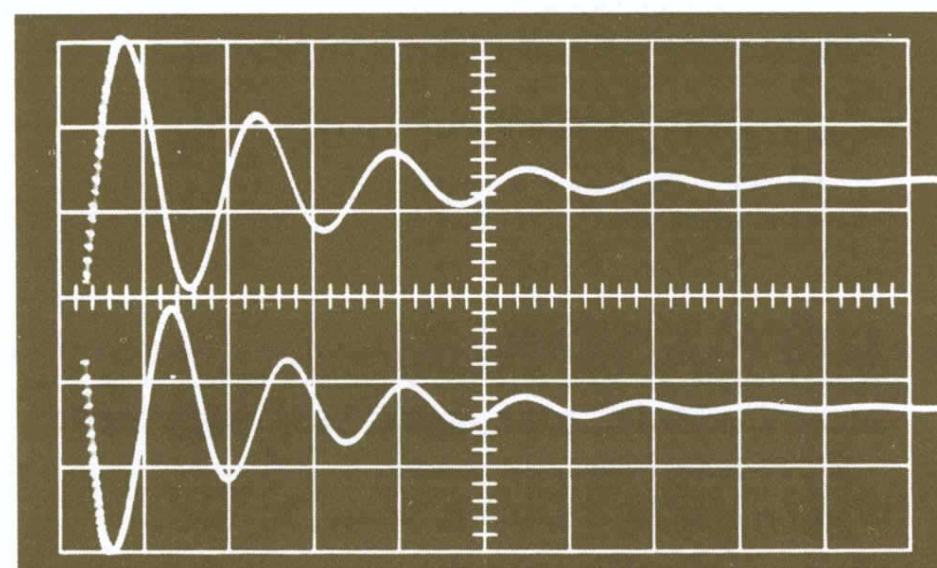
Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—dc to 15 mc, 23 nsec.

With Type 536—dc to 10 mc, 35 nsec.

With Types 541A, 543A, 545A, 555, *581, *585—
dc to 24 mc, 15 nsec.

With Type 551—dc to 22 mc, 16 nsec.



TYPICAL DUAL-TRACE DISPLAY using Chopped Mode of Type C-A Unit. The waveform depicts a simultaneous display of the response of two ringing circuits to the same pulse. In this mode, transients as small as 1 msec can be observed and measured readily.

The Tektronix Type C-A Unit contains two identical input 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.

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.

*A Type 81 Adapter is required for use with Types 581 and 585.

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—When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

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—1 megohm paralleled by approximately 20 pf.

Weight: Net—4 $\frac{3}{4}$ pounds
Shipping—9 pounds, approx.

TYPE C-A PLUG-IN UNIT \$260

Each instrument includes: 2—instruction manuals.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





HIGH-GAIN DC DIFFERENTIAL UNIT Type D

Deflection Factor

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

Frequency Response

DC to 300 kc at 1 mv/cm sensitivity . . . increasing to DC to 2 mc at 50 mv/cm and lower sensitivity. Frequency specifications are at 3-db down.

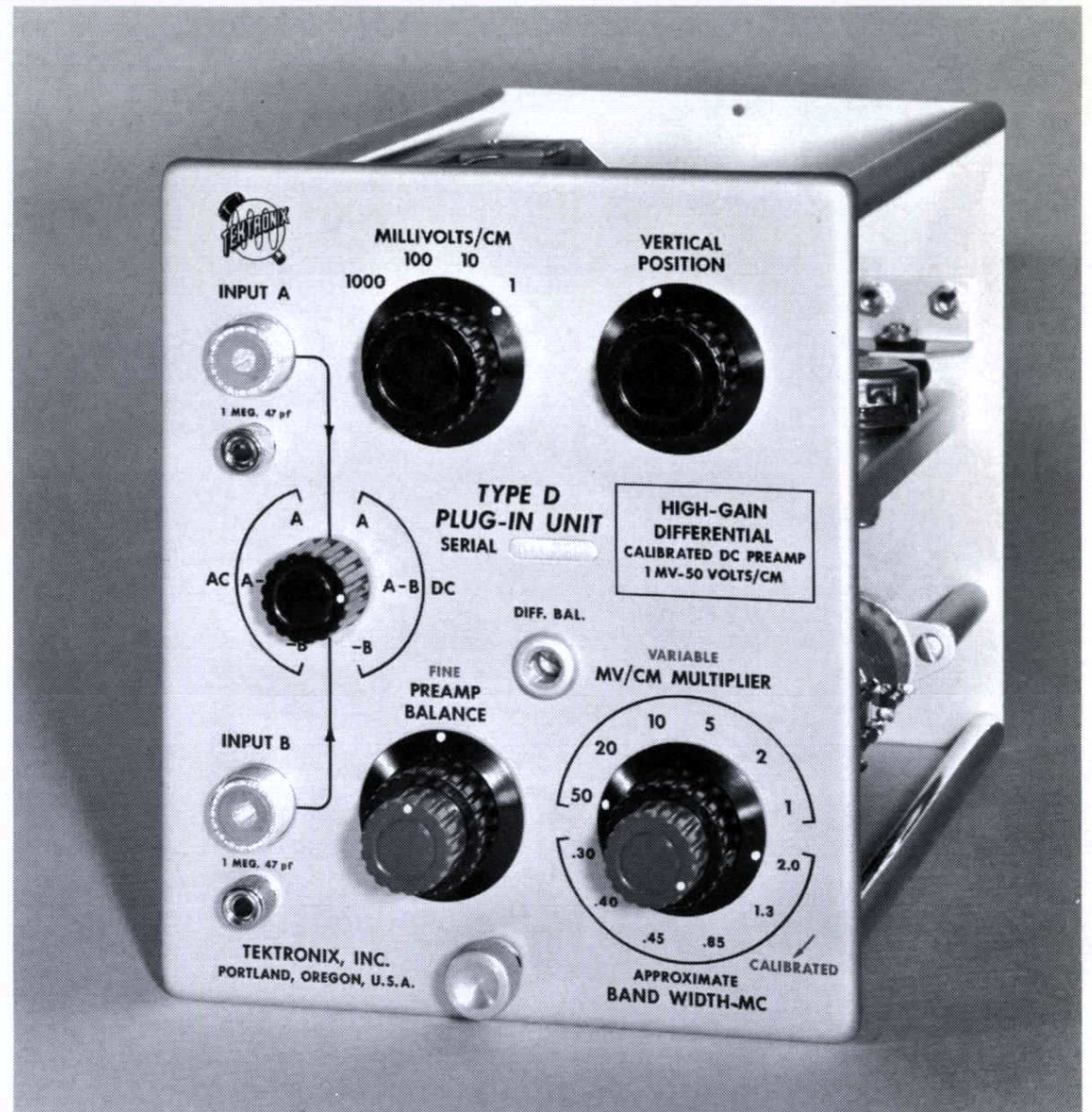
Differential Input

10,000-to-1 rejection ratio between in-phase and out-of-phase signals.

Stability

—Normal drift is from 2 to 5 mv/hr.

The Type D equips Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes for work requiring dc-coupling at a deflection factor of 1 mv/cm. Differential input with high rejection ratio for in-phase signals permits cancellation of unwanted or interfering signals.



Input Selector—A six-position switch provides for use of either input separately, or both together differentially, either ac-coupled or dc-coupled. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X probe.

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. Common mode signal should not exceed 5 volts at the input grid. Thus, at 10 mv/cm and 100 mv/cm, it should not exceed 50 volts and 500 volts respectively.

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

*A Type 81 Adapter is required for use with Types 581 and 585.

(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.

Input Impedance—1 megohm paralleled by approximately 47 pf.

Weight: Net—4 1/2 pounds
Shipping—8 pounds, approx.

TYPE D PLUG-IN UNIT \$170
Each instrument includes: 2—instruction manuals.

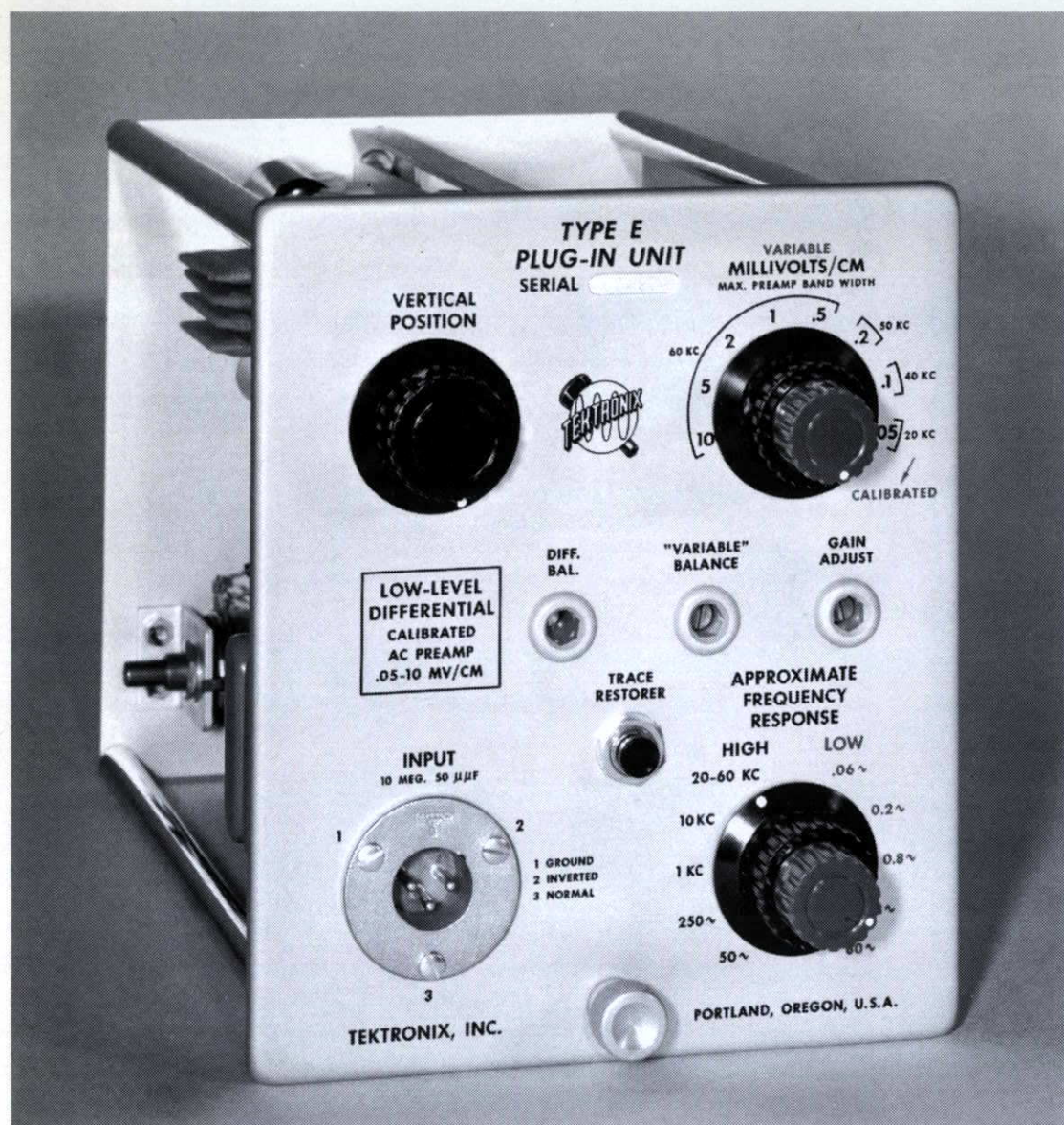
Variable Attenuation Probe

Type P6023 10X Probe compensates for normal attenuator differences between two channels. An adjustable potentiometer compensates the 10:1 attenuation ratio, and two adjustable capacitors compensate for input capacities between 20 pf and 47 pf.

Order Part Number 010-065 \$40
For other low-capacitance probes, please refer to the Catalog Accessory Section.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type E LOW-LEVEL AC DIFFERENTIAL UNIT



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. Frequency specifications are at 3 db down.

Differential Input

50,000-to-1 rejection ratio for in-phase signals up to 1 kc of ± 2 v or less.

The Type E Plug-in Unit provides Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes with a calibrated vertical deflection factor of 50 microvolts/cm for low-level applications. Maximum combined noise and hum is $5 \mu\text{v}$, 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.

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.

*A Type 81 Adapter is required for use with Types 581 and 585.

Bandwidth Control—A five-position switch provides for approximate high-frequency 3-db points of 60, 10, and 1 kc; 250 and 50 cycles. 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—10 megohms paralleled by approximately 50 pf for single-ended applications and 20 megohms paralleled by approximately 50 pf for differential applications.

Weight: Net—4 $\frac{1}{4}$ pounds
Shipping—8 pounds, approx.

TYPE E PLUG-IN UNIT \$190

Each instrument includes: 1—2 conductor cable, 2—instruction manuals.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





WIDE-BAND DC DIFFERENTIAL UNIT Type G

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

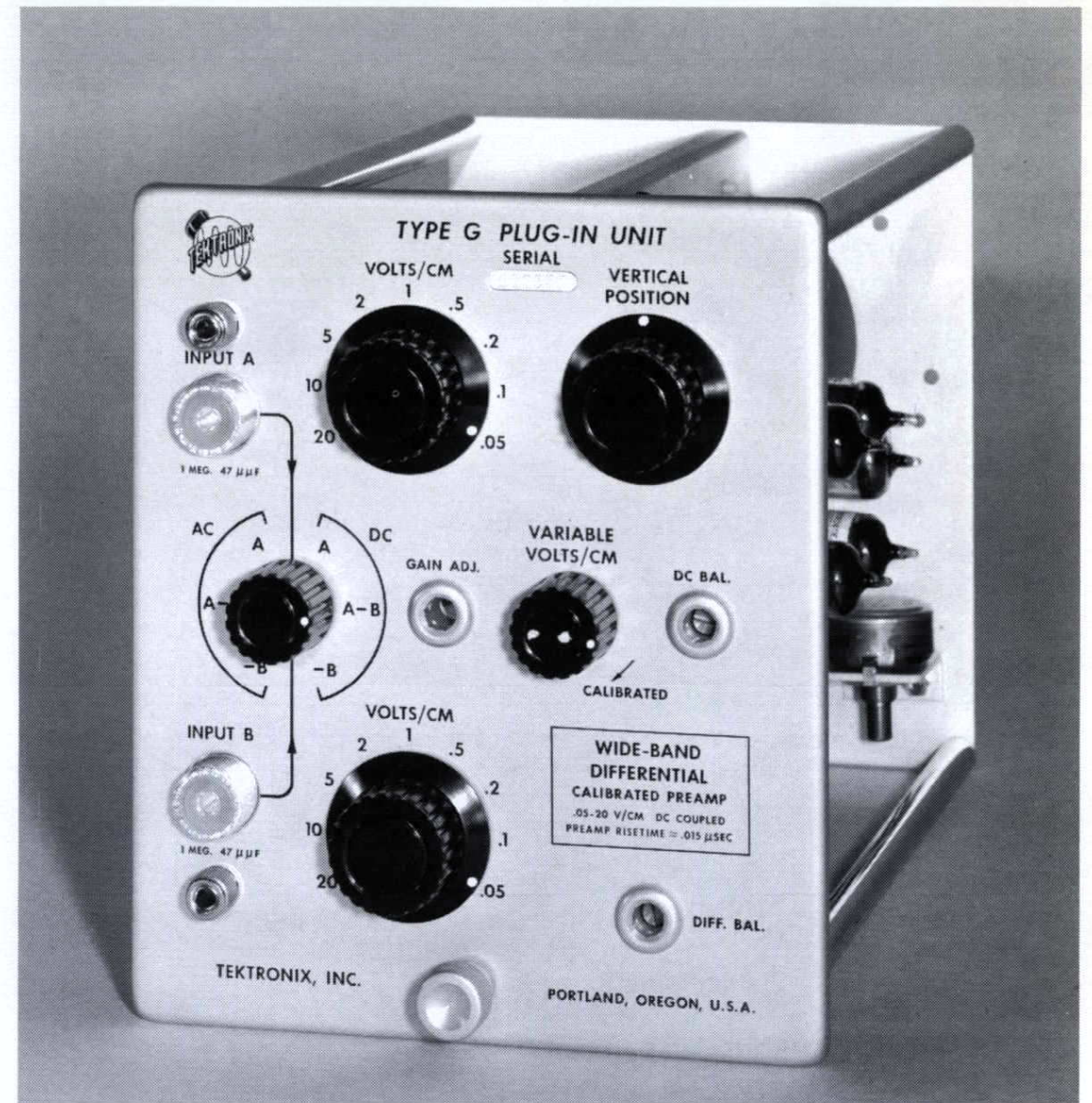
Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—
dc to 14 mc, 25 nsec.

With Type 536 —
dc to 10 mc, 35 nsec.

With Types 541A, 543A, 545A, 555, *581, *585—
dc to 20 mc, 18 nsec.

With Type 551 —
dc to 18 mc, 20 nsec.



The Type G Plug-In Unit equips Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes for wideband 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. Maximum amplitude handling capability, 2 volts pk-to-pk between input grids. At 0.5 v/cm and 5 v/cm, signal should not exceed 20 volts and 200 volts respectively. 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.

CHARACTERISTICS

Input-Selector—A six-position switch provides for use of either input separately, or both together differentially, either ac-coupled or dc-coupled. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

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.

*A Type 81 Adapter is required for use with Types 581 and 585.

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—1 megohm paralleled by approximately 47 pf.

Weight: Net—4 1/4 pounds.
Shipping—9 pounds, approx.

TYPE G PLUG-IN UNIT \$190
Each instrument includes: 2—instruction manuals.

Variable Attenuation Probe

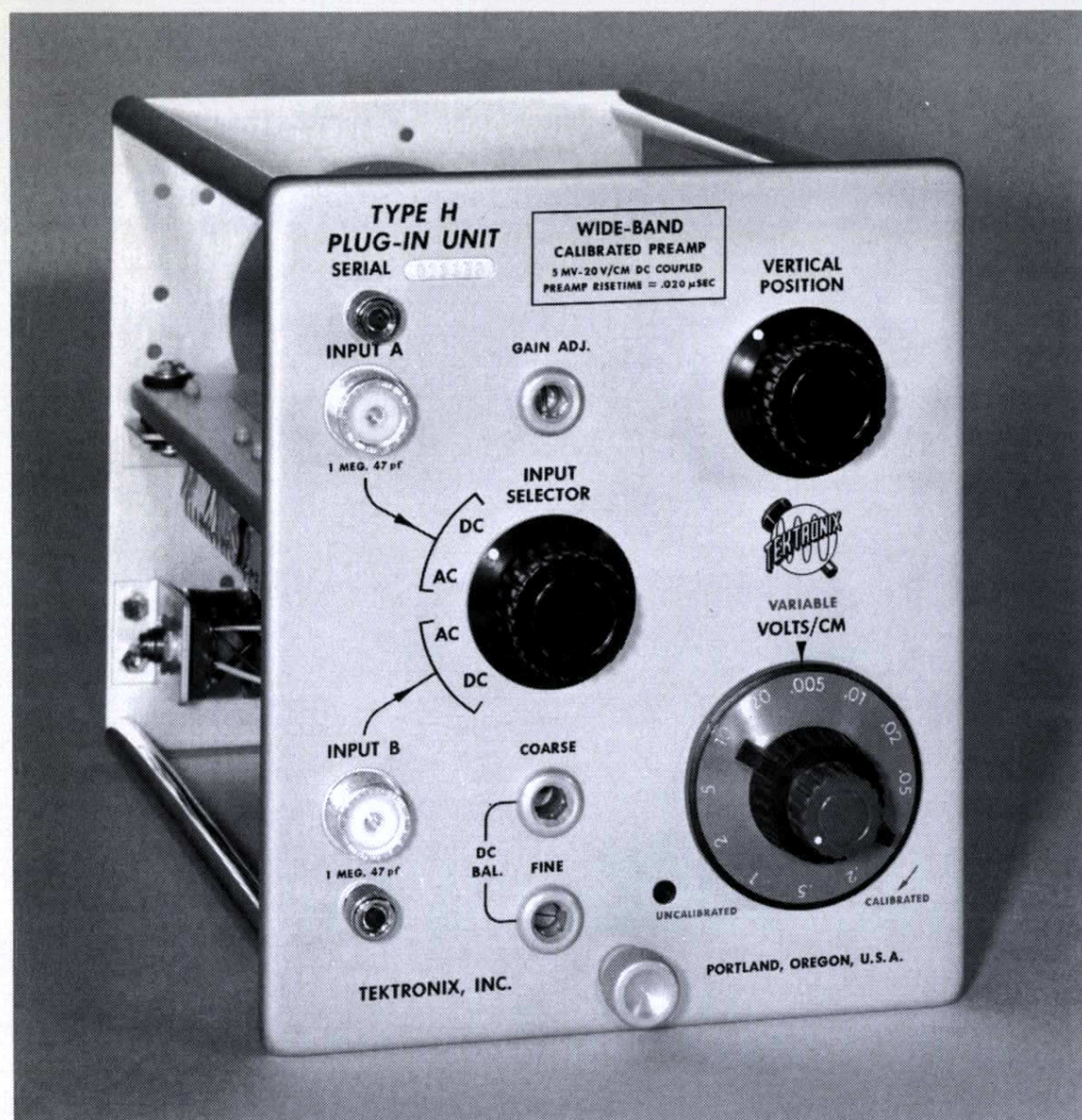
Type P6023 10X Probe compensates for normal attenuator differences between two channels. An adjustable potentiometer compensates the 10:1 attenuation ratio, and two adjustable capacitors compensate for input capacities between 20 pf and 47 pf.

Order Part Number 010-065 \$40

For other low-capacitance probes, please refer to the Catalog Accessory Section.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type H WIDE-BAND HIGH-GAIN DC UNIT



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, 550 and 580* Oscilloscopes, with excellent transient-response characteristics.

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.

*A Type 81 Adapter is required for use with Types 581 and 585.

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

Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—
dc to 11 mc, 31 nsec.

With Type 536 —
dc to 9.5 mc, 37 nsec.

With Types 541A, 543A, 545A, 555, *581, *585—
dc to 15 mc, 23 nsec.

With Type 551 —
dc to 14 mc, 25 nsec.

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. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

Input Impedance—1 megohm paralleled by approximately 47 pf.

Weight: Net—4 pounds
Shipping—8 pounds, approx.

TYPE H PLUG-IN UNIT \$185

Each instrument includes: 2—instruction manuals.

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

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





FAST-RISE DC UNIT Type K

Deflection Factor

Calibrated—0.05 v/cm to 20 v/cm.

Frequency Response and Risetime

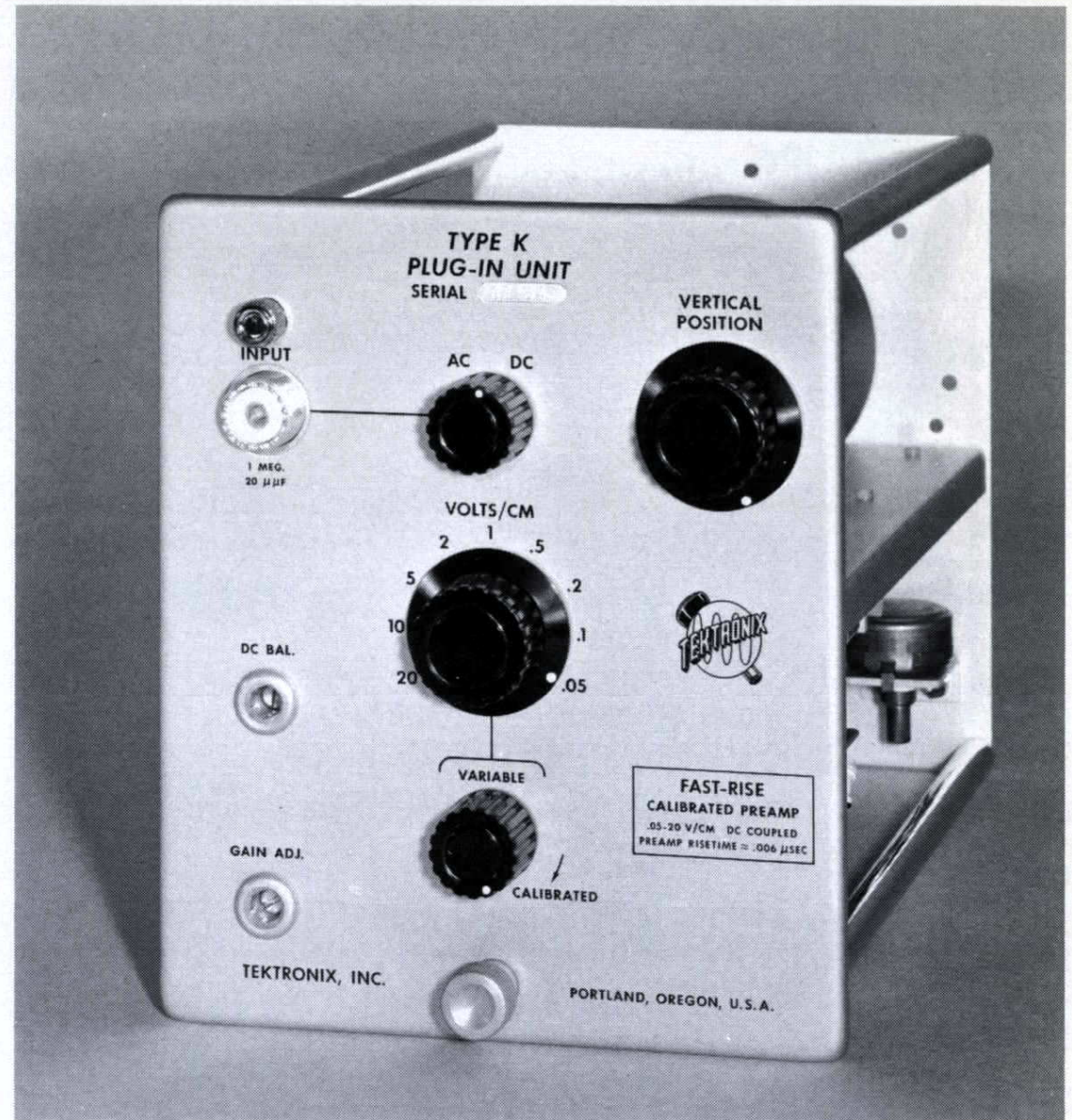
Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—
dc to 15 mc, 23 nsec.

With Type 536 —
dc to 11 mc, 31 nsec.

With Types 541A, 543A, 545A, 555, *581, *585—
dc to 30 mc, 12 nsec.

With Type 551 —
dc to 25 mc, 14 nsec.



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-nanosecond 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. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X probe. The Type K can be used in all Tektronix Type 530, 540, 550 and 580 * Series Oscilloscopes.

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.

*A Type 81 Adapter is required for use with Types 581 and 585.

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—1 megohm paralleled by approximately 20 pf. The 10X attenuator probe, furnished with Tektronix Fast-Rise Oscilloscopes, increases input impedance to 10 megohms paralleled by approximately 8 pf. Other Probes, described in the Accessory Section, provide input capacitances from 12 pf to 2.5 pf, at attenuation ratios from 5 to 1 up to 100 to 1.

Weight: Net—3 3/4 pounds.
Shipping—8 pounds, approx.

TYPE K PLUG-IN \$145

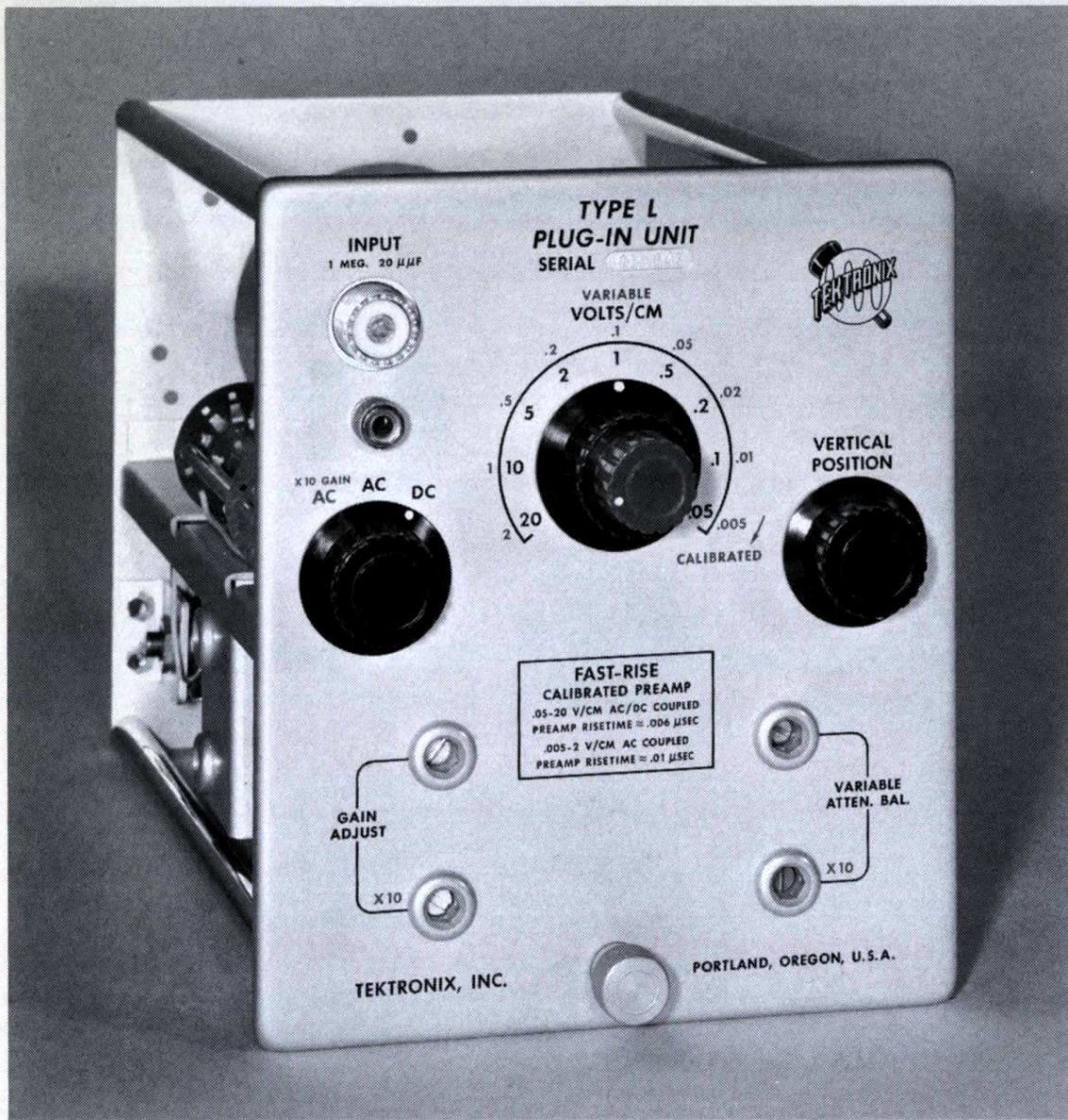
Each instrument includes: 2—instruction manuals.

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

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



Type L FAST-RISE HIGH-GAIN UNIT



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)

Frequency specifications are at 3-db down
 With Types 531A, 533A, 535A—
 dc to 15 mc, 23 nsec.
 With Type 536—dc to 11 mc, 31 nsec.
 With Types 541A, 543A, 545A, 555, *581, *585—
 dc to 30 mc, 12 nsec.
 With Type 551—dc to 25 mc, 14 nsec.

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

Frequency specifications are at 3-db down
 With Types 531A, 533A, 535A—
 3 cycles to 15 mc, 23 nsec.
 With Type 536—3 cycles to 10 mc, 35 nsec.
 With Types 541A, 543A, 545A, 555, *581, *585—
 3 cycles to 24 mc, 15 nsec.
 With Type 551—3 cycles to 22 mc, 16 nsec.

The Type L Fast-Rise High-Gain Unit, duplicates the performance of the Type K and offers increased sensitivity, ac-coupled, to 5 mv/cm. Frequency response is down 3-db \pm 1/2 db at 30 Mc, 6-db at approximately 41 Mc and 12-db at approximately 55 Mc. An ac-coupled amplifier increases the sensitivity by a factor of 10 with slightly reduced frequency response and increased risetime. When used with Type 530-Series Oscilloscopes the unit has somewhat reduced frequency response and increased risetime.

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 between ranges.

*A Type 81 Adapter is required for use with Types 581 and 585.

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—1 megohm paralleled by approximately 20 pf. The 10X attenuator probe, furnished with Tektronix Fast-Rise Oscilloscopes, increases the input impedance to 10 megohms paralleled by approximately 8 pf.

Weight: Net 4 1/2 pounds
 Shipping—8 pounds, approx.

TYPE L PLUG-IN UNIT \$210
 Each instrument includes: 2—instruction manuals.

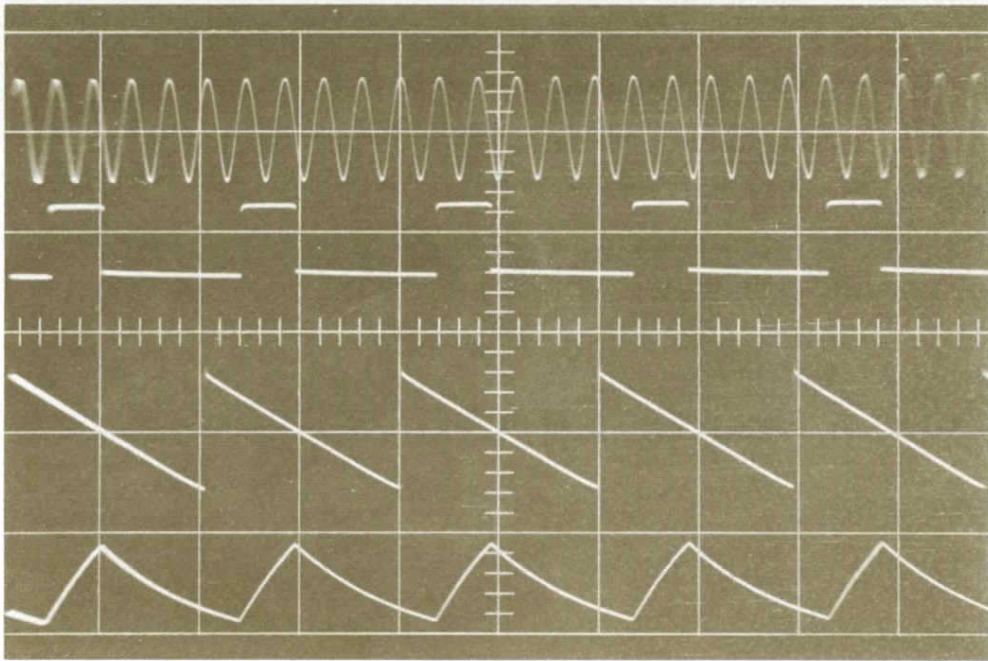
For low-capacitance accessory probes, please see the Catalog Accessory Section.

U.S. Sales Price f.o.b. Beaverton, Oregon
 Please refer to Terms and Shipment, General Information page.





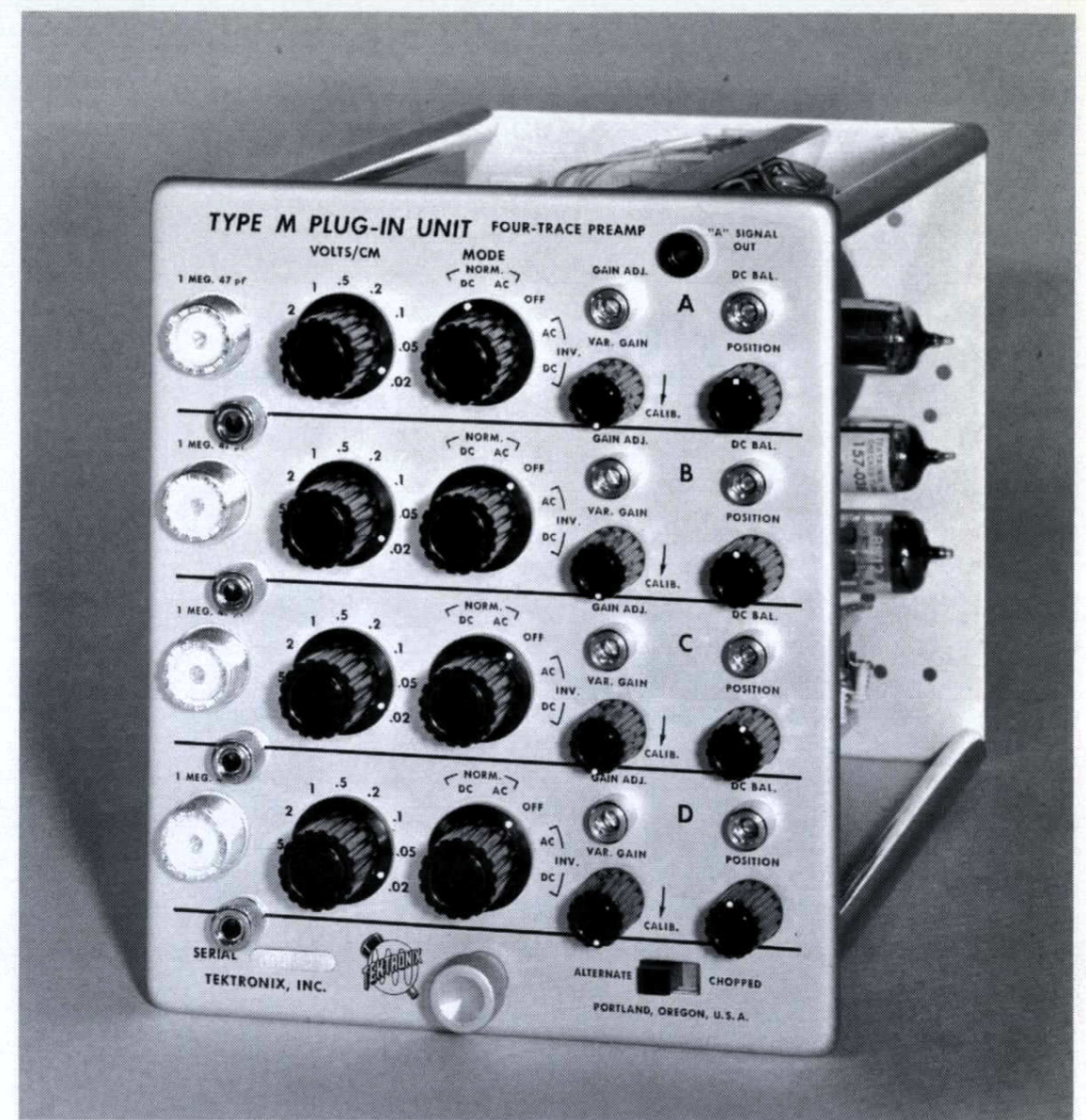
FOUR-TRACE UNIT Type M



ELECTRONIC SWITCHING

DC-TO-20 MC PASSBAND

20 MV/CM MAXIMUM SENSITIVITY



In a Tektronix Oscilloscope that accepts letter-series plug-ins, the Type M Four-Trace Unit provides four identical channels for viewing one to four signals, separately or in any combination. The channels can be electronically switched at a free-running rate of about 1 Mc, or triggered by the oscilloscope sweep. When a Type M Unit is used in a Tektronix Plug-In Unit Power Supply, such as a Type 127, 132, or 133, the output can be used to provide most oscilloscopes with multiple-channel displays at increased gain. The Type M Unit can be used in Tektronix Type 530, 540, 550-Series Oscilloscopes, and 580-Series with Type 81 Adapter.

DEFLECTION FACTOR for each channel is in 9 calibrated steps from 20 mv/cm to 10 v/cm, 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from 20 mv/cm to 25 v/cm.

SIGNAL INPUT for each channel is either ac or dc coupled. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X probe.

POLARITY INVERSION for each channel permits more flexibility in comparison checks of waveforms.

OPERATING MODES consist of Channel A, Channel B, Channel C, Channel D, Chopped (electronic switching at 1 Mc) and Alternate (electronic switching on alternate sweeps). All four channels can be operated separately or in any combination. When operating a single channel, the Chopped or Alternate mode is inoperative. However, when two or more channels are in operation, either Chopped or Alternate is automatically operative.

CHANNEL A SIGNAL available at front panel can be connected to oscilloscope external trigger input for stable triggering in the Chopped Mode—enabling display of all input signals in true time or phase relationship.

MULTI-TRACE TRANSIENT blanking is provided in all Tektronix Oscilloscopes that accept letter-series plug-in units, except Type 532, 536, 551, 581, and 585.

INPUT IMPEDANCE is 1 megohm paralleled by approx. 47 pf.

WEIGHT: Net—5¼ pounds. Shipping—10 pounds, approx.

TYPE M PLUG-IN UNIT \$525

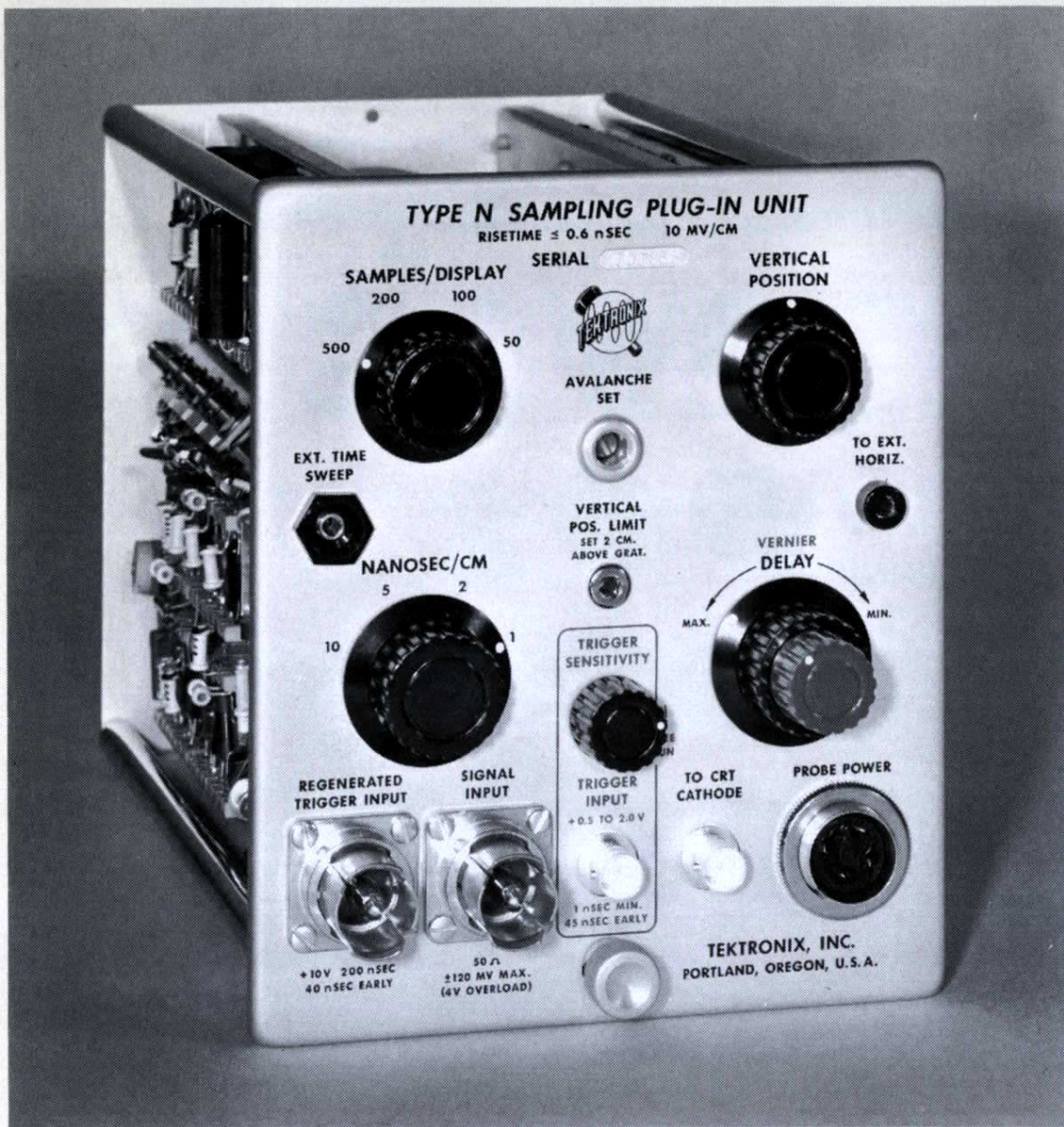
Each instrument includes: 1—test lead, 2—instruction manuals

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Transient Response Characteristics		
Type M Unit and Oscilloscope	Passband (at 3-db down)	Risetime
531A, 533A, 535A RM31A, RM33A, RM35A	dc — 14 Mc	25 nsec
536	dc — 10 Mc	35 nsec
541A, 543A, 545A, RM41A, RM43A, RM45A, 555, *581, *585	dc — 20 Mc	17 nsec
551	dc — 19 Mc	18 nsec

* Requires a Type 81 Adapter

Type N PULSE-SAMPLING UNIT



Designed for use with Tektronix Plug-In Oscilloscopes, the Tektronix Type N Sampling Unit produces a bright display of repetitive high-speed signals. By taking successive samples at a slightly later time at each recurrence of the pulse, the Type N Unit reconstructs the pulse on a relatively long time base. Each sample taken becomes an image-retaining dot on the crt screen.

The Type N Unit provides stable displays with apparent sweep times of 1 nsec/cm (with 10-x magnifier, 100 picoseconds/cm). Delay range of 200 nsec (including display), permits observation of the complete waveform of pulses less than 200-nsec wide, and any portion of the waveform can be observed and measured accurately.

The spacing, between sampling pulses of repetitive high-speed signals, can vary. If the incoming signals are irregularly spaced, the pulses must be separated by 10 μ sec or more. If the incoming signals are regularly spaced, the pulses can occur every 20 nsec.

CHARACTERISTICS

Sweep Range—A four-position NANOSEC/CM, switch provides four equivalent sweep times of 1, 2, 5, and 10 nsec/cm (with the magnifier: 100, 200, 500, and 1000 psec/cm).

External Trigger—The Type N Sampling Unit requires an external trigger applied in advance of the

Risetime

Approximately 0.6 nsec (corresponding to approximately 600 mc).

Input Impedance

50 ohms, higher with probes.

Sensitivity

10 mv/cm (with 2 mv or less amplitude noise).

Dynamic Range

± 120 mv, minimum linear range before overdriving occurs.

Accidental overload of ± 4 volts dc is permissible; higher voltage-pulsed overloads are permissible depending upon duty cycle.

Regulated Supplies

Transistor-regulated +20 v and -20 v dc supplies.

signal. Two input connections are provided on the unit for this purpose. The REGENERATED TRIGGER INPUT minimum requirements for an external start-gate trigger include: repetition rate of 50 cps to 100 kc, 50% rise-time of four nsec, amplitude of +10 volts, duration of 200 nsec, 40 nsec in advance of the signal. The TRIGGER INPUT minimum requirements for a conventional external trigger include: minimum duration of one nsec, amplitude from +0.5 to 2 volts, 45 nsec in advance of the signal, and repetition rate of 50 cps to approximately 50 mc. The recovery time is 10 μ sec. Count down occurs above 100 kc. Satisfactory count down can be obtained up to about 50 mc.

Sampling Information—A four-position SAMPLES/DISPLAY switch determines the number of image-retaining dots appearing on the screen of the cathode-ray tube during one display. The number of dots or samples per display can be 50, 100, 200, or 500. The sampling rate extends from 50 cycles to 100 kilocycles.

Weight: Net—7 $\frac{1}{4}$ pounds.

Shipping—14 pounds, approx.

TYPE N PLUG-IN UNIT \$625

Each instrument includes: 1—unblanking cable and transformer, 1—external horizontal input cable, 1—X2 T attenuator 50 Ω , 1—X5 T attenuator 50 Ω , 1—10 nsec 50 Ω coax cable RG58A/U with G.R. connectors, 1—5 nsec 50 Ω coax cable RG8A/U with G.R. connectors, 2—1 nsec 50 Ω coax cables RG58A/U with G.R. one end only, 2—instruction manuals.



AUXILIARY EQUIPMENT

The Tektronix Type 110 Pulse Generator and Trigger Takeoff System has a trigger regenerator of nominally 10 v for 225 nsec for starting the Type N Unit when the source cannot supply the necessary trigger. The Type 110 can generate pulses of less than 0.25 nsec risetime of 0.5 nsec to 40 nsec width, amplitude to 50 v and either polarity. Please refer to Type 110 catalog page for complete information.

TYPE 110 PULSE GENERATOR \$650

The Tektronix Type 111 Pretrigger Pulse Generator provides fast-rising output and pretrigger pulses. The pretrigger pulses occur from 30 to 250 nsec ahead of each output pulse and can be used as a regenerated trigger signal for the Type N Unit. Please refer to Type 111 catalog page for complete information.

TYPE 111 PRETRIGGER PULSE GENERATOR \$365

The Tektronix Type 113 Delay Cable is used to provide the signal delay ahead of the Type N Unit, (so that triggers arrive in advance of the signals) there is 60 nsec of delay, allowing operation of the Type N with or without a Type 110. Please refer to Type 113 catalog page for complete information.

TYPE 113 DELAY CABLE \$200

Master-Slave Patch Cord

The cord permits simultaneous operation of two Type N Units when used in a Type 551 or Type 555 Oscilloscope. Length is 13 1/8" from tip to tip.

Order Part Number 012-055 \$3.75

PROBES

The TYPE P6025 CATHODE-FOLLOWER PROBE provides 10 megohm input resistance and from 1.2 pf to 5 pf static input capacitance with attenuator heads of 10X to 1000X, in 1-2-5 sequence. ~~When using the 10X through 200X attenuator heads, the risetime is approximately 600 Mc. When using the 500X and 1000X attenuator heads, the risetime is approximately 450 Mc.~~ Refer to Accessory Section for complete information.

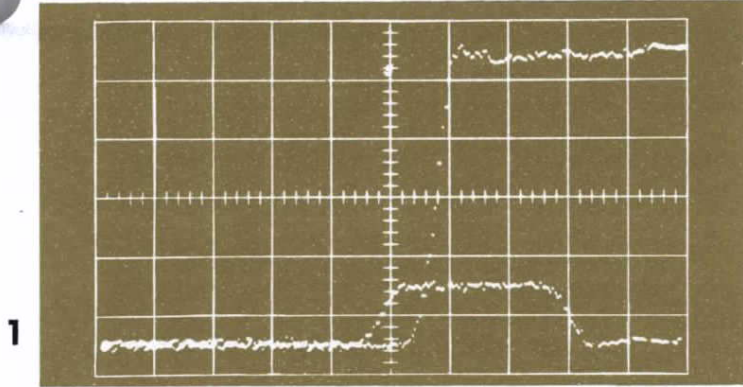
Order Part Number 010-053 \$190

The TYPE P6026 PASSIVE PROBE provides attenuations of 5X to 500X, in 1-2-5 sequence, with an input resistance from 125 ohms to 1.2 kilohms and 0.6 pf to 0.8 pf. Frequency response is 600 Mc for standard 42" cable length. Please refer to Accessory Section for complete information.

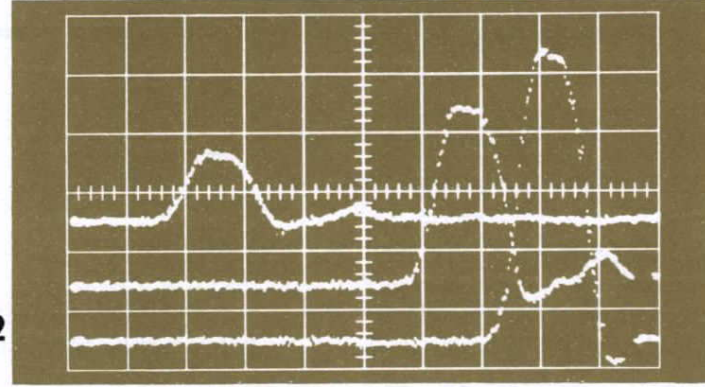
Order Part Number 010-055 \$140

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

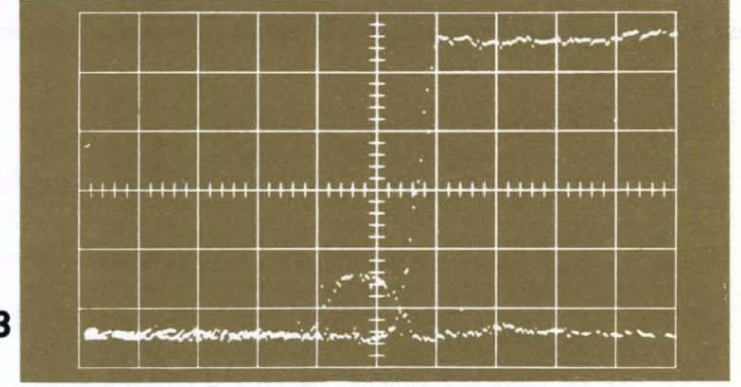
These waveform photographs show the ability of the Tektronix Sampling System to display a wide range of pulses. These photographs were purposely chosen to illustrate the system's abilities under marginal conditions.



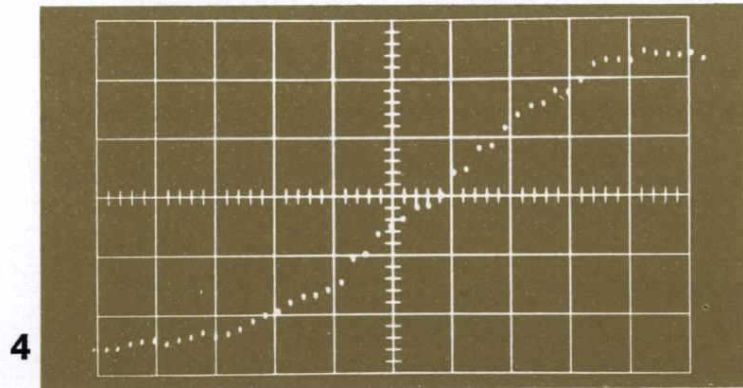
The alternate pulse feature of the Type 110 pulse generator is being used to generate a large, long pulse, and a short, small pulse. The trigger take-off system's sensitivity is set for maximum. The signal level is 100 mv/cm, and the sweep speed is 1 nsec/cm. There is clearly less than 1 nsec time difference in triggering on the 100 mv, 3 nsec and the 500 mv long signal duration.



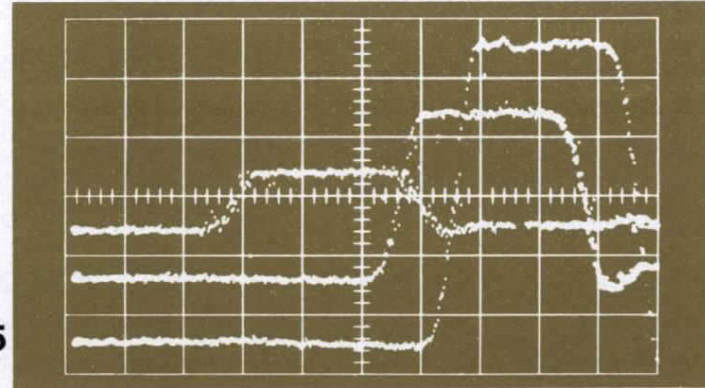
The amplifiers in the trigger channel (used in the previous picture) are switched out. The sensitivity is 2 v/cm. The smallest of the 1 nsec wide pulses furnishes approximately 0.4 v to the trigger regenerator, through the trigger take-off system. This picture is of interest since this is the narrow-pulse response which is obtainable with both the 110 and N Units, when externally triggered with signals between 0.4 and 2 v.



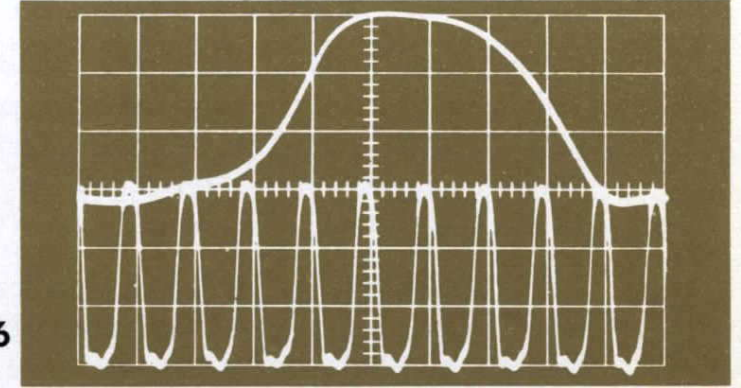
This picture shows the same conditions as in Fig. 1, except the small pulse is now only 1 nsec wide. The time shift relative to the large signal is just over 1 nsec.



The leading edge of the large pulse of Figure 3 is displayed with the 1 nsec/cm sweep speed magnified ten times. This gives an equivalent sweep speed of 100 picoseconds/cm. The risetime of the complete system—110 pulse generator, 110 trigger take-off, 113 delay cable and the N unit—is under 0.6 nsec.



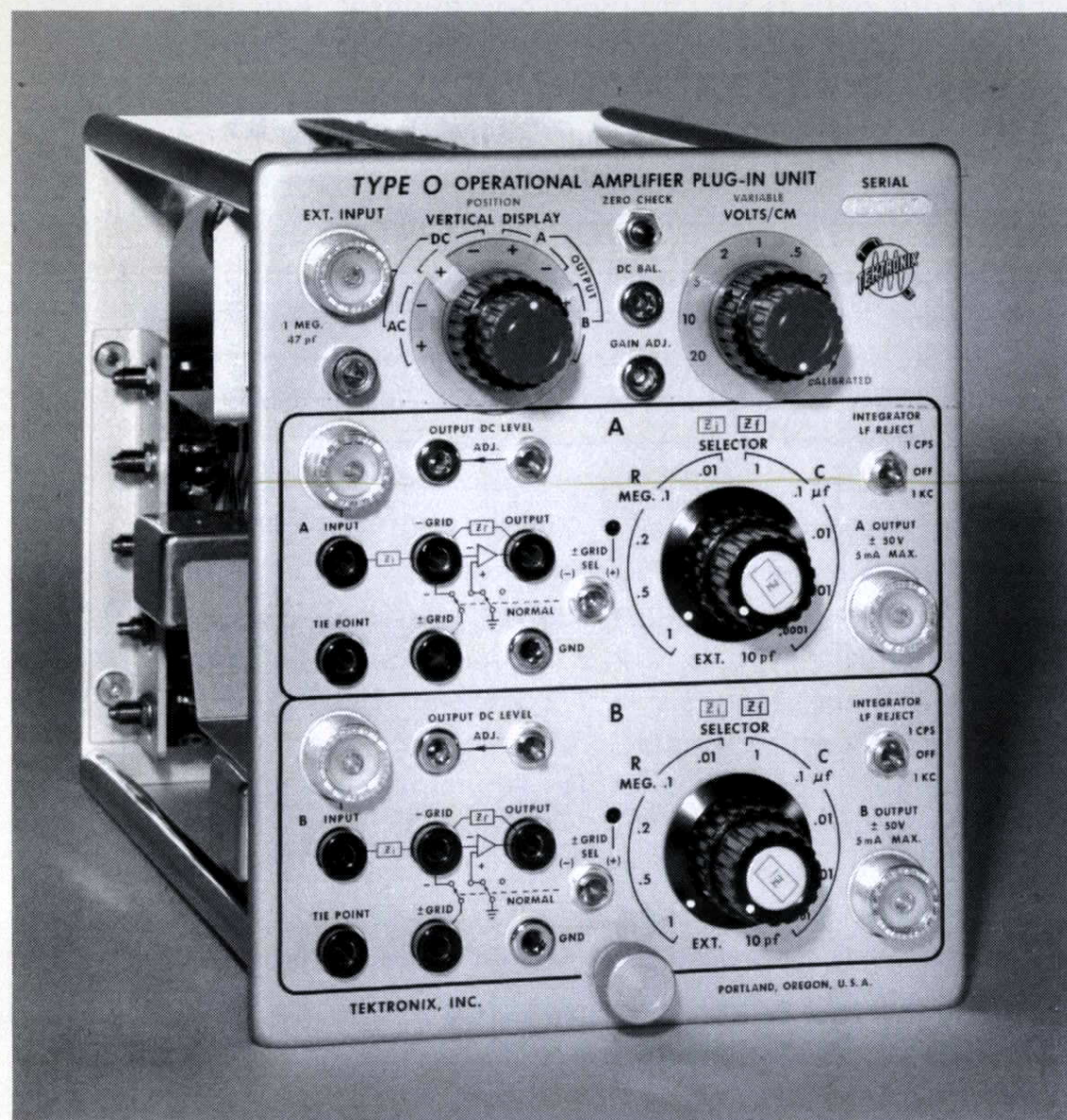
The system is operating at maximum sensitivity, 10 mv/cm. A triple exposure, positioned vertically to align the 50% points, allows easy measurement of the time slip. Under these extreme conditions, the smallest pulse has an energy of about 24 millipicojoules. The trigger take-off system then removes approximately 1 millipicojoule for application to the switched system of amplifiers and the trigger regenerator.



Double exposure shows a 60-mv, 100-mc continuous pulse train at equivalent sweep times of 1 nsec/cm and 10 nsec/cm. The Type 110 derives a trigger from the signal, permitting the Tektronix Sampling System to operate without external triggers, counting down from 100-mc to the 100-kc sampling rate of the N Unit.

11-12-62

Type O OPERATIONAL AMPLIFIER UNIT



1 Vertical Preamplifier

2 Operational Amplifiers

3 Basic Modes of Operation

Selection of Precision Input and Feedback Components

Provision For Use of External Input and Feedback Impedances

In a Tektronix Oscilloscope that accepts letter-series plug-ins, the Type O Operational Amplifier Unit can be used to perform precise operations of integration, differentiation, function generation, linear and nonlinear amplification.

The results can be displayed on the oscilloscope crt or can be fed to other circuitry. In addition, through use of the Type 127, 132, or 133 Plug-In Power Supplies, the Type O can also be used for various other applications. The Type O Unit can be used in any Tektronix Type 530, 540, and 550-Series Oscilloscopes and 580-Series with Type 81 Adapter.

VERTICAL PREAMPLIFIER

Frequency specifications are at 3-db down

PASSBAND AND RISE TIME depend upon the oscilloscope with which the unit is used. With Type 540, 550, and 580-Series with Type 81 Adapter, the passband is dc to 25 Mc, the rise-time is 14 nsec. With Type 530-Series, the passband is dc to 14 Mc, the risetime is 25 nsec (except Types 532 and 536).

DEFLECTION FACTOR is in 9 calibrated steps from 50 mv/cm to 20 v/cm, 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from 50 mv/cm to 50 v/cm.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 47 pf.

SWITCHING FACILITIES permit the vertical amplifier to be used independently or to monitor the output of either operational amplifier.

OPERATIONAL AMPLIFIERS

OPEN-LOOP GAIN-BANDWIDTH PRODUCT is 15 Mc or greater. (Checked at 10 Mc for open-loop gain greater than 1.5.)

CLOSED-LOOP BANDWIDTH is 750 kc or more at unity gain with internal input and feedback resistors, and to 10 Mc with external compensation.

OPEN-LOOP DC GAIN is 2500 minimum. With external input and feedback components, the gain is governed by the ratio of feedback to input values.

OUTPUT RANGE is ± 50 v, ± 5 ma.

OUTPUT DC LEVEL can be adjusted to ground potential from front panel.

OUTPUT IMPEDANCE is approximately 30 ohms at 1 Mc for compensated unity-gain amplifier.

NOISE is typically less than 0.5 mv pk-to-pk, referred to the input. Output noise is approximately 3 mv pk-to-pk.

INPUT IMPEDANCES can be selected from the following: 5 resistance values—10, 100, 200, 500 kilohms, and 1 megohm; 6 capacitance values from 10 picofarads to 1 microfarad, in decade steps. All values within $\pm 1\%$, except for 10 pf and 100 pf values, which are adjustable.

FEEDBACK IMPEDANCES can be selected from the same range of values as the input impedances.

EXTERNAL COMPONENTS can be used independently or in combination with the internal resistor-capacitor combinations.

POSITIVE OR NEGATIVE FEEDBACK is possible.

VOLTAGE REJECTION (with 1 kc square wave) is at least 300 to 1 between operational amplifiers.

GRID CURRENT is less than 0.5 nanoampere for each input grid. Can be adjusted to less than 0.3 nanoampere for -grid and less than 0.15 nanoampere for + grid.

DRIFT is typically less than 10 mv/hr, referred to input, after warmup.

LOW FREQUENCY REJECTION for repetitive integration is possible at either 1 cps or 1 kc, approximately, and can be switched in or out as desired.

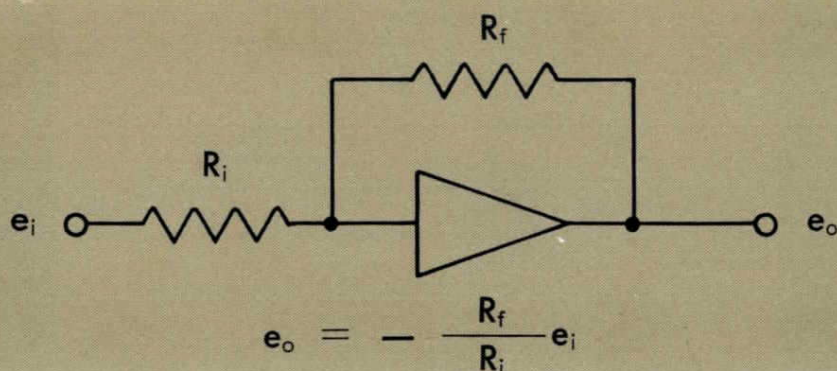
WEIGHT: Net—5½ pounds.
Shipping—9 pounds, approx.

TYPE O OPERATIONAL AMPLIFIER UNIT \$475

Each instrument includes: 2—terminal adapter assemblies, 2—terminal shields, 2—instruction manuals.

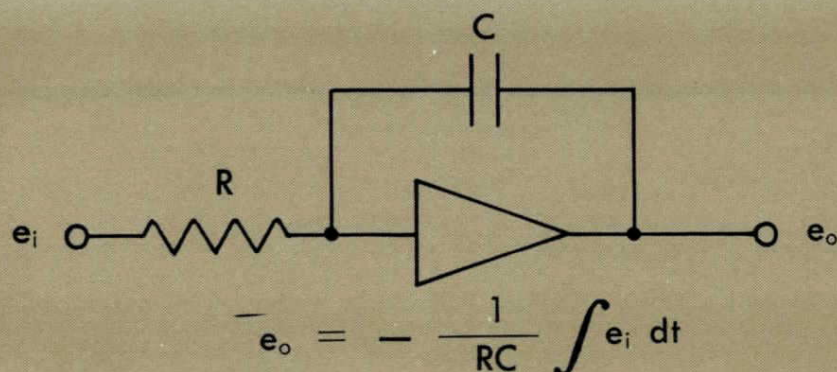
U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

BASIC OPERATING MODES

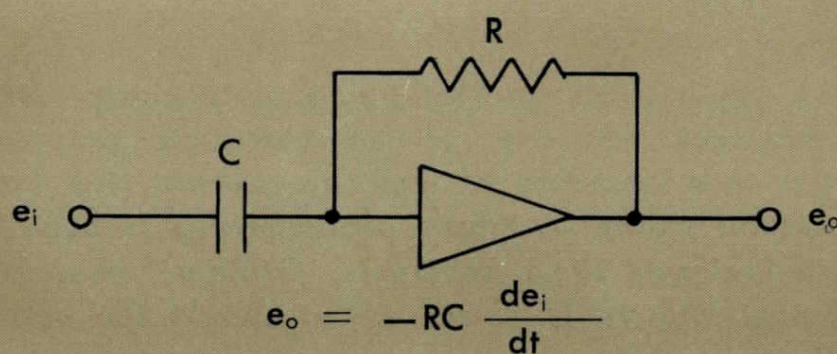


AMPLIFICATION is determined by the ratio of input to feedback resistors. This provides convenient signal step-up or step-down, with low ^{output} impedances, to over 750 kc. Use of external compensation extends the closed-loop gain-bandwidth product to 10 Mc or more.

11-12-62



INTEGRATION is obtained by placing a capacitor in the feedback loop. Unlike the RC integrator, this circuitry permits loading of the output, and integration without loss of signal level. Integration at repetition rates of approximately 5 Mc is possible. Low-frequency rejection allows drift-free repetitive-waveform integration.



DIFFERENTIATION is accomplished by placing a capacitor in the input circuit. The unique characteristic of differentiation is its ability to extract higher frequency waveform components. It can advantageously detect minute information such as transients and slope changes. Differentiation of waveforms with significant components as high as 1.5 Mc is possible.

Type P FAST-RISE TEST UNIT

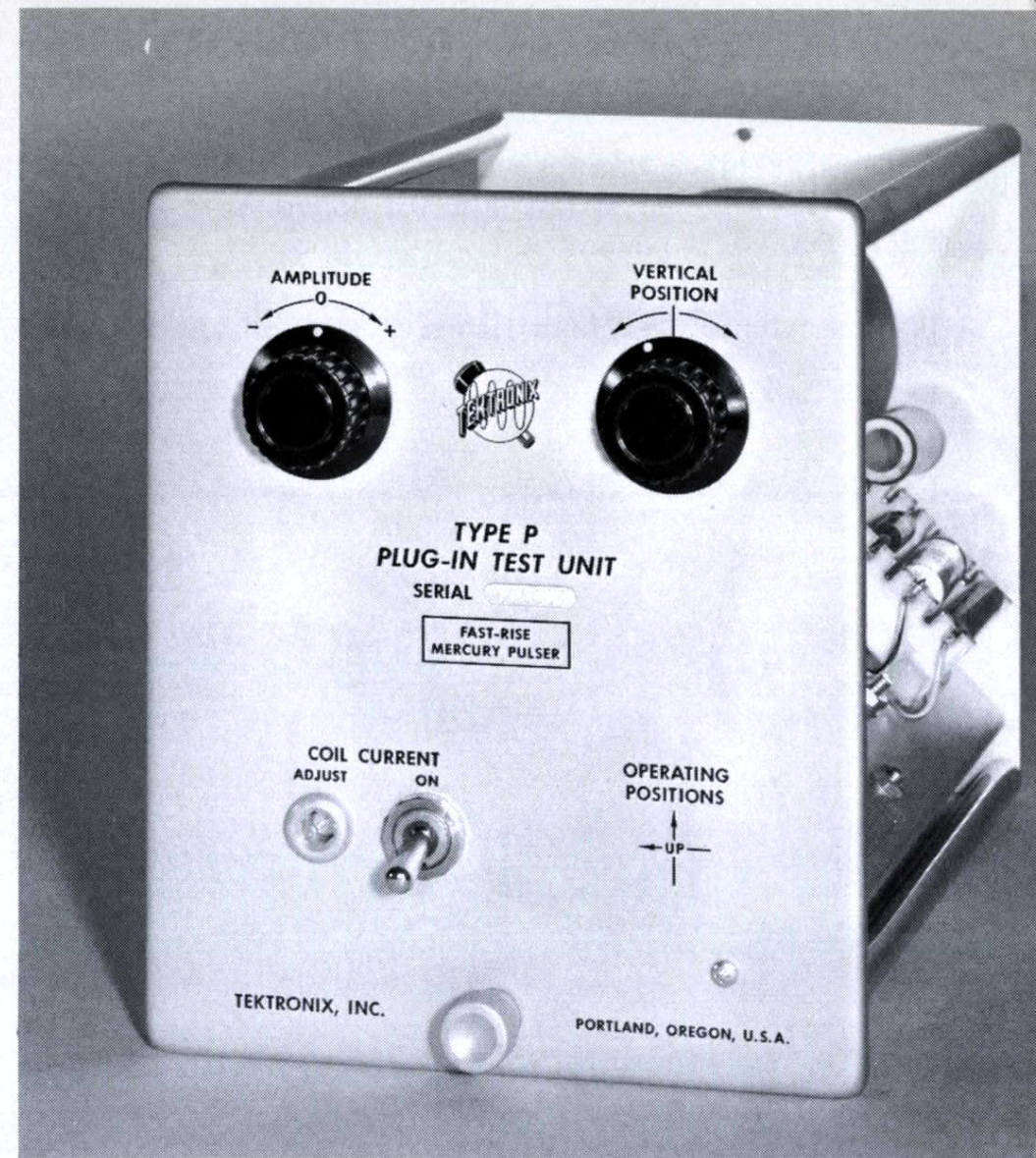


Risetime—When the Type P is used to standardize a Type 540-Series Oscilloscope, risetime of the Type P is approximately 4 nanoseconds (.004 μ sec).

Repetition Rate—240 pulses per second.

Polarity—Either positive or negative.

Amplitude—Continuously adjustable from 0 to 3 major graticule divisions.



The Type P Plug-In Unit fills the need for a test-signal generator of known waveform. It can be used to standardize the main-unit vertical-amplifier transient response of Tektronix Type 540-550 Series Oscilloscopes. In addition, it is suitable for those Type 530 oscilloscopes incorporating a delay line in their vertical deflection system.

The Type P generates a fast-rise step-function test signal of a known waveform. This test signal simulates the output of an ideally compensated Type K Plug-In Unit that is driven with a Tektronix Type 107 Square-Wave Generator.

After standardization, a Type 540-Series Oscilloscope can be used in conjunction with a Type 107 Square-Wave Generator to standardize the transient response of amplifier-type plug-in units. Standardized oscilloscopes and plug-in units can be used interchangeably

without readjustment of the high-frequency compensating circuits.

As a result of component aging, particularly tubes, the transient response of an electronic amplifier changes over a period of time. In contrast, the Type P maintains stable waveform characteristics through its precise Tektronix circuit constants. Ordinary measuring equipment will verify circuit values should the output waveform be in doubt.

Weight: Net—3¼ pounds.

Shipping—7 pounds, approx.

TYPE P PLUG-IN UNIT \$90

Each instrument includes: 2—instruction manuals.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





TRANSDUCER & STRAIN GAGE UNIT Type Q

Carrier Frequency—25 kilocycles.

Risetime—60 μ seconds, (approximately).

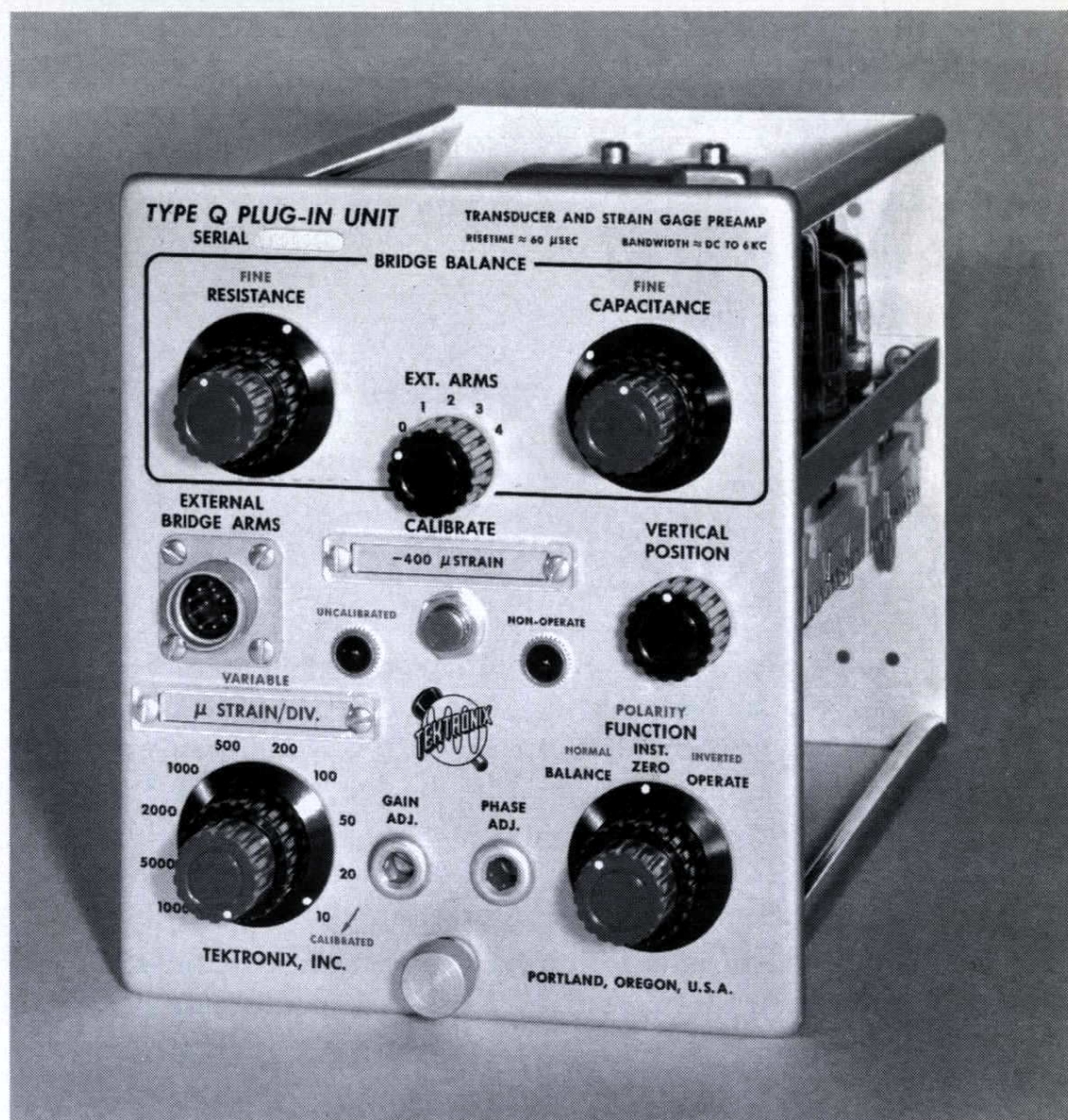
Frequency Response—DC to 6 kilocycles.

Strain Sensitivity—Calibrated in ten steps from 10 to 10,000 microstrain (microinches per inch) per major graticule division $\pm 2\%$. Uncalibrated, the sensitivity is variable between steps. The above condition applies to the Type Q Unit when used with a single strain gage having a gage factor of approximately 2. With four active arms and a gage factor of 2, the maximum sensitivity is 2.5 microstrain per division.

Attenuator Accuracy—When set accurately in any one step, the accuracy in any other position is within two percent of the panel reading.

Noise—The peak-to-peak noise is typically equivalent to 1.5 microstrain at maximum calibrated sensitivity. This approximates an rms noise of 0.5 microstrain.

Drift—The amplification system is essentially drift free. The overall system drift is primarily a function of the transducer stability.



The Type Q Plug-In Unit permits any Tektronix Type 530, 540, 550, or 580* Series Oscilloscopes to be operated with strain gages and other transducers. Designed to measure any mechanical quantity that can be converted to a change in resistance, capacitance, or inductance—through use of a suitable transducing device—this versatile unit provides high gain, low noise, and extremely low drift. Suppressed-carrier amplitude modulation is produced by unbalancing an ac bridge with the strain gages or other transducers. Phase-sensitive demodulation produces the proper deflected-trace direction.

Completely self-contained and requiring no external equipment other than the strain gages or transducers operated with it, the Tektronix Type Q Plug-In Unit bridges the gap between mechanical engineering and electronic instrumentation. Total range of applications is as broad as the mechanical field itself. Applications include stress analysis, vibration studies, and fatigue tests. Typical quantities that can be measured with the unit are force, displacement, acceleration, and strain.

CHARACTERISTICS

Equivalent DC Sensitivity—The Type Q Unit is an impedance sensing preamplifier rather than a voltage sensing device. A comparable dc amplification system would require approximately 10 microvolts per division sensitivity for the same amount of power applied to the input bridge.

Resistance Bridge Balance—Range of control allows sufficient compensation for most standard transducers and strain gages.

Gage Resistance Range—With cable lengths to 100 feet, the useful range of gage resistance extends from approximately 50 ohms to 2000 ohms. For optimum performance, the recommended range is between 120 ohms and 500 ohms.

Transducer Cable—In most applications, either 3-wire or 4-wire shielded microphone cable gives the best results. Long-lead applications utilizing more than 20 feet of cable require two or four bridge arms at the transducer end of the cable.

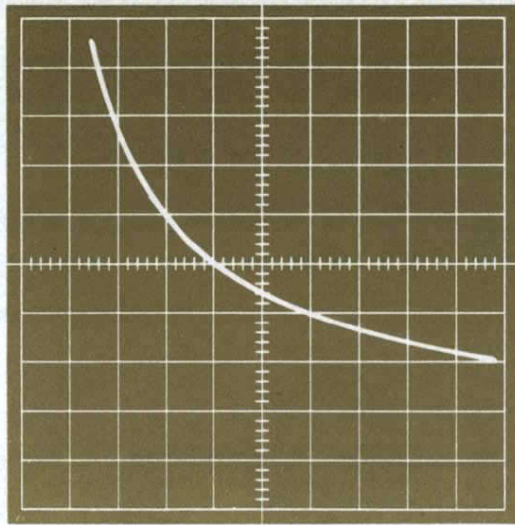
Capacitance Bridge Balance—Range of control allows sufficient compensation for an unbalance of 250 pf across any external resistive arm of the input bridge.

Polarity Inversion—For convenience in reading the display, the two-position switch allows the demonstration to appear normal or inverted.

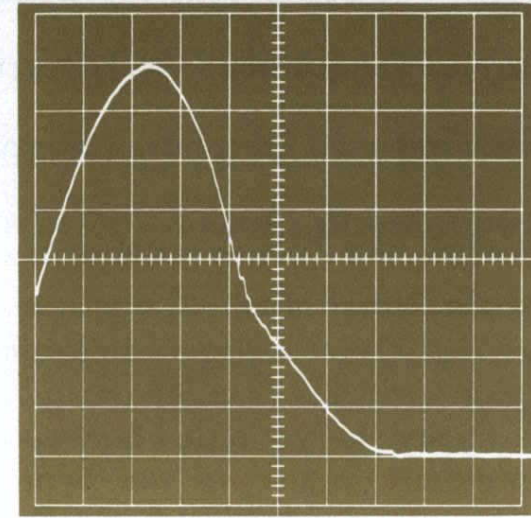
* A Type 81 Adapter is required for use with Types 581 and 585.

Q

Dynamic plot of the depletion-layer capacitance of a back-biased diode.



Pressing force can be accurately controlled by using the Type Q Unit.



Calibration—A push-button switch connects a calibrator resistor across the strain gage electrically to simulate an external mechanical strain. The calibration resistor supplied with the Type Q Unit simulates a $-400 \mu\text{strain}$ unbalance of the bridge, suitable for most strain gage applications. As with the 120-ohm internal bridge resistor, the 150-k calibration resistor is mounted on a handy plug-in receptacle.

To aid in calibration, a nomograph is included in the instruction manual. This nomograph relates calibration of the supplied resistor to gage factors and strain gage resistances.

No special gage dial is necessary for the unit.

To include the gage factor in the calibration, merely increase or decrease the amplifier gain proportionally.

Phase Adjustment—To increase versatility of the unit, the control permits either resistive or reactive transducer applications to be displayed.

Capacitance Measurement—The Type Q Unit can be calibrated for direct reading in capacitance from 1 pf per division to a maximum value of 1000 pf without using a correction curve. Using a correction curve, the range can be extended to 10,000 pf per division. These specifications apply when using the internal 120-ohm bridge circuit. With a 1000-ohm external circuit, the lower limit can be extended to 0.2 pf per division.

Please note that the standard capacitor and test jig are not supplied with the unit.

Capacitance Transducers—Using a capacitance transducer in conjunction with a four-arm resistive bridge results in the following maximum useful sensitivities:

120-ohm bridge (available internally) . . . 1 pf/div
1000-ohm bridge 0.2 pf/div

Useful sensitivities are slightly lower when using long cables.

Inductive Transducers—Although the Type Q Unit will function in conjunction with inductive transducers, differential transformers designed for use at 60 cps are only partially satisfactory when used at 25 kc. Special internal provision for balancing inductive transducers is not included in the unit.

External Bridge—The number of external resistive arms required for strain gage and transducer applications varies from one to four. The versatile Type Q Unit can be used for any of these applications. The input circuit for the Type Q Unit is an ac bridge. The number of external arms required for strain gage and transducer applications varies from one to four. These external transducers become one or more of the input bridge arms. Excitation voltage for the bridge is obtained from a 25-kc oscillator in the Q unit. Total bridge voltage is approximately 5 v rms, regulated.

A five-position switch allows selection of the number of external arms from zero to four. The zero position of the switch permits a quick check of the instrument under normal operation without an external transducer. In addition, the zero position completes the resistive bridge for capacitive transducer applications.

The one-arm position of the switch is used for the simplest type of strain gage application. In this position, an internal bridge resistor is needed to match the value of the single external bridge arm. Standard value of this resistor supplied with the Type Q Unit is 120 ohms. The two-arm and four-arm positions of the switch are used for transducer applications necessitating temperature stability.

Weight: Net— $5\frac{1}{4}$ pounds
Shipping—10 pounds, approx.

TYPE Q PLUG-IN UNIT \$325

Each instrument includes: 1—120- Ω internal bridge resistor assembly, 1—150-k calibration resistor assembly, 1—4-wire 15' shielded connecting cable, 2—instruction manuals.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



TRANSISTOR-RISETIME UNIT Type R

Collector Supply

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

Mercury-Switch Pulse Generator

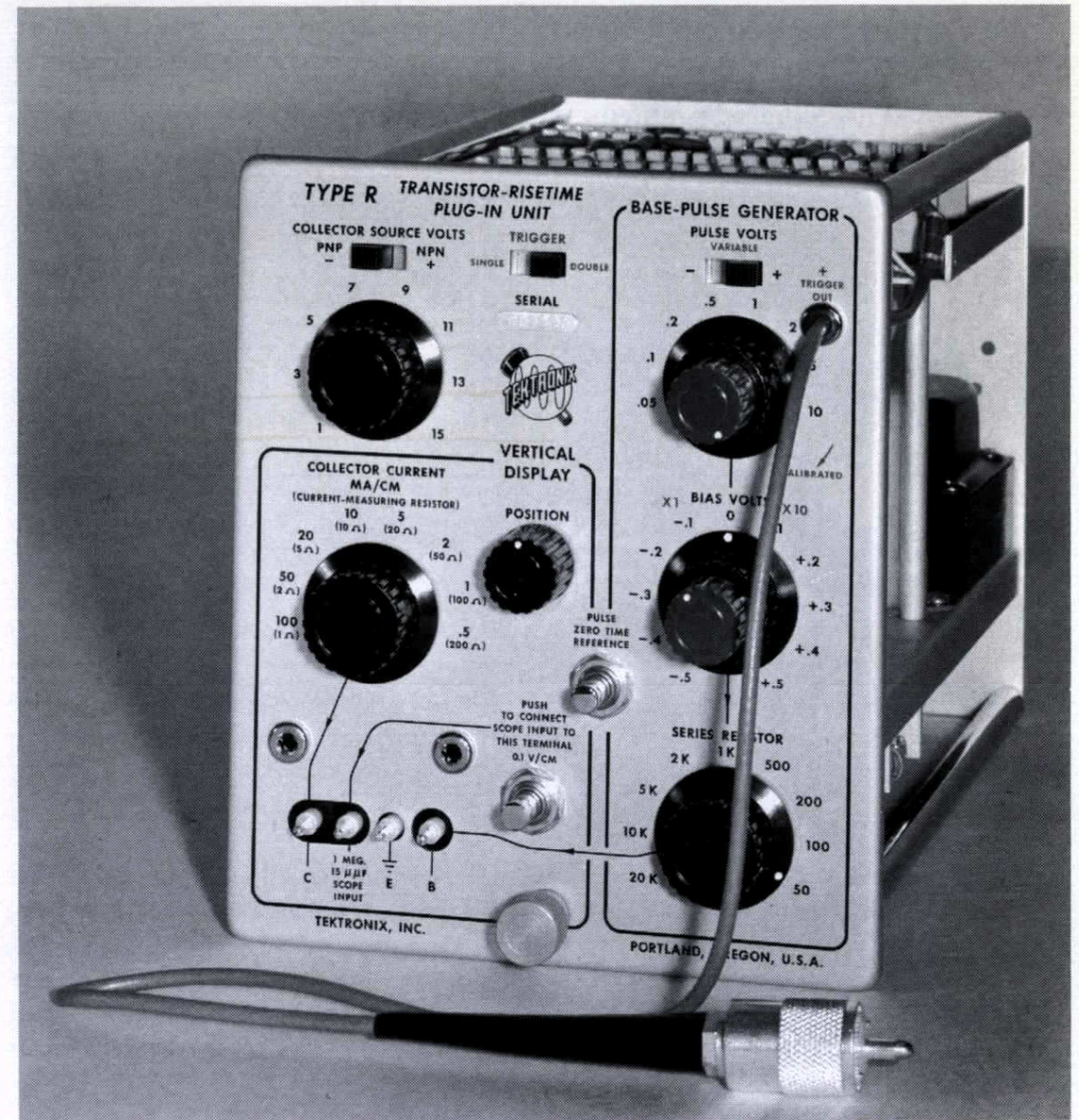
Risetime—less than 5 nsec.
Amplitude—0.02 to 10 v across 50 ohms, positive or negative.

Bias Supply

—0.5 v to +0.5 v and —5 v to +5 v, continuously variable, accuracy within 3%.
Current Capability— ± 100 ma.

Calibrated Vertical Deflection

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



The Type R Transistor Risetime Unit can be used in all Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes 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 nanoseconds, therefore measurement limitations will depend mainly on the risetime of the oscilloscope used. Overall risetimes with the oscilloscopes are as follows:

Type 551—14 nsec

Types 541A, 543A, 545A, 555, *581, *585—12 nsec

Types 531A, 533A, 535A—23 nsec

Type 536—35 nsec (Type 536 has an additional limitation in the lack of signal delay in the main vertical amplifier).

* A Type 81 Adapter is required for use with Types 581 and 585.

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, accuracy within 3%. Connectors are provided for inserting an external resistor in series with the collector.

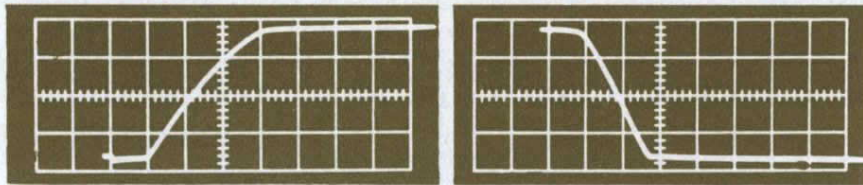
Pulse Generator—A transistor-regulated 10 v dc power supply is chopped by a mercury switch, providing a 120-c/sec test pulse with a risetime of less than 0.005 μ sec. The pulse is applied to the transistor under test through a π attenuator with an output impedance of 50 ohms. Sixteen amplitude steps 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, accuracy within 3%. Bias supply is transistor regulated.

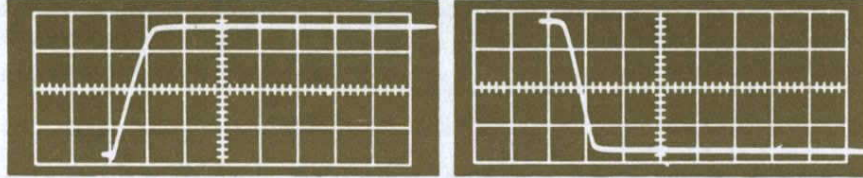
Base Series Resistors—The base driving resistance can be selected from nine values—50, 100, 200, 500 ohms, 1, 2, 5, 10, and 20 kilohms, accuracy within 3%.

R

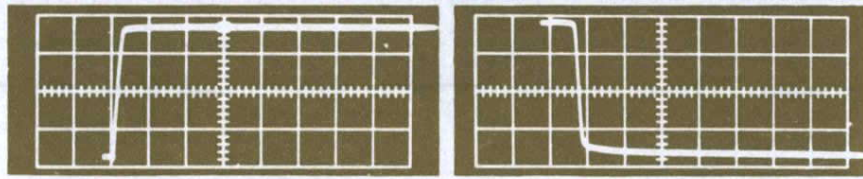
Drive voltage:
10 v through
20 kilohms.



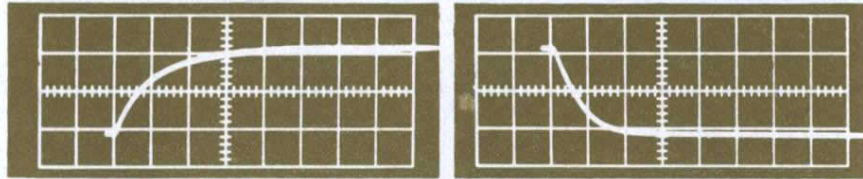
Drive voltage:
2 v through
1 kilohm.



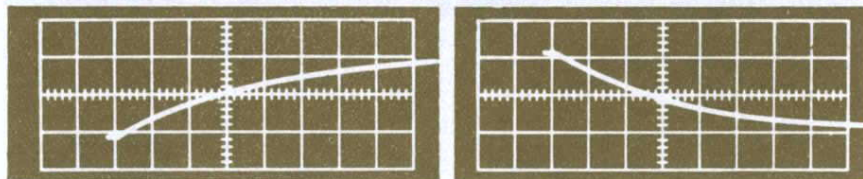
Drive voltage:
0.5 v through
50 ohms.



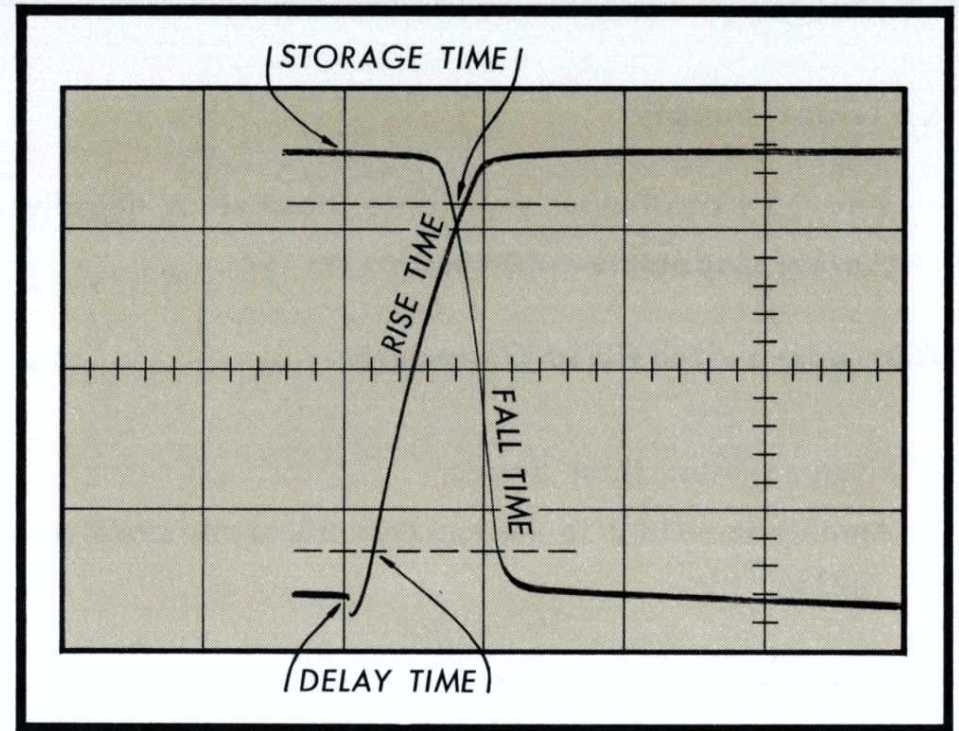
Class A drive:
0.05 v through
50 ohms.



Class A drive:
0.1 v through
1 kilohm.



High-frequency characteristics of a transistor under five different conditions of drive. In each pair, the photograph at left shows delay time and rise time, the start of the driving pulse coinciding with the 2-cm graticule line. The second photograph of each pair shows storage time and fall time, the end of the pulse coinciding with the 2-cm line. The Type R Unit plugged into a Tektronix Type 543A Oscilloscope—3.5-v collector supply, 500-ohm collector load, 2-ma/div vertical calibration, 0.5- μ sec/div sweep rate. Driving conditions at left of each pair.



The Type R Unit can trigger the Oscilloscope sweep either on the start of the test pulse only, or on both the start and finish to display delay, rise, storage, and fall times simultaneously.

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.

Weight: Net—7 1/4 pounds
Shipping—11 pounds, approx.

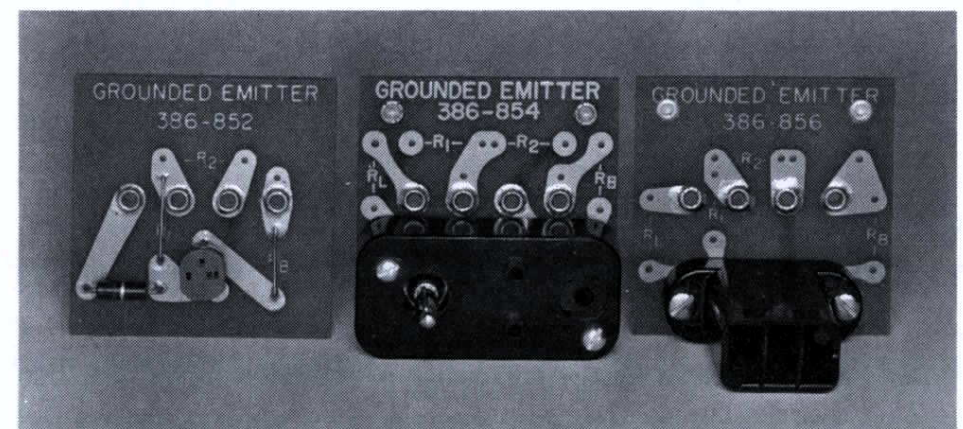
TYPE R PLUG-IN UNIT \$325

Each instrument includes: 1—grounded emitter small transistor socket, 1—grounded base small transistor socket, 10—contact clips, 2—instruction manuals.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

TRANSISTOR MOUNTING BOARDS

Convenient for checking large quantities of different types of transistors. Collector-load, voltage dividing, and base or emitter-driving resistors are not supplied with the boards.



Part No.	Type	Socket Type	Price
386-852	Gnd. Emitter	4-pin	\$1.50
386-853	Gnd. Base	4-pin	1.50
386-854	Gnd. Emitter	For power transistors such as 2N301 or 2N307	2.50
386-855	Gnd. Base	Same as above	2.50
386-856	Gnd. Emitter	Funnel type for long leads	2.50
386-857	Gnd. Base	Same as above	2.50



DIODE RECOVERY UNIT Type S

Diode Measurement Applications

Recovery characteristics are displayed by applying calibrated forward-current through the diode, then abruptly turning off this current and establishing a calibrated, constant, reverse current.

Recovery-Time Measurement

Accurate—to 30 nsec.
Comparative—to 15 nsec.
Predicted—limited only by the forward-reverse current ratio.

Calibrated Forward Currents

1, 2, 5, 10, and 20 milliamps.

Calibrated Reverse Currents

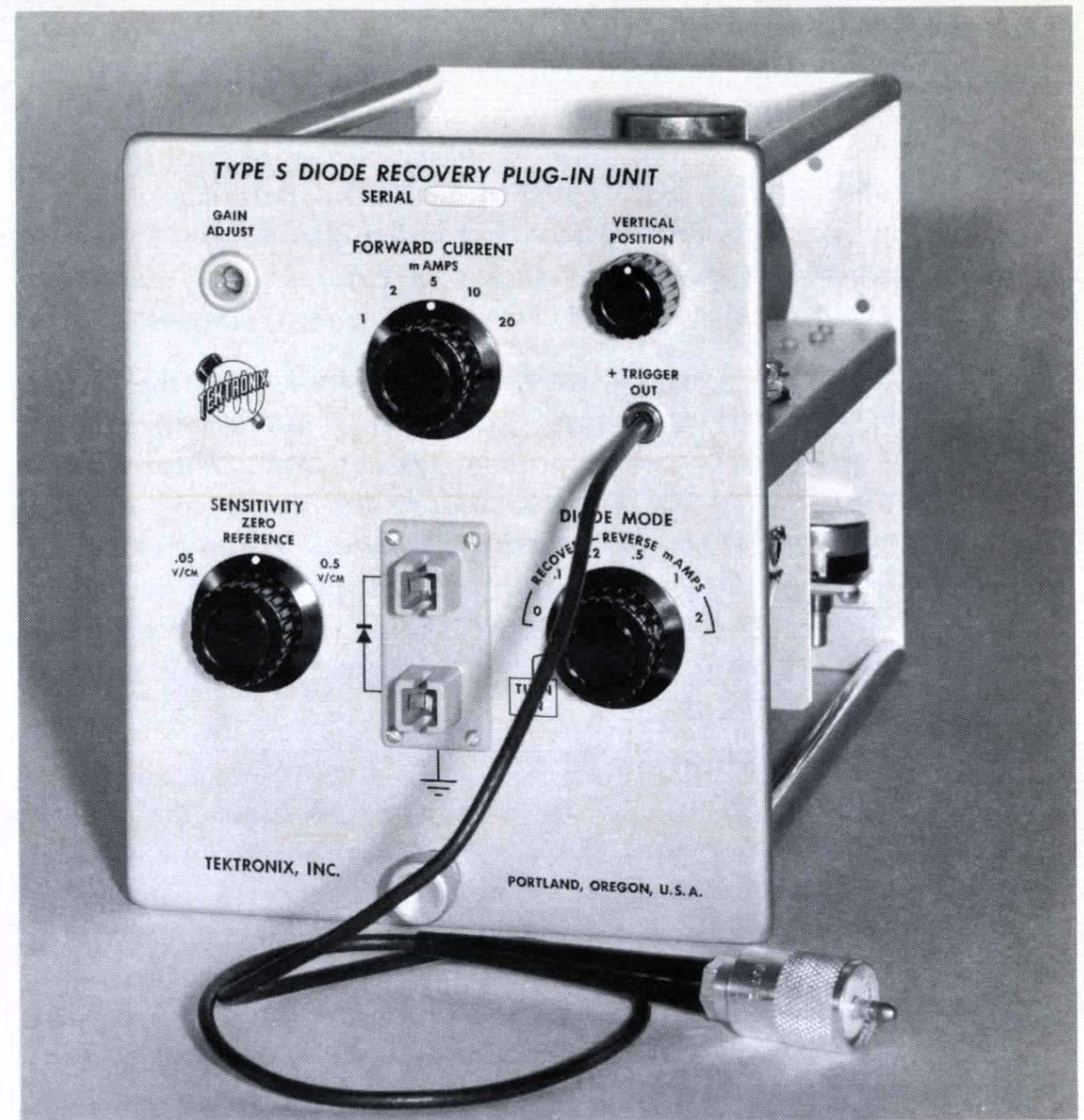
0, 0.1, 0.2, 0.5, 1, and 2 milliamps.

Diode Shunt Capacitance

9 picofarads at 0.5 v/cm.

Amplifier Sensitivity

0.05 v/cm and 0.5 v/cm, calibrated.



The Type S Unit enables you to display semiconductor-diode switching characteristics on your Tektronix Plug-In Oscilloscope. With Tektronix Type 540-Series, Type 550-Series, and Type 580-Series* Oscilloscopes you can find:

Carrier Recombination—Effective lifetimes to 2 nanoseconds.

Stored Charge—To 10 picocoulombs.

Capacitance—Junction capacitance to 2 picofarads.

Resistance—Bare (bulk) resistance to about 1/4 ohms.

The Type S Unit describes the diode in terms of its parameters, while most other currently employed methods describe the diode in terms of its performance in a particular circuit—not necessarily the one in which it will be used. With the Type S method you can predict the behavior of many diodes in many circuits, as well as compare diodes for performance in a particular circuit.

