

# INSTRUCTION MANUAL

Serial Number <sup>71</sup>~~130 41 553~~  
130 41 713

## **P6042 PROBE**

Tektronix, Inc.

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070-0629-00

967



## 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 or Model Number with all requests for parts or service.

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Abbreviations and symbols used in this manual are based on, or taken directly from, IEEE Standard 260 "Standard Symbols for Units" MIL-STD-12B and other standards of the electronics industry. Change information, if any, is located at the rear of this manual.

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

SERIES M MODEL 1,2,3

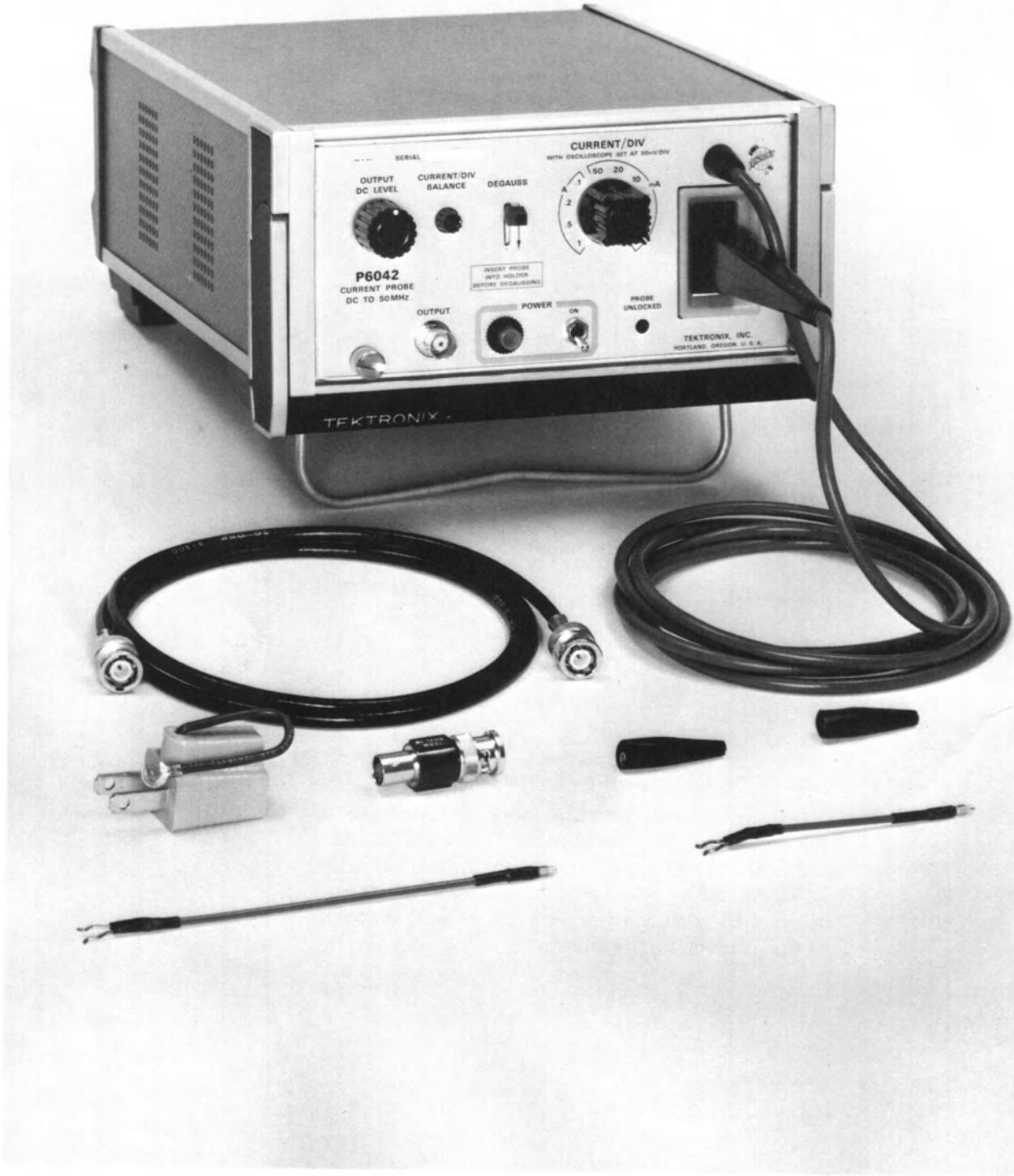


Fig. 1-1. P6042 Current Probe and accessories.

# SECTION 1

## CHARACTERISTICS

Change information, if any, affecting this section is found at the rear of the manual.

### Introduction

The Tektronix P6042 Current Probe is designed for use with oscilloscope systems having either 50-ohm or high-impedance inputs. DC and low-frequency current waveforms, as well as measurements to 50 MHz, can be made accurately and quickly with the probe. To achieve tilt-free display of the current waveform, a Hall Voltage device is used in the probe to supply the DC and low-frequency information to the P6042 amplifier. In the amplifier, low-frequency information is combined with the high-frequency component of the signal and the resultant is developed at the output.

The P6042 is powered by a regulated power supply contained within the instrument, independent of associated test equipment.

### Electrical Characteristics

The electrical characteristics given in Table 1-1 apply over an ambient temperature range from 0° to +50°C, after the probe has been calibrated at +25°C  $\pm$  5%. Warmup time is 5 minutes. Under these conditions, the P6042 Current Probe will meet or exceed the requirements given in the Performance

Requirement column of the table when the instrument is used with a 100 MHz oscilloscope (such as the Type 647A with 10A2A and 11B2A plug-in units). The specifications listed in the table include only the performance of the P6042 Current Probe. Any error introduced by the test equipment must be added to the applicable performance requirements. Performance of the probe is checked to these requirements in the Performance Check section of this manual. If the need for calibration is indicated, a step-by-step procedure is provided in the Calibration section.

The Supplemental Information column of Table 1-1 provides additional information about the probe and describes certain conditions that pertain to the performance requirements. Any characteristics given in the Supplemental Information column are not requirements in themselves, and are not necessarily checked in the manual procedures.

### Environmental Characteristics

The environmental performance of the P6042 Current Probe, a laboratory instrument, is checked at the factory and found to meet the requirements described in Table 1-2.

TABLE 1-1  
ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirement	Supplemental Information
Bandwidth	DC to 50 MHz.	3 dB down.
Transient Response		
Risetime	$\leq 7$ ns.	Calculated from bandwidth.
Aberrations	$\leq 3\%$ from 1 mA/DIV to 50 mA/DIV.	$\pm 5\%$ from .1 A/DIV to 1 A/DIV before first 100 ns.
Noise		
Periodic and Random Deviations	$\leq 0.5$ mA + 0.2 div, tangentially measured.	
Random Trace Shift	$\leq 1.5$ mA.	0.1 Hz to 100 Hz (on selectable bandwidth system).
Dynamic Range	+500 mV to -500 mV at probe amplifier output.	+ and -10 div with oscilloscope set to 50 mV/div.
Compression at limits of dynamic range.		5% or less.
Positioning Range	+300 mV to -300 mV at probe amplifier output.	+ and -6 div with oscilloscope set to 50 mV/div.
Attenuator Accuracy	Within $\pm 3\%$ .	
Insertion Impedance	Typically 0.1 $\Omega$ at 5 MHz.	See Fig. 1-2 for impedance vs. frequency curve.
Maximum Input Current		1 A to 5 mA: 10 A (DC + peak AC). See Fig. 1-3 for derating curve. 2 mA and 1 mA: 0.5 A (DC + peak AC).
Thermal Drift (Probe only)		$\leq 2$ mA/°C from 15°C to +35°C with amplifier temperature constant.
Thermal Drift (Amplifier only)		$\leq 0.2$ div/°C with probe temperature constant.

**TABLE 1-1 (cont)**  
**ELECTRICAL CHARACTERISTICS**

Characteristic	Performance Requirement	Supplemental Information
Voltage-Feedthrough Susceptibility		$\leq 250 \mu\text{A/V}$ at 50 MHz.
External Magnetic Field Susceptibility		$\leq 250 \mu\text{A/Gauss}$ , at 60 Hz.
Required Output Load Impedance		50 $\Omega$ .
Line Voltage Regulation	90 to 136 V RMS or 180 to 272 V RMS.	1.3 crest factor; 3 taps available in each range.
Power Supply Ripple		$\leq 2 \text{ mV}$ peak to peak.
Input Power		$\leq 20 \text{ W}$ .
Input Frequency		50 to 400 Hz.

**TABLE 1-2**  
**ENVIRONMENTAL CHARACTERISTICS**

Characteristic	Performance Requirement	Supplemental Information
Temperature		
Non-operating	$-40^{\circ}\text{C}$ to $+65^{\circ}\text{C}$ .	
Operating	$0^{\circ}\text{C}$ to $+50^{\circ}\text{C}$ Ambient.	
Altitude		
Non-operating	To 50,000 feet.	
Operating	To 15,000 feet.	
Humidity (Non-operating)	5 cycles MIL-STD 202C, Method 106B, omitting freezing and vibration cycles.	
Vibration (operating)	15 minutes along each axis at .015 inch total displacement with frequency varied from 10-50-10 cycles per second in 1-minute cycles. Three minutes at any resonant point or at 50 cycles per second.	Tested with instrument secured to vibration platform.
Shock (Non-operating)	30 g's, $\frac{1}{2}$ sine, 11 ms duration, 2 shocks per axis.	Guillotine-type shocks.
Transportation		
Package Vibration	1 hour at 1 g.	Package just leaves vibration surface.
Package Drop	30 inches on 1 corner, all edges radiating from that corner, and all flat edges.	

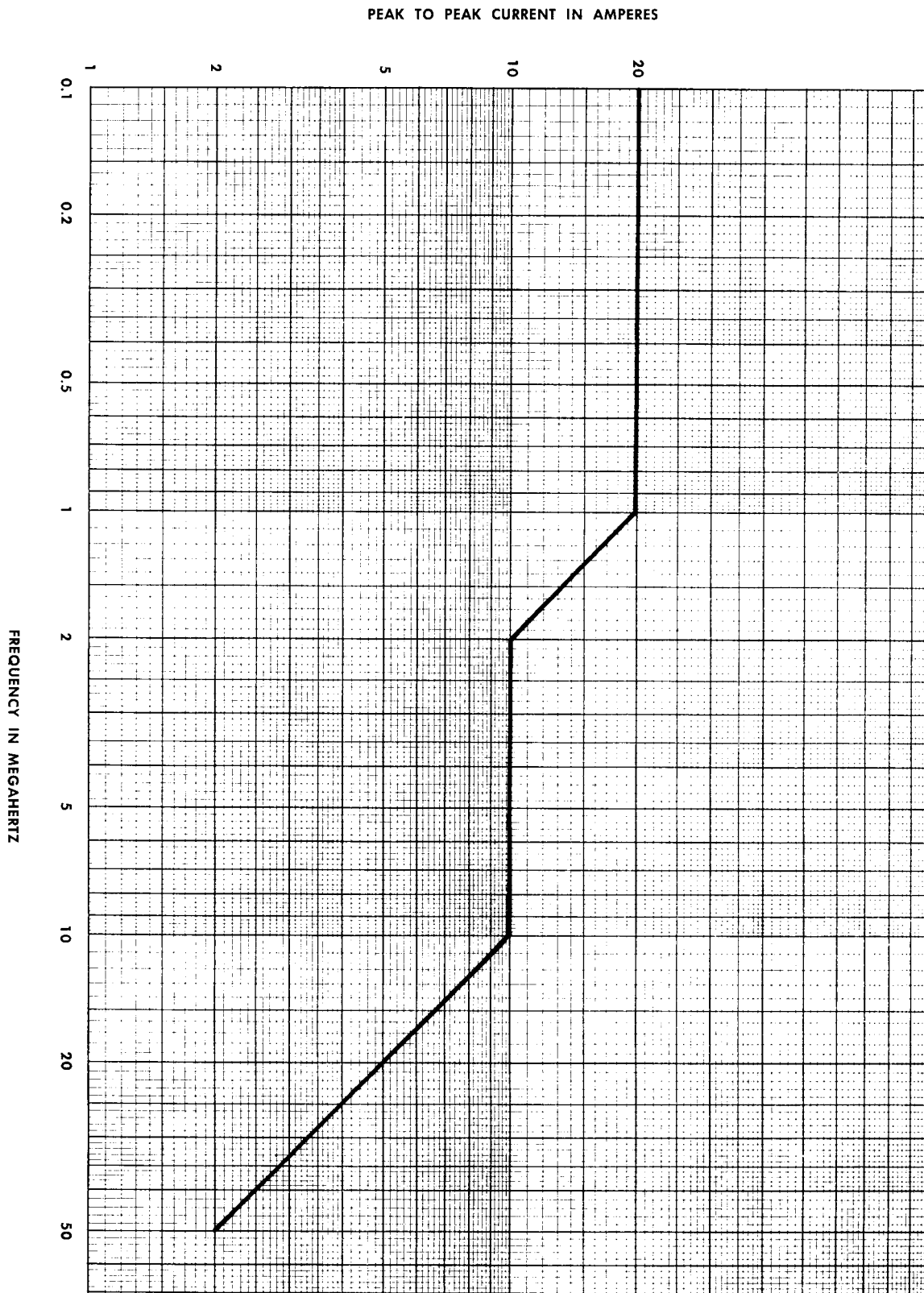


Fig. 1-2. P6042 maximum input current versus frequency curve.

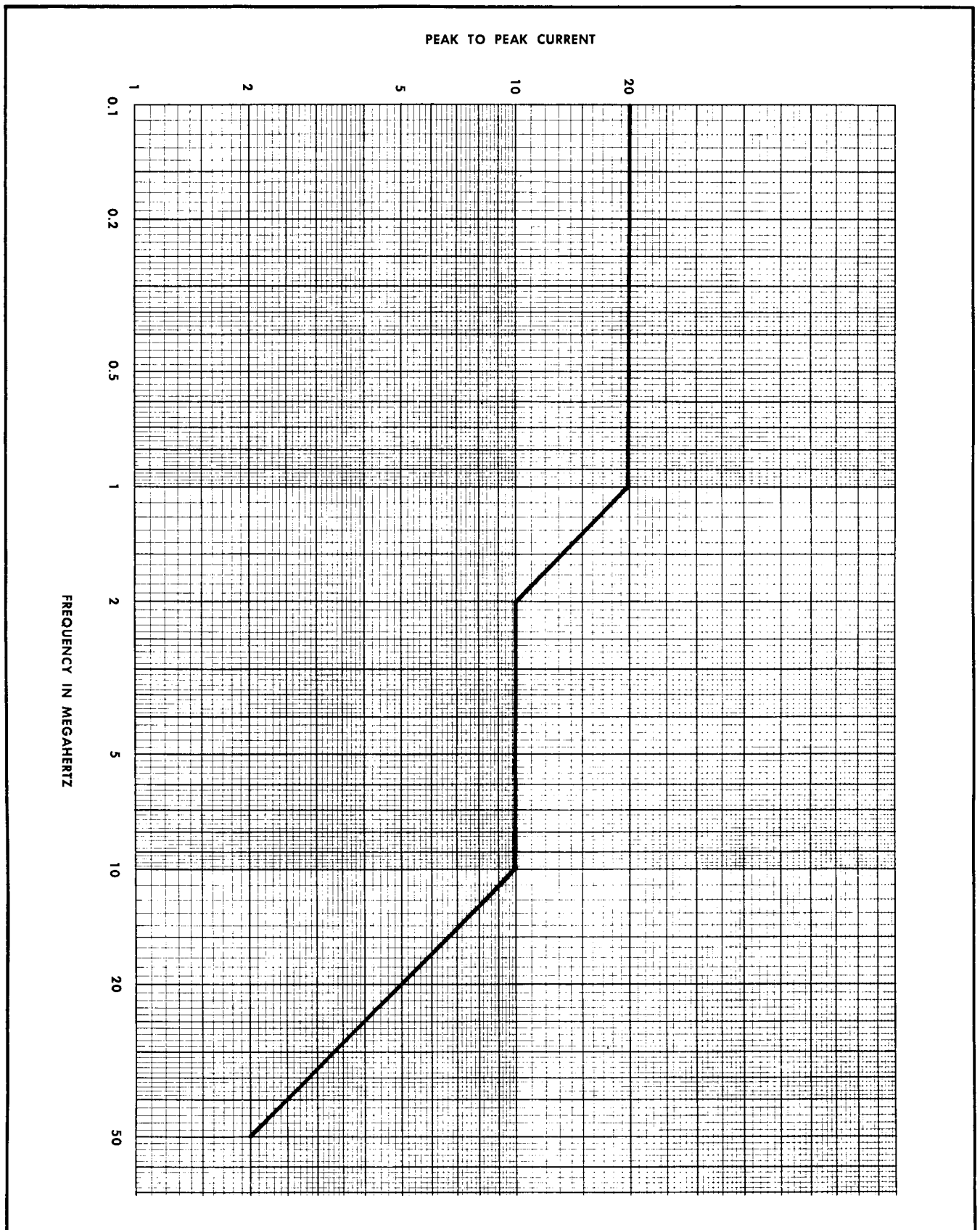


Fig. 1-3. P6042 maximum input current at specific duty factors.



## SECTION 2

# OPERATING INSTRUCTIONS

Change information, if any, affecting this section is found at the rear of the manual.

### General

The P6042 Current Probe is designed to work into either a 50-ohm system or a high impedance oscilloscope using a 50-ohm termination. This section of the manual describes the use of the P6042 Current Probe. Information in this section is given to aid in making accurate measurements with the probe.

### Handling

The P6042 is designed to be as rugged as possible, consistent with good high-frequency response and size. However, as with all precision devices, the probe and cable should be handled with care to avoid damage. Special care should be taken that the cable not be crushed, kinked, or pulled. Avoid dropping the probe, as some of the most sensitive circuitry is located within the probe assembly.

### Operating Voltage

The P6042 can be powered from either a 115-volt or a 230-volt nominal line voltage source. The line voltage selector assembly on the rear panel converts the instrument from one operating range to the other. In addition, this switch assembly changes the primary connections of the power transformer to allow selection of one of three regulating ranges. The assembly also includes the two line fuses. When the instrument is converted from 115-volt to 230-volt nominal operation, or vice versa, the switch assembly connects or disconnects one of the fuses to provide the correct protection for the instrument. Use the following procedure to convert this instrument between nominal line voltages or regulating ranges.

1. Disconnect the instrument from the power source.
2. Loosen the two captive screws which hold the cover onto the switch assembly; then pull to remove the cover.
3. To convert from 115-volt to 230-volt operation, pull out the Voltage Selector switch bar (see Fig. 2-1); turn it around and plug into the remaining holes. Change the power cord to match the powersource receptacle or use a 115-volt to 230-volt plug adapter.
4. To change regulating ranges, pull out the Range Selector switch bar (see Fig. 2-1); slide it to the desired position and plug it back in. Select a range which is centered about the average line voltage to which the instrument will be connected (see Table 2-1).
5. Re-install the cover and tighten the two captive screws.
6. Before applying power to the instrument, check that the indicating tabs on the switch bars are protruding through the correct holes for the desired nominal line voltage and regulating range.

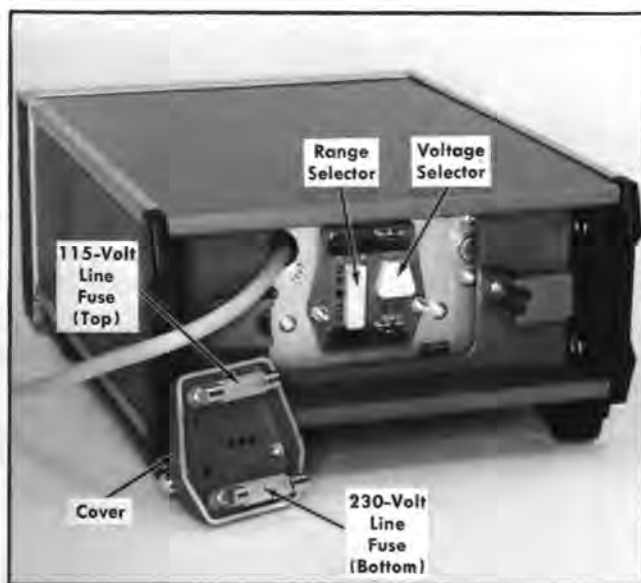


Fig. 2-1. Line Voltage Selector assembly on the rear panel (shown with cover removed).

### CAUTION

The P6042 should not be operated with the Voltage Selector and Range Selector switches in the wrong position for the line voltage applied. Operation of the instrument with the switches in the wrong positions will either provide incorrect operation or damage the instrument.

**TABLE 2-1**  
**Regulating Ranges**

Range Selector Switch Position	Regulating Range	
	115-Volts Nominal	230-Volts Nominal
LO (switch bar in left holes)	90 to 110 volts	180 to 220 volts
M (switch bar in middle holes)	104 to 126 volts	208 to 252 volts
HI (switch bar in right holes)	112 to 136 volts	224 to 272 volts

### Operating Temperature

The P6042 depends upon convection cooling to maintain a safe operating temperature. Adequate clearance on all sides must be provided to allow heat to be dissipated away from the instrument. Do not block or restrict the air flow

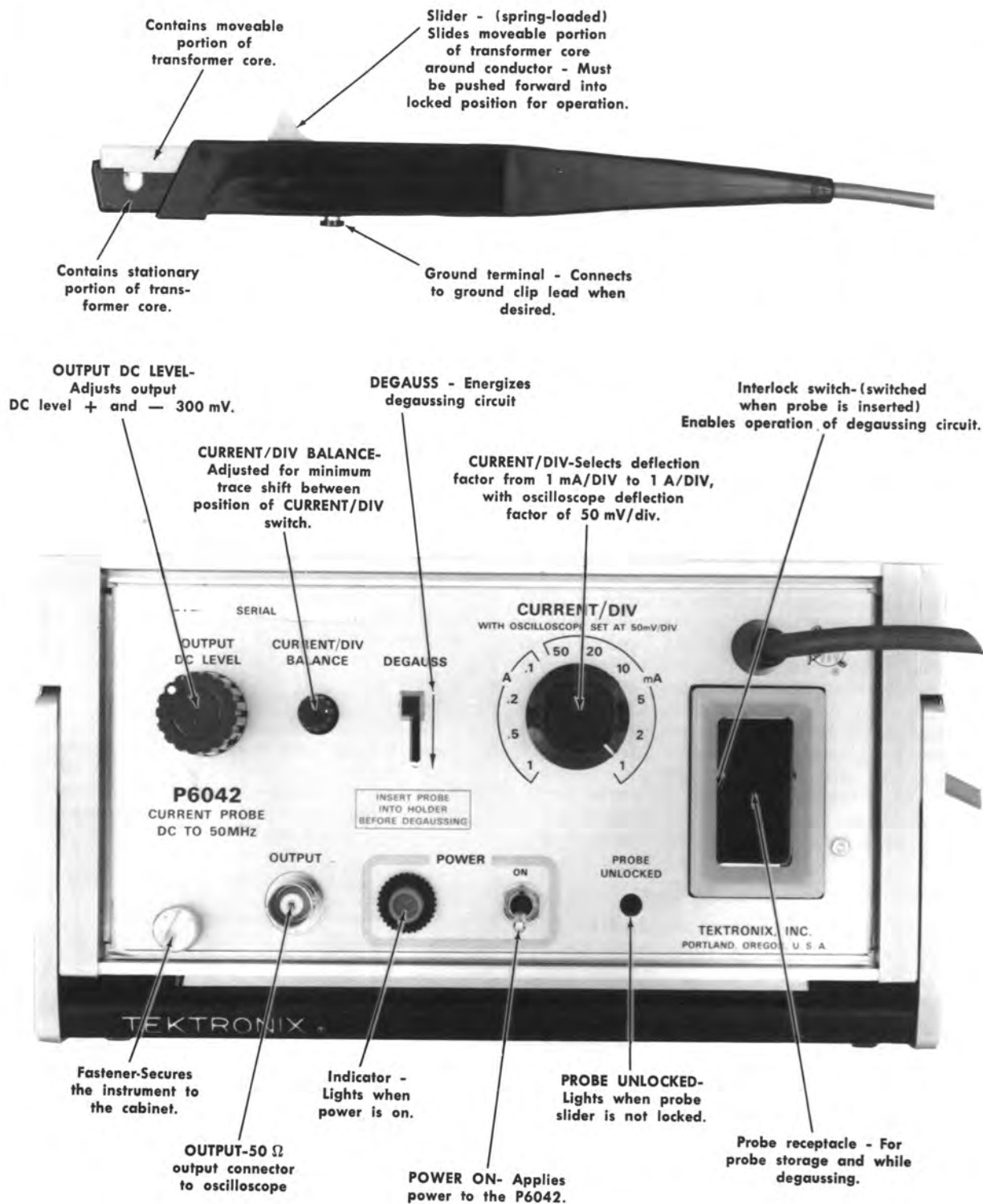


Fig. 2-2. Function of front panel controls and connectors.

through the holes in the cabinet. The clearance provided by the feet on the bottom of the instrument should be maintained. Provide at least three inches of clearance at the sides and top (more if possible). The instrument can be operated where the ambient air temperature is between 0°C and +50°C.

## Controls and Connectors

Fig. 2-2 shows the front-panel controls and connectors on the P6042 and describes the function of each.

## Installation

When shipped from the factory, the P6042 is ready to be used with either a 50-ohm system or a high-impedance oscilloscope and has been factory calibrated to meet the specifications listed in Section 1. Due to normal differences in oscilloscope input characteristics, however, the high-frequency response of the probe should be checked on the system with which it is to be used before making critical high-frequency current measurements.

If the instrument is to be operated with a high-impedance oscilloscope connect the 50-ohm termination (011-0049-00), supplied in the accessory kit, to the input connector of the oscilloscope.

1. Connect the P6042 OUTPUT to the input of the oscilloscope (or termination), using a 50-ohm coaxial cable.

2. Turn the oscilloscope and P6042 power on and allow five minutes warm-up time (at 25°C).

3. Set the oscilloscope controls as follows:

Volts/div	50 mV
Variable (Volts/div)	Calibrated
Input Coupling	Ground

4. Set the P6042 controls as follows:

OUTPUT DC LEVEL	Midrange
CURRENT/DIV BALANCE	Midrange
CURRENT/DIV	1 A

5. Center the trace vertically on the CRT, then switch input coupling to DC.

6. Push the thumb-controlled portion of the probe into the locked position. When the slider is in the locked position the shield around the transformer core is grounded, the PROBE UNLOCKED light is extinguished, and the amplifier is ready for operation.

7. Place the probe in the front-panel receptacle. Momentarily depress the DEGAUSS lever and release. (Time required for probe degaussing is 200 milliseconds.)

### NOTE

To remove any magnetic flux present in the probe transformer core, always degauss the probe after



Fig. 2-3. P6042 Current Probe connected to Type 106 Square-Wave Generator output.

## Operating Instructions—Type P6042

initial turn-on and after making current measurements in excess of the dynamic range of the instrument. To degauss, place the probe in the front-panel receptacle and press the DEGAUSS lever.

8. Adjust OUTPUT DC LEVEL to center the trace vertically on the CRT.

9. Set the CURRENT/DIV switch to the suitable position for the measurement to be made and again degauss the probe.

10. Adjust CURRENT/DIV BALANCE to center the trace vertically on the CRT.

11. Remove the probe from the front-panel receptacle, move the slider back, and place the probe around the conductor under test. Push the slider forward into the locked position. Figure 2-3 shows a test application, using for the signal source the Fast Rise output of a Tektronix Type 106 Square-Wave Generator and a 50-ohm terminating current loop (067-0559-00).

12. With the oscilloscope deflection factor set to 50 mV/div, the amplitude of the current waveform may be read directly from the front panel of the P6042.

### Deflection Factor

If (because of a high-amplitude signal) an oscilloscope deflection factor other than 50 mV/div is desired, the overall deflection factor must be considered when measuring the amplitude of the signal. The following is an example:

CURRENT/DIV switch setting - 1 A

Volts/div switch setting - 200 mV

Deflection of waveform - 2.5 divisions

Calculate the amplitude of the signal:

$$\frac{1 \text{ A}}{50 \text{ mV}} \times \frac{200 \text{ mV}}{\text{div}} \times 2.5 \text{ div} = 10 \text{ A}$$

### Ground Clip Leads

Ground clip leads are furnished with the probe to ground the shield at the probe end when desired. Normally the ground lead is not used in the 1, 2, 5, and 10 mA positions of the CURRENT/DIV switch due to undesirable chassis currents which may appear in the more sensitive positions. When

observing high frequency waveforms, use the short ground clip lead.

### Minimize Loading Effect

To minimize any loading effect of critical circuits clamp the probe at the low or ground end of a component lead wherever possible. This will minimize the voltage feed-through.

#### NOTE

The P6042 Current Probe measures magnetic flux around a conductor due to the current flow through the conductor. This should be kept in mind when making readings of DC current in ferrous leads which may magnetized (such as on transistors). This magnetic flux will cause erroneous readings in the more sensitive positions.

### Direction of Current Flow

Direction of conventional current flow, as opposed to electron flow, is plus to minus. Conventional current flowing in the direction of the arrow on the probe produces a positive deflection of the waveform on the CRT (see Fig. 2-4).

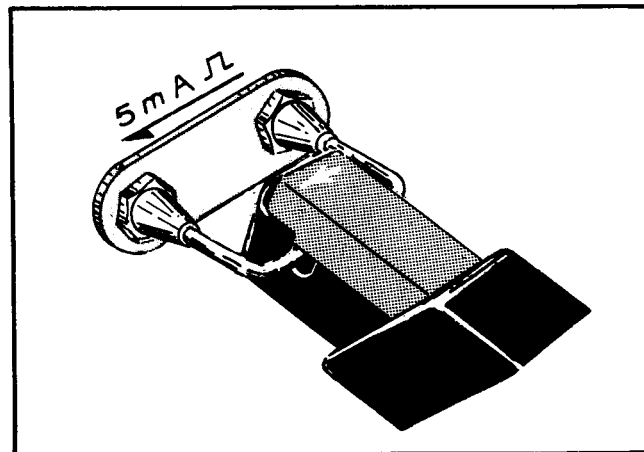


Fig. 2-4. Current flow in a conductor.

