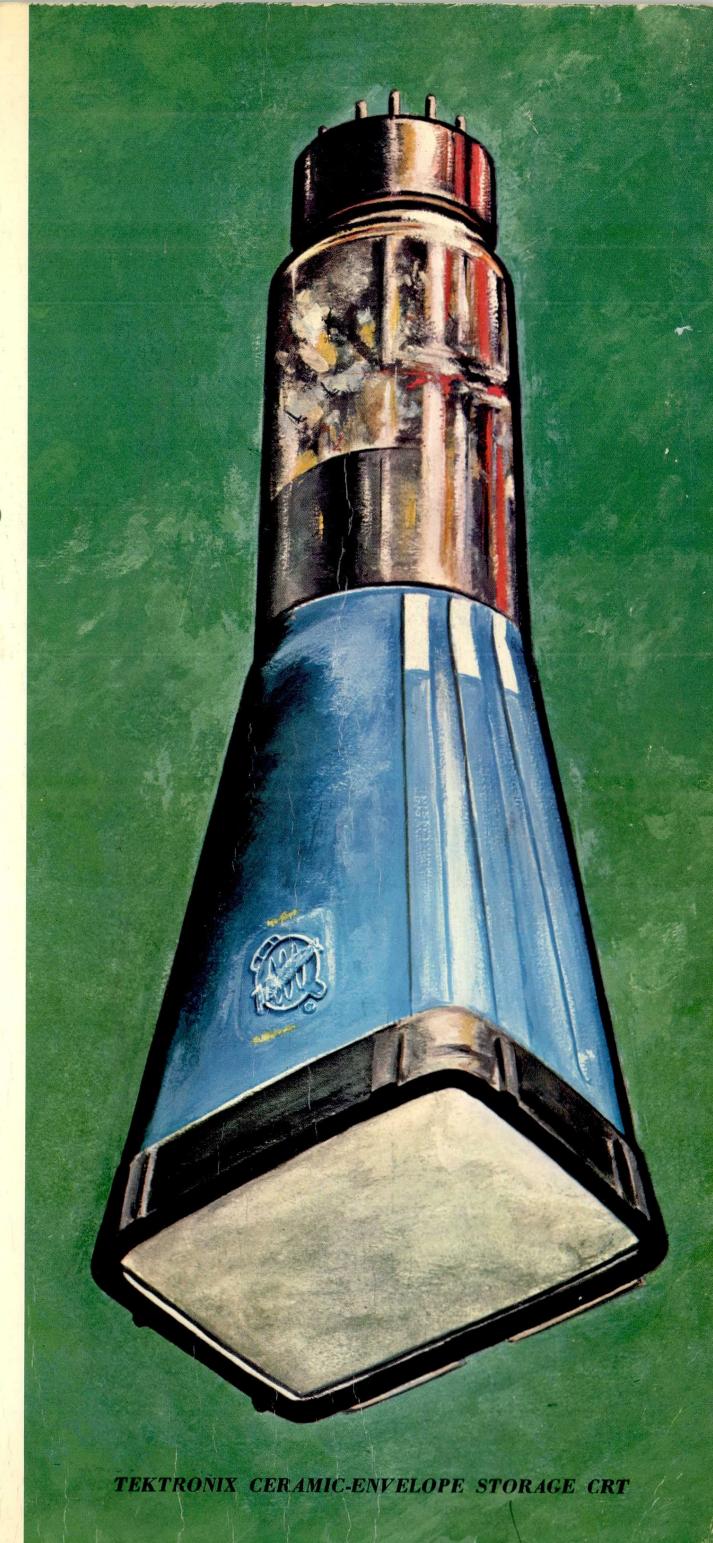


OSCILLOSCOPES

and associated instruments



ATALOG 22 MID 1963 - MID 1964

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	3T77	Sampling Sweep Unit			
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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 Engineer.

TEKTRONIX OSCILLOSCOPES (According to Passband Capabilities)

			(Accordin	g to Pa	ss b and Capab	oilities)				
Instrument	Vertical‡ Passband	Risetime	Calibrated Sensitivity	Signal Delay	Sweep Delay	Calibrated Sweep Range	Magnifier Max. Calib. Sweep Rate		Price	Page
Type 661 @	Equivalent to DC to 3500 MC	0.1 nsec	2 mv/cm to 200 mv/cm	No	through full time base	1 nsec/cm to 100 μsec/cm	2, 5, 10, 20, 50, 100X 10 psec/cm	3 kv	\$1150†	129
Type 661 ®	Equivalent to DC to 1000 MC	0.35 nsec	2 mv/cm to 200 mv/cm	Yes	through full time base	1 nsec/cm to 100 μsec/cm	2, 5, 10, 20, 50, 100 X 10 psec/cm	3 kv	\$1150†	129
Type 519	DC to 1000 MC	0.35 nsec	less than 10 v/cm	Yes	O to 35 nsec	2 nsec/cm to 1 μsec/cm	None	24 kv	\$3900	42
*Type 561A ©	Equivalent	0.4 nsec	2 mv/cm to 200 mv/cm	Yes	through 100 nsec	0.2 nsec/cm to 10 μsec/cm	10X 20 psec/cm	3.5 kv	\$ 470†	85
Type 564 © Storage	to	0.4 nsec	Same featur signal infor		ype 561A (abo	ove) plus SPLIT-S	SCREEN STOR	AGE of	\$ 950†	89
*Type 567 © Readout	DC to 875 MC	0.4 nsec				ve) plus DIGITA ces (with Type 6		The second secon	\$ 700†	97
Type 581A Oscilloscope	See Type 80/F			Yes	None	50 nsec/cm to 2 sec/cm	5X 10 nsec/cm	10 kv	\$1425†	119
*Type 585A Oscilloscope	82, Type 86 dire for passband c	The state of the state of the state of		Yes	2 μsec to 10 sec	50 nsec/cm to 2 sec/cm	5X 10 nsec/cm	10 kv	\$1725†	119
Type 80/P80 Fast-Rise Preamp	DC to 95 MC	3.9 nsec	0.1 v/cm to 5 v/cm						\$ 250	124
Type 82 Dual-Trace Preamp	DC to 85 MC	4 nsec	100 mv/cm to 50 v/cm			Type 82 F	Plug-In Unit an	d probes	\$ 650	126
Type 86 Single-Trace Preamp	DC to 85 Mc	4 nsec	100 mv/cm to 50 v/cm			Type 86 P	lug-In Unit an	d probe	\$ 350	128
Type 517A High-Speed	2.00	7 nsec	25 mv/cm	Yes	None	5 nsec/cm to 20 μsec/cm	None	12 kv or 24 kv	\$3500	39
*Type 541A ® Fast-Rise		12 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μsec/cm to 5 sec/cm	5X 20 nsec/cm	10 kv	\$1225†	69
*Type 543A ® Fast-Rise	DC to 30 MC	12 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μsec/cm to 5 sec/cm	2, 5, 10, 20, 50, 100 X 20 nsec/cm	10 kv	\$1300†	74
*Type 545A ® Fast-Rise	2 3 3 3 ms	12 nsec	50 mv/cm to 20 v/cm	Yes	2 μsec to 10 sec	0.1 μsec/cm to 5 sec/cm	5X 20 nsec/cm	10 kv	\$1550†	69
Type 555 ® Dual-Beam		12 nsec	50 mv/cm to 20 v/cm	Yes	0.1 μsec to 50 sec	0.1 μsec/cm to 5 sec/cm	5X 20 nsec/cm	10 kv	\$2650†	81
Type 551 ® Dual-Beam	DC to 25 MC	14 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μsec/cm to 5 sec/cm	5X 20 nsec/cm	10 kv	\$1850†	77

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

^{*} Rack-Mount models are available.

⁽A) When used with Types 4S2 and 5T1A Sampling Plug-In Units.

[®] When used with Types 4S1 and 5T1A Sampling Plug-In Units.

[©] When used with Types 3S76 and 3T77 Sampling Plug-In Units.

D When used with Type L Plug-In Preamplifier.

⁽E) When used with Type L Plug-In Preamplifier. Type 551 and 555 Oscilloscopes are designed for 2 Plug-In Preamplifiers.

TEKTRONIX OSCILLOSCOPES

(According to Passband Capabilities)

Instrument	Vertical‡ Passband	Risetime	Calibrated Sensitivity	Signal Delay	Sweep Delay	Calibrated Sweep Range	Magnifier Max. Calib. Sweep Rate	Accel. Potential	Price	Page
*Type 515A		23 nsec	50 mv/cm to 20 v/cm	Yes	None	0.2 μsec/cm to 2 sec/cm	5X 40 nsec/cm	4 kv	\$ 875	33
Type 516 Dual-Trace		23 nsec	50 mv/cm to 20 v/cm	Yes	None	0.2 μsec/cm to 2 sec/cm	5X 40 nsec/cm	4 kv	\$1070	36
*Type 531A ®	DC to 15 MC	23 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μsec/cm to .5 sec/cm	5X 20 nsec/cm	10 kv	\$ 995†	59
*Type 533A ®		23 nsec	50 mv/cm to 20 v/cm	Yes	None	0.1 μsec/cm to 5 sec/cm	2, 5, 10, 20, 50, 100 X 20 nsec/cm	10 kv	\$1125†	63
*Type 535A ®		23 nsec	50 mv/cm to 20 v/cm	Yes	2 μsec to 10 sec	0.1 μsec/cm to 5 sec/cm	5X 20 nsec/cm	10 kv	\$1400†	59
Type 536 ® X-Y Curve Tracer	DC to 11 MC	31 nsec	50 mv/div to 20 v/div	No	None	0.2 μsec/div to 2 sec/div	5X 40 nsec/div	4 kv	\$1085†	66
Type 317 Daylight 3" Portable		35 nsec	10 mv/div to 50 v/div	Yes	None	0.2 μsec/div to 2 sec/div	5X 40 nsec/div	9 kv	\$ 875	14
Type 561A [©] Oscilloscope		35 nsec	10 mv/cm to 10 v/cm	No	0.5 μsec to 10 sec	0.5 μsec/cm to 1 sec/cm	5X 0.1 μsec/cm	3.5 kv	\$ 470†	85
Type 564 [©] Storage	DC to 10 MC	Same fe	eatures as Ty ion.	pe 561A	(above) plu	us SPLIT-SCREEN	STORAGE of	signal	\$ 950†	89
*Type 565 [®] Dual-Beam Oscilloscope		35 nsec	10 mv/cm to 10 v/cm	No	1 μsec to 50 sec	1 μsec/cm to 5 sec/cm	10X 0.1 μsec/cm	4 kv	\$1400†	93
Type 321 Transistorized 3" Portable	DC to 5 MC	70 nsec	10 mv/div to 20 v/div	No	None	0.5 μsec/div to 0.5 sec/div	5X 0.1 μsec/div	4 kv	\$ 820	17
Type 310A 3" Portable	DC to 4 MC	0.1 μsec 90 nsec	10 mv/div to 0.1 v/div 0.1 v/div to 50 v/div	No	None	0.5 μsec/div to 0.2 sec/div	5X 0.1 μsec/div	1.8 kv	\$ 675	12
Type 503 Differential X-Y Curve Tracer	DC to 450 KC	0.75 μsec	1 mv/cm to 20 v/cm	No	None	1 μsec/cm to 5 sec/cm	2, 5, 10, 20, and 50X 0.1 μsec/cm	3 kv	\$ 640	25
Type 504		0.75 μsec	5 mv/cm to 20 v/cm	No	None	1 μsec/cm to 0.5 sec/cm	None	3 kv	\$ 540	28
Type 502A Dual-Beam and X-Y Curve Tracer	DC to 50 KC increasing to DC to 1 MC		100 μv/cm to 20 v/cm	No	None	1 μsec/cm to 5 sec/cm	2, 5, 10, and 20X 1 μsec/cm	3 kv	\$1050	22

Frequency Specifications are at 3-db down.

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

^{*} Rack-Mount models are available.

D When used with Type L Plug-In Preamplifier.

⁽F) When used with Type L Plug-In Preamplifier and Type T Plug-In Time Base.

When used with Type 3A1 Plug-In Amplifier and Type 3B3 Plug-In Time Base.

⁽H) When used with Type 3A1 Plug-In Amplifier. Type 565 is designed for 2 Plug-In Amplifiers.

				6 111		· .		C		C-11	14.		1 1 1 1 1 1 E	
Instrument	Ris	etime		Calibrate Sensitivit	y	E CONTROL OF THE PARTY OF THE P	inal lay	Sweep Delay		Calibrated Sweep Range	Magnifier Sweep Rat		Price	Page
Type 507	10) nsec	App	to 500 v/		N	10	None		20 nsec/cm to 50 μ sec/cm	None	24 kv	\$3000	30
					×	TELEVIS	ION OSC	CILLOSCO	OPES	S				
Instrument	Ri	setime		alibrated ensitivity	Signal Delay		ertical / esponse		9	librated Sweep Range	Sweep Magnifier	Accel. Potential	Price	Page
Type 524AD Oscilloscope	3:	5 nsec		5 mv/cm 50 v/cm	Yes	۸	Normal, Flat, IRE	t		μsec/cm 01 sec/cm	3 and 10X	4 kv	\$1300	46
Type 525 Waveform Monitor			1X,	nv/cm with 2X, 5X step ttenuator			Low-Pass, II			eld and ne Rates	5 and 25X	4 kv	\$1140	49
Type 526 Vectorscope		ual Cha iroma si		displays, with	either ve	ector o	r linear-	sweep	pres	sentation of d	emodulated	4 kv	\$1665	52
*Type 527 Waveform Monitor				0.25 v to 1.6 v for 7 cm	No	F	lat, IRE			eld and ne Rates	5 and 25X	4 kv	\$ 925	55
						SAN	PLING S	SYSTEMS	3	<u> </u>				
Instrument		Inped		Risetime	Calibro Sensiti		Signal Delay			Equivalent Sweep Time	Samples Pe Centimeter	ITIMAET	System Price	Pag
Type 661 with 5T1A and 4S2		50 8	Ω	0.1 nsec			No	throu		1 nsec/cm	5, 10, 20,	External	\$3500	129
Type 661 with 5T1A and 4S1		50 9	Ω	0.35 nsec			Yes	time	9	$100~\mu { m sec/cm}$ plus magnifie	1000	Internal or External	\$3330	129
Type 661 with 5T1A and 4S3		100 k,	2 pf	0.35 nsec	2-200 my 1-2-5 seq		No					External	\$3500 (with probes)	133
*Type 561A with Types 3S76 3T77 Units	and	50 9	Ω	0.4 nsec			Yes	Through	sec	0.2 nsec/cm to 10 μsec/cm plus 10X mag	10 or 100	Internal or External	\$2220	85
*Type 561A with Types 3S3 3T77 Units	and	100 k,	2 pf	0.35 nsec	5-100 mv 1-2-5 seq		No					External	\$2620 (with probes)	85
Type 564 with 3S76 and 3T77			Ω	0.4 nsec	STORAG	E of si	gnal inf	ormatic	on.		above) plus SP		\$2700	89
Type 564 with 3S3 and 3T77	Units	100 K,	2 pf	0.35 nsec	Same fe STORAG						ibove) plus SP	LIT-SCREEN	\$3100 (with probes)	89
* Type 567 with 3S76, 3T77, and Units		50	Ω	0.4 nsec							ove) plus DIG width, time di		\$4950	97
* Type 567 with 3S3 and 3T77		100 k,	2 pf	0.35 nsec							oove) plus DIG width, time di		\$5350 (with probes)	97
					SAI	MPLING	SYSTEM			IES				
Instrument					·			cription	A DESCRIPTION OF THE PARTY OF T				Price	Pc
280 Trigger Countdown					variable	from	15 to 45	5 Mc.			Gc. Output rep		\$ 265	200
290 Transistor Switching-Time	Tester				Measure risetime,						asurements of	delay time,	\$ 290	201
291/TF1 Diode Switching Tester	g-Time				Measure better th			g diode	s, fo	orward and r	everse recovery	/. Response	\$ 185 65	202

Type 561A, RM561A, and 564 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 Sampling Units for digital readout. Other Amplifier and Time Base Units can be used without digital readout.

		AMPLI	FIER UNITS				
Туре	Passband (3-db down)	Calib	orated Sen	sitivity *	Input (ac or dc coupled)	Price	Page
2A60	dc — 1 Mc.	50 mv/cm—	-50 v/cm in	4 steps.	1 megohm shunted by 47 pf, 600 volts max.	\$ 105	163
2A61 Low-Level Differential	0.06 cps—300 kc	10 μv/cm—2	20 mv/cm	1-2-5 sequence.	10 meg—50 pf; ±5 v (ac—coupled only)	\$ 385	163
2A63 Differential 50:1 rejection ratio	dc — 300 kc.	1 mv/cm—	-20 v/cm,	1-2-5 sequence.		\$ 130	164
**3A1 Dual-Trace (Identical Channels)	dc — 10 Mc.	10 mv/cm—	-20 v/cm,	1-2-5 sequence.		\$ 410	165
3A72 Dual-Trace (Identical Channe's)	dc — 650 kc	10 mv/cm—	-10 v/cm,	1-2-5 sequence.	1 megohm shunted by 47 pf, 600 volts max.	\$ 250	166
3A74 Four-Trace (Identical Channels)	dc — 2 Mc.	20 mv/cm—	10 v/cm,	1-2-5 sequence.		\$ 550	167
3A75	dc — 4 Mc.	50 mv/cm—	-20 v/cm,	1-2-5 sequence.		\$ 175	166
3C66 Strain Gage	dc—5 kc	10 μstrain, 1-2-5 sequ		0 μstrain/div,		\$ 400	170
3S3 Dual-Trace Sampling (Use with 3T77)	dc to equivalent 1 Gc. (0.35 nsec rise- time).	5 mv/cm—1	00 mv/cm,	1-2-5 sequence.	100 k, 2 pf ±3 v max	\$1500 (with probes)	172
3S76 Dual-Trace Sampling (use with 3T77)	dc to equivalent 875 Mc (0.4 nsec risetime).		-200 mv/cm	, 1-2-5 sequence.	50 Ω 2 volts pk-to-pk. max. dc-coupled	\$1100	173
		TIME-	BASE UNITS				
Туре	Sweep Ro	ate *	Magnifier	Т	riggering	Price	Page
2B67 Single Sweep	$1 \mu { m sec/cm}$ to $5 { m sequence}.$	ec/cm, 1-2-5			l, Line; amplitude-level dc-coupled; automatic lope.		164
3B1 Sweep Delay	0.5 μsec/cm to 1 5 sequence (for and delayed swe	both normal		tion; ac or dc-co	l; amplitude-level selec- upled; automatic (normal ree-run; ± slope.		168
3B3 Calibrated Sweep Delay Single Sweep	0.5 μsec/cm to 1 sequence (for bot delayed sweeps). ly variable calil from 0.5 μsec to	h normal and Continuous- orated delay		tion, ac or dc	l; amplitude-level selectoupled, \pm slope. Norin addition: automatic gle sweep.		169
3T77 Sampling Sweep (use with 3S76)	Equivalent sweet nsec/cm to 10 μ s sequence.	p rates 0.2		Internal or Exteri	nal, \pm slope.	\$ 650	174

^{*} Sensitivity and Sweep Rate are variable between steps, uncalibrated.

^{**} Provides 6-cm linear scan.

Reference

CHARACTERISTICS OF TEKTRONIX OSCILLOSCOPES

			RACIERISTICS O		30.220300123	
		OSCILLOSCOPE FEATURES	* Type 531A General Purpose	* Type 533A General Purpose	* Type 535A Sweep Delay	Type 536 X-Y Curve Tracer
		SIGNAL DELAY		Yes		No
		CALIBRATED SWEEP RANGE	0	.1 μsec/cm to 5 sec/c	φ	See Type T
		SWEEP MAGNIFIER	5X	2, 5, 10, 20, 50, 100X	5X	Time-Base Generator
		SWEEP DELAY	No	one	$2 \mu \text{sec}$ to 10sec	None
		ACCELERATING POTENTIAL		10 kv		4 kv
		PRICE (WITHOUT PLUG-IN UNITS)	\$995	\$1125	\$1400	\$1085
		PAGE NUMBER	59	63	59	66
PLUG-I	n unit type	CALIBRATED SENSITIVITY	RISETIME AND	PASSBAND OF OS	SCILLOSCOPE AND	PLUG-IN UNIT
В	Wide-Band High-Gain Unit	5 mv/cm to 20 mv/cm 50 mv/cm		35 nsec 2 cps to 10 Mc 25 nsec		40 nsec 2 cps to 9 Mc 35 nsec
C-A	Dual-Trace DC Unit	to 20 v/cm 50 mv/cm		dc to 14 Mc		dc to 10 Mc
D	High-Gain DC	to 20 v/cm 1 mv/cm to		dc to 15 Mc 0.18 μsec		dc to 10 Mc
E	Differential Low-Level AC Differential	50 v/cm 50 μv/cm to		dc to 300 kc, increas		
G	Wide-Band DC Differential	10 mv/cm 50 mv/cm to 20 v/cm	0.00	cps to 20 kc, increas 25 nsec dc to 14 Mc	ing to 60 kc	35 nsec dc to 10
Н	Wide-Band High-Gain DC Unit	5 mv/cm to 20 v/cm		31 nsec dc to 11 Mc		37 nsec dc to 9.5 Mc
K	Fast-Rise DC Unit	50 mv/cm to 20 v/cm		23 nsec dc to 15 Mc		31 nsec dc to 11 Mc
	Fast-Rise High-Gain	5 mv/cm to 2 v/cm		23 nsec 3 cps to 15 Mc		35 nsec 3 cps to 10 Mc
•	Unit	50 mv/cm to 20 v/cm		23 nsec dc to 15 Mc		31 nsec dc to 11 Mc
М	Four-Trace Unit	20 mv/cm to 10 v/cm		25 nsec dc to 14 Mc		35 nsec dc to 10 Mc
Ν	Sampling Unit	10 mv/cm	(100 psec/cm with	orresponding to 600 <i>l</i> 10X magnifier), samp equires external trigg	les per display of 50	0, 100, 200, or 500.
0	Operational Amplifier	50 mv/cm to 20 v/cm	Porforms procise o	25 nsec dc to 14 Mc	on differentiation	35 nsec dc to 10 Mc
	Unit	20,70	and linear or nonl	perations of integrati inear amplification.	on, unlerentiation, 1	unction generation,
Q	Strain Gage Unit	10 μstrain/div to 10,000 μstrain/div	60 μsec risetime, of strain any mecho ance, capacitance,	dc to 6 kc. Measu anical quantity that c or inductance.	res force, displacer an be converted to	ment, acceleration, a change in resist-
R	Transistor Risetime Unit	0.5 ma/cm to 100 ma/cm		etime pulse, 400-ma and same as with K		00-ma bias supply,
S	Semiconductor Diode-Recovery Unit	50 mv/cm and 0.5 v/cm	1 to 20 ma forward same as with K U	d current, 0 to 2 ma nit.	reverse current, rise	time and passband
Т	Time-Base Generator Unit		Generates 22 calib magnifier. Triggerin either ac or dc co	rated sweep rates fing facilities include Moupled.	rom 0.2 μsec/div to Nanual, Automatic, H	2 sec/div plus 5X I. F. Sync and Line,
Z	Differential- Comparator Unit	50 mv/cm to 25 v/cm		35 nsec dc to 10 Mc		40 nsec
	Comparator Unit	25 V/ cm	(0 to \pm 100 v) do	tion" up to 500 tir comparison voltage esolution. 40,000 to	s. \pm 2000 cm effe	ective scale length.
,	* Rack-Mount Mode	els are available.				
				73 X X X X X X X X X X X X X X X X X X X		

Chart

Fast-Rise	2, 5, 10, 20 50, 100X	* Type 545A Sweep Delay usec/cm to 5 sec	Type 551 Dual-Beam Yes	Type 555 Dual-Beam	† Type 581A	† * Type 585A			
SX	2, 5, 10, 20 50, 100X	μsec/cm to 5 sec	Voc	Dodi Dodin	Fast-Rise	Sweep Delay			
SX	2, 5, 10, 20 50, 100X	µsec/cm to 5 sec	162		50	Jan 1			
SX	50, 100X		/ cm			c/cm to c/cm			
None				5X					
	e	2 μsec to 10 sec	None	0.1 μ sec to 50 sec	None	$2 \mu \text{sec}$ to 10 sec			
			10 kv						
\$1225	\$1300	\$1550	\$1850	\$2650	\$1425	\$1725			
69	74	69	77	81	119	119			
RISETIME AI	ND PASSBAN	ID OF OSCILLO	SCOPE AND PL	UG-IN UNIT			PRICE	PAGE	PLUG-IN
2 cps 18	onsec to 12 Mc onsec on 20 Mc		30 nsec 2 cps to 12 Mc 20 nsec dc to 18 Mc		30 nsec 2 cps to 12 Mc 18 nsec dc to 20 Mc		\$145	140	В
15	nsec o 24 Mc		16 nsec dc to 22 Mc		15 nsec dc to 24 Mc		\$260	141	C-A
uc 10		0.18 μsec Ic to 300 kc, incre					\$170	142	D
		6 μsec 0.06 cps to 20 kc,		kc			\$190	143	E
A STATE OF THE STA	3 nsec	0.00 cps 10 20 kc,	20 nsec		18 nsec dc to 20 Mc		\$190	144	G
23 nsec dc to 15 Mc dc to 14 Mc					23 nsec		\$185	145	Н
12	dc to 14 Mc dc to 15 mc				\$145	146	K		
1.5	o 30 Mc		dc to 25 Mc 16 nsec 3 cps to 22 Mc		dc to 30 Mc 15 nsec 3 cps to 24 Mc				
12	to 24 Mc		14 nsec		12 nsec		\$210	147	L
17	o 30 Mc		dc to 25 Mc		dc to 30 Mc		\$525	148	M
0.6 nsec risetime		ng to 600 Mc), ap					4.05	1.40	
No signal delay	y, requires ext	fier), samples per ernal trigger in c	idvance of signal				\$625	149	N
	4 nsec o 25 Mc		16 nsec dc to 22 Mc		14 nsec dc to 25 Mc		\$525	151	0
Performs precise and linear or		of integration, di plification.	fferentiation, fund	tion generation	,				
	echanical qua	cc. Measures fo ntity that can be nce.					\$325	154	Q
Supplies 5-nsec	risetime puls	e, 400-ma collec as with K Unit.	tor supply, 100-r	ma bias supply	,		\$325	156	R
		0 to 2 ma revers	e current, risetim	e and passband	4		\$260	158	S
Generates 22 o	same as with K Unit. Generates 22 calibrated sweep rates from 0.2 μsec/div to 2 sec/div plus 5X magnifier. Triggering facilities include Manual, Automatic, H. F. Sync and Line,						\$240	160	T
either ac or do	either ac or dc coupled. 27 nsec								
$(0 \text{ to } \pm 100 \text{ v})$	27 nsec dc to 13 Mc Vertical "magnification" up to 500 times. Calibrated continuously variable (0 to ± 100 v) dc comparison voltages. ± 2000 cm effective scale length. 0.005% maximum resolution. 40,000 to 1 common-mode rejection ratio.						\$525	161	Z

	CHAR	ACTERISTIC-CURVE	TRACERS					
Instrument	Vertical Axis	Horizontal Axis		ole Drive meters	Accel. Potential	A-B Comparison Tests	Price	Page
Type 570 presents an accurate graphic analysis of electron-tube characteristics under almost any conceivable operating condition.	20 μa/div to 50 ma/div 1-2-5 sequence	1 v/div to 50 v/div 1-2-5 sequence	50 v/div grid current vs.		1 kv	Yes	\$1100	111
Type 575 traces characteristic curves for both PNP and NPN transistors and diodes on the face of a crt.	1 μa/div to 2 a/div 10 mv/div to 0.5 v/div	10 mv/div to 20 v/div 10 mv/div to 0.5 v/div	& volta	or current age, Base & voltage.	4 kv	Yes	\$1075	114
Instrument	Collector Supply	Base Su	oply	Calibrate	ed Display	A-B Comparison Tests	Price	Page
Type 175 adapts the Type 575 to measurement of high power (NPN and PNP) transistors and diodes. Specifications apply ONLY when used with Type 575 Curve Tracer.	0 to 20 v or 0 to 100 v, or 0 to 100 with 300-Ω series load resistor.	family. s 10 current po 1 ma to 1 c 5 voltage po	ly, either single esitions—amp/step	Vertical A Collector Horizonta Collector Base Vol	Current I Axis— Voltage	Yes	\$1475	114

	INDUCTANCE AND CAPACITANCE METER										
Instrument	Ranges	Accuracy	Guard Voltage	Price	Page						
Type 130	0 to 3, 10, 30, 100, 300 μ h 0 to 3, 10, 30, 100, 300 μ f	within 3%	Permits mea- suring an un- known ca- pacitance while elimin- ating effects of other ca- pacitances.	\$ 225	188						

	SQI	JARE-WAVE GE	NERATORS		
Instrument	Risetime	Frequency Range	Output Voltage	Price	Pag
Type 105	13 nsec	25 cps to 1 Mc	10 v to 100 v across the in- ternal 600-Ω load	\$ 435	175
Type 107	3 nsec	400 kc to 1 Mc	0.1 v to 0.5 v with 52-Ω ter- mination	\$ 190	177

		×	AMPLIFIE	RS				
Instrument	Gain	Frequency Response‡	Noise Level	Differential Input	Input Impedance	Output Impedance	Price	Page
*Type 122	100X or 1000X	0.2 cps to 40 kc	1-5 μv, rms, grounded	Yes	10 megohms paralleled by 50 pf.	1000 ohms	\$ 135	182
Type 123	100X	3 cps to 25 kc	7.5 μv, rms, or less grounded	No	10 megohms	31 kilohms	\$ 75	184
Type 1121	100X	5 cps to 17 Mc 21-nsec risetime	50 μv or less pk-to-pk, grounded	No	1 megohm paralleled by 22 pf.	93 ohms	\$ 465	203

^{*} Rack-Mount models are available.

PULSE GENERATORS

Instrument	Frequency	Main Pulse Width	Risetime	Delay	Output		Trigger		
					Amplitude	Impedance	Req.	Price	Page
Type 109	275 to 700 cps	0.5 nsec to 300 nsec	< 0.25 nsec	None	0 to 50 v	50 Ω	None	\$360	178
Type 110	360 to 720 cps	0.5 nsec to 300 nsec	< 0.25 nsec	1 nsec	0 to 50 v	50 Ω	Line	\$650	179
Type 111	0 to 100 kc	2 nsec to 0.1 μ sec	0.5 nsec	30 to 250 nsec	±5 v	50 Ω	+5 v	\$365	180
† Type 161	0 to 50 kc	10 μsec to 0.1 sec	0.5 μsec	Variable	0 to ±50 v	1—5 kΩ	+3 v	\$130	193
† Type 162	0 to 10 kc	100 μsec to 10 sec	1 μsec	None	50 v	1 kΩ	+15 v	\$130	194
† Type 163	0 to 500 kc	1 μsec to 10 msec	0.2 μsec	Variable	0 to +25 v	100 Ω—3.5 kΩ	+2 v	\$130	195

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

	TIME-MARK GENERATORS										
Instrument	Time-Mark Interval	Sine-Wave Frequency	Accuracy	Stability††	Price	Page					
Type 180A	2 per decade from 1 μsec to 5 sec, separately or in timing combination.	5 Mc, 10 Mc or 50 Mc	within 0.001%	3 parts per million for 24 hr. period	\$ 625	196					
*Type 181	1 per decade from 1 μ sec to 10 msec.	10 Mc	about 0.03%	0.005% per hour	\$ 265	198					

^{*} Rack-Mount models are available.

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

	CONS	TANT AMPLITUDE SINE-WAVE GENE	ERATOR			
Instrument	Output Frequency	Output Amplitude	Harmonic Content	Output Impedance	Price	Page
Type 190B	Continuously variable from 350 kc to 50 Mc.	Continuously variable from 40 mv to 10 volts, pk-to-pk.	Typically less than 5%.	Nominally $52~\Omega$	\$ 330	199

TRACE-RECORDING CAMERAS (Standard Cameras)

Туре	Lens	Object to Image Ratio	Back	Price	Page
C-12	f/1.9	1:0.9	Polaroid*	\$450	206
C-13	f/4.5	1:0.7	Land 31/4"	\$360	206
C-19	f/1.9	1:0.5	by 41/4"	\$500	206

Optional lens, frames, backs available as individual components to assemble camera to fit any application.

^{*} Registered by Polaroid Corporation.

Reference Information

DESCRIPTIONS AND SPECIFICATIONS

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

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

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

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

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

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

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

PASSBAND AND RISETIME MEASUREMENTS

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

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

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

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

MECHANICAL CONSIDERATIONS

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

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

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

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

Reference Information

TEKTRONIX-MANUFACTURED COMPONENTS

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

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

tubes, transformers, ceramic terminal strips, and etched circuitry—in addition to precision potentiometers, capacitors, 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, persistence, etc. The following table describes the more commonly used phosphors.

PHOSPHOR DATA CHART

Phosphor	Fluorescence	Phosphorescence	Relative A Brightness	Persistence ®	Crystal © Size	Principal Use	Comments
P1	Yellowish- Green	Yellowish- Green	128	Medium	Fine	Slow Repetition Rate Oscilloscope Displays	
P2	Green	Green	238	Medium Short*	Coarse	General Purpose Displays	Good compromise for high and low speed applications.
P4	White	White	165	Medium Short	Coarse	Television Pictures (Image Displays)	
P7	Greenish-Blue	Yellow	128	Long *	Coarse	Slow Speed Displays	
Pll	Blue	Blue	100	Medium Short	Medium	Oscilloscope Photography	High blue light content and small spot size conducive to sharp photographs.
P15	Blueish-Green	Blueish-Green	32	Short	Fine	Moving Film Photography Flying Spot Scanner Displays	Poor for high-speed photog- raphy.
P20	Green	Green	250	Medium	Medium	General Purpose Displays	
P31	Green	Green	284	Medium	Coarse	Oscilloscope Displays In High Ambient Light	

- A Taken with a Spectra Brightness Spot Meter, which incorporates a C.I.E. standard eye filter. Representative of 10 kv aluminized screens.
- B JEDEC classification (to 10% level).
- © FINE = up to 4.9 μ , MEDIUM = 5.0 μ to 9.9 μ , COARSE = 10.0 μ and up.
- * Low-level persistence may last for minutes.

UNITS and ABBREVIATIONS used in this Catalog

Unit	Name	Abbreviation	Unit	Name	Abbreviation	Unit	Name	Abbreviation
0° cycles	gigacycles	Gc	10 ⁻² meter	centimeter	cm	10 ⁻⁶ farad	microfarad	μf
10 ⁶ cycles	megacycles	Mc	10 ⁻³ second	millisecond	msec	10 ⁻⁹ second	nanosecond	nsec
106 ohms	megohms	meg	10 ⁻³ meter	millimeter	mm	10 ⁻¹² farad	picofarad	pf
10 ³ cycles	kilocycles	kc	10 ⁻⁶ second	microsecond	μsec	10 ⁻¹² second	picosecond	psec
10 ³ ohms	kilohms	k						

Type 3 DC-to-4MC OSCILLOSCOPE



SMALL IN SIZE

LOW IN WEIGHT

ELECTRONICALLY-REGULATED DC SUPPLIES

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED SENSITIVITY—
Dc-coupled, 0.1 v/div to 50 v/div.

Ac-coupled, 0.01 v/div to 50 v/div.

PASSBAND—Dc-coupled, dc to 4 Mc.
Ac-coupled, 2 cps to 3.5 Mc.

RISETIME-90 nsec.

INPUT-1 megohm, 40 pf.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.5 μ sec/div to 0.2 sec/div.

SWEEP MAGNIFIER—5X, extends sweep range to 0.1 $\mu sec/div$.

TRIGGER REQUIREMENTS—Internal: 0.5-div deflection. External: 0.2 to $\pm 20 \text{ v}$.

EXTERNAL INPUT-1.5 v/div.

CRT

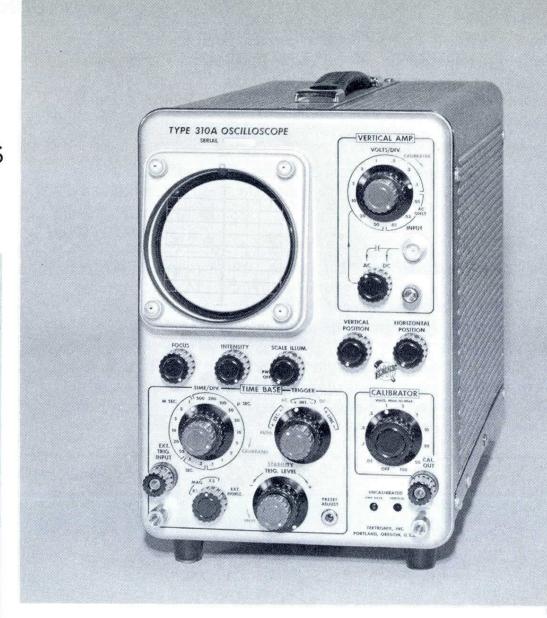
DISPLAY AREA—8 x 10 div. Each div equal to 1/4 inch. ACCELERATING POTENTIAL—1.85 kv.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—50 mv to 100 v, 1-kc square wave.

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

The Type 310A Oscilloscope is an instrument you can take with you—easily, comfortably. Small size and low weight combined with operation on 50 to 800-cycle line frequency make this an ideal instrument for maintenance and calibration of specialized measuring and recording instruments at their point of use. Accurate calibration and excellent linearity assure faithful displays and precise time and amplitude measurements either in the laboratory or in the field. Functional panel design and versatile control systems contribute to operator convenience.



VERTICAL-DEFLECTION SYSTEM

Frequency specifications are at 3-db down

DC-Coupled Vertical Amplifier—Main amplifier passband is dc to 4 Mc. Vertical deflection is calibrated in steps of 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 v/div. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe. An ac-coupled preamplifier switched in by the VOLTS/DIV control provides three additional calibrated steps of 0.01, 0.02, and 0.05 v/div, at a frequency response of 2 cycles to 3.5 mc. In addition, a 2.5-to-1 vernier (uncalibrated) control provides for continuously-variable adjustment from 0.01 v/div to 125 v/div. A light on the front panel indicates when the control is in the variable (uncalibrated) position. Vertical amplifier is factory-adjusted for optimum transient response. Risetime is less than 90 nsec. Input impedance is 1 megohm paralleled by approximately 40 pf.

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

Probe—A low-capacitance probe (10-x atten.) is supplied with the instrument. Input capacitance with the probe is approximately 9.5 pf paralleled by 10 megohms.

HORIZONTAL-DEFLECTION SYSTEM

Wide Sweep Range—The Type 310A has 18 calibrated sweep rates: 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500 μ sec/div, 1, 2, 5, 10, 20, 50 millisec/div, 0.1, 0.2 sec/div. In addition, a vernier (uncalibrated) control provides sweep rates continuously adjustable from 0.5 μ sec/div to 0.6 sec/div. A light in the front panel indicates when the control is in the variable (uncalibrated) position. Calibration accuracy of the 18 fixed sweeps is within 3%.

Sweep Magnifier—Sweep magnification is obtained by increasing the gain of the sweep-output amplifier by a factor of 5. The center 2-division portion of the normal trace is expanded to 10 divisions. The HORIZONTAL POSITION control has sufficient range to display any one-fifth of the magnified sweep. The 5-x magnifier applied to the 0.5- μ sec/div sweep extends the calibrated range to 0.1 μ sec/div. Accuracy is within 3% of the displayed portion of the magnified sweep on all ranges except the 0.5 μ sec/div range, where accuracy is within 5%.

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

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

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

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

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

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

Horizontal Input—A back-panel terminal permits use of an external signal to drive the horizontal amplifier. Deflection factor is 1.5 v/div.

OTHER CHARACTERISTICS

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

Accelerating Potential—1.85 kv accelerating potential, electronically regulated, is applied to the flat-faced cathode-ray tube. A P31 phosphor is normally supplied.

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

Power Requirement—105 v to 125 v or 210 v to 250 v, typically 175 watts.

The Type 310A will operate over the range of 50 to 800 cps, but at 800 cps about 4% greater line voltage is required. This can be partially compensated for by using the multi-tap primary on the power transformer.

Illuminated Graticule—The edge-lighted graticule has 8 vertical and 10 horizontal $\frac{1}{4}$ -inch divisions. Illumination is controlled by a front-panel knob. An appropriate filter is provided to increase contrast when viewing in a brightly-lighted room.

Hinged Chassis—The Type 310A opens up to permit easy accessibility to all tubes and components.

Mechanical Specifications—Dimensions are 10 % " high by 7" wide by 17 % " deep. Net weight is 23 pounds. Shipping weight is 34 pounds, approx.

tion manuals.

FAN BASE

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

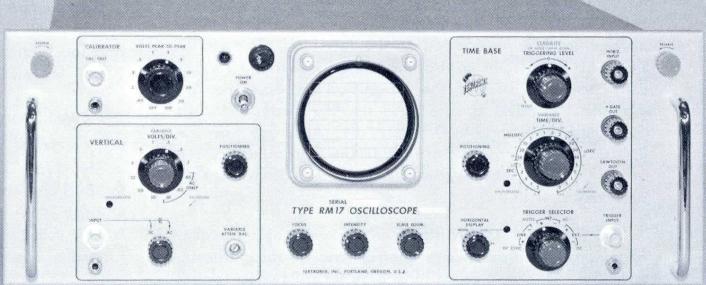
For	use on 105-125 v, 50 to 60 cps only:	
Order	Part Number 016-012	\$50
For	use on 210-250 v, 50 to 60 cps only:	
	Part Number 016.013	\$50

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

DC-to-10MC-9-KV OSCILLOSCOPE







BRIGHT TRACE

ELECTRONICALLY-REGULATED DC SUPPLIES

COMPACT CABINET OR RACK-MOUNT MODELS

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

CHARACTERISTIC SUMMARY VERTICAL

CALIBRATED SENSITIVITY-

Dc-coupled, 0.1 v/div to 50 v/div. Ac-coupled, 0.01 v/div to 50 v/div.

PASSBAND—DC-coupled, dc to 10 Mc.
Ac-coupled, 2 cps to 10 Mc.

RISETIME-35 nsec.

INPUT—1 megohm, 40 pf.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.2 μ sec/div to 2 sec/div. SWEEP MAGNIFIER—5X, extends sweep range to 0.04 μ sec/div.

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

EXTERNAL INPUT—1.4 v/div maximum sensitivity, dc to 400 kc.

CRT

DISPLAY AREA—8 x 10 div. Each div equal to $\frac{1}{4}$ inch. ACCELERATING POTENTIAL—9 kv.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—50 mv to 100 v, 1-kc square

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

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

DC-Coupled Vertical Amplifier — Main amplifier passband is dc to 10 Mc, risetime is 35 nsec. Vertical deflection is calibrated in steps of 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 v/div. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe. An ac-coupled preamplifier switched in by the VOLTS/DIV control provides three additional calibrated steps of 0.01, 0.02 and 0.05 v/div at a frequency response of 2 cycles to 10 mc, risetime 35 nsec. In addition, a 2½-to-1 vernier (uncalibrated) control provides for continuous adjustment from 0.01 v/div to 125 v/div.

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

Input Impedance—1 megohm paralleled by approximately 40 pf.

Delay Network—A signal delay of $0.25 \,\mu\text{sec}$ is introduced by the balanced delay network. Permits observation of the leading edge of the waveform that triggers the sweep.

Probe—The vertical sensitivity of the Type 317 is reduced by a factor of ten by use of the 10-x attenuator probe supplied with the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately 9.5 pf.

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

HORIZONTAL-DEFLECTION SYSTEM

Wide Sweep Range—A single knob is used to select any of 22 calibrated sweep rates: 0.2, 0.5, 1, 2, 5, 10, 20, 50 μ sec/div, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 msec/div, 0.1, 0.2, 0.5, 1, and 2 sec/div. In addition, a vernier (uncalibrated) control provides for continuous adjustment from 0.2 μ sec/div to 6 sec/div. Calibration accuracy of the 22 fixed sweep rates is within 3%.

Sweep Magnifier—When the 5-x magnifier is switched in, calibrated sweep rates are read from the outer ring of numbers circling the TIME/DIV knob. The magnifier expands the normal sweep to fifty divisions, and the HORIZONTAL positioning control has sufficient range to display any ten divisions of the magnified sweep. Calibration accuracy is within 5% of the displayed portion of the magnified sweep.

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

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

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

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



317 RM17

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

High-Frequency Sync—Assures a steady display of sine-wave signals up to approximately 15 MC. Requires a signal large enough to cause a deflection of 0.2 div at 5 Mc, 2 div at 15 Mc, or an external signal of about 2 v.

Trigger Requirements—An internal signal causing deflections of 0.2 div increasing to 2 div at 5 Mc in AC MODE, 0.3 div increasing to 2 div at 5 Mc in DC MODE, and 0.5 div increasing to 2 div at 2 Mc in AUTO MODE, or an external signal of 0.5 vto 20 v.

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

OTHER CHARACTERISTICS

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

Cathode-Ray Tube—A new Tektronix flat-faced 3" cathode-ray tube with helical post-accelerating anode is used in the Type 317. Accelerating potential is 9 kv. A P31 phosphor is normally supplied.

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

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

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

Unless otherwise specified, the instrument will be shipped wired for operation within the line-voltage range of 105 v to 125 v. The Type 317 can be ordered wired for operation on several nominal line voltages as follows:

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

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

Illuminated Graticule—The edge-lighted graticule is divided into 8 vertical and 10 horizontal $\frac{1}{4}$ " divisions. Illumination is controlled by a front-panel knob.

Warning Indicators for Uncalibrated Settings— Separate front-panel neon lights indicate when the vertical-attenuator and sweep-rate controls are not in their calibrated positions.

Cabinet Model—Dimensions are $12\frac{3}{8}$ " high by $8\frac{5}{8}$ " wide by $19\frac{1}{2}$ " deep. Net weight is $33\frac{1}{4}$ pounds. Shipping weight is 47 pounds, approx.

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

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

TYPE 317MOD101 (50 to 400 cps operation) . . \$935 Each instrument includes: 1—10X attenuator probe, 1—binding-post adapter, 1—light filter, 1—3-conductor power cord, 2—instruction manuals.

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 (50 to 60 cps operation) \$950

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

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

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

SUPPORTING CRADLES

When the RM17 or RM17MOD101 is mounted 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.

PORTABLE TRANSISTOR OSCILLOSCOPE Type

LOW WEIGHT SMALL SIZE TRANSISTORIZED BATTERY POWERED

CHARACTERISTIC SUMMARY VERTICAL

CALIBRATED SENSITIVITY—0.01 v/div to 20 v/div. PASSBAND—Dc to 5 Mc. RISETIME—70 nsec.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.5 μ sec/div to 0.5 sec/div.

SWEEP MAGNIFIER—5X, extends sweep range to 0.1 μ sec/div.

TRIGGER REQUIREMENTS—Internal: 1-div deflection. External: 0.5 to 10 v.

EXTERNAL INPUT-1.5 v/div, dc to 1 Mc.

INPUT—1 megohm, 40 pf.

CRT

DISPLAY AREA—6 x 10 div. Each div equal to $\frac{1}{4}$ inch. ACCELERATING POTENTIAL—4 kv.

OTHER CHARACTERISTICS

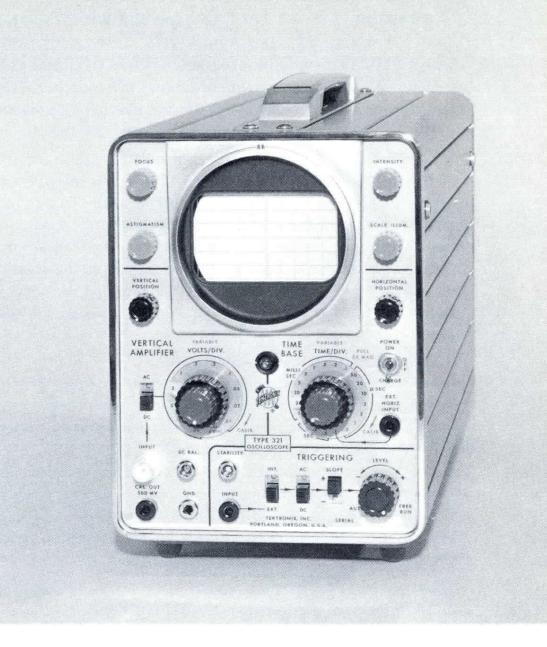
AMPLITUDE CALIBRATOR—500 mv and 40 mv, 2-kc square wave.

POWER REQUIREMENTS—Ten size D batteries, or 11.5 to 35 v dc, or 105 to 125 v or 210 to 250 v ac.

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

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

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



VERTICAL-DEFLECTION SYSTEM

Frequency specifications are at 3-db down

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

Calibration Accuracy—Internal adjustments are provided for setting the gain of the vertical amplifier. When these adjustments are accurately set (with the VOLTS/DIV switch in the fully clockwise position) for four major divisions of signal, the vertical deflection factor for any other switch position will be within 3%.

Input Impedance—1 megohm paralleled by approximately 40 pf.

Probe—The 10-x attenuator probe supplied with the instrument presents an input impedance of 10 megohms paralleled by approximately 9.5 pf, and reduces the vertical sensitivity by a factor of ten.

HORIZONTAL-DEFLECTION SYSTEM

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

Sweep Magnifier—The center two-division portion of the displayed waveform can be expanded to ten divisions. The HORIZONTAL POSITION control has sufficient range to cover any one-fifth of the magnified sweep. The 5X MAG applied to the $0.5~\mu sec/div$ sweep extends the calibrated range to $0.1~\mu sec/div$. Accuracy is within 4% of the displayed portion of the magnified sweep.

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

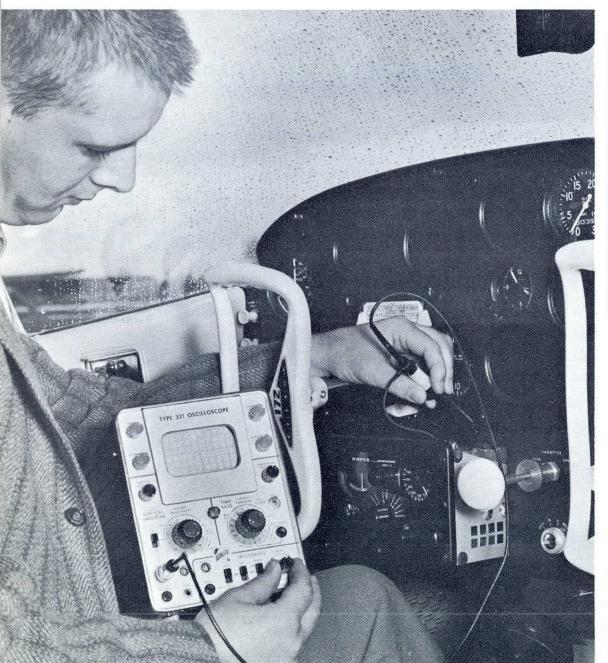
Triggering Facilities—Versatile circuitry provides for complete manual control or fully-automatic triggering.

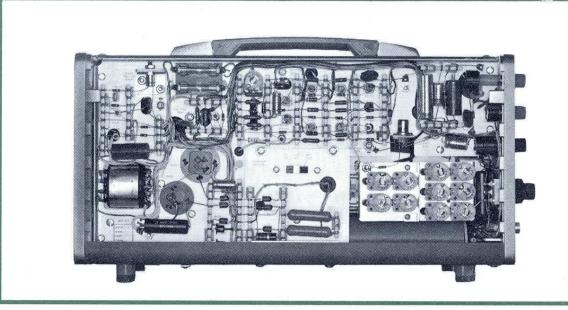
Amplitude-Level Selection—Adjustable amplitude-level and stability controls provide for triggering the sweep at a selected amplitude level on the triggering waveform. Trigger source can be internal or external, ac-coupled or dc-coupled. Trigger point can occur anywhere on the rising slope or falling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

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

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

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







OTHER CHARACTERISTICS

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

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

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

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

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

Power Requirements—Operates from ten size D flashlight cells (approximately ½ hour continuous operation, more on intermittent operation), or from ten size D rechargeable cells (approximately 3 hours continuous operation with standard cells, approximately 4½ continuous operation with extra-capacity cells,

rated at more than 500 complete charge and discharge cycles). Also operates from 11.5 to 35 volts dc, or 105 to 125 volts or 210 to 250 volts, rms single-phase ac. Typical power with 3.5 A.H. Batteries is 20 watts operating, 12 watts charging. For protection, a thermal cutout switch interrupts the power if chassis temperature exceeds 120°F and holds it off until a safe operating temperature is reached.

Battery Charger—The front-panel power switch selects the proper method of recharging the batteries. With the ac power cord connected to the ac line, the batteries can be charged at a trickle-charge rate with the instrument turned on or off; or at a full-charge rate with the instrument turned off.

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

Mechanical Specifications—Dimensions are 8 \(^4\)" high by 5 \(^3\)/" wide by 16 \(^8\)/" deep. Net weight is 13 \(^3\)/4 pounds without batteries, 17 pounds with batteries. Approximate shipping weights are 22 pounds without batteries and 26 pounds with batteries.

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

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

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

Order 10—Part No. 146-005, \$7.00 each
Total \$70.00

CARRYING CASE

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

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

Type 3 6 INDICATOR UNIT



Vertical-Deflection System

Frequency Response—dc to 500 kc.

Sensitivity—

0.05 volts/div to 50 volts/div.

4 calibrated steps.

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

Maximum Input Voltage—

600 volts (dc plus peak ac).

Horizontal-Deflection System

Waveforms Required-

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

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

Frequency Response—dc to 100 kc.

Power Requirements—

DC Power

- +300 volts at 20 ma (unregulated)
- +225 volts at 35 ma (regulated)
- -170 volts at 23 ma (regulated).

AC Power

6.3 volts at 3.5 amps.

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

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

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

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



VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

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

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

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

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

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



HORIZONTAL-DEFLECTION SYSTEM

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

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

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

OTHER CHARACTERISTICS

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

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

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

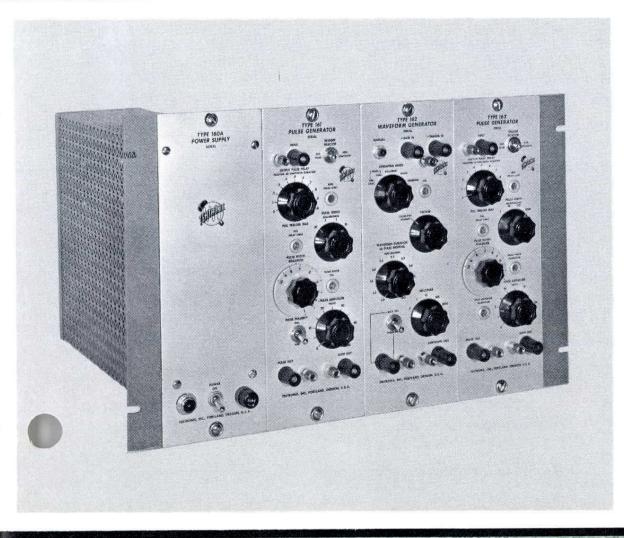
Positioning Controls—Separate knobs for vertical and horizontal positioning are provided on concentric controls.

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

Mechanical Specifications—Dimensions are $12\frac{1}{4}$ " high by $4\frac{1}{8}$ " wide by 14" deep. Net weight is 10 pounds. Shipping weight is 13 pounds, approx.

SEQUENCE CONTROL and MONITORING SYSTEM

struction manual.



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

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

TYPE 160A POWER SUPPLY	\$190
TYPE 161 PULSE GENERATOR	\$130
TYPE 162 WAVEFORM GENERATOR	\$130
TYPE 163 FAST-RISE PULSE GENERATOR	\$130
MOUNTING FRAME (Order Part Number 014-002)	\$7

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

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

Type 5 2 4 100 \mu\/cm DUAL-BEAM OSCILLOSCOPE



2 IDENTICAL VERTICAL AMPLIFIERS

DIFFERENTIAL INPUT AT ALL SENSITIVITIES

X-Y CURVE TRACING WITH 1 OR 2 BEAMS

SINGLE SWEEP OPERATION

BEAM FINDERS

The new Tektronix Type 502A retains the popular dual-beam design of the Type 502, and adds these extremely useful features: $100 \, \mu \text{v/cm}$ sensitivity, single-sweep operation, variable sensitivity and sweep-time controls, intensity balance, beam finders, and other refinements.

TYPE SO2A DUAL-BEAM OSCILLOSCOPE TIME BASE TIME BASE

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED SENSITIVITY—100 μ v/cm to 20 v/cm. PASSBAND—DC-50-kc thru 1 Mc. COMMON-MODE REJECTION—Up to 40,000 to 1. PHASE DIFFERENCE—Less than 5 degrees. INPUT—1 megohm, 47 pf.

HORIZONTAL

CALIBRATED SWEEP RANGE—1 μ sec/cm to 5 sec/cm. SWEEP MAGNIFIER—X2, X5, X10, X20; 3% accuracy to 1 μ sec/cm.

TRIGGER REQUIREMENTS—Internal: 2 mm or greater. External: 0.2 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-kc square wave.

POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 280 watts.

APPLICATIONS

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

- 1. Compare and measure the waveforms at two points in a circuit simultaneously.
- 2. Compare and measure the outputs of two transducers on the same time base.
- 3. Display X-Y curves with one or both beams in a variety of applications.
- 4. Plot one transducer output against another—pressure against volume or temperature for instance.
- 5. Compare and measure stimulus and reaction 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

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 $100 \, \mu \text{v/cm}$ sensitivity, or dual-beam X-Y curves at up to $0.1 \, \text{v/cm}$ sensitivity.

CALIBRATED SENSITIVITY from 100 $\mu v/cm$ to 20 $\mu v/cm$ is in 17 calibrated steps with 1-2-5 sequence, and accurate within 3% of panel reading. Variable controls permit continuous adjustment uncalibrated from 100 $\mu v/cm$ to approximately 50 v/cm.

PASSBANDS are dc to 50 kc at $100~\mu v/cm$, increasing to dc to 100~kc at $200~\mu v/cm$, dc to 200~kc at 1~mv/cm, dc to 400~kc at 50~mv/cm, and dc to 1~Mc at 0.2~v/cm. Passbands at lower sensitivities are dc to 300~kc at 0.5~v/cm and 5~v/cm, dc to 500~kc at 1~v/cm and 10~v/cm, dc to 1~Mc 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 sensitivity and frequency, and are measured using a direct-coupled sinewave. Common-mode signals should not exceed 2 v pk-to-pk at the input grid. With a 1-kc sinewave, rejection ratios are 40,000:1 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 kc with 0.1 mv/cm sensitivity, 1000:1 at 100 kc with 0.2 mv/cm sensitivity, and 50:1 at 400 kc with 0.2 v/cm sensitivity. Measurements are made with a common signal applied to both A and B inputs.

AC or DC COUPLING, or 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 cps direct or 0.2 cps with 10X probe.

INPUT IMPEDANCE is 1 megohm paralleled by 47 pf.

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

HORIZONTAL-DEFLECTION SYSTEM

SWEEP RANGE from 1 μ sec/cm to 5 sec/cm is in 21 calibrated steps with 1-2-5 sequence and is accurate within 3% of panel reading. Sweep speed is continuously variable uncalibrated from 1 μ sec/cm to over 12 sec/cm.

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 μ sec/cm, accuracy is within 3% of the displayed portion of the magnified sweep. A panel light indicates when the maximum calibrated rate is being exceeded, or sweep speed variable is in use.

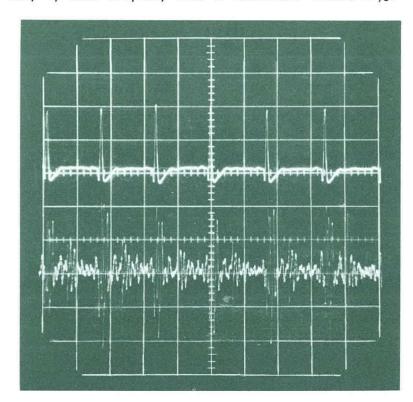
SINGLE SWEEP OPERATION facilitates photographic recording of waveforms. Lockout-reset circuitry provides for one-shot recording. After a single sweep is triggered, the sweep circuit is automatically locked out until manually reset. When reset, the sweep will fire on the next trigger received, then automatically lock out until reset or returned to normal operation.

X-Y OPERATION

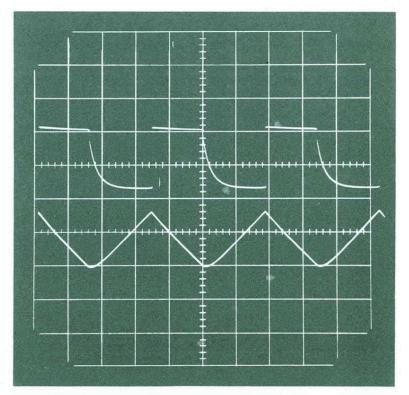
SINGLE BEAM X-Y CURVE TRACING at equal horizontal and vertical sensitivities can be accomplished when the upper-beam vertical amplifier is switched to the crt horizontal-deflection plates. A panel light indicates when the upper-beam amplifier is connected in this manner. The full $100~\mu v/cm$ sensitivity can be used with either single-ended or differential input.

PHASE DIFFERENCE between vertical amplifiers, when both are set at equal sensitivities, is typically less than 5 degrees up to the specified 3-db 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%.



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.

502A

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-cps 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 (0.2 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 from 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 kc.

ELECTRONICALLY-REGULATED DC SUPPLIES insure stable operation between 105 and 125 volts, or 210 and 250 volts. Input stage dc heaters of both vertical amplifiers are transistor regulated.

POWER REQUIREMENT is 105 to 125 volts, or 210 to 250 volts, 50 to 60 cps, typically 280 watts.

OVERALL DIMENSIONS are $15\frac{3}{4}$ " high by $11\frac{1}{2}$ " wide by $23\frac{3}{4}$ " deep. Net weight is $52\frac{1}{2}$ pounds. Shipping weight is 69 pounds, approx.

instruction manuals.

RACK MOUNT ADAPTER

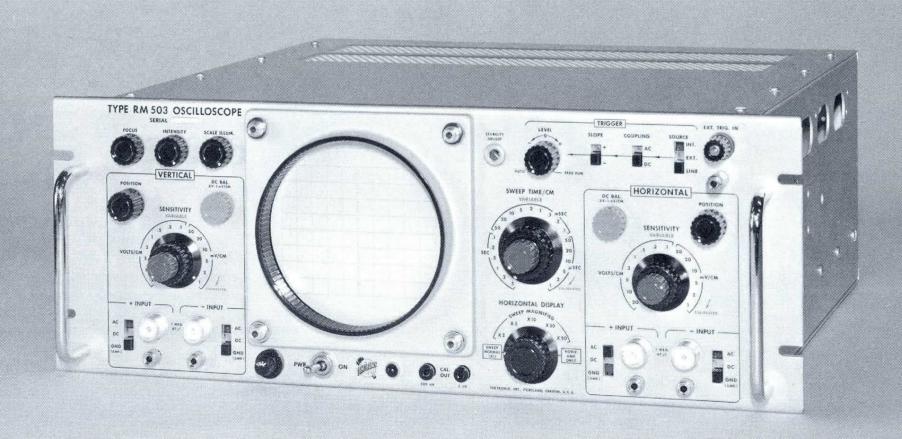
A cradle mount adapts the Type 502A Oscilloscope for rack mounting. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Finish is blue vinyl. Rack height requirement is $17\frac{1}{2}$ ".

Order Part Number 040-278 \$45

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

Easy checking of two waveforms for tone characteristics is possible with this dual-beam oscilloscope. Photograph taken at Rodgers Organ Co., Hillsboro, Oregon, manufacturers of electronic organs.







IDENTICAL VERTICAL & HORIZONTAL AMPLIFIERS DIFFERENTIAL INPUT AT ALL SENSITIVITIES **ELECTRONICALLY-REGULATED DC SUPPLIES** COMPACT CABINET OR RACK-MOUNT MODELS

CHARACTERISTIC SUMMARY

VERTICAL & HORIZONTAL

CALIBRATED SENSITIVITY-1 mv/cm to 20 v/cm. PASSBAND-DC to 450 kc.

COMMON-MODE REJECTION—Up to 100:1.

INPUT—1 megohm, 47 pf.

SWEEP GENERATOR

CALIBRATED SWEEP RANGE—1 µsec/cm to 5 sec/cm. SWEEP MAGNIFIER-X2, X5, X10, X20, X50; 5% accuracy to 0.1 $\mu sec/cm$.

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

CRT

DISPLAY AREA-8 x 10 cm.

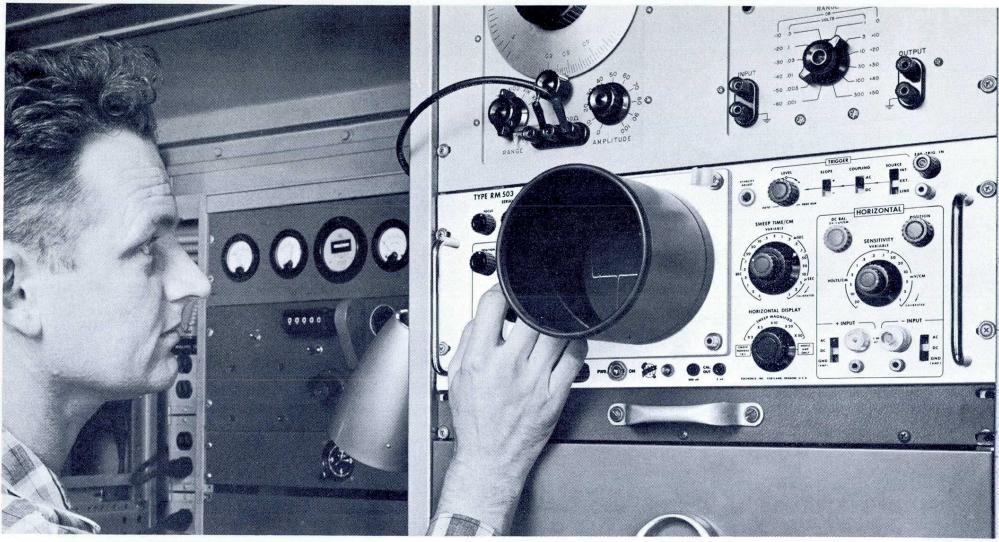
ACCELERATING VOLTAGE—3 kv.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR-5 mv and 0.5 v, 300 to 500cps square wave.

POWER REQUIREMENTS-105 to 125 v or 210 to 250 v, 107 watts.

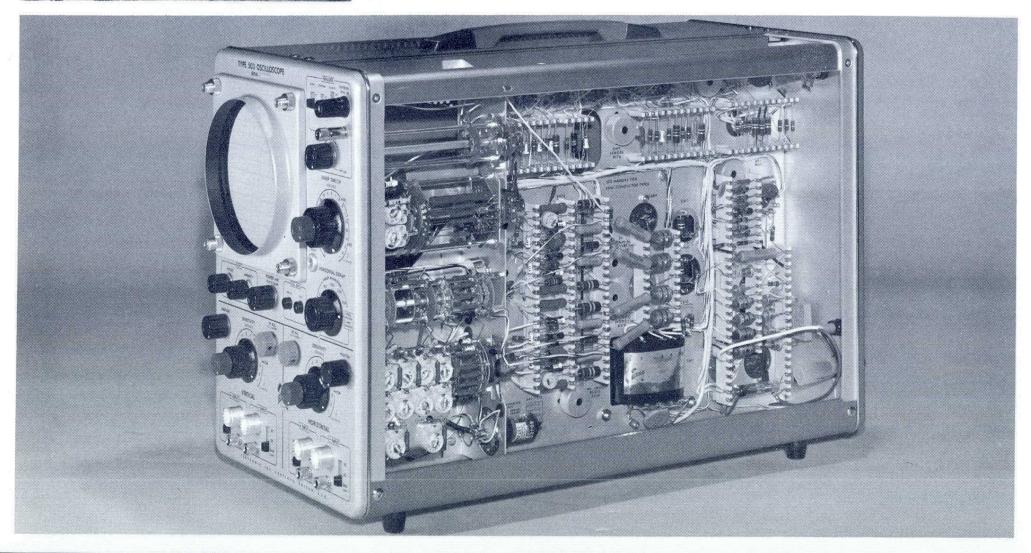
503 RM503





At Shell Development Laboratory, Houston, Texas, a field crew relies upon waveform displays from a Tektronix Type RM503 Oscilloscope to monitor equipment performance accuracy while evaluating underground formations.

Rack-mounted in their truck, the Type RM503 serves to insure accuracy of tool operation while below the surface, since instruments used may be positioned at substantial depths in the bore holes. The operator uses the Type RM503 to display the signals before they are applied to an electronic counter. By observing the quality of these signals appearing on the 5-inch crt—to determine that they are of sufficient amplitude and free of noise and distortion so that the accuracy of the count can be relied upon—the operator thus establishes an effective monitoring system at the surface.



VERTICAL AND HORIZONTAL AMPLIFIERS

PASSBAND of the dc-coupled amplifiers extends to 450 kc at 3-db down.

SENSITIVITY 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.

DIFFERENTIAL INPUT provides an effective means of eliminating unwanted common-mode signals. Common-mode rejection ratio is 100:1 from 1 mv/cm to 0.2 v/cm, and 50:1 from 0.5 v/cm to 20 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 cps direct or 1 cps with optional 10X probe.

INPUT IMPEDANCE is 1 megohm paralleled by about 47 pf, and remains constant with varying sensitivities.

X-Y OPERATION

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

PHASE DIFFERENCE between amplifiers, when both are set at equal sensitivities, does not exceed 1 degree up to 100 kc or 2 degrees up to 450 kc.

SWEEP GENERATOR

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

SWEEP MAGNIFIER expands the center portion of the normal sweep to fill 10 cm. X2, X5, X10, X20, or X50 magnification is available. When the magnified sweep does not exceed the maximum calibrated rate of 0.1 μ sec/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-cps 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 ($\frac{1}{2}$ -cm deflection), external ($\frac{1}{2}$ -volt), 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 cps.

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 cps, typically 107 watts at 117 volts. The low-line voltage requirement increases about 10% at 400 cps, and about 15% at 800 cps.

CABINET MODEL dimensions are $14\frac{3}{4}$ " high by 10" wide by $21\frac{5}{8}$ " deep. Net weight is $29\frac{1}{2}$ 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 48 pounds.

Each instrument includes: 1—set of mounting hardware, 2—binding-post adapters, 1—light filter, 1—3-conductor power cord, 2—instruction manuals.

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 171 installed at the factory.

SLIDE-OUT TRACK KIT (Part No. 351-050) \$45

PROBES

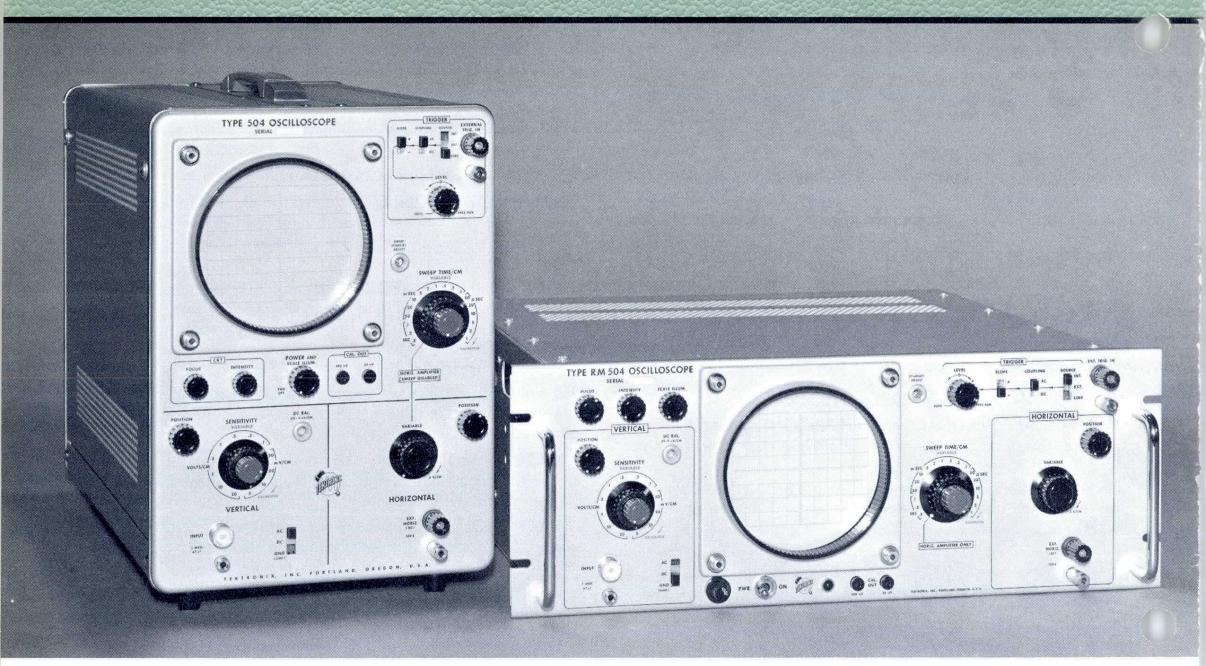
For minimum loading on the circuit under test, RC attenuator probes are recommended. These probes, each with a 42" cable, are ideally suited for use with the Type 503 or RM503 Oscilloscope.

	490	Input Impedance					
Probe	Atten. Ratio	Resist- ance	Capaci- tance	Voltage Rating	Part No.	Price	
P6006	10:1	10 meg Ω	9.5 pf	600 v	010-125	\$22.00	
P6023	10:1	8 meg Ω	12 pf	1000 v	010-065	\$40.00	
P6027	1:1	1 meg Ω	94 pf	600 v	010-070	\$12.50	

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DC-to-450KC OSCILLOSCOPE





CONSTANT INPUT IMPEDANCE

ELECTRONICALLY-REGULATED DC SUPPLIES

COMPACT CABINET OR RACK-MOUNT MODELS

CHARACTERISTIC SUMMARY VERTICAL

CALIBRATED SENSITIVITY—5 mv/cm to 20 v/cm. PASSBAND—DC to 450 kc. INPUT—1 megohm, 47 pf.

HORIZONTAL

CALIBRATED SWEEP RANGE—1 $\mu sec/cm$ to 0.5 sec/cm. TRIGGER REQUIREMENTS—Internal: 0.5-cm deflection. External: 0.5 to 10 v.

EXTERNAL INPUT—0.5 v/cm maximum sensitivity.

CRT

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

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—25 mv and 0.5 v, 300 to 500-cps square wave.

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

VERTICAL-DEFLECTION SYSTEM

PASSBAND of the dc-coupled amplifier extends to 450 kc at 3-db down.

SENSITIVITY from 5 mv/cm to 20 v/cm is in 12 calibrated steps with 1-2-5 sequence, and is accurate within 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 cps direct or 1 cps with optional 10X probe.

INPUT IMPEDANCE is 1 megohm paralleled by about 47 pf, and remains constant with varying sensitivities.

HORIZONTAL-DEFLECTION SYSTEM

SWEEP RANGE from 1 $\mu sec/cm$ to 0.5 sec/cm is in 18 calibrated steps with 1-2-5 sequence, and is accurate within 3%. Sweep speed is variable between steps uncalibrated from 1 $\mu sec/cm$ to over 1.2 sec/cm.

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

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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-cps 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 ($\frac{1}{2}$ -cm deflection), external ($\frac{1}{2}$ -volt), 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 cps.

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 cps, typically 93 watts at 117 volts. The low-line voltage requirement increases about 10% at 400 cps, and about 15% at 800 cps.

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 25½ pounds. Shipping weight is approximately 48 pounds.

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 171 installed at the factory.

SLIDE-OUT TRACK KIT (Part No. 351-050)\$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.

Probe	Atten. Ratio	Input Impedance				
		Resist- ance	Capaci- tance	Voltage Rating	Part No.	Price
P6006	10:1	10 meg Ω	9.5 pf	600 v	010-125	\$22.00
P6027	1:1	1 meg Ω	94 pf	600 v	010-070	\$12.50

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Type SURGE-TESTING OSCILLOSCOPE





SURGE GROUND-CURRENT EFFECTS ON DISPLAY MINIMIZED

BRIGHT SINGLE TRANSIENT DISPLAYS

CHARACTERISTIC SUMMARY VERTICAL

SENSITIVITY—Approximately 50 v/cm to 500 v/cm.

INPUT STEP-ATTENUATOR-10% steps from 10% to 100%.

INPUT—72 ohms (optional down to 50 ohms).

CALIBRATED POSITIONING—At 50 v steps from —150 v to + 150 v.

CREST VOLTAGE INPUT-Up to 3 kv.

HORIZONTAL

CALIBRATED SWEEP RANGE—20 nsec/cm to 50 µsec/

TRIGGER REQUIREMENTS—Internal and external: 100 v to 3 kv.

SINGLE SWEEP CAPABILITY

CRT

DISPLAY AREA—6 x 10 cm. ACCELERATING VOLTAGE—24 kv.

OTHER CHARACTERISTICS

TIME MARKERS—0.05 μ sec to 10 μ sec.

POWER REQUIREMENTS-105 v to 125 v or 210 v to 250 v; 50 to 60 cps; typically 600 watts.

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

VERTICAL-DEFLECTION SYSTEM

Risetime—A passive damping network inserted in the deflection leads to the crt is adjusted for optimum transient response (no overshoot or ringing) of 10 nsec.

Sensitivity—Approximately 50 v/cm to 500 v/cm.

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Step Attenuator—The input signal is connected to a series voltage-divider chain of ten equal resistors (normally 7.2 ohms each) mounted on a tap switch. The ratio of signal applied to the deflection plates can be selected by the tap switch from 10% to 100% in 10% steps. The 72-ohm input impedance presented by the divider chain properly terminates Amphenol Type 21-025 coaxial cable. Step attenuator impedances designed to properly terminate other cable impedances as low as 50 ohms can be provided on request.

The vertical-input system will withstand crest voltages of 3 kv of the standard 1.5 x 40 μ sec surge-testing waveform. Voltage-breakdown and heat-dissipation limitations must be considered before impressing signals greater than 3 kv and/or longer than 40 μ sec.

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

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

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

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

Positioning Switch—The Type 507 has a seven-step vertical-position switch with 50 v steps of -150 v, -100 v, -50 v, 0, +50 v, +100 v, and +150 v. A two-position switch selects either 50 v steps or continuously variable adjustment.

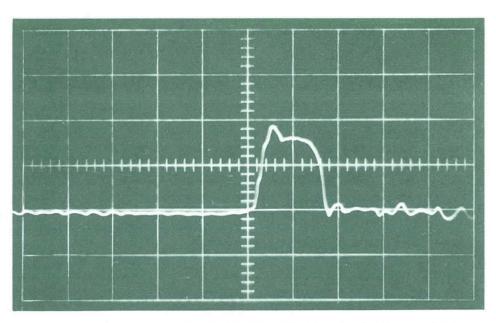
External Voltmeter Connectors—Terminals are provided for a high-impedance ($5000 \,\Omega/\text{volt}$) dc voltmeter, permitting vertical calibration when using the variable positioning.

HORIZONTAL DEFLECTION SYSTEM

Calibrated Linear Sweep Rates—The sweep waveform is generated by a boot-strap circuit and an inverter stage for balanced deflection. Eleven fixed, calibrated sweep rates . . . 20, 50, 100, 200, 500, nanoseconds/cm, 1, 2, 5, 10, 20, and 50 μ sec/cm are provided.

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

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



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

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

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

POWER SUPPLY

Low Voltage—The low-voltage power supply is separate from the indicator unit, supplying power to it by an interconnecting cable. All dc supplies are electronically regulated.

High Voltage—Accelerating potentials for the crt are obtained from an oil-filled oscillator-type supply, all voltages are electronically regulated.

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

OTHER CHARACTERISTICS

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

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

Time Markers—Markers are available as a function of the MICROSECONDS/CM switch for convenient calibration of the sweep. The 0.05- μ sec time mark is available at sweep speeds from $0.02~\mu$ sec/cm to $0.2~\mu$ sec/cm; $0.5~\mu$ sec, from $0.5~\mu$ sec/cm to $2~\mu$ sec/cm; $5~\mu$ sec, from $5~\mu$ sec/cm to $20~\mu$ sec/cm; and $10~\mu$ sec, at $50~\mu$ sec/cm. These are useful as references when photographing pulses.

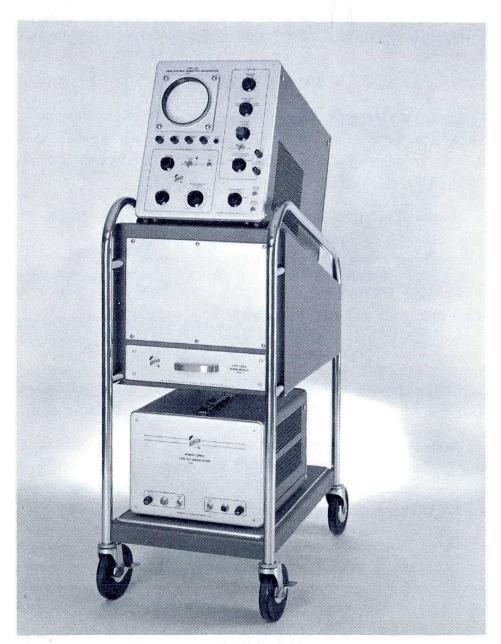
507

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

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

Mechanical Specifications—Dimensions are 16%" high by 13%" wide by 23¾" deep for the indicator unit and 10¾" high by 13½" wide by 17¾" deep for the power-supply unit. Net weight of the indicator unit is 51¼ pounds, and of the power-supply unit is 37½ pounds. In addition, the Scope-Mobile Cart supplied with each Type 507, weighs 35 pounds, net. Total shipping weight is 166 pounds approx. (with indicator unit weighing 71 pounds approx., with power-supply unit weighing 47 pounds approx., and with the Scope-Mobile Cart weighing 48 pounds approx.).

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



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

Tektronix Type C-12 Camera

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

Rack Mount Adapter

A cradle mount to adapt the Type 507 Oscilloscope and its power supply for rack mounting is available. It consists of two cradles and two masks. The cradles, one each for the indicator and power supply units, support the instruments in any standard 19" relay rack. The two masks fit around the regular instrument panels of the two units. Rack height requirements; Indicator mask 17½", Power Supply mask 12¼".

Order Part Number 040-279 \$85

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GROUND CIRCUIT TRANSIENTS

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

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

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

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

To arrange a demonstration of this specialized oscilloscope in your application, please call your Tektronix Field Engineer.



DC-to-15MC OSCILLOSCOPE Type

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED SENSITIVITY—50 mv/cm to 20 v/cm. RISETIME—23 nsec.

PASSBAND-DC to 15 Mc.

INPUT—1 megohm, approx. 36 pf.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.2 μ sec/cm to 2 sec/cm. SWEEP MAGNIFIER—5X, extends sweep range to 40 nsec/cm.

TRIGGER REQUIREMENTS—Internal: 2-mm deflection.

External: 0.5 v to 20 v.

EXTERNAL INPUT-1.4 v/cm, dc to 500 kc.

CRT

DISPLAY AREA—6 x 10 cm.

ACCELERATING VOLTAGE—4 kv.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—50 mv to 100 v, 1-kc square wave.

POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 300 watts.

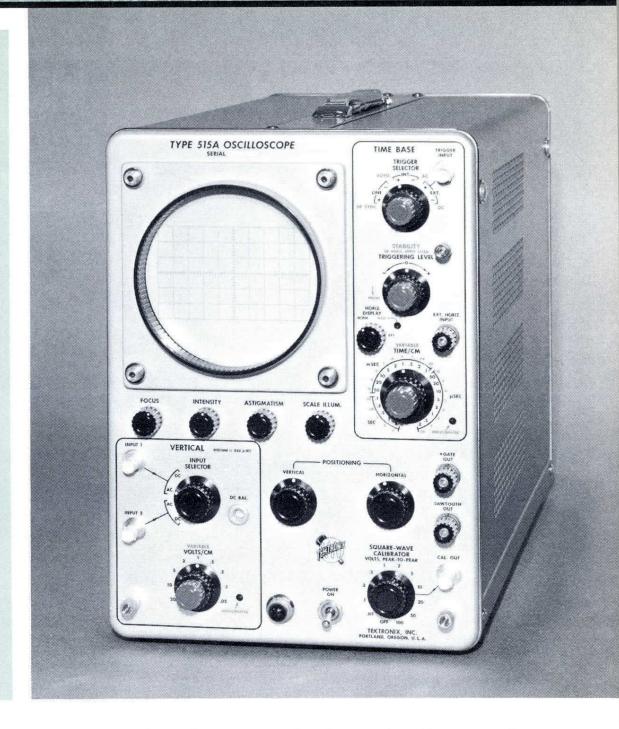
The Tektronix Type 515A is a dc-coupled general-purpose cathode-ray oscilloscope combining reliable Tektronix oscilloscope circuitry in a compact instrument. Wide sweep range of $0.04~\mu sec/cm$ to 6~sec/cm, dc to 15~Mc passband, and calibrated sensitivity to 0.05~v/cm qualify the Type 515A for general-purpose laboratory work and for many field applications.

Accurate calibration of both sweep and vertical amplifiers permit reliable quantitative measurements directly from the screen. Functional panel arrangement and versatile control system makes the Type 515A an easy-to-use oscilloscope for the field and laboratory.

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

DC-Coupled Vertical Amplifier—The Type 515A vertical passband is dc to 15 mc, risetime is 23 nsec. The vertical attenuator is calibrated in VOLTS/CM of deflection. Nine calibrated steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 v/cm. In addition, a vernier (uncalibrated) control provides for continuously-variable adjustment from 0.05 v/cm to 50 v/cm. A front-panel neon light indicates when the control is in the variable (uncalibrated) position.



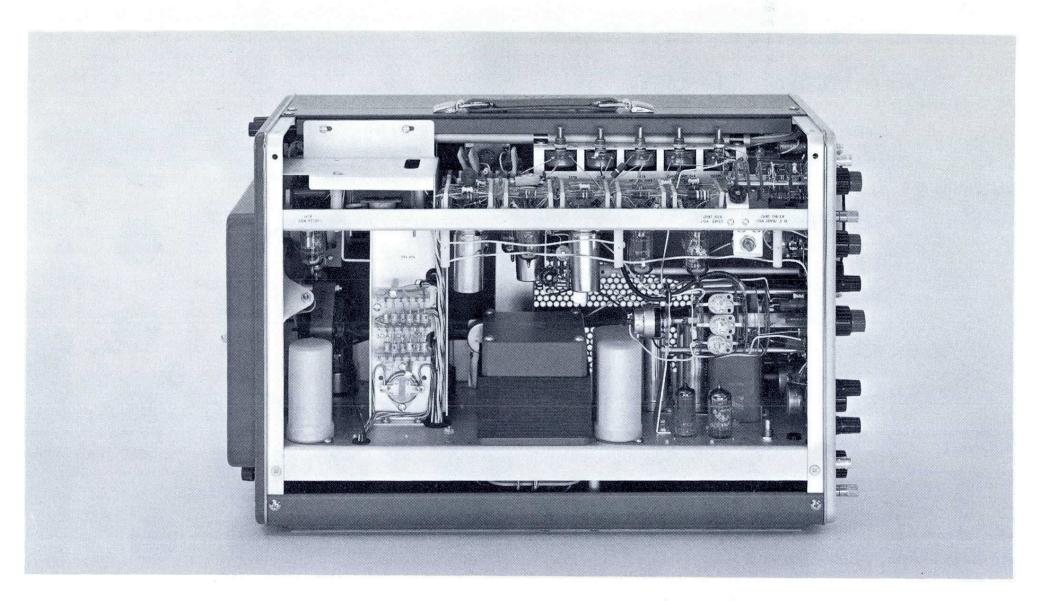
Calibration Accuracy—An internal adjustment is provided for setting the gain of the vertical amplifier. When this adjustment is accurately set with the VOLTS/CM switch in the 0.05 v/cm position, the vertical sensitivity for any other position of the switch will be within 3% of the panel reading for that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

Two Signal Inputs—Two coaxial signal input connectors with more than 60-db isolation are controlled by a four-position switch. The INPUT SELECTOR switch selects ac-coupling or dc-coupling. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

Input Impedance—1 megohm paralleled by approximately 36 pf.

Probe—The vertical sensitivity is reduced by a factor of 10 by use of a 10-x attenuator probe supplied with the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately 9.5 pf.

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



HORIZONTAL-DEFLECTION SYSTEM

Wide Sweep Range—The Type 515A has 22 calibrated sweep rates: 0.2, 0.5, 1, 2, 5, 10, 20, 50 μ sec/cm; 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 millisec/cm; 0.1, 0.2, 0.5, 1, 2 sec/cm. A single 22-position sweep-rate switch is used. In addition, a vernier (uncalibrated) control provides sweep rates continuously adjustable from 0.04 μ sec/cm to 6 sec/cm. A front-panel neon light indicates when the control is in the variable (uncalibrated) position. Calibration accuracy of the fixed sweep rates is within 3%.

Sweep Magnifier—When the 5-x magnifier is switched in, the center two-centimeter portion of the normal sweep is expanded to left and right of center to fill ten centimeters. The HORIZONTAL POSITION control has sufficient range to display any one-fifth of the magnified sweep. Magnifier increases the calibrated sweep rate to $0.04~\mu sec/cm$. TIME/CM of the magnified sweep is indicated by a second blue-colored figure at each position of the sweep-rate switch. Accuracy is within 5% of the displayed portion of the magnified sweep. An indicator light reminds the operator when the magnifier is in use.

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

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

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

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

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

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

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

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

OTHER CHARACTERISTICS

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

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

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

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

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

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

Mechanical Specifications—Dimensions are 14'' high by $9\frac{7}{8}''$ wide by $21\frac{3}{4}''$ deep. Net weight is $42\frac{1}{4}$ pounds. Shipping weight is 52 pounds, approx.

TYPE 515A (50 to 60 cps operation) \$875

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

TYPE 515AMOD101 (50 to 400 cps operation) . . \$935

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

FAN MOTOR KIT

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

Order Part Number 040-140 \$40

RACK MOUNT Type RM15

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

Mechanical Specifications—Dimensions are $8\frac{3}{4}$ " high by 19" wide by $22\frac{3}{4}$ " deep. Net weight is $46\frac{3}{4}$ pounds. Shipping weight is 75 pounds, approx.

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

TYPE RM15 (50 to 60 cps operation) \$950 Each instrument includes: 1—10X attenuator probe, 2—binding-post adapters, 1—light filter, 1—3-conductor power cord, 1—mounting hardware set, 1—pair rails, 2—instruction manuals.

TYPE RM15MOD101 (50 to 400 cps operation) \$1010

Each instrument includes: 1—10X attenuator probe, 2—bindingpost adapters, 1—light filter, 1—3-conductor power cord, 1—
mounting hardware set, 1—pair rails, 2—instruction manuals.



SUPPORTING CRADLES

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

Type 5 DC-to-15MC DUAL-TRACE OSCILLOSCOPE



2 IDENTICAL INPUT CHANNELS CHOPPED OR ALTERNATE SWITCHING

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED SENSITIVITY—50 mv/cm to 20 v/cm. RISETIME—23 nsec. PASSBAND—DC to 15 Mc.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.2 μ sec/cm to 2 sec/cm. SWEEP MAGNIFIER—5X, extends sweep range to 40 nsec/cm.

TRIGGER REQUIREMENTS—Internal: 2-mm deflection. External: 0.5 v to 25 v.

EXTERNAL INPUT-1.4 v/cm, dc to 500 kc.

CRT

DISPLAY AREA—6 x 10 cm.

ACCELERATING VOLTAGE—4 kv.

INPUT-1 megohm, 20 pf.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—50 mv to 100 v, 1-kc square wave.

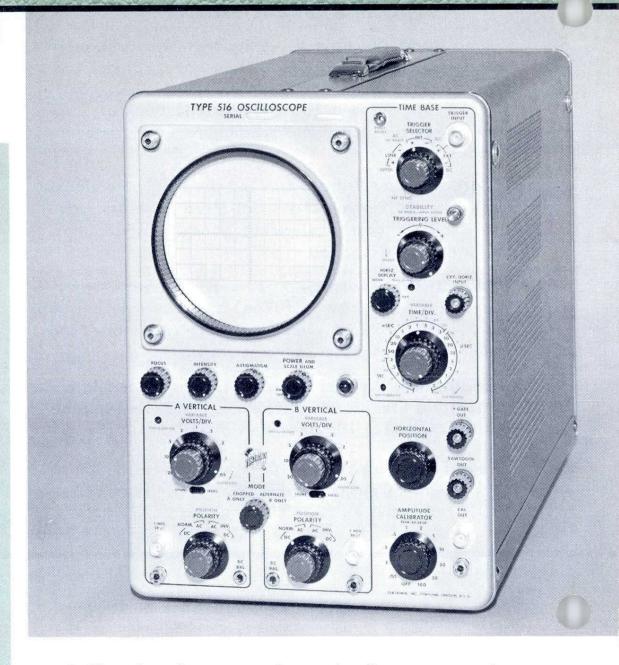
POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 300 watts.

The Type 516 is a dual-trace, semi-portable instrument ideally suited to bench work applications. Vertical calibrated sensitivity 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.