Since the Type S method is a means for plotting voltage across an element while passing constant current through that element, it can also be used to observe the

junction characteristics of transistors and to measure the resistance, capacitance, and inductance of other circuit components.

Note: Risetime of the Type S Unit depends on the capabilities of the oscilloscope with which it is used, therefore the ability to analyze fast diodes with Tektronix Type 530-Series Oscilloscopes will be affected by the lower risetimes of these instruments.

Switching Transient—A large switching transient occurs in the voltage waveform appearing across a semiconductor diode when the diode is abruptly switched from non-conduction to forward conduction. This transient indicates an initial high impedance across the diode as well as the steady-state low impedance well after turn on. A further deviation in the device action (from that of an ideal diode) occurs when the diode is switched from forward conduction to a reverse-bias condition. Instead of an immediate high impedance across the diode, a momentary low impedance condition exists. These switching characteristics are readily apparent with the Type S Plug-In Unit installed in a Tektronix fast-rise oscilloscope, and the contributing factors can be separated and analyzed.

* A Type 81 Adapter is required for use with Types 581 and 585.

Base (or Bulk) Resistance—The curves in Figures 3 & 4 show a sudden decrease in diode terminal voltage when forward current is switched off. This decrease occurs with disappearance of the voltage drop across the diode due to ohmic base resistance. The value of this base resistance can be determined, since the voltage drop across it for a given forward current can be measured. As shown in Figures 3 & 4, this base resistance decreases as forward current increases.

Stored Charge at the Junction—After the initial terminal-voltage drop, the voltage remaining is due to minority carriers stored in the junction. These stored carriers must be removed before the diode can assume its steady-state reverse characteristics. When this stored charge is cleared, the reverse diode voltage increases rapidly, as long as reverse current flows, at a rate determined only by the reverse current and the capacitance at the terminals.

Recombination of Current Carriers—As shown in Figures 1 & 2, the time required to clear the stored charge at reverse current of 2 ma is half the time it takes at 1 ma. Simply multiplying reverse current by the time it flows before removal of the charge yields the amount of stored charge. However, as reverse current decreases, the time required to remove the charge does not increase proportionally. Some other agent—namely, recombination of current carriers—removes part of the charge.

CHARACTERISTICS

Fast-Rise Mercury Switch—Inherent risetime of the mercury switch in the unit is 3 nsec. The switching transient is applied to a fast vacuum tube circuit which shapes the waveform for use as the actual switching signal. Repetition rate is approximately 300 pps for turn-on measurements and approximately 600 pps for recovery measurements.

External Triggering Signals—The Type S Unit supplies an external triggering signal to the associated oscilloscope through its attached coaxial cable. This signal remains constant in polarity and amplitude at +4 v for all conditions.

Vertical Deflection Factors—Two calibrated SENSITIVITY switch positions are provided on the unit: 0.5 v/cm and 0.05 v/cm. In the 0.5 v/cm position, the total diode shunt capacitance is approximately 9 pf. In the 0.05 v/cm position, the total diode shunt capacitance is approximately 16 pf. In addition, a ZERO REFERENCE position is provided to establish a true zero voltage reference trace.

Eleven Calibrated Currents—Two switches, FORWARD CURRENT and DIODE MODE, provide eleven calibrated currents: the forward currents range from 1 to 20 milliamps, and the reverse currents range from zero to 2 milliamps, accuracy within 3%.

Weight: Net—4 1/4 pounds
Shipping—8 pounds approx.

TYPE S PLUG-IN UNIT \$260

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

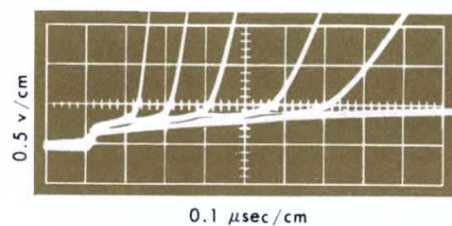


Fig. 1—Diode A

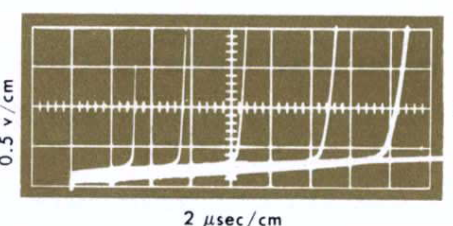


Fig. 2—Diode B

I forward—10 ma. I reverse—2, 1, 0.5, 0.2, 0.1, 0 ma.

Observation of the recovery curves of Figures 1 & 2 shows both reverse current and recombination accounting for removal of the stored charge. It is thus possible to determine not only the stored charge for any of the five forward currents available, but also the rate of recombination. With this information, it is possible to predict diode action to fast transients in any circuit.

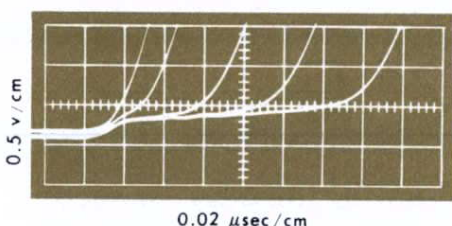


Fig. 3—Diode A

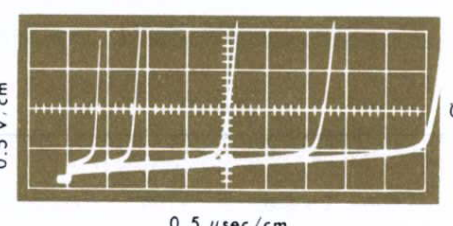


Fig. 4—Diode B

I forward—1, 2, 5, 10, 20 ma. I reverse—2 ma.

Observation of the recovery curves of Figures 3 & 4 shows that the amount of stored charge is proportional to forward current while the recovery time is so short that negligible recombination occurs. Under this condition, after the stored charge is cleared the reverse bias increase is limited only by the diode capacitance (and the shunt capacitance of the instrument). This rate of increase is easily measured at a particular reverse voltage, and thus, the diode capacitance at that voltage can also be determined.

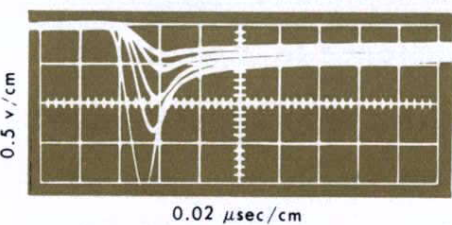


Fig. 5—Diode A

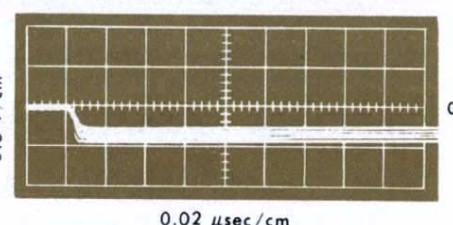


Fig. 6—Diode C

Turn-on—magnified. I forward—1, 2, 5, 10, 20 ma.

Observation of the turn-on characteristics of Figures 5 & 6 shows that the voltage drop across a diode suddenly switched on is not always initially as low as the steady-state drop. It is important to remember that the leading edge of any fast transient passed by a diode may be modified by this phenomenon.

NOTE: The above waveform photos are multiple exposures.



TIME-BASE GENERATOR UNIT Type T

Wide Sweep Range

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

5-x magnifier, accurate on all ranges.

Versatile Triggering

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

The Type T Time-Base Generator Plug-In Unit is intended to provide sawtooth sweep voltages to drive the horizontal-deflection system and the unblanking gate for the crt 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 Type 530, 540, 550 and 580* Series Oscilloscopes. 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 milli-sec/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%.

Output Waveforms—Approximately +20 v Gate and +150 v sawtooth are available at front panel connectors. A 20-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.

Sweep Magnifier—When the 5-x 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.

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

* A Type 81 Adapter is required for use with Types 581 and 585.

DC-Coupled Unblanking—This assures uniform bias for all sweep speeds and repetition rates when used in horizontal channel of a Type 536 Oscilloscope.

Preset Stability—The stability control can be set at a predetermined optimum triggering point.

Amplitude-Level Selection—Adjustable amplitude-level and stability controls provide triggering the sweep at a selected amplitude on the triggering waveform, either on the rising or falling slope of the waveform. Trigger source can be external, line frequency, or the signal under observation.

Automatic Triggering—In this mode of operation, no trigger control adjustment is necessary for most applications. Range of operation is between 60 cps and 2 Mc, approximately. In the absence of a signal a reference trace is displayed at approximately a 50-cps rate.

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 10 v is required.

Weight: Net 4 $\frac{3}{4}$ pounds

Shipping—9 pounds, approx.

TYPE T PLUG-IN UNIT \$240

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

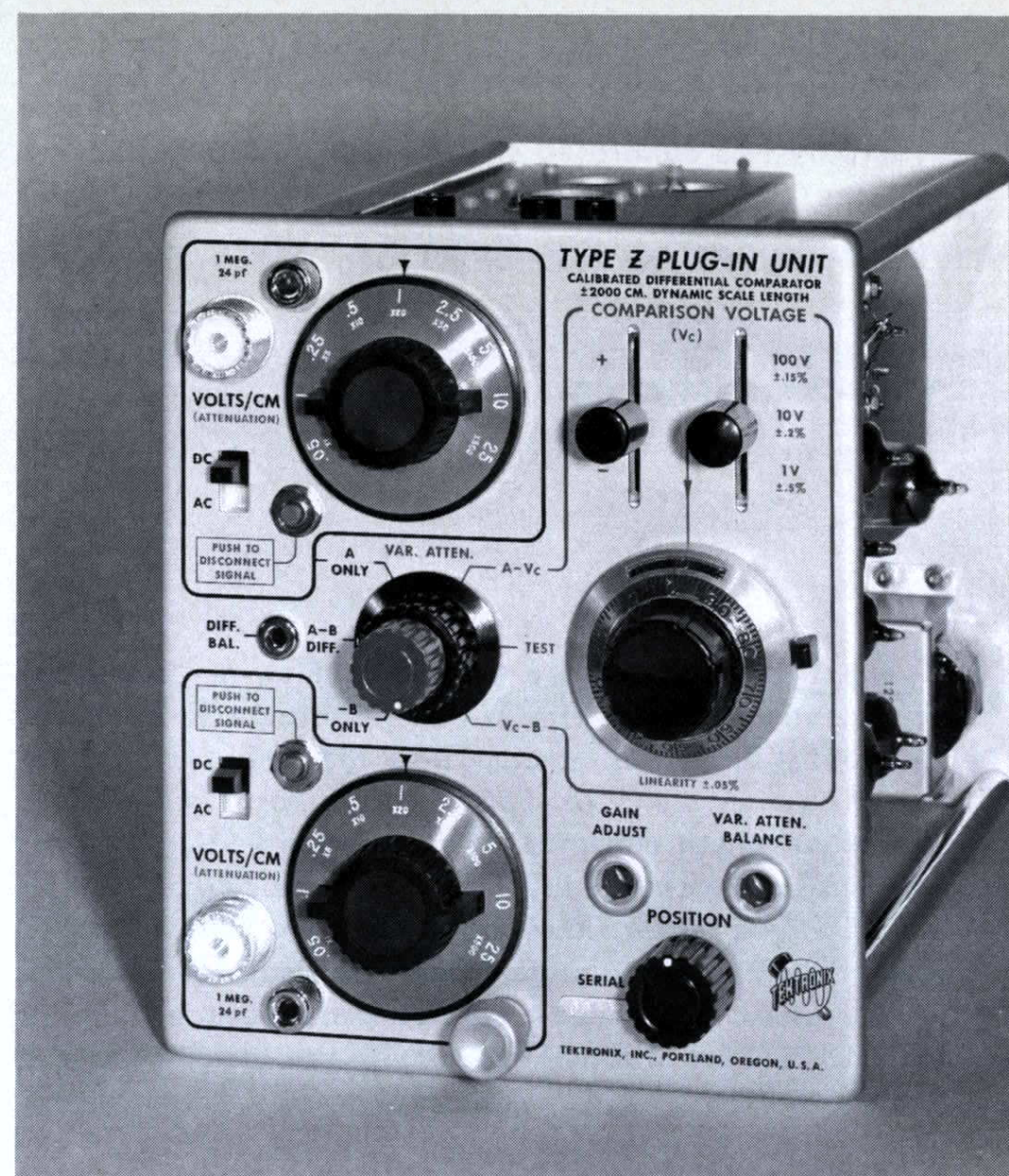
Type Z DIFFERENTIAL COMPARATOR UNIT



The Type Z Plug-in Unit is designed to extend the accuracy of oscilloscope voltage measurements. Highly adaptable, the unit can be used in three modes of operation: (1) as a conventional preamplifier, (2) as a differential-input preamplifier, or (3) as a calibrated differential comparator. Sensitivity is 50 mv/cm. Dynamic range is ± 100 volts. The effective scale length is ± 2000 cm—hence, the resolution is a maximum of 0.005%. The high accuracy of the dc comparison voltage assures precise voltage measurements.

With the Type Z in a Tektronix plug-in oscilloscope, calibrated \pm dc comparison voltages can be added differentially to the input waveform via the slide-back technique. The comparator can follow an input waveform having an instantaneous rate of rise to 1 volt in 7 nsec, and an instantaneous rate of fall to 1 volt in 5 nsec. A 100-volt waveform can be displayed incrementally with high resolution (of 0.05 v/cm).

The dynamic range of the unit permits common-mode signals up to 100 volts to be applied to the amplifier without attenuation. The common-mode rejection ratio of 40,000 to 1 allows measurement of differential signals less than 50 millivolts. Larger signals can be attenuated if they do not exceed the dynamic range of the unit.



MEASUREMENT APPLICATIONS

AC and DC VTVM—

Measures audio-frequency signals with the same accuracy as dc signals.

DC-Coupling—

Eliminate "floating oscilloscope" operation.

Observe small ac signals in the presence of large dc components—for example, low-frequency signals on plate amplifiers or power-supply fluctuations to 0 cps.

Measure both dc and signal levels.

Semiconductor Characteristics—

Measure Zener diode ac admittances and Zener voltage together.

Measure transistor output impedance h_{oe} or h_{ob} .

High Amplitude Hum Rejection—

Reject up to 200 volts peak-to-peak common-mode hum.

Pulse-Height Analysis—

Reject any pulse below a preset dc level.

Fast-Recovery Amplifier—

Monitor wide dynamic range signals.

Observe small signals present, during, or following a large pulse—for example, ultrasonic delay line testing or amplifier overload testing.

Modulation Monitor—

Measure residual amplitude modulation on a carrier, hum noise, etc., or incidental amplitude modulation on an FM or PM signal.

Component Matching—

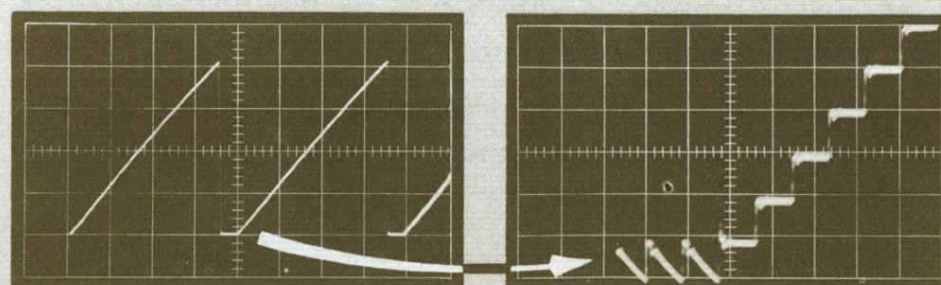
Use differentially as a null detector in bridge setups, with high resolution of the null.

Time-Base or Staircase Comparisons—

Compare incremental linearity of ramps and staircases with high precision.

WAVEFORM DETAILS OF A 100 V STAIRCASE

The Type Z rejects up to 100 v of an input signal and accepts 100 v waveforms for display at 50 mv/cm sensitivity. It provides an equivalent vertical scale length of ± 2000 centimeters.



AS A CONVENTIONAL PREAMPLIFIER

Sensitivity—

0.05 volts/cm to 25 volts/cm in 9 calibrated steps.

Attenuation—

Constant input impedance turret attenuators.
9 turret positions provide attenuation of X1, X2, X5, X10, X20, X50, X100, X200, and X500.
Frequency-compensating adjustment provided on the front panel.

Variable Gain—

The 2.5 to 1 ratio control extends sensitivity to over 60 volts/cm.

Frequency Response and Risetime—

Frequency specifications are at 3-db down (for signals that do not overscan the screen)
With Types 531A, 533A, 535A—dc to 10 Mc, 35 nsec.
With Types 541A, 543A, 545A, 555, *581, *585—dc to 13 Mc, 27 nsec.

Input Impedance—

1 megohm paralleled by approximately 24 pf.

Signal Disconnect Control—

Pushbutton switch allows momentary removal of the signal to establish a zero level.

AS A DIFFERENTIAL INPUT PREAMPLIFIER

(at full sensitivity—50 mv/cm)

Common-mode Signal Level—

±100 volts.

Common-mode Rejection—

40,000 to 1, minimum (common-mode gain/differential input gain). *Good at dc only + decreases with frequency. 11-12-62*
200 volts peak-to-peak or ±100 volts common-mode signal produces a maximum of 1 mm of vertical deflection, equal to 5 mv of differential input signal.

Rate of Change—

The input signals must not exceed +1 volt in 7 nsec (to avoid grid current), or -1 volt in 5 nsec.

AS A CALIBRATED DIFFERENTIAL COMPARATOR

Comparison Voltages—

Three voltage ranges are provided: from zero to ±1 volt, from zero to ±10 volts, and from zero to ±100 volts.

Internal Regulator—

Maintains voltage essentially independent of the actual power-supply voltages furnished by the oscilloscope or the Type 127 or 132 Preamplifier Power Supply.

Comparison Voltage Accuracy—

Within 0.5% on the ±1-volt scale.
Within 0.2% on the ±10-volt scale.
Within 0.15% on the ±100-volt scale.

DC Drift—

Maximum of ±0.1% in 100-hour drift test of comparison voltages.

Precision Potentiometer—

Zero-based linearity of ±0.05%.

Resolution and Accuracy—

0.5 mm (5 mv) resolution equals 0.005% for 100 v signals.

Transient Response—

Rate of rise: The input cathode follower can handle a signal with a rate of rise of less than +1 volt in 7 nanoseconds without the flow of grid current. Grid-current flow will generally distort the waveform.

Rate of fall: The amplifier will be cut off whenever the rate of fall of the input signal exceeds -1 volt in 5 nanoseconds. The amplifier will then "run down" linearly at this rate until it "catches up" with the input signal, and then will resume conduction.

Large fast signals can be attenuated to reduce the switching time.

Attenuator Accuracy—

Input attenuators are the constant-input-impedance, frequency-compensated type.
Resistor tolerance is nominally 1%.
Attenuation accuracy is within 2%.

Weight: Net—5 3/4 pounds.
Shipping—10 pounds, approx.

TYPE Z PLUG-IN UNIT \$525
Each instrument includes: 2—instruction manuals.

Variable Attenuation Probe

Initially designed for the Type Z Plug-In Unit for greatest accuracy at high sensitivity, the Type P6023 10X Probe compensates for normal attenuator differences between two channels. An adjustable potentiometer compensates the 10:1 attenuation ratio, and two adjustable capacitors compensate for input capacities between 20 pf and 47 pf.

Order Part Number 010-065 \$40

Please refer to Catalog Accessory Section for additional information.

* A Type 81 Adapter is required for use with Type 581 and 585.

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 2A60 DC-to-1MC AMPLIFIER UNIT



Formerly Designated Type 60



Designed for use with all Type 560-Series Oscilloscopes, the Type 2A60 Amplifier Unit will satisfy many applications requiring a dc-to-1 Mc passband amplifier.

The Type 2A60 can be used in Types 561, RM561, 561A, RM565, 565, RM567, and 567 Oscilloscopes.

SENSITIVITY is in 4 calibrated steps of 50 mv/cm, 0.5 v/cm, 5 v/cm, and 50 v/cm. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated from 50 mv/cm to 500 v/cm.

PASSBAND is dc to 1 Mc.

MAXIMUM INPUT VOLTAGE is 600 volts.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 47 pf.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel.

Net weight is 3 pounds. Shipping weight is 9 pounds, approx.

TYPE 2A60 AMPLIFIER UNIT \$105

Each instrument includes: 2—instruction manuals.

Type 2A63 DIFFERENTIAL AMPLIFIER UNIT

Formerly Designated Type 63

Designed for use with all Type 560-Series Oscilloscopes, the Type 2A63 is a simple differential-input amplifier unit.

The Type 2A63 Amplifier Unit is extremely useful for making voltage measurements between two above-ground points, and for cancelling in-phase signals such as hum pickup in connecting leads.

The Type 2A63 can be used in Types 561, RM561, 561A, RM565, 565, RM567, and 567 Oscilloscopes.

SENSITIVITY is in 14 calibrated steps from 1 mv/cm to 20 v/cm, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated from 1 mv/cm to 50 v/cm.

PASSBAND is dc to 300 kc.

DIFFERENTIAL INPUT has a 50-to-1 rejection ratio.

MAXIMUM INPUT VOLTAGE is 600 volts.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 47 pf.

PHASE SHIFT is nominally less than 1° at 50 kc.

INTER-STAGE AC COUPLING reduces drift at high gain.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel.

Net weight is 3³/₄ pounds. Shipping weight is 10 pounds, approx.



TYPE 2A63 AMPLIFIER UNIT \$130

Each instrument includes: 2—instruction manuals.

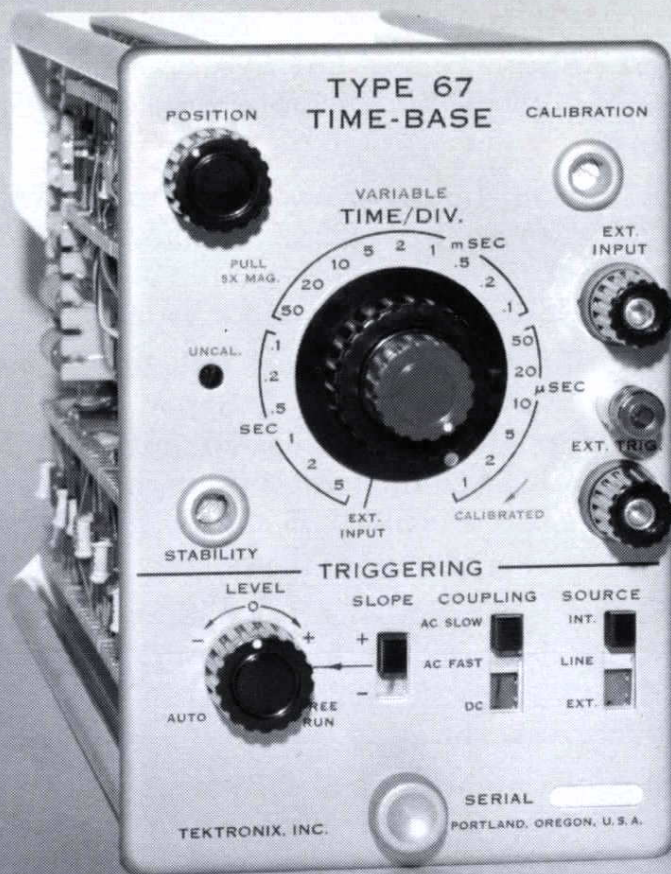
U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





TIME-BASE UNIT Type 2B67

Same as Type 67 with addition of Single-Sweep Feature.



Designed for use with Types 561, RM561, 561A, RM567 and 567 Oscilloscopes, the Type 2B67 Time-Base Unit provides a sweep range of 1 μ sec/cm to 5 sec/cm.

SWEEP RANGE is from 1 μ sec/cm to 5 sec/cm in 21 calibrated rates, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated from 1 μ sec/cm to 12 sec/cm.

5X MAGNIFIER increases the calibrated sweep rate to 0.2 μ sec/cm.

SINGLE SWEEP facilitates photographic recording of one-shot waveforms.

TRIGGER FACILITIES include Internal, External, Line; Amplitude-Level Selection; AC or DC Coupling; Automatic or Free Run; \pm Slope.

EXTERNAL INPUT TO SWEEP AMPLIFIER has sensitivity of 1 v/cm.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel.

Net weight is 4 $\frac{1}{4}$ pounds. Shipping weight is 10 pounds, approx.

TYPE 2B67 TIME-BASE UNIT \$175

Each instrument includes: 2—instruction manuals.

DUAL-TRACE DC-to-10MC UNIT Type 3A1

Designed for use with Type 561A Oscilloscope, the Type 3A1 Amplifier Unit is a general-purpose dual-trace unit with identical channels. Each channel has five operating modes and operates independently for a wide variety of single and dual-trace displays. Linear scan is 6 cm. No delay line is included.

IDENTICAL CHANNELS can be operated independently. Isolation between channels is approximately 50,000 to 1.

OPERATING MODES for each channel include Channel 1 only (can be inverted), Channel 2 only, Chopped, or electronic switching at approximately 200-kc rate (dual-trace blanking provided), Alternate, or electronic switching on alternate sweeps, and Algebraic Addition, or both channels combined at the output, dependent on the settings of the polarity switches.

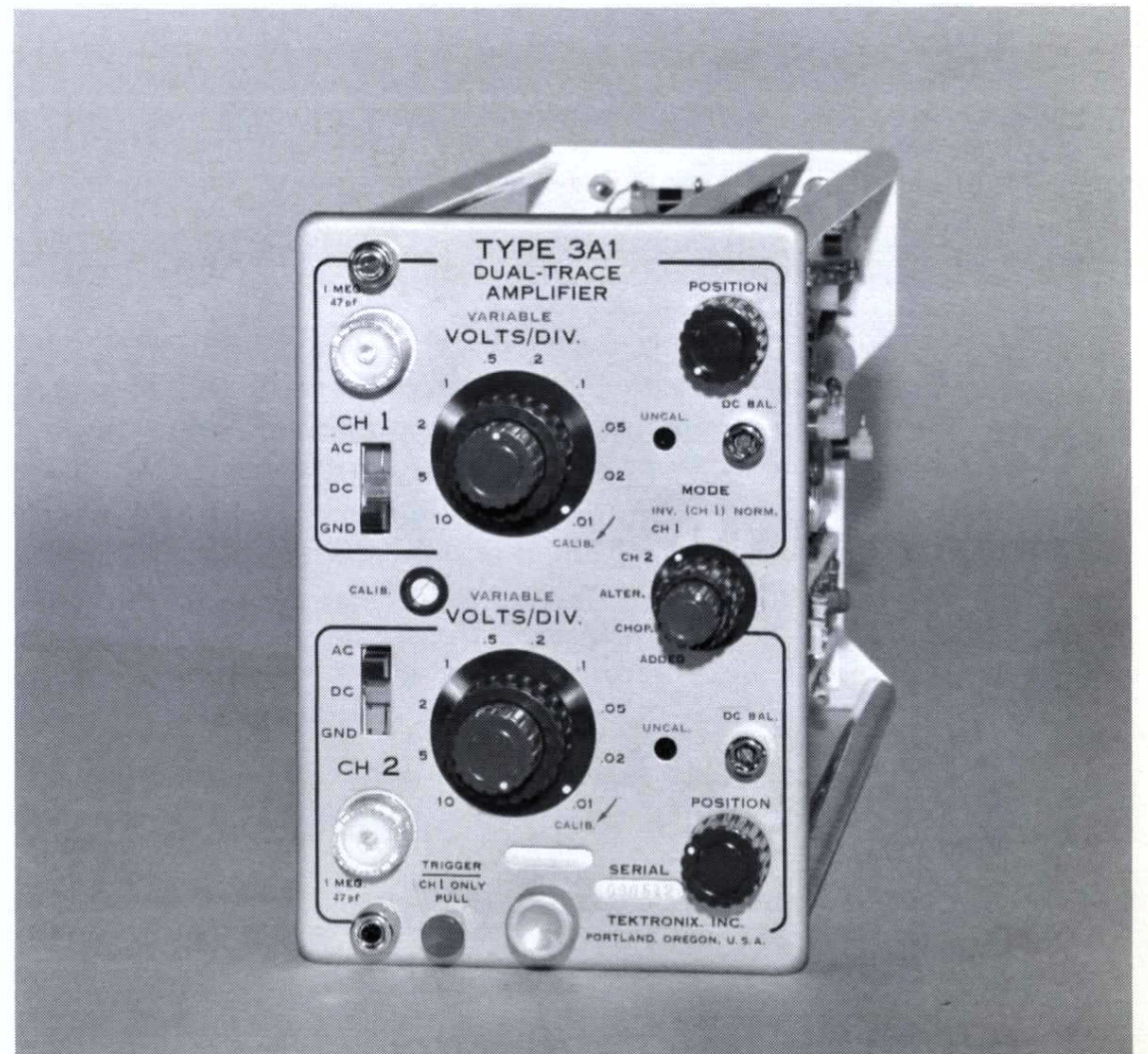
TWO TRIGGERING SIGNALS are internally available: an attenuated sample of the vertical output signal (a composite of the two channels) and a Channel 1 signal only.

SENSITIVITY for each channel is in 10 calibrated steps from 10 mv/cm to 10 v/cm, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated from 10 mv/cm to 25 v/cm.

PASSBAND of each channel is dc to 10 Mc.

RISETIME of each channel is approximately 35 nsec.

INPUT COUPLING for each channel can be ac or dc. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.



INPUT IMPEDANCE is 1 megohm paralleled by 47 pf.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized panel. Net weight is 5 pounds. Shipping weight is 12 pounds, approx.

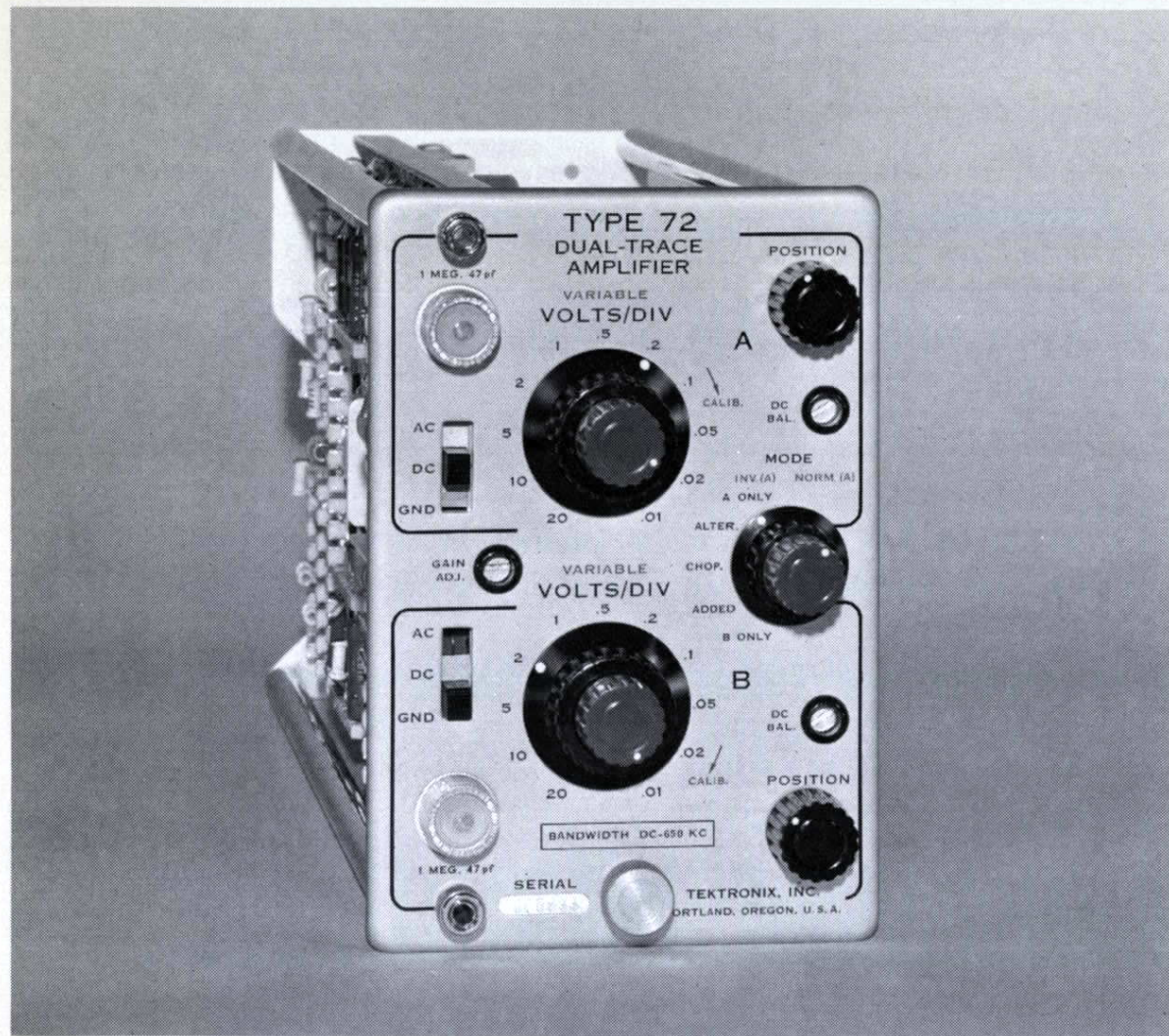
TYPE 3A1 AMPLIFIER UNIT \$410

Each instrument includes: 2—instruction manuals.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 3A72 DUAL-TRACE DC-to-650KC UNIT

Formerly Designated Type 72



Designed for use with all Type 560-Series Oscilloscopes, the Type 3A72 Amplifier Unit is a dual-trace unit with identical channels. Each channel has five operating modes and operates independently for a wide variety of single and dual-trace displays.

The Type 3A72 can be used in Types 561, RM561, 561A, RM565, 565, RM567, and 567 Oscilloscopes.

IDENTICAL CHANNELS can be operated independently.

OPERATING MODES for each channel include: Channel A only (can be inverted), Channel B only, Chopped, or electronic switching at 30-kc rate (dual-trace blanking provided), Alternate, or electronic switching on alternate sweeps, and Algebraic Addition, or both channels combined at the output, adding or subtracting according to the settings of the polarity switches.

SENSITIVITY for each channel is in 11 calibrated steps from 10 mv/cm to 20 v/cm, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated from 10 mv/cm to 50 v/cm.

PASSBAND for each channel is dc to 650 kc.

MAXIMUM INPUT VOLTAGE is 600 volts.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 47 pf.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel.

Net weight is 5 pounds. Shipping weight is 11 pounds, approx.

TYPE 3A72 AMPLIFIER UNIT \$250
Each instrument includes: 2—instruction manuals.

Type 3A75 AMPLIFIER UNIT

Formerly Designated Type 75

Designed for use with all Type 560-Series Oscilloscopes, the Type 3A75 Amplifier Unit has passband from dc to 4 Mc and sensitivity from 50 mv/cm to 20 v/cm.

The Type 3A75 can be used in Types 561, RM561, 561A, RM565, 565, RM567, and 567 Oscilloscopes.

SENSITIVITY is in 9 calibrated steps from 50 mv/cm to 20 v/cm, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated from 50 mv/cm to 50 v/cm.

PASSBAND is dc to 4 Mc.

RISETIME is approximately 85 nsec.

MAXIMUM INPUT VOLTAGE is 600 volts.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 47 pf.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel.

Net weight is 3½ pounds. Shipping weight is 10 pounds, approx.

TYPE 3A75 AMPLIFIER UNIT \$175
Each instrument includes: 2—instruction manuals.

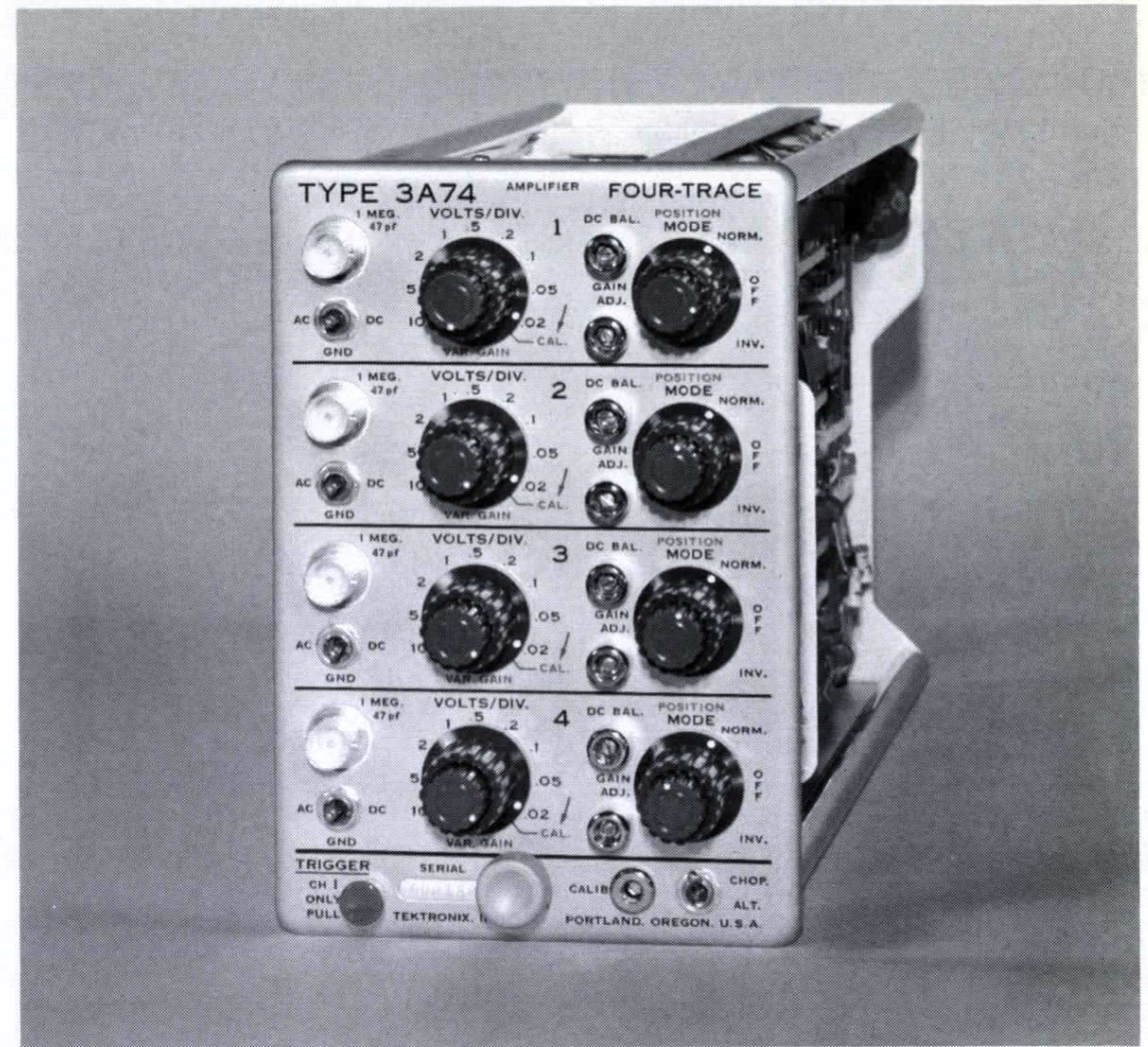
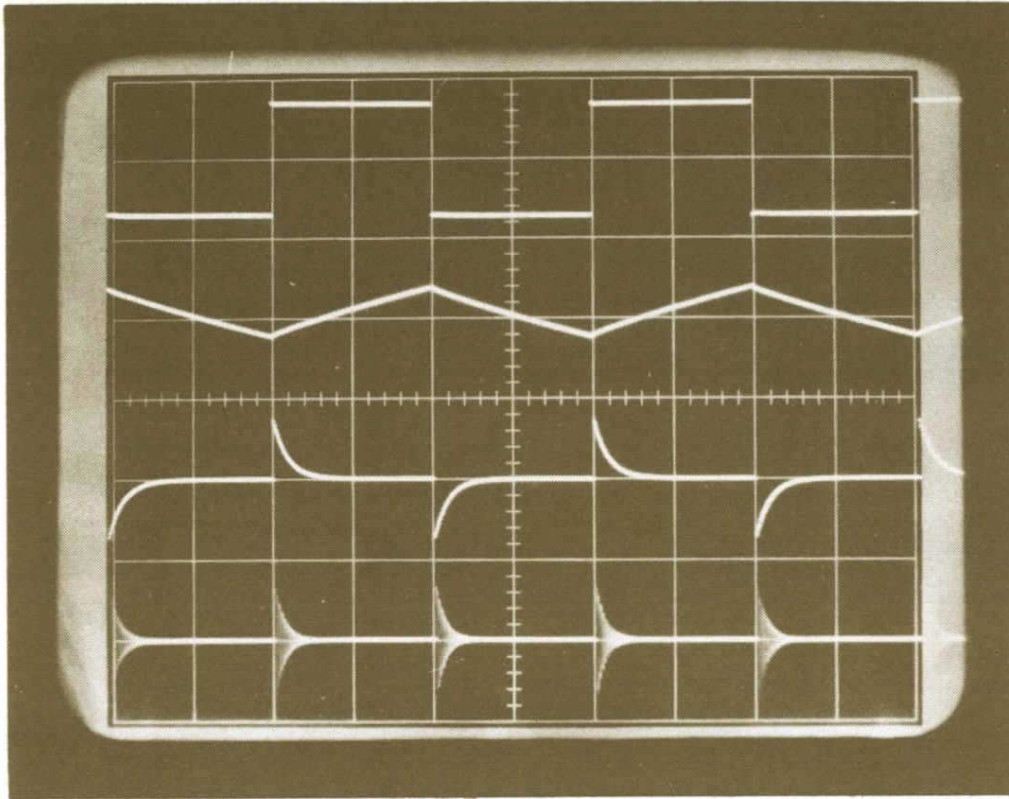


U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





FOUR-TRACE AMPLIFIER UNIT Type 3A74



Designed for use with Types 561, RM561, 561A, RM565, 565, RM567 and 567 Oscilloscopes, the Type 3A74 Amplifier Unit provides a means for viewing up to four signals, either separately or in any combination. Independent controls for each amplifier channel permit positioning, attenuating, and inverting input signals as desired. Synchronization is provided for X-Y operation. A locking feature assures that corresponding channels are displayed together.

OPERATING MODES are any one of the four channels separately; ~~or Channel 4 only~~, Chopped, or electronic switching of two or more channels at approximately a 500 kc rate; * Alternate, or triggered electronic switching of channels at the end of each sweep. **Dual trace blanking provided. 11-12-62*

TWO TRIGGERING SIGNALS are externally selectable: an attenuated sample of the vertical output signal (a composite of the electronically-switched channels) and a Channel 1 signal provided by a separate dc amplifier (dependent on input coupling and attenuation but otherwise independent of Channel 1 operation.)

SENSITIVITY for each channel is in 9 calibrated steps from 20 mv/cm to 10 v/cm, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated from 20 mv/cm to 25 v/cm.

PASSBAND of each channel is dc to 2 Mc.

RISETIME of each channel is 0.17 μ sec.

POLARITY of each channel can be inverted.

INPUT COUPLING for each channel can be either ac or dc. When ac-coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe. The coupling switch also has a GND position to easily obtain ground-level reference.

INPUT IMPEDANCE is 1 megohm paralleled by 47 pf. Input connectors are the BNC Type.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel.

Net weight is 6 $\frac{1}{4}$ pounds. Shipping weight is 12 pounds, approx.

TYPE 3A74 AMPLIFIER UNIT \$550
Each instrument includes: 2—instruction manuals, 4—adapters, BNC to binding post.

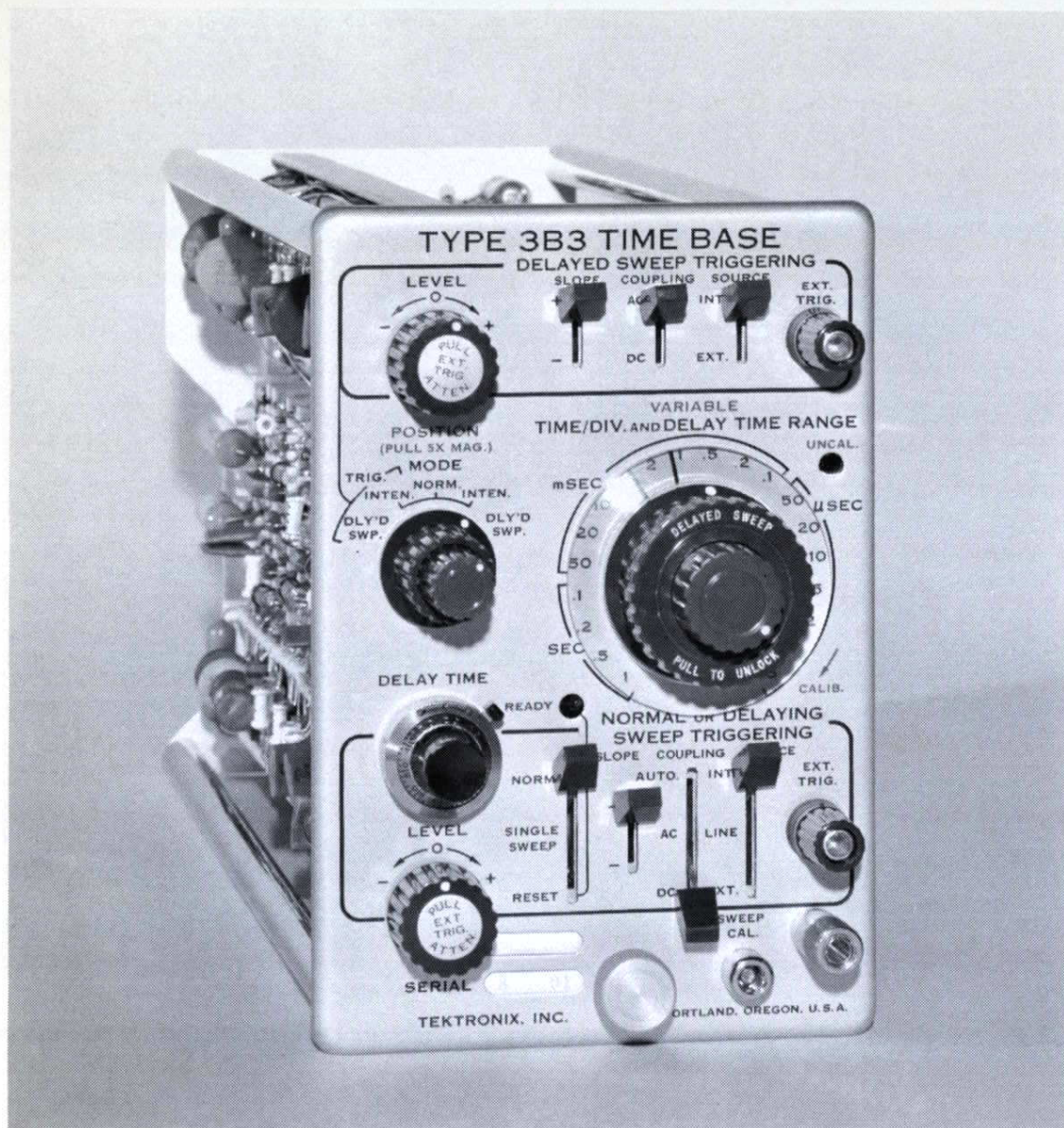
BNC ADAPTERS

Adapter, BNC to UHF
Order Part Number 103-032 \$3.55
Adapter, BNC to Dual Binding Post
Order Part Number 103-035 \$5.35

For BNC probes, cables, and accessories, please refer to Accessory Section.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 3B3 TIME-BASE UNIT



NORMAL AND DELAYED SWEEPS

PRECISION DELAY INTERVAL

FLEXIBLE TRIGGERING

SINGLE SWEEP OPERATION

Designed for use with Types 561A, RM567, and 567 Oscilloscopes, the Type 3B3 generates the time base for both normal and delayed-sweep displays. Flexible triggering facilities are similar for both the normal sweep and the delayed sweep. Calibrated sweep delay enables accurate delay intervals to be set and measured.

SWEEP RANGE for both normal and delayed sweeps is in 20 calibrated rates from 0.5 $\mu\text{sec}/\text{cm}$ to 1 sec/cm , 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated from 0.5 $\mu\text{sec}/\text{cm}$ to 2.5 sec/cm .

5X MAGNIFIER increases the calibrated sweep rate to 0.1 $\mu\text{sec}/\text{cm}$.

SINGLE SWEEP operation (~~for normal sweep~~) facilitates photographic recordings of waveforms. 11-12-62

SWEEP DELAY operation permits accurate setting and measuring of delay intervals from 0.5 μsec to 10 sec . One control can adjust both the normal and delayed sweeps simultaneously or the delayed sweep can be adjusted independently of the normal sweep. Delay accuracy $\pm 1\%$ of full scale reading. Delay time linearity is within $\pm 0.2\%$ of full scale from 5 μsec to 2 seconds of delay.

The normal sweep generator operates as the display time base in (1) the **NORMAL** position, (2) the **INTENSIFIED** position—where the delayed-sweep generator intensifies a portion of the normal sweep trace, indicating the time during which the delayed sweep operates—and (3) the **TRIGGERED, INTENSIFIED** position—where the delayed sweep is armed at the end of the delay time and starts by the delayed sweep trigger . . . intensifying a segment of the normal sweep trace as above.

The delayed-sweep generator operates as the display time base in (1) the **DELAYED SWEEP** position—displaying the portion of the trace which was intensified in the **INTENSIFIED** position . . . with time-jitter less than 1 part in 20,000 of the maximum available delay interval—and (2) the jitter-free **TRIGGERED, DELAYED SWEEP** position—displaying the portion of the trace which was intensified in the **TRIGGERED, INTENSIFIED** position.

TRIGGER FACILITIES include the following:

Normal Sweep Trigger Modes—Internal, External, or Line; AC or DC Coupling; Automatic; \pm Slope.

Delayed Sweep Trigger Modes—Internal or External; AC or DC Coupling; \pm Slope.

External Triggering—2 ranges available, from zero to ± 15 v and from zero to ± 150 v, approximately.

Internal Triggering—2 mm of signal display.

Trigger Frequency—essentially dc to 10 Mc with slightly reduced sensitivity at higher frequencies.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel.

Net weight is 5 $\frac{1}{4}$ pounds. Shipping weight is 12 pounds, approx.

TYPE 3B3 TIME-BASE UNIT \$525

Each instrument includes: 2—instruction manuals.

TYPE 3B1 TIME-BASE UNIT

The Type 3B1 is similar to the Type 3B3 Time-Base Unit. The Type 3B1 has all features of the Type 3B3 with these exceptions: no Line position of the Normal Sweep Trigger Mode, no single-sweep facility, and uncalibrated sweep delay between the 20 calibrated rates from 0.5 microsecond to 10 seconds (instead of continuously calibrated sweep delay in this range as provided by the Type 3B3).

TYPE 3B1 TIME-BASE UNIT \$475

Each instrument includes: 2—instruction manuals.

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





DUAL-TRACE SAMPLING UNIT Type 3S76

Internal Triggering and Delay Lines

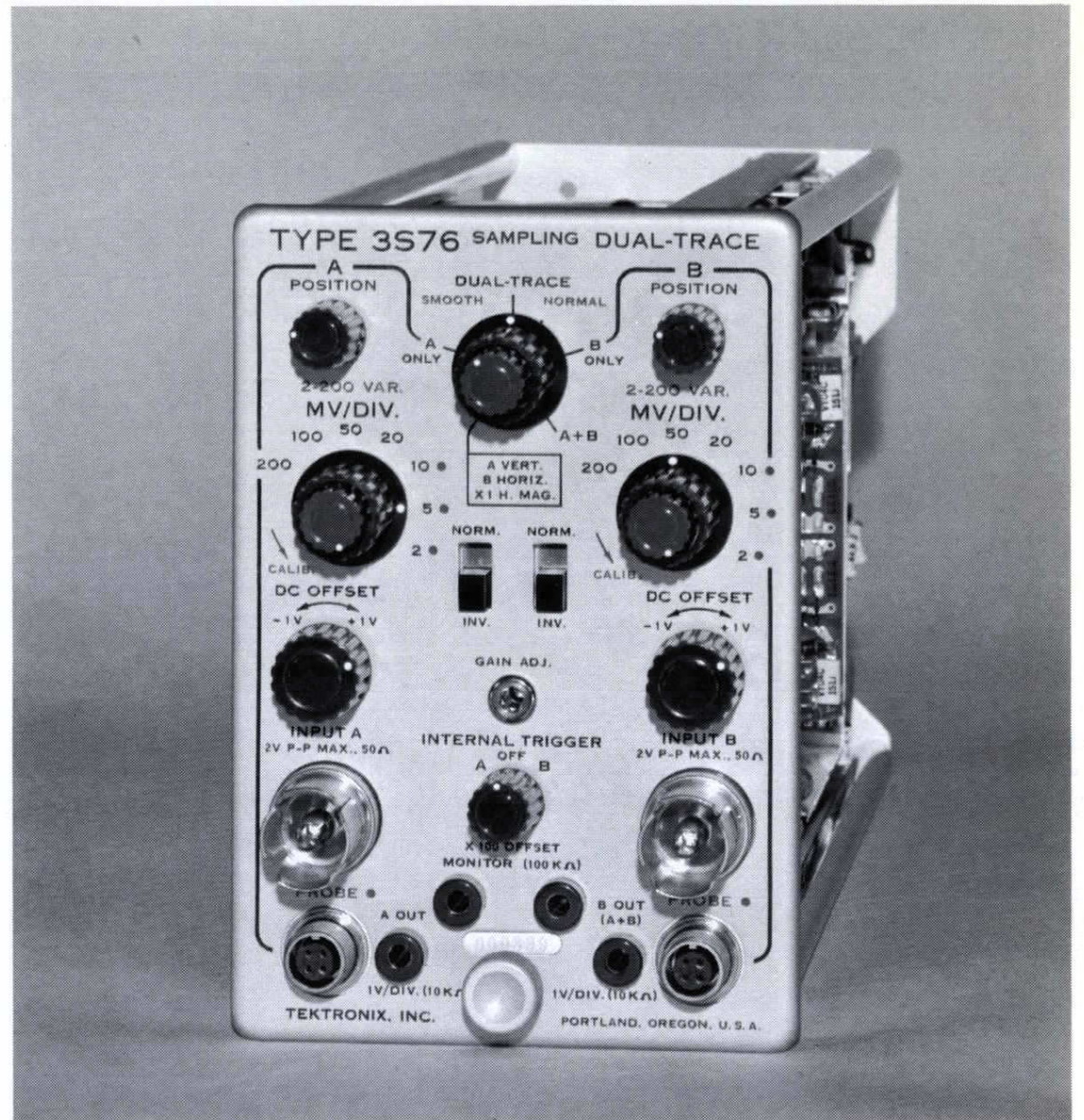
0.4-nsec or less Risetime

2 Identical Channels

5 Operating Modes

Recorder Outputs

Designed for use with Types 561, RM561, 561A, RM567, and 567 Oscilloscopes, the Type 3S76 is a versatile Dual-Trace Sampling Unit. Used in conjunction with a Type 3T77 Sampling Sweep Unit, the combination permits a wide range of sampling displays of repetitive waveforms on the crt of the associated oscilloscope.



OPERATING MODES are Channel A only, Channel B only, Dual-Trace (electronic switching between channels), Algebraic Addition ($\pm A \pm B$), and $\pm A$ Vertical, $\pm B$ Horizontal (for X-Y display).

RISETIME is 0.4 nsec or less, with less than $\pm 3\%$ peak overshoot and undershoot.

FREQUENCY RESPONSE is equivalent to dc-to-3-db down at 875 Mc.

DEFLECTION FACTOR is in 7 calibrated steps from 2 mv/cm to 200 mv/cm, accuracy within 3%, except on the 2 mv/cm and 5 mv/cm steps, which have accuracy within 5%. A variable control permits continuous adjustment between steps.

POLARITY can be inverted on either channel.

NOISE is equivalent to an input signal of 2 mv pk-to-pk with Smooth-Normal Switch in NORMAL position and 1 mv pk-to-pk with Smooth-Normal Switch in SMOOTH position.

DC OFFSET is -1 to $+1$ v, referred to input, and monitorable at the front panel at 100X magnitude.

INPUT IMPEDANCE is 50 ohms.

INPUT SIGNALS can be up to 2 v pk-to-pk.

SIGNAL DELAY through 55-nsec internal delay line for each channel allows viewing of leading edge of input waveform.

TRIGGER SOURCE selects built-in trigger takeoff signal from either channel, or terminates.

VERTICAL SIGNAL OUTPUT is 1 v/cm (through 10 kilohms) dc-coupled at $+10$ volt level, both channels.

PROBE POWER is provided on both channels for cathode-follower probes, such as Tektronix Type P6032.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel. Net weight is $7\frac{1}{2}$ pounds. Shipping weight is 15 pounds, approx.

TYPE 3S76 DUAL-TRACE SAMPLING UNIT \$1100

Each instrument includes: 2—50- Ω 10:1 attenuators, 2—5-nsec RG8A/U cable, 2—instruction manuals.

PROBES

The **TYPE P6034 MINIATURE PASSIVE PROBE** (10X attenuation) with input resistance of 500 ohms at dc and approximately 300 ohms at 1 gigacycle, and input capacitance of 0.7 pf ± 0.1 pf at 1 Mc to 1 gc. Risetime of probe is less than 100 picoseconds. Ringing and overshoot is 2% or less on pulses from 25-ohm source.

Order Part Number 010-110 \$35

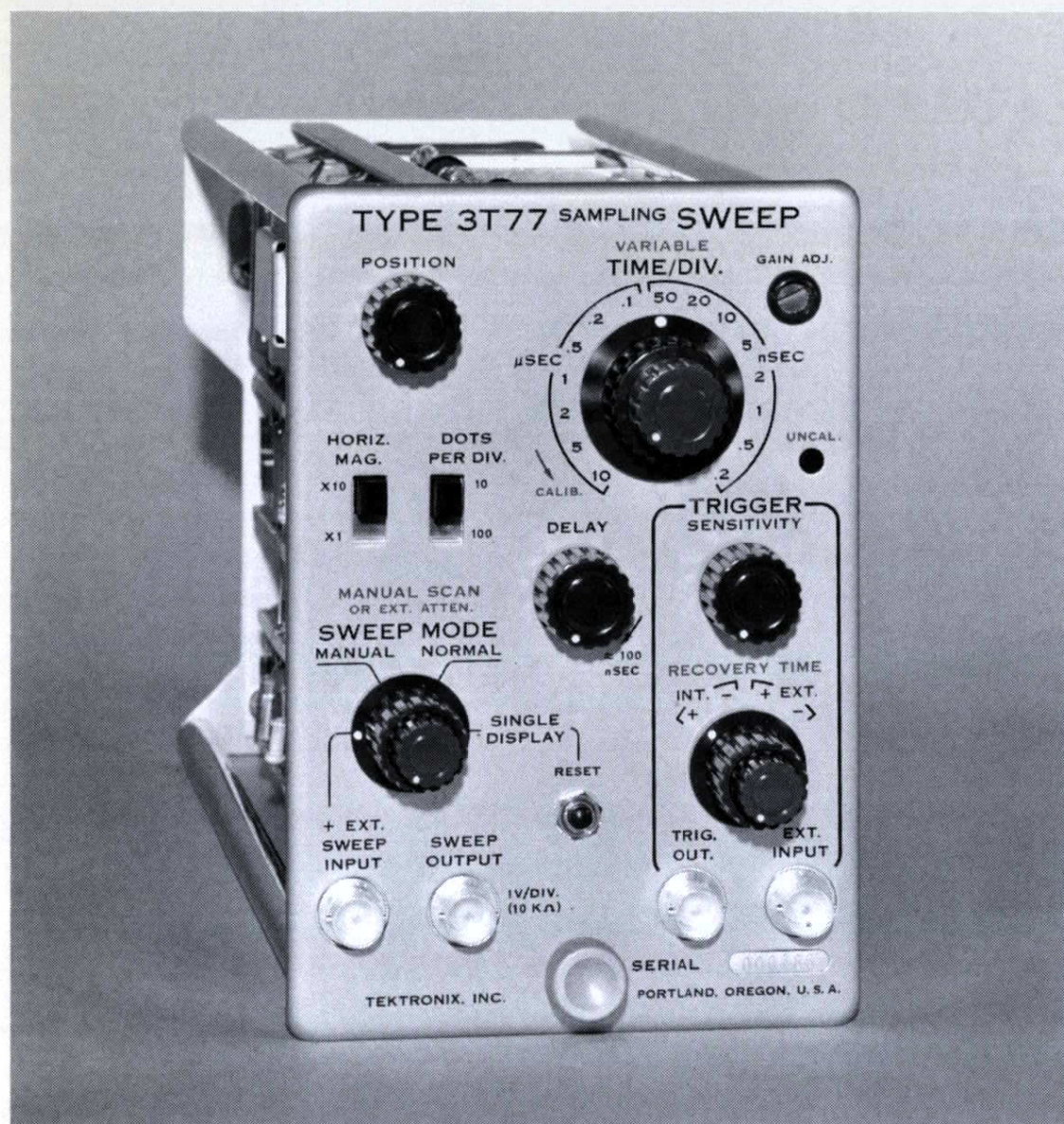
The **TYPE P6032 CATHODE FOLLOWER PROBE** is a high-impedance, dc-coupled probe with an attenuation range of 10X to 1000X, in a 1-2-5 sequence, with 7 plug-on attenuator heads and a capacitor-coupler head. Maximum output is ± 150 mv. Risetime is approximately 0.4 nsec. Frequency response is approximately 850 Mc at 3-db down. Static capacitance is 3.6 to 1.3 pf. Static Resistance is 10 megohms.

Order Part Number 010-108 \$160

See Accessory Section for complete description of these and other probes for pulse-sampling applications.

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 3T77 SAMPLING SWEEP UNIT



Internal or External Triggering

10 μ sec/cm to 0.02 nsec/cm Sweep Speeds

Variable Sweep Delay through 100 nsec

Single-Display Provision

Recorder Output

Designed for use with Types 561, RM561, 561A, RM567, and 567 Oscilloscopes, the Type 3T77 is a versatile Sampling Sweep Unit. Used in conjunction with a Type 3S76 Dual-Trace Sampling Unit, the combination permits a wide range of sampling displays of repetitive waveforms on the crt of the associated oscilloscope.

TRIGGERING CHARACTERISTICS

EXTERNAL TRIGGERING

AMPLITUDE RANGE is 10 mv pk-to-pk minimum, 800 mv pk-to-pk maximum. Damaging overload occurs at 5 volts and greater.

PULSE REPETITION RATE is 10 cps to 300 Mc. Trigger circuitry counts down to maximum sampling rate of approximately 100 kc. (Rate with 3S76, 50 pps to 300 Mc.)

JITTER is 50 picoseconds or 0.1% of fast ramp duration, whichever is greater, for pulses of 50-mv amplitude, 2 nsec width (or 10 mv, 10 nsec width) with repetition rate less than 10 Mc. Jitter increases with less amplitude and/or pulse width, and with repetition rates above 10 Mc.

INTERNAL TRIGGERING

Same specifications as EXTERNAL TRIGGERING, but modified by vertical plug-in being used. When used with 3S76, all specifications are the same except 5X amplitude is required at A or B vertical input.

OTHER CHARACTERISTICS

DISPLAY can be either 10 or 100 dots/cm.

SWEEP RANGE is in 15 calibrated rates from 0.2 nsec/cm to 10 μ sec/cm, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated between calibrated rates.

10X MAGNIFIER extends the calibrated sweep rate to 0.02 nsec/cm.

MANUAL SCAN OR EXTERNAL ATTENUATOR, a dual-purpose control, permits manual scanning of signals or control of external sweep amplitudes.

EXTERNAL SWEEP INPUT is dc-coupled and accepts a minimum 50-v positive going sweep for 10-cm display.

SINGLE DISPLAYS useful for photography can be initiated by a reset button.

SWEEP OUTPUT is 1 v/cm (through 10 kilohms), useful for driving recorders and other devices.

SWEEP DELAY of approximately 100-nsec permits observation of a selected portion of a waveform.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel. Net weight is 5½ pounds. Shipping weight is 14 pounds, approx.

TYPE 3T77 SAMPLING SWEEP UNIT \$650

Each instrument includes: 1—BNC to UHF adapter, 1—BNC to GR adapter, 2—10 nsec RG58A/U cables, 2—10X attenuators, 2—instruction manuals.

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





DUAL-TRACE SAMPLING UNIT Type 4S1

0.35-nsec Risetime

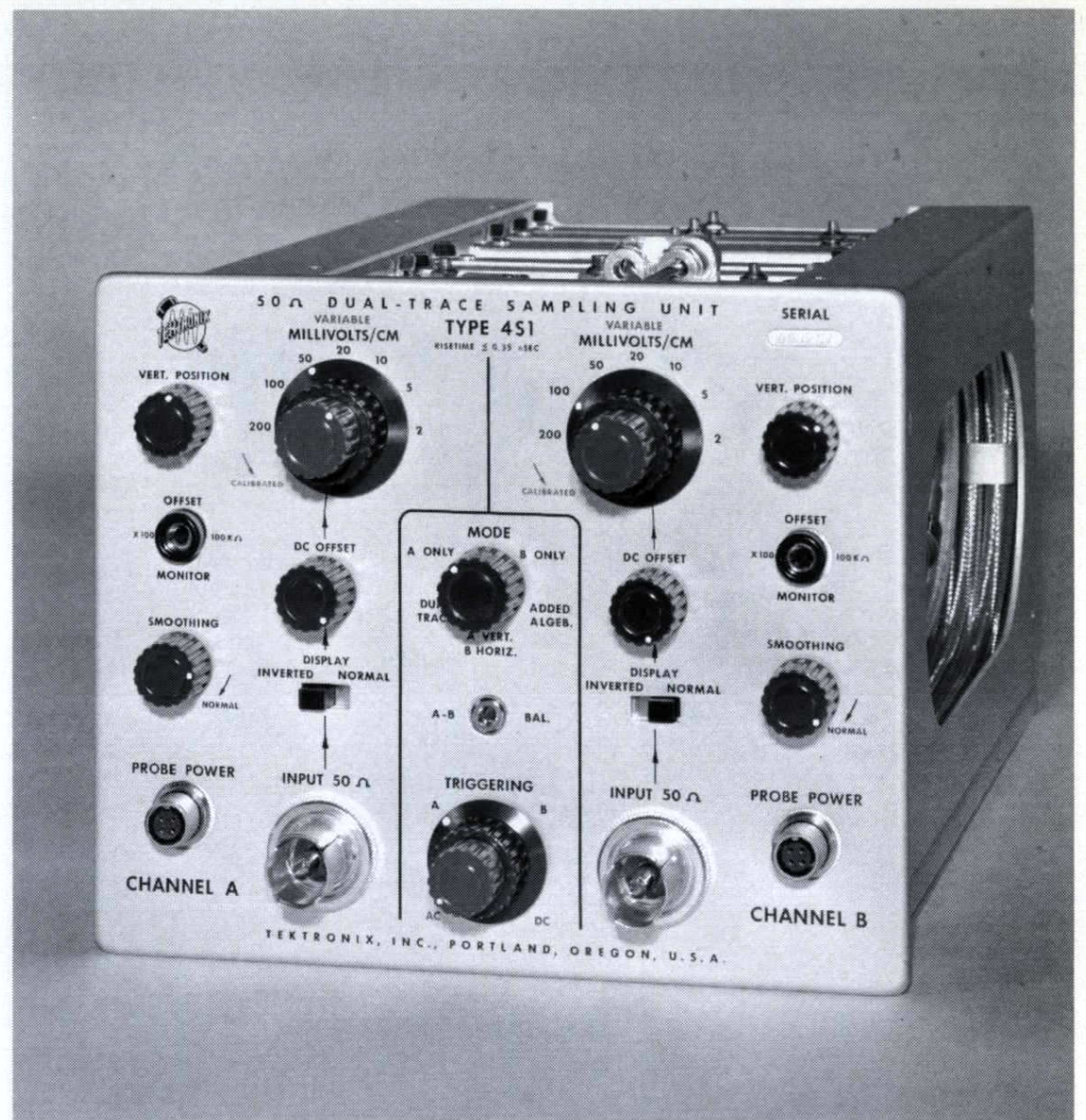
Internal Delay Lines

2 mv/cm to 200 mv/cm Sensitivity

2-volts Dynamic Range

DC Offset Voltage

The Tektronix Type 4S1 Dual-Trace Sampling Unit is a signal plug-in unit for the Type 661 Oscilloscope. The Type 4S1 offers 0.35 nsec or less risetime and time coincidence between Channel A and Channel B within 30 psec. Separate internal trigger take-offs, delay lines, and terminations permit triggering on either A or B input signals.



INPUT CHANNELS can be used in single-trace, dual-trace, algebraic addition, or X-Y operation. Each channel can be operated and controlled independently. Polarity can be inverted for either channel. A smoothing control reduces time jitter and amplitude noises, if needed, when there is sufficient dot density.

RISETIME is 0.35 nsec or less, measured from 10% to 90% amplitude points on an input step.

FREQUENCY RESPONSE is equivalent to dc-to-1000 Mc.

DEFLECTION FACTOR is in 7 calibrated steps from 2 mv/cm to 200 mv/cm, 1-2-5 sequence, accuracy is within 3%. A variable control permits continuous adjustment uncalibrated from 200 mv/cm to 0.6 mv/cm.

NOISE LEVEL is equivalent to an input signal of 1 mv or less unsmoothed or 0.5 mv smoothed. When using both channels (dual-trace), noise will be approximately 1.5 mv.

DC-OFFSET CONTROL provides a means of displaying selected portions of signals having off-screen amplitudes. An externally monitorable variable offset voltage permits dc-coupled measurements of signals riding on a dc voltage as high as ± 1 volt.

INPUT SIGNALS with as high as 2-volts dynamic range can be viewed without overloading the system, even at 0.6 mv/cm sensitivity. Safe overload is ± 10 volts dc (higher with reduced duty factor).

INPUT IMPEDANCE is 50 ohms. A higher impedance is possible using a Tektronix Type P6034 Passive Probe or Type P6032 Cathode-Follower Probe.

PROBE POWER is available at the front panel for cathode-follower probes, such as the Tektronix Type P6032.

WEIGHT: Net—15 $\frac{1}{4}$ pounds.

Shipping—27 pounds, approx.

TYPE 4S1 DUAL-TRACE SAMPLING UNIT \$1430

Each instrument includes: 2—10X 50- Ω attenuators, 2—5-nsec 50- Ω cables, 2—instruction manuals.

PROBES

The **TYPE P6034 MINIATURE PASSIVE PROBE** (10X attenuation) was designed for use with Tektronix plug-ins such as 4S1 and 3S76. Input resistance is 500 ohms at dc and approximately 300 ohms at 1.0 gigacycle. Input capacitance is 0.7 pf ± 0.1 pf at 1.0 Mc to 1.0 gc. Risetime of the probe is less than 100 picoseconds. Ringing and overshoot is 2% or less on pulses from 25 ohm source.

Order Part Number 010-110 \$35

The **TYPE P6032 CATHODE-FOLLOWER PROBE** is a high-impedance, dc-coupled probe with an attenuation range of 10X to 1000X, in a 1-2-5 sequence, with 7 plug-on attenuator heads and a capacitor-coupler head. Maximum output is ± 150 mv. Risetime is typically 0.55 nsec with 4S1. Static capacitance is 3.6 to 1.3 pf. Static resistance is 10 megohms.

Order Part Number 010-108 \$160

FOR THESE AND OTHER LOW CAPACITANCE PROBES
SEE ACCESSORY SECTION.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 5T1 TIMING UNIT



1 nsec/cm to 100 μsec/cm
Calibrated Sweep Speeds

0 to 100 nsec Variable Time Delay

Versatile Triggering

5 to 100 Samples/cm

Repetitive or Single Displays

The Tektronix Type 5T1 Timing Unit is a timing plug-in unit for the Type 661 Oscilloscope. The Type 5T1 generates the time base and provides flexible triggering. Time-base range covers an equivalent sweep rate from 1 nsec/cm to 100 μsec/cm in 16 calibrated rates. This can be extended to 10 psec/cm (with full horizontal magnification of the Type 661 Oscilloscope) and is continuously variable between rates to approximately 3 psec/cm uncalibrated.

INTERNAL TRIGGERING can be accomplished with the Type 4S1 vertical plug-in unit. This feature allows triggering from the vertical input signal and observing the leading edge of fast rise input signals. The internal delay lines eliminate the need for external delay networks and preserves the fast-rise characteristics of the Type 4S1. Nominally, the leading edge of a fast-rise signal will appear 8 to 12 nsec after the equivalent sweep start. Sensitivity is 40 mv for a 2-nsec wide pulse.

FREE RUN TRIGGERING provides stable displays when using the Type 661 delayed-pulse generator.

EXTERNAL 50-OHM TRIGGER INPUT is ac coupled and allows direct connection of the Type 5T1 to the trigger signal. Sensitivity is 5 mv for a fast-rise 2-nsec-wide pulse.

TRIGGER THRESHOLD is continuously variable, ± 200 mv.

RECOVERY TIME may be varied from nominally 10 μsec to 13 μsec on sweep rates faster than 0.2 μsec/cm, longer on slower sweep rates. This normally permits triggering from irregularly spaced pulses.

DISPLAY can be started on either a positive or negative pulse.

SAMPLING DISPLAY is in 5 calibrated steps of 5, 10, 20, 50, or 100 samples/cm (without magnification from Type 661), accuracy within 2%.

EQUIVALENT SWEEP RANGE is in 16 calibrated rates from 1 nsec/cm to 100 μsec/cm, 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from approximately 0.33 nsec/cm to 100 μsec/cm.

VARIABLE TIME DELAY permits moving the equivalent-time sweep start through approximately 100 nsec.

SWEEP MODE selects either repetitive or single displays.

TIME JITTER is less than 30 psec or .01% of fast ramp duration, whichever is greater, on fast-rise pulses of less than 100 kc repetition rate, usable to 1 gigacycle with increased jitter.

MECHANICAL FEATURES include an aluminum-alloy chassis, and anodized front panel. Net weight is 6 pounds. Shipping weight is 12 pounds, approx.

TYPE 5T1 TIMING PLUG-IN UNIT \$750
Each instrument includes: 2—10X 50-Ω attenuators, 1—10-nsec 50-Ω cable, 2—instruction manuals.

TRIGGER PROBE

The P6033 Trigger Probe can be used in applications requiring external signals for triggering units with a 50-ohm external trigger input, such as the Type 5T1. Attenuation of the Type P6033 is 10:1 from 1.5 Mc to 300 Mc and 17:1 from dc-to-100 Kc terminated into 50 ohms (attenuation has a maximum point of 50:1 at 350 kc). Impedance is 1200 ohms paralleled by approximately 2 pf at 250 Mc and 870 ohms at dc, when terminated into 50 ohms (very high at dc when ac coupled, as with the 5T1). Risettime is 1.2 nsec or less. Probe voltage rating is 15 volts dc or rms, dc coupled; 400 v dc or 15 v rms, ac coupled.

Order Part Number 010-100 \$35

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DIGITAL UNIT Type 6R1

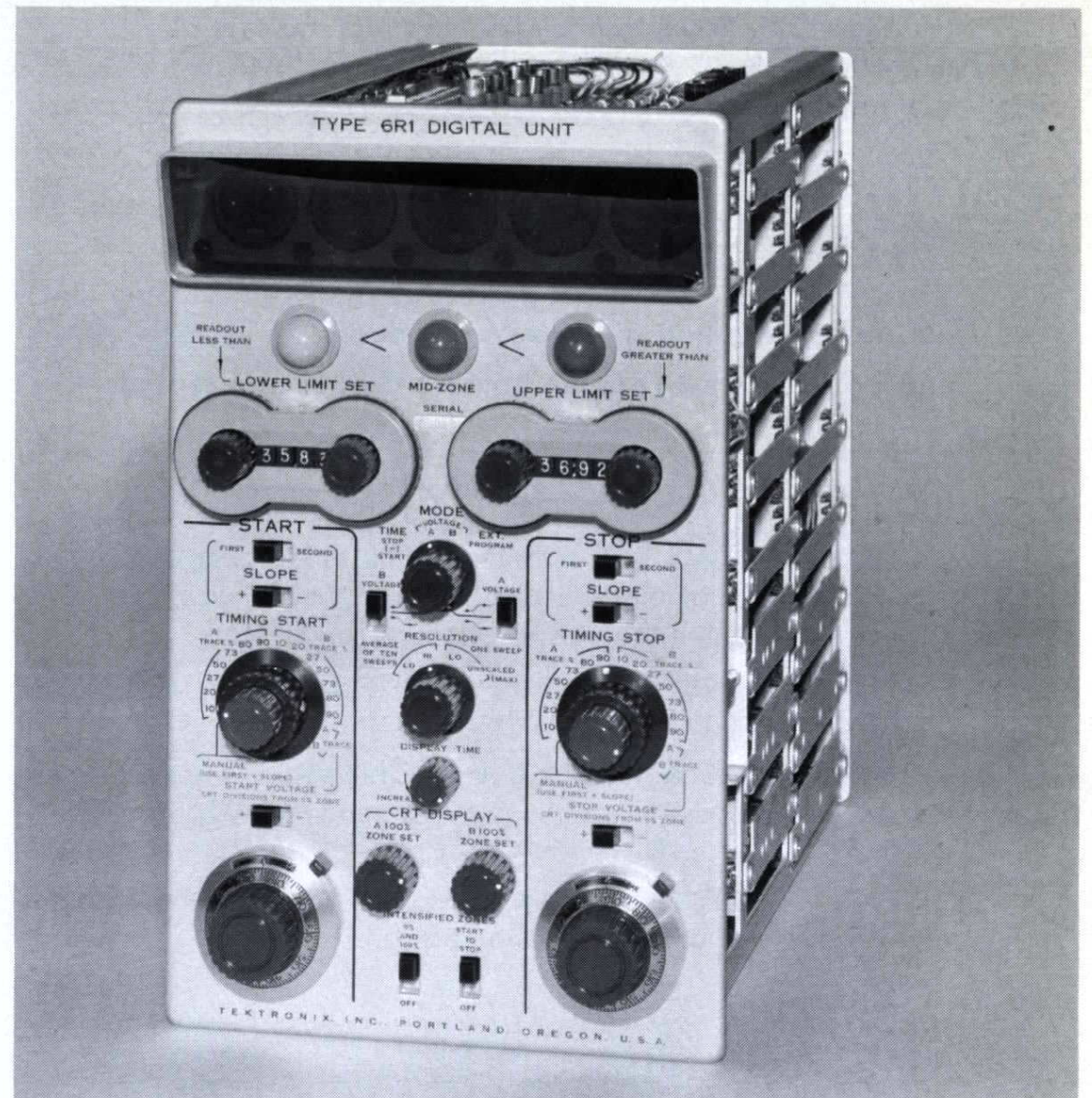
PRESENTS OSCILLOSCOPE MEASUREMENTS IN DIGITAL FORM

DIGITAL READOUT PARAMETERS

- PULSE AMPLITUDE
- PULSE RISE AND FALL
- PULSE WIDTH
- TIME INTERVAL

PROVISIONS FOR EXTERNAL PROGRAMMING AND READOUT

LIMIT SETTINGS AND INDICATORS



The Type 6R1 Digital Unit equips a Tektronix Type 567 Oscilloscope for digital readout. Used with vertical and timing units for the crt displays, the Type 6R1 enables presentation of digital data for a wide variety of repetitive-pulse measurements. The digital presentations can designate voltage measurements, time-difference measurements between similar pulses, and time-difference measurements between percentages of pulse amplitudes. In addition, the Type 6R1 has provision for external programming to facilitate automatic sequential operations. The Type 6R1 enables these time and amplitude measurements to be read directly with up to 4 digit units of measurement.

NOTE: In this presentation, any reference to A or B Channel or A or B trace designates use of a dual-trace unit in the vertical channel of the Type 567 Readout Oscilloscope (along with a sweep unit in the horizontal channel).

OPERATING MODES

TIME STOP-START permits operation of stop and start timing systems.

VOLTAGE A permits A-channel voltage measurements between 0 and 100% zones.

VOLTAGE B permits B-channel voltage measurements between 0 and 100% zones.

EXTERNAL PROGRAM permits external programming from remote or automatic sequences. Couplers/translators not provided.

START TIMING

\pm **SLOPE** selects waveform direction for start timing.

FIRST OR SECOND crossing of the waveform can be selected for start timing. This feature allows starting on first or second pulse in a waveform series.

TIMING START can be from one of seven calibrated % points, 10, 20, 27, 50, 73, 80, and 90% on either A or B trace, accuracy within 2%. The 27% and 73% positions correspond to 1 RC or L/R time constant. A helical measures crt divisions from the 0% zone; accuracy within 2%.

+ OR - SWITCH selects the waveform polarity for start.

MANUAL START, an uncalibrated control, enables start timing at any point on the waveform, and is variable over 9 cm or more of the sweep.

STOP TIMING

The stop-timing system capabilities are identical to the start-timing system but determines the stop-timing point.

6R1

RESOLUTION

AVERAGE TEN SWEEPS-HI—Indicates average of 10 measurements, includes decimal and units of measure.

AVERAGE TEN SWEEPS-LO—Same as HI except units decade is blanked (decimal and units of measure).

ONE SWEEP LO—Indicates measurement of one sweep.

ONE SWEEP UNSCALED—Readout is not scaled for 2 and 5 positions on TIME and AMPLITUDE settings. Readout does not include decimal or units of measure.

DISPLAY TIME—Variable from 0.1 second to 6 seconds.

CRT DISPLAY

A 100% ZONE SET establishes the 100% zone (representing approx. 5% of the sweep) of the channel A waveform. The zone is positionable through 9 horizontal centimeters.

B 100% ZONE SET is identical to A except for positioning on the B waveform.

0% AND 100% INTENSIFIED ZONE switch turns on or off the intensified portion of the waveform in the 0% and 100% zones.

START TO STOP switch turns on or off the intensified portion of the waveform between start and stop.

INDICATOR LAMPS

Can be preset to light when reading is below, above, or within selected limits.

OTHER CHARACTERISTICS

READOUT is in a numerical range from 0.0001 to 9999. Accuracy is within 3%, ± 1 count. Display time is variable from 0.1 second to 6 seconds. Units of measure include: microvolts, millivolts, and volts; nanoseconds, microseconds, milliseconds, and seconds.

INPUT is internally connected from horizontal and vertical plug-in units.

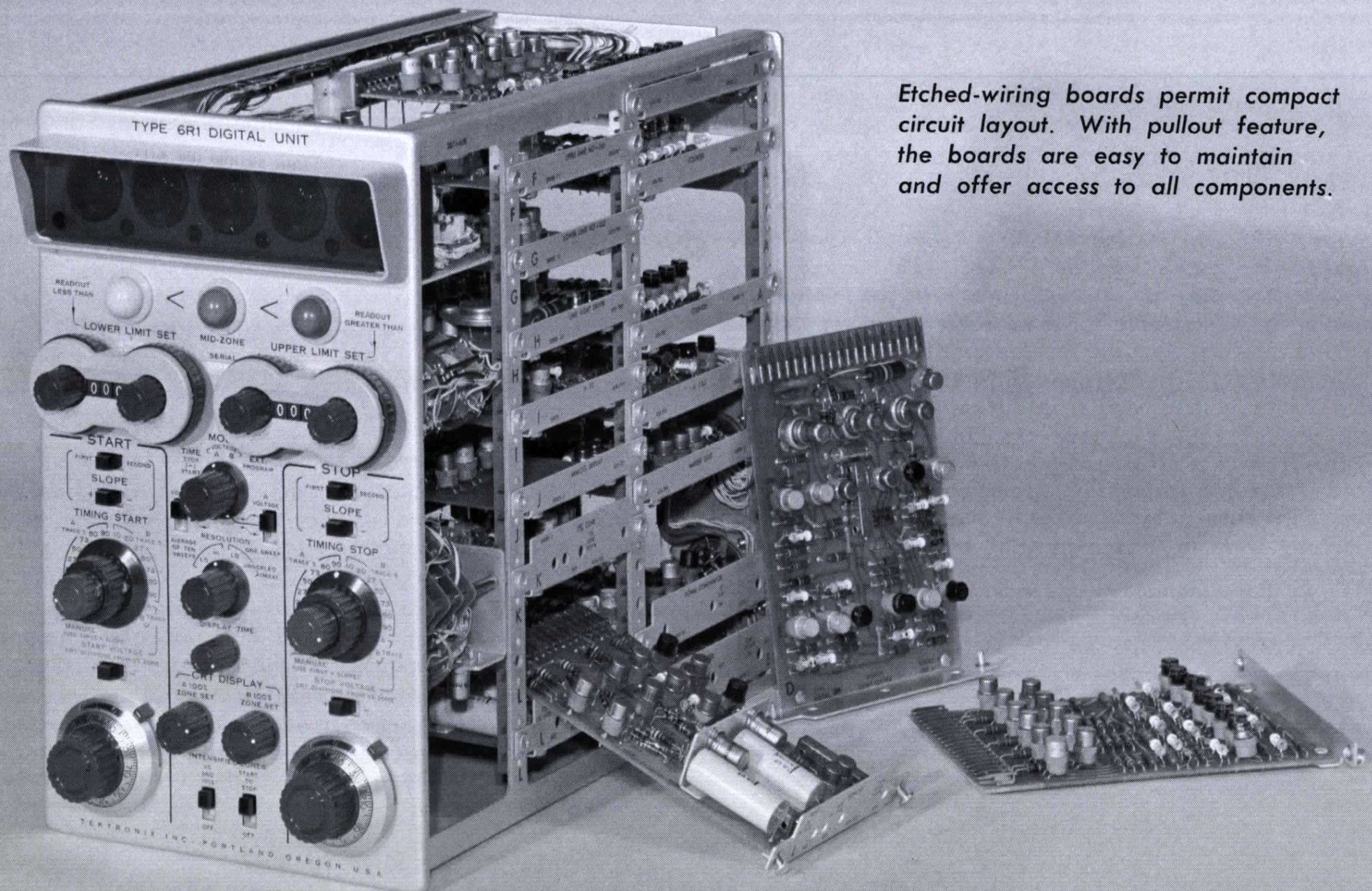
MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel. Net weight is 13 $\frac{3}{4}$ pounds. Shipping weight is 21 pounds, approx.

TYPE 6R1 DIGITAL UNIT \$2500

Each instrument includes: 1—polarized light filter, 2—instruction manuals.

U.S. Sales Price f.o.b. Beaverton, Oregon

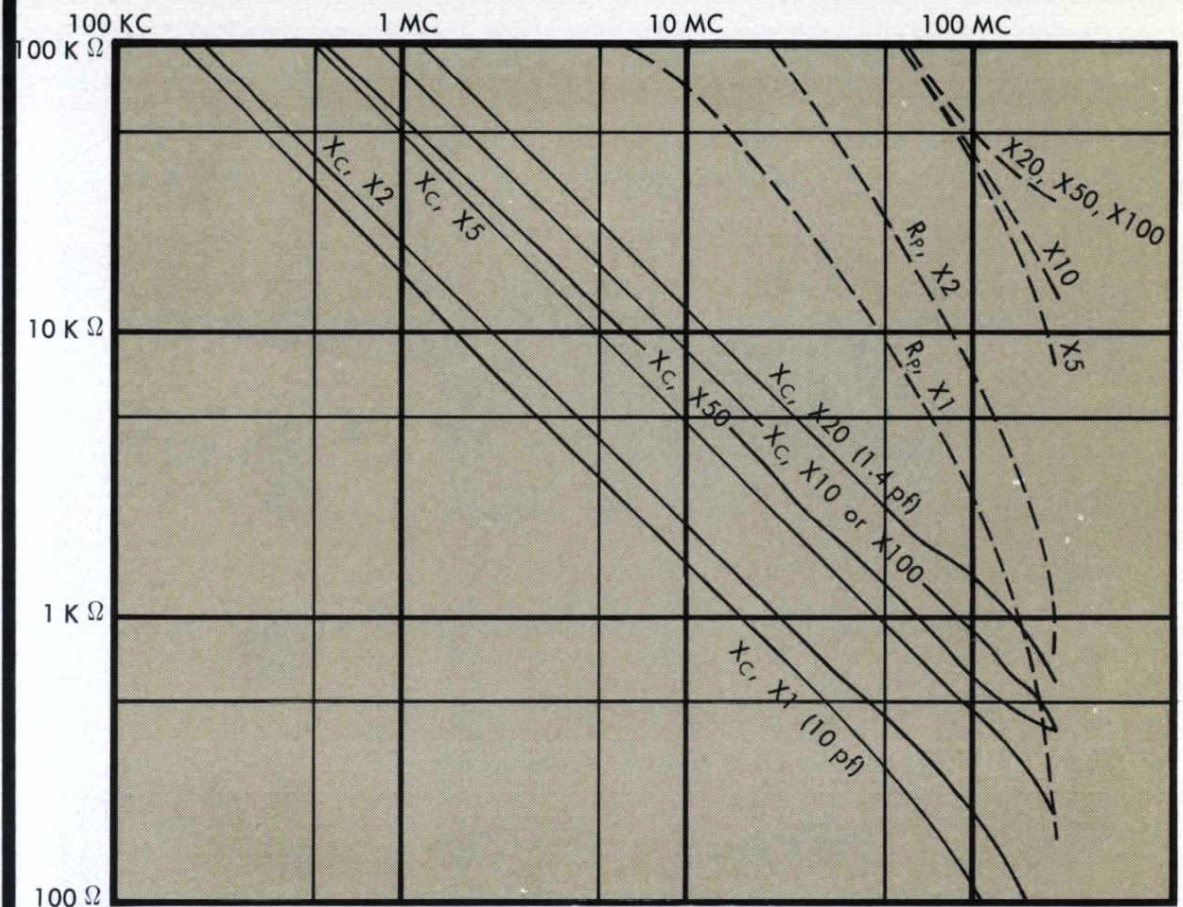
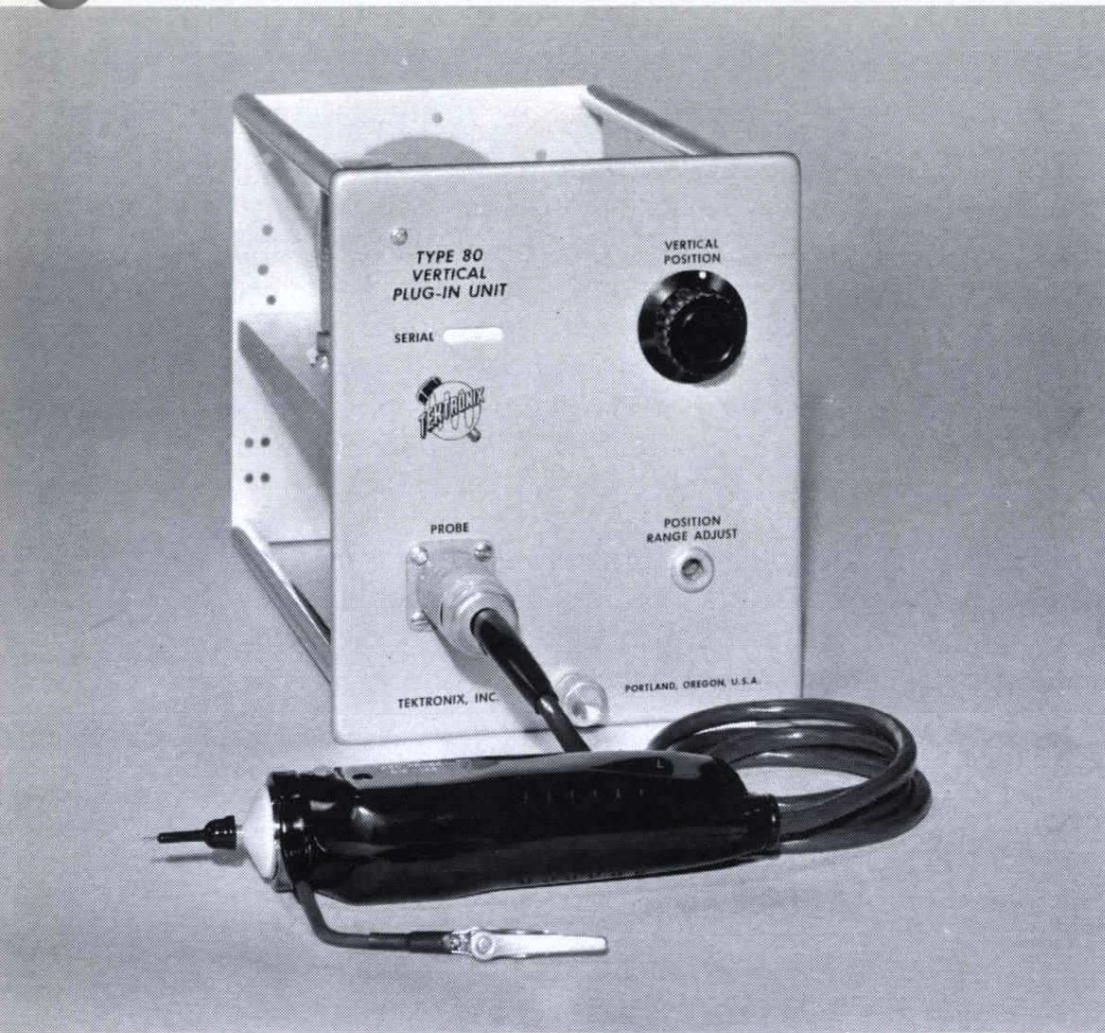
Please refer to Terms and Shipment, General Information page.



Etched-wiring boards permit compact circuit layout. With pullout feature, the boards are easy to maintain and offer access to all components.



PLUG-IN UNIT PROBE Types **80** **P80**



Input Characteristics of Type P80 Probe and Attenuators

Resistive component of input impedance is shown by solid lines for Type P80 alone (X1) and various attenuator heads (X2 through X100). Capacitive reactances for Type P80 alone and with attenuator heads are shown by broken lines.

Above 50 Mc, both input R and C are affected by ground connections. Data shown was measured with coaxial ground connection (013-017) Adapter.

Designed especially for use with the Type 80 Plug-In Unit, the cathode-anode follower Type P80 Probe provides a means for coupling the Type 580-Series Oscilloscopes to the signal source.

The probe can be connected to the signal source using one of the three tips supplied. However, the probe tips and the probe ground lead form a resonant circuit which may produce ringing when excited by fast-rising pulses. Special adapters are available which allow direct connection of the probe nose to Type N, UHF, and BNC connectors. For fast-rising pulses one of these adapters should be used.

Five attenuator heads are supplied with the Type P80 probe. These heads produce vertical deflection factors of 0.2, 0.5, 1, 2, and 5 volts per centimeter. In addition, the heads increase the input resistance of the probe, decrease the input capacitance, and lessen the possibility that the probe will ring.

When used with a Type 581 or Type 585, the following specifications apply: passband dc to approximately 95 Mc... risetime better than 3.9 nsec, 10% to 90%, nominally 3.7 nsec... vertical deflection factor of 0.1 v/cm... input characteristics of 10 pf, 100 kilohms with no attenuation—3.7 pf, 5 megohms with 50X attenuation.

Net weight is 2½ pounds. Shipping weight is 7 pounds.

TYPE 80 PLUG-IN UNIT \$50
Each Plug-In Unit includes: 2 instruction manuals.

TYPE P80 PROBE has impact styrene covering for the shielded components and attached 42" standard cable with 9-pin connector. Dimensions are 5" long (without tip) by 1¼ by 1¾". Net weight is 10 ounces. Shipping weight is 7 pounds, approx.

TYPE P80 PROBE \$99.50

Each Probe includes: 5—attenuator heads (2X, 5X, 10X, 20X, 50X), 2—hook tips, 2—straight tips, 1—ground lead, 1—clip assembly, 1—high-frequency ground clip

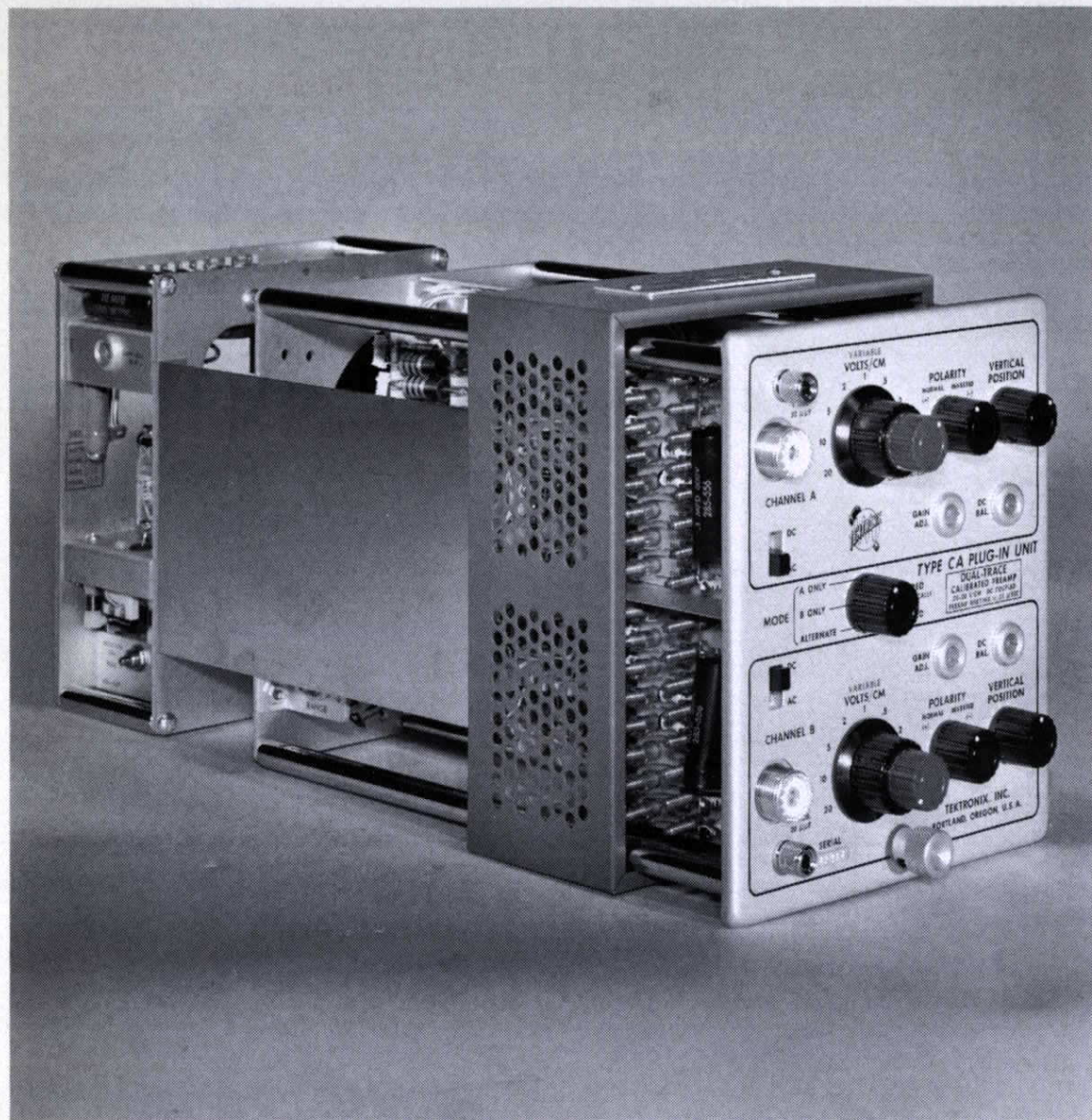
OPTIONAL ACCESSORIES

Description	Features	Part No.	Price
*Standardizing 10X Attenuator Head	Permits additional 10X attenuation with proper impedance matching between P80 probe and one other associated attenuator head.	010-311	\$20.00
Capacitor-Coupler Head	Improves low-frequency 3-db point to 15 cycles with P80 probe.	010-312	\$6.00
*Standardizing 100X Attenuator Head	Permits additional 100X attenuation with proper impedance matching between P80 probe and one other associated attenuator head.	010-321	\$22.50
100:1 Attenuator Head	For minimum input capacitance (1.4 pf) and increased dc resistance (10 megohms).	010-322	\$5.50
Adapter	Adapts probe to Type N connector.	013-016	\$5.00
Adapter	Adapts probe to Type UHF connector	013-017	\$5.00
Adapter	Adapts probe to Type BNC connector	013-018	\$5.00

*The Standardizing 10X or 100X attenuator head permit stacking of it with one other regular attenuator head for higher attenuation with proper impedance matching. Regular P80 attenuator heads, when stacked, will introduce waveform distortion due to impedance mismatch.

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Please refer to Terms and Shipment, General Information page.

Type 81 PLUG-IN ADAPTER



The Tektronix Type 81 Adapter makes possible the use of any Tektronix Type A to Z Plug-In Unit with a Type 581 or Type 585 Oscilloscope. The Type 81 Adapter and appropriate plug-in unit expand the versatility of the 580-Series Oscilloscopes to fields including differential-comparator displays, pulse-sampling, stress analysis, transistor-risetime studies, semiconductor-diode-recovery-time studies, operational amplifiers, and multiple-trace displays, as well as other general and special-purpose applications.

The Type 81 Adapter is extremely easy to use. The Adapter is simply inserted into the Type 580-Series plug-in compartment. The Type A to Z Unit is then plugged into the Adapter. No cabling or switching is required.

Dimensions are 6½" high by 5½" wide by 12½" deep. Net weight is 2½ pounds. Shipping weight is 7 pounds, approx.

TYPE 81 PLUG-IN ADAPTER \$135

Each Adapter includes: 2—instruction manuals.

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



DUAL-TRACE UNIT Type 82

10 MV/CM MAXIMUM SENSITIVITY

CALIBRATED STEP ATTENUATION

4 NSEC RISETIME AT 100 MV/CM

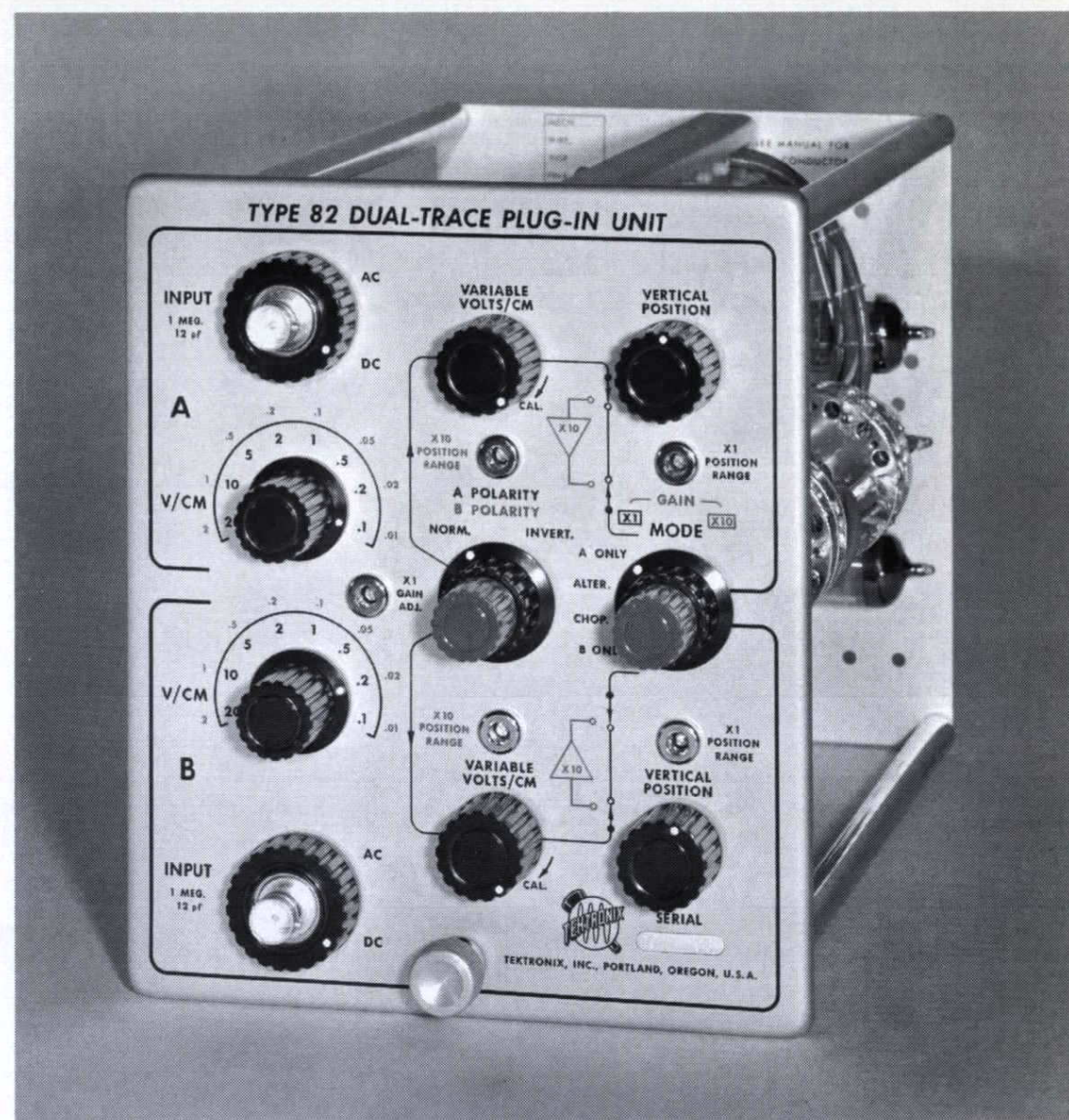
4.3 NSEC RISETIME AT 10 MV/CM

The Type 82 Dual-Trace Plug-In Unit adds dual-trace facility to the Tektronix Type 580-Series Oscilloscopes through its 2 identical input channels.

