INSTRUCTION MANUAL

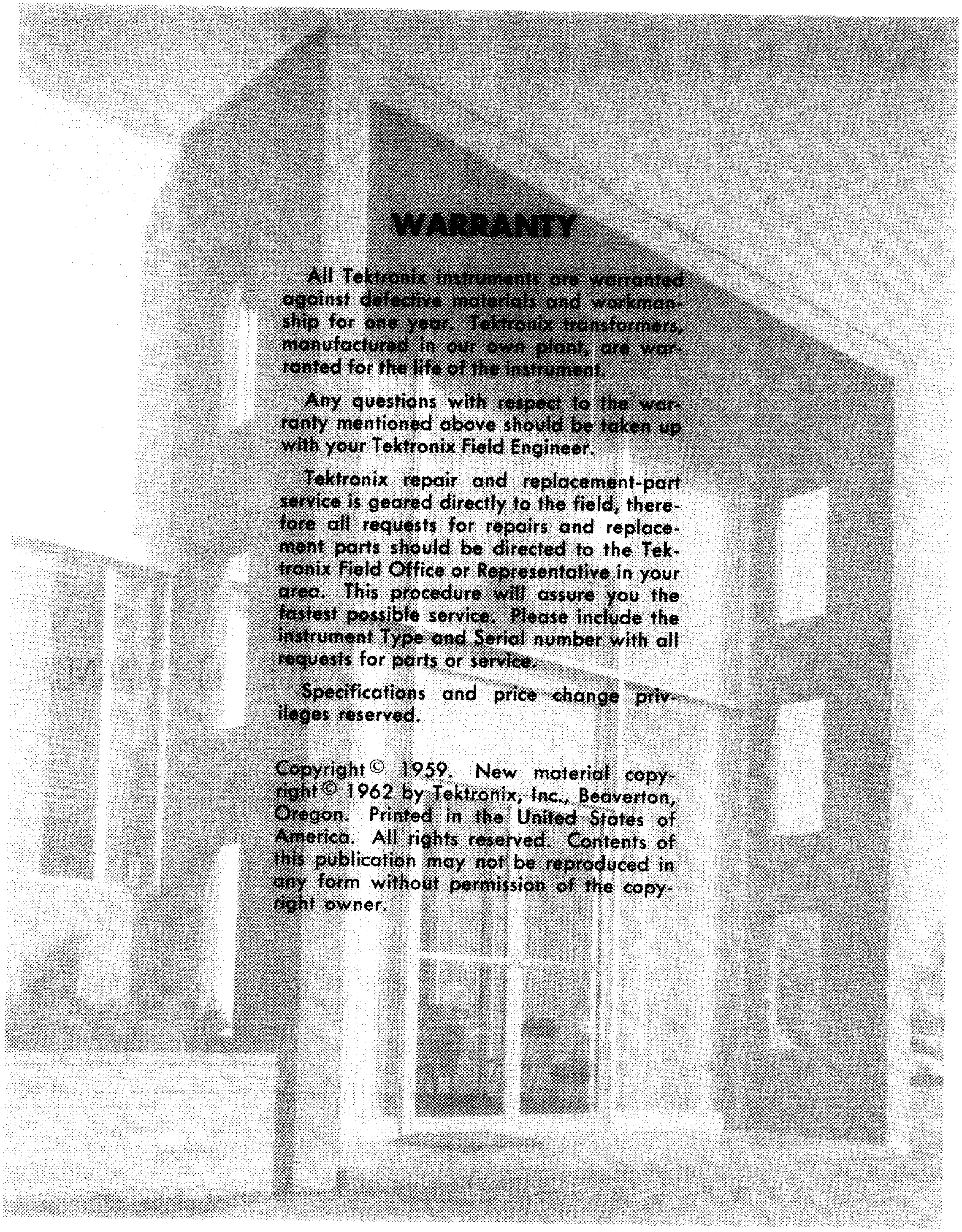
DO NOT REMOVE
SERVICE DEPT. MANUAL

TYPE P PLUG-IN

Tektronix, Inc.
S.W. Millikan Way ● P. O. Box 500 ● Beaverton, Oregon ● Phone MI 4-0161 ● Cables: Tektronix

Tektronix International A.G.
Terrassenweg 1A ● Zug, Switzerland ● PH. 042-49192 ● Cable: Tekintag, Zug Switzerland ● Telex 53.574

070-346



WARRANTY

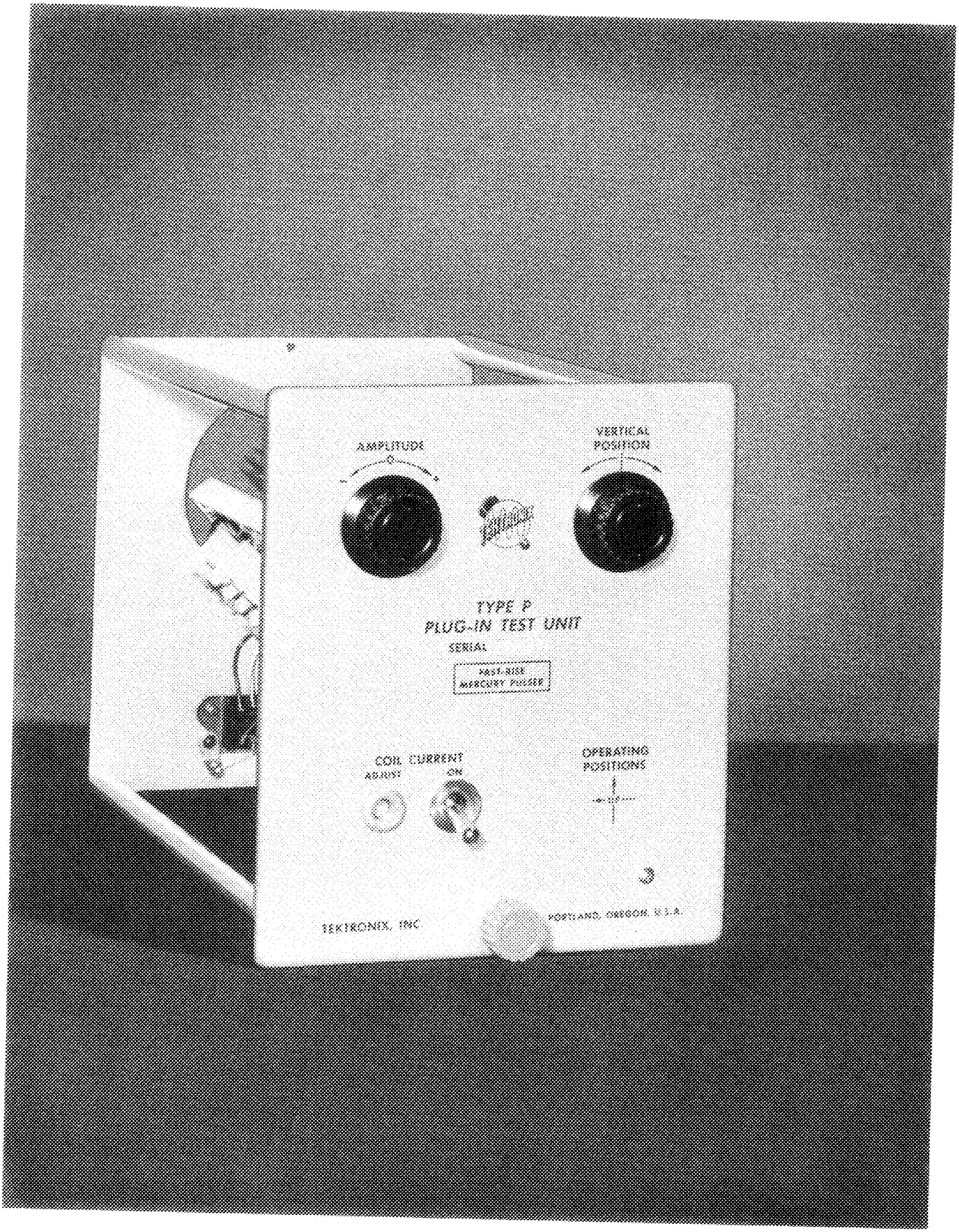
All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own plant, are warranted for the life of the instrument.

