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Instruction Manual



P6008 PROBE

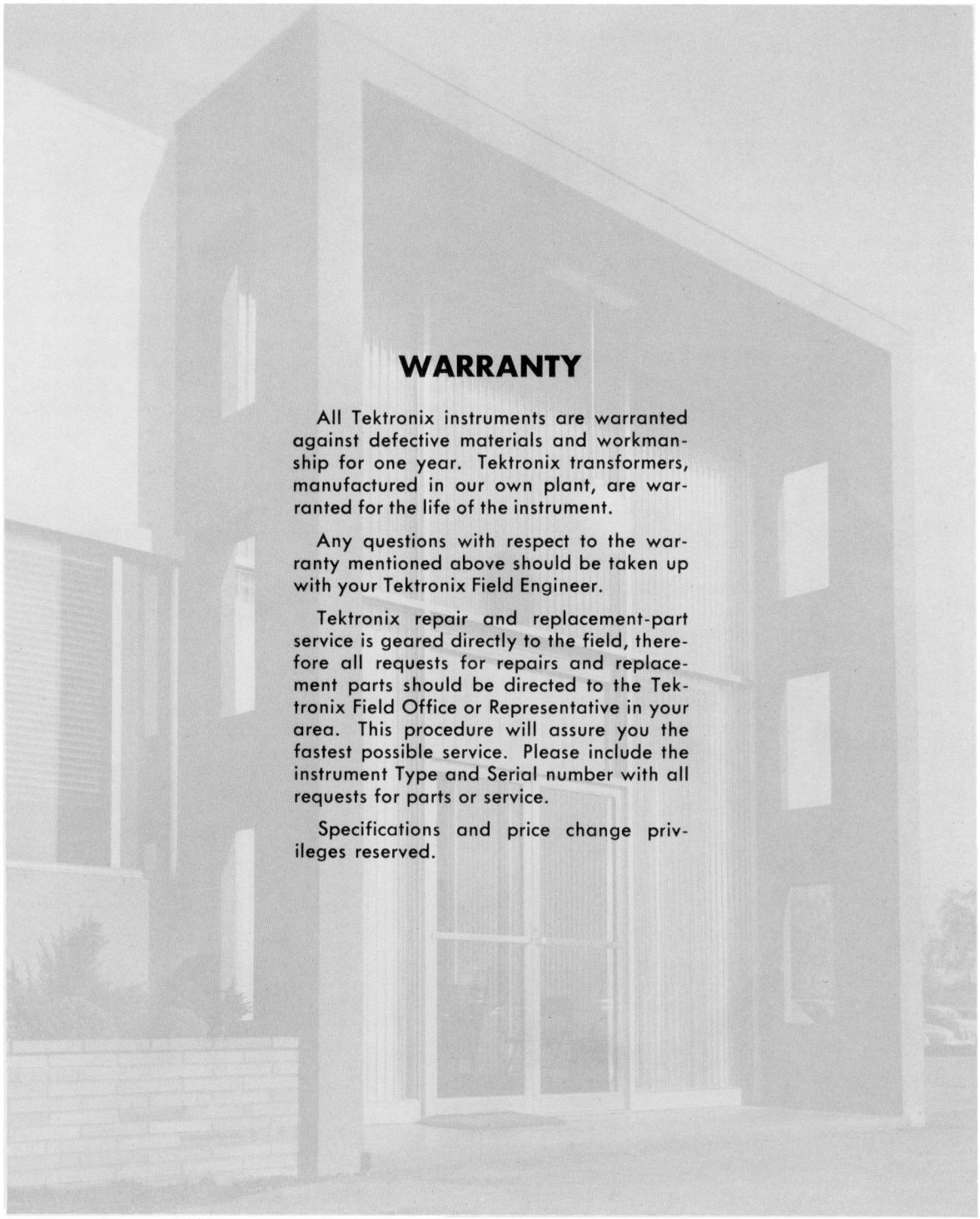
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070-0362-01

Tektronix, Inc.
S.W. Millikan Way ● P. O. Box 500 ● Beaverton, Oregon 97005 ● Phone 644-0161 ● Cables: Tektronix



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.