VERTICAL-DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

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



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

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

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

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

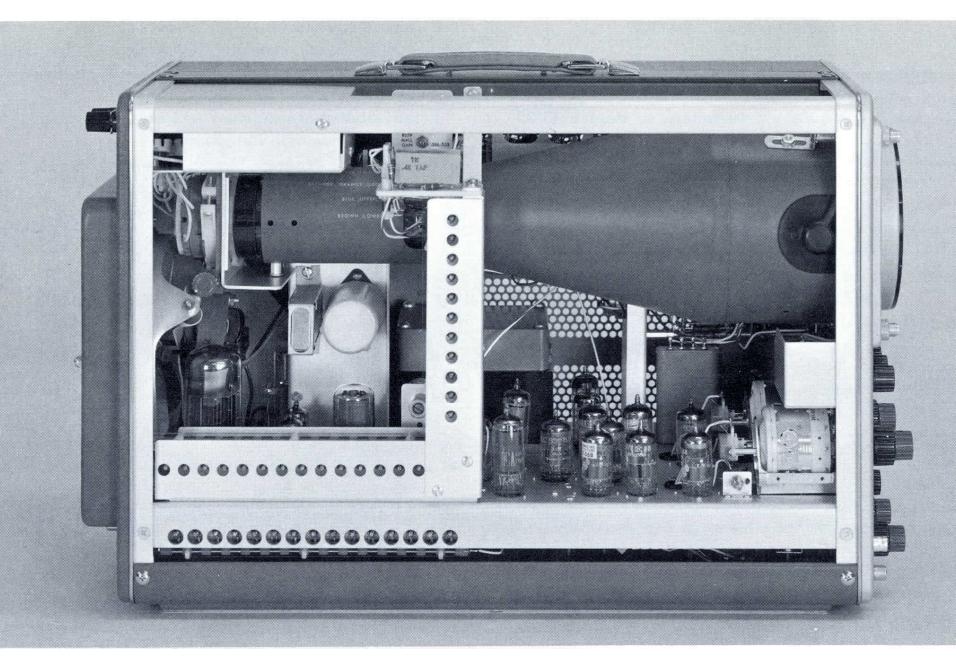
Polarity Control—Each channel has a separate polarity control (for comparison of signals 180 degrees out of phase).

Input Impedance—1 megohm paralleled by 20 pf.

Probes—The vertical sensitivity is reduced by a factor of 10 by use of the 10X attenuator probes supplied with the Type 516. The probes present an input impedance of 10 megohms paralleled by approximately 7 pf.

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





HORIZONTAL-DEFLECTION SYSTEM

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

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

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

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

TRIGGER FACILITIES

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

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

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

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

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

OTHER CHARACTERISTICS

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

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

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

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

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

Warning Indicators for Uncalibrated Settings— Separate front-panel neon lights indicate when the vertical-attenuator and sweep-rate controls are not in their calibrated positions.

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

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

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

Nominal	Line Voltage		Operating Range				
	(Figures	taken	at	60 c	ps)		
	110			99	to	117	volts
	11 <i>7</i>			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.

Mechanical Specifications—Dimensions are 14'' high by 9%'' wide by 21%'' deep. Net weight is 44% pounds. Shipping weight is 54 pounds, approx.

TYPE 516MOD101 (50 to 400 cps operation) .. \$1130 Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—light filter, 1—3-conductor power cord, 2—instruction manuals.

RACK MOUNT ADAPTER

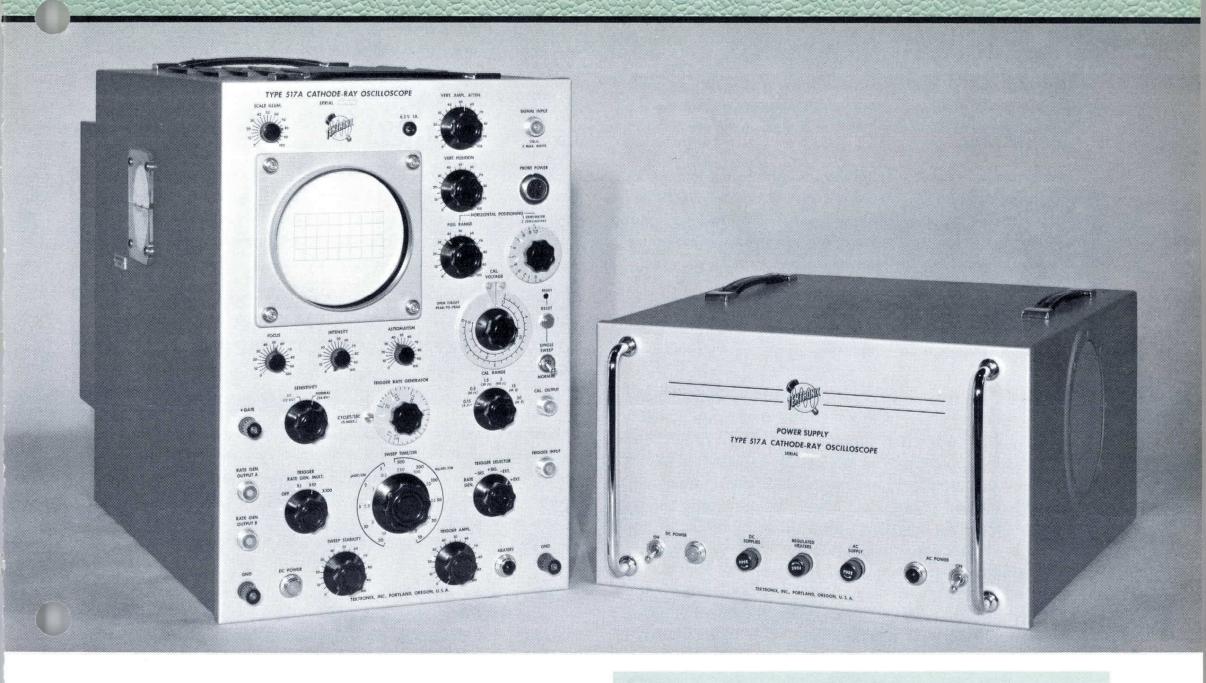
A cradle mount to adapt the Type 516 Oscilloscope for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements 15 3/4".

Order Part Number 040-277 \$45

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



HIGH-SPEED OSCILLOSCOPE Type



UP TO 1100 cm/µsec WRITING RATE

SELECTABLE ACCELERATING VOLTAGE

CALIBRATED HORIZONTAL POSITIONING

SINGLE-SWEEP OPERATION

LESS THAN 2% TIME & AMPLITUDE ERROR

INCLUDED SCOPE-MOBILE® CART

The Tektronix Type 517A Oscilloscope is a wide-band high-voltage instrument for observation and photographic recording of very-fast-rising waveforms having low duty cycle. With its risetime of 7 nsec, 24-kv accelerating potential, and high-speed sweeps, the Type 517A is especially suited to single-sweep applications involving transients of very short duration.

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

CHARACTERISTIC SUMMARY

VERTICAL

CALIBRATED SENSITIVITY—25 mv/cm to 400 v/cm. RISETIME—7 nsec. INPUT—170 Ω .

HORIZONTAL

CALIBRATED SWEEP RANGE—5 nsec/cm to $20\mu sec/cm$. TRIGGER REQUIREMENTS—Internal: 2-mm deflection. External: 0.3 to 15 v. TRIGGER-RATE GENERATOR—15 to 15,000 cps, con-

tinuously variable.

CRT

DISPLAY AREA—4 x 8 cm.

ACCELERATING VOLTAGE—12 or 24 kv, selectable.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.15 to 50 v, approx. 25-kc square wave.

POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 1250 watts.

517A

VERTICAL DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

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

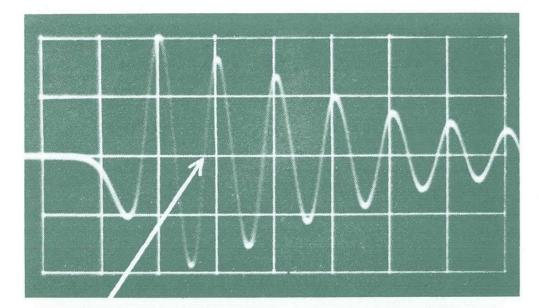
Sensitivity—Basic sensitivity is 50 mv/cm at 24-kv accelerating potential, or 25 mv/cm at 12 kv. A front-panel control selects other normal (24 kv) or X2 sensitivity (12 kv). Vertical amplifier attenuation is continuously adjustable over a 2 to 1 range.

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

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

Sensitivity at 24-KV			17A Potential		Atte	nuation RT
Scope Input	0.05	to	0.1 v/cm	1:1	to	2:1
Probe Body Alone	0.1	to	0.2 v/cm	2:1	to	4:1
Probe with Attenuator I	0.2	to	4 v/cm	4:1	to	80:1
Probe with Attenuator I	1 2	to	40 v/cm	40:1	to	800:1
Probe with Attenuator I	11 20	to	400 v/cm	400:1	to	8000:1

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



Arrow indicates $1100 \text{ cm}/\mu\text{sec}$ writing-rate point on 100-mc damped oscillation, displayed on single 10 nsec/cm sweep of Type 517A Oscilloscope with T517P11 crt. Recorded on 35-mm TRI-X film at f1.9 with 4.2 to 1 reduction, developed 26 minutes in D-19 at $68^{\circ}F$.

Auxiliary Power—A front-panel socket is provided to supply power for a cathode-follower probe or an auxiliary amplifier stage connected close to the circuit under observation. 6.3 v dc at 150 ma and 110 v dc at 9.5 ma are available (in addition to 6.3 v ac at 1 amp at front-panel pin jack).

Signal Delay—Approximately 65 nsec of delay cable is incorporated in the vertical amplifier. This delay, along with an inherent 55 nsec delay in the amplifier, permits the sweep to start before the signal reaches the vertical deflection plates.

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

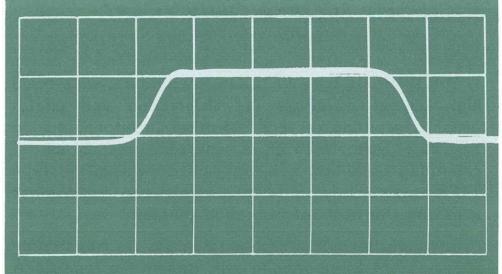
HORIZONTAL DEFLECTION SYSTEM

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

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

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

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



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

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

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

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

POWER SUPPLY

Low Voltage—The low-voltage power supply is separate from the indicator unit, supplying power to it by an inter-connecting cable. All dc supplies are electronically regulated and heaters in the indicator unit are regulated by a saturable-reactor method to insure stable operation over line-voltage and load variations between 105 and 125 v or 210 and 215 v.

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

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

OTHER CHARACTERISTICS

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

Metallized Cathode-Ray Tube—The Type 517A uses a 5" flat-faced metallized precision tube with helical post-accelerating anode. It provides a full 4-cm x 8-cm viewing area when operated at 24-kv accelerating potential. Position of the high-voltage connector permits bringing the tube face flush with the panel. A P11 phosphor is normally furnished.

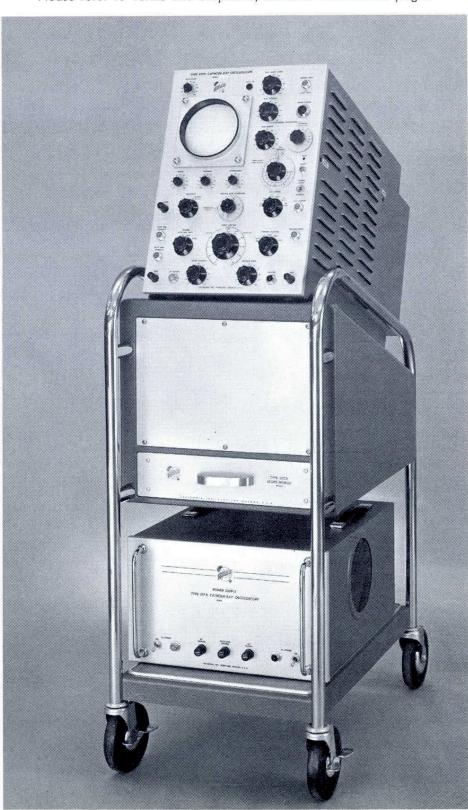
Output Waveforms—In addition to the two triggerrate generator outputs and calibrator output, a +GATE waveform of approximately 30 volts amplitude is available. Its duration is approximately equal to the sweep being generated. Risetime is 30 nsec, from a cathodefollower source impedance of 200 ohms. **Illuminated Graticule**—An edge-lighted graticule is marked in centimeter squares, 4 vertical and 8 horizontal, for convenience in making time and amplitude measurements. Illumination is controlled by a frontpanel knob.

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

TYPE 517A OSCILLOSCOPE \$3500

Each instrument includes: 1—Type 500A Scope-Mobile Cart, 1—Power Supply Unit, 1—P170CF cathode-follower probe, 1—170- Ω step attenuator, 1—170- Ω coaxial cable, 1—viewing hood, 1—bezel, 2—3-conductor power cords, 1—inter-unit cable, 1—light filter, 2—instruction manuals.

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



Type 5 DC-to-1 GIGACYCLE OSCILLOSCOPE



SINGLE-SHOT PHOTOGRAPHS AT 2 NSEC/CM 0.004-INCH SPOT SIZE

SENSITIVE WIDEBAND TRIGGER SYSTEM SYNCHRONIZATION TO OVER 1 GIGACYCLE VSWR 1.25, OR LESS, TO 1 GIGACYCLE DISTRIBUTED-DEFLECTION CRT BUILT-IN DELAY LINE

CHARACTERISTIC SUMMARY

VERTICAL

SENSITIVITY—less than 10 v/cm. RISETIME—less than 0.35 nsec. PASSBAND—DC to 1000 Mc. INPUT—125 Ω $\pm 2\%$.

HORIZONTAL

CALIBRATED SWEEP RANGE—2 to 1000 nsec/cm. SWEEP DELAY—0 to 35 nsec.
TRIGGER REQUIREMENTS—

Internal: 2 trace widths, 1-nsec duration. External: 20 mv, 1-nsec duration. TRIGGER GAIN—X0.2, X1, X5, and X20.

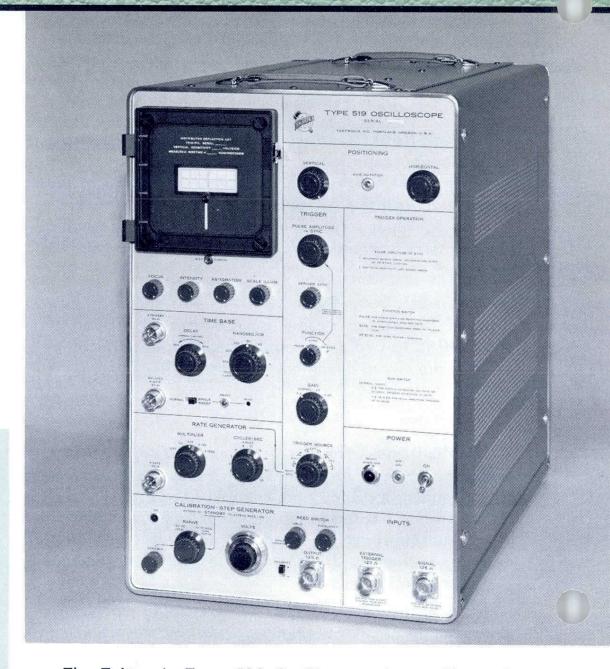
CRT

DISPLAY AREA—2 x 6 cm.
ACCELERATING VOLTAGE—24 kv.

OTHER CHARACTERISTICS

CALIBRATION-STEP GENERATOR—0 to 10 v into 125 Ω or 0 to 1 v into 50 Ω , approx. 0.1-nsec risetime, calibrated and continuously variable. Approximately 750 cps repetition rate.

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

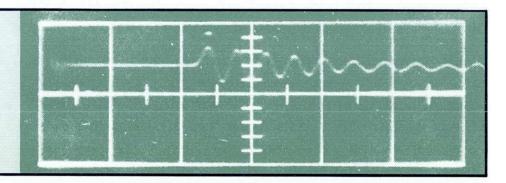


The Tektronix Type 519 Oscilloscope is a calibrated, high-speed, laboratory instrument designed for observation, measurement, and photographic recording of fractional nanosecond risetimes. A 2 x 6 cm viewing area, coupled with 24-kv accelerating potential, affords bright displays with excellent definition.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

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

SINGLE-SHOT PHOTOGRAPHY

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



VERTICAL DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

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

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

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

Input—The dc-coupled signal input has an impedance of $125\,\Omega\,\pm2\,\%$. Maximum signal input is \pm 15 volts dc or rms, or ±100 volts pulse. Maximum power input is 1.8 watts.

TRIGGERING FACILITIES

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

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

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

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

HORIZONTAL DEFLECTION SYSTEM

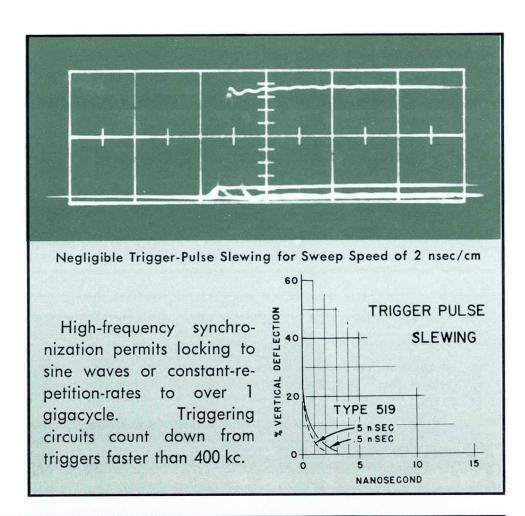
Calibrated Sweep—Nine calibrated rates: 2, 5, 10, 20, 50, 100, 200, 500, and 1000 nsec/cm are provided by a linear, push-pull, time-base generator. Accuracy is typically within 3% for the 2 nsec/cm position and within 2% for slower rates. For the fastest time-base range, only $2.5~\mu sec$ elapses between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

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

Single Sweep—Permits single-sweep presentation to be obtained. After a single sweep is triggered, the sweep circuit is locked out until the RESET button is pressed; sweep will then fire on the next trigger received. An external jack and included plug provide for remote control of single-sweep operation.

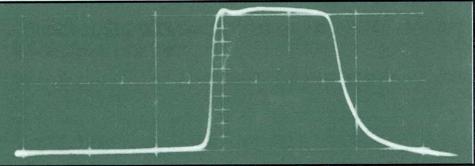
Synchroscope Operation—The output signal from either the +TRIGGER $50~\Omega$, the DELAYED +GATE, or the +RATE $50~\Omega$ connector can be used to initiate the input waveform.

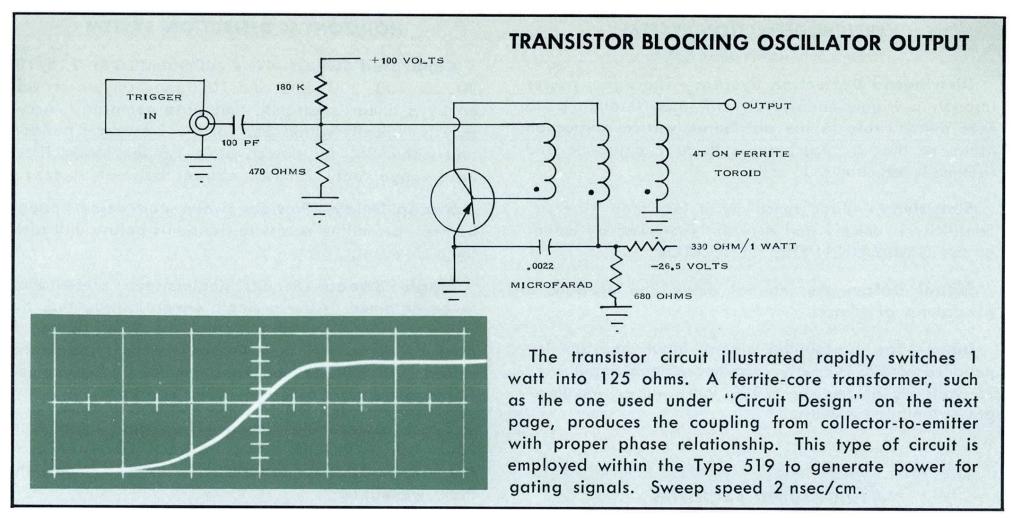
Rate Generator—Output pulse is approximately +15 volts, with risetime of less than 0.8 nsec and duration of 10 nsec. Repetition rate is variable between 3 cps and 30 kc. The output impedance is $50~\Omega$.

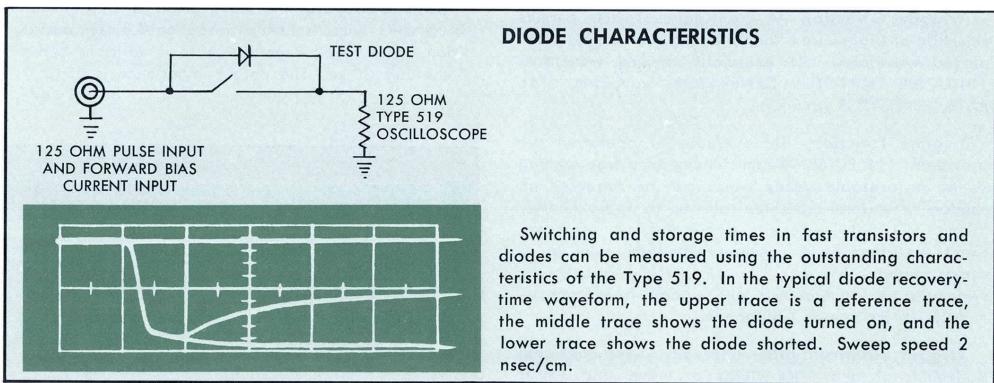


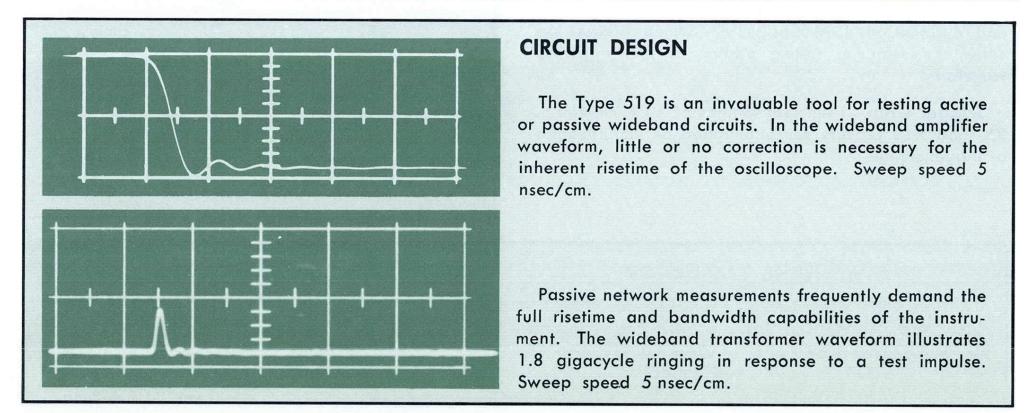
AVALANCHE TRANSISTOR

A Type 2N636 transistor in avalanche generates the pulse shown at the right. This pulse is available from the + RATE 50 Ω connector of the RATE GENERATOR on the Type 519. Sweep speed 5 nsec/cm.





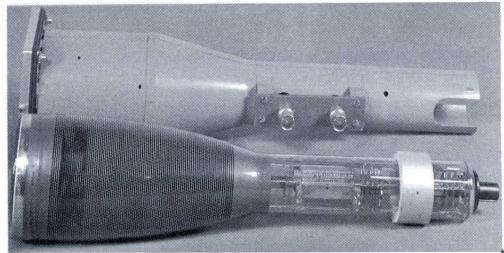




Calibration-Step Generator—A step-waveform of approximately 750 cps, continuously variable and calibrated from 0 to 10 volts into 125 ohms, or 0 to 1 volt into 50 ohms through a T50/T125 adapter, is available at a front-panel 125 ohm connector. Risetime is approximately 0.1 nsec and either positive or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

OTHER CHARACTERISTICS

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



Distributed-Deflection CRT and Close Fitting Magnetic Shield

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

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

Camera Mounting—A special camera-mounting bezel with swing-away hinging easily accepts a Tektronix Type C-12, C-13, or C-19 Trace-Recording Camera. The C-19 is designed for recording high-speed pulses, where maximum light transmission from crt to film is essential. Several lens, viewing system, 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 cycles.

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

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

TYPE 519 OSCILLOSCOPE \$3900

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

DC-to-3 GIGACYCLE OSCILLOSCOPE

This modified Type 519 Oscilloscope incorporates a coaxial-deflection crt to achieve a risetime of 0.13 nsec, corresponding to a 3000-Mc bandwidth. Deflection factor is approximately 180 v/cm. Usable viewing area is 2 x 4 cm. Consult your Field Engineer to learn about the advantages, limitations, and delivery time of this or other modified instruments.

OPTIONAL ACCESSORIES

	Accessory	Part No.	Price
125 -Ω	2:1 attenuator	017-048	\$30.00
125- Ω	5:1 attenuator	017-049	\$30.00
125- Ω	10:1 attenuator	017-050	\$30.00
125- Ω	N50/T125 adapter	017-054	\$17.50
125- Ω	90° elbow assembly	017-043	\$15.00
125- Ω	20-nsec cable	017-511	\$24.00

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



Type 524A TELEVISION OSCILLOSCOPE



Frequency Response

Normal—dc to 10 mc from 0.15 v/cm to 50 v/cm. 2 cycles to 10 mc from 15 mv/cm to 50 v/cm

Flat—within 1% from 60 cycles to 5 mc.

IRE—meets IRE standards for level measurements.

Transient Response—35 nsec risetime.

Sweep Range

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

Time Markers

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

Sweep Delay

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

DC-Coupled Unblanking

Variable Duty-Cycle Amplitude Calibrator

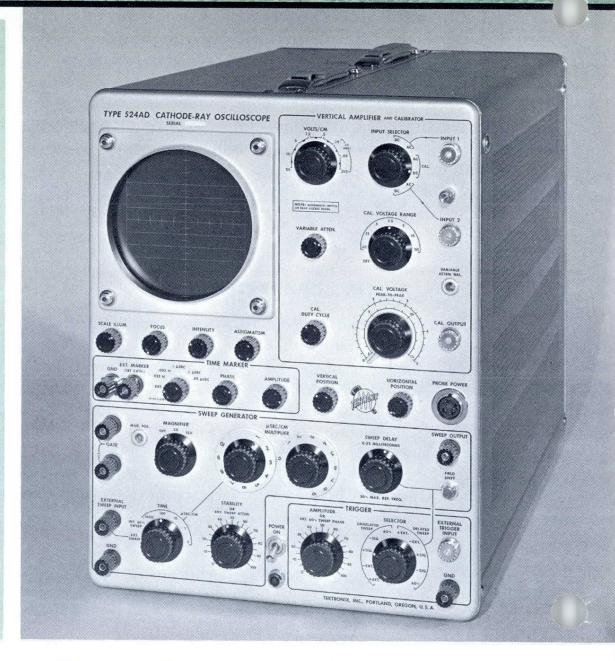
The Tektronix Type 524AD Oscilloscope is a self-contained instrument with the characteristics desirable for maintenance and adjustment of television transmitter and studio equipment. The Type 524AD will prove itself invaluable in enabling the engineer to observe any portion of the television picture — from complete frames to small portions of individual lines.

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

VERTICAL DEFLECTION SYSTEM

Frequency Specifications are at 3-db down

amplifier has a passband of dc to 10 mc for deflection factors from 0.15 v/cm to 50 v/cm. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X probe. An ac-coupled preamplifier switched in by the VOLTS/CM control provides additional deflection factors from 0.015 v/cm to 0.15 v/cm. A variable attenuator control fills in between steps and provides continuously variable adjustment from 0.015 v/cm to 50 v/cm. The vertical amplifier is factory adjusted for optimum transient response. Risetime is less than 35 nsec and the input impedance is 1 megohm paralleled by approximately 45 pf.



Frequency Response—A switch on the access panel selects the desired bandwidth of the vertical amplifier. The NORMal position provides a passband of dc to 10 mc. The FLAT position provides a vertical-amplifier response flat within 1% from 60 cycles to 5 mc. About 5% overshoot will occur on extremely sharp waveforms when the switch is in the FLAT position; however, TV signals within the 5 mc passband are not affected. Response of the amplifier meets the IRE standards for level measurements when the access-panel switch is in the IRE position. EXTernal position provides ac-coupled external connections to the vertical-deflection plates, bypassing the main vertical amplifier but retaining the function of the vertical-position control.

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

Probe—The vertical sensitivity is reduced by a factor of 10 by use of a 10x attenuator probe supplied with the instrument. The probe presents an input impedance of 10 megohms paralleled by approximately 9.5 pf.

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

WAND DO

HORIZONTAL DEFLECTION SYSTEM

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

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

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

Sweep Magnifier—Sweep magnification is obtained by increasing the drive to the sweep-output amplifier by a factor of either 3 or 10. The center portion of the normal sweep is expanded equally to left and right of center. Accuracy is within 7%.

Trigger Selector—Both normal and delayed sweeps can be triggered by an external signal of either polarity,

or internally by either the positive or negative portion of the signal under observation, or by the power-line frequency.

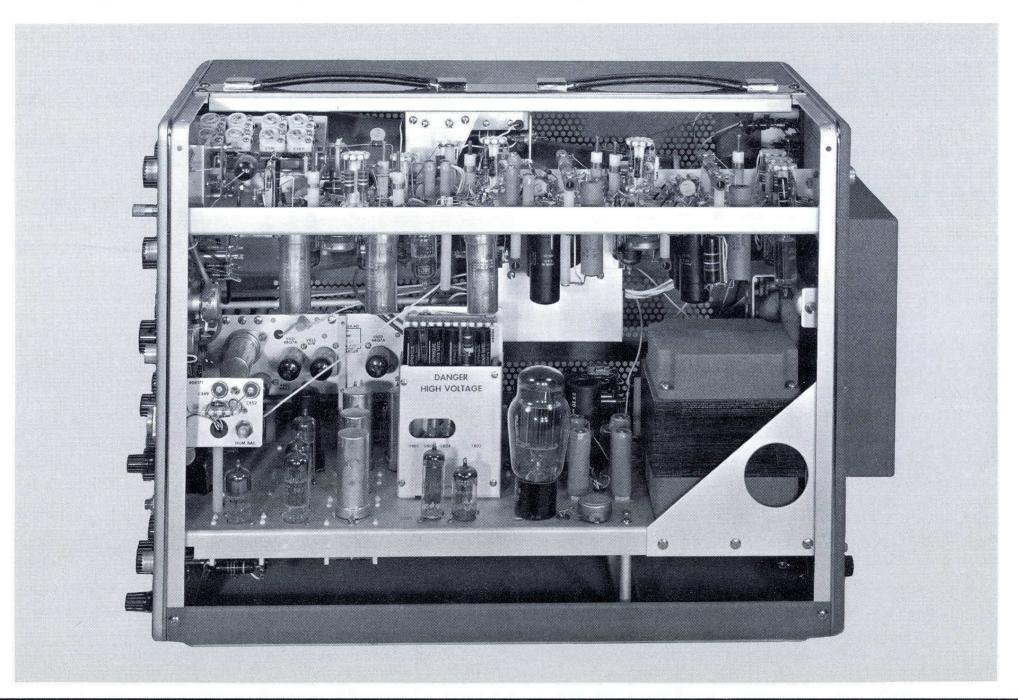
Trigger Requirements—Internal triggering—a signal large enough to produce a one-half centimeter deflection. External—a signal of 0.5 v to 50 v. Composite waveform—a signal large enough to produce a 1.5-centimeter deflection.

OTHER CHARACTERISTICS

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

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

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



524AD

Output Waveforms—Positive and negative-gate waveforms of the same time duration as the sweep, and the sweep sawtooth waveform are available at front-panel connectors.

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

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

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

Illuminated Graticule—An edge-lighted graticule is marked in centimeters. Viewing area is 6 x 10 cm. Illumination is controlled by a front-panel knob. A graticule marked for modulation measurements is also supplied with the instrument.

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

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

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

Mechanical Specifications—Dimensions are 16 3/4" high by 13" wide by 25" deep. Net weight is 61 pounds. Shipping weight is 82 pounds, approx.

TYPE 524AD OSCILLOSCOPE \$1300

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

RACK MOUNT ADAPTER

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

Order Part Number 040-281 \$45

SCOPE-MOBILE® CARTS

See Catalog accessory pages for complete information.

CATHODE-FOLLOWER PROBE

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

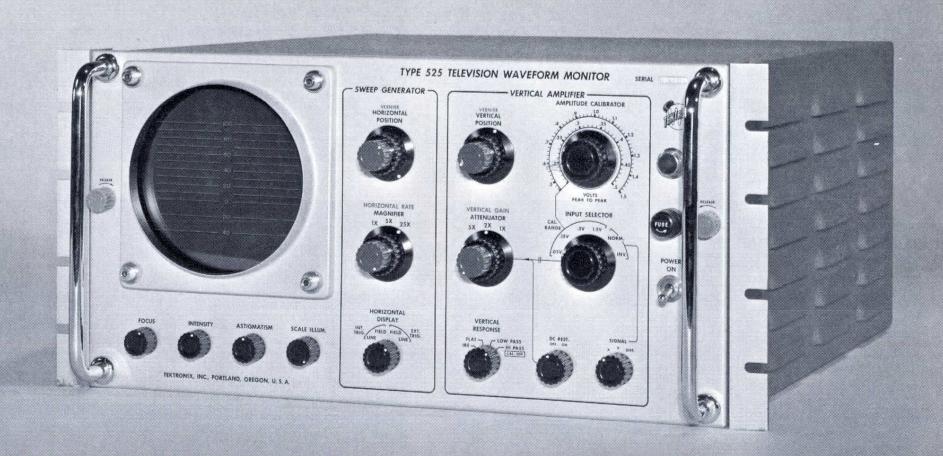
Order Part Number 010-109 \$85

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.



TELEVISION WAVEFORM MONITOR Type



Frequency Response

FLAT—within 1% between 60 cycles and 5 mc. LOW PASS—passes stair steps, eliminating high frequencies.

HIGH PASS—passes high frequencies, eliminating stair steps.

IRE—meets new 1958 Standard 23S-1.

Excellent Linearity

Insures accurate color signal linearity measurements.

Automatically-Synchronized Sweeps

Both field and line rates.

Keyed Clamp-Type DC Restorer

Gain Stability Within 1%

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

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

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

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

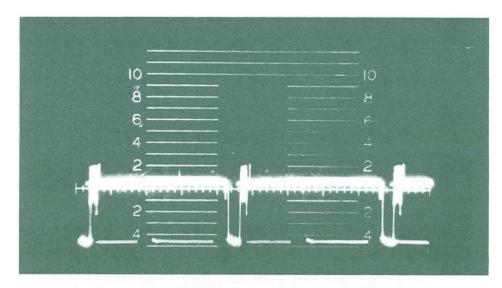


Fig. 1—Horizontal-sync pulse with color burst—Flat vertical response.

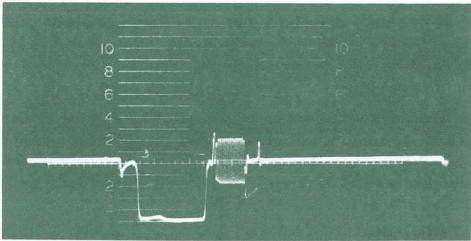


Fig. 2—Same as Fig. 1 with sweep magnified 5 times.

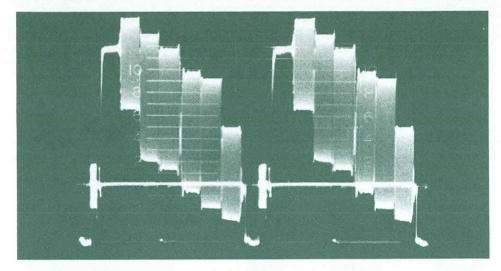


Fig. 3—Color-bar waveform with FLAT vertical response.

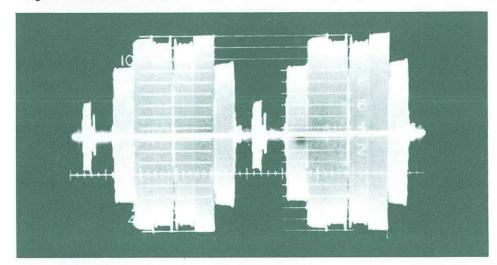


Fig. 5-Fig. 3 waveform with HIGH-PASS response.

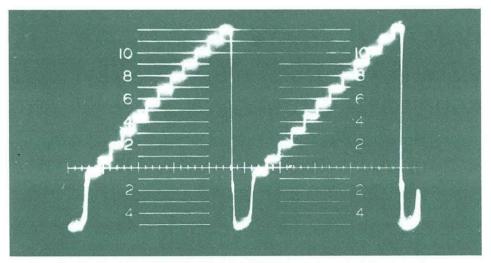


Fig. 7—Same waveform as Fig. 6 with LOW-PASS response.

VERTICAL DEFLECTION SYSTEM

Frequency Response—A response selector switch selects any one of four characteristics: IRE, meets new 1958 Standard 23S-1; FLAT, within 1%, between 60 cycles and 5 mc; LOW PASS, passes the stair steps but eliminates the high frequencies, HIGH PASS, with increase in gain adjustable to 5x, excludes the stair steps but passes the high frequencies for linearity tests.

Sensitivity—The basic deflection factor of the vertical amplifier is 0.015 v/cm. A three-step attenuator, 1x, 2x, 5x, and variable gain control can adjust the waveform to fill the graticule.

Stability—Electronic regulation of all dc power, and use of current stabilization in the amplifier, maintains stability and constant gain. Minimum adjustment of the monitor is required after it is once set. Gain stability is within 1% over a ten-hour period.

Linearity—The vertical amplifier linearity is well above the requirements for highly accurate color-tele-

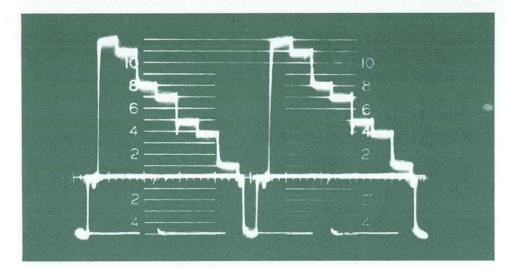


Fig. 4—Same waveform as Fig. 3 with LOW-PASS response.

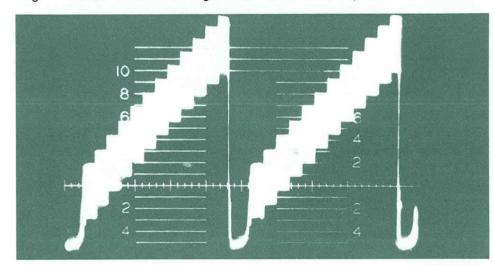


Fig. 6—Staircase with 3.58 mc added—FLAT vertical response.

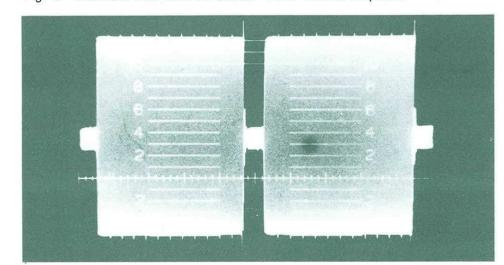


Fig. 8—Fig. 6 waveform with HIGH-PASS response.

vision video signal linearity measurements. Signals can be expanded to the equivalent of 35 cm, with any 7 cm accurately displayed on the screen.

DC Restorer—A clamp circuit, keyed by a pulse derived from the sync-separator circuit, restores the dc level of the display to the tip of the sync pulse at each line-frequency pulse. The restorer can be switched in or out as desired.

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

HORIZONTAL DEFLECTION SYSTEM

Sync Separator—A sync-separator circuit receives the composite video signal either internally from a point on the vertical amplifier, or through an external-trigger connector located at the rear of the instrument. External triggering requires a signal of at least 0.5-v amplitude.

Field and Line Speeds—The sweep will synchronize automatically with either line or field pulses. Sweep frequencies correspond to 7875 cycles for line and 30 cycles for field frequencies. A front-panel switch selects one or the other sweep frequency.

Horizontal Rate, Magnifier—The variable HORI-ZONTAL RATE control adjusts the sweep-time rate so 2, 3, or 4 lines or fields can be displayed at one time. A three-position switch selects accurate magnification of the sweep by 1x, 5x, or 25x. Magnification expands the portion of the sweep that is centered, equally to right and left of screen center.

OTHER CHARACTERISTICS

Amplitude Calibrator—The calibrator provides pulses with a duty cycle of about 75%, and with amplitudes between .015 volts and 1.5 volts, peak-to-peak, continuously adjustable in four ranges, 0.05, 0.15, 0.5, and 1.5 volts. Accuracy is within 2% of full scale on all ranges. The continuously-adjustable interpolating control is linear within 1%.

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

Illuminated Graticule—An edge-illuminated graticule is marked in percentage, to +100 and -40. Each centimeter division equals 20%. Illumination is controlled by a front-panel knob.

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

Accessibility—The Type 525 cabinet is designed for standard rack mounting. Chassis is attached to the cabinet with a slide-out mounting that permits it to be tilted vertically, providing easy access to all components.

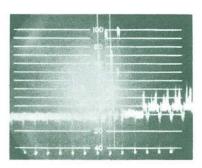
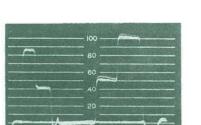


Fig. 9—Two-line test signal displayed at field sweep rate with 25-times sweep with intensifier turned on. Sweep duramagnification. Vertical amplifier is set tion 60 μ sec at line rate, vertical ampliat FLAT response. (flat from 60 cycles fier set at FLAT response. to 5 mc).



20

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

Internal Adjustments — Internal-adjustment controls, which may require readjustment occasionally, are mounted on the left of the chassis near the front, easily accessible to the operator by sliding the monitor partly out of the case.

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

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

Mechanical Specifications—Dimensions are $8\frac{3}{4}$ " high by 19" wide by 21" deep. Net weight is $54\frac{3}{4}$ pounds. Shipping weight is 75 pounds, approx.

Each instrument includes: 1—3-conductor power cord, 2—terminating resistors, 1—green filter, 1—set mounting hardware, 2—instruction manuals.

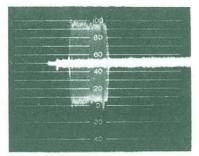
Type 525 With Intensifier

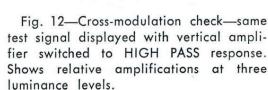
This model is equipped with intensifier for vertical-blanking-interval test signal. Additional circuitry provides for displaying the two or three lines of the vertical blanking interval that are used to carry transmission test signals. The cathode-ray tube is unblanked only during the test-signal period.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

TYPE 525MOD111 OSCILLOSCOPE \$1215

Each instrument includes: 1—3-conductor power cord, 2—terminating resistors, 1—green filter, 1—set mounting hardware, 2—instruction manuals.

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





Type COLOR-TELEVISION VECTORSCOPE





Phase Resolution—0.1° at 5.38 Mc using null technique.

Phase and Saturation Measurements— $\pm 1^{\circ}$ and $\pm 2\%$ on graticule; better when comparing two signals.

Vertical Interval Testing—Interfield signal key permits easy display of test signals during vertical blanking time.

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

Burst Brightening—Positive identification of burst 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 N.T.S.C. color signal. Electronically-switched dual signal channels facilitate matching equipment such as encoders, cameras, etc.

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

PHASE MEASUREMENT

Phase measurements are made by demodulating the chroma signal with a subcarrier signal which can be shifted in phase relative to burst phase in the signal. High accuracy is obtained with the 20-turn precision calibrated phase shifter. This control is a two-speed illuminated dial with direct readout in degrees and tenths of degrees. It has a range of 0° to 200°, and the 180° point can be verified within the instrument. Random phase shifts in the subcarrier signal due to cable length can be cancelled out with a push-button operated phase-shift network covering 0° to 330° in twelve steps. A fine-phase control (±20°) provides for variable adjustment between steps, and fine phase adjustment when using the burst-controlled oscillator.

VECTOR PRESENTATION

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

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 $\pm 1.5^{\circ}$ can be made using the vector display. Accuracy of saturation measurements will be within $\pm 2\%$ on graticule, closer when comparing two signals.

LINEAR-SWEEP PRESENTATION

Phase measurements are simplified by displaying the demodulated chroma signals vertically on a linear horizontal sweep, which is terminated by the horizontal sync pulse and restarts just prior to the burst packet. Using the null technique, differential phase can be measured with an accuracy of $\pm 1^{\circ}$. Resolution is 0.1° at 3.58 mc, or 75 psec. A signal magnifier can be used to expand the vertical deflection approximately 7 times.

DUAL DISPLAYS

Two input channels, each with its own gain control, are electronically switched at about a 500-cycle rate permitting the simultaneous display of two different signals for direct comparison. 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 directly compared for matching purposes.

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 μ sec of the linear sweep. During the 3- μ sec interval the crt trace is brightened for positive identification of the burst packet. Trace brightening during the burst-sampling interval also facilitates adjustment of burst-amplifier gating.

INTERFIELD-SIGNAL KEY

When the INTERFIELD SIGNAL KEY Switch is in the ON position, the cathode-ray tube is gated on only during the 3 or 4 lines occupied by the interfield signal. Video clutter is thus eliminated from the display.

OTHER CHARACTERISTICS

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 volts peak-to-peak minimum.

Vertical Signal Output—The demodulated vertical signal is available at a binding post, dc-coupled, for feeding remote indicators.

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

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

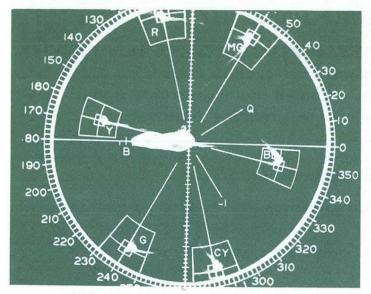


Fig. 1—Vector display of encoder output with 75% saturated color-bar test signal. Test-circle align- of Vectorscope inputs presents signals from two ment with each other and with scribed graticule encoders for direct comparison measurements. circle verifies accuracy of Vectorscope.

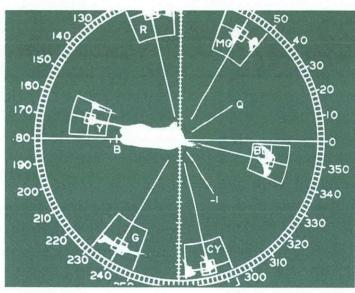


Fig. 2—Dual vector display. Electronic switching

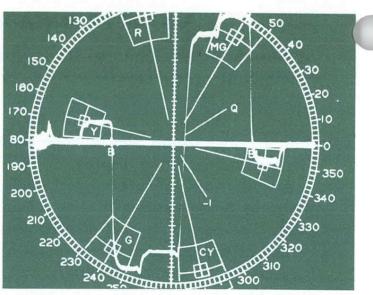


Fig. 3—Demodulated color-bar signal displayed on linear sweep. Burst packet at left end of trace is nulled out, indicating correct phasing of burst at 180°. The signal channel not in use provides a reference trace on the screen at zero signal level.

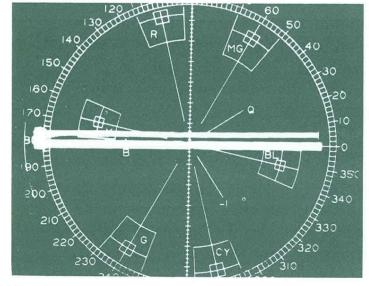
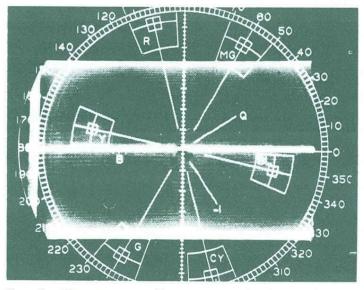


Fig. 4—Line-sweep display of Bell Kelly Set test signal fed directly into Vectorscope, with gain control at maximum and magnifier on. Lower line is reference, upper line is the phase-demodulated 3.58-mc information contained in signal. Lack of differential-phase distortion is evidenced by straight line.



Kelly Set signal with asynchronous demodulation (burst-controlled oscillator free running). Gain control is set at approximately half of maximum and magnifier is turned off. Lack of differentialamplitude distortion is evidenced by lack of variation in amplitude.

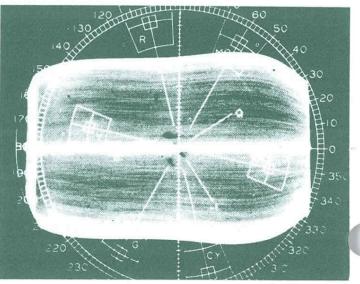


Fig. 5—Vectorscope line-sweep display of Bell Fig. 6—Same conditions as Fig. 5 except signal has passed through an amplifier. Differentialamplitude distortion contributed by the amplifier is measured at 30% by using maximum amplitude as reference.

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. Good broadcast and NTSC limits are indicated. Graticule illumination is controlled by a front-panel knob.

Regulated Power Supplies—The self-contained low-voltage and crt-high-voltage power supplies are electronically regulated against changes in load and line-voltage fluctuations between 105 and 125 volts or 210 and 250 volts.

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

Accessibility—The Type 526 is designed for standard rack mounting. Chassis attaches to rack with slideout mounting that permits it to be tilted vertically, providing easy access to all components.

Mechanical Specifications—Dimensions are 8 3/4" high by 19" wide by 18" rack depth. Net weight is 45 1/4 pounds. Shipping weight is 74 pounds, approx.

TYPE 526 OSCILLOSCOPE \$1665

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

SUPPORTING CRADLES

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

SPECIAL MODEL

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

TYPE 526 MOD 158B OSCILLOSCOPE \$1750

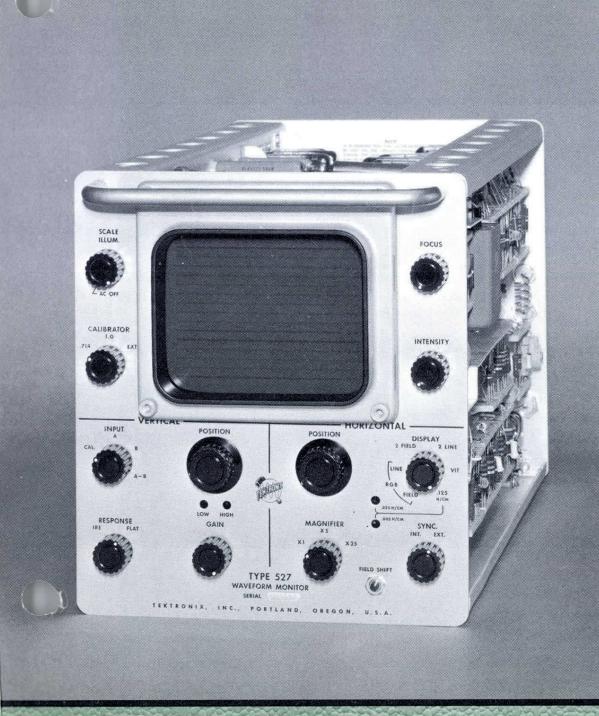
Each instrument includes: 3—75-ohm termination, 1—3-conductor power cord, 1—pair guide rails, 1—light filter, 2—instruction

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



TELEVISION WAVEFORM MONITOR Type





Frequency Response

Flat—within ± 1 % between 60 cycles and 5 mc.

IRE—new 1958 Standard #23S-1

Calibrated Sweeps

Eliminates need for time-markers.

Backporch DC Restoration

Internal Voltage Calibrator

0.714 v or 1.00 v peak-to-peak.

Space-saving Size

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

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

A unique space-saving feature of the Type 527 is that two Type 527's, or two RM527's, or one Type 527 and one 8" commercial monitor, mount in a rack-space only $10\frac{1}{2}$ " high.

$\frac{527}{\mathsf{RM}\,527}$

VERTICAL-DEFLECTION SYSTEM

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

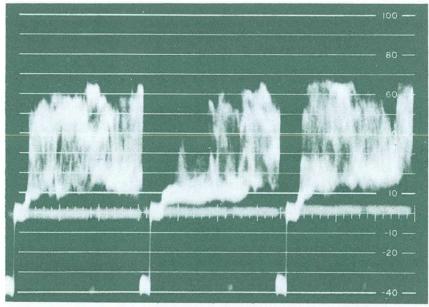
Sensitivity—Variable from 0.25 volt, minimum, to 1.6 volts, maximum, for 140 IRE units (7 centimeters of vertical deflection).

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

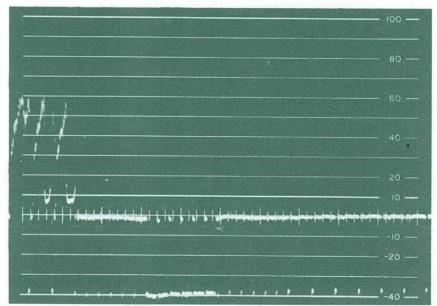
Linearity—Small-signal amplitude linearity of the vertical deflection system is within $\pm 1\%$.

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

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



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



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

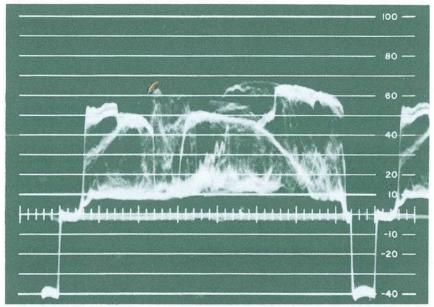
Two bridged 75- Ω compensated signal inputs are provided. Input impedance is never less than 1 megohm. Differential (balanced) input can be used and floating-input operation is possible.

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

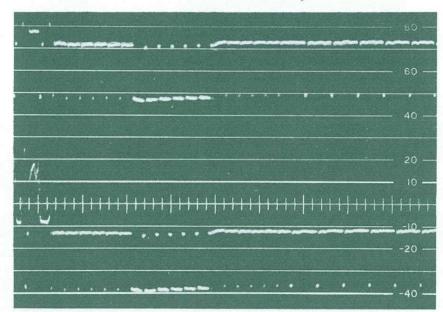
HORIZONTAL-DEFLECTION SYSTEM

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

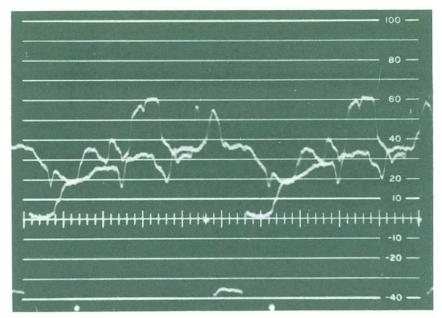
Neon lamps indicate the selected sweep rates when magnifier is used.



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



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



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

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

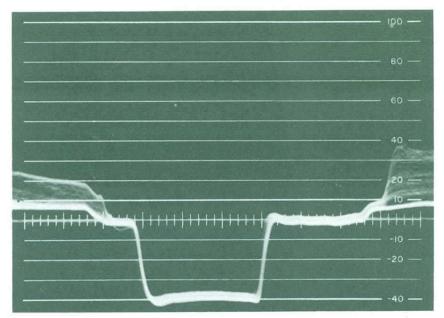
- 2 LINE—Displays approximately 1 ½ lines at ½ the line rate.
- 2 FIELD—Displays approximately 1 ½ fields at the frame rate. A Field Shift pushbutton allows display of odd or even fields.
- VIT—Displays, at the field rate, the portion of the vertical blanking pulse which may contain vertical-interfield test signals. The field-rate display will show the ½-line transposition of horizontal sync pulses due to interlace.
- .125 H/CM—When the Display Switch is set to .125 H/CM, one TV line occupies exactly 8.0 cm and is thus self-checking.

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

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

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

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



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

OTHER FEATURES

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

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

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

The vertical position control requires no adjustment in checking calibration.

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

Illuminated Graticule—The edge-lighted graticule has 7 x 10 centimeters marked in IRE units between —40 and 100. Each scale division equals 10 IRE units. Illumination is controlled with a front-panel knob.

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

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

$\frac{527}{\mathsf{RM}\,527}$



Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 206 watts at 117 v.

Mechanical Specifications—Dimensions are $9\frac{5}{8}$ " high by $8\frac{1}{2}$ " wide by $20\frac{3}{8}$ " deep. Net weight is $31\frac{1}{2}$ pounds. Shipping weight is 41 pounds, approx.

TYPE RM527

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

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

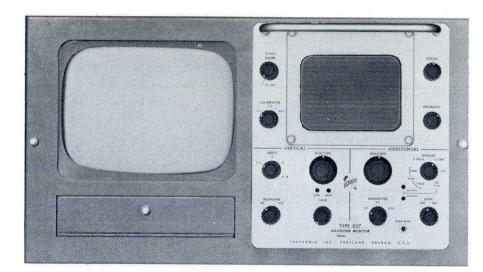
Mechanical Specifications—Dimensions are $5\frac{1}{4}$ " high by $18\frac{1}{4}$ " deep and fits a standard 19" rack. Net weight is 34 pounds. Shipping weight is 62 pounds, approx.

SPECIAL MODEL TYPE 527/RM527

This special model of the waveform monitor has all capabilities of the Type 527 or RM527 plus two additional features—a Line Selector and a Video-Distribution Amplifier.

The Line Selector permits detailed analyses of single television lines (particularly useful with $4\frac{1}{2}$ inch cameras), and the Video-Distribution Amplifier permits slaving a picture monitor to the oscilloscope display.

Consult your Field Engineer to learn about the advantages, limitations, and delivery time of this modified instrument.



Type 527 with Commercial Picture Monitor.

MOUNTING CRADLES

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

Description	Part Number	Price
Cradle Assembly, left-side		
mounting oscilloscope	426-133	\$57.50
Cradle Assembly, right-side		
mounting oscilloscope	426-134	\$57.50
Cradle Assembly, side-by-side		
mounting oscilloscope	426-135	\$57.50

TYPE 527 FIELD CASE



TYPE 527 ACCESSORIES

Description	Part Number	Price
Graticule, non-composite IRE	331-079	\$3.45
Graticule, % video modulation	331-080	\$3.45

TYPE RM527 ACCESSORIES

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

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DC-to-15MC OSCILLOSCOPES Type with SWEEP DELAY

RM31A 531A RM35A 535A



All information in color describes the additional capabilities of the Type 535A and RM35A Oscilloscopes.

HIGH INTENSITY TRACE

14 VERTICAL PLUG-IN UNITS

DELAYED SWEEP

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics extremely flexible through use of 14 Letter-Series Plug-In Units.

HORIZONTAL

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

SWEEP MAGNIFIER—5X, extends sweep range to 0.02 μ sec/cm.

TRIGGER REQUIREMENTS—Internal: 2-mm deflection.

External: 0.2 v to 10 v.

SINGLE SWEEP—(In 535A only) Time Base A.

CALIBRATED SWEEP DELAY—(In 535A only) 2 μsec to 10 sec, continuously variable.

EXTERNAL INPUT—0.2 v/cm to 15 v/cm; dc to 240 kc; 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-kc 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

Frequency Specifications are at 3-db down

For Wide Band Applications—

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

For Multiple-Trace Operation—

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

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

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For Differential Input Applications—

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

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

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

For High DC Sensitivity-

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

For Maximum Frequency Response—

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

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

For Repetitive High-Speed Pulse Applications—

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

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

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

For Transducer and Strain Gage Applications—

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

For Transistor-Risetime Checking—

TYPE R UNIT-23-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

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

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

APPLICATIONS

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

- 1. Make accurate incremental measurements along a complex waveform.
- 2. Make accurate phase-angle measurements between two signals, up to frequencies of 1 mc.
- 3. Display separate channels of a PTM system with effects of time jitter removed, determining pulse amplitude and shape under modulation conditions.
- 4. Measure pulse-to-pulse interval and amount of jitter on computer signals or any train of pulses.
- Make accurate time-difference measurements between pulse-in and pulse-out through an amplifying system.
- Display any selected individual line of a television composite signal.
- 7. Measure time displacement, wave-shape, and amplitude of individual channels in a telemetering system.
- 8. Utilize calibrated sweep magnification up to the highest practical limit.

Plus many more-specialized applications.

VERTICAL-DEFLECTION SYSTEM

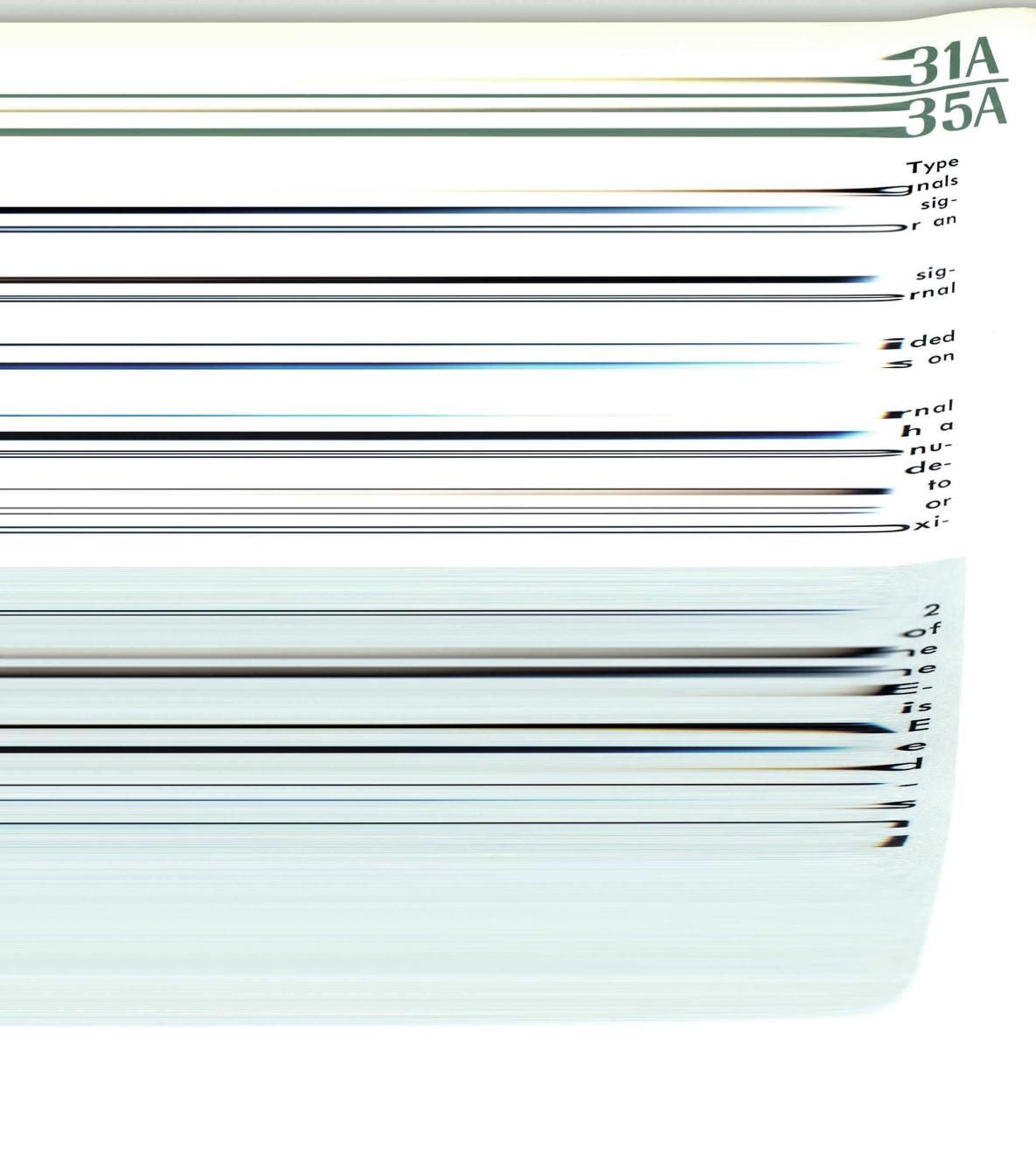
DC-Coupled Output Amplifier—The wide-band dc-coupled amplifier has a risetime of 23 nsec with a Type C-A, K, L, or R Unit plugged in. It is factory adjusted for optimum transient response.

HORIZONTAL-DEFLECTION SYSTEM

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

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

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





RM31A 5 31A RM35A 5 35A

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

Single Sweep—(TIME BASE A only in Type 535A) A RESET pushbutton arms the sweep to fire on the next trigger to arrive. After firing once, the sweep is locked out and cannot fire again until rearmed by pressing the RESET button. The READY light indicates when the sweep is armed to fire on the next trigger.

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

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

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

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

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

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

High Frequency Sync—(TIME BASE A only in Type 535A) Assures a steady display of sine-wave si nals up to approximately 30 megacycles. Requires signal large enough to cause about 2 cm deflection, and external signal of about 2 v

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

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

Horizontal Input Amplifier—DC-coupled external connection to the sweep-output amplifier is through ha front-panel connector. Combination of a step attenuator and variable attenuator makes the horizontal flection factor continuously variable from 0.2 v/cm approximately 15 v/cm. Passband is dc to 240 k or better at maximum gain. Input impedance is approximately 47 pf paralleled by 1 megohm.

SWEEP DELAY

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

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

Conventional Operation—When the triggering controls of TIME BASE A are adjusted to permit the delayed trigger to start the sweep, the delayed sweep starts precisely at the pick-off point, its start delayed the amount of time indicated by the TIME BASE B time/cm switch and the DELAY-TIME MULTIPLIER. Any time modulation or time jitter on the signal will be magnified in proportion to the amount of sweep expansion.

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

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

OTHER CHARACTERISTICS

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

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates. The Tektronix cathode-ray tube is a 5" flat-faced metallized precision tube with a helical post-accelerating anode. For best results, a cathode-ray tube with a P2 phosphor is normally furnished.

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

Illuminated Graticule—For convenience in making time and amplitude measurements, 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.

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

Output Waveforms—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-sawtooth waveform are available at front-panel binding posts via cathode followers. A 20-v positive gate and the delayed trigger from TIME BASE B are also available at front-panel connectors. The vertical signal is brought out to a front-panel terminal, amplitude is approximately 1.5 v/cm of signal on screen.

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

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

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

Probes—Two low capacitance probes (10-X atten.) are supplied with the instrument. Input capacitance is 7 pf with probes and either Type 531A - Type K or Type 535A - Type K combinations. Maximum deflection factor is 0.5 v/cm. Excellent transient response is retained, as the probes introduce no overshoot or ringing.

Regulated Power Supply—Electronic regulation compensates for line-voltage variations between 105 and 125 v or 210 and 250 v, and for current-demand differences among the plug-in units.

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

Cabinet Models—Type 531A and 535A dimensions are 16 % "high by 13 % " wide by 23 % " deep. Type 531A net weight is 57 ¾ pounds; shipping weight is 78 pounds, approx. Type 535A net weight is 61 ½ pounds; shipping weight is 83 pounds, approx.

CUSTOM SPECIALS

Special modifications for the Type 531A, 535A and Rack Mount models are available as factory-installed options. Instruments can be ordered for operation from 50-400 cps in either normal or high-altitude environments, with single-sweep capability, or 12-kv accelerating potential. Consult your Field Engineer to learn about the advantages, limitations, and delivery time of these or other modified instruments.

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

RM31A 531A FM35A 535A

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

Single Sweep—(TIME BASE A only in Type 535A) A RESET pushbutton arms the sweep to fire on the next trigger to arrive. After firing once, the sweep is locked out and cannot fire again until rearmed by pressing the RESET button. The READY light indicates when the sweep is armed to fire on the next trigger.

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

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

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

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

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

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

High Frequency Sync—(TIME BASE A only in Type 535A) Assures a steady display of sine-wave signals up to approximately 30 megacycles. Requires a signal large enough to cause about 2 cm deflection, or an external signal of about 2 v.

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

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

Horizontal Input Amplifier—DC-coupled external connection to the sweep-output amplifier is through a front-panel connector. Combination of a step attenuator and variable attenuator makes the horizontal deflection factor continuously variable from 0.2 v/cm to approximately 15 v/cm. Passband is dc to 240 kc or better at maximum gain. Input impedance is approximately 47 pf paralleled by 1 megohm.

SWEEP DELAY

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

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

Conventional Operation—When the triggering controls of TIME BASE A are adjusted to permit the delayed trigger to start the sweep, the delayed sweep starts precisely at the pick-off point, its start delayed the amount of time indicated by the TIME BASE B time/cm switch and the DELAY-TIME MULTIPLIER. Any time modulation or time jitter on the signal will be magnified in proportion to the amount of sweep expansion.

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

RM31A 531A RM35A 535A

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

OTHER CHARACTERISTICS

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

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates. The Tektronix cathode-ray tube is a 5" flat-faced metallized precision tube with a helical post-accelerating anode. For best results, a cathode-ray tube with a P2 phosphor is normally furnished.

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

Illuminated Graticule—For convenience in making time and amplitude measurements, the edge-lighted graticule has 6×10 centimeters marked in centimeter squares with centerline markings every 2 millimeters. Illumination is controlled by a front-panel knob.

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

Output Waveforms—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-saw-tooth waveform are available at front-panel binding posts via cathode followers. A 20-v positive gate and the delayed trigger from TIME BASE B are also available at front-panel connectors. The vertical signal is brought out to a front-panel terminal, amplitude is approximately 1.5 v/cm of signal on screen.

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

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

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

Probes—Two low capacitance probes (10-X atten.) are supplied with the instrument. Input capacitance is 7 pf with probes and either Type 531A - Type K or Type 535A - Type K combinations. Maximum deflection factor is 0.5 v/cm. Excellent transient response is retained, as the probes introduce no overshoot or ringing.

Regulated Power Supply—Electronic regulation compensates for line-voltage variations between 105 and 125 v or 210 and 250 v, and for current-demand differences among the plug-in units.

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

Cabinet Models—Type 531A and 535A dimensions are 16% high by 13% wide by 23% deep. Type 531A net weight is 57% pounds; shipping weight is 78 pounds, approx. Type 535A net weight is 61½ pounds; shipping weight is 83 pounds, approx.

Rack-Mount Models—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 22 ¾" 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 78 ¼ pounds; shipping weight is 105 pounds, approx.

TYPE 535A, without plug-in units \$1400 Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—light filter, 1—3-conductor power cord, 2—instruction manuals.

TYPE RM31A, without plug-in units \$1095

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

CUSTOM SPECIALS

Special modifications for the Type 531A, 535A and Rack Mount models are available as factory-installed options. Instruments can be ordered for operation from 50-400 cps in either normal or high-altitude environments, with single-sweep capability, or 12-kv accelerating potential. Consult your Field Engineer to learn about the advantages, limitations, and delivery time of these or other modified instruments.

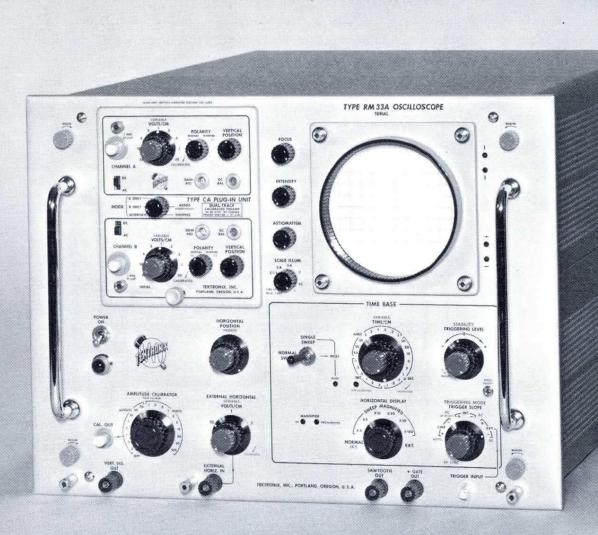
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DC-to-15MC OSCILLOSCOPE Type

with 100X MAGNIFIER







HIGH-INTENSITY TRACE

WIDE RANGE SWEEP MAGNIFICATION

14 VERTICAL PLUG-IN UNITS

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics extremely flexible through use of 14 Letter-Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μ sec/cm to 5 sec/cm. SWEEP MAGNIFIER—X2 to X100, extends sweep range, accurately, to 0.02 μ sec/cm.

TRIGGER REQUIREMENTS—Internal: 2-mm deflection. External: 0.2 v to 10 v.

dc to 240 kc; 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-kc square wave.

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

VERTICAL PLUG-IN UNITS

Frequency Specifications are at 3-db down

For Wide Band Applications—

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

For Multiple-Trace Operation-

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

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

For Differential Input Applications—

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

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

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

533A RM33A

For High DC Sensitivity-

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

For Maximum Frequency Response—

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

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

For Repetitive High-Speed Pulse Applications—

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

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

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

For Transducer and Strain Gage Applications—

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

For Transistor-Risetime Checking-

TYPE R UNIT—23-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

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

The Type 533A is a dc-to-15 mc oscilloscope with wide range of application coverage through Tektronix Type A to Z Plug-In Units. Six different degrees of sweep 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.

VERTICAL-DEFLECTION SYSTEM

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

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

HORIZONTAL-DEFLECTION SYSTEM

A Miller runup type sweep generator is used in the Type 533A. Inverse feedback in the timing circuitry assures excellent linearity. Characteristics of this circuitry make possible the wide range of 0.02 μ sec/cm to 12 sec/cm.

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

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

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

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

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

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

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

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

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

Trigger Requirements—Internal triggering—a signal large enough to cause 2-mm deflection. External triggering—a signal of 0.2 v to 10 v.

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

Horizontal Input—An external signal can be applied to the horizontal deflection plates through the decoupled horizontal amplifier via a front-panel connector. Three calibrated sensitivity steps are provided: 0.1, 1, and 10 v/cm. A variable control provides for continuous adjustment from 0.1 to approximately 100 v/cm. Horizontal amplifier passband is dc to 240 kc or better at maximum gain. Input impedance is approximately 45 pf paralleled by 1 megohm.

OTHER CHARACTERISTICS

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

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates, and in single-sweep applications. The Tektronix cathode-ray tube is a 5" flat-faced metallized precision tube with helical post-accelerating anode. For best results over a wide sweep range of the Type 533A, a P2 phosphor is normally furnished.

Illuminated Graticule—For convenience in making time and amplitude measurements, 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.

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

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

Output Waveforms—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-saw-tooth waveform are available at front-panel binding posts via cathode followers. The vertical signal is brought out to a front-panel terminal, amplitude is approximately 1.5 v/cm of signal on screen.

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

Probes—Two low capacitance probes (10-X atten.) are supplied with the instrument. Input capacitance of the Type 533-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.

Regulated Power Supply—Electronic regulation compensates for line-voltage variations between 105 and 125 v, or 210 and 250 v, and for current-demand differences among the plug-in preamplifiers.

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

Cabinet Model—Type 533A dimensions are 16%" high by 13%" wide by 23%" deep. Net weight is 62% lbs. Shipping weight is 78 lbs., 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 22 ¾" deep. For further mounting information, refer to the Catalog instrument dimension page. Net weight is 74 ½ pounds, approx. Shipping weight is 100 lbs., approx.

post adapters, 1—test lead, 1—light filter, 1—3-conductor power cord, 2—instruction manuals.

TYPE RM33A, without plug-in units \$1225

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

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

Type DC-to-10MC X-Y OSCILLOSCOPE



ACCURATE PHASE BALANCE
WIDE BAND "X-Y" DISPLAY

13 AMPLIFIER PLUG-IN UNITS
TIME-BASE PLUG-IN AVAILABLE

CHARACTERISTIC SUMMARY

VERTICAL AND HORIZONTAL

Both vertical and horizontal deflection characteristics extremely flexible through use of 14 Letter-Series Plug-In Units.

TIME-BASE DEFLECTION (with Type T TIME-BASE GENERATOR)

CALIBRATED SWEEP RANGE—0.2 μ sec/div to 2 sec/div.

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

TRIGGER REQUIREMENT-0.2 v to 10 v.

CRT

DISPLAY AREA— 10×10 divisions (3- $\frac{1}{8} \times 3-\frac{1}{8}$ inches).

ACCELERATING VOLTAGE-4 kv.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mv to 100 v; 1 kc square wave.

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

AMPLIFIER PLUG-IN UNITS

Frequency Specifications are at 3-db down

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

Type C-A—DC to 10 mc, 35 nsec.

Type D—DC to 300 kc at 1 mv/div, increasing to 2 mc at 50 mv/div, 0.18 μ sec.

Type E-0.06 cycles to 20 kc, increasing to 60 kc at 0.5 mv/cm.

Type G-DC to 10 mc, 35 nsec.

Type H—DC to 9.5 mc, 37 nsec.

Type K—DC to 11 mc, 31 nsec.

Type L—DC to 11 mc, 31 nsec at 0.05 to 40 v/div3 cycles to 10 mc, 35 nsec at 0.005 to 4 v/div.

Type M-DC to 10 mc, 35 nsec.

For repetitive high-speed pulse applications— Type N—0.6-nsec risetime (corresponding to approximately 600 mc).



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

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

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

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

ADDITIONAL PLUG-IN UNITS

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

Calibrated Sweep Rates—Twenty-two sweep rates from 0.2 μ sec/div to 2 sec/div.

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

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

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

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

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

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

Type R—for transistor-risetime checking in conventional oscilloscope operation—35-nsec risetime.

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

With two of the same wide-band preamplifiers plugged in, the horizontal and vertical deflection systems are almost identical. Relative phase shift is less than one degree to 15 mc, and, by means of a front-panel control, phase balance can be obtained at any frequency to over 25 mc.

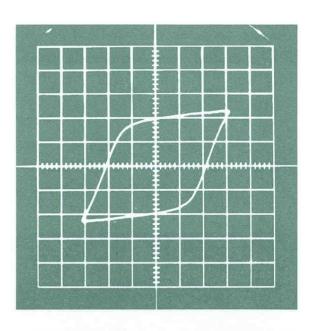
With the Time-Base Plug-In Unit, Type T, plugged into the horizontal amplifier, and one of the Type A to Z wide-band units plugged into the vertical amplifier, the Type 536 functions as a general-purpose oscilloscope.

APPLICATIONS

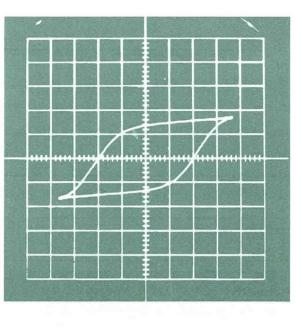
In curve-tracing applications the Type 536 extends the range of familiar techniques to today's higher-frequency problems. Differential input, a feature that eliminates the need for a common XY terminal, is available in the wideband Type G Plug-In Preamplifier. A pair of Type G Units provide accuracy needed in many curve-tracing applications.

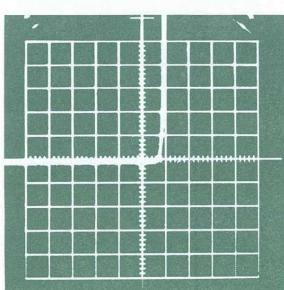
Some applications for a wide-band "X-Y" oscilloscope:

- 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).

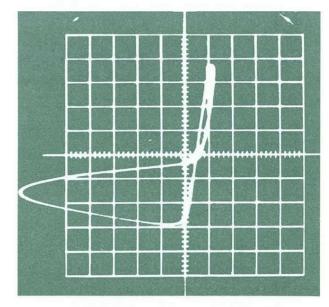


Ferrite bead characteristics at two different temperatures—left, at 25°C; right, at equilibrium temperature due to self heating. Type 536 with two Type G Units, driving frequency 1 mc.





High-condition diffused silicon diode characteristics—left, at 60 cycles; right, at 2 mc. Type 536 with two Type G Units, horizontal calibration 1 v/div; vertical calibration 100 ma/div;



VERTICAL AND HORIZONTAL DEFLECTION SYSTEMS

All characteristics of the horizontal deflection system are the same as those of the vertical deflection system when the same type of Plug-In Unit is plugged into both systems. Both main amplifiers have excellent transient response with risetimes of 31 nsec with Type K Units plugged in. One of the Type A to Z Units can be plugged into the vertical or the horizontal deflection system. Provided the amplifiers are not overdriven by the input signals, relative phase shift with Type K Plug-In Preamplifiers is less than 1 degree from dc to 15 mc. Phase-shift balance can be obtained at any frequency to 30 mc with a front-panel amplifier phasing control.

Type 536 characteristics with Type G Units are:

Passbands—dc to 10 mc.

Risetimes-35 nsec.

Deflection factors—0.05 v/div maximum, 9 calibrated steps from 0.05 v/div to 20 v/div; continuously-variable adjustment between steps.

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

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

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

OTHER CHARACTERISTICS

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

Cathode-Ray Tube—A Tektronix cathode-ray tube provides a 10-by-10 division (3 ½ " x 3 ½ ") 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 accoupling 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 ($3\frac{1}{8}$ by $3\frac{1}{8}$ 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 7 pf, maximum deflection factor is 0.5 v/cm. Excellent transient response is retained, as the probes introduce no overshoot or ringing.

Regulated Power Supply—Electronic regulation compensates for line-voltage variations and for current-demand differences among the plug-in units.

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

Mechanical Specifications—Dimensions are 16% "high by 13%" wide by 23%" deep. Net weight is 55% pounds. Shipping weight is 76 pounds, approx.

TYPE 536, without plug-in units \$1085

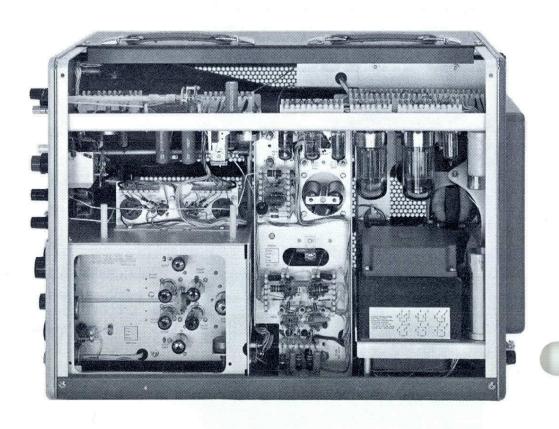
Each instrument includes: 2—10X attenuator probes, 2—bindingpost adapters, 1—test lead, 1—light filter, 1—phase-measuring
graticule, 1—3-conductor power cord, 2—instruction manuals.

Rack Mount Adapter

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

Order Part Number 040-281 \$45

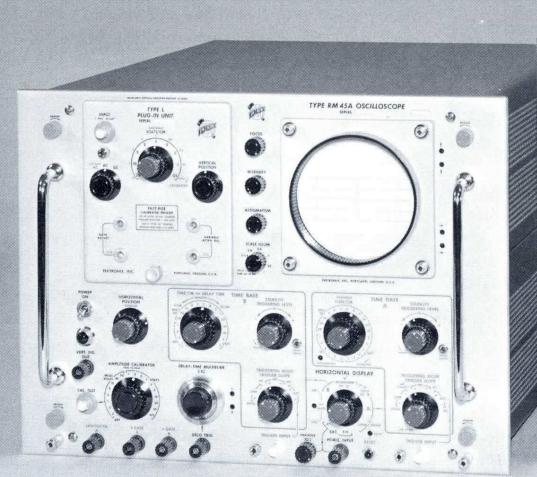
U.S. Sales Prices f.o.b. Beaverton, Oregon Please refer to Terms and Shipment, General Information page.





DC-to-30MC OSCILLOSCOPES Type with SWEEP DELAY

RM41A 541A RM45A 545A





All information in color describes the additional capabilities of the Type 545A and RM45A Oscilloscopes.

HIGH-INTENSITY TRACE

15 VERTICAL PLUG-IN UNITS

CALIBRATED SWEEP DELAY

CHARACTERISTIC SUMMARY VERTICAL

Vertical deflection characteristics are extremely flexible through use of 15 Letter-Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—Time Base A: 0.1 μ sec/cm to 5 sec/cm; Time Base B (Type 545 only): 2 μ sec/cm to 1 sec/cm.

SWEEP MAGNIFIER—5X, extends sweep range to 0.02 $\mu sec/cm$.

CALIBRATED SWEEP DELAY—2 $\mu {\rm sec}$ to 10 sec, continuously variable.

TRIGGER REQUIREMENTS—Internal: 2-mm deflection. External: 0.2 to 10 v. EXTERNAL INPUT—0.2 v/cm to 15 v/cm; dc to 240 kc; 1 megohm, 47 pf.

CRT

DISPLAY AREA—4 x 10 cm.

ACCELERATING VOLTAGE—10 kv.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mv to 100 v; 1-kc square wave.

POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 520 watts maximum for Type 541A, 600 watts maximum for Type 545A.

VERTICAL PLUG-IN UNITS

Frequency specifications are at 3-db down

For Wide Band Applications—

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

For Multiple-Trace Operation—

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

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



RM41A 541A RM45A 545A

For Differential Input Applications—

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

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

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

For High DC Sensitivity-

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

For Maximum Frequency Response—

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

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

For Repetitive High-Speed Pulse Applications-

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

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

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

For Transducer and Strain Gage Applications—

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

For Transistor-Risetime Checking—

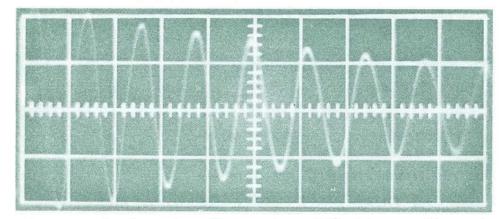
TYPE R UNIT-12-nsec risetime.

For Diode Recovery-Time Measurements—

TYPE S UNIT-12-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 Mc, 27-nsec risetime at 50 mv/cm to 25 v/cm.



20 megacycle damped oscillation shows 250-cm/ μ sec writing rate of the Type 541A Oscilloscope with a T543P11 crt. Recorded on 35 mm Tri-X film at f1.9 with 4.2 to 1 reduction, developed 26 minutes in D-19 at 68°F.

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

APPLICATIONS

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

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

Plus many more-specialized applications.

VERTICAL DEFLECTION SYSTEM

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

The Type K Fast-Rise Plug-In Preamplifier, developed for Type 541A and Type 545A Oscilloscopes, provides a maximum sensitivity of 0.05 v/cm, with 12-nanosecond risetime, dc-to-30 mc passband, and 20 pf input capacitance. (Frequency response is down 3 db $\pm \frac{1}{2}$ db at 30 mc, 6 db at approximately 41 mc, 12 db at approximately 55 mc.)

RM41A 541A FM45A 545A

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

HORIZONTAL DEFLECTION SYSTEM

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

The Type 545A has two time-base generators. TIME BASE A is identical to the time-base generator in the Tektronix Type 541A. TIME BASE B functions as a delay generator. The signal to be observed can be displayed on either time base in the following ways: TIME BASE B normal, TIME BASE B with trace brightening during the period that TIME BASE A is running, TIME BASE A delayed by TIME BASE B, TIME BASE A normal, and TIME BASE A single sweep.

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

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

Single Sweep—(TIME BASE A only in Type 545A) A RESET pushbutton arms the sweep to fire on the next trigger to arrive. After firing once, the sweep is locked out and cannot fire again until rearmed by pressing the RESET button. The READY light indicates when the sweep is armed to fire on the next trigger.

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

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

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

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

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

Low-Frequency Reject—(TIME BASE A only in Type 545A) Prevents low-frequency components, such as hum, from interfering with stable triggering.

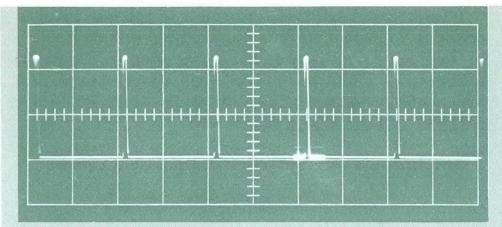
High-Frequency Sync—(TIME BASE A only in Type 545A) Assures a steady display of sine-wave signals up to approximately 30 megacycles. Requires a signal large enough to cause about 2 cm deflection, or an external signal of about 2 v.

Trigger Requirements—Internal Triggering—a signal large enough to cause 2-mm deflection. External Triggering—a signal of 0.2 v to 10 v.

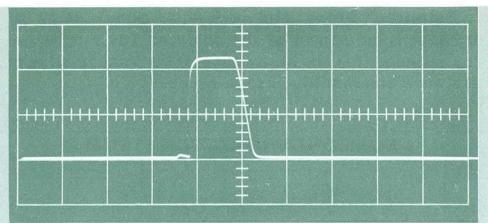
DC-Coupled Unblanking—DC coupling is provided for the unblanking waveforms, assuring uniform bias on the cathode-ray tube for all sweep times and repetition rates.

Horizontal Input Amplifier—DC-coupled external connection to the sweep-output amplifier is through a front-panel connector. Combination of a step attenuator and variable attenuator makes the horizontal deflection factor continuously variable from 0.2 v/cm to approximately 15 v/cm. Passband is dc to 240 kc or better at maximum gain. Input impedance is approximately 47 pf paralleled by 1 megohm.

RM41A 541A RM45A 545A



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



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

SWEEP DELAY

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

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

Conventional Operation—When the triggering controls of TIME BASE A are adjusted to permit the delayed trigger to start the sweep, the delayed sweep starts precisely at the pick-off point, its start delayed the amount of time indicated by the TIME BASE B time/cm switch and the DELAY-TIME MULTIPLIER. Any time modulation or time jitter on the signal will be magnified in proportion to the amount of sweep expansion.

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

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

OTHER CHARACTERISTICS

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

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates. The Tektronix cathode-ray tube is a 5" flat-faced metallized precision tube with a helical post-accelerating anode. For best results over the wide sweep range of the Type 541A and Type 545A, a P2 phosphor is normally furnished.

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

$\frac{RM41A}{RM45A} \frac{541A}{545A}$

Illuminated Graticule—An edge-lighted graticule is marked in centimeter squares with two-millimeter centerline divisions for convenience in making time and amplitude measurements. Viewing area is 4 by 10 cm. Illumination is controlled by a front-panel knob.

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

Output Waveforms—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-sawtooth waveform are available at front-panel binding posts via cathode followers. A 20-v positive gate and the delayed trigger from TIME BASE B are also available at front-panel connectors. The vertical signal is brought out to a front-panel terminal; amplitude is approximately 1.5 v/cm of signal on screen.

Probes—Two low-capacitance probes (10-x atten.) are supplied with the instrument. Input capacitance of the Type 541A-Type K or Type 545A-Type K combination with probes is 7 pf, maximum sensitivity is 0.5 v/cm. Excellent transient response is retained, as the probes introduce no overshoot or ringing, but frequency response is down an additional 1 db at 30 Mc.

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

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

Regulated Power Supply—Electronic regulation compensates for line-voltage variations between 105 and 125 v or 210 and 250 v, and for current-demand differences among the plug-in units.

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

Cabinet Models—Type 541A and 545A dimensions are 16% "high by 13%" wide by 23%" deep. Type 541A net weight is 59 pounds; shipping weight is 79 pounds, approx. Type 545A net weight is 63% pounds; shipping weight is 84 pounds, approx.

Rack-Mount Models—Type RM41A and RM45A 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 22 \(^3\lambda''\) deep. For further mounting information, refer to the Catalog instrument dimension page. Type RM41A net weight is 75 \(^1\lambda'\) pounds; shipping weight is 100 pounds, approx. Type RM45A net weight is 80 pounds; shipping weight is 106 pounds, approx.

TYPE 5	41A, wit	hout pl	ug-in	units			\$1225
Each	instrument	includes:	2-10	X attenua	tor prob	es, 2—bind	ling-
post	adapters,	1—test	lead,	1—light	filter,	1—3-condu	ctor
nowe	r cord 2—	instruction	manua	ls.			

TYPE RM41A, without plug-in units \$1325

Each instrument includes: 2—10X attenuator probes, 2—bindingpost adapters, 1—test lead, 1—light filter, 1—set mounting hardware, 2—instruction manuals.

TYPE RM45A, without plug-in units \$1650

Each instrument includes: 2—10X attenuator probes, 2—bindingpost adapters, 1—test lead, 1—light filter, 1—set mounting hardware, 2—instruction manuals.

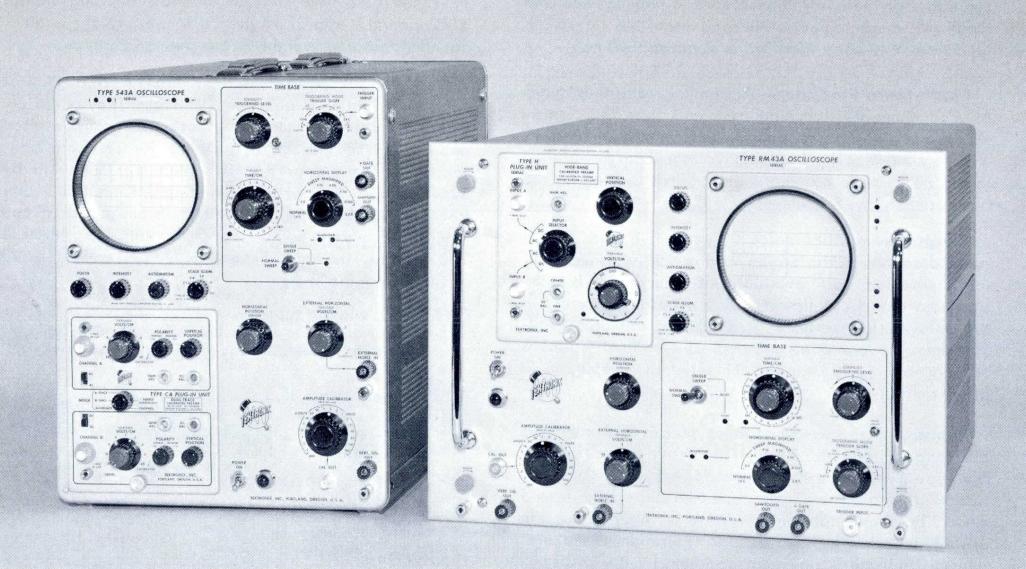
U.S. Sales Prices f.o.b. Beaverton, Oregon Please refer to Terms and Shipment, General Information page.

CUSTOM SPECIALS

Special modifications for the Type 541A, 545A, and Rack Mount models are available as factory-installed options. Instruments can be ordered for operation from 50-400 cps in either normal or high-altitude environments, with single-sweep capability, or 12-kv accelerating potential. Consult your Field Engineer to learn about the advantages, limitations, and delivery time of these or other modified instruments.

DC-to-30MC OSCILLOSCOPE with 100X MAGNIFIER





HIGH-INTENSITY TRACE

WIDE RANGE SWEEP MAGNIFICATION

15 VERTICAL PLUG-IN UNITS

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

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

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics extremely flexible through use of 15 Letter-Series Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μ sec/cm to 5 sec/cm. SWEEP MAGNIFIER—X2 to X100, extends sweep range, accurately, to 0.02 μ sec/cm.

