INSTRUCTION MANUAL

Serial Number _____

P6042 PROBE

Tektronix, Inc.
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070-0629-00

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WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year.

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.

Specifications and price change privileges reserved.

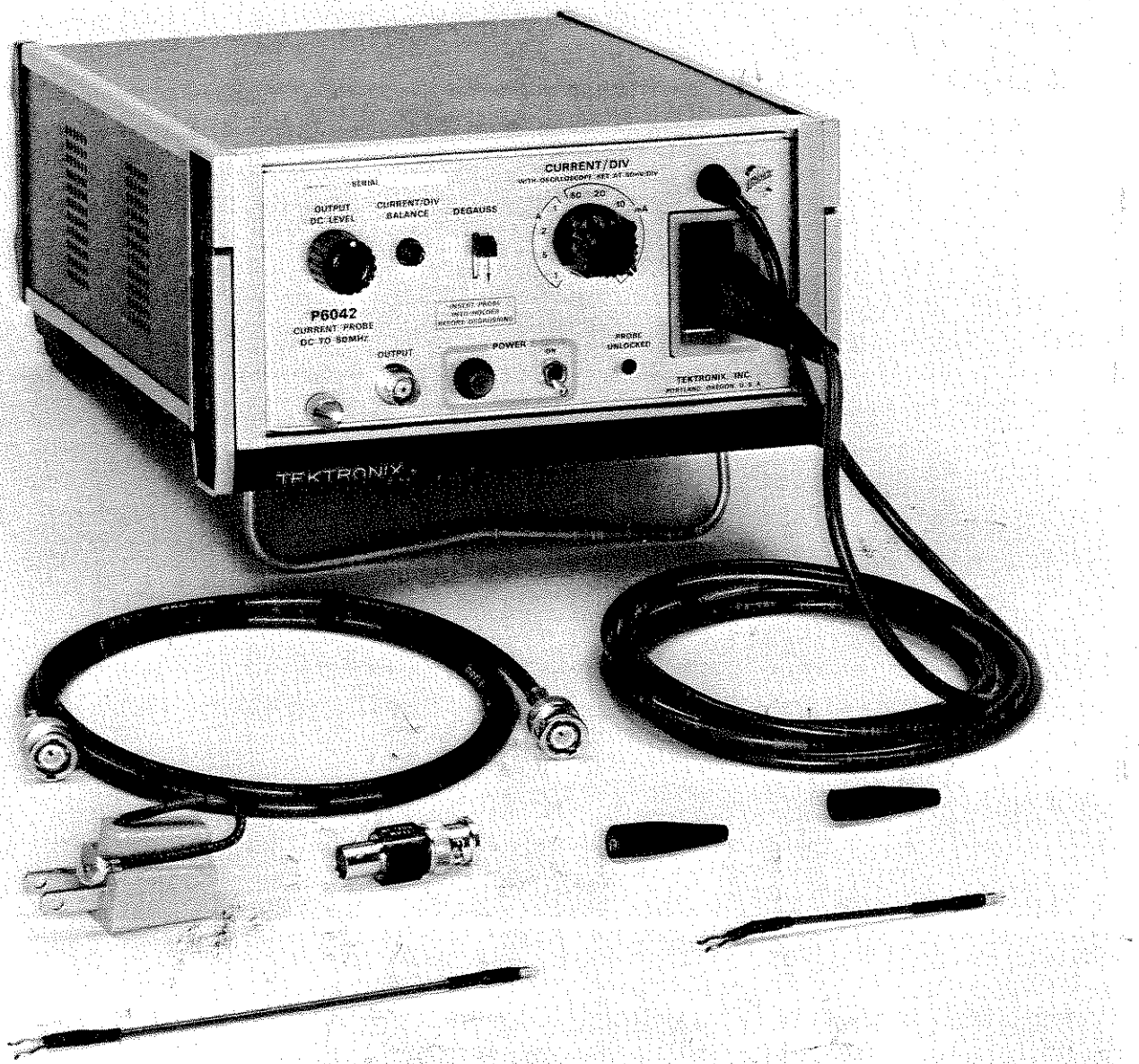

Fig. 1-1. P6042 Current Probe and accessories.