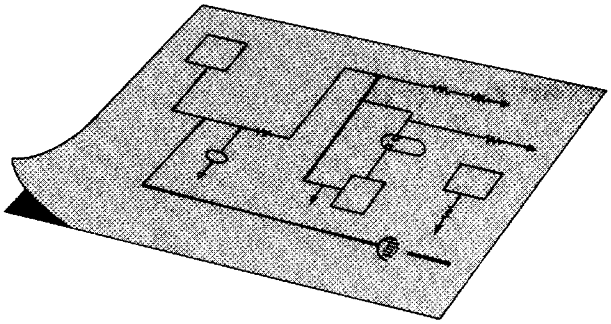
Any questions with respect to the warranty mentioned above should be taken up with your Tektronix Field Engineer.

Tektronix repair and replacement-part service is geared directly to the field, therefore all requests for repairs and replacement parts should be directed to the Tektronix Field Office or Representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type and Serial number with all requests for parts or service.

Specifications and price change privileges reserved.

CONTENTS


AMPLITUDE
VERTICAL POSITION
TYPE P
PLUG-IN TEST UNIT
SERIAL
FAST-RISE MERCURY PULSER
COIL CURRENT
ADJUST
ON
OPERATING POSITIONS
TEKTRONIX, INC.
PORTLAND, OREGON, U.S.A.



SECTION 1

CHARACTERISTICS

The Type P Plug-In Unit generates a fast-rise step-function test signal of 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. The Type P permits the standardization of the main-unit vertical amplifier transient response of a Tektronix convertible oscilloscope.

After standardization, a 540-Series oscilloscope may be used in conjunction with a Type 107 Square Wave Generator to standardize the transient responses of amplifier-type plug-in units. Standardized oscilloscopes and plug-in units may be used interchangeably without readjustment of the high-frequency compensating circuits.

RISETIME

When the Type P is used to standardize a 540-Series oscilloscope, the risetime of the Type P is approximately 4 nanoseconds.

REPETITION RATE

The repetition rate is 240 step functions per second.

Polarity

Either positive or negative step functions may be generated.

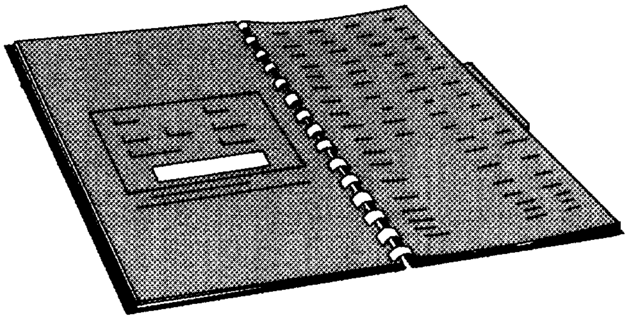
Amplitude

The amplitude of the step function is continuously adjustable from 0 to 3 major graticule divisions.

Physical Characteristics

Construction -- Aluminum alloy chassis.
Finish--Photo-etched anodized panel.
Weight--3 1/2 pounds.

NOTES



SECTION 2

OPERATING INSTRUCTIONS

The Type P Plug-In Test Unit is used principally for setting the vertical-amplifier compensations and adjusting the delay lines of 540- and 550-Series oscilloscopes. In addition to its use in the 540- and 550-Series oscilloscopes, the Type P is suitable for use in those 530-Series Oscilloscopes incorporating a delay line in the vertical deflection system.

CAUTION

Note that the Type P Plug-In Test Unit will only operate in either of the two physical positions indicated by the UP arrows on the front panel. One position corresponds to the usual vertical position of the oscilloscope, the other corresponds to having the oscilloscope resting on its right side. Insert the Type P Plug-In Test Unit and position the oscilloscope to meet requirements.

Coil Current Adjustment

For best results, the coil current adjustment should be made each time the Type P is put into service. The need for readjustment is indicated by erratic mercury switch operation. Refer to the Calibration procedure for this adjustment.

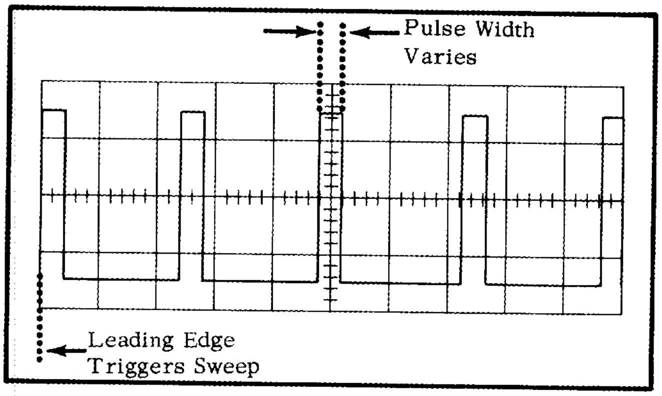


Fig. 2-1. Line drawing of a typical Type P Plug-In Unit waveform at a sweep rate of 2 milliseconds per centimeter. The normal pulse jitter is not reproduced here.

Positive Step Function

Useful oscilloscope displays are obtained at sweep rates of 10 microseconds per centimeter and faster, using internally derived triggering signals. Internal triggering results in a stable display even though the mercury switch has jitter (the usual case).

To display a positive step function preset:

Type P

COIL CURRENT switch	ON
AMPLITUDE	O

Oscilloscope

TRIGGERING MODE	AC LF REJECT/ AC FAST
TRIGGER SLOPE	+ INT
TIME/CM	desired sweep rate
TRIGGERING LEVEL	full clockwise
STABILITY	full clockwise
INTENSITY	normal brilliance

Turn the AMPLITUDE control clockwise until the desired amplitude has been obtained. Now adjust the STABILITY and TRIGGERING LEVEL controls for a triggered waveform. Refer to the oscilloscope manual for triggering procedure.

NOTE

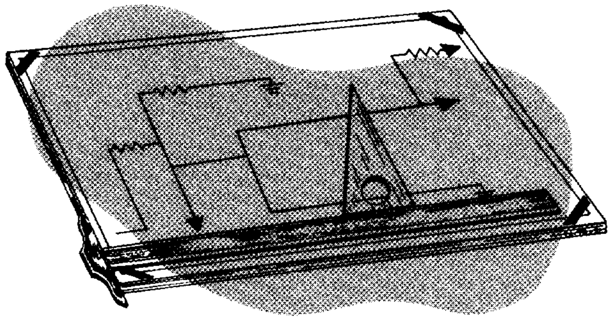
The intensity will have to be turned up to see the waveform. Be sure that when turning up the intensity it does not go high enough to burn the crt phosphor.

Now adjust the FOCUS and ASTIGMATISM for the sharpest trace with the higher intensity.

Negative Step Function

Tektronix oscilloscopes are usually adjusted for optimum response to a positive step function. Should you wish to check the response of your oscilloscope to a negative step function, use the same procedure as with the positive function with the following exceptions.

Set the TRIGGER SLOPE to -INT and when adjusting the AMPLITUDE control for the desired amplitude turn it counterclockwise from O.



SECTION 3

CIRCUIT DESCRIPTION

The Type P fills the need for a test-signal generator of known waveform, that can be used to standardize the main-unit vertical-amplifier transient response of a Tektronix convertible oscilloscope. 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 has very stable waveform characteristics. The waveform of the Type P is determined by stable circuit constants. Ordinary measuring equipment will verify circuit values should the output waveform be in doubt. The Type P provides a known test signal that simulates the output of an ideally compensated Type K Plug-In Unit driven with a fast-rise step function.

