CATALOG 25 APRIL, 1966

TEKTRONIX

OSCILLOSCOPES & ASSOCIATED INSTRUMENTS

The results of 20 years dedication to engineering excellence

NEW INSTRUMENTS

TYPE		PAGE
R422	DC to 15 MHz Oscilloscope	26
453/R453	DC to 50 MHz Oscilloscopes	29
529	Television Waveform Monitor	52
549	DC to 30 MHz Storage Oscilloscope	76
556/R556	DC to 50 MHz Dual-Beam Oscilloscope	86
1A7	High-Gain DC Differential Plug-In Unit	108
1L20	10 MHz to 4.2 GHz Spectrum Analyzer Unit	112
1L30	925 MHz to 10.5 GHz Spectrum Analyzer Unit	112
1S2	Wideband Sampling and TDR Unit	116
3A5	Automatic/Programmable Amplifier Unit	152
3B5	Automatic/Programmable Time-Base Unit	153
3A7	High-Gain Differential Comparator Unit	154
3A8	Operational Amplifier Unit	155
3L10	1 to 36 MHz Spectrum Analyzer Unit	164
106	Squarewave Generator	206
R116	Programmable Pulse Generator	211
184	Time-Mark Generator	227
191	Constant-Amplitude Signal Generator	228
263	3A5/3B5 Programmer	229
281	Time Domain Reflectometer Pulser	231
282	Probe Adapter	231
R293	Programmable Pulse Generator and Power Supply	233
C-30	Oscilloscope Camera	246

OUR CONTINUING CREED IS THAT OF SERVING TEKTRONIX CUSTOMERS WITH PRODUCTS AND POLICIES THAT ARE UNEXCELLED IN THE ELECTRONICS INDUSTRY AND LIMITED ONLY BY THE CURRENT STATE OF THE ART.

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How To Use This Catalog

Readers who know our product line can consult the contents page and go directly to the instrument of interest. Others, who are not so well acquainted must approach the solution to their measurement problem in a different way. This page points out features of this catalog that are included to help the reader find the instrument he requires.

CONTENTS

Instruments are grouped together according to common characteristics; for example, those oscilloscopes that feature portability; those oscilloscopes that use the same group of plug-in units; those oscilloscopes that use the sampling technique for their display, etc. The sequence of instruments within these groups is arranged by instrument type number in an ascending order. The first group starts with the Type 310A and the last group ends with the Type 661. For quick association, you'll find the applicable plug-in units grouped immediately after the group or groups of oscilloscopes in which they are used.

The contents illustrate the grouping of our instruments according to type number designations. For example, we refer to the 300-Series and 400-Series as portable oscilloscopes, the 530, 540, and 550-Series as oscilloscopes that use Letter and 1-Series plug-in units, the 560-Series as oscilloscopes that use 2-Series and 3-Series plug-in units, etc. Other oscilloscopes are listed in their proper numerical sequence. In the last third of the catalog, associated instruments are identified by 100-Series and 200-Series designations.

REFERENCE CHARTS

Since bandwidth, risetime, and deflection factor as well as other parameters are of vital interest to you in selecting an instrument, this catalog contains a group of reference charts that provide these essentials. These charts will allow you to make a quick comparison among instruments. The first chart on pages 4 and 5 starts with the oscilloscope/plug-in combination that offers the greatest bandwidth followed by oscilloscopes in a descending bandwidth capability. Thus, if you wanted a DC to 15 MHz portable instrument, the chart would quickly lead you to the Type 422. Once there, you can move horizontally across the chart and find risetime, deflection factor, signal delay, sweep delay, sweep range, magnifier, and price as well as the number of the catalog page that describes the instrument in detail.

The chart on pages 6 and 7 contain the bandwidth and risetime characteristics for a variety of Letter-Series and 1-Series plug-in units when used with appropriate oscilloscopes. This chart quickly points out the versatility offered by a plug-in type oscilloscope.

Pages 8 and 9 contain five separate charts that describe characteristics of surge-test oscilloscopes, television oscilloscopes, digital readout systems, and 2 and 3-Series plug-in units when used with appropriate oscilloscope. Page 10 contains reference charts on spectrum analyzer plug-in units and page 11 contains charts on sampling type oscilloscopes.

REFERENCE INFORMATION

Page 13 explains the significance of characteristics in terms of measurement capability. Much of the information on bandwidth and risetime will be helpful in judging the applicability of various instruments to a measurement problem. Page 14 discusses Tektronix-manufactured components and also contains a chart of available CRT phosphors with technical data as well as suggested areas of usage.

DEFINITIONS AND ABBREVIATIONS

Pages 15 through 17 are a new feature of this catalog. These definitions represent our concept of the terms used in this catalog. The abbreviations are primarily derived from IEEE standards.

FOR QUICK COMPARISONS

The first page of each major instrument description includes a characteristic summary that contains details of the vertical, horizontal, and CRT systems. Thus, a glance between summaries of two instruments should point out their major differences.

ACCESSORIES

Page 251 is a table of contents for the many accessories listed on pages 252 through 280.

FIELD OFFICE ASSISTANCE

Tektronix maintains 47 domestic and international field offices as well as 31 distributors with 44 offices spread throughout the world. These offices are staffed with qualified field engineers who specialize in solving measurement problems. They provide a direct communication link between you and the factory and are the people to contact for assistance. Please call or visit your nearest field office for details on applications, maintenance, or instrument orders. You'll find these offices listed on pages 285 through 287.

Ordering information such as terms, shipment, and warranty details are contained on pages 283 and 284.

INDEX

The last two pages contain a comprehensive index of (1) instruments in numerical order according to type numbers, and (2) accessories by subject.

Contents

TYPE		PAGE
How to Use the Catalog		1
Contents		2
Reference Charts		4
Reference Information		13
Abbreviations		15
Definitions		16
	PORTABLE OSCILLOSCOPES	
310A	DC to 4 MHz	18
317, RM17	DC to 10 MHz	20
321A	DC to 6 MHz, AC/DC or Battery	23
422, R422	DC to 15 MHz, AC, AC/DC or Battery	26
453, R453	DC to 50 MHz—Sweep Delay	29
	OSCILLOSCOPES WITHOUT PLUG-IN UNITS	
502A, RM502A	100 μV/cm Dual-Beam	33
503, RM503	DC to 450 kHz, X-Y	36
504, RM504	DC to 450 kHz	38
507	High Voltage, Surge Test	238
515A, RM15	DC to 15 MHz	40
516	DC to 15 MHz—Dual-Trace	42
	HIGH-SPEED OSCILLOSCOPE	
519	DC to 1 GHz	44
	TELEVISION OSCILLOSCOPES	
524AD	DC to 10 MHz	47
526	Color TV Vectorscope	49
529, RM529	Waveform Monitor	52
	OSCILLOSCOPES THAT USE LETTER AND 1-SERIES PLUG-IN UNITS	
531A, RM31A	DC to 15 MHz	56
535A, RM35A	DC to 15 MHz—Sweep Delay	56
533A, RM33A	DC to 15 MHz—X100 Magnifier	59
536	DC to 10 MHz—X-Y	62
543B, RM543B	DC to 33 MHz—X100 Magnifier	65
545B, RM545B	DC to 33 MHz—Sweep Delay	65
544, RM544	DC to 50 MHz—X100 Magnifier	69
546, RM546	DC to 50 MHz—Sweep Delay	72
547, RM547	DC to 50 MHz—Automatic Display Switching	72
549	DC to 30 MHz Storage—Sweep Delay	76
551	DC to 27 MHz—Dual-Vertical, Dual-Beam	80
555	DC to 33 MHz—Sweep Delay, Dual-Beam	83
556, R556	DC to 50 MHz—Dual-Vertical and Horizontal —Dual-Beam—Sweep Delay	86
	LETTER AND 1-SERIES PLUG-IN UNITS	
B	High-Gain	90
CA	Dual-Trace DC	91
D	High-Gain DC Differential	92
E	Low-Level AC Differential	93
G	Wide-Band DC Differential	94
H	Wide-Band, High-Gain DC	95
K	Fast-Rise DC	96
L	Fast-Rise, High-Gain	97
M	Four-Trace DC	98
O	Operational Amplifier	99
Q	Transducer and Strain Gage	101
R	Transistor Risetime	238
S	Diode Recovery	238
T	Time-Base Generator	103
W	High-Gain Differential Comparator	104
Z	High-Gain Differential Comparator	238
1A1, 1A2	Wide-Band, High-Gain Dual-Trace	106
1A7	High-Gain DC Differential	108
	1-SERIES SPECTRUM ANALYZER UNITS	
1L10	1 to 36 MHz	111
1L20, 1L30	Multi-Band 10 MHz—10.5 GHz	112
	1-SERIES SAMPLING PLUG-IN UNITS	
1S1	Wide-Band	114
1S2	Reflectometer and Wide-Band	116
	OSCILLOSCOPES THAT USE 2 AND 3-SERIES PLUG-IN UNITS	
561A, RM561A	DC to 15 MHz—X-Y	118
564, RM564	Split-Screen Storage	122
565, RM565	Dual-Beam—Delayed Sweep	127
	DIGITAL READOUT OSCILLOSCOPES AND PLUG-IN UNITS	
567, RM567	Digital Readout Oscilloscope	131
6R1A	Digital Unit	135
3A2	Dual-Trace Unit	138
3B2	Time-Base Unit	138
3S3	Sampling Probe Dual-Trace Unit	139
3S76	Dual-Trace Sampling Unit	140
3T4	Programmable Sampling Sweep Unit	141
3T77A	Sampling Sweep Unit	142
262	Programmer	143
	Sampling Accessories	145
	2 AND 3-SERIES PLUG-IN UNITS	
2A60	DC to 1 MHz	147
2A61	Low-Level Differential	147
2A63	DC to 300 kHz Differential	148
2B67	Time-Base	148
3A1	Dual-Trace DC to 10 MHz	149
3A6	Dual-Trace DC to 10 MHz	149
3A3	100 μV/div DC Differential	150
3A5	DC to 15 MHz Automatic/Programmable Amplifier	152
3B5	Automatic/Programmable Time-Base	153
3A7	High-Gain Differential Comparator	154
3A8	Operational Amplifier	155
3A72	Dual-Trace DC to 650 kHz	157

Contents

3A75 DC to 4 MHz 157
3A74 Four-Trace DC to 2 MHz 158
3B1 Time-Base—Delayed Sweep 159
3B3 Time-Base—Delayed Sweep 160
3B4 Time-Base—X50 Magnifier 161
3C66 Carrier Amplifier 162

3-SERIES SPECTRUM ANALYZER UNIT

3L10 1 to 36 MHz 164

3-SERIES SAMPLING PLUG-IN UNITS

3S3 Sampling-Probe Dual-Trace 166
3S76 Dual-Trace Sampling 167
3T4 Programmable Sampling Sweep 168
3T77A Sampling Sweep 169

CURVE-TRACER OSCILLOSCOPES

570 Vacuum Tube Curve Tracer 238
575 Transistor Curve Tracer 170
175 High-Current Adapter for Type 575 170

HIGH-FREQUENCY OSCILLOSCOPES THAT USE TYPE 80-SERIES PLUG-IN UNITS

581A DC to 85 MHz 175
585A, RM585A DC to 85 MHz—Sweep Delay 175

80-SERIES PLUG-IN UNITS

81 Plug-In Adapter (for 1 and Letter-Series Plug-In Units) 179
82 Dual-Trace DC to 85 MHz 180
86 DC to 85 MHz 181

OSCILLOSCOPES THAT USE 10 AND 11-SERIES PLUG-IN UNITS

647, RM647 DC to 50 MHz—Environmental 182

10 AND 11-SERIES PLUG-IN UNITS

10A1 High-Gain Differential Comparator 185
10A2 Dual-Trace DC to 50 MHz 187
11B1 Time-Base—X50 Magnifier 188
11B2 Time-Base—Delayed Sweep 190
Accessories (Type 647) 192

SAMPLING OSCILLOSCOPE THAT USES 4 AND 5-SERIES PLUG-IN UNITS

661 Sampling 193

4 and 5-SERIES PLUG-IN UNITS

4S1 Dual-Trace Sampling 195
4S2A Dual-Trace Sampling 196
4S3 Sampling-Probe Dual-Trace 197
Sampling Probe 198
5T3 Sampling and Real Time Sweep 199
280 Trigger Countdown 201
292 Semi-Conductor Tester Power Supply 202
Sampling Accessories 203

AUXILIARY INSTRUMENTS

106 Square-wave Generator 206
109 Pulse Generator 207
111 Pretrigger Pulse Generator 208
113 Delay Cable 209
114 Variable Pulse Generator 210
R116 Programmable Pulse Generator 211
122, FM122, RM122 Low-Level Preamplifiers 213
123 Preamplifier 238
125, FM125, RM125 Power Supplies 215
127 Plug-In Unit Power Supply 216
129 Plug-In Unit Power Supply 218
130 L-C Meter 220
132 Plug-In Unit Power Supply 221
133 Plug-In Unit Power Supply 222
160A Power Supply 223
161 Pulse Generator 224
162 Waveform Generator 225
163 Pulse Generator 226
184 Time-Mark Generator 227
191 Constant-Amplitude Signal Generator 228
261 Coaxial Switch 238
263 3A5/3B5 Programmer 229
280 Trigger Countdown 230
281 Time Domain Reflectometer Pulser 231
282 Probe Adapter 231
290 Transistor Switching Time Tester 238
291 Diode Switching-Time Tester 238
292 Semi-Conductor Tester Power Supply 232
R293 Programmable Pulse Generator 233
360 Indicator Unit 235
1121 X100 Amplifier 236

Limited Demand (Types 507, 570, 123, 261, 290, 291, R, S, Z, 500A/500/53A) 238
Cameras 239
Scope-Mobile® Carts 250
Accessory Contents 251
Probe Compatibility Chart 252
Accessories 254

Instrument Dimensions 281
Shipping Weights and Volumes 282
General and Ordering Information 283
Field Offices and Overseas Distributors 285
Index, Instrument 288
Index, Accessory ..... Inside Back Cover

Due to the wide range of capabilities of Tektronix Oscilloscopes, some instruments appear more than once 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 Office.

TEKTRONIX OSCILLOSCOPES

(According to Bandwidth Capabilities)

Oscilloscope	Vertical‡ Bandwidth	Risetime	Calibrated Deflection Factor	Vertical Signal Delay	Calibrated Sweep Delay	Calibrated Sweep Range	Magnifier Max Cal Sweep Range	Price	Page
Type 530, 540, 550, 580†† SeriesⒶ	Equiv to DC to 3900 MHz	90 ps	5 mV/div to 500 mV/div	No	Time Positions through full time base (uncalibrated)	10 ns/div to 1 μs/div	2, 5, 10, 20, 50, 100 X 100 ps/cm		
Type 661Ⓑ	Equiv to DC to 3900 MHz	90 ps	2 mV/cm to 200 mV/cm	No		1 ns/cm to 100 μs/cm and 0.2 ms/cm to 5 s/cm (real-time)	2, 5, 10, 20, 50, 100X 10 ps/cm	$1150†	193
Type 661Ⓒ	Equiv to DC to 1000 MHz	0.35 ns	2 mV/cm to 200 mV/cm	Yes			2, 5, 10, 20, 50, 100 X 10 ps/cm to 100 ps/cm	$1150†	193
Type 530,Ⓓ **540, 550, 580†† Series**	Equiv to DC to 1000 MHz	0.35 ns	2 mV/cm to 200 mV/cm	Yes		1 ns/cm to 50 μs/cm			
Type 519	DC to 1000 MHz	0.35 ns	less than 10 V/cm	Yes	0 to 35 ns	2 ns/cm to 1 μs/cm	None	$3900	44
***Type 561A**Ⓔ	Equiv to DC to 875 MHz	0.4 ns	2 mV/div to 200 mV/div	Yes	Time Positions through full time base (uncalibrated)	0.2 ns/div to 10 μs/div	10X 20 ps/div	$ 500†	118
***Type 564**Ⓔ **Storage**		0.4 ns	Same features as Type 561A (above) plus SPLIT-SCREEN STORAGE of signal information.					$ 875†	122
***Type 567**Ⓔ **Readout**		0.4 ns	Same features as Type 561A (above) plus DIGITAL READOUT of pulse risetime, pulse width, time differences (with Type 6R1A Digital Unit).					$ 700†	131
Type 581AⒻ	DC to 85 MHz	4.2 ns	100 mV/cm to 50 V/cm	Yes	None	50 ns/cm to 2 s/cm	5X 10 ns/cm	$1425†	175
***Type 585A**Ⓕ		4.2 ns	100 mV/cm to 50 V/cm	Yes	2 μs to 10 s	50 ns/cm to 2 s/cm	5X 10 ns/cm	$1725†	175
***Type 453**	DC to 50 MHz	7 ns	5 mV/div to 10 V/div	Yes	1 μs to 50 s	0.1 μs/div to 5 s/div	10X 10 ns/div	$2050	29
***Type 544**Ⓖ		7 ns	50 mV/cm to 20 V/cm	Yes	None	0.1 μs/cm to 5 s/cm	2, 5, 10, 20, 50, 100X 10 ns/cm	$1550†	69
***Type 546**Ⓖ		7 ns	50 mV/cm to 20 V/cm	Yes	0.1 μs to 50 s	0.1 μs/cm to 5 s/cm	2, 5, 10X 10 ns/cm	$1750†	72
***Type 547**Ⓖ **Display-Switching**		7 ns	50 mV/cm to 20 V/cm	Yes	0.1 μs to 50 s	0.1 μs/cm to 5 s/cm	2, 5, 10X 10 ns/cm	$1875†	72
***Type 556**Ⓖ **Dual-Beam Dual Vertical and Sweep**		7 ns	50 mV/cm to 20 V/cm	Yes	0.1 μs to 50 s	0.1 μs/cm to 5 s/cm	10X 10 ns/cm	$3150†	86
***Type 647**Ⓗ **Environmentalized**		7 ns	10 mV/cm to 20 V/cm	Yes	1 μs to 50 s	0.1 μs/cm to 5 s/cm	10X 10 ns/cm	$1350†	182

‡ Frequency Specifications are at 3-dB down.
† Price does not include Plug-In Units.
†† A Type 81 Adapter is required.
* Rack-Mount models are available.
Ⓐ When used with Type 1S2 Sampling Plug-In Unit.
Ⓑ When used with Types 4S2A and 5T3 Sampling Plug-In Units.
Ⓒ When used with Types 4S1 and 5T3 Sampling Plug-In Units.
Ⓓ When used with Type 1S1 Sampling Plug-In Unit.
Ⓔ When used with Types 3S76 and 3T77A Sampling Plug-In Units.
Ⓕ When used with Type 82 or 86 Plug-In Units, 10 mV/cm at DC to 80 MHz.
Ⓖ When used with Type 1A1 Plug-In Preamplifier, 5 mV/cm at DC to 28 MHz.
Ⓗ When used with Type 10A2 Amplifier and Type 11B2 Time Base Unit.

TEKTRONIX OSCILLOSCOPES

(According to Bandwidth Capabilities)

Oscilloscope	Vertical ‡ Bandwidth	Risetime	Calibrated Deflection Factor	Vertical Signal Delay	Calibrated Sweep Delay	Calibrated Sweep Range	Magnifier Max Cal Sweep Range	Price	Page
***Type 543B**Ⓘ	DC to 33 MHz	10.5 ns	50 mV/cm to 20 V/cm	Yes	None	0.1 μs/cm to 5 s/cm	2, 5, 10, 20, 50, 100 X 20 ns/cm	$1300†	65
***Type 545B**Ⓘ		10.5 ns	50 mV/cm to 20 V/cm	Yes	1 μs to 10 s	0.1 μs/cm to 5 s/cm	5X 20 ns/cm	$1550†	65
Type 555Ⓙ **Dual-Beam**		10.5 ns	50 mV/cm to 20 V/cm	Yes	0.1 μs to 50 s	0.1 μs/cm to 5 s/cm	5X 20 ns/cm	$2650†	83
Type 549Ⓘ **Storage**	DC to 30 MHz	12 ns	50 mV/cm to 20 V/cm	Yes	1 μs to 10 s	0.1 μs/cm to 5 s/cm	5X 20 ns/cm	$2375†	76
Type 551Ⓚ **Dual-Beam**	DC to 27 MHz	13 ns	50 mV/cm to 20 V/cm	Yes	None	0.1 μs/cm to 5 s/cm	5X 20 ns/cm	$1850†	80
***Type 515A**	DC to 15 MHz	23 ns	50 mV/cm to 20 V/cm	Yes	None	0.2 μs/cm to 2 s/cm	5X 40 ns/cm	$ 875	40
Type 516 Dual-Trace		23 ns	50 mV/cm to 20 V/cm	Yes	None	0.2 μs/cm to 2 s/cm	5X 40 ns/cm	$1070	42
***Type 531A**Ⓛ		23 ns	50 mV/cm to 20 V/cm	Yes	None	0.1 μs/cm to 5 s/cm	5X 20 ns/cm	$ 995†	56
***Type 533A**Ⓛ		23 ns	50 mV/cm to 20 V/cm	Yes	None	0.1 μs/cm to 5 s/cm	2, 5, 10, 20, 50, 100 X 20 ns/cm	$1125†	59
***Type 535A**Ⓛ		23 ns	50 mV/cm to 20 V/cm	Yes	2 μs to 10 s	0.1 μs/cm to 5 s/cm	5X 20 ns/cm	$1400†	56
***Type 422 Dual-Trace AC or Battery Portable**	DC to 15 MHz 5 Hz to 5 MHz	23 ns 70 ns	10 mV/div to 20 V/div 1 mV/div	Yes	None	0.5 μs/div to 0.5 s/div	10X 50 ns/div	$1400	26
Type 536Ⓜ **X-Y**	DC to 11 MHz	31 ns	50 mV/div to 20 V/div	No	None	0.2 μs/div to 2 s/div	5X 40 ns/div	$1085†	62
***Type 317 3" Portable**	DC to 10 MHz	35 ns	10 mV/div to 50 V/div	Yes	None	0.2 μs/div to 2 s/div	5X 40 ns/div	$ 875	20
***Type 561A**Ⓝ		35 ns	10 mV/div to 10 V/div	Yes	0.5 μs to 10 s	0.5 μs/div to 1 s/div	5X 0.1 μs/div	$ 500†	118
***Type 564**Ⓝ **Storage**		Same features as Type 561A (above) plus SPLIT-SCREEN STORAGE of signal information.						$ 875†	122
***Type 565**Ⓞ **Dual-Beam**		35 ns	10 mV/div to 10 V/div	No	10 μs to 50 s	1 μs/div to 5 s/div	10X 0.1 μs/div	$1400†	127
Type 321A AC or Battery 3" Portable	DC to 6 MHz	58 ns	10 mV/div to 20 V/div	No	None	0.5 μs/div to 0.5 s/div	5X 0.1 μs/div	$ 900	23
Type 310A 3" Portable	DC to 4 MHz	0.1 μs 90 ns	10 mV/div to 0.1 V/div 0.1 V/div to 50 V/div	No	None	0.5 μs/div to 0.2 s/div	5X 0.1 μs/div	$ 675	18
***Type 503 Differential and X-Y**	DC to 450 kHz	0.75 μs	1 mV/cm to 20 V/cm	No	None	1 μs/cm to 5 s/cm	2, 5, 10, 20, and 50X 0.1 μs/cm	$ 640	36
***Type 504**		0.75 μs	5 mV/cm to 20 V/cm	No	None	1 μs/cm to 0.5 s/cm	None	$ 540	38
***Type 502A Dual-Beam and X-Y**	DC to 50 kHz increasing to DC to 1 MHz		100 μV/cm to 20 V/cm	No	None	1 μs/cm to 5 s/cm	2, 5, 10, and 20X 1 μs/cm	$1050	33

‡ Frequency Specifications are at 3-dB down.
† Price does not include Plug-In Units.
* Rack-Mount models are available.
Ⓘ When used with Type 1A1 Plug-In Preamplifier, 5 mV/cm at DC to 23 MHz.
Ⓙ When used with Type 1A1 Plug-In Preamplifier, 5 mV/cm at DC to 23 MHz. Type 555 is designed for 2 Plug-In Preamplifiers.
Ⓚ When used with Type 1A1 Plug-In Preamplifier, 5 mV/cm at DC to 21 MHz. Type 551 is designed for 2 Plug-In Preamplifiers.
Ⓛ When used with Type 1A1 Plug-In Preamplifier, 5 mV/cm at DC to 14 MHz.
Ⓜ When used with Type 1A1 Plug-In Preamplifier and Type T Plug-In Time Base.
Ⓝ When used with Type 3A6 Plug-In Amplifier and Type 3B3 Plug-In Time Base.
Ⓞ When used with Type 3A1 Plug-In Amplifier, Type 565 is designed for 2 Plug-In Amplifiers.

CHARACTERISTICS OF TEKTRONIX OSCILLOSCOPES

PLUG-IN UNIT TYPE		PAGE	PRICE	CALIBRATED DEFLECTION FACTOR	Type 531A*, 533A*, 535A*
1A1	*Wide-Band, High-Gain Dual-Trace Unit*	106	$ 600	≈500 μV/cm, 5 mV/cm 50 mV/cm to 20 V/cm	35 ns; 2 Hz to 10 MHz 25 ns; DC to 14 MHz 23 ns; DC to 15 MHz
1A2	*Wide-Band Dual-Trace Unit*	106	325	50 mV/cm to 20 V/cm	23 ns; DC to 15 MHz
1A7	*High-Gain Differential Unit*	108	425	10 μV/cm to 10 V/cm	
1L10	*Spectrum Analyzer Unit*	111	1100	Sensitivity: to —100 dBm at 1-kHz resolution	
1L20	*Spectrum Analyzer Unit*	112	1825	Sensitivity: to —110 dBm at 1-kHz resolution	
1L30	*Spectrum Analyzer Unit*	112	1825	Sensitivity: to —105 dBm at 1-kHz resolution	
1S1	*Sampling Unit*	114	1100	2 mV/cm to 200 mV/cm	
1S2	*Time Domain Reflectometer and Wide-Band Sampler*	116	1300	ρ = 0.005/div to 0.5/div 5 mV/div to 500 mV/div	
B	*High-Gain Unit*	90	145	5 mV/cm to 20 mV/cm 50 mV/cm to 20 V/cm	35 ns; 2 Hz to 10 MHz 25 ns; DC to 14 MHz
CA	*Dual-Trace DC Unit*	91	260	50 mV/cm to 20 V/cm	23 ns; DC to 15 MH
D	*High-Gain Differential Unit*	92	170	1 mV/cm to 50 V/cm	
E	*Low-Level AC Differential Unit*	93	190	50 μV/cm to 10 mV/cm	
G	*Wide-Band DC Differential Unit*	94	190	50 mV/cm to 20 V/cm	25 ns; DC to 14 MHz
H	*Wide-Band; High-Gain DC Unit*	95	185	5 mV/cm to 20 V/cm	31 ns; DC to 11 MHz
K	*Fast-Rise DC Unit*	96	145	50 mV/cm to 20 V/cm	23 ns; DC to 15 MHz
L	*Fast-Rise High-Gain Unit*	97	210	5 mV/cm to 2 V/cm 50 mV/cm to 20 V/cm	23 ns; 3 Hz to 15 MHz 23 ns; DC to 15 MHz
M	*Four-Trace Unit*	98	525	20 mV/cm to 10 V/cm	25 ns; DC to 14 MHz
O	*Operational Amplifier Unit*	99	525	50 mV/cm to 20 V/cm	
Q	*Strain Gage Unit*	101	325	10 μstrain/div to 10,000 μstrain/div	
T	*Time-Base Generator Unit*	103	240		
W	*High-Gain Differential Comparator Unit*	104	575	1 mV/cm to 1 mV/cm 50 V/cm 50 mV/cm	50 ns; DC to 7 MHz 26 ns; DC to 13.5 MHz

*Rack-Mount Models are available.

†Uses "1" Series and Letter-Series Plug-In Units with Type 81 Adapter.

WITH "1" SERIES AND LETTER SERIES PLUG-IN PREAMPLIFIERS

Type 536	Type 543B*, 545B*, 555, 581A†, 585A†*	Type 544*, 546*, 547*, 556*	Type 549	Type 551
RISETIME AND BANDWIDTH OF OSCILLOSCOPE AND PLUG-IN UNIT				
44 ns; 2 Hz to 8 MHz 33 ns; DC to 10.5 MHz 31 ns; DC to 11 MHz	25 ns; 2 Hz to 14 MHz 15 ns; DC to 23 MHz 10.5 ns; DC to 33 MHz	23 ns; 2 Hz to 15 MHz 12.5 ns; DC to 28 MHz 7 ns; DC to 50 MHz	25 ns; 2 Hz to 14 MHz 15 ns; DC to 23 MHz 12 ns; DC to 30 MHz	26 ns; 2 Hz to 13 MHz 16.5 ns; DC to 21 MHz 13 ns; DC to 27 MHz
31 ns; DC to 11 MHz	10.5 ns; DC to 33 MHz	7 ns; DC to 50 MHz	12 ns; DC to 30 MHz	13 ns; DC to 27 MHz
0.7 μs; DC to 500 kHz; Bandwidth at high and low —3 dB points is selectable.				
Frequency range is 1 to 36 MHz.				
Frequency range is 10 MHz to 4.2 GHz.				
Frequency range is 925 MHz to 10.5 GHz.				
350 ps risetime (corresponding to an equivalent bandwidth of 1 GHz), equivalent sweep range of 100 ps/cm to 50 μs/cm, 50 Ω input.				
90 ps risetime (corresponding to an equivalent bandwidth of 3.9 GHz), full scale time measurements to 10 μs; distance measurements to 1 km.				
40 ns; 2 Hz to 9 MHz 35 ns; DC to 10 MHz	30 ns; 2 Hz to 12 MHz 18 ns; DC to 20 MHz			30 ns; 2 Hz to 12 MHz 20 ns; DC to 18 MHz
[illegible]s; DC to 10 MHz	15 ns; DC to 24 MHz			16 ns; DC to 22 MHz
0.18 μs; DC to 300 kHz, increasing to 2 MHz.				
6 μs; 0.06 Hz to 20 kHz, increasing to 60 kHz.				
35 ns; DC to 10 MHz	18 ns; DC to 20 MHz			20 ns; DC to 18 MHz
37 ns; DC to 9.5 MHz	23 ns; DC to 15 MHz			25 ns; DC to 14 MHz
31 ns; DC to 11 MHz	12 ns; DC to 30 MHz			14 ns; DC to 25 MHz
35 ns; 3 Hz to 10 MHz 31 ns; DC to 11 MHz	15 ns; 3 Hz to 24 MHz 12 ns; DC to 30 MHz			16 ns; 3 Hz to 22 MHz 14 ns; DC to 25 MHz
35 ns; DC to 10 MHz	17 ns; DC to 20 MHz			18 ns; DC to 19 MHz
Performs precise operations of integration, differentiation, function generation, and linear or non-linear amplification.				
60 μs risetime, DC to 6 kHz, measures force, displacement, acceleration, strain . . . any mechanical quantity that can be converted to a change in resistance, capacitance, or induction.				
Generates a sawtooth sweep in 22 calibrated steps from 0.2 μs/div to 2 s/div plus X5 magnifier. Triggering facilities include Manual, Automatic, HF Sync and Line, either AC or DC-coupled.				
54 ns; DC to 6.5 MHz 34 ns; DC to 10.5 MHz	44 ns; DC to 8 MHz 15 ns; DC to 23 MHz			44 ns; DC to 8 MHz 17 ns; DC to 20.5 MHz

HIGH-VOLTAGE SURGE-TEST OSCILLOSCOPES

Oscilloscope	Risetime	Deflection Factor	Signal Delay	Sweep Delay	Calibrated Sweep Range	Sweep Magnifier	Accel Potential	Price	Page
Type 507	10 ns	Approximately 50 V/cm to 500 V/cm	Ext Cable†	None	20 ns/cm to 50 μs/cm	None	24 kV	$2900	238

†Cable not supplied with instrument.

TELEVISION OSCILLOSCOPES

Instrument	Risetime	Calibrated Deflection Factor	Signal Delay	Vertical Response	Calibrated Sweep Range	Sweep Magnifier	Accel Potential	Price	Page
Type 524AD Oscilloscope	35 ns	15 mV/cm to 20 V/cm	Yes	Normal, Flat, IEEE	0.1 μs/cm to 0.01 s/cm	3 and 10X	4 kV	$1300	47
Type 526 Vectorscope	Dual Channel displays, with either vector or linear-sweep presentation of demodulated chroma signal.						4 kV	$1665	49
Type 529* Waveform Monitor		For 6 cm deflection: 1 V, 0.5 V, and 0.2 V steps; 120 mV to 1.5 V (uncalibrated variable range)	No	Flat, IEEE, Low-Pass, High-Pass	0.125 H/cm, Field and Line Rates	5 and 25X	5.5 kV	$1050	52

*Rack-Mount models are available.

TIME-BASE UNITS FOR TYPE 560-SERIES OSCILLOSCOPES

Plug-In Type	Sweep Range*	Magnifier	Triggering	Price	Page
2B67 Single Sweep	1 μs/div to 5 s/div, 1-2-5 sequence.	5X	Internal, External, Line; amplitude-level selection; AC or DC-coupled; automatic or free run; ±slope.	$ 210	148
3B1 Sweep Delay	0.5 μs/div to 1 s/div, 1-2-5 sequence (for both normal and delayed sweeps).	5X	Internal, External; amplitude-level selection; AC or DC-coupled; automatic (normal sweep only) or free-run; ± slope.	$ 535	159
3B2 Calibrated Sweep Delay	2 μs/div to 1 s/div, 1-2-5 sequence. Continuously variable calibrated delay from 5 μs to 10.5 s.	No	Internal, External, Line; amplitude-level selection; AC or DC-coupled; ± slope.	$ 650	138
3B3 Calibrated Sweep Delay Single Sweep	0.5 μs/div to 1 s/div, 1-2-5 sequence (for both normal and delayed sweeps). Continuously variable calibrated delay from 0.5 μs to 10 s.	5X	Internal, External; amplitude-level selection, AC or DC-coupled, ± slope. Normal sweep has in addition: automatic and line plus single sweep.	$ 585	160
3B4 Direct-Reading Magnifier Single Sweep	0.2 μs/div to 5 s/div, 1-2-5 sequence. Magnifier reads sweep range directly up to 50 ns/div.	up to 50X	Internal, External, External ÷10, Line; amplitude-level selection, AC, AC low-frequency reject or DC-coupling; free-run, automatic, or normal modes; ± slope.	$ 400	161
3B5 Automatic/ Programmable	5 s/div to 0.1 μs/div, 1-2-5 sequence.	10X and 100X	Internal, External; amplitude-level selection; AC or DC-coupled; automatic; ± slope.	$ 890	153
3T4 Programmable Sampling Sweep (use with 3S3 or 3S76)	Equivalent sweep range 1 ns/div to 200 μs/div, 1-2-5 sequence. Programmable through front-panel connector.	10X	Internal (3S76 only) or External, ±slope.	$1300	168
3T77A Sampling Sweep (use with 3S3 or 3S76)	Equivalent sweep range 0.2 ns/div to 10 μs/div, 1-2-5 sequence.	10X	Internal (3S76 only), or External, ± slope.	$ 650	169

*Variable between steps, uncalibrated.

Type 561A, RM561A, 564, and RM564 Oscilloscopes use any of these Plug-in Units.

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

AMPLIFIER UNITS FOR TYPE 560-SERIES OSCILLOSCOPES

Plug-In Type	Bandwidth (3-dB down)	Calibrated Deflection Factor*	Input (AC or DC-coupled)	Price	Page
2A60	DC—1 MHz	50 mV/div—50 V/div in 4 steps.	1 megohm shunted by 47 pF, 600 volts max	$ 105	147
2A61 Low-Level Differential	0.06 Hz—300 kHz	10 μV/div—20 mV/div, 1-2-5 sequence.	10 megohm—50 pF; ±5 V (AC-coupled only)	$ 385	147
2A63 Differential 50:1 rejection ratio	DC—300 kHz	1 mV/div—20 V/div, 1-2-5 sequence.	1 megohm shunted by 20 pF, 600 volts max	$ 150	148
3A1 Dual-Trace (Identical Channels)	DC—10 MHz	10 mV/div—20 V/div, 1-2-5 sequence.		$ 450	149
3A2 Dual-Trace (Identical Channels)	DC—500 kHz	10 mV/div—10 V/div, 1-2-5 sequence.		$ 500	138
3A3 Dual-Trace Differential	Selectable DC—5 kHz or DC—500 kHz	100 μV/div—10 V/div, 1-2-5 sequence.		$ 790	150
3A5 Automatic/ Programmable	DC—15 MHz DC—5 MHz	10 mV/div—50 V/div, 1-2-5 sequence. 1 mV/div—5 mV/div, 1-2-5 sequence.	1 megohm shunted by 24 pF, 600 volts max	$ 760	152
3A6 Dual-Trace (Identical Channels)	DC—10 MHz	Identical to Type 3A1 above but with internal delay line.	1 megohm shunted by 47 pF, 600 volts max	$ 540	149
3A7 High Gain Differential Comparator	DC—10 MHz, decreasing to DC—4 MHz	1 mV/div—50 V/div, 1-2-5 sequence, plus 4-step decade attenuator.	1 megohm shunted by 20 pF, 500 volts max	$ 635	154
3A8 Operational Amplifier	DC—3.5 MHz	20 mV/div—10 V/div.	1 megohm shunted by 47 pF, 600 volts max	$ 600	155
3A72 Dual-Trace (Identical Channels)	DC—650 kHz	10 mV/div—20 V/div, 1-2-5 sequence.		$ 275	157
3A74 Four-Trace (Identical Channels)	DC—2 MHz	20 mV/div—10 V/div, 1-2-5 sequence.		$ 590	158
3A75	DC—4 MHz	50 mV/div—20 V/div, 1-2-5 sequence.		$ 175	157
3C66 Strain Gage	DC—5 kHz	10 μstrain/div—10,000 μstrain/div, 1-2-5 sequence.	120 Ω strain gage bridge	$ 400	162
3L10 Spectrum Analyzer	1—36 MHz	—100 dBm at 2 kHz/div dispersion and 1 kHz (coupled) resolution	50 Ω and 600 Ω	$1200	164
3S3 Dual-Trace Sampling (Use with 3T77A or 3T4)	DC to equivalent 1 GHz (0.35 ns risetime)	5 mV/div—100 mV/div, 1-2-5 sequence.	100 kΩ, 2 pF, ±3 V max	$1500 (with probes)	166
3S76 Dual-Trace Sampling (Use with 3T77A or 3T4)	DC to equivalent 875 MHz (0.4 ns risetime)	2 mV/div—200 mV/div, 1-2-5 sequence.	50 Ω, 2 volts P to P max DC-coupled	$1100	167

*Variable between steps, uncalibrated.

Type 561A, RM561A, 564, and RM564 Oscilloscopes use any of these Plug-In Units.

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

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

SPECTRUM ANALYZER PLUG-IN UNITS

		SINGLE-BAND GENERAL PURPOSE		MULTI-BAND (5) HIGH FREQUENCY	
CHARACTERISTICS		3L10	1L10	1L20	1L30
FREQUENCY COVERAGE		1—36 MHz		10—4200 MHz	925—10,500 MHz
SENSITIVITY (dBm)		—100		—110 to —90	—105 to —75
CALIBRATED DISPERSION		10 Hz/div to 2 kHz/div calibrated, plus uncalibrated search. Internal 4 kHz crystal controlled frequency calibrator.	10 Hz/cm to 2 kHz/cm calibrated, plus uncalibrated search.	1 kHz/cm to 10 MHz/cm; 1-2-5 sequence plus uncalibrated search.	
IF CENTER FREQ CONTROL		Range: ±4 kHz max	NA	Range: ±25 MHz max	
DISPLAY FLATNESS		±1 dB		± 1.5 dB (over 100 MHz Dispersion)	
RESOLUTION BANDWIDTH		10 Hz to 1 kHz. Coupled to dispersion.		1 kHz to 100 kHz. Coupled to dispersion.	
INCIDENTAL FM		IF—5 Hz LO—26-61 Hz		Less than 300 Hz with Phase Lock.	
ATTENUATOR (1-dB Step)		(RF) 51 dB, ±0.1 dB per dB		(IF) 51 dB, ±0.1 dB per dB	
IF GAIN CONTROL		60 dB (variable)		50 dB (variable)	
DISPLAY	LOG	50 dB, 8-div vertical display	50 dB, 6-cm vertical display	40 dB, 6-cm vertical display	
	LINEAR	20 dB, 8-div vertical display	26 dB, 6-cm vertical display	26 dB, 6-cm vertical display	
	LINEAR X10	NA	26 dB, 6-cm vertical display	NA	
	SQUARE LAW	NA	NA	13 dB, 6-cm vertical display	
	VIDEO	100 mV/cm (variable), DC to 50 kHz, ≅ 50 Ω input resistance	100 mV/cm (variable), ≤16 Hz to ≥10 MHz, ≅50 Ω input resistance	100 mV/cm (variable), ≤16 Hz to ≥10 MHz, ≅50 Ω input resistance.	
INSTRUMENT USED WITH		Type 560 Series Oscilloscopes	Type 530, 540, 550, and 580* Series Oscilloscopes	Type 530, 540, 550, and 580* Series Oscilloscopes	
INSTRUMENT		Type 3L10	Type 1L10	Type 1L20	Type 1L30
PRICE		$1200	$1100	$1825	$1825
PAGE		164	111	112	112

*Requires a Type 81 Adapter.

DIGITAL READOUT COMBINATIONS

Digital plus analog displays are simultaneously presented on the Type 567 Oscilloscope and Type 6R1A Digital Unit. A Digital Readout Combination consists of a Type 567/6R1A and any of 5 combinations of vertical and horizontal Plug-In Units; Type 3S3/3T77A, 3S76/3T77A, 3A2/3B2, 3S3/3T4, or 3S76/3T4. Other 2-Series and 3-Series Plug-In Units can be used for normal analog CRT display, but do not provide digital readout.

X & Y Plug-Ins	Risetime	Calibrated Deflection Factor	Input RC or Impedance	Calibrated Sweep Range	Time Position	Digital Resolution	Trigger	System Price
3S3/3T77A*	0.35 ns	5 mV/div to 100 mV/div	100 kΩ, 2 pF	equiv 0.2 ns/div to 10 μs/div plus 10X magnifier	Through full time base	10 or 100 dots per div	External	$5450 (including 2 probes)
3S76/3T77A*	0.4 ns	2 mV/div to 200 mV/div	50 Ω				Internal or External	$5050
3A2/3B2	0.7 μs	10 mV/div to 10 V/div	1 MΩ, 47 pF	2 μs/div to 1 s/div	5 μs to 10.5 s	1 μs to 10 ms clock rate in decades		$4450

***The Type 3T4** Programmable Sampling Sweep can be programmed through a front panel connector. Programmable functions include sweep range (1 ns/div to 200 μs/div), 3 calibrated sweep delay ranges (1 μs to 1 ms), samples per sweep (100 or 1000 or alternately 100 or 1000) and single display for real-time measurements. Type 3T4 ..... $1300.

SAMPLING PLUG-IN UNITS FOR TYPE 530, 540, 550, AND 580* SERIES OSCILLOSCOPES

Plug-In	Input Impedance	Risetime	Calibrated Deflection Factor	Signal Delay	Trigger	Time Position	Equivalent Sweep Range	Samples Per Centimeter	Price	Page
1S1	50 Ω	0.35 ns	2—200 mV/cm, 1-2-5 sequence	Yes	Internal or External	0 to 500 μs	100 ps/cm to 50 μs/cm	Variable from approx 5 samples/cm to over 700 samples/cm	$1100†	114
1S2	50 Ω	90 ps	5—500 mV/cm, 1-2-5 sequence	No	External	Through full time base	0.1 ns/cm to 1 μs/cm	Selected by resolution switch	$1300†	116

*A Type 81 Adapter is required. †Price does not include oscilloscope.

SAMPLING SYSTEM FOR TYPE 560-SERIES OSCILLOSCOPES

Instrument	Input RC or Impedance	Risetime	Calibrated Deflection Factor	Signal Delay	Time Position	Equivalent Sweep Range	Samples Per Division	Trigger	System Price	Page
***Type 561A** with Types 3S76 and 3T77A Units	50 Ω	0.4 ns	2-200 mV/div 1-2-5 sequence	Yes	Through full time base	0.2 ns/div to 10 μs/div plus 10X mag	10 or 100	Internal or External	$2250	118
***Type 561A** with Types 3S3 and 3T77A Units	100 kΩ, 2 pF	0.35 ns	5-100 mV/div 1-2-5 sequence	No				External	$2650 (with probes)	118
***Type 564** with Types 3S76 and 3T77A Units	50 Ω	0.4 ns	Same features as Types 561A, 3S76, 3T77A, (above) plus SPLIT-SCREEN STORAGE of signal information.						$2625	122
***Type 564** with Types 3S3 and 3T77A Units	100 kΩ, 2 pF	0.35 ns	Same features as Types 561A, 3S3, 3T77A, (above) plus SPLIT-SCREEN STORAGE of signal information.						$3025 (with probes)	122
***Type 567** with Types 3S76, 3T77A, and 6R1A Units	50 Ω	0.4 ns	Same features as Types 561A, 3S76, 3T77A (above) plus DIGITAL READ-OUT of pulse risetime, pulse amplitude, pulse width, time differences.						$5050	131
***Type 567** with Types 3S3, 3T77A, and 6R1A Units	100 kΩ, 2 pF	0.35 ns	Same features as Types 561A, 3S3, 3T77A (above) plus DIGITAL READ-of pulse risetime, pulse amplitude, pulse width, time differences.						$5450 (with probes)	131

The Type 3T4 Programmable Sampling Sweep is similar to the Type 3T77A except it can be programmed through a front-panel connector. Programmable functions include sweep range 1 ns/cm to 200 μs/cm), 3 calibrated sweep delay ranges (1 μs to 1 ms), samples per sweep (100 or 1000), and single display for real-time measurements. Type 3T4 — $1300.

* Rack Mount models are available

SAMPLING SYSTEMS FOR TYPE 661 OSCILLOSCOPE

Instruments	Input Impedance or RC	Risetime	Calibrated Deflection Factor	Signal Delay	Time Position	Equivalent Sweep Range	Samples Per Division	Trigger	System Price	Page
Type 661 with Types 5T3 and 4S2A	50 Ω	90 ps	2—200 mV/cm, 1-2-5 sequence	No	Through full time base	10 ps/cm to 100 μs/cm	5, 10, 20, 50, 100, or 1000	Ext only	$3400	193
Type 661 with Types 5T3 and 4S1	50 Ω	0.35 ns		Yes				Int or Ext	$3380	193
Type 661 with Types 5T3 and 4S3	100 kΩ 2 pF	0.35 ns		No				Ext only	$3400 with probes	193

SAMPLING SYSTEM ACCESSORIES

Instrument	Description	Price	Page
Type 280 Trigger Countdown	Allows timing systems to be synchronized up to 5 GHz. Output repetition rate variable from 15 to 45 MHz.	$265	201
281 Time Domain Reflectometry Pulser	Provides 0.5 V pulse with ≤0.75 ns risetime and ≥5 μs width for TDR applications. Uses probe power.	$ 95	231
282 Probe Adapter	Allows many conventional probes to work into 50 Ω. Uses probe power.	$ 95	231
Type 290 Transistor Switching-Time Tester	Measures fast transistors, short duty cycle measurements of delay time, risetime, storage time, and fall time.	$290	238
Type 291 Diode Switching-Time Tester	Measures fast-switching diodes, forward and reverse recovery. Response better than 0.35 ns.	$185	238
Type 292 Semiconductor Tester and Power Supply	Furnishes DC power and provides sub-nanosecond environments for reading out time and charge information about fast semiconductor diodes and transistors.	$325	202

AMPLIFIERS

Instrument	Gain	Frequency Bandwidth‡	Noise Level	Differential Input	Input RC	Output Impedance	Price	Page
***Type 122**	100X or 1000X	0.2 Hz to 40 kHz	1-5 μV, RMS, grounded	Yes	10 megohms, 50 pF	1000 ohms	$ 135	213
Type 123	100X	3 Hz to 25 kHz	7.5 μV, RMS, or less grounded	No	10 megohms	31 kilohms	$ 75	238
Type 1121	100X	5 Hz to 17 MHz 21-ns risetime	50 μV or less P to P, grounded	No	1 megohm, 22 pF	93 ohms	$ 465	236

‡ Bandwidth Specifications are at 3-dB down. * Rack-Mount models are available.

PULSE GENERATORS

Instrument	Frequency or Period	Main Pulse Width	Risetime	Delay	Output Amplitude	Output Impedance	Trigger Req	Price	Page
Type 109	275 to 700 Hz	0.5 ns to 300 ns	<0.25 ns	None	0 to 50 V	50 Ω	None	$ 360	207
Type 111	0 to 100 kHz	2 ns to 0.1 μs	0.5 ns	30 to 250 ns	±5 V	50 Ω	+5 V	$ 365	208
Type 114	1 μs to 10 ms	Squarewave and 100 ns to 1 ms	≤10 ns	None	±1 V to ±10 V	16—84 Ω	+2 V to +20 V	$ 350	210
Type R116 (Programmable)	100 ns to 11 ms	50 ns to 550 μs	10 ns to 110 μs (Selectable)	50 ns to 550 μs	0.4 V to 10 V	50 Ω	+2 V to +20 V	$1550	211
†**Type 161**	0 to 50 kHz	10 μs to 0.1 s	0.5 μs	Variable	0 to ±50 V	1—5 kΩ	+3 V	$ 130	224
†**Type 162**	0 to 10 kHz	100 μs to 10 s	1 μs	None	50 V	1 kΩ	+15 V	$ 130	225
†**Type 163**	0 to 500 kHz	1 μs to 10 ms	0.2 μs	Variable	0 to +25 V	100 Ω—3.5 kΩ	2 V	$ 130	226
Type R293 (Programmable)	10 kHz to 100 kHz	2 ns to 250 ns	1 ns	200 ns	6 V to 12 V	50 Ω	+2 V	$1000	233

† Type 160A Power Supply provides power for up to 7 Type 161 or 162 Generators, 5 Type 163 Generators, or 5 Type 360 Indicators. $190

SIGNAL GENERATORS

Instrument	Description	Price	Page
Type 106	Square-Wave Generator; frequency range is 10 Hz to 1 MHz, risetime ≤1 ns; pos and neg outputs of 50 mV to 500 mV into 50 Ω plus high ampl output with ≤12 ns risetime.	$590	206
Type 184	Time-Mark Generator; marker interval range of 100 ns to 5 s in 1-5-10 sequence, crystal-controlled oscillator.	675	227
Type 191	Constant Amplitude Signal Generator; frequency range is 350 kHz to 100 MHz, 5 mV to 5 V amplitude.	400	228

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 OSCILLOSCOPE

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.

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.

ENVIRONMENTAL CHARACTERISTICS

The following instruments are specifically designed for the more severe environments often encountered when they are used in portable or mobile applications:

321A, 422 and R422, 453 and R453, 647 and RM647.

The environmental characteristics listed include some or all of the following:

Temperature, Altitude, Humidity, Vibration, Shock, Electromagnetic interference (EMI, previously RFI), and Transportation.

Sample production instruments are tested periodically as part of a continual quality control process. Complete tests on every production instrument are undersirable as well as uneconomical.

The specifications for humidity, vibration, shock and transportation are intended to be beyond what can be expected in use, and operation at these extremes may cause minor physical deterioration. Such operation, however, should not cause electrical performance deterioration outside specifications. The specifications for temperature and altitude are such that continual use at the limits will not cause significant short term deterioration. Naturally, higher temperature operation can be expected to reduce long term reliability and should be avoided if possible. The EMI test is completely non-destructive.

For more specific information on the environmental characteristics and how they apply to the above instruments, please refer to the page covering that instrument.

BANDWIDTH AND RISETIME MEASUREMENTS

BANDWIDTH

Frequency-response characteristics are at the 3-dB down points unless otherwise stated.

Equipment for measuring frequency response (bandwidth) 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 sinewave generators must usually be terminated to match their output impedance. For oscilloscopes having an upper frequency response in the area from 350 kilohertz through 100 megahertz, Tektronix uses Type 191 Constant Amplitude Signal Generator to check for high frequency roll-off characteristics.

RISETIME

A characteristic of importance to the pulse-measurement field is risetime. This parameter is generally a good indication of relative bandwidth. In short, faster risetime means greater bandwidth (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 1.4 nanoseconds.

RISETIME MEASUREMENT EQUIPMENT

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 106 Square-wave Generator (approximately 1 ns risetime), or Type 109 Pulse Generator (less than 0.25 ns risetime) for checking risetime of general purpose oscilloscopes.

VOLTAGE RATINGS

In general, peak to peak input voltage ratings are for DC and low-frequency values. Because of possible damage to input components, especially solid-state devices, continuous derating is required as frequency is increased. This is especially true with RF at high-sensitivity settings.

Reference Information

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, 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.

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, wirewound 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 phosphor 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, decay, etc. The following table describes the more commonly used phosphors.

PHOSPHOR DATA CHART

Phosphor	*Fluorescence*	*Phosphorescence*Ⓐ	*Relative Luminance*Ⓑ	*Relative Writing Speed*© *(in % based on P-11 as 100%)*	*Decay to 0.1% (time in ms)*	*Comments*
P-1	Yellowish-green	—	45%	35%	95	General purpose.
P-2	Bluish-green	Green	60%	70%	51*	Good compromise for high and low speed applications.
P-4	White	—	50%	75%	20	Television displays.
P-7	Blue-white	Yellow-green	45%	95%	66*	Long decay.
P-11	Purplish-blue	—	25%	100%	17	High photographic writing speed.
P-15	Bluish-green	—	15%	25%	0.05	Very short decay.
P-31	Green	—	100%	75%	32	High luminance; general purpose.

Ⓐ Where different than fluorescence.

© Taken with a Spectra Brightness Spot Meter which incorporates a CIE standard eye filter. Representative of 10 kV aluminized screens. P-31 as reference.

Ⓑ P-11 as reference with Polaroid 410 film. Representative of 10 kV aluminized screens.

* Low level decay lasts over one minute under conditions of low ambient illumination.

Symbols and Abbreviations

The user of this catalog may find some unfamiliar symbols and abbreviations. In general, Tektronix has adopted the Symbols For Units, IEEE Standard Number 260, dated January 15, 1965. The abbreviations have been adopted by Tektronix following a thorough study of available abbreviations and guidelines published by the National Bureau of Standards, United States Government, American Standards Association, and others.

Many of these symbols and abbreviations are new, and inconsistencies between this list and other sources such as instrument panels and existing instrument manuals will be found. Future instruments and manuals will reflect adherence to these new symbols and abbreviations.

Below are some of the symbols and abbreviations used in this catalog. Those symbols found in IEEE Standard Number 260 are marked with an asterisk.

alternating current	AC
*ampere	A
amplitude modulation	AM
approximate	approx
approximately equal to	$\approx$ or $\simeq$
attenuation	atten
audio frequency	AF
automatic	auto
bandwidth	bw
base	b
*bel	B
calibrate	cal
cathode-ray oscilloscope	CRO
cathode-ray tube	CRT
*centimeter	cm
clockwise	cw
common mode rejection	CMR
common mode rejection ratio	CMRR
counterclockwise	ccw
continuous wave	CW
current	I
*decibel	dB
*decibel referred to one milliwatt	dBm
deflection factor	DF
*degree	°
*degree celsius (centigrade)	°C
*degree fahrenheit	°F
*degree kelvin	°K
delayed	dlyd
delay line	DL
differential	diff
direct current	DC
division	div
*farad	F
*foot	ft
*foot lambert	fL
frequency modulation	FM
giga	G
*gigahertz	GHz
graticule	grat
gravity unit	g
greater than	$>$
greater than or equal to	$\geq$
ground	gnd
*henry	H
*hertz	Hz
*hour	h
impedance	Z
inductance	L
intermediate frequency	IF
kilo	k
*kilohertz	kHz
kilohm	kΩ
kilometer	km
*kilovolt	kV
less than	$<$
less than or equal to	$\leq$
local oscillator	LO
low frequency	LF
maximum	max
mega	M
*megahertz	MHz
*megohm	MΩ
*meter	m
micro	μ
*microsecond	μs
milli	m
*millimeter	mm
*millisecond	ms
minus	—
nano	n
*nanosecond	ns
negative	neg
ohm	Ω
operational amplifier	op amp
pair	pr
parts per million	P/M
peak to peak	P to P
pico	p
*picoampere	pA
*pico farad	pF
*picosecond	ps
plus	+
plus and minus	+ and —
plus or minus	$\pm$
positive	pos
pulse per second	p/s
pulse repetition rate	PRR or r_p
pulse width	PW or t_p
radio frequency interference	RFI
resistance	R
resistance capacitance	RC
resistance inductance	RL
root mean square	RMS
*revolution per minute	r/min
risetime	t_r
*second (time)	s
serial number	SN
signal	sig
signal to noise ratio	S/N
standing wave ratio	SWR
storage time	t_s
sweep	swp
synchronize	sync
temperature	T
time domain reflectometry	TDR
tolerance	tol
*volt	V
*watt	W

Glossary of Oscilloscope Terms

This glossary of oscilloscope terms is published to promote better communication through use of a common concept of terms.

These terms are, in part, the result of work performed by the Subcommittee on Oscilloscopes, IEEE G-IM Committee on High Frequency Instruments.

At this time, the proposed list has been submitted, but not yet accepted by the IEEE.

Accelerating Voltage—The cathode-to-screen voltage applied to a cathode-ray tube for the purpose of accelerating the electron beam.

Alternate Mode—A means of displaying output signals of two or more channels by switching the channels, in sequence, after each sweep.

Astigmatism—In the viewing plane of the cathode-ray tube, any deviation of the indicating spot from a circle.

Bandwidth—A statement of the frequencies defining the upper and lower limits of a frequency spectrum where the amplitude response of an amplifier to a sinusoidal waveform becomes 0.707 (—3 dB) the amplitude at a reference frequency. When only one number appears, it is taken as the upper limit.

Bezel—The flange or cover used for holding an external graticule or CRT cover in front of the CRT in an oscilloscope. May also be used for mounting a trace recording camera or other accessory item.

Blanking—Extinguishing of the spot. Retrace Blanking is the extinction of the spot during the retrace portion of the sweep waveform. The term does not necessarily imply blanking during the holdoff interval or while waiting for a trigger in a triggered sweep system.

Brightness—The attribute of visual perception in accordance with which an area appears to emit more or less light. (See Luminance.)

Channel—A single path for transmitting electric signals, usually in distinction from other parallel paths.

Chopped Blanking—The process of blanking the indicating spot during the switching periods in chopped mode.

Chopped Mode—A means of displaying output signals of two or more channels by switching the channels, in sequence, at a rate not referenced to in the sweep.

Chopping Rate—The rate at which channel switching occurs in Chopped Mode.

Chopping Transient Blanking—The process of blanking the indicating spot during the switching periods in Chopped Mode.

Common-Mode Rejection Ratio (CMRR)—The ratio of the deflection factor of a Common-Mode Signal to the deflection factor of a Differential Signal.

Common-Mode Signal—The instantaneous algebraic average of two signals applied to a balanced circuit, all signals referred to a common reference.

DC Balance—An adjustment of circuitry to avoid a change in DC level when changing gain.

DC Offset—A DC level which may be added to the input signal, referred to the input terminals.

DC Shift—An error in transient response with a time constant approaching several seconds.

Deflection Blanking—Blanking by means of a deflection structure in the CRT electron gun which traps the electron beam inside the gun to extinguish the spot, permitting blanking during retrace and between sweeps regardless of intensity setting.

Deflection Factor—The ratio of the input signal amplitude to the resultant displacement of the indicating spot. (e.g., volts/division.)

Delayed Sweep—1. A sweep that has been delayed either by a predetermined period or by a period determined by an additional independent variable. 2. Mode of operation of a sweep, as defined above.

Dual-Beam Oscilloscopes—An oscilloscope in which the cathode-ray tube produces two separate electron beams that may be individually or jointly controlled.

Dual-Trace—A mode of operation in which a single beam in a cathode-ray tube is shared by two signal channels. See Alternate Mode and Chopped Mode.

External Triggering—Introducing the Triggering Signal directly into the trigger circuit from an external source.

Fluorescence—Emission of light from a substance (a phosphor) during excitation by radiant energy.

Focus—The point of maximum convergence on the electron beam manifested by minimum spot size on the cathode-ray tube. (Note definition for Astigmatism.)

Graticule—A scale for measurement of quantities displayed on the cathode-ray tube of an oscilloscope.

Information Writing Speed—The cathode-ray tube characteristic which is an indication of the maximum number of bits of information per second that can be photographically recorded and identified. Test conditions must be specified.

Input RC Characteristics—The DC resistance and capacitance to ground present at the input to an oscilloscope.

Intensity Modulation—The process and/or effect of varying the electron beam current in a cathode-ray tube resulting in varying brightness or luminance of the trace.

Internal Graticule—A graticule whose rulings are a permanent part of the inner surface of the cathode-ray tube faceplate.

Internal Triggering—Using a sample of a deflection signal (usually the vertical deflection signal) as a triggering signal source.

Jitter—An aberration of a repetitive display indicating instability of the signal or of the oscilloscope. May be random or periodic, and is usually associated with the time axis.

Line Triggering—Triggering from the power-line frequency.

Luminance—The photometric equivalent of brightness.

Note: Luminance is recommended for the photometric quantity which has been called brightness. Use of this term permits brightness to be used entirely with reference to the sensory response. The photometric quantity has been confused often with the sensation merely because of the use of one name for two distinct ideas. Brightness will continue to be used properly in non-quantitative statements especially with reference to sensations and perceptions of light.

Magnified Sweep—A sweep whose time per division has been decreased by amplification of the sweep waveform rather than by changing the time constants used to generate it.

Glossary of Oscilloscope Terms

Oscillography—The art and practice of utilizing the oscillograph.

Oscilloscope—An oscillograph primarily intended for the immediate viewing of the graphical plot . . . most commonly used to denote a cathode-ray oscilloscope.

Overshoot—The initial transient response to a unidirectional change in input which occurs simultaneously with the main transmission but exceeds its limiting final value.

Persistence—See Phosphor Decay.

Phosphor Decay—A phosphorescence curve, energy emitted versus time.

Phosphorescence—Emission of light from a substance after excitation has been removed.

Preshoot—The initial transient response to a unidirectional change in input which precedes the main transmission and may be of the same or opposite polarity.

Raster—A predetermined pattern of scanning lines used in a CRT display.

Ringing—An oscillatory transient occurring in the output of a system as a result of a suddenly applied change in input. Usually damped in time.

Risetime—The interval between the instants at which the instantaneous pulse amplitude first reaches specified lower and upper limits. Unless otherwise stated, these limits shall be 10% and 90% of the pulse's amplitude.

Rolloff—The particular manner in which the amplitude-frequency characteristic behaves as it approaches its frequency limits.

Rounding—The loss of a sharp corner of a waveform; hence, a loss of high frequency components in the waveform. Commonly, the loss of the corner following the leading edge of a squarewave.

Signal Delay—The transmission time of a signal through a network. The time is always finite, may be undesired, or may be purposely introduced.

Single Sweep—Operating mode for a triggered-sweep oscilloscope in which the sweep must be reset for each operation, thus preventing unwanted multiple display; particularly useful for trace photography. In the interval after the sweep is reset and before it is triggered it is said to be armed.

Spot—The illuminated spot that appears where the electron beam strikes the fluorescent screen of a CRT.

Stability—Property of retaining defined electrical characteristics for a prescribed period. Deviations from a stable state may be called **drift** or **jitter.** In triggered sweep systems, **triggering stability** may refer to the ability of the trigger and sweep system to maintain jitter-free display of high-frequency waveforms for relatively long (seconds to hours) periods of time. Also the name of the oscilloscope control used to adjust the sweep for triggered, free running, or synchronized operation.

Sweep Accuracy—Accuracy of the trace horizontal displacement compared with the reference independent variable, usually expressed in terms of average rate error as a percent of full scale. (See Sweep Linearity.)

Sweep Delay Accuracy—Accuracy of indicated sweep delay, usually specified in error terms.

Sweep Magnifier—Circuit or control for expanding part of a display in the reference coordinate. Sometimes known as sweep expander.

Sweep Linearity—Maximum displacement error of the independent variable between specified points on the display area. Commonly expressed as a percent of the distance between these points.

Sweep Lockout—Means for preventing multiple sweeps when operating in a single-sweep mode.

Sweep Range—The set of sweep time/division settings provided.

Sweep Reset—In oscilloscopes the single-sweep operation, the arming of the sweep generator to allow it to cycle once.

Sweep Switching—Alternate display of two or more time bases or other sweeps using a single-beam CRT; comparable to dual- or multiple-trace operation of a deflection amplifier.

Sweep Time/Div—The nominal time required for the spot in the reference coordinate to move from one graticule division to the next.

Synchronized Sweep—A sweep which would free-run in the absence of an applied signal but in the presence of the signal, is synchronized by it.

Tilt—The slope associated with the flat portion of a nominally rectangular pulse of given time duration.

Trace Width—The distance between points on opposite sides of a trace at which luminance is 50% of maximum. If the trace departs from a well-behaved (approximately Gaussian) form, it should be smoothed for the purpose of measurement.

Transient Response—Commonly, the characteristic response of a system to a unit step or unit impulse. Elements of transient response most commonly specified are: risetime, falltime, overshoot, undershoot, preshoot, and ringing.

Trigger—A pulse used to initiate some function (e.g., a Triggered Sweep or delay ramp). Where the terms Trigger and Triggering Signal are used together, Triggering Signal conventionally refers to a waveform applied to the triggering circuits and from which a trigger or trigger pulse is derived. Otherwise, Trigger may loosely refer to a waveform of any shape used as a signal from which to derive a trigger pulse, as in "trigger source", "trigger input", etc.

Trigger Countdown—A process that reduces the repetition rate of a triggering signal.

Triggering Level—The instantaneous amplitude of a triggering signal at which a trigger is to be generated. Also the name of the control which selects the level.

Triggering Signal—The signal from which a trigger is derived.

Triggering Slope—The positive-going (+ slope) or negative-going (— slope) portion of a triggering signal from which a Trigger is to be derived. Also, the control which selects the slope to be employed.

Unblanking—Turning on of the CRT beam.

Undershoot—The initial transient response to a unidirectional change in input which occurs simultaneously with the main transmission and is opposite in polarity (See Rounding).

Writing Speed—See Information Writing Speed.

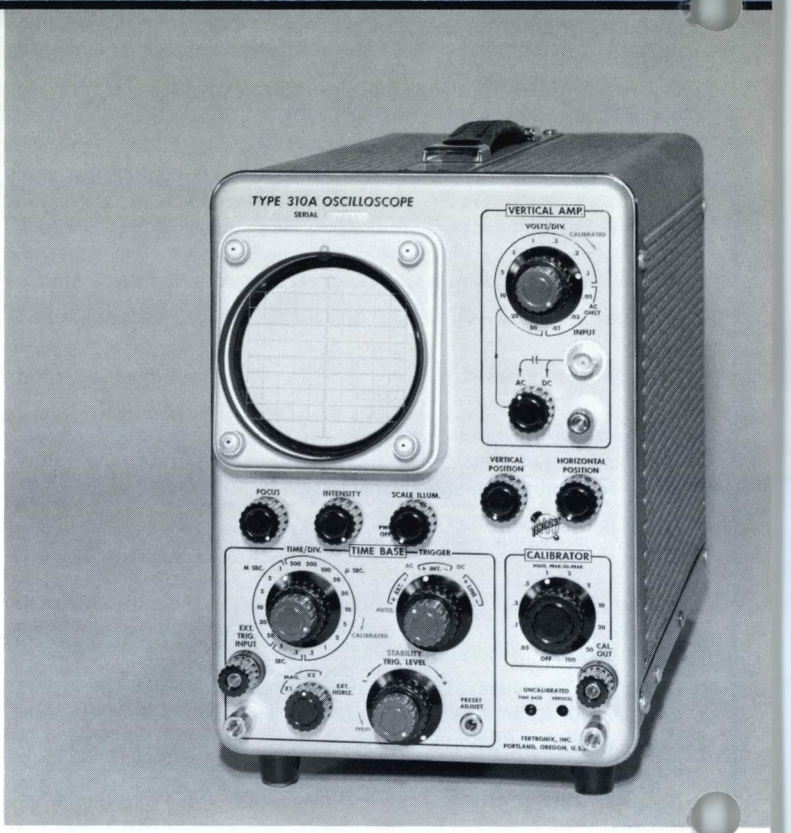
Writing Time/Div—The minimum time per unit distance required to record a trace. The method of recording must be specified.

X-Y Display—A rectilinear coordinate plot of two variables.

Z-Axis Amplifier—An amplifier for signals controlling a display perpendicular to the X-Y Axis (commonly intensity of the spot).

Type 310A DC-to-4 MHz OSCILLOSCOPE

- *SMALL IN SIZE*
- *LOW IN WEIGHT*
- *4 MHz BANDWIDTH*
- *10 mV/div DEFLECTION FACTOR*



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-hertz 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.

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED DEFLECTION FACTOR
DC-coupled, 0.1 V/div to 50 V/div.
AC-coupled only, 0.01 V/div to 0.05 V/div.

BANDWIDTH—0.1 V/div to 50 V/div, DC to 4 MHz. 0.01 V/div to 0.05 V/div, 2 Hz to 3.5 MHz.

INPUT RC—1 megohm paralleled by approx 40 pF.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.5 μs/div to 0.2 s/div.

SWEEP MAGNIFIER—5X, extends sweep time/div to 0.1 μs/div.

TRIGGER REQUIREMENTS—
Internal: 0.5 div deflection at 1 kHz, increasing to 2 div deflection at 5 MHz.
External: 0.2 V peak to peak at 1 kHz, increasing to 2 V peak to peak at 5 MHz.

EXTERNAL INPUT—1.5 V/div.

CRT

DISPLAY AREA—8 x 10 div. Each div equal to ¼ inch.

ACCELERATING POTENTIAL—1.85 kV.

PHOSPHOR—P31.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—50 mV to 100 V, 1-kHz square-wave (approx).

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 175 watts.

VERTICAL-DEFLECTION SYSTEM

BANDWIDTH
DC to 4 MHz (—3 dB), approx 90-ns risetime to 0.1 V/div; 2 Hz to 3.5 MHz (—3 dB), approx 100-ns risetime to 0.01 V/div.

CALIBRATED DEFLECTION FACTOR
100 mV/div to 50 V/div, DC coupled, in 9 steps, 1-2-5 sequence. An AC-coupled preamplifier provides three additional steps of 10 mV/div, 20 mV/div, and 50 mV/div. An uncalibrated control provides adjustment between steps and to approx 125 V/div.

ACCURACY
When gain adjustments are accurately set at 0.1 V/div and 10 mV/div, any other position of the VOLTS/DIV switch will have an accuracy of ±3%.

INPUT RC
1 megohm paralleled by approx 40 pF. With 10X attenuator probe, input RC is 10 megohm paralleled by approx 9.5 pF.

HORIZONTAL-DEFLECTION SYSTEM

CALIBRATED SWEEP RANGE
0.5 μs/div to 0.2 s/div in 18 steps, 1-2-5 sequence. An uncalibrated control provides adjustment between steps and to approx 0.6 s/div. A front-panel warning light indicates when the control is in an uncalibrated position.

SWEEP MAGNIFIER
X5, expands the center 2-division portion of the normal trace to 10 divisions. Extends the fastest sweep range to 0.1 μs/div.

ACCURACY
Normal, ±3%. Magnified, ±3% except the 0.5 μs/div step, which is ±5%.

HORIZONTAL INPUT
Deflection factor is 1.5 V/div. Can be adjusted by a gain control. Bandwidth is DC to 1 MHz (—3 dB). Input R approx 100 kΩ.

TRIGGERING FACILITIES
Triggering level; ± Internal, ±External, or ± Line; AC or DC; Automatic.

TRIGGERING REQUIREMENTS
Internal—0.5-div deflection at 1 kHz, increasing to 2-div deflection at 5 MHz.
External—0.2-V peak to peak at 1 kHz, increasing to 2-V peak to peak at 5 MHz.
Automatic—requires a signal between approx 60 Hz and 2 MHz. In the absence of signal, a reference trace at approx 50 Hz is provided.

UNBLANKING
The unblanking waveform is DC-coupled to the control grid of the CRT, assuring uniform bias for all sweep steps and repetition rates.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR
Squarewave with 11 steps from 50 mV to 100 V peak to peak, 1-2-5 sequence. Accuracy is ±3%. Squarewave repetition rate is approx 1 kHz.

GRATICULE
Edge-lighted, ruled in 8 vertical and 10 horizontal 1/4-inch divisions. Illumination is controlled by a front-panel control.

CATHODE RAY TUBE
The 3-inch flat-faced mono-accelerator CRT operates at 1.85-kV accelerating potential. A P31 phosphor is normally supplied.

POWER REQUIREMENT
105 V to 125 V or 210 to 250 V.
Transformer taps permit selection of center line-voltage within this range. Frequency—50 to 800 Hz. Requires approx 4% higher line voltage at 800 Hz. Power requirements—approx 175 W. Instrument is factory-wired for 105-125 V.

HINGED CHASSIS
The Type 310A opens up to permit easy accessibility to all components.

MECHANICAL
Dimensions are 10 3/8" high by 7" wide by 17 5/8" deep. Net weight is 23 pounds. Shipping weight is 34 pounds, approx.

TYPE 310A OSCILLOSCOPE $675
Each instrument includes: 1—P6006 probe (010-0127-00); 1—patch cord, 18", BNC-to-BNC (012-0087-00); 1—patch cord, 18", BNC-to-banana plug (012-0091-00); 1—post jack, BNC (012-0092-00); 1—3-conductor power cord (161-0024-00); 1—3 to 2-wire adapter (103-0013-00); 1—smoke gray filter (378-0550-00); 2—instruction manual (070-0244-00).

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 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 Hz only:
Order Part Number 016-0012-00 ..... $50

For use on 210-250 V, 50 to 60 Hz only:
Order Part Number 016-0013-00 ..... $50

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

Type 317 / RM 17 DC-to-10 MHz—9-kV OSCILLOSCOPE

- *BRIGHT TRACE*
- *10 MHz BANDWIDTH AT 10 mV/div*
- *INTERNAL DELAY LINE*
- *COMPACT CABINET OR RACK-MOUNT MODELS*

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 MHz vertical response and wide sweep range take care of many of today's complex field and test station applications. Of course, these fine characteristics make it an excellent laboratory oscilloscope, too.

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED DEFLECTION FACTOR—
DC-coupled, 0.1 V/div to 50 V/div.
AC-coupled, 0.01 V/div to 50 V/div.

BANDWIDTH—DC-coupled, DC to 10 MHz. AC-coupled, 2 Hz to 10 MHz.

RISETIME—$\leq$35 ns.

INPUT RC—1 megohm paralleled by approx 40 pF.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.2 μs/div to 2 s/div.

SWEEP MAGNIFIER—5X, extends sweep range to 0.04 μs/div.

TRIGGER REQUIREMENTS—Internal: 0.2-div deflection.
External: 0.5 to 20 V.

EXTERNAL INPUT—1.4 V/div, DC to 400 kHz.

CRT

DISPLAY AREA—8 x 10 div. Each div equal to 1/4 inch.

ACCELERATING POTENTIAL—9 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—50 mV to 100 V, 1-kHz square-wave (approx).

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 260 watts.

VERTICAL-DEFLECTION SYSTEM

BANDWIDTH

DC to 10 MHz (—3 dB), approx 35-ns risetime to 0.1 V/div; 2 Hz to 10 MHz (—3 dB), approx 35-ns risetime to 0.01 V/div.

CALIBRATED DEFLECTION FACTOR

100 mV/div to 50 V/div, DC coupled, in 9 steps, 1-2-5 sequence. An AC-coupled preamplifier provides three additional steps of 10 mV/div, 20 mV/div, and 50 mV/div. An uncalibrated control provides adjustment between steps and to approx 125 V/div.

ACCURACY

When gain adjustments are accurately set at 0.1 V/div and 10 mV/div, any other position of the VOLTS/DIV switch will have an accuracy of ±3%.

INPUT RC

1 megohm paralleled by approx 40 pF. With 10X attenuator probe, input RC is 10 megohms paralleled by approx 9.5 pF.

HORIZONTAL-DEFLECTION SYSTEM

CALIBRATED SWEEP RANGE

0.2 μs/div to 2 s/div in 22 steps, 1-2-5 sequence. An uncalibrated control provides adjustment between steps and to approx 6 s/div. A front-panel light indicates when the control is in an uncalibrated position.

SWEEP MAGNIFIER

X5, expands the center 2-division portion of the normal trace to 10 divisions. Extends the fastest sweep range to 0.04 μs/div.

ACCURACY

Normal, ±3%. Magnified, ±5%.

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

HORIZONTAL INPUT

Deflection factor is 1.4 V/div (approx). Can be adjusted with HORIZ INPUT ATTEN control. Bandwidth is DC to 500 kHz (—3 dB). Input R approx 100 kΩ.

TRIGGERING FACILITIES

Triggering level; ±Internal, ±External, or ±Line; AC or DC; Automatic; HF Sync.

TRIGGER REQUIREMENTS

Internal—0.2-div deflection at 1 kHz, increasing to 2-div at 5 MHz in AC MODE; 0.3-div to 2-div in DC MODE; 0.5-div deflection at 60 Hz, increasing to 2-div at 2 MHz in AUTO MODE.

External—0.5-V peak to peak at 1 kHz, increasing to approx 2-V peak to peak at 5 MHz. TRIGGERING LEVEL control covers range of 0.5 V to 20 V.

Automatic—requires a signal between approx 60 Hz and 2 MHz. In the absence of signal, a reference trace at approx 50 Hz is provided.

High-Frequency Sync—assures a stable display of sinewave signals up to approx 15 MHz. Requires 0.2-div deflection at 5 MHz, 2-div at 15 MHz, or an external signal of approx 2-V.

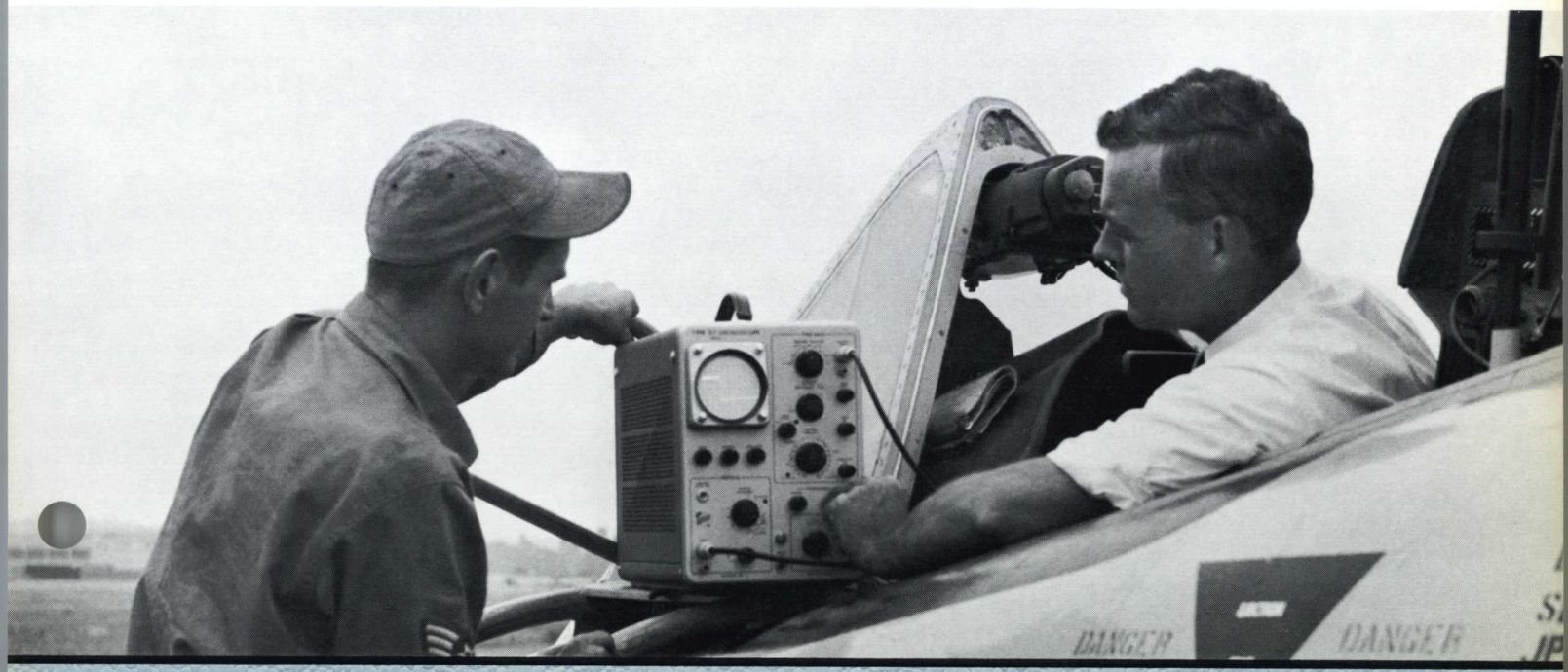
UNBLANKING

The unblanking waveform is DC-coupled to the control grid of the CRT, assuring uniform bias for all sweep steps and repetition rates.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR

Squarewave with 11 steps from 50 mV to 100 V peak to peak, 1-2-5 sequence. Accuracy is ±3%. Squarewave repetition rate is approx 1 kHz.



317
RM17

GRATICULE

Edge-lighted, ruled in 8 vertical and 10 horizontal 1/4-inch divisions. Illumination is controlled by a front-panel control.

CATHODE-RAY TUBE

The 3" flat-faced helical post-accelerator CRT operates at 9-kV accelerating potential. 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 sawtooth waveform are available at front-panel connectors.

WARNING INDICATORS

Separate front-panel neon lights indicate when the variable controls for vertical deflection or sweep range are not in their calibrated positions.

POWER REQUIREMENT

105 V to 125 V or 210 V to 250 V, 50 to 60 Hz, approx 260 W. Instrument factory wired for 105 V to 125 V. Type 317 can be ordered wired for operation on several nominal line voltages as follows:

Nominal Line Voltage	Operating Range
(Figures taken at 60 Hz)	
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.

CABINET MODEL

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 47 pounds, approx.

TYPE 317 ..... **$875**

Each instrument includes: 1—P6006 probe (010-0127-00); 1—patch cord, 18", BNC-to-BNC (012-0087-00); 1—patch cord, 18", BNC-to-banana plug (012-0091-00); 1—post jack, BNC (012-0092-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—smoke gray filter (378-0550-00); 2—instruction manual (070-0297-00).

RACK MOUNT MODEL

Dimensions are 7" high by 19" wide by 17 5/8" deep. The instrument mounts to the standard 19" rack on slide-out tracks and can be pulled forward, tilted, and locked in any of 7 positions for easy servicing. Net weight is 35 pounds. Shipping weight is 66 pounds, approx.

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

TYPE RM17 ..... **$950**

Each instrument includes: 1—P6006 probe (010-0127-00); 1—patch cord, 18", BNC-to-BNC (012-0087-00); 1—patch cord, 18", BNC-to-banana plug (012-0091-00); 1—post jack, BNC (012-0092-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—smoke gray filter (378-0550-00); 1—pair mounting tracks (351-0017-00); 2—instruction manual (070-0325-00).

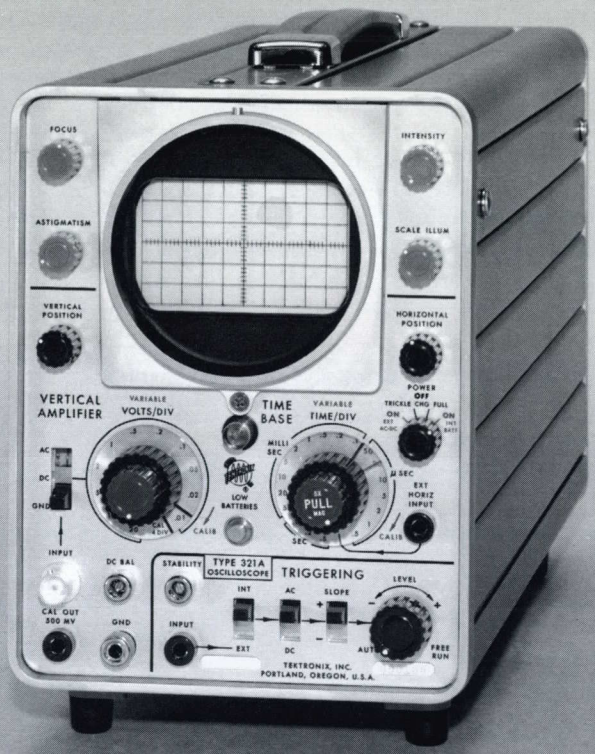
SUPPORTING CRADLES

When the RM17 is mounted in a backless rack, these supporting cradles are necessary for rear-slide support.
Order Part Number 040-0345-00 ..... $12.00

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

PORTABLE OSCILLOSCOPE Type 321A

- *6 MHz BANDWIDTH AT 10 mV/DIV*
- *SMALL SIZE—LIGHT WEIGHT*
- *LOW POWER CONSUMPTION*
- *AC, DC, OR BATTERY OPERATED*
- *DESIGNED FOR SEVERE ENVIRONMENTS*



The Type 321A combines small size with performance equal to laboratory instrument standards of accuracy. Weighing only 17 pounds, complete with re-chargeable batteries, it may be used in the many applications where accurate measurements are required in the field. It can be operated from its own internal battery pack, from the DC systems on boats, airplanes, cars, etc, or from an AC line.

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED DEFLECTION FACTOR—0.01 V/div to 20 V/div, DC coupled.

BANDWIDTH—DC to at least 6 MHz.

INPUT RC—1 megohm paralleled by approx 35 pF.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.5 μs/div to 0.5 s/div.
SWEEP MAGNIFIER—5X, extends sweep time/div to 0.1 μs/div.

TRIGGER REQUIREMENTS—
Internal: AC, DC, Auto—0.2 major div display at 1 kHz increasing to 1 major div display at 6 MHz.
External: AC, DC, Auto—1 V peak to peak at 1 kHz increasing to 3 V peak to peak at 6 MHz.

EXTERNAL INPUT
Deflection Factor: With 5X MAG on, 1 V/div ±10%.
Bandwidth: DC to at least 1 MHz.
Input RC: 100 kΩ paralleled by approximately 30 pF.

CRT

DISPLAY AREA—6 x 10 div. Each div equal to 1/4 inch.

ACCELERATING POTENTIAL—4 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—500-mV squarewave peak to peak and internal 40-mV squarewave peak to peak at approx 2 kHz.

POWER REQUIREMENTS—Approx 700 mA from 10 size D batteries or a DC supply of 11.5 V to 35 V. Approx 20 watts from an AC supply of 115 V ±10% or 230 V ±10%, 45 — 800 Hz.

321A

VERTICAL DEFLECTION SYSTEM

Bandwidth Specifications are at —3 dB.

DC COUPLED VERTICAL AMPLIFIER has a bandwidth of DC to 6 MHz. Vertical deflection is calibrated in 11 steps from 0.01 to 20 V/div in a 1, 2, 5 sequence. 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 squarewave calibration signal.

CALIBRATION ACCURACY is adjusted internally for setting the gain of the vertical amplifier. When this adjustment is set, the vertical deflection factor is ±3% for any V/div switch position.

INPUT RC is 1 megohm paralleled by approximately 35 pF.

MAXIMUM INPUT VOLTAGE RATING is 600 volts combined DC and AC peak.

PROBE providing 10X attenuation is supplied with the instrument and presents an input resistance of 10 megohms paralleled by approximately 8.5 pF. The probe reduces the vertical deflection factor by ten.

HORIZONTAL DEFLECTION FACTOR

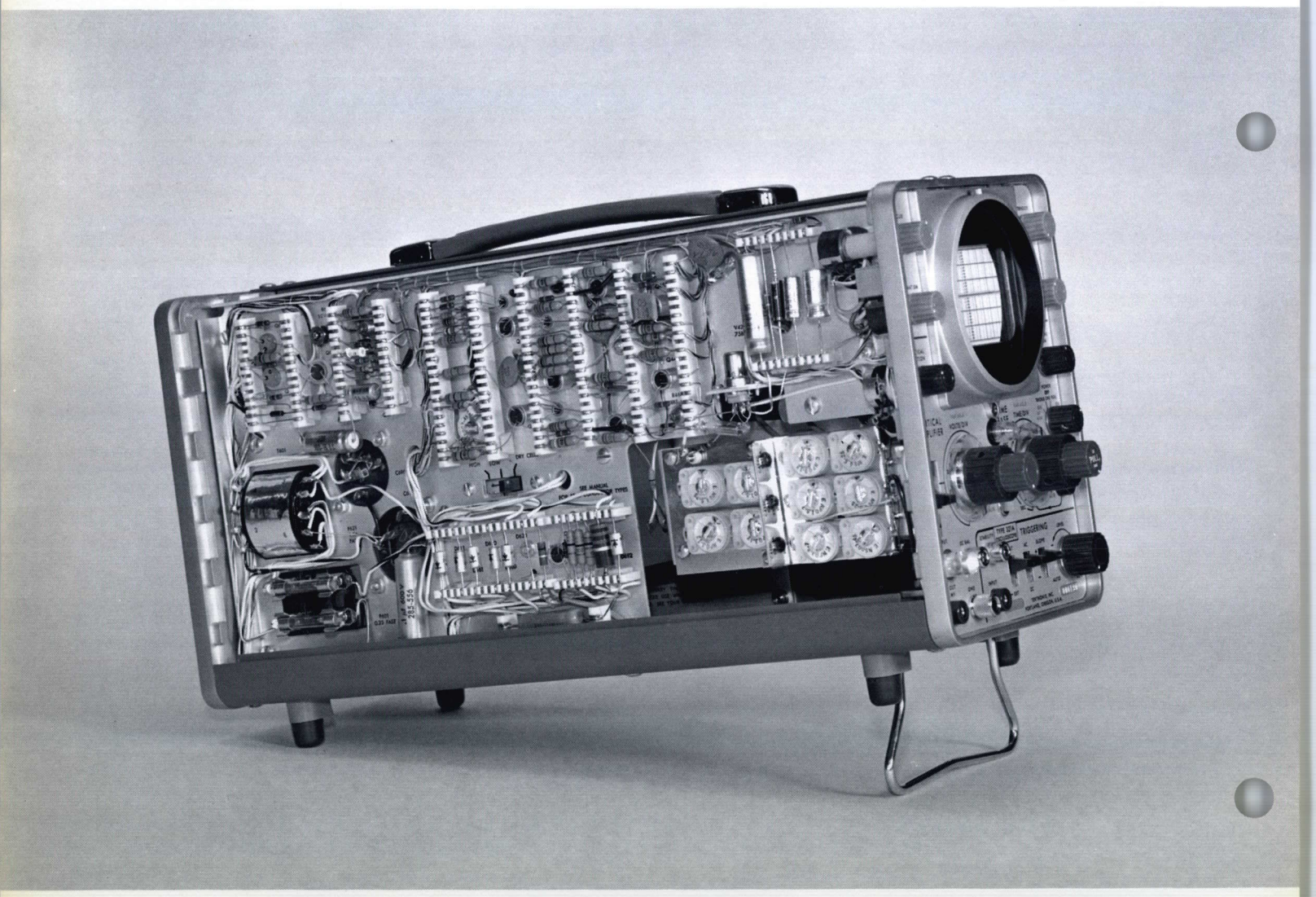
SWEEP RANGE is calibrated in 19 steps from 0.5 μs/div to 0.5 s/div in a 1, 2, 5 sequence. Accuracy is ±3%. A vernier control provides for continuously variable adjustment from 0.5 μs/div to approximately 1.5 s/div, uncalibrated.

DC COUPLED UNBLANKING provides uniform brightness at all sweep time/div settings.

TRIGGERING FACILITIES provide for complete manual control or fully-automatic triggering.

AMPLITUDE-LEVEL SELECTION is accomplished with adjustable amplitude-level and stability controls 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 is provided by an automatic level-seeking trigger circuit which is useful for triggering above 50 Hz. The sweep is triggered automatically at about a 50-Hz 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 0.2 major divisions of vertical deflection at 1 kHz is required, increasing to 1 major division of vertical deflection at 6 MHz. For external triggering: a signal of 1 V peak to peak at 1 kHz is required, increasing to 3 V peak to peak at 6 MHz.

HORIZONTAL INPUT is provided by a DC-coupled external connection to the sweep amplifier through a front-panel connector. Bandwidth is DC to at least 1 MHz. The horizontal deflection factor is 1 V/div ±10% with the 5X MAG on. Input RC is 100 kΩ ±10% paralleled by approximately 30 pF.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR provides a 500 mV peak to peak squarewave voltage through a front-panel connector. In addition, an internally coupled 40 mV peak to peak squarewave voltage is available in the fully clockwise position (CAL 4 DIV) of the VOLTS/DIV switch. Accuracy is ±3%. Repetition rate of the squarewave is approximately 2 kHz.

INTENSITY MODULATION of the cathode-ray tube display is provided 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 low intensity settings.

CATHODE-RAY TUBE is a Tektronix flat-faced, 3-inch post accelerator tube which 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 is edge lighted. Adjustment is provided 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.

ELECTRONICALLY REGULATED DC POWER SUPPLY insures stable operation over line variations between 11.5 and 35 volts DC, or 115 volts ±10% or 230 volts RMS ±10%, 45 to 800 Hz.

POWER REQUIREMENTS are satisfied either from ten size D flashlight cells (approximately ½ hour continuous operation, more on intermittent operation); from ten size D alkaline cells, such as Eveready E95, Burgess A1-2, or Mallory MN-1300 (approximately 2½ hours continuous operation), or from ten size D NiCd rechargeable cells (up to 5 hours continuous operation depending on type used).

The current drain on external DC or on internal batteries is approximately 700 mA regardless of supply voltage. The power consumption from any AC source is approximately 20 watts. A thermal cutout protects the instrument against operation at temperatures in excess of about 55° C.

A light on the front panel indicates when the internal batteries are approaching discharge; it also lights if an external AC or DC supply voltage falls too low.

BATTERY CHARGER is built-in and provides two different charging currents to the internal batteries, or no charging current in the case of dry cells. The mode is selected with an internal switch. A 4-position front-panel switch provides for operation from external AC or DC, or from the internal batteries. It also provides a trickle charge or a full charge to the internal batteries when the instrument is turned off but is connected to the AC line.

DIMENSIONS are 8¼" high by 5¾" wide by 16" deep.

NET WEIGHT is 14 pounds without batteries, 16 pounds with batteries.

SHIPPING WEIGHT is approximately 22 pounds without batteries and 26 pounds with batteries.

ENVIRONMENTAL CAPABILITIES

TEMPERATURE

Operating (without batteries) −15°C to +55°C.
(with batteries installed) 0°C to +40°C.
Non-operating (without batteries) −55°C to +75°C.
(with batteries installed) −40°C to +60°C.

ALTITUDE

Operating: 15,000 ft max.
Non-operating: 50,000 ft max.

VIBRATION

Operating: 15 minutes along each of 3 axes at 0.025" peak to peak displacement (4 g's at 55 Hz), 10 to 55 to 10 Hz in 1-minute cycles.

SHOCK

Operating: 30 g's, ½ sine, 11-ms duration, 12 shocks total.
Non-operating: 60 g's, ½ sine, 11-ms duration, 6 shocks total.

TRANSPORTATION

In shipping carton: meets National Safe Transit test-vibration for one hour at slightly greater than 1 g; 18" drops on one corner, all edges radiating from that corner, and all flat surfaces (total of 10 drops).

TYPE 321A OSCILLOSCOPE (without batteries) **$900**

Each instrument includes: 1—P6006 probe (010-0127-00); 2—patch cord, 18", BNC-to-banana plug (012-0091-00); 1—DC power cord (161-0016-01); 1—3-conductor AC power cord (161-0015-01); 1—3 to 2-wire adapter (103-0013-00); 1—light filter (378-0547-00); 1—mesh filter (378-0577-00); 2—instruction manual (070-0425-00).

Set of ten rechargeable NiCd cells will operate the Type 321A for approximately 5 hours.

Individual batteries—Part Number 146-0005-00, each ... $7.00
Set of 10 Batteries—Part Number 016-0077-00 ..... $70.00

CARRYING CASE

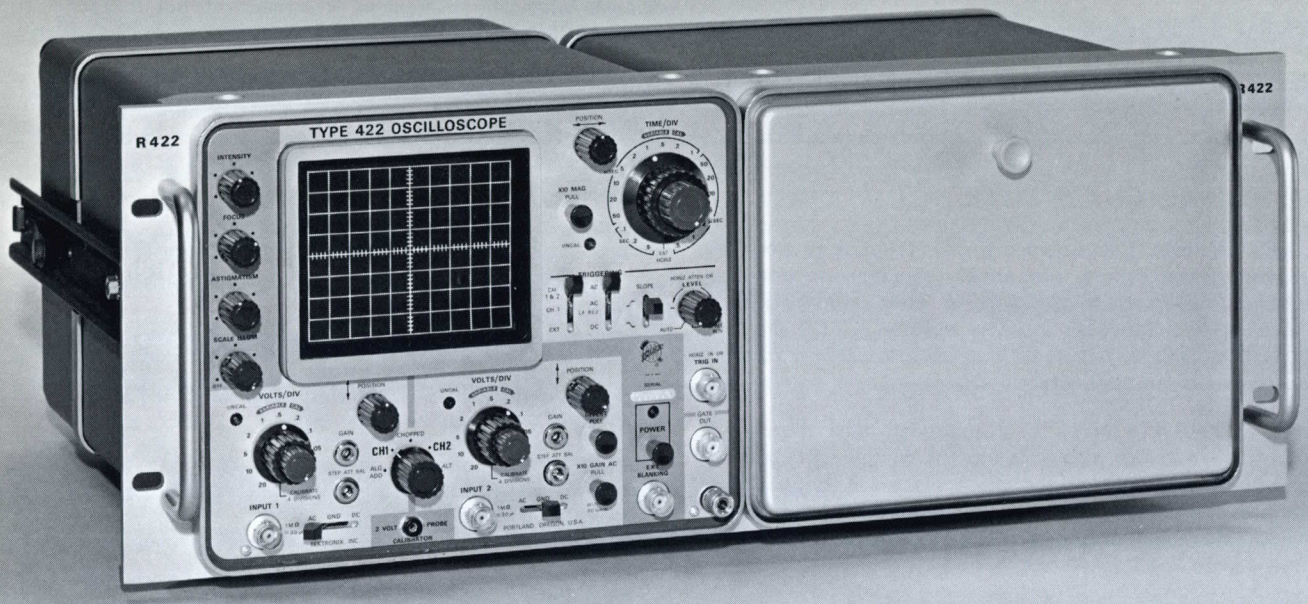
Attractive carrying case for the Type 321A provides in-transit protection as well as a convenient accessory storage compartment.

Order Part Number 016-0026-00 ..... $35

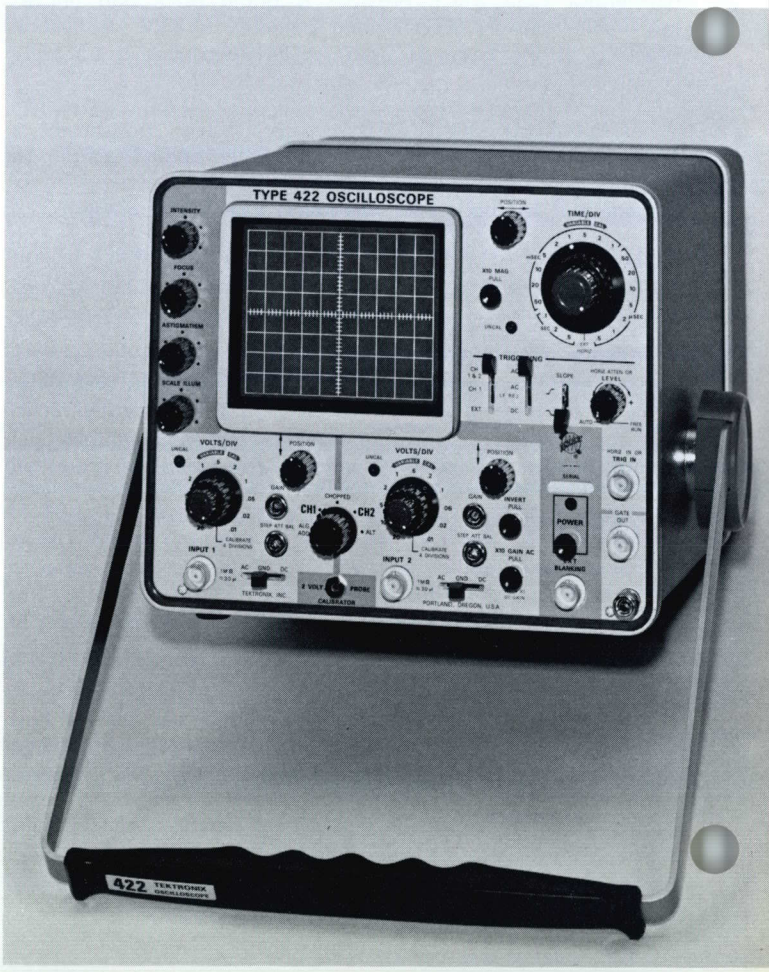
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 422/R422 DC-to-15 MHz OSCILLOSCOPE

NEW



- *SMALL SIZE—LIGHT WEIGHT*
- *DUAL TRACE*
- *SHARP, BRIGHT DISPLAYS*
- *DESIGNED FOR SEVERE ENVIRONMENTS*
- *AC, AC/DC OR BATTERY OPERATED*
- *VERSATILE PERFORMANCE*



CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED DEFLECTION FACTOR—10 mV/div to 20 V/div.
RISETIME—23 ns.
BANDWIDTH—DC to 15 MHz.
INPUT RC—1 megohm paralleled by approximately 30 pF.
DELAY LINE—Approximately 150 ns.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.5 μs/div to 0.5 s/div.
SWEEP MAGNIFIER—10X, extends fastest sweep rate to 0.05 μs/div.
TRIGGER REQUIREMENTS—
Internal: 0.2 divisions of deflection at 5 MHz. 1.0 division of deflection at 15 MHz.
External: 0.125 V up to 5 MHz, 0.6 V at 15 MHz.

CRT

DISPLAY AREA—8 x 10 divisions (0.8 cm/div).
ACCELERATING VOLTAGE—6 kV.
GRATICULE—Internal.

422
R422

The Type 422 is a portable dual-trace oscilloscope that combines small size and light weight with the ability to make precise laboratory measurements. It weighs under 22 pounds and occupies less than 0.6 cubic feet. To make it truly portable the Type 422 is ruggedly constructed to withstand shock, vibration, and extremes of environment. Because of this, it is finding its way on shipboard, flight lines, and even remote communication sites. No longer need measurements be compromised due to adverse field conditions; the Type 422 brings the precision of the laboratory to the field.

The Type R422, on the other hand, is the same instrument arranged in a rackmount panel assembly with a hinged-door compartment for storing accessories. The hinged-door can be removed to allow the installation of a second Type 422 for applications that require two instruments. Connections to the rear of the instrument are easily made since the entire assembly is mounted to the rack with slideout tracks.

VERTICAL DEFLECTION SYSTEM

BANDWIDTH AND RISETIME

DC to ≥15 MHz each channel; ≤23-ns risetime. AC or DC coupled. 5 Hz to 5 MHz, 70-ns risetime, on 10X gain (channel 2).

DEFLECTION FACTOR

10 mV/div to 20 V/div in 11 calibrated steps (each channel). Deflection factor extended to 1 mV/div in 10X position. 2.5:1 vernier allows continuous range (uncalibrated) between steps and extends range (uncalibrated) to 50 V/div. Warning light indicates uncalibrated setting. Accuracy is ±3% of indicated deflection; ±7.5% on 10X AC gain.

INPUT RC

1 megohm paralleled by approx 30 pF. Channel 1 and 2 time constants matched to ±1%.

MAXIMUM INPUT VOLTAGE

300 V combined DC and peak AC.

OPERATING MODES

Channel 1 only; Channel 2 only; Channels 1 and 2 added algebraically; dual-trace chopped; dual-trace alternate. Chopping rate is 100 kHz. Channel 2 has polarity inversion. Common-mode rejection ratio is ≥100:1 at 50 kHz with optimized gain setting.

DELAY LINE

Approx 150 ns.

HORIZONTAL DEFLECTION SYSTEM

SWEEP RANGE

0.5 μs/div to 0.5 s/div, in 19 calibrated steps. Accuracy is ±3%. 2.5:1 vernier gives variable and continuous sweep rates, uncalibrated, between steps. It also extends slowest sweep rates to 1.25 s/div, uncalibrated. Warning light indicates uncalibrated sweep settings. X10 magnifier extends all sweep speeds with fastest extended to 0.05 μs/div; accuracy is ±5%.

EXTERNAL HORIZONTAL INPUT

Deflection Factor: Variable between approx 1 V/div to approx 10 V/div and approx 10 V/div to approx 100 V/div with X10 Mag.

Bandwidth: DC to ≥500 kHz.

Input RC: Approx 300 kΩ paralleled by approx 35 pF.

TRIGGER REQUIREMENTS	
MODE	INTERNAL
DC	0.2 div up to 5 MHz, increasing to 1 div at 15 MHz.
AC	0.2 div up to 5 MHz, increasing to 1 div at 15 MHz. Low frequency response 3-dB down at approx 25 Hz.
AUTOMATIC	0.8 div from 50 Hz to 4 MHz, increasing to 2.5 div at 15 MHz.
AC LOW FREQ REJECT	0.2 div up to 5 MHz, increasing to 1 div at 15 MHz. Low frequency response 3 dB down at approx 25 kHz.
	EXTERNAL
DC	125 mV up to 5 MHz, increasing to 0.6 V at 15 MHz.
AC	125 mV up to 5 MHz, increasing to 0.6 V at 15 MHz. Low frequency response 3 dB down at approx 25 Hz.
AUTOMATIC	0.6 V from 50 Hz to 7 MHz, increasing to 1.2 V at 15 MHz.
AC LOW FREQ REJECT	125 mV to 5 MHz increasing to 0.6 V at 15 MHz. Low frequency response 3 dB down at approximately 25 kHz.

MISCELLANEOUS

FRONT-PANEL OUTPUTS

Amplitude Calibrator: approx 1-kHz squarewave, negative-going. Provides 0.2 V, internally, ±0.7%, and 2 V, ±2.7%, at Probe Cal jack on front panel.

Gate Signal: Rectangular pulse, negative-going; 0.5 V minimum, duration same as sweep. Approx 600-ohm source resistance.

TEKTRONIX CRT

Rectangular, 4-inch, with 0.8-cm divisions; 8 x 10-div display area. Illuminated internal graticule. 6-kV accelerating potential. External blanking, DC-coupled. Phosphor is P31.

MECHANICAL

TYPE 422 NET WEIGHT: AC model—20.5 lbs; AC-DC model—23 lbs, (29 lbs, 12 oz with batteries). Shipping weight: (Including accessories, manuals, and packaging) AC model—28 lbs; AC-DC model—28 lbs, 6 oz, without batteries. Overall height, including feet: 7". Overall width, including handle: 10". Length, including rear feet and front-panel knobs: 14". (To front of panel cover: 16".) To front edge of carrying handle, in forward position: 18". (With AC/DC Power Supply, add 3" to length measurements.)

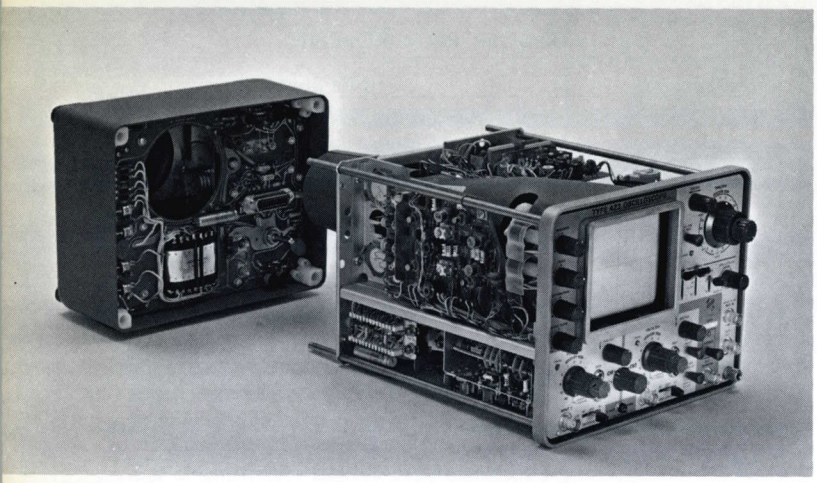
Type R422 NET WEIGHT: 18 lbs; Shipping Weight: (including accessories, manuals, and packaging) 50½ lbs. Overall height: 7". Overall width: 19". Overall depth including rear feet and front panel knobs: 14".

ENVIRONMENTAL FEATURES—AC MODEL

Temperature: Operating: −15°C to +55°C.
Non-operating: −55°C to +75°C.

Altitude: Operating: 15,000 ft, maximum.
Non-operating: 50,000 ft, maximum.

422
R422



Humidity:	Non-operating: Meets electrical performance specification after exposure to five cycles (120 hrs) of MIL-STD-202B, Method 106A (omit freezing and vibration, and allow a 24-hour post-test drying period at room ambient conditions of 25, ±5° C and 20 to 80% relative humidity).
Vibration:	Operating: 0.025" peak to peak displacement (4 g's for 15 minutes along each of 3 axes at 55 Hz) 10-55-10 Hz.
Shock:	Operating: 30 g's, ½ sine, 11-ms duration, 12 shocks total. Non-operating: 60 g's, ½ sine, 11-ms duration, 6 shocks total.
RFI:	Meets interference requirements of MIL-I-6181D and MIL-I-16910A, Power line conducted: 150 kHz—25 MHz. Radiated (with mesh filter installed): 14 kHz—1000 MHz.
Transportation: (In shipping carton.)	National Safe Transit. 1 hour at approx 1 g vibration. 30 inch drops on one corner, all edges radiating from that corner, and all flat surfaces (total of 10 drops).

ENVIRONMENTAL FEATURES—AC/DC MODEL, with batteries

Same as AC MODEL, except,

Temperature:	Operating: —15°C to +40°C Non-operating: —40° C to +60° C
Humidity:	With batteries, derate temperature from +65°C to +60°C.

POWER REQUIREMENTS

AC Model: 115 V or 230 V ±10%, 45 to 440 Hz. Requires approx 40 watts.

AC/DC Model: AC mode: 115 V or 230 V ±20% 45-440 Hz except derate linearly to +10% from 50 Hz to 45 Hz. DC mode: 11.5 V—35 V, approx 23 watts (CONSTANT POWER—2 A max, 650 mA min). Accepts 24 V battery pack.

AC POWERED INSTRUMENTS

TYPE 422 OSCILLOSCOPE $1400

Each instrument includes: 2—P6006 probe (010-0127-00); 1—adapter, BNC to binding post (103-0033-00); 1—ring, ornamental (354-0248-00); 1—filter, light graticule, smoke gray (378-0549-00); 1—plate, protector, clear, CRT (386-0118-00); 1—mesh filter (installed) (378-0571-00); 1—AC power supply (016-0072-00); 1—adapter, 3 to 2-wire (103-0013-00); 1—power cord, 117 V, 3-conductor, right-angle, female w/straight male plug (161-0024-00); 2—instruction manual for Type 422 (070-0434-00).

TYPE R422 OSCILLOSCOPE (mounted on left side) .. $1475
(Includes accessories listed under Type 422 above.)

TYPE R422 OSCILLOSCOPE (mounted on right side)
(Includes accessories listed above)
Type R422 MOD 150E $1475

TYPE 422 OSCILLOSCOPE WITHOUT CABINET for rack-mount conversion. (Includes accessories listed above.)
Type 422 MOD 146B $1375

TWO TYPE 422's MOUNTED IN A RACK-MOUNT PANEL. (Includes 2 sets of accessories listed under Type 422 above.)
Type R422 MOD 150B $2850

DC POWERED INSTRUMENTS

TYPE 422 WITH AC/DC BATTERY POWER SUPPLY, less batteries.
Type 422 MOD 125B $1750

Each instrument includes: 2—P6006 probe (010-0127-00); 1—patch cord, BNC to BNC (012-0084-00); 1—jack, BNC to post (012-0092-00); 1—ring, ornamental (354-0248-00); 1—filter, light, graticule, smoke gray (378-0549-00); 1—plate, protector, clear, CRT (386-0118-00); 1—mesh filter installed (378-0571-00); 1—ac/dc power supply (016-0073-00; 1—adapter, 3 to 2-wire (103-0013-00); 1—power cord, 3-wire ac w/female connector and male plug (161-0015-00); 1—power cord, 3-wire dc w/female connector (161-0016-00); 2—instruction manual for ac/dc power supply (070-0471-00); 2—instruction manual, for Type 422 (070-0434-00).

BATTERY PACK for Type 422 MOD 125B. Provides 24 volts; rechargeable internally from AC line. Powers the Type 422 Oscilloscope for approximately 4 hours. Shipping weight 9 lbs, 15 oz.
Order Part Number 016-0066-00 ..... $125

CONVERSION KITS

Power Supply AC/DC Battery, less batteries.
Shipping weight 10 lbs, 4 oz.

Each supply includes: 1—adapter, 3-wire to 2-wire (103-0013-00); 1—power cord, 3-wire AC w/female connector and male plug (161-0015-01); 1—power cord, 3-wire DC w/female connector (161-0016-01); 2—instruction manual (070-0471-00).
Order Part Number 016-0073-00 ..... $600

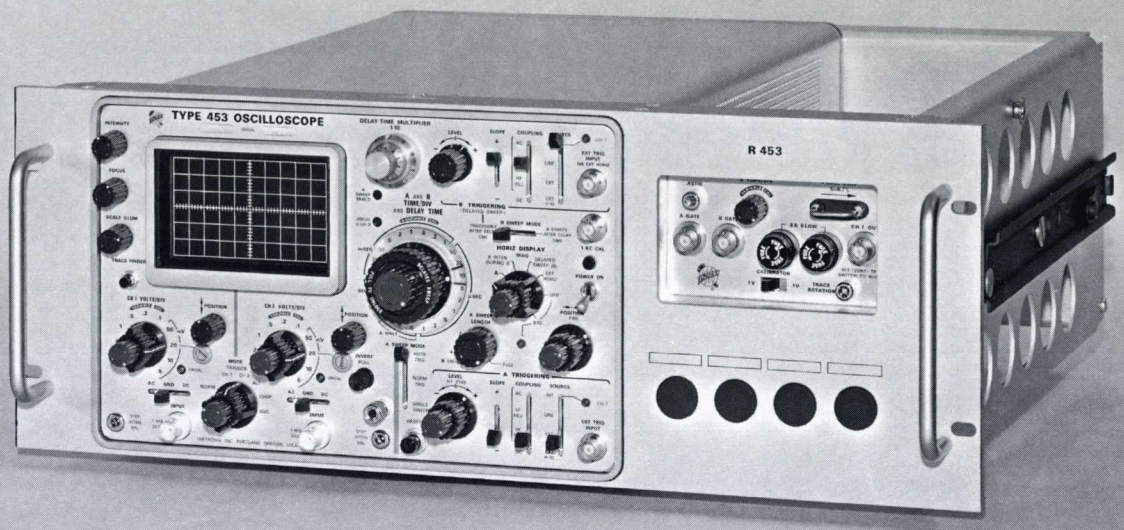
Portable to Rack-mount conversion kit.
This mounting kit includes hardware and instructions to convert existing Type 422 Oscilloscopes for rack-mount installation.
Order Part Number 040-0419-00 ..... $75

Rack-mount to Portable conversion kit.
This kit includes the cabinet and necessary hardware to convert existing Type R422 Oscilloscopes for portable operation.
Order Part Number 040-0421-00 ..... $40

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

DC-to-50 MHz OSCILLOSCOPE Type 453 / R453

NEW



- *COMPACT, LIGHT WEIGHT*
- *DUAL-TRACE, 5-mV DEFLECTION FACTOR*
- *50-MHz BANDWIDTH WITH PROBE*
- *CALIBRATED SWEEP DELAY*
- *FULL-BANDWIDTH TRIGGERING*
- *FULL-SENSITIVITY X-Y DISPLAY*
- *FOR SEVERE ENVIRONMENTS*

The Type 453 combines portability and performance previously unavailable in a DC-to-50 MHz oscilloscope. Weighing only 28 pounds, it is an easy-to-carry instrument ½ to ⅓ the size of previous DC-to-50 MHz oscilloscopes.

The Type R453 is electrically identical to the Type 453. It mounts on tilting, slide-out tracks to a standard 19″ rack, requiring only 7″ of panel height.

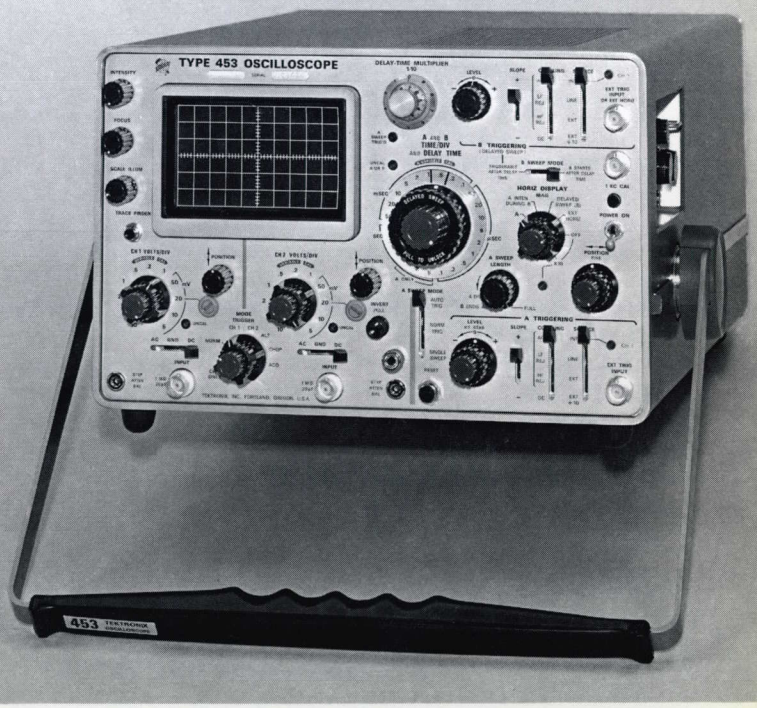
Their general-purpose capabilities are further enhanced by their ruggedness. They operate almost anywhere, and withstand environmental extremes between jobs. The regulated power supply is easily adaptable to a wide range of power-line voltages, and requires approx 100 watts.

Accurate X-Y measurements can be made of low-frequency phenomena, with Channel 2 providing the vertical deflection and Channel 1 providing the horizontal deflection.

A fine-mesh filter placed in front of the CRT attenuates external reflections and significantly improves display contrast, for viewing under high ambient light conditions.

With these state-of-the-art oscilloscopes, Tektronix offers an ideal combination of performance, weight, size and cost: The Type 453 and R453.

NEW



453
R453

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED DEFLECTION FACTOR—5 mV/div to 10 V/div.

BANDWIDTH with P6010 Probe—DC to 50 MHz from 20 mV/div to 10 V/div, DC to 45 MHz at 10 mV/div, DC to 40 MHz at 5 mV/div.

INPUT RC—1 megohm, 20 pF.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μs/div to 5 s/div.

SWEEP MAGNIFIER—X10, extends sweep range to 10 ns/div.

CALIBRATED SWEEP DELAY—1 μs to 50 s.

MINIMUM TRIGGER REQUIREMENTS—
Internal: 0.2 div/deflection (DC to 10 MHz)
1 div/deflection (to 50 MHz).
External: 50 mV (DC to 10 MHz)
200 mV (to 50 MHz).

EXTERNAL INPUT—270 mV/div and 2.7 V/div.

CRT

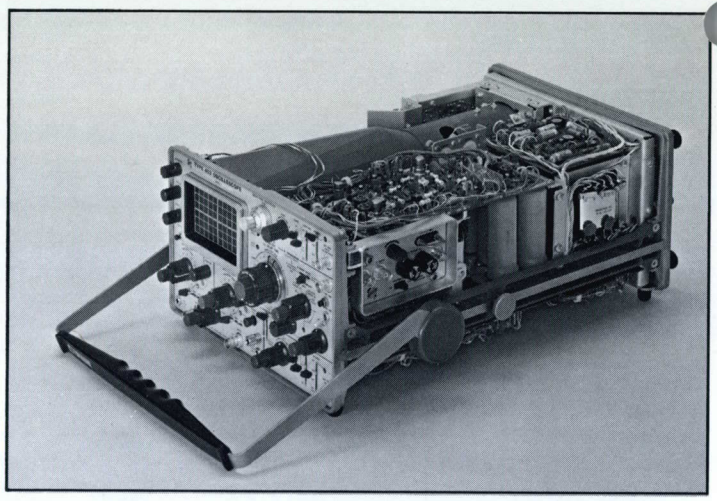
DISPLAY AREA—6 x 10 div (each div = 0.8 cm).

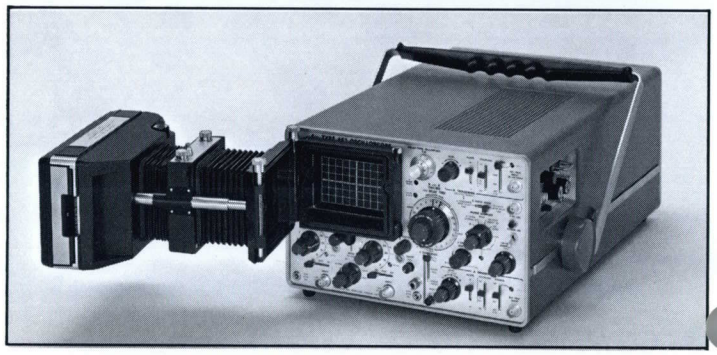
ACCELERATING VOLTAGE—10 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.1 and 1 V, 5 mA, 1 kHz PRR.

POWER REQUIREMENTS—96 to 137 V or 192 to 274 V, 45 to 440 Hz, approx 100 watts.





The Type 453 with the Tektronix C-30 Camera.

VERTICAL-DEFLECTION SYSTEM

DEFLECTION FACTOR	BANDWIDTH*		RISETIME	
	Type 453 Only	With P6010 Probe	Type 453 Only	With P6010 Probe
5 mV/div	DC to ≥41 MHz	DC to ≥40 MHz	≤8.5 ns	≤8.75 ns
10 mV/div	DC to ≥46.5 MHz	DC to ≥45 MHz	≤7.5 ns	≤7.8 ns
20 mV/div through 10 V/div	DC to ≥52.5 MHz	DC to ≥50 MHz	≤6.7 ns	≤7 ns
1 mV/div Ch 1 & 2 Cascaded	DC to ≥25 MHz		≤14 ns	

*Measured at the 3-dB down points. AC response is 3-dB down at ≈1.6 Hz (≈0.16 Hz with P6010 10X probe).

DEFLECTION FACTOR (EACH CHANNEL)
5 mV/div to 10 V/div in 11 calibrated steps (1-2-5 sequence), accuracy within ±3%. Uncalibrated continuous variation between steps and up to ≈25 V/div. Warning lights indicate uncalibrated settings.

INPUT RC
1 megohm ±2% paralleled by 20 pF ±3%.

MAXIMUM INPUT VOLTAGE
600 volts combined DC and peak AC.

OPERATING MODES
Channel 1 only; Channel 2 only (normal or inverted); Added algebraically (≥20:1 Common-Mode Rejection Ratio at up to 20 MHz, linear dynamic range ≥20X indicated deflection factor); Alternate; Chopped (500 kHz ±20% chopping rate).

TRACE DRIFT		
DEFLECTION FACTOR	TIME	TEMPERATURE
5 mV/div	≤1 div/h	≤0.1 div/°C
10 mV/div	≤0.5 div/h	≤0.05 div/°C
20 mV/div through 10 V/div	≤0.25 div/h	≤0.025 div/°C

DELAY LINE
Approx 140 ns.

TRIGGER SOURCE
Normal (displayed signal); Channel 1 (pickoff ahead of channel switching).

HORIZONTAL-DEFLECTION SYSTEM

TIME BASE A SWEEP RANGE

0.1 μs/div to 5 s/div in 24 calibrated steps (1-2-5 sequence). Uncalibrated continuous variation between steps and to ≥12.5 s/div. Warning light indicates uncalibrated setting. Sweep length continuously variable from ≤4 div to 11.0 ±0.5 div.

TIME BASE B SWEEP RANGE

0.1 μs/div to 0.5 s/div in 21 calibrated steps (1-2-5 sequence). Uncalibrated continuous variation between steps and to ≥1.25 s/div. Warning light indicates uncalibrated setting.

TIME BASE A & B SWEEP ACCURACY		
SWEEP RANGE	0°C to 40°C	−15°C to +55°C
0.1 μs/div to 50 ms/div	±3%	±4%
0.1 s/div to 5 s/div	±3%	±5%

TIME BASE A SWEEP MODES

Auto Trigger—sweep free runs in absence of triggering signal; Normal Trigger; Single Sweep. Light indicates when sweep is triggered.

TIME BASE B SWEEP MODES

Time Base B Triggerable after delay time; Time Base B starts after delay time.

X10 MAGNIFIER

Magnifies any portion of displayed sweep ten times, which also extends fastest sweep range to 10 ns/div. Accuracy is 1% in addition to specified basic sweep accuracy.

TIME BASE A & B TRIGGER SENSITIVITY		
TRIGGER MODE	TO 10 MHz	AT 50 MHz
DC INTERNAL	≤0.2 div deflection	≤1 div deflection
DC EXTERNAL	≤50 mV	≤200 mV
AC	As above, except −3 dB at 16 Hz	
AC LF REJECT	As above, except −3 dB at 16 kHz	
AC HF REJECT	As above, except −3 dB at 16 Hz and 100 kHz	

TRIGGER SOURCES

Internal, Line, External, External ÷ 10.

Input RC approx 1 megohm paralleled by approx 20 pF (except in AC LF Reject mode). 600 volts maximum input (DC + peak AC). Level adjustment through ≥ ±2 volts in External, through ≥ ±20 volts in External ÷ 10.

FULL-SENSITIVITY X-Y (CH 1 HORIZ, CH 2 VERT)

5 mV/div to 10 V/div in 11 calibrated steps (1-2-5 sequence), accuracy within ±5% from 0°C to +40°C, within ±8% from −15° C to +55° C. Bandwidth is DC to ≥5 MHz (−3 dB). Phase difference from Channel 2 is ≤3° at 50 kHz.

HORIZONTAL AMPLIFIER (EXTERNAL INPUT)

270 mV/div ±15% in External, 2.7 V/div ±20% in External ÷10. Same bandwidth and phase difference as above.

CALIBRATED SWEEP DELAY

DELAY TIME RANGE

1 μs to 50 s, continuously variable with 10-turn multiplier.

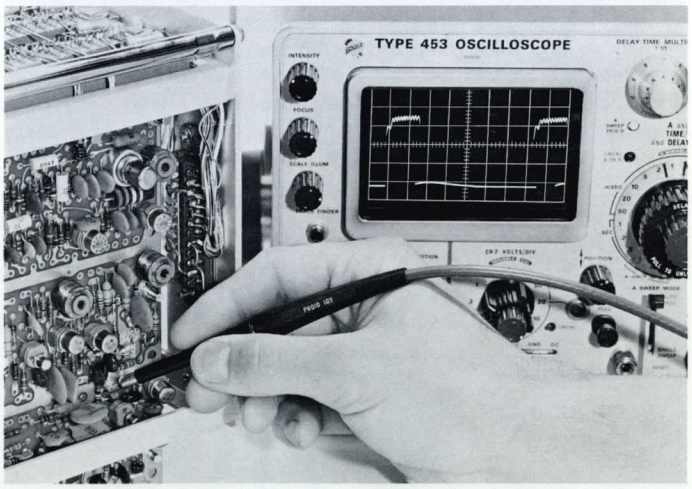
DELAY ACCURACY		
DELAY	0°C to +40°C	−15°C to +55°C
1 μs/div to 50 ms/div	±1.5%	±2.0%
0.1 s/div to 5 s/div	±2.5%	±3.5%

MULTIPLIER INCREMENTAL LINEARITY

Included in delay accuracy: ±0.2% from 0°C to +40°C, ±0.3% from −15°C to +55°C.

JITTER

≤1 part in 20,000 of maximum delay.



Small probe for easy access to dense circuitry.

453
R453

ENVIRONMENTAL CAPABILITIES

TEMPERATURE

Operating: (Type 453) —15° C to +55° C.
Operating: (Type R453) —15° C to +45° C.
Non-operating: (both models) —55° C to +75° C.

ALTITUDE

Operating: 15,000 feet; maximum allowable ambient temperature decreased 1°C/1000 feet from 5,000 to 15,000 feet.
Non-operating: 50,000 feet.

HUMIDITY

Non-operating: Meets electrical performance specifications after exposure to five cycles (120 hours) of Mil-Std-202B, Method 106A (omit freezing and vibration, and allow a 24-hour post-test drying period at +25°C and 20% to 80% relative humidity).

VIBRATION

Operating: 15 minutes along each of the three axes, 0.025 inch peak to peak displacement (4 g's at 55 Hz) 10 to 55 to 10 Hz in 1-minute cycles.

SHOCK

Operating and non-operating: 30 g's, ½ sine, 11-ms duration, 12 shocks total.

TRANSPORTATION

In shipping carton: Meets National Safe Transit test of vibration for 1 hour at slightly greater than 1 g, 30-inch drops on one corner, all edges radiating from that corner, and all flat surfaces (total of 10 drops).

OTHER FEATURES

TIME AND AMPLITUDE CALIBRATOR

1 volt or 0.1 volt output; 5-mA output. Amplitude accuracy within ±1% from 0°C to +40°C, within ±1.5% from —15°C to +55°C. 1-kHz repetition rate accurate within ±0.5% from 0°C to +40°C, within ±1% from —15°C to +55 °C. ≤1-μs risetime; 49% to 51% duty cycle.

SIGNAL OUTPUTS

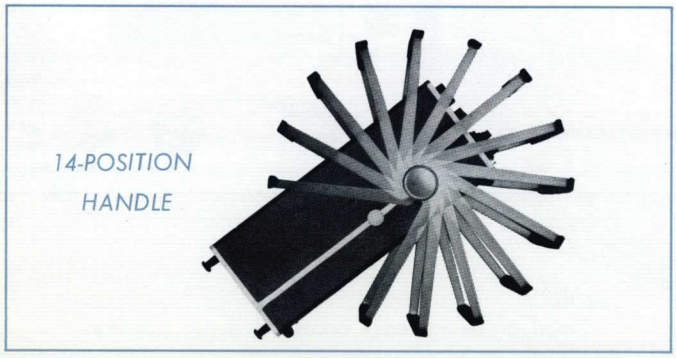
A & B Gates: 12 volts ±10%, approx 1.5 kΩ output resistance. Channel 1 Vertical Signal: ≥25 mV/div into 1 megohm; approx 50 Ω output resistance; DC to ≥25 MHz (—3 dB).

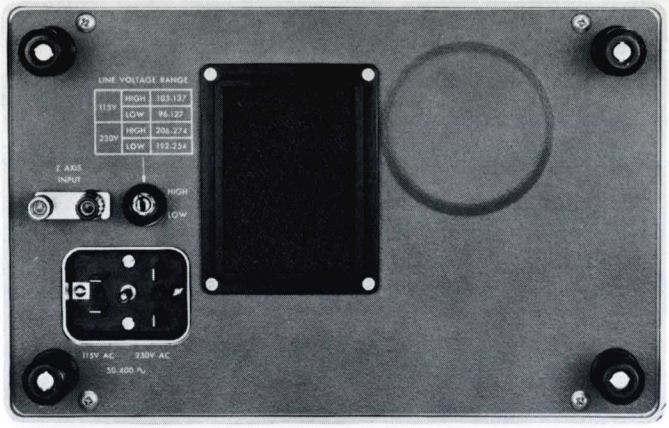
TRACE FINDER

Compresses display within graticule area, for ease in determining the nature of an improper deflection signal.

TEKTRONIX CRT

4-inch rectangular tube; 6 x 10 div (each div = 0.8 cm) display area; P31 phosphor standard. 10-kV accelerating potential. Noticeable modulation at normal intensity with 5 volts or less peak to peak at Z-axis input; DC to ≥50 MHz usable frequency range; 200 volts (DC and peak AC) maximum input voltage.





POWER REQUIREMENTS

Operates from 115-volt or 230-volt nominal line, 45 to 440 Hz. Oscilloscope power supply automatically regulates at either nominal voltage, when appropriate power cord is inserted. Rear-panel switch permits operation on line voltage above or below nominal: high range—103 to 137 volts or 206 to 274 volts, low range—96 to 127 volts or 192 to 254 volts (when line contains ≤2% total harmonic distortion). Power consumption approx 100 watts.

COOLING

Filtered forced-air cooling.

CABINET MODEL

Type 453 net weight is 28¾ pounds, including panel cover. Shipping weight is 36 pounds. Height, including feet: 7.25". Width, including handle: 12.5". Length, including rear feet and front cover: 20.5"; with extended handle: 22.4".

RACK MODEL

Type R453, net weight is approx 32 pounds. Shipping weight 64½ pounds. Height, 7". Width, 19". Length (not including front panel hardware), 17¾".

TYPE 453 OSCILLOSCOPE $2050

Each instrument includes: 2—P6010 3.5 ft 10X probe package (010-0188-00); 1—18" 50-Ω BNC cable (012-0076-00); 1—BNC jack post (012-0092-00); 1—115-volt power cord (161-0024-01); 1—230-volt power cord (161-0027-01); 1—3 to 2-wire adapter (103-0013-00); 1—CRT ornamental ring (354-0269-00); 1—smoke gray light filter (378-0576-00); 1—mesh filter (installed) (378-0573-00); 1—CRT faceplate protector (386-0218-00); 1—oscilloscope dust and rain cover (016-0074-00); 2—BNC to binding post adapter (103-0033-00); 2—instruction manual (070-0478-00).

TYPE R453 OSCILLOSCOPE $2135

Each instrument includes: 2—P6010 3.5 ft 10X probe package (010-0188-00); 1—18" 50-Ω BNC cable (012-0076-00); 1—BNC jack post (012-0092-00); 1—115-volt power cord (161-0024-01); 1—230-volt power cord (161-0027-01); 1—3 to 2-wire adapter (103-0013-00); 1—CRT ornamental ring (354-0269-00); 1—smoke gray light filter (378-0576-00); 1—mesh filter (installed) (378-0573-00); 1—CRT faceplate protector (386-0218-00); 2—BNC to binding post adapter (103-0033-00); 1—set mounting hardware; 1—set slide-out tracks (351-0101-00); 2—instruction manual (070-0478-00).

OPTIONAL ACCESSORIES

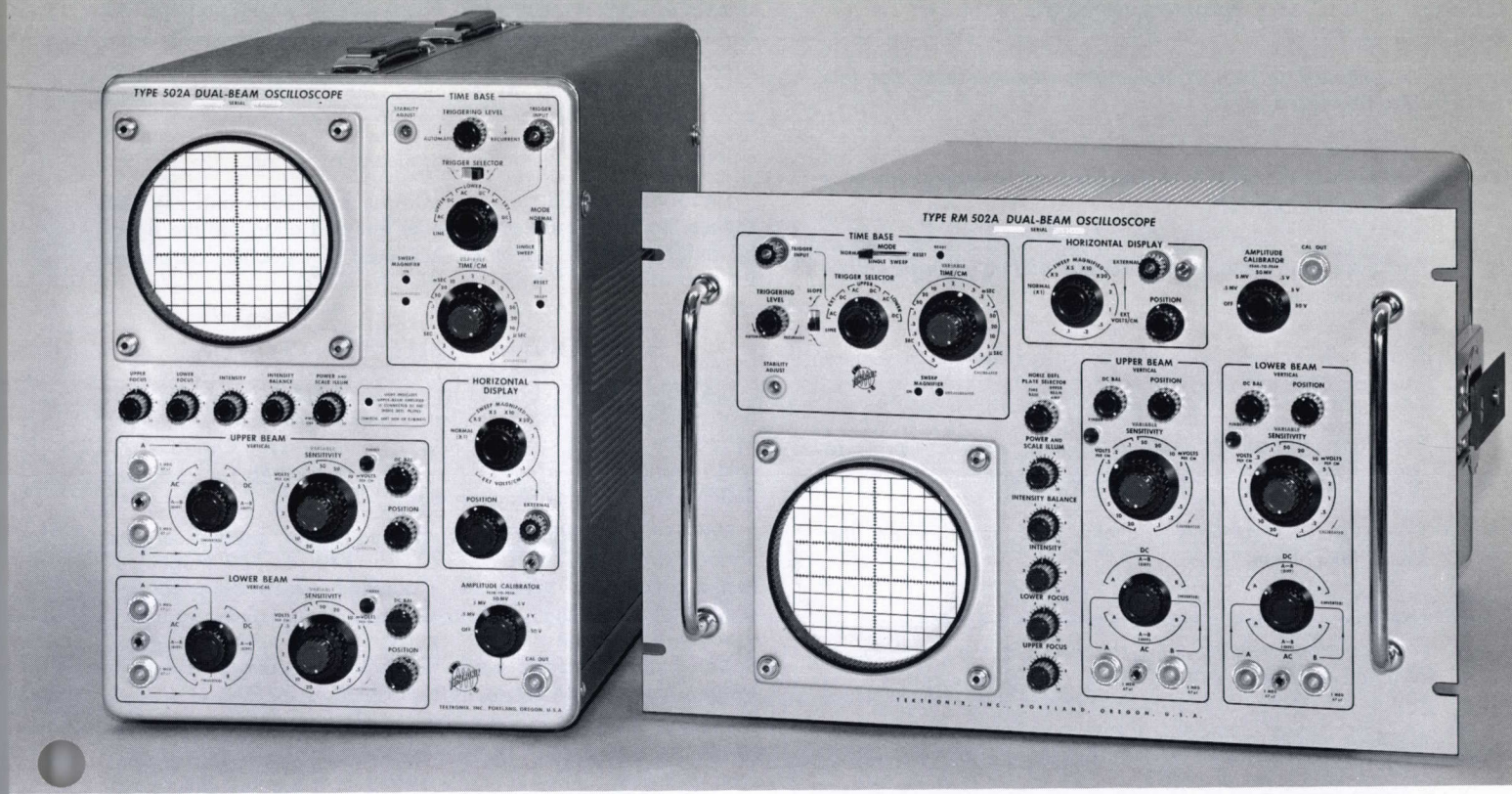
P6010 6 ft 10X Probe Package (010-0185-00) $30
P6011 3.5 ft 1X Probe Package (010-0193-00) $15
P6011 6 ft 1X Probe Package (010-0190-00) $15

RACK-MOUNT CONVERSION KIT (040-0420-00) $85

Includes hardware and instructions to convert existing Type 453 Portable Oscilloscopes for rack-mount installation.

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

100 μV/cm DUAL-BEAM OSCILLOSCOPE Type 502A / RM502A



2 IDENTICAL VERTICAL AMPLIFIERS

DIFFERENTIAL INPUT AT ALL DEFLECTION FACTORS

X-Y CURVE TRACING WITH 1 OR 2 BEAMS

SINGLE SWEEP OPERATION

BEAM FINDERS

The new Tektronix Type 502A and RM502A retains the popular dual-beam design of the Type 502, and adds these extremely useful features: 100 μV/cm deflection factor, single-sweep operation, variable deflection factor and sweep-time controls, intensity balance, beam finders, and other refinements.

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED DEFLECTION FACTOR—100 μV/cm to 20 V/cm.

BANDWIDTH—DC to 50 kHz thru 1 MHz.

COMMON-MODE REJECTION—Up to 40,000 to 1.

PHASE DIFFERENCE—Less than 5 degrees.

INPUT RC—1 megohm, 47 pF.

HORIZONTAL

CALIBRATED SWEEP RANGE—1 μs/cm to 5 s/cm.

SWEEP MAGNIFIER—X2, X5, X10, X20; 3% accuracy to 1 μs/cm.

TRIGGER REQUIREMENTS—Internal: 2 mm or greater.
External: 0.4 to 10 V.

EXTERNAL INPUT—0.1, 0.2, 0.5, 1 and 2 V/cm.

CRT

DISPLAY AREA—8 x 10 cm (each beam).

ACCELERATING VOLTAGE—3 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.5 mV to 50 V, 1-kHz square wave.

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 305 watts, maximum.

502A
RM502A

APPLICATIONS

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

Bandwidth Specifications are at —3 dB.

IDENTICAL VERTICAL AMPLIFIERS provide an accurate means of displaying dual-beam waveforms on a linear time base, single-beam X-Y curves at up to 100 μV/cm deflection factor, or dual-beam X-Y curves at up to 0.1 V/cm deflection factor.

CALIBRATED DEFLECTION FACTOR from 100 μV/cm to 20 V/cm in 17 calibrated steps with 1-2-5 sequence, and accurate within 3% of panel reading. Variable controls permit continuous adjustment uncalibrated from 100 μV/cm to approximately 50 V/cm.

BANDWIDTHS are DC to 50 kHz at 100 μV/cm, increasing to DC to 100 kHz at 200 μV/cm, DC to 200 kHz at 1 mV/cm, DC to 400 kHz at 50 mV/cm, and DC to 1 MHz at 0.2 V/cm. Bandwidths at lower deflection factor are DC to 300 kHz at 0.5 V/cm and 5 V/cm, DC to 500 kHz at 1 V/cm and 10 V/cm, DC to 1 MHz at 2 V/cm and 20 V/cm.

DIFFERENTIAL INPUT provides an effective means of eliminating unwanted common-mode signals. Common-mode rejection ratios vary according to deflection factor and frequency, and are measured using a direct-coupled sinewave. Common-mode signals should not exceed 2 V peak to peak at the input grid. With a 1-kHz sinewave, rejection ratios are 40,00:1 at 0.1 mV/cm, 20,000:1 at 0.2 mV/cm, 100:1 at 0.2 V/cm, and 50:1 at 5 V/cm. Rejection ratios at higher frequencies are 2000:1 at 50 kHz with 0.1 mV/cm deflection factor, 1000:1 at 100 kHz with 0.2 mV/cm deflection factor and 50:1 at 400 kHz with 0.2 V/cm deflection factor. Measurements are made with a common signal applied to both A and B inputs.

AC or DC COUPLING, inversion of the signal to the oscilloscope, is controlled from the front panel. An inverted display on one beam is sometimes desirable in comparison measurements. With AC-coupling, the low-frequency —3-dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by 47 pF.

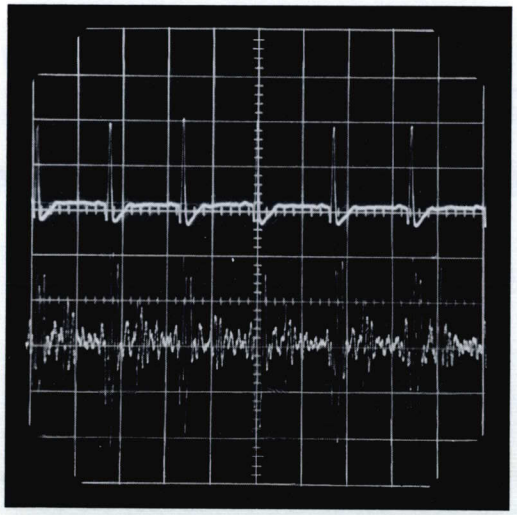
PASSIVE PROBES supplied with the Type 502A and RM502A reduce loading on the circuit under test and attenuate the signal by a factor of 10. Input RC becomes 10 megohms paralleled by approximately 9.5 pF.

HORIZONTAL DEFLECTION SYSTEM

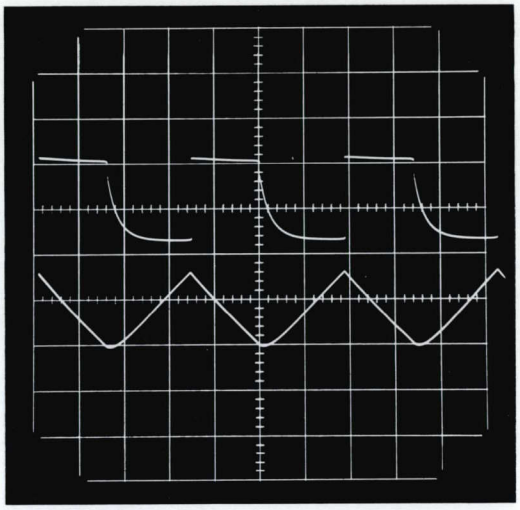
SWEEP RANGE from 1 μs/cm to 5 s/cm is in 21 calibrated steps with 1-2-5 sequence and is accurate within 3% of panel reading. Sweep rate is continuously variable uncalibrated from 1 μs/cm to over 12 s/cm. Sweep rate selected deflects both beams simultaneously.

SWEEP MAGNIFIER expands the center portion of the normal sweep to fill 10 cm. X2, X5, X10, or X20 magnification is available. When the magnified sweep does not exceed the maximum calibrated rate of 1 μs/cm, accuracy is within 5% of the displayed portion of the magnified sweep. A panel light indicates when the maximum calibrated rate is being exceeded, or sweep rate variable is in use.

SINGLE SWEEP OPERATION facilitates photographic recording of waveforms. 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 reset or returned to normal operation.



Dual-beam presentation of electrocardiogram vs heart sounds (upper beam is ECG, lower beam is heart sound). Heart sound was picked up by microphone taped to chest.



Comparison of input and output waveforms. Lower trace is result of passing upper waveform through an integrating network. Lower trace is inverted.

X-Y OPERATION

SINGLE BEAM X-Y CURVE TRACING at equal horizontal and vertical deflection factors can be accomplished when the upper-beam vertical amplifier is switched to the CRT horizontal-deflection plates. A panel light indicates when the upper-beam amplifier is connected in this manner. The full 100 μV/cm deflection factor can be used with either single-ended or differential input.

PHASE DIFFERENCE between vertical amplifiers, when both are set at equal deflection factors, is typically less than 5 degrees up to the specified -3dB point.

DUAL-BEAM X-Y CURVE TRACING can be accomplished when a signal source is applied to the external horizontal amplifier. Horizontal deflection is calibrated in steps of 0.1, 0.2, 0.5, 1, and 2 V/cm, and is accurate within 5%.

TRIGGER

AUTOMATIC OPERATION assures positive sweep triggering by signals of different amplitudes, shapes, and repetition rates. In the absence of an input signal, automatic triggering occurs at about a 50-Hz rate to provide a convenient reference trace.

RECURRENT OPERATION provides a convenient reference at a frequency dependent on the sweep time per centimeter.

TRIGGER LEVEL is adjustable to allow sweep triggering at any selected point on either the rising or falling portion of the waveform.

SOURCE can be internal from either amplifier (2-mm deflection), external (0.4 V to 10 V), or line, and can be AC or DC coupled.

CRT AND DISPLAY FEATURES

TEKTRONIX 5" CRT is a dual-gun tube with two pairs of vertical and one pair of horizontal-deflection plates. A P2 phosphor is normally supplied. Accelerating potential is 3 kV. Display area for each beam is 8 cm by 10 cm. Beams overlap in the center 6-cm vertical area.

CRT CONTROLS include a separate focus adjustment for each beam, a common intensity control, and an intensity balance. The balance control provides an effective method of identifying upper and lower beams, especially when they are superimposed for comparison.

PUSH-BUTTON BEAM FINDERS indicate the relative position of the trace when it is deflected off the CRT screen. This feature is especially useful at the higher sensitivities.

ILLUMINATED GRATICULE with variable edge lighting is accurately ruled in centimeter squares. Viewing area is 10 by 10 centimeters. Vertical centerline and horizontal centerlines for each beam are further marked in 5 minor divisions per cm.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR provides 6 square-wave voltages at the front panel. Peak-to-peak amplitude is 0.5 mV, 5 mV, 50 mV, 0.5 V, 5 V or 50 V, and is accurate within 3%. Frequency is about 1 kHz.

INPUT STAGE DC HEATERS of both vertical amplifiers are transistor regulated.

ELECTRONICALLY-REGULATED DC SUPPLIES insure stable operation between 105 and 125 V or between 210 and 250 V, 50 to 60 Hz. Transformer taps allow operation on either range. Instrument factory wired for 117 V. Power consumption approximately 280 watts.

CABINET MODEL dimensions are 15¾" high by 11½" wide by 23¾" deep. Net weight is 60 pounds. Shipping weight is 65 pounds, approximately.

RACK MOUNT MODEL dimensions are 12¼" high by 19" wide by 22¾" deep. Net weight is 58½ pounds. Shipping weight is 86 pounds approximately. Instrument mounts on tilt-lock slide-out tracks to a standard 19" rack.

TYPE 502A OSCILLOSCOPE $1050

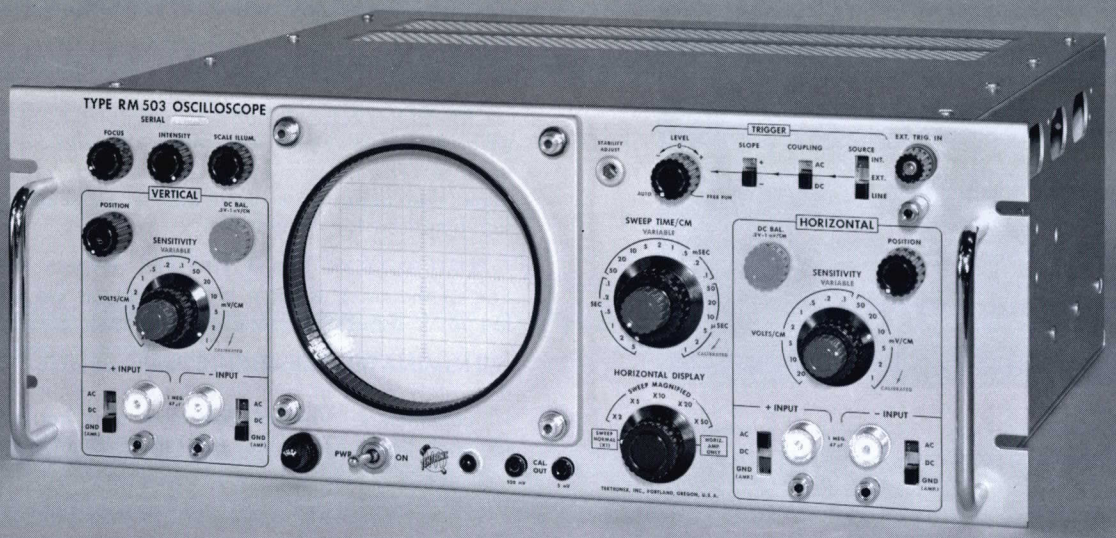
Each instrument includes: 2—P6006 probe (010-0125-00); 1—Test lead (012-0031-00); 2—A510 binding post adapter (013-0004-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray light filter (378-0567-00); 2—Instruction Manual (070-0382-00).

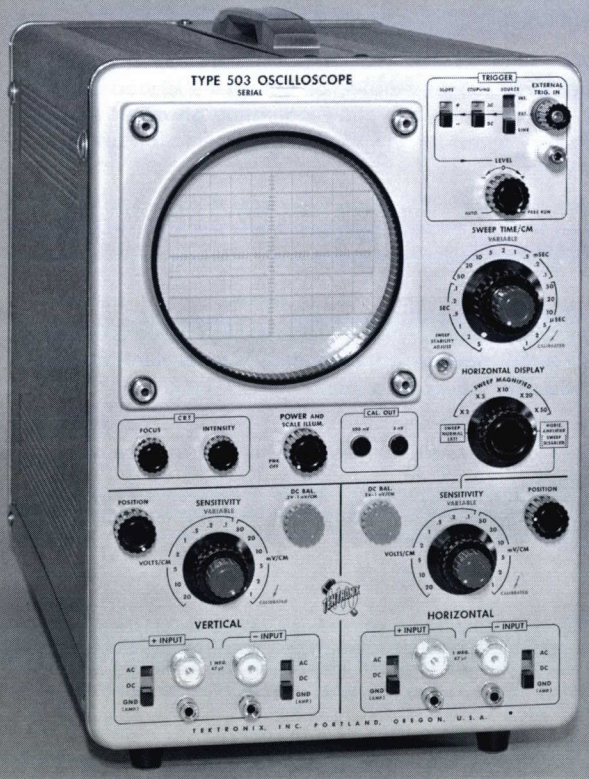
TYPE RM502A OSCILLOSCOPE $1150

Each instrument includes: 2—P6006 probe (010-0125-00); 1—Test lead (012-0031-00); 2—A510 binding post adapter (013-0004-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray light filter (378-0567-00); 1—Pr Mounting tracks (351-0085-00); 1—Set mounting hardware; 2—Instruction Manual (070-0382-00).

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

Type 503 / RM 503 DC-to-450 kHz X-Y OSCILLOSCOPE





IDENTICAL VERTICAL & HORIZONTAL AMPLIFIERS

DIFFERENTIAL INPUT AT ALL DEFLECTION FACTORS

ELECTRONICALLY-REGULATED DC SUPPLIES

COMPACT CABINET OR RACK-MOUNT MODELS

CHARACTERISTIC SUMMARY

VERTICAL & HORIZONTAL

CALIBRATED DEFLECTION FACTOR—1 mV/cm to 20 V/cm.
BANDWIDTH—DC to 450 kHz.
COMMON-MODE REJECTION—100:1 at 1 mV/cm deflection factor. DC to 50 kHz, 4 V P to P, max.
INPUT RC—1 megohm, 47 pF.

SWEEP GENERATOR

CALIBRATED SWEEP RANGE—1 μs/cm to 5 s/cm.
SWEEP MAGNIFIER—X2, X5, X10, X20 X50.
TRIGGER REQUIREMENTS—Internal: 0.5-cm deflection.
External: 0.5 to 10 V.

CRT

DISPLAY AREA—8 x 10 cm.
ACCELERATING VOLTAGE—3 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—5 mV and 0.5 V, approx 400 Hz square wave.
POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 110 watts, max.

VERTICAL AND HORIZONTAL AMPLIFIERS

BANDWIDTH of DC-coupled amplifiers extends to 450 kHz at 3-dB down.

DEFLECTION FACTOR from 1 mV/cm to 20 V/cm is in 14 calibrated steps with 1-2-5 sequence, and is accurate within 3%. A variable control permits continuous adjustment (uncalibrated) from 1 mV/cm to approximately 50 V/cm.

COMMON-MODE REJECTION

REJECTION RATIO	DEFLECTION FACTOR	CMR SIGNAL	FREQUENCY
At least 100:1	1 mV to 0.2 V/cm	4 V P-to-P, max	DC to 50 kHz
At least 30:1	0.5 V to 2 V/cm	40 V P-to-P, max	DC to 50 kHz
At least 30:1	5 V to 20 V/cm	400 V P-to-P, max	DC to 50 kHz

AC or DC COUPLING of the signal to the oscilloscope, or grounding of the input stage grid is controlled from the front panel. With AC coupling, the low-frequency —3-dB point is 10 Hz direct or 1 Hz with optional 10X probe.

INPUT RC is 1 megohm parallaled by 47 pF, and remains constant with varying deflection factors.

X-Y OPERATION

IDENTICAL VERTICAL and HORIZONTAL AMPLIFIERS provide an accurate means of displaying X-Y curves at up to 1 mV/cm deflection factor.

PHASE SHIFT is 1°, or less, at a deflection factor of 1 mV to 0.2 V/cm, up to a frequency of 450 kHz. It is 2°, or less, at a deflection factor of 0.5 V to 20 V/cm, up to a frequency of 50 kHz. (Includes variable sweep between steps.)

SWEEP GENERATOR

SWEEP RANGE from 1 μs/cm to 5 s/cm is in 21 calibrated steps with 1-2-5 sequence, and accurate within 3%. Sweep speed is variable between steps uncalibrated from 1 μs/cm to over 12 s/cm.

SWEEP MAGNIFIER expands any portion of the normal sweep. Magnification of 2X, 5X, 10X, 20X, or 50X is available. When the magnified sweep does not exceed the maximum calibrated rate of 0.1 μs/cm, accuracy is within 5% of the displayed portion of the magnified sweep.

TRIGGER

AUTOMATIC OPERATION assures positive sweep triggering by signals of different amplitudes, shapes, and repetition rates. In the absence of an input signal, automatic triggering occurs at about a 50-Hz rate to provide a convenient reference trace.

FREE-RUNNING OPERATION provides a convenient reference trace at a frequency dependent on the sweep time per centimeter.

TRIGGER LEVEL is adjustable to allow sweep triggering at any selected point on either the rising or falling portion of the waveform.

SOURCE can be internal (minimum trigger requirement ½-cm deflection), external (½-volt minimum required), or line, and can be AC or DC coupled.

CRT & DISPLAY FEATURES

TEKTRONIX 5" CRT provides a high-contrast trace for easy reading under high ambient light conditions. An improved P2 phosphor is normally supplied with the instrument, and offers distinct advantages for oscilloscope photography. Accelerating potential is 3 kV.

DEFLECTION BLANKING assures uniform beam current for all sweep and repetition rates. The system consists in part of two pairs of cross-connected deflection plates which intercept the beam current, and blank the CRT screen except during sweep time.

INTENSITY MODULATION can be accomplished by using the CRT grid-input terminal at the rear of the oscilloscope.

ILLUMINATED GRATICULE with variable edge lighting is accurately ruled in centimeter squares. Viewing area is 8 x 10 centimeters. Vertical and horizontal centerlines are marked in 5 minor divisions per centimeter.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR provides 2 square-wave voltages at the front panel. Peak-to-peak amplitudes are 500 mV and 5 mV, accurate within 3%. Frequency is between 300 and 500 Hz.

ELECTRONICALLY-REGULATED DC SUPPLIES insure stable operation between 105 and 125 volts, or 210 and 250 volts. Input stage heaters of the vertical and horizontal amplifiers are supplied with regulated DC.

POWER REQUIREMENT is 105 to 125 volts, or 210 to 250 volts, 50 to 800 Hz, typically 107 watts at 117 volts. The low-line voltage requirement increases about 10% at 400 Hz, and about 15% at 800 Hz.

CABINET MODEL dimensions are 14¾" high by 10" wide by 21⅝" deep. Net weight is 29½ pounds. Shipping weight is approximately 38 pounds.

RACK MOUNT MODEL dimensions are 7" high by 19" wide by 17" deep. The instrument mounts directly to a standard 19" rack. Optional rack slides are available. Net weight is 27 pounds. Shipping weight is approximately 51 pounds.

TYPE 503 OSCILLOSCOPE **$640**

Each instrument includes: 2—A510 binding-post adapter (013-0004-00); 1—3 to 2-wire adapter (103-0013-00); 1—Smoke gray filter (378-0567-00); 2—Instruction Manual (070-0218-00).

TYPE RM503 OSCILLOSCOPE **$655**

Each instrument includes: 2—A510 binding post adapter (013-0004-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—Set mounting hardware; 1—Smoke gray filter (378-0567-00); 2—Instruction Manual (070-0314-00).

SLIDE-OUT TRACKS FOR TYPE RM503

Slide-out tracks can be used to mount the Type RM503 Oscilloscope to a standard 19" rack. These tracks provide tilting and locking convenience in any of 7 positions. Slide-out tracks can be ordered separately, or as MOD 171A installed at the factory.

TYPE RM503 MOD 171A **$705**

Each instrument includes: 2—A510 binding post adapter (013-0004-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—Set mounting hardware; 1—Smoke gray filter (378-0567-00); 2—Instruction Manual (070-0314-00).

SLIDE-OUT TRACK KIT (Part Number 351-0050-00) $45

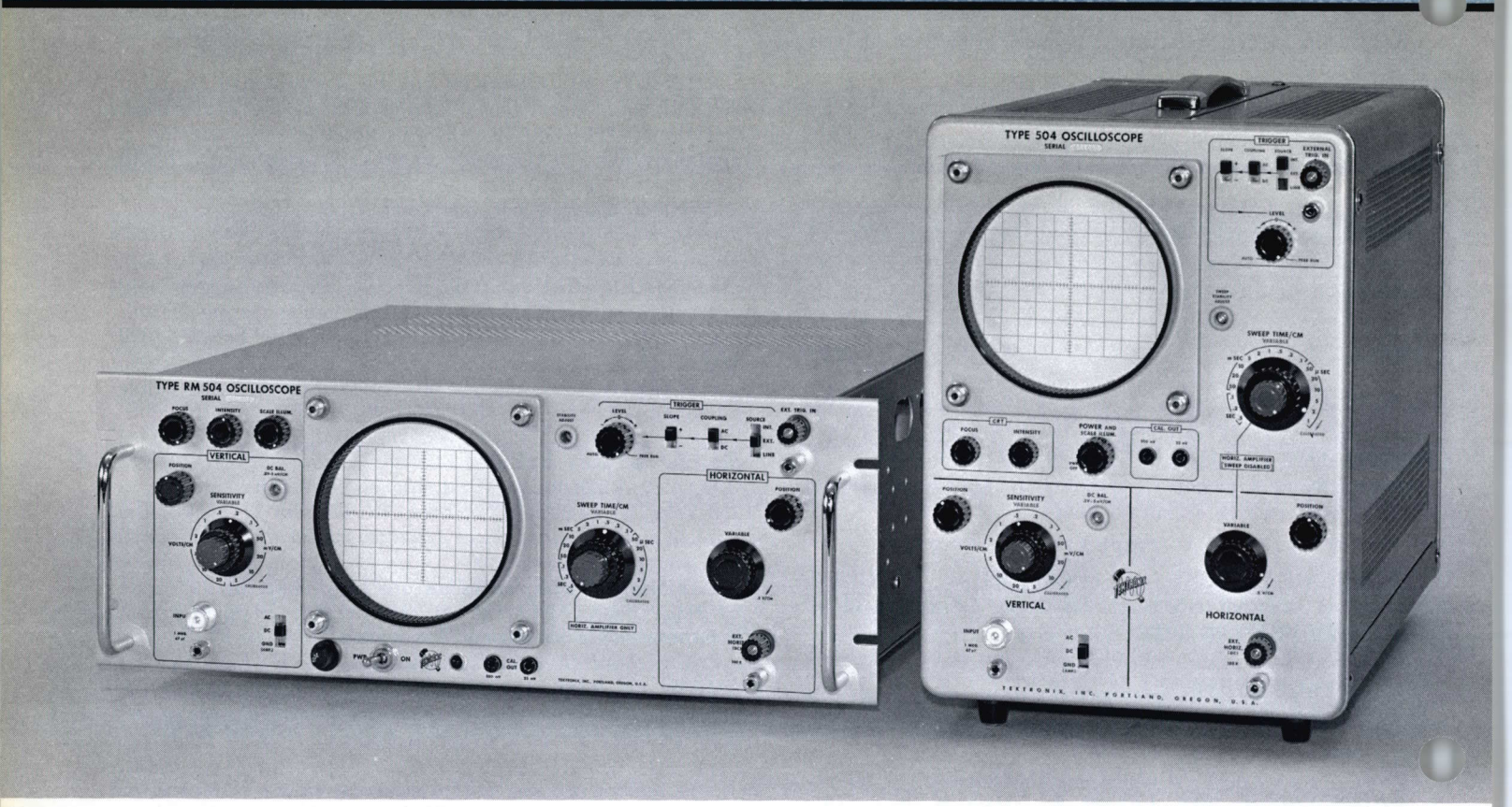
PROBES

For minimum loading on the circuit under test, RC attenuator probes are recommended. These probes, each with a 42" cable, are ideally suited for use with the Type 503 or RM503 Oscilloscope.

Probe	Atten. Ratio	Input RC Resistance	Input RC Capacitance	Voltage Rating	Part No.	Price
P6006	10:1	10 MΩ	9.5 pF	600 V	010-0125-00	$22.00
P6023	10:1	8 MΩ	12 pF	1000 V	010-0065-00	$40.00
P6027	1:1	1 MΩ	87 pF	600 V	010-0070-00	$12.50

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

Type 504 / RM504 DC-to-450 kHz OSCILLOSCOPE



CONSTANT INPUT RC

ELECTRONICALLY-REGULATED DC SUPPLIES

COMPACT CABINET OR RACK-MOUNT MODELS

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED DEFLECTION FACTOR—5 mV/cm to 20 V/cm.