TRIGGER REQUIREMENTS—Internal: 2-mm deflection.
External: 0.2 to 10 v.

EXTERNAL INPUT—0.1 v/cm to 10 v/cm (calibrated); dc to 240 kc; 1 megohm, 47 pf.

CRT

DISPLAY AREA—4 x 10 cm.

ACCELERATING VOLTAGE—10 kv.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mv to 100 v; 1-kc square wave.

POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 530 watts maximum.

VERTICAL PLUG-IN UNITS

Frequency Specifications are at 3-db down

For Wide Band Applications-

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

For Multiple-Trace Operation-

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

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

For Differential Input Applications—

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

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

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

For High DC Sensitivity-

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

For Maximum Frequency Response—

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

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

For Repetitive High-Speed Pulse Applications—

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

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

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

For Transducer and Strain Gage Applications—

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

For Transistor-Risetime Checking—

TYPE R UNIT—12-nsec risetime.

For Diode Recovery-Time Measurements—

TYPE S UNIT-12-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 Mc, 27 nsec risetime at 50 mv/cm to 25 v/cm.

VERTICAL-DEFLECTION SYSTEM

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

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

HORIZONTAL-DEFLECTION SYSTEM

A Miller-runup type sweep generator is used in the Type 543A. Inverse feedback in the timing circuity assures excellent linearity. Characteristics of this circuitry make possible the wide range of $0.02~\mu sec/cm$ to 12~sec/cm.

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

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

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

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

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

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

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

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

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

Trigger Requirements — Internal triggering — a signal large enough to cause 2-mm deflection. External triggering—a signal of 0.2 v to 10 v.

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

Horizontal Input—An external signal can be applied to the horizontal deflection plates through the decoupled horizontal amplifier via a front-panel connector. Three calibrated sensitivity steps are provided: 0.1, 1, and 10 v/cm. A variable control provides for continuous adjustment from 0.1 to approximately 100 v/cm. Horizontal amplifier passband is dc to 240 kc or better at maximum gain. Input impedance is approximately 45 pf paralleled by 1 megohm.

OTHER CHARACTERISTICS

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

Accelerating Potential—10-kv accelerating potential assures bright display when using fast sweeps at low repetition rates, and in single-sweep applications. A Tektronix manufactured cathode-ray tube is a 5" flat-faced metalized precision tube with helical post-accelerating anode. For best results over a wide sweep range, a P2 phosphor is normally furnished. Other phosphors are available on special order.

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

Illuminated Graticule—An edge-lighted graticule is marked in centimeter squares with two-millimeter centerline divisions for convenience in making time and amplitude measurements. Viewing area is 4×10 cm. Illumination is controlled by a front-panel knob.

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

Output Waveforms—A 20-v positive gate of the same duration as the sweep and a 150-v sweep-sawtooth waveform are available at front-panel binding posts via cathode followers. The vertical signal is brought out to a front-panel terminal, amplitude is approximately 1.5 v/cm of signal on screen.

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

Probes—Two low-capacitance 10-x attenuator probes are supplied with the Type 543A. These 10-x probes introduce no overshoot or ringing, but frequency response is down an additional 1 db at 30 Mc. Input capacitance is 7 pf with Type C-A, K, or L Unit.

Regulated Power Supply—Electronic regulation compensates for line-voltage variations between 105 and 125 v or 210 and 250 v, and for current-demand differences among the plug-in preamplifiers.

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

Cabinet Model—Type 543A dimensions are 16%" high by 13%" wide by 23%" deep. Net weight is 59 pounds. Shipping weight is 80 pounds, approx.

Rack-Mount Model—Type RM43A 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 $22\frac{3}{4}$ " deep. For further mounting information, refer to the Catalog instrument dimension page. Net weight is $75\frac{1}{2}$ pounds. Shipping weight is 101 pounds, approx.

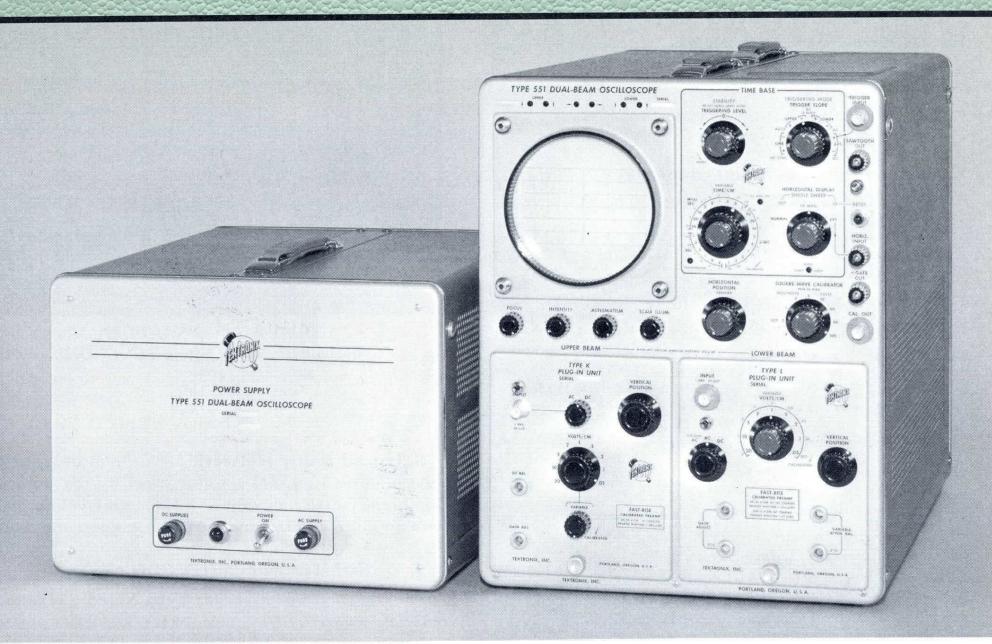
TYPE 543A, without plug-in units \$1300 Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—light filter, 1—3-conductor power cord, 2—instruction manuals.

TYPE RM43A, without plug-in units \$1400 Each instrument includes: 2—10X attenuator probes, 2—binding-post adapters, 1—test lead, 1—light filter, 1—set mounting hardware, 2—instruction manuals.

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



DC-to-25MC DUAL-BEAM OSCILLOSCOPE Type



HIGH-INTENSITY TRACE

DUAL-BEAM CRT

15 VERTICAL PLUG-IN UNITS

The Type 551 uses a Tektronix two-gun cathoderay 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 Type A to Z Plug-In Preamplifiers, providing a high degree of signal-handling versatility in both channels. Both electron beams are simultaneously deflected horizontally at any one of many sweep rates provided by an accurately-calibrated time-base generator.

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

CHARACTERISTIC SUMMARY

VERTICALS

2 identical vertical-deflection systems

15 Letter-Series Plug-In Units offer wide selection of vertical-deflection characteristics for both beams.

HORIZONTAL

CALIBRATED SWEEP RANGE—0.1 μ sec/cm to 5 sec/cm. SWEEP MAGNIFIER—5X, extends sweep range to 0.02 μ sec/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 kc.

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-kc square wave.

POWER REQUIREMENTS—105 v to 125 v or 210 v to 250 v, 900 watts maximum.

VERTICAL PLUG-IN UNITS

Frequency specifications are at 3-db down

For Wide Band Applications—

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

For Multiple-Trace Operation—

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

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

For Differential Input Applications—

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

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

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

For High DC Sensitivity-

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

For Maximum Frequency Response—

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

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

For Repetitive High-Speed Pulse Applications—

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

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

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

For Transducer and Strain Gage Applications—

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

For Transistor-Risetime Checking-

TYPE R UNIT-14-nsec risetime.

For Diode Recovery-Time Measurements—

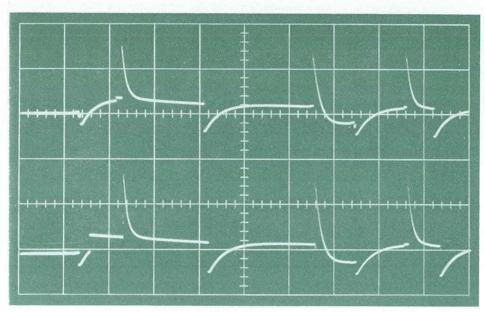
TYPE S UNIT-14-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 Mc, 27-nsec risetime at 50 mv/cm to 25 v/cm.

VERTICAL-DEFLECTION SYSTEMS

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



DUAL-BEAM OPERATION
SHOWING SWITCHING FUNCTIONS

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

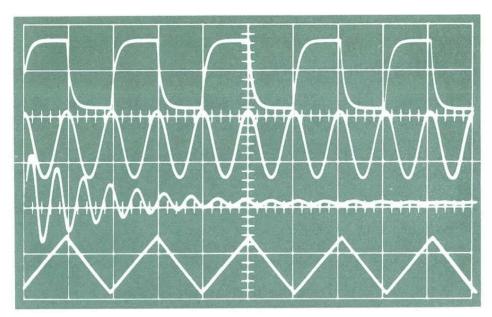
HORIZONTAL-DEFLECTION SYSTEM

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

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

Sweep Magnifier—5-x magnifier increases the calibrated sweep time to 0.02 μ sec/cm. Sweep magnification is obtained by increasing the gain of the sweep output amplifier by a factor of five. The center 2 cm of the normal display is expanded to the left and right of center to fill the screen. Any one-fifth of the magnified sweep can be displayed on the screen by rotating the HORIZONTAL POSITION control. Accuracy is within 5% of the displayed portion of the magnified sweep.

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



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

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

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

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

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

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

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

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

Trigger Requirements — Internal triggering — a signal large enough to cause a 2-mm deflection. External triggering—a signal of 0.2 v to 10 v.

Horizontal Input Amplifier—DC-coupled external connection to the sweep-output amplifier is through a front-panel connector. An attenuator makes the horizontal deflection factor continuously variable from 0.2 v/cm to approximately 50 v/cm. Passband is do to approximately 400 kc at maximum sensitivity.

OTHER CHARACTERISTICS

Amplitude Calibrator — A square-wave calibration voltage is available through a front-panel coaxial connector. Eighteen fixed voltages — 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 millivolts, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 volts peak-to-peak are provided. Accuracy is within 3%. Square-wave frequency is about 1 kc.

Cathode-Ray Tube — 10-kv accelerating potential assures bright displays when using fast sweeps at low repetition rates, and in single-sweep applications. The Tektronix cathode-ray tube is a 5" flat-faced metallized precision dual-beam tube with helical post-accelerating anode. It provides a linear 4-cm x 10-cm viewing area, each beam, with at least 2-cm overlap. For best results over the wide screen range of the Type 551, a P2 screen is normally furnished.

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

Illuminated Graticule — An edge-lighted graticule is marked in centimeter squares with two-millimeter centerline divisions for convenience in making measurements in time and amplitude. Viewing area is 6×10 cm. Illumination of the graticule is controlled by a front-panel knob.

Output Waveforms — A 20-v positive gate voltage of the same duration as the sweep, and a 150-v sweep sawtooth waveform are available at front-panel binding posts via cathode followers.

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

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

Probes—Four 10-x 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 Mc.

Separate Power Supply — A separate unit supplies power to the Type 551 indicator unit through an interunit cable. Electronic regulation compensates for linevoltage variations between 105 and 125 v or 210 and 250 v, and for current-demand differences among the plug-in preamplifiers.

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

Mechanical Specifications—Dimensions for Indicator Unit are 16% " high by 13% " wide by 23%" long. Dimensions for the Power Unit are 10% " high by 13%" wide by 17%" long.

Net Indicator Unit weight is $52 \frac{1}{2}$ pounds. Shipping weight is 74 pounds, approx. Net Power Unit weight is $44 \frac{1}{4}$ pounds. Shipping weight is 52 pounds, approx.

12-KV HIGH VOLTAGE MODIFICATION

For increased brightness and writing rate, the crt accelerating voltage can be increased from 10 to 12 kv. This modification can be ordered as MOD 108A installed at the factory. Consult your Field Engineer to learn about the advantages, limitations, and delivery time of this or other modified instruments.

TYPE 551 MOD 108A, without plug-in units . . . \$1875

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

RACK MOUNT ADAPTER

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

Order Part Number 040-279 \$85

SCOPE-MOBILE® CARTS

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



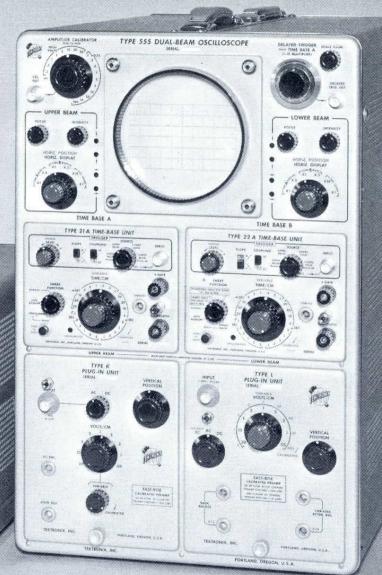


DC-to-30MC DUAL-BEAM OSCILLOSCOPE Type

with SWEEP DELAY

15 VERTICAL PLUG-IN UNITS
CALIBRATED SWEEP DELAY
2 PLUG-IN TIME BASES
HIGH-INTENSITY TRACE





The Type 555 Oscilloscope is a dual-beam laboratory instrument for accurate measurements in the dc to 30 Mc 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 any Tektronix Letter-Series Plug-In Unit, for a high degree of signal-handling versatility.

CHARACTERISTIC SUMMARY VERTICALS

2 identical vertical-deflection systems

15 Letter-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 μ sec/cm to 5 sec/cm. SWEEP MAGNIFIER—5X, extends sweep range to 0.02 μ sec/cm.

CALIBRATED SWEEP DELAY-0.1 µsec to 50 sec.

TRIGGER REQUIREMENTS-

Internal: Less than 1-cm deflection to 30 Mc.

External: 0.2 v to 10 Mc, 0.5 v to 30 Mc.

EXTERNAL INPUT—0.2 to 20 v/cm; dc to 240 kc; 1 meg-ohm, 47 pf.

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-kc square wave.

POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 1050 watts maximum.

VERTICAL PLUG-IN-UNITS

Frequency specifications are at 3-db down

For Wide Band Applications—

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

For Multiple-Trace Operation-

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

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

For Differential Input Applications-

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

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

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

For High DC Sensitivity-

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

For Maximum Frequency Response—

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

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

For Repetitive High-Speed Pulse Applications-

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

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

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

For Transducer and Strain Gage Applications—

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

For Transistor-Risetime Checking-

TYPE R UNIT-12-nsec risetime.

For Diode Recovery-Time Measurements—

TYPE S UNIT-12-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 Mc, 27 nsec risetime at 50 mv/cm to 25 v/cm.

VERTICAL-DEFLECTION SYSTEMS

IDENTICAL MAIN AMPLIFIERS provide 12-nsec risetime and dc-to-30 Mc passband (3-db down) when used with Type K or L Plug-In Units. Any Tektronix Letter-Series Plug-In Unit can be used to deflect either beam.

PASSIVE PROBES supplied with the Type 555 reduce loading on the circuit under test and attenuate the signal by a factor of 10. Input impedance becomes 10 megohms paralleled by approximately 7 pf with Type 555 and K or L Unit. Excellent transient response is retained, as the probes introduce no overshoot or ringing, but frequency response is down an additional 1 db at 30 Mc.

SIGNAL DELAY permits observation of the leading edge of the waveform that triggers the sweep. A 0.2 μ sec 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 μ sec/cm to 5 sec/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 μ sec/cm to 12 sec/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 μ sec/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 cps. Above 20 cps, the time base is triggered at the repetition rate of the incoming trigger signal to achieve jitter-free displays to beyond 30 Mc.

EXTERNAL HORIZONTAL INPUTS provide for horizontal deflection of either beam with an external source. Inputs are at the rear of the oscilloscope. Horizontal sensitivity is continuously variable from 0.2 v/cm to approximately 20 v/cm. Passbands are dc to 240 kc at maximum sensitivity. Input impedances are 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 $\pm 10 \, \text{v}$ range; fine control adjusts over $\pm 1 \, \text{v}$ 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 future Tektronix multi-trace plug-in units.

TRIGGER REQUIREMENT is less than 0.2-cm deflection for internal signals from dc to 5 Mc (approx. 20 cps to 5 Mc using Automatic Baseline), and less than 1-cm deflection to 30 Mc (using Type K or L Plug-In Preamplifier). For external signals, less than 0.2 v is required for reliable triggering to 10 Mc, and less than 0.5 v is required to 30 Mc. When ac coupled, the low-frequency 3-db point is approximately 160 cps.

SWEEP DELAY

CALIBRATED DELAY RANGE from 0.1 μ sec to 50 sec 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 μ sec to 50 sec 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.

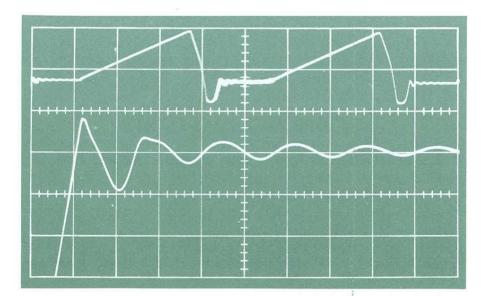
CONVENTIONAL OPERATION holds off the start of the delayed sweep for the precise amount of selected delay time. Any time-modulation or jitter on the signal will be magnified in proportion to the amount of sweep expansion.

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 μ sec/cm and TIME BASE B is operating at 1 μ sec/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.

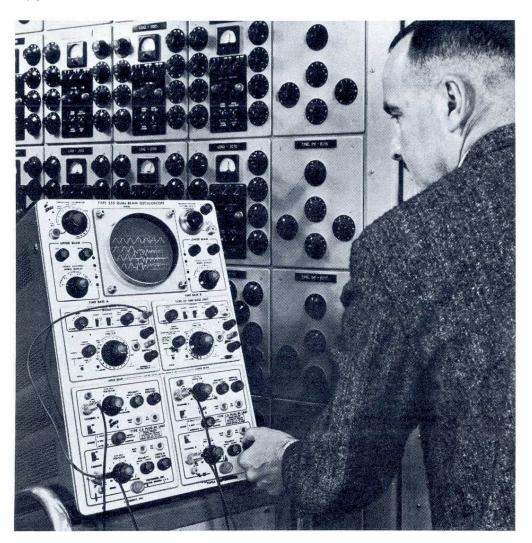
DELAYED TRIGGER used to start the delayed sweep is available at the front panel, and can be used to trigger external equipment at any delay from 0.1 μ sec to 50 sec. Amplitude is approximately 5 volts.



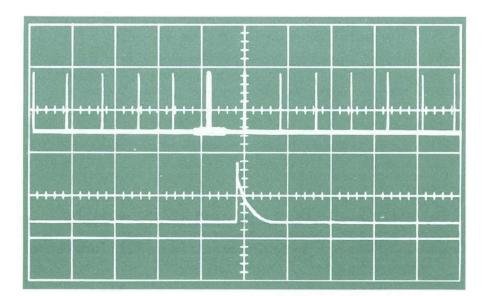
Same signal displayed simultaneously on slow sweep (upper beam) and fast sweep (lower beam) shows both coarse and fine structure of waveform.

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 sweep speeds at low repetition rates, and in single-sweep applications.



At Bonneville Power Administration—in one of many continuing studies with their transient analyzer—a System Engineer uses a Tektronix Type 555 Oscilloscope with 2 dual-trace units to display fast switching transients occurring in each phase of a transmission system. By observing the three switching-transient traces with a timing trace, he can quickly and easily compare magnitudes, phase relationships, transient times, and accurately determine overvoltage characteristics of the system.



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

555

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 square-wave 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%. Square-wave frequency is approximately 1 kc.

OUTPUT WAVEFORMS available at the front panel include 2 positive gates of approximately 20 volts, 2 positive-going sawtooths of approximately 150 volts, and a delayed trigger of approximately 5 volts.

electronically-regulated DC supplies insure stable operation between 105 and 125 volts, or 210 and 250 volts. A separate unit supplies power to the Type 555 indicator unit through an interconnecting cable. All heaters in the indicator unit and amplifier heaters in the power supply are regulated for stable operation and long tube life.

POWER REQUIREMENT is 105 to 125 or 210 to 250 v, 50 to 60 cps, 1050 watts maximum.

INDICATOR UNIT is 201/8" high by 131/8" wide by 24" deep. Net weight is 66 pounds. Shipping weight is 88 pounds, approx.

POWER SUPPLY UNIT is $10^3/_8$ "high by $13^1/_2$ " wide by $17^1/_2$ " deep. Net weight is 51 pounds. Shipping weight is 60 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, 1—time base extension, 1—Power Supply Unit, 1—inter-unit cable, 4—10X attenuator probes, 1—test lead, 2—binding-post adapters, 1—light filter, 1—3-conductor power cord, 2—instruction manuals.

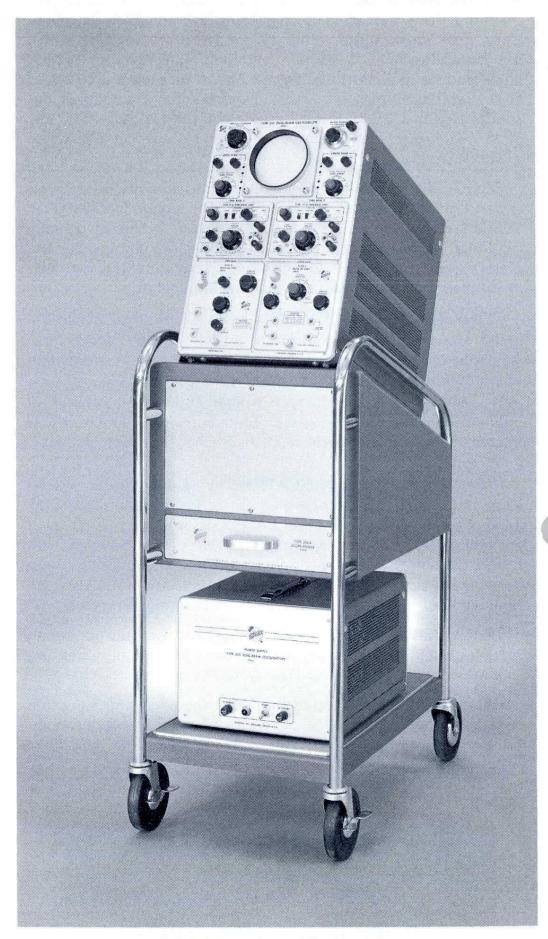
EXTRA TIME-BASE PLUG-IN UNITS

Net weight of each Type 21A and Type 22A Time Base Unit is $4\frac{1}{4}$ 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. Scope-Mobile[®] Carts are available for the Type 555 Oscilloscope and Power Supply Unit to provide easy moving in your work area.



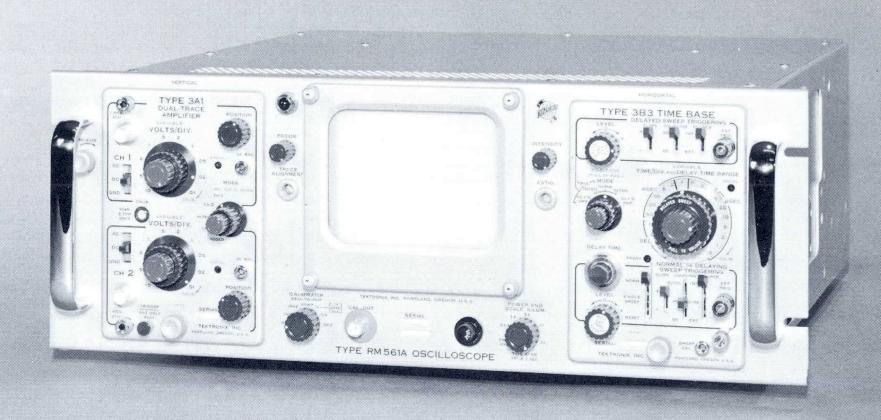
SCOPE-MOBILE® CARTS

TYPE 202-1 TILT-LOCK CART with storage drawer and locking front wheels	
TYPE 202-2 TILT-LOCK CART with storage drawer, plug-in unit carrier, and locking front wheels	
TYPE 500A CART with storage drawer and locking front wheels	
TYPE 500/53A CART with storage drawer, plug-in unit carrier, and locking front wheels	

See Catalog accessory pages for complete information.



OSCILLOSCOPE Type



ILLUMINATED INTERNAL GRATICULE
X-Y DISPLAYS
AMPLIFIER PLUG-IN UNITS
TIME-BASE PLUG-IN UNITS
COMPACT SIZE
RELIABLE PERFORMANCE

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics extremely flexible through use of 10 amplifiers of the 2-Series and 3-Series Plug-In Units.

HORIZONTAL

Horizontal deflection characteristics extremely flexible through use of 4 time-base units and 10 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, and 0.1 v into 50 Ω , power-line frequency.

POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 50 to 400 cps, 240 watts maximum.

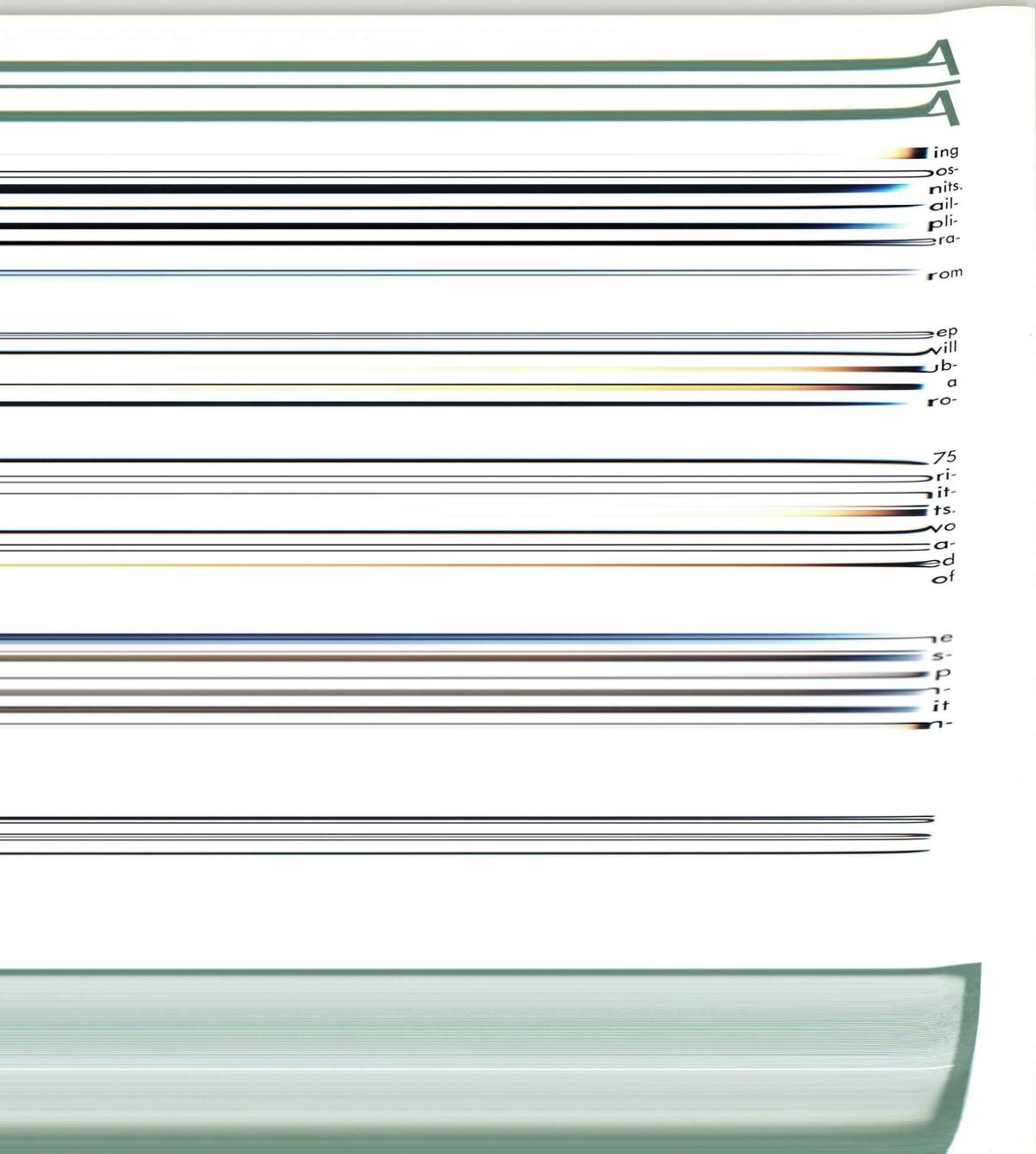


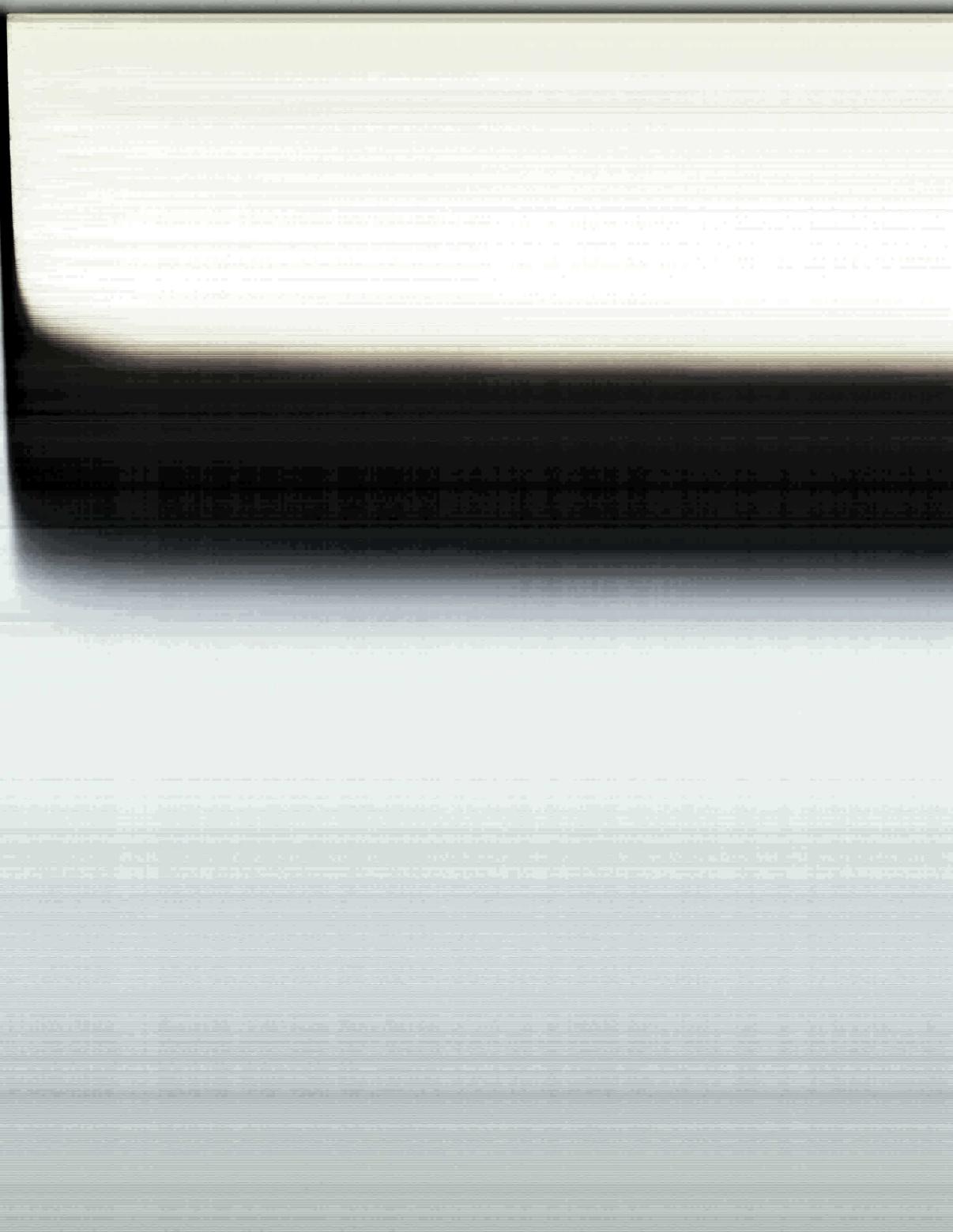
561A RM561A

2-SERIES AND 3-SERIES PLUG-IN UNITS

AMPLIFIER UNITS								
ТҮРЕ	INPUT (ac or dc coupled)	PASSBAND (3-db down)	SENSITIVITY	PRICE				
2A60-Single Trace	1 megohm—47 pf, 600 v max.	dc—1 Mc.	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 cps—300 kc	10 μv/div—20 mv/div, 1-2-5 sequence.	\$385				
2A63—Differential (50:1 rejection ratio)		dc—300 kc.	1 mv/div—20 v/div, 1-2-5 sequence, with variable control.	\$130				
3A1—Dual Trace (identical channels)		dc—10 Mc.	10 mv/div—10 v/div, 1-2-5 sequence, with variable control. 6 cm linear scan	\$410				
3A72—Dual Trace (identical channels)	1 megohm—47 pf, 600 volts max.	dc—650 kc.	10 mv/div—20 v/div, 1-2-5 sequence, with variable control.	\$250				
3A74—Four Trace (identical channels)		dc—2 Mc.	20 mv/div—10 v/div, 1-2-5 sequence, with variable control.	\$550				
3A75—Single trace		dc—4 Mc.	50 mv/div—20 v/div, 1-2-5 sequence, with variable control.	\$175				
3C66—Carrier Amplifier		dc—5 kc (70-μsec risetime)	10 μ strain/div—10,000 μ strain/div, 1-2-5 sequence, wth variable control.	\$400				
3S3—Dual Trace Sampling (for use with 3T77)	100 K—2 pf, ±3 volts max.	equivalent dc—1 Gc. (0.35 nsec risetime)	5 mv/div—100 mv/div, 1-2-5 sequence, with variable control.	\$1500 (with probes)				
3S76—Dual Trace Sampling (for use with 3T77)	50 ohms dc-coupled	equivalent dc—875 Mc. (0.4-nsec risetime)	2 mv/div—200 mv/div, 1-2-5 sequence, with variable control.	\$1100				

TIME-BASE UNITS								
TYPE	SWEEP FEATURES	TRIGGERING	PRICE					
2B67	1 μsec/div to 5 sec/div, 1-2-5 sequence, variable between rates uncalibrated. 5X Magnifier. Single Sweep.	Internal, External, Line; Amplitude-Level Selection; AC or DC-Coupling; Auto- matic or Free-Run; ± Slope.	\$175					
3B1 Normal and Delayed Sweeps—0.5 μsec/div to 1 sec/div, 1-2-5 sequence. 18 calibrated delay settings, 0.5 μsec to 10 sec, variable between rates uncalibrated.		Internal, External; Amplitude-Level Selection; AC or DC-Coupling; Automatic; ± Slope; for Normal Sweep. Same features (except no Automatic) for Delayed Sweep.	\$475					
383	Normal and Delayed Sweeps—0.5 μsec/div to 1 sec/div, 1-2-5 sequence. Continuously variable calibrated delay from 0.5 μsec to 10 sec. Single Sweep for main sweep.	Internal, External, Line; Amplitude-Level Selection; AC or DC-Coupling; Automatic; ± Slope; for Normal Sweep. Same features (except no Line or Automatic) for Delayed Sweep.	\$525					
3T77 Sampling Sweep (for use with 3S3 or 3S76)	Equivalent to 0.2 nsec/div to 10 μsec/div, 1-2-5 sequence, variable between rates uncalibrated. 10X Magnifier.	Internal, External; ± Slope.	\$650					





561A RM561A

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 10-Mc 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. Thus you can adapt them to meet your present requirements and easily and economically expand their range of operations when needed. The deflection plug-in units used are fully compatible with the companion instruments in the entire Type 560-Series.

Both the Type 561A and Type RM561A use a cathoderay tube that features an internal graticule with controllable illumination. Thus you can take photographs with the same ease provided by external graticules and make parallax-free measurements.

Occupying only 7 inches of standard rack height, the Type RM561A bolts directly to the rack but may be ordered with optional slide-out tracks at additional cost.

conventional displays: A wide range of non-sampling sensitivity and passband characteristics are available by choosing from eight 2-Series and 3-Series Amplifier Plug-In Units. Both single-trace and multi-trace display amplifiers are available. Selection of the Type 2A63 will give differential amplifier operation, while strain gage and other transducer operations are available with the Type 3C66.

Desired sweep operation can be selected by choosing from three 2-Series and 3-Series Time-Base Plug-Units.

SAMPLING DISPLAYS: The Type 3T77 Sampling Sweep Unit with either a Type 3S3 or Type 3S76 Amplifier Unit will 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.

X-Y DISPLAYS: Types 2A60, 2A63, 3A72, 3A74 and 3A75 Amplifier Units operate equally well in the vertical and horizontal compartments of the Type 561A and RM561A, permitting X-Y displays using any combination of these plug-in units.

For medium and high-frequency X-Y operation, use of two units of the same type is recommended. Deflection-circuit capacitances of the 561A and RM561A are carefully standardized to minimize high frequency phase-shift between two plug-ins of the same type when operated X-Y.

MULTIPLE X-Y DISPLAYS: Two Type 3A72 Units in the Type 561A or RM561A will provide two independent X-Y displays, properly paired; two Type 3A74 Units will provide up to four independent displays, Channel 1 plotted against Channel 1, Channel 2 against Channel 2, etc. (The Type 3A1 Unit does not provide for X-Y pairing, and is not generally recommended for obtaining multiple X-Y displays.)

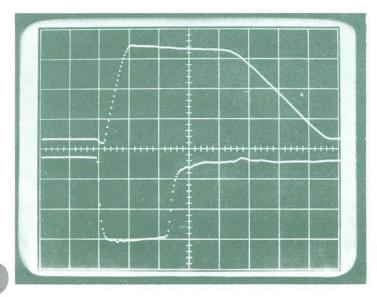
PARALLAX-FREE MEASUREMENTS—CONVENIENT PHOTOGRAPHY—

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 readings.

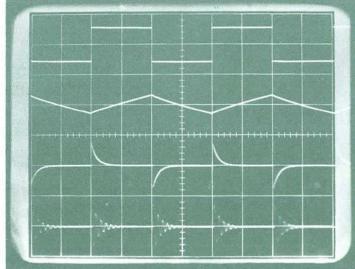
When the trace and graticule are on the same plane, as on the cathode-ray tube of the Type 561A and RM561A Oscilloscope, parallax is eliminated.

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.

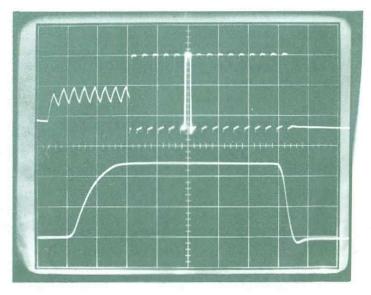
Adding to the convenience of operation are numbered settings of the illumination control that serve as an approximate exposure guide.



SAMPLING
Transistor turn-on and turn-off (upper trace). Driving pulse (lower trace).



MULTIPLE TRACES
Four traces photographed simultaneously.



DELAYING SWEEP (Double exposure Intensified portion of waveform (upper trace) expanded (lower trace) by means of delayed sweep.

561A RM561A

CHARACTERISTICS

PLUG-IN COMPARTMENTS accept all 2-Series and 3-Series Amplifier and Time-Base Units.

TEKTRONIX CRT is a flat-faced tube with internal "no parallax" graticule, controllable edge-lighting, 3.5-kv monoaccelerator, beam-deflection unblanking. A P31 Phosphor is normally supplied.

DISPLAY CONTROLS on the front-panel include Focus, Intensity, and Scale Illumination (of the 8-cm by 10-cm display area), in addition to adjustments for Astigmatism and Trace Alignment.

ILLUMINATED INTERNAL GRATICULE is edge lighted and is 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 through a terminal at the rear of the instrument permits external modulation of the crt cathode.

CALIBRATOR has 18 calibrated square-wave voltages available, from 0.2 mv to 100 v, pk-to-pk—approximately 5 μ sec risetime, at line frequency. The 0.5 calibrator voltage provides 0.1 volts into 50 ohms, for convenient amplitude calibration of sampling units.

ELECTRONICALLY-REGULATED SUPPLIES furnish all voltages required for proper operation of the Indicator and the plug-in units. Regulated dc-supply operates with line voltage between 105 v to 125 v or 210 v to 250 v, 50 to 400 cps . . . provides 85 watts for powering the 2-Series and 3-Series Plug-In Units. Supplies operate normally with or without plug-ins.

POWER REQUIREMENT is 105 v to 125 v; 50 to 400 cps; 240 watts maximum.

CABINET MODEL (561A) is $14\frac{1}{2}$ " high, 10" wide, and $21\frac{1}{8}$ " deep. Net weight is 28 pounds. Shipping weight is 39 pounds, approx.

RACK-MOUNT MODEL (RM561A) is electrically identical to the 561A except the calibrator range is from 1 mv to 100 v and the line frequency range is 50 to 60 cps. The RM561A mounts on a standard 19" rack; is 7" high and 183/8" deep. (Additional mounting information on the Catalog Instrument Dimension page.) Net weight is 30½ pounds. Shipping weight is 54 pounds, approx.

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 171. Slide-out track kits can also be ordered separately.

TYPE RM.	561A MOI) 171, with	out plu	ug-in	units .		\$565
Each ins	trument inclu	des: 1—3-wire	power	cord,	1—light	filter,	2—
instruction	n manuals.						

SLIDE-OUT TRACK KIT (Part No. 351-050) \$45

ACCESSORIES

SCOPE-MOBILE® CARTS

The Type 561A can be given in-plant portability through use of proper Scope-Mobile[®] Carts. Scope-Mobile Carts for the Type 561A have an adjustable tray that tilts and locks in any of nine positions for best oscilloscope viewing angle, 5-inch rubber wheels, two-wheel brakes, and a linoleum-topped shelf on the bottom.

Two carts are available for the Type 561A Oscilloscope. One cart, the Type 201-1, has a drawer installed. Installed in the other cart, the Type 201-2, is both a drawer and a plug-in carrier that provides dust-free storage for two plug-in units.

See Catalog Accessory Section for additional information. TYPE 201-1, with drawer, (Part No. 016-045) \$120 TYPE 201-2, with drawer-carrier (Part No. 016-046) \$130 ®Registered Trademark, Tektronix, Inc.

BLANK PLUG-IN CHASSIS

This chassis contains necessary mechanical parts for construction of a custom plug-in for Type 560-Series Oscilloscopes—including frame, blank front panel, blank chassis, 24-pin connector, latch, and small hardware. Instructions are included on permissible power-supply loading and crt signal requirements. Electrical components are not included.

Blank Plug-In Chassis, Part No. 040-245 \$15

PROBES

Attenuator probes are not included with the Type 561A or RM561A Oscilloscopes. Tektronix probes are recommended when minimum loading of the circuit is required.

The following probes are recommended for use with the Type 2-Series and 3-Series Amplifier Plug-In Units.

See Accessory Section for complete information on the probes.

NON-SAMPLING PROBES

		Input Imp	edance			
	Use	R	C	Rating	Probe No.	Price
1:1	Attenuator	1 meg Ω	97 pf	600 v max	P6028	\$12.50
10:1	Attenuator	10 meg Ω	9.5 pf	600 v max	P6006	22.00
1000:1	High Voltage	100 meg Ω	3 pf	12 kv max	P6013	75.00
1000:1	High Voltage	100 meg Ω	2.7 pf	4 kv max	P6015	200.00
	Current	"我们是我们的		15 amps max	P6016	75.00

SAMPLING PROBES

	Input Im	pedanc	e		
Use	R	С	Rating	Probe No.	Price
10:1 Attenuator	500 Ω	0.7 pf	50 vdc-500 vac	P6034	\$35.00
100:1 Attenuator	5 k Ω	0.6 pf	16 vdc-500 vac	P6035	35.00
Selectable Attenuator	10 meg Ω	varies	varies	P6032	220.00
Current			500 ma	CT1 /P6040	31.00

POLARIZED VIEWER

Under high ambient-light conditions it is often difficult to view oscilloscope traces unless the trace intensity is greatly increased. Many times this is not feasible. The new Tektronix Polarized Viewer makes it easy to see oscilloscope traces of normal to low intensity even with high ambient light.

The curved, circularly polarized filter in the viewer greatly reduces troublesome reflections and glare, with no distortion of the trace. And, the Polarized Viewer allows considerable freedom of movement for the operator—it is not necessary to peer through a narrow eyepiece of any sort.

The Polarized Viewer slips on or off the rectangular graticule covers of the Type 561A or RM 561A in seconds.

Rectangular Polarized Viewer (Part No. 016-039) \$10

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



STORAGE OSCILLOSCOPE Type

MULTI-PURPOSE

10 AMPLIFIER PLUG-IN UNITS

4 TIME-BASE PLUG-IN UNITS

X-Y DISPLAYS

CONVENTIONAL AND STORED DISPLAYS

CHARACTERISTIC SUMMARY

VERTICAL

Vertical deflection characteristics extremely flexible through use of 10 Amplifiers of the 2-Series and 3-Series Plug-In Units. Full passband capabilities of plug-in units available in conventional operation.

HORIZONTAL

Horizontal deflection characteristics extremely flexible through use of 4 Time-Base Units and 10 Amplifiers of the 2-Series and 3-Series Plug-In Units.

CRT

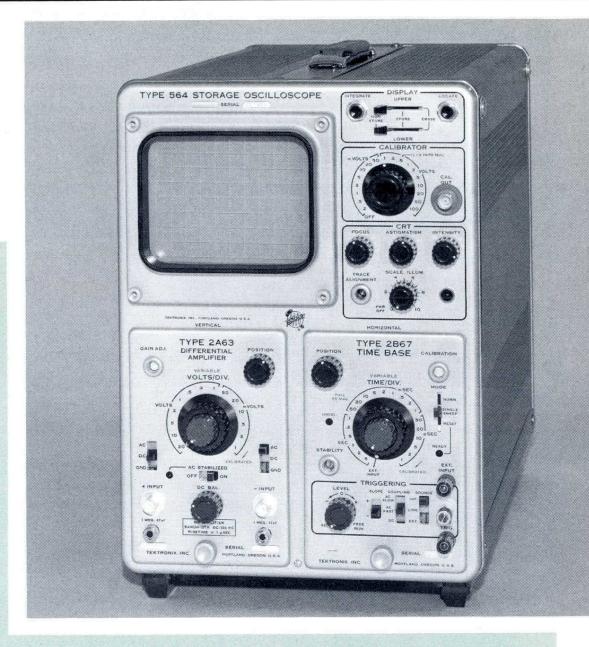
DISPLAY AREA—8 x 10 cm. ACCELERATING VOLTAGE—3.5 kv.

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.

LOCATE BUTTON—Determines vertical position of next trace.



OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mv to 100 v, and 0.1 v into 50 Ω , power line frequency. POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 50 to 400 cps.

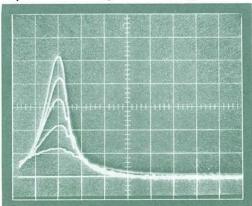
The non-storage capability lends itself to conventional oscil-

loscope displays within the passband and sweep speed

specifications of the plug-in units.

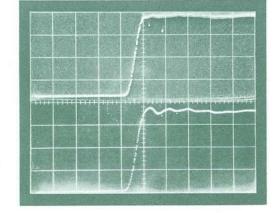
FOR STORAGE AND CONVENTIONAL DISPLAYS

The storage capability lends itself to single-shot signals at slow or medium speeds . . . and repetitive signals at fast speeds using the integration technique.



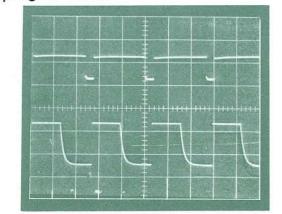
SHOCK TEST

Display shows ability of the Type 564 to store consecutive events for comparison or photography. Waveforms indicate shock imparted by dropping sub-table weight of 5 lbs. from different heights. Drop of 5" = 50.5 g's; 10" = 92.5 g's; 15" = 142 g's; 20" = 181 g's; 25" = 214 g's. Sweep Speed is 2 msec/cm.



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.



INPUT-OUTPUT WAVEFORMS

Display shows ability of the Type 564 to store similar waveforms for easy comparison.

Upper trace shows the trigger input to a multivibrator.

Lower trace shows the output.

2-SERIES AND 3-SERIES PLUG-IN UNITS

AMPLIFIER UNITS								
ТҮРЕ	INPUT (ac or dc coupled)	† PASSBAND (3-db down)	SENSITIVITY	PRICE				
2A60-Single Trace	1 megohm—47 pf, 600 v max.	dc—1 Mc.	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 cps—300 kc	10 μv/div—20 mv/div, 1-2-5 sequence.	\$385				
2A63—Differential (50:1 rejection ratio)		dc—300 kc.	1 mv/div—20 v/div, 1-2-5 sequence, with variable control.	\$130				
3A1—Dual Trace (identical channels)		dc—10 Mc.	10 mv/div—10 v/div, 1-2-5 sequence, with variable control. 6 cm linear scan	\$410				
3A72—Dual Trace (identical channels)	1 megohm—47 pf, 600 volts max.	dc—650 kc.	10 mv/div—20 v/div, 1-2-5 sequence, with variable control.	\$250				
3A74—Four Trace (identical channels)		dc—2 Mc.	20 mv/div—10 v/div, 1-2-5 sequence, with variable control.	\$550				
3A75—Single trace		dc—4 Mc.	50 mv/div—20 v/div, 1-2-5 sequence, with variable control.	\$175				
3C66—Carrier Amplifier		dc—5 kc (70-μsec risetime)	10 μ strain/div—10,000 μ strain/div, 1-2-5 sequence, wth variable control.	\$400				
3S3—Dual Trace Sampling (for use with 3T77)	100 K—2 pf, ±3 volts max.	equivalent dc—1 Gc. (0.35 nsec risetime)	5 mv/div—100 mv/div, 1-2-5 sequence, with variable control.	\$1500 (with probes				
3S76—Dual Trace Sampling (for use with 3T77)	50 ohms dc-coupled	equivalent dc—875 Mc. (0.4-nsec risetime)	2 mv/div—200 mv/div, 1-2-5 sequence, with variable control.	\$1100				

	TIME-BASE	ONTIS		
TYPE	SWEEP FEATURES	TRIGGERING	PRICE \$175	
2B67	1 μsec/div to 5 sec/div, 1-2-5 sequence, variable between rates uncalibrated. 5X Magnifier. Single Sweep.	Internal, External, Line; Amplitude-Level Selection; AC or DC-Coupling; Auto- matic or Free-Run; ± Slope.		
3B1 Normal and Delayed Sweeps—0.5 μsec/div to 1 sec/div, 1-2-5 sequence. 18 calibrated delay settings, 0.5 μsec to 10 sec, variable between rates uncalibrated.		Internal, External; Amplitude-Level Selection; AC or DC-Coupling; Automatic; ± Slope; for Normal Sweep. Same features (except no Automatic) for Delayed Sweep.	\$475	
3B3	Normal and Delayed Sweeps—0.5 μsec/div to 1 sec/div, 1-2-5 sequence. Continuously variable calibrated delay from 0.5 μsec to 10 sec. Single Sweep for main sweep.	Internal, External, Line; Amplitude-Level Selection; AC or DC-Coupling; Automatic; ± Slope; for Normal Sweep. Same features (except no Line or Automatic) for Delayed Sweep.	\$525	
3T77 ampling Sweep (for use with 3S3 or 3S76)	Equivalent to 0.2 nsec/div to 10 μsec/div, 1-2-5 sequence, variable between rates uncalibrated. 10X Magnifier.	Internal, External; ± Slope.	\$650	

The Type 564 is a versatile general-purpose oscilloscope that uses plug-in units for both the vertical and horizontal deflection systems. Thus you can adapt it to meet your present requirements and easily and economically expand its range of operation when needed. The deflection plug-in units used are fully compatible with the companion instruments in the entire Type 560-Series.

In addition to its normal operation, greater versatility is enjoyed with the ability of the Type 564 to store displays. Independent control of either half of the split-screen crt allows the full screen to be used for storage or conventional displays. In addition, one-half of the screen can be used for storage displays while the other half is used for conventional displays, or as a preview area.

AVAILABLE DISPLAYS

Several types of displays are available for both storage and conventional operation of the Type 564. The Type 2-Series and 3-Series Plug-In Units provide a wide range of sensitivity and passband characteristics. (For stored displays however, the deflection characteristics, are limited by the stored-mode writing characteristics of the crt used.)

Single-trace and multi-trace displays are obtained by selecting either sampling or non-sampling amplifier plug-in units. Selection of the Type 2A63 gives differential amplifier operation, while strain gage and other transducer operations are available with the Type 3C66.

Single X-Y displays result from using any combination of the Type 2A60, 2A63, 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 displays are available by using two multi-trace amplifiers. Two Type 3A72 Units provide two independent X-Y displays, properly paired; two Type 3A74 Units provide up to four independent displays, Channel 1 plotted against Channel 1, Channel 2 against Channel 2, etc. (The Type 3A1 Unit does not provide for X-Y pairing, and, is not generally recommended for obtaining multiple X-Y displays.)

Sampling displays with risetimes in the sub-nanosecond region are obtained by using the Type 3T77 Sampling Sweep Unit with either a Type 3S3 or Type 3S76 Amplifier Unit. Either combination will provide a dual-trace display and a single or dual X-Y display. The Type 3S3 provides a system with a high impedance low capacitance input while the Type 3S76 provides a 50-ohm input system.

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.
- 3. Photograph only those stored waveforms you want.
- 4. Compare 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.

STORAGE TIME over one hour.

ERASURE TIME is only 0.25 second.

SINGLE SHOT SIGNALS at slow or medium speeds are easily stored for extended viewing time (within writing-rate capabilities of crt selected).

REPETITIVE SIGNALS at high-speeds can be stored with the integrate technique. Using the integrate feature provides an increase in stored writing rate by 10 times on 12 repetitive traces thus permitting storage of displays much faster than the stated writing rate of the crt.

SPLIT SCREEN allows the operator to store on one-half of the screen and non-store on the other half of the crt screen. Also the entire screen may be used for either storage or conventional displays.

TWO CRTS available for optimum performance in your application. Please read CRT PERFORMANCE that appears later for stored-writing rate and intensity of each tube.

CHARACTERISTICS

PLUG-IN COMPARTMENTS accept 2-Series and 3-Series Amplifier and Time-Base Units.

CRT is a flat-faced tube with beam-deflection blanking and an accelerating voltage of 3.5 kv. It has split-screen storage capabilities with individual storage controls for each half of the screen. Storage time to over one hour with an erase time of 0.25 sec, approx.

LOCATE 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 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 through a terminal at the rear of the instrument permits external modulation of the crt cathode.

CALIBRATOR has 18 amplitude-calibrated square-wave voltages available, from 0.2 mv to 100 v, pk-to-pk; approximately 5 μ sec risetime, at line frequency. The 0.5 v calibrator switch position provides 0.1 volts (pk-to-pk) into 50 ohms, for convenient calibration of sampling units.

ELECTRONICALLY-REGULATED SUPPLIES furnish all voltages required for proper operation of the Indicator and the plug-in units. Regulated dc supply operates with line voltage between 105 v to 125 v or 210 v to 250 v, 50 to 400 cps. . . max. 230 watts, approx.

MECHANICAL FEATURES include dimensions of $13\frac{1}{2}$ " high by $9^{3}\frac{1}{4}$ " wide by $21\frac{1}{2}$ " deep. Net weight is $30\frac{1}{2}$ pounds. Shipping weight is 41 pounds, approx.

ORDERING INFORMATION

The Type 564 has the storage tube T5640-200 (stored display of highest intensity).

The Type 564 MOD 08 has the storage tube T5640-201 (fastest writing rate).

TYPE 564 MOD 08 (without plug-in units) \$950 Each instrument includes: 1—polarized viewing hood, 1—3-wire power cord, 2—instruction manuals.

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 Section for complete information on the probes.

NON-SAMPLING PROBES

		Input Impe	edance			
	Use	R	С	Rating	Probe No.	Price
1:1	Attenuator	1 meg Ω	97 pf	600 v max	P6028	\$12.50
10:1	Attenuator	10 meg Ω	9.5 pf	600 v max	P6006	22.00
1000:1	High Voltage	100 meg Ω	3 pf	12 kv max	P6013	75.00
1000:1	High Voltage	100 meg Ω	2.7 pf	4 kv max	P6015	200.00
	Current			15 amps max	P6016	75.00

SAMPLING PROBES

	Input Impe	dance				a store a particular	
Use	R	C		Rating		Probe No.	Price
10:1 Attenuator	500 Ω	0.7 pf	16	vdc-500	vac	P6034	\$35.00
100:1 Attenuator	5 k Ω	0.6 pf	50	vdc-500	vac	P6035	35.00
Selectable Attenuator	10 meg Ω	varies		varies		P6032	220.00
Current				500 ma		CT1/P6040	31.00

SCOPE-MOBILE® CARTS

Two Scope-Mobile[®] carts are available for the Type 564 Oscilloscope. One cart, the Type 201-1, has a drawer installed. Installed in the other cart, the Type 201-2, is both a drawer and a plug-in carrier that provides dust-free storage for two plug-in units.

See Catalog Accessory Section for additional information. TYPE 201-1, with drawer (Part No. 016-045) ... \$120 TYPE 201-2, with drawer-carrier (Part No. 016-046) \$130 ®Registered Trademark, Tektronix, Inc.

BLANK PLUG-IN CHASSIS

This chassis contains necessary mechanical parts for construction of a custom plug-in for Type 560-Series Oscilloscopes—including frame, blank front panel, blank chassis, 24-pin connector, latch, and small hardware. Instructions are included on permissible power-supply loading and crt signal requirements. Electrical components are not included.

BLANK PLUG-IN CHASSIS (Part No. 040-245) \$15

CRT PERFORMANCE

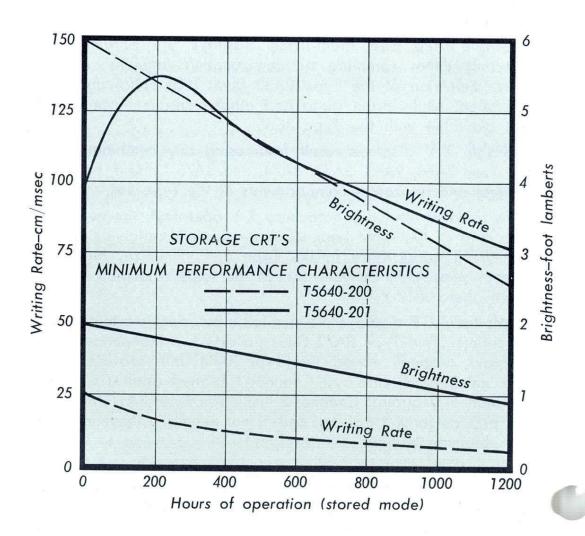
There are two storage tubes available for use in the Type 564 Oscilloscope. Both tubes exhibit characteristics of a conventional crt when used in the non-stored mode. However, when used in the stored mode, each tube has its own set of brightness and writing rate characteristics that differ from the non-stored operation characteristics.

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 rate and intensity for stored-mode operation. If the maximum writing rate is exceeded, a stored display is not generated. The intensity of a stored display for an individual tube is one value regardless of the intensity of the beam that generated it.

One tube, the Type T5640-200, has the brightest stored display. The other tube, the Type T5640-201, has the fastest writing rate. The graph below indicates the minimum stored-mode brightness and writing rate characteristics that can be expected from the crts for up to 1200 hours of stored operation. (The curves on the graph should not be extrapolated beyond the times shown.)

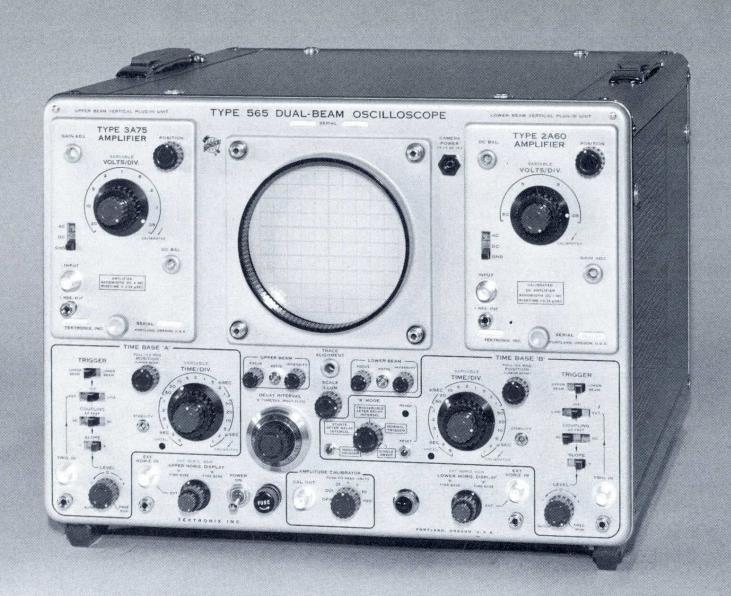
The brightness curves on the graph represent values measured with a Spectra Spot Brightness Meter at operating level with the entire screen faded positive. The writing rate curve was obtained with a crt beam of 30 μ amps. The hours shown are the actual hours the crt is used in the stored mode with repetitive 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 rates shown. Therefore to obtain maximum crt performance and service, the oscilloscope should be in the non-stored mode when stored displays are not needed.





DUAL-BEAM OSCILLOSCOPE Type



TWO COMPLETELY INDEPENDENT BEAMS
TWO INDEPENDENT SWEEP SYSTEMS
PLUG-IN VERTICAL AMPLIFIERS
DELAYING-SWEEP OPERATION
SINGLE-SWEEP OPERATION
REAR-PANEL OUTPUT CONNECTORS

CHARACTERISTIC SUMMARY VERTICAL

Vertical deflection characteristics extremely flexible through use of eight 2-Series and 3-Series Non-Sampling Plug-In Units.

HORIZONTAL

CALIBRATED SWEEP RANGE—1 µsec/div to 5 sec/div.

SWEEP MAGNIFIER—10X, extends sweep range to 0.1 $\mu sec/div$.

TRIGGER REQUIREMENTS-

Internal: 2 minor divisions of deflection up to 50 kc, increasing to 1 major division at 2 Mc.

External: 0.5 v up to 50 kc, increasing to 1 v at 2 Mc.

CALIBRATED SWEEP DELAY—10 $\mu {\rm sec}$ to 50 sec, continuously variable.

EXTERNAL INPUT—Approx. 100 v/div to 300 v/div: dc to 350 kc; 100 kilohms, $\pm 20\%$.

CRT

DISPLAY AREA—10 x 10 cm (each beam 8 cm vertical, overlap of the two beams is 6 cm). Graticule division equals 1 cm, minor division equals 2 mm.

ACCELERATING VOLTAGE-4 kv.

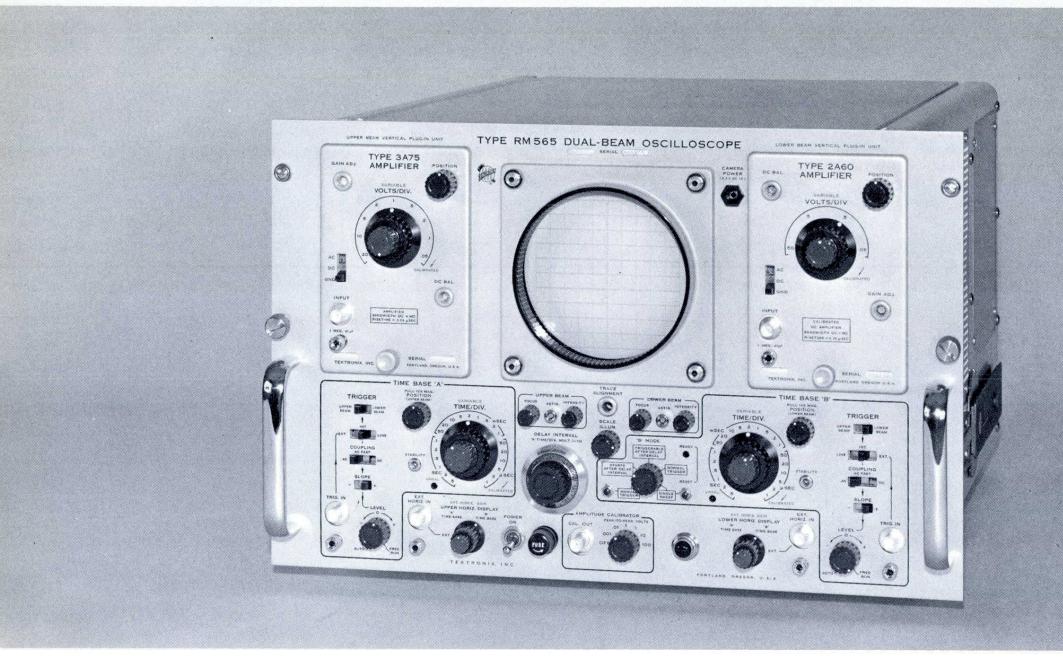
OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—1 mv to 100 v, 1-kc square wave.

REAR-PANEL OUTPUT CATHODE FOLLOWERS—Output impedance approx. 550 ohms; max. load 2 ma.

POWER REQUIREMENTS—105 to 125 v or 210 to 250 v, 600 watts max.

565 RM565



2-SERIES AND 3-SERIES NON-SAMPLING AMPLIFIERS

TYPE	INPUT (ac or dc coupled)	† PASSBAND (3-db down)	SENSITIVITY	PRICE
2A60-Single Trace	1 megohm—47 pf, 600 v max.	dc—1 Mc.	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 cps—300 kc	10 μv/div—20 mv/div, 1-2-5 sequence.	\$385
2A63—Differential (50:1 rejection ratio)		dc—300 kc.	1 mv/div—20 v/div, 1-2-5 sequence, with variable control.	\$130
3A1—Dual Trace (identical channels)		dc—10 Mc.	10 mv/div—10 v/div, 1-2-5 sequence, with variable control. 6 cm linear scan	\$410
3A72—Dual Trace (identical channels)	1 megohm—47 pf, 600 volts max.	dc—650 kc.	10 mv/div—20 v/div, 1-2-5 sequence, with variable control.	\$250
3A74—Four Trace (identical channels)		dc—2 Mc.	20 mv/div—10 v/div, 1-2-5 sequence, with variable control.	\$550
3A75—Single trace		dc—4 Mc.	50 mv/div—20 v/div, 1-2-5 sequence, with variable control.	\$175
3C66—Carrier Amplifier		dc—5 kc (70-μsec risetime)	10 μstrain/div—10,000 μstrain/div, 1-2-5 sequence, wth variable control.	\$400

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 non-sampling Plug-In Units.

The horizontal amplifiers are built-in and can be driven by either of two sweep systems, simultaneously or independently, or from its 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 cathode-follower outputs of: Vertical Signals, Horizontal Signals, +Gates, and Delayed Trigger.

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.

TRIGGER

SENSITIVITY—0.5 volts or 2 minor divisions up to 50 kc, decreasing to 1 volt or 1 cm at 2 Mc.

"AC" coupling time constant—approx. 10^{-2} sec (.01 μf and 1 meg).

"AC FAST" coupling time constant—10⁻⁵ sec (100 pf and 100 k).

HORIZONTAL SWEEP GENERATORS

RANGE—1 μ sec/div to 5 sec/div in 21 calibrated steps, 1-2-5 sequence. Accuracy within 3%.

VARIABLE—Control permits continuous adjustment uncalibrated from 1 µsec/div to 12 sec/div.

MAGNIFIER—10X Magnifier permits expanding any 1 division portion of the display a full 10 divisions, accuracy within 5%. The magnifier can be used to extend the sweep rate to 0.1 μ sec/div.

HORIZONTAL AMPLIFIERS

SENSITIVITY—Approximately 100 mv/div to 300 v/div, continuously adjustable.

INPUT RESISTANCE—100 kilohms, $\pm 20\%$.

PASSBAND—dc-to-350 kc, at maximum sensitivity.

DELAY INTERVAL

RANGE—10 μ sec to 50 sec calibrated and continuously adjustable.

INCREMENTAL ACCURACY—Within 0.5%.

JITTER-1 part in 20,000.

CALIBRATOR

RANGE—1 mv to 100 v pk-to-pk in 6 decade steps, positive-going square wave.

ACCURACY-Within 3%.

FREQUENCY—Approximately 1 kc.

REAR-PANEL OUTPUT CATHODE FOLLOWERS

OUTPUT IMPEDANCE—500 ohms, approximately.

MAXIMUM LOAD CURRENT-2 ma.

VERTICAL OUTPUT—Signal amplitude, dc level, and transient response are dependent upon the vertical plug-in unit used. Typical signal amplitude, 2 v/div to 4 v/div of display; dc level, ±20 volts.

HORIZONTAL OUTPUT—Signal amplitude, at least 50 mv/div of display in External position and 0.5 v/div of display in Sweep position; dc level, 0 to +5 vlots.

+ GATE—Pulse height, 20 v minimum; dc level, zero volts.

DELAYED TRIGGER—Fast-rise pulse amplitude, +8 v minimum; dc level, zero volts.

REAR PANEL POWER PLUG

OUTPUTS—Power supply outputs for future accessories.

POWER REQUIREMENT

OPERATION-105 v to 125 v, 50 to 60 cps.

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

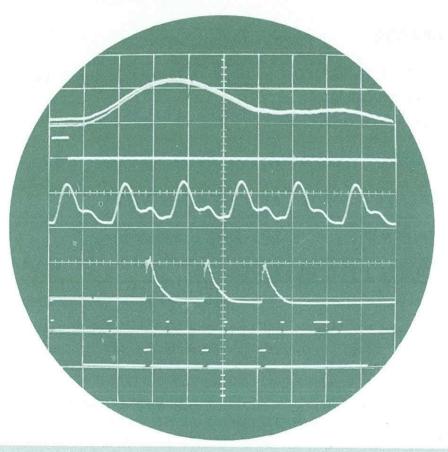
(pertain to both sweep systems except as indicated for "B" sweep)

TRIGGER FACILITIES

Trigger selection is accomplished by slide-switch logic. This arrangement allows quick selection and quick visual checks. Sequence is as follows:

- 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-cps rate (in the absence of a signal) giving a reference trace but will automatically trigger on incoming trigger signals of a higher frequency. At the CW stop of this control, the sweep free runs.

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 sec/div. Lower Beam sweep rate is 0.5 sec/div. The configurations show:

- 1. Arterial Pressure at 50 mm Hg/cm
- 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 using 4-kv accelerating potential.

VERTICAL SCAN—8 cm (each beam), overlap of the two beams is 6 cm.

HORIZONTAL SCAN-10 cm.

CONTROLS—Focus, Intensity, and Astigmatism (separate controls for each beam).

INTERNAL CONTRAST CONTROL—for the intensified section of the "A" sweep.

DEFLECTION-AXIS ROTATER—(front panel screw driver adjustment) for electro magnetically rotating the deflection axis to match the graticule lines.

SCALE ILLUMINATION CONTROL—With controllable edge lighting.

PHOSPHOR—P2 is normally supplied. See phosphor chart for others available.

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 23¾" 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 121/4" 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 DUAL-BEAM OSCILLOSCOPE\$1400
Each instrument includes: 1—power cord, 2—dual binding-post adapters, 1—test lead, 1—green filter, 2—instruction manuals.

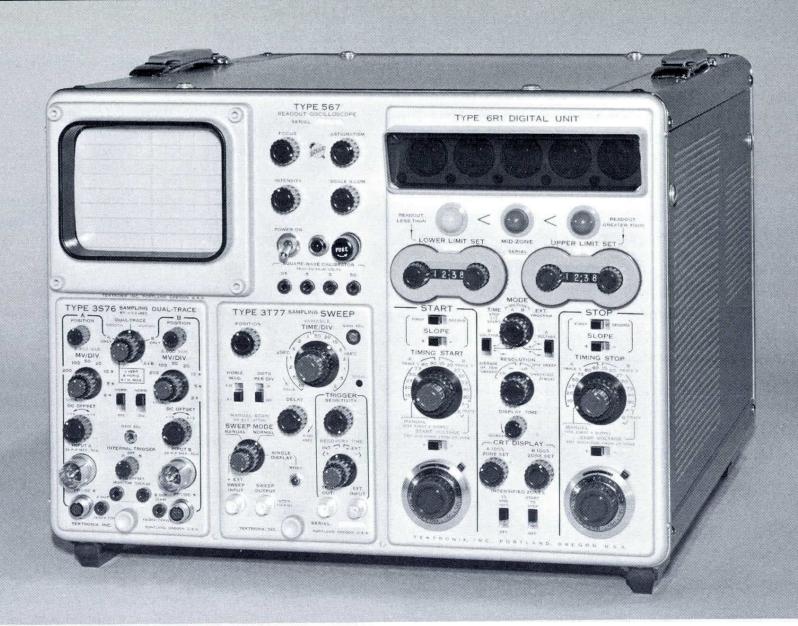
TYPE RM565 DUAL-BEAM OSCILLOSCOPE \$1500 Each instrument includes: 1—power cord, 2—dual binding-post adapters, 1—test lead, 1—light filter, 1—pair guide rails, 2—instruction manuals.

SUPPORTING CRADLES

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



DIGITAL READOUT OSCILLOSCOPE Type



DIGITAL READOUT PLUS ANALOG DISPLAYS

DIGITAL READOUT PLUS ANALOG DISPLAYS

DIGITAL READOUT OF RISETIME

DIGITAL READOUT OF AMPLITUDE

DIGITAL READOUT OF TIME DIFFERENCES

SELECTABLE HIGH AND LOW NO-GO LIMITS

EXTERNALLY PROGRAMMABLE

DIGITAL AND GO/NO-GO OUTPUTS

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 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 measurement points on the displayed waveform, then read data directly in four-digit resolution—tell instantly, by means of indicator lights, whether a measurement is IN, ABOVE, or BELOW preset limits. Using sampling units and the digital unit in a Type 567 you can obtain digital readings of events within the range of microseconds to picoseconds.

Many accessories and associated instruments are available to add to the operational versatility of the Type 567. For example, with the new Tektronix Type 262 Programmer you can very conveniently externally program the Type 567—with completely automatic or manual sequencing of programs.

On a production line or in a laboratory, the Type 567 Readout Oscilloscope can speed-up and simplify your measurement applications.

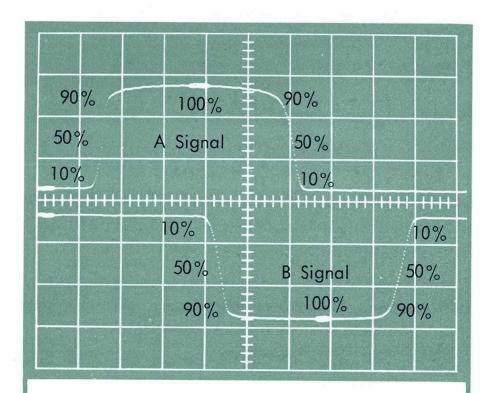
WHAT THE TYPE 567 READOUT OSCILLOSCOPE CAN DO

The Type 567 Readout Oscilloscope utilizes a Type 6R1 Digital Unit and either of two sets of vertical and time-base units for digital readout with a simultaneous crt display.

One set is the Type 3S76 Dual-Trace Sampling Unit with the Type 3T77 Sampling Sweep Unit—ofr 0.4-nsec risetime dual-trace sampling displays and readout.

The other set is the Type 3S3 Dual-Trace Sampling Unit with the Type 3T77 Sampling Sweep Unit—for dual-trace sampling displays and readout with smoothing and risetime controls, and retention of full sensitivity even when operated from source impedances above 50 ohms.

For additional versatility, when digital readout is not needed, the Type 567 will operate with any other Tektronix 2 and 3-Series Plug-In Units—with or without the Type 6R1 Digital Unit.



DUAL-TRACE DISPLAY SHOWING TYPICAL MEASUREMENTS

3110 11 1110	TITICAL MILASURLMILINIS	
MEASUREMENT	6R1 PROGRAM	
	Start	Stop
Risetime A	+10%A	+90%A
Falltime A	-90%A	—10%A
Risetime B	—10%B	−90%B
Falltime B	+90%B	+10%B
Delay A to B	+10%A	—10%B
Storage A to B	−90%A	+90%B
Turn on A to B	+10%A	−90 % B
Turn off A to B	—90%A	+10%B
Width A	+50%A	—50%A
Width B	−50 % B	+50%B

With digital and sampling units in a Type 567 you can:

- 1. Read, digitally, time differences as small as 20 psec up to 100 μsec—displayed-pulse risetimes as fast as 0.4 nsec—pulse amplitudes as small as 2 mv, pk-pk.
- 2. Control start and stop time of measurements on each input signal or between either input signal through automatic timing systems.
- 3. Measure time intervals between selected percentage points (10, 20, 27, 50, 73, 80, 90) on one or both dual-trace waveforms—thus eliminate the need to manually "line-up" the display.
- 4. Initiate and/or stop time-interval measurements by means of continuously-variable calibrated amplitude-discriminators or by any combination of percentage, amplitude, polarity—first or second pulse crossing.
- 5. Readout peak amplitude between 0% and 100% points on the displayed waveform.
- Set 0% and 100% zones that automatically normalize themselves with changes in amplitude or vertical position, or time measurements independent of dc position or pulse amplitude.
- 7. Select and intensify measurement points on the display for easy cross-reference with the digital information.
- 8. Preset the digital comparators for automatic readings of three categories: (1) less than lower limit preset, (2) greater than upper limit preset, (3) mid-zone, through upper and lower limits.
- 9. Readout, in up to four digit resolution, the actual measurement. Decimal point and class of indication (nsec, µsec, msec, mv, v) are automatically presented when time/div, amplitude/div, or program is changed.
- 10. Use external program control such as punch-tapes or stepping relays for automatic sequential operation in automatic-test systems—systems check-out—component testing—microcircuit testing.
- 11. Provide digital and go/no-go outputs for use with printers, summary punches, etc.
- 12. Use the Type 262 Programmer to externally program and sequence the Type 6R1 for any measurement that can be made manually through use of the Type 567/6R1 front-panel controls.
- 13. Trigger internally from either vertical input, as well as externally.

HOW THE TYPE 567 READOUT OSCILLOSCOPE MEASURES TIME

SAMPLING PROCESS

With each repetition of a signal, the circuit measures one point (sample) at a time a little later than the last sample. This process of advancing the sampling time in fixed increments is called strobing. A reconstructed signal, much slower than the original signal, is reproduced on the crt as an amplitude vs. time, point-to-point graph.

EQUIVALENT TIME BASE CLOCK

The equivalent time between each sample depends upon the number of samples per centimeter and the sweep time per centimeter. For instance, 1 nsec/cm and 100 samples/cm = 10 psec/sample. By counting the number of samples between two selected portions of a waveform, the time between these portions can be measured.

AUTOMATIC REFERENCE ZONES

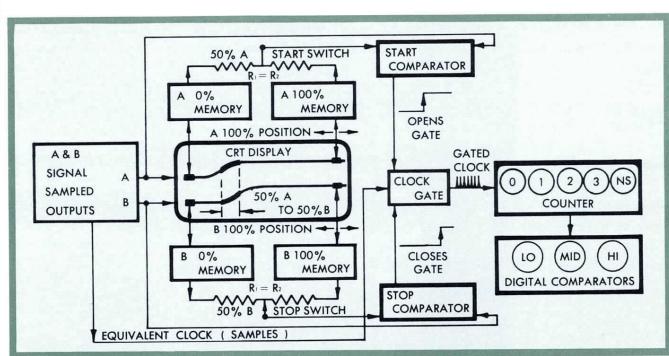
Two intensified zones on each trace indicate 0% and 100% zones. The 0% zone is fixed at the start of the trace. The 100% zone can be positioned at any point on the display the user may want to designate as 100% amplitude. After the first sweep, the amplitudes corresponding to the four zones are stored in memory circuits. Changes in amplitude, vertical position, or waveform automatically re-establish new 0% and 100% memory amplitudes.

START-STOP SYSTEM

In a typical measurement, voltage divider taps between the 0% and 100% memory outputs are set for start and stop timing at selected percentage points such as 10, 20, 27, 50, 73, 80, and 90% of either waveform. The selected percentage reference levels are then compared against the sampled input waveform on the second sweep. Coincidence of the waveform amplitudes with the selected percentage reference amplitudes is sensed by comparators which open and close the clock gate to the digital counter. The crt display can be intensified for the duration of the measured interval as a reference check. The number of clock pulses are read out digitally in nanoseconds, microseconds, or milliseconds, with decimal points included.

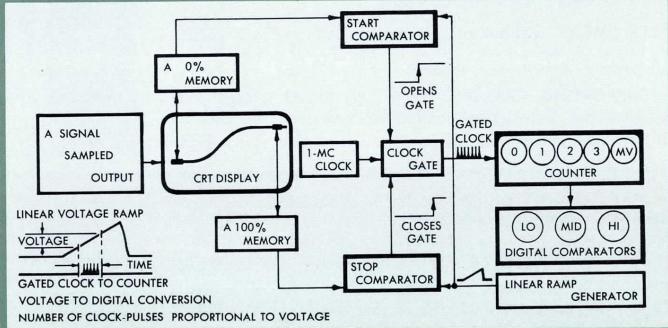
HOW IT MEASURES VOLTAGE

Start and stop comparators gate 1-mc clock pulses for the period of time that a linear ramp voltage is at values between the 0% and 100% amplitudes. The number of clock pulses is proportional to the voltage between the selected measurement points. Readout is in millivolts and volts, with decimal points included.



TYPE 567
BLOCK DIAGRAM
MEASURING TIME

TYPE 567
BLOCK DIAGRAM
MEASURING VOLTAGE



READOUT OSCILLOSCOPE

AMPLITUDE CALIBRATOR is at line frequency and has 4 calibrated pk-to-pk square wave voltages of $0.05\,v$, $0.5\,v$, $5\,v$, and $50\,v$ available at front panel. The $0.5\,v$ position provides $100\,mv$ into a $50-\Omega$ load, for convenient calibration of sampling plug-ins.

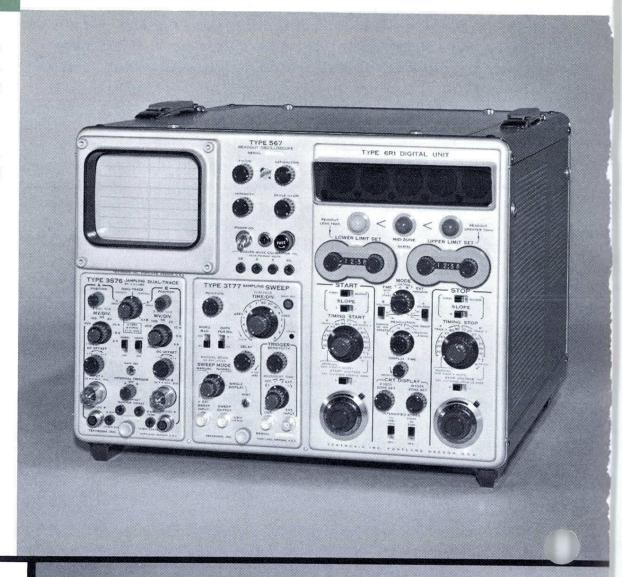
DC-VOLTAGE SUPPLIES are electronically regulated to compensate for widely varying line conditions. Separate regulated heater supply is provided.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v, 50 to 60 cps, (approximately 405 watts with Type 3S76, 3T77, 6R1 Units). A thermal cutout switch prevents overheating of the instrument.

CATHODE-RAY TUBE is a 5-inch rectangular crt using 3.5-kv accelerating potential. A P2 phosphor is normally supplied.

ILLUMINATED GRATICULE has controlled edge-lighting and is marked in 8 vertical and 10 horizontal cm divisions.

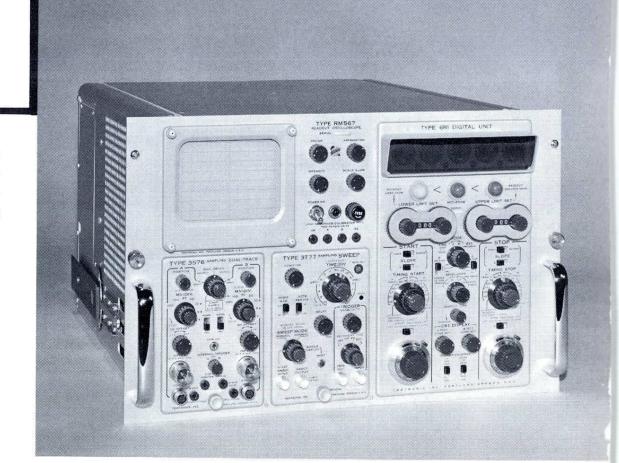
MECHANICAL SPECIFICATIONS: Dimensions are $13^5/8''$ high by 17" wide by 23" deep. Net weight is 49 pounds. Shipping weight is 76 pounds, approx.



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

MECHANICAL SPECIFICATIONS: Dimensions are 121/4" high by 19" wide by 22" deep. Net weight is 501/2 pounds. Shipping weight is 85 pounds, approx.



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 012-066 (24-pin extension) \$23.00

Circuit-Board Extensions for Digital Unit

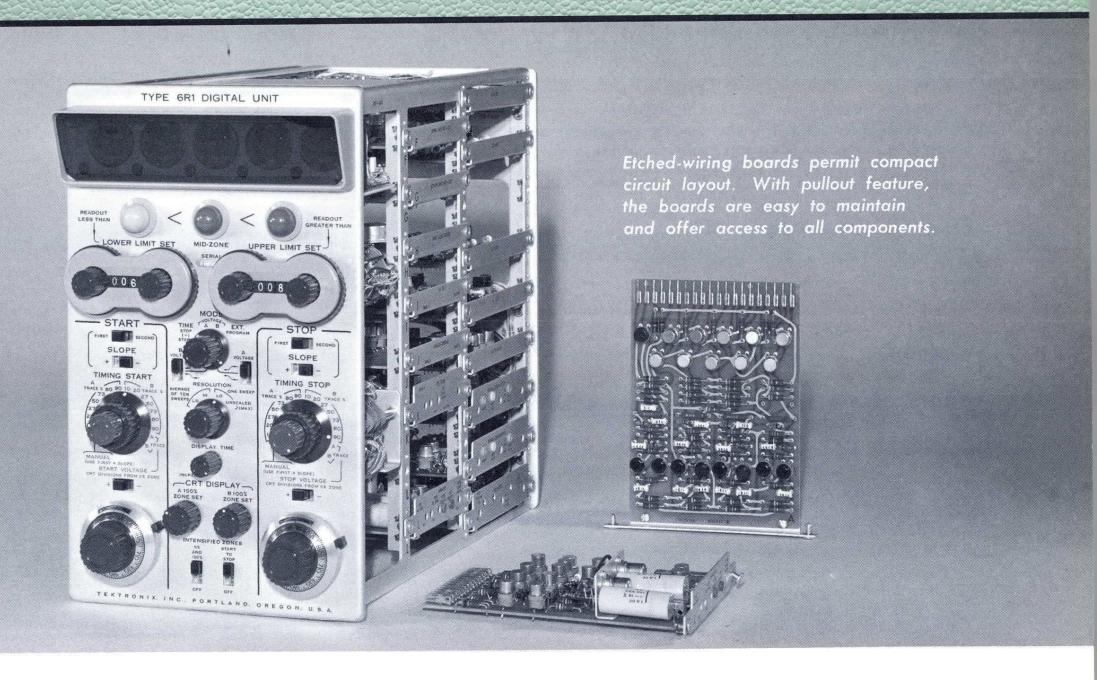
Order Part Number 012-067 (15-pin extension) \$20.00

Order Part Number 012-068 (20-pin extension) \$25.00

These items are offered for the convenience of companies with in-plant instrument-maintenance facilities. If your company has this facility, or if you intend performing your own maintenance, please include 2 plug-in extensions and 2 circuit-board extensions (one each of 15-pin and 20-pin extensions). One set of 4 will usually be adequate for maintenance of several instruments.



DIGITAL UNIT Type



PRESENTS OSCILLOSCOPE MEASUREMENTS IN DIGITAL FORM

DIGITAL READOUT PARAMETERS

PULSE AMPLITUDE
PULSE RISE AND FALL
PULSE WIDTH
TIME INTERVAL

PROVISIONS FOR EXTERNAL PROGRAMMING AND READOUT

LIMIT SETTINGS AND INDICATORS

The Type 6R1 Digital Unit equips a Tektronix Type 567 Oscilloscope for digital readout. Used with vertical and timing units for the crt displays, the Type 6R1 enables presentation of digital data for a wide variety of repetitive-pulse measurements. The digital presentations can designate voltage measurements, time-difference measurements between similar pulses, and time-difference measurements between percentages of pulse amplitudes. In addition, the Type 6R1 has provision for external programming to facilitate automatic sequential operations. The Type 6R1 enables these time and amplitude measurements to be read directly with up to 4 digit units of measurement.

The 6R1 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.

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).

6R1

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.

MODE SWITCH

TIME STOP-START enables operation if start and stop timing systems.

VOLTAGE A measures voltage on A-channel trace between the 0% and 100% zones.

VOLTAGE B measures voltage on B-channel trace between the 0% and 100% zones.

EXTERNAL PROGRAM allows the start-stop and other functions of the 6R1 to be programmed externally from a remote or automatic sequencer. Easy access to the 6R1 circuits is provided.

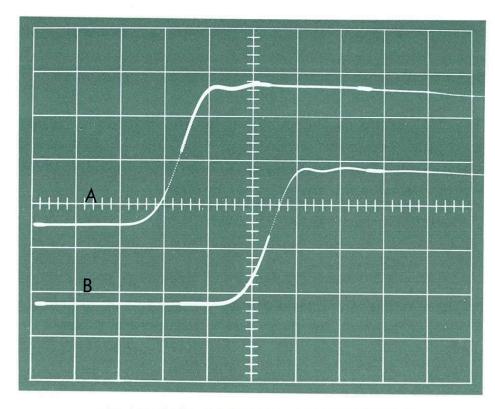
CRT DISPLAY CONTROLS

A 100% ZONE SET allows establishing the 100% reference on the displayed A waveform. A zone representing approximately 3% of the total sweep is positionable throughout 9 cm or more of horizontal sweep of the A trace.

B 100% ZONE SET same as A except for positioning on the B waveform.

0% AND 100% INTENSIFIED ZONES control two intensity markers on each trace at 0% and 100% zones for ease in establishing the position of the zones in relation to the displayed waveforms.

START-TO-STOP INTENSIFIED ZONE intensifies the start-to-stop zone on the displayed waveform and allows verifying start-to-stop interval. When manual start-stop timing is used the intensified zone allows the start-stop positions to be set to any portion of the waveform.



DELAY-TIME INTERVAL MEASUREMENT
Start: +50% A Trace Stop: +50% B Trace

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 nsec/div, samples/div = 100, then equivalent time/sample = 0.1 nsec. If a measurement interval occupied 2.5 cm, 250 samples would be registered in the digital readout counter. Reading would be 25.0 nsec 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 units nixie indicator is rendered inoperative so no reading shows even though its scalar is operating.

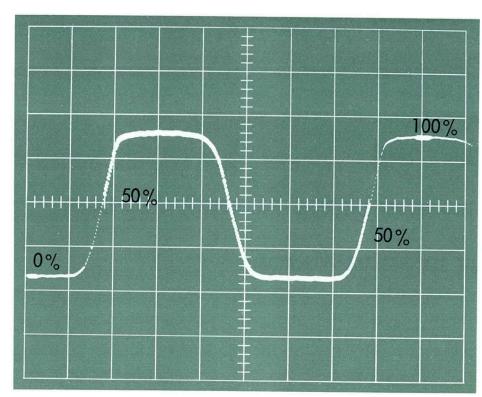
AVERAGE 10 SWEEPS HI permits obtaining reading to high resolution using all four decades. Same as LO except that the units nixie indicator is restored to operation.

1 SWEEP LO registers one sweep only in the digital readout counter. 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.

1 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 continuously variable control between approximately 6 sec and 0.1 sec holds the display for the time needed to observe readings or operate peripheral equipment. (Can be modified for variable control between 1 sec to 10 msec for use with high-speed automatic testing).



PERIOD (1 CYCLE) MEASUREMENT
Start: +50% A Trace
1st Crossing 2nd crossing

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 (Crossing) allows selecting start-timing on either the first or second crossing 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 reference to 0% and 100% zone amplitude). Automatically starts timing at the selected percentage. The 27% and 73% positions correspond to 1 time constant and are useful for TC readings without resorting to slide rule.

MANUAL START enables start-timing at any point on the waveform. Continuously variable over 9 cm 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 helidial setting.

START VOLTAGE HELIDIAL permits start-timing continuously variable between 0-10 divisions of amplitude from 0% zone reference.

STOP-TIMING CONTROLS

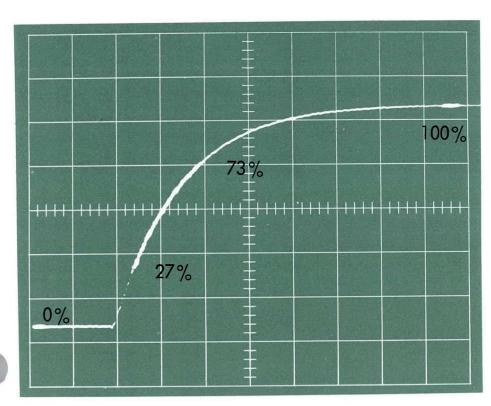
Program the termination of the timing interval. Identical in capability and operation to the start-timing controls in all other respects.

OTHER CHARACTERISTICS

READOUT is in a numerical range from 0.0001 to 9999. Accuracy is within 3%, \pm 1 count. Display time is variable from 0.1 second to 6 seconds. Units of measure include: microvolts, millivolts, and volts; nanoseconds, microseconds, milliseconds, and seconds.

INPUT is internally connected from horizontal and vertical plug-in units.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel. Net weight is 13³/₄ pounds. Shipping weight is 21 pounds, approx.