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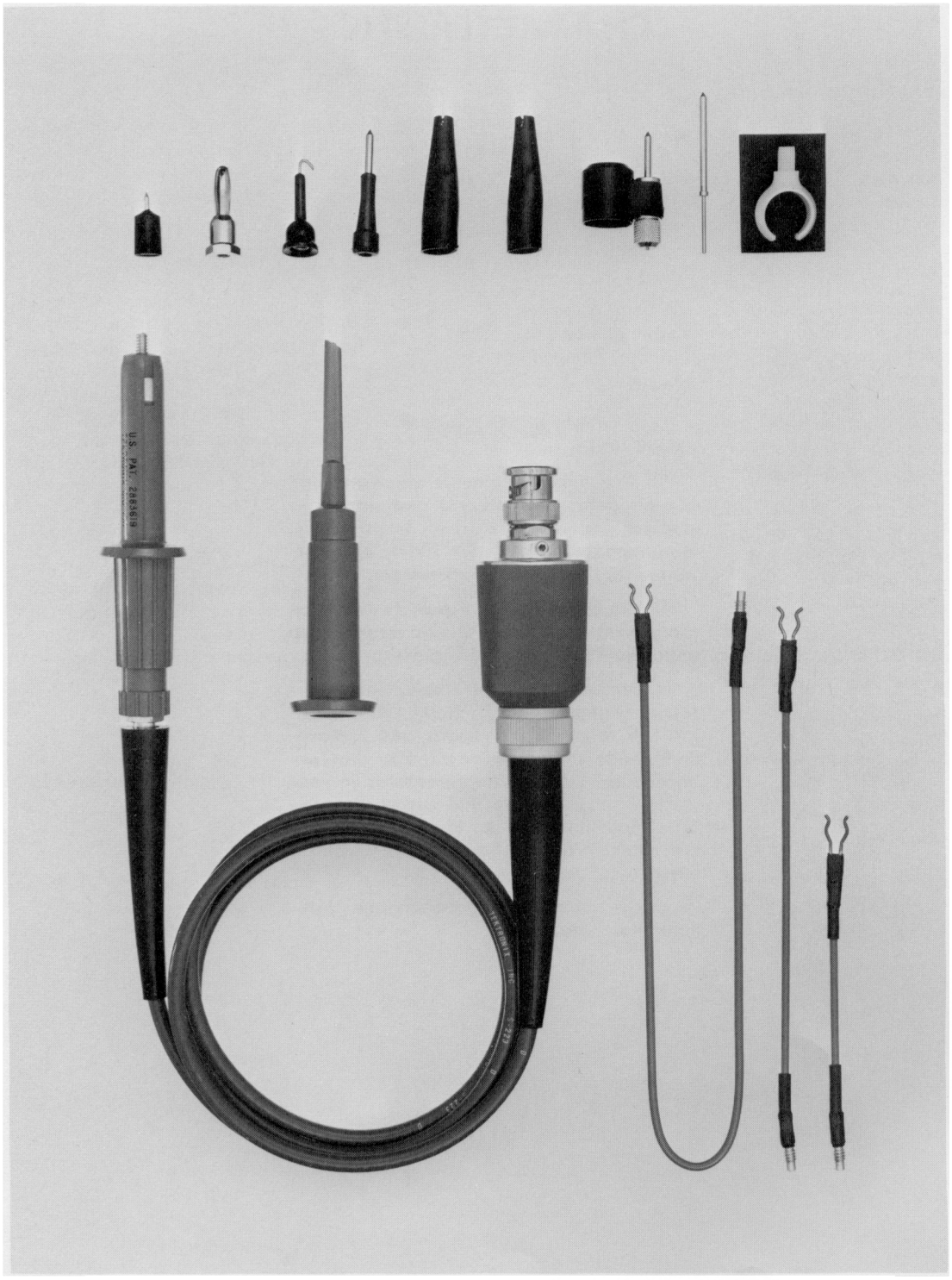


Fig. 1-1. P6008 Probe and accessories.

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SECTION 1

CHARACTERISTICS

General Information

The P6008 Probe, shown at left, is a passive probe with 10X attenuation of signals. It is designed for use with Tektronix Type 82 and 86 plug-in units. The probe provides a convenient means for coupling signals to the plug-in unit with minimum loading and maximum response.

The probe consists of a probe body assembly, a 3½-ft cable, a compensating box assembly, and a BNC connector. The 9-megohm resistor in the probe body assembly has adjustable capacitive compensation which may be set to match the plug-in used. The compensating box houses a network which provides optimum transient response.

The probe is factory calibrated for use with plug-in units which have a 1-megohm input, paralleled by 15 pf. It may be used with units which have up to 20-pf input capacitance, with a corresponding decrease in frequency response.