BANDWIDTH—DC to 450 kHz.

INPUT RC—1 megohm, 47 pF.

HORIZONTAL

CALIBRATED SWEEP RANGE—1 μs/cm to 0.5 s/cm.

TRIGGER REQUIREMENTS—Internal: 0.5-cm deflection.
External: 0.5 to 10 V.

EXTERNAL INPUT—0.5 V/cm maximum deflection factor.

CRT

DISPLAY AREA—8 x 10 cm.

ACCELERATING VOLTAGE—3 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—25 mV and 0.5 V, approx 400-Hz square wave.

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 93 watts.

VERTICAL-DEFLECTION SYSTEM

BANDWIDTH of the DC-coupled amplifier extends to 450 kHz at 3-dB down.

DEFLECTION FACTORS from 5 mV/cm to 20 V/cm are in 12 calibrated steps with 1-2-5 sequence. Accurate to ±3%. A variable control permits continuous adjustment (uncalibrated) from 5 mV/cm to approximately 50 V/cm.

AC or DC COUPLING of the signal to the oscilloscope, or grounding of the input stage grid is controlled from the front panel. With AC coupling, the low-frequency —3-dB point is 10 Hz direct or 1 Hz with optional 10X probe.

INPUT RC is 1 megohm paralleled by about 47 pF. Remains constant with varying deflection factors.

HORIZONTAL-DEFLECTION SYSTEM

SWEEP RANGE from 1 μs/cm to 0.5 s/cm is in 18 calibrated steps with 1-2-5 sequence, and is accurate within 3%. Sweep rate is variable between steps uncalibrated from 1 μs/cm to over 1.2 s/cm.

EXTERNAL HORIZONTAL INPUT provides for horizontal deflection using an external source. Deflection factor is variable from a maximum of 0.5 V/cm.

TRIGGER

AUTOMATIC OPERATION assures positive sweep triggering by signals of different amplitudes, shapes, and repetition rates. In absence of an input signal, automatic triggering occurs at about a 50-Hz rate to provide a convenient reference trace.

FREE-RUNNING OPERATION provides a convenient reference trace at a frequency dependent on the sweep time per centimeter.

TRIGGER LEVEL is adjustable to allow sweep triggering at any selected point on either the rising or falling portion of the waveform.

SOURCE can be internal (1/2-cm deflection minimum trigger requirement), external (1/2-volt minimum trigger requirement), or line, and can be AC or DC coupled.

CRT & DISPLAY FEATURES

TEKTRONIX 5" CRT provides a high-contrast trace for easy reading under high ambient light conditions. An improved P2 phosphor is normally supplied with the instrument, and offers distinct advantages for oscilloscope photography. Accelerating potential is 3 kV.

DEFLECTION BLANKING assures uniform beam current for all sweep and repetition rates. The system consists in part of two pairs of cross-connected deflection plates which intercept the beam current, and blank the CRT screen except during sweep time.

INTENSITY MODULATION can be accomplished by using the CRT grid-input terminal at the rear of the oscilloscope.

ILLUMINATED GRATICULE with variable edge lighting is accurately ruled in centimeter squares. Viewing area is 8 x 10 centimeters. Vertical and horizontal centerlines are marked in 5 minor divisions per centimeter.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR provides 2 square-wave voltages at the front panel. Peak-to-peak amplitudes are 500 mV and 25 mV, accurate within 3%. Frequency is between 300 and 500 Hz.

ELECTRONICALLY-REGULATED DC SUPPLIES insure stable operation between 105 and 125 volts, or 210 and 250 volts. Input stage heaters are supplied with regulated DC.

POWER REQUIREMENT is 105 to 125 volts, or 210 to 250 volts, 50 to 800 Hz, typically 93 watts at 117 volts. The low-line voltage requirement increases about 10% at 400 Hz, and about 15% at 800 Hz.

CABINET MODEL dimensions are 14 3/4" high by 10" wide by 21 5/8" deep. Net weight is 27 1/4 pounds. Shipping weight is approximately 43 pounds.

RACK MOUNT MODEL dimensions are 7" high by 19" wide by 17" deep. The instrument mounts directly to a standard 19" rack. Optional rack slides are available. Net weight is 25 1/2 pounds. Shipping weight is approximately 48 pounds.

TYPE 504 OSCILLOSCOPE **$540**

Each instrument includes: 1—A510 binding-post adapter (013-0004-00); 1—3 to 2-wire adapter (103-0013-00); 1—Smoke gray filter (378-0567-00); 2—Instruction Manual (070-0224-00).

TYPE RM504 OSCILLOSCOPE **$550**

Each instrument includes: 1—A510 binding-post adapter (013-0004-00); 1—3- to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—Set mounting hardware; 1—Smoke gray filter (378-0567-00); 2—Instruction Manual (070-0315-00).

SLIDE-OUT TRACKS FOR TYPE RM504

Slide-out tracks can be used to mount the Type RM504 Oscilloscope to a standard 19" rack. These tracks provide tilting and locking convenience in any of 7 positions. Slide-out tracks can be ordered separately, or as MOD 171A installed at the factory.

TYPE RM504 MOD 171A **$600**

Each instrument includes: 1—A510 binding-post adapter (013-0004-00); 1—3- to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—Set mounting hardware; 1—Smoke gray filter (378-0567-00); 2—Instruction Manual (070-0315-00).

SLIDE-OUT TRACK KIT (Part Number 351-0050-00) $45

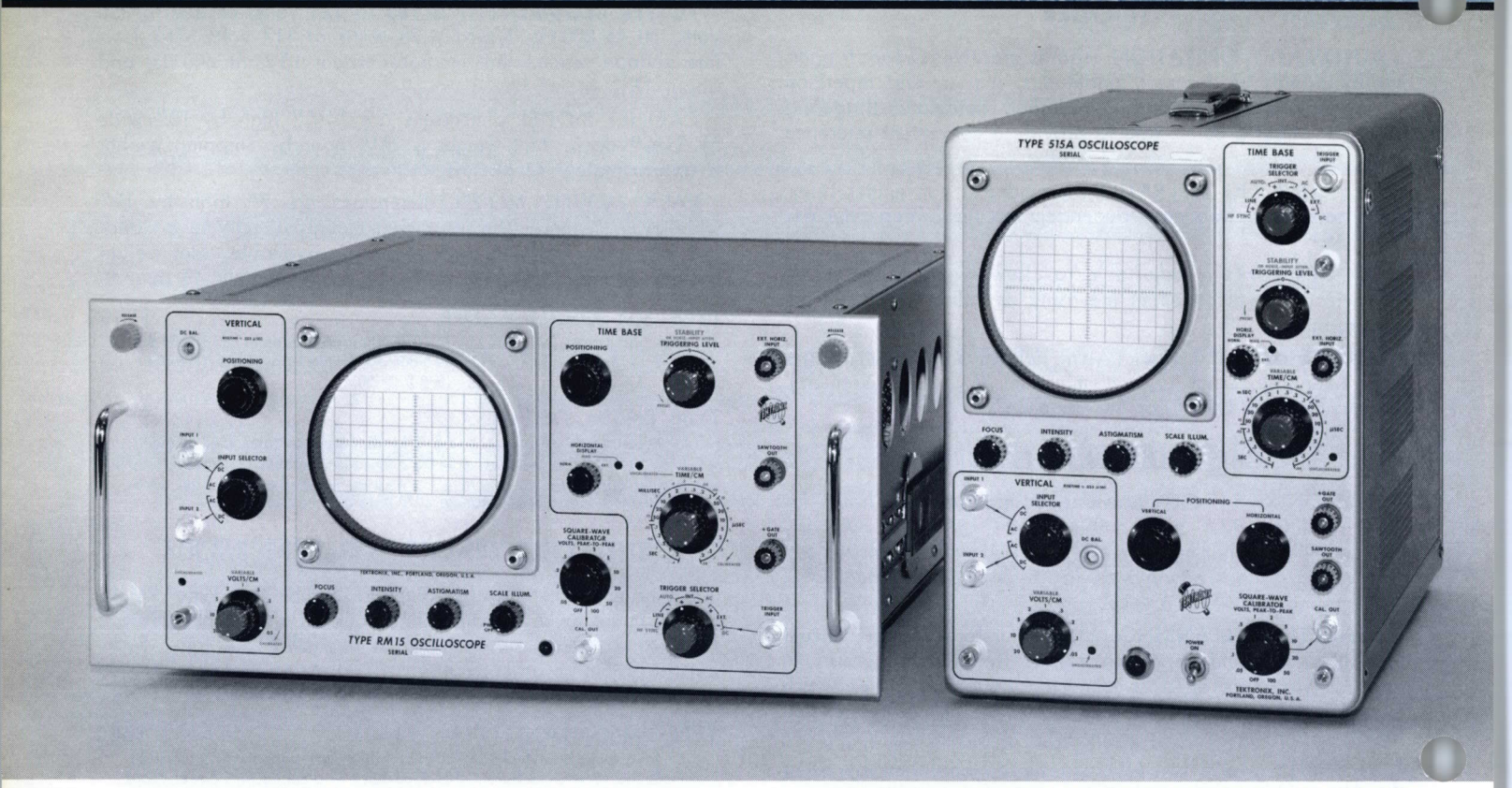
PROBES

For minimum loading on the circuit under test, RC attenuator probes are recommended. These probes, each with a 42" cable, are ideally suited for use with the Type 504 or RM504 Oscilloscope.

		Input RC				
Probe	Atten. Ratio	Resistance	Capacitance	Voltage Rating	Part No.	Price
P6006	10:1	10 MΩ	9.5 pF	600 V	010-0125-00	$22.00
P6027	1:1	1 MΩ	87 pF	600 V	010-0070-00	$12.50

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

Type 515A / RM15 DC-to-15 MHz OSCILLOSCOPE



The Tektronix Type 515A is a DC-coupled general-purpose cathode-ray oscilloscope combining reliable Tektronix oscilloscope circuitry in a compact instrument. Wide sweep range of 0.04 μs/cm to 6 s/cm, DC to 15 MHz bandwidth, and calibrated deflection factor to 0.05 V/cm qualify the Type 515A for general-purpose laboratory work and for many field applications.

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED DEFLECTION FACTOR—50 mV/cm to 20 V/cm.
RISETIME—23 ns.
BANDWIDTH—DC to 15 MHz.
INPUT RC—1 megohm, approx 36 pF.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.2 μs/cm to 2 s/cm.
SWEEP MAGNIFIER—5X, extends sweep range to 40 ns/cm.
TRIGGER REQUIREMENTS—Internal: 2-mm deflection.
External: 0.5 V to 20 V.
EXTERNAL INPUT—1.4 V/cm, DC to 500 kHz at maximum deflection factor.

CRT

DISPLAY AREA—6 x 10 cm.
ACCELERATING VOLTAGE—4 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—50 mV to 100 V, 1-kHz square wave.
POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 300 watts, 50 to 60 Hz.

VERTICAL DEFLECTION SYSTEM

Frequency specifications are at 3-db down

BANDWIDTH AND RISETIME
DC to 15 MHz, 23-ns risetime. AC-coupled, 2 Hz to 15 MHz.

DEFLECTION FACTOR
0.05 V/cm to 20 V/cm in 9 calibrated steps with 1-2-5 sequence. 2.5:1 vernier allows continuous range (uncalibrated) between steps and extends range to 50 V/cm. Neon light indicates when deflection factor is uncalibrated. Accuracy is ±3% of V/cm switch setting.

INPUT RC
1 megohm paralleled by approximately 36 pF.

SIGNAL INPUTS
Two coaxial signal inputs (60-dB isolation) are available with a 4-position AC-DC selector switch.

DELAY LINE
250 ns.

HORIZONTAL DEFLECTION SYSTEM

SWEEP RATES
0.2 μs/cm to 2 s/cm in 22 steps with 1-2-5 sequence. Accuracy is ±3% of time/cm switch setting. A vernier control allows continuous range (uncalibrated) between steps and extends slowest sweep rate to 5 s/cm. Neon light indicates when sweep is uncalibrated.

SWEEP MAGNIFIER
5X magnifier expands center 2-cm of display to full screen width. Magnified sweep is indicated by blue numbers around TIME/CM switch. Accuracy of magnified sweep is ±5%. A neon light indicates when magnified sweep is in use.

DC-COUPLED UNBLANKING
The unblanking waveform is DC-coupled to the control grid of the CRT to assure uniform intensity across the screen for all sweep rates.

HORIZONTAL EXTERNAL INPUT
Through a front-panel connector with deflection factor of approximately 1.4 V/cm continuously variable to more than 25 V/cm. Bandwidth is DC to 500 kHz at 1.4 V/cm.

TRIGGERING

TRIGGER REQUIREMENTS
Internal: signal producing at least 2 mm of vertical display. External: signal between 0.5 V and 20 V P to P.

TRIGGERING FACILITIES
Triggering modes include complete manual control, preset stability, and fully automatic triggering.

LEVEL AND PRESET STABILITY
Level and stability controls allow triggering at selected amplitude levels on the triggering signal. Preset stability allows setting circuit to optimum triggering point with stability control in preset position—requires no readjustment.

AUTOMATIC TRIGGERING
Range of automatic operation is approximately between 60 Hz and 2 MHz. In the absence of an input signal the sweep is automatically triggered at about a 50-Hz rate. This provides a reference trace on the screen.

HIGH-FREQUENCY SYNC
Assures a steady display of sinewave signals up to approximately 20 MHz. Requires a triggering signal large enough to cause about 2 cm of vertical deflection, or an external signal of about 2 V P to P.

MISCELLANEOUS

AMPLITUDE CALIBRATOR
Square-wave voltage available in 11 fixed voltages in a 1-2-5 sequence between 0.05 V and 100 V peak to peak. Accuracy is ±3%, frequency is approximately 1 kHz.

FRONT PANEL OUTPUTS
Gate signal—rectangular pulse, positive-going +20 V, duration same as sweep. Sawtooth—positive-going +150 V, duration same as sweep.

CATHODE-RAY TUBE
5" round, flat-faced tube with helical post-accelerating anode. 4-kV accelerating potential. P31 phosphor normally supplied.

Z-AXIS INPUT (515A only)
External intensity control signals may be applied (AC coupled) to the CRT through a rear panel connector.

ILLUMINATED GRATICULE
Edge-lighted with 6 vertical by 10 horizontal centimeter divisions with 2 millimeter baseline divisions. Lighting controlled by front panel knob.

POWER REQUIREMENT
105 V to 125 V or 210 V to 250 V, 50 to 60 Hz, wired for 117 V. The Type 515 draws 300 watts. Changing taps insures regulation as follows:

110	99 to 117 volts	220	198 to 235 volts
117	105 to 125 volts	234	210 to 250 volts
124	111 to 132 volts	248	223 to 265 volts

MECHANICAL SPECIFICATIONS
Dimensions are 14" high by 9⅞" wide by 21¾" deep. Net weight is 42¼ pounds. Shipping weight is 52 pounds, approx.

TYPE 515A $875

Each instrument includes: 1—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC, (012-0092-00); 2—Instruction Manual (070-0247-00).

RACK-MOUNT OSCILLOSCOPE

The Type RM15 is a mechanically rearranged Type 515A Oscilloscope. It mounts in a standard 19-inch rack on slide out 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 8¾" high by 19" wide by 22¾" deep. Net weight is 57 pounds. Shipping weight is 75 pounds, approx. For more mounting information, please refer to the Mounting Dimensions page in the catalog.

TYPE RM15 OSCILLOSCOPE $950

Each instrument includes: 1—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Pr Mounting tracks (351-0085-00); 2—Instruction Manual (070-0242-00).

SUPPORTING CRADLES. Order Part Number 040-0344-00 . . . . . $11.45

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

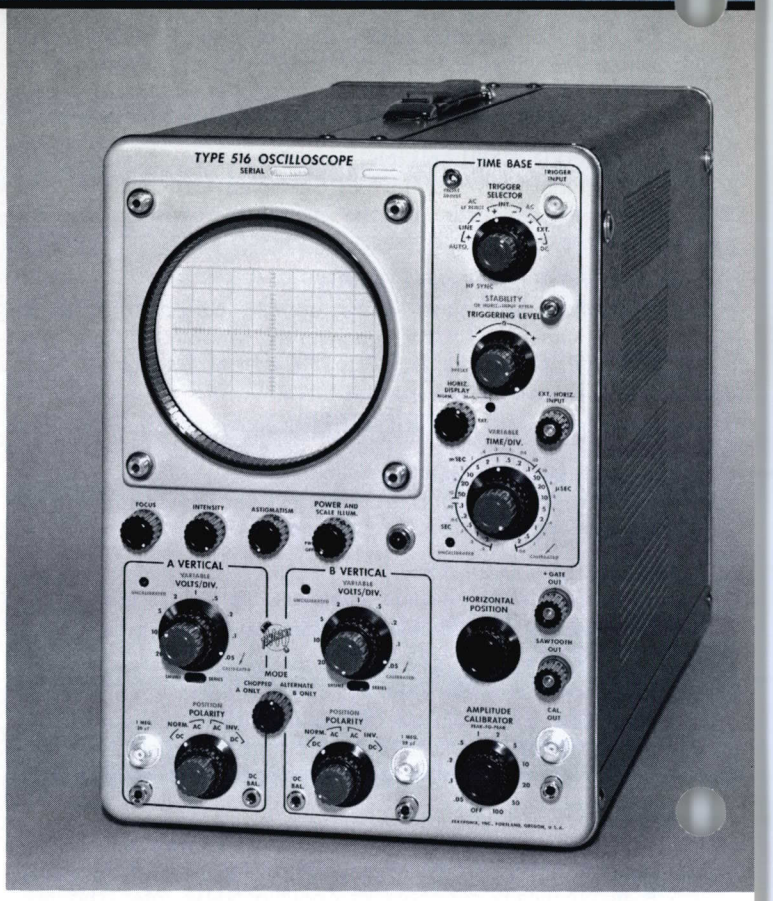
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

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

2 IDENTICAL INPUT CHANNELS

CHOPPED OR ALTERNATE SWITCHING

The Type 516 is a dual-trace, semi-portable instrument ideally suited to bench work applications. Vertical calibrated deflection factor is 0.05 V/cm 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.



CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED DEFLECTION FACTOR—50 mV/cm to 20 V/cm.
RISETIME—23 ns.
BANDWIDTH—DC to 15 MHz.
INPUT RC—1 megohm, 20 pF.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.2 μs/cm to 2 s/cm.
SWEEP MAGNIFIER—5X, extends sweep range to 40 ns/cm.
TRIGGER REQUIREMENTS—Internal: 2-mm deflection
External: 0.5 V to 25 V.
EXTERNAL HORIZONTAL INPUT—1.5 V/cm, DC to 500 kHz.

CRT

DISPLAY AREA—6 x 10 cm.
ACCELERATING VOLTAGE—4 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—50 mV to 100 V, approx 1-kHz square wave.
POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 300 watts.

VERTICAL DEFLECTION SYSTEM

Bandwidth Specifications are at —3 dB

BANDWIDTH AND RISETIME
DC to 15 MHz, 23-ns risetime. AC-coupled, 2 Hz to 15 MHz.

DEFLECTION FACTOR
0.05 V/div to 20 V/div in 9 calibrated steps with 1-2-5 sequence. 2.5:1 vernier allows continuous range (uncalibrated) between steps and extends range to 50 V/div. Neon light indicates when deflection factor is uncalibrated. Accuracy is ±3% of the V/div switch setting.

INPUT RC
1 megohm paralleled by approximately 20 pF.

OPERATING MODES
Channel A only; Channel B only.
Alternate.
Chopped; 3.3 μs segments of each channel are displayed (chopping rate 150 kHz). Chopped transient blanking is provided. Polarity; either channel may be operated as normal or inverted.

SIGNAL DELAY
Permits viewing the leading edge of waveform that triggers the sweep.

HORIZONTAL DEFLECTION SYSTEM

SWEEP RATES
0.2 μs/div to 2 s/div in 22 steps with 1-2-5 sequence. Accuracy is ±3% of time/div switch setting. A vernier control allows continuous range (uncalibrated) between steps and extends the slowest sweep rate to more than 6 s/div. A neon light indicates when sweep is uncalibrated.

SWEEP MAGNIFIER
5X magnifier expands center 2 cm of display to full screen width. Time/cm of magnified sweep is indicated by blue numbers at range switch positions. Accuracy of magnified sweep is ±5%. A neon light indicates when magnified sweep is in use.

DC-COUPLED UNBLANKING
The unblanking waveform is DC-coupled to the control grid of the CRT to assure uniform grid bias for all sweep rates.

HORIZONTAL EXTERNAL INPUT

Through a front panel connector with deflection sensitivity of 1.5 V/cm. Bandwidth is DC to 500 kHz at maximum deflection factor.

TRIGGERING

TRIGGERING REQUIREMENTS

Internal: signal producing at least 2 mm of vertical display. External: signal between 0.5 V and 25 V.

TRIGGERING FACILITIES

Triggering modes include: complete manual control, preset stability, and fully automatic triggering.

LEVEL AND PRESET STABILITY

Level and stability controls allow triggering at selected amplitude levels on the triggering signal. Preset stability allows setting circuit to optimum triggering point with stability control in preset position—requires no readjustment.

AUTOMATIC TRIGGERING

Range of automatic operation is between 50 Hz and 2 MHz. In the absence of an input signal the sweep is automatically triggered at about a 50-Hz rate. This provides a reference trace on the screen.

HIGH-FREQUENCY SYNC

Assures a steady display of sinewave signals up to approximately 20 MHz. Requires a triggering signal large enough to cause about 2 cm of vertical deflection, or an external signal of about 2 volts.

MISCELLANEOUS

AMPLITUDE CALIBRATOR

Square-wave voltage available in 11 fixed voltages between 0.05 V and 100 V peak to peak. Accuracy is ±3%, frequency is approximately 1 kHz.

FRONT PANEL OUTPUTS

Gate signal—rectangular pulse, positive-going +25 V, duration same as sweep. Sawtooth—positive-going to +150 V, duration same as sweep.

CATHODE-RAY TUBE

5" round, flat-faced tube with helical post-accelerating anode. 4 kV accelerating potential. P31 phosphor normally supplied.

ILLUMINATED GRATICULE

Edge-lighted with 6 vertical and 10 horizontal centimeter divisions with 2 millimeter baseline divisions. Lighting controlled by front panel knob.

DUAL-TRACE BLANKING

A rear panel switch provides blanking voltage to eliminate switching transients when operating in the chopped mode.

POWER REQUIREMENT

105 V to 125 V or 210 V to 250 V, 50 to 60 Hz, typically 300 watts at 117 V. If requested the instrument will be wired for any of the following nominal line voltages.

Nominal Line Voltage (Figures taken at 60 Hz)	Operating Range
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

MECHANICAL SPECIFICATIONS

Dimensions are 14" high by 9⅞" wide by 21¾" deep. Net weight is 44¼ pounds. Shipping weight is 54 pounds, approx.

TYPE 516 . . . . . **$1070**

Each instrument includes: 2—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1— 3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0225-00).

RACK-MOUNT ADAPTER.

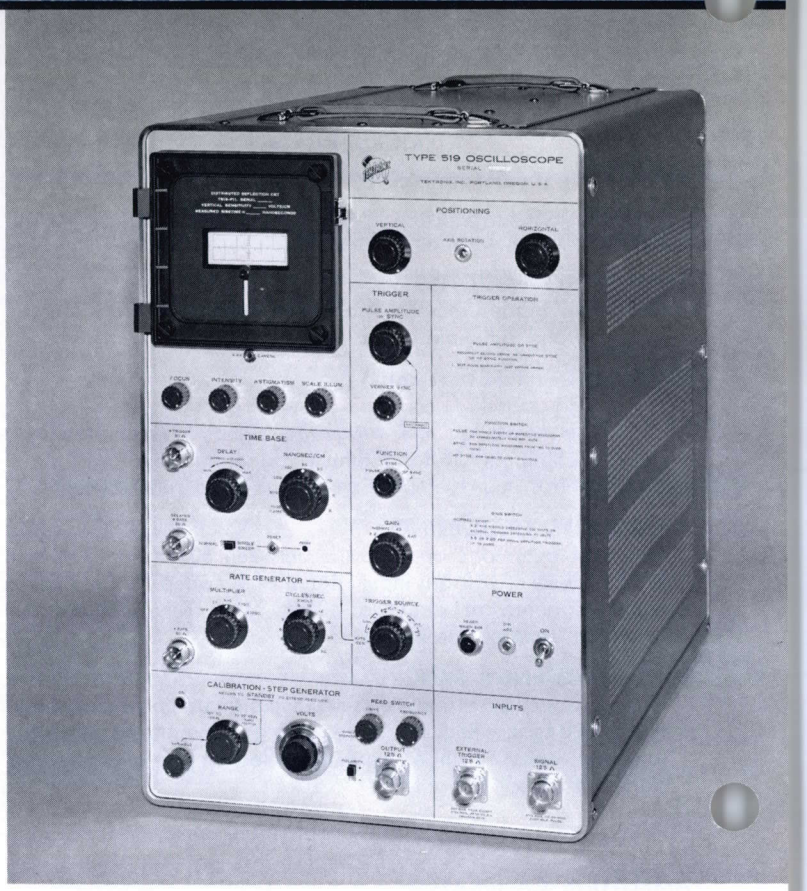
Order Part Number 040-0277-00 . . . . . **$45**

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. Rack height requirement is 15¾".

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

Type 519 DC-to-1 GIGAHERTZ OSCILLOSCOPE

SINGLE-SHOT PHOTOGRAPHS AT 2 NS/CM
0.004-INCH SPOT SIZE
SENSITIVE WIDEBAND TRIGGER SYSTEM
SYNCHRONIZATION TO OVER 1 GIGAHERTZ
VSWR 1.25, OR LESS, TO 1 GIGAHERTZ
DISTRIBUTED-DEFLECTION CRT
BUILT-IN DELAY LINE



CHARACTERISTIC SUMMARY

VERTICAL

DEFLECTION FACTOR— $\leq$10 V/cm.

RISETIME—less than 0.35 ns.

BANDWIDTH—DC to 1000 MHz.

INPUT IMPEDANCE—125 Ω ±2%.

HORIZONTAL

CALIBRATED SWEEP RANGE—2 to 1000 ns/cm.

SWEEP DELAY—0 to 35 ns.

TRIGGER REQUIREMENTS
Internal: 2 trace widths, 1-ns duration.
External: 20 mV, 1-ns duration.

TRIGGER GAIN—X0.2, X1, X5, and X20.

CRT

DISPLAY AREA—2 x 6 cm.

ACCELERATING VOLTAGE—24 kV.

OTHER CHARACTERISTICS

CALIBRATOR-STEP GENERATOR—0 to 10 V into 125 Ω or 0 to 1 V into 50 Ω, calibrated and continuously variable. (0.1 ns risetime, approx.) Approximately 750 Hz repetition rate.

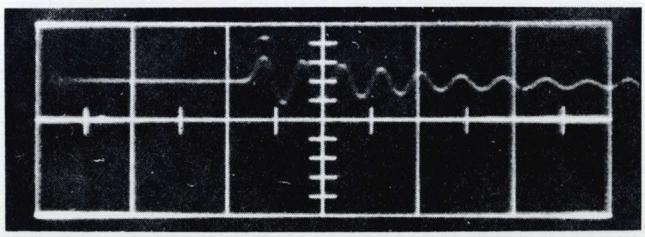
POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 650 watts.

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 resolution. Performance features include: bandwidth from DC to beyond 1 gigahertz, risetime less than 0.35 ns, deflection factor $\leq$10 V/cm, linear sweeps to 2 ns/cm, sweep delay through 35 ns, 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—a connection of the signal from the device under test.

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

SINGLE-SHOT PHOTOGRAPHY

A single-shot exposure was used to take the picture at the right. The display shows a 1 gigahertz damped wave (approximately) on the fastest rate of the oscilloscope.



VERTICAL DEFLECTION SYSTEM

(Bandwidth Specifications are at —3 dB.)

BANDWIDTH AND RISETIME
Bandwidth—DC to 1 GHz.
Risetime—less than 0.35 ns.

DEFLECTION FACTOR
≤10 V/cm.

SIGNAL DELAY
45 ns approx.

INPUT IMPEDANCE
125 Ω ±2%.

MAXIMUM INPUT SIGNAL
±15 VDC or 15 V RMS, or ±100-V pulse. Maximum power input is 1.8 watts.

HORIZONTAL DEFLECTION SYSTEM

SWEEP RANGE
2 ns/cm to 1000 ns/cm in 9 steps with 1-2-5 sequence. Accuracy is ±3%.

SWEEP DELAY
Sweep start delayed 0—35 ns.

SINGLE SWEEP
After a single sweep is generated, the sweep circuit is locked out until the RESET button is pressed—sweep fires on next trigger. An external jack is provided for remote control of single sweep operation.

SYNCHROSCOPE OPERATION
The output signal from either the +TRIGGER 50 Ω, the DELAYED +GATE 50 Ω, or the +RATE 50 Ω connector can be used to control an external device.

RATE GENERATOR
Output pulse approx 15 V, risetime ≤ 0.8 ns, duration approx 10 ns. Repetition rate variable between 3 Hz and 30 kHz.

TRIGGERING

TRIGGER REQUIREMENTS
Internally—A vertical signal deflection of two trace widths and 1 ns duration. Externally—Signal of 20 mV amplitude and 1 ns duration. Sweep triggers on either the positive or negative slope of the triggering signal.

TRIGGER SOURCES
Internal, external, calibration-step generator, and rate generator.

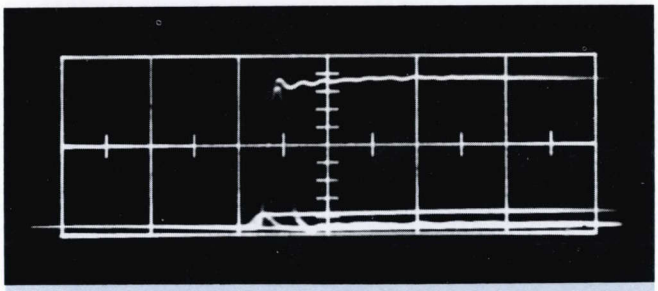
TRIGGER FUNCTIONS
Pulse—Permits choice of a free-running sweep or a stable sweep which can be triggered on random or uniform repetition rates up to approximately 50 MHz. Sync—Permits stable displays of signals occurring at a constant repetition rate to over 100 MHz. HF Sync—Permits the sweep to be synchronized with signals from approximately 100 MHz to over 1 GHz.

TRIGGER GAIN
Four gain settings of X0.2, NORMAL, X5, and X20 provide for attenuation or amplification of trigger signals.

MISCELLANEOUS

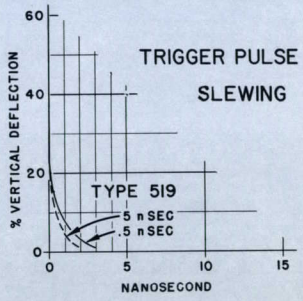
CALIBRATION STEP GENERATOR
A step-waveform of approximately 750 Hz, with amplitude continuously variable and calibrated from 0 to 10 V into 125 Ω, or 0 to 1 V into 50 Ω (through a T50/T125 adapter) is available at a front-panel 125-Ω connector. Risetime is approximately 0.1 ns and either polarity can be selected. Continuously variable uncalibrated amplitudes of 0 to 50 V into 125 Ω are also available.

CATHODE-RAY TUBE
5" round, flat-faced tube. 24 kV accelerating potential. Spot diameter at normal intensity 0.004 inch. Usable viewing area 2 x 6 cm. Maximum x-ray radiation at a distance of two inches from the faceplate does not exceed 0.7 millirems per hour (human limit is 2.5 millirems per hour). At normal viewing distances, x-ray radiation is essentially zero. Normally supplied with P11 phosphor.



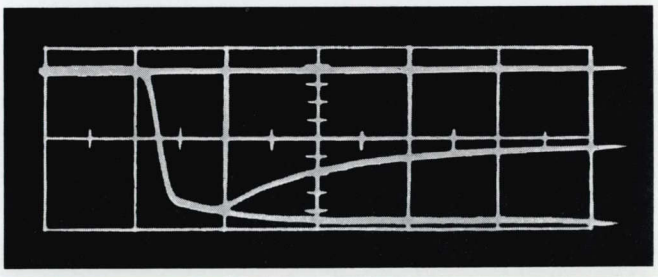
Negligible Trigger-Pulse Slewing for Sweep Time of 2 ns/cm.

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



DIODE CHARACTERISTICS

Switching and storage times of 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. Sweep time 2 ns/cm.



519

GRATICULE

Edge-lighted with 2 vertical - 6 horizontal centimeter divisions. The horizontal center line markings are 5 mm apart and the vertical center line markings are 2 mm apart. Illumination is controlled by a front-panel knob. The graticule can be dropped out of view if desired.

CAMERA MOUNTING

A special camera-mounting bezel with swing-away hinging easily accepts a Tektronix Trace-Recording Camera. Several lenses, viewing systems, and film-back options are available. Please refer to the Camera Section for complete description.

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 hertz.

POWER REQUIREMENT

105 V to 125 V or 210 V to 250 V, 50 to 60 Hz, typically 650 watts.

MECHANICAL SPECIFICATIONS

Dimensions are 22¼" high by 14⅝" wide by 25¼" deep. Net weight is 103¾ pounds. Shipping weight is 136 pounds, approx.

TYPE 519 OSCILLOSCOPE $3900

Each instrument includes: 1—Viewing hood (016-0001-00); 2—125 Ω termination (017-0051-00); 2— 125 Ω insertion unit (017-0013-00); 1—125 Ω coupling capacitor (017-0018-00); 1— 125 Ω 1-GHz timing standard (017-0019-00); 1—Double-button contact assembly (017-0032-00); 1—Panel adapter assembly (017-0033-00); 1—Cable connector (017-0035-00); 1— 125 Ω min loss attenuator, T50/T125 (017-0052-00); 1—125 Ω adapter N50/N125 (017-0053-00); 1— 125 Ω adapter, T50/N125 (017-0055-00); 1—Delay-line equalizer (017-0057-00); 1-ns cable (017-0507-00); 1— 2-ns cable (017-0508-00); 1— 5-ns cable (017-0509-00); 1— 10-ns cable (017-0510-00); 1—3 to 2-wire adapter (103-0013-00); 1—Phone jack plug (134-0069-00); 1— 3-conductor power cord (161-0010-00); 1—Walnut box (202-0083-00); 2—Réed switch (260-0693-00); 1—Accessory box tray (436-0030-00); 2—Instruction Manual (070-0243-00).

OPTIONAL ACCESSORIES

Accessory	Part Number	Price
125-Ω 2:1 attenuator	017-0071-00	$30.00
125-Ω 5:1 attenuator	017-0049-00	30.00
125-Ω 10:1 attenuator	017-0050-00	30.00
125-Ω N50/T125 adapter	017-0054-00	17.50
125-Ω 90° elbow assembly	017-0043-00	15.00
125-Ω 20-ns cable	017-0511-00	24.00

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

TELEVISION OSCILLOSCOPE Type 524AD

FREQUENCY RESPONSE
Normal—DC to 10 MHz from 0.15 V/cm to 50 V/cm. 2 hertz to 10 MHz from 15 mV/cm to 50 V/cm.
Flat—within 1% from 60 hertz to 5 MHz.
IRE—meets IRE standards for level measurements.

TRANSIENT RESPONSE—35 ns risetime.

SWEEP RANGE—Continuously variable, 0.1 μs/cm to 0.01 s/cm.

TIME MARKERS—0.05 μs, 0.1 μs, 1.0 μs, 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 UNBLANKING

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 MHz, flat response within 1% from 60 hertz to 5 MHz for color-television work, variable-duty-cycle amplitude calibrator, and two steps of sweep magnification, 3X and 10X, for detailed observations.

A switch on the access panel selects the desired bandwidth of the vertical amplifier. The NORMal position provides a bandwidth of DC to 10 MHz. The FLAT position provides a vertical-amplifier response flat within 1% from 60 hertz to 5 MHz. About 5% overshoot will occur on extremely sharp waveforms when the switch is in the FLAT position; however, TV signals within the 5 MHz bandwidth 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.

VERTICAL DEFLECTION SYSTEM

Frequency specifications are at 3-db down

FREQUENCY RESPONSE AND RISETIME
Bandwidth—DC to 10 MHz. AC-coupled 2 Hz to 10 MHz.
Risetime—less than 35 ns.

DEFLECTION FACTOR
0.015 V/cm to 50 V/cm in 8 calibrated steps. Signal AC-coupled from 0.015 V/cm to 0.15 V/cm. A variable attenuator control provides between steps adjustment.

INPUT RC
1 megohm paralleled by approximately 45 pF.

OPERATING MODES
Two signal inputs—each input can be switched to AC or DC input coupling.

SIGNAL DELAY
250 ns.

HORIZONTAL DEFLECTION SYSTEM

SWEEP RATES
0.1 μs/cm to 0.01 s/cm in 5 calibrated steps. Dual sweep-time multiplier dials cover the range between steps. Accuracy is ±5%.

SWEEP MAGNIFIER
X3 or X10 selected by a front-panel switch. Accuracy is ±7%.

524AD

SWEEP DELAY
Continuously variable from 0 to 25 ms. Adjustable through about 1½ fields at frame rate of 30 Hz so only consecutive lines of one field are observed at any time. A field-shift button switches to the corresponding line in the other field.

DC-COUPLED UNBLANKING
The unblanking waveform is DC-coupled to the grid of the CRT to assure uniform bias for all sweep rates.

TRIGGERING

TRIGGER REQUIREMENT
Internal—A signal that produces 5 mm of vertical deflection. External—0.5 V. Composite Waveform—A signal that produces 1.5 cm of vertical deflection.

TRIGGER SELECTOR
±internal, ±external, or line. Applies to both normal and delayed sweep.

MISCELLANEOUS

AMPLITUDE CALIBRATOR
0 to 50 V in 7 ranges. Accurate to ±3% of full scale. Variable duty-cycle square-wave of approximately 1 kHz. Variable control linearity ±1% of full scale.

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

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

OUTPUT WAVEFORMS
Positive and negative gate. Same duration as sweep. Sawtooth—same duration as sweep.

LINE-INDICATING VIDEO
When a picture monitor is connected to the coaxial connector at the rear of the cabinet, the picture appearing on the monitor will be brightened during the time of the oscilloscope sweep. This technique is useful when it is desired to know what portion of the picture is being displayed on the oscilloscope.

60 Hz SWEEP
A 60 Hz sweep with variable amplitude and phasing through approximately 150° aids in making bandwidth measurements with a video-sweep generator.

CATHODE-RAY TUBE
5" flat-faced tube with 4-kV electronically-regulated accelerating potential. A P1 phosphor is normally supplied.

GRATICULE
Edge-lighted 6 vertical by 10 horizontal centimeter divisions. A graticule marked for modulation measurements is also supplied with the instrument. A front-panel knob controls graticule illumination.

PROBE POWER SOCKET
6.3 VDC at 1A and 120 VDC (reg) at 15 mA.

POWER REQUIREMENT
105 V to 125 V or 210 V to 250 V, 50 to 60 Hz. Power consumption approximately 500 watts. Unit factory wired for 117 V.

MECHANICAL SPECIFICATIONS
Dimensions are 16¾" high by 13" wide by 25" deep. Net weight is 61 pounds. Shipping weight is 82 pounds, approx.

TYPE 524AD OSCILLOSCOPE **$1300**
Each instrument includes: 1—P6006 probe (010-0125-00); 2—Binding post adapter (013-0004-00); 1—Viewing hood assembly (016-0001-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—TV graticule (331-0009-00); 1—Smoke gray filter (installed) (378-0567-00); 2—Instruction manual (070-0236-00).

RACK-MOUNT ADAPTER. Order Part Number 040-0281-00 ..... **$45**
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 17½".

SCOPE-MOBILE® CARTS

TYPE 202-1 TILT-LOCK CART with storage drawer and locking front wheels $120.00

See Catalog accessory pages for complete information.

CATHODE-FOLLOWER PROBE. Order Part Number 010-0109-00 ..... **$85**
The P500CF Cathode-Follower Probe has input RC of 40 megohms paralleled by 4 pF and gain of 0.8 to 0.85. With 10X attenuator head, input RC is 10 megohms paralleled by 2 pF. Amplitude distortion is less than 3% on unidirectional signals up to 5 V.

A TV Sync Separator is available for use with many Tektronix general-purpose oscilloscopes. The unit provides stable triggering for the display of composite video signals. See the Accessories Section for complete information.

Please refer to Catalog accessory pages 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.

COLOR-TELEVISION VECTORSCOPE Type 526

DIFFERENTIAL PHASE MEASUREMENTS—*To 0.1°.*

DIFFERENTIAL GAIN MEASUREMENTS—*Under 1% can be read.*

VERTICAL INTERVAL TESTING—*A keying circuit permits measurements of differential gain and differential phase during color broadcasts, on test signals transmitted during vertical blanking interval.*

LINEAR TIME BASE—*Operates at line rate, synchronized by horizontal sync pulse.*

BURST BRIGHTENING—*Positive identification of burst pulse.*

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 NTSC 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 reads out directly in degrees and tenths of degrees. It has a range of 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 (±20°) provides for variable adjustment between steps, and fine phase adjustment when using the burst-controlled oscillator.

526

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.

An internally generated 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 ±1.5° can be made using the vector display. Accuracy of saturation measurements will be within ±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 to an accuracy of 0.1° and differential gain to an accuracy of 1%. A signal magnifier can be used to expand the vertical deflection approximately 7 times.

DUAL DISPLAYS

In dual-channel operation, successive 2-ms segments of each channel are displayed at an approx 500-hertz rate per channel. For example, the input signal to a portion of the broadcast plant can be compared to the output signal to measure any phase and/or amplitude distortion caused by the broadcast equipment. Also, the outputs of any two portions of the broadcast plant can be compared.

When using the vector display, either channel can be turned off to provide a zero reference point for the other channel. The reference point is a sharply defined spot in the center of the display. Any drift in the Vectorscope circuit will change the position of the spot, therefore the drift is 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.

BURST BRIGHTENING

The burst amplifier in the burst-controlled oscillator circuit is keyed on during the first 3 μs of the linear sweep. During the 3-μs 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.

VERTICAL INTERVAL TEST SIGNAL OBSERVATION

Line 18 of Field 2 has been reserved for a color test signal, as yet unspecified. Line 19 of Field 2 will carry a linearity test signal. The Type 526 can measure differential gain quite accurately by means of the later test signal. Differential phase measurements may also be made, provided that the same subcarrier source is used for both color burst and the linearity test signal subcarrier. Color burst must be present (during color-casting).

The difficulty in seeing these two lines of test signals amidst the program signals—which hinders measurements—is eliminated by the Interfield Signal Key. Trace intensification during these test lines modulates the CRT display so that by adjusting the Intensity Control, only these two lines per field may be seen.

The resulting display, while dim, is quite usable.

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.

The gain controls of each channel have a range of 40 dB and produce virtually no phase-shift effects.

SYNC INPUT

External, 1-V sync-negative composite video signal or 3.5-V to 8-V negative-going composite sync signal can be used. Also, horizontal drive pulses can be used if interfield keying feature is not used. With external sync, Channels A and B can display non-composite video or chroma signals. External input is high-impedance compensated, loop-through connector for 75-ohm coaxial cable (R = 1 megohm, C = 25 pF).

Internal sync is available.

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 V peak to peak minimum.

VERTICAL SIGNAL OUTPUT

The demodulated vertical signal is available at a binding post, DC-coupled, for feeding remote indicators.

TRACE INTENSIFICATION INPUT

A jack (PL-55) is provided for external trace-brightening pulses. Internal blanking circuitry is disconnected when an external signal is being applied. Signal required for trace brightening is an AC-coupled positive-going 20-volt pulse, which can be obtained from the + GATE terminal of any Tektronix Oscilloscope that is being triggered by the vertical-signal output of the Type 526. This type of trace brightening is useful for determining the time limits over which a phase shift is occurring.

CATHODE-RAY TUBE

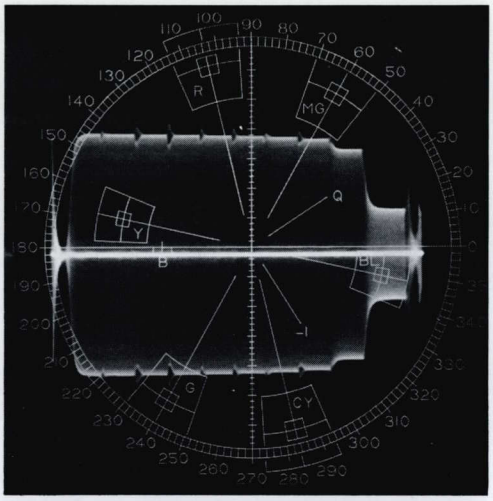
The Type 526 uses a 5" flat-faced monoaccelerator tube with similar vertical and horizontal deflection factors and excellent linearity. Accelerating potential is 4 kV. A P31 phosphor is normally supplied.

ILLUMINATED GRATICULE

The edge-lighted graticule is marked with polar coordinates for hue and saturation of the chrominance signals, and with vectors for the Q, I, and burst signals. The large boxes represent ±20% in amplitude and ±10° in phase. This is in accord with current FCC rules and regulations. The small

(1)

(2)



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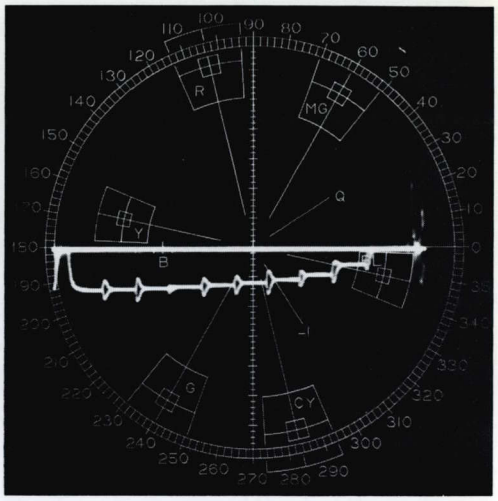

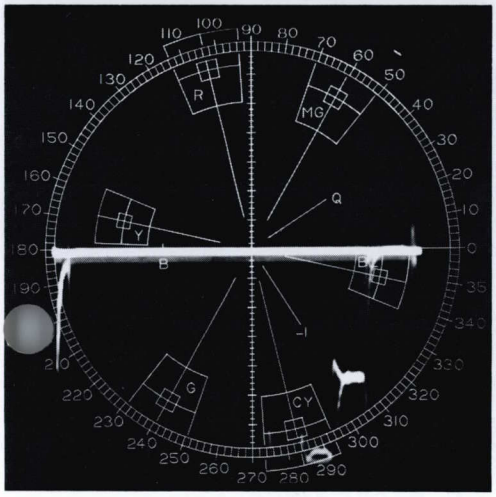

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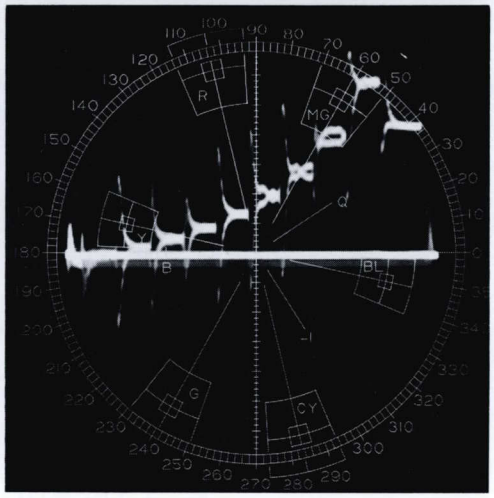

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Figure 1. VECTOR DISPLAY
Modulated Stairstep Signal showing differential gain (differing radial distance from center), and differential phase (rotation of dots around center).

Figure 2. LINE SWEEP DISPLAY
Modulated Stairstep Signal. Subcarrier regenerator is free running to show only differential gain or change in amplitude of subcarrier with changing luminance signal.

Figure 3. LINE SWEEP DISPLAY
Modulated Stairstep Signal. Subcarrier regenerator is locked to color burst to synchronously demodulate the subcarrier. Differential phase is shown by variations in synchronously demodulated subcarriers.

Figure 4. LINE SWEEP DISPLAY
Modulated Stairstep Signal with increased sensitivity and subcarrier phasing adjusted to be in quadrature with the last step of modulated stairstep.

Figure 5. LINE SWEEP DISPLAY
Modulated Stairstep Signal with increased vertical sensitivity and subcarrier phasing adjusted to be in quadrature with first step of the modulated stairstep.

boxes represent ±5% in amplitude and ±3° in phase. These numbers are thought to represent good studio practice. The limits around the burst signal are ±10%. Graticule illumination is controlled by a front-panel knob.

POWER REQUIREMENT

Electronically-regulated DC supplies insure stable operation between 105 and 125 V or between 210 and 250 V, 50 to 60 Hz. Transformer taps allow operation on either range. Instrument factory wired for 117 V. Power consumption approximately 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 8¾" high by 19" wide by 18" rack depth. Net weight is 45¼ pounds, approx. Shipping weight is 74 pounds, approx.

TYPE 526 VECTORSCOPE $1665

Each instrument includes: 3—Terminating resistor (011-0023-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—Smoke gray filter (378-0567-00); 1—Pr mounting tracks (351-0084-00); 2—Instruction Manual (070-0121-00).

SUPPORTING CRADLES.

Order Part Number 040-0344-00 . . . . . $11.45

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

TYPE 526 MOD 158M VECTORSCOPE $1750

The Type 526 MOD 158M is modified and factory calibrated for use at the PAL color subcarrier frequency of 4.43361875 MHz. The Precision Phase Shift dial reads directly in degrees at the PAL frequency. An appropriate graticule will be furnished. All other specifications are identical to those for the Type 526.

Each instrument includes: 3—Terminating resistor (011-0023-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—Smoke gray filter (378-0567-00); 1—Pr mounting tracks (351-0084-00); 2—Instruction Manual (070-0121-00).

A TV Sync Separator is available for use with many Tektronix general-purpose oscilloscopes. The unit provides stable triggering for the display of composite video signals. See the Accessories Section for complete information.

U.S. Sales Prices f.o.b. Beaverton, Oregon
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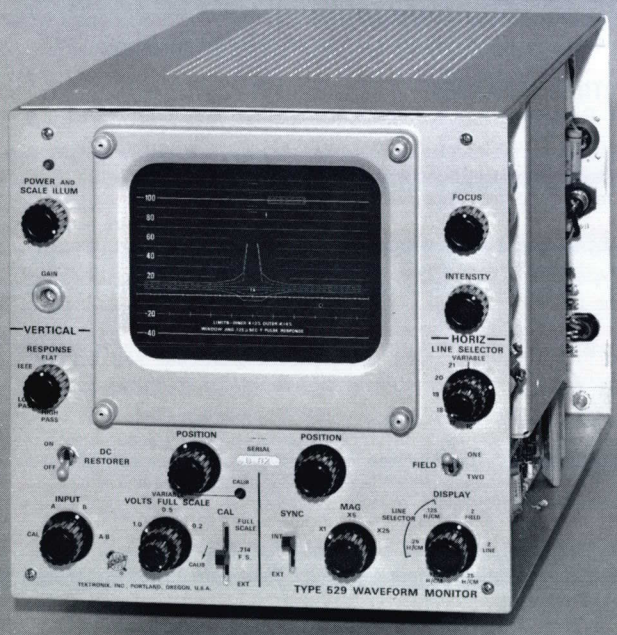
Type 529 / RM 529 WAVEFORM MONITOR

NEW



- *LINE SELECTOR*
- *FLAT TO 8 MHz*
- *4 FREQUENCY RESPONSES*
- *POSITIVE FIELD SELECTOR*
- *45 TRANSISTORS—7 TUBES*
- *COOL—QUIET—CLEAN*
- *NO FAN—ONLY 80 WATTS*

Newest of the Tektronix line of Television Instruments, the Type 529 and RM529 bring to the Industry a new flexibility in waveform monitoring: signal-level monitoring, bandwidth and differential gain measurements, sine^2-pulse and bar testing, monitoring Vertical Interval Test signals, transmitter percent-of-modulation measurements, YRGB or RGB displays (in conjunction with color-processing amplifiers) and others. Included are four video response characteristics, HIGH-PASS, LOW-PASS, IEEE, and FLAT. Both instruments feature FLAT RESPONSE to 8 MHz, assuring excellent waveform fidelity for sine squared testing with 2T, T and $\frac{1}{2}$T pulses.

DC RESTORATION maintains the back porch at an essentially constant level despite changes in signal amplitude, APL, and color burst, and may be turned off for viewing other than video signals. The circuit can easily be modified for sync-tip restoration.

Sensitivity range is 0.12 volts to 1.5 volts for full-scale deflection. Full-scale calibration at 0.714 V or 1.00 V is provided.

BRIGHT WAVEFORM DISPLAYS in line selector operation are obtained with a new, highly efficient 5" ALUMINIZED CRT, operating at increased accelerating potential. The instrument uses the best of both solid-state and vacuum-tube circuitry resulting in improved stability and reliability. These instruments do not require a fan, resulting in cleaner operation and complete freedom from noise.

HORIZONTAL SELECTION provides 2-field or 2-line displays, plus calibrated sweep rates of 0.125 H/cm or 0.25 H/cm. Either calibrated rate may be delayed for line selection. SWEEP MAGNIFICATION extends the sweep rate by X5 or X25, offering calibrated sweep rates from 0.250 H/cm to 0.005 H/cm. POSITIVE FIELD SELECTION assures stable displays in the presence of random noise bursts and video switching. The LINE SELECTOR permits detailed study of any portion of any desired line(s), and a front panel switch selects lines 16 through 21 for viewing VIT signals. A VIDEO-OUTPUT AMPLIFIER supplies video and a brightening pulse to the associated picture monitor, intensifying the same line, or lines, displayed on the instrument when using the LINE SELECTOR. The amplifier has excellent frequency response and linearity.

VIDEO FEATURES

INPUTS
Two unbalanced inputs may be used with either 75-Ω loop-through or bridging connection (input R & C is 1 Meg and 24 pF). Alternatively, one balanced, differential input may be used for 124-Ω circuits.

DEFLECTION FACTOR
120 mV to 1.5 V full scale. Continuously variable between ranges. Calibrated full-scale: 1.0, 0.50 and 0.20 V.

FREQUENCY RESPONSE
4 response characteristics provide: FLAT: +0.0 — 0.1 dB to 6 MHz; +0.0 — 0.3 dB to 8 MHz. IEEE-Spec 23S-1 of 1958 (amended): 3.58 MHz —20 dB. HIGHPASS: 3.58 MHz plus and minus 400 kHz at —3 dB. LOW PASS: —18 dB at 500 kHz.

LOW FREQUENCY TILT
Less than 1% tilt on 50-Hz square wave.

LINEARITY
Differential gain and multiburst axis shift: 1% or less.

DC RESTORER
Keyed back porch* type eliminates drift in DC-coupled vertical amplifier. Does not distort color burst. Blanking level shift due to color burst less than 1 IEEE unit. Waveform will remain on screen if there is a loss of sync pulses for DC restorer keying. DC restorer may be disabled by front-panel switch.

VERTICAL AMPLIFIER
May be DC-coupled to diode demodulator as in % Video Modulation Monitoring. Details are available in manual.

GAIN STABILITY
±1% over rated line voltage and ambient temperature ranges.

TIME-BASE FEATURES

CALIBRATED TIME BASE
0.125 H/cm. Magnifier extends calibrated time base to 0.025 H/cm and 0.005 H/cm. Accuracy is ±3%. Rep rate is ½ of the TV line rate. The time base can be calibrated using TV signals. Color burst is displayed without phase interlace. (see Fig. 6)

*Sync tip restoration available by simple modification.

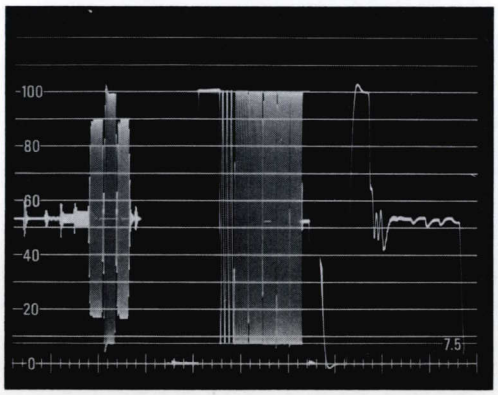


Fig. 1.—Multiburst Signal. Multiple exposure photograph. Left: High-pass response position. Center: Flat-frequency response position. Right: Low-pass response position.

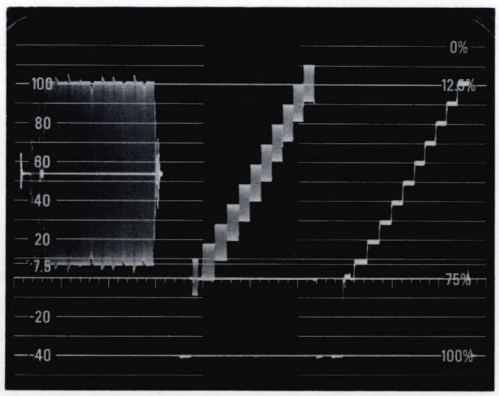


Fig. 2.—Modulated Stair-Step Signal. Multiple exposure. Left: High-pass position, showing gain increased to X5 for measuring differential gain. Center: Flat-response position. Stair-step signal shows 20 IEEE units of color sub-carrier. Right: IEEE response position showing sub-carrier substantially eliminated for accurate level measurements.

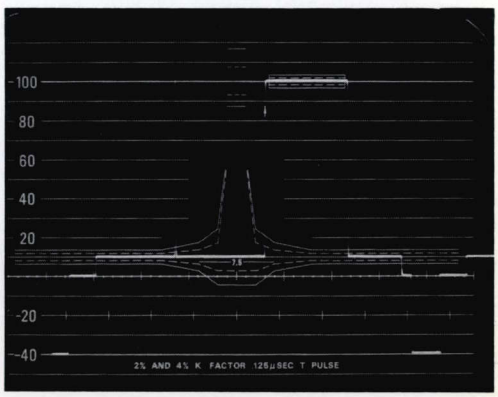


Fig. 3.—Sine² Pulse and Bar Signal. 0.125 μs HAD T-Pulse and Bar.

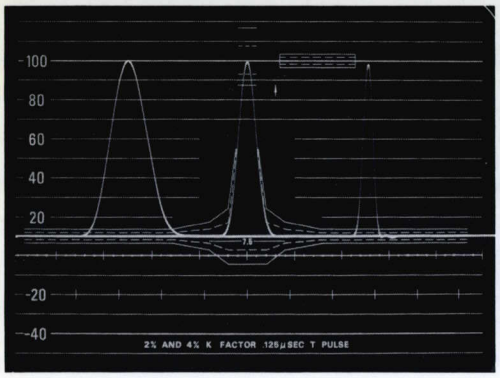


Fig. 4—2T Signal. Multiple exposure. Left: 2T. Center: T. Right: ½ T Sine², 0.25, 0.125, 0.0625 μs HAD.

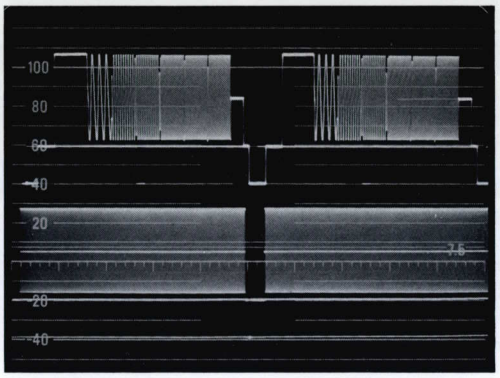


Fig. 5.—Double exposure showing complete two-field displays and two-line displays.

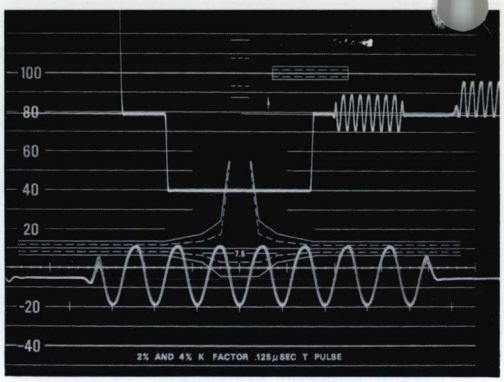


Fig. 6.—Color-Burst Signal. Double exposure. Top: X5 magnification. Horizontal display. 0.125 H/cm. Sweep: 0.025 H/cm. Bottom: X25 magnification. Horizontal display: 0.125 H/cm. Sweep: 0.005 H/cm.

UNCALIBRATED TIME BASE

2 LINE: Triggered time base with rep rate of ⅓ TV line frequency. Provides complete 2-line display with horizontal blanking centered on the screen. (see Fig. 5.)

2 FIELD: Synchronized time base with rep rate the same as the TV frame rate. Entire frame of video is displayed with the vertical blanking centered on the screen. Time base will free-run in the absence of signal, indicating loss of incoming signal.

TIME-BASE MAGNIFIER

X5 and X25. Accuracy ±3%. Magnifier expands the center of the display, convenient for monitoring equalizing or serrated pulses.

COLOR CAMERA YRGB AND RBG DISPLAYS

Can be used with color camera processing amplifiers providing these sequential signals and the staircase signal. To provide RBG display directly, switching is done in the color processing amplifier. Receptacle to interconnect color processing amplifier (relay control, staircase signal input, and ground) is provided on rear panel.

VIT SELECTOR

Front-panel switch selects lines 16 through 21. Knob position indicates line selected for viewing.

LINE SELECTOR

Variable delay allows any line of either field to be viewed.

FIELD SELECTOR

Positive-acting field selection. Noise impulses will not shift the field.

TRIGGER SELECTION

Stable triggering on composite video signals. INTERNAL: 200 mV to 1 V or more, peak to peak. EXTERNAL: 250 mV to 1 V or more, peak to peak.

OTHER FEATURES

REGULATED POWER SUPPLY

Operates on 115 V or 230 V line ± 10% RMS. LINE FREQUENCY: 50-60 Hz. POWER CONSUMPTION: Approx 80 W at 115 V, 60 Hz.

TEKTRONIX CATHODE-RAY TUBE

Flat-faced, 5" rectangular CRT, operating at 5.5 kV accelerating potential. Calibrated viewing area, 7 x 10 cm. Electrical beam rotator provides trace alignment. Standard phosphor furnished (P-31). Scale illumination: Variable edge-lighting.

CALIBRATOR

Two internal calibration voltages of 0.714 V and 1.00 V on 1-volt full-scale range of VERTICAL GAIN switch. An external calibration signal may be used. Internal calibration pulse amplitude ±1% over ambient temperature range and line-voltage range. Reference is a Zener diode.

MECHANICAL FEATURES

VENTILATION

Convection air-cooled. Operating Temperature Range: 0° C to +50° C.

CONSTRUCTION

Aluminum-alloy chassis.

FINISH

Anodized front panel.

DIMENSIONS

Type 529: 8¼" high x 8½" wide x 19" deep overall. Two Type 529 Waveform Monitors can be mounted side by side, or one mounted along side an associated picture monitor, in a standard 19" rack or console.

Type RM529: 5¼" high x 19" wide x 20" deep overall. Fits standard 19" rack. Instrument can be pulled forward and tilted 90°.

NET WEIGHT

Type 529: approx 24 lbs. Shipping weight, 33 lbs.
Type RM529: approx 27 lbs. Shipping weight, 58 lbs.

For 525 LINE, 30 FRAME TELEVISION STANDARDS, TYPE 529 WAVEFORM MONITOR $1050

Each instrument includes: 1—filter, smoke gray (378-0560-00); 1—graticule, composite, as shown in fig. 5 (331-0156-01); 1—graticule, noncomposite, as shown in fig. 1 (331-0077-01); 1—graticule, dual scale, as shown in fig. 2 (331-0157-00); 1—graticule, sine^2, K factor, and IEEE, as shown in figs. 3, 4, 6 (331-0161-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0509-00).

TYPE RM529 WAVEFORM MONITOR $1100

Each instrument includes: 1—filter, smoke gray (378-0560-00); 1—graticule, composite, as shown in fig 5 (331-0156-01); 1—graticule, noncomposite, as shown in fig. 1 (331-0077-01); 1—graticule, dual scale, as shown in fig. 2 (331-0157-00); 1—graticule, sine^2, K factor, and IEEE, as shown in figs. 3, 4, 6 (331-0161-00); 1—3 to 2-wire adapter (103-0013-00); 4—Bar retainer (381-0187-00); 2—instruction manual (070-0466-00).

FOR 625 LINE, 25 FRAME TELEVISION STANDARDS, CALIBRATED WITH CCIR SIGNALS.

Features variable line selector, but without VIT line selector switch. HORIZONTAL DISPLAYS changed to: 2 FIELD, 2 LINE, 0.1 H/cm and 10 μs/cm. LINE SELECTOR SWEEP RATES: 0.2 H/cm and 0.1 H/cm. CALIBRATION VOLTAGES: 0.700 and 1.00 V are provided. HIGH PASS RESPONSE: 4.43 MHz center frequency; bandwidth $\pm$0.4 MHz at —3 dB. LINE VOLTAGE: Fused and wired for 230 V operation. Each instrument includes the same accessories listed above.

TYPE 529, MOD 158L $1050
TYPE RM529, MOD 158L $1100

The Type 529 and RM529 can be adapted for use on other television system standards. Please consult with your Tektronix Field Engineer or Representative.

OPTIONAL ACCESSORIES

Filter, Mesh Assembly with Graticule Cover. Order Part Number 378-0575-00 ..... $15.00

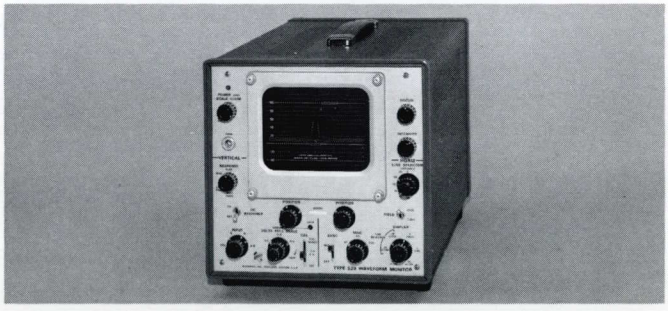
Film, Projected Graticule, 7 cm HAD Sine^2, 2% and 4% K Factor.
Order Part Number 331-0161-01 ..... $.85
(For use with Tektronix Projected Graticule.) See C-12 Camera, Camera Section.

Connector. Use with color processing amplifiers for RBG, etc. displays. Order Part Number 134-0049-00 .... $4.00

Camera Mounting Bezel. For Tektronix Cameras, see Camera Section. For Mounting other commercially available cameras order:
Part Number 014-0031-00 ..... $4.50

TYPE 529 FIELD CASE

Provides cabinet protection for the Type 529 when used for applications outside of the rack. Aluminum construction, blue vinyl finish.
Order Part Number 016-0084-00 ..... $50.00



MOUNTING CRADLES

Two different cradle assemblies, with associated bezels, allow the Type 529 Waveform Monitor to be mounted along side an 8" or 9" Conrac® Picture Monitor, in a standard 19" rack. A cradle and bezel are also available for mounting two Type 529's side-by-side.

FOR MOUNTING 8" CNB-8 PICTURE MONITOR (REQUIRES 10½" RACK SPACE)

Description	Part Number	Price
Cradle Assembly	014-0021-00	$25.00
Bezel, for mounting Type 529 on operator's left	014-0027-00	45.00
Bezel, for mounting Type 529 on operator's right	014-0028-00	45.00

FOR MOUNTING 8" CZB-8 PICTURE MONITOR (REQUIRES 10½" RACK SPACE)

Cradle Assembly	014-0021-00	25.00
Bezel, for mounting Type 529 on operator's left	014-0025-00	45.00
Bezel, for mounting Type 529 on operator's right	014-0026-00	45.00

FOR MOUNTING 9" RNB-9 PICTURE MONITOR (REQUIRES 8¾" RACK SPACE)

Cradle Assembly	014-0020-00	25.00
Bezel, for mounting Type 529 on operator's left	014-0023-00	35.00
Bezel, for mounting Type 529 on operator's right	014-0024-00	35.00

FOR MOUNTING TWO TYPE 529 WAVEFORM MONITORS SIDE-BY-SIDE (REQUIRES 8¾" RACK SPACE)

Cradle Assembly	014-0020-00	25.00
Bezel	014-0022-00	35.00

A TV Sync Separator is available for use with many Tektronix general-purpose oscilloscopes. The unit provides stable triggering for the display of composite video signals. See the Accessories Section for complete information.

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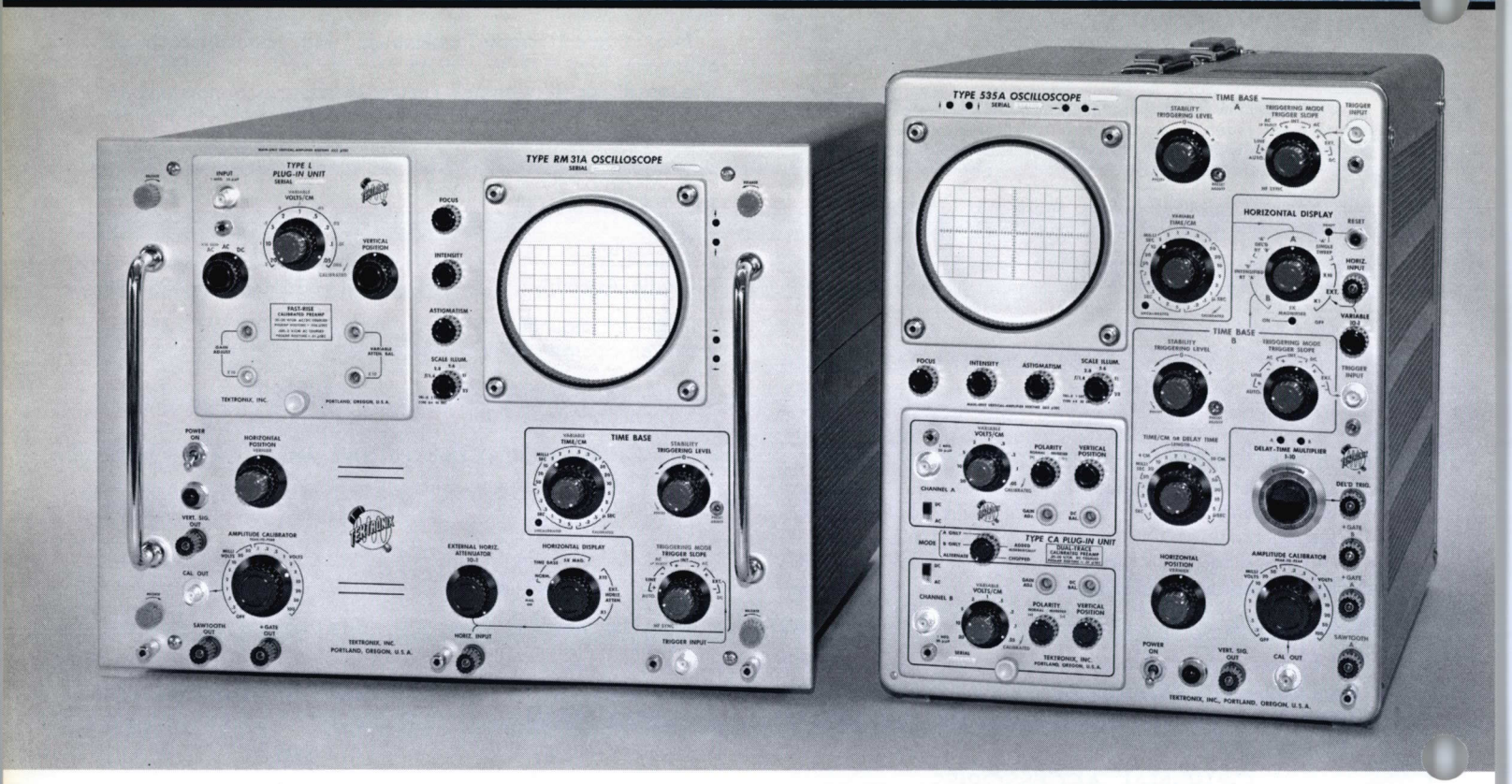
Conrac Division, Giannini
Controls Corporation

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

Type RM 31A 531A / RM 35A 535A DC-to-15 MHz OSCILLOSCOPES



HIGH INTENSITY TRACE

6 X 10 CM DISPLAY

ACCEPTS AMPLIFIER, SPECTRUM ANALYZER, AND SPECIAL PURPOSE PLUG-INS

CALIBRATED SWEEP DELAY (535A ONLY)

The Type 531A and 535A are essentially the same, except that Type 535A includes a second sweep generator (Time Base B) which functions as a delay generator. Both instruments feature a DC-to-15 MHz bandwidth and 23-ns risetime. Also, both utilize a broad selection of PLUG-IN UNITS to adapt the vertical deflection system to various application areas. (see PLUG-IN UNIT chart).

CHARACTERISTIC SUMMARY

VERTICAL

Plug-In Preamplifiers adapt the Type 531A and 535A to a wide range of measurement capabilities. The oscilloscope vertical system accepts all Tektronix Letter-Series and '1' Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—Time Base A: 0.1 μs/cm to 5 s/cm. Time Base B (535A only): 2 μs/cm to 1 s/cm.

SWEEP MAGNIFIER—X5, (extends calibrated sweep rate to 20 ns/cm).

CALIBRATED SWEEP DELAY— 2 μs to 10 s, continuously variable (535A only).

TRIGGER REQUIREMENTS—Internal: 2-mm deflection. External 0.2 V, ±50 V combined DC and peak AC.

EXTERNAL INPUT—0.1 V/cm to 1 V/cm; DC to 350 kHz; 1 megohm, ≈47 pF.

CRT

DISPLAY AREA—6 x 10 cm.

ACCELERATING VOLTAGE—10 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V (1-kHz square wave).

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 455 watts maximum for 531A, 550 watts maximum for 535A.

VERTICAL PLUG-IN UNITS Bandwidth Specifications are at —3 dB			
PLUG-IN UNIT	DEFLECTION FACTOR	BANDWIDTH	RISETIME
For Wide-Band Multiple Trace Applications			
1A1 Dual-Trace	50 mV/cm to 50 V/cm	DC to 15 MHz	23 ns
	5 mV/cm	DC to 14 MHz	25 ns
	500 μV/cm	2 Hz to 8 MHz	44 ns
1A2 Dual-Trace	50 mV/cm to 50 V/cm	DC to 15 MHz	23 ns
CA Dual-Trace	50 mV/cm to 50 V/cm	DC to 13.5 MHz	26 ns
M Four-Trace	20 mV/cm to 25 V/cm	DC to 14 MHz	25 ns
For Wide-Band Applications			
B	50 mV/cm to 50 V/cm	DC to 14 MHz	25 ns
	5 mV/cm to 50 mV/cm	2 Hz to 10 MHz	35 ns
K	50 mV/cm to 40 V/cm	DC to 15 MHz	23 ns
L	50 mV/cm to 40 V/cm	DC to 15 MHz	23 ns
	5 mV/cm to 4 V/cm	3 Hz to 15 MHz	23 ns
For Differential Input Applications			
1A7	10 μV/cm (to 10 V/cm)	DC to 500 kHz	0.7 μs
D High-Gain	1 mV/cm (to 50 mV/cm)	DC to 300 kHz (DC to 2 MHz)	0.18 μs
E Low-Level	50 μV/cm (to 10 mV/cm)	0.06 Hz to 20 kHz (to 60 kHz)	6 μs
G Wide-Band	50 mV/cm to 50 V/cm	DC to 14 MHz	25 ns
For High DC Sensitivity Applications			
H Wide-Band	5 mV/cm to 50 V/cm	DC to 11 MHz	31 ns
For Spectrum Analysis			
Type 1L Series Units—Present units cover 1 MHz to 10.5 GHz.			
For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses			
O Operational Amplifier	50 mV/cm to 50 V/cm	DC to 14 MHz	25 ns
For Transducer and Strain Gage Uses			
Q	10 μstrain/div to 10 k μstrain/div	DC to 6 kHz	60 μs
For Transistor-Risetime Checks			
R	0.5 mA/cm to 100 mA/cm		23 ns
For Diode Recovery Time Measurements			
S	0.05 V/cm and 0.5 V/cm		23 ns
For Precise Amplitude Measurements Via Slide-back			
W	1 mV/cm to 50 V/cm at 1 mV/cm	DC to 13.5 MHz DC to 7 MHz	26 ns to 50 ns
Z	50 mV/cm to 50 V/cm	DC to 13 MHz	27 ns
High-Frequency Sampling Applications			
1S1	2 mV/cm to 200 mV/cm		350 ps
1S2	5 mV/cm to 500 mV/cm		90 ps

VERTICAL DEFLECTION SYSTEM

BANDWIDTH
DC to 15 MHz with Type 1A1 or 1A2 Plug-In Unit. See Plug-In Chart for other combinations.

DELAY LINE
250 ns.

SIGNAL OUT AT FRONT PANEL
1.5 V/cm of displayed signal.

HORIZONTAL DEFLECTION SYSTEM

TIME BASE A
0.1 μs/cm to 5 s/cm; 24 calibrated steps; 1-2-5 sequence. Range continuously variable between steps, uncalibrated. Range extended from 5 to 12 s/cm, uncalibrated. Calibration of fixed sweep rates is typically ±1% of full scale, and in all cases within ±3%.

TIME BASE B (535A only)
2 μs/cm to 1 s/cm; 18 calibrated steps, 1-2-5 sequence. Sweep-length control adjusts length from 4 cm to 10 cm to permit changing sweep repetition rate. Time Base B is therefore useful as a repetition-rate generator over the range of 0.1 Hz to 40 kHz.

SWEEP DELAY (535A only)
Calibrated delay range variable from 2 μs to 10 s. Accuracy from 2 μs to 0.1 s is within ±1% of indicated delay ±2 minor dial divisions of Delay-Time Multiplier control. Accuracy of the three remaining steps, 0.2, 0.5, and 1 second is within ±3%. Time jitter in delayed trigger or delayed sweep less than one part in 20,000.

SWEEP MAGNIFICATION
5X accuracy ±5%, extends sweep to 20 ns/cm.

SINGLE-SWEEP OPERATION (535A only)
Locked out after firing until reset at front panel.

EXTERNAL HORIZONTAL INPUT
DC to at least 350 kHz; deflection factor continuously variable from 0.2 V/cm to approximately 15 V/cm. Input RC is 1 megohm paralleled by 47 pF.

RM31A 531A
RM35A 535A

FRONT-PANEL OUTPUTS

+20 V gates from both time bases; +150 V sawtooth from Time Base A; +5 V delayed trigger pulse.

TRIGGER

Separate and identical for both Time Bases except that Time Base A has two additional modes: HF SYNC and AC LF (low-frequency) REJECT.

TRIGGER MODE

Internal, external, or line. Internal source selected from scope vertical amplifier. Coupling is direct or AC. Features AC Low-Frequency Reject (3 dB down at 1.5 kHz). Also may be triggered or Automatic. Latter provides bright reference trace with no input (or input less than 50 Hz). Above 50 Hz, time base can be triggered at repetition rate of incoming signal. HF SYNC assures a steady display of sine-wave signals up to approximately 30 MHz.

TRIGGER LEVEL

Adjustable to provide triggering at desired point on input waveform (rising or falling portion).

TRIGGER REQUIREMENTS

Internal: Minimum of 2 mm of displayed signal. External: 0.2 V minimum, up to ±50 V combined DC and peak AC.

OTHER CHARACTERISTICS

CRT

The Tektronix cathode-ray tube is a 5" flat-faced metallized tube with a helical post-accelerating anode. 10-kV accelerating potential assures a bright display even with high sweep speeds at low repetition rates. P2 phosphor is normally furnished.

ILLUMINATED GRATICULE

The edge-lighted graticule has 6 x 10 centimeters marked in centimeter squares with centerline markings every 2 millimeters. Illumination is controlled by a front-panel knob.

AMPLITUDE CALIBRATOR

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 kHz.

DISPLAY FEATURES

Front-panel controls: intensity, focus, astigmatism. Internal screwdriver adjustments control display geometry and high-voltage supply level. Beam-position indicators show direction of CRT beam when off screen. DC-coupled unblanking to CRT grid assures uniform beam current for all sweep speeds and repetition rates at any setting of intensity control. Z-Axis input for external modulation of CRT beam is AC coupled; requires 15 V, peak to peak.

POWER REQUIREMENT

Wired for 115 V, 50 to 60 Hz, the electronically-regulated power supplies permit a line voltage variation between 103.5 and 126.5 V (115 V ±10%). Changing transformer taps permits operation at 108, 122, 216, 230, or 244 V regulated within 10%, each range. The Type 531A draws 455 watts maximum; the Type 535A draws 550 watts maximum.

CABINET MODEL DIMENSIONS

Type 531A and 535A dimensions are 16⅞" high by 13⅛" wide by 23⅞" deep. Type 531A net weight is 57¾ pounds; shipping weight is 78 pounds, approx. Type 535A net weight is 61½ pounds; shipping weight is 83 pounds, approx.

RACK-MOUNT MODEL DIMENSIONS

Type RM31A and RM35A cabinets mount to a standard 19" rack. They withdraw from the cabinet on slide-out tracks and can be tilted and locked in any of 7 positions for servicing convenience. Dimensions are 14" high by 19" wide by 22¾" deep. For further mounting information, refer to the Catalog instrument dimension page. Type RM31A net weight is 75 pounds; shipping weight is 101 pounds, approx. Type RM35A net weight is 78¼ pounds; shipping weight is 105 pounds, approx.

TYPE 531A, without plug-in units $995

Each instrument includes: 2—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC, (012-0092-00); 2—Instruction Manual (070-0130-00).

TYPE 535A, without plug-in units $1400

Each instrument includes: 2—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC, (012-0092-00); 2—Instruction Manual (070-0145-00).

Type RM31A, without plug-in units $1095

Each instrument includes: 2—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord, BNC-to-BNC, 18", (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC, (012-0092-00); 1—Set mounting hardware; 2—Instruction Manual (070-0301-00).

TYPE RM35A, without plug-in units $1500

Each instrument includes: 2—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord, BNC-to-BNC, 18", (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC, (012-0092-00); 1—Set mounting hardware; 2—Instruction Manual (070-0306-00).

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

DC-to-15 MHz OSCILLOSCOPE Type 533A / RM 533A
with 100X MAGNIFIER

HIGH-INTENSITY TRACE

WIDE RANGE SWEEP MAGNIFICATION

ACCEPTS AMPLIFIER, SPECTRUM ANALYZER, AND SPECIAL-PURPOSE PLUG-INS

The Type 533A is a DC-to-15 MHz oscilloscope with a wide range of application coverage through use of versatile Tektronix Plug-In Units. Six different degrees of sweep magnification are available. Sweep lockout and high writing rate are combined for best results in one-shot recording.

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

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics are extremely flexible through use of the 1-Series, Spectrum Analyzer, and all Letter-Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μs/cm to 5 s/cm.

SWEEP MAGNIFIER—X2 to X100, extends sweep range, accurately, to 0.02 μs/cm.

TRIGGER REQUIREMENTS (minimum)—Internal: 2-mm deflection.
External: 0.2 V to $\pm$50 V combined DC and peak AC.

EXTERNAL INPUT—0.1 V/cm to 10 V/cm (calibrated) DC to 350 kHz; 1 megohm, 47 pF.

CRT

DISPLAY AREA—6 x 10 cm.

ACCELERATING VOLTAGE—10 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V; 1-kHz square wave.

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 500 watts max.

533A
RM33A

VERTICAL PLUG-IN UNITS Bandwidth Specifications are at —3 dB.			
PLUG-IN UNIT	DEFLECTION FACTOR	BANDWIDTH	RISETIME
For Wide-Band, Multiple Trace Applications			
1A1 Dual-Trace	50 mV/cm to 50 V/cm	DC to 15 MHz	23 ns
	5 mV/cm	DC to 14 MHz	25 ns
	500 μV/cm	2 Hz to 8 MHz	44 ns
1A2 Dual-Trace	50 mV/cm to 50 V/cm	DC to 15 MHz	23 ns
CA Dual-Trace	50 mV/cm to 50 V/cm	DC to 13.5 MHz	23 ns
M Four-Trace	20 mV/cm to 25 V/cm	DC to 14 MHz	25 ns
For Wide-Band Applications			
B	50 mV/cm to 50 V/cm	DC to 14 MHz	25 ns
	5 mV/cm to 50 mV/cm	2 Hz to 10 MHz	35 ns
K	50 mV/cm to 40 V/cm	DC to 15 MHz	23 ns
L	50 mV/cm to 40 V/cm	DC to 15 MHz	23 ns
	5 mV/cm to 4 V/cm	3 Hz to 15 MHz	23 ns
For Differential Input Applications			
1A7	10 μV/cm (to 10 V/cm)	DC to 500 kHz Selectable Bandwidth	0.7 μs
D High-Gain	1 mV/cm (to 50 mV/cm)	DC to 300 kHz DC to 2 MHz	0.18 μs
E Low-Level	50 μV/cm (to 10 mV/cm)	0.06 Hz to 20 kHz; 0.06 Hz to 60 kHz	6 μs
G Wide-Band	50 mV/cm to 50 V/cm	DC to 14 MHz	25 ns
For High DC Sensitivity Applications			
H Wide-Band	5 mV/cm to 50 V/cm	DC to 11 MHz	31 ns
For Spectrum Analysis			
Type 1L Series Units—Present units cover 1 MHz to 10.5 GHz.			
For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses			
O Operational Amplifier	50 mV/cm to 50 V/cm	DC to 14 MHz	25 ns
For Transducer and Strain Gage Uses			
Q	10 μstrain/div to 10 k μstrain/div	DC to 6 kHz	60 μs
For Transistor-Risetime Checks			
R	0.5 mA/cm to 100 mA/cm		23 ns
For Diode Recovery Time Measurements			
S	0.05 V/cm and 0.5 V/cm		23 ns
For Precise Amplitude Measurements Via Slide-back			
W	1 mV/cm to 50 V/cm at 1 mV/cm	DC to 13.5 MHz DC to 7 MHz	26 ns to 50 ns
Z	50 mV/cm to 50 V/cm	DC to 10 MHz	35 ns
High-Frequency Sampling Applications			
1S1	2 mV/cm to 200 mV/cm		350 ps
1S2	5 mV/cm to 500 mV/cm		90 ps

VERTICAL DEFLECTION SYSTEM

BANDWIDTH AND RISETIME

Output Amplifier—DC to 15 MHz.
Risetime—23 ns with Type 1A1, 1A2, CA, K, L, R, or S Plug-In Units.

DELAY LINE

Permits viewing the leading edge of the waveform that triggers the sweep.

MULTI-TRACE BLANKING

A blanking voltage is available to eliminate switching transients from the display when a multi-trace plug-in unit is operated in its chopped mode. External blanking voltage can be applied to the CRT cathode by means of a connector located on the rear panel of the instrument.

HORIZONTAL DEFLECTION SYSTEM

SWEEP RATES

0.1 μs/cm to 5 s/cm in 24 steps with a 1-2-5 sequence. Accuracy is ±3% of the time/cm switch setting. A vernier control allows continuous range (uncalibrated) between steps and extends the slowest rate to 12 s/cm. A neon light indicates when sweep is uncalibrated.

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 μs/cm, accuracy is +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 activates the RESET lever.

DC-COUPLED UNBLANKING
The unblanking waveform is DC-coupled to the control grid of the CRT to assure uniform intensity for all sweep 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 deflection 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 bandwidth is DC to 350 kHz or better at maximum gain. Input RC is approximately 1 megohm paralleled by 47 pF.

TRIGGERING

TRIGGER REQUIREMENTS
Internal: signal producing 2 mm of deflection.
External: signal between 0.2 to ±50 V combined DC and peak AC.

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 or DC coupled. The triggering point can be on either the rising or falling slope of the trigger waveform.

PRESET STABILITY
Same as above, except the stability control is preset to the optimum triggering point and requires no readjustment.

AUTOMATIC TRIGGERING
Range of automatic operation is between 60 Hz and 2 MHz. In the absence of an input signal the sweep is automatically triggered at about a 50 Hz rate. This provides 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 MHz. Requires a signal large enough to cause 2 cm of deflection, or an external signal of about 2 V.

MISCELLANEOUS

AMPLITUDE CALIBRATOR
A square-wave calibration voltage is available through a front-panel connector. Eighteen fixed steps between 0.2 millivolts and 100 volts peak to peak in a 1-2-5 sequence are provided. Accuracy is ±3%. Square-wave frequency is approximately 1 kHz.

FRONT-PANEL OUTPUTS
Gate Signal—Rectangular pulse approx +20 V, same duration as sweep.

Sawtooth—Positive-going approx +150 V, same duration as sweep.

Vertical Signal Out—Approx 1.5 V for each centimeter of vertical deflection on screen.

CATHODE-RAY TUBE
5" flat-faced, metallized tube with helical post-accelerating anode. 10 kV accelerating potential. P2 phosphor is normally supplied.

DIRECT INPUT TO CRT
An opening in the side of the cabinet permits direct connection to the cathode-ray tube deflection plates.

ILLUMINATED GRATICULE
Edge-lighted 6 vertical by 10 horizontal centimeter divisions with 2 millimeter baseline divisions. Lighting controlled by a front-panel knob.

BEAM-POSITION INDICATORS
Two pairs of indicator lights show direction of the electron beam when the spot is not on the screen.

POWER REQUIREMENT
Electronically-regulated DC supplies insure stable operation between 105 and 125 V or between 210 and 250 V, 50 to 60 Hz. Transformer taps allow operation on either range. Instrument factory wired for 117 V. Power consumption approximately 500 watts.

PROBES
Two low capacitance probes (10-X atten) are supplied with the instrument. Input capacitance of the Type 533A—Type K combination with probes, 7 pF; maximum deflection factor is 0.5 V/cm. Excellent transient response is retained, as the probes introduce no overshoot or ringing.

CABINET MODEL
Type 533A dimensions are 16⅞" high by 13⅛" wide by 23⅞" deep. Net weight is 62¼ pounds. Shipping weight is 78 pounds, approx.

RACK-MOUNT MODEL
Type RM33A cabinet mounts to a standard 19" rack. It withdraws from the cabinet on slide-out tracks and can be tilted and locked in any of 7 positions for servicing convenience. Dimensions are 14" high by 19" wide by 22¾" deep. For further mounting information, refer to the Catalog instrument dimension page. Net weight is 74½ pounds, approx. Shipping weight is 100 pounds, approx.

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

Each instrument includes: 2—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch Cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0258-00).

TYPE RM33A, without plug-in units **$1225**

Each instrument includes: 2—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Set mounting hardware; 2—Instruction Manual (070-0304-00).

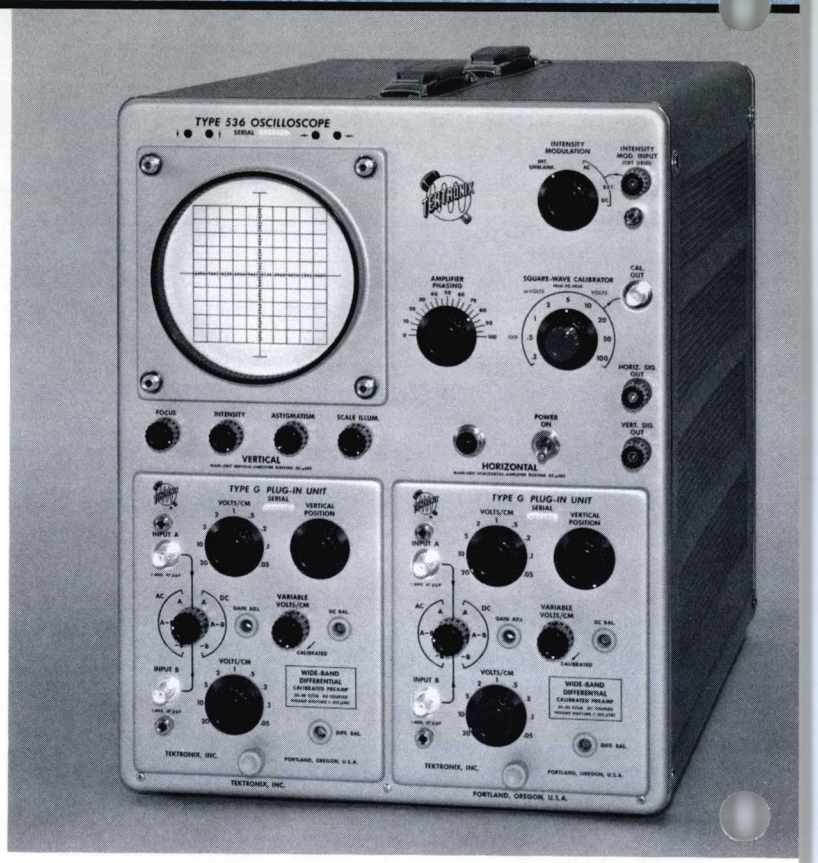
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

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

ACCURATE PHASE BALANCE

WIDE BAND "X-Y" DISPLAY

ACCEPTS AMPLIFIER, SPECTRUM ANALYZER, AND SPECIAL-PURPOSE PLUG-INS



The Type 536 represents a combination of wide-band "X-Y" and general-purpose laboratory oscilloscopes. Identical main amplifiers and a Tektronix CRT with equal X and Y deflection characteristics are the basic components. Using identical wide-band Plug-In Units, horizontal and vertical deflection systems are almost identical. Relative phase shift is less than 1° to 15 MHz, and phase balance can be obtained at any frequency to over 25 MHz.

With the Type T utilized in the horizontal deflection, and a Type 1A1, 1A2, or Letter-Series units in the vertical, the Type 536 functions as a general-purpose instrument. In order to view the leading edge of a fast-rising waveform, a pretrigger signal occurring approx 0.2 μs in advance of the signal to be viewed must be applied to the external trigger input of the Type T Unit.

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).

CHARACTERISTIC SUMMARY
VERTICAL AND HORIZONTAL

Both vertical and horizontal deflection characteristics extremely flexible through use of the 1-Series, Spectrum Analyzer, and Letter-Series Plug-In Units.

TIME-BASE DEFLECTION
(with Type T Time-Base Generator)

CALIBRATED SWEEP RANGE—0.2 μs/div to 2 s/div.

SWEEP MAGNIFIER—5X, extends sweep range to 0.04 μs/div.

TRIGGER REQUIREMENT—0.2 V to 10 V.

CRT

DISPLAY AREA—10 x 10 divisions (3⅛ x 3⅛ inches).

ACCELERATING VOLTAGE—4 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V; 1 kHz square wave.

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V; approximately 625 watts, with two Type K Units.

AMPLIFIER PLUG-IN UNITS

Bandwidth Specifications are —3 dB.

TYPE 1A1—DC to 11 MHz, 31 ns at 0.05 V/div to 50 V/div . . . DC to 10.5 MHz, 33 ns at 0.005 V/div, increasing to 11 MHz, 31 ns at 0.05 V/div.

TYPE 1A2—DC to 11 MHz, 31 ns at 0.05 V/div to 50 V/div.

TYPE B—DC to 10 MHz, 35 ns at 0.05 V/div to 50 V/div . . . 2 hertz to 9 MHz, 0.04 μs at 5 mV/div to 0.05 V/div.

TYPE CA—DC to 10 MHz, 35 ns.

TYPE D—DC to 300 kHz at 1 mV/div, increasing to 2 MHz at 50 mV/div, 0.18 μs.

TYPE E—0.06 hertz to 20 kHz, increasing to 60 kHz at 0.5 mV/cm.

TYPE G—DC to 10 MHz, 35 ns.

TYPE H—DC to 9.5 MHz, 37 ns.

TYPE K—DC to 11 MHz, 31 ns.

TYPE L—DC to 11 MHz, 31 ns at 0.05 to 40 V/div . . . 3 hertz to 10 MHz, 35 ns at 0.005 to 4 V/div.

TYPE M—DC to 10 MHz, 35 ns.

For operations of integration, differentiation, function generation, and linear or nonlinear amplification—
TYPE O—DC to 10 MHz, 35 ns.

For transducer and strain gage applications—
TYPE Q—Sensitivity 10 microstrain/div, DC to 6 kHz.

For precise amplitude measurements via the slide-back technique—TYPE W and TYPE Z Units.

ADDITIONAL PLUG-IN UNITS

TYPE T—Must be plugged into horizontal for conventional operation. Specifications of horizontal-deflection system with TYPE T Unit:

Calibrated Sweep Range—Twenty-two sweep ranges from 0.2 μs/div to 2 s/div.

5X Sweep Magnifier—Increases calibrated sweep range to 0.04 μs/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—No trigger control adjustment necessary for trigger signals between 60 Hz and approx 2 MHz.

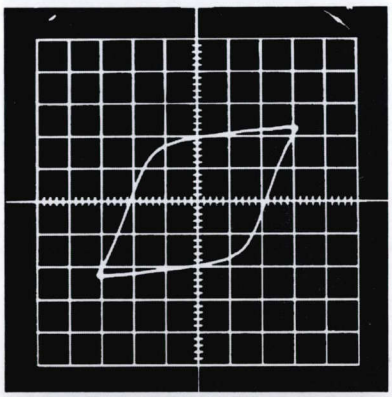
High-Frequency Sync—Synchronizes with sine-wave signals in frequency range of 5 MHz to 15 MHz.

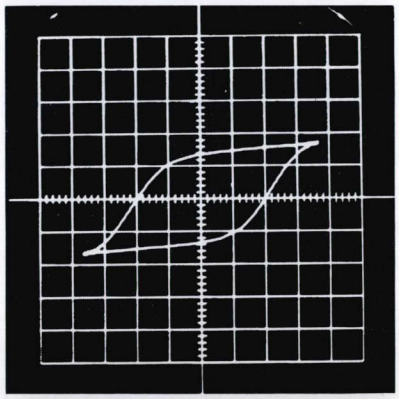
Please refer to the description of the Type T Time-Base Generator for complete characteristics.

TYPE R Plug-In, for transistor risetime measurements, and TYPE S Plug-In, for diode-recovery measurements, are electrically compatible with the Type 536, but because of the matched X-Y delay of the instrument (no vertical system delay line) and its 35-ns amplifier risetime, utility of these plug-ins is severely restricted.

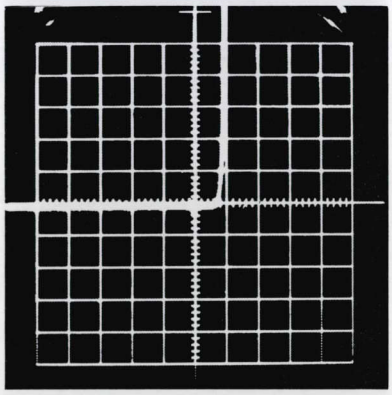
For Spectrum Analysis—
TYPE 1L-Series Units—Present Units cover 1-10,400 MHz.

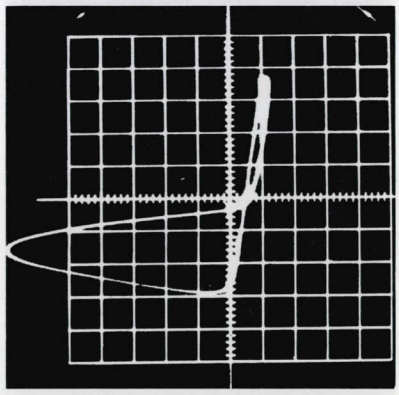
For High-Frequency Sampling Applications—
TYPE 1S1 Sampling Unit—350-ps risetime.





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 MHz.





High-condition diffused silicon diode characteristics—left, at 60 hertz; right, at 2 MHz. Type 536 with two Type G Units, horizontal calibration 1 V/div; vertical calibration 100 mA/div.

536

VERTICAL AND HORIZONTAL DEFLECTION SYSTEMS

All characteristics of the horizontal deflection systems are identical to those of the vertical deflection system when identical Plug-In Units are used. Both main amplifiers have excellent transient response. Following are typical specifications using the K and G Units. (All specifications are valid providing amplifiers are not overdriven by input signal.)

TYPE 536 USED WITH TYPE K UNITS

RISETIME—31 ns. BANDWIDTH—DC to 11 MHz. RELATIVE PHASE SHIFT—less than 1 degree from DC to 15 MHz. PHASE-SHIFT BALANCE—obtainable at any frequency to 30 MHz, using the front-panel Amplifier Phasing Control.

TYPE 536 USED WITH TYPE G UNITS

RISETIME—35 ns. BANDWIDTH—DC to 10 MHz. RELATIVE PHASE SHIFT—less than one degree to 15 MHz, less than two degrees to 17 MHz, less than five degrees to 23 MHz. PHASE-SHIFT BALANCE—obtainable at any frequency to over 25 MHz.

FOLLOWING ARE APPLICABLE TO BOTH K AND G UNITS USED WITH TYPE 536:

DEFLECTION FACTORS: 0.05 V/div max, 9 calibrated steps from 0.05 V/div to 20 V/div; continuously variable adjustment between steps. DEFLECTION CAPABILITY—five divisions of deflection can be obtained at 20 MHz without overdriving the input amplifiers.

MISCELLANEOUS

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 ±3%. Square-wave frequency is approximately 1 kHz.

CATHODE-RAY TUBE

A Tektronix cathode-ray tube provides a 10-by-10 division (3⅛" x 3⅛") 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.

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

ILLUMINATED GRATICULE

The edge-lighted graticule is marked in 10 by 10 divisions (3⅛ by 3⅛ inches total area), with centerlines marked every one-fifth of a division. Illumination is controlled by a front-panel knob.

PROBES

Two low capacitance probes (10-X atten) are supplied with the instrument. Input capacitance of the Type 536—Type K combination with probes is 7 pF, maximum deflection factor is 0.5 V/cm. Excellent transient response is retained, as the probes introduce no overshoot or ringing.

POWER REQUIREMENT

Wired for 115 V, 50 to 60 Hz, the electronically-regulated power supplies permit a line-voltage variation between 103.5 and 126.5 V (115 V ±10%). Changing transformer taps permits operation at 108, 122, 216, 230, or 244 V, regulated within 10%, each range. The Type 536 draws 625 watts, typically, with two Type K Units.

MECHANICAL SPECIFICATIONS

Dimensions are 16⅞" high by 13⅛" wide by 23⅞" deep. Net weight is 55¾ pounds. Shipping weight is 76 pounds, approx.

TYPE 536, without plug-in units **$1085**

2—P6006 probe (010-0127-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Graticule (331-0057-00); 1—Smoke gray filter (378-0567-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0270-00).

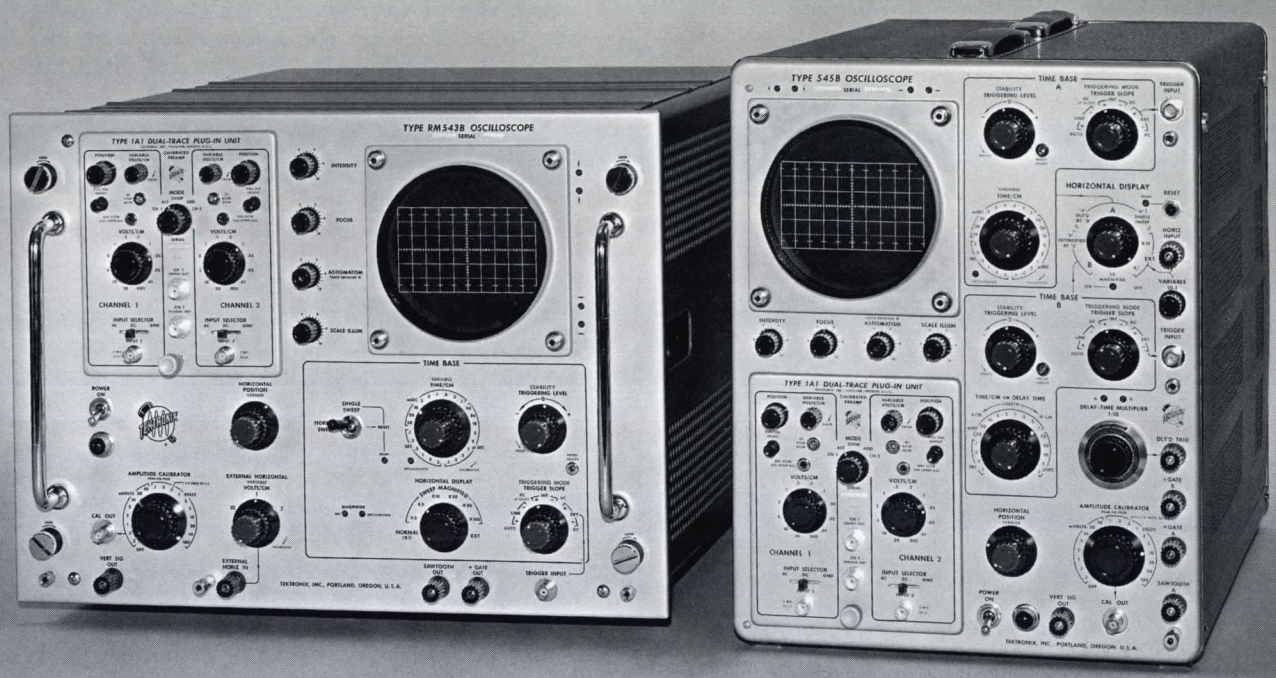
RACK-MOUNT ADAPTER.

Order Part Number 040-0281-00 ..... **$45**

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 17½".

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

DC-to-33 MHz OSCILLOSCOPES Type 543B RM543B 545B RM545B



All information in color describes the additional capabilities of the Type 545B and RM545B. Time Base A characteristics described are the same for the Time Base in the Type 543B/RM543B.

- *UNIFORM-FOCUS 6 x 10-cm DISPLAY*
- *ILLUMINATED NO-PARALLAX GRATICULE*
- *X100 SWEEP MAGNIFIER (543B)*
- *FULL BANDWIDTH TRIGGERING*
- *CALIBRATED SWEEP DELAY (545B)*
- *ACCEPTS AMPLIFIER, SPECTRUM ANALYZER, AND SPECIAL PURPOSE PLUG-IN UNITS*
- *90-ps SAMPLING AND TDR WITH TYPE 1S2 PLUG-IN UNIT*

The Type 543B and 545B are versatile laboratory oscilloscopes designed for use with all Tektronix 1-Series and Letter-Series Plug-In Units. The Type 545B and RM545B have many of the features of the Type 543B and also contain an additional time base with calibrated sweep delay.

The sweep magnifier of the Type 543B is adjustable in steps from X2 to X100 while the Type 545B contains a single X5 magnifier.

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics are extremely flexible through use of all 1-Series and Letter-Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μs/cm to 5 s/cm. Time Base B 2 μs/cm to 1 s/cm.

SWEEP MAGNIFIER—X2 to X100, extends calibrated sweep range to 0.02 μs/cm. (543B)

CALIBRATED SWEEP DELAY—1 μs to 10 s.

EXTERNAL INPUT—RC 1 megohm, 55 pF (approx).
Bandwidth: (543B) DC to 500 kHz.
(545B) DC to 350 kHz.

Deflection Factor: (543B) 0.1, 1, 10 V/cm plus 10:1 variable.
(545B) at least 0.2 V/cm to 2 V/cm plus 10:1 variable, X1 and X10 atten.

CRT

ILLUMINATED NO-PARALLAX GRATICULE

DISPLAY AREA—6 x 10 cm.

ACCELERATING VOLTAGE—10 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V ±3%; 1-kHz squarewave.

POWER REQUIREMENTS—108, 115, 122, 216, 230, or 244 V (±10% on each range). 600 watts maximum (Type 545B-535 watts).

543B RM543B
545B RM545B

VERTICAL PLUG-IN UNITS (Bandwidth specifications at 3-dB down.)			
PLUG-IN UNIT	CALIBRATED DEFLECTION FACTOR	BANDWIDTH	RISETIME
For Wide-Band, Multiple Trace Applications			
1A1 Dual-Trace	50 mV/cm to 20 V/cm	DC to 33 MHz	10.5 ns
	5 mV/cm	DC to 23 MHz	15 ns
	≈500 μV/cm	2 Hz to 14 MHz	25 ns
1A2 Dual-Trace	50 mV/cm	DC to 33 MHz	10.5 ns
	20 V/cm		
CA Dual-Trace	50 mV/cm to 20 V/cm	DC to 24 MHz	15 ns
M Four-Trace	20 mV/cm to 10 V/cm	DC to 20 MHz	17 ns
For Wide-Band Applications			
B	50 μV/cm to 20 V/cm	DC to 20 MHz	18 ns
	5 mV/cm to 50 mV/cm	2 Hz to 12 MHz	30 ns
K	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
L	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
	5 mV/cm to 2 V/cm	3 Hz to 24 MHz	15 ns
For Differential Input Applications			
1A7 High-Gain	10 μV/cm to 10 V/cm	DC to 500 kHz	0.7 μs
D High-Gain	1 mV/cm (to 50 mV/cm)	DC to 300 kHz DC to 2 MHz	
E Low-Level	50 μV/cm (to 10 mV/cm)	0.06 Hz to 20 kHz 20 kHz to 60 kHz	
G Wide-Band	50 mV/cm to 20 V/cm	DC to 20 MHz	18 ns
For High DC Sensitivity Applications			
H Wide-Band	5 mV/cm to 20 V/cm	DC to 15 MHz	23 ns
For Spectrum Analysis			
1L10, 1L20, 1L30 Units cover 1-10,500 MHz.			
For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses			
O Operational Amplifier	50 mV/cm to 20 V/cm	DC to 25 MHz	14 ns
For Transducer and Strain Gage Uses			
Q	10 μstrain/div to 10 k μstrain/div	DC to 6 kHz	60 μs
For Transistor-Risetime Checks			
R	0.5 mA/cm to 100 mA/cm		12 ns
For Diode Recovery Time Measurements			
S	0.05 V/cm and 0.5 V/cm		12 ns
For Precise Amplitude Measurements Via Slide-Back			
W	1 mV/cm to 50 mV/cm at 1 mV/cm	DC to 23 MHz DC to 8 MHz	15 ns 44 ns
Z	50 mV/cm to 25 V/cm	DC to 13 MHz	27 ns
High-Frequency Sampling Applications			
1S1	2 mV/cm to 200 mV/cm	Equiv to DC to 1 GHz	350 ps
1S2	5 mV/cm to 500 mV/cm	Equiv to DC to 3.9 GHz	90 ps

VERTICAL-DEFLECTION SYSTEM

BANDWIDTH with these Plug-in Units extends from DC to 30 MHz, depending on the unit used. Specialized Plug-In Units adapt the oscilloscopes to strain-gage, operational-amplifier, multi-channel, and other applications. Dual-Trace DC-to-33 MHz displays at 50 mV/cm are achieved with either the Type 1A1, or Type 1A2 Plug-In Units. The Type 1A1 offers 5 mV/cm sensitivity from DC-to-23-MHz.

SIGNAL DELAY permits observation of the leading edge of the waveform that triggers the sweep.

SIGNAL OUTPUT from the front panel provides 1.2 volts or more for each centimeter of displayed signal.

HORIZONTAL-DEFLECTION SYSTEM

Two separate time bases are featured in the Type 545B. Either time base can be used alone, or Time Base B can be used to accurately delay the start of Time Base A.

TIME BASE A SWEEP RANGE from 0.1 μs/cm to 5 s/cm is in 24 calibrated steps with 1-2-5 sequence, accuracy within ±3%. Sweep rates are also continuously variable uncalibrated between steps and to approximately 12 s/cm. A front-panel lamp indicates uncalibrated sweep rates.

TIME BASE B SWEEP RANGE from 2 μs/cm to 1 s/cm is in 18 calibrated steps with 1-2-5 sequence, accuracy within ±3%. A control for varying the sweep length from 4 to 10 cm allows maximum duty cycle which allows maximum brightness when using delaying sweep and also permits use of Time Base B as a repetition-rate generator from 0.1 Hz to 40 kHz.

5X SWEEP MAGNIFIER expands the center 2-cm of a signal displayed on either time base so that it covers a full 10 centimeters. The magnifier can be used to extend the Time Base A calibrated sweep rate to 20 ns/cm, and the Time Base B calibrated sweep rate to 0.4 μs/cm. Sweep accuracy when using the magnifier is within ±5%.

X2 to X100 SWEEP MAGNIFIER (Type 543B/RM543B only) expands the center portion of a displayed signal so that it covers a full 10 centimeters. Magnified sweep accuracy is ±5% up to the fastest calibrated rate of 20 ns/cm. An indicator light warns the operator when the maximum calibrated rate is exceeded.

SINGLE-SWEEP OPERATION facilitates photographic recording of waveforms. The front-panel reset control arms the sweep to fire on the next received trigger. After firing once, the sweep is locked out until reset. A lamp indicates when the time base is ready to fire.

EXTERNAL INPUT provides for horizontal beam deflection with an external source.

EXTERNAL INPUT—RC 1 megohm, 55 pF (approx).

Bandwidth: (543B) DC to 500 kHz.
(545B) DC to 350 kHz.

Deflection Factor: (543B) 0.1, 1, 10 V/cm plus 10:1 variable.
(545B) at least 0.2 V/cm to 2 V/cm plus 10:1 variable, X1 and X10 atten.

FRONT PANEL OUTPUTS include gates from both time bases (0 to at least +20 volts), sawtooth from Time Base A (typically 0 to at least +130 volts), and a delayed-trigger pulse (at least 5 volts).

SWEEP DELAY

Highly-accurate time measurements can be made with the 2 time bases used for sweep delay. Two modes of delay are available: triggered and conventional.

CALIBRATED DELAY RANGE is continuously variable from 1 μs to 10 s, accuracy within 1%. Incremental accuracy of the Delay-Time Multiplier is 0.2%.

TRIGGERED OPERATION holds off the start of the delayed sweep until the arrival of the first trigger signal following the selected delay time. Because the delayed sweep is actually triggered by the signal under observation, the display is completely jitter free. A steady display is thus provided for time-modulated pulses and signals with inherent jitter.

CONVENTIONAL OPERATION holds off the start of the delayed sweep for the precise amount of the selected delay time. Any time-modulation or jitter on the signal will be magnified in proportion to the amount of sweep expansion. Time jitter in the delayed trigger pulse or delayed sweep is less than one part in 20,000 of maximum available delay time.

WIDE-RANGE MAGNIFICATION is readily accomplished when Time Base A is operated at a faster rate than Time Base B. For example, if Time Base A is operating at 1 μs/cm and Time Base B is operating at 50 μs/cm, the magnification is 50 times.

TRACE BRIGHTENING indicates the exact portion of the signal that will appear on the magnified display, and also the point-in-time relationship of the magnified display to the original display.

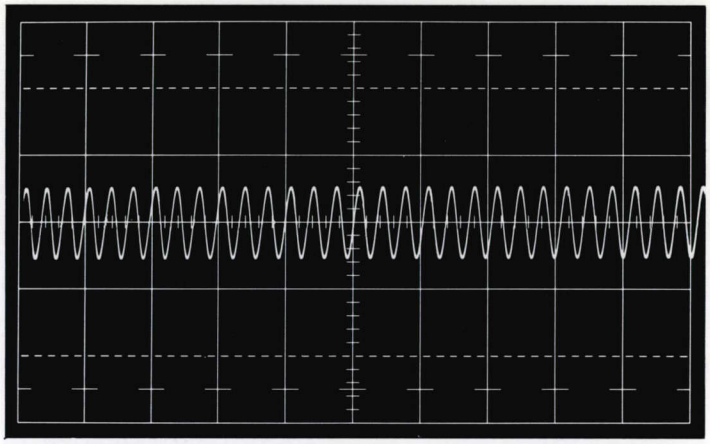
CRT AND DISPLAY FEATURES

These instruments use a T5470 CRT which is a new flat-faced tube with electrostatic focus and deflection, and a helical post accelerator operated at a 10-kV total potential. A longer envelope, careful gun design, and a low 5:1 post-to-gun accelerating voltage ratio provide several characteristics which contribute directly to the many advanced performance features achieved in these instruments.

The CRT produces a small 9-mil nominal spot diameter at 2-μA beam current (2-μA provides a bright display under average ambient light for repetitive signals even at high sweep-rates). Focus of the spot is very uniform over the full 6 x 10-cm viewing area. In flat-faced electrostatically-focused tubes, the spot size varies most at the ends of the horizontal axis. In the T5470, a centered 9-mil spot measures no more than 12 mils at either end; a change ratio of only 1:1.3 compared with a typical change of 1:4 in comparable CRT's operated at 10 kV. Even with 6 cm of vertical scan, high deflection sensitivity is maintained, deflection-plate input capacity is low, and linearity and overall pattern geometry is superior. P31 phosphor is standard.

INTERNAL 6 x 10-CM GRATICULE with variable edge-lighting provides a no-parallax display for viewing or for photographic recording. The graticule is marked in centimeter squares with 2-mm divisions on the vertical and horizontal center lines. Two special horizontal lines have been added to the graticule for convenience in making accurate risetime measurements.

FRONT-PANEL CONTROLS include trace rotation (a screwdriver adjustment), intensity, focus, and astigmatism.



Small spot size and uniform focus provide fine trace definition across the entire 6 x 10-cm viewing area. Risetime and falltime measurements (10 to 90%) are easily made using the dashed graticule lines. A 30-MHz sine wave (internally triggered) is displayed.

BEAM-POSITION INDICATORS show the direction of the CRT beam when it is deflected from the center-screen area.

DC-COUPLED UNBLANKING to the CRT grid assures uniform beam current for all sweep speeds and repetition rates at any setting of the intensity control.

Z-AXIS INPUT through a terminal at the rear of the instrument permits external modulation of the CRT cathode. The input is AC-coupled and requires approx 15 volts, peak to peak for visible modulation.

TRIGGER

Triggering system is separate but similar for both time bases. The trigger circuits offer complete manual control, preset stability, and fully-automatic triggering.

TRIGGER SOURCE can be internal, external, or line, either AC or DC-coupled. The instruments can be externally triggered from Channel 1 only of the Type 1A1 Dual-Trace Unit.

TRIGGERING LEVEL adjusts to allow sweep triggering at any selected point on either the rising or falling portion of the waveform.

STABILITY can be preset at an optimum triggering point to eliminate further adjustment, and is also used to obtain free-running displays.

AUTOMATIC TRIGGERING provides normal triggering on signals with repetition rates higher than about 50 Hz. With no trigger signal, or with a lower repetition rate, the trigger circuit free runs at about 40 Hz and triggers the time base at this rate, providing a reference trace.

543B RM543B
545B RM545B

TRIGGER REQUIREMENTS			
	TRIGGER MODE	TIME BASE A	TIME BASE B
INTERNAL	AC	2-mm deflection from 150 Hz to 10 MHz, increasing to 1 cm at 30 MHz. Will trigger below 150 Hz with increased deflection.	2-mm deflection from 300 Hz to 5 MHz, increasing to 1 cm at 10 MHz. Will trigger below 300 Hz with increased deflection.
	AC LF REJECT	2-mm deflection from 30 kHz to 10 MHz, increasing to 1 cm to 30 MHz. Will trigger below 30 kHz with increased deflection.	
	DC	6-mm deflection to 10 MHz.	6-mm deflection to 5 MHz.
	AUTOMATIC	5-mm deflection at 150-Hz. With increasing deflection, to 10 MHz. Will trigger to 50 Hz with increased deflection.	5-mm deflection from 300 Hz to 5 MHz. Will trigger to 50 Hz with increased deflection.
EXTERNAL	AC	0.2 V from 150 Hz to 10 MHz, increasing to 1 V at 30 MHz. Will trigger below 150 Hz with increased signal.	0.5 V at 300 Hz to 5 MHz, increasing to 1 V at 10 MHz. Will trigger below 300 Hz with increased signal.
	AC LF REJECT	0.2 V from 30 kHz to 10 MHz, increasing to 1 V at 30 MHz. Will trigger below 30 kHz with increased signal.	
	DC	0.2 V to 10 MHz, increasing to 1 V at 30 MHz.	0.2 V to 5 MHz, increasing to 1 V at 10 MHz.
	AUTOMATIC	0.5 V at 150 Hz. With increasing deflection, to 10 MHz. Will trigger to 50 Hz with increased deflection.	0.5 V at 300 Hz to 5 MHz. Will trigger to 50 Hz with increased signal.

OTHER CHARACTERISTICS

POWER REQUIREMENT is 115 V, 50 to 60 Hz. Instrument factory wired for 115 V. The electronically-regulated power supplies permit a line-voltage variation between 103.5 V and 126.5 V (115 V ±10%). Changing transformer taps permits operation at 108, 122, 216, 230, or 244 V, regulated within 10%, on each range. The Type 543B draws 535 watts, maximum. (Type 545B-585 watts). For other line frequency operation, please consult your Tektronix field office or representative.

AMPLITUDE CALIBRATOR provides 18 squarewave voltages from 0.2 mV to 100 V in a 1-2-5 sequence, accuracy within ±3%. Squarewave frequency is approximately 1 kHz. A special output, useful in calibrating sampling plug-ins, provides 0.1 V ±3% into 50 Ω.

DIMENSIONS are 16⅞" high by 13⅛" wide by 23⅞" deep. Net weight is approximately 64 pounds, without plug-in units.

TYPE 543B OSCILLOSCOPE, without plug-in units .. **$1300**

Each instrument includes: 2—P6006 Probe (BNC) (010-0127-00); 1—Power Cord (161-0010-00); 1—3 to 2-Wire Adapter (103-0013-00); 1—50 Ω Cable BNC to BNC 18" (012-0076-00); 1—Smoke gray filter (378-0567-00); 1—Plate, protector, CRT, clear (378-0918-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00), 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC, (021-0092-00); 2—Instruction Manual (070-0429-00).

TYPE 545B OSCILLOSCOPE, without plug-in units .. **$1550**

Each instrument includes: 2—P6006 Probe (BNC) (010-0127-00); 1—Power Cord (161-0010-00); 1—3 to 2-Wire Adapter (103-0013-00); 1—Plate, protector, CRT, clear (387-0918-00); 1—50 Ω Cable BNC to BNC, 18" (012-0076-00); 1—Smoke gray filter (378-0567-00); 2—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0428-00).

RACK-MOUNT OSCILLOSCOPES

The Type RM543B and RM545B are electrically identical to their cabinet counterparts but are mechanically rearranged to fit a 19-inch rack. The instrument withdraws from its cabinet on slide-out tracks and can be tilted and locked in any one of 7 positions. Dimensions are 14" high by 19" wide by 22¾" deep. Net weight is 81 pounds (RM543B) and 85 pounds (RM545B) without plug-in units.

TYPE RM543B OSCILLOSCOPE, less plug-in units ... **$1400**

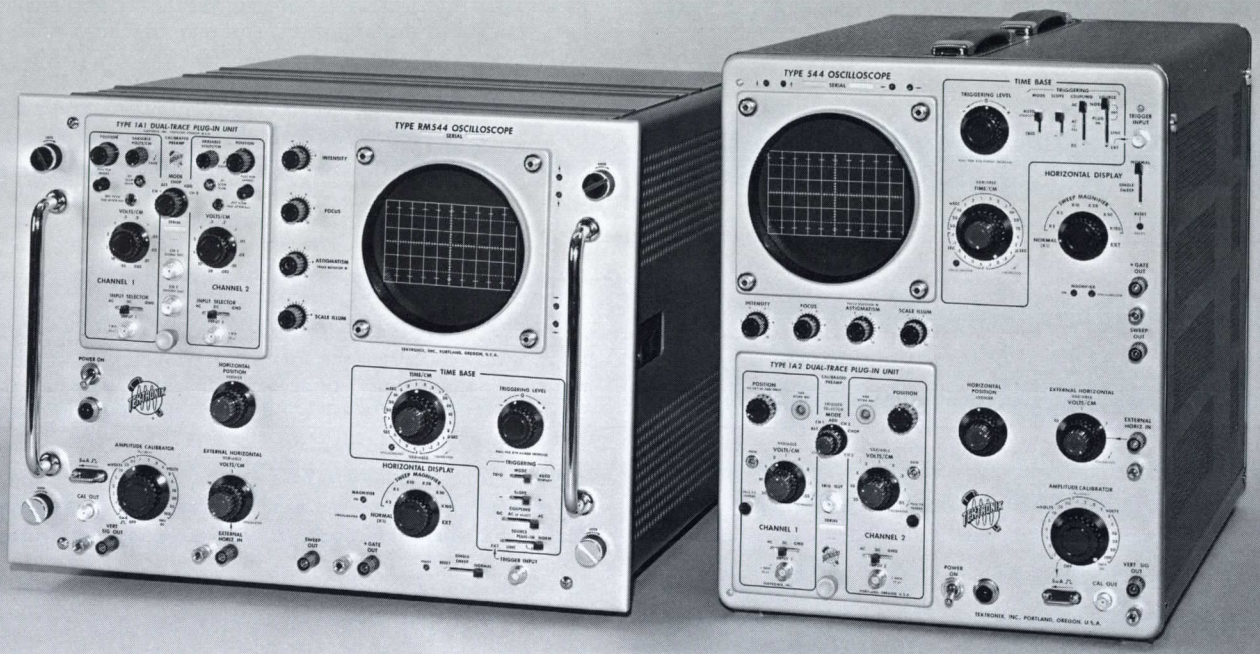
Each instrument includes: 2—P6006 probe (BNC) (010-0127-00); 1—Power Cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—50 Ω cable BNC-to-BNC, 18" (012-0076-00); 1—Smoke gray filter (378-0567-00); 1—Plate, protector, CRT, clear (387-0918-00); 1—Patch cord BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Set mounting hardware; 2—Instruction manual (070-0437-00).

TYPE RM545B OSCILLOSCOPE, less plug-in units ... **$1650**

Each instrument includes: 2—P6006 Probe (BNC) (010-0127-00); 1—Power Cord (161-0010-00); 1—3 to 2-Wire Adapter (103-0013-00); 1—Plate, protector, CRT, clear (387-0918-00); 1—50 Ω Cable BNC to BNC, 18" (012-0076-00); 1—Smoke gray filter (378-0567-00); 2—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); Set mounting hardware; 2—Instruction Manual (070-0438-00).

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

DC-to-50 MHz OSCILLOSCOPE Type 544 / RM544
with X100 MAGNIFIER



- *UNIFORM-FOCUS 6 x 10-CM DISPLAY*
- *ILLUMINATED NO-PARALLAX GRATICULE*
- *WIDE-RANGE SWEEP MAGNIFIER*
- *FULL-BANDWIDTH TRIGGERING*
- *ACCEPTS AMPLIFIER, SPECTRUM ANALYZER, 90 ps SAMPLING AND TDR PLUG-INS*

CHARACTERISTIC SUMMARY

VERTICAL

Plug-In Preamplifiers adapt the Type 544 to a wide range of measurement capabilities. The oscilloscope vertical system accepts all Tektronix Letter-Series, and 1-Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μs/cm to 5 s/cm.

SWEEP MAGNIFIER—X2, X5, X10, X20, X50, X100 (extends calibrated sweep rate to 10 ns/cm).

TRIGGER REQUIREMENTS—Internal: 2-mm deflection.
External: 0.2 V, AC or DC.

EXTERNAL INPUT—0.1 V/cm to 10 V/cm, DC to 400 kHz. Input RC, 1 megohm, 55 pF (approx).

CRT

DISPLAY AREA—6 x 10 cm.

ACCELERATING VOLTAGE—10 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V (1 kHz squarewave), 100 V DC, 5 mA DC, 5 mA 1-kHz squarewave.

POWER REQUIREMENTS—108, 115, 122, 216, 230, or 244 V (±10% on each range), typically 400 watts.

544
RM544

VERTICAL PLUG-IN UNITS Bandwidth specifications are at 3-dB down.			
PLUG-IN UNIT	CALIBRATED DEFLECTION FACTOR	BANDWIDTH	RISETIME
For Wide-Band, Multiple Trace Applications			
1A1 Dual-Trace	50 mV/cm to 20 V/cm	DC to 50 MHz	7 ns
	5 mV/cm	DC to 28 MHz	12.5 ns
	≈500 μV/cm	2 Hz to 15 MHz	23 ns
1A2 Dual-Trace	50 mV/cm to 20 V/cm	DC to 50 MHz	7 ns
CA Dual-Trace	50 mV/cm to 20 V/cm	DC to 24 MHz	15 ns
M Four-Trace	20 mV/cm to 10 V/cm	DC to 20 MHz	17 ns
For Wide-Band Applications			
B	50 mV/cm to 20 V/cm	DC to 20 MHz	18 ns
	5 mV/cm to 20 mV/cm	2 Hz to 12 MHz	30 ns
K	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
L	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
	5 mV/cm to 2 V/cm	3 Hz to 24 MHz	15 ns
For High DC Sensitivity Applications			
H Wide-Band	5 mV/cm to 20 V/cm	DC to 15 MHz	23 ns
For Differential Input Applications			
D High-Gain	1 mV/cm (to 50 mV/cm)	DC to 300 kHz (DC to 2 MHz)	0.18 μs
E Low-Level	50 μV/cm (to 10 mV/cm)	0.06 Hz to 20 kHz (to 60 kHz)	6 μs
G Wide-Band	50 mV/cm to 20 V/cm	DC to 20 MHz	18 ns
1A7 High-Gain	10 μV/cm to 10 V/cm	DC to 500 kHz Selectable Bandwidth	0.7 μs
For Spectrum Analysis			
1L10, 1L20, 1L30 Units cover 1-10,500 MHz.			
For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses			
O Operational Amplifier	50 mV/cm to 20 V/cm	DC to 25 MHz	14 ns
For Transducer and Strain Gage Uses			
Q	10 μstrain/div to 10 k μstrain/div	DC to 6 kHz	60 μs
For Transistor-Risetime Checks			
R	0.5 mA/cm to 100 mA/cm		12 ns
For Diode Recovery Time Measurements			
S	0.05 V/cm and 0.5 V/cm		12 ns
For Precise Amplitude Measurements Via Slide-Back			
W	1 mV/cm to 50 mV/cm	DC-8 MHz to DC-23 MHz	44 ns to 15 ns
Z	50 mV/cm to 25 V/cm	DC to 13 MHz	27 ns
High-Frequency Sampling Applications			
1S1	2 mV/cm to 200 mV/cm	Equiv to 1 GHz	350 ps
1S2	5 mV/cm to 500 mV/cm	Equiv to 3.9 GHz	90 ps

VERTICAL DEFLECTION

BANDWIDTH with the Type 1A1 Plug-In Unit is DC to 50 MHz from 50 mV/cm to 20 V/cm, DC to 28 MHz at 5 mV/cm. Letter-Series Plug-In Units provide response from DC to 30 MHz depending on the unit used. Specialized Letter-Series Units adapt the Type 544 to strain-gage, operational amplifier, multi-channel, and other applications.

SIGNAL DELAY permits observation of the leading edge of the waveform that triggers the sweep.

SIGNAL OUTPUT from the front panel provides approximately 0.4 V/cm of displayed signal. This AC-coupled signal output has a risetime capability of 20 ns.

HORIZONTAL DEFLECTION

SWEEP RANGE from 0.1 μs/cm to 5 s/cm is in 24 calibrated steps with 1-2-5 sequence, accuracy within ±2%. Sweep rates are also continuously variable uncalibrated between steps and to approximately 12 s/cm. A front-panel lamp indicates uncalibrated sweep rates.

X2 to X100 SWEEP MAGNIFIER expands the center portion of a displayed signal so that it covers a full 10 centimeters. Magnified sweep accuracy is within ±5% up to the fastest calibrated rate of 10 ns/cm. An indicator light warns the operator when the maximum calibrated rate is exceeded.

SINGLE-SWEEP OPERATION facilitates photographic recording of waveforms. A front-panel reset control arms the sweep to fire on the next received trigger. After firing once, the sweep is locked out until reset at the front panel, or with a +20-volt pulse applied through a rear-panel connector. A front-panel lamp indicates when the time base is ready to fire. It extinguishes as soon as the sweep starts.

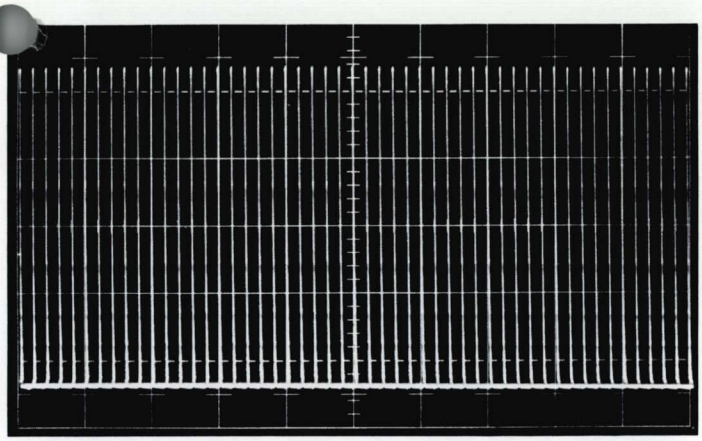
EXTERNAL HORIZONTAL INPUT provides for horizontal beam deflection with an external source. Horizontal Amplifier bandwidth is DC to at least 400 kHz (3-dB down). Deflection factor is 0.1, 1, or 10 V/cm with step attenuation. Deflection factor potentiometer is continuously variable over a 10:1 range. Input RC is 1 megohm paralleled by approximately 55 pF.

FRONT-PANEL OUTPUTS include a +20-V gate having the same duration as the sweep and a 100-V sawtooth (both voltages are approximate).

TRIGGER

Wide-range trigger circuits allow triggering to beyond 50 MHz. The Trigger signal is selected and processed by a series of four lever switches.

TRIGGER SOURCE can be internal, external, or line. The internal source can be selected from the oscilloscope vertical amplifier, or direct from Channel 1 of the Type 1A1 Dual-Trace Plug-In Unit, or Channel 1 or 2 of Type 1A2. With a Type 1A1 operating in one of its channel-switching modes, the internal trigger signal can be selected from Channel 1 before switching occurs, or from the composite signal after the two channels have been combined. When triggering from Channel 1, the true time relationship between Channel 1 and 2 signals is displayed. With the Type 1A1 Unit, or 1A2, in "Alternate" switching mode, triggering internally from Channels 1 and 2 composite signal allows observation of 2 signals which are not harmonically related.



UNIFORM-FOCUS 6 x 10-CM DISPLAY

TRIGGER COUPLING can be direct or AC-coupled. AC Low-Frequency Reject (approximately 3-dB down at 1.5 kHz) prevents low-frequency components such as 60-Hz hum from interfering with stable operation.

TRIGGER MODE selects either Triggered or Automatic operation. Automatic triggering provides a bright reference trace (regardless of sweep speed) when no input signal is applied, or when the trigger-signal repetition rate is less than 20 Hz. Above 20 Hz, the time base can be triggered at the repetition rate of the incoming trigger signal to achieve jitter-free displays to beyond 50 MHz.

TRIGGER LEVEL adjusts to allow sweep triggering at any selected point on either the rising or falling portion of the waveform. A two-position control permits trigger-level selection between ±2 V or ±20 V.

TRIGGER REQUIREMENTS for internal triggering are a minimum of 2 mm of displayed signal, increasing to 1 cm at approximately 50 MHz (either AC-coupled mode) and 5 mm at DC with direct coupling. External triggering requires 0.2 V, AC or DC.

CRT AND DISPLAY FEATURES

The Tektronix T5470 CRT is a new flat-faced tube with electrostatic focus and deflection, and a helical post accelerator operated at a 10-kV total potential. A longer envelope, careful gun design, and a low 5:1 post-to-gun accelerating-voltage ratio provide several characteristics which contribute directly to the many advanced performance features achieved in the Type 544 and RM544: 6-cm vertical scan with 50 MHz bandwidth, 10 ns/cm maximum sweep rate, bright displays with high resolution and read-out accuracy.

The CRT produces a small 9-mil (nominal) spot diameter at 2 μA beam current (2 μA provides a bright display under average ambient light for repetitive signals even at high sweep rates). Focus of the spot is very uniform over the full 6 x 10-cm viewing area. In flat-faced electrostatically-focused tubes, the spot size varies most at the ends of the horizontal axis. In the T5470, a centered 9-mil spot measures no more than 12 mils at either end; a change ratio of only 1:1.3 compared with a typical change of 1:4 in comparable tubes operated at 10 kV. Even with 6 cm of vertical scan, high deflection sensitivity is maintained, deflection-plate input capacitance is low, and linearity and overall pattern geometry is superior. P31 phosphor is standard.

INTERNAL 6 x 10-CM GRATICULE with variable edge-lighting provides a no-parallax display for viewing or for photographic recording. The graticule is marked in centimeter squares with 2-mm divisions on the vertical and horizontal center lines. Two special horizontal lines have been added to the graticule for convenience in making accurate risetime measurements.

FRONT-PANEL CONTROLS include trace rotation (a screwdriver adjustment), intensity, focus, and astigmatism. Internal screwdriver adjustments control display geometry and the high-voltage supply level.

BEAM-POSITION INDICATORS show the direction of the CRT beam when it is deflected away from the center-screen area.

DC-COUPLED UNBLANKING to the CRT grid assures uniform beam current for all sweep speeds and repetition rates at any setting of the intensity control.

Z-AXIS INPUT, AC-coupled, through terminal at rear of instrument, permits external modulation of CRT cathode. Requires 15 V, peak to peak.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR provides 18 squarewave voltages from 0.2 mV to 100 volts in a 1-2-5 sequence, accuracy within 2%. Output resistance is 50 ohms from 0.2 mV to 0.2 V. Frequency is approximately 1 kHz. Risetime and falltime is 0.6 μs from 0.2 mV to 5 V, and 1.0 μs from 10 V to 100 V. A 100-volt DC output is also provided. Reference currents supplied through the front-panel loop are 5-mA DC and a 5-mA 1 kHz squarewave. Current probes can be slipped directly over the loop for calibration.

POWER REQUIREMENT is 115 V, 50 to 60 Hz. Instrument factory wired for 115 V. The electronically-regulated power supplies permit a line-voltage variation between 103.5 and 126.5 V (115 V ±10%). Changing transformer taps permits operation at 108, 122, 216, 230, or 244 V, regulated within 10%, each range. The Type 544 draws 400 watts, typically. For other line frequency operation, please consult your Tektronix field office or representative.

CABINET MODEL DIMENSIONS are 16⅞" high by 13⅛" wide by 23⅞" deep. Net weight is 59¾ pounds. Shipping weight is approximately 80 pounds.

RACK-MOUNT MODEL DIMENSIONS are 14" high by 19" wide by 22¾" deep. The Type RM544 is electrically identical to the Type 544, but mechanically rearranged to fit a standard 19-inch rack. They withdraw from their cabinet on slide-out tracks and can be tilted and locked in any of 7 positions. Net weight is 80½ pounds. Shipping weight is approximately 109 pounds.

TYPE 544 OSCILLOSCOPE, without plug-in units **$1550**

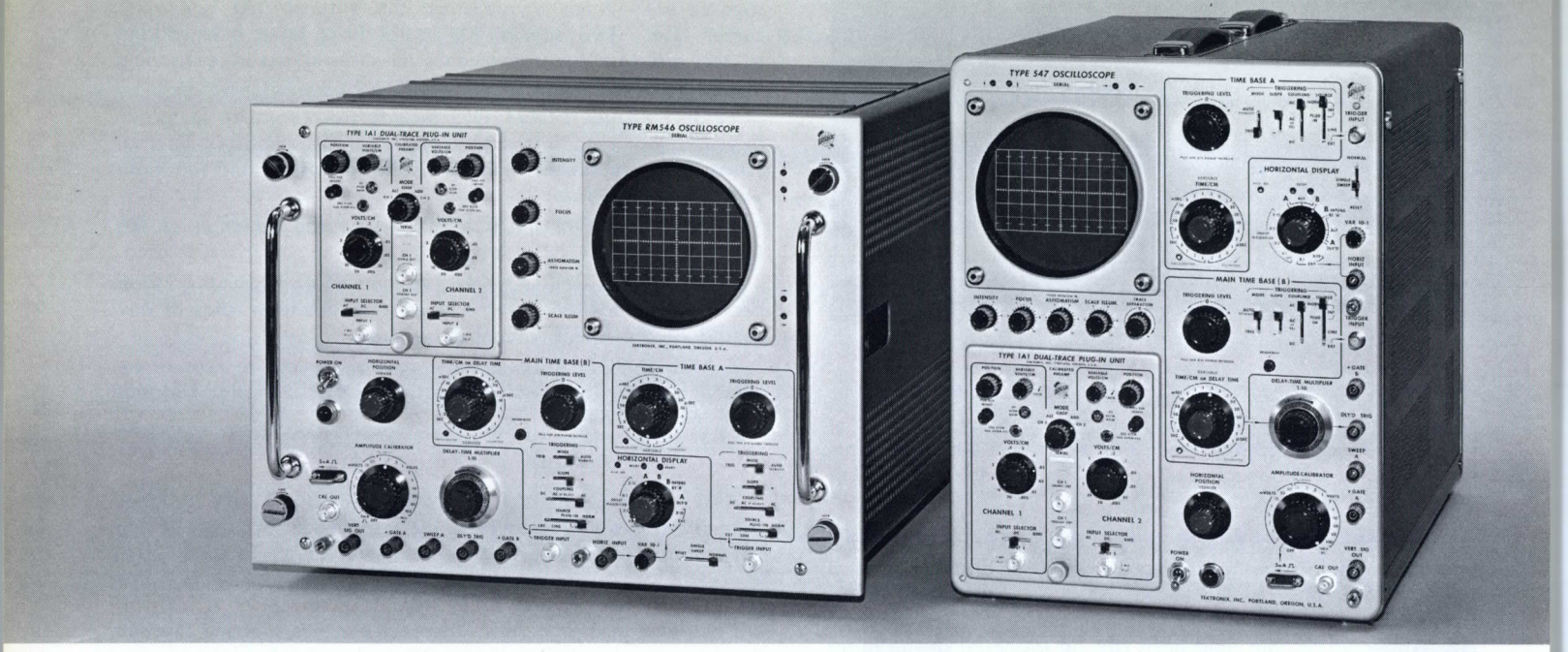
Each instrument includes: 2—P6008 probe (010-0129-00); 1—Plate, protector, CRT (387-0918-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—Smoke gray filter (installed) (378-0567-00); 2—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0418-00).

TYPE RM544 OSCILLOSCOPE, without plug-in units .. **$1650**

Each instrument includes: 2—P6008 probe (010-0129-00); 1—Plate, protector, CRT (387-0918-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—Smoke gray filter (installed) (378-0567-00); 2—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Set mounting hardware; 2—Instruction Manual (070-0422-00).

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

Type 546 RM546 547 RM547 DC-to-50 MHz OSCILLOSCOPES



- *FULL-BANDWIDTH TRIGGERING*
- *ILLUMINATED NO-PARALLAX GRATICULE*
- *ACCEPTS AMPLIFIER, SPECTRUM ANALYZER, AND SAMPLING PLUG-INS*
- *CALIBRATED SWEEP DELAY*
- *AUTOMATIC DISPLAY SWITCHING (Type 547)*

The 546 and 547 are essentially identical instruments. Type 547 features AUTOMATIC DISPLAY SWITCHING which provides general dual-beam performance without the additional cost of a dual-beam oscilloscope. With appropriate Plug-In units, both instruments are adaptable to a wide variety of applications such as WIDE-BAND RESPONSE (up to 50 MHz with Type 1A1 Plug-In Unit), DIFFERENTIAL INPUT, OPERATIONAL, TRANSDUCER AND STRAIN-GAGE, and others.

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics extremely flexible through use of all 1-Series and Letter-Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μs/cm to 5 s/cm.

SWEEP MAGNIFIER—X2, X5, or X10, extends calibrated sweep to 10 ns/cm.

CALIBRATED SWEEP DELAY—0.1 μs to 50 s.

EXTERNAL INPUT—0.1 V/cm to 1 V/cm deflection factor, DC to 500 kHz. Input RC 1 megohm paralleled by 55 pF, (approx).

TRIGGER REQUIREMENT—Internal, 1-cm deflection at 50 MHz. External, 0.2 V, AC or DC.

CRT

ILLUMINATED NO-PARALLAX GRATICULE

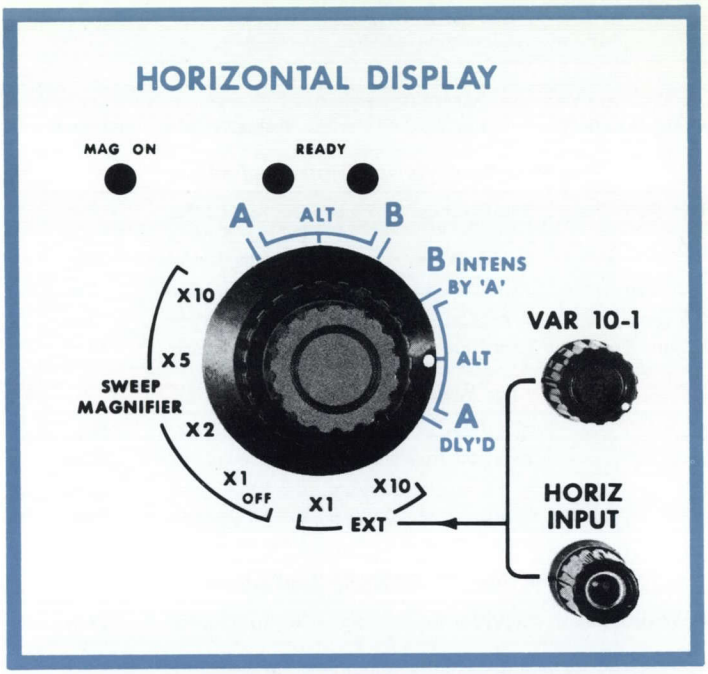
DISPLAY AREA—6 x 10 cm.

ACCELERATING VOLTAGE—10 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V (1 kHz squarewave), 100 V DC, 5 mA DC, 5 mA 1-kHz squarewave.

POWER REQUIREMENT—103.5 to 126.5 V, 510 watts.

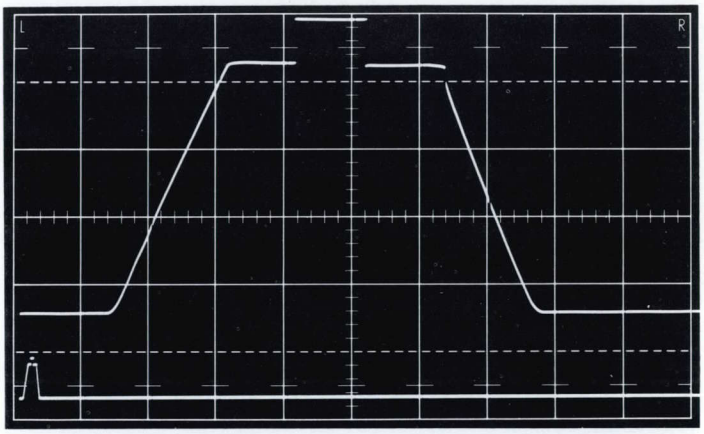


AUTOMATIC DISPLAY SWITCHING

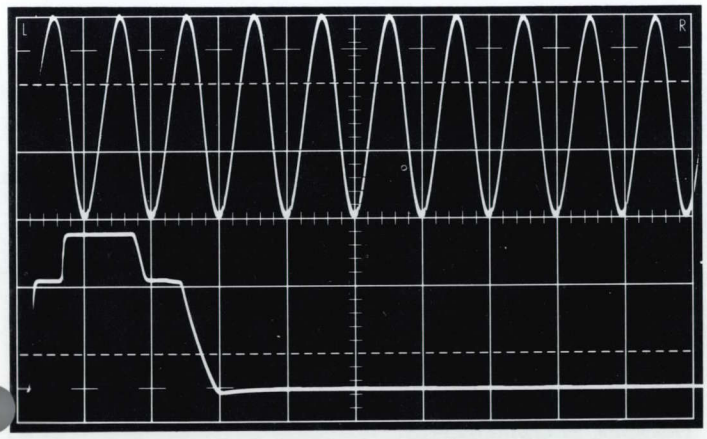
featured in the Type 547 and RM547 Oscilloscopes

Electronic switching between 2 wide-range time bases allows an alternate presentation of the same signal at 2 different sweep rates. Gallium Arsenide diodes in the switching circuit provide fast switching between time bases, and insure that only the desired time base is displayed at one time.

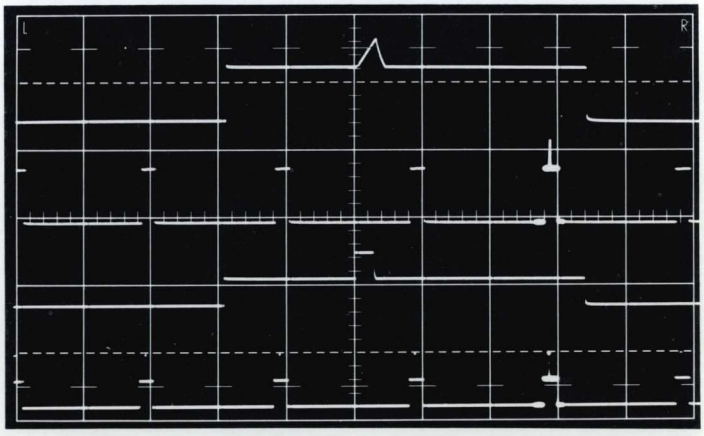
Two different signals can be alternately displayed at the same or different sweep rates with a dual-trace unit such as the new Type 1A1 or 1A2. In many applications, this provides equivalent dual-beam operation without the additional cost and complexity of a dual-beam oscilloscope. Dual displays are equal in quality to the finest single presentations. Also, the full 6 x 10-cm screen area can be used to display signals on either time base. A trace separation control operates in conjunction with the normal vertical position to allow full control of dual displays.



Vertical and Horizontal Expansion—same signal applied to both channels of the Type 1A1 Dual-Trace Unit with independent control of sensitivity and sweep rate in each channel.



Dual-Scope Operation—independent control of each signal with Channel 1 of the Type 1A1 Dual-Trace Unit locked to Time Base A, and Channel 2 locked to Time Base B.



Calibrated Sweep Delay—alternate presentation of 2 signals brightened over a selected portion, and the selected portions expanded to fill 10 cm.

546 RM546
547 RM547

VERTICAL PLUG-IN UNITS (Bandwidth is specified at —3 dB.)			
PLUG-IN UNIT	CALIBRATED DEFLECTION FACTOR	BANDWIDTH	RISETIME
For Wide-Band, Multiple Trace Applications			
1A1 Dual-Trace	50 mV/cm to 20 V/cm	DC to 50 MHz	7 ns
	5 mV/cm	DC to 28 MHz	12.5 ns
	≈500 μV/cm	2 Hz to 15 MHz	23 ns
1A2 Dual-Trace	50 mV/cm to 20 V/cm	DC to 50 MHz	7 ns
CA Dual-Trace	50 mV/cm to 20 V/cm	DC to 24 MHz	15 ns
M Four-Trace	20 mV/cm to 10 V/cm	DC to 20 MHz	17 ns
For Wide-Band Applications			
B	50 mV/cm to 20 V/cm	DC to 20 MHz	18 ns
	5 mV/cm to 20 mV/cm	2 Hz to 12 MHz	30 ns
K	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
L	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
	5 mV/cm to 2 V/cm	3 Hz to 24 MHz	15 ns
For High DC Sensitivity Applications			
H Wide-Band	5 mV/cm to 20 V/cm	DC to 15 MHz	23 ns
For Differential Input Applications			
D High-Gain	1 mV/cm (to 50 mV/cm)	DC to 300 kHz (DC to 2 MHz)	0.18 μs
E Low-Level	50 μV/cm (to 10 mV/cm)	0.06 Hz to 20 kHz (to 60 kHz)	6 μs
G Wide-Band	50 mV/cm to 20 V/cm	DC to 20 MHz	18 ns
1A7 High-Gain	10 μV/cm to 10 V/cm	DC to 500 kHz Selectable Bandwidth	0.7 μs
For Spectrum Analysis			
1L10, 1L20, 1L30 Units cover 1-10,500 MHz.			
For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses			
O Operational Amplifier	50 mV/cm to 20 V/cm	DC to 25 MHz	14 ns
For Transducer and Strain Gage Uses			
Q	10 μstrain/div to 10 k μstrain/div	DC to 6 kHz	60 μs
For Transistor-Risetime Checks			
R	0.5 mA/cm to 100 mA/cm		12 ns
For Diode Recovery Time Measurements			
S	0.05 V/cm and 0.5 V/cm		12 ns
For Precise Amplitude Measurements Via Slide-Back Technique			
W	1 mV/cm to 50 mV/cm	DC—8 MHz to DC—23 MHz	44 ns to 15 ns
Z	50 mV/cm to 25 V/cm	DC to 13 MHz	27 ns
High-Frequency Sampling Applications			
1S1	2 mV/cm to 200 mV/cm	Equiv to DC to 1 GHz	350 ps
1S2	5 mV/cm to 500 mV/cm	Equiv to DC to 3.9 GHz	90 ps

VERTICAL DEFLECTION SYSTEM

(Bandwidth is specified at —3 dB)

BANDWIDTH
DC to 50 MHz with Type 1A1 or 1A2 Plug-in Unit. See Plug-In Chart for other combinations.

DELAY LINE
170 ns.

SIGNAL OUT AT FRONT PANEL
0.5 V/cm of displayed signal; risetime 20 ns.

HORIZONTAL DEFLECTION SYSTEM

TIME BASE A
0.1 μs/cm to 5 s/cm; 24 calibrated steps accurate to ±2%, 1-2-5 sequence. Range continuously variable between steps, uncalibrated. Range extended from 5 to 12 s/cm, uncalibrated.

TIME BASE B
Identical to Time Base A.

SWEEP DELAY
Calibrated Delay Range variable from 0.1 μs to 50 s. Accuracy from 50 μs to 50 s is within ±1% of indicated delay ±2 minor dial divisions of Delay-Time Multiplier control. For delays less than 50 μs, accuracy is the same plus 75-100 ns (inherent circuit delay). Delay Range extended to 120 s, uncalibrated. Time jitter in delayed trigger or delayed sweep less than one part in 20,000.

SWEEP MAGNIFICATION
2, 5, or 10X; accuracy ±5%, extends sweep to 10 ns/cm.

SINGLE-SWEEP OPERATION
Locked out after firing until reset at front panel, or with 20 V at rear. Time Base A and B reset by same switch.

EXTERNAL HORIZONTAL INPUT
DC to at least 400 kHz deflection factor 0.1 V/cm or 1 V/cm with 10X step attenuation. Deflection factor continuously variable over 10 to 1 range. Input RC: 1 megohm paralleled with 55 pF (approx).

FRONT PANEL OUTPUTS
+20 V gates from both time bases; +100 V sawtooth from Time Base A; +10 V delayed trigger pulse.

TRIGGER
Separate and identical for both Time Bases. Trigger circuits respond to beyond 50 MHz.

TRIGGER SOURCE
Internal, external, or line. Internal source selected from oscilloscope vertical amplifier, or direct from certain Plug-In Units such as the Type 1A1 Dual-Trace. Coupling is direct or AC Features AC Low-Frequency Reject (3-dB down at 1.5 kHz).

TRIGGER MODE
Triggered or Automatic. Latter provides bright reference trace with no input (or input less than 20 Hz). Above 20 Hz, time base can be triggered at repetition rate of incoming signal. Display is jitter-free to beyond 50 MHz.

TRIGGER LEVEL
Adjustable to provide triggering at desired point on input waveform (rising or falling portion). Switch provides either ±2% or ±20 V trigger-level selection.

TRIGGER REQUIREMENTS
Internal: Minimum of 2 mm of displayed signal; increasing to 1 cm at approx 50 MHz, AC coupled, or 5 mm, DC input, directly coupled. External: 0.2 V, AC or DC.

OTHER CHARACTERISTICS

CRT

Tektronix T5470, flat-faced, electrostatic focus and deflection. Helical post accelerator. 5:1 post-to-post accelerating-voltage ratio. 6 cm vertical scan; bright display with high resolution. 9-mil spot diameter (nominal) at 2 μA beam current provides bright display under average ambient light even at high sweep rates. Uniform focus over full cm viewing area. P31 Phosphor. Centered 9-mil spot expands to not more than 12 mils at either end (ratio of 1:1.3 as compared to typical change of 1:4 in comparable tubes operated at 10 kV). Throughout full 6 cm of vertical scan, high deflection sensitivity is maintained. Deflection-plate input capacitance is low; linearity and over-all pattern geometry is superior.

GRATICULE

Internal, 6 x 10 cm; no parallax; variable edge-lighting. Graduated in centimeter squares with 2-mm divisions scribed on vertical and horizontal center lines. Has two additional horizontal lines to aid in risetime measurements.

DISPLAY FEATURES

Front-panel controls: trace rotation (screwdriver adjustment), intensity, focus, astigmatism. Internal screwdriver adjustments control display geometry and high-voltage supply level. Beam-position indicators show direction of CRT beam when off screen. DC-coupled unblanking to CRT grid assures uniform beam current for all sweep speeds and repetition rates at any setting of intensity control. Z-Axis input for external modulation of CRT beam is AC coupled; requires 15 V, peak to peak.

AMPLITUDE CALIBRATOR

Provides 18 squarewave voltages, 0.2 mV to 100 V, $\pm$2%, 1-2-5 sequence. Output Z is 50 ohms, 0.2 mV to 0.2 V. Frequency approx 1 kHz. Risetime and falltime: 0.6 μs from 0.2 mV to 5 V, and 1 μs from 10 V to 100 V. 100-V DC output also provided. Reference currents supplied through front-panel loop: 5 mA DC and 5 mA, 1-kHz squarewave.

POWER REQUIREMENT

Wired for 115 V, 50 to 60 Hz, the electrically-regulated power supplies permit a line-voltage variation between 103.5 and 126.5 V (115 V $\pm$10%). Changing transformer taps permits operation at 108, 122, 216, 230, or 244 V, regulated within 10%, each range. The Type 546/547 draws 510 watts, typically. For other line frequency operation, please consult your Tektronix field office or representative.

CABINET MODEL DIMENSIONS

16 7/8" high by 13 1/8" wide by 23 7/8" deep. Net weight: 65 3/4 lbs; shipping weight approx 85 lbs.

RACK-MOUNT MODEL DIMENSIONS

14" high by 19" wide by 23 3/4" deep. Type RM546 and RM547 are electrically identical to the Type 546 and 547. Can be withdrawn from cabinet on slide-out tracks and tilted and locked in 7 positions. Net weight: 87 lbs, ea. Shipping weight: approx 114 and 116 lbs, respectively.

TYPE 546 OSCILLOSCOPE, without plug-in units ... **$1750**

Each instrument includes: 2—P6008 probes (010-0129-00); 1—Plate, Protector, CRT (387-0918-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—Smoke gray filter (installed) (378-0567-00); 3—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0367-00).

TYPE 547 OSCILLOSCOPE, without plug-in units ... **$1875**

Each instrument includes: 2—P6008 probes (010-0129-00); 1—Plate, Protector, CRT (387-0918-00); 1— 3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—Smoke gray filter (installed) (378-0567-00); 3—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0398-00).

TYPE RM546 OSCILLOSCOPE, without plug-in units .. **$1850**

Each instrument includes: 2—P6008 probes (010-0129-00); 1—Plate, Protector, CRT (387-0918-00); 1— 3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—Smoke gray filter (installed) (378-0567-00); 3—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Set mounting hardware; 2—Instruction Manual (070-0421-00).

TYPE RM547 OSCILLOSCOPE, without plug-in units .. **$1975**

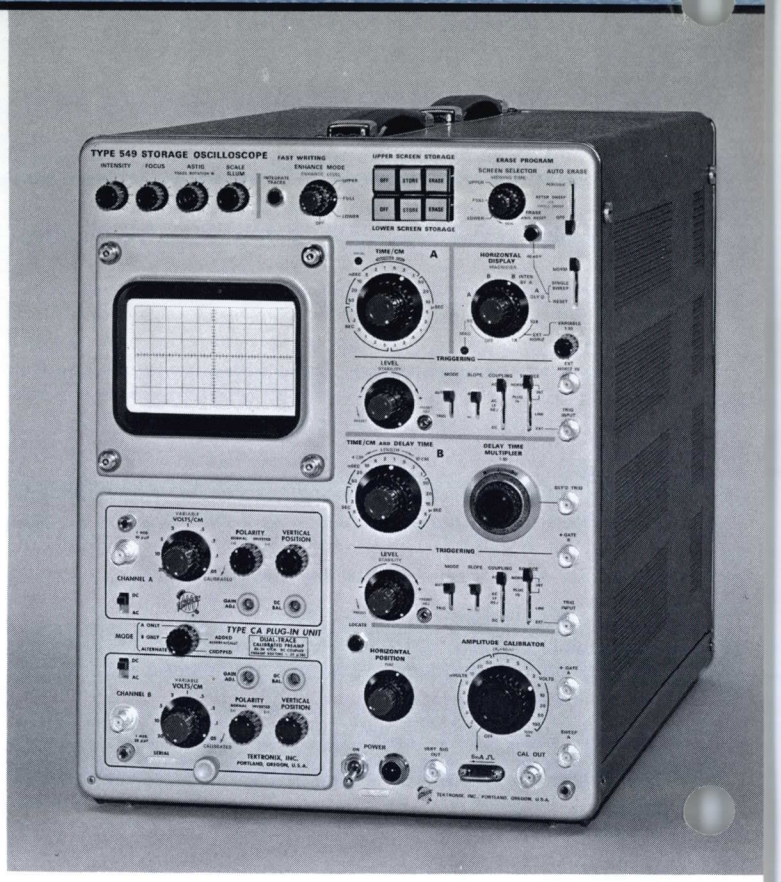
Each instrument includes: 2—P6008 probes (010-0129-00); 1—Plate Protector, CRT (387-0918-00); 1— 3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—Smoke gray filter (installed) (378-0567-00); 3—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Set mounting hardware; 2—Instruction Manual (070-0420-00).

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

Type 549 DC-to-30 MHz STORAGE OSCILLOSCOPE

NEW

- BISTABLE SPLIT-SCREEN STORAGE AND CONVENTIONAL DISPLAYS
- AUTOMATIC ERASE SYSTEM
- 5 cm/μs WRITING SPEED
- CALIBRATED SWEEP DELAY
- ACCEPTS LETTER-SERIES AND 1-SERIES PLUG-IN UNITS



CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics extremely flexible through use of all Letter-Series and 1-Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μs/cm to 5 s/cm.

SWEEP MAGNIFIER—5X, extends sweep range to 0.02 μs/cm.

TRIGGER REQUIREMENTS—Internal: less than 2-cm deflection to 30 MHz. External: less than 3 V to 30 MHz.

CALIBRATED SWEEP DELAY—1 μs to 10 s.

EXTERNAL INPUT—0.2 V/cm maximum, DC to 350 kHz.

STORAGE CRT

DISPLAY AREA—6 x 10 cm.

SPLIT SCREEN STORAGE—Store on either upper or lower half of screen with non-storage on other half; store on entire screen; or non-store on entire screen.

LOCATE ZONE—Locate button permits vertical position finding.

STORAGE TIME—Up to one hour.

ERASE TIME—150 ms maximum.

WRITING SPEED—0.5 cm/μs. 5 cm/μs with enhancement.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V. Source impedance 50 Ω from 0.2 mV to 0.2 V; frequency, 1-kHz squarewave. Front-panel current loop output, 5 mA DC and 5 mA, 1-kHz squarewave output.

POWER REQUIREMENTS—104, 115, 127, or 208, 230, and 254 volts, center value (regulation range $\pm$10%), 650 W (approx) maximum.

The Type 549 is a new instrument that extends the exclusive Tektronix split-screen and bistable storage features into research and development applications. The Type 549 offers a high degree of versatility. It accepts all letter-series and 1-series plug-in units covering a multitude of applications including sampling and spectrum analysis. A wide-band vertical system, plus a delaying sweep circuit, insures accurate measurements in both stored and conventional modes of operation.

A new split-screen, bistable CRT offers high contrast displays coupled with unparalleled writing speeds. Each half of the 6 x 10-cm display area can be independently controlled, thus allowing stored or conventional displays on either the upper or lower half. A stored display can then be compared simultaneously with a conventional display. Or, a test or standard signal can be stored on one half of the screen, and compared in detail with successive signals displayed on the other half.