Free-running or triggered electronic switching between channels enables simultaneous observation of two signals. Independent controls for each channel allow individual attenuation, positioning, inversion, and coupling as desired.

With the Type 82 Plug-In Unit, a 580-Series Oscilloscope can display the time difference between two signals, the response of two circuits to the same pulse, the input and output waveforms of a circuit, and many other dual-trace operations—quickly and easily.

NOTE: Some early Type 580-Series Oscilloscopes must be modified to provide optimum transient response with the Type 82 Plug-In Unit.



RISETIME of the Type 82 with Type 580-Series Oscilloscope is nominally 4 nsec at 100 mv/cm, always less than 4.2 nsec. At 10 mv/cm, using the 10X Amplifier, risetime is nominally 4.3 nsec, always less than 4.5 nsec.

4 OPERATING MODES include Channel A only, Channel B only, Chopped (free-running electronic switching between channels at either approximately 100 kc or 1 Mc) and Alternate (triggered electronic switching between channels, at the end of each sweep).

DEFLECTION FACTOR is in 8 calibrated steps from 100 mv/cm to 20 v/cm, 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from 100 mv/cm to approximately 40 v/cm.

10X AMPLIFIER, dc-coupled, extends sensitivity to 10 mv/cm. Deflection factor is then in 8 calibrated steps from 10 mv/cm to 2 v/cm, 1-2-5 sequence. The variable control provides uncalibrated adjustment from 10 mv/cm to approximately 4 v/cm.

POLARITY INVERSION can be used to compare signals 180° out of phase.

AC or DC COUPLING is possible. When ac-coupled, the low-frequency 3-db point is 15 cps direct or 1.5 cps with the P6008 10X Probe.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 12 pf.

WEIGHT: Net—4³/₄ pounds
Shipping—10 pounds, approx.

TYPE 82 DUAL-TRACE PLUG-IN UNIT \$650

Each Type 82 includes 2 instruction manuals and two P6008 10X passive probes. The probes increase the input resistance to 10 megohms and decreases the input capacitance to approximately 7 pf. The risetime of a Type 580-Series Oscilloscope, a Type 82 Plug-In Unit, and a P6008 Probe, at an overall sensitivity of 1 v/cm is approximately 5 nsec.

MODIFICATION FOR EARLY INSTRUMENTS

TYPE 581/585 VERTICAL STANDARDIZATION MOD KIT improves and standardizes the transient response of early Type 580-Series Oscilloscopes. The Mod Kit is essential for the use of a Type 82 Plug-In Unit in the early instruments and also improves the performance of these instruments when used with the Type 80/P80 combination.

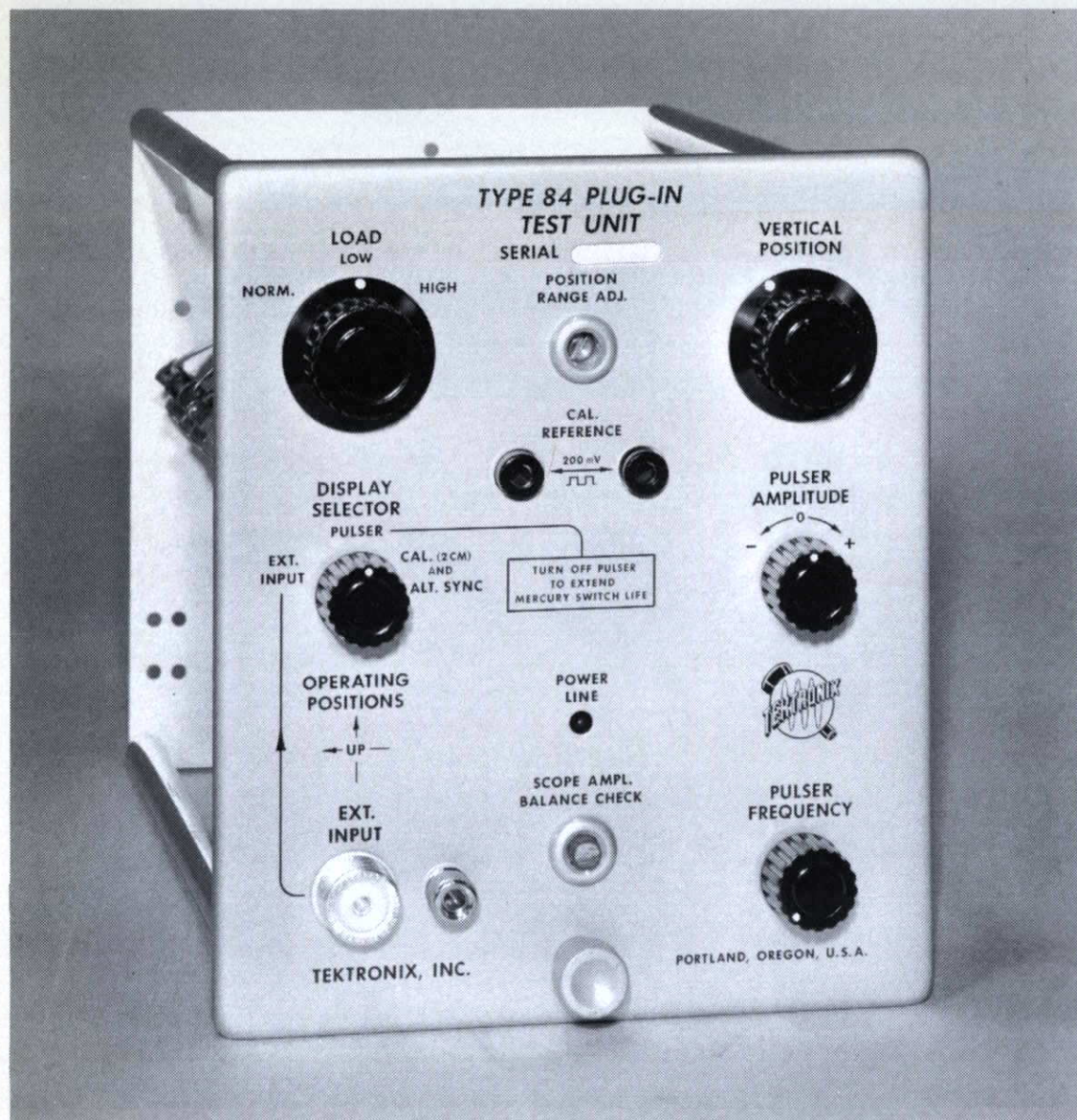
Tektronix Type 580-Series Oscilloscopes with serial numbers prior to #950 for Type 581 and #2585 for Type 585 may require this modification. If in doubt about instrument modification, please consult your Field Engineer.

Order Part Number 040-275 \$25

Each kit includes components to change delay-line impedance, standardize crt termination, modify crt and distributed-amplifier circuitry, and modify Type 80 Plug-In Unit—Type P80 Probe combination.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 84 PLUG-IN TEST UNIT



...for standardizing vertical sensitivity and transient response of Type 580-Series Oscilloscopes and checking general oscilloscope performance.

Variable 500-800 (approx.) PPS Mercury Pulser

0.2 nsec Pulse Risetime

Continuously Adjustable Pulse Amplitude,
0 to 4 major divisions.

Positive or Negative Polarity

External Input for Time Markers

Selectable Loads for Checking Oscilloscope Power Supply
Ripple at Low and High Load

200 mv $\pm 2\%$ Reference Voltage for Gain
Standardization.

The Type 84 Plug-In Test Unit generates a fast-rise, step-function test signal of known waveshape for use in standardizing the transient response of the oscilloscope. In addition, the Type 84 Test Unit facilitates checking (1) the dual-trace alternate sync, (2) the main oscilloscope amplifier gain, (3) the power-supply regulation at minimum and maximum load capabilities, and (4) the oscilloscope dc vertical balance.

After standardizing a Type 580-Series Oscilloscope with the Type 84 Test Unit, the oscilloscope will accept either a Type 80 or Type 82 Plug-In Unit without readjustment of the frequency-compensating circuits.

Note: As a result of component aging, particularly tubes, the transient response of an amplifier changes over a period of time. In contrast, the Type 84 Plug-In Test Unit will maintain stable waveform characteristics.

WEIGHT: Net—4³/₄ pounds
Shipping—10 pounds, approx.

TYPE 84 PLUG-IN TEST UNIT \$195
Each plug-in unit includes: 2—instruction manuals.

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





SQUARE-WAVE GENERATOR Type 105

Risetime

Less than 20 nsec into a terminated 93-ohm cable.
As short as 13 nanoseconds 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.



The Tektronix Type 105 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. Risetime is less than 20 nsec into a terminated 93-ohm cable, and is approximately 13 nanoseconds into a 52-ohm cable terminated at both ends.

Testing wide-band amplifiers with a Type 105 Square-Wave Generator and an oscilloscope is a fast, efficient method for revealing pulse characteristics such as transient response, bandwidth, and phase shift. The Tektronix Type 105 Square-Wave Generator makes 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 risetime 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.

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.

Risetime—Less than 20 nsec into a terminated 93-ohm cable; approximately 18 nanoseconds when the 93-ohm cable is terminated at both ends; approximately 13 nanoseconds 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.

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.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 250 watts.

Mechanical Specifications—Dimensions are 16 $\frac{7}{8}$ " high by 10 $\frac{3}{8}$ " wide by 15 $\frac{1}{4}$ " deep. Net weight is 34 $\frac{1}{4}$ pounds. Shipping weight is 47 pounds, approx.

TYPE 105 GENERATOR \$435

Each instrument includes: 1—93- Ω 42" coaxial cable, 1—93- Ω terminating resistor, 1—binding-post adapter, 1—3-conductor power cord, 1—clip-lead adapter, 2—instruction manuals.

Optional Cables and Resistors

93-ohm cable and resistor normally is 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.

Attenuators, Cables and Terminations

A selection of terminating resistors, attenuators, 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 attenuators can be supplied upon request.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

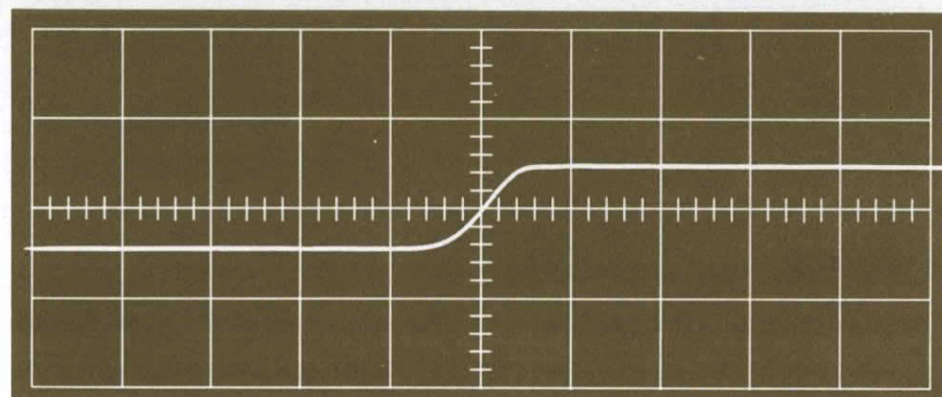


Fig. 1. 13-nanosecond risetime of the Type 105 displayed on 20 nsec/cm sweep. Generator connected to vertical deflection plates of T54P crt, sensitivity 7 v/cm, with 52-ohm cable terminated at both ends.

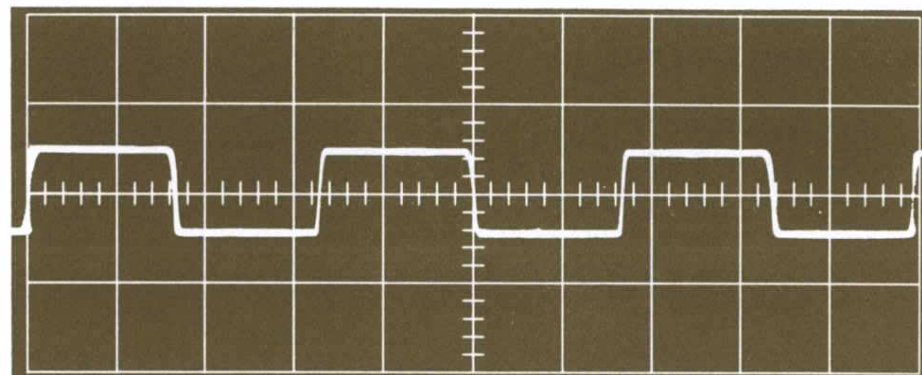


Fig. 2. Sharp leading edge, square corner, and flat top of 1-mc square-wave output of Type 105 displayed on 0.3 μ sec/cm sweep. Other conditions same as in Fig. 1.



SQUARE-WAVE GENERATOR Type 107

Risetime

Less than 3 nsec 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.



The Type 107 Square-Wave Generator is basically intended as a test accessory for Tektronix Instruments.

With less than 3-nsec risetime, the Type 107 provides a suitable square wave for checking and adjusting high-frequency response of most Tektronix Oscilloscope and Wide-Band Preamplifiers. Source impedance is approximately 52 ohms. Output is ac coupled.

CHARACTERISTICS

Risetime—Less than 3 nanoseconds 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 greater than 1 Mc.

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

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.

Power Supply—A conventional full-wave rectifier system employs a capacitor-input filter, a regulated +150 v is supplied for the output tube screen grid to insure constant output amplitude with a given APPROXIMATE AMPLITUDE setting.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 100 watts.

Mechanical Specifications—Dimensions are 10-9/16" high by 7" wide by 11 1/8" deep. Net weight is 13 pounds. Shipping weight is 20 pounds, approx.

TYPE 107 GENERATOR \$190

Each instrument includes: 1—52-Ω 42" coaxial cable, 1—52-Ω terminating resistor, 1—3-conductor power cord, 1—52-Ω "T" attenuator, 2—instruction manuals.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 109 PULSE GENERATOR



0.25 nsec Risetime Pulses

Alternate Pulses of Equal or Different Time Duration

Calibrated Variable Amplitude Pulses of Either Positive or Negative Polarity

Pulse Durations to 40 nsec

The Type 109 is intended for use with fast-rise sampling systems or conventional oscilloscopes that generate their own internal sweep trigger. The Type 109 is transistorized and requires no warmup time before operating.

CHARACTERISTICS

PULSE RISETIME is less than 0.25 nsec.

PULSE WIDTH is near 0.5 nsec to a maximum of 40 nsec at full repetition rate; 300 nsec at half repetition rate. An external charge network with a 10X attenuation provides long duration pulses. Amplitude decay is only 10% in 300 nsec.

REPETITION RATE is preset between 550 pulses/sec to 720 pulses/sec.

PULSE AMPLITUDE can be selected from three calibrated ranges extending from zero volts through fifty volts, accuracy within 3%.

PULSE POLARITY can be either positive or negative.

OUTPUT IMPEDANCE is 50 ohms.

CHARGE LINES, either one or two, can be used to provide alternate equal or unequal pulses as desired. Equal charge lines produce a repetition rate of 550 pulses/sec to 720 pulses/sec.

EXTERNAL DC CHARGE VOLTAGE INPUTS permit alternate pulses of different amplitudes and/or polarity. Maximum external charge voltage is 600 volts. With up to 100 volts input, the output amplitude will be half the external input amplitude. At voltage inputs over 100 volts, the output amplitude will be less than half the input amplitude.

DC-POWER SUPPLIES are electronically regulated to compensate for widely varying load conditions.

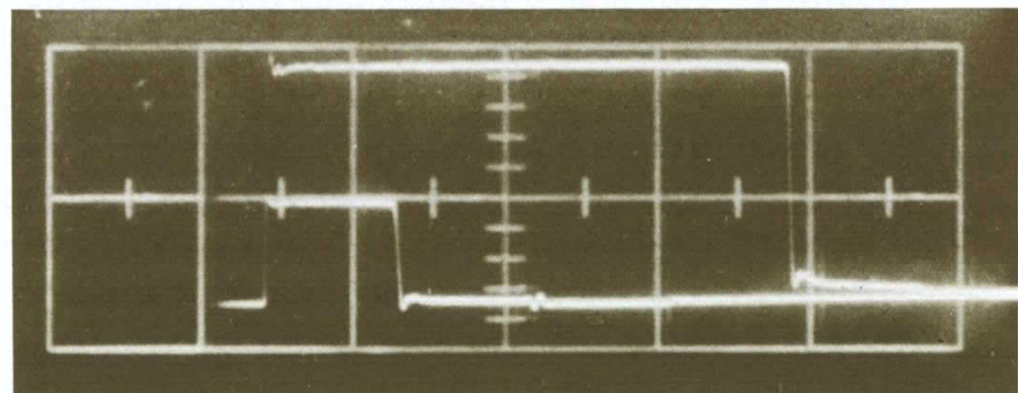
POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v, 50 to 800 cps, typically 60 watts.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel. Dimensions are 7⁷/₈" high by 5" wide by 11³/₄" deep. Net weight is 8¹/₂ pounds. Shipping weight is 18 pounds, approx.

TYPE 109 PULSE GENERATOR \$360

Each instrument includes: 1—3-conductor power cord, 3—charge lines (GR RG8/AU 50-Ω, 5-nsec cables), 1—charging network, 2—instruction manuals.

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



Alternate pulses of different widths and amplitudes produced by using 5-nsec and 20-nsec charge lines and external charge voltages. Vertical sensitivity 10 v/cm, sweep speed 10 nsec/cm.



PULSE GENERATOR Type 110

PULSE GENERATOR

Pulse risetime—less than 0.25 nsec.

Pulse width—approximately 0.5 nsec, minimum, 40 nsec maximum at full repetition rate, 300 nsec at half repetition rate (one charge line disabled).

Output— ± 50 v maximum calibrated output on internal power supply; ± 500 v maximum allowed from external sources with single charge lines and ± 400 v maximum with charge lines connected to both sides.

Output impedance—50 ohms.

Repetition rate—720 pulses/sec, nominally. Can be synced with line frequency.

TRIGGER TAKEOFF SYSTEM

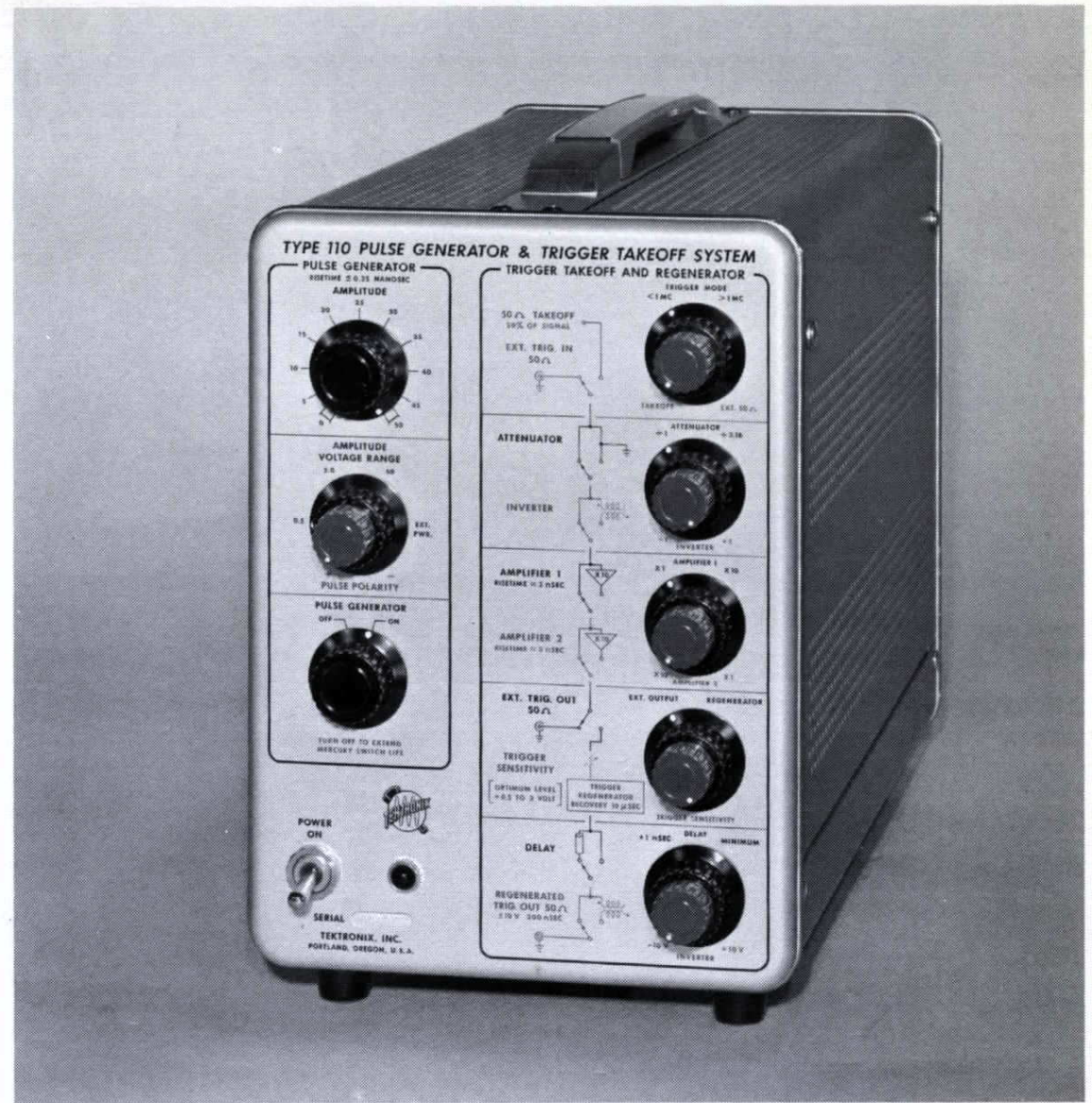
Input impedance—50 ohms.

Output signal to trigger system—amplitude approximately 20% of input signal.

Input signals through system—50 mv to 50 volts (transmission losses and reflections less than 2½%).

Direct external trigger input—10 mv to 10 volt signal.

Regenerated trigger out signal— ± 6 to 10 v, 4 nsec 50% risetime, 220 to 280 nsec duration.



The Tektronix Type 110 Pulse Generator and Trigger Takeoff System generates pulses of less than 0.25 nsec risetime by means of a mercury relay. Repetition rate is nominally 720 pulses/sec. Output impedance is 50 ohms. The system will generate alternate pulses of different widths, and with externally applied voltage, different amplitudes and/or polarities.

The Trigger Takeoff System uses two amplifiers that assure stable triggering over a wide range of signal amplitudes. The switching system permits polarity change and trigger signal amplification, necessary to drive the trigger regenerator. The trigger regenerator output of nominally 6 to 10 volts for 220 to 280 nsec is adequate for triggering oscilloscopes with relatively slow trigger responses and for starting the Type N Sampling Unit. Maximum random repetition rate is about 100 kc, but the system counts down from approximately 100 Mc. Trigger-response impulse speed is about 1 nsec without amplifiers and 3 nsec with amplifiers. Normal triggering occurs on signals down to 50 mv.

With its calibrated output, the Type 110 Pulse Generator and Trigger Takeoff System facilitates measurement of amplifier linearity and trigger sensitivity to amplitude or pulse-width changes. The system is useful for sampling applications and conventional applications with oscilloscopes having inadequate triggering characteristics.

Charge Lines—One or two charge lines can be used to provide equal or unequal alternate pulses.

Equal charge lines produce 720 pulses/sec free running or line sync. Unequal charge lines produce wider alternate pulses. External charge voltage permits alternate pulses of different amplitudes and polarity.

Trigger Takeoff—The signal is patched into a 50-ohm "loop through" arrangement. Approximately 98% of the input voltage appears at the output after passing through the takeoff (a 2% reflection appears at the input). Approximately 20% of the signal voltage appears as a trigger signal.

Regenerated Trigger—A regenerated trigger signal of ± 6 to 10 volts amplitude and 220 to 280 nsec duration is available at the REGENERATOR OUT connector. Timing delay is nominally 20 nsec, an additional nsec is available from a front-panel switch. The recovery time is 10 μ sec, with count down from approximately 100 Mc at a uniform repetition rate. Below 100 kc, a random repetition rate is permissible.

DC-Voltage—Supplies are electronically regulated.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 48 watts at 117 v.

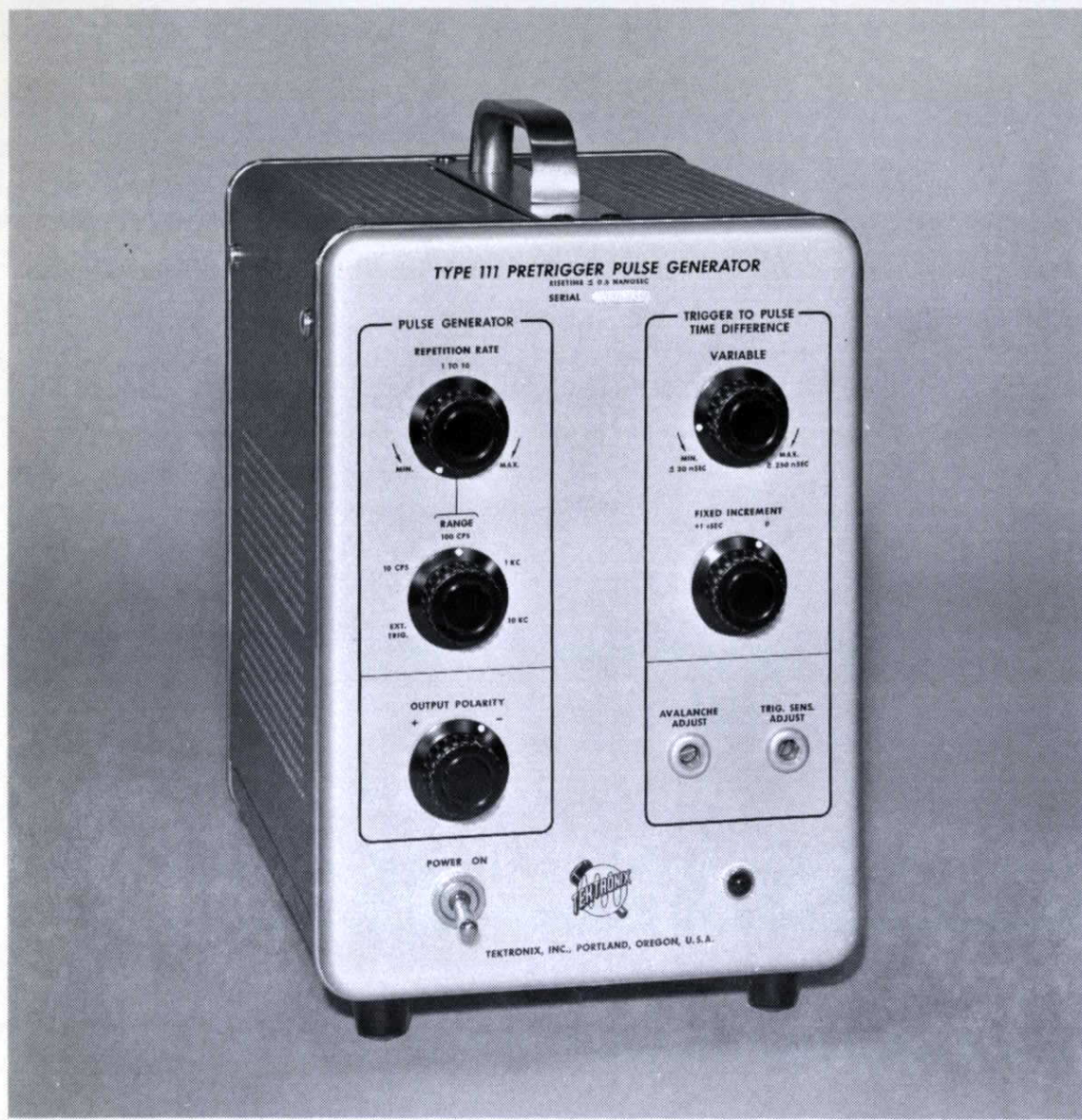
Mechanical Specifications—Dimensions are 10¾" high by 7" wide by 15⅞" deep. Net weight is 14¾ pounds. Shipping weight is 23 pounds, approx.

TYPE 110 PULSE GENERATOR \$650

Each instrument includes: 1—2 nsec 50 Ω coax cable RG58A/U with G.R. connectors, 1—5 nsec 50 Ω coax cable RG8A/U with G.R. connectors, 1—20 nsec 50 Ω coax cable RG8/U with G.R. connectors, 2—instruction manuals.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 111 PULSE GENERATOR



The Type 111 is a high-repetition rate, fast-rise pulse generator. It is primarily intended for use with the Tektronix Type N Sampling Plug-In Unit; however, its characteristics make it ideally suited for use with conventional oscilloscopes and other equipment as well. The unit provides two pulse outputs: the fast-rising Output Pulses and the Pretrigger Pulses. The Pretrigger Pulses occur from 30 to 250 nanoseconds ahead of each Output Pulse. These Pretrigger Pulses can be used as a Regenerated Trigger Signal for the Type N Unit or as a triggering signal for a conventional oscilloscope. The amount of delay between the Pretrigger Pulse and the Output Pulses is variable by means of a front panel control. This eliminates the need in most applications for low loss delay cables.

Output Pulse Risetime—Equal to or less than 0.5 nsec when the OUTPUT POLARITY Switch is in the (+) position. When the switch is in the (−) position, the risetime is slightly longer.

Output Pulse Duration—Minimum, approximately 2 nsec with no external charge line. Maximum, 100 nsec at low repetition rates decreasing to 20 nsec at 100 kc repetition rate. Maximums are obtained with an external charge line.

Output Pulse Polarity—Either (+) or (−) as selected by a front panel control.

Output Pulse Repetition Rate—Four repetition rate ranges and a vernier control provide a continuous range of adjustment from approximately 10 pps to approximately 100 kc. Overlap between ranges is about 5%.

Output Pulse Aberrations—When the output is properly terminated, overshoot and other aberrations are less than 5% of the peak amplitude of the Output Pulses (as observed on an oscilloscope with a Type N Plug-In Unit).

Pulse Amplitude—More than ± 5 volts. The output voltage is fixed by the particular avalanche transistor used. External attenuators are necessary to vary the output amplitude. Refer to Accessories section for available 50 Ω attenuators.

Pretrigger Pulse Characteristics—Amplitude is about 10 volts, duration is about 250 nsec, and half-amplitude risetime is about 4 nsec.

Pulse Delay—The Output Pulse is delayed from 30 to 250 nsec after generation of the Pretrigger Pulse. The delay is continuously variable by means of a front panel control. Time jitter between the Pretrigger and the Output Pulse is less than 100 picoseconds.

Output Impedance—50 ohms.

External Trigger Signal—Positive 5 volts or greater at rise rate of 3 volts/ μ sec or faster and repetition rate from dc to about 100 kc.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 35 watts at 117 v.

Mechanical Specifications—Dimensions are 11 $\frac{1}{8}$ " high by 7" wide by 11 $\frac{1}{8}$ " deep. Net weight is 8 $\frac{3}{4}$ pounds. Shipping weight is 16 pounds, approx.

TYPE 111 GENERATOR \$365

Each instrument includes: 1—72" GR RG58A/U 9-nsec coaxial cable, 1—50- Ω 10X attenuator, 1—3-wire power cord, 2—instruction manuals.

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



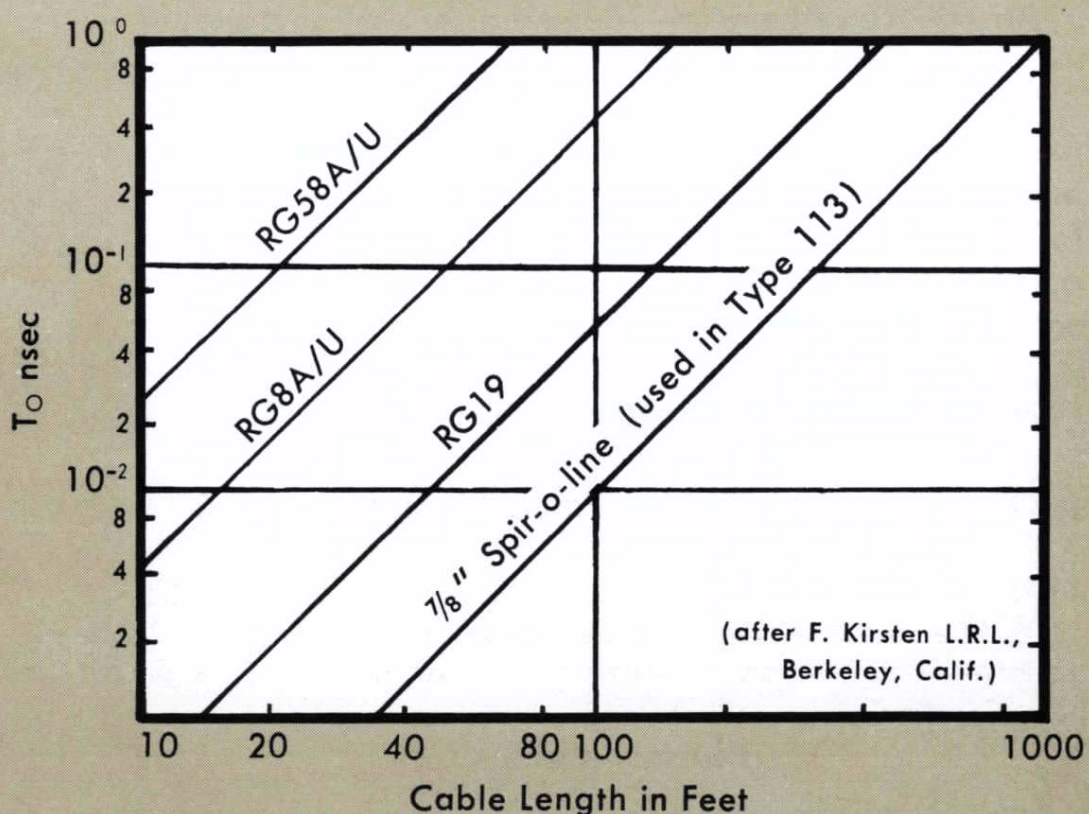


TRANSMISSION LINES

Transmission lines used for nanosecond pulses are commonly of the transverse electric and magnetic fields mode type. The Type 113 uses this mode, because response is desired to zero frequency with minimum dispersion. In the nanosecond region, skin effect losses cause most of the pulse distortion in well-constructed cables. This results in a nongaussian response. Risetimes of cascaded cables do not follow the usual rms addition method of combining risetimes, as in gaussian amplifiers.

Transmission line distortion of a step function shows up in a distinctive way. After a small transition period, the output rises fairly rapidly and then slows considerably, compared to an RC charge. An RC step requires 2.2 time constants to change from 10% to 90% of the input step. A transmission line requires 30 times the 0-to-50% risetime period to accomplish this (10% to 90%) transition.

The graph illustrates time of rise from 0-to-50% (T_0) of the input for various common coaxial cables. Note that the risetime deteriorates as the square of the length. Thus, it is very important to keep cable lengths (or delays) to a minimum. The Type 113 uses about 50 feet of $\frac{7}{8}$ " diameter cable, resulting in a 0-to-50% risetime of about 0.0025 nanosecond, and 10% to 90% of better than 0.1 nanosecond.



In general, the Tektronix Type 113 Delay Cable is used in those sampling applications in which the Type 110 Trigger Takeoff derives the trigger from a signal—so the trigger can arrive ahead of the signal at the Type N Sampling Plug-In Unit.

The Type 113 Delay Cable may also be used in those applications in which the signal source supplies a suitable trigger—for direct operation of the Type N without need of the Type 110.

Adequate Time Delay—60 nsec inserted in the system where required (with the Type 110 and N system, about 10 nsec can be seen ahead of a fast leading edge).

High Quality Cable—Approximately 1.5 db loss per 100 feet at 1000 mc. Risetime is approximately 0.1 nsec.

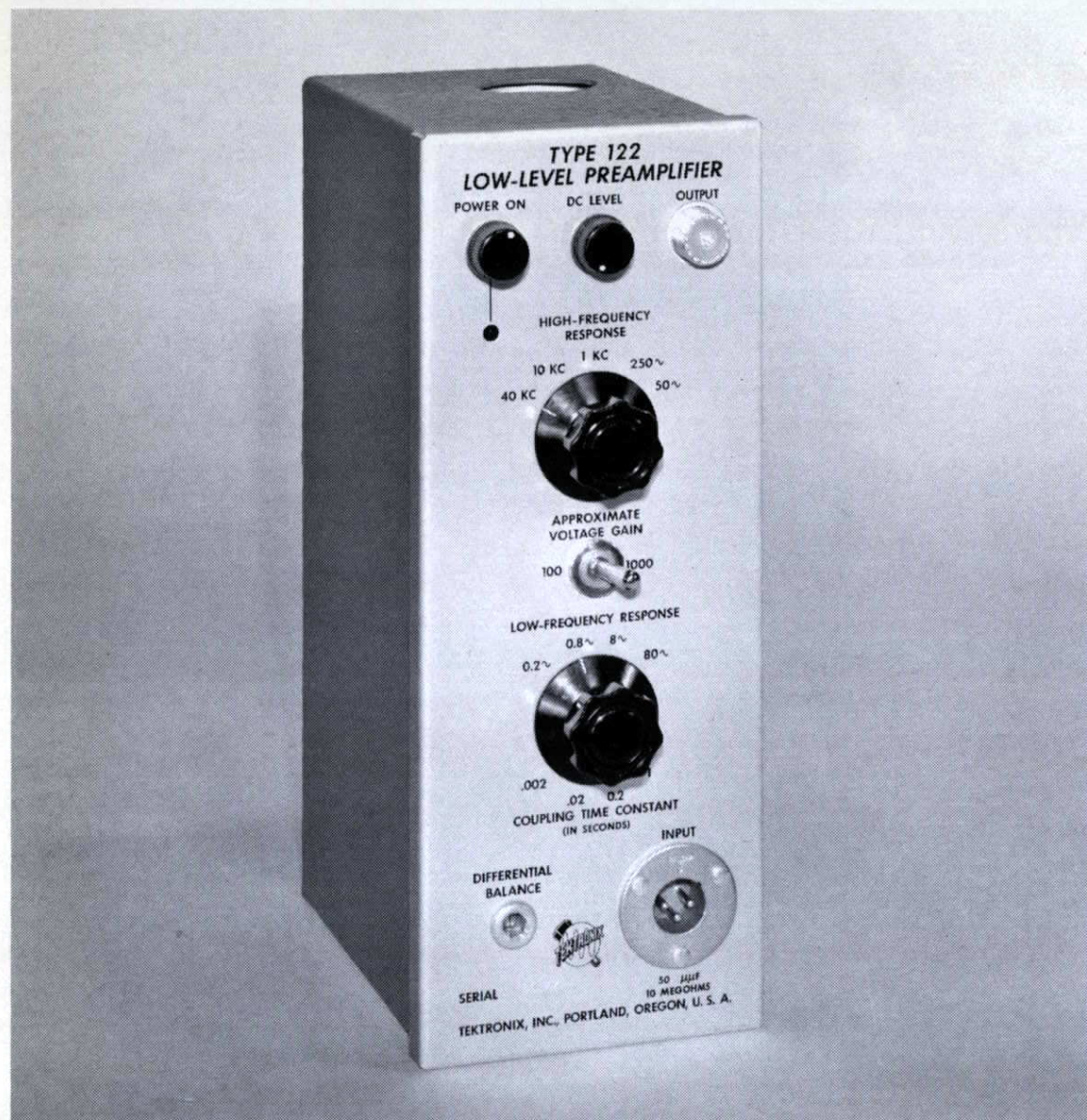
Mechanical Specifications—Three-piece cabinet houses the coaxial cable compactly coiled between two G.R. connectors. Side panels and bottom panel are easily removable. Rubber feet installed in one side, the bottom, and the back, facilitate use of the Tektronix Type 113 Delay Cable in any of three positions.

Dimensions are $22\frac{3}{8}$ " high by $8\frac{5}{8}$ " wide by $21\frac{7}{8}$ " deep. Net weight is $44\frac{3}{4}$ pounds. Shipping weight is 61 pounds, approx.

TYPE 113 DELAY CABLE \$200

U. S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 122 LOW-LEVEL PREAMPLIFIER



Voltage Gain

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

Frequency Response

0.2 cps to 40 kc maximum.

Input Selection

Single ended or differential.

The Tektronix Type 122 Low-Level Preamplifier is a compact 3-stage 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. 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 the Tektronix Type 125 Power Supply or battery power reduce microphonics, noise, and hum to a low level.

Frequency Response—Maximum passband is 0.2 cycles to 40 kc, with 5 approximate high-frequency 3-db cutoff points. . . 50, 250 cps, 1, 10, and 40 kc; and 4 approximate 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 points are controlled by separate switches so a variety of frequency response characteristics can be obtained.

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

Rejection Ratio—80 to 100 db for in-phase signals from 5 cycles to 40 kc; maximum common-mode signal input is 4 v.

Signal Output—Maximum signal output is 20 v (peak-to-peak) for a maximum signal input of 0.02 v (peak-to-peak) in high gain position and 0.1 v (peak-to-peak) in low gain position. AC input signals up to these maximums or dc levels up to ± 0.1 v (either gain setting) can be handled by the Type 122 before waveform distortion occurs. Output impedance is approximately 1000 ohms.

Input Impedance—With single-ended input, the impedance is 10 megohms paralleled by approximately 50 pf. Impedance for differential input is 20 megohms paralleled by approximately 50 pf.

Noise Level—Depending on the setting of the frequency response controls, the noise level, referred to the input, is 1 to 5 microvolts rms with the input terminals grounded.

Power Requirement—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 Type 122 can be powered by the Type 125 Power Supply or by batteries. 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.

Mechanical Specifications—Dimensions are 12 1/4" high by 4 1/8" wide by 7 1/8" deep. Net weight is 4 3/4 pounds. Shipping weight is 9 pounds, approx.

TYPE 122 PREAMPLIFIER \$135

Each instrument includes: 1—battery cable, 1—input plug, 1—output cable, 2—instruction manuals.

Battery Cables

Extra long battery cables can be ordered to fit a particular arrangement.

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



FRAME MOUNT Type FM122

CHARACTERISTICS

The Type FM122 has a specially designed front panel and cabinet for use where mounting in a vertical position is required. It can be mounted in an existing support or adapted to mounting in a standard rack by a Tektronix Mounting Frame.

Electrical characteristics of the Type FM122 are the same as described for the Tektronix Type 122 Preamplifier.

Mechanical Specifications—Dimensions are 12 1/4" high by 4 1/8" wide by 7" deep. Net weight is 5 1/2 pounds. Shipping weight is 9 pounds, approx.

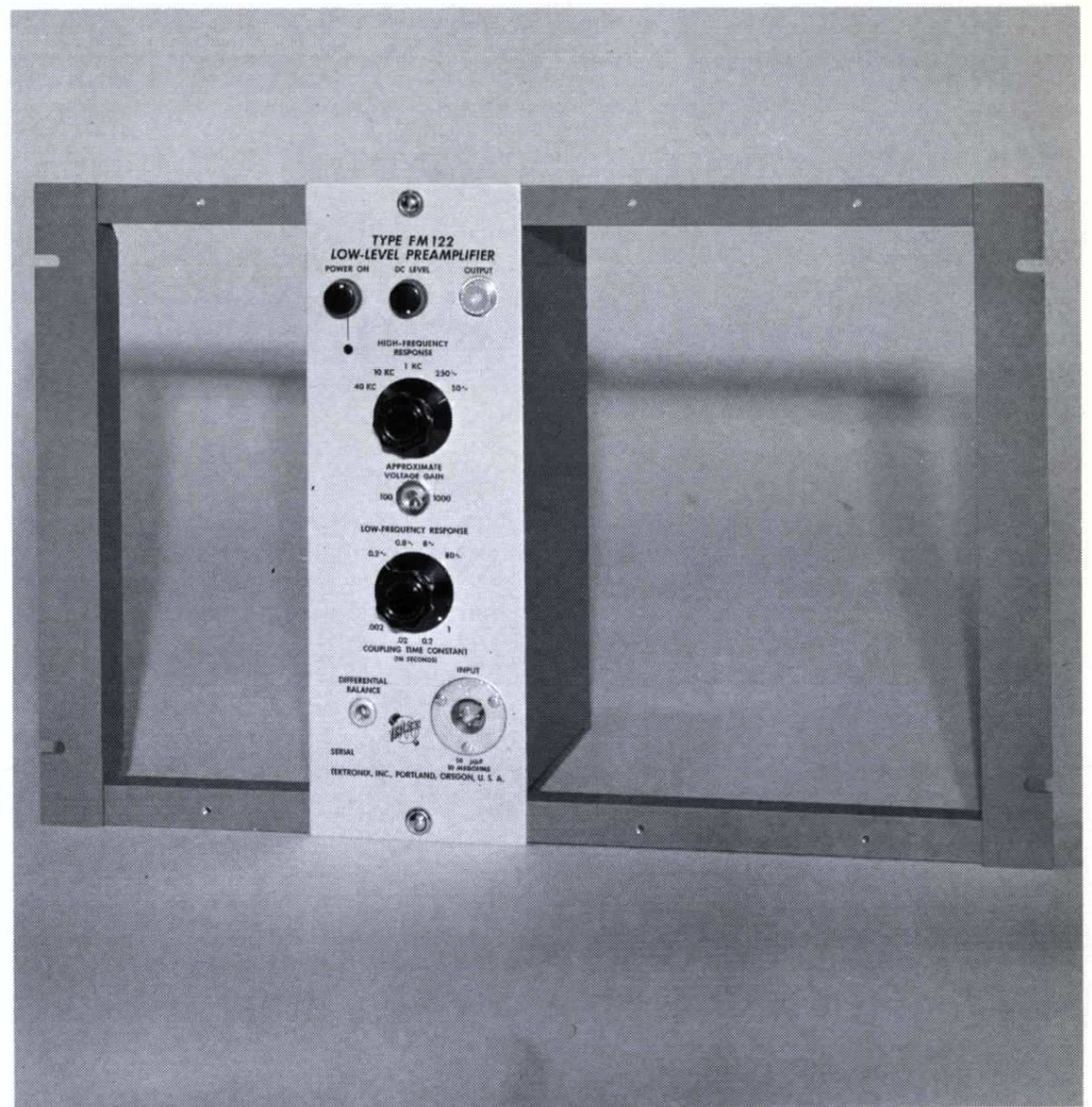
TYPE FM122 (without Mounting Frame) \$140

Each instrument includes: 1—battery cable, 1—input cable, 1—output cable, 2—instruction manuals.

Mounting Frame

Fits any standard 19-inch rack and is fastened to the front of the rack by four screws. Adapts Type FM122 Preamplifier to rack mounting. Capacity is four of any combination of Type 122 Preamplifier, Type 125 Power Supply, Type 360 Indicator, and Type 160-Series units. Order Part Number 014-002 \$5

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



RACK MOUNT Type RM122

CHARACTERISTICS

The Type RM122 is a mechanically rearranged Type 122 Preamplifier for horizontal mounting in a standard 19-inch rack. The instrument is fastened to the front of the rack by four screws. It requires only 5 1/4 inches of rack height.

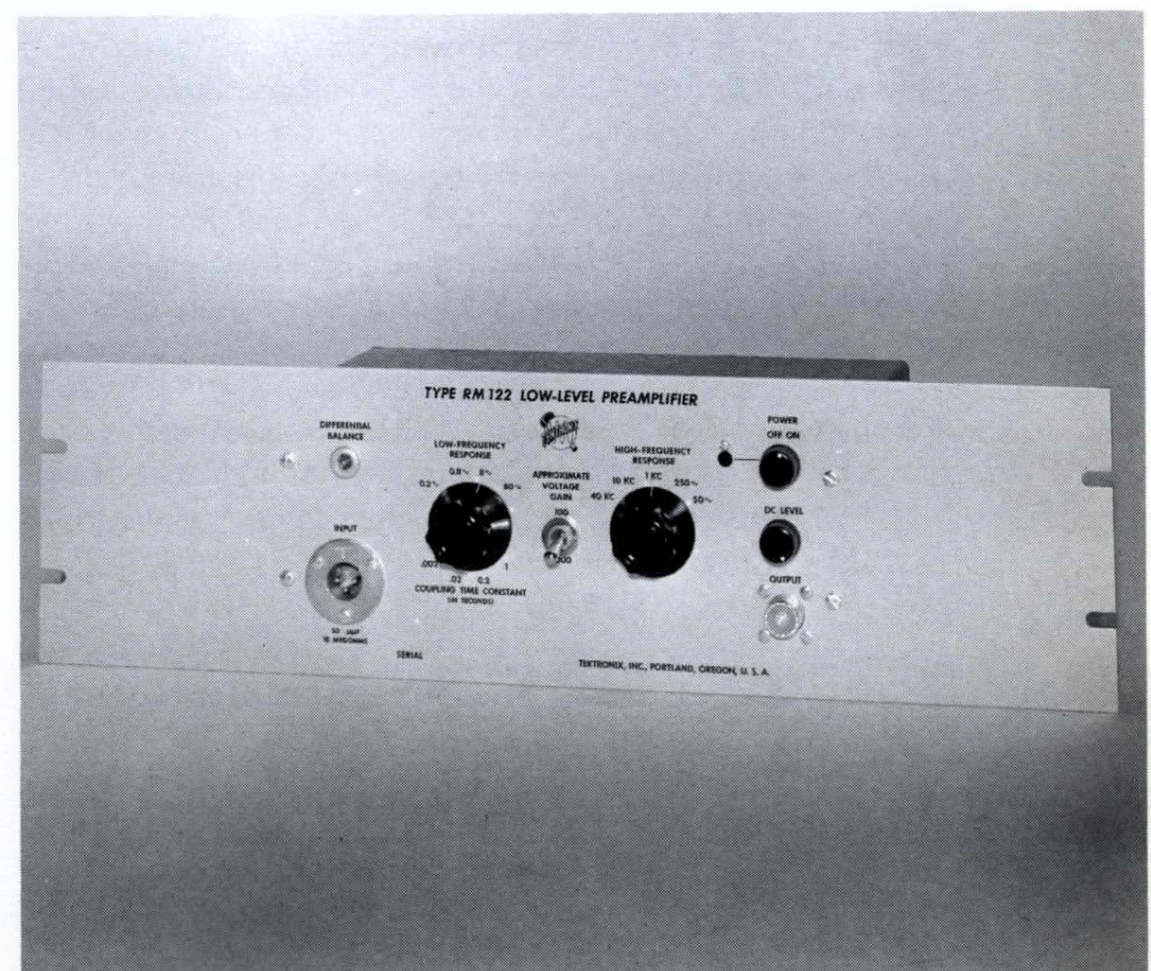
Electrical characteristics of the Type RM122 are the same as described for the Tektronix Type 122 Preamplifier.

Mechanical Specifications—Dimensions are 5 1/4" high by 19" wide by 7" deep. Net weight is 6 pounds. Shipping weight is 12 pounds, approx.

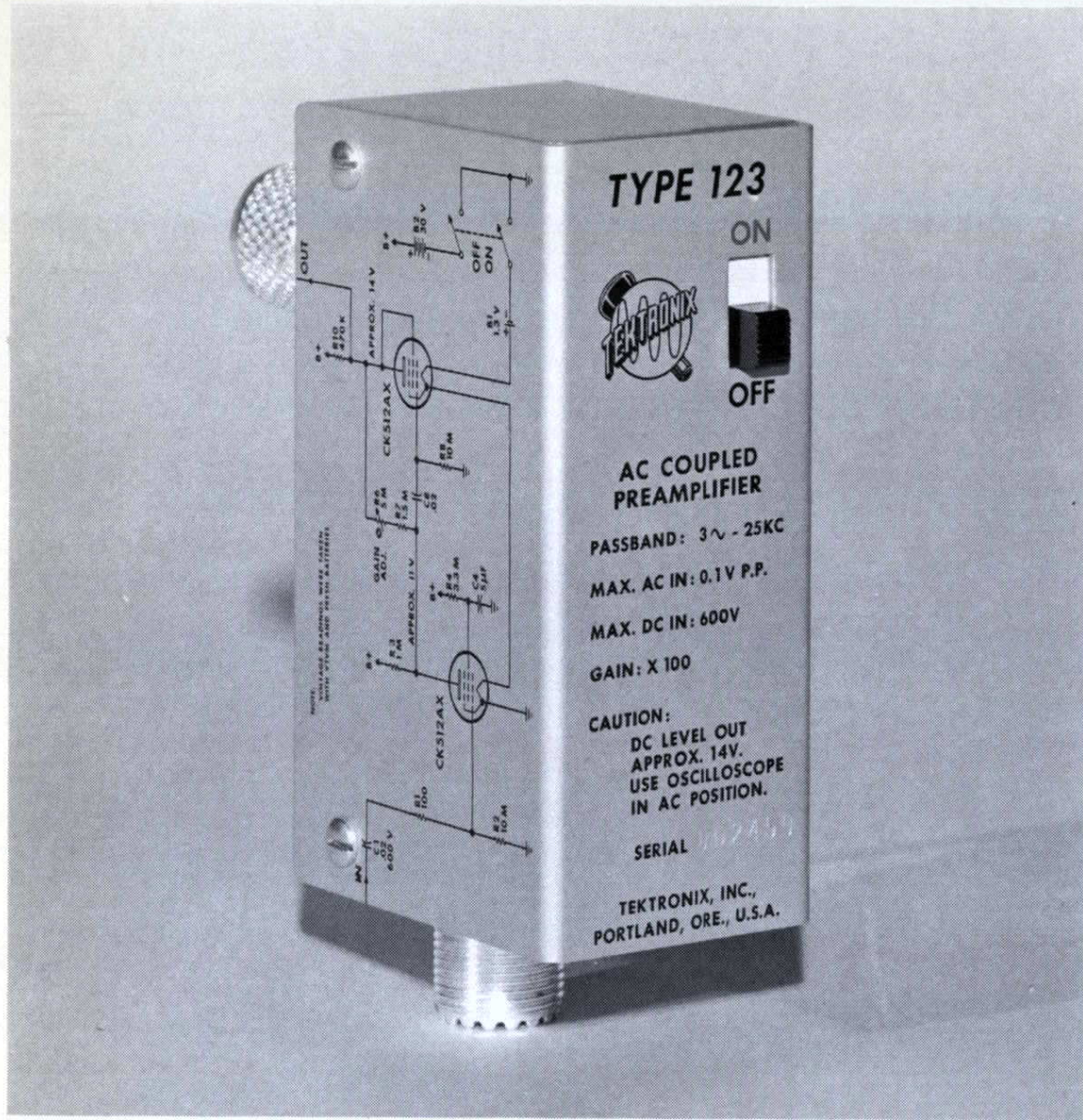
TYPE RM122 \$140

Each instrument includes: 1—battery cable, 1—input cable, 1—output cable, 2—instruction manuals.

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



Type 123 PREAMPLIFIER



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 within 3-db from 3 cps to 25 kc. 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 preamplifier, 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 cps to 25 kc. Within 2% from 15 cps to 6 kc.

Compact

4 1/4" high, 1 1/2" wide, 3 7/8" deep.

Weights only 10 ounces.

Voltage Gain

Accurately set at 100 times.

Passband

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

Maximum Input Signal

0.1 v peak-to-peak.

Hum-Free Low-Level Amplification

Powered by miniature batteries.

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 approximately ~~100~~ ¹⁵⁹⁰ hours.

Noise Level—The maximum noise level, referred to the input, 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.

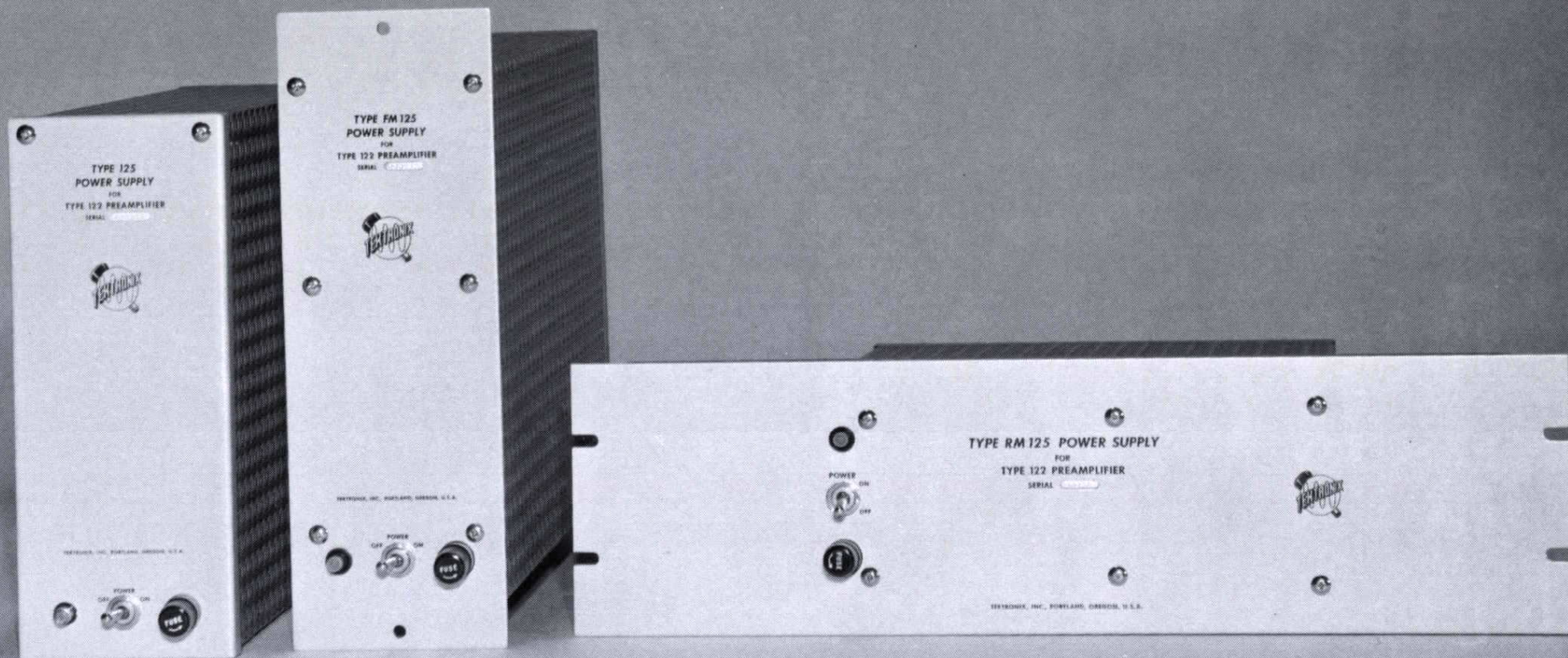
Power Requirement—One 1.345 v mercury cell and one 30 v miniature battery, included with the instrument.

Mechanical Specifications—Dimensions are 4 1/4" high by 1 1/2" wide by 3 7/8" deep. Net weight is 10 ounces. Shipping weight is 2 pounds, approx.

TYPE 123 PREAMPLIFIER ^{7.50} \$50
Each instrument includes: 1—schematic

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





Electronic Voltage Regulation

Output Voltages

- + 135 v dc, 0 to 20 ma.
- 90 v dc, 0 to 20 ma.
- 6 v dc, 0.7 to 4 amp.

The Type 125 Power Supply provides power for one to four Type 122 Amplifiers.

Peak-to-peak ripple voltages are: + 135 v supply, less than 3 mv; - 90 v supply, less than 2 mv; - 6 v supply, less than 5 mv. Voltage stability of the Type 125 is assured by use of regulated voltages applied to the tube heaters.

Power Requirement—105 v to 125 v, or 210 v to 250 v, 50 to 60 cps, 110 watts.

Mechanical Specifications—Dimensions are 14 5/8" high by 4 1/8" wide by 10 3/8" deep. Net weight is 15 pounds. Shipping weight is 23 pounds, approx.

TYPE 125 POWER SUPPLY \$285
Each instrument includes: 4—36" interconnecting cables, 1—3-conductor power cord, 2—instruction manuals.

The Type FM125 has a specially designed front panel for use where vertical mounting in a standard rack is desired. It can be mounted in an existing support or adapted to mounting by a Tektronix mounting frame. Electrical characteristics are the same as described for the Type 125 Power Supply.

Mechanical Specifications—Dimensions are 12 1/4" high by 4 1/8" wide by 13 1/2" deep. Net weight is 15 pounds. Shipping weight is 23 pounds, approx.

TYPE FM125 \$290
Each instrument includes: 4—36" interconnecting cables, 1—3-conductor power cord, 2—instruction manuals.

Mounting Frame

Fits any standard 19-inch rack and is fastened to the front of the rack by four screws. Capacity is four of any combination of Type 122 Preamplifier, Type 125 Power Supply, Type 360 Indicator, and Type 160-Series units.
Order Part Number 014-002 \$5

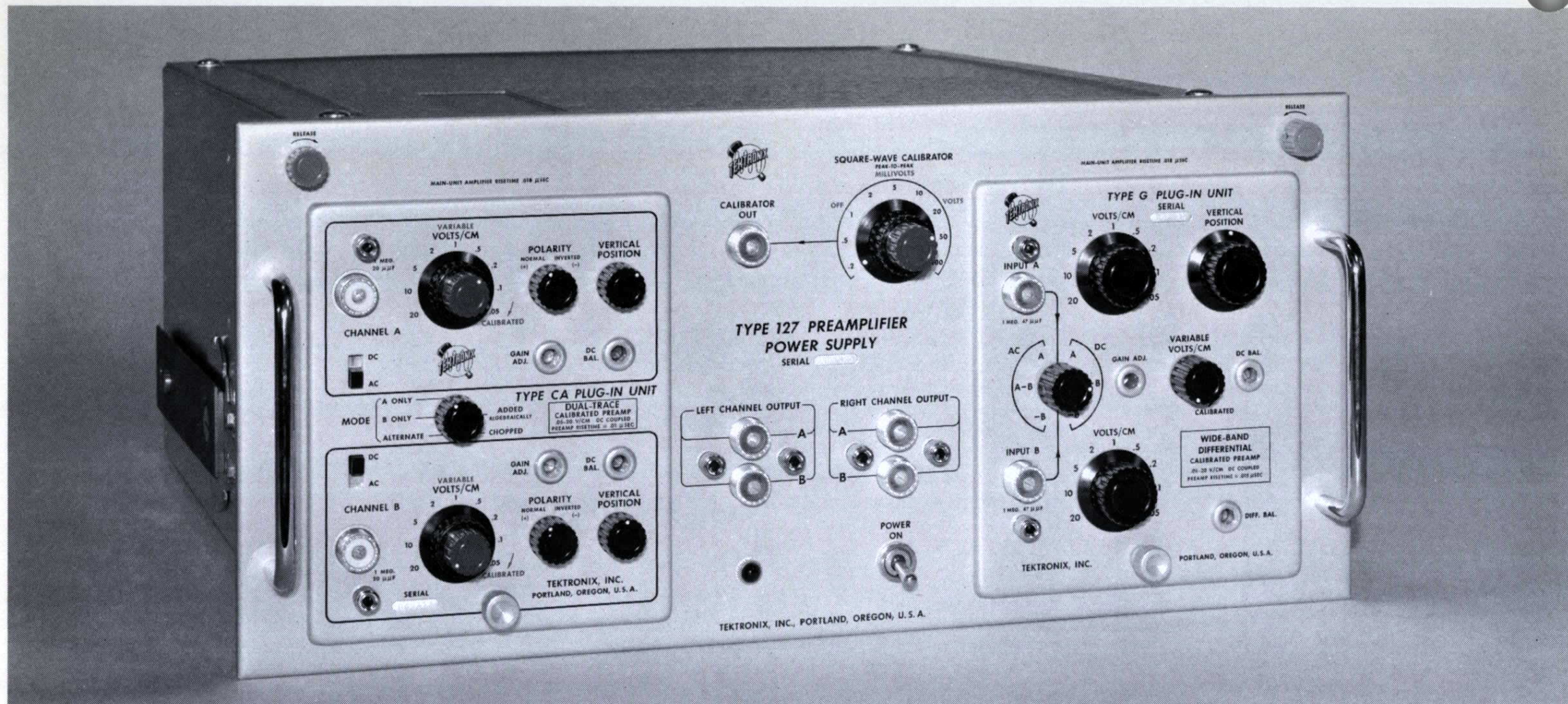
The Type RM125 is a mechanically rearranged Type 125 for horizontal mounting in a standard 19" rack. Electrical characteristics are the same as described for the Type 125.

Mechanical Specifications—Dimensions are 5 7/32" high by 19" wide by 13 1/2" deep. Net weight is 15 pounds. Shipping weight is 23 pounds, approx.

TYPE RM125 \$290
Each instrument includes: 4—36" interconnecting cables, 1—3-conductor power cord, 2—instruction manuals.

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 127 PREAMPLIFIER POWER SUPPLY



CHARACTERISTICS

The Tektronix Type 127 Preamplifier Power Supply provides operating power to one or any combination of two Tektronix Type A to Z Plug-In Units. This permits the operation of Tektronix Plug-Ins separate from the oscilloscope in which they are normally used. Tektronix Plug-In Units, powered by the Type 127 can be used to further increase the signal-handling versatility of Tektronix Oscilloscopes employing Type A to Z Plug-In Units. For example, a double-differential dual-trace display can be obtained with a Type 127 and two Type D, E, or G Plug-In Units—when used in conjunction with an oscilloscope and Type C-A Plug-In Unit.

Also Triggering Signal Input Terminals are provided at the rear of the instrument to permit the introduction of triggering pulses into a Type C-A Unit or Type M Unit to utilize the alternate-sweep features of these multitrace units. The triggering pulses may be obtained from the + GATE OUT terminal of the associated oscilloscope.

The Type 127 also facilitates the use of Tektronix Plug-In Units in other applications.

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 18 nsec, permitting maximum utilization of the response of Tektronix Type 530-Series Oscilloscopes. Push-pull output swing is linear $\pm 3\%$ over a range of ± 0.3 volt into 170-ohm termination. 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.

Electronic Regulation—All dc supply voltages to the Plug-In Units are electronically regulated to compensate for line voltage and load variations between 105 and 125 v or 210 and 250 v and for current-demand difference among the Plug-In Units. 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.

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

Mechanical Specifications—Dimensions are 8 3/4" high by 19" wide by 21 5/8" deep. Net weight is 39 1/2 pounds. Shipping weight is 74 pounds, approx.

TYPE 127 POWER SUPPLY (without plug-in units) \$650

Each instrument includes: 4—170-ohm coaxial cables, 5' long, 4—170-ohm terminating resistors, 1—3-conductor power cord, 1—pair guide rails, 2—instruction manuals.

Supporting Cradles

For rear slide support when the instrument is to be mounted in a backless rack. Two cradles with necessary mounting hardware.

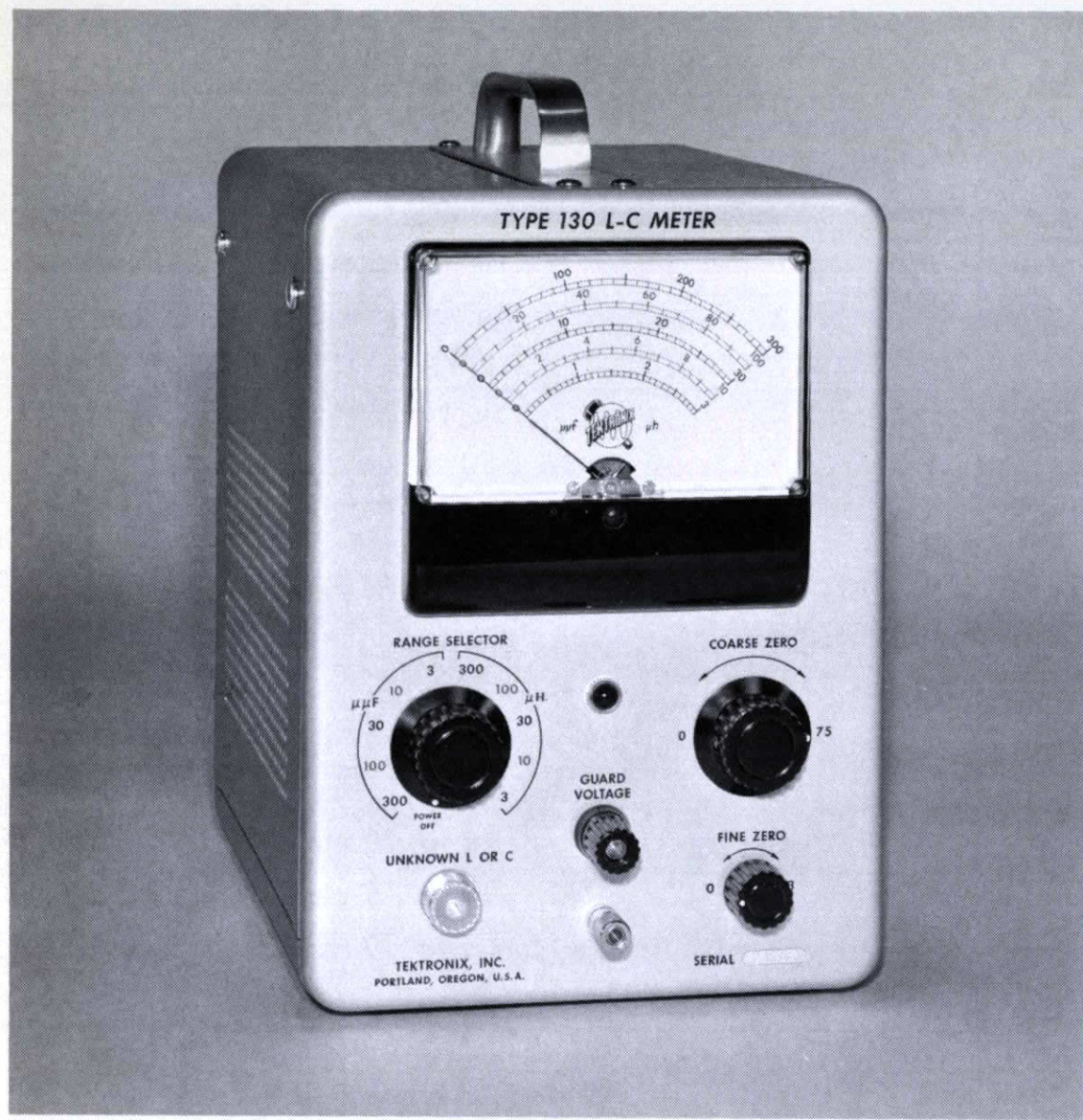
Order Part Number 426-063 \$7.50

U. S. Sales Prices f.o.b. Beaverton, Oregon
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	23 nsec
B	2 20	dc to 15 mc 5 cps to 11 mc	23 nsec 30 nsec
C-A	2	dc to 17 mc	20 nsec
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 at a gain of 200	
G	2	dc to 15 mc	23 nsec
H	20	dc to 12 mc	29 nsec
K	2	dc to 19 mc	18 nsec
L	2 20	dc to 19 mc 3 cps to 17 mc	18 nsec 20 nsec
M	5	dc to 15 mc	23 nsec

Type 130 DIRECT-READING LC METER



Five Ranges

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

Picofarads—0 to 3, 10, 30, 100, 300.

Accuracy

Within 3% of full scale.

4 1/2" Meter

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.

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 picofarads.

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 pf.

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.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 40 watts.

Mechanical Specifications—Dimensions are 10 5/8" high by 7" wide by 11 1/8" deep. Net weight is 8 3/4 pounds. Shipping weight is 15 pounds, approx.

TYPE 130 DIRECT-READING L-C METER \$225

Each instrument includes: 1—probe, 1—black output lead, 1—red output lead, 1—3-conductor power cord, 2—instruction manuals.

Production Test Fixture

For use with the Type 130 L-C Meter. Speeds sorting and testing of capacitors and inductors.

Order Part Number 013-001 \$3

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.

Order Part Number 015-001 \$22

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





PLUG-IN UNIT POWER SUPPLY Type 132

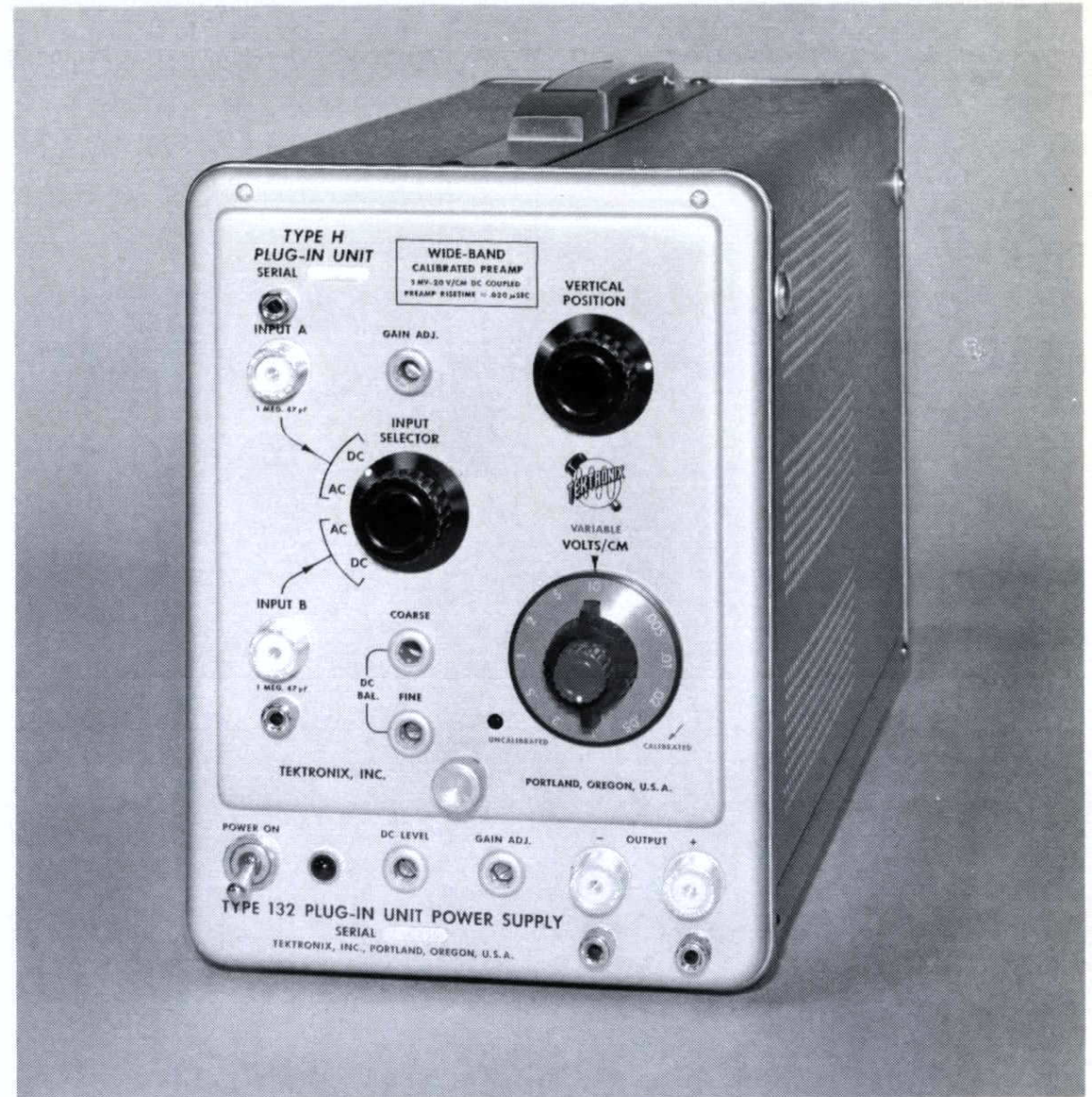
The Type 132 provides an electronically regulated power supply and amplifier for any Tektronix Type A to Z Plug-In Unit.

Easily portable, it enables the many plug-ins to be used with or without an oscilloscope in a wide variety of applications.

Frequency response of the amplifier is dc to 15 mc, with a risetime of 23 nsec, when using a Tektronix Type K or L Plug-In Unit.

The electronically regulated power supply provides correct operating voltages for both the internal amplifier and plug-in unit and assures stable operation.

Convenient front-panel terminals for either push-pull or single-ended output facilitate connections to associated equipment.



CHARACTERISTICS

Frequency Specifications are at 3-db down

Frequency Response and Risetime—DC to 15 mc, 23 nsec, when used with a Tektronix Type K or Type L Plug-In Unit and terminated with a 52 Ω load.

Gain—The push-pull gain is 10 when using a Tektronix Plug-In Unit at 50 mv/cm sensitivity, terminated with 93 Ω load. (approximately 5 into 52 Ω load).

Output Terminals—Push-Pull, or single-ended + or — outputs are available at front-panel terminals.

Output Voltage—High impedance load; ± 50 volts at each connector and ± 100 volts push-pull. Source impedance is approximately 5000 ohms with ± 10 ma available (unterminated). With 93-ohm load, voltage swing is approximately ± 1 volt.

Dual-Trace Operation—Convenient back-panel jacks and switching arrangements provide for use of the alternate and chopped modes of operation and blanking, with a Tektronix Type C-A or M Plug-In Unit.

Power Supply—Electronically regulated. Provides correct voltages for the amplifier and any Tektronix Type A to Z Plug-In Unit and assures stable operation.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 320 watts.

Mechanical Specifications—Dimensions are 10 $\frac{1}{4}$ " high by 7 $\frac{1}{8}$ " wide by 19 $\frac{1}{8}$ " deep. Net weight is 21 $\frac{1}{2}$ pounds. Shipping weight is 36 pounds, approx.

TYPE 132 PLUG-IN UNIT POWER SUPPLY (without plug-in units) \$390

Each instrument includes: 1—3-conductor power cord, 2—93- Ω terminations, 1.5 w, 2—93 Ω output cables, 2—instruction manuals.

U.S. Sales Price f.o.b. Beaverton, Oregon

Please refer to Terms and Shipment, General Information page.

TYPE 132 TYPICAL PERFORMANCE WITH A TO Z SERIES PLUG-IN UNITS

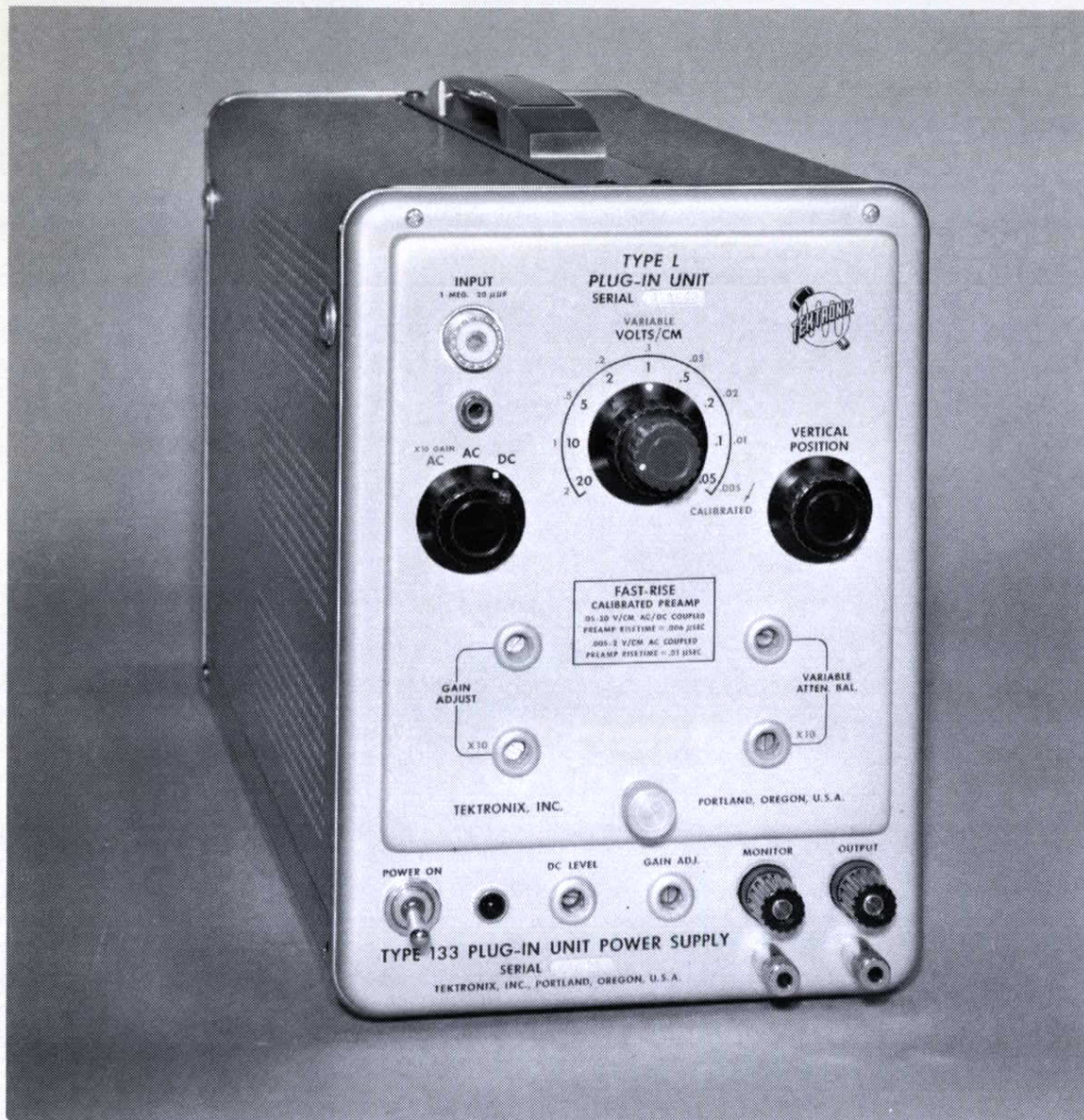
PLUG-IN TYPE	Equivalent noise referred to input (pk-pk)	Performance * With no termination		Performance * Terminated in 93 Ω		Performance * Double terminated 93 Ω	
		System \ddagger Gain	Band Width	System \ddagger Gain	Band Width	System \ddagger Gain	Band Width
A	200 μ volt	500	500 kc	10	14 mc	5	16 mc
B	200 μ volt	500 5000	500 kc	10 100	14 mc 10 mc	5 50	16 mc 10 mc
C-A	200 μ volt	500	500 kc	10	14 mc	5	16 mc
D	100 μ volt	useful to 20,000	400 kc 250 kc	10 500	2 mc 350 kc	5 250	2 mc 350 KC
E	35 μ volt	useful to 10,000	†	10,000	†	5000	†
G	200 μ volt	500	500 kc	10	14 mc	5	16 mc
H	200 μ volt	5000	500 kc	100	11 mc	50	12 mc
K	200 μ volt	500	500 kc	10	14 mc	5	16 mc
L	200 μ volt	500 5000	500 kc	10 100	14 mc 14 mc	5 50	16 mc 16 mc
M	200 μ volt	500	500 kc	10	14 mc	5	16 mc
Z	200 μ volt	500	500 kc	10	10 mc	5	10 mc

* Performance measured with pushpull output of Type 132 connected into C-A unit in a Type 541A Oscilloscope.

\ddagger System Gain—Overall gain from input of Plug-in to the push-pull output cables. If only one output of Type 132 is used this gain figure will be halved. When used with system gain of 500 or higher, dc drift in the input of the plug-in unit may become significant.

† See E Unit specifications.

Type 133 PLUG-IN UNIT POWER SUPPLY



The Type 133 provides power to an internal, transistorized amplifier and any Tektronix Type A to Z Plug-In Unit. The flexibility of this plug-in feature permits quick adaptation of the Type 133 to meet any particular requirement.

The frequency response of the transistorized amplifier is dc to 100 kc and the output is ± 5 volts. The source impedance is 2 ohms. Characteristics of this unit make it particularly useful for driving recorders, and in audio or other low-frequency work.

Connectors on the front-panel enable the output to be fed directly into an oscilloscope or used for other applications.

A typical application of the Type 133 is its use in conjunction with the Tektronix Type Q Transducer and Strain Gage Unit. This completely self-contained combination requires no external equipment other than the strain gages or transducers needed for the particular operation. The output can drive a recorder and be monitored visually, with an oscilloscope, at the same time.

CHARACTERISTICS

Frequency specifications are at 3-db down

Frequency Response—DC to 100 kc.

Gain—The gain is 10, single-ended.

Output— ± 5 v (high impedance load.)
1.5 a (short circuit).

The source impedance is 2 ohms.

DC Adjust—The output dc operating level adjusts to ground potential.

Phase Inversion—An internal switch permits phase inversion of the signal.

Monitor Jack—A monitor jack provides a means of constantly observing the output with an oscilloscope without switching any cables.

Dual-Trace Operation—Convenient back-panel jacks and switching arrangements provide for use of the Alternate mode of operation when using a Tektronix Type C-A or M Plug-In Unit.

Power Supply—Electronic regulation of the power supply assures stable operation under changing loads or line voltages.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 320 watts.

Mechanical Specifications—Dimensions are 10 1/4" high by 7 1/8" wide by 19 1/4" deep. Net weight is 22 pounds. Shipping weight is 35 pounds, approx.

TYPE 133 PLUG-IN UNIT POWER SUPPLY (without plug-in units) ~~8.440~~ 3-1-63 ~~330~~

Each instrument includes: 1—3-conductor power cord, 2—instruction manuals.

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

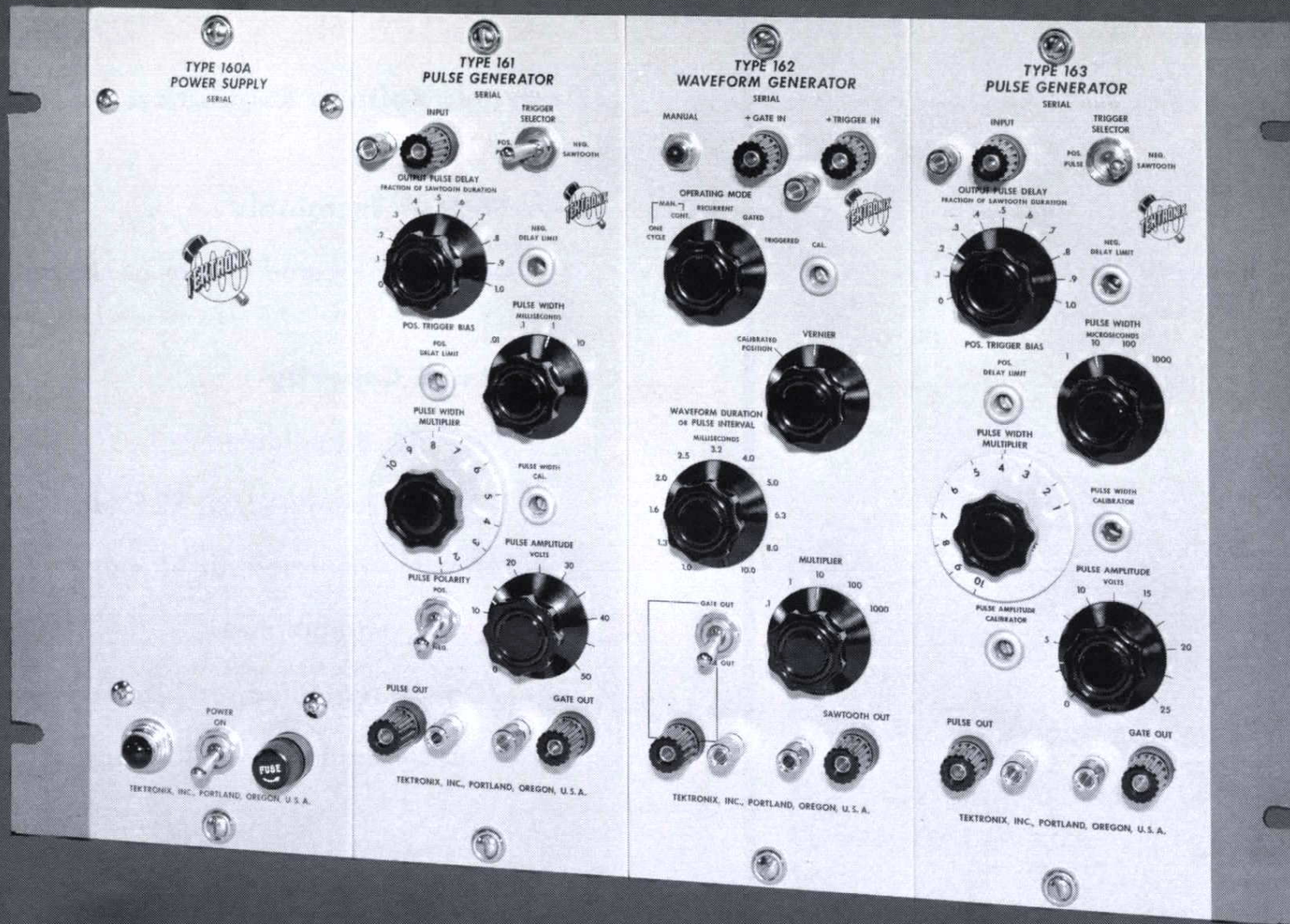
TYPE 133 TYPICAL PERFORMANCE WITH A to Z SERIES PLUG-IN UNITS

PLUG-IN TYPE	Equivalent noise referred to Input	Overall Gain (No Load)	Bandwidth
A	200 μ volt	10	DC to 100 kc
B	200 μ volt	10 100 (AC only)	DC to 100 kc 2 cps to 100 kc
C-A	200 μ volt	10	DC to 100 kc
D	100 μ volt	500	DC to 100 kc
E	35 μ volt	10,000	See E Unit Specifications
G	200 μ volt	10	DC to 100 kc
H	200 μ volt	100	DC to 100 kc
K	200 μ volt	10	DC to 100 kc
L	200 μ volt	10 100 (AC only)	DC to 100 kc 3 cps to 100 kc
M	200 μ volt	10	DC to 100 kc
Z	200 μ volt	10	DC to 100 kc





SEQUENCE CONTROL and MONITORING SYSTEM



Designed for complex measurement applications, the system consists of the Type 160-Series instruments and the Type 360 Indicator Unit. The Type 160-Series produces accurate timed pulses of adjustable amplitude, duration, and repetition rate. The series includes power-supply unit, pulse generator, waveform generator and fast-rise pulse generator. The Type 360 Indicator Unit provides bright displays of information generated by the Type 160-Series instruments.

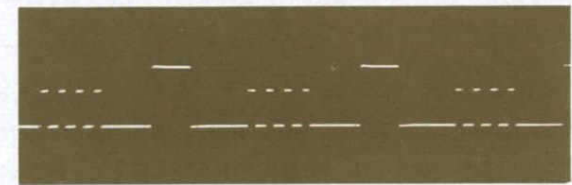
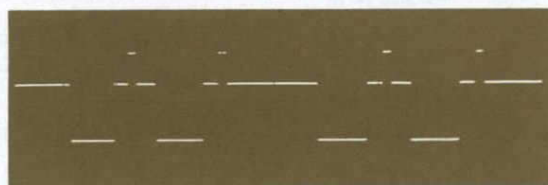
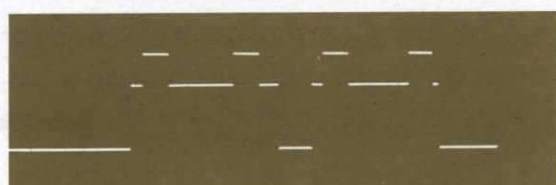
Using several Type 160-Series instruments together produces many complex waveform patterns. The flexible system fits a wide variety of applications, including nerve stimulation in neurophysical experiments, timed gating devices for complex equipment, component testing for quality control, and data recording in the bio-physical and geophysical fields, among others.

Rack-mounting the Sequence Control and Monitoring System offers compact convenience. The Type 360 Indicator Unit and the illustrated Type 160-Series instruments bolt quickly and easily to a Mounting Frame, which bolts to a standard nineteen-inch rack. As shown in the picture, the mounting frame securely holds four instruments.

TYPE 160A POWER SUPPLY	\$190
TYPE 161 PULSE GENERATOR	\$130
TYPE 162 WAVEFORM GENERATOR	\$130
TYPE 163 FAST-RISE PULSE GENERATOR	\$130
TYPE 360 INDICATOR UNIT	\$270
MOUNTING FRAME	
Order Part Number 014-002	\$5

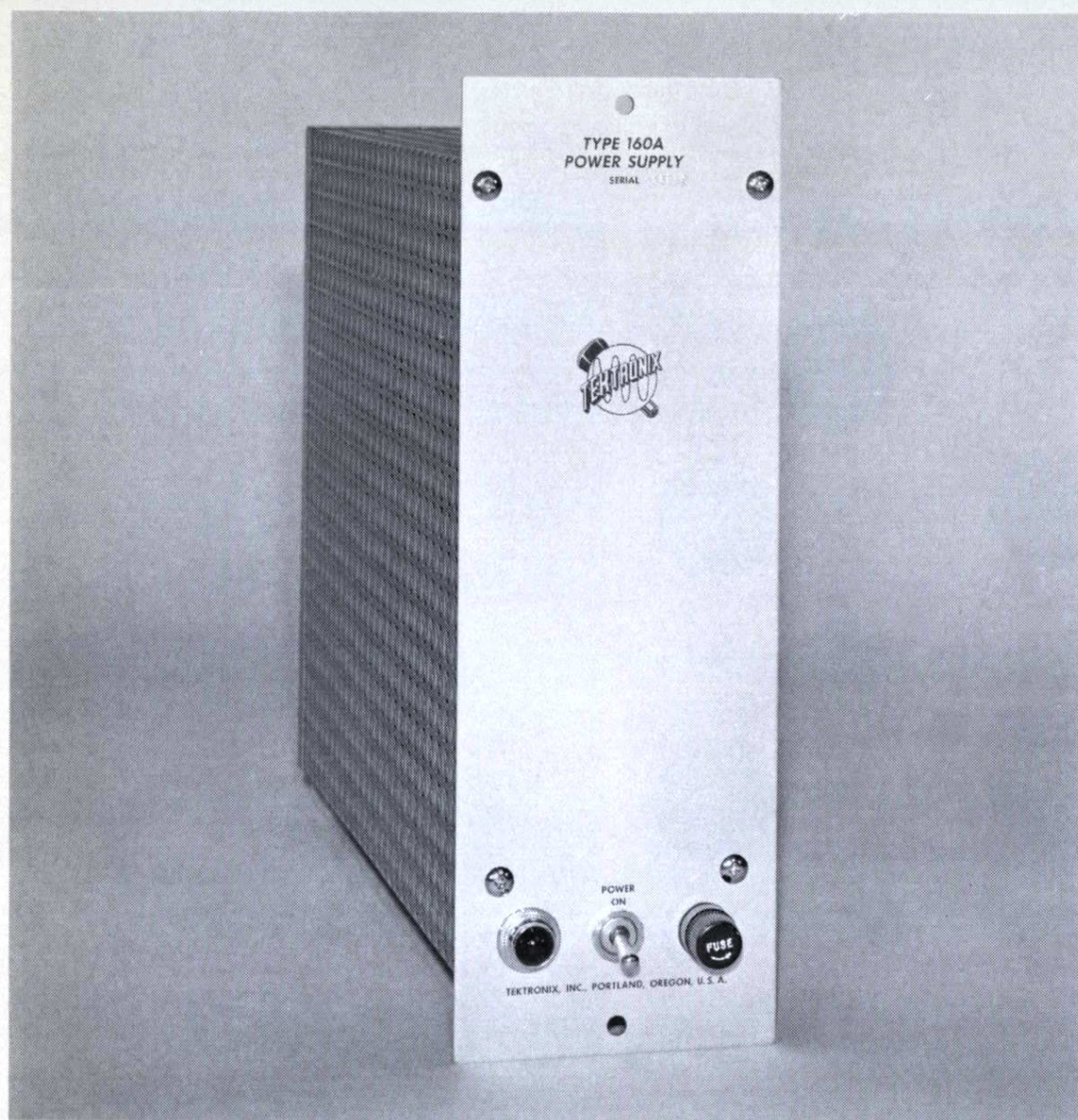
See appropriate pages for complete information on these instruments.

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



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

Type 160A POWER SUPPLY



Electronic Voltage Regulation

Four Output Terminals

Conveniently located at rear of chassis.

Large Load Capacity

- +300 v dc, unregulated.
- +225 v dc, regulated, at 225 ma.
- +150 v dc, regulated, at 15 ma.
- +80 v dc, unregulated.
- 170 v dc, regulated, at 125 ma.
- 6.3 v ac, unregulated, at 20 amps.

The Type 160A Power Supply provides the required currents and voltages for one Type 360 Indicator Unit in combination with up to six Type 160-Series Generators. Power capability handles up to five Type 360 Indicator Units, up to five Type 163 Fast-Rise Pulse Generators, up to seven Type 162 Waveform Generators, or up to seven Type 161 Pulse Generators. Output terminals are four octal sockets on the back of the instrument.

Electronic regulation compensates for line-voltage variations between 105 and 125 v or 210 and 250 v, and for any current-demand differences between instruments.

MAXIMUM LOAD CONDITIONS

The maximum amount of current that can be drawn from the +300 v unregulated supply is limited by the amount of current drawn from the +225 v regulated supply and varies between 250 ma, in the absence of any current drawn from the +225 v supply, and zero when maximum current is drawn from the +225 v supply.

Output current of the +225 v supply is limited to 175 ma with no shunt across the series tube and increases to a maximum of 225 ma with a 1500-ohm shunt.

Power Requirement —105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 350 watts maximum.

The Type 160A can be conveniently mounted with other Type 160-Series Instruments or the Type 360 Indicator Unit in a mounting frame that fits a standard 19" rack.

Dimensions are 12 1/4" high by 4 1/8" wide by 14 3/8" deep. Net weight is 20 1/4 pounds. Shipping weight is 30 pounds approx.

TYPE 160A POWER SUPPLY \$190

Each instrument includes: 2—inter-unit power cables, 1—3-conductor power cord, 2—instruction manuals.

Mounting Frame

A Mounting Frame conveniently adapts the Type 160A for rack mounting. The frame accepts up to 4 Type 160-Series Instruments or up to 3 Type 160-Series Instruments and a Type 360 Indicator Unit. The frame fits a standard 19" rack. Rack height required is 12 1/4".

Order Part Number 014-002 \$5

Blank Panel for above, occupies same panel area as Type 160-Series Generator or Type 360 Indicator Unit.

Order Part Number 333-157 ~~\$8.50~~ \$5.00

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



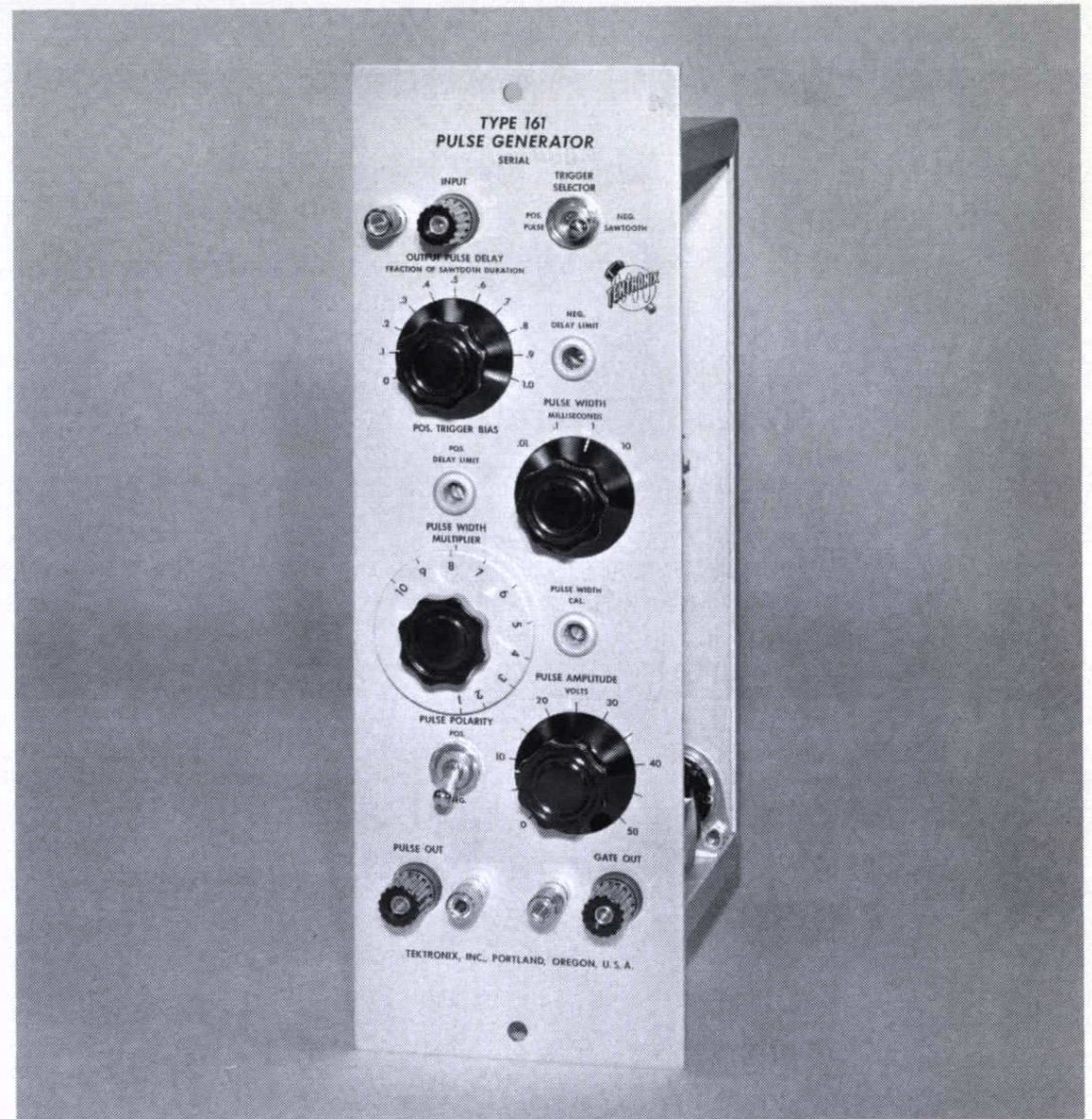


PULSE GENERATOR Type 161

The Tektronix Type 161 Pulse Generator is designed to supply calibrated rectangular output pulses from zero to 50 v in amplitude and 10 μ sec to 100 msec in duration when an external trigger of required voltage is received. An excellent trigger source is the Type 162 Waveform Generator. The 50-v Gate Output has the same duration and timing as the pulse, but is of fixed amplitude.