Characteristics (when used with Type 82 or 86 plug-in unit)

Input Impedance

10 megohms paralleled by about 7 pf. Fig. 2-3 shows input impedance vs frequency up to 250 megacycles.

Attenuation

DC attenuation is 10X, ±3%, with plug-in. Probe attenuation is ±2%.

Voltage Rating

Maximum dc or ac peak-to-peak below 20 megacycles: 600 volts. Above 20 megacycles, maximum voltage must be derated according to frequency duty factor. See the curves in Fig. 2-4.

Frequency and Transient Response

Probe alone has a characteristic risetime of less than 3 nanoseconds, corresponding to a frequency response of dc to 116 megacycles or higher. With a Type 82 or 86 plug-in unit and 580-Series Oscilloscope, typical risetime with the GAIN switch set to X1 is 5.3 nanoseconds which corresponds to 66 megacycles; a X10 GAIN risetime is 5.5 nanoseconds which corresponds to 63 megacycles.

Connecting Cable

Cable is 3½ feet long with a special resistive center conductor which provides critical damping of reflections. This allows the probe to present a relatively high impedance without mismatch when viewing signals from low-impedance sources.

Environmental Capability

Probe will operate normally with temperatures to 75°C.

Plug-In Connector

BNC type; mates with connectors of Type 82 and 86 plug-in units.

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NOTES

SECTION 2
OPERATING INSTRUCTIONS

General Information

The P6008 Probe allows you to connect an oscilloscope into a circuit with minimum loading and without impedance matching. Before using the probe, compensate it according to the procedure given in the following paragraphs. Always check compensation when connecting the probe to the plug-in, and recheck it before making critical measurements. Slight variations in input capacitance between different plug-ins of the same type affect compensation. Lack of compensation can cause measurement error since it affects both waveshape and magnitude of the display. The probe is therefore provided with an adjustment to match it to the plug-in used.

Compensation

To compensate the P6008 Probe, proceed as follows:

1. Set the oscilloscope calibrator for an output of suitable amplitude.

2. Hold the probe body and tip assembly and loosen the locking sleeve several turns (see Fig. 2-1).

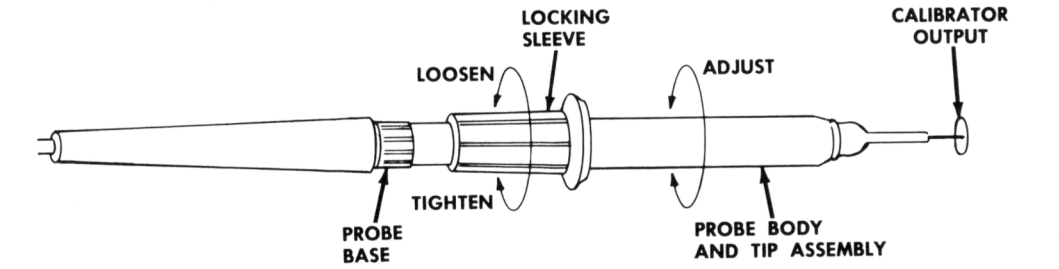
3. Touch the probe tip to the oscilloscope calibrator output connector.

4. Set the sweep rate to display several cycles of the calibrator output signal.

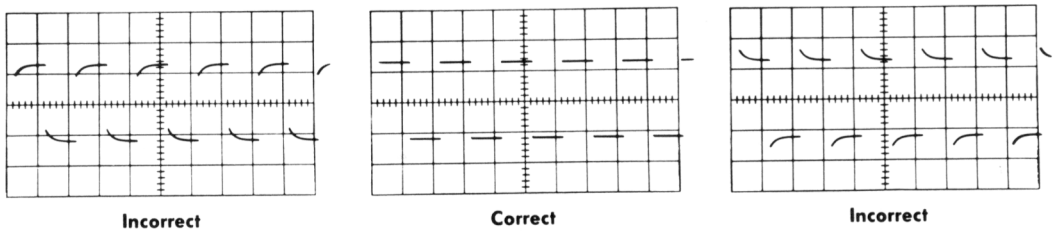
5. Hold the base bushing and turn the probe body and tip assembly to obtain an undistorted presentation of the calibrator output signal.

6. Hold the probe body and tip assembly and carefully hand-tighten the locking sleeve.

If the probe changes adjustment while you are tightening the locking sleeve, continue turning the sleeve until it is just tight. Then, as a fine adjustment, hold the probe body and the locking sleeve and turn the base bushing assembly carefully in the direction that will properly compensate the probe.



