

POWER SUPPLY TYPE 160A

INSTRUCTION MANUAL



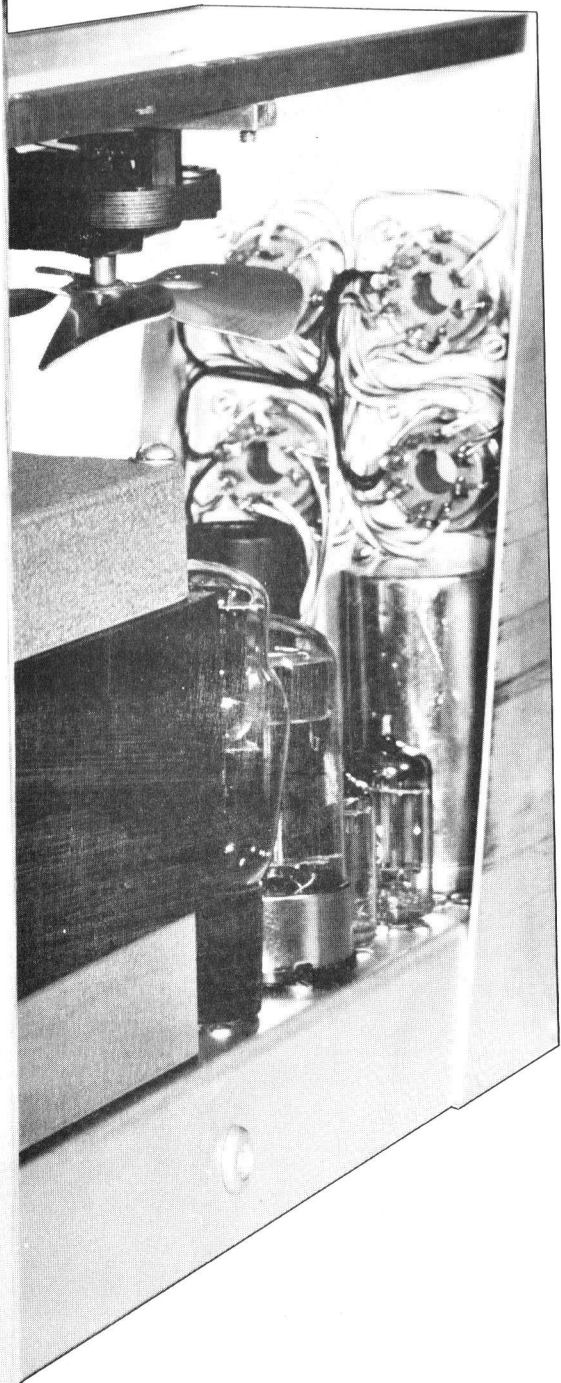
TEKTRONIX, INC.
MANUFACTURERS OF CATHODE-RAY AND VIDEO TEST INSTRUMENTS

P. O. Box 500 • Beaverton, Oregon, U.S.A Phone: Mitchell 4-0161 • Cables: Tektronix

TYPE 160A
POWER SUPPLY
SERIAL



TEKTRONIX, INC., PORTLAND, OREGON, U.S.A.



GENERAL DESCRIPTION

General

The Tektronix Type 160A Power Supply is designed to supply the currents and voltages for Tektronix Type 161, 162, and 163 Pulse and Waveform Generators. One Type 160A can supply as many as seven Type 161, or seven Type 162, or five Type 163 units. The output terminals consist of four octal sockets, each capable of supplying power for two of these units.

Maximum Output

- +300 volts dc, unregulated, at 250 milliamps.¹
- +225 volts dc, regulated, at 175 milliamps.²
- +150 volts dc, regulated at 15 milliamps.
- +70 volts dc, unregulated.¹
- 170 volts dc, regulated, at 125 milliamps.
- 6.3 volts ac, unregulated, at 20 amps.

¹ Voltage varies with load.

² Will regulate at 225 ma with a 1500-ohm shunt across the series tube.

Regulated Supplies

Electronic regulation compensates for line-voltage variations between 105 and 125 volts, and for current-demand differences of the units connected to the power supply.

Ripple

At rated load the ripple is about 40 millivolts in the +225-volt supply, 25 millivolts in the -170-volt supply and 8 millivolts in the +150-volt supply.

Mounting Frame

A mounting frame is available at extra cost which will adapt the Type 160A Power Supply and three other units of the 160 series for rack mounting.

Cooling

Forced-air ventilation maintains a safe operating temperature for the supply.

Power Requirements

105 to 125 or 210 to 250 volts, 50 to 60 cycles ac, 350 watts maximum at 117 volts.