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 ±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 requirments 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	≤7 ns.	Calculated from bandwidth.
Aberrations	≤3% from 1 mA/DIV to 50 mA/DIV.	±5% from .1 A/DIV to 1 A/DIV before first 100 ns.
Noise		
Periodic and Random Deviations	≤0.5 mA + 0.2 div, tangentially measured.	
Random Trace Shift	≤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.
Deflection Factor	1 mA/div to 1 A/div in 1, 2, 5 sequence	With oscilloscope set to 50 mV/div
Attenuator Accuracy	Within ±3%.	
Insertion Impedance	Typically 0.1 Ω 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)		≤2 mA/°C from 15°C to +35°C with amplifier temperature constant.
Thermal Drift (Amplifier only)		≤0.2 div/°C with probe temperature constant.

TABLE 1-1 *(cont)*

ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirement	Supplemental Information
Voltage-Feedthrough Susceptibility		≤250 μA/V at 50 MHz.
External Magnetic Field Susceptibility		≤250 μA/Gauss, at 60 Hz.
Required Output Load Impedance		50 Ω.
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		≤2 mV peak to peak.
Input Power		≤20 W.
Input Frequency		50 to 400 Hz.

TABLE 1-2

ENVIRNOMENTAL CHARACTERISTICS

Characteristic	Performance Requirement	Supplemental Information
Temperature		
Non-operating	−40°C to +65°C.	
Operating	0°C to +50°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, ½ 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.	