## SECTION 3

# CIRCUIT DESCRIPTION

Change information, if any, affecting this section is found at the rear of the manual.

In this section you will find descriptions of the circuitry in the power supply, the current probe, and the current probe amplifier. The amplifier is divided into three functions: low-frequency amplification, high-frequency amplification, and probe degaussing.

### POWER SUPPLY

The power supply provides the power for the P6042 from two regulated supplies, +16 volts and -16 volts. Electronic regulation is used to provide stable output voltages. Switches on the rear panel change the connections to the primary of the transformer for 115 volts or 230 volts, as well as for low, medium or high line.

Power is applied to the transformer primary through the power plug (P141), the power switch (SW141) and the fuse (F141). F142 is switched in for 230-volt operation only. The secondary of the power transformer has two windings, one for the +16-volt supply, and the other for the -16-volt supply. The 60-Hz line voltage is full-wave rectified by D151 in the +16-volt supply, and by D171 in the -16-volt supply. C152 and C172 provide filtering for the respective regulated supplies.

### +16-Volt Supply

Q156 provides constant current for the collector of Q167, and R157 provides a small amount of feedback to null the ripple at the output of the supply.

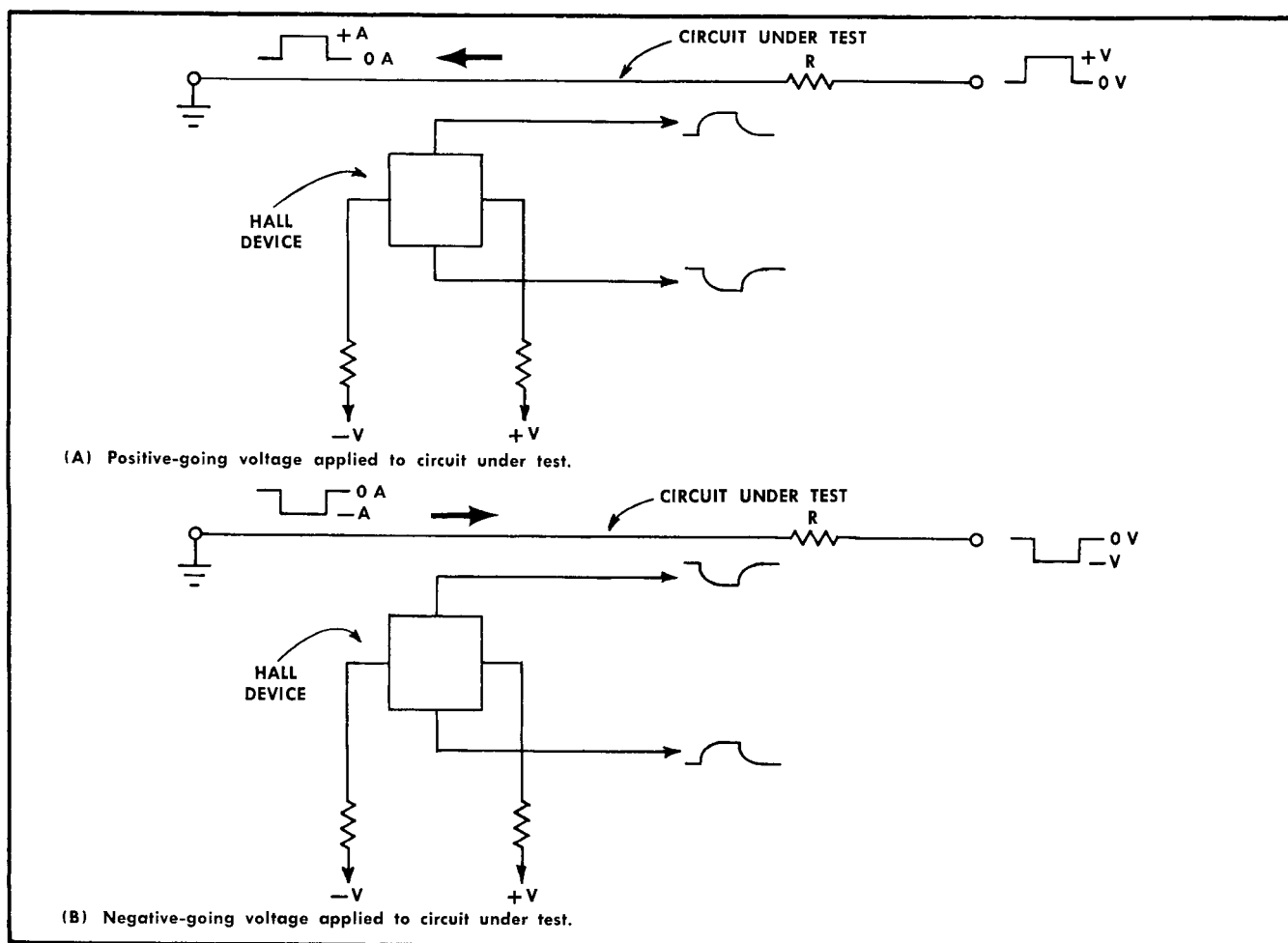


Fig. 3-1. The polarities of the waveform at the output terminals of the Hall device are determined by the direction of current flow in the conductor.

## Circuit Description—Type P6042

Q167, the feedback transistor, has a zener diode in its emitter circuit, holding the voltage at 7.5 volts. From the voltage divider in the output (R164, R165, and R166), a portion of the output voltage is applied to the base of Q167. As the output attempts to go positive, the base of Q167 also goes positive, increasing the current through Q167 and thereby lowering the level at the collector due to the increased drop across Q156. As the base of Q161 lowers, so does the emitter, lowering the current through Q163, the series regulating transistor, and bringing the voltage level down at the output. The level at which the output stabilizes is set by the +16 Volts adjustment, R165.

### —16-Volt Supply

The —16-volt supply operates in a manner similar to the +16-volt supply. The ripple-free voltage required at the base of Q175 is provided in this case by the +16-volt supply. The emitter of Q177 is tied to ground, causing the output to go to —16 volts, set by the —16 Volts adjustment, R180.

As the probe is connected around the current-carrying conductor, the spring-loaded slider, when released, positions the movable portion of the transformer core over the stationary portion. When the slider is pushed forward into the locked position, pressure is applied to the movable portion of the core, assuring positive contact between the two core pieces. Until the slider is pushed forward into the locked position, switching SW3, the PROBE UNLOCKED light on the front panel (B5) remains on. When the slider is locked, the indicator bulb extinguishes and the shield around the transformer is grounded.

The Hall device, a thin rectangular sheet of semiconductor material sandwiched in the stationary portion of the transformer core, carries an electric current in the direction of its length. When the probe is subjected to a magnetic field normal to the semiconductor sheet, a voltage is developed at the output terminals. This resultant voltage is at right angles both to the direction of the current and to the magnetic field. This "Hall Effect" voltage is applied to the low-frequency amplifier.

## CURRENT PROBE

The P6042 Current Probe contains a stationary core around which is wound a 50-turn secondary, a movable core which slides over the end of the stationary core, a ground switch, and a Hall voltage device. The insertion impedance of the probe is typically  $0.1\ \Omega$  at 5 MHz. See Fig. 1-2 insertion impedance vs. frequency curve.

## CURRENT PROBE AMPLIFIER

### Low Frequency Amplifier

With the probe connected to the conductor under test, and with DC voltages applied to the input terminals of the Hall device, the signal at the output terminals varies in direct proportion with the current passing through the conductor

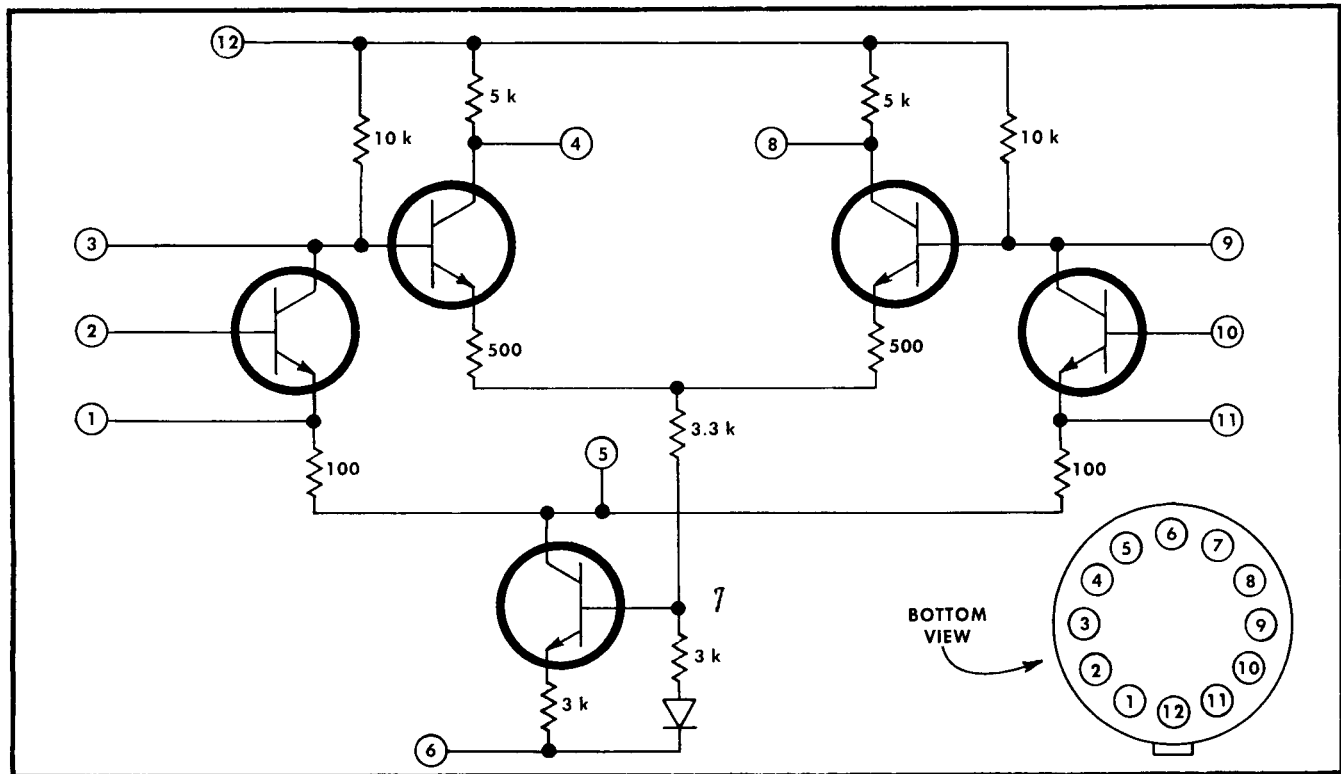


Fig. 3-2. M18, a differential amplifier integrated circuit.

under test. The low-frequency waveforms at the two output terminals of the Hall device are equal in amplitude and opposite in polarity. The peak-to-peak difference of the two waveforms is determined by the amount of current passing through the conductor, and the polarity is determined by the direction of current flow. See Fig. 3-1.

The components on the decoupling board (C5, R5, C6, C9, LR7, and LR8), located at the input of the amplifier, form a low-pass filter to isolate the cable from the amplifier system. R10 and R14, in series with the inputs of the Hall device, are factory-selected according to the input resistance of the device to allow a current of approximately 20 mA. As the temperature in the Hall device varies, the voltage drop across the input terminals changes. The temperature compensation network (R11, R12, and R13), applies a portion of the Hall device input voltage to the output, reducing the drift caused by temperature change. The output signals from the Hall device are applied to pins 2 and 10 of M18, a differential amplifier circuit. See Fig. 3-2.

Pins 1, 5, and 11 of the integrated circuit are connected to the CURRENT/DIV BALANCE control through R16 and R17. This balance network is adjusted for zero volts at connector J59 with no signal applied to the probe. The Hall Bandwidth potentiometer, R18, and a factory-selected capacitor, C18, connected to pins 3 and 9 of the integrated circuit, provide the bandwidth adjustment for the low frequency amplifier.

Q22 and Q24 reduce the voltage level at the output of the integrated circuit, which is near one-half the supply voltage for the following stage. The voltage gain of this stage is adjusted by the Loop Gain potentiometer, R24.

Q42, Q44, Q45, Q51, Q53 and Q54 form a current amplifier. Q42 and Q51 provide constant current for Q44 and Q53. Q44 and Q53 are the drivers for Q45 and Q54, respectively. Q45 or Q54, depending upon the polarity of the signal at the collector of Q29, provide the current path through the 50-turn secondary winding in the probe and through the attenuator. When the signal at the collector of Q29 is negative, Q44 increases conduction which lowers the base voltage of Q45 and turns it off. Q53 reduces conduction, causing an electron flow from  $-16\text{ V}$  through Q54, which is turned on, through the probe secondary and the attenuator to ground. As the collector of Q29 goes positive, current through Q53 increases, causing an electron flow from ground through the attenuator, through the 50-turn secondary, and through Q45 to  $+16\text{ V}$ . Q44-Q45 and Q53-Q54 are thermally coupled to hold the voltage between the base of the driver and the output of the stage constant. This prevents thermal runaway. R49 and C49 provide stabilization for the output to prevent oscillation.

The CURRENT/DIV switch provides attenuation of the signal in a 1, 2 and 5 sequence up to 1000 times attenuation in the 1 A position. In all positions of the CURRENT/DIV switch, the attenuator and R81 provide 50 ohms input to the high-frequency amplifier. In the 1 mA and 2 mA positions of the CURRENT/DIV switch the collector of Q29 is limited to  $+$  or  $-0.5\text{ V}$  by D39 or D37, respectively.

The current from the DC amplifier through the coil of the probe transformer causes a flux in the core equal and opposite to the flux generated by the signal being measured. This gives a resultant zero flux in the core. This feedback

system permits the Hall element and ferrite core to operate at very low flux densities, providing excellent sensitivity and linearity.

## High Frequency Amplifier

The Attenuator Balance, R84, is adjusted for zero volts at the base of Q87 with J80 disconnected. Q87, an emitter follower thermally coupled to Q96, stabilizes the current flowing through Q96 at various temperatures. Q96, Q113, and Q121 make up a complementary feedback amplifier. The gain of the amplifier is set by the ratio of R96 to R107 and R108. High-frequency waveform compensation is provided by the peaking network paralleled with the gain-setting resistors. The DC level at the output of the amplifier is set internally by the Output DC Level Range control, R93, and by the front-panel OUTPUT DC LEVEL, R91. Q113 is biased at its maximum power point for a minimum temperature coefficient.

When the probe is unlocked (SW3 grounded) D128 conducts, bringing the base of Q123 up and turning the transistor on. This latches up the output of the high-frequency amplifier and prevents any display.

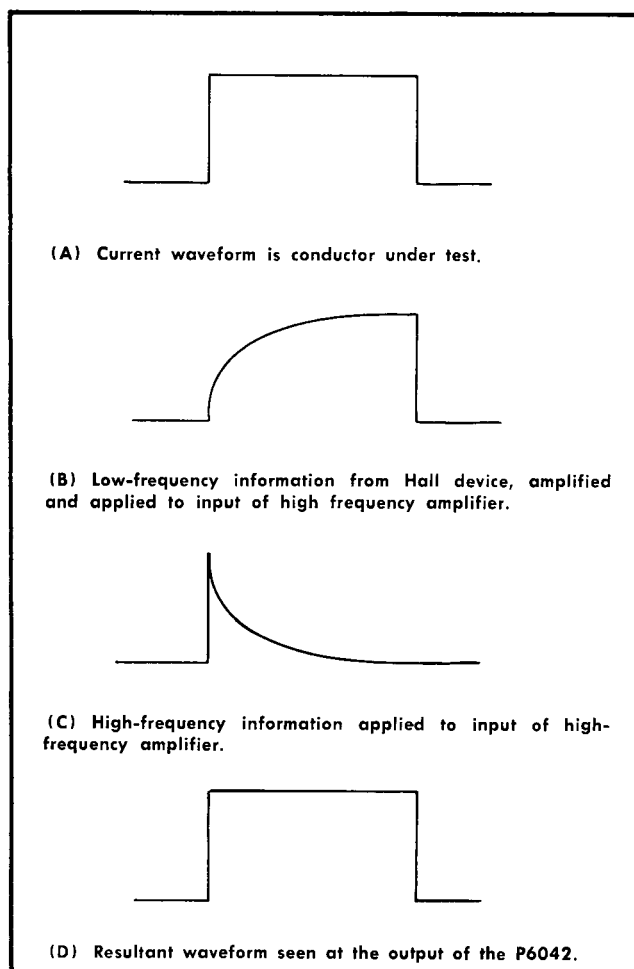


Fig. 3-3. P6042 amplifier operation.

## Amplifier Operation

When the current waveform in the conductor under test (see Fig. 3-3A) is applied to the transformer core in the probe, the signal is seen at the input of the low-frequency amplifier (through the Hall device) and at the input of the high-frequency amplifier (through the secondary winding in the probe). The low-frequency or DC information from the Hall device is amplified and applied to the input of the high frequency amplifier (see Fig. 3-3B). The high-frequency information applied to the amplifier (see Fig. 3-3C) combines with the low-frequency information, producing the resultant waveform (see Fig. 3-3D) at the output, an accurate representation of the original signal.

The portion of the signal amplified by each of the two stages depends upon the frequency of the signal being measured. If the signal is near DC, the output of the low-frequency amplifier closely resembles the original signal. Conversely with higher frequency signals, only the DC level is seen by the low-frequency amplifier.

## Probe Degaussing

Whenever a magnetic field is applied to the transformer core in the probe with the system turned off, or if a current

beyond the maximum specified level is applied, the probe may be magnetized. A portion of this magnetic flux is likely to remain in the current probe core, causing erroneous measurements. To remove this flux, a degauss circuit (Q73 and Q79) is provided. With the probe inserted in the front-panel receptacle, SW70 closes and allows operation of the degauss circuit. When the DEGAUSS lever is depressed, the 50-turn secondary is removed from the amplifier and connected to the output of the degauss oscillator Q73 and Q79. C65 (charged to +16 volts) is applied to the circuit, which oscillates at approximately 10 kilohertz. As C65 discharges, the amplitude of the oscillator signal decays exponentially, degaussing the probe core. The time required for probe degaussing is about 200 milliseconds. See Fig. 3-4.

Q31, which is normally off, is associated with the degauss circuit. To successfully degauss the probe core, the junction of R46 and R56 must be near zero volts when the DEGAUSS lever is released. When the DEGAUSS lever is depressed Q31 turns on, bringing the bases of Q44, Q53 and the output of the current amplifier near zero volts. When the DEGAUSS lever is released, C33 discharges and slowly turns Q31 off, thereby preventing a transient from being applied to the 50-turn coil by the current amplifier.

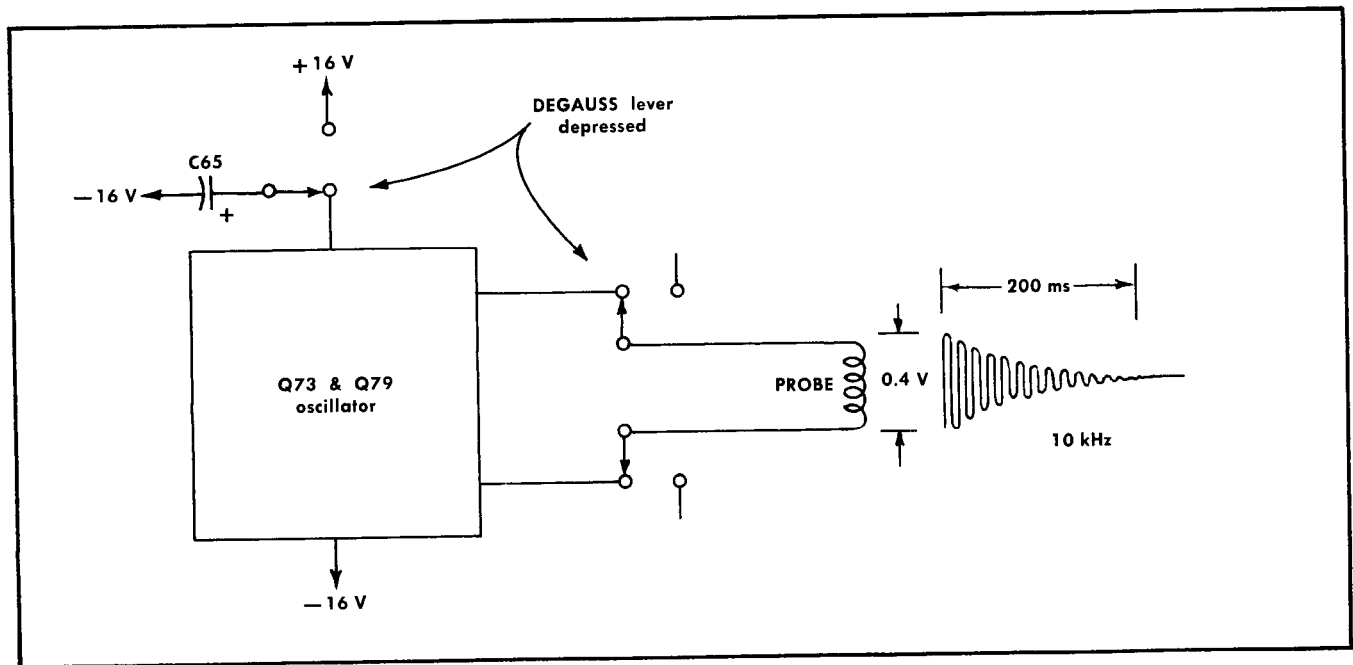


Fig. 3-4. Degauss circuit.



# SECTION 4

## MAINTENANCE

Change information, if any, affecting this section is found at the rear of the manual.

### Introduction

This section of the manual presents preventive maintenance troubleshooting, and corrective maintenance information for servicing and repairing the P6042. If trouble occurs in the probe or amplifier, corrective maintenance should be performed immediately to avoid additional damage and to restore the instrument to proper operation.

### PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, and recalibration. The conditions of the environment in which the instrument is used will determine the need for maintenance. The probe should be taken apart and cleaned periodically.

### Probe Disassembly

1. Move the probe slider to the open position.

2. Remove the two screws from the bottom of the probe body and move the strain relief boot back over the cable.

3. While holding the probe horizontally with the slider up, lift the top half of the probe body up and slide it off the end of the probe. Be careful that the metal ball does not fall out of the hole in the top of the slider.

4. Remove the metal ball from the slider.

5. With a small screwdriver, lift the spring retainer and spring out of the holder and remove. (Lift the back of the slider slightly.)

6. Lay the probe on its side and remove the slide assembly. When removing the movable portion of the transformer core and the contact from the slider, note the position of the contact spring. Neither the spring nor the switch contacts are removable.

7. Remove the spring holder from the bottom half of the probe body. When removing the stationary portion of the transformer core, note the position of the pins on the 8-pin plug. If necessary, unsolder the connections to the bottom half of the probe body. The probe is shown disassembled in Fig. 4-1.

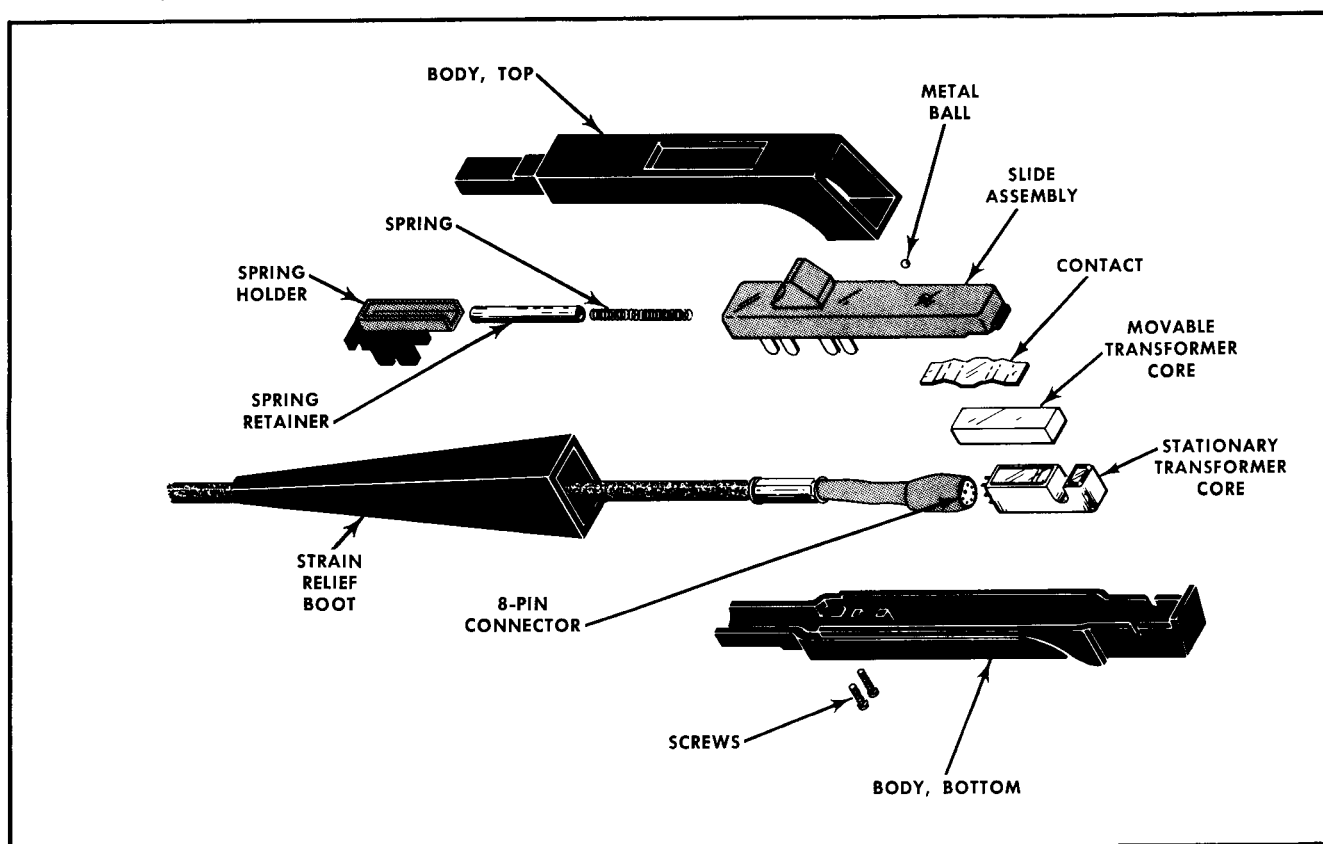


Fig. 4-1. Disassembled P6042 Probe.

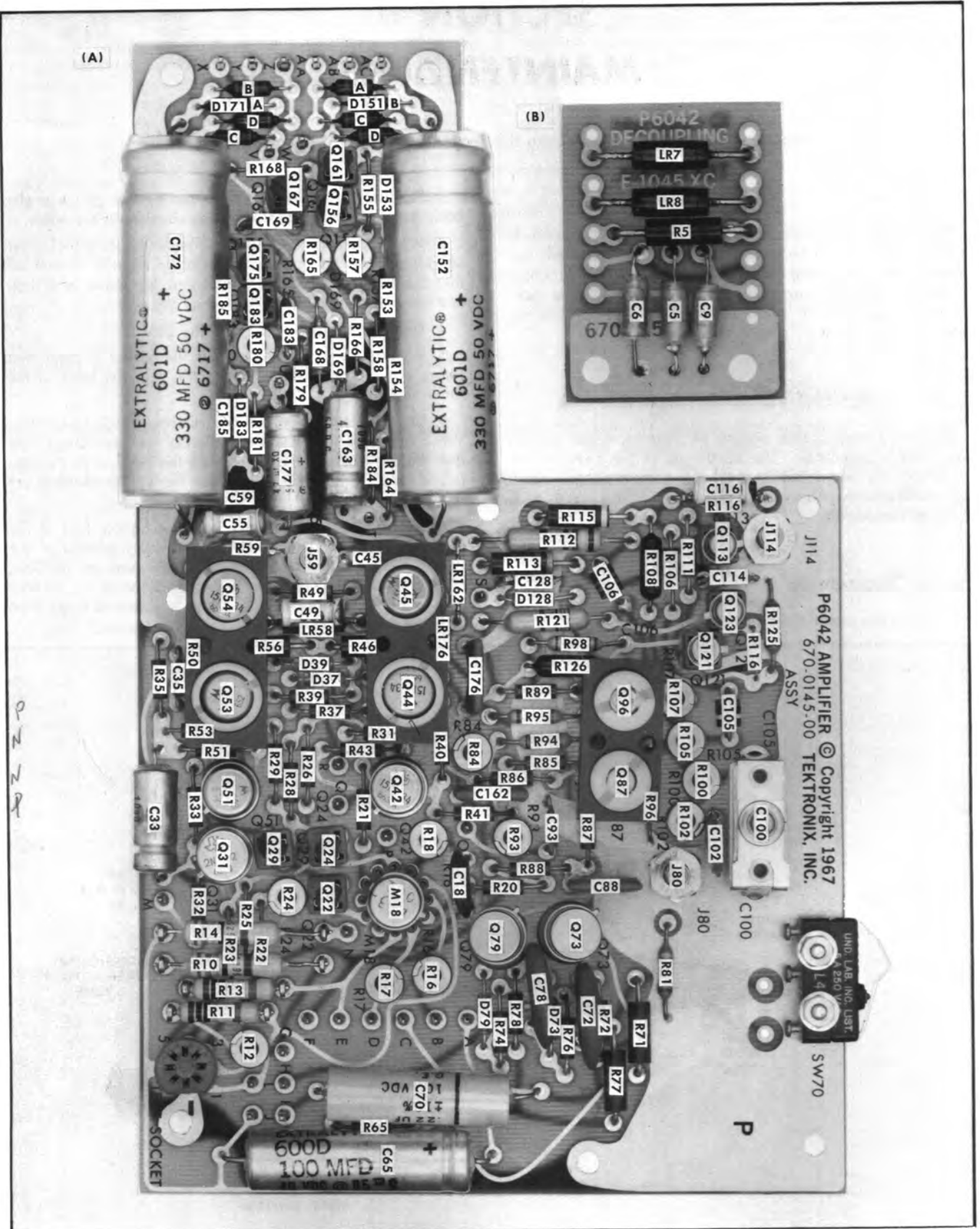


Fig. 4-2. Locations of components mounted on circuit boards. (A) Amplifier circuit board (B) Decoupling circuit board.