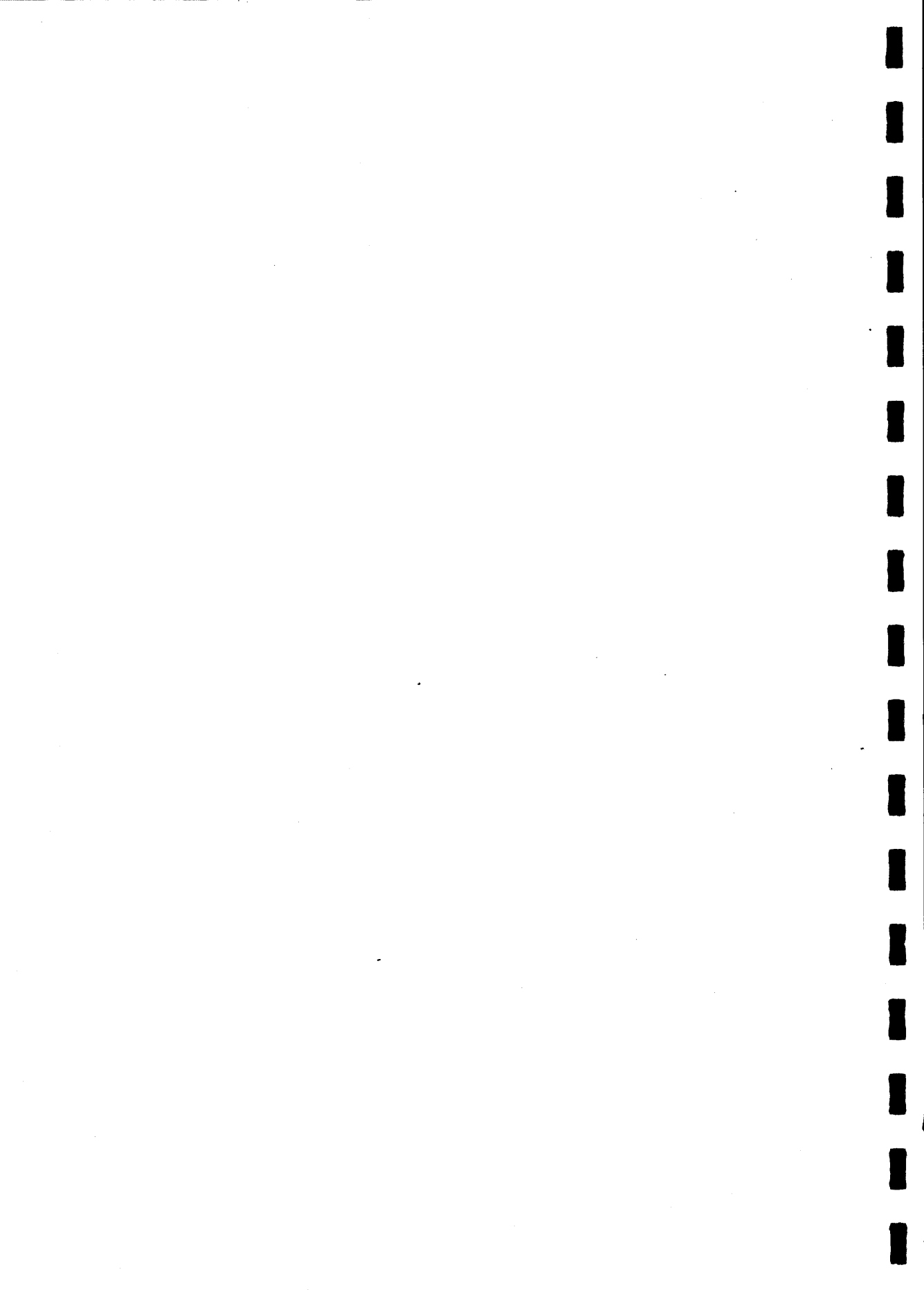
Mechanical Description

Front-panel dimensions, 4-1/8" wide by 12-1/4" high, cabinet 13-3/4" deep. Weight, 21 lbs. The instrument is constructed of aluminum alloy, with photo-engraved anodized front panel. The perforated steel cabinet is finished with blue wrinkle enamel.

Accessories Included

- 2 — W160-20, 20 inch connecting cables
- 1 — Set mounting screws and cup washers
- 1 — Instruction manual





CIRCUIT DESCRIPTION

General

Rectifier tubes, V1, V30 and V31, are conventional full-wave rectifiers. Electrolytic capacitors, C1 and C30, are used as filters.

—170-volt Regulated Supply

The negative 170-volt supply is regulated by comparing the voltage of the reference tube, V6, with the voltage from a voltage divider connected between ground and the —170-volt bus. The error signal is amplified in V7A, and is applied to the grids of V16 and V17 via the cathode follower, V7B. A screwdriver adjustment, R10, labeled ADJ. —170 v, permits the voltage to be set correctly. The remaining two regulated supplies are referred to the —170-volt bus.

+225-volt Regulated Supply

The positive 225-volt supply is regulated by comparing with ground potential the voltage from a voltage divider connected between the +225-volt bus and the —170-volt bus. The error signal is amplified in V33 and applied to the grids of V35, the series-regulator tube. Current available is limited to about 175 ma by the limitation of the series tube, but this tube can be shunted with a 1500-ohm resistor to increase the current capability to 225 ma. A screw-driver adjustment labeled ADJ. +225 v permits the voltage to be set correctly.

+150-volt Regulated Supply

The reference element is the —170-volt bus. The positive 150-volt supply is regulated by comparing to ground potential the voltage of a voltage divider connected between the —170-volt bus and the +150-volt bus. The error signal is amplified in V47A, and applied to the grid of V47B, the series-regulator tube. Output from this bus is limited by the current limitation of the series tube and the existing load on the +225-volt supply, because this current is supplied from the +225-volt regulator.

+300-volt Unregulated Supply

This output comes from the unregulated side of the series-regulator tube, V35 and is used to supplement the 225-volt supply to provide the required current for the 160-Series instruments. The use of the +300-volt source is not recommended for other purposes because of ac ripple. Current limitation is determined by the transformer secondary winding and the existing current through the +225-volt supply. The total current from the plus-supply rectifiers should not exceed 250 ma.

6.3-volt AC Unregulated Supply

This voltage is supplied from a 6.3-volt winding on the power transformer. Filaments of all tubes in the three regulators are also supplied by this winding. Current available external to the supply is limited to 20 amps.



MAINTENANCE

Replacement of Components

Tektronix will supply replacement components at current net prices. However, since most of the components are standard electronic and radio parts we suggest you get them from your local dealer if you can. Be sure to consult your instruction manual first to see what tolerances are required.

We specially select some of the components, whose values must fall within prescribed limits, by sorting through our regular stocks. The components so selected will have standard RETMA color-code marks showing the values and tolerances of the stock they were selected from, but they will not in general be replaceable from dealers stocks.

Such selected parts, as well as the parts we manufacture at Tektronix, are identified in the parts lists either by notes or by our own stock numbers. Order these parts from the Tektronix factory in Portland, Oregon.

Parts Ordering Information

You will find a serial number on the frontispiece of this manual. This is the serial number of the instrument the manual was prepared for. Be sure the manual number matches the number of the instrument when you order parts.

A Tektronix instruction manual usually contains hand-made changes to diagrams and parts lists, and sometimes text. These changes are in general only appropriate to the instrument whose serial number appears on the manual frontispiece. The hand-made changes show changes to the instrument that have been made after the printing of the manual.

We make some of the instrument changes during the factory test procedure. Our technicians hand-tailor the circuits, if it seems appropriate, to provide the widest possible latitude of operation. Other changes are made to include the latest circuit improvements as they are developed in our engineering department, or when improved components become available. In any event, the changes are to your benefit. We have tried to give you the best instrument we can.

Soldering Precaution

The solder used on the ceramic terminals in this instrument must contain a small percentage of silver. If for any reason you resolder, be sure the solder you use contains silver. Silver-bearing solder is used in printed-circuit techniques, and is therefore now available from all solder manufacturers. Repeated use of ordinary tin-lead solder will dissolve the fused bond of silver that makes the solder adhere to the porcelain, especially if the soldering iron is quite hot.

Trouble Locating

The following may help in determining the cause of equipment trouble. Tube failure will be the principal cause of trouble involving high or low voltage, lack of regulation or absence of any voltage. Low emission in the rectifiers or series tubes may cause the supplies to drop out of regulation. Since the other supplies are referenced to the -170-volt bus, check this supply first. Remove all external loads to determine whether the trouble lies elsewhere.

In case of absence of voltage at all terminals, check whether the power cord is firmly seated and check the 4-amp fuse mounted on the lower part of the front panel. A simple method of checking the fuse is to replace it with a good one. If a replacement fuse should blow look for shorted tubes by replacing them all. If this procedure clears the trouble, the offending tube can be found by replacing the old tubes one at a time. If tube replacement does not clear the trouble, lift the ungrounded lead of each of the four capacitors, C1, C2, C5 and C6. If this clears the trouble, the offending capacitor can be determined by replacing the leads one at a time.

Adjustment

If readjustment of the regulated voltages is required, adjust the negative 170-volt supply first because this bus is used as the reference for both the positive regulated supplies. R10, labeled ADJ. -170 v, accessible from the left side of the instrument, adjusts the -170-volt supply. R42, labeled ADJ. +225 v, accessible from the right, adjusts the +225-volt supply. No adjustment for the 150-volt supply is provided.