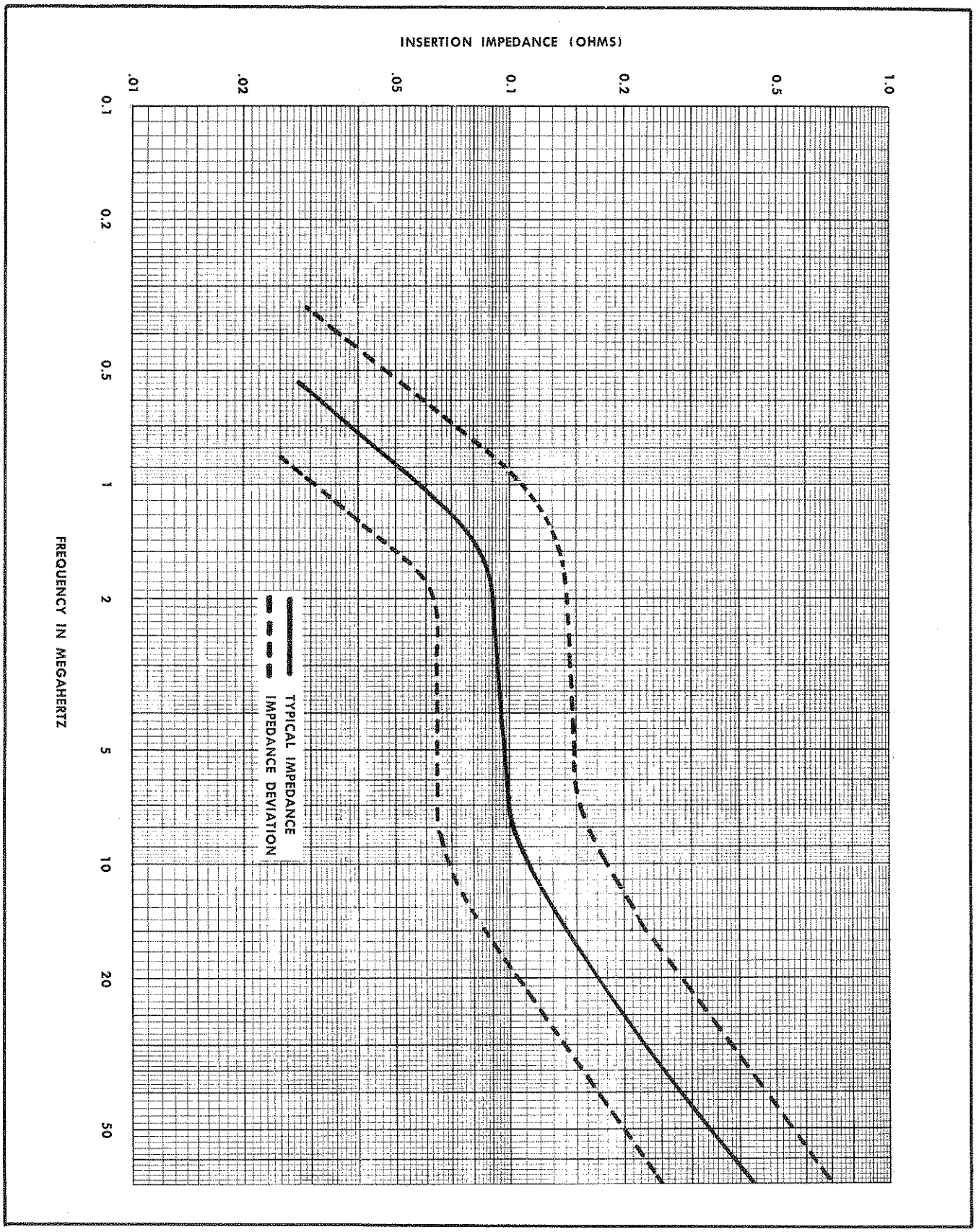

Fig. 1-2. P6042 Insertion Impedance vs. frequency curve.