OUTPUT WAVEFORM

Simulation of the output of a Type K Plug-In Unit involves two separate and distinct waveform slopes. In Fig. 3-1 (I), that portion of the waveform between points **a** and **b** corresponds to the risetime of a Type K. The gradual slope from **b** to **c** corresponds to a long time-constant undershoot of a Type K. For clarity, the amount of the undershoot is exaggerated.

Fig. 3-1 (II) shows the main-unit vertical-amplifier response of a properly adjusted oscilloscope. A slight overshoot of the main-unit oscilloscope amplifier compensates for the undershoot of the Type K (here simulated by the Type P Plug-In Test Unit). Once again, the overshoot of the main-unit vertical amplifier is exaggerated for clarity. The actual overshoot is approximately 2 per cent.

You do not actually observe the curves of Fig. 3-1 (I) and Fig. 3-1 (II) when you use the Type P. The waveform displayed on the oscilloscope screen is shown in Fig. 3-1 (III). You automatically overcompensate the main-unit vertical amplifier by the proper amount when you adjust for the optimum over-all response shown.

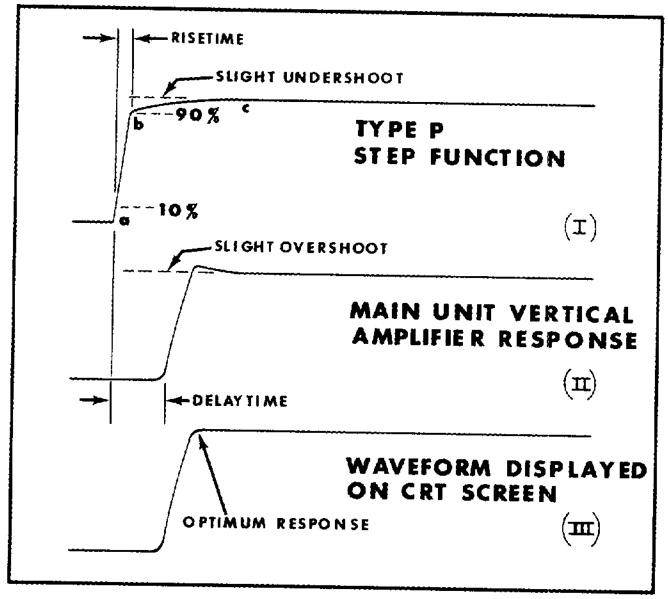


Fig. 3-1. Waveform differences in a Type P/540 Series oscilloscope combination.

MERCURY SWITCH

The fast rise and stable display of the Type P is made possible by the bounce-free low-impedance mercury switch incorporated into the design. The figure below illustrates the important switch details. For simplicity, an extra pair of contacts not used in the electrical circuit are omitted as a safety precaution, the high-pressure hydrogen-filled glass envelope is encapsulated in an additional plastic case.

Although it is not readily apparent, the stationary electrodes marked **A** and **B** form the single-throw switch shown in our circuit diagram. A description of the switching action follows:

1. When the actuating coil is not energized, the armature is held by spring force against contact **A**.

2. Mercury is fed from the reservoir into the hairpin loop **C** at the end of the armature by capillary action. When the switch is in operation, the capillary transfer of the mercury from the reservoir to the hairpin loop is aided by centrifugal force.

3. Magnetic materials are used in fabricating the switch contacts and the armature. These switch parts are located in and form a part of the magnetic circuit. When the actuating coil is energized, magnetic forces move the armature from contact **A** to contact **B**.

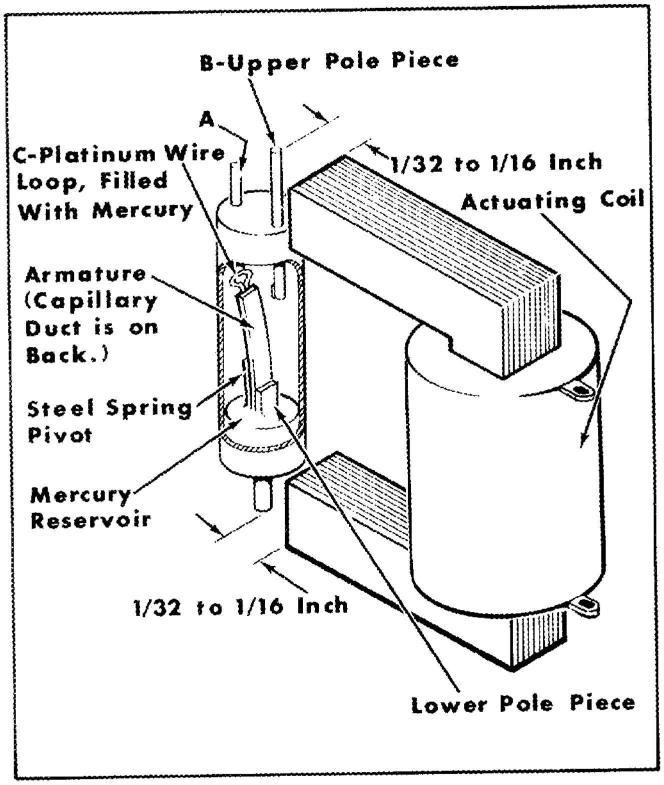


Fig. 3-2. The Type P Unit mercury switch. The drawing is not to scale.

4. The armature and the switch contacts are wetted by the mercury, allowing the mercury to adhere to their surfaces. When the hairpin loop moves from contact **A** to contact **B**, a column of mercury momentarily bridges the gap between these electrodes. After a short time the mercury column falls and returns to the reservoir. The time that the mercury column maintains contact between the terminals **A** and **B** varies considerably from switch to switch and from one switch operation to the next for a particular switch. Usually the connection lasts for a period of more than 50 microseconds. This far exceeds the requirements for the Type P in its normal application.

5. As the actuating coil is deenergized, the armature returns to its normal rest position, repeating the switching action. This gives two switch closures for each complete cycle of the vibrating armature. The armature normally vibrates at 120 cycles per second, corresponding to 240 switch closures per second.

ACTUATING-COIL CIRCUIT

One of the design objectives for the Type P Plug-In Test Unit was to increase the pulse repetition rate to the highest practical value. Higher repetition rates correspond to increased apparent trace brightness. The maximum usable repetition rate is determined by the mercury switch capabilities. Reliable switching is observed for armature-vibration frequencies up to about 120 cycles per second.

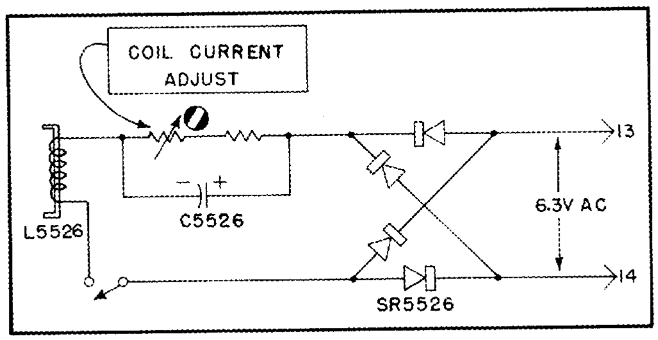


Fig. 3-3. The actuating-coil circuit diagram.

A full-wave bridge selenium rectifier, SR5526, is used to rectify the 60-cycle supply voltage. The resultant voltage waveform has a large 120-cycle component as well as a dc component. Most of the 120-cycle voltage component is applied directly to the actuating coil, L5526, as a result of the bypassing action of C5526. The COIL CURRENT ADJUST control serves primarily to adjust the dc current flowing in the actuating coil. When properly adjusted, this control sets the average position of the mercury-switch armature to a reliable operating point.