## Probe Cleaning

Use a soft bristle brush to dislodge the dust and wipe clean with a lint-free cloth. If a persistent coating of dirt remains, it can be removed by washing the probe parts in warm water with some liquid detergent added. (Unsolder the cable from the connections on the bottom half of the probe before washing.) After drying, apply a coating of Lubriplate or similar lubricant to the moving parts of the probe.

### NOTE

Do not use any organic solvents to clean the probe.

## Probe Assembly

1. If unsoldered, resolder the cable to the bottom half of the probe.
2. Insert the pins of the stationary portion of the transformer core into the receptacle on the end of the cable and place the core in position. Replace the spring holder.
3. Replace the contact spring and the movable portion of the core in the slider. Place the spring and retainer in position on the spring guide.
4. Insert the tip of the slider into the slot provided at the front of the probe and bring the two pieces together. Be sure that the slider switch contacts go on the inside of the stationary contacts. As the two pieces are brought together, push the spring retainer into position in the holder.
5. Hold the probe with the slider up and place the metal ball in the hole in the slider.
6. Replace the top half of the probe, the strain relief boot, and the two screws.

## Amplifier Cabinet Removal

In order to gain access to the circuitry in the amplifier for calibration or troubleshooting, it is necessary to remove the instrument chassis from the cabinet. To remove the cabinet, disconnect the power plug and loosen the thumb-screw at the lower left corner of the front panel. Reach to the back of the instrument and push the chassis out through the front of the cabinet. Pull the power cord through the cabinet.

## Visual Inspection

The P6042 amplifier should be inspected occasionally for possible defects such as damaged parts. The procedures for correcting most visible defects are obvious, but particular care should be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument. Therefore, it is important that the cause of the overheating be found and corrected to prevent a recurrence of the damage.

### CAUTION

Before removing the shield from the bottom of the chassis, disconnect the power cord from the power source to avoid a short-circuit with the contacts on the POWER switch.

## Recalibration

To assure the correct and accurate operation of the P6042 Probe, it should be checked after each 1000 hours of operation and recalibrated if necessary. A complete recalibration should be performed at least once every six months, even if the probe is used only intermittently. Minor troubles that may not be apparent during normal use may be detected during the calibration procedure.

## TROUBLESHOOTING

The following information is provided to aid in locating and correcting trouble in the P6042 Probe. Information found in the Circuit Description, Performance Check, and Calibration will also be helpful when attempting to troubleshoot the instrument.

### Troubleshooting Aids

**Diagram.** The circuit diagram of the P6042 Probe is given at the rear of this manual. Circuit numbers and electrical values of the components are shown on the diagram. Portions of the circuitry that are mounted on circuit boards are outlined in dashed lines.

**Circuit Board Illustrations.** Many of the electrical components in the P6042 amplifier are mounted on circuit boards. To aid in locating components and identifying connections to the circuit boards, Fig. 4-2 shows the physical locations of all components mounted on the boards and the color code of the connecting wires.

### Troubleshooting Procedure

The following general procedure is suggested for isolation of a malfunction in the probe circuitry.

**Check Associated Equipment.** If trouble occurs in the P6042, disconnect the probe from the oscilloscope input and check that the oscilloscope is operating properly without the probe.

**Check Voltages.** If the associated equipment appears to be operating normally, check through the circuitry for correct operating voltages as given on the schematic diagram. The DC voltages are obtained with no signal applied to the probe and with the OUTPUT DC LEVEL control set for zero volts. Place the probe in the front-panel receptacle while measuring voltages and degauss periodically.

**Check Circuit Calibration.** If the preceding voltage checks indicate improper operation of a particular part of the circuitry, check the calibration of that circuit according to the procedure given in the Calibration section of this manual. Improper setting of a calibration adjustment can often cause incorrect operation of a circuit, and thus of subsequent circuits.

**Check Semiconductors.** Most circuit problems result from the failure of a transistor or diode due to normal aging and use. The recommended method of checking transistors in

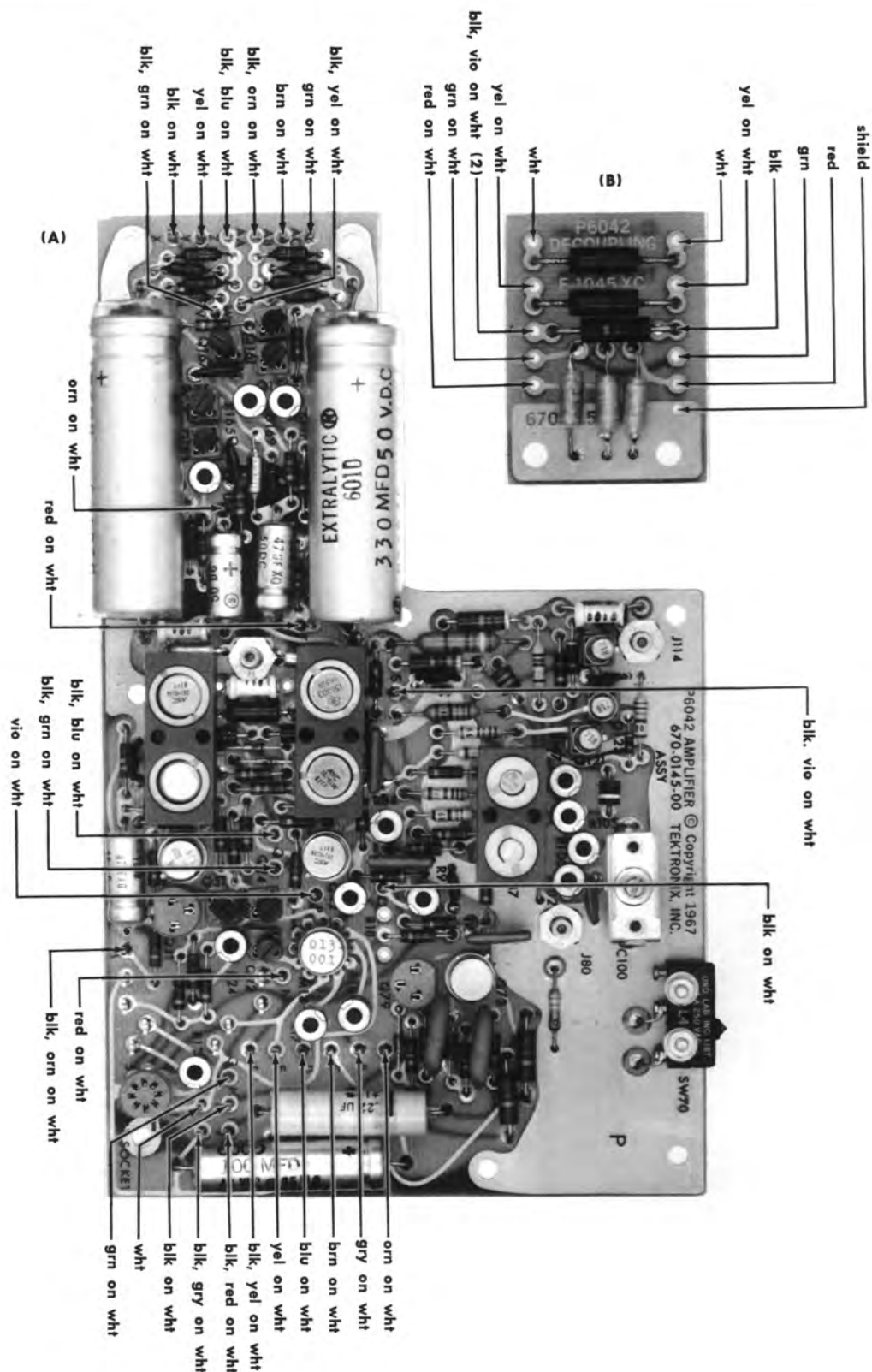


Fig. 4-3. Locations of color code of wiring connections. (A) Amplifier circuit board (B) Decoupling circuit board.

## Maintenance—Type P6042

the amplifier unit is by direct substitution, since static parameter testers do not indicate the circuit performance of the component. NPN or PNP transistor junctions can be tested for open or shorted conditions by treating the base-collector and base-emitter junctions as separate diode junctions and measuring the resistance between terminals. A resistance scale that has an internal voltage source between 800 mV and 3 volts should be used. The resistance should measure very high in one direction and very low in the other direction.

### CAUTION

An ohmmeter scale that has a source voltage outside of the range of 800 mV to 3 volts will probably give an incorrect reading and may damage the component.

A dynamic parameter tester, such as the Tektronix Type 575 Transistor Curve Tracer, may also be useful for checking transistors, signal diodes, or zener diodes that are suspected of being defective. The components will have to be disconnected from the circuit for testing. Be sure to return the transistors and diodes to their original positions if they are found to be operating correctly.

Since each transistor has its own individual operating characteristics, a transistor should not be replaced unless it is actually defective. Any replacement transistor should be of the original or equivalent type and should be mounted in the same manner as the original transistor. Bend the leads to fit the socket correctly and cut the leads to a length of approximately  $\frac{1}{4}$  inch (6 mm). Since transistor lead wiring is no longer consistently arranged as to collector-base-emitter connections, the lead configuration of the replacement transistor must be known. All of the transistor sockets in the P6042 are wired for the standard collector-base-emitter configuration. If the leads of the replacement transistor are not arranged in this sequence, they must be bent into this configuration before being installed. After any transistor has been replaced, the calibration of the instrument must be checked.

**Check Passive Components.** A passive component such as a resistor or capacitor in the amplifier unit can be checked with the appropriate meter after unsoldering one end of the component to eliminate the effect of the surrounding circuitry.

## CORRECTIVE MAINTENANCE

Corrective maintenance generally consists of component replacement and instrument repair. The following paragraphs provide information that may be helpful if parts in the P6042 require replacement.

### Replacement Parts

Replacements for all electrical and mechanical parts used in the P6042 Probe and amplifier can be obtained through your local Tektronix field office or representative. Some of the standard electronic components can be obtained more quickly, however, by purchasing them locally. Before ordering or purchasing any replacement parts, refer to the Parts List in this manual for the required characteristics and correct description.

In addition to the standard electronic components, many special parts and components are used in the P6042. These parts are manufactured by or for Tektronix or are selected to meet specific requirements. Each of these special electrical components is indicated by an asterisk preceding the part number in the Parts List. In addition, most of the mechanical parts used in the probe are manufactured by Tektronix and are not available from other sources. Order all special parts directly from your Tektronix field office or representative.

When ordering parts from Tektronix, always include the instrument type and a complete description of the part as given in the Parts List. (For an electrical part, also give the circuit number of the component, such as Q163.)

**Circuit Boards.** The circuit boards in the P6042 can be ordered either with or without circuit components wired in place. The Tektronix part numbers of the boards are given in the Parts List. To obtain a replacement board with the components soldered in place, be sure to order the replacement board assembly. (The socket-mounted transistors in the amplifier section are not included in the assembly number.)

**Probe Transformer.** The stationary and movable portions of the probe transformer are supplied as a unit, matched at the factory. Should replacement become necessary, replace as a set. Also supplied with the transformer are R10, R11, R13, R14, and C18 which are factory-selected to match the characteristics of the transformer. Installation instructions are furnished with the replacement kits.

### Circuit Board Repair

**Soldering.** The components mounted on the circuit boards in the amplifier can be replaced using normal circuit board soldering techniques. Keep the following points in mind when soldering to the circuit boards:

1. Use a pencil-type soldering iron with a power rating from 15 to 50 watts.
2. Apply heat from the soldering iron quickly to the junction between the component and the circuit board.
3. Heat-shunt the lead of the component by means of a pair of long-nosed pliers.
4. Avoid excessive heating of the junction with the circuit board, as this could separate the circuit board wiring from the laminate.
5. Use electronic grade 60-40 tin-lead solder.
6. Clip off any excess lead length extending beyond the circuit board and clean off any residual flux with a flux-removing solvent. Be careful that the solvent does not remove any printing from the circuit board.

**Board Replacement.** If the amplifier circuit board is damaged and cannot be repaired, replace as follows:

1. Disconnect all wiring connections from the circuit board.
2. Unscrew the five screws that fasten the board to the lugs attached to the chassis. The board may then be removed.

When installing the replacement board, use the wiring color code given in Fig. 4-3 to connect the wires to the square-pin connectors on the board.

## Probe Cable Replacement

If the probe cable becomes defective, it may be replaced as follows:

1. Remove the probe from the cable as described previously under "Probe Disassembly". (Unsolder the two connections to the bottom half of the probe assembly.)

2. Remove the amplifier cabinet and unsolder the cable connections to the DEGAUSS switch and the decoupling board.

3. Loosen the cable clamp on the back of the front sub-panel and straighten the cable.

4. Pull the cable through the front-panel grommet and remove the probe strain relief boot from the cable.

To replace the cable, reverse the above procedure. The probe strain relief boot must be placed on the new cable before the cable is reconnected to the amplifier, due to the size of the transformer receptacle on the probe end of the cable. Refer to Fig. 4-3 for color code of decoupling board connections.

# SECTION 5

## PERFORMANCE CHECK

Change information, if any, affecting this section is found at the rear of the manual.

### General Information

This section of the manual provides a means of checking the performance of the Type P6042 Current Probe. It is intended to check the calibration of the instrument without the need for performing the complete calibration procedure. Failure to meet the requirements given in this procedure indicates the need for internal checks or adjustments. The user should refer to the Calibration section of this manual.

Performance of the P6042 should be checked after each 1000 hours of operation and at least once every six months to assure that the instrument is operating correctly and accurately.

The step by step instructions of the procedure furnish an orderly approach to the isolation of possible malfunctions, and thus serve as an aid in troubleshooting and repairing the probe. Any maintenance that is known to be needed should be performed before starting the procedure. If any trouble becomes apparent during the performance check, this should also be corrected and the procedure started over. Repair and servicing information is given in the Maintenance section of this manual.

### Equipment Required

The following (or equivalent) items of equipment are required to check the performance of the P6042 Current Probe. If substitute equipment is used, it must equal or exceed the given requirements in order to check the P6042 to the given accuracy.

1. Storage oscilloscope, Tektronix Type 549 with Tektronix Type 1A7 vertical plug-in unit. Minimum alternate requirements: Sweep rates from 50 ms/cm to 50  $\mu$ s/cm; single-sweep display; vertical deflection factors from 500  $\mu$ V/cm to 0.5 V/cm; vertical bandwidth selectable: DC to 500 kHz, and 0.1 Hz to 100 Hz; 5 mA calibrated current loop.

2. High-frequency test oscilloscope, Tektronix Type 647A with Type 10A2A and 11B2A plug-in units. Minimum alternate requirement: Vertical deflection factors from 2 V/cm to 20 mV/cm; sweep rates from 1 ms/cm to .02  $\mu$ s/cm (with  $\times 10$  magnifier). Vertical bandwidth of DC to 100 MHz. A single vertical input channel is used.

3. Square-wave generator, Tektronix Type 106. Minimum requirements: Output amplitude of 10 V into 50  $\Omega$ , 200 mA; output repetition rate of 1 kHz.

4. Constant amplitude signal generator, Tektronix Type 191. Minimum requirements: Output amplitude of 5 V into 50  $\Omega$ , 100 mA; variable frequency to 50 MHz.

5. Pulse generator, Tektronix Type 109. Minimum requirements: Risettime of 0.25 ns; adjustable amplitude; 50  $\Omega$  output.

6. Delay Cable, Tektronix Type 113. Requirements: 60 ns delay; characteristic impedance of 50  $\Omega$ .

7.  $1\times$  probe with BNC connector, P6011, Tektronix Part No. 010-0193-00.

8. GR 50  $\Omega$  terminating current loop, Tektronix Part No. 067-0559-00.

9. Two GR 50  $\Omega$   $10\times$  attenuators, Tektronix Part No. 017-0078-00.

10. GR-to-BNC adapter, Tektronix Part No. 017-0063-00.

11. Two 5 ns lengths of RG-8A/U with GR connectors, Tektronix Part No. 017-0502-00.

12. Rectangular viewer, for use with the Type 647A test oscilloscope, Tektronix Part No. 016-0039-00.

13. Resistor, 10  $\Omega$ ,  $\pm 10\%$ ,  $\frac{1}{4}$  W, Tektronix Part No. 316-0100-00.

### NOTE

The high-frequency performance checks for the P6042 Current Probe should be made with a DC to 100 MHz test oscilloscope. Using a lower bandwidth oscilloscope may result in an overall system bandwidth lower than 50 MHz. Using a higher bandwidth oscilloscope may cause aberrations in excess of the specified 3%.

### PRELIMINARY PROCEDURE

1. Set the Voltage and Range Selector switches on the rear of the P6042 to the appropriate positions to match the line voltage being used. (Refer to the Operating Instructions section of this manual.)

2. Connect the P6042 to the power source and turn the POWER switch ON. Allow five minutes warmup time at 25° C.

3. Place the selectable bandwidth plug-in unit in the storage oscilloscope. Connect the  $1\times$  probe to the +Input connector. Connect a ground lead to the probe.

4. Preset the controls as follows:

#### Storage Oscilloscope

Enhance Mode	Off
Upper Screen Storage	Off
Lower Screen Storage	Off
Screen Selector	Full
Auto Erase	Off
Horizontal Display	A
Mag	Off
Norm-Single Sweep	Norm
A Time/cm	50 mS

## Performance Check—Type P6042

A Triggering	
Level	midrange
Stability	clockwise
Mode	Trig
Slope	+
Coupling	AC
Source	Norm
Power	On

### Selectable Bandwidth Plug-In

Volts/cm	.1 volt
Low Freq 3 dB Point	DC
High Freq 3 dB Point	500 kHz
DC Offset	Off
+Input Coupling	DC
—Input Coupling	Gnd
Position	trace centered

### P6042 Current Probe

OUTPUT DC LEVEL	midrange
CURRENT/DIV BALANCE	midrange
CURRENT/DIV	1 A

## 1. Check PROBE UNLOCKED Indicator

- Remove the P6042 probe from the front-panel probe holder.
- Pull the thumb-controlled slider back, opening the probe, and allow the spring to return the slider to the partially closed position. Do not push forward.
- Check to see that the front-panel PROBE UNLOCKED indicator light is on.
- Push the slider forward into the closed position. The PROBE UNLOCKED indicator should extinguish.

## 2. Check DEGAUSS Operation

- Construct a  $10\ \Omega$  closed loop, using a short piece of wire and a  $10\ \Omega$  resistor.
- Connect the probe to the  $10\ \Omega$  loop. Lock the slider.
- Connect the  $1\times$  probe across the  $10\ \Omega$  resistor.
- Switch display to Single Sweep. While operating the Reset lever, turn Triggering Stability counterclockwise until the Ready light stays on. Push Upper and Lower Store buttons.
- Reach inside the front-panel probe holder and close the probe-operated switch (simulating the probe inserted into the holder). While holding the switch closed, push the DEGAUSS lever (hold for the duration of the sweep) and release.
- Check the stored display for a four-centimeter (0.4 V) damped waveform lasting approximately 200 milliseconds. See Fig. 5-1.

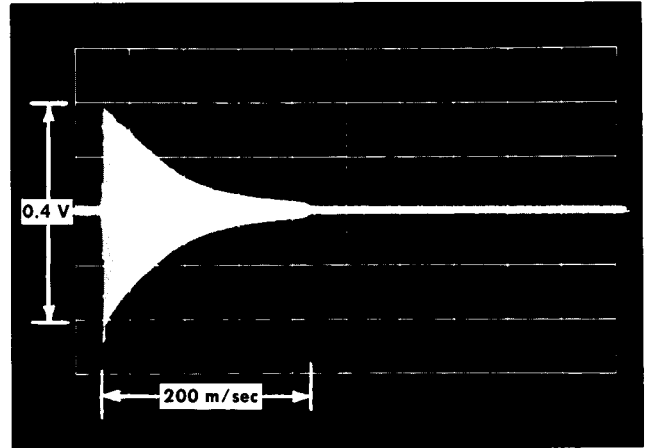


Fig. 5-1. Degauss waveform, coupled through  $10\ \Omega$  loop.

- Remove the probes from the  $10\ \Omega$  loop, place the P6042 probe in the holder (lock the slider), and remove the  $1\times$  probe from the oscilloscope input. Push Upper and Lower Screen Storage Off buttons and switch display to Norm.

## 3. Check OUTPUT DC LEVEL Range

- Connect the P6042 OUTPUT to the +Input connector, terminated in 50 ohms.
- Set Time/cm to  $50\ \mu\text{s}$ , and Triggering Mode to Auto. Switch +Input coupling to Gnd, position the trace on the center graticule line, and return to DC.
- Rotate the OUTPUT DC LEVEL control throughout its range and check for a positioning range of at least + and —3 centimeters ( $\geq +$  and —300 mV at the probe amplifier output). See Fig. 5-2.

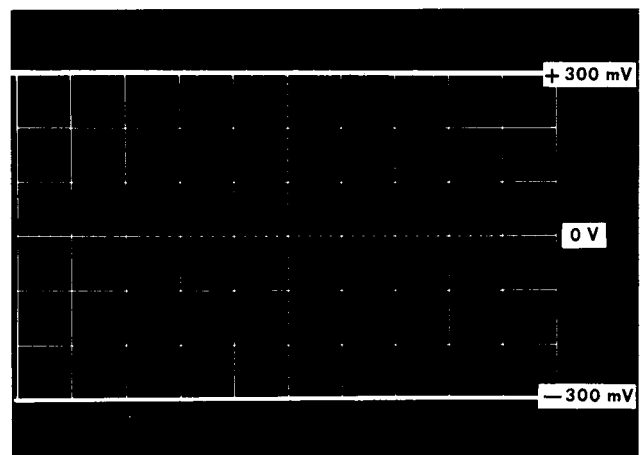


Fig. 5-2. Positioning range of OUTPUT DC LEVEL with test oscilloscope set to 0.1 V/cm.

- Switch Volts/cm to 50 mV and position the trace on the center graticule line with the OUTPUT DC LEVEL control.



#### 4. Check CURRENT/DIV BALANCE Range

a. Set CURRENT/DIV to 10 mA, degauss the probe and position the trace on screen with the CURRENT/DIV BALANCE.

b. Check the range of the CURRENT/DIV BALANCE for  $\geq 5$  cm.

c. Switch CURRENT/DIV to 1 mA, degauss the probe, and position the trace on the center graticule line with the CURRENT/DIV BALANCE.

d. Degauss the probe several times and check to see that the trace returns to within one centimeter of the previous position.

#### 5. Check Gain

a. Set Time/cm to 1 ms, and Volts/cm to .2 volt.

b. Preset the square-wave generator controls as follows:

Repetition Rate Range	1 kHz
Multiplier	1
Symmetry	midrange
Mode	Hi Amplitude
Power	On

c. Remove the cable from the P6042 OUTPUT and connect to the square-wave generator Hi Amplitude output, using the GR-to-BNC adapter.

d. Adjust the square-wave generator Amplitude for 5 centimeters of deflection (1 volt).

e. Remove the GR-to-BNC adapter and connect the cable to the P6042 OUTPUT. Connect the GR 50  $\Omega$  terminating current loop to the square-wave generator output (producing a 20 mA square wave through the current loop).

f. Set CURRENT/DIV to 5 mA and Volts/cm to 50 mV. Degauss the probe and connect to the current loop.

g. Check for 4 centimeters of deflection.

#### 6. Check CURRENT/DIV Attenuation

a. With the test equipment set as in the previous step, change CURRENT/DIV to 10 mA and check for 2 centimeters of deflection,  $\pm 3\%$ . Switch to 20 mA and check for 1 centimeter of deflection.

b. Remove the current loop from the square-wave generator.

c. Remove the cable from the P6042 OUTPUT and connect to the square-wave generator, using the GR-to-BNC adapter.

d. Switch Volts/cm to 2 volts and adjust square-wave generator Amplitude for 5 centimeters of deflection (10 volts).

e. Reconnect the cable to the P6042 OUTPUT, and the current loop and probe to the square-wave generator.

f. Change Volts/cm to 50 mV and CURRENT/DIV to 50 mA. Check for 4 centimeters of deflection,  $\pm 3\%$ .

g. Switch CURRENT/DIV to .1 A and check for 2 centimeters of deflection,  $\pm 3\%$ .

h. Switch CURRENT/DIV to .2 A, .5 A, and 1 A positions and check for deflections of 1, 0.4, and 0.2 centimeter, respectively. (The 1 A position may be checked for 0.5 centimeter with the Volts/cm switch set to 20 mV.) This step is not intended as an accurate check of the attenuator tolerance, but as a check for obvious open-circuit conditions in the switch.

i. Remove the probe from the current loop and connect it to the test oscilloscope 5 mA current loop. Set the Calibrator switch to the 5 mA square-wave position.

j. Set Volts/cm to 50 mV, CURRENT/DIV to 1 mA, and degauss the probe. Check for 5 centimeters of deflection.

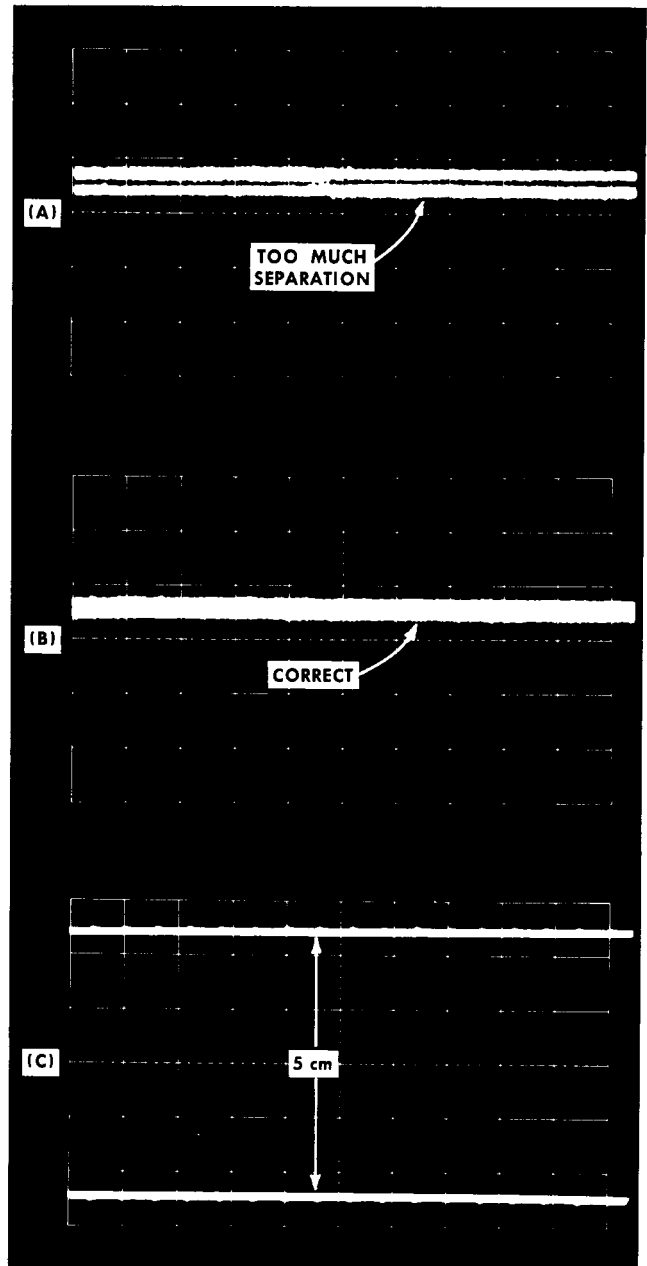


Fig. 5-3. Tangential noise check showing (A) too much separation in amplitude adjustment (B) current amplitude with traces just joining (C) maximum amplitude at 10 mA/DIV with 10 $\times$  attenuators removed.

## Performance Check—Type P6042

k. Change CURRENT/DIV to 2 mA and check for 2.5 centimeters of deflection.

### 7. Check Noise

a. Connect the two GR 10× 50 Ω attenuators and the current loop to the square-wave generator Hi Amplitude output. Connect the probe to the current loop.

b. Set the CURRENT/DIV switch to 1 mA, Time/cm to .1 ms, Triggering Mode to Trig, and Stability clockwise to display two free-running traces.

c. Reduce the square-wave generator Amplitude until the two traces just merge (the point at which the dark band between the traces just disappears). See Fig. 5-3B.

d. Switch CURRENT/DIV to 10 mA and remove the two 10× attenuators. Connect current loop and probe to the square-wave generator output.

e. Check the amplitude of the display for  $\leq 5$  cm ( $\leq 0.5$  mA + 0.2 cm, tangentially measured). See Fig. 5-3C.

f. Remove the probe from the square-wave generator output and place in the holder (lock the slider).

### 8. Check Random Trace Shift

a. Set CURRENT/DIV to 1 mA, degauss the probe, and center the trace with the CURRENT/DIV BALANCE.

b. Set the controls as follows:

Storage Oscilloscope	
Upper Screen Storage	Store
Lower Screen Storage	Store
Norm - Single Sweep	Single Sweep
Triggering Mode	Auto

Selectable Bandwidth Plug-In	
Low Freq 3 dB Point	.1
High Freq 3 dB Point	100

c. Push Erase and Reset button several times while adjusting Intensity so that the brightness of the trace is at minimum storage level.

d. Set Time/cm to 5 sec and push Erase and Reset button.

e. Check stored display for  $\leq 1.5$  centimeters peak to peak. See Fig. 5-4.

### 9. Check Aberrations

a. Turn the DC to 100 MHz test oscilloscope on and set the controls as follows:

Vertical Plug-In	
Mode	Ch 1
Trigger	Norm
Volts/cm	.2
Variable	Cal
Input Coupling	DC
Position	Trace centered

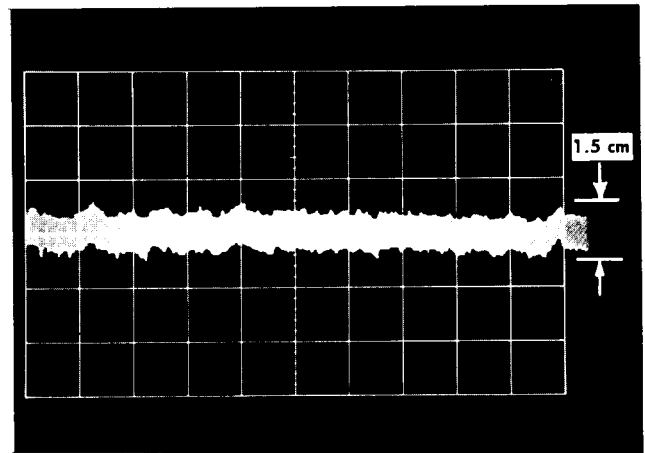


Fig. 5-4. Maximum random trace shift at 5 sec/cm, stored.