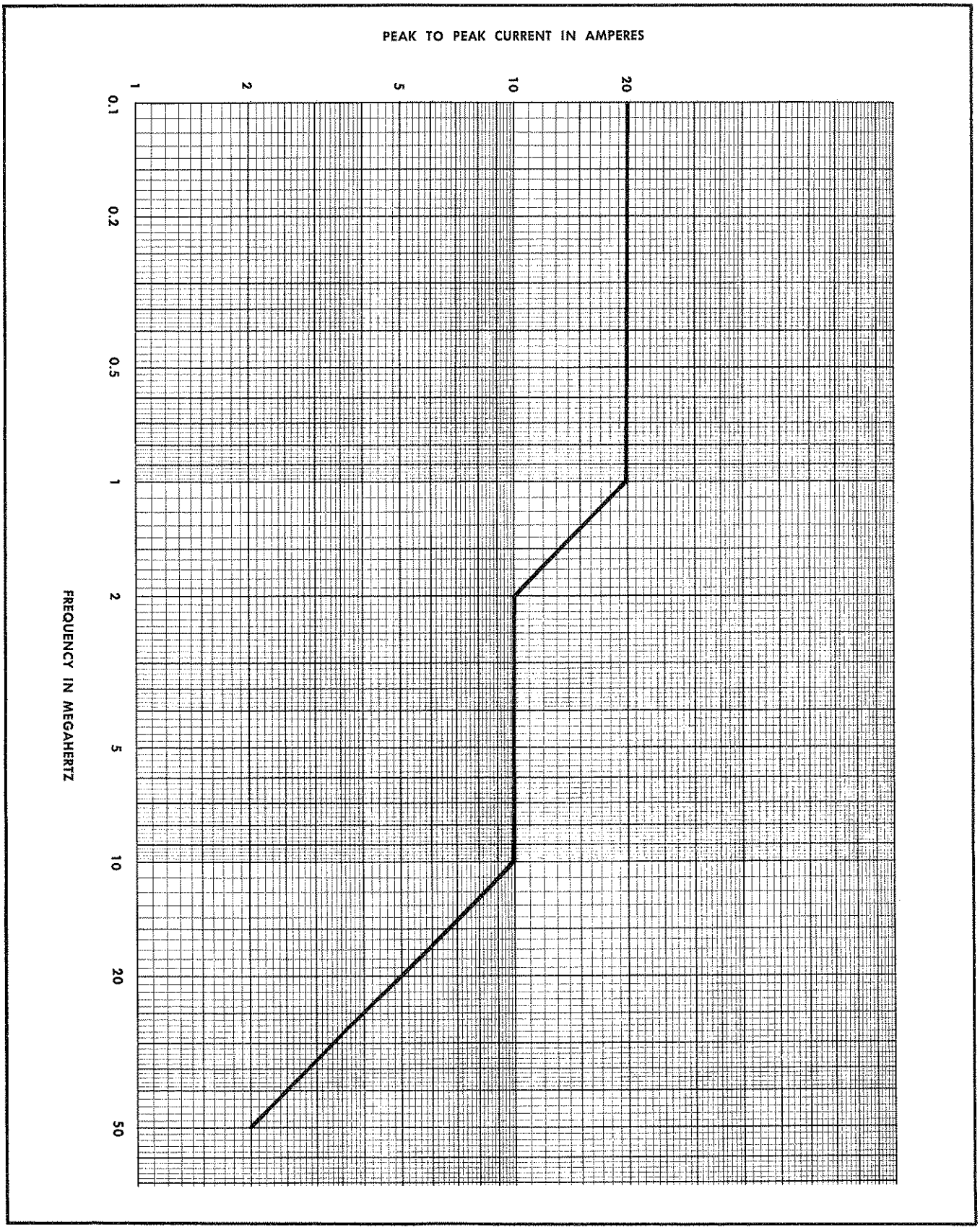

Fig. 1-3. P6042 maximum input current vs. frequency curve.

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.

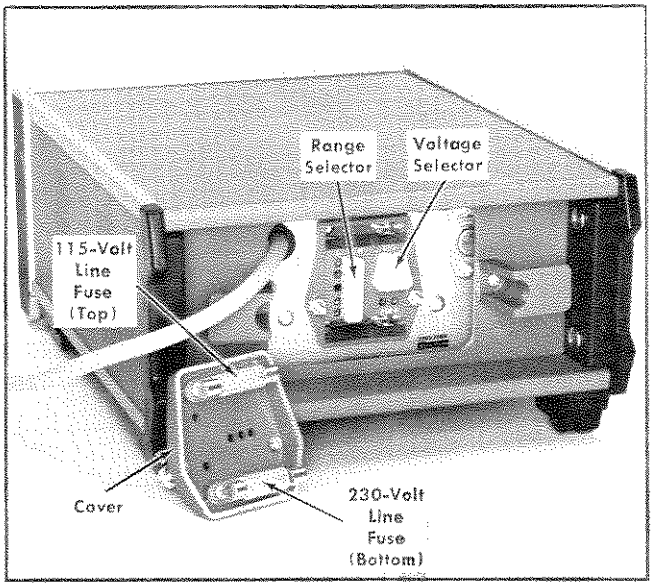

Fig. 2-1. Line Voltage Selector assembly on the rear panel (shown with cover removed).