An automatic erase system offers a new convenience to storage oscilloscope users. Through front panel controls, this system can be directed to automatically erase either one, or both halves of the display area after a predetermined viewing time. Automatic circuitry includes a timing circuit which permits viewing time to be varied from 0.5 seconds to 5 seconds with AUTO ERASE selected for either PERIODIC or AFTER-SWEEP operation. Used in conjunction with the SINGLE SWEEP, the "After-Sweep" erase circuit automatically resets the Single-Sweep circuit at the end of the viewing-time interval.

AVAILABLE DISPLAYS

With the wide range of sensitivity and bandwidth of the Type 549, several storage and conventional displays are obtainable. The Type 549, by virtue of a **new** bistable split-screen storage CRT capable of unparalleled writing speeds, extends storage-measuring capability into previously unattainable areas.

SINGLE-TRACE AND MULTI-TRACE

Multi-trace displays are obtained by selecting a Type 1A1, 1A2, CA, or M Amplifier Plug-In Unit. All other 1-Series and Letter-Series Plug-In Units will give single-trace displays. Selection of the Type 1A7, D, E, or G gives differential amplifier operation, while strain gage and other transducer operations are available with the Type O Unit.

SAMPLING DISPLAYS

Sampling displays with risetimes in the sub-nanosecond region are obtained using a Type 1S1 or 1S2 Sampling Unit. The Type 1S1 is a general-purpose sampler with 1 GHz bandwidth, delay line and internal triggering. The Type 1S2 is designed specifically for TDR (time-domain reflectometry) applications, but offers general-purpose sampling with 3.9 GHz bandwidth and built-in triggering.

SPECTRUM ANALYSIS

Spectral displays are obtained using a Type 1L10, 1L20, or 1L30 Spectrum Analyzer Plug-In Unit to cover a frequency range from 1 MHz to 10.5 GHz.

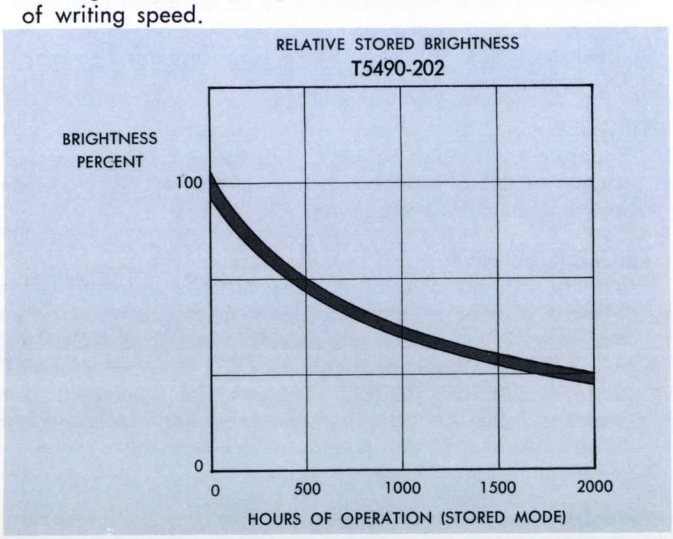
There are decided advantages in using the storage oscilloscope for spectrum analysis. When slow sweep rates are used, it is often difficult to view a complete display; however, by storing the display it can be completely and easily observed.

Signal drift is easily measured using the storage technique. The signal is stored and then as subsequent displays are stored, drift of the signal can be observed. Or, the spectral display can be stored on one half of the screen and simply compared with a similar non-stored display on the other.

STORAGE CHARACTERISTICS

STORAGE CRT

Direct viewing, bistable, split-screen, mono-accelerating with 4-kV accelerating potential and separate non-store "locate zone". External edge-lighted graticule. Tektronix bistable storage offers: 1) Brightness of a stored trace independent of viewing time; 2) Contrast of a stored trace independent of viewing time; and 3) Brightness of a stored trace independent of writing speed.



DISPLAY AREA

6 x 10-cm split-screen storage area with independent or common control, plus locate zone.

SPLIT-SCREEN STORAGE

Store on either upper or lower half of screen with conventional display on other half; store on entire screen; or, non-store on entire screen. Independent operation of both halves.

STORAGE TIME

Bistable storage yields a stable display for up to one hour. Where applications require maximum writing speed, viewing times of 20 minutes or less are recommended.

ENHANCE MODE

Controls the single sweep storage capabilities of the storage CRT. Through adjustment of ENHANCE LEVEL control, single-trace spot velocities up to 5 cm/μs or better can be stored with minimal loss of resolution and contrast.

LOCATE BUTTON (Serves two functions)

STORAGE—When depressed, the beam appears at the left of the CRT screen marking the vertical position of the next sweep. CONVENTIONAL DISPLAYS—Permits beam finding of off screen signals.

ERASE TIME

150 ms maximum.

AUTO ERASE SYSTEM

Viewing time before erase continuously variable from 0.5 s to 5 s (approximately).

In the PERIODIC Mode, there is a continuous sequence of storing, viewing time and erasure. This sequence occurs regardless of whether or not a signal is present and is independent of the sweep. In the AFTER SWEEP mode—which is used in conjunction with the SINGLE SWEEP—the sequence of viewing time and erasure is part of a cycle. This cycle occurs in the presence of a signal and begins with the arrival of the signal. The signal initiates a sweep by triggering the Single Sweep circuitry. Viewing time begins as the sweep ends and is followed by erasure. Erasure automatically resets the SINGLE SWEEP readying it for the next signal and thus completes the cycle. The cycle will automatically repeat itself as long as a signal is available.

Manual control available through Erase and Reset button or by Reset position of Single Sweep switch.

REMOTE CONTROL OPERATION

The Type 549 has remote control-operation capabilities using contact closure. A 9-pin connector, located on the rear panel, supplies one ground and 7 inputs (plus one spare) that allows the following functions:

1. Remote erase of upper screen.
2. Remote erase of lower screen.
3. Remote resetting of sweep for single-sweep operation.
4. Remote erase of both halves of the screen and resetting of the sweep.
5. Remote switching from conventional operation to storage operation (independently or commonly) of upper or lower screen halves.
6. Remote interruption of the Auto Erase sequence in order to hold a stored waveform.

Operation of these circuits is achieved by grounding the appropriate pin in the connector.

REMOTE CONTROL UNIT

(Optional accessory, part number 012-0102-00). Performs Remote Erase and Reset functions numbers 1, 2, and 3 above.

549

VERTICAL PLUG-IN UNITS (Bandwidth Specifications are at —3 dB.)			
PLUG-IN UNIT	DEFLECTION FACTOR	BANDWIDTH	RISETIME
For Wide-Band, Multiple Trace Applications			
1A1 Dual-Trace	50 mV/cm to 50 V/cm	DC to 30 MHz	12 ns
	5 mV/cm	DC to 23 MHz	15 ns
	500 μV/cm	2 Hz to 14 MHz	26 ns
1A2 Dual-Trace	50 mV/cm to 50 V/cm	DC to 30 MHz	12 ns
CA Dual-Trace	50 mV/cm	DC to 24 MHz	15 ns
	50 V/cm		
M Four-Trace	20 mV/cm to 25 V/cm	DC to 20 MHz	17 ns
For Wide-Band Applications			
B	50 mV/cm to 50 V/cm	DC to 20 MHz	18 ns
	5 mV/cm to 50 mV/cm	2 Hz to 12 MHz	30 ns
K	50 mV/cm to 40 V/cm	DC to 30 MHz	12 ns
L	50 mV/cm to 40 V/cm	DC to 30 MHz	12 ns
	5 mV/cm to 4 V/cm	3 Hz to 24 MHz	15 ns
For Differential Input Applications			
1A7 High-Gain	10 μV/cm to 10 V/cm	DC to 500 kHz	0.7 μs
D High-Gain	1 mV/cm (to 50 mV/cm)	DC to 300 kHz DC to 2 MHz	0.18 μs
E Low-Level	50 μV/cm (to 10 mV/cm)	0.06 Hz to 20 kHz (to 60 kHz)	6 μs
G Wide-Band	50 mV/cm to 50 V/cm	DC to 20 MHz	18 ns
For High DC Sensitivity Applications			
H Wide-Band	5 mV/cm to 50 V/cm	DC to 15 MHz	23 ns
For Spectrum Analysis			
1L10, 1L20, 1L30 Units cover 1 MHz to 10.5 GHz.			
For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses			
O Operational Amplifier	50 mV/cm to 50 V/cm	DC to 25 MHz	14 ns
For Transducer and Strain Gage Uses			
Q	10 μstrain/div to 10 k μstrain/div	DC to 6 kHz	60 μs
For Transistor-Risetime Checks			
R	0.5 mA/cm to 100 mA/cm		12 ns
For Diode Recovery Time Measurements			
S	0.05 V/cm and 0.5 V/cm		12 ns
For Precise Amplitude Measurements Via Slide-Back Technique			
W	1 mV/cm to 50 mV/cm	DC-7 MHz to DC-23 MHz	50 ns to 15 ns
Z	50 mV/cm to 50 V/cm	DC to 13 MHz	27 ns
High-Frequency Sampling Applications			
1S1	2 mV/cm to 200 mV/cm	DC to 1 GHz	350 ps
1S2	5 mV/cm to 500 mV/cm	DC to 3.9 GHz	90 ps

VERTICAL DEFLECTION SYSTEM

Frequency Specifications are at —3 dB

BANDWIDTH—DC to ≥30 MHz*.

RISETIME—≤12 ns*.

SIGNAL DELAY—200 ns, approx.

HORIZONTAL DEFLECTION SYSTEM

TIME BASE A

0.1 μs/cm to 5 s/cm; 24 calibrated steps accurate within ±3%, 1-2-5 sequence. Range continuously variable between steps, uncalibrated. (Extends to 12 s/cm, uncalibrated.)

TIME BASE B

2 μs/cm to 1 s/cm; 18 calibrated steps accurate within ±3%, 1-2-5 sequence. No variable time/cm control.

SWEEP DELAY

Calibrated delay range from 1 μs to 10 s. ACCURACY: from 1 μs to 1 s is ±1% of TIME BASE B sweep accuracy and ±2 minor dial divisions, plus signal processing time (typically 200 ns depending on signal risetime); within ±3% from 1 s to 10 s. LINEARITY: 0.2% of full scale.

SWEEP MAGNIFIER

X5; accuracy, +2% added to the specified sweep time accuracy, extends Time Base A sweep to 20 ns/cm and Time Base B sweep to 0.4 μs/cm.

SINGLE SWEEP

Controls Time Base A in "A" position of Horiz Display switch. Controls Time Base B in "B", "B intensified by A", and "A dly'd" positions. A three-position switch selects normal, single sweep, or reset operation. Reset may be accomplished by the ERASE and RESET button, or by remote control through remote control connector.

EXTERNAL HORIZONTAL INPUT

DC to 350 kHz at minimum deflection factor; 0.2 V/cm in 1X position, or 2 V/cm with 10X attenuation. Continuously variable 10:1 gain control for up to 100X attenuation.

FRONT PANEL OUTPUTS

Gates from both time bases (0 to at least +20 V). Sawtooth from Time Base A (typically 0 to at least +130 V), and a delayed trigger pulse (at least +5 V). Vertical-Signal-Out Risetime ≤1 μs, deflection factor 1.5 V/displayed cm ±20%, DC coupled.

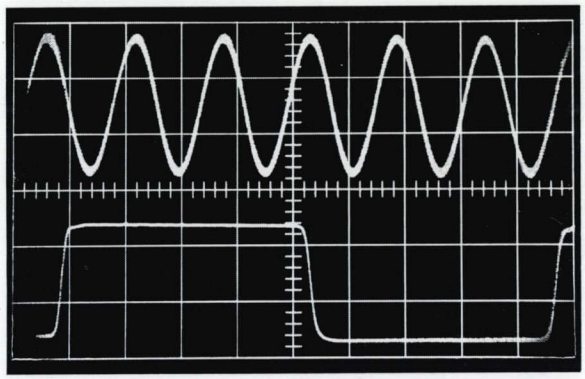
TRIGGER

Separate but similar trigger circuits for both time bases. The trigger circuits offer complete manual control, preset stability, and fully-automatic triggering.

TRIGGER SOURCE

Internal, external or line, either AC or DC coupled. (The Type 549 can also be internally triggered from Channel 1 only of the Type 1A1 or 1A2 Dual-Trace Plug-In Units.) COUPLING: AC, AC Low Frequency Reject, or DC. TRIGGER POLARITY: ±slope. TRIGGER MODES: Triggered or Automatic. Latter provides reference trace with no input (or inputs less than 50 Hz). Above 50 Hz, time base automatically triggers at repetition rate of incoming signal.

*With Types K, L, 1A1, or 1A2 Plug-In Units.

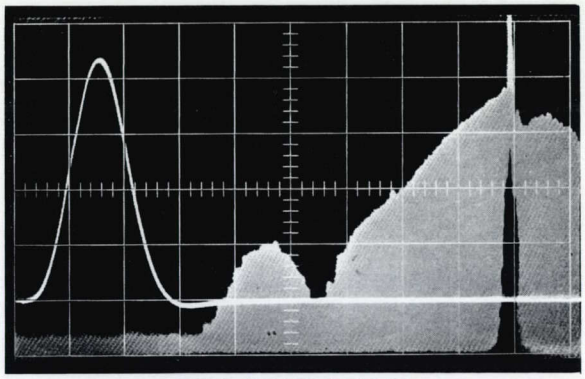


5 cm/μs FAST SINGLE SWEEP

Upper display shows a single shot 625-kHz sinewave stored in enhanced mode of operation. Sweep rate is 1 μs/cm.

FAST REPETITIVE DISPLAY

Lower display is a recurrent, 1-MHz squarewave with a risetime of 20 ns stored without enhancement. Sweep rate is 0.1 μs.



DUAL STORED DISPLAY

(1L20 Spectrum Analyzer Plug-In Unit)

At left—Time domain display of sine² pulse (used extensively in TV testing), sweep speed 0.2 μs/cm.

At right—Frequency domain display of the same pulse. Sweep speed 5 s/cm, 2-MHz/cm dispersion and logarithmic vertical display. The feed-through signal at the center of the main lobe is a "zero" hertz marker.

TRIGGERING LEVEL
Adjustable to allow triggering at desired point on input waveform (rising or falling portion).

STABILITY
Can be preset to an optimum triggering point to eliminate further adjustment. Also used to obtain free-running displays.

TRIGGER REQUIREMENTS

	MODE	TIME BASE A	TIME BASE B
INTERNAL	DC	Min 2 mm of deflection, DC to 10 MHz, increasing to 2 cm at 30 MHz.	Min 0.2 cm of deflection, DC to 1 MHz, increasing to 1 cm at 10 MHz.
	AC	Same amplitude as DC 300 Hz to 30 MHz.	Same amplitude as DC 300 Hz to 10 MHz.
	AC LF REJ	Same amplitude as DC 200 kHz to 30 MHz.	Same amplitude as DC 200 kHz to 10 MHz.
	AUTOMATIC	Min 2 mm of deflection, 50 Hz to 10 kHz, increasing to 2 cm at 1 MHz.	Same as Time Base A
EXTERNAL	DC	Min 0.3 V sig, DC to 10 MHz increasing to 3 V at 30 MHz.	Min 0.3 V sig, DC to 1 MHz, increasing to 1.5 V at 10 MHz.
	AC	Same amplitude as DC 300 Hz to 30 MHz.	Same amplitude as DC 300 Hz to 10 MHz.
	AC LF REJ	Same amplitude as DC 200 kHz to 30 MHz.	Same amplitude as DC 200 kHz to 10 MHz.
	AUTOMATIC	Min 0.3 V sig, 50 Hz to 10 kHz, increasing to 3 V at 1 MHz.	Same as Time Base A

Z-AXIS INPUT
A CRT grid selector switch on the rear panel allows the CRT grid to be driven from the internal unblanking signal, or from an external source, DC coupled. A CRT CATHODE-SELECTOR switch allows the cathode to be driven from the internal chopped-blanking signal, or from an external source, AC coupled.

AMPLITUDE CALIBRATOR
Squarewave output from 0.2 mV to 100 V, accurate to within ±2%. Source impedance is 50 Ω from 0.2 mV to 0.2 V. Frequency is approx 1 kHz. A 100-V DC-coupled output is also provided. Reference currents supplied through front-panel loop: 5-mA DC, and a 5-mA, 1-kHz squarewave output for current-probe calibration.

POWER REQUIREMENTS
Electronically-regulated power supply operates on nominal voltages of 104, 115, 127, or 208, 230, and 254 V (±10% regulation range on each range), 50-60 Hz. Appropriate range selected by rear-panel and internal switches. MAX POWER CONSUMPTION: ≈650 W, ≈750 VA.

DIMENSIONS AND WEIGHT
17" high by 13" wide by 24" deep. Net weight is 66 lbs. Shipping weight is 86 lbs, approx.

TYPE 549 OSCILLOSCOPE (without plug-in units) . . **$2375**

Each instrument includes: 2—P6006 probes (010-0127-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 2—patch cord, BNC-to-banana plugs, red, 17¾" (012-0087-00); 1—smoke gray filter (378-0567-00); 1—adapter, BNC-to-binding post (103-0033-00); 2—instruction manual (070-0058-00).

OPTIONAL ACCESSORIES

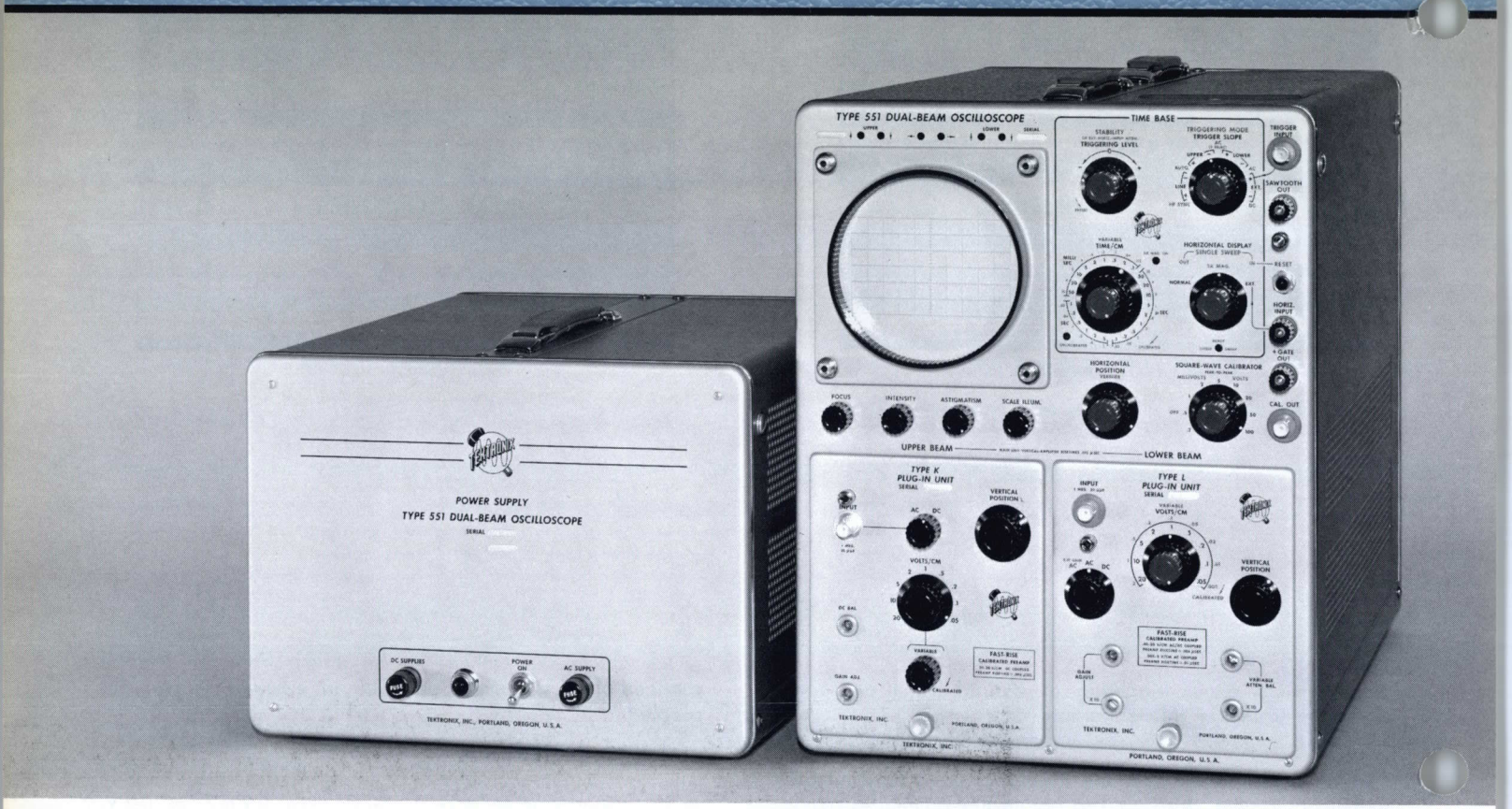
REMOTE CONTROL UNIT (012-0102-00) $25

CONNECTOR 9-pin Amphenol (136-0089-00) ..... $ 6

MESH CRT FILTER, with graticule cover (378-0572-00) $15

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

Type 551 DC-to-27 MHz DUAL-BEAM OSCILLOSCOPE



- *TWO VERTICAL DEFLECTION SYSTEMS*
- *DUAL-BEAM CRT*
- *ACCEPTS AMPLIFIER, SPECTRUM ANALYZER, OR SAMPLING PLUG-INS*

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 in the Type 551 are designed for Tektronix Letter-Series and 1-Series Plug-In Units, 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.

CHARACTERISTIC SUMMARY

VERTICAL

2 identical vertical-deflection systems.

Letter-Series, 1-Series, Spectrum Analyzer and Sampling Plug-In Units offer a wide selection of vertical-deflection characteristcis for both beams.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μs/cm to 5 s/cm.

SWEEP MAGNIFIER—5X, extends sweep range to 0.02 μs/cm.

TRIGGER REQUIREMENTS—Internal: 2-mm deflection.
External: 0.2 V to 10 V.

EXTERNAL INPUT—0.2 V to 50 V/cm; DC to 400 kHz.

CRT

DISPLAY AREA—4 x 10 cm (each beam), 2-cm overlap.

ACCELERATING VOLTAGE—10 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V, 1-kHz square-wave.

POWER REQUIREMENTS—105 V to 125 V or 210 V to 250 V, 900 watts maximum.

VERTICAL PLUG-IN UNITS

Bandwidth specifications are at 3 dB down.

PLUG-IN UNIT	CALIBRATED DEFLECTION FACTOR.	BANDWIDTH	RISETIME
For Wide-Band, Multiple Trace Applications			
1A1 Dual Trace	50 mV/cm to 20 V/cm	DC to 27 MHz	13 ns
	5 mV/cm to 50 mV/cm	DC to 21 MHz	16.5 ns
	≈500 μV/cm	2 Hz to 13 Hz	26 ns
1A2 Dual Trace	50 mV/cm to 20 V/cm	DC to 27 MHz	13 ns
CA Dual Trace	50 mV/cm to 20 V/cm	DC to 27 MHz	16 ns
M Four Trace	20 mV/cm to 10 V/cm	DC to 19 MHz	18 ns
For Wide-Band Applications			
B	50 mV/cm to 20 V/cm	DC to 18 MHz	20 ns
	5 mV/cm to 20 mV/cm	2 Hz to 12 MHz	30 ns
K	50 mV/cm to 20 V/cm	DC to 25 MHz	14 ns
L	50 mV/cm to 20 V/cm	DC to 25 MHz	14 ns
	5 mV/cm to 2 V/cm	2 Hz to 22 MHz	16 ns
For Differential Input Applications			
1A7 High-Gain	10 μV/cm to 10 V/cm	DC to 500 kHz	0.7 μs
D High-Gain	1 mV/cm (to 50 mV/cm)	DC to 350 kHz (DC to 2 MHz)	0.18 μs
E Low-Level	50 μV/cm (to 10 mV/cm)	0.06 Hz to 20 kHz (20 kHz to 60 kHz)	6 μs
G Wide-Band	50 mV/cm to 20 V/cm	DC to 18 MHz	20 ns
For High DC Sensitivity Applications			
H Wide-Band	5 mV/cm to 20 V/cm	DC to 14 MHz	25 ns
For Spectrum Analysis			
1L10, 1L20, 1L30 Units cover 1-10,500 MHz.			
For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses.			
O Operational Amplifier	50 mV/cm to 20 V/cm	DC to 22 MHz	16 ns
For Transducer and Strain Gage Uses			
Q	10 μstrain/div to 10 k μstrain/div	DC to 6 kHz	60 μs
For Transistor-Risetime Checks			
R	0.5 mA/cm to 100 mA/cm		14 ns
For Diode Recovery Time Measurements			
S	0.05 V/cm and 0.5 V/cm		14 ns
For Precise Amplitude Measurements Via Slide-Back			
W	1 mV/cm to 50 mV/cm	DC to 8 MHz to DC to 23 MHz	44 ns to 15 ns
Z	50 mV/cm to 25 V/cm	DC to 13 MHz	27 ns
High-Frequency Sampling Applications			
1S1	2 mV/cm to 200 mV/cm	Equiv to 1.0 GHz	350 ps
1S2	5 mV/cm to 500 mV/cm	Equiv to 3.9 GHz	90 ps

VERTICAL-DEFLECTION SYSTEMS

DC-COUPLED MAIN AMPLIFIERS

Risetime—14 ns (with K or L Plug-In). Accepts any Letter-Series or 1-Series Plug-In Unit.

BALANCED DELAY NETWORK

Signal Delay—0.2 μs.

HORIZONTAL DEFLECTION SYSTEM

Both electron beams of the Type 551 are deflected by the same sweep voltage.

SWEEP RANGES

0.1 μs/cm to 5 s/cm in 24 calibrated steps. Accuracy is ±3%. A vernier control provides a continuous adjustment of sweep times (uncalibrated) from 0.1 μs/cm to 12 s/cm.

SWEEP MAGNIFIER

5X magnifier increases sweep time to 0.02 μs/cm. Accuracy is ±5%.

EXTERNAL HORIZONTAL INPUT

DC-coupled through a front-panel connector. Variable deflection factor —0.2 V/cm to 50 V/cm. Bandwidth—DC to 400 kHz (approx).

SINGLE SWEEP

A front-panel Reset push button arms the sweep to fire once on receipt of the next trigger. Sweep is then locked out until rearmed with reset push button.

UNBLANKING

DC-coupled unblanking to the grid of the CRT assures uniform bias for all sweep rates.

TRIGGERING

TRIGGER REQUIREMENTS

Internal: A signal producing 2 mm of deflection.
External: 0.2 V to 10 V.

TRIGGERING FACILITIES

Triggering modes include complete manual control, preset stability control and fully automatic triggering.

LEVEL AND PRESET STABILITY

Level and stability controls allow triggering at selected amplitude levels on the triggering signal. Preset stability allows setting circuit to optimum triggering point with stability control in preset positions—requires no readjustment. Trigger source can be internal, external or line frequency, either AC or DC coupled.

AUTOMATIC TRIGGERING

Range of automatic operation is approximately between 60 Hz and 2 MHz. In the absence of an input signal the sweep is automatically triggered at about a 50 Hz rate. This provides a reference trace on the CRT.

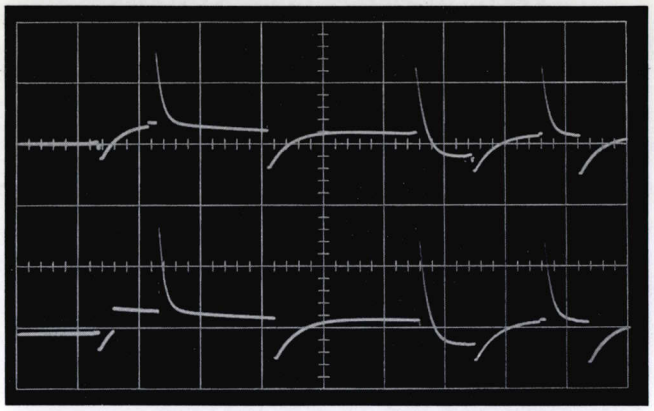
HIGH-FREQUENCY SYNC

Assures a steady display of sinewave signals up to approximately 30 MHz. Requires a signal large enough to cause 2 cm of deflection or an external signal of 2 V.

LOW-FREQUENCY REJECT

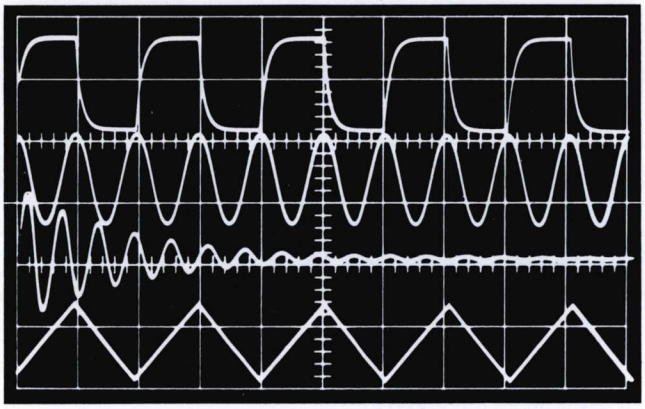
This position of the triggering mode switch prevents low-frequency components, such as hum, from interfering with triggering.

551



Dual-beam operation showing switching functions.

Dual-beam operation with dual-trace plug-in units.



MISCELLANEOUS

AMPLITUDE CALIBRATOR
Squarewave voltage available in 18 fixed voltage steps between 0.2 mV to 100 V peak to peak. Accuracy is ±3%. Frequency is approximately 1 kHz.

CATHODE-RAY TUBE
5" flat-faced tube with helical post-accelerating anode. 10-kV accelerating potential. Linear 4 x 10 cm viewing area, each beam, with at least 2-cm overlap. P2 phosphor normally supplied. An opening in the side of the cabinet permits direct connection to the CRT deflection plates.

FRONT PANEL OUTPUTS
+ Gate Output—+20 V. Sawtooth—+150 V.

ILLUMINATED GRATICULE
Edge-lighted 6 vertical by 10 horizontal divisions with 2 millimeter baseline divisions. Lighting controlled by front panel knob.

BEAM POSITION INDICATORS
Indicator lights show the direction of each electron beam when it is not on the screen.

PROBES
Four 10X attenuation low-capacitance probes are supplied with the instrument. Input capacitance of the Type 551-K combination with probes is 7 pF. Excellent transient response is retained, as the probes introduce no overshoot or ringing, but frequency response is down an additional 1 dB at 25 MHz.

POWER REQUIREMENT
A separate unit supplies power to the Type 551 indicator unit through an inter-unit cable. Wired for 117 V, 50 to 60 Hz, the electronically-regulated power supplies permit a line-voltage variation between 105 and 125 V. Changing transformer taps permits operation at 107, 127, 214, 234, or 254 V. The Type 551 draws 850 watts, typically, with two Type CA Plug-In Preamplifiers.

MECHANICAL SPECIFICATIONS
Dimensions for Indicator Unit are 16⅞" high by 13⅛" wide by 23⅞" long. Dimensions for the Power Unit are 10⅜" high by 13½" wide by 17½" long.

Net Indicator Unit weight is 52½ pounds. Shipping weight is 74 pounds, approx. Net Power Unit weight is 44¼ pounds. Shipping weight is 52 pounds, approx.

TYPE 551, without plug-in units **$1850**

Each instrument includes: 4—P6006 probe (010-0127-00); 1—inter-unit cable (012-0032-00); 1—power supply for Type 551; 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—smoke gray filter (378-0567-00); 2—patch cord, BNC-to-BNC, 18" (012-0087-00); 1—patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—post jack, BNC (012-0092-00); 2—instruction manual (070-0245-00).

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 17½", Power Supply mask 12¼". Tektronix blue vinyl finish.

Order Part Number 040-0279-00 ..... $75.00

SCOPE-MOBILE CARTS

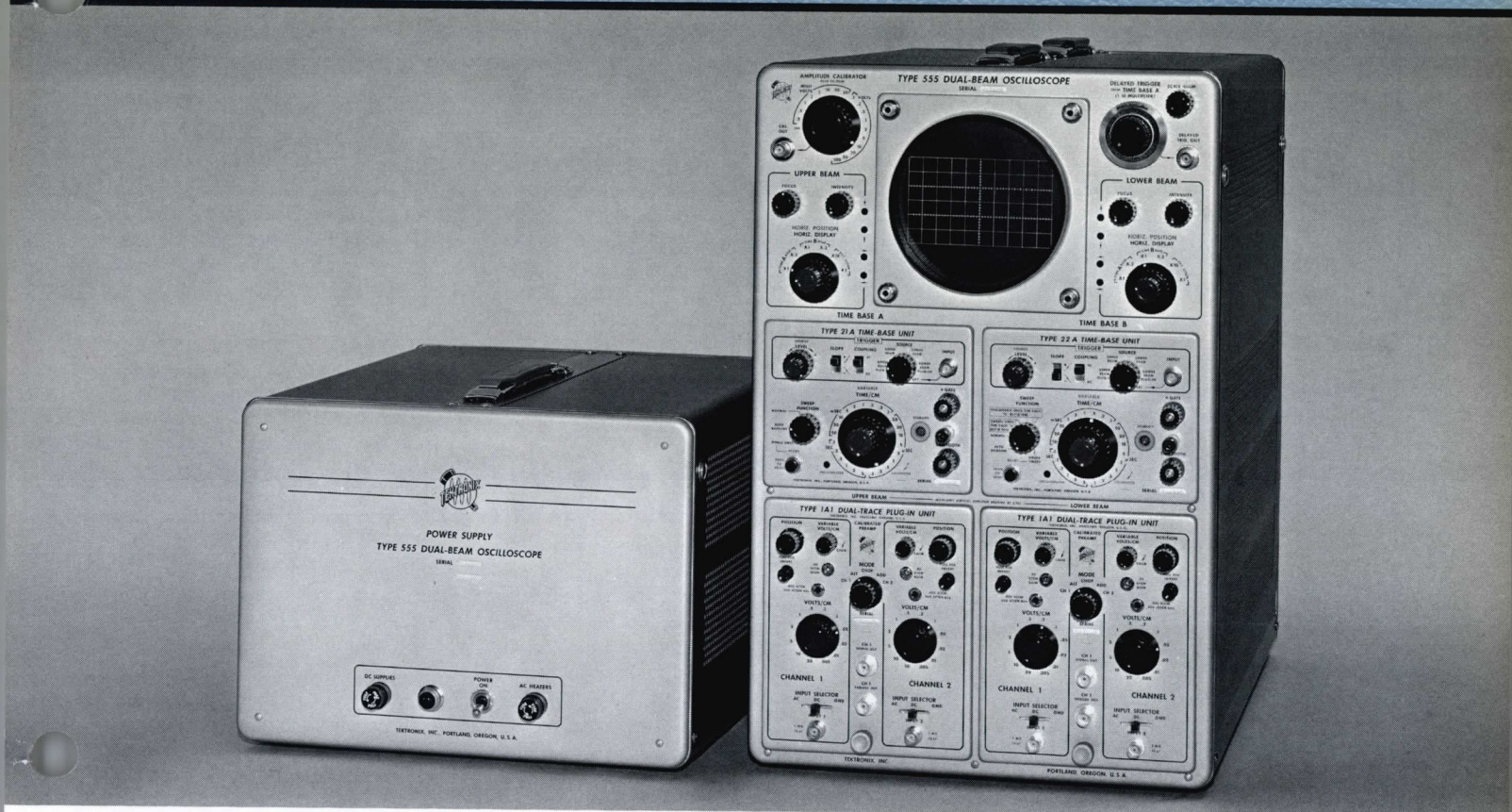
TYPE 202-1 TILT-LOCK CART with storage drawer and locking front wheels $120

TYPE 202-2 TILT-LOCK CART with storage drawer, plug-in unit carrier, and locking front wheels $130

See Catalog accessory pages for complete information.

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

DC-to-33 MHz DUAL BEAM OSCILLOSCOPE with SWEEP DELAY Type 555



- *ILLUMINATED NO-PARALLAX GRATICULE*
- *ACCEPTS AMPLIFIER, SPECTRUM ANALYZER, AND SPECIAL-PURPOSE PLUG-INS*
- *CALIBRATED SWEEP DELAY*
- *DUAL-BEAM DISPLAYS*

The Type 555 Oscilloscope is a dual-beam laboratory instrument for accurate measurements in the DC to 33 MHz range. Two complete horizontal-deflection systems and two independent vertical amplifiers provide for completely independent deflection of the two beams.

Either of two plug-in time base units can control the sweep of either or both electron beams. In addition, a continuously-variable calibrated sweep delay allows expansion of a selected portion of the undelayed sweep for precise time measurements. Delayed and undelayed sweeps can be presented simultaneously.

The wide-band main amplifiers in the Type 555 are designed to accept Letter-Series and 1-Series Plug-In Units for a high degree of signal-handling versatility.

CHARACTERISTIC SUMMARY

VERTICALS

2 identical vertical-deflection systems

Letter-Series and 1-Series Plug-In Units offer wide selection of vertical-deflection characteristics for both beams.

HORIZONTALS

2 independent horizontal-deflection systems

CALIBRATED SWEEP RANGE—0.1 μs/cm to 5 s/cm.

SWEEP MAGNIFIER—5X, extends sweep range to 0.02 μs/cm.

CALIBRATED SWEEP DELAY—0.1 μs to 50 s.

TRIGGER REQUIREMENTS—Internal: 2-cm deflection to 33 MHz.
External: 0.5 V to 10 MHz, 1.5 V to 33 MHz.

EXTERNAL INPUT—0.2 to 20 V/cm; DC to 350 kHz; 1 megohm, 47 pF (approx).

CRT

ILLUMINATED NO-PARALLAX GRATICULE

DISPLAY AREA—4 x 10 cm (each beam), 2-cm overlap.

ACCELERATING VOLTAGE—10 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V, 1-kHz square-wave.

POWER REQUIREMENTS—105 to 125 V, or 210 to 250 V, 50 to 60 Hz, 1050 watts maximum.

555

VERTICAL PLUG-IN UNITS (Bandwidth is specified at —3 dB.)			
PLUG-IN UNIT	CALIBRATED DEFLECTION FACTOR	BANDWIDTH	RISETIME
For Wide-Band, Multiple Trace Applications			
1A1 Dual-Trace	50 mV/cm to 20 V/cm	DC to 33 MHz	10.5 ns
	5 mV/cm	DC to 23 MHz	15 ns
	≈500 μV/cm	2 Hz to 14 MHz	25 ns
1A2 Dual-Trace	50 mV/cm to 20 V/cm	DC to 33 MHz	10.5 ns
CA Dual-Trace	50 mV/cm to 20 V/cm	DC to 24 MHz	15 ns
M Four-Trace	20 mV/cm to 10 V/cm	DC to 20 MHz	17 ns
For Wide-Band Applications			
B	50 μV/cm to 20 V/cm	DC to 20 MHz	18 ns
	5 mV/cm to 50 mV/cm	2 Hz to 12 MHz	30 ns
K	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
L	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
	5 mV/cm to 2 V/cm	3 Hz to 24 MHz	15 ns
For Differential Input Applications			
1A7 High-Gain	10 μV/cm to 10 V/cm	DC to 500 kHz	0.7 μs
D High Gain	1 mV/cm (to 50 mV/cm)	DC to 300 kHz (DC to 2 MHz)	
E Low-Level	50 μV/cm (to 10 mV/cm)	0.06 Hz to 20 kHz	
		(20 kHz to 60 kHz)	
G Wide-Band	50 mV/cm to 20 V/cm	DC to 20 MHz	18 ns
For High DC Sensitivity Applications			
H Wide-Band	5 mV/cm to 20 V/cm	DC to 15 MHz	23 ns
For Spectrum Analysis			
1L10, 1L20, 1L30 Units cover 1-10,500 MHz			
For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses			
O Operational Amplifier	50 mV/cm to 20 V/cm	DC to 25 MHz	14 ns
For Transducer and Strain Gage Uses			
Q	10 μstrain/div to 10 k μstrain/div	DC to 6 kHz	60 μs
For Transistor-Risetime Checks			
R	0.5 mA/cm to 100 mA/cm		12 ns
For Diode Recovery Time Measurements			
S	0.05 V/cm and 0.5 V/cm		12 ns
For Precise Amplitude Measurements Via Slide-Back			
W	1 mV/cm to 50 mV/cm	DC to 8 MHz to DC to 23 MHz	44 ns to 15 ns
Z	50 mV/cm to 25 V/cm	DC to 13 MHz	27 ns
High-Frequency Sampling Applications			
1S1	2 mV/cm to 200 mV/cm	Equiv to 1.0 GHz	350 ps
1S2	5 mV/cm to 500 mV/cm	Equiv to 3.9 GHz	90 ps

VERTICAL-DEFLECTION SYSTEMS

IDENTICAL MAIN AMPLIFIERS provide 10.5-ns risetime and DC-to-33 MHz (3-dB down) when used with the Type 1A1 or 1A2 Plug-In Units. In addition, any Tektronix Letter-Series or Spectrum Analyzer Plug-In Units can be used in the Type 555 Oscilloscope.

PASSIVE PROBES supplied with the Type 555 reduce loading on the circuit under test and attenuate the signal by a factor of 10. Input RC becomes 10 megohms paralleled by approximately 7 pF with Type 555 and Type 1A1 or 1A2 Unit. Excellent transient response is retained, as the probes introduce no overshoot or ringing, but frequency response is down an additional 1 dB at 33 MHz.

SIGNAL DELAY permits observation of the leading edge of the waveform that triggers the sweep. A 0.2 μs delay is introduced into each channel by the balanced (push-pull) delay networks.

HORIZONTAL-DEFLECTION SYSTEMS

PLUG-IN TIME-BASE UNITS incorporate Miller runup type sweep generators and inverse feedback in the timing circuits to assure excellent sweep linearity. The plug-in design of the Type 21A and 22A Time-Base Units provides easy access to all components for ease in maintenance. The Type 22A Time Base is identical to the Type 21A Time Base except for additional sweep-delay capabilities.

SWEEP RANGE from 0.1 μs/cm to 5 s/cm is in 24 calibrated steps with 1-2-5 sequence. Accuracy is typically within 1% of full scale, and in all cases within 3%. Sweep range is continuously variable uncalibrated from 0.1 μs/cm to 12 s/cm. An indicator light warns the operator when the sweep is uncalibrated.

5X SWEEP MAGNIFIER expands the center 2-cm portion of the normal display to fill 10 cm, and can be used to increase the calibrated sweep time to 0.02 μs/cm. Any one-fifth of the magnified sweep can be displayed. Accuracy is within 5% of the displayed portion of the magnified sweep.

SINGLE SWEEP OPERATION facilitates photographic recording of waveforms. 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.

AUTOMATIC BASELINE SWEEP MODE provides a bright reference trace (regardless of sweep speed) when no input signal is applied, or when the input signal repetition rate is less than 20 Hz. Above 20 Hz, the time base is triggered at the repetition rate of the incoming trigger signal to achieve jitter-free displays to beyond 33 MHz.

EXTERNAL HORIZONTAL INPUTS provide for horizontal deflection of either beam with an external source. Inputs are at the rear of the oscilloscope. Horizontal deflection factor is continuously variable from 0.2 V/cm to approximately 20 V/cm. Bandwidth is DC to 350 kHz at minimum deflection factor. Input RC is 1 megohm paralleled by approximately 47 pF.

TRIGGER

TRIGGER LEVEL adjusts to allow sweep triggering at any selected point on either the rising or falling portion of the waveform. Main level control operates over a ±10 V range; fine control adjusts over ±1 V range.

TRIGGER SOURCE can be internal, external, or line, and can be AC or DC coupled. Internally, either sweep can be triggered from the upper or lower beam, or directly from either vertical plug-in unit. The latter permits direct triggering from a single channel of Types 1A1 and 1A2 Tektronix multi-trace plug-in units.

TRIGGER REQUIREMENT is 0.5-cm deflection for internal signals from DC to 5 MHz (approx 20 Hz to 5 MHz using automatic baseline, 2-cm deflection to 33 MHz (using Type 1A1 or 1A2 Plug-In Preamplifier). For external signals, 0.5 V is required for reliable triggering to 5 MHz and 1.5 V is required to 33 MHz. When AC-coupled, the low-frequency 3-dB point is approximately 160 Hz.

SWEEP DELAY

CALIBRATED DELAY RANGE from 0.1 μs to 50 s is derived from the TIME BASE A Plug-In Unit and can be used to delay the start of any TIME BASE B sweep. The 24 calibrated steps are those described for the Type 21A and 22A Time Base Units, and are accurate within 3% of panel reading and within 3% of each other. A ten-turn precision potentiometer permits calibrated delay-time adjustments to any value from 0.1 μs to 50 s with accuracy within 3%. Incremental accuracy of this control is within 0.2% on all ranges. For extreme accuracy, any of the calibrated steps can be adjusted to the accuracy of an external standard.

TRIGGERED OPERATION holds off the start of the delayed sweep until the arrival of the first trigger signal following the selected delay time. Because the delayed sweep is actually triggered by the signal under observation, the display is completely jitter free. A steady display is thus provided for time-modulated pulses and signals with inherent jitter.

CONVENTIONAL OPERATION holds off the start of the delayed sweep for the precise amount of selected delay time. Any time-modulation or 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 maximum available delay interval (where this interval is 10 times the Time/cm or Delay-Time setting).

HIGH SWEEP MAGNIFICATION is readily accomplished when TIME BASE B is operated at a faster rate than TIME BASE A. For example, if TIME BASE A is operating at 50 μs/cm and TIME BASE B is operating at 1 μs/cm, the magnification is 50 times. Both the original and magnified displays can be viewed simultaneously when the signal is introduced into both vertical channels, so that both beams are deflected.

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.

DELAYED TRIGGER used to start the delayed sweep is available at the front panel, and can be used to trigger external equipment at any delay from 0.1 μs to 50 s. Amplitude is approximately 5 V.

CRT AND DISPLAY FEATURES

TEKTRONIX DUAL-BEAM CRT is a 5" metalized tube with separate vertical and horizontal deflection plates for each beam. Each beam has a linear display area of 4 by 10 cm, with at least 2-cm overlap. For best results over the wide sweep range of the Type 555, a P2 phosphor is normally supplied. 10-kV accelerating potential assures bright displays when using fast sweeps at low repetition rates, and in single-sweep applications.

ILLUMINATED NO-PARALLAX GRATICULE is edge lighted and is marked in 6 vertical and 10 horizontal centimeters.

CRT CONTROLS include separate focus and intensity adjustments for each beam. A screw-driver adjustment is provided for magnetic alignment of the traces to the graticule.

BEAM POSITION INDICATORS light to show the direction of each electron beam when it is not on the screen.

ILLUMINATED GRATICULE with variable edge lighting is accurately ruled in centimeter squares. Viewing area is 6 by 10 cm. Vertical and horizontal centerlines for each beam are further marked in 2-mm divisions for convenience in making time and amplitude measurements.

MULTI-TRACE BLANKING eliminates 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 at the rear of the oscilloscope.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR provides 18 squarewave voltages at the front panel. Peak to peak amplitude from 0.2 mV to 100 V is in 1-2-5 sequence and accurate within 3%. Squarewave frequency is approximately 1 kHz.

OUTPUT WAVEFORMS available at the front panel include 2 positive gates of approximately 20 V, 2 positive-going sawtooths of approximately 150 V, and a delayed trigger of approximately 5 V.

POWER REQUIREMENT—A separate unit supplies power to the Type 555 Indicator Unit through an inter-unit cable. Wired for 117 V, 50 to 60 Hz, the electronically-regulated power supplies permit a line-voltage variation between 105 and 125 V. Changing transformer taps permits operation at 107, 127, 214, 234, or 254 V. All heaters in the indicator unit and amplifier heaters in the power supply are regulated for stable operation and long tube life. The Type 555 draws 1050 watts, maximum.

INDICATOR UNIT is 20⅛" high by 13⅛" wide by 24" deep. Net weight is 66 pounds. Shipping weight is 89 pounds, approx.

POWER SUPPLY UNIT is 10⅜"high by 13½" wide by 17½" deep. Net weight is 50¼ pounds. Shipping weight is 61 pounds, approx.

TYPE 555, without preamplifier plug-in units $2650

Each instrument includes: 1—Type 21A Time-Base Plug-In Unit; 1—Type 22A Time-Base Plug-In Unit; 4—P6006 probe (010-0127-00); 1—Inter-unit cable (012-0032-00); 1—Power Supply for Type 555; 1—Time base extension (013-0013-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 1—Plate, Protector, CRT, clear (387-0918-00); 2—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0403-00).

EXTRA TIME-BASE PLUG-IN UNITS

Net weight of each Type 21A and Type 22A Time Base Unit is 4¼ pounds, shipping weight of each is 6 pounds, approx.

TYPE 21A TIME-BASE UNIT $275

TYPE 22A TIME-BASE UNIT $285

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

Please refer to Terms and Shipment, General Information page.

Type 556 / R556 DC-to-50 MHz DUAL BEAM OSCILLOSCOPE WITH SWEEP DELAY

NEW

- *TWO VERTICAL AND HORIZONTAL SYSTEMS*
- *ACCEPTS TWO AMPLIFIER, SPECTRUM ANALYZER, OR SPECIAL PURPOSE PLUG-INS*
- *OVER 50 DISPLAY MODES*
- *ONE PROBE—DUAL BEAM DISPLAY—NORMAL OR SINGLE-SWEEP*
- *FULL-BANDWIDTH TRIGGERING*
- *CALIBRATED SWEEP DELAY*
- *ILLUMINATED NO-PARALLAX GRATICULE —6 x 10-cm SCAN PER BEAM*

The Type 556 and R556 are dual-beam laboratory instruments for accurate measurement in the DC to 50 MHz range. Features include independent vertical and horizontal deflection systems, trigger selectability for cross triggering, and uniform-focus CRT with 6 x 10-cm scan per beam.

Unique display capability allows simultaneous display of one signal at two different sweep times, using only one probe for minimum circuit loading.

CHARACTERISTIC SUMMARY

VERTICAL

2 identical vertical-deflection systems

Letter-Series and 1-Series Plug-In Units offer wide selection of vertical-deflection characteristics for both beams.

HORIZONTAL

2 independent horizontal-deflection systems

CALIBRATED SWEEP RANGE—0.1 μs/cm to 5 s/cm.

SWEEP MAGNIFIER—X10, extends sweep range to 10 ns/cm.

CALIBRATED SWEEP DELAY—0.1 μs to 50 s.

MINIMUM TRIGGER REQUIREMENTS—

Internal: 2 mm deflection (60 Hz to 10 MHz)
1 cm deflection (to 50 MHz).

External: 0.2 V (DC to 10 MHz)
0.4 V (to 50 MHz).

EXTERNAL INPUT—≤0.1 V/cm to approx 10 V/cm; DC to ≥400 kHz.

CRT

DISPLAY AREA—6 x 10 cm per beam, 4-cm overlap.

ACCELERATING VOLTAGE—10 kV.

OTHER CHARACTERISTICS

ELECTROMAGNETIC INTERFERENCE—Meets MIL-I-6181D, Radiated: 150 kHz to 1 GHz; Conducted: 150 kHz to 25 MHz.

AMPLITUDE CALIBRATOR—1-kHz squarewave; 0.2 mV to 100 V; 100 VDC; 5 mA, 1-kHz squarewave; 5 mA DC.

POWER REQUIREMENTS—90 to 117 V, 100 to 130 V, 180 to 234 V, or 200 to 260 V; 50 to 60 Hz; approx 840 watts, 1 kVA (maximums).

NEW

VERTICAL-PLUG-IN UNITS

Bandwidth specifications are at 3-dB down.

PLUG-IN UNIT	CALIBRATED DEFLECTION FACTOR	BANDWIDTH	RISETIME
For Wide-Band, Multiple Trace Applications			
1A1 Dual-Trace	50 mV/cm to 20 V/cm	DC to 50 MHz	7 ns
	5 mV/cm	DC to 28 MHz	12.5 ns
	≈500 μV/cm	2 Hz to 15 MHz	23 ns
1A2 Dual-Trace	50 mV/cm to 20 V/cm	DC to 50 MHz	7 ns
CA Dual-Trace	50 mV/cm to 20 V/cm	DC to 24 MHz	15 ns
M Four-Trace	20 mV/cm to 10 V/cm	DC to 20 MHz	17 ns
For Wide-Band Applications			
B	50 mV/cm to 20 V/cm	DC to 20 MHz	18 ns
	5 mV/cm to 20 mV/cm	2 Hz to 12 MHz	30 ns
K	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
L	50 mV/cm to 20 V/cm	DC to 30 MHz	12 ns
	5 mV/cm to 2 V/cm	3 Hz to 24 MHz	15 ns
For High DC Sensitivity Applications			
H Wide-Band	5 mV/cm to 20 V/cm	DC to 15 MHz	23 ns
For Differential Input Applications			
D High-Gain	1 mV/cm (to 50 mV/cm)	DC to 300 kHz (DC to 2 MHz)	0.18 μs
E Low-Level	50 μV/cm (to 10 mV/cm)	0.06 Hz to 20 kHz (to 60 kHz)	6 μs
G Wide-Band	50 mV/cm to 20 V/cm	DC to 20 MHz	18 ns
1A7 High-Gain	10 μV/cm to 10 V/cm	DC to 500 kHz Selectable	0.7 μs

PLUG-IN UNIT	CALIBRATED DEFLECTION FACTOR	BANDWIDTH	RISETIME
For Integration, Differentiation, Function Generation, Linear and Non-Linear Uses			
O Operational Amplifier	50 mV/cm to 20 V/cm	DC to 25 MHz	14 ns
For Transducer and Strain Gage Uses			
Q	10 μstrain/div to 10 k μstrain/div	DC to 6 kHz	60 μs
For Transistor-Risetime Checks			
R	0.5 mA/cm to 100 mA/cm		12 ns
For Diode Recovery Time Measurements			
S	0.05 V/cm and 0.5 V/cm		12 ns
For Precise Amplitude Measurements Via Slide-Back			
W	1 mV/cm to 50 mV/cm	DC to 8 MHz to DC to 23 MHz	44 ns to 15 ns
Z	50 mV/cm to 25 V/cm	DC to 13 MHz	27 ns
For Spectrum Analysis			
1L10, 1L20, 1L30 Units cover 1-10,500 MHz.			
High-Frequency Sampling Applications			
1S1	2 mV/cm to 200 mV/cm	Equiv to 1.0 GHz	350 ps
1S2	5 mV/cm to 500 mV/cm	Equiv to 3.9 GHz	90 ps

556
R556

VERTICAL DEFLECTION

2 identical systems

BANDWIDTH

DC to ≥50 MHz at 3-dB down with Type 1A1 or 1A2 Plug-In Unit. Accepts all other "1" Series and Letter-Series Units.

SIGNAL DELAY

Approx 170-ns delay line requires no tuning.

HORIZONTAL DEFLECTION

2 identical systems

SWEEP RANGE

0.1 μs/cm to 5 s/cm in 24 calibrated steps (1-2-5 sequence), accuracy within ±3%. Uncalibrated continuous variation between steps and to approx 12.5 s/cm. Warning light indicates uncalibrated setting.

X10 MAGNIFIER

Extends fastest sweep to 10 ns/cm. Accuracy of magnified sweep within ±5%.

SWEEP MODES

Time Base A—Normal and Single Sweep.
Time Base B—Normal, B delayed by A, and Single Sweep.

CALIBRATED SWEEP DELAY

0.1 μs to 50 s, continuously variable and calibrated, accuracy within ±1%. Uncalibrated delay to approx 120 s. Incremental delay linearity within ±1% of indicated delay ±2 minor dial divisions on Delay-Time Multiplier (±5 minor divisions from 0.1 μs/cm to 0.5 μs/cm) + ≤150-ns fixed delay in system. Short-term jitter ≤1 part in 20,000 of the available delay time.

EXTERNAL HORIZONTAL INPUT

≤0.1 V/cm with X10 Display Mag, ≤1 V/cm with X1 Display Mag, continuously variable from ≤0.1 V/cm to approx 10 V/cm. DC to ≥400 kHz at 3-dB down. 50-V maximum (DC + peak AC).

TRIGGER

2 identical systems

TIME BASE A & B TRIGGER SENSITIVITY		
TRIGGER COUPLING	TO 10 MHz	TO 50 MHz
INTERNAL AC	≤2-mm display above 60 Hz	1-cm display
EXTERNAL	≤0.2 V above 60 Hz	≤0.4 V
INTERNAL DC	≤3.5-mm display	2-cm display
EXTERNAL	≤0.2 V	≤0.4 V
AC HF REJECT		
INTERNAL	≤2-mm display from 60 Hz to 60 kHz, 3 cm at 2 MHz	
EXTERNAL	≤0.2 V from 60 Hz to 60 kHz, 2 V at 2 MHz	
AC LF REJECT		
INTERNAL	≤2-mm display above 2.5 kHz	1-cm display
EXTERNAL	≤0.2 V above 2.5 kHz	≤0.4 V

SOURCES

Internal from left or right vertical amplifier, left or right plug-in, external, or line. External trigger input RC approx 1 megohm paralleled by approx 30 pF. 50-V maximum external input (DC + peak AC). Internal source selectable from the oscilloscope vertical amplifier, or direct from a single channel of Type 1A1 and 1A2 Plug-In Units. The latter mode displays the true time relationship between signals when plug-in units are in chopped or alternate operation.

MODES

Triggered and Auto Stability. Latter mode free runs sweep in absence of triggering signal, triggers on signals ≥20 Hz.

TRIGGERING LEVEL

Permits triggering on rising or falling portion of signals ≥2 V (or ≥20 V with LEVEL knob pulled outward).

DISPLAY LOGIC

UPPER BEAM

Signals from left or right plug-in unit may be displayed with either A or B Time Base, or an external signal (Ext Horiz In); triggered from either plug-in unit (single channel or composite signal), externally or from line.

LOWER BEAM

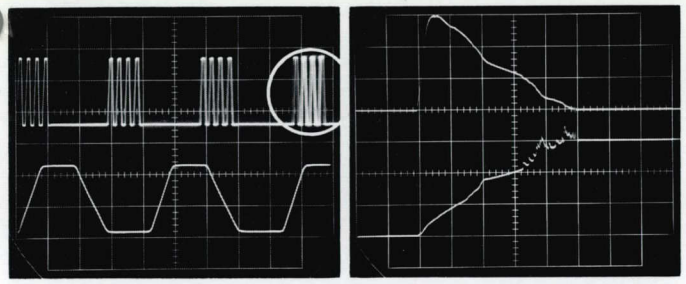
Signals from right plug-in unit may be displayed with either Time Base B or an external signal; triggered from either plug-in unit (single channel or composite signal), externally or from line.

SIMULTANEOUS DISPLAY CAPABILITIES				
UPPER BEAM		LOWER BEAM		TYPE OF DISPLAY
Plug-in Unit	Horizontal Deflection	Plug-in Unit	Horizontal Deflection	
left	A sweep	right	B sweep	Independent deflection systems.
right	A sweep	right	B sweep	Same signal at 2 different sweep time/cm settings, minimizes circuit loading.
left	B sweep	right	B sweep	2 signals, common sweep time/cm setting.
right	external	right	B sweep	X-Y and Y-T displays.
left	external	right	B sweep	
left	A sweep	right	external	
right	A sweep	right	external	
left	B sweep	right	external	
right	B sweep	right	external	
left	external	right	external	Dual-beam X-Y displays.
15 additional single-sweep combinations.				
4 additional delay-sweep combinations.				

CRT AND DISPLAY FEATURES

TEKTRONIX DUAL-BEAM CRT

5-inch round tube, 8 x 10 cm display area; ≥6 x 10 cm per beam with 4-cm overlap. Spot size, focus uniformity and geometry equivalent to our finest single-beam tubes. Aluminized construction, helical post acceleration. P31 phosphor.

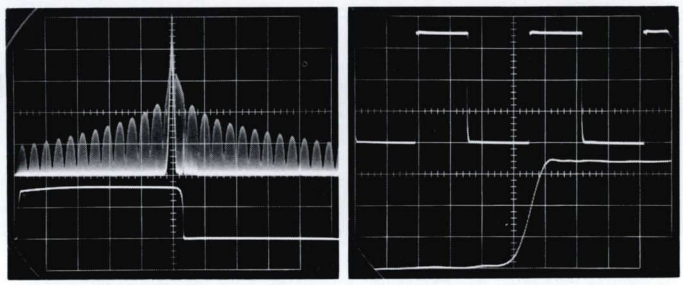


SINGLE-INPUT DUAL-BEAM DISPLAYS (Above left)

Upper beam shows bursts of 2.5 MHz pulses on Time Base A with time variation between bursts. This shows up as increasing time-jitter between the first and successive bursts. The lower beam shows Time Base B (0.1 μs/cm) delayed by Time Base A and triggered on the second pulse of the last burst to provide a jitter-free expanded display of the A Sweep intensified zone. The use of only one probe and one plug-in input simplifies signal connection and provides minimum loading on the signal source.

SIMULTANEOUS SINGLE-SHOT DISPLAYS (Above right)

Current versus voltage display of a 0.75 ampere, fast-blow fuse during destructive overload. Both beams are driven by B Time Base (50 μs/cm) which is delayed by pre-triggered A Time Base to provide base reference lines before and after the event. The upper beam shows the current through the fuse at 30 A/cm while the lower beam shows the corresponding voltage across the fuse at 100 V/cm.



TIME AND FREQUENCY DISPLAYS (Above left)

Upper beam shows the spectral output of a 200-MHz gated oscillator applied as IF feedthrough to a Type 1L20 Spectrum Analyzer; the calibrated dispersion is 1 MHz/cm. The lower beam shows a real-time display of the 10-kHz gating pulse (0.5 μs/cm).

SAMPLING AND REAL-TIME DISPLAYS (Above right)

Upper beam shows a squarewave at 1 μs/cm, as applied to a Type 1A2 Plug-In. The lower beam shows the leading-edge of the same waveform at 1 ns/cm, as applied to a Type 1S1 Wide-Band Sampling Plug-In.

INTERNAL GRATICULE

Variable edge lighting. Vertical and horizontal centerlines marked in 2-mm divisions.

DISPLAY CONTROLS

Separate intensity, focus and astigmatism controls for each beam, intensity contrast between A sweep and non-intensified-B-zone of A sweep, trace rotation (screwdriver adjustment), and trace separation. BEAM FINDER button functions in both X-Y systems, indicates direction of off-screen signals.

Z-AXIS INPUT

$\leq$+15-V peak to peak causes noticeable modulation at normal intensity. Input R at DC is 1 megohm ±10%.

OTHER CHARACTERISTICS

ELECTROMAGNETIC INTERFERENCE

Meets interference specifications of MIL-I-6181D over the following frequency ranges: Radiated (with CRT mesh filter installed) —150 kHz to 1 GHz; conducted (power line) —150 kHz to 25 MHz.

AMPLITUDE CALIBRATOR

0.2 mV to 100 V in 18 calibrated steps (1-2-5 sequence), accuracy within ±2%. 50-Ω source resistance from 0.2 mV to 0.2 V. $\leq$1.5-μs risetime; 1-kHz ±25% repetition rate; 45% to 55% duty cycle. 100-V DC output also provided. Front-panel current loop for 5 mA ±2%, squarewave or DC.

OUTPUT WAVEFORMS

A Gate: $\geq$+10 V, B Gate: $\geq$+10 V, Delayed Trigger: $\geq$7 V, A Sawtooth: $\geq$9 V/cm, B Sawtooth: $\geq$9 V/cm.

POWER REQUIREMENTS

Wired for 100 to 130 V RMS, 50 to 60 Hz source having less than 2% harmonic distortion. Quick-change transformer taps allow 4 regulation ranges and do not require soldering. The following table describes the power source requirements for the Type 556 and R556. Power consumption: approx 840 W max and approx 1 kVA max.

$\leq$2% HARMONIC DISTORTION	>2% HARMONIC DISTORTION*
90 to 117 V RMS	127 to 165 V Peak
100 to 130 V RMS	142 to 183 V Peak
180 to 234 V RMS	254 to 330 V Peak
200 to 260 V RMS	284 to 366 V Peak

$$\frac{\text{*Peak V}}{\text{RMS V}} \text{ between 1.2 and 1.414}$$

COOLING

Filtered forced-air cooling.

CABINET MODEL

Type 556 is 15" high, 17" wide, 24" long. Net weight is 81 pounds without plug-in units; shipping weight is approx 111 pounds.

RACK MODEL

Type R556 mounts on tilting slide-out tracks to standard 19" rack. Dimensions are 14" high, 19" wide, 22⅝" long. Net weight is 86 pounds without plug-in units, shipping weight approx 126 pounds.

TYPE 556 OSCILLOSCOPE $3150

Each instrument includes: 4—P6008 10X probe (010-0129-00); 1—CRT mesh filter, installed (378-0572-00); 1—graticule cover (200-0382-00); 18—BNC caps (016-0088-00); 1—clear CRT protector plate (387-0918-00); 1—smoke gray light filter (378-0567-00); 1—3-conductor power cord (161-0030-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0511-00).

TYPE R556 OSCILLOSCOPE $3250

Each instrument includes: 4—P6008 10X probe (010-0129-00); 1—CRT mesh filter, installed (378-0572-00); 1—graticule cover (200-0382-00); 18—BNC caps (016-0088-00); 1—clear CRT protector plate (387-0918-00); 1—smoke gray light filter (378-0567-00); 1—3-conductor power cord (161-0030-00); 1—3 to 2-wire adapter (103-0013-00); 1—set mounting hardware; 1—pr mounting tracks (351-0086-00); 2—instruction manual (070-0511-00).

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

Type B WIDE-BAND HIGH-GAIN UNIT

- *5 mV/cm to 20 V/cm CALIBRATED DEFLECTION FACTOR*
- *DC-TO-20 MHz BANDWIDTH*

The Type B Plug-In Preamplifier meets the requirements of many wide-band applications. Wide bandwidth, excellent transient response, DC-coupling, and calibrated deflection factors 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.

Type 127, 132, and 133 Power Supplies are available to operate this plug-in unit outside an oscilloscope. See description of these instruments for details.

CHARACTERISTICS

DEFLECTION FACTOR RANGE is from 5 mV/cm to 20 V/cm in 12 calibrated steps, 1-2-5 sequence; accuracy is ±3%. A variable control permits uncalibrated adjustment between ranges and to approx 50 V/cm.

INPUT COUPLING is either AC or DC to 50 mV/cm, and AC only to 5 mV/cm. With AC, the low frequency —3 dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by approx 47 pF.

WEIGHT: Net—4 pounds. Shipping—6 pounds, approx.

TYPE B PLUG-IN UNIT $145
Each instrument includes: 2—instruction manual (070-0219-00).

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

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

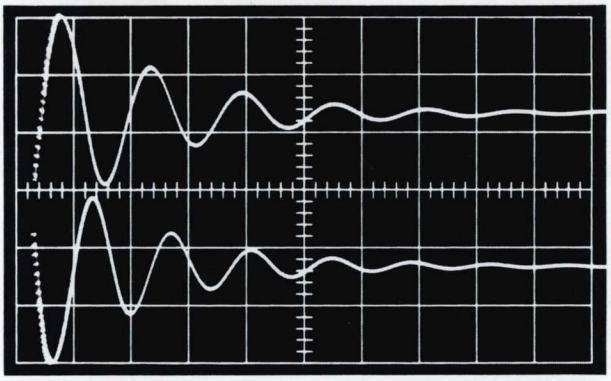
*A Type 81 Adapter is required.

TRANSIENT RESPONSE CHARACTERISTICS

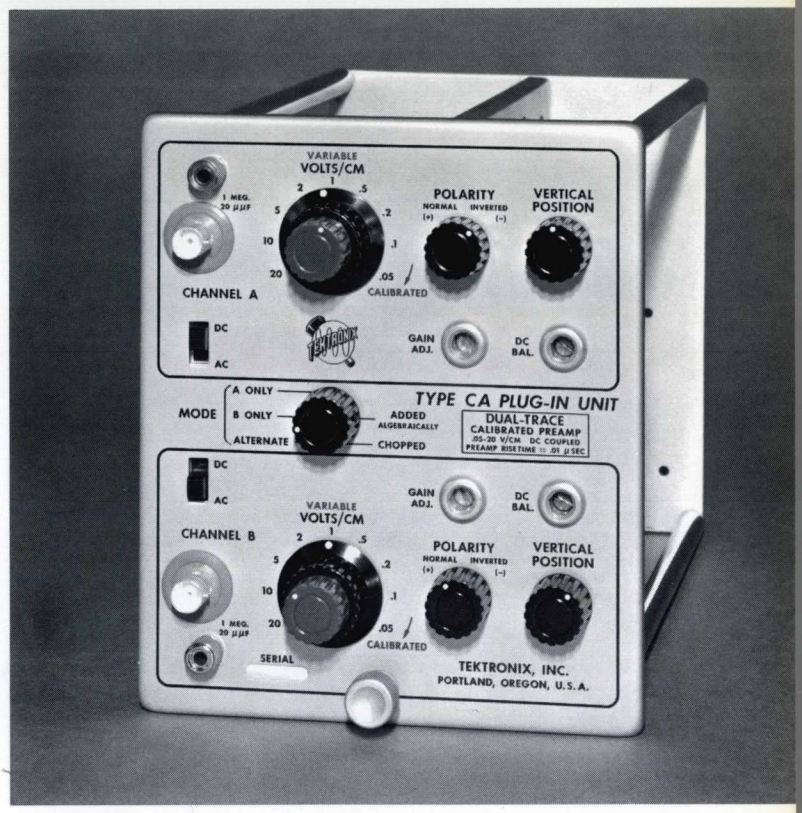
TYPE B UNIT AND OSCILLOSCOPE	DEFLECTION FACTOR	BANDWIDTH (at 3-dB down)	RISETIME
531A, 533A, 535A	50 mV/cm to 20 V/cm	DC to 14 MHz	25 ns
	5 mV/cm to 50 mV/cm	2 Hz to 10 MHz	35 ns
536	50 mV/cm to 20 V/cm	DC to 10 MHz	35 ns
	5 mV/cm to 50 mV/cm	2 Hz to 9 MHz	40 ns
541A, 543A, 543B, 544, 545A, 545B, 546, 547, 549, 555, 556, 581A*, 585A*	50 mV/cm to 20 V/cm	DC to 20 MHz	18 ns
	5 mV/cm to 50 mV/cm	2 Hz to 12 MHz	30 ns
551	50 mV/cm to 20 V/cm	DC to 18 MHz	20 ns
	5 mV/cm to 50 mV/cm	2 Hz to 12 MHz	30 ns

DUAL-TRACE DC UNIT Type CA

- *DUAL-TRACE VERSATILITY*
- *5 OPERATING MODES*
- *DC-TO-24 MHz BANDWIDTH*
- *CMRR 20:1 to 24 MHz*



TYPICAL DUAL-TRACE DISPLAY using Chopped Mode of Type CA Unit. The waveform depicts a display of the response of two ringing circuits to the same pulse. In this mode, transients as small as 1 ms can be observed and measured readily.



The Tektronix Type CA Unit contains two identical input channels. Either channel can be operated separately. The two channels can be electronically switched, either at a chopped rate of about 100 kHz, 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 ratio (CMRR) is at least 20 to 1 over the entire bandwidth 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.

Type 127, 132, and 133 Power Supplies are available to operate this plug-in outside an oscilloscope. See the description of these instruments for details.

CHARACTERISTICS

(Identical for each Channel)

DEFLECTION FACTOR RANGE is from 50 mV/cm to 20 V/cm in 9 calibrated steps, 1-2-5 sequence; accuracy is ±3%. A variable control permits uncalibrated adjustment between ranges and to approx 50 V/cm.

INPUT COUPLING is either AC or DC. With AC, the low frequency —3-dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by approx 20 pF.

OPERATING MODES are: Channel A only; Channel B only; Electronic switching at 100-kHz rate (chopped); Electronic switching on alternate sweeps; Both channels added algebraically (±A±B).

In chopped operation, successive 5-μs segments of each channel are displayed at an approx 100-kHz rate per channel. Chopped transient blanking is provided, except when Type CA is used in the Type 536, 551, 581A, and 585A Oscilloscope.

POLARITY of either channel can be inverted (front-panel control) for comparisons of signals 180 degrees out of phase, and for A — B or A + B mixing.

WEIGHT: Net—4¾ pounds. Shipping—9 pounds, approx.

TYPE CA PLUG-IN UNIT **$260**

Each instrument includes: 2—instruction manual (070-0318-00).

TRANSIENT RESPONSE CHARACTERISTICS

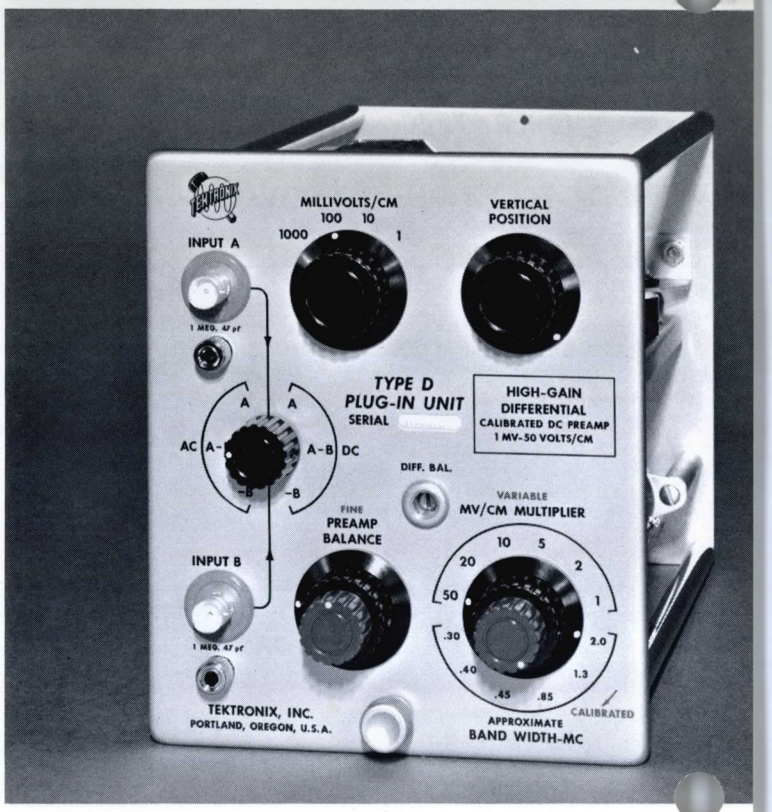
TYPE CA UNIT AND OSCILLOSCOPE	BANDWIDTH (at —3 dB)	RISETIME
531A, 533A, 535A	DC to 13.5 MHz	26 ns
536	DC to 10 MHz	35 ns
541A, 543A, 543B, 544, 545A, 545B, 546, 547, 549, 555, 556, 581A*, 585A*	DC to 24 MHz	15 ns
551	DC to 22 MHz	16 ns

*A Type 81 Adapter is required.

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

Type D HIGH-GAIN DC DIFFERENTIAL UNIT

- *1 mV/cm TO 50 V/cm CALIBRATED DEFLECTION FACTOR*
- *CMRR 10,000:1*
- *HIGH DC STABILITY*



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.

The Type 127, 132, and 133 Power Supplies are available to operate this plug-in unit outside an oscilloscope. See the description of these instruments for details.

CHARACTERISTICS

DEFLECTION FACTOR RANGE is from 1 mV/cm to 50 V/cm in 6 calibrated steps, 1-2-5 sequence, and 4 calibrated decade ranges; accuracy is ±3%. A variable control permits uncalibrated adjustment between ranges and to approx 125 V/cm.

INPUT COUPLING is either AC or DC. With AC, the low frequency —3 dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by approx 47 pF.

INPUT SELECTOR SWITCH provides for use of either input separately, or both together differentially, either AC or DC-coupled.

DIFFERENTIAL INPUT provides a mode of operation 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.

COMMON MODE REJECTION RATIO (CMRR) is 10,000-to-1 for in-phase signals up to 20 kHz 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.

*A Type 81 Adapter is required.

STABILITY is from 2 to 5 mV/h (normal drift).

BANDWIDTH is DC to 300 kHz at 1 mV/cm, increasing to DC to 2 MHz at 50 mV/cm and greater. (Bandwidth is specified at —3 dB.) The mV/cm MULTIPLIER switch indicates bandwidth for each position.

REGULATED HEATER VOLTAGE is supplied for all electron tubes in the Type D Unit, derived from the regulated DC voltage supplies in the associated oscilloscope.

WEIGHT: Net—4½ pounds. Shipping—8 pounds, approx.

TYPE D PLUG-IN UNIT $170

Each instrument includes: 2—instruction manual (070-0228-00).

VARIABLE ATTENUATION PROBE

The 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 capacitances between 20 pF and 47 pF.

Order Part Number 010-0167-00 ..... $40

For other probes, please refer to the Catalog Accessory pages.

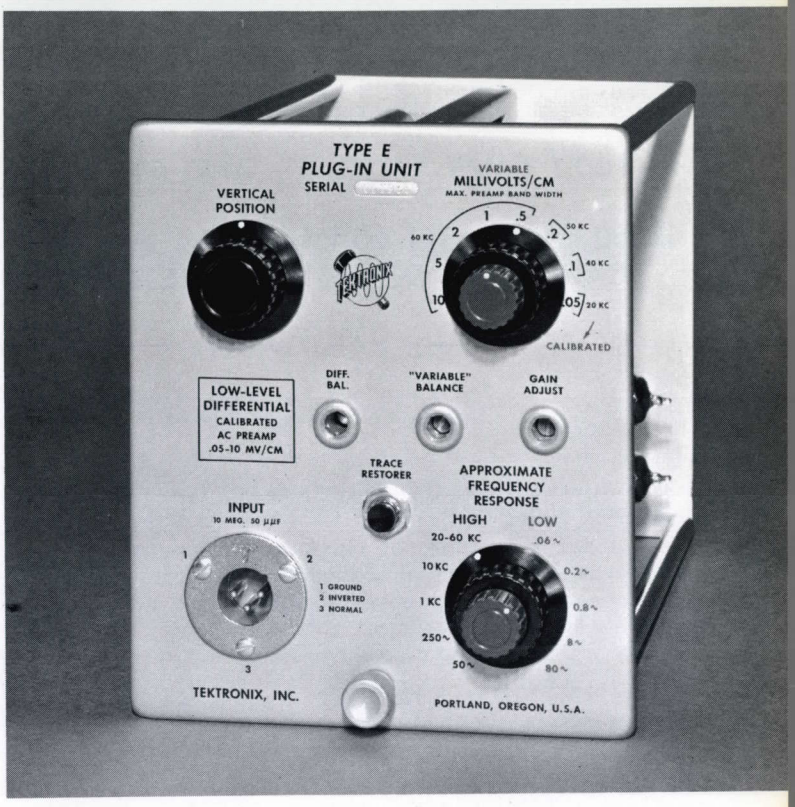
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

LOW-LEVEL AC DIFFERENTIAL UNIT Type E

- *50 μV/cm to 10 mV/cm CALIBRATED DEFLECTION FACTOR*
- *LOW NOISE*
- *CMRR 50,000:1*
- *SELECTABLE BANDWIDTH CHARACTERISTICS*

The Type E Plug-In Unit provides Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes with a calibrated deflection factor of 50 μV/cm for low-level applications. Separate high-frequency and low-frequency response controls permit restricting the bandwidth to increase the signal-to-noise ratio.

The Type 127, 132, and 133 Power Supplies are available to operate this plug-in unit outside an oscilloscope. See the description of these instruments for details.



CHARACTERISTICS

DEFLECTION FACTOR RANGE is from 10 μV/cm to 10 mV/cm in 8 calibrated steps, 1-2-5, sequence; accuracy is ±3%. A variable control permits uncalibrated adjustment between ranges and to approx 25 mV/cm.

INPUT COUPLING is AC only, with a low frequency —3-dB point of 0.06 Hz.

INPUT RC is 10 megohms paralleled by approx 50 pF for single-ended applications, and 20 megohms paralleled by approx 50 pF for differential applications.

DIFFERENTIAL INPUT feature permits measurements in which the plug-in output is proportional to the difference between signals applied to the two signal input connections. (A shielded 2-conductor cable and connector are supplied with the instrument.) Differential operation is useful for cancelling in-phase signals such as hum pickup at the signal source.

COMMON-MODE REJECTION RATIO (CMRR) is 50,000-to-1 for in-phase signals up to 1 kHz with amplitudes of ±2 V (peak to peak) or less. This figure holds true at all settings of the MILLIVOLTS/cm control. Input to grid is DC-coupled to provide good rejection at low frequencies.

*A Type 81 Adapter is required.

COMBINED NOISE AND HUM is 5 μV, RMS (maximum) with input grids grounded at the input connector.

BANDWIDTH (at —3 dB) is 0.06 Hz to 20 kHz at 50 μV/cm, increasing to 60 kHz at 0.5 mV/cm and greater. The MILLIVOLTS/cm switch indicates bandwidth for each position.

BANDWIDTH CONTROLS permit selection of the high-frequency and low-frequency —3 dB points. The high-frequency switch provides 5 steps at 60, 10, and 1 kHz; 250 and 50 Hz. The low-frequency switch provides 5 steps at 0.06, 0.2, 0.8, 8, and 80 Hz. Restricting the bandwidth to the requirements of the particular application will provide an increase in the signal-to-noise ratio.

TRACE RESTORER button provides a means of returning the trace to its normal position immediately if the trace should be driven from the screen by a large transient.

WEIGHT: Net—4¼ pounds. Shipping—8 pounds, approx.

TYPE E PLUG-IN UNIT $190

Each instrument includes: 1—2-conductor cable (012-0022-00); 2—instruction manual (070-0226-00).

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

Type G WIDE-BAND DC DIFFERENTIAL UNIT

- *100:1 CMRR AT 20 MHz AND 50 mV/cm*
- *50 mV/cm TO 20 V/cm CALIBRATED DEFLECTION FACTOR*
- *DC-TO-20 MHz BANDWIDTH*

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 bandwidth at full gain. 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.

Type 127, 132, and 133 Power Supplies are available to operate this plug-in outside an oscilloscope. See the description of these instruments for details.

CHARACTERISTICS

DEFLECTION FACTOR RANGE (each input) is from 50 mV/cm to 20 V/cm in 9 calibrated steps, 1-2-5 sequence; accuracy is ±3%. A variable control permits uncalibrated adjustment between ranges to approx 50 V/cm.

INPUT COUPLING is either AC or DC-coupled. With AC, the low frequency —3 dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by approx 47 pF.

INPUT SELECTOR SWITCH provides for use of either input separately, or both together differentially, AC or DC-coupled.

A-B (DIFFERENTIAL) provides a mode of operation as a differential amplifier whose output is proportional to the difference between signals applied to input A and input B. This is useful in making voltage measurements between two above-ground points, and for cancelling in-phase signals such as hum pickup in connecting leads or at the signal source. (See Type 536 for other applications.)

COMMON MODE REJECTION RATIO (CMRR) is better than 100 to 1 at 20 MHz and 50 mV/cm, and better than 300 to 1 at 60 Hz. Common-mode signal should not exceed 2 volts (peak to peak) between input grids. At 0.5 V/cm and 5 V/cm, the input signal should not exceed 20 volts and 200 volts respectively.

*A Type 81 Adapter is required.

WEIGHT: Net—4¼ pounds. Shipping—6 pounds approx.

TYPE G PLUG-IN UNIT **$190**

Each instrument includes: 2—instruction manual (070-0241-00).

TRANSIENT RESPONSE CHARACTERISTICS		
TYPE G UNIT AND OSCILLOSCOPE	BANDWIDTH (at —3 dB)	RISETIME
531A, 533A, 535A	DC to 14 MHz	25 ns
536	DC to 10 MHz	35 ns
541A, 543A, 543B, 544, 545A, 545B, 546, 547, 549, 555, 556, 581A*, 585A*	DC to 20 MHz	18 ns
551	DC to 18 MHz	20 ns

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 capacitances between 20 pF and 47 pF.

Order Part Number 010-0167-00 ..... $40

For other probes, please refer to the Catalog Accessory pages.

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

WIDE-BAND HIGH-GAIN DC UNIT Type H

- *5 mV/cm TO 20 V/cm DC CALIBRATED DEFLECTION FACTOR*
- *DC-TO-15 MHz BANDWIDTH*

The Type H is a wide-band preamplifier with DC coupling over its full deflection-factor 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.

Type 127, 132, and 133 Power Supplies are available to operate this plug-in outside an oscilloscope. See the description of these instruments for details.

CHARACTERISTICS

DEFLECTION FACTOR RANGE is from 5 mV/cm to 20 V/cm in 12 calibrated steps, 1-2-5 sequence; accuracy ±3%. A variable control permits uncalibrated adjustment between ranges and to approx 50 V/cm.

INPUT COUPLING is either AC or DC. With AC, the low frequency —3 dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by approx 47 pF.

WEIGHT: Net—4 pounds. Shipping—9 pounds, approx.

*A Type 81 Adapter is required.

TYPE H PLUG-IN UNIT $185

Each instrument includes: 2—instruction manual (070-0272-00).

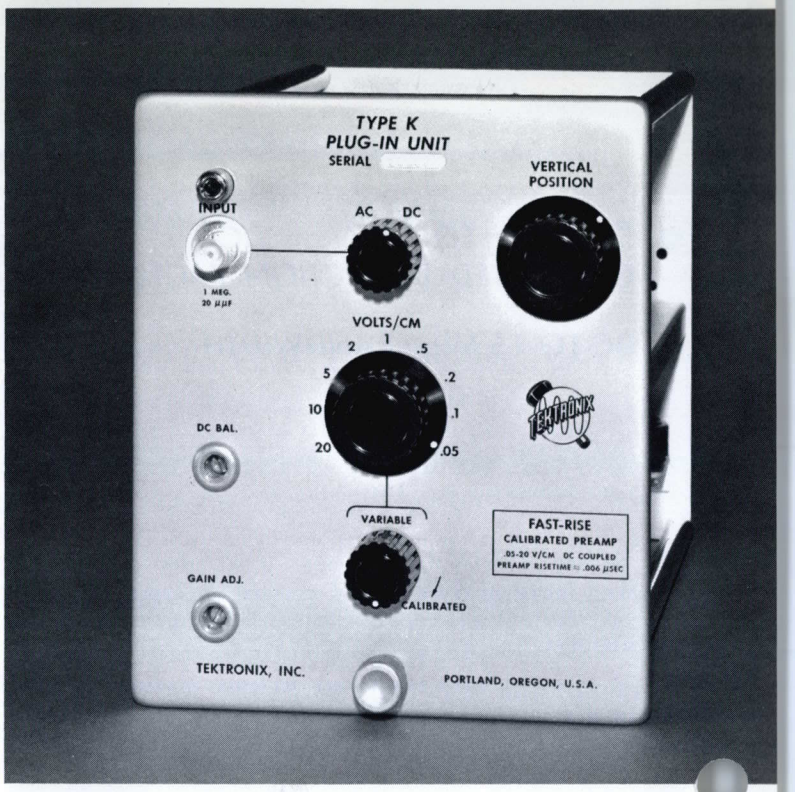
For probes, please see the Catalog Accessory pages.

TRANSIENT RESPONSE CHARACTERISTICS		
TYPE H UNIT AND OSCILLOSCOPE	BANDWIDTH (at —3 dB)	RISETIME
531A, 533A, 535A	DC to 11 MHz	31 ns
536	DC to 9.5 MHz	37 ns
541A, 543A, 543B, 544, 545A, 545B, 546, 547, 549, 555, 556, 581A*, 585A*	DC to 15 MHz	23 ns
551	DC to 14 MHz	25 ns

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

Type K FAST-RISE DC UNIT

- *DC-TO-30 MHz BANDWIDTH*
- *50 mV/cm TO 20 V/cm CALIBRATED DEFLECTION FACTOR*



The Type K Fast-Rise Unit provides Types 540, 550, and 580* Series Oscilloscopes with calibrated deflection factors 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.

Type 127, 132, and 133 Power Supplies are available to operate this plug-in outside an oscilloscope. See the description of these instruments for details.

CHARACTERISTICS

DEFLECTION FACTOR RANGE is from 50 mV/cm to 20 V/cm in 9 calibrated steps, 1-2-5 sequence; accuracy is ±3%. A variable control permits uncalibrated adjustment between ranges and to approx 40 V/cm.

INPUT COUPLING is either AC or DC. With AC, the low frequency —3 dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by approx 20 pF.

WEIGHT. Net—3¾ pounds. Shipping—8 pounds approx.

*A Type 81 Adapter is required.

TYPE K PLUG-IN $145

Each instrument includes: 2—instruction manual (070-0230-00).

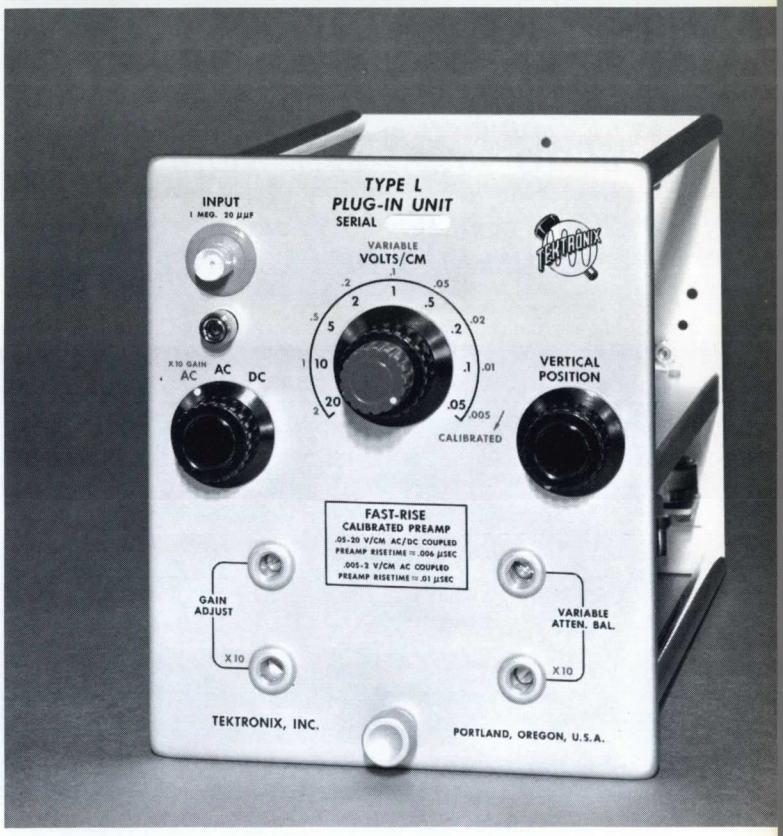
For probes, please see the Catalog Accessory pages.

TRANSIENT RESPONSE CHARACTERISTICS		
TYPE K UNIT AND OSCILLOSCOPE	BANDWIDTH (at —3 dB)	RISETIME
531A, 533A, 535A	DC to 15 MHz	23 ns
536	DC to 11 MHz	31 ns
541A, 543A, 543B, 544, 545A, 545B, 546, 547, 549, 555, 556, 581A*, 585A*	DC to 30 MHz	12 ns
551	DC to 25 MHz	14 ns

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

FAST-RISE HIGH-GAIN UNIT Type L

- *5 mV/cm to 20 V/cm CALIBRATED DEFLECTION FACTOR*
- *DC-TO-30 MHz BANDWIDTH*



The Type L Fast-Rise High-Gain Unit duplicates the performance of the Type K and offers an extended deflection factor to 5 mV/cm, AC-coupled. An AC-coupled amplifier provides a gain of 10X with slightly reduced bandwidth and increased risetime. When used with Type 530-Series Oscilloscopes, the unit has somewhat reduced bandwidth and increased risetime.

Type 127, 132, and 133 power supplies are available to operate this plug-in outside an oscilloscope. See the description of these instruments for details.

CHARACTERISTICS

DEFLECTION FACTOR RANGE is from 50 mV/cm to 20 V/cm in 9 calibrated steps; accuracy is ±3%. With the additional amplifier stage switched in, the range is 5 mV/cm to 2 V/cm. A variable control permits uncalibrated adjustment between ranges.

INPUT COUPLING is either AC or DC to 50 mV/cm, and AC only to 5 mV/cm. With AC, the low frequency —3-dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by approx 20 pF.

WEIGHT: Net—4½ pounds. Shipping—8 pounds, approx.

TYPE L PLUG-IN UNIT $210

Each instrument includes: 2—instruction manual (070-0336-00).

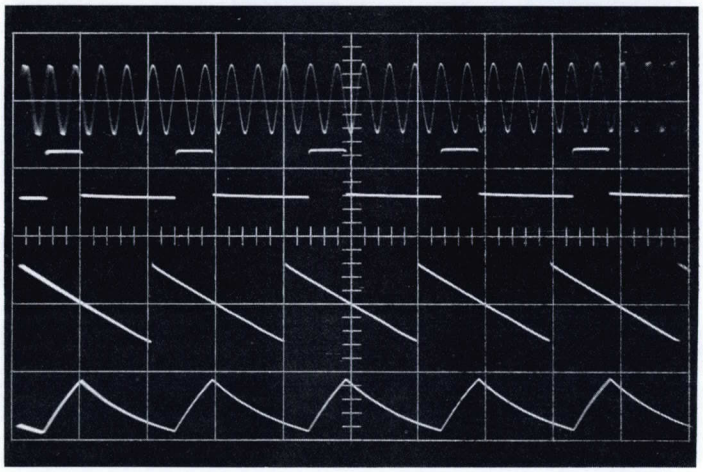
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

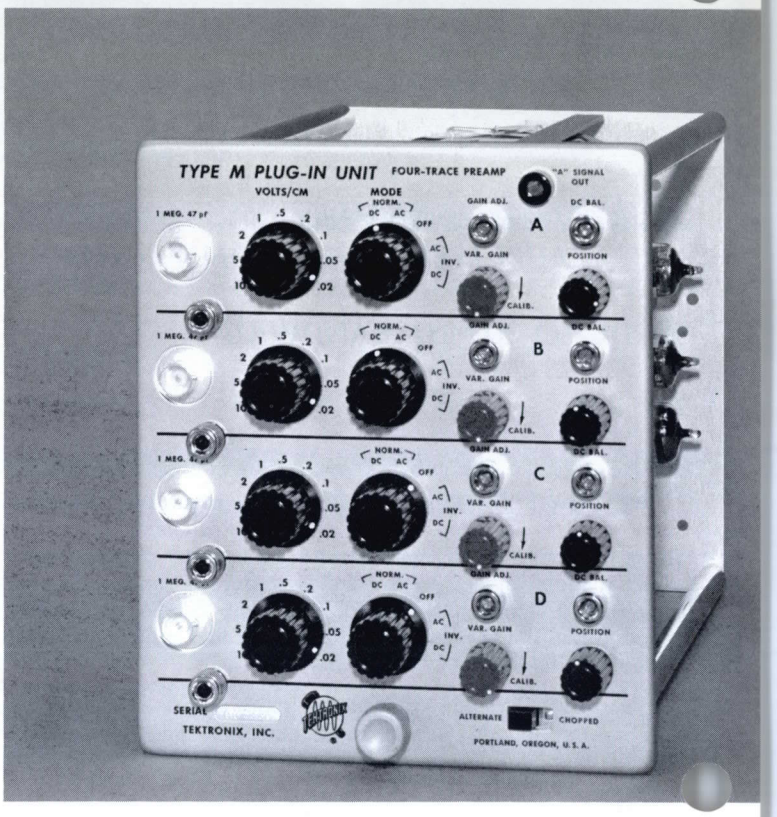
TRANSIENT RESPONSE CHARACTERISTICS			
TYPE L UNIT AND OSCILLOSCOPE	DEFLECTION FACTOR	BANDWIDTH (at 3-dB down)	RISE-TIME
531A, 533A, 535A	50 mV/cm to 20 V/cm 5 mV/cm to 2 V/cm	DC to 15 MHz 3 Hz to 15 MHz	23 ns 23 ns
536	50 mV/cm to 20 V/cm 5 mV/cm to 2 V/cm	DC to 11 MHz 3 Hz to 10 MHz	31 ns 35 ns
541A, 543A, 543B, 544, 545A, 545B, 546, 547, 549, 555, 556, 581A*, 585A*	50 mV/cm to 20 V/cm 5 mV/cm to 2 V/cm	DC to 30 MHz 3 Hz to 24 MHz	12 ns 15 ns
551	50 mV/cm to 20 V/cm 5 mV/cm to 2 V/cm	DC to 25 MHz 3 Hz to 22 MHz	14 ns 16 ns
*Requires a Type 81 Adapter			

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

Type M FOUR-TRACE UNIT

- *ELECTRONIC SWITCHING*
- *DC TO 20 MHz BANDWIDTH*
- *20 mV/cm TO 10 V/cm CALIBRATED DEFLECTION FACTOR*





In a Tektronix Oscilloscope that accepts letter-series plug-ins, the Type M Four-Trace Unit provides four channels for viewing one to four signals, separately or in any combination. The Type M Unit can be used in Tektronix Type 530, 540, 550, or 580*-Series Oscilloscopes. 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.

Each of the four channels has identical characteristics.

DEFLECTION FACTOR is from 20 mV/cm to 10 V/cm in 9 calibrated steps; accuracy is 3%. A variable control permits uncalibrated adjustment from 20 mV/cm to 25 V/cm.

INPUT COUPLING is either AC or DC. With AC, the low frequency 3-dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by approx 47 pF.

POLARITY of the signal from each channel can be inverted by a front-panel switch.

OPERATING MODES include: any one of the four channels separately; Alternate—any combination of two or more channels switched electronically on alternate sweeps; Chopped—In chopped operation, successive 1-μs (approx) segments of each channel are displayed at an approx rate per channel of: 500 kHz when using two channels; 333 kHz when using three channels; and 250 kHz when using four channels.

CHANNEL A SIGNAL available at front panel can be connected to oscilloscope external trigger input for stable triggering in the Chopped or Alternate 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, 581A, 585, and 585A.

WEIGHT: Net—5¼ pounds. Shipping—8 pounds, approx.

TYPE M PLUG-IN UNIT $525

Each instrument includes: 4—BNC-to-binding post adapters (103-0033-00); 1—BNC-to-BNC, 18″ red patch cord (012-0087-00); 1—BNC-to-banana plug, 18″ red patch cord (012-0091-00); 2—instruction manual (070-0295-00).

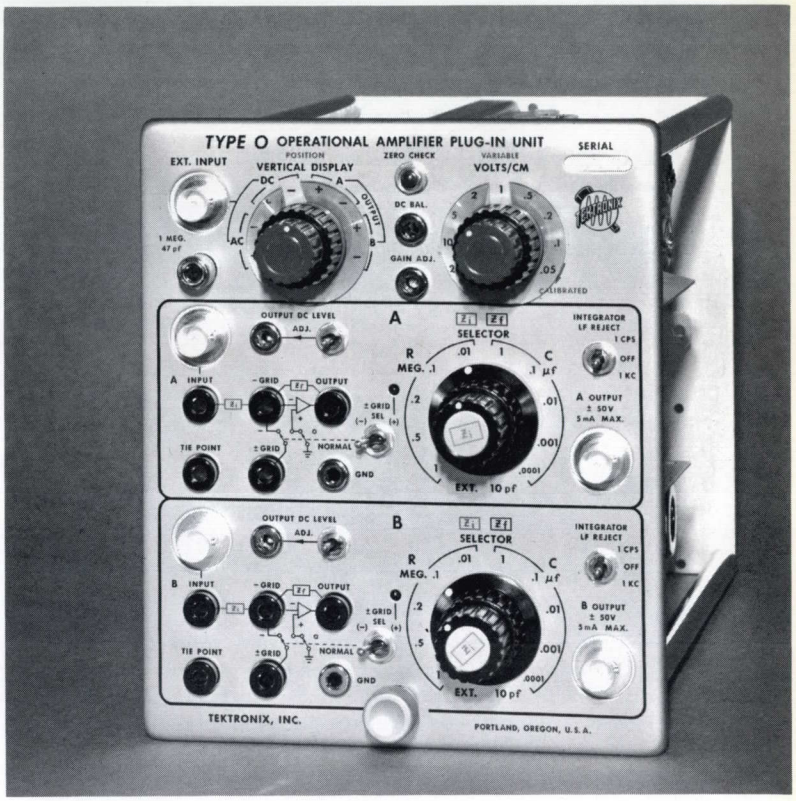
U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

TRANSIENT RESPONSE CHARACTERISTICS		
Type M Unit and Oscilloscope	Bandwidth (at 3-dB down)	Risetime
531A, 533A, 535A,	DC — 14 MHz	25 ns
536	DC — 10 MHz	35 ns
541A, 543A, 543B, 544, 545A, 545B, 549, 546, 547, 581A*, 585A*, 555, 556	DC — 20 MHz	17 ns
551	DC — 19 MHz	18 ns

*Requires a Type 81 Adapter

OPERATIONAL AMPLIFIER UNIT Type O

- *TWO OPERATIONAL AMPLIFIERS*
- *INTEGRATION, DIFFERENTIATION AND FUNCTION GENERATION*
- *INTERNAL PRECISION INPUT AND FEEDBACK COMPONENTS*
- *EXTERNAL INPUT AND FEEDBACK IMPEDANCE JACKS*



Designed for Tektronix Oscilloscopes that accept letter-series plug-ins, the Type O Operational Amplifier Unit performs precise operations of integration, differentiation, function generation, linear and nonlinear amplification. The results can be displayed on the oscilloscope CRT or fed to other circuitry.

The Type O Unit can be used in any Type 530, 540, 550, or 580*-Series Oscilloscope. For applications that do not require the CRT display, the unit can be operated in a Type 127, 132, or 133 Plug-In Power Supply.

DEFLECTION AMPLIFIER

Frequency specifications are at 3-dB down.

BANDWIDTH AND RISETIME depend upon the oscilloscope used. With Type 540, 550, and 580-Series, the bandwidth is DC to 25 MHz, and the risetime is 14 ns (except Type 551, DC to 23 MHz, 16 ns). With Type 530-Series, the bandwidth is DC to 14 MHz and the risetime is 25 ns (except Types 532 and 536).

DEFLECTION FACTOR is 50 mV/cm to 20 V/cm in 9 calibrated steps, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment from 50 mV/cm to 50 V/cm (uncalibrated).

INPUT RC is 1 megohm paralleled by approx 47 pF.

SWITCHING FACILITIES permit the deflection amplifier to be used independently or to monitor the output of either operational amplifier.

OPERATIONAL AMPLIFIERS

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.

OPEN-LOOP GAIN-BANDWIDTH PRODUCT is 15 MHz or greater. (Checked at 10 MHz for open-loop gain greater than 1.5.)

CLOSED-LOOP BANDWIDTH is 750 kHz or more at unity gain with internal input and feedback resistors, and to 10 MHz with external compensation.

* A Type 81 Adapter is required.

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 MHz for compensated unity-gain amplifier.

NOISE is typically less than 0.5 mV peak to peak (equivalent input noise), approximately 3 mV peak to peak additional output-noise when R_f = 1 megohm.

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 ±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 kHz squarewave) 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/hour, referred to input, after warmup.

O

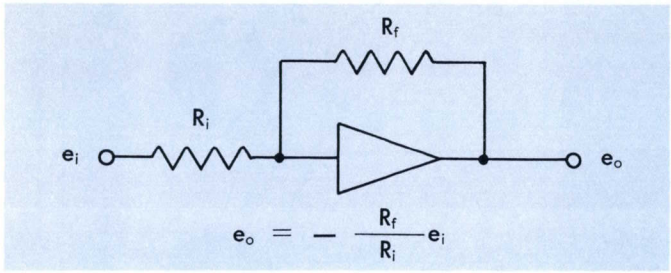
LOW FREQUENCY REJECTION for repetitive integration is possible at either 1 Hz or 1 kHz, approximately, and can be switched in or out as desired.

WEIGHT: Net—5½ pounds.
Shipping—9 pounds, approx.

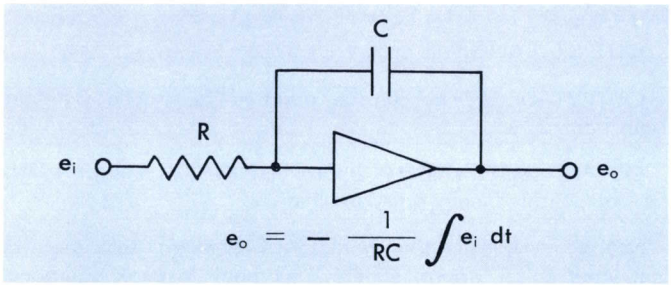
TYPE O OPERATIONAL AMPLIFIER UNIT $525

Each instrument includes: 2—terminal adapter assemblies (013-0048-00); 2—terminal shields (013-0049-00); 2—BNC to binding-post adapters (103-0033-00); 2—BNC-to-BNC, 18″ red patch cords (012-0087-00); 2—instruction manuals (070-0323-00).

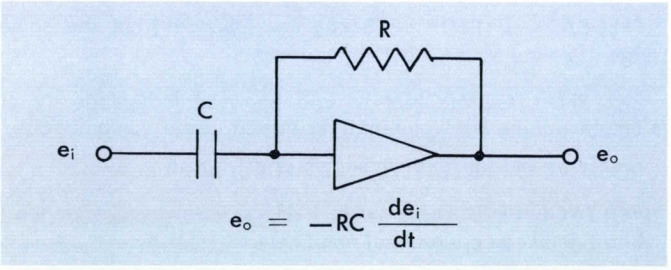
BASIC OPERATING MODES



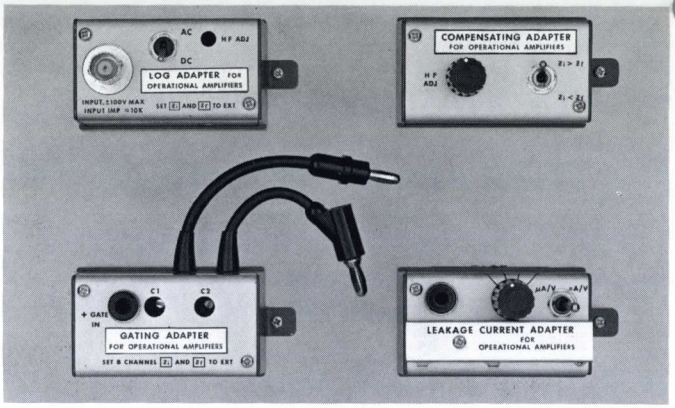
AMPLIFICATION is determined by the ratio of input to feedback resistors. This provides convenient signal step-up or step-down, with low output impedances, to over 750 kHz. Use of external compensation extends the closed-loop gain-bandwidth product to 10 MHz or more.



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 MHz 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 MHz is possible.



LOG ADAPTER

The Log Adapter with the Type O Plug-In Unit allows the display and measurement of high-amplitude signals mixed with low-amplitude signals. Pulses and transient waveforms differing in amplitude by up to 1000 to 1 can be displayed and measured on the same trace.

The Log Adapter is a logarithmic feedback network that converts the A or B operation amplifier in a Type O Plug-In Unit from a linear amplifier to essentially a logarithmic amplifier. The adapter can be plugged directly into the jacks on the front panel of the Type O Plug-In Unit.

Order Part Number 013-0067-00 ..... $75

COMPENSATING ADAPTER

The Compensating Adapter extends the high-frequency performance of either operational amplifier of the Type O Plug-In Unit when the internal Z_i and Z_f resistors are used in any combination for either gain or attenuation.

Without the Compensating Adapter, stray capacitance associated with the internal Z_i and Z_f resistors limits the operational amplifiers high-frequency performance. The adapter can be plugged into the front panel of the Type O Plug-In Unit.

Order Part Number 013-0081-00 ..... $35

GATING ADAPTER

The Gating Adapter allows repetitive signals with an integral other than zero to be integrated and displayed using the Type O Plug-In Unit. Without the Gating Adapter, true integration of such repetitive signals is impossible since the integral will accumulate to a voltage beyond the range of the Type O Plug-In Unit.

The adapter can be plugged directly into the jacks on the front panel of the Type O Plug-In Unit.

Order Part Number 013-0068-00 ..... $75

LEAKAGE CURRENT ADAPTER

Used with the Type O Plug-In Unit, the Leakage Current Adapter provides the facility for measuring leakage current of semiconductor diodes and small signal transistors.

The adapter plugs into the operational jacks located on the front panel of the Type O Unit. A positive-going sawtooth voltage is required for driving the adapter. Tektronix Oscilloscopes that accept the Type O Plug-In Unit have a Sawtooth or Sweep-Out jack conveniently located on the front panel for supplying the required sawtooth voltage.

Order Part Number 013-0086-00 ..... $85

Please refer to the catalog accessory pages for complete information on the above adapters.

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

TRANSDUCER & STRAIN GAGE UNIT Type Q

- *HIGH GAIN*
- *LOW NOISE*
- *ESSENTIALLY DRIFT FREE*

The Type Q Plug-In Unit permits any Tektronix Type 530, 540, 550, or 580* Series Oscilloscope 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.

Requiring no external equipment other than the strain gages or transducers operated with it and the associated oscilloscope, 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.

Type 127, 132, and 133 power supplies are available to operate this plug-in outside an oscilloscope. See the description of these instruments for details.

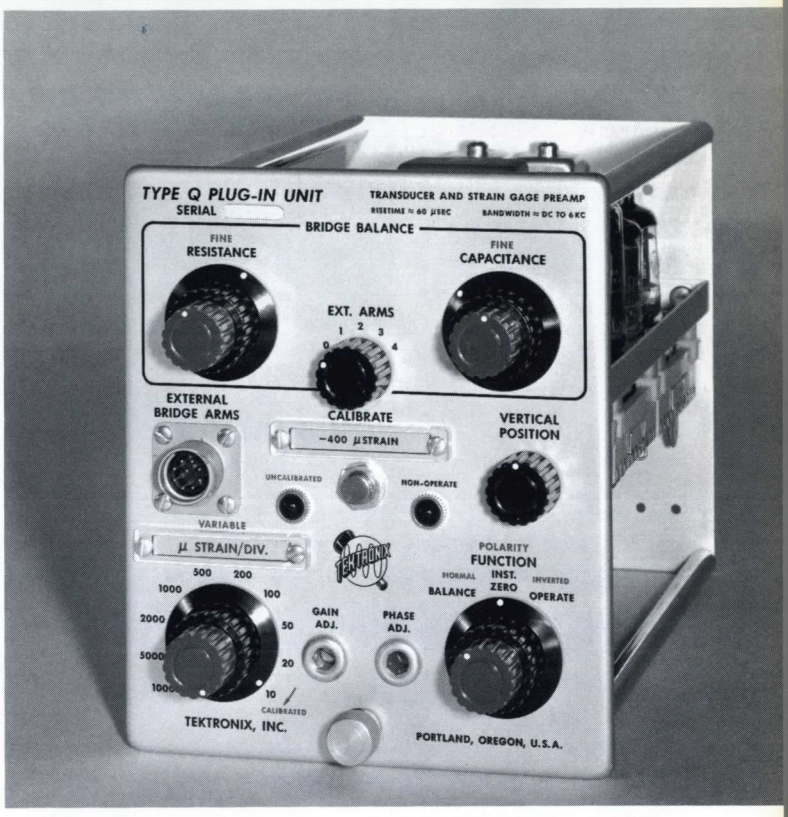
CALIBRATED DEFLECTION FACTOR is 10 μstrain/div to 10,000 μstrain/div (microinches per inch/div) in 10 steps when used with a single strain gage having a gage factor of approx 2. With four active arms and a gage factor of 2, deflection factor extends to 2.5 μstrain/div. An uncalibrated control permits continuous adjustment between ranges and to approx 25,000 μstrain/div.

ATTENUATOR ACCURACY, when set accurately in any one step, is within 2% on all other steps.

GAGE FACTORS from 1 to 6 are usable without changing steps of the μstrain/div control. This range of factors is compensated for by adjusting the Gain Adj Control.

EQUIVALENT DC SENSITIVITY in a comparable DC amplification system would require a deflection factor of approx 10 μV/div for the same amount of power applied to the input bridge.

*A Type 81 Adapter is required.



BANDWIDTH is DC to 6 kHz.

RISETIME is 60 μs (approx).

NOISE is typically equivalent to an input of 1.5 μstrain (peak to peak) at 10 μstrain/div deflection factor. This approximates an RMS noise of 0.5 μstrain.

DRIFT of the over-all system is primarily a function of the transducer stability. The Type Q amplification system is essentially drift free.

INPUT is to an AC bridge with 25-kHz excitation voltage. One or more of the four bridge arms can have transducers attached to them. Total bridge voltage is approx 5 V RMS, regulated.

CAPACITIVE TRANSDUCERS used in conjunction with a four-arm resistive bridge results in the following maximum deflection capabilities: 120-ohm bridge (available internally), 1 pF/div; 1000-ohm bridge, 0.2 pF/div; useful deflection capabilities are slightly lower when using long cables.

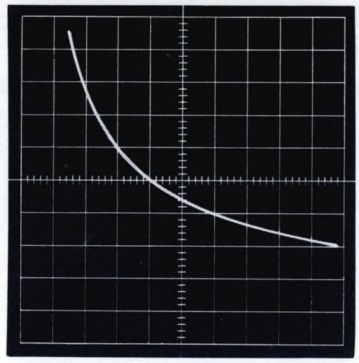
INDUCTIVE TRANSDUCERS must have characteristics compatible with the 25-kHz carrier frequency to function properly. Linear-variable-differential transformers designed for carrier frequencies of 2 kHz and higher usually operate satisfactorily without additional circuitry.

TRANSDUCER CABLE consisting of 3-wire or 4-wire shielded microphone cable gives the best results.

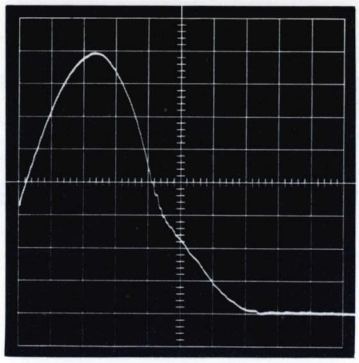
CAPACITANCE BRIDGE BALANCE has a range of control that allows compensation for an unbalance of up to 250 pF across any external resistive arm of the input bridge.

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.



RESISTANCE BRIDGE BALANCE has sufficient range to compensate for most standard transducers and strain gages.

GAGE RESISTANCE RANGE is useful with cable lengths to 100 feet and extends from approx 50 ohms to 2000 ohms. For optimum performance, the recommended range is between 120 ohms and 500 ohms.

PHASE ADJUSTMENT permits either resistive or reactive transducer applications to be displayed.

POLARITY INVERSION allows the display to appear normal or inverted for convenience in reading the display.

CALIBRATE SWITCH connects a calibration resistor across the strain gage electrically to simulate an external mechanical strain. The calibration resistor supplied with the Type Q Unit simulates a —400-μstrain unbalance of the bridge, suitable for most strain gage applications. As with the 120-ohm internal bridge resistor, the 150-kΩ calibration resistor is mounted on a 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.

To include the gage factor in the calibration, merely increase or decrease the amplifier gain proportionally.

CAPACITANCE MEASUREMENTS can be read directly in capacitance from 1 pF/div to 1000 pF/div without using a correction curve by calibrating the Type Q in capacitance. Using a correction curve, the range can be extended to 10,000 pF/div. 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/div. Please note that the standard capacitor and test jig are not supplied with the unit.

WEIGHT: Net—5¼ pounds. Shipping—8 pounds (approx).

TYPE Q PLUG-IN UNIT $325

Each instrument includes: 1—120-Ω resistor assembly (013-0025-00); 1—150-kΩ plug-in resistor board (013-0078-00); 1—4-wire 15′ shielded connecting cable (012-0040-00); 2—instruction manual (070-0199-00).

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

TIME-BASE GENERATOR UNIT Type T

- *WIDE SWEEP RANGE*
- *VERSATILE TRIGGERING*
- *5X MAGNIFIER*

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 can also be used in the vertical-deflection system of any of the Tektronix Type 530, 540, 550, and 580*-Series Oscilloscopes for some applications requiring a raster-like display.

CHARACTERISTICS

SWEEP RANGE is from 0.2 μs/div to 2 s/div in 22 calibrated steps; 1-2-5 sequence. A variable control permits uncalibrated adjustment between ranges and to approx 6 s/div. Accuracy of fixed steps is within 3%.

5X MAGNIFIER extends calibrated sweep range to 0.04 μs/div, expanding the center two-division portion of the normal sweep to fill ten divisions.

TRIGGER FACILITIES include External, Line; Triggering-Level Selection; AC or DC coupling; AC LF Reject; Automatic or HF Sync; Stability Preset; ±Slope.

TRIGGERING LEVEL selection permits triggering the sweep at a selected amplitude on the triggering waveform, either on the rising or falling slope of the waveform.

AUTOMATIC TRIGGERING provides stable operation without triggering level control adjustment for most applications. Range of operation is between 60 Hz and 2 MHz approximately. In the absence of a triggering signal, a reference trace is displayed at approx 50 Hz.

HF SYNC assures a stable display of sinewave signals up to approx 15 MHz. Requires an external signal of about 2 V.

TRIGGER REQUIREMENTS for normal triggering is a signal of 0.2 V to 10 V.

OUTPUT WAVEFORMS include a positive-gate waveform (approx 20 V) of the same duration as the sweep, and a positive-going sawtooth (approx 150 V). Both waveforms are available at front-panel connectors.

WEIGHT: Net—4¾ pounds. Shipping—7 pounds, approx.

TYPE T PLUG-IN UNIT $240

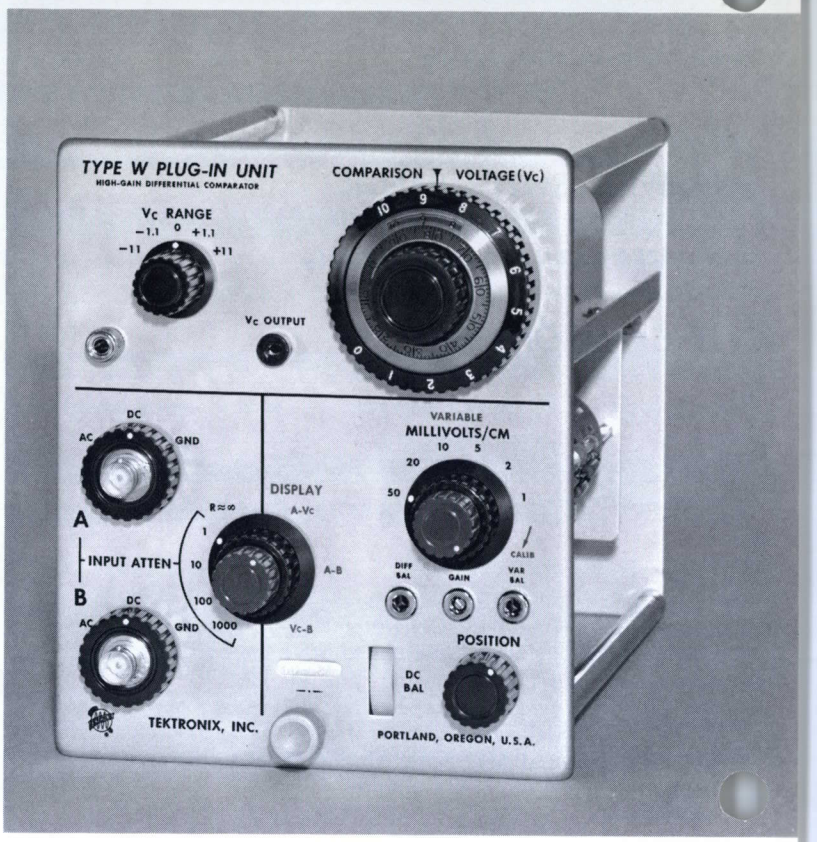
Each instrument includes: 2—instruction manual (070-0337-00).

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

*A Type 81 Adapter is required.

Type W HIGH-GAIN DIFFERENTIAL COMPARATOR

- *UP TO 23-MHz BANDWIDTH*
- *20,000:1 COMMON-MODE REJECTION*
- *11,000 cm EFFECTIVE SCREEN HEIGHT*



The Type W High-Gain Differential Comparator adds to the measurement capabilities of all Tektronix Oscilloscopes using Letter-Series and 1-Series Plug-In Units. Used with Type 127, 132 or 133 Power Supply, the Type W can drive recording equipment, X-Y plotters, oscilloscopes, or other indicators.

As a differential input preamplifier, the dynamic range of the W Unit permits common-mode signals up to ±15 volts in amplitude to be applied to the amplifier without attenuation. With a rejection ratio of 20,000 to 1 for DC or low-frequency signals, signals of 1 mV or less on large common-mode signals can be measured. A front-panel attenuator permits the acceptance of common-mode voltages up to 500 V.

As a differential comparator, voltage measurements using the slide-back technique can be made with this unit. The high accuracy and stability of the DC comparison voltage added differentially to the input signal makes precise voltage measurements possible. Using this mode of operation, the W Unit has an effective screen height of ±11,000 cm. This is equivalent to a ±11-volt dynamic signal range at a deflection factor of 1 mV/cm. Within this range, calibrated ±DC comparison voltages can be added differentially to the input signal to permit a maximum of about 0.001% or 100 μV per mm to be resolved.

CONVENTIONAL PREAMPLIFIER

OSCILLOSCOPE TYPE	DEFLECTION FACTOR	BANDWIDTH	RISETIME
531A; 535A	1 mV 50 mV	7 MHz 13.5 MHz	50 ns 26 ns
536	1 mV 50 mV	6.5 MHz 10.5 MHz	54 ns 34 ns
543A; 543B; 544; 545A; 545B; 546; 547; 549; 555; 556; 581A*; 585A*	1 mV 50 mV	8 MHz 23 MHz	44 ns 15 ns
551	50 mV 1 mV	20.5 MHz 8 MHz	17 ns 44 ns

*A Type 81 Adapter is required.

CALIBRATED DEFLECTION FACTOR

1 mV/cm to 50 V/cm, depending on millivolts/cm and attenuator settings. Accuracy of millivolts/cm positions is ±3%. Uncalibrated continuous variation between steps and to approximately 125 V/cm.

ATTENUATORS

4 decade steps covering range of 1 to 1,000. X10 position accurate within ±0.05%; X100 within ±0.15%; X1000 within ±3%.

INPUTS

DC or AC-coupled. Low-frequency response in AC mode is down no more than 3 dB at 2 Hz. INPUT RESISTANCE is 1 megohm paralleled by 20 pF (except in additional X1 attenuation position ($R \approx \infty$) where $R > 10{,}000$ megohm). Input resistance of X10 and X1 attenuators is matched within ±0.1%.

DIFFERENTIAL-INPUT PREAMPLIFIER

COMMON-MODE REJECTION

At least 20,000:1 at DC to 20 kHz with 30-V peak to peak, DC-coupled. AC COMMON-MODE REJECTION: at least 1000:1 at 60 Hz, with 30-V peak to peak, AC-coupled.

MAXIMUM PEAK INPUT

±15 volts, increasing to ±150 volts with X10 attenuation and +500 volts with X100 or X1000 attenuation.

CALIBRATED DIFFERENTIAL COMPARATOR

COMPARISON VOLTAGE
0 to ±1.1 V, or 0 to ±11 V. Accuracy: ±(0.15% of indicated value plus 0.05% of Vc range).

Vc SUPPLY RESOLUTION
0 to ±1.1 V range: 100 μV per minor dial div; 0 to ±11 V range: 1 mV per minor dial div.

MAXIMUM PEAK INPUT
Same as for Differential-Input.

OVERDRIVE RECOVERY
Recovers to within 10 mV of reference signal within 300 ns after the signal returns to the screen. Certain overdrive signals can cause an additional slow (thermal) shift of up to 5 mV in the reference level.

WEIGHT
Net—5 pounds, shipping—7 pounds, approx.

Type W PLUG-IN UNIT **$575**
Each instrument includes: 2—instruction manual (070-0432-00).

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

HIGH-RESOLUTION VOLTAGE MEASUREMENT
using the slide-back technique

A 150-volt sawtooth waveform is applied and clipped with a zener diode, shown in Figure 1. The knee of the curve is shown expanded vertically and horizontally in Figures 2 and 3. This resolution is made possible in the Type W Unit by using the slide-back technique. Figure 3 clearly shows zener noise. 10X more "vertical magnification", to 1 mV/cm, could be used, if desired.

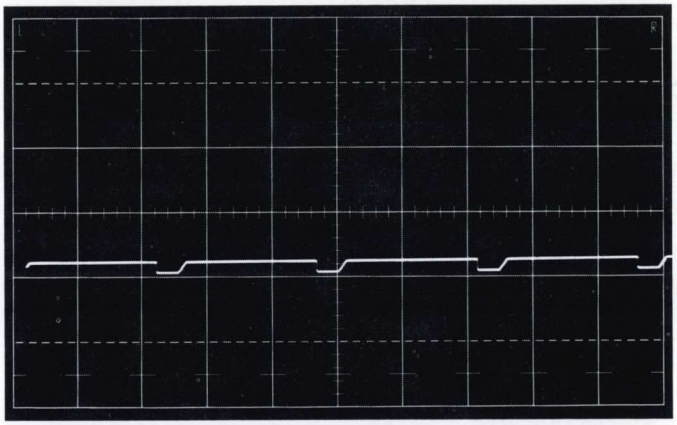


Figure 1—50 V/cm, 5 ms/cm.

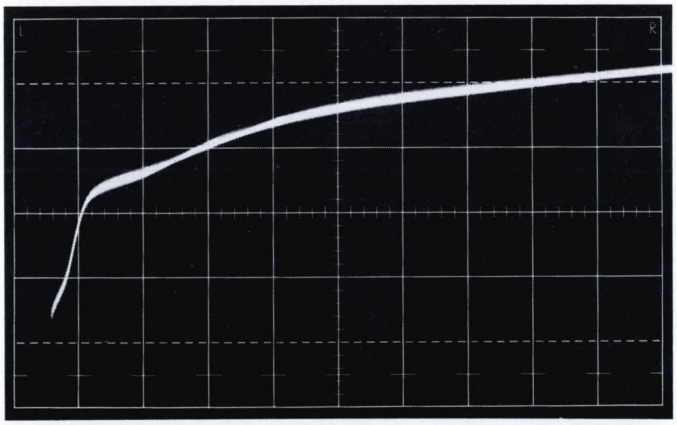


Figure 2—50 mV/cm, 0.2 ms/cm.

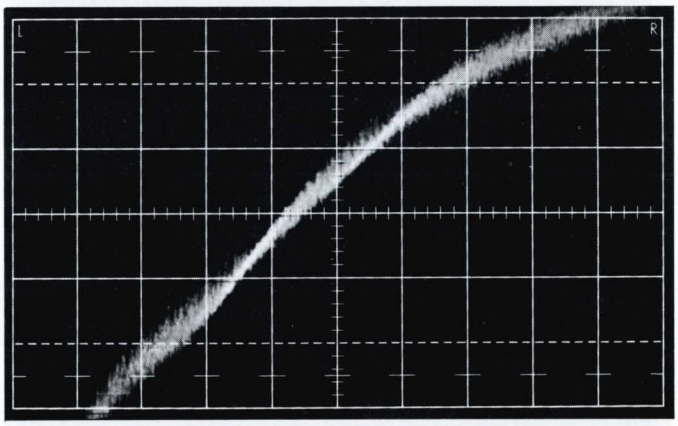
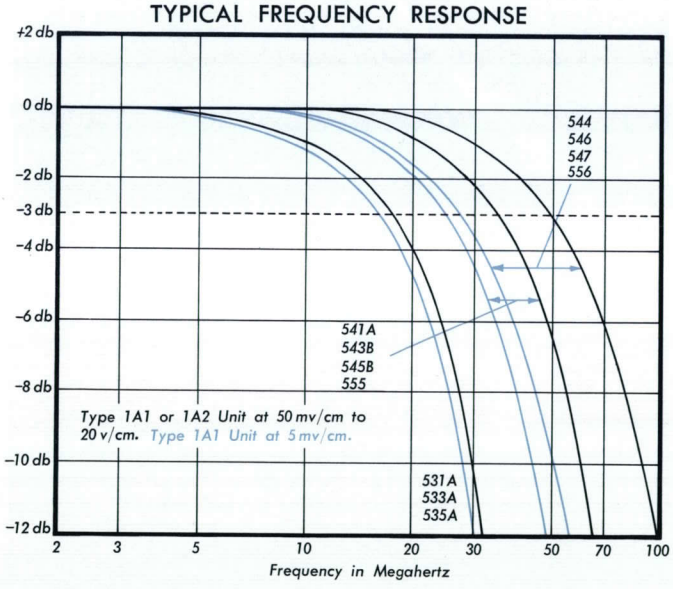


Figure 3—(Single sweep), 10 mV/cm, 100 μs/cm.

Type 1A1 / 1A2 WIDE-BAND DUAL-TRACE DC UNITS

Here are two wide-band dual-trace plug-in units for Tektronix Type 530, 540, 550, and 580*-Series Oscilloscopes. Both Types 1A1 and 1A2 provide optimum bandwidth capabilities in the Type 544, 546, 547, and 556 Oscilloscopes, and also extend the measurement capabilities of all other Tektronix Oscilloscopes that accept Letter-Series Plug-In Units. The Type 1A1 offers these outstanding additional features: 5 mV/cm deflection factor (DC coupled), and front-panel signal output. This Channel 1 Output, when cascaded into Channel 2, provides approximately 500-μV/cm deflection factor (AC coupled).

TYPICAL FREQUENCY RESPONSE



*Type 580-Series Oscilloscopes require a Type 81 Adapter.

COMMON CHARACTERISTICS

TWO SIGNALS can be added algebraically, displayed singly, or together, using either chopped or alternate-trace modes. To extend the usefulness of chopped mode at faster sweep rates, chopping in the Type 1A1 occurs at an approx 1-MHz rate to show successive 500-ns segments of each trace. In the Type 1A2, electronic switching occurs at an approximate 220-kHz rate to show successive 2-μs segments of each trace. Chopped transient blanking is provided in all Type 530, 540, and 550-Series Oscilloscopes except Type 536 and 551. When either plug-in unit is used with the Type 547 or RM547, the alternate switching circuit in the plug-in can be slaved to the Display Switching circuit in the oscilloscope, thus locking Channel 1 to Time Base A and Channel 2 to Time Base B. For many applications, this provides equivalent dual-beam operation without the additional complexity and cost of a dual-beam oscilloscope.

POLARITY INVERSION can be used to closely compare signals 180° out of phase.

AC OR DC COUPLING or grounding of the input is conveniently controlled at the front panel. With AC coupling the low-frequency —3-dB point is 2 Hz direct, 0.2 Hz with a 10X Probe.

INPUT RC is 1 megohm paralleled by approximately 15 pF. P6008 10X Passive Probes (included with the Type 544, 546, 547, and 556 Oscilloscopes) increase the input resistance to 10 megohms and decrease the input capacitance to approximately 7.5 pF.

MAXIMUM INPUT VOLTAGE is 600 volts (DC plus peak AC).

TYPE 1A1

DEFLECTION FACTOR from 5 mV/cm to 20 V/cm is in 12 calibrated steps with 1-2-5 sequence, accuracy within 3%. An uncalibrated control permits continuous adjustment between steps and to approximately 50 V/cm.

CHANNEL 1 SIGNAL OUTPUT is available at the front panel with up to 10X amplification. Output is at a source impedance of ≃50 Ω. The Channel 1 output may be AC coupled into Channel 2, providing approximately 500-μV/cm deflection factor at bandwidths indicated in the chart. A suitable noise or frequency filter can be inserted between channels, if desired. Bandwidth of the Channel 1 output alone is DC to 35 MHz.

CHANNEL 1 TRIGGER OUTPUT is available at the front panel and also at the rear plug-in connector* Triggering directly from Channel 1 conveniently permits viewing the true time relationship between two signals when using either alternate or chopped mode.

NET WEIGHT is 5½ pounds. Shipping weight is approximately 10 pounds.

TYPE 1A1 DUAL-TRACE PLUG-IN UNIT $600

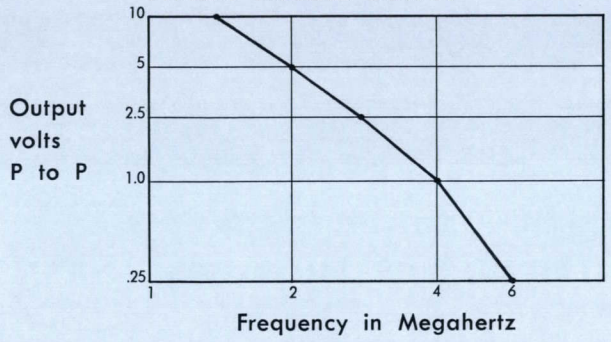
Each instrument includes: 1—50-Ω male BNC to male BNC cable (012-0076-00); 2—instruction manual (070-0378-01).

TYPE 1A2

DEFLECTION FACTOR from 50 mV/cm to 20 V/cm is in 9 calibrated steps with 1-2-5 sequence, accuracy within 3%. An uncalibrated control permits continuous adjustment between steps and to approximately 50 V/cm.

TRIGGER OUTPUT is available at the front panel and also at the rear plug-in connector*. The output can be taken from either Channel 1 or Channel 2. Triggering directly from one of the channels conveniently permits viewing the true time relationship between two signals when using either alternate or chopped mode.

TYPICAL TRIGGER OUTPUT



*The internal output is utilized in Type 544, 546, 547, 549 and 556 Oscilloscopes.

COMMON-MODE REJECTION is at least 20:1 throughout the full instrument bandwidth for signals up to 0.5 V peak to peak amplitude (measured at 50 mV/cm with variable attenuator in calibrated position).

NET WEIGHT is 4¼ pounds. Shipping weight is approximately 8 pounds.

TYPE 1A2 DUAL-TRACE PLUG-IN UNIT $325

Each instrument includes: 2—instruction manual (070-0430-00).

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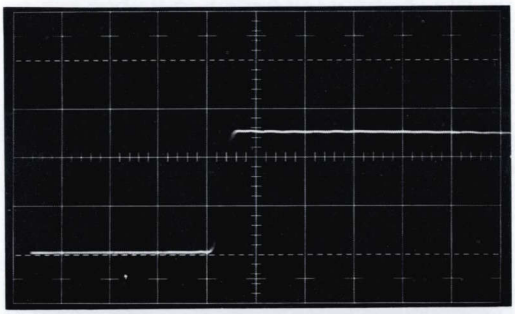
Please refer to Terms and Shipment, General Information page.

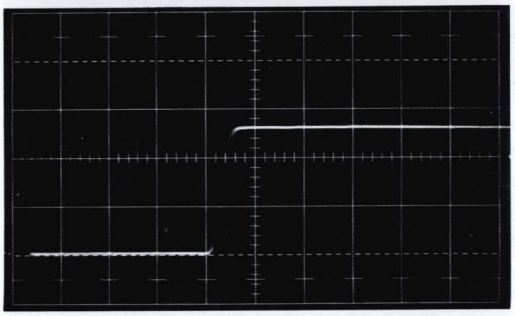
CLEAN HIGH-FREQUENCY RESPONSE

A significant improvement in built-in step attenuator design is realized in the Type 1A1 and 1A2 Dual-Trace Units. The severest test of any step attenuator is at its maximum setting where feed through, lead inductance and inadequate grounding techniques have the most effect.

Response of the Types 1A2/547 to the output of a Tektronix Type 109 Pulse Generator (risetime less than 0.25 ns) indicates no appreciable change between minimum (50 mV/cm) and maximum (20 V/cm) calibrated attenuator settings.



MAXIMUM ATTENUATION (20 V/cm), 20 ns/cm sweep rate.



MINIMUM ATTENUATION (50 mV/cm), 20 ns/cm sweep rate.

GAIN/BANDWIDTH CHARACTERISTICS

OSCILLOSCOPE TYPE	TYPE 1A1 Only: Single-Channel Bandwidth and Risetime at 500 μV/cm	TYPE 1A1 Only: Dual-Channel Bandwidth and Risetime at 5 mV/cm	Type 1A1 and 1A2: Dual-Channel Bandwidth and Risetime at 50 mV/cm
544, 546, 547, 556	2 Hz to 15 MHz, 23 ns	DC to 28 MHz, 12.5 ns	DC to 50 MHz**, 7 ns
541A, 543A, 543B, 545A, 545B, 555, 581A*, 585A*	2 Hz to 14 MHz, 25 ns	DC to 23 MHz, 15 ns	DC to 33 MHz, 10.5 ns
549	2 Hz to 14 MHz, 26 ns	DC to 23 MHz, 15 ns	DC to 30 MHz, 12 ns
551	2 Hz to 13 MHz, 26 ns	DC to 21 MHz, 16.5 ns	DC to 27 MHz, 13 ns
531A, 533A, 535A	2 Hz to 10 MHz, 35 ns	DC to 14 MHz, 25 ns	DC to 15 MHz, 23 ns
536	2 Hz to 8 MHz, 44 ns	DC to 10.5 MHz, 33 ns	DC to 11 MHz, 31 ns

*Type 580-Series Oscilloscopes require a Type 81 Adapter.

**Bandwidth with P6008 10X Passive Probes (included with the Type 544, 546, 547 and 556) is 45 MHz or greater at 3-dB down. Risetime is approximately 8 ns.

Type 1A7 HIGH-GAIN DC DIFFERENTIAL UNIT

- *DC TO 500 kHz SELECTABLE BANDWIDTH*
- *10 μV/cm TO 10 V/cm DEFLECTION FACTOR*
- *LOW DC DRIFT, LOW NOISE*
- *≥50,000:1 COMMON-MODE REJECTION*
- *300 mV DC DIFFERENTIAL OFFSET*
- *DC-COUPLED FRONT-PANEL SIGNAL OUTPUT*

This general-purpose plug-in unit can be used with any Tektronix 530, 540, 550, or (with adapter) 580-Series Oscilloscope. Used with Type 127, 132 or 133 Power Supply, the Type 1A7 can drive recording equipment, X-Y plotters, oscilloscopes or other indicators. Featuring simplified DC balancing, high sensitivity, and selectable upper and lower 3-dB points, the Type 1A7 offers previously unavailable measurement capabilities. Capable of differential measurements with simultaneous DC offset, the Type 1A7 allows observation of very small differential signals which may have a considerable difference in DC potential. Common-mode rejection is 50,000:1 for signals up to 20 volts peak to peak, and up to 100 kHz. It can be adjusted to ≥310,000:1 for signals from DC to 20 kHz.

The DC to 500 kHz bandwidth is constant from 10 μV/cm to 10 V/cm. Drift ≤200 μV/h with ambient temperature and line voltage constant; ≤150 μV/°C. Input noise is 3.3-μV RMS, maximum (not including drift). Equivalent to 800-Ω short-circuit noise resistance (wide-band).

DEFLECTION FACTOR
10 μV/cm to 10 V/cm in 19 calibrated steps, 1-2-5 sequence. Uncalibrated continuous variation between steps and to approx 25 V/cm.

BANDWIDTH
DC to 500 kHz; bandwidth independent of deflection factor. Selectable high and low-frequency 3-dB points.

HIGH-FREQUENCY 3-dB POINTS
500 kHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, 1 kHz, 300 Hz and 100 Hz.

LOW-FREQUENCY 3-dB POINTS
DC, 0.1 Hz, 1 Hz, 10 Hz, 100 Hz, 1 kHz and 10 kHz.

DC DRIFT
With time: ≤200 μV/h, averaged over 10 h, with ambient temperature and line voltage constant. With temperature: ≤150 μV/°C.

DEFLECTION FACTOR AND DC OFFSET		
V/CM ACCURACY	CALIBRATED DEFLECTION FACTOR	MAX DC OFFSET (approx)
2%	10 μV/cm, 20 μV/cm, and 50 μV/cm	±300 mV
1.5%	100 μV/cm to 10 mV/cm, in 1-2-5 sequence	±300 mV
2%	20 mV/cm, 50 mV/cm, and 0.1 V/cm.	±3 V
2%	0.2 V/cm, 0.5 V/cm, and 1 V/cm	±30 V
2%	2 V/cm, 5 V/cm and 10 V/cm	±300 V

INPUT NOISE
3.3 μV, RMS, maximum (not including drift). Equivalent to 800-Ω short-circuit noise resistance (wideband).

BALANCE CONTROLS
One front-panel control balances entire instrument. A non-interacting coarse control provides the proper operating range of the step attenuator DC BALANCE control. When instrument amplifier frequency response is limited by the LOW FREQ 3 dB POINT control, DC drift is eliminated, and DC balance controls are inoperative.

FRONT-PANEL SIGNAL OUTPUT
34 mV ±10%, per displayed cm. DC-coupled, internally adjustable to ground reference.

COMMON-MODE REJECTION RATIOS*			
FREQUENCY	REJECTION RATIO	SINEWAVE AMPLITUDE	DEFLECTION FACTOR
DC to 20 kHz	≥310,000:1 (110 dB)†	≤20 V P to P	10 μV/cm to 10 mV/cm
DC to 100 kHz	≥50,000:1	≤20 V P to P	10 μV/cm to 10 mV/cm
DC to 1 kHz	≥5,000:1†	≤200 V P to P	20 mV/cm to 10 V/cm
1 kHz to 100 kHz	≥500:1†	≤200 V P to P	20 mV/cm to 10 V/cm
60 Hz, AC-coupled at input	≥2000:1	20 V P to P	10 μV/cm to 10 mV/cm
		200 V P to P	20 mV/cm to 10 V/cm

*At 25° C ambient, with no DC offset.
†With internal adjustment.

DIFFERENTIAL OVERLOAD LIGHT
When lit, indicates excessive differential drive to input of amplifier.

INPUT RC
1 megohm, paralleled by 47 pF.

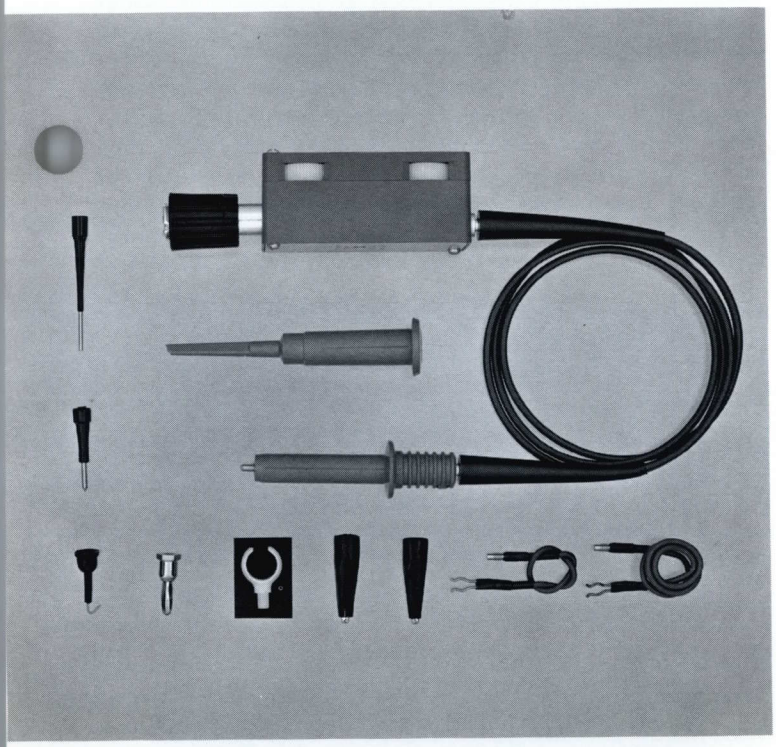
MAXIMUM INPUT VOLTAGE
200 V, combined DC and peak AC (60 Hz) from 10 μV/cm to 10 mV/cm. 600 V, combined DC and peak AC (60 Hz) from 20 mV/cm to 10 V/cm.

INPUT COUPLING
May be switched to AC, GND, or DC. Input coupling capacitor is automatically charged to proper voltage through a 1-megohm resistor when switch is in GND position.

WEIGHT
Net—4½ pounds. Shipping—9 pounds, approx.

TYPE 1A7 DIFFERENTIAL AMPLIFIER UNIT $425
Each instrument includes: 2—instruction manual (070-0379-00).

P6023 10X PROBE



The P6023 low-capacitance probe is well suited for use with most Tektronix differential units.

The probe can be adjusted to match plug-in unit input capacitance ranging from 20 pF to 50 pF. The X10 attenuation ratio is adjustable over a ±2.5% range to compensate for differences in the input resistance of the plug-in unit. When two P6023 probes are used to drive the two inputs of a differential amplifier, the ability to change the attenuation ratio of one probe versus the other helps to maintain the common-mode rejection ratio of the system.

ATTENUATION RATIO
10X, adjustable ±2.5%.

INPUT RESISTANCE
8 MΩ.

INPUT CAPACITANCE
Approximately 12 pF when used with an instrument having a 20 pF or 47 pF input capacitance.

PROBE RISETIME
Less than 7 ns.

VOLTAGE RATING
1000 V DC or AC peak to peak.

CABLE
3.5′ terminated with a locking BNC connector.

P6023 PROBE PACKAGE (010-0167-00) $40

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

SPECTRUM ANALYSIS

Present users of Tektronix Type 530, 540, 550 and (with adapter) 580-Series Oscilloscopes* can now achieve high-quality spectrum analysis at a fraction of the cost of other analyzers. A plug-in analyzer and oscilloscope offer several advantages over ordinary spectrum analyzers. The oscilloscope's calibrated time base and versatile triggering allow direct measurement of pulse repetition rate and provide stable displays even in the presence of interference. The oscilloscope also powers the analyzer, and displays the spectrum on its CRT. One oscilloscope then serves two functions: operates in the conventional time-based mode using Letter-Series or 1-Series Plug-In Units (or the analyzer's video input), operates in a frequency-based mode with the Type 1L10 1-to-36 MHz Analyzer, Type 1L20 10-to-4200 MHz Analyzer or Type 1L30 925-to-10500 MHz Analyzer.

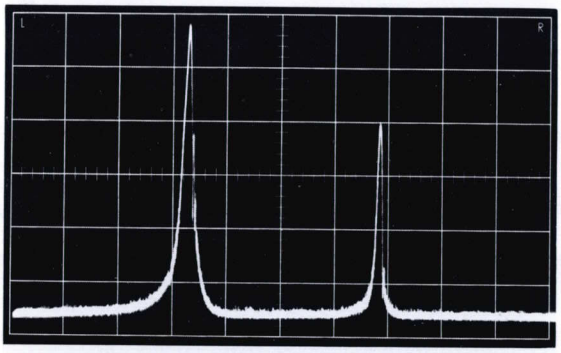
Typically, the Spectrum Analyzer Plug-In Unit selects a portion of the electromagnetic spectrum—as wide as 100 MHz, for example—and displays visually on the oscilloscope CRT all the radio activity occurring there. Within the portion of the spectrum that concerns you, any signal, amplitude or frequency modulated, pulsed carriers, etc.—is displayed as a series of "pips" on the CRT. CALIBRATED DISPERSION permits detailed study of the signal, with frequency difference read directly from the CRT. Signals separated by 10 Hz can be resolved with the Type 1L10; signals separated by 1 kHz can be resolved with the Type 1L20 or 1L30.

The dynamic range capability of the Tektronix Spectrum Analyzers is greatly increased by the inclusion of square-law and logarithmic detection modes as well as a linear mode. The ability to compress or expand signals greatly enhances the versatility of these instruments. Signals of very nearly the same amplitude can be displayed in the SQUARE-LAW MODE which expands the small difference to a proportion that facilitates measurements. Conversely, signals of greatly different amplitude (40 dB, for example) can be displayed in the LOG MODE which compresses the difference between them. In addition, the Analyzer's VIDEO INPUT allows conventional time-based displays from $\leq$16 Hz to $\geq$10 MHz.

The units manufactured by Tektronix are extremely sensitive and will give usable displays with inputs lower than —100 dBm. This represents a power level of 10^{-13} watts, using the conventional reference level of 0 dBm = one milliwatt.

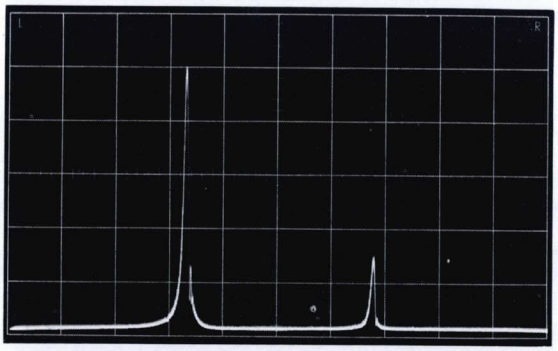
The usefulness of Tektronix Spectrum Analyzers extends into many measurement areas. They are used by Government Agencies to check the sidebands of radio-transmitting devices. Telephone companies find transmission-line carrier measurements quick and accurate, often providing data not obtainable by other means. Spectrum Analyzers are finding increased use in missile projects and the exploration of outer space, especially in association with the maintenance and trouble-shooting of telemetry equipment. They are indispensable to recently developed techniques of servicing radar and microwave equipment. You are encouraged to discuss your measurement and test problems with your Tektronix Field Engineer or Distributor.

*Type 3L10 1-to-36 MHz Analyzer fits Type 561A and Type 564 Oscilloscopes.

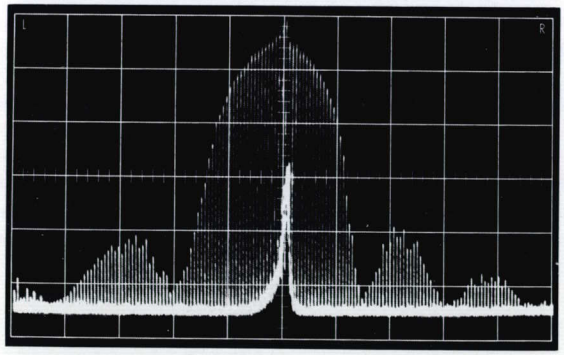


Log Detection Mode

500-Hz Modulation of 450-MHz Signal

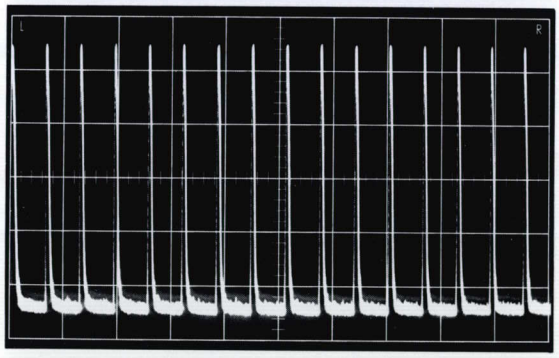


Linear Detection Mode



Repetition-Rate lines evident at 5 ms/cm
(Note: CW Feedthrough)

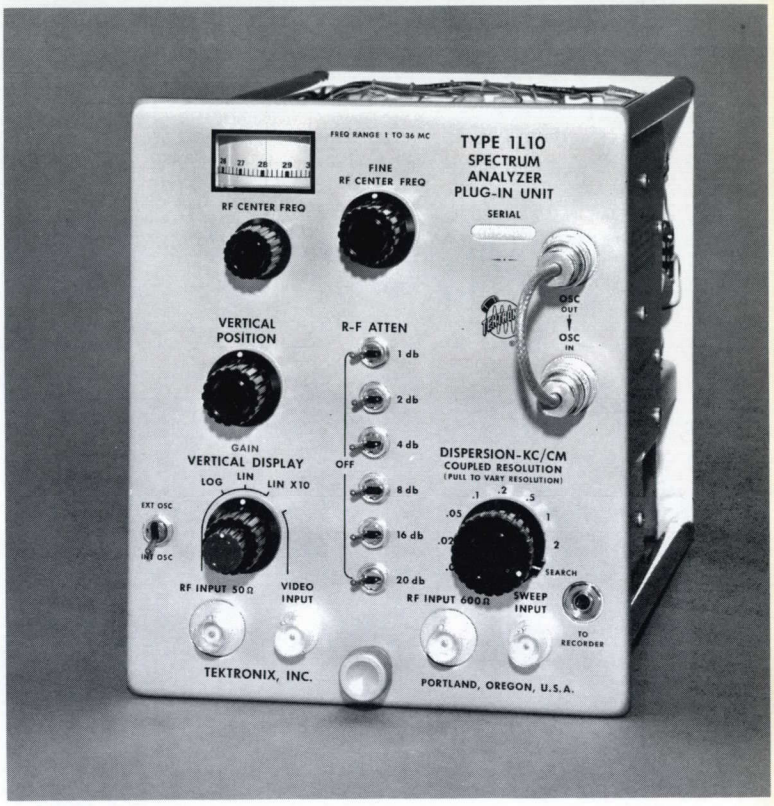
200-MHz Pulsed RF



Repetition-Rate measurement at 0.5 ms/cm
Zero Dispersion

1-to-36 MHz SPECTRUM ANALYZER Type 1L10

- *CALIBRATED DISPERSION*
- *COUPLED RESOLUTION*
- *CRYSTAL-CONTROLLED SWEPT OSCILLATOR*
- *IMAGE REJECTION*
- *RECORDER OUTPUT*
- *STORED SPECTRAL DISPLAYS*
  with Type 549 Oscilloscope



1 to 36-Mc spectral displays can now be viewed on any Tektronix Type 530, 540, 550 or (with adapter) 580-Series Oscilloscope. The new Type 549 Oscilloscope adds further convenience to spectrum analysis—allowing storage and simultaneous comparison of spectral displays.

CALIBRATED DISPERSION from 10 cps/cm to 2 kc/cm makes frequency measurement as easy and accurate as time measurement. Frequency differences can be read directly from the CRT. The SEARCH MODE permits rapid location of signals for analysis.

COUPLED RESOLUTION from 10 cps to 1 kc greatly simplifies operation, providing narrow resolution bandwidth at narrow dispersion and wide resolution bandwidth at wide dispersion. Dispersion and resolution controls can be uncoupled and operated separately if desired, for optimized viewing of a particular signal.

IF stability is achieved through use of CRYSTAL-CONTROLLED OSCILLATORS. Even the swept local oscillator is controlled through a crystal discriminator. An external, front-end crystal-operated oscillator can be connected through a front-panel patch arrangement to provide added stability to spectral displays within or outside the normal 1 to 36-Mc range of the Type 1L10.

IMAGE REJECTION is achieved through use of a 60-Mc first IF amplifier which places images at more than twice the upper tuning frequency of the Type 1L10.

FREQUENCY RANGE
1 to 36 Mc, fine and coarse tuning.
Dial Accuracy within ± (100 kc + 1% of reading).

SENSITIVITY (50 Ω INPUT)
—100 dbm, measured at 2 kc/cm dispersion and 1 kc (coupled) resolution.

FREQUENCY STABILITY
IF within 2 p/m per °F change, 1 p/m per 1 V line change.
LO within 150 p/m per °F change, 10 p/m per 1 V line change.

MAXIMUM FM
IF within 5 cps.
LO within 25 cps + 1 cps/Mc dial frequency.

CALIBRATED DISPERSION
0.01 kc/cm to 2 kc/cm, 8 steps, 1-2-5 sequence.
Accuracy within ±3% when adjusted for individual oscilloscope, within ±7% without adjustment. Dispersion linearity within ±5%. Search position (uncalibrated)—minimum 20 kc + 1 kc/Mc dial frequency full scale (10 cm).

COUPLED RESOLUTION
10 cps to 1 kc, coupled with calibrated dispersion positions, and separately switchable. Search position—approximately 10 kc.

DISPLAY FLATNESS
±1 db.

INPUT IMPEDANCE
Approx 50 Ω and approx 600 Ω.

MAXIMUM INPUT POWER
+24 dbm at full RF attenuation, —20 dbm without RF attenuation.

RF ATTENUATOR
51 db ±0.1 db/db in 1-db steps.
½ watt maximum power-handling capability.

IF GAIN CONTROL
>60 db range.

VERTICAL DISPLAY
Log—50-db dynamic range over 6 cm.
Linear—26-db dynamic range over 6 cm.
Linear X10—26-db dynamic range over 6 cm.
Video—100 mV/cm (variable), ≤16 cps to ≥10 Mc, approx 50-Ω input resistance.

RECORDER OUTPUT
DC-coupled, approx 600-Ω source resistance, 15 mV/cm display in Linear mode, output linear with voltage.

WEIGHT
Net—6 pounds, shipping—10 pounds, approx.

TYPE 1L10 SPECTRUM ANALYZER UNIT $1100
Each instrument includes: 1—cable assembly, BNC to BNC, 2½" (012-0097-00); 1—cable assembly, BNC to banana plug, 24" (012-0096-00); 1—tini-plug (134-0052-00); 2—instruction manual (070-0510-00).

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

Type 1L20 / 1L30 MULTI-BAND SPECTRUM ANALYZERS

TYPE 1L20 covers 10 MHz to 4.2 GHz.

- ***PHASE LOCK***
  for stability at minimum dispersion
- ***CALIBRATED DISPERSION***
  from 1 kHz/cm to 10 MHz/cm
- ***COUPLED RESOLUTION***
  1 kHz to 100 kHz
- ***±1.5 dB DISPLAY FLATNESS***
  over 100 MHz dispersion
- ***RECORDER OUTPUT***
  for chart recorders
- ***STORED SPECTRAL DISPLAYS***
  with Type 549 Oscilloscope

Type 1L30 covers 925 MHz to 10.5 GHz

New operating convenience and state-of-the-art performance is now offered in multi-band plug-in units for all present Tektronix Type 530, 540, 550, or (with adapter) 580-Series Oscilloscopes. The new Type 549 Oscilloscope adds further convenience to spectrum analysis—allowing storage and simultaneous comparison of spectral displays.

BUILT IN PHASE LOCK circuit synchronizes the analyzer local oscillator with a stable reference frequency (internal 1 MHz or external 1 to 5 MHz). When the local oscillator is locked in phase to the reference frequency, the local oscillator stability approaches that of the reference frequency. This allows very narrow dispersion at high frequencies where the analyzer would normally be limited by oscillator drift, microphonics, and other perturbations. Phase lock can be used to view any signal within the tuning range of the analyzer.

CALIBRATED DISPERSION from 1 kHz/cm to 10 MHz/cm makes frequency measurement as easy and accurate as time measurement. Frequency differences can be read directly from the CRT.

COUPLED RESOLUTION from 1 kHz to 100 kHz greatly simplifies operation, providing narrow resolution bandwidth at narrow dispersion and wide resolution bandwidth at wide dispersion. Dispersion and resolution controls can be uncoupled and operated separately if desired, for optimized viewing of a particular signal.

CHARACTERISTICS	BAND	TYPE 1L20	TYPE 1L30
FREQUENCY RANGE (MHz)	1	10 to 275	925 to ≈2000
	2	275 to 900	≈2000 to 4100
	3	850 to 2000	4100 to 6250
	4	1950 to 3100	6200 to 8400
	5	3000 to 4200	8300 to 10,500
SENSITIVITY measured at 5 kHz/cm dispersion, 1 kHz resolution	1	—100 dBm	—105 dBm
	2	—110 dBm	—100 dBm
	3	—100 dBm	—95 dBm
	4	—95 dBm	—90 dBm
	5	—90 dBm	—75 dBm

DIAL ACCURACY
± (2 MHz + 1% of dial reading).

IF CENTER FREQUENCY
+ and —, 5 turn Coarse and a Fine control, ±25 MHz windowing (from center frequency) from 5 MHz/cm to 0.2 MHz/cm dispersion positions, ±2.5 MHz windowing from 500 kHz/cm to 1 kHz/cm dispersion positions.

CALIBRATED DISPERSION
1 kHz/cm to 10 MHz/cm in 1-2-5 sequence, 2 ranges (kHz/cm—MHz/cm). Accuracy of 10-cm display, throughout full range of IF center frequency control, within ±3% except at 2 MHz/cm (±5%) and 1 MHz/cm (±7%). Accuracy can be increased using internal 1-MHz crystal markers for calibration. Dispersion linearity within ±3%. Zero dispersion useful for PRF measurements.

COUPLED RESOLUTION
1 kHz to 100 kHz, coupled with calibrated dispersion positions but separately switchable.

DISPLAY FLATNESS
±1.5 dB over 100-MHz dispersion, except over ±25 MHz for Band 1 of Type 1L20.

INCIDENTAL FM
Less than 300 Hz at fundamental, with Phase Lock.

FREQUENCY STABILITY
kHz/cm dispersion range—±10 kHz from 103.5 to 126.5 VAC after 1 minute; ±5 kHz/°C. MHz/cm dispersion range—±200 kHz from 103.5 to 126.5 VAC after 1 minute; ±20 kHz/°C. 1 MHz internal markers—0.01% (100 Hz).

PHASE LOCK
Internal 1-MHz reference accurate within 0.01%. External input accepts 1-MHz to 5-MHz signals from 1 V to 5 V peak to peak.

INPUT IMPEDANCE
Approx 50 Ω.

MAXIMUM INPUT POWER
—30 dBm for linear operation.

IF ATTENUATOR
51 dB in 1-dB steps, ±0.1 dB/dB.

IF GAIN CONTROL
>50 dB range.

VERTICAL DISPLAY (6 CM)
Log—≥40-dB dynamic range.
Linear—≥26-dB dynamic range.
Square Law—≥13-dB total dynamic range.
Video— ≤16 Hz to ≥10 MHz, approx 50-Ω input resistance.

RECORDER OUTPUT
1.5 mV/cm in Linear Display, DC-coupled, approx 600-Ω source resistance.

+10 V DC OUTPUT
Provides external accessory power, +10 V ±5%, 20 mA maximum.

WEIGHT
Net weight approx 7½ pounds for Type 1L20, approx 7 pounds for Type 1L30. Shipping weight approx 11 pounds each.

TYPE 1L20 SPECTRUM ANALYZER UNIT $1825
Each instrument includes: 1—patch cord, BNC to banana (012-0091-00); 1—protector plug (134-0076-00); 1—tini-plug (134-0052-00); 2—instruction manual (070-0519-00).

TYPE 1L30 SPECTRUM ANALYZER UNIT $1825
Each instrument includes: 1—patch cord, BNC to banana (012-0091-00); 1—protector plug (134-0076-00); 1—tini-plug (134-0052-00); 2—instruction manual (070-0520-00).

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

Type 1S1 WIDE-BAND SAMPLING UNIT

- *INTERNAL TRIGGERING*
- *INTERNAL DELAY LINE*
- *DIRECT-READING MAGNIFIER*
- *LOW DISPLAY NOISE*

Used with any of the Type 530, 540, 550 or 580*-Series Oscilloscopes, the Type 1S1 Sampling Unit extends the measuring capabilities to 1 gigahertz. Operation is like a conventional oscilloscope—but with a combination of bandwidth and sensitivity possible only through sampling.

The Type 1S1 features internal triggering with a built-in delay line—no need for pretriggers or external delay lines. The tunnel-diode trigger circuit assures stable triggering through 1 gigahertz. Calibrated sweep ranges are from 100 ps/cm to 50 μs/cm. A single control is used to select the sweep range and magnify the display up to X100 when desired. This single-control feature allows direct read-out of the sweep range even when magnified.

Calibrated vertical deflection factors range from 2 mV/cm to 200 mV/cm. Noise in the display is less than 1 mV, and can be reduced by a smoothing control. A DC-offset control permits observation of millivolt signals in the presence of up to ±1 volt input levels. Output signals are available at the front panel for driving chart recorders.

VERTICAL SYSTEM

RISETIME
Less than or equal to 0.35 ns.

DEFLECTION FACTOR
7 calibrated steps from 2 mV/cm through 200 mV/cm. Variable between steps, extending to 500 μV/cm (uncalibrated)

NOISE
Less than 1 mV. Can be reduced to less than 500 μV with smoothing control.

INPUT IMPEDANCE
50 Ω nominal.

DYNAMIC RANGE
±2 V. Deflection factors to 2 mV/cm can be used with signals up to ±2 volts in amplitude. Safe overload is ±5 V (higher with reduced duty factor).

DC OFFSET
Range is ±1 V. OUTPUT: (for monitoring the DC-offset level) ten times actual offset through 10 kΩ.

VERTICAL OUTPUT
200 mV per displayed centimeter through 10 kΩ.

*Type 81 Plug-In Adapter required.