WAVEFORM SHAPING CIRCUITS

In Fig. 3-4, we have reproduced that part of the Type P circuit diagram associated with waveform shaping. Included on the diagram are the input capacitances of the oscilloscope under test (C_1 and C_2). The resistors connecting the wave-shaping circuits to the VERTICAL POSITION and AMPLITUDE potentiometers (not shown in the figure) are large enough to effectively

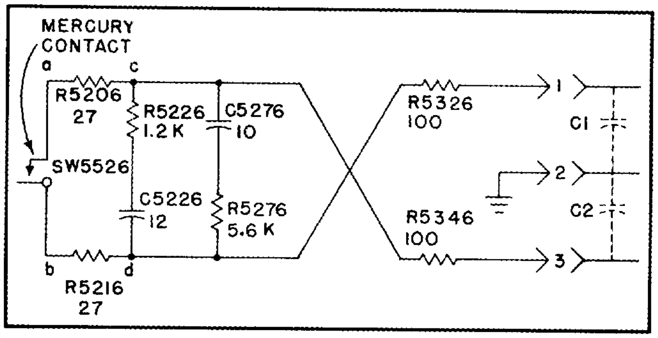


Fig. 3-4. The waveform-shaping circuit diagram.

isolate the circuit capacitances of the VERTICAL POSITION and AMPLITUDE circuits. Charging currents flowing in these resistors when the mercury switch closes are negligible.

For purposes of qualitative analysis, we can simplify the circuit shown in Fig. 3-4. C5276 and R5276 perform nearly the same circuit function as R5226 and C5226. Since these branch circuits differ only in terms of their respective time constants, we can temporarily remove C5276 and R5276. If we consider only the voltage change at connector pin 3 resulting from the mercury switch closure, R5216 and R5326 may be neglected. The simplified and rearranged circuit is shown in Fig. 3-5.

Prior to the time of mercury switch closure, the voltage across C5226 and C_2 is determined by the setting of the AMPLITUDE control. When the AMPLITUDE control is set for a positive step-function display, the voltage polarity is as shown in Fig. 3-5. C5226 and C_2 act as the electron source during the time interval immediately following mercury switch closure. At the time of mercury switch closure, the voltage between points **c** and **d** falls almost immediately to within a few per cent of the final value as a result of the voltage dividing action of R5206 and R5226. Then, as C5226 discharges through R5206 and R5226, the voltage between points **c** and **d** continues to fall at a much slower rate toward zero.

The circuit action just described shapes the waveform to simulate the long time-constant undershoot of the Type K. We can now see the effect of C5276 and R5276 in Fig. 3-4. This resistor-capacitor combination gives an additional long time-constant correction to better simulate the waveform characteristics of the Type K. Concurrently with the discharge of C5226, C_2 discharges though R5346 and R5206, producing the less abrupt fall indicated by the waveform at pin 3. The resulting composite waveform simulates the output of a Type K Plug-In Unit driven with a fast-rise step function.

In the preceding section, we have analyzed the generation of a negative step function at pin 3 of the connector. A similar analysis will show that a positive step function is generated at pin 1 of the connector simultaneously.

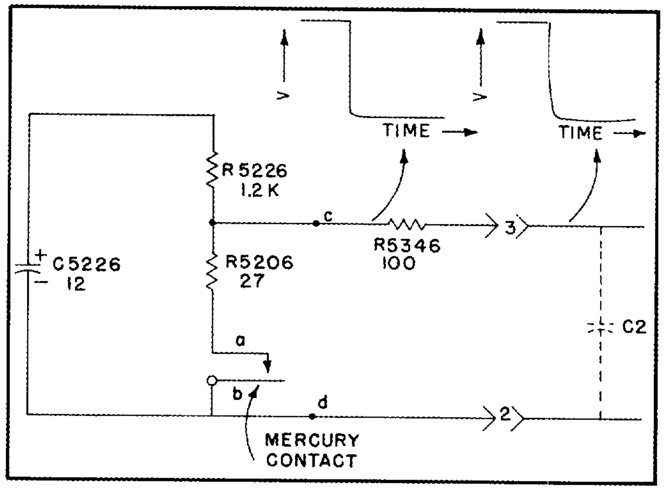
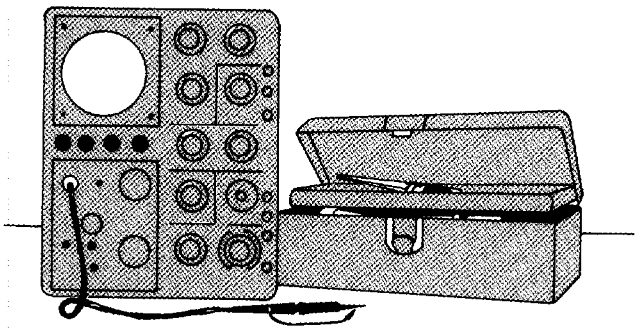


Fig. 3-5. Simplified waveform-shaping circuit diagram. The waveform rolloffs are exaggerated for clarity.

The risetime of the Type P is dependent upon the input capacitances (C_1 and C_2) of the oscilloscope under test. With a 540-Series oscillocope, the risetime of the Type P is about 4 nanoseconds. This risetime is slightly faster that that of the Type K Plug-In Unit. The faster risetime of the Type P allows a sharper adjustment of the first few sections of the delay line.

The useful part of the Type P waveform is generated when the mercury switch closes. The risetime of the step function generated when the mercury switch opens is very much longer. For this reason, you are cautioned to use the pulse polarities and trigger settings outlined under Operating Instructions.

NOTES



SECTION 4

MAINTENANCE

Recalibration

The Type P Plug-In Unit is designed for maximum stability and should not require frequent calibration. However, to insure the accuracy of measurements, we suggest that you calibrate the instrument after each 500-hour period of operation (or every six months if the unit is used intermittently). A complete step-by-step procedure for calibrating the unit and checking its operation is given in the Calibration section of this manual. The accuracy of adjustments made with the Type P Unit depends not only on the accuracy of the Type P Unit but on the associated oscilloscope calibration as well. Therefore, it is essential that the oscilloscope be maintained in proper calibration.

Visual Inspection

Many potential and existent troubles can be detected by a visual inspection of the unit. For this reason, you should perform a complete visual check every time the instrument is calibrated or repaired. Apparent defects may include loose or broken connections, damaged connectors, scorched or burned parts, or broken terminal strips, as well as many other troubles. The remedy for these troubles is readily apparent except in the case of heat-damaged parts. Damage of parts due to heat is often the direct result of other, less apparent troubles in the circuit. It is essential that you determine the cause of overheating before replacing the damaged parts to prevent damage to the new components.

COMPONENT REPLACEMENT

The procedures for replacing most parts in the Type P Unit are obvious. Detailed instructions for their removal are therefore not required. Other components, however, can best be removed if a definite procedure is followed or if certain precautions are taken. Additional information for the replacement of some of these parts is contained in the following paragraphs.

Mercury Switch

Special care is required to replace the mercury switch. The switch consists of a glass envelope containing the contacts, the mercury reservoir, and a gas under high pressure. If the glass should be broken or cracked during removal or replacement of the switch, the envelope will likely explode. This could produce serious injury to the eyes due to flying glass.

Soldering and Ceramic Strips

Many of the components in your Tektronix instrument are mounted on ceramic terminal strips. The notches in these strips are lined with a silver alloy. Repeated use of excessive heat, or use of ordinary tin-lead solder will break down the silver-to-ceramic bond. Occasional use of tin-lead solder will not break the bond if excessive heat is not applied.

If you are responsible for the maintenance of a large number of Tektronix instruments, or if you contemplate frequent parts changes, we recommend that you keep on hand a stock of solder containing about 3% silver. This type of solder is used frequently in printed circuitry and should be readily available from radio-supply houses. If you prefer, you can order directly from Tektronix in one-pound rolls. Order by Tektronix part number 251-514.