TIME-CONSTANT MEASUREMENT

Start (from) 27% A Trace Stop (to) +73% A Trace



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

Type 3 5 7 6 DUAL-TRACE SAMPLING UNIT



Internal Triggering and Delay Lines

- 0.4-nsec or less Risetime
- 2 Identical Channels
- 5 Operating Modes

Recorder Outputs

The Type 3S76 Sampling Unit is a dual-trace amplifier. Used with a sampling time-base unit, the unit can perform in one of five operating modes for a variety of single, dual-trace, and X-Y displays. The Type 3S76 has two separate channels, each with identical characteristics. The unit can be used in any of the Type 560-Oscilloscopes* except the Type 560, 565 and RM565. In the Type 567 and RM567, information can be presented in digital form as well as the usual crt analog form.

OPERATING MODES include Channel A only (normal or inverted); Channel B only (normal or inverted); Dual-Trace—electronic switching between the traces with either channel normal or inverted; A + B—outputs of Channel A and B algebraically added (either channel normal or inverted); A Vertical and B Horizontal—Channel A produces vertical deflection and Channel B produces horizontal deflection for X-Y displays (either channel normal or inverted).

CALIBRATED SENSITIVITY is from 2 mv/cm to 200 mv/cm in 7 calibrated steps, accuracy within 3%, except on the 2 mv/cm and 5 mv/cm steps, which have accuracy within 5%. A variable control permits continuous adjustment between steps.

FREQUENCY RESPONSE is equivalent to dc-to-3-db down at 875 Mc.

RISETIME is 0.4 nsec or less, with less than $\pm 3\%$ peak overshoot and undershoot.

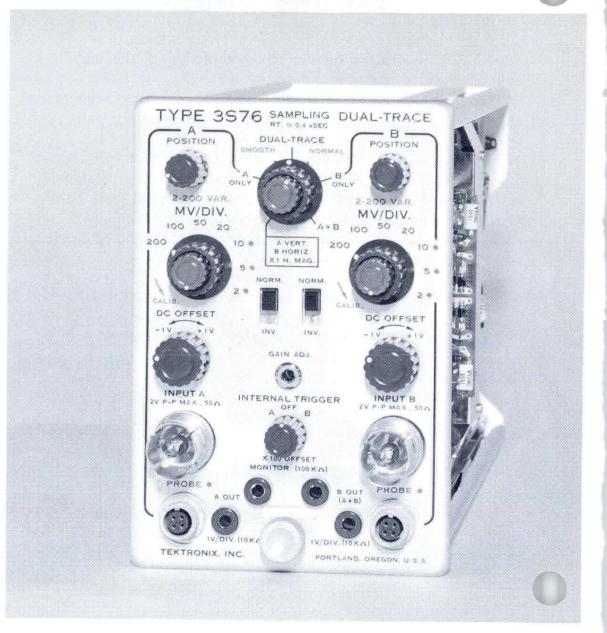
NOISE is equivalent to an input signal of 2 mv pk-to-pk with Smooth-Normal Switch in NORMAL position and 1 mv pk-to-pk with Smooth-Normal Switch in SMOOTH position.

DC OFFSET is -1 to +1 v, referred to input, and monitorable at the front panel at 100X magnitude.

INPUT IMPEDANCE is 50 ohms.

INPUT SIGNALS can be up to 2 v pk-to-pk.

*For optimum operation, Type 561 Oscilloscopes below Serial Number 580 must be modified with Modification Kit Tektronix No. 040-267.



SIGNAL DELAY through 55-nsec internal delay line for each channel allows viewing of leading edge of input waveform.

TRIGGER SOURCE selects built-in trigger takeoff signal from either channel, or terminates.

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.

NET WEIGHT is $7\frac{1}{2}$ pounds. Shipping weight is 12 pounds, approx.

TYPE 3S76 DUAL-TRACE SAMPLING UNIT \$1100 Each instrument includes: 2—50-Ω 10:1 attenuators, 2—5-nsec RG8A/U cable, 2—instruction manuals.

PROBES

The following Tektronix probes are recommended for use with the Type 3S76 and other Type 2-Series and 3-Series Sampling Plug-In Units. See Catalog Accessory Section for complete information on the probes.

	Input Imp	edance			
Use	R	С	Rating	Prob. 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 meg Ω	varies	varies	P6032	220
Current			500 ma	CTI/P6040	31

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SAMPLING SWEEP UNIT Type

Internal or External Triggering

 $10~\mu sec/cm$ to 0.02~nsec/cm Sweep Speeds

Variable Sweep Delay through 100 nsec

Single-Display Provision

Recorder Output

The Type 3T77 is a Sampling Sweep Plug-In Unit. It paired with a Sampling Amplifier Unit provides sub-nanosecond capabilities. The Type 3T77 can be used in any of the Type 560-Series Oscilloscopes* except the Type 560, 565 and RM565. In the Type 567 and RM567, information can be presented in digital form as well as the usual crt analog form.

TRIGGERING CHARACTERISTICS

EXTERNAL TRIGGERING

AMPLITUDE RANGE is 10 mv pk-to-pk minimum, 800 mv pk-to-pk maximum. Damaging overload occurs at 5 volts and greater.

PULSE REPETITION RATE is 10 cps to 300 Mc. Trigger circuitry counts down to maximum sampling rate of approximately 100 kc. (Rate with 3S76, 50 pps to 300 Mc.)

JITTER is 50 picoseconds or 0.1% of fast ramp duration, whichever is greater, for pulses of 50-mv amplitude, 2 nsec width (or 10 mv, 10 nsec width) with repetition rate less than 10 Mc. Jitter increases with less amplitude and/or pulse width, and with repetition rates above 10 Mc.

INTERNAL TRIGGERING

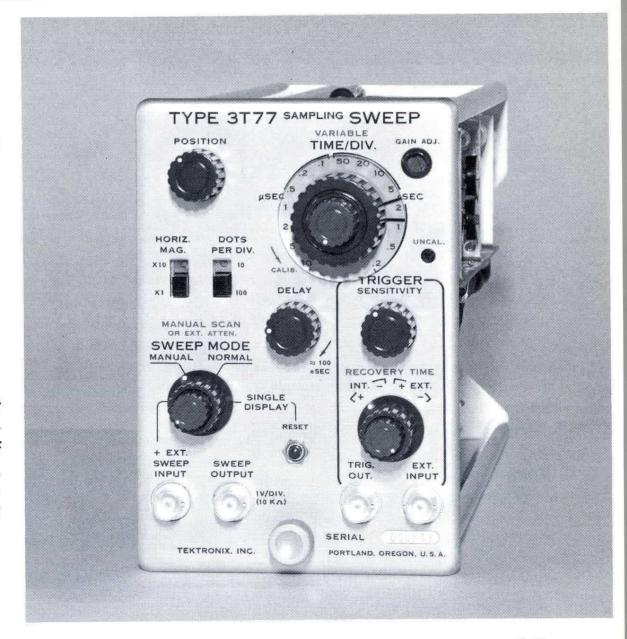
Same specifications as EXTERNAL TRIGGERING, but modified by vertical plug-in being used. When used with 3S76, all specifications are the same except 5X amplitude is required at A or B vertical input.

OTHER CHARACTERISTICS

DISPLAY can be either 10 or 100 dots/cm.

CALIBRATED SWEEP RANGE is from 0.2 nsec/div to 10 μ sec/div in 15 calibrated steps, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated between calibrated rates.

* For optimum operation, Type 561 Oscilloscopes below Serial Number 580 must be modified with Modification Kit Tektronix No. 040-267.



10X MAGNIFIER extends the calibrated sweep rate to 0.02 nsec/cm.

MANUAL SCAN OR EXTERNAL ATTENUATOR, a dual-purpose control, permits manual scanning of signals or control of external sweep amplitudes.

EXTERNAL SWEEP INPUT is dc-coupled and accepts a minimum 50-v positive going sweep for 10-cm display.

SINGLE DISPLAYS useful for photography can be initiated by a reset button.

RECORDER SWEEP OUTPUT is 1 v/cm (through 10 kilohms), useful for driving recorders and other devices.

SWEEP DELAY of approximately 100-nsec permits observation of a selected portion of a waveform.

NET WEIGHT is $5\frac{1}{2}$ pounds. Shipping weight is 9 pounds, approx.

TYPE 3T77 SAMPLING SWEEP UNIT \$650

Each instrument includes: 1—BNC to UHF adapter, 1—BNC to GR adapter, 2—10 nsec RG58A/U cables, 2—10X attenuators, 2—instruction manuals.

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

Type SAMPLING-PROBE DUAL-TRACE UNIT



EXTREMELY COMPACT PROBES DUAL-TRACE DISPLAYS 100 K, 2 pf INPUT LOW NOISE RECORDER OUTPUTS

The Type 3S3 Sampling Unit is a low-noise dual-trace amplifier. Used with a sampling time-base unit and Type P6038 Probe, the unit can perform in one of five operating modes for a variety of single, dual-trace, and X-Y displays. The Type 3S3 has two separate channels, each with identical characteristics. The unit can be used in any of the Type 560-Oscilloscopes* except Type 560, 565 and RM565. In the Type 567 and RM567, information can be presented in digital form as well as the usual crt analog form.

OPERATING MODES include Channel A only (normal or inverted); Channel B only (normal or inverted); Dual-Trace—electronic switching between the traces with either channel normal or inverted, A + B—outputs of Channel A and B algebraically added (either channel normal or inverted); A Vertical and B Horiontal—Channel A produces vertical deflection and Channel B produces horizontal deflection for X-Y displays (either channel normal or inverted).

CALIBRATED SENSITIVITY 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 sensitivity to approximately 2 mv/div.

RISETIME AND SMOOTHING controls adjust the instrument for least noise, best risetime, or a compromise between the two while maintaining correct dot transient response. A switch selects one of two risetimes. The smoothing control affects both the noise level and dot transient response. The smoothing control has an adjustment range that maintains correct dot transient response and the noise level is adjusted within this range.

At low signal repetition rates, there is one smoothing control setting for correct dot transient response and thus no further adjustment for noise level is available. As the signal repetition rate increases, there is an increasingly wider range of smoothing control settings for correct dot transient response and therefore greater adjustment range for noise level is then available.

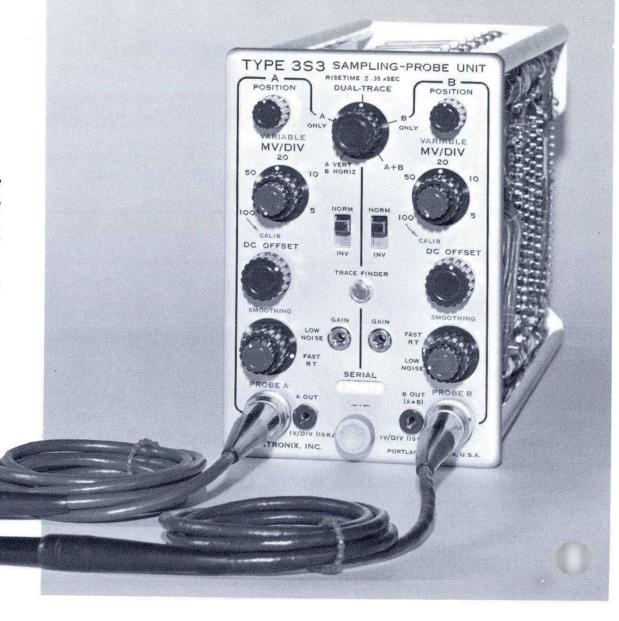
RISETIME (with a 50-ohm input source impedance) is 0.35 nsec with the switch set at the FAST RISETIME position and 1 nsec at the LOW NOISE position.

NOISE (with 50-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 of less than 25 ohms to at least 300 ohms.

INPUT IMPEDANCE is 100 k paralleled by approx. 2 pf.

*For optimum operation, Type 561 Oscilloscopes below Serial Number 580 must be modified with Modification Kit Tektronix No. 040-267.



MAXIMUM INPUT SIGNAL is \pm 1.5 v with Risetime control set to LOW NOISE and \pm 3 v when the control is set to FAST RISETIME.

EXTERNAL TRIGGER is required, approximately 50 nsec prior to signal. Minimum repetition rate is 50 cps.

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. A control permits displaying of signals riding on a dc voltage as high as $\pm 0.5 \, \text{v}$.

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.

PROBE (Type P6038) used with the Type 3S3 is extremely compact. The sampling bridge is contained in the probe head to obtain optimum results with the input impedance of 100 k paralleled by 2 pf. Probe can be changed from channel to channel with only minor recalibration.

NET WEIGHT is $6^{3}/_{4}$ pounds. Shipping weight is 9 pounds, approx.

TYPE 3S3 AMPLIFIER UNIT

REPLACEMENT P6038 PROBE (Part Number 010-156) ... \$225 Each probe includes: Normalizer, 10X attenuator, capacitor coupler, miscellaneous tips.

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Please refer to Terms and Shipment, General Information page.



PROGRAMMER Type



WITH THE TYPE 262 PROGRAMMER YOU CAN EXTERNALLY PROGRAM AND SEQUENCE THE TYPE 6R1 DIGITAL UNIT USED IN THE TYPE 567 READOUT OSCILLOSCOPE—IT OFFERS EVEN GREATER MEASUREMENT FLEXIBILITY THAN IS AVAILABLE THROUGH USE OF THE FRONT-PANEL CONTROLS OF THE TYPE 567/6R1.

8 DIFFERENT MEASUREMENT PROGRAMS PER TYPE 262
UP TO 24 PROGRAMS WITH 3 TYPE 262'S
UP TO 8 PROGRAMS PER SECOND
MANUAL PUSH-BUTTON PROGRAM SELECTION
REMOTE PROGRAM SELECTION
CHANGE TEST SETUPS BY CHANGING PROGRAM BOARDS
OPTIONAL FEATURES

SELF-SYNCHRONIZING WITH EXTERNAL EQUIPMENT
AUTOMATIC SEQUENCING
PROGRAM ADDITIONAL TEST EQUIPMENT

Each Type 262 Programmer holds eight program boards. All information required to program the Type 567/6R1, including both upper and lower test limits, is contained in the program boards. This feature simplifies the measurement setup and increases the flexibility of the system.

The measurement programs can be selected by frontpanel push-button, externally by contact closure to ground, or sequentially with an automatic sequencer accessory.

In addition, an auxiliary programmer is available as a modification. With this auxiliary programmer, the Type 262 can program external circuitry such as signal generators, signal attenuators, power supplies. The auxiliary program is selected concurrently with the test program.

PROGRAM BOARDS

Plug-in program boards come pre-wired, ready for programming. Boards are programmed by soldering in appropriate jumpers and values of resistors. This manner of program connection assures maximum electrical and mechanical reliability.

Each Type 262 holds up to 8 program boards. Each board can be programmed for a particular time or amplitude measurement such as risetime, delay time, period, pulse amplitude, time interval between percentage or voltage points on either A or B signal waveforms of either polarity, 1st or 2nd pulse selection. Upper and lower test limits can also be programmed on the boards.

If a change of a measurement program is desired, the plug-in program boards can be removed and other pre-wired programs inserted in a matter of seconds, or the boards can be easily rewired.

MANUAL CONTROL

Front-panel push-buttons allow selection of measurements. The sequence is determined by the operator and any program can be held for as long a period as needed. The measurement rate is determined by the Type 6R1.

EXTERNAL SCAN

Programs can be selected externally through the control lines available at the rear-panel connector. Selection is by contact closure to ground.

AUTOMATIC SEQUENCER ACCESSORY

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 scan up to 8 programs per Type 262.

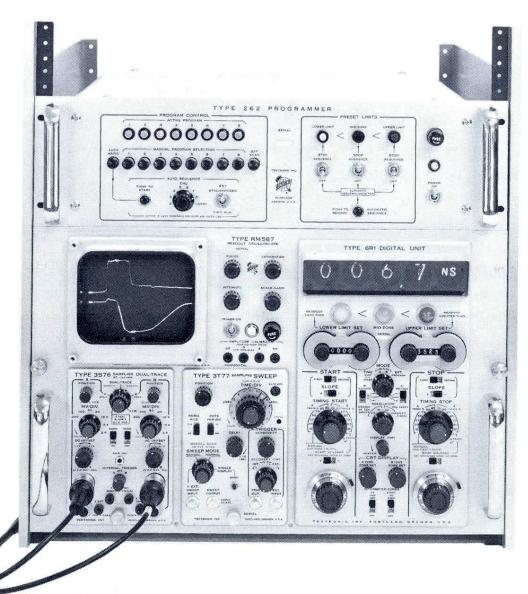
Front-panel switches, in conjunction with the Automatic Sequencer, allow for interrupting the automatic sequence in accordance with pre-established upper and lower limits. Any combination of the upper, middle, or lower limits can be used.

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.

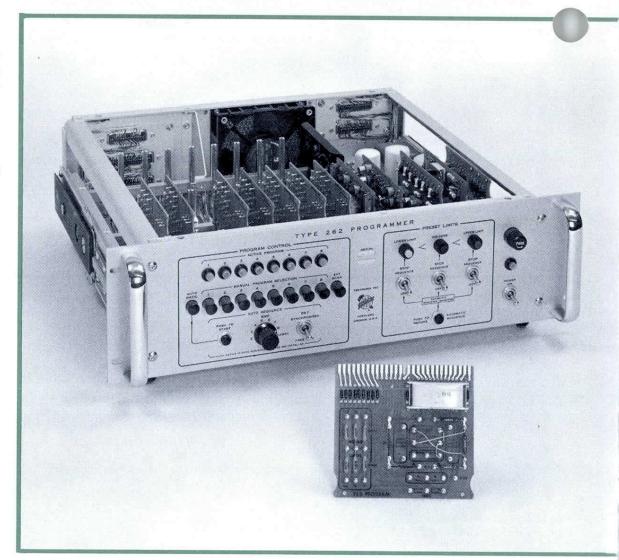
Both manual push-button control and external control are still available when the automatic sequencer is installed.

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.



Type 262 programming the Type RM567/6R1 in a sequence of transistor switching measurements.

Risetime (10% to 90%) measurement shown.



MEASUREMENT RATE

WITHOUT AUTOMATIC SEQUENCER

The measurement rate is governed by the Type 6R1 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 6R1 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.

AUXILIARY PROGRAMMER MODIFICATION

An auxiliary programmer is available as a modification which can be incorporated in the Type 262 at the time of purchase, at additional cost, or can be purchased separately. Installation of this modification requires only a few simple soldering operations.

The auxiliary programmer can accommodate a total of 8 auxiliary plug-in program boards.

The auxiliary program is selected simultaneously with the selection of the regular program board.

The eight connectors from the auxiliary program boards have parallel connections to 54 control lines available at the rear-panel of the Type 262 for programming signal attenuators, signal generators, trigger source switches, signal switches, power supplies. An additional 7.5 watts of regulated dc power is also available for use in this section.

MECHANICAL FEATURES

The Type 262 mounts in a standard 19" rack and occupies only $5\frac{1}{4}$ " 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.

NECESSARY ACCESSORIES FOR BASIC OPERATION

For basic operation of the Type 262, at least one program board is required. One of two types of interconnecting cable is also required: (1) for connecting the Type 262 to the Type 6R1, (2) for connecting the Type 262 to another Type 262.

RAM BO	100 000		500.00	
262/6R1				2.00
262/262				NAME OF THE OWNER

PROGRAM BOARD EXTENSION

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.

AUXILIARY PROGRAMMER MODIFICATION

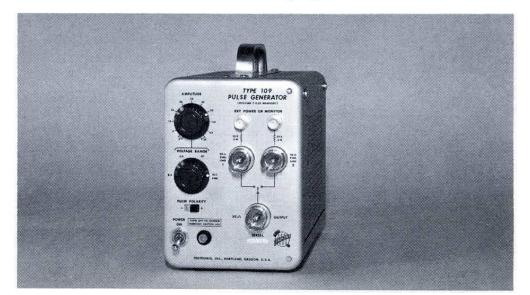
The auxiliary accessory programmer enables the Type 262 to program accessories such as signal generators, trigger sources, power supplies. It requires the installation of a simple modification. The Type 262 can be ordered, at additional cost, with this modification installed, or the modification kit can be purchased separately, for installation by the user.

TYPE 262 /	MOD 799A \$1350
AUXILIARY	PROGRAMMER MODIFICATION KIT (Part No.
040-330)	

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SAMPLING ACCESSORIES

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 give here. For full specifications, please refer to each instrument on the page listed in the index.



TYPE 109 PULSE GENERATOR

The Type 109 produces 0.25-nsec risetime pulses of either equal or alternately different time duration. Pulse width is 0.5 to a maximum of 40 nsec at the full repetition rate of typically 550 to 720 pulses/sec; to 300 nsec at half repetition rate.

Pulse amplitude can be selected from three calibrated ranges extending from 0 v through 50 v, accuracy within 3%. Polarity can be either positive or negative.



TYPE 110 PULSE GENERATOR AND TRIGGER TAKE-OFF SYSTEM

The Type 110 is similar to the Type 109 plus a Trigger Take-off and Regenerator. Approximately 98% of the input voltage appears at the output after passing through the takeoff, and approximately 20% of the signal voltage appears as a trigger signal.

A regenerated trigger signal of \pm 6 v to \pm 10 v amplitude and 220-nsec to 280-nsec duration is available. Timing delay is nominally 20 nsec, and recovery time is 10 μ sec, with countdown from about 100 Mc at a uniform repetition rate.

TYPE 110 PULSE GENERATOR \$650

SAMPLING ACCESSORIES

TYPE 111 PULSE GENERATOR

The Type 111 is a high-repetition rate, fast-rise pulse generator that provides two pulse outputs: OUTPUT PULSE—with risetime equal to or less than 0.5 nsec for positive; slightly longer for negative pulse. Repetition rate is continuously adjustable from 10 pps to 100 kc. Pulse duration is 2 nsec minimum to 100 nsec maximum with an external charge line. Pulse amplitude is over ± 5 volts.

PRETRIGGER PULSE amplitude is 10 v, duration is 250 nsec, and half-amplitude risetime is 4 nsec. (Approximately).

Time delay between pretrigger and output pulse is continuously variable from 30 nsec to 250 nsec.





TYPE 290 TRANSISTOR SWITCHING-TIME TESTER

The Type 290, driven by a Tektronix fast rise pulse generator and combined with a Tektronix sampling system, provides a transistor testing system with an over-all transient response of less than 1 nsec. This system tests fast transistors on a short duty-cycle basis for delay time, risetime, storage time, and fall time.

Two continuously variable collector voltages are available: 0-to-30 v and 0-to-100 v. Base supply voltage is continuously variable from 0 to \pm 10 v.

When using a single-trace oscilloscope, the input signal can be switched to the output for observation; when using a dualtrace oscilloscope, the input and output signal can be viewed simultaneously.

TYPE 290 \$290

TYPE CT-1 CURRENT TRANSFORMER AND P6040 PROBE

The Type CT-1 Current Transformer and P6040 Probe, used with the Type 567, will measure milliampere currents at frequencies beyond 1 Gc. Sensitivity of the Type CT-1/P6040 is 5 mv/ma into a 50- Ω load. Risetime is less than 0.35 nsec, and accuracy is \pm 3%.

The Type CT-1/P6040 gives true readings of current flow while keeping loading effects to a minimum. The P6040 Probe is used as a convenient plug-on inter-connecting cable for the Type CT-1.

TYPE CT-1 and P6040 (Part No. 015-041) \$31

TYPE CT-1 only (Part No. 015-040) \$17

TYPE P6040 only (Part No. 010-133 \$14

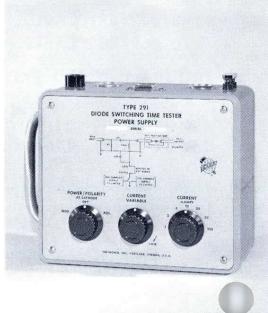
TYPE 280 TRIGGER COUNTDOWN UNIT

The Type 280, used with the Type 567/3S76/3T77 or Type 567/3S3/3T77, allows synchronization on frequencies up to 5 Gc. The Type 280 can be used to lower the frequency of the triggering signals to within a range of 15 to 45 Mc. 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 Mc to 5 Gc; input signal range is 50 mv to 4 v, peak-to-peak. Output repetition rate is continously variable from 15 to 45 Mc. Fast-rise trigger output is 150 mv with less than 0.4-nsec risetime and 1.5 v with less than 4-nsec risetime.

TYPE 280 TRIGGER COUNTDOWN UNIT \$265





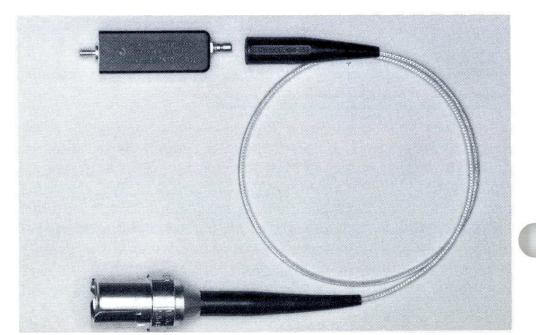
TYPE 291 DIODE SWITCHING-TIME TESTER and TF-1 TEST FIXTURE

The Type 291 enables measurement of fast-switching diode characteristics. The diode under test is magnetically held in the TF-1 Test Fixture and ejected by push button. Ejection can be actuated by a solenoid (not included) for automated testing.

The Type 291 provides a range of dc test currents to 100 ma—with provision for external current supply to 500 ma and an external current monitor. The input pulse should be supplied from a fast-rise generator such as the Tektronix Type 109 or 110.

The Type 291/TF-1 response is less than 0.35 nsec; diode recovery loop impedance is 100Ω .

TYPE 291	(without test	fixture)		\$185
TYPE TF-1	TEST FIXTURE	(Part No.	017-072)	\$65





ELECTRON-TUBE-CURVE TRACER Type

Displays Family of Curves on CRT Screen

Four to twelve characteristic curves per family.

Plots All Important Characteristics

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

Positive-Bias Curves

Plots up to 8 positive-bias curves per family. (up to 12 negative-bias curves)

Calibrated Controls

Accurate current and voltage readings directly from the crt screen.

Wide Display Range

- 11 current ranges from 0.02 ma/div to 50 ma/div. 9 voltage ranges from 0.1 v/div to 50 v/div.
- 11 series-load resistors from 300 ohms to 1 megohm.
 7 grid-step values from 0.1 v/step to 10 v/step.

TYPE 570 CHARACTERISTIC-CURVE TRACER

RAIL-SWIEP GENERATOR

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The Tektronix Type 570 Characteristic-Curve Tracer presents an accurate graphic analysis of electron-tube characteristics under almost any conceivable operating conditions. Circuit design can now be tailored to more closely fit the operating characteristics of available tubes. Tubes can be selected faster and more accurately for circuits requiring other than average electron-tube characteristics. Two-socket arrangement with front-panel switching permits rapid comparisons between two tubes, or two sections of the same tube. Rapid comparisons can be made with preselected curves outlined on a crt mask. Patch-cord connector system with socket-adapter plates enables complete control of operating-condition setup.

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

CATHODE-RAY-TUBE DISPLAY

Positioning—Concentric controls provide for both vertical and horizontal positioning of the display.

Vertical Axis—Concentric controls provide for selection of plate, screen, or grid current display; and selection of any one of eleven current-per-division values—0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 ma/div. A graticule divides the screen into ten vertical divisions. Calibration accuracy is within 3%, permitting accurate current readings directly from the screen.

Horizontal Axis—Either plate or grid voltage can be displayed on the horizontal axis, and nine voltage-per-division values are available—0.1, 0.2, 0.5, 1, 2, 5, 10, 20, and 50 v/div. Ten horizontal divisions are scribed on the graticule. Calibration accuracy is within 3%, permitting accurate voltage readings directly from the screen.

GRID-STEP GENERATOR

Family of Curves—A variable control is provided to adjust the number of curves in the display. As few as four and as many as twelve curves can be selected. A single family can be safely displayed with the tube under heavy overload conditions by means of a position on the STEPS/FAMILY control and a push button. With the STEPS/FAMILY control in the single-family position, pressing the button applies the selected conditions to the tube for only a fraction of second. Use of the SINGLE FAMILY push button permits observation or photography of tube characteristics under unusual conditions without danger of damage to the tube under test.

The STEPS/SEC switch controls the switching-rate of the step generator. A 120 or 240-steps/sec rate can be selected. The extra 120-steps/sec position causes switching to occur at the opposite end of the characteristic curve, for convenience when the area of interest is at either end of the curves displayed. (When the Type 570 is used with a 50-cycle supply frequency, the step/sec rate will be either 100 or 200.)

Bias voltage applied to the grid of the tube under test is impressed in a series of steps to produce the number of curves desired in the display. The voltage difference between steps is selected by a seven-position switch. Calibrated switch positions are: 0.1, 0.2, 0.5, 1, 2, 5, and 10 volts/step, accurate within 3%. Up to 150 ma peak grid current is available. A variable control is provided to adjust the starting point to a positive voltage, zero, or a negative voltage. Pressing the ZERO BIAS push button causes the display of the zero-bias curve only, to use as a reference in adjusting the starting point. As many as eight positive-bias curves can be included in the display.

PLATE-SWEEP GENERATOR

An eleven-position switch selects the desired series-load resistance for the plate circuit of the tube under test. Series-load values are: 300 ohms, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k, 200 k, 500 k, and 1 megohm. Power-handling capacity of all load resistors is sufficient to dissipate the maximum power available in the plate circuit.

The peak voltage applied to the plate through the series-load resistance is selected by an eight-position switch. Peak voltages are: 5, 10, 20, 50, 100, 200, 300, and 500 volts.

OPERATING VOLTAGES

Heater voltage is available in 17 fixed steps: 1.25, 1.4, 2.0, 2.35, 2.5, 3.15, 4.2, 4.7, 5.0, 6.3, 7.5, 12.6, 18.9, 25, 35, 50, and 117 volts ac. A control permits adjusting the selected heater voltage approximately ±20% for simulating the effects of low or high line voltage. The variable control provides sufficient spread between steps to supply the proper heater voltage for practically all receiving-type vacuum tubes. Maximum power available from the heater transformer is 30 watts.

Positive dc voltage is available in five calibrated steps: 20, 50, 100, 200, and 300 volts, accurate within 3%. The positive voltage is also continuously variable from approximately 10 to 300 v. Up to 50 ma steady current is supplied. An adequate reserve is available for higher peak currents.

Negative dc voltage is available, continuously variable from 0 to -100 v. The negative dc supply is capable of delivering up to 1 watt.

ADAPTER PLATES

Eight quick-changing adapter plates are furnished with the Type 570 — 2 with octal sockets, 2 with nine-pin miniature sockets, 2 with seven-pin miniature sockets, and 2 with pilot holes only. Plate receptacle holds any two adapter plates at the same time. Small banana jacks connect to each socket terminal thus making it possible to patch any tube element to any voltage supplied by the instrument.

Other adapter plates are available as optional accessories.

VOLTMETER

The built-in voltmeter indicates the positive and negative operating voltages in seven ranges: 0 to 7, 14, 35, 70, 140, 350, 700 volts. The voltmeter can be switched to show the percent of heater voltage indicated by the heater-voltage selector switch.

OTHER FEATURES

Tube-Socket Switching—The TEST POSITION switch in the center of the front panel is used to switch in either of two vacuum tubes during comparison tests. It has an OFF position for changing tubes and for establishing a reference trace on the screen. Control-grid potential drops to -150 v in the off position.

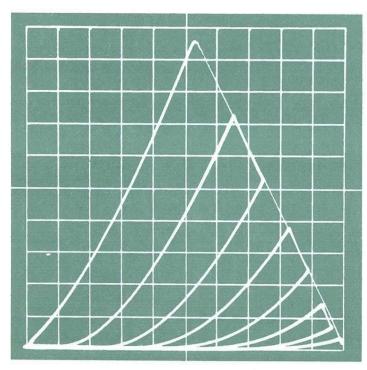


Fig. 1—Plate current plotted against plate voltage for one triode section of a 12AU7. Plate load is 5 k, peak plate-supply voltage is 500 v. Grid voltage is changed 5 v between curves, from —35 v to zero. Vertical sensitivity is 5 ma/div, horizontal sensitivity 50 v/div. Calibrated controls permit accurate current and voltage readings directly from the screen.

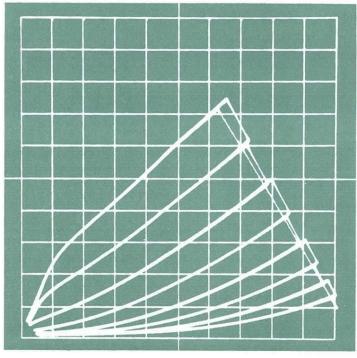


Fig. 2.—Same triode section of 12AU7 with only 20-v peak plate supply and sensitivities increased to 0.2 ma/div vertical and 2 v/div horizontal. Grid voltage is changed 2 v between curves, from —14 v to zero. This is essentially a 25-times magnification of the lower left portion of Fig. 1, showing the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

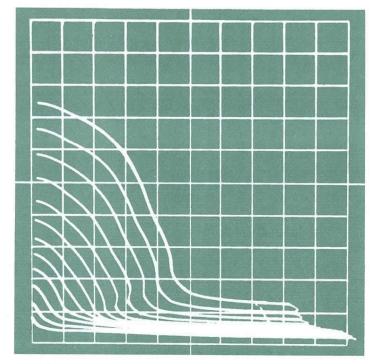


Fig. 3—Screen current plotted against plate voltage with positive grid bias on a 6AQ5. Pload is 300 ohms, peak plate voltage is 10 screen-grid voltage is 100 v, with grid voltage changing 2 v/step from +16 v to below zero. Vertical scale is 10 ma/div, horizontal scale is 10 v/div.

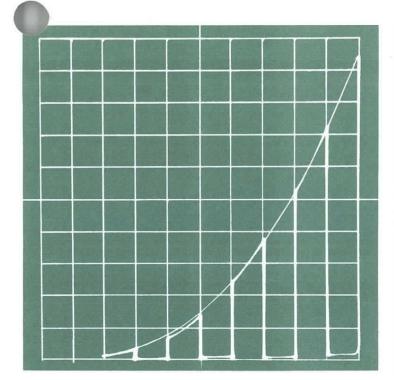


Fig. 4—Typical 12AU7 Eg-Ip curves. Plate load 5 k, peak plate-supply voltage 500 v, grid voltage changing 5 v/step from —35 v to zero, vertical sensitivity 5 ma/div, horizontal sensitivity 5 v/div.

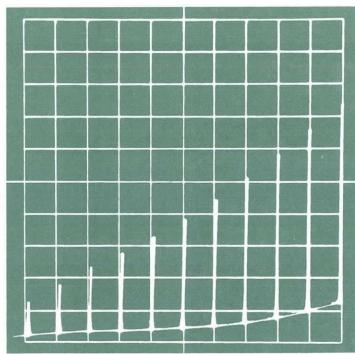


Fig. 5—Another family of curves with positive grid bias. Screen current is plotted against grid voltage. Operating conditions of the 6AQ5 are identical to Fig. 3, except horizontal sensitivity is 2 v/div.

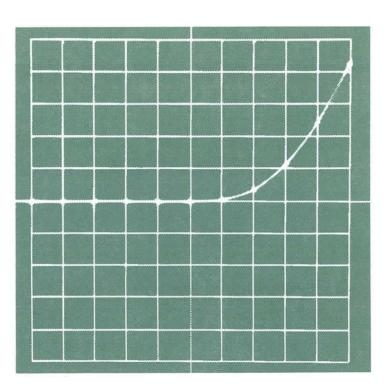


Fig. 6—Typical GERMANIUM DIODE curve. Inherent flexibility of the Type 570 permits accurate evaluation of diode characteristics and detailed examination of any part of the curve. Calibrated scales above are 0.2 v/div horizontal, 0.5 ma/div vertical, with zero points at center of screen.

Safety Switch—The extremely flexible operationalsetup facility of the Type 570 requires that potentially dangerous voltages be present at the patch panel. These voltages can be removed by a front panel switch for safety and convenience. A jewel light indicates when power is present at the patch panel.

Regulated Power Supply—Electronic voltage regulation is used to compensate for line-voltage changes and variations in loading. All voltages affecting calibrations are fully regulated. Heater, negative-dc, and peak-plate supplies are unregulated.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 400 watts maximum, 300 watts standby. Note: For 50 cps supply, the switching rate will be either 100 steps/sec or 200 steps/sec.

Cathode-Ray Tube—The Tektronix crt uses 4-kv accelerating potential. A P1 phosphor is normally supplied.

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

Mechanical Specifications—Dimensions are 17'' high by $13\frac{1}{8}''$ wide by $23\frac{1}{4}''$ deep. Net weight is $74\frac{3}{4}$ pounds. Shipping weight is 94 pounds, approx.

TYPE 570 CURVE TRACER \$1100

Each instrument includes: 2—7 pin adapter plates, 2—8 pin adapter plates, 2—9 pin adapter plates, 2—blank adapter plates, 5—double patch cords, black 6", 5—double patch cord, red 6", 2—suppressor cords, 100 Ω , 6", 2—suppressor cords, 300 Ω , 6" 2—suppressor cords, 1 k Ω , 6", 5—single patch cords, black 6", 5—single patch cords, red 6", 5—1/16-amp 3AG Fast-Blo fuses, 5—1/2-amp 3AG Fast-Blo fuses, 1—6U8 electron tube, 1—3-conductor power cord, 1—light filter, 2—instruction manuals.

Optional Adapter Plates

Optional adapter plates with various sockets are available.

13 Pin Nixie (Burroughs) Base (016-040) . . . \$12.50 5 Pin Nuvister Twelvar Base (Part No. 016-041) \$10.00 7 Pin Nuvister Twelvar Base (Part No. 016-042) \$10.00 12 Pin Compactron Base (Part No. 016-043) . . \$12.50 9 Pin Novar Base (016-044) \$10.00

Rack Mount Adapter

A cradle mount to adapt the Type 570 Characteristic-Curve Tracer for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Rack height requirements 17 ½".

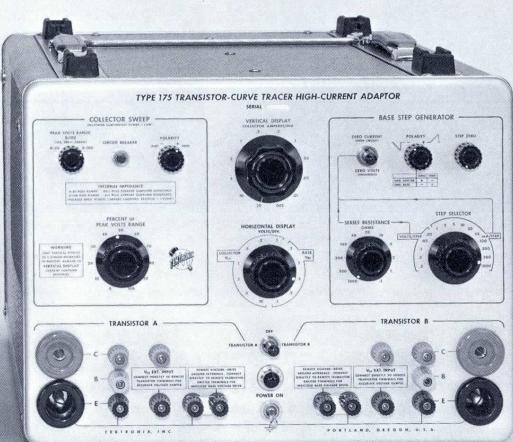
Order Part No. 040-281 \$45

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

TRANSISTOR-CURVE TRACER HIGH-CURRENT ADAPTER







In most instances the operation of the Type 175 is the same as that of the Type 575. Where and how the Type 175 differs from the Type 575 is shown in color.

CHARACTERISTIC SUMMARY SEMI-CONDUCTOR DRIVING CAPABILITIES

BASE OR EMITTER STEP GENERATOR-

Frequency—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 with 2.4-ampere current capability.

(With Type 175) selectable values from 0.02 v/step to 0.5 v/step with 12-ampere current capability.

Current Increments—Selectable values from 0.001 ma/step to 200 ma/step.

(With Type 175) 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 with 10-ampere current capability and from 0 v to 200 v with 1-ampere current capability.

(With Type 175) continuously variable from 0 v to 20 v with 200-ampere current capability and 0 v to 100 v with 40-ampere current capability.

Polarity—Positive or negative.

VERTICAL DISPLAY

CALIBRATED SENSITIVITY-

Transistor Collector Current—0.001 ma/div to 2000 ma/div.

(With Type 175)—0.005 amp/div to 20 amp/div.

Transistor Base or Emitter Current—0.001 ma/div to 200 ma/div.

(With Type 175)—Not available.

Transistor Base or Emitter Voltage—0.01 v/div to 0.5 v/div.

(With Type 175)—Not available.

Base or Emitter Source Voltage—0.01 v/div to 0.2 v/div. (With Type 175)—Not available.

HORIZONTAL DISPLAY

CALIBRATED SENSITIVITY-

Transistor Collector Voltage—0.01 v/div to 20 v/div. (With Type 175)—0.1 v/div to 10 v/div.

Transistor Base or Emitter Current—0.001 ma/div to 200 ma/div.

(With Type 175)—Not available.

Transistor Base or Emitter Voltage—0.01 v/div to 0.5 v/div.

(With Type 175) -0.1 v/div to 2 v/div.

Base or Emitter Source Voltage—0.01 v/div to 0.2 v/div. (With Type 175)—Not available.

CRT

DISPLAY AREA—10 x 10 cm.

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 cps, 410 watts max.

(For Type 175)—105 to 125 v, 50 to 60 cps, 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 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.

BASE OR EMITTER STEP GENERATOR

The Step Generator develops families of steps to drive the base or emitter (whichever is ungrounded) of the transistor under test. These families of steps are used to generate either repetitive or single-family (as selected) characteristic curves for display. The steps in a family 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/sec or 240 steps/sec (values equal to 2X or 4X the line frequency). A control is available to set, to zero, the starting point of families of steps.

Each step in a family of steps 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 is selected from 24 values that range from 1 ohm to 22 kilohms. 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 sweeps 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-ampere capability or from zero to 200 v with 1-ampere current capability.

The collector current limiting resistance is selected from 16 values ranging from 1 ohm to 100 kilohms. Any other desired value can be added externally.

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-ampere capability of from zero to 100 v with 40-ampere 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 sensitivities available.

CALIBRATED SENSITIVITY-

Transistor Collector Current—0.01 ma/div to 1000 ma/div in 16 steps, 1-2-5 sequence. Pushbuttons are provided for multiplying each step by 2 or 0.1 thus extending the sensitivity from 0.001 ma/div to 2000 ma/div.

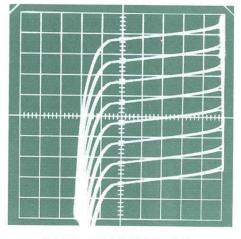
(With Type 175)—0.005 amp/div to 20 amp/div in 12 steps, 1-2-5 sequence.

Transistor Base or Emitter Current—0.001 ma/div to 200 ma/div in 17 steps, 1-2-5 sequence.
(With Type 175)—Not available.

Transistor Base or Emitter Voltage—0.01 v/div to 0.5 v/div in 6 steps, 1-2-5 sequence.
(With Type 175)—Not available.

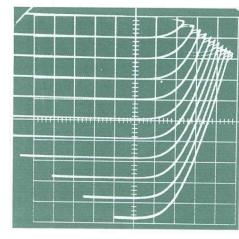
Base or Emitter Source Voltage—0.01 v/div to 0.2 v/div in 5 steps, 1-2-5- sequence.

(With Type 175)—Not available.



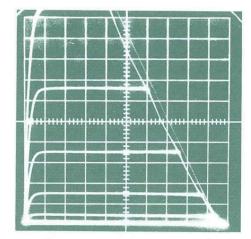
PNP TRANSISTOR

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.

HORIZONTAL-DEFLECTION SYSTEM

Signals used for horizontal deflection are selected from various points in the transistor test circuit. Each point has several selectable deflection sensitivities available.

CALIBRATED SENSITIVITY-

Transistor Collector Voltage—0.01 v/div to 20 v/div in 11 steps, 1-2-5 sequence.

(With Type 175)—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.
(With Type 175)—Not available.

Transistor Base or Emitter Voltage—0.01 v/div to 0.5 v/div in 6 steps, 1-2-5 sequence.

(With Type 175)—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.

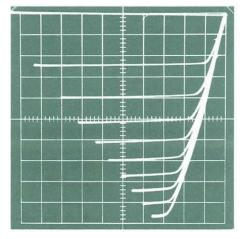
(With Type 175)—Not available.

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 semi-conductors. 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.

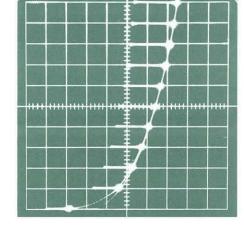
The Type 175 Transistor Test Panel is basically the same as that of the Type 575. Special connectors and cables are provided for high-current applications and for eliminating measurement errors due to voltage drops in high-current carrying leads.

CATHODE-RAY TUBE—The crt used has an accelerating voltage of 4 kv and is supplied with a P1 phosphor unless another phosphor is requested.



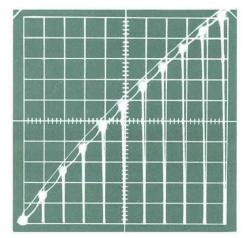
PNP TRANSISTOR

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.



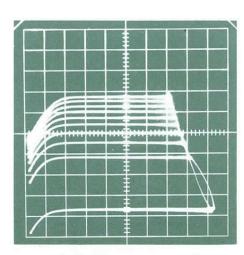
NPN TRANSISTOR

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.



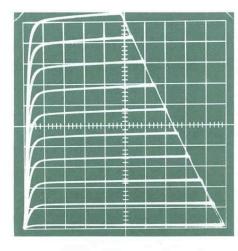
NPN TRANSISTOR

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.



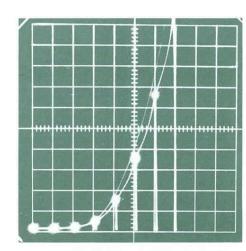
NPN TRANSISTOR

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.

ILLUMINATED GRATICULE—The edge-lighted graticule is marked in 10 by 10 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—105 to 125 v or 210 to 250 v, 50 to 60 cps, typically 410 watts maximum, 220 watts standby. Type 175—105 to 125 v, 50 to 60 cps, 1100 watts max.

MECHANICAL—Dimensions are 16% high by 13% wide by 23% deep. Net weight is 66 pounds. Shipping weight is 85 pounds, approx. Type 175—Dimensions are 12% high by 15% wide by 23% deep. Net weight is 93 pounds. Shipping weight is 118 pounds, approx.

TYPE 575 TRANSISTOR CURVE-TRACER \$1075

Each instrument includes: 1—light filter, 2—2N1381 test transistors, 2—long-lead transistor receptacles, 2—short-lead transistor receptacles, 1—3-conductor power cord, 2—instruction manuals.

TYPE 175 HIGH CURRENT ADAPTER \$1475

Each instrument includes: 1—6' 3-conductor power cord, 1—20" 3-conductor power cord, 2—red high current test cables, 2—black test leads, 2—red test leads, 2—blue test leads, 1—interconnecting cable (to Type 575), 1—modification kit (for Type 575), 2—instruction manuals.

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 volts, maximum short circuit current of 1 milliampere) and also much higher Collector Supply (up to 400 volts, at 0.5 ampere).

TYPE 575 MOD 122C \$1325

Each instrument includes: 1—light filter, 2—2N1381 test transistors, 2—long-lead transistor receptacles, 2—short-lead transistor receptacles, 1—3-conductor power cord, 2—instruction manuals.

TYPE 175 MOD 167C

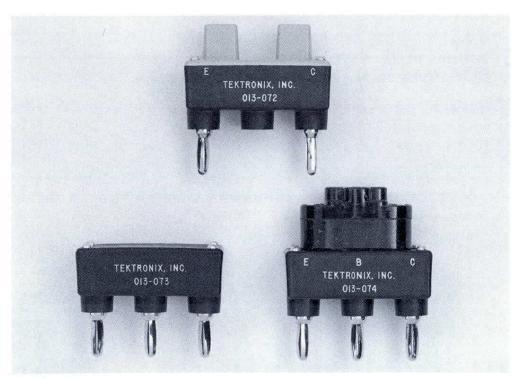
Modified Type 175 operates from 210 v to 250 v, 50 to 60 cps. TYPE 175 MOD 167C HIGH CURRENT ADAPTER . . \$1475

Each instrument includes: 1—6' 3-conductor power cord, 1—20" 3-conductor power cord, 2—red high current test cables, 2—black test leads, 2—red test leads, 2—blue test leads, 1—interconnecting cable (to Type 575), 1—modification kit (for Type 575), 2—instruction manuals.

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 171/2".

TYPE 575 TEST BOARDS



The following optional accessories are available for the Type 575.

Diode Test Jig—This test board is used to hold axial-lead diodes for testing.

DIODE TEST JIG (013-072) \$3.50

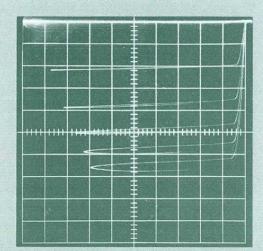
Adapter Box—This accessory allows you to make your own test board by mounting a desired semi-conductor socket on the adapter box.

Power Transistor Jig—This is a test socket for power transistors with hook leads.

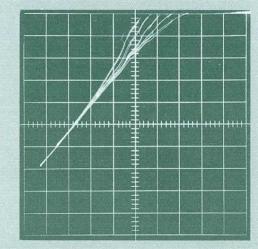
POWER TRANSISTOR JIG (013-074) \$5.00

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

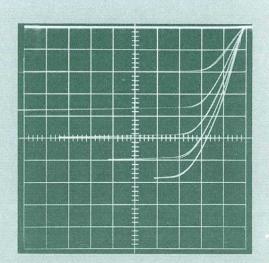
CHARACTERISTIC CURVE DISPLAYS WITH TYPE 175



Collector current vs. collector voltage (emphasis on saturation resistance). Vertical deflection is 10 amp/div, horizontal deflection is 0.2 v/div. Base drive is 500 ma/step (top curve is 2.5 amp).



Collector current vs. base voltage (collector sweep voltage is 4.2 v). Vertical deflection is 10 amp/div, horizontal deflection is 0.1 v/div. Base drive is 500 ma/step.



Collector current vs. collector voltage. Vertical deflection is 10~amp/div, horizontal deflection is 1.0~v/div. Base drive is 500~ma/step (top curve is 2.5~amp).

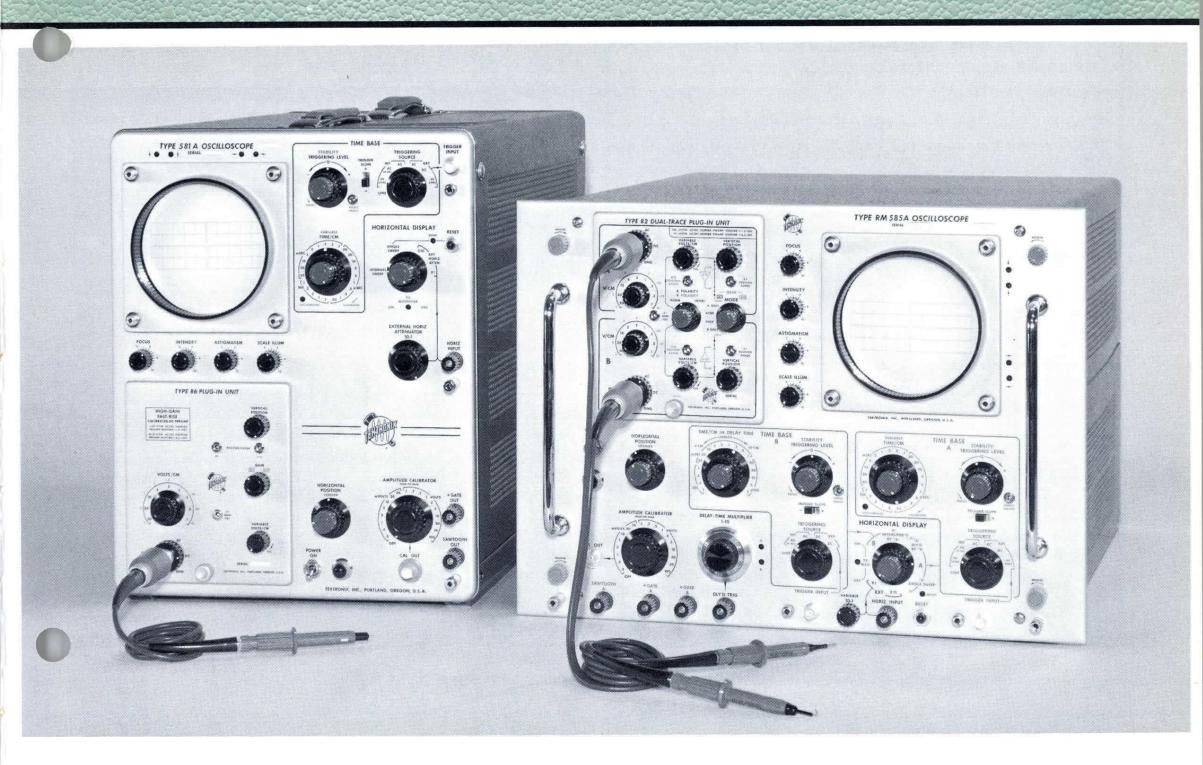


DC-to-95MC OSCILLOSCOPE Type

 $\mathbf{e} \, \frac{301A}{585A}$

RM585A





All information in color describes the additional capabilities of the Type 585A and RM585A.

TUNNEL DIODE TRIGGERING TO BEYOND 150 MC SYNCHRONIZATION TO 250 MC

CALIBRATED SWEEP DELAY

SINGLE-SWEEP PHOTOGRAPHY AT 10 NSEC/CM

3 FAST-RISE VERTICAL PLUG-IN UNITS

15 OTHER VERTICAL PLUG-IN UNITS (with adapter)

SMALL BRIGHT CRT SPOT

Dual-trace dc-to-85 Mc (approx. 3-db down) displays at 100 mv/cm or dc-to-80 Mc (approx. 3-db down) displays at 10 mv/cm are now available with the Type 82 Dual-Trace Plug-In Unit. Other single-channel 80-Series Plug-In Units are designed to utilize the wide passband and fast-rise characteristics of the Type 581A, 585A, and RM585A Oscilloscopes.

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: $0.05~\mu sec/cm$ to 2~sec/cm; Time Base B (Type 585A and RM585A only): $2~\mu sec/cm$ to 1~sec/cm.

SWEEP MAGNIFIER—5X, extends Time Base A sweep range to 0.01 μ sec/cm.

CALIBRATED SWEEP DELAY—2 μ sec to 10 sec, continuously variable.

TRIGGER REQUIREMENTS-

Internal: 2-mm deflection, ac coupled.

External: $0.2 \text{ v to } \pm 15 \text{ v, ac or dc coupled.}$

EXTERNAL INPUT—0.2 v/cm to 15 v/cm; dc to 350 kc; 1 megohm, approx. 47 pf.

CRT

DISPLAY AREA—4 x 10 cm.

ACCELERATING VOLTAGE—10 kv.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR—0.2 mv to 100 v, 1-kc square wave.

POWER REQUIREMENT—105 to 125 v or 210 to 250 v, 560 watts maximum for Type 581A, 630 watts maximum for Type 585A.

TYPE 80-SERIES VERTICAL PLUG-IN UNITS

Frequency specifications are at approximately 3-db down

HIGH GAIN DUAL TRACE—

TYPE 82 DUAL-TRACE UNIT—DC to 80 Mc at 10 mv/cm, DC to 85 Mc at 100 mv/cm. Risetime at 100 mv/cm is nominally 4 nsec, always less than 4.2 nsec. Risetime at 10 mv/cm is nominally 4.3 nsec, always less than 4.5 nsec.

HIGH GAIN SINGLE TRACE—

TYPE 86 PLUG-IN UNIT—DC to 80 Mc at 10 mv/cm, DC to 85 Mc at 100 mv/cm. Risetime at 100 mv/cm is nominally 4 nsec, always less than 4.2 nsec. Risetime at 10 mv/cm is nominally 4.3 nsec, always less than 4.5 nsec.

WIDE PASSBAND-

TYPE 80 PLUG-IN UNIT/P80 PROBE—DC to 95 Mc at 0.1 v/cm.

SWEEP DELAY APPLICATIONS

In addition to the usual applications of the dc-to-95 Mc Type 581A Oscilloscope, the calibrated sweep delay of the Type 585A and RM585A Oscilloscopes enables the user to:

- 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.
- Utilize effective calibrated sweep magnification up to the highest practical limit. Actual magnification is the ratio of Time Base A sweep speed to Time Base B sweep speed.

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 PASSBAND depend on the plug-in unit and probe used with the oscilloscope.

	Rise	Passband		
Oscilloscope used with	nominally	always less than	at 3db, approx.	
Type 82 or 86 Plug-In Unit at 10 mv/cm	4.3 nsec	4.5 nsec	80 Mc	
Type 82 or 86 Plug-In Unit at 100 mv/cm	4.0 nsec	4.2 nsec	85 Mc	
Type 80 Plug-In Unit with P80 Probe at 0.1 v/cm	3.7 nsec	3.9 nsec	95 Mc	

Risetime of the Oscilloscope, Type 82 or 86 Plug-In Unit, and supplied probe, at an overall sensitivity of 0.1 v/cm, is approx. 4.5 nsec.

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 . . . as well as many other general-purpose laboratory measurements.

HORIZONTAL-DEFLECTION SYSTEM

TIME BASE A SWEEP RANGE from 50 nsec/cm to 2 sec/cm is in 24 calibrated steps with 1-2-5 sequence. Accuracy is typically within 2%, and in all cases within 3% of panel reading. Sweep speed is continuously variable uncalibrated from 50 nsec/cm to over 5 sec/cm.

TIME BASE B SWEEP RANGE from $2\,\mu sec/cm$ to $1\,sec/cm$ is in 18 calibrated steps with 1-2-5 sequence. Accuracy is typically within 1%, and in all cases 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 cps to 40 kc.

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 nsec/cm, and Time Base B to $0.4~\mu sec/cm$. 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-19 Camera and Polaroid Type 410 film, 4-cm single transients at 10 nsec/cm sweep speed can be recorded in their entirety.

EXTERNAL HORIZONTAL INPUT provides for horizontal beam deflection with an external source. Horizontal sensitivity is continuously variable from 0.2 v/cm to over 15 v/cm. Passband is dc to 350 kc 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 \pm 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 Mc to 250 Mc, 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.

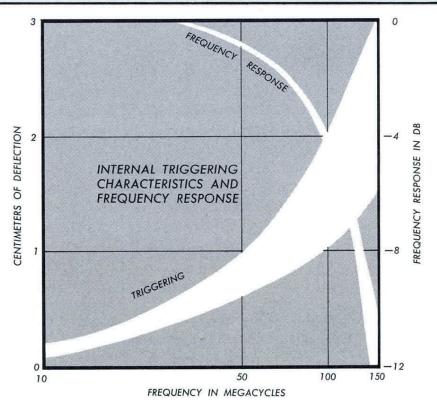
LOW-FREQUENCY REJECT operates above 15 kc to prevent low-frequency components, such as 60-cycle hum, from interfering with stable triggering. This mode also allows bright trace displays when a multiple-channel plug-in unit is operated in its alternate mode.

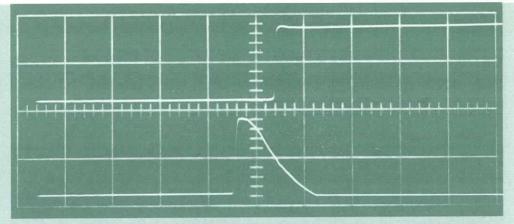
TRIGGER REQUIREMENTS for Type 581A and Time Base A of the Type 585A and RM585A are as follows:

	11	NTERNA	\L	external		
FREQUENCY	AC	AC LF REJ	HF SYNC	AC/DC	HF SYNC	
15 cps to 15 kc	2 mm	7		0.2 v		
15 kc to 5 Mc	2 mm	2 mm	-	0.3 v	0.1 v pk-pk	
5 Mc to 10 Mc	4 mm	4 mm	4 mm	0.3 v	0.1 v pk-pk	
10 Mc to 50 Mc	1 cm	1 cm	4 mm	0.5 v	0.1 v pk-pk	
50 Mc to 100 Mc	2 cm	2 cm	4 mm	1.5 v	0.1 v pk-pk	
100 Mc to 150 Mc	3 cm	3 cm	4 mm	2.0 v	0.1 v pk-pk	
150 Mc to 250 Mc			4 mm		0.1 v pk-pk	

TRIGGER REQUIREMENTS for Time Base B of Type 585A and RM585A are as follows:

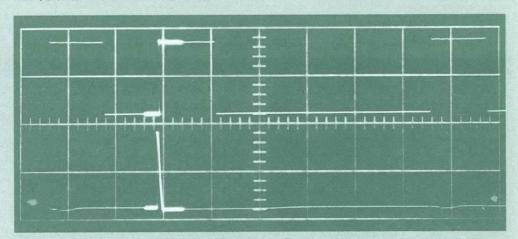
	INT	ERNAL	EXTERNAL				
FREQUENCY	AC	AC LF REJ	AC/DC				
15 cps—15 kc	4 mm		0.2 v pk-pk				
15 kc—1 Mc	4 mm	4 mm	0.5 v pk-pk				
1 Mc—5 Mc	1 cm	1 cm	1.5 v pk-pk				





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 μ sec 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 μ sec to 0.1 sec is within 1% of the indicated delay. Accuracy of the 3 remaining calibrated steps from 0.2 sec to 1 sec is within 3% of the indicated delay. A 10-turn precision potentiometer permits calibrated delay-time adjustments to any value from 2 μ sec 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 μ sec/cm and TIME BASE B is operating at 50 μ sec/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.

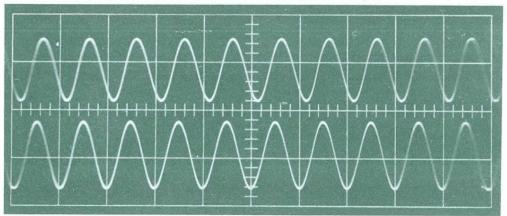
CRT AND DISPLAY FEATURES

TEKTRONIX 5" CRT is a metalized, lumped constant traveling wave tube incorporating a helical post accelerating anode and achieving a small, bright crt 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.

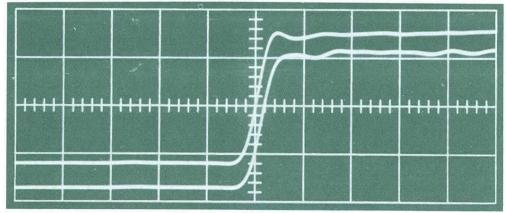
ILLUMINATED GRATICULE with variable edge lighting is accurately ruled in centimeter squares. Viewing area is 4 by 10 cm. Vertical and horizontal centerlines are further marked in 2-mm divisions.

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.



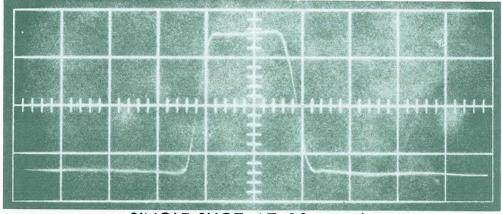
PHASE COMPARISON

Dual-trace display of 100 Mc sine waves at 10 nsec/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 nsec/cm. Lower trace delayed 1 nsec 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 nsec/cm.



SINGLE-SHOT AT 10 nsec/cm

For recording fast transients, the Single-Sweep feature facilitates photographic recording of most one-shot phenomena.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR provides 18 square-wave 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 within 3%. Square-wave frequency is approximately 1 kc.

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.

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 $0.05~\mu sec$ to 10~sec. 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.

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 cps. Maximum power consumption is 560 watts for the Type 581A, and 630 watts for the Type 585A and RM585A.

CABINET MODEL dimensions are 16% high by 13% wide by 23% deep. Type 581A net weight is 71 pounds. Shipping weight is 80 pounds, approx. Type 585A net weight 74 pounds. Shipping weight is 84 pounds, approx.

RACK-MOUNT MODEL dimensions are 14" high by 19" wide by 22³/₄" deep. Type RM585A net weight is 81 pounds. Shipping weight is 110 pounds, approx.

MAINTENANCE AIDS

6" PLUG-IN EXTENSION allows a Type 80, 82, 84, or 86 Plug-In Unit to be serviced while partially removed from the oscilloscope.

Order Part Number 013-055 \$14.50

FREQUENCY DOUBLER, for timing the fast sweep of the Type 580-Series Oscilloscopes, converts the 50-Mc output of a Type 180A Time Mark Generator to 100 Mc.

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 $17\frac{1}{2}$ ".

Order Part Number 040-281 \$45.00

The TU-5 tunnel-diode pulser generates a fast-rise, flattop square wave designed to aid in adjustment of transient response of the Tektronix 80-Series Plug-In Units. It can also be used with letter series and sampling plug-in units. When used with letter-series plug-in units the pulser is sufficiently fast to show the risetime of the oscilloscope and plug-in unit. The oscilloscope calibrator output provides the proper input to the pulser.

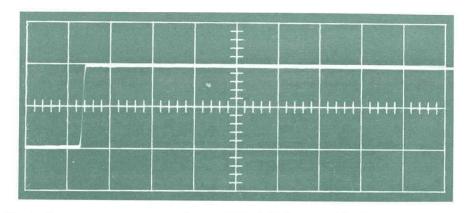
A bias adjustment on the pulser provides for changes in tunnel-diode characteristics due to temperature variations, tolerance, or other variables.

RISETIME—less than or equal to 1.5 nsec into 50 ohms.

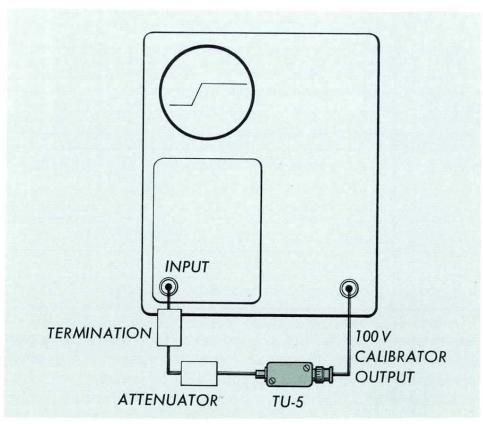
AMPLITUDE—at least 200 mv with 50-ohm termination, 20 mv with 10X attenuator and 50-ohm termination.

PULSE WIDTH—about 0.5 msec, dependent on oscilloscope calibrator output, (oscilloscope calibrator is 1 kc).

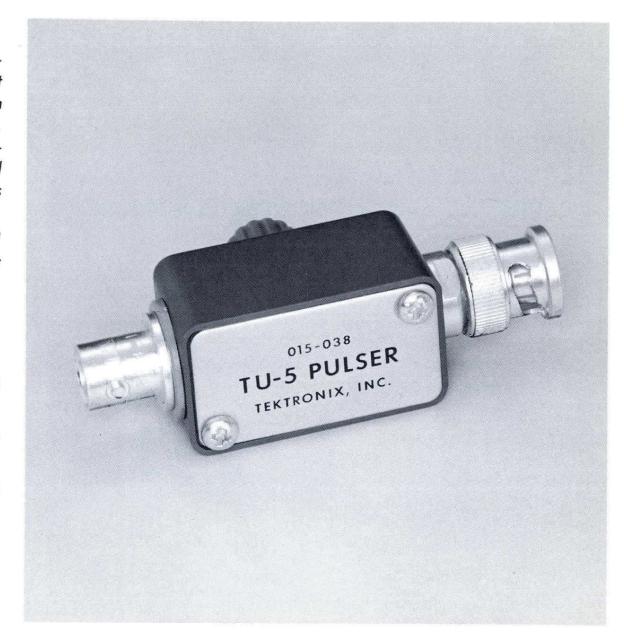
OUTPUT IMPEDANCE—50 ohms (25 ohms when used with 50 ohm termination).



Fast-rise square wave from TU-5 Pulser with Type 86 Plug-In Unit and Type 585 Oscilloscope—50 nsec/cm sweep speed, taken with Tektronix Type C-12 Camera.



Fast-rise square wave from oscilloscope calibrator output—with TU-5 Pulser and optional accessories.



SOURCE VOLTAGE—100 volt square wave (10 ma) from the oscilloscope calibrator output.

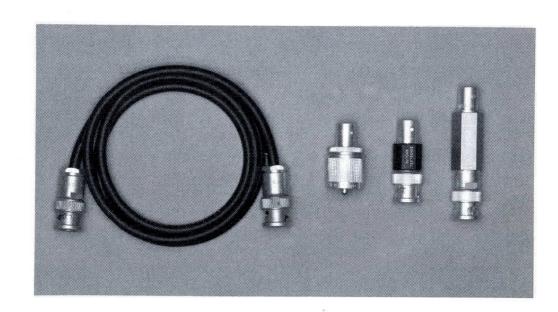
REPETITION RATE—same as source voltage (1 kc from oscilloscope calibrator output).

BNC CONNECTORS—for input and output.

TU-5 PULSER with accessories (part no. 015-043) \$46.50

Includes one each: 50-ohm 10X BNC attenuator, 50-ohm BNC termination, BNC cable, UHF to BNC adapter.

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

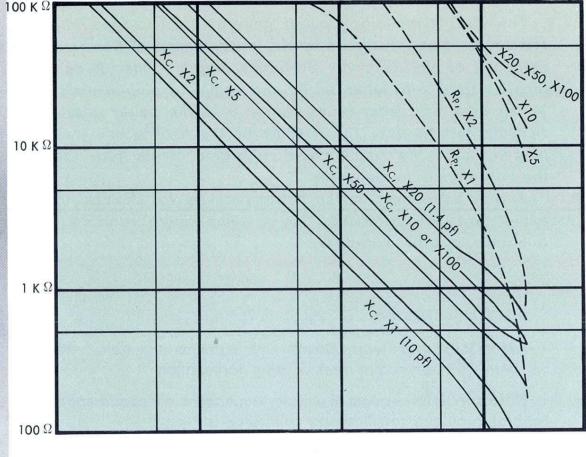


Type $\frac{80}{P80}$ PLUG-IN UNIT PROBE



100 MC





10 MC

1 MC

100 KC

DC-to-95 Mc passband is provided for Type 580-Series Oscilloscopes with the Type 80 Vertical Plug-In Unit and the cathode-anode follower P80 Probe.

The probe can be connected to the signal source using one of the three tips supplied. However, the probe tips and the probe ground lead form a resonant circuit which may produce ringing when excited by fast-rising pulses. Special adapters are available which allow direct connection of the probe nose to Type N, UHF, and BNC connectors. For fast-rising pulses one of these adapters should be used.

Five attenuator heads are supplied with the Type P80 probe. These heads produce vertical deflection factors of 0.2, 0.5, 1, 2, and 5 volts per centimeter. In addition, the heads increase the input resistance of the probe, decrease the input capacitance, and lessen the possibility that the probe will ring.

When used with a Type 581A or Type 585A, the following specifications apply: passband dc to approximately 95 Mc... risetime better than 3.9 nsec, 10% to 90%, nominally 3.7 nsec... sensitivity of 0.1 v/cm...input characteristics of 10 pf, 100 kilohms with no attenuation—3.7 pf, 5 megohms with 50X attenuation.

The P80 PROBE has impact styrene covering for the shielded components and attached 42" standard cable with 9-pin connector. Dimensions are 5" long (without tip) by $1\frac{1}{4}$ " by $1\frac{3}{4}$ ". The P80 Probe weighs 10 ounces. The Type 80 Plug-In Unit weighs $2\frac{1}{2}$ pounds. Type 80/P80 shipping weight is 7 pounds, approx.

TYPE 80 PLUG-IN UNIT/P80 PROBE \$250

Type 80/P80 includes: 5—attenuator heads (2X, 5X, 10X, 20X, 50X), 2—hook tips, 2—straight tips, 1—ground lead, 1—clip assembly, 1—high-frequency ground clip, 2—instruction manuals.

Input Characteristics of Type P80 Probe and Attenuators

Resistive component of input impedance is shown by broken lines for Type P80 alone (X1) and various attenuator heads (X2 through X100). Capacitive reactances for Type P80 alone and with attenuator heads are shown by solid lines.

Above 50 Mc, both input R and C are affected by ground connections. Data shown was measured with coaxial ground connection (013-017) Adapter.

OPTIONAL ACCESSORIES

Description	Features	Part No.	Price
	Permits additional 10X attenuation with proper impedance matching between P80 probe and one other associated attenuator head.	010-311	\$20.00
100X Attenuator	Permits additional 100X attenuation with proper impedance matching between P80 probe and one other associated attenuator head.	010-321	\$22.50
	For minimum input capacitance (1.4 pf) and increased dc resistance (10 megohms).	010-322	\$8.00
Adapter	Adapts probe to Type N connector.	013-016	\$8.00

*The Standardizing 10X or 100X attenuator head permit stacking of it with one other regular attenuator head for higher attenuation with proper impedance matching. Regular P80 attenuator heads, w stacked, will introduce waveform distortion due to impedance mismatch.

Adapts probe to Type UHF connector

Adapts probe to Type BNC connector

Adapter

Adapter

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

013-017

013-018

\$8.00

\$8.00

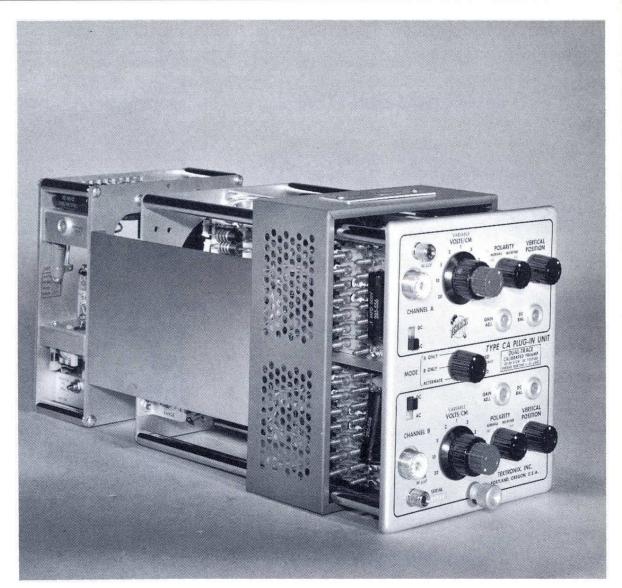
PLUG-IN ADAPTER Type

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, and multiple-trace displays, as well as other general and special-purpose applications.

The Type 81 Adapter is extremely easy to use. The Adapter is simply inserted into the Type 580-Series plug-in compartment. The Letter-Series Unit is then plugged into the Adapter. No cabling or switching is required.

Dimensions are $6\frac{1}{2}$ " high by $5\frac{1}{2}$ " wide by $12\frac{1}{2}$ " deep. Net weight is 4 pounds. Shipping weight is 6 pounds, approx.

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

For Wide Band Applications—

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

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

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

For Multiple-Trace Operation—

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

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

For Differential Input Applications—

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

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

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

For High DC Sensitivity—

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

For Repetitive High-Speed Pulse Applications—

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

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

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

For Transducer and Strain Gage Applications—

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

For Transistor-Risetime Checking—

TYPE R UNIT—12-nsec risetime.

For Diode Recovery-Time Measurements—

TYPE S UNIT—12-nsec risetime.

For Precise Amplitude Measurement via the Slide-Back Technique—

TYPE Z DIFFERENTIAL COMPARATOR UNIT—DC to 13 Mc, 27 nsec risetime at 50 mv/cm to 25 v/cm.

Type DUAL-TRACE UNIT



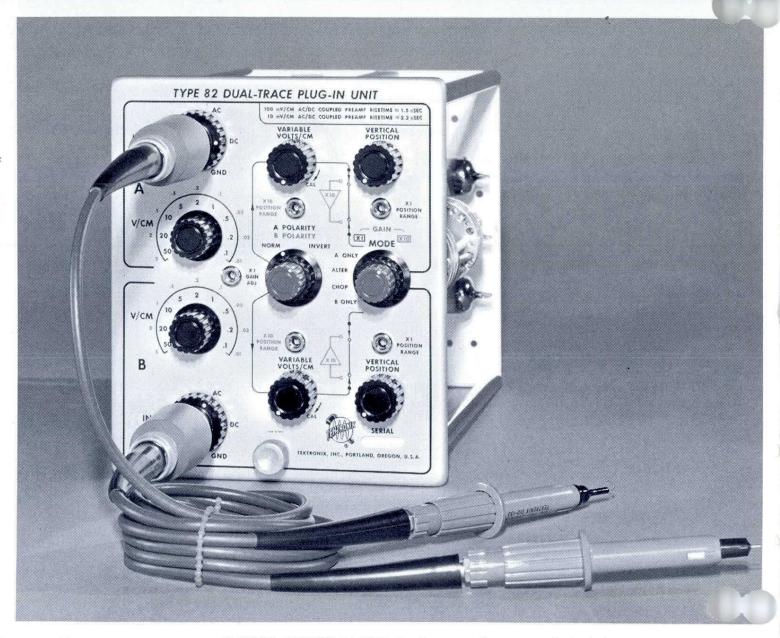
10 MV/CM SENSITIVITY

DC TO 85 MC AT 100 MV/CM*

DC TO 80 MC 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 Oscilloscope is nominally 4 nsec at 100 mv/cm, always less than 4.2 nsec. At 10 mv/cm, using the 10X Amplifier, risetime is nominally 4.3 nsec, always less than 4.5 nsec. 100 mv/cm 12-db point is approximately 150 Mc.

4 OPERATING MODES include Channel A only, Channel B only, Chopped (free-running electronic switching between channels at either approximately 100 kc or 1 Mc) and Alternate (triggered electronic switching between channels, at the end of each sweep).

CALIBRATED SENSITIVITY 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 sensitivity to 10 mv/cm. Sensitivity is then in 9 calibrated steps from 10 mv/vm 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 15 cps direct or 1.5 cps with the P6008 10X Probe.

* Approximate 3-db points.

INPUT IMPEDANCE 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 sensitivity of 100 mv/cm is approximately 4.5 nsec.

WEIGHT: Net-43/4 pounds. Shipping-7 pounds, approx.

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 040-275\$25

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PLUG-IN TEST UNIT Type

For standardizing vertical sensitivity and transient response, and checking general Type 580-Series oscilloscope performance.

Variable 500-800 (approx.) PPS Mercury Pulser

0.2 nsec Pulse Risetime

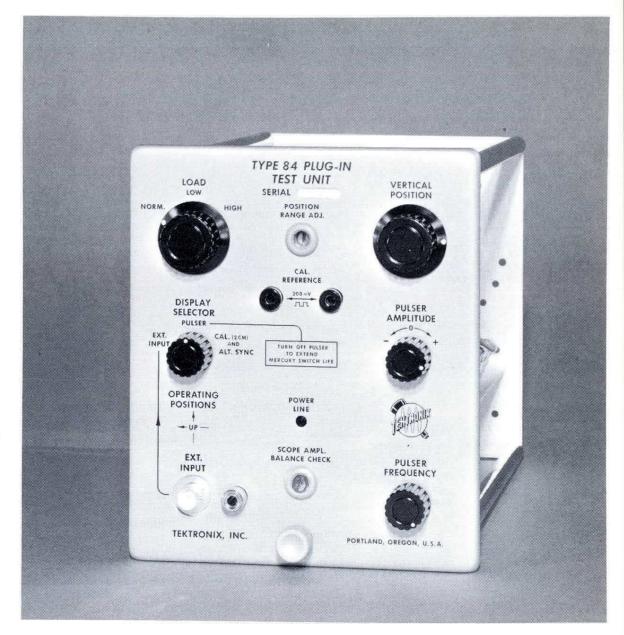
Continuously Adjustable Pulse Amplitude, 0 to 4 major divisions.

Positive or Negative Polarity

External Input for Time Markers

Selectable Loads for Checking Oscilloscope Power Supply Ripple at Low and High Load

 $200 \text{ mv } \pm 2 \%$ Reference Voltage for Gain Standardization.



The Type 84 Plug-In Test Unit generates a fast-rise, stepfunction test signal of known waveshape for use in standardizing the transient response of the oscilloscope. In addition, the Type 84 Test Unit facilitates checking (1) the dualtrace alternate sync, (2) the main oscilloscope amplifier gain, (3) the power-supply regulation at minimum and maximum load capabilities, and (4) the oscilloscope dc vertical balance.

After standardizing a Type 580-Series Oscilloscope with the Type 84 Test Unit, the oscilloscope will accept a Type 80/P80, 82, or 86 Plug-In Unit without readjustment of the frequency-compensating circuits.

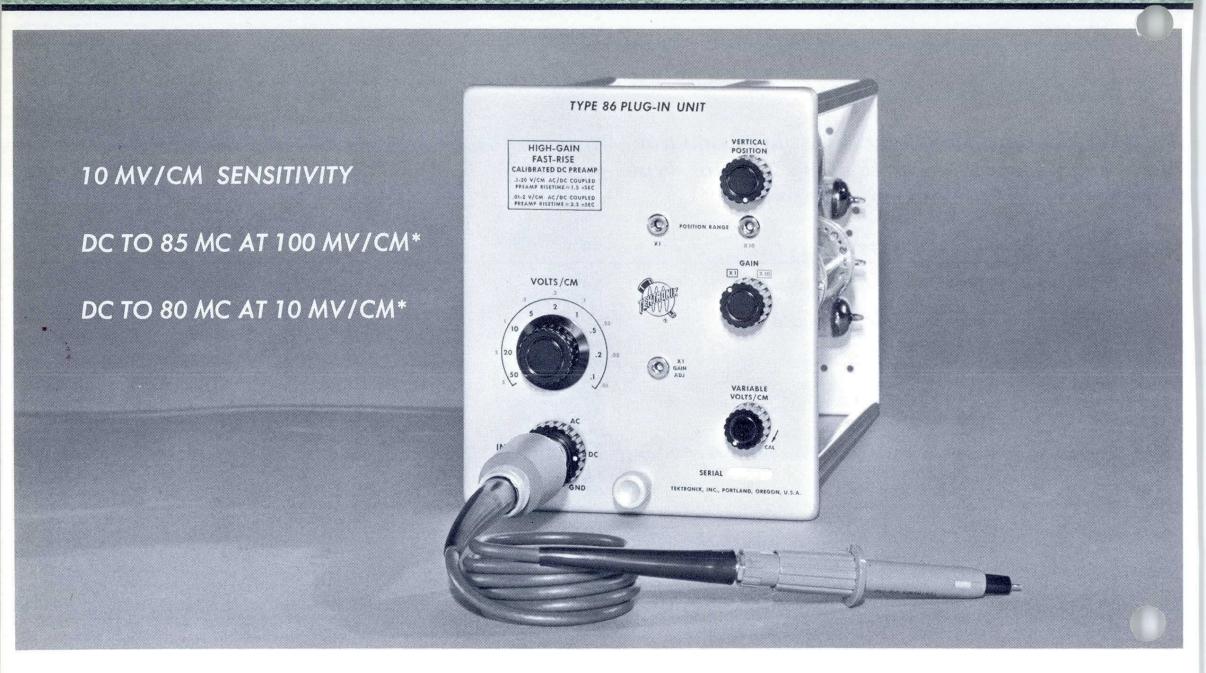
Note: As a result of component aging, particularly tubes, the transient response of an amplifier changes over a period of time. In contrast, the Type 84 Plug-In Test Unit will maintain stable waveform characteristics.

WEIGHT: Net—4³/₄ pounds Shipping—7 pounds, approx.

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

Type B PLUG-IN UNIT





RISETIME of the Type 86 and Type 580-Series Oscilloscope is nominally 4 nsec at 100 mv/cm, always less than 4.2 nsec. At 10 mv/cm, using the 10X Amplifier, risetime is nominally 4.3 nsec, always less than 4.5 nsec. 100 mv/cm 12 db point is at approximately 150 Mc.

CALIBRATED SENSITIVITY from 100 mv/cm to 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 sensitivity to 10 mv/cm. Sensitivity 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 15 cps direct or 1.5 cps with the P6008 10X Probe.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 15 pf.

P6008 10X PASSIVE PROBE increases the input resistance to 10 megohms and decreases the input capacitance to approximately 7 pf. The risetime of a Type 580-Series Oscilloscope, a Type 86 Plug-In Unit, and a P6008 Probe, at an overall sensitivity of 100 mv/cm is approximately 4.5 nsec.

* Approximate 3-db points.

WEIGHT: Net—31/4 pounds Shipping—5 pounds, approx.

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.

Order Part Number 040-275 \$25

Each kit includes components to change delay-line impedance, standardize crt termination, modify crt and distributedamplifier circuitry and modify Type 80 Plug-In Unit/Type P80 Probe combination.

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SAMPLING OSCILLOSCOPE Type

2 mv/cm to 200 mv/cm Calibrated Sensitivity Monitorable Dc Offset

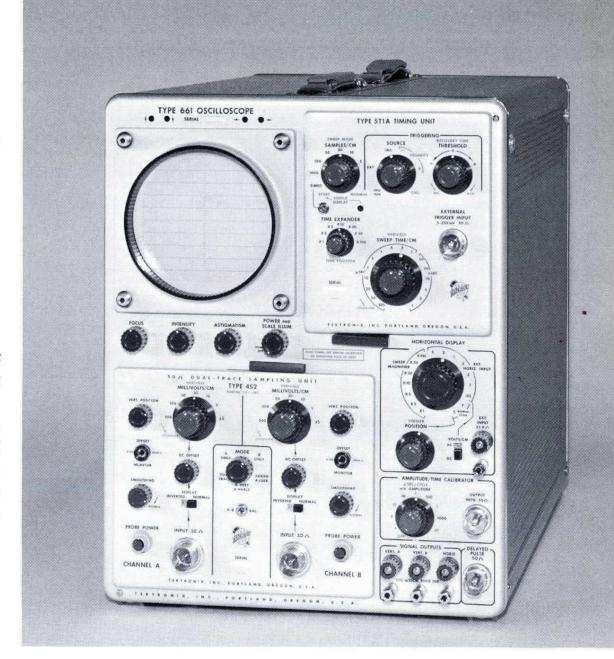
1 nsec/cm to 100 μsec/cm Calibrated Sweep Speed X2 to X100 Time Expander (constant dots/cm) Repetitive, single, or Timed Displays Delay through Full Time Base Duration

This compact and complete sampling system consists of a Type 5T1A Timing Plug-In Unit and either of three Vertical Plug-In Units used with the Type 661 Oscilloscope.

The 2 mv/cm sensitivity of the vertical units, in conjunction with their dc offset capability, allows 1000-to-1 vertical resolution. 100X 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.



- 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. Observe less than 10-psec time jitter on fastest sweep range (optimum triggering conditions).
- 3. Measure pulse risetimes with 0.35 nanosecond response in both channels. Full scale time-measurement range extends to 1 millisecond.
- 4. Use time expansion of either 1, 2, 5, 10, 20, 50, or 100 times, while maintaining a constant number of samples/cm.
- 5. Change time position over full time-base duration for viewing expanded signals.



- 6. Display repetitive signals on 16 calibrated equivalent sweep rates from 1 nsec/cm to 100 μsec/cm, accurate within 3%. Magnifier provides sweep expansion from 2 to 100 times . . . time per dot remains the same for digital readout (rear panel connector provides signals for connection to counter).
- 7. Dot transient response and dc reference are independent of signal source impedance.
- 8. Reduce random system time jitter and amplitude noise by means of a smoothing control.
- Measure millivolt signals in the presence of a substantial dc component by means of a dc-offset voltage monitorable at the front panel.
- Calibrate with amplitude signals available from the front panel. Calibrate with timing signals traceable to National Bureau of Standards.
- 11. Show lissajous patterns in addition to single and dualtrace 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 sec/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 1X, 2X, 5X, 10X, 20X, 50X, or 100X, symmetrical about the screen center, reduces the number of dots/cm and keeps time/dot uniform.

EXTERNAL HORIZONTAL INPUT permits externally scanning the sampled display. 50 mv/cm to 5 v/cm sensitivity (into 25-K 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 μ sec/cycle to 10 μ sec/cycle in 4 decade steps. Accuracy with 50-ohm load is within 0.2%, except within 2% at 0.01 μ sec/cycle.

DELAYED-PULSE AND SIGNAL OUTPUTS

DELAYED PULSE 50-ohm output permits the Type 661 (with 4S1 or 4S2 and 5T1A Units) to serve as a rate generator to trigger external circuitry. Pulses occur nominally 50 nsec after the equivalent sweep start with a Type 4S1 Unit, or 10 nsec after sweep start with a Type 4S2 Unit. Amplitude is at least —350 my and risetime is less than 70 psec.

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 2.7-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 ISO-LATED 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 cps, typically 450 watts.

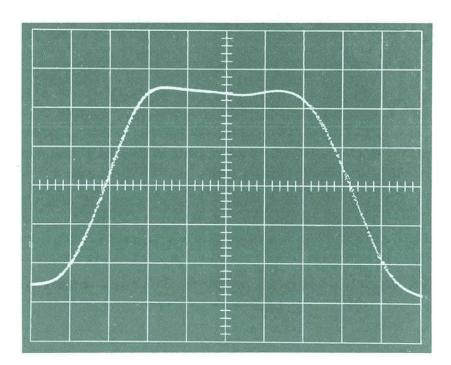
MECHANICAL FEATURES

Dimensions are $16\frac{7}{8}$ " high by $13\frac{1}{8}$ " wide by $23\frac{3}{4}$ " deep. Net weight is $49\frac{1}{2}$ pounds. Shipping weight is 67 pounds, approx.

TYPE 661 OSCILLOSCOPE, without plug-in units \$1150

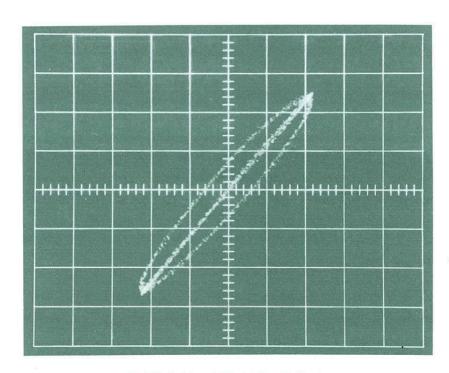
Each instrument includes: 1—light filter, 1—3-conductor power cord, 2—instruction manuals.

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



TIME JITTER

A 1-volt 1.2 nsec pulse internally triggering the 4S1/5T1A system. Vertical sensitivity is 200 mv/cm, sweep speed is 0.2 nsec/cm (1 nsec/cm with 5X expander). Note very small amount of time jitter. Note clean 0.2-nsec risetime of the Type 109 Pulse Generator and 0.35-nsec risetime of the Type 4S1 combined for less than 0.4-nsec total risetime.



TYPICAL APPLICATION

2 gigacycle sine-wave driving inputs to 4S1 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

0.35-nsec Risetime

Internal Delay Lines

2 mv/cm to 200 mv/cm Calibrated Sensitivity

2-volt Dynamic Range

±1 volt DC Offset

Less than 1 mv noise (unsmoothed, ½ mv smoothed)

The Type 4S1 Dual-Trace Sampling Unit is a generalpurpose sampling plug-in unit with separate internal trigger takeoffs, delay lines, and terminations, which permit triggering on either A or B input signals.

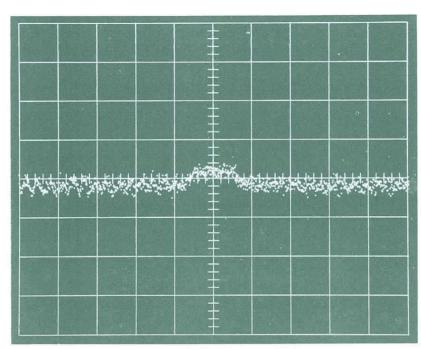
DISPLAY MODES include $\pm A$ only, $\pm B$ only, Dual-Trace, Algebraic Addition, and an X-Y display of A—vertically and B—horizontally (for observation of hysteresis loops, phase shift, similar displays). Independent controls for each channel permit positioning and inverting input signals as desired.

RISETIME is 0.35 nsec or less, measured from 10% to 90% amplitude points on an input step.

FREQUENCY RESPONSE is equivalent to dc-to-1000 Mc.

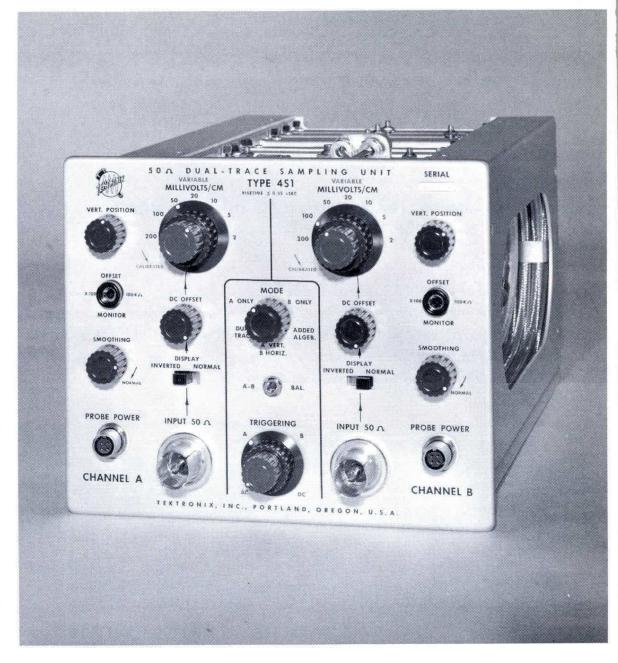
SENSITIVITY is in 7 calibrated steps from 2 mv/cm to 200 mv/cm, 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from 200 mv/cm to 0.67 mv/cm.

SMOOTHING CONTROL reduces system time jitter and amplitude noises, if needed when there is sufficient dot density.



TANGENTIAL NOISE

A 0.8-millivolt 2.5-nsec pulse externally triggering the 4S1/5T1A system. Vertical sensitivity 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 millivolts (4 mm quasi peak-to-peak); thus the RMS noise is approximately 270 microvolts (unsmoothed). Random noise decreases 2X with smoothing.



NOISE LEVEL is equivalent to an input signal of 1 mv or less (tangential noise) unsmoothed, or 0.5 mv smoothed. (Tangential noise is approximately 3 times the RMS amplitude, and is the level "seen" on sampling oscilloscopes. 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 order signal discontinuities.

DYNAMIC RANGE is 2 volts. Full sensitivity can be used with overloads 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 ½ the input signal amplitude. Risetime of the trigger amplifier system is nominally 0.6 nsec (600 Mc bandwidth).

INPUT IMPEDANCE is 50 ohms. Input connectors are GR 874. Special 2% Tektronix 45-nsec delay lines terminate in 2 pf and 50-ohm 1% resistor.