HORIZONTAL SYSTEM

SWEEP RANGES
18 calibrated steps from 100 ps/cm to 50 μs/cm. ACCURACY: ±3% normal or magnified. Variable between steps, extending sweep range to 33 ps/cm (uncalibrated).

MAGNIFIER
Allows display to be magnified around a fixed time-reference point while maintaining a constant number of samples/cm. Provides magnification up to X100. Sweep range has direct read-out even when magnified.

TIME POSITION
Moves the displayed time window and positions the time-reference point for magnification. Range is 500 μs to 50 ns in 5 decade steps. Time position variables provide adjustment of delay from zero to the range step selected.

SAMPLES/CM
Continuously variable, allowing optimum adjustment of display rate and dot density.

TRIGGERING
3 trigger modes, AC-coupled: ±internal, ±external, and free run. EXTERNAL SENSITIVITY: 5 mV to 200 mV. RESPONSE: Sinewave triggering or synchronizing from 100 Hz through 1 GHz. Pulse triggering down to 10 p/s.

DISPLAY MODES
Repetitive, single display, manual scan, or external scan. Front-panel START button for single-display operation.

HORIZONTAL OUTPUT
1 V per displayed centimeter; 10 kΩ source impedance.

PROBE POWER OUTPUT

Front-panel connector for use with cathode-follower type probes, Type 281 TDR Pulser, and Type 282 Adapter for high-impedance probes.

DIMENSIONS AND WEIGHT

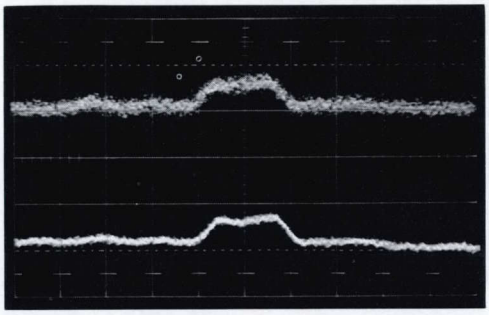
Dimensions—11½" long by 5⅞" wide by 6 15/16" deep.
Net weight—8 lbs. Shipping weight—11 lbs, approx.

TYPE 1S1 SAMPLING UNIT $1100

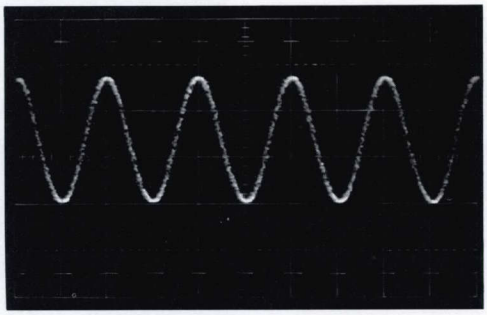
Each instrument includes: 1—cable, 5 ns, RG213 with GR connectors (017-0502-00); 1—cable, 50-Ω 10 ns, RG-58 with GR connectors (017-0501-00); 1—patch cord, 18" with banana connectors (012-0039-00); 2—attenuator, 10X, 50-Ω (017-0078-00); 1—adapter, GR-to-BNC female (017-0063-00); 1—adapter, GR-to-BNC male (017-0064-00); 2—instruction manual (070-0475-00).

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

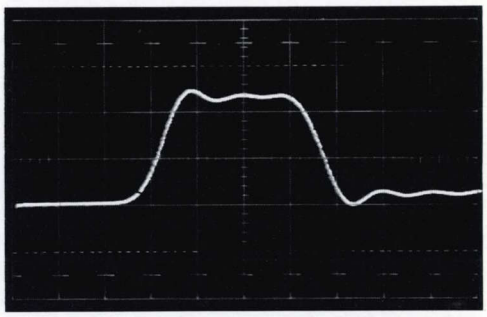
THE WAVEFORM PHOTOGRAPHS BELOW ILLUSTRATE THE PERFORMANCE CAPABILITIES OF THE TYPE 1S1 SAMPLING UNIT. THESE INCLUDE LOW INHERENT DISPLAY NOISE, STABLE TRIGGERING, REAL-TIME SAMPLING, PLUS TYPICAL TIME-DOMAIN REFLECTOMETRY MEASUREMENTS.



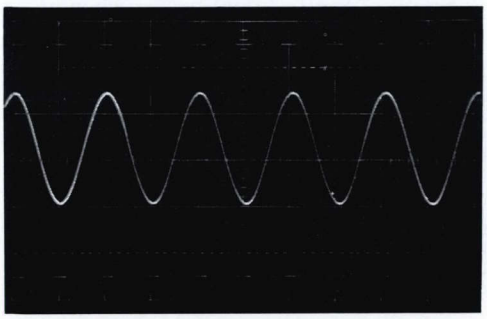
TANGENTIAL NOISE
A 1-mV, 2-ns wide pulse externally triggered. Upper waveform is unsmoothed. The lower is smoothed.
Vert: 2 mV/cm
Horiz: 1 ns/cm



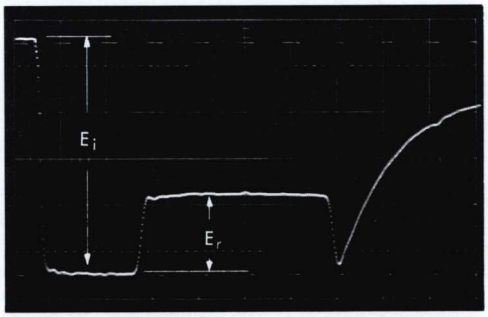
TRIGGERING AT 1 GHz
A 1-GHz sinewave; internally triggered.
Vert: 100 mV/cm
Horiz: 0.5 ns/cm



PULSE TRIGGERING
A 50-mV, 2-ns wide pulse; internally triggered.
Vert: 20 mV/cm
Horiz: 0.5 ns/cm



REAL-TIME SAMPLING DISPLAY
A 100-Hz sinewave; Internal Main Frame triggering.
Vert: 100 mV/cm
(free running sampler)
Horiz: 0.5 ms/cm
(realtime—main frame)



TIME DOMAIN REFLECTOMETRY
The display shows a 50-Ω system with a transition to a 25-Ω system, terminated with an inductive load.
Vert: 100 mV/cm
Horiz: 5 ns/cm

TIME DOMAIN REFLECTOMETRY
The display shows a 50-Ω system with a transition to a 25-Ω system, terminated with a capacitive load.
Vert: 100 mV/cm
Horiz: 5 ns/cm

$$\rho = \frac{E_r}{E_i} \qquad Z_L = Z_o \frac{1 + \rho}{1 - \rho}$$

Type 1S2 REFLECTOMETER AND WIDEBAND SAMPLING UNIT

- VERTICAL CALIBRATION IN RHO (ρ) OR VOLTAGE
- HORIZONTAL CALIBRATION IN TIME OR DISTANCE
- TWO INTERNAL PULSE SOURCES
- LIGHTED READOUT OF HORIZONTAL SCALE FACTOR
- 90-ps GENERAL-PURPOSE SAMPLER

Time-domain reflectometry measurements are easier than ever to make! The Type 1S2 in any Tektronix Oscilloscope that accepts Letter and 1-Series Plug-Ins is a complete TDR measurement system.

The ≤90-ps risetime, 5-mV/div deflection factor and built-in triggering capability make the Type 1S2 useful in many other sampling measurements.

SYSTEM PERFORMANCE AS REFLECTOMETER

VERTICAL

SYSTEM RISETIME
≤140 ps, for the displayed reflection from an open-circuited 20-cm air line.

VERTICAL SCALE
Calibrated in ρ (rho) and volts: 0.005 ρ/div to 0.5 ρ/div or 5 mV/div to 500 mV/div in 7 calibrated steps (1-2-5 sequence), accuracy within ±3%. Continuously variable between steps, uncalibrated.

RESOLUTION
Reflection coefficients as small as 0.001 can be observed.

OFFSET RANGE
±2-V offset, monitorable at front panel, permits ±1% accuracy for slide-back measurements of either ρ or voltage.

VERTICAL OUTPUT
1 V for each major division of displayed signal, 10 kΩ ±1% source impedance.

HORIZONTAL

HORIZONTAL SCALE
Calibrated in distance and time: full-scale, 10-div display (without magnification) of 10 m, 100 m, or 1 km; 100 ns, 1 μs, or 10 μs. Accuracy is ±3% with or without magnification.

MAGNIFIER
X1 to X100 in 7 calibrated steps (1-2-5 sequence). Continuously variable between steps. Allows display to be magnified from a fixed on-screen reference point: 1 major division from the left edge of the graticule.

UNITS/DIV CALCULATOR
Horizontal scale factor (combination of horizontal range and magnification settings) readout directly at front panel, indicates either distance or time/div.

DISTANCE OR TIME POSITION
Ten-turn dial directly reads one-way distance or round-trip time to test-line discontinuity. Round-trip time readings are accurate to within ±2%. Range of 10-turn dial is the same as the full-scale, 10-div display without magnification.

JITTER
≤20 ps with internal pulse sources.

DIELECTRIC
Calibrated for air, Teflon*, and polyethylene lines. Preset mode adjustable for lines with velocity of propagation from 0.6 to 1.0X velocity of light.

DISPLAY MODES
Repetitive or single sweep, manual or external scan.

HORIZONTAL OUTPUT
1 V for each major division of displayed signal, 10 kΩ ±1% source impedance.

PULSE SOURCES

FAST-RISE OUTPUT
Approximately 50-ps risetime at approximately 250 mV, 50 Ω ±1% (reverse terminated).

LARGE-AMPLITUDE OUTPUT
Approximately 1-ns risetime at approximately 1.0 V, 50 Ω ±1% (reverse terminated).

*Registered Trade-Mark E.I. du Pont de Nemours & Co.

PERFORMANCE AS GENERAL-PURPOSE SAMPLER

RISETIME
≤90 ps.

TRIGGERING
±Pulses: 10 Hz to 5 GHz, 50 mV to 1 V. Sinewaves: 100 kHz to 5 GHz, 50 mV to 1 V.

DYNAMIC RANGE
±2 V, ±5 V safe overload.

NOISE
Less than 2 mV.

TYPE 1S2 SAMPLING UNIT $1300

Each instrument includes: 2—GR elbows (017-0070-00); 1—5X attenuator (017-0079-00); 1—2X attenuator (017-0080-00); 1—50-Ω termination (017-0081-00); 1—20-cm airline (017-0084-00); 1—5-ns RG 8/AU (017-0502-00); 1—18″ patch cord (012-0031-00); 2—instruction manual (070-0543-00).

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

HOW THE MEASUREMENT IS MADE

Two methods may be used to determine the time or distance between the incident pulse and a discontinuity in the line. First, the dielectric selector and range selector are set for the particular line to be tested (in this case air and 10 m respectively). With the calibrated 10-turn position control set at zero, the incident pulse (the Type 1S2 has 2 internal pulse sources) is automatically aligned with the graticule reference line 1 major division from the left edge of the display. This is still true if another range is selected. A discontinuity is observed approximately 3.5 div to the right of the incident pulse (Fig 1). Since this discontinuity is quite short, X2 magnification is used for more detailed examination (Fig 2).

The first method utilizes the horizontal units/div calculator on the front panel. The 50 cm/div indication takes into consideration the 10-m full scale range (1 m/div) and X2 magnification. The CRT now indicates the discontinuity approximately 7 div to the right of the incident pulse. At 50 cm/div, the discontinuity is located about 350 cm down the line.

The second method allows measurement accuracy to within ±2%, utilizing the calibrated 10-turn control. As this control is turned from its zero setting, the entire display (incident pulse and discontinuity) moves to the left (Fig 3). When the discontinuity is aligned with the graticule reference line, the position control directly reads position as a percentage of position range (amount of delay). The position control in our example now reads 0.36, indicating the discontinuity at 360 cm.

There are also two methods of determining the reflection coefficient or voltage amplitude of the discontinuity. The measurement can be made directly from the CRT (divisions of deflection times vertical units/div control setting). A more accurate method utilizes the ±2-V offset and offset output. With a null volt-meter connected to the front-panel offset output, the baseline just preceding the reflection is aligned with a graticule line; the meter reading is then noted (Fig 4). The reflection is then repositioned (using the offset control) to align the peak of the reflection with the same graticule line (Fig 5). The difference between the present meter reading and the preceding one is the actual amplitude of the reflection. The meter reading in volts is equivalent to the numerical value of ρ when the ρ — volts switch on the Type 1S2 is in the ρ position; the meter reading is in volts with the switch in the volts position.

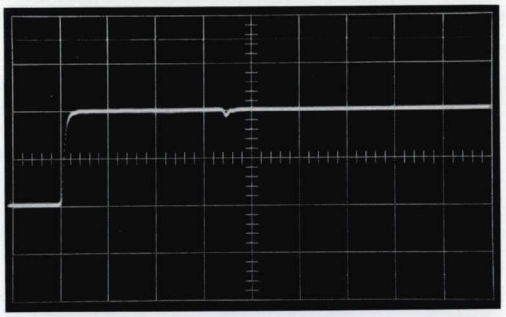


Fig 1 Vertical: ρ = 0.5/div Horizontal: 100 cm/div

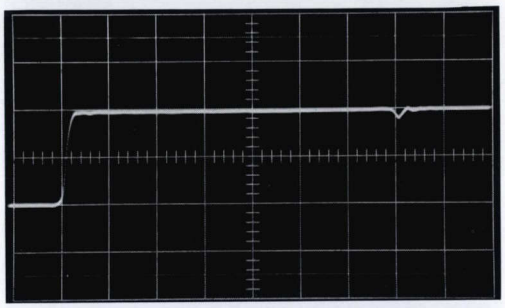


Fig 2 Vertical: ρ = 0.5/div Horizontal: 50 cm/div

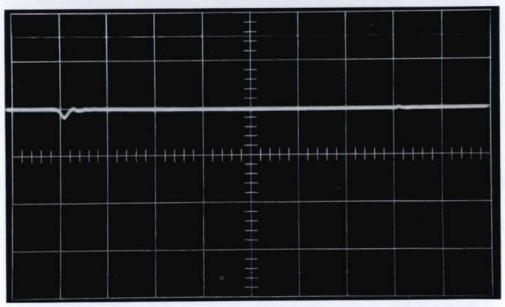


Fig 3 Vertical: ρ = 0.5/div Horizontal: 50 cm/div

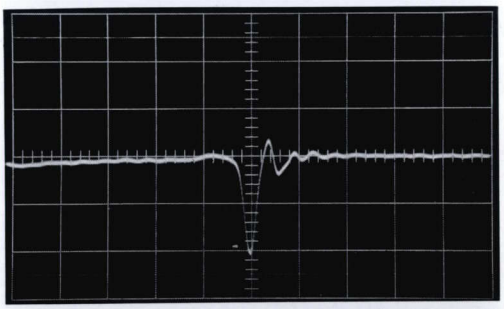


Fig 4 Vertical: ρ = 0.05/div Horizontal: 20 cm/div

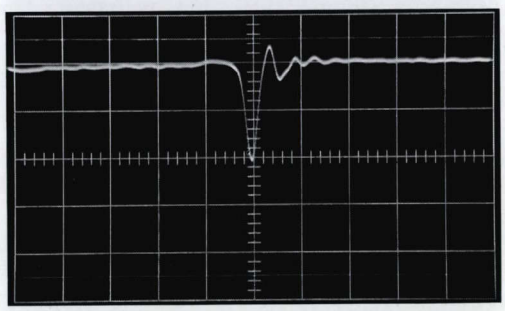
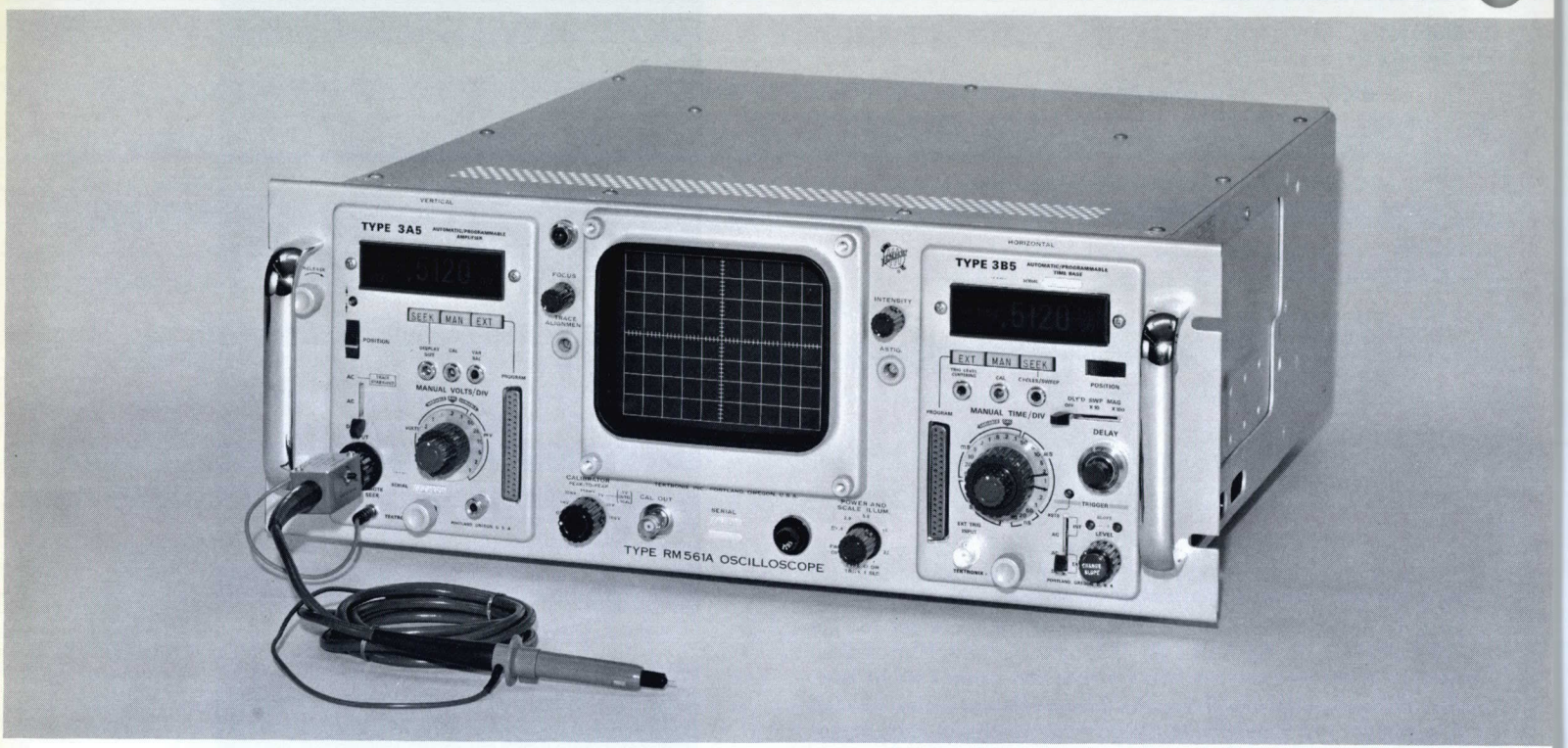


Fig 5 Vertical: ρ = 0.05/div Horizontal: 20 cm/div

Type 561A / RM561A OSCILLOSCOPE



- *R & D TO PRODUCTION APPLICATIONS*
- *SPECTRUM ANALYSIS OR AUTOMATIC DC-15 MHz SYSTEMS BY PLUG-IN VERSATILITY*
- *ILLUMINATED NO-PARALLAX GRATICULE*
- *X-Y DISPLAYS*

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics are extremely flexible through use of 2-Series and 3-Series Plug-In Units.

HORIZONTAL

Horizontal deflection characteristics are extremely flexible through use of versatile time-base units and amplifiers of the 2-Series and 3-Series Plug-In Units.

CRT

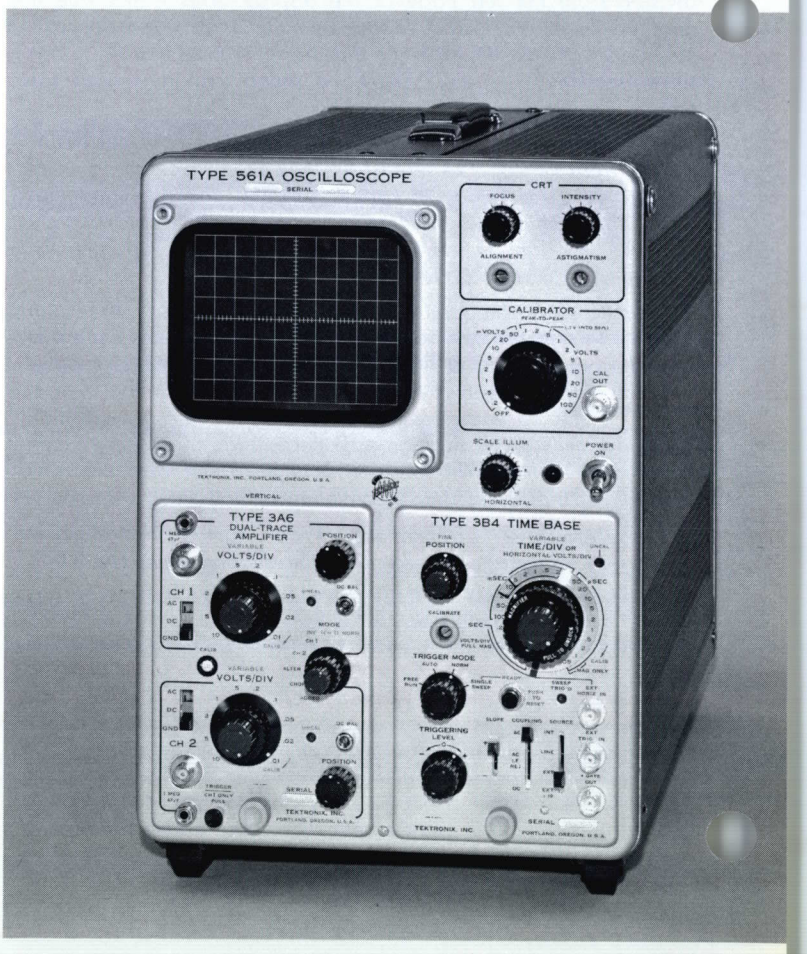
DISPLAY AREA—8 x 10 cm.

ACCELERATING VOLTAGE—3.5 kV.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V (561A), 10 V to 100 V (RM561A), and 0.1 V into 50 Ω, power line frequency.

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 50 to 400 Hz (561A), 50 to 60 Hz (RM561A), 240 watts maximum.



High in performance, low in cost, the Type 561A and Type RM561A Oscilloscopes represent an advance in value and versatility in the Type 560-Series Oscilloscopes.

Conventional operation extends to the 15-MHz range, with sub-nanosecond capabilities available, through the use of sampling plug-in units.

The Type 561A and RM561A use plug-in units for both the vertical and horizontal deflection systems. New plug-in units have extended the capability of these instruments to spectrum analysis, operational amplifiers, and automatic seeking amplifier-time base combinations.

Both the Type 561A and the Type RM561A use a cathode-ray tube that features an internal graticule with controllable illumination. Thus, you can take photographs with the same ease, but without the parallax of the external graticule.

Occupying only 7 inches of rack height, the Type RM561A bolts directly to the rack but may be ordered with optional slide-out tracks at additional cost.

CONVENTIONAL DISPLAYS

A wide range of non-sampling bandwidths and deflection factors are available in the selection of 2-Series and 3-Series Amplifier Plug-In Units. These include both single-trace and multi-trace units. The Types 2A61, 2A63, 3A3, and 3A7 are differential amplifier units while the Type 3C66 is useful for strain-gage and similar transducer operations.

Normal sweep, single sweep, magnified or delayed sweep is available with the group of 2-Series and 3-Series time-base plug-in units.

AUTOMATIC SEEKING

The Types 3A5 Amplifier (DC — 15 MHz) and 3B5 Time-Base are automatic-seeking plug-in units. These units, when commanded, have the ability to sense voltage levels and time changes and adjust their circuitry to present calibrated on-screen displays.

SAMPLING DISPLAYS

The Type 3T77A and 3T4 Sampling Sweep Units with either a Type 3S3 or Type 3S76 Amplifier Unit give a dual-trace sampling system with risetimes in the subnanosecond region. The Type 3S3 provides a system with a high-impedance low-capacity input while the Type 3S76 provides a 50-ohm input system.

SPECTRUM ANALYSIS

The Type 3L10 Spectrum Analyzer Plug-In Unit covers the 1-36 MHz range. This plug-in unit with a sensitivity of —100 dBm and calibrated dispersion allows the display of RF signals with a resolution of 10 Hz to 1 kHz.

X-Y DISPLAYS

The Types 2A60, 2A63, 3A3, 3A72, 3A74, and 3A75 Amplifier Plug-In 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. Plug-In units other than these listed above are not recommended for X-Y displays.

For medium and high-frequency X-Y operation, use of two units of the same type is recommended. Deflection-circuit 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

Using two type 3A72 or two Type 3A74 Plug-In Units, both synchronization and automatic pairing are provided. With two 3A72's operated X-Y in the dual-trace mode, Channel 1 of the left-hand plug-in is always plotted against Channel 1 of the right-hand plug-in. With two Type 3A74's, two, three, or four independent displays may be obtained, properly paired: Channel 4 versus Channel 4, Channel 3 versus Channel 3, etc. . . .

Using two Type 3A1 or two Type 3A6 Plug-In Units, dual-trace switching is not synchronized. Dual X-Y displays within the center 8 cm x 8 cm area of the graticule may be obtained, but one plug-in or the other must usually be limited to single-trace operation unless four displays are wanted.

Using two Type 3A3 Plug-In Units, dual-trace switching is synchronized, so one Y Channel remains plotted against the same X Channel once the display is set up. There is no provision for consistent pairing each time the system is operated.

As with single X-Y displays, two plug-ins of the same type should always be used where X-Y phase relationships are to be preserved.

RASTER GENERATION

A raster display can be presented by using two time-base plug-in units, one in each compartment. Signal modulation can be achieved through the Z-axis of the CRT.

TYPE 561A CHARACTERISTICS

PLUG-IN COMPARTMENTS

Accepts all 2-Series and 3-Series Amplifier and Time-Base Units.

TEKTRONIX CRT

Flat-faced rectangular 5" tube with internal "no parallax" graticule, controllable edge-lighting, 3.5-kV monoaccelerator, beam-deflection unblanking. A P31 Phosphor is normally supplied.

DISPLAY CONTROLS

Front-panel controls include Focus, Intensity, and Scale Illumination (of the 8-cm by 10-cm display area), in addition to screwdriver adjustments for Astigmatism and Trace Alignment.

ILLUMINATED INTERNAL GRATICULE

Edge lighted graticule marked in 8 vertical and 10 horizontal cm divisions. The centerlines are marked every 2 mm. Illumination is controlled by a front-panel knob.

Z-AXIS INPUT

Accessible through a terminal at the rear of the instrument permits external modulation of the CRT cathode.

CALIBRATOR

18 calibrated squarewave voltages available, from 0.2 mV to 100 V, peak to peak—approximately 5-μs risetime, at line frequency. For 50 Ω systems the 0.5 V position provides 0.1 V into 50 ohms for convenient amplitude calibration of sampling units.

ELECTRONICALLY-REGULATED SUPPLIES

All voltages required for proper operation of the indicator and the plug-in units are regulated. DC-supply operates with line voltage between 105 V to 125 V or 210 V to 250 V, 50 to 400 Hz . . . provides 85 watts for powering the 2-Series and 3-Series Plug-In Units. Supplies operate normally with or without plug-ins.

POWER REQUIREMENT

105 V to 125 V, 50 to 400 Hz; 240 watts maximum. Unit factory wired for 117 V.

561A
RM561A

2-SERIES AND 3-SERIES AMPLIFIER PLUG-IN UNITS				
Type	INPUT RC (AC or DC coupled)	BANDWIDTH (—3 dB)	CALIBRATED DEFLECTION FACTOR	PRICE
2A60—Single Trace	1 megohm—47 pF, 600 V max	DC—1 MHz	50 mV/div—50 V/div, 4 decade steps, with variable control.	$105
2A61—Differential (low level)	10 megohm—50 pF, ±5 V (AC-coupled only)	0.06 Hz—300 kHz	10 μV/div—20 mV/div, 1-2-5 sequence, with variable control.	385
2A63—Differential (50:1 rejection ratio)	1 megohm—47 pF, 600 volts max	DC—300 kHz	1 mV/div—20 V/div, 1-2-5 sequence, with variable control.	150
3A1—Dual Trace (identical channels)		DC—10 MHz	10 mV/div—10 V/div, 1-2-5 sequence, with variable control.	450
3A3—Dual Trace Differential		DC—500 kHz	100 μV/div—10 V/div, 1-2-5 sequence, with variable control.	790
3A5 Automatic/ Programmable	1 megohm—24 pF	DC—15 MHz	1 mV/div—50 V/div, 1-2-5 sequence, with variable control.	760
3A6—Dual Trace (identical channels)	1 megohm—47 pF, 600 volts max	DC—10 MHz (has delay line)	10 mV/div—10 V/div, 1-2-5 sequence, with variable control.	540
3A7—Differential Comparator	1 megohm—20 pF	DC—10 MHz	1 mV/div—50 V/div, 1-2-5 sequence, with variable control.	635
3A8—Operational Amplifier	1 megohm—47 pF, 600 volts max	DC—3.5 MHz	0.2 V/div—10 V/div, 1-2-5 sequence, with variable control.	600
3A72—Dual Trace (identical channels)		DC—650 kHz	10 mV/div—20 V/div, 1-2-5 sequence, with variable control.	275
3A74—Four Trace (identical channels)		DC—2 MHz	20 mV/div—10 V/div, 1-2-5 sequence, with variable control.	590
3A75—Single Trace		DC—4 MHz	50 mV/div—20 V/div, 1-2-5 sequence, with variable control.	175
3C66—Carrier Amplifier	120-Ω strain-gage bridge	DC—5 kHz (70 μs risetime)	10 μstrain/div—10,000 μstrain/div, 1-2-5 sequence, with variable control.	400
3L10—Spectrum Analyzer	approx 50 Ω approx 600 Ω	1—36 MHz	sensitivity —100 dBm	1200
3S3—Dual Trace Sampling (for use with 3T77A)	100 kΩ — 2 pF, ±3 volts max	equivalent DC—1 GHz (0.35 ns risetime)	5 mV/div—100 mV/div, 1-2-5 sequence, with variable control.	1500 (with probes)
3S76—Dual Trace Sampling (for use with 3T77A)	50 ohms DC-coupled	equivalent DC—875 MHz (0.4-ns risetime)	2 mV/div—200 mV/div, 1-2-5 sequence, with variable control.	1100

TIME-BASE UNITS				
TYPE	SWEEP RANGE	MAGNIFIER	FEATURES	PRICE
2B67	1 μs/div to 5 s/div	5X	Single sweep—triggering is internal, external, line, auto or free run.	$210
3B1 **3B3**	0.5 μs/div to 1 s/div	5X	3B1—Delayed sweep. 3B3—Calib Delayed sweep, single sweep.	535 585
3B4	0.2 μs/div to 1 s/div	1X to 50X	Single sweep—triggering is internal, external, line, auto or free-run.	400
3B5 Automatic/ Programmable	0.1 μs/div to 5 s/div	10X 100X	Calibrated delay magnifier automatic-seeking programmable.	890
3T4 Programmable Sampling	equiv to 1 ns/div to 200 μs/div	10X	Programmable sweep range, single sweep, manual scan, calibrated delay.	1300
3T77A Sampling	equiv to 0.2 ns/div to 10 μs/div	10X	Single sweep, manual scan, sweep delay.	650

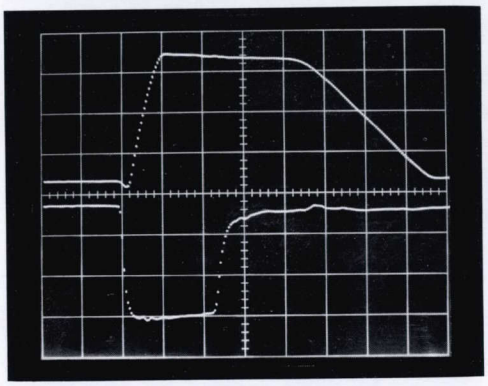
PARALLAX-FREE MEASUREMENTS—CONVENIENT PHOTOGRAPHY—

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 angle for all parts of the display.

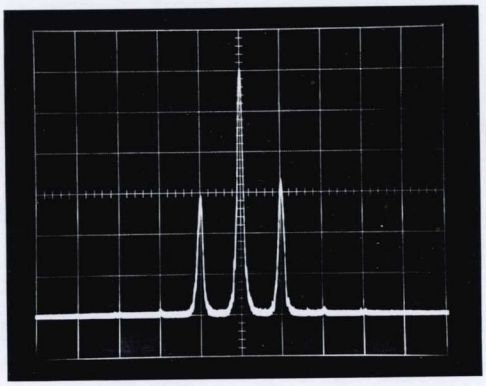
When the trace and graticule are on the same plane, as on the cathode-ray tube of the Type 561A and RM561A Oscilloscope, parallax is eliminated.

Controllable illumination of the internal graticule 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.

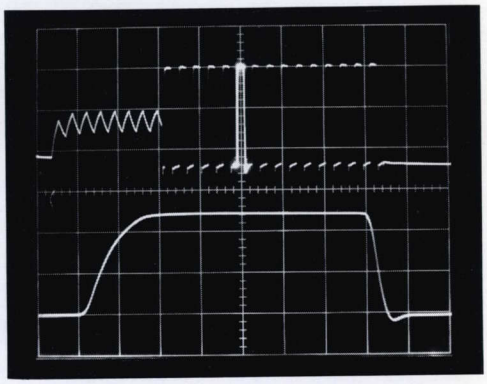
Adding to the convenience of operation the Type RM561A has numbered settings of the illumination control that serve as an approximate exposure guide.



SAMPLING
Transistor turn-on and turn-off (upper trace). Driving pulse lower trace).



SPECTRUM ANALYZER
Waveform showing center frequency and two sidebands.



DELAYING SWEEP (Double exposure)
Intensified portion of waveform (upper trace) expanded (lower trace) by means of delayed sweep.

MECHANICAL SPECIFICATIONS (561A)

14½" high, 10" wide, 21⅛" deep. Net weight is 28 pounds. Shipping weight is 39 pounds, approx.

TYPE 561A, without plug-in units $500

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—plate, protector, CRT, clear (387-0935-00); 1—filter, smoke gray (installed) (378-0560-00); 1—patch cord, BNC-to-BNC, 18", red (012-0087-00); 1—patch cord, BNC-to-banana plug, 18", red (012-0091-00); 1—post jack, BNC, red (012-0092-00); 2—instruction manual (070-0342-00).

RACK MOUNT MODEL

TYPE RM561A is electrically identical to the Type 561A except the calibrator range is from 1 mV to 100 V and the line frequency range is 50 to 60 Hz. The RM561A mounts on a standard 19" rack; is 7" high and 18⅜" deep. (Additional mounting information on the Catalog Instrument Dimensions page.) Net weight is 30½ pounds. Shipping weight is 54 pounds, approx.

TYPE RM561A, without plug-in units $550

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—plate, protector, CRT, clear (387-0935-00); 1—filter, smoke gray (installed) (378-0560-00); 1—patch cord, BNC-to-BNC, 18", red (012-0087-00); 1—patch cord, BNC-to-banana plug, 18", red (012-0091-00); 1—post jack, BNC, red (012-0092-00); 1—set mounting hardware; 2—instruction manual (070-0352-00).

TYPE RM561A WITH SLIDE-OUT TRACKS

A slide-out track kit can be used to mount the RM561A to a standard 19" rack. When mounted this way, the RM561A can be pulled out from the rack, tilted, and locked in any of 7 positions for convenient servicing. An RM561A with a slide-out track kit attached is available as MOD 171A. Slide-out track kits can also be ordered separately.

TYPE RM561A MOD 171A, without plug-in units . . $600

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—plate, protector, CRT, clear (387-0935-00); 1—filter, smoke gray (installed) (378-0560-00); 1—patch cord, BNC-to-BNC, 18", red (012-0087-00); 1—patch cord, BNC-to-banana plug, 18", red (012-0091-00); 1—post jack, BNC, red (012-0092-00); 1—set mounting hardware; 1—pr mounting tracks (315-0027-00); 2—instruction manual (070-0352-00).

SLIDE-OUT TRACK KIT (Part Number 351-0050-00) $45

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.

The following probes are recommended for use with most Type 2-Series and 3-Series Amplifier Plug-In Units.

See Accessory pages for further information on probes.

STANDARD PROBES

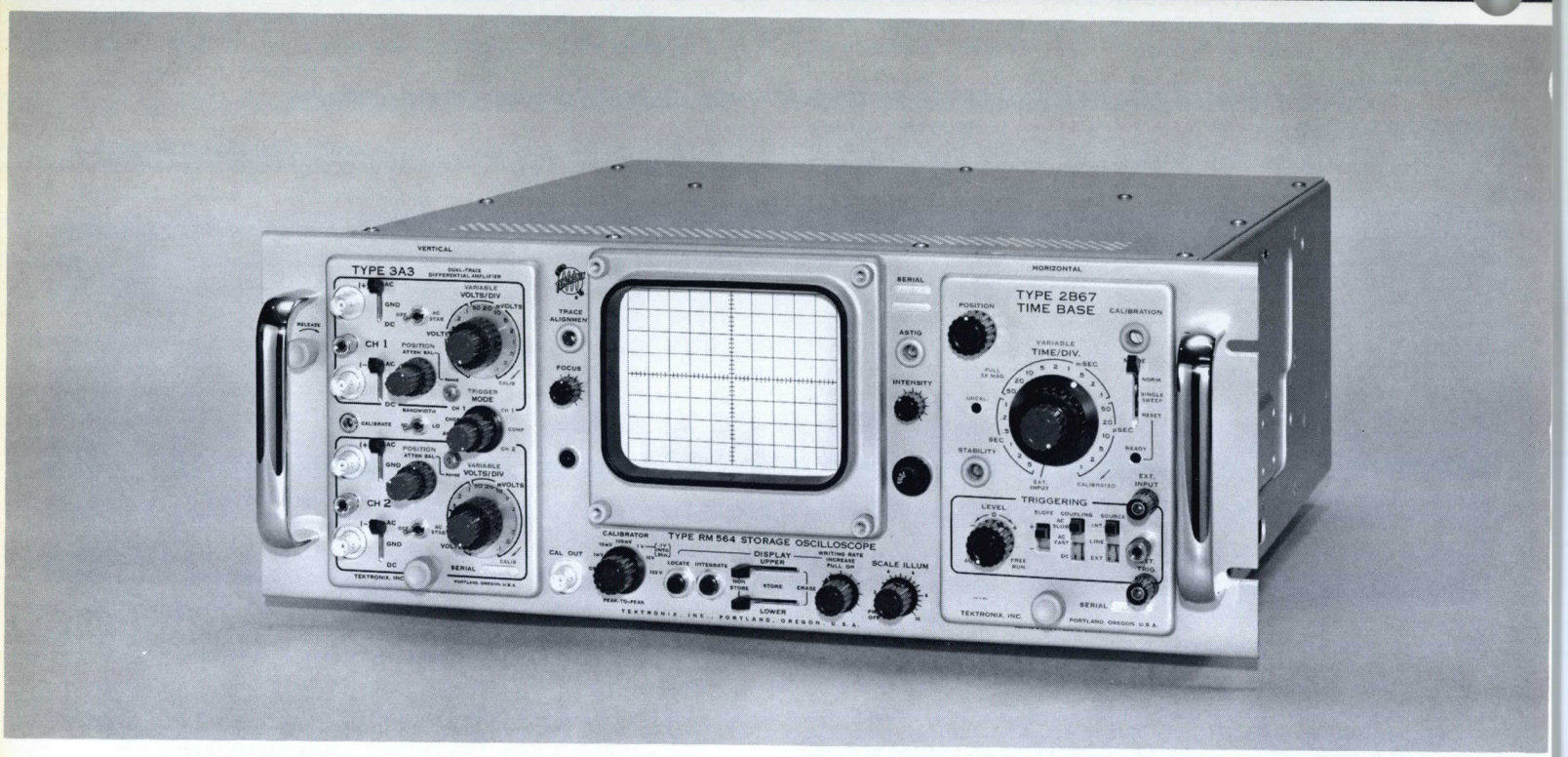
Use	Input Inductance R	C	Rating	Probe Number	Price
1:1 Attenuator	1 MΩ	97 pF	600 V max	P6028	$ 12.50
10:1 Attenuator	10 MΩ	9.5 pF	600 V max	P6006	22.00
1000:1 High Voltage	100 MΩ	3 pF	12 kV max	P6013	75.00
1000:1 High Voltage	100 MΩ	2.7 pF	40 kV max	P6015	200.00
Current			15 A max	P6019	75.00

SAMPLING PROBES

Use	Input Inductance R	C	Rating	Probe Number	Price
10:1 Attenuator	500 Ω	0.7 pF	16 VDC 500 VAC	P6034	$ 35.00
100:1 Attenuator	5 kΩ	0.6 pF	50 VDC 500 VAC	P6035	35.00
10:1 to 1000:1 CF	10 MΩ	varies	varies	P6032	220.00
Current			500 mA	CT1/P6040	31.00

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

Type 564 / RM 564 STORAGE OSCILLOSCOPE



- *SPLIT SCREEN STORAGE*
- *STORED DISPLAY TO ONE HOUR*
- *PLUG-IN VERSATILITY*
- *SPECTRUM ANALYSIS AND SAMPLING STORAGE*

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics are extremely flexible through use of 2-Series and 3-Series Plug-In Units. Full bandwidth capabilities of plug-in units available in conventional use.

HORIZONTAL

Horizontal deflection characteristics are extremely flexible through use of versatile Time-Base Units and Amplifiers of the 2-Series and 3-Series Plug-In Units.

STORAGE CRT

DISPLAY AREA—8 x 10 cm.
ACCELERATING VOLTAGE—3.5 kV.
SPLIT SCREEN STORAGE—Store on either upper or lower half of screen with non-storage on other half; store on entire screen; or non-store on entire screen.
STORAGE TIME—Up to one hour.
ERASE TIME—Approximately 0.25 second.
WRITING SPEED—500 cm/ms.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V (564), 1.0 mV to 100 V (RM564), and 0.1 V into 50 Ω, power line frequency.
POWER REQUIREMENTS—105 to 125 V or 210 to 250 V.

STORAGE OPERATION

Features of the Type 564 as a storage oscilloscope include—

Long-term storage with short-time erasure.
Storage of single shot signals.
Split-screen with individual controls for each half.

SOME THINGS YOU CAN DO WITH TYPE 564 STORED DISPLAYS

1. *Observe single-shot phenomena.*
2. *Study, for long periods of time, a waveform without having to photograph it. (Stored brightness and contrast remain essentially constant for up to an hour.)*
3. *Photograph only those stored waveforms you want.*
4. *Compare changing waveforms to a stored waveform, each displayed on half of the CRT face.*
5. *Change the stored standard while viewing other waveforms on the non-stored half.*
6. *Photograph a multi-event stored display with only one exposure.*
7. *Store fast recurrent phenomena by using the integrate feature.*
8. *Store X-Y displays.*

AVAILABLE DISPLAYS

With the wide-range sensitivity and bandwidth of the Type 564, several storage and conventional operation displays are obtainable. The range of signals which may be stored is limited by stored-mode writing characteristics of the CRT.

SINGLE-TRACE AND MULTI-TRACE

These displays are obtained by selecting either sampling or non-sampling amplifier plug-in units. Selection of the Type 2A61, 2A63, or 3A3, gives differential amplifier operation, while strain gage and other transducer operations are available with the Type 3C66.

SAMPLING

Risetimes in the sub-nanosecond region are obtained by using Type 3T77A, or 3T4, Sampling Sweep Unit with either a Type 3S3 or Type 3S76 Amplifier Unit. Either combination will provide a dual-trace display or a single display. The Type 3S3 provides a system with a high-impedance low-capacitance input while the Type 3S76 provides a 50-Ω input system.

SPECTRUM ANALYSIS

The Type 3L10 Spectrum Analyzer Plug-In Unit covers the 1—36 MHz range. This plug-in unit with a sensitivity of —100 dBm and calibrated dispersion allows the display of RF signals with a resolution of 10 Hz to 1 kHz.

SINGLE X-Y

X-Y display can be obtained by using any combination of the Type 2A60, 2A63, 3A3, 3A72, 3A74, and 3A75 Units in both the vertical and horizontal compartments of the Type 564.

For medium and high-frequency X-Y operation, however, use two units of the same type. Careful standardization of deflection-circuit capacitance in the Type 564, minimizes high frequency phase-shift between two of the same type plug-in units when operated X-Y.

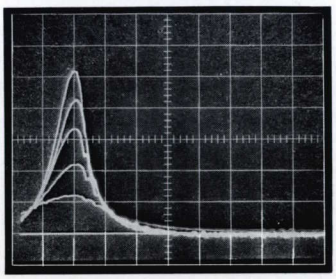
MULTIPLE X-Y

Using two Type 3A72 or two Type 3A74 Plug-In Units, both synchronization and automatic pairings are provided. With two 3A72's operated X-Y in the dual trace mode, Channel 1 of the left-hand plug-in is always plotted against Channel 1 of the right-hand plug-in. With two Type 3A74's, two, three, or four independent displays may be obtained, properly paired: Channel 4 versus Channel 4, Channel 3 versus Channel 3, etc. . . .

Using two Type 3A1 or two Type 3A6 Plug-In Units, dual-trace switching is not synchronized. Dual X-Y displays within the center 8 cm x 8 cm area of the graticule may be obtained, but one plug-in or the other must usually be limited to single-trace operation unless four displays are wanted.

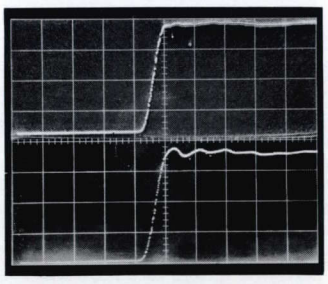
Using two Type 3A3 Plug-In Units, dual-trace switching is synchronized, so one Y Channel remains plotted against the same X Channel once the display is set up. There is no provision for consistent pairing each time the system is operated.

As with single X-Y displays, two plug-ins of the same type should always be used where X-Y phase relationships are to be preserved.



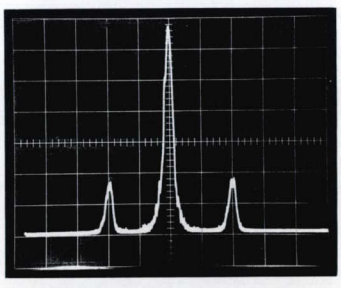
SHOCK TEST

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 Rate is 2 ms/cm.



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.



STORED SPECTRAL DISPLAY

Stored waveform showing center frequency with two sidebands. Using single-sweep and storage allows measurement of frequency drift with the spectrum analyzer unit.

2-SERIES AND 3-SERIES AMPLIFIER PLUG-IN UNITS				
Type	INPUT RC (AC or DC coupled)	BANDWIDTH (—3 dB)	CALIBRATED DEFLECTION FACTOR	PRICE
2A60—Single Trace	1 megohm—47 pF, 600 V max	DC—1 MHz	50 mV/div—50 V/div, 4 decade steps, with variable control.	$105
2A61—Differential (low level)	10 megohm—50 pF, ±5 V (AC-coupled only)	0.06 Hz—300 kHz	10 μV/div—20 mV/div, 1-2-5 sequence, with variable control.	385
2A63—Differential (50:1 rejection ratio)	1 megohm—47 pF, 600 volts max	DC—300 kHz	1 mV/div—20 V/div, 1-2-5 sequence, with variable control.	150
3A1—Dual Trace (identical channels)		DC—10 MHz	10 mV/div—10 V/div, 1-2-5 sequence, with variable control.	450
3A3—Dual Trace Differential		DC—500 kHz	100 μV/div—10 V/div, 1-2-5 sequence, with variable control.	790
3A5 Automatic/ Programmable	1 megohm—24 pF	DC—15 MHz	1 mV/div—50 V/div, 1-2-5 sequence, with variable control.	760
3A6—Dual Trace (identical channels)	1 megohm—47 pF, 600 volts max	DC—10 MHz (has delay line)	10 mV/div—10 V/div, 1-2-5 sequence, with variable control.	540
3A7—Differential Comparator	1 megohm—20 pF	DC—10 MHz	1 mV/div—50 V/div, 1-2-5 sequence, with variable control.	635
3A8—Operational Amplifier	1 megohm—47 pF, 600 volts max	DC—3.5 MHz	0.2 V/div—10 V/div, 1-2-5 sequence, with variable control.	600
3A72—Dual Trace (identical channels)		DC—650 kHz	10 mV/div—20 V/div, 1-2-5 sequence, with variable control.	275
3A74—Four Trace (identical channels)		DC—2 MHz	20 mV/div—10 V/div, 1-2-5 sequence, with variable control.	590
3A75—Single Trace		DC—4 MHz	50 mV/div—20 V/div, 1-2-5 sequence, with variable control.	175
3C66—Carrier Amplifier	120-Ω strain-gage bridge	DC—5 kHz (70 μs risetime)	10 μstrain/div—10,000 μstrain/div, 1-2-5 sequence, with variable control.	400
3L10—Spectrum Analyzer	approx 50 Ω approx 600 Ω	1—36 MHz	sensitivity —100 dBm	1200
3S3—Dual Trace Sampling (for use with 3T77A)	100 kΩ — 2 pF, ±3 volts max	equivalent DC—1 GHz (0.35 ns risetime)	5 mV/div—100 mV/div, 1-2-5 sequence, with variable control.	1500 (with probes)
3S76—Dual Trace Sampling (for use with 3T77A)	50 ohms DC-coupled	equivalent DC—875 MHz (0.4-ns risetime)	2 mV/div—200 mV/div, 1-2-5 sequence, with variable control.	1100

TIME-BASE UNITS				
TYPE	SWEEP RANGE	MAGNIFIER	FEATURES	PRICE
2B67	1 μs/div to 5 s/div	5X	Single sweep—triggering is internal, external, line, auto or free run.	$210
3B1 **3B3**	0.5 μs/div to 1 s/div	5X	3B1—Delayed sweep. 3B3—Calib Delayed sweep, single sweep.	535 585
3B4	0.2 μs/div to 1 s/div	1X to 50X	Single sweep—triggering is internal, external, line, auto or free-run.	400
3B5 Automatic/ Programmable	0.1 μs/div to 5 s/div	10X 100X	Calibrated delay magnifier automatic-seeking programmable.	890
3T4 Programmable Sampling	equiv to 1 ns/div to 200 μs/div	10X	Programmable sweep range, single sweep, manual scan, calibrated delay.	1300
3T77A Sampling	equiv to 0.2 ns/div to 10 μs/div	10X	Single sweep, manual scan, sweep delay.	650

CRT PERFORMANCE

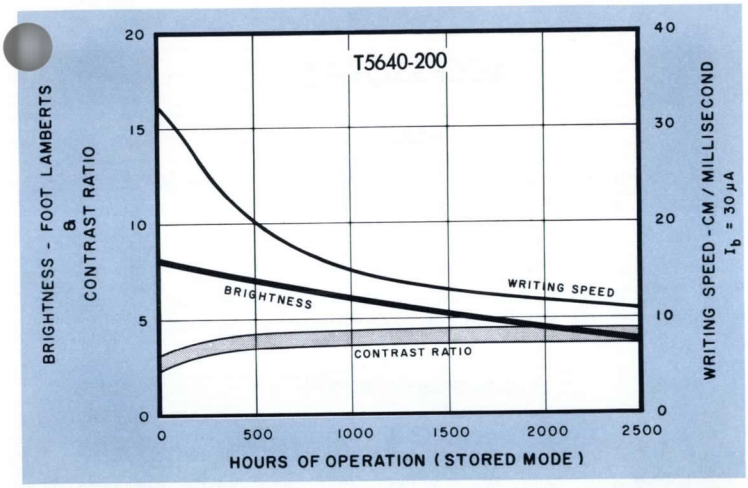
There are two storage tubes available for use in the Type 564 Oscilloscope. Both tubes exhibit characteristics of a conventional CRT when used in the non-stored mode. One tube, the Type T5640-200, has the brighter stored display. The other tube, the Type T5640-201, has the faster writing speed.

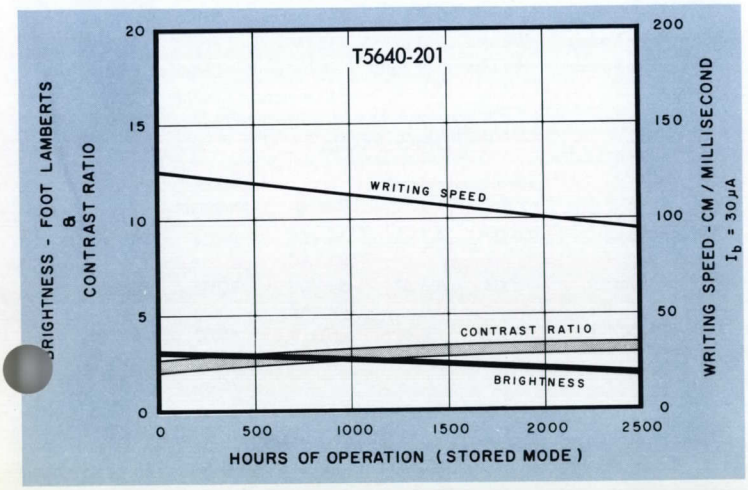
By selecting the proper tube, you can obtain optimum oscilloscope performance for your particular application. Such selection is important because each tube has its own maximum writing speed and brightness for stored-mode operation. The brightness of a stored display for an individual tube is one value regardless of the intensity of the beam that generated it.

The brightness curves on the graph represent values measured with a Spectra Spot Brightness Meter at operating level with the entire screen faded positive. The writing speed curve was obtained with a CRT beam current of 30 μA. The hours shown are the actual hours the CRT is used in the stored mode with repetitive writing, storing, and erasing.

It should be noted that non-storage operation of the CRT has little effect on the stored-mode brightness and writing speeds shown. Therefore to obtain maximum CRT performance and service, the oscilloscope should be in the non-stored mode when stored displays are not needed.

TYPICAL LIFE CHARACTERISTICS





CRT

The CRT is a Tektronix Type T5640, flat-faced bistable storage tube with beam-deflection blanking and an accelerating voltage of 3.5 kV. It has an 8 x 10 cm storage target divided into two 4 x 10 cm areas, individually controllable for storage and erasure.

WARRANTED MINIMUM CHARACTERISTICS		
Characteristics	T5640-200*	T5640-201†
Minimum Initial Brightness	6 foot-lamberts	2 foot-lamberts
Typical Brightness at 1000 hours (% of initial)	70%	80%
Writing Speed, Initial Minimum	25 cm/ms	100 cm/ms††
Writing Speed at 1000 hours, (% of initial)	25%	90%
*Supplied with Type 564 †Supplied with Type 564 MOD 08 ††Specification holds true for middle 7 x 9 cm area.		

STORAGE CHARACTERISTICS

STORAGE TIME

Displays can be stored for up to 1 hour. Longer times may be obtained but tend to reduce target sensitivity in the stored areas.

ERASURE TIME

Approximately 0.25 second.

STORED WRITING-SPEED ENHANCEMENT

This feature controls the single-sweep storage capabilities of the storage CRT. Through adjustment of the front-panel Writing-Rate Increase control, single-trace spot velocities up to 250 cm/ms using the T5640-200 CRT or up to 500 cm/ms using the T5640-201 CRT can be stored with minimal loss of resolution and contrast in the center 7 x 9 cm.

SINGLE SHOT SIGNALS

At slow or medium speeds, single-shot signals are easily stored for extended viewing time (within writing-speed capabilities of CRT selected).

INTEGRATE MODE

Increases the effective writing speed for repetitive fast signals with repetition rates that are too low for effective storage, but which may be too fast for satisfactory single-shot storage with enhancement.

TYPE 564 CHARACTERISTICS

PLUG-IN COMPARTMENTS

The instrument accepts 2-Series and 3-Series Amplifier and Time-Base Units.

LOCATE BUTTON

This button, when depressed, causes a spot or spots to appear at the left of the CRT screen at the vertical position of the next sweep.

GRATICULE

The graticule is edge lighted and is marked in 8 vertical and 10 horizontal cm divisions. The centerline is marked every 2 mm. Illumination is controlled by a front-panel knob.

Z-AXIS INPUT

Accessible through a terminal at the rear of the instrument permits external modulation of the CRT cathode.

564
RM564

CALIBRATOR

There are 18 amplitude-calibrated squarewave voltages available, from 0.2 mV to 100 V, peak to peak; approximately 5-μs risetime, at line frequency. For 50-Ω systems, the 0.5-V switch position provides 0.1 V (peak to peak) into 50 ohms, for convenient calibration of sampling units.

ELECTRONICALLY REGULATED SUPPLIES

Regulated power supplies furnish all voltages required for proper operation of the Indicator and the plug-in units. Regulated DC supplies operate with line voltage between 105 V to 125 V or 210 V to 250 V, 50 to 400 Hz . . . max 240 watts, approx. Unit factory wired for 117 V.

MECHANICAL

Dimensions of 13½" high by 9¾" wide by 21½" deep. Net weight is 33 pounds. Shipping weight is 41 pounds, approx.

ORDERING INFORMATION

The Type 564 has the storage tube T5640-200 (stored display of highest intensity).

TYPE 564 (without plug-in units) $875

Each instrument includes: 1—Polarized viewer (016-0039-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction manual (070-0351-00).

The Type 564 MOD 08 has the storage tube T5640-201 (fastest stored writing speed).

TYPE 564 MOD 08 (without plug-in units) $875

Each instrument includes: 1—Polarized viewer (016-0039-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction manual (070-0351-00).

RACK MOUNT MODEL

The Type RM564 Oscilloscope, only 7" in height, is suited for applications where panel space might be at a premium. The Type RM564 is electrically identical to the Type 564 except the amplitude calibrator range is from 1.0 mV to 100 V and the instrument operates on power line frequency of 50 to 60 Hz. The Type RM564 provides for remote erase of the stored waveform on either or both halves of the split screen storage tube. The Type RM564 mounts in a 19" rack, is 7" high, and is 18⅜" deep. (Additional mounting information on the catalog instrument dimension page.) Net weight is 31 pounds. Shipping weight is 41 pounds, approx.

ORDERING INFORMATION

The Type RM564 has the storage tube T5640-200 (stored display of highest intensity).

TYPE RM564 (without plug-in units) $960

Each instrument includes: 1—Polarized viewer (016-0039-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Set mounting hardware; 2—Instruction manual (070-0415-00).

The Type RM564 MOD 08 has the storage tube T5640-201 (fastest stored writing speed).

TYPE RM564 MOD 08 (without plug-in units) $960

Each instrument includes: 1—Polarized viewer (016-0039-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Set mounting hardware; 2—Instruction manual (070-0415-00).

TYPE RM564 WITH SLIDE-OUT TRACKS

RM564 or RM564 MOD 08 with slide-out track kit can be used to mount the RM564 or RM564 MOD 08 in a standard 19" rack to allow the instrument to be pulled out from the rack, tilted and locked in any of 7 positions for convenient servicing. An RM564 or RM564 MOD 08 is available with the track kit installed as **MOD 171A** or the tracks may be ordered separately (below). A cradle assembly 040-0344-00 should be ordered separately if the instrument is to be mounted on slide-out tracks in a backless rack.

RM564 MOD 171A or RM564 MOD 08, MOD 171A . $1,010

Each instrument includes: 1—Polarized viewer (016-0039-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Set mounting hardware; 2—Instruction manual (070-0415-00).

RM564 ACCESSORIES

Slide-out Track Kit (Part Number 351-0050-00) $45

Cradle Assembly — For use when slide-out tracks are installed in a rack without rear-support rails (not required when slide-out tracks are not used).

Cradle Assembly (Part Number 040-0344-00) $11.45

Remote-Erase Connector—Mates with connector on RM564—Cable not included (Part Number 134-0049-00) $4.00

ACCESSORIES

PROBES

Attenuator probes are not included with the Type 564 Oscilloscope. Tektronix probes are recommended when minimum loading of the circuit is required.

The following probes are recommended for use with the Type 2-Series and 3-Series Amplifier Plug-In Units. See Catalog Accessory pages for complete information on the probes.

STANDARD PROBES

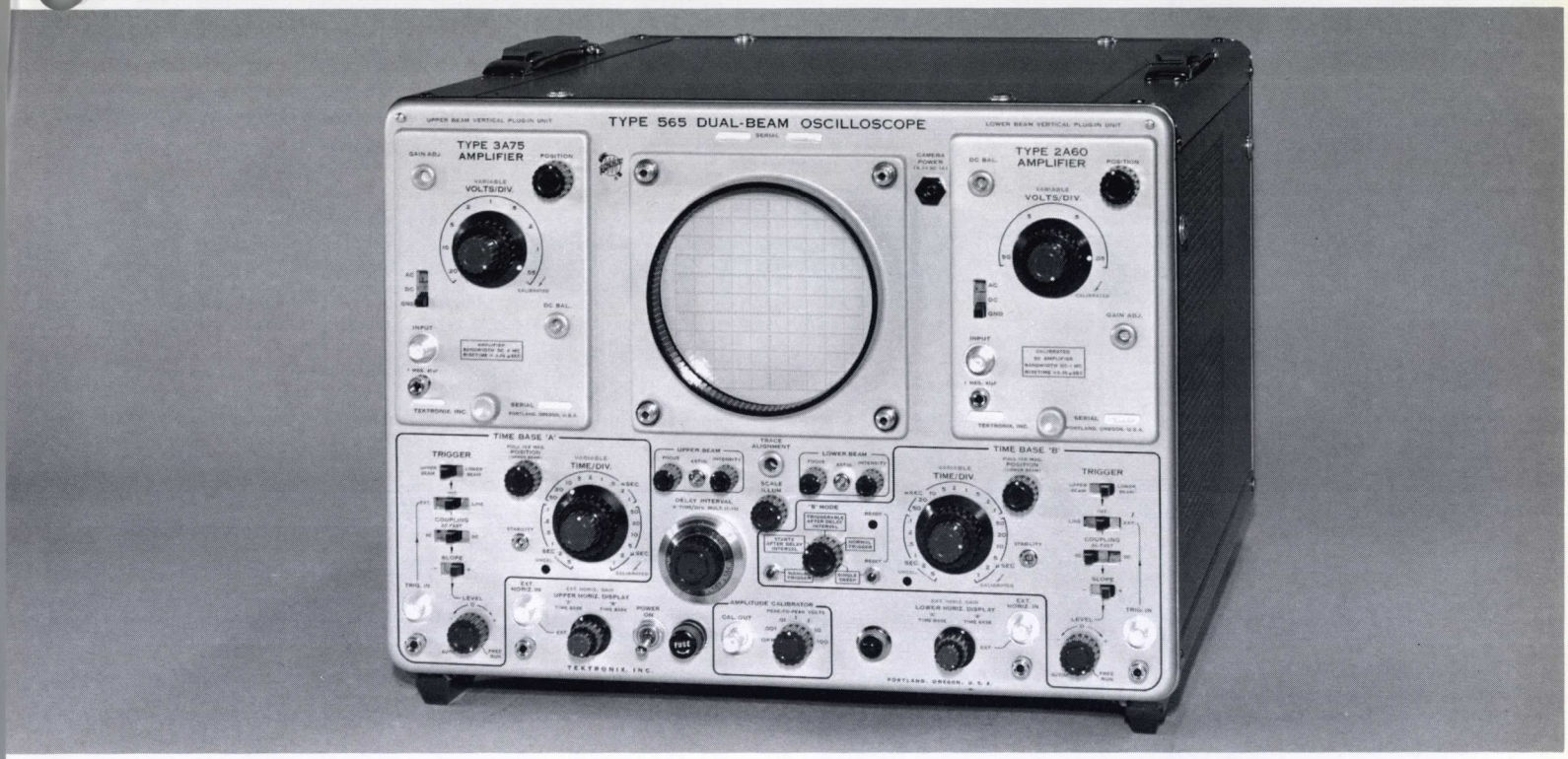
Use	Input Inductance R	Input Inductance C	Rating	Probe Number	Price
1:1 Attenuator	1 MΩ	97 pF	600 V max	P6028	$ 12.50
10:1 Attenuator	10 MΩ	9.5 pF	600 V max	P6006	22.00
1000:1 High Voltage	100 MΩ	3 pF	12 kV max	P6013	75.00
1000:1 High Voltage	100 MΩ	2.7 pF	40 kV max	P6015	200.00
Current			15 A max	P6019	75.00

SAMPLING PROBES

Use	Input Inductance R	Input Inductance C	Rating	Probe Number	Price
10:1 Attenuator	500 Ω	0.7 pF	16 VDC 500 VAC	P6034	$ 35.00
100:1 Attenuator	5 kΩ	0.6 pF	50 VDC 500 VAC	P6035	35.00
10:1 to 1000:1 CF	10 MΩ	varies	varies	P6032	220.00
Current			500 mA	CT1/ P6040	31.00

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

DUAL-BEAM OSCILLOSCOPE Type 565 / RM565



- *TWO INDEPENDENT BEAMS*
- *ILLUMINATED NO-PARALLAX GRATICULE*
- *TWO INDEPENDENT SWEEP SYSTEMS*
- *PLUG-IN VERTICAL AMPLIFIERS*
- *DELAYING-SWEEP OPERATION*
- *SINGLE-SWEEP OPERATION*
- *REAR-PANEL OUTPUT CONNECTORS*

A Type 565—or rack-mount counterpart, Type RM565—is essentially two single-beam oscilloscopes sharing a common cathode-ray tube, power supply and housing. Each beam has separate vertical and horizontal deflection systems, focus, and intensity controls.

The vertical amplifiers can be any of the 2-Series or 3-Series Plug-In Units, except Sampling Units.

The horizontal amplifiers are built-in and can be driven by either of two sweep systems, simultaneously or independently, or from their external inputs. 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.

There are rear-panel outputs of: Vertical Signals, Horizontal Signals, +Gate, Delayed Trigger, and Auxiliary Power.

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics are extremely flexible through use of 2-Series and 3-Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—1 μs/div to 5 s/div.

SWEEP MAGNIFIER—10X, extends sweep range to 0.1 μs/div.

TRIGGER REQUIREMENTS—

Internal: 2 minor divisions of deflection up to 50 kHz, increasing to 1 major division at 2 MHz.

External: 0.5 V up to 50 kHz, increasing to 1 V at 2 MHz.

CALIBRATED SWEEP DELAY—10 μs to 50 s, continuously variable.

EXTERNAL INPUT—Approx 100 mV/div to 300 V/div: DC to 350 kHz; input resistance 100 kilohms, ±20%.

CRT

DISPLAY AREA—10 x 10 cm (each beam scans 8 cm vertical, overlap of the two beams is 6 cm). Major graticule division equals 1 cm, minor division equals 2 mm. Illuminated no-parallax graticule.

ACCELERATING VOLTAGE—4 kV.

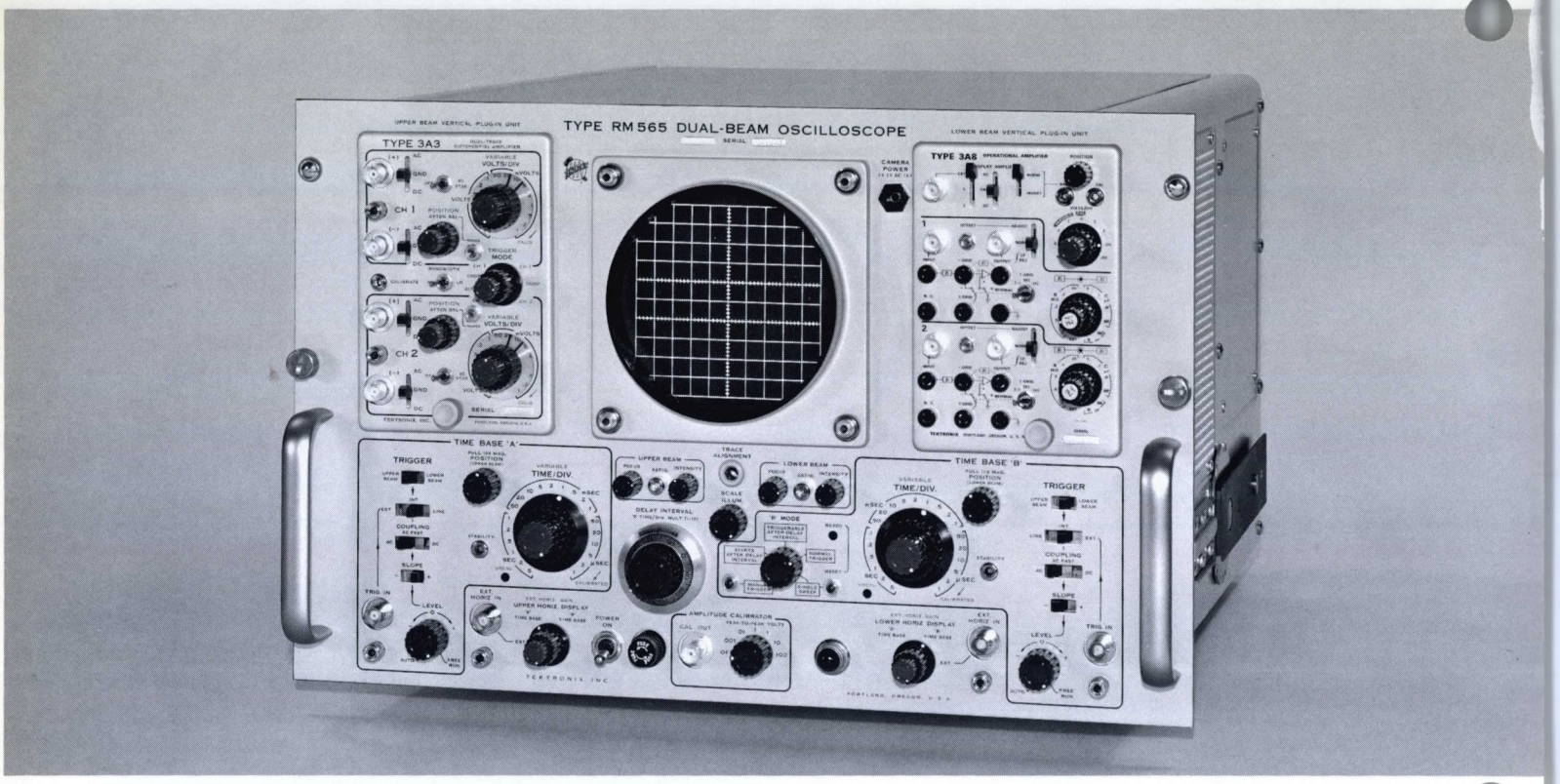
OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—1 mV to 100 V, 1-kHz square wave, in six steps.

REAR-PANEL SIGNAL OUTPUTS — Output impedance approx 500 ohms; max load 2 mA.

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 600 watts.

565
RM565



ELECTRICAL CHARACTERISTICS

(pertain to circuitry for each of the two beams)

VERTICAL DEFLECTION SYSTEMS

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. (The 565 does not use Sampling Plug-In Units.)

TRIGGER

SENSITIVITY—0.5 volts or 2 minor divisions up to 50 kHz, decreasing to 1 volt or 1 div at 2 MHz.

"*AC*" coupling time constant—approx 10^{-2} s (0.01 μF and 1 MΩ).

"*AC FAST* " coupling time constant—10^{-5} s (100 pF and 100 k).

HORIZONTAL SWEEP GENERATORS

RANGE—1 μs/div to 5 s/div in 21 calibrated steps, 1-2-5 sequence. Accuracy $\pm$3%.

VARIABLE—Control permits continuous adjustment (uncalibrated) from 1 μs/div to 12 s/div.

MAGNIFIER—10X Magnifier permits expanding any 1 division portion of the display a full 10 divisions, accuracy $\pm$5%. The magnifier can be used to extend the sweep rate to 0.1 μs/div.

HORIZONTAL AMPLIFIERS

DEFLECTION FACTOR—Approximately 100 mV/div to 300 V/div, continuously adjustable. Maximum input voltage: 300 V RMS

INPUT RESISTANCE—100 kilohms, $\pm$20%.

BANDWIDTH—DC-to-350 kHz, at maximum sensitivity. Bandwidth is specified at —3 dB.

DELAY INTERVAL

RANGE—10 μs to 50 s calibrated and continuously adjustable.

INCREMENTAL ACCURACY—$\pm$0.5%.

JITTER—1 part in 20,000.

CALIBRATOR

RANGE—1 mV to 100 V peak to peak in 6 decade steps, positive-going square wave.

ACCURACY—$\pm$3%.

FREQUENCY—Approximately 1 kHz.

REAR-PANEL OUTPUTS

VERTICAL SIGNAL OUT (both upper and lower)—Signal amplitude, DC level, and transient response depend on the vertical plug-in unit used. Typical signal amplitude: 2 V/div to 4 V/div of display; DC level $\pm$20 V. Output impedance: approx 500 ohms; maximum load current 2 mA.

HORIZONTAL OUTPUTS (both upper and lower)—Signal amplitude, at least 50 mV/div of display in External position and 0.5 V/div of display in Sweep position. DC level 0 to +5 volts. Output impedance: approx 500 ohms; maximum load current 2 mA.

2-SERIES AND 3-SERIES AMPLIFIER PLUG-IN UNITS*				
Type	INPUT RC (AC or DC coupled)	BANDWIDTH (—3 dB)	CALIBRATED DEFLECTION FACTOR	PRICE
2A60—Single Trace	1 megohm—47 pF, 600 V max	DC—1 MHz	50 mV/div—50 V/div, 4 decade steps, with variable control.	$105
2A61—Differential (low level)	10 megohm—50 pF, ±5 V (AC-coupled only)	0.06 Hz—300 kHz	10 μV/div—20 mV/div, 1-2-5 sequence, with variable control.	385
2A63—Differential (50:1 rejection ratio)	1 megohm—47 pF, 600 volts max	DC—300 kHz	1 mV/div—20 V/div, 1-2-5 sequence, with variable control.	150
3A1—Dual Trace (identical channels)		DC—10 MHz	10 mV/div—10 V/div, 1-2-5 sequence, with variable control.	450
3A2**—Dual Trace		DC—500 kHz	10 mV/div—10 V/div, 1-2-5 sequence, with variable control.	500
3A3—Dual Trace Differential		DC—500 kHz	100 μV/div—10 V/div, 1-2-5 sequence, with variable control.	790
3A5 Automatic/ Programmable	1 Megohm—24 pF	DC—15 MHz	1 mV/div—50 V/div, 1-2-5 sequence, with variable control.	760
3A6—Dual Trace (identical channels)	1 megohm—47 pF, 600 volts max	DC—10 MHz (has delay line)	10 mV/div—10 V/div, 1-2-5 sequence, with variable control.	540
3A7—Differential Comparator		DC—10 MHz	1 mV/div—50 V/div, 1-2-5 sequence, with variable control.	635
3A8—Operational Amplifier		DC—3.5 MHz	20 mV/div—10 V/div, 1-2-5 sequence, with variable control.	600
3A72—Dual Trace (identical channels)		DC—650 kHz	10 mV/div—20 V/div, 1-2-5 sequence, with variable control.	275
3A74—Four Trace (identical channels)		DC—2 MHz	20 mV/div—10 V/div, 1-2-5 sequence, with variable control.	590
3A75—Single Trace		DC—4 MHz	50 mV/div—20 V/div, 1-2-5 sequence, with variable control.	175
3C66—Carrier Amplifier	120-Ω strain-gage bridge	DC—5 kHz (70 μs risetime)	10 μstrain/div—10,000 μstrain/div, 1-2-5 sequence, with variable control.	400

*For 3-Series Spectrum Analyzer Plug-In operation, consult your Tektronix Field Office or Spectrum Analyzer Manual. 2 and 3-Series Time Base Plug-Ins can be used for raster generation.
**Designed primarily for the Type 567 Digital Readout Oscilloscope.

A AND B +GATES—Pulse height 20 V minimum; DC level zero volts. Output impedance: approx 500 ohms; maximum load current 2 mA.

DELAYED TRIGGER—Fast-rise pulse amplitude +8 V minimum; DC level zero volts. Output impedance: approx 50 ohms; maximum load current 2 mA.

REAR-PANEL AUXILIARY POWER PLUG

OUTPUTS—Power supply outputs for future accessories.

POWER REQUIREMENT

OPERATION—105 V to 125 V, 50 to 60 Hz.

VOLTAGE—99 V to 132 V or 198 V to 265 V (through use of selectable transformer taps).

WATTAGE—600 watts maximum (depends upon plug-in combination).

OPERATIONAL FEATURES

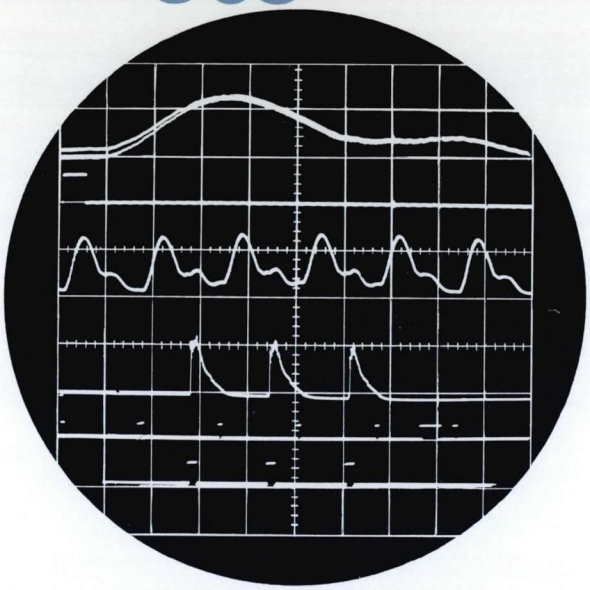
(pertain to both sweep systems except as indicated for "B" sweep)

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. 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-Hz 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.

565
RM565



The Type 565 is used in exploring methods of measuring blood flow by angiography. Investigators initiate and evaluate angiographic injectors in a wide variety of exploratory techniques with artificial arteries and photography. The dual-beam capability of the Type 565 and multi-channel plug-in units permit investigators to monitor injection time and injection pressure in addition to most parameters of interest in the artificial artery such as flow, EKG, pulse, and pressure.

Waveform display shows first and second traces on the upper beam and third through sixth traces on the lower beam. Upper Beam sweep rate is 0.15 s/div. Lower Beam sweep rate is 0.5 s/div. The configurations show:

1. *Arterial Pressure at 50 mm Hg/div*
2. *Simulated R wave of EKG*
3. *Artificial Arterial Pressure*
4. *Injection Pressure*
5. *Simulated EKG with delayed camera pulse*
6. *Delay and duration of injector solenoid*

SWEEP GENERATORS "A" AND "B"

Independent operation of the two generators; delaying sweep operation; single-sweep operation on "B" time base only, 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.

In the "Single-Sweep" position, the "B" 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.

CRT AND DISPLAY FEATURES

CATHODE-RAY TUBE—Round, flat-faced aluminized 5-inch dual-beam tube with an illuminated, internal, no-parallax graticule. Accelerating potential is 4 kV.

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. (Internal adjustment)

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.

RETRACE BLANKING—DC coupled.

Z-AXIS MODULATION—Of both CRT beam grids through rear panel connector. Time constant 3.5 milliseconds, nominally.

CHOPPED TRACE BLANKING

CABINET MODEL

TYPE 565—Dimensions are 13½" high by 17" wide by 28⅜" deep. Net weight is 62 pounds. Shipping weight is 92 pounds, approx.

RACK-MOUNT MODEL

TYPE RM565—Mounts on tilt-lock slide-out tracks to a standard 19" rack. Dimensions are 12¼" high by 19" wide by 22" deep. Net weight is 67 pounds. Shipping weight is 101 pounds, approx. For more mounting information, please refer to the Mounting Dimension page in the catalog.

TYPE 565, without plug-in units $1400

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—smoke gray filter (installed) (378-0567-00); 1—plate, protector, CRT, clear (387-0918-00); 2—patch cord, BNC-to-BNC, 18" (012-0087-00); 1—post jack, BNC (012-0092-00); 2—instruction manual (070-0269-00).

TYPE RM565, without plug-in units $1500

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0024-00); 1—smoke gray filter (installed) (378-0567-00); 1—plate, protector, CRT, clear (387-0918-00); 2—patch cord, BNC-to-BNC 18" (012-0087-00); 1—post jack, BNC (012-0092-00); 1—pair mounting slides (351-0086-00); 2—instruction manual (070-0353-00).

SUPPORTING CRADLES

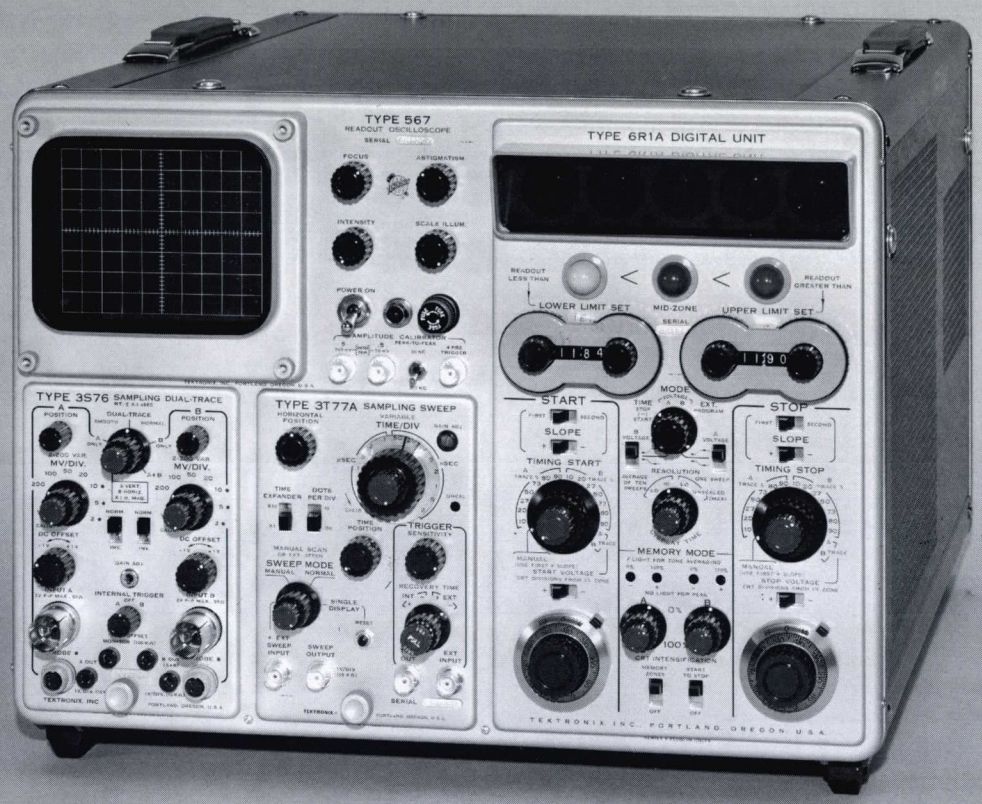
When the Type RM565 is used in a backless rack, these supporting cradles are necessary for rear-slide support.

Order Part Number 040-0346-00 . . . . . $11.45

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

Please refer to Terms and Shipment, General Information page.

DIGITAL READOUT OSCILLOSCOPE Type 567



DIGITAL READOUT PLUS ANALOG DISPLAYS

DIGITAL READOUT OF RISETIME, AMPLITUDE AND TIME DIFFERENCES

SELECTABLE HIGH AND LOW NO-GO LIMITS

EXTERNALLY PROGRAMMABLE

DIGITAL AND GO/NO-GO OUTPUTS

ILLUMINATED NO-PARALLAX GRATICULE

The Type 567 Readout Oscilloscope introduces a new concept in oscilloscopes—DIGITAL READOUT of signal information in addition to a conventional cathode-ray oscilloscope display.

With the Type 567 and associated Plug-In Units you can make measurements with greater accuracy, speed, and convenience than possible when interpreting just a cathode-ray oscilloscope display.

To make measurements, you select regions on the displayed waveform, then read data directly in four-digit resolution. Decimal point and unit of measure (ns, μs, ms, s, mV, V) are automatically presented when time/div, amplitude/div, or program is changed. Indicator lights show instantly whether a measurement is WITHIN, LESS THAN, OR GREATER THAN set limits.

Many accessories and associated instruments are available to add to the operational versatility of the system. For example, with the Tektronix Type 262 Programmer you can conveniently externally program the Type 567—with completely automatic or manual sequencing of measurement parameters.

On a production line or in a laboratory, the Type 567 Readout Oscilloscope can speed-up and simplify your test and measurement applications.

567

HOW THE TYPE 567 READOUT OSCILLOSCOPE AND TYPE 6R1A DIGITAL UNIT FUNCTION

SAMPLING PROCESS (SAMPLING UNITS)

With each repetition of a signal, sampling units strobe (sample) one point at a time a little later than the previous sample. This process of advancing the sampling instant in fixed increments is called strobing. A reconstructed replica, much slower than the original signal, is reproduced on the CRT as an amplitude vs time, point-to-point graph.

HOW THEY INDICATE TIME

The equivalent time between each sample depends upon the number of samples per centimeter and the sweep time per centimeter. For instance, 1 ns/div and 100 samples/div = 10 ps/sample. By counting the number of samples between two selected portions of a waveform, the time between these portions can be determined. Counter circuits drive NIXIE indicator tubes which display the measured interval.

AUTOMATIC REFERENCE ZONES

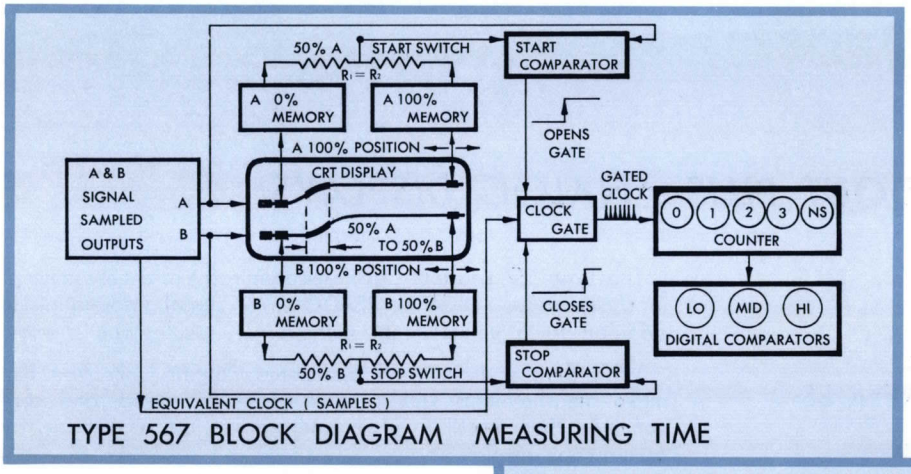
Two intensified portions of each trace identify 0% and 100% zones. Each zone can be positioned to cover any point on the display. Amplitudes corresponding to the zones are stored in voltage memory circuits. Changes in amplitude, vertical position, or waveform automatically reestablish corresponding 0% and 100% memory amplitudes. There are two voltage memory circuits for each signal input channel, making a total of four. Each of the two traces displays its own intensified zones.

START-STOP CIRCUITS

In a typical measurement, voltage divider taps between the 0% and 100% memory voltages are set for start and stop timing at selected percentage points such as 10, 20, 27, 50, 73, 80, and 90% of either waveform. Coincidence of the input waveform amplitudes with the selected percentage reference amplitudes is sensed by comparators which open and close the clock gate to the digital counter. The traces can be intensified for the duration of the measured interval as a functional check. The number of clock pulses are read out digitally in nanoseconds, microseconds, milliseconds, or seconds (with decimal points included) on NIXIE display tubes.

HOW THEY INDICATE VOLTAGE

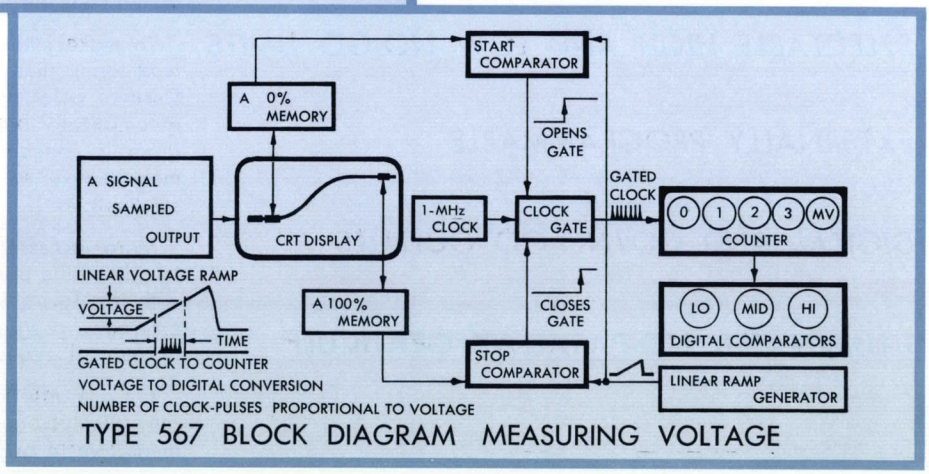
Start and stop comparators gate 1-MHz clock pulses for the period of time that a linear ramp voltage is at values between the 0% and 100% amplitudes. The number of clock pulses is proportional to the voltage between the selected measurement points. Readout is in millivolts or volts, with decimal points included on NIXIE display tubes.



TYPE 567 BLOCK DIAGRAM MEASURING TIME

TYPES 567/6R1A BLOCK DIAGRAM MEASURING TIME

TYPES 567/6R1A BLOCK DIAGRAM MEASURING VOLTAGE



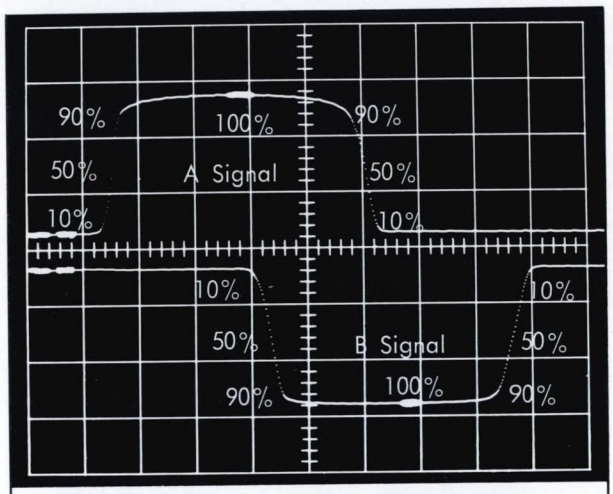
TYPE 567 BLOCK DIAGRAM MEASURING VOLTAGE

DIGITAL READOUT COMBINATIONS

Digital plus analog displays are simultaneously presented on the Type 567 Oscilloscope and Type 6R1A Digital Unit. A Digital Readout Combination consists of a Type 567/6R1A and any of 5 combinations of vertical and horizontal Plug-In Units; Type 3S3/3T77A, 3S76/3T77A, 3A2/3B2, 3S3/3T4, or 3S76/3T4. Other 2-Series and 3-Series Plug-In Units can be used for normal analog CRT display, but do not provide digital readout.

X & Y Plug-Ins	Risetime	Calibrated Deflection Factor	Input RC	Calibrated Sweep Time/cm	Sweep Delay	Digital Resolution	Trigger	System Price
3S3/3T77A*	0.35 ns	5 mV/cm to 100 mV/cm	100 kΩ, 2 pF	equiv 0.2 ns/cm to 10 μs/cm plus 10X magnifier	Through approx 100 ns	10 or 100 dots per cm	External	$5450 (including 2 probes)
3S76/3T77A*	0.4 ns	2 mV/cm to 200 mV/cm	50 Ω					$5050
3A2/3B2	0.7 μs	10 mV/cm to 10 V/cm	1 MΩ, 47 pF	2 μs/cm to 1 s/cm	5 μs to 10.5 s	1 μs to 10 ms clock rate in decades	Internal or External	$4450

***The Type 3T4** Programmable Sampling Sweep can be programmed through a front panel connector. Programmable functions include sweep rates (1 ns/cm to 200 μs/cm), 3 calibrated sweep delay ranges (1 μs to 1 ms), samples per sweep (100 or 1000 or alternately 100 or 1000), and single display for real-time measurements. Type 3T4 .... $1300.



DUAL-TRACE DISPLAY SHOWING TYPICAL MEASUREMENTS

MEASUREMENT	6R1A 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

MEASUREMENT CAPABILITIES

TIME MEASUREMENTS can be made between 2 points on the same waveform, or between separate points on Channel A and Channel B. Points are determined (1) as a percentage of signal amplitude, (2) as a particular voltage level referenced to the signal, or (3) at a desired interval during the sweep. With the Types 3S3/3T77A or 3S76/3T77A time differences ranging from 20 ps up to 100 μs can be displayed. With the Types 3A2/3B2 time differences from a few μs to 10 s can be displayed.

VOLTAGE MEASUREMENTS can be made between 2 points on the waveform: (1) peak to peak, (2) average-to-peak, (3) peak-to-average. Also, the average DC level occurring between positionable limits can be measured.

LIMIT SELECTION presets digital comparators for automatic readings in three categories: (1) less than lower limit, (2) greater than upper limit, and (3) mid-zone — between upper and lower limits.

PERMANENT RECORDS of each test can be made with external equipment. The Type 6R1A provides digital and go/no-go outputs for use with (1) electric typewriters, (2) punch cards, (3) perforated tape, and (4) numerical printers.

EXTERNAL PROGRAMMING with the Type 262 Programmer permits rapid sequencing of measurements without changes in the Type 6R1A front-panel controls. Test parameters are set up on program cards in the Type 262, and can be selected manually by push button or automatically (with optional accessory). See Type 262 for more details.

567

AMPLITUDE CALIBRATOR, provides front-panel selection of squarewave outputs of 20 kHz, crystal-controlled, or 1 kHz, RC time-constant controlled. Output voltages are 5 V and 0.5 V into an impedance of 1 MΩ, or greater, or 0.5 V and 0.05 V into 50 Ω. Both connectors are BNC.

DC-VOLTAGE SUPPLIES are electronically regulated to compensate for widely varying line conditions. Separate regulated heater supply is included.

POWER REQUIREMENT is 105 V to 125 V or 210 V to 250 V, 50 to 60 Hz, (approximately 405 watts with Type 3S76, 3T77A, 6R1A Units). A thermal cutout switch prevents overheating of the instrument. Instrument factory wired for 117 V.

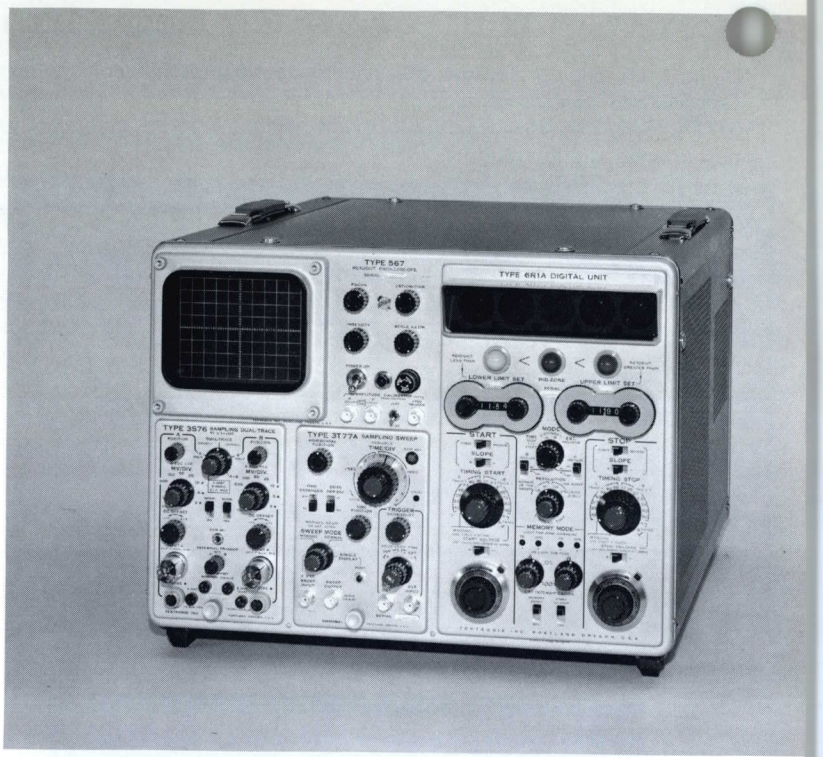
CATHODE-RAY TUBE is a 5-inch rectangular CRT using 3.5-kV accelerating potential. A P2 phosphor is normally supplied.

ILLUMINATED, NO-PARALLAX, INTERNAL GRATICULE has controlled edge-lighting and is marked in 8 vertical and 10 horizontal cm divisions.

MECHANICAL SPECIFICATIONS: Dimensions are 13⅝" high by 17" wide by 23" deep. Net weight is 49 pounds. Shipping weight is 76 pounds, approx.

TYPE 567, without plug-in units $700

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Plate, protector, CRT, clear (387-0935-00); 1—Filter, smoke gray (installed) (378-0567-00); 2—Instruction Manual (070-0322-01).



Type RM567 RACK MOUNT

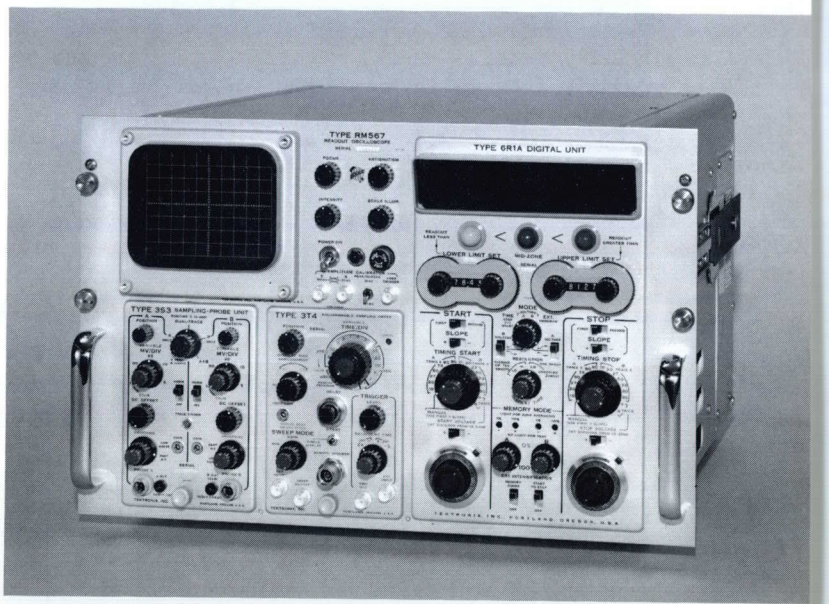
The Type RM567 Readout Oscilloscope is electrically identical to the Type 567 but adapted to rack mounting in a standard 19-inch rack. The instrument mounts to the rack on slide-out tracks. For more mounting information, please refer to the Mounting Dimension page in the catalog.

MECHANICAL SPECIFICATIONS: Dimensions are 12¼" high by 19" wide by 22" deep. Net weight is 50½ pounds. Shipping weight is 85 pounds, approx.

TYPE RM567, without plug-in units $800

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Plate, protector, CRT, clear (387-0935-00); 1—Filter, smoke gray (installed) (378-0567-00); 1—Pair mounting slides (351-0086-00); 1—Set mounting hardware; 2—Instruction Manual (070-0348-01).

SUPPORTING CRADLES: When Type RM567 is used in a backless rack, these cradles are necessary for rear slide support.
Order Part Number 040-0346-00 ..... $11.45



MAINTENANCE of the Type 567 or RM567 and the plug-in units will require these items:

Plug-In Extension for Sampling and Digital Units.
Order Part Number 012-0066-00 (24-pin extension) $23.00
Circuit-Board Extensions for Digital Unit
Order Part Number 012-0068-00 (20-pin extension) $25.00
Order Part Number 012-0067-00 (15-pin extension) $20.00

These items are offered for the convenience of companies with in-plant instrument maintenance facilities. 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.

DIGITAL UNIT Type 6R1A

- **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**

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).*

The Type 6R1A Digital Unit equips a Tektronix Type 567 or Type RM567 Oscilloscope for digital readout. Used with vertical and timing units, the Type 6R1A 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 6R1A has provision for external programming to facilitate automatic sequential operations. The Type 6R1A enables these time and amplitude measurements to be read directly with up to 4 digit units of measurement.

Output connectors are provided on the rear panel to permit recording of the displayed digits on a printer, card punch, tape recorder, electric typewriter, etc.

The 6R1A contains the circuitry for the analog to digital and digital readout functions of the Type 567 Readout Oscilloscope. The characteristics are described by giving the purpose of each front-panel control.

GO/NO-GO CONTROLS

LOWER LIMIT SET presets the lower limit. Any digital reading less than the lower limit causes the LOWER LIMIT indicator to light.

UPPER LIMIT SET presets the upper limit. Any digital reading greater than the upper limit causes the UPPER LIMIT indicator to light. Readings between the lower and upper limits cause the MID-ZONE indicator to light.

6R1A

MODE SWITCH

The type of measurement to be made (time or voltage) is selected by the Mode Switch.

TIME STOP (—) START sets the 6R1A to measure time durations set between the start and stop of timing circuits.

VOLTAGE A sets the Type 6R1A to measure voltage between A Channel 0% and 100% memory zones. Polarity is selected by an adjacent slide switch.

VOLTAGE B sets the Type 6R1A to measure voltage between B Channel 0% and 100% memory zones. Polarity is selected by an adjacent slide switch.

EXTERNAL PROGRAM sets the Types 6R1A to accept programming from an external source, such as the Tektronix Type 262 Programmer. The variety and flexibility of measurements possible with external programming are even greater than those possible through use of the Type 6R1A front-panel controls and measurements and limits can be changed more rapidly.

RESOLUTION SWITCH

Time measurements are performed by gating clock-pulses during the measurement interval. The clock in the case of sampling is the samples per unit equivalent time. For instance, sweep speed = 10 ns/div, samples/div = 100, then equivalent time/sample = 0.1 ns. If a measurement interval occupied 2.5 div, 250 samples would be registered in the digital readout counter. Reading would be 25.0 ns on the readout indicator.

AVERAGE 10 SWEEPS-LO minimizes random noise that could be associated with a measurement. The digital readout counter registers 10 timing intervals (sweeps) and automatically divides the reading by 10. The unit's numerical readout indicator is rendered inoperative so no reading shows even though its scalar is operating. For sweep speed with multipliers of 2 or 5 the counter only registers 1 out of 2 or 5, respectively, clock-pulses and repositions the decimal point to give the correct reading.

AVERAGE 10 SWEEPS-HI permits obtaining reading to high resolution using all four decades. Same as LO except that the unit's numerical readout indicator is restored to operation.

ONE SWEEP-LO registers one sweep only in the digital readout counter.

ONE SWEEP-UNSCALED enables obtaining maximum resolution in just one sweep in the 2 and 5 multiplier positions. Only one sweep is used to fill the digital counter. The reading on the indicator will only be relative on the 2 and 5 multiplier positions of the plug-ins. Decimal points and units of measurement are not indicated in this position to show that readings are only proportional to time.

DISPLAY TIME CONTROL

A control, continuously variable between approximately 5 s and 0.1 s, holds the display for the time needed to observe readings or operate peripheral equipment. (Can be modified for variable control between 1 s and 10 ms for use with high-speed automatic testing.)

MEMORY MODES

The Type 6R1A has 2 internally-selected memory modes: averaging and peak to peak. The mode of operation is made apparent by neon indicators on the front panel. When Types 3A2 and 3B2 Plug-In Units are used, digital readout of amplitude requires an input waveform with constant amplitude for at least 5 μs, in order to establish a 100% reference level.

AVERAGE MODE stores the average DC level of the signal occurring during the 0% and 100% memory zones, to develop TIMING START and TIMING STOP percentage levels. Zones are adjustable in width and positionable on the sweep.

PEAK TO PEAK MODE stores the most negative and most positive levels of the signal occuring during the 0% and 100% memory zones, respectively. Zones are adjustable in width from 0.1 div to 10 div and positionable on the sweep.

ZONE POSITIONING CONTROLS

A 0% and 100% controls position the 0% and 100% references on the displayed waveform. Each zone representing a selected portion of the total sweep is positionable throughout 9 div or more of the A sweep.

B 0% and 100% controls duplicate on Channel B the functions of A 0% and 100% positioning.

0% AND 100% INTENSIFICATION turns on and off two intensity markers on each trace at 0% and 100% zones.

START-TO-STOP INTENSIFICATION turns on and off the start-to-stop zone on the displayed waveform which allows verifying start-to-stop interval.

START-TIMING CONTROLS

These controls program the initiation of timing.

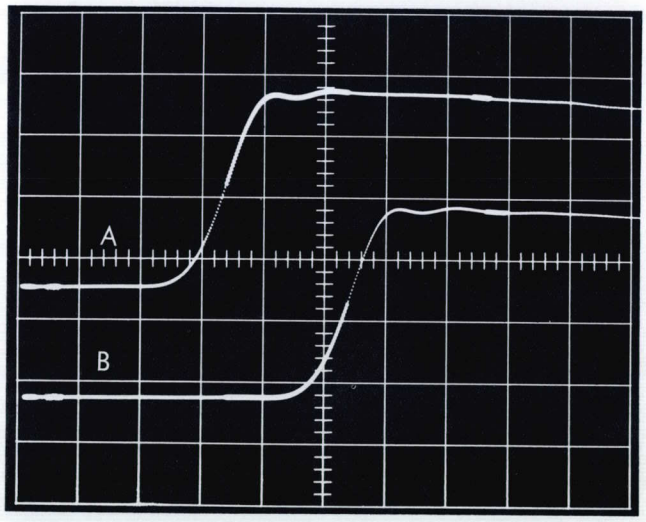
+SLOPE,—SLOPE selects which direction of the waveform will be used to start the timing.

FIRST, SECOND (Cycle) allows selecting start-timing on either the first or second cycle of the waveform through the selected start-timing setting.

TIMING START provides 7 calibrated percentage steps at 10, 20, 27, 50, 73, 80 and 90% from either A or B trace (in references to 0% and 100% zone amplitude). Automatically starts timing at the selected percentage. The 27% and 73% positions are used for 1 time constant measurements and are useful for TC readings (10% to 73% and 27% to 90%) without resorting to slide rule.

MANUAL START enables start-timing at any point on the waveform. Continuously variable over 9 div or more of the sweep.

START VOLTAGE + OR — selects which polarity from 0% zone the waveform will start timing after reaching the amplitude as set by the START VOLTAGE 10-turn dial setting.



DELAY-TIME INTERVAL MEASUREMENT
Start: +50% A Trace Stop: +50% B Trace

START VOLTAGE 10-turn dial permits start-timing continuously variable between 0-10 CRT divisions of amplitude from 0% zone reference.

STOP-TIMING CONTROLS

Program the termination of the timing interval. Identical in capability and operation to the start-timing controls in all other respects.

OTHER CHARACTERISTICS

READOUT is in a numerical range from 0.0001 to 9999. Display time is variable between approximately 5 s and 0.1 s. Units of measure include: microvolts, millivolts, and volts; nanoseconds, microseconds, milliseconds, and seconds.

DIGITAL READOUT ACCURACY of the 6R1A, in addition to providing measurement results in fast, convenient digital form, reduces the magnitude of measurement errors that are attributable to the visual resolution difficulties of a cathode-ray tube display. For assistance in determining system accuracy in specific applications, consult your Field Engineer.

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 13¾ pounds. Shipping weight is 21 pounds, approx.

TYPE 6R1A DIGITAL UNIT $2600

Each instrument includes: 2—instruction manuals (070-0411-00).

EXTERNAL PROGRAMMING

See information on Type 261 Coaxial Switch, Type 262 Programmer, and associated accessories. For custom arrangements, one or both of the following connectors will be necessary.

41-pin Connector for external programming and control.
Part Number 131-0239-00 ..... $15.00

55-pin Connector for external read-out (limit lamps, etc.).
Part Number 131-0240-00 ..... $18.00

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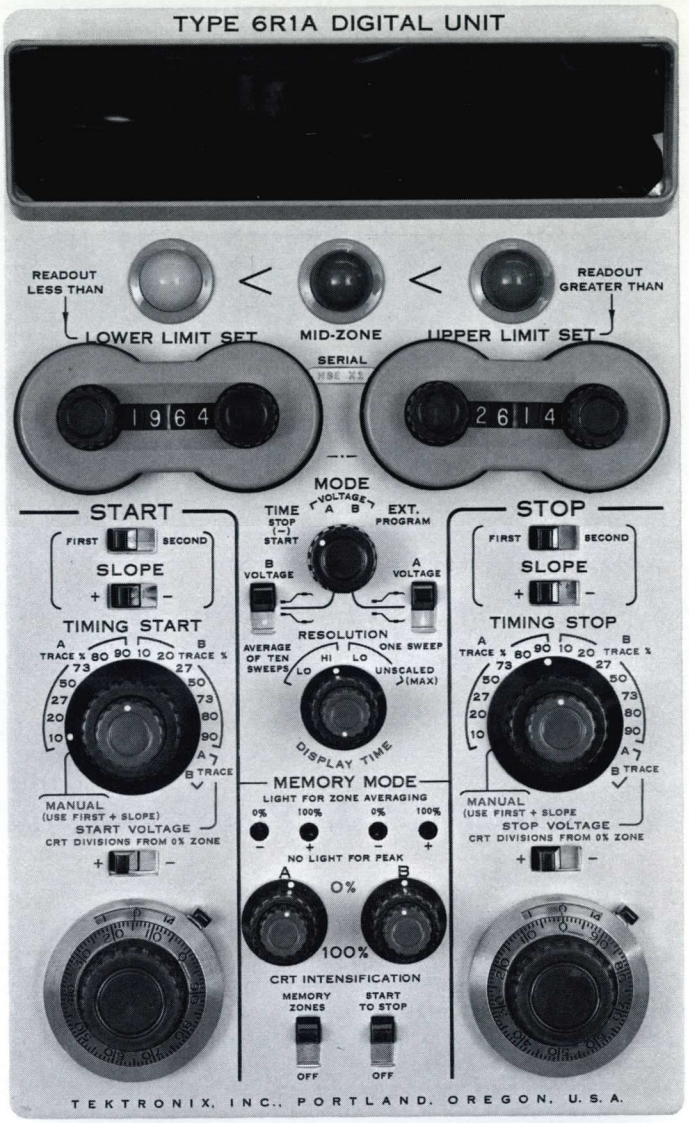
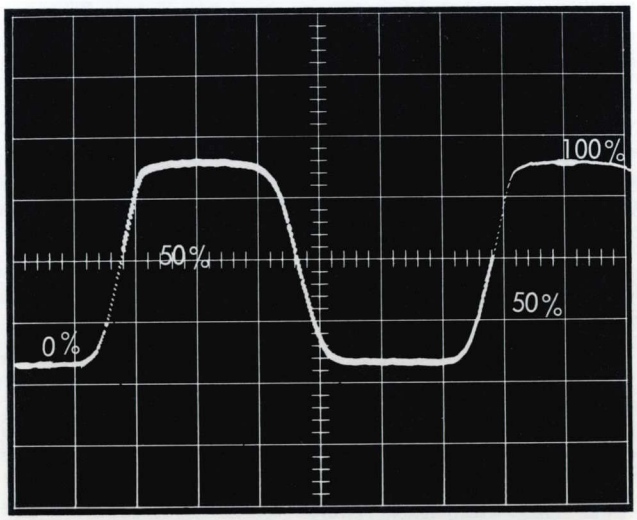
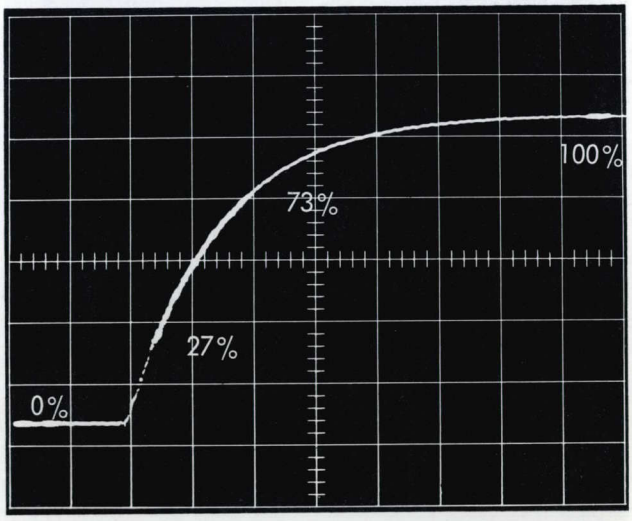




PERIOD (1 CYCLE) MEASUREMENT

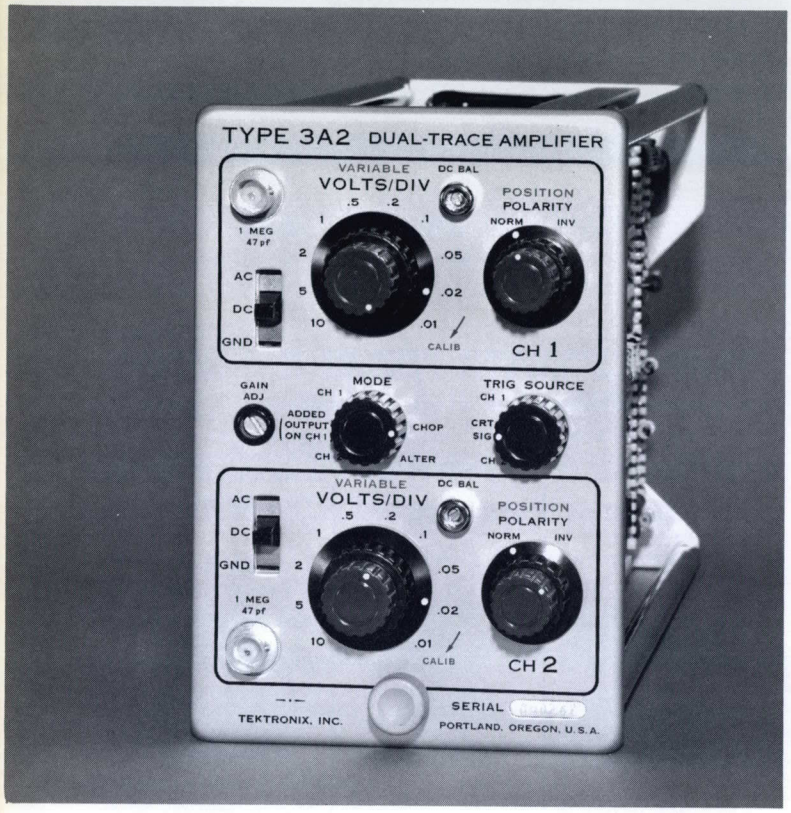
Start: 50% A Trace, 1st +slope
Stop: 50% A Trace, 2nd +slope

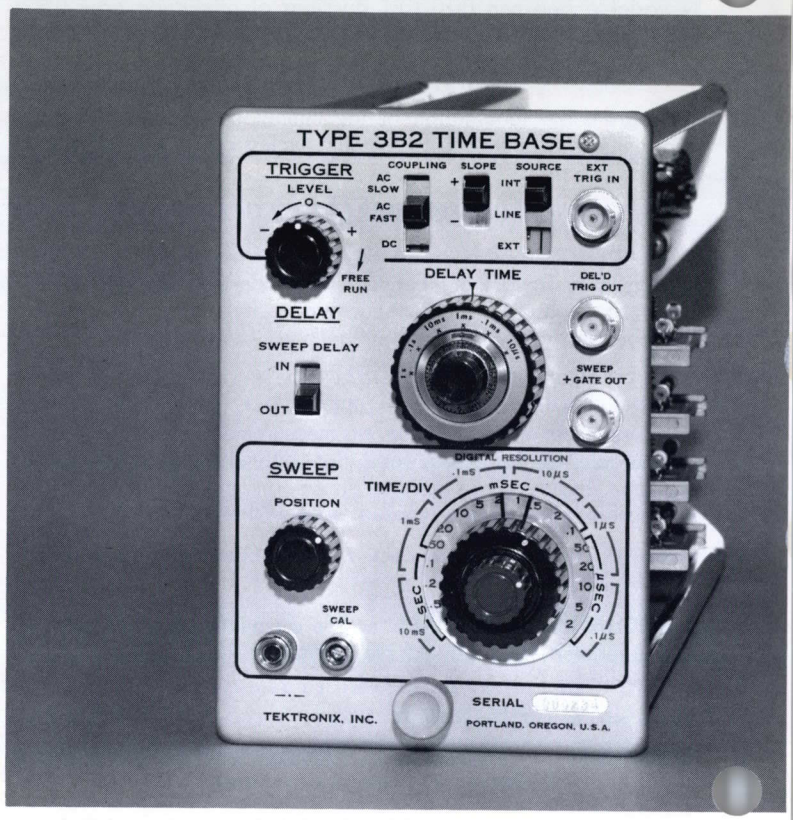


TIME-CONSTANT MEASUREMENT

Start (from) 27% A Trace
Stop (to) +73% A Trace

Type 3A2 / 3B2 DUAL-TRACE AMPLIFIER UNIT TIME-BASE UNIT





Tektronix Type 3A2 Dual-Trace Amplifier Unit and Type 3B2 Time-Base Unit enable low and medium frequency digital read-out with the Type 567 Oscilloscope and Type 6R1A Digital Unit. They also provide analog displays when used with Type 561A or 564 Oscilloscopes.

TYPE 3A2 DUAL-TRACE AMPLIFIER UNIT

OPERATING MODES are Channel 1, Channel 2, Added, Alternate, or Chopped. In chopped operation, successive 12 μs segments of each channel are displayed at an approx 40 kHz rate per channel. Chopped transient blanking is provided.

DEFLECTION FACTOR is from 10 mV/div to 10 V/div in 10 calibrated steps with 1-2-5 sequence, accuracy within 3%. An uncalibrated control permits continuous adjustment between steps and to approximately 25 V/div.

AMPLIFIER BANDWIDTH is DC to 500 kHz for analog display.

SEPARATE CONTROLS include those for attenuation, inversion, positioning, and AC or DC-coupling of each channel.

TRIGGERING can be from Channel 1, Channel 2, or from the signal displayed on the screen.

INPUT RC is 1 megohm, paralleled by approximately 47 pF.

MAXIMUM VOLTAGE INPUT is 600 V (DC plus peak AC).

NET WEIGHT is 5¼ pounds. Shipping weight is 8 pounds, approx.

TYPE 3A2 DUAL-TRACE AMPLIFIER UNIT **$500**

Each instrument includes: 1—patch cord, BNC-to-BNC, 18" (012-0087-00); 2—instruction manual (070-0354-00).

TYPE 3B2 TIME-BASE UNIT

TRIGGERING LEVEL operates over a ±12-volt range.

TRIGGER SOURCE can be internal with 2-mm signal display, external with 0.4-V signal, or line.

TRIGGER COUPLING can be AC Slow, AC Fast, or DC; ± Slope.

SWEEP TIME/DIV from 2 μs/div to 1 s/div is in 18 calibrated steps with 1-2-5 sequence, accuracy within 3%. Calibrated digital readout available from 1 s/div through 20 μs/div ranges.

DIGITAL RESOLUTION selects crystal-controlled clock rates from 1.0 μs to 10 ms in 5 decade steps. Resolution can be selected independently of sweep time, to increase readout accuracy when the first significant digit is known. The front panel indicates the maximum resolution (without possible counter overflow) that can be attained for each sweep rate.

CALIBRATED SWEEP DELAY can be switched in or out. Delay time is continuously variable from 5 μs to 10.5 s, accuracy within 1%.

OUTPUTS are available at front-panel BNC connectors. The Delayed Trigger output is nominally +5 V; Sweep Gate is nominally +15 V.

NET WEIGHT is 5 pounds. Shipping weight is 8 pounds, approx.

TYPE 3B2 TIME-BASE UNIT **$650**

Each instrument includes: 2—instruction manuals (070-0355-00).

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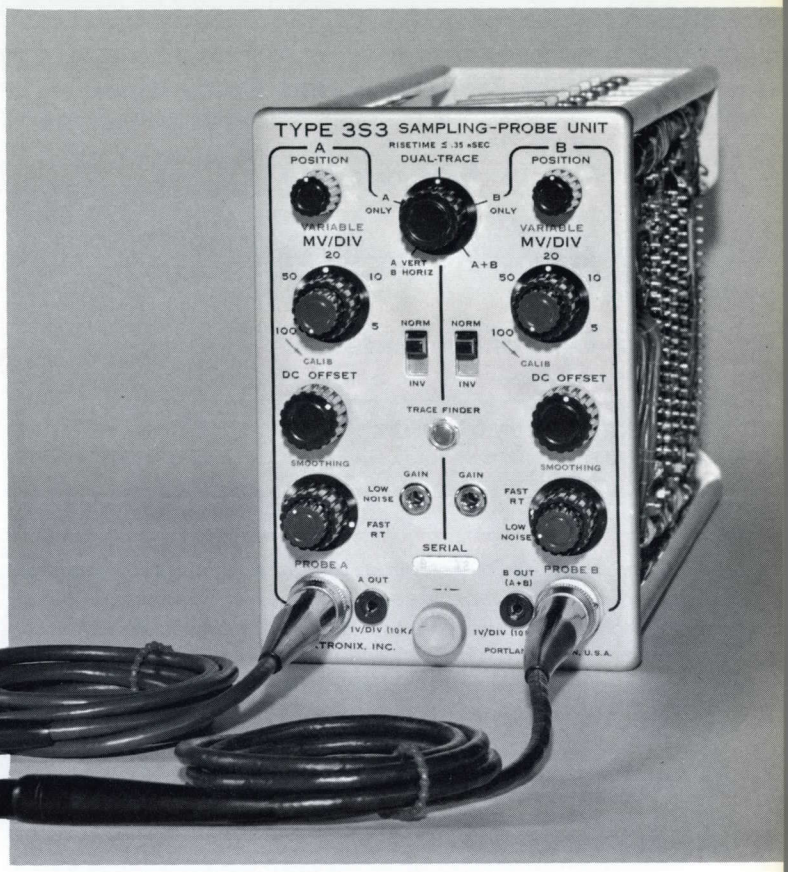
Please refer to Terms and Shipment, General Information page.

SAMPLING-PROBE DUAL-TRACE UNIT Type 3S3

- *COMPACT PROBES*
- *DUAL-TRACE DISPLAYS*
- *0.35 ns OR LESS RISETIME*
- *100 kΩ, 2 pF INPUT*
- *LOW NOISE*
- *RECORDER OUTPUTS*



The Type 3S3 Sampling-Probe Unit is a low-noise dual-trace amplifier employing extremely compact sampling probes. It has two separate channels with identical characteristics and can operate in any one of five modes for a variety of single, dual-trace and X-Y displays. The Type 3S3 is designed to operate in conjunction with a Type 3T77A or Type 3T4 Sampling Sweep Unit in the Type 561A, 564, or 567 Oscilloscopes. In the Type 567, information can be presented in digital as well as analog form.

OPERATING MODES include Channel A only; Channel B only; Dual Trace—Channels A and B switched electronically; A + B Outputs of Channel A and B added algebraically; A Vertical/B Horizontal—Channel A deflected vertically and B horizontally for X-Y displays. Independent controls for each channel provide for trace positioning and polarity inversion.

CALIBRATED DEFLECTION FACTOR is 5 mV/div, 10 mV/div, 20 mV/div, 50 mV/div, and 100 mV/div; accuracy within 3%. An uncalibrated continuous control extends the deflection factor to approximately 2 mV/div.

RISETIME AND SMOOTHING controls, while maintaining correct dot transient response, adjust the instrument for: least noise, best risetime, or a compromise of the two, with signal source from below 25 ohms to beyond 300 ohms. A Fast-RT/Low-Noise switch in conjunction with the Smoothing control allows the operator to select optimum risetime at a sacrifice in noise level. Or, he may elect for a low noise level at some sacrifice in risetime.

At low signal repetition rates the trace may take up to several seconds to traverse the CRT screen. A Type 3S3 in a Type 564 Storage Oscilloscope offers the most advantageous combination for visually displaying these signals.

RISETIME (with a 50-ohm input source impedance) is 0.35 ns with the switch set at the FAST RT position and 1 ns at the LOW NOISE position.

RANDOM NOISE (with 50-ohm-input source impedance) can be adjusted to a minimum value equal to an input signal of less than 0.5 mV peak to peak.

CORRECT DOT TRANSIENT RESPONSE can be achieved with source impedances from 25 ohms to 300 ohms.

INPUT RC is 100 kΩ paralleled by approx 2 pF.

DYNAMIC RANGE is ±1.5 V with Risetime control set to LOW NOISE and ±3 V when the control is set to FAST RISETIME. Safe overload is ±10 V.

EXTERNAL TRIGGER is required, at least 50 ns prior to signal. Minimum repetition rate is 50 Hz.

RECORDER SIGNAL OUTPUT of Channel A, Channel B, or Channel (A + B) is ≅1 V/div (through 10 kilohms), DC-coupled at +10 volt level.

DC OFFSET provides a means of displaying selected portions of signals having off-screen amplitudes, or for displaying signals riding on a DC voltage as high as ±0.5 V.

TRACE FINDER button returns the trace to CRT screen to aid in vertical positioning when the trace is driven off the screen by a large signal.

PROBES (Type P6038) used with the Type 3S3 are extremely compact. The sampling bridge is contained in the probe head to obtain optimum results with an input RC of 100 kΩ paralleled by 2 pF. Probe can be changed from channel to channel with only minor recalibration.

NET WEIGHT is 6¾ pounds. Shipping weight is 9 pounds, approx.

TYPE 3S3 SAMPLING PROBE UNIT
(with two Type P6038 Probes) $1500

Each instrument includes: 2—instruction manuals (070-0374-00); 2—P6038 Probe Package (010-0156-00), which includes; 1—P6038 probe 010-0157-00); 1—Response normalizer (011-0070-00); 1—X10 attenuator (011-0071-00); 2—Test point jack (131-0258-00); 1—Coupling capacitor (011-0072-00); 1—Hook tip assembly (206-0114-00); 1—Ground clip (175-0249-00); 1—Probe holder (352-0068-00); 1—Bayonet ground assembly (013-0085-00); 1—Instruction Manual (070-0400-00).

REPLACEMENT P6038 PROBE PACKAGE (Part Number 010-0156-00) $225

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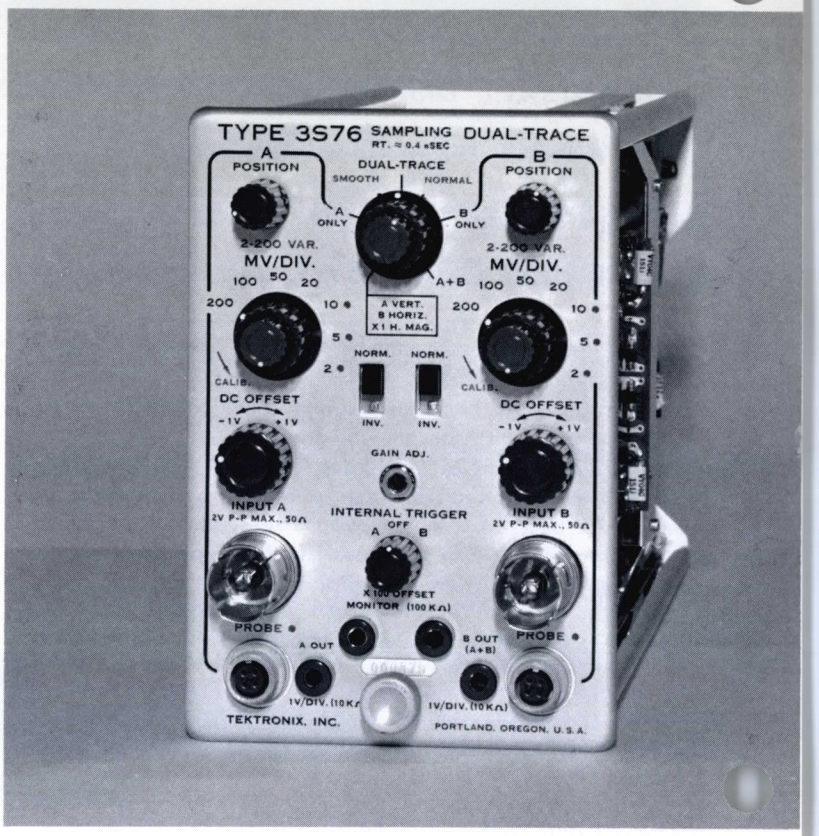
Please refer to Terms and Shipment, General Information page.

Type 3S76 DUAL-TRACE SAMPLING UNIT

- *Internal Triggering and Delay Lines*
- *0.4-ns or Less Risetime*
- *2 Identical Channels*
- *5 Operating Modes*
- *Recorder Outputs*



The Type 3S76 Sampling Unit is a dual-trace amplifier containing two separate channels which possess identical characteristics. The unit can perform in any of five operating modes for a variety of single, dual-trace and X-Y displays. It is designed to operate in conjunction with a Type 3T4 or Type 3T77A Sampling Sweep Unit in Type 561A, 564 and 567 Oscilloscopes. In the Type 567, information will be presented in digital as well as analog form.

OPERATING MODES include Channel A only; Channel B only; Dual-Trace—Channels A and B switched electronically on alternate samples; A+B—outputs of Channels A and B added algebraically; A Vertical/B Horizontal—Channel A deflected vertically and B horizontally for X-Y displays. Independent controls for each channel provide for trace positioning and polarity inversion.

CALIBRATED DEFLECTION FACTOR is from 2 mV/div to 200 mV/div in 7 calibrated steps, accuracy within 3%, except on the 2 mV/div and 5 mV/div steps, which have accuracy within 5%. A variable control permits continuous adjustment between steps.

BANDWIDTH is equivalent to DC to 875 MHz.

RISETIME is 0.4 ns or less, with less than ±3% peak overshoot.

RANDOM NOISE is equivalent to an input signal of less than 2 mV peak to peak with Smooth-Normal Switch in NORMAL position and 1 mV peak to peak with Smooth-Normal Switch in SMOOTH position.

DC OFFSET is ±1 V, referred to input, and monitorable at the front panel at 100 X magnitude. Can be used to permit viewing of signals with off-screen amplitudes or signals riding on a DC voltage up to ±1 V.

INPUT IMPEDANCE is 50 ohms.

DYNAMIC RANGE is ±2 V. Full sensitivity can be used with signals up to ±2 V in amplitude. Momentary overload limit is ±5 V.

SIGNAL DELAY through 55-ns 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.

RECORDER SIGNAL OUTPUT is 1 V/div (through 10 kilohms) DC-coupled at +10 volt level, both channels.

PROBE POWER is provided on both channels for cathode-follower probes (see P6032), Type 281 TDR Pulser, and Type 282 Adapter for high-impedance probes.

NET WEIGHT is 7½ pounds. Shipping weight is 12 pounds, approx.

TYPE 3S76 DUAL-TRACE SAMPLING UNIT $1100
Each instrument includes: 2—10X attenuator, 50 Ω (017-0078-00); 2—5-ns cable (017-0502-00); 2—Instruction Manual (070-0332-00).

PROBES

The following Tektronix probes are recommended for use with the Type 3S76. See Catalog Accessory pages for complete information on the probes.

Use	Input Impedance R	Input Impedance C	Rating	Probe No.	Price
10:1 Attenuator	500 Ω	0.7 pF	16 VDC, 500 VAC	P6034	$ 35
100:1 Attenuator	5 k Ω	0.6 pF	50 VDC, 500 VAC	P6035	35
Selectable Attenuator	10 MΩ	varies	varies	P6032	220
Current	—	—	500 mA	CTI/P6040	31

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PROGRAMMABLE SAMPLING UNIT Type 3T4

- *CALIBRATED SWEEP RANGES*
- *CALIBRATED SWEEP DELAY*
- *100 OR 1000 SAMPLES PER SWEEP*
- *NORMAL OR SINGLE DISPLAY*
- *SINGLE DISPLAY START*

The 3T4 Sampling Unit extends the convenience of operation of the Type 567 Digital Readout System by providing remote control of the horizontal time base. This unit is compatible with the following equipment: 3S76, 3S3, and other 3-series sampling units; 561A, 564, and 567 Indicator Units; 6R1 and 6R1A Digital Units, and the 262 Programmer.

The multiple-pin connector on the front panel affords external control of equivalent-time sweep steps, delay time, samples per sweep, normal or single-display modes, and single-display start. These operations are obtained through the grounding of certain pins of the front-panel connector. Delay time is determined by the value of resistors added externally.

Front-panel outputs are TRIGGER OUT, which provides a 500-mV, negative pulse coinciding with the input trigger, and SWEEP OUTPUT which provides a staircase ramp. The unit also can be triggered internally and responds to input signals up to 1000 MHz. The SINGLE DISPLAY feature permits photographic trace recording. The 10X MAGNIFIER extends the on-screen calibrated sweep range. A dual-purpose front-panel control permits manual or external scanning of the display, thus providing convenient operation of either X-Y or Y-T recorders.

SWEEP TIME/DIV

Equivalent-Time Sampling—1 ns/div to 200 μs/div, $\pm$3%, in 2-5-10 sequence.

Real-Time Sampling—External clock, trigger, and single-display start inputs are required.

DELAY RANGE

1 ns/div through 0.1 μs/div—1000 ns delay range.
0.2 μs/div through 10 μs/div—100 μs delay range.
20 μs/div through 100 μs/div—1000 μs delay range.
(No delay range for 200 μs/div sweep range, or in real-time sampling mode.)

SWEEP MODES

+External Input—Scanning accomplished by external signal. Deflection factor adjustable from 5 to 20 volts/horizontal division.

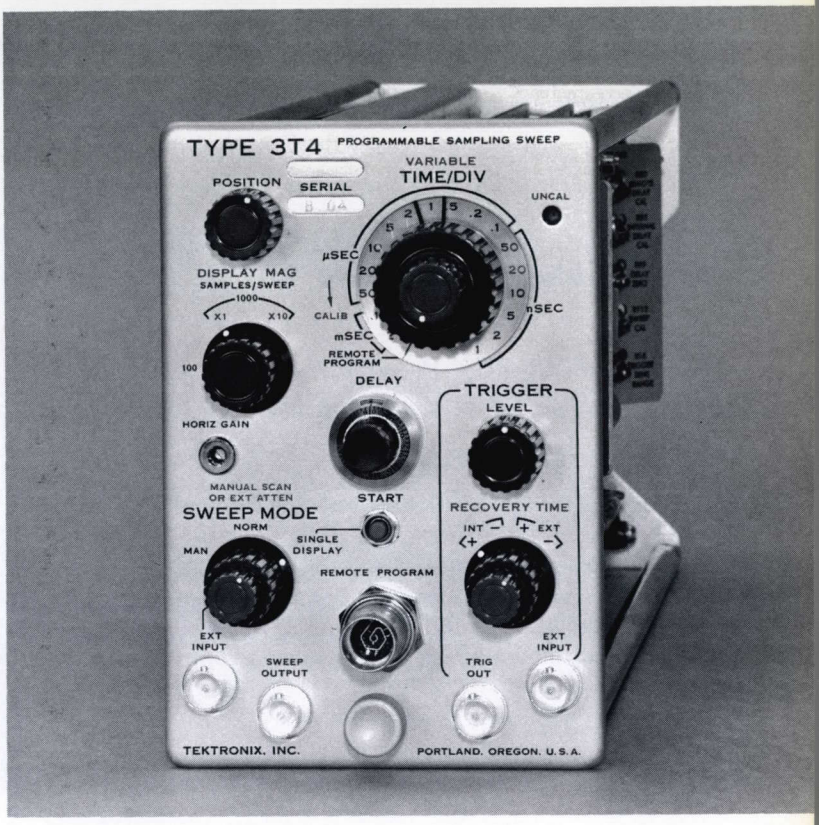
Manual Scan—Display scanned by front-panel control.

Normal—Repetitive sweep.

Single Display—One sweep each time START button is depressed.

OTHER SWEEP CHARACTERISTICS

Samples per sweep—100 or 1000.
Magnification of CRT display—X1 and X10.
Front-panel sweep output—Staircase ramp, 1 volt/horizontal division.



TRIGGERING

Trigger Inputs—Internal or External + and —. Trigger responds to inputs up to 1000 MHz.
Trigger Output—500 mV, negative polarity.

REMOTELY PROGRAMMABLE FUNCTIONS

Equivalent-Time Sweep Ranges.
Delay Time.
Samples per Sweep (digital read-out decimal information correct only on 1000 samples/sweep).
Normal or Single-Display Modes.
Single-Display Start (when remotely programmed for SINGLE DISPLAY)

DIMENSIONS AND WEIGHT

Instrument is 16½" long by 4¼" wide by 6¼" high. Net weight is 5¾ lbs; shipping weight is 11¾ lbs.

TYPE 3T4 SAMPLING SWEEP UNIT $1300
Each instrument includes: 2—Instruction Manual (070-0439-00).

OPTIONAL ACCESSORIES

Connector, 19-Pin, Male, Miniature. Mates with front-panel connector of 3T4 Unit for external programming.
(131-0388-00) $32.50
Extender Card, 56-Pin (Modified 262). The card is a rigid extension which enables the printed-circuit cards to operate out of the Type 3T4 for servicing convenience.
(012-0078-00) $20.00
Remote Program Cable, 10 ft long, 19-Pin Miniature Connector, Male to 36-Pin Male Miniature Connector.
(012-0101-00) $85.00

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Type 3T77A SAMPLING SWEEP UNIT

- *Triggering Through 1 Gigahertz*
- *10 μs/div to 0.02 ns/div Sweep Range*
- *Variable Sweep Delay*
- *Single-Display Provision*
- *Recorder Output*

The Type 3T77A is a Sampling Sweep Unit. It provides subnanosecond capabilities when used in conjunction with a Type 3S3 or 3S76 Sampling Unit in a Type 561A, 564 or 567 Oscilloscope. In the Type 567, information can be presented in digital as well as analog form.

TRIGGERING CHARACTERISTICS

SINEWAVE TRIGGERING

FREQUENCY RANGE is from 100 kHz through 1 GHz.

AMPLITUDE RANGE is from 10 mV to 800 mV peak to peak for external triggering. Five times more trigger amplitude is required for equivalent internal triggering. Optimum trigger amplitude for least jitter depends on frequency. Damaging overload can occur at 5 V or greater.

JITTER varies with trigger amplitude, frequency and TIME/DIV setting. Typical figures are less than 50 ps jitter for 100 mV peak to peak 30 MHz to 50 MHz sinewave. A special synchronizing mode may be used above 30 MHz for extra stability.

PULSE TRIGGERING

REPETITION RATE RANGE is from 30 p/s (limited by memory drift in the vertical plug-in) through 10^9 p/s (1 GHz).

AMPLITUDE RANGE is from 10 mV to 800 mV peak to peak for external triggering. Minimum trigger rise rate is approx 150 mV/μs. Optimum trigger amplitude for least jitter depends on rise rate and rep rate. Damaging overload can occur at 5 V or greater.

JITTER is typically 50 ps or 0.1% of fast ramp duration whichever is greater for pulses of 50 mV amplitude, 2 ns width (or 10 mV, 10 ns width).

OTHER CHARACTERISTICS

DOT DENSITY can be either 10 or 100 dots/div.

CALIBRATED SWEEP TIME/DIV is from 0.2 ns/div to 10 μs/div in 15 calibrated steps, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated between calibrated ranges.

TIME EXPANDER provides X10 expansion that maintains a constant number of samples per centimeter. Extends calibrated sweep range to 0.02 ns/div.

MANUAL OR EXTERNAL SCANNING of the display provides convenient operation of remote recorders. At least 5 V/div (positive-going) is required for an external sweep.

SINGLE DISPLAYS useful for photography or storage can be initiated by a reset button.

RECORDER SWEEP OUTPUT is ≃1 V/div (through 10 kilohms), useful for driving recorders and other devices.

TIME POSITION provides a sweep delay range of at least one full horizontal scale, unexpanded, and at least ten scales (100 div) when expanded.

NET WEIGHT is 5½ pounds. Shipping weight is 9 pounds, approx.

TYPE 3T77A SAMPLING SWEEP UNIT **$650**

Each instrument includes: 2—10X attenuator, 50 Ω (017-0078-00); 1—Adapter, BNC-to-GR (017-0064-00); 2—10-ns GR cable (017-0501-00); 1—Adapter, BNC-to-UHF (103-0032-00); 2—Instruction Manual 070-0546-00).

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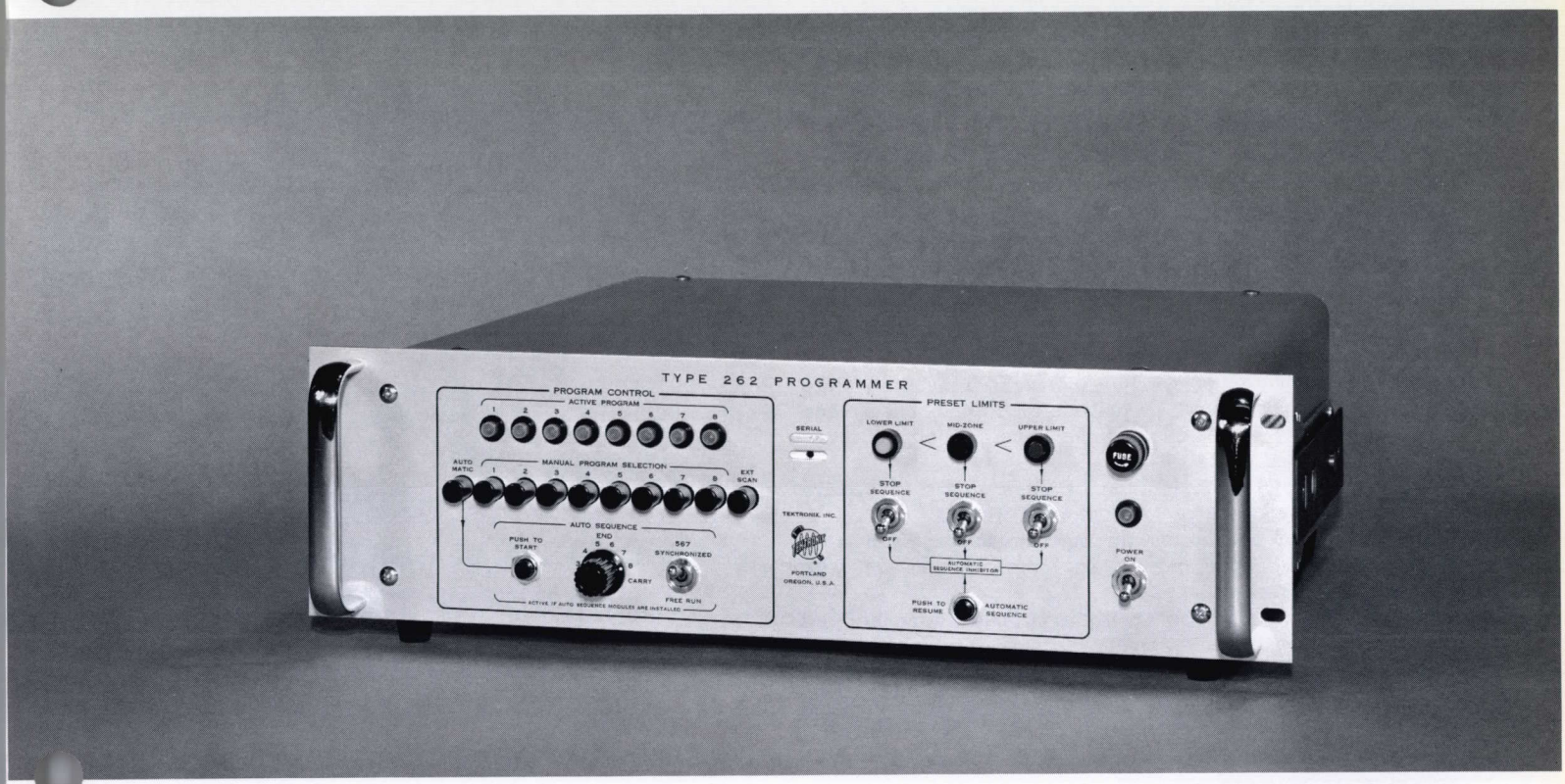
Please refer to Terms and Shipment, General Information page.

PROGRAMMER Type 262



- **FOR 567/6R1A DIGITAL READOUT COMBINATION**
- **UP TO 8 DIFFERENT MEASUREMENTS FOR EACH TYPE 262**
- **UP TO 3 TYPE 262's OPERATE TOGETHER FOR 24 MEASUREMENTS**
- **UP TO 8 MEASUREMENTS PER SECOND**
- **PUSH BUTTON MEASUREMENT SELECTION OR**
- **OPTIONAL AUTOMATIC SEQUENCE OF MEASUREMENTS***
- **OPTIONAL SYNCHRONOUS CONTROL OF OTHER EQUIPMENT**

The Type 262 Programmer makes it possible to remotely control the measurement and readout capabilities of the 6R1A Digital Unit. Any set of up to eight different pre-selected time or voltage measurements can be made with each Type 262 used. The measurements are made from the same signal as is displayed on the Type 567 cathode-ray-tube screen, using plug-in units that furnish digital data to the 6R1A Digital Unit.

The kind of measurement selected is determined by the circuits on each of eight plug-in circuit cards that are plugged into the Type 262 during operation. Other plug-in program cards may be interchanged for a different set of measurements when different measurements are required.

* Automatic sequencers are required.

Up to three Type 262's may be used together at any one time to make up to 24 different tests or measurements without interchanging program cards.**

When a Type 6R1A is under the control of a Type 262 the circuits on the program cards take the place of circuits otherwise selected from the front panel of the 6R1A. Each wired program card represents a particular combination of some front panel control settings on the 6R1A.

PROGRAM CARDS

Plug-in program cards come ready for wiring. Cards are wired by soldering in appropriate jumpers and resistors according to instructions in the manual for the 262.

Each card is wired for a particular time or amplitude measurement. Examples are: risetime, delay time, pulse duration, pulse amplitude, time interval between two pulses. Upper and lower test limits can also be selected by wiring the cards as instructed.

If a change of measurement is desired, the plug-in program cards can be removed and other pre-wired cards inserted in a matter of seconds. Or the cards can be easily rewired.

AUXILIARY EQUIPMENT CONTROL

The Type 262 also accommodates 8 auxiliary equipment plug-in programming cards. The connectors from the auxiliary cards have parallel connections to 54 control lines available at the rear-panel of the Type 262 for controlling signal attenuators, signal generators, trigger source switches, signal switches, power supplies, etc., in step with the 6R1A measurement sequence.

** Cable capacitance and environmental noise limit the number of programmers that can be used in series.

262

MANUAL CONTROL

Front-panel push-buttons allow manual selection of measurements. The sequence is determined by the operator and any step in a program can be held for as long a period as needed. The measurement rate is determined by the Type 6R1A.

EXTERNAL CONTROL

Measurements can be selected externally through control lines available at the rear-panel connector. Selection is by contact closure to ground.

AUTOMATIC SEQUENCE CONTROL

The Type 262 is pre-wired to facilitate the installation of an Automatic Sequencer consisting of a synchronizer board and a counter board. This accessory will automatically control sequence of up to 8 measurements per Type 262.

Front-panel switches allow an automatic sequence to be interrupted in accordance with pre-established upper and lower limits. Any combination of the upper, middle, or lower limits can be used.

The position of the boards can be interchanged to achieve any particular sequence of measurements wanted.

The Automatic Sequencer can be synchronized with data recording devices such as printers, card punches, or with various test fixtures.

Both manual push-button control and external control are still available when the Automatic Sequencer is installed.

Up to three Type 262 Programmers can be used in series for a total of 24 different measurement programs. For automatic sequencing, each individual Type 262 requires an Automatic Sequencer accessory.

MEASUREMENT RATE

WITHOUT AUTOMATIC SEQUENCER

The measurement rate is governed by the Type 6R1A display time of 0.1 to 6 seconds, and is also dependent upon the sweep time.

WITH AUTOMATIC SEQUENCER

With the Automatic Sequencer installed, the measurement rate can be synchronized with auxiliary equipment or can be determined by the Type 567 and Type 262.

In a non-synchronized mode of operation, the measurement rate is determined by the sum of the Type 6R1A display time and the Type 262 display time. Display time of the Type 262 is continuously variable within the range of 50 to 500 milliseconds. In this mode, up to 8 measurements per second can be made.

In a synchronized mode of operation, the display is held, upon completion of a measurement, until an external completion pulse is received. In the synchronized mode, up to 6 measurements per second can be made.

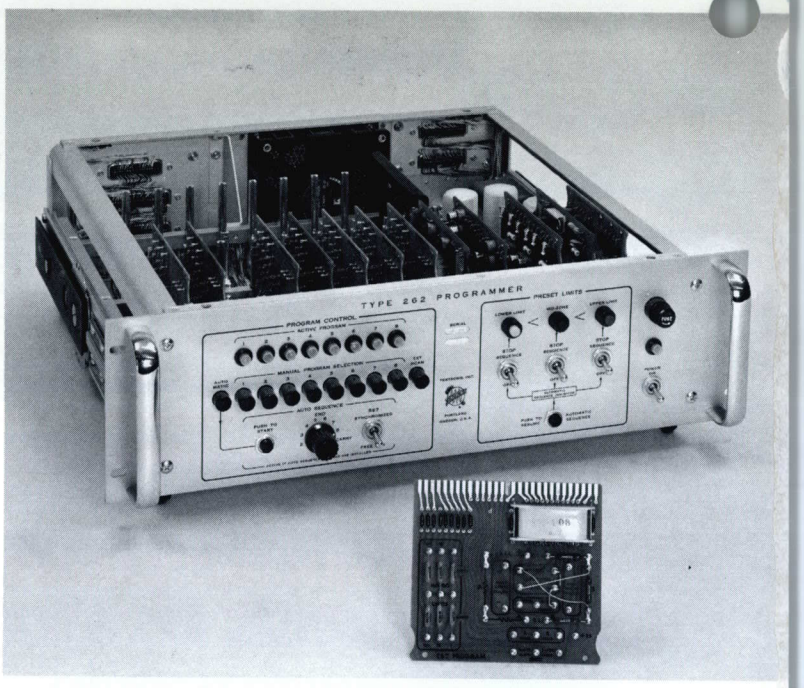
MECHANICAL FEATURES

The Type 262 mounts in a standard 19" rack and occupies only 5¼" of rack height. It has slide-out tilt-lock tracks that permit it to be pulled forward, tilted, and locked in any of five positions for convenient programming and servicing. Cabinet feet are included for installation when not rack-mounted.

TYPE 262 PROGRAMMER $1350

Each instrument includes: 1—Cabinet feet kit (016-0052-00); 4—Washer (210-0833-00); 4—Washer (210-0917-00); 4—Screw (212-0512-00); 4—Screw (212-0561-00); 1—Pr Mounting tracks (351-0085-00); 1—Power cord (161-0022-00); 1—3 to 2-wire adapter (103-0013-00); 1—6R1A to 262 cable (012-0081-00)*; 2—Instruction Manual (070-0399-00).

*If the Type 262 is to be used with another Type 262, indicate on your order that you need a 262/262 cable (012-0082-00) rather than a 262/6R1A cable (012-0081-00).



NECESSARY ACCESSORIES FOR BASIC OPERATION

For basic operation of the Type 262, at least one program card is required.

PROGRAM CARD (Part Number 018-0007-00) each . . . $25

PROGRAM CARD EXTENSION

A 56-pin rigid extension enables the program cards to operate out of the Type 262 housing for servicing convenience.

56-PIN RIGID CARD EXTENSION
(Part Number 012-0078-00) $20

OPTIONAL RESISTOR KIT

A resistor kit containing 176, ¼ W, 1% resistors is available for use with program cards.

RESISTOR KIT (Part Number 016-0056-00) $50

Complete instructions to program the cards are included in the instruction manual.

AUTOMATIC SEQUENCER ACCESSORY

A sequencer, composed of a synchronizer board and a counter board, provides for automatic scan of up to 8 programs per Type 262.

AUTOMATIC SEQUENCER (Part Number 040-0331-00) . $215

SYNCHRONIZER BOARD Only
(Part Number 018-0005-00) $95

COUNTER BOARD Only (Part Number 018-0006-00) . . $120

AUXILIARY PROGRAMMING CARDS (not furnished with Type 262)

The Type 262 accommodates 8 auxiliary plug-in programming cards. Each card has gold, through-hole plating for best possible electrical contact.

CARD with 11 reed relay assembly
(Part Number 018-0003-00) $25

CARD only (Part Number 018-0004-00) $18

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

The usefulness of the Type 567 and Type RM567 Oscilloscope is further augmented by a wide range of accessories and associated instruments. Brief descriptions of some of these are given here. For full specifications, please refer to each instrument on the page listed in the index.

TYPE 109 PULSE GENERATOR

Produces 0.25-ns risetime pulses of either equal or alternately different time duration. Pulse width is 0.5 to 100 ns at full repetition rate of 550 to 720 p/s; and to 300 ns at half repetition rate.

Pulse amplitude is variable from 0 V through 50 V, accuracy within 3%. Polarity can be either positive or negative.

External DC charge voltage inputs permit alternate pulses of different amplitudes and/or polarity.

TYPE 109 PULSE GENERATOR $360

TYPE 111 PULSE GENERATOR

The Type 111 is a high-repetition rate, fast-rise pulse generator that provides two pulse outputs:

OUTPUT PULSE has a risetime $\leq$0.5 ns for positive and negative polarity. Repetition rate is variable from 10 p/s to 100 kHz. Pulse duration is 2 ns to 1500 ns with an external charge line. Pulse amplitude is $\pm$10 V.

PRETRIGGER PULSE amplitude is $\approx$10 V, duration is 250 ns, and half-amplitude risetime is 5 ns (approx).

Time delay between pretrigger and output pulse is variable from 30 ns to 250 ns.

TYPE 111 PULSE GENERATOR $365

TYPE 113 DELAY CABLE

The Type 113 Delay Cable provides 60-ns delay so trigger signals can arrive ahead of the vertical deflection signal. The Type 113 has a 0 to 50% risetime of about 0.0025 ns, and 10 to 90% risetime of better than 0.1 ns. Impedance is 50 Ω $\pm$1%.

TYPE 113 DELAY CABLE $250

TYPE 280 TRIGGER COUNTDOWN UNIT

The Type 280, used with the Type 3T77A or Type 3T4, allows synchronization on frequencies up to 5 GHz. The Type 280 can be used to lower the frequency of the triggering signals to within a range of 15 to 45 MHz. This permits the trigger circuit of the sampling system to lock in solidly with a much higher input signal frequency.

Input frequency is from 30 MHz to 5 GHz; input signal range is 50 mV to 4 V, peak to peak. Output repetition rate is continuously variable from 15 to 45 MHz. Fast-rise trigger output is 150 mV with less than 0.4-ns risetime and 1.5 V with less than 4-ns risetime.

TYPE 280 TRIGGER COUNTDOWN UNIT $265

TYPE 281 TIME DOMAIN REFLECTOMETRY PULSER

Type 281 is a compact current source designed for use with Type 3S76, 4S1, and 1S1 50-Ω Sampling Units; power is obtained from their probe power connectors.

PULSE AMPLITUDE is approx 18.5 mA; RISETIME $\leq$0.75 ns at leading negative transition; WIDTH $\geq$5 μs from negative-going edge to positive-going edge, at 50% amplitude points; FLATNESS $\pm$2% overshoot and ringing following negative-going edge for first 10 ns, 0.5% thereafter; LOADING EFFECT on 50-Ω SYSTEM $\leq$10% reflection (capacitive).

TYPE 281 TDR PULSER $95

TYPE 292 SEMICONDUCTOR TESTER POWER SUPPLY

The Type 292 supplies DC power and connection for a sub-nanosecond environment test fixture. The fixture can be wired for measuring time and charge characteristics of diodes and transistors.

The Type 292 is normally used between a sub-nanosecond pulse generator and a 50-Ω input sampling oscilloscope. Signal connections are made directly to the test fixture through miniature coaxial cables.

Test voltage range is from 1 to 20 V; bias current is from 0.1 to 200 mA. External supplies may be used for other voltages and currents, limited to 1 A maximum.

TYPE 292 ..... $325

OPTIONAL TEST FIXTURES AVAILABLE:

DIODE TEST JIG (Part Number 013-0080-00) $40
ADAPTER FOR DIODE TEST JIG (Part Number 016-0059-00) $25

TYPE CT-1 CURRENT TRANSFORMER

Type CT-1 provides a means for accurate measurement of current flow in a circuit, while keeping loading effects to a minimum. TYPE P6040 serves as an inter-connecting cable between the CT-1 and an oscilloscope. SENSITIVITY is 5 mV/mA into a 50-Ω load. BANDWIDTH is 35 kHz to 1 GHz. RISETIME for pulse response is less than 0.35 ns. DECAY TIME CONSTANT is 5 μs, approximated by 1% per 50 ns; limit, 1 μs. MAXIMUM VOLTAGE is 1000 V, DC. CURRENT RATINGS are 500 mA maximum RMS, 100 A peak pulse.

CT-1 (ORDER PART NUMBER 015-0040-00) $17
P6040 PROBE (ORDER PART NUMBER 010-0133-00) $14
TYPE CT-1 AND P6040 (ORDER PART NUMBER 015-0041-00) $31

TYPE CT-2 CURRENT TRANSFORMER AND P6041 PROBE

Type CT-2 and probe are similar to CT-1 with probe, except for lower bandwidth limits, higher RMS current rating, and reduced sensitivity. SENSITIVITY is 1 mV/mA into a 50-Ω load. BANDWIDTH is 30% down at 1.2 kHz to 7% down at 200 MHz. RISETIME is approximately 0.5 ns. DECAY TIME CONSTANT is 125 μs, approximated by 1% per 1.25 μs; limit, 25 μs. CURRENT RATINGS are 2.5 A maximum RMS, 100 A peak pulse. Though designed primarily for conventional oscilloscopes, the longer decay time constant and higher RMS current rating make Type CT-2 useful for some sampling oscilloscope applications. (Requires BNC to GR adapter).

CT-2 (ORDER PART NUMBER 015-0046-00) $17
P6041 PROBE (ORDER PART NUMBER 010-0164-00) $12
BNC to GR ADAPTER (Part Number 017-0063-00) $4.75

TYPE CT-3 50-OHM SIGNAL PICKOFF

The Type CT-3 provides a convenient means of picking off a signal in a 50-Ω system. Used with a Tektronix Sampling Instrument, the CT-3 provides the link for uses as a trigger source.

Sensitivity is 10% of the voltage under test, into a 50-Ω load. Risetime is less than 0.4 ns. Insertion impedance with a 50-Ω termination is 1 Ω shunted by 4.5 μH; or 2 Ω shunted by 4.5 μH without 50 Ω termination. VSWR approx 1.2 at 1.5 GHz.

ORDER PART NUMBER 017-0061-00 ..... $30.00

SAMPLING ACCESSORIES

TYPE P6032 CATHODE-FOLLOWER PROBE

Type P6032 with a bandwidth of greater than 800 MHz, permits accurate measurements of high-speed repetitive pulses. The DC-coupled probe uses 7 plug-in attenuator heads (10X to 1000X). Risetime is typically 0.4 ns for probe and attenuator head. Maximum output is ±150 mV into a 50-Ω load. Signal delay is approximately 10 ns.

ORDER PART NUMBER 010-0108-00 ..... $220

MINIATURE PASSIVE PROBES

Type P6034 permits accurate measurement of high-speed pulses. Attenuation ratio is 10X. Input resistance is 500 Ω at DC and approximately 300 Ω at 1.0 GHz with an input capacitance of 0.7 pF ±0.1 pF at 1.0 MHz to 1.0 GHz. Risetime is less than 100 ps. Maximum DC input, DC-coupled, is 16 V and, AC-coupled, is 500 V. Ringing and overshoot is ≤2% on pulses ≥25 Ω source.

ORDER PART NUMBER 010-0110-00 ..... $35

Type P6035 is similar to P6034, except that attenuation is 100X. Input resistance is 5000 Ω at DC and approximately 1500 Ω at 1.0 GHz. Input capacitance is 0.6 pF ±0.1 pF at 1.0 MHz to 1.0 GHz. Risetime is less than 200 ps. Maximum DC input, DC-coupled, is 50 V and, AC-coupled, is 500 V.

ORDER PART NUMBER 010-0111-00 ..... $35

Various probe nose adapters are available to facilitate connecting to BNC, GR, etc. (See Accessory Section for details.)

VOLTAGE PICKOFF

The VP-1 and VP-2 are 50 Ω "T" type voltage pickoffs for use with Tektronix probes while introducing minimum disturbance of the equipment under test. VP-1 fits the P6034 and P6035 probes, while VP-2 fits the P6038 probe.

VP-1—ORDER PART NUMBER 017-0073-00 ..... $25
VP-2—ORDER PART NUMBER 017-0077-00 ..... $30

TYPE 282 ADAPTER FOR HIGH-IMPEDANCE PROBES

This accessory permits the use of conventional high-impedance probes with 50-Ω sampling plug-ins units, such as Types 1S1, 4S1, 4S2A, and 3S76. Now, with a wide-range sampling timing unit (Types 1S1 or 5T3), one oscilloscope can cover nearly the entire range of signal measurement (from power-supply ripple to sub-nanosecond events).

Other advantages include: voltage offset, smoothing, and overload-recovery features of sampling not normally available with a conventional oscilloscope; no loss of DC stability with sampling units; and excellent linearity over entire dynamic range.

The adapter is recommended for use with P6008 or P6009 Probes. It can also be used with P6010 or P6011.

TYPE 282 PROBE ADAPTER $95

MISCELLANEOUS SAMPLING ACCESSORIES

A variety of items are available to facilitate inter-connection between sampling plug-in units and other related devices. Examples are: GR, UHF, BNC, TYPE C and TYPE N adapters; 50-ohm connecting cables (GR-TYPE CONNECTORS) of various lengths; and attenuators, terminations, 50-ohm T and L fittings, etc. (See Accessory Section for descriptions.)

GENERAL RADIO 50-Ω POWER DIVIDER, TYPE 874-TPD

This divider is designed for use in broad-band 50-Ω systems where the mismatch introduced by ordinary "Tee" connectors is undesirable. It is especially useful in a time-domain reflectometer set-up where test line, pulser, and oscilloscope must be coupled with a minimum of reflection-producing discontinuities.

DIMENSIONS: Height—$2\frac{5}{16}$", width—4", depth—$\frac{13}{16}$".
NET WEIGHT: 5 ounces
TYPE 874-TPD POWER DIVIDER
ORDER PART NUMBER 017-0082-00 ..... $70

MAINTENANCE AIDS

These items are offered for the convenience of companies with in-plant instrument-maintenance facilities. If 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.

FLEXIBLE EXTENSION — 30" long, permits Type 3S76 and Type 3T77A Sampling Plug-In Units to be operated away from oscilloscope.

ORDER PART NUMBER 012-0066-00 ..... $23

15-PIN PLUG-IN EXTENSION CARD — Allows protrusion of Type 6R1A 15-pin etched-circuit boards.

ORDER PART NUMBER 012-0067-00 ..... $20

20-PIN PLUG-IN EXTENSION CARD — Allows protrusion of Type 6R1A 20-pin etched-circuit boards.

ORDER PART NUMBER 012-0068-00 ..... $25

56-PIN PLUG-IN EXTENSION CARD—Allows protrusion of Type 3T4 56-pin etched-circuit boards. Also used for extending Type 262 Programmer cards.

ORDER PART NUMBER 012-0078-00 ..... $20

TYPE 3S3 SUB-CHASSIS EXTENSION — Allows maintenance of Type 3S3 sub-chassis when 3S3 is extended out of oscilloscope.

ORDER PART NUMBER 012-0077-00 ..... $25

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

DC-to-1 MHz AMPLIFIER UNIT Type 2A60

The Type 2A60 is a general purpose plug-in unit. It may be used in the Type 561A, Type 564, Type 565, or Type 567 Oscilloscope. However, in the Type 567, the measurements will not be presented in digital form. Used with the Type 129 Power Supply, the Type 2A60 can drive recorders, X-Y plotters, oscilloscopes, and other indicators.