Because of the shape of the terminals on the ceramic strips it is advisable to use a wedge-shaped tip on your soldering iron when you are installing or removing parts from the

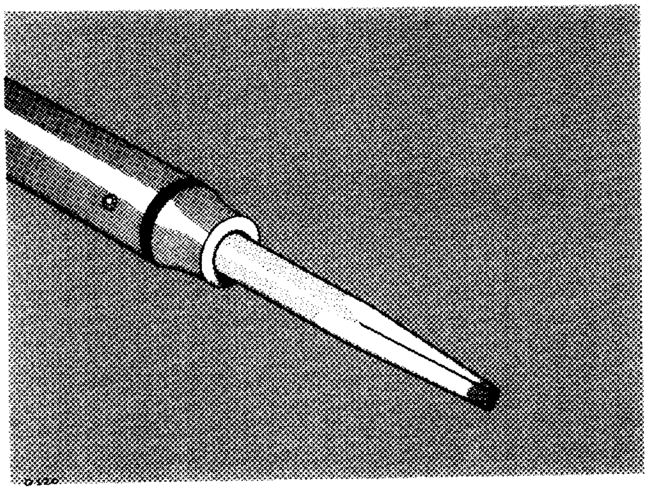


Fig. 4-1. Soldering iron tip properly shaped and tinned.

strips. Fig. 4-1 will show you the correct shape for the tip of the soldering iron. Be sure and file smooth all surfaces of the iron which will be tinned. This prevents solder from building up on rough spots where it will quickly oxidize.

When removing or replacing components mounted on the ceramic strips you will find that satisfactory results are obtained if you proceed in the manner outlined below.

1. Use a soldering iron of about 75-watt rating.

2. Prepare the tip of the iron as shown in Fig. 4-1.

3. Tin only the first 1/16 to 1/8 inch of the tip. For soldering to ceramic terminal strips tin the iron with solder containing about 3% silver.

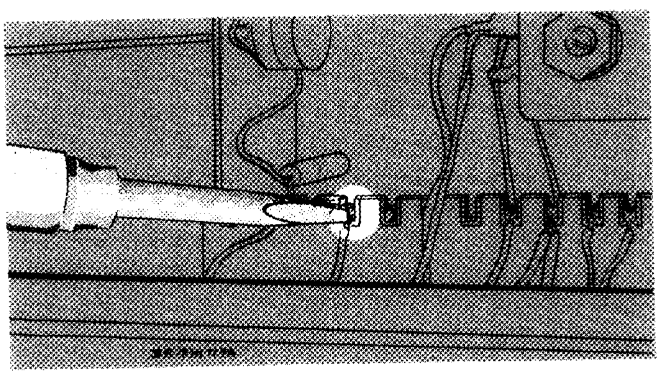


Fig. 4-2. Correct method of applying heat in soldering to a ceramic strip.

4. Apply one side of the tip to the notch where you wish to solder (see Fig. 4-2).

5. Apply only enough heat to make the solder flow freely.

6. Do not attempt to fill the notch on the strip with solder; instead, apply only enough solder to cover the wires adequately, and to form a slight fillet on the wire as shown in Fig. 4-3.

In soldering to metal terminals (for example, pins on a tube socket) a slightly different technique should be employed. Prepare the iron as outlined above, but tin with ordinary tin-lead solder. Apply the iron to the part to be soldered as shown in Fig. 4-4. Use only enough heat to allow the solder to flow freely along the wire so that a slight fillet will be formed as shown in Fig. 4-4.

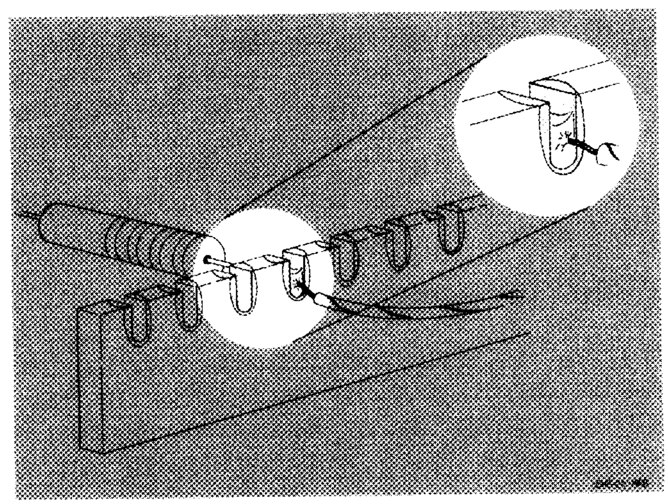


Fig. 4-3. A slight fillet of solder is formed around the wire when heat is applied correctly.

General Soldering Considerations

When replacing wires in terminal slots clip the ends neatly as close to the solder joint as possible. In clipping ends or wires take care the end removed does not fly across the room as it is clipped.

Occasionally you will wish to hold a bare wire in place as it is being soldered. A handy device for this purpose is a short length of wooden dowel, with one end shaped as shown in Fig. 4-5. In soldering to terminal pins mounted in plastic rods it is necessary to use some from of "heat sink" to avoid

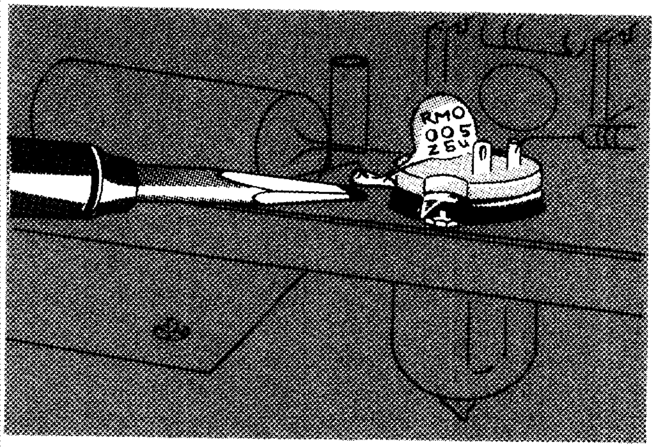


Fig. 4-4. Soldering to a terminal. Note the slight fillet of solder--exaggerated for clarity--formed around the wire.

melting the plastic. A pair of long-nosed pliers (see Fig. 4-6) makes a convenient tool for this purpose.

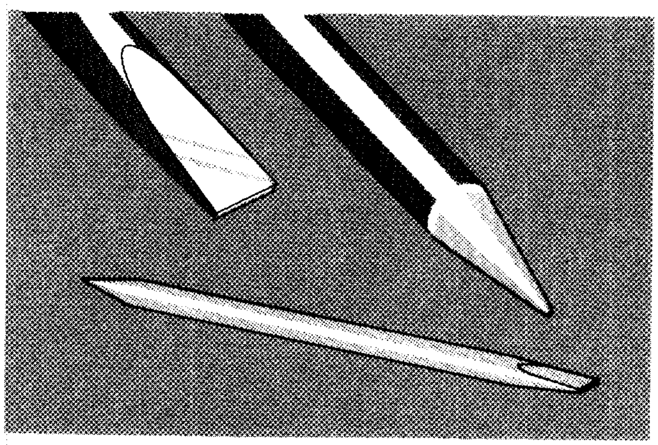


Fig. 4-5. A soldering aid constructed from a 1/4 inch wooden dowel.

Ceramic Strips

Two distinct types of ceramic strips have been used in Tektronix instruments. The earlier type mounted on the chassis by means of #2-56 bolts and nuts. The later type is mounted with snap-in plastic fittings. Both styles are shown in Fig. 4-7.

To replace ceramic strips which bolt to the chassis, screw a #2-56 nut onto each mounting bolt, positioning the nut so that the distance between the bottom of the nut and the bottom of the ceramic strip equals the height at which you wish to mount the strip above the chassis. Secure the nuts to the bolts with a drop of red glyptal. Insert the bolts through the holes in the chassis where the original strip was mounted, placing a #2 star-washer between each nut and the chassis.