PROBE POWER is available at the front panel for cathodefollower probes. See accessory list.

WEIGHT: Net—151/4 pounds. Shipping—21 pounds, approx.

TYPE 4S1 DUAL-TRACE SAMPLING UNIT \$1430

Each instrument includes: 2-10X $50-\Omega$ attenuators, 2-5-nsec $50-\Omega$ cables, 2- instruction manuals.

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

Type 4 S DUAL-TRACE SAMPLING UNIT



0.1-nsec Risetime

2 mv/cm to 200 mv/cm Calibrated Sensitivity

±1 volt Dynamic Range

±1 volt DC Offset

4 mv noise (unsmoothed, 2 mv smoothed)

The Type 4S2 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, except for delay lines and internal triggering.

661/5T1A/4S2 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 pico-coulomb/milliampere region (generally limited by diode capacity and turn-on capability).

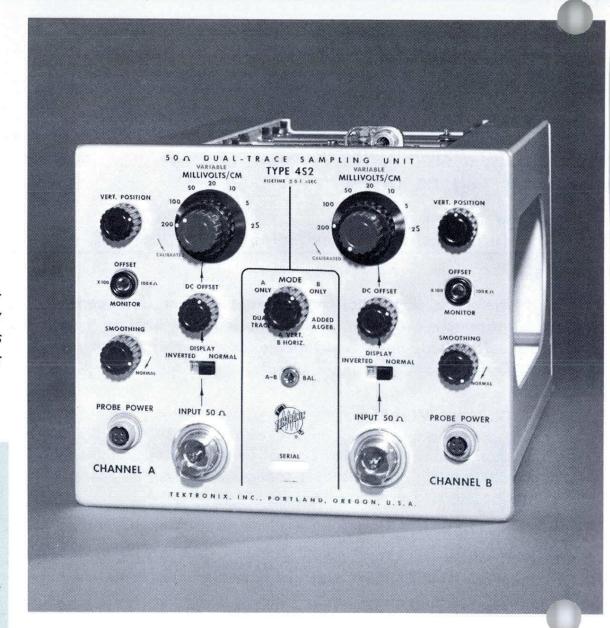
DISPLAY fractions of a degree of relative phase shift to over 3 gigacycle frequency with lissajous-mode operation (usually limited by harmonic content or residual reflections to a few degrees absolute). Over 500 Mc, use Type 280 Trigger Count-Down Unit.

DISPLAY MODES include $\pm A$ only, $\pm B$ 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 0.1 nsec or less, measured from 10% to 90% amplitude points on an input step. Transient abberations are within $\pm 5\%$.

FREQUENCY RESPONSE is equivalent to dc-to-3500 Mc.

SENSITIVITY 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.

NOISE LEVEL is less than 4 mv (tangential noise) unsmoothed or 2 mv smoothed. (Tangential noise is approximately 3 times the RMS amplitude and is the level "seen" on sampling oscilloscopes. 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).

TRIGGERING is external (required 50-nsec prior to signal). No internal delay lines included. Please refer to Timing Plug-In Unit specifications.

INPUT IMPEDANCE is 50 ohms. Input connectors are GR 874. Termination is 50-ohm $\pm 1\%$ resistor and approximately 3 pf.

PROBE POWER is available at the front panel for cathodefollower probes. See accessory list.

WEIGHT: Net—9 pounds. Shipping—15 pounds, approx.

TYPE 4S2 DUAL-TRACE SAMPLING UNIT \$1600 Each instrument includes: 2 — 10X 50-Ω attenuators, 2 — 5-nsec

50- Ω cables, 2 — instruction manuals.

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

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





SAMPLING-PROBE DUAL-TRACE UNIT Type

0.35-nsec Risetime

Miniature Direct Sampling Probes

100 k, 2 pf Input Impedance

2 mv/cm to 200 mv/cm Calibrated Sensitivity

Less than 300 \(\mu \) noise (smoothed)

±2-volt Dynamic Range

±1-volt DC Offset

The Type 4S3 Sampling Probe Unit 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 4S2, such as 2 mv/cm sensitivity, 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 $\pm A$ only, $\pm B$ 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.

RISETIME is 0.35 nsec or less (FAST RISETIME) and approximately 0.5 nsec (LOW NOISE) with a $50-\Omega$ source.

FREQUENCY RESPONSE is equivalent to dc-to-1000 Mc.

SENSITIVITY 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.

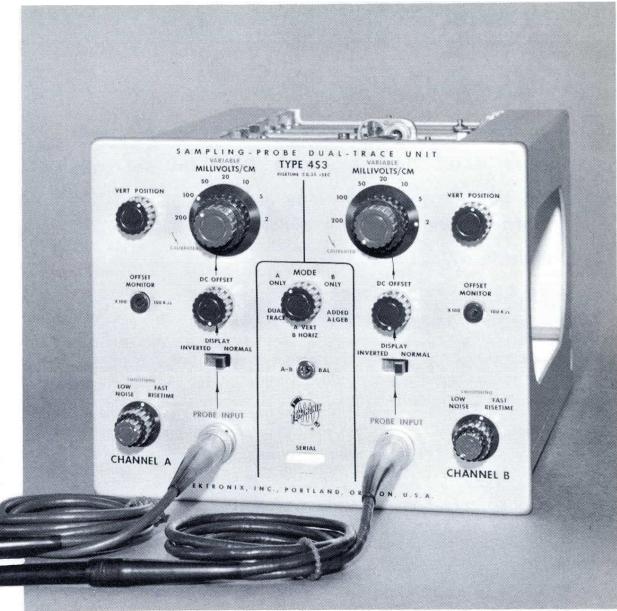
SMOOTHING CONTROL reduces system jitter and amplitude noises, if needed, when there is sufficient dot density. Correct dot transient response can be obtained with signal sources from below 50 ohms to beyond 300 ohms.

NOISE LEVEL is less than 0.5 mv unsmoothed (LOW NOISE), 1 mv (FAST RISE), or approximately 300 μ v smoothed, when using a 50-ohm source.

DC OFFSET through ± 1 volt for signal levels exceeding "on screen" sensitivity settings allows utilization of full sensitivity to display and accurately measure small discontinuities.

DYNAMIC RANGE is ± 2 volts. Full sensitivity can be used with overloads up to ± 2 volts in amplitude. Safe overload is 10 volts momentary dc or peak ac (100 volts with 10X attenuator).

TRIGGERING is external (required approximately 50 nsec prior to signal). Please refer to Timing Unit specifications.



MINIATURE DIRECT SAMPLING PROBES used with the Type 4S3 incorporate sampling circuitry in the probe head to permit low-noise full-sensitivity measurements even when operated with source impedances above 50 ohms. Probe input impedance is 100 kilohms paralleled by 2 pf \pm 10%. The Type 4S3 and P6038 Probes are calibrated and color coded for respective channels but probes can be interchanged or used with another Type 4S3 Unit.

FURNISHED ACCESSORIES include blocking capacitors, 10X attenuators, and special response normalizers. The response normalizers minimize variations in base line and dot transient response due to changes in source impedance. With the blocking capacitor, and with or without the response normalizer, low-frequency response is approximately 3-db down at 1.5 kc. With the blocking capacitor and 10X attenuator, low-frequency response is approximately 3-db down at 150 cps.

RECOMMENDED OPTIONAL ACCESSORIES include probeto-GR adapter, probe-to-BNC adapter, and 50-ohm voltage pickoff. Contact your Tektronix Field Office for price and availability.

WEIGHT: Net—93/4 pounds. Shipping—12 pounds, approx.

Each instrument includes: 2—P6038 Probes with accessories, 2—instruction manuals.

REPLACEMENT P6038 PROBE (Part Number 010-156) ... \$225 Each Probe Package includes: 1—response normalizer, 1—10X attenuator, 1—coupling capacitor, 2—test point jacks, 1—hook tip assembly, 1—ground clip, 1—probe holder, 1—accessory box, 1—instruction manual.

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

Type TIMING UNIT



1 nsec/cm to 100 µsec/cm Calibrated Sweep Speeds
X2 to X100 Time Expander (constant dots/cm)
Time position provides delay
through full time base duration

Versatile Triggering
5 to 1000 Samples/cm

Repetitive Single or Timed Displays

The Type 5T1A Timing Plug-In Unit provides flexible triggering and generates the time base. External trigger sensitivity is 5 mv, for pulses 1 nsec or wider. Triggers larger than 250 mv can be accommodated with external attenuators. External input is ac coupled, approximately 3-db down at 300 kc (sine-wave) at the low end.

SAMPLING DISPLAY is in 5 calibrated steps of 5, 10, 20, 50, 100, (accuracy within 2%), and nominal 1000 samples/cm.

SWEEP MODE selects either NORMAL (repetitive), SINGLE, or TIMED displays. A timed slow scan is provided for those applications requiring the connection of a Y-T or X-Y Recorder. The slow scan is nominally 7.5 sec/cm and adjustable from 5 sec/cm to approximately 10 sec/cm.

EQUIVALENT SWEEP RANGE from 1 nsec/cm to 100 μ sec/cm is in 16 calibrated rates with 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from approximately 0.33 nsec/cm (3.3 psec/cm time expanded) to 100 μ sec/cm.

TIME EXPANDER provides X1, 2, 5, 10, 20, 50, and 100 expansion that maintains a constant number of samples per centimeter. Full time expansion extends calibrated sweep range to 10 psec/cm.

TIME POSITION allows time "windowing" over the full time base duration.

INTERNAL TRIGGERING, with the Type 4S1 vertical plug-in unit, allows triggering from the vertical input signal. This feature facilitates observation of the leading edge of fast-rise input-signals. Nominally, the leading edge of a fast-rise signal will appear more than 8 nsec after the equivalent sweep start. Sensitivity is 40 mv for a 2-nsec wide pulse.

FREE RUN TRIGGERING provides stable displays when using the Type 661 delayed-pulse generator.



EXTERNAL 50-OHM TRIGGER INPUT is ac coupled (1 μ sec time constant) and allows direct connection of the Type 5T1A to the trigger signal. Sensitivity is 5 mv for a fast-rise 2-nsec wide pulse. An isolation stage reduces kickout to 5 mv or less, with less than 1/2 nsec decay time constant.

TRIGGER THRESHOLD is continuously variable, ± 200 mv. RECOVERY TIME may be varied from nominally 10 μ sec to 13 μ sec on sweep rates faster than 0.1 μ sec/cm, longer on slower sweep rates. This normally permits triggering from irregularly spaced pulses.

TRIGGER POLARITY can be either positive or negative.

TIME JITTER is less than 10 psec at 1 nsec/cm, and less

than 30 psec (or 0.01% of fast ramp, whichever is larger) at 2 nsec/cm or slower. This is under optimum conditions of 100 kc or less repetition rate, and fast-rise triggers of 40 mv, 1 nsec duration. Jitter increases with reduced trigger rise rate, amplitude, or duration, and increased repetition rate. Internal triggering with the Type 4S1, on a 50 mv signal of 1 nsec duration, will display typically less than 100 psec of jitter. Internal triggering on a 100 Mc sine wave, 1 v pk-to-pk, displays less than 50 psec of jitter. Synchronizing at 1000 Mc (100 mv pk-to-pk external or 1 v internal) displays typically 80% of dots within 100 psec.

WEIGHT: Net-6 pounds. Shipping-12 pounds, approx.

50- Ω cable, 2 — instruction manuals.

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





TRIGGER COUNTDOWN UNIT Type

INPUT SIGNAL FREQUENCIES—30 megacycles to 5 gigacycles.

OUTPUT SIGNAL FREQUENCIES—Continuously variable from 15 to 45 megacycles.

The Tektronix Type 280 Trigger Countdown Unit allows timing systems to be synchronized on frequencies up to 5 gigacycles. It can be used to lower the frequency of the triggering signals to within a range of 15 to 45 megacycles. 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 gigacycle range.

CHARACTERISTICS

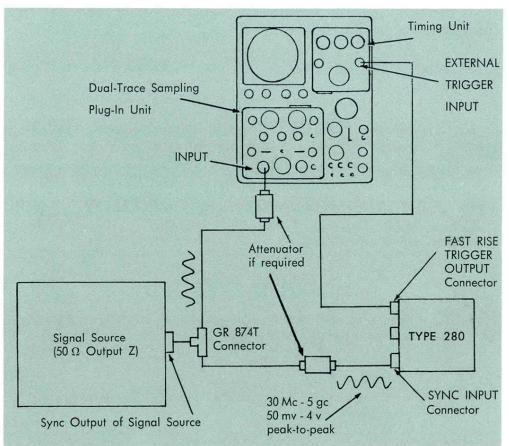
INPUT FREQUENCY is from 30 megacycles to 5 gigacycles.

INPUT SIGNAL VOLTAGE is 50 millivolts to 4 volts peak-to-peak.

INPUT IMPEDANCE is approximately 50 ohms.

OUTPUT REPETITION is continuously variable from 15 to 45 megacycles.

JITTER is 10 psec, 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-nsec long, with less than 4-nsec risetime, (for use with Type N Sampling Plug-In and high-speed conventional oscilloscopes).

FAST-RISE TRIGGER OUTPUT (terminated in 50 ohms is 150 millivolts, with less than 0.4-nsec risetime, decaying with 2-nsec time constant, (for use with Type 5T1, 5T1A, or 3T77 and other high-speed sampling oscilloscopes).

AMPLITUDE OF TRIGGER OUTPUT as seen at oscilloscope input connector is approximately 50 millivolts decaying with a 4-nsec time constant.

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 cps, 10 watts.

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 6 pounds, approx.

TYPE 280 TRIGGER COUNTDOWN UNIT \$265
Includes: 2—instruction manuals, 1—5-nsec cable, 1—3-conductor power

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

Type 290 TRANSISTOR SWITCHING-TIME TESTER



TESTS FAST-SWITCHING TRANSISTORS RESPONSE TO LESS THAN 1 NSEC WIDE RANGE OF TEST VOLTAGES

The Tektronix Type 290 Transistor Switching-Time Tester permits dc-coupled pulse-response characteristics of fast-switching transistors to be observed and measured on Tektronix oscilloscopes. Driven by a Tektronix fast-rise pulse generator and combined with a Tektronix fast-rise sampling oscilloscope, the Type 290 becomes an integral part of a transistor testing system with an over-all transient response of less than 1 nanosecond. (When a non-sampling oscilloscope is used, transient response is limited by the risetime of the oscilloscope.) This system can test fast NPN or PNP transistors on a short duty-cycle basis for delay, rise, storage, and fall times. Since these characteristics vary considerably with operating conditions, the Type 290 supplies a wide range of operating voltages.

The Type 290 does not use speedup capacitors or catching diodes. Use of these capacitors and diodes tends to test a circuit rather than a transistor.

TWO TRANSISTOR TEST SOCKETS (HIGH and LOW) are mounted on the Type 290 to provide for easy insertion of the transistor into grounded-emitter test circuit. The HIGH socket connects to a collector supply of 0-100 v and the other connects a collector supply of 0-30 v.

INPUT SIGNALS from the pulse generator go to the base of the transistor under test. For each volt of the input pulse in excess of $V_{\rm be}$ there is 1 ma of base current. (A Type 290 MOD 788A is available that will give 0.2 ma of base current for each input volt in excess of $V_{\rm be}$.)

The input signal is attenuated 50-to-1 and appears at the Type 290 INPUT MONITOR connector. A similar input signal can be switched to the OUTPUT connector.

OUTPUT SIGNALS originate at the transistor collector and appear at the Type 290 OUTPUT connector. The collector circuit provides a resistive load of 200 ohms monitored by an internal dc-coupled passive probe. A transistor in the HIGH test socket has a passive probe output attenuation of 250-to-1 from the collector to the OUTPUT connector. A transistor in the LOW socket has an attenuation of 50-to-1 from the collector to the OUTPUT connector.

SIGNAL TRANSIT TIMES in the Type 290 are matched so the input pulse is compared to the transistor collector signal on a dual-trace oscilloscope using one trace attached to the INPUT MONITOR connector and the other attached to the OUTPUT connector. To compare the two signals on a single-trace oscilloscope, the trace is attached to the OUTPUT connector and the signals are switched with a front panel control.



LEAD LENGTH of the transistor test, up to approximately 2 inches, is unimportant at speeds slower than 2 nsec.

CONNECTORS are terminated in 50 ohms.

REGULATED SUPPLIES provide the collector and base voltage. Collector voltage is continuously variable from zero to 30 volts in the LOW position and from zero to 100 volts in the HIGH position. Base supply voltage is continuously variable from zero to \pm 10 volts.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v, 50 to 800 cps, 15 watts.

MECHANICAL FEATURES include dimensions of $7^3/_8$ " high by $7^5/_8$ " wide by 5" deep. Net weight is 5 pounds. Shipping weight is 7 pounds, approx.

TYPE 290 TRANSISTOR SWITCHING-TIME TESTER . . \$290 Each instrument includes: 2—instruction manuals, 1—10-nsec cable, 1—3-conductor power cord.

MODIFIED TYPE 290

MOD 788A changes each volt of input signal in excess of $V_{\rm be}$ to 0.2 ma of test base current.

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



DIODE SWITCHING-TIME TESTER Type

The Type 291 with an associated Test Fixture in conjunction with a suitable pulse generator and oscilloscope permits measurement of fast-switching diode characteristics. Dc coupling permits direct reading of forward and reverse recovery current on the oscilloscope crt screen. Since the switching characteristics vary with diode current, the Type 291 Power Supply provides a range of dc test current to 100 milliamperes—with provision for external current supply to 500 milliamperes.

THE PULSE GENERATOR used should have a fast rise output; such as the Type 109 or 110. Pulse risetime should be short compared to the diode reverse-recovery time expected. Pulse width should be longer than the diode reverse-recovery time. Amplitude is called out in the diode test specifications but should not exceed half the diode-breakdown voltage.

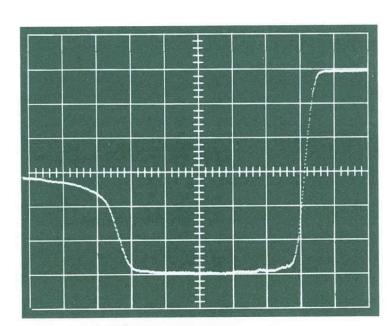
THE OSCILLOSCOPE used should have a risetime faster than the expected reverse-recovery time, such as either the 560-Series or Type 661 with sampling plug-in units.

DIODE RECOVERY LOOP IMPEDANCE is 100 ohms.

SUPPLY CURRENT is provided in seven calibrated steps from 1 milliampere to 100 milliamperes 1-2-5 sequence. Calibration accuracy is within \pm 2% for all steps except the 100-milliamperes step, which is \pm 3%. Uncalibrated, continuous adjustment from less than 1 milliampere to 100 milliamperes is also available. The current may be monitored externally.

POWER REQUIREMENT is 105 to 125 v or 210 v to 250 v, 50 to 400 cps, 6 watts.

MECHANICAL FEATURES include dimensions of $4^{11}/_{16}$ " high by $6^{9}/_{16}$ " wide by $8^{1}/_{8}$ " deep. Net weight is $4^{3}/_{4}$ pounds. Shipping weight is 7 pounds, approx.

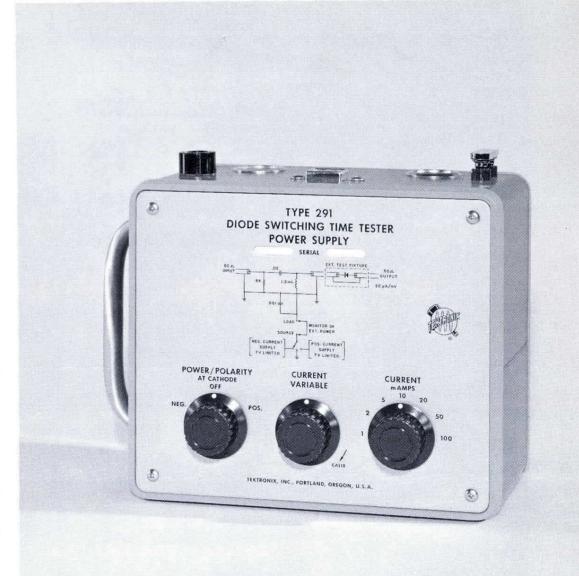


Horizontal — 1 nsec/div

Vertical — 10 ma/div

Diode Reverse Recovery Waveform

In this diode-recovery waveform (displayed on a Tektronix Type 661 Sampling Oscilloscope), the diode shows a stored charge of approximately 6 picocoulombs per milliampere. Note the freedom from ringing and overshoot of the recovery waveform, owing to strip-line testing environment of the Diode Switching-Time Tester.



TYPE TF-1 DIODE TEST FIXTURE

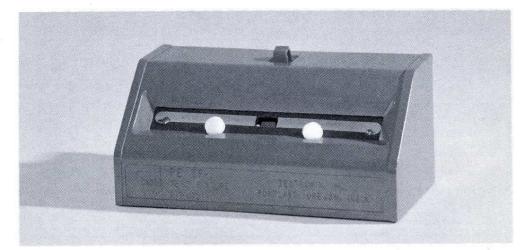
The TF-1 Test Fixture provides for easy and rapid diode testing with the Type 291. The Fixture holds diodes magnetically as they are tested and introduces less than 2% ringing in a 0.35 nanosecond risetime system.

DIODE EJECTION is accomplished with either a push-button or, for automatic testing, with a solenoid (not included).

OPERATING TEMPERATURES up to 150°C are possible.

RESPONSE of Fixture with Type 291, less than 0.35 nsec.

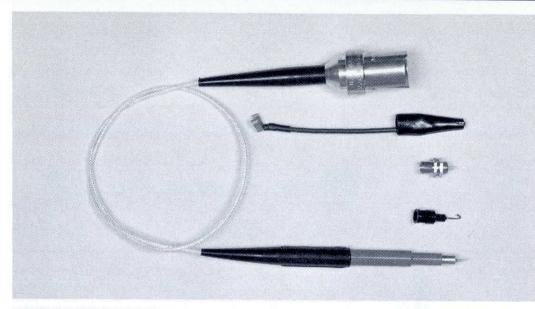
MECHANICAL FEATURES include dimensions of $2\frac{1}{2}$ " high by $3\frac{5}{16}$ " wide by $4\frac{7}{8}$ " deep. Net weight is 1 pound. Shipping weight is 2 pounds, approx.

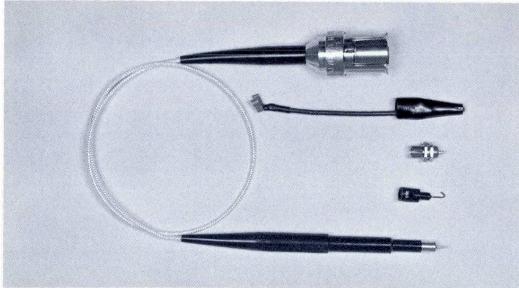


TYPE TF-1 DIODE TEST FIXTURE (Part No. 017-072) . \$65 Includes: 1—instruction sheet.

SAMPLING ACCESSORIES







MINIATURE PASSIVE PROBES

for use with 50 ohm systems

TYPE P6034—10X Attenuation

The Type P6034 provides accurate measurements of high-speed pulses. Input resistance is 500 ohms at dc and approximately 300 ohms at 1.0 gigacycle. Input capacitance is 0.7 pf \pm 0.1 pf at 1.0 Mc to 1.0 gc. Risetime of the probe is less than 100 picoseconds. Maximum dc input, dc-coupled, is 16 v and ac-coupled, is 500 v. Ringing and overshoot is 2% or less on pulses from 25-ohm or more source. Peak-to-peak voltage derating is necessary for CW sine waves higher than 800 Mc.

TYPE P6035—100X Attenuation

The Type P6035 provides accurate measurements of high-speed pulses. Input resistance is 5000 ohms at dc and approximately 1500 ohms at 1.0 gigacycle. Input capacitance is 0.6 pf \pm 0.1 pf at 1.0 Mc to 1.0 gc. Risetime of the probe is less than 200 picoseconds. Maximum dc input, dc-coupled, is 50 v and, ac-coupled, is 500 v. Ringing and overshoot is 2% or less on pulses from 25-ohm or more source. Peak-to-peak voltage derating is necessary for CW sine waves higher than 500 Mc.

50-OHM PICKOFF POINT

The VP-1 is a 50-ohm coaxial "T" with GR connectors on each end and a plastic center collar formed to provide a branch for insertion of a Type P6034 or P6035 Miniature Passive Probe.

With the VP-1 you can inspect signals within a 50-ohm system, provide a trigger takeoff . . . with transient reflection coefficients of less than 2% with either probe, or less than 3% without probe, as seen on a Type 4S1. Resistive reflection depends upon probe used.

Order Part Number 017-073 \$25

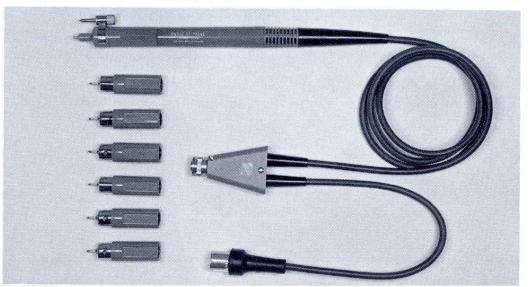
CATHODE-FOLLOWER PROBE

for use with Type 4S1, 4S2 or 3S76 Plug-In Units

Type P6032—10X to 1000X Attenuation

Attenuator Head	Max. Input Voltage*	Input Capacitance at DC (±10%)	Input Resistance at DC (±2%)
10X	±1.5 v	3.6 pf	10 meg
20X	±3.0 v	2.6 pf	10 meg
50X	±7.5 v	1.8 pf	10 meg
100X	±15 v	1.5 pf	10 meg
200X	±30 v	1.4 pf	10 meg
500X	±75 v**	1.3 pf	10 meg
1000X	±150 v**	1.3 pf	10 meg
Attenuator Head		out Voltage (pec t 100% duty fa 750 Mc 1000 N	ctor)
500X	150 v	150 v 150 v	
1000X	300 v	200 v 150 v	

^{*} Limited by linearity of cathode follower. This value may be exceeded by more than 50% for pulses without damage to probe components.



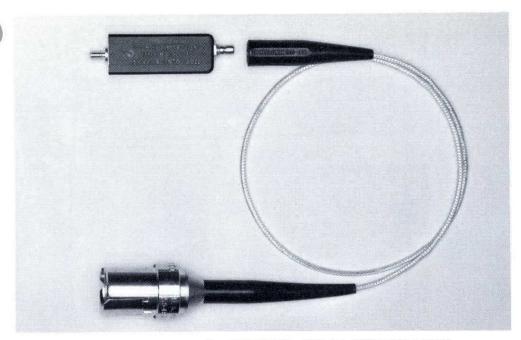
The Type P6032 with a bandwidth greater than 800 Mc, provides accurate measurements of high-speed repetitive pulses. The dc-coupled probe uses 7 plug-in attenuator heads. Risetime is typically 0.4 nsec for probe and attenuator head. Maximum output is \pm 150 mv into a 50-ohm load. Signal delay is approximately 10 nsec.

Order Part Number 010-108 \$220



^{**} Must be derated for continuous-wave use. Peak-to-peak voltage derating is necessary with CW sine waves higher than 500 Mc for the 1000X attenuator head and 1000 Mc for the 500X attenuator head.

SAMPLING ACCESSORIES

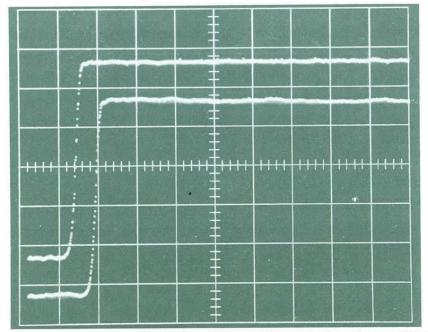


TYPE CT-1 CURRENT TRANSFORMER

The Type CT-1 Current Transformer provides for accurate measurement of current flow in a circuit, while keeping loading effects to a minimum. One or several Type CT-1 Transformers can monitor critical points in a circuit. One or more P6040 Probes can then be used to feed the resultant voltages to the oscilloscope.

TYPE P6040 PROBE

The Type P6040 is used as an inter-connecting cable for the Type CT-1 Transformer or other monitoring points using Amphenol series 27 Sub-Minax or Selectro Sub-Miniature RF connectors. The plug-on feature provides a quick means of connection to the CT-1. The 18"cable terminates in a GR type connector.



Dual-Trace Display of input and output of the Type CT-1.

Vertical Sensitivity 10 mv/cm—Sweep Speed 5 nsec/cm.

Upper waveform shows an input current step with 1-nsec risetime.

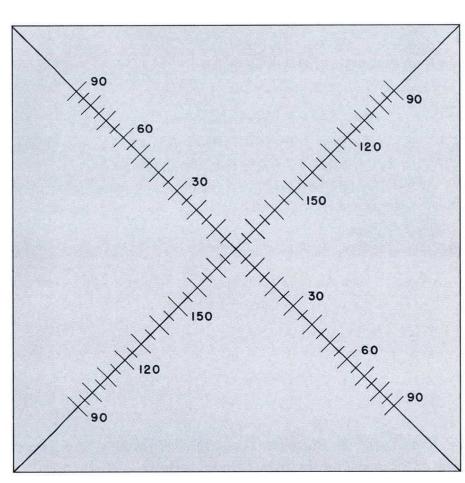
Lower waveform shows the output of the Type CT-1. Photo taken with Tektronix Type C-12 Camera and Type 661/4S1/5T1A Sampling System.



TRANSFORMER MATCHED "T"

This unit provides two 50-ohm outputs from one 50-ohm input and divides the regenerated trigger for simultaneous triggering of two sampling-sweep systems.

Order Part Number 017-012 \$45



SPECIAL GRATICULE

MAINTENANCE AIDS

These items are offered for the convenience of companies with in-plant instrument-maintenance facilities. If your company has this facility, or you intend performing your own maintenance, please include 2 plug-in extensions (one each for the dual-trace and timing units), 1 circuit-board extension, and 2 coaxial trigger cables with your initial instrument order. One set of 5 will usually be adequate for maintenance of several instruments.

Plug-In Extension for Dual-Trace and Timing Units
Order Part Number 012-064 (24-pin extension) \$23.00
Circuit-Board Extension for Dual-Trace Unit
Order Part Number 012-069 (22-pin extension) \$25.00
Coaxial Cable for Coupling Trigger Signals
Order Part Number 012-070 \$10.50

Type |

WIDE-BAND HIGH-GAIN UNIT



Sensitivity

AC-Coupled Only—0.005 v/cm to 0.05 v/cm.

AC or DC-Coupled—0.05 v/cm to 50 v/cm.

Calibrated—0.005 v/cm to 20 v/cm.

Continuously Variable—0.005 v/cm to 50 v/cm.

Frequency Response and Risetime (0.05 to 20 v/cm)

Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—dc to 14 mc, 25 nsec.

With Types 536—dc to 10 mc, 35 nsec.

With Types 541A, 543A, 545A, 555, *581, *585, *581A, *585A—dc to 20 mc, 18 nsec.

With Type 551—dc to 18 mc, 20 nsec.

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

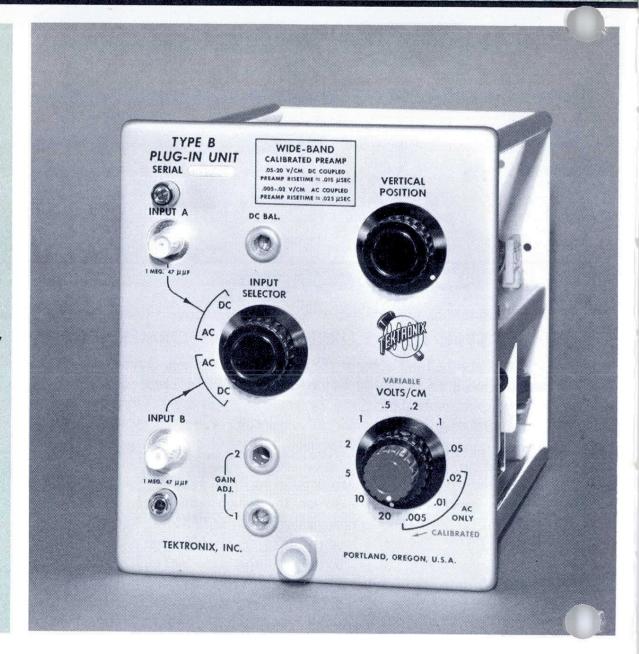
Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—2 cycles to 10 mc, 35 nsec.

With Type 536—2 cycles to 9 mc, 40 nsec.

With Types 541A, 543A, 545A, 555, *581, *585, *581A, *585A—2 cycles to 12 mc, 30 nsec.

With Type 551—2 cycles to 12 mc, 30 nsec.



The Type B Plug-In Preamplifier meets the requirements of most wide-band applications. Wide passband, excellent transient response, dc-coupling, and calibrated sensitivity are qualities most users require in an oscilloscope vertical amplifier. The Type B gives all of these qualities to Tektronix Type 530, 540, 550 and *580 Series Oscilloscopes.

CHARACTERISTICS

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

* A Type 81 Adapter is required.

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

Signal Inputs—Two signal input connectors with more than 60-db isolation are controlled by a four-position switch. The INPUT SELECTOR provides for ac-coupling or dc-coupling through either input. When ac coupled, the low-frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

Input Impedance—1 megohm paralleled by approximately 47 pf.

Weight: Net—4 pounds Shipping—6 pounds, approx.

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



DUAL-TRACE DC UNIT Type

Frequency Response and Risetime

Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—dc to 15 mc, 23 nsec.

With Type 536—dc to 10 mc, 35 nsec.

With Types 541A, 543A, 545A, 555, *581, *585,

*581A, *585A—dc to 24 mc, 15 nsec.

With Type 551—dc to 22 mc, 16 nsec.

Five Operating Modes

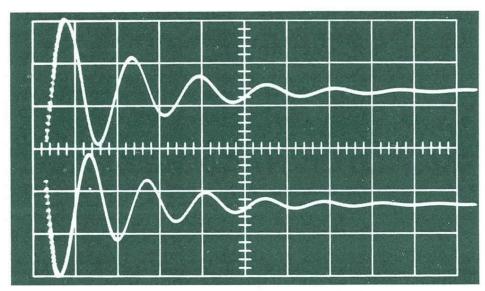
Channel A only.

Channel B only.

Electronic switching at 100 kc (chopped).

Electronic switching on alternate sweeps.

Both channels combined at output (A \pm B).



TYPICAL DUAL-TRACE DISPLAY using Chopped Mode of Type C-A Unit. The waveform depicts a simultaneous display of the response of two ringing circuits to the same pulse. In this mode, transients as small as 1 msec can be observed and measured readily.

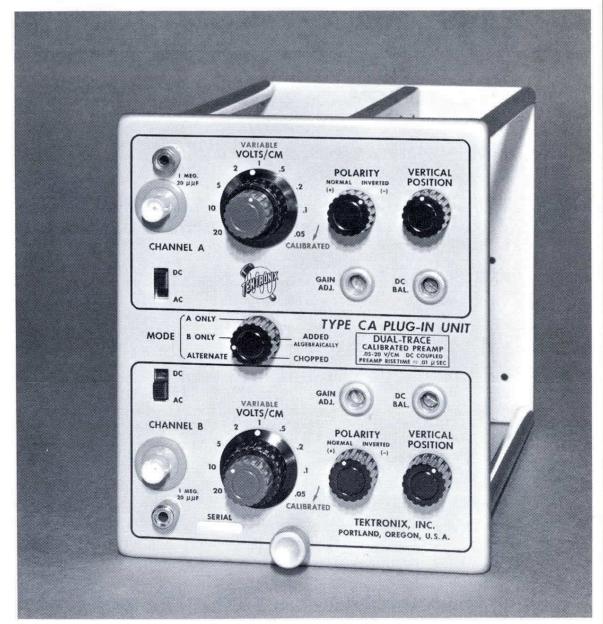
The Tektronix Type C-A Unit contains two identical input channels. Either channel can be operated separately. The two channels can be electronically switched, either at a free-running rate of about 100 kc, or triggered by the oscilloscope sweep. In addition both channels can be combined at the output,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

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

CHARACTERISTICS

Calibrated Sensitivity—The vertical attenuators are calibrated in VOLTS/CM of deflection. Nine calibrated steps are provided for each channel: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 and 20 v/cm. In addition, vernier (uncalibrated) controls provide for continuously-variable adjustments from 0.05 v/cm to 50 v/cm for each channel.

* A Type 81 Adapter is required.



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

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

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

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

Polarity Inversion—Polarity can be inverted on either channel for comparisons of signals 180 degrees out of phase, and A—B or A+B mixing.

Input Impedance—1 megohm paralleled by approximately 20 pf.

Weight: Net—4 ¾ pounds Shipping—8 pounds, approx.

TYPE C-A PLUG-IN UNIT \$260

Each instrument includes: 2—instruction manuals.

Type

HIGH-GAIN DC DIFFERENTIAL UNIT



Sensitivity

Calibrated—1 mv/cm to 50 v/cm.
Continuously Variable—1 mv/cm to 125 v/cm.

Frequency Response

DC to 300 kc at 1 mv/cm sensitivity . . . increasing to DC to 2 mc at 50 mv/cm and lower sensitivity. Frequency specifications are at 3-db down.

Differential Input

10,000-to-1 rejection ratio between in-phase and outof-phase signals.

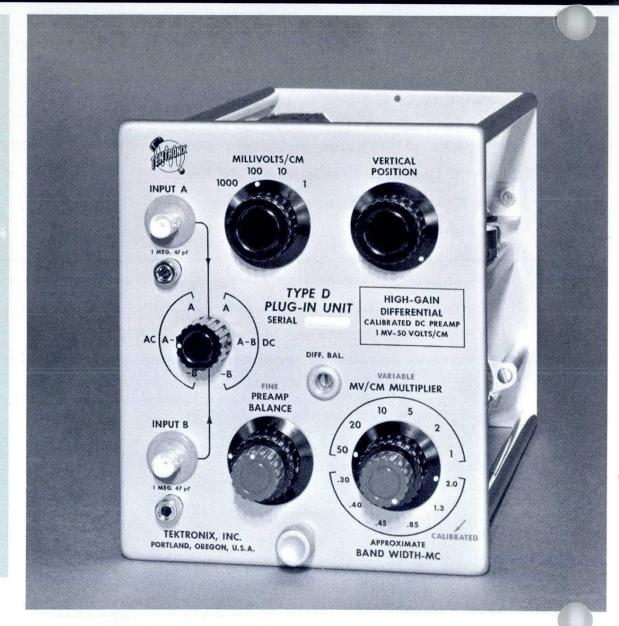
Stability—Normal drift is from 2 to 5 mv/hr.

The Type D equips Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes for work requiring dc-coupling at a sensitivity of 1 mv/cm. Differential input with high rejection ratio for in-phase signals permits cancellation of unwanted or interfering signals.

Input Selector—A six-position switch provides for use of either input separately, or both together differentially, either ac-coupled or dc-coupled. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X probe.

Differential Input—in the A-minus-B position of the input selector switch, the Type D operates as a differential amplifier whose output is proportional to the difference between signals applied to input A and input B. The differential feature is useful in making voltage measurements between two above-ground points, and for cancelling in-phase signals such as hum pickup in connecting leads. By careful adjustment of the differential-balance control, 10,000-to-1 rejection ratio for in-phase signals up to 20 kc can be achieved at all positions of the MV/CM MULTIPLIER switch. Common mode signal should not exceed 5 volts at the input grid. Thus, at 10 mv/cm and 100 mv/cm, it should not exceed 50 volts and 500 volts respectively.

Calibrated Sensitivity—The MILLIVOLTS/CM switch has four calibrated positions: 1, 10, 100, and 1000 mv/cm. A MV/CM MULTIPLIER switch provides for multiplication by 1, 2, 5, 10, 20, and 50. Approximate 3-db point of amplifier high frequency response for each position is also indicated by this switch. The MV/CM MULTIPLIER, by attenuating within the amplifier, reduces drift and increases bandpass in applications that require less than maximum sensitivity. A vernier (uncalibrated) control provides for continuously-variable adjustment from 1 mv/cm to 125 v/cm.



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

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

Input Impedance—1 megohm paralleled by approximately 47 pf.

Weight: Net—4½ pounds Shipping—6 pounds, approx.

Variable Attenuation Probe

For other low-capacitance probes, please refer to the Catalog Accessory Section.

 ^{*} A Type 81 Adapter is required.

Sensitivity

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

Frequency Response

0.06 cycles to 20 kc at full gain, increasing to 60 kc at 0.5 mv/cm. Frequency specifications are at 3 db down.

Differential Input

50,000-to-1 rejection ratio for in-phase signals up to 1 kc of \pm 2 v or less.

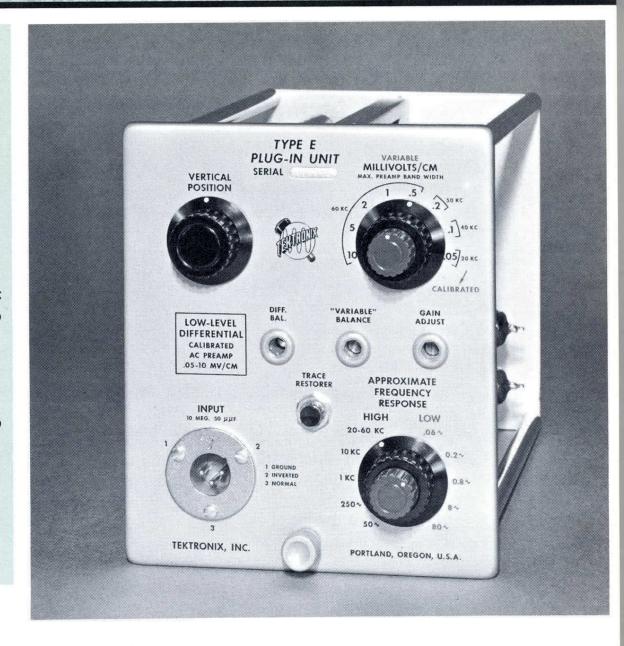
The Type E Plug-in Unit provides Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes with a calibrated sensitivity of 50 microvolts/cm for low-level applications. Maximum combined noise and hum hum is 5 μ v, rms, with input grids grounded at the input connector. Separate high-frequency and low-frequency response controls permit restricting the bandwidth to further increase the signal-to-noise ratio. A rejection ratio of 50,000 to 1 for in-phase signals up to 1 kc can be achieved by careful adjustment of the front-panel differential-balance control. Use of the internal attenuators has a negligible effect on the rejection figure.

CHARACTERISTICS

Calibrated Sensitivity—The vertical attenuator is calibrated in MILLIVOLTS/CM of deflection. Eight calibrated steps are provided: 0.05, 0.1, 0.2, 0.5, 1, 2, 5 and 10 millivolts/cm. In addition, a vernier (uncalibrated) control provides for continuously-variable adjustment from 50 microvolts/cm to 25 millivolts/cm.

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

* A Type 81 Adapter is required.



Bandwidth Control—A five-position switch provides for approximate high-frequency 3-db points of 60, 10, and 1 kc; 250 and 50 cycles. Another five-position switch selects the approximate low-frequency 3-db points of 0.06, 0.2, 0.8, 8 and 80 cycles. Restricting the bandwidth to the requirements of the particular application will provide an increase in the signal-to-noise ratio. Input to grids is dc-coupled to provide good rejection at low frequencies.

Trace Restorer—If the trace should be driven from the screen by a large transient, it can be returned to its normal position immediately by pressing the trace restorer button.

Input Impedance—10 megohms paralleled by approximately 50 pf for single-ended applications and 20 megohms paralleled by approximately 50 pf for differential applications.

Weight: Net—4 1/4 pounds Shipping—6 pounds, approx.

Type WIDE-BAND DC DIFFERENTIAL UNIT



Common-mode Rejection

100 to 1 at full gain.

Sensitivity

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

Frequency Response and Risetime

Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—dc to 14 mc, 25 nsec.

With Type 536 — dc to 10 mc, 35 nsec.

With Types 541A, 543A, 545A, 555, 581*, 585*, 581A*, 585A*—dc to 20 mc, 18 nsec.

With Type 551 — dc to 18 mc, 20 nsec.

TYPE G PLUG-IN UNIT
SERIAL VERICAL
POSITION

1 MG. 77 ppr

AC
A
A
DC
GAIN ADJ.
A-B
VOLTS/CM
VOLTS/CM

VARIABLE
VOLTS/CM
DC BAL.

VARIABLE
VOLTS/CM
DIFFERENTIAL
CALIBRATED

VIDE-BAND
DIFFERENTIAL
CALIBRATED
PRIMARY PRINTING NO SPINIC
PORTLAND, OREGON, U.S.A.

PORTLAND, OREGON, U.S.A.

The Type G Plug-In Unit equips Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes for wideband differential-input applications. Common-mode rejection is better than 100 to 1 for the entire passband at full gain, better than 300 to 1 at 60 cycles. Maximum amplitude handling capability, 2 volts pk-to-pk between input grids. At 0.5 v/cm and 5 v/cm, signal should not exceed 20 volts and 200 volts respectively. Independent step attenuators in each input with 80-db isolation permit mixing signals of wide amplitude difference. Either input can be used separately, INPUT B giving a polarity-inverted display.

CHARACTERISTICS

Input-Selector—A six-position switch provides for use of either input separately, or both together differentially, either ac-coupled or dc-coupled. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

Calibrated Sensitivity—Each of the two attenuators has 9 calibrated positions: 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 and 20 v/cm. A variable attenuator fills in between steps making the adjustment continuously variable from 0.05 v/cm to 50 v/cm. The variable attenuator affects the gain of both inputs at the same time.

* A Type 81 Adapter is required.

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

Input Impedance—1 megohm paralleled by approximately 47 pf.

Weight: Net—4 1/4 pounds.

Shipping—6 pounds approx.

Variable Attenuation Probe

Type P6023 10X Probe compensates for normal attenuator differences between two channels. An adjustable potentiometer compensates the 10:1 attenuation ratio, and two adjustable capacitors compensate for input capacities between 20 pf and 47 pf.

Order Part Number 010-167 \$40

For other low-capacitance probes, please refer to the Catalog Accessory Section.



WIDE-BAND HIGH-GAIN DC UNIT Type

Sensitivity

AC or DC-Coupled —

Calibrated — 0.005 to 20 v/cm.

Continuously Variable — 0.005 to 50 v/cm.

Frequency Response and Risetime

Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—

dc to 11 mc, 31 nsec.

With Type 536 -

dc to 9.5 mc, 37 nsec.

With Types 541A, 543A, 545A, 555, *581, *585, *581A, *585A—dc to 15 mc, 23 nsec.

With Type 551 —

dc to 14 mc, 25 nsec.



The Type H is a wide-band preamplifier with dc-coupling over its full sensitivity range. It provides a maximum sensitivity of 5 mv/cm, dc-coupled, in Types 530, 540, 550 and 580* Oscilloscopes, with excellent transient-response characteristics.

CHARACTERISTICS

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

* A Type 81 Adapter is required.

Calibration Accuracy—A front-panel adjustment is provided for setting the gain of the unit. When this adjustment is accurately set with the VOLTS/CM switch in the 0.005 v/cm position, the sensitivity for any other position of the switch will be within 3% of the panel reading for that position.

Signal Inputs—Two signal input connectors with more than 60 db isolation are controlled by a four-position switch. The INPUT SELECTOR provides for accoupling or dc-coupling through either input. When accoupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X Probe.

Input Impedance—1 megohm paralleled by approximately 47 pf.

Weight: Net-4 pounds

Shipping—6 pounds, approx.

TYPE H PLUG-IN UNIT \$185

Each instrument includes: 2—instruction manuals.

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

Type FAST-RISE DC UNIT



Sensitivity

Calibrated—0.05 v/cm to 20 v/cm.

Frequency Response and Risetime

Frequency specifications are at 3-db down

With Types 531A, 533A, 535A—dc to 15 mc, 23 nsec.

With Type 536 — dc to 11 mc, 31 nsec.

With Types 541A, 543A, 545A, 555, *581, *585, *581A, *585A—dc to 30 mc, 12 nsec.

With Type 551 — dc to 25 mc, 14 nsec.



The Type K Fast-Rise Unit provides Types 540 and 550 Series Oscilloscopes with calibrated sensitivity at low input capacitance, taking maximum advantage of the excellent transient response and wide frequency range of the oscilloscope vertical-deflection system. The Type K combined with a fast-rise oscilloscope makes a 12-nanosecond risetime combination, ideal for applications involving fast-rising waveforms. Frequency response is down 3 db $\pm \frac{1}{2}$ db at 30 mc, 6 db at approximately 41 mc, 12 db at approximately 55 mc. The combined vertical-amplifier system is dc-coupled. When ac coupled, the low frequency 3-db point is 2 cps direct or 0.2 cps with 10X probe. The Type K can be used in all Tektronix. Type 530, 540, 550 and 580 * Series Oscilloscopes.

CHARACTERISTICS

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

* A Type 81 Adapter is required.

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

Input Impedance—1 megohm paralleled by approximately 20 pf. The 10X attenuator probe, furnished with Tektronix Fast-Rise Oscilloscopes, increases input impedance to 10 megohms paralleled by approximately 7 pf.

Weight: Net—3 ¾ pounds. Shipping—5 pounds, approx.

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



FAST-RISE HIGH-GAIN UNIT Type

Sensitivity

AC or DC-Coupled—0.05 v/cm.
9 calibrated steps from 0.05 v/cm to 20 v/cm.

AC-Coupled Only-0.005 v/cm.

10x gain amplifier switched in provides 9 calibrated steps from 0.005 v/cm to 2 v/cm.

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

Frequency specifications are at 3-db down With Types 531A, 533A, 535A—dc to 15 mc, 23 nsec.

With Type 536—dc to 11 mc, 31 nsec.

With Type 541A, 543A, 545A, 555, *581, *585, *581A, *585A—dc to 30 mc, 12 nsec.

With Type 551—dc to 25 mc, 14 nsec.

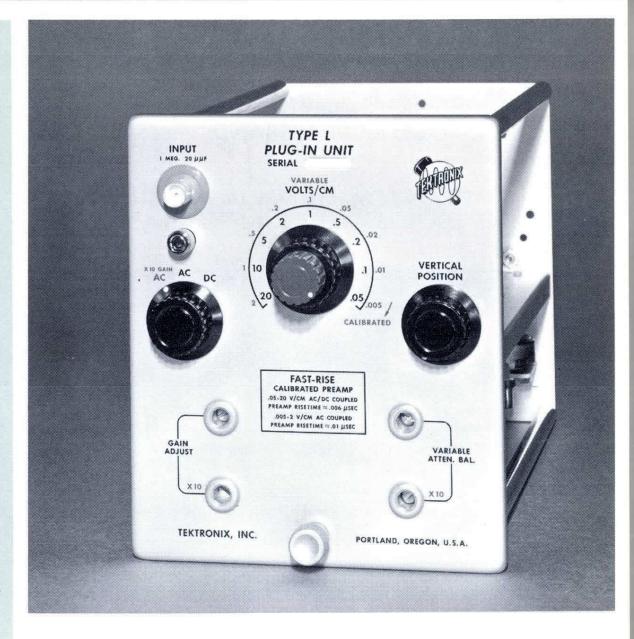
Frequency Response and Risetime (0.005 to 4 v/cm)

Frequency specifications are at 3-db down With Types 531A, 533A, 535A—3 cycles to 15 mc, 23 nsec.

With Type 536—3 cycles to 10 mc, 35 nsec.

With Types 541A, 543A, 545A, 555, *581, *585, *581A, *585A—3 cycles to 24 mc, 15 nsec.

With Type 551—3 cycles to 22 mc, 16 nsec.



The Type L Fast-Rise High-Gain Unit, duplicates the performance of the Type K and offers increased sensitivity, ac-coupled, to 5 mv/cm. Frequency response is down $3\text{-db} \pm \frac{1}{2}$ db at 30 Mc, 6-db at approximately 41 Mc and 12-db at approximately 55 Mc. An accoupled amplifier increases the sensitivity by a factor of 10 with slightly reduced frequency response and increased risetime. When used with Type 530-Series Oscilloscopes the unit has somewhat reduced frequency response and increased risetime.

CHARACTERISTICS

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

*A Type 81 Adapter is required.

Calibration Accuracy—Front-panel adjustments are provided for setting the gain of the unit. When these adjustments are accurately set with the VOLTS/CM switch in the 0.05 v/cm position, the sensitivity at any other position of the switch will be within 3% of the panel reading for that switch position.

Input Impedance—1 megohm paralleled by approximately 20 pf. The 10X attenuator probe, furnished with Tektronix Fast-Rise Oscilloscopes, increases the input impedance to 10 megohms paralleled by approximately 7 pf.

Weight: Net 4 ½ pounds

Shipping—6 pounds, approx.

TYPE L PLUG-IN UNIT \$210

Each instrument includes: 2—instruction manuals.

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



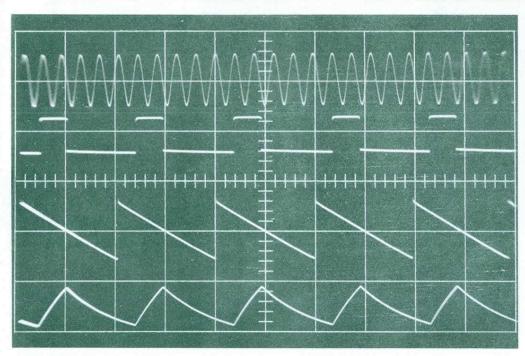
Type FOUR-TRACE UNIT



ELECTRONIC SWITCHING

DC-TO-20 MC PASSBAND

20 MV/CM MAXIMUM SENSITIVITY



TYPE M PLUG-IN UNIT FOUR-TRACE PREAMS VOLTS/CM CHOPPED TEKTRONIX, INC.

In a Tektronix Oscilloscope that accepts letter-series plugins, the Type M Four-Trace Unit provides four channels for viewing one to four signals, separately or in any combination. When a Type M Unit is used in a Tektronix Plug-In Unit Power Supply, such as a Type 127, 132, or 133, the output can be used to provide most oscilloscopes with multiple-channel displays at increased gain. The Type M Unit can be used in Tektronix Type 530, 540, 550, or (with Type 81 Adapter) 580-Series Oscilloscope.

Each of the four channels has identical characteristics.

SENSITIVITY 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 cps direct or 0.2 cps with 10X probe.

INPUT IMPEDANCE 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 consist of Channel A, Channel B, Channel C, Channel D, Chopped (electronic switching at 1 Mc) and Alternate (electronic switching on alternate sweeps). All four channels can be operated separately or in any combination. When operating a single channel, the Chopped or Alternate mode is inoperative. However, when two or more channels are in operation, either Chopped or Alternate is automatically operative.

CHANNEL A SIGNAL available at front panel can be connected to oscilloscope external trigger input for stable triggering in the Chopped 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—51/4 pounds. Shipping—8 pounds, approx. TYPE M PLUG-IN UNIT \$525

Each instrument includes: 1—test lead, 4—BNC binding-post adaptors, 2—instruction manuals.

Transien	Response Characte	eristics
Type M Unit and Oscilloscope	Passband (at 3-db down)	Risetime
531A, 533A, 535A RM31A, RM33A, RM35A	dc — 14 Mc	25 nsec
536	dc — 10 Mc	35 nsec
541 A, 543 A, 545 A, RM41 A, RM43 A, RM45 A, 555, *581, *581 A, *585, *585 A	dc — 20 Mc	17 nsec
551	dc — 19 Mc	18 nsec



PULSE-SAMPLING UNIT Type

Risetime

Approximately 0.6 nsec (corresponding to approximately 600 mc).

Input Impedance

50 ohms, higher with probes.

Sensitivity

10 mv/cm (with 2 mv or less amplitude noise).

Dynamic Range

 \pm 120 mv, minimum linear range before overdriving occurs.

Accidental overload of ± 4 volts dc is permissible; higher voltage-pulsed overloads are permissible depending upon duty cycle.

Regulated Supplies

Transistor-regulated +20 v and -20 v dc supplies.

Designed for use with Tektronix Plug-In Oscilloscopes, the Tektronix Type N Sampling Unit produces a bright display of repetitive high-speed signals. By taking successive samples at a slightly later time at each recurrence of the pulse, the Type N Unit reconstructs the pulse on a relatively long time base. Each sample taken becomes an image-retaining dot on the crt screen.

The Type N Unit provides stable displays with apparent sweep times of 1 nsec/cm (with 10-x magnifier, 100 picoseconds/cm). Delay range of 200 nsec (including display), permits observation of the complete waveform of pulses less than 200-nsec wide, and any portion of the waveform can be observed and measured accurately.

The spacing, between sampling pulses of repetitive high-speed signals, can vary. If the incoming signals are irregularly spaced, the pulses must be separated by 10 μ sec or more. If the incoming signals are regularly spaced, the pulses can occur every 20 nsec.

CHARACTERISTICS

Sweep Range—A four-position NANOSEC/CM, switch provides four equivalent sweep times of 1, 2, 5, and 10 nsec/cm (with the magnifier: 100, 200, 500, and 1000 psec/cm).

External Trigger—The Type N Sampling Unit requires an external trigger applied in advance of the signal. Two input connections are provided on the unit for this purpose. The REGENERATED TRIGGER INPUT



minimum requirements for an external start-gate trigger include: repetition rate of 50 cps to 100 kc, 50% risetime of four nsec, amplitude of +10 volts, duration of 200 nsec, 40 nsec in advance of the signal. The TRIGGER INPUT minimum requirements for a conventional external trigger include: minimum duration of one nsec, amplitude from +0.5 to 2 volts, 45 nsec in advance of the signal, and repetition rate of 50 cps to approximately 50 mc. The recovery time is $10 \, \mu \rm sec$. Count down occurs above $100 \, \rm kc$. Satisfactory count down can be obtained up to about 50 mc.

Sampling Information—A four-position SAMPLES/DISPLAY switch determines the number of image-retaining dots appearing on the screen of the cathoderay tube during one display. The number of dots or samples per display can be 50, 100, 200, or 500. The sampling rate extends from 50 cycles to 100 kilocycles.

Weight: Net—71/4 pounds.
Shipping—10 pounds, approx.

TYPE N PLUG-IN UNIT \$625

Each instrument includes: 1—unblanking cable and transformer, 1—external horizontal input cable, 1—X2 T attenuator 50 Ω , 1—X5 T attenuator 50 Ω , 1—X10 attenuator 50 Ω , 1—10 nsec 50 Ω coax cable RG58A/U with G.R. connectors, 1—5 nsec 50 Ω coax cable RG8A/U with G.R. connectors, 2—1 nsec 50 Ω coax cables RG58A/U with G.R. one end only, 2—instruction manuals.

SEE NEXT PAGE FOR ADDITIONAL INFORMATION.

AUXILIARY EQUIPMENT

The Tektronix Type 110 Pulse Generator and Trigger Takeoff System has a trigger regenerator of nominally 10 v for 225 nsec for starting the Type N Unit when the source cannot supply the necessary trigger. Please refer to Type 110 catalog page.

TYPE 110 PULSE GENERATOR \$650

The Tektronix Type 111 Pretrigger Pulse Generator provides fast-rising output and pretrigger pulses for the Type N Unit. Please refer to Type 111 catalog page for complete information.

TYPE 111 PRETRIGGER PULSE GENERATOR \$365

Master-Slave Patch Cord

PROBES

The TYPE P6025 CATHODE-FOLLOWER PROBE provides 10 megohm input resistance and from 1.2 pf to 5 pf static input capacitance with attenuator heads of 10X to 1000X, in 1-2-5 sequence. Refer to Catalog Accessory Section for complete information.

Order Part Number 010-053 \$260

The TYPE P6026 PASSIVE PROBE provides attenuations of 5X to 500X, in 1-2-5 sequence, with an input resistance from 125 ohms to 1.2 kilohms and 0.6 pf to 0.8 pf. Risetime is 0.85 nsec for standard 42" cable length. Refer to Catalog Accessory Section for complete information.

Order Part Number 010-055 \$140

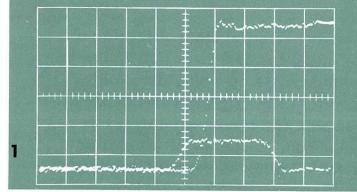
CALIBRATOR ADAPTER

Converts oscilloscope 50-volt calibrator output to a 40 mv signal with 50 ohm impedance for calibrating sampling system sensitivity. Not usable with RM561A, 567, or RM567.

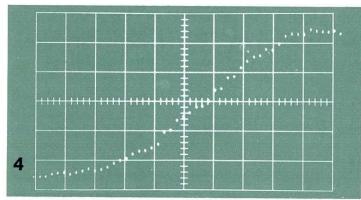
With UHF connectors, Order Part No. 017-010 . . \$20 With BNC connectors, Order Part No. 017-074 . . \$20

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

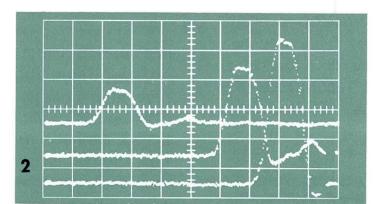
These waveform photographs show the ability of the Tektronix Sampling System to display a wide range of pulses. These photographs were purposely chosen to illustrate the system's abilities under marginal conditions.



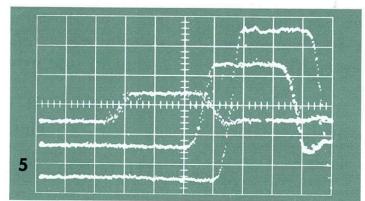
The alternate pulse feature of the Type 110 pulse generator is being used to generate a large, long pulse, and a short, small pulse. The trigger take-off system's sensitivity is set for maximum. The signal level is 100 mv/cm, and the sweep speed is 1 nsec/cm. There is clearly less than 1 nsec time difference in triggering on the 100 mv, 3 nsec and the 500 mv long signal duration.



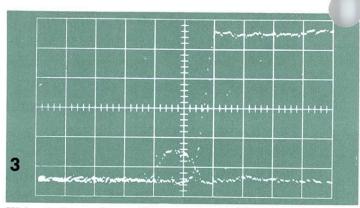
The leading edge of the large pulse of Figure 3 is displayed with the 1 nsec/cm sweep speed magnified ten times. This gives an equivalent sweep speed of 100 picoseconds/cm. The risetime of the complete system—110 pulse generator, 110 trigger take-off, 113 delay cable and the N unit—is under 0.6 nsec.



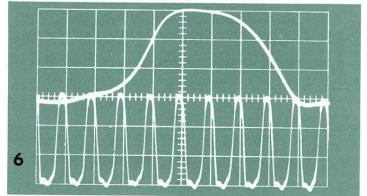
The amplifiers in the trigger channel (used in the previous picture) are switched out. The sensitivity is 2 v/cm. The smallest of the 1 nsec wide pulses furnishes approximately 0.4 v to the trigger regenerator, through the trigger take-off system. This picture is of interest since this is the narrow-pulse response which is obtainable with both the 110 and N Units, when externally triggered with signals between 0.4 and 2 v.



The system is operating at maximum sensitivity, 10 mv/cm. A triple exposure, positioned vertically to align the 50% points, allows easy measurement of the time slip. Under these extreme conditions, the smallest pulse has an energy of about 24 millipicojoules. The trigger take-off system then removes approximately 1 millipicojoule for application to the switched system of amplifiers and the trigger regenerator.



This picture shows the same conditions as in Fig. 1, except the small pulse is now only 1 nsec wide. The time shift relative to the large signal is just over 1 nsec.



Double exposure shows a 60-mv, 100-mc continuous pulse train at equivalent sweep times of 1 nsec/cm and 10 nsec/cm. The Type 110 derives a trigger the signal, permitting the Tektronix Sampling Systo operate without external triggers, counting down from 100-mc to the 100-kc sampling rate of the N Unit.



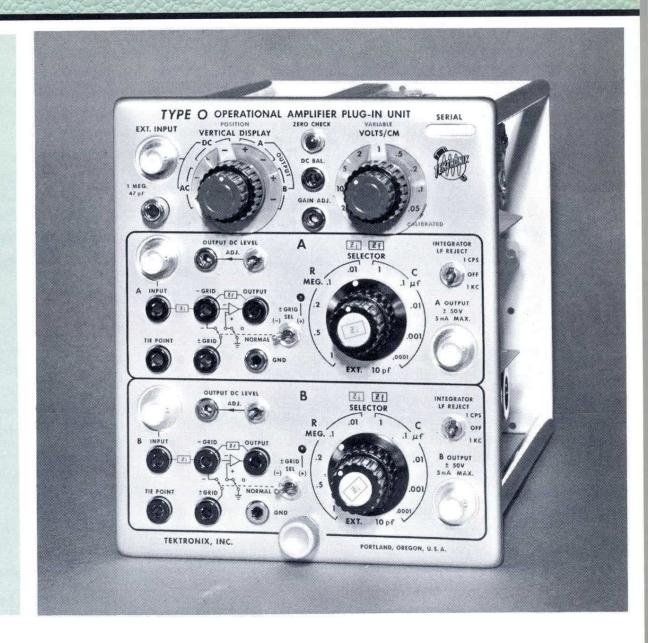
OPERATIONAL AMPLIFIER UNIT Type



- 1 Vertical Preamplifier
- 2 Operational Amplifiers
- 3 Basic Modes of Operation

Selection of Precision Input and Feedback Components

Provision For Use of External Input and Feedback Impedances



In a Tektronix Oscilloscope that accepts letter-series plugins, the Type O Operational Amplifier Unit can be used to perform precise operations of integration, differentiation, function generation, linear and nonlinear amplification.

The results can be displayed on the oscilloscope crt or can be fed to other circuitry. In addition, through use of the Type 127, 132, or 133 Plug-In Power Supplies, the Type O can also be used for various other applications. The Type O Unit can be used in any Tektronix Type 530, 540, 550, or (with Type 81 Adapter) 580-Series Oscilloscopes.

VERTICAL PREAMPLIFIER

Frequency specifications are at 3-db down

PASSBAND AND RISETIME depend upon the oscilloscope with which the unit is used. With Type 540, 550, and 580-Series with Type 81 Adapter, the passband is dc to 25 Mc, the risetime is 14 nsec. With Type 530-Series, the passband is dc to 14 Mc, the risetime is 25 nsec (except Types 532 and 536).

SENSITIVITY is in 9 calibrated steps from 50 mv/cm to 20 v/cm, 1-2-5 sequence, accuracy within 3%. A variable control permits continuous adjustment uncalibrated from 50 mv/cm to 50 v/cm.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 47 pf.

SWITCHING FACILITIES permit the vertical amplifier to be used independently or to monitor the output of either operational amplifier.

OPERATIONAL AMPLIFIERS

OPEN-LOOP GAIN-BANDWIDTH PRODUCT is 15 Mc or greater. (Checked at 10 Mc for open-loop gain greater than 1.5.)

CLOSED-LOOP BANDWIDTH is 750 kc or more at unity gain with internal input and feedback resistors, and to 10 Mc with external compensation.

OPEN-LOOP DC GAIN is 2500 minimum. With external input and feedback components, the gain is governed by the ratio of feedback to input values.

OUTPUT RANGE is $\pm 50 \text{ v}$, $\pm 5 \text{ ma}$.

OUTPUT DC LEVEL can be adjusted to ground potential from front panel.

OUTPUT IMPEDANCE is approximately 30 ohms at 1 Mc for compensated unity-gain amplifier.

NOISE is typically less than 0.5 mv pk-to-pk, referred to the input. Output noise is approximately 3 mv pk-to-pk.

INPUT IMPEDANCES can be selected from the following: 5 resistance values—10, 100, 200, 500 kilohms, and 1 megohm; 6 capacitance values from 10 picofarads to 1 microfarad, in decade steps. All values within $\pm 1\%$, except for 10 pf and 100 pf values, which are adjustable.

FEEDBACK IMPEDANCES can be selected from the same range of values as the input impedances.

EXTERNAL COMPONENTS can be used independently or in combination with the internal resistor-capacitor combinations.

POSITIVE OR NEGATIVE FEEDBACK is possible.

VOLTAGE REJECTION (with 1 kc square wave) is at least 300 to 1 between operational amplifiers.

GRID CURRENT is less than 0.5 nanoampere for each input grid. Can be adjusted to less than 0.3 nanoampere for —grid and less than 0.15 nanoampere for + grid.

DRIFT is typically less than 10 mv/hr, referred to input, after warmup.

LOW FREQUENCY REJECTION for repetitive integration is possible at either 1 cps or 1 kc, approximately, and can be switched in or out as desired.

WEIGHT: Net—5½ pounds. Shipping—9 pounds, approx.

TYPE O OPERATIONAL AMPLIFIER UNIT \$525

Each instrument includes: 2—terminal adapter assemblies, 2—terminal shields, 4—BNC to binding post adaptors, 2—instruction manuals.

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

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. Please refer to the catalog Accessory Section for complete information.

Order Part Number 013-067 \$75

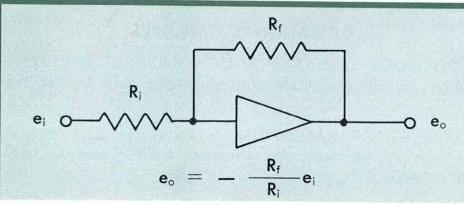
GATING ADAPTER

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.

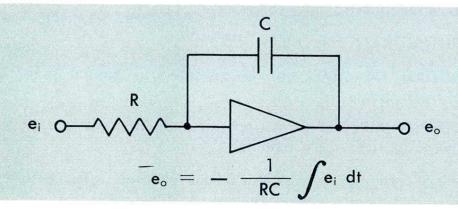
The adapter can be plugged directly into the jacks on the front panel of the Type O Plug-In Unit. Please refer to the catalog Accessory Section for complete information.

Order Part Number 013-068 \$75

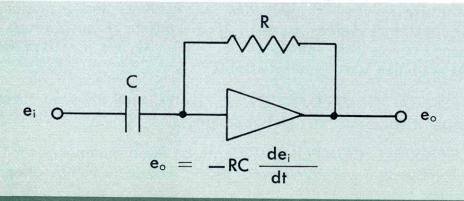
BASIC OPERATING MODES



AMPLIFICATION is determined by the ratio of input to feedback resistors. This provides convenient signal step-up or step-down, with low output impedances, to over 750 kc. Use of external compensation extends the closed-loop gain-bandwidth product to 10 Mc or more.



INTEGRATION is obtained by placing a capacitor in the feedback loop. Unlike the RC integrator, this circuitry permits loading of the output, and integration without loss of signal level. Integration at repetition rates of approximately 5 Mc is possible. Low-frequency rejection allows drift-free repetitive-waveform integration.



DIFFERENTIATION is accomplished by placing a capacitor in the input circuit. The unique characteristic of differentiation is its ability to extract higher frequency waveform components. It can advantageously detect minute information such as transients and slope changes. Differentiation of waveforms with significant components as high as 1.5 Mc is possible.



FAST-RISE TEST UNIT Type

Risetime—When the Type P is used to standardize a Type 540-Series Oscilloscope, risetime of the Type P is approximately 4 nanoseconds (.004 μ sec).

Repetition Rate—240 pulses per second.

Polarity—Either positive or negative.

Amplitude—Continuously adjustable from 0 to 3 major graticule divisions.



The Type P Plug-In Unit fills the need for a test-signal generator of known waveform. It can be used to standardize the main-unit vertical-amplifier transient response of Tektronix Type 540-550 Series Oscilloscopes. In addition, it is suitable for those Type 530 oscilloscopes incorporating a delay line in their vertical deflection system.

The Type P generates a fast-rise step-function test signal of a known waveform. This test signal simulates the output of an ideally compensated Type K Plug-In Unit that is driven with a Tektronix Type 107 Square-Wave Generator.

After standardization, a Type 540-Series Oscilloscope can be used in conjunction with a Type 107 Square-Wave Generator to standardize the transient response of amplifier-type plug-in units. Standardized oscilloscopes and plug-in units can be used interchangeably

without readjustment of the high-frequency compensating circuits.

As a result of component aging, particularly tubes, the transient response of an electronic amplifier changes over a period of time. In contrast, the Type P maintains stable waveform characteristics through its precise Tektronix circuit constants. Ordinary measuring equipment will verify circuit values should the output waveform be in doubt.

Weight: Net—3 ¼ pounds.
Shipping—5 pounds, approx.

TYPE P PLUG-IN UNIT \$90 Each instrument includes: 2—instruction manuals.

Type TRANSDUCER & STRAIN GAGE UNIT



Carrier Frequency—25 kilocycles.

Risetime—60 μ seconds, (approximately).

Frequency Response—DC to 6 kilocycles.

Strain Sensitivity—Calibrated in ten steps from 10 to 10,000 microstrain (microinches per inch) per major graticule division \pm 2%. Uncalibrated, the sensitivity is variable between steps. The above condition applies to the Type Q Unit when used with a single strain gage having a gage factor of approximately 2. With four active arms and a gage factor of 2, the maximum sensitivity is 2.5 microstrain per division.

Attenuator Accuracy—When set accurately in any one step, the accuracy in any other position is within two percent of the panel reading.

Noise—The peak-to-peak noise is typically equivalent to 1.5 microstrain at maximum calibrated sensitivity. This approximates an rms noise of 0.5 microstrain.

Drift—The amplification system is essentially drift free. The overall system drift is primarily a function of the transducer stability.

The Type Q Plug-In Unit permits any Tektronix Type 530, 540, 550, or 580* Series Oscilloscopes to be operated with strain gages and other transducers. Designed to measure any mechanical quantity that can be converted to a change in resistance, capacitance, or inductance—through use of a suitable transducing device this versatile unit provides high gain, low noise, and extremely low drift. Suppressed-carrier amplitude modulation is produced by unbalancing an ac bridge with the strain gages or other transducers. Phase-sensitive demodulation produces the proper deflected-trace direction.

Completely self-contained and requiring no external equipment other than the strain gages or transducers operated with it, the Tektronix Type Q Plug-In Unit bridges the gap between mechanical engineering and electronic instrumentation. Total range of applications is as broad as the mechanical field itself. Applications include stress analysis, vibration studies, and fatigue tests. Typical quantities that can be measured with the unit are force, displacement, acceleration, and strain.

* A Type 81 Adapter is required.



CHARACTERISTICS

Equivalent DC Sensitivity—The Type Q Unit is an impedance sensing preamplifier rather than a voltage sensing device. A comparable dc amplification system would require approximately 10 microvolts per division sensitivity for the same amount of power applied to the input bridge.

Resistance Bridge Balance—Range of control allows sufficient compensation for most standard transducers and strain gages.

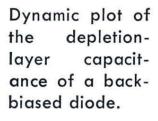
Gage Resistance Range—With cable lengths to 100 feet, the useful range of gage resistance extends from approximately 50 ohms to 2000 ohms. For optimum performance, the recommended range is between 120 ohms and 500 ohms.

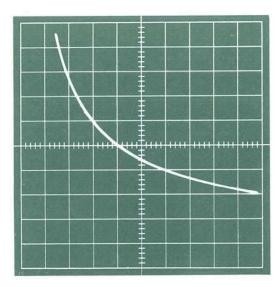
Transducer Cable—In most applications, either 3wire or 4-wire shielded microphone cable gives the best results. Long-lead applications utilizing more than 20 feet of cable require two or four bridge arms at the transducer end of the cable.

Capacitance Bridge Balance—Range of control allows sufficient compensation for an unbalance of 250 pf across any external resistive arm of the input bridge.

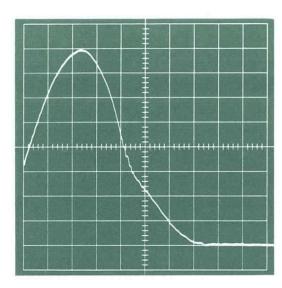
Polarity Inversion—For convenience in reading the display, the two-position switch allows the demonstration to appear normal or inverted.







Pressing force can be accurately controlled by using the Type Q Unit.



Calibration—A push-button switch connects a calibrator resistor across the strain gage electrically to simulate an external mechanical strain. The calibration resistor supplied with the Type Q Unit simulates a-400 μ strain unbalance of the bridge, suitable for most strain gage applications. As with the 120-ohm internal bridge resistor, the 150-k calibration resistor is mounted on a handy plug-in receptacle.

To aid in calibration, a nomograph is included in the instruction manual. This nomograph relates calibration of the supplied resistor to gage factors and strain gage resistances.

No special gage dial is necessary for the unit.

To include the gage factor in the calibration, merely increase or decrease the amplifier gain proportionally.

Phase Adjustment—To increase versatility of the unit, the control permits either resistive or reactive transducer applications to be displayed.

Capacitance Measurement—The Type Q Unit can be calibrated for direct reading in capacitance from 1 pf per division to a maximum value of 1000 pf without using a correction curve. Using a correction curve, the range can be extended to 10,000 pf per division. These specifications apply when using the internal 120-ohm bridge circuit. With a 1000-ohm external circuit, the lower limit can be extended to 0.2 pf per division.

Please note that the standard capacitor and test jig are not supplied with the unit.

Capacitance Transducers—Using a capacitance transducer in conjunction with a four-arm resistive bridge results in the following maximum useful sensitivities:

120-ohm bridge (available internally) ... 1 pf/div 1000-ohm bridge 0.2 pf/div Useful sensitivities are slightly lower when using

long cables.

Inductive Transducers—Although the Type Q Unit will function in conjunction with inductive transducers, differential transformers designed for use at 60 cps are only partially satisfactory when used at 25 kc. Special internal provision for balancing inductive transducers is not included in the unit.

External Bridge—The number of external resistive arms required for strain gage and transducer applications varies from one to four. The versatile Type Q Unit can be used for any of these applications. The input circuit for the Type Q Unit is an ac bridge. The number of external arms required for strain gage and transducer applications varies from one to four. These external transducers become one or more of the input bridge arms. Excitation voltage for the bridge is obtained from a 25-kc oscillator in the Q unit. Total bridge voltage is approximately 5 v rms, regulated.

A five-position switch allows selection of the number of external arms from zero to four. The zero position of the switch permits a quick check of the instrument under normal operation without an external transducer. In addition, the zero position completes the resistive bridge for capacitive transducer applications.

The one-arm position of the switch is used for the simplest type of strain gage application. In this position, an internal bridge resistor is needed to match the value of the single external bridge arm. Standard value of this resistor supplied with the Type Q Unit is 120 ohms. The two-arm and four-arm positions of the switch are used for transducer applications necessitating temperature stability.

Weight: Net—5 1/4 pounds Shipping—8 pounds, approx.

Type ?

TRANSISTOR-RISETIME UNIT



Collector Supply

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

Mercury-Switch Pulse Generator

Risetime—less than 5 nsec.

Amplitude—0.02 to 10 v across 50 ohms, positive or negative.

Bias Supply

-0.5 v to +0.5 v and -5 v to +5 v, continuously variable, accuracy within 3%.

Current Capability—±100 ma.

Calibrated Vertical Deflection

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

The Type R Transistor Risetime Unit can be used in all Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes when operated on 50 to 60 cycle line frequency. It supplies a fast-rising pulse and the required supply and bias voltages for measurement of transistor rise, fall, delay, and storage times.

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

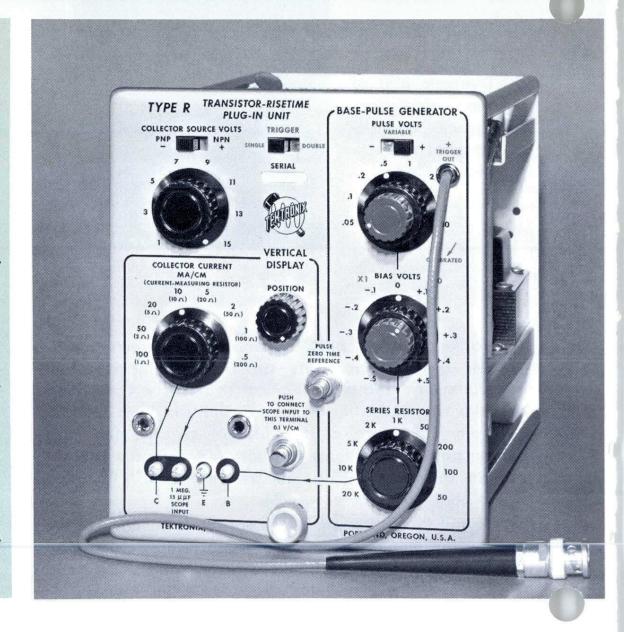
Type 551—14 nsec

Types 541A, 543A, 545A, 555, *581, *581A, *585, *585A—12 nsec

Types 531A, 533A, 535A—23 nsec

Type 536—35 nsec (Type 536 has an additional limitation in the lack of signal delay in the main vertical amplifier).

* A Type 81 Adapter is required for use with 580 Series.



CHARACTERISTICS

Collector Supply—Positive and negative voltage, 1 v to 15 v continuously adjustable is available from a transistor-regulated supply. Vertical display is calibrated in ma/cm of collector current, 0.5, 1, 2, 5, 10, 20, 50, and 100 ma/cm, accuracy within 3%. Connectors are provided for inserting an external resistor in series with the collector.

Pulse Generator—A transistor-regulated 10 v dc power supply is chopped by a mercury switch, providing a 120-c/sec test pulse with a risetime of less than 0.005 μ sec. The pulse is applied to the transistor under test through a π attenuator with an output impedance of 50 ohms. Sixteen amplitude steps are provided: +0.05, +0.1, +0.2, +0.5, +1, +2, +5, +10v and -0.05, -0.1, -0.2, -0.5, -1, -2, -5, -10v. A vernier (uncalibrated) control fills in between steps.

Bias Supply—Bias voltage is available for base or emitter in two ranges, -0.5 v through zero to +0.5 v and -5 v through zero to +5 v, accuracy within 3%. Bias supply is transistor regulated.

Base Series Resistors—The base driving resistance can be selected from nine values—50, 100, 200, 500 ohms, 1, 2, 5, 10, and 20 kilohms, accuracy within 3%.



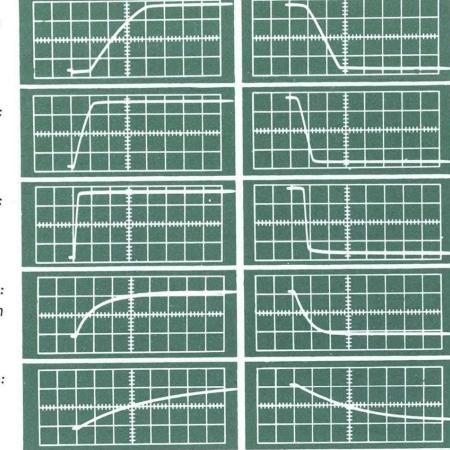
Drive voltage: 10 v through 20 kilohms.

> Drive voltage: 2 v through 1 kilohm.

> Drive voltage: 0.5 v through 50 ohms.

Class A drive: 0.05 v through 50 ohms.

Class A drive: 0.1 v through 1 kilohm.



High-frequency characteristics of a transistor under five different conditions of drive. In each pair, the photograph at left shows delay time and rise time, the start of the driving pulse coinciding with the 2-cm graticule line. The second photograph of each pair shows storage time and fall time, the end of the pulse coinciding with the 2-cm line. The Type R Unit plugged into a Tektronix Type 543A Oscilloscope—3.5-v collector supply, 500-ohm collector load, 2-ma/div vertical calibration, 0.5- μ sec/div sweep rate. Driving conditions at left of each pair.

Reference Displays—Zero time reference can be displayed by means of a pushbutton. Another pushbutton permits observation of the voltage on the transistor collector or base, through use of external connections. Amplifier sensitivity for these displays is 0.1 v/cm.

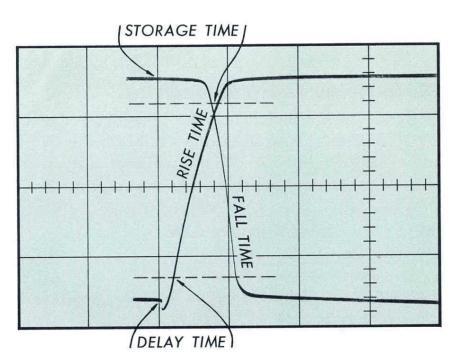
Triggering—A positive constant-amplitude trigger for the oscilloscope sweep is furnished through a short coaxial cable permanently attached to the Type R Unit.

Weight: Net—7 1/4 pounds Shipping—11 pounds, approx.

TYPE R PLUG-IN UNIT \$325

Each instrument includes: 1—grounded emitter small transistor socket, 1—grounded base small transistor socket, 10—contact clips, 2—instruction manuals.

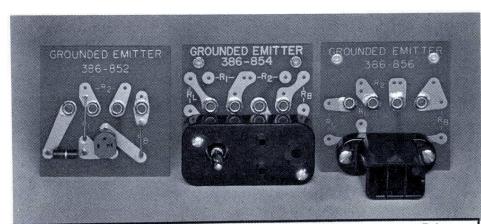
U. S. Sales Price f.o.b. Beaverton, Oregon Please refer to Terms and Shipment, General Information page.



The Type R Unit can trigger the Oscilloscope sweep either on the start of the test pulse only, or on both the start and finish to display delay, rise, storage, and fall times simultaneously.

TRANSISTOR MOUNTING BOARDS

Convenient for checking large quantities of different types of transistors. Collector-load, voltage dividing, and base or emitter-driving resistors are not supplied with the boards.



Part No.	Туре	Socket Type	Price
386-852	Gnd. Emitter	4-pin	\$1.50
386-853	Gnd. Base	4-pin	1.50
386-854	Gnd. Emitter	For power transistors such as 2N301 or 2N307	2.50
386-855	Gnd. Base	Same as above	2.50
386-856	Gnd. Emitter	Funnel type for long leads	2.50
386-857	Gnd. Base	Same as above	2.50

Type DIODE RECOVERY UNIT



Diode Measurement Applications

Recovery characteristics are displayed by applying calibrated forward-current through the diode, then abruptly turning off this current and establishing a calibrated, constant, reverse current.

Recovery-Time Measurement

Accurate—to 30 nsec.

Comparative—to 15 nsec.

Predicted—limited only by the forward-reverse current ratio.

Calibrated Forward Currents

1, 2, 5, 10, and 20 milliamps.

Calibrated Reverse Currents

0, 0.1, 0.2, 0.5, 1, and 2 milliamps.

Diode Shunt Capacitance

9 picofarads at 0.5 v/cm.

Amplifier Sensitivity

0.05 v/cm and 0.5 v/cm, calibrated.



The Type S Unit enables you to display semiconductor-diode switching characteristics on your Tektronix Plug-In Oscilloscope. With Tektronix Type 540-Series, Type 550-Series, and Type 580-Series* Oscilloscopes you can find:

Carrier Recombination—Effective lifetimes to 2 nanoseconds.

Stored Charge—To 10 picocoulombs.

Capacitance—Junction capacitance to 2 picofarads.

Resistance—Bare (bulk) resistance to about 1/4 ohms.

The Type S Unit describes the diode in terms of its parameters, while most other currently employed methods describe the diode in terms of its performance in a particular circuit—not necessarily the one in which it will be used. With the Type S method you can predict the behavior of many diodes in many circuits, as well as compare diodes for performance in a particular circuit.

Since the Type S method is a means for plotting voltage across an element while passing constant current through that element, it can also be used to observe the

* A Type 81 Adapter is required.

junction characteristics of transistors and to measure the resistance, capacitance, and inductance of other circuit components.

Note: Risetime of the Type S Unit depends on the capabilities of the oscilloscope with which it is used, therefore the ability to analyze fast diodes with Tektronix Type 530-Series Oscilloscopes will be affected by the lower risetimes of these instruments.

Switching Transient—A large switching transient occurs in the voltage waveform appearing across a semiconductor diode when the diode is abruptly switched from non-conduction to forward conduction. This transient indicates an initial high impedance across the diode as well as the steady-state low impedance well after turn on. A further deviation in the device action (from that of an ideal diode) occurs when the diode is switched from forward conduction to a reverse-bias condition. Instead of an immediate high impedance across the diode, a momentary low impedance condition exists. These switching characteristics are readily apparent with the Type S Plug-In Unit installed in a Tektronix fast-rise oscilloscope, and the contributing factors can be separated and analyzed.



Base (or Bulk) Resistance—The curves in Figures 3 & 4 show a sudden decrease in diode terminal voltage when forward current is switched off. This decrease occurs with disappearance of the voltage drop across the diode due to ohmic base resistance. The value of this base resistance can be determined, since the voltage drop across it for a given forward current can be measured. As shown in Figures 3 &4, this base resistance decreases as forward current increases.

Stored Charge at the Junction—After the initial terminal-voltage drop, the voltage remaining is due to minority carriers stored in the junction. These stored carriers must be removed before the diode can assume its steady-state reverse characteristics. When this stored charge is cleared, the reverse diode voltage increases rapidly, as long as reverse current flows, at a rate determined only by the reverse current and the capacitance at the terminals.

Recombination of Current Carriers—As shown in Figures 1 & 2, the time required to clear the stored charge at reverse current of 2 ma is half the time it takes at 1 ma. Simply multiplying reverse current by the time it flows before removal of the charge yields the amount of stored charge. However, as reverse current decreases, the time required to remove the charge does not increase proportionally. Some other agent namely, recombination of current carriers—removes part of the charge.

CHARACTERISTICS

Fast-Rise Mercury Switch—Inherent risetime of the mercury switch in the unit is 3 nsec. The switching transient is applied to a fast vacuum tube circuit which shapes the waveform for use as the actual switching signal. Repetition rate is approximately 300 pps for turn-on measurements and approximately 600 pps for recovery measurements.

External Triggering Signals—The Type S Unit supplies an external triggering signal to the associated oscilloscope through its attached coaxial cable. This signal remains constant in polarity and amplitude at +4 v for all conditions.

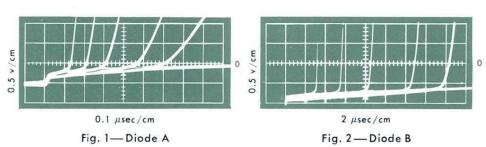
Vertical Deflection Factors—Two calibrated SEN-SITIVITY switch positions are provided on the unit: 0.5 v/cm and 0.05 v/cm. In the 0.5 v/cm position, the total diode shunt capacitance is approximately 9 pf. In the 0.05 v/cm position, the total diode shunt capacitance is approximately 16 pf. In addition, a ZERO REFERENCE position is provided to establish a true zero voltage reference trace.

Eleven Calibrated Currents—Two switches, FOR-WARD CURRENT and DIODE MODE, provide eleven calibrated currents: the forward currents range from 1 to 20 milliamps, and the reverse currents range from zero to 2 milliamps, accuracy within 3%.

Weight: Net—4 1/4 pounds Shipping—6 pounds, approx.

TYPE S PLUG-IN UNIT Each instrument includes: 2—instruction manuals.

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



I forward—10 ma. I reverse—2, 1, 0.5, 0.2, 0.1, 0 ma.

Observation of the recovery curves of Figures 1 & 2 shows both reverse current and recombination accounting for removal of the stored charge. It is thus possible to determine not only the stored charge for any of the five forward currents available, but also the rate of recombination. With this information, it is possible to predict diode action to fast transients in any circuit.

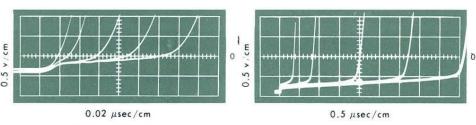
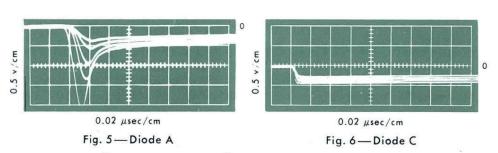


Fig. 3 - Diode A

Fig. 4 - Diode B

I forward—1, 2, 5, 10, 20 ma. I reverse—2 ma.

Observation of the recovery curves of Figures 3 & 4 shows that the amount of stored charge is proportional to forward current while the recovery time is so short that negligible recombination occurs. Under this condition, after the stored charge is cleared the reverse bias increase is limited only by the diode capacitance (and the shunt capacitance of the instrument). This rate of increase is easily measured at a particular reverse voltage, and thus, the diode capacitance at that voltage can also be determined.



Turn-on — magnified. I forward — 1, 2, 5, 10, 20 ma.

Observation of the turn on characteristics of Figures 5 & 6 shows that the voltage drop across a diode suddenly switched on is not always initially as low as the steady-state drop. It is important to remember that the leading edge of any fast transient passed by a diode may be modified by this phenomenon.

NOTE: The above waveform photos are multiple exposures.

Type

TIME-BASE GENERATOR UNIT



Wide Sweep Range

Twenty-two calibrated sweep rates from 0.2 μ sec/div to 2 sec/div.

5-x magnifier, accurate on all ranges.

Versatile Triggering

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

The Type T Time-Base Generator Plug-In Unit is intended to provide sawtooth sweep voltages to drive the horizontal-deflection system and the unblanking gate for the crt in the Type 536 Cathode-Ray Oscilloscope. This plug-in unit can also be used in the vertical-deflection system of any of the Tektronix Type 530, 540, 550 and 580* Series Oscilloscopes. The Type T unit provides the Type 536 with a wide range of sweep rates for use in the usual oscilloscope applications. Trigger shaping and dc-coupled unblanking circuits are included in the Type T Unit.

HORIZONTAL-DEFLECTION SYSTEM

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

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

Sweep Magnifier—When the 5-x magnifier is switched in, the center two-division portion of the normal sweep is expanded to the left and right of center to fill ten divisions. The POSITION control has sufficient range to display any one-fifth of the magnified sweep. Magnifier increases the calibrated sweep rate to 0.04 $\mu sec/div$. Accuracy is within 5% of the displayed portion of the magnified sweep.

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

* A Type 81 Adapter is required.



DC-Coupled Unblanking—This assures uniform bias for all sweep speeds and repetition rates when used in horizontal channel of a Type 536 Oscilloscope.

Preset Stability—The stability control can be set at a predetermined optimum triggering point.

Amplitude-Level Selection—Adjustable amplitude-level and stability controls provide triggering the sweep at a selected amplitude on the triggering waveform, either on the rising or falling slope of the waveform. Trigger source can be external, line frequency, or the signal under observation.