Time-Base Plug-In	
Horiz Display	A
Mag	On
Time/cm	.2 $\mu$ s
Trig Mode	Auto
Slope	+
Coupling	AC
Source	Int

b. Connect the cable from the P6042 OUTPUT to the DC to 100 MHz test oscilloscope Ch 1 Input, terminated in 50 ohms.

c. Remove the current loop from the square-wave generator and connect to the pulse generator output. Connect the probe to the current loop. Connect the delay cable to the pulse generator charge line connectors, using the two lengths of RG-8A/U.

d. Set the pulse generator Voltage Range to 5.0, Pulse Polarity to — and turn power on.

e. Adjust pulse generator Amplitude and test oscilloscope Trig Level to obtain a 4-centimeter display. (Use the viewing hood if necessary).

f. Check aberrations for  $\leq 3\%$ , peak to peak. Remove the probe from the pulse generator and place in the holder. Turn  $\times 10$  Mag off.

### 10. Check AC Dynamic Range

a. Connect the current loop to the constant amplitude signal generator output.

b. Set the controls as follows:

DC to 100 MHz Test Oscilloscope	
Volts/cm	.5
Time/cm	20 $\mu$ s
Input Coupling	Gnd
Vertical Position	trace centered

## Constant Amplitude Signal Generator

Frequency Range	50 kHz Only
Amplitude	5
Amplitude Range	.5 - 5 V
Power	On

- c. Degauss the probe and connect to the current loop.
- d. Switch test oscilloscope input coupling to DC and adjust CURRENT/DIV BALANCE to center the display on the CRT. Trigger the sweep.
- e. Increase the signal generator Amplitude until waveform distortion occurs. Check for an undistorted dynamic range of at least + and -1 cm ( $\geq$  + and -500 mV at probe amplifier output). See Fig. 5-5.

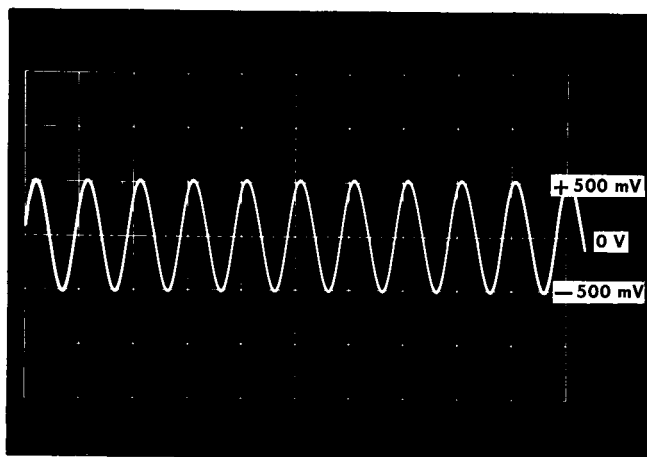


Fig. 5-5. Dynamic range of P6042, test oscilloscope set to 0.5 V/div.

## 11. Check Bandwidth

- a. Set Volts/cm to .2 and adjust signal generator Amplitude for 5 centimeters of deflection.

- b. Increase the frequency of the constant amplitude signal generator until the amplitude of the display reduces from 5 centimeters to 3.5 centimeters. See Fig. 5-6.

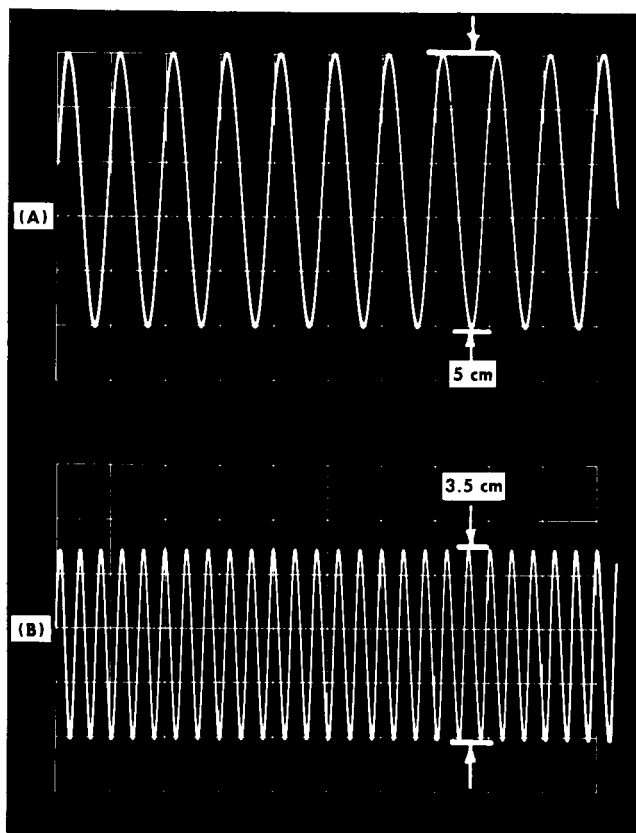


Fig. 5-6. Bandwidth of P6042 (A) 50 kHz display (B) 50 MHz display.

- c. Check the frequency setting of the signal generator for  $\geq 50$  MHz.
- d. Calculate the risetime of the probe from the measured bandwidth.

## This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

# SECTION 6

## CALIBRATION

Change information, if any, affecting this section is found at the rear of the manual.

### General Information

This section of the manual contains information to be used in calibrating and checking the operation of the P6042 Current Probe. The Procedure is arranged in a sequence that permits calibration of the instrument with a minimum of adjustment interaction.

When performing a complete recalibration of the probe, best overall performance will be obtained if each adjustment is made to the exact setting, even if the observed performance is within the allowable tolerance. To make only the control adjustments without completely checking the performance of the probe, do only the Adjust steps. The symbol **Ⓐ** is provided to help locate those steps. Any equipment connections or control settings that are changed during the omitted steps must be noted and performed if necessary.

### Equipment Required

The following (or equivalent) items of equipment are required to calibrate the P6042 Current Probe. The recommended equipment is illustrated in Fig. 6-1. If substitute equipment is used, it must equal or exceed the given requirements in order to calibrate and check the P6042 to the given accuracy.

1. Storage oscilloscope, Tektronix Type 549. Minimum alternate requirements: Sweep rates from 50 ms/cm to 50  $\mu$ s/cm; single sweep display; 5 mA calibrated current loop.

2. Differential comparator plug-in unit, Tektronix Type W. Compatible with the storage oscilloscope (item 1); vertical deflection factors from 10 mV/cm to 100 mV/cm; internal comparison voltage of  $\pm 1.6$  volts.

3. Selectable bandwidth plug-in unit, Tektronix Type 1A7. Compatible with the storage oscilloscope (item 1); vertical deflection factors from 500  $\mu$ V/cm to 0.5 V/cm; vertical bandwidth selectable: DC to 300 Hz, and 0.1 Hz to 100 Hz.

4. High-frequency test oscilloscope, Tektronix Type 647A with Type 10A2A and 11B2A plug-in units. Minimum alternate requirements: Vertical deflection factors from 2 V/cm to 20 mV/cm; sweep rates from 1 ms/cm to .02  $\mu$ s/cm (with  $\times 10$  magnifier). Vertical bandwidth from DC to 100 MHz. A single vertical input channel is used.

5. Variable autotransformer. Minimum requirements: Output voltage variable from 104 volts to 126 volts AC RMS for 115-volt operation or from 208 volts to 252 volts AC RMS for 230-volt operation. Variac, General Radio Corporation, recommended.

6. DC voltmeter. Triplett, model 630-NA volt-ohmmeter, recommended.

7. Square-wave generator, Tektronix Type 106. Minimum requirements: Output amplitude of 10 V into 50  $\Omega$ , 200 mA; output repetition rate of 1 kHz.

8. Constant amplitude signal generator, Tektronix Type 191. Minimum requirements: Output amplitude of 5 V into 50  $\Omega$ , 100 mA; variable frequency to 50 MHz.

9. Pulse generator, Tektronix Type 109. Minimum requirements: Risettime of 0.25 ns; adjustable amplitude; 50  $\Omega$  output.

10. Delay Cable, Tektronix Type 113. Requirements: 60 ns delay; characteristics impedance of 50  $\Omega$ .

11.  $1\times$  probe with BNC connector, P6011, Tektronix Part No. 010-0193-00.

12. GR 50  $\Omega$  terminating current loop, Tektronix Part No. 067-0559-00.

13. Two GR 50  $\Omega$   $10\times$  attenuators, Tektronix Part No. 017-0078-00.

14. GR-to-BNC adapter, Tektronix Part No. 017-0063-00.

15. Two 5 ns lengths of RG-8A/U with GR connectors, Tektronix Part No. 017-0502-00.

16. Rectangular viewer, for use with the Type 647A test oscilloscope, Tektronix Part No. 016-0039-00.

17. Resistor, 10  $\Omega$ ,  $\pm 10\%$ ,  $\frac{1}{4}$  W, Tektronix Part No. 316-0100-00.

18. Nylon adjusting tool, Tektronix Part Nos. 003-0307-00 (handle) and 003-0334-00 (insert).

### INDEX AND RECORD

The following outline is provided to serve as a verification and/or calibration record. It may be reproduced for that purpose or as a guide for calibrators who are familiar with the procedure.

Calibration Date \_\_\_\_\_ Engineer \_\_\_\_\_

Cal. Record No. \_\_\_\_\_

- |   |          |
|---|----------|
| <input type="checkbox"/> 1. Check Power Supply Resistances            | Page 6-5 |
| +16 V, $\geq 300 \Omega$ ; -16 V, $\geq 200 \Omega$ .                 |          |
| <input type="checkbox"/> 2. Adjust + 16 Volts (R165) Check Regulation | Page 6-5 |
| + 16 volts at test point.   |          |
| <input type="checkbox"/> 3. Adjust - 16 Volts (R180) Check Regulation | Page 6-6 |
| - 16 volts at test point.   |          |
| <input type="checkbox"/> 4. Adjust Ripple Null (R157)                 | Page 6-6 |
| $\leq 2$ mV peak to peak on + 16 V and - 16 V supplies.               |          |

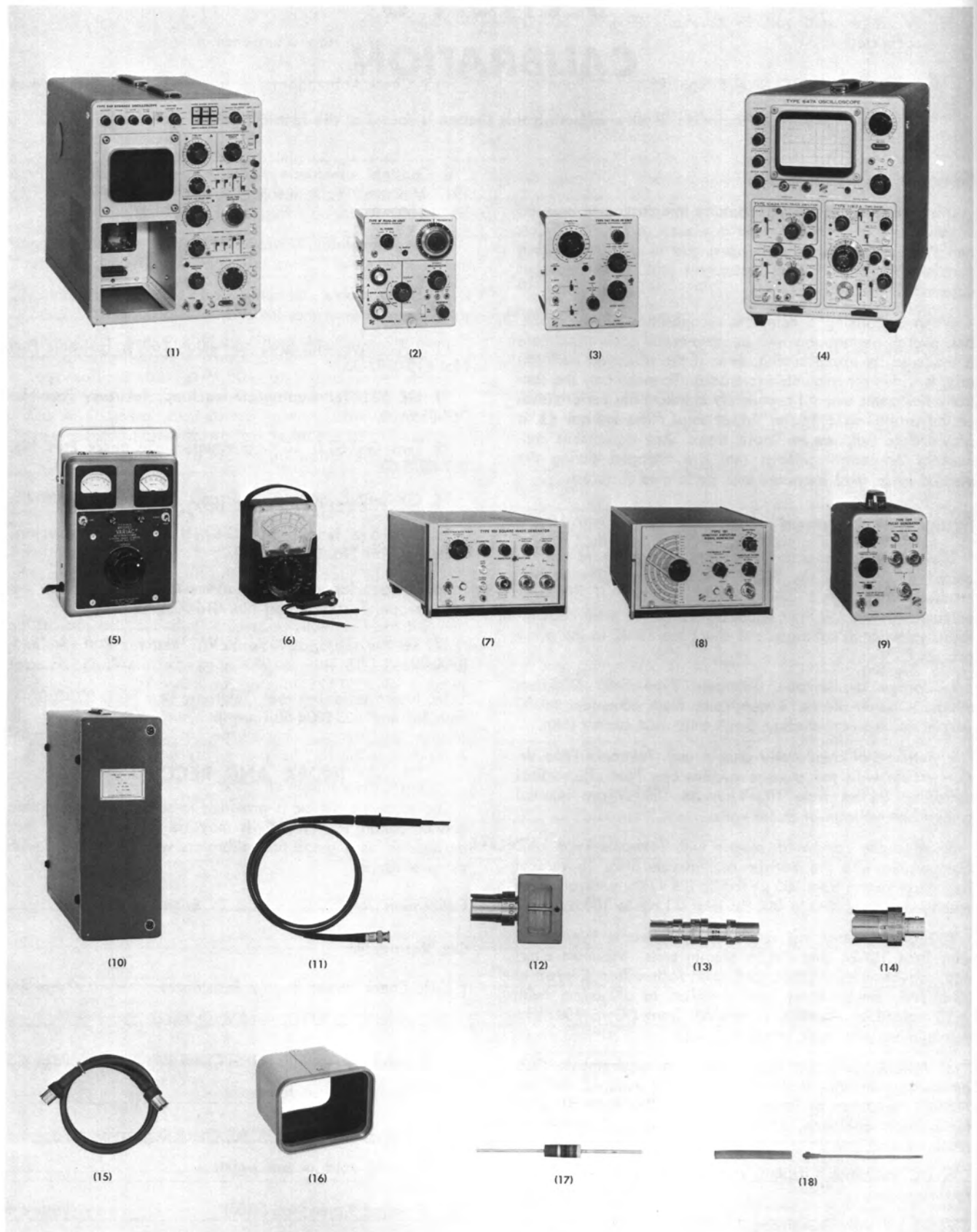


Fig. 6-1. Test equipment recommended.

- ☐ 5. Adjust Attenuator Balance (R84) Page 6-6  
Adjust for zero volts at base of Q87 with J80 disconnected.
- ☐ 6. Adjust Output DC Level Range (R93) Page 6-7  
Adjust for zero volts at OUTPUT with OUTPUT DC LEVEL at midrange and J80 disconnected.
- ☐ 7. Check PROBE UNLOCKED Indicator page 6-7  
Indicator lights when probe is not locked.
- ☐ 8. Check DEGAUSS Operation page 6-8  
0.4 V damped waveform (coupled through 10  $\Omega$  closed loop) with duration of 200 milliseconds.
- ☐ 9. Adjust CURRENT/DIV BALANCE Range page 6-9  
(R16 or R17)  
Adjust either R16 or R17 for zero volts at OUTPUT with CURRENT/DIV BALANCE at midrange and CURRENT/DIV set to 1 mA.
- ☐ 10. Adjust Gain (R107) page 6-9  
Adjust for 4 centimeters deflection, with 20 mA square wave, CURRENT/DIV set to 5 mA position.
- ☐ 11. Check CURRENT/DIV Attenuation page 6-9  
1, 2, 5 sequence from 1 mA to 1 A.
- ☐ 12. Check Noise page 6-12.  
 $\leq 1.5 \text{ mA} + 0.2 \text{ cm}$ , tangentially measured.
- ☐ 13. Check Random Trace Shift page 6-12  
 $\leq 1.5 \text{ mA}$  trace shift in 10 cm, stored.

- ☐ 14. Adjust Compensation Circuits (R102, R18, R24, C100, R100 and R105) page 6-12  
Adjust in above sequence.
- ☐ 15. Check Abberations page 6-14  
 $\leq 3\%$  peak to peak.
- ☐ 16. Check AC Dynamic Range page 6-16  
 $\geq +$  and  $-$  500 mV at probe amplifier output.
- ☐ 17. Check Bandwidth page 6-17  
 $\geq 50 \text{ MHz}$ .

#### NOTE

The high-frequency adjustments and performance checks for the P6042 Current Probe should be made with a DC to 100 MHz test oscilloscope. Using a lower bandwidth oscilloscope may result in an overall system bandwidth lower than 50 MHz. Using a higher bandwidth oscilloscope may cause aberrations in excess of the specified 3%.

#### PRELIMINARY PROCEDURE

1. Remove the P6042 amplifier from the cabinet.
2. With the probe slider in the locked position, place the probe in the front panel holder.
3. Set the Line Voltage Selector switch on the rear of the P6042 to the appropriate position to match the line voltage being used (115 volts or 230 volts). Set the Range Selector switch to M (104-125 volts or 208-252 volts).
4. Place the differential comparator plug-in unit in the storage oscilloscope. Connect the 1 $\times$  probe to the Channel A input. See Fig. 6-2 for preliminary test setup.
5. Preset the controls as follows:

#### NOTES

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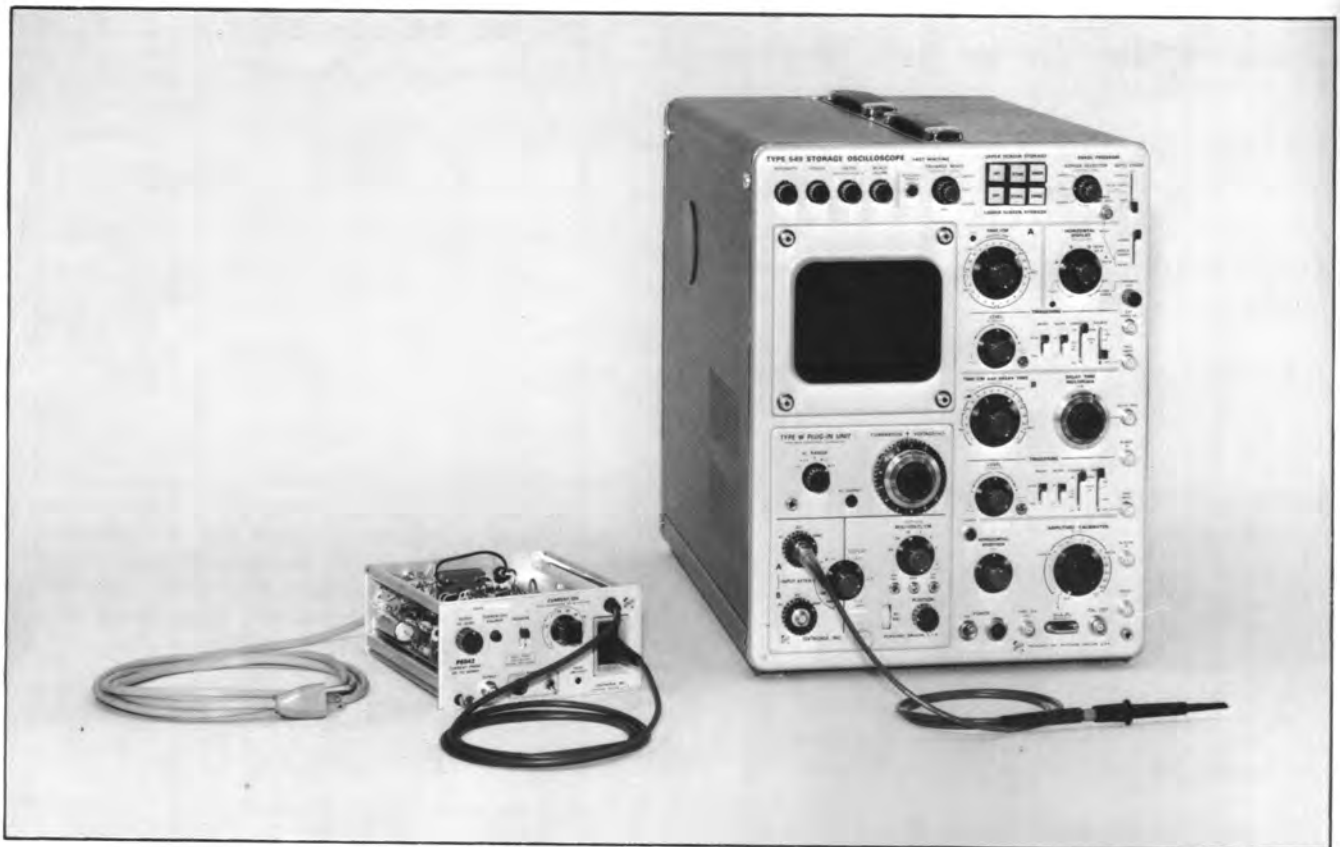


Fig. 6-2. Preliminary test setup.

**Storage Oscilloscope**

Enhance Mode	Off
Upper Screen Storage	Off
Lower Screen Storage	Off
Screen Selector	Full
Auto Erase	Off
Horizontal Display	A
Mag	Off
Norm - Single Sweep	Norm
A Time/cm	50 $\mu$ s
A Triggering	
Level	Midrange
Stability	Clockwise
Mode	Auto
Slope	+
Coupling	AC
Source	Line
Power	On

**Differential Comparator Plug-In**

Vertical Range	+11
Comparison Voltage	1.600

Input Atten	10
A Input Coupling	Gnd
B Input Coupling	Gnd
Display	A - B
Millivolts/cm	10
Variable	Calib
Position	trace centered

**P6042 Current Probe**

CURRENT DC LEVEL	midrange
CURRENT/DIV BALANCE	midrange
CURRENT/DIV	1 A
POWER	off

Before starting the procedure, preset R16, R17, and R18 counterclockwise. Do not preset any other internal calibration controls unless they are known to be significantly out of adjustment. In this case, set the remaining controls, with the exception of R12 to midrange. Do not adjust R12, which is a part of the temperature compensation network. This is set at the factory according to the requirements of the Hall device. If the probe transformer is replaced, contact your local field office for adjustment procedure. Fig. 6-3 shows the location of internal adjustments.



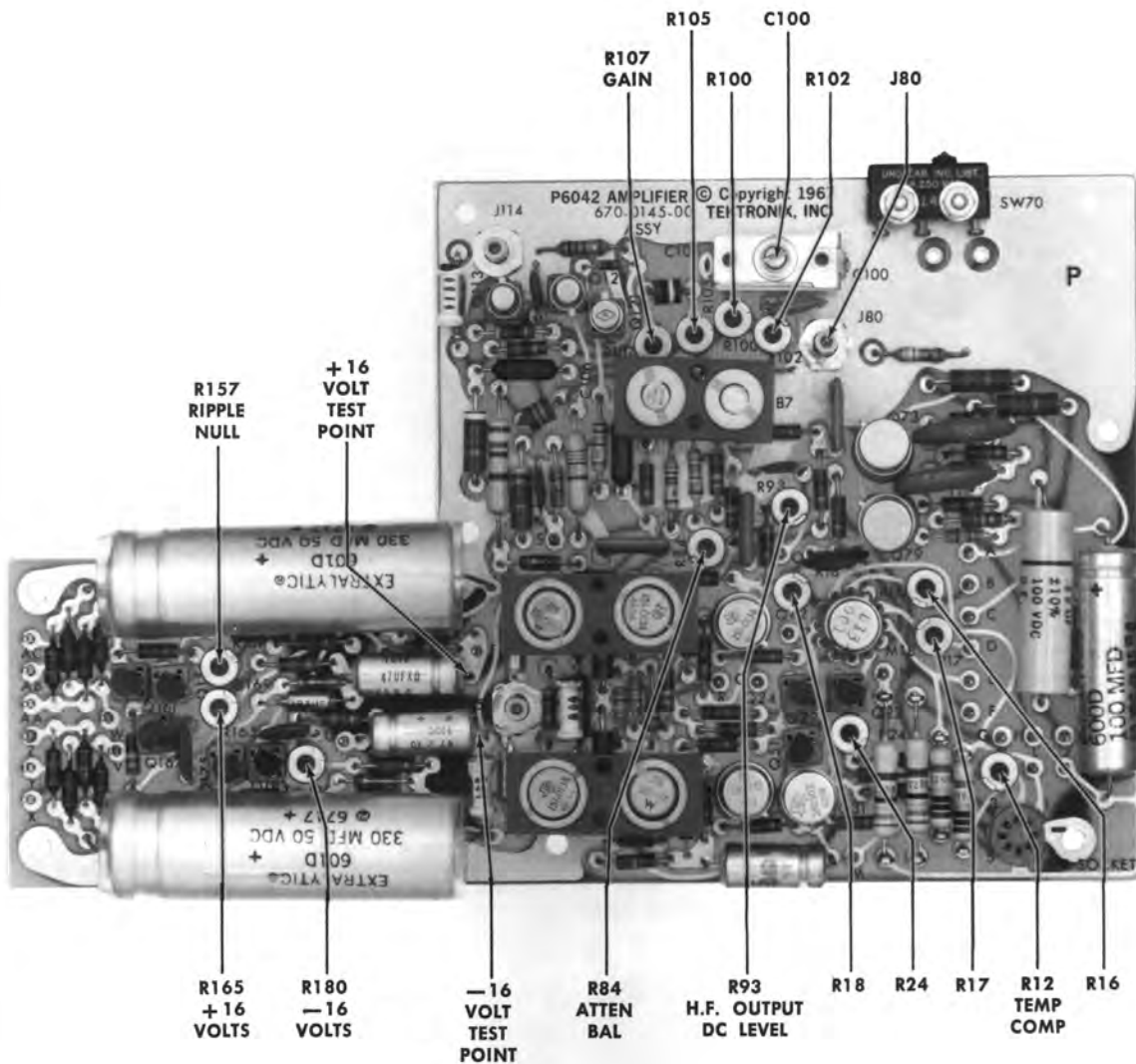


Fig. 6-3. Location of internal adjustments and test points.

## CALIBRATION

### 1. Check Power Supply Resistances

a. Using an ohmmeter, measure the resistance to ground at the +16 volt test point (see Fig. 6-3 for location of test point). Check for  $\geq 300 \Omega$ . Connect positive probe to test point.

b. Check the resistance to ground at the -16 volt test point (see Fig. 6-3) for  $\geq 200 \Omega$ . Connect negative probe to test point.

### 2. Adjust +16 Volts (R165) Check Regulation

a. Connect the P6042 power cord to the variable autotransformer, set to 115 volts (230 volts) and turn the P6042 POWER on. Allow five minutes for warm-up time at  $+25^\circ\text{C}$ .

b. Connect the  $1\times$  probe to the +16 volt test point. Switch Channel A input coupling to DC and Display to A-Vc.

c. Adjust R165 to position the trace on the center graticule line.

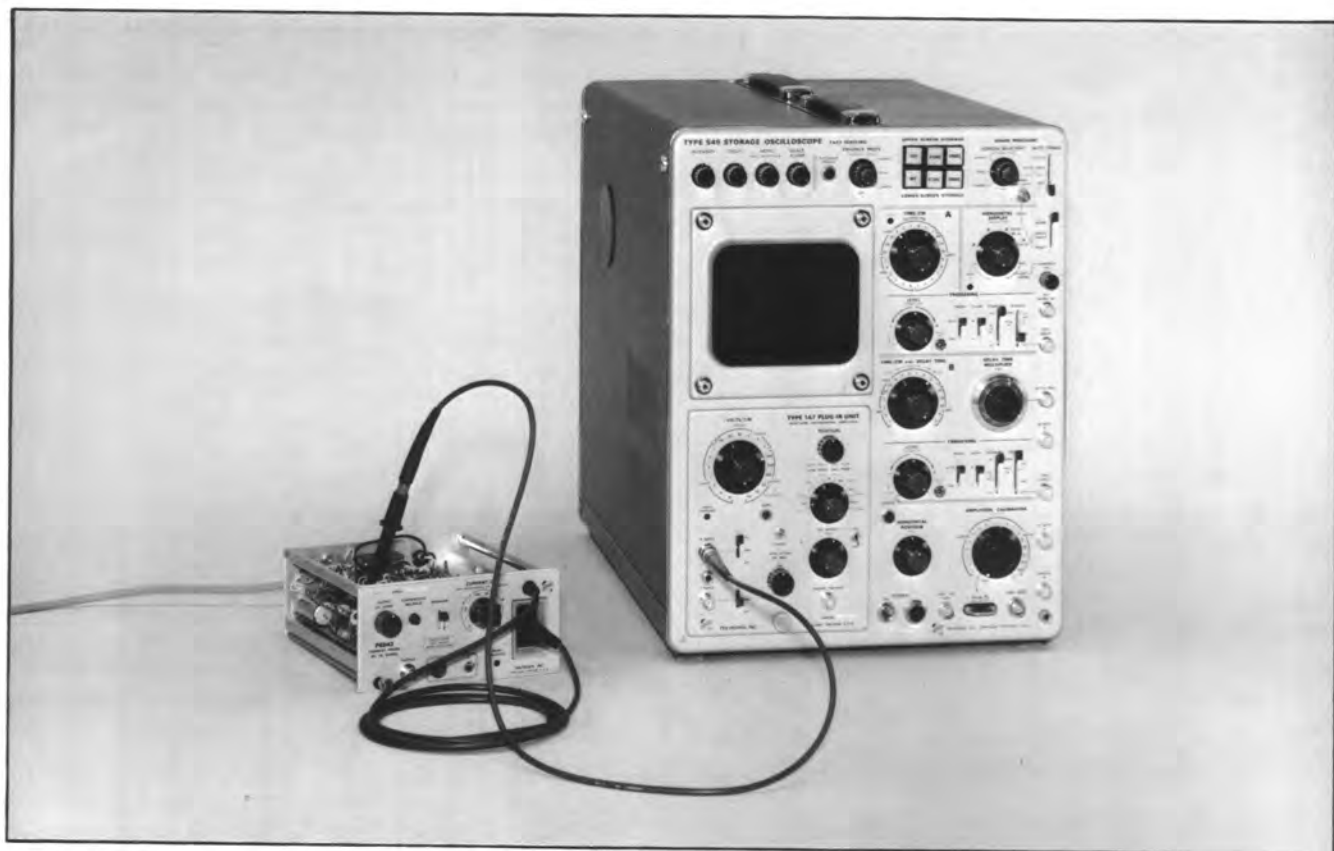


Fig. 6-4. Test setup for step 4.

d. Vary the autotransformer voltage from 104 to 126 volts (208 to 252 volts) and check for no trace shift. Return to 115 volts (230 volts).