When triggered by a negative-going sawtooth, the output pulse and gate can be adjusted to occur at any designated point along the sawtooth. A calibrated control indicates output delay as a fraction of the triggering sawtooth duration. Other calibrated controls indicate pulse and gate width (in milliseconds) and pulse amplitude (in volts). When triggered by a positive pulse, the same output waveforms are available. In this instance the delay control functions as a triggering-level selector.

Voltages necessary to operate the Type 161 can be obtained from the Type 160A Power Supply, which can power up to seven Type 161 Generators.



Output Waveforms

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

Output Characteristics

Risetime—Positive pulse; within 0.5 μ sec when load capacitance is 10 pf or less, within 0.75 μ sec for 100 pf or less load capacitance. Negative pulse; within 0.5 μ sec when load capacitance is 10 pf or less, within 1.5 μ sec for 100 pf or less load capacitance. Overshoot less than 5%.

Duration—calibrated, variable, 10 μ sec to 0.1 sec.

Delay—continuously variable, 0 to 100% of triggering sawtooth waveform.

Amplitude Peak-to-Peak

Pulse—calibrated, continuously variable, 0 to 50 v.

Gate—fixed, 50 v positive, pk-to-pk minimum.

Output Impedance

Positive pulse—1.8 kilohms maximum.

Negative pulse—5 kilohms approximately.

Positive gate—1 kilohm maximum.

Trigger Requirements

Positive pulse, 3 v pk-to-pk minimum. Negative-going sawtooth; must include dc bias sufficient to keep voltage positive. Maximum repetition rate, 50 kc.

Power Requirements

—170 v dc at 17 ma, +225 v dc at 22 ma,
6.3 v ac at 1.65 amps.

The Type 161 can be conveniently mounted with other Type 160-Series Instruments or the Type 360 Indicator Unit in a Mounting Frame that fits a standard 19" rack.

Dimensions are 12 1/4" high by 4 1/8" wide by 6 3/8" deep.

Net weight is 3 1/2 pounds. Shipping weight is 9 pounds, approx.

TYPE 161 PULSE GENERATOR \$130

Each instrument includes: 1—inter-unit power cable, 1—set mounting hardware, 2—instruction manuals.

Mounting Frame

A Mounting Frame conveniently adapts the Type 161 for rack mounting. The frame accepts up to 4 Type 160-Series Instruments or up to 3 Type 160-Series Instruments and a Type 360 Indicator Unit. The Frame fits a standard 19" rack. Rack height required is 12 1/4".

Order Part Number 014-002 \$5

Blank Panel for above, occupies same panel area as Type 160-Series Generator or Type 360 Indicator Unit.

Order Part Number 333-157 \$8.50

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 162 WAVEFORM GENERATOR



The Type 162 Waveform Generator produces three types of calibrated output waveforms. Both the duration and repetition rate of the output waveforms—pulse, gate, and sawtooth—are adjustable. Triggering can occur from an external electrical impulse or by front-panel push button. The unit is designed to operate as a delay generator in conjunction with one of these instruments, and to supply a sweep voltage for the Type 360 Indicator Unit. It is useful for initiating chains of events electrically, for controlling their duration and repetition rate, and for generating waveforms recurrently. As such it is a stable repetition rate generator.

Amplitude of the pulse and gate waveforms is 50 volts, with minimum risetime of 1 μ sec. Amplitude of the sawtooth waveform decreases linearly from +150 volts to +20 volts. A calibrated control indicates waveform duration. Shortest pulse duration is approximately 10 μ sec.

Voltages necessary to operate the Type 162 can be obtained from the Type 160A Power Supply, which can power up to seven Type 162 Generators.

Output Waveforms

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

Output Characteristics

Risetime—1- μ sec minimum.

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

Repetition Rate—0.1 cps to 10 kc, recurrent operation.

Amplitude

Pulse and gate—fixed, positive, 50 v pk-to-pk minimum.

Sawtooth—decreases linearly with time from +150 volts to +20 volts, $\pm 4\%$.

Cathode-Follower Outputs

Output Impedance

1000 ohms approximately for all outputs.

Trigger Requirements

Positive pulse—15 volts.

Positive gate—8 volts.

Sine wave—6 volts rms, frequency from 5 cps to 50 kc. At frequencies below 5 cps, the product of rms voltage times frequency must exceed 10.

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.

The Type 162 can be mounted conveniently with other Type 160-Series Instruments or the Type 360 Indicator Unit in a Mounting Frame that fits a standard 19" rack.

Dimensions are 12 $\frac{1}{4}$ " high by 4 $\frac{1}{8}$ " wide by 6 $\frac{3}{8}$ " deep. Net weight is 3 $\frac{1}{2}$ pounds. Shipping weight is 9 pounds, approx.

TYPE 162 WAVEFORM GENERATOR \$130

Each instrument includes: 1—inter-unit power cable, 1—set mounting hardware, 2—instruction manuals.

Mounting Frame

A Mounting Frame conveniently adapts the Type 162 for rack mounting. The frame accepts up to 4 Type 160-Series Instruments or up to 3 Type 160-Series Instruments and a Type 360 Indicator Unit. The Frame fits a standard 19" rack. Rack height required is 12 $\frac{1}{4}$ ".

Order Part Number 014-002 \$5

Blank Panel for above, occupies same panel area as Type 160-Series Generator or Type 360 Indicator Unit.

Order Part Number 333-157 \$8.50

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.





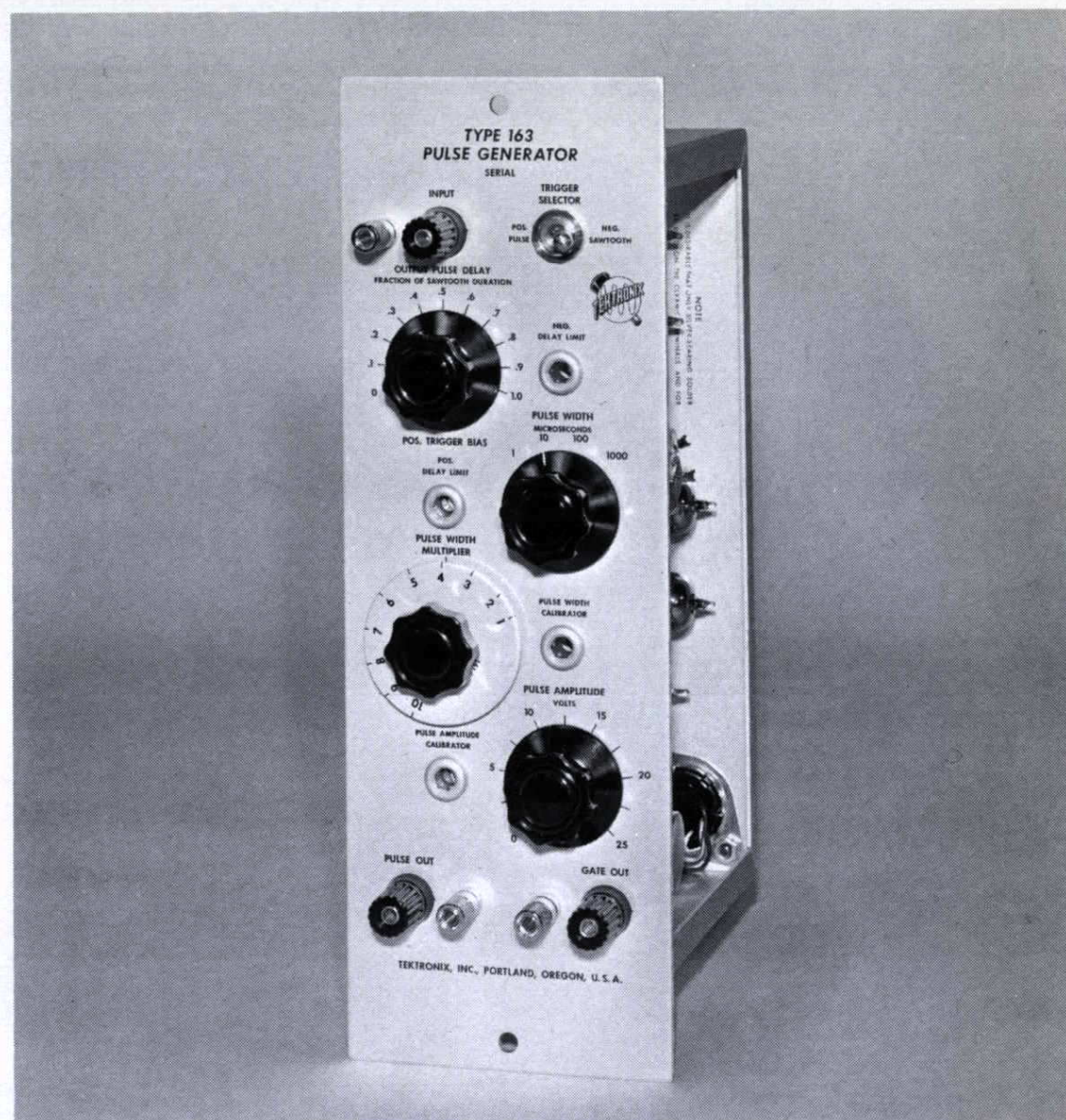
FAST-RISE PULSE GENERATOR Type 163

The Tektronix Type 163 Fast-Rise Pulse Generator is designed to supply rectangular output pulses from 0 to 25 v in amplitude and 1 μ sec to 10 msec in duration when an external trigger of required voltage is received. An excellent trigger source is the Type 162 Waveform Generator. The 25 v Gate Output has the same characteristics as the pulse, but is of fixed amplitude.

When triggered by a negative-going sawtooth, the output pulse and gate can occur at any designated point along the sawtooth. A calibrated control indicates output delay as a fraction of the triggering sawtooth duration. Other calibrated controls indicate pulse and gate width (in microseconds) and pulse amplitude (in volts).

The Type 163 operates up to 50% duty cycle at the minimum time setting on any range. With higher multiplier-control settings, the duty cycle is correspondingly higher. Maximum repetition rate is 500 kc—with a generated pulse of 1 μ sec duration.

Voltages necessary to operate the Type 163 can be obtained from the Type 160A Power Supply, which can power up to five Type 163 Generators.



Output Waveform

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

Output Characteristics

- Risetime—Within 0.2 μ sec when load capacitance is 10 pf or less, within 0.25 μ sec for 100 pf or less load capacitance. Overshoot can be adjusted to zero.
- Duration—calibrated, variable, 1 μ sec to 10,000 μ sec.
- Delay—continuously variable, 0 to 100% of triggering sawtooth duration.
- Decay Time—0.2 to 0.5 μ sec.

Amplitude Peak-to-Peak

- Pulse—calibrated, continuously variable, 0 to 25 v.
- Gate—fixed, positive, 25 v pk-to-pk minimum.

Cathode-Follower Outputs

Output Impedance

- Pulse—500 ohms (varies with pulse-amplitude control setting).
- Gate—100 ohms.
- Minimum load resistance—3.5 kilohms.

Trigger Requirements

- Positive pulse, 2 v peak-to-peak minimum.
- Negative-going sawtooth; must include dc bias sufficient to keep voltage positive. Maximum repetition rate, 500 KC.

Power Requirements

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

The Type 163 can be conveniently mounted with other Type 160-Series Instruments or the Type 360 Indicator Unit in a Mounting Frame that fits a standard 19" rack.

Dimensions are 12 1/2" high by 4 1/8" wide by 6 3/8" deep.

Net weight is 3 1/2 pounds. Shipping weight is 9 pounds, approx.

TYPE 163 PULSE GENERATOR \$130

Each instrument includes: 1—inter-unit power cable, 1—set mounting hardware, 2—instruction manuals.

Mounting Frame

A Mounting Frame conveniently adapts the Type 163 for rack mounting. The frame accepts up to 4 Type 160-Series Instruments or up to 3 Type 160-Series Instruments and a Type 360 Indicator Unit. The frame fits a standard 19" rack. Rack height required is 12 1/4".

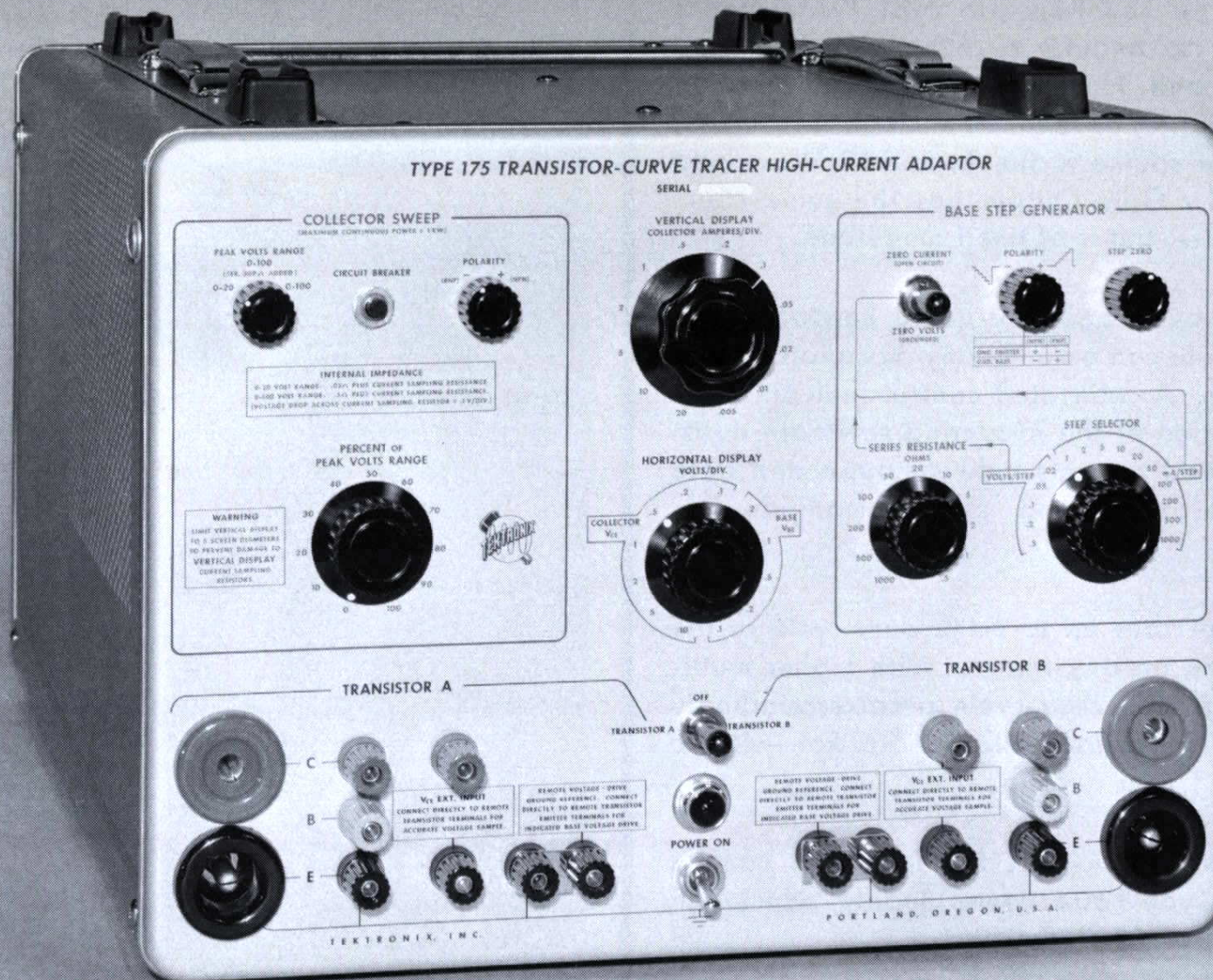
Order Part Number 014-002 \$5

Blank Panel for above, occupies same panel area as Type 160-Series Generator or Type 360 Indicator Unit.

Order Part Number 333-157 \$8.50

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 175 HIGH-CURRENT ADAPTER



200-AMPERE COLLECTOR DISPLAYS (Single Family Presentation)

- 100-ampere peak continuous supply current.
- 1 KW continuous collector power available.

3 RANGE COLLECTOR SUPPLY (PLUS OR MINUS)

- 0 to 20 v, 0.03 Ω plus current sampling resistance.
- 0 to 100 v, 0.5 Ω plus current sampling resistance.
(Voltage drop across current sampling resistance 0.1 v/div).
- 0 to 100 v, 300 Ω series load resistor.

12-AMPERE BASE SUPPLY

- \pm base stepping (4 to 12 steps per family, either repetitive or single family presentation, from Type 575).
- 10 current step positions ranging from 1 ma to 1 amp per step.
- 5 voltage step positions ranging from 0.02 to 0.5 volts per step—with 11 different driving resistances from 0.5 ohms to 1,000 ohms.

CALIBRATED DISPLAYS

- Vertical Axis—Collector Current.
- Horizontal Axis—Collector Voltage (V_{CE}), or Base Voltage (V_{BE}).

4-TERMINAL VOLTAGE SENSING FACILITY

- The voltage at the collector and the emitter of either transistor under test may be sampled at the transistor terminals.

The Tektronix Type 175 High-Current Adapter has been specifically designed for use with the Tektronix Type 575 Transistor-Curve Tracer. The Type 175 extends the range of the Type 575 to plot and display the characteristic curves of high power (NPN and PNP) transistors, and diodes. The Type 175 in combination with the Type 575 plots a family of transistor collector current curves to more than 200 amperes and a family of diode curves to more than 100 amperes. The High-Current Adapter also supplies transistor base currents up to 12 amperes.

The Type 175 High-Current Adapter contains a Collector Sweep Circuit and a Step Amplifier, functionally the same as those in the Type 575 Transistor Curve-Tracer.

When the Type 575 Vertical and Horizontal switches are set to EXT, all controls on the Type 575, duplicated on the Type 175 become inoperative. Transistor connections are made at the Type 175 instead of the Type 575.

A front panel switch enables comparison of two transistors by switching test conditions from one transistor to the other.

CATHODE-RAY TUBE DISPLAY

Vertical Axis—The VERTICAL DISPLAY switch selects the collector current supplied to the transistor under test. The switch has twelve positions ranging from 0.005 to 20 amp/div.

The POSITION control, AMPLIFIER CALIBRATION switch and DC BAL. adjustment in the vertical amplifier of the Type 575 perform the same function with or without the Type 175.

Horizontal Axis—The HORIZONTAL DISPLAY switch selects either the base voltage or the collector voltage applied to the transistor under test. Calibrated horizontal deflection in volts-per-division for base voltage is selected from five switch positions, 0.1 v/div to 2 v/div. Calibrated deflection for collector voltage is selected from the remaining seven switch positions, 0.1 v/div to 10 v/div.

BASE STEP GENERATOR

The Type 175 step generator produces ten input steps of constant current from 1 ma/step to 1 amp/step and five input steps of constant voltage from 0.02 v/step to 0.5 v/step. A polarity switch provides for stepping the input in either the positive or negative direction. The STEPS/FAMILY control on Type 575 adjusts the number of steps per family from 4 to 12. A repetitive or single-family display can be presented. Either a 120-steps/sec or 240-steps/sec repetition rate can be selected. When used with a 50-cycle supply, the step/sec rate will be either 100 or 200.

A switch grounds the transistor input for a zero voltage reference check, and opens 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 source impedance of the step generator. This driving resistance can be selected from eleven values, 0.5 ohms to 1,000 ohms.

COLLECTOR SWEEP

A 300-ohm resistor in series with the transistor collector in one of the PEAK VOLTS RANGE switch positions is the only dissipation limiting resistor in the Type 175. Additional external dissipation limiting resistors can be connected in series with the collector of the transistor under test. It will be necessary to connect them to the V_{CE} EXT INPUT terminals, for accurate presentation of collector-to-emitter voltages.

The Type 175 collector supply consists of a variable transformer driving a power transformer that has its primary protected by an 8 amp circuit breaker. The supply has a rectified output of 0-20 volts or 0-100 volts. The 0-100 volt range can be selected with an optional 300-ohm resistor in series for transistor protection.

A polarity switch permits the collector voltage to sweep either positive or negative.

TRANSISTOR TEST PANEL

The Type 175 Transistor Test Panel is basically the same as that of the Type 575. Special connectors and cables are provided for high-current applications and for elimination of measurement errors due to voltage drops in high-current carrying leads. The collector, base, and emitter connections are made to the binding posts C, B, and E, respectively. The large C and E terminals are for peak collector currents of more than 25 amperes.

TYPE 575 MOUNTING

The Type 575 can be secured atop the Type 175 with two hinge bolts. A brace attached to the top rear of the Type 175 allows the Type 575 to be raised for more convenient viewing.



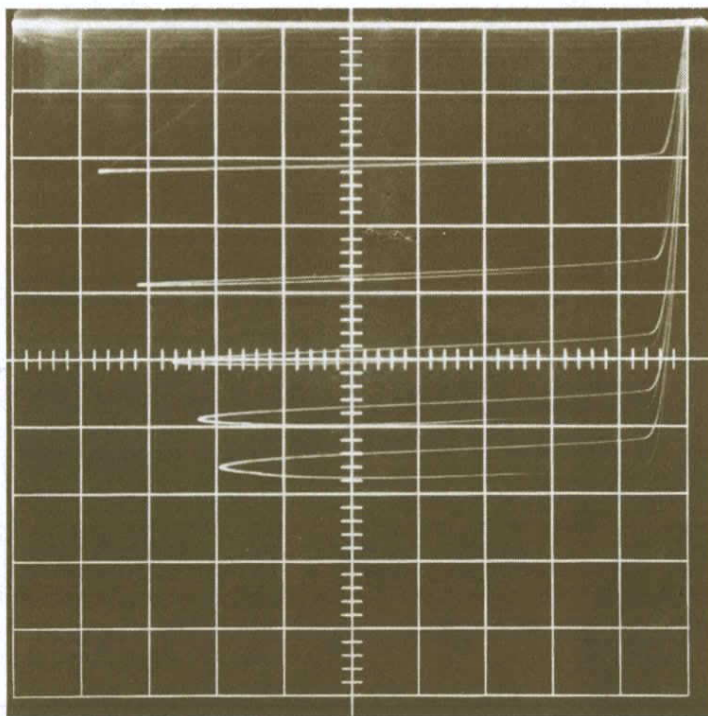
175

Power Requirement—105 v to 125 v, 50 to 60 cps. Wattage depends upon transistor under test, approximately 1100 watts maximum.

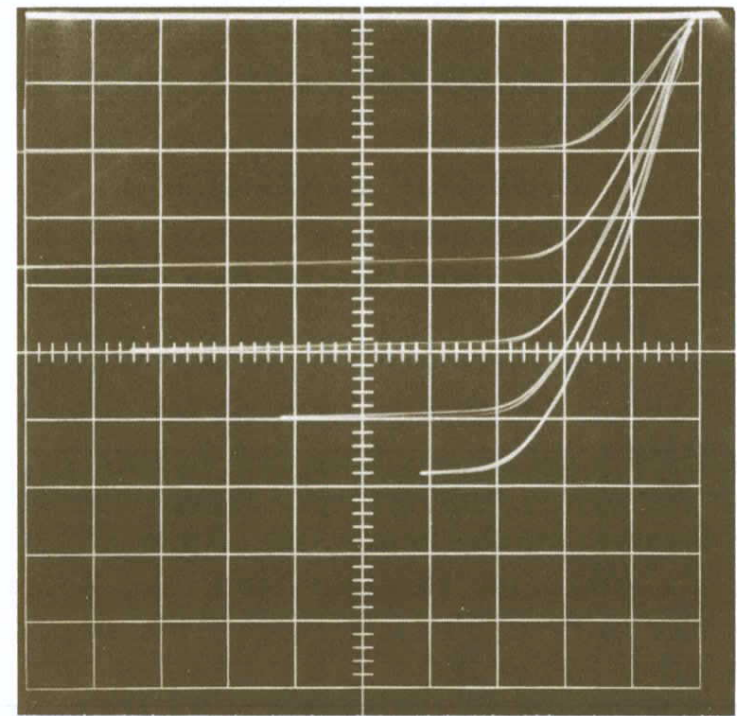
Mechanical Specifications—Dimensions are 12 1/4" high by 15 1/4" wide by 23 5/8" deep. Net weight is 93 pounds. Shipping weight is 119 pounds, approx.

TYPE 175 HIGH CURRENT ADAPTER \$1475

Each instrument includes: 1—6' 3-conductor power cord, 1—20" 3-conductor power cord, 2—red high current test cables, 2—black high current test cables, 2—black test leads, 2—red test leads, 2—blue test leads, 1—interconnecting cable (to Type 575), 1—modification kit (for Type 575), 2—instruction manuals.

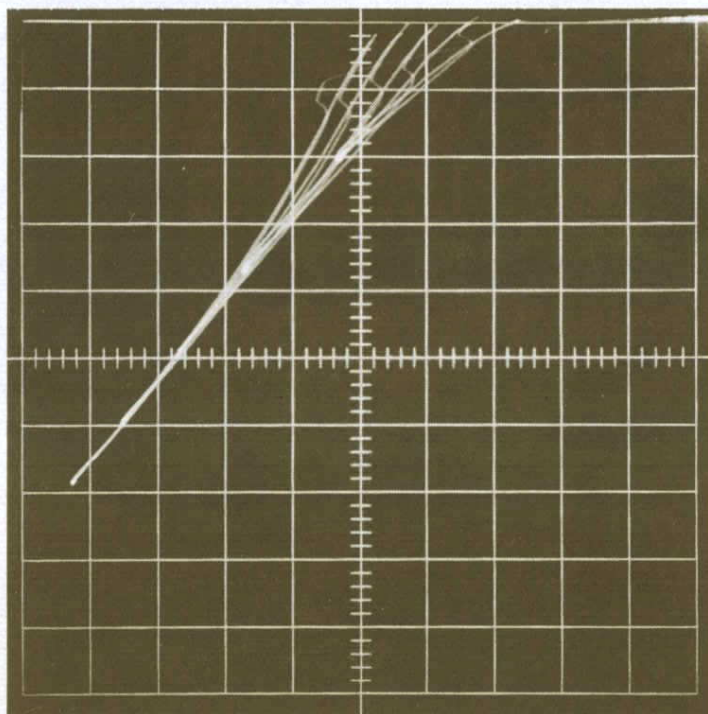


Collector current vs. collector voltage (emphasis on saturation resistance). Vertical deflection is 10 amp/div, horizontal deflection is 0.2 v/div. Base drive is 500 ma/step (top curve is 2.5 amp).

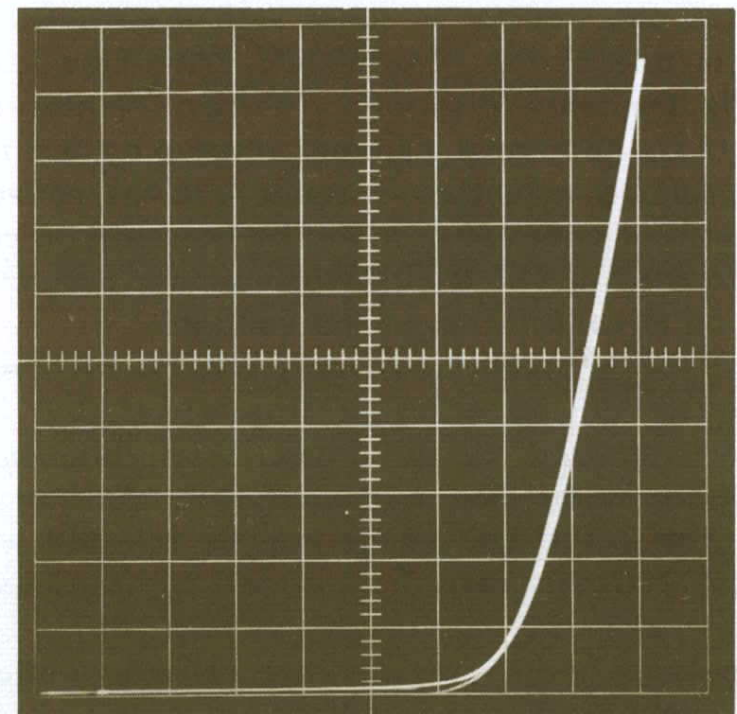


Collector current vs. collector voltage. Vertical deflection is 10 amp/div, horizontal deflection is 1.0 v/div. Base drive is 500 ma/step (top curve is 2.5 amp).

Collector current vs. base voltage (collector sweep voltage is 4.2 v). Vertical deflection is 10 amp/div, horizontal deflection is 0.1 v/div. Base drive is 500 ma/step.



Rectifier characteristics (forward). Vertical deflection is 5.0 amp/div, horizontal deflection is 0.1 v/div. Peak value is 44 amp.



MOD161C

Modified Type 175 operates from 210 v to 250 v, 50 to 60 cps.

TYPE 175MOD161C HIGH CURRENT ADAPTER . . \$1475 (includes same accessories as standard Type 175)

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



TIME-MARK GENERATOR Type 180A

14 Time-Mark Intervals

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

Three Sine-Wave Frequencies

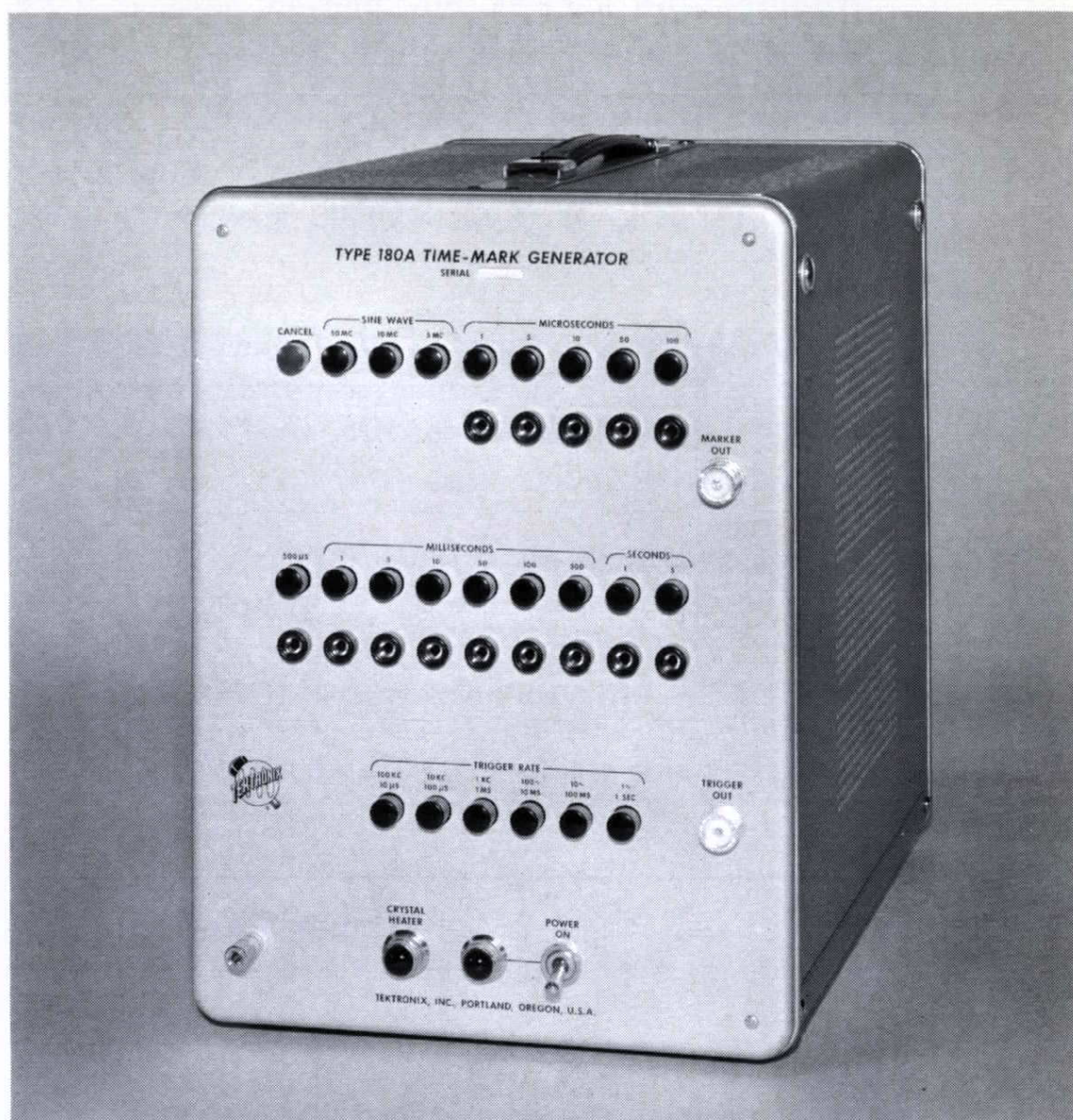
5 mc, 10 mc, and 50 mc.

Six Trigger-Rate Frequencies

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

Accuracy Within 0.001 %

Stability of 3 parts per million over a 24-hour period.



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 .001% and stability of 3 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.

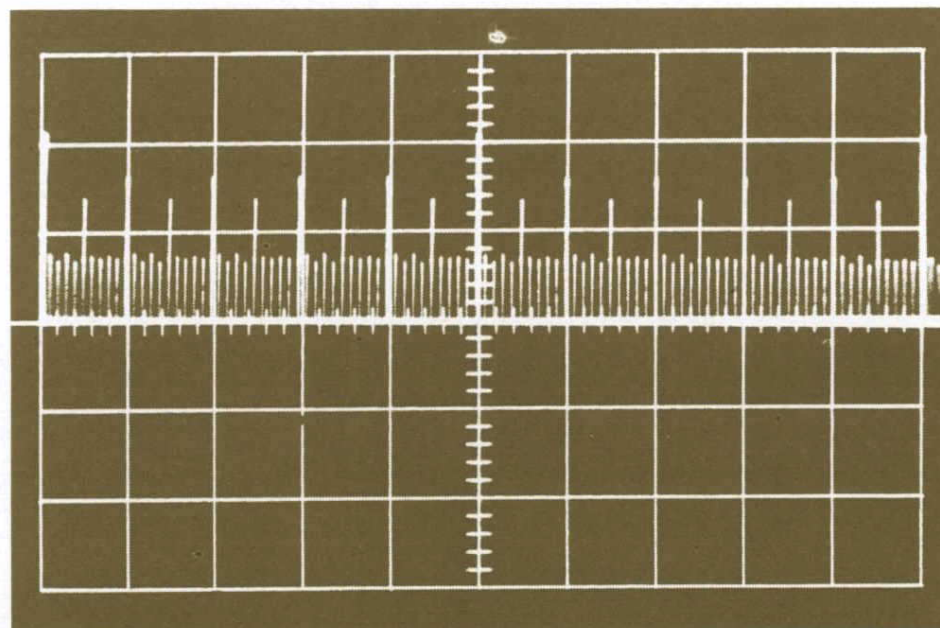
CHARACTERISTICS

Time Markers—Time markers occur at intervals of 1, 5, 10, 50, 100, 500 μ 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 3 volts minimum across 52 ohms.

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.

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



180A

Stability—All outputs are derived from a 1-mc crystal-controlled oscillator with a frequency tolerance of about 0.001%. The 1-mc crystal is mounted in a temperature-stabilized oven and a trimmer capacitor provides a means of adjusting the crystal frequency to zero beat with W.W.V. Stability is within 3 parts per million over a 24-hour period.

Regulated Power Supply—Electronically-regulated dc supplies insure stable operation over line-voltage and load variations between 105 and 125 v or 210 and 250 v, 50-60 cycles.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 240 watts at 117 v.

Mechanical Specifications—Dimensions are 13³/₄" high by 10" wide by 16⁵/₈" deep. Net weight is 30¹/₄ pounds. Shipping weight is 45 pounds, approx.

TYPE 180A TIME-MARK GENERATOR \$625

Each instrument includes: 2—93-Ω output cables, 1—clip-lead adapter, 1—3-conductor power cord, 2—instruction manuals.

Rack Mount Adapter

A cradle mount to adapt the Type 180A Time-Mark Generator for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements 15¹/₂".

Order Part Number 040-277 \$45

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Nominal Voltage, Impedance and Risetime Values

	Marker Out Terminal			Jacks	
	Open Circuit Voltage	Impedance for Half-Voltage	Risetime *	Open Circuit Voltage	Impedance for Half-Voltage
Markers	3 volt minimum	390 Ω or less	0.07 μsec at 1 μsec to 1.7 μsec at 5 seconds	25 v minimum Using a P6000 probe	390 Ω at 1 μsec to 900 Ω at 5 seconds
Trigger Pulses	6 volt minimum	56 Ω or less	0.08 μsec at 100 kc to 0.30 μsec at 1 cps		
Sine Waves	3 volt minimum across 52-ohms				

* With MARKER OUT and TRIGGER OUT terminated in 93 Ω



TIME-MARK GENERATOR Type 181

Five Time-Mark Intervals

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

Stability

0.005% per hour
3 parts per million with optional Crystal-Oven combination.

Portability

10" high, 17 1/8" wide, 17 3/4" deep, 15 1/2 pounds.

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 mounted in a temperature-controlled oven is available as an accessory, or as MOD110 installed in the instrument. This plug-in crystal provides a stability of 3 parts per million over a 24-hour period.



Nominal Output Values

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

Regulated Power Supply—DC voltages are electronically regulated to compensate for line-voltage and load variations between 105 and 125 v or 210 and 250 v.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 800 cps, typically 100 watts at 117 v.

Mechanical Specifications—Dimensions are 10" high by 7 1/8" wide by 17 3/4" deep. Net weight is 15 1/2 pounds. Shipping weight is 23 pounds, approx.

TYPE 181 TIME-MARK GENERATOR \$265

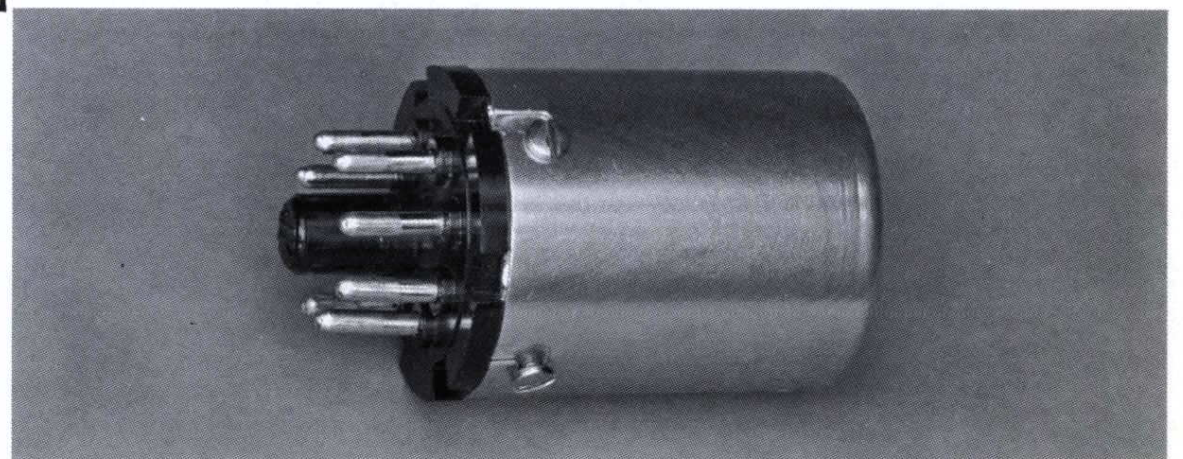
Each instrument includes: 1—93-Ω output cable, 1—black test lead, 1—red test lead, 1—3-conductor power cord, 2—instruction manuals.

TYPE 181 MOD110 TIME-MARK GENERATOR \$285

Each instrument includes: 1—93-Ω output cable, 1—black test lead, 1—red test lead, 1—3-conductor power cord, 2—instruction manuals.

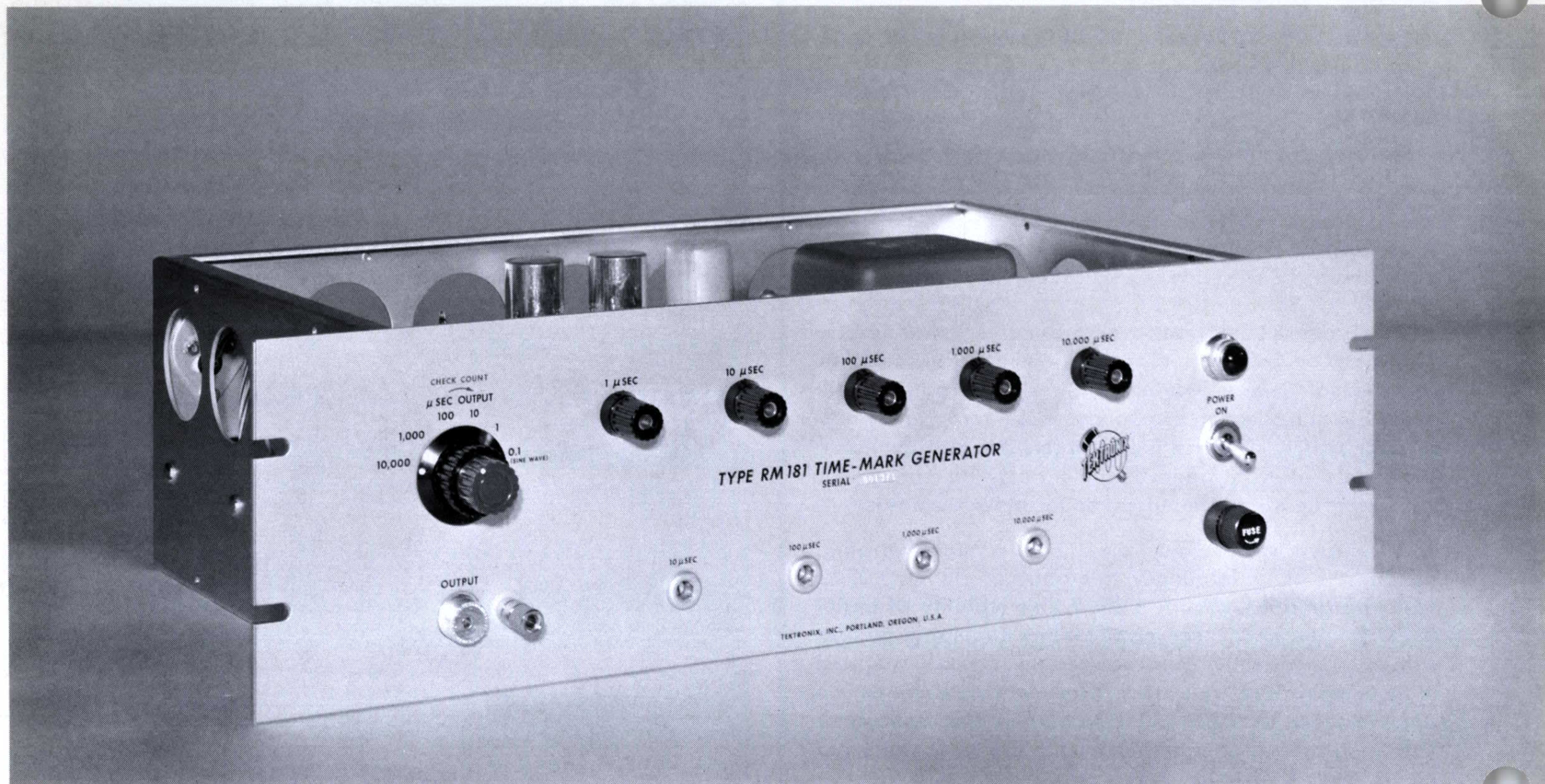
Crystal-Oven Combination—A 1-mc crystal mounted in a temperature-stabilized oven. Frequency adjustable to zero beat with W.W.V. Accuracy is 0.001% and frequency stability is 3 parts per million over a 24-hour period.

Order Part Number 158-007 \$27



U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type RM181 RACK MOUNT



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.

The Type RM181 is a mechanically rearranged Type 181 Time-Mark Generator for mounting in a standard 19-inch rack. The instrument is fastened to the front of the rack by four screws. It requires only 5 1/4 inches of rack height, and 10 1/2" of rack depth. Net weight is 15 3/4 pounds. Shipping weight is 30 pounds, approx.

TYPE RM181 TIME-MARK GENERATOR \$290

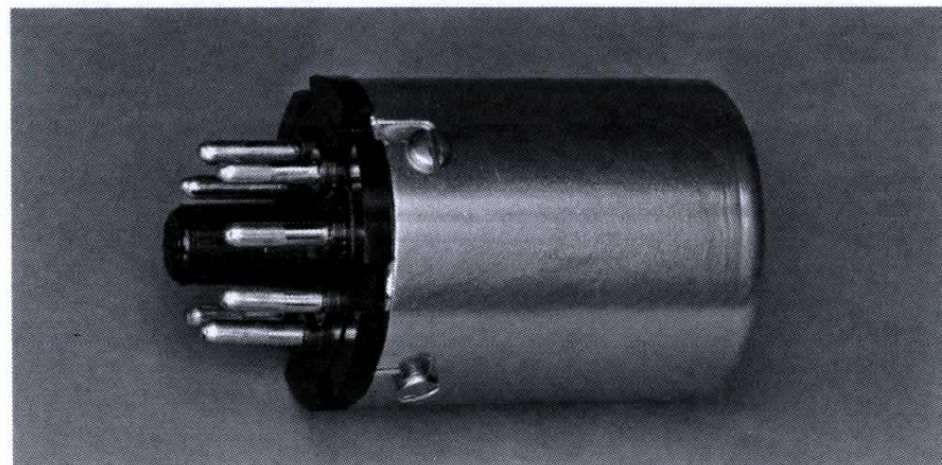
Each instrument includes: 1—93-Ω output cable, 1—black test lead, 1—red test lead, 1—3-conductor power cord, 1—set mounting hardware, 2—instruction manuals.

TYPE RM181MOD110 TIME-MARK GENERATOR . . \$310

Each instrument includes: 1—93-Ω output cable, 1—black test lead, 1—red test lead, 1—3-conductor power cord, 1—set mounting hardware, 2—instruction manuals.

Crystal-Oven Combination — A 1-mc crystal mounted in a temperature-stabilized oven. Frequency adjustable to zero beat with W.W.V. Accuracy is 0.001% and frequency stability is 3 parts per million over a 24-hour period.

Order Part Number 158-007 \$27



U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



SINE-WAVE GENERATOR Type 190B

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%.

Output Amplitude

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

Harmonic Content

The harmonic content is typically less than 5%.

The Tektronix Type 190B 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.



Amplitude Variation

When load resistance is 52 ohms, and when the load-shunt capacitance does not exceed 10 pf, the output amplitude varies less than $\pm 2\%$ from 50 kc to 30 mc; less than $\pm 5\%$ from 30 mc to 50 mc. Peak-to-peak level of the output signal at the input to the attenuator is indicated on the amplitude meter. The Output Amplitude control sets the amount of signal voltage applied to the input of the external attenuator head. The signal voltage at the attenuator-head input is automatically held constant at the value you select by means of the Output Amplitude control. Therefore, you don't have to readjust the Output Amplitude control when you change the generator frequency. The output source impedance of the attenuator head varies with attenuator setting approximately as follows:

Output impedance

Nominal, 52 ohms. Actual values:

Attenuator setting volts, peak-to-peak	Output impedance in ohms, approx.
10	0
5	39
2.5	49
1.0 to .1	52

Regulated Power Supply

Electronic regulation compensates for line-voltage and load variations between 105 and 125 v or 210 and 250 v.

Power Requirement

105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 100 watts.

Mechanical Specifications

Dimensions are 13 $\frac{3}{4}$ " high by 9 $\frac{7}{8}$ " wide by 12" deep. Attenuator unit is 2 $\frac{5}{8}$ " by 2 $\frac{1}{4}$ " by 2", with 36" connecting cable. Net weight is 23 $\frac{1}{2}$ pounds. Shipping weight is 33 pounds, approx.

TYPE 190B SINE-WAVE GENERATOR \$330

Each instrument includes: 1—attenuator unit, 1—3-conductor power cord, 2—instruction manuals.

Rack Mount Adapter

A cradle mount to adapt the Type 190B Signal Generator for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements 15 $\frac{1}{2}$ ".

Order Part Number 040-277 \$45

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 1121 AMPLIFIER



Amplifier Gain

Accurately set at 100 x.

Input Attenuator

Attenuates input signal by a factor of 1X through 500X in 9 calibrated steps.

Gain Stability

Within $\pm 1\%$ over 24-hour period.

Frequency Response

5 cycles to 17 megacycles (3 db down) at 1X, 2X, 5X, and 10X attenuator settings.

Transient Response

Risetime—21 nanoseconds.

Probe Power

Heater supply—6.3 v dc, 0.2 amp.
Plate supply—120 v dc, 10 ma regulated.

The Type 1121 Wide-Band Amplifier is a low-noise, cascode-input amplifier designed with Tektronix precision, quality, and style. It increases the amplitude of low-level wide-band signals; thus increases the sensitivity of the oscilloscope or other associated instrument with which it is operated.

The output, terminated in 93-ohm coaxial cable, allows separation of at least 100 feet between the Type 1121 and associated instrument without causing noticeable deterioration of the response. Output voltage of ± 1 volt guarantees linear amplification of any input signal up to ± 10 mv at full gain. Internal noise is no more than $50 \mu\text{v}$ peak-to-peak with the input grounded and the INPUT ATTENUATOR control in the 1-X position. As in all Tektronix instruments, optimum response is a prime consideration. Risetime is approximately 21 nsec, and passband extends from 5 cycles to over 17 mc with the INPUT ATTENUATOR control in the 1-X, 2-X, 5-X or 10-X positions.

Power is available at the front panel for a cathode-follower probe. For applications requiring both high impedance input and high gain or where the attenu-

ation of an rc probe would be objectionable, a Tektronix P170CF cathode-follower probe can be used.

The Type 1121 has a turret-type step attenuator that permits attenuation of the input level to a factor of 500X in nine calibrated steps. Unique design of the attenuator allows the series and shunt compensations to be conveniently set without removing the instrument side panels. Hum pick-up at the input is minimized by the inherently short internal leads. These leads are of the same length in all positions of the attenuator, thus lower, more-stable values of circuit capacitance are realized. Input impedance is 1 megohm paralleled by approximately 22 pf at all step-attenuator positions. This feature enables the use of a probe with minimum circuit loading on the point measured.

Other features include a cascode-input circuit using a frame-grid triode, two voltage amplifier stages (that retains the polarity of the input at the output), and transistor-regulated heater supplies.

Its compactness, reliability, and low noise level adapt the versatile Type 1121 to almost any application involving wide-band amplification.

CHARACTERISTICS

Input Impedance—Direct, 1 megohm paralleled by approximately 22 pf.

Internal Noise—Internally generated noise is equivalent to an input signal of 50 μ v, pk-to-pk, maximum, with the INPUT ATTENUATOR at 1X.

Gain Stability—After initial warmup, and under all conditions of line voltage between 105 and 125 volts or 210 and 250 volts, gain stability of the Type 1121 is well within $\pm 1\%$ over a twenty-four hour period.

Input Attenuation—The newly-designed turret-type step attenuator permits accurate attenuation of the input level from a net gain factor of 100 x to 0.2 x in nine calibrated steps: 1X, 2X, 5X, 10X, 20X, 50X, 100X, 200X, and 500X. Attenuator accuracy is 1%. A screwdriver control at each attenuator position provides compensating adjustment for optimum square wave response. Access is via a hole in the front panel, behind the INPUT ATTENUATOR knob flange.

Probe Power—The front-panel PROBE POWER socket provides 0.2 amp dc at 6.3 volts for the heater supply and 10 ma regulated dc at 120 volts for the plate supply of a cathode-follower probe. The Tektronix P170CF cathode-follower probe is ideally suited for use with Type 1121 Amplifier.

Frequency Response—With the INPUT ATTENUATOR control in the 1-X, 2-X, 5-X, or 10-X positions, transient response is clean over a band extending from 5 cps to 17 mc (at 3 db down). Passbands for the remaining attenuator positions are as follows: 20X—5 cps to 16.5 mc, 50X—5 cps to 16.0 mc, 100X—5 cps to 15.5 mc, 200X—5 cps to 14.0 mc, and 500X—5 cps to 12.0 mc.

When a P170CF cathode-follower probe is used with a Type 1121 Amplifier ahead of a Type 540 or 540A-Series Oscilloscope and a Type L Plug-In Unit set at 0.05 v/cm, overall sensitivity of the combination is 1 mv/cm. Passband will be 5 cps to 16 mc. At this sensitivity, noise inherent in the Type 1121 will appear as 0.1 centimeter of deflection. With the L unit set at 0.005 v/cm, overall sensitivity is 0.1 mv/cm. Passband will be 5 cps to 15 mc and inherent noise will appear as 1 centimeter of deflection. Input impedance of the P170CF probe is 12 megohm paralleled by 5 pf.

Note: It is necessary to terminate the 170-ohm cable of the P170CF probe at the amplifier input. A Tektronix-made 170-ohm resistor (part No. 011-016) is recommended for this purpose.

Using a P6002 100-x attenuator probe with the same combination and the L unit set at 0.05 v/cm, overall sensitivity is 50 mv/cm. Passband will be 5 cps to 15.5 mc. Again, at this sensitivity, noise inherent in the Type 1121 will appear as 0.1 centimeter of deflection. With the L unit set at 0.005 v/cm, overall sensitivity is 5 mv/cm. Passband will be 5 cps to 14 mc and inherent noise will appear as 1 centimeter of deflection. Input impedance of the P6002 100-x attenuator probe is 9.1 megohms paralleled by 2.5 pf.

Output Voltage—Capable of a ± 1 volt swing in a terminated 93-ohm coaxial cable, the Type 1121 reproduces any input signal up to ± 10 mv at full gain. The output, via cathode followers, permits up to 100 foot separation between the amplifier and associated instrument without noticeable waveform distortion.

Output Connection—Output of the Type 1121 is connected to the associated instrument via a 93-ohm coaxial cable, containing a $\frac{1}{2}$ w, 93-ohm terminating resistor. The terminated end of the cable must be connected to the associated instrument for minimum waveform distortion. If additional cable length is required, insert a section of RG62U (93 ohm) cable between the Type 1121 OUTPUT and the cable supplied with the amplifier.

Regulated Power Supplies—The Type 1121 embodies exceptionally stable power-supply voltage regulation. Transistor-regulated heater circuits limit the heater-supply ripple components to less than 4 mv. Electronically-regulated plate circuits insure stable operation over line fluctuations between 105 to 125 volts or 210 to 250 volts.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 150 watts.

Mechanical Specifications—Dimensions are 10 $\frac{3}{4}$ " high by 7" wide by 15 $\frac{7}{8}$ " deep. Net weight is 18 $\frac{1}{2}$ pounds. Shipping weight is 26 pounds, approx.

TYPE 1121 AMPLIFIER \$465

Each instrument includes: 1—output cable, 1—3-conductor power cord, 2—instruction manuals.

U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

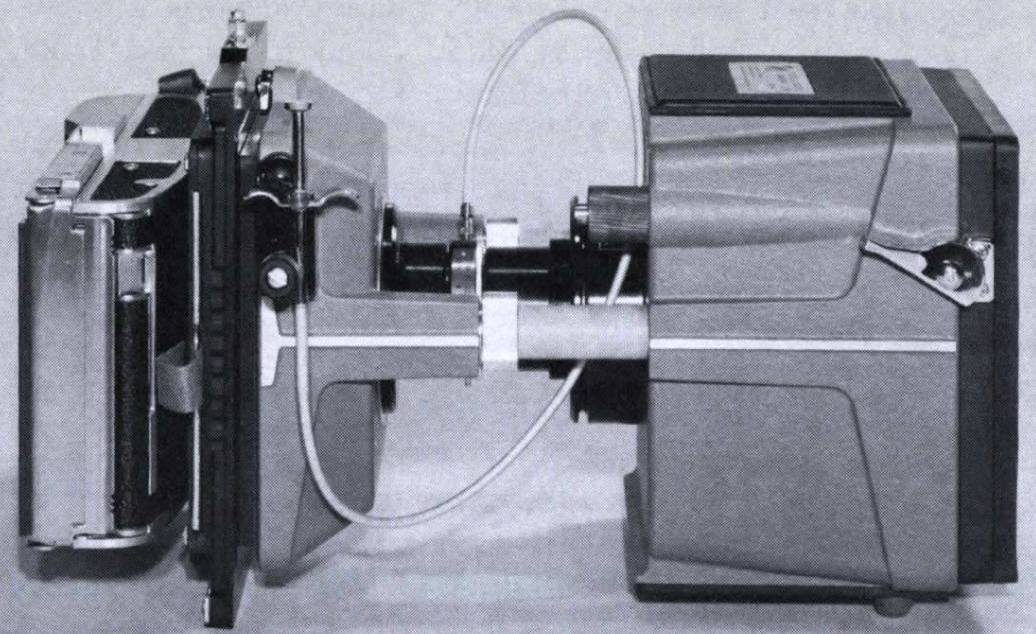
Cameras Type C-12, C-13 & C-19



The Tektronix C-12, C-13 and C-19 Trace-Recording Cameras, designed for use with Tektronix 5-inch Oscilloscopes, combine flexibility with simplicity to achieve quality and detail in pictures of crt displays.

The C-12 and C-13 suit general-purpose trace-recording applications, while the C-19 suits special-purpose high-speed pulse recordings.

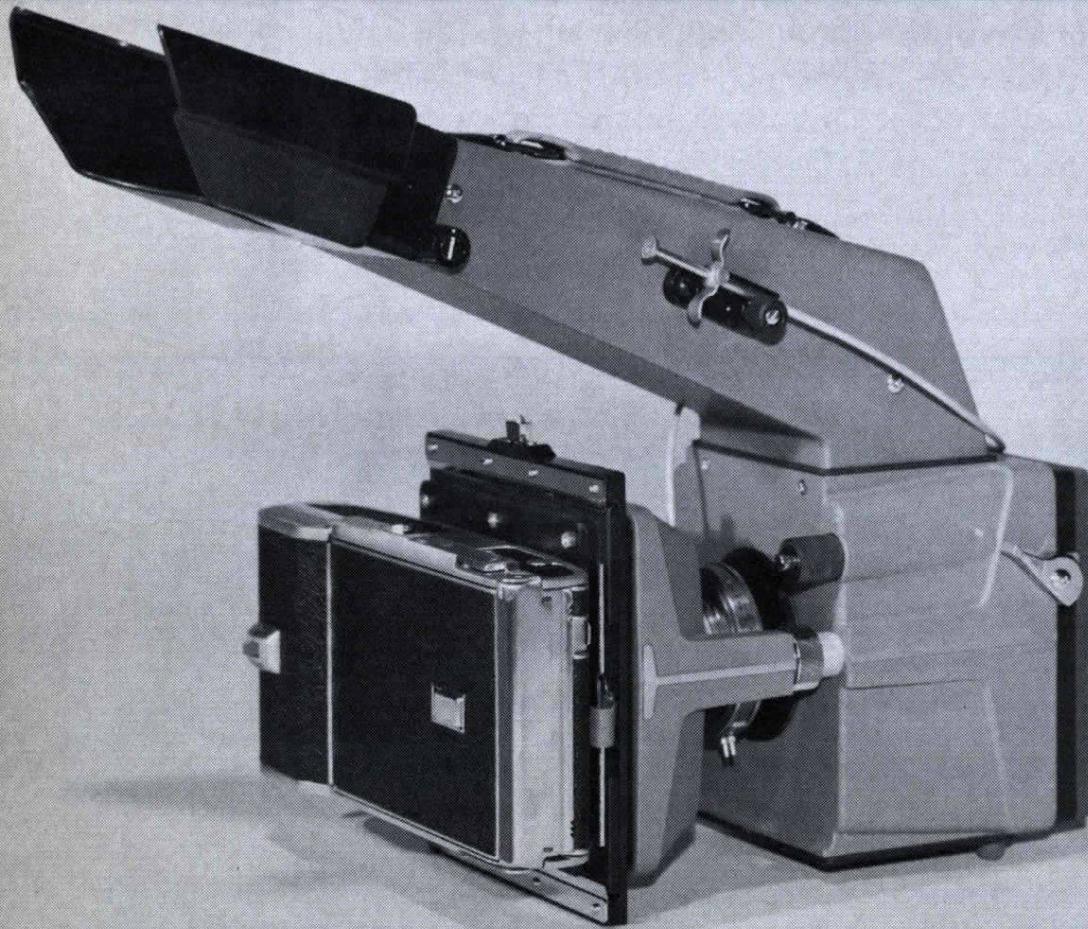
Types C-12, C-13, and C-19 are standard camera assemblies and are delivered as complete units ready for trace recording. Special combinations of Camera Frame, Lens, and Film Back are also available, and can be shipped assembled as a complete unit. Please consult your local Tektronix Field Office (or Overseas Distributor) before ordering a non-standard combination.



C-13 CAMERA \$375
Includes: f/4.5 Lens with 1:0.7 object-to-image ratio, a Polaroid Land 3 $\frac{1}{4}$ " by 4 $\frac{1}{4}$ " Camera Back with focus plate, and a 412-005 Camera Frame.

The C-13 Camera is 8 $\frac{3}{4}$ " high by 9 $\frac{5}{8}$ " wide by 14 $\frac{1}{4}$ " long. Net weight is 11 $\frac{1}{2}$ pounds. Shipping weight is 17 pounds, approx.

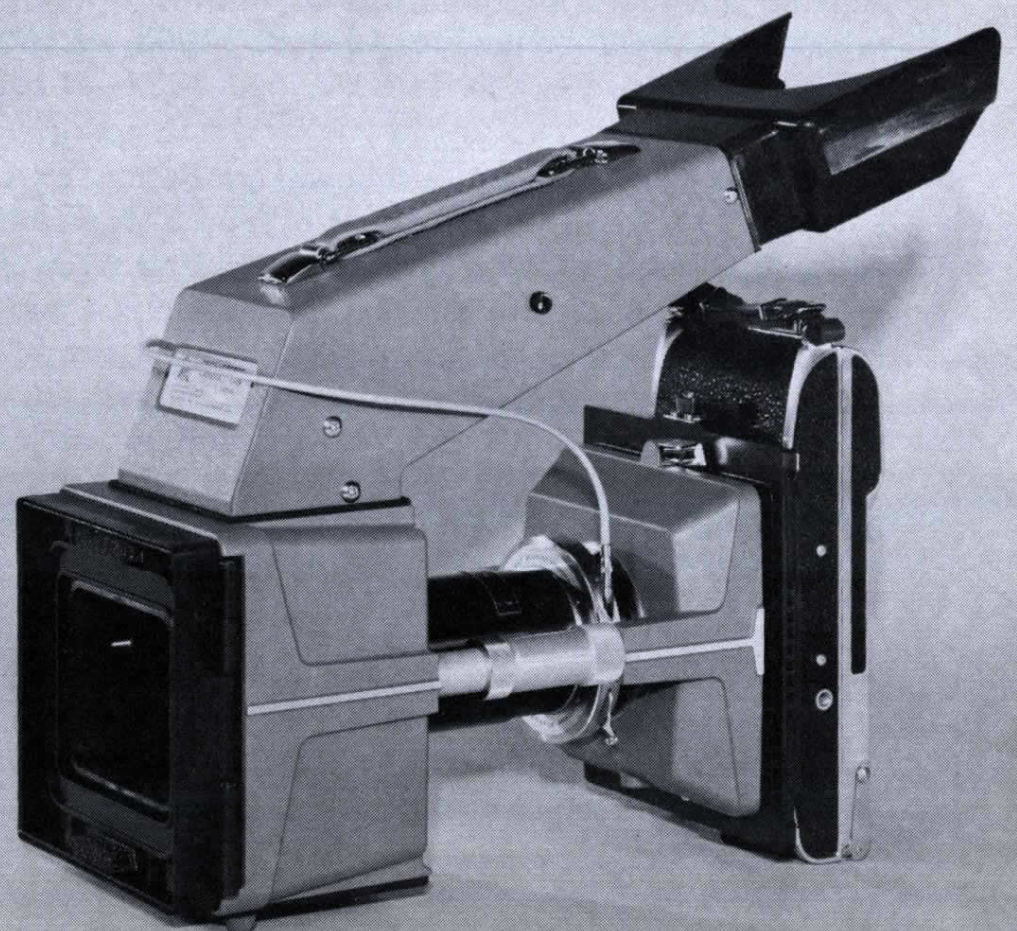
Standard Camera Assemblies



C-12 CAMERA \$465
Includes: f/1.9 Lens with 1:0.9 object-to-image ratio, a Polaroid* Land 3 $\frac{1}{4}$ " by 4 $\frac{1}{4}$ " Camera Back with focus plate, and 412-004 Camera Frame.

The C-12 Camera is 14 $\frac{3}{4}$ " high by 9 $\frac{5}{8}$ " wide by 17 $\frac{1}{4}$ " long. Net weight is 14 $\frac{1}{4}$ pounds. Shipping weight is 25 pounds, approx.

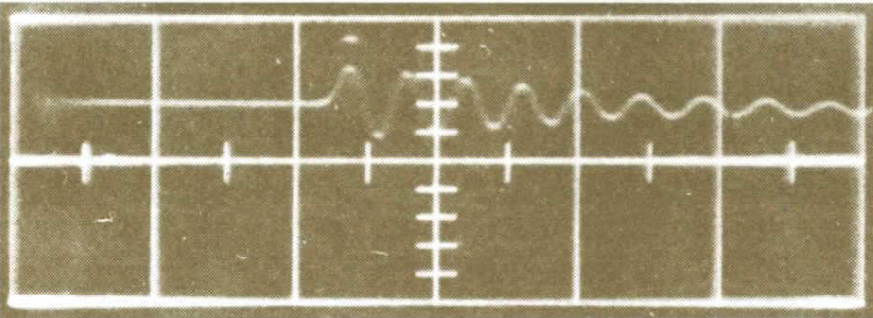
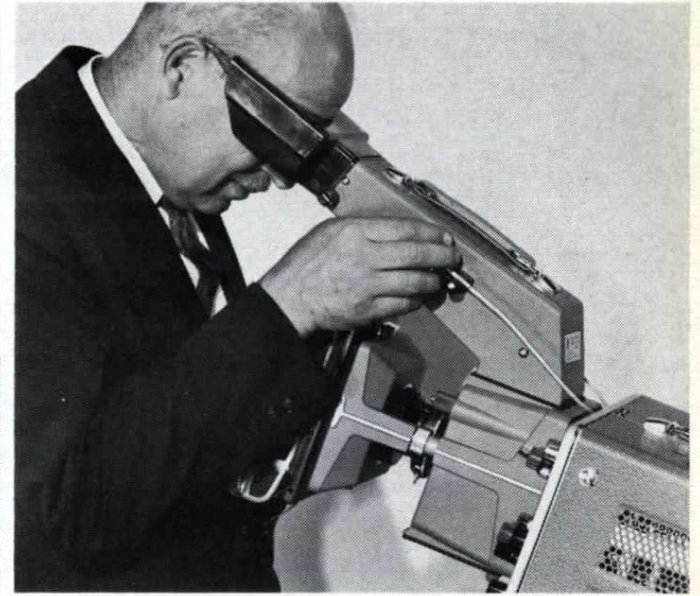
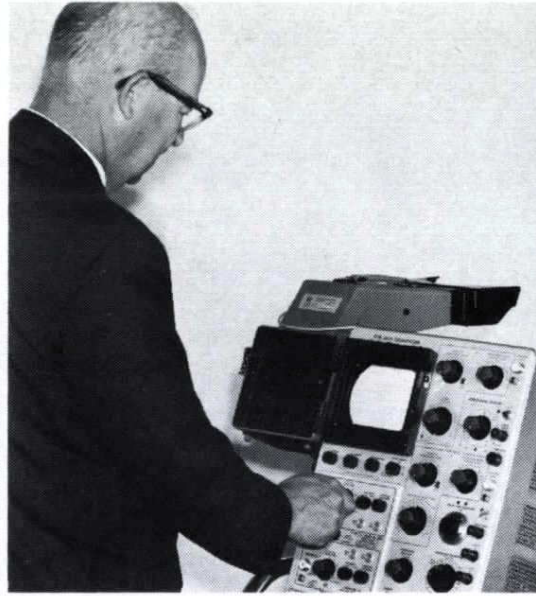
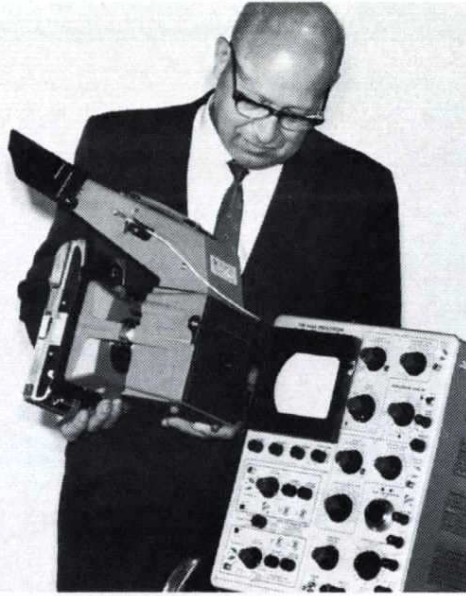
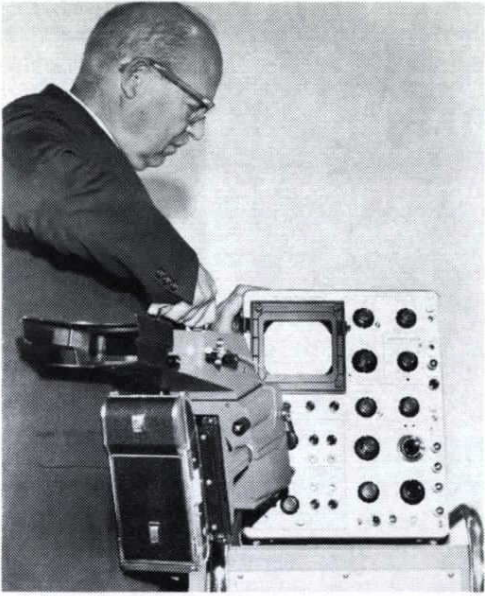
* Registered by Polaroid Corporation.



C-19 CAMERA \$515
Includes: f/1.9 Lens with 1:0.5 object-to-image ratio, a Polaroid Land 3 $\frac{1}{4}$ " by 4 $\frac{1}{4}$ " Camera Back with focus plate, and a 412-006 Camera Frame.

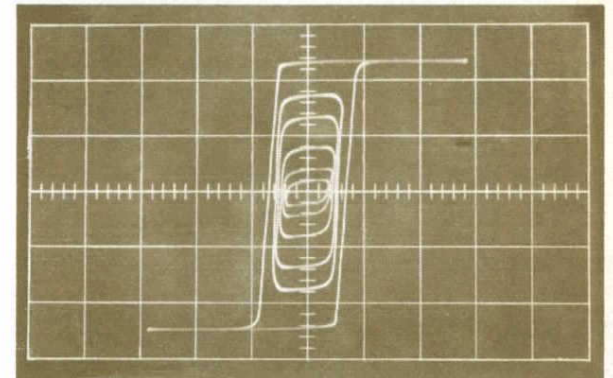
The C-19 Camera is 14 $\frac{3}{4}$ " high by 9 $\frac{5}{8}$ " wide by 17 $\frac{1}{4}$ " long. Net weight is 15 $\frac{1}{2}$ pounds. Shipping weight is 26 pounds, approx.

Cameras



Single-Shot—1 gigacycle ringing circuit on Type 519 oscilloscope. Sweep speed 2 nsec/cm. Taken on the C-19 Camera using Polaroid PolaScope/Type 410 Film (ASA 10,000). f/1.9; 1:0.5 lens.

- One-Hand Portability
- Lift-On Mounting
- Swing-Away Hinging
- Comfortable viewing—
with or without glasses



Typical hysteresis loops
(multiple exposure of varying amplitudes)

Individual Components

Please consult your local Tektronix Field Office (or Overseas Distributor) if you wish to order a combination of these components to be delivered as an assembled camera.

LENSES

All lenses fit a prefocused mount, enabling easy interchange of lenses. Shutter speed and aperture can be quickly and easily adjusted; these controls always appear at the same accessible position on the camera.

Part No.	Aperture Max.	Object-to-Image Ratio	Shutter	Price
122-548	f/1.9	1:0.9	Alphax No. 3 Ilex No. 3X	\$160
122-547	f/1.9	1:0.7	Alphax No. 3	\$180
122-549	f/1.9	1:0.5	Alphax No. 3	\$200
122-550	f/4.5	1:0.7	Alphax No. 1	\$105
122-553	f/1.5	1:1	Alphax No. 4	\$280

CAMERA FRAMES

Frames are constructed of die-cast aluminum. Rugged design permits long and continuous use.
A focus lock provides convenient locking in any position of the focus control.

Frame Part No.	Assembly	Bezel	Price
412-004	Complete Frame Assembly with dichroic mirror and viewing tunnel.	Standard Mounting Bezel for a	\$240
412-005	Complete Frame Assembly.	Tektronix 5" round crt.	\$210
412-006	Complete Frame Assembly with viewing tunnel.		\$255

FILM BACKS

Backs rotate through 90° increments...move horizontally or vertically through nine positions, with respect to lens...sliding back can be indexed along short or long axis of film frame.

Part No.	Type and Size	Film	Price
122-556	*Polaroid Land 3 1/4" by 4 1/4" includes dark slide.	Uses all types of larger size Polaroid Land roll film.	\$75
122-557	Graflok 4" by 5"	Can be used with Graflok accessories such as film-pack adapters and roll-film holders.	\$45

*Focus plate for use with the Polaroid Land Back (not needed with assemblies that include the Graflok Back).
Order Part Number 387-460 \$5

SHUTTER ACTUATOR

The Tektronix Shutter Actuator can be used to obtain electrically triggered exposures. The Shutter Actuator consists of a solenoid actuator and a power supply with trigger controls. This combination provides an impulse to the shutter tripping mechanism, electrically simulating local manual operation.

The power supply operates on nominal 117 v, 60 cps, and can be converted for 234 v use. One power supply can energize more than one solenoid.

The Shutter Actuator (includes power supply and one solenoid) can be used with all lenses except Type f/4.5; 1:0.7.

Shutter Actuator (includes power supply and one solenoid)
Order Part Number 016-205 \$125

Additional Solenoids
Order Part Number 016-211 \$30

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Accessories



SCOPE-MOBILE® CARTS

Tektronix Scope-Mobile® Carts provide a convenient support for 5-inch oscilloscopes or other electronic instruments.

The TYPE 200-SERIES features an adjustable tray that can be tilt-locked in any one of nine positions through 36°.

The TYPE 500-SERIES features a stationary tray that tilts upward at a 20° angle, a handy storage drawer, and a compartment for housing auxiliary equipment mounted behind a blank front panel.

The Scope-Mobile® Carts can be ordered with or without plug-in carriers. Or, these plug-in carriers can be ordered separately. They mount below the tray and keep the plug-in units dust free and readily accessible.



TYPE 200-SERIES

Four Scope-Mobile® Carts comprise the Type 200-Series. These include the Types 201 and 202 (without plug-in carriers) and the Types 203 and 204 (with plug-in carriers factory installed).

CHARACTERISTICS

ADJUSTABLE TRAY tilt-locks in one of nine positions. It can be adjusted through six 4.5° steps in the upward direction from the horizontal axis (desk height) and two 4.5° steps in the downward direction.

TRAY WIDTH of the Types 201 and 203 is 10½ inches. (Will hold Types 503, 504, 515A, 516, 561A Oscilloscopes.)

TRAY WIDTH of the Types 202 and 204 is 14 inches. (Will hold Types 530, 540, 550, 580-Series Oscilloscopes; 524AD, 517A, 507, 502 Oscilloscopes; 570, 575 Curve Tracers.) #66)

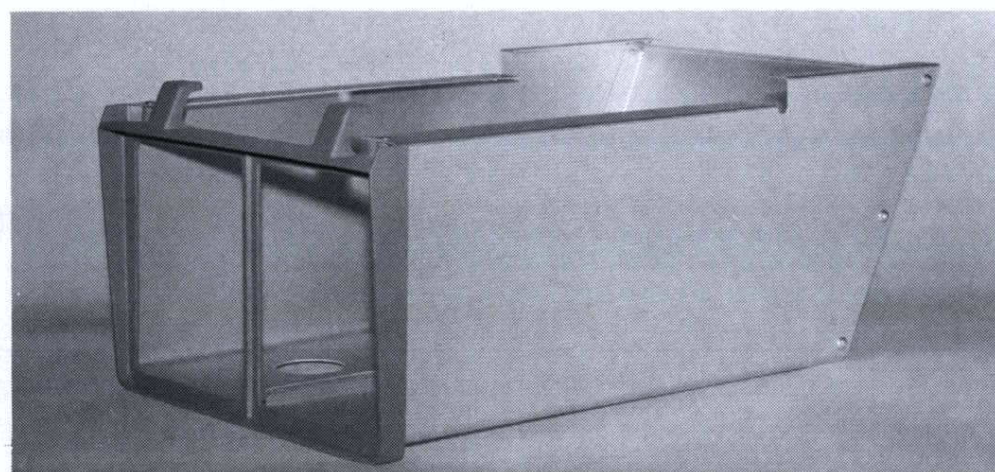
MECHANICAL FEATURES include aluminum construction, 5-inch rubber wheels, and a linoleum-topped steel shelf (17½" wide by 26⅞" deep) at the bottom.

DIMENSIONS are approximately 35" high by 17½" wide by 27" deep.

WEIGHT is approximately 35 pounds.

TYPE 200-SERIES SCOPE-MOBILE® CARTS

Type	Part Number	Plug-In Carrier	Price
201	016-030	No	\$85.00
202	016-031	No	\$85.00
203	016-033	Yes	\$99.50
204	016-034	Yes	\$99.50



PLUG-IN CARRIERS

(can be ordered separately)

Type	Part Number	Description	Price
For 201	014-007	Holds two (6½" high by 4½" wide by 14" deep) plug-in units.	\$20
For 202	014-008	Holds two (6⅜" high by 5⅜" wide by 9" deep) plug-in units.	\$20

U.S. Sales Prices f.o.b. Beaverton, Oregon
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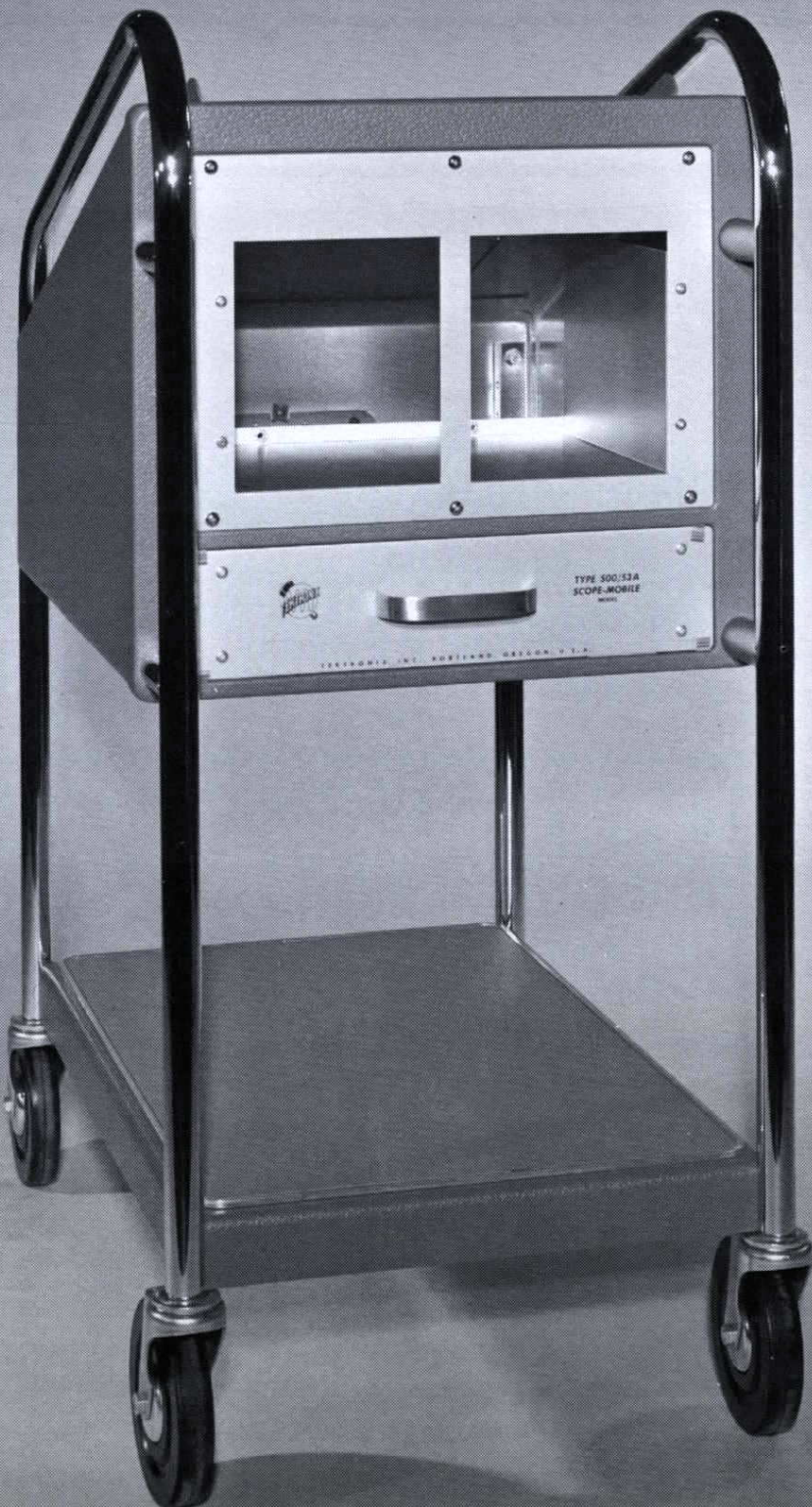
Accessories

TYPE 500-SERIES

Two Scope-Mobile® Carts comprise the Type-500 Series. These are the Type 500A (without plug-in carrier but with blank front panel) and the Type 500/53A (with plug-in carrier factory installed). Each of these can be ordered with wheel brakes on two wheels or four wheels at additional cost.

Convenient feature of the Type 500A is the compartment for housing auxiliary equipment mounted behind the blank front panel. This compartment is 8½" high by 13¾" wide for the first 5½" of depth tapering from this point, at a 20° angle, to a minimum height of 2½" at a depth of 19½".

Ventilation can be provided for this equipment compartment by an available fan kit.



CHARACTERISTICS

STATIONARY TRAY slants upward at a 20° angle.

TRAY WIDTH is 13¾ inches.

STORAGE DRAWER is felt-lined and slides on nylon guides, provides handy storage for accessory items, such as probes, cables, and manuals.

WEIGHT is approximately 35 pounds.

TYPE 500-SERIES SCOPE-MOBILE® CARTS			
Type	Part Number	Plug-in Carrier	Price
500A	016-018	No	\$ 99.50
500/53A	016-019	Yes	\$110.00

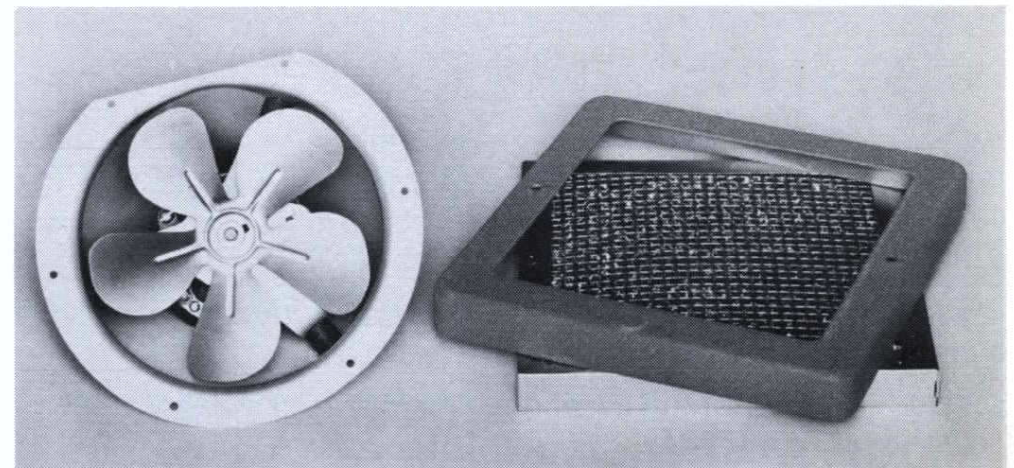
WHEEL BRAKES

TYPE 500AMOD741A (two wheels).....	\$114.50
TYPE 500AMOD741B (four wheels).....	\$129.50
TYPE 500/53AMOD741A (two wheels).....	\$125.00
TYPE 500/53AMOD741B (four wheels).....	\$140.00

PLUG-IN CARRIER

(can be ordered separately)

Replacing the blank panel on the Type 500A, this carrier (a special panel) provides storage space for two plug-in units. Order Part Number 014-005 \$10.50



FAN KIT

Providing forced-air ventilation for the instruments housed in the equipment compartment, this Fan Kit contains a motor, 5-inch blade, filter, and mounting hardware.

Order Part Number 040-161.....\$15

SPECIAL TRAYS

Available in two sizes, these special trays furnish a secure positioning mount for Tektronix Oscilloscopes smaller in size than those for which the Scope-Mobile® Cart was originally designed.

Oscilloscopes	Part Number	Price
502	436-019	\$8.75
503, 504, 515A, 516, 561A	436-020	\$9.75

U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Accessories

PROBES

Tektronix manufactures many types of probes for use with its electronic equipment. In general, these can be grouped into three main categories: (1) general-purpose probes, (2) special-purpose probes, and (3) pulse-sampling probes.

The general-purpose probes include mainly passive probes with various attenuation ratios.

The special-purpose probes include cathode-follower probes (for use with particular instruments), the high-voltage probe, and the current probe with amplifier or passive termination, among others.

The pulse-sampling probes include passive probes, cathode-follower probes, and a trigger probe.

When selecting your probe, please consider these factors:

1. The probe must accommodate the input resistance and capacitance of the oscilloscope used and must have the proper type of connector.
2. The probe must accommodate the risetime and bandwidth capabilities of the oscilloscope and application.
3. The probe must accommodate the lowest compatible input capacitance for the most accurate measurement. When considering high input impedance, select the shortest cable length and highest attenuation probe compatible with the application.
4. The probe for RF (CW) or high-voltage applications must have an adequate RF or HV rating. Most probes require derating for RF work.

When ordering any probe, please designate not only the type but also the six-digit part number.

If you desire help in selecting the right probe for your applications, please consult your Tektronix Field Engineer.

GENERAL PURPOSE PROBES

P6000 and P6003 10X PROBES

The P6000 and P6003 low input-capacitance passive probes are identical probes in all respects with the exception of the connectors. The P6000 uses a UHF connector. The P6003 uses a BNC connector.

These probes are free of overshoot and ringing and have a uniform frequency response.

Peak to peak voltage derating is necessary at CW frequencies higher than 10 Mc.

Probe input capacitance can be compensated for oscilloscope input capacitances between 20 pf and 50 pf.

CHARACTERISTICS

ATTENUATION RATIO is 10X.

INPUT RESISTANCE is 10 megohm.

INPUT CAPACITANCE is 11.5 pf minimum, 14.5 pf maximum.

MAXIMUM INPUT VOLTAGE is 600 volts.

RISETIME is approximately 14 nsec when using a Type 540-Series oscilloscope and Type K Plug-In Unit.

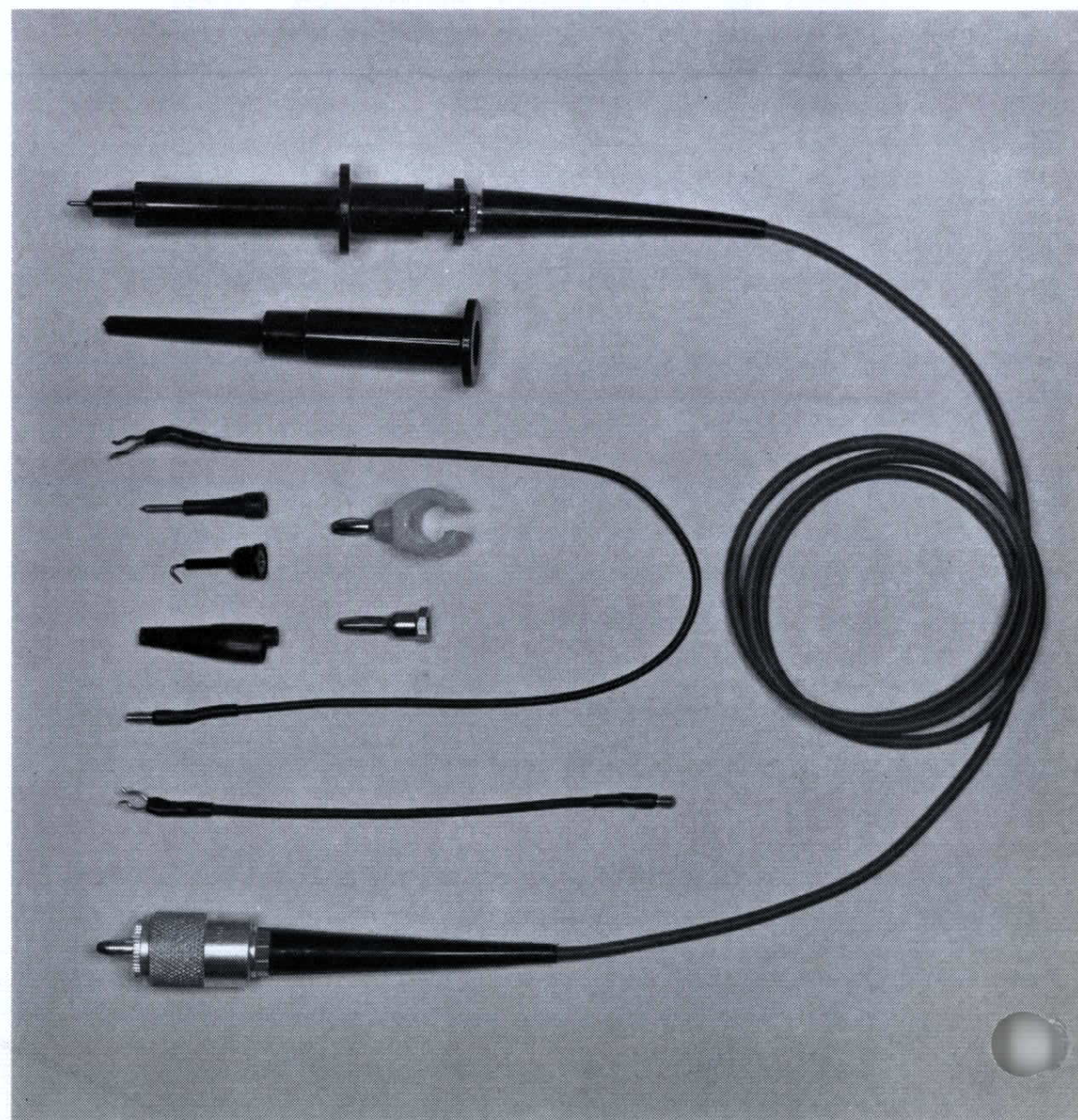
INSERTION LOSS is 1.2 db at 30 Mc.

CABLE LENGTH is 42".

P6000 with UHF connector (010-020)\$19.50

P6003 with BNC connector (010-027).....\$19.50

Each probe includes: 1—straight tip, 1—hooked tip, 1—spring tip, 1—pincher tip, 1—banana tip, 1—probe holder, 1—minigator clip, 1—5" ground lead, 1—12" ground lead.



U. S. Sales Prices f.o.b. Beaverton, Oregon
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P6002 and P6005 100X PROBES

The P6002 and P6005 low input-capacitance passive probes are identical probes in all respects with the exception of the connectors. The P6002 uses a UHF connector. The P6005 uses a BNC connector.

Peak to peak voltage derating is necessary at CW frequencies higher than 30 Mc.

In addition to the standard 42" cable length, these probes are available in cable lengths of 6', 9', and 12'. Insertion loss increases with probe cable length. For a 12' cable length probe, insertion loss is an additional 3 db at 20 Mc.

Probe input capacitance can be compensated for oscilloscope input capacitances between 20 pf and 50 pf.

CHARACTERISTICS

ATTENUATION RATIO is 100X.

INPUT RESISTANCE is 9.1 megohms.

INPUT CAPACITANCE is 2.5 pf minimum, 2.8 pf maximum for standard cable length probe.

MAXIMUM INPUT VOLTAGE is 2000 v.

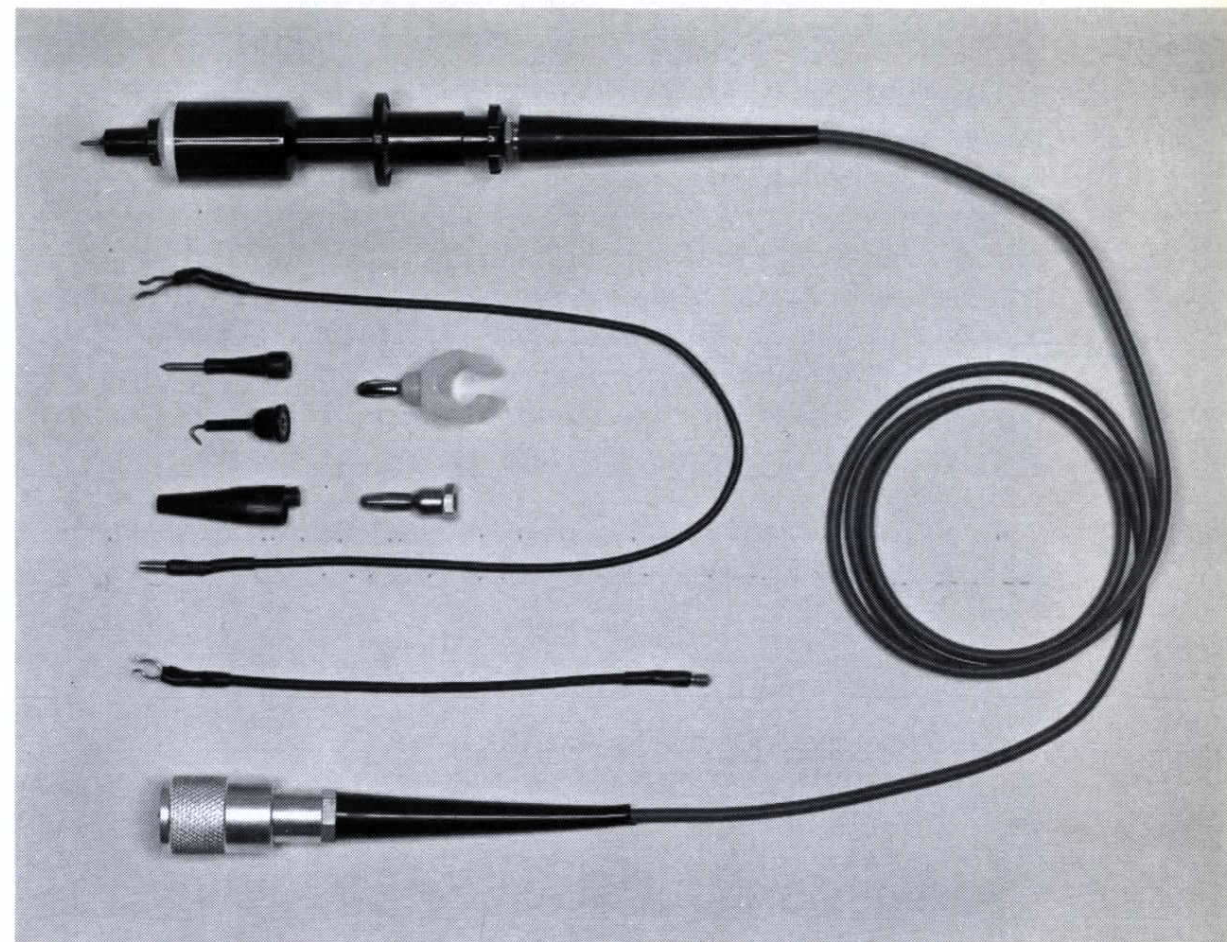
INSERTION LOSS is 1.2 db at 30 Mc for standard cable length probe.

STANDARD CABLE LENGTH is 42".

P6002 with UHF connector (010-024).....\$21.50

P6005 with BNC connector (010-029).....\$21.50

Each probe includes: 1—straight tip, 1—hooked tip, 1—spring tip, 1—banana tip, 1—probe holder, 1—minigator clip, 1—5" ground lead, 1—12" ground lead.



P6002 and P6005 PROBES with over 42" cable lengths

Probe	Cable Length	Con- nector	Part No.	Input Capacitance		Price
				Min-pf	Max-pf	
P6002 P6005	6 ft.	UHF BNC	010-034 010-050	2.8	3.25	\$22.50
P6002 P6005	9 ft.	UHF BNC	010-043 010-051	3.5	4.0	\$23.75
P6002 P6005	12 ft.	UHF BNC	010-044 010-052	3.8	4.0	\$25.00

P6008 10X PASSIVE PROBE

The P6008 low-capacitance probe is designed for use with Tektronix Type 82 Plug-In Units.

Probe input capacitance can be compensated for the input capacitance of the plug-in unit by merely turning the probe body with respect to the probe base.

CHARACTERISTICS

ATTENUATION RATIO is 10X.

INPUT RESISTANCE is 10 megohms.

INPUT CAPACITANCE is approximately 7 pf.

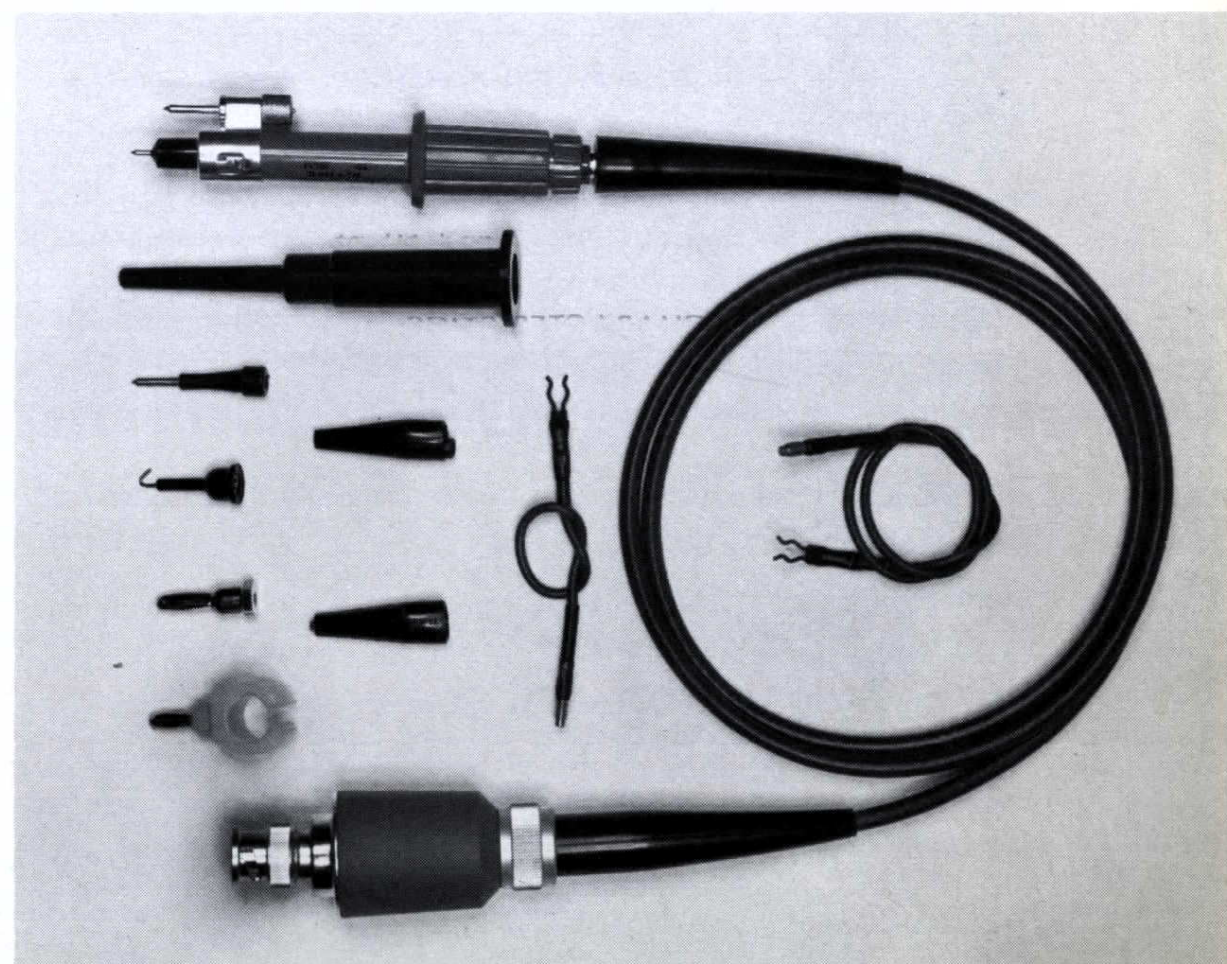
MAXIMUM INPUT VOLTAGE is 600 volts dc or pk-to-pk.

PROBE RISETIME is approximately 3 nsec.

CABLE is 42" long and terminated with a BNC connector.

P6008 PROBE, (010-129) \$35

Each probe includes: 1—straight tip, 1—hooked tip, 1—spring tip, 1—banana tip, 1—probe holder, 1—minigator clip, 1—5" ground lead, 1—12" ground lead, 1—bayonet ground assembly, 1—BNC tip, 1—pincher tip, 1—3" ground lead.



U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Accessories

P6017 and P6022 10X PROBES

The P6017 and P6022 passive probes are identical in all respects with the exception of the connectors. The P6017 uses a UHF connector. The P6022 uses a BNC connector.

In addition to the standard 42" cable length, these probes are available in cable lengths of 6', 9', and 12'. Insertion loss increases with probe cable length. For a 12' cable length probe, insertion loss is an additional 3 db at 16 Mc.

Peak to peak voltage derating is necessary at CW frequencies higher than 1.5 Mc for the standard probe, 1.0 Mc for probes with 6' and 9' cable lengths and 10 Mc for probes with 12' cable lengths.

~~Probe input capacitance remains constant for oscilloscope input capacitances between 20 pf and 50 pf.~~ 11-12-62

CHARACTERISTICS

ATTENUATION RATIO is 10X.

INPUT RESISTANCE is 10 megohms.

INPUT CAPACITANCE is 14 pf, for standard cable length probe.

MAXIMUM INPUT VOLTAGE is 600 v.