ABBREVIATIONS

Cer.	ceramic	m	milli or 10 ⁻³
Comp.	composition	Ω	ohm
EMC	electrolytic, metal cased	Poly.	polystyrene
EMT	electrolytic, metal tubular	Prec.	precision
f	farad	PT	paper tubular
h	henry	Tub.	tubular
k	kilohm or 10 ³ ohms	v	working volts dc
meg	megohm or 10 ⁶ ohms	Var.	variable
μ	micro or 10 ⁻⁶	w	watt
μμ	micromicro or 10 ⁻¹²	WW	wire wound
GMV		guaranteed minimum value	

Bulbs

B1	#47		150001
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Capacitors

C1	2x20 μf	EMC	Fixed	450 v	-20%+50%	290036
C7	.005 μf	Cer.	Fixed	500 v	GMV	283001
C9	.047 μf	PT	Fixed	400 v	20%	285519
C11	.1 μf	PT	Fixed	400 v	20%	285526
C30	2x40 μf	EMC	Fixed	450 v	-20%+50%	290043
C41	.047 μf	PT	Fixed	400 v	20%	285519
C47	.005 μf	Cer.	Fixed	500 v	GMV	283001

Fuses

Fuse	4 amp	3AG	Slo-Blo	for 117 v operation	159027
Fuse	2 amp	3 AG	Slo-Blo	for 234 v operation	159023

Resistors

R1	47 k	½ w	Fixed	Comp.	10%	302473
R2	150 k	½ w	Fixed	Comp.	10%	302154
R3	2.2 meg	½ w	Fixed	Comp.	10%	302225
R7	47 k	½ w	Fixed	Comp.	10%	302473
R8	470 k	½ w	Fixed	Comp.	10%	302474
R9	38 k	½ w	Fixed	Prec.	1%	309124
R10	10 k	2 w	Var.	WW	20%	311015
R11	38 k	½ w	Fixed	Prec.	1%	309124
R13	10 k	½ w	Fixed	Comp.	10%	302103
R14	100 k	½ w	Fixed	Comp.	10%	302104
R15	470 k	½ w	Fixed	Comp.	10%	302474
R16	1 k	½ w	Fixed	Comp.	10%	302102
R17	1 k	½ w	Fixed	Comp.	10%	302102
R20	100 k	½ w	Fixed	Comp.	10%	302104
R30	330 k	½ w	Fixed	Comp.	10%	302334
R31	220 k	½ w	Fixed	Comp.	10%	302224
R32	560 k	½ w	Fixed	Comp.	10%	302564
R33	1 meg	½ w	Fixed	Comp.	10%	302105
R34	1 k	½ w	Fixed	Comp.	10%	302102
R35	1 k	½ w	Fixed	Comp.	10%	302102
R40	470 k	½ w	Fixed	Comp.	10%	302474
R41	490 k	½ w	Fixed	Prec.	1%	309002
R42	50 k	2 w	Var.	Comp.	20%	311023
R43	333 k	½ w	Fixed	Prec.	1%	309053
R46	270 k	½ w	Fixed	Comp.	10%	302274
R47	390 k	½ w	Fixed	Prec.	1%	309056
R48	429 k	½ w	Fixed	Prec.	1%	309170



Switches

SW1	single pole	single throw	toggle	POWER ON	260134
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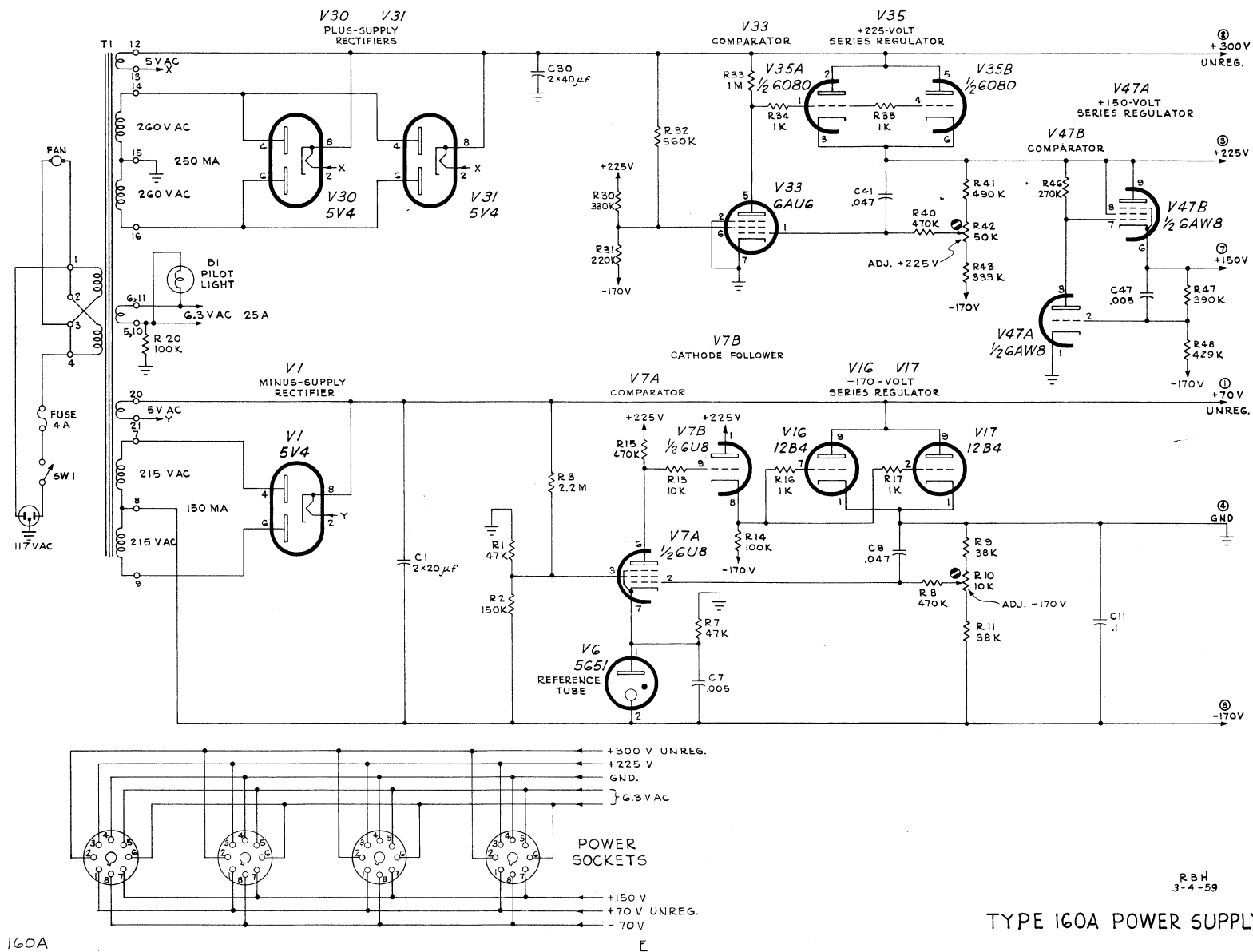
Transformers

T1	Power Transformer	T160PB1	120054
	Primary:	117/234 vac	50-60 cycle
	Secondary:	Term. 7-8-9	260-0-260 at 250 ma
		14-15-16	227-0-227 at 150 ma
		5-6	6.3 vac at 12.5A
		10-11	6.3 vac at 12.5A
		12-13	5 vac at 4A
		20-21	5 vac at 2A