### 3. Adjust —16 Volts (R180) Check Regulation

①

a. Connect the 1× probe to the —16 volt test point. Switch Vc Range to —11.

b. Adjust R180 to position the trace on the center graticule line.

c. Vary the autotransformer voltage from 104 to 126 volts (208 to 252 volts) and check for no trace shift. Return to 115 volts (230 volts).

d. Disconnect the probe from the —16 volt test point and remove the differential comparator plug-in unit from the storage oscilloscope.

### 4. Adjust Ripple Null (R157)

①

a. Place the selectable bandwidth plug-in unit in the storage oscilloscope and set the controls as follows:

Volts/cm	500 $\mu$ V
Low Freq 3 dB Point	DC

High Freq 3 dB Point	300 Hz
DC Offset	Off
+ Input Coupling	AC
— Input Coupling	Gnd
Position	trace centered

Set the storage oscilloscope Time/cm to 5 ms.

b. Connect the 1× probe from the + Input to the +16 volt test point. See Fig. 6-4.

c. Adjust R157 for minimum ripple. Fig. 6-5 shows a typical ripple display at 500  $\mu$ V/cm.

d. Check ripple for  $\leq 2$  mV peak to peak ( $\leq 4$  cm at 500  $\mu$ V/cm).

e. Connect the 1× probe to the —16 volt test point and check ripple for  $\leq 2$  mV peak to peak.

f. Remove the probe from the test point.

### 5. Adjust Attenuator Balance (R84)

①

a. Remove the connection from J80, on the amplifier circuit board. See Fig. 6-3 for location of J80.

b. Change Time/cm to 50  $\mu$ s, and switch input coupling to Gnd. Position the trace on the center graticule line and switch input to DC.

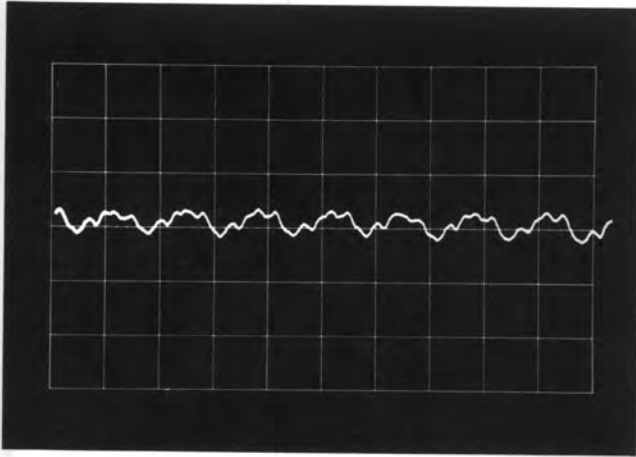


Fig. 6-5. Typical ripple on + 16 volt supply at 500  $\mu$  volts/cm.

c. Connect a ground lead from the 1 $\times$  probe to the P6042 chassis near J80.

d. Hold the probe tip on the center conductor of J80 and adjust R84 for zero volts (trace centered vertically on the CRT).

## 6. Adjust Output DC Level Range (R93) ①

a. Remove the 1 $\times$  probe and connect the 50  $\Omega$  termination to the + Input connector. Connect a 50  $\Omega$  cable from the P6042 OUTPUT to the termination. See Fig. 6-6.

b. Set + Input coupling to Gnd, Volts/cm to .1 volt, and center the trace on the CRT. Switch input coupling to DC.

c. Adjust R93 to position the trace on the center graticule line (with front-panel OUTPUT DC LEVEL set to midrange).

d. Rotate the OUTPUT DC LEVEL control throughout its range and check for a positioning range of + and -3 cm ( $\geq +$  and -300 mV). If necessary, readjust R93 so that the + and - ranges of the OUTPUT DC LEVEL control are equal. See Fig. 6-7. Return trace to the center graticule line with the OUTPUT DC LEVEL.

e. Reconnect the cable from the CURRENT/DIV switch to J80 on the amplifier circuit board.

## 7. Check PROBE UNLOCKED Indicator

a. Remove the probe from the front-panel holder. Pull the thumb-controlled slider back, opening the probe, and allow the spring to return the slider to the partially-closed position. Do not push forward.

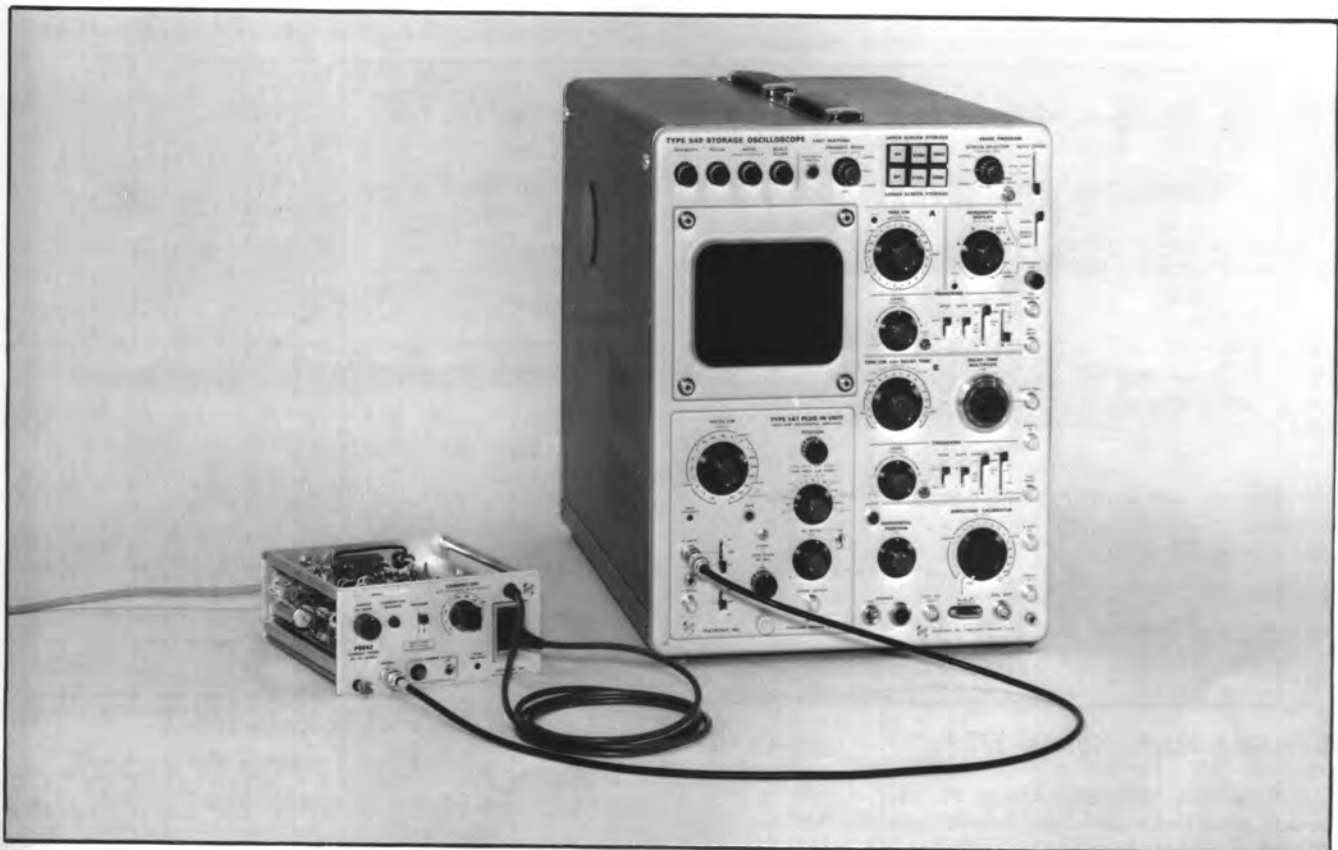


Fig. 6-6. Test setup for steps 6 through 9.

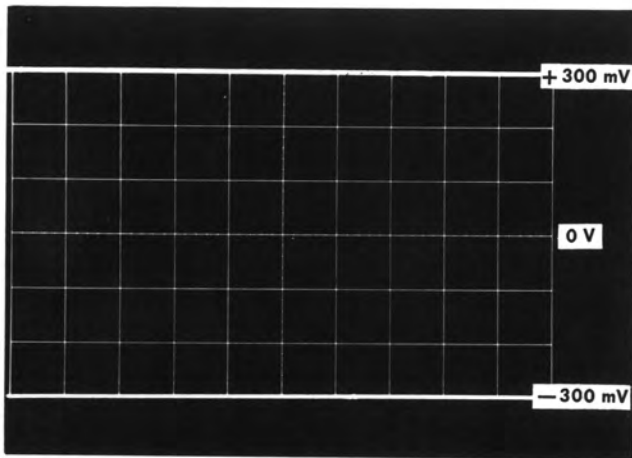


Fig. 6-7. Positioning range of OUTPUT DC LEVEL, with test oscilloscope set to 0.1 v/cm.

b. Check to see that the front-panel PROBE UNLOCKED indicator is on and the trace is off screen.

c. Push the slider forward into the closed position. The PROBE UNLOCKED indicator should extinguish and the trace should come on screen.

### 8. Check DEGAUSS Operation

a. Remove the termination from the test oscilloscope + Input and connect the 1× probe.

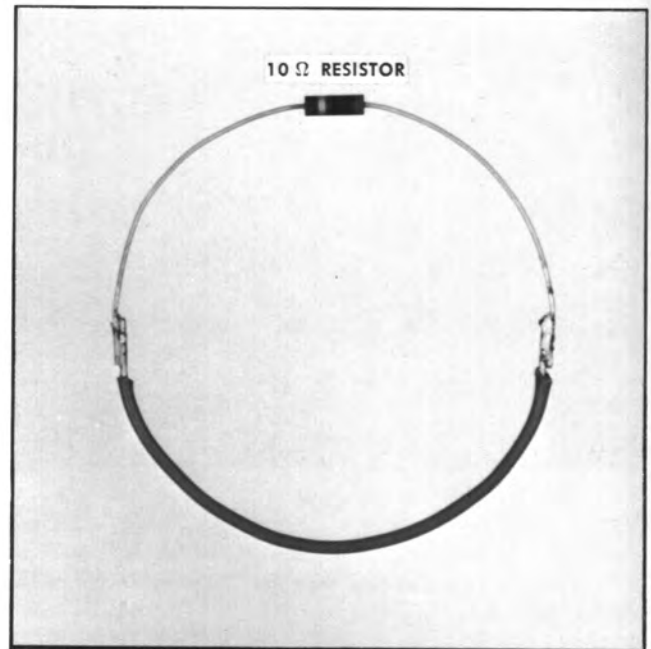


Fig. 6-8. 10  $\Omega$  closed loop.

b. Construct a 10  $\Omega$  closed loop, using a short piece of wire and a 10  $\Omega$  resistor. See Fig. 6-8.

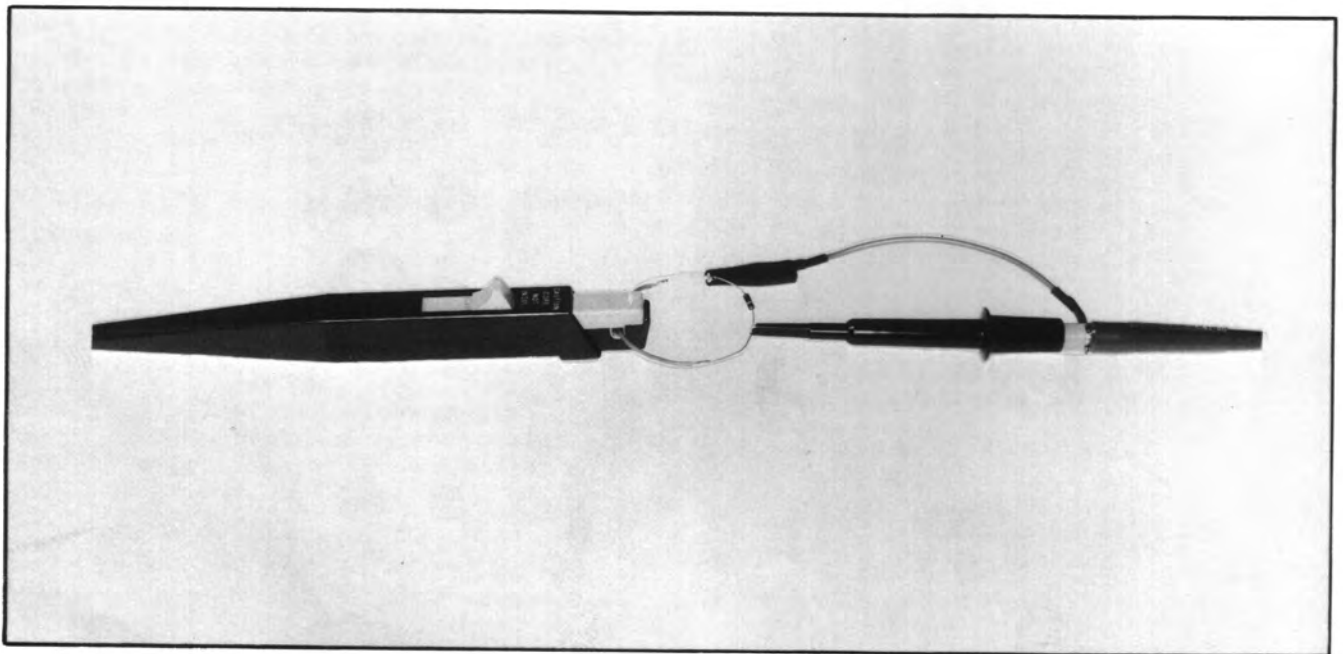


Fig. 6-9. Test setup for step 8.

c. Connect the P6042 probe to the  $10\ \Omega$  loop. Lock the slider.

d. Connect the  $1\times$  probe across the  $10\ \Omega$  resistor. See Fig. 6-9.

e. Switch Triggering Mode to Trig, Source to Norm, Time/cm to 50 ms, and display to Single Sweep. Set High Freq 3 dB Point to 500 kHz. While operating the Reset lever, turn Triggering Stability counterclockwise until the Ready light stays on. Push Upper and Lower Store buttons.

f. Reach inside the front-panel probe holder and close the probe-operated switch (simulating the probe inserted into the holder). While holding the switch closed, push the DEGAUSS lever (hold for the duration of the sweep) and release.

g. Check the stored display for a four-centimeter (0.4 V) damped waveform lasting approximately 200 milliseconds. See Fig. 6-10.

h. Remove the probes from the  $10\ \Omega$  loop, place the P6042 probe in the holder (lock the slider), and remove the  $1\times$  probe from the oscilloscope input. Push Upper and Lower Screen Storage Off buttons and switch display to Norm.

## 9. Adjust CURRENT/DIV BALANCE Range (R16 or R17) ①

a. Reconnect the P6042 OUTPUT, terminated in  $50\ \Omega$ , to the oscilloscope input. See Fig. 6-6.

b. Set Volts/cm to 50 mV, Time/cm to  $50\ \mu\text{s}$ , and Triggering Mode to Auto. Switch input coupling to Gnd, position the trace on the center graticule line, and return to DC.

c. With the CURRENT/DIV switch set to 1 A, degauss the probe and center the trace with the OUTPUT DC LEVEL control.

d. Switch CURRENT/DIV to 1 mA and again degauss the probe.

e. Adjust either R16 or R17 to position the trace near the center graticule line. (Leave the remaining adjustment counterclockwise.)

f. Degauss the probe several times and check to see that the trace returns to within one centimeter of the previous position.

g. Switch CURRENT/DIV to 10 mA and check range of CURRENT/DIV BALANCE for  $\geq 5\ \text{cm}$ . Switch to 1 mA, degauss probe, and return trace to center graticule line with CURRENT/DIV BALANCE.

## 10. Adjust Gain (R107) ①

a. Set Time/cm to 1 ms, and Volts/cm to .2 volt.

b. Preset the square-wave generator control as follows:

Repetition Rate Range	1 kHz	•
Multiplier	1	
Symmetry	Midrange	
Mode	Hi Amplitude	
Power	On	

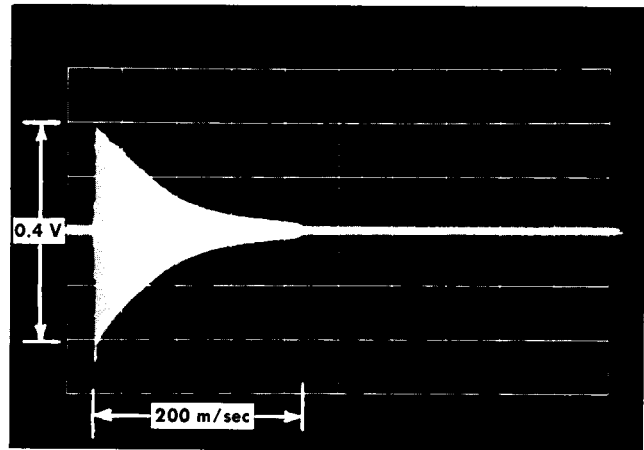


Fig. 6-10. Degauss waveform, coupled through  $10\ \Omega$  loop.

c. Remove the cable from the P6042 OUTPUT and connect to the square-wave generator Hi Amplitude output, using the GR-to-BNC adapter. See Fig. 6-11.

d. Adjust the square-wave generator Amplitude for 5 centimeters of deflection (1 volt).

e. Remove the GR-to-BNC adapter and connect the cable to the P6042 OUTPUT. Connect the GR  $50\ \Omega$  terminating current loop to the square-wave generator output (producing a 20 mA square wave through the current loop).

f. Set CURRENT/DIV to 5 mA and Volts/cm to 50 mV. Degauss the probe and connect to the current loop. See Fig. 6-12.

g. Adjust R107 for 4 centimeters of deflection.

## 11. Check CURRENT/DIV Attenuation

a. With the test equipment set as in the previous step, change CURRENT/DIV to 10 mA and check for 2 centimeters of deflection,  $\pm 3\%$ .

b. Remove the current loop from the square-wave generator and disconnect the cable from the P6042 OUTPUT.

c. Connect the test equipment as in Fig. 6-11.

d. Switch Volts/cm to 2 volts and adjust square-wave generator Amplitude for 5 centimeters of deflection (10 volts).

e. Connect the test equipment as in Fig. 6-12.

f. Change Volts/cm to 50 mV and CURRENT/DIV to 50 mA. Check for 4 centimeters of deflection,  $\pm 3\%$ .

g. Switch CURRENT/DIV to .1 A and check for 2 centimeters of deflection,  $\pm 3\%$ .

h. Switch CURRENT/DIV to .2 A, .5 A and 1 A positions and check for deflection of 1, 0.4 and 0.2 centimeter, respectively. (The 1 A position may be checked for 0.5 centimeter with the Volts/cm switch set to 20 mV.) This step is not intended as an accurate check of the attenuator tolerance, but as a check for obvious open-circuits conditions in the switch.

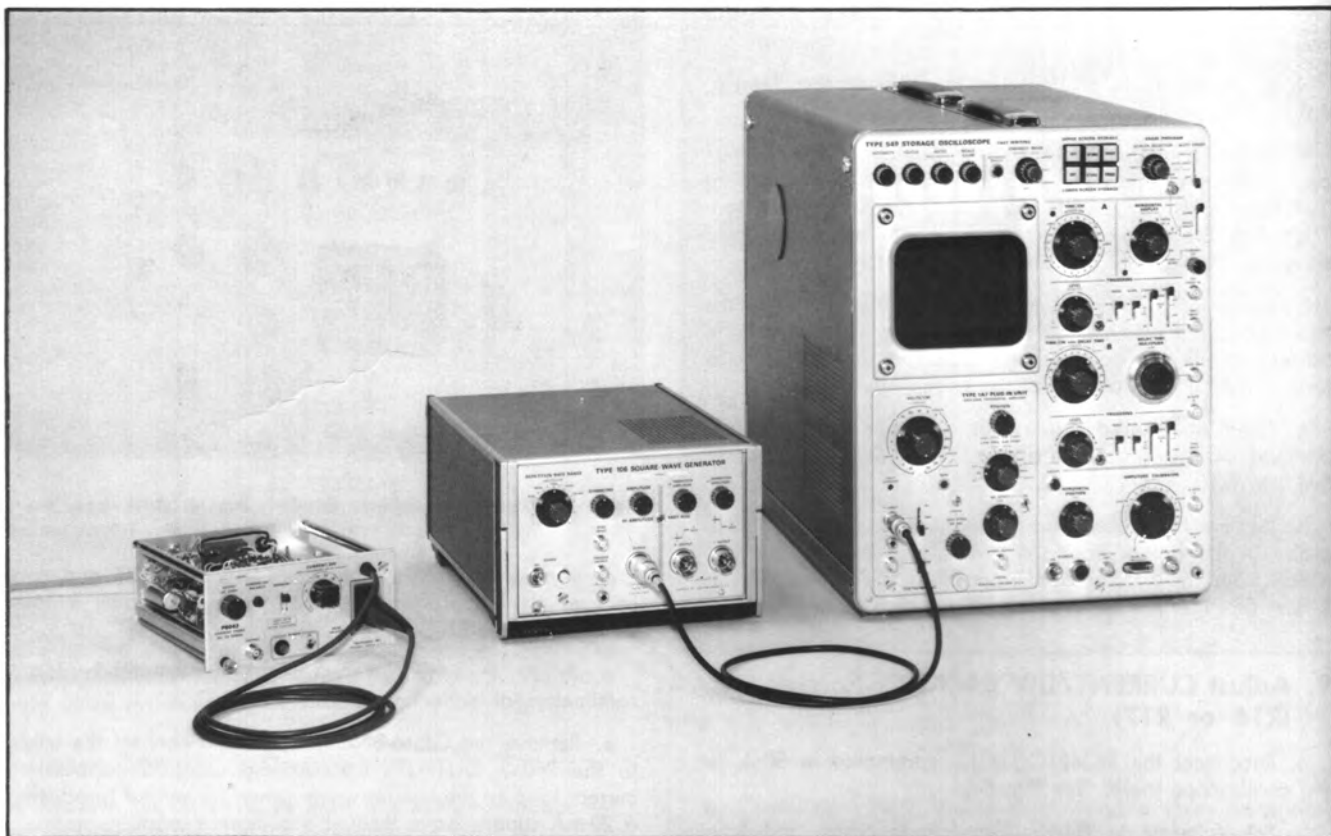


Fig. 6-11. Preliminary test setup for steps 10 and 11.

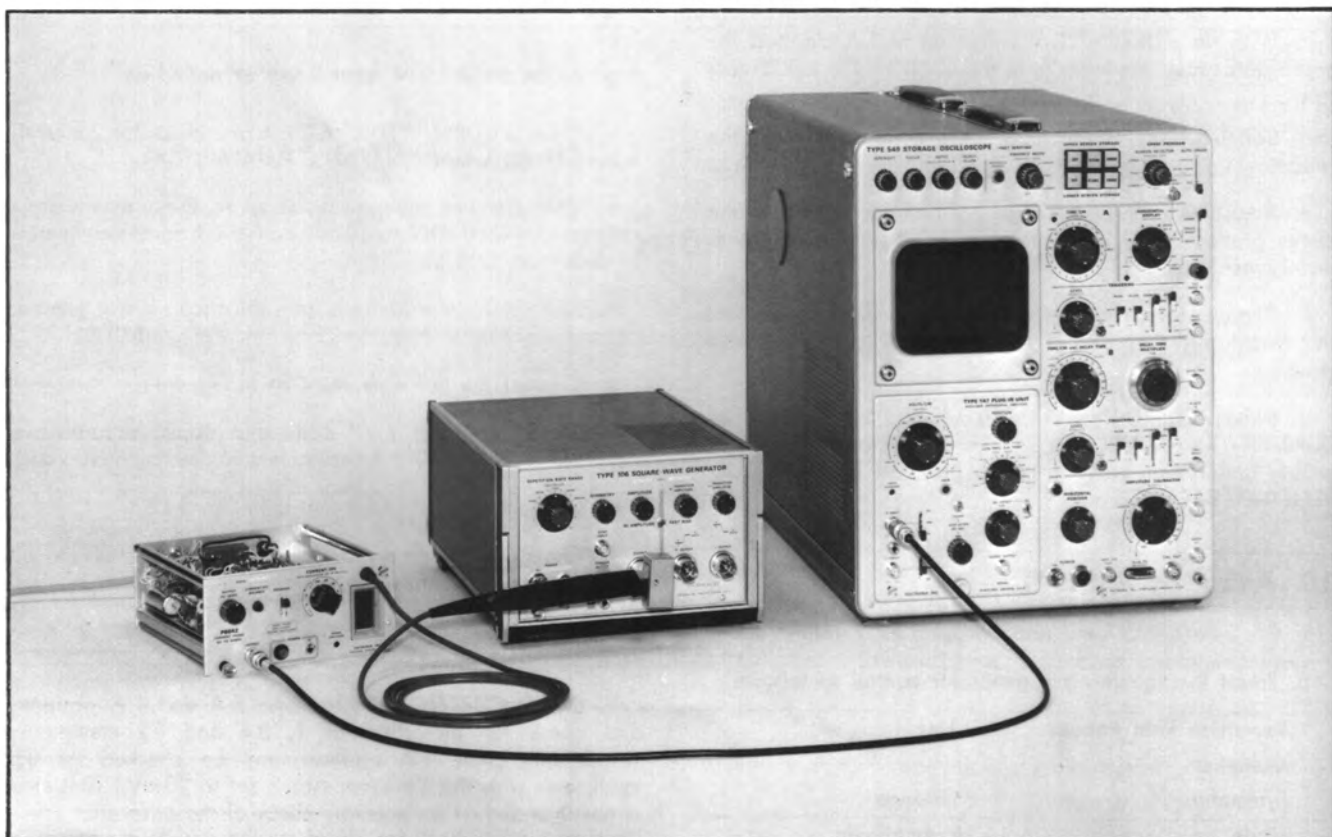
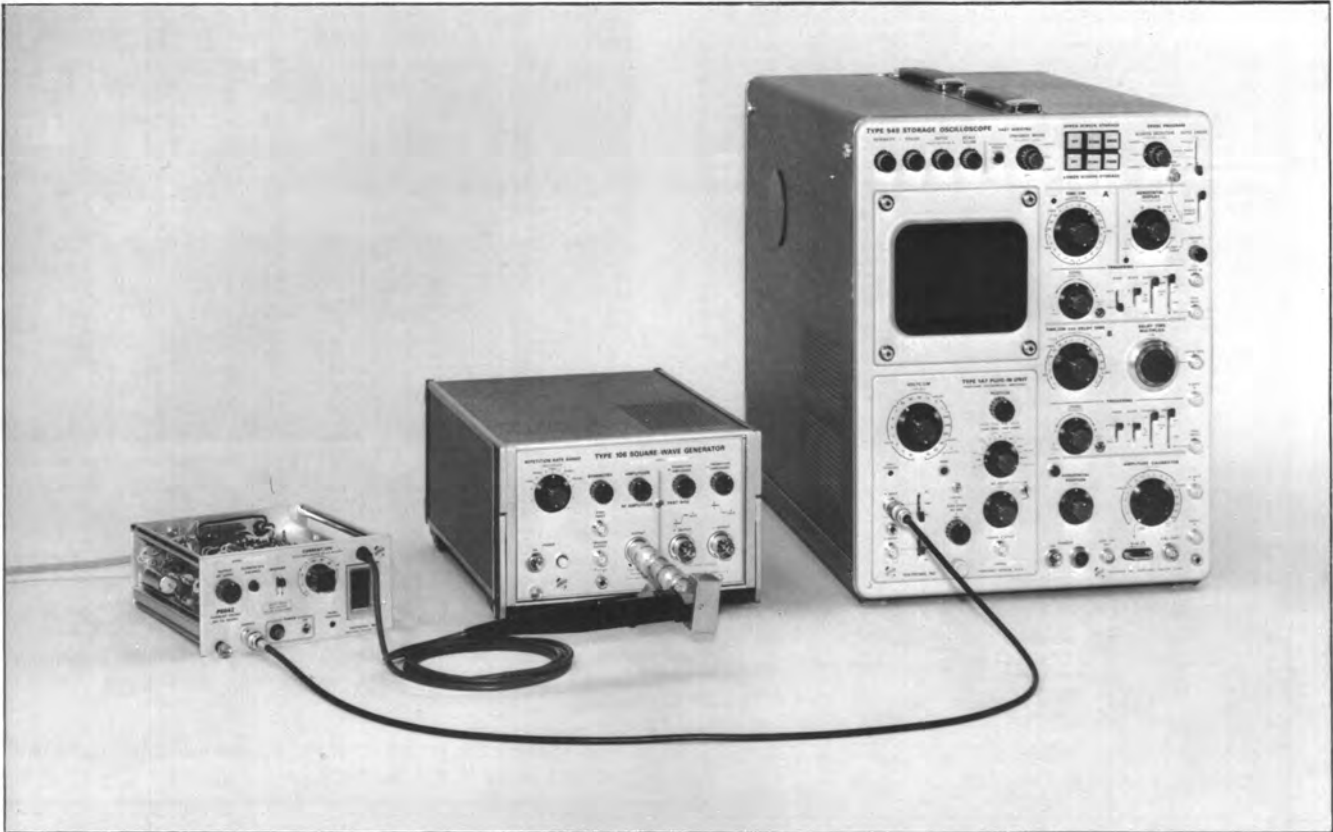


Fig. 6-12. Test setup for steps 10 and 11.





**Fig. 6-13. Test setup for step 12.**

- i. Remove the probe from the current loop and connect to the test oscilloscope 5 mA current loop. Set the Calibrator switch to the 5 mA square-wave position.

- j. Set Volts/cm to 50 mV, CURRENT/DIV to 1 mA, and

degauss the probe. Check for 5 centimeters of deflection.

- k. Change CURRENT/DIV to 2 mA and check for 2.5 centimeters of deflection.