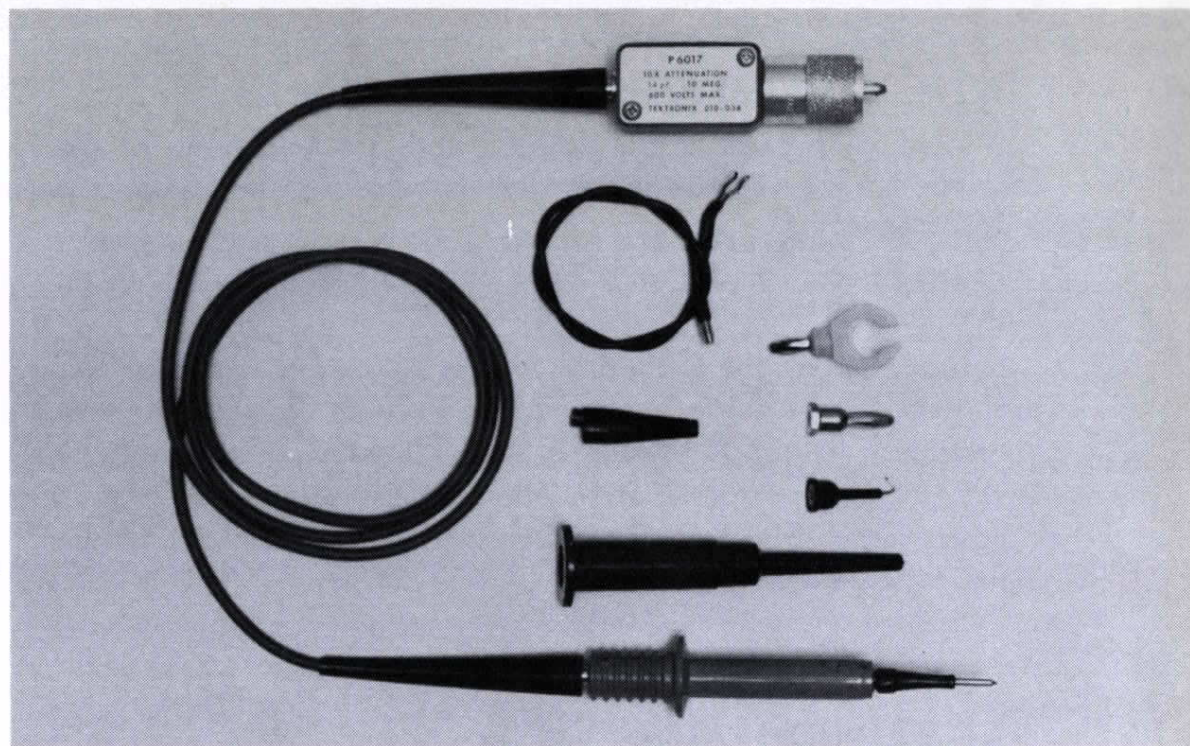
INSERTION LOSS is 1 db at 30 Mc for standard cable length probe.

STANDARD CABLE LENGTH is 42".

P6017 with UHF connector (010-038).....\$12.50

P6022 with BNC connector (010-064).....\$12.50

Each probe includes: 1—hook tip, 1—spring tip, 1—pincher tip, 1—banana tip, 1—probe holder, 1—minigator clip, 1—12" ground lead.



P6017 and P6022 PROBES with over 42" cable lengths						
Probe	Cable Length	Con- nector	Part No.	Input Capacitance		Price
				Min	Max	
P6017 P6022	6 ft.	UHF BNC	010-056 010-066	17	17	\$13.50
P6017 P6022	9 ft.	UHF BNC	010-057 010-067	20	20	\$14.75
P6017 P6022	12 ft.	UHF BNC	010-058 010-068	23	23	\$16.00

P6027 and P6028 1X PROBES

The P6027 and P6028 passive probes are identical in all respects with the exception of the connectors. The P6027 uses a UHF connector. The P6028 uses a BNC connector.

Peak to peak voltage derating is necessary of CW frequencies higher than 1.0 Mc.

In addition to the standard 42" cable length, these probes are available in cable lengths of 6', 9', and 12'. Insertion loss increases with probe cable length. ~~For a 12' cable length probe, insertion loss is an additional 3 db at 16 Mc.~~

~~Probe input capacitance can be compensated for oscilloscope input capacitances between 20 pf and 50 pf.~~ 11-12-62

CHARACTERISTICS

ATTENUATION RATIO is 1X.

INPUT RESISTANCE is 1 megohm.

INPUT CAPACITANCE is 67 pf minimum, 94 pf maximum for standard cable length probe.

MAXIMUM INPUT VOLTAGE is 600 v.

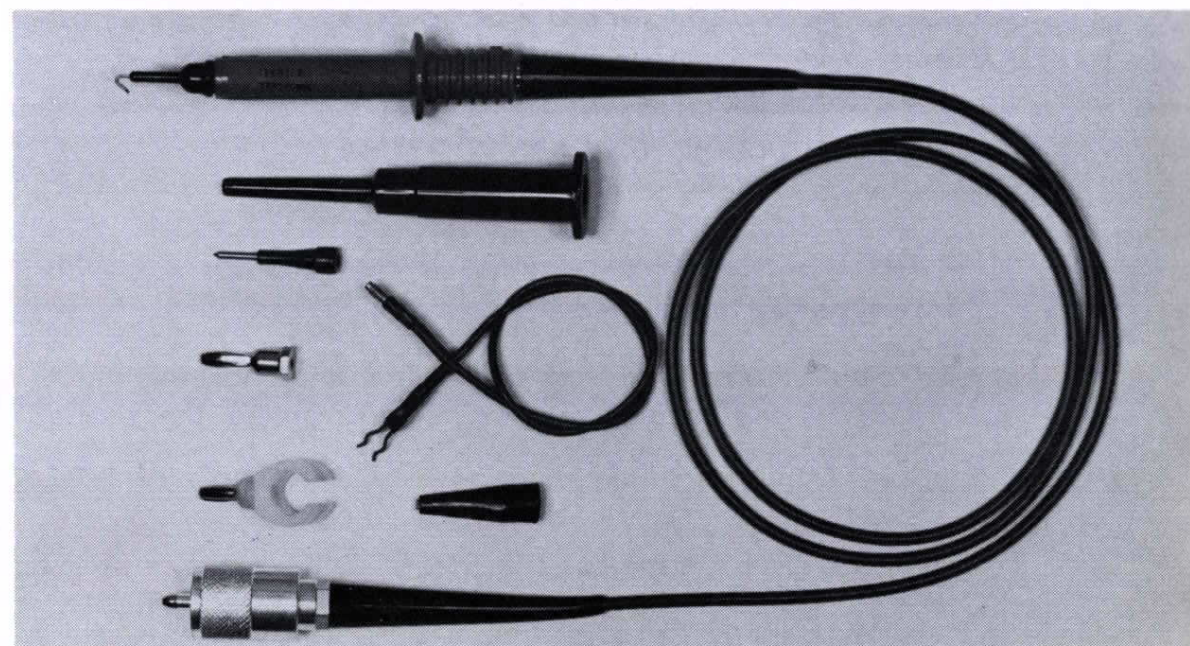
INSERTION LOSS is 1 db at 30 Mc for standard cable length probe.

STANDARD CABLE LENGTH is 42".

P6027 with UHF connector (010-070).....\$12.50

P6028 with BNC connector (010-074).....\$12.50

Each probe includes: 1—hook tip, 1—spring tip, 1—pincher tip, 1—banana tip, 1—probe holder, 1—minigator clip, 1—12" ground lead.



P6027 and P6028 PROBES with over 42" cable lengths						
Probe	Cable Length	Con- nector	Part No.	Input Capacitance		Price
				Min	Max	
P6027 P6028	6 ft.	UHF BNC	010-071 010-075	93.0	120.0	\$13.50
P6027 P6028	9 ft.	UHF BNC	010-072 010-076	120.0	147.0	\$14.75
P6027 P6028	12 ft.	UHF BNC	010-073 010-077	146.0	173.0	\$16.00

U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

SPECIAL PURPOSE PROBES

P170CF CATHODE-FOLLOWER PROBE

The P170CF has been developed for use with the Tektronix Type 517A Oscilloscope. When used with oscilloscopes other than the Type 517A, the P170CF requires use of a power supply such as the Tektronix Type 128 Probe Power Supply.

The preamplifier grid line in the Type 517A acts as the 170-ohm termination for the P170CF probe. When the probe is used with oscilloscopes other than the Type 517A, the Tektronix 170-ohm terminating resistor is recommended for proper termination of the P170CF.

The probe uses three variable (10:1) attenuator heads for attenuations up to 4000X.

CHARACTERISTICS

PROBE ALONE:

ATTENUATION is 2X.

GAIN is 0.5.

RISETIME is less than 2 nsec.

FREQUENCY RESPONSE is down less than 0.5 db at 65 Mc for high frequency and down 3 db at 15 cps for low frequency.

INPUT SHUNT CAPACITANCE is 5 to 5.5 pf.

LOW FREQUENCY INPUT RESISTANCE is 12 megohms, isolated by 0.001 μ f coupling capacitor.

MAXIMUM VOLTAGE INPUT is ± 0.5 v peak.

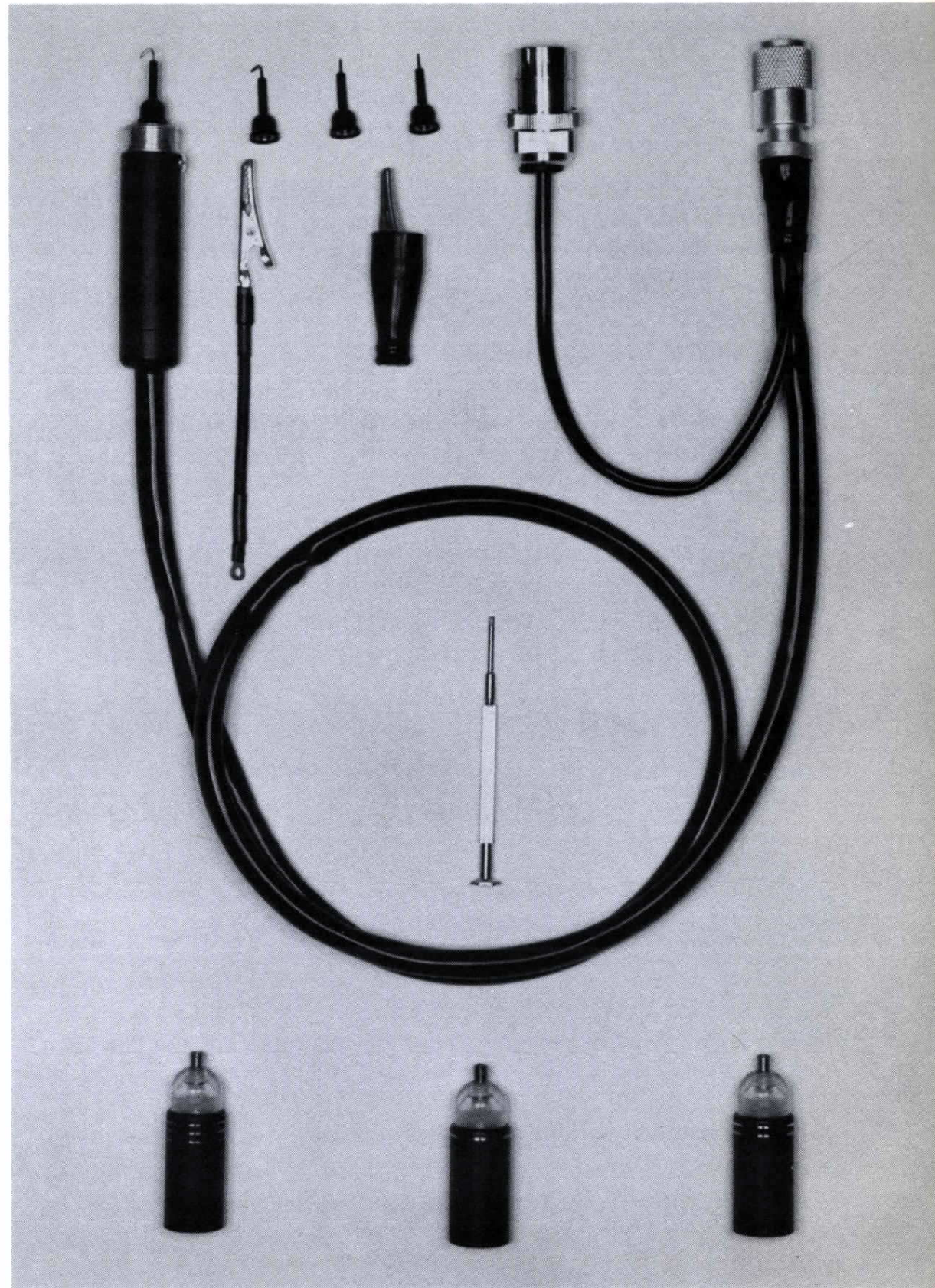
POWER SUPPLY REQUIREMENTS are regulated + 120 v at 10 ma, regulated or unregulated 6.3 v at 150 ma.

PROBE CABLE is 42" long.

P170CF CATHODE-FOLLOWER PROBE (010-101) \$86

Each probe includes: 1—PAX-I attenuator head, 1—PAX-II attenuator head, 1—PAX-III attenuator head, 1—jewel screwdriver, 2—hooked tips, 2—straight tips, 1—clip assembly, 1—instruction manuals.

11-12-62



P170CF ATTENUATOR HEADS						
Type	Attenuation (includes P170CF)	Input Capacity	Low-Freq. 3-db Point	Max. Voltage Input	Part No.	Price
PAX-I	4X min. 40X max.	5 pf 1.2 pf	800 cps 1700 cps	± 1 v pk.	010-301	\$11
PAX-II	40X min. 400X max.	5 pf 1.2 pf	150 cps 150 cps	± 10 v pk.	010-302	\$11
PAX-III	400X min. 4000X max.	3 pf 1.1 pf	60 cps 60 cps	± 100 v pk.	010-303	\$11

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Please refer to Terms and Shipment, General Information page.

Accessories

P500CF CATHODE-FOLLOWER PROBE

The P500CF Probe has been developed for use with the Tektronix Type 524AD Oscilloscope. When used with oscilloscopes other than the Type 524AD, the P500CF requires use of a power supply such as the Tektronix Type 128 Probe Power Supply.

CHARACTERISTICS

PROBE GAIN is from 0.8 to 0.85.

ATTENUATION is 10X with attenuator head.

INPUT IMPEDANCE is 40 megohms paralleled by 4 pf when using the probe alone and 10 megohms paralleled by 2 pf when using 10X attenuator head.

HIGH FREQUENCY RESPONSE is 0.5-db down at 10 Mc.

LOW FREQUENCY RESPONSE is 3-db down at 5 cps.

AMPLITUDE DISTORTION is less than 3% for peak amplitudes up to 5 v when using the probe alone, or up to 50 v when using the 10X attenuator head.

MAXIMUM INPUT VOLTAGE is approximately 5 v at 10 Mc or 2 v at 30 Mc for the probe alone and approximately 50 v at 10 Mc or 20 v at 30 Mc when using the 10X attenuator head.

HUM LEVEL is less than 1.5 mv at maximum sensitivity.

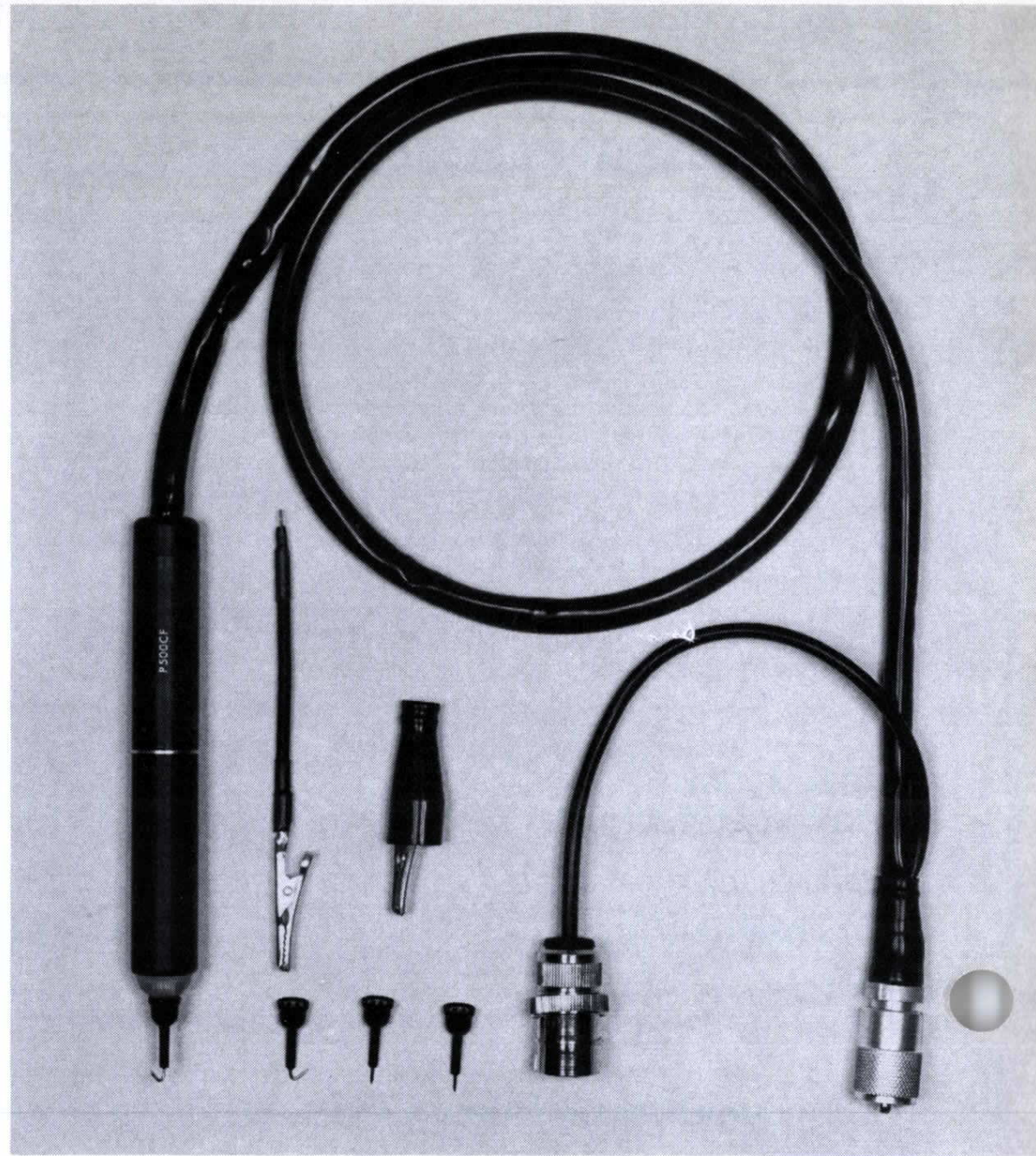
POWER SUPPLY REQUIREMENTS are regulated +120 v at 25 ma, regulated or unregulated +6.3 v at 150 ma, dc voltages.

PROBE CABLE is 42" long.

P500CF CATHODE-FOLLOWER PROBE (010-109) \$64

Each probe includes: 1—10X attenuator head, 1—5" ground strap, 2—hooked tips, 2—straight tips, 1—clip assembly, 1—instruction manuals.

11-12-62



P6013 HIGH-VOLTAGE PROBE

The Type P6013 provides 1000X attenuation as a means for oscilloscope measurements of high-amplitude waveforms or dc potentials up to 12 kv. Pulse frequency can be up to 100 kc at 12 kv.

Peak to peak voltage derating is necessary at CW frequencies higher than 100 kc.

The probe can be compensated for oscilloscope input capacities up to 60 pf.

CHARACTERISTICS

ATTENUATION is 1000X.

INPUT IMPEDANCE is 100 megohms paralleled by 3 pf.

RISETIME is 14 nsec when using a Type 545A Oscilloscope and Type K Plug-In Unit.

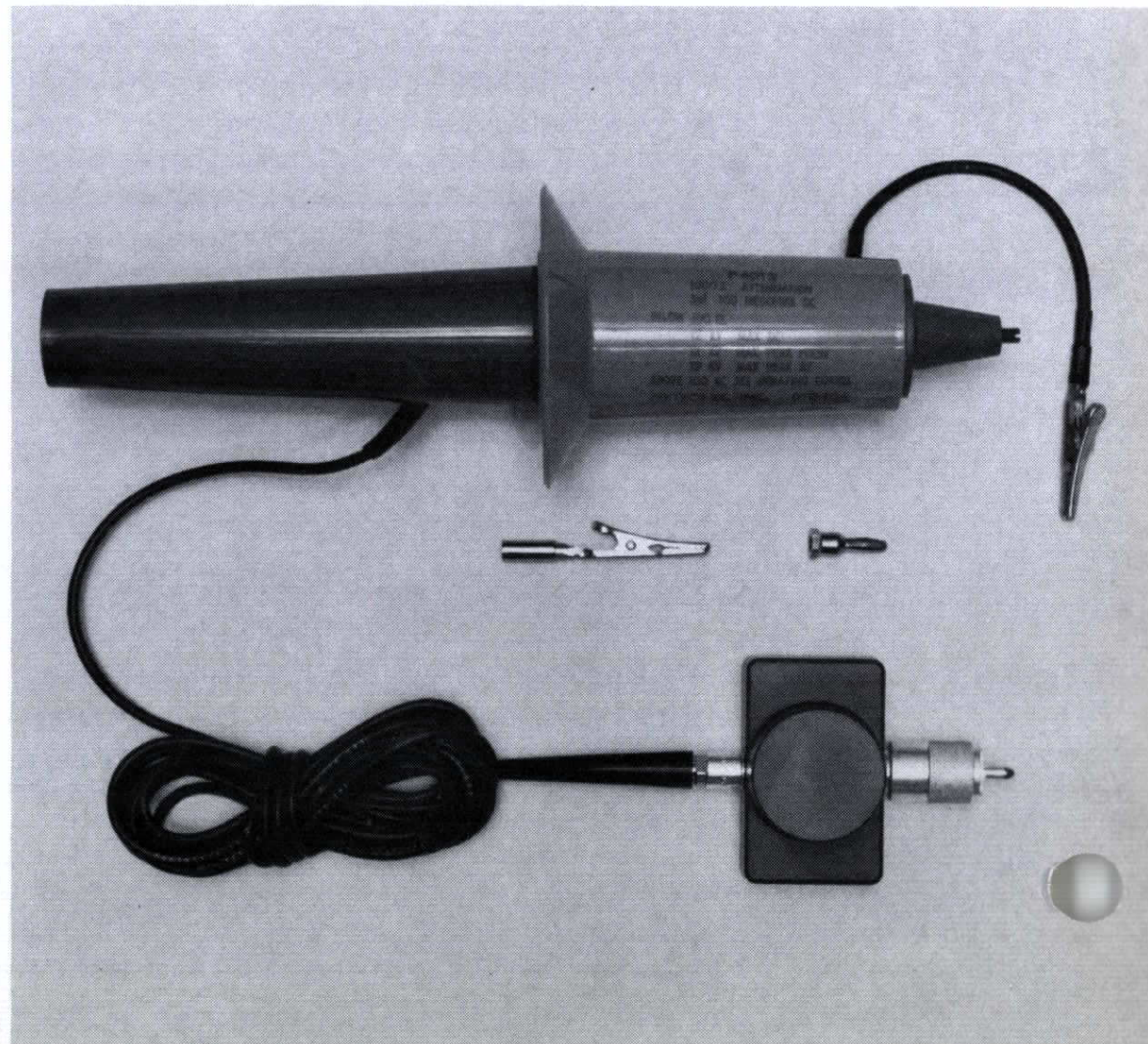
MAXIMUM VOLTAGE RATING is 12 kv dc, peak pulse, or peak ac at frequencies below 100 kc. Voltage derating required for voltages at frequencies over 100 kc.

CABLE LENGTH is 10'.

P6013 PROBE (010-106).....\$50

Each probe includes: 1—banana tip, 1—alligator tip, 1—7" ground strap, 1—instruction manuals.

11-12-62



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P6016 AC CURRENT PROBE

The P6016 Probe offers two current detecting systems for use with Tektronix wide-band oscilloscopes, the P6016 Probe and Type 131 Amplifier combination, or the P6016 Probe and Passive Termination combination.

The Probe and Amplifier combination measures currents over a wide range with risetimes to 20 nsec. The Probe and Passive combination is not quite as flexible, but has improved passband characteristic.

PROBE AND TYPE 131 AMPLIFIER CHARACTERISTICS

SENSITIVITY with a 50 mv/div oscilloscope input is 1 ma/div basic sensitivity with 10 calibrated steps from 1 ma/div to 1 amp/div in a 1-2-5 sequence, accuracy within 3%. Variable control on the oscilloscope provides continuous uncalibrated ranging between steps.

NOISE is equivalent to a 100- μ amp, pk-to-pk, input signal.

RISETIME is 20 nsec with a Tektronix Type K Plug-In Unit and Type 540A-Series Oscilloscope.

PASSBAND is approximately 17 Mc at 3-db down.

DELAY TIME is ~~32~~⁴⁰ nsec or less measured at the 50% pulse amplitude points.

LOW-FREQUENCY RESPONSE is 50 cps at ~~30~~⁴⁰ db down.

AC CURRENT SATURATION RATING is 15 amps pk-to-pk, decreasing to 8 amps at 400 cps, 400 ma at 50 cps.

POWER REQUIREMENT is 105-125 v ac, approximately ~~0.25~~^{0.5} watt at 117 v, or approximately ~~0.25~~^{0.5} watt at 234 v ac.

PROBE AND PASSIVE TERMINATION CHARACTERISTICS

SENSITIVITY is either 2 ma/mv or 10 ma/mv of oscilloscope sensitivity, accuracy within 3%.

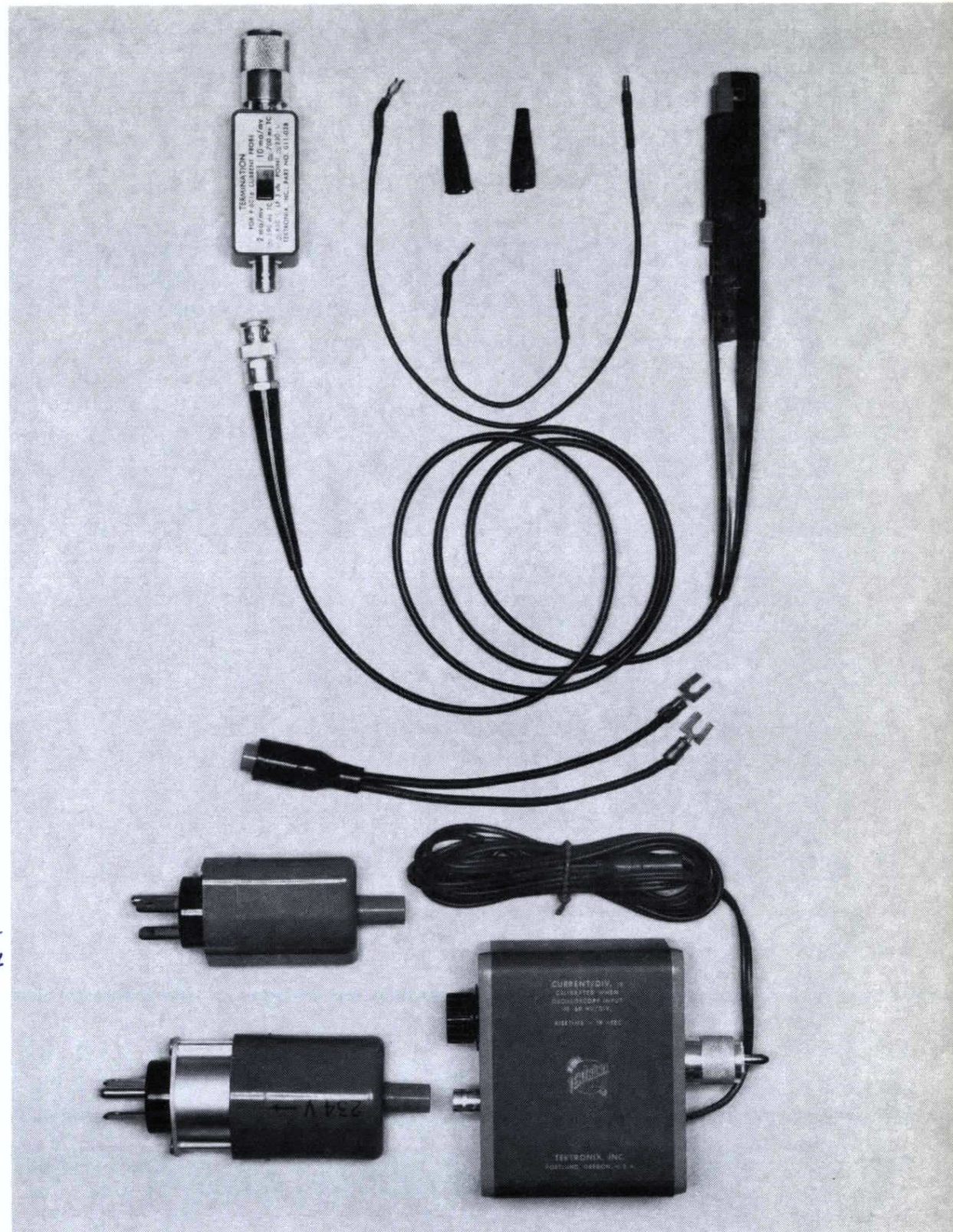
RISETIME is 17 nsec, $\pm 4\%$ maximum rolloff, overshoot, and ringing, with a Tektronix Type K Plug-In Unit and Type 540A-Series Oscilloscope.

PASSBAND is approximately 20 Mc at 3-db down.

DELAY TIME is ~~20~~³⁰ nsec or less measured at the 50% pulse amplitude points.

LOW-FREQUENCY RESPONSE at 3-db down is approximately 850 cps at 2 ma/mv (5% tilt of 10 μ sec square-wave pulse) and approximately 230 cps at 10 ma/mv (5% tilt of 35 μ sec square-wave pulse).

MAXIMUM CURRENT RATING is 15 amps pk-to-pk.



COMMON TO BOTH SYSTEMS

DC SATURATION THRESHOLD is 0.5 amp.

MAXIMUM BREAKDOWN VOLTAGE is 600 v.

INSERTION IMPEDANCE after a step function has been applied to the conductor under test is (1) 0.06 Ω after 50 nsec, (2) 0.04 Ω after 100 nsec, (3) 0.015 Ω after 1 μ sec, and (4) 0.006 Ω after 10 μ sec. Dependent upon size of the wire, the capacitance between the conductor and probe case is typically 1 pf.

P6016 PROBE (010-037)	\$ 75
PASSIVE TERMINATION (011-028)	\$ 15
PROBE AND PASSIVE TERMINATION (011-044)	\$ 90
TYPE 131 AMPLIFIER 117 v (015-011)	\$160
TYPE 131 AMPLIFIER 234 v (015-024)	\$160
PROBE AND AMPLIFIER (015-030) .117 V	\$235

Each probe includes, 1-5" ground lead, 1-12" ground lead, 2-minigator clips, instruction manuals.

PROBE + AMPLIFIER (015-045) 234 V \$235 (2-18)

U. S. Sales Prices f.o.b. Beaverton, Oregon

Please refer to Terms and Shipment, General Information page.

Accessories

P6023 10X PROBE

Initially designed for Tektronix Type Z Plug-In Unit, the Type P6023 applies its specifications as well to other Tektronix differential preamplifiers.

Peak to peak voltage derating is necessary at CW frequencies higher than 5 Mc.

The probe can be compensated for input capacities between 20 pf and 50 pf. The attenuation can be compensated for normal plug-in attenuator differences between two plug-in units or two channels of the same plug-in unit.

CHARACTERISTICS

RISETIME is less than 7 nsec.

MAXIMUM INPUT VOLTAGE is 1000 v, dc or pk-to-pk. Voltage derating is required for RF measurements over 5 Mc.

INPUT CAPACITANCE is 12 pf or less.

INPUT RESISTANCE is 8 megohms.

COMPENSATING CAPACITY is from 1.5 pf to 5 pf for fine adjustment and from 7 pf ^{to 45 pf} for coarse adjustment.

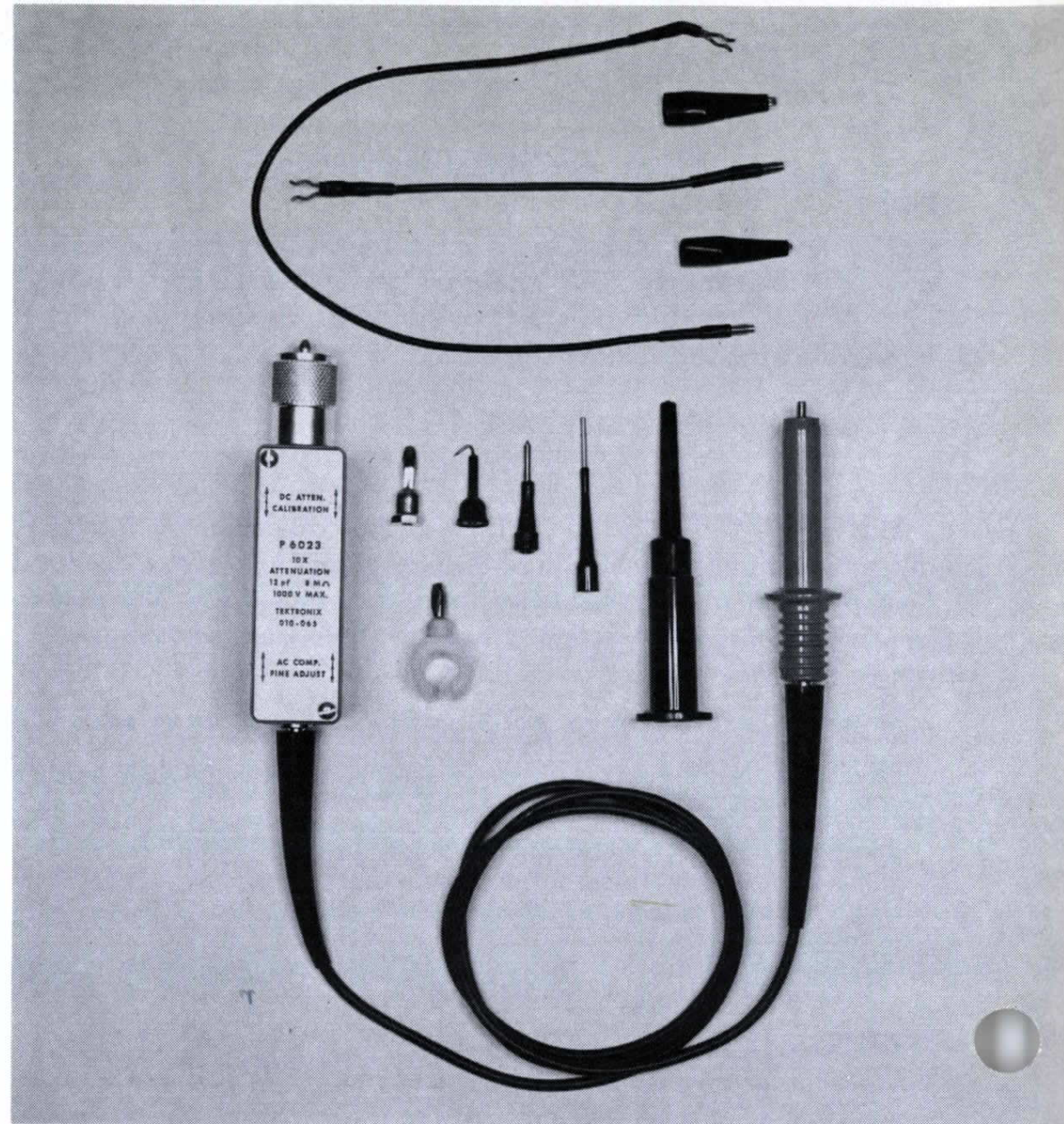
ATTENUATION RATIO is 10:1, $\pm 2.5\%$.

CABLE LENGTH is 42".

TYPE P6023 10X PROBE (010-065) \$40

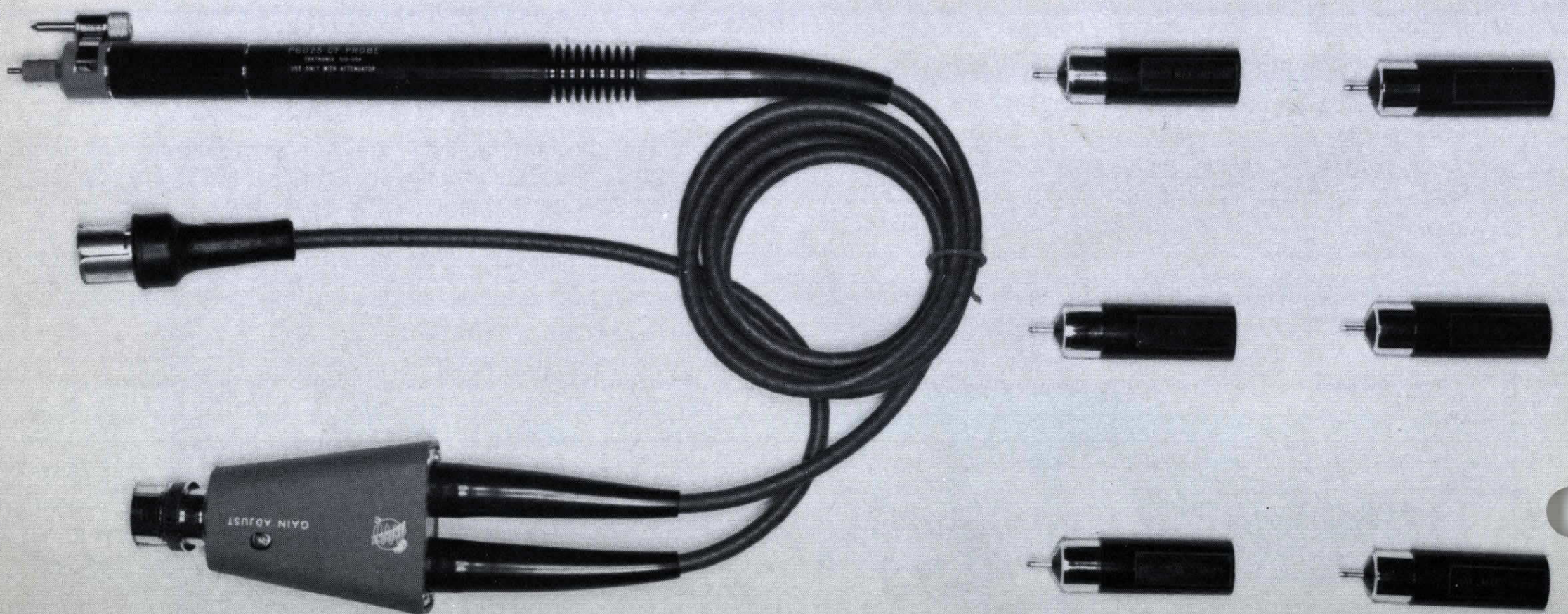
Each probe includes: 1—spring tip, 1—hook tip, 1—pincher tip, 1—probe holder, 1—banana plug, 2—minigator clips, 1—5" ground strap, 1—12" ground strap.

U.S. Sales Price f.o.b. Beaverton, Oregon
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PULSE SAMPLING PROBES

P6025 CATHODE-FOLLOWER PROBE



Accessories

The P6025 Cathode-Follower Probe, a high-frequency probe designed for use with the Tektronix Type N Pulse Sampling Plug-In Unit, offers flexibility through 7 attenuator heads. All attenuator heads can be compensated for proper ac attenuation ratios.

Normally dc coupled, the probe can also be ac-coupled with a capacitor-coupler head that is supplied with the probe.

CHARACTERISTICS

OUTPUT is ± 100 mv into a 50-ohm load.

OUTPUT DC LEVEL is approximately +350 mv.

INPUT RESISTANCE is 10 megohms with an attenuator head.

RISETIME of the probe, attenuator head, Type N Unit, is 0.85 nsec for attenuations of 200X and less, and 1 nsec for attenuations above 200X, when using a 25-ohm source impedance. A higher source impedance imposes an RC charge time as a restriction on the probe risetime.

ATTENUATOR HEADS (DC COUPLED)								
Attenuator		10X	20X	50X	100X	200X	500X	1000X
Input Capacitance in PicoFarads $\pm 10\%$		5.0	3.5	2.5	1.8	1.5	1.3	1.2
Max. Linear Voltage Input in \pm Volts		1	2	5	10	20	50	100

CAPACITOR-COUPLER HEAD is rated at 0.001 μ fd, 600 v dc, and has a low-frequency 3-db point of approximately 20 cps.

POWER REQUIREMENTS are 6.3 v ac at 200 ma for the heater and +100 v dc at approximately 12 ma for the plate.

CABLE is 54 inches long with GR connector.

P6025 PROBE, (010-053) ~~\$190~~ ^{#260.}

Each probe includes: 1—ground clip assembly, 2—spring clips, 7—attenuator heads, 1—capacitor-coupler head, 1—instruction manuals.

11-12-62

P6026 PASSIVE PROBE

The Type P6026 Probe, usable with any of the Tektronix 50-ohm input, sampling systems, has extremely low input capacitance with passband characteristics to 600 Mc.

The seven attenuator heads are easily interchangeable and do not require compensation.

The probe includes two 50-ohm terminations, one for ac coupling and one for dc coupling.

CHARACTERISTICS

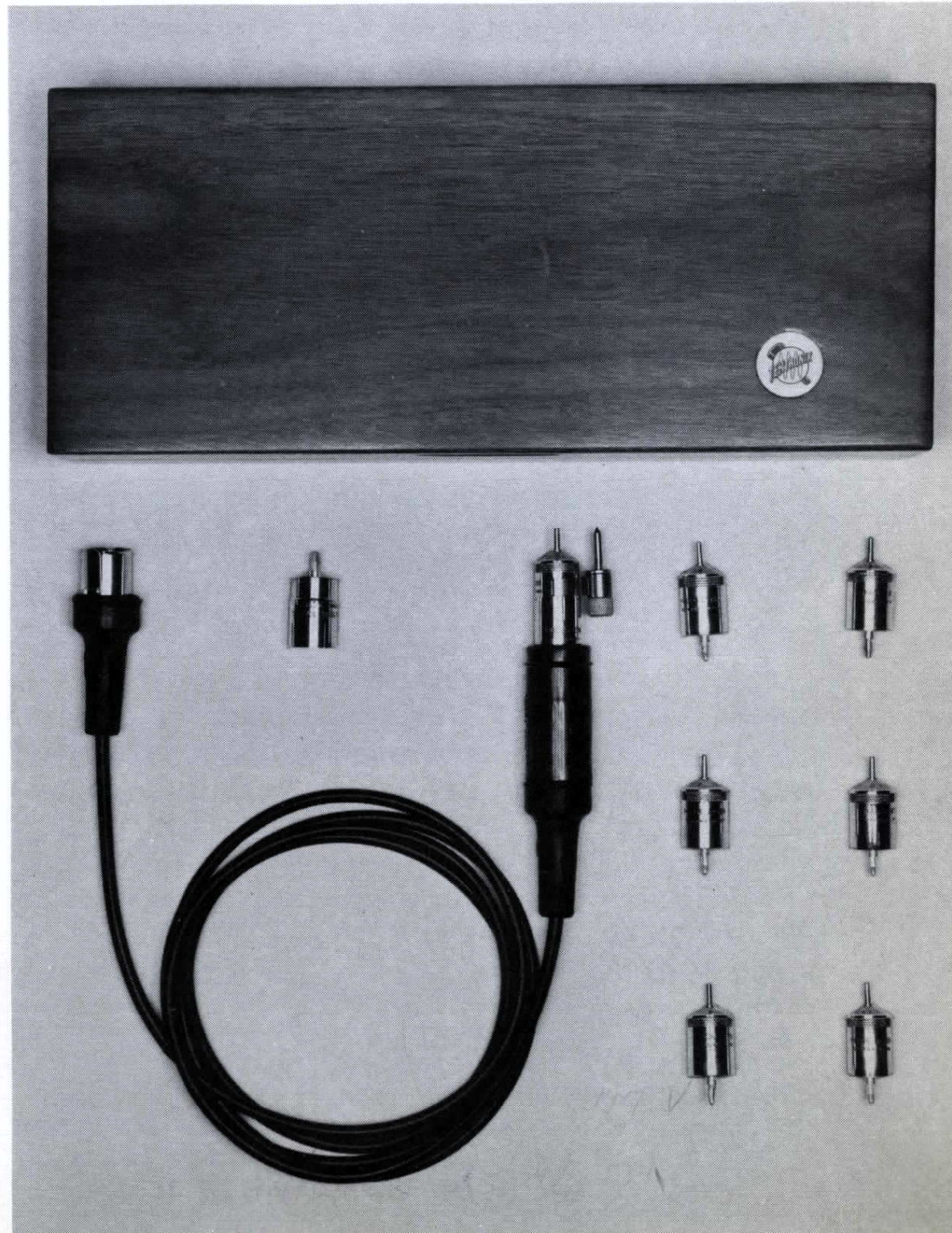
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Attenuator-DC accuracy within 2%	Input C at 600 Mc	Input R at 600 Mc	Input R at DC	Low freq. AC coupled approx. 3 db point
5X	0.5 pf	125 Ω	125 Ω	1.4 Mc
10X	0.5 pf	250 Ω	250 Ω	720 kc
20X	0.6 pf	500 Ω	500 Ω	360 kc
50X	0.8 pf	1 k Ω	1.25 k Ω	140 kc
100X	0.8 pf	2 k Ω	2.5 k Ω	65 kc
200X	0.8 pf	3.25 k Ω	5 k Ω	32 kc
500X	0.8 pf	4 k Ω	12.5 k Ω	13 kc

STANDARD CABLE is a 10-nsec RG58A/U cable, approximately 6 1/2 feet long; 5-nsec and 10-nsec RG8/U cables are available for extending the cable length. A frequency response loss becomes apparent when the cable is extended beyond 20 feet.

P6026 PROBE, (010-055) \$140

Each probe includes: 7—attenuator heads, 1—50- Ω ac termination, 1—50- Ω dc termination, 1—ground clip, 1—GR connector-to-probe adapter, 1—50- Ω 10-nsec cable, 1—carrying case.



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Accessories

P6032 CATHODE-FOLLOWER PROBE

The P6032 is a high-frequency cathode-follower probe designed for use with Tektronix vertical sampling plug-in units, such as the Type 3S76 and Type 4S1.

The attenuator heads can be compensated for ac input capacitances of the plug-in units.

CHARACTERISTICS

RISETIME is typically 0.4 nsec for probe and attenuator head.

MAXIMUM OUTPUT is ± 150 mv into a 50- Ω load.

SIGNAL DELAY is approximately 10 nsec.

POWER REQUIREMENTS are 12.6 v at 180 ma for the filament and +100 v at 12 ma for the plate.

Attenuator Head	Max. Input Voltage*	Input Capacitance at DC ($\pm 10\%$)	Input Resistance at DC ($\pm 2\%$)
10X	± 1.5 v	3.6 pf	10 meg
20X	± 3.0 v	2.6 pf	10 meg
50X	± 7.5 v	1.8 pf	10 meg
100X	± 15 v	1.5 pf	10 meg
200X	± 30 v	1.4 pf	10 meg
500X	± 75 v**	1.3 pf	10 meg
1000X	± 150 v**	1.3 pf	10 meg

* Limited by linearity of cathode follower. This value may be exceeded by 50% for pulses without damage to probe components.

** Must be derated for continuous wave use. Peak to peak voltage derating is necessary at CW frequencies higher than 500 Mc for the 1000X attenuator head and 1000 Mc for the 500X attenuator head.

Attenuator Head	Max. Input Voltage (peak-to-peak) (at 100% duty factor)			
	500 Mc	750 Mc	1000 Mc	1250 Mc
500X	150 v	150 v	150 v	125 v
1000X	300 v	200 v	150 v	125 v

P6033 TRIGGER PROBE

The P6033 Probe assists Tektronix pulse-sampling systems in providing stable displays of high-frequency repetitive pulses through external triggering.

The P6033 accepts triggering signals with risetimes near 1.2 nsec, or sine-wave frequencies to about 300 Mc.

CHARACTERISTICS

INPUT IMPEDANCE into a 50-ohm termination is approximately 1.2 k Ω paralleled by 2 pf at 250 Mc, and 870 Ω at dc.

TYPICAL ATTENUATION RATIOS with 50-ohm terminations are 17:1 (-24 db), between dc and 100 kc; 50:1 (-35 db), at 350 kc; and 10:1 (-20 db), between 1.5 Mc and 300 Mc.

RISETIME is 1.2 nsec or less when driven by a 25-ohm source.

TRIGGER DELAY is approximately 10 nsec.

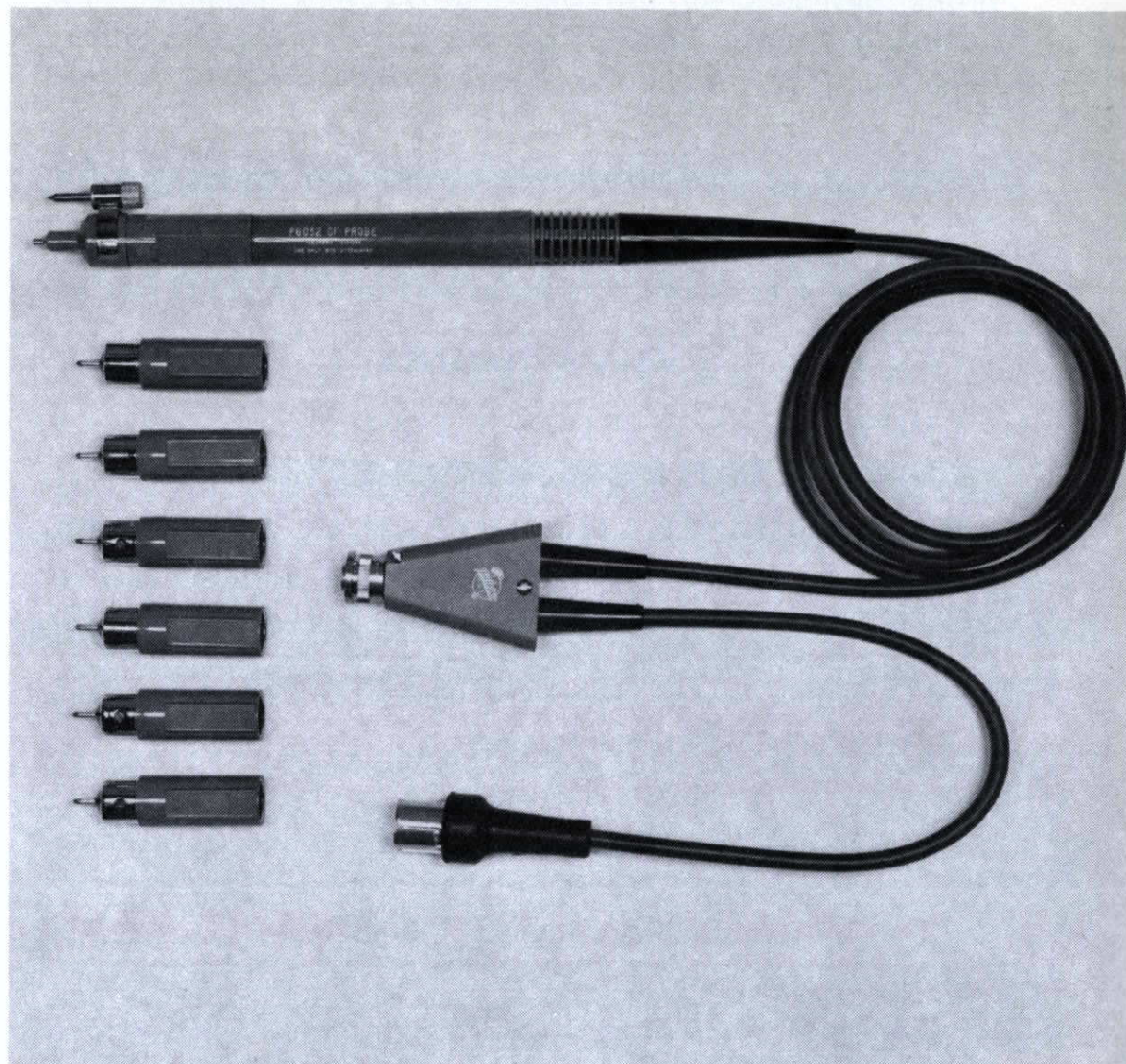
VOLTAGE RATING is 15 v dc or rms, dc coupled; 400 v dc or 15 v rms, ac coupled.

CABLE is 5' long with GR connectors.

P6033 TRIGGER PROBE, (010-100)\$35

Each probe includes: 1—hook tip, 1—pincher tip, 1—banana tip, 1—probe holder, 2—minigator clips, 1—5' ground strap, 1—12' ground strap, 1—instruction manuals.

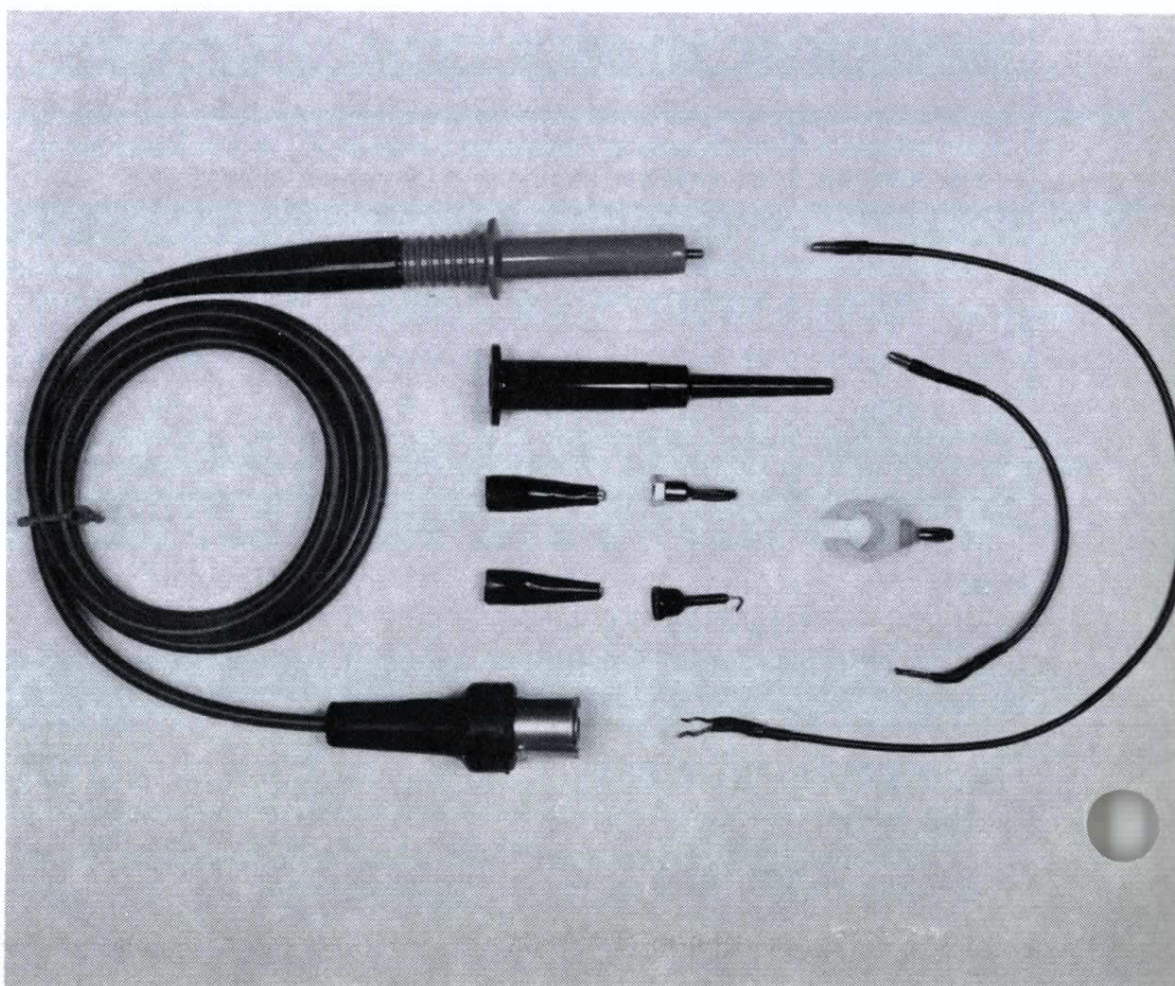
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Please refer to Terms and Shipment, General Information page.



CAPACITOR-COUPLER HEAD is rated at 0.001 μ fd, 600 v dc. Low frequency 3-db point is 16 cps.
CABLE is 54" long with GR connector.

P6032 PROBE, (010-108)\$160

Each probe includes: 7—attenuator heads, 1—capacitor-coupler head, 1—ground-clip assembly, 2—solderable ground-clip assemblies, 1—instruction manuals.



P6034 10X PROBE

The P6034 low-capacity, miniature passive probe assists Tektronix Type 4S1 and Type 3S76 Pulse-Sampling Plug-In Units in realizing accurate measurements of high-speed repetitive pulses. Risetime of the probe conforms to the risetime of the plug-in units.

Peak-to-peak voltage derating is necessary for CW frequencies higher than 800 Mc.

The probe is marked for attenuation ratio, wattage rating, and resistance of the probe.

Probe is properly compensated for a 25-ohm source when shipped.

CHARACTERISTICS

INPUT CAPACITY is 0.7 pf at 1 gigacycle.

INPUT RESISTANCE is 300 ohm at 1 gigacycle.

MAXIMUM DC INPUT is 16 v dc-coupled and 500 v ac-coupled.

ATTENUATION RATIO is 10X.

MAXIMUM POWER is $\frac{1}{2}$ w.

PASSBAND is dc to 1.5 gigacycle (3-db down).

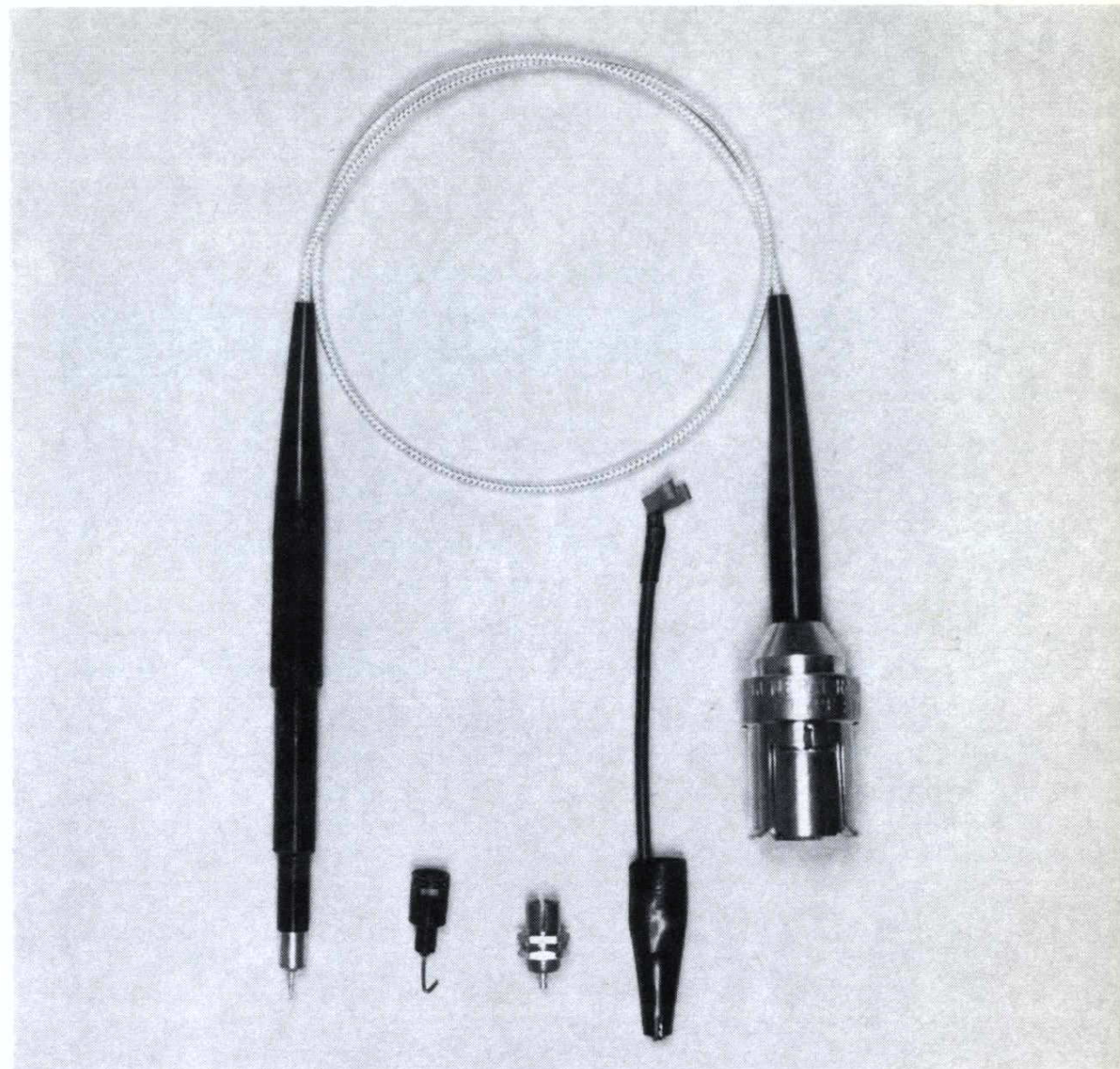
LOW FREQUENCY RESPONSE is approximately 70 kc at 3-db down, ac coupled.

MAXIMUM RINGING AND OVERSHOOT is 2% when using a 25-ohm source.

CABLE LENGTH is 18".

P6034 10X PROBE, (010-110).....\$35

Each probe includes: 1—hook tip, 1—2½" ground strap, 6—ground clips, 2—test jacks.



P6035 100X PROBE

The P6035 low-capacitance miniature passive probe physically resembles the P6034 probe and also conforms to the risetime of the Type 4S1 and Type 3S76 Sampling Plug-In Units when making high-speed repetitive-pulse measurements.

Peak-to-peak voltage derating is necessary for CW frequencies higher than 500 Mc.

The probe is marked for attenuation ratio, wattage rating, and resistance of the probe.

Probe is properly compensated for a 25-ohm source when shipped.

CHARACTERISTICS

INPUT CAPACITY is 0.6 pf at 1 gigacycle.

INPUT RESISTANCE is 1.5 k Ω at 1 gigacycle.

MAXIMUM DC INPUT is 50 v dc-coupled and 500 v ac-coupled.

ATTENUATION RATIO is 100X.

MAXIMUM POWER is $\frac{1}{2}$ w.

PASSBAND is dc to 1.5 gigacycle (3-db down).

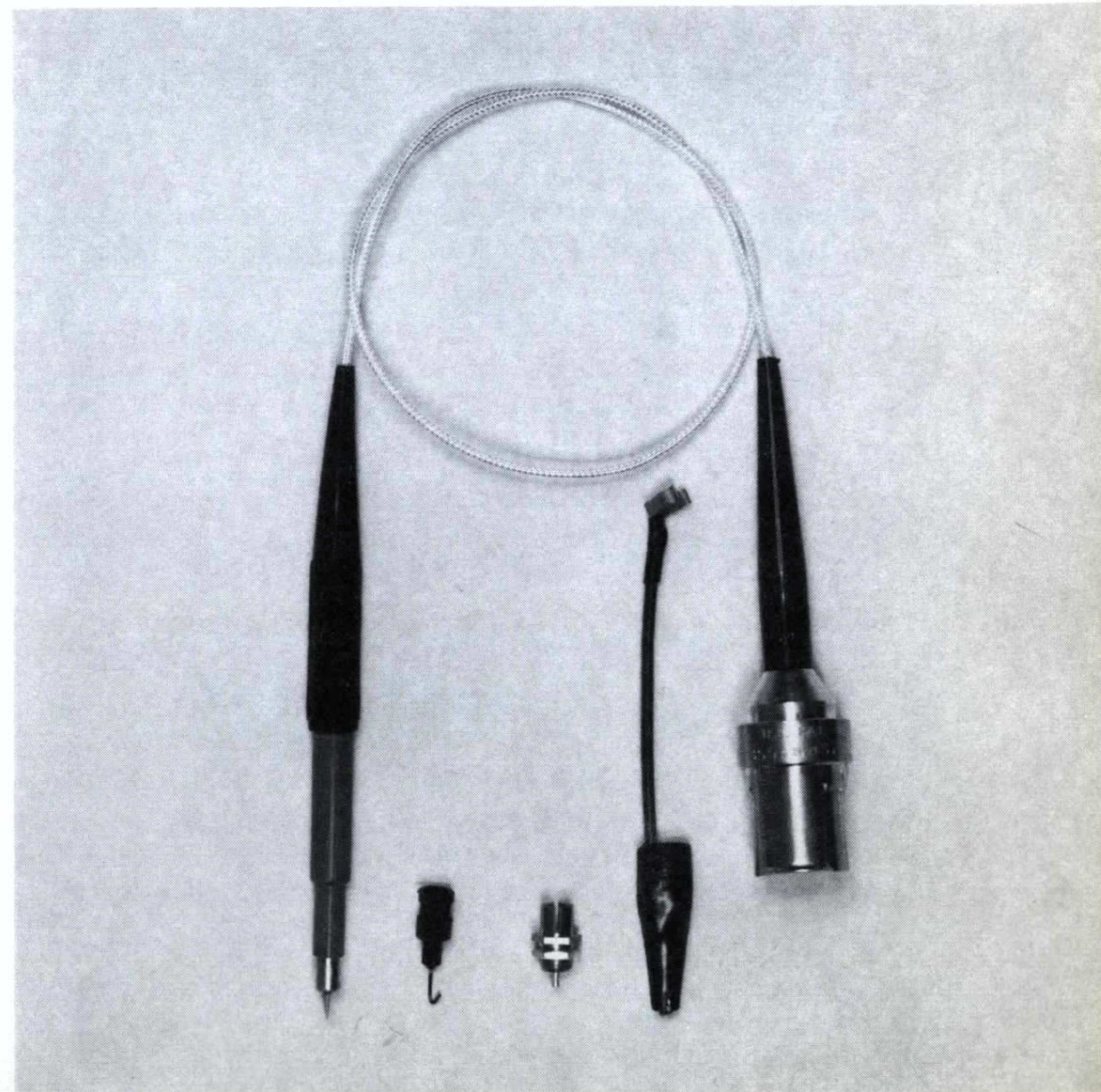
LOW FREQUENCY RESPONSE is approximately 6 kc at 3-db down, ac coupled.

MAXIMUM RINGING AND OVERSHOOT is 2% when using a 25-ohm source.

CABLE LENGTH is 18".

P6035 100X PROBE, (010-111).....\$35

Each probe includes: 1—hook tip, 1—2½" ground strap, 6—ground clips, 2—test jacks.



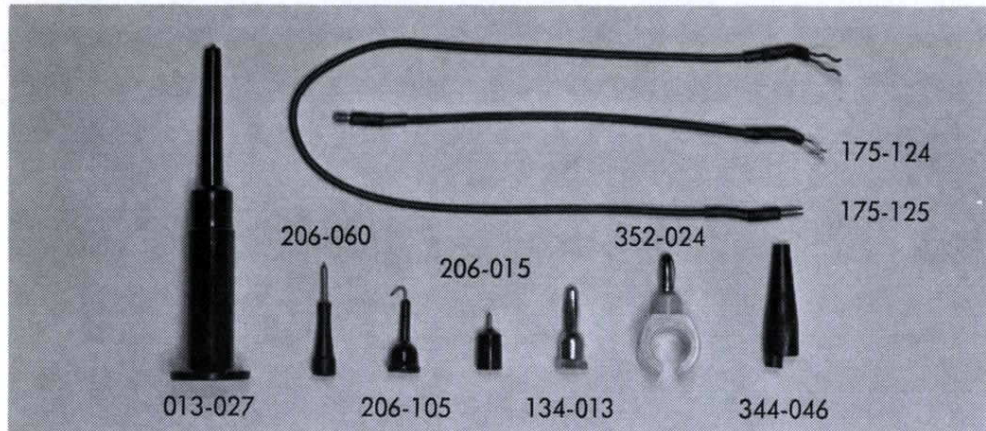
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Accessories

PROBE ACCESSORIES

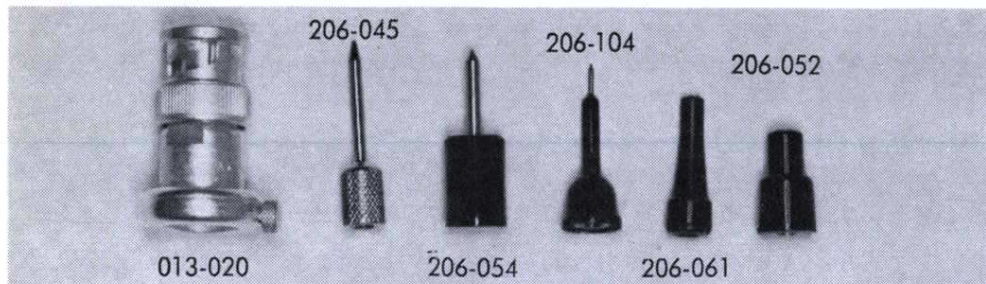
PROBE TIPS



STANDARD TIPS

The following tips are for probes having a 6-32 thread size.

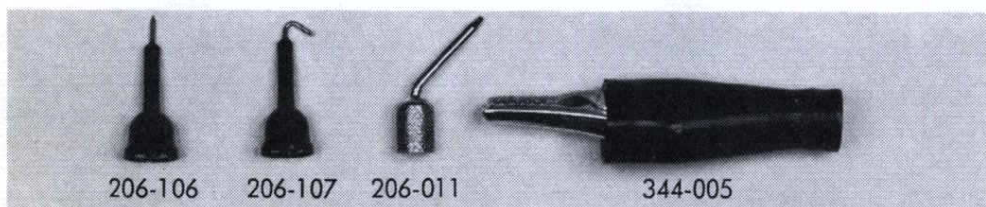
Description	Part Number	Price
Short Straight Shank	206-015	\$.25
Hook Shank	206-105	.25
Spring Tip	206-060	.25
Banana	134-013	.10
Pincher	013-027	2.00
Holder	352-024	.25
5-inch Ground Lead	175-124	.50
12-inch Ground Lead	175-125	.55
Minigator Clip	344-046	.15



SPECIAL-PURPOSE TIPS

The following tips are for probes having a 6-32 thread size.

Description	Part Number	Price
Straight Shank, fits 0.082" pin jacks	206-045	\$.25
Long Straight Shank	206-104	.25
Spring Tip, without shank	206-061	.40
Recessed, fits 0.065" recessed pin or plug	206-052	.45
Straight Shank, similar to 206-045 with insulation	206-054	.25
Adapts probe to male BNC connector (except P6002-6005)	013-020	4.25

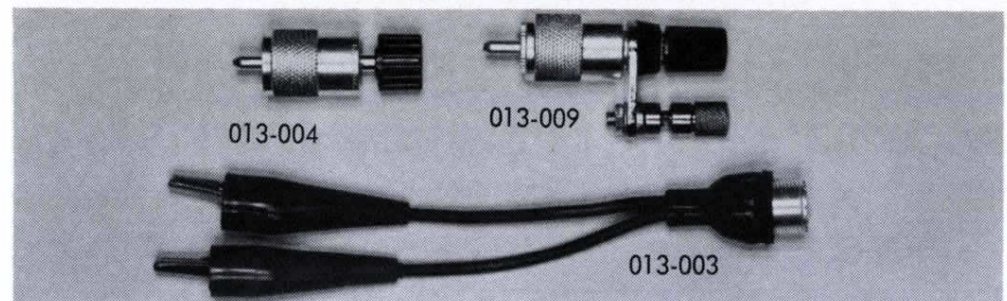


SPECIAL-PURPOSE TIPS FOR P170CF, P500CF AND P410 PROBES

The following tips are for probes having a 10-32 thread size.

Description	Part Number	Price
Hook Shank	206-107	\$.25
Straight Shank	206-106	.25
Bent Shank, fits 0.082" pin jacks	206-011	.25
Alligator-Clip Assembly	344-005	.40

ADAPTERS



Description	Part Number	Price
Adapter, clip lead	013-003	\$ 2.00
Adapter, binding post	013-004	2.00
Binding Post Adapter, with ground terminal, 3/4" spacing	013-009	3.00

PROBE POWER SUPPLY



The Type 128 Probe Power Supply furnishes the necessary plate and filament voltages for cathode-follower probes such as the Tektronix P170CF and P500CF.

The two probe connections use separate +6.3 v dc voltage supplies.

PLATE SUPPLY is +120 v dc, regulated, at 25 ma.

HEATER SUPPLIES consist of two unregulated +6.3 v dc at 150 ma.

PLATE SUPPLY RIPPLE is 5 mv pk-to-pk, maximum.

HEATER SUPPLY RIPPLE is 75 mv pk-to-pk, maximum.

POWER REQUIREMENTS are 105 to 125 v or 210 to 250 v, 50 to 800 cps, 25 watts (with two P500CF probes).

MECHANICAL FEATURES include an aluminum-alloy chassis, three piece blue vinyl-finish cabinet, anodized front panel.

Dimensions are 7 3/4" high by 4 3/4" wide by 9" deep. Net weight is 6 pounds. Shipping weight is 12 pounds, approximately.

TYPE 128 PROBE POWER SUPPLY \$110

Each instrument includes: 1—3-conductor power cord, 2—instruction manuals.

POWER CABLE EXTENSION

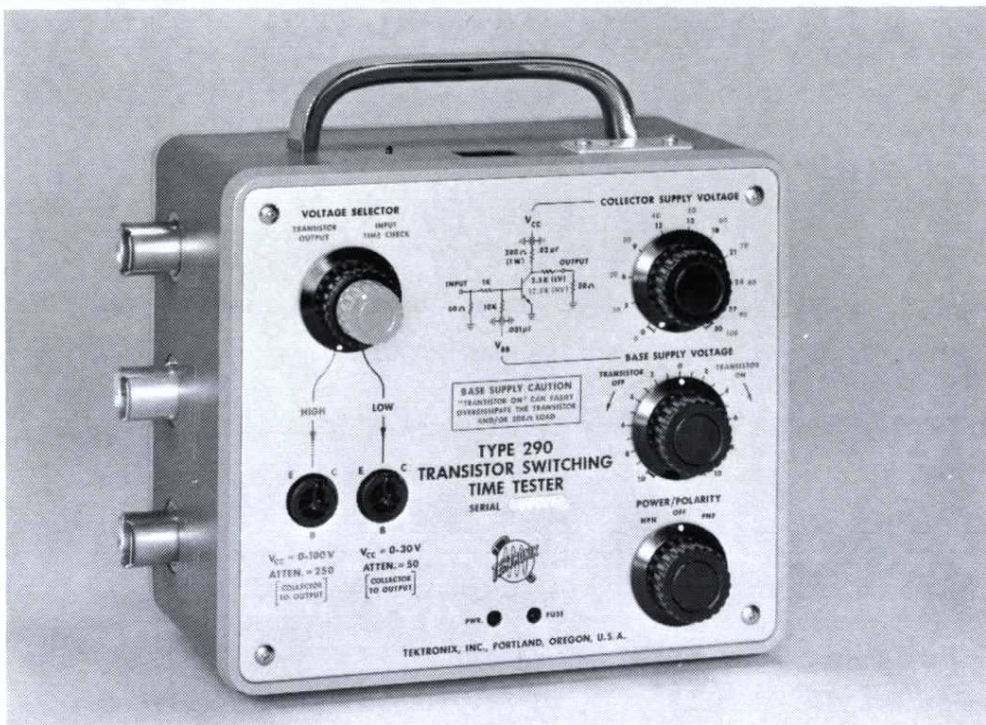
Probe Power-Cable Extension—A 30" 3-conductor power-cable extension for Tektronix cathode-follower probes, permits wider separation of the probe power source from the instrument signal input.

Order Part Number 012-030.....\$5

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PULSE SAMPLING ACCESSORIES

TYPE 290 TRANSISTOR SWITCHING-TIME TESTER



The Type 290 Transistor Switching Time Tester is designed for use with Tektronix Pulse-Sampling Systems or with wide-band conventional oscilloscopes. The tester permits dc-coupled pulse-response characteristics, such as delay time, risetime, storage time, and fall time, of fast switching transistors to be observed on a short duty-cycle basis with variable collector voltage and base drive conditions.

CHARACTERISTICS

50-OHM INPUT applies 1 ma/v of input pulse to the test transistor base.

OUTPUT SIGNAL is taken from the collector of the transistor under test. The input signal can be switched to the output for observation of the input signal when using a single-trace system.

INPUT MONITOR permits simultaneous viewing of the input and output of the transistor under test when using a dual-trace system. The input monitor has a 50-to-1 attenuation ratio.

LOW-HIGH TRANSISTOR SOCKETS connect to the respective high and low collector supplies. The transistor under test has an attenuation of 50X into the 50-ohm output when in the LOW socket, and an attenuation of 250X into the 50-ohm output when in the HIGH socket.

LOW-HIGH COLLECTOR VOLTAGES are variable from 0 to 30 v for the low and from 0 to 100 v for the high. Both voltages are regulated and within 10% of indicated front panel voltage markings.

BASE SUPPLY VOLTAGE is a regulated ± 0 to 10 v, continuously variable, and within 10% of indicated front panel voltage markings.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v, 50 to 1200 cps, 15 watts.

MECHANICAL FEATURES include an aluminum-alloy chassis, die-cast aluminum alloy top and bottom covers with a blue-vinyl finish, steel, wrap-around housing.

Dimensions are 6" high by 7" wide by 4" deep. Net weight is 5 pounds. Shipping weight is 11 pounds, approx.

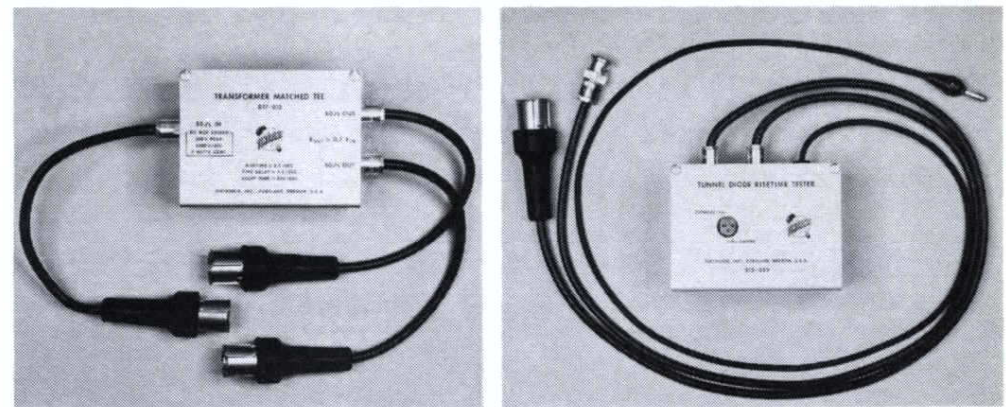
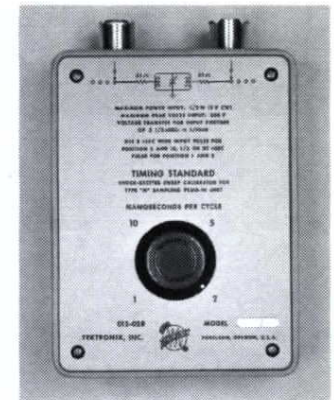
TYPE 290 TRANSISTOR SWITCHING-TIME TESTER. . . \$290

Each tester includes: 1—3-wire power cord, 2—instruction manuals.

TIMING STANDARD

The Timing Standard is used for calibrating equivalent sweep speeds of the Tektronix pulse-sampling systems. It is designed to ring at periods of 1, 2, 5, and 10 nsec when excited by a fast-rising pulse.

Order Part Number 013-028 \$60



TRANSFORMER MATCHED "T"

This unit provides two 50-ohm outputs from one 50-ohm input and divides the regenerated trigger for simultaneous triggering of two sampling sweep systems.

Order Part Number 017-012 \$35

TUNNEL DIODE RISETIME TESTER

This unit tests 1 to 20 ma diodes by using the + GATE OUT waveform of an oscilloscope, or tests higher-current diodes by using an external pulse generator such as the Tektronix Type 105 Square-Wave Generator or Type 110 Pulse Generator.

Order Part Number 013-029 \$50

50-OHM STEP ATTENUATOR



The Step Attenuator provides, by switching, attenuations of 2X, 5X and 10X.

Order Part Number 017-011 . . \$120

CALIBRATOR ADAPTER

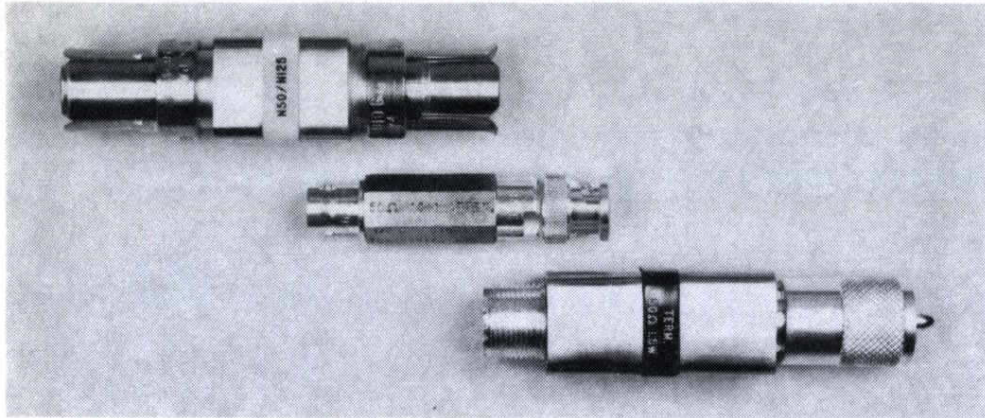
The Adapter is basically intended for use with the Type N Plug-In Unit, but can be used with any Tektronix sampling system except those incorporating the Type RM561 and Type 567 Oscilloscopes. The Adapter converts a 50-volt output from the oscilloscope calibrator to 40 mv at 50-ohm impedance, for use in calibrating the gain of the sampling systems.

Order Part Number 017-010 \$15

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Accessories

ADAPTERS—ATTENUATORS—TERMINATIONS



Each accessory is clearly marked as to type, ratio, maximum power, and correct orientation. Attenuators with UHF, GR, and TEK 125-ohm connectors have color-coded bands that designate the attenuation ratio, and gold-plated connectors that designate all 125-ohm ends.

ACCESSORIES WITH UHF-TYPE CONNECTORS

Description	Part Number	Price
50-Ω 10:1 attenuator	011-031	\$ 16.00
50-Ω 5:1 attenuator	011-032	16.00
75-Ω 10:1 attenuator	011-033	16.00
75-Ω 5:1 attenuator	011-034	16.00
93-Ω 10:1 attenuator	011-035	16.00
93-Ω 5:1 attenuator	011-036	16.00
50-Ω termination	011-045	15.00
75-Ω termination	011-046	15.00
93-Ω termination	011-047	15.00
170-Ω* termination	011-048	15.00
50-Ω to 75-Ω min. loss atten.	011-041	16.00
50-Ω to 93-Ω min. loss atten.	011-042	16.00
50-Ω to 170-Ω min. loss atten.	011-043	16.00

* Frequency response 30 mc; vswr less than 1.25 up to 30 mc.

ACCESSORIES WITH GR-TYPE CONNECTORS

50-Ω 10:1 attenuator	017-044	\$ 19.00
50-Ω 5:1 attenuator	017-045	19.00
50-Ω 2:1 attenuator	017-046	19.00
50-Ω termination	017-047	17.50

ACCESSORIES WITH TEK 125-Ω TYPE CONNECTORS

125-Ω 2:1 attenuator	017-048	\$ 25.00
125-Ω 5:1 attenuator	017-049	25.00
125-Ω 10:1 attenuator	017-050	25.00
125-Ω termination	017-007	20.00
125-Ω TEK 125-Ω to 200-Ω H. P.	017-038	20.00

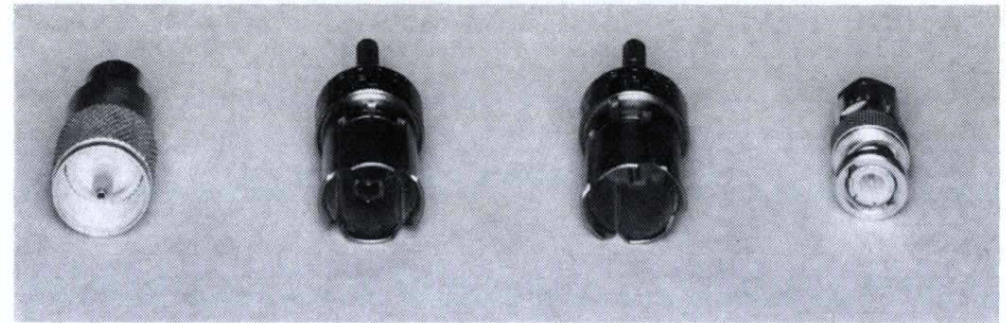
ACCESSORIES WITH GR-TEK 125-Ω TYPE CONNECTORS

50-Ω to 125-Ω min. loss atten.	017-052	\$ 25.00
125-Ω adapter N50/N125	017-053	17.50
125-Ω adapter N50/T125	017-054	17.50
125-Ω adapter T50/N125	017-055	23.00

ACCESSORIES WITH BNC-TYPE CONNECTORS

50-Ω termination (high capacitance)	011-049	\$ 8.75
75-Ω termination	010-315	8.75
93-Ω termination	010-317	8.75
50-Ω 10:1 attenuator	010-314	8.75
75-Ω 10:1 attenuator	010-316	8.75
93-Ω 10:1 attenuator	010-318	8.75
50-Ω to 75-Ω min. loss attenuator	010-319	8.75
50-Ω to 93-Ω min. loss attenuator	010-320	8.75

CONNECTOR TYPES



UHF TYPE GR TYPE TEK 125-Ω BNC TYPE

Tektronix adapters, attenuators, and terminators use four types of connectors allowing the accessories to be used in a diversified area of applications.

Accuracy of Indicated Attenuation Ratio:

UHF	±2% at dc; ±3% at 100 megacycles.
GR	±2% at dc; ±3% at 1 gigacycle.
TEK 125-Ω	±2% at dc; ±3% at 1 gigacycle.
BNC	±2% at dc; ±3% at 100 megacycles.

Voltage Standing Wave Ratio:

UHF	less than 1.2 up to 100 megacycles.
GR	less than 1.1 up to 1 gigacycle.
TEK 125-Ω	less than 1.1 up to 1 gigacycle.
BNC	less than 1.1 up to 100 megacycles.

Power Rating:

UHF	1.5 watts.
GR	1 watt.
TEK 125-Ω	1 watt.
BNC	0.5 watt.

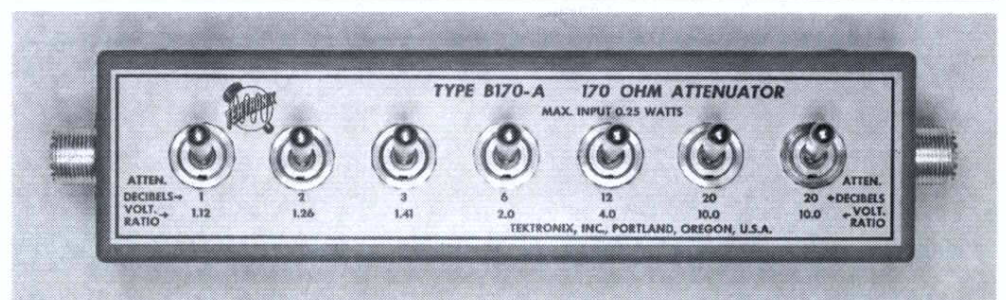
Output to Input Voltage Ratios for Minimum-Loss Attenuators:

When properly terminated the E_{out}/E_{in} ratios for the various minimum-loss attenuators are as follows:

Connection	E_{out}/E_{in}
50 Ω → 75 Ω	0.63
75 Ω → 50 Ω	0.42
50 Ω → 93 Ω	0.59
93 Ω → 50 Ω	0.32
50 Ω → 125 Ω	0.56
125 Ω → 50 Ω	0.23
50 Ω → 170 Ω	0.54
170 Ω → 50 Ω	0.16

All attenuators, with the exception of minimum-loss types, are T-type attenuators.

B170-A ATTENUATOR



170-Ω pi-attenuator, uses 2% precision resistors, 1 to 64 db in 1 db steps, 0.25 watt.
Order Part Number 011-017.....\$ 45.00

U. S. Sales Prices f.o.b. Beaverton, Oregon
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Accessories

INPUT TIME-CONSTANT STANDARDIZERS



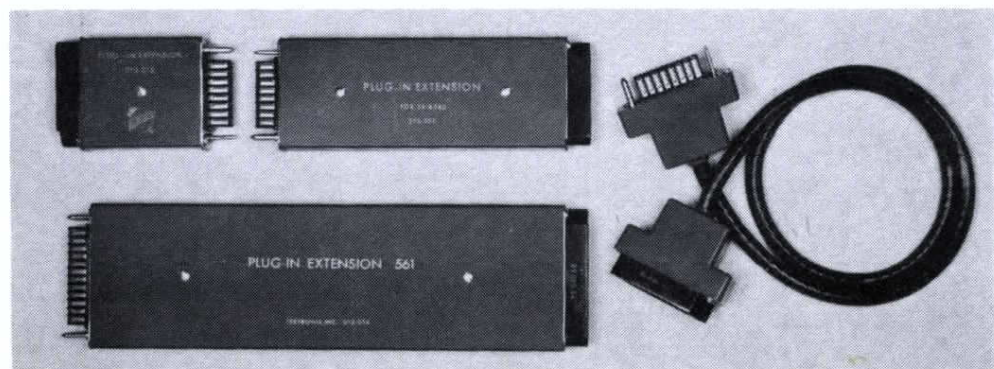
Four input time-constant standardizers are available for standardizing input capacitances of 12 pf, 20 pf, 24 pf, and 47 pf. Each standardizer has an approximate 1 megohm impedance and 2X voltage attenuation.

- 20 pf STANDARDIZER (Part Number 011-022) .. \$10.00
- 24 pf STANDARDIZER (Part Number 011-029) .. \$10.00
- 47 pf STANDARDIZER (Part Number 011-030) .. \$10.00
- 12 pf STANDARDIZER (Part Number 011-051) .. \$10.00

OUTPUT CABLES

- 52 ohms nominal impedance, 42 inches long.
Order Part Number 012-001.....\$ 4.00
- 75 ohms nominal impedance, 42 inches long.
Order Part Number 012-002.....\$ 4.00
- 93 ohms nominal impedance, 42 inches long.
Order Part Number 012-003.....\$ 4.00
- 93 ohms, 42 inches long, terminated with variable attenuator.
Order Part Number 012-004.....\$13.50
- 93 ohms, 42 inches long, terminated with 1/2 watt 93 ohm resistor.
Order Part Number 012-005.....\$ 5.00
- 170 ohms nominal impedance, 42 inches long.
Order Part Number 012-006.....\$ 9.50

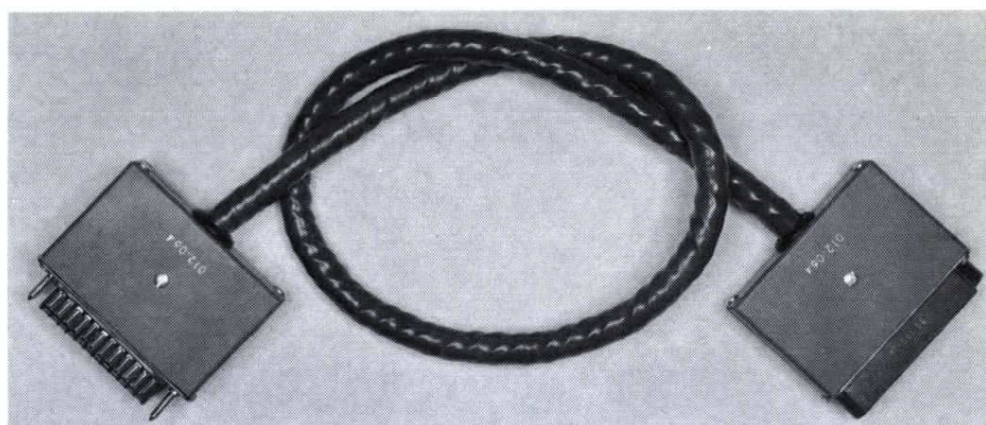
PLUG-IN UNIT ACCESSORIES



PLUG-IN EXTENSIONS—allow unit to be operated partially out of the oscilloscope:

- For units in Type 530, 540, 550-Series Oscilloscopes
Order Part Number 013-019.....\$13.50
- For units in Type 560-Series Oscilloscopes
Order Part Number 013-034.....\$14.00
- For units in Type 580-Series Oscilloscopes
Order Part Number 013-055.....\$14.50
- For Type R Unit only
Order Part Number 013-015.....\$ 8.50

FLEXIBLE EXTENSION— 30" long, permits A to Z Plug-In operation away from the oscilloscope. Useful for troubleshooting—do not use for plug-in calibration.
Order Part Number 012-038.....\$15.00

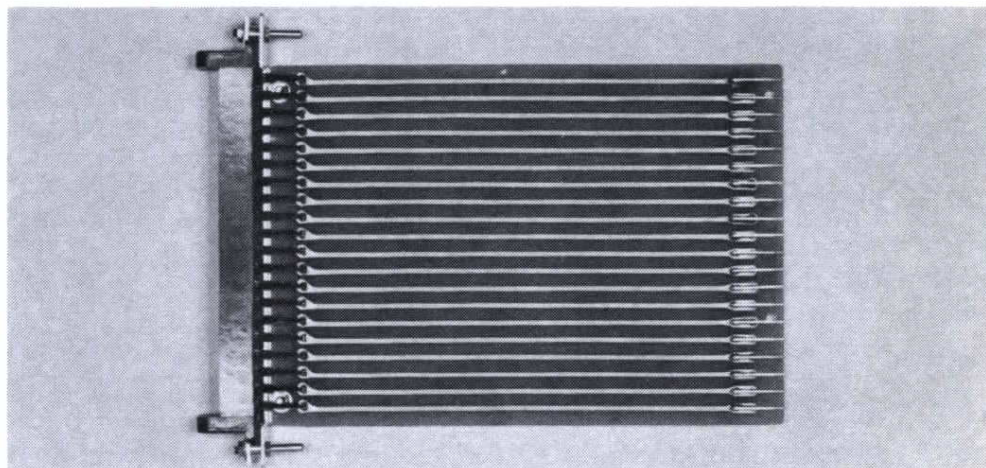


FLEXIBLE EXTENSION — 30" long, permits Type 661 vertical or sweep plug-in units to be operated away from oscilloscope. See Greomar Cable.

Order Part Number 012-064.....\$23.00

FLEXIBLE EXTENSION — 30" long, permits Type 3S76 and Type 3T77 Sampling Plug-In Units to be operated away from oscilloscope.

Order Part Number 012-066.....\$23.00

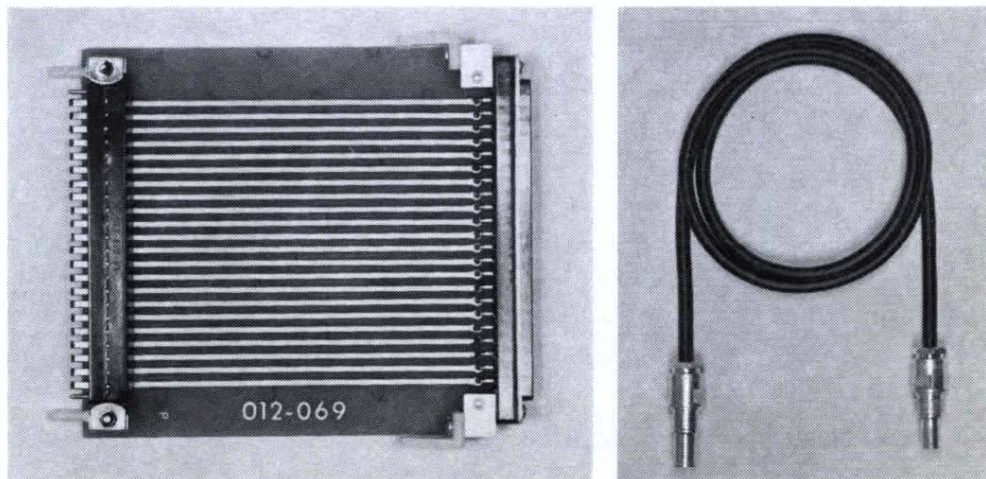


15-PIN PLUG-IN EXTENSION BOARD — Allows protrusion of Type 6R1 15-pin etched-circuit boards.

Order Part Number 012-067.....\$20.00

20-PIN PLUG-IN EXTENSION BOARD — Allows protrusion of Type 6R1 20-pin etched-circuit boards.

Order Part Number 012-068.....\$25.00



TYPE 4S1 SUB-CHASSIS EXTENSION — Allows maintenance of Type 4S1 sub-chassis when 4S1 is extended out of oscilloscope.

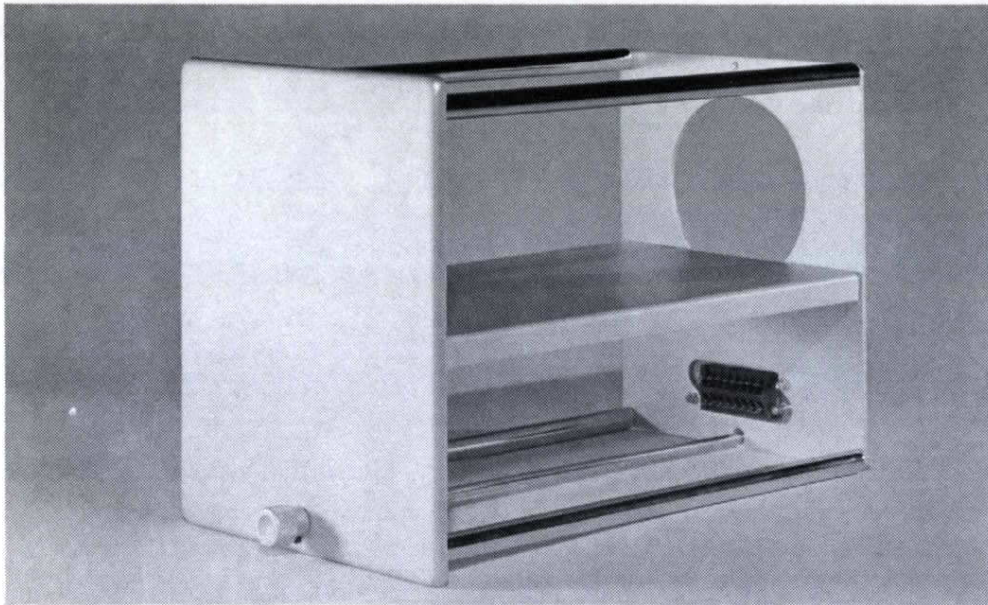
Order Part Number 012-069.....\$17.50

50-OHM GREOMAR CABLE — For retaining internal trigger and snap-off driver connection between plug-in units of the Type 661 when one or both plug-in units are extended out of oscilloscope.

Order Part Number 012-070.....\$ 9.75

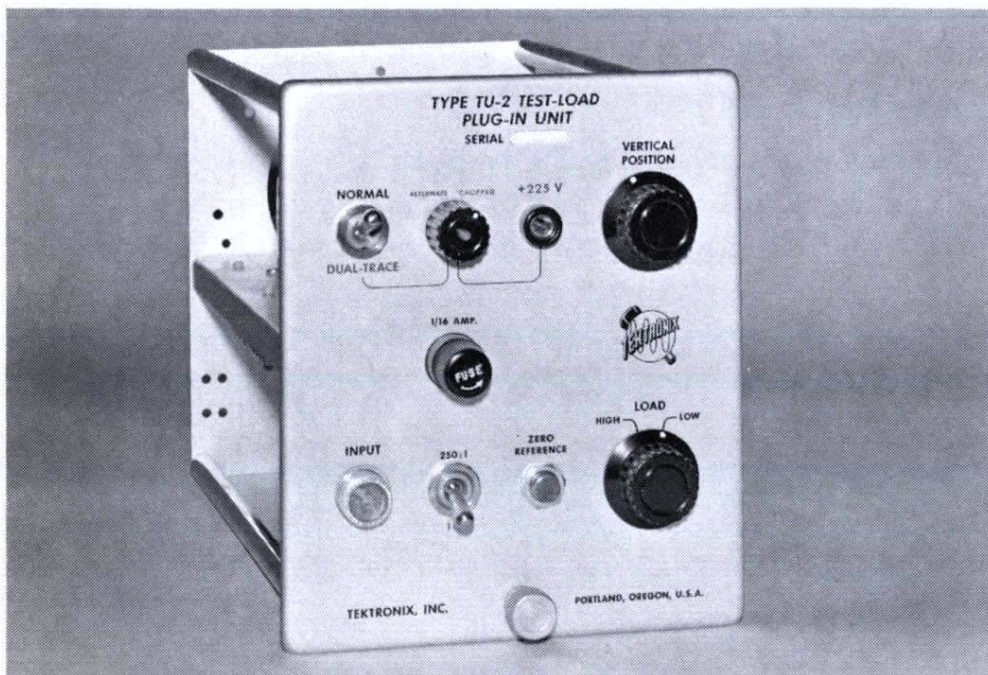
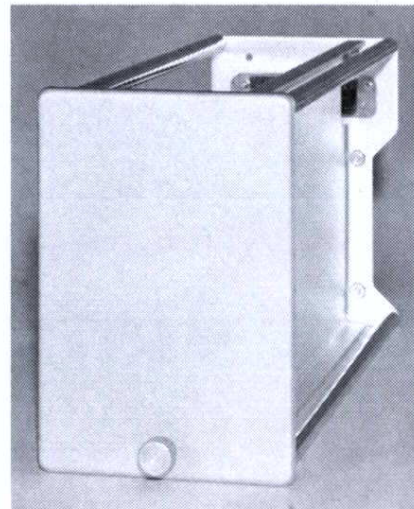
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Accessories



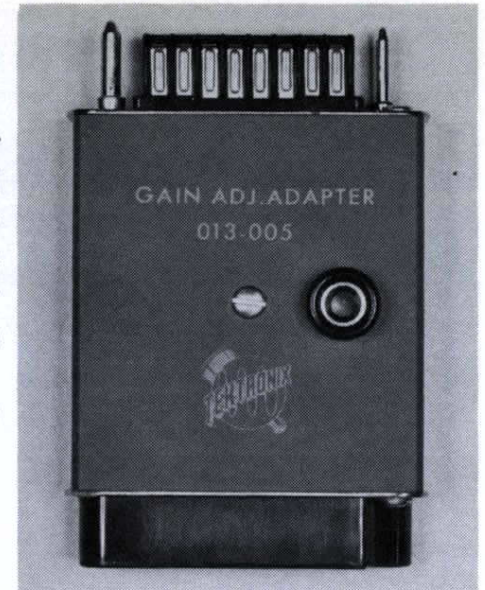
BLANK A TO Z TYPE PLUG-IN CHASSIS—Useful for constructing your own special circuits.
Order Part Number 040-065.....\$15

BLANK TYPE 560-SERIES PLUG-IN CHASSIS—For special circuit construction of sweep or vertical amplifiers.
Order Part Number 040-245...\$15



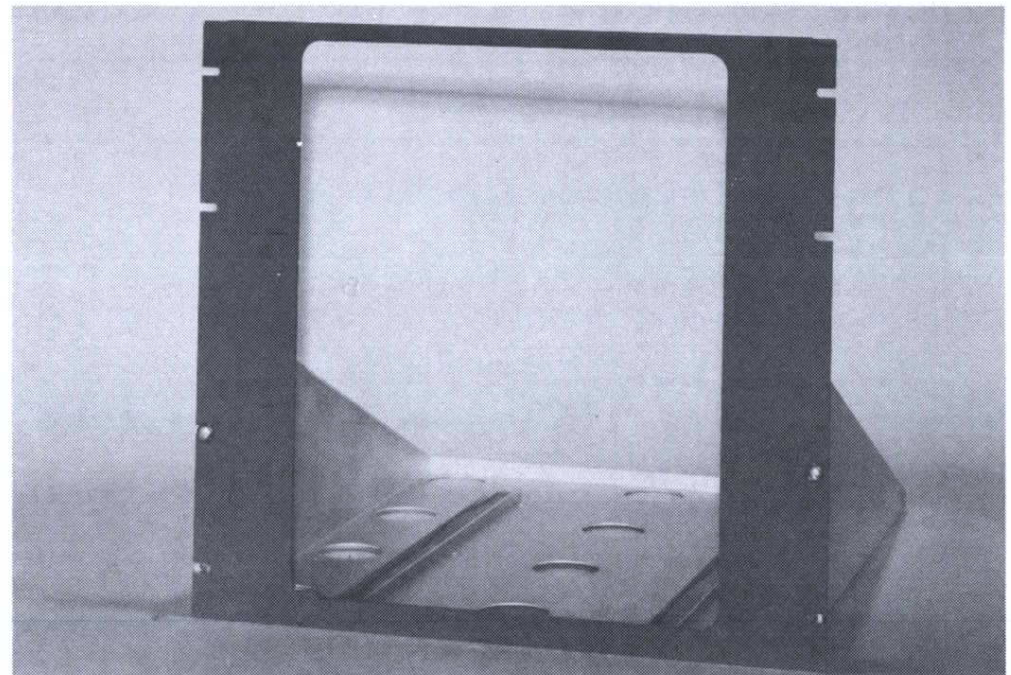
TYPE TU-2 TEST-LOAD PLUG-IN UNIT—A convenient special-purpose test tool for the maintenance of Tektronix Type 530, 540, 550-Series Oscilloscopes. The unit is used to check power-supply regulation under high load and low load demands of all A to Z plug-in units. It can also be used to check vertical amplifier balance, vertical amplifier gain, and dual-trace function of the oscilloscope. It eliminates the need to keep plug-in preamplifiers in the maintenance area to make these checks.
TYPE TU-2 TEST UNIT.....\$75

CARRYING CASE FOR A TO Z PLUG-IN UNITS—Provides protection for 1 out-of-oscilloscope plug-in unit.
Order Part Number 437-065.....\$35



GAIN ADJUST ADAPTER—Permits an external calibrating signal to bypass the plug-in pre-amplifier, for calibrating the sensitivity of the main amplifier of Type 530, 540 and 550-Series Oscilloscopes.
Order Part Number 013-005 \$10

MOUNTING ACCESSORIES



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. Blue vinyl finish.