Vacuum Tubes

V1	5V4	Minus-Supply Rectifier	154008
V6	5651	Reference Tube	154052
V7A	½ 6U8	Comparator	154033
V7B	½ 6U8	Cathode Follower	154044
V16	12B4	-170-volt Series Regulator	154044
V17	12B4	-170-volt Series Regulator	154008
V30	5V4	Plus-Supply Regulator	154008
V31	5V4	Plus-Supply Regulator	154022
V33	6AU6	Comparator	154056
V35A	½ 6080/6AS7GA	+225-volt Series Regulator	}
V35B	½ 6080/6AS7GA	+225-volt Series Regulator	
V47A	½ 6AW8	+150-volt Series Regulator	
V47B	½ 6AW8	Comparator	
			154095





ABBREVIATIONS USED IN OUR PARTS LISTS

Cer.	ceramic	m	milli
Comp.	composition	Ω	ohm
EMC	electrolytic, metal cased	Poly.	polystyrene
EMT	electrolytic, metal tubular	Prec.	precision
f	farad	PT	paper tubular
h	henry	Tub.	tubular
k	thousands of ohms	v	working volts dc
meg	megohms	Var.	variable
μ	micro	w	watt
$\mu\mu$	micromicro	WW	wire wound
	GMV		guaranteed minimum value

ABBREVIATIONS USED IN OUR CIRCUIT DIAGRAMS

Resistance values are in ohms. The symbol k stands for thousands. A resistor marked 2.7 k has a resistance of 2,700 ohms. The symbol M stands for million. For example, a resistor marked 5.6 M has a resistance of 5.6 megohms.

Unless otherwise specified on the circuit diagram, capacitance values marked with the number 1 and numbers greater than 1 are in $\mu\mu\text{f}$. For example, a capacitor marked 3.3 would have a capacitance of 3.3 micromicrofarads. Capacitance values marked with a number less than 1 are in μf . For example, a capacitor marked .47 would have a capacitance of .47 microfarads.

Inductance values marked in mh are in millihenrys. Inductance values marked in μh are in microhenrys.

Your instrument **WARRANTY** appears on the reverse side of this sheet.

SERIAL NO. 4740

IMPORTANT

Include the INSTRUMENT TYPE and the above SERIAL NUMBER in any correspondence regarding this instrument. The above serial number must match the instrument serial number if parts are to be ordered from the manual. Your help in this will enable us to answer your questions or fill your order with the least delay possible.



WARRANTY

All Tektronix instruments are fully guaranteed against defective materials and workmanship for one year. Should replacement parts be required, whether at no charge under warranty or at established net prices, notify us promptly, including sufficient details to identify the required parts. We will ship them pre-paid (via air if requested) as soon as possible, usually within 24 hours.

Tektronix transformers, manufactured in our own plant, carry an indefinite warranty.

All price revision and design modification privileges reserved.

Accessories

SMALL INSTRUMENTS

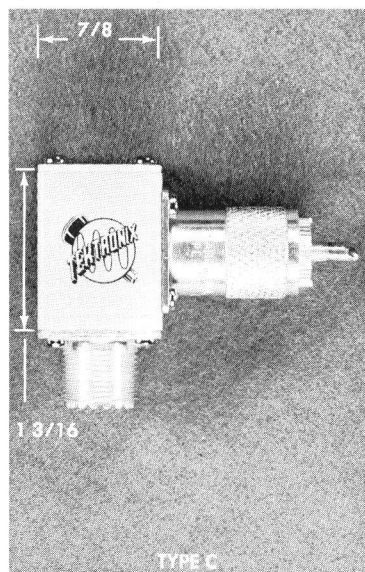
CABLE TERMINATORS...



TYPE A



TYPE B



TYPE C

Type B52-R 52-ohm terminating resistor, 1.5 w, Type A case. Part No. 011-001 \$8.50

Type B52-L5 52-ohm 'L' pad, 5 to 1 voltage ratio, 1.5 w, Type A case. Part No. 011-002 \$8.50

Type B52-L10 52-ohm 'L' pad, 10 to 1 voltage ratio, 1.5 w, Type A case. Part No. 011-003 \$8.50

Type B52-75L Minimum-loss pad, 52 ohms to 75 ohms, Type A case. Part No. 011-004 \$11.50

Type B52-170L Minimum-loss pad, 52 ohms to 170 ohms, Type B case. Part No. 011-005 \$11.50

Type B52-T10 52-ohm 'T' pad, 10 to 1 voltage ratio 1.5 w, Type B case. Part No. 011-006 \$11.50

Type B75-R 75-ohm terminating resistor, 1.5 w, Type A case. Part No. 011-007 \$8.50

Type B75-L5 75-ohm 'L' pad, 50 to 1 voltage ratio, 1.5 w, Type A case. Part No. 011-008 \$8.50

Type B75-L10 75-ohm 'L' pad, 10 to 1 voltage ratio, 1.5 w, Type A case. Part No. 011-009 \$8.50

Type B75-T10 75-ohm 'T' pad, 10 to 1 voltage ratio 1.5 w, Type B case.

Part No. 011-010 \$11.50

Type B93-R 93-ohm terminating resistor, 1.5 w, Type A case. Part No. 011-011 \$8.50

Type B93-L5 93-ohm 'L' pad, 5 to 1 voltage ratio, 1.5 w, Type A case. Part No. 011-012 \$8.50

Type B93-L10 93-ohm 'L' pad, 10 to 1 voltage ratio, 1.5 w, Type A case. Part No. 011-013 \$8.50

Type B93-52L Minimum-loss pad, 93 ohms to 52 ohms, 1.5 w, Type A case. Part No. 011-014 \$11.50

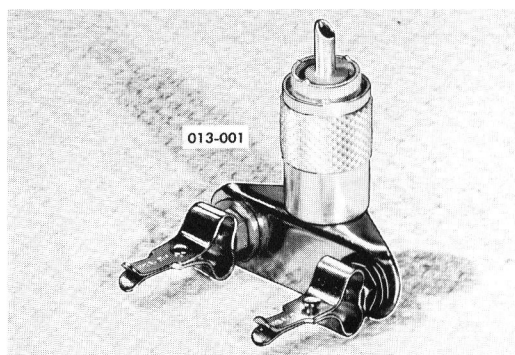
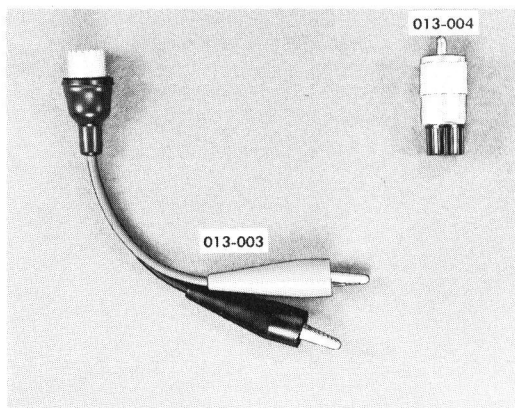
Type B93-T10 93-ohm 'T' pad, 10 to 1 voltage ratio, 1.5 w, Type B case. Part No. 011-015 \$11.50

Type B170-R 170-ohm terminating resistor, 1.5 w, Type C case. Part No. 011-016 \$8.50

Type B170-A 170-ohm pi-attenuator, using 2% precision resistors, 1 to 64 db in 1-db steps, 0.25 w, (not shown in photograph). Part No. 011-017 \$45.00



COAXIAL ADAPTERS...