## NOTES

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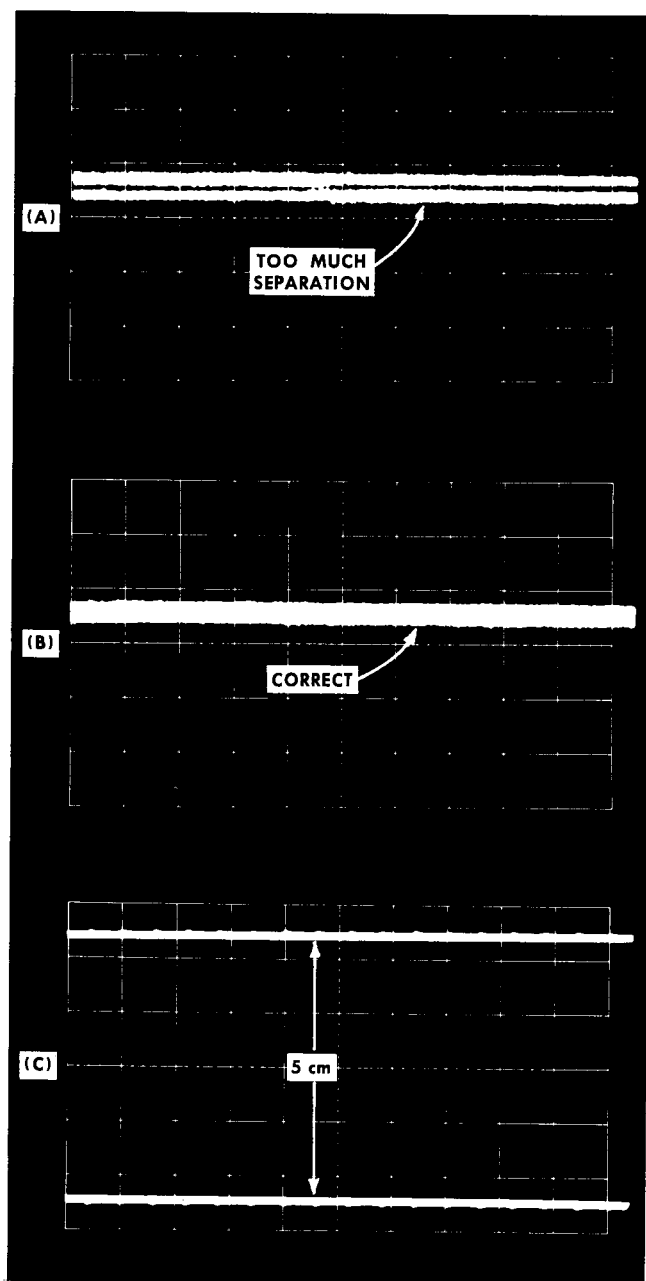


Fig. 6-14. Tangential noise check showing (A) too much separation in amplitude adjustment (B) correct amplitude with traces just joining (C) maximum amplitude at 10 mA/DIV with 10 $\times$  attenuators removed.

## 12. Check Noise

a. Connect the two GR 10 $\times$  50  $\Omega$  attenuators and the current loop to the square-wave generator Hi Amplitude output. Connect the probe to the current loop. See Fig. 6-13.

b. Set the CURRENT/DIV switch to 1 mA, Time/cm to .1 ms, Triggering Mode to Trig, and Stability clockwise to display two free-running traces.

c. Reduce the square-wave generator Amplitude until the two traces just merge (the point at which the dark band between the trace just disappears). See Fig. 6-14B.

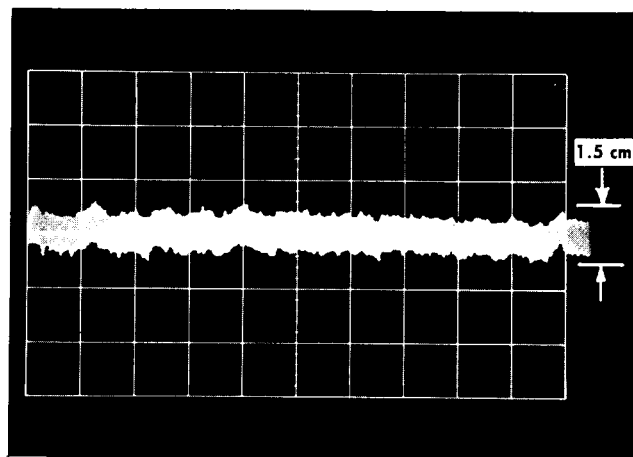


Fig. 6-15. Maximum random trace shift at 5 sec/cm, stored.

d. Switch CURRENT/DIV to 10 mA and remove the two 10 $\times$  attenuators. Connect current loop and probe as in Fig. 6-12.

e. Check the amplitude of the display for no more than 5 cm ( $\leq 0.5 \text{ mA} + 0.2 \text{ cm}$ , tangentially measured). See Fig. 6-14C.

f. Remove the probe from the square-wave generator output and place in the holder (lock the slider).

## 13. Check Random Trace Shift

a. Set CURRENT/DIV to 1 mA, degauss the probe, and center the trace with the CURRENT/DIV BALANCE.

b. Set the controls as follows:

### Storage Oscilloscope

Upper Screen Storage	Store
Lower Screen Storage	Store
Norm - Single Sweep	Single Sweep
Triggering Mode	Auto

### Selectable Bandwidth Plug-In

Low Freq 3 dB Point	.1
High Freq 3 dB Point	100

c. Push Erase and Reset button several times while adjusting intensity so that the brightness of the trace is at a minimum storage level.

d. Set the Time/cm to 5 sec and push Erase and Reset button.

e. Check stored display for  $\leq 1.5$  centimeters peak to peak. See Fig. 6-15.

## 14. Adjust Compensation Circuits (R102, R18, R24, C100, R100 and R105)

a. Turn the DC to 100 MHz test oscilloscope power on and set the controls as follows:



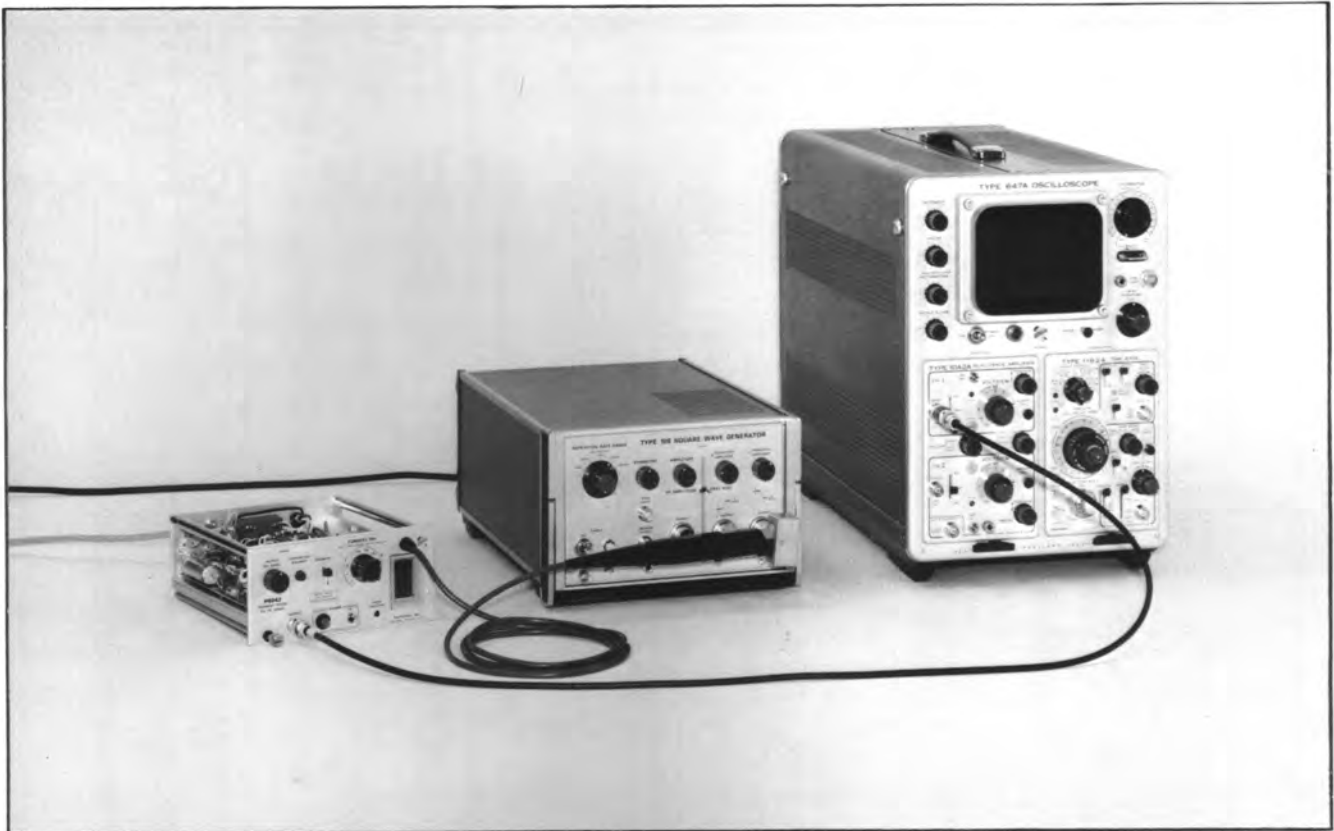


Fig. 6-16. Test setup for step 14.

**Vertical Plug-In**

Mode	Ch 1
Trigger	Norm
Volts/cm	.05
Variable	Cal
Input Coupling	DC
Position	trace centered

**Time-Base Plug-In**

Horiz Display	A
Mag	Off
Time/cm	20 $\mu$ s
Trig Mode	Auto
Slope	+
Coupling	AC
Source	Int

b. Connect the cable from the P6042 OUTPUT to the DC to 100 MHz test oscilloscope Ch 1 Input, terminated in 50  $\Omega$ .

c. Connect the current loop to the square-wave generator —Transition output. Connect the probe to the current loop. See Fig.6-16.

d. Set the square-wave generator Repetition Rate Range to 10 kHz and switch to Fast Rise. Adjust —Transition Amplitude for a 4-centimeter display.

e. Refer to Fig. 6-17 for location of compensation adjustments and square-wave time relationship of each.

f. Adjust R102 for best leading edge and square corner on waveform.

g. Change Time/cm to 2  $\mu$ s. Adjust R18 and R24 for flat top and no ringing.

h. Change Time/cm to .1  $\mu$ s. Adjust C100, R100, and R105 for best leading edge and square corner on waveform.

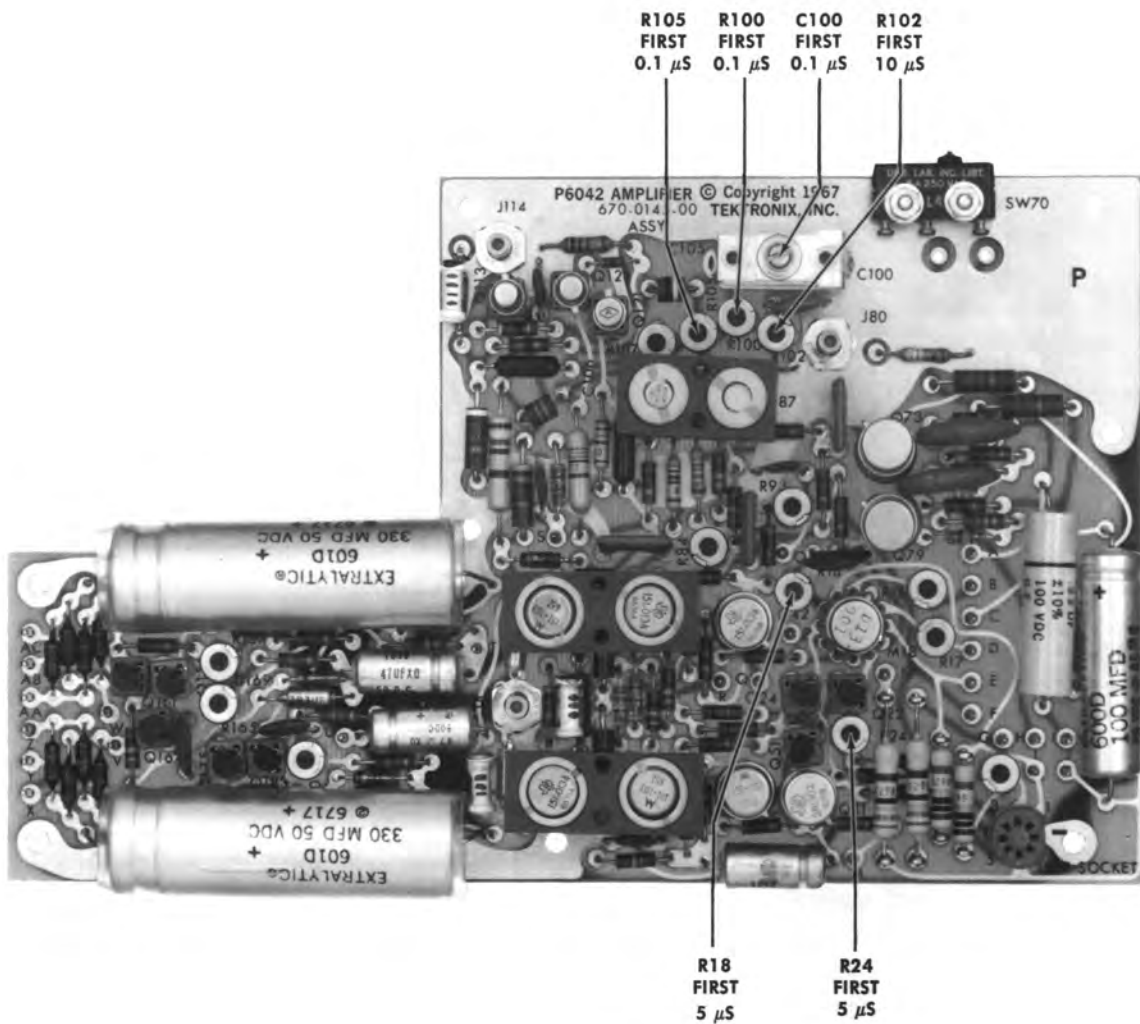


Fig. 6-17. Location of compensation adjustment and square-wave time relationship of each.

## NOTES

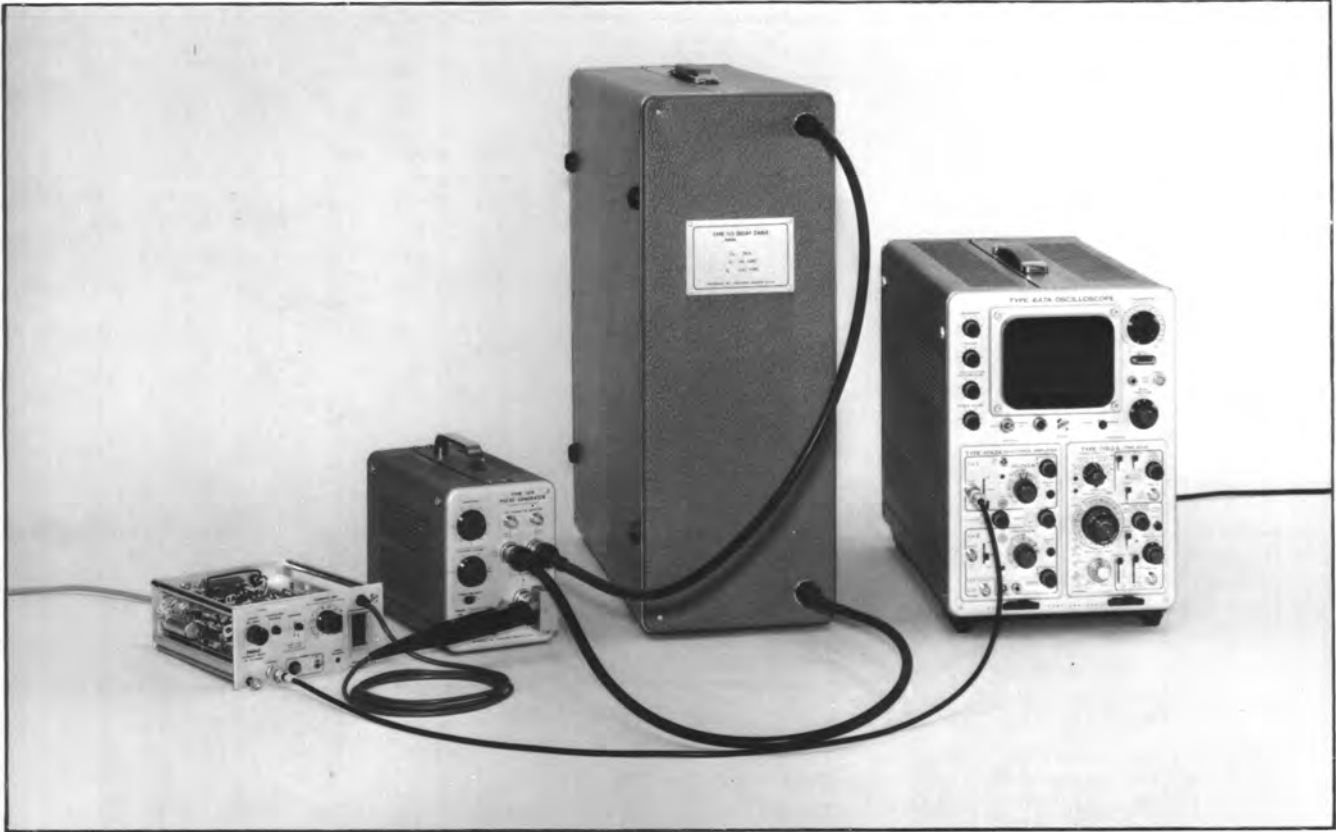


Fig. 6-18. Test setup for step 15.

## 15. Check Aberrations

a. Remove the current loop and probe from the square-wave generator and connect to pulse generator output. Connect the delay cable to the pulse generator charge line connectors, using the two lengths of RG-8A/U. See Fig. 6-18.

b. Set pulse generator Voltage Range to 5.0, Pulse Polarity to —, and turn power on. Set test oscilloscope Volts/cm to

.2 volt, Time/cm to  $.2 \mu\text{s}$  and turn  $\times 10$  Mag on.

c. Adjust pulse generator Amplitude and test oscilloscope Trig Level to obtain a 4-centimeter display. (Use the viewing hood if necessary).

d. Check aberrations for  $\leq 3\%$ , peak to peak.

e. Remove the probe from the pulse generator and place in the holder. Turn  $\times 10$  Mag off.

## NOTES

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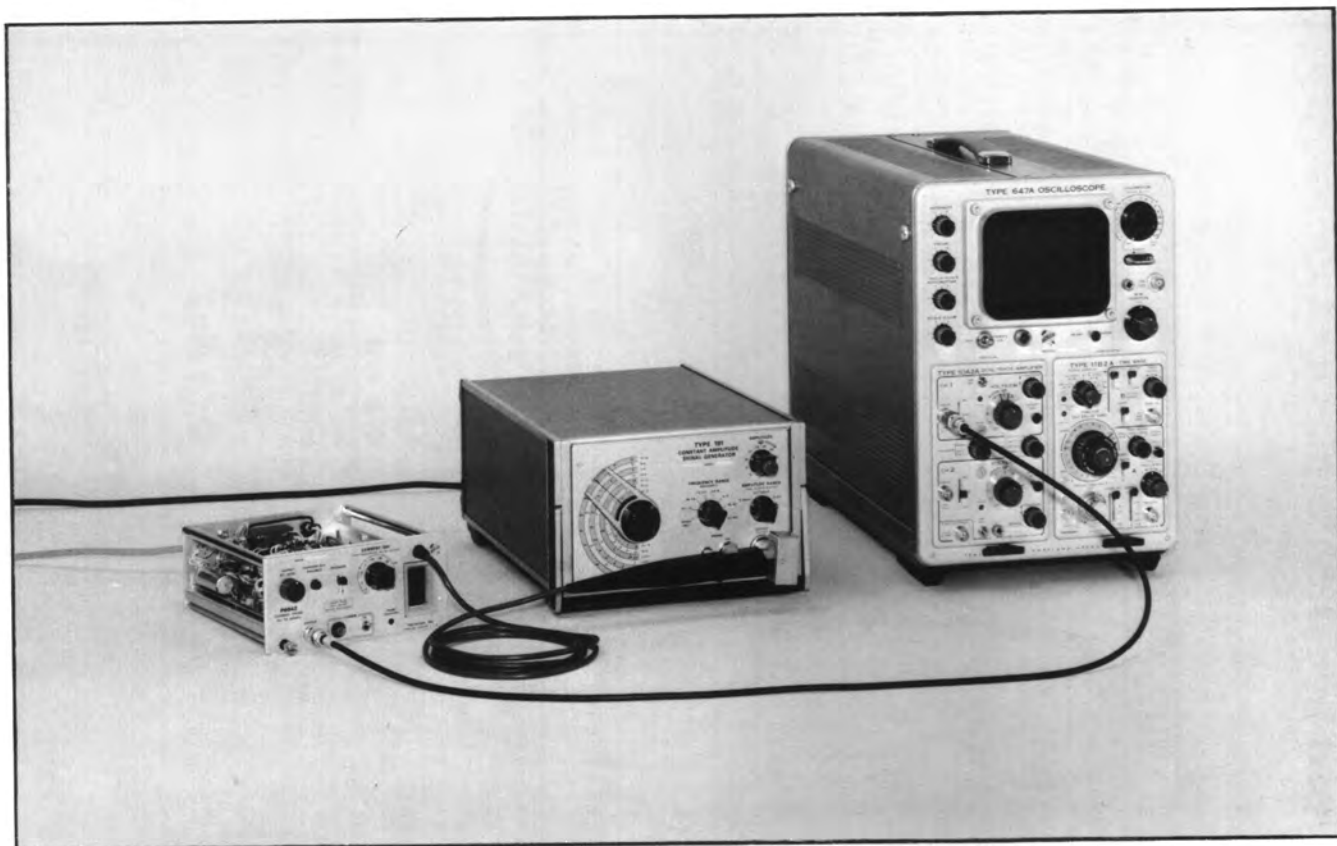


Fig. 6-19. Test setup for steps 16 and 17.

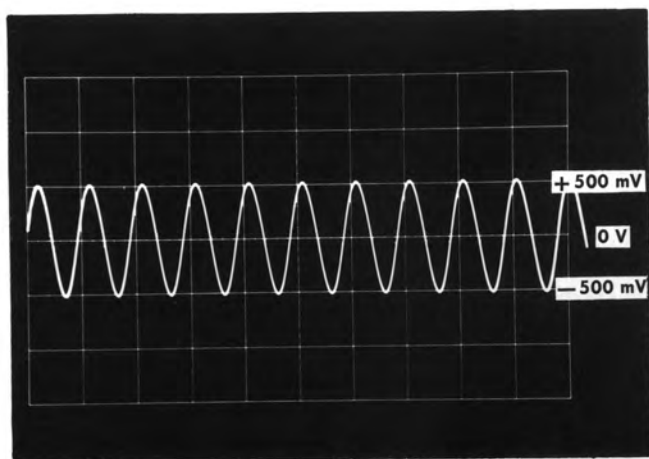


Fig. 6-20. Dynamic range of P6042, test oscilloscope set to 0.5 V/div.

## 16. Check AC Dynamic Range

- Connect the current loop to the constant amplitude signal generator output.
- Set the controls as follows:

### DC to 100 MHz Test Oscilloscope

Volts/cm	.5
Time/cm	20 $\mu$ s
Input Coupling	Gnd
Vertical Position	trace centered

### Constant Amplitude Signal Generator

Frequency Range	50 kHz Only
Amplitude	5
Amplitude Range	.5 - 5 V
Power	On

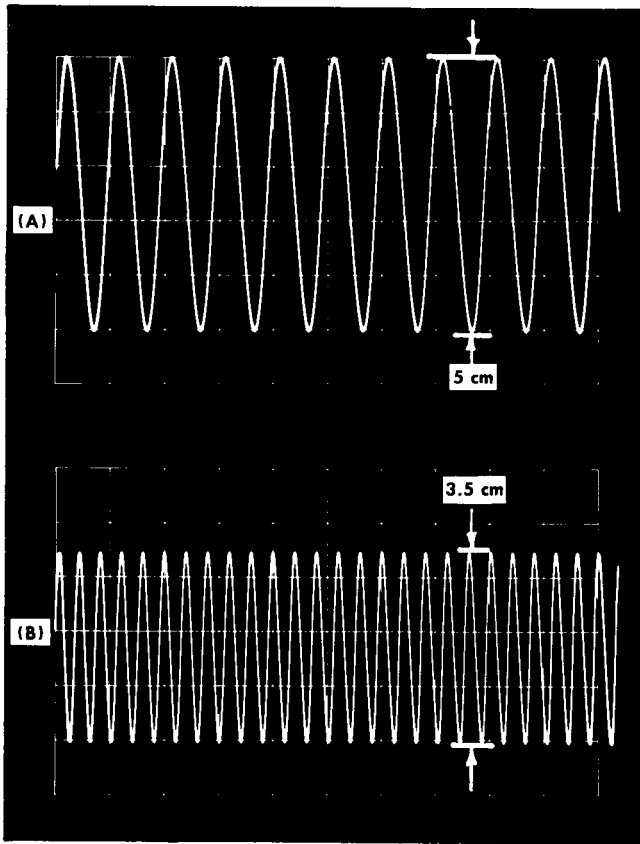


Fig. 6-21. Bandwidth of P6042 (A) 50 kHz display (B) 50 MHz display.

c. Degauss the probe and connect to the current loop. See Fig. 6-19.

d. Switch test oscilloscope input coupling to DC and adjust CURRENT/DIV BALANCE to center the display on the CRT. Trigger the sweep.

e. Increase the signal generator Amplitude until waveform distortion occurs.

f. Check for an undistorted dynamic range of at least + and -1 cm ( $\geq$  + and -500 mV at probe amplifier output). See Fig. 6-20.

## 17. Check Bandwidth

a. Set Volts/cm to .2 and adjust signal generator Amplitude for 5 centimeters of deflection.

b. Increase the frequency of the constant amplitude signal generator until the amplitude of the display reduces from 5 centimeters to 3.5 centimeters. See Fig. 6-21.

c. Check the frequency setting of the signal generator for  $\geq 50$  MHz.

### NOTE

If unable to make bandwidth of 50 MHz, recheck setting of R100, adjusted in step 14, as this adjustment greatly affects the risetime of the high frequency amplifier.

d. Calculate the risetime of the probe from the measured bandwidth.

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## ABBREVIATIONS AND SYMBOLS

A or amp	amperes	L	inductance
AC or ac	alternating current	$\lambda$	wavelength
AF	audio frequency	$\gg$	large compared with
$\alpha$	alpha—common-base current amplification factor	$<$	less than
AM	amplitude modulation	LF	low frequency
$\approx$	approximately equal to	lg	length or long
$\beta$	beta—common-emitter current amplification factor	LV	low voltage
BHB	binding head brass	M	mega or $10^6$
BHS	binding head steel	m	milli or $10^{-3}$
BNC	baby series "N" connector	M $\Omega$ or meg	megohm
X	by or times	$\mu$	micro or $10^{-6}$
C	carbon	mc	megacycle
C	capacitance	met.	metal
cap.	capacitor	MHz	megahertz
cer	ceramic	mm	millimeter
cm	centimeter	ms	millisecond
comp	composition	—	minus
conn	connector	mtg hdw	mounting hardware
~	cycle	n	nano or $10^{-9}$
c/s or cps	cycles per second	no. or #	number
CRT	cathode-ray tube	ns	nanosecond
csk	countersunk	OD	outside diameter
$\Delta$	increment	OHB	oval head brass
dB	decibel	OHS	oval head steel
dBm	decibel referred to one milliwatt	$\Omega$	ohm
DC or dc	direct current	$\omega$	omega—angular frequency
DE	double end	p	pico or $10^{-12}$
$^{\circ}$	degrees	/	per
$^{\circ}\text{C}$	degrees Celsius (degrees centigrade)	%	percent
$^{\circ}\text{F}$	degrees Fahrenheit	PHB	pan head brass
$^{\circ}\text{K}$	degrees Kelvin	$\phi$	phi—phase angle
dia	diameter	$\pi$	pi—3.1416
$\div$	divide by	PHS	pan head steel
div	division	+	plus
EHF	extremely high frequency	$\pm$	plus or minus
elect.	electrolytic	PIV	peak inverse voltage
EMC	electrolytic, metal cased	plstc	plastic
EMI	electromagnetic interference (see RFI)	PMC	paper, metal cased
EMT	electrolytic, metal tubular	poly	polystyrene
$\epsilon$	epsilon—2.71828 or % of error	prec	precision
$\geq$	equal to or greater than	PT	paper, tubular
$\leq$	equal to or less than	PTM	paper or plastic, tubular, molded
ext	external	pwr	power
F or f	farad	Q	figure of merit
F & I	focus and intensity	RC	resistance capacitance
FHB	flat head brass	RF	radio frequency
FHS	flat head steel	RFI	radio frequency interference (see EMI)
Fil HB	fillister head brass	RHB	round head brass
Fil HS	fillister head steel	$\rho$	rho—resistivity
FM	frequency modulation	RHS	round head steel
ft	feet or foot	r/min or rpm	revolutions per minute
G	giga or $10^9$	RMS	root mean square
g	acceleration due to gravity	s or sec.	second
Ge	germanium	SE	single end
GHz	gigahertz	Si	silicon
GMV	guaranteed minimum value	SN or S/N	serial number
GR	General Radio	$\ll$	small compared with
$>$	greater than	T	tera or $10^{12}$
H or h	henry	TC	temperature compensated
h	height or high	TD	tunnel diode
hex.	hexagonal	THB	truss head brass
HF	high frequency	$\theta$	theta—angular phase displacement
HHB	hex head brass	thk	thick
HHS	hex head steel	THS	truss head steel
HSB	hex socket brass	tub.	tubular
HSS	hex socket steel	UHF	ultra high frequency
HV	high voltage	V	volt
Hz	hertz (cycles per second)	VAC	volts, alternating current
ID	inside diameter	var	variable
IF	intermediate frequency	VDC	volts, direct current
in.	inch or inches	VHF	very high frequency
incd	incandescent	VSWR	voltage standing wave ratio
$\infty$	infinity	W	watt
int	internal	w	wide or width
$\int$	integral	w/	with
k	kilohms or kilo ( $10^3$ )	w/o	without
k $\Omega$	kilohm	WW	wire-wound
kc	kilocycle	xmfr	transformer
kHz	kilohertz		



## PARTS ORDERING INFORMATION

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

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, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

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

## SPECIAL NOTES AND SYMBOLS

- |   |   |
|---|---|
| ×000  | Part first added at this serial number  |
| 00×   | Part removed after this serial number   |
| *000-0000-00  | Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, Inc., or reworked or checked components. |
| Use 000-0000-00   | Part number indicated is direct replacement.  |
|  | Screwdriver adjustment.   |
|  | Control, adjustment or connector.   |



# SECTION 7

## ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff Disc	Description
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### Bulbs

B5	150-0046-00	Incandescent	
B141	150-0019-00	Neon w/translucent lens	

### Capacitors

Tolerance  $\pm 20\%$  unless otherwise indicated.