CALIBRATED DEFLECTION FACTOR is 0.05 V/div, 0.5 V/div, 5 V/div and 50 V/div; accuracy is ±3%. Uncalibrated continuous control from 0.05 V/div to 500 V/div.

BANDWIDTH is DC to 1 MHz. Bandwidth is specified at —3 dB.

RISETIME is 0.35 μs.

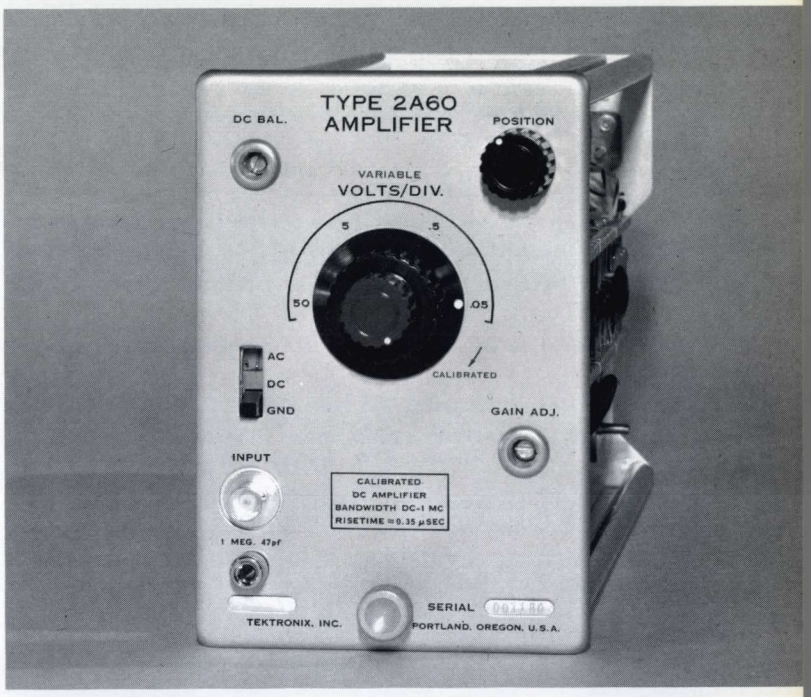
MAXIMUM INPUT VOLTAGE is 600 volts.

INPUT RC is 1 megohm paralleled by approximately 47 pF.

NET WEIGHT is 3 pounds. Shipping weight is 4 pounds, approx.

TYPE 2A60 AMPLIFIER UNIT **$105**

Each instrument includes: 2—instruction manual (070-0263-00).



LOW-LEVEL DIFFERENTIAL Type 2A61 AMPLIFIER

The Type 2A61 is a high-gain AC Differential Amplifier with excellent common-mode rejection and other features that have been optimized for low-level applications. It may be used in the Type 561A, Type 564, Type 565, or Type 567 Oscilloscope. However, in the Type 567, the measurements will not be presented in digital form. Used with the Type 129 Power Supply, the Type 2A61 can drive recorders, X-Y plotters, oscilloscopes, and other indicators.

OPERATING MODES include Input A only; negative Input B only; Input A minus Input B; and CM (common mode)—for checking differential rejection ratio.

CALIBRATED DEFLECTION FACTOR is from 0.01 mV/div to 20 mV/div in 11 steps, 1-2-5 sequence; accuracy ±5%. Uncalibrated continuous control from 0.01 mV/div to 50 mV/div.

BANDWIDTH is 0.06 Hz to approximately 0.3 MHz decreasing to 0.1 MHz at 0.01 mV/div. Bandwidth is specified at —3 dB.

FREQUENCY RESPONSE CONTROL selects high-frequency and low-frequency —3 dB points thus restricting the bandwidth to improve the signal-to-noise ratio.

COMMON-MODE REJECTION RATIO is 50,000 to 1 below 10 kHz with a 5-V common-mode input.

LINE-FREQUENCY NOISE FILTER is a notch filter that provides better than 50 to 1 rejection of 60 Hz line-frequency noise. Filters for 50 Hz and 400 Hz are also available.

EQUIVALENT INPUT NOISE is less than 20 μV peak to peak (3.5 μV RMS) at maximum bandwidth.

TRACE RESTORER button returns the trace to its normal vertical position after the trace has been driven off the screen.

INPUT RC is 10 megohms paralleled by approx 50 pF.

NET WEIGHT is 4¼ pounds. Shipping weight is approx 5 pounds.

TYPE 2A61 AMPLIFIER UNIT **$385**

Each instrument includes: 2—instruction manual (070-0328-00); 1—input cable (012-0072-00).

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

Type 2A63 DIFFERENTIAL AMPLIFIER UNIT

The Type 2A63 is a differential-input amplifier plug-in unit that can be used to make voltage measurements between two above-ground points while at the same time cancelling in-phase signals such as hum pickup in the connecting leads. The Type 2A63 may be used in the Type 561A, Type 564, Type 565, or Type 567 Oscilloscope. However, in the Type 567, the measurements will not be presented in digital form. Used with the Type 129 Power Supply, the Type 2A63 can drive recorders, X-Y plotters, oscilloscopes, and other indicators.

CALIBRATED DEFLECTION FACTOR is from 1 mV/div to 20 V/div in 14 steps, 1-2-5 sequence; accuracy within 3%. Uncalibrated continuous control from 1 mV/div to 50 V/div.

BANDWIDTH is DC to 300 kHz. Bandwidth is specified at —3 dB.

RISETIME is 1 μs (approx).

DIFFERENTIAL INPUT has better than 50-to-1 CMR (Common Mode Rejection) at 0.2 V/div with 50 kHz sine wave.

PHASE SHIFT between two Type 2A63 units used for X-Y displays is nominally less than 1° at 50 kHz.

INTER-STAGE AC COUPLING reduces drift at high gain.

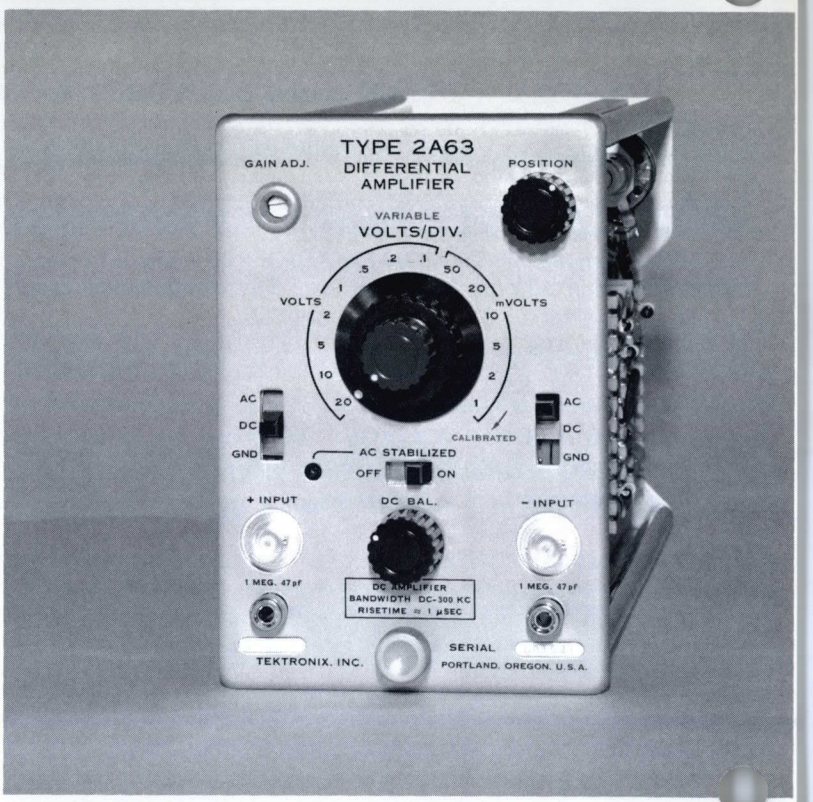
INPUT RC is 1 megohm paralleled by approximately 47 pF.

MAXIMUM INPUT VOLTAGE is 600 volts.

NET WEIGHT is 3¾ pounds. Shipping weight is 5 pounds, approx.

TYPE 2A63 AMPLIFIER UNIT $150

Each instrument includes: 2—instruction manuals (070-0266-00).



Type 2B67 TIME-BASE UNIT

The Type 2B67 is a Time-Base Plug-In Unit that may be used to generate a sweep in the Type 561A, Type 564, Type 565 (raster generation), or Type 567 Oscilloscope. However, in the Type 567, the measurements will not be presented in digital form. The Type 2B67 also has facilities for an external input to the sweep amplifier.

CALIBRATED SWEEP RANGE is from 1 μs/div to 5 s/div in 21 steps, 1-2-5 sequence; accuracy 3%—with magnifier 5%. Uncalibrated continuous control from 1 μs/div to 12 s/div.

5X MAGNIFIER extends sweep rate to 0.2 μs/div.

SINGLE SWEEP for one-shot waveform photography and storage applications.

TRIGGER FACILITIES include Internal, External, Line; Amplitude-Level Selection; AC or DC Coupling; Automatic or Free Run; ±Slope.

TRIGGER REQUIREMENT for internal is 2 minor graticule divisions of deflection; for external, minimum is from 0.5 V at DC to 2.0 V at 2 MHz.

EXTERNAL INPUT TO SWEEP AMPLIFIER has a bandwidth of DC to 750 kHz and a deflection factor of about 1 V/div.

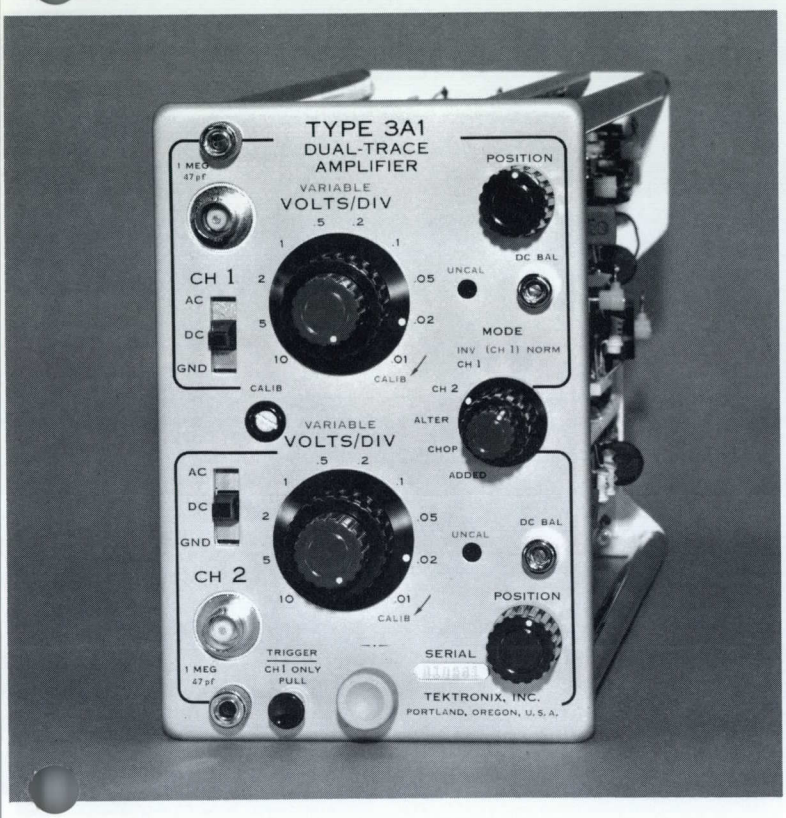
NET WEIGHT is 4¼ pounds. Shipping weight is 5 pounds, approx.

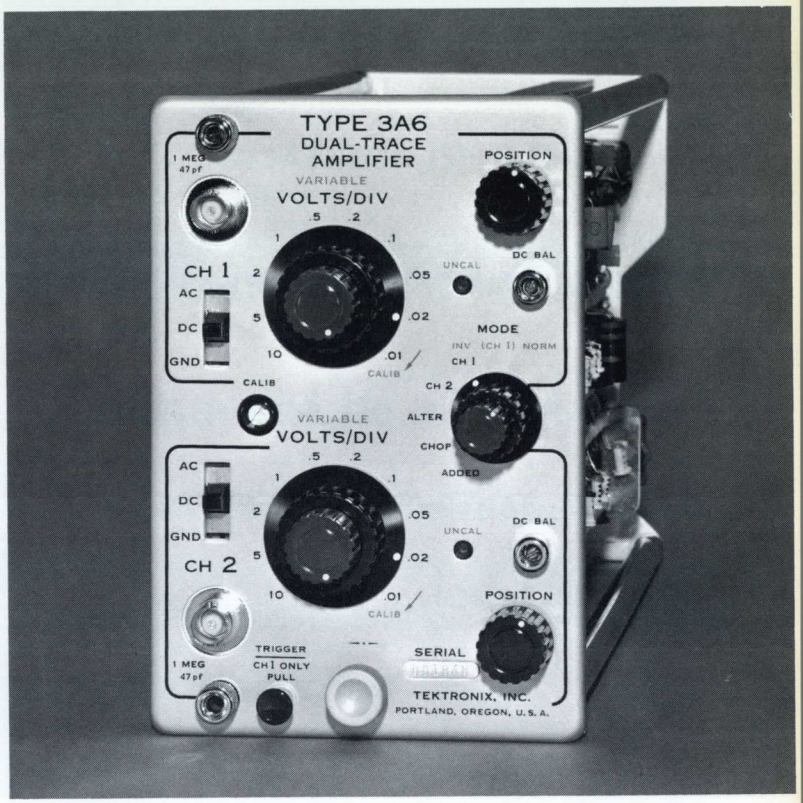
TYPE 2B67 TIME-BASE UNIT $210

Each instrument includes: 2—instruction manual (070-0366-00).

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

DUAL-TRACE DC-to-10 MHz UNIT Type 3A1 / 3A6





The Type 3A1 and Type 3A6 Amplifiers are general-purpose dual-trace plug-in units. Performance of the two units is the same except that the Type 3A1 does not have a signal-delay line. The Type 3A6 does contain an internal 260-nanosecond signal-delay line that allows viewing of the leading edge of the sweep-triggering waveform when using a high-speed time base such as the Type 3B1, 3B3, 3B4, and 3B5 Time-Base Units.*

Both units have two separate channels, each with identical characteristics. The units can operate in one of five modes for a variety of single and dual-trace displays. Two Type 3A1's or two Type 3A6's may be used in the chopped mode for X-Y curve tracing, but there is no provision for synchronized switching or channel pairing. Because of its delay line, the Type 3A6 Amplifier will show marked phasing error above the audio range if used X-Y with other than another Type 3A6 Amplifier. Either instrument can be used in the Type 561A, Type 564, and Type 565 Oscilloscopes. They may also be used in the Type 567 Readout Oscilloscope when digital readout is not required. Linear scan is 8 cm.

OPERATING MODES include Channel 1 only; Channel 2 only; Alternate-Channel 1 and 2 switched electronically on alternate sweeps; Chopped—In chopped operation, successive 4-μs (approx) segments of each channel are displayed at an approx 125 kHz rate per channel (chopped transient blanking is provided); and Added—outputs of Channel 1 and 2 added algebraically.

POLARITY of Channel 1 can be changed to provide 180° inversion. No polarity inversion on Channel 2.

CALIBRATED DEFLECTION FACTOR is 10 mV/div to 10 V/div in 18 steps, 1-2-5 sequence; accuracy within 3%. Uncalibrated continuous control from 10 mV/div to 25 V/div.

BANDWIDTH is DC to 10 MHz. Bandwidth is specified at —3 dB.

RISETIME is approximately 35 ns.

INPUT COUPLING is either AC or DC. AC-coupled low frequency —3 dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by 47 pF.

INTERNAL TRIGGER SIGNAL (for the time base) is selectable either from the output of Channel 1 only, or from the combined output of the unit.

NET WEIGHT: Type 3A1, 6 pounds; Type 3A6, 6 pounds. Shipping weight: Type 3A1, 8 pounds (approx); Type 3A6, 8 pounds (approx).

TYPE 3A1 AMPLIFIER UNIT $450
Each instrument includes: 2—instruction manual (070-0343-00).

TYPE 3A6 AMPLIFIER UNIT $540
Each instrument includes: 2—instruction manual (070-0419-00).

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

**The Type 3A1 and Type 3A6 can be used with a Type 2B67 or Type 3B2 Time-Base Units, but it will not usually be possible to view the entire leading edge of the triggering waveform when used in conjunction with these time bases or the Type 565 and RM565 Oscilloscopes.*

Type 3A3 DUAL-TRACE DIFFERENTIAL AMPLIFIER

100 μV/cm DEFLECTION FACTOR DIRECT COUPLED

50,000:1 COMMON-MODE REJECTION

CONSTANT BANDWIDTH AT ALL DEFLECTION FACTORS

HI OR LO BANDWIDTH SELECTION

AC STABILIZATION

The Type 3A3 Dual-Trace Differential Amplifier is designed to use in the Type 561A, Type 564, Type 565, or Type 567 Oscilloscope. However, in the Type 567, the measurements will not be presented in digital form. Used with the Type 129 Power Supply, the Type 3A3 can drive recorders, X-Y plotters, oscilloscopes, and other indicators. The Type 3A3 contains two independent high-gain amplifier channels. Either channel may be used to produce a display, or the two channels may be electronically switched to produce dual-trace displays. The Type 3A3 has high sensitivity with direct-coupled inputs and a high degree of common-mode rejection.

DEFLECTION FACTOR from 100 μV/cm to 10 V/cm is in 16 calibrated steps with 1-2-5 sequence, and is accurate within 3%. Continuously adjustable (uncalibrated) from 100 μV/cm to at least 25 V/cm.

BANDWIDTH for both channels is selected at the front panel. Either HI (DC to greater than 500 kHz at —3 dB) or LO (DC to 5 kHz at —3 dB) bandwidth is available. The selected bandwidth remains constant at all deflection factors.

AC STABILITY for each channel provides virtually drift-free operation in the 4 most sensitive ranges. With AC stability, and direct input coupling, the low-frequency —3 dB points are approximately 0.15 Hz at 1 mV/cm, 0.3 Hz at 0.5 mV/cm, 0.75 Hz at 0.2 mV/cm, and 1.5 Hz at 0.1 mV/cm.

DISPLAY MODES include CH 1, CH 2, or dual-trace with either chopped or alternate switching. In chopped operation, electronic switching occurs at approx a 250-kHz rate to show successive 2-μs segments of each trace. Chopped transient blanking is provided.

NOISE with grounded input is less than 10 μV peak to peak with LO bandwidth, less than 40 μV peak to peak with HI bandwidth.

DRIFT is typically less than 500 μV/hour after 30-minute warm-up.

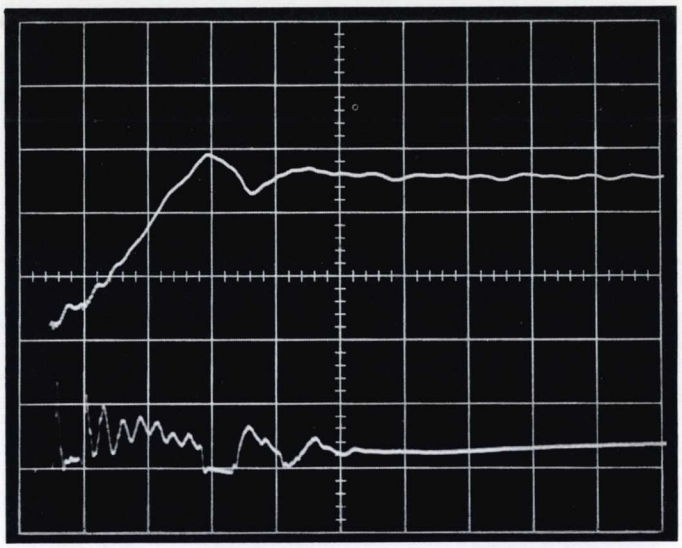
PHASE SHIFT is less than 2° from DC to 100 kHz between any 2 Type 3A3 Amplifiers used in X-Y operation. Phase shift can be adjusted to 0° at any particular deflection factor.

MULTIPLE X-Y DISPLAYS can be obtained with two Type 3A3 Plug-In Units. Dual-trace switching is synchronized, so that one Y-channel remains plotted against the same X-channel once the display is set up. There is no provision for consistent pairing each time the system is operated.

INPUT COUPLING can be AC or DC, and is individually selected for each input (2 per channel). Amplifier input grids can be grounded with these same controls. With AC coupling, the low-frequency —3 dB point is approximately 2 Hz direct, or 0.2 Hz with 10X probe.

INPUT RC is 1 megohm paralleled by 47 pF. The input R can be disconnected by removing internal wire link.

TRIGGER PICKOFF is internally coupled, and can be selected from CH 1, CH 2, or the composite signal after switching.



IMPACT STUDY

Chopped display of displacement and acceleration of a body at rest being struck by a solenoid plunger. Strain gage is differentially connected to upper channel at 100 μV/cm (DC coupled). Accelerometer is connected single-ended to the lower channel at 200 μV/cm (DC coupled).

DIFFERENTIAL CF OUTPUTS are available at the plug-in unit rear connecting pins. These ground-referenced outputs can be used to drive recorders with high input impedance, or other equipment. Output from CH 1 or CH 2 is a differential ≈2.5-volt signal for each centimeter of displayed signal. Output from the common output amplifier is a differential ≈5-volt signal for each centimeter of displayed signal. Bandwidth is DC to ≈500 kHz with a non-capacitive load. Jacks can be easily installed at the rear of the oscilloscope to provide access to these outputs.

INTERCHANNEL ISOLATION

ELECTROSTATIC ISOLATION is 10^6:1 (120 dB) or better referred to input signal levels.

SWITCHING ISOLATION in chopped operation is 100:1 or better referred to centimeters of display. The switching circuit introduces negligible interaction in all other operating modes.

TYPE 3A3 DUAL-TRACE DIFFERENTIAL AMPLIFIER . . $790

Each instrument includes: 4—BNC-to-binding-post adapters (103-0033-00); 2—BNC-to-BNC 18" red patch cords (012-0087-00); 2—Instruction Manual (070-0408-00).

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

COMMON-MODE REJECTION[A]

	Referred to Input Connectors		Referred to Input of Properly Adjusted P6023 Probes	
	DC-Coupled Input	AC-Coupled Input With Low-Z Source	DC-Coupled Input	AC-Coupled Input With Low-Z Source
0.1 mV/cm to 10 mV/cm[B]				
DC to 100 kHz	50,000:1			
500 kHz	1,000:1	1,000:1		
DC to 10 Hz			50,000:1	
15 Hz		500:1		
60 Hz		2,000:1		
100 Hz			10,000:1	
1 kHz to 10 kHz			1,000:1	1,000:1
100 kHz		50,000:1	500:1	500:1
20 mV/cm to 10 V/cm[C] (Equal to, or adjustable to, the following CMR ratios.)				
DC to 1 kHz	10,000:1			
DC to 100 kHz	1,000:1			
500 kHz	500:1	500:1		
15 Hz		500:1		
60 Hz		2,000:1		

[A] For ground-referenced sine-wave common-mode signals.

[B] With 10 volts peak to peak or less in common mode at input connectors.

[C] With common-mode amplitude at input connectors of 100 volts peak to peak or less from 20 mV/cm to 0.1 V/cm, and with 600 volts peak to peak or less from 0.2 V/cm to 10 V/cm.

These common-mode signals will not overdrive the amplifier:
0.1 mV/cm to 10 mV/cm, ±20 V from ground (40 V peak to peak AC)
20 mV/cm to 0.1 V/cm, ±200 V from ground (400 V peak to peak AC)
0.2 V/cm to 10 V/cm, ±600 V from ground (1200 V peak to peak AC)

Type 3A5 AUTOMATIC/PROGRAMMABLE AMPLIFIER UNIT

AUTOMATIC SENSITIVITY "SEEKING"
PROGRAMMABLE FRONT-PANEL FUNCTIONS
DIGITAL INDICATION OF CONTROL SETTINGS
STABLE DISPLAYS

You can make measurements faster and easier with this new high-performance plug-in unit*. Press the "seek" button on the special 10X probe and the instrument automatically selects the volts/division setting for a convenient display size. This "seek" feature is ideal for applications where the instrument is located out of reach, or for production-line testing that would normally require continuous readjustment of the volts/division control.

Upon receipt of the "seek" command, the deflection factor is automatically readjusted so that neither peak of the displayed waveform extends more than 3 divisions from the graticule center, thus establishing the display within the CRT viewing area. Large, lighted indicators in the front-panel window tell you at a glance the volts/division setting, input coupling, and when the manual variable volts/division control is in the uncalibrated position.

The Type 3A5 can be operated manually for applications that do not require the automatic features. In addition, the automatic functions are overridden whenever the manual V/div setting is changed. The plug-in can also be operated remotely using the Type 263 External Programmer. Both the "seek" feature and manual operation of the control settings are overridden when the instrument is programmed externally.

Other features of the Type 3A5 include a special "AC Trace Stabilized" circuit that minimizes trace drift. This feature is particularly useful when the instrument is operated at high sensitivity or when long term trace-stability is required. An internal signal delay line insures the display of the leading edge of the waveform.

OPERATING MODES

SEEK, MANUAL AND EXTERNAL
Seek operation selected by front-panel push button or push button on the P6030 Probe. Manual or external operation selected by front-panel push buttons.

SEEKING CHARACTERISTICS

DEFLECTION FACTOR
10 mV/div to 50 V/div without probe; 0.1 V/div to 500 V/div with probe.

SEEKING TIME
$\leq$200 ms. (Time required to complete one "seek" operation.)

CYCLING TIME
2 to 4 s (interval between seek operations with "seek" command button held down continuously).

LOGIC CIRCUIT RESPONSE
Seeking circuitry functions for signal rep-rates up to 20 MHz.

GENERAL CHARACTERISTICS

READOUT FACILITY
Bulb-and-film digits ½" high. Readout information includes 1 mV/div to 50 V/div (10 mV/div to 0.5 kV/div when special 10X probe activates the 10X circuit); "AC" or "DC" input coupling, "with probe" indication, and "uncal" indication of the variable manual V/div control.

**Recommended for use with the Type 561A Oscilloscope or Type 564 Storage Oscilloscope.*

DEFLECTION FACTOR
12 calibrated steps from 10 mV/div to 50 V/div, 1, 2, 5 sequence. Accuracy is ±3% with gain set to match indicator. Additional steps of 1, 2 and 5 mV/div in manual operation only; accurate to ±5%. A manual control provides variable V/div settings between all steps in all modes of operation (uncalibrated).

BANDWIDTH (3-dB down)
DC to $\geq$15 MHz, from 10 mV/div to 50 V/div (all modes). 5 MHz at 1, 2 or 5 mV/div (manual mode only).

RISETIME
$\leq$23 ns at a deflection factor of 10 mV to 50 V/div.

INPUT RC
1 megohm paralleled by approx 24 pF.

PROGRAMMABLE FUNCTIONS
V/div setting, 10X probe attenuation factor, AC or DC input coupling, AC Trace Stabilization, by contact closure to ground. Vertical positioning by analog current.

P6030 PROBE
10X probe with "seek" command button and 6′ cable. Supplied with the instrument.

NET WEIGHT
5¼ lbs. Shipping weight, approx 8 lbs.

TYPE 3A5 AUTOMATIC/PROGRAMMABLE AMPLIFIER UNIT $760

Each instrument includes: 1—P6030 Probe (010-0195-00); 1—connector, 37 pin (131-0422-00); 1—cover, connector (200-0660-02); 2—instruction manual (070-0500-00).

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

FOR A PROGRAMMABLE SYSTEM, SEE THE TYPE 263 EXTERNAL PROGRAMMER

AUTOMATIC/PROGRAMMABLE TIME-BASE UNIT Type 3B5

AUTOMATIC TIME-BASE "SEEKING"
PROGRAMMABLE FRONT-PANEL FUNCTIONS
DIGITAL INDICATION OF CONTROL SETTINGS
DELAYED-SWEEP MAGNIFIER

Used in association with the Type 3A5 Amplifier and P6030 Probe, the Type 3B5 automatically establishes a triggered time-base display upon receipt of the "seek" command from the probe. The time/division setting is automatically selected to provide a convenient display of 2 to 6 cycles. Lighted indicators in the front-panel window show the selected time/division setting. They also indicate when the time base is not triggered and when the manual variable time/division control is in the uncalibrated position.

The Type 3B5 features a delayed-sweep magnifier for expanding the display by X10 or X100. A calibrated delay control permits any portion of the magnified display to be viewed. When the sweep magnifier is in operation, the time/division readout is automatically corrected to indicate the magnified setting, and a "magnified sweep" indication lights up in the readout window.

The automatic "seek" feature of the Type 3B5 is overridden when the manual time/division control is used. Both the "seek" feature and manual operation of the control setting are overridden when the instrument is programmed remotely using the Type 263 External Programmer.

OPERATING MODES

SEEK, MANUAL AND EXTERNAL

Manual or external operation selected by front-panel push buttons. Seek operation selected by front-panel push button or push button on the P6030 Probe supplied with the Type 3A5 Amplifier.

SEEKING CHARACTERISTICS

SWEEP RANGE

5 s/div to 0.1 μs/div.

SEEKING TIME

≤500 ms (time required to complete one "seek" operation).

CYCLING TIME

2 to 4 s ("seek" command button held down continuously).

LOGIC CIRCUIT RESPONSE

Seeking circuitry functions for signal rep-rates from 30 Hz to 20 MHz.

GENERAL CHARACTERISTICS

READOUT FACILITY

Bulb-and-film digits ½" high. Readout information includes 5 s/div to 10 ns/div sweep times, plus "Magnified Sweep," "Not Triggered," and "Uncalibrated" indications.

SWEEP RANGE

27 calibrated steps from 5 s/div to 10 ns/div, 1-2-5 sequence. Accuracy is ±3% from 0.5 s/div to 0.1 μs/div. ±5% at 1, 2 or 5 s/div, and at 50, 20, 10 ns/div. A manual control provides variable time/div settings between all steps in all modes of operation (uncalibrated).

DELAYED SWEEP MAGNIFIER

Expands the display by a factor of X10 or X100. X10 range magnifies time/division settings from 5 s/div to 1 μs/div. X100 range magnifies time/division settings from 5 s/div to 10 μs/div. Accuracy is ±3% for all magnified sweep times except the 5, 2, or 1 s/div (±5%). VARIABLE DELAY: 10-turn control determines portion of sweep to be magnified.

TRIGGER MODES

Internal: AC-coupled or Auto. External: AC-coupled or DC-coupled.

TRIGGER REQUIREMENTS

Internal AC: 0.2 div of signal displayed, 50 Hz to 20 MHz.
Internal Auto: 0.5 div of signal displayed, 50 Hz to 20 MHz.
External AC: 0.5 V to 40 V peak to peak, 50 Hz to 20 MHz.
External DC: 1 V to 40 V peak to peak, DC to 20 MHz.

PROGRAMMABLE FUNCTIONS

Time/div, magnifier range, trigger-mode, slope, and coupling, by contact closure to ground. Horizontal positioning, trigger level, and magnifier delay by analog current.

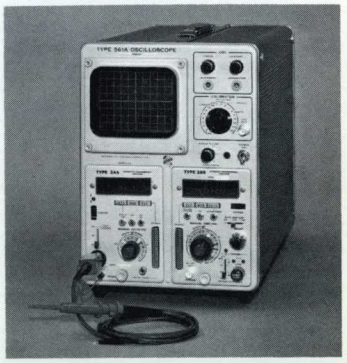
TYPE 3B5 AUTOMATIC/PROGRAMMABLE TIME BASE UNIT $890

Each instrument includes: 1—connector, 37 pin (131-0422-00); 1—cover, connector (200-0660-01); 2—instruction manual (070-0538-00).

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

AUTOMATIC SEEKING OSCILLOSCOPE SYSTEM

The Type 3A5 and 3B5 Plug-In Units, combined with a Type 561A Oscilloscope or Type 564 Storage Oscilloscope, offer a new automatic system for making amplitude and time measurements. By simply pressing the "seek" button on the special probe, the control functions of both plug-in units are automatically established. This new "seek" feature speeds up laboratory or production measurements by eliminating frequent readjustment of the front-panel controls.



Type 3A7 DIFFERENTIAL COMPARATOR UNIT

- *UP TO 10 MHz BANDWIDTH*
- *20,000:1 COMMON-MODE REJECTION*
- *11,000 cm EFFECTIVE SCREEN HEIGHT*

The Type 3A7 High-Gain Differential Comparator adds to the measurement capabilities of Type 561A, 564, and 565 Oscilloscopes. It can also be used in Type 567 Oscilloscopes, but does not provide digital readout. Used with Type 129 Power Supply, the Type 3A7 can drive recording equipment, X-Y plotters, oscilloscopes, or other indicators.

As a differential input amplifier, the dynamic range of the 3A7 Unit permits common-mode signals up to ±15 volts in amplitude to be applied to the amplifier without attenuation. With a rejection ratio of about 20,000 to 1 for DC or low-frequency signals, differential signals of 1 mV or less on large common-mode signals can be measured. A front-panel attenuator permits the acceptance of common-mode voltages up to 500 V.

As a differential comparator, voltage measurements using the slide-back technique can be made with this unit. The high accuracy and stability of the DC comparison voltage, added differentially to the input signal, makes precise voltage measurements possible. Using this mode of operation, the 3A7 Unit has an effective screen height of ±11,000 cm. This is equivalent to a ±11-volt dynamic signal range at a deflection factor of 1 mV/cm. Within this range, calibrated ±DC comparison voltages can be added differentially to the input signal to permit a maximum of about 0.001% or 100 μV per mm to be resolved.

CALIBRATED DEFLECTION FACTOR

1 mV/div to 50 V/div, depending on millivolts/div and attenuator settings. Accuracy of millivolts/div positions is ±3%. Uncalibrated continuous variation between steps and to approx 125 V/div.

BANDWIDTH		
MV/DIV	FREQUENCY	RISETIME
50 mV/div	DC to ≥ 10 MHz	≤ 35 ns
20 mV/div	DC to ≥ 10 MHz	≤ 35 ns
10 mV/div	DC to ≥ 10 MHz	≤ 35 ns
5 mV/div	DC to ≥ 8 MHz	≤ 44 ns
2 mV/div	DC to ≥ 6 MHz	≤ 58 ns
1 mV/div	DC to ≥ 4 MHz	≤ 88 ns

INPUT CHARACTERISTICS		
INPUT ATTEN	MAX PEAK INPUT VOLTS Common or Differential Mode	MAX INPUT ATTEN ERROR
R ≈ ∞	±15 V	*
1X	±15 V	**
10X	±150 V	±0.05%
100X	±500 V	±0.15%
1000X	±500 V	±3%

*10 to 50 MΩ input R.
**1X input R within ±0.1% of 10X input R.

INPUTS

Direct or AC coupled. Low-frequency response in AC mode down no more than 3 dB at 2 Hz. Input RC: 1 megohm paralleled by approx 20 pF.

COMMON-MODE REJECTION RATIO AT 1 mV/div	
DC COUPLED	≥20,000:1 with ±15 VDC or 30 V P to P AC, DC to 20 kHz
AC COUPLED	≥1000:1 with 30 V P to P at 60 Hz, to ≥20,000:1 at 20 kHz
HF (AC OR DC COUPLED)	≥500:1 with 30 V P to P at 500 kHz

COMPARISON VOLTAGE

0 to ±1.1 V, or 0 to ±11 V. Accuracy: ± (0.15% of indicated value plus 0.05% of V_c Range).

OVERDRIVE RECOVERY

Recovers to within 10 mV of reference signal within 300 ns after the signal returns to the screen. Certain overdrive signals can cause an additional slow (thermal) shift of up to 5 mV in the reference level.

WEIGHT

Net weight is 5¼ lbs. Shipping weight approx 9 lbs.

TYPE 3A7 DIFFERENTIAL COMPARATOR $635

Each instrument includes: 2—instruction manual (070-0477-00).

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

OPERATIONAL AMPLIFIER UNIT Type 3A8

OSCILLOSCOPE DEFLECTION AMPLIFIER

20 mV/div - 10 V/div.

DC to 3.5 MHz.

TWO OPERATIONAL AMPLIFIERS

≥ 15,000 Open-loop gain.

≥ 10 MHz Gain-bandwidth product.

Output: ±25 V, ±7.5 mA.

INTEGRAL PRECISION INPUT AND FEEDBACK COMPONENTS

The Type 3A8 Operational Amplifier performs precise integration, differentiation, function generation, linear and nonlinear amplification. The unit can be used in any Tektronix 560-Series Oscilloscope including the Type 561A, 564, 565 or 567 (without digital readout). Not for use with the Type 560. Signals from the operational amplifiers can be displayed on the oscilloscope and/or fed to other devices.

Used with the Type 129 Power Supply, the Type 3A8 can drive recorders, X-Y plotters, oscilloscopes, and other indicators.

DEFLECTION AMPLIFIER

BANDWIDTH

DC to ≥3.5 MHz (3-dB down).

RISETIME

≤100 ns.

DEFLECTION FACTOR

20 mV/div to 10 V/div in 1-2-5 sequence. Nine calibrated steps, accurate to within 3% after adjustment at 0.02 V/div. A variable control permits continuous uncalibrated adjustment from 20 mV/div to approx 25 V/div.

INPUT RC

1 megohm paralleled by 47 pF.

SWITCHING FACILITIES

Signal source selection from either operational amplifier or an external signal. AC or DC coupling. The display can be inverted to provide the desired deflection polarity.

OPERATIONAL AMPLIFIERS

OPEN-LOOP GAIN

≥15,000 at DC.

OPEN-LOOP GAIN-BANDWIDTH PRODUCT

≥10 MHz.

OUTPUT RANGE

±25 V, ±7.5 mA. Protected against shorts to ground.

INPUT OFFSET

Voltage: adjustable to zero ±500 μV (front-panel control).

Current: adjustable to zero ±50 pA (calibration control).

DRIFT

Typically <0.5 mV/hour referred to input (after warmup), averaged over 10 hours.

OUTPUT IMPEDANCE

≤30 Ω at 1 MHz for compensated unity-gain amplifier.

FEEDBACK

Provisions for negative and/or positive feedback. Negative feedback utilizes internal and/or external impedances; positive feedback utilizes external impedances only.

SELECTABLE INPUT AND FEEDBACK COMPONENTS

Front-panel switches allow independent selection of the following resistors and capacitors in any combination as Z_i and Z_f: 0.01, 0.1, 0.2, 0.5 and 1 megohm; 10 pF, 100 pF, 0.001, 0.01, 0.1 and 1 μF. All values are ±1% except 10 pF and 100 pF which are adjustable.

INTEGRATION LOW-FREQUENCY REJECT

An RC network which rejects integration below approx 1 Hz (voltage or current offset drift) can be switched in or out as needed. Other networks can be connected externally.

3A8

TWO SHIELDED TERMINAL ADAPTERS are included for construction of external circuitry for custom applications. Over one hundred suggested circuits for special applications are shown in the instruction manual.

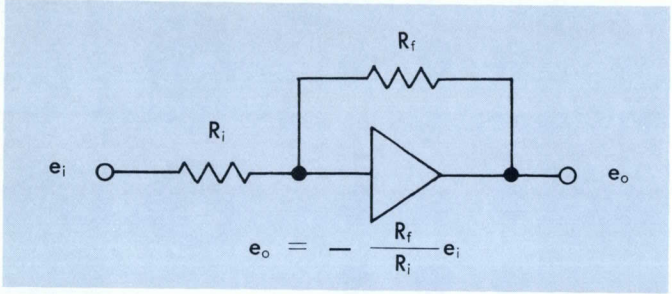
NET WEIGHT

Approx 4¼ lbs. Shipping weight approx 10 lbs.

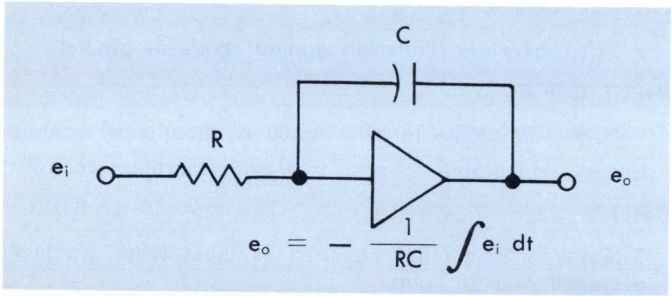
TYPE 3A8 OPERATIONAL AMPLIFIER UNIT $600

Each instrument includes: 2—terminal adapter (013-0048-01); 2—terminal shield (013-0049-01); 2—BNC to binding post adapter (103-0033-00); 2—instruction manual (070-0507-00).

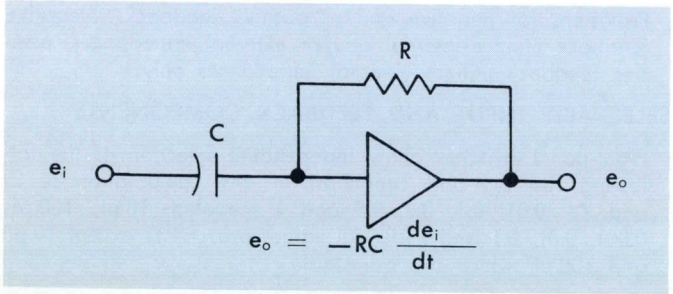
BASIC OPERATING MODES



AMPLIFICATION is determined by the ratio of R_f to R_i due to the high open-loop gain. This provides convenient signal step-up or step-down with low output impedance. External compensation extends the closed-loop gain-bandwidth (see Compensating Adapter).



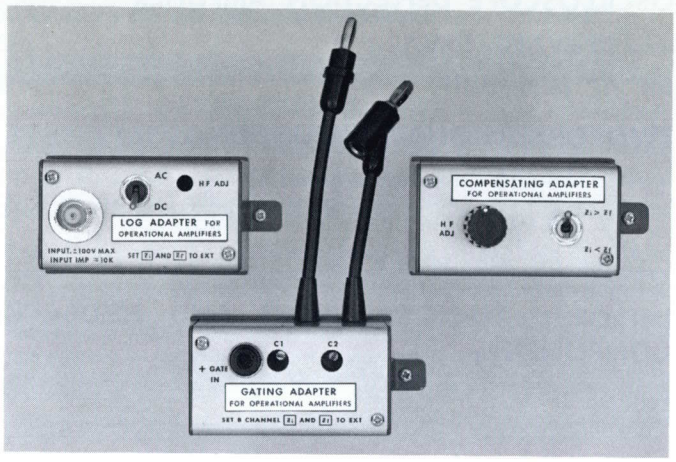
INTEGRATION is obtained by placing a capacitor in the feedback loop. Unlike the RC integrator, this circuit permits output loading. Typical applications include magnetic core B-H loop studies.



DIFFERENTIATION is accomplished by placing a capacitor in the input circuit. The unique characteristic of this circuit is the extraction of higher frequency signal components without loss of signal level. It can detect minute information such as transients and slope changes.

THREE ADAPTERS FOR THE TYPE 3A8

The adapters plug into the jacks on the Type 3A8 front panel.



LOG ADAPTER

Mixed low- and high-amplitude signals can be measured using the Log Adapter. Pulses and transient waveforms spanning three voltage decades to plus 100 volts or minus 100 volts can be displayed and measured on the same trace.

Order Part Number 013-0067-00 ..... $75

GATING ADAPTER

With the Gating Adapter, repetitive signals with a net integral other than zero can be integrated and displayed. The adapter uses Operational Amplifier "2" of the Type 3A8 to gate amplifier "1" on and off in response to an external gating signal, such as the +Gate signal from a Type 3B4 Time Base Plug-In Unit. The signal applied to amplifier "1" is then amplified, integrated, or differentiated only during the "on" time.

Order Part Number 013-0068-00 ..... $75

COMPENSATING ADAPTER

For extending the high-frequency performance of either operational amplifier when the internal Z_i and Z_f resistors are used in any combination for gain or attenuation. The adapter compensates for stray capacitance associated with the internal resistors, providing an adjustment for optimum HF response.

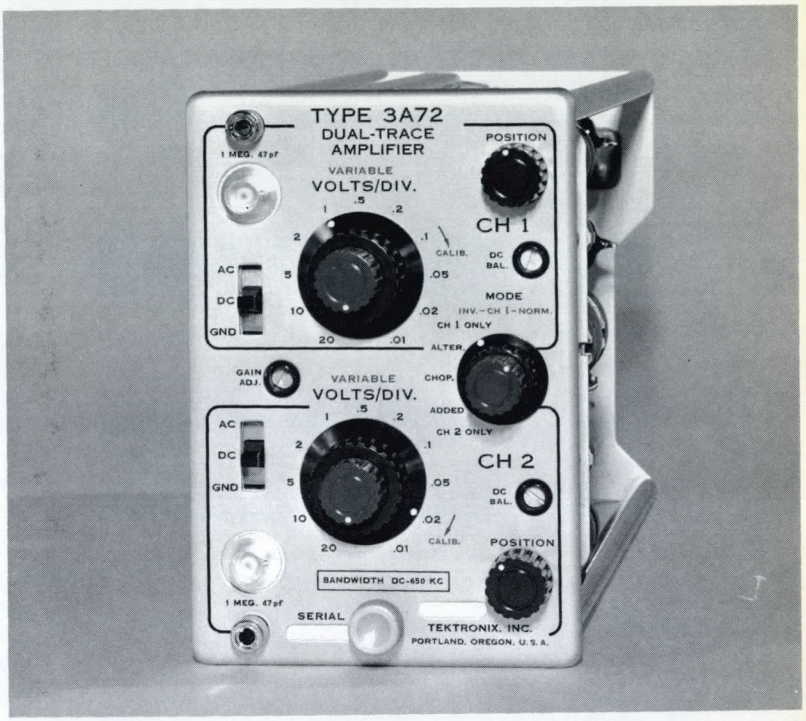
Order Part Number 013-0081-00 ..... $35

Please refer to the catalog accessory pages for complete information on the above adapters.

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

DUAL-TRACE DC-to-650 kHz UNIT Type 3A72

The Type 3A72 Amplifier is a general purpose dual-trace plug-in unit that has two separate channels, each with identical characteristics. The unit can operate in any of five operating modes for a variety of single and dual-trace displays. This unit can be used in the Type 561A, Type 564, Type 565 or Type 567 Oscilloscope. However, in the Type 567, the measurements will not be presented in digital form.



OPERATING MODES include Channel 1 only (normal or inverted); Channel 2 only; Alternate—Channel 1 and 2 switched electronically on alternate sweeps; Chopped—successive 16-μs segments of each channel are displayed at an approx 30-kHz rate per channel. Chopped transient blanking is provided; Added—outputs of Channel 1 and 2 algebraically added.

MULTIPLE X-Y DISPLAYS can be obtained with two Type 3A72 Plug-In Units; both synchronization and automatic pairing are provided. With two Type 3A72's operated in the dual-trace mode, Channel 1 of the left-hand unit is always plotted against Channel 1 of the right-hand unit.

CALIBRATED DEFLECTION FACTOR is 10 mV/div to 20 V/div in 11 steps, 1-2-5 sequence; accuracy within 3%. Uncalibrated continuous control from 10 mV/div to 50 V/div.

BANDWIDTH is DC to 650 kHz. Bandwidth is specified at —3 dB.

MAXIMUM INPUT VOLTAGE is 600 volts.

INPUT RC is 1 megohm paralleled by 47 pF.

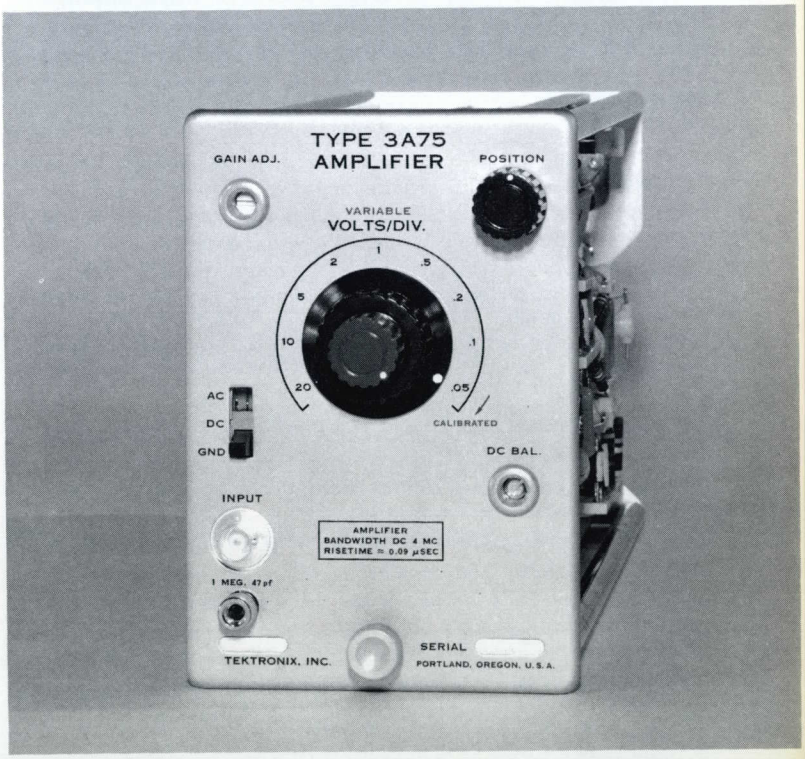
NET WEIGHT is 5 pounds. Shipping weight is 6 pounds, approx.

TYPE 3A72 AMPLIFIER UNIT $275

Each instrument includes: 2—instruction manuals (070-0274-00).

AMPLIFIER UNIT Type 3A75

The Type 3A75 Amplifier is a general purpose wide-band plug-in unit. It may be used in the Type 561A, Type 564, Type 565, or Type 567 Oscilloscope. However, in the Type 567, the measurement will not be presented in digital form. Used with the Type 129 Power Supply, the Type 3A75 can drive recorders, X-Y plotters, oscilloscopes, and other indicators.



CALIBRATED DEFLECTION FACTOR is 50 mV/div to 20 V/div in 9 steps, 1-2-5 sequence; accuracy within 3%. Uncalibrated continuous control from 50 mV/div to 50 V/div.

BANDWIDTH is DC to 4 MHz. Bandwidth is specified at —3 dB.

RISETIME is approximately 0.09 μs.

MAXIMUM INPUT VOLTAGE is 600 volts.

INPUT RC is 1 megohm paralleled by approximately 47 pF.

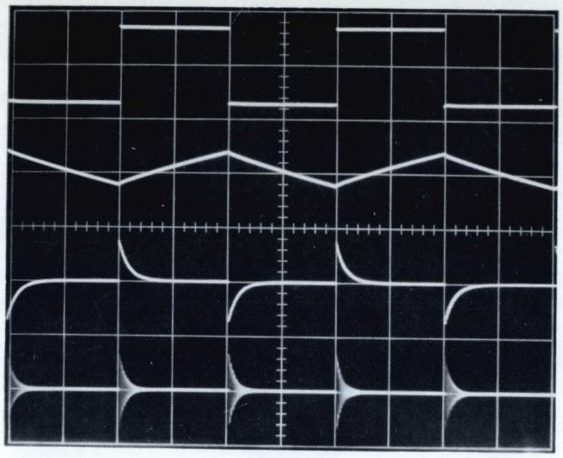
NET WEIGHT is 3½ pounds. Shipping weight is 8 pounds, approx.

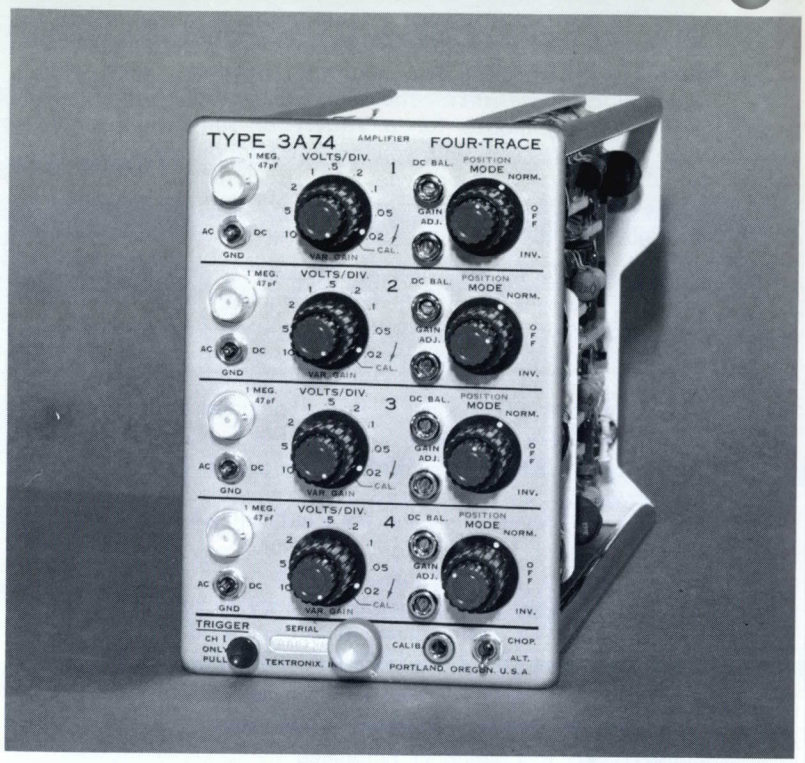
TYPE 3A75 AMPLIFIER UNIT $175

Each instrument includes: 2—instruction manuals (070-0275-00).

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

Type 3A74 FOUR-TRACE AMPLIFIER UNIT





The Type 3A74 Amplifier is a general purpose multi-trace plug-in unit that has four separate channels, each with identical characteristics. The unit can operate in a number of modes for a variety of single and multi-trace displays. The Type 3A74 can be used in the Type 561A, Type 564, Type 565, or Type 567 oscilloscope. However, in the Type 567, the measurements will not be presented in digital form.

OPERATING MODES include any one of the four channels separately (normal or inverted); Alternate—any combination of two or more channels switched electronically on alternate sweeps; Chopped—successive 2-μs segments of each channel are displayed at an approx rate per channel of: 250 kHz when using two channels; 167 kHz when using three channels; and 125 kHz when using four channels. Chopped transient blanking is provided.

CALIBRATED DEFLECTION FACTOR is 0.02 V/div to 10 V/div in 9 steps, 1-2-5 sequence, accuracy within 3%. Uncalibrated continuous control from 0.02 V/div to 25 V/div.

MULTIPLE X-Y DISPLAYS can be obtained with two Type 3A74 Plug-In Units; both synchronization and automatic pairing are provided. With two Type 3A74's, two, three or four independent displays may be obtained, properly paired: Channel 4 of the left-hand unit is always plotted against Channel 4 of the right-hand unit, Channel 3 versus Channel 3, etc. . . .

BANDWIDTH is DC to 2 MHz. Bandwidth is specified at —3 dB.

INPUT RC is 1 megohm paralleled by approx 47 pF.

RISETIME is approximately 0.17 μs.

INPUT COUPLING is either AC or DC. AC-coupled low frequency —3 dB point is 2 Hz direct or 0.2 Hz with 10X probe.

INTERNAL TRIGGER SIGNAL (for the time-base) is from one of two sources as selected; either from the output of Channel 1 only or the combined output of the amplifier.

NET WEIGHT is 6¼ pounds. Shipping weight is 7 pounds, approx.

TYPE 3A74 AMPLIFIER UNIT $590

Each instrument includes: 2—instruction manuals (070-0347-00), 4—BNC to binding-post adapters (103-0033-00).

BNC ADAPTERS

Adapter, BNC to Binding Post
Order Part Number 103-0033-00 . . . . . $1.60

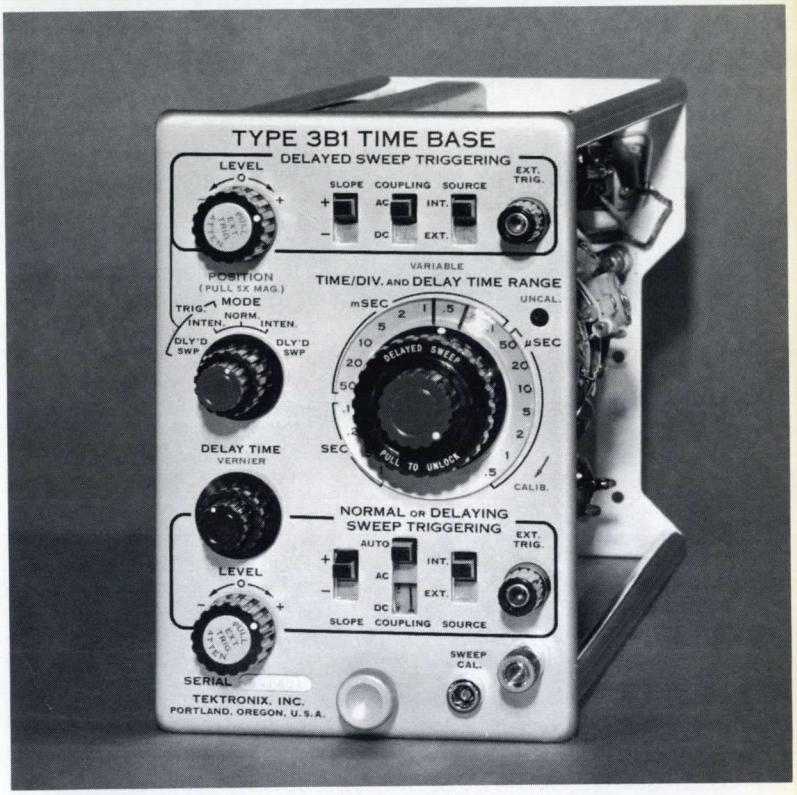
Adapter, BNC to UHF
Order Part Number 103-0032-00 . . . . . $1.70

For BNC probes, cables, and accessories, please refer to Catalog Accessory Section.

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

TIME-BASE UNIT Type 3B1

- *NORMAL AND DELAYED SWEEPS*
- *FLEXIBLE TRIGGERING*
- *5X MAGNIFICATION*



The Type 3B1 Time-Base Unit is used to generate normal and delayed-sweeps. Flexible triggering facilities are similar for both the normal sweep and the delayed sweep. The unit can be used with the Type 561A, Type 564, Type 565, (raster generation), or Type 567 Oscilloscope. However, in the Type 567, the measurements will not be presented in digital form.

CALIBRATED SWEEP RANGE for both normal and delayed sweeps is 0.5 μs/div to 1 s/div in 20 steps, 1-2-5 sequence; accuracy is within 3%. Sweep rates can also be varied continuously (uncalibrated) between steps and to 2.5 s/div. The Variable control operates with the normal sweep in the normal display mode, and with delayed sweep in all other display modes.

5X MAGNIFIER increases the calibrated sweep rate to 0.1 μs/div.

SWEEP DELAY permits operation of the delayed sweep after a delay interval of 0.5 μs to 10 s, continuously variable in 20 ranges. After the delay range is selected, pulling the Time/Div knob disengages the ganged controls to allow independent setting of the delayed sweep time/div. Delay time is continuously variable (uncalibrated) from 1X to 10X the delay range setting by means of the Delay Time and Vernier controls.

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; AC or DC Coupling; Automatic; ±Slope.

Delayed Sweep Trigger Modes—Internal or External; AC or DC Coupling; ±Slope.

External Triggering—2 Ranges from 0.5 to 15 V and 5 to 150 V, plus or minus polarity.

TRIGGER REQUIREMENTS for both sweeps:

Internal Triggering—0.4 major graticule divisions from DC to 5 MHz, increasing to 1 major division at 10 MHz.

External Triggering—0.5 V from DC to 5 MHz, increasing to 1.25 V at 10 MHz.

NET WEIGHT is 5¼ pounds. Shipping weight is 8 pounds, approx.

TYPE 3B1 TIME-BASE UNIT $535
Each instrument includes: 2—instruction manuals (070-0344-00).

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*

The Type 3B3 Time-Base Unit is used to generate normal and delayed-sweeps. Flexible triggering facilities are similar for both the normal sweep and delayed sweep. Calibrated sweep delay enables accurate delay intervals to be set and measured. The unit can be used with the Type 561A, Type 564, Type 565 (raster generation), or Type 567 Oscilloscope. However, in the Type 567 the measurements will not be presented in digital form.

CALIBRATED SWEEP RANGE for both normal and delayed sweeps is 0.5 μs/div to 1 s/div in 20 steps, 1-2-5 sequence; accuracy is within 3%. Sweep rates can also be varied continuously (uncalibrated) between steps and to 2.5 s/div. The Variable control operates with the normal sweep in the normal display mode, and with delayed sweep in all other display modes.

5X MAGNIFIER increases the calibrated sweep rate to 0.1 μs/div.

SINGLE SWEEP operation facilitates photographic recordings of waveforms.

SWEEP DELAY operation permits accurate setting and measuring of delay intervals from 0.5 μs to 10 s. One control can select both the normal and delayed sweeps simultaneously or the delayed sweep rate can be selected independent of the normal sweep. Delay accuracy is ±1% of full scale reading and delay time linearity is within ±0.2% of full scale from 5 μs to 2 s 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; ± Slope.

Delayed Sweep Trigger Modes—Internal or External; AC or DC Coupling; ± Slope.

External Triggering—2 ranges from 0.5 to 15 V and 5 to 150 V, plus or minus polarity.

TRIGGER REQUIREMENTS for both sweeps:

Internal Triggering—0.4 major graticule division from DC to 5 MHz, increasing to 1 major division at 10 MHz.

External Triggering—0.5 V from DC to 5 MHz, increasing to 1.25 V at 10 MHz.

NET WEIGHT is 6 pounds. Shipping weight is 7 pounds, approx.

TYPE 3B3 TIME-BASE UNIT $585

Each instrument includes: 2—instruction manuals (070-0365-00).

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

TIME-BASE UNIT Type 3B4

DIRECT READING MAGNIFIER

FLEXIBLE, HI-SPEED TRIGGERING

CALIBRATED EXTERNAL HORIZONTAL INPUT

SINGLE SWEEP OPERATION

The Type 3B4 Plug-In Unit is a wide-range time base with flexible, high-speed triggering facilities, and a wide-range, direct-reading magnifier. Can be used in the Type 561A, Type 564, Type 565 (raster generation), or the Type 567*. The Type 3B4 is recommended over the Type 2B67 for operation with Types 3A1, 3A6 and other wideband ($\geq$5 MHz) vertical amplifier plug-in units.

In addition to time base facilities, the 3B4 provides a DC-coupled external input amplifier with calibrated deflection factors from 0.2 to 5 V/div.

CALIBRATED SWEEP RANGE is 0.2 μs/div to 5 s/div in 23 calibrated steps in a 1-2-5 sequence. Accuracy is $\pm$3% from 0.2 μs/div to 2 s/div; $\pm$5% at 5 s/div. Sweep rates are continuously variable (uncalibrated) between steps and also to 12.5 s/div.

DIRECT READING MAGNIFIER provides sweep expansion up to X50 and extends the fastest sweep rate to 50 ns/div. The MAGNIFIER control is concentric with the TIME/DIV control, providing a direct indication of both the sweep rate being magnified and the magnified time/div rate. Up to 5 magnification steps are provided, to X40 or X50, depending on the TIME/DIV control setting before magnification. Magnified sweep rates are confined to the time/div steps on the panel, so there are no 'forbidden' (uncalibrated) combinations. Magnified sweep accuracy is $\pm$5%.

The MAGNIFIER control is also used to set the external input deflection factor when the TIME/DIV control is in the "Ext Input" position.

SINGLE SWEEP operation facilitates waveform photography, and operation in the Types 564 and RM564 storage oscilloscopes.

**In the Type 567 or RM567, the 3B4 may be used as a display time-base, but does not activate the digital readout circuitry. In the Type 565 or RM565 (having integral time-bases) the Type 3B4 may be used to provide a vertical time-base for raster applications, but does not provide retrace blanking.*

TRIGGER FACILITIES include:

TRIGGERING MODES—	Free-Run, Automatic (with bright base-line in the absence of a trigger), Normal, Single Sweep.
SOURCE—	Internal, Line, External, External ÷ 10.
COUPLING—	AC, AC LF Reject, DC.
TRIGGER POINT—	$\pm$Slope, $\pm$Level: Two effective level ranges for external triggering — $\pm$15 V (Ext) or $\pm$150 V (Ext ÷ 10).
AMPLITUDE REQUIRED—	1 minor graticule division Int or 0.2 V Ext (2 V in Ext ÷ 10). DC to 20 MHz.
FREQUENCY RANGE—	Essentially DC to 20 MHz with reduced sensitivity above 20 MHz.
TRIGGER LIGHT—	A front panel light indicates when the sweep is receiving a triggering signal—especially convenient when using an external trigger.

EXTERNAL HORIZONTAL INPUT is calibrated in 5 steps from 0.2 V/div to 5 V/div (max input $\pm$20 V); accuracy, when plug-in unit is matched to oscilloscope, is within 3%. The External Input Amplifier is DC coupled.

NET WEIGHT is 4½ pounds. Shipping weight is 6 pounds, approx.

TYPE 3B4 TIME BASE UNIT $400

Each instrument includes: 2 instruction manuals (070-0431-00).

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

Type 3C66 CARRIER AMPLIFIER

- *HIGH GAIN*
- *LOW NOISE*
- *ESSENTIALLY DRIFT FREE*
- *RECORDER OUTPUT*

The Type 3C66 Carrier Amplifier with suitable transducer measures mechanical quantities that can be converted to a change in resistance, capacitance, or inductance. This unit may be used in the Type 561A, Type 564, Type 565, or Type 567 Oscilloscope. However in the Type 567 and RM567, the measurements will not be presented in digital form. Used with the Type 129 Power Supply, the Type 3C66 can drive recorders, X-Y plotters, oscilloscopes, or other indicators.

The gap between mechanical engineering and electronic instrumentation is bridged with the Type 3C66 and suitable transducers. The total range of applications is as broad as the mechanical field itself and includes stress analysis, vibration studies, and fatigue tests. Typical quantities measured are force, displacement, acceleration, and strain.

The Type 3C66 operates on an AC carrier principle. It uses an AC bridge at the input to convert transducer signals into an amplitude-modulated carrier signal. The carrier signal is amplified by a high-gain AC amplifier and then demodulated to obtain the CRT deflection voltages.

Advantages of the 3C66 Carrier Amplifier include:

1. Desirable high gain with essentially no drift resulting from input signal conversion to carrier modulation followed by AC amplification.
2. Both static and dynamic strain are measured because of the DC to 5-kHz bandwidth.
3. Most of the undesired pickup from the input is eliminated because of selective filtering.
4. Reactive transducers (including some differential transformers) as well as capacitive and resistive transducers can be used with the unit.
5. Up to four simultaneous signals to the input bridge are possible.

CALIBRATED DEFLECTION FACTOR is from 10 microstrain/div (micro-inches per inch/div) to 10,000 microstrain/div when the Type 3C66 is used with a single strain gage having a gage factor of approximately 2. Uncalibrated continuous control from 10 microstrain/div to 25,000 microstrain/div.

ATTENUATOR ACCURACY, when set accurately in any one step, is within 2% on all other steps.

GAGE FACTORS from 1 to 6 are usable without changing the steps of the sensitivity control. This range of factors is compensated for by adjusting the Gain Adjust Control.

EQUIVALENT DC SENSITIVITY in a comparable DC amplification system would require approximately 10 microvolts/div sensitivity for the same amount of power applied to the Type 3C66.

BANDWIDTH is DC to 5 kHz.

RISETIME is 70 microseconds, approx.

NOISE is typically equivalent to an input of 2.0 microstrain (peak to peak) at maximum calibrated sensitivity. This approximates an RMS noise of 0.5 microstrain.

DRIFT of the over-all system is primarily a function of the transducer stability. The Type 3C66 Amplifier system is essentially drift free.

INPUT is to an AC bridge with 25-kHz excitation voltage. One or more of the four bridge arms can have transducers attached to them. Total bridge voltage is approximately 5 V RMS, regulated.

CAPACITIVE TRANSDUCERS used in conjunction with a four-arm resistive bridge results in the following maximum useful sensitivities: 120-ohm bridge, 1 pF/div; 1000-ohm bridge, 0.2 pF/div; useful sensitivities are slightly lower when using long cables.

INDUCTIVE TRANSDUCERS must have characteristics compatible with the 25-kHz carrier frequency to function properly. Linear-variable-differential transformers designed for nominal carrier frequencies of 2 kHz and higher usually operate satisfactorily without additional circuitry.

TRANSDUCER CABLE consisting of either 3-wire or 4-wire shielded microphone cable gives the best results in most applications.

CAPACITANCE BRIDGE BALANCE has a range of control that allows compensation for an unbalance of up to 250 pF across any external resistive arm of the input bridge.

RESISTIVE BRIDGE BALANCE has sufficient control to compensate for most standard transducers and strain gages.

GAGE RESISTANCE RANGE is useful with cable lengths to 100 feet and extends from approximately 50 ohms to 2000 ohms.

PHASE ADJUSTMENT permits either resistive or reactive transducer applications to be displayed (thus making the Type 3C66 very versatile).

CALIBRATION rotary 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 and is suitable for most strain gage applications. The 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.

SYNC IN AND OUT CONNECTORS are used for synchronizing oscillators of two units thus eliminating low frequency beat notes which sometimes occur when two units are used in the same indicator at high sensitivities.

RECORDER SIGNAL OUTPUT is DC coupled and has an output of about 3 V for each major division of CRT display. DC level is adjustable to 0 V by an internal control.

NET WEIGHT is 5¼ pounds. Shipping weight is 7 pounds, approx.

TYPE 3C66 AMPLIFIER UNIT $400

Each instrument includes: 1—synchronizing cable, RG174/U (012-0063-00); 1—4-wire 15′ shielded connector cable (012-0040-00); 2—instruction manuals (070-0357-00).

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

TYPE 3C66 CARRIER AMPLIFIER BLOCK DIAGRAM

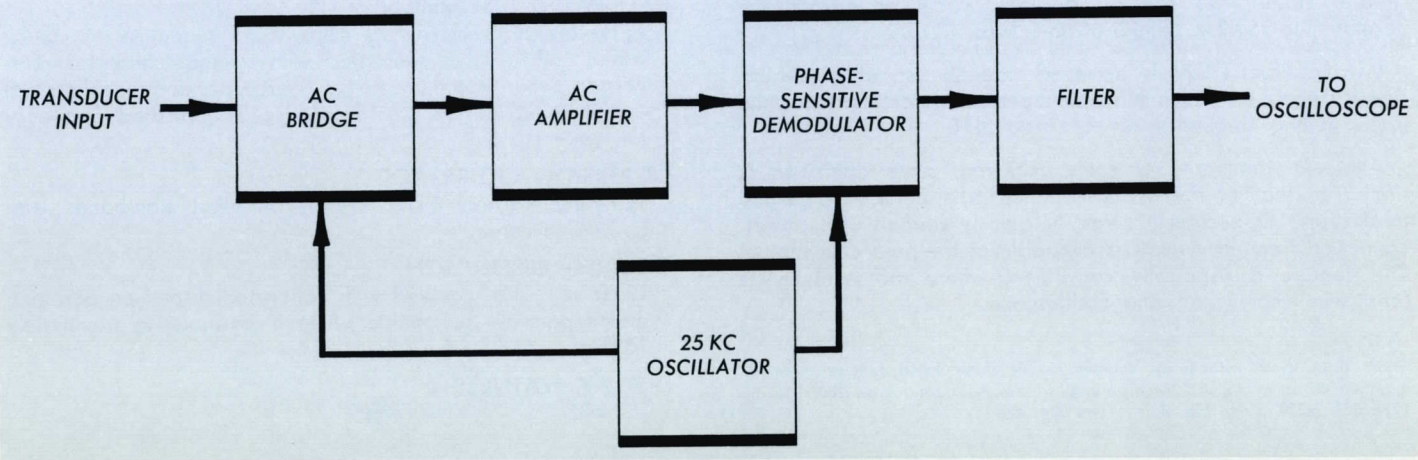
The input circuit for the unit is an AC bridge that has an external transducer connected into one or more of the bridge arms. Excitation voltage for the bridge is obtained from the 25-kHz oscillator.

In operation, the transducer signals unbalance the bridge to modulate the 25-kHz signal to produce an amplitude modulated suppressed-carrier output. The amplitude of the signal from the bridge is determined by amount of unbalance produced by the transducer signal. With no signal from the transducer, the carrier is suppressed. The phase of the bridge output is determined by the direction and type of unbalance.

The suppressed-carrier output of the bridge circuit is applied to the AC amplifier where the desired modulation sidebands are amplified while unwanted frequencies are rejected. An attenuator and gain control located in the amplifier determine the overall sensitivity of the unit.

The amplified modulation sidebands are applied to the phase-sensitive demodulator where a carrier is added in proper phase. The carrier permits only the desired phase to be demodulated.

The output of the demodulator circuit is applied to a filter network where the undesirable modulation components are eliminated. The output from the filter is then applied to the associated oscilloscope through the interconnecting plug. The signal applied to the oscilloscope corresponds exactly to the signal applied to the input bridge circuit by the external transducer.



Type 3L10 1-to-36 MHz SPECTRUM ANALYZER

- *CALIBRATED DISPERSION*
- *COUPLED RESOLUTION*
- *CRYSTAL-CONTROLLED SWEPT OSCILLATOR*
- *IMAGE REJECTION*
- *RECORDER OUTPUT*
- *STORED SPECTRAL DISPLAYS*

This 1-to-36 MHz Analyzer permits low-cost spectrum analysis with the compact Type 561A Oscilloscope, and stored or non-stored displays with the equally-compact Type 564 Oscilloscope. The Type 3L10 can be used with a Type 2B67, 3B1, 3B3, 3B4 or 3B5 Time Base Unit.*

CALIBRATED DISPERSION from 10 Hz/div to 2 kHz/div makes frequency measurement as easy and accurate as time measurement. Frequency differences can be read directly from the CRT. The SEARCH MODE permits rapid location of signals for analysis.

COUPLED RESOLUTION from 10 Hz to 1 kHz greatly simplifies operation, providing narrow resolution bandwidth at narrow dispersion and wide resolution bandwidth at wide dispersion. Dispersion and resolution controls can be uncoupled and operated separately if desired, for optimized viewing of a particular signal.

IF stability is achieved through use of CRYSTAL-CONTROLLED OSCILLATORS. Even the swept local oscillator is controlled through a crystal discriminator. An external front-end oscillator can be connected through a front-panel input to provide still greater stability to spectral displays within or outside the normal 1-to-36 MHz range of the Type 3L10.

IMAGE REJECTION is achieved through use of a 60-MHz first IF amplifier, which places images at more than twice the upper tuning frequency of the Type 3L10.

Analyzer familiarity is soon achieved, since operation is similar to that of the oscilloscope—with dispersion calibrated in kHz/div. Dispersion accuracy is quickly verified with crystal-controlled frequency markers available at the push of a button. This feature is especially convenient where the Analyzer is used with more than one oscilloscope.

*Time Base Units with serial numbers under those listed require a simple modification to provide a sweep signal to the Analyzer. Type 2B67: 15180, Type 3B1: 4040, Type 3B3: 4270, Type 3B4: 740.

FREQUENCY RANGE
1 to 36 MHz.
Dial Accuracy within ± (100 kHz + 1% of dial reading).

SENSITIVITY (50-Ω INPUT)
—100 dBm, measured at 2 kHz/div dispersion and 1 kHz (coupled) resolution.

FREQUENCY STABILITY
IF within 2 p/m per °F change, 1 p/m per 1-V line change.
LO within 150 p/m per °F change, 10 p/m per 1-V line change.

MAXIMUM FM
IF within 5 Hz.
LO within 25 Hz + 1 Hz/MHz dial frequency.

CALIBRATED DISPERSION
10 Hz/div to 2 kHz/div, 8 steps, 1-2-5 sequence. Accuracy within ±3% when calibrated with internal calibrator. Dispersion linearity within ±5%. Search position (uncalibrated) — minimum 20 kHz + 1 kHz/MHz of indicated frequency full scale (10 div).

DISPERSION CALIBRATOR
10.7-MHz carrier, 4-kHz crystal-controlled side-bands with ±0.1% accuracy.

COUPLED RESOLUTION
10 Hz to 1 kHz, coupled with calibrated dispersion positions, and separately switchable. Search position—approximately 10 kHz.

DISPLAY FLATNESS
±1 dB.

INPUT IMPEDANCE
Approx 50 Ω and approx 600 Ω.

MAXIMUM INPUT POWER
+24 dBm at full RF attenuation, —20 dBm without RF attenuation.

RF ATTENUATOR
51 dB ±0.1 dB/dB in 1-dB steps.
½ watt maximum power-handling capability.

IF GAIN CONTROL
>60-dB range.

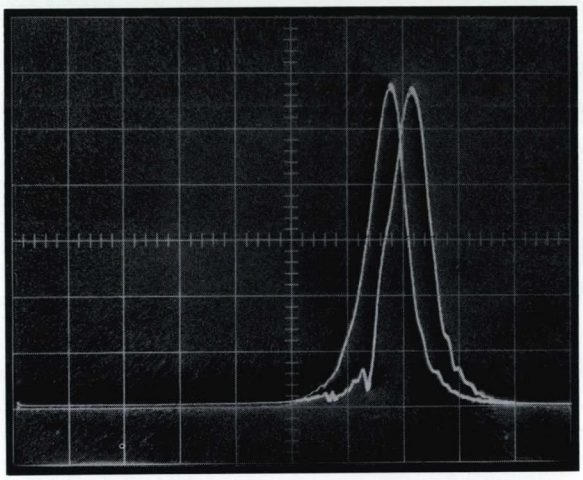
VERTICAL DISPLAY
Log—50-dB dynamic range over 8 div.
Linear—20-dB dynamic range over 8 div.
Video—100 mV/div (variable) DC to 50 kHz, approx 50-Ω input resistance.

RECORDER OUTPUT
DC-coupled, approx 600-Ω source resistance, 15 mV/div display in Linear mode, output linear with voltage.

WEIGHT
Net—6¼ pounds, shipping—11 pounds, approx.

TYPE 3L10 SPECTRUM ANALYZER UNIT $1200
Each instrument includes: 1—tini-plug (134-0052-00); 2—instruction manual (070-0521-00).

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



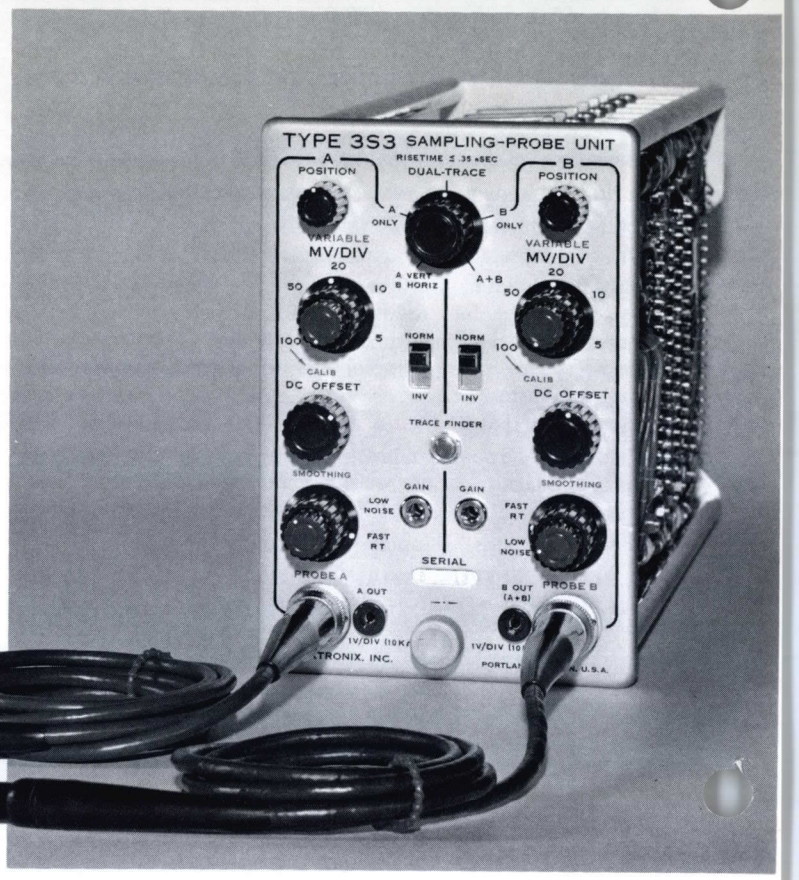
STORED SPECTRAL DISPLAY
with Type 564 Oscilloscope

Using the single-shot capabilities of the Type 2B67, and the storage capabilities of the Type 564, we are able to measure the drift of a 60-MHz crystal oscillator, as supplied to the IF of the Type 3L10.

Temperature variation shows as a drift of approx 4 Hz between sweeps. Dispersion is 10 Hz/div.

Type 3S3 SAMPLING-PROBE DUAL-TRACE UNIT

- *COMPACT PROBES*
- *DUAL-TRACE DISPLAYS*
- *0.35 ns OR LESS RISETIME*
- *100 kΩ, 2 pF INPUT*
- *LOW NOISE*
- *RECORDER OUTPUTS*



The Type 3S3 Sampling-Probe Unit is a low-noise dual-trace amplifier employing extremely compact sampling probes. It has two separate channels with identical characteristics and can operate in any one of five modes for a variety of single, dual-trace and X-Y displays. The Type 3S3 is designed to operate in conjunction with a Type 3T77A or Type 3T4 Sampling Sweep Unit in the Type 561A, 564, or 567 Oscilloscopes. In the Type 567, information can be presented in digital as well as analog form.

OPERATING MODES include Channel A only; Channel B only; Dual Trace—Channels A and B switched electronically; A + B Outputs of Channel A and B added algebraically; A Vertical/B Horizontal—Channel A deflected vertically and B horizontally for X-Y displays. Independent controls for each channel provide for trace positioning and polarity inversion.

CALIBRATED DEFLECTION FACTOR is 5 mV/div, 10 mV/div, 20 mV/div, 50 mV/div, and 100 mV/div; accuracy within 3%. An uncalibrated continuous control extends the deflection factor to approximately 2 mV/div.

RISETIME AND SMOOTHING controls, while maintaining correct dot transient response, adjust the instrument for: least noise, best risetime, or a compromise of the two, with signal source from below 25 ohms to beyond 300 ohms. A Fast-RT/Low-Noise switch in conjunction with the Smoothing control allows the operator to select optimum risetime at a sacrifice in noise level. Or, he may elect for a low noise level at some sacrifice in risetime.

At low signal repetition rates the trace may take up to several seconds to traverse the CRT screen. A Type 3S3 in a Type 564 Storage Oscilloscope offers the most advantageous combination for visually displaying these signals.

RISETIME (with a 50-ohm input source impedance) is 0.35 ns with the switch set at the FAST RT position and 1 ns at the LOW NOISE position.

RANDOM NOISE (with 50-ohm-input source impedance) can be adjusted to a minimum value equal to an input signal of less than 0.5 mV peak to peak.

CORRECT DOT TRANSIENT RESPONSE can be achieved with source impedances from 25 ohms to 300 ohms.

INPUT RC is 100 kΩ paralleled by approx 2 pF.

DYNAMIC RANGE is ±1.5 V with Risetime control set to LOW NOISE and ±3 V when the control is set to FAST RISETIME. Safe overload is ±10 V.

EXTERNAL TRIGGER is required, at least 50 ns prior to signal. Minimum repetition rate is 50 Hz.

RECORDER SIGNAL OUTPUT of Channel A, Channel B, or Channel (A + B) is ≅1 V/div (through 10 kilohms), DC-coupled at +10 volt level.

DC OFFSET provides a means of displaying selected portions of signals having off-screen amplitudes, or for displaying signals riding on a DC voltage as high as ±0.5 V.

TRACE FINDER button returns the trace to CRT screen to aid in vertical positioning when the trace is driven off the screen by a large signal.

PROBES (Type P6038) used with the Type 3S3 are extremely compact. The sampling bridge is contained in the probe head to obtain optimum results with an input RC of 100 kΩ paralleled by 2 pF. Probe can be changed from channel to channel with only minor recalibration.

NET WEIGHT is 6¾ pounds. Shipping weight is 9 pounds, approx.

TYPE 3S3 SAMPLING PROBE UNIT
(with two Type P6038 Probes) **$1500**

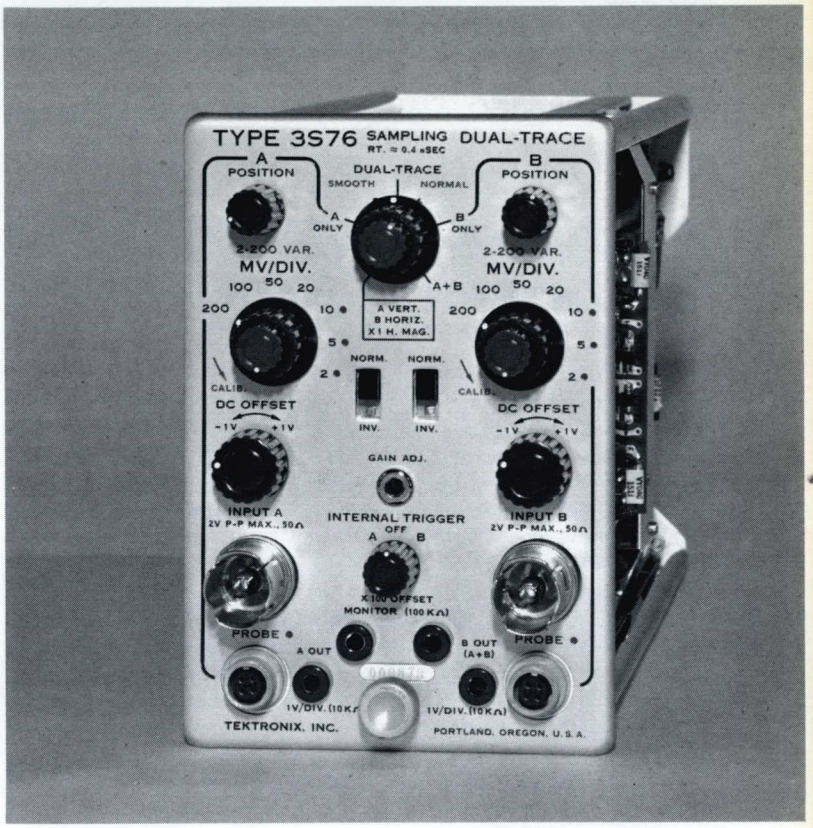
Each instrument includes: 2—instruction manuals (070-0374-00); 2—P6038 Probe Package (010-0156-00), which includes; 1—P6038 probe 010-0157-00); 1—Response normalizer (011-0070-00); 1—X10 attenuator (011-0071-00); 2—Test point jack (131-0258-00); 1—Coupling capacitor (011-0072-00); 1—Hook tip assembly (206-0114-00); 1—Ground clip (175-0249-00); 1—Probe holder (352-0068-00); 1—Bayonet ground assembly (013-0085-00); 1—Instruction Manual (070-0400-00).

REPLACEMENT P6038 PROBE PACKAGE (Part Number 010-0156-00) **$225**

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-ns or Less Risetime*
- *2 Identical Channels*
- *5 Operating Modes*
- *Recorder Outputs*



The Type 3S76 Sampling Unit is a dual-trace amplifier containing two separate channels which possess identical characteristics. The unit can perform in any of five operating modes for a variety of single, dual-trace and X-Y displays. It is designed to operate in conjunction with a Type 3T4 or Type 3T77A Sampling Sweep Unit in Type 561A, 564 and 567 Oscilloscopes. In the Type 567, information will be presented in digital as well as analog form.

OPERATING MODES include Channel A only; Channel B only; Dual-Trace—Channels A and B switched electronically on alternate samples; A+B—outputs of Channels A and B added algebraically; A Vertical/B Horizontal—Channel A deflected vertically and B horizontally for X-Y displays. Independent controls for each channel provide for trace positioning and polarity inversion.

CALIBRATED DEFLECTION FACTOR is from 2 mV/div to 200 mV/div in 7 calibrated steps, accuracy within 3%, except on the 2 mV/div and 5 mV/div steps, which have accuracy within 5%. A variable control permits continuous adjustment between steps.

BANDWIDTH is equivalent to DC to 875 MHz.

RISETIME is 0.4 ns or less, with less than ±3% peak overshoot.

RANDOM NOISE is equivalent to an input signal of less than 2 mV peak to peak with Smooth-Normal Switch in NORMAL position and 1 mV peak to peak with Smooth-Normal Switch in SMOOTH position.

DC OFFSET is ±1 V, referred to input, and monitorable at the front panel at 100 X magnitude. Can be used to permit viewing of signals with off-screen amplitudes or signals riding on a DC voltage up to ±1 V.

INPUT IMPEDANCE is 50 ohms.

DYNAMIC RANGE is ±2 V. Full sensitivity can be used with signals up to ±2 V in amplitude. Momentary overload limit is ±5 V.

SIGNAL DELAY through 55-ns 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.

RECORDER SIGNAL OUTPUT is 1 V/div (through 10 kilohms) DC-coupled at +10 volt level, both channels.

PROBE POWER is provided on both channels for cathode-follower probes (see P6032), Type 281 TDR Pulser, and Type 282 Adapter for high-impedance probes.

NET WEIGHT is 7½ pounds. Shipping weight is 12 pounds, approx.

TYPE 3S76 DUAL-TRACE SAMPLING UNIT $1100

Each instrument includes: 2—10X attenuator, 50 Ω (017-0078-00); 2—5-ns cable (017-0502-00); 2—Instruction Manual (070-0332-00).

PROBES

The following Tektronix probes are recommended for use with the Type 3S76. See Catalog Accessory pages for complete information on the probes.

	Input Impedance				
Use	R	C	Rating	Probe No.	Price
10:1 Attenuator	500 Ω	0.7 pF	16 VDC, 500 VAC	P6034	$ 35
100:1 Attenuator	5 k Ω	0.6 pF	50 VDC, 500 VAC	P6035	35
Selectable Attenuator	10 MΩ	varies	varies	P6032	220
Current	—	—	500 mA	CTI/P6040	31

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

Type 3T4 PROGRAMMABLE SAMPLING UNIT

- *CALIBRATED SWEEP RANGES*
- *CALIBRATED SWEEP DELAY*
- *100 OR 1000 SAMPLES PER SWEEP*
- *NORMAL OR SINGLE DISPLAY*
- *SINGLE DISPLAY START*

The 3T4 Sampling Unit extends the convenience of operation of the Type 567 Digital Readout System by providing remote control of the horizontal time base. This unit is compatible with the following equipment: 3S76, 3S3, and other 3-series sampling units; 561A, 564, and 567 Indicator Units; 6R1 and 6R1A Digital Units, and the 262 Programmer.

The multiple-pin connector on the front panel affords external control of equivalent-time sweep steps, delay time, samples per sweep, normal or single-display modes, and single-display start. These operations are obtained through the grounding of certain pins of the front-panel connector. Delay time is determined by the value of resistors added externally.

Front-panel outputs are TRIGGER OUT, which provides a 500-mV, negative pulse coinciding with the input trigger, and SWEEP OUTPUT which provides a staircase ramp. The unit also can be triggered internally and responds to input signals up to 1000 MHz. The SINGLE DISPLAY feature permits photographic trace recording. The 10X MAGNIFIER extends the on-screen calibrated sweep range. A dual-purpose front-panel control permits manual or external scanning of the display, thus providing convenient operation of either X-Y or Y-T recorders.

SWEEP TIME/DIV

Equivalent-Time Sampling—1 ns/div to 200 μs/div, ±3%, in 2-5-10 sequence.

Real-Time Sampling—External clock, trigger, and single-display start inputs are required.

DELAY RANGE

1 ns/div through 0.1 μs/div—1000 ns delay range.
0.2 μs/div through 10 μs/div—100 μs delay range.
20 μs/div through 100 μs/div—1000 μs delay range.
(No delay range for 200 μs/div sweep range, or in real-time sampling mode.)

SWEEP MODES

+External Input—Scanning accomplished by external signal. Deflection factor adjustable from 5 to 20 volts/horizontal division.

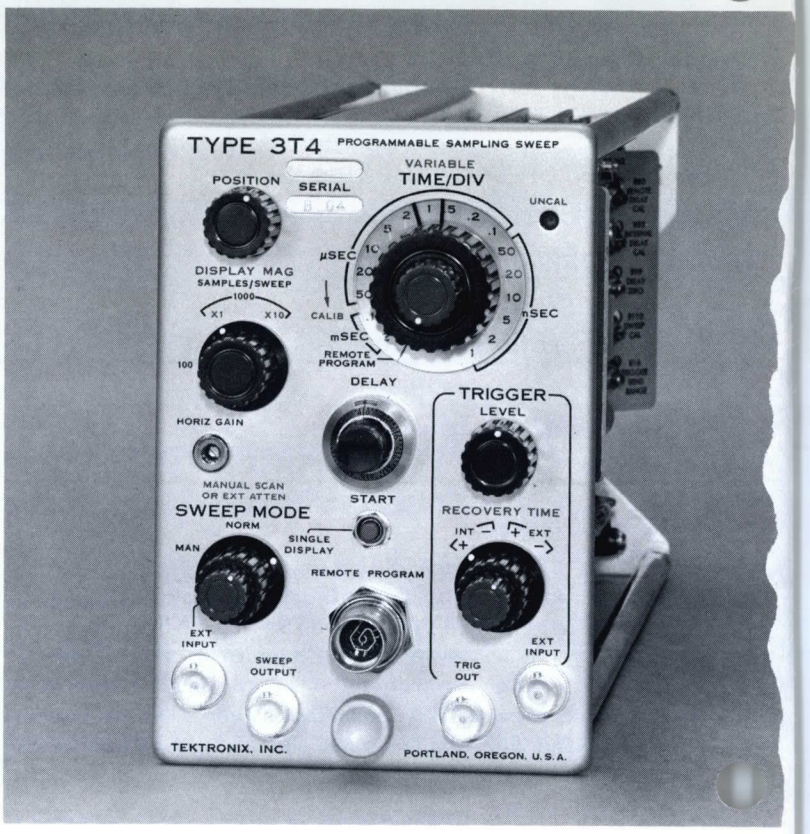
Manual Scan—Display scanned by front-panel control.

Normal—Repetitive sweep.

Single Display—One sweep each time START button is depressed.

OTHER SWEEP CHARACTERISTICS

Samples per sweep—100 or 1000.
Magnification of CRT display—X1 and X10.
Front-panel sweep output—Staircase ramp, 1 volt/horizontal division.



TRIGGERING

Trigger Inputs—Internal or External + and —. Trigger responds to inputs up to 1000 MHz.
Trigger Output—500 mV, negative polarity.

REMOTELY PROGRAMMABLE FUNCTIONS

Equivalent-Time Sweep Ranges.
Delay Time.
Samples per Sweep (digital read-out decimal information correct only on 1000 samples/sweep).
Normal or Single-Display Modes.
Single-Display Start (when remotely programmed for SINGLE DISPLAY).

DIMENSIONS AND WEIGHT

Instrument is 16½" long by 4¼" wide by 6¼" high. Net weight is 5¾ lbs; shipping weight is 11¾ lbs.

TYPE 3T4 SAMPLING SWEEP UNIT $1300
Each instrument includes: 2—Instruction Manual (070-0439-00).

OPTIONAL ACCESSORIES

Connector, 19-Pin, Male, Miniature. Mates with front-panel connector of 3T4 Unit for external programming.
(131-0388-00) $32.50

Extender Card, 56-Pin (Modified 262). The card is a rigid extension which enables the printed-circuit cards to operate out of the Type 3T4 for servicing convenience.
(012-0078-00) $20.00

Remote Program Cable, 10 ft long, 19-Pin Miniature Connector, Male to 36-Pin Male Miniature Connector.
(012-0101-00) $85.00

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

SAMPLING SWEEP UNIT Type 3T77A

- *Triggering Through 1 Gigahertz*
- *10 μs/div to 0.02 ns/div Sweep Range*
- *Variable Sweep Delay*
- *Single-Display Provision*
- *Recorder Output*

The Type 3T77A is a Sampling Sweep Unit. It provides subnanosecond capabilities when used in conjunction with a Type 3S3 or 3S76 Sampling Unit in a Type 561A, 564 or 567 Oscilloscope. In the Type 567, information can be presented in digital as well as analog form.

TRIGGERING CHARACTERISTICS

SINEWAVE TRIGGERING

FREQUENCY RANGE is from 100 kHz through 1 GHz.

AMPLITUDE RANGE is from 10 mV to 800 mV peak to peak for external triggering. Five times more trigger amplitude is required for equivalent internal triggering. Optimum trigger amplitude for least jitter depends on frequency. Damaging overload can occur at 5 V or greater.

JITTER varies with trigger amplitude, frequency and TIME/DIV setting. Typical figures are less than 50 ps jitter for 100 mV peak to peak 30 MHz to 50 MHz sinewave. A special synchronizing mode may be used above 30 MHz for extra stability.

PULSE TRIGGERING

REPETITION RATE RANGE is from 30 p/s (limited by memory drift in the vertical plug-in) through 10^9 p/s (1 GHz).

AMPLITUDE RANGE is from 10 mV to 800 mV peak to peak for external triggering. Minimum trigger rise rate is approx 150 mV/μs. Optimum trigger amplitude for least jitter depends on rise rate and rep rate. Damaging overload can occur at 5 V or greater.

JITTER is typically 50 ps or 0.1% of fast ramp duration whichever is greater for pulses of 50 mV amplitude, 2 ns width (or 10 mV, 10 ns width).

OTHER CHARACTERISTICS

DOT DENSITY can be either 10 or 100 dots/div.

CALIBRATED SWEEP TIME/DIV is from 0.2 ns/div to 10 μs/div in 15 calibrated steps, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated between calibrated ranges.

TIME EXPANDER provides X10 expansion that maintains a constant number of samples per centimeter. Extends calibrated sweep range to 0.02 ns/div.

MANUAL OR EXTERNAL SCANNING of the display provides convenient operation of remote recorders. At least 5 V/div (positive-going) is required for an external sweep.

SINGLE DISPLAYS useful for photography or storage can be initiated by a reset button.

RECORDER SWEEP OUTPUT is ≃1 V/div (through 10 kilohms), useful for driving recorders and other devices.

TIME POSITION provides a sweep delay range of at least one full horizontal scale, unexpanded, and at least ten scales (100 div) when expanded.

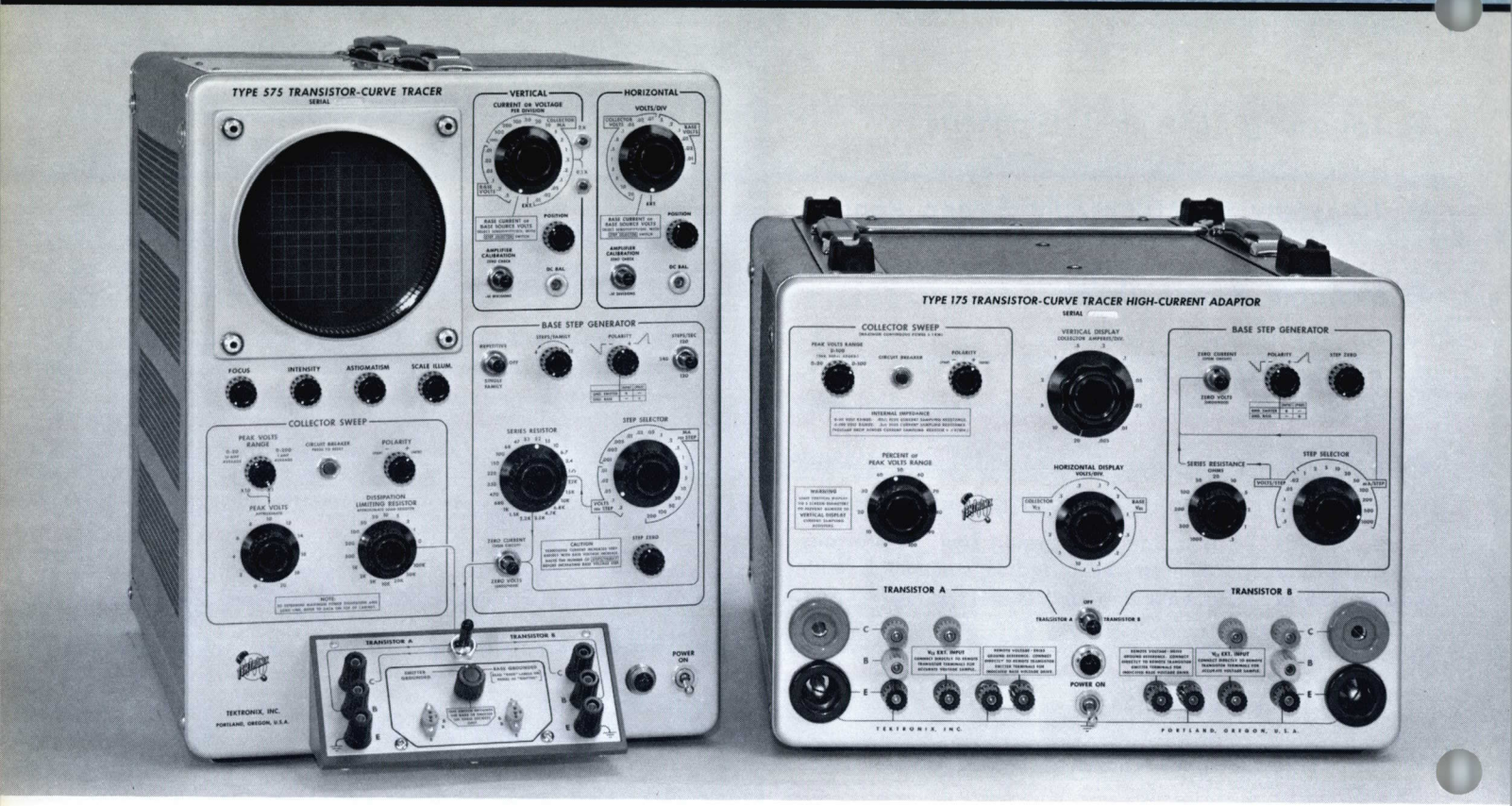
NET WEIGHT is 5½ pounds. Shipping weight is 9 pounds, approx.

TYPE 3T77A SAMPLING SWEEP UNIT $650

Each instrument includes: 2—10X attenuator, 50 Ω (017-0078-00); 1—Adapter, BNC-to-GR (017-0064-00); 2—10-ns GR cable (017-0501-00); 1—Adapter, BNC-to-UHF (103-0032-00); 2—Instruction Manual 070-0546-00).

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

Type 575/175 TRANSISTOR-CURVE TRACER HIGH-CURRENT ADAPTER



- *SINGLE OR REPETITIVE DISPLAYS*
- *DIRECT COMPARISON OF TRANSISTOR CHARACTERISTICS*
- *SELECT CIRCUIT PARAMETERS WITH FRONT PANEL CONTROLS*
- *MAKE TOTAL DIODE MEASUREMENTS*

In most instances the operation of the Type 175 is the same as that of the Type 575. The added capabilities of the Type 575 when used with the Type 175 are shown in color.

CHARACTERISTIC SUMMARY

SEMI-CONDUCTOR DRIVING CAPABILITIES

BASE OR EMITTER STEP GENERATOR—

Stepping Rate—2 or 4 times line frequency.

Number of Steps—Continuously variable from 4 to 12 steps per family of characteristic curves.

Single or Repetitive—Stops after a single family of curves is generated, or repeatedly generates the family of curves.

Type of Steps—Steps are increments of voltage or current and are either positive or negative.

Voltage Increments—Selectable values from 0.01 V/step to 0.2 V/step ±3% with 2.4-A current capability. —Selectable values from 0.02 V/step to 0.5 V/step with 12-A current capability.

Current Increments—Selectable values from 0.001 mA/step to 200 mA/step, ±3%. —Selectable values from 1 mA/step to 1000 mA/step.

COLLECTOR SWEEP GENERATOR—

Frequency—2 times line frequency.

Peak Sweep Voltage—Continuously variable from 0 V to 20 V minimum with 10-A current capability and from 0 V to 200 V minimum with 1-A current capability. —Continuously variable from 0 V to 20 V with 200-A current capability and 0 V to 100 V with 40-A current capability.

POLARITY—Positive or negative.

VERTICAL DISPLAY

CALIBRATED DEFLECTION FACTOR—

Transistor Collector Current—0.001 mA/div to 1000 mA/div, ±3%. —0.005 A/div to 20 A/div.

Transistor Base or Emitter Current—0.001 mA/div to 200 mA/div, ±3%.

Transistor Base or Emitter Voltage—0.01 V/div to 0.5 V/div, ±3%.

Base or Emitter Source Voltage—0.01 V/div to 0.2 V/div, ±3%.

HORIZONTAL DISPLAY

CALIBRATED DEFLECTION FACTOR—

Transistor Collector Voltage—0.01 V/div to 20 V/div, ±3%. —0.1 V/div to 10 V/div.

Transistor Base or Emitter Current—0.001 mA/div to 200 mA/div, ±3%.

Transistor Base or Emitter Voltage—0.01 V/div to 0.5 V/div, ±3%. —0.1 V/div to 2 V/div.

Base or Emitter Source Voltage—0.01 V/div to 0.2 V/div, ±3%.

CRT

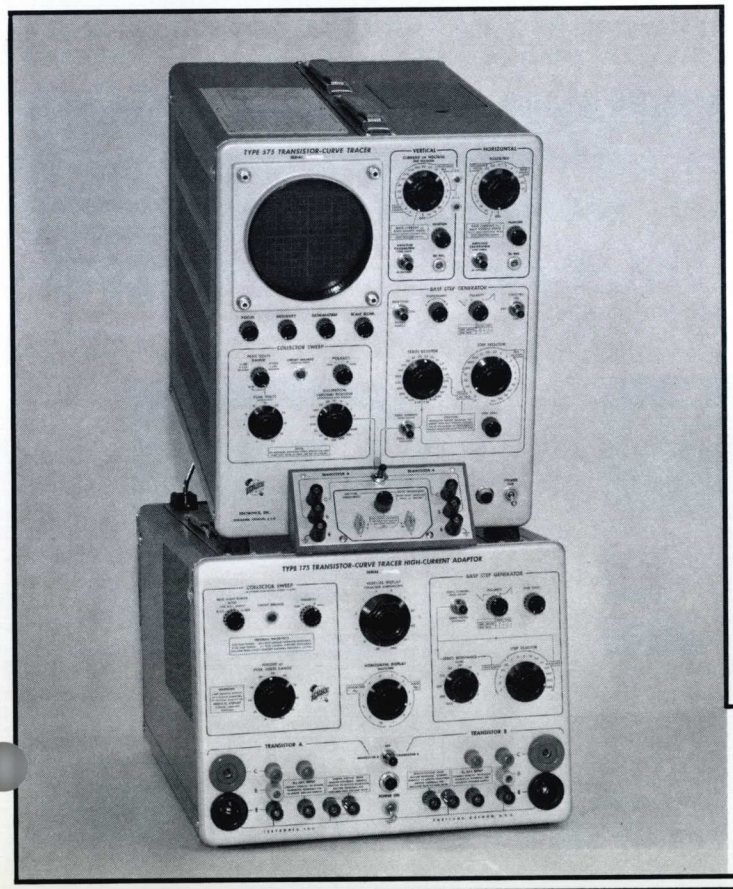
DISPLAY AREA—10 x 10 div ($\frac{5}{16}$" per div).

ACCELERATING VOLTAGE—4 kV.

OTHER CHARACTERISTICS

COMPARISON SWITCH—Switch allows switching between two semi-conductors for comparison.

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 50 to 60 Hz, 410 watts max. —105 to 125 V, 50 to 60 Hz, 1100 watts max.



The Type 575 Transistor-Curve Tracer displays the dynamic characteristic curves of both NPN and PNP transistors on the screen of a 5-inch cathode-ray tube. Several different transistor characteristic curves may be displayed, including the collector family in the common-base and common-emitter configuration. In addition to the transistor characteristic curves, the Type 575 is used to display dynamic characteristics of a wide range of semi-conductor devices.

Transistors under test are inserted into either a common-base or common-emitter test circuit. The transistor collector has a sweep voltage applied to it while a step voltage or current is applied to either the base or emitter (whichever is ungrounded). Voltage, for the collector, sweeps between zero and a selectable value and is generated by the Collector Sweep Generator. The Base or Emitter Step Generator applies steps to the base or emitter that start at zero and build up to a value determined by the number of steps and value of each step as selected with front-panel controls. Each sequence of steps, from zero to the maximum attained value, in conjunction with the sweep voltage on the collector produces one family of characteristic curves.

Signals used for vertical and horizontal deflection on the CRT are either current or voltage values selected from various points in the transistor test circuit. Thus, a selected vertical signal can be plotted against a selected horizontal signal to trace the desired semi-conductor characteristic curve. Selection of the deflection signal source is accomplished with front panel controls. Vertical deflection signal sources include: transistor collector current, transistor base or emitter current, transistor base or emitter voltage, and source voltage for the base or emitter. Horizontal deflection signal sources include: transistor collector voltage, transistor base or emitter current, transistor base or emitter voltage, and source voltage for the base or emitter.

The Type 175 Transistor-Curve Tracer High-Current Adapter enables the Type 575 to plot and display characteristic curves of high-current semi-conductors. Basically the Type 175 contains a high-current Collector Sweep Generator, a high-current Base or Emitter Step Generator and high-current test circuits that are used in place of those in the Type 575. The 175 also contains the necessary circuits to convert these high currents into deflection signals suitable for display on the Type 575 CRT. There is one source for the vertical deflection signal: the transistor collector current. There are two sources for the horizontal deflection signal: transistor collector voltage and transistor base or emitter voltage.

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.

575
175

BASE OR EMITTER STEP GENERATOR

The Step Generator develops current or voltage steps to drive the base or emitter (whichever is ungrounded) of the transistor under test. These steps are used to generate either repetitive or single-family (as selected) characteristic curves for display. The steps are adjustable in number from 4 to 12 and move in a positive or negative direction depending on the polarity switch setting. Step repetition rate is selectable as either 120 steps/s or 240 steps/s (values equal to 2X or 4X the line frequency). A control is available to set the starting point of a series of steps to zero.

Each step has a rise that is selected as either a value of current or a value of voltage. The value of each step rise in current ranges from 0.001 mA/step to 200 mA/step and is selected from 17 values that are in a 1-2-5 sequence. The value of each step rise in voltage is from 0.01 V/step to 0.2 V/step and is selected from 5 values that are in a 1-2-5 sequence. Also a switch is provided for grounding the transistor input to give a zero drive-voltage reference check, and opening the transistor input to give a zero drive-current reference check.

The driving resistance of the step generator, when developing voltage steps, is selected from 24 values that range from 1 ohm to 22 kilohms ±10%. Any other value can be added externally.

The Type 175 Step Generator output is basically the same as that of the Type 575. However, the current steps are selected from 10 values ranging from 1 mA/step to 1000 mA/step and the voltage steps are selected from 5 values ranging from 0.5 V/step to 10 V/step. In addition, the driving resistance is selected from 11 values ranging from 0.5 ohm to 1 kilohm. Any other resistance value can be added externally.

COLLECTOR SWEEP GENERATOR

The Collector Sweep Generator provides the sweep voltages that drive the collector of the transistor under test. These voltages sweep between zero and a peak value selected with a front-panel control. The peak voltage is either positive or negative depending on the setting of the polarity switch to allow the collector voltages to sweep between zero and positive peak values or zero and negative peak values. The repetition rate of the sweep is 2 times the line frequency; thus the collector voltage sweeps between zero and the peak value at least once for each step applied to the transistor base or emitter.

The peak sweep voltage is continuously adjustable from zero to 20 V with 10-A capability or from zero to 200 V with 1-A current capability.

The collector current limiting resistance is selected from 16 values ranging from 1 ohm to 100 kilohms ±5%.

The Type 175 Collector Sweep Generator output is basically the same as that of the Type 575. However, the peak sweep voltage is continuously adjustable from zero to 20 V with 200-A capability of from zero to 100 V with 40-A capability. Also, in the 0-100 V range a 300-ohm collector current-limiting resistor can be switched in. Any other desired resistance can be added externally.

VERTICAL-DEFLECTION SYSTEM

Signals used for vertical deflection are selected from various points in the transistor test circuit. Each point has several selectable deflection factors available.

CALIBRATED DEFLECTION FACTOR

TRANSISTOR COLLECTOR CURRENT—0.01 mA/div to 1000 mA/div in 16 steps, 1-2-5 sequence. Push buttons are provided for multiplying each step by 2 or 0.1 thus extending the deflection factor from 0.001 mA/div to 2000 mA/div. —0.005 A/div to 20 A/div in 12 steps, 1-2-5 sequence.

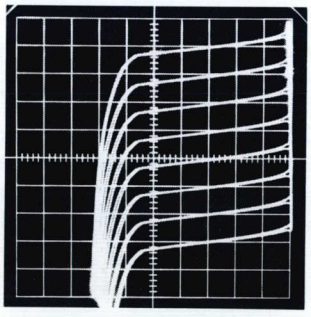
TRANSISTOR BASE OR EMITTER CURRENT—0.001 mA/div to 200 mA/div in 17 steps, 1-2-5 sequence.

TRANSISTOR BASE OR EMITTER VOLTAGE—0.01 V/div to 0.5 V/div in 6 steps, 1-2-5 sequence.

BASE OR EMITTER SOURCE VOLTAGE—0.01 V/div to 0.2 V/div in 5 steps, 1-2-5 sequence.

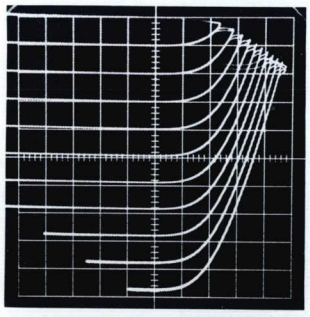
HORIZONTAL-DEFLECTION SYSTEM

Signals used for horizontal deflection are selected from various points in the transistor rest circuit. Each point has several selectable deflection factors available.



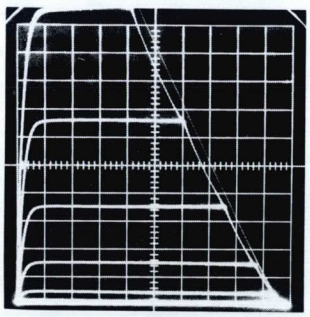
PNP TRANSISTOR

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.

CALIBRATED DEFLECTION FACTOR

Transistor Collector Voltage—0.01 V/div to 20 V/div in 11 steps, 1-2-5 sequence.
—0.1 V/div to 10 V/div in 7 steps, 1-2-5 sequence.

Transistor Base or Emitter Current—0.001 mA/div to 200 mA/div in 17 steps, 1-2-5 sequence.

Transistor Base or Emitter Voltage—0.01 V/div to 0.5 V/div in 6 steps, 1-2-5 sequence.
—0.1 V/div to 2 V/div in 5 steps, 1-2-5 sequence.

Base or Emitter Source Voltage—0.01 V/div to 0.2 V/div in 5 steps, 1-2-5 sequence.

OTHER CHARACTERISTICS

TRANSISTOR TEST PANEL—The transistor test panel has provisions for two transistors at the same time. Two sockets accept low-power transistors with short leads and three binding posts along side the sockets accept other transistor and semiconductors. One switch will change the sockets from the common-emitter to the common-base test circuit configuration. A second switch allows two transistors inserted into the test circuit to be rapidly compared by switching the test conditions from one to the other.

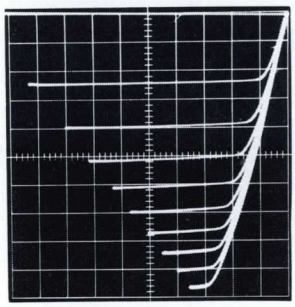
The Type 175 Transistor Test Panel is basically the same as that of the Type 575. Special connectors and cables are provided for high-current applications and for eliminating measurement errors due to voltage drops in high-current carrying leads.

CATHODE-RAY TUBE—The CRT used has an accelerating voltage of 4 kV and is supplied with a P31 phosphor unless another phosphor is requested.

ILLUMINATED GRATICULE—The $3\frac{1}{8}$" x $3\frac{1}{8}$" edge-lighted graticule is marked in 10 by $10\frac{5}{16}$" divisions, with centerlines marked every one-fifth of a division. Illumination is controlled by a front-panel knob.

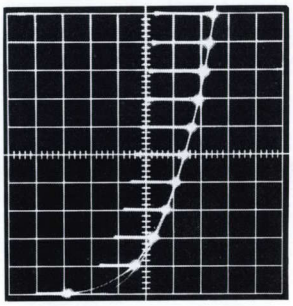
REGULATED POWER SUPPLY—Electronic voltage regulation is used to compensate for line-voltage changes and for variations in loading. All voltages affecting calibrations are fully regulated.

POWER REQUIREMENT—The Type 575 is wired for 117 V, 50 to 60 Hz. The electronically-regulated power supplies permit a line-voltage variation between 105 and 125 V. Changing transformer taps permits operation at 107, 127, 214, 234, or 254 V. The Type 575 draws 220 watts standby, 410 watts maximum. The Type 175 requires 117 V, 50 to 60 Hz, and regulates between 105 and 125 V. It draws 1100 watts maximum.



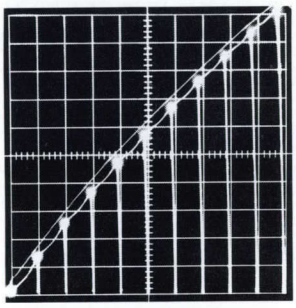
PNP TRANSISTOR

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.



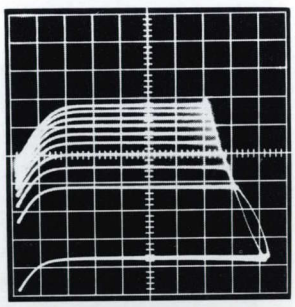
NPN TRANSISTOR

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.



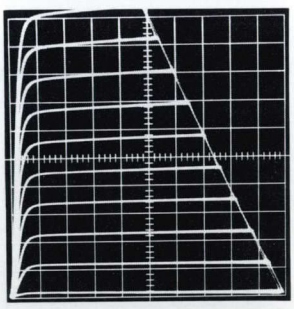
NPN TRANSISTOR

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.



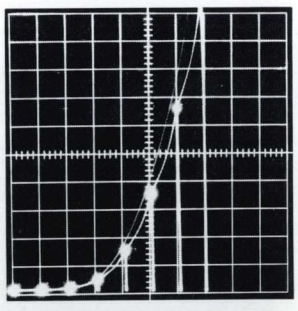
NPN TRANSISTOR

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.

575
175

MECHANICAL—Dimensions are 16⅞" high by 13⅛" wide by 23⅜" deep. Net weight is 66 pounds. Shipping weight is 85 pounds, approx. Type 175—Dimensions are 12¼" high by 15¼" wide by 23⅜" deep. Net weight is 93 pounds. Shipping weight is 118 pounds, approx.

TYPE 575 TRANSISTOR CURVE-TRACER $1075

Each instrument includes: 2—Transistor adapter, long (013-0069-00); 2—Transistor adapter, TO-3 (013-0070-00); 1—3 to 2-wire adapter (103-0013-00); 2—2N1381 transistor (151-0039-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 2—Instruction Manual (070-0255-00).

TYPE 175 HIGH CURRENT ADAPTER $1475

Each instrument includes: 2—Black output lead (012-0014-00); 2—Red output lead (012-0015-00); 1—Interconnecting cable (012-0042-00); 2—Red test cable (012-0043-00); 2—Black test cable (012-0044-00); 1—575 adapter cable (012-0045-00); 2—Blue test lead (012-0056-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—3-conductor power cord, 20" (161-0014-00); 2—Lock washer (210-0010-00); 2—Nut (210-0410-00); 2—Screw (212-0520-00); 2—Bolt hinge (214-0152-00); 2—Instruction Manual (070-0255-00).

INCREASED COLLECTOR VOLTAGE

Although similar to the Type 575 Transistor Curve-Tracer, a special model, Type 575 MOD 122C, provides much higher diode breakdown test voltage (variable from zero to 1500 V, maximum short circuit current of 1 mA) and also much higher Collector Supply (up to 400 V, at 0.5 A).

TYPE 575 MOD 122C $1325

Each instrument includes: 2—Transistor adapter, long (013-0069-00); 2—Transistor adapter, TO-3 (013-0070-00); 1—3 to 2-wire adapter (103-0013-00); 2—2N1381 transistor (151-0039-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 2—Instruction Manual (070-0255-00).

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 17½".

Order Part Number 040-0281-00 . . . . . $45

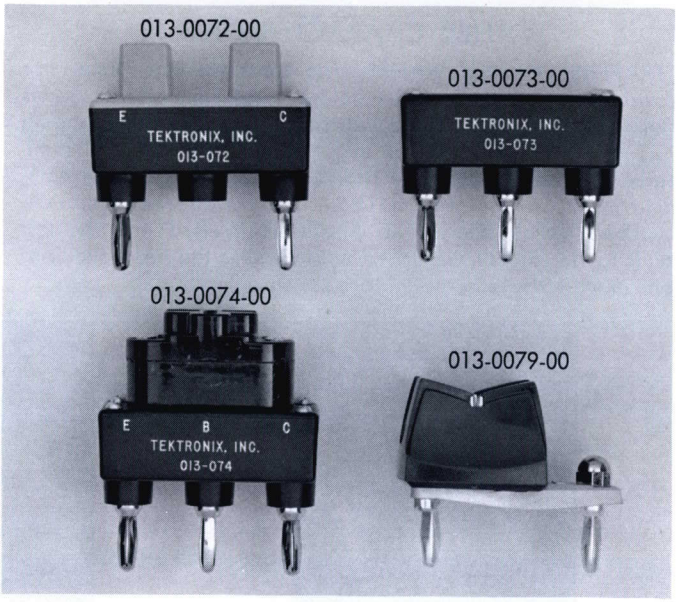
TYPE 175 MOD 167C

Modified Type 175 operates from 210 V to 250 V, 50 to 60 Hz.

TYPE 175 MOD 167C HIGH CURRENT ADAPTER . . $1475

Each instrument includes: 2—Black output lead (012-0014-00); 2—Red output lead (012-0015-00); 1—Interconnecting cable (012-0042-00); 2—Red test cable (012-0043-00); 2—Black test cable (012-0044-00); 1—575 adapter cable (012-0045-00); 2—Blue test lead (012-0056-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—3-conductor power cord, 20" (161-0014-00); 2—Lock washer (210-0010-00); 2—Nut (210-0410-00); 2—Screw (212-0520-00); 2—Bolt hinge (214-0152-00); 2—Instruction Manual (070-0255-00).

TYPE 575 OPTIONAL TEST BOARDS



DIODE TEST JIG (013-0072-00)—holds axial-lead diodes $5.00

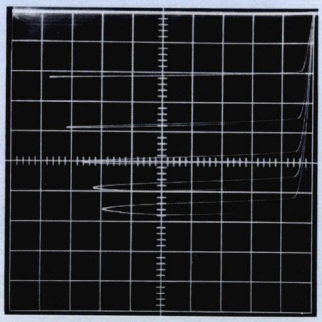
ADAPTER BOX (013-0073-00)—allows you to mount your own semiconductor socket on the box 4.00

POWER TRANSISTOR JIG (013-0074-00)—for power transistors with hook leads 5.00

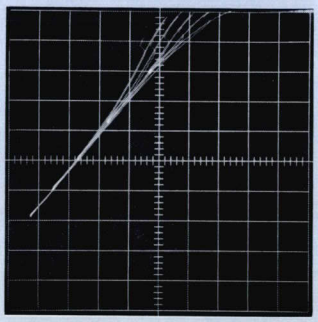
DIODE TEST JIG (013-0079-00)—production test jig for rapid handling 25.00

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

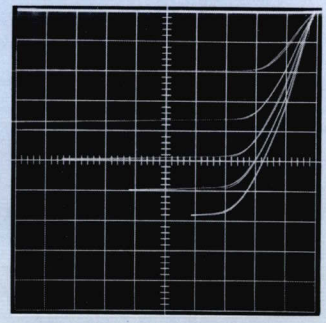
CHARACTERISTIC CURVE DISPLAYS WITH TYPE 175



Collector current vs collector voltage (emphasis on saturation resistance). Vertical deflection is 10 A/div, horizontal deflection is 0.2 V/div. Base drive is 500 mA/step (top curve is 2.5 A).



Collector current vs base voltage (collector sweep voltage is 4.2 V). Vertical deflection is 10 A/div, horizontal deflection is 0.1 V/div. Base drive is 500 mA/step.



Collector current vs collector voltage. Vertical deflection is 10 A/div, horizontal deflection is 1.0 V/div. Base drive is 500 mA/step (top curve is 2.5 A).

DC-to-85 MHz OSCILLOSCOPE Type 581A / 585A RM585A

All information in color describes the additional capabilities of the Type 585A and RM585A.

ILLUMINATED NO-PARALLAX GRATICULE

TUNNEL DIODE TRIGGERING TO BEYOND 150 MHz

SYNCHRONIZATION TO 250 MHz

CALIBRATED SWEEP DELAY

SINGLE-SWEEP PHOTOGRAPHY AT 10 ns/cm

2 FAST-RISE VERTICAL PLUG-IN UNITS

21 OTHER VERTICAL PLUG-IN UNITS (with adapter)

SMALL BRIGHT CRT SPOT

Dual-trace DC to 85 MHz (approx 3-dB down) displays at 100 mV/cm or DC to 80 MHz (approx 3-dB down) displays at 10 mV/cm are now available with the Type 82 Dual-Trace Plug-In Unit.

The Type 585A, and RM585A incorporate all the features of the Type 581A, but have an additional time base and the capability of calibrated sweep delay.

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics are extremely flexible through use of a wide selection of plug-in units.

HORIZONTAL

CALIBRATED SWEEP RANGE—Time Base A: 0.05 μs/cm to 2 s/cm; Time Base B (Type 585A and RM585A only): 2 μs/cm to 1 s/cm.

SWEEP MAGNIFIER—5X, extends Time Base A sweep range to 0.01 μs/cm.

CALIBRATED SWEEP DELAY—2 μs to 10 s, continuously variable.

TRIGGER REQUIREMENTS—Internal: 2-mm deflection, AC-coupled. External: 0.2 V to $\pm$15 V, AC or DC-coupled.

EXTERNAL INPUT—0.2 V/cm to 15 V/cm; DC to 350 kHz; 1 megohm, approx 47 pF.

CRT

ILLUMINATED NO-PARALLAX INTERNAL GRATICULE

DISPLAY AREA—4 x 10 cm.

ACCELERATING VOLTAGE—10 kV.

581A / 585A RM585A

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mV to 100 V 1-kHz square-wave.

POWER REQUIREMENT—105 to 125 V or 210 to 250 V, 50 to 60 Hz, 560 watts maximum for Type 581A, 630 watts maximum for Type 585A.

TYPE 80-SERIES VERTICAL PLUG-IN UNITS

Bandwidth Specifications are at —3 dB.

HIGH GAIN DUAL TRACE—

TYPE 82 DUAL-TRACE UNIT—DC to 80 MHz at 10 mV/cm, DC to 85 MHz at 100 mV/cm. Risetime at 100 mV/cm is nominally 4 ns, always less than 4.2 ns. Risetime at 10 mV/cm is nominally 4.3 ns, always less than 4.5 ns.

HIGH GAIN SINGLE TRACE—

TYPE 86 PLUG-IN UNIT—DC to 80 MHz at 10 mV/cm, DC to 85 MHz at 100 mV/cm. Risetime at 100 mV/cm is nominally 4 ns, always less than 4.2 ns. Risetime at 10 mV/cm is nominally 4.3 ns, always less than 4.5 ns.

SWEEP DELAY APPLICATIONS

In addition to the usual applications of the DC-to-85 MHz Type 581A Oscilloscope, the calibrated sweep delay of the Type 585A and RM585A Oscilloscopes 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 modulation conditions.*
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 amplifier input and output pulses.*
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. Actual magnification is the ratio of Time Base B TIME/CM to Time Base A TIME/CM.*

VERTICAL-DEFLECTION SYSTEM

DC-COUPLED MAIN AMPLIFIER consists of a two-stage distributed amplifier, a balanced fixed delay line, and a twin-pentode output stage.

BALANCED DELAY NETWORK permits observation of the leading edge of the waveform that triggers the sweep.

RISETIME and BANDWIDTH depend on the plug-in unit and probe used with the oscilloscope.

Oscilloscope used with	Risetime		Bandwidth
	nominally	always less than	at —3 dB approx
Type 82 or 86 Plug-In Unit at 10 mV/cm	4.3 ns	4.5 ns	80 MHz
Type 82 or 86 Plug-In Unit at 100 mV/cm	4.0 ns	4.2 ns	85 MHz

Risetime of the Oscilloscope, Type 82 or 86 Plug-In Unit, and supplied probe, at an overall deflection factor of 0.1 V/cm, is approx 4.5 ns.

TYPE 81 ADAPTER equips the oscilloscope to accept any Tektronix Letter-Series Plug-In Unit. Applications include sampling . . . transistor-risetime test . . . semiconductor-diode recovery-time studies . . . strain gage and other transducer measurements . . . differential-comparator displays . . . operational amplifier functions . . . multi-trace work . . . spectrum analysis, as well as many other general-purpose laboratory measurements.

HORIZONTAL-DEFLECTION SYSTEM

TIME BASE A SWEEP RANGE from 50 ns/cm to 2 s/cm is in 24 calibrated steps with 1-2-5 sequence. Accuracy is within 3% of panel reading. Sweep speed is continuously variable uncalibrated from 50 ns/cm to over 5 s/cm.

TIME BASE B SWEEP RANGE from 2 μs/cm to 1 s/cm is in 18 calibrated steps with 1-2-5 sequence. Accuracy is within 3% of panel reading. A control for varying the sweep length from 4 to 10 cm permits Time Base B to be used as a repetition-rate generator from 0.1 Hz to 40 kHz.

5 DISPLAY MODES include Time Base A normal, Time Base B normal, Time Base A single sweep, Time Base A delayed by Time Base B, and Time Base B with trace brightening during the period that Time Base A runs.

5X SWEEP MAGNIFIER expands the center 2-cm portion of the normal display to fill 10 cm and operates on all ranges for both time bases. It can be used to extend the calibrated sweep time of Time Base A to 10 ns/cm, and Time Base B to 0.4 μs/cm. Any one-fifth of the magnified sweep can be displayed. Accuracy of the displayed portion of the magnified sweep is within 5% of the figured sweep rate.

SINGLE SWEEP OPERATION facilitates photographic recording of waveforms. The time base can be made to run immediately when the RESET button is pressed, or can be made to wait after the button is pressed until a proper trigger signal occurs. The READY light indicates when the sweep is armed to fire on the next received trigger. Using a Tektronix C-27 Camera with a 1:0.5, f/1.3 lens and Polaroid Type 410 film, writing speeds of 340 μs/cm, displayed on P31 phosphor, can be recorded. With an optional P11 phosphor, writing speeds of 400 μs/cm can be recorded.

EXTERNAL HORIZONTAL INPUT provides for horizontal beam deflection with an external source. Horizontal deflection factor is continuously variable from 0.2 V/cm to over 15 V/cm. Bandwidth is DC to 350 kHz or better at maximum gain. Input impedance is 1 megohm paralleled by approximately 47 pF.

TRIGGER

TRIGGER LEVEL adjusts to allow sweep triggering at any selected point on either the rising or falling portion of the waveform, and up to ± 15 V (external) in amplitude.

TRIGGER STABILITY can be locked at an optimum triggering point to eliminate further adjustment.

TRIGGER SOURCE can be internal, external, or line. Internal sources are AC coupled; external sources can be AC or DC coupled.

HIGH-FREQUENCY SYNC provides steady displays of signals from 5 MHz to 250 MHz, with a fraction of a cm of displayed amplitude. This mode operates from internal and external sources on the Type 581A, and Time Base A of the Type 585A and RM585A.

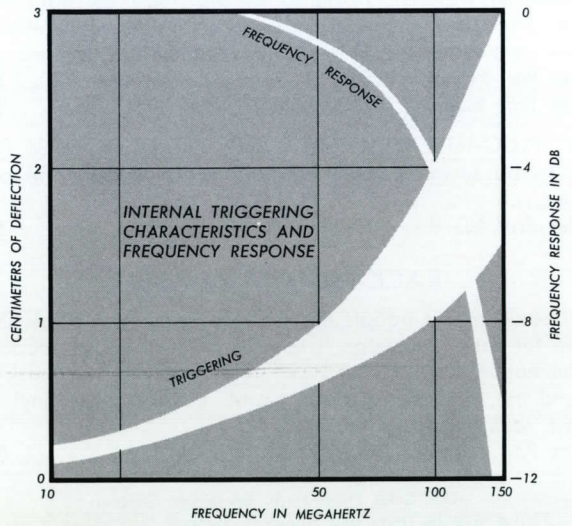
LOW-FREQUENCY REJECT operates above 15 kHz to prevent low-frequency components, such as 60-hertz hum, from interfering with stable triggering. This mode also allows bright trace displays when a multiple-channel plug-in unit is operated in its alternate mode.

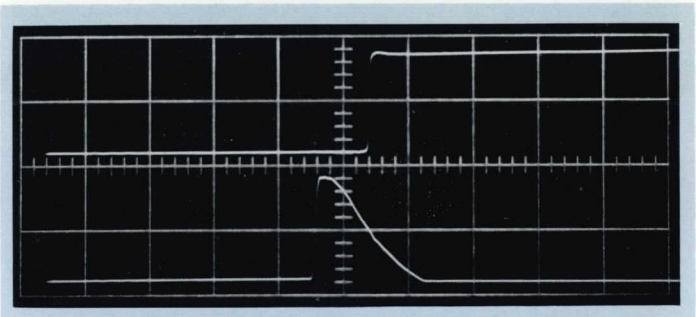
TRIGGER REQUIREMENTS for Type 581A and Time Base A and RM585A are as follows:

FREQUENCY	INTERNAL			EXTERNAL	
	AC	AC LF REJ	HF SYNC	AC/DC	HF SYNC
15 Hz to 15 kHz	2 mm	—	—	0.3 V	—
15 kHz to 5 MHz	2 mm	2 mm	—	0.3 V	—
5 MHz to 10 MHz	4 mm	4 mm	4 mm	0.3 V	0.2 V P to P
10 MHz to 50 MHz	1 cm	1 cm	4 mm	0.5 V	0.2 V P to P
50 MHz to 100 MHz	2 cm	2 cm	4 mm	1.5 V	0.2 V P to P
100 MHz to 150 MHz	3 cm	3 cm	4 mm	2.0 V	0.2 V P to P
150 MHz to 250 MHz	—	—	4 mm	—	0.2 V P to P

TRIGGER REQUIREMENTS for Time Base B of Type 585A and RM585A are as follows:

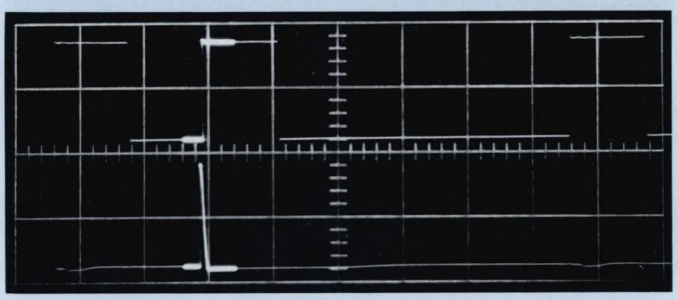
FREQUENCY	INTERNAL		EXTERNAL
	AC	AC LF REJ	AC/DC
15 Hz—15 kHz	4 mm	—	0.5 V P to P
15 kHz—1 MHz	4 mm	4 mm	0.5 V P to P
1 MHz—5 MHz	2 cm	2 cm	1.5 V P to P





SWEEP DELAY

Waveforms above are brightened portions (expanded) of waveforms below. Waveforms above are displayed in the 'A' DEL'D BY 'B' mode. Waveforms below are displayed in the 'B' INTENSIFIED BY 'A' mode.



SWEEP DELAY

CALIBRATED DELAY RANGE from 2 μs to 10 seconds can be used to delay the start of any Time Base A sweep. Time Base B provides accurate time delay and Time Base A presents normal sweep at the end of the delay period. Accuracy of the 15 calibrated delay steps from 2 μs to 0.1 s is within 1% of the indicated delay. Accuracy of the 3 remaining calibrated steps from 0.2 s to 1 s is within 3% of the indicated delay. A 10-turn precision potentiometer permits calibrated delay-time adjustments to any value from 2 μs to 10 seconds. Incremental accuracy of this control is within 0.2% of the indicated setting.

TRIGGERED OPERATION holds off the start of the delayed sweep until the arrival of the first trigger signal following the selected delay time. Because the delayed sweep is actually triggered by the signal under observation, the display is completely jitter free. A steady display is thus provided for time-modulated pulses and signals with inherent jitter.

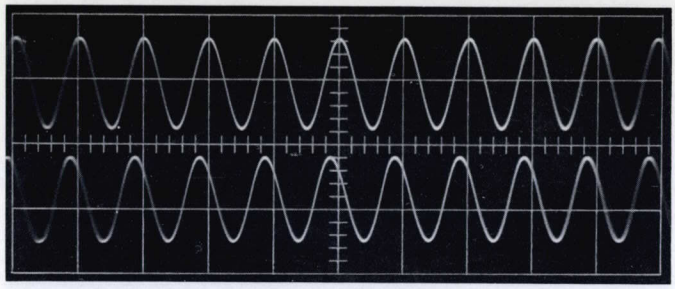
CONVENTIONAL OPERATION holds off the start of the delayed sweep for the precise amount of the selected delay time. Any time-modulation or jitter on the signal will be magnified in proportion to the amount of sweep expansion.

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 this interval is 10 times the Time/cm or Delay-Time setting).

SWEEP MAGNIFICATION is readily accomplished when Time Base A is operated at a faster rate than Time Base B. For example, if TIME BASE A is operating at 1 μs/cm and TIME BASE B is operating at 50 μs/cm, the magnification is 50 times.

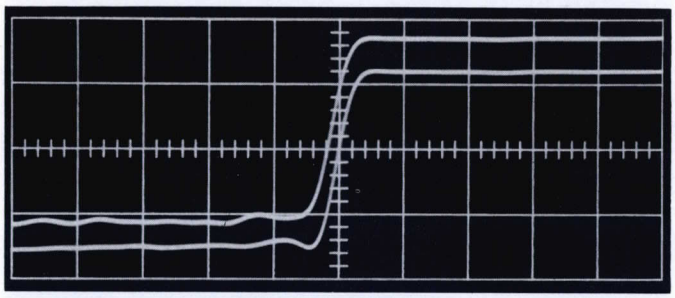
TRACE BRIGHTENING indicates the exact portion appearing on the magnified display, and shows the point-in-time relationship of the magnified display to the original display.

581A / 585A RM585A



PHASE COMPARISON

Dual-trace display of 100 MHz sinewaves at 10 ns/cm. Phase difference is approximately 55 degrees. Phase comparison and similar measurements are possible with the stable high-frequency triggering system of the Type 581A and 585A.



TIME COINCIDENCE

Dual-trace display of input and output pulses of a transistor amplifier at 10 ns/cm. Lower trace delayed 1 ns by the amplifier under observation. Note time resolution. The Type 581A or 585A Oscilloscope—with 82 Unit—can display time coincidence between input channels with no measurable difference at 10 ns/cm.

CRT AND DISPLAY FEATURES

TEKTRONIX 5" CRT is a metalized, lumped constant traveling wave tube incorporating a helical post accelerating anode and achieving a small, bright spot. Accelerating potential is 10 kV. A P31 phosphor is normally supplied.

BEAM POSITION INDICATORS light to show the direction of the beam when it is not on the screen.

ILLUMINATED NO-PARALLAX GRATICULE with variable edge lighting is accurately ruled in centimeter squares. Viewing area is 4 by 10 cm. Vertical and horizontal centerlines are further marked in 2-mm divisions.

UNBLANKING WAVEFORM is DC coupled to the CRT grid. This assures uniform beam intensity for all sweep speeds and repetition rates at any setting of the intensity control.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR provides 18 squarewave voltages at the front panel. Peak to peak amplitudes from 0.2 mV/cm to 100 V are in 1-2-5 sequence and accurate to ±3%. Squarewave frequency is approximately 1 kHz.

DELAYED TRIGGER used to start the delayed sweep is available at the front panel. This can be used to trigger external equipment at any delay from 0.05 μs to 10 s. When used with the delayed sweep, the resulting waveform can be observed. Amplitude is approximately +5 volts. A positive gate of the same duration as B sweep (approximately 20 volts) is also available at the front panel.

OUTPUT WAVEFORMS available at the front panel via cathode followers are a positive gate of approximately 20 V, and a positive-going sawtooth of approximately 150 V.

ELECTRONICALLY-REGULATED DC SUPPLIES insure stable operation between 105 and 125 V, or 210 and 250 V. Heaters in the vertical plug-in unit and in the oscilloscope vertical amplifier are regulated for stable operation and long life.

POWER REQUIREMENT is 105 to 125 V or 210 to 250 V, 50 to 60 Hz. Maximum power consumption is 560 watts for the Type 581A, and 630 watts for the Type 585A and RM585A. Instrument factory wired for 117 V.

CABINET MODEL dimensions are 16⅞" high by 13⅛" wide by 23⅞" deep. Type 581A net weight is 71 pounds. Shipping weight is 80 pounds, approx. Type 585A net weight 74 pounds. Shipping weight 84 pounds, approx.

RACK-MOUNT MODEL dimensions are 14" high by 19" wide by 22¾" deep. Type RM585A net weight is 81 pounds. Shipping weight is 110 pounds, approx.

TYPE 581A, without plug-in units $1425

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (installed) (378-0567-00); 1—Plate, protector, CRT, clear (387-0918-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0390-00).

TYPE 585A, without plug-in units $1725

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (installed) (378-0567-00); 1—Plate, protector, CRT, clear (387-0918-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 2—Instruction Manual (070-0391-00).

TYPE RM585A, without plug-in units $1825

Each instrument includes: 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (installed) (378-0567-00); 1—Plate, protector, CRT, clear (387-0918-00); 1—Patch cord, BNC-to-BNC, 18" (012-0087-00); 1—Patch cord, BNC-to-banana plug, 18" (012-0091-00); 1—Post jack, BNC (012-0092-00); 1—Set mounting hardware; 2—Instruction Manual (070-0392-00).

MAINTENANCE AIDS

Please refer to catalog accessory pages
for more-complete information

TU-5 PULSER generates a flat-top square wave to aid in adjustment of transient response of the Type 80-Series Plug-In Units. The TU-5 connects between the Type 581A/585A calibrator output and the plug-in unit. Risetime is 1.0 ns, maximum.
Order Part Number 015-0043-00 (includes accessories) . . $46.50
Order Part Number 015-0038-00 (TU-5 only) $25.00

6" PLUG-IN EXTENSION allows a Type 82 or 86 Plug-In Unit to be serviced while partially removed from the oscilloscope.
Order Part Number 013-0055-00 . . . . . $14.50

RACK-MOUNT ADAPTER

A cradle mount adapts the Type 581A or Type 585A Oscilloscope for rack mounting. 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. Finish is blue vinyl. Rack height requirement is 17½".
Order Part Number 040-0281-00 . . . . . $45.00

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

PLUG-IN ADAPTER Type 81

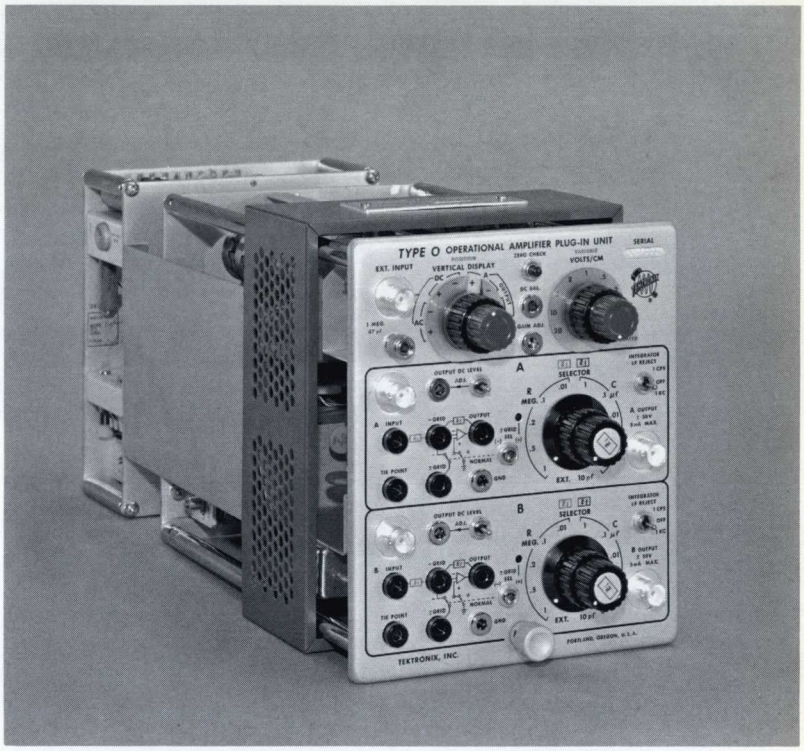
The Tektronix Type 81 Adapter makes possible the use of any Tektronix Letter-Series Plug-In Unit with any Type 580-Series Oscilloscope. The Type 81 Adapter and appropriate plug-in unit expand the versatility of the 580-Series Oscilloscopes to fields including differential-comparator displays, sampling, stress analysis, transistor-risetime studies, semiconductor-diode-recovery-time studies, operational amplifiers, spectrum analysis, 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 Letter-Series 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 4 pounds. Shipping weight is 6 pounds, approx.

TYPE 81 PLUG-IN ADAPTER $135
Each Adapter includes: 2—instruction manuals (070-0232-00).

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



EXTEND CAPABILITIES OF TYPE 580-SERIES OSCILLOSCOPES TO THESE AREAS

(Bandwidth is specified as —3 dB)

FOR MULTIPLE-TRACE OPERATION

TYPE 1A1 DUAL-TRACE UNIT—DC to 33 MHz, 10.5-ns risetime at 50 mV/cm to 50 V/cm—DC to 23 MHz, 15-ns risetime at 5 mV/cm increasing to 33 MHz at 50 mV/cm.

TYPE 1A2 DUAL-TRACE UNIT—DC to 33 MHz, 10.5-ns risetime at 50 mV/cm to 50 V/cm.

TYPE CA DUAL-TRACE UNIT—DC to 24 MHz, 15-ns risetime at 50 mV/cm to 50 V/cm.

TYPE M FOUR-TRACE UNIT—DC to 20 MHz, 17-ns risetime at 20 mV/cm to 25 V/cm.

FOR WIDE BAND APPLICATIONS

TYPE B WIDE-BAND UNIT—DC to 20 MHz, 18-ns risetime at 50 mV/cm to 50 V/cm—2 Hz to 12 MHz, 30-ns risetime at 5 mV/cm to 50 mV/cm.

TYPE K FAST-RISE UNIT—DC to 30 MHz, 12-ns risetime at 50 mV/cm to 40 V/cm.

TYPE L FAST-RISE UNIT—DC to 30 MHz, 12-ns risetime at 50 mV/cm to 40 V/cm—3 Hz to 24 MHz, 15-ns risetime at 5 mV/cm to 4 V/cm.

FOR SPECTRUM ANALYSIS

TYPE 1L10, 1L20, 1L30 UNITS— cover 1-10,500 MHz.

FOR DIFFERENTIAL INPUT APPLICATIONS

TYPE 1A7 HIGH-GAIN UNIT—DC to 500 kHz at 10 μV/cm.

TYPE D HIGH-GAIN UNIT—DC to 300 kHz at 1 mV/cm increasing to 2 MHz at 50 mV/cm.

TYPE E LOW-LEVEL UNIT—0.06 Hz to 20 kHz at 50 μV/cm, increasing to 60 kHz at 0.5 mV/cm to 25 mV/cm.

TYPE G WIDE-BAND UNIT—DC to 20 MHz, 18-ns risetime at 50 mV/cm to 50 V/cm.

FOR HIGH DC DEFLECTION FACTOR

TYPE H WIDE-BAND UNIT—DC to 15 MHz, 23-ns risetime at 5 mV/cm to 50 V/cm.

FOR OPERATIONS OF INTEGRATION, DIFFERENTIATION, FUNCTION GENERATION, AND LINEAR OR NONLINEAR AMPLIFICATION

TYPE O OPERATIONAL AMPLIFIER—DC to 25 MHz, 14-ns risetime at 50 mV/cm to 50 V/cm.

FOR TRANSDUCER AND STRAIN GAGE APPLICATIONS

TYPE Q UNIT—DC to 6 kHz, 60 μs risetime at 10 μstrain/div to 10,000 μstrain/div.

FOR TRANSISTOR-RISETIME CHECKING

TYPE R UNIT—12-ns risetime.

FOR DIODE RECOVERY-TIME MEASUREMENTS

TYPE S UNIT—12-ns risetime.

FOR PRECISE AMPLITUDE MEASUREMENT VIA THE SLIDE-BACK TECHNIQUE

TYPE W DIFFERENTIAL COMPARATOR UNIT—DC to 23 MHz, at 50 mV/cm, decreasing to 8 MHz at 1 mV/cm. 15-ns risetime at 50 mV/cm, increasing to 44-ns at 1 mV/cm.

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 MHz, 27-ns risetime at 50 mV/cm to 25 V/cm.

FOR HIGH-FREQUENCY SAMPLING APPLICATIONS

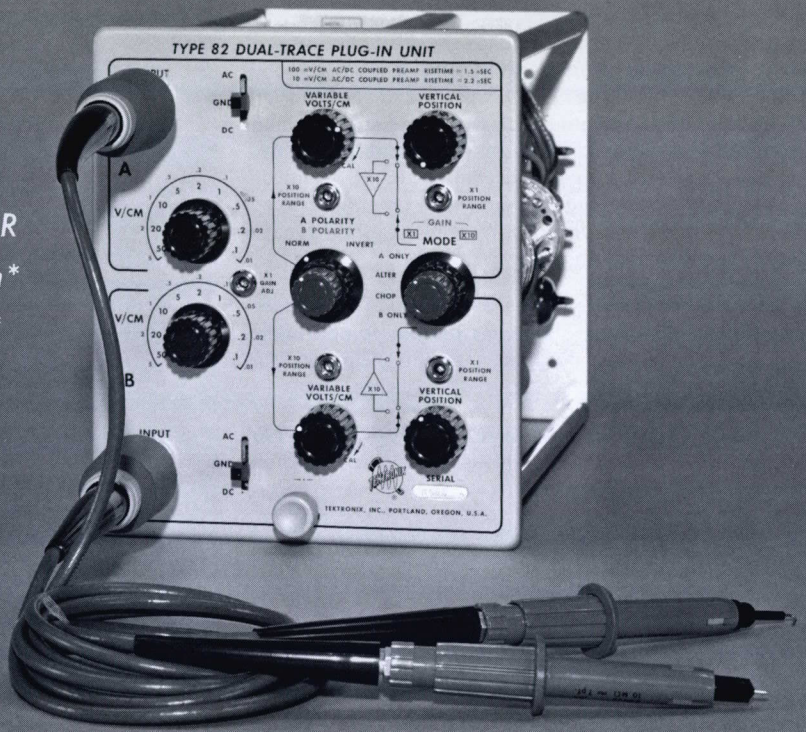
TYPE 1S1 SAMPLING UNIT—350-ps risetime.

TYPE 1S2 TDR SAMPLING UNIT—90-ps risetime.

Type 82 DUAL TRACE UNIT

10 mV/cm DEFLECTION FACTOR
*DC TO 85 MHz AT 100 mV/cm**
*DC TO 80 MHz AT 10 mV/cm**
CHOPPED
OR ALTERNATE SWITCHING

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.



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.

RISETIME of the Type 82 with Type 580-Series Oscilloscopes is approximately 4 ns at 100 mV/cm, always less than 4.2 ns. At 10 mV/cm, using the X10 Amplifier, risetime is approximately 4.3 ns, always less than 4.5 ns. 100 mV/cm —12 dB point is approximately 150 MHz.

4 OPERATING MODES include Channel A only, Channel B Only, Alternate (triggered electronic switching between channels, at the end of each sweep), and chopped. In chopped operation, successive 5-μs segments are displayed at an approximate 100-kHz rate per channel, or 500-ns segments at an approximate 1-MHz rate per channel.

CALIBRATED DEFLECTION FACTOR from 100 mV/cm to 50 V/cm is in 9 steps with 1-2-5 sequence, and is accurate within 3%. A variable control permits uncalibrated adjustment from 100 mV/cm to approximately 100 V/cm.

10X AMPLIFIER, DC-coupled, extends deflection factor to 10 mV/cm. Deflection factor is then in 9 calibrated steps from 10 mV/cm to 5 V/cm, 1-2-5 sequence. The variable control provides uncalibrated adjustment from 10 mV/cm to approximately 10 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 1.6 Hz direct or 0.16 Hz with the P6008 10X Probe.

*Approximate —3 dB points.

INPUT RC is 1 megohm paralleled by approximately 15 pF.

P6008 10X PASSIVE PROBES increase the input resistance to 10 megohms and decrease 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 deflection factor of 100 mV/cm is approximately 4.5 ns.

MECHANICAL SPECIFICATIONS: Net weight is 4¾ pounds. Shipping weight is 10 pounds, approx.

TYPE 82 DUAL-TRACE PLUG-IN UNIT **$650**
Each instrument includes: 2—P6008 probe (010-0129-00); 2—instruction manual (070-0349-01).

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.

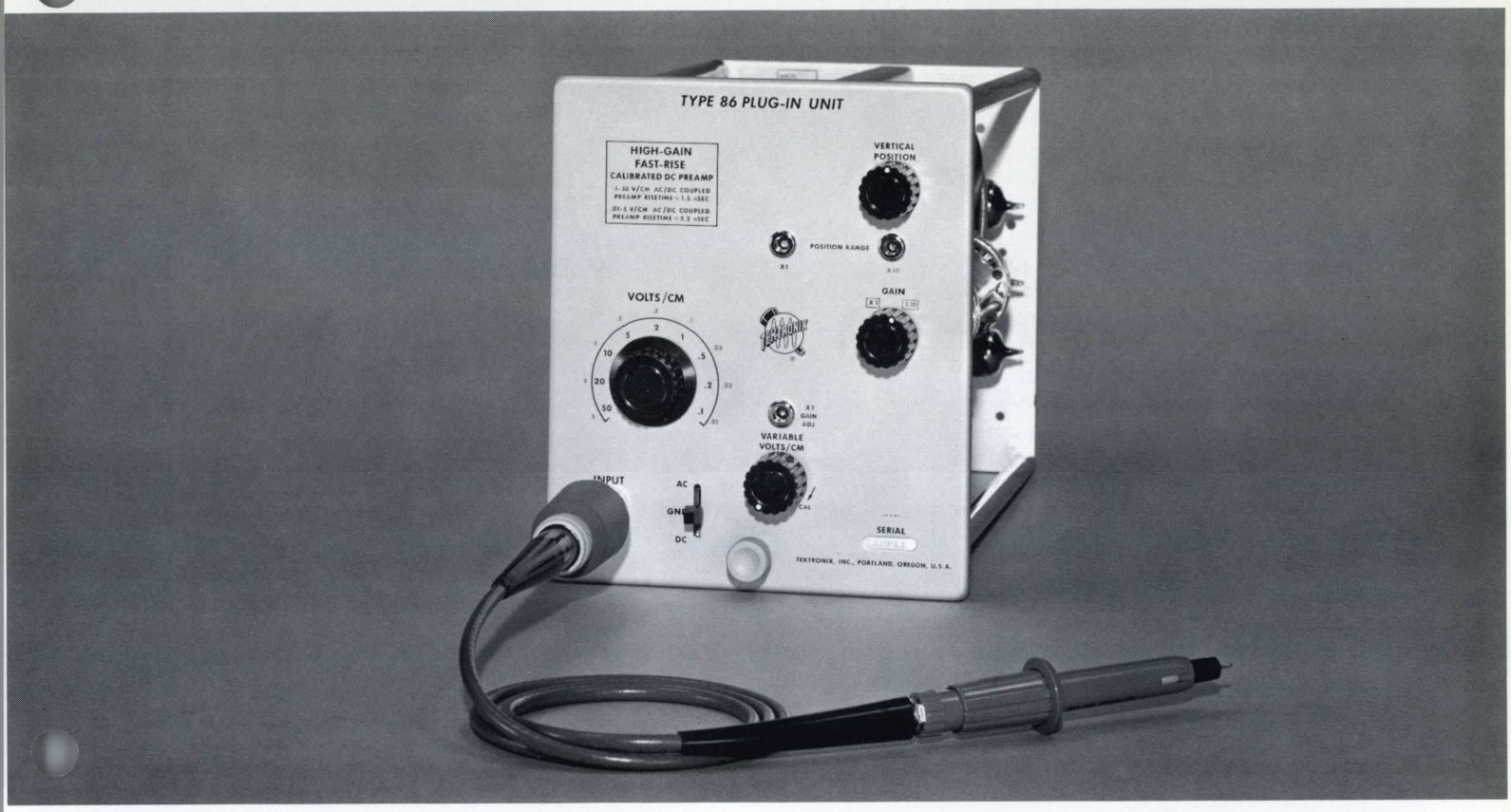
Tektronix Type 580-Series Oscilloscopes with serial numbers prior to #950 for Type 581 and #2585 for Type 585 may require this modification. Please consult your Field Engineer.

Each kit includes components to change delay-line impedance, standardize CRT termination, modify CRT and distributed amplifier circuitry, and modify Type 80/P80 combination.

Order Part Number 040-0275-00 ..... $25

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

PLUG-IN UNIT Type 86



- *10 mV/cm DEFLECTION FACTOR*
- *DC TO 85 MHz AT 100 mV/cm**
- *DC TO 80 MHz AT 10 mV/cm**

RISETIME of the Type 86 and Type 580-Series Oscilloscope is approximately 4 ns at 100 mV/cm, always less than 4.2 ns. At 10 mV/cm, using the X10 Amplifier, risetime is approximately 4.3 ns, always less than 4.5 ns. 100 mV/cm —12 dB point is approximately 150 MHz.

CALIBRATED DEFLECTION FACTOR from 100 mV/cm to 50 V/cm is in 9 calibrated steps with 1-2-5 sequence, accuracy within 3%. A variable control permits uncalibrated adjustment from 100 mV/cm to approximately 100 V/cm.

10X AMPLIFIER, DC-coupled, extends deflection factor to 10 mV/cm. Deflection factor is then in 9 calibrated steps from 10 mV/cm to 5 V/cm, 1-2-5 sequence. The variable control provides uncalibrated adjustment from 10 mV/cm to approximately 10 V/cm.

INPUT can be AC or DC-coupled. When AC-coupled, the low-frequency —3 dB point is 1.6 Hz direct or 0.16 Hz with the P6008 10X Probe.

INPUT RC is 1 megohm paralleled by approximately 15 pF.

*Approximate —3 dB points.

P6008 10X PASSIVE PROBE increases the input resistance to 10 megohms and decreases the input capacitance to approximately 4 pF. The risetime of a Type 580-Series Oscilloscope, a Type 86 Plug-In Unit, and a P6008 Probe, at an overall deflection factor of 100 mV/cm is approximately 4.5 ns.

MECHANICAL SPECIFICATIONS: Net weight is 3¼ pounds. Shipping weight is 7 pounds, approx.

TYPE 86 PLUG-IN UNIT $350

Each instrument includes: 1—P6008 probe (010-0129-00); 2—instruction manual (070-0364-01).

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.

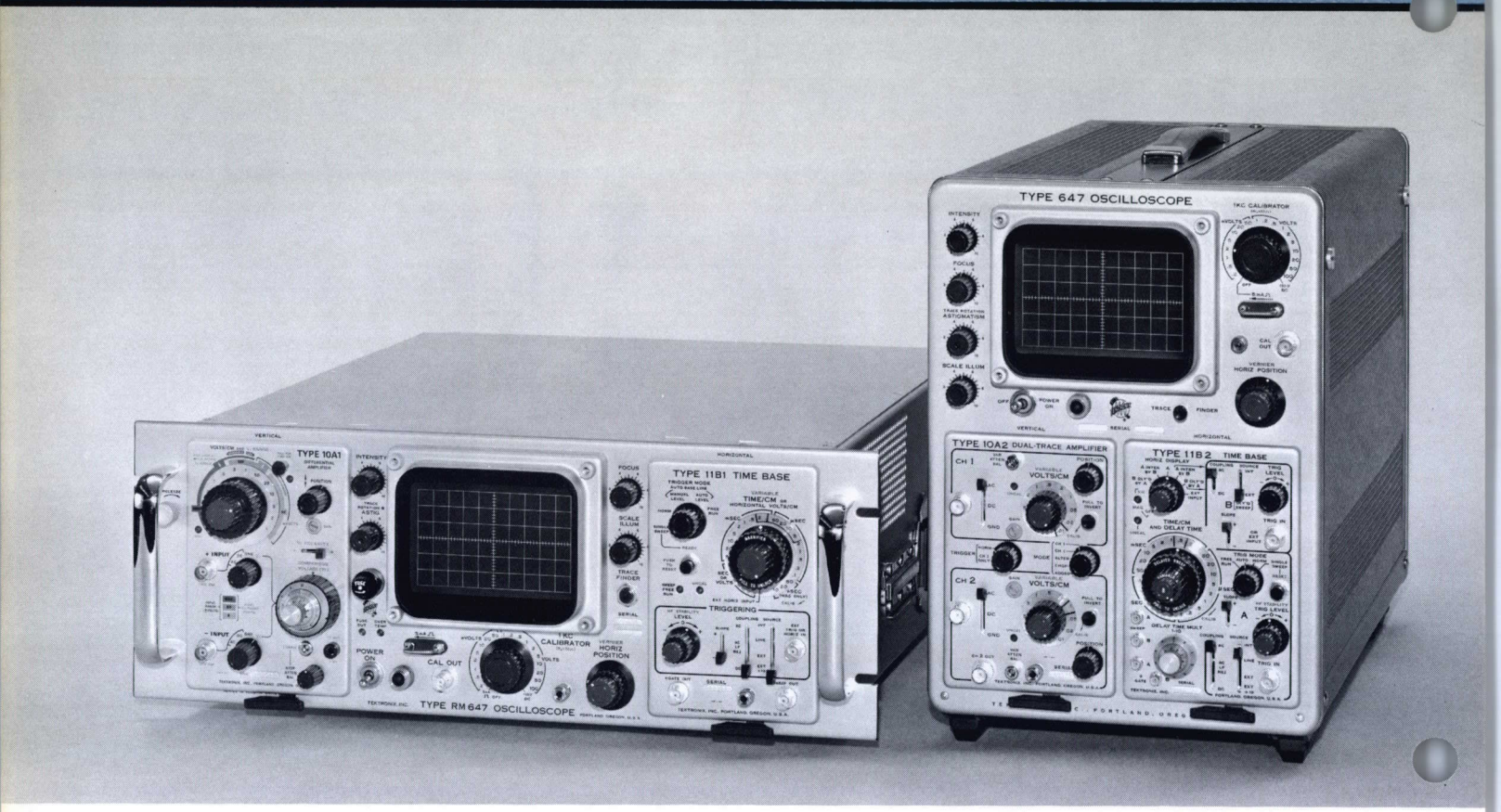
Tektronix Type 580-Series Oscilloscope with serial numbers prior to #950 for Type 581 and #2585 for Type 585 may require this modification. If in doubt about instrument modification, please consult your Field Engineer.

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.

Order Part Number 040-0275-00 ..... $25

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

Type 647 / RM647 DC-to-50 MHz OSCILLOSCOPES



The Type 647 and RM647 Oscilloscopes are the result of research and design toward compact, high-performance instruments capable of accurate measurement in severe environments (—30°C to +65°C) and offering an extra margin of dependability and even greater accuracy in normal environments (0°C to +40°C).

Design goals placed these "most wanted" features in a ruggedized oscilloscope: vertical plug-ins for DC to 50 MHz (dual-trace or wide-band differential comparator operation), choice of horizontal plug-ins for calibrated sweep delay or wide-range magnification, bright 6 x 10 cm no-parallax displays, low power requirements, ease of maintenance . . . all in a compact easily-handled package.

VERTICAL DEFLECTION

VERTICAL SYSTEM accepts a 10-Series Plug-In Unit.