Automatic Triggering—In this mode of operation, no trigger control adjustment is necessary for most applications. Range of operation is between 60 cps and 2 Mc, approximately. In the absence of a signal a reference trace is displayed at approximately a 50-cps rate.

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

Trigger Requirements—A signal of 0.2 v to 10 v is required.

Weight: Net 4 3/4 pounds

Shipping—7 pounds, approx.

TYPE T PLUG-IN UNIT \$240

Each instrument includes: 2—instruction manuals.

DIFFERENTIAL COMPARATOR UNIT Type

The Type Z Plug-In Unit is designed to extend the accuracy of oscilloscope voltage measurements. Highly adaptable, the unit can be used in three modes of operation: (1) as a conventional preamplifier, (2) as a differential-input preamplifier, or (3) as a calibrated differential comparator. Sensitivity is 50 mv/cm. Dynamic range is ± 100 volts. The effective scale length is ± 2000 cm—hence, the resolution is a maximum of 0.005%. The high accuracy of the dc comparison voltage assures precise voltage measurements.

With the Type Z in a Tektronix plug-in oscilloscope, calibrated ±dc comparison voltages can be added differentially to the input waveform via the slide-back technique. The comparator can follow an input waveform having an instantaneous rate of rise to 1 volt in 7 nsec, and an instantaneous rate of fall to 1 volt in 5 nsec. A 100-volt waveform can be displayed incrementally with high resolution (of 0.05 v/cm).

The dynamic range of the unit permits common-mode signals up to 100 volts to be applied to the amplifier without attenuation. The common-mode rejection ratio of 40,000 to 1 at dc or low frequencies allows measurement of differential signals less than 50 millivolts. Larger signals can be attenuated if they do not exceed the dynamic range of the unit.

MEASUREMENT APPLICATIONS

AC and DC VTVM-

Measures audio-frequency signals with the same accuracy as dc signals.

DC-Coupling-

Eliminate "floating oscilloscope" operation.

Observe small ac signals in the presence of large dc components—for example, low-frequency signals on plate amplifiers or power-supply fluctuations to 0 cps.

Measure both dc and signal levels.

Semiconductor Characteristics-

Measure Zener diode ac admittances and Zener voltage together.

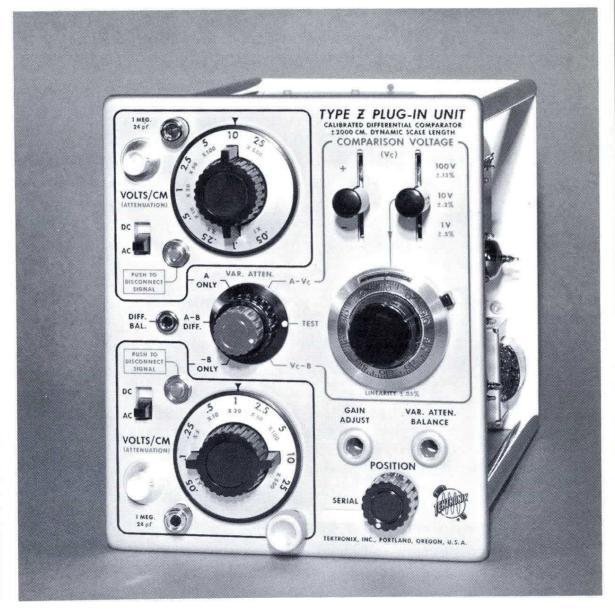
Measure transistor output impedance hoe or hob.

High Amplitude Hum Rejection—

Reject up to 200 volts peak-to-peak common-mode hum.

WAVEFORM DETAILS OF A 100 V STAIRCASE

The Type Z rejects up to $100\,\mathrm{v}$ of an input signal and accepts $100\,\mathrm{v}$ waveforms for display at $50\,\mathrm{mv/cm}$ sensitivity. It provides an equivalent vertical scale length of ± 2000 centimeters.



Pulse-Height Analysis-

Reject any pulse below a preset dc level.

Fast-Recovery Amplifier—

Monitor wide dynamic range signals.

Observe small signals present, during, or following a large pulse—for example, ultrasonic delay line testing or amplifier overload testing.

Modulation Monitor-

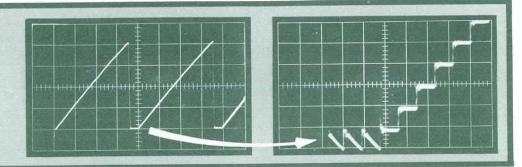
Measure residual amplitude modulation on a carrier, hum noise, etc., or incidental amplitude modulation on an FM or PM signal.

Component Matching-

Use differentially as a null detector in bridge setups, with high resolution of the null.

Time-Base or Staircase Comparisons—

Compare incremental linearity of ramps and staircases with high precision.



AS A CONVENTIONAL PREAMPLIFIER

Sensitivity—

0.05 volts/cm to 25 volts/cm in 9 calibrated steps.

Attenuation—

Constant input impedance turret attenuators.

9 turret positions provide attenuation of X1, X2, X5, X10, X20, X50, X100, X200, and X500.

Frequency-compensating adjustment provided on the front panel.

Variable Gain-

The 2.5 to 1 ratio control extends sensitivity to over 60 volts/cm.

Frequency Response and Risetime—

Frequency specifications are at 3-db down (for signals that do not overscan the screen)

With Types 531A, 533A, 535A—dc to 10 Mc, 35 nsec.

With Types 541A, 543A, 545A, 555, *581, *585, *581A, *585A—dc to 13 Mc, 27 nsec.

Input Impedance—

1 megohm paralleled by approximately 24 pf.

Signal Disconnect Control—

Pushbutton switch allows momentary removal of the signal to establish a zero level.

AS A DIFFERENTIAL INPUT PREAMPLIFIER

(at full sensitivity—50 mv/cm)

Common-mode Signal Level—

 ± 100 volts.

Common-mode Rejection—

Ratio is 40,000 to 1 at 0.05 volt per centimeter with a 1-kc sine wave, lower at other sensitivities and higher frequencies.

200 volts peak-to-peak or ± 100 volts common-mode signal produces a maximum of 1 mm of vertical deflection, equal to 5 mv of differential input signal.

Rate of Change—

The input signals must not exceed +1 volt in 7 nsec (to avoid grid current), or -1 volt in 5 nsec.

AS A CALIBRATED DIFFERENTIAL COMPARATOR

Comparison Voltages—

Three voltage ranges are provided: from zero to ± 1 volt, from zero to ± 10 volts, and from zero to ± 100 volts.

Internal Regulator—

Maintains voltage essentially independent of the actual power-supply voltages furnished by the oscilloscope or the Type 127 or 132 Preamplifier Power Supply.

* A Type 81 Adapter is required.

Comparison Voltage Accuracy—

Within 0.5% on the ± 1 -volt scale. Within 0.2% on the ± 10 -volt scale. Within 0.15% on the ± 100 -volt scale.

DC Drift-

Maximum of $\pm 0.1\%$ in 100-hour drift test of comparison voltages.

Precision Potentiometer—

Zero-based linearity of $\pm 0.05\%$.

Resolution and Accuracy—

0.5 mm (5 mv) resolution equals 0.005% for 100 v signals.

Transient Response-

Rate of rise: The input cathode follower can handle a signal with a rate of rise of less than +1 volt in 7 nanoseconds without the flow of grid current. Grid-current flow will generally distort the waveform.

Rate of fall: The amplifier will be cut off whenever the rate of fall of the input signal exceeds —1 volt in 5 nanoseconds. The amplifier will then "run down" linearily at this rate until it "catches up" with the input signal, and then will resume conduction.

Large fast signals can be attenuated to reduce the switching time.

Attenuator Accuracy—

Input attenuators are the constant-input-impedance, frequency-compensated type.

Resistor tolerance is nominally 1%.

Attenuation accuracy is within 2%.

Weight: Net—5¾ pounds.
Shipping—8 pounds, approx.

Variable Attenuation Probe

Initially designed for the Type Z Plug-In Unit for greatest accuracy at high sensitivity, the Type P6023 10X Probe compensates for normal attenuator differences between two channels. An adjustable potentiometer compensates the 10:1 attenuation ratio, and two adjustable capacitors compensate for input capacities between 20 pf and 47 pf.

Order Part Number 010-167 \$40

Please refer to Catalog Accessory Section for additional information.



DC-to-1MC AMPLIFIER UNIT Type

The Type 2A60 Amplifier is a general purpose plug-in unit. The unit may be used in any of the Type 560-Series Oscilloscopes. However in the Type 567 and RM567, the measurements will not be presented in digital form.

CALIBRATED SENSITIVITY is 0.05 v/div, 0.5 v/div, 5 v/div and 50 v/div; accuracy is within 3%. Uncalibrated continuous control from 0.05 v/div to 500 v/div.

PASSBAND is dc to 1 Mc.

MAXIMUM INPUT VOLTAGE is 600 volts.

INPUT IMPEDANCE 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 manuals.



The Type 2A61 is a low-level ac differential amplifier that is useful for very low-level ac signals in addition to usual differential operation. This unit may be used in any of the Type 560-Series Oscilloscopes. However in the Type 567 and RM567, the measurements will not be presented in digital form.

OPERATING MODES include Input A only; negative Input B only; Input A minus Input B; and Common Mode.

CALIBRATED SENSITIVITY 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.

FREQUENCY RESPONSE is 0.06 cps to approximately 0.3 Mc decreasing to 0.1 Mc at 0.01 mv/div.

COMMON MODE REJECTION RATIO is 50,000 to 1 below 10 kc with a 5-v common-mode input.

PASSBAND CONTROL selects several high-frequency and low-frequency 3-db points thus restricting the passband to improve the signal-to-noise ratio.

LINE-FREQUENCY NOISE FILTER is a notch filter that provides better than 50 to 1 rejection of 60 cps line-frequency noise. Filters for 50 cps and 400 cps 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 IMPEDANCE is 10 megohms paralleled by 50 pf.

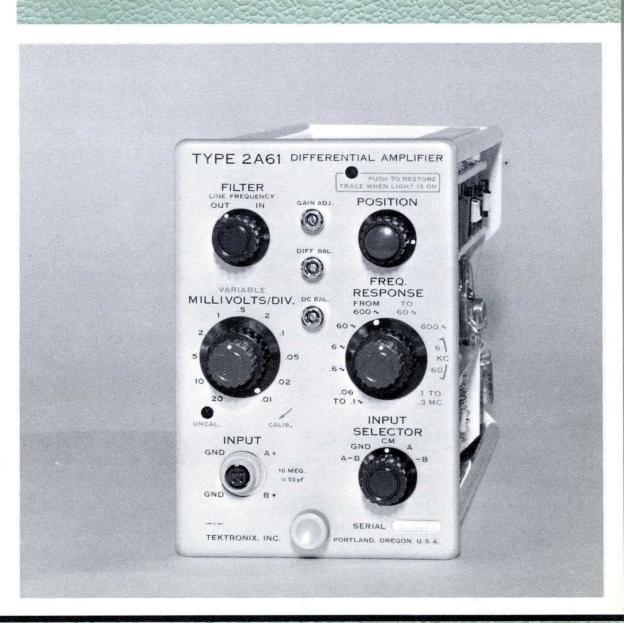
NET WEIGHT is $4\frac{1}{4}$ pounds. Shipping weight is 5 pounds, approx.

TYPE 2A61 AMPLIFIER UNIT \$385

Each instrument includes: 2—instruction manuals, 1—input cable.

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

LOW-LEVEL DIFFERENTIAL Type 2 A 6 1 AMPLIFIER





Type 2 A 6 3 DIFFERENTIAL AMPLIFIER UNIT



The Type 2A63 is a differential-input amplifier unit that is extremely useful for making voltage measurements between two above-ground points and for canceling in-phase signals such as hum pickup in connecting leads. This unit may be used in any of the Type 560-Series Oscilloscopes. However in the Type 567 and RM567, the measurements will not be presented in digital form.

CALIBRATED SENSITIVITY 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.

PASSBAND is dc to 300 kc.

DIFFERENTIAL INPUT has a 50-to-1 rejection ratio.

PHASE SHIFT is nominally less than 1° at 50 kc.

INTER-STAGE AC COUPLING reduces drift at high gain.

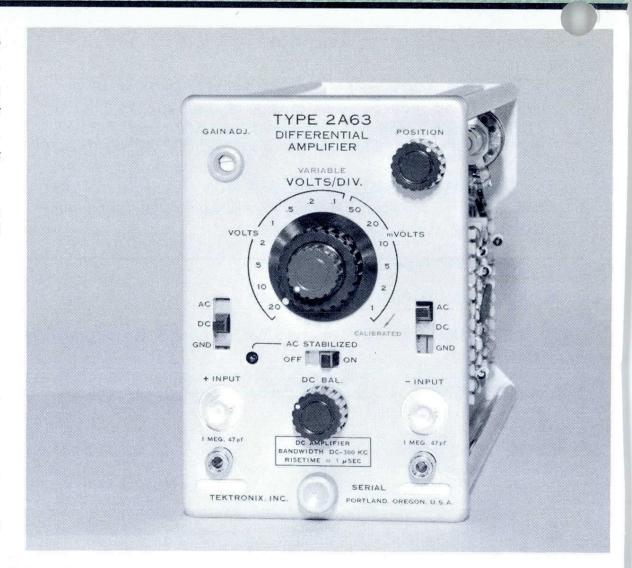
INPUT IMPEDANCE is 1 megohm paralleled by approximately 47 pf.

MAXIMUM INPUT VOLTAGE is 600 volts.

NET WEIGHT is 33/4 pounds. Shipping weight is 5 pounds, approx.

TYPE 2A63 AMPLIFIER UNIT \$130

Each instrument includes: 2—instruction manuals.



Type 2B67 UNIT TIME-BASE

The Type 2B67 is a Time-Base Unit that may be used to generate a sweep for any of the 560-Series Oscilloscopes, except the Type 565 and RM565. However in the Type 567 and RM567, the measurements will not be presented in digital form. The Type 2B67 has facilities for an external input to the sweep amplifier.

CALIBRATED SWEEP RANGE is from 1 µsec/div to 5 sec/div in 21 steps,1-2-5 sequence; accuracy 3%—with magnifier 5%. Uncalibrated continuous control from 1 µsec/div to 12 sec/div.

5X MAGNIFIER extends sweep rate to $0.2 \,\mu sec/div$.

SINGLE SWEEP for one-shot waveform photography.

TRIGGER FACILITIES include Internal, External, Line; Amplitude-Level Selection; AC or DC Coupling; Automatic or Free Run; \pm Slope.

TRIGGER REQUIREMENT for internal is 2 minor graticule divisions of deflection; for external is from 0.5 v dc to 2.0 v at 2 Mc.

SWEEP AMPLIFIER has a passband of dc to 750 kc and a sensitivity of about 1 v/div.

NET WEIGHT is 41/4 pounds. Shipping weight is 5 pounds, approx.



TYPE 2B67 TIME-BASE UNIT

\$175

Each instrument includes: 2—instruction manuals.





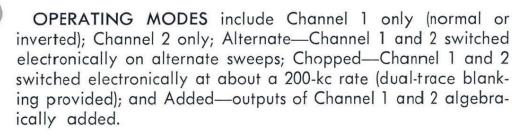
DUAL-TRACE DC-to-10MC UNIT Type

WIDE BAND

DUAL-TRACE

5 OPERATING MODES

The Type 3A1 Amplifier is a general purpose dual-trace plug-in unit that has two separate channels, each with identical characteristics. The unit can operate in one of five operating modes for a variety of single and dual-trace displays. Linear scan is 6 cm. No delay line is included. The Type 3A1 can be used in the Type 561A, RM561A, 564, 565, and RM565.



CALIBRATED SENSITIVITY is 10 mv/div to 10 v/div in 10 steps, 1-2-5 sequence; accuracy within 3%. Uncalibrated continuous control from 10 mv/div to 25 v/div.

PASSBAND is dc to 10 Mc.

RISETIME is approximately 35 nsec.

INPUT COUPLING is either ac or dc. Ac-coupled low frequency 3-db point is 2 cps direct or 0.2 cps with 10% probe.

INPUT IMPEDANCE is 1 megohm paralleled by 47 pf.

MAXIMUM INPUT VOLTAGE is 600 volts peak-to-peak.

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 unit.

NET WEIGHT is 5 pounds. Shipping weight is 6 pounds, approx.

CH 1 2 05 MODE

SCAN 10 OI FORTION

CALIB. CH 2

SCAN 2 SCAN COLUMN CH 15 NORM

CALIB. CH 2

SCAN COLUMN CH 15 NORM

CALIB. CH 2

SCAN DO OI FOSTION

CALIB. CH 2

I MEG. CH 10 NILY

PULL

TENTRONIX INC.

PORTLAND. GREGON. U.S. A

PROBES

TYPE 3A1 DUAL-TRACE AMPLIFIER

The following Tektronix probes are recommended for use with the Type 3A1 and other Type 2-Series and 3-Series Non-Sampling Plug-In Units. See Catalog Accessory Section for complete information on the probes.

	Input I	npedan	ce		
Use	R	С	Rating	Probe No.	Price
1:1 Attenuator	1 meg Ω	97 pf	600 v	P6028	\$12.50
10:1 Attenuator	10 meg Ω	9.5 pf	600 v	P6006	22.00
1000:1 High Voltage	100 meg Ω	3 pf	12 kv	P6013	75.00
1000:1 High Voltage	100 meg Ω	2.7 pf	4 kv	P6015	200.00
Current			15 amps	P6016	75.00

PLUG-IN UNIT EXTENSION

A plug-in unit extension is available that will allow any of the Type 2-Series and 3-Series Plug-In Units to operate while extended out through the front of the oscilloscope opening. Such an extension is valuable while doing maintenance work on the plug-in unit. See Catalog Accessory Section for additional information.

PLUG-IN UNIT EXTENSION (Part No. 013-034) \$14

BNC ADAPTERS

Adapter, BNC to UHF	
Order Part Number 103-032	\$3.55
Adapter, BNC to Binding Post	
Order Part Number 103-033	\$1.60

For BNC cables and accessories, please refer to Catalog Accessory Section.

Type 3 A 7 2 DUAL-TRACE DC-to-650KC UNIT



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 one of five operating modes for a variety of single and dual-trace displays. This unit may be used in any of the Type 560-Series Oscilloscopes except the Type 560. However in the Type 567 and RM567, the measurements will not be presented in digital form.

OPERATING MODES include Channel A only (normal or inverted); Channel B only; Alternate—Channel A and B switched electronically on alternate sweeps; Chopped—Channel A and B switched electronically at about a 30-kc rate (dual-trace blanking provided); and Added—outputs of Channel A and B algebraically added.

CALIBRATED SENSITIVITY 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.

PASSBAND is dc to 650 kc.

INPUT IMPEDANCE is 1 megohm paralleled by 47 pf.

MAXIMUM INPUT VOLTAGE is 600 volts.

NET WEIGHT is 5 pounds. Shipping weight is 6 pounds, approx.

TYPE 3A72 AMPLIFIER UNIT \$250

Each instrument includes: 2—instruction manuals.



Type 3 / 75 AMPLIFIER UNIT

The Type 3A75 Amplifier is a general purpose wideband plug-in unit. The unit may be used in any of the Type 560-Series Oscilloscopes except the Type 560. However in the Type 567 and RM567, the measurements will not be presented in digital form.

CALIBRATED SENSITIVITY 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.

PASSBAND is dc to 4 Mc.

RISETIME is approximately 85 nsec.

MAXIMUM INPUT VOLTAGE is 600 volts.

INPUT IMPEDANCE is 1 megohm paralleled by approximately 47 pf.

NET WEIGHT is $3\frac{1}{2}$ pounds. Shipping weight is 8 pounds, approx.

TYPE 3A75 AMPLIFIER UNIT \$175

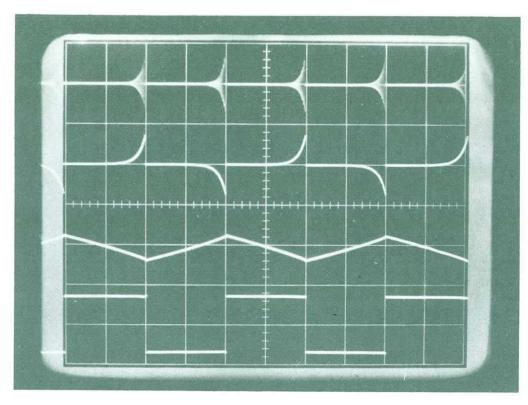
Each instrument includes: 2—instruction manuals.

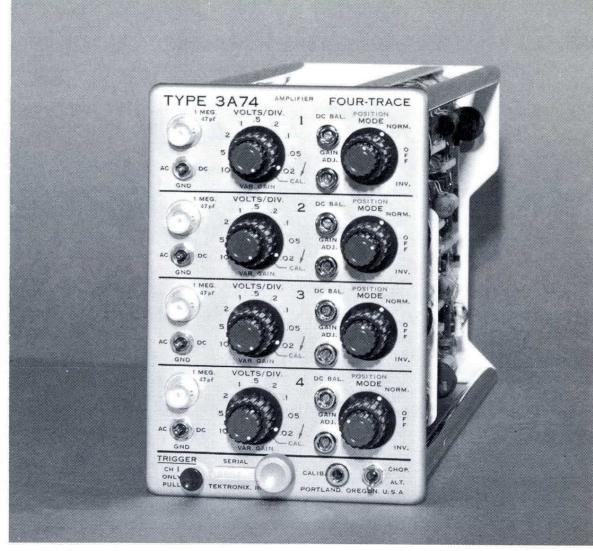






FOUR-TRACE AMPLIFIER UNIT Type 3/4/2





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 any of the Type 560-Series Oscilloscope* except the Type 560. However, in the Type 567 and RM567, 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 with each individual channel either normal or inverted; Chopped—any combination of two or more channels switched electronically at approximately a 500 kc rate each individual channel either normal or inverted.

CALIBRATED SENSITIVITY 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.

PASSBAND is dc to 2 Mc.

* For optimum operation, Type 561 Oscilloscopes below Serial Number 580 must be modified with Modification Kit Tektronix No. 040-267.

RISETIME is approximately 0.17 μ sec.

INPUT COUPLING is either ac or dc. Ac-coupled low frequency 3-db point is 2 cps direct or 0.2 cps with 10X probe.

MAXIMUM INPUT VOLTAGE is 600 volts peak-to-peak.

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 $6\frac{1}{4}$ pounds. Shipping weight is 7 pounds, approx.

BNC ADAPTERS

Adapter, BNC to Binding Post Order Part Number 103-033	\$1.60
Adapter, BNC to UHF Order Part Number 103-032	\$3.55

For BNC probes, cables, and accessories, please refer to Catalog Accessory Section.

Type TIME-BASE UNIT



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, RM561A, 564, 567, and RM567 Oscilloscopes. However in the Type 567 and RM567, the measurements will not be presented in digital form.

CALIBRATED SWEEP RANGE for both normal and delayed sweeps is $0.5~\mu sec/div$ to 1~sec/div in 20~steps, 1-2-5~sequence; accuracy is within 3%. Uncalibrated continuous control for both sweeps is from $0.5~\mu sec/div$ to 2.5~sec/div.

5X MAGNIFIER increases the calibrated sweep rate to 0.1 μ sec/cm.

SWEEP DELAY operation permits accurate setting and measuring of delay intervals at the 20 calibrated sweep range steps from 0.5 μ sec/div to 1 sec/div. An uncalibrated continuous control is available from 0.5 μ sec/div to 2.5 sec/div. One control can adjust both the normal and delayed sweeps simultaneously or the delayed sweep can be adjusted independently of the normal sweep.

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 TRIG-GERED, 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 0.5 to 150 v, plus or minus polarity.

Internal Triggering—2 mm of signal display.

Trigger Frequency—essentially dc to 10 Mc with slightly reduced sensitivity at higher frequencies.

NET WEIGHT is $5\frac{1}{4}$ pounds. Shipping weight is 6 pounds, approx.





TIME-BASE UNIT Type

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, RM561A, 564, 567, and RM567 Oscilloscopes. However, in the Type 567 and RM567, the measurements will not be presented in digital form.

CALIBRATED SWEEP RANGE for both normal and delayed sweeps is $0.5~\mu sec/div$ to 1~sec/div in 20 steps, 1-2-5 sequence; accuracy is within 3%. Uncalibrated continuous control from $0.5~\mu sec/div$ to 2.5~sec/div.

5X MAGNIFIER increases the calibrated sweep rate to 0.1 $\mu sec/cm$.

SINGLE SWEEP operation facilitates photographic recordings of waveforms.

SWEEP DELAY operation permits accurate setting and measuring of delay intervals from 0.5 μ sec to 10 sec. One control can adjust both the normal and delayed sweeps simultaneously or the delayed sweep can be adjusted independently of the normal sweep. Delay accuracy $\pm 1\%$ of full scale reading. Delay time linearity is within $\pm 0.2\%$ of full scale from 5 μ sec to 2 seconds of delay.

The normal sweep generator operates as the display time base in (1) the NORMAL position, (2) the INTENSIFIED position—where the delayed-sweep generator intensifies a portion of the normal sweep trace, indicating the time during which the delayed sweep operates—and (3) the TRIGGERED, INTENSIFIED position—where the delayed sweep is armed at the end of the delay time and starts by the delayed sweep trigger . . . intensifying a segment of the normal sweep trace as above.



The delayed-sweep generator operates as the display time base in (1) the DELAYED SWEEP position—displaying the portion of the trace which was intensified in the INTENSIFIED position...with time-jitter less than 1 part in 20,000 of the maximum available delay interval—and (2) the jitter-free TRIGGERED, DELAYED SWEEP position—displaying the portion of the trace which was intensified in the TRIGGERED, INTENSIFIED position.

TRIGGER FACILITIES include the following:

Normal Sweep Trigger Modes—Internal, External, or Line; AC or DC Coupling; Automatic; ± Slope.

Delayed Sweep Trigger Modes—Internal or External; AC or DC Coupling; \pm Slope.

External Triggering—2 ranges from 0.5 to $15\,v$ and 0.5 to $150\,v$, plus or minus polarity.

Internal Triggering—2 mm of signal display.

Trigger Frequency—essentially dc to 10 Mc with slightly reduced sensitivity at higher frequencies.

NET WEIGHT is $5\frac{1}{4}$ pounds. Shipping weight is 6 pounds, approx.

TYPE 3B3 TIME-BASE UNIT \$525

Each instrument includes: 2—instruction manuals.

Type 3066 CARRIER AMPLIFIER



HIGH GAIN

LOW NOISE

ESSENTIALLY DRIFT FREE

RECORDER OUTPUT

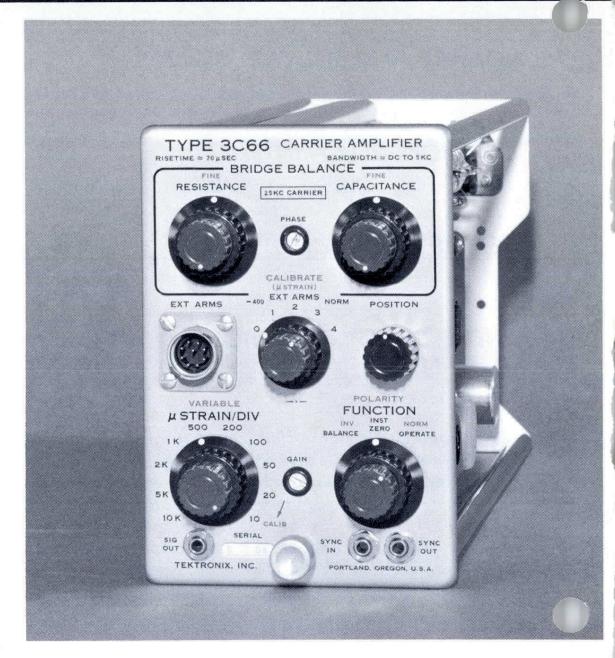
The Type 3C66 Carrier Amplifier with suitable transducer measures mechanical quantities that can be converted to a change in resistance, capacitance, or inductance. This unit may be used in any of the Type 560-Series Oscilloscopes except the Type 560. However in the Type 567 and RM567, the measurements will not be presented in digital form.

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-kc passband.
- 3. Most of the undesired pickup from the input is eliminated because of selective filtering.
- Reactive transducers (including some differential transformers) as well as capacitive and resistive transducers can be used with the unit.
- Up to four simultaneous inputs to the input bridge is possible.



CALIBRATED SENSITIVITY is from 10 microstrain/div (microinches 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.

FREQUENCY RESPONSE is dc to 5 kc.

RISETIME is 70 microseconds, approx.

NOISE is typically equivalent to an input of 2.0 microstrain (pk-to-pk) 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-kc 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; 100-ohm bridge, 0.2 pf/div; useful sensitivities are slightly lower when using long cables.

INDUCTIVE TRANSDUCERS must have characteristics compatible with the 25-kc carrier frequency to function properly. Linear-variable-differential transformers designed for nominal carrier frequencies of 2 kc 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 push-button switch connects a calibration resistor across the strain gage electrically to simulate an external mechanical strain. The calibration resistor supplied with the Type 3C66 Unit simulates a —400 microstrain unbalance of the bridge 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 volts for each major division of crt display. Its dc level is adjustable to 0 v by an internal control.

NET WEIGHT is $5\frac{1}{4}$ pounds. Shipping weight is 7 pounds, approx.

TYPE 3C66 AMPLIFIER UNIT \$400

Each instrument includes: 1—synchronizing cable, 1—15' shielded 4-wire connector cable, 1—120 Ω internal bridge resistor assembly, 2—instruction manuals.

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

TYPE 3C66 CARRIER AMPLIFIER BLOCK DIAGRAM

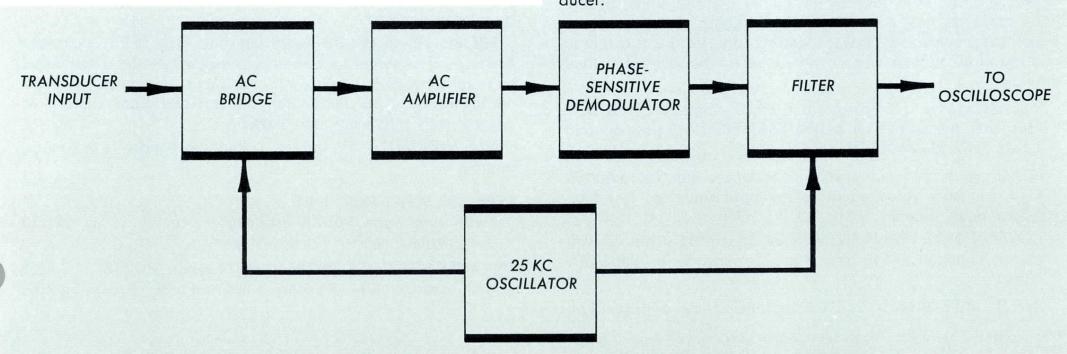
The input circuit for the unit is an ac bridge that has an external transducer connected into one or more of the bridge arms. Excitation voltage for the bridge is obtained from the 25-kc oscillator.

In operation, the transducer signals unbalance the bridge to modulate the 25-kc 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 when 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 undersirable 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 3 SAMPLING-PROBE DUAL-TRACE UNIT



EXTREMELY COMPACT PROBES DUAL-TRACE DISPLAYS 100 K, 2 pf INPUT LOW NOISE RECORDER OUTPUTS

The Type 3S3 Sampling Unit is a low-noise dual-trace amplifier. Used with a sampling time-base unit and Type P6038 Probe, the unit can perform in one of five operating modes for a variety of single, dual-trace, and X-Y displays. The Type 3S3 has two separate channels, each with identical characteristics. The unit can be used in any of the Type 560-Oscilloscopes* except Type 560, 565 and RM565. In the Type 567 and RM567, information can be presented in digital form as well as the usual crt analog form.

OPERATING MODES include Channel A only (normal or inverted); Channel B only (normal or inverted); Dual-Trace—electronic switching between the traces with either

channel normal or inverted, A + B—outputs of Channel A and B algebraically added (either channel
normal or inverted); A Vertical and
B Horiontal—Channel A produces vertical
deflection and Channel B produces horizontal deflection for X-Y displays (either channel normal or inverted).

CALIBRATED SENSITIVITY 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 sensitivity to approximately 2 mv/div.

RISETIME AND SMOOTHING controls adjust the instrument for least noise, best risetime, or a compromise between the two while maintaining correct dot transient response. A switch selects one of two risetimes. The smoothing control affects both the noise level and dot transient response. The smoothing control has an adjustment range that maintains correct dot transient response and the noise level is adjusted within this range.

At low signal repetition rates, there is one smoothing control setting for correct dot transient response and thus no further adjustment for noise level is available. As the signal repetition rate increases, there is an increasingly wider range of smoothing control settings for correct dot transient response and therefore greater adjustment range for noise level is then available.

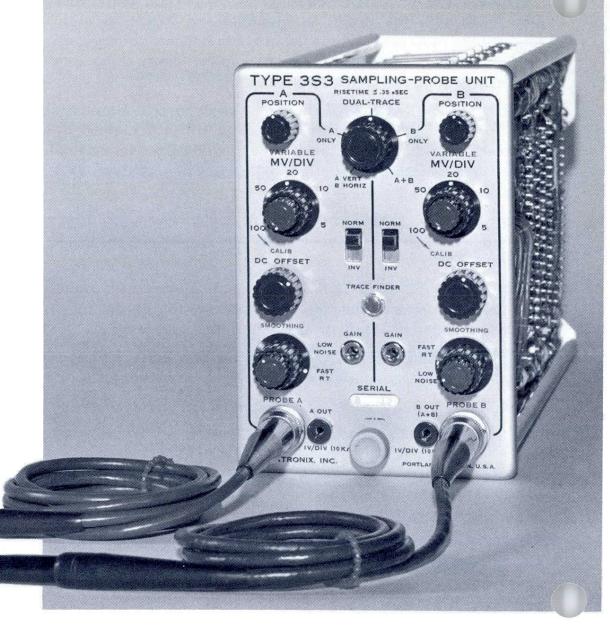
RISETIME (with a 50-ohm input source impedance) is 0.35 nsec with the switch set at the FAST RISETIME position and 1 nsec at the LOW NOISE position.

NOISE (with 50-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 of less than 25 ohms to at least 300 ohms.

INPUT IMPEDANCE is 100 k paralleled by approx. 2 pf.

*For optimum operation, Type 561 Oscilloscopes below Serial Number 580 must be modified with Modification Kit Tektronix No. 040-267.



MAXIMUM INPUT SIGNAL is \pm 1.5 v with Risetime control set to LOW NOISE and \pm 3 v when the control is set to FAST RISETIME.

EXTERNAL TRIGGER is required, approximately 50 nsec prior to signal. Minimum repetition rate is 50 cps.

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. A control permits displaying of signals riding on a dc voltage as high as $\pm 0.5 \, \text{v}$.

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.

PROBE (Type P6038) used with the Type 3S3 is extremely compact. The sampling bridge is contained in the probe head to obtain optimum results with the input impedance of 100 k paralleled by 2 pf. Probe can be changed from channel to channel with only minor recalibration.

NET WEIGHT is $6^{3}/_{4}$ pounds. Shipping weight is 9 pounds, approx.

TYPE 3S3 AMPLIFIER UNIT

REPLACEMENT P6038 PROBE (Part Number 010-156) . . . \$225 Each probe includes: Normalizer, 10X attenuator, capacitor coupler, miscellaneous tips.





DUAL-TRACE SAMPLING UNIT Type 3 5 7

Internal Triggering and Delay Lines

- 0.4-nsec or less Risetime
- 2 Identical Channels
- 5 Operating Modes

Recorder Outputs

The Type 3S76 Sampling Unit is a dual-trace amplifier. Used with a sampling time-base unit, the unit can perform in one of five operating modes for a variety of single, dual-trace, and X-Y displays. The Type 3S76 has two separate channels, each with identical characteristics. The unit can be used in any of the Type 560-Oscilloscopes* except the Type 560, 565 and RM565. In the Type 567 and RM567, information can be presented in digital form as well as the usual crt analog form.

OPERATING MODES include Channel A only (normal or inverted); Channel B only (normal or inverted); Dual-Trace—electronic switching between the traces with either channel normal or inverted; A + B—outputs of Channel A and B algebraically added (either channel normal or inverted); A Vertical and B Horizontal—Channel A produces vertical deflection and Channel B produces horizontal deflection for X-Y displays (either channel normal or inverted).

CALIBRATED SENSITIVITY is from 2 mv/cm to 200 mv/cm in 7 calibrated steps, accuracy within 3%, except on the 2 mv/cm and 5 mv/cm steps, which have accuracy within 5%. A variable control permits continuous adjustment between steps.

FREQUENCY RESPONSE is equivalent to dc-to-3-db down at 875 Mc.

RISETIME is 0.4 nsec or less, with less than $\pm 3\%$ peak overshoot and undershoot.

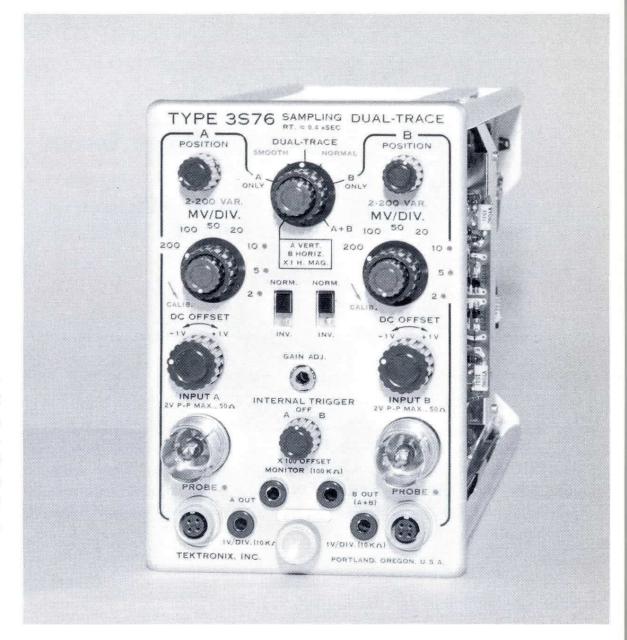
NOISE is equivalent to an input signal of 2 mv pk-to-pk with Smooth-Normal Switch in NORMAL position and 1 mv pk-to-pk with Smooth-Normal Switch in SMOOTH position.

DC OFFSET is -1 to +1 v, referred to input, and monitorable at the front panel at 100X magnitude.

INPUT IMPEDANCE is 50 ohms.

INPUT SIGNALS can be up to 2 v pk-to-pk.

*For optimum operation, Type 561 Oscilloscopes below Serial Number 580 must be modified with Modification Kit Tektronix No. 040-267.



SIGNAL DELAY through 55-nsec internal delay line for each channel allows viewing of leading edge of input waveform.

TRIGGER SOURCE selects built-in trigger takeoff signal from either channel, or terminates.

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.

NET WEIGHT is $7\frac{1}{2}$ pounds. Shipping weight is 12 pounds, approx.

TYPE 3S76 DUAL-TRACE SAMPLING UNIT \$1100 Each instrument includes: 2—50-Ω 10:1 attenuators, 2—5-nsec RG8A/U cable, 2—instruction manuals.

PROBES

The following Tektronix probes are recommended for use with the Type 3S76 and other Type 2-Series and 3-Series Sampling Plug-In Units. See Catalog Accessory Section for complete information on the probes.

	Input Imp	edance			
Use	R	С	Rating	Prob. 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 meg Ω	varies	varies	P6032	220
Current		-	500 ma	CTI/P6040	31



Type SAMPLING SWEEP UNIT



Internal or External Triggering

 $10~\mu sec/cm$ to 0.02~nsec/cm Sweep Speeds

Variable Sweep Delay through 100 nsec

Single-Display Provision

Recorder Output

The Type 3T77 is a Sampling Sweep Plug-In Unit. It paired with a Sampling Amplifier Unit provides sub-nanosecond capabilities. The Type 3T77 can be used in any of the Type 560-Series Oscilloscopes* except the Type 560, 565 and RM565. In the Type 567 and RM567, information can be presented in digital form as well as the usual crt analog form.

TRIGGERING CHARACTERISTICS

EXTERNAL TRIGGERING

AMPLITUDE RANGE is 10 mv pk-to-pk minimum, 800 mv pk-topk maximum. Damaging overload occurs at 5 volts and greater.

PULSE REPETITION RATE is 10 cps to 300 Mc. Trigger circuitry counts down to maximum sampling rate of approximately 100 kc. (Rate with 3S76, 50 pps to 300 Mc.)

JITTER is 50 picoseconds or 0.1% of fast ramp duration, whichever is greater, for pulses of 50-mv amplitude, 2 nsec width (or 10 mv, 10 nsec width) with repetition rate less than 10 Mc. Jitter increases with less amplitude and/or pulse width, and with repetition rates above 10 Mc.

INTERNAL TRIGGERING

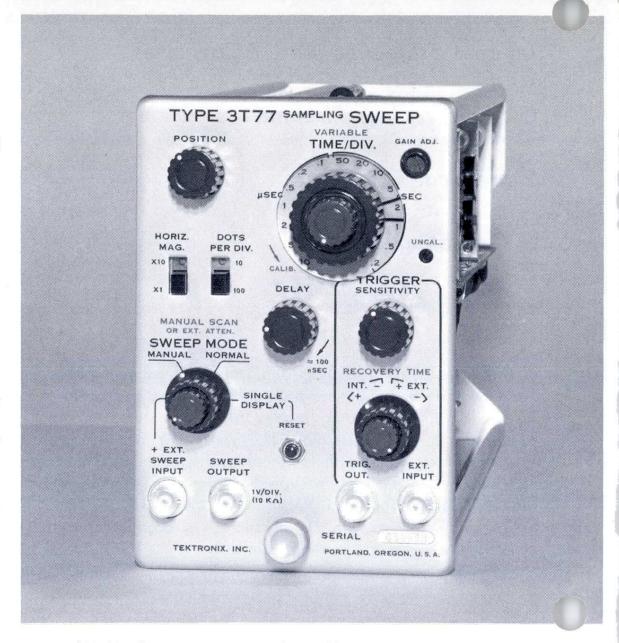
Same specifications as EXTERNAL TRIGGERING, but modified by vertical plug-in being used. When used with 3S76, all specifications are the same except 5X amplitude is required at A or B vertical input.

OTHER CHARACTERISTICS

DISPLAY can be either 10 or 100 dots/cm.

CALIBRATED SWEEP RANGE is from 0.2 nsec/div to 10 μ sec/div in 15 calibrated steps, 1-2-5 sequence. Accuracy is within 3%. A variable control permits continuous adjustment uncalibrated between calibrated rates.

* For optimum operation, Type 561 Oscilloscopes below Serial Number 580 must be modified with Modification Kit Tektronix No. 040-267.



10X MAGNIFIER extends the calibrated sweep rate to 0.02 nsec/cm.

MANUAL SCAN OR EXTERNAL ATTENUATOR, a dual-purpose control, permits manual scanning of signals or control of external sweep amplitudes.

EXTERNAL SWEEP INPUT is dc-coupled and accepts a minimum 50-v positive going sweep for 10-cm display.

SINGLE DISPLAYS useful for photography can be initiated by a reset button.

RECORDER SWEEP OUTPUT is 1 v/cm (through 10 kilohms), useful for driving recorders and other devices.

SWEEP DELAY of approximately 100-nsec permits observation of a selected portion of a waveform.

NET WEIGHT is 51/2 pounds. Shipping weight is 9 pounds, approx.

TYPE 3T77 SAMPLING SWEEP UNIT \$650

Each instrument includes: 1—BNC to UHF adapter, 1—BNC to GR adapter, 2—10 nsec RG58A/U cables, 2—10X attenuators, 2—instruction manuals.





SQUARE-WAVE GENERATOR Type

Risetime

Less than 20 nsec into a terminated 93-ohm cable. As short as 13 nanoseconds under suitable conditions.

Frequency Range

25 cycles to 1 mc, continuously variable.

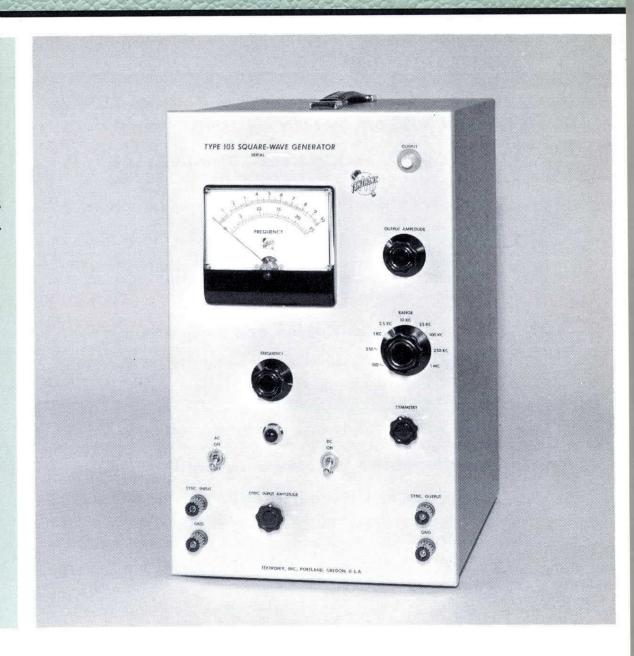
Frequency Meter

Direct reading, accurate within 3% of full scale.

Maximum Output

QUINO USA

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



The Tektronix Type 105 produces square waves with flat horizontal portions, free of overshoot and ringing, over a wide frequency range. Square-wave current greater than 160 ma, peak-to-peak, available at the output terminal, permits a useable voltage swing across very-low impedance loads. Risetime is less than 20 nsec into a terminated 93-ohm cable, and is approximately 13 nanoseconds into a 52-ohm cable terminated at both ends.

Testing wide-band amplifiers with a Type 105 Square-Wave Generator and an oscilloscope is a fast, efficient method for revealing pulse characteristics such as transient response, bandwidth, and phase shift. The Tektronix Type 105 Square-Wave Generator makes it possible to quickly and accurately test amplifiers, filters, etc., having passbands from a few cycles to 20 mc.

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

CHARACTERISTICS

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

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

Risetime—Less than 20 nsec into a terminated 93-ohm cable; approximately 18 nanoseconds when the 93-ohm cable is terminated at both ends; approximately 13 nanoseconds into a 52-ohm cable terminated at both ends. For higher output voltages larger output impedances can be used, with a corresponding increase in risetime.

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

105

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

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

Mechanical Specifications—Dimensions are $16\frac{7}{8}$ " high by $10\frac{3}{8}$ " wide by $15\frac{1}{4}$ " deep. Net weight is $34\frac{1}{4}$ pounds. Shipping weight is 47 pounds, approx.

TYPE 105 GENERATOR \$435

Each instrument includes: 1—93- Ω coaxial cable, 1—93 Ω terminating resistor, 1—binding-post adapter, 1—3-conductor power cord, 1—clip-lead adapter, 2—instruction manuals.

Optional Cables and Resistors

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

Attenuators, Cables and Terminations

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

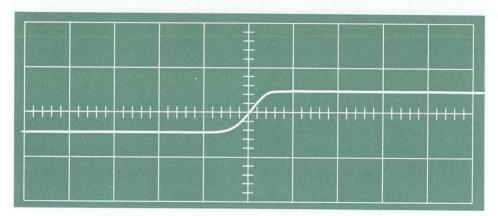


Fig. 1. 13-nanosecond risetime of the Type 105 displayed on 20 nsec/cm sweep. Generator connected to vertical deflection plates of T54P crt, sensitivity 7 v/cm, with 52-ohm cable terminated at both ends.

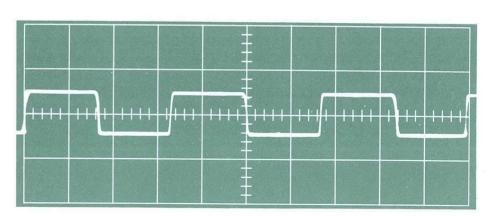


Fig. 2. Sharp leading edge, square corner, and flat top of 1-mc square-wave output of Type 105 displayed on 0.3 μ sec/cm sweep Other conditions same as in Fig. 1.



SQUARE-WAVE GENERATOR Type

Risetime

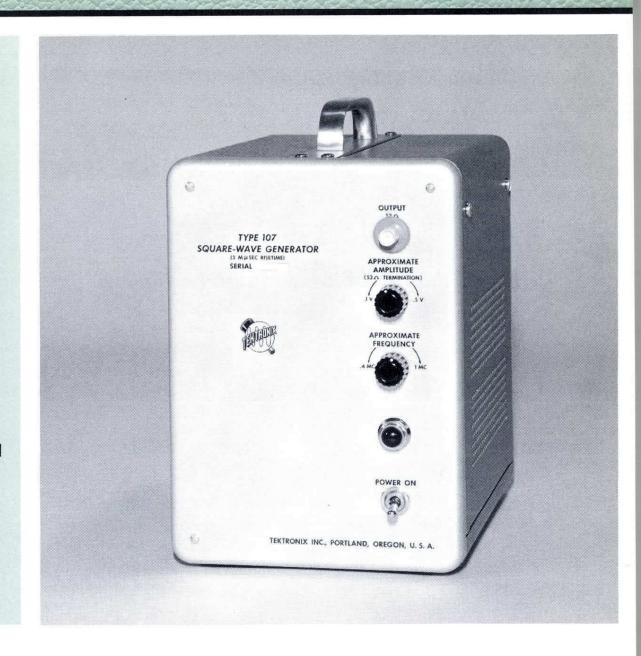
Less than 3 nsec into a terminated 52-ohm cable.

Frequency Range

Approximately 400 kc to 1 Mc, uncalibrated.

Output Voltage

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



The Type 107 Square-Wave Generator is basically intended as a test accessory for Tektronix Instruments.

With less than 3-nsec risetime, the Type 107 provides a suitable square wave for checking and adjusting high-frequency response of most Tektronix Oscilloscopes and Wide-Band Preamplifiers. Source impedance is approximately 52 ohms. Output is ac coupled.

CHARACTERISTICS

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

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

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

Output Trigger—Output voltage is approximately 1.5 v pk-to-pk with a 93-ohm cable termination. The negative portion of the trigger slightly precedes the positive-going portion of the square-wave output. The trigger signal is available at a coaxial connector at the rear of the instrument.

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

Power Supply—A conventional full-wave rectifier system employs a capacitor-input filter, a regulated + 150 v is supplied for the output tube screen grid to insure constant output amplitude with a given APPROXI-MATE AMPLITUDE setting.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 100 watts.

Mechanical Specifications—Dimensions are 10-9/16" high by 7" wide by 11 ½" deep. Net weight is 13 pounds. Shipping weight is 20 pounds, approx.

TYPE 107 GENERATOR \$190

Each instrument includes: 1—50 Ω cable, 1—50 Ω terminating resistor, 1—3-conductor power cord, 1—X10 attenuator, 2—instruction manuals.

Type PULSE GENERATOR



0.25 nsec Risetime Pulses

Alternate Pulses of Equal or Different Time Duration

Calibrated Variable Amplitude Pulses of Either Positive or Negative Polarity

Pulse Durations to 40 nsec

The Type 109 is intended for use with fast-rise sampling systems or conventional oscilloscopes that generate their own internal sweep trigger. The Type 109 is transistorized and requires no warmup time before operating.

CHARACTERISTICS

PULSE RISETIME is less than 0.25 nsec.

PULSE WIDTH is near 0.5 nsec to a maximum of 40 nsec at full repetition rate; 300 nsec at half repetition rate. An external charge network with a 10X attenuation provides long duration pulses. Amplitude decay is only 10% in 300 nsec.

REPETITION RATE is preset between 550 pulses/sec to 720 pulses/sec.

PULSE AMPLITUDE can be selected from three calibrated ranges extending from zero volts through fifty volts, accuracy within 3%.

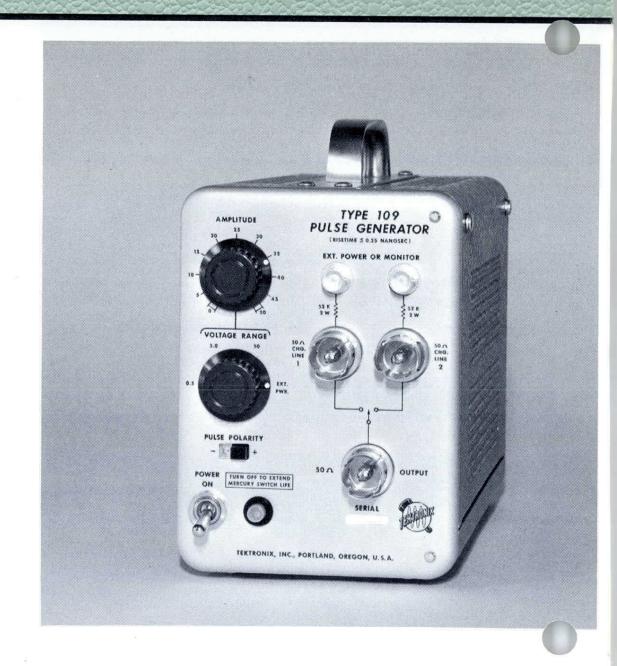
PULSE POLARITY can be either positive or negative.

OUTPUT IMPEDANCE is 50 ohms.

CHARGE LINES, either one or two, can be used to provide alternate equal or unequal pulses as desired. Equal charge lines produce a repetition rate of 550 pulses/sec to 720 pulses/sec.

EXTERNAL DC CHARGE VOLTAGE INPUTS permit alternate pulses of different amplitudes and/or polarity. Maximum external charge voltage is 600 volts. With up to 100 volts input, the output amplitude will be half the external input amplitude. At voltage inputs over 100 volts, the output amplitude will be less than half the input amplitude.

DC-POWER SUPPLIES are electronically regulated to compensate for widely varying load conditions.



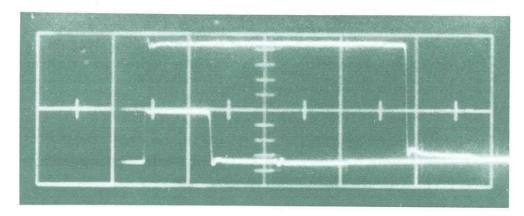
POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v, 50 to 800 cps, typically 60 watts.

MECHANICAL FEATURES include an aluminum-alloy chassis and anodized front panel. Dimensions are 7½ high by 5″ wide by 11¾ deep. Net weight is 8½ pounds. Shipping weight is 18 pounds, approx.

TYPE 109 PULSE GENERATOR \$360

Each instrument includes: 1 — 3-conductor power cord, 3 — charge lines (GR RG8/AU 50- Ω , 5-nsec cables), 1 — charging network, 2 — instruction manuals.

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



Alternate pulses of different widths and amplitudes produced by using 5-nsec and 20-nsec charge lines and external charge voltages. Vertical sensitivity 10 v/cm, sweep speed 10 nsec/cm.

PULSE GENERATOR Type

PULSE GENERATOR

PULSE RISETIME—less than 0.25 nsec.

PULSE WIDTH RANGE—with both charge lines, approx. 0.5 nsec to 40 nsec; with one charge line disabled, up to approx. 300 nsec (at half of repetition rate).

OUTPUT VOLTAGE—variable from 0 to 50 v, plus or minus with internal supply; $\pm 300 v$ maximum allowed from external supply.

OUTPUT IMPEDANCE-50 ohms.

REPETITION RATE—720 pulses/sec, typically.

TRIGGER TAKEOFF SYSTEM

INPUT IMPEDANCE-50 ohms.

OUTPUT SIGNAL TO TRIGGER SYSTEM—amplitude approximately 20% of input signal.

INPUT SIGNAL THROUGH SYSTEM—20 mv to 50 volts (transmission losses and reflections less than 2 ½%).

DIRECT EXTERNAL TRIGGER INPUT—5 mv to 10 volt signal.

REGENERATED TRIGGER OUT SIGNAL— ±6 to 10 v 220 to 280 nsec duration.

The Tektronix Type 110 Pulse Generator and Trigger Takeoff System is two instruments in one unit. The pulse generator produces fast-rise pulses. The trigger takeoff system can amplify and/or regenerate pulses as well as provide an efficient method of deriving trigger pulses from a signal without significantly disturbing the signal itself.

PULSE GENERATOR—A mercury switch alternately switches between two charge lines to give output pulses with a risetime of less than 0.25 nsec and at a repetition rate of about 720 pulses/sec. The output impedance is 50 ohms.

Pulse widths from 0.5 nsec to 40 nsec are available when two charge lines are used. Width of alternate pulses will be unequal if the two charge line lengths are unequal. Pulse widths over 40 nsec up to 300 nsec are available if one charge line is disabled (however, the repetition rate is reduced to one-half).

An internal voltage source will provide positive or negative pulses with amplitude adjustable between 0 and 50 volts. When external voltage sources are used, alternate pulses with different polarities and different amplitudes (up to a maximum of about 300 volts) are available.

TRIGGER TAKEOFF SYSTEM—In the takeoff circuit a trigger signal is "picked off" of a signal looped through the system. The signal passing through is reduced to about 98% and about a 2% reflection appears at the input. After pickoff, the trigger signal is transformed to about 20% of the input signal amplitude and may appear as an output trigger signal (either unaltered, amplified, or attenuated), or as a regenerated signal.



An externally applied trigger signal can also appear as an output after it has either been amplified, attenuated, or regenerated.

The regenerated trigger signals have an output of \pm 6 to 10 volts and 220 to 280 nsec duration. The recovery time is 10 μ sec and maximum random repetition rate is about 100 kc, but the system can count down from approximately 100 Mc. Trigger response impulse speed is about 1 nsec without amplifiers and 3 nsec with amplifiers. Time delay is nominally 20 nsec with an additional 1 nsec available by using a front-panel switch. This additional accurate 1 nsec delay is useful for checking timing accuracy of the indicator used.

DC-VOLTAGE—Supplies are electronically regulated.

POWER REQUIREMENT—105 v to 125 v or 210 v to 250 v, 50 to 800 cps, typically 48 watts at 117 v.

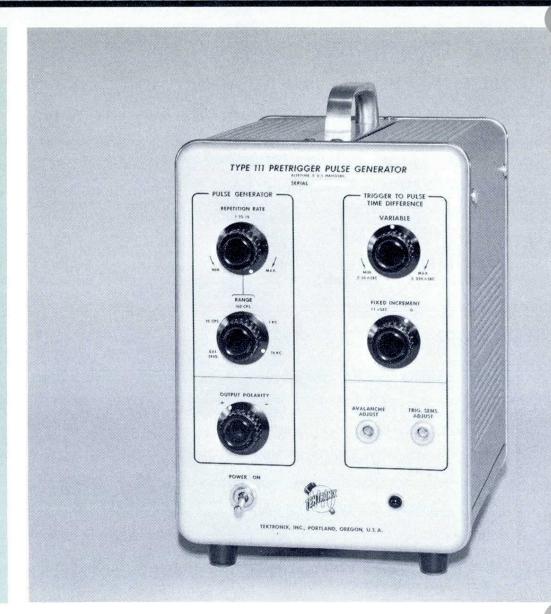
MECHANICAL SPECIFICATIONS—Dimensions are $10^3/_4$ " high by 7" wide by $15^7/_8$ " deep. Net weight is $14^3/_4$ pounds. Shipping weight is 25 pounds, approx.

nectors, 1—20 nsec 50 Ω coax cable RG8A/U with G.R. connectors, 1—3-wire power cord, 2—instruction manuals.

Type PULSE GENERATOR



The Type 111 is a high-repetition rate, fast-rise pulse generator. It is primarily intended for use with the Tektronix Type N Sampling Plug-In Unit; however, its characteristics make it ideally suited for use with conventional oscilloscopes and other equipment as well. The unit provides two pulse outputs: the fast-rising Output Pulses and the Pretrigger Pulses. The Pretrigger Pulses occur from 30 to 250 nanoseconds ahead of each Output Pulse. These Pretrigger Pulses can be used as a Regenerated Trigger Signal for the Type N Unit or as a triggering signal for a conventional oscilloscope. The amount of delay between the Pretrigger Pulse and the Output Pulses is variable by means of a front panel control. This eliminates the need in most applications for low loss delay cables.



Output Pulse Risetime—Equal to or less than 0.5 nsec when the OUTPUT POLARITY Switch is in the (+) position. When the switch is in the (-) position, the risetime is slightly longer.

Output Pulse Duration—Minimum, approximately 2 nsec with no external charge line. Maximum, 100 nsec at low repetition rates decreasing to 20 nsec at 100 kc repetition rate. Maximums are obtained with an external charge line.

Output Pulse Polarity—Either (+) or (—) as selected by a front panel control.

Output Pulse Repetition Rate—Four repetition rate ranges and a vernier control provide a continuous range of adjustment from approximately 10 pps to approximately 100 kc. Overlap between ranges is about 5%.

Output Pulse Aberrations—When the output is properly terminated, overshoot and other aberrations on the rising and sustained portion of the output pulse are less than 5% of the peak amplitude. On the falling portion of the pulse, aberrations are less than 10% of the peak amplitude.

Pulse Amplitude—More than ± 5 volts. The output voltage is fixed by the particular avalanche transistor used. External attenuators are necessary to vary the output amplitude. Refer to Accessories section for available 50 Ω attenuators.

Pretrigger Pulse Characteristics—Amplitude is about 10 volts, duration is about 250 nsec, and half-amplitude risetime is about 4 nsec.

Pulse Delay—The Output Pulse is delayed from 30 to 250 nsec after generation of the Pretrigger Pulse. The delay is continuously variable by means of a front panel control. Time jitter between the Pretrigger and the Output Pulse is less than 100 picoseconds.

Output Impedance—50 ohms.

External Trigger Signal—Positive 5 volts or greater at rise rate of 3 volts/ μ sec or faster and repetition rate from dc to about 100 kc.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 800 cps, typically 35 watts at 117 v.

Mechanical Specifications—Dimensions are $11 \frac{1}{8}$ " high by 7" wide by $11 \frac{1}{8}$ " deep. Net weight is $8 \frac{3}{4}$ pounds. Shipping weight is 16 pounds, approx.

TYPE 111 GENERATOR \$365

Each instrument includes: 1—5 nsec 50 Ω coax cable R68A/U with G.R. connectors, 1—9 nsec 50 Ω coax cable R68A/U with G.R. connectors, 1—50 Ω 10X attenuator, 1—3-wire power cord, 2—instruction manuals.

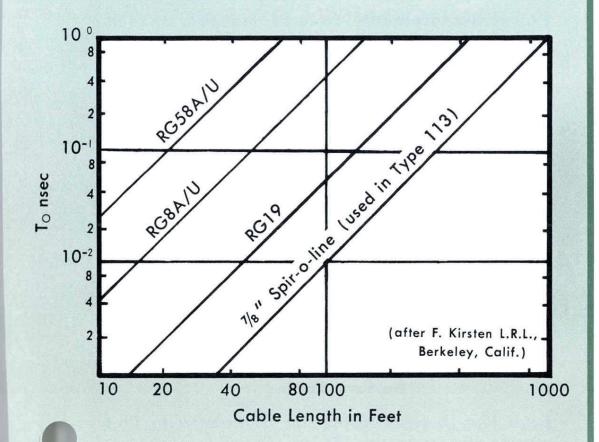


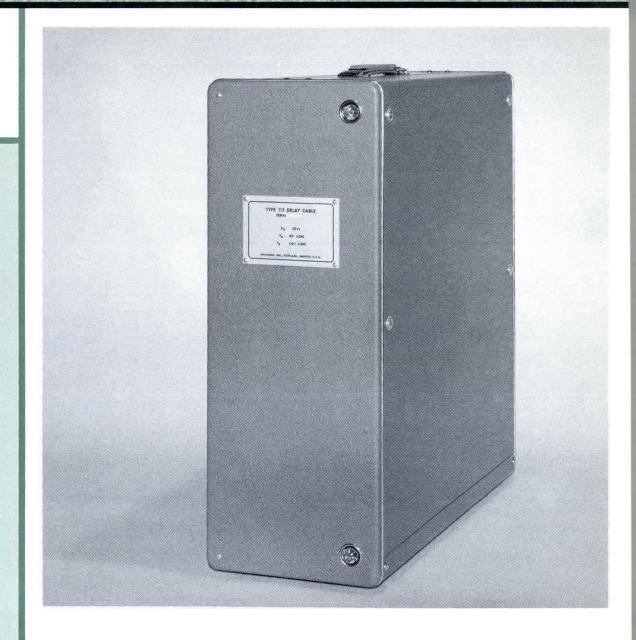
TRANSMISSION LINES

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% (T₀) 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 nsec. In general it is used in those sampling applications in which the Type 110 Trigger Takeoff derives the trigger from a signal—so the trigger can arrive ahead of the signal at the Type N Sampling Plug-In Unit.

The Type 113 Delay Cable may also be used in those applications in which the signal source supplies a suitable trigger—for direct operation of the Type N without need of the Type 110.

Adequate Time Delay—With 60 nsec inserted in the Type 110 and N system, about 10 nsec can be seen ahead of a fast leading edge.

High Quality Cable—Approximately 1.5 db loss per 100 feet at 1000 mc. Risetime approximately 0.1 nsec.

Mechanical Specifications—Three-piece cabinet houses the coaxial cable compactly coiled between two G.R. connectors. Side panels and bottom panel are easily removable. Rubber feet installed in one side, the bottom, and the back, facilitate use of the Tektronix Type 113 Delay Cable in any of three positions.

Dimensions are 22 % " high by 8 % " wide by 21 % " deep. Net weight is 44 ¾ pounds. Shipping weight is 59 pounds, approx.

TYPE 113 DELAY CABLE \$250

Type DD LOW-LEVEL PREAMPLIFIER





Voltage Gain

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

Frequency Response

0.2 cps to 40 kc maximum.

Input Selection

Single ended or differential.

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

The Type 122 can be used with any dc-coupled oscilloscope, increasing its sensitivity by a factor of either 1000 or 100. If the Type 122 is used with an accoupled oscilloscope, the overall low-frequency response will be limited to that of the oscilloscope.

Shock mounting, careful bypassing, and use of the Tektronix Type 125 Power Supply or battery power reduce microphonics, noise, and hum to a low level.

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

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

Rejection Ratio—80 to 100 db for in-phase signals from 5 cycles to 40 kc; maximum common-mode signal input is 4 v.

Signal Output—Maximum signal output is 20 v (peak-to-peak) for a maximum signal input of 0.02 v (peak-to-peak) in high gain position and 0.1 v (peak-to-peak) in low gain position. AC input signals up to these maximums or dc levels up to $\pm 0.1 \text{ v}$ (either gain setting) can be handled by the Type 122 before waveform distortion occurs. Output impedance is approximately 1000 ohms.

Input Impedance—With single-ended input, the impedance is 10 megohms paralleled by approximately 50 pf. Impedance for differential input is 20 megohms paralleled by approximately 50 pf.

Noise Level—Depending on the setting of the frequency response controls, the noise level, referred to the input, is 1 to 5 microvolts rms with the input terminals grounded.

Power Requirement—Powered through a standard octal plug: $+135 \, \text{v}$ at $5 \, \text{ma}$, $-90 \, \text{v}$ at $4 \, \text{ma}$, and $6.3 \, \text{v}$ at $0.9 \, \text{amp}$. The Type 122 can be powered by the Type 125 Power Supply or by batteries. The battery cable furnished with the instrument is designed to be used with five 45-volt dry-cell batteries and one 6.3-volt storage battery. Batteries are not included with the Type 122.

Mechanical Specifications—Dimensions are $12\frac{1}{4}$ " high by $4\frac{1}{8}$ " wide by $7\frac{1}{8}$ " deep. Net weight is $4\frac{3}{4}$ pounds. Shipping weight is 7 pounds, approx.

Battery Cables

Extra long battery cables can be ordered to fit a particular arrangement.



FRAME MOUNT Type FM122

CHARACTERISTICS

The Type FM122 has a specially designed front panel and cabinet for use where mounting in a vertical position is required. It can be mounted in an existing support or adapted to mounting in a standard rack by a Tektronix Mounting Frame.

Electrical characteristics of the Type FM122 are the same as described for the Tektronix Type 122 Preamplifier.

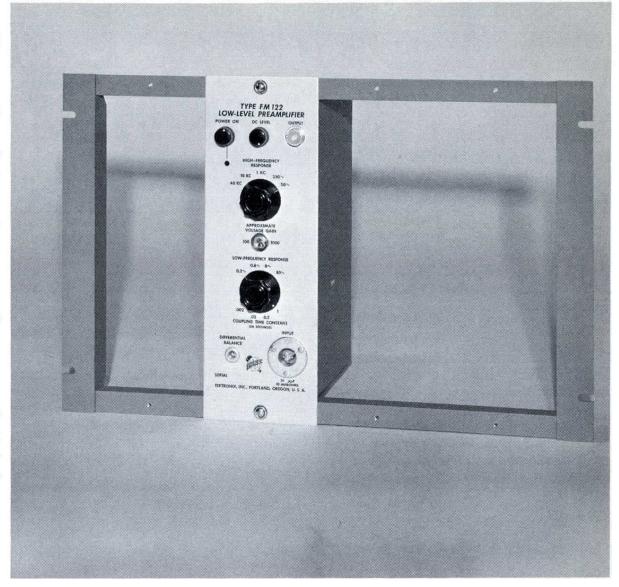
Mechanical Specifications—Dimensions are $12\frac{1}{4}$ " high by $4\frac{1}{8}$ " wide by 7" deep. Net weight is $5\frac{1}{2}$ pounds. Shipping weight is 7 pounds, approx.

TYPE FM122 (without Mounting Frame) \$140

Each instrument includes: 1—battery cable, 1—input cable, 1—
output cable, 2—instruction manuals.

Mounting Frame

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



RACK MOUNT Type RM122

CHARACTERISTICS

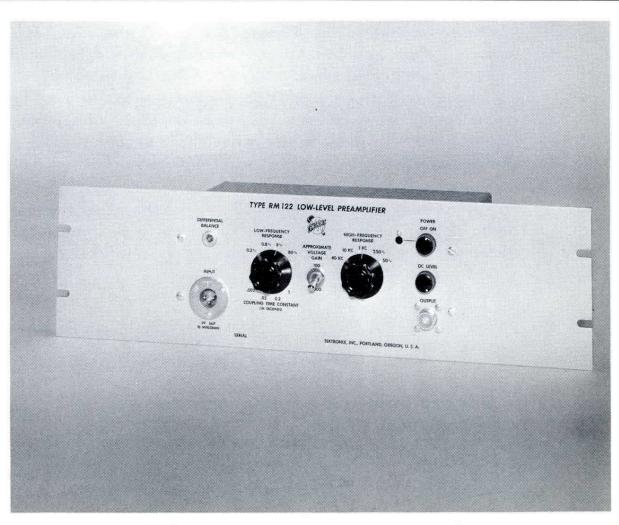
The Type RM122 is a mechanically rearranged Type 122 Preamplifier for horizontal mounting in a standard 19-inch rack. The instrument is fastened to the front of the rack by four screws. It requires only $5\frac{1}{4}$ inches of rack height.

Electrical characteristics of the Type RM122 are the same as described for the Tektronix Type 122 Preamplifier.

Mechanical Specifications—Dimensions are $5\frac{1}{4}$ " 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, 1—input cable, 1—output cable, 2—instruction manuals.



Type PREAMPLIFIER



Compact

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

Weighs only 10 ounces.

Voltage Gain

Accurately set at 100 times.

Passband

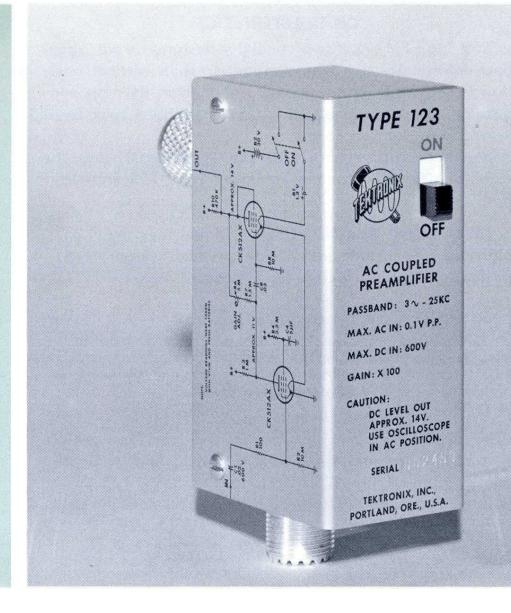
Within 3-db from 3 cps to 25 kc. Within 2% from 15 cps to 6 kc.

Maximum Input Signal

0.1 v peak-to-peak.

Hum-Free Low-Level Amplification

Powered by miniature batteries.



The Tektronix Type 123 Preamplifier is a compact, light-weight, battery-operated amplifier for use in applications where a gain of 100 without additional hum signal is desired. Passband is within 3-db from 3 cps to 25 kc. Where reduced high-frequency response is permissible, ground-loop hum pickup can be virtually eliminated by mounting the Type 123 close to the circuit under observation. Coaxial connectors permit the Type 123 to be connected directly to an oscilloscope or other instrument, and at reduced high-frequency response, in a connecting cable, or even for use as a probe. Shockmounted chassis reduces the effects of microphonics, shift, and drift.

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

CHARACTERISTICS

Voltage Gain—Gain is 100, adjustable with screwdriver calibration control.

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

Battery Powered—A small mercury cell supplies the filament voltage and a miniature 30 v battery is the source of plate voltage. Life of the mercury cell is approximately 100 hours. Plate-voltage battery life is about the same as shelf life, typically 1000 hours.

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

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

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

Input Impedance—10 megohms.

Effective Output Impedance—31 kilohms.

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

Mechanical Specifications—Dimensions are $4\frac{1}{4}$ " high by $1\frac{1}{2}$ " wide by $3\frac{1}{8}$ " deep. Net weight is 10 ounces. Shipping weight is 2 pounds, approx.

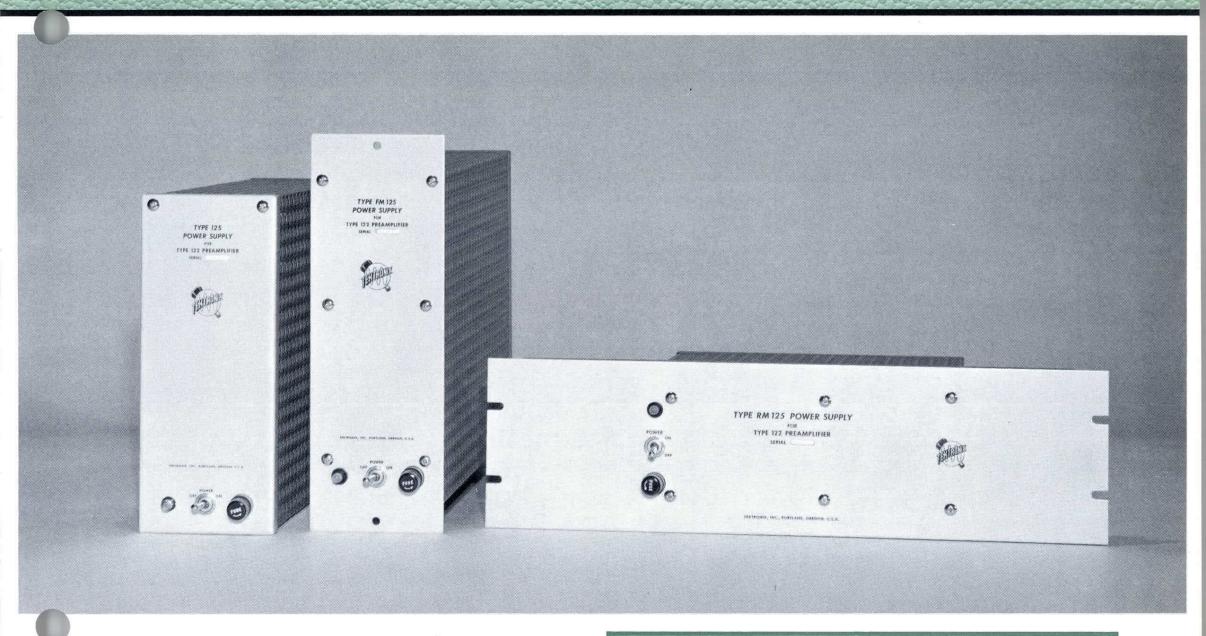
TYPE 123 PREAMPLIFIER \$75

Each instrument includes: 1—schematic





POWER SUPPLY Type FM125



Electronic Voltage Regulation Output Voltages

+ 135 v dc, 0 to 20 ma.

—90 v dc, 0 to 20 ma.

-6 v dc, 0.7 to 4 amp.

The Type 125 Power Supply provides power for one to four Type 122 Amplifiers.

Peak-to-peak ripple voltages are: $+135 \, \text{v}$ supply, less than $3 \, \text{mv}$; $-90 \, \text{v}$ supply, less than $2 \, \text{mv}$; $-6 \, \text{v}$ supply, less than $5 \, \text{mv}$. Voltage stability of the Type 125 is assured by use of regulated voltages applied to the tube heaters.

Power Requirement—105 v to 125 v, or 210 v to 250 v, 50 to 60 cps, 110 watts.

Mechanical Specifications—Dimensions are $14\frac{5}{8}$ " high by $4\frac{1}{8}$ " wide by $10\frac{3}{8}$ " deep. Net weight is 19 pounds. Shipping weight is 27 pounds, approx.

TYPE 125 POWER SUPPLY \$285

Each instrument includes: 4—36" interconnecting cables, 1—3-conductor power cord, 2—instruction manuals.

The Type FM125 has a specially designed front panel for use where vertical mounting in a standard rack is desired. It can be mounted in an existing support or adapted to mounting by a Tektronix mounting frame. Electrical characteristics are the same as described for the Type 125 Power Supply.

Each instrument includes: 4—36" interconnecting cables, 1—3-conductor power cord, 2—instruction manuals.

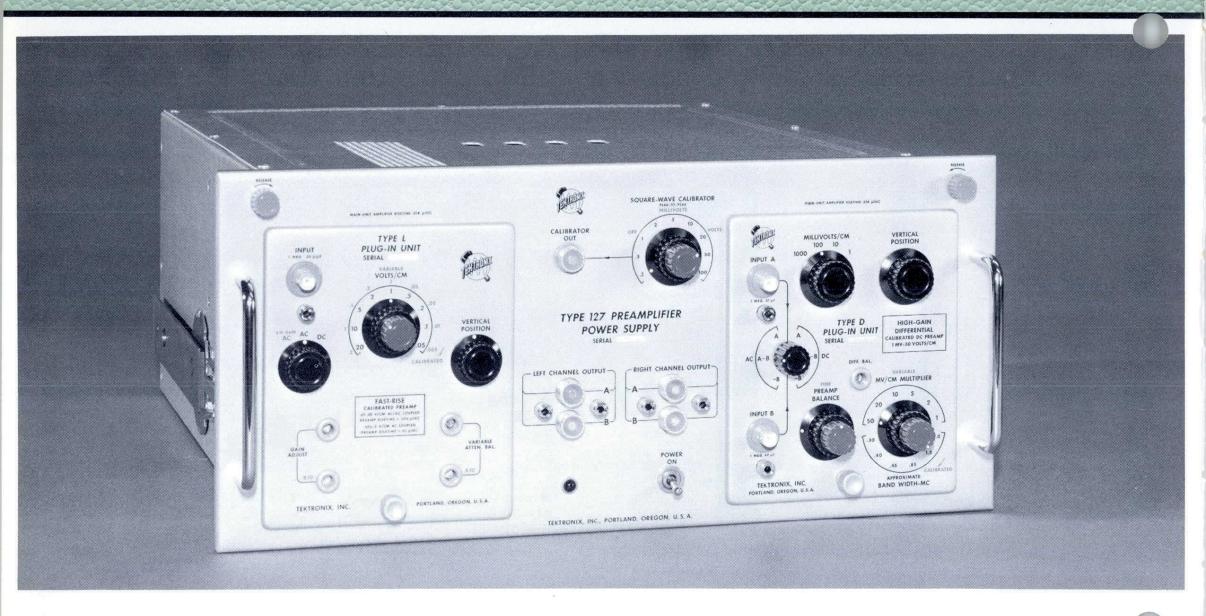
Mounting Frame

The Type RM125 is a mechanically rearranged Type 125 for horizontal mounting in a standard 19" rack. Electrical characteristics are the same as described for the Type 125.

Each instrument includes: 4—36" interconnecting cables, 1—3-conductor power cord, 2—instruction manuals.

Type PREAMPLIFIER POWER SUPPLY





The Tektronix Type 127 Preamplifier Power Supply provides operating power to one or any combination of two Tektronix Type A to Z Plug-In Units. This permits the operation of Tektronix Plug-Ins separate from the oscilloscope in which they are normally used. Tektronix Plug-In Units, powered by the Type 127 can be used to further increase the signal-handling versatility of Tektronix Oscilloscopes employing Type A to Z Plug-In Units. For example, a double-differential dual-trace display can be obtained with a Type 127 and two Type D, E, or G Plug-In Units—when used in conjunction with an oscilloscope and Type C-A Plug-In Unit.

Also Triggering Signal Input Terminals are provided at the rear of the instrument to permit the introduction of triggering pulses into a Type C-A Unit or Type M Unit to utilize the alternate-sweep features of these multitrace units. The triggering pulses may be obtained from the + GATE OUT terminal of the associated oscilloscope.

The Type 127 also facilitates the use of Tektronix Plug-In Units in other applications.

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 nsec, permitting maximum utilization of the response of Tektronix Type 530-Series Oscilloscopes. Push-pull output swing is linear \pm 3% over a range of \pm 0.3 volt into 170-ohm termination. Output dc operating levels are adjustable to ground potential.

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

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

Electronic Regulation—All dc supply voltages to the Plug-In Units are electronically regulated to compensate for line voltage and load variations between 105 and 125 v or 210 and 250 v and for current-demand difference among the Plug-In Units. A current-sensitive relay switches in a compensating power load when only one preamplifier is plugged into the Type 127.



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

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

Mechanical Specifications—Dimensions are $8\frac{3}{4}$ " high by 19" wide by $21\frac{5}{8}$ " deep. Net weight is $39\frac{1}{2}$ pounds. Shipping weight is 69 pounds, approx.

TYPE 127 POWER SUPPLY (without plug-in units) \$650

Each instrument includes: 4—170-ohm coaxial cables, 5', long, 4—170-ohm terminating resistors, 1—3-conductor power cord, 1—pair guide rails, 2—instruction manuals.

Supporting Cradles

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

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

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

Plug-In Unit	Maximum Voltage Gain (push-pull output)	Frequency Response	Risetime
Α	2	dc to 15 mc	23 nsec
В	2 20	dc to 15 mc 5 cps to 11 mc	23 nsec 30 nsec
C-A	2	dc to 17 mc	20 nsec
D	100	dc to 300 kc at a gain of 100, increasing to 2 mc at a gain of 2	
E	2000	.06 cps to 20 kc at full gain, increasing to 60 kc at a gain of 200	
G	2	dc to 15 mc	23 nsec
н	20	dc to 12 mc	29 nsec
К	2	dc to 19 mc	18 nsec
L	2 20	dc to 19 mc 3 cps to 17 mc	18 nsec 20 nsec
M	5	dc to 15 mc	23 nsec

Type | DIRECT-READING LC METER



Five Ranges

Microhenries—0 to 3, 10, 30, 100, 300. Picofarads—0 to 3, 10, 30, 100, 300.

Accuracy

Within 3% of full scale.

4 1/2" Meter

Saves engineering time in circuit development work by providing quick inductance and capacitance readings even while circuit changes are being made. Aids in correct placement of critical components and leads.

Guard circuit produces a voltage of the same amplitude and phase as the voltage at the UNKNOWN terminals, but isolated from the frequency determining portions of the rest of the circuit. This permits separation of the capacitance to be measured from other capacitances and strays. Accurate measurements of direct inter-electrode capacitance in vacuum tubes can be made with ease.

The Type 130 can also be used for component testing, sorting, and color-code checking on a production basis.

The unknown value to be measured will determine the frequency of the variable oscillator in the Type 130. This frequency is beat against a 140-kc fixed oscillator. The difference frequency is shaped and counted, causing meter deflection proportional to the difference frequency. The direct-reading meter is calibrated in microhenries and picofarads.

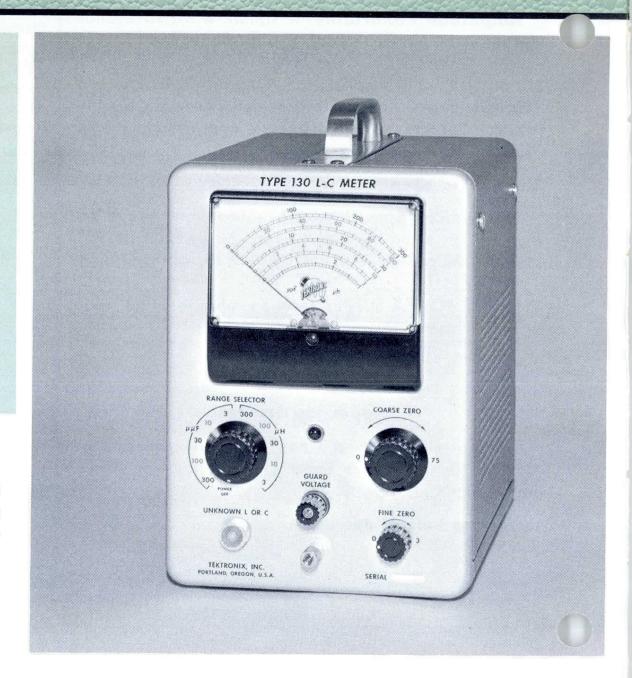
Small actual and stray capacitances have very little effect on inductance measurements made with the Type 130. For instance, the meter reading will be affected less than 1% on inductance measurements where the actual and stray capacitances are as great as 50 pf.

Load Resistance Limits—The following loads will not appreciably alter the indication:

Capacitance, 0.1 megohm shunt.

Inductance, 20 k shunt, 10 ohms series.

A table included in the instruction manual provides corrections for greater loads.



Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 40 watts.

Mechanical Specifications—Dimensions are 10 \(^5\)/8" high by 7" wide by 11 \(^8\)/8" deep. Net weight is 8 \(^3\)/4 pounds. Shipping weight is 15 pounds, approx.

TYPE 130 DIRECT-READING L-C METER \$225

Each instrument includes: 1—probe, 1—black output lead, 1—red output lead, 1—3-conductor power cord, 2—instruction manuals.

Production Test Fixture

Delta Standards

For calibration of the Type 130 L-C Meter. The unit provides accurately adjusted steps of capacitance and inductance, selected by a rotary selector switch. Values of the capacitance steps correspond to the full-scale adjustments required on the five scales of the Type 130. Two resistors of identical manufacture and similar capacitance, values of 1 megohm and 0.1 megohm, are provided for the resistance compensation adjustment. A 300- μ h standard permits proper adjustments of the inductance ranges.



PLUG-IN UNIT POWER SUPPLY Type

The Type 132 provides an electronically regulated power supply and amplifier for any Tektronix Type A to Z Plug-In Unit.

Easily portable, it enables the many plug-ins to be used with or without an oscilloscope in a wide variety of applications.

Frequency response of the amplifier is dc to 15 mc, with a risetime of 23 nsec, when using a Tektronix Type K or L Plug-In Unit.

The electronically regulated power supply provides correct operating voltages for both the internal amplifier and plug-in unit and assures stable operation.

Convenient front-panel terminals for either push-pull or single-ended output facilitate connections to associated equipment.

CHARACTERISTICS

Frequency Specifications are at 3-db down

Frequency Response and Risetime—DC to 15 mc, 23 nsec, when used with a Tektronix Type K or Type L Plug-In Unit and terminated with a 52 Ω load.

Gain—The push-pull gain is 10 when using a Tektronix Plug-In Unit at 50 mv/cm sensitivity, terminated with 93 Ω load. (approximately 5 into 52 Ω load).

Output Terminals—Push-Pull, or single-ended + or — outputs are available at front-panel terminals.

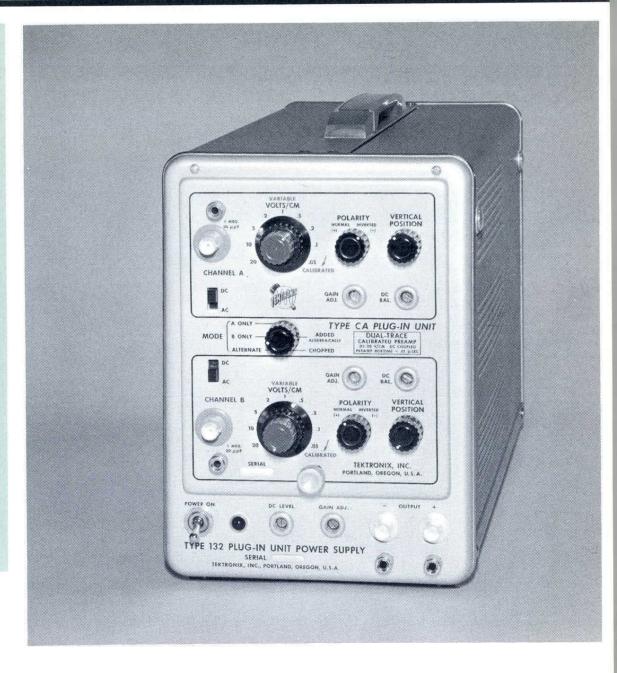
Output Voltage—High impedance load; ± 50 volts at each connector and ± 100 volts push-pull. Source impedance is approximately 5000 ohms with ± 10 ma available (unterminated). With 93-ohm load, voltage swing is approximately ± 1 volt.

Dual-Trace Operation—Convenient back-panel jacks and switching arrangements provide for use of the alternate and chopped modes of operation and blanking, with a Tektronix Type C-A or M Plug-In Unit.

Power Supply—Electronically regulated. Provides correct voltages for the amplifier and any Tektronix Type A to Z Plug-In Unit and assures stable operation.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 320 watts.

Mechanical Specifications—Dimensions are $10\frac{1}{4}$ " high by $7\frac{1}{8}$ " wide by $19\frac{1}{8}$ " deep. Net weight is $21\frac{1}{2}$ pounds. Shipping weight is 36 pounds, approx.



TYPE 132 PLUG-IN UNIT POWER SUPPLY (without plug-in units) \$460

Each instrument includes: 1—3-conductor power cord, 2—93- Ω terminations, 1.5 w, 2—93 Ω output cables, 2—instruction manuals.

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

	Performance * With no termination		Performance * Terminated in 93 Ω		Performance * Double terminated 93 Ω		
PLUG-IN TYPE	Equivalent noise referred to input (pk-pk)	System ‡ Gain	Band Width	System ‡ Gain	Band Width	System ‡ Gain	Band Width
Α	200 μvolt	500	500 kc	10	14 mc	5	16 mc
В	200 μvolt	500 5000	500 kc	10 100	14 mc 10 mc	5 50	16 mc 10 mc
C-A	200 μvolt	500	500 kc	10	14 mc	5	16 mc
D	100 μvolt	useful to 20,000	400 kc 250 kc	10 500	2 mc 300 kc	5 250	2 mc 300 kc
E	35 μvolt	useful to 10,000	†	10,000	1	5000	i i
G	200 μvolt	500	500 kc	10	14 mc	5	16 mc
Н	200 μvolt	5000	500 kc	100	11 mc	50	12 mc
К	400 μvolt	500	500 kc	10	14 mc	5	16 mc
Ĺ	200 μvolt	500 5000	500 kc	10 100	14 mc 14 mc	5 50	16 mc 16 mc
М	200 μvolt	500	500 kc	10	14 mc	5	16 mc
Z	200 μvolt	500	500 kc	10	10 mc	5	10 mc

* Performance measured with push-pull output of Type 132 connected into C-A unit in a Type 541A Oscilloscope.

‡System Gain—Overall gain from input of plug-in to the push-pull output cables. If only one output of Type 132 is used, this gain figure will be halved. When used with system gain of 500 or higher, dc drift in the input of the plug-in unit may become significant.

† See E Unit Specifications.

Type PLUG-IN UNIT POWER SUPPLY



The Type 133 provides power to an internal, transistorized amplifier and any Tektronix Type A to Z Plug-In Unit. The flexibility of this plug-in feature permits quick adaptation of the Type 133 to meet any particular requirement.

The frequency response of the transistorized amplifier is dc to 100 kc and the output is ± 5 volts. The source impedance is 2 ohms. Characteristics of this unit make it particularly useful for driving recorders, and in audio or other low-frequency work.

Connectors on the front-panel enable the output to be fed directly into an oscilloscope or used for other applications.

A typical application of the Type 133 is its use in conjunction with the Tektronix Type Q Transducer and Strain Gage Unit. This completely self-contained combination requires no external equipment other than the strain gages or transducers needed for the particular operation. The output can drive a recorder and be monitored visually, with an oscilloscope, at the same time.

CHARACTERISTICS

Frequency specifications are at 3-db down

Frequency Response—DC to 100 kc.

Gain—The gain is 10, single-ended.

Output— ± 5 v (high impedance load.) 1.5 a (short circuit).

The source impedance is 2 ohms.

DC Adjust—The output dc operating level adjusts to ground potential.

Phase Inversion—An internal switch permits phase inversion of the signal.

Monitor Jack—A monitor jack provides a means of constantly observing the output with an oscilloscope without switching any cables.

Dual-Trace Operation—Convenient back-panel jacks and switching arrangements provide for use of the Alternate mode of operation when using a Tektronix Type C-A or M Plug-In Unit.

Power Supply—Electronic regulation of the power supply assures stable operation under changing loads or line voltages.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 320 watts.

Mechanical Specifications—Dimensions are $10\frac{1}{4}$ " high by $7\frac{1}{8}$ " wide by $19\frac{1}{4}$ " deep. Net weight is 22 pounds. Shipping weight is 36 pounds, approx.