Type A100 Clip-Lead Adapter. Provides clip-lead connections for a coaxial cable.

Part No. 013-003 \$2.00

Type A510 Binding-Post Adapter. Provides binding-post connection to the center conductor of a coaxial connector.

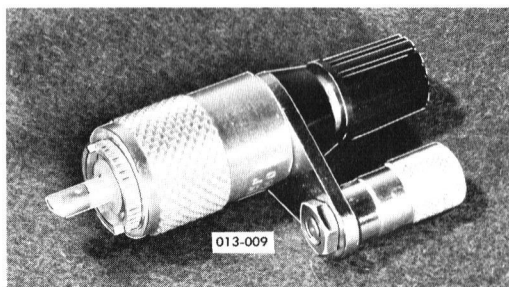
Part No. 013-004 \$2.00

Binding Post Adapter. Similar to Type A510 binding post adapter, but includes ground terminal. $\frac{3}{4}$ " spacing between connector centers.

Part No. 013-009 \$3.00

Type F30 Production Test Fixture. This fixture was designed for use with the Type 130 L, C Meter in production line sorting and testing. It may be used to terminate the output of any standard coaxial connector.

Part No. 013-001 \$3.00



INTERCONNECTING CABLES...

Type W122 Battery power lead for Type 122 (see photo). Part No. 012-009 \$7.50

Type W130B Black, 30" flexible output lead with banana-type connector at one end and alligator clip at other. Part No. 012-014 ... \$1.00

Type W160-20 8-conductor inter-unit power cable terminated in male and female octal connectors. For use with 160-Series instruments and Type 360. 20" long. Part No. 012-016 ... \$2.00

Type W160-10 8-conductor inter-unit power cable terminated in octal connectors. For use with 160-Series instruments and Type 360. 10" long. Part No. 012-017 \$2.00

3-conductor power cable for Tek cathode-fol-
lower probes. 24" long.
Part No. 012-030 \$5.00

Type PC-6B Black, 6" flexible cord terminated in combination male and female banana-type connectors. The combination type connectors permit "stacking". Part No. 012-023 \$1.25

Type PC-6R Similar to Type PC-6B except colored red. Part No. 012-024 \$1.25

Type PC-18R Similar to Type PC-6B except 18" long and colored red.

Part No. 012-031 \$1.50

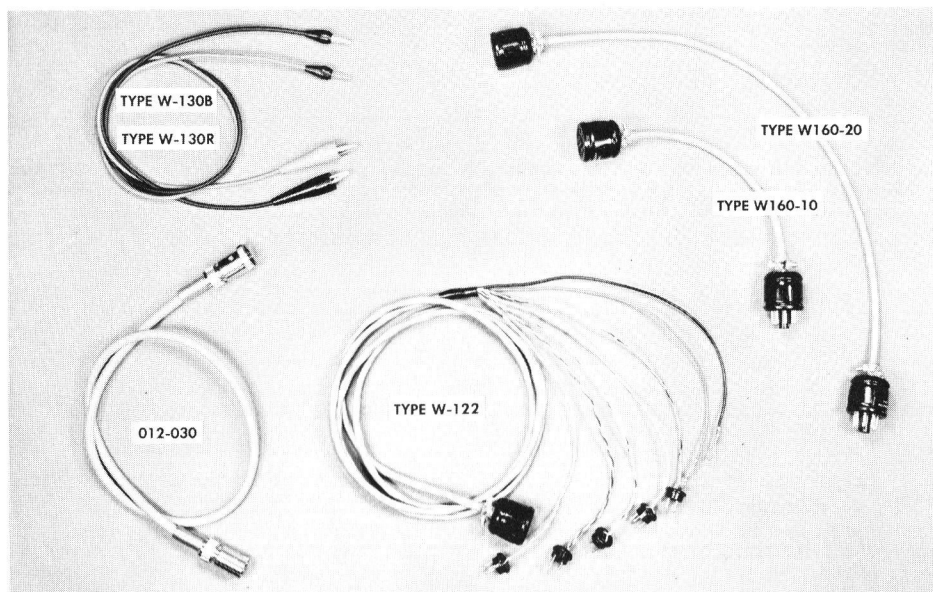
Type W-531B Black, 6" flexible cord terminated in male banana-type connectors.

Part No. 012-028 \$1.00

Type W-531R Similar to Type W-531B except colored red. Part No. 012-029 \$1.00

Suppressor cord for Type 570. Similar to Type W-531 cords except includes 100 Ω resistor.

Part No. 012-025 \$1.50



Suppressor cord for Type 570. Similar to Type W-531 cords except includes 300 Ω resistor.
Part No. 012-026 1.50

Suppressor cord for Type 570. Similar to Type W-531 cords except includes 1 k resistor. Part No. 012-027 \$1.50

POWER CORDS...

2-conductor, 8' rubber-covered power cord with Type C connector. No. 18 wire.

Part No. 161-001 \$1.25

2-conductor, 8' rubber-covered power cord with no female connector. (For permanent connection to instrument).

Part No. 161-002 \$1.10

2-conductor, 1' rubber-covered power cord with Type C connector. No. 18 wire.

Part No. 161-003 \$.85

2-conductor, 8' rubber-covered power cord with Type C connector. No. 16 wire.

Part No. 161-004 \$1.75

3-conductor, 8' rubber-covered power cord with Type A connector. No. 16 wire.

Part No. 161-005 \$2.00

3-conductor, 10' rubber-covered power cord with no female connector. (For permanent connection to instrument). No. 16 wire.

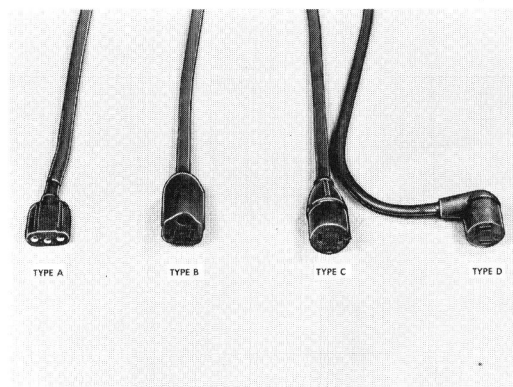
Part No. 161-006 \$3.00

2-conductor, 8' rubber-covered power cord with Type D connector. No. 18 wire.

Part No. 161-007 \$1.25

3-conductor, 8' rubber-covered power cord with Type B connector. No. 18 wire.

Part No. 161-008 \$1.50



3-conductor, 8' rubber-covered power cord with Type B connector. No. 18 wire.

Part No. 161-010 \$1.75

3-conductor, 1' rubber-covered power cord with Type B connector. No. 18 wire.

Part No. 161-011 \$1.25

3-conductor, 8' rubber-covered power cord with no female connection. (For permanent connection to instrument, NO. 18 wire.

Part No. 161-012 \$1.25



COAXIAL CABLES...

Type P52 Coaxial cable, 52 ohms nominal impedance, 42" long.

Part No. 012-001 \$4.00

Type P75 Coaxial cable, 75 ohms nominal impedance, 42" long.