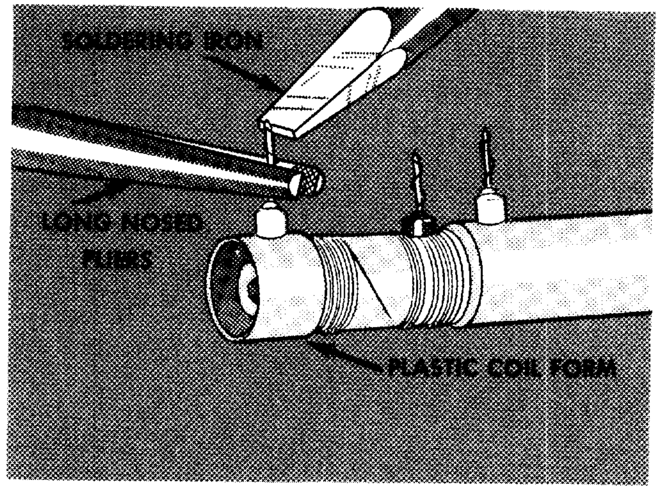


Fig. 4-6. Soldering to a terminal mounted in plastic. Note the use of the long-nosed pliers between the iron and the coil form to absorb the heat.

Place a second set of #2 flatwashers on the protruding ends of the bolts, and fasten them firmly with another set of #2-56 nuts. Place a drop of red glyptal over each of the second set of nuts after fastening.

Mounting Later Ceramic Strips

To replace strips which mount with snap-in plastic fittings, first remove the original fittings from the chassis. Assemble the mount-

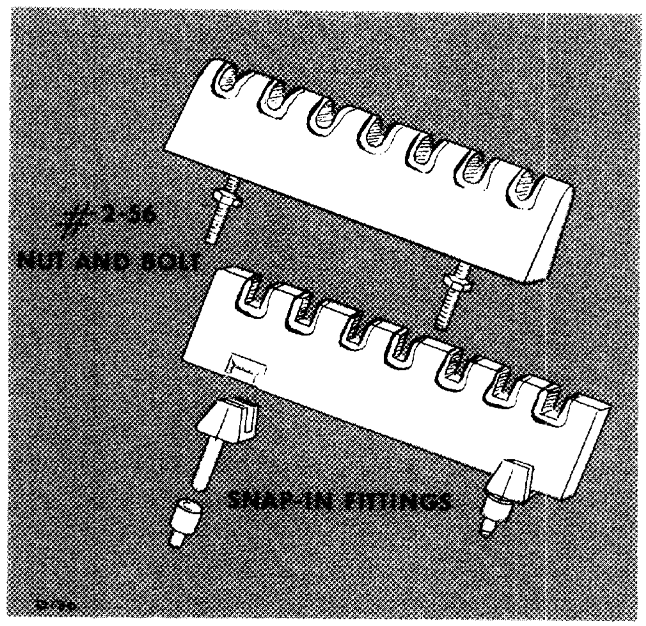


Fig. 4-7. Two types of ceramic strip mountings.

ing post on the ceramic strip. Insert the nylon collar into the mounting holes in the chassis. Carefully force the mounting post into the nylon collars. Snip off the portion of the mounting post which protrudes below the nylon collar on the reverse side of the chassis.

NOTE

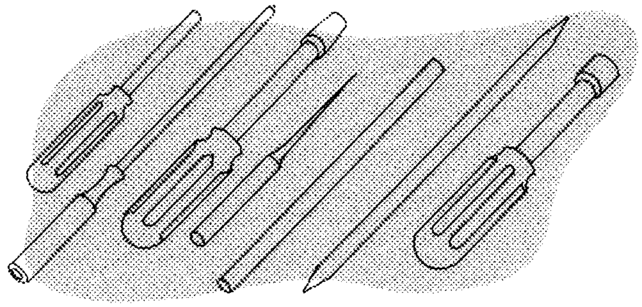
Considerable force may be necessary to push the mounting rods into the nylon collars. Be sure that you apply this force to that area of the ceramic strip directly above the mounting rods.

TROUBLESHOOTING

This section is included to provide you with information about the Type P Plug-In Unit that will enable you to more efficiently troubleshoot the instrument in the event of equipment failure. During troubleshooting work, you should correlate information contained in this section with information obtained from other sections of this manual.

A schematic diagram of the circuit is contained in the rear portion of this manual. The reference designation of each electronic component in the instrument is shown on the circuit diagram as well as important voltages. These voltages may be used during troubleshooting to isolate the cause of the trouble.

All wiring in the Type P Unit is color coded to facilitate circuit tracing. Specific color codes are used to distinguish the leads for the power-supply voltages obtained from the oscilloscope. These power-supply leads follow the standard RETMA code. The -150 volts bus wire is coded brown-green-brown; the +350 volts bus is coded orange-green-brown; the +225 volts bus is coded red-red-brown and the +100 volts bus is coded brown-black-brown. The widest stripe identifies the first color of the code.



SECTION 5

CALIBRATION PROCEDURE

Equipment Required

1. Tektronix convertible oscilloscope.

2. DC voltmeter with sensitivity of at least 20,000 -ohms per volt.

1. Preliminary

Before installing the Type P Plug-In Unit in the oscilloscope, make a careful visual inspection of the wire dress. This is particularly important if any soldering has been done to the unit. Now check the clearance between the contacts of the mercury switch and the pole faces of the magnet. This clearance should be 1/32 to 1/16 of an inch. Then make the following resistance-to-ground checks at the 16-pin interconnecting plug. The table below lists the nominal resistance value from each pin to ground.

The Type P is a stable plug-in and shouldn't require frequent calibration. However, a periodic calibration is desirable from the standpoint of preventive maintenance.

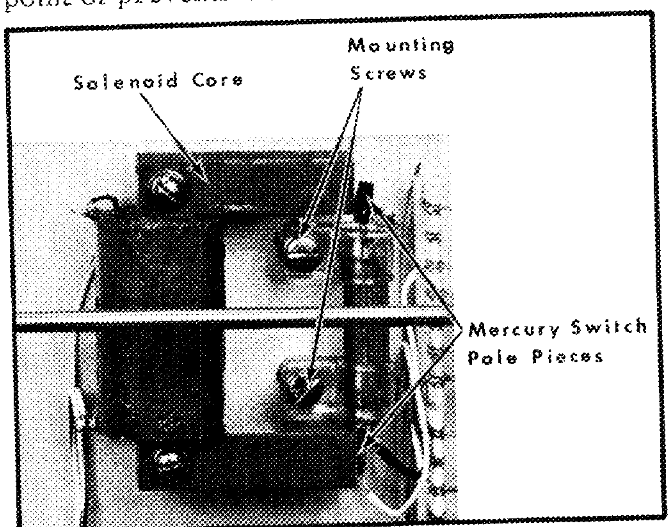


Fig. 5-1. The mercury-switch pole pieces should be positioned within 1/32 to 1/16 inch of the solenoid core. Loosening the mounting screws permits adjustment.

NOMINAL RESISTANCES AT INTERCONNECTING PLUG

PIN NUMBER	RESISTANCE-TO-GROUND
1	3.4k
2	0
3	3.4k
4	infinite
5	infinite
6	infinite
7	infinite
8	infinite
9	18k
10	7.5k
11	10.5k
12	infinite
13	infinite
14	infinite
15	500
16	infinite

Install the Type P unit into the oscilloscope and set the oscilloscope controls as follows:

HORIZONTAL DISPLAY	INTERNAL SWEEP (Type 541A) NORMAL (Type 543A) "A" (Type 545A)
TRIGGERING MODE	AUTOMATIC
TRIGGER SLOPE	+INT
STABILITY	Not used in Automatic mode
TRIGGERING LEVEL	
TIME/CM	5 MILLISEC
VARIABLE	CALIBRATED
5X MAGNIFIER	OFF

The Type P controls are set:

AMPLITUDE	centered
VERTICAL POSITION	centered
COIL CURRENT	off

Turn on the oscilloscope and while it is warming up lay the oscilloscope on its right side and remove the bottom plate from the oscilloscope.

2. DC Output Level

Measure the voltage between pin 1 and ground, and between 3 and ground, of the interconnecting plug. These voltages should measure +67 to 70 volts.