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

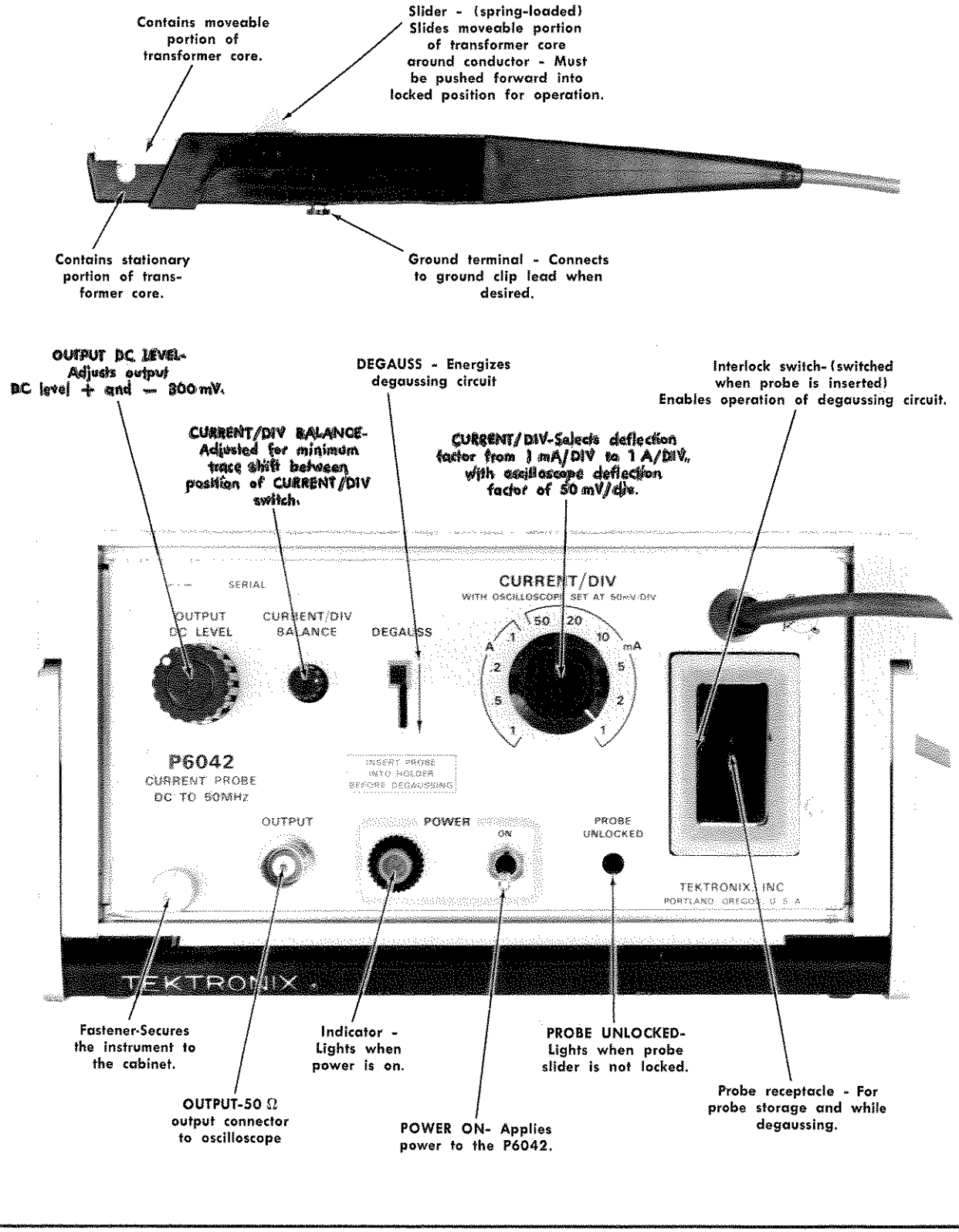

Fig. 2-2. Function of front panel controls and connectors.