TYPE 133 PLUG-IN UNIT POWER SUPPLY (without plugin units) \$440

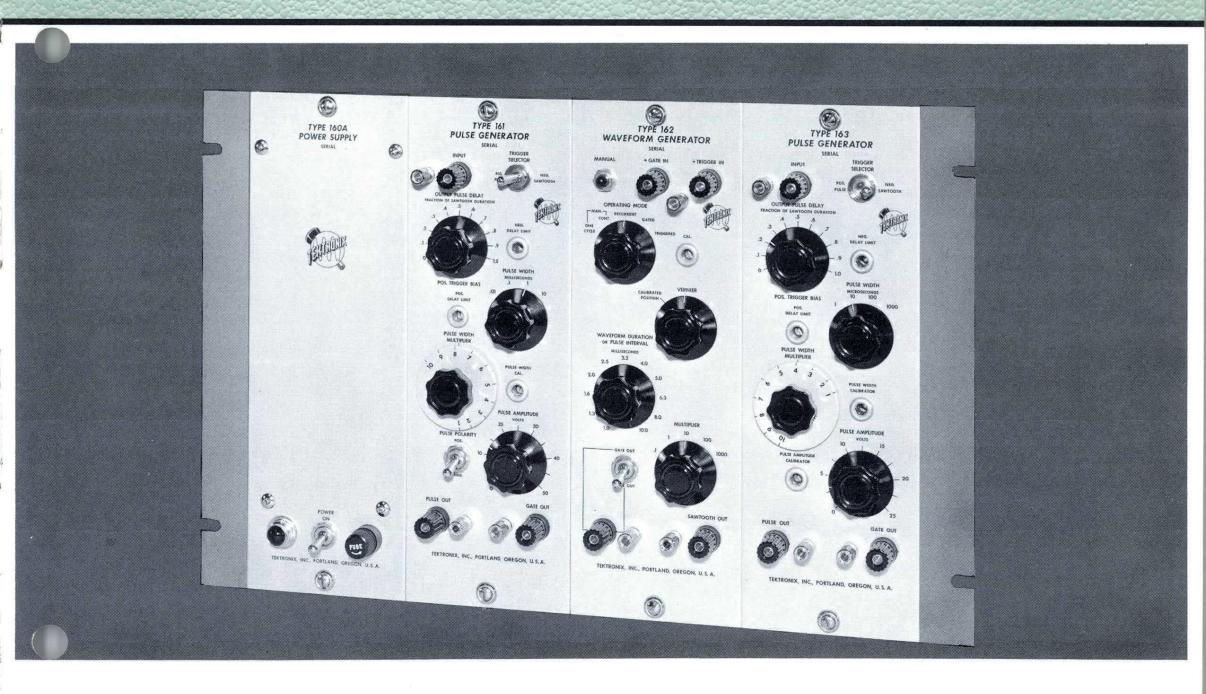
Each instrument includes: 1—3-conductor power cord, 2—instruction manuals.

TYPE 133 TYPICAL PERFORMANCE WITH A to Z SERIES PLUG-IN UNITS					
PLUG-IN TYPE	Equivalent noise referred to Input		Bandwidth		
Α	200 μvolt	10	DC to 100 kc		
В	200 μvolt	10 100 (AC only)	DC to 100 kc 2 cps to 100 kc		
C-A	200 μ volt	10	DC to 100 kc		
D	100 μ volt	500	DC to 100 kc		
E.	35 μvolt	10,000	See E Unit Specifications		
G	200 μvolt	10	DC to 100 kc		
Н	200 μ volt	100	DC to 100 kc		
K	200 μ volt	10	DC to 100 kc		
L	200 μvolt	10 100 (AC only)	DC to 100 kc 3 cps to 100 kc		
М	200 μvolt	10	DC to 100 kc		
Z	200 μvolt	10	DC to 100 kc		





SEQUENCE CONTROL and MONITORING SYSTEM



Designed for complex measurement applications, the system consists of the Type 160-Series instruments and the Type 360 Indicator Unit. The Type 160-Series produces accurate timed pulses of adjustable amplitude, duration, and repetition rate. The series includes power-supply unit, pulse generator, waveform generator and fast-rise pulse generator. The Type 360 Indicator Unit provides bright displays of information generated by the Type 160-Series instruments.

Using several Type 160-Series instruments together produces many complex waveform patterns. The flexible system fits a wide variety of applications, including nerve stimulation in neurophysical experiments, timed gating devices for complex equipment, component testing for quality control, and data recording in the biophysical and geophysical fields, among others.

Rack-mounting the Sequence Control and Monitoring System offers compact convenience. The Type 360 Indicator Unit and the illustrated Type 160-Series instruments bolt quickly and easily to a Mounting Frame, which bolts to a standard nineteen-inch rack. As shown in the picture, the mounting frame securely holds four instruments.

TYPE 160A POWER SUPPLY	\$190			
TYPE 161 PULSE GENERATOR	\$130			
TYPE 162 WAVEFORM GENERATOR	\$130			
TYPE 163 FAST-RISE PULSE GENERATOR	\$130			
TYPE 360 INDICATOR UNIT	\$270			
MOUNTING FRAME				
Order Part Number 014-002	. \$7			
See appropriate pages for complete information on these instruments.				

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







Some of the waveform combinations possible with Tektronix Type 160-Series Waveform Generators

Type 160 A POWER SUPPLY



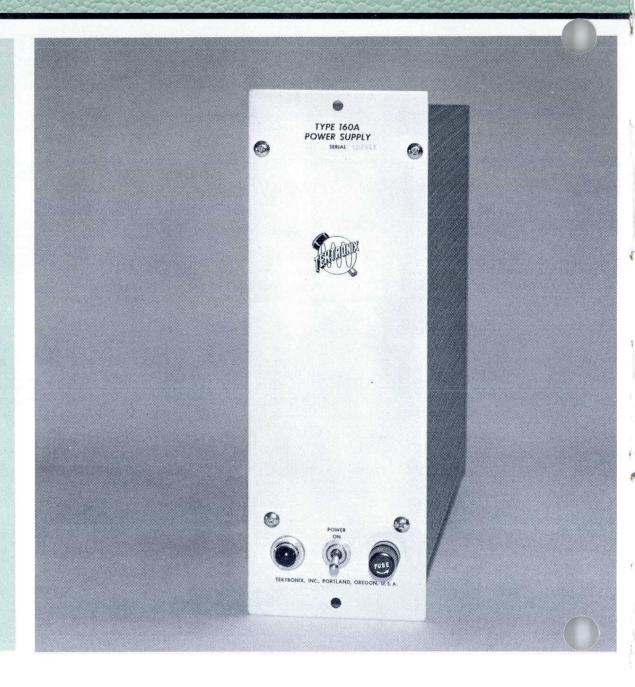
Electronic Voltage Regulation

Four Output Terminals

Conveniently located at rear of chassis.

Large Load Capacity

- +300 v dc, unregulated.
- + 225 v dc, regulated, at 225 ma.
- +150 v dc, regulated, at 15 ma.
- +80 v dc, unregulated.
- -170 v dc, regulated, at 125 ma.
- 6.3 v ac, unregulated, at 20 amps.



The Type 160A Power Supply provides the required currents and voltages for one Type 360 Indicator Unit in combination with up to six Type 160-Series Generators. Power capability handles up to five Type 360 Indicator Units, up to five Type 163 Fast-Rise Pulse Generators, up to seven Type 162 Waveform Generators, or up to seven Type 161 Pulse Generators. Output terminals are four octal sockets on the back of the instrument.

Electronic regulation compensates for line-voltage variations between 105 and 125 v or 210 and 250 v, and for any current-demand differences between instruments.

MAXIMUM LOAD CONDITIONS

The maximum amount of current that can be drawn from the $+300\,\mathrm{v}$ unregulated supply is limited by the amount of current drawn from the $+225\,\mathrm{v}$ regulated supply and varies between 250 ma, in the absence of any current drawn from the $+225\,\mathrm{v}$ supply, and zero when maximum current is drawn from the $+225\,\mathrm{v}$ supply.

Output current of the $+225\,\mathrm{v}$ supply is limited to 175 ma with no shunt across the series tube and increases to a maximum of 225 ma with a 1500-ohm shunt.

Power Requirement —105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 350 watts maximum.

The Type 160A can be conveniently mounted with other Type 160-Series Instruments or the Type 360 Indicator Unit in a mounting frame that fits a standard 19" rack.

Dimensions are $12\frac{1}{4}$ " high by $4\frac{1}{8}$ " wide by $14\frac{3}{8}$ " deep. Net weight is $20\frac{1}{4}$ pounds. Shipping weight is 28 pounds approx.

Mounting Frame

ductor power cord, 1—instruction manual.

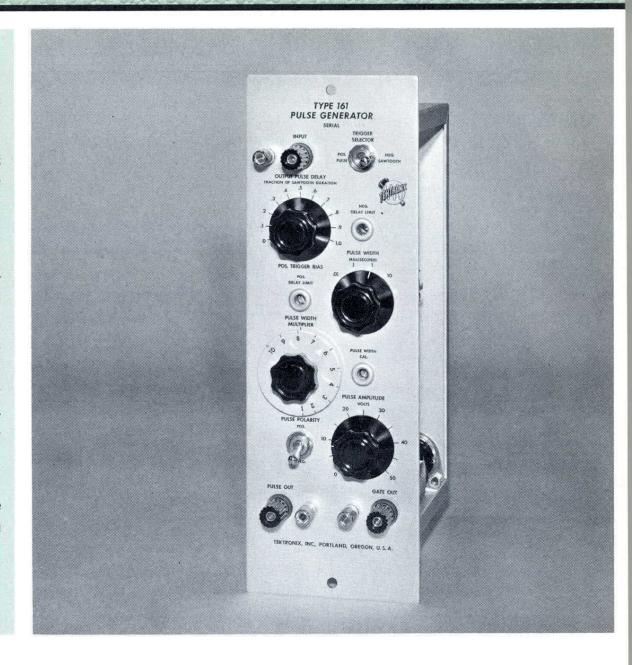


PULSE GENERATOR Type

The Tektronix Type 161 Pulse Generator is designed to supply calibrated rectangular output pulses from zero to 50 v in amplitude and 10 μ sec to 100 msec in duration when an external trigger of required voltage is received. An excellent trigger source is the Type 162 Waveform Generator. The 50-v Gate Output has the same duration and timing as the pulse, but is of fixed amplitude.

When triggered by a negative-going sawtooth, the output pulse and gate can be adjusted to occur at any designated point along the sawtooth. A calibrated control indicates output delay as a fraction of the triggering sawtooth duration. Other calibrated controls indicate pulse and gate width (in milliseconds) and pulse amplitude (in volts). When triggered by a positive pulse, the same output waveforms are available. In this instance the delay control functions as a triggering-level selector.

Voltages necessary to operate the Type 161 can be obtained from the Type 160A Power Supply, which can power up to seven Type 161 Generators.



Output Waveforms

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

Output Characteristics

Risetime—Positive pulse; within $0.5~\mu sec$ when load capacitance is 10 pf or less, within $0.75~\mu sec$ for 100 pf or less load capacitance. Negative pulse; within $0.5~\mu sec$ when load capacitance is 10 pf or less, within $1.5~\mu sec$ for 100 pf or less load capacitance. Overshoot less than 5%.

Duration—calibrated, variable, 10 μ sec to 0.1 sec. Delay—continuously variable, 0 to 100% of triggering sawtooth waveform.

Amplitude Peak-to-Peak

Pulse—calibrated, continuously variable, 0 to 50 v. Gate—fixed, 50 v positive, pk-to-pk minimum.

Output Impedance

Positive pulse—1.8 kilohms maximum. Negative pulse—5 kilohms approximately. Positive gate—1 kilohm maximum.

Trigger Requirements

Positive pulse, 3 v pk-to-pk minimum. Negative-going sawtooth; must include dc bias sufficient to keep voltage positive. Maximum repetition rate, 50 kc.

Power Requirements

— 170 v dc at 17 ma, + 225 v dc at 22 ma, 6.3 v ac at 1.65 amps.

The Type 161 can be conveniently mounted with other Type 160-Series Instruments or the Type 360 Indicator Unit in a Mounting Frame that fits a standard 19" rack.

Dimensions are 12 1/4" high by 4 1/8" wide by 6 3/8"

Net weight is $3\frac{1}{2}$ pounds. Shipping weight is 8 pounds, approx.

Mounting Frame

Type 160-Series Generator or Type 360 Indicator Unit.

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Order Part Number 333-157 \$5

Type WAVEFORM GENERATOR



The Type 162 Waveform Generator produces three types of calibrated output waveforms. Both the duration and repetition rate of the output waveforms—pulse, gate, and sawtooth— are adjustable. Triggering can occur from an external electrical impulse or by front-panel push button. The unit is designed to operate as a delay generator in conjunction with one of these instruments, and to supply a sweep voltage for the Type 360 Indicator Unit. It is useful for initiating chains of events electrically, for controlling their duration and repetition rate, and for generating waveforms recurrently. As such it is a stable repetition rate generator.

Amplitude of the pulse and gate waveforms is 50 volts, with minimum risetime of 1 μ sec. Amplitude of the sawtooth waveform decreases linearly from +150 volts to +20 volts. A calibrated control indicates waveform duration. Shortest pulse duration is approximately 10 μ sec.

Voltages necessary to operate the Type 162 can be obtained from the Type 160A Power Supply, which can power up to seven Type 162 Generators.

Output Waveforms

Positive pulse, positive gate, and negative-going positive sawtooth.

Output Characteristics

Risetime— $1-\mu$ sec minimum.

Duration—pulse, 10 μ sec to 0.05 sec, gate and sawtooth, 100 μ sec to 10 sec.

Repetition Rate—0.1 cps to 10 kc, recurrent operation.

Amplitude

Pulse and gate—fixed, positive, 50 v pk-to-pk minimum.

Sawtooth—decreases linearly with time from +150 volts to +20 volts, $\pm4\%$.

Cathode-Follower Outputs

Output Impedance

1000 ohms approximately for all outputs.

Trigger Requirements

Positive pulse—15 volts.

Positive gate—8 volts.

Sine wave—6 volts rms, frequency from 5 cps to 50 kc. At frequencies below 5 cps, the product of rms voltage times frequency must exceed 10.



Power Requirements

-170 v dc at 7 ma. +150 v dc at 1 ma.

+225 v dc at 28 ma. 6.3 v ac at 1.7 amps.

The Type 162 can be mounted conveniently with other Type 160-Series Instruments or the Type 360 Indicator Unit in a Mounting Frame that fits a standard 19" rack.

Dimensions are $12\frac{1}{4}$ " high by $4\frac{1}{8}$ " wide by $6\frac{3}{8}$ " deep. Net weight is $3\frac{1}{2}$ pounds. Shipping weight is 8 pounds, approx.

TYPE 162 WAVEFORM GENERATOR \$130

Each instrument includes: 1—inter-unit power cable, 1—set mounting hardware, 1—instruction manual.

Mounting Frame

A Mounting Frame conveniently adapts the Type 162 for rack mounting. The frame accepts up to 4 Type 160-Series Instruments or up to 3 Type 160-Series Instruments and a Type 360 Indicator Unit. The Frame fits a standard 19" rack. Rack height required is 12 1/4".

Blank Panel for above, occupies same panel area as Type 160-Series Generator or Type 360 Indicator Unit.

Order Part Number 333-157 \$5

FAST-RISE PULSE GENERATOR Type

The Tektronix Type 163 Fast-Rise Pulse Generator is designed to supply rectangular output pulses from 0 to 25 v in amplitude and 1 μ sec to 10 msec in duration when an external trigger of required voltage is received. An excellent trigger source is the Type 162 Waveform Generator. The 25 v Gate Output has the same characteristics as the pulse, but is of fixed amplitude.

When triggered by a negative-going sawtooth, the output pulse and gate can occur at any designated point along the sawtooth. A calibrated control indicates output delay as a fraction of the triggering sawtooth duration. Other calibrated controls indicate pulse and gate width (in microseconds) and pulse amplitude (in volts).

The Type 163 operates up to 50% duty cycle at the minimum time setting on any range. With higher multiplier-control settings, the duty cycle is correspondingly higher. Maximum repetition rate is 500 kc—with a generated pulse of 1 μ sec duration.

Voltages necessary to operate the Type 163 can be obtained from the Type 160A Power Supply, which can power up to five Type 163 Generators.

Output Waveform

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

Output Characteristics

Risetime—Within 0.2 μ sec when load capacitance is 10 pf or less, within 0.25 μ sec for 100 pf or less load capacitance. Overshoot can be adjusted to zero.

Duration—calibrated, variable, 1 μ sec to 10,000 μ sec.

Delay—continuously variable, 0 to 100% of triggering sawtooth duration.

Decay Time—0.2 to 0.5 μ sec.

Amplitude Peak-to-Peak

Pulse—calibrated, continuously variable, 0 to 25 v. Gate—fixed, positive, 25 v pk-to-pk minimum.

Cathode-Follower Outputs

Output Impedance

Pulse—500 ohms (varies with pulse-amplitude control setting).

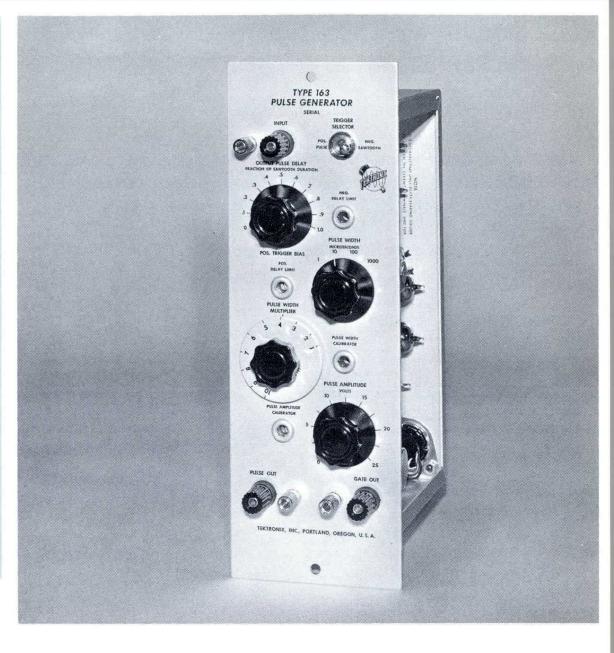
Gate-100 ohms.

Minimum load resistance—3.5 kilohms.

Trigger Requirements

Positive pulse, 2 v peak-to-peak minimum.

Negative-going sawtooth; must include dc bias sufficient to keep voltage positive. Maximum repetition rate, 500 KC.



Power Requirements

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

The Type 163 can be conveniently mounted with other Type 160-Series Instruments or the Type 360 Indicator Unit in a Mounting Frame that fits a standard 19" rack.

Dimensions are $12\frac{1}{2}$ " high by $4\frac{1}{8}$ " wide by $6\frac{3}{8}$ "

Net weight is $3\frac{1}{2}$ pounds. Shipping weight is 8 pounds, approx.

TYPE 163 PULSE GENERATOR \$130

Each instrument includes: 1—inter-unit power cable, 1—set mounting hardware, 1—instruction manual.

Mounting Frame

Type 1804 TIME-MARK GENERATOR



14 Time-Mark Intervals

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

Three Sine-Wave Frequencies

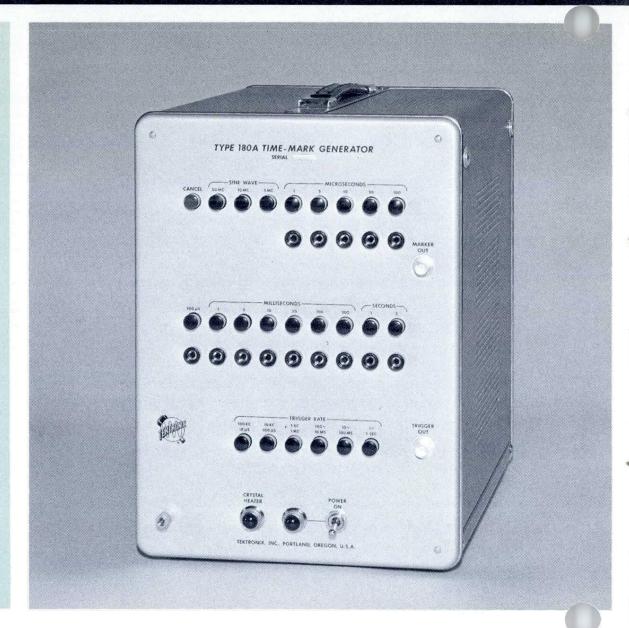
5 mc, 10 mc, and 50 mc.

Six Trigger-Rate Frequencies

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

Accuracy Within 0.001%

Stability of 3 parts per million over a 24-hour period.



The Type 180A Time-Mark Generator is a high-quality source of time markers, sine waves and trigger impulses. Fourteen time markers, 3 sine-wave frequencies and 6 trigger-rate frequencies provide instrument versatility for a large number of applications in the laboratory or on the production line. With its frequency accuracy of .001% and stability of 3 ppm, the Type 180A is an ideal calibrating source for oscilloscope sweeps, oscillators, and counters. It can also be used as a time-measuring instrument and as a trigger-rate generator. Markers can be presented separately or mixed into a timing-comb combination.

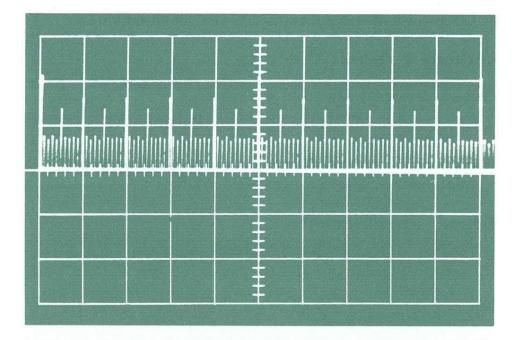
CHARACTERISTICS

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

Sine Waves—Push-button switches connect the sinewave frequencies of 5 mc, 10 mc or 50 mc to the output connector. Output is 3 volts minimum across 52 ohms.

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

Timing comb formed by a combination of 100, 500 µsec, 1, and 5 msec markers. Sweep time/cm, 1 msec.



Stability—All outputs are derived from a 1-mc crystal-controlled oscillator with a frequency tolerance of about 0.001%. The 1-mc crystal is mounted in a temperature-stabilized oven and a trimmer capacitor provides a means of adjusting the crystal frequency to zero beat with W.W.V. Stability is within 3 parts per million over a 24-hour period.

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

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, typically 240 watts at 117 v.

Mechanical Specifications—Dimensions are $13\frac{3}{4}$ " high by 10" wide by $16\frac{5}{8}$ " deep. Net weight is $30\frac{1}{4}$ pounds. Shipping weight is 47 pounds, approx.

TYPE 180A TIME-MARK GENERATOR \$625

Each instrument includes: $2-93-\Omega$ output cables, 1-clip-lead adapter, 1-3-conductor power cord, 2-instruction manuals.

FREQUENCY DOUBLER

This accessory is useful for timing the sweep on Type 580-Series Oscilloscopes. It doubles the 50-Mc output of the Type 180A to 100 Mc.

RACK MOUNT ADAPTER

A cradle mount to adapt the Type 180A Time-Mark Generator for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements 15 \(^3\pmu''\).

Order Part Number 040-277 \$45

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

Nominal Voltage, Impedance and Risetime Values

	Mark	er Out Terminal	Jacks		
	Open Circuit Voltage	Impedance for Half-Voltage	Risetime *	Open Circuit Voltage	Impedance for Half-Voltage
Markers	3 volt minimum	390 Ω or less	0.07 μ sec at 1 μ sec to 1.7 μ sec at 5 seconds	25 v minimum Using a P6000 probe	$390~\Omega$ at $1~\mu{ m sec}$ to $900~\Omega$ at $5~{ m sec}$ onds
Trigger Pulses	6 volt minimum	56 Ω or less	$0.08~\mu { m sec}$ at $100~{ m kc}$ to $0.30~\mu { m sec}$ at $1~{ m cps}$		
Sine Waves	3 volt minimum across 52-ohms				

 * With MARKER OUT and TRIGGER OUT terminated in 93 Ω

TIME-MARK GENERATOR





FIVE TIME-MARK INTERVALS

The Type 181 and RM181 provide accurate time-markers of 1, 10, 100, 1000, and 10,000 microseconds, plus a 10-Mc sine wave. These markers are used for oscilloscope sweep calibration and comparison time measurements. Any of the six signals can be switched to a front-panel output connector. Also the five time-markers are available separately at front-panel binding posts.

STABILITY

All outputs are derived from a 1-Mc crystal-controlled oscillator with a frequency tolerance of about 0.03% and after initial warmup, a short time stability of about 0.005% per hour. Greater stability is available with a directly interchangeable crystal mounted in a temperature-controlled oven. This plug-in crystal is available as an accessory, or as MOD 110 installed in the generator and provides a stability of 3 parts per million over a 24-hour period.

NOMINAL OUTPUT VALUES				
Marker	Amplitude	Risetime	Impedance	
0.1 μsec	2 v	sine wave	150 ohms	
1 μsec	2 v	$0.05~\mu sec$	80 ohms	
10 μsec	2 v	$0.13~\mu sec$	80 ohms	
100 μsec	2 v	0.2 μsec	80 ohms	
1000 μsec	2 v	$0.4~\mu sec$	80 ohms	
10,000 μsec	2 v	$0.4~\mu sec$	80 ohms	

POWER REQUIREMENT—105 v to 125 v or 210 v to 250 v, 50 to 800 cps, typically 100 watts at 117 v.

CABINET MODEL—Dimensions are 10" high by $7\frac{1}{8}$ " wide by $17\frac{3}{4}$ " deep. Net weight is $15\frac{1}{2}$ pounds. Shipping weight is 23 pounds, approx.

RACK MOUNT MODEL—For 19" rack it requires $5\frac{1}{4}$ " of rack height and $10\frac{1}{2}$ " depth. Net weight is $15\frac{3}{4}$ " pounds. Shipping weight is 30 pounds, approx.

TYPE 181 MOD 110 TIME-MARK GENERATOR \$285 Each instrument includes: $1-93~\Omega$ output cable, 2-test leads, 1-adapter BNC to binding post, 1-3-conductor power cord, 2-instruction manuals

TYPE RM181 TIME-MARK GENERATOR\$290 Each instrument includes: $1-93~\Omega$ output cable, 2-test leads, 1-adapter BNC to binding post, 1-3-conductor power cord, 1-set mounting hardware, 2-instruction manuals.

TYPE RM181 MOD 110 TIME-MARK GENERATOR .. \$310 Each instrument includes: $1-93~\Omega$ output cable, 2-test leads, 1-adapter BNC to binding post, 1-3-conductor power cord, 1-set mounting hardware, 2-instruction manuals.



SINE-WAVE GENERATOR Type

Output Frequency

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

Output Amplitude

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

Harmonic Content

The harmonic content is typically less than 5%.

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



Amplitude Variation

When load resistance is 52 ohms, and when the load-shunt capacitance does not exceed 10 pf, the output amplitude varies less than $\pm 2\%$ from 50 kc to 30 mc; less than $\pm 5\%$ from 30 mc to 50 mc. Peak-to-peak level of the output signal at the input to the attenuator is indicated on the amplitude meter. The Output Amplitude control sets the amount of signal voltage applied to the input of the external attenuator head. The signal voltage at the attenuator-head input is automatically held constant at the value you select by means of the Output Amplitude control. Therefore, you don't have to readjust the Output Amplitude control when you change the generator frequency. The output source impedance of the attenuator head varies with attenuator setting approximately as follows:

Output impedance

Nominal, 52 ohms. Actual values:

Attenuator setting	Output impedance
volts, peak-to-peak	in ohms, approx.
10	0
5	39
2.5	49
1.0 to .1	52

Regulated Power Supply

Electronic regulation compensates for line-voltage and load variations between 105 and 125 v or 210 and 250 v.

Power Requirement

105 v to 125 v or 210 v to 250 v, 50 to 800 cps, typically 100 watts.

Mechanical Specifications

Dimensions are $13\frac{3}{4}$ " high by $9\frac{7}{8}$ " wide by 12" deep. Attenuator unit is $3\frac{5}{16}$ " by $2\frac{3}{8}$ by $1\frac{3}{4}$ ", with connecting cable. Net weight is $23\frac{1}{2}$ pounds. Shipping weight is 35 pounds, approx.

TYPE 190B SINE-WAVE GENERATOR \$330

Each instrument includes: 1—attenuator unit, 1—3-conductor power cord, 2—instruction manuals.

Rack Mount Adapter

A cradle mount to adapt the Type 190B Signal Generator for rack mounting is available. It consists of a cradle to support the instrument in any standard 19" relay rack and a mask to fit around the regular instrument panel. Tektronix blue vinyl finish. Rack height requirements $15\frac{3}{4}$ ".

Order Part Number 040-277 \$45

Type 28 TRIGGER COUNTDOWN UNIT



INPUT SIGNAL FREQUENCIES—30 megacycles to 5 gigacycles.

OUTPUT SIGNAL FREQUENCIES—Continuously variable from 15 to 45 megacycles.

The Tektronix Type 280 Trigger Countdown Unit allows timing systems to be synchronized on frequencies up to 5 gigacycles. It can be used to lower the frequency of the triggering signals to within a range of 15 to 45 megacycles. 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 gigacycle range.

CHARACTERISTICS

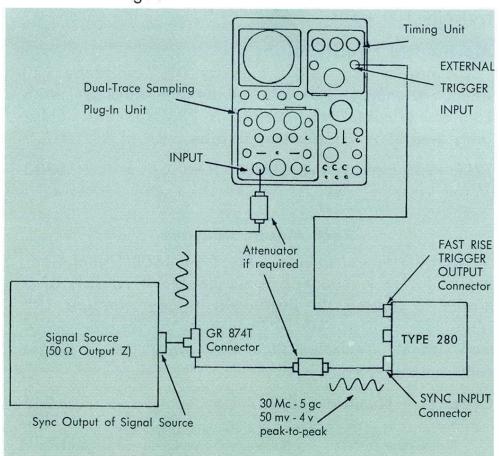
INPUT FREQUENCY is from 30 megacycles to 5 gigacycles.

INPUT SIGNAL VOLTAGE is 50 millivolts to 4 volts peak-to-peak.

INPUT IMPEDANCE is approximately 50 ohms.

OUTPUT REPETITION is continuously variable from 15 to 45 megacycles.

JITTER is 10 psec, 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-nsec long, with less than 4-nsec risetime, (for use with Type N Sampling Plug-In and high-speed conventional oscilloscopes).

FAST-RISE TRIGGER OUTPUT (terminated in 50 ohms is 150 millivolts, with less than 0.4-nsec risetime, decaying with 2-nsec time constant, (for use with Type 5T1, 5T1A, or 3T77 and other high-speed sampling oscilloscopes).

AMPLITUDE OF TRIGGER OUTPUT as seen at oscilloscope input connector is approximately 50 millivolts decaying with a 4-nsec time constant.

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 cps, 10 watts.

MECHANICAL FEATURES include an aluminum-alloy chassis, die-cast aluminum-alloy top and bottom covers, and steel wraparound 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 6 pounds, approx.

TYPE 280 TRIGGER COUNTDOWN UNIT \$265
Includes: 2—instruction manuals, 1—5-nsec cable, 1—3-conductor power



TRANSISTOR SWITCHING-TIME TESTER Type

TESTS FAST-SWITCHING TRANSISTORS RESPONSE TO LESS THAN 1 NSEC WIDE RANGE OF TEST VOLTAGES

The Tektronix Type 290 Transistor Switching-Time Tester permits dc-coupled pulse-response characteristics of fast-switching transistors to be observed and measured on Tektronix oscilloscopes. Driven by a Tektronix fast-rise pulse generator and combined with a Tektronix fast-rise sampling oscilloscope, the Type 290 becomes an integral part of a transistor testing system with an over-all transient response of less than 1 nanosecond. (When a non-sampling oscilloscope is used, transient response is limited by the risetime of the oscilloscope.) This system can test fast NPN or PNP transistors on a short duty-cycle basis for delay, rise, storage, and fall times. Since these characteristics vary considerably with operating conditions, the Type 290 supplies a wide range of operating voltages.

The Type 290 does not use speedup capacitors or catching diodes. Use of these capacitors and diodes tends to test a circuit rather than a transistor.

TWO TRANSISTOR TEST SOCKETS (HIGH and LOW) are mounted on the Type 290 to provide for easy insertion of the transistor into grounded-emitter test circuit. The HIGH socket connects to a collector supply of 0-100 v and the other connects a collector supply of 0-30 v.

INPUT SIGNALS from the pulse generator go to the base of the transistor under test. For each volt of the input pulse in excess of $V_{\rm be}$ there is 1 ma of base current. (A Type 290 MOD 788A is available that will give 0.2 ma of base current for each input volt in excess of $V_{\rm be}$.)

The input signal is attenuated 50-to-1 and appears at the Type 290 INPUT MONITOR connector. A similar input signal can be switched to the OUTPUT connector.

OUTPUT SIGNALS originate at the transistor collector and appear at the Type 290 OUTPUT connector. The collector circuit provides a resistive load of 200 ohms monitored by an internal dc-coupled passive probe. A transistor in the HIGH test socket has a passive probe output attenuation of 250-to-1 from the collector to the OUTPUT connector. A transistor in the LOW socket has an attenuation of 50-to-1 from the collector to the OUTPUT connector.

SIGNAL TRANSIT TIMES in the Type 290 are matched so the input pulse is compared to the transistor collector signal on a dual-trace oscilloscope using one trace attached to the INPUT MONITOR connector and the other attached to the OUTPUT connector. To compare the two signals on a single-trace oscilloscope, the trace is attached to the OUTPUT connector and the signals are switched with a front panel control.



LEAD LENGTH of the transistor test, up to approximately 2 inches, is unimportant at speeds slower than 2 nsec.

CONNECTORS are terminated in 50 ohms.

REGULATED SUPPLIES provide the collector and base voltage. Collector voltage is continuously variable from zero to 30 volts in the LOW position and from zero to 100 volts in the HIGH position. Base supply voltage is continuously variable from zero to \pm 10 volts.

POWER REQUIREMENT is 105 v to 125 v or 210 v to 250 v, 50 to 800 cps, 15 watts.

MECHANICAL FEATURES include dimensions of $7^3/_8$ " high by $7^5/_8$ " wide by 5" deep. Net weight is 5 pounds. Shipping weight is 7 pounds, approx.

TYPE 290 TRANSISTOR SWITCHING-TIME TESTER . . \$290 Each instrument includes: 2—instruction manuals, 1—10-nsec cable, 1—3-conductor power cord.

MODIFIED TYPE 290

MOD 788A changes each volt of input signal in excess of $V_{\rm be}$ to 0.2 ma of test base current.

Type 291/TF1 DIODE SWITCHING-TIME TESTER



The Type 291 with an associated Test Fixture in conjunction with a suitable pulse generator and oscilloscope permits measurement of fast-switching diode characteristics. Dc coupling permits direct reading of forward and reverse recovery current on the oscilloscope crt screen. Since the switching characteristics vary with diode current, the Type 291 Power Supply provides a range of dc test current to 100 milliamperes—with provision for external current supply to 500 milliamperes.

THE PULSE GENERATOR used should have a fast rise output; such as the Type 109 or 110. Pulse risetime should be short compared to the diode reverse-recovery time expected. Pulse width should be longer than the diode reverse-recovery time. Amplitude is called out in the diode test specifications but should not exceed half the diode-breakdown voltage.

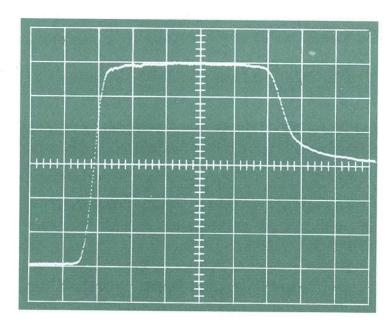
THE OSCILLOSCOPE used should have a risetime faster than the expected reverse-recovery time, such as either the 560-Series or Type 661 with sampling plug-in units.

DIODE RECOVERY LOOP IMPEDANCE is 100 ohms.

SUPPLY CURRENT is provided in seven calibrated steps from 1 milliampere to 100 milliamperes 1-2-5 sequence. Calibration accuracy is within \pm 2% for all steps except the 100-milliamperes step, which is \pm 3%. Uncalibrated, continuous adjustment from less than 1 milliampere to 100 milliamperes is also available. The current may be monitored externally.

POWER REQUIREMENT is 105 to 125 v or 210 v to 250 v, 50 to 400 cps, 6 watts.

MECHANICAL FEATURES include dimensions of $4^{11}/_{16}$ " high by $6^{9}/_{16}$ " wide by $8^{1}/_{8}$ " deep. Net weight is $4^{3}/_{4}$ pounds. Shipping weight is 7 pounds, approx.

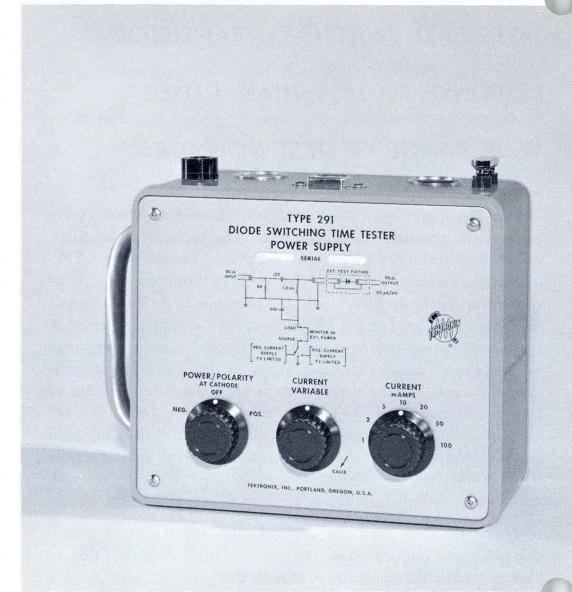


Horizontal — 1 nsec/div

Vertical — 10 ma/div

Diode Reverse Recovery Waveform

In this diode-recovery waveform (displayed on a Tektronix Type 661 Sampling Oscilloscope), the diode shows a stored charge of approximately 6 picocoulombs per milliampere. Note the freedom from ringing and overshoot of the recovery waveform, owing to strip-line testing environment of the Diode Switching-Time Tester.



TYPE TF-1 DIODE TEST FIXTURE

The TF-1 Test Fixture provides for easy and rapid diode testing with the Type 291. The Fixture holds diodes magnetically as they are tested and introduces less than 2% ringing in a 0.35 nanosecond risetime system.

DIODE EJECTION is accomplished with either a push-button or, for automatic testing, with a solenoid (not included).

OPERATING TEMPERATURES up to 150°C are possible.

RESPONSE of Fixture with Type 291, less than 0.35 nsec.

MECHANICAL FEATURES include dimensions of $2\frac{1}{2}$ " high by $3\frac{5}{16}$ " wide by $4\frac{7}{8}$ " deep. Net weight is 1 pound. Shipping weight is 2 pounds, approx.



TYPE TF-1 DIODE TEST FIXTURE (Part No. 017-072) . \$65 Includes: 1—instruction sheet.



AMPLIFIER Type

Amplifier Gain

Accurately set at 100 x.

Input Attenuator

Attenuates input signal by a factor of 1X through 500X in 9 calibrated steps.

Gain Stability

Within $\pm 1\%$ over 24-hour period.

Frequency Response

5 cycles to 17 megacycles (3 db down) at 1X, 2X, 5X, and 10X attenuator settings.

Transient Response

Risetime—21 nanoseconds.

Probe Power

Heater supply—6.3 v dc, 0.2 amp. Plate supply—120 v dc, 10 ma regulated.

The Type 1121 Wide-Band Amplifier is a low-noise, cascode-input amplifier designed with Tektronix precision, quality, and style. It increases the amplitude of low-level wide-band signals; thus increases the sensitivity of the oscilloscope or other associated instrument with which it is operated.

The output, terminated in 93-ohm coaxial cable, allows separation of at least 100 feet between the Type 1121 and associated instrument without causing noticeable deterioration of the response. Output voltage of ± 1 volt guarantees linear amplification of any input signal up to ± 10 mv at full gain. Internal noise is no more than 50 μ v peak-to-peak with the input grounded and the INPUT ATTENUATOR control in the 1-X position. As in all Tektronix instruments, optimum response is a prime consideration. Risetime is approximately 21 nsec, and passband extends from 5 cycles to over 17 mc with the INPUT ATTENUATOR control in the 1-X, 2-X, 5-X or 10-X positions.

Power is available at the front panel for a cathodefollower probe. For applications requiring both high impedance input and high gain or where the attenu-



ation of an rc probe would be objectionable, a Tektronix P170CF cathode-follower probe can be used.

The Type 1121 has a turret-type step attenuator that permits attenuation of the input level to a factor of 500X in nine calibrated steps. Unique design of the attenuator allows the series and shunt compensations to be conveniently set without removing the instrument side panels. Hum pick-up at the input is minimized by the inherently short internal leads. These leads are of the same length in all positions of the attenuator, thus lower, more-stable values of circuit capacitance are realized. Input impedance is 1 megohm paralleled by approximately 22 pf at all step-attenuator positions. This feature enables the use of a probe with minimum circuit loading on the point measured.

Other features include a cascode-input circuit using a frame-grid triode, two voltage amplifier stages (that retains the polarity of the input at the output), and transistor-regulated heater supplies.

Its compactness, reliability, and low noise level adapt the versatile Type 1121 to almost any application involving wide-band amplification.

CHARACTERISTICS

Input Impedance—Direct, 1 megohm paralleled by approximately 22 pf.

Internal Noise—Internally generated noise is equivalent to an input signal of 50 μ v, pk-to-pk, maximum, with the INPUT ATTENUATOR at 1X.

Gain Stability—After initial warmup, and under all conditions of line voltage between 105 and 125 volts or 210 and 250 volts, gain stability of the Type 1121 is well within ± 1 % over a twenty-four hour period.

Input Attenuation—The newly-designed turret-type step attenuator permits accurate attenuation of the input level from a net gain factor of 100 x to 0.2 x in nine calibrated steps: 1X, 2X, 5X, 10X, 20X, 50X, 100X, 200X, and 500X. Attenuator accuracy is 3%. A screwdriver control at each attenuator position provides compensating adjustment for optimum square wave response. Access is via a hole in the front panel, behind the INPUT ATTENUATOR knob flange.

Frequency Response—With the INPUT ATTENUATOR control in the 1-X, 2-X, 5-X, or 10-X positions, transient response is clean over a band extending from 5 cps to 17 mc (at 3 db down). Passbands for the remaining attenuator positions are as follows: 20X—5 cps to 16.5 mc, 50X—5 cps to 16.0 mc, 100X—5 cps to 15.5 mc, 200X—5 cps to 14.0 mc, and 500X—5 cps to 12.0 mc.

Probe Power—The front-panel PROBE POWER socket provides 0.2 amp dc at 6.3 volts for the heater supply and 10 ma regulated dc at 120 volts for the plate supply of a cathode-follower probe. The Tektronix P170CF cathode-follower probe is ideally suited for use with Type 1121 Amplifier.

When a P170CF cathode-follower probe is used with a Type 1121 Amplifier ahead of a Type 540 or 540A-Series Oscilloscope and a Type L Plug-In Unit set at 0.05 v/cm, overall sensitivity of the combination is 1 mv/cm. Passband will be 5 cps to 16 mc. At this sensitivity, noise inherent in the Type 1121 will appear as 0.1 centimeter of deflection. With the L unit set at 0.005 v/cm, overall sensitivity is 0.1 mv/cm. Passband will be 5 cps to 15 mc and inherent noise will appear as 1 centimeter of deflection. Input impedance of the P170CF probe is 12 megohm paralleled by 5 pf.

Other passive probes are available. Please refer to the Catalog Accessory Section.

Output Voltage—Capable of a ± 1 volt swing in a terminated 93-ohm coaxial cable, the Type 1121 reproduces any input signal up to ± 10 mv at full gain. The output, via cathode followers, permits up to 100 foot separation between the amplifier and associated instrument without noticeable waveform distortion.

Output Connection—Output of the Type 1121 is connected to the associated instrument via a 93-ohm coaxial cable 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 OUT-PUT and the cable supplied with the amplifier.

Regulated Power Supplies—The Type 1121 embodies exceptionally stable power-supply voltage regulation. Transistor-regulated heater circuits limit the heater-supply ripple components to less than 4 mv. Electronically-regulated plate circuits insure stable operation over line fluctuations between 105 to 125 volts or 210 to 250 volts.

Power Requirement—105 v to 125 v or 210 v to 250 v, 50 to 60 cps, 150 watts.

Mechanical Specifications—Dimensions are $10\frac{3}{4}$ " high by 7" wide by $15\frac{7}{8}$ " deep. Net weight is $18\frac{1}{2}$ pounds. Shipping weight is 28 pounds, approx.

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).

P93A Coaxial Output Cable—For applications requiring variable attenuation between steps, a P93A coaxial output cable can be used. The 93-ohm, 42" cable terminates in a variable attenuator with UHF connector.

P93A OUTPUT CABLE (012-004) \$13.50

BNC to UHF Adapter—This adapter makes the above accessories with UHF connectors compatible with the Type 1121 Amplifier.

BNC MALE ADAPTER (103-032) \$3.55

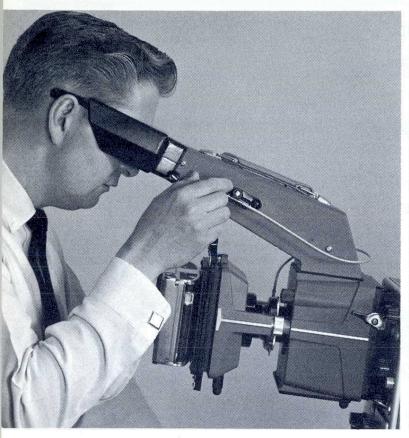


ACCESSORY SECTION CONTENTS

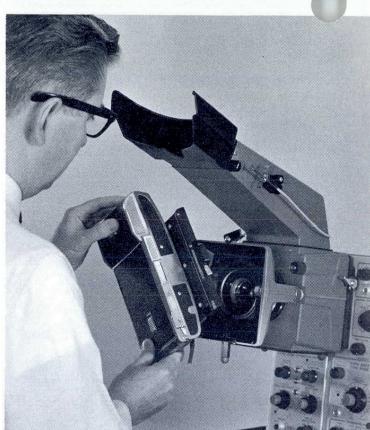
TRACE-RECORDING CAMERAS	TYPE 130 L.C. METER ACCESSORIES
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Cameras Type C-12, C-13 & C-19









DESIGN FEATURES

- Lift-On Mounting and Swing-Away Hinging—unrestricted crt viewing for normal oscilloscope operation
- Easily-Accessible Shutter Controls—no groping or camera removal necessary
- Comfortable Binocular Viewing—with or without glasses*
- Locking Focus Control—quick adjustment for use on more than one oscilloscope
- Nine Positive Detent Positions—for multiple exposures
- Rotating Back—horizontal or vertical mounting for most efficient use of film

*C-13 features hinged viewing aperture in place of viewing hood.









Cameras

C-12 CAMERA \$450

The C-12 Camera consists of a f/1.9 lens with 1:0.9 object-to-image ratio, a Polaroid® Land $3\frac{1}{4} \times 4\frac{1}{4}$ roll film back, focus plate, rear frame, and main frame assembly with beam-splitting mirror. Order proper mounting bezel below. Dimensions overall are $15\frac{3}{8}$ "high by $9\frac{3}{4}$ " wide by $17\frac{1}{4}$ "long. Net weight is 14 pounds. Shipping weight is 15 pounds, approx.

C-13 CAMERA \$360

The C-13 Camera consists of a f/4.5 lens with 1:0.7 object-to-image ratio, a Polaroid® Land $3\frac{1}{4} \times 4\frac{1}{4}$ roll film back, focus plate, rear frame, and main frame assembly with hinged viewing aperture. Order proper mounting bezel below. Dimensions overall are $8\frac{3}{4}$ " high by $9\frac{3}{4}$ " wide by $14\frac{1}{4}$ " long. Net weight is 11 pounds. Shipping weight is 14 pounds, approx.

C-19 CAMERA \$500

The C-19 Camera consists of a f/1.9 lens with 1:0.5 object-to-image ratio, a Polaroid® Land $3\frac{1}{4} \times 4\frac{1}{4}$ roll film back, focus plate, rear frame, and main frame assembly with maximum light transmission from crt to film. Order proper mounting bezel below. Dimensions overall are $15\frac{3}{8}$ " high by $9\frac{3}{4}$ " wide by $17\frac{1}{4}$ " long. Net weight is 15 pounds. Shipping weight is 17 pounds, approx.

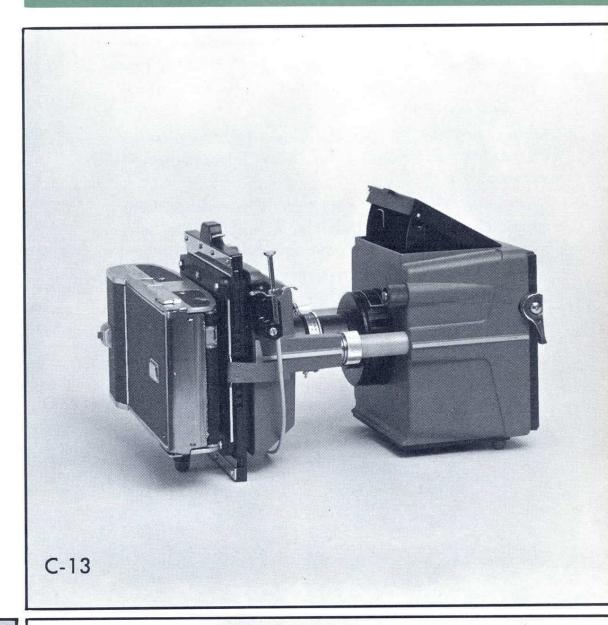
Mounting bezel for Tektronix Oscilloscopes with round 5" crt. Not required for Type 519.

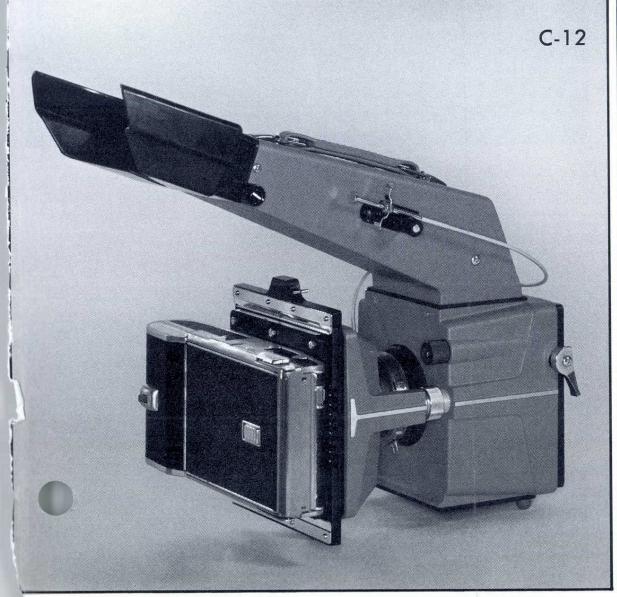
Part No. 122-568 \$15

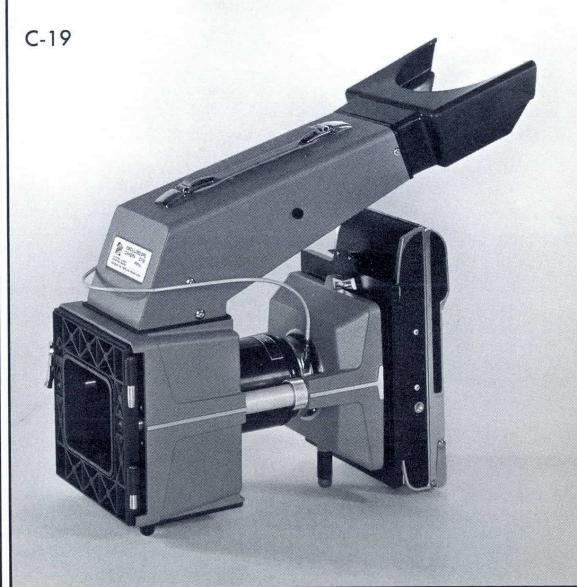
Mounting bezel for Tektronix 560-Series Oscilloscopes with rectangular crt.

Tektronix Trace-Recording Cameras can also be adapted to some non-Tektronix Oscilloscopes. Contact your Tektronix Field Office for information.

Standard Camera Assemblies







Cameras

A WORD ABOUT LENSES

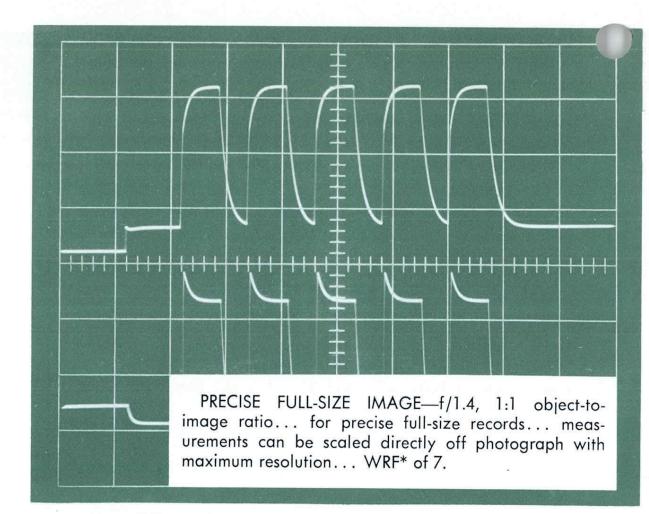
Five interchangeable lenses are available for use with the Polaroid[®] Land or Graflok Film Backs. The Type 350 Camera Attachment contains its own lens.

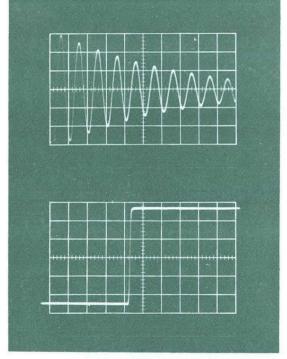
Lens optics are designed to meet the strict requirements of precision oscillography: flat field, low distortion, and high resolution even at highest aperture openings.

Lenses are set for precise object-to-image ratios in prefocused mounts, for easy interchange in camera.

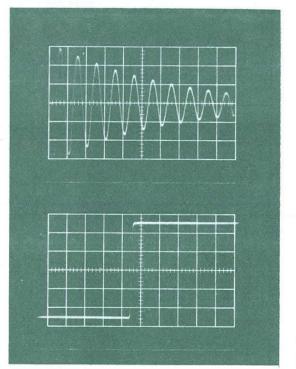
The wide range of object-to-image ratios and maximum apertures permit selection of the lens which is most right for your application.

*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.

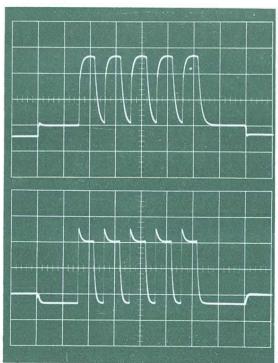




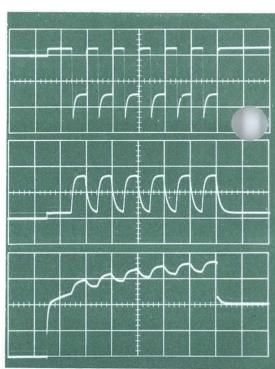
ULTRA-HIGH WRITING RATE—f/1.3, 1:0.5 object-to-image ratio . . . for applications where writing rate is the prime consideration . . . advances the state of the art and in combination with the C-19 Main Frame makes possible the recording of higher-speed phenomena than before . . . WRF* of 12.



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.

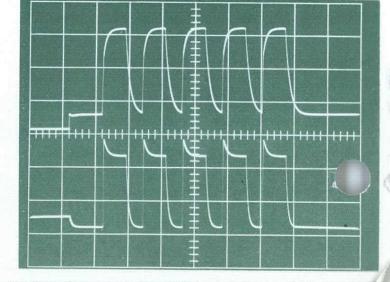


ECONOMY—f/4.5, 1:0.7 object-to-image ratio . . . for economy of price and efficient use of film where high writing rate is not required . . . 3 records of 4 x 10-cm graticule, or 2 records of 6 x 10-cm graticule on 3½ x 4½ film . . . WRF* of 1.



ECONOMY & SPEED—f/1.9, 1:0.7 object-to-image ratio . . . efficient use of film . . . WRF* of 5.

GENERAL PURPOSE—f/1.9, 1:0.9 object-to-image ratio . . . image brightness sufficient for most applications . . . records up to 8×10 -cm graticule on $3\frac{1}{4} \times 4\frac{1}{4}$ film with maximum resolution . . . WRF* of 4.



Cameras

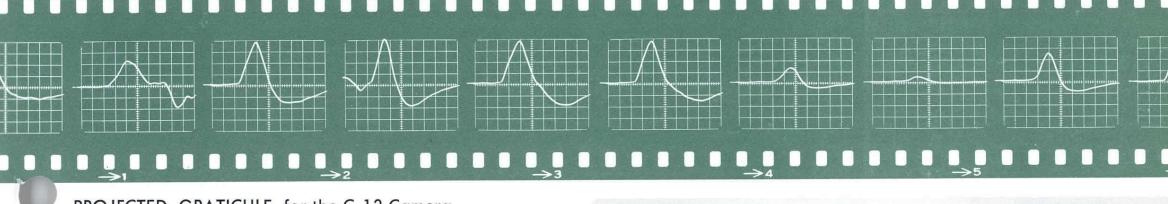


NEW 35-MM ATTACHMENT FOR ALL TEKTRONIX CAMERAS

The Type 350 Camera Attachment consists of a 35-mm film-back and shutter, integral f/1.9 lens with 1:0.2 object-to-image ratio, and mounting hardware to fit a C-12, C-13, or C-19 Main Frame Assembly. Shown with a C-13 Camera frame. WRF* is 9.

The "automatic" advance feature of the Type 350 Camera Attachment allows a rapid sequence of exposures with no break needed to manually advances the film to each new frame. The spring motor automatically advance the film one frame each time the shutter trigger is depressed and released. 20 x 20-mm image field permits photographic coverage of up to 10 x 10 cm. Film can be oriented horizontally or vertically. An image magnifier for focusing and a take-up spool are included. Net weight is $3\frac{1}{4}$ pounds. Shipping weight is 4 pounds, approx. See page 211 for further information.

TYPE 350 CAMERA ATTACHMENT \$400



PROJECTED GRATICULE for the C-12 Camera

The Projected Graticule eliminates parallax, one of the most common problems in making accurate readings of oscillographs taken of external graticule crt's.

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.

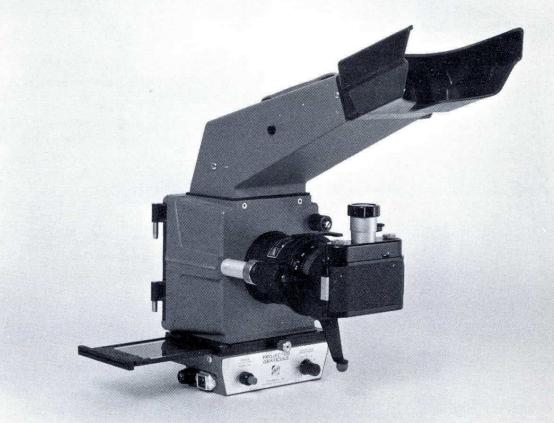
To eliminate parallax, a virtual image of the graticule is presented at the crt phosphor plane as viewed by the operator and as projected to the camera film plane.

Special graticules, reference waveforms, or any image that can be recorded on a film transparency, can be superimposed on the crt display. The transparency is held in a slide holder and is easily slipped in and out of the Projected Graticule case, making possible rapid change of graticule slides.

The transparency provides an 8 x 10-cm projection, a portion of which can be used for write-in data. Colored filters can be inserted to match or contrast the projection with the crt phosphor.

Calibrated light source is indexed in equivalent $\frac{1}{2}$ 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.





Power requirements are 90 to 130 v, or 180 to 260 v, 60 cps. Although the projected Graticule case is small (it adds only 2½'' 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.

PROJECTED GRATICULE (016-204)\$160

Includes: $1-8 \times 10$ -cm graticule transparency, $1-6 \times 10$ -cm graticule transparency with data write-in space, $1-4 \times 10$ -cm graticule transparency with data write-in space, $1-4 \times 10$ -cm graticule mask, $1-6 \times 10$ -cm graticule mask, 2-instruction manuals, 1-3-conductor power cord.

Cameras

MOUNTING MAIN FRAME **BEZELS ASSEMBLIES** For Tektronix Oscilloscopes with round 5" crt. (not needed with Type 519) Part No. 122-568 \$ 15 C-12 Main Frame with beam-splitting mirror and on-axis binocular viewing. Part No. 122-635 \$155 For Tektronix 560-Series Oscilloscopes with rectangular crt. Part No. 016-217 \$ 15 C-13 Main Frame with hinged viewing aperture and maximum light transmission from crt to film. Part No. 122-609 \$120 For some non-Tektronix Oscilloscope. Contact your Tektronix Field Office for ordering information.

INTERCHANGEABLE LENSES



f/1.9—1:0.9 General Purpose Alphax & Ilex No. 3X Shutter Part No. 122-548 ... \$160



f/1.9—1:0.7 Economy plus Speed Alphax & Ilex No. 3X Shutter Part No. 122-547 ... \$180



f/1.9—1:0.5 High Writing Rate Alphax & Ilex No. 3X Shutter Part No. 122-549 . . . \$200



f/4.5—1:0.7 Economy of Film & Price Alphax No. 1 Shutter Part No. 122-550 ... \$105

C-19 Main Frame with maximum light trans-

mission from crt to film and low-angle binocu-

Part No. 122-636 \$165

lar viewing.

Cameras

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INTERCHANGEABLE

LENSES

f/1.4-1:1Precise full-size Image Alphax No. 3 Shutter Part No. 122-608 ... \$275



f/1.3—1:0.5 ra-High Writing Rate No. 3X Shutter Part No. 122-662 ... \$325

REAR FRAME

INTERCHANGEABLE FILM BACKS

TYPE 350 CAMERA ATTACHMENT



Polaroid® Land 31/4" by 41/4" Roll Film Back (See focus plate, below). Part No. 122-603 ... \$75

Focus Plate for Polaroid Back (not needed if Graflok Back is available for focusing). Part No. 387-460 .. \$ 5



Type 350 Camera Attachment 35-mm Back and integral f/1.9 lens with 1:0.2 object-to-image ratio. 30 or 55 exposures per roll, 24 by 24-mm frame size, automatic springwound advance \$400

35-mm Accessories Type TR Bulk-loading Cassette Part No. 016-221\$5.95 Type NR Take-up Cassette Part No. 016-222 \$5.95



Standard Frame

(not needed with Type



Adapts Polaroid or Graflok Back to rear frame. Part No. 122-602 . . \$25



4 x5 Graflok Back with Focusing Screen accepts standard cut-film holders, film-back adapters, rollfilm (120) adapters, Polaroid 4 x5 Film Holder. Part No. 122-604 . . \$45

SHUTTER ACTUATOR

The Tektronix Shutter Actuator can be used to obtain electrically triggered exposures. The Shutter Actuator consists of a solenoid actuator and a power supply with trigger controls. This combination provides an impulse to the shutter tripping mechanism, electrically simulating local manual operation.

The power supply operates on nominal 117 v, 60 cps, and can be converted for 234 v use.

The Shutter Actuator can be used with all lenses except Type f/4.5; 1:0.7.

The chart lists the number of solenoids that can be used with different shutters at various line voltages.

Line Voltage	130	120	110	100
Alphax #3	7	6	5	4
Ilex #3X	5	4	3	2
Alphax #4	5	4	3	2
SHUTTER ACTUAT Includes: 1—power				\$125
Additional Soleno	ids (016	-211) .		\$30

ORDERING INFORMATION

Tektronix Trace-Recording Cameras are designed for maximum flexibility and easy interchange of components. The C-12, C-13, and C-19 Cameras are complete trace-recording systems. The systems are easily modified or added to by selection of any of the above components. If desired, a complete custom camera can be assembled from components in these columns. One component from each heading makes up a complete camera. In the case of the Type 350 Camera Attachment, only a Main Frame Assembly and proper Mounting Bezel are required to complete a 35-mm camera system.

If you would like assistance in selecting or ordering a custom camera, your nearest Tektronix Field Office (or Overseas Distributor) is ready to help you.



SCOPE-MOBILE® CARTS

TYPE 200-SERIES

Five models comprise the Type 200-Series Scope-Mobile[®] Carts which feature 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 probes, clip leads, other 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. All tilt-lock models come equipped with front-wheel brakes.

1. Tray width of the Types 201-1 and 201-2 is $10\frac{1}{2}$ inches. Tektronix oscilloscopes that fit this tray width include the Types 503, 504, 515A, 516, 561A, and 564.



Plug-in carrier of the Type 201-2 accommodates a pair of the 2-series and 3-series plug-in units.

2. Tray width of the Types 202-1 and 202-2 is 14 inches. Tektronix oscilloscopes that fit this tray width include the Types 502A (with special adapter), 507, 517A, 530-Series, 540-Series, 550-Series, 580-Series, and 661— plus the Types 570 and 575 Curve Tracers.

Plug-in carrier of the Type 202-2 accommodates a pair of the letter-series plug-in units.

- 3. Tray width of the Type 202-1 Mod 52 is 14³/₄ inches. This modified Scope-Mobile Cart is designed specifically for the Type 519 Oscilloscope. Please consult your Tektronix Field Engineer for price, availability and other information.
- 4. Tray width of the Type 205-1 is 173/4 inches.

Tektronix oscilloscopes that fit this tray width include the Types 565, 567, and all rack-mount models.

Note: 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.

CHARACTERISTICS

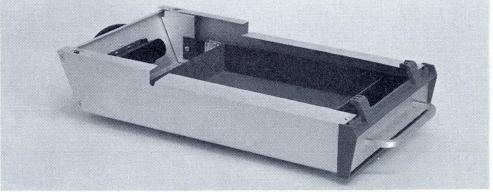
ADJUSTABLE TRAY tilt-locks in either of six 4.5° steps in the upward direction or two 4.5° steps in the downward direction from the horizontal axis.

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 $17\frac{1}{2}$ " wide by 28" deep for the 201-1, -2 and the 202-1, -2; 36" high by 22" wide by 28" deep for the 205-1.

NET WEIGHT is approximately 38 pounds for the 201-1, -2 and the 202-1, -2; approximately 43 pounds for the 205-1.

Туре	Part No.		Price
201-1	016-045	with drawer	\$120.00
201-2	016-046	with drawer and plug-in carrier	130.00
202-1	016-047	with drawer	120.00
202-2	016-048	with drawer and plug-in carrier	130.00
205-1	016-049	with drawer	135.00
	436-033	Adapts Type 502A Oscilloscope to 202-1, -2	2.40



Storage drawers and storage drawer/plug-in carrier combinations can be ordered separately as follows:

014-012 drawer for 201-1	\$40
014-013 drawer/plug-in carrier combination for 201-2	\$45
014-014 drawer for 202-1	\$40
014-015 drawer/plua-in carrier combination for 202-2	\$45

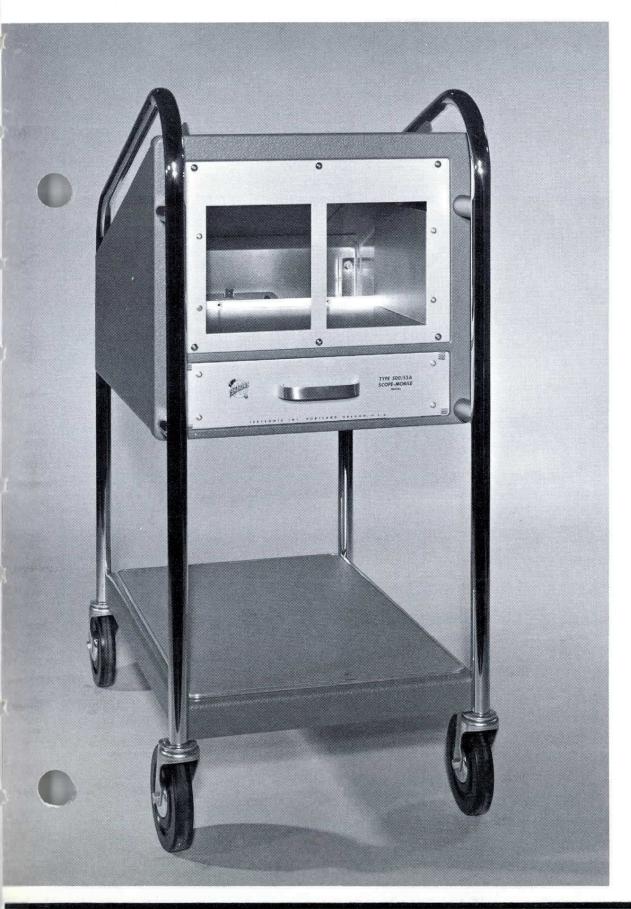
U.S. Sales Prices f.o.b. Beaverton, Oregon Please refer to Terms and Shipment, General Information page.

TYPE 500-SERIES

The Type 500A (without plug-in carrier but with blank front panel) and the Type 500/53A (with plug-in carrier factory installed) Scope-Mobile® Carts comprise the Type 500 Series. These carts come equipped with front wheel brakes. Four wheel brakes can be ordered at additional cost.

Convenient feature of the Type 500A is the compartment for housing auxiliary equipment mounted behind the blank front panel. This compartment is $8\frac{1}{2}$ " high by $13\frac{3}{4}$ " wide for the first $5\frac{1}{2}$ " of depth tapering from this point, at a 20° angle, to a minimum height of $2\frac{1}{2}$ " at a depth of $19\frac{1}{2}$ ".

An available fan kit provides ventilation for the equipment compartment.



CHARACTERISTICS

STATIONARY TRAY slants upward at a 20° angle. TRAY WIDTH is 13³/₄ inches.

STORAGE DRAWER is felt-lined and slides on nylon guides, provides handy storage for accessory items, such as probes, cables, and manuals.

NET WEIGHT is approximately 35 pounds.

Туре	Part No.		Price
500A	016-018	without plug-in carrier	\$ 99.50
500/53A	016-019	with plug-in carrier	\$110.00

WHEEL BRAKES

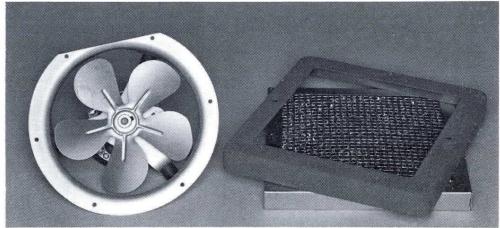
TYPE	500A MOD	741B	(four	wheels)		\$114.50
TYPE	500/53A M	OD 74	1B (for	ur wheels	s)	\$125.00

PLUG-IN CARRIER

(can be ordered separately)

This carrier replaces the blank panel on the Type 500A and provides storage space for two letter or 80-series plug-in units.

Order Part Number 014-005\$10.50



FAN KIT

SPECIAL TRAYS

Special trays furnish a secure positioning mount for Tektronix Oscilloscopes smaller in size than those for which the Scope-Mobile® Cart was intended.

		Oscillo	scope	s		Part Number	Price
		502	2A			436-019	\$8.75
503,	504,	515A,	516,	561A,	564	436-020	\$9.75

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

	CT-1,	P6016	P6035	P6034	P6026	P6028	P6023	P6015	P6013	P6008	P6006	P6032	P6025	P500CF**	P500CF	P170CF*	P170CF
	P6040						0	SCILLO	SCOPES	<u> </u>							
310A		x				x		x	x		x			0		0	
317		x				x		x	X		X			0		D-07	Skir
RM17		X									120		AT.	CELL STATE		0	
321		X				X		X	X		X			0		0	
360		x				X		X	X		X			0		0	
502A		x				X	x	X	X		X			0		0	
502A		X				X	PARKING STATE	The second second	X		X			0		0	
RM503		X				X	X	X	X		X			0		0	
504		X				X	X	X	X		X			0		0	
RM504		X				Total Control of the			X		X			0		0	
515A		x				X		X	X		X			0		0	
RM15		x				X		X	X		X			0		0	
516		X			The same of		- DE 2	X	X		X			0		0	
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CA		х				x	0	x	х		X			0		0	
D		Х				X	X	X	X		X			0		0	
G		х				X	х	x	Х		X			0		0	
н		х		N text section		x		X	Х		X			0		0	11.5
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N	Х		0	0	Х								Х				100
0		Х				Х		х	X		Х			0		0	4.5
Z		Х					X	0	0		0			0		0	-1.1
2A60		X				X		Х	Х		X			0		0	245
2A63		х				X	X	X	X		X		15-00 To	0		0	
3A1		х				X	0	х	Х		x			0		0	
3A2		Х				X		X	X		X			0		0	1000
3A72		х				X	0	X	X		X			0		0	111
3A74		х				x		x	x		Х			0		0	
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O These combinations have limitations, but they may be very useful in certain applications.

** With 128 Power Supply

PROBES

Tektronix manufactures both active and passive probes that broaden application areas for Tektronix oscilloscopes.

Most Tektronix probes are selectable for their attenuation ratios. They not only attenuate the signal to the oscilloscope but also reduce the loading effect of the oscilloscope on the circuit under test.

To assist in selection, the probes have been grouped as to general-purpose, special-purpose, and sampling. When making your selection, consider these guiding principles:

- 1. Be sure the desired probe will accommodate the input resistance and capacitance of the oscilloscope used, and is equipped with the proper type of 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.
- 3. Select for appropriate 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 compatible input capacitance will generally provide the most accurate measurements.

When ordering any probe, please designate not only the type but also the six-digit part number.

If you desire help in selecting the right probe for your applications, please consult your Tektronix Field Engineer.

GENERAL PURPOSE PROBES

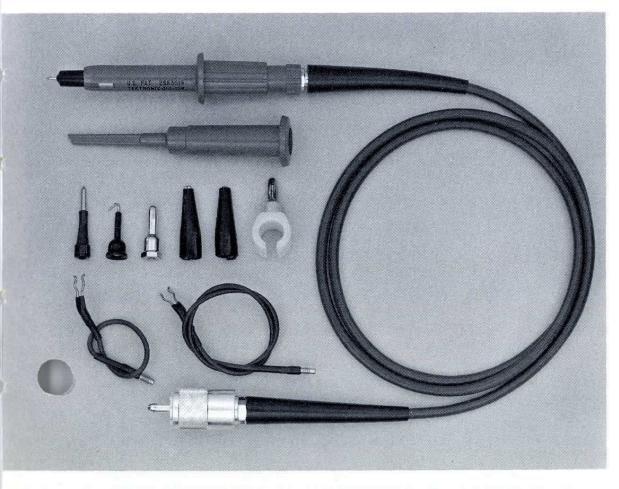
P6006 10X PASSIVE PROBE

The Type P6006 low input-capacitance probe has improved design and electrical characteristics over its predecessors, the Types P6000, P6003, P6017, and P6022 Probes.

By rotating the probe body with respect to its base, the probe time-constant can be adjusted for the input time-constant of the oscilloscope or plug-in unit.

Peak-to-peak voltage derating is necessary for CW frequencies higher than 5.7 Mc when working into a 20 pf input, or higher than 3.6 Mc when working into a 47 pf input.

The probe is available with 6', 9', or 12' cable lengths in addition to the standard 3.5' cable length and either BNC or UHF connectors. BNC to UHF or UHF to BNC adapters are available from your local supplier or Tektronix, Inc.



CHARACTERISTICS

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 nsec.

TYPICAL RISETIME of probe, Type K Plug-In Unit, and Type 540-Series Oscilloscope is 13 nsec.

VOLTAGE RATING is 600 volts dc or ac pk-to-pk.

P6006 PROBE (010-127 BNC or 010-125 UHF) \$22

Includes: 1—pincher tip, 1—short straight tip, 1—hook tip, 1—spring tip, 1—banana tip, 1—probe holder, 1—5" ground lead, 1—12" ground lead, 2—minigator clip, 1—instruction manual.

ADDITIONAL CABLE LENGTH P6006 PROBE PACKAGE WITH CORRESPONDING INPUT C CHANGE.

	Elettine		Part N	lumber	
Cable		ut C	BNC	UHF	
Length	20 pf	47 pf	Connector	Connector	Price
6'	8.5 pf	11.0 pf	010-160	010-158	\$22
9'	11.0 pf	13.5 pf	010-146	010-142	22
12'	13.0 pf	15.5 pf	010-148	010-144	22

REPLACEMENT PROBES (without tips and ground leads)

	Part Nu	mber	
Cable Length	BNC Connector	UHF Connector	Price
3.5'	010-128	010-126	\$19.50
6'	010-161	010-159	19.50
9'	010-147	010-143	19.50
12'	010-149	010-145	19.50

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

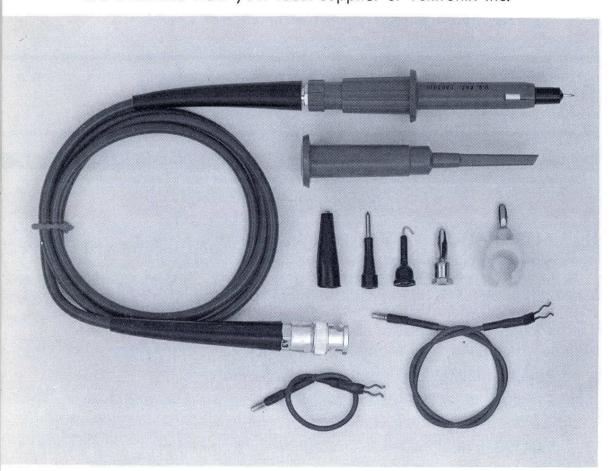
P6007 100X PASSIVE PROBE

The Type P6007 low input-capacitance probe has improved overall design and electrical characteristics over its predecessors, the Types P6002 and P6005 Probes.

By rotating the probe body with respect to its base, the probe time constant can be adjusted for the input time constant of the oscilloscope or plug-in unit.

Peak-to-peak voltage derating is necessary for CW frequencies higher than 200 kc.

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.



CHARACTERISTICS

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 with an instrument having a 47 pf input capacitance.

TYPICAL RISETIME of probe, Type K Plug-In Unit, and Type 540-Series Oscilloscope is 13 nsec.

VOLTAGE RATING is 1.5 kv dc or ac RMS, 4.2 kv ac peak-to-peak.

P6007 PROBE (010-150 BNC or 010-134 UHF) \$22 Includes: 1-pincher tip, 1—short straight tip, 1—hook tip, 1—spring tip, 1—minigator clip, 1—banana plug, 1—probe holder, 1—5" ground lead, 1—12" ground lead, 1—instruction manual.

ADDITIONAL CABLE LENGTH P6007 PROBE PACKAGE WITH CORRESPONDING INPUT C CHANGE.

	5.1.2.3		Part N	lumber		
Cable Length	Inpu 20 pf		BNC Connector	UHF Connector	Price	
6'	2.2	2.5	010-165	010-162	\$22.00	
9'	2.4	2.7	010-152	010-136	22.00	
12'	2.6	2.8	010-154	010-138	22.00	

REPLACEMENT PROBES (without Tips and Ground Leads).

Cable Length	BNC Connector	UHF Connector	Price
3.5 ′	010-151	010-135	\$19.50
6'	010-166	010-163	19.50
9'	010-153	010-137	19.50
12'	010-155	010-139	19.50

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

P6027 and P6028 1X PROBES

The P6027 and P6028 passive probes are identical in all respects with the exception of the connectors. The P6027 uses a UHF connector. The P6028 uses a BNC connector.

Peak-to-peak voltage derating is necessary of CW frequencies higher than 1.0 Mc.

In addition to the standard 42" cable length, these probes are available in cable lengths of 6', 9', and 12'. Insertion loss increases with probe cable length. For a 12' cable length probe, insertion loss is an additional 3-db at 16 MC.

CHARACTERISTICS

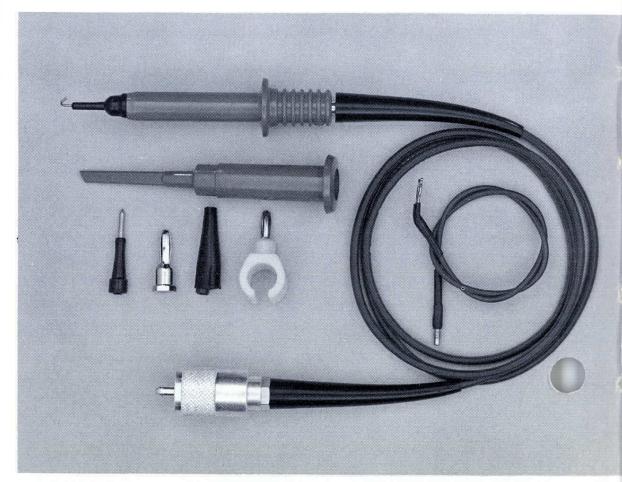
ATTENUATION RATIO is 1X.

INPUT RESISTANCE is 1 megohm.

INPUT CAPACITANCE is 67 pf minimum, 94 pf maximum for standard cable length probe.

MAXIMUM INPUT VOLTAGE is 600 v.

STANDARD CABLE LENGTH is 42".



REPLACEMENT PROBES (without tips and ground leads)

Cable	Part N	lumber	
Length	P6027	P6028	Price
3.5'	010-116	010-120	\$9.45
6'	010-117	010-121	\$9.45
9'	010-118	010-122	\$9.45
12'	010-119	010-123	\$9.45

P6027 and P6028 PROBES with over 42" cable lengths

Probe	Cable Length	Con- nector	Part No.	Capac	out citance Max-pf	Price
P6027 P6028	6 ft.	UHF BNC	010-071 010-075	93.0	120.0	\$12.50
P6027 P6028	.9 ft.	UHF BNC	010-072 010-076	120.0	147.0	\$12.50
P6027 P6028	12 ft.	UHF BNC	010-073 010-077	146.0	173.0	\$12.50

SPECIAL PURPOSE PROBES

P170CF CATHODE-FOLLOWER PROBE

The P170CF has been developed for use with the Tektronix Type 517A Oscilloscope. When used with oscilloscopes other than the Type 517A, the P170CF requires use of a power supply such as the Tektronix Type 128 Probe Power Supply.

The preamplifier grid line in the Type 517A acts as the 170-ohm termination for the P170CF probe. When the probe is used with oscilloscopes other than the Type 517A, the Tektronix 170-ohm terminating resistor is recommended for proper termination of the P170CF.

The probe uses three variable attenuator heads for attenuations up to 4000X.

CHARACTERISTICS

PROBE ALONE:

ATTENUATION is 2X.

RISETIME is less than 2 nsec.

FREQUENCY RESPONSE is down less than 0.5 db at 65 Mc for high frequency and down 3 db at 15 cps for low frequency.

INPUT SHUNT CAPACITANCE is 5 to 5.5 pf.

LOW FREQUENCY INPUT RESISTANCE is 12 megohms, isolated by 0.001 μf coupling capacitor.

MAXIMUM VOLTAGE INPUT is $\pm 0.5 \,\mathrm{v}$ peak.

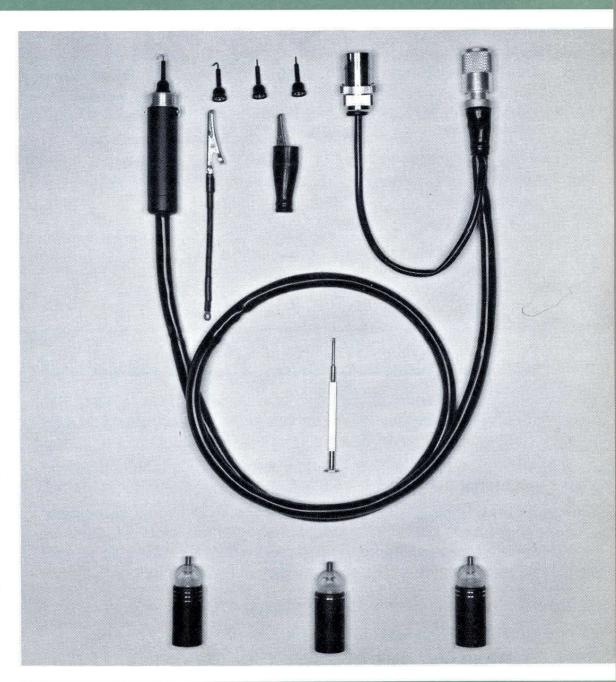
POWER SUPPLY REQUIREMENTS are regulated + 120 v at 10 ma, regulated or unregulated 6.3 v at 150 ma.

PROBE CABLE is 42" long.

P170CF CATHODE-FOLLOWER PROBE (010-101) . . \$99.50 Each probe includes: 1—PAX-I attenuator head, 1—PAX-II attenuator head, 1—PAX-III attenuator head, 1—jewel screwdriver, 2—hooked tips, 2—straight tips, 1—clip assembly, 1—instruction manual.

P170CF ONLY (010-102) \$53.00

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



		P170CF	ATTENUAT	OR HEADS		
Туре	Attenuation (includes P170CF)	Input Capacity	Low-Freq. 3-db Point	Max. Voltage Input	Part No.	Price
PAX-I	4X min. 40X max.	5 pf 1.2 pf	800 cps 1700 cps	±1 v pk.	010-301	\$14.00
PAX-II	40X min. 400X max.	5 pf 1.2 pf	150 cps 150 cps	±10 v pk.	010-302	\$14.00
PAX-III	400X min. 4000X max.	3 pf 1.1 pf	60 cps 60 cps	±100 v pk.	010-303	\$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 use of a power supply such as the Tektronix Type 128 Probe Power Supply.

CHARACTERISTICS

PROBE GAIN is from 0.8 to 0.85.

ATTENUATION is 10X with attenuator head.

INPUT IMPEDANCE is 40 megohms paralleled by 4 pf when using the probe alone and 10 megohms paralleled by 2 pf when using 10X attenuator head.

HIGH FREQUENCY RESPONSE is 0.5-db down at 10 Mc.

LOW FREQUENCY RESPONSE is 3-db down at 5 cps.

AMPLITUDE DISTORTION is less than 3% for peak amplitudes up to 5 v when using the probe alone, or up to 50 v when using the 10X attenuator head.

MAXIMUM INPUT VOLTAGE is approximately 5 v at 10 Mc or 2 v at 30 Mc for the probe alone and approximately 50 v at 10 Mc or 20 v at 30 Mc when using the 10X attenuator head.

HUM LEVEL is less than 1.5 mv at maximum sensitivity.

POWER SUPPLY REQUIREMENTS are regulated +120 v at 25 ma, regulated or unregulated $+6.3 \,\mathrm{v}$ at 150 ma, dc voltages.

PROBE CABLE is 3.5' long.

manual.

P500CF CATHODE-FOLLOWER PROBE (010-109) \$85 Each probe includes: 1—10X attenuator head, 1—5" ground strap, 2—hooked tips, 2—straight tips, 1—clip assembly, 1—instruction



Initially designed for Tektronix Type Z Plug-In Unit, the Type P6023 applies its specifications as well to other Tektronix differential preamplifiers.

Peak to peak voltage derating is necessary at CW frequencies higher than 5 Mc.

The probe can be compensated for input capacities between 20 pf and 50 pf. The attenuation can be compensated for normal plug-in attenuator differences between two plug-in units or two channels of the same plug-in unit.

CHARACTERISTICS

RISETIME is less than 7 nsec.

MAXIMUM INPUT VOLTAGE is 1000 v, dc or pk-to-pk.

INPUT CAPACITANCE is 12 pf or less.

INPUT RESISTANCE is 8 megohms.

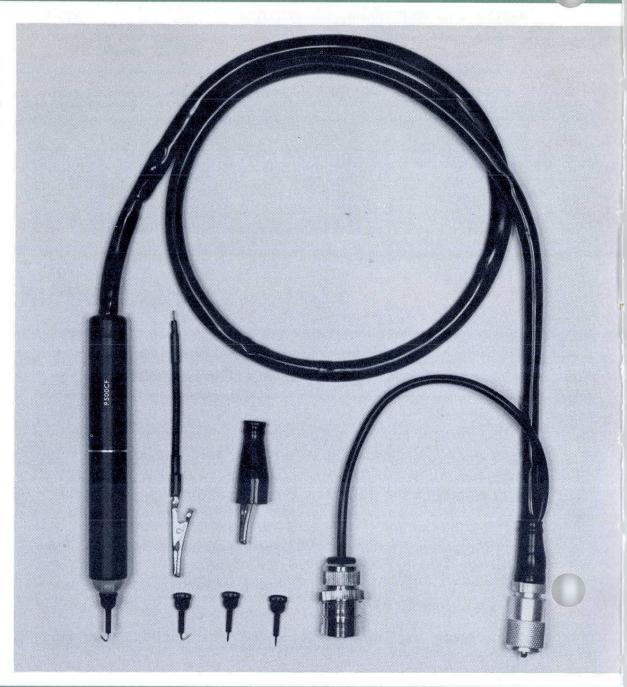
ATTENUATION RATIO is $10:1, \pm 2.5\%$.

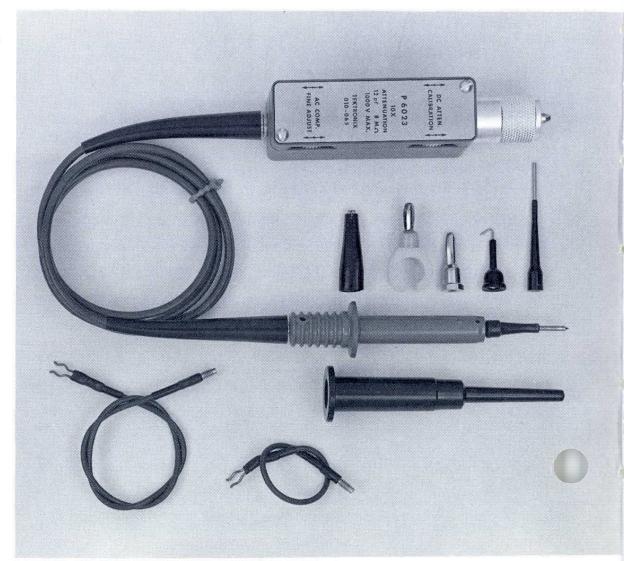
CABLE LENGTH is 3.5'.

P6023 PROBE (010-167 BNC or 010-065 UHF) \$40 Each probe includes: 1—spring tip, 1—hook tip, 1—pincher tip, 1—probe holder, 1—banana plug, 1—minigator clips, 1—5" ground strap, 1—12" ground strap, 1—instruction manual.

P6023 PROBE ONLY (010-168 BNC or 010-097 UHF) . . \$33

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P6008 10X PASSIVE PROBE

The P6008 low-capacitance probe is designed for use with Tektronix Type 82 and Type 86 Plug-In Units.

Probe input capacitance can be compensated for the input capacitance of the plug-in unit by merely turning the probe body with respect to the probe base.

When observing high-frequency signals with the Type P6008, it is necessary to use the shortest ground lead possible in order to avoid excessive inductance between test point and probe.

CHARACTERISTICS

ATTENUATION RATIO is 10X.

INPUT RESISTANCE is 10 megohms.

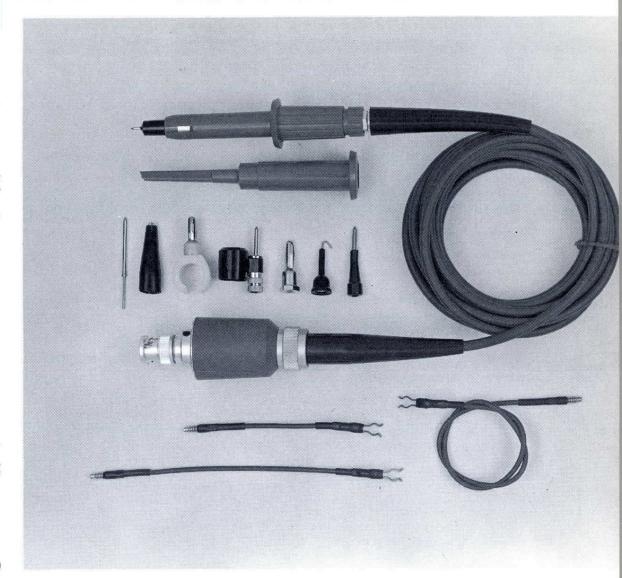
INPUT CAPACITANCE is approximately 7 pf.

MAXIMUM INPUT VOLTAGE is 600 volts dc or pk-to-pk.

PROBE RISETIME is approximately 3 nsec.

CABLE is 3.5' long and terminated with a BNC connector.

P6008 PROBE ONLY (010-130) \$40



P6009 100X PASSIVE PROBE

The P6009 low-capacitance probe is designed for use with Tektronix Type 82 and Type 86 Plug-In Units.

The probe can be adjusted by rotating the probe body with respect to the probe base, so that the probe input time-constant equals that of the Type 82 or Type 86 Plug-In Unit input time-constant.

Typically, voltage derating is required for CW frequencies over $200\ kc$.

CHARACTERISTICS

ATTENUATION RATIO is 100X, $\pm 3\%$.

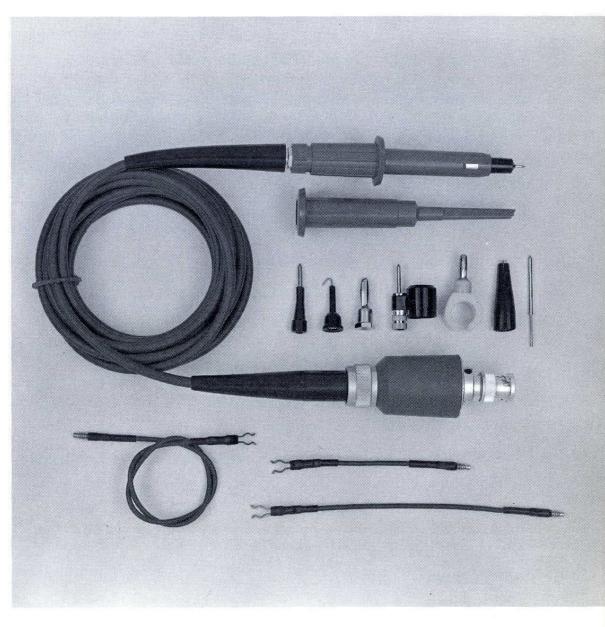
INPUT RESISTANCE is 10 megohms.

INPUT CAPACITANCE is 2.5 pf.