For Type 524AD, Type 530-Series, Type 540-Series, and Type 570 with serial numbers above 5000, Type 530A-Series, Type 540A-Series, Type 575 and Type 580-Series all serial numbers (1 mask, 1 cradle). Rack height requirements 17 1/2".
Order Part Number 040-281.....\$45
will hold 661 →

For Type 507 and Type 551 instruments (2 masks, 2 cradles). Rack height requirements; Indicator mask 17 1/2", Power Supply mask 12 1/4".
Order Part Number 040-279.....\$85

For Type 180A, Type 190A, Type 503, Type 504, Type 515A and Type 516 instruments (1 mask, 1 cradle). Rack height requirements 15 1/2".
Order Part Number 040-277.....\$45

For Type 502 instruments (1 mask, 1 cradle). Rack height requirements 17 1/2".
Order Part Number 040-278.....\$45

For Type 555 (2 masks, 2 cradles). Rack height requirements: Indicator mask 21", Power Supply mask 12 1/4".
Order Part Number 040-280.....\$85

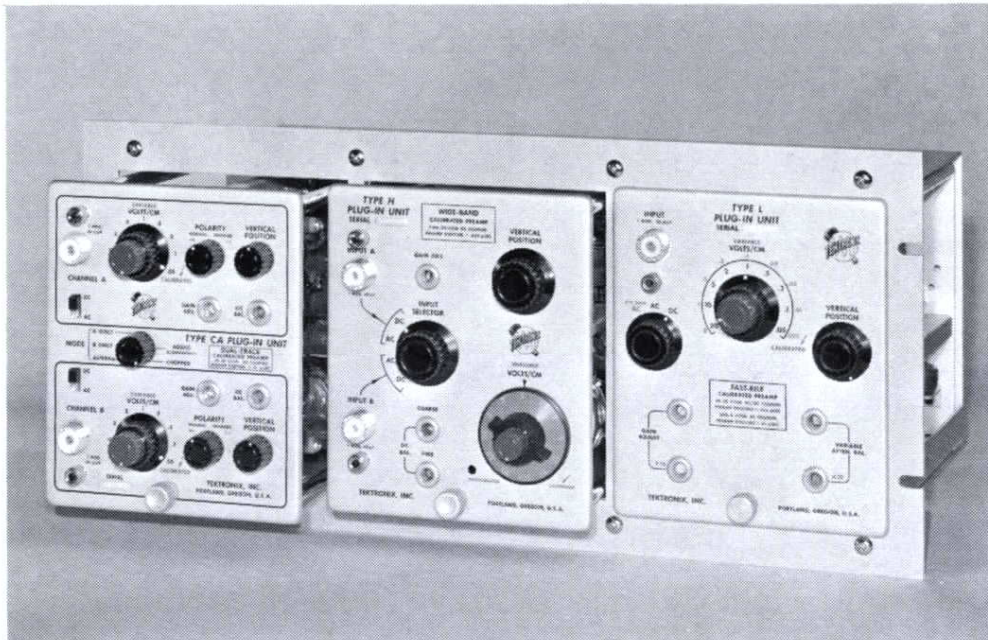
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U. S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.



Accessories

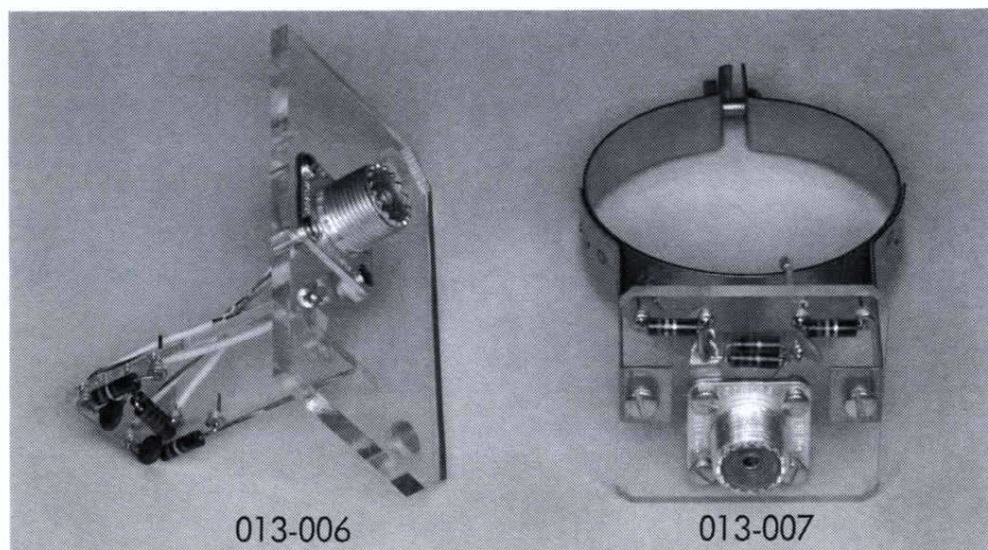
MOUNTING FRAME—Holds four of any combination of Type FM122, Type 360, or Type 160-Series units. Mounts to standard instrument rack.
Order Part Number 014-002.....\$ 5.00

BLANK PANEL—Provides coverage for mounting frame Type FM122 area not being used.
Order Part Number 333-157.....\$ 8.50



PLUG-IN PREAMPLIFIER STORAGE CABINET—Mounts in standard rack, holds three Tektronix A to Z Plug-In Preamplifiers. Dimensions: 19" wide, 8³/₄" high, 9³/₈" deep.
Order Part Number 437-031.....\$25.00

DEFLECTION PLATE CONNECTORS



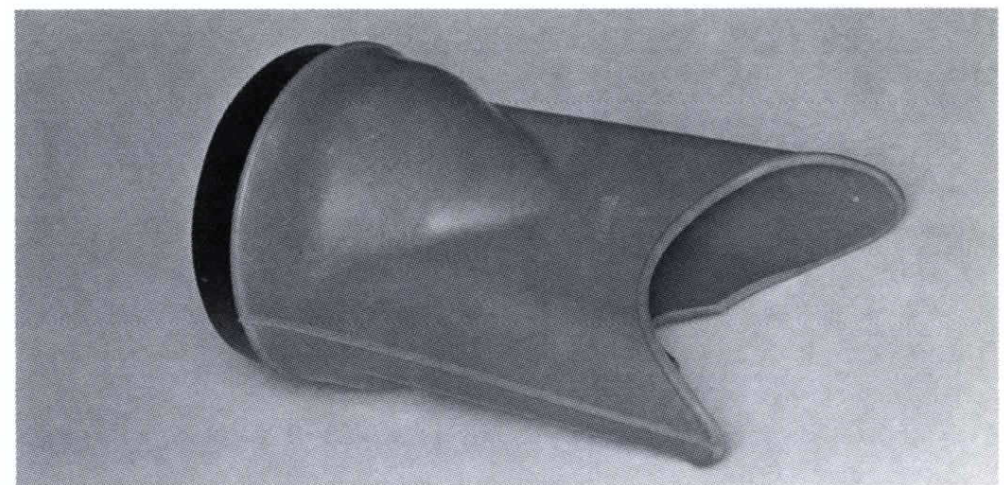
These connectors can be used with Types 530, 540, 530A, and 540A-Series Oscilloscopes. They provide a convenient means of making a connection directly to the cathode-ray tube vertical deflection plates to realize the maximum frequency response of the crt. They are designed for use with high-frequency, fast-rise pulses or transient signals. The function of the vertical position control of the oscilloscope is retained. The connectors are designed for use with 52-ohm cables. The connectors are not recommended for use with frequencies below 8 kc or pulses with correspondingly slow risetimes.

For instruments with serial numbers below 5001,
Order Part Number 013-006.....\$ 5.00

For instruments with serial numbers 5001 and above,
Order Part Number 013-007.....\$ 5.00

VIEWING ACCESSORIES

POLARIZED VIEWER—For Tektronix 5" Oscilloscopes using a standard, round, graticule cover. The viewer reduces troublesome reflections and glare under high ambient-light conditions.
Order Part Number 016-035 \$10.00



VIEWING HOOD—For Tektronix 5" Oscilloscopes. Includes molded rubber eyepiece and separate tubular light shield.
Order Part Number 016-001.....\$ 4.50

VIEWING HOOD—For Tektronix 3" Oscilloscopes except Type 321. Includes molded rubber eyepiece and separate tubular light shield.
Order Part Number 016-002.....\$ 4.50

COLLAPSIBLE VIEWING HOOD—For Tektronix 3" Oscilloscopes except Type 321. It is made of black acrylic plastic with handy fastening arrangement.
Order Part Number 016-010.....\$ 3.50



BEZEL—For mounting cameras, other than Tektronix types, on Tektronix 5" Oscilloscopes. Dimensions—5⁷/₈" square; ring 7/8" deep, diameter 5⁵/₈" outside, 5¹/₈" inside. Die-cast construction, wrinkle finish, felt lined.
Order Part Number 014-010.....*Black*.....\$ 4.50

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Accessories

CATHODE-RAY TUBE LIGHT FILTERS

For Types 310, 310A, RM16, 317, RM17, and 360

Order Part Number	378-509	3"	Green	.....\$	.50
	378-510	3"	Blue	.....	.50
	378-511	3"	Amber	.....	.50
	378-512	3"	Yellow	.....	.50

For Type 315D

Order Part Number	378-505	3"	Green	.....\$	.50
	378-506	3"	Amber	.....	.50
	378-507	3"	Blue50
	378-508	3"	Yellow50

For Type 321

Order Part Number	378-521	3"	Green\$.50
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For Types 503, 504

Order Part Number	378-522	5"	Green\$.90
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For all 5" oscilloscopes except the Type 503, 504, 527, RM527

Order Part Number	378-514	5"	Green\$.90
	378-515	5"	Blue90
	378-516	5"	Amber90

For Types 527, RM527

Order Part Number	378-525	5"	Green\$.60
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UNRULED GRATICULES

For Types 310, 310A, 316, RM16, RS16, 317, RM17, and 360

Order Part Number	386-395\$	1.25
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For Types 315 and 315D

Order Part Number	386-312\$	1.25
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For Types 502, 507, 511A, 512, 513, 514, 514A, 524D, 524AD, 525, 526, 531, RM31, 532, RM32, 535, RM35, 536, 570 and 575

Order Part Number	331-093\$	1.25
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For Types 515, 515A, RM15, 516, 517A, 531A, RM31A, 533, RM33, 535A, RM35A, 541, RM41, 541A, RM41A, 543, RM43, 545, RM45, 545A, RM45A, 551, 555, 581 and 585

Order Part Number	386-451\$	1.45
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TEKTRONIX CATHODE-RAY TUBES

Tektronix replacement cathode-ray tubes are normally available with phosphors 1, 2, 7, 11, or P31. Please specify the phosphor desired when ordering. Price is the same regardless of phosphor unless otherwise designated. Other phosphors are available on special order; please consult your Tektronix Field Engineer for details.

Used in Types 513, 531, RM31, 535 and RM35

T51P____(formerly designated 5BGP____)\$	75.00
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Used in Types 525, 532, RM32, 570 and 575

T52P____(formerly designated 5CAP____)\$	50.00
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Used in Types 541, RM41, 545 and RM45

T54P____(formerly designated 5BHP____)\$	99.50
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Used in Types 515A, RM15 and 516

T55P____(formerly designated 5CBP____)\$	60.00
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Used in Types 310A and 360

T310P____\$	40.00
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Used in Types 316, RM16 and RS16

T316P____(formerly designated T32P____)\$	50.00
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Used in Types 317 and RM17

T317P____(formerly designated T33P____)\$	65.00
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Used in Type 321

T321P____\$	75.00
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Used in Type 502

T5021P____(replaced T502P____/T60P____)\$	150.00
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Used in Types 503, 504, 560 and 561

T503P____\$	60.00
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Used in Types RM561 and RM567

T503RP____\$	60.00
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Used in Type 517A

T517P____(formerly designated T54P____H)\$	110.00
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Used in Type 519

T519P____\$	1000.00
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Used in Type 526

T526P____\$	99.50
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Used in Types 527, RM527

T527P____\$	80.00
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Used in Types 531A, RM31A, 533, RM33, 535A and RM35A

T533P____(formerly designated T64P____)\$	90.00
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Used in Type 536

T536P____(formerly designated T56P____)\$	60.00
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Used in Types 541A, RM41A, 543, RM43, 545A and RM45A

T543P____(formerly designated T65P____)\$	110.00
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Used in Type 551

T5511P____(replaced T551P____)\$	150.00
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Used in Type 555

T555P____(formerly designated T59P____)\$	225.00
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Used in Types 581 and 585

T581P____\$	200.00
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Used in Type 507

T507P____(formerly designated T53P____)\$	125.00
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Available normally in P11 phosphors only. Some other phosphors are available on special order.

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Tektronix Field Services

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

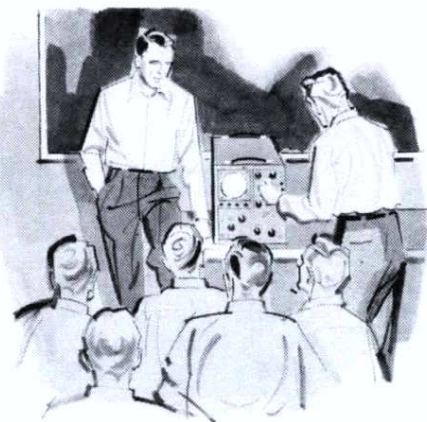


Ordering—There are many types of oscilloscopes, each designed for a specific application area. Your Field Engineer can help you select the one best suited to your present and future needs, and he will be happy to arrange a demonstration of the instrument...in your application if you so desire.

If you are a Purchasing Agent or Buyer, your Field Engineer

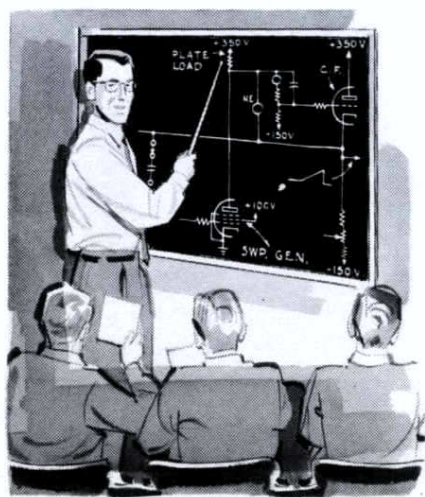
or his secretary can help you with information on prices, terms, shipping estimates, and best method of transportation on instruments, accessories, and replacement parts.

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

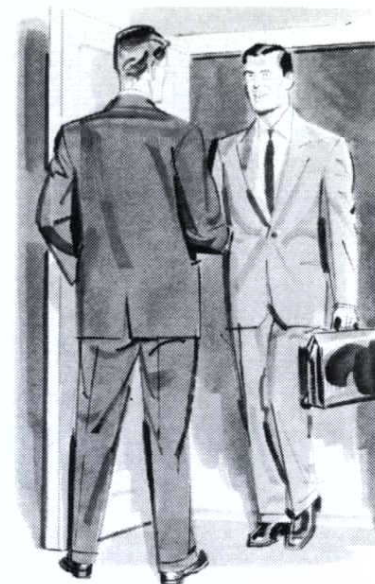


Maintenance—Tektronix willingly assumes much of the responsibility for continued efficient operation of the instruments it manufactures. If you should experience a stubborn maintenance problem, your Field Engineer will gladly help you isolate the cause. Often a telephone discussion with him will help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

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



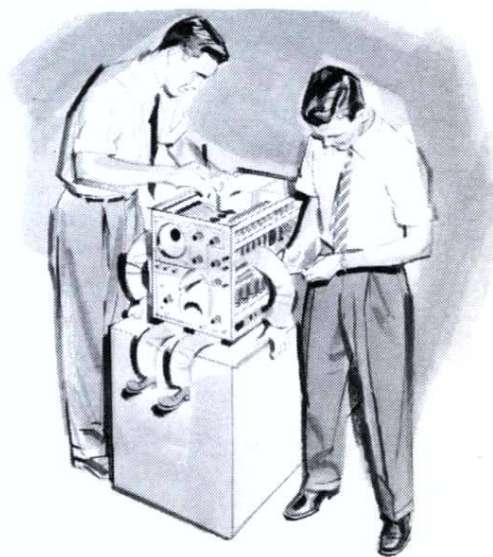
If you are responsible for the maintenance of a large quantity of Tektronix Instruments, ask your Field Engineer about the free factory training course in maintenance and calibration.



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



Instrument Reconditioning—An older Tektronix Oscilloscope, properly reconditioned, can give you many additional years of service. Your Field Engineer will gladly explain the advantages of instrument reconditioning, major repair, and recalibration that can be performed at a nearby Field Repair Center. Ask your Field Engineer about this service to Tektronix customers.



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

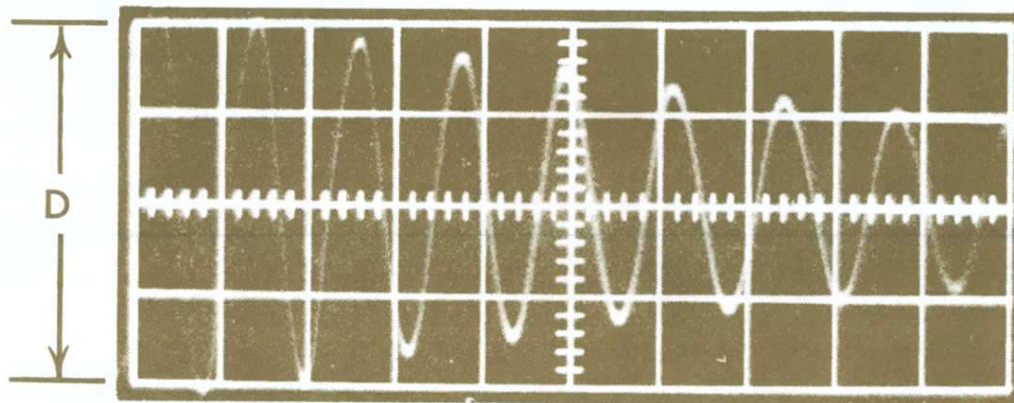


Writing Rate Considerations

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:

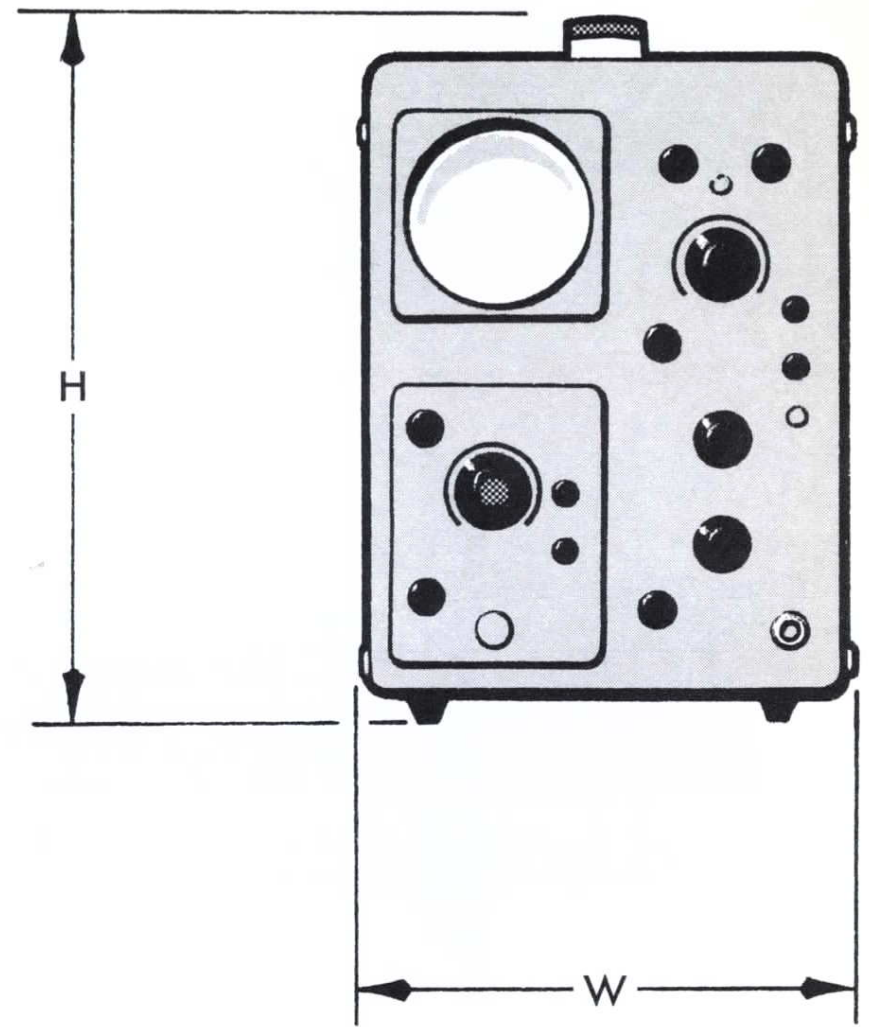
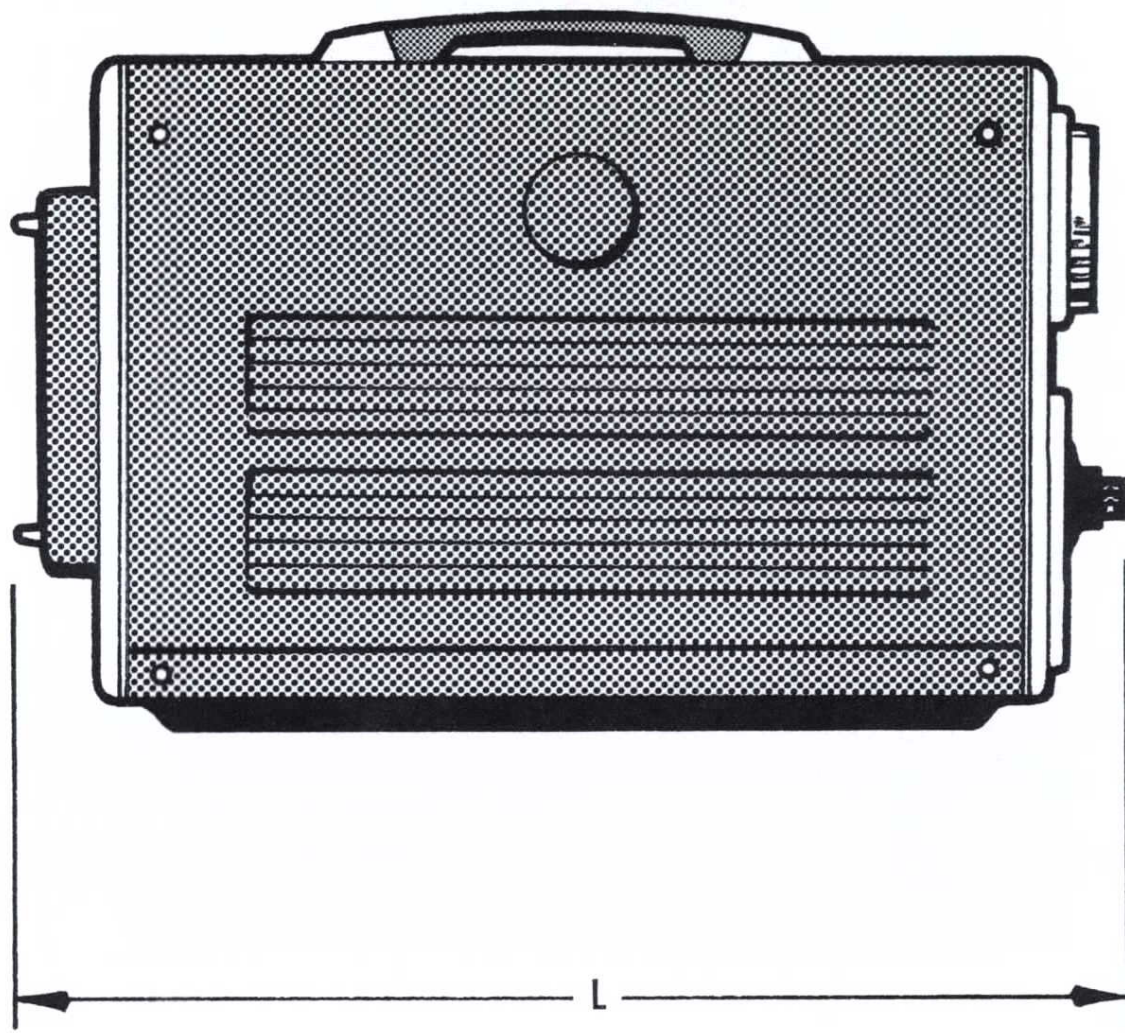
$$\text{Maximum writing rate} = 3.14 Df$$

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.

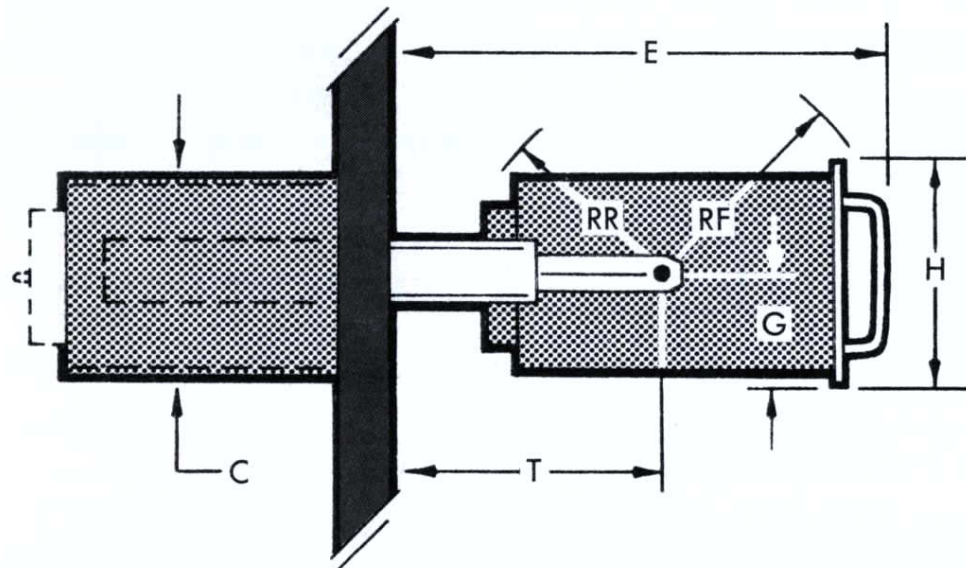
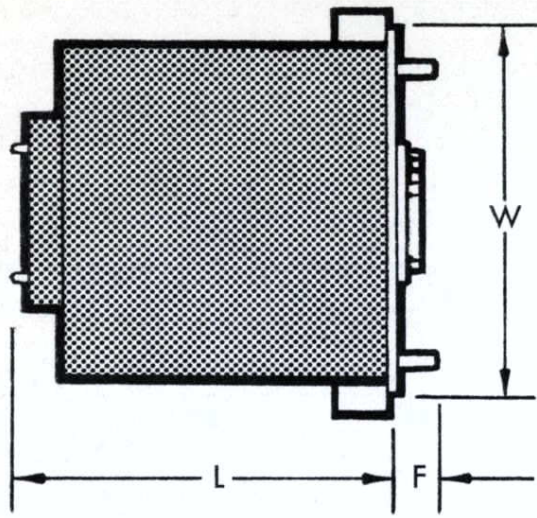
Instrument Dimensions



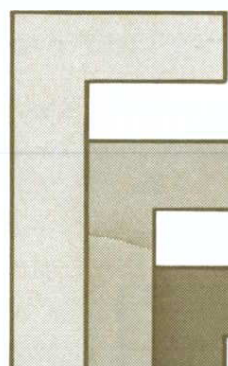
CABINET MODEL INSTRUMENTS		
Symbol	Description	Definition
H	Height	Bottom of feet or rails to top of handle (resting down).
W	Width	Overall width including latch mounting.
L*	Length	Front of front protrusion to greatest rear permanent protrusion, excluding cables.

* Note: Plug-in units could change dimension "L".

Instrument Dimensions



RACK MOUNT INSTRUMENTS EXCLUSIVE OF PLUG-IN UNITS AND PROBES		
Symbol	Description	Definition
H	Height	Height of front panel.
W	Width	Width of front panel.
L	Length	Rack front mounting surface to rearmost permanent fixture, excluding cables.
F	Forward Clearance	Rack front mounting surface to foremost protrusion.
G	Vertical Axis	Bottom of front panel to axis of rotation.
E	Extended Inst.	Maximum forward clearance with instrument out and horizontal.
RF	Radius — front	Axis of rotation to forward protrusion.
RR	Radius — rear	Axis of rotation to rearmost protrusion.
T	Track	Fully extended chassis track axis of rotation.
C	Cabinet	Cabinet height.



These instruments mount with sliding tracks in a cabinet that mounts to a standard 19" rack.

These instruments mount with sliding tracks to a standard 19" rack. Rear support for chassis tracks is required, such as an enclosed rack.

These instruments bolt directly to a standard 19" rack.

MOUNTING DIMENSIONS												
TYPE	H	W	L	F	G	E	RF	RR	T	C		
RM15	8 ³ / ₄	19	22 ⁹ / ₁₆	1 ³ / ₄	2 ⁷ / ₁₆	29 ⁵ / ₈	13 ⁷ / ₈	12 ¹ / ₂	16 ¹ / ₂	8 ⁵ / ₈		
RM17	7	19	17 ⁵ / ₈	1 ³ / ₄	2 ¹³ / ₁₆	21 ¹ / ₈	12 ⁹ / ₁₆	7 ³ / ₄	9 ¹ / ₈	6 ¹³ / ₁₆		
127	8 ³ / ₄	19	21 ⁵ / ₈	1 ³ / ₄	2 ⁷ / ₁₆	28 ⁵ / ₈	12 ¹¹ / ₁₆	12 ¹ / ₄	16 ³ / ₈	8 ³ / ₄		
525	8 ³ / ₄	19	20 ¹⁵ / ₁₆	1 ¹¹ / ₁₆	2 ³ / ₈	24 ¹ / ₈	14 ⁵ / ₈	9 ¹ / ₈	10 ³ / ₈	8 ¹ / ₂		
526	8 ³ / ₄	19	17 ¹⁵ / ₁₆	1 ³ / ₄	2 ⁷ / ₁₆	21 ¹ / ₂	11 ³ / ₄	10	10 ⁵ / ₈	8 ⁵ / ₈		
RM527	5 ¹ / ₄	19	18 ¹ / ₄	1 ⁷ / ₈	2 ¹ / ₄	21 ¹ / ₄	12	8 ¹ / ₂	9 ³ / ₈	5 ¹ / ₁₆		
RM31A	14	19	22 ³ / ₄	2 ¹ / ₈	7 ¹ / ₁₆	29 ¹ / ₂	14	12 ³ / ₈	16 ³ / ₈	13 ⁷ / ₈		
RM33A	14	19	22 ³ / ₄	2 ¹ / ₈	7 ¹ / ₁₆	29 ¹ / ₂	14	12 ³ / ₈	16 ³ / ₈	13 ⁷ / ₈		
RM35A	14	19	22 ³ / ₄	2 ¹ / ₈	7 ¹ / ₁₆	29 ¹ / ₂	14	12 ³ / ₈	16 ³ / ₈	13 ⁷ / ₈		
RM41A	14	19	22 ³ / ₄	2 ¹ / ₈	7 ¹ / ₁₆	29 ¹ / ₂	14	12 ³ / ₈	16 ³ / ₈	13 ⁷ / ₈		
RM43A	14	19	22 ³ / ₄	2 ¹ / ₈	7 ¹ / ₁₆	29 ¹ / ₂	14	12 ³ / ₈	16 ³ / ₈	13 ⁷ / ₈		
RM45A	14	19	22 ³ / ₄	2 ¹ / ₈	7 ¹ / ₁₆	29 ¹ / ₂	14	12 ³ / ₈	16 ³ / ₈	13 ⁷ / ₈		
RM567	12 ¹ / ₄	19	22	1 ⁷ / ₈	2 ⁷ / ₁₆	31 ⁵ / ₈	16 ⁷ / ₈	12	16 ⁹ / ₁₆	12 ³ / ₁₆		
RM565	12 ¹ / ₄	19	22	1 ⁷ / ₈	2 ⁷ / ₁₆	30 ⁹ / ₁₆	15 ¹³ / ₁₆	14	16 ⁵ / ₈	12 ³ / ₁₆		
RM503	7	19	17									
RM504	7	19	17									
RM561	7	19	18 ³ / ₈									

Shipping Weights and Volumes

Type	Net Wt. in lbs.	Domestic Packed in lbs.	Export Packed		Cu. Ft. Volume
			Weight lbs.	Kgs.	
B	4	8	14	6	2
C-A	4 ³ / ₄	9	14	6	2
C-12	14 ¹ / ₄	25	40	18	4
C-13	11 ¹ / ₂	17	28	13	3
C-19	15 ¹ / ₂	26	48	22	6
D	4 ¹ / ₂	8	15	7	2
E	4 ¹ / ₄	8	14	6	2
FM122	5 ¹ / ₂	9	15	7	1
FM125	15	23	38	17	4
G	4 ¹ / ₄	9	14	6	2
H	4	8	14	6	2
K	3 ³ / ₄	8	14	6	2
L	4 ¹ / ₂	8	14	6	2
M	5 ¹ / ₄	10	14	6	2
MC	5 ¹ / ₄	9	16	7	2
ML	5	9	16	7	2
N	7 ¹ / ₄	14	18	8	2
O	5 ¹ / ₂	9	13	6	2
P	3 ¹ / ₄	7	10	5	2
Q	5 ¹ / ₄	10	16	7	2
R	7 ¹ / ₄	11	17	8	2
RM122	6	12	22	10	3
RM125	15	23	50	23	4
RM17	35	67	89	40	10
RM181	15 ³ / ₄	30	44	20	4
RM31A	75	104	123	56	10
RM33	74 ¹ / ₂	104	124	56	10
RM35A	78 ¹ / ₄	108	127	58	10
RM41A	75 ¹ / ₂	105	124	56	10
RM43	75 ¹ / ₂	105	125	57	10
RM45A	80	110	128	58	10
RM503	27	52	73	33	10
RM504	25 ¹ / ₂	51	70	32	10
RM527	34	64	83	38	10
RM561	30 ¹ / ₂	56	59	27	5
RM565	67	99			
RM567	50 ¹ / ₂	84	104	47	10
S	4 ¹ / ₄	8	14	6	2
T	4 ³ / ₄	9	15	7	2
Z	5 ³ / ₄	10	15	7	2
105	34 ¹ / ₄	47	61	28	4
107	13	20	29	13	3
109	8 ¹ / ₂	18	23	10	2
110	14 ³ / ₄	23	33	15	3
111	8 ³ / ₄	16	24	11	3
1121	18 ¹ / ₂	26	35	16	3
113	44 ³ / ₄	61	78	35	6
122	4 ³ / ₄	9	15	7	1
123	1	2	8	4	1
125	15	23	33	15	3
127	39 ¹ / ₂	74	94	43	10
130	8 ³ / ₄	15	25	11	3
132	21 ¹ / ₂	36	47	21	4
133	22	35	47	21	4
160A	20 ¹ / ₄	30	37	17	3
161	3 ¹ / ₂	9	14	6	1
162	3 ¹ / ₂	9	14	6	1

Type	Net Wt. in lbs.	Domestic Packed in lbs.	Export Packed		Volume Cu Ft.
			Weight lbs.	Kgs.	
163	3 ¹ / ₂	9	14	6	1
175	93	119	136	62	7
180A	30 ¹ / ₄	45	58	26	4
181	15 ¹ / ₂	23	32	15	3
190B	23 ¹ / ₂	33	46	21	4
2A60	3	9	18	8	3
2A63	3 ³ / ₄	10	19	9	3
2B67	4 ¹ / ₄	10	19	9	3
3A1	5	12	19	9	3
3A72	5	11	20	10	3
3A74	6 ¹ / ₄	12			
3A75	3 ¹ / ₂	10	19	9	3
3B3	5 ¹ / ₄	12	19	9	3
3S76	7 ¹ / ₂	15	25	11	3
3T77	5 ¹ / ₂	14	23	10	3
310A	23	36	45	20	4
317	33 ¹ / ₄	46	59	27	4
321	14	28	31	14	3
360	10	19	25	11	3
4S1	15 ¹ / ₄	27	37	17	4
5T1	6	12	19	9	3
502	52 ¹ / ₂	77	95	43	8
503	29 ¹ / ₂	46	60	27	5
504	27 ¹ / ₄	44	57	26	5
507	88 ¹ / ₄	122	209	95	19
515A	42 ¹ / ₄	60	75	34	5
516	44 ¹ / ₄	63	76	34	5
517A	140 ¹ / ₄	178	277	126	21
519	99 ³ / ₄	126	165	75	11
Accessories	4	7	12	6	1
524AD	58 ³ / ₄	80	109	49	9
525	54 ³ / ₄	78	98	44	10
526	45 ¹ / ₄	75	96	44	10
527	31 ¹ / ₂	53	65	29	5
531A	57 ³ / ₄	80	98	44	8
533A	62 ¹ / ₄	81	98	44	8
535A	61 ¹ / ₂	85	102	46	8
536	55 ³ / ₄	78	96	44	8
541A	59	81	99	45	8
543A	59	82	100	45	8
545A	63 ³ / ₄	86	103	47	8
551	96 ¹ / ₂	129	159	72	12
555	117	154	187	85	13
561A	27 ¹ / ₂	45	59	27	5
565	62	92			
567	49	79	99	45	10
570	74 ³ / ₄	96	114	53	8
575	66	87	105	48	8
581	63 ¹ / ₂	85	106	48	8
585	67	90	111	50	8
6R1	13 ³ / ₄	21	34	15	4
661	49 ¹ / ₂	69	88	40	8
80	2 ¹ / ₂	7	14	6	2
81	4	7	15	7	2
82	4 ³ / ₄	10	16	7	2
84	4 ³ / ₄	10	16	7	2
945	80	117	128	58	10

General Information

Tektronix, Inc. is an Oregon Corporation, Home Office & Factory, P. O. Box 500, Beaverton, Oregon
Telephone: Mltchell 4-0161 TWX—503-291-6805 Telex: 036-636 Cable: TEKTRONIX

ORDERING PROCEDURES FOR THE UNITED STATES

Instrument Orders, Terms and Shipment

Orders should be placed with your Tektronix Field Engineering Office listed on the facing page.

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 quotations are f.o.b. Beaverton, Oregon.

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.

Delivery

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

Field Maintenance

To help assure adequate instrument-maintenance facilities for our customers, Tektronix has established Field Engineering Offices and Repair Centers at strategic points in the United States. Those offices having fully equipped instrument repair shops are identified on the facing page by a dot (•). Your own Tektronix Field Office will process all orders for repair parts promptly, and provide emergency parts service when needed to restore an instrument to operating condition. Your Field Office will also arrange for fast service with necessary recalibration or repair work on your instruments at nearby Repair Center.

Tektronix repair and replacement-part service is geared directly to the field, therefore all requests for repairs and replacement parts should be directed to the Tektronix Field Office or Representative in your area. This procedure will assure you the fastest possible service. **Please include instrument Type number and Serial number with all requests for parts or service.**

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. Ask your Field Engineer about possible modifications for your older instruments.

Special-Instrument Service

Many Tektronix Instruments can be supplied with such specials as painted panels, altered specification ranges, special connectors, and other features. Please consult your Field Engineer for prices, delivery schedules, and special ordering information.

Warranty

All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own plant, are warranted for the life of the instrument.

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

Field Engineering Offices

- ARIZONA**
 - Phoenix... 7000 E. Camelback Road, Scottsdale... TWX: 602-949-0102..... WHitney 6-4273
Tucson Area: Enterprise 383
- CALIFORNIA**
 - San Diego... 3045 Rosecrans Street, San Diego 10... TWX: 714-276-4265..... ACademy 2-0384
 - Los Angeles Area*
 - Encino... 17418 Ventura Blvd., Encino... TWX: 213-783-3434..... STate 8-5170
 - Orange... 1722 E. Rose Avenue, Orange... TWX: 714-633-2542..... 633-3450
 - Pasadena... 1194 East Walnut Street, Pasadena... TWX: 213-449-1151..... 449-2164
From Los Angeles telephones call: 681-0201
 - West L.A. ... 11681 San Vicente Blvd., West Los Angeles 49... TWX: 213-490-3958.... GRanite 3-1105
From Los Angeles telephones call: BRadshaw 2-1563
 - San Francisco Bay Area*
 - Lafayette... 3530 Golden Gate Way, Lafayette... TWX: 415-281-5262..... YELlowstone 5-6101
From Oakland, Berkeley, Richmond, Albany and San Leandro: CLifford 4-5353
 - Palo Alto... 3944 Fabian Way, Palo Alto... TWX: 415-492-9458..... DAvenport 6-8500
- COLORADO**
 - Denver... 2120 South Ash Street, Denver 22... TWX: 303-292-1702 SKYline 7-1249, 7-1240
Salt Lake Area: Zenith 381
- FLORIDA**
 - Orlando... 205 East Colonial Drive, Orlando... TWX: 305-275-1734..... GArden 5-3483
(also serves Puerto Rico)
- GEORGIA**
 - Atlanta... 467 Armour Circle, N.E., Atlanta 9... TWX: 404-527-1029..... 873-5708
Huntsville, Alabama Area: WX2000
- HAWAII**
 - Kentron Hawaii, Ltd., 1140 Waimanu Street, Honolulu 14... Telex: MHU 0093..... Phone: 53975
- ILLINOIS**
 - Chicago... 400 Higgins Road, Park Ridge... TWX: 312-823-3639..... TAlcott 5-6666
- INDIANA**
 - Indianapolis... 3937 North Keystone Avenue, Indianapolis 5... TWX: 317-634-0156 LLiberty 6-2408, 6-2409
- KANSAS**
 - Kansas City... 5920 Nall, Mission... TWX: 913-552-7309..... HEdrick 2-1003
St. Louis Area: ENterprise 6510
- MARYLAND**
 - Baltimore... 724 York Road, Towson 4... TWX: 301-828-7054..... VALley 5-9000
- MASSACHUSETTS**
 - Boston... 442 Marrett Road, Lexington 73... TWX: 617-862-2249..... VOLunteer 2-7570
- MICHIGAN**
 - Detroit... 27310 Southfield Road, Lathrup Village... TWX: 313-357-4618..... ELgin 7-0040
- MINNESOTA**
 - Minneapolis... 3307 Vera Cruz Ave. North, Suite 102, Minneapolis 22... TWX: 612-292-4133.. 533-2727
- NEW MEXICO**
 - Albuquerque... 509 San Mateo Blvd., N.E., Albuquerque... TWX: 505-243-8433 268-3373
Southern New Mexico Area: Enterprise 678
- NEW YORK**
 - Buffalo... 961 Maryvale Drive, Buffalo 25... TWX: 716-770-1565..... NF 3-7861
 - Endicott... 3214 Watson Blvd., Endwell... TWX: 607-262-0277..... PIONEER 8-8291
 - Poughkeepsie... 8 Raymond Ave., Poughkeepsie... TWX: 914-452-7738..... GRover 1-3620
 - Syracuse... East Molloy Road & Pickard Drive, P.O. Box 155, Syracuse 11
TWX: 315-477-1195..... GLenview 4-2426
 - New York City Area*
 - New York City and Long Island... 840 Willis Avenue, Albertson, L. I.
TWX: 516-248-9249..... PIONEER 7-4830
 - Northern N. J. ... 400 Chestnut Street, Union, New Jersey... TWX: 201-687-6177..... MURdock 8-2222
 - Westchester County, Western Conn., Hudson River Valley... 144 Morgan Street, Stamford, Connecticut
TWX: 203-327-9538..... DAvis 5-3817
- NORTH CAROLINA**
 - Greensboro... 1838 Banking Street, Greensboro... TWX: 919-292-1064..... 274-4647
- OHIO**
 - Cleveland... 1503 Brookpark Road, Cleveland 9... TWX: 216-749-6426..... FLorida 1-8414
 - Dayton... 3601 South Dixie Drive, Dayton 39... TWX: 513-944-0448..... AXminster 3-4175
- OREGON**
 - Portland... 4010 S.W. 114th Avenue, Beaverton... TWX: 503-291-6805..... MITchell 4-9169
- PENNSYLVANIA**
 - Philadelphia... 126 Presidential Blvd. North, Bala-Cynwyd... TWX: 215-667-3935..... TENnyson 9-3111
 - Pittsburgh... 3834 Northern Pike, Monroeville... TWX: 412-372-4620..... ELectric 1-3345
- TEXAS**
 - Dallas... 6211 Denton Drive, P.O. Box 35726, Dallas 35... TWX: 214-899-8364..... FL eetwood 7-9128
 - Houston... 2605 Westgrove Lane, Houston 27... TWX: 713-571-2291..... MOhawk 7-8301, 7-8302
- WASHINGTON**
 - Seattle... 236 S.W. 153rd St., Seattle 66... TWX: 206-998-0618..... CHerry 3-2494
- WASHINGTON, D.C.**
 - Washington, D.C. ... 4205 Evergreen Lane, Annandale, Virginia... TWX: 703-256-8902..... 256-6700
Norfolk, Portsmouth, and Hampton, Virginia Area: Enterprise 741

TWX numbers effective September 4, 1962. Telephone Area Code Numbers are the first three digits of the TWX number.

TEKTRONIX CANADA LTD.

- QUEBEC**
 - Montreal... 3285 Cavendish Blvd., Suite 160, Montreal 28... Telex: 01-2867..... HUNter 9-9707
- ONTARIO**
 - Toronto... 4A Finch Ave. West, Willowdale... Telex: 02-2776..... Toronto, 225-1138

• ALSO REPAIR CENTER

Tektronix International A.G., Terrassenweg 1A, Zug, Switzerland; Telephone: 042 49192, Telex: 5374, or Cable: TEKINTAG.

Tektronix Overseas Distributors in 27 countries.

NEW INSTRUMENTS IN THIS CATALOG

TYPE		PAGE
561A	Oscilloscope	87
565, RM565	Dual-Beam Oscilloscopes	90
567, RM567	Readout Oscilloscopes	94
661	Sampling Oscilloscope	109
ML	Militarized Preamplifier	113
M	Four-Trace DC Unit	125
O	Operational Amplifier Unit	128
3A1	Dual-Trace DC Amplifier	141
3A74	Four-Trace DC Amplifier	143
3B1, 3B3	Time-Base Units	144
3S76	Dual-Trace Sampling Unit	145
3T77	Sampling Sweep Unit	146
4S1	Dual-Trace Sampling Unit	147
5T1	Sampling Timing Unit	148
6R1	Digital Unit	149
82	Dual-Trace Unit	153
84	Test Unit	154
109	Pulse Generator	158





MULTI-PURPOSE OSCILLOSCOPE . . .

AMPLIFIER PLUG-IN UNITS
TIME BASE PLUG-IN UNITS
PARALLAX-FREE INTERNAL GRATICULE
CONTROLLABLE GRATICULE LIGHTING
RECTANGULAR CERAMIC CRT
EASY PORTABILITY
CONVENIENT OPERATION
DEPENDABLE PERFORMANCE

... TYPE 561A & TYPE RM561A

*THESE TWO VERSATILE INSTRUMENTS
EXTEND YOUR OSCILLOSCOPE APPLICATIONS AREA*

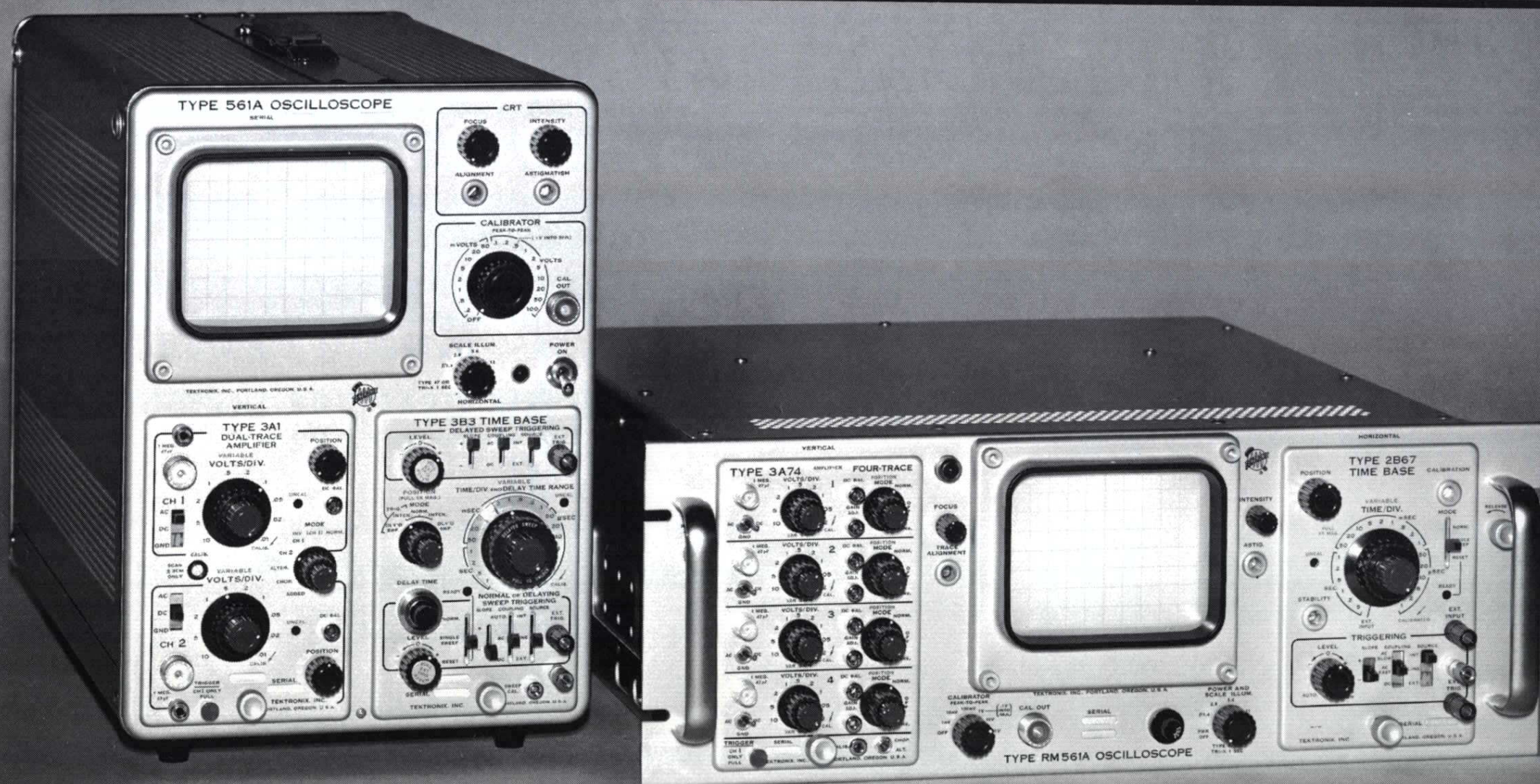
High in performance, low in cost, the Type 561A and Type RM561A Oscilloscopes represent a new advance in value and versatility in the Tektronix Type 560-Series Oscilloscopes.

Conventional operation is now extended to the dc to 10-Mc range, with sub-nanosecond capabilities available through the use of sampling plug-in units.

The Type 561A and RM561A, as most of the Type 560-Series Oscilloscopes, use plug-in units for both the vertical and horizontal deflection systems. Thus you can adapt them to meet your present requirements and easily and economically expand their range of operations when needed. They are fully compatible with all deflection plug-ins used with their companion instruments, the Type 564 Storage Oscilloscope, the Type 565 Dual-Beam Oscilloscope, and the Type 567 Readout Oscilloscope.

Both the Type 561A and Type RM561A use a ceramic cathode-ray tube of exceptionally rugged construction, with an internal graticule and controllable illumination. Thus you can make parallax-free measurements and take photographs with the same ease provided by external graticules.

Occupying only 7 inches of standard rack height, the Type RM561A bolts directly to the rack but may be ordered with optional slide-out tracks at additional cost. Ask your Tektronix Field Engineer about this option.



PLUG-IN UNITS TO MEET PRESENT AND FUTURE NEEDS—

A wide range of performance characteristics is provided by available plug-in units—from the simple single-channel Type 2A60 Amplifier to the dual-channel 0.4-nsec risetime Type 3S76 Sampling Unit. Also, the two latest plug-ins, the Type 3A1 Amplifier Unit and the Type 3B3 Time-Base Unit provide high-sensitivity wide-band dual-trace operation combined with calibrated sweep delay.

X-Y DISPLAYS: Types 2A60, 2A63, 3A72, 3A74, and 3A75 Amplifier Units operate equally well in the vertical and horizontal compartments of the Type 561A and RM561A, permitting X-Y displays using any combination of these plug-in units.

For medium and high-frequency X-Y operation, use of two units of the same type is recommended. Deflection-plate capacitances of the Type 561A and RM561A are carefully standardized to minimize high-frequency phase-shift between two plug-ins of the same type when operated X-Y.

MULTIPLE X-Y DISPLAYS: Two Type 3A72 Units in the Type 561A or RM561A will provide two independent X-Y displays, properly paired; two Type 3A74 units will provide up to four independent displays such as Channel 1 plotted against Channel 1, Channel 2 plotted against Channel 2, etc. (The Type 3A1 Unit does not provide for X-Y pairing, and, due to its 6-cm scan limitation, is not generally recommended for obtaining multiple X-Y displays).

AMPLIFIER UNITS				
Type	Passband (3-db down)	Calibrated Deflection Factor ††	Input (ac or dc coupled)	Price
*2A60	dc — 1 Mc.	50 mv/cm—50 v/cm in 4 steps.	1 megohm shunted by 47 pf, 600 volts max.	\$105
2A61 Low-Level Differential	0.06 cps—300 kc	10 μ v/cm—20 mv/cm, 1-2-5 sequence.	10 meg—50 pf; ± 5 v (ac-coupled only)	\$385
*2A63 Differential 50:1 rejection ratio	dc — 300 kc.	1 mv/cm—20 v/cm, 1-2-5 sequence.	1 megohm shunted by 47 pf, 600 volts max.	\$130
**3A1 Dual-Trace (Identical Channels)	dc — 10 Mc. (each channel).	10 mv/cm—20 v/cm, 1-2-5 sequence.		\$410
*3A72 Dual-Trace (Identical Channels)	dc — 650 kc (each channel).	10 mv/cm—10 v/cm, 1-2-5 sequence.		\$250
3A74 Four-Trace (Identical Channels)	dc — 2 Mc. (each channel).	20 mv/cm—10 v/cm, 1-2-5 sequence.		\$550
*3A75	dc — 4 Mc.	50 mv/cm—20 v/cm, 1-2-5 sequence.		\$175
3S76 Dual-Trace Sampling (use with 3T77)	dc to equivalent 875 Mc. (each channel).	2 mv/cm—200 mv/cm, 1-2-5 sequence.	50 Ω 2 volts pk-to-pk. max. dc-coupled	\$1100

TIME-BASE UNITS				
Type	Sweep Rate ††	Magnifier	Triggering	Price
†2B67 Single Sweep	1 μ sec/cm to 5 sec/cm, 1-2-5 sequence.	5X	Internal, External, Line; amplitude-level selection; ac or dc-coupled; automatic or free run; \pm slope.	\$175
3B1 Sweep Delay	0.5 μ sec/cm to 1 sec/cm, 1-2-5 sequence (for both normal and delayed sweeps).		Internal, External; amplitude-level selection; ac or dc-coupled; automatic (normal sweep only) or free-run; \pm slope.	\$475
3B3 Calibrated Sweep Delay Single Sweep	0.5 μ sec/cm to 1 sec/cm, 1-2-5 sequence (for both normal and delayed sweeps). Continuously variable calibrated delay from 0.5 μ sec to 10 sec.		Internal, External; amplitude-level selection, ac or dc coupled, \pm slope. Normal sweep has in addition: automatic and line plus single sweep.	\$525
3T77 Sampling Sweep (use with 3S76)	Equivalent sweep rates 0.2 nsec/cm to 10 μ sec/cm, 1-2-5 sequence.	10X	Internal or External, \pm slope.	\$650

* Formerly designated by last two digits.

** Provides 6-cm linear scan.

† Same as former Type 67 with addition of single-sweep feature.

†† Deflection factor and Sweep Rate are variable between steps, uncalibrated.

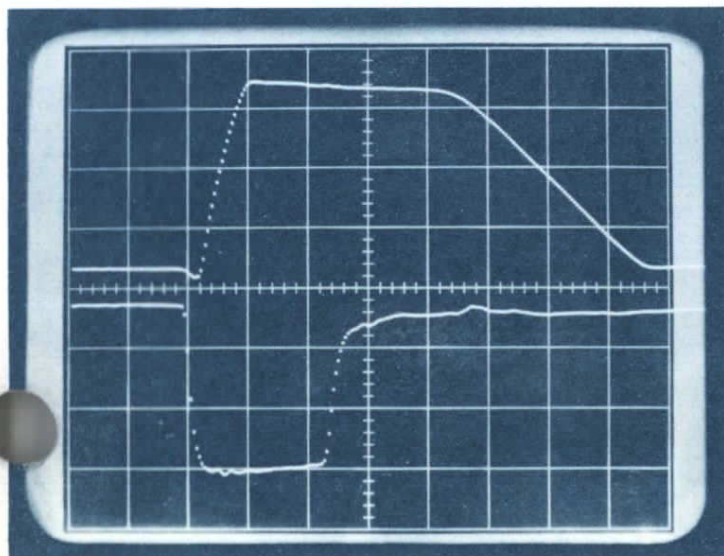
PARALLAX-FREE MEASUREMENTS—CONVENIENT PHOTOGRAPHY—

The internal graticule eliminates parallax, a common cause of erroneous readings. Parallax is an apparent displacement of the trace in relationship to the graticule. It occurs when the trace is on a different plane than the graticule and is not viewed from exactly the same point for all readings.

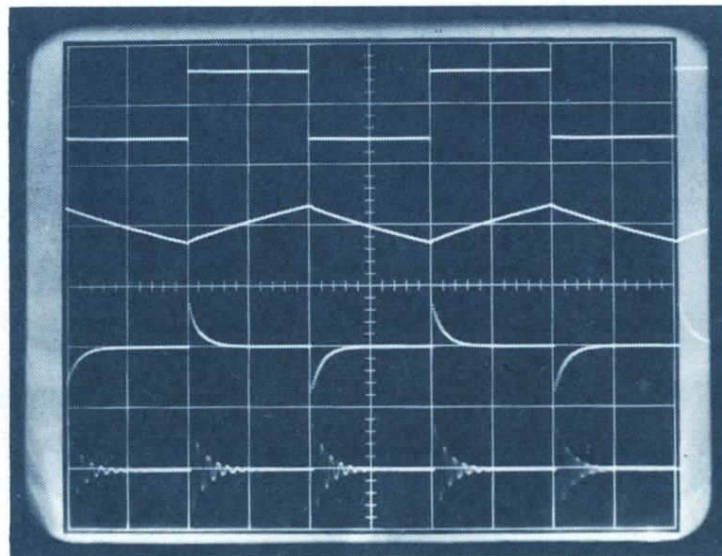
When the trace and graticule are on the same plane, as on the ceramic cathode-ray tube of the Type 561A and RM561A Oscilloscope, parallax is eliminated.

Controllable illumination of the internal graticule—a feature unique with Tektronix—enables you to easily take waveform photographs in which the graticule rulings are sharply delineated. This was formerly possible only with oscilloscopes using external graticules.

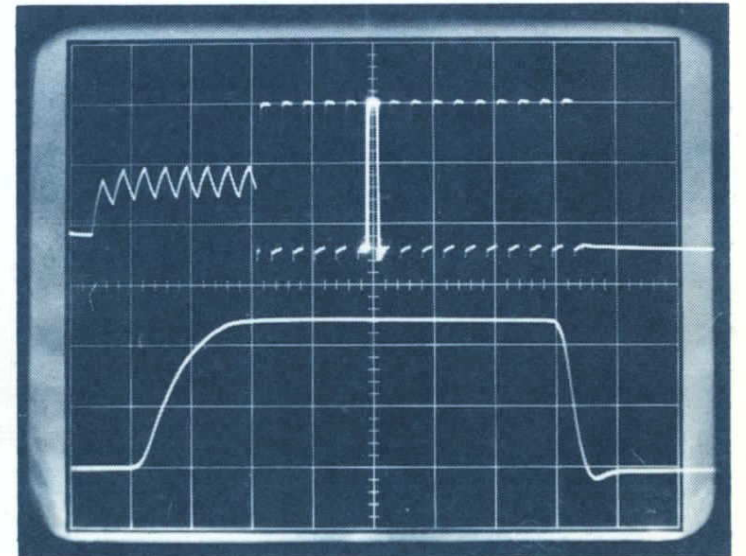
Adding to the convenience of operation are numbered settings of the illumination control that serve as an approximate exposure guide.



SAMPLING (Double exposure)
Transistor turn-on and turn-off (upper trace).
Driving pulse (lower trace).



MULTIPLE TRACES
Four traces photographed simultaneously.



DELAYING SWEEP (Double exposure)
Intensified portion of waveform (upper trace) expanded (lower trace) by means of delayed sweep.

TYPE 561A AND RM561A CHARACTERISTICS

PLUG-IN COMPARTMENTS accept all 2-Series and 3-Series Amplifier and Time-Base Units.

TEKTRONIX CRT is a new flat-faced "ceramic envelope" tube, with internal "parallax-free" graticule (on a parallel-ground glass face), controllable edge-lighting, 3.5 kv monoaccelerator, beam-deflection unblanking. A P31 Phosphor is normally supplied.

DISPLAY CONTROLS on the front panel include Focus, Intensity, and Scale Illumination (of the 8-cm by 10-cm display area) in addition to adjustments for astigmatism and trace-alignment.

CALIBRATOR has 18 calibrated square-wave voltages available, from 0.2 mv to 100 v, pk-pk—approximately 5 μ sec rise-time, at line frequency, convenient for time-base calibration. The 0.5 calibrator voltage provides 0.1 volts into 50 ohms, convenient for calibration of sampling units.

ELECTRONICALLY-REGULATED SUPPLIES furnish all voltages required for proper operation of the Indicator and the plug-in units. Regulated dc-supply provides 85 watts for powering the 2-Series and 3-Series Plug-In Unit. Supplies operate normally with or without plug-ins.

AMBIENT TEMPERATURE RANGE for proper operation is approximately 20° F to 120° F. If internal temperature becomes excessive, the power will automatically shut off and remain off until the temperature returns to the proper operating range.

Z-AXIS INPUT through a terminal at the rear of the instrument permits external modulation of the crt cathode.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v ac, 50 to 400 cps, approximately 210 watts at 117 v and 240 watts maximum at 125 v.

MECHANICAL FEATURES include an aluminum-alloy chassis and three-piece cabinet. Dimensions are 14-1/2" high by 10" wide by 21-1/8" deep. Net weight is 28 pounds. Shipping weight is 45 pounds, approx.

TYPE 561A OSCILLOSCOPE (without plug-in units) \$470

The Type RM561A is identical, electronically, to the cabinet model Type 561A with the following exceptions:

CALIBRATOR range is 1 mv to 100 v in decade steps.

POWER REQUIREMENT line-frequency range is 50 to 60 cps.

TYPE RM561A OSCILLOSCOPE (without plug-in units) . . . \$525

OSCILLOSCOPE ACCESSORIES

SCOPE-MOBILE® CART

The Type 201 Scope-Mobile Cart gives the Type 561A Oscilloscope in-plant portability. Features include an adjustable tray that tilts and locks in any of nine positions for best viewing angle, 5-inch rubber wheels, aluminum construction, and a linoleum-topped steel shelf at the bottom.

The Scope-Mobile Cart is available with an installed plug-in carrier that provides dust-free storage for two plug-in units. The plug-in carriers can be ordered separately.

Type 201	\$85.00
Type 203 (Type 201 with Plug-In Carrier installed)	\$99.50
Plug-In Carrier (Part No. 014-007)	\$20.00

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BLANK PLUG-IN CHASSIS

This chassis contains necessary unique mechanical parts for construction of a custom plug-in for Type 560-Series Oscilloscopes—including frame, blank front panel, blank chassis, 24-pin connector, latch, and small hardware. Instructions are included on permissible power-supply loading and crt signal requirements. Electrical components are not included.

Order Part Number 040-245 \$15

PROBES

Attenuator probes are not included with the Type 561A or RM561A Oscilloscopes. Tektronix probes are recommended when minimum loading of the circuit is required.

Your Tektronix Field Engineer can help you select the probes best suited for your particular applications.

POLARIZED VIEWERS

Under high ambient-light conditions it is often difficult to view oscilloscope traces unless the trace intensity is greatly increased. Many times this is not feasible. The new Tektronix Polarized Viewers make it easy to see oscilloscope traces of normal to low intensity even when the ambient light is very high.

The curved, circularly polarized filter in the viewers greatly reduces troublesome reflections and glare, with no distortion of the trace. And, the Polarized Viewers allow considerable freedom of movement for the operator—it is not necessary to peer through a narrow eyepiece of any sort.

The Polarized Viewers slip on or off the rectangular graticule covers of the Type 561A or RM561A in a matter of seconds. Rectangular Polarized Viewer, Part No. 016-039 \$10

U. S. Sales Prices f.o.b. Beaverton, Oregon

**For a demonstration—
please call your Tektronix Field Engineer.**

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Tektronix Field Offices are located in principal cities throughout the United States. Please consult your Telephone Directory.

Tektronix Canada Ltd: Montreal, Quebec • Toronto (Willowdale) Ontario • Tektronix International A. G., Terrassenweg 1A, Zug, Switzerland.

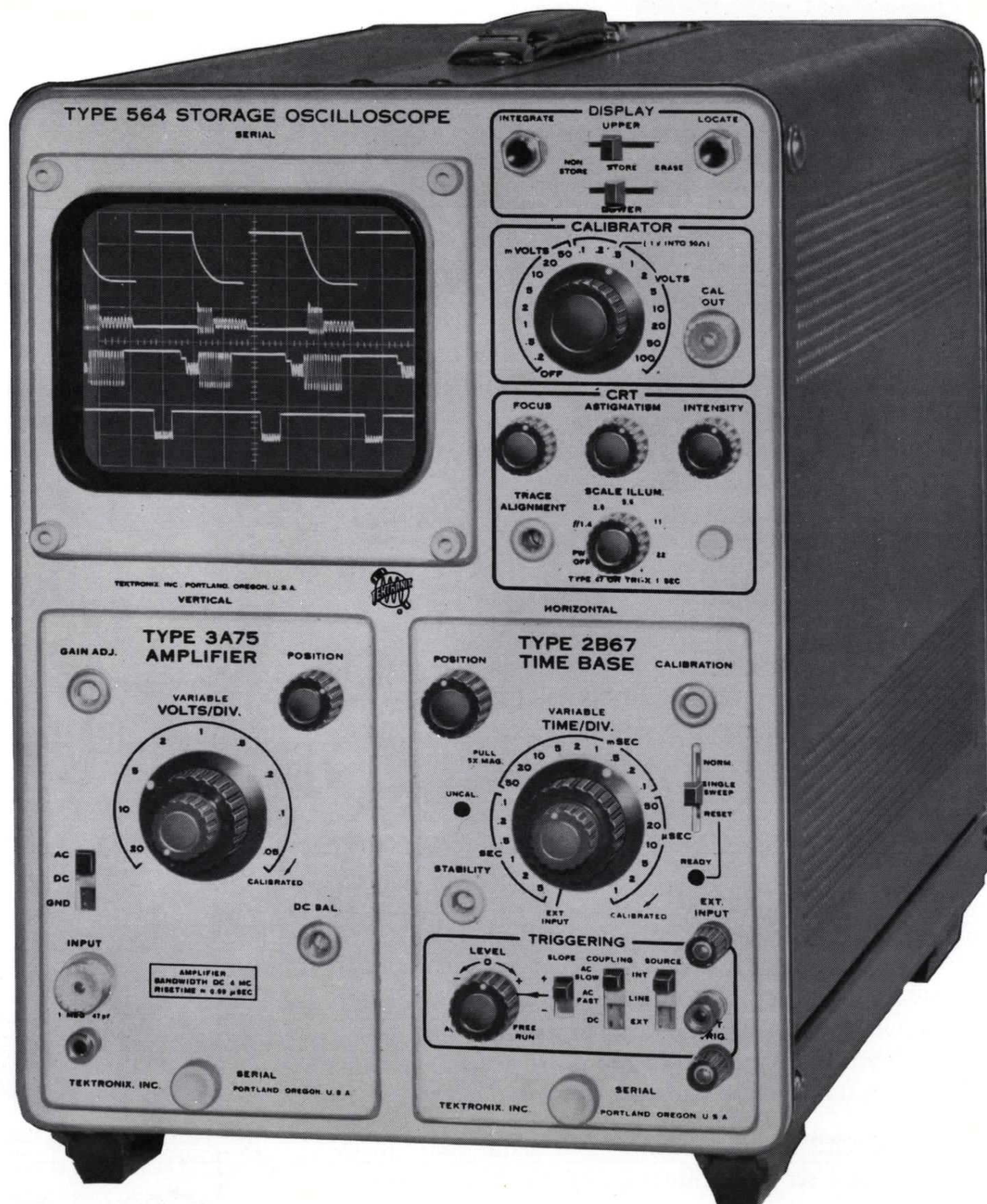


t e n t a t i v e

NEW STORAGE OSCILLOSCOPE

LOW-COST SPLIT SCREEN

TEKTRONIX TYPE 564

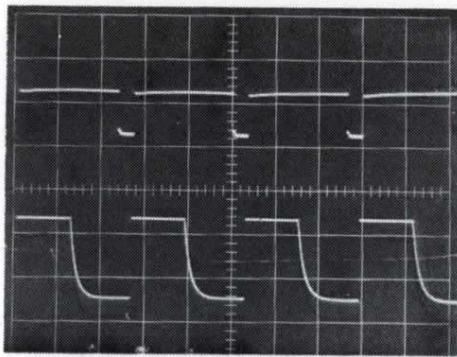


SPLIT-SCREEN DISPLAYS — with a single control for each half — in either storage or non-storage operation.

TEKTRONIX, INC.

TRANSITION FROM ENGINEERING MODEL TO PRODUCTION MODEL MAY REQUIRE MINOR SPECIFICATION CHANGES. FINAL SPECIFICATIONS WILL BE RELEASED LATER.

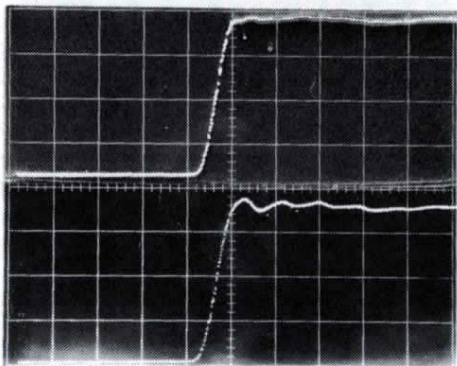
FOR STORAGE AND NON-STORAGE DISPLAYS



INPUT-OUTPUT WAVEFORMS

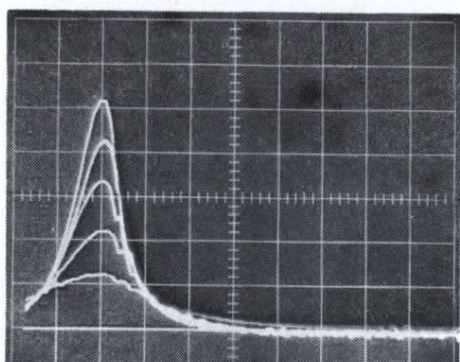
Display shows ability of the Type 564 to store similar waveforms for easy comparison.

Upper trace shows the trigger input to a multivibrator. Lower trace shows the output.



LOW-REPETITION-RATE SAMPLING

Display shows ability of the Type 564 (with sampling plug-in units) to record complete sampling waveforms at low repetition rates. Upper trace is stored. Lower trace is not stored. This capability for storing low-repetition-rate waveforms allows observation and analysis of the **entire sampled display** at one time.



SHOCK TEST

Display shows ability of the Type 564 to store consecutive events for comparison or photography. Waveforms indicate shock imparted by dropping sub-table weight of 5 lbs. from different heights. Drop of 5" = 50.5 g's; 10" = 92.5 g's; 15" = 142 g's; 20" = 181 g's; 25" = 214 g's. Sweep Speed is 2 msec/cm. Accelerometer is ENDEVCO MODEL 2215.

CONVENIENT FEATURES

INDIVIDUAL CONTROLS FOR SPLIT-SCREEN DISPLAYS—include one for upper-half crt displays and erasure and one for lower-half crt displays and erasure. On either half, the control **left** permits non-storage operation . . . the control **center** permits storage operation . . . and the control **right** with spring return, erases the displays.

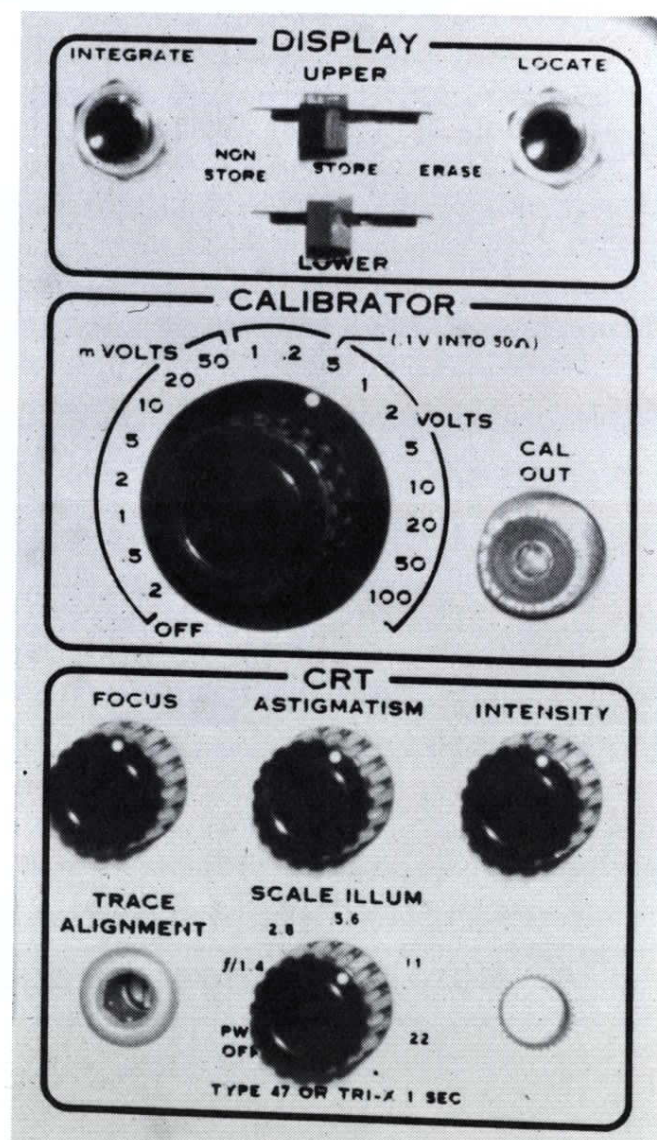
LOCATE BUTTON—when depressed, permits viewing starting point of the next trace to be stored. If it appears that the next trace will overlap the last stored trace, the starting point can be moved up or down by using the vertical position control.

INTEGRATE BUTTON—when depressed, permits storage display of repetitive high-speed signals faster than 25 centimeters per millisecond. Using the integration technique (storing charges from **repetitive** traces) permits storage displays much faster than stated writing rate of the crt.

OTHER CRT DISPLAY CONTROLS include those for changing focus, astigmatism, trace intensity, and scale illumination of the 8-cm by 10-cm display area, plus an adjustment for trace alignment.

CALIBRATOR—provides a convenient means for checking calibration of the amplifier and time-base units. The calibrator has 18 voltage settings, 1-2-5 sequence, from 0.2 millivolt to 100 volts, peak-to-peak—approximately 5 microsecond risetime at line frequency. The 0.5-volt position (providing 0.1 volt into 50 ohms) can be used for calibrating the sampling plug-in units.

PLUG-IN COMPARTMENTS—accept the 2-Series and 3-Series Amplifier and Time-Base Units—which drive the crt deflection plates directly. The compartments can accept identical plug-ins for matched X-Y displays.



TEKTRONIX TYPE 564 SPLIT-SCREEN OSCILLOSCOPE



Highly versatile, the new Type 564 Oscilloscope features independent control of either half of the unique split-screen crt. Thus, the full screen can be used for storage or non-storage displays. Or, one-half of the screen can be used for storage displays with the other half used for non-storage displays, or as a preview area.

Accepting a wide range of vertical and time-base plug-in units, the Type 564 permits the type of performance demanded for particular applications. And, with approximately two-thirds of the circuitry housed within the plug-ins, servicing is easy and down-time is minimized.

FOR STORAGE AND NON-STORAGE DISPLAYS

The Type 564 has display capabilities for upper-half, lower-half, or full-screen storage or non-storage (with conventional crt operation in the non-storage mode).

The storage capability lends itself to single-shot displays at slow or medium speeds . . . and repetitive displays at fast speeds using the integration technique.

Single-trace writing speed is faster than 25 centimeters per millisecond. On repetitive traces, the integrate feature provides an increase in stored writing rate. For example, it is possible to increase the stored writing rate by at least 10X on 12 repetitive traces. Storage time can be more than one hour; erase time approximately 250 milliseconds.

PLUG-IN UNIT CHARACTERISTICS

The Type 564 has display capabilities for differential, multi-trace, wide-band, delaying sweep, and sampling applications. Type and degree of performance depend upon 2-Series and 3-Series Amplifier and Time-Base Units used. The Type 3A75 Amplifier Unit and Type 2B67 Time-Base Unit appear in the illustration in a full-screen-storage display. Main characteristics of these two units—and nine other presently available plug-ins—appear in a chart on the back page.



*Small-Size—only 14½" high by 10" wide by 21⅞" deep.
Light Weight—less than 40 pounds, with plug-ins.*

CRT CHARACTERISTICS

Rugged electrically and mechanically—because of its rectangular design and ceramic construction—the new split-screen tube is comparable to conventional Tektronix crt's.

The flat-face storage tube is the direct viewing, bistable type and has a parallel-ground glass face with full 8-cm by 10-cm display area.

Type 564 Storage Oscilloscope (without plug-in units)	\$950
Type 3A75 50 mv/cm Amplifier Unit	\$175
Type 2B67 Time-Base Unit with single sweep . .	\$175

PLUG-IN UNIT CHARACTERISTICS

2-SERIES AND 3-SERIES PLUG-IN UNITS

A wide range of performance characteristics is provided by available plug-in units—from the simple single-channel Type 2A60 Amplifier to the dual-channel 0.4-nsec-risetime Type 3S76 Sampling Unit. Also, the two latest plug-ins, the Type 3A1 Amplifier Unit and the Type 3B3 Time-Base Unit provide high-sensitivity wide-band dual-trace operation combined with calibrated sweep delay.

X-Y DISPLAYS: Types 2A60, 2A63, 3A72, 3A74 and 3A75 Amplifier Units operate equally well in the vertical and horizontal compartments of the Type 564, permitting X-Y displays using any combination of these plug-in units.

For medium and high-frequency X-Y operation, use of two units of the same type is recommended. Deflection-plate capacitances of the 564 are carefully standardized to minimize high frequency phase-shift between two plug-ins of the same type when operated X-Y.

STORAGE OF SAMPLED DATA: When used with Types 3S76 and 3T77 Sampling Plug-ins, flicker-free storage of low repetition rate, fast-rise signals can be achieved. A sampled and stored reference signal can be placed on one-half the screen, and subsequent signals can be compared on the other half of the screen.

AMPLIFIER UNITS				
TYPE	INPUT (ac or dc coupled)	† PASSBAND (3-db down)	SENSITIVITY	PRICE
2A60	1 megohm paralleled by 47 pf 600 volts max.	dc—1 Mc.	50 mv/cm—50 v/cm, 4 decade steps, with variable control.	\$105
2A63 (50:1 rejection ratio)		dc—300 kc.	1 mv/cm—20 v/cm, 1-2-5 sequence, with variable control.	\$130
3A1—Dual Trace (Identical Channels)		dc—10 Mc. (each channel)	10 mv/cm—10 v/cm, 1-2-5 sequence, with variable control. 6 cm Linear scan.	\$410
3A72—Dual Trace (Identical Channels)		dc—650 kc. (each channel)	10 mv/cm—20 v/cm, 1-2-5 sequence, with variable control.	\$250
3A74—Four Trace (Identical Channels)		dc—2 Mc. (each channel)	20 mv/cm—10 v/cm, 1-2-5 sequence, with variable control.	\$550
3A75		dc—4 Mc.	50 mv/cm—20 v/cm, 1-2-5 sequence, with variable control.	\$175
3S76—Dual Trace Sampling (for use with 3T77)	50 ohms dc-coupled	equivalent dc-to-875 Mc. (0.4-nsec risetime)	2 mv/cm—200 mv/cm, 1-2-5 sequence, with variable control.	\$1100
TIME-BASE UNITS				
TYPE	SWEEP FEATURES		TRIGGERING	PRICE
* 2B67	1 μ sec/cm to 5 sec/cm, 1-2-5 sequence, variable between rates. 5X Magnifier. Single Sweep.		Internal, External, Line; Amplitude-Level Selection; AC or DC-Coupling; Auto- matic or Free-Run; \pm Slope.	\$175
3B1	Normal and Delayed Sweeps—0.5 μ sec/ cm to 1 sec/cm, 1-2-5 sequence. 18 cali- brated delay settings, 0.5 μ sec to 10 sec, variable between rates uncalibrated.		Internal or External; Amplitude-Level Selec- tion; AC or DC-Coupling; Automatic; \pm Slope; for Normal Sweep. Same features (except no Automatic) for Delayed Sweep.	\$475
3B3	Normal and Delayed Sweeps—0.5 μ sec/ cm to 1 sec/cm, 1-2-5 sequence. Con- tinuously variable calibrated delay from 0.5 μ sec to 10 sec. Single Sweep for main sweep.		Internal, External, Line; Amplitude-Level Selection; AC or DC-Coupling; Automatic; \pm Slope; for Normal Sweep. Same fea- tures (except no Line or Automatic) for Delayed Sweep.	\$525
3T77 Sampling Sweep (for use with 3S76)	Equivalent to 0.2 nsec/cm to 10 μ sec/ cm, 1-2-5 sequence, variable between rates. 10X Magnifier.		Internal or External \pm Slope.	\$650
† Passband characteristics pertain to non-storage mode.			* Same as former Type 67 with addition of single-sweep feature.	

U.S. Sales Prices f.o.b. Beaverton, Oregon

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TYPE 530-SERIES OSCILLOSCOPES

accept any of these Plug-In Units



Change the plug-in unit and you equip any of the Tektronix Type 530-Series Oscilloscopes — including rack-mount models—with high performance needed for particular applications.

The Type 530-Series Oscilloscopes with various letter-series plug-ins through Type M, the four-trace unit, fit general-purpose applications, and with other letter-series plug-ins—through Type Z, the differential-comparator unit—fit special-purpose applications.

The Type 531A, 533A, or 535A, with any of the plug-in units, performs simply and reliably in the many applications within its capabilities. For complete information on the characteristics of any of these combinations, please call your Tektronix Field Engineer.



TYPE B \$145

General-Purpose Wide-Band High-Gain Unit • Calibrated Sensitivity—5 mv/cm to 20 mv/cm • Risetime—35 nsec • Passband—2 c to 10 mc • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—25 nsec • Passband—dc to 14 mc.



TYPE CA \$260

General-Purpose Dual-Trace DC Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—23 nsec • Passband—dc to 15 mc.



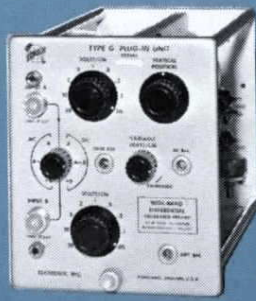
TYPE D \$170

General-Purpose High-Gain DC Differential Unit • Calibrated Sensitivity—1 mv/cm to 50 v/cm • Risetime—0.18 μ sec • Passband—dc to 300 kc—increasing to 2 mc.



TYPE E \$190

General-Purpose Low-Level AC Differential Unit • Calibrated Sensitivity—50 μ v/cm to 10 mv/cm • Risetime—6 μ sec • Passband—0.06 c to 20 kc—increasing to 60 kc.



TYPE G \$190

General-Purpose Wide-Band DC Differential Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—25 nsec • Passband—dc to 14 mc.



TYPE H \$185

General-Purpose Wide-Band High-Gain DC Unit • Calibrated Sensitivity—5 mv/cm to 20 v/cm • Risetime—31 nsec • Passband—dc to 11 mc.



TYPE K \$145

General-Purpose Fast-Rise DC Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—23 nsec • Passband—dc to 15 mc.



TYPE L \$210

General-Purpose Fast-Rise High-gain Unit • Calibrated Sensitivity—5 mv/cm to 2 v/cm • Risetime—23 nsec • Passband—3 c to 15 mc • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—23 nsec • Passband—dc to 15 mc.



TYPE M \$525

General-Purpose Four-Trace Unit • Calibrated Sensitivity—20 mv/cm to 10 v/cm • Risetime—25 nsec • Passband—dc to 14 mc.



TYPE N \$625

Sampling Unit — for displaying repetitive high-speed signals by the sampling process • Calibrated Sensitivity—10 mv/cm • Risetime—0.6 nsec • Passband—dc to 600 mc.



TYPE O \$475

Operational-Amplifier Unit—for displaying operations of integration, differentiation, function generation, linear and non-linear amplification • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—25 nsec • Passband—dc to 14 mc.



TYPE Q \$325

Transducer and Strain-Gage Unit —for displaying mechanical quantities converted to a change in resistance, capacitance, or inductance • Calibrated Sensitivity—10 μ strain/div to 10,000 μ strain/div • Risetime—60 μ sec • Passband—dc to 6 kc.



TYPE R \$325

Transistor - Risetime Unit — for displaying simultaneously delay, rise, storage, and fall times of transistors • Calibrated Sensitivity—0.5 ma/cm to 100 ma/cm • Risetime—23 nsec • Passband—dc to 15 mc.



TYPE S \$260

Diode-Recovery Unit—for displaying forward and reverse switching characteristics of semiconductor diodes • Calibrated Sensitivity—1 to 20 ma forward current, 0 to 2 ma reverse • Risetime—23 nsec • Passband—dc to 15 mc.



TYPE Z \$525

Differential-Comparator Unit—for displaying an *equivalent* vertical scale length up to ± 2000 cm at 50 mv/cm • Calibrated Sensitivity—50 mv/cm to 25 v/cm • Risetime—35 nsec • Passband—dc to 10 mc.

TEST UNIT AND POWER SUPPLY UNITS ALSO AVAILABLE

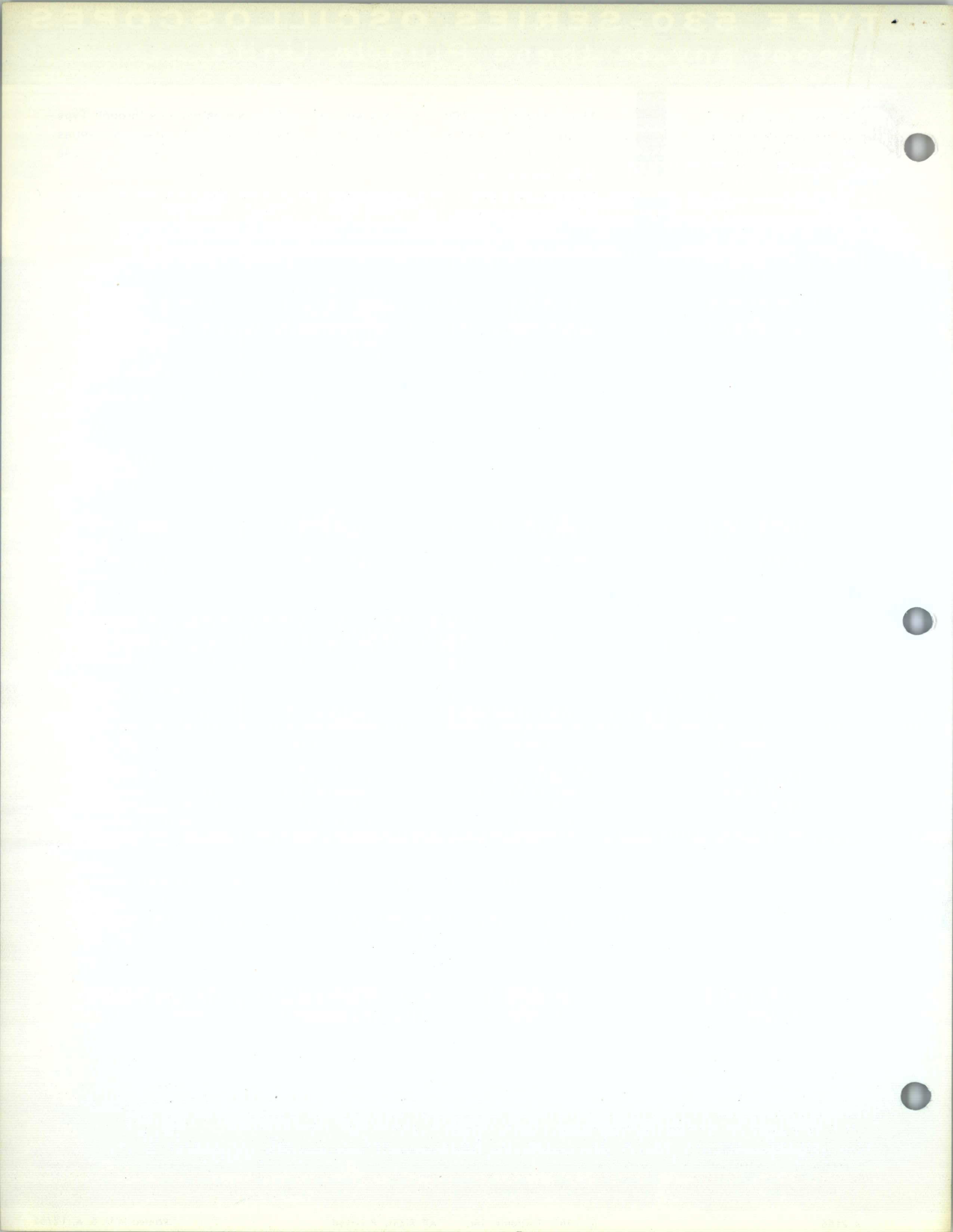
TYPE P FAST-RISE UNIT \$ 90
For checking vertical amplifier response, 4-nsec risetime.

TYPE 127 POWER SUPPLY UNIT . . . \$650
For powering one or two plug-in units, 18-nsec risetime (with fast-rise units).

TYPE 132 POWER SUPPLY UNIT . . . \$390
For powering one plug-in unit, 23-nsec risetime (with fast-rise units).

TYPE 133 POWER SUPPLY UNIT . . . \$390
For powering one plug-in unit, dc-to-100 kc frequency response, ± 5 volts output, 2-ohm source impedance.

U. S. Sales Prices f.o.b. Beaverton, Oregon



TYPE 540-SERIES OSCILLOSCOPES

accept any of these Plug-In Units



Change the plug-in unit and you equip any of the Tektronix Type 540-Series Oscilloscopes—including rack-mount models—with high performance needed for particular applications.

The Type 540-Series Oscilloscopes with various letter-series plug-ins through Type M, the four-trace unit, fit general-purpose applications, and with other letter-series plug-ins—through Type Z, the differential-comparator unit—fit special-purpose applications.

The Type 541A, 543A, or 545A, with any of the plug-in units, performs simply and reliably in the many applications within its capabilities. For complete information on the characteristics of any of these combinations, please call your Tektronix Field Engineer.



TYPE B \$145

General - Purpose Wide - Band High-Gain Unit • Calibrated Sensitivity—5 mv/cm to 20 mv/cm • Risetime—30 nsec • Passband—2 c to 12 mc • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—18 nsec • Passband—dc to 20 mc.



TYPE CA \$260

General-Purpose Dual-Trace DC Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—15 nsec • Passband—dc to 24 mc.



TYPE D \$170

General-Purpose High-Gain DC Differential Unit • Calibrated Sensitivity—1 mv/cm to 50 v/cm • Risetime—0.18 μ sec • Passband—dc to 300 kc—increasing to 2 mc.



TYPE E \$190

General-Purpose Low-Level AC Differential Unit • Calibrated Sensitivity—50 μ v/cm to 10 mv/cm • Risetime—6 μ sec • Passband—0.06 c to 20 kc—increasing to 60 kc.



TYPE G \$190

General-Purpose Wide-Band DC Differential Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—18 nsec • Passband—dc to 20 mc.



TYPE H \$185

General - Purpose Wide - Band High-Gain DC Unit • Calibrated Sensitivity—5 mv/cm to 20 v/cm • Risetime—23 nsec • Passband—dc to 15 mc.



TYPE K \$145

General-Purpose Fast-Rise DC Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—12 nsec • Passband—dc to 30 mc.



TYPE L \$210

General-Purpose Fast-Rise High-gain Unit • Calibrated Sensitivity—5 mv/cm to 2 v/cm • Risetime—15 nsec • Passband—3 c to 24 mc • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—12 nsec • Passband—dc to 30 mc.



TYPE M \$525

General-Purpose Four-Trace Unit • Calibrated Sensitivity—20 mv/cm to 10 v/cm • Risetime—17 nsec • Passband—dc to 20 mc.



TYPE N \$625

Sampling Unit — for displaying repetitive high-speed signals by the sampling process • Calibrated Sensitivity—10 mv/cm • Risetime—0.6 nsec • Passband—dc to 600 mc.



TYPE O \$475

Operational - Amplifier Unit—for displaying operations of integration, differentiation, function generation, linear and non-linear amplification • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—14 nsec • Passband—dc to 25 mc.



TYPE Q \$325

Transducer and Strain-Gage Unit—for displaying mechanical quantities converted to a change in resistance, capacitance, or inductance • Calibrated Sensitivity—10 μ strain/div to 10,000 μ strain/div • Risetime—60 μ sec • Passband—dc to 6 kc.



TYPE R \$325

Transistor - Risetime Unit — for displaying simultaneously delay, rise, storage, and fall times of transistors • Calibrated Sensitivity—0.5 ma/cm to 100 ma/cm • Risetime—12 nsec • Passband—dc to 30 mc.



TYPE S \$260

Diode-Recovery Unit—for displaying forward and reverse switching characteristics of semiconductor diodes • Calibrated Sensitivity—1 to 20 ma forward current, 0 to 2 ma reverse • Risetime—12 nsec • Passband—dc to 30 mc.



TYPE Z \$525

Differential-Comparator Unit—for displaying an *equivalent* vertical scale length up to ± 2000 cm at 50 mv/cm • Calibrated Sensitivity—50 mv/cm to 25 v/cm • Risetime—24 nsec • Passband—dc to 13 mc.

TEST UNIT AND POWER SUPPLY UNITS ALSO AVAILABLE

TYPE P FAST-RISE UNIT \$90
For checking vertical amplifier response, 4-nsec risetime.

TYPE 127 POWER SUPPLY UNIT . . . \$650
For powering one or two plug-in units, 18-nsec risetime (with fast-rise units).

TYPE 132 POWER SUPPLY UNIT . . . \$390
For powering one plug-in unit, 23-nsec risetime (with fast-rise units).

TYPE 133 POWER SUPPLY UNIT . . . \$390
For powering one plug-in unit, dc-to-100 kc frequency response, ± 5 volts output, 2-ohm source impedance.

U.S. Sales Prices f.o.b. Beaverton, Oregon

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TYPE 551 OSCILLOSCOPE

accepts any of these Plug-In Units



Change the plug-in units and you equip the Tektronix Type 551 Oscilloscope with high performance needed for particular applications.

The Type 551 Oscilloscope with letter-series plug-ins through Type M, the four-trace unit, fits general-purpose applications, and with other letter-series plug-ins—through Type Z the differential-comparator unit—fits special-purpose applications.

The Type 551 Oscilloscope and plug-in units perform simply and reliably in the many dual-beam applications within its capabilities. For complete information on the characteristics of any of these combinations, please call your Tektronix Field Engineer.



TYPE B \$145

General-Purpose Wide-Band High-Gain Unit • Calibrated Sensitivity—5 mv/cm to 20 mv/cm • Risetime—30 nsec • Passband—2 c to 12 mc • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—20 nsec • Passband—dc to 18 mc.



TYPE CA \$260

General-Purpose Dual-Trace DC Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—16 nsec • Passband—dc to 22 mc.



TYPE D \$170

General-Purpose High-Gain DC Differential Unit • Calibrated Sensitivity—1 mv/cm to 50 v/cm • Risetime—0.18 μ sec • Passband—dc to 300 kc—increasing to 2 mc.



TYPE E \$190

General-Purpose Low-Level AC Differential Unit • Calibrated Sensitivity—50 μ v/cm to 10 mv/cm • Risetime—6 μ sec • Passband—0.06 c to 20 kc—increasing to 60 kc.



TYPE G \$190

General-Purpose Wide-Band DC Differential Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—20 nsec • Passband—dc to 18 mc.



TYPE H \$185

General-Purpose Wide-Band High-Gain DC Unit • Calibrated Sensitivity—5 mv/cm to 20 v/cm • Risetime—25 nsec • Passband—dc to 14 mc.



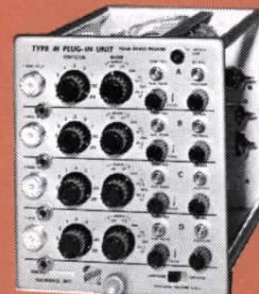
TYPE K \$145

General-Purpose Fast-Rise DC Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—14 nsec • Passband—dc to 25 mc.



TYPE L \$210

General-Purpose Fast-Rise High-gain Unit • Calibrated Sensitivity—5 mv/cm to 2 v/cm • Risetime—15 nsec • Passband—3 c to 24 mc • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—14 nsec • Passband—dc to 25 mc.



TYPE M \$525

General-Purpose Four-Trace Unit • Calibrated Sensitivity—20 mv/cm to 10 v/cm • Risetime—18 nsec • Passband—dc to 19 mc.



TYPE N \$625

Sampling Unit — for displaying repetitive high-speed signals by the sampling process • Calibrated Sensitivity—10 mv/cm • Risetime—0.6 nsec • Passband—dc to 600 mc.



TYPE O \$475

Operational-Amplifier Unit—for displaying operations of integration, differentiation, function generation, linear and non-linear amplification • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—16 nsec • Passband—dc to 22 mc.



TYPE Q \$325

Transducer and Strain-Gage Unit—for displaying mechanical quantities converted to a change in resistance, capacitance, or inductance • Calibrated Sensitivity—10 μ strain/div to 10,000 μ strain/div • Risetime—60 μ sec • Passband—dc to 6 kc.



TYPE R \$325

Transistor - Risetime Unit — for displaying simultaneously delay, rise, storage, and fall times of transistors • Calibrated Sensitivity—0.5 ma/cm to 100 ma/cm • Risetime—14 nsec • Passband—dc to 25 mc.



TYPE S \$260

Diode-Recovery Unit—for displaying forward and reverse switching characteristics of semiconductor diodes • Calibrated Sensitivity—1 to 20 ma forward current, 0 to 2 ma reverse • Risetime—14 nsec • Passband—dc to 25 mc.



TYPE Z \$525

Differential-Comparator Unit—for displaying an *equivalent* vertical scale length up to ± 2000 cm at 50 mv/cm • Calibrated Sensitivity—50 mv/cm to 25 v/cm • Risetime—24 nsec • Passband—dc to 13 mc.