Part No. 012-002 \$4.00

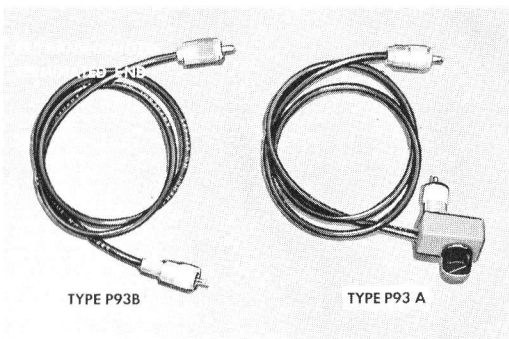
Type P93 Coaxial cable, 93 ohms nominal impedance, 42" long.

Part No. 012-003 \$4.00

Type P93A Coaxial output cable, 93 ohms, terminated with variable attenuator, 42" long. (See photo). Part No. 012-004 \$13.50

Type P93B Coaxial output cable, 93 ohms, terminated with 1/2-watt 93-ohm resistor, 42" long. (See photo). Part No. 012-005 \$5.00

Type P170 Coaxial cable, 170 ohms nominal im-



pedance, 42" long. Part No. 012-006 \$9.50

Coaxial cable, 170 ohms nominal impedance, 5' long. Part No. 012-034 \$5.00

AUXILIARY DEVICES...

TYPE 128

Type 128 Probe Power Supply for P500CF and P170CF cathode-follower probes. The Type 128 supplies the necessary plate and filament voltages for one or two probes, making it possible to use the cathode-follower probes with oscil-



losopes not equipped with a probe-power outlet.

DC Output Voltages:

+120 v regulated, at 25 ma

+6.3 v unregulated, at 150 ma

+6.3 v unregulated, at 150 ma

When a P170CF probe is to be used with an instrument other than the Tektronix Type 517, a 170-ohm terminating resistor is required. The

B170R Terminating Resistor is recommended for this purpose.

Ripple—Ripple on the 120 v supply is not more than 5 mv peak-to-peak, and not more than 75 mv peak-to-peak, on the 6.3 v supplies.

Power Requirements—105 to 125 v or 210 to 250 v, 50 to 60 cycles, 25 watts using two Type P500CF probes.

Dimensions—4 3/4" wide, 7 3/4" high, 9" overall depth.

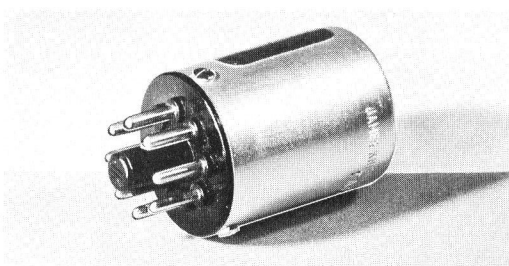
Weight—6 lbs.

Type 128, Part No. 015-006 \$100.00

CRYSTAL OVEN

C0181A Crystal-Oven Combination. A 1-mc crystal mounted in a temperature-stabilized oven. Directly interchangeable with standard crystal. Plugs into crystal socket of the Type 181—no wiring changes necessary. Provides a frequency stability of 2 ppm over a 24-hour period.

Part No. 158-007 \$27.00



TYPE S30



S30 Delta Standard, 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.

Part No. 015-001 \$22.00

INSTRUCTION MANUALS

105	\$1.75
107	1.75
121	1.50
122	1.50
126	1.50
127	2.00
128	1.50
130	1.50
160A	1.50
161	1.50
162	1.50
163	1.50
180A	2.00
181	1.75
190A	1.50
360	1.75

AIR FILTERS

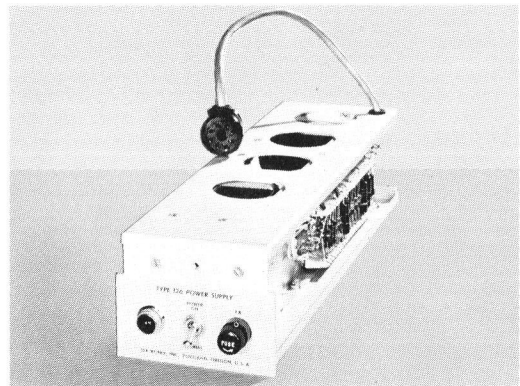
Aluminum 7" for Type 180A and Type 127.
Part No. 378-015 \$2.25

TYPE 126

The Tektronix Type 126 Power Supply supplies the required voltages and currents necessary to power one Type 360 Indicator or any one of the Type 160-Series Waveform Generators. The Type 126 mounts beneath the unit to be powered, and includes a cabinet to house both the Type 126 and the powered unit.

A Type 126 Power Supply combined with a Type 360 Indicator makes a practical, compact slave unit for any Tektronix oscilloscope. (The oscilloscope has the necessary sweep sawtooth and unblanking pulse for the Type 360 Indicator available at front-panel connectors.)

Price \$100.00



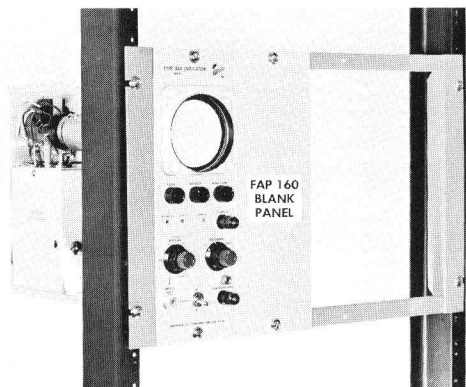
TYPE FA160

FA160 Mounting Frame. Holds four of any combination of Type 122, 160-Series and Type 360. Mounts to standard instrument rack.

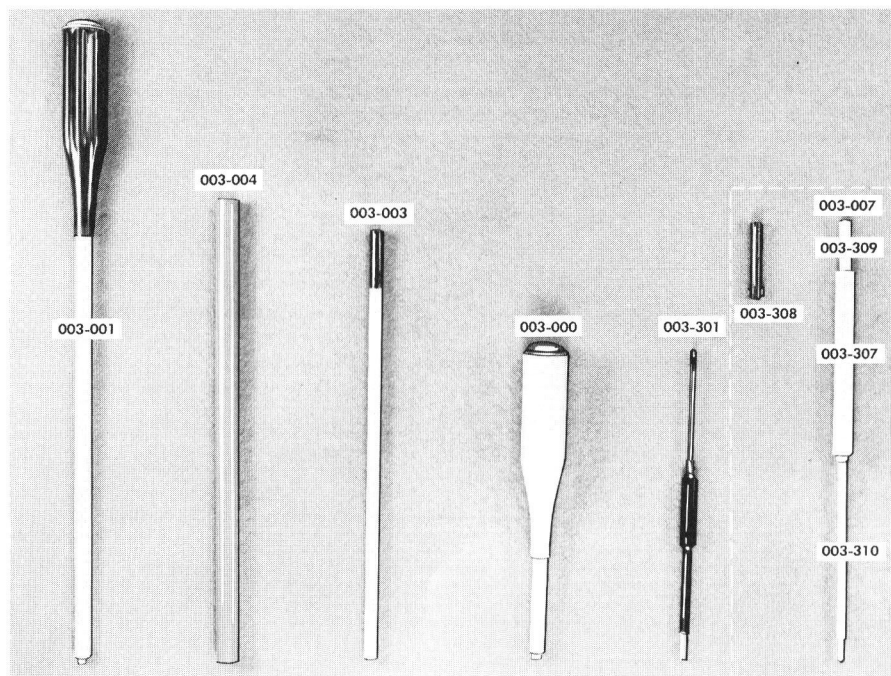
Part No. 014-002 \$5.00

FAP160 Blank Panel. 4 $\frac{1}{8}$ " x 12 $\frac{1}{4}$ ", covers openings in frame-mounted sets of Type 160-Series instruments.