MAXIMUM INPUT VOLTAGE is 1.5 kv ac RMS, or 1.5 kv dc.

PROBE RISETIME is approx. 2 nsec.

CABLE is 9' and terminated with a BNC connector.



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P6013 HIGH-VOLTAGE PROBE

The Type P6013 provides 1000X attenuation as a means for oscilloscope measurements of high-amplitude waveforms or dc potentials up to 12 kv. Pulse frequency can be up to 100 kc at 12 kv.

Peak-to-peak voltage derating is necessary at CW frequencies higher than 100 kc.

The probe can be compensated for oscilloscope input capacities up to 60 pf.

CHARACTERISTICS

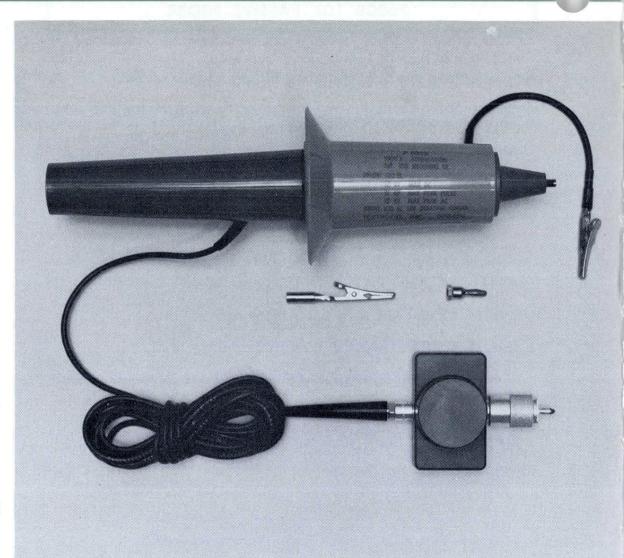
ATTENUATION is 1000X.

INPUT IMPEDANCE is 100 megohms paralleled by 3 pf.

RISETIME is 14 nsec when using a Type 545A Oscilloscope and Type K Plug-In Unit.

MAXIMUM VOLTAGE RATING is 12 kv dc, peak pulse, or peak ac at frequencies below 100 kc. Voltage derating required for voltages at frequencies over 100 kc.

CABLE LENGTH is 10'.



P6015 HIGH-VOLTAGE PROBE

The Type P6015 provides 1000X attenuation for oscilloscope measurements of waveforms reaching up to 40-kv peak. Voltage or duty cycle derating is necessary for RF voltages at frequencies over 100 kc, or in environmental temperatures above 25° C.

The probe time constant can be adjusted to equal that of the oscilloscope input time constant for those instruments having between 12 pf and 50 pf input capacitance.

CHARACTERISTICS

VOLTAGE RATING is 40-kv max. pk ac or pulse, 20-kv max. dc or rms continuous at 25° C environmental temperature.

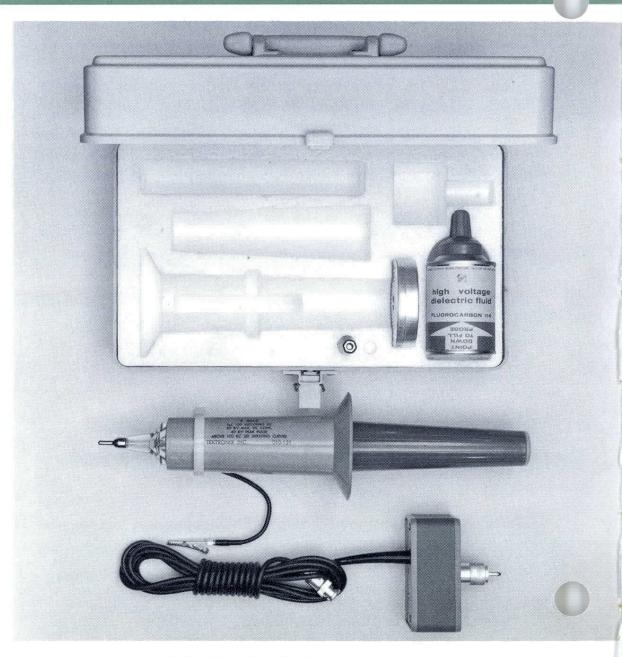
ATTENUATION RATIO is 1000X with approx. $\pm 9\%$ variable adjustment.

DC INPUT RESISTANCE is 100 megohms.

INPUT CAPACITY is approx. 2.7 pf.

RISETIME (of probe and compensator box) is approximately 4 nsec.

TEMPERATURE RANGE is 10°C to 55°C environmental temperature. Calibration adjustments are necessary when environmental temperature changes.



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P6016 AC CURRENT PROBE

The P6016 Probe offers two current detecting systems for use with Tektronix wide-band oscilloscopes, the P6016 Probe and Type 131 Amplifier combination, or the P6016 Probe and Passive Termination combination.

The Probe and Amplifier combination measures currents over a wide range with risetimes to 20 nsec. The Probe and Passive combination is not quite as flexible, but has improved passband characteristics.

PROBE AND TYPE 131 AMPLIFIER CHARACTERISTICS

SENSITIVITY with a 50 mv/div oscilloscope input is 1 ma/div basic sensitivity with 10 calibrated steps from 1 ma/div to 1 amp/div in a 1-2-5 sequence, accuracy within 3%. Variable control on the oscilloscope provides continuous uncalibrated ranging between steps.

NOISE is equivalent to a $100-\mu$ amp, pk-to-pk, input signal. RISETIME is 20 nsec with a Tektronix Type K Plug-In Unit and Type 540A-Series Oscilloscope.

PASSBAND is approximately 17 Mc at 3-db down.

DELAY TIME is 40 nsec or less measured at the 50% pulse amplitude points.

LOW-FREQUENCY RESPONSE is 3-db down at 50 cps. AC CURRENT SATURATION RATING is 15 amps pk-to-pk, decreasing to 8 amps at 400 cps, 400 ma at 50 cps.

POWER REQUIREMENT is $105-125\,\mathrm{v}$ ac, approximately $0.5\,\mathrm{watt}$ at $117\,\mathrm{v}$, or approximately 1 watt at $234\,\mathrm{v}$ ac, or $0.2\,\mathrm{watt}$ at 22.5^* battery charge.

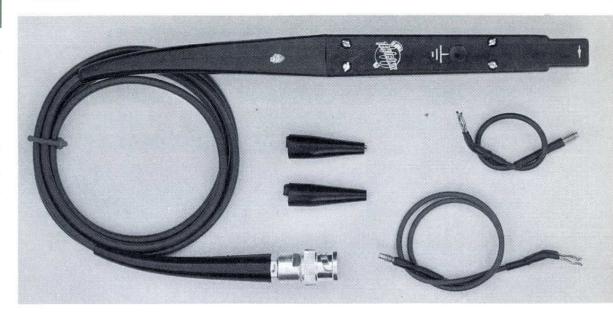
P6016 PROBE, TYPE 131 AMPLIFIER, 117 V POWER (015-030)	SUPPLY \$235.00
P6016 PROBE, TYPE 131 AMPLIFIER, 234 V POWER (015-045)	SUPPLY 235.00
TYPE 131 AMPLIFIER AND 117 V POWER SUPPLY (015-011)	160.00
TYPE 131 AMPLIFIER AND 234 V POWER SUPPLY (015-024)	160.00
TYPE 131 AMPLIFIER AND 22.5 V BATTERY ADAPTER (015-026)	120.00
P6016 PROBE (010-037)	75.00
TYPE 131 AMPLIFIER, less power supply (015-029)	115.00
117 V POWER SUPPLY ONLY (015-027)	60.00
234 V POWER SUPPLY ONLY (015-028)	60.00
*22.5 V BATTERY ADAPTER ONLY (013-050)	8.00
CALIBRATOR ADAPTER (017-031)	8.40

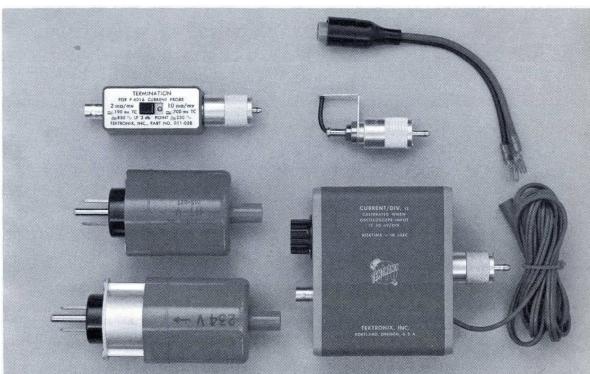
COMMON TO BOTH SYSTEMS

DC SATURATION THRESHOLD is 0.5 amp.

MAXIMUM BREAKDOWN VOLTAGE is 600 v.

INSERTION IMPEDANCE after a step function has been applied to the conductor under test is (1) $0.06\,\Omega$ after 50 nsec, (2) $0.04\,\Omega$ after 100 nsec, (3) $0.015\,\Omega$ after 1 μ sec, and (4) $0.006\,\Omega$ after 10 μ sec. Dependent upon size of the wire, the capacitance between the conductor and probe case is typically 1 pf.





PROBE AND PASSIVE TERMINATION CHARACTERISTICS

SENSITIVITY is either 2 ma/mv or 10 ma/mv of oscilloscope sensitivity, accuracy within 3%.

RISETIME is 17 nsec, $\pm 4\%$ maximum rolloff, overshoot, and ringing, with a Tektronix Type K Plug-In Unit and Type 540A-Series Oscilloscope.

PASSBAND is approximately 20 Mc at 3-db down.

DELAY TIME is 20 nsec or less measured at the 50% pulse amplitude points.

LOW-FREQUENCY RESPONSE at 3-db down is approximately 850 cps at 2 ma/mv (5% tilt of 10 μ sec square-wave pulse) and approximately 230 cps at 10 ma/mv (5% tilt of 35 μ sec square-wave pulse).

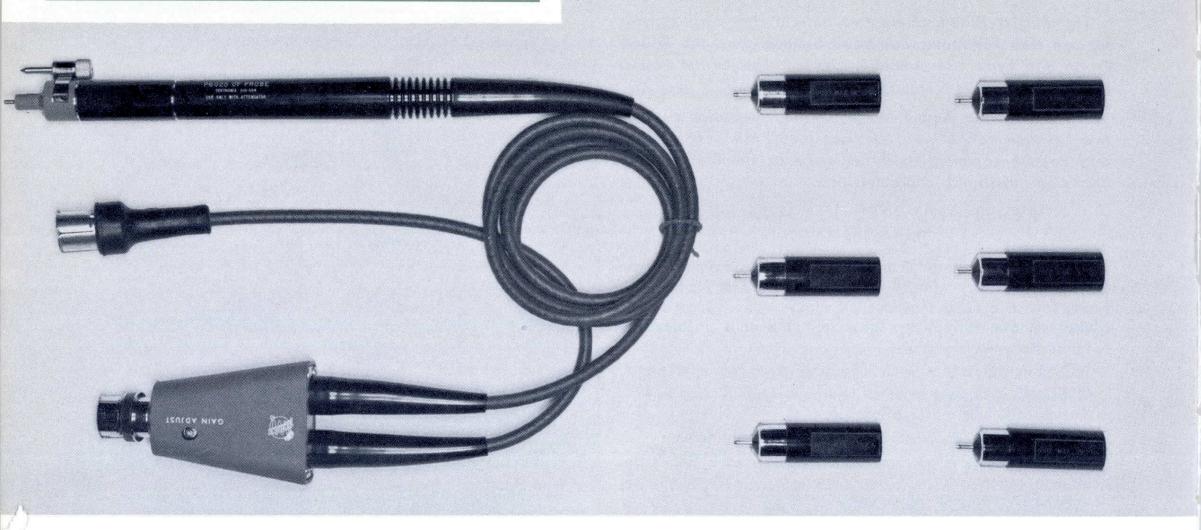
MAXIMUM CURRENT RATING is 15 amps pk-to-pk.

P6016 PROBE (010-037)	\$ 75.00
PROBE AND PASSIVE TERMINATION (011-044)	90.00
PASSIVE TERMINATION (011-028 UHF/011-064 BNC) .	20.00

Each probe includes, 1—5'' ground lead, 1—12'' ground lead, 2—minigator clips, 1—instruction manual.
*Use Eveready #763 or equivalent.

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Please refer to Terms and Shipment, General Information page.

P6025 CATHODE-FOLLOWER PROBE



The P6025 Cathode-Follower Probe, a high-frequency probe designed for use with the Tektronix Type N Sampling Plug-In Unit, offers flexibility through 7 attenuator heads. All attenuator heads can be compensated for proper ac attenuation ratios.

Normally dc coupled, the probe can also be ac-coupled with a capacitor-coupler head that is supplied with the probe.

CHARACTERISTICS

OUTPUT is $\pm 100 \, \mathrm{mv}$ into a 50-ohm load.

OUTPUT DC LEVEL is approximately +350 mv.

INPUT RESISTANCE is 10 megohms with an attenuator head.

POWER REQUIREMENTS are $6.3\,\mathrm{v}$ ac at 200 ma for the heater and $+\ 100\,\mathrm{v}$ dc at approximately 12 ma for the plate.

CABLE is 54 inches long with GR connector.

RISETIME of the probe, attenuator head, Type N Unit, is 0.85 nsec for attenuations of 200X and less, and 1 nsec for attenuations above 200X, when using a 25-ohm source impedance. A higher source impedance imposes an RC charge time as a restriction on the probe risetime.

CAPACITOR-COUPLER HEAD is rated at 0.001 $\mu {\rm fd}$, 500 v dc, and has a low-frequency 3-db point of 16 cps.

Each probe includes: 1—ground clip assembly, 2—spring clips, 7—attenuator heads, 1—capacitor-coupler head, 1—instruction manual.

P6025 PROBE Only (010-054) \$165

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ATTENUATOR HEADS (DC COUPLED)							
ATTENUATOR	10X	20X	50X	100X	200X	500X	1000X
Input Capacitance in Picofarads ±10%	5.0	3.5	2.5	1.8	1.5	1.3	1.2
Max. Linear Voltage Input in ± Volts	1	2	5	10	20	50	100
Part Number	010-323	-324	-325	-326	-327	-328	-329
Price	\$16	\$16	\$16	\$16	\$16	\$16	\$16

P6026 PASSIVE PROBE

The Type P6026 Probe, usable with any of the Tektronix 50-ohm input sampling systems, has extremely low input capacitance with passband characteristics to 600 Mc.

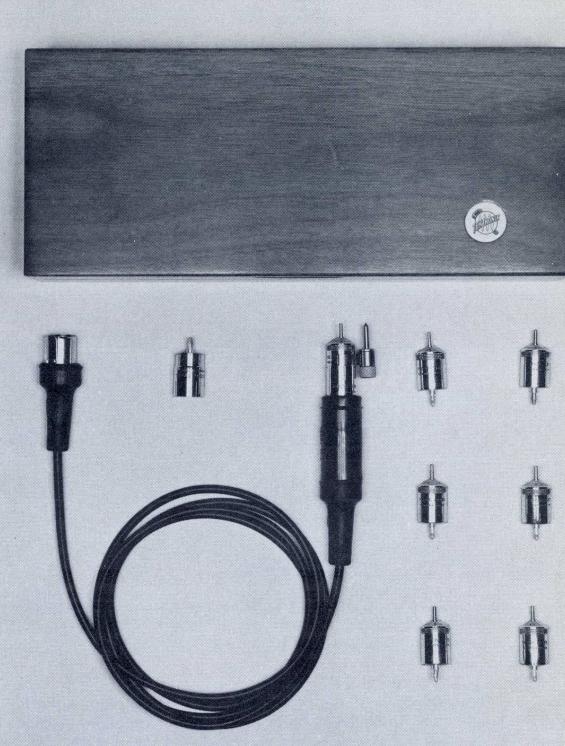
The seven attenuator heads are easily interchangeable and do not require compensation.

The probe includes two 50-ohm terminations, one for ac coupling and one for dc coupling.

		CHARAC	CTERISTICS	5	
Part Number	Attenu- ator-DC Accuracy within 2%	Input C	Input R at 600 Mc	Input R at DC	Low freq. coupled approx. AC 3 db point
010-333	5X	0.5 pf	125 Ω	125 Ω	1.4 Mc
010-334	10X	0.5 pf	250 Ω	250 Ω	720 kc
010-335	20X	0.6 pf	500 Ω	500 Ω	360 kc
010-336	50X	0.8 pf	1 kΩ	$1.25~\mathrm{k}\Omega$	140 kc
010-337	100X	0.8 pf	2 kΩ	$2.5 \text{ k}\Omega$	65 kc
010-338	200X	0.8 pf	$3.25 \text{ k}\Omega$	5 kΩ	32 kc
010-339	500X	0.8 pf	$4 k\Omega$	$12.5 \text{ k}\Omega$	13 kc
010-331	50 Ω DC	terminat	ion		
010-340	50 Ω AC	terminat	ion		
All Head	ds			\$	14.00 ea.

STANDARD CABLE is a 10-nsec RG58A/U cable, approximately $61/_2$ feet long; 5-nsec and 10-nsec RG8/U cables are available for extending the cable length. A frequency response loss becomes apparent when the cable is extended beyond 20 feet.



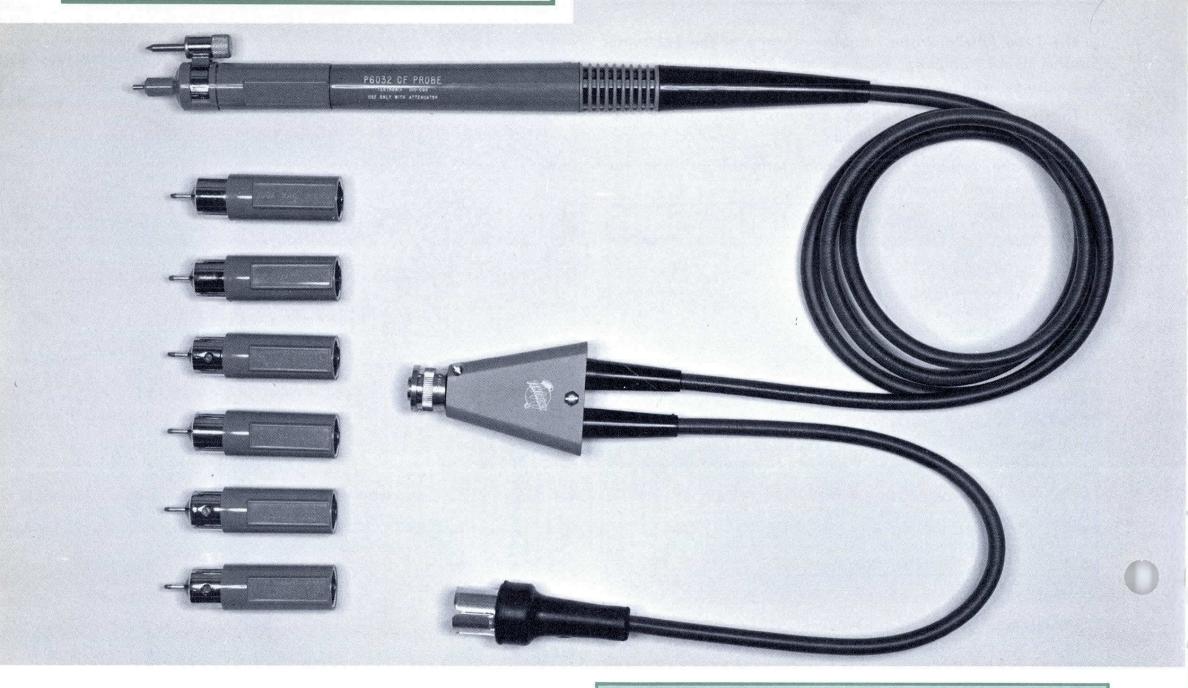


P6026 PROBE, (010-055) \$140

Each probe includes: 7—attenuator heads, 1—50- Ω ac termination, 1—50- Ω dc termination, 1—ground clip, 1—GR connector-to-probe adapter, 1—50- Ω 10-nsec cable, 1—carrying case, 1—instruction manual.

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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, Type 4S1, and Type 4S2.

The attenuator heads can be compensated for ac attenuation ratios.

CHARACTERISTICS

RISETIME is typically 0.4 nsec for probe and attenuator head.

MAXIMUM OUTPUT is ± 150 mv into a $50-\Omega$ load.

SIGNAL DELAY is approximately 10 nsec.

POWER REQUIREMENTS are 12.6 v at 180 ma for the filament and +100 v at 12 ma for the plate.

CABLE is 54" long with GR connector.

CAPACITOR-COUPLER HEAD is rated at 0.001 μ fd, 500 v dc. Low frequency 3-db point is 16 cps.

Order Part Number 010-330 \$4

P6032 PROBE, (010-108) \$220

Each probe includes: 7—attenuator heads, 1—capacitor-coupler head, 1—ground-clip assembly, 2—solderable ground-clip assemblies, 1—instruction manual.

P6032 PROBE ONLY (010-098) \$115

Part Number	Attenuator Head	Max. Input Voltage*	Input Capacitance (± 10%)
010-350	10X	± 1.5 v	3.6 pf
010-351	20X	± 3.0 v	2.6 pf
010-352	50X	± 7.5 v	1.8 pf
010-353	100X	± 15 v	1.5 pf
010-354	200X	± 30 v	1.4 pf
010-355	500X	± 75 v**	1.3 pf
010-356	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 Mc for the 1000X attenuator head and 1000 Mc for the 500X attenuator head.

Attenuator			age (peak-to duty factor)	
Head	500 Mc	750 Mc	1000 Mc	1250 Mc
500X	150 v	150 v	150 v	125 v
1000X	300 v	200 v	150 v	125 v

INPUT RESISTANCE at DC of all attenuator heads is $10 \,$ megohms $\pm \,$ 2% .

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P6034 10X PROBE

The P6034 low-capacity, miniature passive probe assists Tektronix Type 4S1, 4S2 and Type 3S76 Pulse-Sampling Plug-In Units in realizing accurate measurements of high-speed repetitive pulses. Risetime of the probe conforms to the risetime of the plug-in units.

Peak-to-peak voltage derating is necessary for CW frequencies higher than 800 Mc.

The probe is marked for attenuation ratio, wattage rating, and resistance of the probe.

CHARACTERISTICS

INPUT CAPACITY is 0.7 pf at 100 Mc.

DC INPUT RESISTANCE is 500 ohms.

INPUT RESISTANCE is 300 ohms at 1 gigacycle.

MAXIMUM DC INPUT is 16 v dc-coupled and 500 v accoupled.

ATTENUATION RATIO is 10X.

MAXIMUM POWER is 1/2 w.

PASSBAND is dc to 3.5 gigacycles (3-db down).

LOW FREQUENCY RESPONSE is approximately 70 kc at 3-db down, ac coupled.

MAXIMUM RINGING AND OVERSHOOT is 2% when using a 25-ohm source.

CABLE LENGTH is 18".

Each probe includes: 1—hook tip, $1-2\frac{1}{2}$ ground strap, 6—ground clips, 2—test jacks, 1—instruction manual.

P6035 100X PROBE

The P6035 low-capacitance miniature passive probe physically resembles the P6034 probe and adheres closely to the risetime of the Type 4S1, 4S2 and Type 3S76 Sampling Plug-In Units when making high-speed repetitive-pulse measurements.

Peak-to-peak voltage derating is necessary for CW frequencies higher than 500 Mc.

The probe is marked for attenuation ratio, wattage rating, and resistance of the probe.

CHARACTERISTICS

INPUT CAPACITY is 0.6 pf at 1 gigacycle.

DC INPUT RESISTANCE is 5 kilohms.

INPUT RESISTANCE is $1.5 \text{ k}\Omega$ at 1 gigacycle.

MAXIMUM DC INPUT is 50 v dc-coupled and 500 v accoupled.

ATTENUATION RATIO is 100X.

MAXIMUM POWER is 1/2 w.

PASSBAND is dc to 1.5 gigacycle (3-db down).

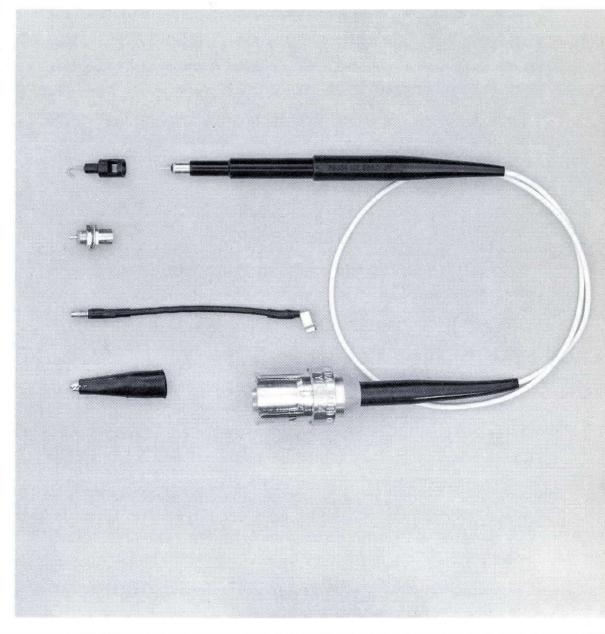
LOW FREQUENCY RESPONSE is approximately 6 kc at 3-db down, ac coupled.

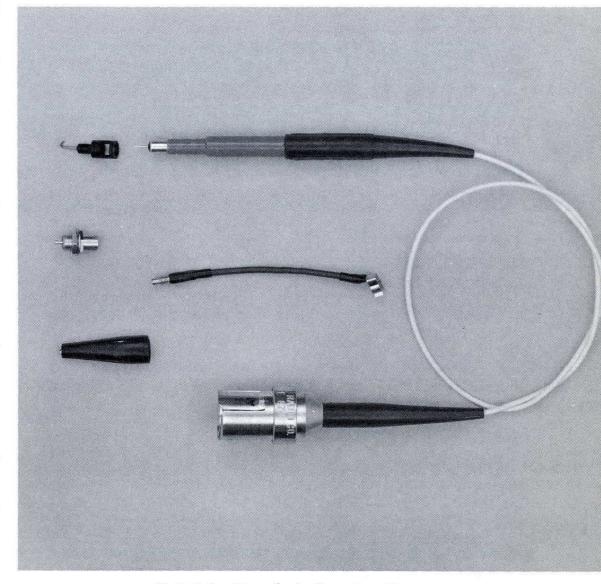
MAXIMUM RINGING AND OVERSHOOT is 2% when using a 25-ohm source.

CABLE LENGTH is 18".

P6035 100X PROBE, (010-111) \$35

Each probe includes: 1—hook tip, 1—2½" ground strap, 6—ground clips, 2—test jacks, 1—instruction manual.





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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 kc to beyond 1 Gc.

Because of its compact size (approx. 2" long, $\frac{9}{16}$ " wide and $\frac{3}{8}$ " thick) the CT-1 is easy to use in crowded circuits. Its insulated case eliminates the possibility of shorting-out adjacent components or wiring.

CHARACTERISTICS

SENSITIVITY is 5 mv/ma into a 50- Ω load. Accuracy is better than \pm 3%.

DECAY is approx. 2% at 100 nsec and 20% at 1 μ sec.

RISETIME is less than 0.35 nsec.

FREQUENCY RESPONSE at the approximate 3-db down points is 35 kc at the low end and 1 Gc at the high end.

INSERTION IMPEDANCE AND CIRCUIT LOADING with a 50- Ω termination is 1- Ω shunted by approximately 5 μ h; without a 50- Ω termination is 2- Ω shunted by approximately 5 μ h. Capacitance added to wire passing through the Type CT-1 is typically 0.6 pf for #20 bare wire and typically 1.5 pf for #14 wire. A #14 wire passing through the Type CT-1 Transformer acts as an approximate 50- Ω transmission line.

MAXIMUM VOLTAGE ON CIRCUIT UNDER TEST is 1000 volts, dc.

DIRECT CURRENT of 0.6 a, changes the pulse response to less than 5% down at 100 nsec and makes the low end 3-db down point 100 kc.

PULSE CURRENT RATING is 100 a, peak, with an ampsecond product of 1 a μ sec. When the ampsecond product is exceeded, the core saturates and the CT-1 output reduces to zero.

RMS CURRENT RATING is 500 ma, maximum.

TEMPERATURE RATING is -25° C to +65° C.

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.

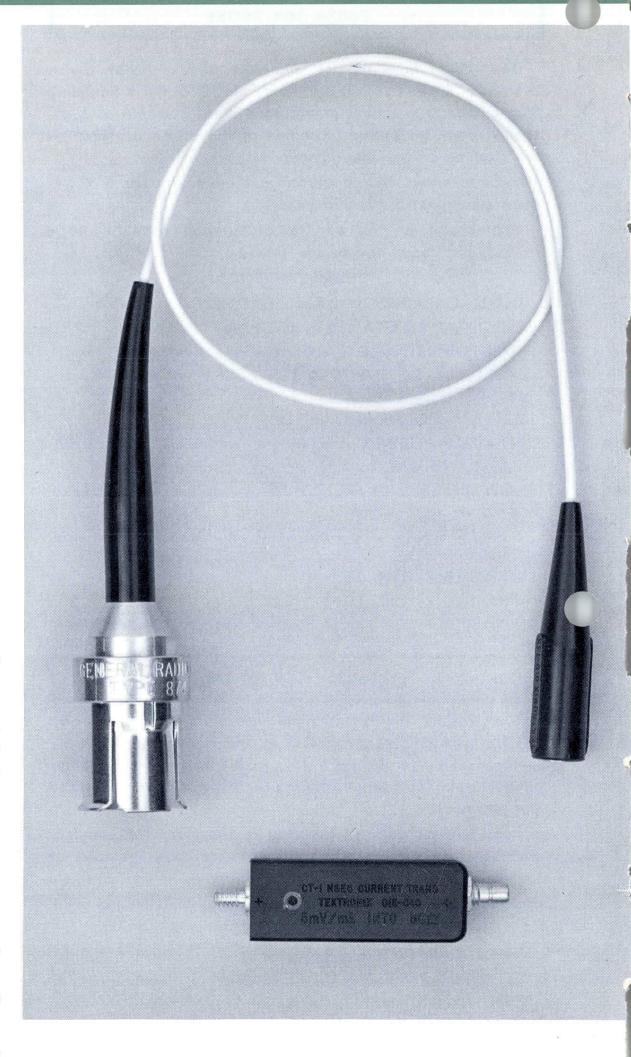
The P6040 can be used with other test-point connectors, such as Amphenol series 27 Sub-Minax or Sealectro Sub-Miniature Rf.

IMPEDANCE is 50Ω .

ATTENUATION is 1X.

OUTPUT CONNECTOR is a GR type.

CABLE LENGTH is 18 inches. Additional $50-\Omega$ cable can be used in series with the probe. RG8/U or RG58A/U is recommended for best preservation of the CT-1 Transformer high-frequency response.



CT-1 AND P60	40 (015-041)	\$31
CT-1 CURRENT	TRANSFORMER (015-040)	1 <i>7</i>
P6040 PROBE	(010-133)	14

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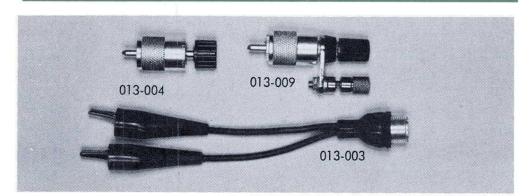
PROBE ACCESSORIES

IDENTIFICATION TAGS

Probe identification tags for multi-probe applications help locate correlating probe ends quickly. One package contains 2 each of 10 colors.

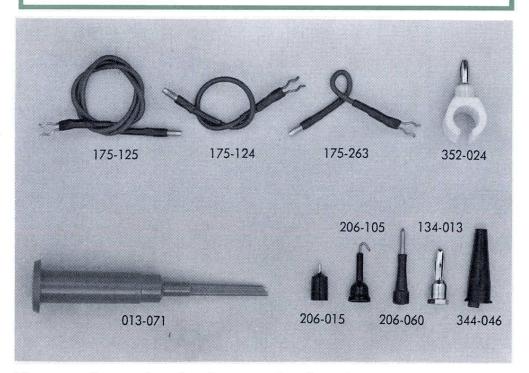
Order Part Number 334-798 \$1.25

ADAPTERS



Description	Part Number	Price
Adapter, clip lead BNC	013-076	\$3.00
Adapter, clip lead UHF	013-003	3.00
Adapter, binding post	013-004	2.00
Binding Post Adapter, with ground	d	
terminal, 3/4" spacing	013-009	3.25

PROBE TIPS AND GROUND LEADS



Tips are for probes having a 6-32 thread size.

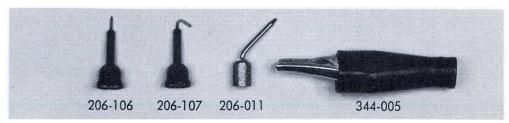
Description	Part Number	Price
Short Straight Shank	206-015	\$.25
Hook Shank	206-105	.25
Spring Tip	206-060	.50
Banana	134-013	.10
Pincher	013-071	2.00
Holder	352-024	.25
3-inch Ground Lead	175-263	.55
5-inch Ground Lead	175-124	.50
12-inch Ground Lead	175-125	.55
Minigator Clip	344-046	.15



SPECIAL-PURPOSE TIPS AND ADAPTERS

The following tips have a 6-32 thread size.

Description	Part Number	Price
Straight Shank, fits 0.082" pin jacks	206-045	\$.25
Long Straight Shank	206-104	.25
Spring Tip, without shank	206-061	.40
Recessed, fits 0.065" recessed pin	or	
plug	206-052	.45
Straight Shank, similar to 206-045 wi	th	
insulation	206-054	.25
Adapts probe to male BNC connected	or 013-056	4.50
Probe tip to BNC adapter		
(for P6006 and P6008)	013-054	4.50
Probe tip to BNC adapter		
(for P6025, P6026, P6032)	013-057	4.50
Ground Clip Assembly	010.007	0.50
(for P6025 and P6026)	013-037	2.50



SPECIAL-PURPOSE TIPS FOR P170CF, P500CF AND P410 PROBES

The following tips are for probes having a 10-32 thread size.

Description	Part Number	Price
Hook Shank	206-107	\$.25
Straight Shank	206-106	.25
Bent Shank, fits 0.082" pin jacks	206-011	.25
Alligator-Clip Assembly	344-005	.40

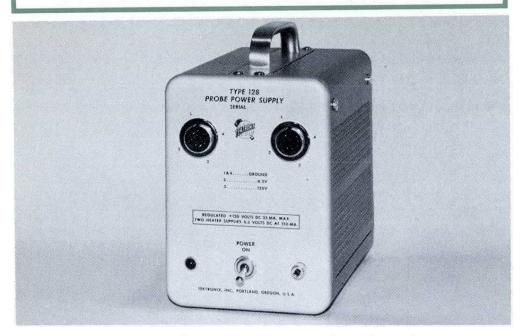
POWER CABLE EXTENSION

Probe Power-Cable Extension—A 30" 3-conductor power-cable extension for Tektronix P170CF and P500CF cathode-follower probes, permits wider separation of the probe power source from the instrument signal input.

Order Part Number 012-030 \$7.50

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PROBE POWER SUPPLY



The Type 128 Probe Power Supply furnishes the necessary plate and filament voltages for cathode-follower probes such as the Tektronix P170CF and P500CF.

The two probe connections use separate $+6.3 \,\mathrm{v}$ dc voltage supplies.

PLATE SUPPLY is +120 v dc, regulated, at 25 ma.

HEATER SUPPLIES consist of two unregulated $+6.3 \, \text{v}$ dc at 150 ma.

PLATE SUPPLY RIPPLE is 5 mv pk-to-pk, maximum.

HEATER SUPPLY RIPPLE is 75 mv pk-to-pk, maximum.

POWER REQUIREMENTS are 105 to 125 v or 210 to 250 v, 50 to 800 cps, 25 watts (with P500CF probes).

MECHANICAL FEATURES include an aluminum-alloy chassis, three piece blue vinyl-finish cabinet, anodized front panel.

Dimensions are $7^3/_4$ " high by $4^3/_4$ " wide by 9" deep. Net weight is 6 pounds. Shipping weight is 12 pounds, approximately.

TYPE 128 PROBE POWER SUPPLY \$110

Each instrument includes: 1—3-conductor power cord, 2—instruction manuals.

INPUT TIME-CONSTANT STANDARDIZERS



Five input time-constant standardizers are available for standardizing input capacitances of 12 pf, 15 pf, 20 pf, 24 pf, and 47 pf. Each standardizer has an approximate 1 megohm impedance and 2X voltage attenuation.

12 pf (011-051	UHF) (011-065	BNC)	\$10.00
15 pf (011-073	BNC)	********	\$10.00
20 pf (011-022	UHF) (011-066	BNC)	\$10.00
24 pf (011-029	UHF) (011-067	BNC)	\$10.00
47 pf (011-030	UHF) (011-068	BNC)	\$10.00

SAMPLING ACCESSORIES



ADAPTERS

	Part No.	Price
GR to C male	017-027	\$6.25
GR to N male	017-021	\$4.50
GR to UHF female	017-022	\$4.00
GR to UHF male	017-023	\$4.25
GR to BNC female	017-063	\$4.75
GR to BNC male	017-064	\$5.25
GR to C female	017-065	\$5.50

DELAY CABLE (GR-TYPE CONNECTORS)

	Part No.	Price
10 ns	017-501	\$12.25
5 ns-RG8	017-502	\$19.25
1 ns	017-503	\$ 7.50
20 ns	017-504	\$16.50
2 ns	017-505	\$13.50
9 ns	017-506	\$ 8.25
_5 ns-RG58	017-512	\$19.25

ACCESSORIES WITH GR-TYPE CONNECTORS

	Part No.	VSWR Rating	Price
50Ω 10:1 Attenuator	017-044	<1.1 to 1 GC	\$20.00
50Ω 5:1 Attenuator	017-045	<1.1 to 1 GC	\$20.00
50Ω 2:1 Attenuator	017-046	<1.1 to 1 GC	\$20.00
50 Ω Termination	017-047	<1.1 to 1 GC	\$20.00
50 Ω Type 874-K Coupling			
Cap	017-028	< 1.06 to 1 GC	\$ 9.45
50 Ω Type 875-X Insertion			NAMES OF STREET
Unit	017-030	_	\$11.50
50 Ω Type 874-EL 90°			
Elbow	017-070	< 1.06 to 2 GC	\$ 8.50
		<1.5 to 4 GC	
50 Ω Type 874-T Tee	017-069		\$11.00
50Ω to 125Ω Min Loss	manage same		1
Attenuator	017-052	<1.2 to 1 GC	\$30.00

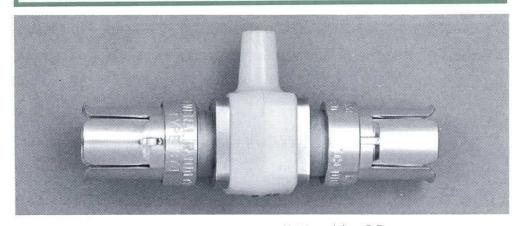
CALIBRATOR ADAPTER

The Adapter is basically intended for use with the Type N Plug-In Unit, but can be used with any Tektronix sampling system except those incorporating the Type RM561 and Type 567 Oscilloscopes. The Adapter converts a 50-volt output from the oscilloscope calibrator to 40 mv at 50-ohm impedance, for use in calibrating the gain of the sampling systems.

Order	Part	Number	(017-010	UHF)		\$20
			(017-074	BNC)	****	\$20

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Please refer to Terms and Shipment, General Information page.

50-OHM PICKOFF "T"



The VP-1 is a 50-ohm coaxial "T" with GR connectors on each end. A plastic center collar provides a branch for insertion of a P6034 or P6035 Miniature Passive Probe.

With the VP-1 you can inspect signals within a 50-ohm system, provide a trigger takeoff . . . with transient reflection coefficients of less than 2% with either probe, or less than 3% without probe, as seen on a Type 4S1. Resistive reflection depends upon probe used.

Order Part Number 017-073 \$25

TIMING STANDARD

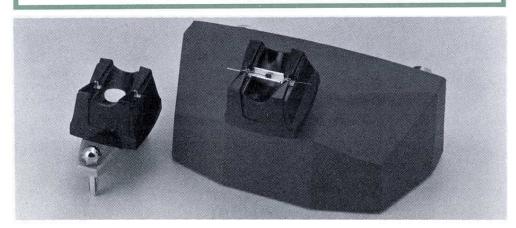
The Timing standard is a 3% device for calibrating equivalent sweep speeds of the Tektronix sampling systems. It is designed to ring at periods of 1, 2, 5, and 10 nsec when excited by a fast-rising pulse.

TRANSFORMER MATCHED "T"

This unit provides two 50-ohm outputs from one 50-ohm input and divides the regenerated trigger for simultaneous triggering of two sampling sweep systems.

Order Part Number 017-012 \$45

DIODE TEST JIGS

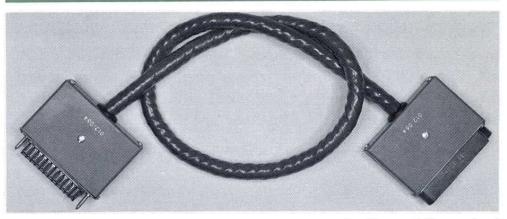


DIODE TEST JIG for the **Type 291 DIODE SWITCHING TIME TESTER** uses magnetic attraction to assure good electrical contact with either round or ribbon lead diodes. The diode is pulled into electrical contact with the terminals and, yet, easily removed without shock hazard.

The jig has excellent transient response when used with the adapter that operates directly with the Type 291.

Adapter for Type 291, part number 017-075 \$55 Jig for Adapter, part number 013-080 \$40

PLUG-IN UNIT ACCESSORIES

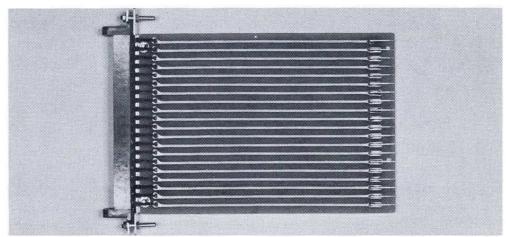


FLEXIBLE EXTENSION — 30" long, permits Type 661 vertical or sweep plug-in units to be operated away from oscilloscope. See Gremar Cable.

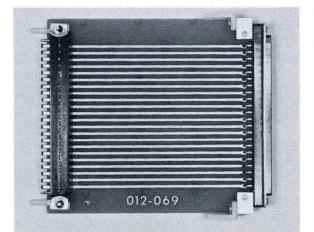
Order Part Number 012-064 \$23.00

FLEXIBLE EXTENSION — 30" long, permits Type 3S76 and Type 3T77 Sampling Plug-In Units to be operated away from oscilloscope.

Order Part Number 012-066 \$23.00



Order Fart Number 012-007 \$20.00





TYPE 4S1 SUB-CHASSIS EXTENSION — Allows maintenance of Type 4S1 sub-chassis when 4S1 is extended out of oscilloscope.

Order Part Number 012-069 \$25.00

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 012-070 \$10.50

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INPUT ADAPTERS—ATTENUATORS—TERMINATIONS

Each accessory is marked as to type, ratio, maximum power, and correct orientation. Attenuators with UHF, GR, and TEKTRONIX 125-ohm connectors have color-coded bands that designate the attenuation ratio. Gold-plated connectors designate all 125-ohm ends.

ACCESSORIES WITH UHF-TYPE CONNECTORS

Description	Part Number	Price
$50-\Omega$ 10:1 attenuator	011-031	\$16.00
$50-\Omega$ 5:1 attenuator	011-032	16.00
75- $Ω$ 10:1 attenuator	011-033	16.00
$75-\Omega$ 5:1 attenuator	011-034	16.00
93- Ω 10:1 attenuator	011-035	16.00
93 Ω 5:1 attenuator	011-036	16.00
50-Ω termination	011-045	15.00
75 Ω termination	011-046	15.00
93-Ω termination	011-047	15.00
$170-\Omega^*$ termination	011-048	15.00
$50-\Omega$ to $75-\Omega$ min. loss atten.	011-041	16.00
$50-\Omega$ to $93-\Omega$ min. loss atten.	011-042	16.00
$50-\Omega$ to $170-\Omega$ min. loss atten.	011-043	16.00
* vswr less than 1.25 up to 30 mc.		

ACCESSORIES WITH GR-TYPE CONNECTORS

$50-\Omega$ 10:1 attenuator	017-044	\$20.00
$50-\Omega$ 5:1 attenuator	017-045	20.00
$50-\Omega$ 2:1 attenuator	017-046	20.00
50- Ω termination	017-047	20.00

ACCESSORIES WITH TEKTRONIX 125-Ω TYPE CONNECTORS

$125-\Omega$ 2:1 attenuator $125-\Omega$ 5:1 attenuator	017-071 017-049	\$25.00 30.00
$125-\Omega$ 10:1 attenuator	017-050	30.00
125- Ω termination 125- Ω to 200- Ω H. P.	01 <i>7-</i> 051 01 <i>7-</i> 038	20.00 20.00

ACCESSORIES WITH GR-TEKTRONIX $125-\Omega$ TYPE CONNECTORS

50-Ω t	o 125-Ω	min. loss atten.	017-052	\$30.00
$125-\Omega$	adapter	N50/N125	017-053	17.50
$125-\Omega$	adapter	N50/T125	017-054	17.50
$125-\Omega$	adapter	T50/N125	017-055	23.00

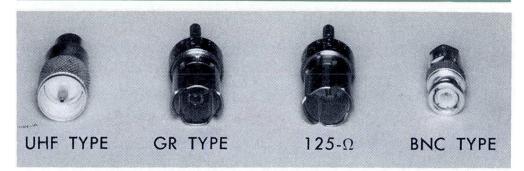
ACCESSORIES WITH BNC-TYPE CONNECTORS

50- $Ω$ termination	011-049	\$ 8.75
75-Ω termination	011-055	8.75
93- Ω termination	011-056	8.75
50- Ω 10:1 attenuator	011-059	8.75
75- $Ω$ 10:1 attenuator	011-061	8.75
93- Ω 10:1 attenuator	011-062	8.75
$50-\Omega$ to $75-\Omega$ min. loss attenuator	011-057	8.75
50 - Ω to 93 - Ω min. loss attenuator	011-058	8.75
$50-\Omega$ 5:1 attenuator	011-060	16.00
170- Ω termination	011-063	15.00

TERMINATION BLOCKS W/O ELECTRICAL COMPONENTS

111/16'' block with UHF connector	
Order Part Number 011-019	\$5.00
27/16" block with UHF connector	M. Darrison
Order Part Number 011-020	\$5.00
	40.00

CONNECTOR TYPES



Tektronix adapters, attenuators, and terminations use four types of connectors allowing the accessories to be used in a diversified area of applications.

Accuracy of Indicated Attenuation Ratio:

UHF		$\pm 2\%$	at	dc;	$\pm 3\%$	at	100 megacycles.
GR		$\pm 2\%$	at	dc;	$\pm 3\%$	at	1 gigacycle.
TEKTRONIX 1	25Ω	$\pm 2\%$	at	dc;	$\pm 3\%$	at	1 gigacycle.
BNC		±2%	at	dc;	$\pm 3\%$	at	100 megacycles.

Voltage Standing Wave Ratio:

UHF		less	than	1.2	up	to	100 megacycles.
GR		less	than	1.1	up	to	1 gigacycle.
TEKTRONIX	125Ω	less	than	1.1	up	to	1 gigacycle.
BNC							100 megacycles.

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:

Co	nne	ection	E _{out} /E _{in}
50Ω	\rightarrow	75Ω	0.63
75Ω	\rightarrow	50Ω	0.42
50Ω	\rightarrow	93 Ω	0.59
93 Ω	\rightarrow	50Ω	0.32
50Ω	\rightarrow	125Ω	0.56
125Ω	\rightarrow	50Ω	0.23
50Ω	\rightarrow	170Ω	0.54
170Ω	\rightarrow	50Ω	0.16

All attenuators, with the exception of minimum-loss types, are T-type attenuators.

B170-A ATTENUATOR

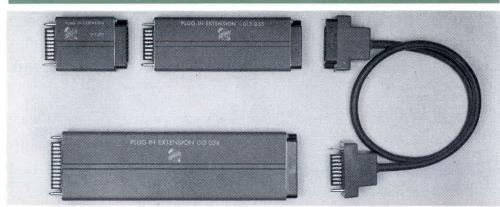


 $170-\Omega$ pi-attenuator, uses 2% precision resistors, 1 to 64 db in 1 db steps, 0.25 watt.

Order Part Number 011-017 \$60.00

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PLUG-IN UNIT ACCESSORIES



PLUG-IN EXTENSIONS—allow unit to be operated partially out of the oscilloscope:

For units in Type 560-Series Oscilloscopes
Order Part Number 013-034
For units in Type 530-, 540-, 550-, 580-Series Oscilloscopes
Order Part Number 013-055 \$14.50
For Type R Unit only
Order Part Number 013-015
For Type 21A and 22A Time-Base Units

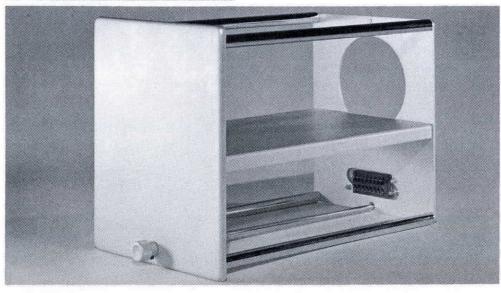
FLEXIBLE EXTENSION—30" long, permits A to Z Plug-In operation away from the oscilloscope. Useful for trouble-shooting—do not use for plug-in calibration.

Order Part Number 012-038 \$20.00



GAIN ADJUST ADAPTER—Permits an external calibrating signal to bypass the plug-in preamplifier, for calibrating the sensitivity of the main amplifier of Types 530, 540 and 550-Series Oscilloscopes.

Order Part Number 013-005 \$15





MOUNTING ACCESSORIES

CRADLE-MOUNT—For rack mounting cabinet-type oscilloscopes. Each cradle-mount consists of a cradle (or "shelf") to support the instrument in any standard 19" relay rack, and a mask to fit over the regular instrument panel. Blue vinyl finish.

For Type 507 and Type 551 instruments (2 masks, 2 cradles). Rack height requirements; Indicator mask 17½", Power Supply mask 12½".

For Type 555 (2 masks, 2 cradles). Rack height requirements: Indicator mask 21", Power Supply mask 121/4".

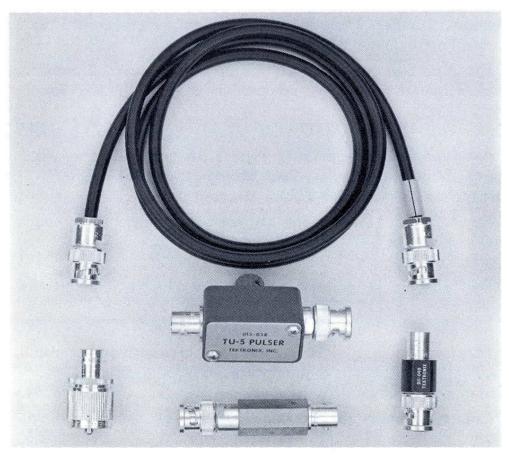
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TEST UNITS



TYPE TU-2 TEST-LOAD PLUG-IN UNIT—The unit is used to check Tektronix Type 530, 540, 550-Series Oscilloscope power-supply regulation under high load and low load demands of A to Z plug-in units. It can also be used to check vertical amplifier balance, vertical amplifier gain, and dual-trace function of the oscilloscope.

TYPE TU-2 TEST UNIT \$75



TYPE TU-5 PULSER—The TU-5 tunnel diode pulser generates a fast-rise, flat-top square wave designed to aid in adjustment of transient response of the Tektronix 80-Series Plug-In Units. It can also be used with letter series and sampling plug-in units. When used with letter-series plug-in units the pulser is sufficiently fast to show the 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 1.5 nsec into 50 ohms.

AMPLITUDE—at least 200 mv with 50-ohm termination, 20 mv with 10X attenuator and 50-ohm termination.

PULSE WIDTH—about 0.5 msec, dependent on oscilloscope calibrator output, (oscilloscope calibrator is 1 kc).

OUTPUT IMPEDANCE—50 ohms (25 ohms when used with 50 ohm termination).

SOURCE VOLTAGE—100 volt square wave (10 ma) from the oscilloscope calibrator output.

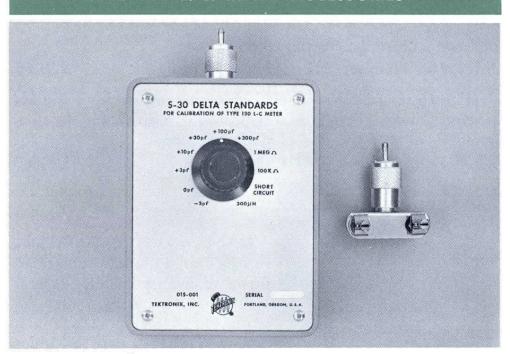
REPETITION RATE—same as source voltage (1 kc from oscilloscope calibrator output).

BNC CONNECTORS—for input and output.

TU-5 PULSER (part no. 015-038) \$25.00

TU-5 PULSER with accessories (part no. 015-043) \$46.50 Includes one each: 50-ohm 10X BNC attenuator, 50-ohm BNC termination, BNC cable, UHF to BNC adapter.

TYPE 130 L. C. METER ACCESSORIES



DELTA STANDARDS—For calibration of the Type 130 L-C Meter. The unit provides accurate steps of capacitance and inductance, selectable by a rotary selector switch. Values of the capacitance steps correspond to the full-scale adjustments required on the five scales of the Type 130. Two resistors of identical manufacture and similar capacitance, values of 1 megohm and 0.7 megohm, are provided for the resistance compensation adjustment. A 300-µh standard permits proper adjustments of the inductance ranges.

Order Part Number 015-001 \$40

PRODUCTION TEST FIXTURE—For use with the Type 130 L-C Meter. Speeds sorting and testing of capacitors and inductors.

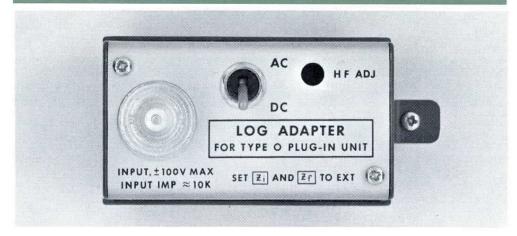
Order Part Number 013-001\$5

CRYSTAL OVEN

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TYPE "O" PLUG-IN UNIT ACCESSORIES

LOGARITHMIC AMPLIFIER ADAPTER



The Logarithmic Amplifier Adapter converts linear amplification characteristics of the A or B operational amplifiers in the Type O Operational Amplifier Plug-In Unit to approximate logarithmic characteristics.

CHARACTERISTICS

ALLOWABLE INPUT SIGNAL— $\pm 100 \, \text{v}$ 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 \pm 0.1 v to \pm 100 v.

Signal-In	Deflection
\pm 0.1 v	$1~\mathrm{cm}~\pm~0.5~\mathrm{mm}$
\pm 1.0 v	$2~{\rm cm}~\pm~0.5~{\rm mm}$
\pm 10.0 v	$3~\mathrm{cm}~\pm~1.0~\mathrm{mm}$
\pm 100 v	$4 \text{ cm} \pm 1.0 \text{ mm}$

Below an input level of \pm 0.05 v, the amplifier is no longer logarithmic.

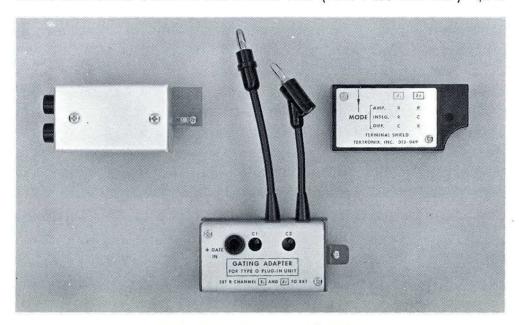
RISETIME—Typically 0.2 μsec —for a 10-v signal to rise from 0.1 v to 10 v.

FALLTIME—Typically 0.3 μ sec—for a 10-v signal to fall from 10 v to 0.1 v.

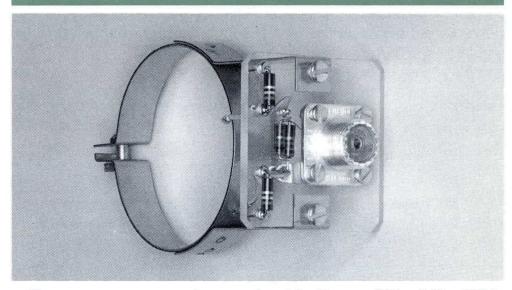
LOW FREQUENCY RESPONSE—65 cps. (In the AC-coupled mode, the 3-db point for signals of over 500 mv peak amplitude, and where the effective input resistance is 10 k).

PASSBAND—The —3-db apparent passband varies with both signal amplitude and signal dc level. It varies typically from 400 kc to 1 Mc, depending on the input signal.

LOGARITHMIC AMPLIFIER ADAPTER (Part No. 013-067) \$75



DEFLECTION PLATE CONNECTOR



The connector can be used with Types 530, 540, 530A, and 540A-Series Oscilloscopes. It provides a convenient means of making a connection directly to the cathode-ray tube vertical deflection plates. It is designed for use with high-frequency, fast-rise pulses or transient signals. The function of the vertical position control of the oscilloscope is retained. The connector is designed for use with 52-ohm cables. The connector is not recommended for use with frequencies below 8 kc or pulses with correspondingly slow risetimes.

For instruments with serial numbers 5001 and above, Order Part Number 013-007\$10

DUAL-INPUT SWITCHING ASSEMBLY

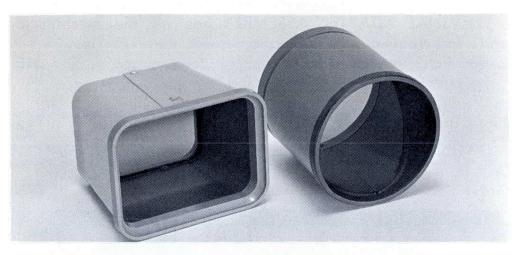
VIEWING ACCESSORIES



BEZEL—For mounting cameras, other than Tektronix types, on Tektronix 5" Oscilloscopes. Dimensions— $5\frac{7}{8}$ " square; ring $\frac{7}{8}$ " deep, diameter $\frac{55}{8}$ " outside, $\frac{51}{8}$ " inside. Die-cast construction.

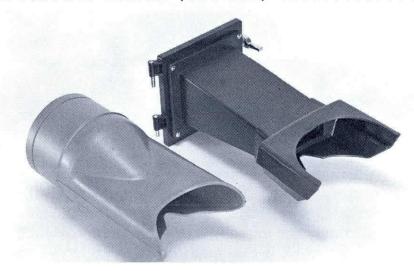
Order Part Number 014-011 \$4.50

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POLARIZED VIEWERS—For Tektronix 5" Oscilloscopes. The viewers reduce troublesome reflections and glare under high ambient-light conditions.

ROUND	VIEWER	(016-0	35)			 	•				•	\$10
RECTAN	GULAR V	IEWER	(016-	039)	 				•		10



VIEWING HOOD—For Tektronix 3" Oscilloscopes except Type 321 below S/N 3210. Includes molded rubber eyepiece and separate tubular light shield.

Order Part Number 016-002 \$4.50

VIEWING HOOD—For Tektronix Type 519 Oscilloscope.
Order Part Number 016-025\$ 36.50

CARRYING CASES

BATTERIES

NiCd CELLS— $3\frac{1}{2}$ A.H., rechargeable, for Type 321 Portable Oscilloscope.

Order 10—(Part Number 146-005), \$7.00 each \$70.00

TYPE Q PLUG-IN UNIT RESISTOR BOARDS

120-OHM PLUG-IN RESISTOR BOARD	
Order Part Number 013-025	\$2.25
150 K-OHM PLUG-IN RESISTOR BOARD	
Order Part Number 013-026	2.25

TYPE R PLUG-IN UNIT PLATE WIRED ASSEMBLIES

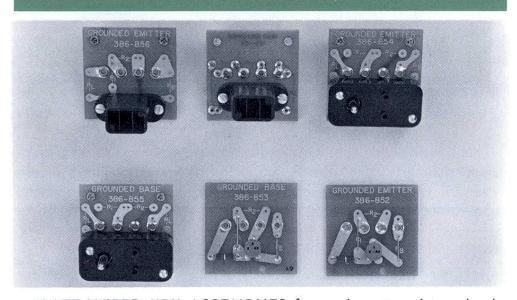
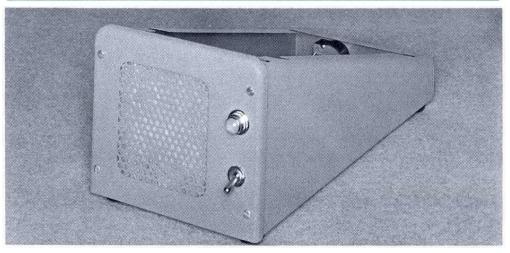


PLATE WIRED "R" ASSEMBLIES for various transistor checks Part No. Description Price 386-852 grounded emitter socket \$1.50 386-853 grounded base socket 1.50 grounded emitter power socket 386-854 2.50 grounded base power socket 386-855 2.50 386-856 grounded emitter adapter 2.50 386-857 grounded base adapter 2.50

FAN BASE



310A FAN BASE provides filtered forced-air ventilation to reduce operating temperature when the Type 310A is used continuously for prolonged periods of time or in a hot or limited-ventilation area.

GROUND CONNECTOR

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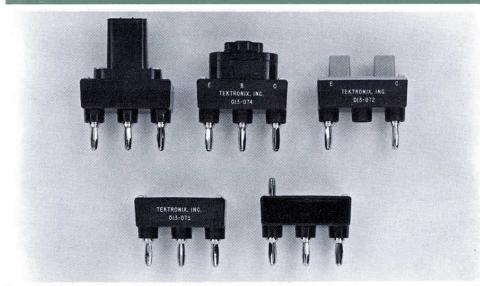
TYPE 570 ADAPTER PLATES



With Jacks Installed

Part No.	Description	Price
016-004	7-pin adapter plate	\$10.00
016-005	8-pin adapter plate	10.00
016-006	9-pin adapter plate	10.00
016-007	blank adapter plate	5.00
016-040	13-pin Nixie Base	12.50
016-041	5-pin Nuvistor Twelvar Base	10.00
016-042	7-pin Nuvistor Twelvar Base	10.00
016-043	12-pin Compactron duodecar Base	12.50
016-044	9-pin Novar Base	10.00

TYPE 575 TRANSISTOR ADAPTERS



Part No.	Description	Price
013-069	3-terminal (for wide lead transistors)	\$5.00
013-070	3-terminal (for 2-pin base power transistors	s) 5.50
013-072	Diode Test Jig	3.50
013-073	Blank Adapter Box	3.00
013-074	Power Transistor Adapter	5.00
	(for transistors with hook leads)	

TYPE 519 ACCESSORIES



Part No.	Description	Price
017-019	1000 Mc Timing Standard	\$35.00
017-032	Double Button Contact Assembly	2.25
017-033	Connector Panel Assembly	7.00
017-057	Delay Line Equalizer	10.00
175-098	Crt Input Cable	23.55

ADDITIONAL 125 Ω ACCESSORIES

Other than those listed under Oscilloscope Input Adapters, Attenuators and Terminations.

Part No.	Description	Price
017-009	1.4:1 for 125 Ω Connector	\$25.00
017-013	Insertion Unit	10.00
017-018	Coupling Capacitor	10.75
017-035	Cable Connector Spare Kit	7.00
017-043	90° Elbow Assembly	15.00
017-507	1 nsec delay cable, RG63/U	16.50
017-508	2 nsec delay cable, RG63/U	16.00
017-509	5 nsec delay cable, RG63/U	16.75
017-510	10 nsec delay cable, RG63/U	17.50
017-511	20 nsec delay cable, RG63/U	24.00

MISCELLANEOUS ADAPTERS

	#네트라이네 # 5명 보안 (Start) [20 10 10 20 20 20 10 10 10 10 20 20 20 20 20 20 20 20 20 20 20 20 20	
Part No.	Description	Price
103-013	Power Cord, 3 wire to 2 wire,	\$.40
103-015	UHF Male to BNC Female	2.75
103-025	UHF Female to Female	1.45
103-026	UHF T Male to 2 Female	3.40
103-027	UHF Elbow	2.15
103-028	BNC Female to Female	2.40
103-029	BNC Male to Male	5.45
103-030	BNC T Male to 2 Female	4.60
103-031	BNC Elbow	3.70
103-032	Male BNC to Female UHF	3.55
103-033	BNC to Binding Post	1.60
103-035	BNC Dual Binding Post	5.35

MISCELLANEOUS CABLES

		ACTION COST
Part No.	Description	Price
012-001	42 inches long, 52 ohms nominal impedance, Output Cable	\$ 4.00
012-003	42 inches long, 93 ohms nominal impedance, Output Cable	4.00
012-004	42 inches long, 93 ohms, Output Cable terminated with variable attenuator	13.50
012-005	42 inches long, 93 ohms, Output Cable terminated with ½ watt 93-ohm resistor	5.00
012-006	42 inches long, 170 ohms nominati impedance, Output Cable	9.50
012-009	Battery Cable, for Type 122	15.00
012-012	Inter-connecting Cable for Type 517	20.00
012-016	20 inches long Inter-connecting Cable for Type 160 Generator and Type 360	7.00
012-017	10 inches long Inter-connecting Cable for Types 161, 162, and 163 Generators	5.00
012-022	30" two-conductor Shielded Cable (53/54E)	6.00
012-032	30" Inter-connecting Cable for 551, 507, 517, 555	27.00
012-034	5 feet long 170-ohm Coaxial Cable for Type 127 Power Supply	5.00
012-040	Input Cable for Q Unit	12.00
	(continu	ued)

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

Part No. Description Price 012-031 18 inches long, red patch cord w banana plug at both ends	th \$1.20
012-043 Transistor Test Cable—Red Plug \$ 9.00 012-039 Same as 012-031, only black for 175 012-055 Master and slave patch cord for	1.20 the 3.75
012-044 Transistor Test Cable—Black Plug 9.00 Type N Plug-In Unit	J.75
012 045 175 Adapter Socket Cald	
012-051 6 feet long Inter-connecting Cable 28.40	
I MILLION DESCRIPTION	Price
Type N Plug-In Unit	\$1.60
012-053 30" Horizontal Input Cable for 7.50 w/male plug other end open 8 feet long, 16 gage, 2 conductor	
Type N Plug-In Unit with banana and UHF connector 161-004 8 feet long, 16 gage, 2 conductor 8 feet long, 16 gage, 3 conductor	
w/male & female plus	
(banana plua ends) 161-006 10 feet long, 18 gage, 3 conductor	r, 6.10
012-057 50 Ω Coax Cable assembly with 11.35 w/male plug only, other end ope	
BNC assembly 161-00/ 8 feet long, 18 gage, 2 conductor	3.70
012-059 Cable Adapter A100 3.50 rt. angle female plug & straight	
012-072 5 feet 4-conductor Input Cable for 10.00 male plug	
Type 2A61 Plug-In 161-010 8 feet long, 16 gage, 3 wire w/m	
175-074 4-inch 50 0 regenerated trigger input 8.00 & temale (parallel blades) round	round
for the Type N Unit 161-013 8 feet long, 18 gage, 3 conductor	rt. 4.15
and formale plus straight male a	
7 men, signal import (ROSS) for the 0.15 161 014 20 inches long 14 gags 2 with	1.40
161 015 9 foot long 20 gags 2 wins AC	3.20
173-002 6-mcn, 50 12 external frigger and 16.00	
1/1 01/ 0 (1 00 0 00 0 00 0 00 0 00 0 0	
Cellerator	2.70
175-094 Charge line for Type 111 Generator 5.55 w/female connector (gray vinyl)	1.05
175-095 Pre-trigger output for Type 111 Generator 5.40 161-017 8 feet long, 18 gage, 3 wire, w/r	ale 1.95
175-096 Pulse output for Type 111 Generator 8.10 connector one end (gray vinyl)	
175-097 Mercury Trigger Cable for Type 110 8.05 161-019 8 feet long, 18 gage, 3 wire, w/n Generator & female	ale 5.00
175-151 135/8 inches long input coaxial for Type 2.60	
RM527 Oscilloscope PLEXIGLASS LIGHT FILTERS	
175-154 15 inches long input coaxial for Type 2.30	
Type 527 Oscilloscope Part No. Description	Price
175-155 18 inches long input coaxial for Type 2.65 378-505 3" green	.50
527 Oscilloscope 378-506 3'' amber	.50
$175-156$ $16\frac{1}{2}$ inches long input coaxial for Type 2.05 $378-507$ 3" blue	.50
527 Oscilloscope 378-508 3'' yellow	.50
175-157 17 inches long input coaxial for Type 3.05 378-509 $3\frac{5}{16} \times 3\frac{9}{16}$ green	.50
527 Oscilloscope 378-510 3 ⁵ / ₁₆ x 3 ⁹ / ₁₆ blue	.50
378-511 3 ⁵ / ₁₆ x 3 ⁹ / ₁₆ amber	.50
378-512 35/16 x 39/16 yellow	.50
MISCELLANEOUS CORDS AND LEADS 378-514 5" green with cam hole	.90
378-515 5" blue with cam hole	.90
Part No. Description Price 378-516 5" amber with cam hole	.90
$378-521$ 3" x 2^{3} /" green	.50
012-014 Approximately 3 feet long, black output \$2.50 378-523 3" × 23/" blue	1.15
lead with banana plug at one end 378-524 3" x 23/" ambor	1.10
and an alligator clip at the other 378-525 55/. × 413/. green	
1117-1115 Same as $1117-1114$ only red	.60
1117-1173 6 Inches long black patch cord with	.90
hanging plug and jack combination at	.90
both ends $378-536$ $3\frac{1}{2} \times 4\frac{1}{2}$ amber	.90
012-024 Same as 012-023, only red 1.15	
012-025 6 inches long, 100-ohm suppressor 3.00 GRATICULES	
cord with banana plug at both ends	
	Price
one of the less fortige, 300-online suppressor	
Total with pariation program both chas	5.75
012-027 6 inches long, 1-kilohm suppressor 3.00 1/4" division, for Type 315 Oscillos	
cord with banana plug at both ends 331-006 5-inch with 6 vertical/10 horizonta	2.90
012-028 6 inches long, black patch cord with 2.00 centimeter divisions, for Type 512	
	ontinued)
012-029 Same as 012-028, only red 2.00 U.S. Sales Prices f.o.b. Beaverton, Oregon	
Please refer to Terms and Shipment, General Informa	ion page.

Part No.	Description	Price	Part No. Description Price
331-007	5-inch with 4 vertical/10 horizontal	\$ 2.90	
331-007	centimeter divisions, for Type 513	ψ 2.70	331-097 5-inch with 8 vertical/10 horizontal \$2.30 centimeter divisions for Type 564
331-008	5-inch with finished 4 vertical/8	8.05	331-105 5-inch blank for Type 503, 504, 560, 1.45
	horizontal centimeter divisions,		561 and 661 Oscilloscopes
	for Type 517 Oscilloscope		
331-009	5-inch with RMA ruling for percentage	3.45	UNSCRIBED GRATICULES
221 017	measurements, for Type 524 Oscilloscope	2.90	UNSCRIBED GRATICULES
331-016	5-inch with 6 vertical/10 horizontal centimeter divisions	2.70	Part No. Description Price
331-027	3-inch with 8 vertical/10 horizontal	1.75	
	1/4" divisions for Type 310 Oscilloscope		386-395 For Types 310, 310A, 316, RM16 1.25 RS16, 317, RM17, and 360
	and Type 360 Indicator		386-451 For Type 517, 507, 515A, RM15, 516, 1.45
331-028	5-inch with 10 vertical/10 horizontal	2.90	530-Series, 540-Series, 551 (Mod 108A)
331-030	⁵ / ₁₆ " divisions for Type 570 5-inch (without cam) with 4 vertical/8	8.05	
331-030	8 horizontal centimeter divisions, for	0.03	DIRECT REPLACEMENT CATHODE RAY TUBES
	Type 517A Oscilloscope		
331-031	5-inch, 3.4 cm x 8.5 cm, spec 540 H.V.	2.90	All Tektronix direct replacement Crt's are under a new
331-033	5-inch with 4 vertical/8 horizontal	2.90	numbering system that provides more flexibility for future
001 004	centimeter divisions, for Type 517A	0.00	designations of the crt's.
331-034	5-inch (with cam) with 4 vertical/10 horizontal centimeter divisions for	2.90	Francis 75410 21 1
	Type 540-Series Oscilloscopes		Example T5610-31-1 tube type-phosphor-internal graticule design variation
331-035	5-inch with—40 to +100 vertical	3.45	Tube Type - phosphor - Internal grancole design variation
	centimeter divisions for percentage		In the following list, phosphor designation is eliminated
	measurements on Type 525		in order to avoid much repetition. Replacement crt's are
331-037	5-inch (with cam) with 6 vertical/10	2.90	normally available with phosphors P1, 2, 7, 11, or 31.
331-039	horizontal centimeter divisions For Type 190A/190B Generator above	1.05	It will be necessary to specify the phosphor desired when
331-037	s/n 5000	1.03	ordering. Other phosphors are available on special order.
331-042	3-inch with 8 vertical/10 horizontal	1.75	Consult your Tektronix Field Engineer for particulars.
	1/4" divisions for Type 316 Oscilloscope		B. Tall
331-045	5-inch with 6 vertical/10 horizontal	2.90	Part No. Description Price
221 047	centimeter divisions for Type 551	0.00	T5191—(formerly designated T519P) \$1000.00
331-047	5-inch with 10 vertical/10 horizontal centimeter divisions for Type 502A	2.90	T5260—(formerly designated T526P) \$ 99.50 T5270—(formerly designated T527P) \$ 80.00
331-051	5-inch with special H.V. Mod. 108A	2.90	
	for Types 531, 535A, 533 and RM		T5330—(formerly designated T533P) \$ 75.00 T5360—(formerly designated T536P) \$ 75.00
	versions of these oscilloscopes		T5430—(formerly designated T543P) \$ 75.00
331-052	5-inch with special H.V. Mod. 108A for	2.90	T5511—(formerly T511P) \$ 180.00
	Types 541, 545A, 543 and RM versions	•	T5550—(formerly designated T555P) \$ 225.00
331-053	of these oscilloscopes 5-inch with special H.V. Mod. 108	2.90	T5610
001 000	for Type 551 Oscilloscope	2.70	T5640 \$ 450.00
331-055	3-inch for Type 321 Oscilloscope	1.75	T5650
331-056	5-inch with 8 vertical/10 horizontal	2.90	T5810—(formerly designated 581P) \$ 175.00
	centimeter divisions for Type 503		T5070—(formerly designated T507P) \$ 125.00
331-057	5-inch for phase-angle measurements	3.45	T5032—(formerly designated T503RS-) \$ 60.00
331-065	5-inch for Type 519 Oscilloscope	17.25	T0510—(formerly designated T51P) \$ 75.00
331-068	5-inch for Type RM527 Oscilloscope	3.45	T0520—(formerly designated T52P)\$ 60.00 T0540—(formerly designated T54P)\$ 75.00
331-069	5-inch for Type 527 Oscilloscope	3.45	
331-070	5-inch for Type 560 Oscilloscope in special Kidder application	3.45	T0550—(formerly designated T55P) \$ 60.00 T3100—(formerly designated T310P) \$ 45.00
331-076	5-inch for Type RM561 Oscilloscope	2.90	T3160—(formerly designated T316P) \$ 80.00
331-077	Non-composite IRE for Type RM527	3.45	T3170—(formerly designated T317P) \$ 90.00
331-078	Percent video modulation for RM527	3.45	T3210—(formerly designated T321P) \$ 85.00
331-079	Non-composite IRE for Type 527	3.45	T5021—(formerly T5021P) \$ 125.00
331-080	Percent video modulation for Type	3.45	T5030—(formerly designated T503P) \$ 60.00
	527 Oscilloscope	SOUNDS - WARRINGS	T5031—(formerly designated T503RP) \$ 60.00
331-084	1-inch blank	2.30	T0541—(formerly designated T517P) \$ 110.00
331-090	5-inch for Type 561 A	2.30	
331-093	5-inch blank with red inserts	1.45	Please refer to Terms and Shipment, General Information page.
331-095	3-inch blank	1.75	U.S. Sales Prices f.o.b. Beaverton, Oregon

Tektronix Field Services

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



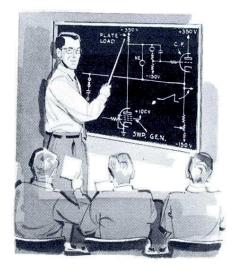
Ordering—There are many types of oscilloscopes, each designed for a specific application area. Your Field Engineer can help you select the one best suited to your present and future needs, and he will be happy to arrange a demonstration of the instrument....in your application if you so desire.

If you are a Purchasing Agent or Buyer, your Field Engineer

or his secretary can help you with information on prices, terms, shipping estimates, and best method of transportation on instruments, accessories, and replacement parts.

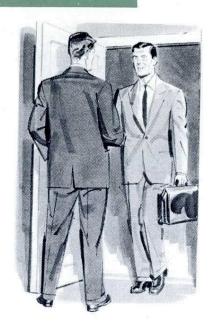
Operation—Your Tektronix Oscilloscope can be most useful to you when you are familiar with all control functions. Your Field Engineer will be glad to demonstrate the use of your instrument in various applications to help you become more familiar with its operation. If your instrument is to be used by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





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

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



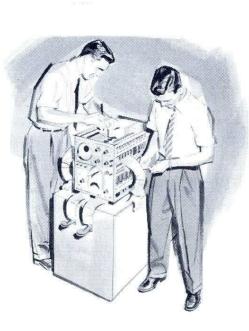
If you are responsible for the maintenance of a large quantity of Tektronix Instruments, ask your Field Engineer about the free factory training course in maintenance and calibration.



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

Instrument Reconditioning

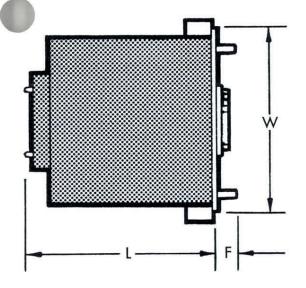
—An older Tektronix Oscilloscope, properly reconditioned, can give you many additional years of service. Your Field Engineer will gladly explain the advantages of instrument reconditioning, major repair, and recalibration that can be performed at a nearby Field Repair Center. Ask your Field Engineer about this service to Tektronix customers.

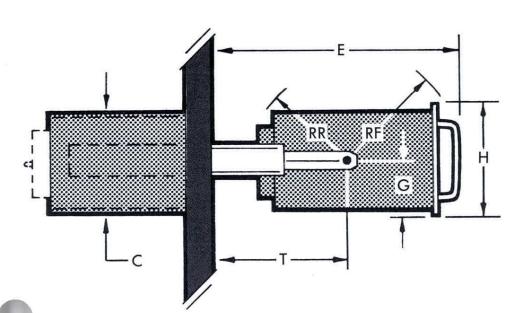




Communications — Your Field Engineer is a valuable communication I in k between you and the factory. He knows the exact person to contact in each circumstance, and he can reach that person fast and easily. Let him help speed your communications with the factory on any problem related to your Tektronix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

Instrument Dimensions





	RACK MOUNT	INSTRUMENTS
EX	CLUSIVE OF PLUG-IN	N UNITS AND PROBES
Symbol	Description	Definition
H	Height	Height of front panel.
W	Width	Width of front panel.
L	Length	Rack front mounting surface to rearmost permanent fixture, excluding cables.
F	Forward Clearance	Rack front mounting surface to foremost protrusion.
G	Vertical Axis	Bottom of front panel to axis of rotation.
E	Extended Inst.	Maximum forward clearance with instrument out and horizontal.
RF	Radius — front	Axis of rotation to torward protrusion.
RR	Radius — rear	Axis of rotation to rearmost protrusion.
Т	Track	Fully extended sliding track axis of rotation.
C	Cabinet	Cabinet height.

These instruments mount with sliding tracks in a cabinet that mounts to a standard 19" rack.

These instruments mount with sliding tracks to a standard 19" rack. Rear support for 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.

			MOUNT	TING DI	MENSIO	NS				
TYPE	H	W	1 1	F	G	E	RF	RR	- T	С
RM15	83/4	19	22%/16	13/4	27/16	295/8	137/8	121/2	161/2	85/8
RM17	7	19	175/8	13/4	213/16	21 1/8	12%/16	73/4	91/8	613/16
127	83/4	19	215/8	13/4	27/16	285/8	1211/16	121/4	163/8	83/4
525	83/4	19	2015/16	-111/16	23/8	241/8	145/8	91/8	10 ³ / ₈	81/2
526	83/4	19	1715/16	13/4	27/16	21 1/2	113/4	10	105/8	85/8
RM527	51/4	19	181/4	17/8	21/4	211/4	12	81/2	93/8	51/16
RM31A	14	19	223/4	21/8	71/16	291/2	14	123/8	16 ³ / ₈	137/8
RM33A	14	19	223/4	21/8	71/16	291/2	14	123/8	$16^{3}/_{8}$	137/8
RM35A	14	19	223/4	21/8	71/16	291/2	14	123/8	163/8	137/8
RM41A	14	19	223/4	21/8	71/16	291/2	14	123/8	163/8	137/8
RM43A	14	19	223/4	21/8	71/16	291/2	14	123/8	163/8	137/8
RM45A	14	19	223/4	21/8	71/16	291/2	14	123/8	163/8	137/8
RM567	121/4	19	22	17/8	27/16	31.5/8	167/8	12	16%16	$12^{3}/_{16}$
RM565	121/4	19	22	17/8	27/16	30%/16	1513/16	14	165/8	$12^{3}/_{16}$
RM503	7	19	17	13/4	31/2	223/4	117/8	79/16	111/8	7
RM504	7	19	17	13/4	31/2	223/4	117/8	79/16	111/8	7
RM561A	7	19	183/8	111/16	25/16	245/16	137/16	71/8	111/8	67/8
RM585A	14	19	223/4	21/8	71/16	291/2	14	123/8	163/8	137/8

Shipping Weights and Volumes

		Domestic		oort Pack	
Туре	Net Wt. in Ibs.	Packed in Ibs.	Weig lbs.	ght Kgs.	Volume Cu. Ft.
B CA C-12 C-13 C-19 D E FM125 G H K L M N O P Q R RM15 RM122 RM125 RM17 RM181 RM31A RM35A RM41A RM45A RM503 RM504 RM527 RM561 A RM565 RM565 RM565 RM565 RM565 RM565 RM565 RM561 A RM565 RM565 RM561 A RM565	4 43/4 141/4 111/2 151/2 151/2 151/2 151/2 151/2 19 41/4 51/2 19 41/4 51/2 19 41/4 51/2 19 41/4 51/2 19 41/4 51/2 151/4 71/4 463/4 6 19 35 153/4 751/2 751/2 80 27 251/2 34 301/2 67 501/2 81 41/4 43/4 13 81/2 143/4 13 81/2 143/4 19 39 1/2 22 20 1/4 31/2 22 20 1/4 31/2 22 20 1/4 31/2 23 1/2	6 8 15 14 18 6 7 27 6 6 5 8 10 9 5 8 9 75 14 29 66 32 100 105 100 101 106 48 48 62 54 101 85 110 67 87 20 17 25 16 27 69 17 27 27 27 27 27 27 27 27 27 27 27 27 27	14 15 32 31 35 14 14 15 42 14 13 14 16 20 17 13 16 18 96 25 49 87 44 122 121 126 121 122 127 72 69 82 74 122 106 131 14 15 16 16 17 17 18 18 18 18 18 18 18 18 18 18 18 18 18	6 7 15 14 16 6 6 7 19 6 6 6 7 7 8 44 11 22 39 20 55 55 55 58 33 55 48 59 6 7 7 28 14 13 17 12 18 18 18 18 18 18 18 18 18 18 18 18 18	2244422142222222229459499999999999999999

_	NI-t MA	Domestic		oort Pack	
Туре	Net Wt. in Ibs.	Packed in lbs.	Weig Ibs.	Kgs.	Volume Cu Ft.
2A60 2A61 2A63 2B67 262 280 290 291 3A1 3A72 3A74 3A75 3B1 3B3 3C66 3S3 3S76 3T77 310A 317 321 360 4S1 4S2 4S3 5T1 A 502 A 503 504 507 515 A 517 A 519 524 A D 525 526 527 531 A 533 A 543 A 544 A 557 5 567 5 570 5 575 5 581 A 585 A 681 661 80 / P80 81 82 84 86	3 4 ¹ / ₄ 3 ³ / ₄ 4 ¹ / ₂ 5 4 ³ / ₄ 5 6 ¹ / ₄ 5 ¹ / ₄ 5 ¹ / ₄ 5 ¹ / ₄ 5 ¹ / ₄ 6 ³ / ₄ 7 ¹ / ₂ 5 ¹ / ₂ 23 33 ¹ / ₄ 10 15 ¹ / ₄ 9 9 ³ / ₄ 6 52 ¹ / ₂ 29 ¹ / ₂ 27 ¹ / ₄ 88 ³ / ₄ 42 ¹ / ₄ 41 ¹ / ₄ 175 99 ³ / ₄ 61 54 ³ / ₄ 41 ¹ / ₄ 175 99 ³ / ₄ 61 52 ¹ / ₂ 27 ¹ / ₄ 81 ¹ / ₂ 55 ³ / ₄ 61 ¹ / ₂ 59 ³ / ₄ 61 ³ / ₄ 41 ³ / ₄ 49 ¹ / ₂ 3 ¹ / ₄ 4 ³ / ₄	4 5 5 39 6 7 7 6 6 7 8 6 6 7 9 12 9 34 47 26 13 12 12 69 38 34 17 6 12 12 12 12 12 12 12 12 12 12 12 12 12	17 18 18 18 19 15 15 15 18 19 20 17 19 18 15 18 23 20 45 57 37 31 29 23 20 84 49 57 205 63 65 21 106 96 97 101 155 183 50 57 101 155 183 50 105 105 105 105 105 105 105 105 105	8 8 8 8 8 8 8 7 7 7 7 9 9 9 8 7 8 9 9 8 7 8 10 9 26 17 14 13 10 9 38 22 26 33 29 127 7 48 44 43 43 44 44 46 46 46 46 46 46 46 46 46 46 46	33335222333333223334444433338659661399948888888888888888888888888888888888

General Information

ORDERING PROCEDURES

ORDER PLACEMENT

AUSTRALIA U.S.A. CANADA Orders should be placed with your Tektronix Field Engineering Office listed on Page 242 and Page 243.

TERMS

In accordance with Tektronix marketing practices, open account terms may be arranged whenever time and conditions permit. Shipping delay may be prevented by establishing credit at the time of placing your order. COD shipments can be arranged.

Normally, all prices for the U.S.A. are f.o.b. Beaverton, Oregon. For Canada, they are f.o.b. Toronto, Montreal, or Vancouver; and for Australia, they are f.o.b. your plant in Australia.

SHIPMENTS

Unless otherwise specified, shipment will be made collect via Motor Freight. If other surface transportation 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 specifications, Air Freight and full valuation will be used.

ORDER PLACEMENT

A TEKTRONIX Distributors in many overseas DISTRIBUTOR countries to provide personal assistance in both ordering and servicing our instruments. If you are located in a country served by a Tektronix Distributor, the Distributor will be pleased to furnish you with a quotation based upon f.o.b. prices for your country. A list of Tektronix Distributors is on Page 243.

COUNTRIES WITH NO TEKTRONIX DISTRIBUTOR

If your place of business is in a EUROPEAN country not served by a Tektronix Distributor, please

address all requests for a quotation to:

TEKTRONIX, Limited
Post Office Box 36
St. Peter Port
Guernsey, Channel Islands

Other countries please address:

TEKTRONIX, Inc.
International Marketing
Post Office Box 500
Beaverton, Oregon, U.S.A.

A pro forma invoice will be issued, if requested, indicating prices and sales conditions. Quotations will normally be provided f.o.b. the Tektronix facility that can supply your instruments. We can quote you FAS, C&F, CIF, etc., prices. Tektronix has European manufacturing facilities in Guernsey, Channel Islands and in Heerenveen, The Netherlands.

TERMS

Whenever time permits and market conditions allow, open account terms may be established. Otherwise, full payment in advance of shipment or confirmed irrevocable letter of credit will be requested.

When our pro forma invoice or purchase order acknowledgement is issued, we will indicate the documents needed to ship your order. Documents with fixed time limits should be sent to us promptly to avoid delay of shipment due to expiration of these documents.

SHIPMENTS

Shipment is made in accordance with your request (air, vessel, etc.). There is no charge for Air Shipment packaging. A nominal charge may be made for surface shipment packaging.

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.

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.

PLEASE DO NOT RETURN INSTRUMENTS OR PARTS BEFORE RECEIVING DIRECTIONS.

Replacement parts for instruments under warranty will be shipped by best surface route prepaid C.I.F. point of unloading. If Air Shipment is requested, we will pay onehalf the shipping charges. The other half will be invoiced to you C.I.F. airport of destination.

United States and Canada

TEKTRONIX, INC.

Tektronix, Inc., an Oregon Corporation, Home Office & Factory, P. O. Box 500, Beaverton, Oregon 97005 Telephone: MItchell 4-0161 TWX—503-291-6805 Telex: 036-691 Cable: TEKTRONIX

FIELD ENGINEERING OFFICES

	FIELD ENGINEERING OFFICES
ALABAMA ARIZONA	Huntsville 3322 South Memorial Parkway, Suite 102, Huntsville Telex 05-9422 Telephone: (205)881-2912 Phoenix 7000 E. Camelback Road, Scottsdale Telex 031-701 Telephone: (602)946-4273 Tucson Area: Enterprise 383
CALIFORNIA	San Diego 3045 Rosecrans Street, San Diego 10Telex 039-825 Telephone: (714)222-0384
Los Angeles Area	Encino 17418 Ventura Blvd., EncinoTelex 06-74395
	From Los Angeles telephones call: 873-6868
	Island of Oahu, Hawaii Area: ENterprise 5-700 • Orange 1722 E. Rose Avenue, OrangeTelex 06-78812
	Pasadena 1194 East Walnut Street, PasadenaTWX: 213-449-115Telex 06-74397
	Telephone (213) 449-2164
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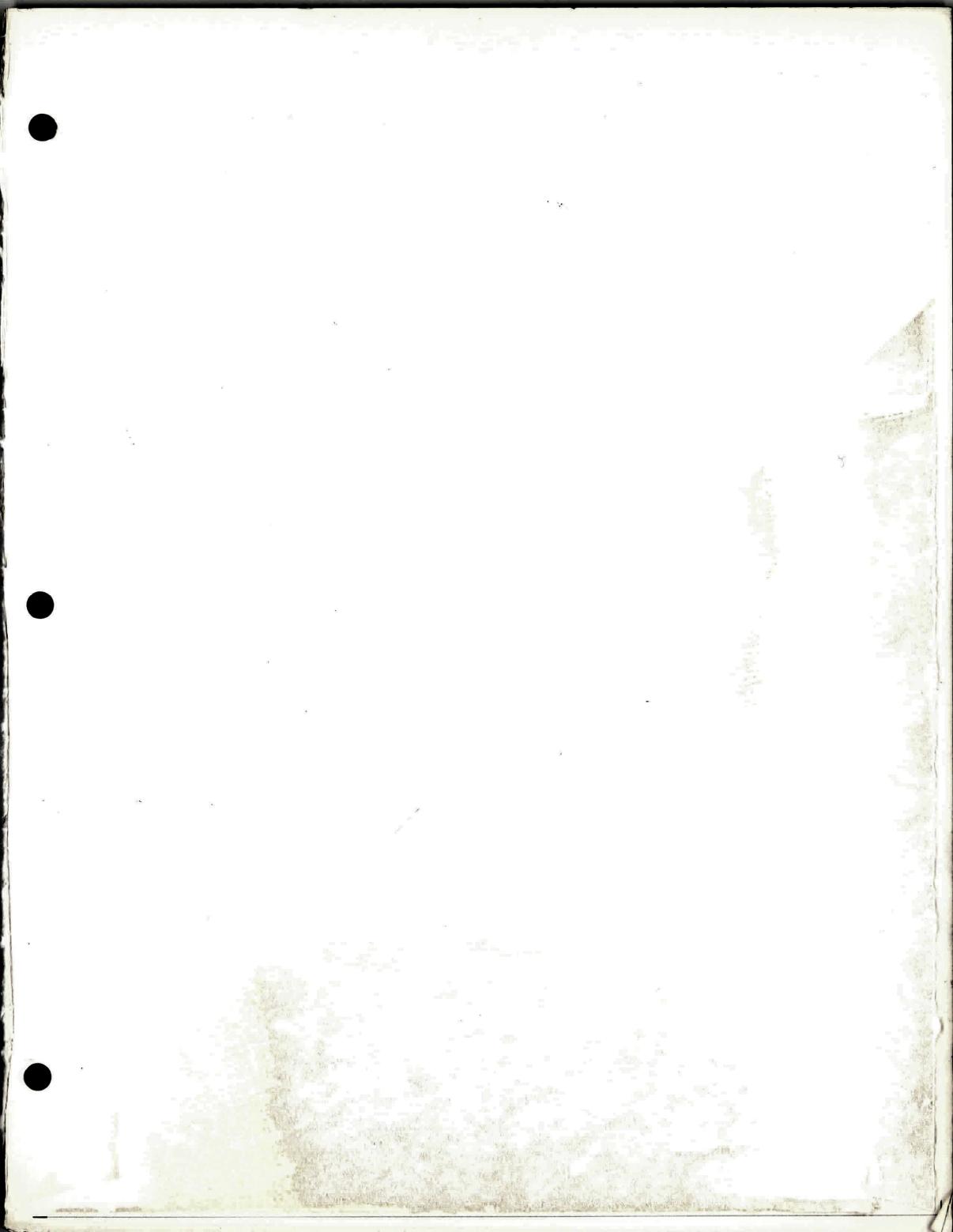
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