TEST UNIT AND POWER SUPPLY UNITS ALSO AVAILABLE

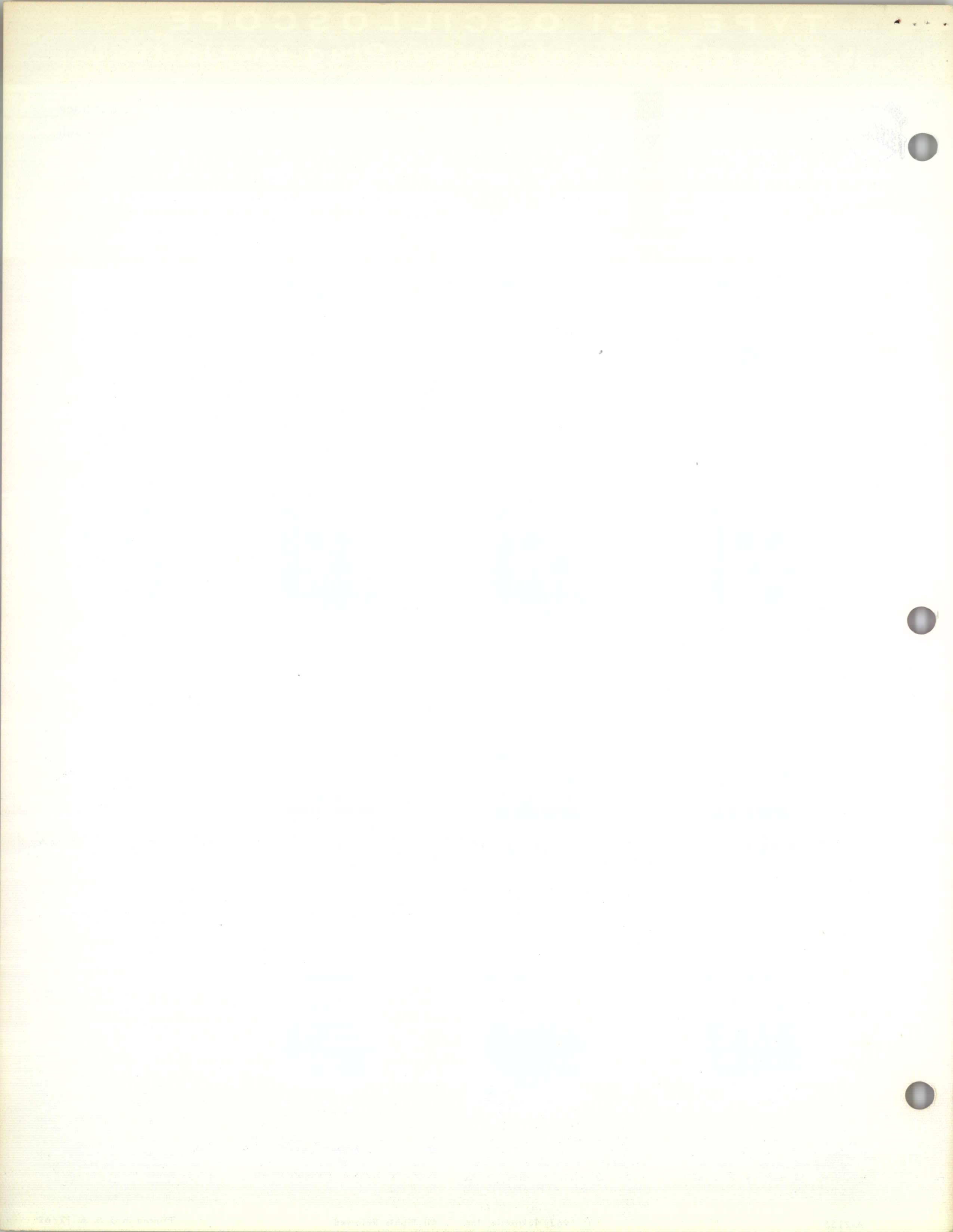
TYPE P FAST-RISE UNIT \$ 90
For checking vertical amplifier response, 4-nsec risetime.

TYPE 127 POWER SUPPLY UNIT . . . \$650
For powering one or two plug-in units, 18-nsec risetime (with fast-rise units).

TYPE 132 POWER SUPPLY UNIT . . . \$390
For powering one plug-in unit, 23-nsec risetime (with fast-rise units).

TYPE 133 POWER SUPPLY UNIT . . . \$390
For powering one plug-in unit, dc-to-100 kc frequency response, ± 5 volts output, 2-ohm source impedance.

U. S. Sales Prices f.o.b. Beaverton, Oregon



TYPE 580-SERIES OSCILLOSCOPES

accept any of these Plug-In Units



Using the Type 81 Adapter, you can change the plug-in unit and equip the Tektronix Type 580-Series Oscilloscopes with high performance needed for particular applications.

The Type 580-Series Oscilloscopes with various letter-series plug-ins through Type M, the four-trace unit, fit general-purpose applications, and with other letter-series plug-ins—through Type Z, the differential-comparator unit—fit special-purpose applications.

The Type 581 or 585, with any of the plug-in units, performs simply and reliably in the many applications within its capabilities. For complete information on the characteristics of any of these combinations, please call your Tektronix Field Engineer.



TYPE B \$145

General - Purpose Wide - Band High-Gain Unit • Calibrated Sensitivity—5 mv/cm to 20 mv/cm • Risetime—30 nsec • Passband—2 c to 12 mc • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—18 nsec • Passband—dc to 20 mc.



TYPE CA \$260

General-Purpose Dual-Trace DC Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—15 nsec • Passband—dc to 24 mc.



TYPE D \$170

General-Purpose High-Gain DC Differential Unit • Calibrated Sensitivity—1 mv/cm to 50 v/cm • Risetime—0.18 μ sec • Passband—dc to 300 kc—increasing to 2 mc.



TYPE E \$190

General-Purpose Low-Level AC Differential Unit • Calibrated Sensitivity—50 μ v/cm to 10 mv/cm • Risetime—6 μ sec • Passband—0.06 c to 20 kc—increasing to 60 kc.



TYPE G \$190

General-Purpose Wide-Band DC Differential Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—18 nsec • Passband—dc to 20 mc.



TYPE H \$185

General - Purpose Wide - Band High-Gain DC Unit • Calibrated Sensitivity—5 mv/cm to 20 v/cm • Risetime—23 nsec • Passband—dc to 15 mc.



TYPE K \$145

General-Purpose Fast-Rise DC Unit • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—12 nsec • Passband—dc to 30 mc.



TYPE L \$210

General-Purpose Fast-Rise High-gain Unit • Calibrated Sensitivity—5 mv/cm to 2 v/cm • Risetime—15 nsec • Passband—3 c to 24 mc • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—12 nsec • Passband—dc to 30 mc.



TYPE M \$525

General-Purpose Four-Trace Unit • Calibrated Sensitivity—20 mv/cm to 10 v/cm • Risetime—17 nsec • Passband—dc to 20 mc.



TYPE N \$625

Sampling Unit — for displaying repetitive high-speed signals by the sampling process • Calibrated Sensitivity—10 mv/cm • Risetime—0.6 nsec • Passband—dc to 600 mc.



TYPE O \$475

Operational - Amplifier Unit—for displaying operations of integration, differentiation, function generation, linear and non-linear amplification • Calibrated Sensitivity—50 mv/cm to 20 v/cm • Risetime—14 nsec • Passband—dc to 25 mc.



TYPE Q \$325

Transducer and Strain-Gage Unit —for displaying mechanical quantities converted to a change in resistance, capacitance, or inductance • Calibrated Sensitivity—10 μ strain/div to 10,000 μ strain/div • Risetime—60 μ sec • Passband—dc to 6 kc.



TYPE R \$325

Transistor - Risetime Unit — for displaying simultaneously delay, rise, storage, and fall times of transistors • Calibrated Sensitivity—0.5 ma/cm to 100 ma/cm • Risetime—12 nsec • Passband—dc to 30 mc.



TYPE S \$260

Diode-Recovery Unit—for displaying forward and reverse switching characteristics of semiconductor diodes • Calibrated Sensitivity—1 to 20 ma forward current, 0 to 2 ma reverse • Risetime—12 nsec • Passband—dc to 30 mc.



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Differential-Comparator Unit—for displaying an *equivalent* vertical scale length up to ± 2000 cm at 50 mv/cm • Calibrated Sensitivity—50 mv/cm to 25 v/cm • Risetime—24 nsec • Passband—dc to 13 mc.

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For powering one plug-in unit, 23-nsec risetime (with fast-rise units).

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For powering one plug-in unit, dc-to-100 kc frequency response, ± 5 volts output, 2-ohm source impedance.

U.S. Sales Prices f.o.b. Beaverton, Oregon





TYPE O

OPERATIONAL AMPLIFIER

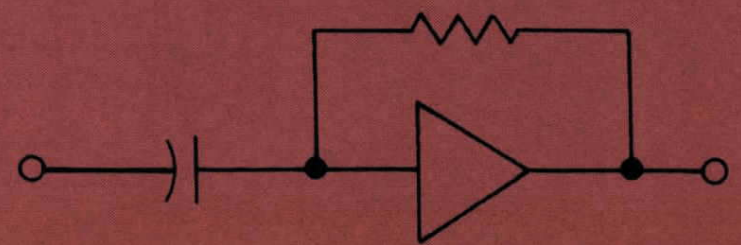
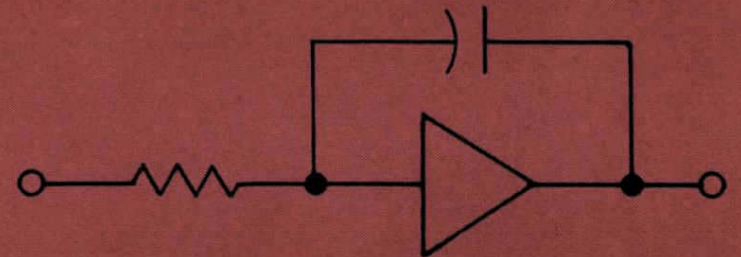
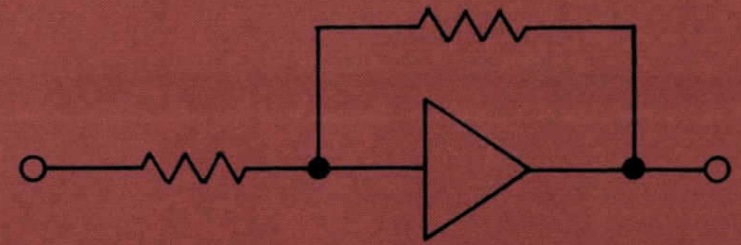
PLUG-IN UNIT



AMPLIFICATION

INTEGRATION

DIFFERENTIATION



WHAT THE TYPE O WILL DO

The Tektronix Type O Operational Amplifier performs precise operations of integration, differentiation, function generation, and linear or nonlinear amplification. As the operation is performed, the results can be displayed by the oscilloscope in which the Type O is used or can be fed to other circuitry.

The Type O can be used with any Tektronix Type 530, 540, 550, or (with a Type 81 Adapter Unit) 580-Series Oscilloscope. In addition, through use of the Type 127, 132, or 133 Plug-In Power Supplies, the Type O can also be used for other purposes.

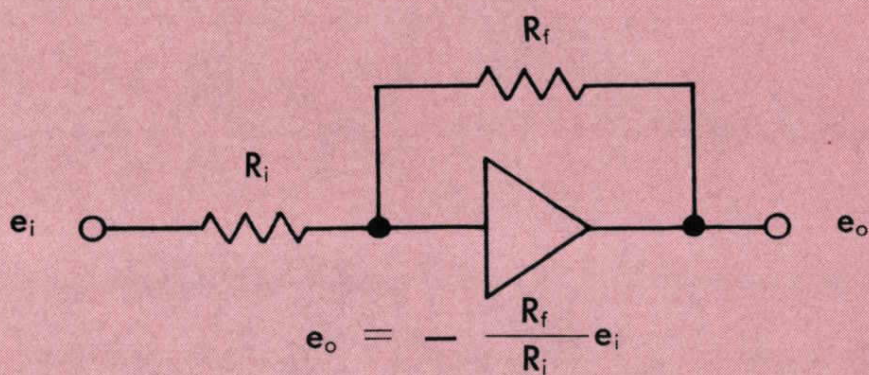
BASIC CHARACTERISTICS AND OPERATIONS

The Type O contains two separate but identical operational amplifiers plus a vertical preamplifier. The vertical preamplifier monitors the output of either operational amplifier or can be used as an independent oscilloscope preamplifier.

Each operational amplifier is a high-gain inverting amplifier with selectable input and feedback impedances. The types of input and feedback impedances and their ratios determine the gain and type of operation.

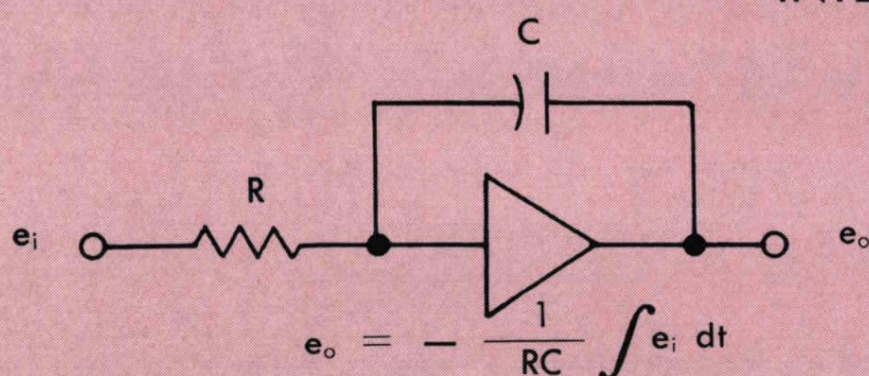
Normally, resistors and capacitors are used as input and feedback impedances. Front-panel switches on the Type O allow selection from a wide range of internal precision resistors and capacitors. Provision is made for use of external input and feedback impedances. External components can be used independently or in combination with the internal resistor-capacitor combinations.

AMPLIFICATION



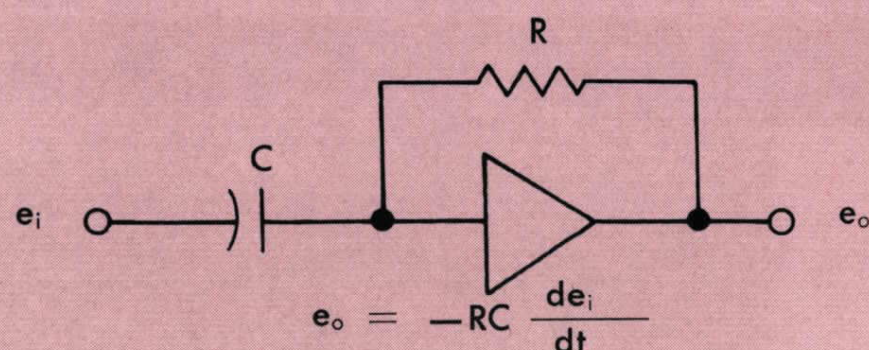
Amplification of a signal is obtained by using resistors for the input and feedback impedances. Due to the high open-loop gain of the amplifier, the closed-loop gain is determined by the ratio of R_f to R_i . In the Type O, various R_i and R_f values are selectable by front-panel switches. This provides convenient signal step-up or step-down operation, with low output impedances, to over 750 kc (Gain-Bandwidth product). Use of external high-frequency compensation extends the closed-loop gain-bandwidth product to 10 mc, or more.

INTEGRATION



Precise integration is obtained by placing a capacitor in the feedback loop. The integrating capacitors and resistors are selectable by front-panel switches. Typical applications include magnetic core B-H loop studies and finding the area under pulse waveforms.

DIFFERENTIATION



Differentiation is accomplished by placing a capacitor in the input circuit. Capacitors of various values are selectable by front-panel switches. The unique characteristic of differentiation is its ability to extract higher-frequency waveform components. It can advantageously detect minute information such as noise, transients and slope changes.

NOTE: It is convenient to represent high-gain dc operational amplifiers by a triangular figure as shown. The base of the triangle is the input; the apex is the output. For most operations, the "negative" grid (i.e., the grid which produces a positive-going output for a negative-going input) is used, and the "positive" grid is grounded internally. Where the input grid is not identified (+ or -), the input is to the negative (-) grid.

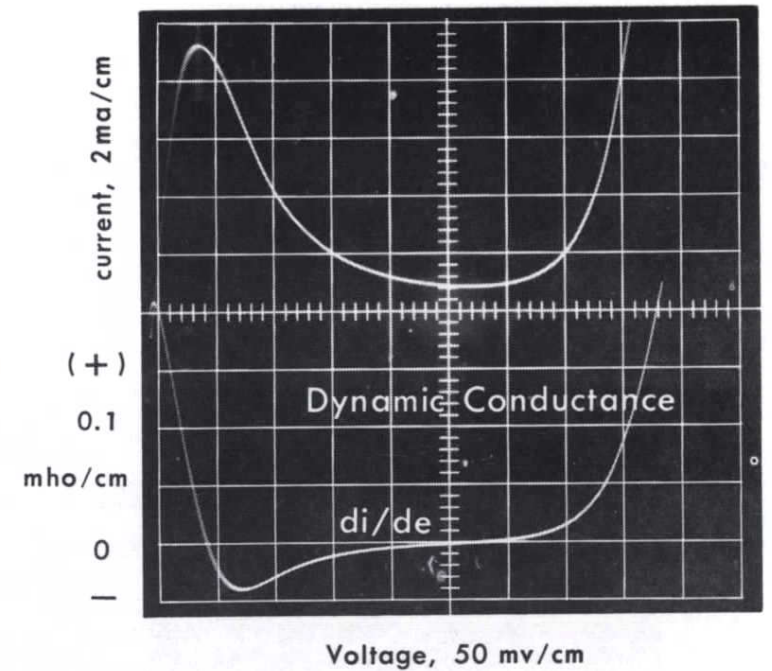
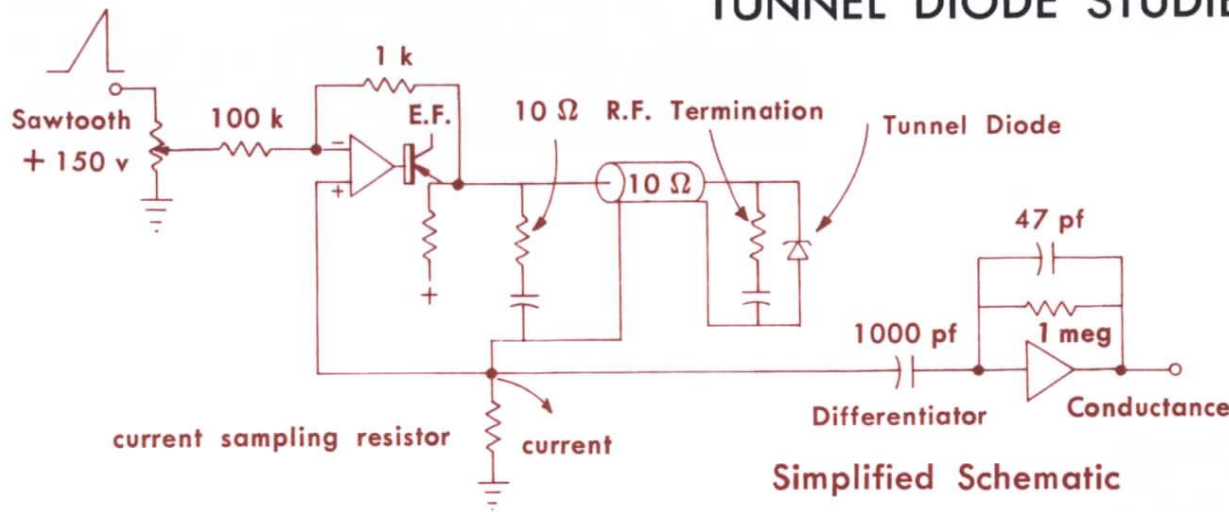
A COMPLETELY FUNCTIONAL OPERATIONAL AMPLIFIER

TYPICAL OPERATIONS AND APPLICATIONS *

With the Type O, you can display the output of either operational amplifier—display both outputs simultaneously, using a dual-beam oscilloscope—feed the output of one of the operational amplifiers to the input of the other and display the resultant output—apply the output of either, or both, amplifiers to an external circuit.

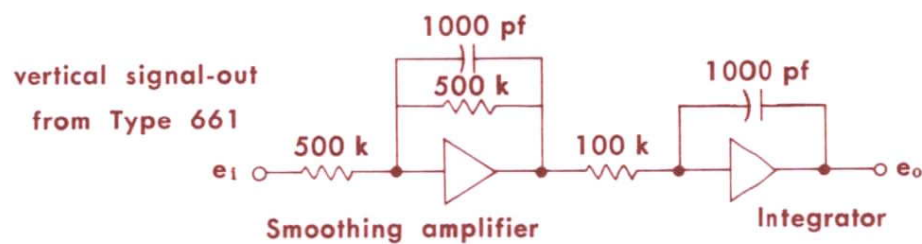
Because of this versatility, many combinations of the basic modes of operation are possible. This permits use of the Type O in a wide variety of applications such as:

TUNNEL DIODE STUDIES

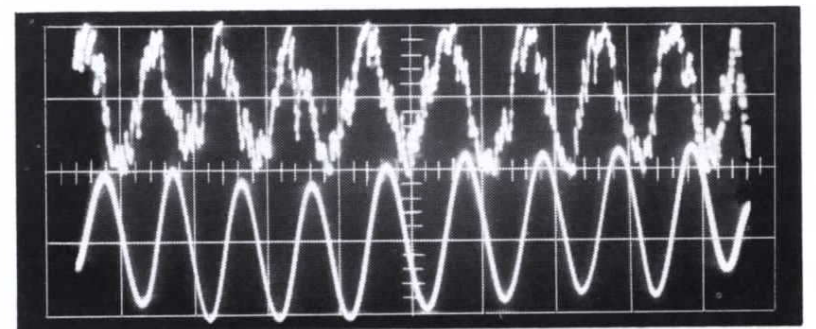


The Type O, with associated circuitry, can drive a tunnel diode with very low impedance. The diode is stabilized at high-frequencies by an R.F.-terminated jig, and thus may be driven by a very slow ramp-voltage. Linear drive of the tunnel diode allows differentiation of the current and obtainment of di/de curve.

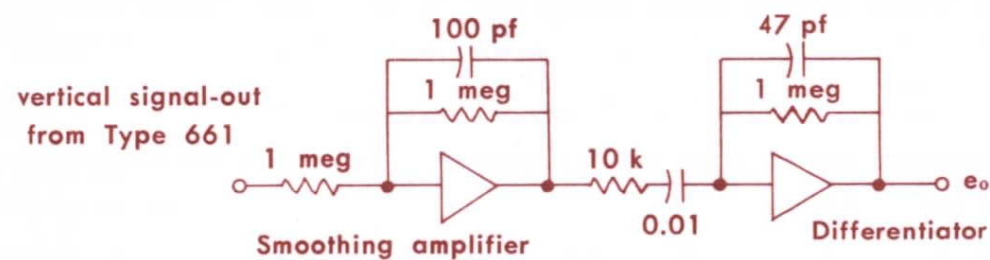
INTEGRATION OF SAMPLED DATA



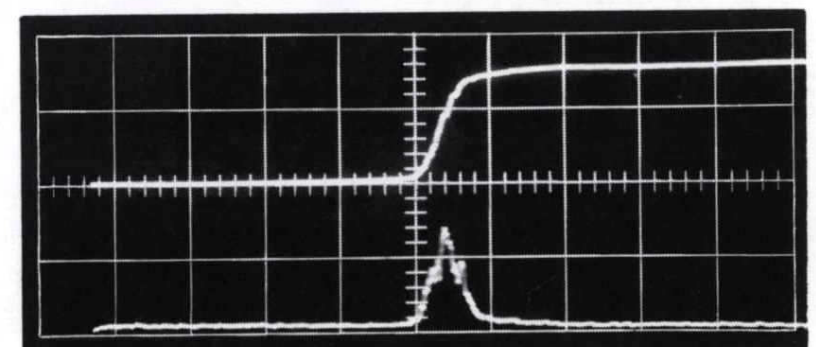
It is possible to integrate repetitive signals to approximately 1 gigacycle using the vertical signal-out from a sampling oscilloscope such as the Tektronix Type 661. Sampled data contains many high-frequency components as well as the desired lower-frequency signals. In some operations it may be necessary to insert a smoothing amplifier before performing linear operations.



DIFFERENTIATION OF SAMPLED DATA



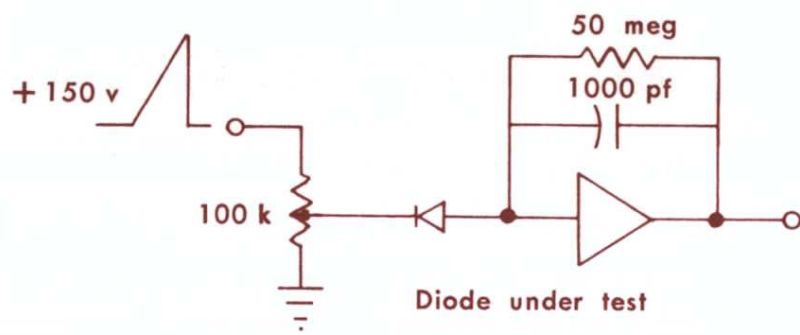
Differentiation of sampled signals can be performed after passing the sampled signal through a smoothing amplifier. An additional high-frequency limiting circuit is necessary in differentiation. It is possible to differentiate signals with nanosecond risetimes.



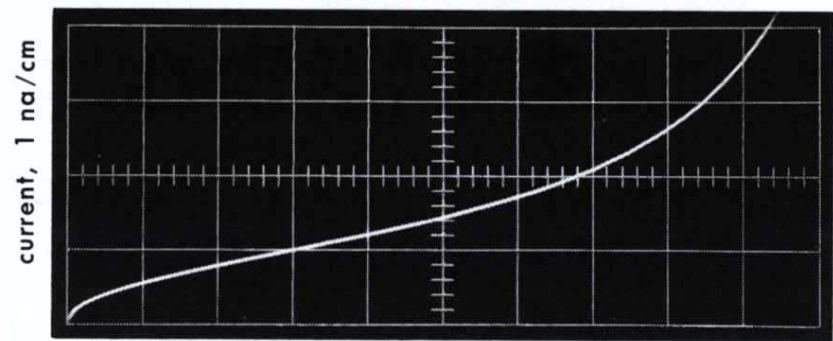
* Note: All multiple-trace photographs are double exposures.

TYPICAL APPLICATIONS

VERY LOW CURRENT MEASUREMENTS

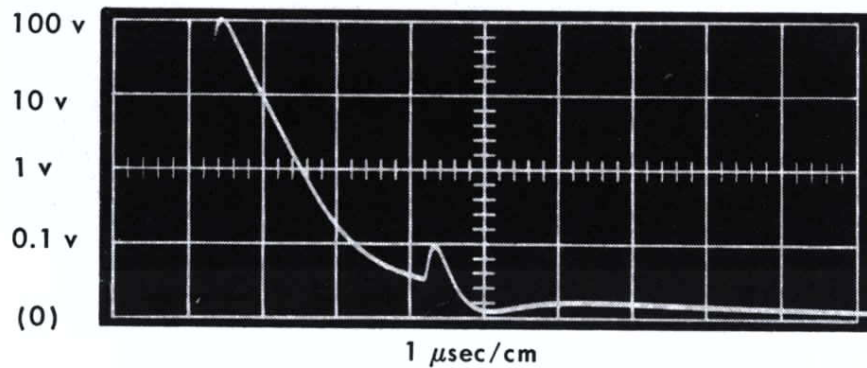


Diode reverse-leakage current can be continuously plotted on the crt, using the oscilloscope sweep-sawtooth. Currents in the nanoampere region are easily displayed and measured.



Reverse Voltage, 10 v/cm

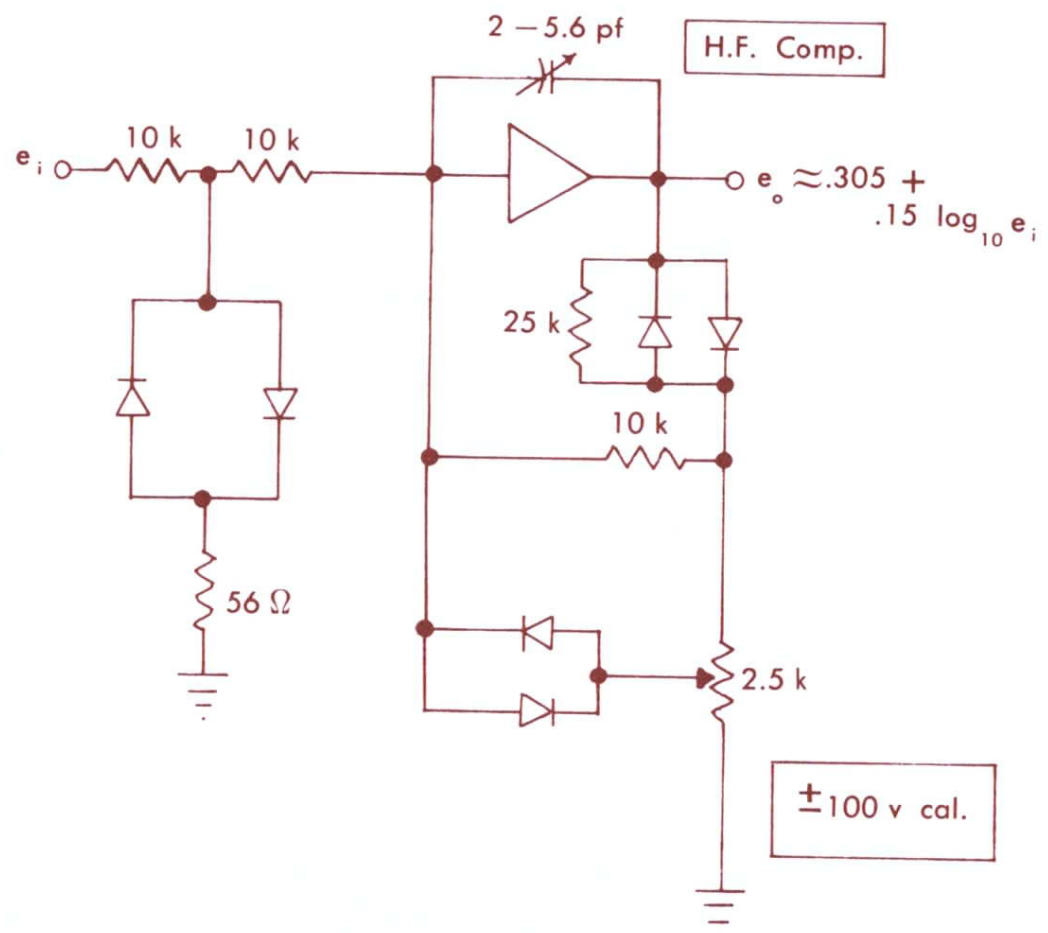
LOGARITHMIC AMPLIFICATION



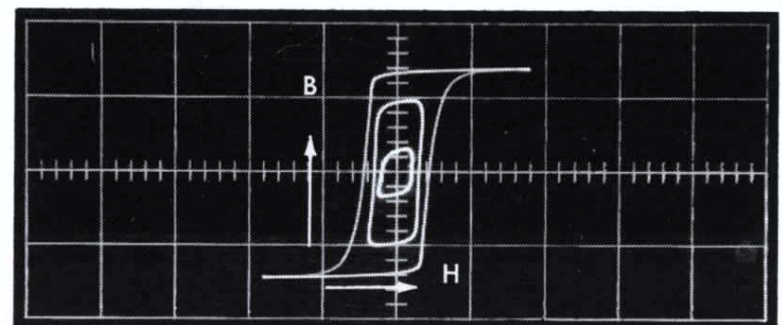
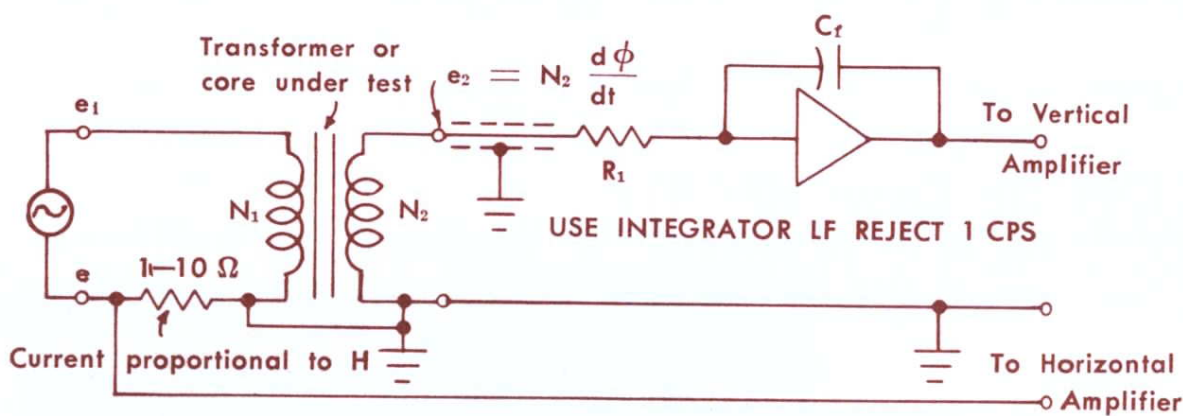
An advantage of a logarithmic amplifier is its ability to accept a wide range of signal levels without being overdriven.

Used as a logarithmic amplifier, the Type O allows the display and measurement of high-amplitude signals mixed with low-amplitude signals. An example of this type of composite signal is the waveforms resulting from an explosion or similar type shock.

Set up as shown in the diagram, the Type O accepts signals varying in amplitude from 0 to ± 100 volts. Many other nonlinear amplifier configurations are possible including square root, power function, symmetrical, etc.



DISPLAYING B-H LOOP FOR MAGNETIC MATERIALS



Three Levels of Supply Voltage to an Inductor

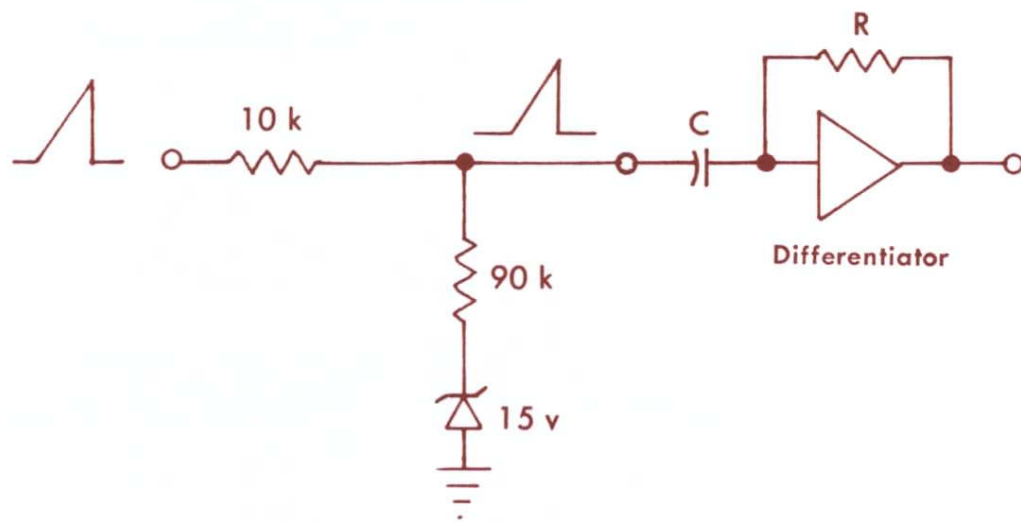
To study the magnetic properties of core materials, a B-H loop display is often employed. The Type O Unit can be used as an integrator to integrate the secondary voltage of a transformer to obtain a voltage proportional to flux ϕ , or flux density, "B".

Since the primary current is proportional to the

magnetizing force "H", when the voltage across the current-sampling resistor is applied to the Horizontal Input, B-H loops can be displayed.

Various magnetic characteristics can be studied such as core saturation current, residual magnetism, dc offset bias, or shorted turn in winding.

ANALYSIS OF LINEARITY



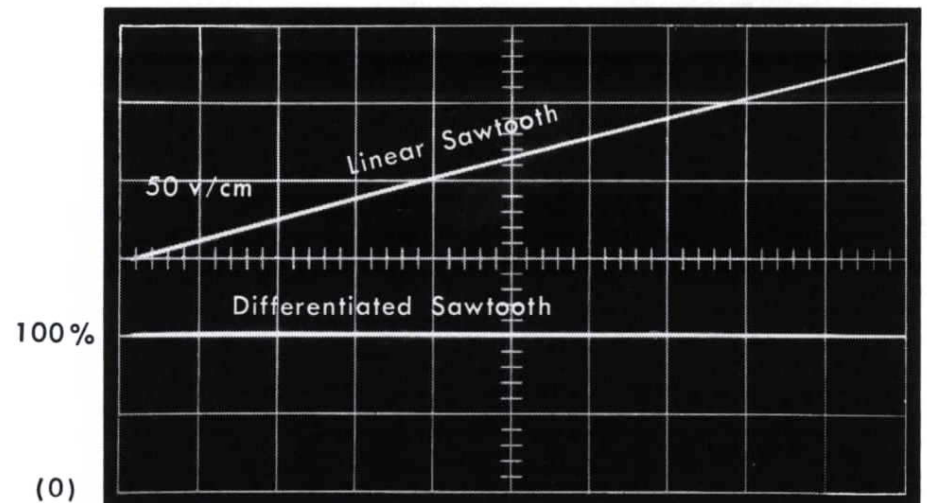
Simulated Non-linearity

With the O Unit, you can detect and measure non-linearity of motion. Transducer output from the source being measured, in the form of a ramp (sawtooth) waveform, is differentiated and then displayed on the associated oscilloscope.

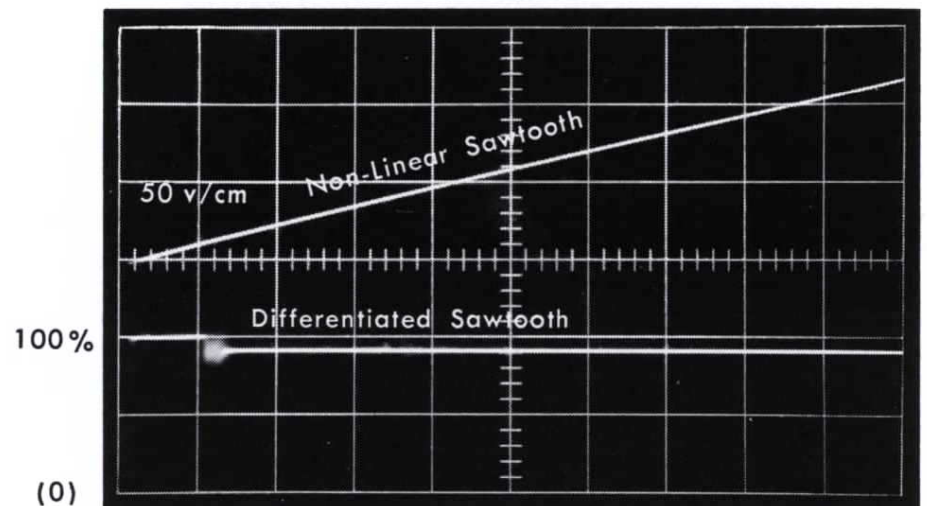
Measurements of non-linearity can be accurately made. Typical applications are measurements of acceleration, rotation, linearity of amplifiers, or circuits.

In the example shown, a non-linear sawtooth with a 10% change of slope was generated to simulate non-linear motion.

The degree of non-linearity can be read directly from the oscilloscope display.

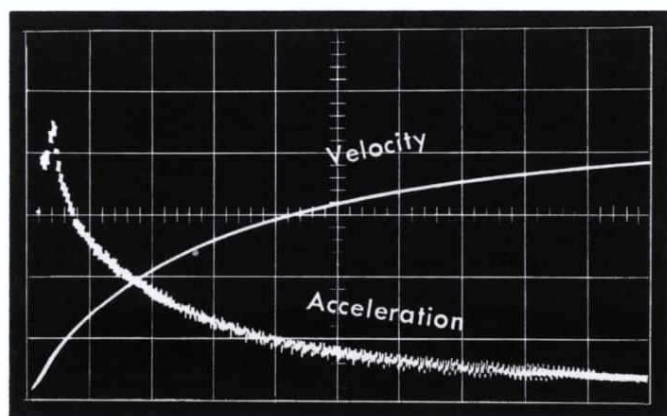


.2 v/cm
Linear Sweep 1 msec/cm

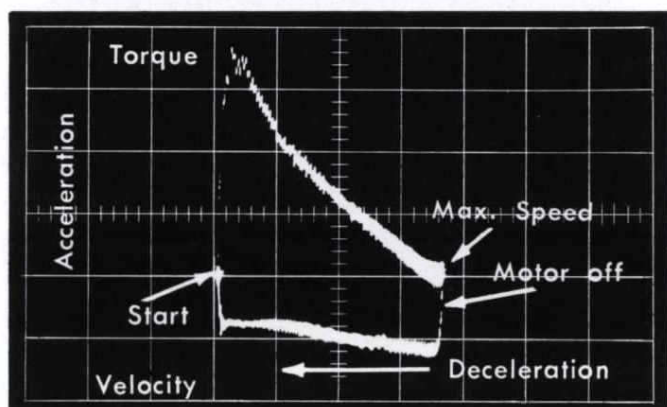


Differentiated Waveform Showing 10% Non-Linearity (also detects Zener noise)

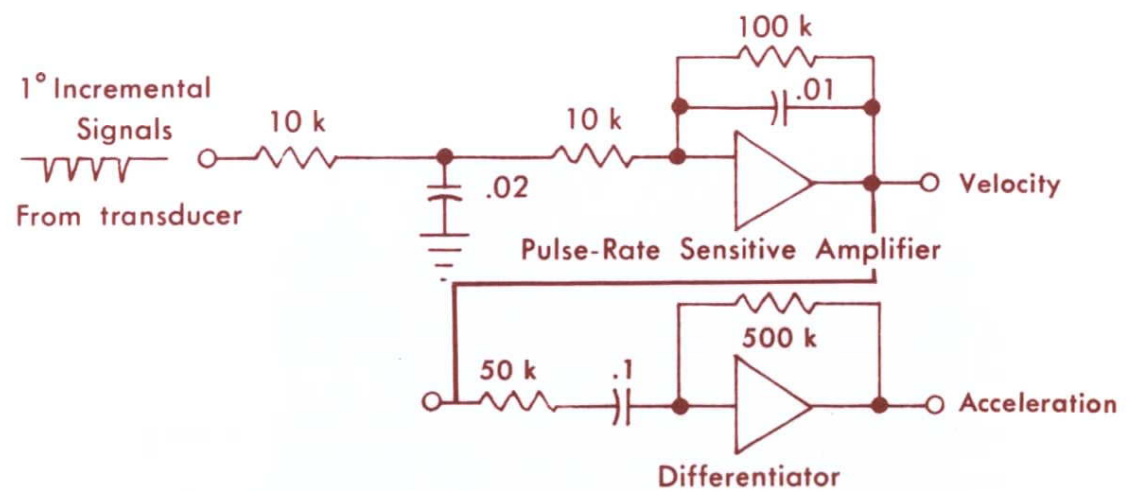
ROTATIONAL ANALYSIS



Velocity (1 cm equivalent to 200 rad/sec)
Acceleration (1 cm equivalent to 2000 rad/sec²)



Velocity (1 cm equivalent to 200 rad/sec)
Acceleration (1 cm equivalent to 2000 rad/sec²)



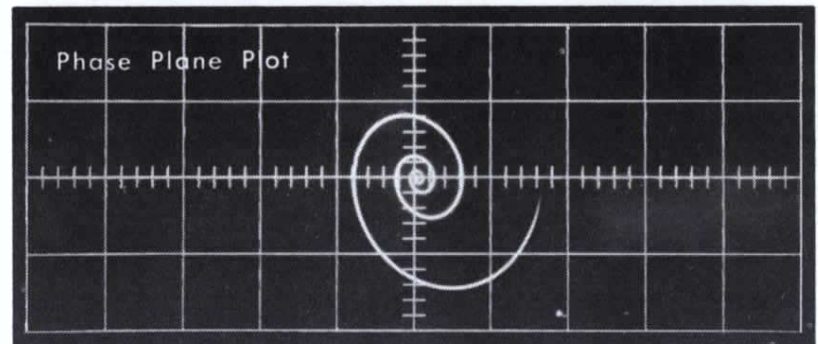
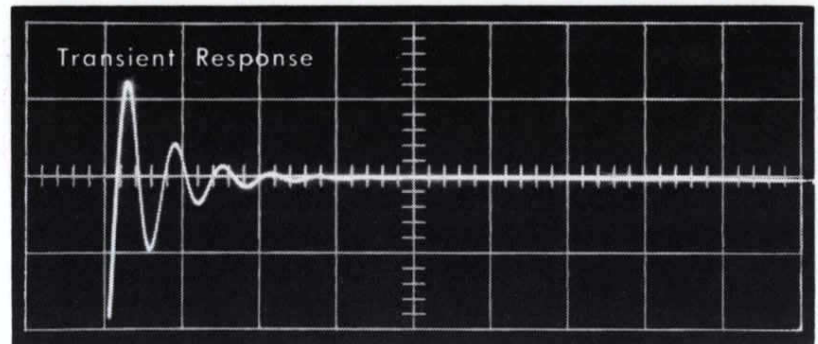
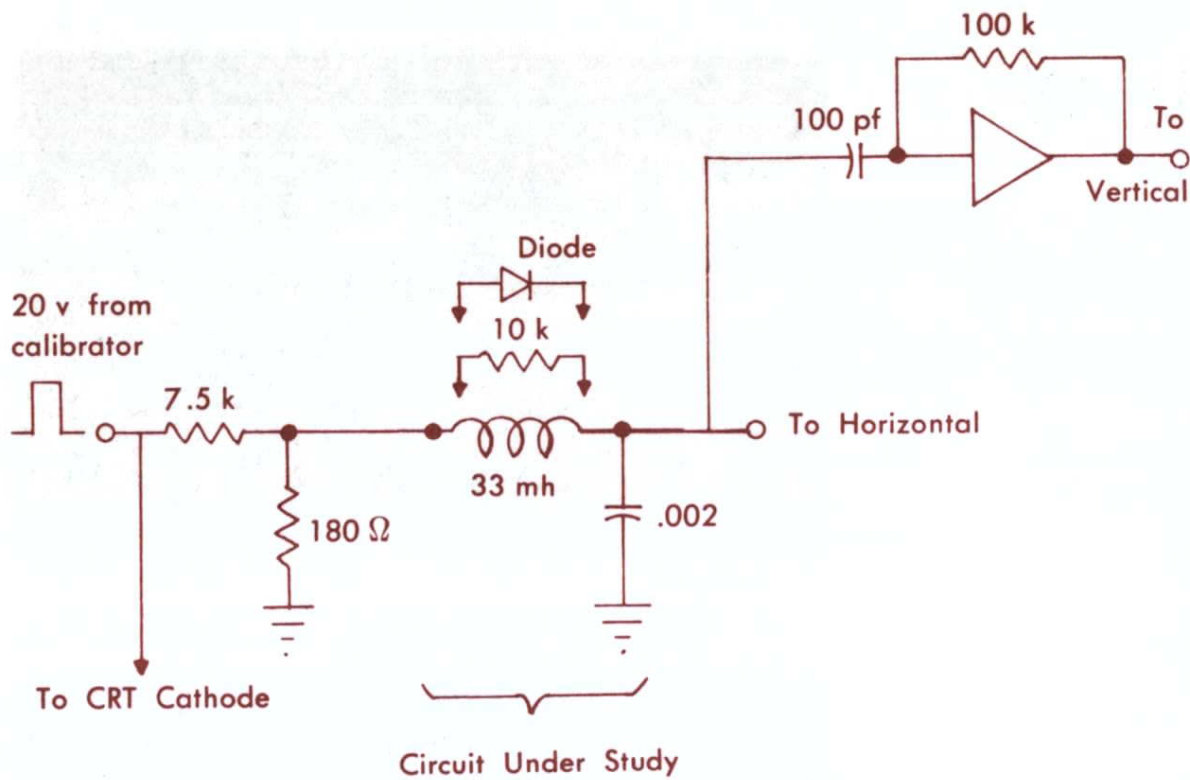
The Type O can be used to great advantage in the analysis of velocity, acceleration, speed, and torque of rotating machinery such as electric motors.

In the example shown, the Type O, used as a pulse-rate sensitive amplifier, converts 1° incremental signals from a transducer to angular velocity. It then differentiates the velocity waveform to obtain the acceleration.

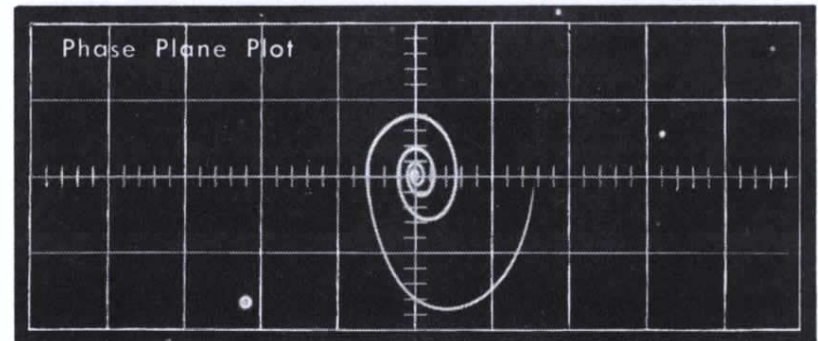
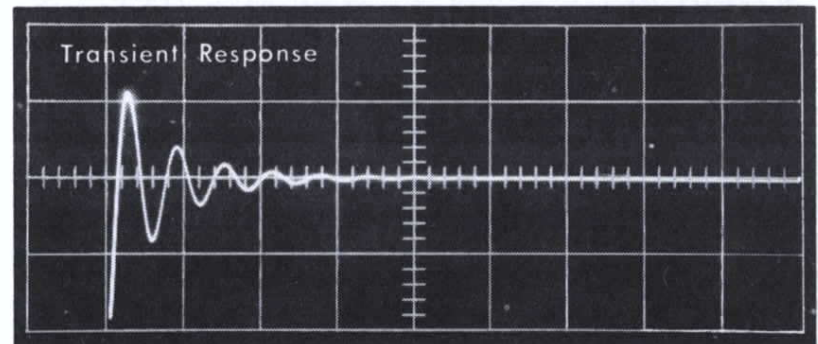
The speed-torque plot is obtained by an X-Y display of the velocity and acceleration waveforms.

TYPICAL APPLICATIONS

PHASE PLANE PLOT



10 k Damping



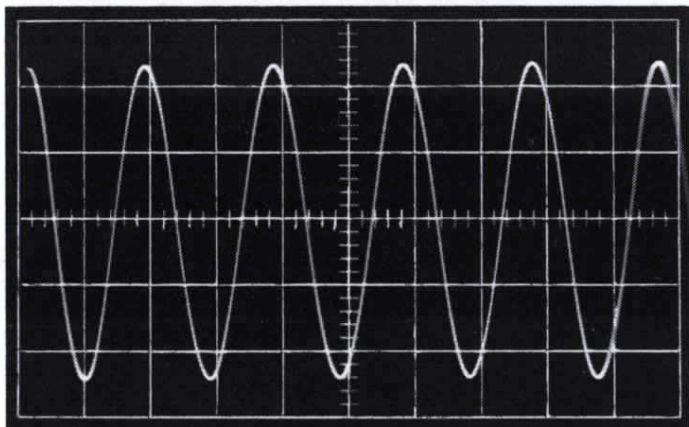
Diode Damping

In studying system stability of control systems or feedback systems, transient response is often employed. If a non-linear element is involved in a system, stability criteria usually becomes quite complex, and analysis is normally limited to linear approximations.

A phase plane plot can overcome some of this limitation since it can present the stability, as well as the nature of non-linearity.

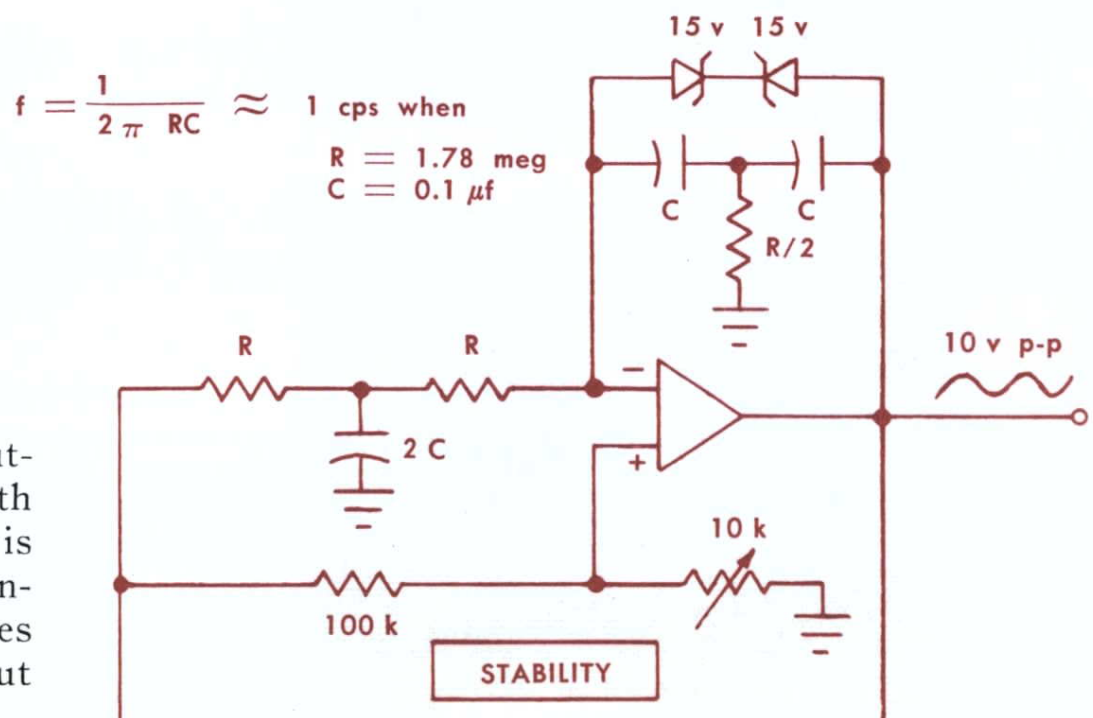
As an illustration, the effect of resistive and diode damping on an LCR circuit is compared in a transient response display and a phase plane plot. Circuit values are chosen such that the diode does not conduct very heavily and it is very difficult to distinguish non-linearity in the transient response display. However, when the original (transient response) signal is plotted against the differentiated signal, the non-linear effect is easily observed.

LOW-FREQUENCY SINE-WAVE GENERATOR

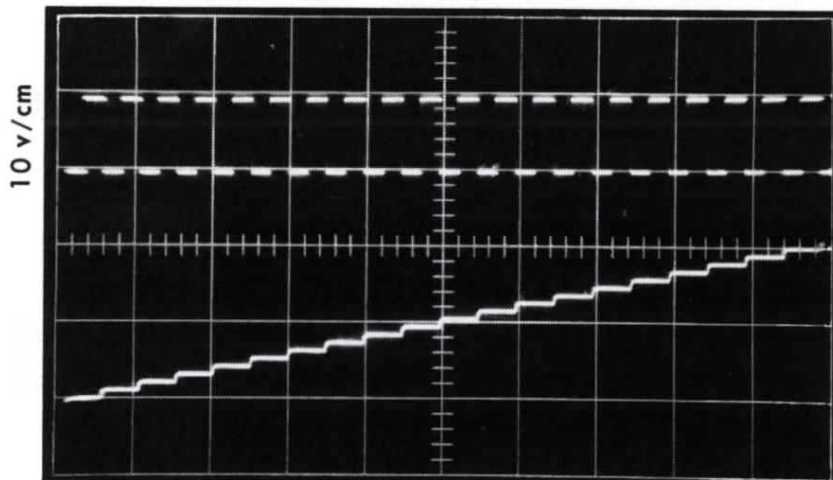
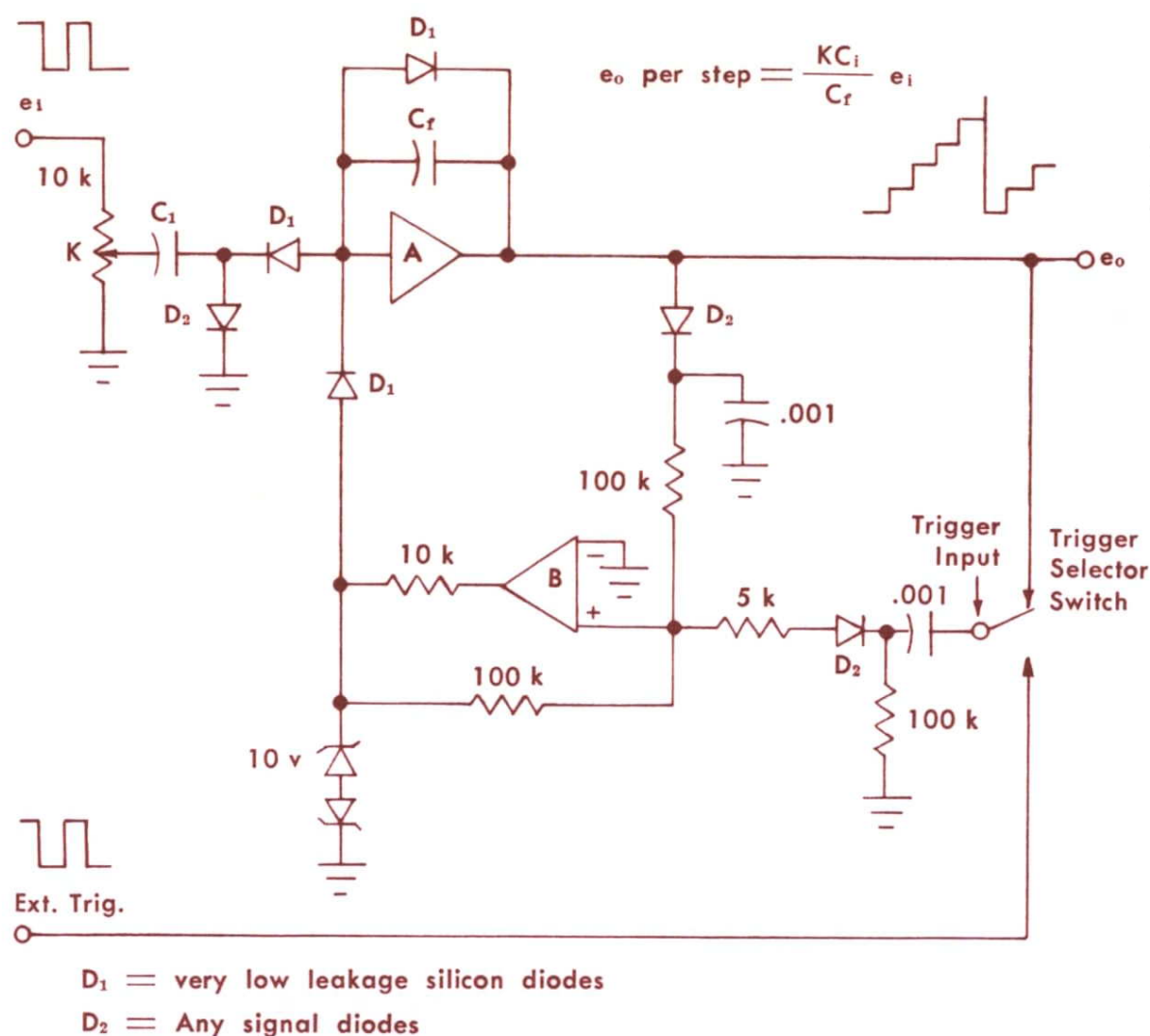


Low frequency Sine-wave

This circuit is a parallel-T oscillator. The output of the oscillator is a stable sine wave with very low harmonic content. Output voltage is approximately 10 volts, peak-to-peak. The non-linear resistance of the back-to-back Zener diodes in the negative feedback loop controls the output amplitude and maintains good stability.



STAIR-STEP GENERATOR

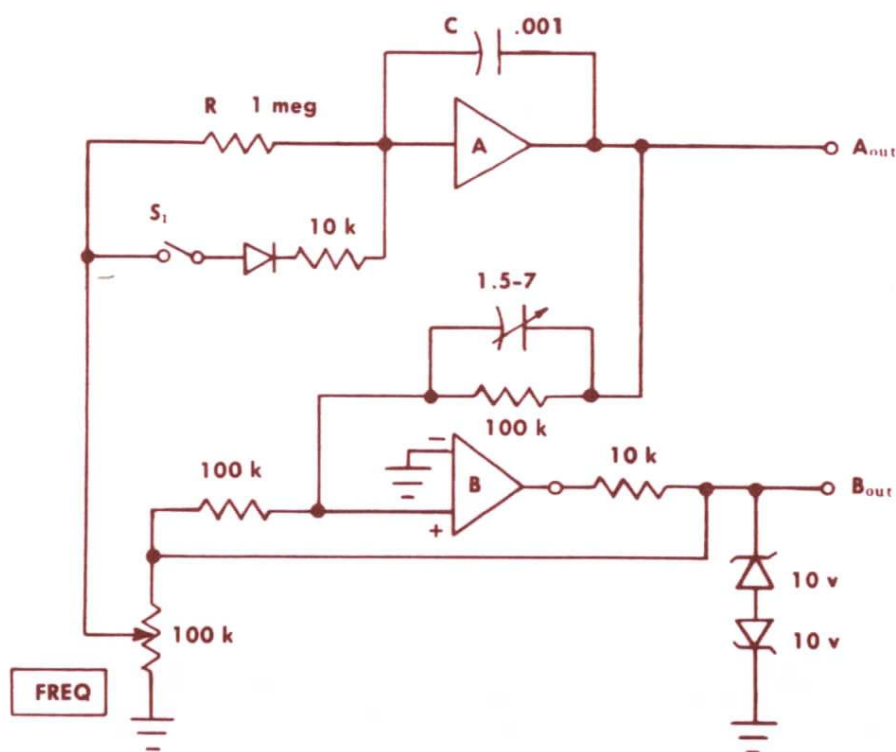


STAIR-STEP Generator 5 v/cm Sweep 2 msec/cm

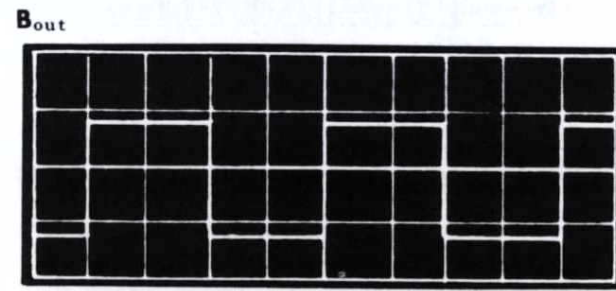
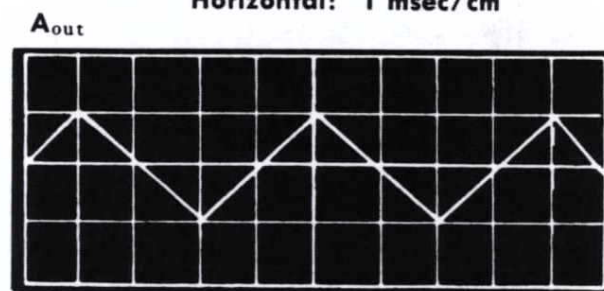
This arrangement provides a convenient laboratory stair-step generator useful in applications such as pulse rate count down, transistor base drive, or pulse controlled time base.

Amplifier A operates as a pulse integrator and amplifier B functions as a bistable comparator. Through use of the trigger selector switch, the circuit can operate in either a repetitive or triggered mode.

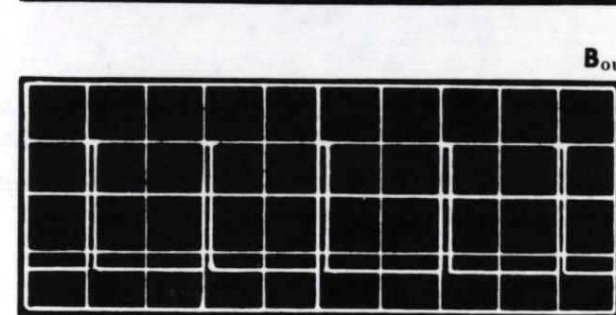
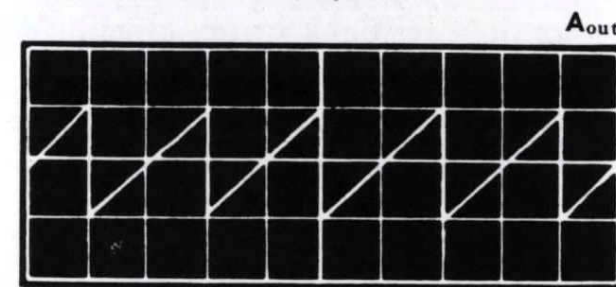
SQUARE, TRIANGLE, SAWTOOTH AND PULSE GENERATOR



Waveforms
 Vertical: 10 v/cm
 Horizontal: 1 msec/cm



S_1 open



S_1 closed

This function generator makes simultaneous use of both operational amplifiers. The A amplifier functions as an integrator while the B amplifier functions as a flip-flop multivibrator.

The frequency of the output is determined by the value of R and C, and the setting of the FREQ. control. Frequency range of from 0.01 cps up to 50 kc is possible through selection of frequency multiplier capacitors without seriously distorting waveforms.

The output waveforms are modified by closing switch S_1 . This permits a diode to reduce the charging time for C in one direction only, changing the symmetrical ramp waveform to an unsymmetrical one as shown. This also affects the switching time of amplifier B and its duty cycle.

TYPE O OPERATIONAL AMPLIFIER

CHARACTERISTICS

TWO OPERATIONAL AMPLIFIERS

Both amplifiers have identical characteristics, and separate, but identical facilities for controlling the various operations.

OPEN-LOOP GAIN-BANDWIDTH PRODUCT—15 mc, or greater.

CLOSED-LOOP GAIN-BANDWIDTH PRODUCT—To 750 kc, with internal input and feedback resistors. To 10 mc, with external compensation.

OPEN-LOOP DC GAIN—2500, minimum. With external input and feedback components, the system gain is governed by the ratio of feedback to input values.

$$\text{Type O System Gain} = \frac{Z_f}{Z_i + \frac{Z_i + Z_f}{2500}}$$

OUTPUT RANGE— ± 50 v, ± 5 ma.

OUTPUT DC LEVEL—Adjustable to ground potential by a front-panel control.

OUTPUT IMPEDANCE—Approximately 30Ω at 1 mc for compensated, unity-gain amplifier.

NOISE—Less than 0.5 mv, peak-to-peak, referred to input. Approximately 3 mv, peak-to-peak, output noise.

SELECTABLE FEEDBACK IMPEDANCES—A front-panel switch allows selection of the following resistors and capacitors: 0.01, 0.1, 0.2, 0.5, and 1 megohm; 10 pf, 100 pf, 0.001, 0.01, 0.1, and 1 μ fd. All values are $\pm 1\%$, except the 10 pf and 100 pf, which are adjustable.

SELECTABLE INPUT IMPEDANCES—A front-panel switch allows selection from a set of resistors and capacitors within the same range of values as the feedback impedances. Where $\frac{R_f}{R_i}$ is 50 or more, R_i is automatically shunted with gain-correcting resistor to preserve gain accuracy.

FEEDBACK—Facilities provide for either positive or negative feedback.

CROSSTALK—Voltage rejection (with 1 kc square wave) is at least 300:1 from one operational amplifier to the other.

DRIFT—Typically less than 10 mv/hour referred to input (after warm-up).

LOW-FREQUENCY REJECTION—For integration of repetitive signals, a low-frequency rejection circuit prevents undesired integration of dc components, and also prevents dc drift from forcing the oscilloscope trace off the crt. It is possible to reject line-frequency pick-up and other low-frequency noise. A front-panel control permits rejection at either 1 cps or 1 kc (approx). The rejection circuit can be switched in or out as desired.

VERTICAL PREAMPLIFIER

(Frequency specifications are at 3 db down)

PASSBAND AND RISE TIME—DC to 25 mc, 14 nsec, in Tektronix Type 540A-Series Oscilloscopes. DC to 14 mc, 25 nsec, in Tektronix Type 530A-Series Oscilloscopes.

CALIBRATED SENSITIVITY—0.05 v/cm to 20 v/cm in nine steps. 1-2-5 sequence. Accuracy is within 3% of panel-reading on all ranges after adjustment on any one range. Variable (uncalibrated) between steps and to 50 v/cm.

INPUT IMPEDANCE—1 megohm paralleled by 47 pf.

SWITCHING FACILITIES—Permit the vertical preamplifier to be used as an independent oscilloscope preamplifier or in conjunction with the operational amplifiers.

TYPE O UNIT U. S. Sales Price, f.o.b. Beaverton, Oregon \$525

**For a demonstration—
please call your Tektronix Field Engineer.**

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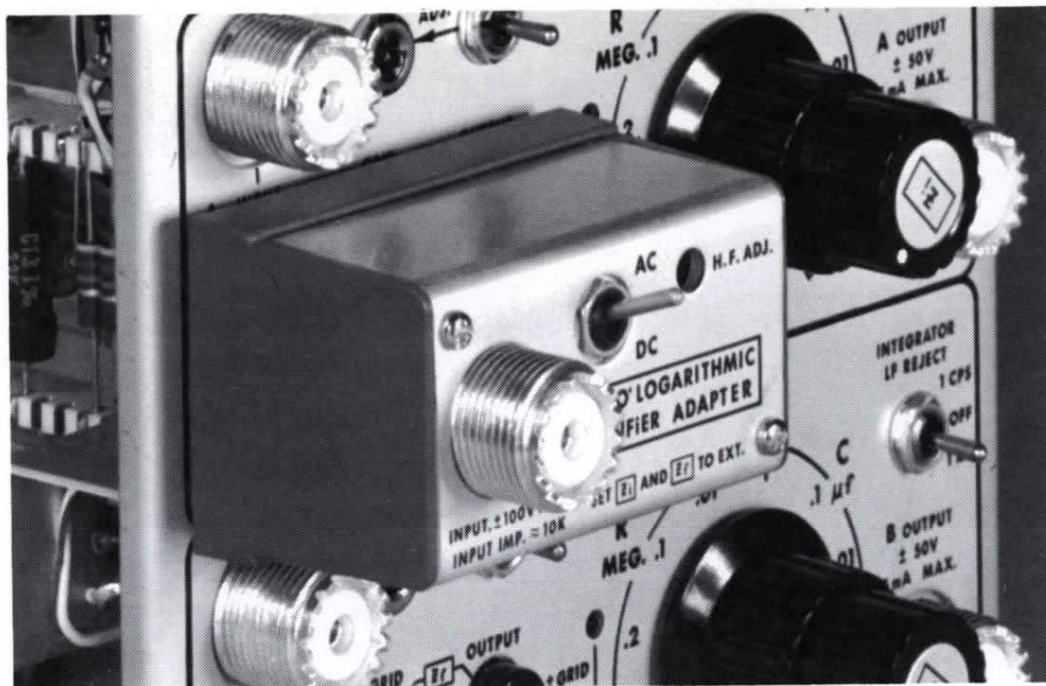


t e n t a t i v e

DISPLAY --- ON THE SAME TRACE ---

SIGNALS DIFFERING IN AMPLITUDE

BY 1000 to 1



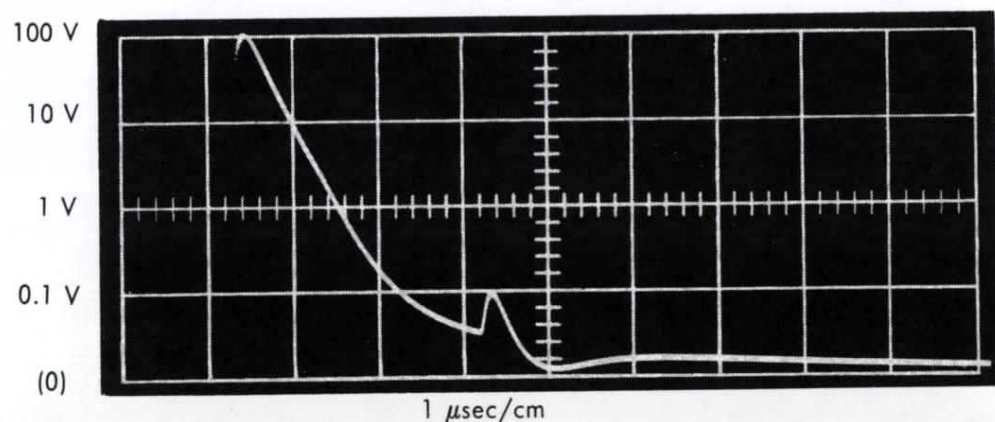
LOGARITHMIC AMPLIFIER ADAPTER

FOR THE TYPE O PLUG-IN UNIT

The new Tektronix Logarithmic Amplifier Adapter converts the linear amplification characteristics of the A or B operational amplifiers in the Type O Operational Amplifier Plug-In Unit to approximately logarithmic characteristics.

Used as a logarithmic amplifier, the Type O allows the display and measurement of high-amplitude signals mixed with low-amplitude signals. For example, you can observe and measure, on the same trace, pulses and transient waveforms differing in amplitude by up to 1000 to 1.

Conversion of the Type O Operational Amplifier Plug-In Unit to logarithmic amplification is quick and convenient—you simply plug the Logarithmic Amplifier Adapter into the external jacks provided on the front panel of the Type O.



Waveform showing ability of the Type O Operational Amplifier Plug-In Unit, used with a Logarithmic Amplifier Adapter, to display, on the same trace, signals differing in amplitude by 1000 to 1.

PERFORMANCE CHARACTERISTICS

ALLOWABLE INPUT SIGNAL — ± 100 v maximum, ac or dc coupled.

INPUT IMPEDANCE — Approximately 10 kilohms.

AMPLIFICATION CHARACTERISTICS — With the Logarithmic Amplifier Adapter, the operational amplifier approximates a logarithmic amplification response for input signals from ± 0.1 v to ± 100 v.

Signal-In	Deflection
± 0.1 v	1 cm ± 0.5 mm
± 1.0 v	2 cm ± 0.5 mm
± 10.0 v	3 cm ± 0.5 mm
± 100 v	4 cm ± 0.5 mm

Below an input level of ± 0.05 v, the amplifier is no longer logarithmic.

RISETIME — Typically $0.2 \mu\text{sec}$ — for a 10-v signal to rise from 0.1 v to 10 v.

FALLTIME — Typically $0.3 \mu\text{sec}$ — for a 10-v signal to fall from 10 v to 0.1 v.

BANDWIDTH — Because the logarithmic amplifier driven by a sinusoidal input waveform does not produce a sinusoidal output (pk-pk and RMS —3-db points will be different), and because both output amplitude and effective bandwidth are affected by both the amplitude and the dc-level of the incoming signal, no specific bandwidth can be stated.

APPARENT BANDWIDTH — The apparent —3-db bandwidth is that upper frequency at which the output from the logarithmic amplifier, driven from a constant-amplitude sine-wave generator, drops to the same level as that caused by a 30% reduction in input-signal amplitude.

Typical apparent bandwidth figures are:

Signal Amplitude	Apparent Bandwidth	
	—3 db	—17 db
100 mv peak	400 kc	750 kc
1.0 v peak	700 kc	1.15 Mc
2.5 v peak	700 kc	1.15 Mc
5.0 v peak	1.1 Mc	2.0 Mc

LOW FREQUENCY RESPONSE — 65 cps. (In the AC-coupled mode, the —3 db point for signals of over 500 mv peak amplitude, and where the effective input resistance is 10 k).

Price and availability will be released later.

A-2167

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TEKTRONIX, INC.

P. O. BOX 500 BEAVERTON, OREGON

TRANSITION FROM ENGINEERING MODEL TO PRODUCTION MODEL MAY REQUIRE MINOR SPECIFICATION CHANGES. FINAL SPECIFICATIONS WILL BE RELEASED LATER.



DISPLAY -- ON THE SAME TRACE --

SIGNALS DIFFERING IN AMPLITUDE

BY 100 TO 1



1953

TELETYPE UNIT IS NOT TO BE USED FOR COMMUNICATIONS
WHICH MAY BE OF A NATURE WHICH COULD BE INTERFERED BY
OTHER TELETYPE UNITS ALL OF WHICH ARE TO BE USED FOR



LOW-LEVEL DIFFERENTIAL AMPLIFIER

FOR USE WITH TEKTRONIX TYPE 560-SERIES OSCILLOSCOPES



10 μ V/DIV Maximum Sensitivity

50,000 to 1 Common-Mode Rejection Ratio

Bandwidth Control

0.06 CPS to 0.3 Mc Passband

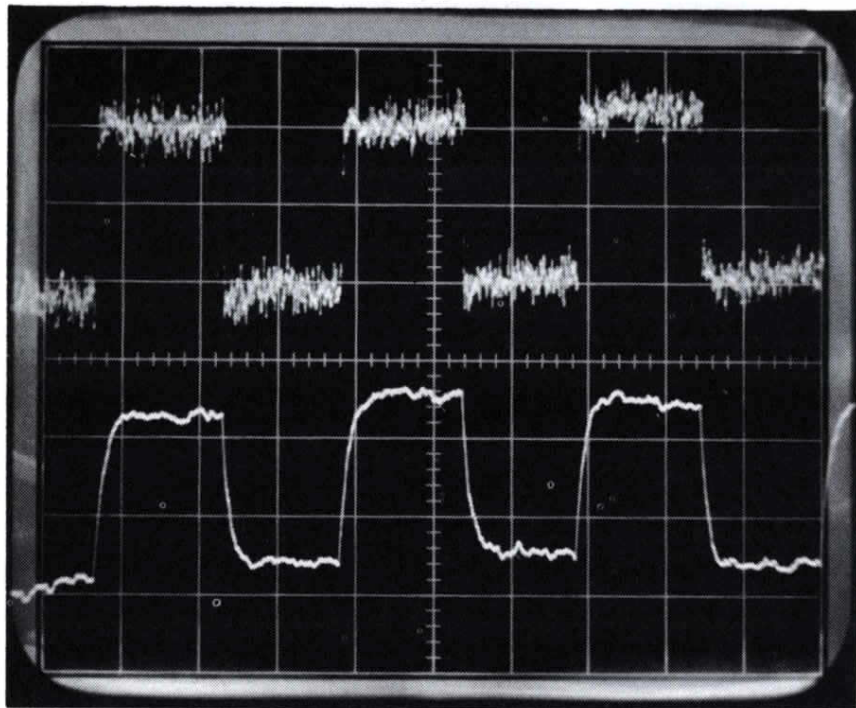
— *specifications* —

TYPE 2A61

With the new Type 2A61 Low-Level Differential Amplifier in your Tektronix Type 560-Series Oscilloscope you can display and measure the difference between signals applied to Input A and Input B—cancel unwanted or interfering signals—make voltage measurements between two above-ground points—use each input separately to display and measure very low-level signals.

Through use of separate controls for limiting the low-frequency and high-frequency response you can attain an optimum signal-to-noise ratio for each particular application.

Among the features which add to the operating convenience of the Type 2A61 are a built-in line-frequency filter and a trace-restorer button.



Typical improvement of signal-to-noise ratio through use of bandwidth control. 1 kc square wave shown at 10 $\mu\text{v}/\text{div}$ vertical sensitivity.

Upper trace bandwidth: 6 cps to 100 kc.
Lower trace bandwidth: 6 cps to 6 kc.

(Double exposure)

CHARACTERISTICS

(Frequency specifications are at 3 db down)

CALIBRATED SENSITIVITY— 0.01 mv/div to 20 mv/div in eleven steps. 1-2-5 sequence. A variable control provides continuous adjustment (uncalibrated) between steps and to 50 mv/div.

FREQUENCY RESPONSE— 0.06 cps to approximately 0.3 Mc decreasing to 0.1 Mc at 10 $\mu\text{v}/\text{div}$.

COMMON-MODE REJECTION RATIO— 50,000 to 1 below 10 kc (with up to 5 v common-mode input).

BANDWIDTH CONTROL— Front-panel controls provide for selection of the following high-frequency and low-frequency 3 db ($\pm 30\%$) points:

High Frequency	Low Frequency
0.3 Mc (0.1 Mc)	0.06 cps (0.1 cps)
60 kc	0.6 cps
6 kc	6 cps
600 cps	60 cps
60 cps	600 cps

(Limits vary slightly with gain)

Restricting the bandwidth to the requirements of a particular application improves the signal-to-noise ratio.

LINE-FREQUENCY NOISE FILTER— A built-in 60 cps line-frequency notch filter provides better than 50 to 1 rejection of 60 cps line-frequency noise. 50 cps and 400 cps line-frequency filters are available.

EQUIVALENT INPUT NOISE— Less than 20 μv peak-to-peak (3.5 μv rms) at maximum bandwidth.

INPUT IMPEDANCE— 50 pf (approx.) paralleled by 10 megohms, each side.

TRACE RESTORER— A trace driven off the screen by a large transient returns to its normal position when the Trace-Restorer button is pressed.

CONSTRUCTION— Aluminum-alloy chassis.

FINISH— Photoetched, anodized panel.

CONNECTING CABLE— A 60" low-noise cable is included with the Type 2A61.

Type 2A61 \$385

U.S. Sales Price f.o.b. Beaverton, Oregon

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A-2077-3
(replaces A-2077-2)

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t e n t a t i v e

DIGITAL READOUT of Low & Medium Frequency Signals



TWO NEW PLUG-IN UNITS EXTEND DIGITAL READOUT of signal information to low and medium frequency applications. The Type 3A2 Dual-Trace Amplifier and Type 3B2 Time Base have been designed for use with the Type 567 Readout Oscilloscope and the Type 6R1 Digital Unit. (They can also be used in other Type 560-Series Oscilloscopes for conventional analog displays.)

Repetitive signal information can be read in digital form on the Type 6R1 as well as in analog form on the Type 567 Oscilloscope cathode-ray tube. Non-repetitive information can be read-out digitally only in certain applications. For amplitude measurements, the input waveform must maintain constant amplitude for at least 5 microseconds, in order to establish the 100% reference level. Digital accuracy and resolution are dependent on signal parameters.

Accuracy of time interval measurements is dictated by the 1-Mc clock rate. For example, accuracy is $\pm 5\%$ for signals of 20 microseconds width. Accuracy for signals longer than 20 microseconds is better than 5%; error exceeds 5% for time intervals shorter than 20 microseconds. Maximum available resolution is 1 microsecond.

TEKTRONIX, INC.

TRANSITION FROM ENGINEERING MODEL TO PRODUCTION MODEL MAY REQUIRE MINOR SPECIFICATION CHANGES. FINAL SPECIFICATIONS WILL BE RELEASED LATER.

PLUG-IN UNIT CHARACTERISTICS

TYPE 3A2 DUAL-TRACE AMPLIFIER UNIT

AMPLIFIER PASSBAND is dc to 500 kc for analog display.

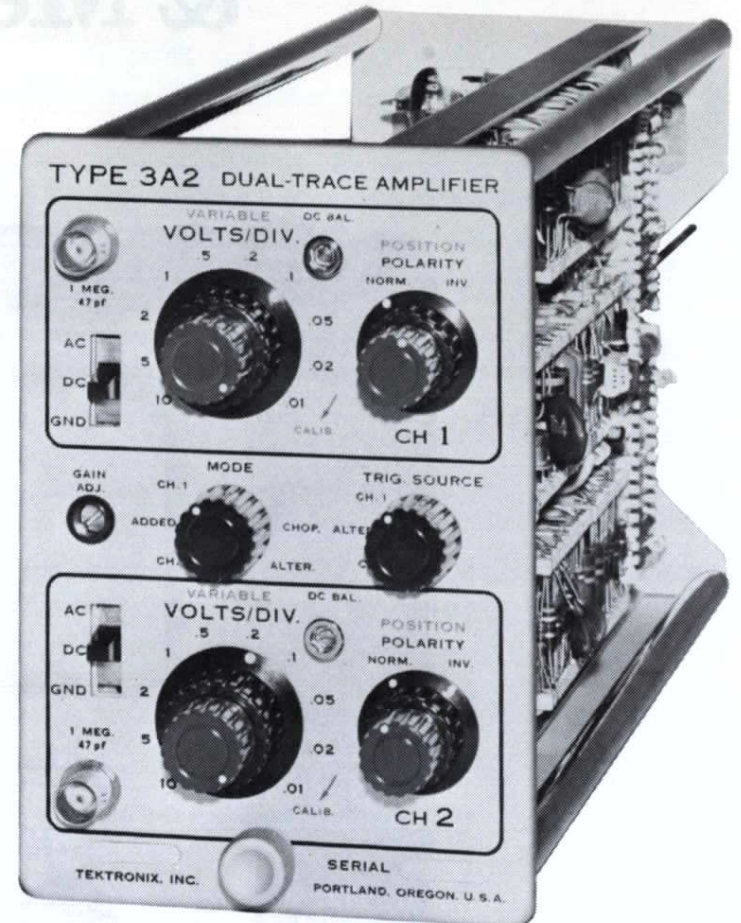
SENSITIVITY from 10 mv/cm to 10 v/cm, is in 10 calibrated steps with 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from 10 mv/cm to 25 v/cm.

SEPARATE CONTROLS include those for attenuation, inversion, positioning, and ac or dc-coupling of each channel.

OPERATING MODES are Channel 1, Channel 2, Added, Alternate, or Chopped. In chopped mode, switching occurs at about a 40-kc rate.

TRIGGERING can be from Channel 1, Channel 2, or from the signal displayed on the screen.

INPUT IMPEDANCE is 1 megohm, paralleled by approximately 47 pf.



TYPE 3B2 TIME BASE UNIT

SWEEP RANGE from 2 μ sec/cm to 1 sec/cm is in 18 calibrated steps with 1-2-5 sequence, accuracy within 3%.

DIGITAL RESOLUTION permits 10X resolution at sweep speeds of 0.2 ms/cm and slower.

SWEEP DELAY can be switched in or out. Delay time is continuously variable from 5 μ sec to 10.5 sec.

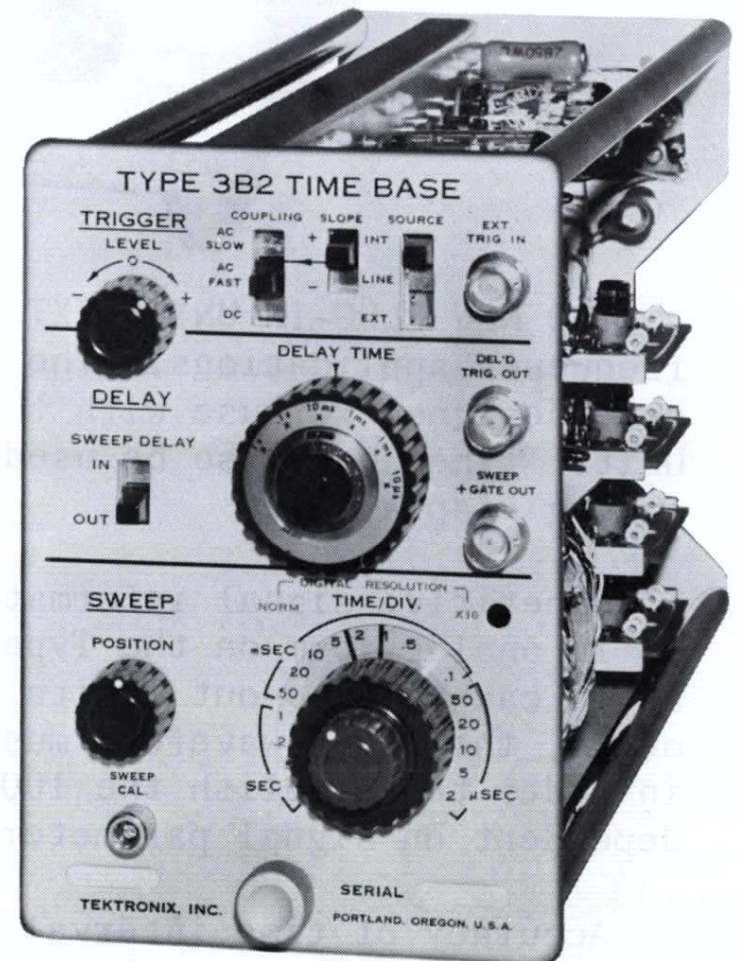
1-MC CLOCK is crystal controlled for added stability.

TRIGGERING LEVEL operates over a ± 12 volt range.

TRIGGER SOURCE can be internal with 2 mm of signal display, external with 0.4 v signal, or line.

TRIGGER COUPLING can be AC Slow, AC Fast, or DC; \pm Slope.

OUTPUTS available through front-panel BNC connectors are Delayed Trigger and Sweep + Gate.



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t e n t a t i v e

DIRECT SAMPLING PROBE & PLUG-IN UNIT

with sampling bridge in the probe head



THE TEKTRONIX TYPE 3S3 SAMPLING DUAL-TRACE PLUG-IN UNIT in a Type 560-Series Oscilloscope retains full sensitivity when operated with source impedances above 50 ohms (limited by 100 k, 2 pf input impedance).

Two physically identical miniature probes are integral parts of the Type 3S3. The probes can be interchanged between channels or used with another Type 3S3. A minor recalibration of the instrument will be required. As shipped, the instruments are calibrated and probes are color coded for respective channels.

The Type 3S3 can be used in a Type 561A, 564, 567, RM561A, or RM567 Oscilloscope. To provide the sampling sweep necessary, a Type 3T77 Plug-In Unit must also be used.

CHARACTERISTICS

TEKTRONIX, INC.

TRANSITION FROM ENGINEERING MODEL TO PRODUCTION MODEL MAY REQUIRE MINOR SPECIFICATION CHANGES. FINAL SPECIFICATIONS WILL BE RELEASED LATER.

TYPE 3S3

Front-panel smoothing and risetime controls adjust the instrument for least noise, best risetime, or a compromise between the two.

The following chart indicates typical risetime and noise figures at different source impedances with two conditions of noise suppression.

Source Impedance	Risetime	Noise	
		correct dot transient response	smoothed
50 ohms	.5 nsec	1.3 mv	1/3 mv
50 ohms	1.5 nsec	1/3 mv	not obtainable
300 ohms	1.5 nsec	not obtainable	1-1/3 to 1/3 mv
300 ohms	2.2 nsec	1.3 mv	1/3 mv

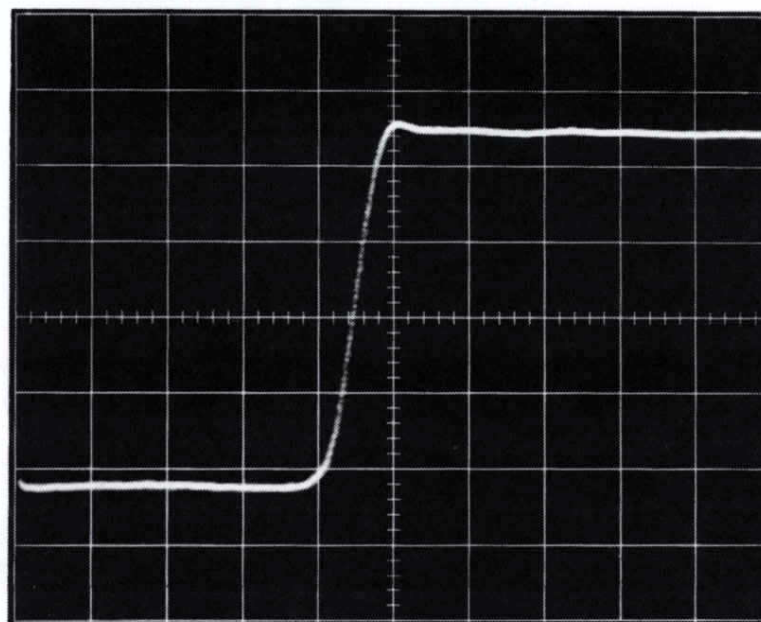
Tunnel Diode Pulser Waveform:

Vertical: 5 mv/cm

Horizontal: 1 nsec/cm

Source Impedance: 50 ohms

Type 3S3 risetime control set at minimum and smoothing control near center of its range.



CHARACTERISTICS

RISETIME is 0.5 nsec with 25- Ω or less source impedance; adjustable with a front-panel control to approximately 1.5 nsec (risetimes quoted with correct dot transient response).

NOISE (referred to input) is less than 0.33 mv at 25- Ω source impedance.

OPERATING MODES are A only, B only, Dual-Trace, A \pm B.

SENSITIVITY is 100 mv/cm to 5 mv/cm, calibrated in 5 steps, 1-2-5 sequence. Uncalibrated variable control extends the sensitivity to approximately 2 mv/cm.

INPUT IMPEDANCE is 100 k shunted by approximately 2 pf.

MAXIMUM SIGNAL INPUT is ± 1.5 v with the risetime control in the ccw position and ± 3 v with the control in the cw position.

OUTPUT MONITOR is 1 v/cm with a + 10 v dc level.

EXTERNAL TRIGGERING is required, approximately 50 nsec prior to signal.

MINIMUM TRIGGER REPETITION RATE is 50 cps.

Price and availability will be released later

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t e n t a t i v e

Carrier Amplifier

. . . brings electronic instrumentation
to the fields of mechanical engineering

The Type 3C66 Carrier Amplifier permits any Tektronix Type 561, RM561, 561A, 564, 565, RM565, 567, or RM567 Oscilloscopes to be operated with strain gages and other transducers.

With the help of a suitable transducing device, the Type 3C66 Carrier Amplifier will measure mechanical quantities that can be converted to a change in resistance, capacitance, or inductance.

The Type 3C66 Plug-In Unit is useable in many applications including stress analysis, vibration studies, and fatigue tests. Typical quantities measurable with the Type 3C66 are force, displacement, acceleration, and strain.



CHARACTERISTICS

CARRIER FREQUENCY— 25 kilocycles.

RISETIME— 60 microseconds, (approx).

FREQUENCY RESPONSE— DC to 6 kilocycles.

STRAIN SENSITIVITY — Calibrated in ten steps from 10 microstrain/div (microinches per inch) to 10,000 microstrain/div. Uncalibrated, the sensitivity is variable between steps. The above condition applies to the Type 3C66 Unit when used with a single strain gage having a gage factor of approximately 2.

ATTENUATOR ACCURACY— When set accurately in any one step— accuracy is within 2%.

NOISE— The pk-to-pk noise is typically equivalent to 2.0 microstrain at maximum calibrated sensitivity. This approximates an rms noise of 0.5 microstrain.

DRIFT— The amplification system is essentially drift free. The overall system drift is primarily a function of the transducer stability.

TEKTRONIX, INC.

TRANSITION FROM ENGINEERING MODEL TO PRODUCTION
MODEL MAY REQUIRE MINOR SPECIFICATION CHANGES.
FINAL SPECIFICATIONS WILL BE RELEASED LATER.

OTHER TYPE 3C66 CARRIER AMPLIFIER CHARACTERISTICS

EQUIVALENT DC SENSITIVITY— The Type 3C66 Unit is an impedance sensing preamplifier rather than a voltage sensing device. A comparable dc amplification system would require approximately 10 microvolts/div sensitivity for the same amount of power applied to the input bridge.

RESISTANCE BRIDGE BALANCE— Range of control allows sufficient compensation for most standard transducers and strain gages.

GAGE RESISTANCE RANGE— With cable lengths to 100 feet, the useful range of gage resistance extends from approximately 50 ohms to 2000 ohms.

TRANSDUCER CABLE— In most applications, either 3-wire or 4-wire shielded microphone cable gives the best results.

CAPACITANCE BRIDGE BALANCE— Range of control allows compensation for an unbalance of 250 pf across any external resistive arm of the input bridge.

PHASE ADJUSTMENT— To increase versatility of the unit, the control permits either resistive or reactive transducer applications to be displayed.

CALIBRATION— A push-button switch connects a calibration resistor across the strain gage electrically to simulate an external mechanical strain. The calibration resistor supplied with the Type 3C66 Unit simulates a -400 microstrain unbalance of the bridge, suitable for most strain gage applications. As with the 120 ohm internal bridge resistor, the 150-K calibration resistor is mounted on a handy plug-in receptacle. No special gage dial is necessary for the unit.

To aid in calibration, a nomograph is included in the instruction manual. This nomograph relates calibration of the supplied resistor to gage factors and strain gage resistances.

To include the gage factor in the calibration, merely increase or decrease the amplifier gain proportionally.

EXTERNAL BRIDGE— The number of external resistive arms required for strain gage and transducer applications varies from one to four. The versatile Type 3C66 Unit can be used for any of these applications. Input circuit for the unit is a bridge. The external transducer becomes one or more of the bridge arms. Excitation voltage for the bridge is obtained from a 25-kc oscillator. Total bridge voltage is approximately 5 v rms, regulated.

CAPACITANCE TRANSDUCERS— Using a capacitance transducer in conjunction with a four-arm resistive bridge results in the following maximum useful sensitivities: 120-ohm bridge (available internally) 1 pf/div, 1000-ohm bridge 0.2 pf/div; useful sensitivities are slightly lower when using long cables.

INDUCTIVE TRANSDUCERS— The Type 3C66 functions with inductive transducers having characteristics compatible with the 25 kc carrier frequency. Linear-variable-differential transformers designed for nominal carrier frequencies of 2 kc and higher usually operate satisfactorily without additional circuitry.

SIGNAL OUT— A front-panel signal output that is dc coupled at dc ground level with an internal dc level set adjust. The signal is approximately 3 v/cm of screen deflection.

SYNC IN AND OUT— Used for synchronizing oscillators of two units — eliminates low frequency beat notes which sometimes occur when two units are used in the same indicator at high sensitivities.

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A-2091-2
Replaces A-2091-1

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t e n t a t i v e

TYPE 4S2 50-ohm

DUAL-TRACE SAMPLING PLUG-IN UNIT

NEW VERTICAL PLUG-IN UNIT FOR
TEKTRONIX TYPE 661 PULSE-SAMPLING
OSCILLOSCOPE will extend risetime
capabilities to 0.1 nanosecond.



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TRANSITION FROM ENGINEERING MODEL TO PRODUCTION MODEL MAY REQUIRE MINOR SPECIFICATION CHANGES. FINAL SPECIFICATIONS WILL BE RELEASED LATER.

TYPE 4S2 PLUG-IN UNIT

The second in the vertical plug-in series for the Type 661 Oscilloscope, the Type 4S2 is a Sampling Plug-In Unit with dual-trace capabilities (time coincidence better than 30 picoseconds). Five modes of operation include: display of A only, B only, $\pm A \pm B$, dual-trace, and uniquely with Tektronix Sampling Oscilloscopes, a lissajous type display, of A-vertically and B-horizontally — for observing hysteresis loops, phase shift, similar displays.

A Type 661 Oscilloscope — with new Type 4S2 Dual-Trace Sampling Plug-In Unit and Type 5T1 Timing Plug-In Unit — is a Pulse-Sampling System with risetime of 0.1 nanosecond.

TYPE 4S2 CHARACTERISTICS

Input Channels— Can be used in single-trace, dual-trace, algebraic addition, or lissajous-pattern operation. Each channel can be operated and controlled independently. A smoothing control reduces time and amplitude noises when operating at extremes of sensitivity.

Input Impedance— 50 ohms. With limited risetime capabilities, higher input impedance is possible with Tektronix Type P6034 and P6035 Passive Probes or a P6032 Cathode-Follower Probe.

Risetime— 100 picoseconds or less (10% to 90%).

Calibrated Sensitivity— 7 calibrated steps of 2, 5, 10, 20, 50, 100, and 200 mv/cm. A variable control permits ranging uncalibrated between steps and extends the sensitivity to approximately 0.67 mv/cm. The 2 mv/cm position is smoothed.

Noise Level— Less than 4 mv (peak-to-peak) unsmoothed or 2 mv smoothed.

Dynamic Range— ± 1 volt. Sampling allows overload recovery (thus the 0.67 mv/cm sensitivity can be used with signals up to 2 volts in amplitude). Safe over-

load, ± 10 volts dc (higher with reduced duty factor).

DC-Offset— Up to ± 1 volt. Variable offset voltage (externally monitorable) allows dc-coupled observation and measurement of signals riding on a direct-current voltage as high as ± 1 volt. Control provides a means of displaying selected portions of signals having off-screen amplitudes.

Triggering— External triggering required 50 nsec prior to signal. No internal delay lines included. Please refer to Type 5T1 Timing Plug-In Unit specifications (and Type 113 Delay Cable specifications).

Probe Power— A socket on the front panel accepts and powers a Cathode-Follower Probe, such as a Tektronix Type P6032.

Type 4S2 Dual-Trace Sampling Unit— Dimensions— 7" high by 8½" wide by 14" deep. Weight 8 pounds.

Price and Availability will be released later.

PROBES

The TYPE P6032 CATHODE-FOLLOWER PROBE is a high-impedance, dc-coupled probe with an attenuation range of 10X to 1000X, in a 1-2-5 sequence, with 7 plug-in attenuator heads and a capacitor-coupler head. Maximum output is ± 150 mv. Risetime is typically 0.4 nsec with 4S2. Static capacitance is 3.6 to 1.3 pf. Static resistance is 10 megohms.

The TYPE P6034 MINIATURE PASSIVE PROBE (10X attenuation) is designed for use with Tektronix plug-ins such as 4S2, 4S1 and 3S76. Input resistance is 500 ohms at dc and approxi-

mately ± 0.1 pf at 1.0 Mc to 1.0 gc. Risetime of the probe is less than 200 picoseconds. Ringing and overshoot is 2% or less on pulses from 25-ohm source.

The TYPE P6035 MINIATURE PASSIVE PROBE (100X attenuation) is designed for use with Tektronix plug-ins such as 4S2, 4S1 and 3S76. Input resistance is 500 ohms at dc and approximately 1500 ohms at 1.0 gigacycle. Input capacitance 0.7 pf ± 0.1 pf at 1.0 Mc to 1.0 gc. Risetime of the probe is less than 200 picoseconds. Ringing and overshoot is 2% or less on pulses from 25-ohm source.

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t e n t a t i v e

DIRECT SAMPLING PROBE

AND PLUG-IN UNIT

with sampling bridge in the probe head.

The TEKTRONIX TYPE 4S3 SAMPLING DUAL-TRACE PLUG-IN UNIT in a Type 661 Oscilloscope retains full sensitivity when operated with source impedances above 50 ohms (limited by 100 k, 2 pf input impedance).



As with the general purpose Type 4S1 and special purpose Type 4S2, the Type 4S3 provides 200 to 2 mv/cm sensitivity, monitorable dc offset, independent channel inverting, and modes of single trace, dual-trace, algebraic add and lissajous operation.

Two physically identical miniature probes are integral parts of the Type 4S3. The probes can be interchanged between channels or used with another Type 4S3. A minor recalibration of the instrument will be required. As shipped, the instruments are calibrated and probes are color coded for respective channels.

Accessories furnished with the Type 4S3 include blocking capacitors, 10X attenuators, and special response normalizers. These response normalizers minimize variations in base line and in dot transient response with changing source impedance (raises input capacity about 1 pf).

TYPE 4S3 CHARACTERISTICS

RISETIME is 0.5 nsec or less with a terminated 50- Ω source.

NOISE is less than 0.5 mv unsmoothed or approximately 200 μ v smoothed, when using a 50- Ω terminated source.

OPERATING MODES are \pm A only, \pm B only, Dual-Trace, \pm A \pm B, and A vertical B horizontal.

SENSITIVITY is 200 mv/cm to 2 mv/cm, calibrated in 7 steps, 1-2-5 sequence. Uncalibrated variable control extends the sensitivity to approximately 0.67 mv/cm.

INPUT IMPEDANCE is 100 k shunted by approximately 2 pf.

MAXIMUM SIGNAL INPUT is 2 v.

DC OFFSET VOLTAGE is \pm 1 v.

EXTERNAL TRIGGERING is required, approximately 50 nsec prior to signal.

MINIMUM TRIGGER REPETITION RATE is 50 cps (lower with special circuitry).

A-2173

Price and availability will be released later.