SIGNAL DELAY permits observation of the leading edge of the waveform that triggers the sweep. The delay line requires no tuning.

HORIZONTAL DEFLECTION

HORIZONTAL SYSTEM accepts an 11-Series Plug-In Unit.

CRT AND DISPLAY FEATURES

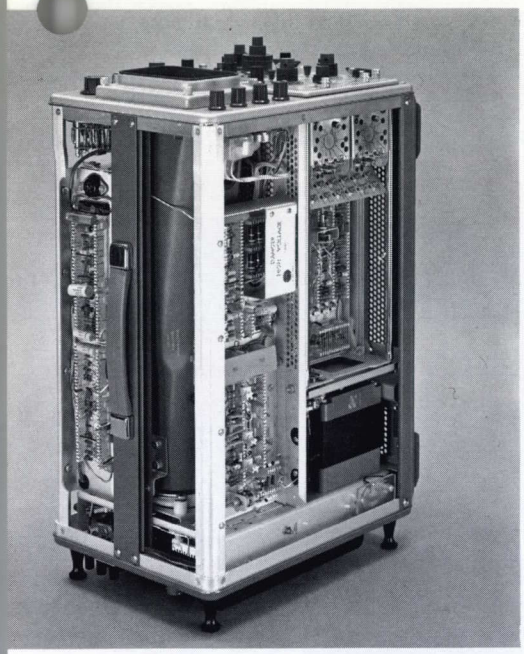
TEKTRONIX CRT is a rectangular flat-faced tube. Accelerating potential is 14 kV. A P31 phosphor is normally supplied.

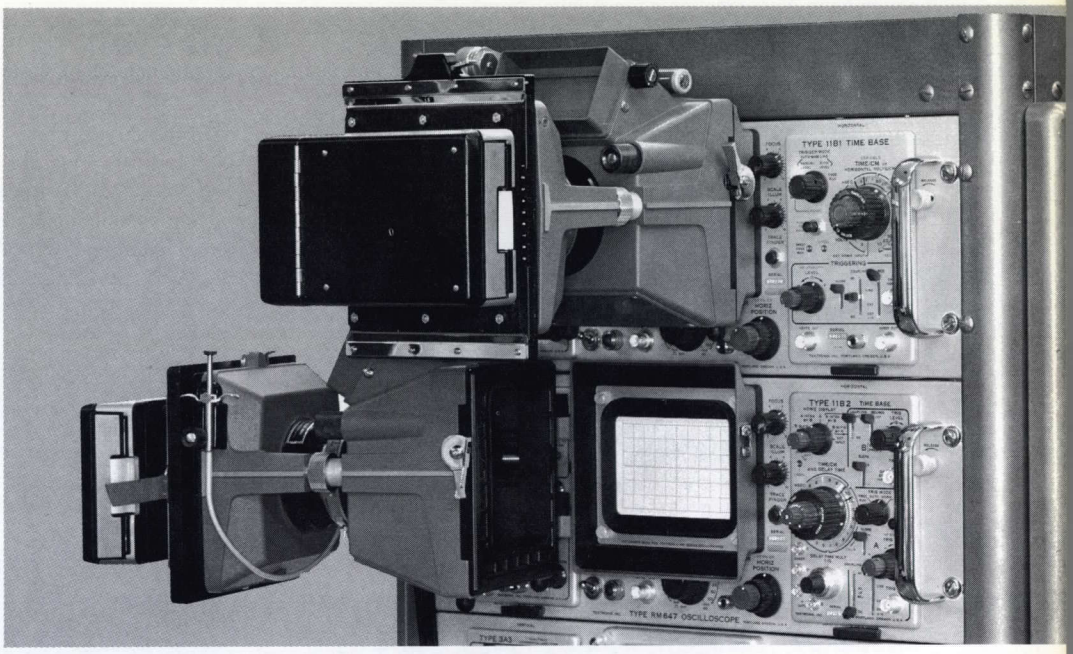
INTERNAL GRATICULE with variable edge lighting is accurately ruled in centimeter squares. Viewing area is 6 x 10 cm. Vertical and horizontal centerlines are marked in 2-mm divisions.

TRACE FINDER attenuates both horizontal and vertical voltages to aid in positioning the display.

DC-COUPLED UNBLANKING to the CRT grid assures uniform beam intensity for all sweep speeds and repetition rates at any setting of the intensity control.

EXTERNAL CRT INPUTS are located at the rear of the oscilloscope. Unblanking amplifier bandwidth (for small signals) is DC to 10 MHz. Gain is 1.5. Cathode Z-axis input is AC coupled (0.015 μF and 22 kΩ).



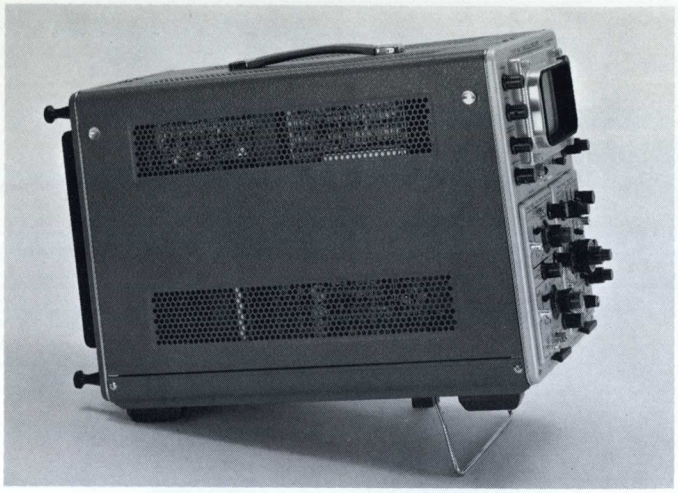


ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE	OPERATING Type RM647: —30°C to +65°C. Type 647: —30°C to +65°C, continuous, when instrument is not tipped more than 20° in any direction from level position. When instrument is operated vertically (with front panel up), the maximum ambient temperature is +55°C. NON-OPERATING —55°C to +75°C.
VIBRATION*	OPERATING AND NON-OPERATING 0.025 inch peak to peak, 10 to 55 to 10 Hz in 1 minute sweeps (4G's) for 15 minutes on each axis. 3 minute vibration at resonance or 55 Hz (each axis).
ALTITUDE	OPERATING 15,000 feet maximum. Maximum operating temperature of the Type 647 at 130 V line reduced by 10°C. NON-OPERATING 50,000 feet, maximum.
SHOCK	NON-OPERATING 20 G's, one-half sine, 11-millisecond duration. Two shocks each direction along each of the three major axes; total of 12 shocks.
HUMIDITY	NON-OPERATING Meets electrical performance specifications after exposure to five cycles (120 hours) of Mil-Std-202B, method 106A (omit freezing and vibration, and allow 24-hour post-test drying period before operating).
TRANSPORTATION	NON-OPERATING Meets National Safe Transit test when factory-packaged: Vibration for one hour at slightly greater than one G. 30-inch drops on one corner, the three edges radiating from that corner, and all flat surfaces; total of 10 drops.

*Applicable to RM647 when mounted in a rack with rear support kit 040-0394-00.

647
RM647



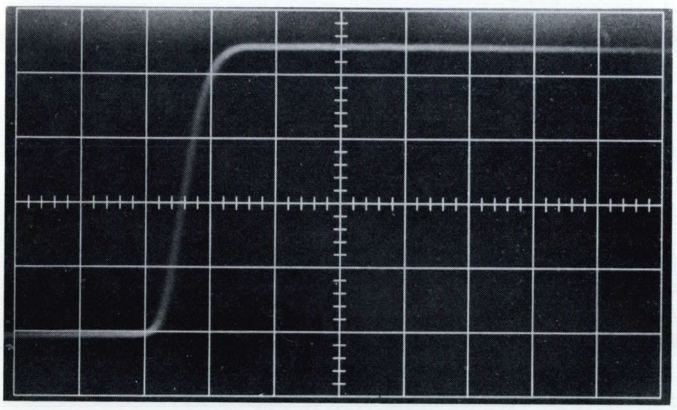
OTHER CHARACTERISTICS

1-kHz CALIBRATOR provides 18 squarewave voltages from 0.2 mV to 100 V, 1-2-5 sequence.

AMPLITUDE ACCURACY	0°C to +40°C	−30°C to +65°C
100 V and 100 mV	±1%	±1.5%
All other positions	±2%	±3%

Frequency is crystal controlled, and is accurate within ±0.1% from −30°C to +65°C. Output resistance is 50 ohms from 0.2 mV to 0.2 V. Squarewave symmetry is accurate within ±0.1%. Risetime is less than 1 μs. The calibrator also provides a 100 V DC output. For Current Probe calibration, a 5-mA squarewave output is available through a front panel loop.

ELECTRONICALLY-REGULATED DC SUPPLIES insure stable, low-drift operation. All supplies are protected against accidental short circuit. Supply voltages are available at the rear panel for external application. 45 to 440-Hz line frequency can be used with either 100 to 130 V AC, or 200 to 260 V AC line. A multi-tap transformer provides a selection of operating voltages within these ranges. Power consumption is approximately 185 watts at 117 V AC (with Type 10A2 and 11B2 Units). Instrument factory wired for 117 V.

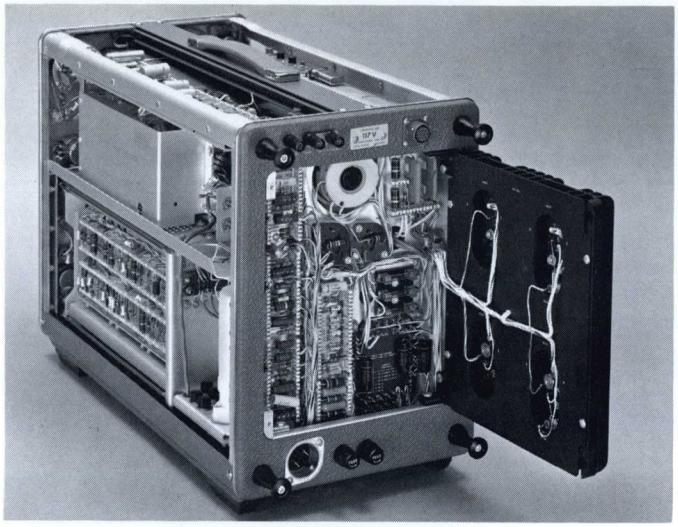


SINGLE-SHOT at 10 ns/cm

*High writing-rate index of the new T6470-31-1 CRT allows permanent records of fast single-shot displays. Photographed with Tektronix C-27 Camera and Polaroid * Land 10,000 speed film. (*Registered Trade-Mark, Polaroid Corporation)*

CONVECTION COOLING provides adequate ventilation to +65°C, when the Type 647 is not tipped by more than 20° on any axis from the normal position. A thermal cutout protects the instrument from overheating.

DIMENSIONS are 14¼" high by 10" wide by 23" deep. Net indicator weight is 40½ pounds. Net weight with Type 10A2 and 11B2 Plug-In Units is 52 pounds.



TYPE 647 OSCILLOSCOPE, without plug-in units . . . **$1350**

Each instrument includes: 1—smoke grey light filter, installed (378-0548-00), 1—clear implosion shield (337-0573-00), 1— 20-inch 50-Ω cable, BNC male to BNC male (012-0076-00), 1— 18-inch patch cord, BNC to BNC (012-0087-00), 1— 18-inch patch cord, BNC to banana plug (012-0091-00), 1—post jack, BNC (012-0092-00), 1—3-conductor power cord (161-0022-00), 1—3 to 2-wire adapter (103-0013-00), 2—instruction manuals (070-0370-00).

RUGGED RACK MOUNT

The Type RM647 Oscilloscope provides the electrical and environmental capabilities of the Type 647 in only 7" of rack height. The instrument mounts on slide-out tracks to a standard 19" rack. Depth is 19". Power consumption is approximately 200 watts at 117 volts (with Type 10A2 and 11B2 Plug-In Units).

The Type RM647 is forced-air cooled.

The standard model operates from a 50 to 60-hertz line (100 to 130 volts or 200 to 260 volts). An extra-cost option (MOD 101K) allows operation from 50 to 60 and 400-hertz line. Net indicator weight (with track assembly) is 50 pounds. Net weight with Type 10A2 and 11B2 Plug-In Units (and track assembly) is 61½ pounds.

TYPE RM647 OSCILLOSCOPE, without plug-in units . . **$1500**

Each instrument includes: 1—smoke grey light filter, installed (378-0548-00), 1—clear implosion shield (337-0573-00), 1— 20-inch 50-Ω cable, BNC male to BNC male (012-0076-00), 1— 18-inch patch cord, BNC to BNC (012-0087-00), 1— 18-inch patch cord, BNC to banana plug (012-0091-00), 1—post jack, BNC (012-0092-00), 1—3-conductor power cord (161-0022-00), 1—3 to 2-wire adapter (103-0013-00), 1 set—mounting tracks (351-0085-00) and hardware, 2—instruction manuals (070-0435-00).

RACK MOUNT REAR SUPPORT KIT

The kit is recommended where maximum resistance to vibration and shock are desired in a rack installation. It rigidly secures the rear of the Type RM647 to the rear rack members, to minimize amplification of vibration and shock forces, yet through use of a guide-pin system, allows easy withdrawal on the slide-out tracks.

Order Part Number 040-0394-00 ..... **$12**

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

Please refer to Terms and Shipment, General Information page.

HIGH-GAIN DIFFERENTIAL COMPARATOR Type 10A1

A CONVENTIONAL AMPLIFIER

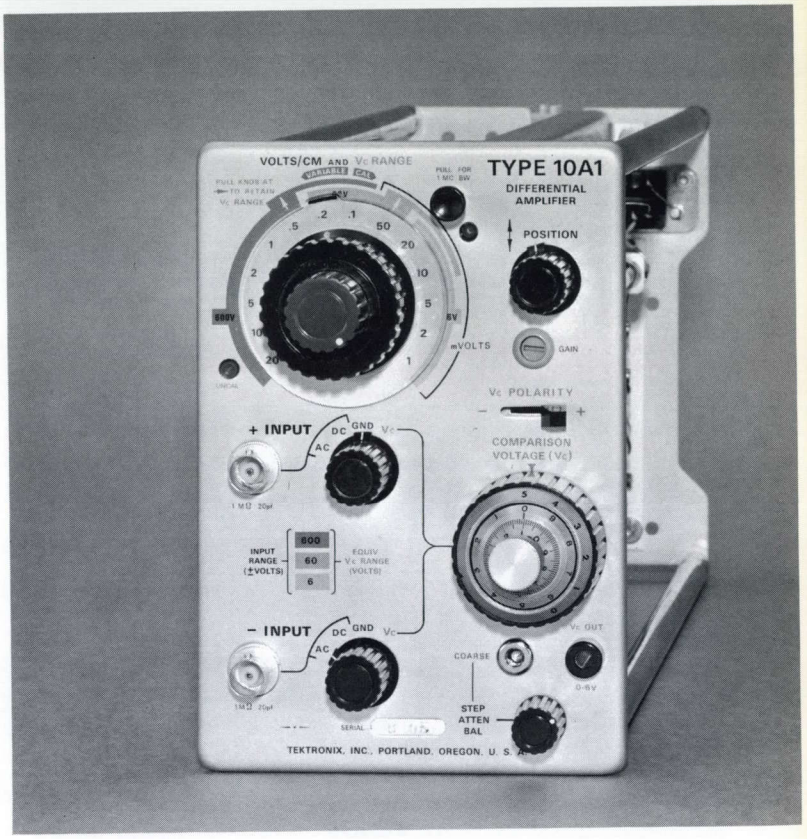
DC to 45 MHz at 5 mV/cm
DC to 35 MHz at 1 mV/cm

A DIFFERENTIAL AMPLIFIER

20,000:1 CMR to 100 kHz
10,000:1 CMR to 1 MHz
1,000:1 CMR to 10 MHz

A CALIBRATED COMPARATOR

6, 60 and 600-volt equivalent Vc range
6,000-cm slide-back scale
± (0.1% + 5 mV) Vc accuracy



The Type 10A1 combines high-gain DC, differential, wide-band, and calibrated comparator features in a single high-performance plug-in unit for Type 647 and RM647 Oscilloscopes. With DC to 35-MHz bandwidth at 1 mV/cm (DC to 45 MHz at 5 mV/cm) the Type 10A1 provides the greatest 1 mV/cm real-time bandwidth presently available in the Tektronix line. Rapid recovery from large differential overload allows detailed study of pulse-top flatness, as well as comparator measurement of transient amplitudes. Its effective 6,000 cm slideback scale and 20,000:1 common-mode rejection ratio permit high-accuracy measurements and comparisons; rugged design insures accuracy even outside the laboratory, where environmental extremes often preclude accurate results.

CONVENTIONAL AMPLIFIER

DEFLECTION FACTOR from 1 mV/cm to 20 V/cm is in 14 calibrated steps with 1-2-5 sequence. An uncalibrated vernier allows continuous variation between steps and to at least 50 V/cm. DEFLECTION FACTOR at any one step can be adjusted to zero error with the front-panel gain control. When gain has been accurately adjusted at 5 mV/cm, accuracies are as follows:

VOLTS/CM ACCURACY		
DEFLECTION FACTOR	0°C to +40°C	−30°C to +65°C
1 mV/cm (also 10 mV/cm and 0.1 V/cm with Vc range extended)	±2.5%	±4%
2 mV/cm through 2 V/cm (except 10 mV/cm and 0.1 V/cm and Vc range extended)	±1.5%	±2.5%
5 V/cm through 20 V/cm	±3%	±4%

BANDWIDTH/RISETIME performance is given for the Type 10A1 installed in a Type 647 or RM647 Oscilloscope. Bandwidth is specified at −3 dB; risetime is measured between the 10% and 90% amplitude points. Bandwidth can be limited to 1 MHz ±10%, when desired, for noise reduction at higher sensitivities.

BANDWIDTH/RISETIME CAPABILITIES		
DEFLECTION FACTOR	0°C to +40°C	−30°C to +65°C
5 mV/cm to 20 V/cm	≥ 45 MHz ≤ 7.8 ns	≥ 40 MHz ≤ 8.7 ns
1 mV/cm and 2 mV/cm	≥ 35 MHz ≤ 10 ns	≥ 35 MHz ≤ 11.7 ns

INPUTS are direct or AC coupled. Low-frequency response with AC coupling is −3 dB at 2 Hz.

INPUT RC is 1 megohm paralleled by 20 pF.

STABILITY		
	0°C to +40°C	−30°C to +65°C
DC Thermal Drift	≤ 0.5 mV/degree	≤ 0.5 mV/degree
Thermal Gain Variations	≤ ±3%	≤ ±5%

10A1

DIFFERENTIAL AMPLIFIER

COMMON-MODE REJECTION RATIOS apply throughout the range of 0°C to +40°C. DEFLECTION FACTOR is 1 mV/cm for all values in the chart. At 10 mV/cm, using the internal 10X attenuator, CMR ≥ 2,000:1 for a 20-V peak to peak 10-kHz sinewave.

COMMON-MODE REJECTION		
FREQUENCY	REJECTION RATIO	SINEWAVE AMPLITUDE
DC to 100 kHz	≥ 20,000:1	10 V P to P
100 kHz to 1 MHz	≥ 10,000:1	10 V P to P
1 MHz to 10 MHz	≥ 10,000:1 frequency in MHz	10 V frequency in MHz
20 MHz	≥ 100:1	1 V P to P
60 Hz AC coupled	≥ 2,000:1	10 V P to P

INPUT VOLTAGE		
DEFLECTION FACTOR	LINEAR DYNAMIC RANGE and EQUIVALENT Vc RANGE	MAXIMUM COMBINED DC AND PEAK AC
1 mV/cm through 20 mV/cm	±6 V	±20 V
10 mV/cm through 0.2 V/cm	±60 V	±600 V
0.1 V/cm through 20 V/cm	±600 V	±600 V

RECOVERY TIME after differential offset ≤ 0.3 μs for a return to within ±2 mV. Recovery DC error ≤ 0.5 mV after 1-ms recovery time. Characteristics apply from 0°C to +40°C.

CALIBRATED DIFFERENTIAL COMPARATOR

COMPARISON VOLTAGE (Vc) can be used to offset the input waveform via the slideback technique. The internal Vc source allows measurement of signals up to 600 volts in amplitude, with 4-digit resolution. Equivalent Vc range is selected simultaneously with deflection factor, unless the operator chooses to extend the Vc range for a limited number of steps. Bandwidth/risetime in the extended positions is the same as at 1 mV/cm and 2 mV/cm.

Vc CHARACTERISTICS			
EQUIVALENT Vc RANGE	SLIDEBACK MEASUREMENT ACCURACY		DEFLECTION FACTOR
	0°C to +40°C	−30°C to +65°C	
6 volts	±(0.1% + 5 mV)	±(0.15% + 8 mV)	1 mV/cm through 20 mV/cm
60 volts	±(0.225% + 50 mV)	±(0.4% + 80 mV)	10 mV/cm through 0.2 V/cm*
600 volts	±(0.35% + 0.5 V)	±(0.65% + 0.8 V)	0.1 V through 20 V/cm*
*Pull knob to retain Vc range at two lowest deflection factors.			

Vc OUTPUT is available at the front panel as well as internally. Output is continuously variable from 0 to ±6 volts (0 to ±0.6 volts when V/cm is set to 5, 10, or 20 V/cm). Accuracy is within ±(0.1% + 5 mV) from 0°C to +40°C and within ±(0.15% + 8 mV) from −30°C to +65°C. (Open circuit values)

Vc CHARACTERISTICS WITH P6023 PROBE			
EQUIVALENT Vc RANGE	SLIDEBACK MEASUREMENT ACCURACY		DEFLECTION FACTOR
	0°C to +40°C	−30°C to +65°C	
60 volts	±(0.225% + 50 mV)	±(0.4% + 80 mV)	10 mV/cm through 0.2 V/cm
600 volts	±(0.5% + 0.5V)	±(0.95% + 0.8 V)	0.1 V/cm through 0.2 V/cm*
6000 volts**	+(1% + 5 V)	±(2% + 8 V)	1 V/cm through 200 V/cm*
*Pull knob to retain Vc range at two lowest deflection factors.			
**Probe rating is 1000 volts maximum.			

WEIGHT: Net—4¾ pounds, shipping—11 pounds, approx.

TYPE 10A1 DIFFERENTIAL AMPLIFIER $900

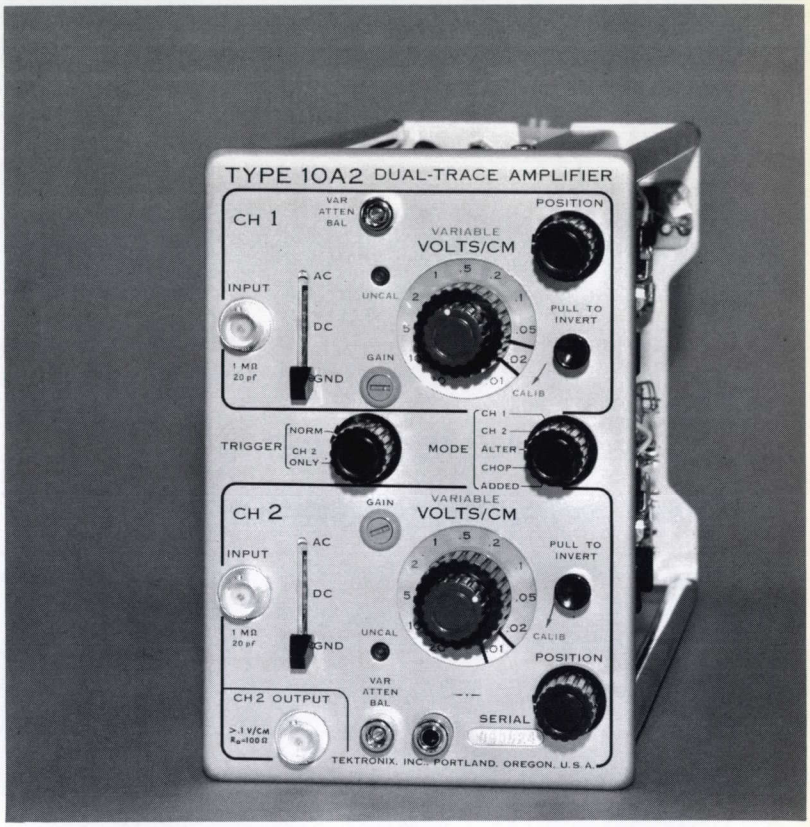
Each instrument includes: 2—instruction manuals (070-0464-00).

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

Please refer to Terms and Shipment, General Information page.

DUAL-TRACE AMPLIFIER UNIT Type 10A2

- *DC TO 50 MHz BANDWIDTH*
- *5 OPERATING MODES*
- *10 mV/cm DEFLECTION FACTOR*
- *CHANNEL 2 OUTPUT*
- *TRIGGER SELECTION*



The Type 10A2 Amplifier is a ruggedized, dual-trace plug-in unit, giving the Type 647 Oscilloscope a DC to 50 MHz bandwidth. Solid-state design has made possible the construction of this compact high-performance unit. The Type 10A2 is environmentalized to operate under adverse extremes, and provides even greater reliability under normal operating conditions.

IDENTICAL CHANNELS can be added algebraically, operated singly with either polarity, or dual-trace with either alternate or chopped switching. In alternate operation, electronic switching occurs at the end of each sweep. In chopped operation, successive 500-ns segments of each channel are displayed at a 1-MHz (±20%) rate per channel. Chopped transient blanking is provided.

BANDWIDTH with the Type 647 Oscilloscope is DC to at least 50 MHz (3-dB down) from 0°C to +40°C.

RISETIME with the Type 647 Oscilloscope is less than 7 ns from 0°C to +40°C.

DEFLECTION FACTOR from 10 mV/cm to 20 V/cm is in 11 calibrated steps with 1-2-5 sequence. Deflection factor at any one position can be adjusted to the accuracy of the standard used, plus limits of resolution, with the front-panel gain adjustment. Attenuator accuracy at all other positions is within ±2% from —30° C to +65° C. A variable control permits continuous uncalibrated adjustment from 10 mV/cm to 50 V/cm.

POLARITY INVERSION for both channels can be used to compare signals 180° out of phase.

COMMON MODE REJECTION in the added-algebraically mode is at least 20:1 up to 25 MHz for common-mode signals up to 10 cm.

CHANNEL ISOLATION is at least 80-dB up to 25 MHz.

INTERNAL TRIGGER is obtained from the common output amplifier, or can be switched to Channel 2 only. Triggering from Channel 2 provides the correct time relationship between channels in Alternate and Chopped operation.

CHANNEL 2 OUTPUT is available at the front panel for external triggering or driving other equipment. This ≥10X output, when fed into Channel 1, provides 1 mV/cm deflection factor at a DC to 20 MHz bandwidth.

AC OR DC COUPLING or grounding of the input is controlled from the front panel. With AC coupling, the low-frequency —3-dB point is ≤2 Hz.

MAXIMUM INPUT is 600 volts (DC + peak AC).

INPUT RC is 1 megohm paralleled by 20 pF.

MECHANICAL SPECIFICATIONS: Net weight is 5 pounds. Shipping weight is 7 pounds, approx.

ENVIRONMENTAL		
CHARACTERISTICS	0° C to +40° C	—30° C to +65° C
AC Gain Stability Display Signal CH 2 OUT Signal	 ±1.5% ±1%	 ±3% ±2%
—3-dB Bandwidth	50 MHz, minimum	40 MHz, minimum
DC Trace Displacement	1 cm/20° C	

TYPE 10A2 AMPLIFIER **$725**

Each instrument includes: 2—instruction manual (070-0376-00).

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

Type 11B1 TIME-BASE UNIT

- *WIDE SWEEP RANGE*
- *DIRECT-READING MAGNIFIER*
- *FLEXIBLE TRIGGERING*
- *SINGLE-SWEEP OPERATION*

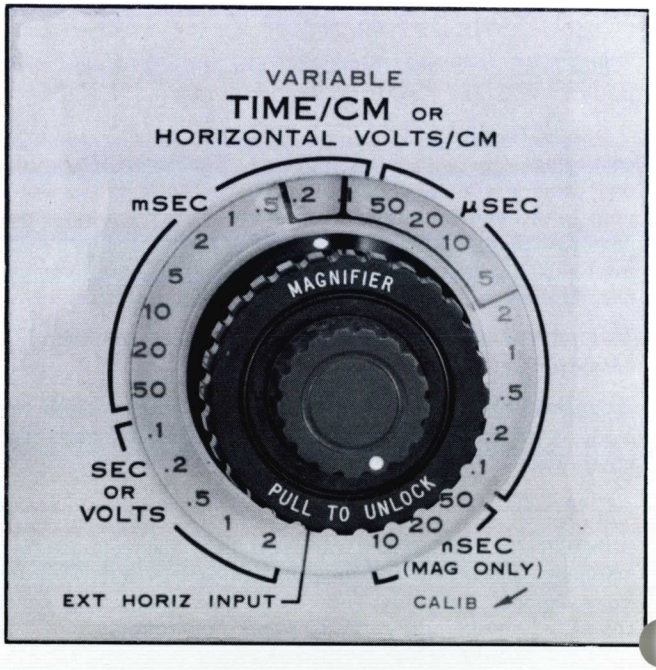
The Type 11B1 is a ruggedized time-base unit for the Type 647 Oscilloscope. It features a single wide-range time base and a direct-reading 1X to 50X sweep magnifier.

SWEEP RANGE from 0.1 μs/cm to 2 s/cm is in 23 calibrated steps with 1-2-5 sequence. Sweep range is continuously variable uncalibrated from 0.1 μs/cm to approx 5 s/cm. A front-panel lamp indicates uncalibrated sweep range.

DIRECT-READING SWEEP MAGNIFIER provides up to 50X expansion, depending on the basic sweep time/cm. The magnifier knob indicates directly the time/cm of the magnified sweep. With the magnifier, the calibrated sweep time/cm can be extended to 10 ns/cm.

ACCURACIES	0°C to +40°C	−30°C to +65°C
2 s/cm to 0.1 s/cm	±3%	+4%, −6%
50 ms/cm to 0.1 μs/cm	±1.5%	±2.5%
Magnifier additional:		
Up to 50 ns/cm	±1%	±1.5%
20 or 10 ns/cm	±2%	±2.5%

SINGLE SWEEP OPERATION facilitates photographic recording of waveforms. A Reset pushbutton arms the sweep to fire on the next received trigger. The sweep can also be remotely reset, through a rear-panel jack on the Type 647 or RM647 Oscilloscope. After firing once, the sweep is locked out until rearmed by pressing the Reset button. The button lights to indicate when the sweep is armed to fire on the next received trigger.



+GATE and SAWTOOTH OUTPUTS are available at the front panel. Output is ≃ 15 volts from the + gate and ≃ +10 volts from the sweep.

EXTERNAL HORIZONTAL INPUT provides for horizontal beam deflection with an external source. Horizontal deflection factor is 0.1 V/cm to 2 V/cm in 5 steps, accuracy within ±2%, or 1 mV/cm to 20 V/cm in 5 steps, accuracy within ±5% using the ÷10 input attenuator. Deflection factor is continuously variable uncalibrated between steps. Bandwidth is DC to at least 3 MHz (3-dB down). With AC coupling the low-frequency —3-dB point is approximately 16 Hz. With AC Low-Frequency Reject the low-frequency —3-dB point is 17 kHz. Input RC is 1 megohm paralleled by approximately 35 pF in the "Ext" input position, or 10 megohms paralleled by approximately 6 pF in the "Ext ÷10" position.

TRIGGER MODES include Free-Running, Single-Sweep, Normal, and 2 types of Automatic Base Line operation (manual or fixed trigger level). The Automatic Base Line provides a bright reference trace (regardless of sweep speed) when no input signal is applied, and provides stable triggered-sweeps for triggering signal repetition rates above 20 Hz.

FIXED-LEVEL AUTOMATIC OPERATION presets the trigger level to near zero. It offers the most triggering convenience for high duty-cycle waveforms.

MANUAL-LEVEL AUTOMATIC OPERATION offers full operator control of trigger level for both + and — slope triggering, even on signals of very low duty cycle.

TRIGGER LEVEL adjusts to allow sweep triggering at any selected point on either the rising or falling portion of the waveform. Level range for internal triggering covers the entire screen; for external triggering it is ±5 V, or ±50 V using the external ÷10 trigger attenuator.

TRIGGER SOURCE can be internal, external, external ÷10, or line.

TRIGGER COUPLING can be DC, AC (—3 dB at approx 16 Hz), or AC low-frequency reject (—3 dB at approx 17 kHz).

TRIGGER REQUIREMENTS are a 2-mm deflection or 125-mV external signal to 50 kHz, increasing to a 1-cm deflection or 250-mV external signal to 50 MHz. These requirements apply to Normal triggering, and also Automatic Base Line when using manual-level control.

HIGH-FREQUENCY STABILITY changes the time base recovery time to reduce high frequency jitter.

FREE-RUN LIGHT warns the operator when the sweep is free running. The indicator is particulary useful when setting up triggering in the automatic mode from a high repetition-rate external trigger source.

WEIGHT: Net—4½ pounds. Shipping—7 pounds, approx.

TYPE 11B1 TIME BASE **$650**

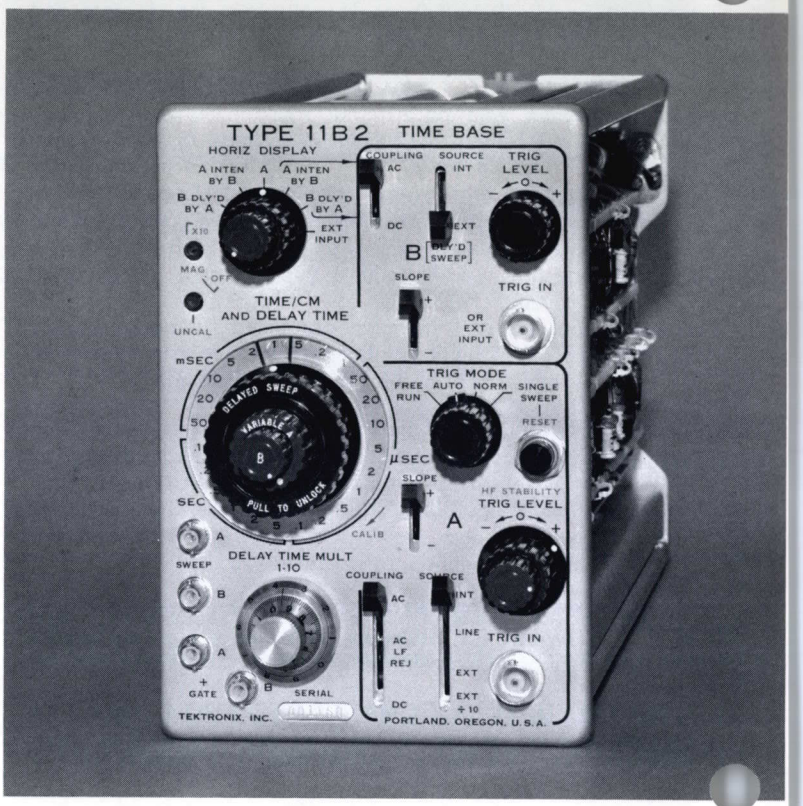
Each instrument includes: 2-instruction manuals (070-0424-00).

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

Please refer to Terms and Shipment, General Information page.

Type 11B2 TIME-BASE UNIT

- *NORMAL AND DELAYED SWEEPS*
- *X10 SWEEP MAGNIFIER*
- *FLEXIBLE TRIGGERING*
- *SINGLE-SWEEP OPERATION*



The Type 11B2 is a ruggedized time-base unit for the Type 647 Oscilloscope. Two separate time-base generators provide for calibrated sweep delay. Time Base A is the normal sweep and is also used to delay the start of Time Base B. This high performance unit is designed for severe operating and storage conditions.

TIME BASE A and B SWEEP RANGE from 0.1 μs/cm to 5 s/cm is in 24 calibrated steps with 1-2-5 sequence. Sweep range is continuously variable uncalibrated from 0.1 μs/cm to approximately 12 s/cm. A front-panel lamp indicates uncalibrated sweep range.

10X SWEEP MAGNIFIER expands the center portion of the unmagnified display to fill 10 cm. It can be used to extend the calibrated sweep range to 10 ns/cm.

ACCURACIES	0°C to +40°C	−30°C to +65°C
5 s/cm to 0.1 s/cm	±3%	+4%, −6%
50 ms/cm to 0.1 μs/cm	±1.5%	±2.5%
10X Magnifier additional:		
Up to 50 ns/cm	±1%	±1.5%
20, 10 ns/cm	±2%	±2.5%

DISPLAY MODES include Time Base A only, A intensified by B, or B delayed by A. In the 2 latter modes, Time Base B can be started automatically at the end of the delay period, or is triggerable at the end of the delay period.

SINGLE SWEEP OPERATION facilitates photographic recording of waveforms displayed on Time Base A. A RESET pushbutton arms the sweep to fire on the next received trigger. The sweep can also be remotely reset, through a rear-panel jack on the Type 647 Oscilloscope. After firing once, the sweep is locked out until rearmed by pressing the RESET button. The button lights to indicate when the sweep is armed to fire on the next received trigger.

+GATE AND SAWTOOTH OUTPUTS from each time base are available at the front panel. Output is ≃ +15 V from A and B gate, and ≃ +10 V from A and B sweep.

EXTERNAL HORIZONTAL INPUT provides for horizontal beam deflection with an external source. Horizontal deflection factor is 1 V/cm ±10% without magnification or 0.1 V/cm ±10% with X10 magnifier. Bandwidth is DC to at least 3 MHz (3-dB down). With AC coupling, the low-frequency −3-dB point is approximately 16 Hz. Input RC is 1 megohm paralleled by approximately 30 pF.

TRIGGER

TRIGGER MODE includes free-running, normal, single-sweep, or automatic operation.

AUTOMATIC TRIGGERING provides a bright reference trace (regardless of sweep range) in the absence of an input signal, provides a free-running display until triggering is achieved, and permits stable triggering from 20 Hz to above 50 MHz.

TRIGGER LEVEL adjusts to allow sweep triggering at any selected point on either the rising or falling portion of the waveform, and up to ±5 or ±50 V (Time Base A), or ±10 V (Time Base B) external.

TRIGGER SOURCE can be internal or external (Time Base B), internal, external, external ÷10, or line (Time Base A). Time Base B is AC or DC coupled. Time Base A has AC or DC coupling plus AC low-frequency reject.

LOW-FREQUENCY REJECT (—3 dB at approx 17 kHz) enables triggering on high-frequency components of waveforms, with reduced interference from low-frequency components such as line-frequency hum.

HIGH-FREQUENCY STABILITY changes Time Base A recovery time to reduce high-frequency jitter.

TIME BASE A and B TRIGGER REQUIREMENTS for internal triggering are 2-mm deflection to 50 kHz, 1-cm deflection at 50 MHz. External triggering requires 125 mV to 50 kHz, 250 mV to 50 MHz.

SWEEP DELAY

CALIBRATED DELAY RANGE from Time Base A is continuously variable, 1 μs to 50 s. A ten-turn precision potentiometer permits accurate delay time multiplication of the Time Base A delay steps. The 3 fastest Time Base A ranges are not normally used for delay generation.

DELAY ACCURACIES*	0° C to +40° C	−30°C to +65°C
5 s/cm to 0.1 s/cm	±2.5% I	+3%, −6% I
50 ms/cm to 1.0 μs/cm	±1.0% I	±2% I
Multiplier Incremental Linearity	±0.15% FS	±0.2% FS
Jitter, Parts in 10^5 of Maximum Available Delay Period	<5	<5

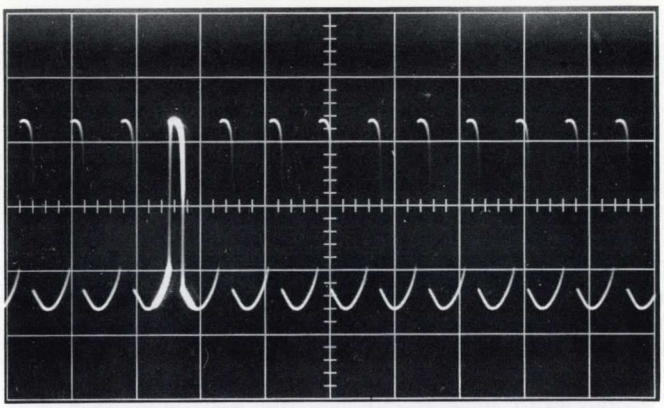
*I = % of indicated delay.

FS = % of full scale (10X TIME/cm or DELAY TIME setting). For absolute delay from trigger point to display start, trigger processing time (typically <100 ns) must be added.

TRIGGERED OPERATION holds off the start of the delayed sweep until the arrival of the first trigger signal following the selected delay time. Because the delayed sweep is actually triggered by the signal under observation, the display is jitter free. A steady display is thus provided for time-modulated pulses and signals with inherent jitter.

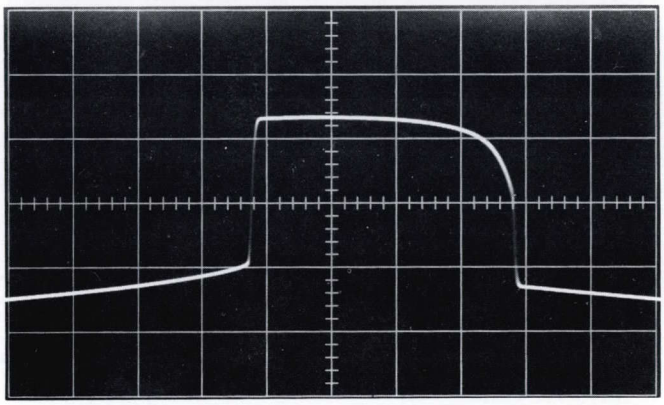
CONVENTIONAL OPERATION holds off the start of the delayed sweep for the precise amount of the selected delay time. Any time-modulation or jitter on the signal will be magnified in proportion to the amount of sweep expansion.

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 this interval is 10 times the Time/cm or Delay-Time setting).



CALIBRATED SWEEP DELAY

Above waveform (A intensified by B) indicates by trace brightening the portion expanded 20X below (B delayed by A). Time Base A — 2 μs/cm, Time Base B — 0.1 μs/cm.



WIDE-RANGE MAGNIFICATION is readily accomplished when Time Base B is operated at a faster rate than Time Base A. For example, if TIME BASE B is operating at 1 μs/cm and TIME BASE A is operating at 50 μs/cm, the magnification is 50 times.

TRACE BRIGHTENING indicates the portion that will appear on the magnified display, and shows the point-in-time relationship of the magnified display to the original display.

WEIGHT: Net —6½ pounds, Shipping—9 pounds, approx.

TYPE 11B2 TIME BASE $850

Each instrument includes: 1—BNC female to BSM female adapter (103-0036-00), 2—instruction manuals (070-0377-00).

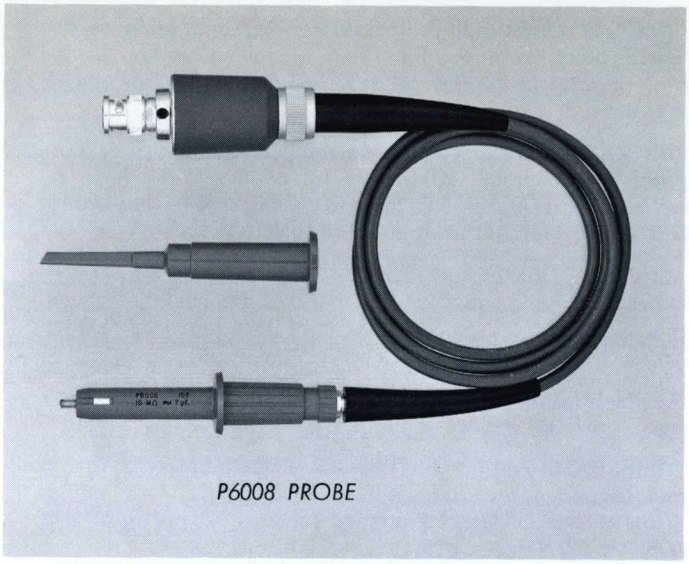
U.S. Sales Price f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 647 ACCESSORIES

ATTENUATOR PROBES

Attenuator Probes reduce loading on the circuit under test, and increase the input resistance of the measuring system. All probes include a variety of tips for easy access to components, even in crowded circuit conditions.

The P6023 Probe is recommended for use with Type 10A1 in making accurate slide-back measurements and for differential measurements where common-mode signal rejection is important. Where these capabilities are not required, P6008 and P6009 Probes can be used to give maximum bandwidth with Type 10A1. P6006 and P6007 Probes offer a cost advantage with some sacrifice in bandwidth. P6010 and P6011 Probes are extra small in size and are well suited for servicing sub-miniature circuits where access is limited.



P6008 PROBE

CHARACTERISTICS OF PROBES WITH TYPE 10A1 AND 10A2 AMPLIFIERS

PROBE	P6006	P6007	P6008	P6009	P6010	P6011	P6023
ATTENUATION RATIO	10X	100X	10X	100X	10X	1X	10X
INPUT RESISTANCE	10 megohms	10 megohms	10 megohms	10 megohms	10 megohms	1 megohm	8 megohms
INPUT CAPACITANCE (Typical)	6.7 pF	2.1 pF	7.7 pF	2.6 pF	10 pF	28 pF	12 pF
TOTAL RISETIME—10A1	<10.6 ns	<10.6 ns	<8.8 ns	<7.9 ns	<7.9 ns	<15 ns	<10.5 ns
10A2	<10 ns	<10 ns	<8.1 ns	<7.1 ns	<7.1 ns	<15 ns	<10 ns
VOLTAGE RATING	600 volts DC or AC P to P	1.5 kV DC or AC RMS, 4.2 kV AC P to P	600 volts DC or AC P to P	1.5 kV DC or AC RMS, 4.2 kV AC P to P	500 volts DC or AC P to P	600 volts DC or AC P to P	1000 volts DC or AC P to P
VOLTAGE DERATING*	5.7 MHz	200 kHz	20 MHz	300 kHz	2.5 MHz	0.5 MHz	5 MHz
CABLE LENGTH	3.5′ †	3.5′ †	3.5′	9′	3.5′ ††	3.5′ ††	3.5′
PART NUMBER	010-0127-00	010-0150-00	010-0129-00	010-0170-00	010-0188-00	010-0193-00	010-0167-00
PRICE	$22	$22	$35	$55	$30	$15	$40

*Peak to peak voltage derating is necessary for CW frequencies higher than those listed.

†P6006 and P6007 Probes can be ordered in 6, 9, or 12-foot lengths at no additional cost. Longer lengths increase input capacitance and risetime.

††P6010 and P6011 Probes can be ordered in 6-foot length at no additional cost. Longer length increases input capacitance and risetime.

PLUG-IN EXTENSIONS

12″ Rigid Extension (Part Number 013-0077-00) $20.00
30″ Flexible Extension (Part Number 012-0080-00) 24.00

REAR-PANEL CONNECTOR

10-Pin Connector for remote single sweep reset and external use of power supply voltages (Part Number 131-0300-00) $13.00

BNC TO BSM ADAPTER

Converts front-panel outputs on the Type 11B2 to accept BNC cables (Part Number 103-0036-00) $5.00

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

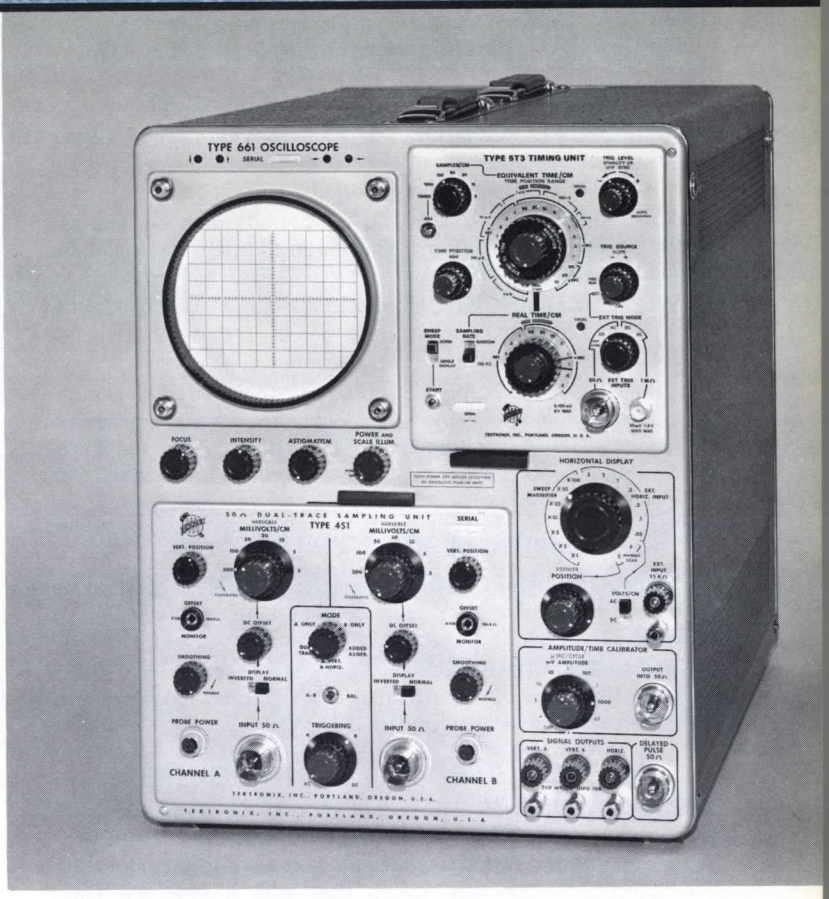
SAMPLING OSCILLOSCOPE Type 661

- **2 mV/cm TO 200 mV/cm CALIBRATED DEFLECTION FACTOR**
- **MONITORABLE DC OFFSET**
- **10 ps/cm TO 100 μs/cm CALIBRATED SWEEP TIME/cm**
- **X1 TO X100 TIME EXPANDER (CONSTANT DOTS/cm)**
- **REPETITIVE, SINGLE, OR TIMED DISPLAYS**
- **DELAY THROUGH FULL TIME BASE DURATION**

The above features of Type 661 are capabilities with Type 5T1A or 5T3 Timing Units and Type 4S1, 4S2A, or 4S3 Dual-Trace Sampling Units.

This compact and complete sampling system consists of either a Type 5T1A or Type 5T3 Timing Plug-In Unit and any of three Vertical Plug-In Units used with the Type 661 Oscilloscope.

The 2 mV/cm deflection factor of the vertical units in conjunction with their DC offset capability, allows 1000-to-1 vertical resolution. X100 time expansion and wide-range time position allows 1000-to-1 time resolution. To help make these features applicable to your problem, Tektronix offers a wide variety of probes, test fixtures, and accessories.



Some Of The Things Possible With The Type 661, Type 4S1, And Type 5T3 Combination

1. *Trigger internally—observe fast leading edges of both A and B traces. Matched internal delay lines in both vertical channels assure accurate time comparisons.*
2. *Measure pulse risetime wth 0.35-nanosecond response in both channels.*
3. *Display repetitive signals on 22 calibrated equivalent-time sampling sweep ranges from 10 ps/cm to 100 μs/cm, accurate within 3%.*
4. *Display either repetitive or non-repetitive signals on 14 calibrated real-time sampling sweep ranges from 0.2 ms/cm to 5 s/cm.*
5. *Magnify any portion of the display up to 100 times on sweep ranges from 1 ns/cm to 100 μs/cm. Magnification occurs about a fixed time-reference point while maintaining a constant number of samples/cm.*
6. *Position the magnified equivalent-time display anywhere on the unmagnified time-base duration. Time position range is at least 20 ns or 1 screen diameter, whichever is greater, and is indicated directly at the time/cm control.*
7. *Change signal source impedance without affecting dot transient response or ground reference.*
8. *Reduce random system time jitter and amplitude noise by means of a smoothing control.*
9. *Measure millivolt signals in the presence of a substantial DC component by means of a DC-offset voltage monitorable at the front panel.*
10. *Calibrate voltage and time scales with signals available from the front panel.*
11. *Show lissajous patterns in addition to single and dual-trace displays and signals added algebraically.*
12. *Drive X-Y plotters or similar readout accessories, manually or automatically. Slow speed scan nominally set at 7.5 s/cm.*
13. *Drive external equipment, with fast-rise delayed pulse output.*

661

PLUG-IN UNIT COMPARTMENTS

VERTICAL SYSTEM accepts any 4-series plug-in unit.
HORIZONTAL SYSTEM accepts any 5-series plug-in unit.

HORIZONTAL DISPLAY CONTROLS

HORIZONTAL POSITION controls provide either coarse or fine adjustment-shift of display over 10 centimeters unmagnified or 1000 centimeters 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 X1, X2, X5, X10, X20, X50, or X100, 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. 50 mV/cm to 5 V/cm deflection factor (into 25-kΩ impedance) is in 7 steps, 1-2-5 sequence, either AC or DC-coupled. Equivalent time per centimeter remains calibrated.

AMPLITUDE/TIME CALIBRATOR

CALIBRATED AMPLITUDES range from 1 mV to 1000 mV in 4 decade steps. Accuracy with 50-ohm load is within 2% at 1000 mV.

CALIBRATED TIMES range from 0.01 μs/cycle to 10 μs/cycle in 4 decade steps. Accuracy with 50-ohm load is within 0.2%, except within 2% at 0.01 μs/cycle.

DELAYED-PULSE AND SIGNAL OUTPUTS

DELAYED PULSE 50-ohm output permits the Type 661 (with 4S1 or 4S2A and 5T1A or 5T3 Units) to serve as a rate generator to trigger external circuitry. Pulses occur nominally 50 ns after the equivalent sweep start with a Type 4S1 Unit, or 10 ns after sweep start with a Type 4S2A Unit. Amplitude is at least −350 mV and risetime is less than 150 ps.

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.

CATHODE-RAY TUBE DISPLAY

TEKTRONIX CRT is a flat-faced, 5" tube with an 8-cm by 10-cm viewing area and ≈3 kV accelerating potential. A P2 phosphor will be supplied with the instrument unless another phosphor is specified.

BEAM-POSITION INDICATORS show the direction of the CRT beam when it is deflected away from the center-screen area.

ILLUMINATED GRATICULE with variable edge lighting is accurately ruled in centimeter squares. Viewing area is 8 by 10 cm. Vertical and horizontal centerlines are further marked in 2-mm divisions for convenience in making time and amplitude measurements.

ELECTRONICALLY-REGULATED POWER SUPPLIES

TEMPERATURE COMPENSATED AND REFERENCE ISOLATED SUPPLIES provide adequate power for stable operation of the oscilloscope with plug-in units. Line voltage changes within the operating range cause imperceptible changes in the display. Thermal cutout interrupts the power if chassis temperature becomes excessive.

POWER REQUIREMENT is 105 V, to 125 V or 210 V to 250 V, 50 to 60 Hz, typically 450 watts.

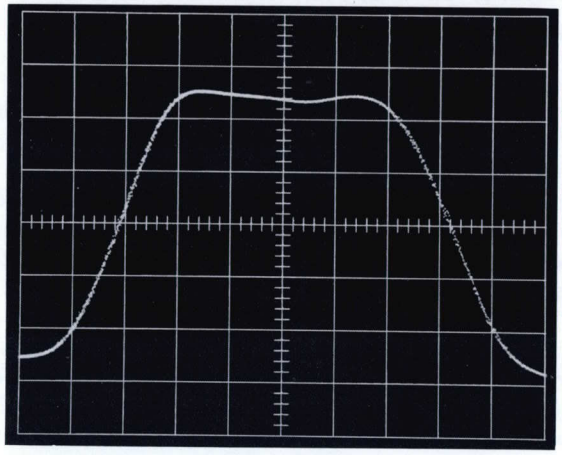
MECHANICAL FEATURES

Dimensions are 16⅞" high by 13⅛" wide by 23¾" deep. Net weight is 49½ pounds. Shipping weight is ≈ 67 pounds.

TYPE 661 OSCILLOSCOPE, without plug-in units . . $1150

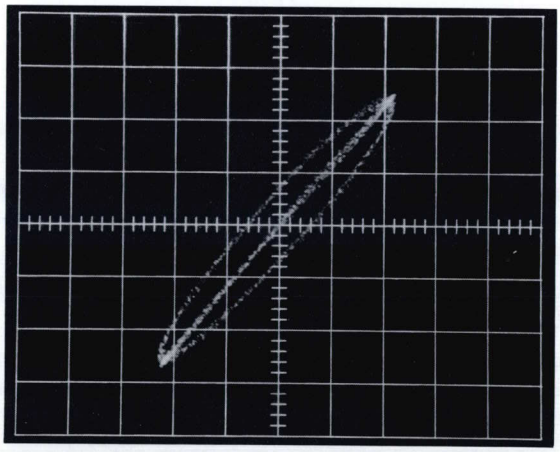
Each instrument includes: 1—3- to 2-wire adapter (103-0013-00); 1—3-conductor power cord (161-0010-00); 1—Smoke gray filter (378-0567-00); 2—Instruction Manual (070-0324-00).

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



TIME JITTER

A 250 mV, 1.0 ns-wide pulse internally triggering the 4S1/5T3 system. Vertical deflection factor is 50 mV/cm; sweep range is 0.2 ns/cm. Note very small amount of jitter.



TYPICAL APPLICATION

2 gigahertz sine-wave driving inputs to 4S2A for X-Y operation. 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.

DUAL-TRACE SAMPLING UNIT Type 4S1

- ***0.35 ns RISETIME***
- ***INTERNAL DELAY LINES***
- ***2 mV/cm TO 200 mV/cm CALIBRATED DEFLECTION FACTOR***
- ***±2 VOLT DYNAMIC RANGE***
- ***±1 VOLT DC OFFSET***
- ***LESS THAN 1 mV RANDOM NOISE (UNSMOOTHED, ½ mV SMOOTHED)***

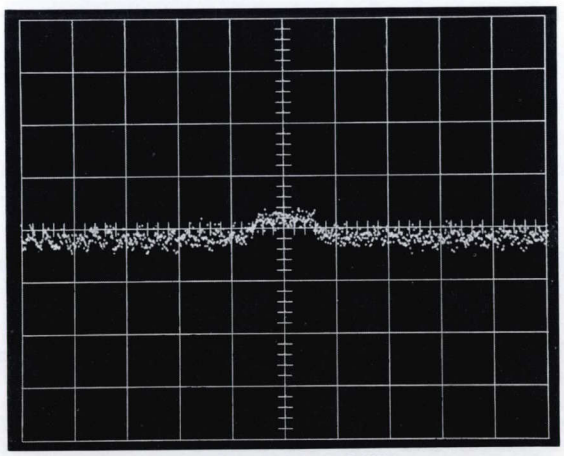
The Type 4S1 Dual-Trace Sampling Unit is a general-purpose sampling plug-in unit for the Type 661 Sampling Oscilloscope. Separate internal trigger takeoffs, delay lines, and terminations are provided, which permit triggering on either A or B input signals.

DISPLAY MODES include ±A only, ±B only, Dual-Trace, Algebraic Addition, and an X-Y display of A—vertically and B—horizontally (for observation of hysteresis loops, phase shift, similar displays). Independent controls for each channel permit positioning and inverting input signals as desired.

RISETIME is 0.35 ns or less, measured from 10% to 90% amplitude points on an input step.

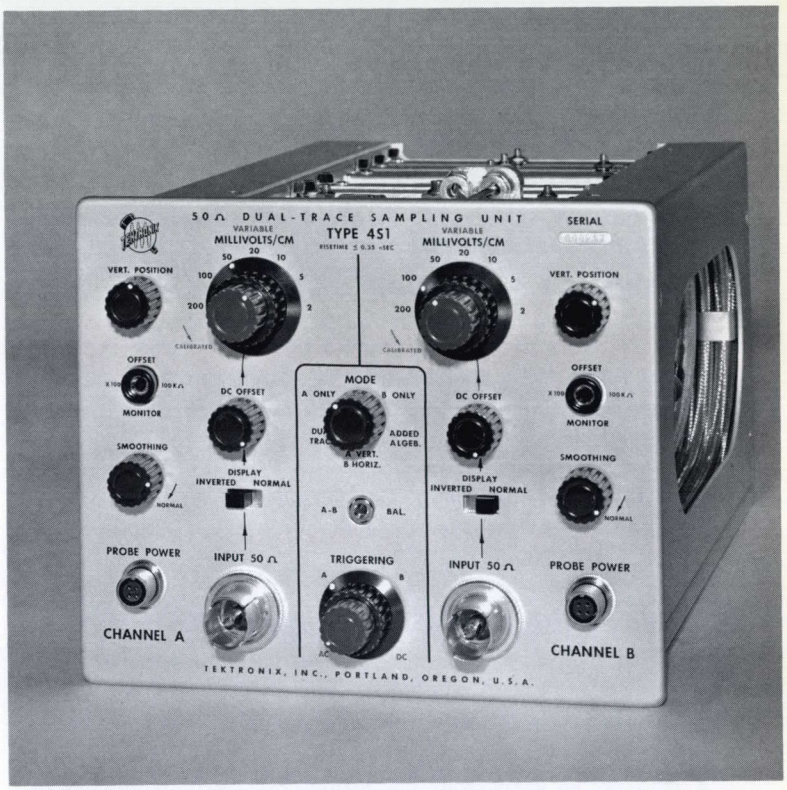
BANDWIDTH is equivalent to DC-to-1000 MHz.

DEFLECTION FACTOR is in 7 calibrated steps from 2 mV/cm to 200 mV/cm, 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from 200 mV/cm to 0.67 mV/cm.



TANGENTIAL NOISE

A 0.8-millivolt 2.5 ns pulse with Type 5T3 externally triggered. Vertical deflection factor is 2 mV/cm. This displays a typical tangential noise of the Type 4S1 (specification: 1 millivolt). A tangential noise measurement is more useful than an RMS noise measurement, when taking a visual reading, as the eye easily interprets a quasi peak to peak noise value. A peak to peak value of 3 times the RMS value contains approximately 90% of the trace dots. Most observers agree that the tangential noise displayed is 0.8 millivolt (4 mm quasi peak to peak); thus the RMS noise is approximately 270 microvolts (unsmoothed). Random noise decreases 2X with smoothing.



SMOOTHING CONTROL reduces system time jitter and amplitude noises, if needed, when there is sufficient dot density.

RANDOM NOISE LEVEL is equivalent to an input signal of 1 mV or less (quasi peak to peak) unsmoothed, or 0.5 mV smoothed. Only approximately 10% of the random noise dots are outside this level.

DC OFFSET through ±1 volt, for signal levels exceeding "on screen" sensitivity settings, allows utilization of full sensitivity to display and accurately measure small signals.

DYNAMIC RANGE is ±2 V. Full sensitivity can be used with signals up to ±2 volts in amplitude. Safe overload is ±10 volts DC (higher with reduced duty factor).

TRIGGERING can be either internal or external. Separate internal delay lines and trigger takeoffs permit triggering on either A or B input signals. The trigger takeoffs deliver to the timing unit approximately ⅛ the input signal amplitude. Risetime of the trigger amplifier system is nominally 0.6 ns (600 MHz bandwidth).

INPUT IMPEDANCE is 50 ohms. Input connectors are GR 874. Tektronix 45-ns delay lines terminate in 2 pF and 50-ohm 1% resistor.

PROBE POWER is available at the front panel for cathode-follower probes, Type 281 TDR Pulser and Type 282 Adapter for high-impedance probes. See Accessory pages.

WEIGHT: Net—15¼ pounds. Shipping—21 pounds, approx.

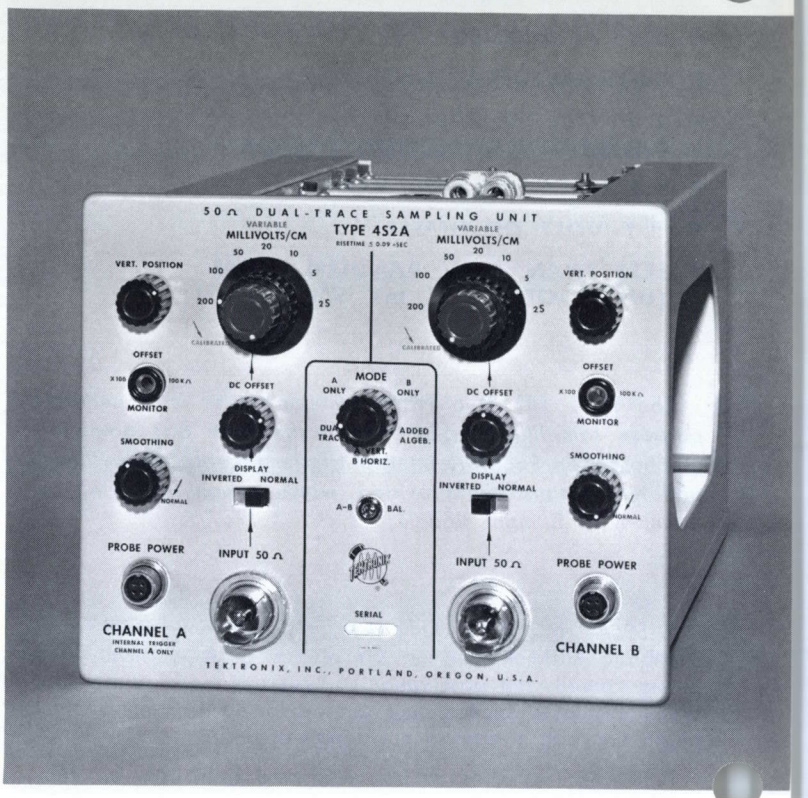
TYPE 4S1 DUAL-TRACE SAMPLING UNIT $1430

Each instrument includes: 2—X10 50-Ω attenuators (017-0078-00); 2—5-ns 50-Ω cables (017-0502-00); 2—instruction manual (070-0329-00).

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

Type 4S2A DUAL-TRACE SAMPLING UNIT

- ***90 ps RISETIME***
- ***2 mV/cm TO 200 mV/cm CALIBRATED DEFLECTION FACTOR***
- ***±1 VOLT DYNAMIC RANGE***
- ***±1 VOLT DC OFFSET***
- ***RANDOM NOISE LESS THAN 4 mV (UNSMOOTHED, <2 mV SMOOTHED)***
- ***VSWR <1.5 THROUGH 5 GHz***



The Type 4S2A Dual-Trace Sampling Unit is a special-purpose sampling plug-in unit which makes possible a new degree of time resolution. This vertical plug-in unit retains most features of the general-purpose Type 4S1 when used in a Type 661 Sampling Oscilloscope, except for delay lines and internal triggering.

661/5T3/4S2A CAPABILITIES

DISPLAY 0.1% system discontinuities as reflectometer with centimeter separation capability (limited by external pulse generators, delay lines, attenuators).

DISPLAY millivolts of information on top of signals hundreds of millivolts in amplitude (not limited by the usual amplifier overload problem).

DISPLAY fastest present switching transistor risetimes, including commercially available avalanche types (usually limited by the transistor or the transistor case).

DISPLAY most tunnel diode switching times. (Only diodes with better than 3 mA/pF are faster).

DISPLAY stored charge in switching diodes to the 0.01 picocoulomb/milliampere region (generally limited by diode capacity and turn-on capability).

DISPLAY fractions of a degree of relative phase shift to over 3 gigahertz frequency with lissajous-mode operation (usually limited by harmonic content or residual reflections to a few degrees absolute).

DISPLAY MODES include ±A only, ±B only, Dual-Trace, Algebraic Addition, and an X-Y display of A—vertically and B—horizontally (for observation of hysteresis loops, phase shift, similar displays). Independent controls for each channel permit positioning and inverting input signals as desired.

RISETIME is 90 ps or less, measured from 10% to 90% amplitude points on an input step. Overshoot, blowby, and other transient aberrations are less than ±1%.

BANDWIDTH is equivalent to DC-to-3900 MHz.

DEFLECTION FACTOR is in 7 calibrated steps from 2 mV/cm to 200 mV/cm, 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from 200 mV/cm to 0.67 mV/cm.

SMOOTHING CONTROL reduces system time jitter and amplitude noises, if needed, when there is sufficient dot density.

RANDOM NOISE LEVEL is less than 4 mV (quasi peak to peak) unsmoothed or 2 mV smoothed. Only 10% of the random noise dots are outside this level.

DC-OFFSET through ±1 volt, for signal levels exceeding "on screen" sensitivity settings, allows utilization of full sensitivity to display and accurately measure small order signal discontinuities.

DYNAMIC RANGE is ±1 volt. Full sensitivity can be used with overloads up to ±1 volt in amplitude. Safe overload is ±10 volts DC (higher with reduced duty factor).

INTERNAL TRIGGERING is available on Channel A only. No internal delay line is provided with either channel.

INPUT IMPEDANCE is 50 ohms. Input connectors are GR 874. Termination is 50-ohm ±1% resistor and approximately 0.5 pF.

PROBE POWER is available at the front panel for cathode-follower probes and Type 282 Adapter for high-impedance probes. See accessory pages.

WEIGHT: Net—9 pounds. Shipping—15 pounds, approx.

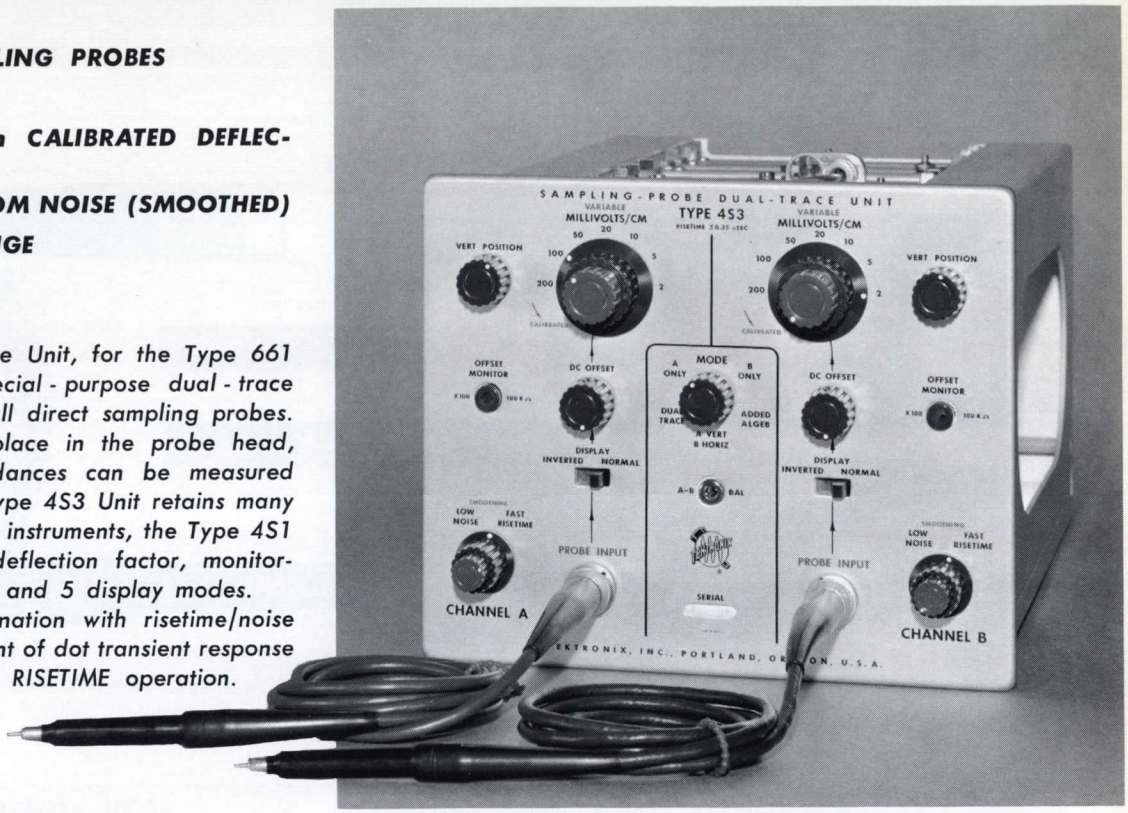
TYPE 4S2A DUAL-TRACE SAMPLING UNIT $1450

Each instrument includes: 2—X10 attenuator, 50-Ω (017-0078-00); 2—5 ns cable, 50-Ω (017-0502-00); 2—Instruction Manual (070-0356-00).

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

SAMPLING-PROBE DUAL-TRACE UNIT Type 4S3

- ***0.35 ns RISETIME***
- ***MINIATURE DIRECT SAMPLING PROBES***
- ***100 kΩ, 2 pF INPUT RC***
- ***2 mV/cm TO 200 mV/cm CALIBRATED DEFLECTION FACTOR***
- ***LESS THAN 300 μV RANDOM NOISE (SMOOTHED)***
- ***±2 VOLT DYNAMIC RANGE***
- ***±1 VOLT DC OFFSET***



The Type 4S3 Sampling Probe Unit, for the Type 661 Sampling Oscilloscope is a special-purpose dual-trace unit incorporating extremely small direct sampling probes. Since sampling actually takes place in the probe head, signals with high source impedances can be measured at a very low noise level. The Type 4S3 Unit retains many of the features of its companion instruments, the Type 4S1 and 4S2A, such as 2 mV/cm deflection factor, monitorable DC offset, signal inversion, and 5 display modes.

Smoothing controls, in combination with risetime/noise selection, permit correct adjustment of dot transient response for either LOW-NOISE or FAST RISETIME operation.

DISPLAY MODES include ±A only, ±B only, Dual-Trace, Algebraic Addition, and an X-Y display of A—vertically and B—horizontally (for observation of hysteresis loops, phase shift, similar displays). Independent controls for each channel permit positioning and inverting input signals as desired. Time coincidence between channels is within 60 picoseconds.

DEFLECTION FACTOR from 2 mV/cm to 200 mV/cm is in 7 calibrated steps with 1-2-5 sequence, and is accurate within 3%. A variable control permits continuous adjustment uncalibrated from 200 mV/cm to approximately 0.67 mV/cm.

BANDWIDTH is equivalent to DC-to-1000 MHz.

RISETIME AND SMOOTHING controls, while maintaining correct dot transient response, adjust the instrument for: least noise or best risetime, or a compromise of the two, with signal sources from below 25 ohms to beyond 300 ohms. A Fast-Risetime/Low-Noise switch in conjunction with the smoothing control allows the operator to select optimum risetime at a sacrifice in noise level. Or, he may select for a low noise level at some sacrifice in risetime.

RISETIME is 0.35 ns or less (FAST RISETIME) and approximately 0.5 ns (LOW NOISE) with a 50-Ω source.

RANDOM NOISE is less than 0.5 mV unsmoothed (LOW NOISE), 1 mV (FAST RISETIME), or approximately 300 μV smoothed, when using a 50-ohm source.

DC OFFSET through ±1 V for signal levels exceeding "on screen" deflection factor settings allows utilization of full sensitivity to display and accurately measure small discontinuities.

DYNAMIC RANGE is ±2 V. Full sensitivity can be used with signals up to ±2 V in amplitude. Safe overload is ±10 V.

TRIGGERING is external (required approximately 50 ns prior to signal). Please refer to Timing Unit specifications.

SAMPLING PROBES included with the Type 4S3 are extremely compact. The sampling bridge is contained in the probe head to obtain optimum results with the input RC of 100 kΩ paralleled by 2 pF. Low-frequency response is approximately 3-dB down at 1.5 kHz with the blocking capacitor; approximately 3-dB down at 150 Hz with the blocking capacitor and 10X attenuator. Probes can be changed from channel to channel with only minor readjustment.

RECOMMENDED OPTIONAL ACCESSORIES include probe-to-GR adapter, probe-to-BNC adapter, and 50-ohm voltage pickoff. See catalog page 198 for additional information.

WEIGHT: Net—13 pounds. Shipping—16 pounds, approx.

TYPE 4S3/P6038 SAMPLING PROBE DUAL-TRACE UNIT $1450

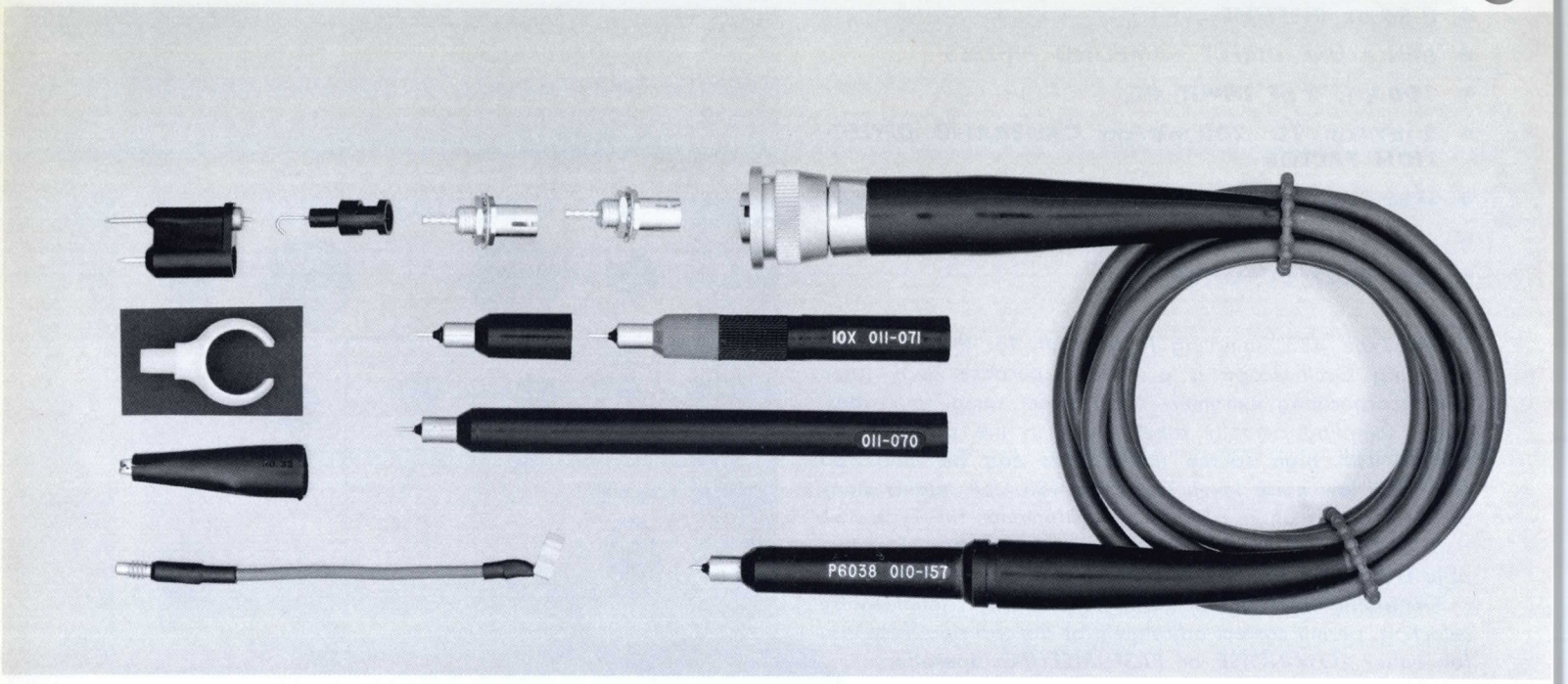
Each instrument includes: 2—P6038 probe package (010-0156-00); 2—Instruction Manual (070-0397-00).

P6038 DIRECT SAMPLING PROBE (010-0156-00) . $225

Each Probe Package includes: 1—P6038 probe (010-0157-00); 1—Response normalizer (011-0070-01); 1—X10 attenuator (011-0071-00); 2—Test point jack (131-0258-00); 1—Coupling capacitor (011-0072-00); 1—Hook-tip assembly (206-0114-00); 1—Ground clip (175-0249-00); 1—Probe holder (352-0068-00); 1—Bayonet ground assembly (013-0085-00); 1—Carrying case (202-0123-00); 1—Minigator clip (344-0046-00); 1—Instruction Manual (070-0400-00).

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

P6038 DIRECT SAMPLING PROBE



Specifically designed for use with the Type 3S3 and 4S3 Sampling Plug-Ins, the P6038 Probe features wide-band performance in the DC-to-1000 MHz range.

Very small in size for ease of handling, the P6038 Probe contains sampling circuitry in the probe head, permitting low-noise, full-sensitivity measurements even when used with source impedances above 50 ohms.

Standard accessories supplied with the P6038 Probe include a 10X Attenuator, a Coupling Capacitor for blocking the DC component of the signal, and a non-attenuating Response Normalizer to assure the probe input is insensitive to source impedance variations.

PROBE ALONE:

ATTENUATION is 1X.

INPUT RESISTANCE is 100 kΩ ±1%.

INPUT CAPACITANCE is 2 pF ±10%.

TYPICAL RISETIME with Type 3S3 or 4S3 Plug-In Unit and a 50-ohm source is 0.35 ns or less.

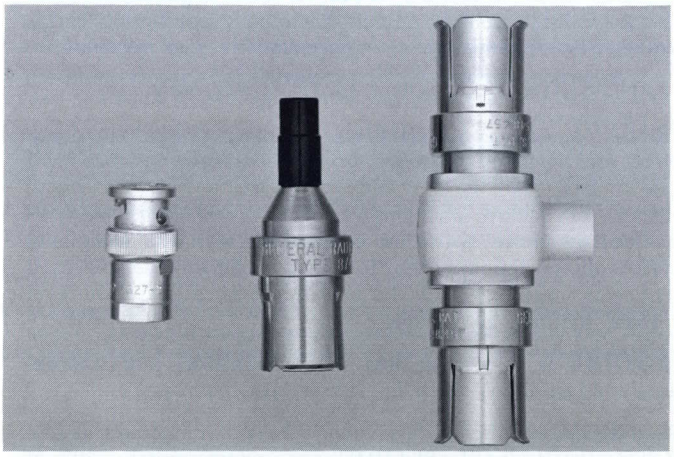
CABLE is approximately 4.5′ with special 4-pin connector.

P6038 PROBE PACKAGE (010-0156-00) $225

Includes:

1—P6038 probe, 010-0157-00
1—coupling capacitor, 011-0072-00
1—10X attenuator, 011-0071-00
1—response nomalizer, 011-0070-00
2—test-point jacks, 131-0258-00
1—bayonet ground assembly, 013-0085-00
1—hook tip, 206-0114-00
1—2½″ ground lead, 175-0249-00
1—probe holder, 352-0068-00
1—carrying case, 202-0123-00
1—minigator clip, 344-0046-00
1—instruction manual, 070-0400-00

PROBE/ADAPTER CHARACTERISTICS		
	INPUT R	INPUT C
PROBE AND COUPLING CAPACITOR		3.5 pF ± 10%
PROBE AND 10X ATTENUATOR	1 MΩ ± 1%	1.8 pF ± 10%
PROBE AND RESPONSE NORMALIZER	100.3 kΩ ± 1%	3.5 pF ± 10%



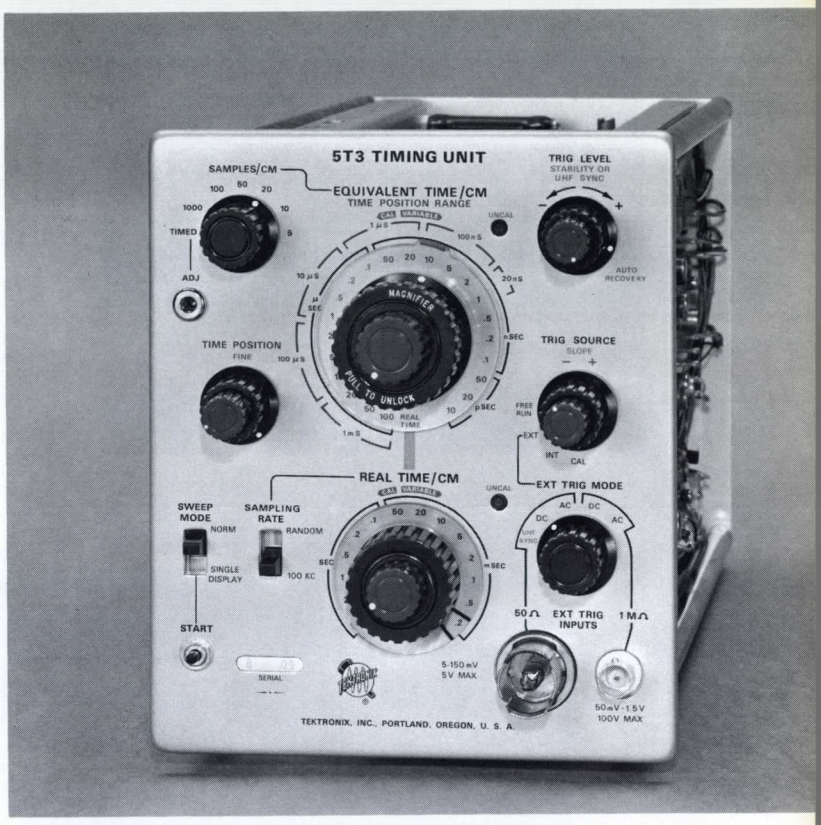
OPTIONAL ACCESSORIES

PROBE TIP-TO-BNC ADAPTER (013-0084-00) 4.50
PROBE TIP-TO-GR ADAPTER (017-0076-00) ..... $ 4.50
VP-2 VOLTAGE PICKOFF "T" (017-0077-00) 30.00

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

TIMING UNIT Type 5T3

- ***10 ps/cm to 5 s/cm CALIBRATED SWEEP TIME/CM***
- ***DC to 500-MHz TRIGGERING, 500-MHz to 5 GHz SYNCHRONIZATION—AT LEVELS OF A FEW MILLIVOLTS***
- ***MAGNIFICATION AND TIME POSITIONING OF EQUIVALENT-TIME DISPLAYS***
- ***THREE TRIGGER MODES, FOUR TRIGGER SOURCES***
- ***REPETITIVE OR SINGLE DISPLAYS***



The Type 5T3 Timing Unit for Type 661 Oscilloscopes incorporates both EQUIVALENT-TIME and REAL-TIME SAMPLING, to provide an extremely wide range of sweep times. THREE TRIGGER MODES together with FOUR TRIGGER SOURCES including 50-ohm and 1-megohm external trigger inputs offer convenient and flexible wide-range triggering. Trigger kick-out using external modes is reduced to less than 10 mV by isolation amplifiers.

TIMING SECTION

REAL-TIME SAMPLING

0.2 ms/cm to 5 s/cm, 14 calibrated steps (1-2-5 sequence), accuracy within 3%. Uncalibrated continuous variation between steps and to ≈ 80 μs/cm. The Sweep Magnifier in the Type 661 Oscilloscope allows up to X100 magnification of the CRT display. The 100-kHz sampling rate can be frequency modulated to easily detect and correct false displays.

EQUIVALENT-TIME SAMPLING

10 ps/cm to 100 μs/cm, 22 calibrated steps (1-2-5 sequence), accuracy within 3%. Uncalibrated continuous variation between steps and to ≈ 4 ps/cm. Sweep steps from 1 ns/cm to 100 μs/cm can be magnified up to X100 while maintaining a constant number of samples/cm. Magnification occurs from a fixed time-reference point at the left edge of the screen. Equivalent-time sweep ranges, whether magnified or not, are read out directly. Coarse and fine control position the displayed time "window" and set the time-reference point for magnification.

SAMPLING DISPLAY

Real-time displays are in the form of dots; the number of samples/cm depends on sweep time. Equivalent-time displays can be viewed at 5, 10, 20, 50, 100, or 1000 samples/cm, or a timed slow scan (≈ 0.5 s/cm to ≈ 5 s/cm) for chart recorder use.

SWEEP MODES

Normal (repetitive) and Single Display.

TRIGGER SECTION

NORMAL MODE

Triggering from DC to several hundred megahertz at 5-mV sensitivity. Schmitt-type tunnel-diode logic, operation similar to conventional real-time oscilloscope. Stability and level controls; free-running displays possible.

AUTOMATIC RECOVERY MODE

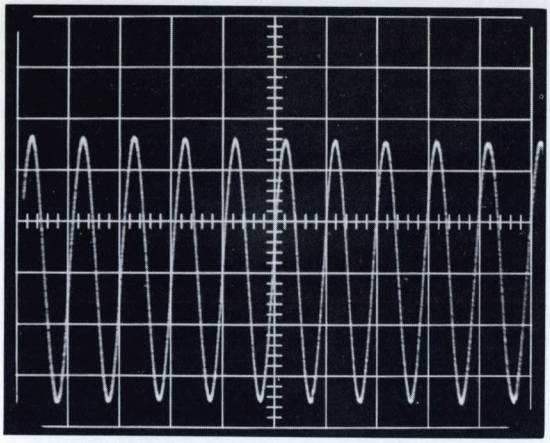
Easy triggering on fast, short pulses or synchronizing on high-frequency signals up to 500-MHz repetition rate—at 5-mV sensitivity. One-knob adjustment for a wide variety of trigger signals.

UHF SYNC MODE

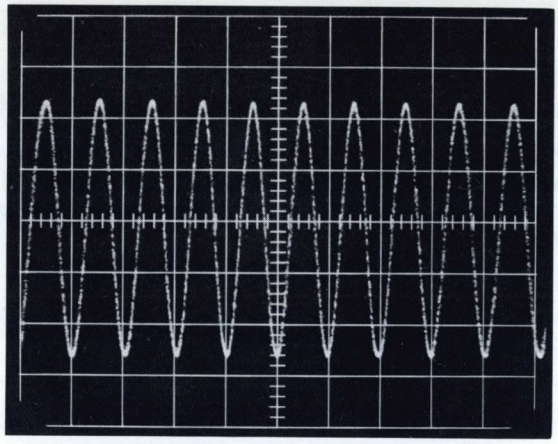
Stable synchronization on low-amplitude signals from 500 MHz to 5 GHz. 50-ohm input connected directly (by-passing transistor amplifiers) through high-pass filter to very fast tunnel-diode multivibrator.

5T3

VIEWS THESE 2 SIGNALS WITH THE TYPE 661/5T3/4S2A



50-Hz REAL-TIME DISPLAY
Horiz: 20 ms/cm; Vert: 100 mV/cm
External trigger, 1-megohm input



5-GHz EQUIVALENT-TIME DISPLAY
Horiz: 0.2 ns/cm; Vert: 100 mV/cm
External trigger, UHF Sync Mode

TRIGGER CAPABILITIES

TRIGGER SOURCE	FREQUENCY COVERAGE†	COUPLING	DYNAMIC RANGE	MAXIMUM OVERLOAD
External 1-megohm input	DC to 20 MHz 160 Hz to 20 MHz	DC AC	±50 mV to 1.5 V	±100 V
External 50-ohm input	DC to 500 MHz 500 kHz to 500 MHz 500 MHz to 5 GHz	DC AC UHF Sync	±5 mV to 150 mV	±5 V
Internal from Sampling Plug-In Unit	DC to ≈ 1 GHz	DC coupled in Type 5T3	Trigger takeoffs in the Type 4S1 Sampling Unit deliver ≈ 1/8 of input signal amplitude	
Internal from Oscilloscope Calibrator		AC	100-mV signal from Amplitude/Time Calibrator	

† AC lower-frequency limits refer to sinewaves only.

TRIGGER JITTER

MODE	JITTER	FREQUENCY	PEAK TO PEAK VOLTAGE
NORMAL	≤ 30 ps	2-ns pulse width (50% points)	50 mV at 50-Ω input or 400 mV internal
AUTO RECOVERY	≤ 70 ps	500 MHz	50 mV at 50-Ω input or 400 mV internal
	≤ 30 ps	2-ns pulse width (50% points)	
UHF SYNC	≤ 30 ps	2 GHz	10 mV at 50-Ω input
		5 GHz	50 mV at 50-Ω input

WEIGHT

Net—6¾ pounds, shipping—13 pounds approx.

TYPE 5T3 TIMING UNIT **$800**

Each instrument includes: 2—10X 50 Ω attenuators (017-0078-00), 1—10-ns 50-Ω cable (017-0501-00), 1—BNC-to-banana plug patch cord (012-0090-00), 2—instruction manuals (070-0470-00).

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

TRIGGER COUNTDOWN UNIT Type 280

INPUT SIGNAL FREQUENCIES—*30 megahertz to 5 gigahertz.*

OUTPUT SIGNAL FREQUENCIES—*Continuously variable from 15 to 45 megahertz.*

The Tektronix Type 280 Trigger Countdown Unit allows timing systems to be synchronized on frequencies up to 5 gigahertz. It can be used to lower the frequency of the triggering signals to within a range of 15 to 45 megahertz. This permits triggering circuits of timing systems to lock in solidly with high-frequency signals.

By using the Type 280 with a Tektronix sampling oscilloscope, microwave engineers can observe RF signals in the gigahertz range.

CHARACTERISTICS

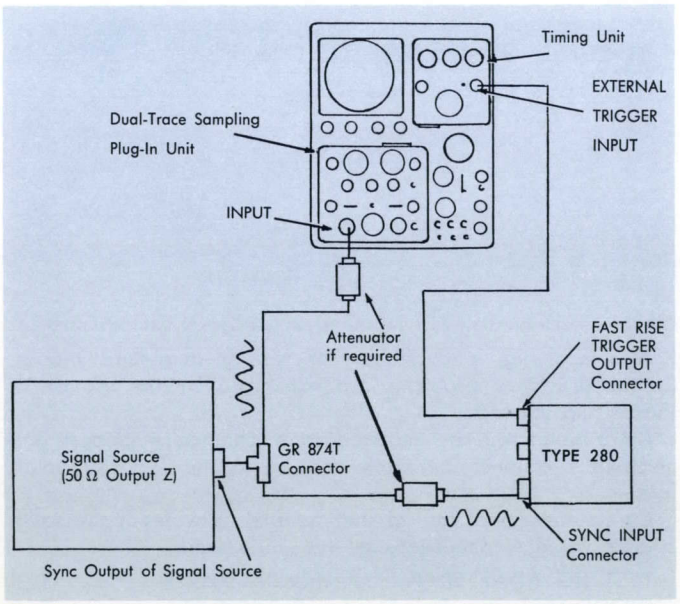
INPUT FREQUENCY is from 30 megahertz to 5 gigahertz.

INPUT SIGNAL VOLTAGE is 50 millivolts to 4 volts peak to peak.

INPUT IMPEDANCE is nominally 50 ohms.

OUTPUT REPETITION is continuously variable from 15 to 45 megahertz.

JITTER is 10 ps, or less than 1% of input signal period, whichever is larger.



Type 280 connected for use with Type 661 Oscilloscope.

TWO OUTPUTS—

LARGE AMPLITUDE TRIGGER OUTPUT is 1.5 volts, nominally 8-ns long, with less than 4-ns risetime, (for use with high-speed conventional oscilloscopes).

FAST-RISE TRIGGER OUTPUT (terminated in 50 ohms) is 150 millivolts, with less than 0.4-ns risetime, decaying with 2-ns time constant, (for use with Type 1S1, 5T1, 5T1A, 3T4, 3T77, or 3T77A and other high-speed sampling oscilloscopes).

AMPLITUDE OF TRIGGER OUTPUT as seen at input connector is $\leq$125 mV peak to peak.

SHIELDING of the Type 280 is adequate to permit operation in areas that have significant RF radiation levels.

POWER REQUIREMENT is 105 V to 125 V or 210 V to 250 V, 50 to 800 Hz 10 W. Transformer taps allow operation on either range. Instrument factory wired for 117 V.

MECHANICAL FEATURES include an aluminum-alloy chassis, die-cast aluminum-alloy top and bottom covers, and steel wrap-around housing. Overall dimensions are 7 3/8" high by 7 5/8" wide by 4 5/8" deep. Net weight is 4 1/2 pounds. Shipping weight is 9 pounds, approx.

TYPE 280 TRIGGER COUNTDOWN UNIT $265

Each instrument includes: 1—5-ns cable (017-0512-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord, AC (161-0015-00); 2—Instruction Manual (070-0350-00).

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

Type 292 SEMICONDUCTOR TESTER POWER SUPPLY

Type 292, with a test fixture, furnishes DC power and provides sub-nanosecond environment for reading out time and charge information about fast semiconductor diodes and transistors. A Type 292 is used between a sub-nanosecond pulse generator and the 50-Ω input of a sampling oscilloscope. Two variable electronically-regulated power supplies, TEST VOLTS and BIAS CURRENT, are electrically connected through a supporting platform to the test fixture in use. Polarity of either power supply can be inverted from the front panel; both supplies are short-circuit and open-circuit protected.

A general-purpose unwired plug-in transistor test fixture is shipped with each Type 292. The fixture consists of an etched-circuit board with a transistor socket mounted in the center. Signal connections to the fixture are made through coaxial connectors mounted on the circuit board. A number of isolated tie points are provided on the test fixture board to facilitate wiring of experimental circuits.

Banana-pin jacks at the rear of the Type 292 can be used for two purposes:

1. *Monitoring either the internal TEST VOLTS or BIAS CURRENT supply, or*
2. *Connecting external sources of current and voltage to the test fixture in use.*

Leads from the banana-pin jacks to the test fixture limit externally-supplied currents to 1 ampere or less.

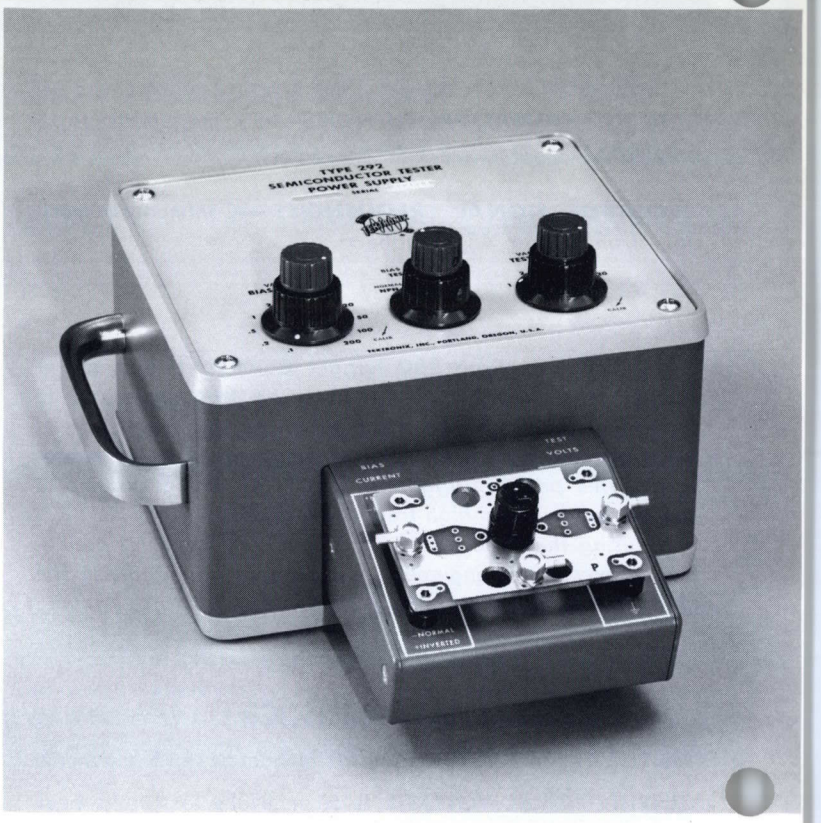
TEST VOLTS POWER SUPPLY supplies fixed DC voltages of 1, 2, 5, 10 and 20 volts, accuracy within ±3% when the variable control is fully clockwise. An uncalibrated variable control allows the voltage of a fixed step to be divided by any factor between 1 and at least 10. Ripple voltage (either polarity) is equal to, or less than, 4 mV peak to peak at any voltage, over a current range of 0-200 mA, for line voltages from 105 to 125 V AC, or 230 to 250 V AC. Maximum short-circuit current is about 400 mA on all ranges.

BIAS CURRENT POWER SUPPLY supplies fixed DC currents in 11 calibrated steps from 0.1 mA to 200 mA, 1-2-5 sequence, accuracy within ±3% when the variable control is fully clockwise. An uncalibrated variable control allows the current of a fixed step to be divided by any factor between 1 and at least 10. Ripple current (either polarity), listed below, applies for any current from about 2 μA to 200 mA, for line voltages from 105 to 125 V AC or 230 to 250 V AC, providing the load on the current supply limits the output voltages to less than 20 volts.

RANGE	RIPPLE
0.1 to 20 mA	less than 5 μA
50 mA	less than 10 μA
100 mA	less than 20 μA
200 mA	less than 100 μA

POWER REQUIREMENTS are from 105 V to 125 V or 210 V to 250 V, 50 to 60 hertz, 30 W. Transformer taps allow operation on either range. Instrument factory wired for 117 V.

MECHANICAL SPECIFICATIONS include dimensions of 4⅝" high by 8" wide by 10" deep. Net weight is 6¼ pounds, approx. Shipping weight is 12 pounds, approx.

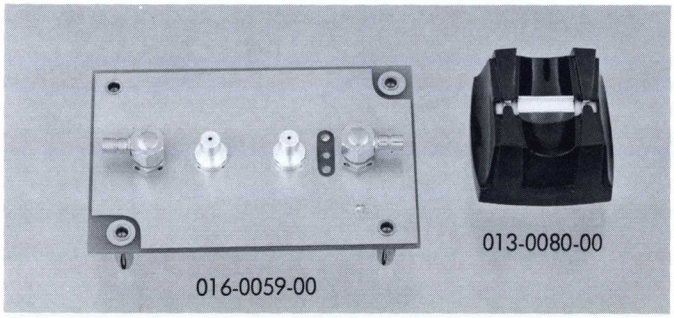


TYPE 292 SEMICONDUCTOR TESTER POWER SUPPLY $325

Each instrument includes: 1—Adapter, 3-wire (103-0013-00); 3—P6040 probe (010-0133-00); 1—Transistor test fixture, unwired (016-0057-00); 1—Power cord (161-0015-00); 2—Instruction Manual (070-0410-00).

OPTIONAL TEST ACCESSORIES

TRANSISTOR TEST FIXTURE, UNWIRED, Part Number 016-0057-00 ..... **$20**



A special jig is available for testing axial-lead diodes. Contact-resistance problems are minimized by the use of V-shaped jig contacts.

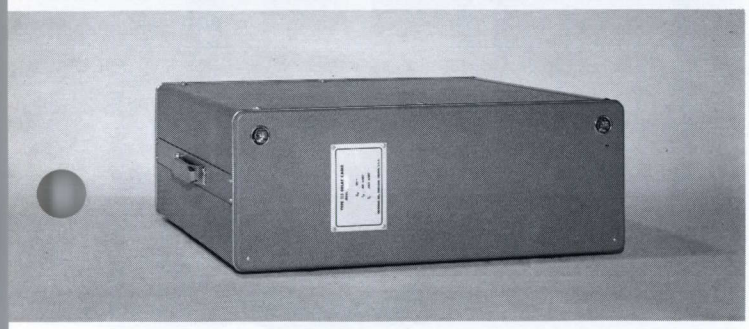
An adapter will be required to mechanically support and electrically connect the diode test jig to the Type 292 platform.

Careful design of the jig and adapter provides high-quality 50-ohm coaxial connections to the diode leads.

TEST JIG ADAPTER, Part Number 016-0059-00 ..... **$25**
DIODE TEST JIG, Part Number 013-0080-00 ..... **$40**

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

The usefulness of the Type 661 Oscilloscope is further augmented by a wide range of accessories and associated instruments. Brief descriptions of some of these are given here. For full specifications, please refer to each instrument on the page listed in the index.



TYPE 281 TIME DOMAIN REFLECTOMETRY PULSER

Type 281 is a compact current source designed for use with Type 3S76, 4S1, and 1S1 50-Ω Sampling Units; power is obtained from their probe power connectors.

PULSE AMPLITUDE is approx 18.5 mA; RISETIME $\leq$0.75 ns at leading negative transition; WIDTH $\geq$5 μs from negative-going edge to positive-going edge, at 50% amplitude points; FLATNESS $\pm$2% overshoot and ringing following negative-going edge for first 10 ns, 0.5% thereafter; LOADING EFFECT on 50-Ω SYSTEM $\leq$10% reflection (capacitive).

TYPE 281 TDR PULSER $95

TYPE 282 ADAPTER FOR HIGH-IMPEDANCE PROBES

This accessory permits the use of conventional high-impedance probes with 50-Ω sampling plug-ins units, such as Types 1S1, 4S1, 4S2A, and 3S76. Now, with a wide-range sampling timing unit (Types 1S1 or 5T3), one oscilloscope can cover nearly the entire range of signal measurement (from power-supply ripple to sub-nanosecond events).

Other advantages include: voltage offset, smoothing, and overload-recovery features of sampling not normally available with a conventional oscilloscope; no loss of DC stability with sampling units; and excellent linearity over entire dynamic range.

The adapter is recommended for use with P6008 or P6009 Probes. It can also be used with P6010 or P6011.

TYPE 282 PROBE ADAPTER $95

TYPE 109 PULSE GENERATOR

Produces 0.25-ns risetime pulses of either equal or alternately different time duration. Pulse width is 0.5 to 100 ns at full repetition rate of 550 to 720 p/s; and to 300 ns at half repetition rate.

Pulse amplitude is variable from 0 V through 50 V, accuracy within 3%. Polarity can be either positive or negative.

External DC charge voltage inputs permit alternate pulses of different amplitudes and/or polarity.

TYPE 109 PULSE GENERATOR $360

TYPE 111 PULSE GENERATOR

The Type 111 is a high-repetition rate, fast-rise pulse generator that provides two pulse outputs:

OUTPUT PULSE has a risetime $\leq$0.5 ns for positive and negative polarity. Repetition rate is variable from 10 p/s to 100 kHz. Pulse duration is 2 ns to1500 ns with an external charge line. Pulse amplitude is $\pm$10 V.

PRETRIGGER PULSE amplitude is $\approx$10 V, duration is 250 ns, and half-amplitude risetime is 5 ns (approx).

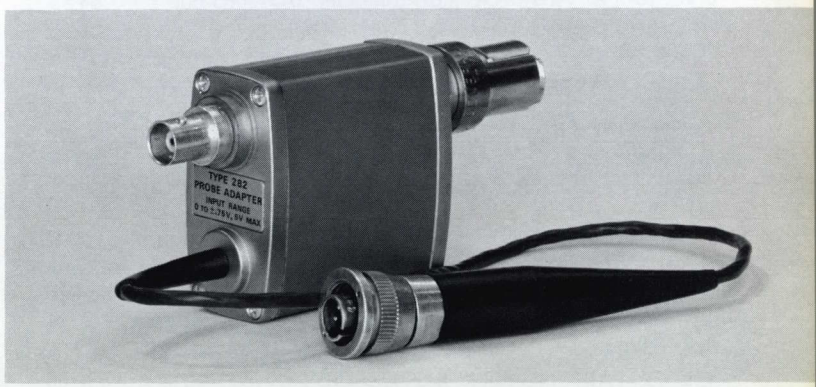
Time delay between pretrigger and output pulse is variable from 30 ns to 250 ns.

TYPE 111 PULSE GENERATOR $365

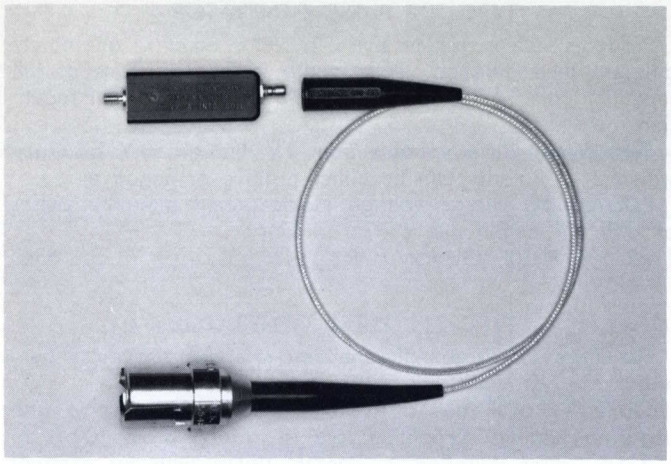
TYPE 113 DELAY CABLE

The Type 113 Delay Cable provides 60-ns delay so trigger signals can arrive ahead of the vertical deflection signal. The Type 113 has a 0 to 50% risetime of about 0.0025 ns, and 10 to 90% risetime of better than 0.1 ns. Impedance is 50 Ω $\pm$1%.

TYPE 113 DELAY CABLE $250



SAMPLING ACCESSORIES



TYPE CT-1 CURRENT TRANSFORMER

Type CT-1 provides a means for accurate measurement of current flow in a circuit, while keeping loading effects to a minimum. TYPE P6040 serves as an inter-connecting cable between the CT-1 and an oscilloscope. SENSITIVITY is 5 mV/mA into a 50-Ω load. BANDWIDTH is 35 kHz to 1 GHz. RISETIME for pulse response is less than 0.35 ns. DECAY TIME CONSTANT is 5 μs, approximated by 1% per 50 ns; limit, 1 μs. MAXIMUM VOLTAGE is 1000 V, DC. CURRENT RATINGS are 500 mA maximum RMS, 100 A peak pulse.

CT-1 (ORDER PART NUMBER 015-0040-00) $17

P6040 PROBE (ORDER PART NUMBER 010-0133-00) $14

TYPE CT-1 AND P6040 (ORDER PART NUMBER 015-0041-00) $31

TYPE CT-2 CURRENT TRANSFORMER AND P6041 PROBE

Type CT-2 and probe are similar to CT-1 with probe, except for lower bandwidth limits, higher RMS current rating, and reduced sensitivity. SENSITIVITY is 1 mV/mA into a 50-Ω load. BANDWIDTH is 30% down at 1.2 kHz to 7% down at 200 MHz. RISETIME is approximately 0.5 ns. DECAY TIME CONSTANT is 125 μs, approximated by 1% per 1.25 μs; limit, 25 μs. CURRENT RATINGS are 2.5 A maximum RMS, 100 A peak pulse. Though designed primarily for conventional oscilloscopes, the longer decay time constant and higher RMS current rating make Type CT-2 useful for some sampling oscilloscope applications. (Requires BNC to GR adapter.)

CT-2 (ORDER PART NUMBER 015-0046-00) $17

P6041 PROBE (ORDER PART NUMBER 010-0164-00) $12

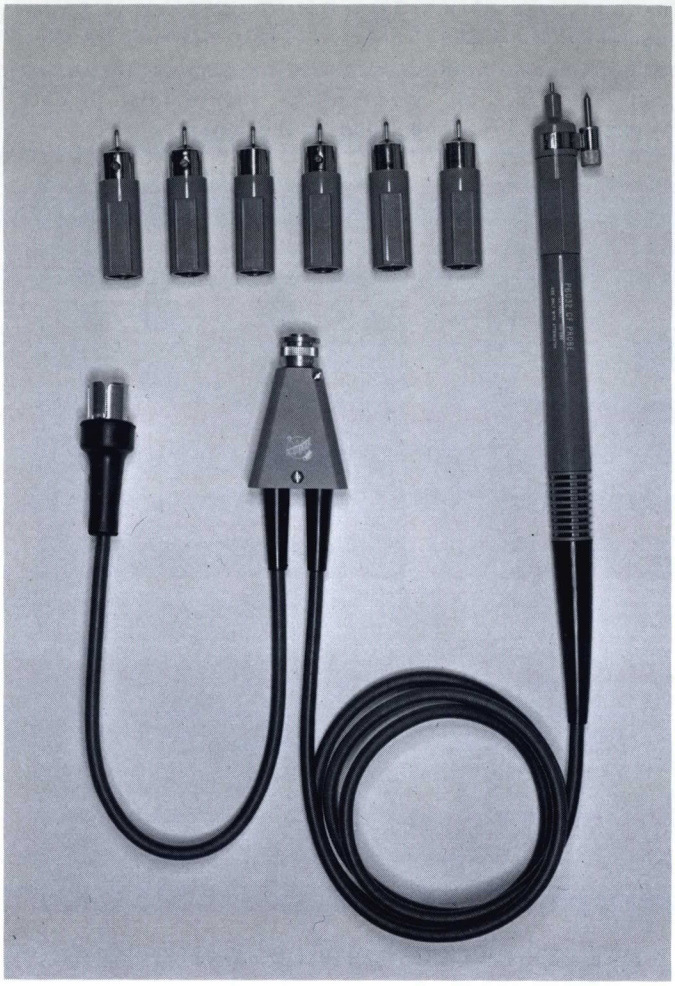
BNC to GR ADAPTER (Part Number 017-0063-00) $4.75

TYPE CT-3 50-OHM SIGNAL PICKOFF

The Type CT-3 provides a convenient means of picking off a signal in a 50-Ω system. Used with a Tektronix Sampling Instrument, the CT-3 provides the link for uses as a trigger source.

Sensitivity is 10% of the voltage under test, into a 50-Ω load. Risetime is less than 0.4 ns. Insertion impedance with a 50-Ω termination is 1 Ω shunted by 4.5 μH; or 2 Ω shunted by 4.5 μH without 50 Ω termination. VSWR approx 1.2 at 1.5 GHz.

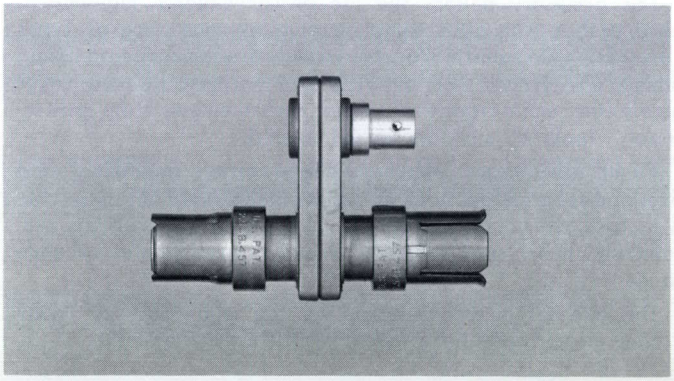
ORDER PART NUMBER 017-0061-00 ..... $30.00

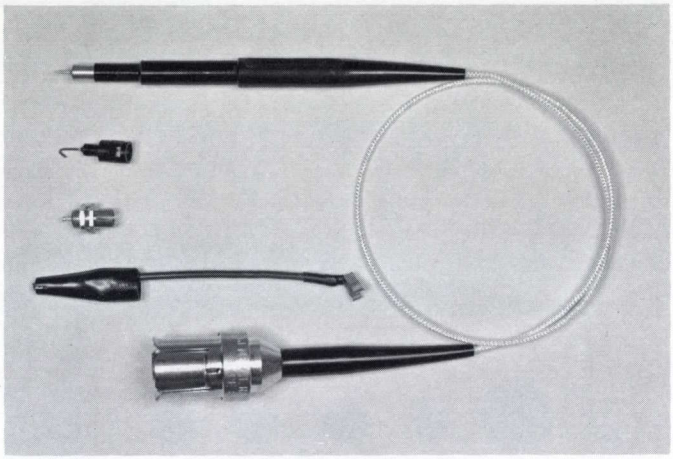


TYPE P6032 CATHODE-FOLLOWER PROBE

Type P6032 with a bandwidth of greater than 800 MHz, permits accurate measurements of high-speed repetitive pulses. The DC-coupled probe uses 7 plug-in attenuator heads (10X to 1000X). Risetime is typically 0.4 ns for probe and attenuator head. Maximum output is ±150 mV into a 50-Ω load. Signal delay is approximately 10 ns.

ORDER PART NUMBER 010-0108-00 ..... $220



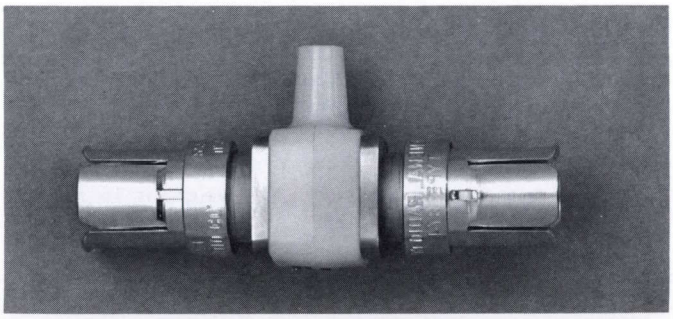


MINIATURE PASSIVE PROBES

Type P6034 permits accurate measurement of high-speed pulses. Attenuation ratio is 10X. Input resistance is 500 Ω at DC and approximately 300 Ω at 1.0 GHz with an input capacitance of 0.7 pF ±0.1 pF at 1.0 MHz to 1.0 GHz. Risetime is less than 100 ps. Maximum DC input, DC-coupled, is 16 V and, AC-coupled, is 500 V. Ringing and overshoot is ≤2% on pulses from a 25 Ω source.
ORDER PART NUMBER 010-0110-00 ..... $35

Type P6035 is similar to P6034, except that attenuation is 100X. Input resistance is 5000 Ω at DC and approximately 1500 Ω at 1.0 GHz. Input capacitance is 0.6 pF ±0.1 pF at 1.0 MHz to 1.0 GHz. Risetime is less than 200 ps. Maximum DC input, DC-coupled, is 50 V and, AC-coupled, is 500 V.
ORDER PART NUMBER 010-0111-00 ..... $35

Various probe nose adapters are available to facilitate connecting to BNC, GR, etc. (See Accessory Section for details.)

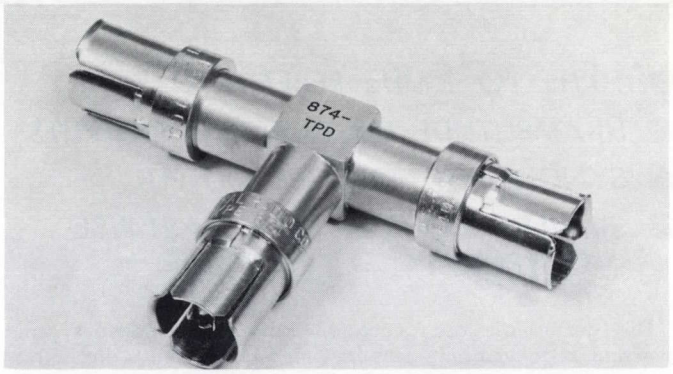


VOLTAGE PICKOFF

The VP-1 and VP-2 are 50 Ω "T" type voltage pickoffs for use with Tektronix probes while introducing minimum disturbance of the equipment under test. VP-1 fits the P6034 and P6035 probes, while VP-2 fits the P6038 probe.
VP-1—ORDER PART NUMBER 017-0073-00 ..... $25
VP-2—ORDER PART NUMBER 017-0077-00 ..... $30

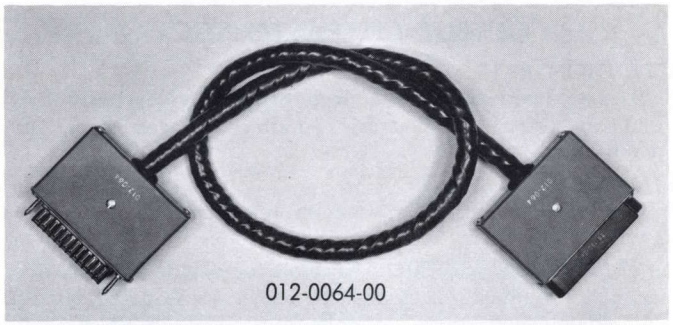
MISCELLANEOUS SAMPLING ACCESSORIES

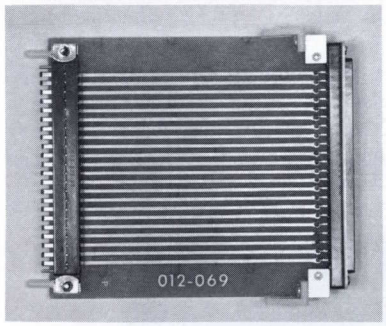
A variety of items are available to facilitate inter-connection between sampling plug-in units and other related devices. Examples are: GR, UHF, BNC, TYPE C and TYPE N adapters; 50-ohm connecting cables (GR-TYPE CONNECTORS) of various lengths; and attenuators, terminations, 50-ohm T and L fittings, etc. (See Accessory Section for descriptions.)



GENERAL RADIO 50-Ω POWER DIVIDER, TYPE 874-TPD

This divider is designed for use in broad-band 50-Ω systems where the mismatch introduced by ordinary "Tee" connectors is undesirable. It is especially useful in a time-domain reflectometer set-up where test line, pulser, and oscilloscope must be coupled with a minimum of reflection-producing discontinuities.
ORDER PART NUMBER 017-0082-00 ..... $70





MAINTENANCE AIDS

These items are offered for the convenience of companies with in-plant instrument-maintenance facilities. If 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.

Plug-In Extension for Dual-Trace and Timing Units
Order Part Number 012-0064-00 (24-pin extension) ... $23.00
Circuit-Board Extension for Dual-Trace Unit
Order Part Number 012-0069-00 (22-pin extension) ... $25.00
Coaxial Cable for Coupling Trigger Signals
Order Part Number 012-0070-00 ..... $10.50

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

Type 106 SQUARE-WAVE GENERATOR

- *10 Hz TO 1 MHz REPETITION RATE*
- *HI-AMPLITUDE OR FAST-RISE OUTPUTS*
- *SYNC INPUT, TRIGGER OUTPUT*
- *SIMULTANEOUS + & — FAST-RISE OUTPUTS*

This general-purpose generator provides simultaneous positive and negative-going outputs with ≤1-ns risetime into 50 Ω, and a positive-going hi-amplitude output with ≤12-ns risetime into 50 Ω. A clean transition and flat top make the Type 106 ideal for checking oscilloscope transient response. In addition to its use in the calibration or maintenance lab, it can be used in such applications as diode recovery, core testing, digital and analog design. Little bench space is required for this compact instrument. It can be tilted for convenience, or stacked atop other instruments.

OUTPUT CHARACTERISTICS

REPETITION RATE

10 Hz to 1 MHz in decade steps, accuracy within ±10% of indicated rate. Continuously variable between steps, uncalibrated.

SYMMETRY

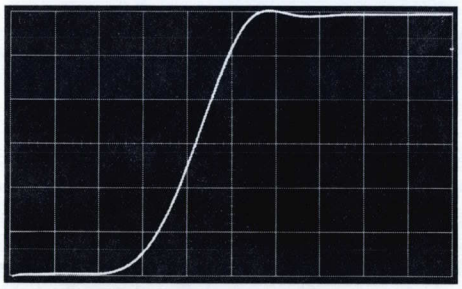
Duty cycle variable between 45 and 55%.

FAST-RISE OUTPUTS

≤1-ns risetime into 50 Ω. Separate amplitude controls and outputs for simultaneous positive and negative-going signals. Amplitude continuously variable from 50 mV to 500 mV into 50 Ω. Aberrations ≤2% in first 5 ns, ≤0.5% after first 5 ns.

HI-AMPLITUDE OUTPUT

≤12-ns risetime into 50 Ω. Amplitude continuously variable from ≤0.5 V to 12 V with 50-Ω load, ≤7 V to ≥120 V unterminated. Output DC levels are from a negative potential to ground. Aberrations ≤2% in first 100 ns, ≤0.5% peak to peak after first 100 ns.



HI-AMPLITUDE OUTPUT

5 ns/cm, 100 mV/cm deflection factor, external 10X attenuator. Waveform displayed on Type 547 Oscilloscope with Type 1S1 Sampling Unit; photographed with C-12 Camera, projected graticule.

OTHER CHARACTERISTICS

SYNC INPUT

Accepts sinewaves, squarewaves, or pulses. Accepts 5 V to 100 V peak to peak sinewave, 2.5 V to 50 V pulse or squarewave.

TRIGGER OUTPUT

Differentiated squarewave, +triggers coincide (within 50 ns) with leading edge of all outputs. ≤50-ns risetime into 50 Ω, ≥0.15 V into 50 Ω, ≤300-ps time jitter.

POWER REQUIREMENTS

103.5 V to 126.5 V or 207 V to 253 V, 50 to 60 Hz. Low or high range selected by rear-panel switch. Approx 85 watts maximum power consumption at 115 VAC.

MECHANICAL

Foot permits tilting for convenient bench-top operation. Handle hinges out for carrying. Net weight is 15 pounds. Shipping weight is approx 21 pounds. Dimensions are 6" high by 9" wide by 14¾" deep.

TYPE 106 SQUARE-WAVE GENERATOR $590

Each instrument includes: 1—5-ns cable (017-0502-00); 1—50-Ω GR to BNC in-line termination (017-0083-00); 1—right-angle 3-conductor power cord (161-0024-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0523-00).

TYPE 106 SQUARE-WAVE GENERATOR MOD 146B . $565

As above, but less cabinet, for mounting in Rack Adapter.

RACK ADAPTER FOR TYPE 106, 114, 184 and 191

The Rack Adapter converts the latest series of Tektronix Generators for rack mounting. Any combination of two instruments can be mounted (less cabinets) side by side in a 19" rack, in only 5¼" of panel height. The Rack Adapter provides forced air ventilation and shielding between compartments. A blank panel is included to cover the unused opening when only one Generator is installed.

RACK ADAPTER (016-0086-00) **$125**

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

PULSE GENERATOR Type 109

0.25-NS RISETIME PULSES

ALTERNATE PULSES OF EQUAL OR DIFFERENT TIME DURATION

CALIBRATED VARIABLE AMPLITUDE PULSES

OF EITHER POSITIVE OR NEGATIVE POLARITY

PULSE DURATIONS TO 100 NS

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
Less than 0.25 ns.

PULSE WIDTH
From approximately 0.5 ns to a maximum of 100 ns at full repetition rate; 300 ns at half repetition rate. An external charge network with a 10X attenuation provides long duration pulses. Amplitude decay is approx 10% in 300 ns.

REPETITION RATE
Preset between 550 pulses per second to 720 pulses per second.

PULSE AMPLITUDE
Can be selected from three calibrated ranges extending from zero through 55 volts, accuracy within 3%.

PULSE POLARITY
Can be either positive or negative.

OUTPUT IMPEDANCE
50 ohms.

CHARGE LINES
Either one or two charge lines can be used to provide alternate equal or unequal pulses as desired. Equal charge lines produce a repetition rate of 500 pulses per second to 720 pulses per second.

EXTERNAL DC CHARGE VOLTAGE INPUTS
Use of external charge voltages allows attenuated pulses to be of different amplitude and 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. At pulse outputs over 50 volts, irregularities may occur.

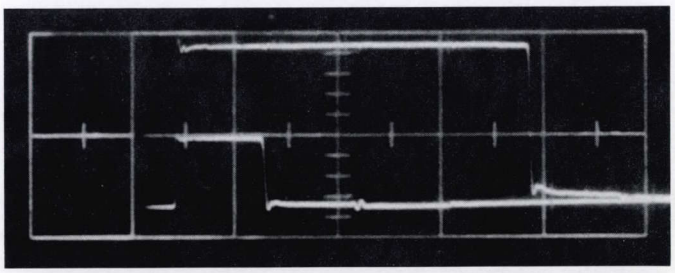
DC POWER SUPPLY
Electronically regulated to compensate for varying load conditions.

POWER REQUIREMENT
105 V to 125 V or 210 V to 250 V, 50 to 800 Hz, 60 watts.

MECHANICAL
Aluminum-alloy chassis, anodized front-panel. Dimensions: 7⅞" high by 5" wide by 11¾" deep. Net weight: 8½ pounds. Shipping weight: 18 pounds.

TYPE 109 PULSE GENERATOR $360
Each instrument includes: 1—charge network (017-0067-00); 3—5 ns cable (017-0502-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0299-00).

U.S. Sales Prices 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-ns and 20-ns charge lines and external charge voltages. Vertical deflection factor 10 V/cm, sweep speed 10 ns/cm.

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 Sampling Plug-In Units; 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 Sampling Systems without internal delay lines or as a triggering signal for a conventional oscilloscope. The amount of delay between the Pretrigger Pulse and the Output Pulse can be varied by means of a front panel control. This eliminates the need for delay cables.

OUTPUT PULSE RISETIME
≤0.5 ns for both (+) and (—) polarity.

OUTPUT PULSE DURATION
Minimum is approx 2 ns with no external charge line. Maximum, 1500 ns at low rep rates decreasing to 30 ns at 100-kHz rep 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 ranges: 10 Hz, 100 Hz, 1 kHz, 10 kHz. A vernier provides continuous adjustment from 10 Hz to 100 kHz.

OUTPUT PULSE ABERRATIONS
Overshoot and other aberrations on the leading edge and top of the output pulse are less than 5% peak to peak of the pulse amplitude when output is properly terminated. Aberrations following the pulse are less than 10% peak to peak of the pulse amplitude. Pulse aberration figures are taken as viewed on a Tektronix Type 4S3 or equivalent.

PULSE AMPLITUDE
More than 10 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: ≈ 10 V, duration: ≈ 300 ns, risetime: ≈ 5 ns.

PULSE DELAY
30 to 250 ns, continuously variable. Time jitter less than 100 ps.

OUTPUT IMPEDANCE
50 ohms.

EXTERNAL TRIGGER SIGNAL
+3 V or greater at a rate of rise of 3 V/μs or faster. As long as rate of rise is maintained, repetition rates from 0 to 100 kHz can be used.

POWER REQUIREMENT
105 V to 125 V or 210 V to 250 V, 50 to 800 Hz, approximately 35 watts at 117 V. Unit factory wired for 117 V.

MECHANICAL SPECIFICATIONS
Dimensions are 11⅛" high by 7" wide by 11⅛" deep. Net weight is 8¾ pounds. Shipping weight is 16 pounds, approx.

TYPE 111 GENERATOR $365
Each instrument includes: 1—5-ns 50-Ω cable (017-0502-00); 1—9-ns 50-Ω charge line (017-0506-00); 1—50-Ω 10X attenuator (017-0078-00); 1—3-wire power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0252-00).

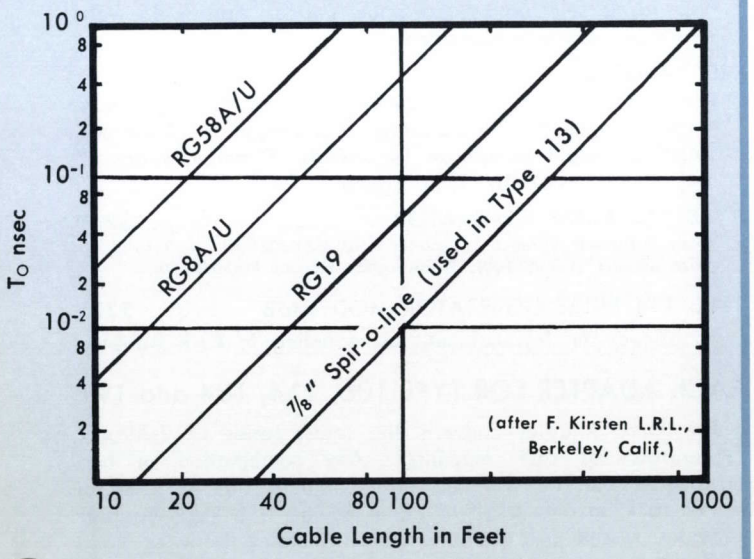
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

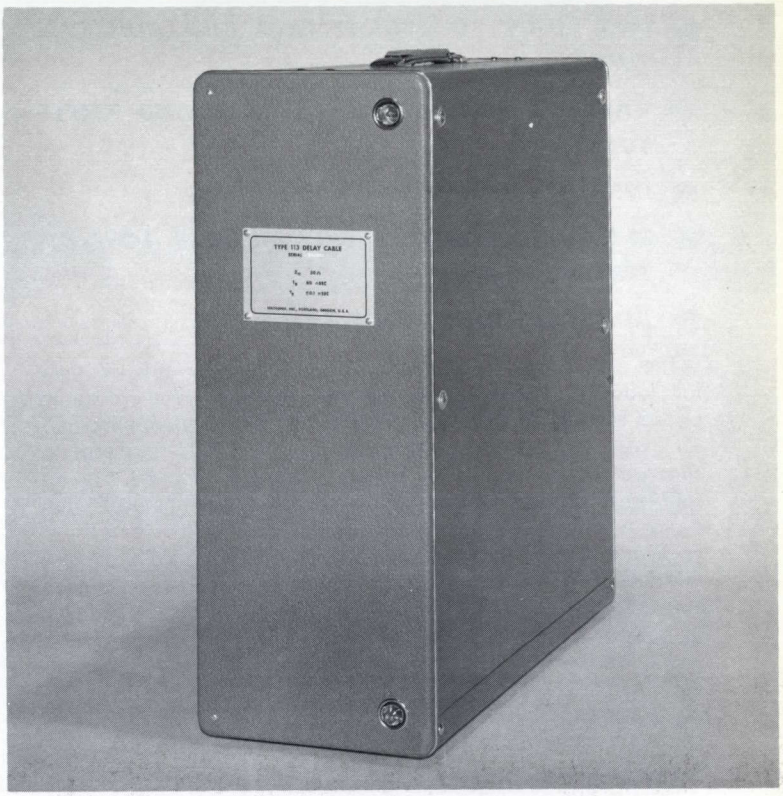
TRANSMISSION LINES

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_o) 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 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.





The Tektronix Type 113 Delay Cable has a delay of 60 ns and a characteristic impedance of 50 Ω. In general it is used in those sampling applications where the vertical amplifier does not contain internal delay lines and the triggering of the sweep is external and signal delay is required.

CHARACTERISTIC IMPEDANCE

50 Ω ±1%.

HIGH QUALITY CABLE

Approximately 1.5-dB loss per 100 feet at 1000 MHz. Risetime approximately 0.1 ns.

MECHANICAL SPECIFICATIONS

Three-piece cabinet houses the coaxial cable compactly coiled between two GR 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 3/8" high by 8 5/8" wide by 21 7/8" deep. Net weight is 44 3/4 pounds. Shipping weight is 59 pounds, approx.

TYPE 113 DELAY CABLE **$250**

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

Type 114 PULSE GENERATOR

- ***LESS THAN 10-NANOSECOND RISE AND FALL TIME***
- ***VARIABLE PULSE PERIOD, WIDTH, AND AMPLITUDE***
- ***INSTANT SQUARE-WAVE SELECTION***
- ***REGULATED POWER SUPPLY—STABLE, LOW-JITTER OPERATION***
- ***ALL SOLID STATE—NO FAN***

The new Type 114 is a general-purpose generator designed for laboratory and production test facilities. The versatility of the Type 114 makes it well suited for numerous applications, such as medical stimulation, studying network response to changes in period and/or width, or determining the step response of systems. It can also serve as a repetition-rate generator or as a delay generator.

Compact in size, the Type 114 utilizes solid-state circuitry throughout, insuring trouble-free operation and long component life. Functional front-panel layout makes the instrument easy to operate. Three switches are used for selecting pulse period, width, and amplitude. Each switch has a variable control for use over the selected range. A front-panel lamp indicates when the pulse width exceeds the maximum allowed by the period. The width selector switch features a square-wave position providing symmetrical square-wave output at all pulse periods.

Front-panel connectors are provided for pulse output, trigger output, and external trigger input. Two Type 114's can be connected together so that the output pulse of the second unit is delayed by the pulse width of the first unit.

OUTPUT CHARACTERISTICS

RISE AND FALL TIME
10 ns or less.

PULSE ABERRATIONS
5% or less (at maximum amplitude).

POLARITY
Positive or negative.

PULSE PERIOD
5 switched positions from 1 μs to 10 ms, plus external trigger position; continuously variable from 1 μs to 100 ms. ACCURACY: $\pm$3% with variable control in calibrated position; square-wave mode $\pm$5% from 100 ms to 10 μs, $\pm$10% at 1 μs. JITTER: $\leq$0.05%.

PULSE WIDTH
5 switched positions from 100 ns to 1 ms, (continuously variable from 100 ns to 10 ms) plus square-wave mode. ACCURACY: $\pm$3% with variable control in calibrated position. JITTER: $\leq$0.05% plus 2 ns. Front-panel lamp indicates when pulse width exceeds pulse period. SQUARE-WAVE OUTPUT: symmetrical square-wave output at all Pulse Period settings.

PULSE AMPLITUDE
4 switched positions: —1 V to —3 V, —3 V to —10 V; +1 V to +3 V, +3 V to +10 V. Variable within each range. Maximum output into a 50-Ω load is 10 V; 16 V into 1000-Ω load. Maximum DC voltage fed back into Type 114 from device under test should not exceed $\pm$0.5 V.

OTHER CHARACTERISTICS

EXTERNAL TRIGGER INPUT REQUIREMENT
Trigger signals from +2 V to +20 V having a risetime of 1 μs or less. Signals up to 2 MHz may be used.

TRIGGER OUTPUT
$\geq$2 V, open circuit; approx 0.5 V into 50-Ω load. Front-panel switch sets trigger output pulse to occur at leading or trailing edge of output pulse.

POWER REQUIREMENTS
94.5 V to 137.5 V or 189 V to 275 V, 50 to 400 Hz. Low or high range selected by rear-panel switch. Approx 15 watts maximum power consumption.

MECHANICAL
Foot permits tilting for convenient bench-top operation. Handle hinges out for carrying. Net weight is 10 pounds. Shipping weight is approx 14 pounds. Dimensions are 6" high by 9" wide by 12½" deep.

TYPE 114 PULSE GENERATOR $350
Each instrument includes: 1—power cord (161-0024-00), 1—3 to 2-wire adapter (103-0013-00), 2—instruction manual (070-0465-00).

TYPE 114 PULSE GENERATOR MOD 146B $325
As above, but less cabinet, for mounting in Rack Adapter.

RACK ADAPTER FOR TYPE 106, 114, 184 and 191

The Rack Adapter converts the latest series of Tektronix Generators for rack mounting. Any combination of two instruments can be mounted (less cabinets) side by side in a 19" rack, in only 5¼" of panel height. The Rack Adapter provides forced air ventilation and shielding between compartments. A blank panel is included to cover the unused opening, when only one Generator is installed.

RACK ADAPTER (016-0086-00) $125

U.S. Sales Prices f.o.b. Beaverton, Oregon
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PROGRAMMABLE PULSE GENERATOR Type R116

NEW

CALIBRATED & PROGRAMMABLE PARAMETERS

- TRIGGER SOURCE
- PERIOD
- DELAY OR BURST TIME
- MODE
- DC OFFSET
- RISETIME & FALLTIME
- WIDTH
- AMPLITUDE
- POLARITY

The Type R116 is a 10-MHz, 10-volt programmable pulse generator with rise and fall time variable to 10 nanoseconds. The unit is primarily intended for applications where various combinations of pulse amplitude, polarity, shape, and other parameters are required in rapid sequence. All functions are programmable and, in addition, the Type R116 can be operated from calibrated front-panel controls for applications which do not require external programming.

Programming is accomplished by a combination of digital and analog methods. Switching functions such as trigger source (internal or external), mode of operation, ranges, and polarity require voltage-level logic inputs. A logical "1" is zero volts (contact closure to ground) and a logical "0" is +12 volts (or an open). Variable functions such as period, delay or burst time, width, amplitude, risetime, falltime, and DC offset all are linearly related to the value of analog resistances connected by the programmer between appropriate program leads. Programming inputs are via a microribbon connector at the rear of the instrument.

Programmable parameters can be remotely controlled (automatic sequence optional) with the Type 262 Programmer. The Type 567 Readout Oscilloscope and Type 6R1A Digital Unit display the results of each measurement and indicate whether these results are within, above, or below predetermined limits.

PULSE CHARACTERISTICS

At 10 Volts Amplitude

RISETIME AND FALLTIME

10 ns to 110 μs, continuously variable and calibrated in 4 ranges: 10 ns to 110 ns, 100 ns to 1.1 μs, 1 μs to 11 μs, 10 μs to 110 μs. Risetime and falltime independently variable within the same range. Accuracy within ±5% of dial reading (except ±10% on fastest range). Complete programming requires 1 resistor per program for risetime, 1 resistor per program for falltime and 3 bits for range selection.

PERIOD

100 ns to 11 ms, continuously variable and calibrated in 5 ranges: 100 ns to 1.1 μs, 1 μs to 11 μs, 10 μs to 110 μs, 100 μs to 1.1 ms, 1 ms to 11 ms. Accuracy within ±3% of dial reading (except ±5% on shortest period range). Complete programming requires 1 resistor per program for multiplier and 4 bits for range selection.

DELAY OR BURST TIME

50 ns to 550 μs, continuously variable and calibrated in 4 ranges: 50 ns to 550 ns, 500 ns to 5.5 μs, 5 μs to 55 μs, 50 μs to 550 μs. Accuracy within ±3% of dial reading (±5% on shortest delay range). Complete programming requires 1 resistor per program for multiplier and 3 bits for range selection.

R116

WIDTH
50 ns to 550 μs, continuously variable and calibrated in 4 ranges: 50 ns to 550 ns, 500 ns to 5.5 μs, 5 μs to 55 μs, 50 μs to 550 μs. Accuracy within ±3% of dial reading (±5% on shortest-width range). Complete programming requires 1 resistor per program for multiplier and 3 bits for range selection.

AMPLITUDE
0.4 V to 10 V (into 50 Ω), either polarity, continuously variable and calibrated in 3 ranges: 0.4 V to 2 V, 1 V to 5 V, 2 V to 10 V. Accuracy within ±3% of dial reading. Complete programming requires 1 resistor per program for multiplier and 2 bits for range selection.

POLARITY
Positive or negative. Programming requires 1 bit.

DC OFFSET
−5 V to +5 V into 50 Ω, continuously variable and calibrated. Full DC offset in either direction and full pulse amplitude of either polarity permitted simultaneously. Accuracy within ±150 mV of dial reading, ±50 mV at zero offset. DC offset range reduced by pulse attenuator, both internal and external. Programming requires 1 resistor per program.

ABERRATIONS
≤3% peak overshoot, rounding, tilt or other aberration.

PROGRAM ACCURACY

Accuracy of the remote program when using recommended program resistor values is the same as the corresponding front-panel control plus 2%, plus any error in the value of the program resistor. For example, the period which has a basic accuracy of ±3% from the front panel would have a maximum error of ±5%, plus the error in the programming resistor when it is remotely programmed. Accuracy of remote programming may be improved by calibrating the instrument for remote programming rather than for front-panel operation.

OPERATING MODES

SINGLE
Undelayed pulses.

DELAYED SINGLE
Pulses occurring at the end of the delay time.

DOUBLE
Pairs of pulses: one occurring at the time of the normal undelayed pulse, one occurring at the end of the delay time.

BURST
Output pulses obtained for the duration of Burst Time when initiated by external triggering pulse. Pulses occur at internal repetition rate.

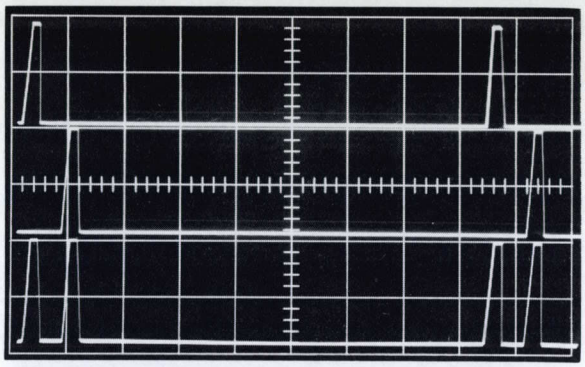
GATED OUTPUT
Output pulses obtained for the duration of input gate. Pulses are synchronous with input gate and occur at internal repetition rate.

REMOTE PROGRAM
Permits remote programming of the operating mode. Programming requires 4 bits.

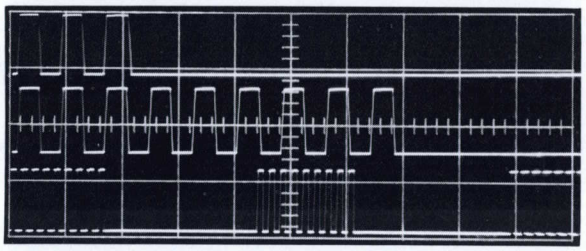
INPUTS

+TRIGGER
Accepts trigger from +2 V to +20 V, for triggering signals having at least 100 ns separation; +2 V to +4 V for signals having at least 50 ns separation. DC-coupled input.

+GATE
Accepts gate from +2 V to +10 V. Output pulses start approximately 100 ns after gate reaches +2-V level and continue until gate drops below +2 V. Output pulses synchronous with gate. DC-coupled input.



Multiple exposure showing timing relationships between Single, Delayed Single, and Double operating modes. Oscilloscope triggered from Type R116 Pretrigger. 50 μs/cm sweep time, 5 V/cm deflection factor.



Multiple exposure showing burst capabilities of the Type R116. Upper trace shows burst of 3 pulses. Center trace shows burst of 9; lower trace shows bursts of 9 on a slower time scale. 5 μs/cm sweep time on upper 2 traces; 20 μs/cm on lower trace. 5 V/cm deflection factor.

AUXILIARY OUTPUTS

+PRETRIGGER
2 V minimum into 1 kΩ, risetime less than 20 ns. Occurs approx 30 ns prior to start of the undelayed output pulse.

+DELAYED TRIGGER
2 V minimum into 1 kΩ, risetime less than 20 ns. Occurs approx 30 ns prior to the start of the delayed output pulse.

OTHER CHARACTERISTICS

POWER REQUIREMENTS
94.5 to 137.5 or 189 to 275 volts, 50 to 60 Hz. Low or high range selected by rear-panel switch. Approx 100 watts maximum power consumption.

MECHANICAL
Net weight is 25¼ pounds. Shipping weight is approx 65 pounds. Dimensions (including panel knobs, handles, and connectors) are 5¼" high by 19" wide by 18⅛" deep.

COOLING
Filtered forced air.

TYPE R116 PULSE GENERATOR $1550
Each instrument includes: 1—42" 50-Ω BNC cable (012-0057-00); 1—50-Ω BNC termination (011-0049-00); 1—36 pin remote program connector (131-0293-00); 1—set mounting tracks (351-0084-00); 1—set mounting hardware; cabinet feet kit (016-0052-00); 1—3-conductor power cord (161-0024-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0498-00).

Circuit Card extension for servicing (012-0078-00) $20

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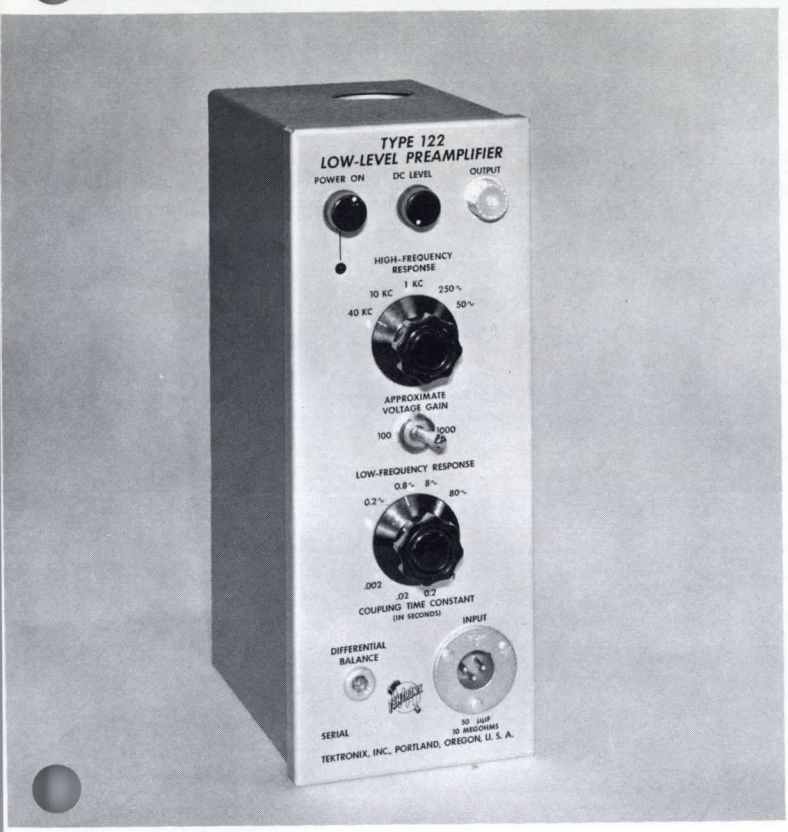
Please refer to Terms and Shipment, General Information page.

LOW-LEVEL PREAMPLIFIER Type 122



VOLTAGE GAIN

High position—approximately 1000.

Low position—approximately 100.

BANDWIDTH—0.2 Hz to 40 kHz 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 that require 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.

BANDWIDTH

0.2 Hz to 40 kHz. High and low-frequency —3 dB points can be set by front panel switches.

VOLTAGE GAIN

100 or 1000, selected by a toggle switch.

COMMON-MODE REJECTION RATIO (CMRR)

100 dB between 5 Hz and 40 kHz. Maximum common-mode input signal: 4 V.

SIGNAL OUTPUT

20 V (peak to peak) maximum in high gain position, 10 V (peak to peak) maximum in low gain position; AC signals up to 0.02 V (gain 1000) or 0.1 V (gain 100) and DC levels up to ±0.1 V (either gain setting) can be applied before waveform distortion occurs. Output impedance is approximately 1000 ohms.

INPUT RC

10 megohms paralleled by approximately 50 pF.

NOISE LEVEL

1 to 5-μV RMS referred to input with input grounded.

POWER REQUIREMENT

+135 V at 5 mA, —90 V at 4 mA, and 6.3 V at 0.9 A, applied through a standard octal plug. 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 V dry-cell batteries and one 6.3 V storage battery. Batteries are not included with the Type 122.

MECHANICAL SPECIFICATIONS

Dimensions are 12¼" high by 4⅛" wide by 7⅛" deep. Net weight is 4¾ pounds. Shipping weight is 9 pounds, approx.

TYPE 122 PREAMPLIFIER **$135**

Each instrument includes: 1—battery cable (012-0009-00); 1—output cable (012-0003-00); 1—input plug (131-0013-00); 2—instruction manual (070-0246-00).

BATTERY CABLES

Extra long battery cables can be ordered to fit a particular arrangement.

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Please refer to Terms and Shipment, General Information page.

Type FM122 FRAME MOUNT

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 12¼" high by 4⅛" wide by 7" deep. Net weight is 5½ pounds. Shipping weight is 9 pounds, approx.

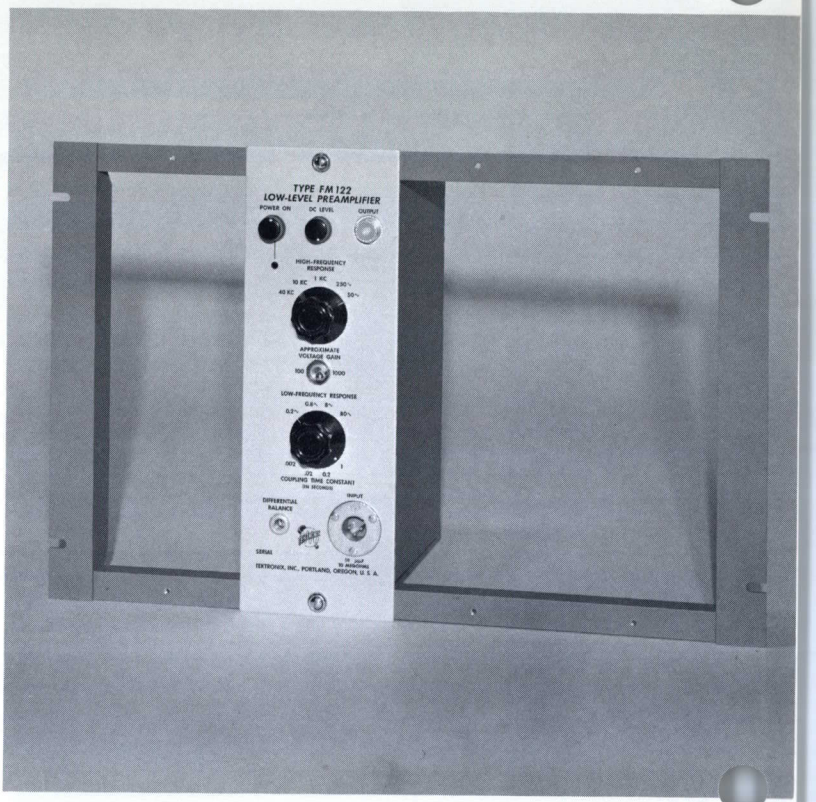
TYPE FM122 (without Mounting Frame) **$140**

Each instrument includes: 1—battery cable (012-0009-00); 1—output cable (012-0003-00); 1—input plug (131-0013-00); 1—set mounting hardware; 2—instruction manual (070-0246-00).

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 FM122 Preamplifier, Type 360 Indicator, Type 160-Series Units, and Type FM125 Power Supply. (Note: Because the Type FM122 Preamplifier has high sensitivity, it is recommended that it be mounted at least 4 inches to the left of the Type FM125 Power Supply or other source of transformer hum field.)

Part Number 014-0002-00 . . . . . $7



Type RM122 RACK MOUNT

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 5¼ inches of rack height.

Electrical characteristics of the Type RM122 are the same as described for the Tektronix Type 122 Preamplifier.

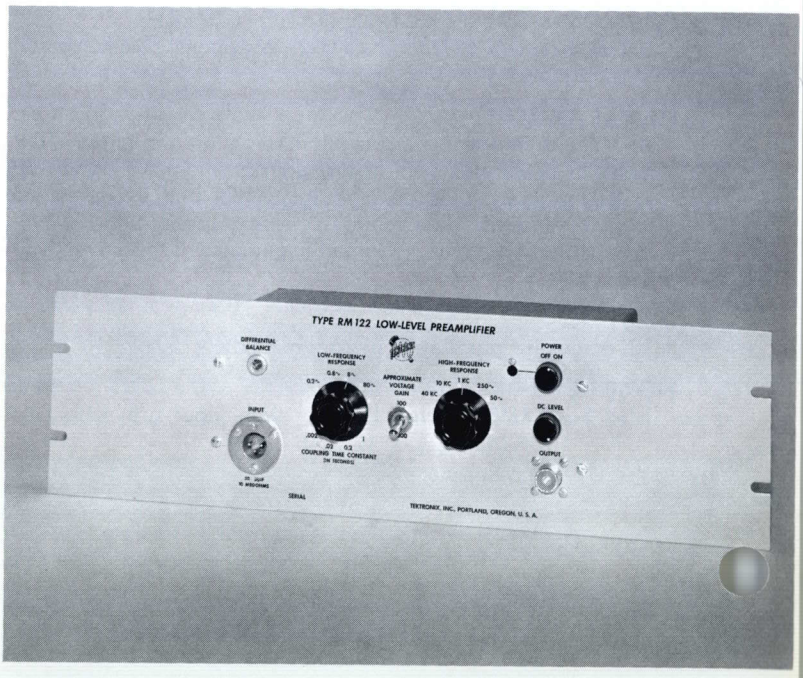
MECHANICAL SPECIFICATIONS

Dimensions are 5¼" high by 19" wide by 7" deep. Net weight is 6 pounds. Shipping weight is 14 pounds, approx.

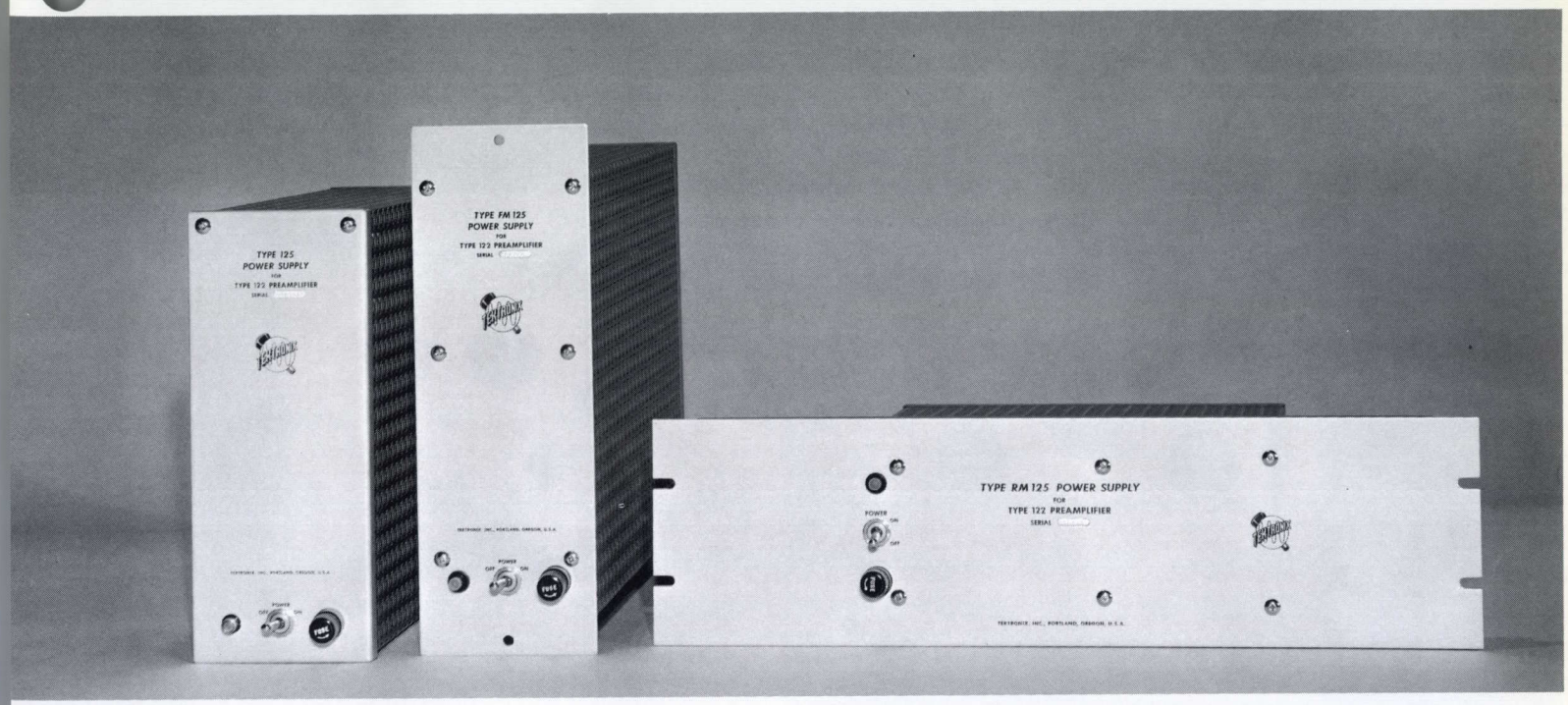
TYPE RM122 . . . . . **$140**

Each instrument includes: 1—battery cable (012-0009-00); 1—output cable (012-0003-00); 1—input plug (131-0013-00); 1—set mounting hardware; 2—instruction manual (070-0246-00).

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



POWER SUPPLY Type 125 / FM125 / RM125



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 A.

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 Hz, 110 watts. Unit factory wired for 117 V.

MECHANICAL SPECIFICATIONS

Dimensions are 14⅝" high by 4⅛" wide by 10⅜" deep. Net weight is 19 pounds. Shipping weight is 27 pounds, approx.

TYPE 125 POWER SUPPLY **$285**

Each instrument includes: 4—36" interconnecting cable (012-0065-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0246-00).

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 the Type 125.

MECHANICAL SPECIFICATIONS

Dimensions are 12¼" high by 4⅛" wide by 13½" deep. Net weight is 19 pounds. Shipping weight is 27 pounds. approx.

TYPE FM125 ..... **$290**

Each instrument includes: 4—36" interconnecting cable (012-0065-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—set mounting hardware; 2—instruction manual (070-0246-00).

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 FM122 Preamplifier, Type FM125 Power Supply, Type 360 Indicator, and Type 160-Series Units. (Note: Because the Type FM122 Preamplifier has high sensitivity, it is recommended that it be mounted at least 4 inches to the left of the Type FM125 Power Supply.)

ORDER PART NUMBER 014-0002-00 ..... $7

The Type RM125 is a mechanically rearranged Type 125 for horizontal mounting in a standard 19" rack. Electrical characteristics are the same as the Type 125.

MECHANICAL SPECIFICATIONS

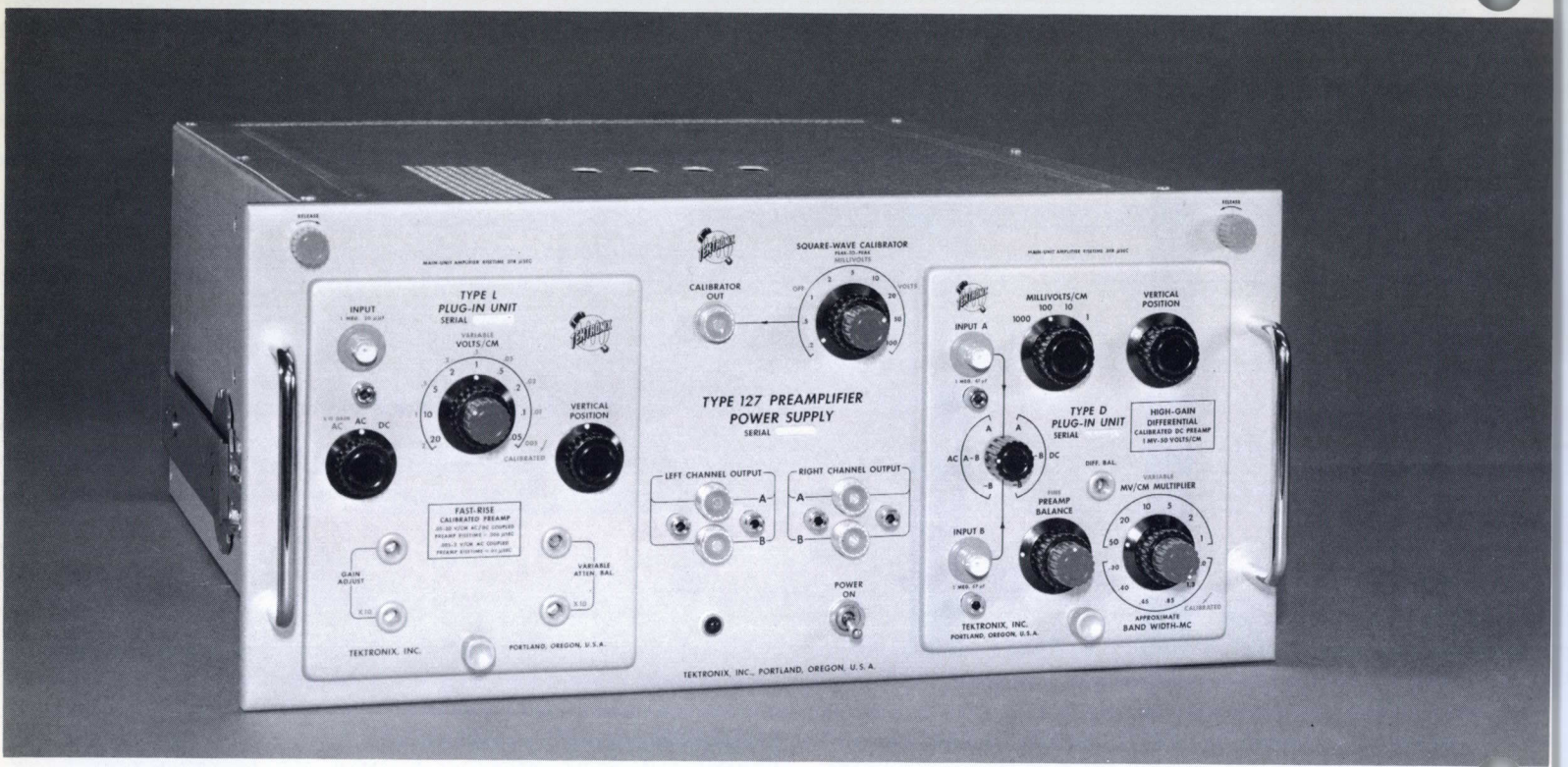
Dimensions are 5¼" high by 19" wide by 13½" deep. Net weight is 19 pounds. Shipping weight is 29 pounds, approx.

TYPE RM125 ..... **$290**

Each instrument includes: 4—36" interconnecting cable (012-0065-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—set mounting hardware; 2—instruction manual (070-0246-00).

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

Type 127 PREAMPLIFIER POWER SUPPLY



The Tektronix Type 127 Preamplifier Power Supply provides operating power to one or any combination of two Tektronix Letter Series or "1" Series Plug-In Units. This permits the operation of Tektronix Plug-Ins separate from the oscilloscope in which they are normally used. For example, a double-differential dual-trace display can be obtained with a Type 127 and two Type 1A7, D, E, or G Plug-In Units—when used in conjunction with an oscilloscope and Type CA, 1A1, or 1A2 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 CA, 1A1, 1A2, 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.