Part No. 333-157 \$3.00



RECALIBRATION TOOLS...



The tools shown above are handy—and in some cases, necessary—tools for the recalibration of Tektronix Instruments. All of the tools except the assembly at the right (003-007) are available through most radio parts suppliers.

003-000 Jaco No. 125 insulated screw driver. This tool is similar to 003-001 but has a $1\frac{1}{2}$ " shank \$.75

003-001 Jaco No. 125 insulated screw driver with 7" shank and metal bit. This tool is useful for adjusting hard-to-reach adjustments on oscilloscopes \$1.25

003-003 Walsco No. 2519 insulated alignment tool. This double-ended tool is useful for adjusting variable inductors in Tektronix Instruments \$1.25

003-004 Walsco No. 2503 $\frac{1}{4}$ " insulated hexagonal wrench. This tool is useful for tightening variable inductor lock nuts on older Tektronix instruments. Current production instrments do

not have lock nuts on coil assemblies \$.60

003-007 Tektronix recalibration tool assembly. This 4-unit tool assembly provides most of the necessary tools for adjusting variable inductors in Tektronix Instruments. The price for the entire assembly is \$2.50

Individual unit prices are as follows:

003-307 Handle \$.75

003-308 Red nylon insert with wire pin50

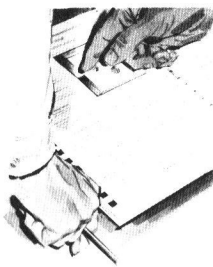
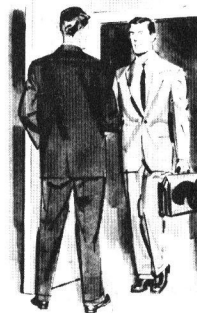
003-309 White cymac insert with wire pin. .50

003-310 Hexagonal core insert75

003-301 Walsco No. 2543 double-ended 0.1" hexagonal wrench. This tool is useful for adjusting variable inductors with hexagonal cores \$1.00

TEKTRONIX FIELD SERVICES

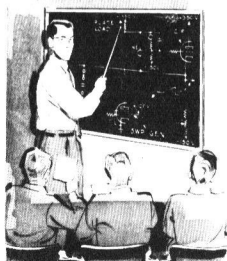
Tektronix Customers are urged to take advantage of the many field services available to them through Tektronix Field-Engineering Offices, Engineering Representatives, and Overseas Engineering Organizations. Some of these services are described below.



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.

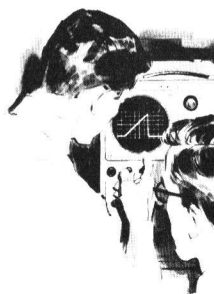
Operation—Your Tektronix Oscilloscope can be most useful to you when you are familiar with all control functions. Your Field Engineer will be glad to demonstrate the use of your instrument in various applications to help you become more familiar with its operation. If your instrument is to be used by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



In 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.

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

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

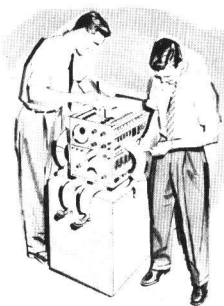


Applications—Perhaps the answers you need in a specific application can be obtained faster and easier through use of your Tektronix Oscilloscope. Your Field Engineer can help you find out, and if use of your oscilloscope is indicated, help you with procedures. He may also be able to suggest many time-saving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

Instrument Reconditioning

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

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



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

Tektronix, Inc.

Tektronix, Inc., P. O. Box 831, Portland 7, Oregon

Telephone: CYPRESS 2-2611

TWX—PD 311

Cable: TEKTRONIX

AN OREGON CORPORATION

Field Engineering Offices

ALBUQUERQUE*	Tektronix, Inc., 127C Jefferson St. N. E., Albuquerque, New Mexico	...TWX—AQ 96	AMherst 8-3373
ATLANTA*	Tektronix, Inc., 3272 Peachtree Road, N. E., Atlanta 5, Georgia	...TWX—AT 358	CEdar 3-4484
BALTIMORE*	Tektronix, Inc., 724 York Road, Towson 4, Maryland	...TWX—TOWSON MD 535	VAley 5-9000
BOSTON*	Tektronix, Inc., 18 Austin St., Newtonville 60, Massachusetts	...TWX—NEWTON MASS 940	Lasell 7-2212
BUFFALO	Tektronix, Inc., 961 Maryvale Drive, Buffalo 25, New York	...TWX—WMSV 2	SPring 7861
CHICAGO*	Tektronix, Inc., 7514 W. North Ave., Elmwood Park 35, Illinois	...TWX—RIVER GROVE ILL 1395	GLadstone 6-7930
CLEVELAND	Tektronix, Inc., 3353 Edgecliff Terrace, Cleveland 11, Ohio	...TWX—CV 352	CLearwater 2-2121
		Pittsburgh Area: ZEnith 0212	
DALLAS*	Tektronix, Inc., 6211 Denton Drive, P. O. Box 35104, Dallas 35, Texas	...TWX—DL 264	Fleetwood 2-4087
DAYTON	Tektronix, Inc., 3601 South Dixie Drive, Dayton 39, Ohio	...TWX—DY 363	AXminster 3-4175
DENVER	Hytronic Measurements, Inc., 1295 South Bannock Street, Denver 23, Colorado	...TWX—DN 863	PEarl 3-3701
DETROIT*	Tektronix, Inc., 27310 Southfield Road, Lathrup Village, Michigan	...TWX—SOUTHFIELD MICHIGAN 938	
		Elgin 7-0040	
ENDICOTT*	Tektronix, Inc., 3214 Watson Blvd., Endwell, New York	...TWX—ENDICOTT NY 290	ENdicott 8-8291
HOUSTON	Tektronix, Inc., 2605 Westgrove Lane, Houston 27, Texas	...TWX—HO 743	MOhawk 7-8301, 7-8302
KANSAS CITY	Tektronix, Inc., 5920 Nall, Mission, Kansas	...TWX—MISSION KAN 1112	RAndolph 2-6522/3
		St. Louis Area: ENterprise 6510	
LOS ANGELES AREA			
East L. A.	Tektronix, Inc., 5441 East Beverly Blvd., East Los Angeles 22, California	...TWX—MTB 7762	RAYmond 3-9408
*West L. A.	Tektronix, Inc., 11681 San Vicente Blvd., West Los Angeles 49, California	...TWX—WEST LOS ANGELES CAL 6698	BRadshaw 2-1563
		Granite 3-1105	
MINNEAPOLIS	Tektronix, Inc., 3100 W. Lake Street, Minneapolis 16, Minnesota	...TWX—MP 983	WAlnut 7-9559
NEW YORK CITY AREA			
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Westchester County, Western Connecticut, Hudson River Valley served by:			
	Tektronix, Inc., 49 Pondfield Road, Bronxville 8, New York	...TWX—BRONXVILLE NY 1207	DEerfield 7-3771
*Northern New Jersey served by:			
	Tektronix, Inc., 412 Chestnut Street, Union, New Jersey	...TWX—UNVL 82	MURdock 8-2222
ORLANDO*	Tektronix, Inc., 205 East Colonial Drive, Orlando, Florida	...TWX—OR 7008	GArden 5-3483
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PHILADELPHIA*	Tektronix, Inc., 7709 Ogontz Ave., Philadelphia 50, Pennsylvania	...TWX—PH 930	WAverly 4-5678
PHOENIX	Tektronix Inc., 7000 E. Camelback Road, Scottsdale Arizona	...TWX—SCOTTSDALE ARIZ 52	WHitney 6-1601
PORTLAND	Hawthorne Electronics, 700 S. E. Hawthorne Blvd., Portland 14, Oregon	...TWX—SE 798	ELmont 4-9375
SALT LAKE CITY	Hytronic Measurements, Inc., 2022 South Main St., Salt Lake City 15, Utah	...TWX—SU 563	INGersoll 6-4924
SAN DIEGO	Tektronix, Inc., 1900 Rosecrans Street, P. O. Box 6157, San Diego 6, California	...TWX—SD 6341	ACademy 2-0384
SEATTLE	Hawthorne Electronics, 101 Administration Bldg., Boeing Field, Seattle, Washington	...TWX—SE 798	PArkway 5-1460
ST. PETERSBURG	Tektronix Inc., 2330 Ninth Street South, St. Petersburg 5, Florida	...TWX—ST PBG 8034	ORange 1-6139
SYRACUSE*	Tektronix, Inc., 313 Nottingham Road, Syracuse 10, New York	...TWX—SS 423	GLbson 6-5630
TORONTO*	Tektronix, Inc., 3 Finch Ave., East, Willowdale, Ontario, Canada		Toronto, BAIdwin 5-1138
WASHINGTON D. C.*	Tektronix, Inc., 9619 Columbia Pike, Annandale, Virginia	...TWX—FALLS CHURCH VA 760	CLearbrook 6-7411