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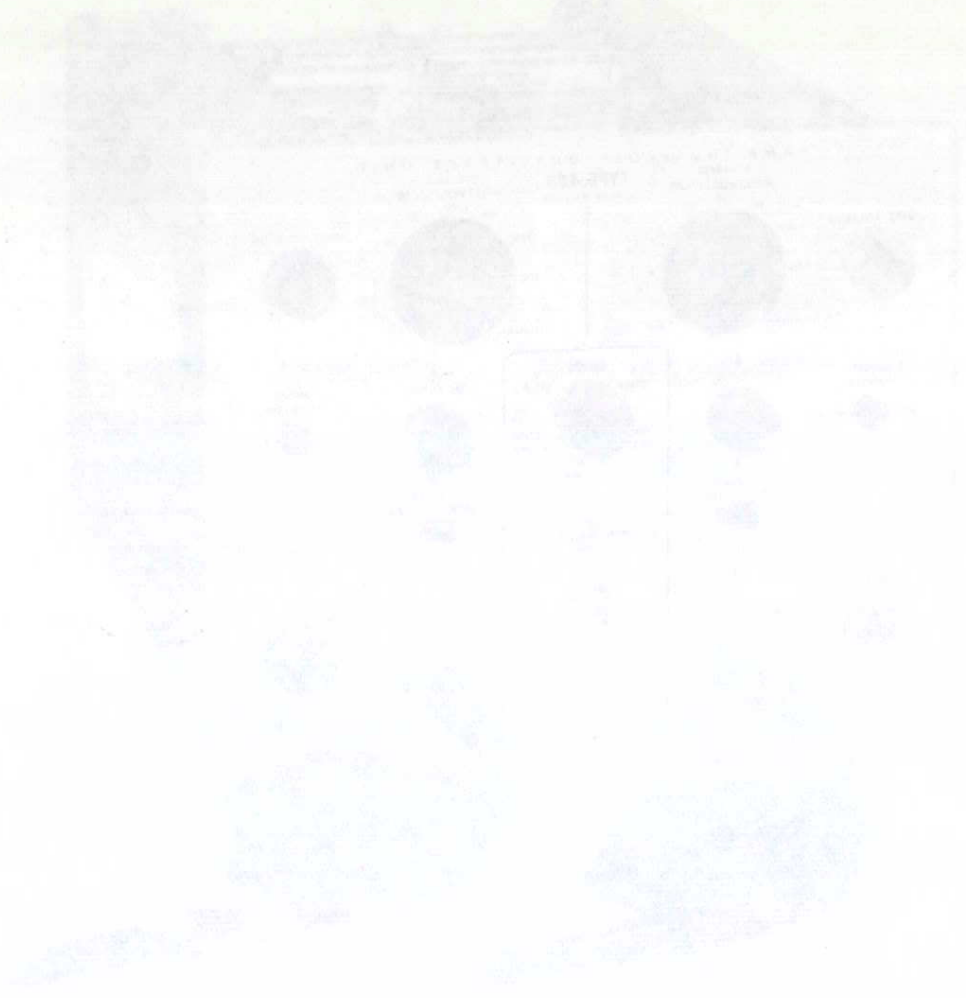
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TEKTRONIX, INC.

P. O. BOX 500 BEAVERTON, OREGON

TRANSITION FROM ENGINEERING MODEL TO PRODUCTION MODEL MAY REQUIRE MINOR SPECIFICATION CHANGES. FINAL SPECIFICATIONS WILL BE RELEASED LATER.



DIRECT SAMPLING PROBE
AND PLUG-IN UNIT

The sample is held in the probe head.
The probe is inserted into the sample.
The probe is retracted and the sample is ejected.

The probe is used for direct sampling of samples.
The probe is inserted into the sample.
The probe is retracted and the sample is ejected.
The probe is used for direct sampling of samples.
The probe is inserted into the sample.
The probe is retracted and the sample is ejected.

3183

Patent and availability will be released later.

A-5115

Printed in U.S.A.

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TRANSITION FROM ENGINEERING MODEL TO PRODUCTION
MODEL MAY REQUIRE MINOR REVISIONS. CHANGES
FINAL SPECIFICATIONS WILL BE RELEASED LATER.

TEKTRONIX, INC.
P. O. BOX 500 BEAVERTON OREGON



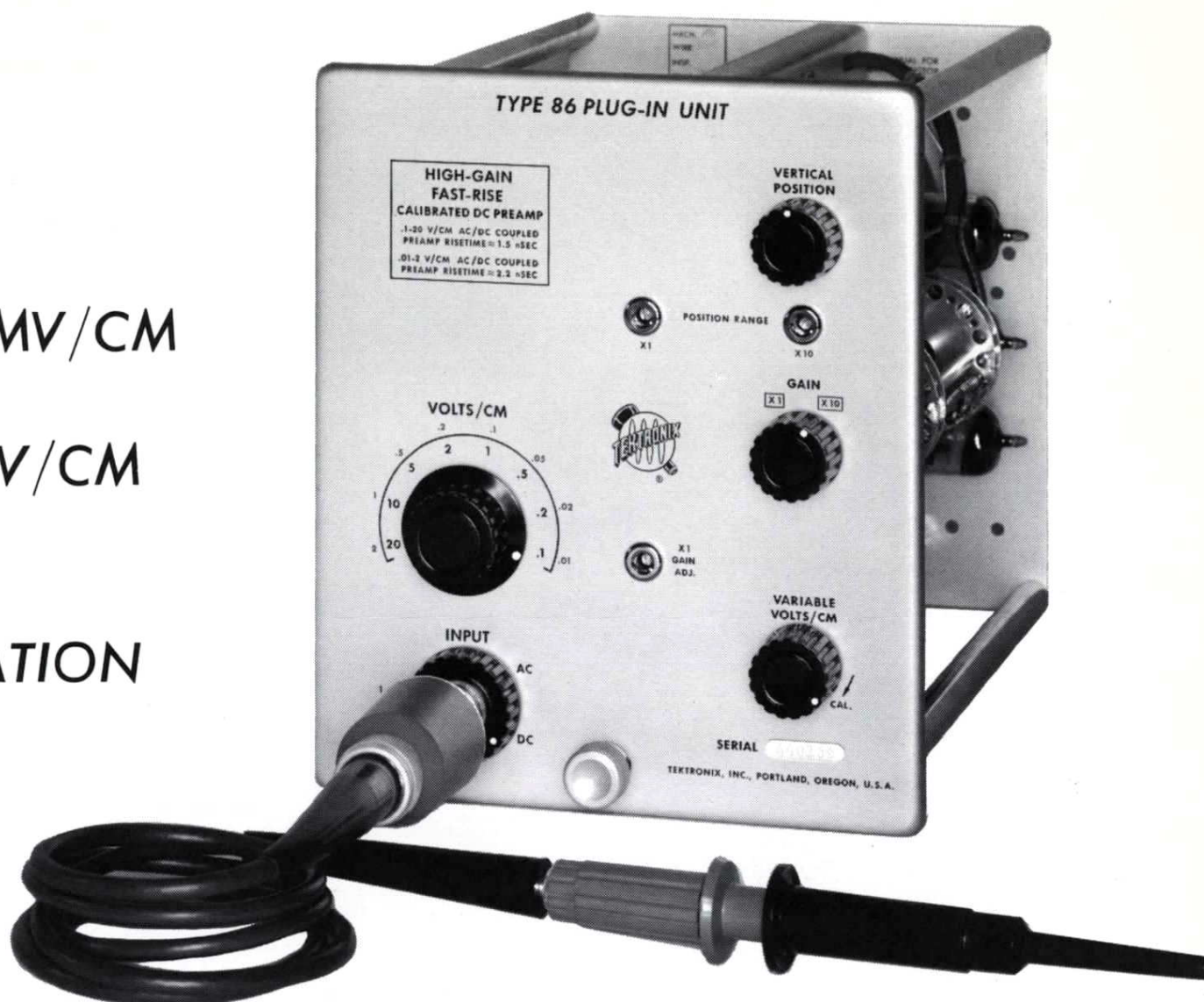
TYPE 86 PLUG-IN UNIT for use with Type 580-Series Oscilloscopes

10 MV/CM SENSITIVITY

DC TO 85 MC AT 100 MV/CM

DC TO 80 MC AT 10 MV/CM

**CALIBRATED STEP
ATTENUATION**



RISETIME of the Type 86 and Type 580-Series Oscilloscope is nominally 4 nsec at 100 mv/cm, always less than 4.2 nsec. At 10 mv/cm, using the 10X Amplifier, risetime is nominally 4.3 nsec, always less than 4.5 nsec. 100 mv/cm 12 db point is at approximately 150 Mc.

CALIBRATED SENSITIVITY from 100 mv/cm to 20 v/cm is in 8 calibrated steps with 1-2-5 sequence, accuracy within 3%. A variable control permits uncalibrated adjustment from 100 mv/cm to approximately 40 v/cm.

10X AMPLIFIER, dc-coupled, extends sensitivity to 10 mv/cm. Calibrated sensitivity is then in 8 calibrated steps from 10 mv/cm to 2 v/cm, 1-2-5 sequence. The variable control provides uncalibrated adjustment from 10 mv/cm to approximately 4 v/cm.

INPUT can be ac or dc-coupled. When ac-coupled, the low-frequency 3-db point is 15 cps direct or 1.5 cps with the P6008 10X Probe.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 12 pf.

P6008 10X PASSIVE PROBE increases the input resistance to 10 megohms and decreases the input capacitance

to approximately 7 pf. The risetime of a Type 580-Series Oscilloscope, a Type 86 Plug-In Unit, and a P6008 Probe, at an overall sensitivity of 100 mv/cm is approximately 5.25 nsec.

MODIFICATION FOR EARLY INSTRUMENTS

TYPE 581/585 VERTICAL STANDARDIZATION MOD KIT improves and standardizes the transient response of early Type 580-Series Oscilloscopes. The Mod Kit is essential for the use of a Type 82 or 86 Plug-In Unit in the early instruments and also improves the performance of these instruments when used with the Type 80/P80 combination.

Tektronix Type 580-Series Oscilloscopes with serial numbers prior to #950 for Type 581 and #2585 for Type 585 may require this modification. If in doubt about instrument modification, please consult your Field Engineer.

Order Part Number 040-275.....\$25
Each kit includes components to change delay-line impedance, standardize crt termination, modify crt and distributed-amplifier circuitry and modify Type 80 Plug-In Unit/Type P80 Probe combination.

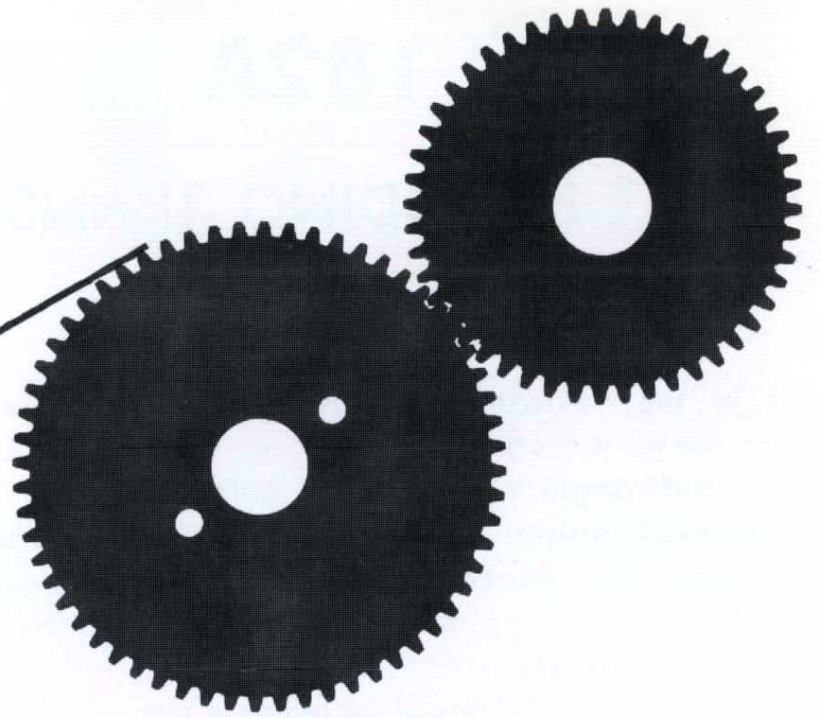
Type 86 Plug-In Unit with P6008 Probe.....\$350.

U.S. Sales Prices f.o.b. Beaverton, Oregon

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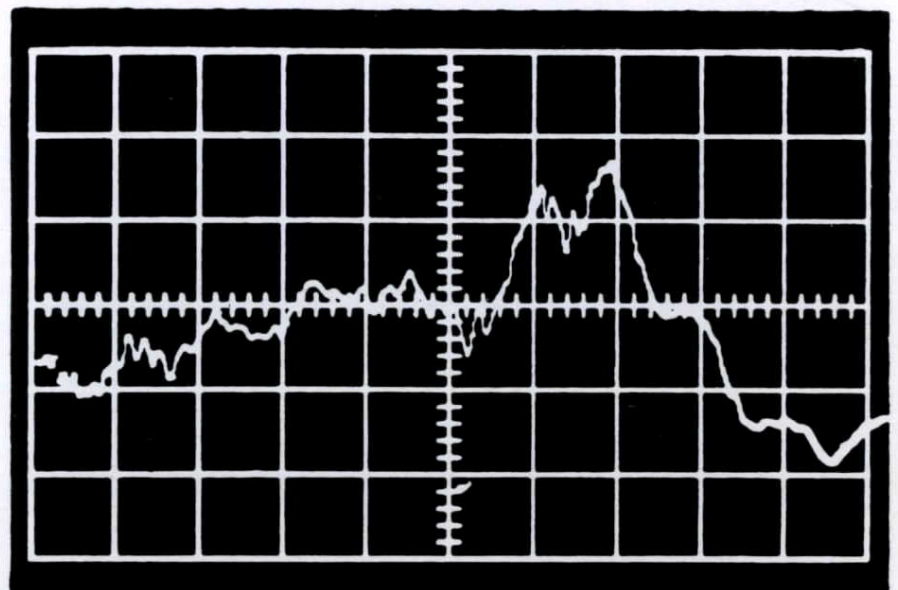
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NEW

**ANGULAR
TRANSDUCER
INSTRUMENT
SYSTEM**



Oscilloscope Display Showing Vibration vs. Crank Angle in a Gasoline Engine.

182A

ANGLE-ENCODING TRANSDUCER

In the Tektronix ROTAN System the Type 182A is the angle-encoding transducer. It converts increments of shaft-angle rotation into pulses of light, then into electrical pulses at the output. These output pulses activate the sweep circuit of a Tektronix oscilloscope (after being amplified and standardized by the rotational analyzer).

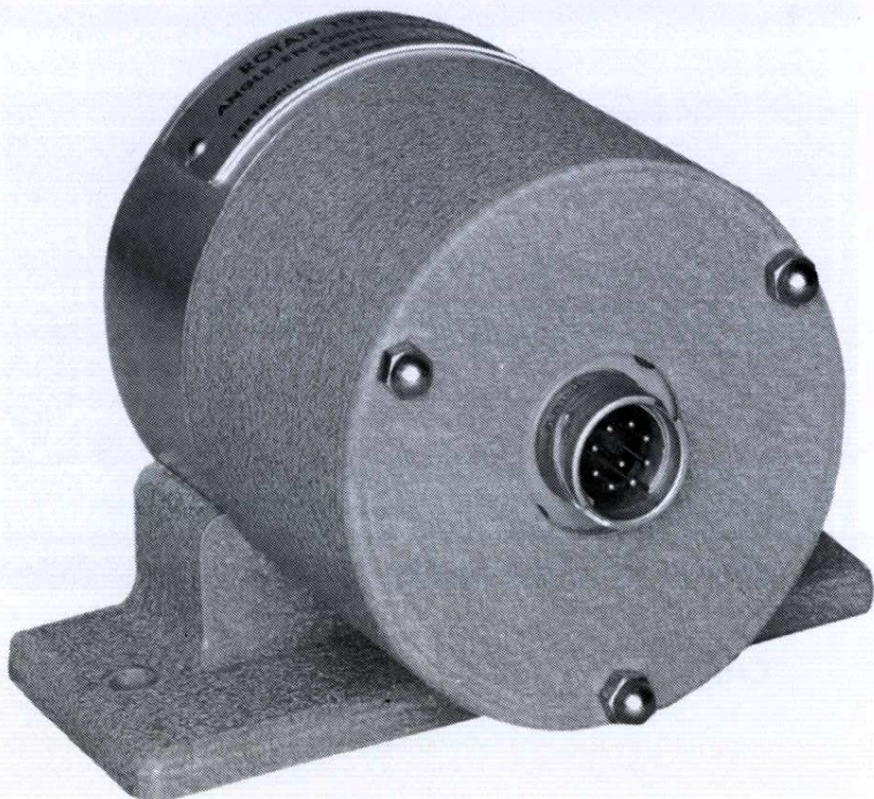
To convert rotational increments into electrical pulses, the Type 182A incorporates a disc fixed internally to the transducer shaft. This shaft and contiguous disc couple mechanically to the drive shaft of the machine under test. The disc has three concentric tracks with 1° , 10° , and 360° markings and rotates in relation to another disc, a stationary disc, which is a photographic negative of the rotating disc. Working together the two discs act as a shutter on a camera. As the shafts rotate, the two discs interrupt light beams from exciter lamps within the transducer unit and produce pulses of light. These light pulses—emanating from 1° , 10° , and 360° tracks—serve to excite the three photo-transistors within the unit. And this excitation results in electrical pulses at the output of the Type 182A.

TYPE 182A PERFORMANCE FEATURES

4 Transistors—Three photo-transistors operate at -4.5 volts direct current, receive pulsed light from their respective 1° , 10° , and 360° tracks.

One temperature-compensating transistor operates at -15 volts direct current, cancels heat-produced output (for heat has same effect on a photo-transistor as light), but does not affect the output due to the exciter lamps.

3 Exciter Lamps—Provide the light source necessary to operate the photo-transistors, operate at six volts

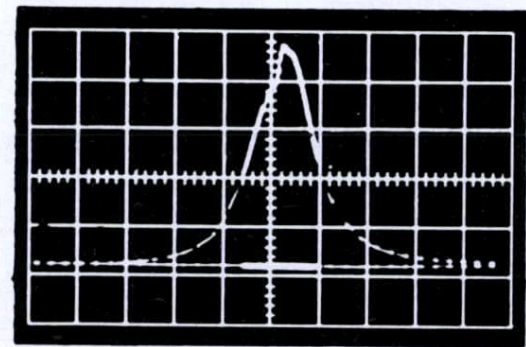


Electronic Approach

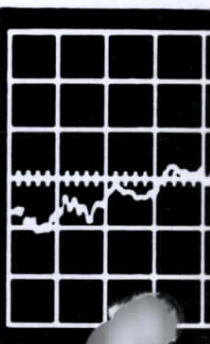
TEKTRONIX R

A Type 182A Angle-Encoding Transducer and a Type 183A Rotational Analyzer comprise the new Tektronix ROTAN System. Designed to study rotation-associated phenomena in machinery, the two ROTAN units adapt an oscilloscope to provide horizontal trace deflection proportional to angular displacement of a rotating shaft. The ROTAN system generates a horizontal sweep representing shaft angle—at speeds from essentially zero to 20,

TYPICAL ROT



Diesel engine cylinder pressure vs. crank angle. 360° display with 10° intensity markers. Intensified portion is the 50° sector covered by the main sweep, starting at 160° .



Vibration vs. crank angle. 360° display with 10° intensity markers. Intensified portion is the 50° sector covered by the main sweep, starting at 160° .

direct current (to reduce ripple in the transducer output), remove easily (should replacement become necessary).

Power Supply—from the Type 183A Rotational Analyzer.

Operating Temperature— 75° Centigrade, maximum ambient.

Signal Output— 0.2 volts peak-to-peak, from zero to approximately 120,000 pulses per second.

Angular Velocity—Minimum, essentially zero revolutions per minute. (Below 1 rpm, a drift component is usually present in the oscilloscope sweep). Maximum, approximately 20,000 rpm. Moment of inertia, loading nominally 10 gram/cm². Angular marker error, 15 minutes of arc, overall maximum.

DIMENSIONS OF TYPE 182A

Length including shaft	$5\frac{3}{8}$ "
Shaft length exposed	$1\frac{5}{8}$ "
Width at base	$4\frac{1}{2}$ "
Height	$3\frac{1}{4}$ "
Weight	1 lb. $10\frac{1}{4}$ oz.

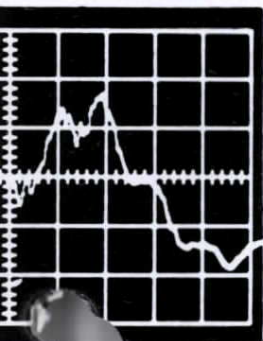
to Mechanical Studies

ROTAN SYSTEM

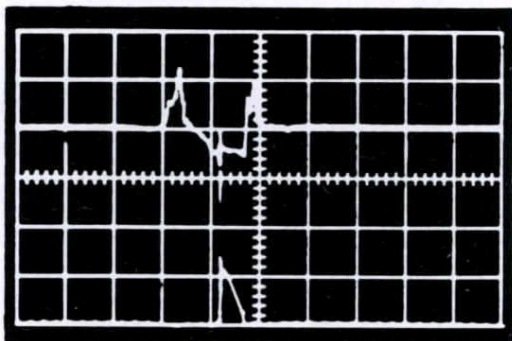
000 rpm. Transduced data, such as velocity, pressure, acceleration, or vibration (applied to the oscilloscope vertical input), appears on the crt screen correctly referenced to this instantaneous angular position.

This electronic approach to mechanical studies eliminates errors of inherent instrument inertia often encountered in dynamic measurements on machinery.

AN DISPLAYS



ank angle. 360° display, 1-cylinder gaso-



Ignition vs. crank angle. 360° display with 10° intensity markers. The upper trace is the secondary voltage and the lower trace is the secondary current.

TYPE 183A PERFORMANCE FEATURES

Marker Pulses—Two output connectors provide 1°, 10°, or 360° increments at not less than a 10-volt peak.

Trigger Pulses—Available as successive or alternate pulses at 1°, 10°, or 360° increments at not less than a 7-volt peak.

Calibrator—Sets the amplitude level of the display and provides a means for fine adjustments in spacing of the dots across the oscilloscope screen (in essence shaft revolutions or fractions of revolutions per sweep).

Sweep Increment—Applying rotational increments to the oscilloscope necessitates a simple conversion of the Miller Sweep circuit to a base of angular displacement instead of time.

Power Supply—Operates nominally at 117 volts ac, also supplies power to the Type 182A.

DIMENSIONS OF TYPE 183A

Length	10"
Width	4 3/4"
Height	6 3/8"
Weight	5 lb. 12 1/2 oz.

183A

ROTATIONAL ANALYZER

In the Tektronix ROTAN System the Type 183A is the rotational analyzer. It amplifies and standardizes the output pulses of the angle-encoding transducer and permits a choice of three marker pulses as the signal from either of two output connectors. These pulses can be used as amplitude markers on the oscilloscope, as triggering signals for other electronic equipment, or for z-axis modulation.

For initiating the display on the oscilloscope, the Type 183A provides three trigger-pulse increments, with several different modes of operation possible. For example, when using 360° increments and the SUCCESSION mode, the oscilloscope sweep will trigger on every shaft rotation, but when using the ALTERNATE mode, the sweep will trigger on every other rotation. This ALTERNATE mode is especially useful in conjunction with four-cycle reciprocating engines—for either the power stroke or the intake stroke can be displayed, observed, and analyzed. In addition, a SINGLE SWEEP position facilitates photographic recording of the display and allows observation of random or one-time phenomena.

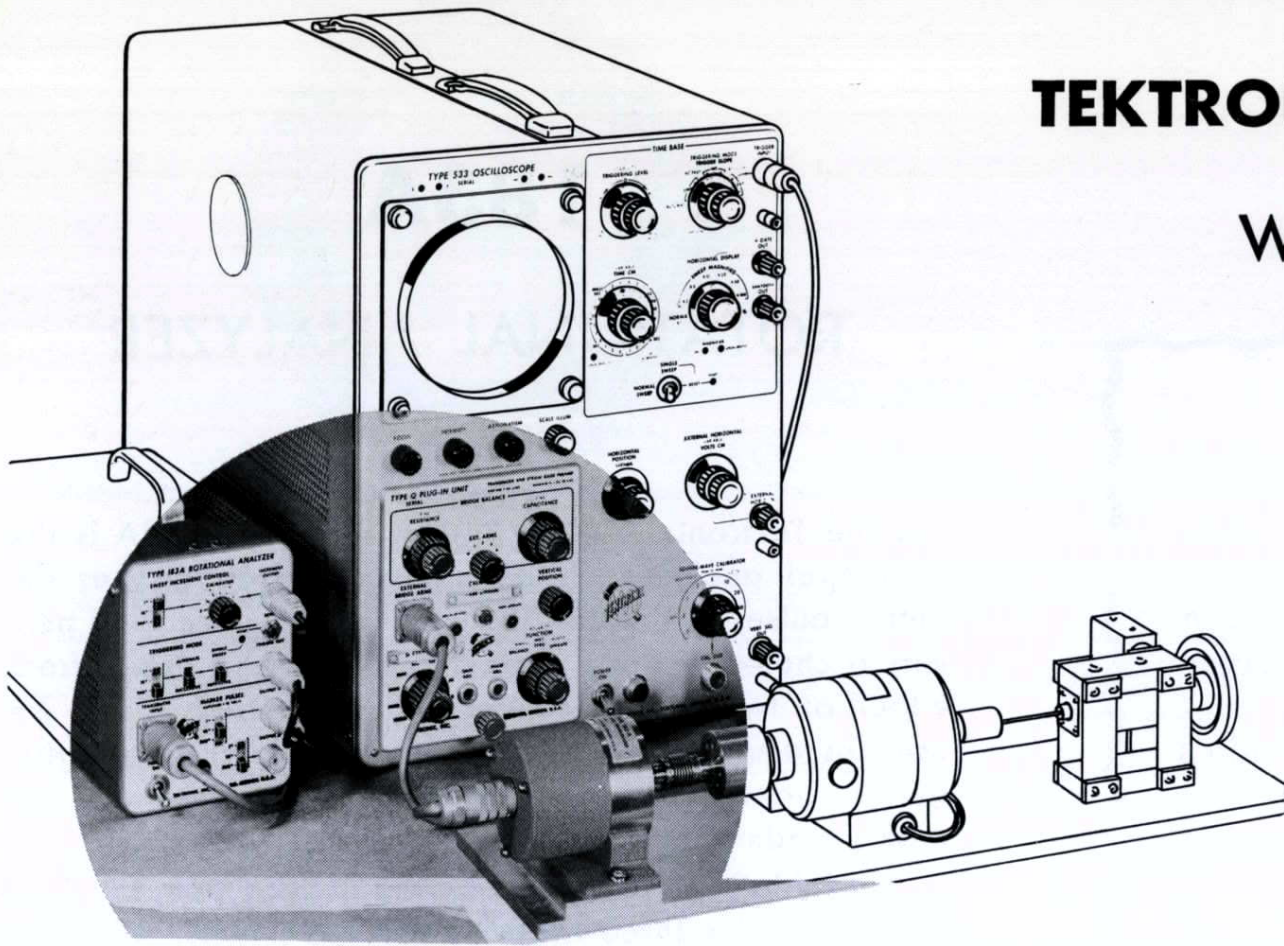
Using the Type 183A calibrator and the oscilloscope controls will permit full horizontal display of anything from a very few degrees of angular rotation up to several complete revolutions of the shaft.

Price, ROTAN System \$850.00
(f.o.b. factory)



TEKTRONIX ROTAN SYSTEM

Wheel-Balancing Application



Instrumentation for the wheel-balancing application shown includes the two units of the ROTAN System—Type 182A Angle-Encoding Transducer and Type 183A Rotational Analyzer—working in conjunction with a linear variable differential transformer (lvdt) and a Type Q Plug-In Unit in a Type 533 Oscilloscope (fitted with a jack to accept the rotational increments from the Type 183A).

In this application, the Type Q Unit—with the lvdt—senses and measures the amount of unbalance on a wheel and presents this rotation-related phenomena on the vertical axis. In normal use, 360° rotation of the wheel equals ten major graticule divisions—with start of the trace occurring at the same point on each revolution cycle. The horizontal axis display appears continuous, but actually combines both digital and analog information.

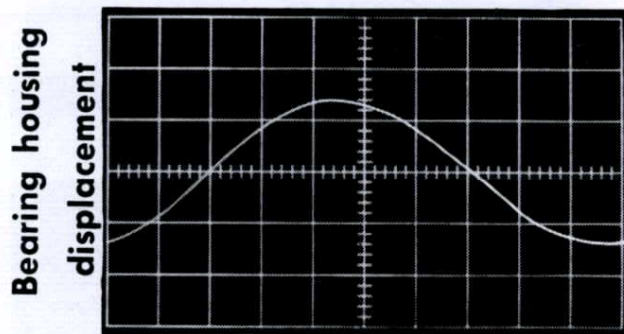
This instrumentation allows magnified displays or normal displays with or without markers superim-

posed. The single-sweep feature of the Rotational Analyzer facilitates photographic recording of the trace during one revolution cycle.

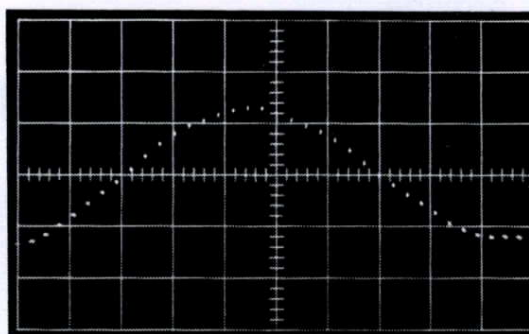
In this wheel-balancing application the three waveform pictures illustrate bearing-housing displacement vs. angular shaft position. Lower left display is a normal trace showing 360° rotation of a wheel. Middle display is a normal trace intensity modulated at 10° increments. Lower right display is a magnified trace (using oscilloscope magnifier) showing incremental nature of the sweep. Amplitude designates the amount of wheel unbalance. Peak designates the point of unbalance. Add or subtract the correct amount of weight at the precise point—and the wheel is balanced.

Price, ROTAN System \$850.00
(f.o.b. factory)

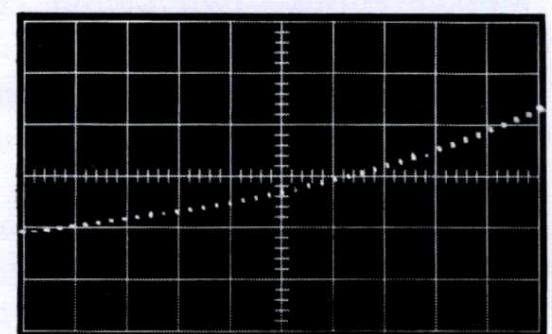
Call your Field Engineer for a demonstration of the Tektronix ROTAN System in your own application.



360° Display without markers



360° Display with 10° markers



Magnified display showing 1° increments

Tektronix, Inc.

P. O. Box 500 • Beaverton, Oregon

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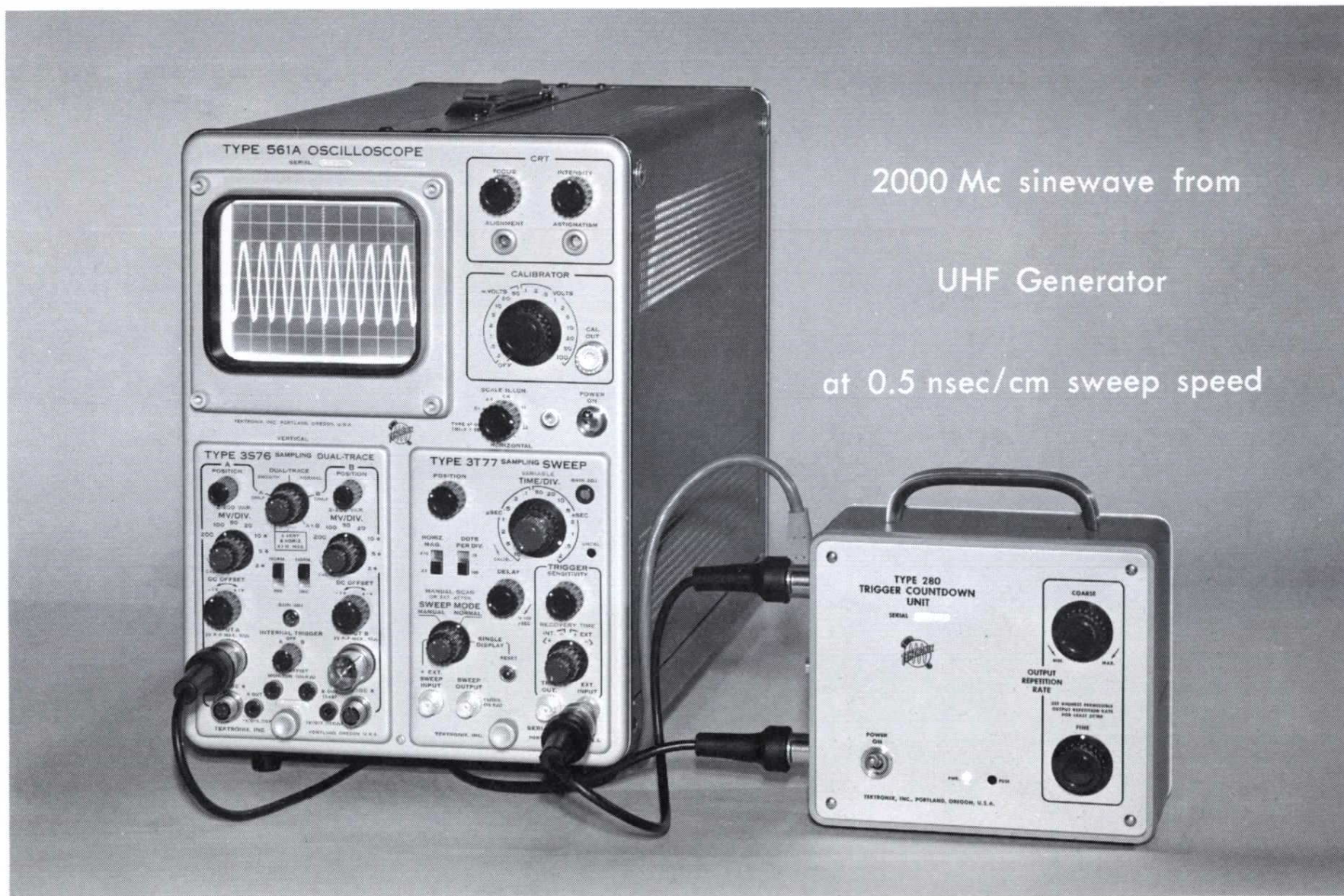
TRIGGER COUNTDOWN UNIT... for use with Tektronix Sampling Oscilloscopes



The Tektronix Type 280 Trigger Countdown Unit—used with Tektronix Sampling Oscilloscopes—allows synchronization on frequencies up to 5 gigacycles. The Type 280 can be used to lower the frequency of the triggering signals to within a range of 15 to 45 megacycles. This permits the trigger circuit of the sampling system to lock in solidly with a much higher input signal frequency.

Adequately shielded, the Type 280 permits operation in areas that have significant rf radiation levels.

The Type 280 can be used with any Tektronix oscilloscope using these plug-in units: Type 5T1, Type 3T77, or Type N.



Typical application of the Type 280 and Sampling Oscilloscope is in microwave research and design.

Up to now, sampling systems have been limited in sinusoidal displays to 1000 megacycles or less. Sampling has not been used generally in microwave work, where display of the detected envelope rather than the klystron signal itself is a common practice. Until recently, oscilloscope sampling

techniques have been used mainly in high speed pulse work—for display of recurrent semiconductor signals with risetimes in the order of nanoseconds or less, often at low repetition rates.

Now, by using the 280 Trigger Countdown Unit with a Tektronix Sampling Oscilloscope, microwave engineers can extend their performance in rf signal applications to the gigacycle range.

specifications

TRIGGER COUNTDOWN UNIT CHARACTERISTICS

INPUT IMPEDANCE is approximately 50 ohms.

INPUT FREQUENCY is from 30 megacycles to 5 gigacycles.

INPUT SIGNAL RANGE is 50 millivolts to 4 volts, peak-to-peak.

OUTPUT REPETITION RATE is continuously variable from 15 to 45 megacycles.

FAST-RISE TRIGGER OUTPUT (load terminated in 50 ohms) is 150 millivolts with less than 0.4-nanosecond risetime.

The fast-rise trigger output permits easy use with Tektronix Type 3T77 Sampling Sweep Plug-In Unit and Type 561A, 564, or 567 Oscilloscopes and rack-mount models, or a Type 5T1 Timing Plug-In Unit and Type 661 Oscilloscope.

LARGE-AMPLITUDE TRIGGER OUTPUT is 1.5 volts with less than 4-nanosecond risetime.

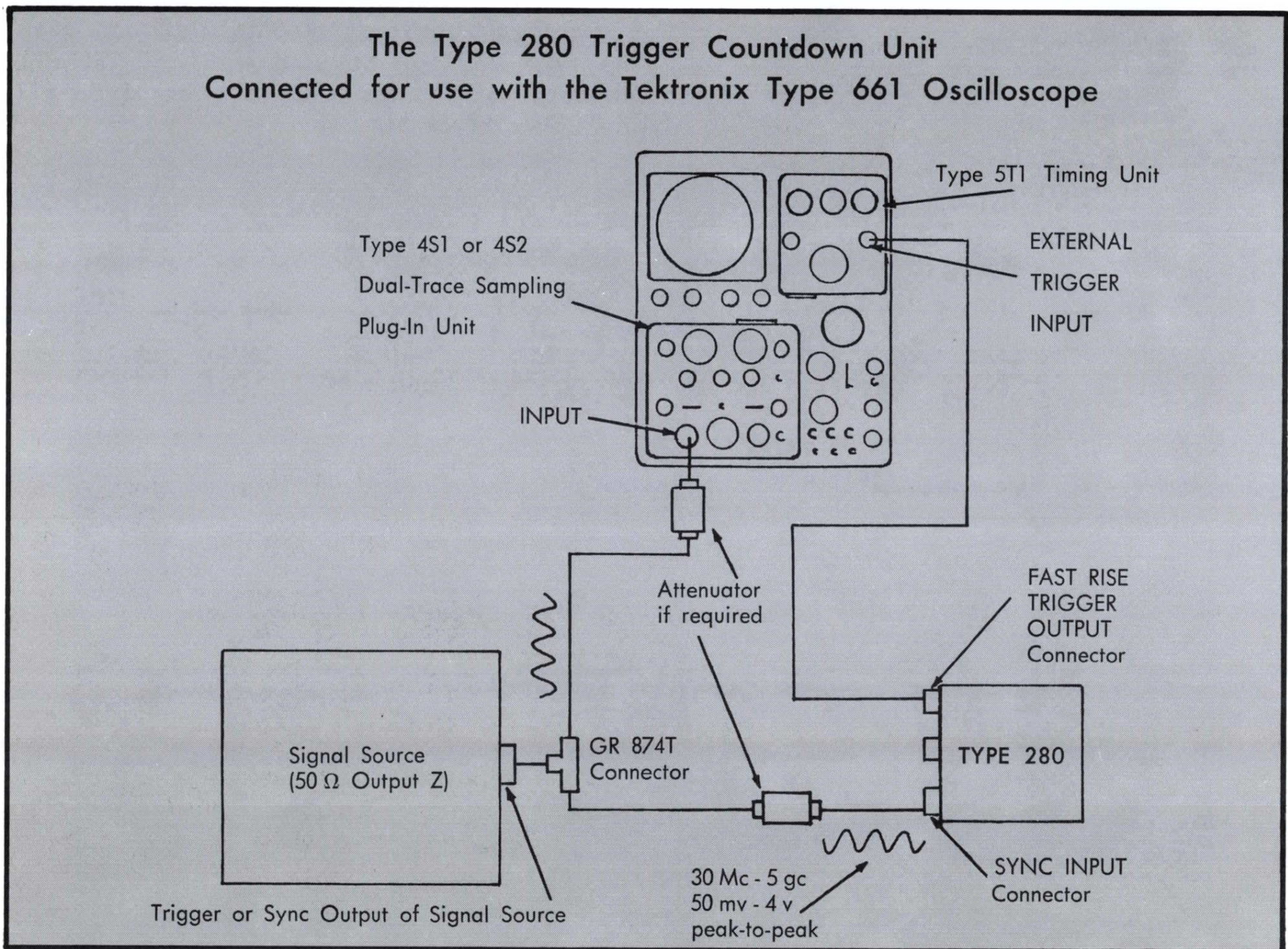
The large-amplitude trigger output permits easy use with Tektronix Type N Sampling Plug-In Unit and Type 530, 540, 550, or (with Type 81 Adapter) Type 580 Series Oscilloscopes.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v, 50 to 800 cps, 10 watts.

MECHANICAL FEATURES include an aluminum-alloy chassis, die-cast aluminum alloy top and bottom covers with a blue-vinyl finish, steel, wrap-around housing. Size is $7\frac{3}{8}$ " high by $7\frac{5}{8}$ " wide by $4\frac{1}{4}$ " deep. Weight is less than 5 pounds.

Type 280 Trigger Countdown Unit \$265

U.S. Sales Prices f.o.b. Beaverton, Oregon



The high frequency test signal is fed into the oscilloscope vertical input and, as a trigger signal, also into the 280 input, through a 50 Ω GR connector. The Trigger Countdown Unit drives the external trigger input of the scope from either of

two outputs available. Input frequency range of the Type 280 is 30 Mc to 5 Gc. Output frequency is continuously variable from 15 Mc to 45 Mc with coarse and fine controls.

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A-2130-2
(replaces A-2130-1)

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1/63
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DIODE SWITCHING-TIME TESTER

TYPE 291 . . . and test fixture

FEATURES



- ...Strip-line environment for clean response better than 0.35 nanosecond.
- ...100-ohm diode-recovery loop.
- ...Ease of diode insertion.
- ...Push button ejection after test—can be actuated by a solenoid for automated testing (not included).
- ...Up to 100 milliamperes available for forward current.
- ...Provisions for external current supply to 500 ma or external monitor.
- ...Plug-in test fixture (017-072) can be operated remotely from the power supply portion of the Type 291.
- ...Compatibility with Tektronix Type 109 and 110 Pulse Generators, and with Tektronix Sampling Oscilloscopes.
- ...DC-Coupling—for direct reading on the oscilloscope of forward and recovery currents.

Diode Recovery Waveform

6-V in 100-ohm Loop

(3-V pulse from Type 109 Pulse Generator)

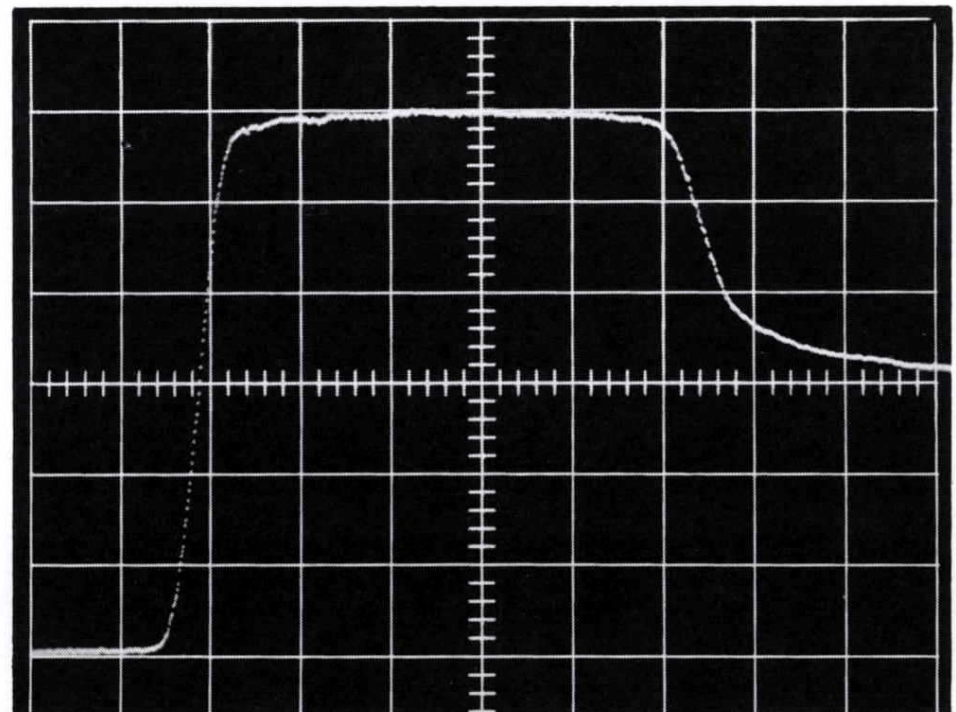
Horizontal—1 nsec/cm

Vertical—10 ma/cm

Diode—Tektronix "Snap-off Diode"

In this diode-recovery waveform (displayed on a Tektronix Type 661 Sampling Oscilloscope), the diode shows a stored charge of approximately 6 picocoulombs per milliampere.

Note the freedom from ringing and overshoot of the recovery waveform, owing to strip-line testing environment of the Diode Switching-Time Tester.



Type 291 Power Supply, without test fixture. \$185

Type TF-1 Diode Test Fixture (017-072) . . . \$65

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Other Overseas areas, please write or cable directly to Tektronix, Inc., International Marketing Department, P. O. Box 500, Beaverton, Oregon, U.S.A. Cable: TEKTRONIX.

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Replaces A-2129-1

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DIODE SWITCHING-TIME TESTER
TYPE 291



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TYPE 291
DIODE SWITCHING-TIME TESTER

1964

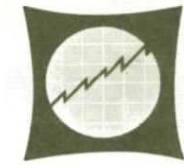
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SALES BULLETIN



CLEVELAND OFFICE
TEKTRONIX, INC.

IMPROVED 200 SERIES SCOPE-MOBILES REPLACE OLDER MODELS

Five improved 200 Series Scope-Mobiles and several accessories for Scope-Mobiles will replace all older Type 200 Models and their accessories; all new models have braking casters on the two front-wheel positions.

TYPE 201-1 SCOPE-MOBILE (Tek No. 016-045)

Width: 10-1/2" -- With drawer *
Will hold Types 503, 504, 515A, 516, 561A, and 564 Oscilloscopes.

TYPE 201-2 SCOPE-MOBILE (Tek No. 016-046)

Similar in all respects to Type 201-1.
Includes Drawer/Plug-in Carrier to hold two Type 2 and 3 Series Plug-in Units. **

TYPE 202-1 SCOPE-MOBILE (Tek No. 016-047)

Width: 14" -- With drawer ***
Will hold Types 530/540/550/580 Series Oscilloscopes; Types 524AD, 517A, 507, 661 Oscilloscopes, and Type 575 Curve Tracers.

TYPE 202-2 SCOPE-MOBILE (Tek No. 016-048)

Similar in all respects to Type 202-1.
Includes Drawer/Plug-in Carrier to hold two Tektronix letter-series Plug-in Units. ****

NOTE: The 202-1 and 202-2 Scope-Mobiles can be adapted for the 502 Oscilloscope with special adapter brackets, Tek No. 436-033.

TYPE 205-1 SCOPE-MOBILE (Tek No. 016-049)

Width: 17-3/4" -- With drawer
Will hold Types 565, 567, and all Tektronix Rackmount Oscilloscopes.

- * Drawer for 10-1/2" width Type 200 Series Scope-Mobiles can be attached to older Type 201 Scope-Mobiles to make them equivalent to 201-1. Tek number is 014-012.
- ** Drawer/Plug-in Carrier combination can be added to older Type 201 Scope-Mobiles to make them equivalent to 201-2. Tek number is 014-013.
- *** Drawer for 14" width Type 200 Series Scope-Mobiles can be attached to older Type 202 Scope-Mobiles to make them equivalent to 202-1. Tek number is 014-014.
- **** Drawer/Plug-in Carrier combination can be added to older Type 202 Scope-Mobiles to make them equivalent to 202-2. Tek number is 014-015.

NOTE: Drawers and Drawer/Plug-in Carriers may be added to the Types 203 and 204 Scope-Mobiles, but the old plug-in carrier must be removed.

Consult PAL for price and availability.



SALES BULLETIN

IMPROVED 300 SERIES SCOPE-MOBILES REPLACE OLDER MODELS

The improved 300 Series Scope-Mobiles and several accessories for Scope-Mobiles will replace all older 300 Series models and their accessories. All new models have pricing control on the two front wheel positions.

Model 300-1014-Mobile (Form 144-300-1014)

Model 300-1014-Mobile (Form 144-300-1014)

Model 300-1014-Mobile (Form 144-300-1014)

Model 300-1014-Mobile (Form 144-300-1014)

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Model 300-1014-Mobile (Form 144-300-1014)

Model 300-1014-Mobile (Form 144-300-1014)

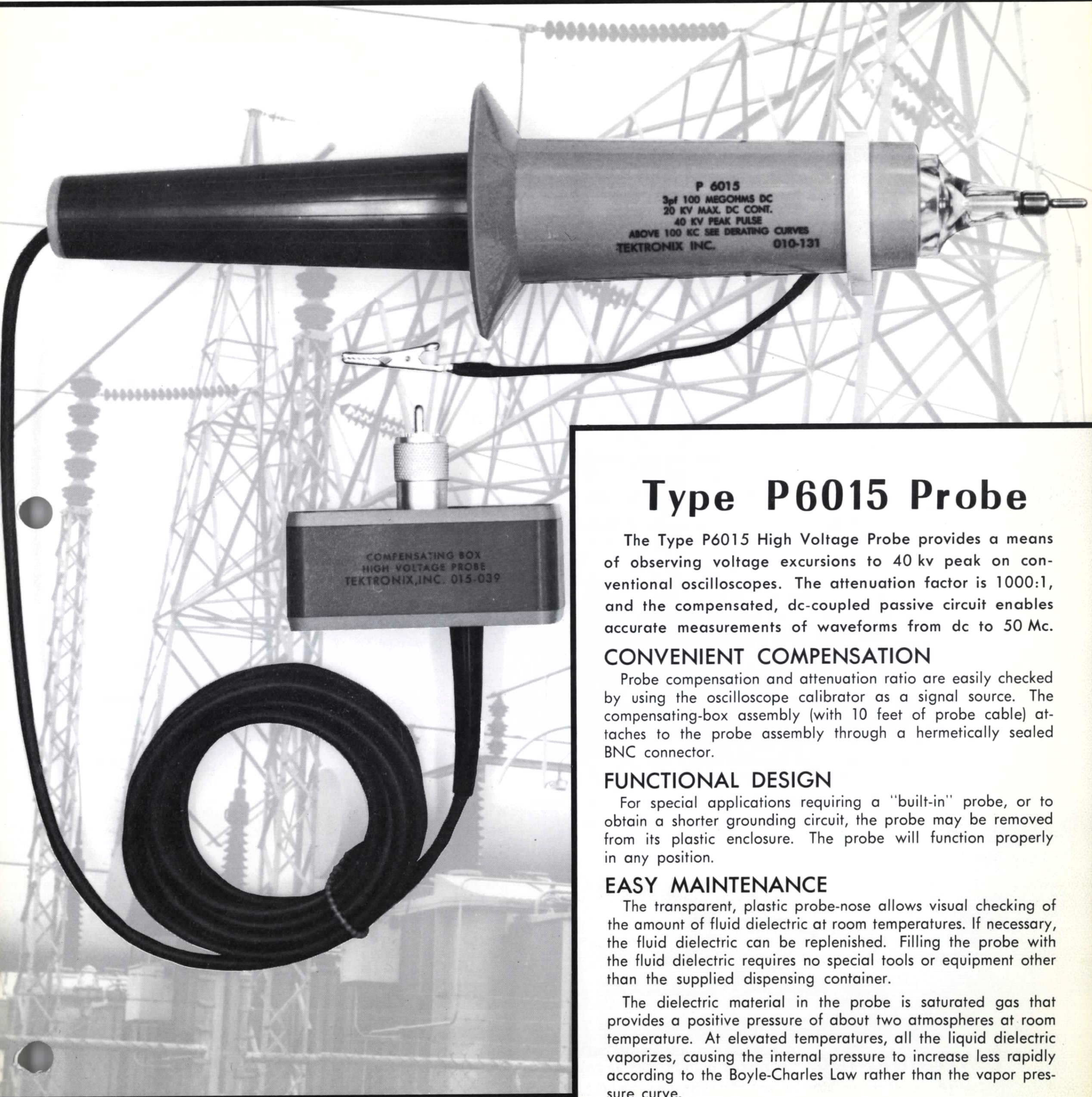
Model 300-1014-Mobile (Form 144-300-1014)

NOTE: Drawers and Drawer/Plug-in Carriers may be added to the Types 303 and 304 Scope-Mobiles, but the old plug-in carrier must be removed.

Consult PAL for price and availability.



WIDE-BAND HIGH VOLTAGE MEASUREMENTS



P 6015
3pf 100 MEGOHMS DC
20 KV MAX. DC CONT.
40 KV PEAK PULSE
ABOVE 100 KC SEE DERATING CURVES
TEKTRONIX INC. 010-131

COMPENSATING BOX
HIGH VOLTAGE PROBE
TEKTRONIX, INC. 015-039

Type P6015 Probe

The Type P6015 High Voltage Probe provides a means of observing voltage excursions to 40 kv peak on conventional oscilloscopes. The attenuation factor is 1000:1, and the compensated, dc-coupled passive circuit enables accurate measurements of waveforms from dc to 50 Mc.

CONVENIENT COMPENSATION

Probe compensation and attenuation ratio are easily checked by using the oscilloscope calibrator as a signal source. The compensating-box assembly (with 10 feet of probe cable) attaches to the probe assembly through a hermetically sealed BNC connector.

FUNCTIONAL DESIGN

For special applications requiring a "built-in" probe, or to obtain a shorter grounding circuit, the probe may be removed from its plastic enclosure. The probe will function properly in any position.

EASY MAINTENANCE

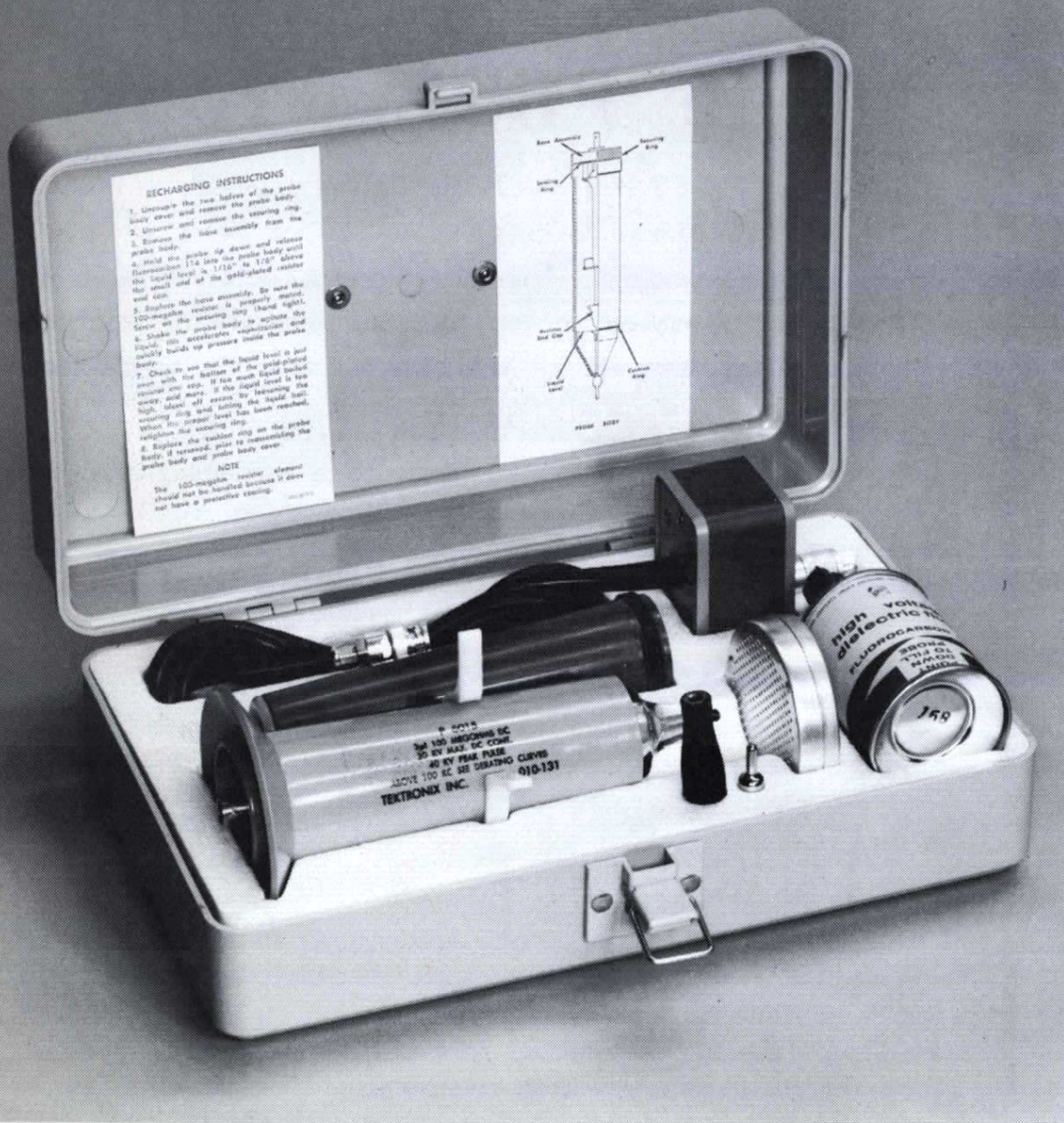
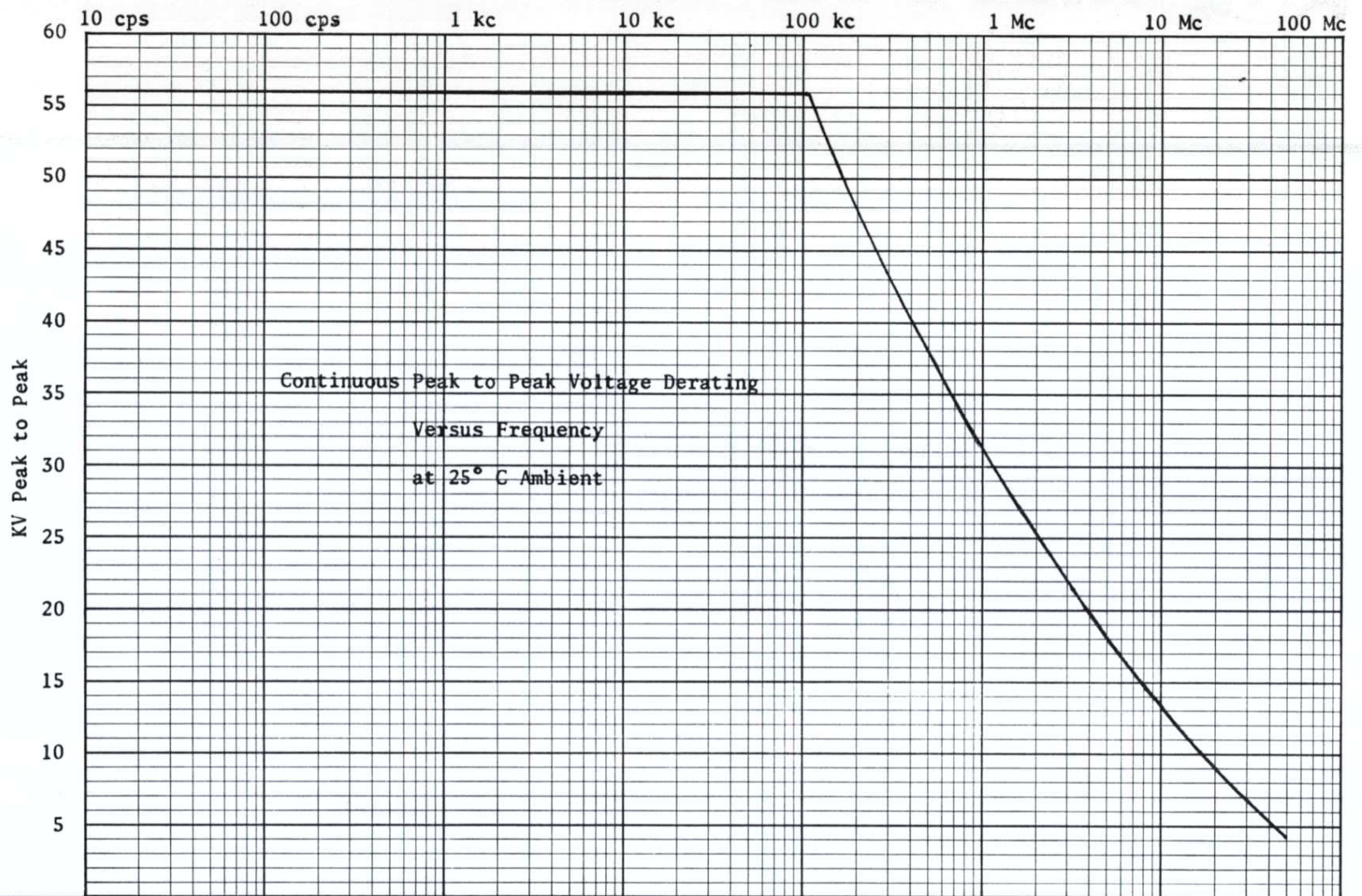
The transparent, plastic probe-nose allows visual checking of the amount of fluid dielectric at room temperatures. If necessary, the fluid dielectric can be replenished. Filling the probe with the fluid dielectric requires no special tools or equipment other than the supplied dispensing container.

The dielectric material in the probe is saturated gas that provides a positive pressure of about two atmospheres at room temperature. At elevated temperatures, all the liquid dielectric vaporizes, causing the internal pressure to increase less rapidly according to the Boyle-Charles Law rather than the vapor pressure curve.

TEKTRONIX, INC. MANUFACTURER OF OSCILLOSCOPES
AND ASSOCIATED INSTRUMENTS



Type P6015 HIGH VOLTAGE Probe



SPECIFICATIONS

- VOLTAGE RATING**—40 kv maximum peak ac or pulse.
20 kv maximum dc or rms continuous at 25°C environmental temperature. Voltage or duty cycle derating is necessary when the P6015 is used to observe RF voltage of frequencies over 100 kc, or in environmental temperatures elevated above 25°C.
- ATTENUATION RATIO**—1000:1 with approximately $\pm 9\%$ variable adjustment.
- DC INPUT RESISTANCE**—100 megohms.
- INPUT CAPACITY**—Approximately 2.7 picofarads.
- RISETIME**—(of probe and compensator box) Approximately 4 nanoseconds.
- FREQUENCY RESPONSE**—Flat within 2%.
- COMPENSATION**—Compensates to oscilloscope inputs of 1 megohm and up to 50 picofarads.
- TEMPERATURE RANGE**—Operates in environmental temperatures from 10°C to 55°C. Calibration adjustments are necessary when environmental temperature changes.
- MECHANICAL**—Weight is approximately 15 ounces and length is 14-1/4" from the tip to the end of the handle.
- P6015 High Voltage Probe .. *910-132* \$200
- INCLUDED ACCESSORIES**
1—7" ground lead, 1—Can of liquid dielectric, with dispenser, 1—Probe tip, rounded edges, polished, 1—Alligator clip tip, 1—Instruction manual, 1—Carrying Case.
- U. S. Sales Price f.o.b. Beaverton, Oregon

Tektronix, Inc. / P. O. BOX 500 • BEAVERTON, OREGON / Mitchell 4-0161 • TWX-503-291-6805 • Cable: TEKTRONIX.
OVERSEAS DISTRIBUTORS IN 27 COUNTRIES AND HONOLULU, HAWAII.

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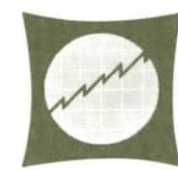
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↑
SPR-133

date

10-9-62

SALES BULLETIN



CHANGE IN 291 ORDERING AND NUMBERING SYSTEM

The 291 has been divided into two separate items. The 291 is the power supply portion and the TF-1 is the diode test fixture. The change provides a means for ordering either item separately if desired and will accommodate future diode test fixtures as they are developed. This eliminates the need for a different number for every power supply and test fixture combination.

All future orders for the 291's should be listed as two separate line items: 291 diode switching time tester power supply at \$ 185.00, and 017-072 TF-1 diode test fixture at \$ 65.00. Present orders for 291's at \$ 250.00 will be filled with a 291 and a TF-1. No change orders will be required.

Spec sheets will be distributed shortly.

DC

RECEIVED
OCT 10 1962

CLEVELAND OFFICE
TEKTRONIX, INC.



WITNESS BULLETIN

CHANGE IN THE FURNISHING AND HANDLING OF A SYSTEM

The following information was furnished to the undersigned by the [illegible] on [illegible] at [illegible]. The [illegible] is a [illegible] of the [illegible] and is [illegible] to the [illegible] of the [illegible]. The [illegible] is [illegible] to the [illegible] of the [illegible] and is [illegible] to the [illegible] of the [illegible]. The [illegible] is [illegible] to the [illegible] of the [illegible] and is [illegible] to the [illegible] of the [illegible].

The [illegible] is [illegible] to the [illegible] of the [illegible] and is [illegible] to the [illegible] of the [illegible]. The [illegible] is [illegible] to the [illegible] of the [illegible] and is [illegible] to the [illegible] of the [illegible]. The [illegible] is [illegible] to the [illegible] of the [illegible] and is [illegible] to the [illegible] of the [illegible].

Witnessed and attested to on this [illegible] day of [illegible] 1962.

[illegible]

[illegible]

NEW



ATTENUATORS

TERMINATIONS

ADAPTERS



These Tektronix attenuators, terminations, and adapters offer improvements in both electrical performance and mechanical design—improvements that help you obtain consistently accurate and dependable measurements.

Carefully chosen components, close tolerances, and precisely controlled internal geometry assure stable performance and accuracy over a long period of time.

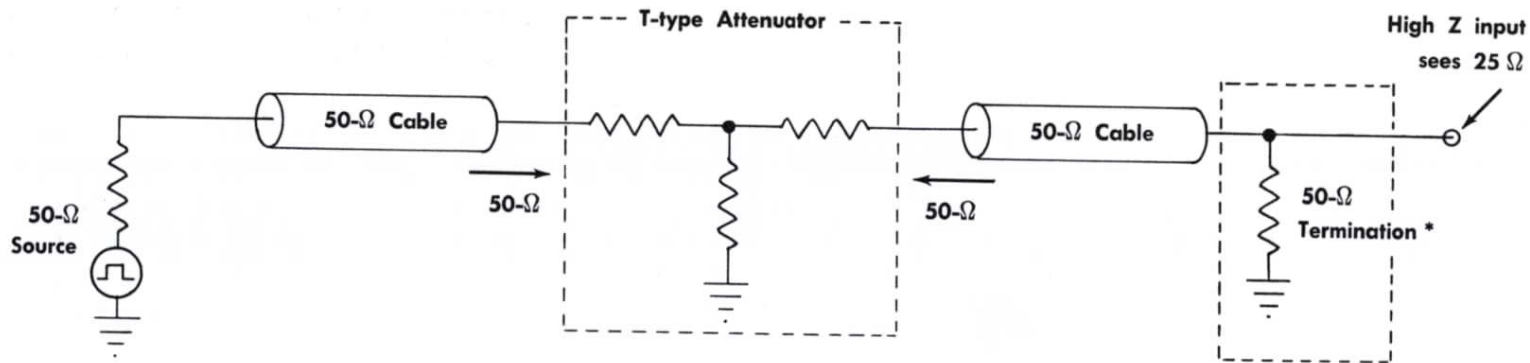
To increase ease of use and lessen the chance of operator error, each accessory is clearly marked as to type, ratio, maximum power, and correct orientation. In addition, attenuators with UHF, GR, and TEK 125- Ω connectors have color-coded bands that show at a glance the attenuation ratio, and gold-plated connectors that designate all 125- Ω ends, thus reducing the probability of improper connections.

The rugged bodies, of compact, modern design, will stand-up under heavy everyday use with little possibility of damage.

BASIC FUNCTIONS OF ATTENUATORS, TERMINATIONS, AND ADAPTERS

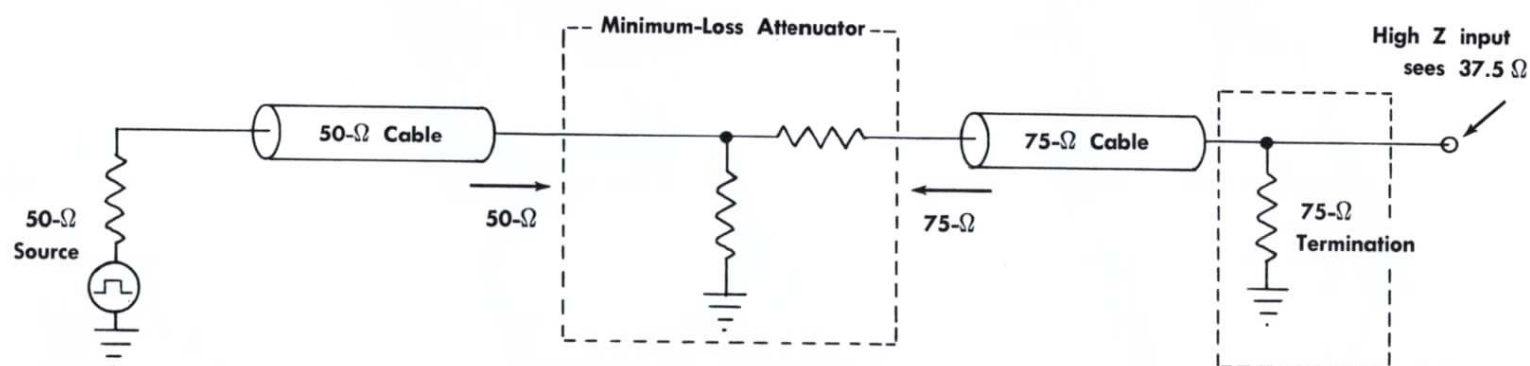
1. **ATTENUATORS**—Two types are included under this designation, the T type and the minimum-loss type.

T-TYPE—maintain the proper impedance match between the signal source and the input to an instrument while attenuating the signal by an indicated ratio. T-type attenuators must have a load of the correct impedance to give the indicated attenuation ratio.



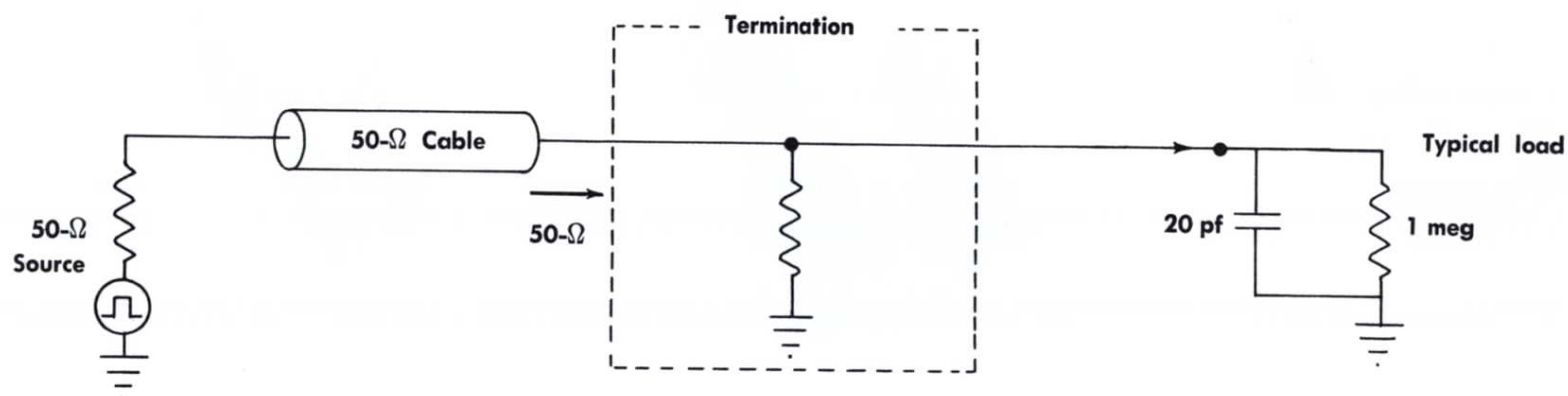
Typical Use of a T-type Attenuator, and a Termination.

MINIMUM-LOSS TYPE—provide a convenient means of matching a source or load with cables of different characteristic impedances. Tektronix minimum-loss attenuators assure proper matching, with a minimum loss of signal strength.



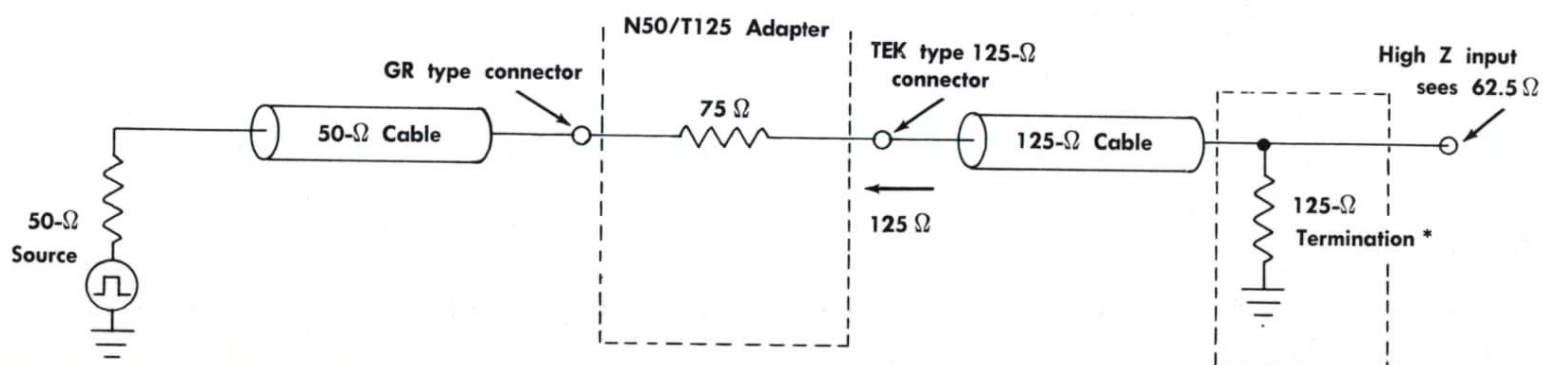
Typical Use of a Minimum-Loss Attenuator and a Termination

2. **TERMINATIONS**—terminate a cable in its characteristic impedance. Improper termination, or no termination, can cause ringing, reflections, and other adverse effects. Tektronix 50-ohm and 125-ohm instruments have built-in terminations.



Typical Use of a 50-ohm Termination

3. **ADAPTERS**—connect cables of different characteristic impedances and different connectors. They are used only where impedance matching is not important. Tektronix adapters use the letter N to designate a non-terminated end and the letter T to designate a terminated end.



Typical Use of a N50/T125 Adapter and a Termination

* Not necessary when instruments have built-in terminations.

CONNECTOR TYPES

To fill the needs of a wide area of applications, Tektronix attenuators, terminations, and adapters use four different types of connectors:



(1) UHF TYPE



(2) GR TYPE



(3) TEK 125-Ω



(4) BNC TYPE

PERFORMANCE CHARACTERISTICS

Accuracy of Indicated Attenuation Ratio:

TYPE

UHF	±2% at dc; ±3% at 100 megacycles.
GR	±2% at dc; ±3% at 1 gigacycle.
TEK 125-Ω	±2% at dc; ±3% at 1 gigacycle.
BNC	±2% at dc; ±3% at 100 megacycles.

Voltage Standing Wave Ratio:

TYPE

UHF	less than 1.2 up to 100 megacycles.
GR	less than 1.1 up to 1 gigacycle.
TEK 125-Ω	less than 1.1 up to 1 gigacycle.
BNC	less than 1.1 up to 100 megacycles.

Power Rating:

TYPE

UHF	1.5 watts.
GR	1 watt.
TEK 125-Ω	1 watt.
BNC	0.5 watt.

Output to Input Voltage Ratios for Minimum-Loss Attenuators:

When properly terminated the E_{out}/E_{in} ratios for the various minimum-loss attenuators are as follows:

Connection	E_{out}/E_{in}
50 Ω → 75 Ω	0.63
75 Ω → 50 Ω	0.42
50 Ω → 93 Ω	0.59
93 Ω → 50 Ω	0.32
50 Ω → 125 Ω	0.56
125 Ω → 50 Ω	0.23
50 Ω → 170 Ω	0.54
170 Ω → 50 Ω	0.16

All attenuators, with the exception of minimum-loss types, are T-type attenuators.

For further information, or a demonstration of these accessories in your applications, please call your Tektronix Field Engineer.

ACCESSORIES WITH UHF-TYPE CONNECTORS

DESCRIPTION	PART NO.	PRICE
50-Ω 10:1 attenuator	011-031	16.00
50-Ω 5:1 attenuator	011-032	16.00
75-Ω 10:1 attenuator	011-033	16.00
75-Ω 5:1 attenuator	011-034	16.00
93-Ω 10:1 attenuator	011-035	16.00
93-Ω 5:1 attenuator	011-036	16.00
50-Ω termination	011-045	15.00
75-Ω termination	011-046	15.00
93-Ω termination	011-047	15.00
170-Ω * termination	011-048	15.00
50-Ω to 75-Ω min. loss atten.	011-041	16.00
50-Ω to 93-Ω min. loss atten.	011-042	16.00
50-Ω to 170-Ω min. loss atten.	011-043	16.00

ACCESSORIES WITH GR-TYPE CONNECTORS

50-Ω 10:1 attenuator	017-044	19.00
50-Ω 5:1 attenuator	017-045	19.00
50-Ω 2:1 attenuator	017-046	19.00
50-Ω termination	017-047	17.50

ACCESSORIES WITH TEK 125-Ω TYPE CONNECTORS

125-Ω 2:1 attenuator	017-048	25.00
125-Ω 5:1 attenuator	017-049	25.00
125-Ω 10:1 attenuator	017-050	25.00
125-Ω termination	017-007	20.00
125-Ω TEK 125-Ω to 200-Ω H.P.	017-038	20.00

* Frequency response 30 mc; vswr less than 1.25 up to 30 mc.

ACCESSORIES WITH GR-TEK 125-Ω TYPE CONNECTORS

DESCRIPTION	PART NO.	PRICE
50-Ω to 125-Ω min. loss atten.	017-052	25.00
125-Ω adapter N50/N125	017-053	17.50
125-Ω adapter N50/T125	017-054	17.50
125-Ω adapter T50/N125	017-055	23.00

U.S. Sales Prices f.o.b. Beaverton, Oregon

ACCESSORIES WITH BNC-TYPE CONNECTORS *

50-Ω termination (high capacitance)	011-049
50-Ω termination (high inductance)	010-313
75-Ω termination	010-315
93-Ω termination	010-317
50-Ω 10:1 attenuator	010-314
75-Ω 10:1 attenuator	010-316
93-Ω 10:1 attenuator	010-318
50-Ω to 75-Ω min. loss attenuator	010-319
50-Ω to 93-Ω min. loss attenuator	010-320

* Prices will be available later.



Tektronix, Inc.

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ENGINEERING REPRESENTATIVES: Kentron Hawaii Ltd., Honolulu, Hawaii. Tektronix is represented in twenty-five overseas countries by qualified engineering organizations.

European and African countries, the countries of Lebanon and Turkey, please contact TEKTRONIX INTERNATIONAL A.G., Terrassenweg 1A, Zug, Switzerland, for the name of your local engineering representative. Other Overseas areas, please write or cable directly to Tektronix, Inc., International Marketing Department, P. O. Box 500, Beaverton, Oregon, U.S.A. Cable: TEKTRONIX.



MINIATURE FAST-RISE PULSER



Actual Size

The TU-5 tunnel-diode pulser generates a fast-rise, flat-top square wave designed to aid in adjustment of transient response of the Tektronix 80-Series Plug-In Units. It can also be used with letter series and sampling plug-in units. When used with letter-series plug-in units the pulser is sufficiently fast to show the rise-time of the oscilloscope and plug-in unit.

The oscilloscope calibrator output provides the proper input to the pulser. The TU-5 can be driven from the Type 105 Square-Wave Generator, using a TU-5/105 Adapter.

A bias adjustment on the pulser provides for changes in tunnel-diode characteristics due to temperature variations, tolerance, or other variables.

CHARACTERISTICS

RISETIME—less than or equal to 1.5 nsec into 50 ohms.

AMPLITUDE—at least 200 mv with 50-ohm termination, 20 mv with 10X attenuator and 50-ohm termination.

PULSE WIDTH—about 0.5 msec, dependent on oscilloscope calibrator output, (oscilloscope calibrator is 1 kc).

OUTPUT IMPEDANCE—50 ohms (25 ohms when used with 50 ohm termination).

SOURCE VOLTAGE—100 volt square wave (10 ma) from the oscilloscope calibrator output, or with a TU-5/105 Adapter, from the Type 105 Square-Wave Generator, providing output frequencies up to 1 Mc.

REPETITION RATE—same as source voltage (1 kc from oscilloscope calibrator output).

BNC CONNECTORS—for input and output.

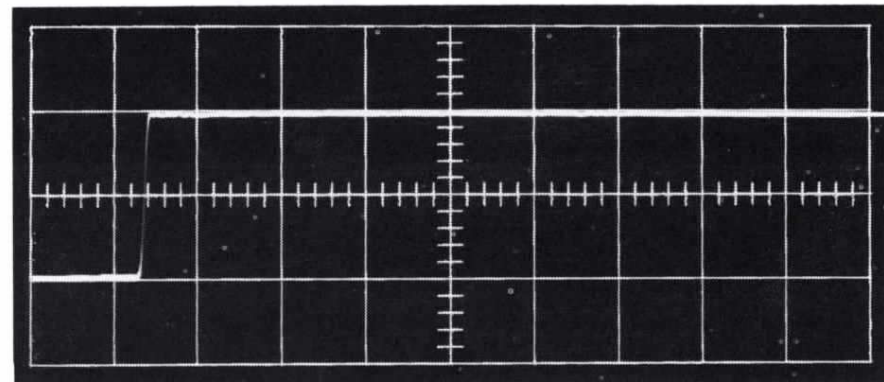
TU-5 PULSER (part no. 015-038) \$25.00

TU-5 PULSER with accessories (part no. 015-043) \$46.50
Includes one each: 50-ohm 10X BNC attenuator, 50-ohm BNC termination, BNC cable, UHF to BNC adapter.

U.S. Sales Prices f.o.b. Beaverton, Oregon

TU-5/105 ADAPTER (part no. 013-075)

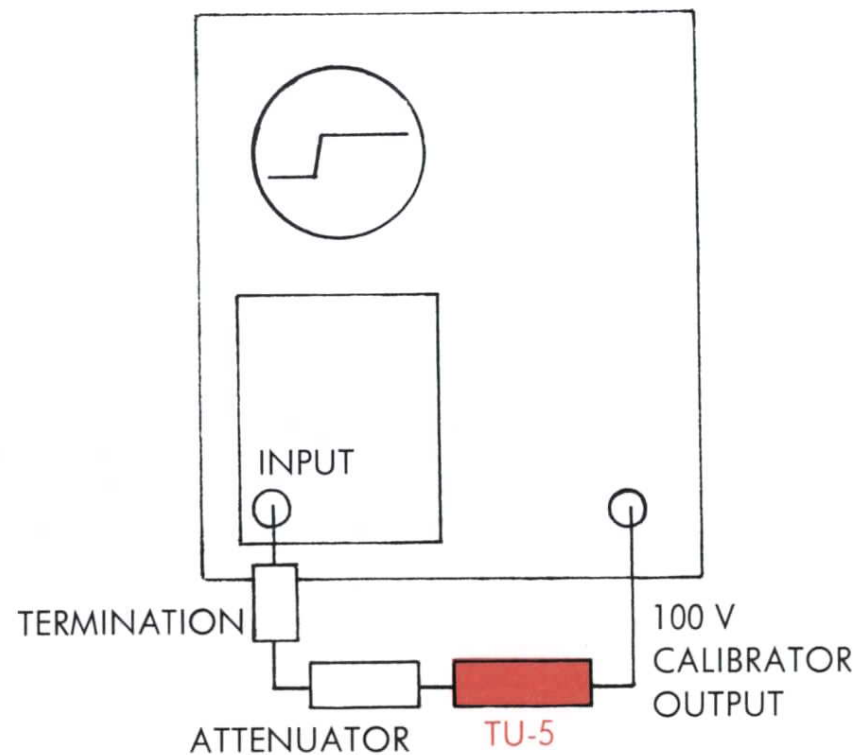
Price and availability will be released later.



Fast-rise square wave from TU-5 Pulser with Type 86 Plug-In Unit and Type 585 Oscilloscope—50 nsec/cm sweep speed, taken with Tektronix Type C-12 Camera.



ACCESSORIES

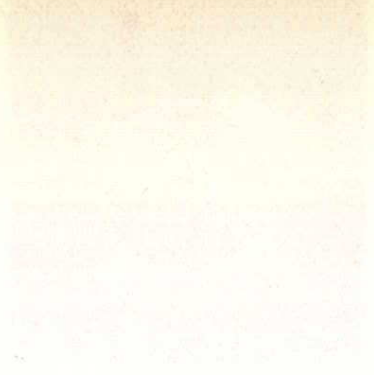


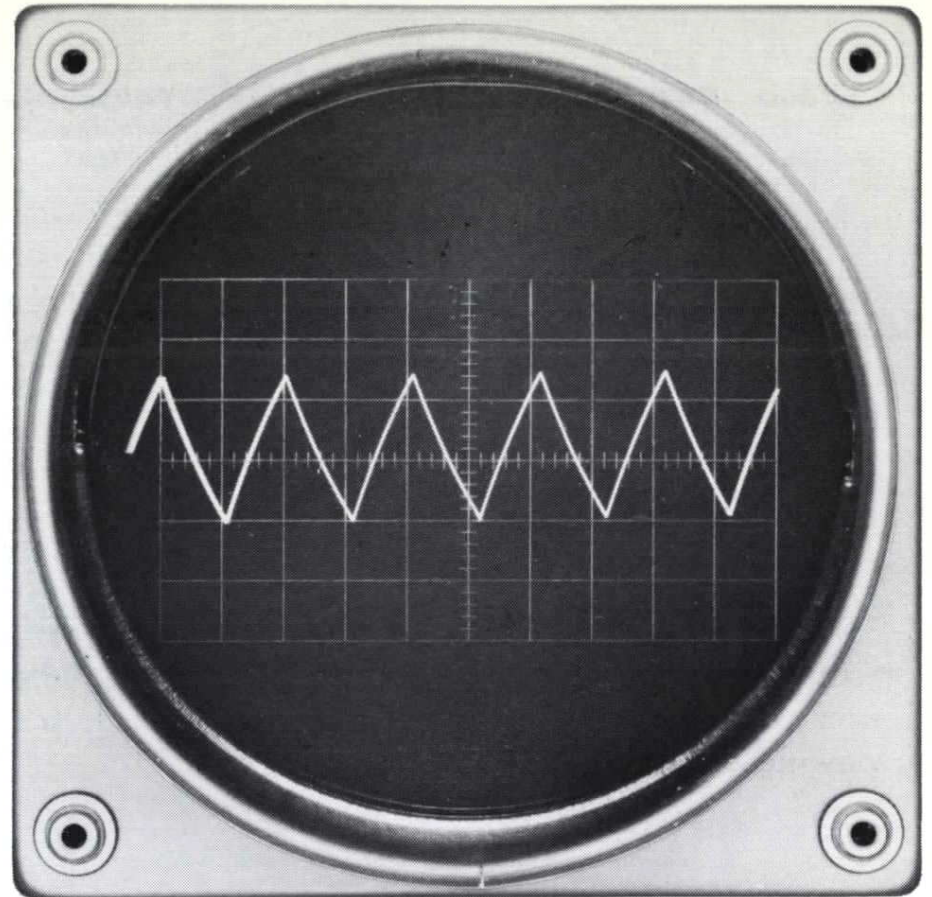
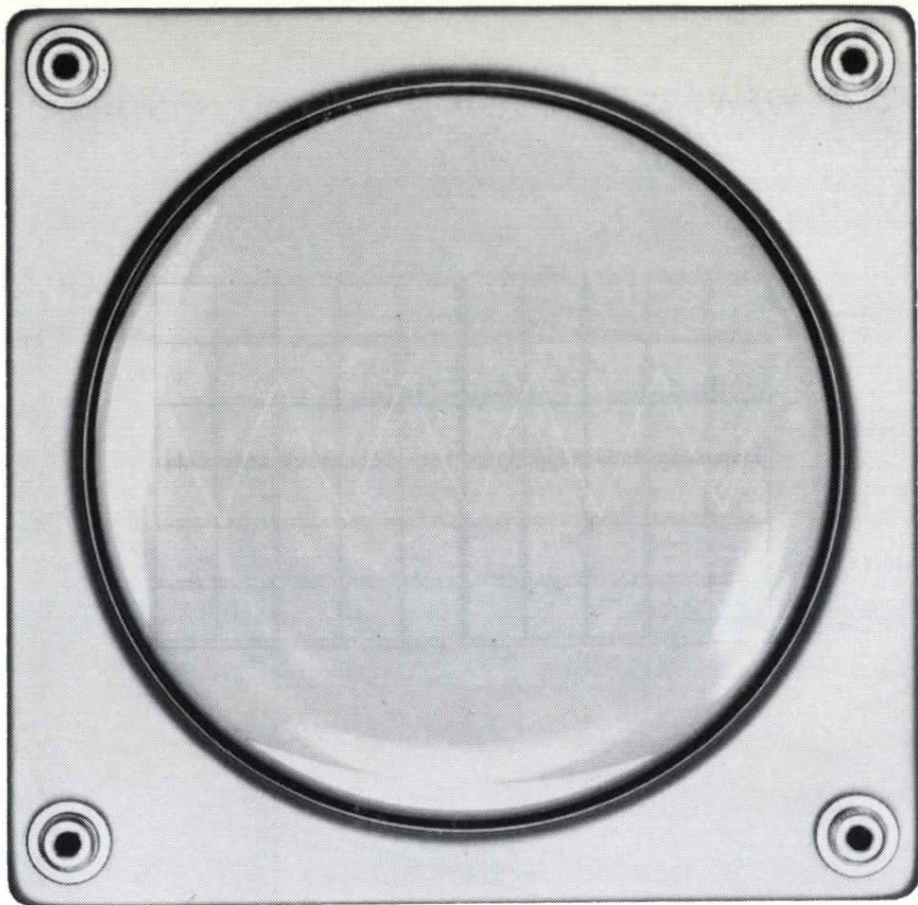
Fast-rise square wave from oscilloscope calibrator output—with TU-5 Pulser and optional accessories.

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*ever have **TOO MUCH** light on the subject?*

Under high ambient-light conditions it is often difficult to view oscilloscope traces unless the trace intensity is greatly increased. Many times this is not feasible. The new Tektronix POLARIZED VIEWERS make it easy to see oscilloscope traces of normal to low intensity even when the ambient light is very high.

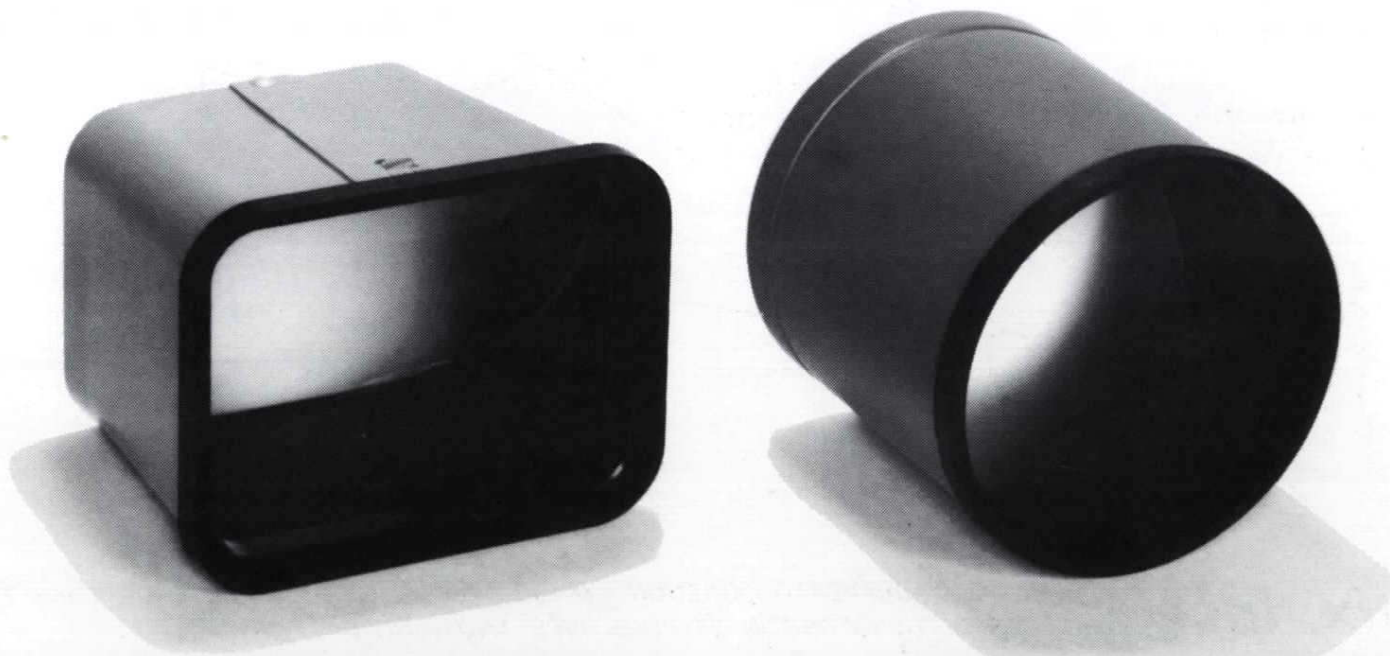
The curved, circularly polarizing filter greatly reduces troublesome reflections and glare, with no distortion of the trace. And, the POLARIZED VIEWERS allow considerable freedom of movement for the operator—it is not necessary to peer through a narrow eyepiece of any sort.

Designed for use with Tektronix 5" oscilloscopes using rectangular or standard, round, graticule covers, the POLARIZED VIEWERS can be slipped on or off in a matter of seconds.



Round POLARIZED VIEWER, Part No. 016-035 \$10.00
Rectangular POLARIZED VIEWER, Part No. 016-039 \$10.00

U.S. Sales Prices f.o.b. Beaverton, Oregon



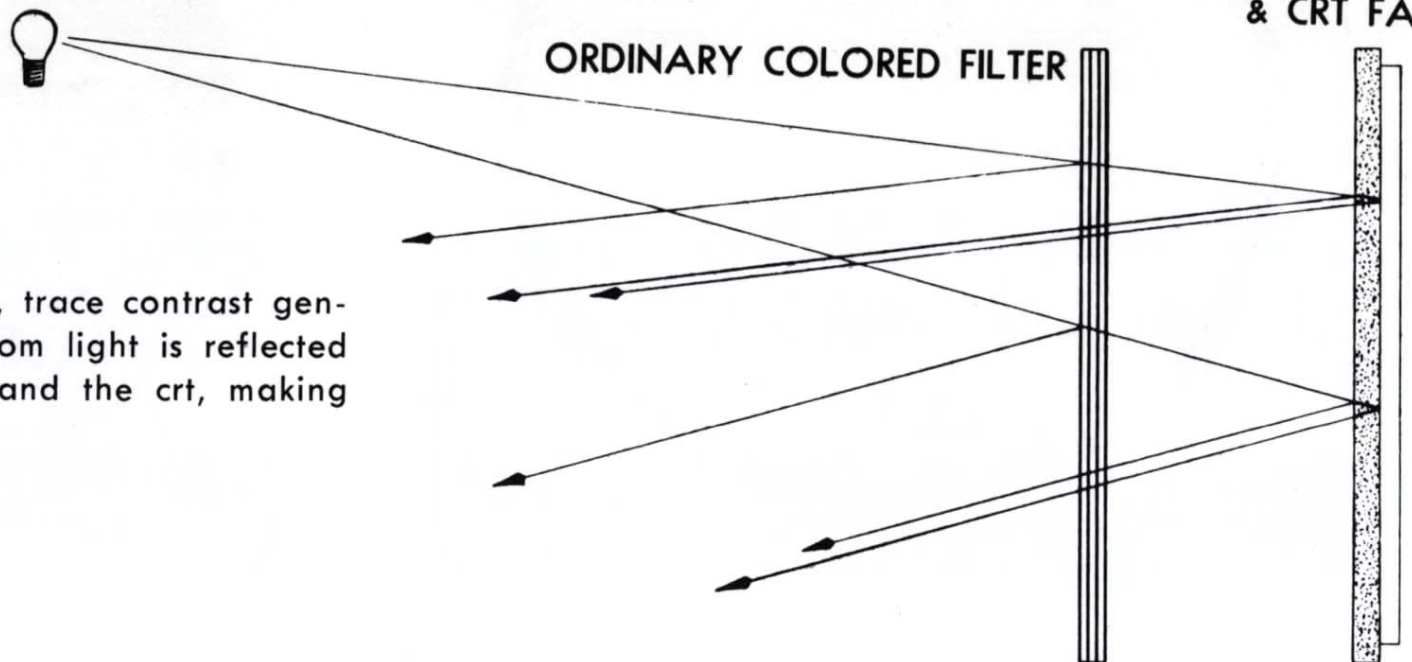
TEKTRONIX POLARIZED VIEWERS

These illustrations show how the Tektronix POLARIZED VIEWERS give you improved viewing.

GRATICULE
& CRT FACE

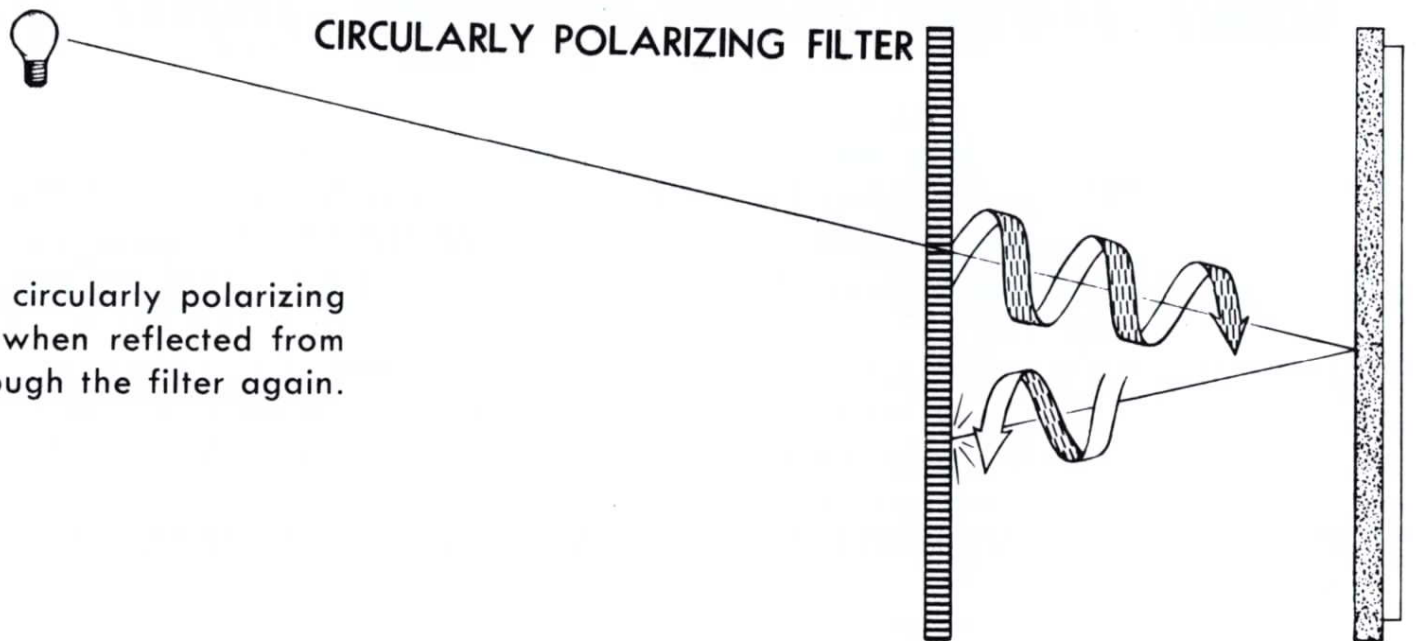
ORDINARY COLORED FILTER

1. With an ordinary colored filter, trace contrast generally varies from 3:1 to 8:1. Room light is reflected from the face of both the filter and the crt, making viewing difficult.



CIRCULARLY POLARIZING FILTER

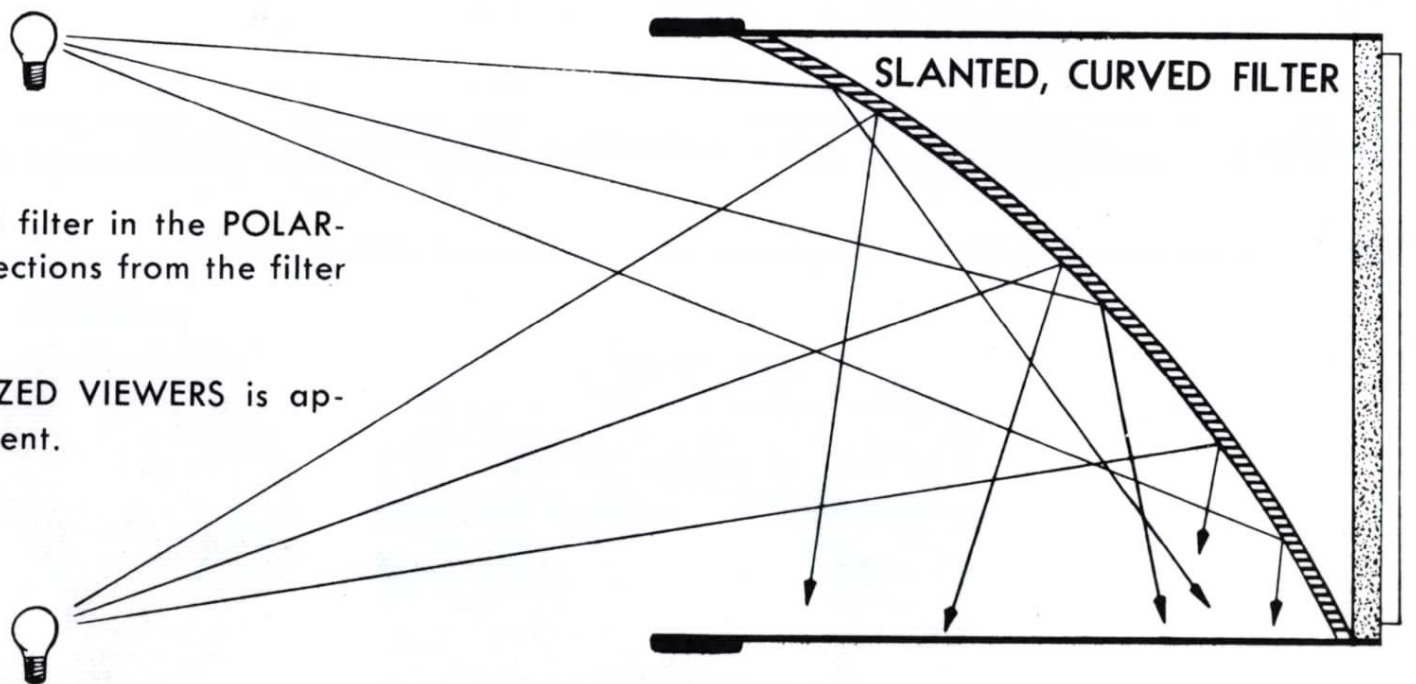
2. Light which passes through the circularly polarizing filter in the POLARIZED VIEWERS, when reflected from the crt face, cannot pass back through the filter again.



SLANTED, CURVED FILTER

3. The slanted, and slightly curved filter in the POLARIZED VIEWERS deflects light so reflections from the filter surface itself are not seen.

Trace contrast with the POLARIZED VIEWERS is approximately 20:1, a vast improvement.



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