CHARACTERISTICS

BALANCED OUTPUT

The outputs of Plug-In Units powered by the Type 127 are fed through DC-coupled differential amplifier stages and cathode followers to provide a push-pull signal at the output terminals. Risetime of the unit is 18 ns. Push-pull output swing is linear ±3% over a range of ±0.3 volt into 170-Ω 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-Ω output cables are furnished.

ELECTRONIC REGULATION

All DC supply voltages 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 squarewave 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%. Squarewave frequency is approximately 1 kHz.

POWER REQUIREMENT

105 V to 125 V or 210 V to 250 V, 50 to 60 Hz, 450 watts maximum. Unit factory wired for 117 V.

MECHANICAL SPECIFICATIONS

Dimensions are 8¾" high by 19" wide by 21⅝" deep. Net weight is 39½ pounds. Shipping weight is 69 pounds, approx.

TYPE 127 POWER SUPPLY (without plug-in units) . . . $650

Each instrument includes: 4—170-Ω termination (011-0048-00); 4—170-Ω coaxial cable (012-0034-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—pair mounting tracks (351-0085-00); 4—adapter, BNC to UHF (103-0032-00); 4—adapter, UHF to BNC (103-0015-00); 2—instruction manual (070-0284-00).

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 040-0344-00 ..... $11.45

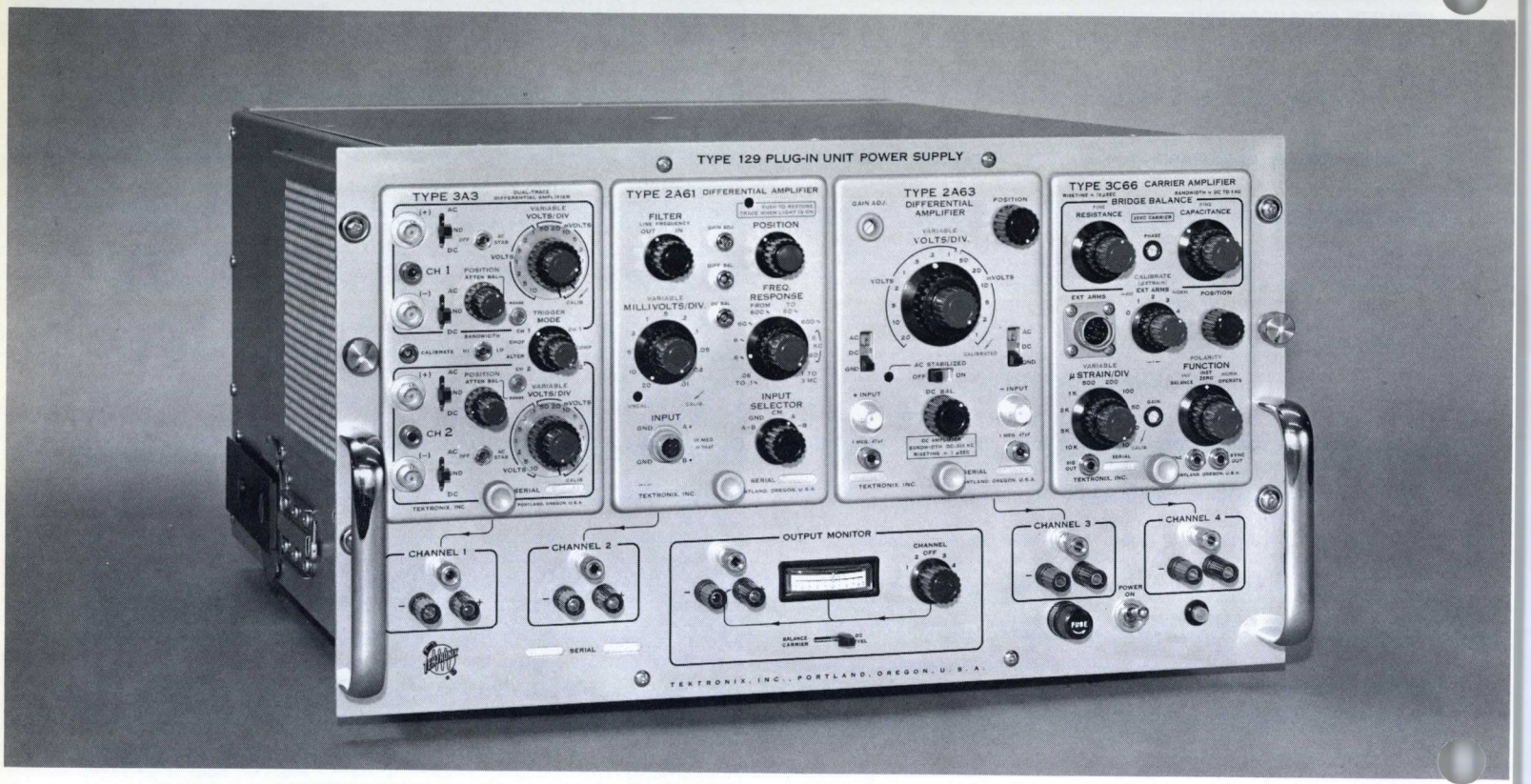
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

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

Plug-In Unit	Maximum Voltage Gain (push-pull output)	Bandwidth	Risetime
B	2 20	DC to 15 MHz 2 Hz to 11 MHz	23 ns 30 ns
CA	2	DC to 17 MHz	20 ns
D	100	DC to 300 kHz at a gain of 100, increasing to 2 MHz at a gain of 2	
E	2000	0.06 Hz to 20 kHz at full gain, increasing to 60 kHz at a gain of 200	
G	2	DC to 15 MHz	23 ns
H	20	DC to 12 MHz	29 ns
K	2	DC to 19 MHz	18 ns
L	2 20	DC to 19 MHz 3 Hz to 17 MHz	18 ns 20 ns
M	5	DC to 15 MHz	23 ns
O	2	DC to 17 MHz	20 ns
Q	*	DC to 6 kHz	60 μs
W	2 100	DC to 16.5 MHz DC to 7.5 MHz	21 ns 46 ns
Z	2	DC to 11 MHz	31 ns
1A1	2 20 200	DC to 19 MHz DC to 17 MHz 2 Hz to 11 MHz	18 ns 20 ns 30 ns
1A2	2	DC to 19 MHz	18 ns
1A7	10,000	DC to 500 kHz	0.7 μs
1S1	50	Equiv to DC to 1 GHz	0.35 ns
1S2	20	Equiv to DC to 3.9 GHz	90 ps

*A 10 μstrain input produces a 100 mV output.

Type 129 PLUG-IN UNIT POWER SUPPLY



. . . a means for out-of-scope use of Tektronix 2 and 3-Series Plug-In Units

The Type 129 Plug-In Supply provides a new way to utilize the 2 and 3-Series Amplifier Plug-In Units in a wide variety of instrumentation systems. With this power supply the amplifiers are useful for driving recording equipment, X-Y plotters, oscilloscopes, or other external indicators having requirements within the plug-in unit specifications.

The Type 129 Plug-In Power Supply is recommended for use with the 2 and 3-Series single channel low-frequency amplifiers.

Multiple-trace plug-ins are usable in the Type 129, but operation should be limited to single-trace modes unless provision is made to operate the multiple-trace switching circuits at a relatively slow rate compatible with the output circuit bandwidth.

The Type 129 powers up to four 2 and 3-Series plug-in units*, singly or in combination. Each plug-in unit fits into a plug-in module having an output connector at the front and rear panels. A selectable cathode-follower or passive circuit card placed between the plug-in unit and the output connector controls the output characteristics. Each channel must use one of these cards in order to function properly with plug-in units except sampling and Type 3C66.

With the cathode-follower plug-in circuit card installed, push-pull, low impedance signals (to approximately 8 V peak to peak) are available via cathode followers at front and rear connectors. An automatic DC level-setting circuit keeps the average DC level of the two connectors close to 0 V. Bandwidth of the cathode-follower output circuit is DC to approximately 1 MHz.

With the passive card installed, a high-impedance push-pull signal is available at the front panel for balancing and a single-ended signal at low impedance (approximately 500 ohms) is available at the rear output connector. Bandwidth of the passive divider output circuit is DC to approximately 100 kHz and is dependent upon the plug-in used.

Each output can be switched to a meter for DC balance indication. This allows quick setting of the plug-in position control. In addition to the output monitor switch, a two-position switch has been included for balancing of the Type 3C66 Carrier Amplifier Plug-In Unit.

**Sampling plug-ins, designed to operate in pairs (one vertical and one sweep), and Spectrum Analyzer or Automatic "Seeking" plug-ins designed to operate in conjunction with another 2 or 3 series plug-in, must be "paired up" in Channels 1 and 2 or 3 and 4.*

TYPICAL APPLICATIONS

PLUG-IN TYPE	INDICATED DEFLECTION FACTOR	APPROXIMATE SYSTEM GAIN		
			With CF Output Card**	
		With Passive Output Card*	Single Ended	Push-Pull
2A60	50 mV/div	50	20	40
2A61	0.01 mV/div (AC)	2.5×10^5	10^5	2×10^5
2A63	1 mV/div (DC)	2.5×10^3	10^3	2×10^3
3A3	100 μV/div	2.5×10^4	10^4	2×10^4
3A5/3B5	1 mV/div to 0.1 μs/div	Automatic/Programmable Amplifier and Time Base for automatic seeking operation.		
3A75	50 mV/div	50	20	40
3C66	10 μstrain/div	0.25 V/μstrain	0.1 V/μstrain	0.2 V/μstrain
3L10	To be used with any 2 or 3-Series Time Base to provide 1 to 36 MHz Spectrum Analysis.			
3S3/3S76	2 mV/div (max)	Sampling Amplifier (must be paired with Sampling Time Base).		
3T4/3T77A	to 0.2 μs/div	Sampling Time Base (must be paired with Sampling Amplifier).		

*Output single ended at rear connector.

**Output at front or rear connector.

In addition to supplying power for the plug-in compartments, the Type 129 provides regulated voltages at a rear-panel connector for powering accessories.

Two low-noise fans provide forced-air cooling for the power supply and plug-in compartments.

Electronically-regulated DC supplies insure stable operation with as much as —10% to +7% variation from design-center line voltage. The instrument is normally wired to operate at a design center of 117 volts, but a multi-tap transformer permits operation at design centers of 110, 117, 124, 220, 234, or 248 volts, 50 to 60 Hz. Power consumption is typically 575 watts maximum under full load.

Dimensions are 10½" high by 19" wide by 23½" deep. Net weight is 46 pounds. Shipping weight is approximately 85 pounds.

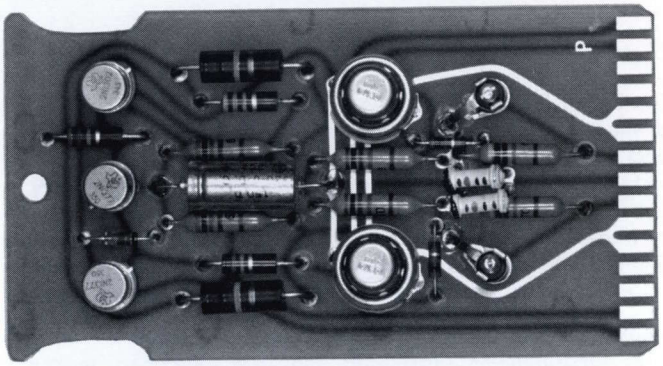
TYPE 129 RACK-MOUNT PLUG-IN UNIT POWER SUPPLY
(without circuit cards) $650

Each instrument includes: 1—right angle power cord (161-0024-00); 1—3 to 2-wire adapter (103-0013-00); 1—pair mounting tracks (351-0085-00); 2—instruction manual (070-0409-00).

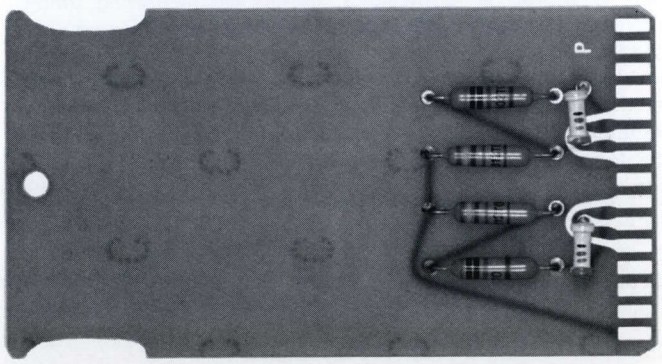
BLANK PLUG-IN CHASSIS

This chassis contains necessary unique mechanical parts for construction of a custom plug-in including frame, blank front panel, blank chassis, 24-pin connector, latch, and small hardware. Electrical components are not included.

BLANK PLUG-IN CHASSIS (Part Number 040-0245-00) .. $25



CATHODE-FOLLOWER CIRCUIT CARD
(Part Number 018-0001-00) $40



PASSIVE DIVIDER CIRCUIT CARD
(Part Number 018-0002-00) $10

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

Type 130 DIRECT-READING L-C METER

FIVE RANGES

MICROHENRYS—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

The Type 130 L-C Meter is a direct-reading reactance meter that measures small reactances in a series mode at a frequency between 125 kHz and 140 kHz. Meter indicates inductance up to 300 μH and capacitance up to 300 $\mu\mu$F (pF). The unknown inductor or capacitor is part of a resonant circuit whose frequency is compared to a 140-kHz reference oscillator. Meter indicates the two oscillators frequency difference but is calibrated directly in μH and $\mu\mu$F.

Measurement of very small reactances is possible by using special measurement procedures that are described in the instrument instruction manual.

The Type 130 is particularly useful for measuring small capacitances in the presence of environmental strays. A front-panel Guard Voltage output connector provides in-phase drive to the environmental capacitance to eliminate strays from the measurement. Thus it is possible to measure vacuum tube interelectrode capacitances. Up to 300 pF environmental capacitance around an unknown capacitor can be guarded if the guard terminal loading is not excessive. Loading limits are outlined in the instruction manual.

Resistance loading compensation is optimized for 117-volts RMS operation. The following loads will not appreciably alter the measurement indication:

Capacitance: as low as 100-kΩ shunt.

Inductance: as low as 20-kΩ shunt, up to 10-Ω series.

Correction tables in instruction manual indicate needed corrections for other values of load resistance. Actual corrections determined for each instrument at time of each recalibration.

**Full scale accuracy of any one range can be improved by special calibration at the time of making a measurement.*

POWER REQUIREMENT

105 V to 125 V or 210 V to 250 V, 50 to 60 Hz, 40 watts. Unit factory wired for 117 V.

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 (010-0003-00); 1—black output lead (012-0014-00); 1—red output lead (012-0015-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0231-00).

PRODUCTION TEST FIXTURE

For use with the Type 130 L-C Meter. Speeds sorting and testing of capacitors and inductors.

Order Part Number 013-0001-00 ..... $5

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 similar capacitance, values of 1 megohm and 0.1 megohm, are provided for the resistance compensation adjustment. A 330-μH standard permits proper adjustments of the inductance ranges.

Order Part Number 015-0001-00 ..... $40

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

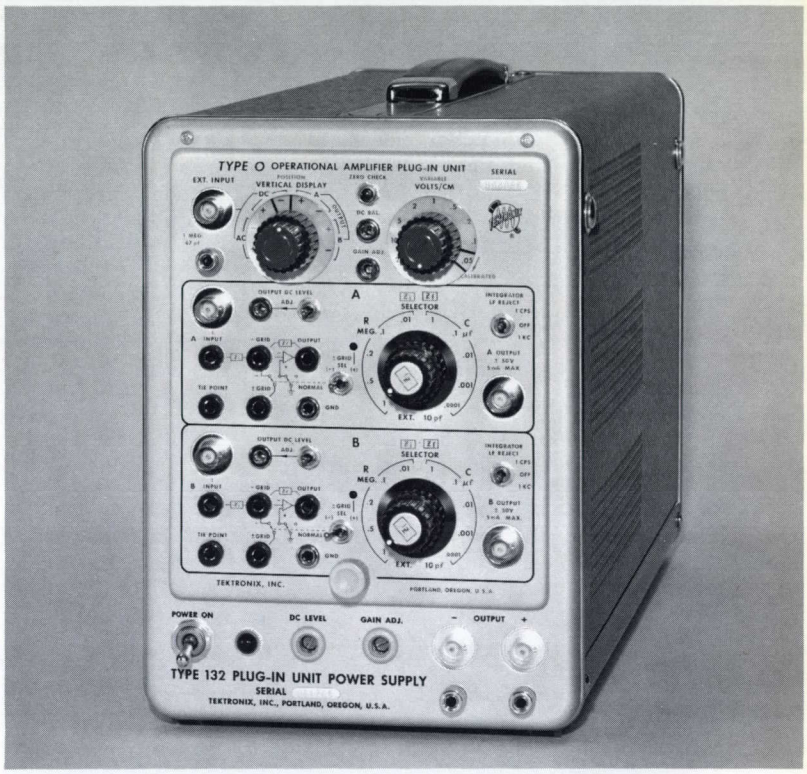
PLUG-IN UNIT POWER SUPPLY Type 132

The Type 132 provides an electronically regulated power supply and amplifier for any Tektronix Letter-Series or "1" Series 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.

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

Bandwidth Specifications are at —3 dB.

BANDWIDTH AND RISETIME

DC to 15 MHz, 23 ns, when used with a Tektronix Type K or Type L Plug-In Unit and terminated with a 50-Ω load.

GAIN

10 (push-pull) when using a Tektronix Plug-In Unit at 50 mV/cm deflection factor, terminated with a 93-Ω load (approximately 5 into 50-Ω load).

OUTPUT TERMINALS

Push-pull, or single-ended + or — outputs on front panel.

OUTPUT VOLTAGE

High impedance load; ±50 V at each connector and ±100 V push-pull. Source impedance is approximately 5000 Ω with ±10 mA available (unterminated). With 93-Ω load, voltage swing is approximately ±1 V.

DUAL-TRACE OPERATION

Back-panel jacks and switching arrangements provide for use of the alternate and chopped modes of operation including blanking, with a Tektronix Type 1A1, 1A2, CA or M Plug-In Unit.

POWER REQUIREMENT

Electronically-regulated DC supplies insure stable operation between 105 and 125 V or between 210 and 250 V, 50 to 60 Hz. Transformer taps allow operation on either range. Instrument factory wired for 117 V. Power consumption approximately 320 watts.

MECHANICAL SPECIFICATIONS

Dimensions are 10¼" high by 7⅛" wide by 19⅛" deep. Net weight is 21½ pounds. Shipping weight is 36 pounds, approx.

TYPE 132 PLUG-IN UNIT POWER SUPPLY

(without plug-in units) $460

Each instrument includes: 2—93-Ω termination, BNC (011-0056-00); 2—93-Ω cable, BNC (012-0075-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0288-00).

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

TYPE 132 TYPICAL PERFORMANCE WITH TEKTRONIX PLUG-IN UNITS

TYPE	Equivalent noise referred to input (P to P)	Performance* Terminated in 93 Ω		Performance* Double terminated 93 Ω	
		System‡ Gain	Band-Width	System‡ Gain	Band-Width
B	200 μV	100 10	10 MHz 14 MHz	50 5	10 MHz 16 MHz
CA	200 μV	10	14 MHz	5	16 MHz
D	100 μV	10 500	2 MHz 300 kHz	5 250	2 MHz 300 kHz
E	35 μV	10,000	See Manual	5000	See Manual
G	200 μV	10	14 MHz	5	16 MHz
H	200 μV	100	11 MHz	50	12 MHz
K	200 μV	10	14 MHz	5	16 MHz
L	200 μV	100 10	14 MHz 14 MHz	50 5	16 MHz 16 MHz
M	200 μV	10	14 MHz	5	16 MHz
O	200 μV	10	14 MHz	5	16 MHz
Q	See Manual		6 kHz		6 kHz
W	200 μV	500 10	7 MHz 14.5 MHz	250 5	7 MHz 16 MHz
Z	200 μV	10	10 MHz	5	10 MHz
1A1	200 μV	 1000 100 10	2 Hz to 10 MHz 14 MHz 14 MHz	 500 50 5	2 Hz to 10 MHz 16 MHz 16 MHz
1A2	200 μV	10	14 MHz	5	16 MHz
1A7	10 μV	Useful to 20,000	500 kHz	Useful to 10,000	500 kHz
1S1	1 mV	250	Equiv to 1 GHz	125	Equiv to 1 GHz
1S2	1 mV	100	Equiv to 3.9 GHz	50	Equiv to 3.9 GHz

*Performance measured with push-pull output of Type 132 connected into CA unit in a Type 545B Oscilloscope.

‡System Gain = Overall gain from input of plug-in to the push-pull output cables.

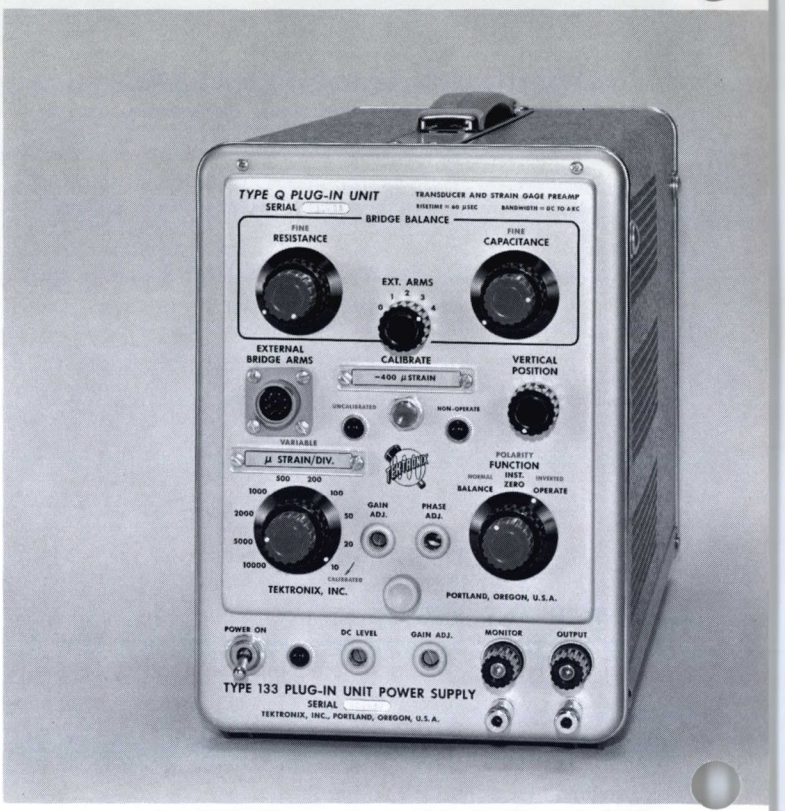
Type 133 PLUG-IN UNIT POWER SUPPLY

The Type 133 provides power to an internal, transistorized amplifier and any Tektronix Letter-Series or "1" Series 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 kHz and the output is ±5 V. The source impedance is 2 Ω. 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 at the same time with an oscilloscope. The indicating instrument should have some response at 25 kHz to enable balancing the bridge in the Type Q Unit, otherwise an external monitor must be used.



BANDWIDTH
DC to 100 kHz. Specified at —3 dB.

GAIN
10, single-ended.

OUTPUT
±5 V (high-impedance load). 1.5 A (short circuit). Source impedance 2 Ω.

DC ADJUST
The output DC operating level adjusts to ground potential.

PHASE INVERSION
An internal switch permits either output polarity.

MONITOR JACK
Allows observation of the output with an oscilloscope without switching cables.

DUAL-TRACE OPERATION
Back-panel jacks and switching arrangements provide for use of the Alternate mode of operation when using a Tektronix Type 1A1, 1A2, CA or M Plug-In Unit.

POWER SUPPLY
Electronic regulation 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 Hz, 320 watts. Unit factory wired for 117 V.

MECHANICAL SPECIFICATIONS
Dimensions are 10¼" high by 7⅛" wide by 19¼" deep. Net weight is 22 pounds. Shipping weight is 36 pounds, approx.

TYPE 133 POWER SUPPLY (without plug-in units) $440
Each instrument includes: 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0290-00).

TYPE 133 TYPICAL PERFORMANCE
Bandwidth Specifications are at —3 dB

PLUG-IN TYPE	EQUIVALENT NOISE REFERRED TO INPUT	OVERALL GAIN (NO LOAD)	BANDWIDTH
B	200 μV	10 100 (AC only)	DC to 100 kHz 2 Hz to 100 kHz
CA	200 μV	10	DC to 100 kHz
D	100 μV	500	DC to 100 kHz
E	35 μV	10,000	See E Unit
G	200 μV	10	DC to 100 kHz
H	200 μV	100	DC to 100 kHz
K	200 μV	10	DC to 100 kHz
L	200 μV	10 100 (AC only)	DC to 100 kHz 3 Hz to 100 kHz
M	200 μV	10	DC to 100 kHz
O	200 μV	10	DC to 100 kHz
Q	See Manual		DC to 6 kHz
Z	200 μV	10	DC to 100 kHz
1A1	200 μV	10 100 1000	DC to 100 kHz DC to 100 kHz 2 Hz to 100 kHz
1A2	200 μV	10	DC to 100 kHz
1A7	10 μV	50,000	DC to 100 kHz
1S1	<1 mV	250	Equiv to DC to 1 GHz
1S2	<1 mV	100	Equiv to DC to 3.9 GHz

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

POWER SUPPLY Type 160A

ELECTRONIC VOLTAGE REGULATION
OUTPUT CONNECTORS

For Sockets in Parallel

Conveniently Located at Rear of Chassis

LARGE LOAD CAPACITY

+300 V DC, Unregulated.

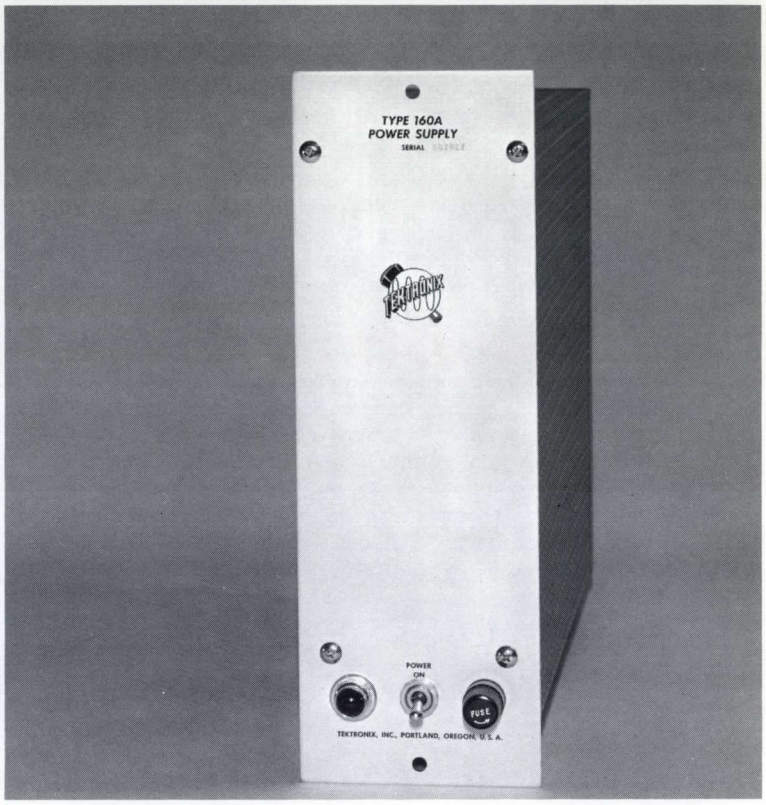
+225 V DC, Regulated, at 225 mA.

+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 A.



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 275 mA, in the absence of any current drawn from the +225-V supply, and 50 mA 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 Hz, 350 watts maximum. Unit factory wired for 117 V.

MECHANICAL

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 12¼″ high by 4⅛″ wide by 14⅜″ deep. Net weight is 20¼ pounds. Shipping weight is 28 pounds approx.

TYPE 160A POWER SUPPLY **$190**

Each instrument includes: 2—inter-unit power cable (012-0016-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 1—set mounting hardware; 1—instruction manual (070-0220-00).

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 12¼″.

Order Part Number 014-0002-00 ..... $7

Blank Panel for above, occupies same panel area as Type 160-Series Generator or Type 360 Indicator Unit.

Order Part Number 333-0157-00 ..... $2.50

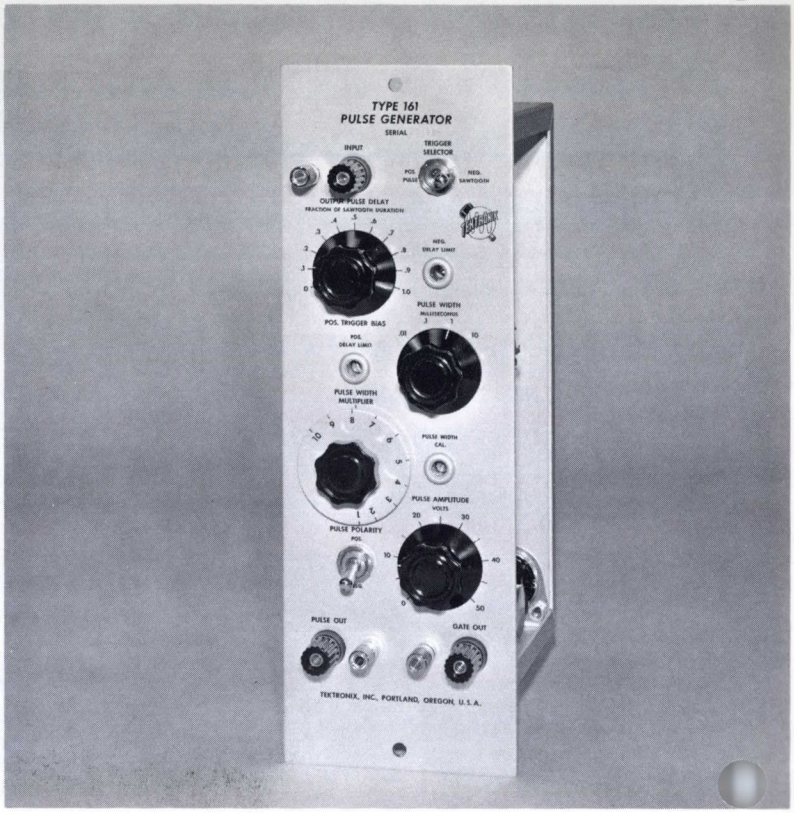
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type 161 PULSE GENERATOR

The Tektronix Type 161 Pulse Generator is designed to supply calibrated rectangular output pulses from zero to 50-V amplitude and 10 μs to 100 ms 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 μs when load capacitance is 10 pF or less, within 0.75 μs for 100 pF or less load capacitance. Negative pulse; within 0.5 μs when load capacitance is 10 pF or less, within 1.5 μs for 100 pF or less load capacitance. Overshoot less than 5%.

Duration—calibrated, variable, 10 μs to 0.1 s.

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, peak to peak 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 peak to peak minimum. Negative-going sawtooth; must include DC bias sufficient to keep voltage positive. Maximum repetition rate, 50 kHz.

POWER REQUIREMENTS

—170 V DC at 17 mA +225 VDC at 22 mA, 6.3 VAC at 1.65 A.

MECHANICAL

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 12¼" high by 4⅛" wide by 6⅜" deep. Net weight is 3½ pounds. Shipping weight is 8 pounds, approx.

TYPE 161 PULSE GENERATOR $130

Each instrument includes: 1—inter-unit power cable (012-0017-00); 1—set mounting hardware; 1—instruction manual (070-0220-00).

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 12¼".

Order Part Number 014-0002-00 ..... $7

Blank Panel for above, occupies same panel area as Type 160-Series Generator or Type 360 Indicator Unit.

Order Part Number 333-0157-00 ..... $2.50

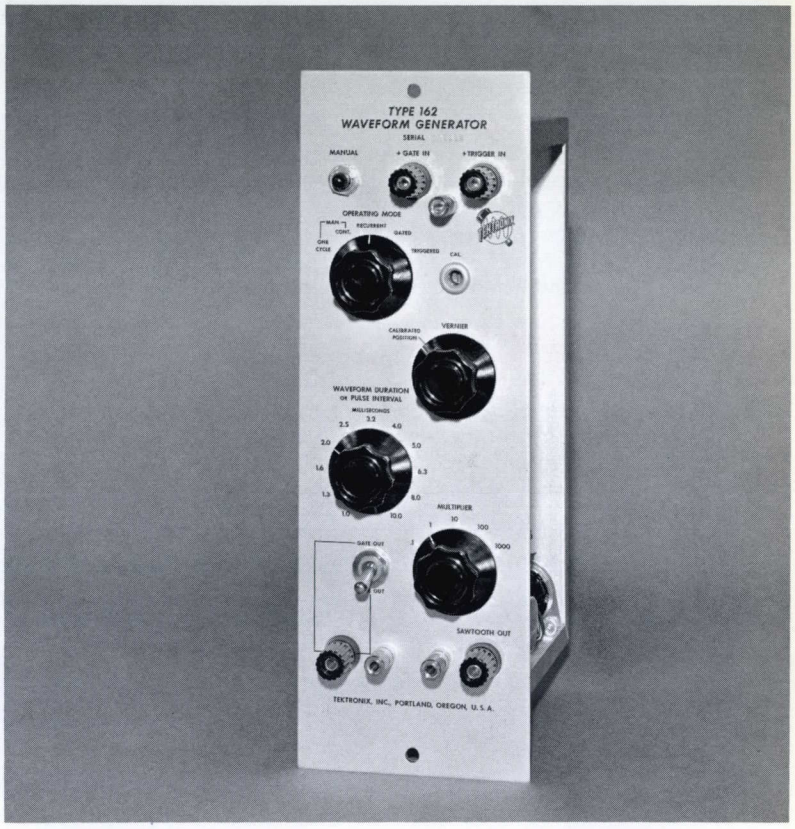
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

WAVEFORM GENERATOR Type 162

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 the Type 161 or Type 163, 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 V, with minimum risetime of 1 μs. Amplitude of the sawtooth waveform decreases linearly from $\geq$ +148 V to $\leq$ +20 V. A calibrated control indicates waveform duration. Shortest pulse duration is approximately 10 μs.

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-μs minimum.
Duration: pulse, 10 μs to 0.05 s, gate and sawtooth, 100 μs to 10 s.
Repetition Rate: 0.1 Hz to 10 kHz, recurrent operation.

AMPLITUDE

Pulse and gate are fixed, positive, 50-V peak to peak minimum. Sawtooth decreases linearly with time from $\geq$ +148 V to $\leq$ +20 V, $\pm$4%.

OUTPUT IMPEDANCE

1000 ohms approximately for all outputs.

TRIGGER REQUIREMENTS

Positive pulse—15 V. Positive gate—8 V. Sinewave—6 V RMS, frequency from 5 Hz to 50 kHz. At frequencies below 5 Hz, the product of RMS voltage time 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 A.

MECHANICAL

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 12¼" high by 4⅛" wide by 6⅜" deep. Net weight is 3½ pounds. Shipping weight is 8 pounds, approx.

TYPE 162 WAVEFORM GENERATOR $130

Each instrument includes: 1—inter-unit power cable (012-0017-00); 1—set mounting hardware; 1—instruction manual (070-0220-00).

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 12¼".
Order Part Number 014-0002-00 . . . . . $7

Blank Panel for above, occupies same panel area as Type 160-Series Generator or Type 360 Indicator Unit.
Order Part Number 333-0157-00 . . . . . $2.50

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

Type 163 FAST-RISE PULSE GENERATOR

The Tektronix Type 163 Fast-Rise Pulse Generator is designed to supply rectangular output pulses from 0 to 25 V in amplitude and 1 μs to 10 ms 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 kHz—with a generated pulse of 1-μs 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 WAVEFORMS

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

OUTPUT CHARACTERISTICS

Risetime—Within 0.2 μs when load capacitance is 10 pF or less, within 0.25 μs for 100 pF or less load capacitance. Overshoot can be adjusted to zero.
Duration—calibrated, variable, 1 μs to 10 ms.
Delay—continuously variable, 0 to 100% of triggering sawtooth duration.
Decay Time—0.2 to 0.5 μs.

AMPLITUDE PEAK TO PEAK

Pulse—calibrated, continuously variable, 0 to 25 V.
Gate—fixed, positive, 25 V minimum.

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 kHz.

POWER REQUIREMENTS

—170 V DC at 25 mA, +225 V DC at 45 mA. 6.3 V AC at 3.6 A.

MECHANICAL

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 12½" high by 4⅛" wide by 6⅜" deep. Net weight is 3½ pounds. Shipping weight is 8 pounds, approx.

TYPE 163 PULSE GENERATOR $130

Each instrument includes: 1—inter-unit power cable (012-0017-00); 1—set mounting hardware; 1—instruction manual (070-0220-00).

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 12¼".

Order Part Number 014-0002-00 ..... $7

Blank Panel for above, occupies same panel area as Type 160-Series Generator or Type 360 Indicator Unit.

Order Part Number 333-0157-00 ..... $2.50

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

TIME-MARK GENERATOR Type 184

- *16 MARKER INTERVALS, 5 SINEWAVE FREQUENCIES*
- *500-MHz SINEWAVE OUTPUT*
- *CRYSTAL-CONTROLLED OSCILLATOR*
- *PUSH BUTTON SELECTION*
- *COOL AND COMPACT*

Unique in having a 500-MHz OUTPUT, the Type 184 is a compact, wide-range time-mark generator. It is CRYSTAL-CONTROLLED and provides 16 MARKER INTERVALS, 5 SINEWAVE FREQUENCIES, and 7 TRIGGER-PULSE INTERVALS.

Marker push buttons are self-cancelling so that when any marker button is pushed, other buttons are automatically released. More than one marker interval (up to two decades apart) can be obtained at one time by pushing the desired buttons simultaneously. Triggers are time-coincident with the corresponding markers.

The Type 184 is transistorized (plus 6 nuvistors) and is frequency controlled by a temperature-stabilized 10-MHz crystal oscillator. This instrument gives you great versatility for many laboratory or production-line applications.

Compact design requires little bench space. The Type 184 can be tilted for convenience, or stacked with other new Tektronix Generators.

OUTPUT CHARACTERISTICS

CRYSTAL-CONTROLLED OSCILLATOR
10 MHz, adjustable to a primary standard; long-term stability, 3 p/m per 24 h; temperature-stabilized.

MARKER OUTPUT
Positive-going markers with 16 intervals of 100 ns to 5 s in 1-5-10 sequence, 1-V minimum amplitude into 50 ohms.

MARKER AMPLIFIER OUTPUT
Positive- or negative-going markers with 14 intervals of 1 μs to 5 s in 1-5-10 sequence, 25-V minimum amplitude into 1 kΩ.

SINEWAVE OUTPUTS
10-ns, 20-ns, and 50-ns sinewave signals at Marker Output connector with 1-V minimum peak to peak amplitude into 50 ohms. 2-ns and 5-ns sinewave signals at HF output connector with 0.3-V minimum peak to peak amplitude into 50 ohms.

TRIGGER OUTPUT
Positive-going pulses with 7 intervals of 1 μs to 1 s in 1-10 sequence, 0.4-V minimum amplitude into 50 ohms.

OTHER CHARACTERISTICS

POWER REQUIREMENTS
94.5 V to 137.5 V or 189 V to 275 V, 50 to 400 Hz. Low or high range selected by rear-panel switch. Approx 40 W power consumption.

MECHANICAL
Foot permits tilting for convenient bench-top operation. Handle hinges out for carrying. Net weight is 13 pounds. Shipping weight is approx 18 pounds. Dimensions are 6" high by 9" wide by 15" deep.

TYPE 184 TIME-MARK GENERATOR **$675**
Each instrument includes: 2—50-Ω BNC cables (012-0057-00); 1—50-Ω BNC termination (011-0049-00); 1—power cord (161-0024-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0499-00).

TYPE 184 TIME-MARK GENERATOR MOD 146B . . **$650**
As above, but less cabinet, for mounting in Rack Adapter.

RACK ADAPTER FOR TYPE 106, 114, 184, and 191

The Rack Adapter converts the latest series of Tektronix Generators for rack mounting. Any combination of two instruments can be mounted (less cabinets) side by side in a 19" rack in only 5¼" of panel height. Additional mounting information on Catalog Instrument Dimensions page. The Rack Adapter provides forced air ventilation and shielding between compartments. A blank panel is included to cover the unused opening when only one Generator is installed.

RACK ADAPTER (016-0086-00) **$125**

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

Type 191 CONSTANT-AMPLITUDE SIGNAL GENERATOR

- *350 kHz to 100 MHz SINEWAVES*
- *5 mV to 5.5 V CONSTANT AMPLITUDE*
- *50 kHz AMPLITUDE REFERENCE*

Frequency is continuously variable and calibrated from 350 kHz to 100 MHz. A 50 kHz reference output is also provided. Amplitude is calibrated from 5 mV to 5 V peak to peak into 50 Ω (twice this amplitude unterminated). Output amplitude is held constant by continuous peak to peak voltage sampling. Source impedance is 50 Ω for all control settings.

Compact design requires little bench space. The Type 191 can be tilted for convenience, or stacked with other new Tektronix Generators.

OUTPUT CHARACTERISTICS

FREQUENCY RANGE
Continuously variable and calibrated in 7 ranges from 350 kHz to 100 MHz, plus 50-kHz reference output. Accuracy within ±2% of selected frequency with output terminated in 50 Ω or unterminated (except ±5% on 0.5-5 V range with output unterminated).

AMPLITUDE RANGE
5 mV to 5 V peak to peak in 3 ranges (10 calibrated steps per range) into 50 Ω termination. Unterminated output is 2X indicated output. Amplitude is continuously variable (uncalibrated) between steps and to 10% over the top of each range (5.5 V terminated or 11 V unterminated).

AMPLITUDE ACCURACY
50-kHz reference output accurate within ±3% of indicated amplitude on 0.5-5 V range, ±4% on 50-500 mV range, and ±5% on 5-50 mV range, into ±1% 50 Ω termination. Accuracy improved with a more accurate termination. Unterminated output is 2X indicated amplitude, at same accuracy.

AMPLITUDE REGULATION INTO 50 Ω
Output amplitude (at output connector or through 5-ns or less of RG8 cable) varies no more than ±3% from actual amplitude at 50 kHz, when frequency is varied from 350 kHz to 100 MHz, except +3%, —5% from 42 MHz to 100 MHz on 5 mV to 50 mV range.

HARMONIC CONTENT
Typically less than 5%.

OTHER CHARACTERISTICS

POWER REQUIREMENTS
103.5 V to 126.5 V or 207 V to 253 V, 50 to 400 Hz. Low or high range selected by rear-panel switch. Approx 25 watts maximum power consumption.

MECHANICAL
Foot permits tilting for convenient bench-top operation. Handle hinges out for carrying. Net weight is approx 13¾ pounds. Shipping weight is approx 18 pounds. Dimensions are 6" high by 9" wide by 15⅝" deep.

TYPE 191 CONSTANT AMPLITUDE SIGNAL GENERATOR $400

Each instrument includes: 1—5-ns cable (017-0502-00); 1—50-Ω GR to BNC in-line termination (017-0083-00); 1—right-angle 3-conductor power cord (161-0024-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0522-00).

TYPE 191 CONSTANT AMPLITUDE SIGNAL GENERATOR MOD 146B $375

As above, but less cabinet, for mounting in Rack Adapter.

RACK ADAPTER FOR TYPE 106, 114, 184, and 191

The Rack Adapter converts the latest series of Tektronix Generators for rack mounting. Any combination of two instruments can be mounted (less cabinets) side by side in a 19" rack, in only 5¼" of panel height. Refer to Instrument Dimension page for mounting information. The Rack Adapter provides forced air ventilation and shielding between compartments. A blank panel is included to cover the unused opening, when only one Generator is installed.

RACK ADAPTER (016-0086-00) $125

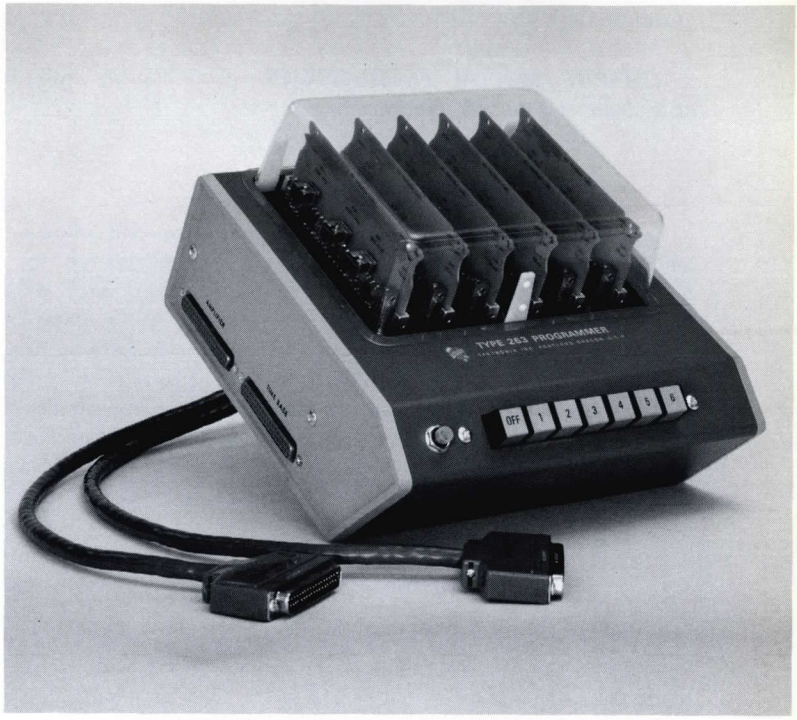
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

EXTERNAL PROGRAMMER Type 263

NEW

The Type 263 Programmer provides the facility for controlling the Type 3A5 and 3B5 Automatic/Programmable Plug-In Units remotely. Push buttons on the front panel of the Programmer select any one of six internal program cards. Each card, after initial set up, establishes the plug-in functions required for a particular test or measurement. More than one programmer can be cascaded for applications requiring more than the six initial measurement set-ups.

The plug-in type program cards are identical, allowing them to be interchanged or arranged in any sequence. New programs are easily established by relocating small jumpers and changing the potentiometer settings on the cards.



PROGRAM CAPABILITIES

Vertical V/div Setting (10 mV/div—50 V/div), Input Coupling (AC, AC Stabilized, DC), X10 Probe; Horizontal Time/Div Settings (5 s to 10 ns), Trigger Mode selection and Coupling (Ext DC, Ext AC, Int AC, AUTO), Trigger Slope; X1, X10, X100 Magnifier for Delayed Sweep, auxiliary SP6T switch function. All established by jumper connection. Vertical and Horizontal Positioning, Trigger Level, and variation of Sweep Delay, by potentiometer setting.

PROGRAM CARDS

Interchangeable, plug-in type.

OUTPUT CABLES

Two 3′ cables with multipin connectors.

CONSTRUCTION

Cast aluminum side plates with wrap-around steel cabinet.

DIMENSIONS

5½″ high x 8⅝″ wide x 9″ deep overall.

NET WEIGHT

Approx 5 lbs. Shipping weight, approx 8 lbs.

TYPE 263 PROGRAMMER **$325**

Each instrument includes: 6—program cards (670-0226-00); 11—leads, electrical (175-0674-00); 2—instruction manual (070-0535-00).

EXTRA PROGRAM CARDS (Order Part Number 670-0226-00) each $30

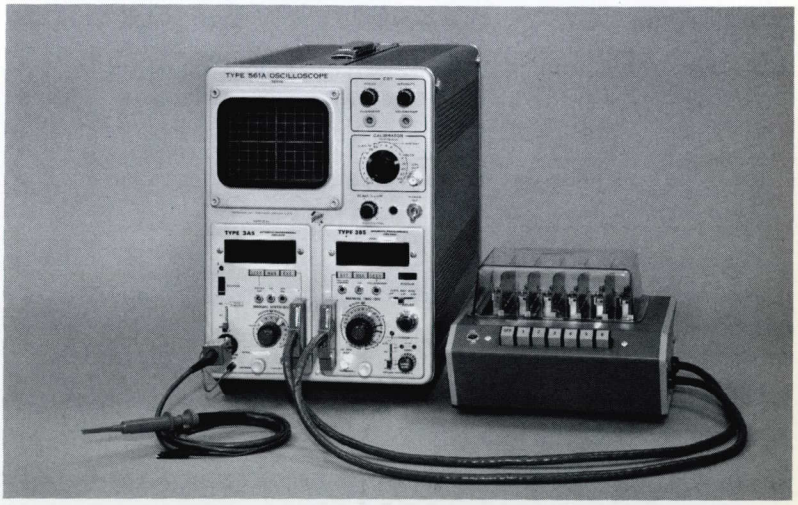
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

PROGRAMMABLE SYSTEM FOR FAST PRODUCTION-LINE TESTING

The Type 561A Oscilloscope* combined with the Type 3A5, 3B5 Plug-In Units and the Type 263 Programmer, offer the ideal system for making production-line measurements quickly and conveniently . . . and with less chance for operator error.

The system allows measurements to be made at the push of a button without changing the manual controls of either plug-in unit. The oscilloscope settings are programmed for a particular measurement and read out in large, lighted indicators on the face of the plug-in units. After the initial program is established, this new system can be operated by personnel with little or no technical training.

*Also Type 564 for storage applications.



SEE THE TYPE 3A5 AND 3B5 PAGES FOR PLUG-IN UNIT INFORMATION

Type 280 TRIGGER COUNTDOWN UNIT

INPUT SIGNAL FREQUENCIES—*30 megahertz to 5 gigahertz.*

OUTPUT SIGNAL FREQUENCIES—*Continuously variable from 15 to 45 megahertz.*

The Tektronix Type 280 Trigger Countdown Unit allows timing systems to be synchronized on frequencies up to 5 gigahertz. It can be used to lower the frequency of the triggering signals to within a range of 15 to 45 megahertz. This permits triggering circuits of timing systems to lock in solidly with high-frequency signals.

By using the Type 280 with a Tektronix sampling oscilloscope, microwave engineers can observe RF signals in the gigahertz range.

CHARACTERISTICS

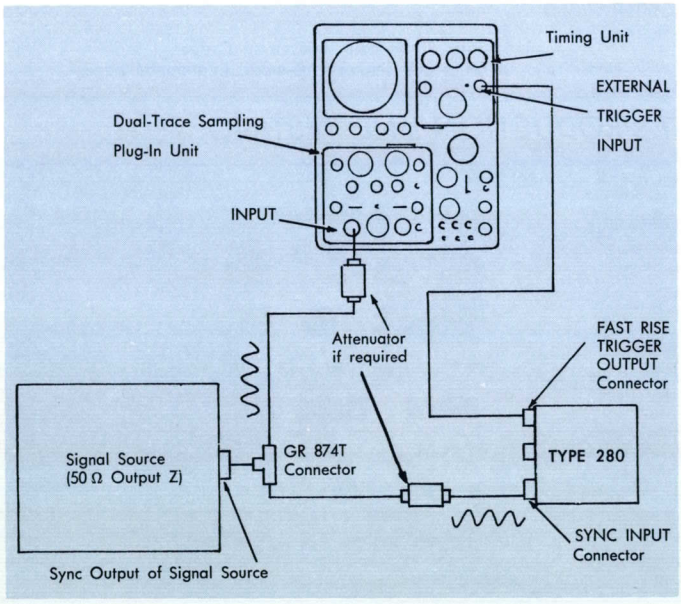
INPUT FREQUENCY is from 30 megahertz to 5 gigahertz.

INPUT SIGNAL VOLTAGE is 50 millivolts to 4 volts peak to peak.

INPUT IMPEDANCE is nominally 50 ohms.

OUTPUT REPETITION is continuously variable from 15 to 45 megahertz.

JITTER is 10 ps, or less than 1% of input signal period, whichever is larger.



Type 280 connected for use with Type 661 Oscilloscope.

TWO OUTPUTS—

LARGE AMPLITUDE TRIGGER OUTPUT is 1.5 volts, nominally 8-ns long, with less than 4-ns risetime, (for use with high-speed conventional oscilloscopes).

FAST-RISE TRIGGER OUTPUT (terminated in 50 ohms) is 150 millivolts, with less than 0.4-ns risetime, decaying with 2-ns time constant, (for use with Type 1S1, 5T1, 5T1A, 3T4, 3T77, or 3T77A and other high-speed sampling oscilloscopes).

AMPLITUDE OF TRIGGER OUTPUT as seen at input connector is $\leq$125 mV peak to peak.

SHIELDING of the Type 280 is adequate to permit operation in areas that have significant RF radiation levels.

POWER REQUIREMENT is 105 V to 125 V or 210 V to 250 V, 50 to 800 Hz 10 W. Transformer taps allow operation on either range. Instrument factory wired for 117 V.

MECHANICAL FEATURES include an aluminum-alloy chassis, die-cast aluminum-alloy top and bottom covers, and steel wrap-around housing. Overall dimensions are 7 3/8" high by 7 5/8" wide by 4 5/8" deep. Net weight is 4 1/2 pounds. Shipping weight is 9 pounds, approx.

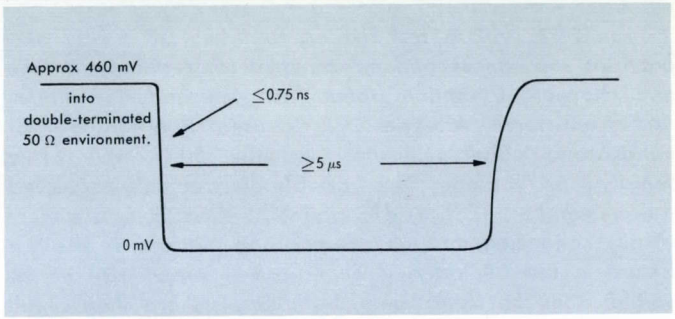
TYPE 280 TRIGGER COUNTDOWN UNIT $265

Each instrument includes: 1—5-ns cable (017-0512-00); 1—3 to 2-wire adapter (103-0013-00); 1—3-conductor power cord, AC (161-0015-00); 2—Instruction Manual (070-0350-00).

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

TIME-DOMAIN REFLECTOMETER PULSER Type 281

This compact current pulse source is designed for use with Tektronix Type 3S76, 4S1, and 1S1 Sampling Units; power is obtained from their probe power connector.



AMPLITUDE
18.5 mA ±1.5 mA.

RISETIME
≤0.75 ns at negative transition.

WIDTH
≥5 μs from negative-going edge to positive-going edge, at 50% amplitude points.

FLATNESS
≤±2% overshoot and ringing following negative-going edge for first 10 ns, 0.5% thereafter.

LOADING EFFECT ON 50-Ω SYSTEM
≤10% reflection (capacitive).

TYPE 281 TDR PULSER $95
Each instrument includes: 2—instruction manual (070-0515-00).

PROBE ADAPTER Type 282

The Type 282 permits the use of conventional high-impedance probes with 50-Ω sampling plug-in units, such as Types 1S1, 4S1, 4S2, 4S2A, and 3S76. Power is obtained from their probe power connector.

With wide-range sampling units such as Types 1S1, or 5T3 Timing Unit and a 4 series sampling vertical unit, one oscilloscope can cover nearly the entire range of signal measurement from power-supply ripple to nanosecond events.

Other advantages include: voltage offset, smoothing, and overload-recovery features of sampling not normally available with a conventional oscilloscope; no loss of DC stability with sampling units; and excellent linearity over entire dynamic range.

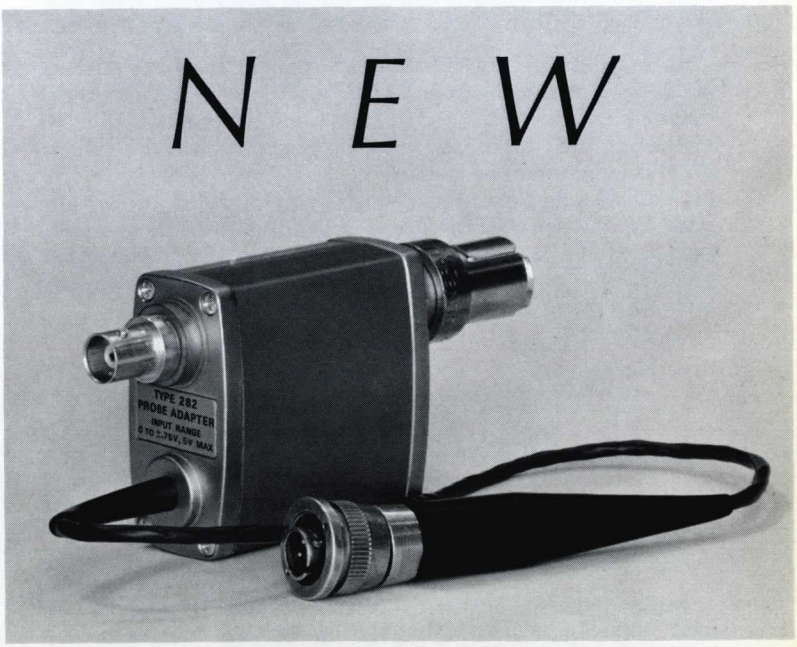
Risetime is ≤3 ns from a 25-Ω source directly into the Type 282 input. Gain is unity ±3%, non-inverting. Dynamic range is up to ±750 mV into 50 Ω. Maximum input is ±5 V.

CHARACTERISTICS REFERRED TO PROBE TIP

Probe	Overall Risetime	Input RC	Dynamic Range	Deflection Factor	Offset
P6008 (10X)	≈4 ns	10 MΩ, 7.5 pF	±7.5 V	20 mV/cm to 2 V/cm	±10 V
P6009 (100X)	≈3.5 ns	10 MΩ, 2.5 pF	±75 V	200 mV/cm to 20 V/cm	±100 V
P6010 (10X)	≈3.5 ns	10 MΩ, 10 pF	±7.5 V	20 mV/cm to 2 V/cm	±10 V
P6011* (1X)	≈12 ns	1 MΩ, 42 pF	±0.75 V	2 mV/cm to 200 mV/cm	±1 V

*Care must be used to avoid exceeding the ±5 V max input limit of the Type 282.

TYPE 282 PROBE ADAPTER $95
Each instrument includes: 2—instruction manual (070-0544-00).



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

Type 292 SEMICONDUCTOR TESTER POWER SUPPLY

Type 292, with a test fixture, furnishes DC power and provides sub-nanosecond environment for reading out time and charge information about fast semiconductor diodes and transistors. A Type 292 is used between a sub-nanosecond pulse generator and the 50-Ω input of a sampling oscilloscope. Two variable electronically-regulated power supplies, TEST VOLTS and BIAS CURRENT, are electrically connected through a supporting platform to the test fixture in use. Polarity of either power supply can be inverted from the front panel; both supplies are short-circuit and open-circuit protected.

A general-purpose unwired plug-in transistor test fixture is shipped with each Type 292. The fixture consists of an etched-circuit board with a transistor socket mounted in the center. Signal connections to the fixture are made through coaxial connectors mounted on the circuit board. A number of isolated tie points are provided on the test fixture board to facilitate wiring of experimental circuits.

Banana-pin jacks at the rear of the Type 292 can be used for two purposes:

1. *Monitoring either the internal TEST VOLTS or BIAS CURRENT supply, or*
2. *Connecting external sources of current and voltage to the test fixture in use.*

Leads from the banana-pin jacks to the test fixture limit externally-supplied currents to 1 ampere or less.

TEST VOLTS POWER SUPPLY supplies fixed DC voltages of 1, 2, 5, 10 and 20 volts, accuracy within ±3% when the variable control is fully clockwise. An uncalibrated variable control allows the voltage of a fixed step to be divided by any factor between 1 and at least 10. Ripple voltage (either polarity) is equal to, or less than, 4 mV peak to peak at any voltage, over a current range of 0-200 mA, for line voltages from 105 to 125 V AC, or 230 to 250 V AC. Maximum short-circuit current is about 400 mA on all ranges.

BIAS CURRENT POWER SUPPLY supplies fixed DC currents in 11 calibrated steps from 0.1 mA to 200 mA, 1-2-5 sequence, accuracy within ±3% when the variable control is fully clockwise. An uncalibrated variable control allows the current of a fixed step to be divided by any factor between 1 and at least 10. Ripple current (either polarity), listed below, applies for any current from about 2 μA to 200 mA, for line voltages from 105 to 125 V AC or 230 to 250 V AC, providing the load on the current supply limits the output voltages to less than 20 volts.

RANGE	RIPPLE
0.1 to 20 mA	less than 5 μA
50 mA	less than 10 μA
100 mA	less than 20 μA
200 mA	less than 100 μA

POWER REQUIREMENTS are from 105 V to 125 V or 210 V to 250 V, 50 to 60 hertz, 30 W. Transformer taps allow operation on either range. Instrument factory wired for 117 V.

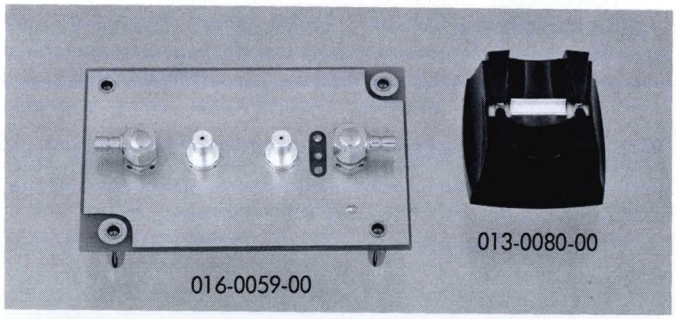
MECHANICAL SPECIFICATIONS include dimensions of 4⅝" high by 8" wide by 10" deep. Net weight is 6¼ pounds, approx. Shipping weight is 12 pounds, approx.

TYPE 292 SEMICONDUCTOR TESTER POWER SUPPLY $325

Each instrument includes: 1—Adapter, 3-wire (103-0013-00); 3—P6040 probe (010-0133-00); 1—Transistor test fixture, unwired (016-0057-00); 1—Power cord (161-0015-00); 2—Instruction Manual (070-0410-00).

OPTIONAL TEST ACCESSORIES

TRANSISTOR TEST FIXTURE, UNWIRED, Part Number 016-0057-00 ..... $20



A special jig is available for testing axial-lead diodes. Contact-resistance problems are minimized by the use of V-shaped jig contacts.

An adapter will be required to mechanically support and electrically connect the diode test jig to the Type 292 platform.

Careful design of the jig and adapter provides high-quality 50-ohm coaxial connections to the diode leads.

TEST JIG ADAPTER, Part Number 016-0059-00 ..... $25
DIODE TEST JIG, Part Number 013-0080-00 ..... $40

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

PROGRAMMABLE PULSE GENERATOR AND POWER SUPPLY Type R293

NEW

PROGRAMMABLE PARAMETERS

- PULSE AMPLITUDE
- PULSE WIDTH
- PULSE REPETITION RATE
- REGULATED VOLTAGE
- REGULATED CURRENT

The Type R293 is a combination pulse generator and power supply which may be used for testing time and charge parameters of semiconductor devices. It can also be used to measure switching and propagation times of micro-logic circuits. The unit is useful in a wide variety of applications which require fast-rise and fast-fall pulses. The remote program capabilities make the instrument useful in production line and systems applications.

Programming is accomplished by analog resistances connected between appropriate program leads. One program resistor per program is required for each of the five programmable functions. The programmed value for each function is linearly related to the conductance of its respective programming resistor. Any single or combination of programmable parameters can be externally programmed, with the remaining parameters controlled from the front panel.

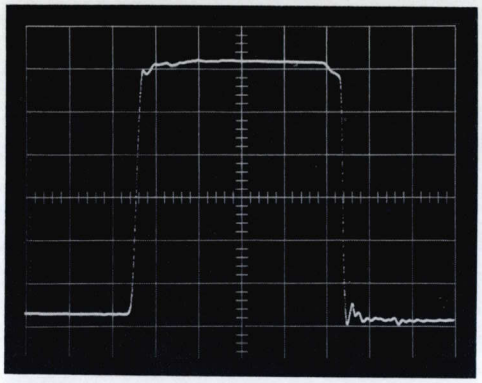
As an example, programmable parameters can be remotely controlled (automatic sequence optional) with the Type 262 Programmer. The Type 567 Readout Oscilloscope and Type 6R1A Digital Unit may be used to display the results of each measurement and indicate whether results are within, above, or below predetermined limits.

Pulse output is via a GR connector. Regulated voltage and regulated current are available via a 4-pin Bendix connector.

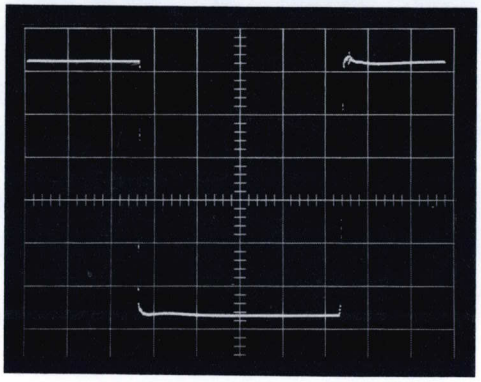
The Type R293 includes slide-out tracks for mounting in a standard 19″ rack, and requires only 3½″ of panel height.

R293

PULSE OUTPUT



+12-volt pulse, 5 ns/cm.



—12-volt pulse, 50 ns/cm.

RISETIME
≤1 ns, at maximum pulse amplitude.

FALLTIME
≤1 ns, at maximum pulse amplitude, ≥20-ns pulse width.
≤2 ns, at maximum pulse amplitude, 5 to 20 ns pulse width.

AMPLITUDE
6 V ±3% to 12 V ±3%, continuously variable. Accuracy* when programmed within ±3% of programmed value.

POLARITY
Positive or negative.

WIDTH
≤2 ns to ≥250 ns, continuously variable. Accuracy* when programmed within ± (3% of programmed value +3 ns). ≤100-ps width jitter.

**Stated program accuracy is with 1% program resistor. Accuracy can be improved by calibrating the instrument for remote programming rather than for front-panel operation.*

REPETITION RATE
≤10 kHz to 100 kHz, —10% +0%. Accuracy* when programmed within ±10% of programmed value.

PRESHOOT
≤1%.

LEADING EDGE CHARACTERISTICS (first 10 ns)
Overshoot ≤3%; rounding ≤5%; ringing ≤3%.

DROOP
≤1%.

TRAILING-EDGE CHARACTERISTICS (last 15 ns)
Rounding ≤5%; ringing ≤10%; overshoot ±5%; storage ≤5%.

FLAT-TOP ABERRATIONS
≤2% (after first 10 ns and before last 15 ns).

PRETRIGGER PULSE
≥ + ½ V into 50 Ω and ≥ + 2 V into open circuit, occurs approximately 200 ns before leading edge of main pulse. 100-ps maximum jitter between pretrigger and leading edge of main pulse.

EXTERNAL TRIGGER REQUIREMENT
≥2-V; DC to 100 kHz; ≤1-μs risetime; 200 V DC maximum.

POWER SUPPLY

REGULATED CURRENT SUPPLY
300 μA to 300 mA (continuously variable) at up to 20 V, positive or negative polarity. Accuracy* within ± (3% of dial reading) +50 μA, or ± (3% of programmed value) +50 μA. ±1% maximum change with line change from 93.5 V to 135 V. Ripple ≤0.5% or 50 μA, whichever is greater. Overshoot ≤0.5% of change in programmed current.

REGULATED VOLTAGE SUPPLY
0 to ±50 V (continuously variable) at up to 200 mA. Accuracy* within ± (2% of dial reading) +25 mV, or ± (3% of programmed value) +25 mV. ±1% maximum change with line change from 93.5 V to 135 V. Ripple ≤0.05% or 5 mV, whichever is greater. Overshoot ≤5% of change in programmed voltage.

OTHER CHARACTERISTICS

POWER REQUIREMENTS
93.5 V to 135 V or 187 V to 270 V, 50 to 400 Hz. Low or high range selected by rear-panel switch. Approx 65 watts maximum power consumption.

MECHANICAL
Net weight is 20½ pounds. Shipping weight is approx 56 pounds. Dimensions are 3½" high by 19" wide by 18" deep.

TYPE R293 PULSE GENERATOR AND POWER SUPPLY $1000

Each instrument includes: 1—5-ns 50-Ω GR cable (017-0502-00); 1—4-pin power supply output connector (131-0268-00); 1—24-pin remote program connector (131-0325-00); 1—set mounting tracks (351-0084-00); mounting hardware; 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0433-00).

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

Bandwidth—DC to 500 kHz.

Deflection Factor—
0.05 V/div to 50 V/div.
4 calibrated steps.
Continuously variable between steps, and to approximately 500 V/div.

Input RC is 1 megohm paralleled by approximately 40 pF.

Maximum Input Voltage—600 V (DC plus peak AC).

HORIZONTAL-DEFLECTION SYSTEM

Waveforms Required—
Positive or negative-going sawtooth, 110 to 150 V excursion within the limits of −95 V to +170 V.
Gate, 45 to 75 V positive same duration as the sawtooth.

Bandwidth—DC to 100 kHz.

POWER REQUIREMENTS—

DC Power
+300 V at 20 mA (unregulated).
+225 V at 35 mA (regulated).
−170 V at 23 mA (regulated).

AC Power
6.3 V at 3.5 A.

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.

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.

OTHER CHARACTERISTICS

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.

CATHODE-RAY TUBE

A flat-faced, 3-inch cathode-ray tube provides a bright trace. Accelerating potential is 1.5 kV. A P2 phosphor is normally supplied.

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 12¼″ high by 4⅛″ wide by 14″ deep. Net weight is 10 pounds. Shipping weight is 17 pounds, approx.

TYPE 360 INDICATOR $270

Each instrument includes: 1—P6006 probe (010-0125-00); 1—inter-unit power cable (012-0016-00); 1—smoke gray filter (378-0550-00); 1—set mounting hardware; 1—instruction manual (070-0220-00).

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.

INPUT ATTENUATOR
Attenuates input signal by a factor of 1X through 500X in 9 calibrated steps.

GAIN STABILITY
±1% over 24-hour period.

BANDWIDTH
5 Hz to 17 MHz (3-dB down) at 1X, 2X, 5X, and 10X attenuator settings.

RISETIME
21 ns.

PROBE POWER
Heater supply—6.3 V DC, 0.2 A.
Plate supply—120 V DC, 10 mA regulated.

The Type 1121 Wide-Band Amplifier is a cascaded-input, low-noise amplifier designed with Tektronix precision, quality, and style. It increases the amplitude of low-level wideband 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-μV peak to peak referred to the input with the input grounded and the INPUT ATTENUATOR control in the 1X position. As in all Tektronix instruments, optimum response is a prime consideration. Risetime is approximately 21 ns, and bandwidth extends from 5 Hz to over 17 MHz with the INPUT ATTENUATOR control in the 1X, 2X, 5X, or 10X 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 attenuation 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 pickup 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 RC 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.

Its compactness, reliability, and low noise level adapt the versatile Type 1121 to almost any application involving wide-band amplification.

CHARACTERISTICS

INPUT RC
Direct, 1 megohm paralleled by approximately 22 pF.

INTERNAL NOISE
Internally generated noise is equivalent to an input signal of 50-μV, peak to peak, maximum, with the INPUT ATTENUATOR at 1X.

GAIN STABILITY
After initial warmup, and under all conditions of line voltage between 105 and 125 V or 210 and 250 V, gain stability of the Type 1121 is ±1% over a 24-hour period.

INPUT ATTENUATION

The turret-type step attenuator permits accurate attenuation of the input level from a net gain factor of 100X to 0.2X in nine calibrated steps: 1X, 2X, 5X, 10X, 20X, 50X, 100X, 200X, and 500X. Attenuator accuracy is ±3%.

BANDWIDTH

With the INPUT ATTENUATOR control in the 1X, 2X, 5X, or 10X positions, transient response is clean over a band extending from 5 Hz to 17 MHz (at —3 dB). Bandwidth for the remaining attenuator positions are as follows: 20X — 5 Hz to 16.5 MHz, 50X — 5 Hz to 16.0 MHz, 100X — 5 Hz to 15.5 MHz, 200X — 5 Hz to 14.0 MHz, and 500X — 5 Hz to 12.0 MHz.

POWER PROBE

The front-panel PROBE POWER socket provides 0.2 A DC at 6.3 V for the heater supply and 10 mA regulated DC at 120 V for the plate supply of a cathode-follower probe. The Tektronix P170CF cathode-follower probe is ideally suited for use with Type 1121 Amplifier.

When a P170CF cathode-follower probe is used with a Type 1121 Amplifier ahead of a Type 540A or 540B-Series Oscilloscope and a Type L Plug-In Unit set at 0.05 V/cm, overall sensitivity of the combination is 1 mV/cm. Bandwidth will be 5 Hz to 16 MHz. At this sensitivity, noise inherent in the Type 1121 will appear as 0.1 cm of deflection. With the L Unit set at 0.005 V/cm, overall sensitivity is 0.1 mV/cm. Bandwidth will be 5 Hz to 15 MHz and inherent noise will appear as 1 cm of deflection. Input RC of the P170CF probe is 12 megohm paralleled by 5 pF.

Other passive probes are available. Please refer to the catalog Accessory pages.

OUTPUT VOLTAGE

Capable of a ±1 V 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 and 93-ohm termination. 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 V or 210 to 250 V.

POWER REQUIREMENT

105 V to 125 V or 210 V to 250 V, 50 to 60 Hz, 150 watts. Unit factory wired for 117 V.

MECHANICAL SPECIFICATIONS

Dimensions are 10¾" high by 7" wide by 15⅞" deep. Net weight is 18½ pounds. Shipping weight is 28 pounds, approx.

TYPE 1121 AMPLIFIER **$465**

Each instrument includes: 1—93-Ω termination, BNC (011-0056-00); 1—93-Ω cable, BNC (012-0075-00); 1—3-conductor power cord (161-0010-00); 1—3 to 2-wire adapter (103-0013-00); 2—instruction manual (070-0204-00).

ACCESSORIES

P170CF CATHODE-FOLLOWER PROBE

The probe alone has an attenuation ratio of 2X. With the 3 included attenuator heads, attenuation is variable from 4X to 4000X. Probe power is obtained directly from the Type 1121 Amplifier. When used with the Type 1121, a 170-ohm termination is required (see below).

P170CF CATHODE-FOLLOWER PROBE (010-0101-00) .. $99.50

170-OHM UHF TERMINATION (011-0048-00) $15.00

COAXIAL OUTPUT CABLE

For applications requiring variable attenuation between steps, a 93-ohm, 42" coaxial output cable (with UHF connectors) that terminates in a variable attenuator can be used.

OUTPUT CABLE (012-0004-00) $13.50

BNC TO UHF ADAPTER

This adapter makes the above accessories with UHF connectors compatible with the Type 1121 Amplifier.

BNC MALE ADAPTER (103-0032-00) $1.70

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

LIMITED-DEMAND INSTRUMENTS

The instruments described on this page are in limited demand, but represent a desirable choice in a few specialized cases. As such, they remain available for you who still have a need for them. Consult your Tektronix Field Engineer for information on other instruments in the Tektronix product line that generally give greater value in application areas presently filled by these instruments.

TYPE 507 OSCILLOSCOPE

The Tektronix Type 507 is a specialized oscilloscope, designed primarily for high-voltage surge testing of power transformers, high-voltage insulators, lightning arrestors, etc. Careful design of circuitry grounding points ensures minimum sensitivity to extraneous disturbances caused by large voltage transients often introduced into the grounding system.

TYPE 507 OSCILLOSCOPE $2900

TYPE 570 CHARACTERISTIC-CURVE TRACER

The Type 570 Characteristic-Curve Tracer presents an accurate graphic analysis of electron-tube characteristics under almost any conceivable operating conditions. The cathode-ray tube display consists of a family of curves with from four to twelve curves per family. The display is accurately calibrated, with current and voltage readings made directly from the CRT screen. All operating parameters are set at the front panel with calibrated controls. A grid-step generator provides stepping from curve to curve. Bias voltage between each step is selected by a calibrated control.

TYPE 570 CURVE TRACER $1100

TYPE 123 PREAMPLIFIER

The Type 123 is a compact, battery-operated amplifier for use in applications where a gain of 100 without AC hum is desired. Bandwidth is within 3 dB from 3 Hz to 25 kHz. Maximum input signal for linear amplification is 0.1 V, peak to peak. Input resistance is 10 MΩ and effective output impedance is 31 kΩ. The unit is powered by internal miniature batteries.

TYPE 123 PREAMPLIFIER $75

TYPE 261 COAXIAL SWITCH

The Type 261 is designed primarily for use as part of an automated electronic-testing system, such as Types 567/6R1A/262. Type 261 will switch signal offset voltages, trigger signals, loads, attenuators, signal delays, and provide ground references for subnanosecond measurements in a 50-ohm environment. Switching functions are performed by eight single-pole double-throw mercury wetted relays. Signal connections are made with 50-ohm coaxial cables with General Radio Type 874 connectors. The Type 261 is rack-mount in configuration, requiring only 5¼ inches of rack height.

TYPE 261 COAXIAL SWITCH $700

TYPE 290 TRANSISTOR SWITCHING-TIME TESTER

The Type 290 permits DC-coupled pulse-response characteristics of fast-switching transistors to be observed and measured on Tektronix oscilloscopes. When driven by a fast-rise pulse generator and monitored on a fast-rise sampling oscilloscope, Type 290 becomes an integral part of a transistor testing system with an overall risetime of less than 1 ns. An Input Monitor connector permits comparison of the input pulse and the transistor collector signal on a dual-trace oscilloscope.

TYPE 290 TRANSISTOR SWITCHING-TIME TESTER . $290

TYPE 291 DIODE SWITCHING-TIME TESTER

The Type 291 with associated Diode Test Jig and Adapter in conjunction with a fast-rise pulse generator (such as Type 109) and a fast-rise oscilloscope, permits measurement of fast-switching diode characteristics. Fast-rise resolution of reverse-recovery measurements depend primarily on the characteristics of the pulse generator and oscilloscope used.

TYPE 291 DIODE SWITCHING-TIME TESTER POWER SUPPLY $185
DIODE TEST JIG (Part Number 013-0080-00) 40
ADAPTER (Part Number 017-0075-00) 55

TYPE R TRANSISTOR-RISETIME UNIT

Type R Plug-In Unit can be used in all Tektronix Type 530, 540, 550, and 580* Series Oscilloscopes. 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 ns, therefore measurement limitations depend mainly on the risetime of the oscilloscope used (to 12 ns with Type 540, 550, and 580* Series Oscilloscopes).

TYPE R PLUG-IN UNIT $325

TYPE S DIODE RECOVERY UNIT

The Type S Plug-In Unit permits display of semiconductor-diode switching characteristics on a Tektronix Type 530, 540, 550, or 580* Series Oscilloscope. Risetime of the overall measurement depends on the oscilloscope used. Calibrated test parameters assure accuracy in measurements of carrier recombination, stored charge, capacitance, and resistance.

TYPE S DIODE RECOVERY UNIT $260

TYPE Z DIFFERENTIAL COMPARATOR UNIT

Type Z Plug-In Unit can be used in all Tektronix Type 530, 540, 550, and 580* Series Oscilloscopes.

The Type Z Plug-In Unit is designed to improve the accuracy of oscilloscope voltage measurements. The unit has three modes of operation: (1) conventional preamplifier, (2) differential-input preamplifier, (3) calibrated differential comparator. Resolution to 0.005% is attainable. In the differential-comparator mode of operation, accurate DC comparison voltages are added differentially to the input waveform via the slide-back technique, providing a vertical scale of up to ±2000 cm.

TYPE Z PLUG-IN UNIT $525

TYPE 500 SERIES SCOPE-MOBILE® CARTS

The Type 500A (without plug-in carrier) and the Type 500/53A (with plug-in carrier factory installed) Scope-Mobile® Carts comprise the Type 500 Series. Both carts have front wheel parking brakes. These carts are designed for supporting a Tektronix Oscilloscope, and provide portability.

TYPE 500A (without plug-in carrier) ..... $ 99.50
TYPE 500/53A (with plug-in carrier) 110.00
PLUG-IN CARRIER (converts 500A to 500/53A) (Part Number 014-0005-00) 10.50

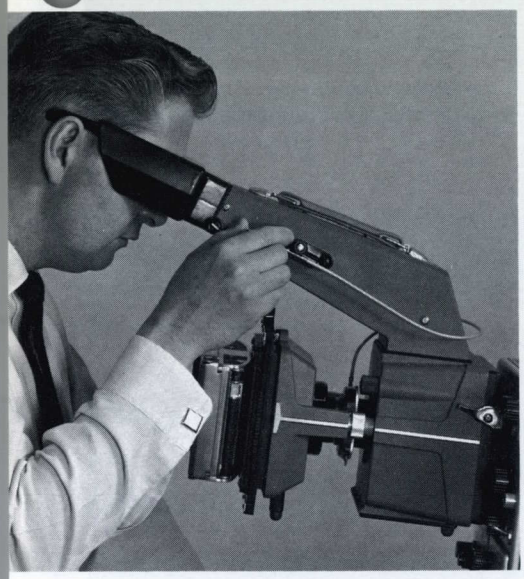
Special trays provide a positioning mount for smaller Tektronix Oscilloscopes.

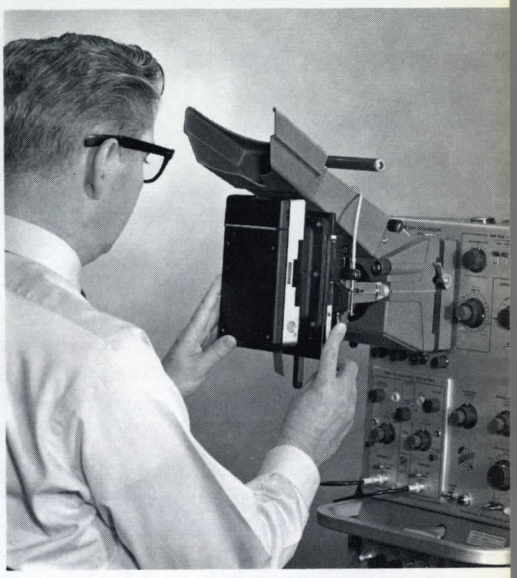
TRAY FOR TYPE 502A (Part Number 436-0019-00) $5.00
TRAY FOR TYPES 503, 504, 515A, 516, 561A, 564 (Part Number 436-0058-00) $5.00

*A Type 81 Adapter is required.

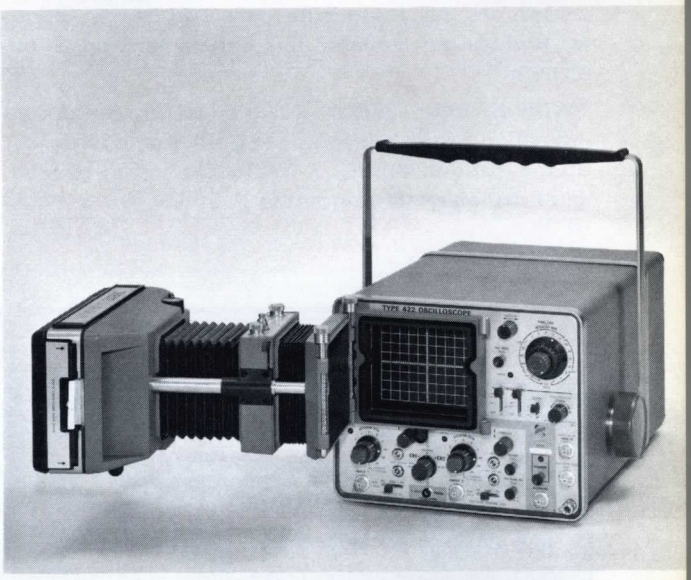
U.S. Sales Prices f.o.b. Beaverton, Oregon
Please refer to Terms and Shipment, General Information page.

Type C-12, C-27 & C-30 Cameras

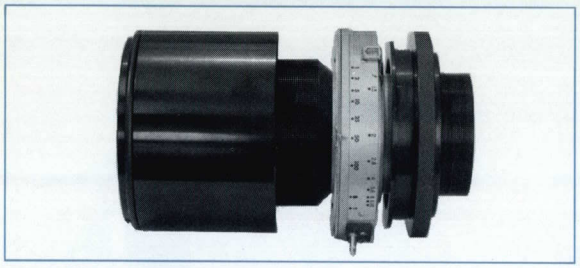




- LIFT-ON MOUNTING AND SWING-AWAY HINGING
- EASILY-ACCESSIBLE CONTROLS
- COMFORTABLE BINOCULAR VIEWING, C-12 & C-27
- ROTATING AND SLIDING BACK, C-12 & C-27
- VARIABLE MAGNIFICATION, C-30



Camera Lenses

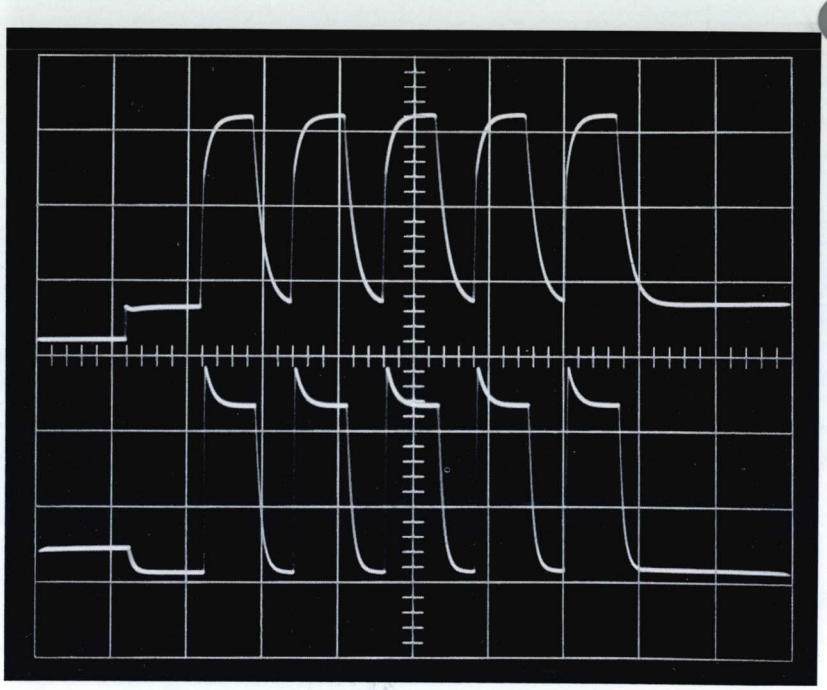


Seven interchangeable lenses are available for C-12 and C-27 Cameras with the Polaroid[1] Land or Graflok[2] Film Backs. The wide range of object-to-image ratios and maximum apertures permits selection of the lens which is best for your application.

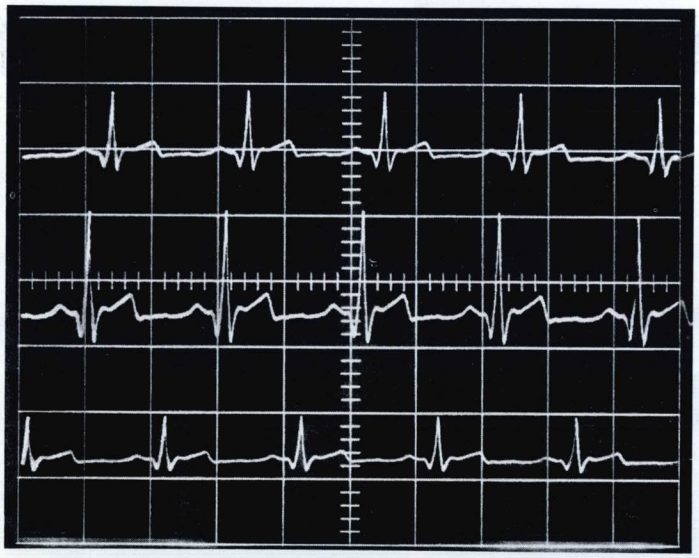
Lens optics are designed to meet the strict requirements of precision oscillography: flat field, low distortion, and high resolution even at maximum aperture openings.

Lenses are set for precise object-to-image ratios in prefocused mounts, for easy interchange in camera.

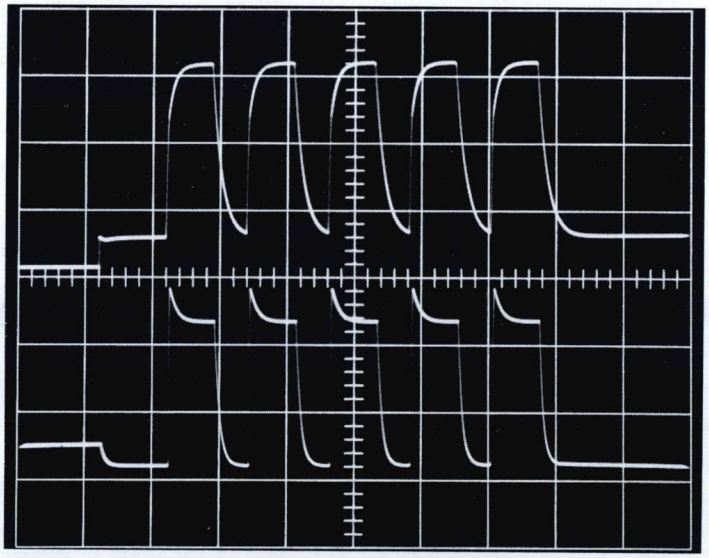
*Writing Rate Factor (WRF) is an arbitrary indication of the relative light-gathering capability of the various lenses. A WRF of 4 indicates four times as much light-gathering ability as a WRF of 1.



PRECISE FULL-SIZE IMAGE & HIGH WRITING RATE —f/1.4, 1:1 object-to-image ratio . . . for precise full-size records . . . measurements can be scaled directly off photograph with maximum resolution . . . WRF* of 7.



GENERAL PURPOSE—f/1.9, 1:0.85 object-to-image ratio . . . image brightness sufficient for most applications. When photographing 8 x 10 cm graticules or 10 x 10 division graticules, such as used on Tektronix Types 570, 575, and 536, we recommend use of the f/1.9, 1:0.85 lens to provide the largest size image that will still fall within the maximum recording area of 3¼ x 4¼ size Polaroid film . . . WRF* of 4.

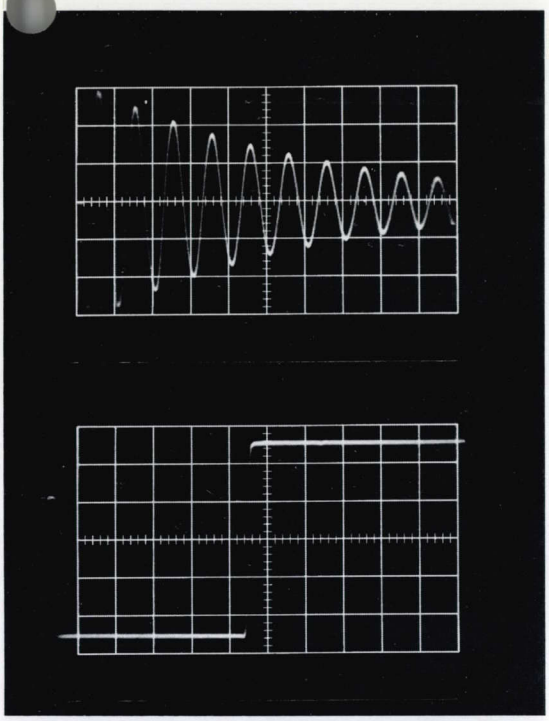


GENERAL PURPOSE—f/1.9, 1:0.9 object-to-image ratio . . . image brightness sufficient for most applications . . . records up to 8 x 10-cm graticule on 3¼ x 4¼ film with maximum resolution . . . WRF* of 4.

[1]Registered Trade-Mark Polaroid Corporation

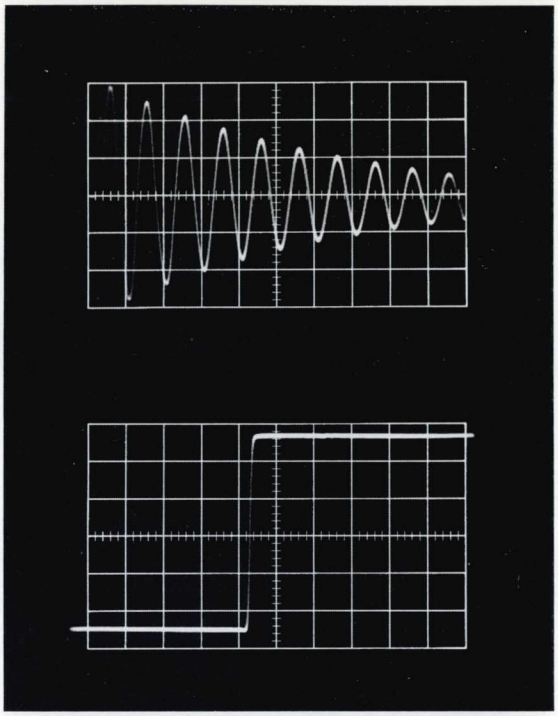
[2]Registered Trade-Mark Graflex, Inc.

Camera Lenses

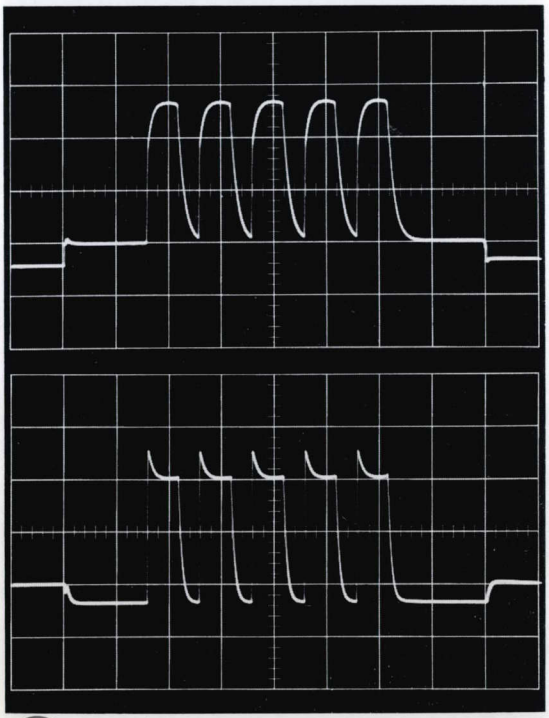


HIGH WRITING RATE—f/1.9, 1:0.5 object-to-image ratio . . . for high writing rate applications such as single-shot photography of fast transients . . . recommended for use with Tektronix Type 519 and 580-Series Oscilloscopes . . . WRF* of 6.

Photographs taken under identical conditions illustrate relative writing-rate capabilities of the f/1.9 and f/1.3 lenses.

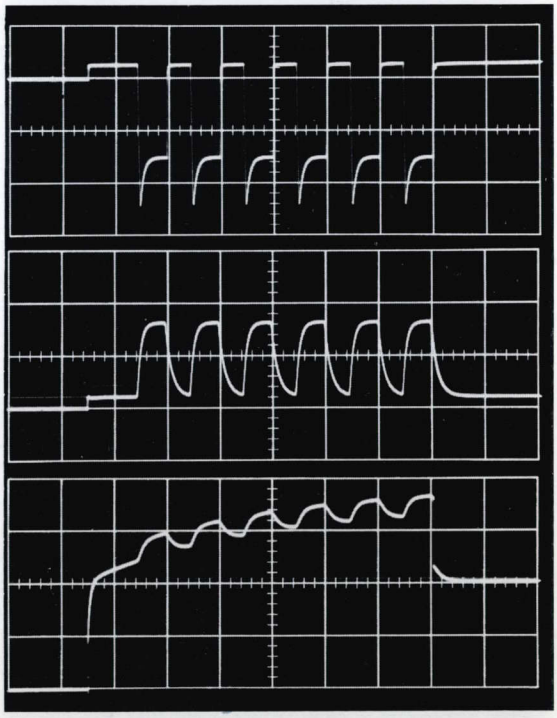


ULTRA-HIGH WRITING RATE—f/1.3, 1:0.5 object-to-image ratio . . . for applications where writing rate is the prime consideration . . . advances the state of the art and in combination with the C-27 Main Frame records higher-speed phenomena than before . . . WRF* of 12.



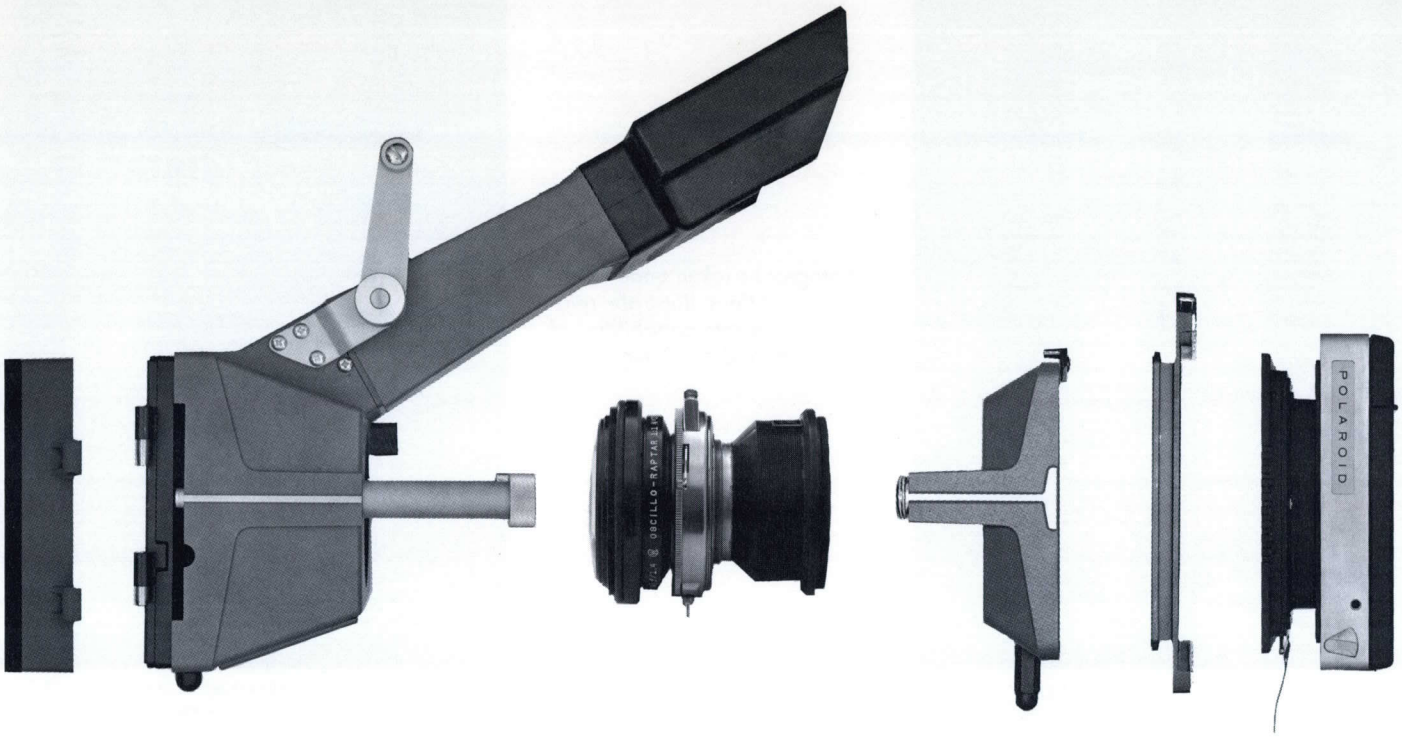
M & LENS ECONOMY—f/4.5, 1:0.7 object-to-image ratio . . . for economy of price and efficient use of film where high writing rate is not required . . . records 3 4 x 10-cm or 2 6 x 10-cm graticule on 3¼ x 4¼ film . . . WRF* of 1.

Photographs on these two pages reproduced in the actual size of the print.



FILM ECONOMY & MEDIUM WRITING RATE —f/1.9, 1:0.7 object-to-image ratio . . . efficient use of film . . . WRF* of 5.

Camera Backs & Film



Tektronix C-12 and C-27 Cameras are designed for maximum flexibility and easy interchange of components. A complete camera consists of an appropriate mounting bezel, main frame assembly, lens, rear frame, rotating slide adapter, and Graflok or Polaroid Land film back. Standard Camera Assemblies are described on the following pages. Variations of the standard cameras (using interchangeable lenses and backs and incorporating a shutter actuator with built-in power supply) are also available as custom cameras. Each component part can be ordered separately for further versatility or for addition to a present Tektronix Trace-Recording Camera. Your nearest Tektronix Field Office or Representative is ready to assist you in your trace-recording needs.

CAMERA BACKS AND FILM

Four different backs are available for Tektronix Trace-Recording Cameras: Polaroid 3¼ x 4¼ Pack Film and Roll Film Backs, and Graflok 4 x 5 and 2¼ x 3¼ Backs. The choice of a Camera Back will depend primarily on (1) the intended use for the photograph, (2) how quickly you want the finished photograph, (3) how large an area you wish to photograph, (4) the magnification factor of the particular lens used, and (5) the size of the positive or negative desired. If you want to obtain a negative from which a number of prints can be made, either Type 55 P/N film (which comes in Polaroid Land 4 x 5, only) or conventional film is quite satisfactory.

With either Polaroid Land or conventional films, the exposable area of the film used by the selected back must be at least as large as the image from the lens. Size will depend on the object-to-image ratio of the camera lens and on the size of the oscilloscope display. For example, the roll film back for 120 or 620 film would probably not be used with a 1:0.9 lens and a 10-cm wide oscilloscope display. This is because the image of the display is 9 centimeters wide and the exposable area (long dimension) of the film is only about 8.25 centimeters. Thus at least 7.5 mm would be cut off of the photograph. The film size should be at least 5 mm larger than the size of the image to allow for normal tolerances in the construction of the Camera Backs and for the position of the film in the back.

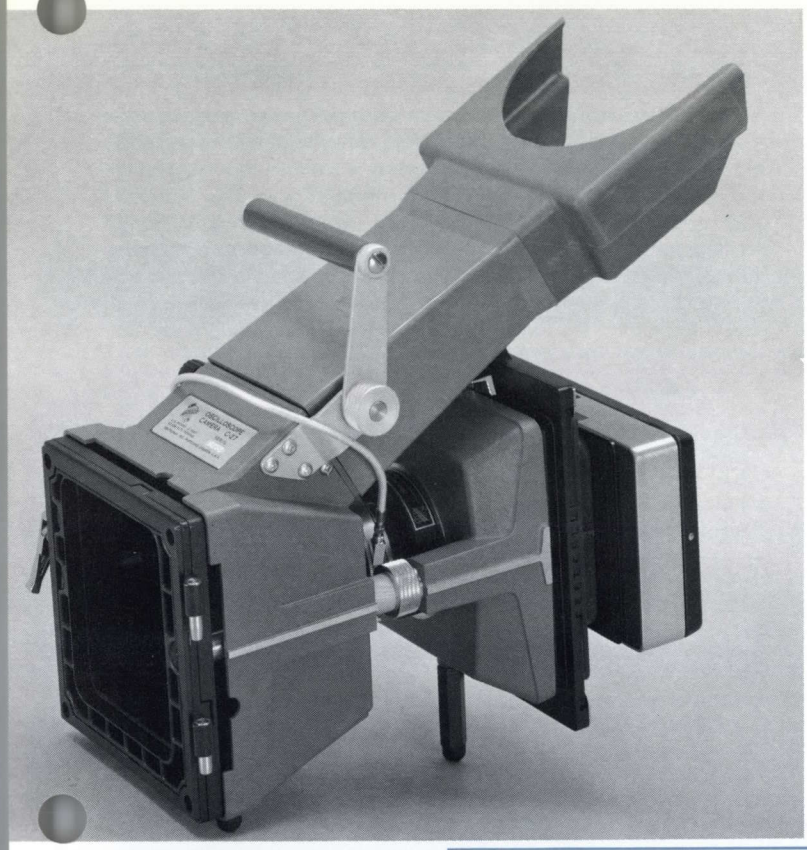
Available film types and film speed are other important considerations in choosing a back, especially where single-shot transients must be recorded. Polaroid Type 47 and Type 107 (roll film and pack film, respectively) each have an ASA equivalent exposure index of 3000. Polaroid Type 410 roll film is especially suited for high-speed photography. It has an ASA equivalent of 10,000. Each film type has 8 exposures, and develops in 10 seconds. Roll-film versions develop inside the film back; pack film develops outside.

Polaroid films can also be used in a Polaroid 4 x 5 film holder with the 4 x 5 Graflok Back. This combination, used with Type 57 film (3000 speed), a 1:1 lens, and a C-27 Main Frame will give full-size records of graticule areas as large as 8 x 10 cm. A Standard C-27 Camera (1:0.85 lens) equipped in the same way will make a complete record of a 10 x 10 cm graticule.

Conventional cut film and 120 roll film can be used with either the 4 x 5 or 2¼ x 3¼ Graflok Back and the proper holder or adapter. A number of film types, manufactured by Eastman Kodak, Agfa, Ansco, and others, are available in both forms, at ASA speeds of from 64 to 1250.

A detailed list of film types and characteristics of these and other films not mentioned here can be obtained from the respective manufacturer.

C-27 Camera



The C-27 Standard Camera combines general-purpose utility and performance in a design compact enough for multiple stacking on 7" Rack-Mount Oscilloscopes.

Direct binocular viewing is featured. For stacking, the viewing tunnel is removed and the carrying handle folded out of the way. The camera frame can be rotated 90° or 180° to view from the top, bottom, or either side. The f/1.9—1:0.85 lens supplied with the Standard C-27 offers an ideal compromise of writing rate and image size (8 x 10-cm on 3¼ x 4¼ film or 10 x 10-cm coverage on 4 x 5 film) in a moderately-priced camera.

The Polaroid Land Pack-Film Back offers convenient loading and picture development outside the camera. Dimensions overall are 13 7/32" high (only 8" with viewing tunnel removed) by 7½" wide by 13 11/32" long (only 12" with viewing tunnel removed). Net weight is 10 pounds. Shipping weight is approximately 14 pounds.

C-27 CAMERA **$420**
Each camera includes: 1—cable release (122-0586-00), 1—focus plate (387-0893-00), 2—instruction manual (070-0383-01).

ROLL-FILM CAMERA identical to the Standard C-27, except a Polaroid Roll-Film Back is substituted for the Pack-Film Back.
C-27-R CAMERA **$420**

ELECTRICALLY-ACTUATED* CAMERA identical to the Standard C-27, but with a shutter actuator and built-in power supply. (See page 247.)
C-27-S CAMERA **$575**

ELECTRICALLY-ACTUATED* CAMERA with Roll-Film Back combines features of the C-27-R and C-27-S, above.
C-27-RS CAMERA **$575**

All cameras are sold less mounting bezel; order from page 248.

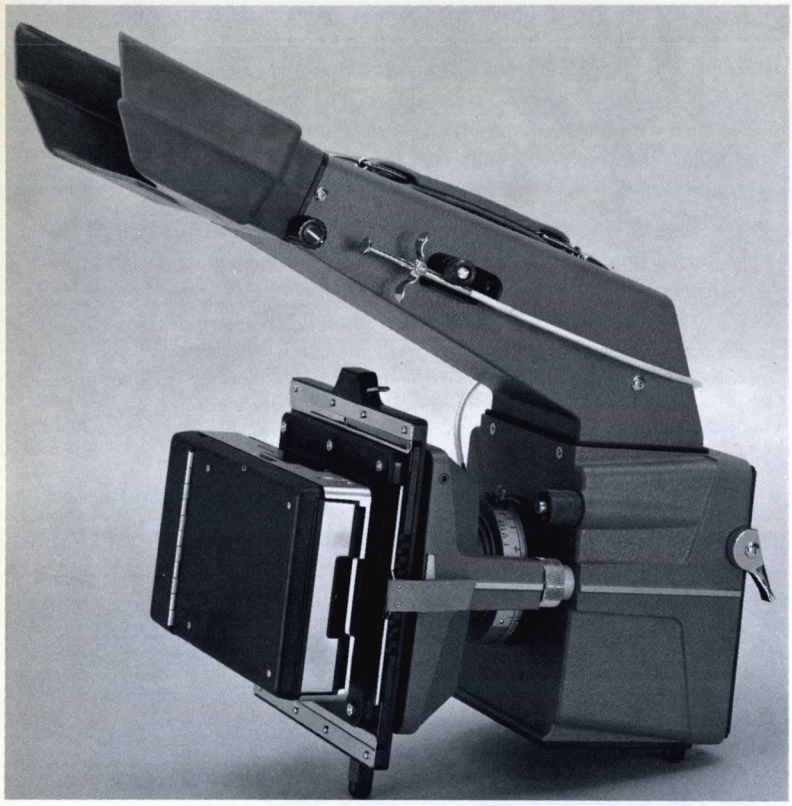
CUSTOM C-27 CAMERAS

LENS (Writing rate factor compared to Standard f/1.9, 1:0.85 lens)	SHUTTER ACTUATOR and BUILT-IN POWER SUPPLY*	POLAROID FILM BACK	ORDER NUMBER	PRICE
FILM ECONOMY & MEDIUM WRF—f/1.9, 1:0.7 Records two 6 x 10-cm, three 4 x 10-cm or one 10 x 10 cm graticule on 3¼ x 4¼ film. Writing rate factor 1.25X Standard Lens.	No	Pack Film	C-27-547	$440
		Roll Film	C-27-547 R	440
	Yes	Pack Film	C-27-547 S	595
		Roll Film	C-27-547 RS	595
GENERAL-PURPOSE—f/1.9, 1:0.9 Records an 8 x 10-cm graticule on 3¼ x 4¼ film. Writing rate factor same as Standard Lens.	No	Pack Film	C-27-548	420
		Roll Film	C-27-548 R	420
	Yes	Pack Film	C-27-548 S	575
		Roll Film	C-27-548 RS	575
HIGH WRITING RATE—f/1.9, 1:0.5 Records fast-writing displays such as single-shot transients. Writing rate factor 1.5X Standard Lens.	No	Pack Film	C-27-549	460
		Roll Film	C-27-549 R	460
	Yes	Pack Film	C-27-549 S	615
		Roll Film	C-27-549 RS	615
FILM & LENS ECONOMY—f/4.5, 1:0.7 Records two 6 x 10-cm or three 4 x 10-cm graticules on each film. Writing rate factor 0.25X Standard Lens.	No	Pack Film	C-27-550	365
		Roll Film	C-27-550 R	365
PRECISE FULL-SIZE IMAGE & HIGH WRITING RATE—f/1.4, 1:1. Records full-size image of 10 x 10-cm graticule (on 4 x 5 film with Graflok Back). Writing rate factor 1.75X Standard Lens.	No	Pack Film	C-27-608	535
		Roll Film	C-27-608 R	535
	Yes	Pack Film	C-27-608 S	690
		Roll Film	C-27-608 RS	690
ULTRA-HIGH WRITING RATE—f/1.3, 1:0.5 Records two 6 x 10-cm graticules on each film. Writing rate factor 3X Standard Lens.	No	Pack Film	C-27-662	585
		Roll Film	C-27-662 R	585
	Yes	Pack Film	C-27-662 S	740
		Roll Film	C-27-662 RS	740

Any C-27 Standard or Custom Trace-Recording Camera can be ordered less back. Use suffix 'G' after the Order Number and deduct $80 from the price. 4 x 5 and 2¼ x 3¼ Graflok Backs and accessories are shown on page 249.

***Power supplies are normally wired for 115 V. For 230 V add suffix 'B' to the Order Number. Price for either is the same.**

C-12 Camera



The C-12 Standard Camera is ideally suited for general-purpose trace recording. A beam-splitting mirror provides the operator with an on-axis binocular view of the CRT display, and also allows use of the Projected Graticule accessory (see next page). The f/1.9—1:0.9 lens supplied with the Standard C-12 offers the ideal compromise of writing rate and image size (up to 8 x 10 cm coverage) in a moderately-priced camera. The Polaroid Land Pack-Film Back offers convenient loading and picture development outside the camera. Dimensions overall 15⅜" high by 7½" wide by 17¼" long. Net weight is 12¾ pounds. Shipping weight is approximately 15 pounds.

C-12 CAMERA $450

Each camera includes: 1—cable release (122-0586-00), 1—focus plate (387-0893-00), 2—instruction manual (070-0383-01).

ROLL-FILM CAMERA identical to the Standard C-12, except a Polaroid Roll-Film Back is substituted for the Pack-Film Back.

C-12-R CAMERA $450

ELECTRICALLY-ACTUATED* CAMERA identical to the Standard C-12, but with a shutter actuator and built-in power supply.

C-12-S CAMERA $605

ELECTRICALLY-ACTUATED* CAMERA with Roll-Film Back combines features of the C-12-R and C-12-S, above.

C-12-RS CAMERA $605

All cameras are sold less mounting bezel; order from page 248.

CUSTOM C-12 CAMERAS

LENS (Writing rate factor compared to Standard f/1.9, 1:0.9 lens)	SHUTTER ACTUATOR and BUILT-IN POWER SUPPLY*	POLAROID FILM BACK	ORDER NUMBER	PRICE
FILM ECONOMY & MEDIUM WRF—f/1.9, 1:0.7 Records two 6 x 10-cm or three 4 x 10-cm graticules on each film. Writing rate factor 1.25X Standard Lens.	No	Pack Film	C-12-547	$470
		Roll Film	C-12-547 R	470
	Yes	Pack Film	C-12-547 S	625
		Roll Film	C-12-547 RS	625
HIGH WRITING RATE—f/1.9, 1:0.5 Records fast-writing displays such as single-shot transients. Writing rate factor 1.5X Standard Lens.	No	Pack Film	C-12-549	490
		Roll Film	C-12-549 R	490
	Yes	Pack Film	C-12-549 S	645
		Roll Film	C-12-549 RS	645
FILM & LENS ECONOMY—f/4.5, 1:0.7 Records two 6 x 10-cm or three 4 x 10-cm graticules on each film. Writing rate factor 0.25X Standard Lens.	No	Pack Film	C-12-550	395
		Roll Film	C-12-550 R	395
PRECISE FULL-SIZE IMAGE & HIGH WRITING RATE—f/1.4, 1:1 Records full-size image of 8 x 10-cm graticule (on 4 x 5 film with Graflok Back). Writing rate factor 1.75X Standard Lens.	No	Pack Film	C-12-608	565
		Roll Film	C-12-608 R	565
	Yes	Pack Film	C-12-608 S	720
		Roll Film	C-12-608 RS	720
ULTRA-HIGH WRITING RATE—f/1.3, 1:0.5 Where writing rate is prime consideration Records two 6 x 10-cm graticules on each film. Writing rate factor 3X Standard Lens.	No	Pack Film	C-12-662	615
		Roll Film	C-12-662 R	615
	Yes	Pack Film	C-12-662 S	770
		Roll Film	C-12-662 RS	770
GENERAL-PURPOSE—f/1.9, 1:0.85 Complete 8 x 10-cm graticule is always positioned within exposable area of 3¼ x 4¼ film. Writing rate factor same as Standard C-12.	No	Pack Film	C-12-692	450
		Roll Film	C-12-692 R	450
	Yes	Pack Film	C-12-692 S	605
		Roll Film	C-12-692 RS	605

Any C-12 Standard or Custom Trace-Recording Camera can be ordered less back. Use suffix 'G' after the Order Number and deduct $80 from the price. 4 x 5 and 2¼ x 3¼ Graflok Backs and accessories are shown on page 249.

***Power supplies are normally wired for 115 V. For 230 V add suffix 'B' to the Order Number. Price for either is the same.**

Projected Graticule for the C-12 Camera

The Projected Graticule eliminates parallax, one of the most common problems in viewing and photographing waveforms on an external graticule.

Parallax is the apparent displacement of the trace in relation to the graticule. Error is introduced since the graticule and CRT phosphor are on different planes.

To eliminate parallax, a virtual image of the graticule is presented at the CRT phosphor plane, as viewed by the operator and as projected to the camera film plane.

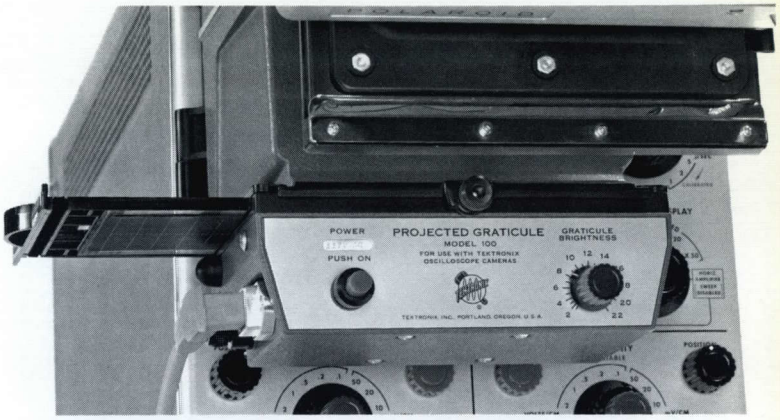
Special graticules, reference waveforms, or any image that can be recorded on a film transparency, can be superimposed on the CRT display. The graticule is held in a slide assembly and is easily slipped in and out of the Projected Graticule case, making possible rapid change of graticules. The included slide assembly has a clear window. Assemblies can be obtained (see below) in several colors to match or contrast the projection with the CRT phosphor.

The projected graticule provides up to an 8 x 10-cm projection, a portion of which can be used for write-in data.

The light source is indexed in approx ½ f stop increments for use as a film exposure guide. This source can also be used for precise prefogging of film for increased sensitivity in fast writing-rate applications.

Operates on 90 to 130 V, or 180 to 260 V, 50 to 440 Hz.

Although the Projected Graticule case is small (it adds only 2¼" to camera height), clearance problems exist with the Type 81 Adapter and a few plug-in unit/probe combinations. If in doubt about compatibility, please consult your Tektronix Field Office or Representative.



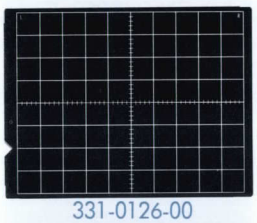
PROJECTED GRATICULE for 115 volts (016-0204-00) $160
PROJECTED GRATICULE for 230 volts (016-0234-00) $160

Includes: 1—power cord (161-0015-00); 1—3 to 2-wire adapter (103-0013-00); 1—graticule, 4 x 10 cm with write-in area and short minor lines (331-0117-00); 1—graticule, 6 x 10-cm with write-in area and short minor lines (331-0111-00); 1—graticule, 8 x 10 cm without write-in area, but with full minor lines (331-0119-00); 1—graticule mask, 4 x 10 cm (331-0118-00); 1—graticule mask, 6 x 10 cm (331-0116-00); 1—instruction manual (070-0383-01).

GRATICULE SLIDE ASSEMBLIES ..... $3 each

Clear Window 122-0659-00	Green Window 122-0668-00
Blue Window 122-0667-00	Amber Window 122-0669-00

OPTIONAL GRATICULES and MASKS ..... $0.85 each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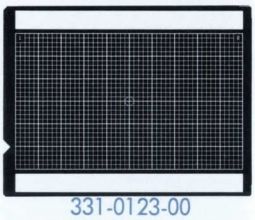
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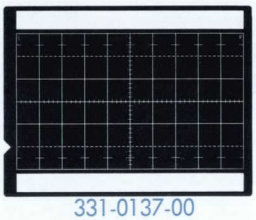
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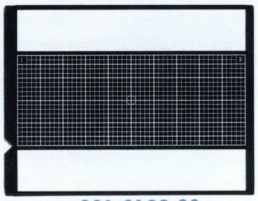
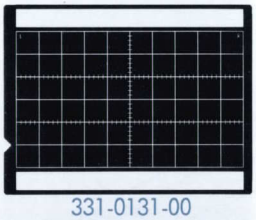

331-0122-00

6 x 10 cm Mask
331-0116-00

331-0119-00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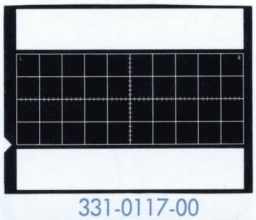
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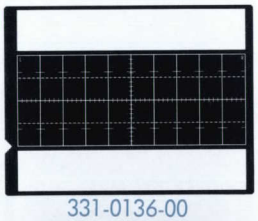
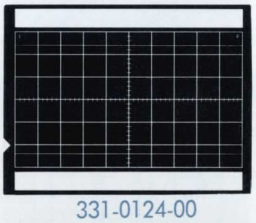

331-0136-00

4 x 10 cm Mask
331-0118-00

331-0130-00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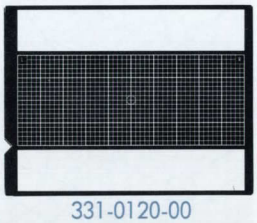
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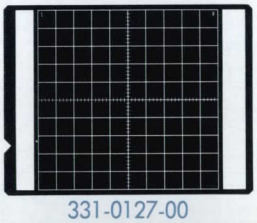
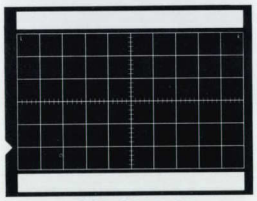

331-0127-00

10 x 10 div Mask (for Type 570, 575, 536)
331-0129-00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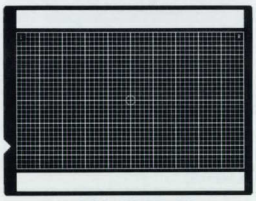
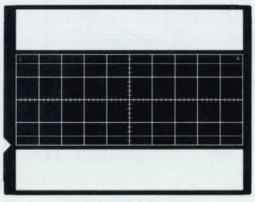
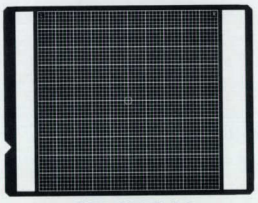
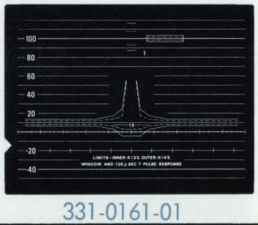

331-0125-00

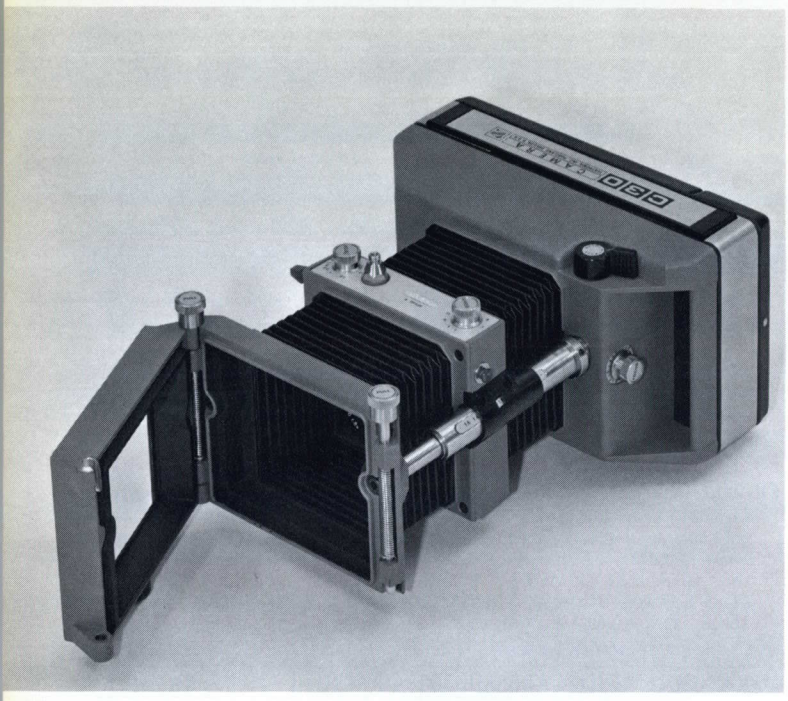

331-0121-00

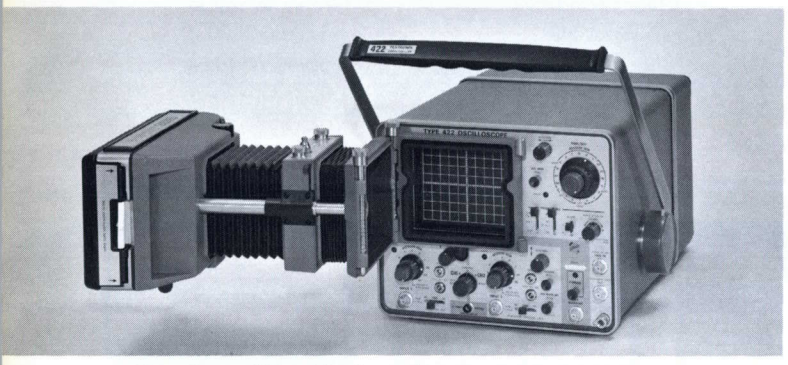

331-0128-00



331-0161-01

C-30 Camera





The Type 422 with the Tektronix C-30 Camera.

The C-30 is a compact, light weight camera which mounts directly to Tektronix Type 422 and 453 Oscilloscopes. Optional bezels are available for other oscilloscopes.

f STOPS
1.9, 2.8, 4, 5.6, 8, 11 and 16.

SHUTTER SPEEDS
T and B and seven shutter speeds from 1 second to 1/50 second.

MAGNIFICATION
Variable in indexed steps of 1.5, 1.4, 1.3, 1.2, 1.1, 1.0, 0.9, 0.85, 0.8 and 0.7. At 1:0.7 magnification, an 8 x 10-cm or 10 x 10-div graticule can be recorded in its entirety.

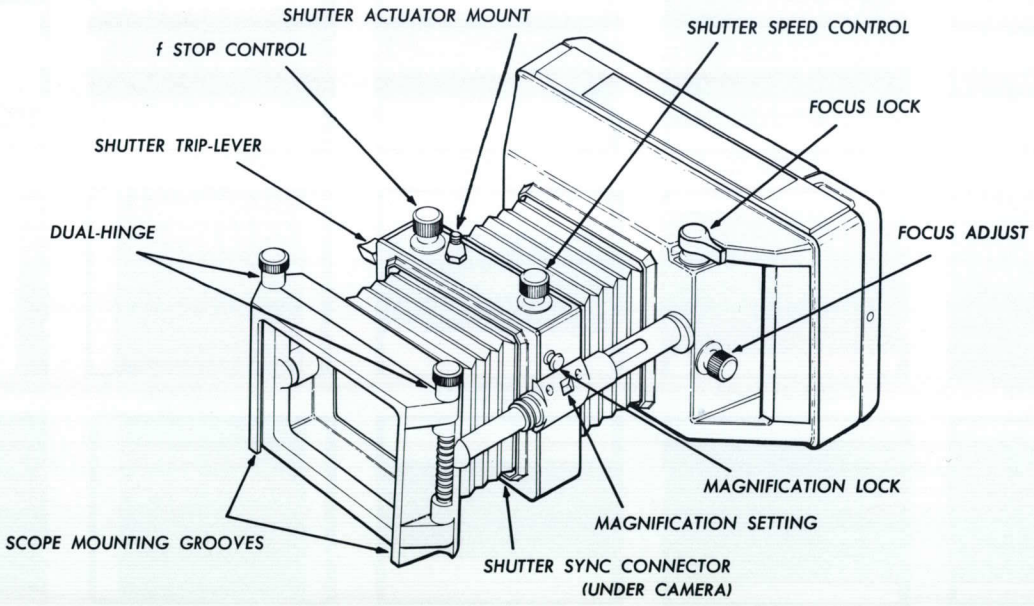
LENS
57-mm, f/1.9 oscilloscope recording lens. Custom designed for high performance, comparable to lenses used with other Tektronix cameras. Writing rate factor (at 1:0.7 mag) equal to C-12 standard f/1.9 1:0.9 lens.

FILM TYPE
Accepts Polaroid Type 107 film (3000 speed). Film develops outside camera in about 10 seconds.

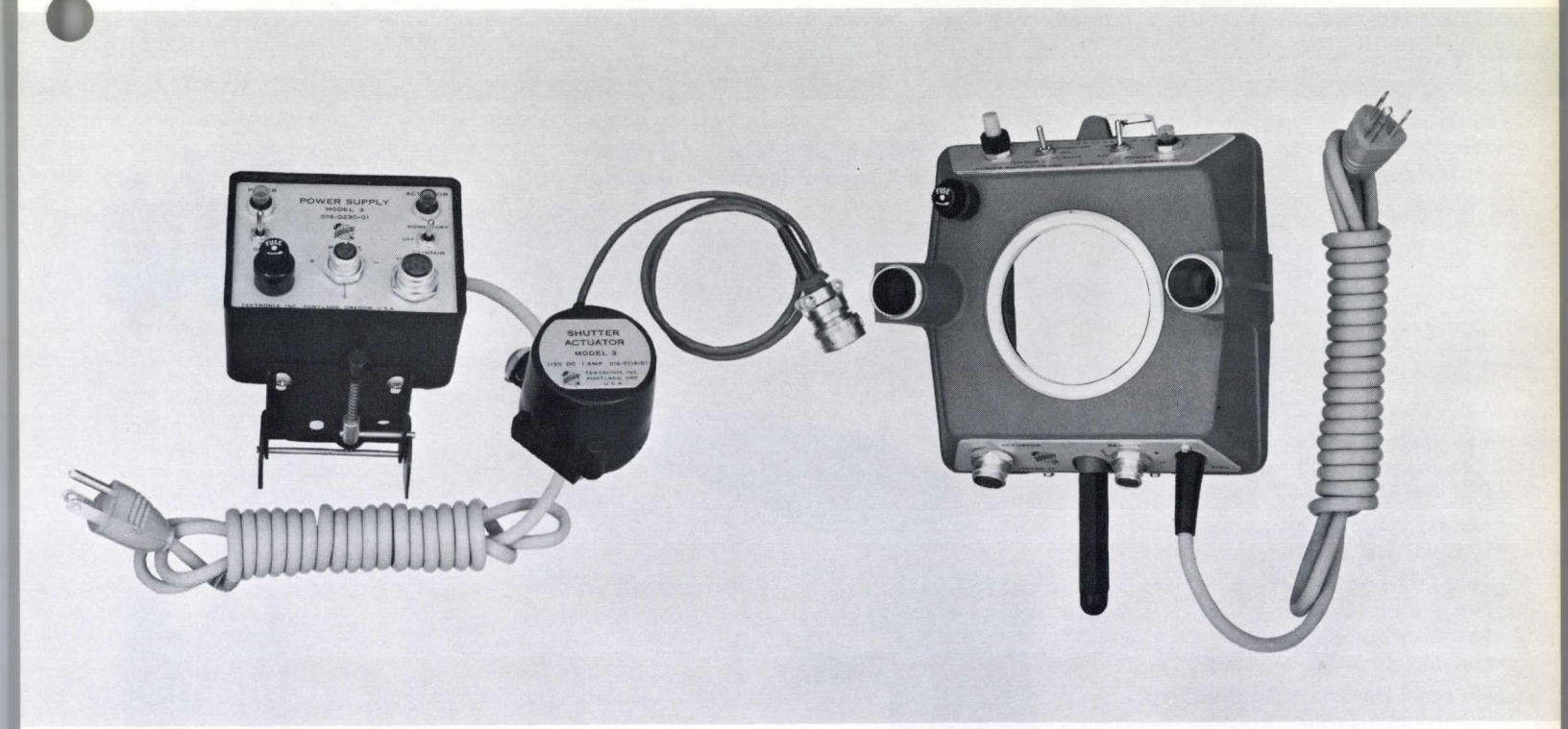
CONSTRUCTION
Attaches directly to Type 422 and 453 Oscilloscopes; no bezel needed. Can be hinged from oscilloscope to left or right side. Accepts Tektronix Shutter Actuator. Rear casting recessed for carrying. Net weight is 4¾ pounds. Shipping weight is approx 9 pounds.

C-30 CAMERA $390
Each camera includes: 1—light seal for Type 422 Oscilloscope (354-0279-00); 1—light seal for Type 453 Oscilloscope (354-0280-00); 1—focus plate (387-0893-00); 2—instruction manual (070-0527-00).

OPTIONAL BEZELS . . . . . $15 each	
OSCILLOSCOPE TYPE	PART NUMBER
321, 321A	016-0242-00
Tektronix Oscilloscopes with 5" round CRT (not 519).	016-0243-00
Tektronix 560-Series with rectangular CRT, 529 and RM529.	016-0244-00



Shutter Actuator



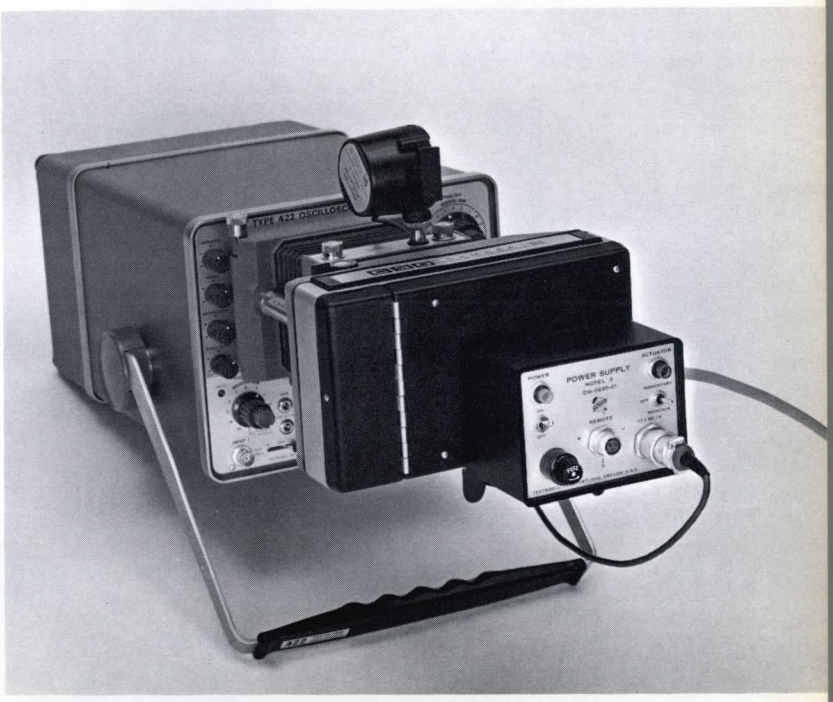
The Shutter Actuator System (Model 3) is a rotary solenoid-operated release that closely simulates the action of a hand-operated cable release. It permits electrical actuation of most Tektronix Trace-Recording Cameras.

A holding circuit in the power supply allows the actuator to be energized indefinitely without overheating. This feature is especially useful in obtaining Time exposures. Several actuators can be operated simultaneously by paralleling their REMOTE inputs and applying 24 VDC.

Two power supply packages are available. They are electrically identical, and differ only in mechanical configuration. One takes the place of the standard Rear Frame in the C-12, and C-27 Camera. The other is a separate small housing which can be mounted to either of the Polaroid Backs, or used remotely. Only the small power supply can be used with the C-30 Camera.

The actuator mounts to the cable release bushing of the C-30 Camera, or Alphax #3 and Ilex #3 shutters. It is not compatible with the Alphax #1 shutter used in the f/4.5—1:0.7 lens.

Operating time from switch contact to full open blades at 115 VAC is 20 to 25 ms.



Power requirement is 115 VAC, 50 to 400 Hz, or 115 VDC.

Actuator for either supply (016-0218-01) ..... $ 75

Separate Power Supply (016-0230-01) ..... $ 85
Includes hinged mounting bracket (122-0713-00)

Built-in Power Supply (016-0231-01) $125

Power requirement is 230 VAC, 50 to 400 Hz, or 230 VDC.

Actuator for either supply (016-0235-01) ..... $ 75

Separate Power Supply (016-0236-01) ..... $ 85
Includes hinged mounting bracket (122-0713-00)

Built-in Power Supply (016-0237-01) $125

Camera Components

MOUNTING BEZELS

Polarized viewers are available for most bezels. See Accessory pages.

FOR C-12 CAMERA

For Tektronix Oscilloscopes with round 5" CRT.
Part No. 016-0226-00 ... $15

For Tektronix 560-Series Oscilloscopes with rectangular CRT, Type 529 and RM529.
Part No. 016-0217-00 ... $15

For Tektronix Type 519.
Part No. 016-0239-00 ... $25

For some Hewlett-Packard Oscilloscopes. Contact your local Tektronix Field Office or Representative.
Part No. 016-0229-00 ... $16

FOR C-27 CAMERA

For all Tektronix Oscilloscopes with 5" round CRT.
Part No. 016-0225-00 ... $15

For all Tektronix 560-Series Oscilloscopes with rectangular CRT, Type 529 and RM529.
Part No. 016-0224-00 ... $15

For Tektronix Type 647 and RM647 Oscilloscopes.
Part No. 016-0223-00 ... $15

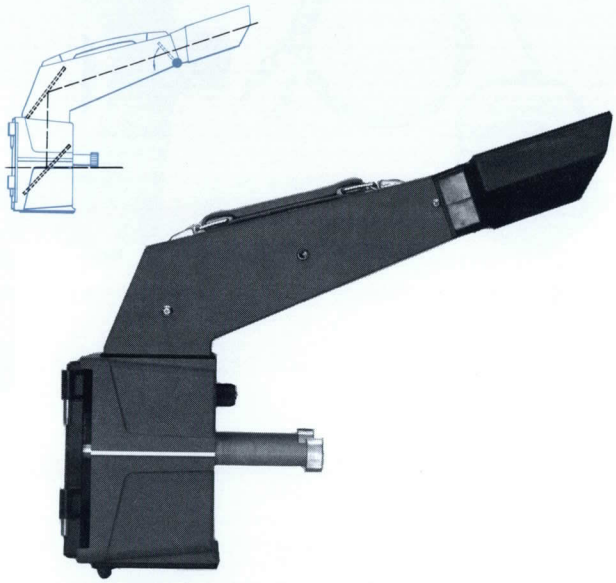
For Tektronix Type 519
Part No. 016-0240-00 ... $25

For most models of Hewlett-Packard Oscilloscopes. Contact your local Tektronix Field Office or Representative.
Part No. 016-0228-00 ... $15

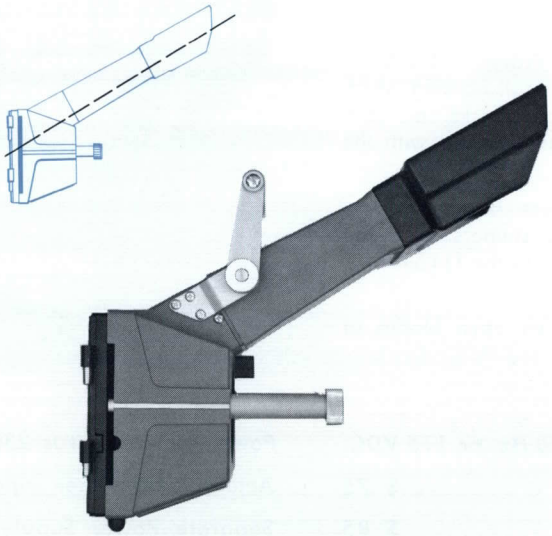
For some models of DuMont Oscilloscopes. Contact your local Tektronix Field Office or Representative.
Part No. 016-0227-00 ... $15

MAIN FRAME ASSEMBLIES

Each Main Frame Assembly includes a cable release and standard camera instruction manual.



C-12 Main Frame with beam-splitting mirror and on-axis binocular viewing.
Part No. 122-0635-00 ..... $155



C-27 Main Frame with direct binocular viewing, removable viewing tunnel and maximum light transmission from CRT to film.
Part No. 122-0676-00 ..... $125

INTERCHANGEABLE LENSES

f/1.9—1:0.7
Film Economy
Medium Writing Rate
Alphax or Ilex
No. 3X Shutter
Part No. 122-0547-00 $180

f/1.9—1:0.9
General Purpose
Alphax or Ilex
No. 3X Shutter
Part No. 122-0548-00 $160

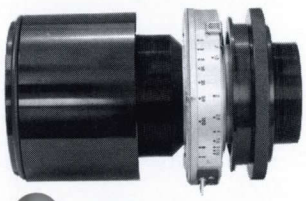
f/1.9—1:0.5
High Writing Rate
Alphax or Ilex
No. 3X Shutter
Part No. 122-0549-00 $200

f/4.5—1:0.7
Economy of Film & Price
Alphax No. 1 Shutter
Part No. 122-0550-00 $105

Camera Components

INTERCHANGEABLE LENSES

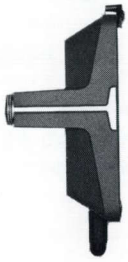
f/1.4—1:1
Precise full-size Image
High Writing Rate
Alphax No. 3 Shutter
Part No. 122-0608-00 $275



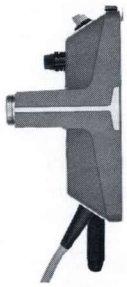
—1:0.5
Ultra-High Writing Rate
Ilex No. 3X Shutter
Part No. 122-0662-00 $325

f/1.9—1:0.85
General Purpose
Alphax or Ilex
No. 3X Shutter
Part No. 122-0692-00 $160

REAR FRAMES



Standard Frame
Part No. 122-0591-00 $45

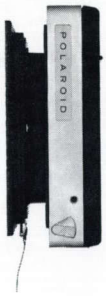


Power Supply Frame for Model 3 Shutter Actuator
Refer to page 247.

ROTATING SLIDE ADAPTER

Adapts Polaroid or Graflok Back to rear frame.
Part No. 122-0602-00 $25

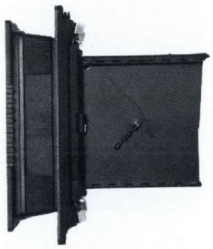
INTERCHANGEABLE FILM BACKS



Polaroid Land 3¼ x 4¼
Pack-Film Back, 8 exp.
Part No. 122-0671-00 $ 75
Focus Plate for above.
Part. No. 387-0893-00 $ 5

Polaroid Land 3¼ x 4¼
Roll-Film Back, 8 exp.
Part No. 122-0603-00 $ 75
Focus Plate for above.
Part No. 387-0460-00 $ 5

(Focus Plates not needed if Graflok Back is available.)

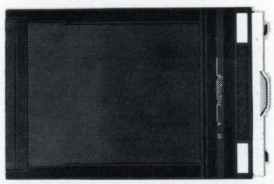


4 x 5 Graflok Back with Focusing Screen accepts standard cut-film holders, film-pack adapters, roll-film (120) holders, Polaroid 4 x 5 Film Holder.
Part No. 122-0604-00 $ 45

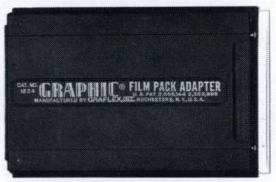
2¼ x 3¼ Graflok Back with Focusing Screen accepts standard cut-film holders, film-pack adapters, roll-film (120) holders.
Part No. 016-0233-00 $ 45

ACCESSORIES FOR GRAFLOK BACKS

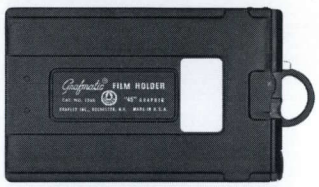
Readily available from local camera shops.



Cut-Film Holder
2 exposures



Film-Pack Adapter
12 exposures



Film Holder
6 exposures

120 Roll-Film Holder
8 exposures, 2¼ x 3 1/16

120 Roll-Film Holder
10 exposures, 2¼ x 2¾

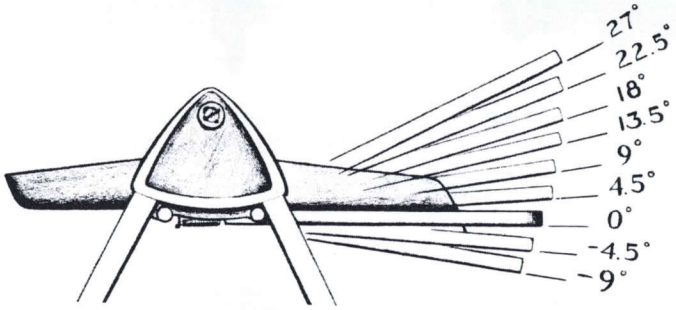
120 Roll-Film Holder
12 exposures, 2¼ x 2¼

Polaroid Land 4 x 5 Film Holder.

Scope-Mobile® Carts

Five models comprise the Type 200-Series Scope-Mobile® Carts featuring tilt locking in one of nine tray positions. These tilt-lock models include the Types 201-1, 201-2, 202-1, 202-2, and 205-1. The three models ending with -1 have a storage drawer for holding accessory items. The two models ending with -2 have a storage drawer and a plug-in carrier for housing a pair of plug-in units. Three AC-receptacles are located at the rear of the storage drawer for supplying power to the oscilloscope and associated instruments. A flange around the receptacles provides convenient storage for the power cord when not in use. All tilt-lock models come equipped with front-wheel brakes.

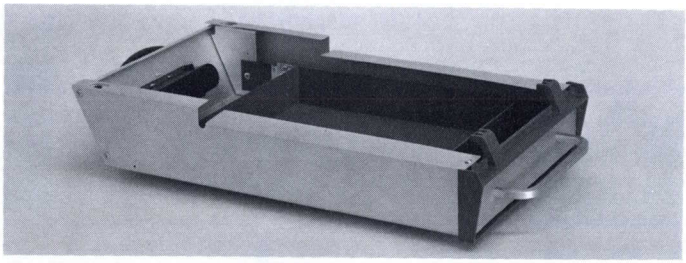
ADJUSTABLE TRAY tilt-locks in either of six 4.5° steps in the upward direction or two 4.5° steps in the downward direction from the horizontal axis.



MECHANICAL FEATURES include aluminum construction, 5 inch rubber wheels with front wheel brakes, and linoleum-topped steel shelf at the bottom.

OVERALL DIMENSIONS are approximately 36" high by 19" wide by 29" deep for the 201-1, -2 and the 202-1, -2; 36" high by 23" wide by 29" deep for the 205-1.

Either the storage drawer or the storage drawer and plug-in carrier combination can be ordered separately to modernize older 200-Series Scope-Mobile® Carts.



014-0012-00 drawer for 201-1 ..... $40
014-0013-00 drawer/plug-in carrier combination for 201-2 .. 45
014-0014-00 drawer for 202-1 40
014-0015-00 drawer/plug-in carrier combination for 202-2 .. 45

MODEL	DRAWER	PLUG-IN CARRIER	TRAY WIDTH	TRAY DESIGNED FOR TEKTRONIX OSCILLOSCOPE TYPE	BOTTOM TRAY DIMENSIONS**	NET WEIGHT	PRICE
201-1	YES	NO	10½"	422, 503, 504, 515A, 516 561A, 564, 647	15½" by 25"	38 lbs	$120.00
201-2		2, 3, 9, 10 and 11 Series	10½"				130.00
202-1 MOD 52		NO	14¾"	519			155.00
202-1		NO	14"	453, 502A*, 507, 517, 517A, 524AD, 530, 540, 580 Series; 551, 555, 570, 575, 661			120.00
202-2		1, 80 and Letter Series	14"				130.00
205-1		NO	17¾"	556, 565, 567, and Rackmount Instruments	18½" by 25"	43 lbs	135.00

**Requires special adapter, Part Number 040-0365-00 .... $2.75*

***Useable dimensions may be limited by height required.*

ACCESSORY CONTENTS

PROBES 252

Introduction

Probe-Instrument Compatibility Chart

General Purpose Probes

Special Purpose Probes

Sampling Probes

CT-1 Current Transformer and P6040 Probe

CT-2 Current Transformer and P6041 Probe

CT-3 50-ohm Signal Pickoff

PROBE ACCESSORIES 268

Identification Tags

Grounding Adapter

Probe Tips, Adapters, Ground Leads

SAMPLING ACCESSORIES 269

Cable Adapters

50-ohm Connecting Cables

50-ohm Attenuators, Terminations

Plug-In Extensions

50-ohm Voltage Pickoff "T"

PLUG-IN UNIT ACCESSORIES 270

Blank Plug-In Chassis

Storage Cabinets

Extensions

Gain Adjust Adapter

Operational Amplifier Adapters

ATTENUATORS, TERMINATIONS 272

Input Adapters, Attenuators, Terminations

MISCELLANEOUS CABLES 273

CABLE ADAPTERS, CORDS 274

Miscellaneous Adapters

Power Cords

Miscellaneous Cords and Leads

INSTRUMENT COVERS, CASES 275

Carrying Cases

Dust Covers

VIEWING ACCESSORIES 275

Polarized Viewers

Viewing Hoods

MOUNTING ACCESSORIES 276

Cradle Mounts

Rack Adapter

Camera Mounting Adapters

REPLACEMENT CATHODE-RAY TUBES 277

REPLACEMENT GRATICULES 278

UNSCRIBED GRATICULES 279

CRT LIGHT FILTERS 279

Plexiglass Filters

Mesh Filters

MISCELLANEOUS ACCESSORIES 280

Tunnel Diode Pulser

TV Sync Separator

Replacement Batteries

ACCESSORY INDEX ..... *Inside Back Cover*

Probes

Tektronix manufactures both active and passive probes for broadening the applications of Tektronix preamplifiers and oscilloscopes.

A prime consideration in selecting a probe is the attenuation ratio. Probe attenuation allows the measurement of signals that would otherwise over-drive the preamplifier or oscilloscope. In addition, the higher input resistance and lower input capacitance associated with the attenuation reduces the loading effect of the oscilloscope on the circuit under test.

To help you select the right probe for your application, the probes have been grouped in three categories: general purpose, special purpose, and sampling. The following factors should be considered in making your selection:

1. Be sure the desired probe will match the input resistance and capacitance of the oscilloscope used, and is equipped with the proper connector.

2. For RF (CW) or high-voltage applications, select a probe with an adequate RF or HV rating. Most probes require derating for RF work, due to heating effects.

3. Select a probe with adequate risetime and bandwidth for the oscilloscope and application.

4. When considering high input impedance, select the shortest cable length, highest attenuation probe compatible with the application. The probe with the lowest input capacitance will generally provide the most accurate measurements.

When ordering any probe, please designate not only the type but also the nine-digit part number.

If you desire help in selecting the right probe for your application, please consult your Tektronix Field Engineer.

PROBE-INSTRUMENT COMPATIBILITY CHART

OSCILLOSCOPES

*	P6006/ P6007	P6008/ P6009	P6010	P6011	P6013/ P6015	P6019	P6020	P6023	P6027/ P6028	P6030	P6032	P6034/ P6035	P6038	P170CF	P500CF	CT-1/ P6040	CT-2/ P6041	CT-3
310A	X			X	X	X	0		X								X	
317	X			X	X	X	0		X								X	
321A	X			X	X	X	0		X								X	
360	X			X	X	X	0		X								X	
422	X			+	X	X	0	0	X								X	
453	0	X	+	+	X	X	+	0	X							0	X	0
502A	X			X	X	X		X	X								0	
503	X			X	X	X		0	X								0	
504	X			X	X	X			X								0	
515A	X			X	X	X			X								X	
516	X		0	X	X	X		0	X								X	
519												0				0	0	0
524AD	X			X					X						+			
526				X					X									
529				X					X									

PLUG-IN UNITS

B	X			X	X	X			X								X	
CA	X		0	X	X	X		0	X								X	
D	X			X	X	X		X	X								X	
G	X			X	X	X		X	X								X	
H	X			X	X	X			X								X	
K	X		0	X	X	X			X								X	
L	X		0	X	X	X			X								X	
M	X			X	X	X			X								X	
O	X			X	X	X			X								X	
W	X		0	X	X	X		X	X								X	
1A1	0	X	X	X	X	X	+		X			0				0	X	0
1A2	0	X	X	X	X	X	+		X			0				0	X	0
1A7	X			X	0	X		X	X								0	
1S1											X	+				X	0	X
1S2												+				X	0	X
2A60	X			X	X	X			X								X	
2A63	X			X	X	X		0	X								X	
3A1	X			X	X	X			X								X	

*Both Cabinet and Rackmount Versions

\+ Specifically designed for use with this instrument

X Recommended

0 These combinations have limitation, but may be very useful in certain applications

	P6006/ P6007	P6008/ P6009	P6010	P6011	P6013/ P6015	P6019	P6020	P6023	P6027/ P6028	P6030	P6032	P6034/ P6035	P6038	P170CF	P500CF	CT-1/ P6040	CT-2/ P6041	CT-3
PLUG-IN UNITS (Cont.)																		
3A2	X			X	X	X			X								X	
3A3	X			X	X	X		X	X								X	
3A5	0			0	0	0			0	+							0	
3A6	X			X	X	X			X								X	
3A7	X		0	X	X	X		X	X								X	
3A72	X			X	X	X		0	X								X	
3A74	X			X	X	X			X								X	
3A75	X			X	X	X			X								X	
3A8	X			X	X	X			X								X	
10A1	0	X	X	X	X	X	X	X	X							0	X	0
10A2	0	X	X	X	X	X	X		X			0				0	X	0
82	0	+	X	0	X	X	+		0			0				0	X	0
86	0	+	X	0	X	X	+		0			0				0	X	0
3S76											X	+	+			X	0	X
3S3																0	0	0
4S1											X	+				X	0	X
4S2											X	+	+			X	0	X
4S3																0	0	0
AMPLIFIERS AND ADAPTERS																		
134						+	+											
282	0	X	X	0	0													
1121	X								X					+				
VP-1												+						
VP-2													+					

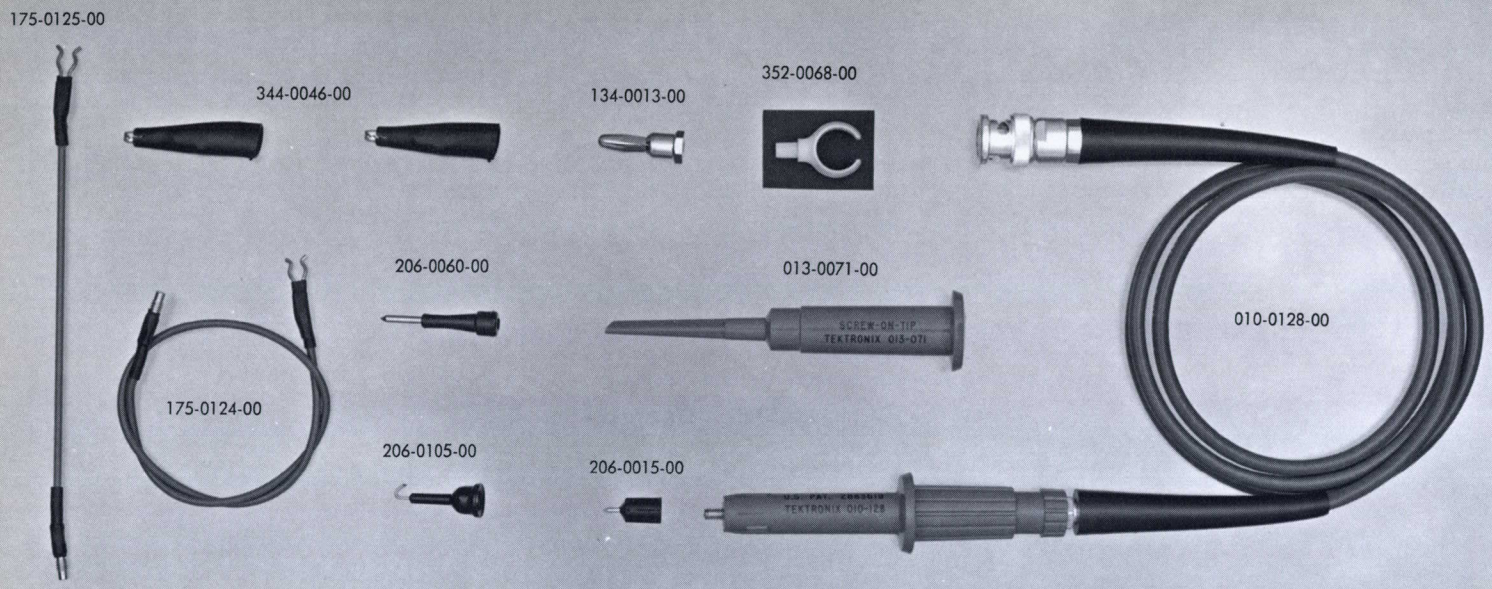
* Specifically designed for use with this instrument

X Recommended

0 These combinations have limitations, but may be very useful in certain applications

General Purpose Probes

P6006 10X PASSIVE PROBE



The Type P6006 low input-capacitance probe is designed for use with Tektronix low- and medium-frequency instruments.

By rotating the probe body with respect to its base, the probe time-constant can be made equal to the input time-constant of the oscilloscope or plug-in unit.

At no additional cost, the probe is available with 6′, 9′ and 12′ cable lengths in addition to the standard 3.5′ cable length, with either BNC or UHF connectors. UHF to BNC adapters are available from your local supplier or Tektronix, Inc.

ATTENUATION RATIO is 10X.

INPUT RESISTANCE is 10 megohms.

INPUT CAPACITANCE for standard length probe is approximately 7 pF when used with an instrument having a 20 pF input capacitance and approximately 9.5 pF when used with an instrument having a 47 pF input capacitance.

PROBE RISETIME is approximately 5 ns.

TYPICAL RISETIME of probe, Type 1A2 Plug-In Unit, and Type 545B Oscilloscope is 12 ns.

VOLTAGE RATING is 600 V DC or AC peak to peak.*

STANDARD CABLE is 3.5′ long, terminated with BNC or UHF connector.

P6006 PROBE PACKAGE

(010-0127-00 BNC or 010-0125-00 UHF) $22

Includes:

1—P6006 probe, 010-0128-00 BNC or 010-0126-00 UHF
1—straight tip, 206-0015-00
1—hook tip, 206-0105-00
1—retractable hook tip, 013-0071-00
1—spring tip, 206-0060-00
1—banana plug, 134-0013-00
2—minigator clips, 344-0046-00
1—probe holder, 352-0068-00
1—5″ ground lead, 175-0124-00
1—12″ ground lead, 175-0125-00
1—instruction manual, 070-0381-00

ADDITIONAL CABLE LENGTH P6006 PROBE PACKAGE WITH CORRESPONDING INPUT C.

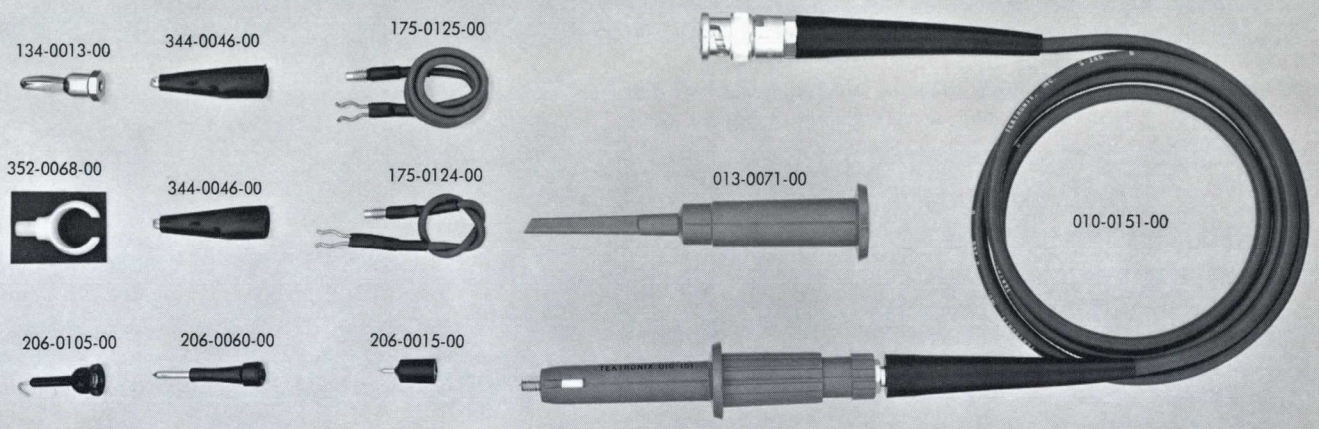
Cable Length	Input C		Part Number BNC Connector	Part Number UHF Connector	Price
	20 pF	47 pF			
6′	8.5 pF	11.0 pF	010-0160-00	010-0158-00	$22
9′	11.0 pF	13.5 pF	010-0146-00	010-0142-00	22
12′	13.0 pF	15.5 pF	010-0148-00	010-0144-00	22

*Peak to peak voltage derating is necessary for CW frequencies higher than 5.7 MHz when working into a 20 pF input, or higher than 3.6 MHz when working into a 47 pF input.

SEE PAGE 252 FOR PROBE COMPATIBILITY

General Purpose Probes

P6007 100X PASSIVE PROBE



The Type P6007 low input-capacitance probe is designed for use with Tektronix low and medium frequency instruments.

By rotating the probe body with respect to its base, the probe time constant can be made equal to the input time constant of the oscilloscope or plug-in unit.

At no additional cost, the probe is available with 6′, 9′, and 12′ cable lengths in addition to the standard 3.5′ cable length with either BNC or UHF connectors. UHF to BNC adapters are available from your local supplier or Tektronix, Inc.

ATTENUATION RATIO is 100X.

INPUT RESISTANCE is 10 megohms.

INPUT CAPACITANCE for a standard length probe is approximately 2.0 pF when used with an instrument having a 20 pF input capacitance and approximately 2.3 pF when used with an instrument having a 47 pF input capacitance.

PROBE RISETIME is approximately 7 ns.

TYPICAL RISETIME of probe, Type 1A2 Plug-In Unit, and Type 545B Oscilloscope is approx 12.5 ns.

VOLTAGE RATING is 1.5 kV DC or AC RMS, 4.2 kV AC peak to peak.*

STANDARD CABLE is 3.5′ long, terminated with BNC or UHF connector.

P6007 PROBE PACKAGE
(010-0150-00 BNC or 010-0134-00 UHF) **$22**

Includes:
1—P6007 probe, 010-0151-00 BNC or 010-0135-00 UHF
1—straight tip, 206-0015-00
1—hook tip, 206-0105-00
1—retractable hook tip, 013-0071-00
1—spring tip, 206-0060-00
1—banana plug, 134-0013-00
2—minigator clip, 344-0046-00
1—probe holder, 352-0068-00
1—5″ ground lead, 175-0124-00
1—12″ ground lead, 175-0125-00
1—instruction manual, 070-0388-00

ADDITIONAL CABLE LENGTH P6007 PROBE PACKAGE WITH CORRESPONDING INPUT C.

Cable Length	Input C		Part Number BNC Connector	Part Number UHF Connector	Price
	20 pF	47 pF			
6′	2.2	2.5	010-0165-00	010-0162-00	$22.00
9′	2.4	2.7	010-0152-00	010-0136-00	22.00
12′	2.6	2.8	010-0154-00	010-0138-00	22.00

*Peak to peak voltage derating is necessary for CW frequencies higher than 200 kHz. At 10 MHz, the maximum allowable peak to peak voltage is 2 kV. Above 10 MHz, additional derating is required depending on the input capacitance of the plug-in or instrument used.

SEE PAGE 252 FOR PROBE COMPATIBILITY

General Purpose Probes

P6008 and P6009 PASSIVE PROBES

The P6008 and P6009 low-capacitance probes are designed for use with Tektronix Type 82 and 86 Plug-In Units. They are also recommended for use with Types 1A1, 1A2, or the Type 453 Oscilloscope. In addition, the P6008 and a separate version of the P6009 can be used with the Type 10A2.

The time-constant of the probe is adjusted by rotating the probe body with respect to its base. The range of adjustment is sufficient to match the input time-constant of all Tektronix Plug-In Units ranging from 8 to 50 pF capacitance. Maximum frequency response (minimum risetime) is obtained when the P6008 or P6009 is used with plug-in units having minimum input capacitance.

P6008 10X PASSIVE PROBE

ATTENUATION RATIO is 10X.

INPUT RESISTANCE is 10 megohms.

INPUT CAPACITANCE is approximately 7.5 pF.

PROBE RISETIME is less than 3 ns.

TYPICAL RISETIME of probe, Type 82 Plug-In Unit, and Type 580-Series Oscilloscope is 5 ns.

VOLTAGE RATING is 600 V DC or AC peak to peak.*

CABLE is 3.5′ long, terminated with a BNC connector.