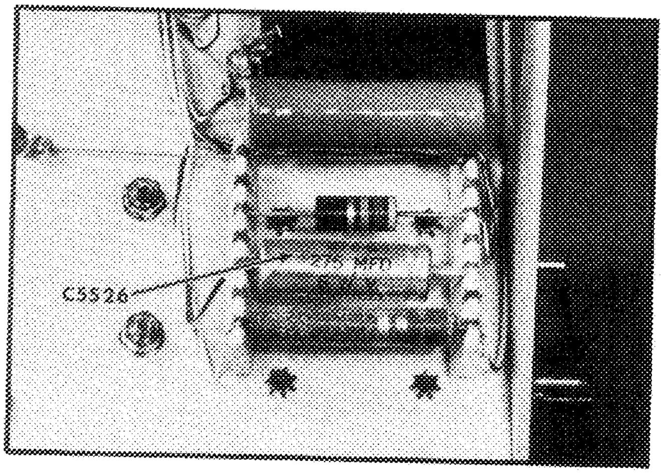


Fig. 5-2. The dc voltage across C552b should be from 2.5 to 4.4 volts depending on the setting of the CURRENT ADJUST control.

3. Setting COIL CURRENT ADJUST

Place the oscilloscope so that the Type P will be in one of its operating positions. Turn the COIL CURRENT on and adjust the COIL CURRENT ADJUST for fastest switching rate of the Mercury switch, indicated by the highest pitch of audible switch noise.

Now using the VERTICAL POSITION and AMPLITUDE controls obtain 3 cm of positive going pulse display. Readjust the COIL CURRENT ADJUST slightly to obtain the most stable display.

4. Operating Positions

Check to see that the plug-in will operate in either of its two operating positions. These two positions are indicated by arrows on the front panel of the Type P.

5. Positioning the Knobs

Find the vertical-system electrical center of the oscilloscope by connecting the two vertical plate pins of the crt together with a short jumper. Note the vertical position of the trace and disconnect the jumper.

With the COIL CURRENT switch off, position the trace of the oscilloscope with the VERTICAL POSITION control until it is superimposed upon the position where the vertical-system electrical center was found to be. The index dot on the knob should now be pointing at the vertical line, if it isn't loosen the set screw and adjust the knob until it does.

Now with the COIL CURRENT switch ON position the amplitude of the display to zero with the AMPLITUDE control. The index dot on the knob should now point at the zero, if it doesn't loosen the set screw and position the knob until it does.

It may be necessary to recheck the VERTICAL POSITION control as there may be some interaction between the VERTICAL POSITION and AMPLITUDE controls.

6. Checking the Output Waveform

NOTE

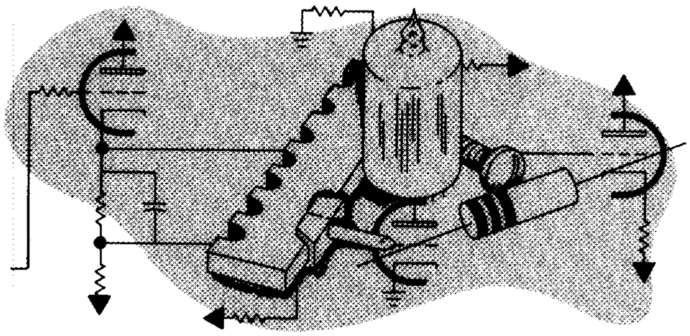
Where final checking of the output waveform is concerned, it should be remembered that the Type P unit is a standardizing tool, not a "standard" that can be calibrated to a fixed waveshape and risetime. Bearing this fact in mind, the following procedure will give you a sufficiently accurate check of the Type P waveshape.

Insert the Type P into a Tektronix Type 540 or 530 series oscilloscope. Now adjust the delay-line of the oscilloscope as instructed in the calibration section of the oscilloscope Instruction Manual.

After the delay-line has been completely tuned with the Type P a Type K should then be inserted. With a 400kc signal from a Tektronix Type 107 connected to the Type K touch up both the Type K adjustments and the delay-line adjustments of the oscilloscope, until the line is tuned.

Now following the instructions given in the oscilloscope Instruction Manual check the passband and risetime of the Type K oscilloscope combination. If the passband and risetime figures are found to correspond to those called out in the characteristic section of the oscilloscope manual, then the output waveform of the Type P is acceptable. If the figures disagree then the components which affect the output waveform of the Type P must be checked.

NOTES



SECTION 6

PARTS LIST AND SCHEMATICS

ABBREVIATIONS

Cer.	Ceramic	n	Nano or 10^{-9}
Comp.	Composition	Ω	ohm
EMC	Electrolytic, metal cased	p	Pico or 10^{-12}
f	Farad	PTB	Paper, "Bathtub"
G	Giga, or 10^{9}	PMC	Paper, metal cased
GMV	Guaranteed minmum value	Poly.	Polystyrene
h	Henry	Prec.	Precision
K or k	Kilohms or kilo (10^{3})	PT	Paper Tubular
M/Cer.	Mica or Ceramic	T	Terra or 10^{12}
M or meg	Megohms or mega (10^{6})	v	Working volts DC
μ	Micro. or 10^{-6}	Var.	Variable
$\mu\mu$	Micromicro or 10^{-12}	w	Watt
m	milli or 10^{-3}	WW	Wire-wound

SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number.

000X Part removed after this serial number.

*000-000 Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, also reworked or checked components.

HOW TO ORDER PARTS

Replacement parts are available from or through your local Tektronix Field Office.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, for your order to contain the following information: Part number including any suffix, instrument type, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Field Office will contact you concerning any change in part number.

ELECTRICAL PARTS LIST

Values are fixed unless marked Variable

Ckt. No.	Tektronix Part Number	Description					S/N Range

Capacitors

Tolerance ±20% unless otherwise indicated.

Ckt. No.	Tektronix Part Number	Value	Type	Voltage	Tolerance	S/N Range
C5226	281-506	12 pf	Cer.	500 v	10%	
C5276	281-504	10 pf	Cer.	500 v	10%	
C5526	290-020	275 μf	EMT	6 v	−10% +250%	

Inductors

Ckt. No.	Tektronix Part Number	Description	S/N Range
L5526	*108-127	Iron Core, Solenoid	

Rectifiers

Ckt. No.	Tektronix Part Number	Description	S/N Range
SR5526	*106-016	1-500 ma plate per leg	

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

Ckt. No.	Tektronix Part Number	Value	Wattage		Type	Tolerance / Function	S/N Range
R5026	308-054	10 k	5 w		WW	5%	
R5046	305-432	4.3 k	2 w			5%	
R5076	308-062	3 k	5 w		WW	5%	
R5106	311-007	2 x 1 k	2 w	Var.		VERTICAL POSITION	
R5136	311-007	2 x 1 k	2 w	Var.		AMPLITUDE	
R5166	301-562	5.6 k	½ w			5%	
R5196	301-562	5.6 k	½ w			5%	
R5206 [1]	Use 301-270	27 Ω	½ w			5%	
R5216 [1]	Use 301-270	27 Ω	½ w			5%	
R5226	302-122	1.2 k	½ w				
R5256	301-112	1.1 k	½ w			5%	
R5276	302-562	5.6 k	½ w				
R5296	301-112	1.1 k	½ w			5%	
R5326 [2]	Use 301-101	100 Ω	½ w			5%	
R5346 [2]	Use 301-101	100 Ω	½ w			5%	
R5366	301-102	1 k	½ w			5%	
R5386	301-102	1 k	½ w			5%	
R5416	306-333	33 k	2 w				101-132
	306-183	18 k	2 w				133-up
R5426	308-018	2.5 k	10 w		WW	5%	101-132X
R5436	306-473	47 k	2 w				X133-up
R5466	308-096	500 Ω	20 w		WW	5%	
R5516	311-001	10 Ω	4 w	Var.	WW	COIL CURRENT ADJUST	
R5526	308-095	2.2 Ω	2 w		WW		

Switches

Ckt. No.	Tektronix Part Number	Description	S/N Range
	Unwired		
SW5516	260-134	Toggle, single-pole, single-throw.	
SW5526	Use *050-106	Mercury, encapsulated.	101-2397
	260-539	Mercury, encapsulated	2398-up