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

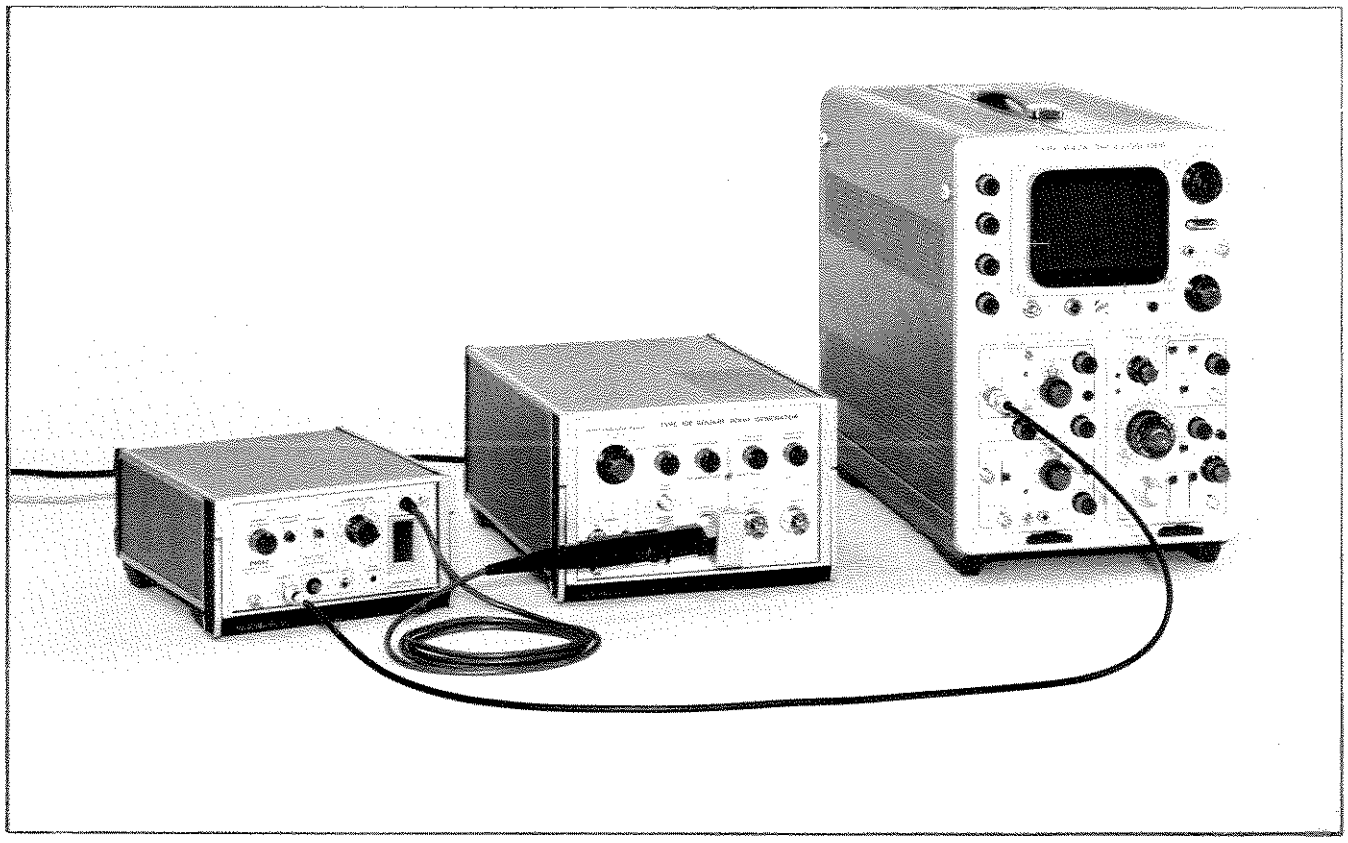

Fig. 2-3. P6042 Current Probe connected to Type 106 Square-Wave Generator output.

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 be 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).

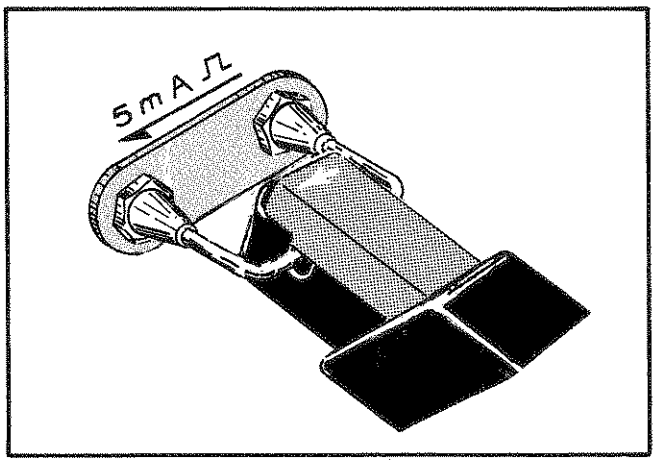

Fig. 2-4. Current flow in a conductor.