P6008 PROBE PACKAGE (010-0129-00) **$35**

Includes:

1—P6008 probe, 010-0130-00
1—bayonet adapter, 013-0052-00
1—hook tip, 206-0105-00
1—retractable hook tip, 013-0071-00
1—spring tip, 206-0060-00
1—straight tip, 206-0015-00
1—banana plug, 134-0013-00
1—center pin, 214-0325-00
2—minigator clip, 344-0046-00
1—probe holder, 352-0068-00
1—3″ ground lead, 175-0263-00
1—5″ ground lead, 175-0124-00
1—12″ ground lead, 175-0125-00
1—instruction manual 070-0362-00

*Peak to peak voltage derating is necessary for CW frequencies higher than 20 MHz. At 40 MHz, the maximum allowable peak to peak voltage is 300 V.

P6009 100X PASSIVE PROBE

ATTENUATION RATIO is 100X.

INPUT RESISTANCE is 10 megohms.

INPUT CAPACITANCE is 2.5 pF.

PROBE RISETIME is approximately 2 ns.

TYPICAL RISETIME of probe, Type 82 Plug-In Unit, and 580-Series Oscilloscope is 4.5 ns.

VOLTAGE RATING is 1.5 kV DC or AC RMS, 4 kV AC peak to peak.*

CABLE is 9′ long, terminated with a BNC connector.

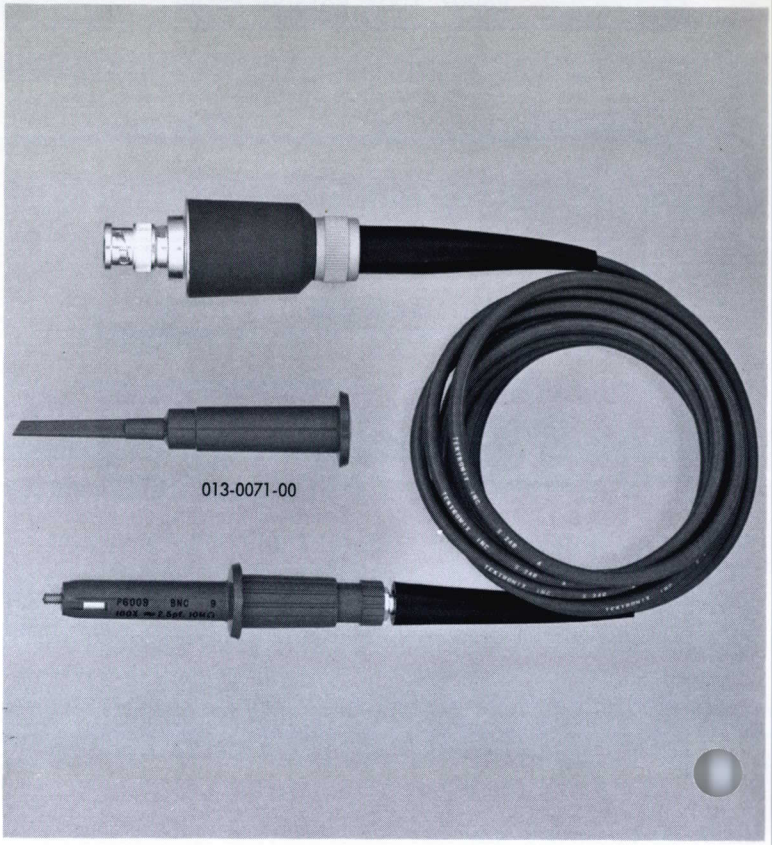
P6009 PROBE PACKAGE (010-0140-00) **$55**

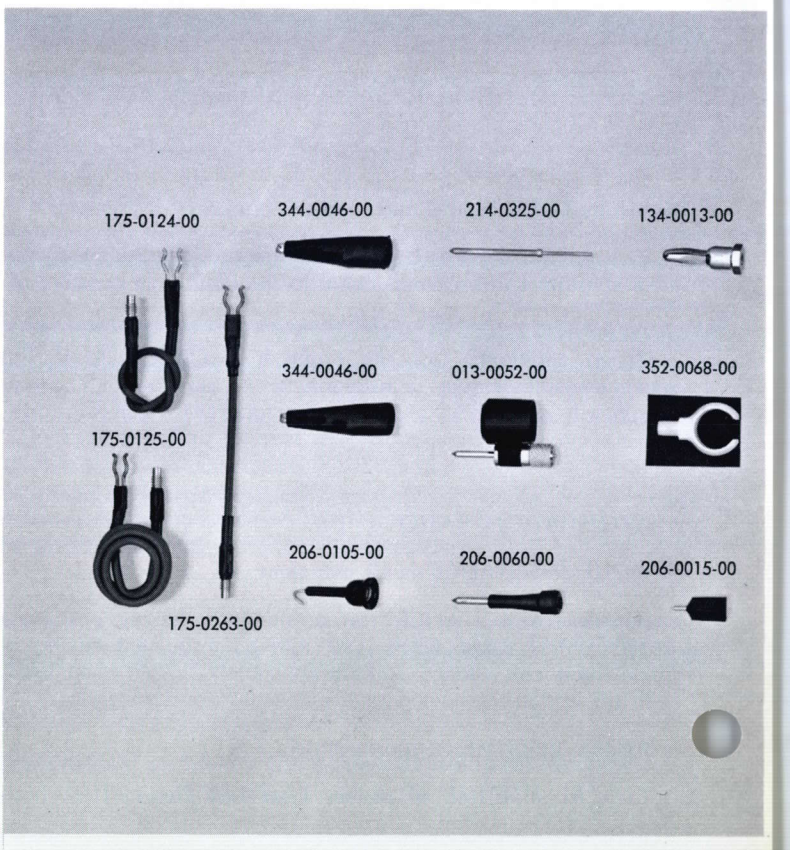
P6009 PROBE PACKAGE, for Type 10A2 (010-0170-00) . **$55**

Includes:

1—P6009 probe, 010-0141-00 or 010-0171-00
1—bayonet adapter, 013-0052-00
1—hook tip, 206-0105-00
1—retractable hook tip, 013-0071-00
1—spring tip, 206-0060-00
1—straight tip, 206-0015-00
1—banana plug, 134-0013-00
1—center pin, 214-0325-00
2—minigator clip, 344-0046-00
1—probe holder, 352-0068-00
1—3″ ground lead, 175-0263-00
1—5″ ground lead, 175-0124-00
1—12″ ground lead, 175-0125-00
1—instruction manual, 070-0401-00

*Peak to peak voltage derating is necessary for CW frequencies higher than 300 kHz. At 40 MHz, the maximum allowable peak to peak voltage is 575 V.

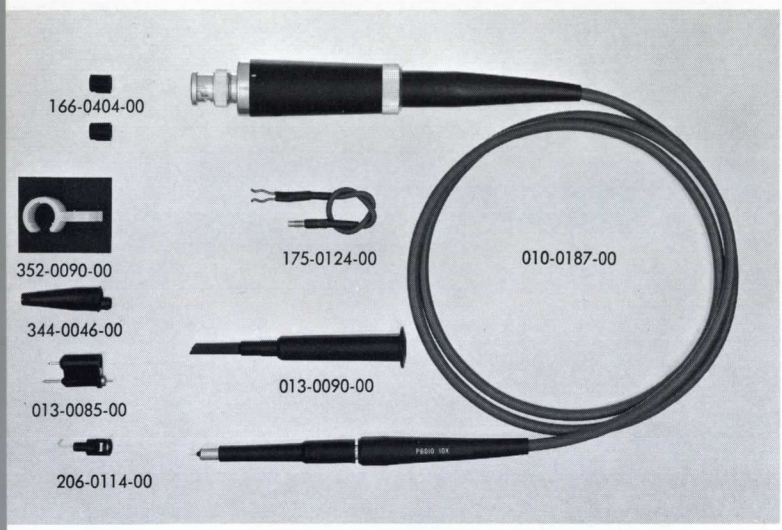




SEE PAGE 252 FOR PROBE COMPATIBILITY

General Purpose Probes

P6010 10X PASSIVE PROBE



The P6010 is a miniature passive probe designed for use with Tektronix wide-band oscilloscopes. The probe is easily compensated for use with any instrument having an input capacitance of 14 to 21 pF.

Extra small in size, the P6010 is well suited for servicing subminiature circuits where easy access is required. In addition to the standard 3.5′ length, the probe is available with a 6′ or 9′ cable at no additional cost.

ATTENUATION is 10X.

INPUT RESISTANCE is 10 megohms.

INPUT CAPACITANCE for the standard length probe is approximately 10 pF when used with instruments having a 14 to 21 pF input capacitance; 12 pF for the 6′ version, 15.5 pF for the 9′ version.

PROBE RISETIME is less than 2 ns.

TYPICAL RISETIME of probe with Type 453 Oscilloscope is 7 ns.

VOLTAGE RATING is 500 V DC, AC peak, or DC and AC peak combined.*

STANDARD CABLE is 3.5′ long, terminated with a BNC connector.

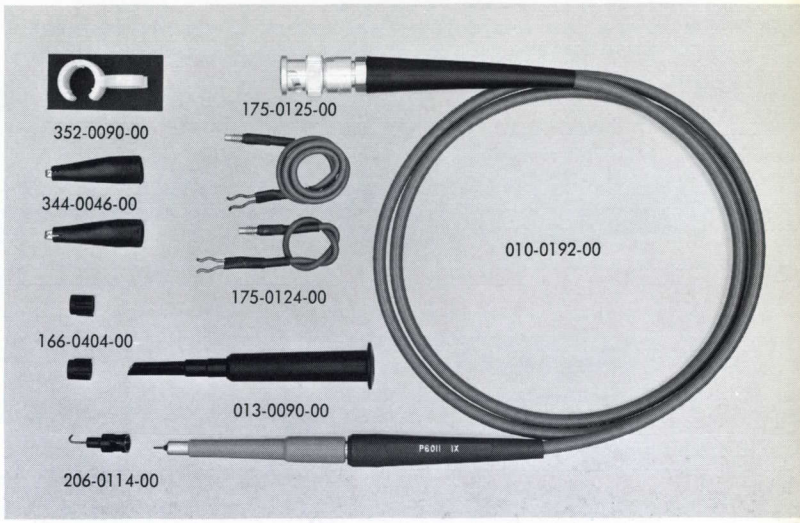
P6010 3.5′ PROBE PACKAGE (010-0188-00) **$30.00**
P6010 6′ PROBE PACKAGE (010-0185-00) **$30.00**
P6010 9′ PROBE PACKAGE (010-0201-00) **$30.00**

Includes:

- 1—P6010 probe, 010-0187-00, 010-0184-00 or 010-0200-00
- 1—hook tip, 206-0114-00
- 1—retractable hook tip, 013-0090-00
- 1—bayonet ground adapter, 013-0085-00
- 1—minigator clip, 344-0046-00
- 1—probe holder, 352-0090-00
- 1—5″ ground lead, 175-0124-00
- 2—insulating tube, 166-0404-00
- 1—instruction manual, 070-0495-00

*Peak voltage derating is necessary for CW frequencies higher than 2.5 MHz. At 20 MHz, the maximum allowable peak voltage is 175 V; 60 V at 60 MHz.

P6011 1X PASSIVE PROBE



The P6011 1X Passive Probe can be used with all Tektronix general-purpose oscilloscopes. Like the P6010, the small size of the probe body makes it ideal for working on compact circuitry.

The probe cable utilizes a resistive center conductor for damping critical reflections, insuring maximum bandwidth. In addition to the standard 3.5′ length, the probe is available with a 6′ cable at no additional cost.

ATTENUATION is 1X.

INPUT RESISTANCE is 1 megohm.

INPUT CAPACITANCE for standard length probe is approx 28 pF; 48 pF for the 6′ version, instrument excluded.

PROBE RISETIME for the standard cable length is less than 12 ns working into a plug-in with an input capacitance of 15 pF; less than 15 ns working into a plug-in with an input capacitance of 20 pF. The probe risetime of the 6′ version is less than 15 ns into 15 pF or less than 17 ns into 20 pF.

VOLTAGE RATING is 600 V DC, AC peak, or DC and AC peak combined.*

STANDARD CABLE is 3.5′ long with a BNC connector.

P6011 3.5′ PROBE PACKAGE (010-0193-00) **$15.00**
P6011 6′ PROBE PACKAGE (010-0190-00) **$15.00**

Includes:

- 1—P6011 probe, 010-0189-00 or 010-0192-00
- 1—hook tip, 206-0114-00
- 1—retractable hook tip, 013-0090-00
- 2—minigator clip, 344-0046-00
- 1—probe holder, 352-0090-00
- 2—insulating tube, 166-0404-00
- 1—5″ ground lead, 175-0124-00
- 1—12″ ground lead, 175-0125-00
- 1—instruction manual, 070-0512-00

*Peak voltage derating is necessary for CW frequencies higher than 0.5 MHz. When the probe is used with a plug-in having an input C of 20 pF, the maximum allowable peak voltage at 1 MHz is 510 V. At 5 MHz, the maximum is 100 V; 46 V at 10 MHz. When the probe is used with a plug-in having a 47 pF input, the allowable voltage will be lower by a ratio of 1:3.

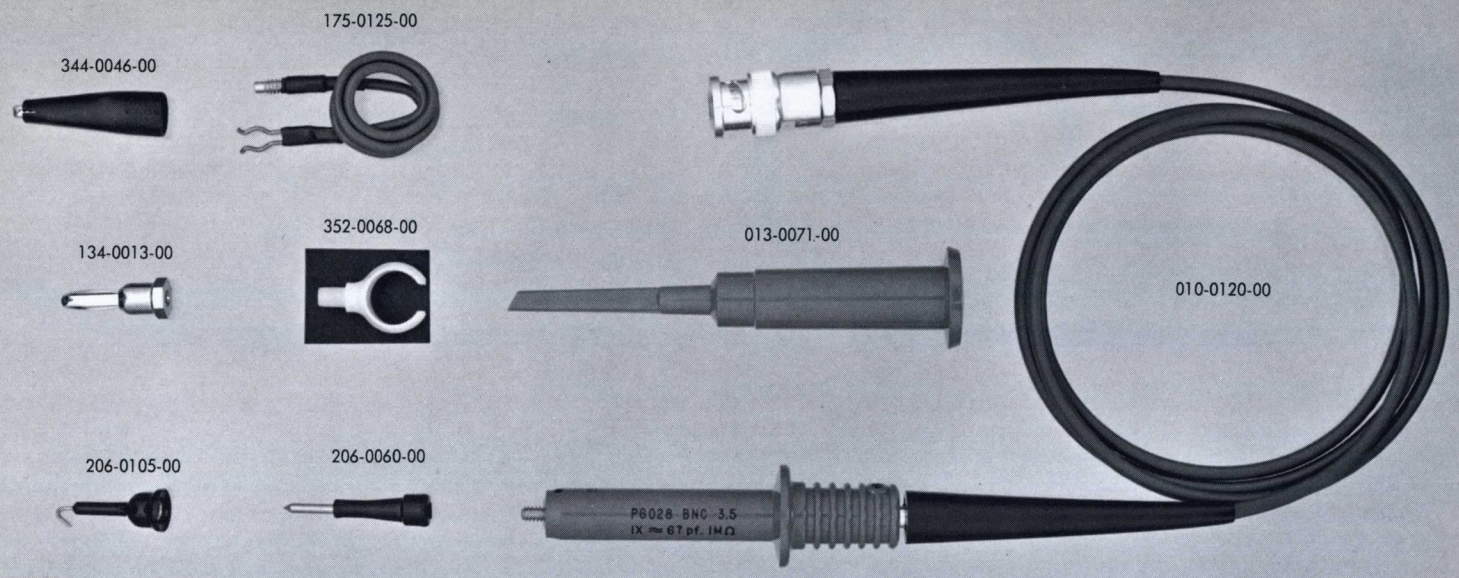
OPTIONAL ACCESSORIES

P6010 or P6011-to-BNC ADAPTER (013-0084-00) $3.00
P6010 or P6011-to-GR ADAPTER (017-0076-00) $4.50

SEE PAGE 252 FOR PROBE COMPATIBILITY

General Purpose Probes

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.

In addition to the standard 3.5′ cable length, these probes are available in cable lengths of 6′, 9′, and 12′, at no additional cost. Insertion loss increases with probe cable length.

ATTENUATION RATIO is 1X.

INPUT RESISTANCE is 1 megohm.

INPUT CAPACITANCE for a standard length probe is 60 pF when used with an instrument having a 20 pF input capacitance and 87 pF when used with an instrument having a 47 pF input capacitance.

PROBE RISETIME is approximately 10 ns.

TYPICAL RISETIME of probe, Type K Plug-In Unit, and Type 540-Series Oscilloscope is 16 ns.

VOLTAGE RATING is 600 V DC or AC peak to peak.*

*peak to peak voltage derating is necessary for CW frequencies higher than 1 MHz. At 10 MHz, the maximum allowable peak to peak voltage is 60 V.

STANDARD CABLE is 3.5′ long, terminated with BNC or UHF connector.

P6027 PROBE PACKAGE
with UHF connector (010-0070-00) $12.50

P6028 PROBE PACKAGE
with BNC connector (010-0074-00) $12.50

Each probe package includes:

- 1—probe, 010-0116-00 UHF, or 010-0120-00 BNC
- 1—hook tip, 206-0105-00
- 1—retractable hook tip, 013-0071-00
- 1—spring tip, 206-0060-00
- 1—banana plug, 134-0013-00
- 1—minigator clip, 344-0046-00
- 1—probe holder, 352-0068-00
- 1—12″ ground lead, 175-0125-00
- 1—parts list

P6027 and P6028 PROBES *with over 3.5′ cable lengths*

Probe	Cable Length	Connector	Part Number	Input Capacitance Min-pF	Input Capacitance Max-pF	Price
P6027 P6028	6 ft	UHF BNC	010-0071-00 010-0075-00	83.0	110.0	$12.50
P6027 P6028	9 ft	UHF BNC	010-0072-00 010-0076-00	110.0	137.0	$12.50
P6027 P6028	12 ft	UHF BNC	010-0073-00 010-0077-00	138.0	165.0	$12.50

SEE PAGE 252 FOR PROBE COMPATIBILITY

Special Purpose Probes

P6013 HIGH-VOLTAGE PROBE

The Type P6013 provides 1000X attenuation for oscilloscope measurements of high amplitude waveforms or DC potentials up to 12 kV. Pulse frequency can be up to 100 kHz at 12 kV.

The probe can be compensated for oscilloscope input capacities up to 60 pF.

ATTENUATION RATIO is 1000X.

INPUT RESISTANCE is 100 megohms.

INPUT CAPACITANCE is 3 pF.

PROBE RISETIME is less than 7 ns.

TYPICAL RISETIME of probe, Type 1A1 Plug-In Unit, and Type 545B Oscilloscope is 13 ns.

VOLTAGE RATING is 12 kV DC, peak pulse, or peak AC.*

CABLE is 10′ long, terminated with a LOCKING BNC or UHF connector.

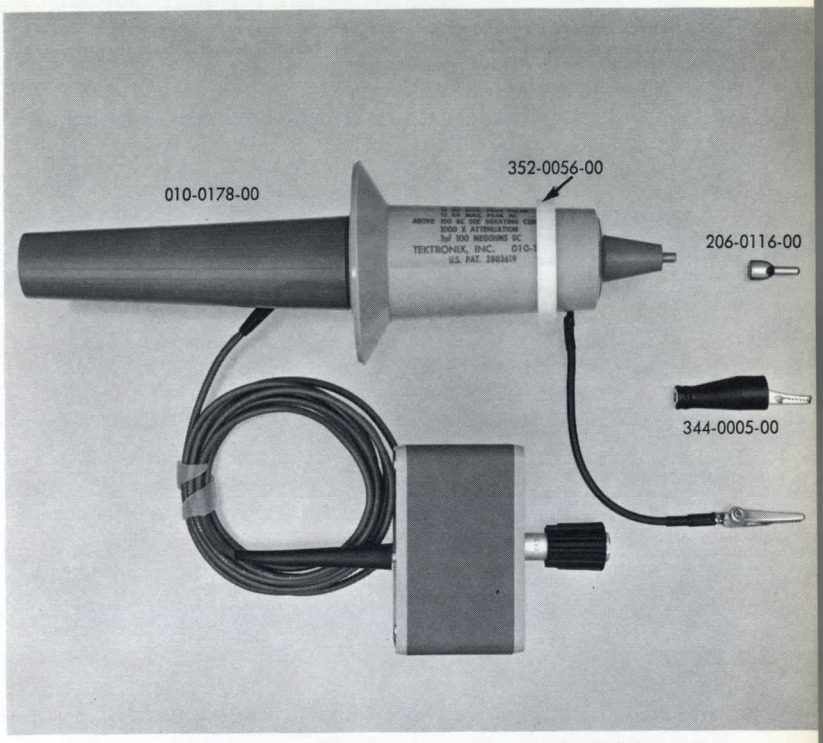
P6013 PROBE PACKAGE (010-0177-00 LOCKING BNC or 010-0181-00 UHF) **$75**

Includes:

- 1—P6013 Probe, 010-0178-00 BNC, or 010-0182-00 UHF
- 1—banana plug tip, 206-0116-00
- 1—alligator clip, 344-0005-00
- 1—probe holder, 352-0056-00
- †1—storage case, 202-0139-00
- †1—storage case tray, 436-0062-00
- †1—storage case pad, 004-0217-00
- †1—instruction manual, 070-0321-00

†not shown

*peak to peak voltage derating is necessary for CW frequencies higher than 100 kHz. At 1 MHz, the maximum allowable peak to peak voltage is 5.5 kV.



P6015 HIGH-VOLTAGE PROBE

The Type P6015 provides 1000X attenuation for oscilloscope measurements up to 40-kV peak. Voltage or duty cycle derating is necessary for RF voltages at frequencies over 100 kHz, or in environmental temperatures above 25°C.

The probe time constant can be adjusted to equal the oscilloscope input time constant for instruments with 12 pF to 50 pF input capacitance.

ATTENUATION RATIO is 1000X, adjustable ± 9%.

INPUT RESISTANCE is 100 megohms.

INPUT CAPACITANCE is approximately 2.7 pF.

PROBE RISETIME is approximately 4 ns.

TYPICAL RISETIME of the probe, Type 1A1 Plug-In Unit, and Type 545B Oscilloscope is 11.5 ns.

TEMPERATURE RANGE is 10° C to 55° C environmental temperature. Calibration adjustments are necessary when environmental or nose resistor temperature changes.

VOLTAGE RATING is 40 kV peak AC or pulse, 20 kV DC or RMS continuous at 25°C environmental temperature.*

CABLE is 10′ long, terminated with a BNC or UHF connector.

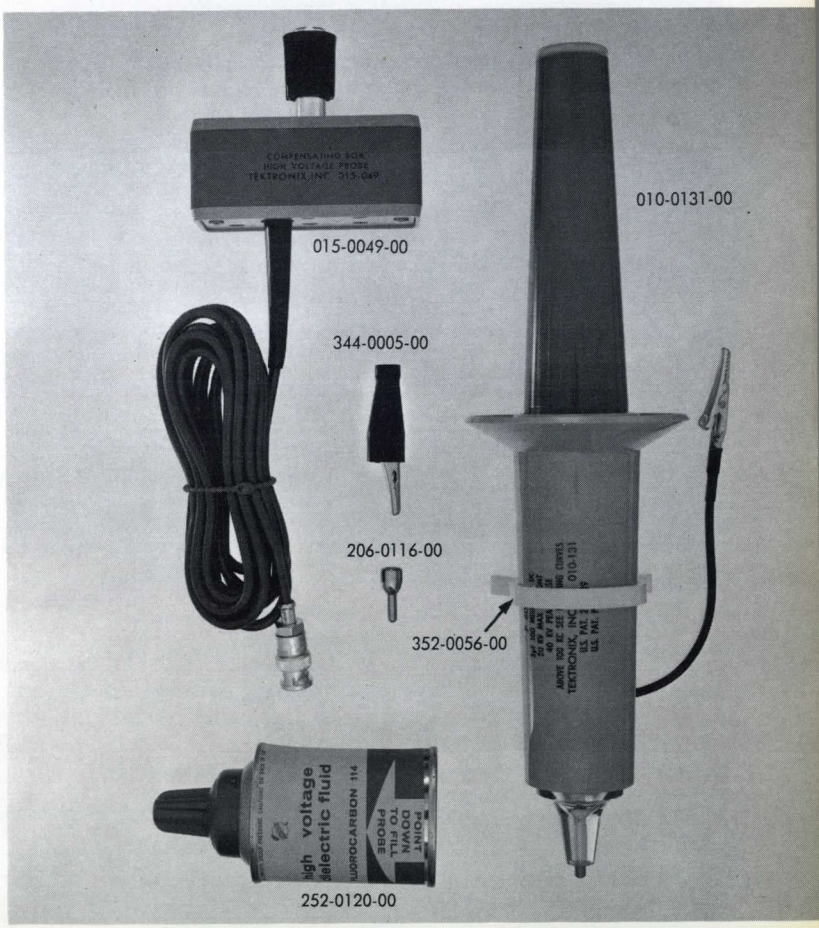
P6015 PROBE PACKAGE (010-0172-00 LOCKING BNC or 010-0132-00 UHF) **$200**

Includes:

- 1—P6015 probe, 010-0131-00
- 1—compensating box, 015-0049-00 BNC, or 015-0039-00 UHF
- 1—banana plug tip, 206-0116-00
- 1—alligator clip, 344-0005-00
- 1—probe holder, 352-0056-00
- 1—can, dielectric, 252-0120-00
- †1—silica-gel, 256-0570-00
- †1—storage case, 202-0139-00
- †1—storage case tray, 436-0035-00
- †1—storage case pad, 004-0217-00
- †1—instruction manual, 070-0373-00

*peak to peak voltage derating is necessary for CW frequencies higher than 100 kHz. At 10 MHz, the maximum allowable peak to peak voltage is 13 kV.

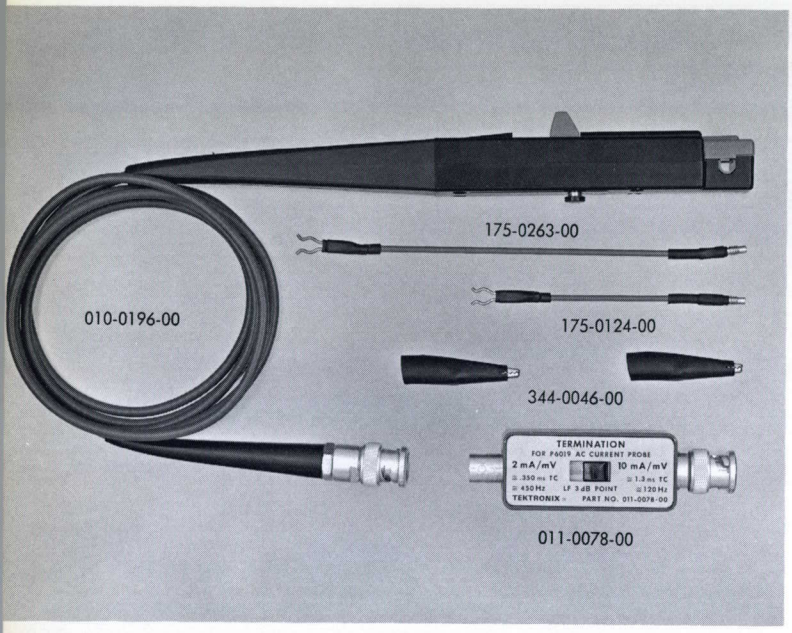
†not shown.

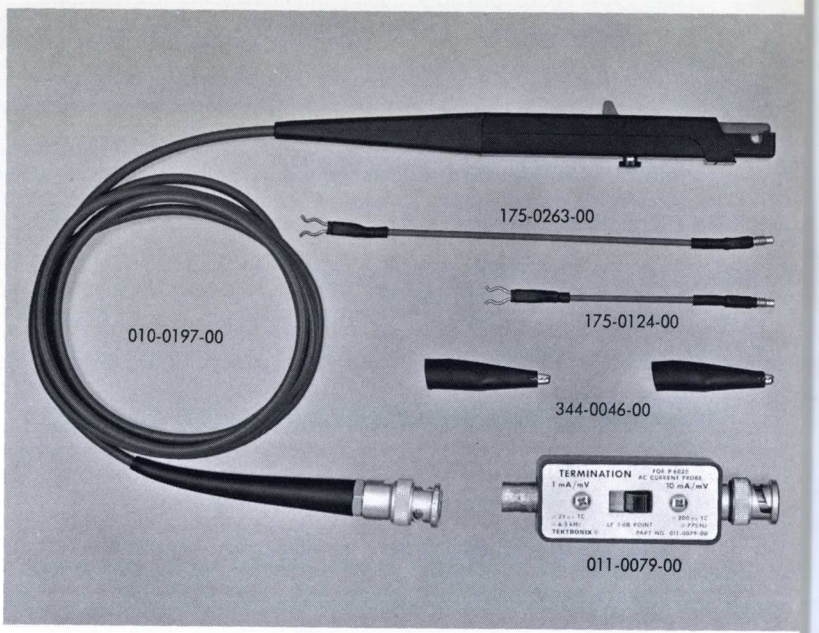


SEE PAGE 252 FOR PROBE COMPATIBILITY

Special Purpose Probes

P6019, P6020 CURRENT PROBES, AND TYPE 134 CURRENT AMPLIFIER





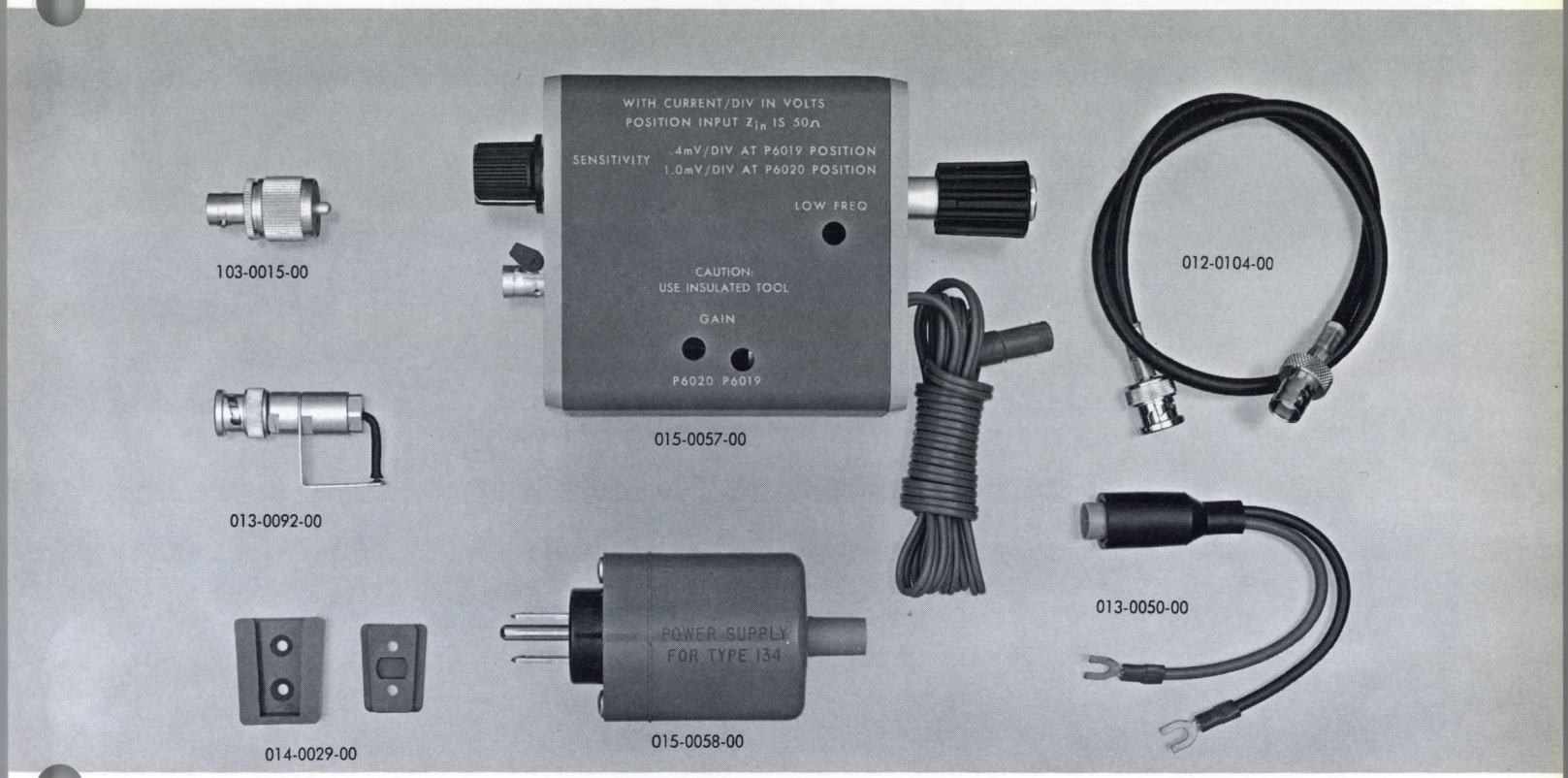
With these new AC current probes, you can make accurate current measurements over a wide range of frequencies, without breaking the circuit under test. Simply open the spring-loaded slide, place the conductor in the probe slot, and release the slide . . . no electrical connection required. The shielded probe head is not grounded when the slide is in the open position, eliminating accidental grounding of the circuit under test.

For general-purpose applications, the P6019 offers wide-band performance with excellent low-frequency characteristics. The extra-small size of the P6020 makes it ideally suited for measuring current in compact semiconductor circuits. The low frequency capabilities and sensitivity of both the P6019 and P6020 Probes can be expanded using the Type 134 Current Probe Amplifier. The amplifier also serves as an auxiliary voltage amplifier.

PERFORMANCE CHARACTERISTICS				
	P6019 PROBE WITH PASSIVE TERMINATION	*P6019 PROBE WITH TYPE 134 AMPLIFIER*	*P6020 PROBE WITH PASSIVE TERMINATION*	*P6020 PROBE WITH TYPE 134 AMPLIFIER*
SENSITIVITY	2 mA or 10 mA for each mV/div of oscilloscope deflection. Selected by termination switch. Accuracy ±3%.	Switched current amplifier steps from 1 mA/div to 1 A/div (with 50 mV/div oscilloscope setting). Accuracy ±3%.	1 mA or 10 mA for each mV/div of oscilloscope deflection. Selected by termination switch. Accuracy ±3%.	Switched current amplifier steps from 1 mA/div to 1 A/div (with 50 mV/div oscilloscope setting). Accuracy ±3%.
HIGH FREQ (—3 dB)	60 MHz at 10 mA/mV.	≥40 MHz	200 MHz at 10 mA/mV.	≥70 MHz
LOW FREQ (—3 dB)	450 Hz at 2 mA/mV. 120 Hz at 10 mA/mV.	≤12 Hz (within 0.4 dB at 30 Hz)	6.5 kHz at 1 mA/mV. 775 Hz at 10 mA/mV.	≤50 Hz
RISETIME	≤5.8 ns	≤9 ns	≤1.75 ns	≤5 ns
ABERRATIONS (first 50 ns of display)	≤4%	≤5% from 1 mA to 20 mA. ≤6% from 50 mA to 1 A.	≤4% to 100 MHz	≤5% from 1 mA to 20 mA. ≤6% from 50 mA to 1 A.
FLATNESS	≤4% of 10 μs square pulse at 2 mA/mV. ≤4% of 35 μs square pulse at 10 mA/mV.	≤3% tilt during 400 μs of displayed square-wave.	≤4% of 1 μs square pulse at 1 mA/mV. ≤4% of 10 μs square pulse at 10 mA/mV.	≤3% tilt during 80 μs of displayed square-wave.
NOISE		≤150 μA		≤150 μA.
MAXIMUM CURRENT RATING	15 A Peak to Peak.	15 A Peak to Peak.	6 A Peak to Peak.	6 A Peak to Peak.
MAXIMUM BREAKDOWN VOLTAGE	600 V	600 V	600 V	600 V

SEE PAGE 252 FOR PROBE COMPATIBILITY

Special Purpose Probes



TYPE 134 AS A VOLTAGE AMPLIFIER

DEFLECTION FACTOR: (with 50 mV/div oscilloscope input setting) 1 mV/div or 0.4 mV/div. Selected by lever switch.

GAIN: 50 or 125, ±3%.

IMPEDANCE: (input and output) approx 50 Ω, AC-coupled.

BANDWIDTH: 8 Hz to 54 MHz at a gain of 50; 10 Hz to 30 MHz at a gain of 125 (3-dB down).

ORDERING INFORMATION

CURRENT PROBES* WITH TERMINATION

P6019 PROBE WITH PASSIVE TERMINATION (015-0065-00) $ 90
P6019 PROBE ONLY (010-0196-00) ..... $ 75
P6019 PASSIVE TERMINATION (011-0078-00) ..... $ 20
P6020 PROBE WITH PASSIVE TERMINATION (015-0066-00) $135
P6020 PROBE ONLY (010-0197-00) $110
P6020 PASSIVE TERMINATION (011-0079-00) ..... $ 30

*Each probe includes: 1—3″ ground lead, 175-0124-00; 1—5″ ground lead, 175-0263-00; 2—alligator clip, 344-0046-00; 2—instruction manual, 070-0524-00.

CURRENT PROBES WITH TYPE 134 CURRENT AMPLIFIER **

P6019 PROBE, TYPE 134 AMPLIFIER WITH 117 V POWER SUPPLY (015-0067-00) $275
P6019 PROBE, TYPE 134 AMPLIFIER WITH 234 V POWER SUPPLY (015-0068-00) $275
P6020 PROBE, TYPE 134 AMPLIFIER WITH 117 V POWER SUPPLY (015-0069-00) $310
P6020 PROBE, TYPE 134 AMPLIFIER WITH 234 V POWER SUPPLY (015-0070-00) $310
TYPE 134 AMPLIFIER ONLY (015-0057-00) $180
POWER SUPPLY ONLY, 117 V (015-0058-00) ..... $ 30
POWER SUPPLY ONLY, 234 V (015-0059-00) ..... $ 30

** Each probe/amplifier includes: 1—hanger assembly, 014-0029-00; 1—cable, coax, 18″, 012-0104-00; 1—carrying case†, 016-0078-00; 1—3″ ground lead, 175-0124-00; 1—5″ ground lead, 175-0263-00; 2—alligator clip, 344-0046-00; 2—instruction manual, 070-0524-00.

OPTIONAL ACCESSORIES

BATTERY ADAPTER* (013-0050-00) $8.00
CALIBRATOR ADAPTER, BNC (013-0092-00) $3.50
ADAPTER, BNC TO UHF (103-0015-00) $1.15

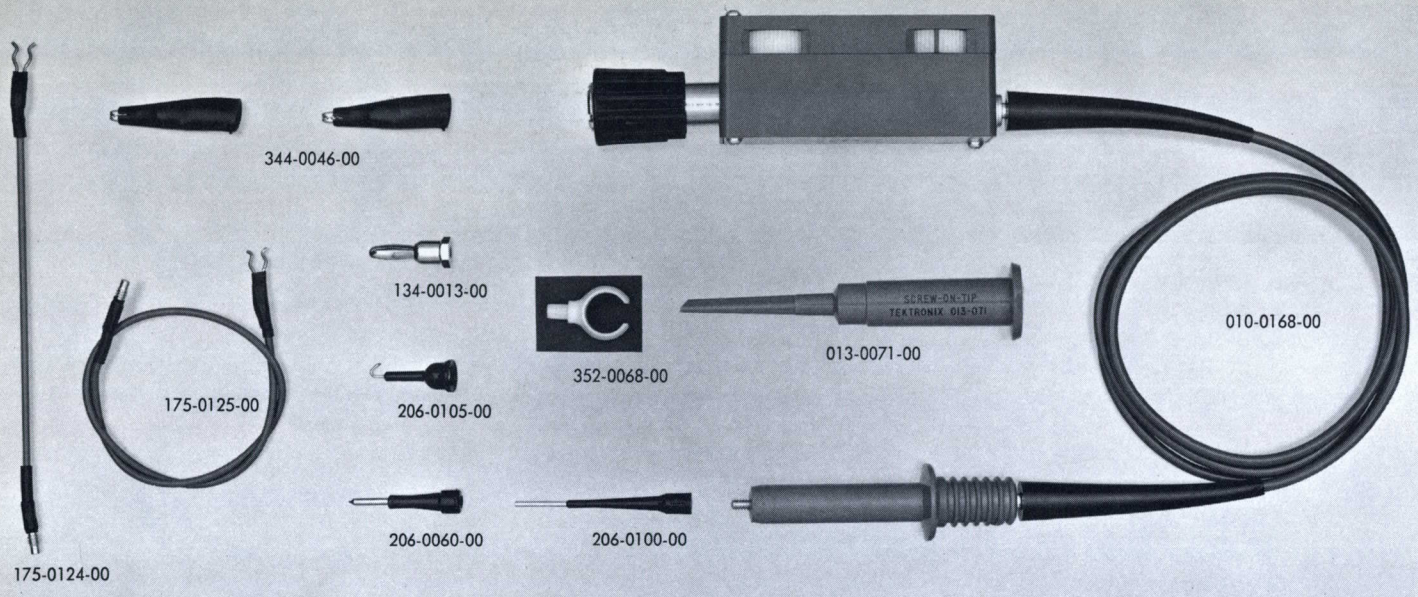
†Not shown.

*For 16 V to 33 V battery operation of amplifier. Use Eveready #763 or equivalent.

SEE PAGE 252 FOR PROBE COMPATIBILITY

Special Purpose Probes

P6023 10X PROBE



The P6023 Low-Capacitance Probe is designed for use with Tektronix differential preamplifiers.

The probe can be adjusted to match plug-in input capacitance ranging from 20 pF to 50 pF. The X10 attenuation ratio is adjustable over a ±2.5% range to compensate for differences in the input resistance of the plug-in unit. When two P6023 probes are used to drive the two inputs of a differential amplifier, the ability to change the attenuation ratio of one probe versus the other helps to maintain the common-mode rejection ratio of the system.

ATTENUATION RATIO is 10X, adjustable ±2.5%.

INPUT RESISTANCE is ≈8 megohms.

INPUT CAPACITANCE is approximately 12 pF when used with an instrument having a 20 pF or 47 pF input capacitance.

PROBE RISETIME is less than 7 ns.

TYPICAL RISETIME of probe, Type W Plug-In Unit, and Type 545B Oscilloscope is 17 ns.

VOLTAGE RATING is 1000 V DC or AC peak to peak.*

CABLE is 3.5′ long, terminated with a locking BNC or UHF connector.

P6023 PROBE PACKAGE

(010-0167-00 LOCKING BNC or 010-0065-00 UHF) $40

Includes:

- 1—P6023 probe, 010-0168-00 BNC or 010-0097-00 UHF
- 1—spring tip, 206-0060-00
- 1—hook tip, 206-0105-00
- 1—retractable hook tip, 013-0071-00
- 1—calibration tip, 206-0100-00
- 1—banana plug, 134-0013-00
- 2—minigator clip, 344-0046-00
- 1—probe holder, 352-0068-00
- 1—5″ ground lead, 175-0124-00
- 1—12″ ground lead, 175-0125-00
- 1—instruction manual, 070-0294-00

*Peak to peak voltage derating is necessary for CW frequencies higher than 5 MHz. At 20 MHz, the maximum allowable peak to peak voltage is 300 V.

SEE PAGE 252 FOR PROBE COMPATIBILITY

Special Purpose Probes

P170CF CATHODE-FOLLOWER PROBE

The P170CF Probe is recommended for use with the Tektronix Type 1121 Amplifier. An output connector on the front of the amplifier supplies the necessary voltage to operate the probe. When the P170CF is used with other instruments, an external power source is required.

The probe is supplied with three adjustable attenuator heads, offering attenuation up to 4000X. A 170-ohm termination is required when the probe is used with the Type 1121 Amplifier.

PROBE ALONE:

ATTENUATION is 2X.

RISETIME is less than 2 ns.

INPUT SHUNT CAPACITANCE is 5 to 5.5 pF.

LOW FREQUENCY INPUT RESISTANCE is 12 megohms, isolated by 0.001 μF coupling capacitor.

FREQUENCY RESPONSE is down less than 0.5 dB at 65 MHz for high frequency and down 3 dB at 15 Hz for low frequency.

MAXIMUM VOLTAGE INPUT is $\pm$0.5 V peak.

POWER SUPPLY REQUIREMENTS are regulated +120 V at 10 mA, regulated or unregulated 6.3 V at 150 mA.

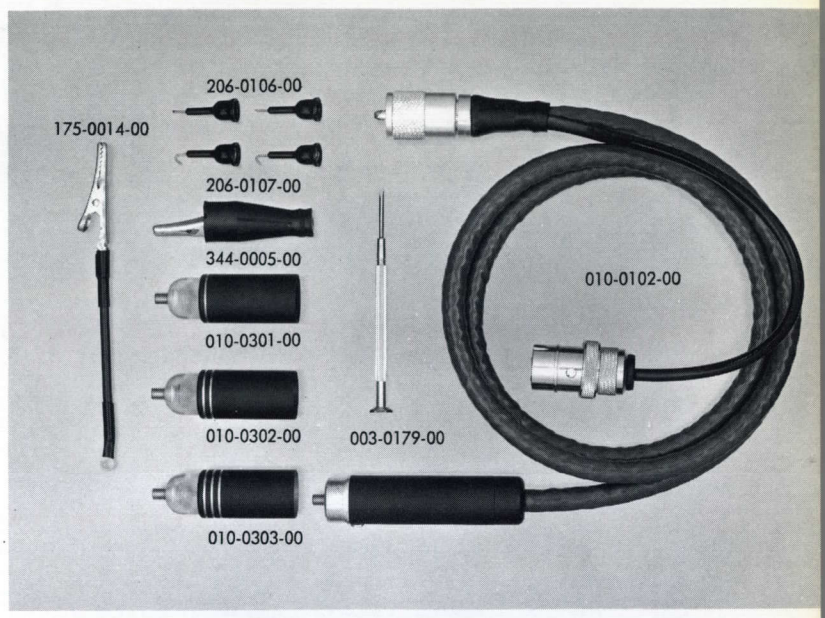
CABLE is 3.5′ long, terminated with a UHF connector.

P170CF PROBE PACKAGE (010-0101-00) $99.50

Includes:

1—P170CF probe, 010-0102-00
1—PAX-1 attenuator head, 010-0301-00
1—PAX-11 attenuator head, 010-0302-00
1—PAX-111 attenuator head, 010-0303-00
2—hook tips, 206-0107-00
2—straight tips, 206-0106-00
1—ground lead, 175-0014-00
1—clip, 344-0005-00
1—screwdriver, 003-0179-00
1—instruction manual, 070-0201-00

170-Ω TERMINATION (011-0048-00) $15.00



P170CF ATTENUATOR HEADS						
Type	*Attenuation (includes P170CF)*	*Input Capacity*	*Low-Freq 3-dB Point*	*Max Voltage Input*	*Part Number*	*Price*
PAX-I	4X min 40X max	5 pF 1.2 pF	800 Hz 1700 Hz	$\pm$1 V peak	010-0301-00	$14.00
PAX-II	40X min 400X max	5 pF 1.2 pF	150 Hz 150 Hz	$\pm$10 V peak	010-0302-00	$14.00
PAX-III	400X min 4000X max	3 pF 1.1 pF	60 Hz 60 Hz	$\pm$100 V peak	010-0303-00	$14.00

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 an external power source.

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 MHz.

LOW FREQUENCY RESPONSE is 3-dB down at 5 Hz.

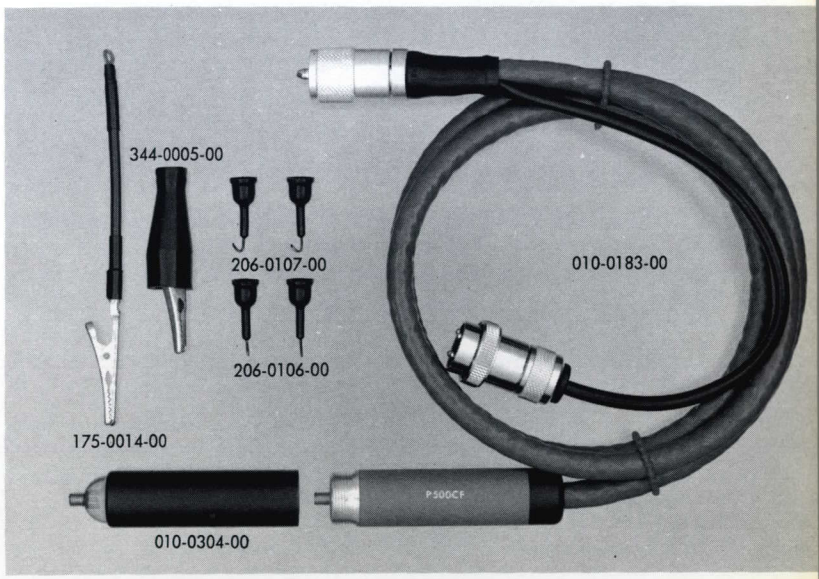
AMPLITUDE DISTORTION is less than 3% for peak amplitudes up to 5 V when using the probe alone, or up to 50 V when using the 10X attenuator head.

MAXIMUM INPUT VOLTAGE is approximately 5 V at 10 MHz or 2 V at 30 MHz for the probe alone and approximately 50 V at 10 MHz or 20 V at 30 MHz 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.

CABLE is 3.5′ long, terminated with a UHF connector.



P500CF PROBE PACKAGE (010-0109-00) $85

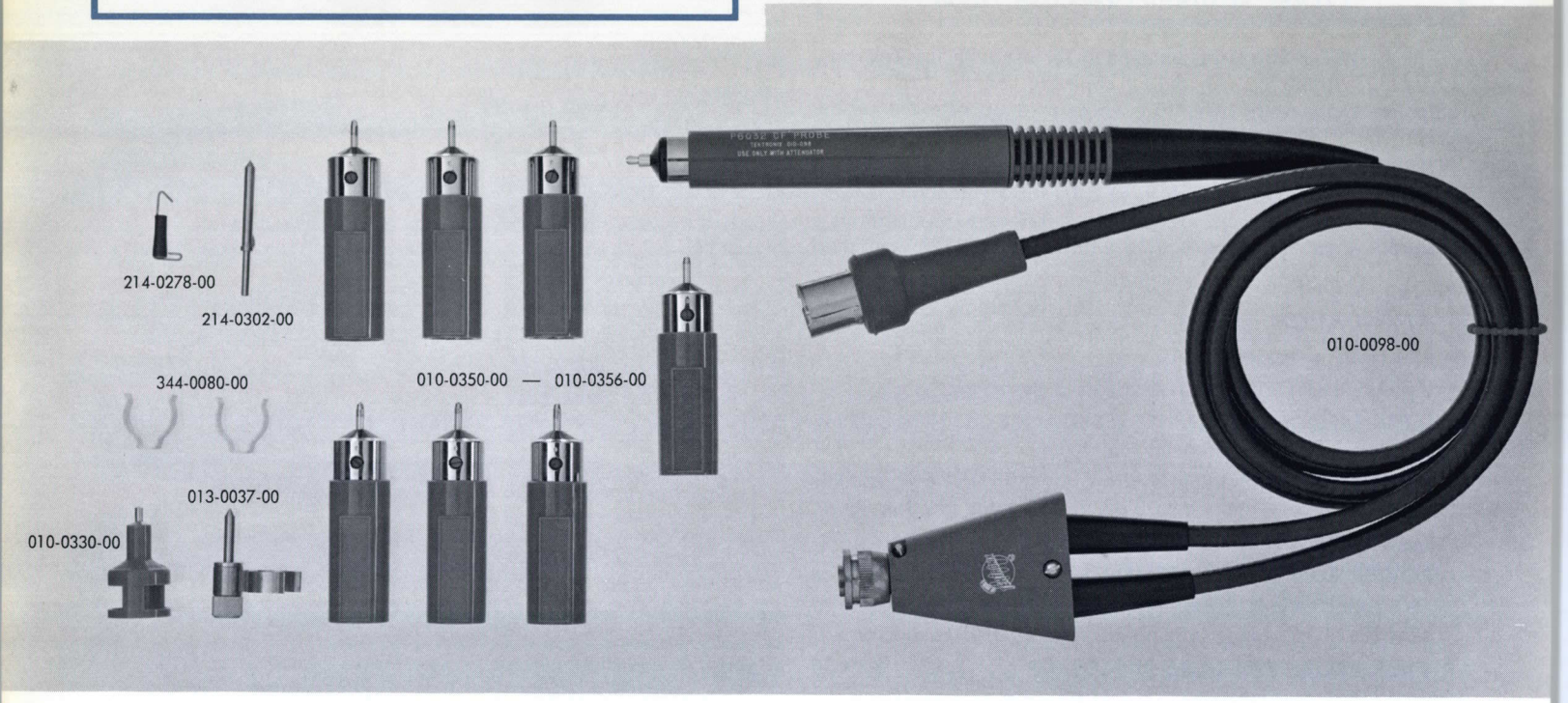
Includes:

1—P500CF probe, 010-0183-00
1—10X probe head, 010-0304-00
2—hook tips, 206-0107-00
2—straight tip, 206-0106-00
1—ground lead, 175-0014-00
1—clip, 344-0005-00
1—instruction manual, 070-0212-00

SEE PAGE 252 FOR PROBE COMPATIBILITY

Sampling Probes

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, 4S1, 4S2A, or 1S1.

The attenuator heads can be compensated for AC attenuation ratios.

RISETIME is typically 0.4 ns for probe and attenuator head.

MAXIMUM OUTPUT is ±150 mV into a 50-Ω load.

SIGNAL DELAY is approximately 10 ns.

POWER REQUIREMENTS are 12.6 V at 180 mA for the filament and +100 V at 12 mA for the plate.

CABLE is 54" long with GR connector.

CAPACITOR-COUPLER HEAD is rated at 0.001 μF, 600 V DC. Low frequency 3-dB point is 16 Hz.
Order Part Number 010-0330-00 ..... $4

P6032 PROBE PACKAGE (010-0108-00) $220

Includes:
- 1—P6032 probe, 010-0098-00
- 1—capacitor-coupler head, 010-0330-00
- 1—ground clip, 013-0037-00
- 1—spring contact, 214-0278-00
- 7—attenuator head
- †not shown
- 1—center pin, 214-0302-00
- 2—solderable ground clip, 344-0080-00
- † 4—indicator ring, 354-0196-00
- † 4—indicator ring, 354-0197-00
- † 1—storage case, 202-0136-00
- † 1—instruction manual, 070-0327-00

Part Number	*Attenuator Head*	*Max Input Voltage**	*Input Capacitance (±10%)*
010-0350-00	10X	± 1.5 V	3.6 pF
010-0351-00	20X	± 3.0 V	2.6 pF
010-0352-00	50X	± 7.5 V	1.8 pF
010-0353-00	100X	± 15 V	1.5 pF
010-0354-00	200X	± 30 V	1.4 pF
010-0355-00	500X	± 75 V**	1.3 pF
010-0356-00	1000X	± 150 V**	1.3 pF

*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 MHz for the 1000X attenuator head and 1000 MHz for the 500X attenuator head.

Attenuator Head	*Max Input Voltage (peak to peak) (at 100% duty factor)*			
	500 MHz	*750 MHz*	*1000 MHz*	*1250 MHz*
500X	150 V	150 V	150 V	125 V
1000X	300 V	200 V	150 V	125 V

INPUT RESISTANCE at DC of all attenuator heads is 10 megohms ±2%.

All Heads ..... $18.00 ea

SEE PAGE 252 FOR PROBE COMPATIBILITY

P6034 10X PROBE

The P6034 low-capacitance, miniature passive probe is designed for use with Tektronix Type 4S1, 4S2A, 1S1, 1S2 or Type 3S76 Pulse-Sampling Plug-In Units for making accurate measurements of high-speed repetitive pulses. Risetime of the probe conforms to the risetime of the plug-in units.

ATTENUATION RATIO is 10X.

INPUT RESISTANCE is 500 ohms ±1.5%, approximately 300 ohms at 1 GHz.

INPUT CAPACITANCE is 0.7 pF, DC to 100 MHz.

PROBE RISETIME is less than 100 ps.

BANDWIDTH is DC to 3.5 GHz (3-dB down).

LOW FREQUENCY RESPONSE is approximately 70 kHz at 3-dB down, AC-coupled.

MAXIMUM RINGING AND OVERSHOOT is 2% using a 25-ohm source and coaxial probe ground.

VOLTAGE RATING is 16 V DC or 45 V peak to peak.*

CABLE is 18" long with GR connector.

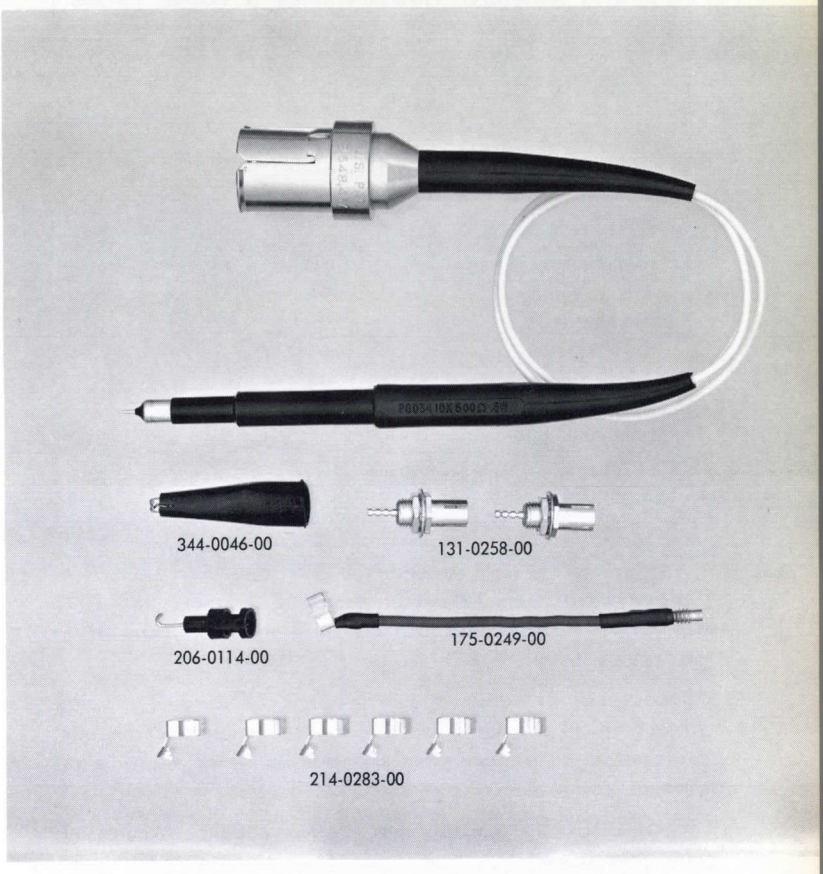
P6034 PROBE PACKAGE (010-0110-00) $35

Includes:

- 1—P6034 probe
- 1—hook tip, 206-0114-00
- 6—ground clip, 214-0283-00
- 1—minigator clip, 344-0046-00
- 2—test jack, 131-0258-00
- 1—2½" ground lead, 175-0249-00
- 1—instruction manual, 070-0368-00

*peak to peak voltage derating is necessary for CW frequencies higher than 800 MHz. At 1 GHz, the maximum allowable peak to peak voltage is 25 V.

OPTIONAL ACCESSORIES—see probe adapters on page 268.



P6035 100X PROBE

The P6035 low-capacitance, miniature passive probe physically resembles the P6034 probe. It is designed for use with the Types 4S1, 4S2A, 1S1, 1S2, and 3S76 Sampling Plug-In Units for making high-speed repetitive-pulse measurements.

ATTENUATION RATIO is 100X.

INPUT RESISTANCE is 5 kilohms ±1.5%, approximately 1.5 k at 1 GHz.

INPUT CAPACITANCE is 0.6 pF, DC to 100 MHz.

PROBE RISETIME is less than 200 ps.

BANDWIDTH is DC to 1.7 GHz (3-dB down).

LOW FREQUENCY RESPONSE is approximately 6 kHz at 3-dB down, AC-coupled.

MAXIMUM RINGING AND OVERSHOOT is 2% using a 25-ohm source and coaxial probe ground.

VOLTAGE RATING is 50 V DC or 140 V peak to peak.*

CABLE is 18" long with GR connector.

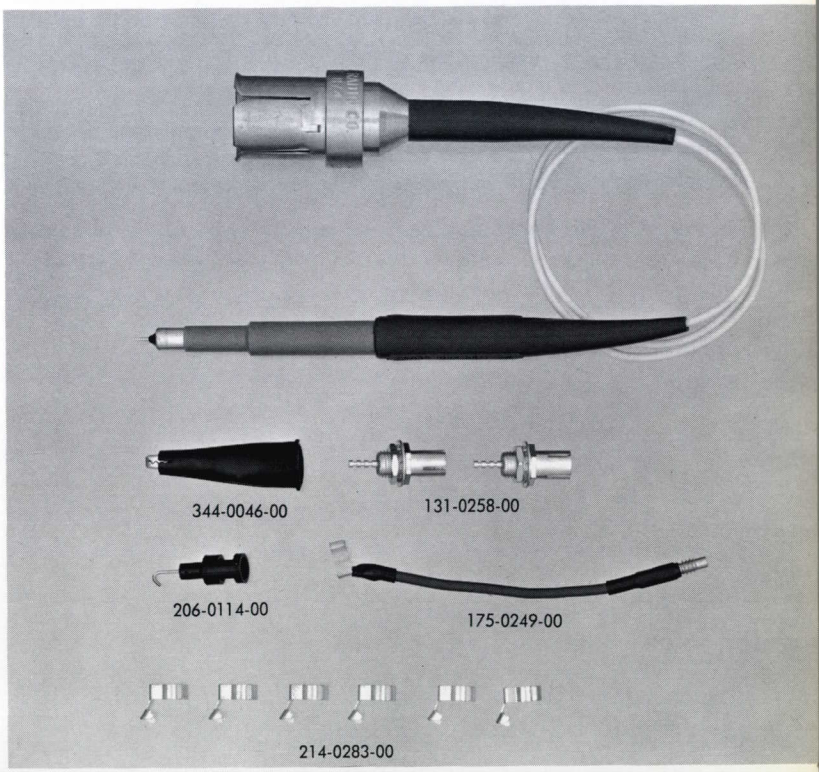
P6035 PROBE PACKAGE (010-0111-00) $35

Includes:

- 1—P6035 probe
- 1—hook tip, 206-0114-00
- 6—ground clip, 214-0283-00
- 1—minigator clip, 344-0046-00
- 2—test jack, 131-0258-00
- 1—2½" ground lead, 175-0249-00
- 1—instruction manual, 070-0369-00

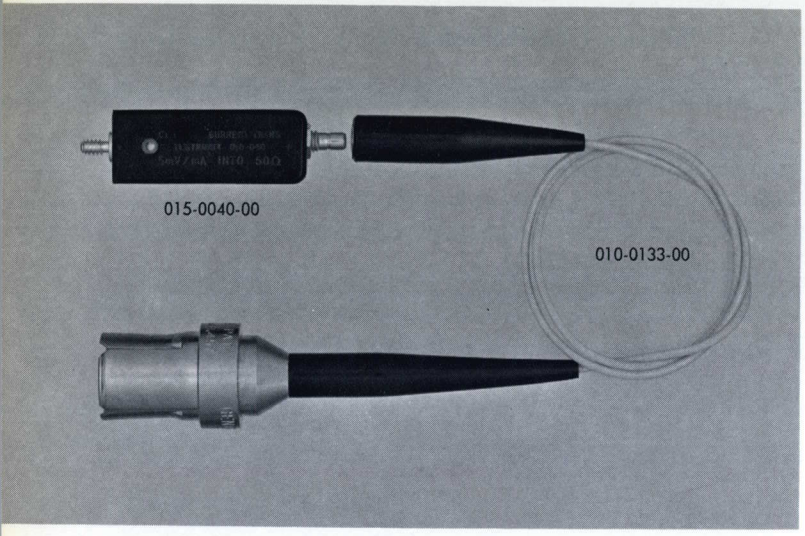
*peak to peak voltage derating is necessary for CW frequencies higher than 500 MHz. At 1 GHz, the maximum allowable peak to peak voltage is 60 V.

OPTIONAL ACCESSORIES—see probe adapters on page 268.



Sampling Probes

TYPE CT-1 CURRENT TRANSFORMER & P6040 PROBE



When used with Tektronix sampling systems, the CT-1 and P6040 combination will measure milliamp currents at frequencies from 35 kHz to beyond 1 GHz.

Because of its compact size (approx 2" long, 9/16" wide and 3/8" thick) the CT-1 is easy to use in compact circuits. Its insulated case eliminates the possibility of shorting-out adjacent components or wiring.

SENSITIVITY is 5 mV/mA into a 50-ohm load. Accuracy is better than ±3%.

DECAY TIME CONSTANT is 5 μs, approximated by 1% per 50 ns; limit, 1 μs.

RISETIME is less than 0.35 ns.

FREQUENCY RESPONSE is 35 kHz to 1 GHz (3 dB down points).

INSERTION IMPEDANCE with a 50-ohm termination is 1 ohm shunted by approximately 5 μH; 2 ohms shunted by approximately 5 μH without a 50-ohm termination.

CAPACITIVE LOADING to a bare wire passing through the CT-1 transformer is typically 1.5 pF for #14 gauge, 0.6 pF for #20 gauge.

MAXIMUM VOLTAGE OF CIRCUIT UNDER TEST is 1000 V DC.

DIRECT CURRENT reduces the L/R time constant by a factor of 2 at 0.6 A.

PULSE CURRENT RATING is 100 A peak, with an amp/second product of 1 A/μs. When the A/s product is exceeded, the core saturates reducing the CT-1 output to zero.

RMS CURRENT RATING is 500 mA maximum.

TEMPERATURE RATING is −25°C to +65°C.

PHYSICAL DIMENSIONS are 3/8" x 9/16" x 1 13/16" plus 1/4" x 6-32 mounting stud.

TYPE P6040 PROBE

The P6040 Probe is an inter-connecting cable for the CT-1, used between the transformer and oscilloscope input.

If several CT-1 Transformers are in a circuit, the P6040 Probe can be used to monitor any one of them.

The P6040 can be used with other test-point connectors, such as Amphenol series 27 Sub-Minax or Sealectro Sub-Miniature RF.

IMPEDANCE is 50 ohms.

ATTENUATION is 1X.

OUTPUT CONNECTOR is a GR type.

CABLE LENGTH is 18 inches. Additional 50-Ω cable can be used in series with the probe. RG8/U or RG58/AU is recommended for best preservation of the CT-1 Transformer high-frequency response.

CT-1 AND P6040 (015-0041-00) **$31**
CT-1 CURRENT TRANSFORMER (015-0040-00) **17**
P6040 PROBE (010-0133-00) **14**

SEE PAGE 252 FOR PROBE COMPATIBILITY

TYPE CT-2 CURRENT TRANSFORMER & P6041 PROBE

The CT-2 Current Transformer and P6041 Probe combination is designed for use with conventional oscilloscopes such as the Tektronix Type 530, 540, 550 and 580 Series. Since the frequency response of the CT-2/P6041 is only 0.6-dB down at 200 MHz, the response of the system will be that of the oscilloscope used.

The insulated case of the CT-2 Current Transformer is convenient to use in applications where limited circuit space exists. Several CT-2 Transformers may be placed throughout the circuit and monitored by one or more P6041 Probes.

SENSITIVITY is 1 mV/mA into a 50-ohm load. Accuracy is better than ±3%.

DECAY TIME CONSTANT is 125 μs, approximated by 1% per 1.25 μs; limit, 25 μs.

RISETIME is approximately 0.5 ns.

FREQUENCY RESPONSE is 3-dB down at 1.2 kHz, 0.6-dB down at 200 MHz.

INSERTION IMPEDANCE with a 50-ohm termination is 0.04 ohms shunted by approximately 5 μH; 0.08 ohms shunted by approximately 5 μH without a 50-ohm termination.

CAPACITIVE LOADING to a bare wire passing through the CT-2 Transformer is typically 2.1 pF for #16 gauge, 0.7 pF for #22 gauge.

MAXIMUM VOLTAGE OF CIRCUIT UNDER TEST is 1000 V DC.

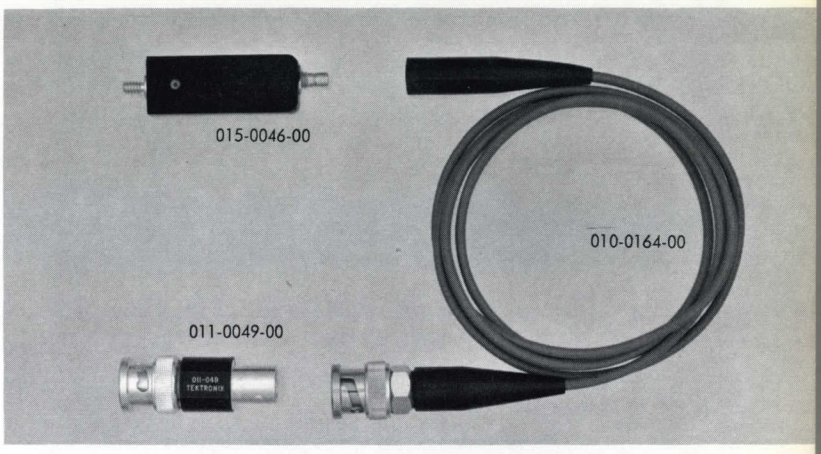
DIRECT CURRENT reduces the L/R time constant by a factor of 2 at 0.5 A.

PULSE CURRENT RATING is 100 A peak, with an amp/second product of 50 A/μs. When the A/s product is exceeded, the core saturates reducing the CT-2 output to zero.

RMS CURRENT RATING is 2.5 A maximum.

TEMPERATURE RATING is −25° C to +65° C.

PHYSICAL DIMENSIONS are 3/8" x 9/16" x 1 13/16" plus 1/4" x 6-32 mounting stud.



TYPE P6041 PROBE

The P6041 Probe serves as an interconnecting cable between the CT-2 Transformer and the oscilloscope input. A 50-ohm termination is used in conjunction with the P6041 for terminating the probe at the high impedance input of the oscilloscope used.

Although designed for use with the CT-2, the P6041 Probe can be used with other test-point connectors, such as Amphenol Series 27 Sub-Minax or Sealectro Sub-Miniature RF.

IMPEDANCE is 50 ohms.

ATTENUATION is 1X.

OUTPUT CONNECTOR is BNC type.

CABLE LENGTH is 42". Additional 50-ohm cable can be used in series with the probe. RG8/U or RG58A/U cable is recommended to preserve the high-frequency response.

CT-2 AND P6041/50-OHM TERMINATION (015-0047-00) .. $37.75

CT-2 CURRENT TRANSFORMER (015-0046-00) 17.00

P6041 PROBE (010-0164-00) 12.00

50-OHM TERMINATION (011-0049-00) 8.75

TYPE CT-3 50-OHM SIGNAL PICKOFF

Designed for use with high-frequency oscilloscopes, the CT-3 Pickoff provides a convenient means of picking off a signal in a 50-ohm system. Used with any of the Tektronix Sampling Instruments, the CT-3 provides the link for use as a trigger source.

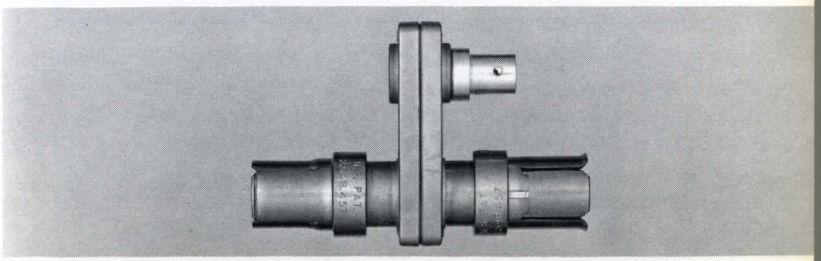
The CT-3 inductively meters the current in a circuit, developing a proportional output voltage. Used in a 50-ohm system, the output voltage of the CT-3 is 10% of the voltage at the center conductor.

SENSITIVITY is 10% of the voltage under test, into a 50-ohm load.

DECAY TIME CONSTANT is 4.5 μs at 0 DC current.

RISETIME is less than 0.4 ns.

FREQUENCY RESPONSE is 50 kHz to 875 MHz at 0 DC current.



INSERTION IMPEDANCE with a 50-ohm termination is 1 ohm shunted by 4.5 μH; 2 ohms shunted by 4.5 μH without a 50-ohm termination.

VSWR is less than 1.2 at 1.5 GHz.

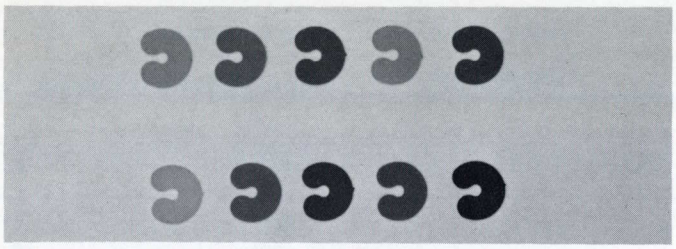
VOLTAGE RATING at 0 V DC is 25 V RMS, 1 kV pulse peak. The volts/second product is 100 V/μs. If exceeded, the L/R decay will decay rapidly toward zero.

ORDER PART NUMBER 017-0061-00 ..... $30.00

SEE PAGE 252 FOR PROBE COMPATIBILITY

Probe Accessories

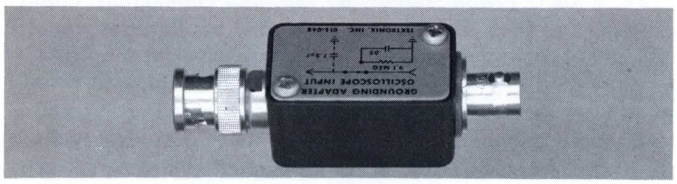
IDENTIFICATION TAGS



Probe identification tags for multi-probe applications help locate correlating probe ends quickly. One package contains 2 each of 10 colors.

Order Part Number 334-0798-00 ..... $1.00

PROBE GROUNDING ADAPTER



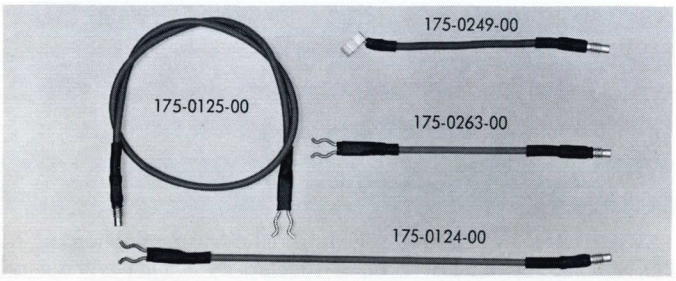
PROBE GROUNDING ADAPTER for Tektronix 10X probes provides a convenient method of establishing the vertical position of the oscilloscope trace in relation to zero volts input at the probe tip. The adapter eliminates the need for moving the probe tip from the signal source to ground.

Push-button operation of the Adapter disconnects the oscilloscope input from the probe and, at the same time, connects the input to ground through a parallel combination of a 9.1 megohm resistor and a 0.03 μF capacitor.

The Probe Grounding Adapter adds 7.5 pF to the input capacitance of the plug-in or oscilloscope. Readjustment of the probe is necessary for proper squarewave response.

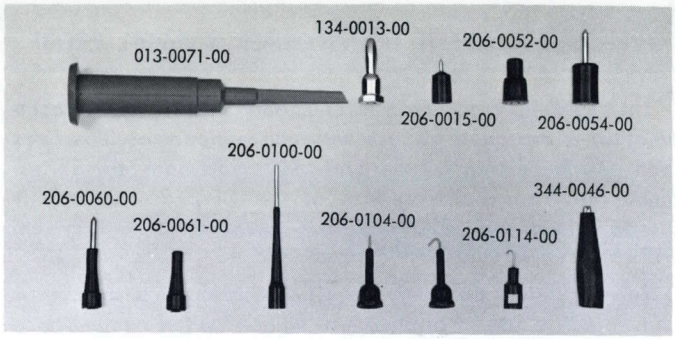
Order Part Number (015-0048-00 BNC) $11
(015-0044-00 UHF) 11

PROBE TIPS, GROUND LEADS AND ADAPTERS



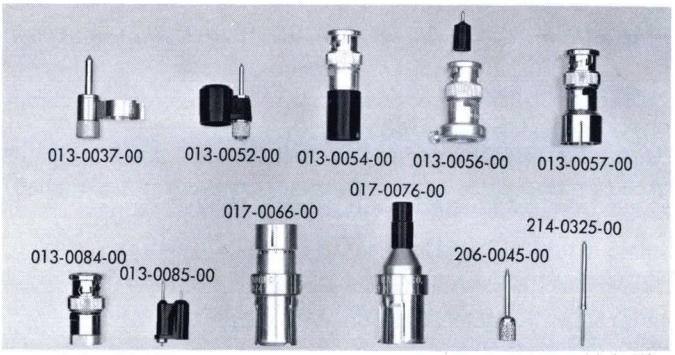
The following Ground Leads have a 6-32 thread size.

DESCRIPTION	PART NUMBER	PRICE
3-inch Ground Lead	175-0263-00	$ .60
5-inch Ground Lead	175-0124-00	.60
12-inch Ground Lead	175-0125-00	.60
2½-inch Ground Lead (for P6034, P6035, P6038)	175-0249-00	1.70



The following Tips have a 6-32 thread size.

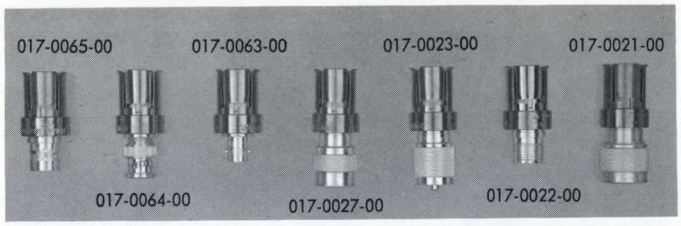
DESCRIPTION	PART NUMBER	PRICE
Calibration tip (P6023)	206-0100-00	$ .75
Insulated Straight Shank	206-0054-00	.25
Long Straight Shank	206-0104-00	.25
Spring Tip, without Shank	206-0061-00	.40
Recessed, fits 0.065" recessed pin or plug	206-0052-00	.25
Short Straight Shank	206-0015-00	.25
Spring Tip	206-0060-00	.50
Hook Tip (P6038)	206-0114-00	.40
Banana Tip	134-0013-00	.20
Minigator Tip	344-0046-00	.20
Retractable Hook Tip	013-0071-00	2.00



DESCRIPTION	PART NUMBER	PRICE
Probe Tip to GR Adapter ((for P6010, P6011, P6034, P6035, P6038)	017-0076-00	$4.50
Probe Tip to GR Adapter (for P6025, P6026, P6032)	017-0066-00	6.25
Probe to male BNC Connector	013-0056-00	3.00
Probe Tip to BNC Adapter (for P6006, P6007, P6008, P6009)	013-0054-00	3.00
Probe Tip to BNC Adapter (for P6025, P6026, P6032)	013-0057-00	4.50
Probe Tip to BNC Adapter (for P6010, P6011, P6034, P6035, P6038)	013-0084-00	3.00
Bayonet Ground Assembly (for P6010, P6011, P6034, P6035, P6038)	013-0085-00	2.50
Bayonet Ground Assembly (for P6008, P6009)	013-0052-00	2.50
Ground Clip Assembly (for P6025, P6026)	013-0037-00	2.50
Straight Shank, fits 0.082" pin jacks	206-0045-00	.25
Center Pin (for 013-0052-00)	214-0325-00	.25

Sampling Accessories

CABLE ADAPTERS



Adapter	Part Number	Price
GR to C male	017-0027-00	$7.00
GR to N male	017-0021-00	5.50
GR to UHF female	017-0022-00	5.50
GR to UHF male	017-0023-00	5.00
GR to BNC female	017-0063-00	4.75
GR to BNC male	017-0064-00	6.50
GR to C female	017-0065-00	7.50

50-OHM CONNECTING CABLES

(GR-TYPE CONNECTORS)

Delay	Cable Type	Part Number	Price
1 ns	RG58/CU*	017-0503-00	$ 8.25
2 ns	RG58/CU	017-0505-00	13.50
5 ns	RG8/213	017-0502-00	13.50
10 ns	RG58/CU	017-0501-00	13.50
20 ns	RG8/213	017-0504-00	16.50

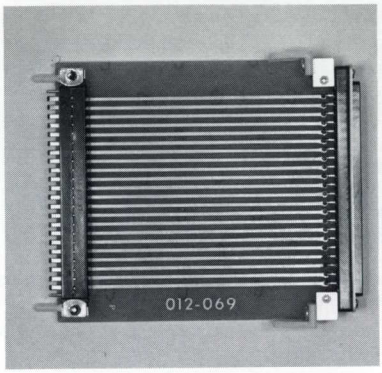
*Connector on one end only.

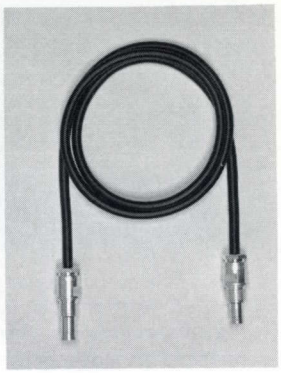
ATTENUATORS, TERMINATIONS

Item	Part Number	VSWR Rating*	Price
50-Ω 10:1 Attenuator	017-0078-00	<1.1 to 1 GHz	$30.00
50-Ω 5:1 Attenuator	017-0079-00	<1.1 to 1 GHz	30.00
50-Ω 2:1 Attenuator	017-0080-00	<1.1 to 1 GHz	30.00
50-Ω Termination (end-line)	017-0081-00	<1.1 to 1 GHz	25.00
50-Ω Type 874-L20 20-cm Airline	017-0084-00	<1.1 to 1 GHz	10.50
50-Ω Type 874-K Coupling Cap	017-0028-00	<1.06 to 1 GHz	10.50
50-Ω Type 874-X Insertion Unit	017-0030-00	—	13.00
50-Ω Type 874-EL 90° Elbow	017-0070-00	<1.06 to 2 GHz <1.15 to 4 GHz	11.00
50-Ω Type 874-T Tee	017-0069-00	—	15.00
50-Ω to 125-Ω Min Loss Attenuator	017-0052-00	<1.2 to 1 GHz	30.00
50-Ω Type 874-TPD Power Divider	017-0082-00	—	70.00
50-Ω Termination, GR to BNC (mid-line)	017-0083-00	—	28.00

*See Page 272 For Connector Characteristics.

SAMPLING PLUG-IN ACCESSORIES





15-PIN PLUG-IN EXTENSION CARD—Allows protrusion of Type 6R1A 15-pin etched-circuit boards.
Order Part Number 012-0067-00 . . . . . $20

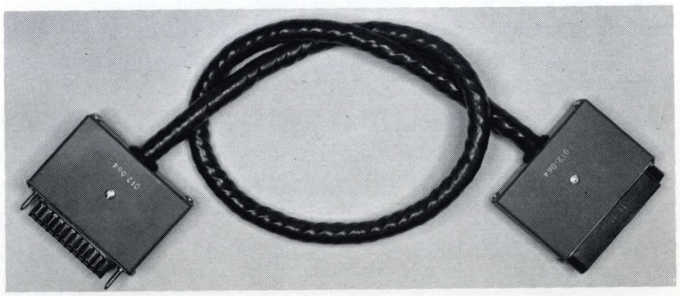
20-PIN PLUG-IN EXTENSION CARD—Allows protrusion of Type 6R1A 20-pin etched-circuit boards.
Order Part Number 012-0068-00 . . . . . $25

56-PIN PLUG-IN EXTENSION CARD—Allows protrusion of Type 3T4 56-pin etched-circuit boards. Also used for extending Type 262 Programmer cards.
Order Part Number 012-0078-00 . . . . . $20

TYPE 3S3 SUB-CHASSIS EXTENSION—Allows maintenance of Type 3S3 sub-chassis when 3S3 is extended out of oscilloscope.
Order Part Number 012-0077-00 . . . . . $25

TYPE 4S1 SUB-CHASSIS EXTENSION—Allows maintenance of Type 4S1 sub-chassis when 4S1 is extended out of oscilloscope.
Order Part Number 012-0069-00 . . . . . $25

50-OHM GREMAR 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 012-0070-00 . . . . . $10.50

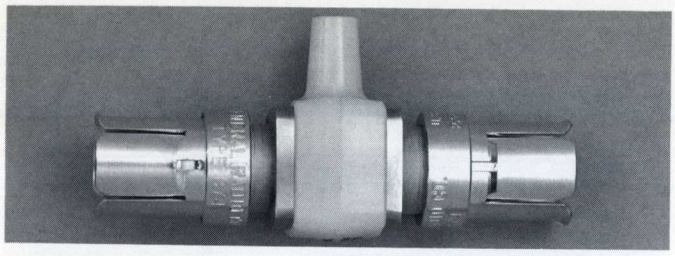


FLEXIBLE EXTENSION—30" long, permits Type 661 vertical or sweep plug-in units to be operated away from oscilloscope. See Gremar Cable.
Order Part Number 012-0064-00 . . . . . $23

FLEXIBLE EXTENSION—30" long, permits Type 3S76, 3T4, 3S3 and Type 3T77A Sampling Plug-In Units to be operated away from oscilloscope.
Order Part Number 012-0066-00 . . . . . $23

Plug-In Unit Accessories

50-OHM VOLTAGE PICKOFF "T"



The 50-ohm "T" type pickoff allows signal pickoff from a closed 50-ohm system with minimum disturbance of the system's characteristics. The coaxial "T" incorporates GR Type connectors at each end, with a plastic center collar for probe tip insertions.

TYPE VP-1 is designed for use with the P6034 or P6035 Miniature Passive Probes. The reflection coefficient of the VP-1 alone is approximately 3%. With the P6034 or P6035 inserted, it is typically 2%. The resistive reflection of the VP-1 is ½% when used with the P6035, 5% when used with the P6034.

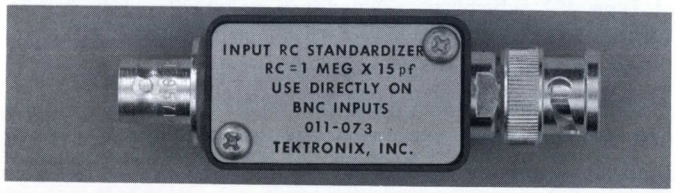
Order Part Number 017-0073-00 . . . . . $25

TYPE VP-2 is used in conjunction with the P6038 Direct Sampling Probe. The reflection coefficient without the P6038 Probe is approximately 4%. With the probe inserted it is typically 6%.

All accessory heads supplied with the P6038 Probe can be used with the VP-2.

Order Part Number 017-0077-00 . . . . . $30

INPUT TIME-CONSTANT STANDARDIZERS



Five input standardizers are available for standardizing the input time-constant of plug-ins or oscilloscopes having a nominal capacitance of 12 pF, 15 pF, 20 pF, 24 pF, or 47 pF. Each standardizer has an approximate 1 megohm resistance and 2X voltage attenuation.

12 pF (011-0051-00 UHF) (011-0065-00 BNC) $10.00
15 pF (011-0073-00 BNC) 10.00
20 pF (011-0022-00 UHF) (011-0066-00 BNC) 10.00
24 pF (011-0029-00 UHF) (011-0067-00 BNC) 10.00
47 pF (011-0030-00 UHF) (011-0068-00 BNC) 10.00

BLANK PLUG-IN CHASSIS

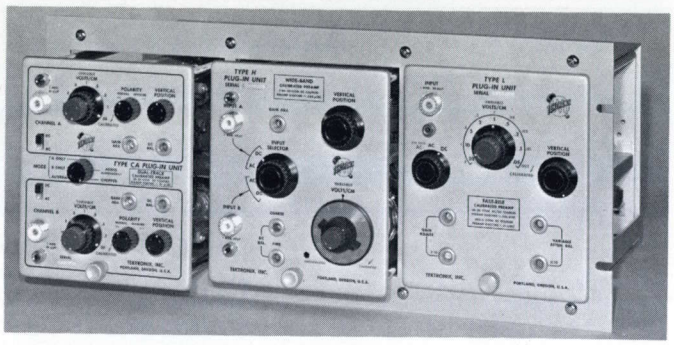
BLANK 1-SERIES AND LETTER-SERIES PLUG-IN CHASSIS—Useful for constructing your own special circuits.

Order Part Number 040-0065-00 . . . . . $25.00

BLANK TYPE 560-SERIES PLUG-IN CHASSIS—For special circuit construction of sweep or vertical amplifier.

Order Part Number 040-0245-00 . . . . . $25.00

STORAGE CABINETS



PLUG-IN PREAMPLIFIER STORAGE CABINET mounts in standard rack, available in two types:

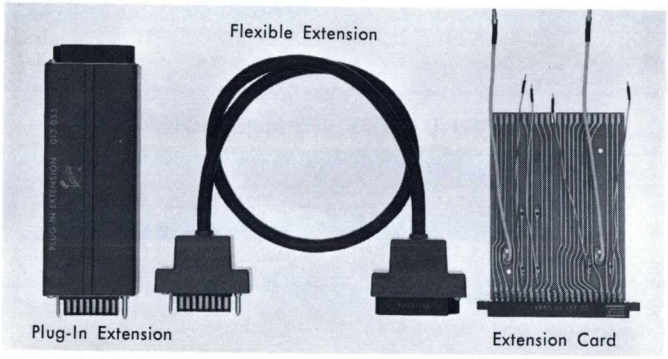
FOR 1-SERIES AND LETTER-SERIES PLUG-IN UNITS—holds 3 plug-in units. Measures 19" wide, 8¾" high, 9⅜" deep.

Order Part Number 437-0031-00 . . . . . $25

FOR 2 AND 3-SERIES PLUG-IN UNITS—holds 4 plug-in units. Measures 19" wide, 7" high, 13 5/16" deep.

Order Part Number 437-0071-00 . . . . . $30

EXTENSIONS



PLUG-IN EXTENSIONS—allow unit to be operated partially out of the oscilloscope:

For units in Type 560-Series Oscilloscopes

Order Part Number 013-0034-00 . . . . . $14.00

For units in Type 530-, 540-, 550-, 580-Series Oscilloscopes

Order Part Number 013-0055-00 . . . . . $14.50

For units in Type 647 Oscilloscope

Order Part Number 013-0077-00 . . . . . $20.00

For Type 21A and 22A Time-Base Units

Order Part Number 013-0013-00 . . . . . $20.00

EXTENSION CARDS—extend removable circuit cards for ease of calibration and maintenance:

For Type 1A1 Plug-In Unit

Order Part Number 012-0100-00 . . . . . $20.00

For Type 262 Programmer

Order Part Number 012-0078-00 . . . . . $20.00

FLEXIBLE EXTENSIONS—permit plug-in unit operation away from the oscilloscope. Useful for trouble shooting—not used for calibration:

For 1-Series and Letter-Series Plug-In Units

Order Part Number 012-0038-00 . . . . . $20.00

For 10 and 11-Series Plug-In Units

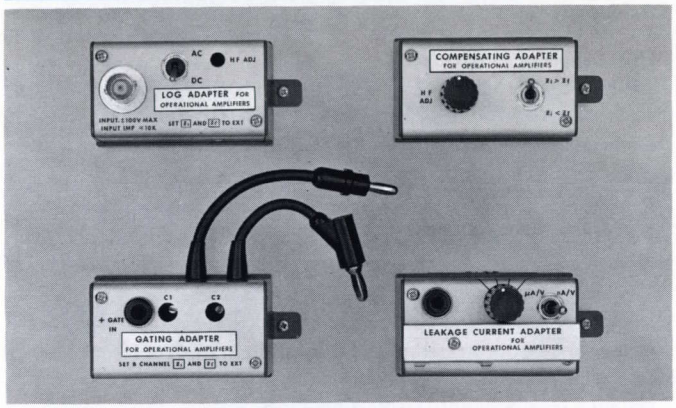
Order Part Number 012-0080-00 . . . . . $24.00

Plug-In Unit Accessories

GAIN ADJUST ADAPTER

Permits an external signal to bypass the plug-in preamplifier. For adjusting the deflection factor of the main amplifier of Types 530, 540 and 550-Series Oscilloscopes. Order Part Number 013-0005-00 . . . . . $15

OPERATIONAL AMPLIFIER ADAPTERS



LOGARITHMIC AMPLIFIER ADAPTER

The Logarithmic Amplifier Adapter converts linear amplification characteristics of either operational amplifier in the Type O or 3A8 Plug-In Unit to approximate logarithmic 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	Signal-In	Deflection
±0.1 V	1 cm ±0.5 mm	±10.0 V	3 cm ±1.0 mm
±1.0 V	2 cm ±0.5 mm	±100 V	4 cm ±1.0 mm

Below an input level of ±0.05 V, the amplifier is no longer logarithmic.

RISETIME—Typically 0.2 μs—for a 10-V signal to rise from 0.1 V to 10 V.

FALLTIME—Typically 0.3 μs—for a 10-V signal to fall from 10 V to 0.1 V.

LOW FREQUENCY RESPONSE—65 Hz. (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.)

BANDWIDTH—The —3 dB apparent bandwidth varies with both signal amplitude and signal DC level. It varies typically from 400 kHz to 1 MHz, depending on the input signal.

LOGARITHMIC AMPLIFIER ADAPTER (013-0067-00) $75

GATING ADAPTER

The Gating Adapter permits on and off gating of the Type O Unit from the +20 V gate output of the oscilloscope used. The Adapter can also be used with the Type 3A8 using an external gating signal.

With the Adapter plugged into the lower operational amplifier, the upper operational amplifier is gated on or off. The signal applied is then amplified, integrated or differentiated only during the "on" time.

The Adapter is particularly useful for integration operations where the accumulative voltage of repetitive signals would exceed the voltage rating of the deflection amplifier input.

GATING ADAPTER (013-0068-00) $75

COMPENSATING ADAPTER

The Compensating Adapter extends the frequency performance of the Plug-In Unit Operational Amplifiers.

The adapter compensates for stray capacitance associated with the internal Z_i and Z_f resistors, providing an adjustment for optimum HF response.

CHARACTERISTICS

PLUG-IN AND ADAPTER

TYPICAL FREQUENCY RESPONSE— ≈750 kHz.

INPUT RESISTANCE—0.01 to 1 megohm, determined by Z_i Selector position.

INPUT CAPACITANCE—approximately 40 to 450 pF, depending on the Z_f Selector position. (Maximum at X100 gain)

MAXIMUM INPUT VOLTAGE—400 V DC or 150 V RMS.*

MAXIMUM OUTPUT VOLTAGE— ±50 V peak.

MAXIMUM TEMPERATURE— +55° C.

COMPENSATING ADAPTER (013-0081-00) $35

*Voltage derating is necessary for frequencies above 1 MHz.

LEAKAGE CURRENT ADAPTER

The Leakage Current Adapter, used with Tektronix Operational Amplifier Plug-In Units, adapts the plug-in for measuring the reverse leakage current of semiconductor diodes and small-signal transistors. The adapter may also be used for measuring junction resistance or capacitance.

Banana plugs on the base of the adapter allow the unit to be plugged into the jacks on the front panel of the Plug-In Unit. Axial-lead diodes are checked by placing them in a notched retainer mounted on a swing-down cover. When closed, the cover places the leads against spring-contact clips, assuring good electrical contact. A four-pin socket is provided for checking small-signal transistors. The diode clips and the transistor socket are completely shielded to minimize leakage capacitance.

A positive-going sawtooth voltage is required for driving the adapter. Tektronix Oscilloscopes that accept the Type O Plug-In Unit have a Sawtooth or Sweep Out jack conveniently located on the front panel for supplying the required sawtooth voltage. The Type 3A8 requires an external source of the required sawtooth voltage.

VERTICAL DEFLECTION FACTOR—1 microampere/volt or 1 nanoampere/volt, selected by a toggle switch.

VERTICAL DEFLECTION ACCURACY— ±8%.

HORIZONTAL DEFLECTION FACTOR—(with 100-V sawtooth, minimum). 1, 2, 5 and 10-V/cm selected by Horizontal V/CM switch.

HORIZONTAL DEFLECTION ACCURACY— ±3%.

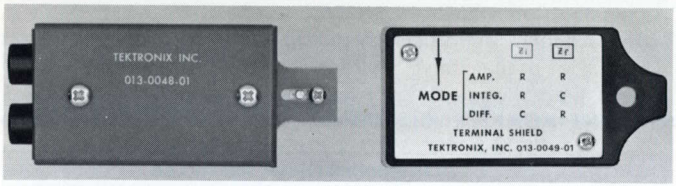
INPUT SAWTOOTH VOLTAGE—100 to 200 V (for 10-V/cm horizontal deflection).

MAXIMUM INTERNAL LEAKAGE—50 picoamperes at 100 V.

LEAKAGE CURRENT ADAPTER (013-0086-00) $85

Attenuators, Terminations

TERMINAL ADAPTERS AND SHIELDS



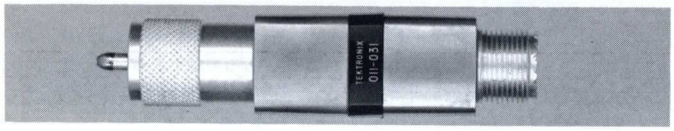
TERMINAL ADAPTER ASSEMBLY has all the mechanical parts for creating a custom adapter for the Operational Plug-In Unit.

Order Part Number 013-0048-01 ..... $10

TERMINAL SHIELD protects exposed terminals of the Plug-In Unit from spurious signals.

Order Part Number 013-0049-01 ..... $2.50

INPUT ADAPTERS—ATTENUATORS—TERMINATIONS



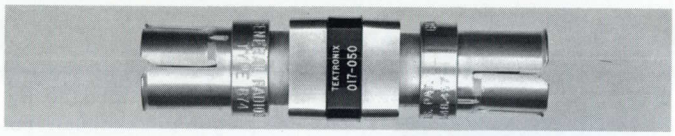
ACCESSORIES WITH UHF-TYPE CONNECTORS

Description	Part Number	Price
50-Ω termination	011-0045-00	$15.00
50-Ω 5:1 attenuator	011-0032-00	16.00
50-Ω 10:1 attenuator	011-0031-00	16.00
50-Ω to 75-Ω min loss attenuator	011-0041-00	16.00
50-Ω to 93-Ω min loss attenuator	011-0042-00	16.00
50-Ω to 170-Ω min loss attenuator	011-0043-00	16.00
75-Ω termination	011-0046-00	15.00
75-Ω 5:1 attenuator	011-0034-00	16.00
75-Ω 10:1 attenuator	011-0033-00	16.00
93-Ω termination	011-0047-00	15.00
93-Ω 5:1 attenuator	011-0036-00	16.00
93-Ω 10:1 attenuator	011-0035-00	16.00
170-Ω* termination	011-0048-00	15.00

*VSWR less than 1.25 up to 30 MHz.

ACCESSORIES WITH BNC-TYPE CONNECTORS

50-Ω termination	011-0049-00	$ 8.75
50-Ω 2:1 attenuator	011-0069-00	10.00
50-Ω 2.5:1 attenuator	011-0076-00	10.00
50-Ω 5:1 attenuator	011-0060-00	10.00
50-Ω 10:1 attenuator	011-0059-00	10.00
50-Ω to 75-Ω min loss attenuator	011-0057-00	10.00
50-Ω to 93-Ω min loss attenuator	011-0058-00	10.00
75-Ω termination	011-0055-00	8.75
75-Ω 10:1 attenuator	011-0061-00	10.00
93-Ω termination	011-0056-00	8.75
93-Ω 10:1 attenuator	011-0062-00	10.00
170-Ω termination (UHF to BNC)	011-0063-00	10.00

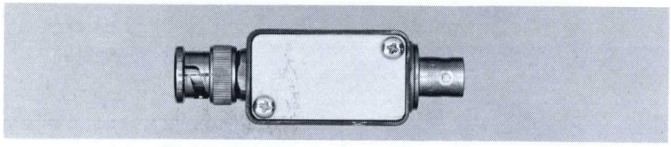


ACCESSORIES WITH TEKTRONIX 125-Ω TYPE CONNECTORS

125-Ω termination	017-0051-00	$20.00
125-Ω 2:1 attenuator	017-0071-00	30.00
125-Ω 5:1 attenuator	017-0049-00	30.00
125-Ω 10:1 attenuator	017-0050-00	30.00

ACCESSORIES WITH GR-TEKTRONIX 125-Ω TYPE CONNECTORS

50-Ω to 125-Ω min loss atten	017-0052-00	$30.00
125-Ω adapter N50/N125	017-0053-00	17.50
125-Ω adapter N50/T125	017-0054-00	17.50
125-Ω adapter T50/N125	017-0055-00	23.00



ACCESSORY HOUSINGS W/O ELECTRICAL COMPONENTS

Component housings are useful for applications requiring special circuitry.

Coupler, Test Set with UHF connectors
Order Part Number 011-0080-00 ..... $5.00

Coupler, Test Set with BNC connectors
Order Part Number 011-0081-00 ..... $5.00

CONNECTOR CHARACTERISTICS

Accuracy of Indicated Attenuation Ratio:

UHF	±2% at DC; ±3% at 100 MHz.
GR	±2% at DC; ±3% at 1 GHz.
TEKTRONIX 125 Ω	±2% at DC; ±3% at 1 GHz.
BNC	±2% at DC; ±3% at 100 MHz.

Voltage Standing Wave Ratio:

UHF	less than 1.2 up to 100 MHz.
GR	less than 1.1 up to 1 GHz.
TEKTRONIX 125 Ω	less than 1.1 up to 1 GHz.
BNC	less than 1.1 up to 100 MHz.

Power Rating:

UHF	1.5 watts.
GR	1 watt.
TEKTRONIX 125 Ω	1 watt.
BNC	1 watt.

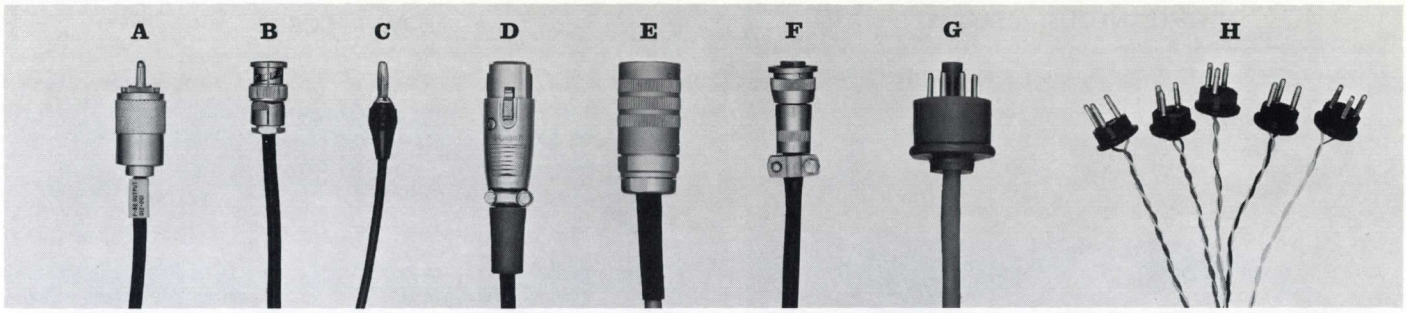
Output to Input Voltage Ratios for Minimum-Loss Attenuators:

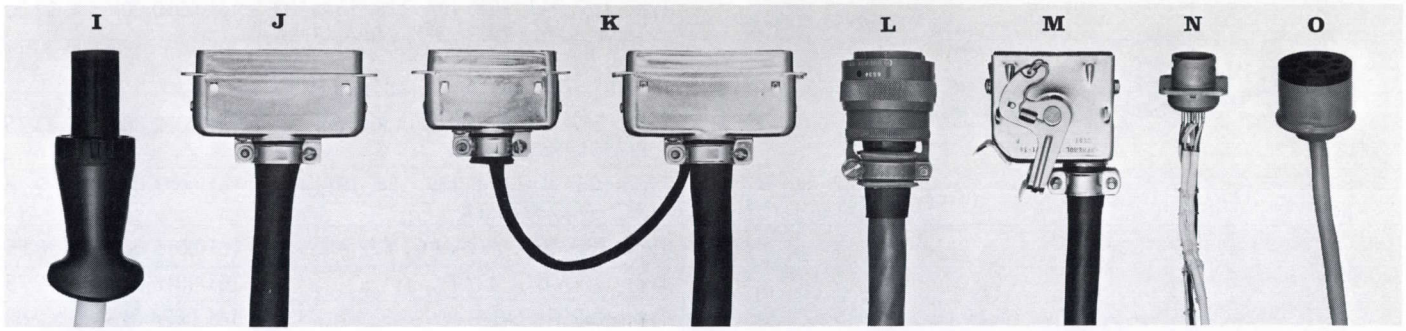
When properly terminated the E_{out}/E_{in} ratios for the various minimum-loss attenuators are as follows:

Connection	E_{out}/E_{in}	Connection	E_{out}/E_{in}
50 Ω → 75 Ω	0.63	50 Ω → 125 Ω	0.56
75 Ω → 50 Ω	0.42	125 Ω → 50 Ω	0.23
50 Ω → 93 Ω	0.59	50 Ω → 170 Ω	0.54
93 Ω → 50 Ω	0.32	170 Ω → 50 Ω	0.16

All attenuators, with the exception of minimum-loss types, are T-type attenuators.

Miscellaneous Cables

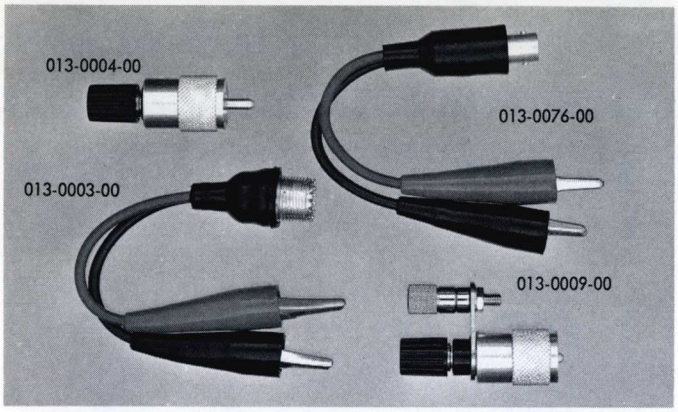


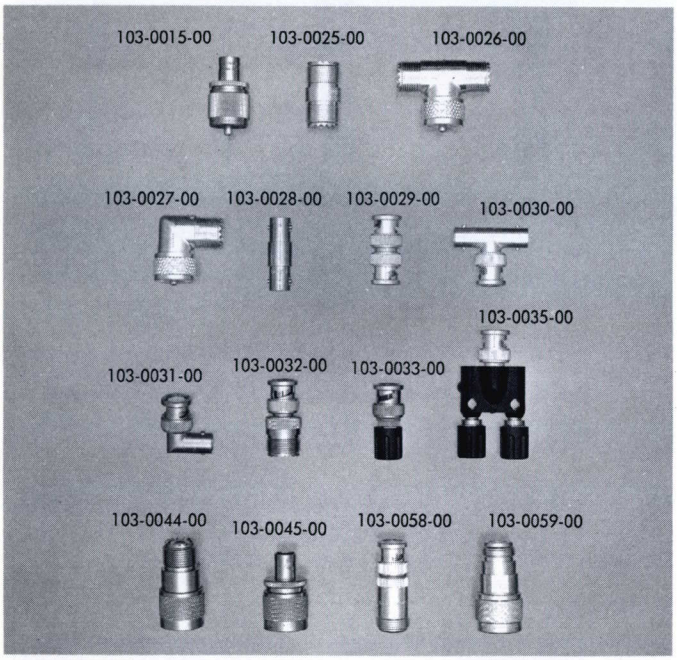


INSTRUMENT TYPE	FUNCTION	LENGTH (INCHES)	IMPEDANCE (OHMS)	CONNECTOR TYPE	CONNECTOR FIG	PART NUMBER	PRICE
GENERAL	Output	42	50	UHF	A-A	012-0001-00	$ 6.50
GENERAL	Output	42	50	BNC	B-B	012-0057-00	4.00
GENERAL	Output	42	75	UHF	A-A	012-0002-00	7.50
GENERAL	Output	42	75	BNC	B-B	012-0074-00	6.50
GENERAL	Output	42	93	UHF	A-A	012-0003-00	6.50
GENERAL	Output	42	93	BNC	B-B	012-0075-00	4.00
GENERAL	Output-Terminated with 93 Ω Resistor	42	93	UHF	A-A	012-0005-00	6.50
GENERAL	Output-Terminated with Variable Attenuator	42	93	UHF	A-A	012-0004-00	13.50
GENERAL	Output	42	170	UHF	A-A	012-0006-00	7.50
GENERAL	Horizontal Input	18	—	Banana	C-C	012-0054-00	2.50
GENERAL	Adapter Cable	5	—	2-Banana to UHF	A-C	012-0059-00	3.50
E	Input	30	—	Special 3-pin	D	012-0022-00	6.00
Q	Input	15 ft	—	Special 9-pin	E	012-0040-00	12.00
2A61	Input	60	—	Special 4-pin	F	012-0072-00	10.00
122	Battery Cable	7 ft	—	Octal to (5) 3-pin	H-O	012-0009-00	15.00
127	Input	60	170	UHF	A-A	012-0034-00	7.50
160A, 360	Inter-connecting	20	—	Octal	G-O	012-0016-00	7.00
161, 162, 163	Inter-connecting	10	—	Octal	G-O	012-0017-00	5.00
175	Test Cable	30	—	Banana to Alligator	C	012-0056-00	1.75
175	Test Cable-Black Plug	42	—	Special Plug	I	012-0044-00	9.00
175	Test Cable-Red Plug	42	—	Special Plug	I	012-0043-00	9.00
175	Socket Adapter	—	—	Special 9-pin	N	012-0045-00	11.25
262	6R1A Inter-connecting	6 ft	—	36-50 Pin Ribbon Special 41-pin	K-L	012-0081-00	60.00
262	262 Inter-connecting	48	—	50-pin Ribbon	J-J	012-0082-00	60.00
551, 555	Inter-connecting	72	—	16-pin Ribbon	M-M	012-0051-00	28.50

Cable Adapters, Cords

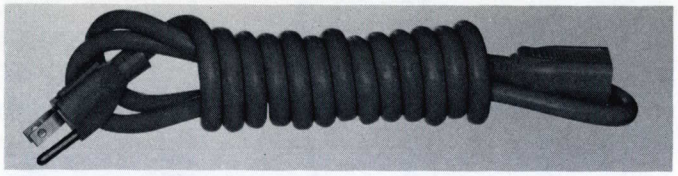
MISCELLANEOUS ADAPTERS





Description	Part Number	Price
Adapter, clip lead BNC	013-0076-00	$3.00
Adapter, clip lead UHF	013-0003-00	3.00
Adapter, binding post	013-0004-00	3.00
Binding Post Adapter, with ground terminal, 3/4" spacing	013-0009-00	3.50
UHF Male to BNC Female	103-0015-00	1.15
UHF Female to Female	103-0025-00	3.30
UHF T Male to 2 Female	103-0026-00	2.60
UHF Elbow	103-0027-00	2.25
BNC Female to Female	103-0028-00	1.60
BNC Male to Male	103-0029-00	3.00
BNC T Male to 2 Female	103-0030-00	3.50
BNC Elbow	103-0031-00	2.75
Male BNC to Female UHF	103-0032-00	1.70
BNC to Binding Post	103-0033-00	1.60
BNC Dual Binding Post	103-0035-00	5.25
UHF Female to N Male	103-0044-00	2.95
BNC Female to N Male.	103-0045-00	1.65
N Female to BNC Male	103-0058-00	2.15
N Female to UHF Male	103-0059-00	2.25

POWER CORDS

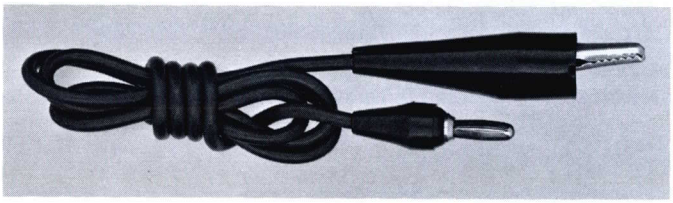


Instrument*	Part Number	Price
Type 109, 111, 125, 127, 130, 132, 133, 160A, 175†, R293, 317, 502A, 515A, 516, 519, 524, 526, 530-, 540-, 550-, 560-, 570-, 580-Series, 661, 1121	161-0010-00	$2.50
Type 262, 310A, RM503, RM504, RM564, RM565, 647	161-0022-00	3.75
Type 106, 114, 116, 129, 184, 191, 422-AC only, RM561A	161-0024-00	2.75
Type 280, 292, 321A-AC, 422-AC	161-0015-01	3.25
Type 321A-DC, 422-DC	161-0016-01	2.75
Type 453 (117 V)	161-0024-01	2.80
Type 453 (230 V)	161-0027-01	4.00

*Also applies to rack-mount version if detachable cord is used (except where rack-mount version is listed separately).

†161-0014-00 @ $1.40 also used with this instrument.

MISCELLANEOUS CORDS AND LEADS



Description	Length (Inches)	Connectors	Part Number	Price
Output Lead, Black	30	Banana Plug to Alligator Clip	012-0014-00	$2.50
Output Lead, Red			012-0015-00	2.50
Patch Cord, Black	6	Banana Plug-Jack (Both Ends)	012-0023-00	1.15
Patch Cord, Red			012-0024-00	1.15
100-Ω Suppressor Cord		Banana Plug (Both Ends)	012-0025-00	3.00
300-Ω Suppressor Cord			012-0026-00	3.00
1000-Ω Suppressor Cord			012-0027-00	3.00
Patch Cord, Black			012-0028-00	2.00
Patch Cord, Red			012-0029-00	2.00
Patch Cord, Red	18		012-0031-00	1.20
Patch Cord, Black			012-0039-00	1.20

Instrument Covers, Cases Viewing Accessories

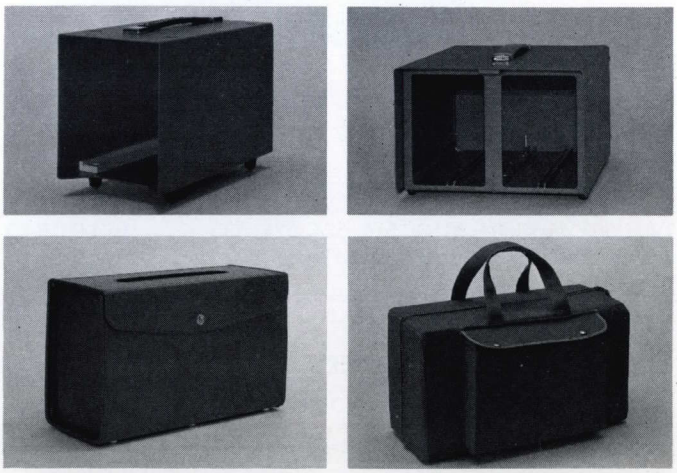
OSCILLOSCOPE DUST COVERS

The slip-on cover provides protection for instruments during transport or storage. Made of water-proof blue vinyl, the cover features a clear frontal area for easy identification of the instrument.

INSTRUMENT	PART NUMBER
Type 422 (with battery pack)	016-0075-00
Type 422 (without battery pack)	016-0076-00
Type 453	016-0074-00
Type 502A	016-0070-00
Type 529 (with field case)	016-0085-00
Type 503, 504, 515A, 516, 647; 560-Series (except Type 565, 567)	016-0067-00
Type 565, 567, 556	016-0069-00
Type 661; 530-, 540-, 550-, and 580-Series (except Type 555)	016-0068-00

OSCILLOSCOPE DUST COVER $7.50

CARRYING CASES



CARRYING CASE FOR LETTER-SERIES OR 1-SERIES PLUG-IN UNITS—Provides protection for one oscilloscope plug-in unit.
Order Part Number 437-0065-00 ..... $20

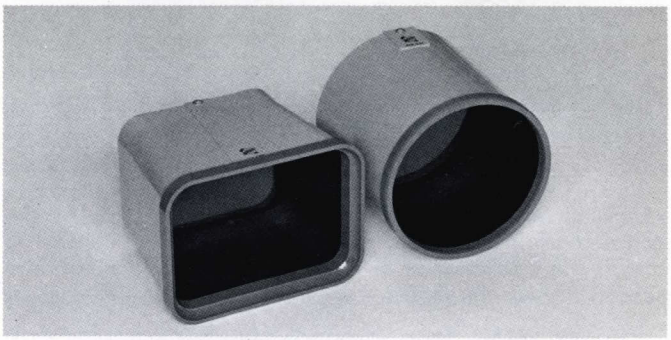
CARRYING CASE FOR 2, 3, 10 and 11 SERIES PLUG-IN UNITS—accommodates two plug-in units.
Order Part Number 437-0070-00 ..... $20

CARRYING CASE—For Type 321A Portable Oscilloscope.
Order Part Number 016-0026-00 ..... $35

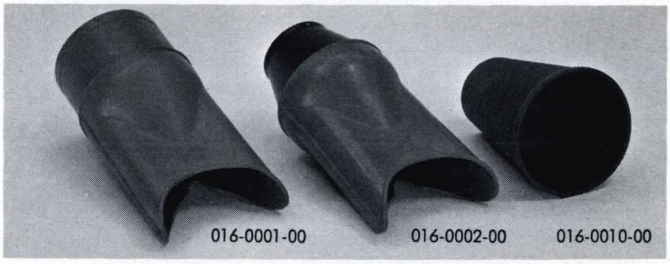
CARRYING CASE—For Type 310A Oscilloscope. Made of sturdy, turquoise-colored canvas.
Order Part Number 016-0028-00 ..... $17.50

VIEWING ACCESSORIES

The viewing accessories listed normally mount on the oscilloscope graticule cover. In many cases, they will also fit camera-mounting bezels. If you intend using a camera on your oscilloscope, check with your Tektronix Field Engineer for bezel-viewer compatibility before ordering.



POLARIZED VIEWERS—For Tektronix 5" Oscilloscopes. The viewers reduce troublesome reflections and glare under high ambient-light conditions.
RECTANGULAR VIEWER (016-0039-00) $10
PLASTIC ROUND VIEWER (016-0053-00) 10



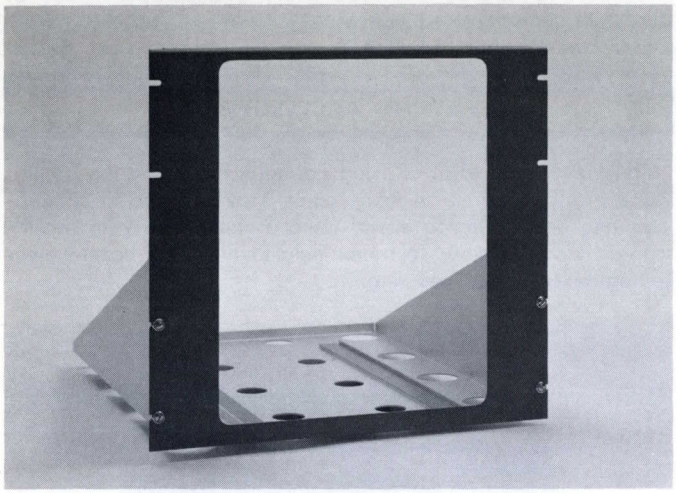
VIEWING HOOD—For Tektronix 5" Oscilloscopes. Includes molded rubber eyepiece and separate tubular light shield.
Order Part Number 016-0001-00 ..... $5.00

VIEWING HOOD—For Tektronix 3" Oscilloscopes. Includes molded rubber eyepiece and separate tubular light shield.
Order Part Number 016-0002-00 ..... $5.00

COLLAPSIBLE VIEWING HOOD—For Tektronix 3" Oscilloscopes. It is made of black acrylic plastic with handy fastening arrangement.
Order Part Number 016-0010-00 ..... $3.50

Mounting Accessories

CRADLE MOUNTS



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, 540-, 570-Series and Type 661 (1 mask, 1 cradle). Rack height requirements 17½".
Order Part Number 040-0281-00 ..... $45

For Type 551 Oscilloscope (2 masks, 2 cradles). Rack height requirements: Indicator mask 17½", Power Supply mask 12¼".
Order Part Number 040-0279-00 ..... $75

For Type 515A and Type 516 instruments (1 mask, 1 cradle). Rack height requirements 15¾".
Order Part Number 040-0277-00 ..... $45

For Type 502A instruments (1 mask, 1 cradle). Rack height requirements 17½".
Order Part Number 040-0278-00 ..... $40

For Type 555 (2 masks, 2 cradles). Rack height requirements: Indicator mask 21", Power Supply mask 12¼".
Order Part Number 040-0280-00 ..... $75

For Types 503, 504, 561A, 564 instruments (1 mask, 1 cradle). Rack height requirements 15¾".
Order Part Number 040-0321-00 ..... $50

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 014-0002-00 ..... $7.00

BLANK PANEL—Provides coverage for mounting frame Type FM122 area not being used.
Order Part Number 333-0157-00 ..... $2.50

RACK ADAPTER FOR TYPES 106, 114, 184, 191

The Rack Adapter converts the latest series of Tektronix Generators for rack mounting. Any combination of two instruments can be mounted side-by-side in 19" rack, occupying only 5¼" of vertical rack space. Mounting brackets located on the rear of the unit are adjustable for installation in racks of different depths. The brackets can be adjusted for a depth of 8½" to 26".

Forced air ventilation is provided by two fan assemblies. The fans can be operated from a 115 or 230 voltage source. Outlets located on the rear of the unit provide a convenient source of power for the instruments. A blank panel is included to cover the opening when only one instrument is installed in the Rack Adapter.

RACK ADAPTER (016-0086-00) **$125**

CAMERA MOUNTING ADAPTERS

Bezels for mounting commercially available cameras on Tektronix Oscilloscopes. Mounting ring measures 5⅝" outside diameter. Die-cast construction.

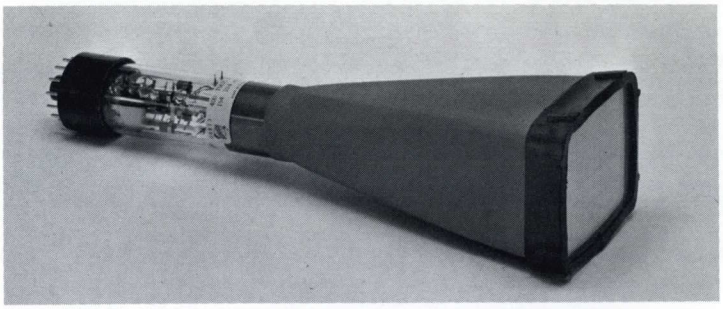
INSTRUMENT*	PART NUMBER
Type 502, 503, 504, 515A, 516, 524, 526, 530-, 540-, 550-, 580-Series, 565, 661	014-0018-00
Type 561A, 564, 567	014-0016-00
Type 647	014-0017-00
Type 529	014-0031-00

CAMERA MOUNTING ADAPTER $4.50

*Also rackmount version.

Cathode-Ray Tubes

Replacement CRT's listed are for current production instruments only. Phosphor types other than indicated are available on special order. (See page 14 for phosphor descriptions.) Direct-replacement CRT's for all earlier instruments not listed are also available. Consult your Tektronix Field Engineer for particulars.



Instrument†	Phosphor	Graticule Used	Notes	Part Number	Price
310A, 360	P1 P2* P7 P11 P31*	External	310A: all SN's 360: SN 2577-up P31 is Standard Phosphor for 310A; P2 for 360	154-0362-00 154-0363-00 154-0364-00 154-0365-00 154-0366-00	$ 45.00 45.00 45.00 45.00 45.00
317	P1 P2 P7 P11 P31*	External	For all Serial Numbers	154-0216-00 154-0196-00 154-0217-00 154-0218-00 154-0346-00	90.00 90.00 90.00 90.00 90.00
321A	P2 P7 P11 P31*	External	For all Serial Numbers	154-0442-00 154-0443-00 154-0444-00 154-0433-00	85.00 85.00 85.00 85.00
422	P1 P2 P7 P11 P31*	Internal	For SN 1890 and above only	154-0466-06 154-0466-07 154-0466-08 154-0466-09 154-0466-05	140.00 140.00 140.00 140.00 140.00
453	P1 P2 P7 P11 P31*	Internal	For all Serial Numbers	154-0492-00 154-0492-01 154-0492-02 154-0492-03 154-0492-04	175.00 175.00 175.00 175.00 175.00
502A	P1 P2* P7 P11 P31	External	For all Serial Numbers	154-0245-00 154-0246-00 154-0247-00 154-0248-00 154-0348-00	125.00 125.00 125.00 125.00 125.00
503, 504	P1 P2* P7 P11 P31	External	For all Serial Numbers	154-0264-00 154-0265-00 154-0266-00 154-0267-00 154-0341-00	60.00 60.00 60.00 60.00 60.00
515A, 516	P1 P2 P7 P11 P31*	External	For all Serial Numbers	154-0125-00 154-0120-00 154-0126-00 154-0127-00 154-0344-00	60.00 60.00 60.00 60.00 60.00
519	P11*	External	For SN 244 and above only	154-0308-00	1000.00

Instrument†	Phosphor	Graticule Used	Notes	Part Number	Price
524AD	P1* P11	External	For all Serial Numbers	154-0068-01 154-0070-01	40.00 40.00
526	P31*	External	For all Serial Numbers	154-0289-01	99.00
529	P1 P2 P7 P11 P31*	External	For all Serial Numbers	154-0469-00 154-0470-00 154-0471-00 154-0472-00 154-0473-00	60.00 60.00 60.00 60.00 60.00
531A, 533A 535A	P1 P2* P7 P11 P31	External	For all Serial Numbers	154-0178-00 154-0165-00 154-0179-00 154-0180-00 154-0350-00	75.00 75.00 75.00 75.00 75.00
536	P1 P2 P7 P11 P31*	External	For all Serial Numbers	154-0140-00 154-0133-00 154-0135-00 154-0136-00 154-0351-00	75.00 75.00 75.00 75.00 75.00
543B, 544, 545B, 546, 547	P2 P7 P11 P31*	Internal	Kit 050-0246-00 required for early Serial Numbers	154-0478-01 154-0478-02 154-0478-03 154-0478-00	120.00 120.00 120.00 120.00
549	202	External	For all Serial Numbers	154-0498-00	450.00
551	P1 P2* P7 P11 P31	External	For SN 2032 and above only	154-0251-00 154-0252-00 154-0254-00 154-0255-00 154-0352-00	180.00 180.00 180.00 180.00 180.00
555	P2* P7 P11 P31	Internal	For SN 10,410 and above only	154-0476-00 154-0476-01 154-0476-02 154-0476-03	245.00 245.00 245.00 245.00
556	P1 P2 P7 P11 P31*	Internal	For all Serial Numbers	154-0500-01 154-0500-02 154-0500-03 154-0500-04 154-0500-00	245.00 245.00 245.00 245.00 245.00
561A, 567	P2* P7 P11 P31*	Internal	561A: 12696-up RM561A: 6886-up 567: 1999-up RM567: 2000-up 561A: P31 Phosphor 567: P2 Phosphor	154-0454-00 154-0455-00 154-0456-00 154-0449-00	80.00 80.00 80.00 80.00
564	200 201	External	Optimum stored Brightness Optimum Writing Rate	154-0410-00 154-0418-00	300.00 300.00

Continued ⟶

Graticules

Instrument†	Phosphor	Graticule Used	Notes	Part Number	Price
565	P2* P7 P11 P31	Internal	565: SN 1370-up RM565: SN 1279-up	154-0477-00 154-0477-01 154-0477-02 154-0477-03	195.00 195.00 195.00 195.00
575	P1 P2 P7 P11 P31*	External	SN 1352-up	154-0093-00 154-0097-00 154-0102-00 154-0103-00 154-0343-00	60.00 60.00 60.00 60.00 60.00
581A, 585A	P2 P11 P31*	Internal	581A: SN 5390-up 585A: SN 10,205-up RM585A: 1171-up	154-0479-01 154-0479-02 154-0479-00	195.00 195.00 195.00

Instrument†	Phosphor	Graticule Used	Notes	Part Number	Price
647	P11 P31*	Internal	647: SN 220 and above only RM647: All Serial Numbers	154-0434-00 154-0448-00	270.00 270.00
661	P1 P2* P7 P11 P31	External	For SN 310 and above only	154-0264-00 154-0265-00 154-0266-00 154-0267-00 154-0341-00	60.00 60.00 60.00 60.00 60.00

† Both Cabinet and Rackmount versions unless Rackmount is listed.
* Standard Phosphor shipped with the instrument initially.

REPLACEMENT GRATICULES

INSTRUMENT TYPE*	GRATICULE RULING			PART NUMBER	PRICE
	DIVISION	VERTICAL	HORIZONTAL		
310A, 360	1/4"	8	10	331-0027-00	$3.00
317	1/4"	8	10	331-0095-00 (adjustable) 331-0042-00 (not adjustable)	3.00 3.00
321A	1/4"	6	10	331-0055-00	3.00
502A	1 cm	10	10	331-0047-00	4.00
503, 504, 661	1 cm	8	10	331-0056-00	4.00
515A, 516, 531A 533A, 535A, 549	1 cm	6	10	331-0037-00 (adjustable) 331-0016-00 (not adjustable)	4.00 4.00
519	1 cm	2	6	331-0065-00	9.50
524AD	1 cm	6	10	331-0006-00	4.00
524AD	1/8" x 1 cm	17	10	331-0009-00	4.50
524AD	Color TV Bar Dimensions			331-0040-00	4.50
526	Marked in Degrees for Color TV Vector Analysis			331-0104-00	9.50
529	7 cm, composite —50 to +110 IEEE			331-0156-01	4.50
	50 to +120 IEEE and 0 to 100 Modulation non-composite IEEE			331-0157-00 331-0077-01	4.50 4.50
	7 cm, HAD, sine²; 2%, 4% K Factor; 0.125, 0.250 μs HAD			331-0161-00	4.50
536	For Phase Angle Measurements			331-0057-00	4.50
536, 575	5/16"	10	10	331-0028-00	4.00
551, 555	1 cm	6	10	331-0045-00	4.00
564	1 cm	8	10	331-0097-00	4.00

*For both cabinet and rack-mount instruments.

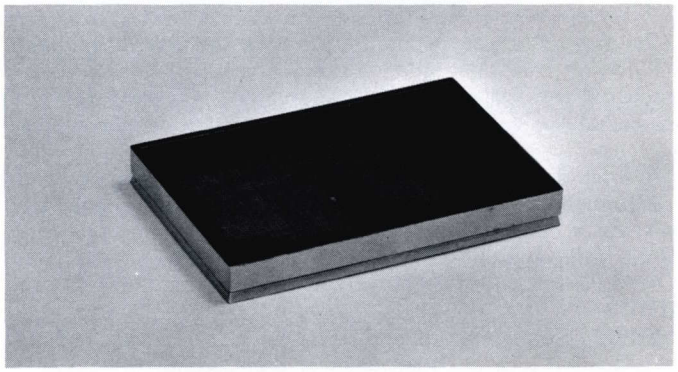
Unscribed Graticules Light Filters

UNSCRIBED GRATICULES

INSTRUMENT*	PART NUMBER	PRICE
310A, 317, 360, 502A,	386-0395-00	$1.50
524AD, 526, 536, 551, 555, 575;	331-0093-00	2.00
503, 504, 661, 515A, 516,	331-0105-00	2.00
549	386-0451-00	2.00
531A, 533A, 535A	386-0451-00 (adjustable)	2.00
	331-0093-00 (not adjustable)	2.00

*For both cabinet and rack-mount instruments.

CRT MESH FILTERS



The mesh filter improves display contrast for oscilloscope viewing under high-ambient light conditions. The filter is a direct replacement for the existing graticule cover on most Tektronix instruments, or, in the case of the new portable oscilloscopes, snaps in the CRT opening on the front panel.

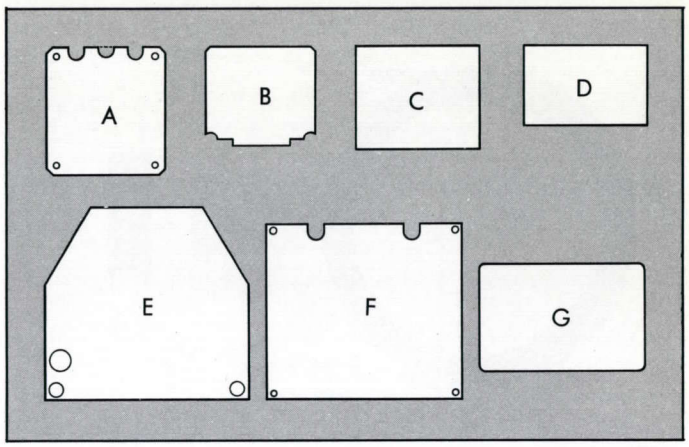
A fine metal screen with a matte black surface is utilized to reduce light reflections. Although light transmission from the CRT is reduced to approximately 28%, the high attenuation of external reflections allows viewing low-intensity displays in room light or other bright surroundings.

The mesh filter also serves as an RFI filter. Installed on the instrument, the metal frame of the filter is grounded, providing effective filtering of the RFI spectrum.

INSTRUMENT*	PART NUMBER	PRICE
Type 321A	378-0577-00	$12.00
Type 422	378-0571-00	12.00
Type 453	378-0573-00	12.00
Type 502A, 503, 504, 515A, 516, 524AD, 526, 661; 530, 540, 550, 580-Series, 565	378-0572-00	15.00
Type 529, 560-Series (except 565)	378-0575-00	15.00
Type 647	378-0574-00	15.00

*For both cabinet and rack-mount instruments.

CATHODE-RAY TUBE LIGHT FILTERS



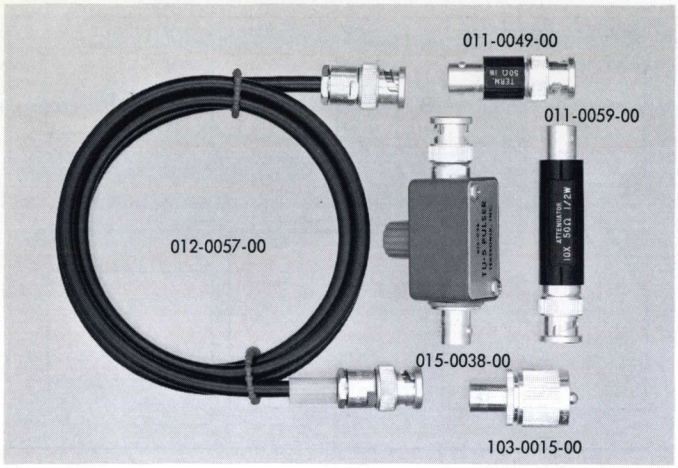
INSTRUMENT*	FIG	COLOR	PART NUMBER	PRICE
Type 310A, 317, RM17, 360	A	Smoke gray†	378-0550-00	$1.35
		Green	378-0551-00	1.35
		Blue	378-0552-00	1.35
		Amber	378-0553-00	1.35
Type 321A	B	Smoke gray†	378-0547-00	1.15
		Green	378-0554-00	1.15
		Blue	378-0555-00	1.15
		Amber	378-0556-00	1.15
Type 422	C	Smoke gray†	378-0549-00	.90
		Green	378-0557-00	.90
		Blue	378-0558-00	.90
		Amber	378-0559-00	.90
Type 453	D	Smoke gray†	378-0576-00	.90
		Green	378-0576-03	.90
		Blue	378-0576-02	.90
		Amber	378-0576-01	.90
Type 502A, 503, 504, 515A, 516, 524AD, 526, 530-, 540-, 550-Series, 565, 580-Series, 661	E	Smoke gray†	378-0567-00	1.60
		Green	378-0568-00	1.60
		Blue	378-0569-00	1.60
		Amber	378-0570-00	1.60
Type 529, 561A, 567	F	Smoke gray†	378-0560-00	1.35
		Green	378-0561-00	1.35
		Blue	378-0562-00	1.35
		Amber	378-0563-00	1.35
Type 647	G	Smoke gray†	378-0548-00	1.15
		Green	378-0564-00	1.15
		Blue	378-0565-00	1.15
		Amber	378-0566-00	1.15

*For both cabinet and rack-mount instruments unless rack-mount version is listed.

†Standard filter supplied with instrument.

Miscellaneous Accessories

TYPE TU-5 PULSER



The TU-5 tunnel diode pulser generates a fast-rise, flat-top squarewave 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 and 80-series plug-in units the pulser is sufficiently fast to show the risetime of the oscilloscope and plug-in unit.

The oscilloscope calibrator output provides the proper input to the pulser.

A bias adjustment on the pulser provides for changes in tunnel-diode characteristics due to temperature variations, tolerance, or other variables.

RISETIME—less than or equal to 1.0 ns 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 ms, dependent on oscilloscope calibrator output, (oscilloscope calibrator is 1 kHz).

OUTPUT IMPEDANCE—50 ohms (25 ohms when used with 50 ohm termination).

SOURCE VOLTAGE—100 volt squarewave (10 mA) from the oscilloscope calibrator output.

REPETITION RATE—same as source voltage (1 kHz from oscilloscope calibrator output).

BNC CONNECTORS—for input and output.

TU-5 PULSER PACKAGE (015-0043-00) **$46.50**
Includes: 1—TU-5 Pulser, 015-0038-00; 1—10X attenuator, 011-0059-00; 1—50-ohm termination, 011-0049-00; 1—UHF to BNC adapter, 103-0015-00; 1—50-ohm cable, 012-0057-00.

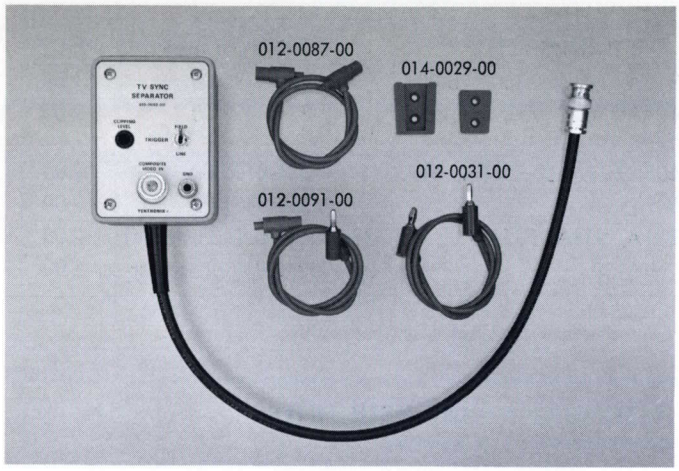
TU-5 PULSER ONLY (015-0038-00) **$25.00**

TU-5/105 ADAPTER—allows the TU-5 Pulser to be used with the Type 105 Square-Wave Generator.

The Adapter inverts the negative 100 V output of the Type 105 to a positive voltage source for driving the TU-5. A brighter trace display is possible because of the faster repetition rate of the Type 105 output.

TU-5/105 ADAPTER (013-0075-00) **$20.00**

TV SYNC SEPARATOR



The new TV Sync Separator provides the trigger facilities for viewing composite video signals on a conventional oscilloscope. It can be used with any Tektronix Oscilloscope that has a 100-volt calibrator output. When used with other instruments, a separate 100-V source is required to power the unit.

A front panel switch selects field- or line-rate triggers, and a separate output jack supplies field triggers continuously. The unit has a clipping level control, allowing it to be used with signals ranging from 0.5 V to 8.5 V in amplitude.

POWER REQUIREMENTS—7 mA, operates on 100 V DC, or 60 Hz and 1 kHz calibrators.

INPUT—Composite video signal from signal source or from Vert Sig Out jack on front panel of oscilloscope.

OUTPUT— ≈10-V negative-going composite sync for line rate triggering or ≈6-V negative-going field rate triggers. Selected by toggle switch. Also second output for field-rate triggers.

TV SYNC SEPARATOR (015-0062-00) **$85**
Each instrument includes: 1—patch cord, BNC to banana, 18″ (012-0091-00); 1—patch cord, BNC to BNC, 18″ (012-0087-00); 1—patch cord, banana to banana, 18″ (012-0031-00); 1—hanger assembly (014-0029-00); 2—instruction manual (070-0542-00).

REPLACEMENT BATTERIES

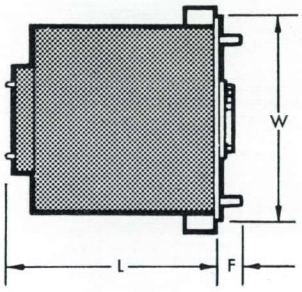
NiCad CELLS—3½ AH 'D' size rechargeable, for Tektronix Portable Oscilloscopes.

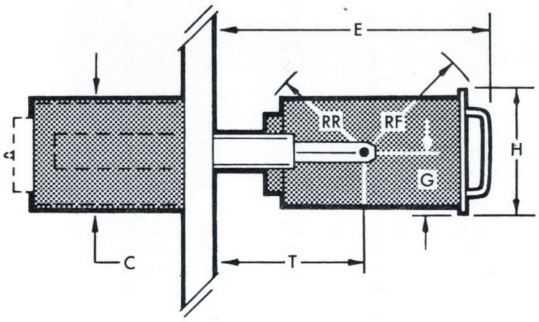
For Type 321A: Order 1 ea (146-0005-00) ..... $ 7
Order 1 set (016-0077-00) ..... $ 70

For Type 422: Order Battery Pack (016-0066-00) $125

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

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 to rearmost permanent fixture, excluding cables.
F	Forward Clearance	Back of front panel to foremost protrusion.
G	Vertical Axis	Bottom of front panel to horizontal plane of rotation.
E	Extended Inst	Maximum forward clearance with instrument out and horizontal.
RF	Radius — front	Front radius of rotation.
RR	Radius — rear	Rear radius of rotation.
T	Track	Rack front to pivot point.
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 sliding tracks is required, such as an enclosed rack.

These instruments bolt directly to a standard 19" rack. They can be ordered at additional cost, with tilt-lock, sliding tracks. Rear support for tracks is required.

	MOUNTING DIMENSIONS									
TYPE	H	W	L	F	G	E	RF	RR	T	C
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
129	10 1/2	19	21 3/4	2 1/8	1 3/4	29 1/2	17 5/8	11 1/16	13 1/4	10 7/16
R116	5 1/4	19	17 1/2	1 5/8	1 3/4	25 3/4	11 1/2	8 1/4	14 5/8	5
R293	3 7/16	19	16 5/16	1 7/16	1 3/4	22 3/16	9 5/8	8 3/16	12 5/8	3 3/8
R422	7	19	14 5/16	1 13/16		16 5/8				6 7/8
R453	7	19	18 5/16	1 13/16	3 1/2	20 11/16	11 5/8	7 7/8	9 5/16	6 7/8
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
RM31A, RM33A, 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
RM502A	12 1/4	19	21 1/2	1 7/8	2 7/16	26	15 5/8	10 3/8	13	11
RM503, RM504	7	19	17	1 3/4	3 1/2	22 3/4	11 7/8	7 9/16	11 1/8	7
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
RM529	5 1/4	19	18 1/4	1 3/4	2 3/8	21 1/4	12 1/8	8 1/2	9 3/8	—
RM543B, RM544, RM545B, RM546, RM547	14	19	22 5/8	1 15/16	7 1/16	28 3/4	13 7/16	13	16 3/8	13 7/8
R556	14	19	22 11/16	1 3/4	8 1/8	30 3/8	13 1/4	14 7/8	18 1/2	13 15/16
RM561A	7	19	18 3/8	1 11/16	2 5/16	24 5/16	13 7/16	7 1/8	11 1/8	6 7/8
RM564	7	19	18 3/8	1 11/16	2 7/16	24 5/16	13 3/4	7 7/8	11	6 3/4
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
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
RM585A	14	19	22 3/4	2 1/8	7 1/16	29 1/2	14	12 3/8	16 3/8	13 7/8
RM647	7	19	19	1 11/16	2 7/16	27 7/8	13 5/8	8 11/16	14 5/8	6 3/4
016-0086-00*	5 1/4	19	17 5/8							

*A special rack adapter is available for rack-mounting Type 106, 114, 184, and 191. The adapter has an adjustable mounting bracket to accommodate various rack depths. (See Accessory Section for details.)

Shipping Weights and Volumes

Type	Net Wt in lbs	Domestic Packed in lbs	Export Packed Weight lbs	Export Packed Weight kgs	Export Packed Volume Cubic Ft
B	4	6	14	6	2
CA	4¾	9	15	7	2
C-12	14¼	16	32	15	4
C-27	10	14	29	13	3
C-30	4¾	9			
D	4½	8	14	6	2
E	4¼	8	14	6	2
FM122	5½	9	15	7	1
FM125	19	27	42	19	4
G	4¼	6	14	6	2
H	4	9	14	6	2
K	3¾	8	13	6	2
L	4½	8	14	6	2
M	5¼	8	16	7	2
O	5½	9	17	7	2
Q	5¼	10	16	7	2
R	7¼	9	18	8	2
R116	25½	56			
RM15	57	75	96	44	9
RM122	6	14	25	11	4
RM125	19	29	39	22	5
RM17	35	66	87	39	9
RM31A	75	101	122	55	9
RM33A	74½	100	121	55	9
RM35A	78¼	105	126	57	9
R293	20½	56			
R422	18	51			
R453	32	65			
RM502A	90	97	117	51	9
RM503	27	51	72	33	9
RM504	25½	48	69	31	9
RM529	27	58	81	37	10
RM543B	81	108	130	56	9
RM544	80½	109	132	57	9
RM545B	85	113	135	59	9
RM546	87	114	136	59	9
RM547	87	116	139	60	9
RM556	86	126			
RM561A	30½	54	74	33	10
RM564	31	41	80	35	9
RM565	67	101	122	55	9
RM567	50½	85	106	48	9
RM585A	81	110	131	59	9
RM647	50	61	84	37	9
S	4¼	9	14	6	2
T	4¾	9	15	7	2
W	5	7	11	5	2
Z	5¾	10	16	7	2
1A1	5½	10	13	6	1
1A2	4¼	8	15	7	1
1A7	4½	9			
1S1	7¾	11	15	7	2
1S2	5	11			
1L10	6	10	14	7	2
1L30	7	11	15	7	2
1L20	7½	11	17	8	2
106	16½	21			
109	8½	18	28	13	3
111	8¾	16	27	12	3
113	44¾	59	75	34	6
114	10	14	19	9	3
1121	18½	28	40	18	4
122	4¾	9	14	6	1
123	1	2	8	4	1
125	15	19	42	19	4
127	39½	69	90	41	9
129	46	85	103	45	8
130	8¾	15	26	12	3
132	21½	36	67	30	4
133	22	36	67	30	4
160A	20¼	28	44	20	3
161	3½	8	13	6	1
162	3½	8	13	6	1
163	3½	8	13	6	1
175	93	118	139	63	9
184	13	19			
191	13¾	18			
2A60	3	4	17	8	3
2A61	4¼	5	18	8	3
2A63	3¾	5	18	8	3
2B67	4¼	5	18	8	3
261	17½	28	50	22	9
262	24	39	50	23	5
263	5	8			

Type	Net Wt in lbs	Domestic Packed in lbs	Export Packed Weight lbs	Export Packed Weight kgs	Export Packed Volume Cubic Ft
280	4½	9	15	7	2
281	½	2			
282	1	2			
290	6	9	15	7	2
291	6	9	15	7	2
292	6¼	12	17	7	1
3A1	6	8	13	6	3
3A2	5¼	8	13	6	2
3A3	6	10	15	7	2
3A5	5¼	11			
3A6	6	8	13	6	2
3A7	5½	10			
3A8	4½	10	14	6	2
3A72	5	6	19	9	3
3A74	6¼	7	20	9	3
3A75	3½	8	17	8	3
3B1	5¼	8	19	9	3
3B2	5	8	13	6	2
3B3	6	7	18	8	3
3B4	4½	6	11	5	1
3B5	8	13			
3C66	5¼	7	15	7	2
3L10	6¼	11			
3S3	6¾	9	18	8	2
3S76	7½	12	23	10	3
3T4	5¾	8	12	6	3
3T77A	5½	9	20	9	3
310A	23	34	45	20	4
317	33¼	47	57	26	4
321A	14	22	29	13	3
360	10	17	31	14	4
422	22½	31	45	21	5
453	28¾	40	54	25	5
4S1	15¼	21	29	13	4
4S2A	9	15	23	10	3
4S3	13	16	16	23	103
5T3	6¾	13	17	8	3
502A	60	65	84	38	8
503	29½	38	49	22	6
504	27¼	43	57	26	5
507	94½	120	147	67	12
515A	42¼	52	63	29	6
516	44¼	54	65	29	6
519	103¾	136	169	77	13
524AD	61	82	106	48	9
526	45¼	74	95	43	9
529	24	33			
531A	57¾	78	95	43	8
533A	62¼	78	95	43	8
535A	61½	83	100	45	8
536	55¾	76	93	42	8
543B	64	81	99	43	8
544	59¾	80	98	43	8
545B	64	84	102	46	8
546	65¾	85	103	45	8
547	65¾	85	103	45	8
549	66	87	102	46	8
551	96¾	126	155	70	12
555	116¼	150	183	83	13
556	81	111			
561A	28	39	50	23	6
564	33	41	52	24	6
565	62	92	113	49	9
567	49	76	97	44	9
570	74¾	94	111	50	8
575	66	85	102	46	8
581A	71	80	97	44	8
585A	74	84	101	46	8
6R1A	13¾	21	32	14	4
647	40½	51	62	27	6
661	49½	67	84	38	8
81	4	6	17	8	3
82	4¾	10	16	7	2
86	3¼	7	13	6	2
10A1	4¾	9	13	6	2
10A2	5	7	19	8	4
11B1	4½	7	12	5	2
11B2	6½	9	14	7	2
500A and 500/53A	35	52	58	26	7
201	34	49	62	28	15
202	38	53	68	31	15
205	43	62	78	35	20

All weights are approximate and may vary depending upon packing materials used.

GENERAL AND ORDERING INFORMATION

THE UNITED STATES

INSTRUMENT ORDERS, TERMS, AND SHIPMENT

Orders should be placed with your Tektronix Field Engineering Office listed on page 285.

TERMS OF SALE

Tektronix standard terms of sale are NET 30 DAYS. Other credit terms are available for a customer's particular requirements. Credit accommodations and terms of sale are arranged through your Tektronix Field Engineer.

Normally all prices and quotations are FOB Beaverton, Oregon.

Unless otherwise specified on your order, shipment will be made via most economical method. If a specific surface 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 used.

FIELD MAINTENANCE

To help assure adequate instrument-maintenance facilities for our customers, Tektronix has established Field Engineering Offices and Service Centers at strategic points in the United States. 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 adjustments or repair of your instruments at a nearby Service 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 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. PLEASE DO NOT RETURN INSTRUMENTS OR PARTS BEFORE RECEIVING DIRECTIONS.

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.

Tektronix, Inc. is an Oregon Corporation,

Home Office & Factory, P.O. Box 500, Beaverton, Oregon 97005

Telephone: 644-0161 TWX—503-291-6805 Telex: 036-636 Cable: TEKTRONIX

GENERAL AND ORDERING INFORMATION

CUSTOMERS OUTSIDE THE UNITED STATES

To provide you with personal assistance in ordering as well as servicing Tektronix instruments, we have established Field Engineering Offices and technically qualified Tektronix distributors in many countries throughout the world. The Tektronix office or distributor in your country will be pleased to help you select the instrument that best suits your requirements in performance, and provide you with prompt ordering service.

SERVICE

If you require service, replacement parts, a warranty question resolved, or other help, please notify the Tektronix facility through which you ordered your instrument. They will process all orders for repair parts promptly, and provide emergency parts service when needed to restore an instrument to operating condition. They will also arrange for fast service with necessary recalibration or repair work on your instrument.

WARRANTY

All Tektronix instruments are warranted against defective material and workmanship for one year from date of shipment. Tektronix transformers, manufactured in our own plant, are warranted for the life of the instrument.

PLEASE DO NOT RETURN INSTRUMENTS OR PARTS BEFORE RECEIVING DIRECTIONS.

COUNTRIES WITH TEKTRONIX FIELD ENGINEERING OFFICES

AUSTRALIA
CANADA
SWITZERLAND
UNITED KINGDOM

Listed on pages 286-287

The Tektronix Field Engineering office in your country will provide you with quotations and accept your orders. Normally, prices quoted are FOB your plant.

COUNTRIES WITH TEKTRONIX DISTRIBUTORS

Listed on pages 286-287

Your Tektronix distributor will provide you with quotations FOB your country and accept your orders.

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Please address your inquiries and orders to:

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International Marketing Dept.
P. O. Box 500
Beaverton, Oregon, USA

INFORMATION AND QUOTATIONS

Staff Field Engineers will be pleased to provide you with information on Tektronix instruments and answer your technical questions. A pro forma invoice will be issued, if requested, indicating price and sales conditions. When our pro forma invoice or purchase order acknowledgement is issued, we will indicate the documents needed to ship your order. We will be glad to prepare necessary export documentation for you and make all shipping arrangements.

METHOD OF PAYMENT

We would like to make our products available to customers on open account terms, whenever conditions permit. Upon request for open account terms consideration will be given to foreign exchange convertibility, and the credit rating of the customer. Where time will not permit enough information to be presented to establish open account terms or where financial practices preclude open account terms, payment will be requested by cash in advance or irrevocable letter of credit. Extended payment terms will be considered, if requested, with approval subject to the conditions listed above.

SHIPMENTS

Unless otherwise requested, shipments will be made by the most economical method.

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Instrument Index

TYPE	INSTRUMENT DESCRIPTION	PAGE
B	High-Gain Unit	90
CA	Dual-Trace DC Unit	91
D	High-Gain DC Differential Unit	92
E	Low-Level AC Differential Unit	93
G	Wide-Band DC Differential Unit	94
H	Wide-Band, High-Gain DC Unit	95
K	Fast-Rise DC Unit	96
L	Fast-Rise, High-Gain Unit	97
M	Four-Trace DC Unit	98
O	Operational Amplifier Unit	99
Q	Transducer & Strain Gage Unit	101
R	Transistor Risetime Unit	238
S	Diode Recovery Unit	238
T	Time-Base Generator	103
W	High-Gain Differential Comparator Unit	104
Z	High-Gain Differential Comparator Unit	238
21A	Time-Base Unit	85
22A	Time-Base Unit	85
81	Plug-In Unit Adapter (for 1- and Letter-Series Plug-In Units)	179
82	Dual-Trace DC to 85 MHz Unit	180
86	DC to 85 MHz Unit	181
106	Square-wave Generator	206
109	Pulse Generator	207
111	Pretrigger Pulse Generator	208
113	Delay Cable	209
114	Variable Pulse Generator	210
R116	Programmable Pulse Generator	211
122, FM122, RM122	Low-Level Preamplifiers	213
123	Preamplifier	238
125, FM125, RM125	Power Supplies	215
127	Plug-In Unit Power Supply	216
129	Plug-In Unit Power Supply	218
130	L-C Meter	220
132	Plug-In Unit Power Supply	221
133	Plug-In Unit Power Supply	222
160A	Power Supply	223
161	Pulse Generator	224
162	Waveform Generator	225
163	Pulse Generator	226
175	High-Current Adapter For Type 575	170
184	Time-Mark Generator	227
191	Constant-Amplitude Signal Generator	228
1A1	Wide-Band, High-Gain, Dual-Trace Unit	106
1A2	Wide-Band Dual-Trace Unit	106
1A7	High-Gain DC Differential Unit	108
1L10	1 to 36 MHz Spectrum Analyzer Unit	111
1L20	Multi-Band 10 MHz to 4.2 GHz Spectrum Analyzer Unit	112
1L30	Multi-Band 925 MHz to 10.5 GHz Spectrum Analyzer Unit	112
1S1	Wide-Band Sampling Unit	114
1S2	Reflectometer and Wide-Band Sampling Unit	116
10A1	High-Gain Differential Comparator	185
10A2	Dual-Trace DC to 50 MHz Unit	187
11B1	Time-Base X50 Magnifier Unit	188
11B2	Time-Base—Delayed Sweep Unit	190
261	Coaxial Switch	238
262	Programmer Unit	143
263	3A5/3B5 Programmer Unit	229
280	Trigger Countdown	201, 230
281	Time Domain Reflectometer Pulser	231
282	Probe Adapter	231
290	Transistor Switching Time Tester	238
291	Diode Switching Time Tester	238
292	Semi-Conductor Tester Power Supply	202, 232
R293	Programmable Pulse Generator	233
2A60	DC to 1 MHz Unit	147
2A61	Low-Level Differential Unit	147
2A63	DC to 300 kHz Differential Unit	148
2B67	Time-Base Unit	148

TYPE	INSTRUMENT DESCRIPTION	PAGE
310A	DC to 4 MHz Portable Oscilloscope	18
317, RM17	DC to 10 MHz Oscilloscope	20
321A	DC to 6 MHz, AC/DC Battery Portable Oscilloscope	23
360	Indicator Unit	235
3A1	Dual-Trace DC to 10 MHz Unit	149
3A2	Dual-Trace Unit	138
3A3	100 μV/div DC Differential Unit	150
3A5	DC to 15 MHz Automatic/Programmable Amplifier	152
3A6	Dual-Trace DC to 10 MHz Unit	149
3A7	High-Gain Differential Comparator Unit	154
3A8	Operational Amplifier Unit	155
3A72	Dual-Trace DC to 650 kHz Unit	157
3A74	Four-Trace DC to 2 MHz Unit	158
3A75	DC to 4 MHz Unit	157
3B1	Time-Base—Delayed Sweep Unit	159
3B2	Time-Base Unit	138
3B3	Time-Base—Delayed Sweep Unit	160
3B4	Time-Base—X50 Magnifier Unit	161
3B5	Automatic/Programmable Time-Base Unit	153
3C66	Carrier Amplifier Unit	162
3L10	1 to 36 MHz Spectrum Analyzer	164
3S3	Sampling-Probe Dual-Trace Unit	139, 166
3S76	Dual-Trace Sampling Unit	140, 167
3T4	Programmable Sampling Sweep Unit	141, 168
3T77A	Sampling Sweep Unit	142, 169
422, R422	DC to 15 MHz, AC, AC/DC or Battery Portable Oscilloscope	26
453, R453	DC to 50 MHz—Sweep Delay Portable Oscilloscope	29
4S1	Dual-Trace Sampling Unit	195
4S2A	Dual-Trace Sampling Unit	196
4S3	Sampling-Probe Dual-Trace Unit	197
502A, RM502A	100 μV/cm Dual-Beam Oscilloscope	33
503, RM503	DC to 450 kHz, X-Y Oscilloscope	36
504, RM504	DC to 450 kHz Oscilloscope	38
507	High Voltage, Surge Test Oscilloscope	238
515A, RM15	DC to 15 MHz Oscilloscope	40
516	DC to 15 MHz—Dual-Trace Oscilloscope	42
519	DC to 1 GHz Oscilloscope	44
524AD	DC to 10 MHz Television Oscilloscope	47
526	Color TV Vectorscope	49
529, RM529	TV Waveform Monitor	52
531A, RM31A	DC to 15 MHz Oscilloscope	56
533A, RM33A	DC to 15 MHz—X100 Magnifier Oscilloscope	59
535A, RM35A	DC to 15 MHz—Sweep Delay Oscilloscope	56
536	DC to 10 MHz—X-Y Oscilloscope	62
543B, RM543B	DC to 33 MHz—X100 Magnifier Oscilloscope	65
544, RM544	DC to 50 MHz—X100 Magnifier Oscilloscope	69
545B, RM545B	DC to 33 MHz—Sweep Delay Oscilloscope	65
546, RM546	DC to 50 MHz—Sweep Delay Oscilloscope	72
547, RM547	DC to 50 MHz—Automatic Display Switching Oscilloscope	72
549	DC to 30 MHz Storage—Sweep Delay Oscilloscope	76
551	DC to 27 MHz—Dual-Vertical, Dual-Beam Oscilloscope	80
555	DC to 33 MHz—Sweep Delay, Dual-Beam Oscilloscope	83
556, R556	DC to 50 MHz—Dual-Vertical and Horizontal Oscilloscope—Dual-Beam—Sweep Delay	86
561A, RM561A	DC to 15 MHz—X-Y Oscilloscope	118
564, RM564	Split-Screen Storage Oscilloscope	122
565, RM565	Dual-Beam—Delayed Sweep Oscilloscope	127
567, RM567	Digital Readout Oscilloscope	131
570	Vacuum Tube Curve Tracer	238
575	Transistor Curve Tracer	170
581A	DC to 85 MHz Oscilloscope	175
585A, RM585A	DC to 85 MHz—Sweep Delay Oscilloscope	175
5T3	Sampling and Real Time Sweep Unit	199
647, RM647	DC to 50 MHz—Environmental Oscilloscope	182
661	Sampling Oscilloscope	193
6R1A	Digital Unit	135
1121	X100 Amplifier	236
C-12	Trace-Recording Camera	244
C-27	Trace-Recording Camera	243
C-30	Trace-Recording Camera	246
200-Series	Scope-Mobile Carts	250

Accessory Index

Page

A

Accessory Housings 272
Adapters
  Cable 269, 274
  Camera Mounting 276
  Gain Adjust 271
  Probe 268
  Probe Grounding 268
  Rack 276
  Type O, 3A8 ..... 271, 272
  Type TU-5 280
Amplifier, Current 260, 261
Attenuators 269, 272

B

Base, Fan, for Type 310A 19
Batteries, Replacement 280
Bezels, Camera Mounting 276

C

Cabinets, Plug-In Storage 270
Cable Adapters 269, 274
Cables
  Delay 269
  Gremar 269
  Miscellaneous 273
Camera Mounting Adapter 276
Cards, Extension 269, 270
Cases, Carrying 275
Cathode-Ray Tubes 277
  Graticules 278, 279
  Filters 279
Chassis, Blank Plug-In 270
Compensating Adapter, Type O, 3A8 271
Connector Characteristics 272
Cords
  Miscellaneous 274
  Power 274
Covers, Dust 275
Cradle Mount 276
Current Amplifier 261, 262
Current Probes 260, 261

D

Delay Cables, 50 Ω 269
Delta Standards, Type 130 220
Diode Test Jig 174, 202
Dust Covers 275

E

Extension
  Flexible 269, 270
  Plug-In 269, 270
  Sub-Chassis 269

F

Fan Base, Type 310A 19
Filters
  Light 279
  Mesh 279
Fixture, Test, Type 130 220
Frame, Mounting 276

G

Gain Adjust Adapter 271
Gating Adapter, Type O, 3A8 271
Graticules
  Replacement 278
  Unscribed 279
Gremar Cable 269
Ground Leads, Probe 268
Grounding Adapter, Probe 268

H

High Voltage Probes 259
Hoods, Viewing 275
Housing, Accessory 272

I

Identification Tags, Probe 268
Input Adapters 272
Input Cables 273
Input Standardizers 270

L

Leads, Miscellaneous 274
Leakage Current Adapter, Type O, 3A8 271
Light Filters 279
Log Amplifier Adapter, Type O, 3A8 271

M

Mesh Filters 279
Mounts, Cradle 276
Mounting Adapters, Camera 276
Mounting Frame 276

O

Operational Amplifier Accessories 271, 272
Output Cables 273

P

Probes
  Cathode-Follower 263, 264
  Current 260, 261
  General Purpose 254-258
  High Voltage 259
  Sampling 198, 264-267
Probe Accessories
  Adapters 268
  Grounding Adapter 268
  Ground Leads 268
  Identification Tags 268
  Tips 268
Pickoff "T", Voltage 270
Polarized Viewers 275
Power Cords 274
Production Test Fixtures, Type 130 220
Pulser, TU-5 280

R

Rack Adapter 276

S

Sampling Accessories 203-205, 269
Sampling Probes 198, 264-267
Separator, TV Sync 280
Signal Pickoff, CT-3 267
Shield, Type O, 3A8 Terminal 272
Standard, Type 130 Delta 220
Standardizers, Input Time-Constant 270
Storage Cabinets, Plug-In 270

T

Tags, Probe Identification 268
Terminations 269, 272
Test Fixture, Type 130 220
Test Jig Adapter 202
Test Jig, Diode 174, 202
Terminal Adapters, Type O, 3A8 272
Terminal Shields, Type O, 3A8 272
Tips, Probe 268
Transistor Test Boards, Type 575 174
TU-5 Adapter 280
  Pulser 280
TV Sync Separator 280

U

Unscribed Graticules 279

V

Viewing Hoods 275
Viewers, Polarized 275
Voltage Pickoff "T" 270

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