C5	290-0136-00	2.2 $\mu\text{F}$	Elect.	20 V	
C6	290-0136-00	2.2 $\mu\text{F}$	Elect.	20 V	
C9	290-0136-00	2.2 $\mu\text{F}$	Elect.	20 V	
C18	Selected				
C33	290-0272-00	47 $\mu\text{F}$	Elect.	50 V	
C35	283-0067-00	0.001 $\mu\text{F}$	Cer	200 V	
C45	290-0136-00	2.2 $\mu\text{F}$	Elect.	20 V	
C49	281-0550-00	120 pF	Cer	500 V	10%
C55	290-0136-00	2.2 $\mu\text{F}$	Elect.	20 V	
C59	281-0543-00	270 pF	Cer	500 V	10%
C62	281-0617-00	15 pF	Cer	200 V	
C65	290-0307-00	100 $\mu\text{F}$	Elect.	40 V	
C70	285-0633-00	0.22 $\mu\text{F}$	PTM	100 V	10%
C72	283-0027-00	0.02 $\mu\text{F}$	Cer	50 V	
C78	283-0027-00	0.02 $\mu\text{F}$	Cer	50 V	
C88	283-0134-00	47 $\mu\text{F}$	Cer	50 V	+80%—20%
C93	283-0067-00	0.001 $\mu\text{F}$	Cer	200 V	10%
C100	281-0125-00	90-400 pF, Var	Mica		
C102	283-0110-00	0.005 $\mu\text{F}$	Cer	150 V	
C105	281-0538-00	1 pF	Cer	500 V	
C106	281-0537-00	0.68 pF	Cer	500 V	
C114	283-0067-00	0.001 $\mu\text{F}$	Cer	200 V	10%
C116	281-0579-00	21 pF	Cer	500 V	5%
C128	283-0067-00	0.001 $\mu\text{F}$	Cer	200 V	10%
C152	290-0325-00	330 $\mu\text{F}$	Elect.	50 V	+75%—10%
C162	283-0059-00	1 $\mu\text{F}$	Cer	25 V	+80%—20%
C163	290-0272-00	47 $\mu\text{F}$	Elect.	50 V	
C168	290-0246-00	3.3 $\mu\text{F}$	Elect.	15 V	10%
C169	283-0095-00	56 pF	Cer	200 V	10%
C172	290-0325-00	330 $\mu\text{F}$	Elect.	50 V	+75%—10%

## Capacitors (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	No. Disc	Description		
C176	283-0059-00		1 $\mu$ F	Cer	25 V	+80%—20%
C177	290-0272-00		47 $\mu$ F	Elect.	50 V	
C183	283-0144-00		33 pF	Cer	500 V	2%
C185	290-0246-00		3.3 $\mu$ F	Elect.	15 V	10%

## Diodes

D37	152-0141-00		Silicon	1N3605	
D39	152-0141-00		Silicon	1N3605	
D73	152-0141-00		Silicon	1N3605	
D79	152-0141-00		Silicon	1N3605	
D128	152-0141-00		Silicon	1N3605	
D151A,B,C,D	*152-0107-00		Silicon	Replaceable by 1N647	
D153	152-0278-00		Zener	1N4372A 0.4 W, 3 V, 5%	
D169	152-0127-00		Zener	1N755A 0.4 W, 7.5 V, 5%	
D171A,B,C,D	*152-0107-00		Silicon	Replaceable by 1N647	
D183	152-0127-00		Zener	1N755A 0.4 W, 7.5 V, 5%	

## Fuses

F141	159-0044-00		2/10 A	3AG Slo-Blo
F142	159-0048-00		1/10 A	3AG Slo-Blo

## Connectors

J59	131-0391-00	50 $\Omega$ , Male	
J80	131-0391-00	50 $\Omega$ , Male	
J114	131-0391-00	50 $\Omega$ , Male	
J119	131-0106-01	1 contact, Female	

## Inductors

LR7	*108-0368-00	10 $\mu$ H (wound on a 1 k $\Omega$ resistor)
LR8	*108-0368-00	10 $\mu$ H (wound on a 1 k $\Omega$ resistor)
LR58	*108-0457-00	5.5 $\mu$ H (wound on a 51 $\Omega$ resistor)
LR162	*108-0331-01	0.75 $\mu$ H (wound on a 120 $\Omega$ resistor)
LR176	*108-0331-01	0.75 $\mu$ H (wound on a 120 $\Omega$ resistor)

## Integrated Circuit

M18	156-0014-00	Differential Amplifier
-----	-------------	------------------------

## Transistors

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
Q22	151-0188-00		Silicon	2N3906
Q24	151-0188-00		Silicon	2N3906
Q29	*151-0192-00		Silicon	Replaceable by MPS-6521
Q31	*151-0238-00		Selected	
Q42	*151-0134-00		Silicon	Replaceable by 2N2905
Q44	*151-0134-00		Silicon	Replaceable by 2N2905
Q45	*151-0103-00		Silicon	Replaceable by 2N2219
Q51	*151-0103-00		Silicon	Replaceable by 2N2219
Q53	*151-0103-00		Silicon	Replaceable by 2N2219
Q54	*151-0134-00		Silicon	Replaceable by 2N2905
Q73	*151-0136-00		Silicon	Replaceable by 2N3053
Q79	*151-0136-00		Silicon	Replaceable by 2N3053
Q87 } Q96 }	*153-0553-00		Matched Pair	
Q113	*151-0212-00		Silicon	Tek Spec
Q121	*151-0212-00		Silicon	Tek Spec
Q123	*151-0212-00		Silicon	Tek Spec
Q156	151-0188-00		Silicon	2N3906
Q161	151-0190-00		Silicon	2N3904
Q163	151-0226-00		Silicon	2N3767
Q167	*151-0195-00		Silicon	Replaceable by MPS-6515
Q175	151-0190-00		Silicon	2N3904
Q177	151-0226-00		Silicon	2N3767
Q183	*151-0195-00		Silicon	Replaceable by MPS-6515

## Resistors

Resistors are fixed, composition,  $\pm 10\%$  unless otherwise indicated.

R1 <sup>1</sup>		100 $\Omega$		
R2 <sup>1</sup>		100 $\Omega$		
R5	301-0151-00	150 $\Omega$	$\frac{1}{2}$ W	5%
R10	Selected			
R11	Selected			
R12	311-0607-00	10 k $\Omega$ , Var		
R13	Selected			
R14	Selected			
R16	311-0635-00	1 k $\Omega$ , Var		
R17	311-0635-00	1 k $\Omega$ , Var		
R18	311-0634-00	500 $\Omega$ , Var		
R19	311-0574-00	100 $\Omega$ , Var		
R20	315-0511-00	510 $\Omega$	$\frac{1}{4}$ W	5%
R21	315-0511-00	510 $\Omega$	$\frac{1}{4}$ W	5%
R22	315-0202-00	2 k $\Omega$	$\frac{1}{4}$ W	5%

<sup>1</sup>Furnished as a unit with T1.

# Electrical Parts List—P6042 Probe

## Resistors (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff Disc	Description		
R23	315-0202-00	2 k $\Omega$	1/4 W		5%
R24	311-0634-00	500 $\Omega$ , Var			
R25	315-0100-00	10 $\Omega$	1/4 W		5%
R26	315-0201-00	200 $\Omega$	1/4 W		5%
R28	315-0201-00	200 $\Omega$	1/4 W		5%
R29	315-0202-00	2 k $\Omega$	1/4 W		5%
R31	315-0472-00	4.7 k $\Omega$	1/4 W		5%
R32	315-0101-00	100 $\Omega$	1/4 W		5%
R33	315-0122-00	1.2 k $\Omega$	1/4 W		5%
R35	315-0273-00	27 k $\Omega$	1/4 W		5%
R37	315-0103-00	10 k $\Omega$	1/4 W		5%
R39	315-0103-00	10 k $\Omega$	1/4 W		5%
R40	315-0241-00	240 $\Omega$	1/4 W		5%
R41	315-0302-00	3 k $\Omega$	1/4 W		5%
R43	315-0510-00	51 $\Omega$	1/4 W		5%
R46	307-0051-00	2.7 $\Omega$	1/2 W		5%
R49	315-0300-00	30 $\Omega$	1/4 W		5%
R50	315-0302-00	3 k $\Omega$	1/4 W		5%
R51	315-0241-00	240 $\Omega$	1/4 W		5%
R53	315-0510-00	51 $\Omega$	1/4 W		5%
R56	307-0051-00	2.7 $\Omega$	1/2 W		5%
R59	317-0101-00	100 $\Omega$	1/8 W		5%
R60A	321-0749-06	450 $\Omega$	1/8 W	Prec	1/4 %
R60B	307-0129-00	55.5 $\Omega$	Film Disc.		1 %
R60D	321-0748-06	4.95 k $\Omega$	1/8 W	Prec	1/4 %
R60E	307-0128-00	50.5 $\Omega$	Film Disc.		1 %
R61A	321-0751-06	50 $\Omega$	1/8 W	Prec	1/4 %
R61B	307-0131-00	100 $\Omega$	Film Disc.		1 %
R61D	321-0126-06	200 $\Omega$	1/8 W	Prec	1/4 %
R61E	307-0130-00	62.5 $\Omega$	Film Disc.		1 %
R61G	321-0749-06	450 $\Omega$	1/8 W	Prec	1/4 %
R61H	321-0750-06	55.5 $\Omega$	1/8 W	Prec	1/4 %
R62	317-0151-00	150 $\Omega$	1/8 W		5%
R63	315-0271-00	270 $\Omega$	1/4 W		5%
R65	315-0183-00	18 k $\Omega$	1/4 W		5%
R71	301-0511-00	510 $\Omega$	1/2 W		5%
R72	315-0270-00	27 $\Omega$	1/4 W		5%
R74	315-0163-00	16 k $\Omega$	1/4 W		5%
R76	315-0163-00	16 k $\Omega$	1/4 W		5%
R77	301-0511-00	510 $\Omega$	1/2 W		5%
R78	315-0270-00	27 $\Omega$	1/4 W		5%
R81	321-0068-00	49.9 $\Omega$	1/8 W	Prec	1 %
R84	311-0644-00	20 k $\Omega$ , Var			
R85	315-0103-00	10 k $\Omega$	1/4 W		5%
R86	315-0203-00	20 k $\Omega$	1/4 W		5%

## Resistors (cont)

Ckt. No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Description		
R87	315-0151-00			150 $\Omega$	$\frac{1}{4}$ W	
R88	315-0102-00			1 k $\Omega$	$\frac{1}{4}$ W	5%
R89	315-0202-00			2 k $\Omega$	$\frac{1}{4}$ W	5%
R91	311-0006-00			1 k $\Omega$ , Var		5%
R93	311-0609-00			2 k $\Omega$ , Var		
R94	321-0247-00			3.65 k $\Omega$	$\frac{1}{8}$ W	Prec
R95	321-0261-00			5.11 k $\Omega$	$\frac{1}{8}$ W	Prec
R96	321-0059-00			40.2 $\Omega$	$\frac{1}{8}$ W	Prec
R98	321-0203-00			1.27 k $\Omega$	$\frac{1}{8}$ W	Prec
R100	311-0622-00			100 $\Omega$ , Var		1%
R102	311-0609-00			2 k $\Omega$ , Var		
R105	311-0614-00			30 k $\Omega$ , Var		
R106	315-0560-00			56 $\Omega$	$\frac{1}{4}$ W	
R107	311-0635-00	B010100	B039999	1 k $\Omega$ , Var		5%
R107	311-0609-00	B040000		2 k $\Omega$ , Var		
R108	321-0251-00	B010100	B039999	4.02 k $\Omega$	$\frac{1}{8}$ W	Prec
R108	321-0247-00	B040000		3.65 k $\Omega$	$\frac{1}{8}$ W	Prec
R111	315-0470-00			47 $\Omega$	$\frac{1}{4}$ W	
R112	323-0221-00			1.96 k $\Omega$	$\frac{1}{2}$ W	Prec
R113	301-0431-00			430 $\Omega$	$\frac{1}{2}$ W	
R114	317-0200-00	XB030618		20 $\Omega$	$\frac{1}{8}$ W	5%
R115	301-0911-00			910 $\Omega$	$\frac{1}{2}$ W	5%
R116	321-0065-00			46.4 $\Omega$	$\frac{1}{8}$ W	Prec
R121	322-0170-00			576 $\Omega$	$\frac{1}{4}$ W	Prec
R123	317-0470-00			47 $\Omega$	$\frac{1}{8}$ W	
R125	321-0223-00			2.05 k $\Omega$	$\frac{1}{8}$ W	Prec
R126	321-0234-00			2.67 k $\Omega$	$\frac{1}{8}$ W	Prec
R141	315-0224-00			220 k $\Omega$	$\frac{1}{4}$ W	5%
R153	301-0152-00			1.5 k $\Omega$	$\frac{1}{2}$ W	
R154	315-0751-00			750 $\Omega$	$\frac{1}{4}$ W	5%
R155	315-0221-00			220 $\Omega$	$\frac{1}{4}$ W	5%
R157	311-0607-00			10 k $\Omega$ , Var		5%
R158	315-0822-00			8.2 k $\Omega$	$\frac{1}{4}$ W	5%
R164	315-0561-00			560 $\Omega$	$\frac{1}{4}$ W	
R165	311-0605-00			200 $\Omega$ , Var		5%
R166	315-0561-00			560 $\Omega$	$\frac{1}{4}$ W	5%
R168	315-0103-00			10 k $\Omega$	$\frac{1}{4}$ W	5%
R179	315-0561-00			560 $\Omega$	$\frac{1}{4}$ W	5%
R180	311-0605-00			200 $\Omega$ , Var		
R181	315-0561-00			560 $\Omega$	$\frac{1}{4}$ W	5%
R184	315-0103-00			10 k $\Omega$	$\frac{1}{4}$ W	5%
R185	315-0103-00			10 k $\Omega$	$\frac{1}{4}$ W	5%

## Switches

Unwired or Wired

SW3<sup>2</sup>

SW40

SW60

260-0850-00  
Wired \*262-0805-00Lever  
RotaryDEGAUSS  
CURRENT/DIV<sup>2</sup>See Mechanical Parts List.

# Electrical Parts List—P6042 Probe

## Switches (cont)

Ckt. No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Description
	Wired or Unwired			
SW60	260-0851-00		Rotary	CURRENT/DIV
SW70	260-0516-00		Push	POWER
SW141	260-0834-00		Toggle	

## Transformers

050 0439-01-

T1	*120-0464-00	Transformer Assembly
T3	*120-0501-00	Toroid, 7 turns bifilar
T140	*120-0497-00	Power

## FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations which appear on the pullout pages immediately following the Diagrams section of this instruction manual.

## INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the Description column.

*Assembly and/or Component*  
*Detail Part of Assembly and/or Component*  
*mounting hardware for Detail Part*  
*Parts of Detail Part*  
*mounting hardware for Parts of Detail Part*  
*mounting hardware for Assembly and/or Component*

Mounting hardware always appears in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

**Mounting hardware must be purchased separately, unless otherwise specified.**

## PARTS ORDERING INFORMATION

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

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, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

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

Change information, if any, is located at the rear of this manual.

## ABBREVIATIONS AND SYMBOLS

For an explanation of the abbreviations and symbols used in this section, please refer to the page immediately preceding the Electrical Parts List in this instruction manual.

# SECTION 8

## MECHANICAL PARTS LIST

FIG. 1 P6042 PROBE PACKAGE

Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q t y	1	2	3	4	5	Description
PROBE PACKAGE										
1—7	010-0207-00	-	-	1						PROBE PACKAGE, P6042
	-	-	-	-						probe package includes:
PROBE ONLY										
1	010-0206-00			1						PROBE, P6042
STANDARD ACCESSORIES										
2	012-0057-01			1						CABLE ASSEMBLY, coaxial, BNC, 50 OHM
3	175-0124-00			1						CABLE, ground lead, 5 inches
4	175-0263-00			1						CABLE, ground lead, 3 inches
5	344-0046-00			2						CLIP, probe
6	011-0049-00			1						TERMINATION, 50 OHM
7	103-0013-00			1						ADAPTER, power cord, 3 wire to 2 wire
	070-0629-00			2						MANUAL, instruction (not shown)
	006-0351-00			1						BAG, plastic, 4 x 6 inches (not shown)



FIG. 2 P6042 PROBE

Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q † y						Description
					1	2	3	4	5	
2-	010-0221-00			1						PROBE, P6042
	- - - - -			-						probe includes:
-1	204-0293-00			1						BODY, probe, bottom
-2	204-0288-00			1						BODY, probe, top
-3	351-0121-00			1						SLIDE ASSEMBLY
-4	214-0835-00			1						SPRING, compression
-5	214-0849-00			1						RETAINER, spring return
-6	352-0106-00			1						HOLDER, spring return
-7	214-0854-00			1						CONTACT, electrical
-8	- - - - -			1						TRANSFORMER (T1)~
-9	211-0034-00			2						SCREW, 2-56 x 1/2 inch, RHS
-10	175-0431-00			1						CABLE ASSEMBLY, special purpose
-11	214-0997-00			1						BALL, metal

FIG. 3 AMPLIFIER &amp; POWER SUPPLY UNIT

Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q t y	1	2	3	4	5	Description
3-	010-0206-00			1						PROBE, P6042
-1	366-0148-00			1						probe includes: KNOB, charcoal—OUTPUT DC LEVEL
	213-0004-00			1						knob includes: SCREW, set, 6-32 x $\frac{3}{16}$ inch, HSS
-2				1						RESISTOR, variable
	210-0840-00			1						mounting hardware: (not included w/resistor)
	210-0012-00			1						WASHER, flat, 0.390 ID x $\frac{9}{16}$ inch OD
-3	210-0590-00			1						LOCKWASHER, internal, $\frac{3}{8}$ ID x $\frac{1}{2}$ inch OD
				1						NUT, hex., $\frac{3}{8}$ -32 x $\frac{9}{16}$ inch
-4	366-0283-00			1						KNOB, grey—CURRENT/DIV BALANCE
	214-0395-00			1						knob includes: SPRING
-5				1						RESISTOR, variable
	213-0020-00			1						mounting hardware: (not included w/resistor)
-6				1						SCREW, set, 6-32 x $\frac{1}{8}$ inch, HSS
-7	366-0215-01			1						KNOB, charcoal—DEGAUSS
-8	260-0850-00			1						SWITCH, lever—DEGAUSS
	210-0586-00			2						mounting hardware: (not included w/switch)
-9				2						NUT, keps, 4-40 x $\frac{1}{4}$ inch
-10	366-0322-01			1						KNOB, charcoal—CURRENT/DIV
	213-0004-00			1						knob includes: SCREW, set, 6-32 x $\frac{3}{16}$ inch, HSS
-11	262-0805-00			1						SWITCH, wired—CURRENT/DIV
	260-0851-00			1						switch includes: SWITCH, unwired
	131-0371-00			2						CONNECTOR, single contact (not shown)
-12	131-0155-00			1						CONNECTOR, coaxial, female
	210-0012-00			1						mounting hardware: (not included w/switch)
	210-0840-00			1						LOCKWASHER, internal, $\frac{3}{8}$ ID x $\frac{1}{2}$ inch OD
-13	210-0590-00			1						WASHER, flat, 0.390 ID x $\frac{9}{16}$ inch OD
				1						NUT, hex., $\frac{3}{8}$ -32 x $\frac{9}{16}$ inch
-14	260-0834-00			1						SWITCH, toggle, w/mounting hardware—ON
-15	210-0940-00			1						WASHER, flat, $\frac{1}{4}$ ID x $\frac{3}{8}$ inch OD
-16	378-0541-02			1						FILTER, lens, red
-17	352-0084-00			1						HOLDER, neon
-18	200-0609-00			1						CAP, lamp holder, neon
-19				1						ASSEMBLY, bulb, w/mounting hardware
-20	131-0106-01			1						CONNECTOR, receptacle electrical, w/mounting hardware
				1						mounting hardware: (not included w/connector)
-21	210-0255-00			1						LUG, solder, $\frac{3}{8}$ ID x 0.500 inch OD, SE
-22	214-0553-00			1						SCREW, latch
-23	358-0255-00			1						BUSHING, latch
-24	333-0975-01			1						PANEL, front
				1						mounting hardware: (not included w/panel)
-25	213-0055-00			1						SCREW, thread forming, 2-32 x $\frac{5}{16}$ inch, PHS
-26	386-1183-00			1						SUB-PANEL, front
-27	343-0081-00			1						CLAMP, cable, plastic, $\frac{3}{16}$ inch h
	210-0457-00			1						mounting hardware: (not included w/clamp)
				1						NUT, keps, 6-32 x $\frac{5}{16}$ inch

FIG. 3 AMPLIFIER &amp; POWER SUPPLY UNIT (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q t y						Description
					1	2	3	4	5	
3-28	358-0314-00			1						BUSHING, strain relief
-29	220-0455-00			2						NUT, block
	- - - - -			-						mounting hardware for each: (not included w/nut)
-30	211-0101-00			1						SCREW, 4-40 x 1/4 inch, 100° csk, FHS
-31	670-0158-00			1						ASSEMBLY, circuit board—DECOUPLING
	- - - - -			-						assembly includes:
	388-0901-00			1						BOARD, circuit
	- - - - -			-						mounting hardware: (not included w/board)
-32	211-0116-00			2						SCREW, sems, 4-40 x 5/16 inch, PHB
-33	214-0975-00			1						INSULATOR, plate, fish paper
-34	441-0717-00			1						CHASSIS, amplifier
	- - - - -			-						mounting hardware: (not included w/chassis)
	211-0504-00			3						SCREW, 6-32 x 1/4 inch, PHS
-35	211-0538-00			2						SCREW, 6-32 x 5/16 inch, 100° csk, FHS
-36	343-0088-00			1						CLAMP, cable, plastic
-37	348-0055-00			1						GROMMET, plastic, 1/4 inch diameter
-38	214-0867-00			1						ESCUTCHEON, probe tray
-39	436-0070-01			1						TRAY HALF, probe left
	- - - - -			-						mounting hardware: (not included w/tray half)
-40	210-0586-00			4						NUT, keps, 4-40 x 1/4 inch
	211-0025-00			1						SCREW, 4-40 x 3/8 inch, 100° csk, FHS
	211-0110-00			1						SCREW, 4-40 x 5/16 inch, PHB
-41	211-0008-00			2						SCREW, 4-40 x 1/4 inch, PHS
-42	436-0071-00			1						TRAY HALF, probe, right
	- - - - -			-						mounting hardware: (not included w/tray half)
-43	210-0586-00			4						NUT, keps, 4-40 x 1/4 inch
-44	211-0025-00			1						SCREW, 4-40 x 3/8 inch, 100° csk, FHS
-45	211-0110-00			3						SCREW, 4-40 x 5/16 inch, PHB
-46	670-0145-00			1						ASSEMBLY, circuit board—POWER
	- - - - -			-						assembly includes:
	388-0858-00			1						BOARD, circuit
-47	260-0516-00			1						SWITCH, push
	- - - - -			-						mounting hardware: (not included w/switch)
-48	211-0034-00			2						SCREW, 2-56 x 1/2 inch, RHS
	210-0938-00			2						WASHER, flat, #2 (not shown)
	210-0053-00			2						LOCKWASHER, split, #2
-49	210-0405-00			2						NUT, hex., 2-56 x 3/16 inch
-50	136-0183-00			9						SOCKET, transistor, 3 pin
-51	136-0219-00			3						SOCKET, transistor, 4 pin
-52	136-0220-00			10						SOCKET, transistor, 3 pin
-53	136-0237-00			1						SOCKET, transistor, 8 pin
-54	136-0252-00			12						SOCKET, pin connector
-55	214-0798-00			2						HEAT SINK, transistor
-56	- - - - -			1						ASSEMBLY, transistor, matched
	- - - - -			-						assembly includes:
-57	214-0818-01			1						HEAT SINK
-58	214-0506-00			28						PIN, connector
-59	131-0505-00			8						TERMINAL, stud
-60	131-0391-00			3						CONNECTOR, coaxial, male
	- - - - -			-						mounting hardware: (not included w/assembly)
-61	211-0116-00			7						SCREW, sems, 4-40 x 5/16 inch, PHB

FIG. 3 AMPLIFIER &amp; POWER SUPPLY UNIT (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q † y 1 2 3 4 5						Description
3-62	384-0660-00			3						ROD, spacing
-63	212-0044-00			1						mounting hardware for each: (not included w/rod) SCREW, 8-32 x 1/2 inch, RHS
-64	351-0118-00			1						GUIDE, slide
-65	211-0538-00			2						mounting hardware: (not included w/guide) SCREW, 6-32 x 5/16 inch, 100° csk, FHS
	212-0044-00			1						SCREW, 8-32 x 1/2 inch, RHS (not shown)
	214-0680-00			1						PIN, locating (not shown)
-66	214-0680-00			1						PIN, locating
-67	210-0458-00			1						mounting hardware: (not included w/pin) NUT, keps, 8-32 x 1 1/32 inch
-68	- - - - -			1						TRANSFORMER
-69	337-0988-00			1						mounting hardware: (not included w/transformer) SHIELD, transformer
-70	211-0019-00			2						SCREW, 4-40 x 1 inch, RHS
-71	210-0586-00			2						NUT, keps, 4-40 x 1/4 inch
-72	- - - - -			2						TRANSISTOR
-73	211-0510-00			2						mounting hardware for each: (not included w/transistor) SCREW, 6-32 x 3/8 inch, PHS
-74	386-0143-00			1						PLATE, insulator
	210-0811-00			2						WASHER, fiber, shouldered, #6
	210-0802-00			2						WASHER, flat, 0.150 ID x 5/16 inch OD
-75	210-0202-00			1						LUG, solder, SE #6
-76	210-0006-00			1						LOCKWASHER, internal, #6
-77	210-0407-00			2						NUT, hex., 6-32 x 1/4 inch
-78	129-0006-00			1						POST, connecting
	210-0202-00			1						mounting hardware: (not included w/post) LUG, solder, SE #6
-79	210-0006-00			1						LOCKWASHER, internal, #6
-80	210-0407-00			1						NUT, hex., 6-32 x 1/4 inch
-81	358-0091-00			1						BUSHING, strain relief
-82	161-0035-00			1						CORD, power
-83	204-0279-00			1						BODY, line voltage selector
	210-0006-00			2						mounting hardware: (not included w/body) LOCKWASHER, internal, #6
	210-0407-00			2						NUT, hex., 6-32 x 1/4 inch (not shown)

FIG. 3 AMPLIFIER &amp; POWER SUPPLY UNIT (cont)

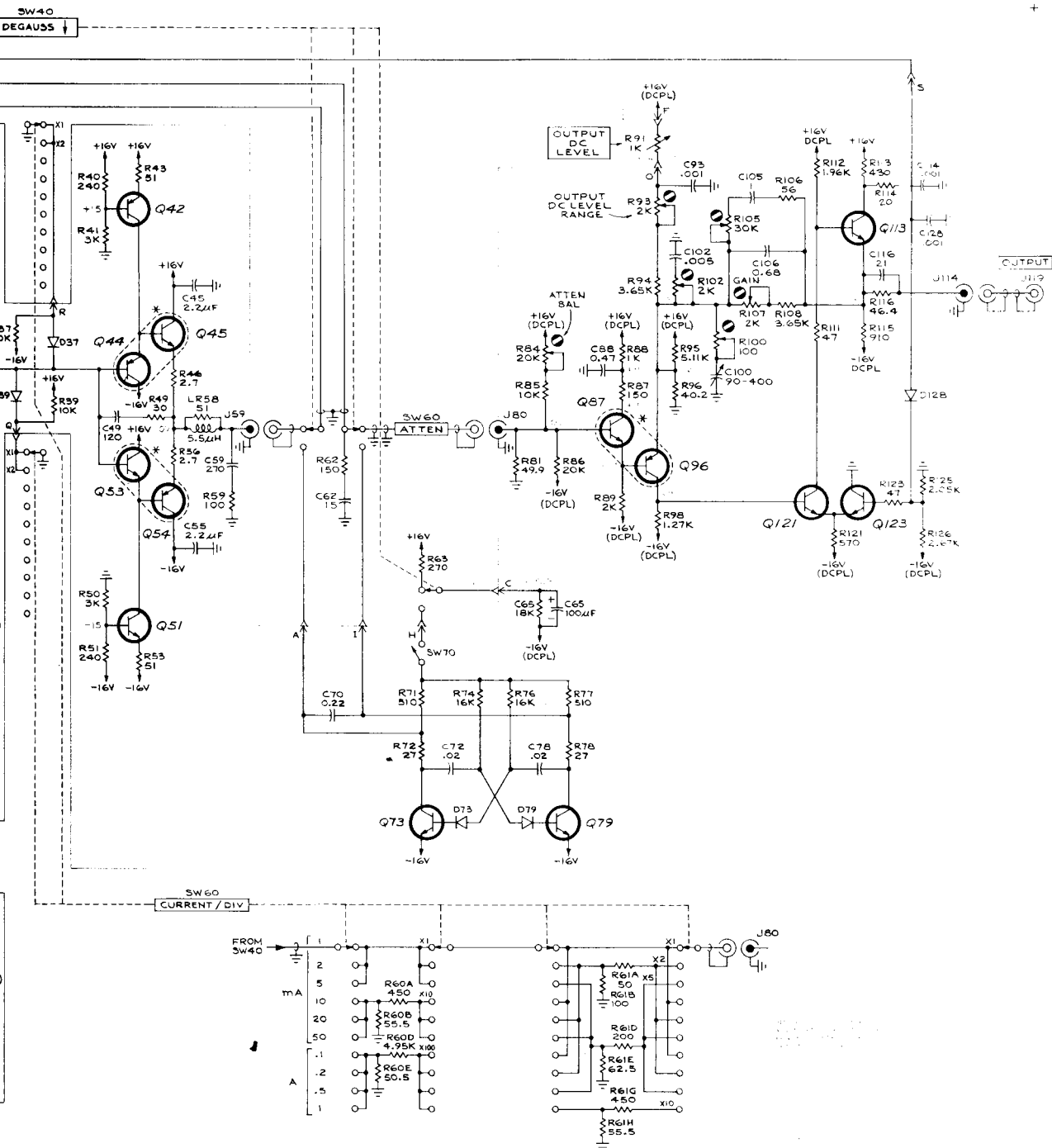
Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q					Description
				t y	1	2	3	4	
-84	200-0762-00			1					COVER, line voltage selector
	- - - - -			-					cover includes:
-85	352-0102-00			2					HOLDER, fuse, plastic
	- - - - -			-					mounting hardware for each: (not included w/holder)
-86	213-0035-00			2					SCREW, thread forming, 4-40 x 1/4 inch, PHS
-87	386-1184-01			1					PANEL, rear
-88	337-0965-00			1					SHIELD
	- - - - -			-					mounting hardware: (not included w/shield)
	211-0008-00			2					SCREW, 4-40 x 1/4 inch, PHS
-89	179-1205-00			1					CABLE HARNESS, line voltage selector w/connectors
-90	179-1204-00			1					CABLE HARNESS, power
	- - - - -			-					cable harness includes:
-91	131-0371-00			22					CONNECTOR, single contact
-92	131-0155-00			2					CONNECTOR, coaxial, female
-93	131-0371-00			4					CONNECTOR, single contact