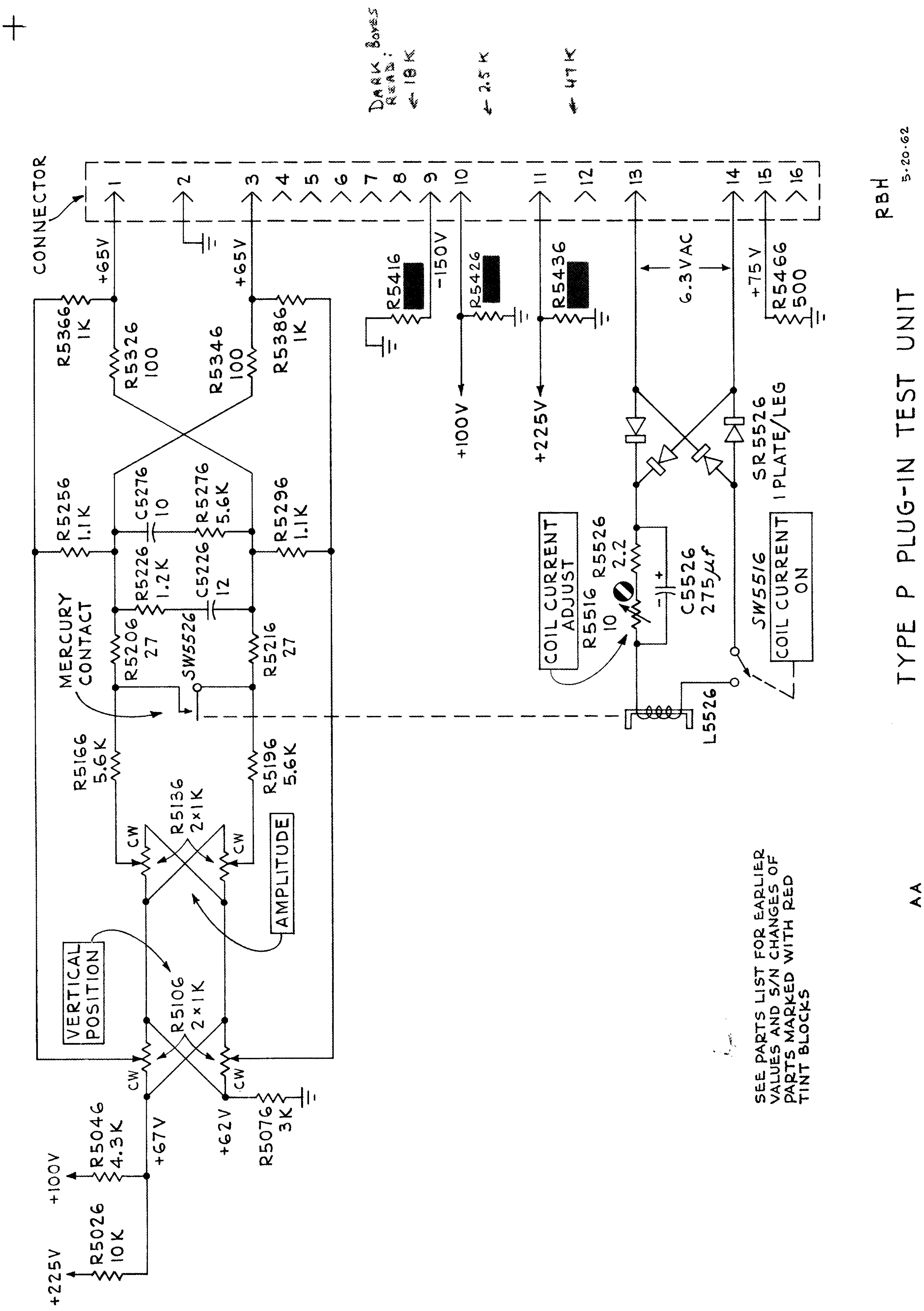
[1] Below S/N 1130 R5206 and R5216 have to be replaced at the same time.
[2] Below S/N 1340 R5326 and R5346 have to be replaced at the same time.

Type P
Mechanical Parts List

	Tektronix Part Number
Bushing, $^3/_8$-32 x $^9/_{16}$ x .412	358-010
Cable, harness	179-157
Chassis	441-158
Clamp, cable $^7/_{16}$" plastic	343-005
Connector, chassis mtd., amph., 16-contact, male	131-017
Knob, large black	366-028
Knob, alum.	366-125
Lockwasher, steel, int. #4	210-004
Lockwasher, steel, int. #6	210-006
Lockwasher, steel, int. #8	210-008
Lockwasher, steel, ext. #10	210-009
Lockwasher, steel, int. $^3/_8$ x $^{11}/_{16}$	210-013
Lug, solder, SE4	210-201
Lug, solder, SE8	210-205
Lug, solder, SE10, long	210-206
Nut, hex 4-40 x $^3/_{16}$	210-406
Nut, hex 6-32 x $^1/_4$	210-407
Nut, hex 8-32 x $^5/_{16}$	210-409
Nut, hex 10-32 x $^5/_{16}$	210-410
Nut, hex $^3/_8$-32 x $^1/_2$	210-413
Nut, hex $^3/_8$-32 x $^1/_2$ x $^{11}/_{16}$	210-494
Panel, front	use 333-518
Plate, sub panel	386-636
Plate, frame back	387-564
Ring, retaining, #18 securing	354-025
Rod, $^3/_8$ x 12, tapped 8-32 both ends	384-508
Rod, $^3/_{16}$ x 10$^1/_2$, threaded one end	384-510
Screw, 4-40 x $^5/_{16}$ BHS	211-011
Screw, 6-32 x $^3/_8$ BHS	211-510
Screw, 6-32 x $^3/_8$ FHS 100° CSK, Phillips	211-559
Screw, 8-32 x 1 BHS	212-020
Screw, 8-32 x 1$^1/_4$ RHS	212-031

Mechanical Parts List *(continued)*

	Tektronix Part Number
Screw, 8-32 x 1/2 FHS 100° CSK, Phillips	212-043
Screw, 8-32 x 1/2 RHS, Phillips	212-044
Screw, 10-32 x 1 1/4 HHS	212-520
Screw, #4 x 1/4 type B, thread forming	213-088
Spacer, nylon molded 1/16, for ceramic strip	361-007
Spacer, nylon molded 5/16, for ceramic strip	361-009
Strip, ceramic 3/4 x 7 notches, clip-mounted	124-089
Strip, ceramic 3/4 x 9 notches, clip-mounted	124-090
Tube, spacer, alum.	166-006
Washer, steel, 8S x 3/8 x .032	210-804
Washer, fiber, #10	210-812
Washer, steel, .390 x 9/16 x .020	210-840
Washer, poly, .190 x 7/16 x 1/32	210-894


DARK BOXES READ: ← 10K
← 2.5K
← 47K
CONNECTOR
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
+65V
+65V
-150V
R5416 [redacted]
R5426 [redacted]
R5436 [redacted]
6.3VAC
+75V
R5466 500
RBH 5-20-62
R5366 1K
R5326 100
R5346 100
R5386 1K
+100V
+225V
SR5526 1 PLATE/LEG
R5256 1.1K
C5276 10
R5276 5.6K
R5296 1.1K
R5226 1.2K
C5226 12
COIL CURRENT ADJUST
R5516 10
R5526 2.2
C5526 275µf
SW5516
COIL CURRENT ON
MERCURY CONTACT
R5206 27
SW5526
R5216 27
L5526
R5166 5.6K
R5196 5.6K
R5136 2×1K
CW
CW
AMPLITUDE
VERTICAL POSITION
R5106 2×1K
CW
CW
R5076 3K
+67V
+62V
R5046 4.3K
+100V
R5026 10K
+225V
TYPE P PLUG-IN TEST UNIT
SEE PARTS LIST FOR EARLIER VALUES AND S/N CHANGES OF PARTS MARKED WITH RED TINT BLOCKS
AA