*ALSO REPAIR CENTERS

Overseas Representatives

ARGENTINA	Ricma Argentina S. A., Sarmiento 309-Tercer Piso, Casilla Correo 2824, Buenos Aires, Argentina	Gerencia: 31-3990
AUSTRALIA	Electronic Industries Imports Pty. Ltd., 90 Grote St., Adelaide, S.A., Australia	LA-5295
	Electronic Industries Imports Pty. Ltd., 52 Bowen St., Brisbane, Qld., Australia	B-6462
	Electronic Industries Imports Pty. Ltd., 139-143 Bouverie St., Carlton, N. 3, Melbourne, Australia	FJ-4161/8
	Electronic Industries Imports Pty. Ltd., 68 Railway Pde., West Perth, W.A., Perth, Australia	BA-8587/9686
	Electronic Industries Imports Pty. Ltd., 713 Parramatta Rd., Leichhardt, NSW, Sydney, Australia	LM-6327
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BELGIUM	Regulation-Mesure, S.P.R.L. 22, rue Saint-Hubert, Bruxelles, Belgium	70. 79. 89
BRAZIL	Consulting & Suppliers Company for South America Inc., 61 Broadway, New York 6, New York	BOWling Green 9-0610
	Importacao Industria E Comercio Ambriex S. A., Av. Graca Aranha 57-510 Rio De Janeiro, Brazil	42-7990, 42-7291
	Palmar Ltda., Rua 7 de Abril 252, Sao Paulo, Brazil	34-4497
CUBA	Laboratorios Meditron, Calle B No. 56 Vedado, Habana, Cuba	F-5970
DENMARK	Tage Olsen A/S, Centrungsgaarden, Room 133, 60, Vesterbrogade, Kobenhavn V, Denmark	Palae 1369, Palae 1343
ENGLAND	Livingston Laboratories Ltd., Retcar Street, London N.19, England	Archway 6251
FINLAND	Into O/Y, 11 Meritullinkatu, Helsinki, Finland	62 14 25, 35 125
FRANCE	Maurice I. Parisier & Co., 741-745 Washington St., New York 14, N. Y.	Algonquin 5-8900
	Relations Techniques Intercontinentales, 134 Avenue de Malakoff, Paris 16, France	Passy 08-36, Kleber 54-82
INDIA	Electronic Enterprises, 46, Karani Building, Opp. Cama Bag., New Charni Road, Bombay 4, India	75376
ISRAEL	Landseas Products Corp., 48 West 48th Street, New York 36, New York	COLUMbus 5-8323
	Landseas Eastern Co., P. O. Box 2554, Tel Aviv, Israel	66890
ITALY	Silverstar, Ltd., 21 Via Visconti Di Modrone, Milan, Italy	792.791/709.536
	Silverstar, Ltd., Via Paisiello 12, Roma, Italy	8-74623
JAPAN	Midoriya Electric Co., Ltd., 3-2-Chome, Kyobashi, Chuo-ku, Tokyo, Japan	Kyobashi (56) 1786, 7415, 7416, 7439
NETHERLANDS	C. N. Rood, n. v., 11-13 Cort van der Lindenstraat, Rijswijk, Z.H., Netherlands	The Hague 98.51.53
NORWAY	Morgenstjerne & Company, Colletts Gate 10, Oslo, Norway	60 17 90
SWEDEN	Erik Ferner AB, Bjornsonsgatan 197, Bromma, Stockholm, Sweden	870140
SWITZERLAND	Omni Ray AG, Dufourstrasse 56, Zurich 8, Switzerland	(051) 34-44-30
UNION OF SOUTH AFRICA		
	Protea Holdings, Ltd., 42, Faraday Street, Wemmer, Johannesburg, Union of South Africa	33-4762/3
URUGUAY	Compania Uruguaya De Rayos X y Electromedicina S. A. Mercedes 1300, Yaguaron 1449, Montevideo, Uruguay	8 58 29
WEST GERMANY	Rohde & Schwarz Vertriebs, GmbH, Berlin W30, Augsburgstrasse 33, West Germany	91 27 62
	Rohde & Schwarz Vertriebs, GmbH, Hannover, Schillerstrasse 23, West Germany	1 33 80
	Rohde & Schwarz Vertriebs, GmbH, Karlsruhe, Kriegstrasse 39, West Germany	25202
	Rohde & Schwarz Vertriebs, GmbH, Koln, Habsburger-Ring 2-12, West Germany	215341
	Rohde & Schwarz Vertriebs, GmbH, Munchen 9, Auerfeldstrasse 22, West Germany	4 46 38
	Rohde & Schwarz Vertriebs, GmbH, Munchen 9, Brienerstrasse 23, West Germany	59 52 65

Other OVERSEAS areas please write or cable directly to the Export Department, Portland, Oregon, U.S.A.