FIG. 4 CABINET

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	No. Disc	Q † y	1	2	3	4	5	Description
4-	437-0091-00			1						ASSEMBLY, cabinet
	- - - - -			-						assembly includes
-1	124-0199-00			1						STRIP, trim, pivot arm, left
-2	124-0198-00			1						STRIP, trim, pivot arm, right
-3	367-0070-01			1						HANDLE, pivot arm, left
	- - - - -			-						mounting hardware: (not included w/handle)
-4	214-0554-00			1						BOLT, hinge
-5	214-0558-00			1						WASHER, thrust
-6	367-0071-01			1						HANDLE, pivot arm, right
	- - - - -			-						mounting hardware: (not included w/handle)
-7	214-0554-00			1						BOLT, hinge
-8	214-0558-00			1						WASHER, thrust
-9	367-0074-00			1						HANDLE, carrying
	- - - - -			-						mounting hardware: (not included w/handle)
-10	212-0040-00			2						SCREW, 8-32 x 3/8 inch, 100° csk, FHS
-11	348-0099-01			1						FLIPSTAND, cabinet
-12	348-0074-00			1						FOOT, bail limiting, right front
	- - - - -			-						mounting hardware: (not included w/foot)
-13	211-0532-00			2						SCREW, 6-32 x 3/4 inch, Fil HS
	348-0074-00			1						FOOT, bail limiting, left rear (not shown)
	- - - - -			-						mounting hardware: (not included w/foot)
	211-0532-00			2						SCREW, 6-32 x 3/4 inch, Fil HS
	210-0457-00			1						NUT, keps, 6-32 x 5/16 inch
-14	348-0073-00			1						FOOT, bail limiting, right rear
	- - - - -			-						mounting hardware: (not included w/foot)
-15	211-0532-00			2						SCREW, 6-32 x 3/4 inch, Fil HS
-16	348-0073-00			1						FOOT, bail limiting, left front
	- - - - -			-						mounting hardware: (not included w/foot)
-17	210-0457-00			1						NUT, keps, 6-32 x 5/16 inch
-18	211-0532-00			2						SCREW, 6-32 x 3/4 inch, Fil HS
-19	377-0119-00			4						INSERT, foot
-20	386-1186-00			1						CABINET, bottom
-21	386-1182-00			1						CABINET, top
-22	386-1185-00			2						CABINET, side
	- - - - -			-						mounting hardware for each: (not included w/cabinet)
-23	212-0002-00			2						SCREW, 8-32 x 1/4 inch, 100° csk, FHS

FIG. 4 CABINET (cont)

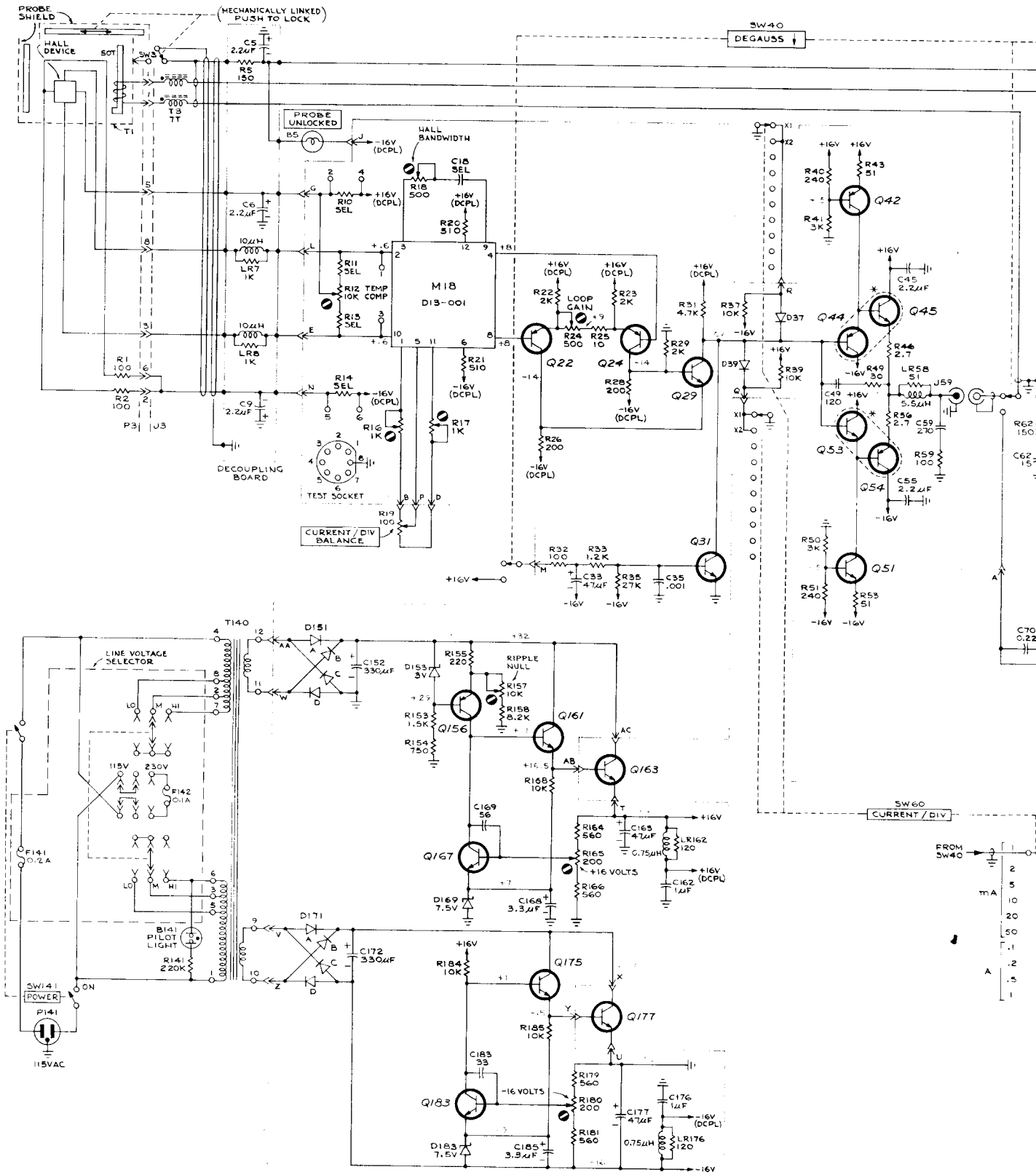
Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q						Description
				t	y	1	2	3	4	
4-24	426-0337-01			1						FRAME, section, left
-25	124-0196-00			1						STRIP, trim, frame section, left
-26	426-0338-01			1						FRAME, section, right
-27	124-0197-00			1						STRIP, trim, frame section, right
-28	426-0355-00			1						FRAME, section, top, front
	- - - - -			-						mounting hardware: (not included w/frame)
-29	212-0002-00			4						SCREW, 8-32 x 1/4 inch, 100° csk, FHS
-30	426-0356-00			2						FRAME, section, bottom, front
	- - - - -			-						mounting hardware: (not included w/frame)
-31	212-0004-00			2						SCREW, 8-32 x 5/16 inch, PHS
-32	212-0002-00			2						SCREW, 8-32 x 1/4 inch, 100° csk, FHS
-33	381-0280-00			1						BAR, guide
	- - - - -			-						mounting hardware: (not included w/bar)
-34	212-0023-00			1						SCREW, 8-32 x 3/8 inch, PHS
	210-0007-00			1						LOCKWASHER, external, #8
	211-0510-00			1						SCREW, 6-32 x 3/8 inch, PHS
	210-0005-00			1						LOCKWASHER, external, #6
-35	351-0116-00			1						SLIDE, frame rod
-36	358-0293-01			1						BUSHING, plug-in securing, left
	- - - - -			-						mounting hardware: (not included w/bushing)
	212-0001-00			1						SCREW, 8-32 x 1/4 inch, PHS
	210-0007-00			1						LOCKWASHER, external, #8
-37	358-0294-01			1						BUSHING, plug-in securing, right
	- - - - -			-						mounting hardware: (not included w/bushing)
-38	212-0001-00			1						SCREW, 8-32 x 1/4 inch, PHS
	210-0007-00			1						LOCKWASHER, external, #8
	211-0510-00			1						SCREW, 6-32 x 1/4 inch, PHS
	210-0005-00			1						LOCKWASHER, external, #6
-39	210-0457-00			1						NUT, keps, 6-32 x 5/16 inch
-40	426-0352-00			1						FRAME, panel, rear
-41	407-0322-00			2						BRACKET, power cable
	- - - - -			-						mounting hardware for each: (not included w/bracket)
-42	211-0012-00			1						SCREW, 4-40 x 3/8 inch, PHS
-43	210-0586-00			1						NUT, keps, 4-40 x 1/4 inch
-44	337-0898-00			2						GUARD, rear
	- - - - -			-						mounting hardware for each: (not included w/guard)
-45	212-0039-00			2						SCREW, 8-32 x 3/8 inch, THS



\* THERMAL COUPLER

SEE PARTS LIST FOR  
SEMICONDUCTOR TYPES





P6042 CURRENT PROBE DC TO 50MHZ

FIG. 1 P6042 PROBE PACKAGE (STANDARD ACCESSORIES)

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+<sup>A</sup>

P6042 PROBE

FIG. 2 P6042 PROBE MECHANICAL PARTS

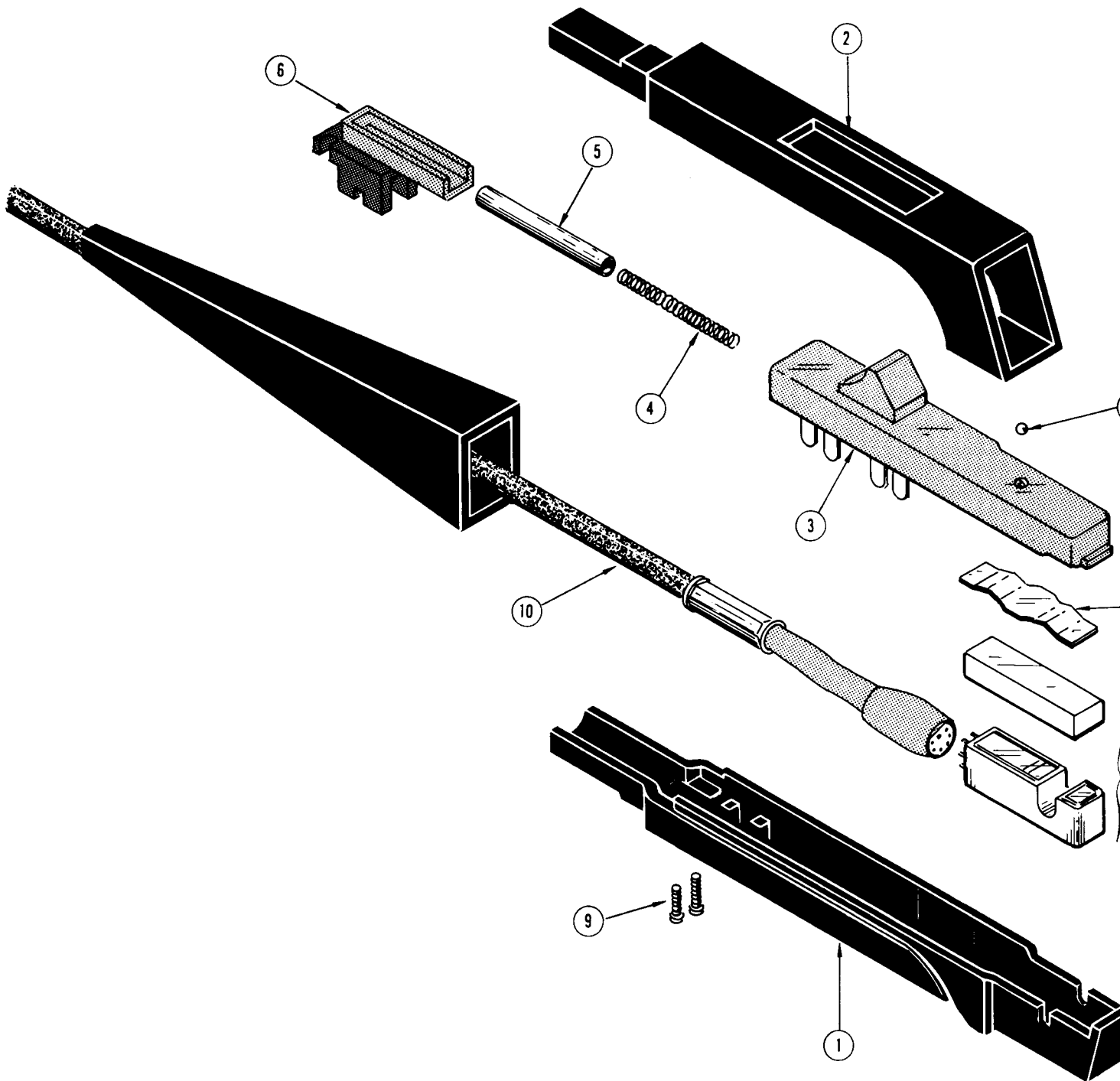
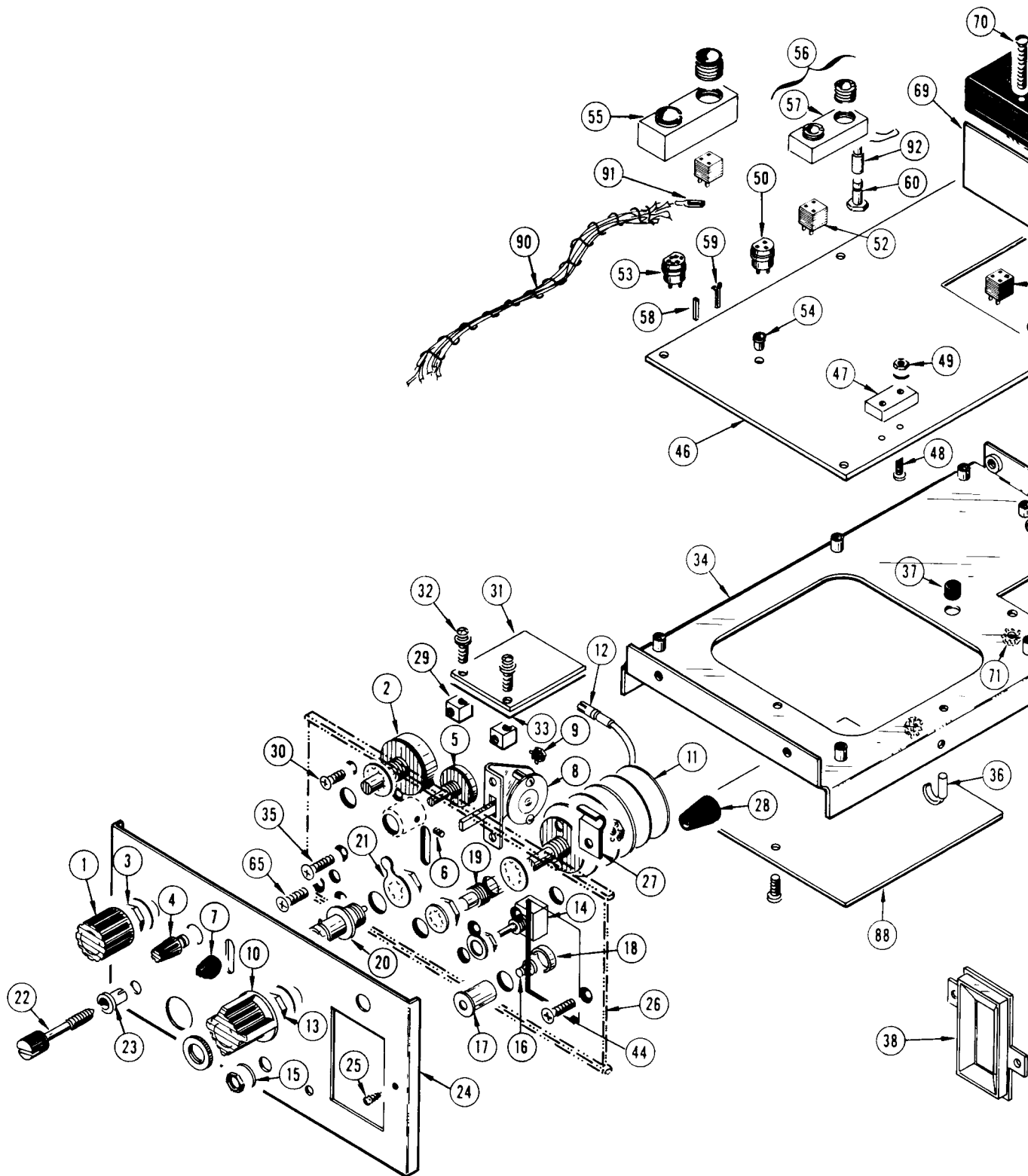


FIG. 3 AMPLIFIER & PO



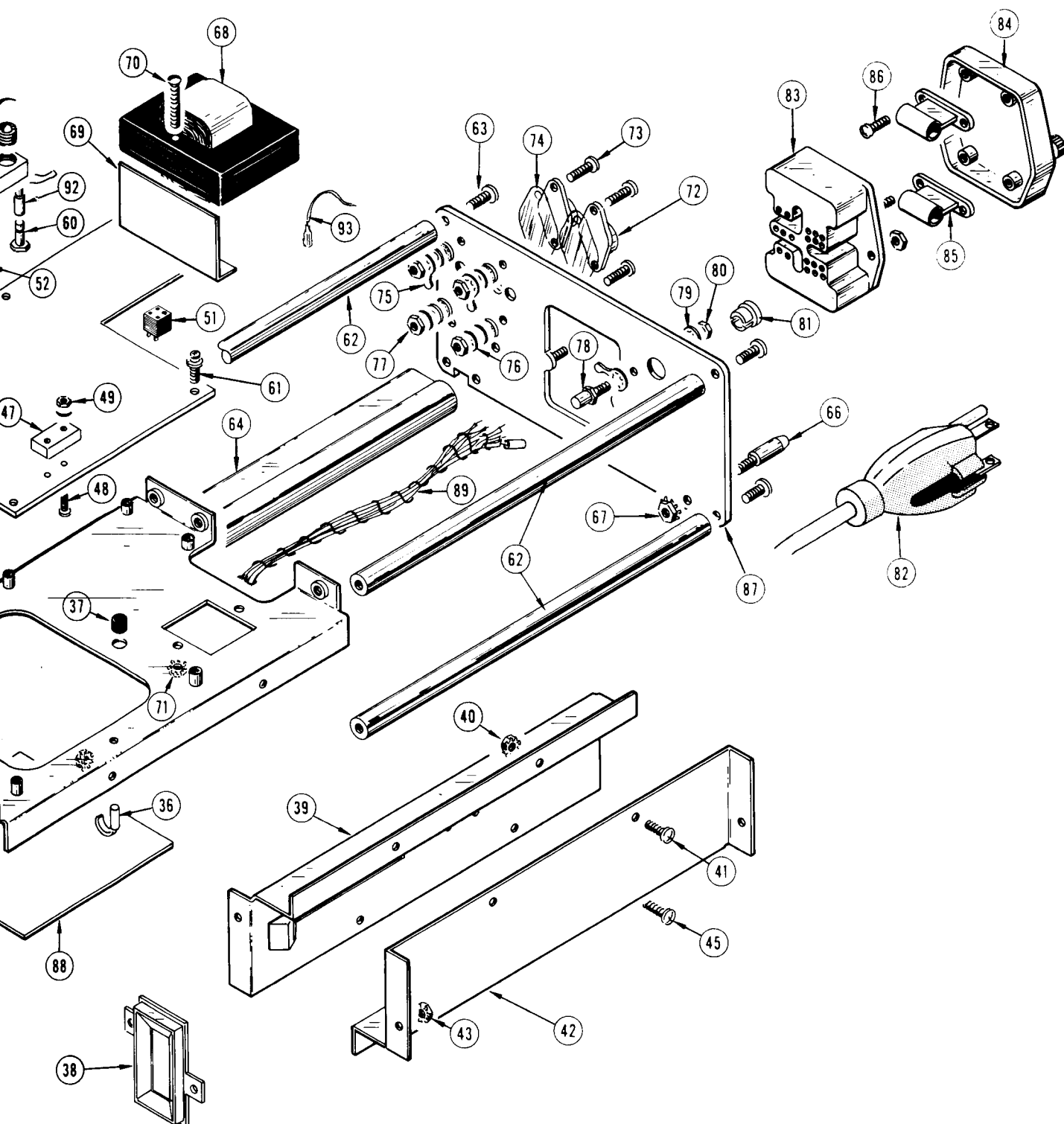


FIG. 4 CABINET

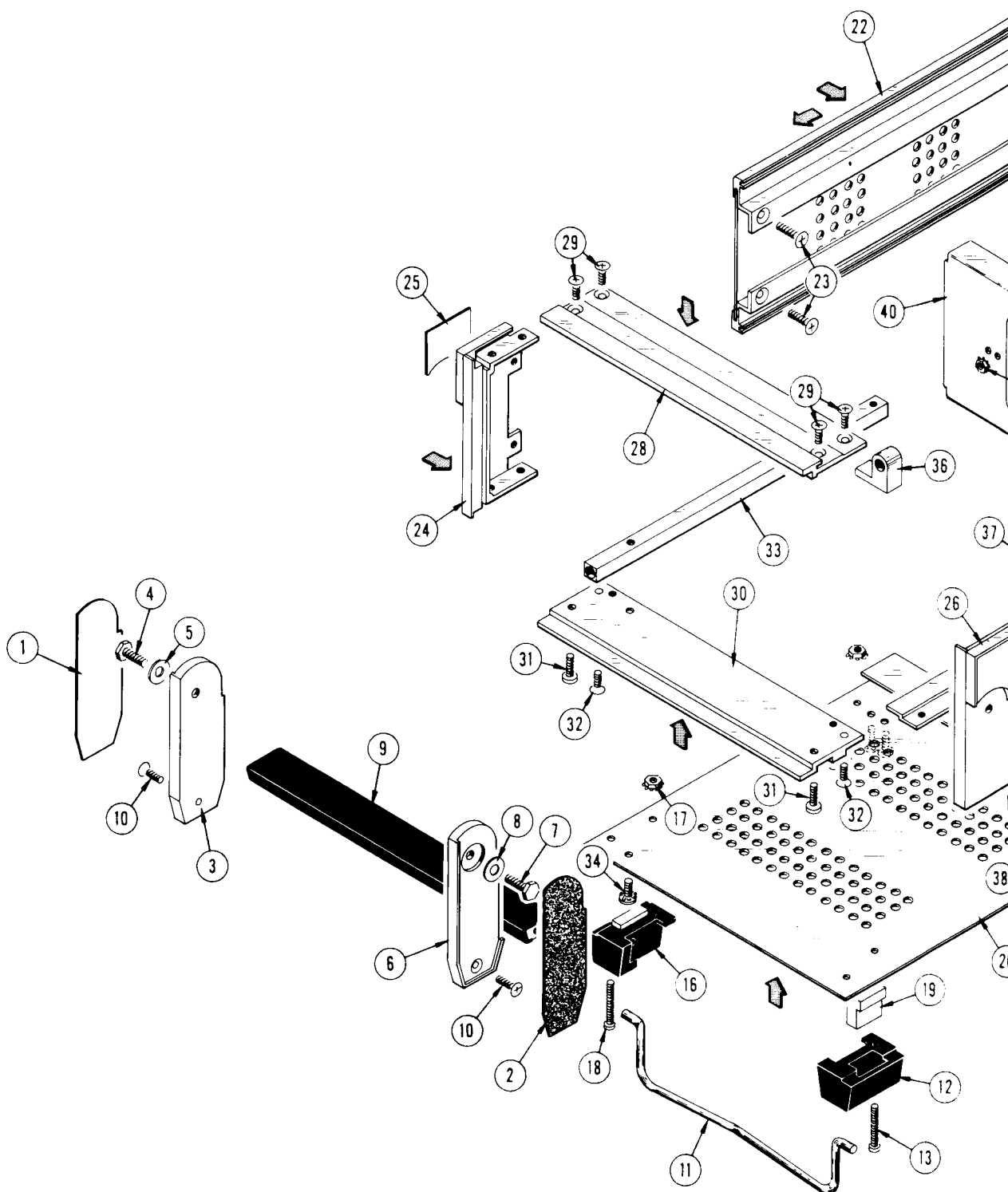
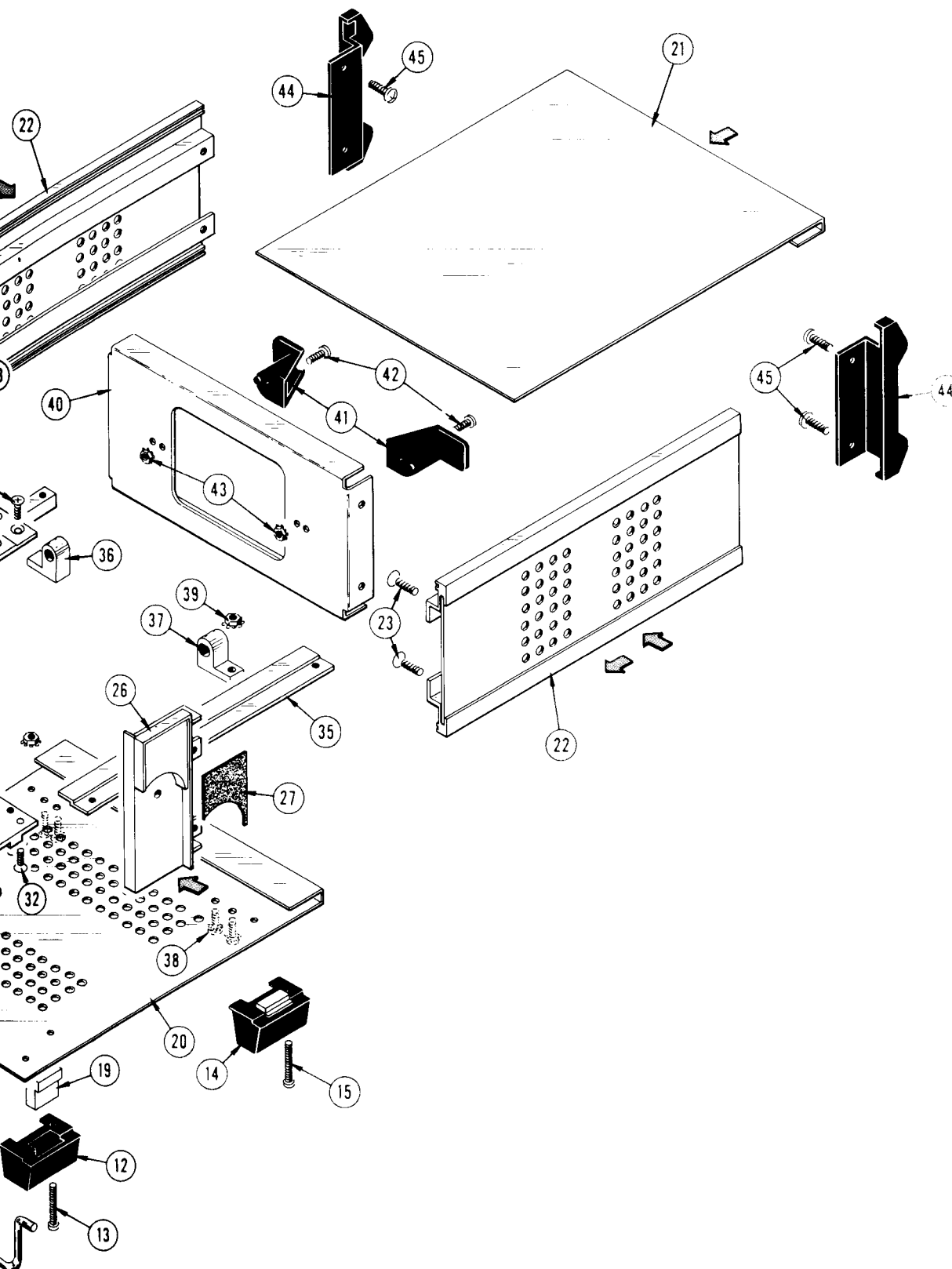


FIG. 4 CABINET

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TEXT CORRECTIONS

Section 1        Characteristics

Page 1-4        Fig. 1-3

CHANGE: the caption to read:

Fig. 1-3.    P6042 maximum input current vs. frequency curve.



# **K4XL's BAMA**

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