(a) Probe adjustments



Incorrect Correct Incorrect

(b) Waveforms from 1-kc oscilloscope calibrator

Fig. 2-1. Probe compensation.

Connecting the Probe to the Signal Source

The probe may be connected to the signal source by means of the tips, leads, and connectors supplied. Generally, you should select the tips and leads that are best suited physically. When measuring high-frequency signals, use the shortest ground connection possible. Longer ground leads may result in ringing because of the inductive reactance of the ground lead. Be careful not to short-circuit between wires, connections, etc. in the circuit under test with the probe tip. Always provide some form of ground between the probe and the circuit under test to prevent hum pickup, ringing, and other spurious signals. The 5" and 12" ground leads clip to the junction of the probe bushing assembly and the cable assembly.

The 3-inch ground lead is used with the bayonet ground assembly (see Fig. 2-2). To connect the 3-inch ground lead to the bayonet ground assembly, slip the ground assembly onto the probe body and tip assembly. Unscrew the knurled nut and clip the ground lead to the pin holder at the end of the holder opposite from the knurled nut. Be careful not to drop the pin or the spring.

Considerations

After compensating the probe, consider the following before connecting the probe and making measurements:

1. Loading—Fig. 2-3 is a graph of the probe input resistance and reactance versus frequency measured with the probe connected to the plug-in and an R-X meter connected to the probe input. X_p represents capacitive reactance, and R_p represents resistance. The input impedance of the probe may affect the operation of the circuit under test.

2. Frequency Response—The frequency response of the probe, plug-in, and oscilloscope is stated in Section 1. Although the system 3-db point is near 70 megacycles, the probe and oscilloscope are useful at higher frequencies with a corresponding decrease in gain.

3. Voltage Rating—Fig. 2-4 is a graph of the maximum voltage rating at various frequencies with various duty factors. At higher frequencies, the maximum voltage decreases because charging currents in the probe cable, which charge the input capacitance of the plug-in, increase until the cable overheats. When computing duty factor, the maximum "on" time is one second. If "on" time and "off" time are less than one second, then duty factor:

$$DF = \frac{\text{ON time}}{\text{ON time} + \text{OFF time}}$$

(CW signals have a DF of 1)

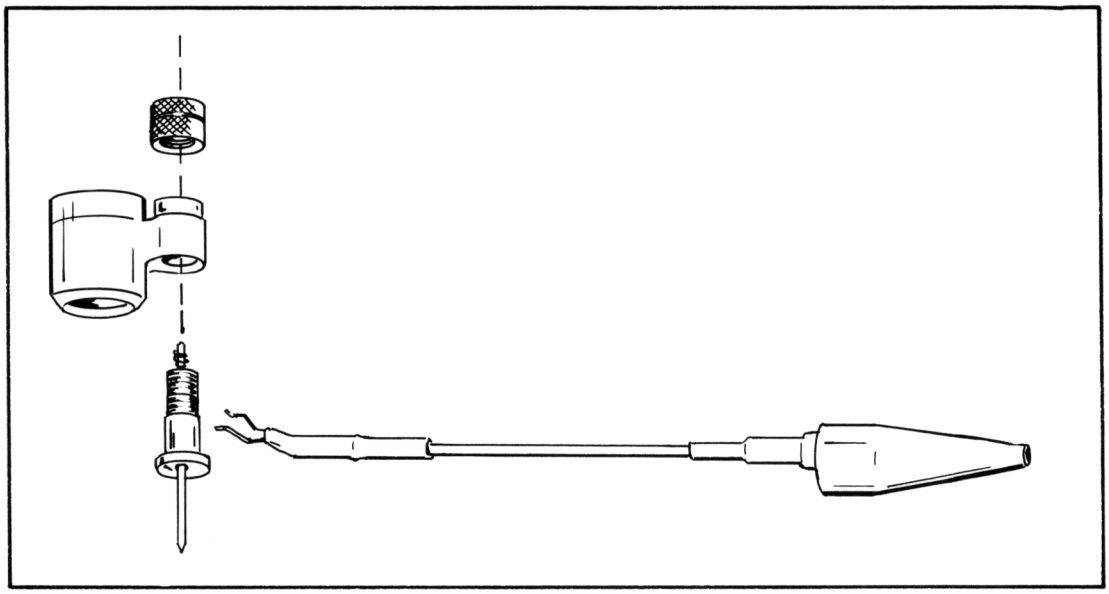


Fig. 2-2. Connecting 3-inch ground lead to bayonet ground assembly.

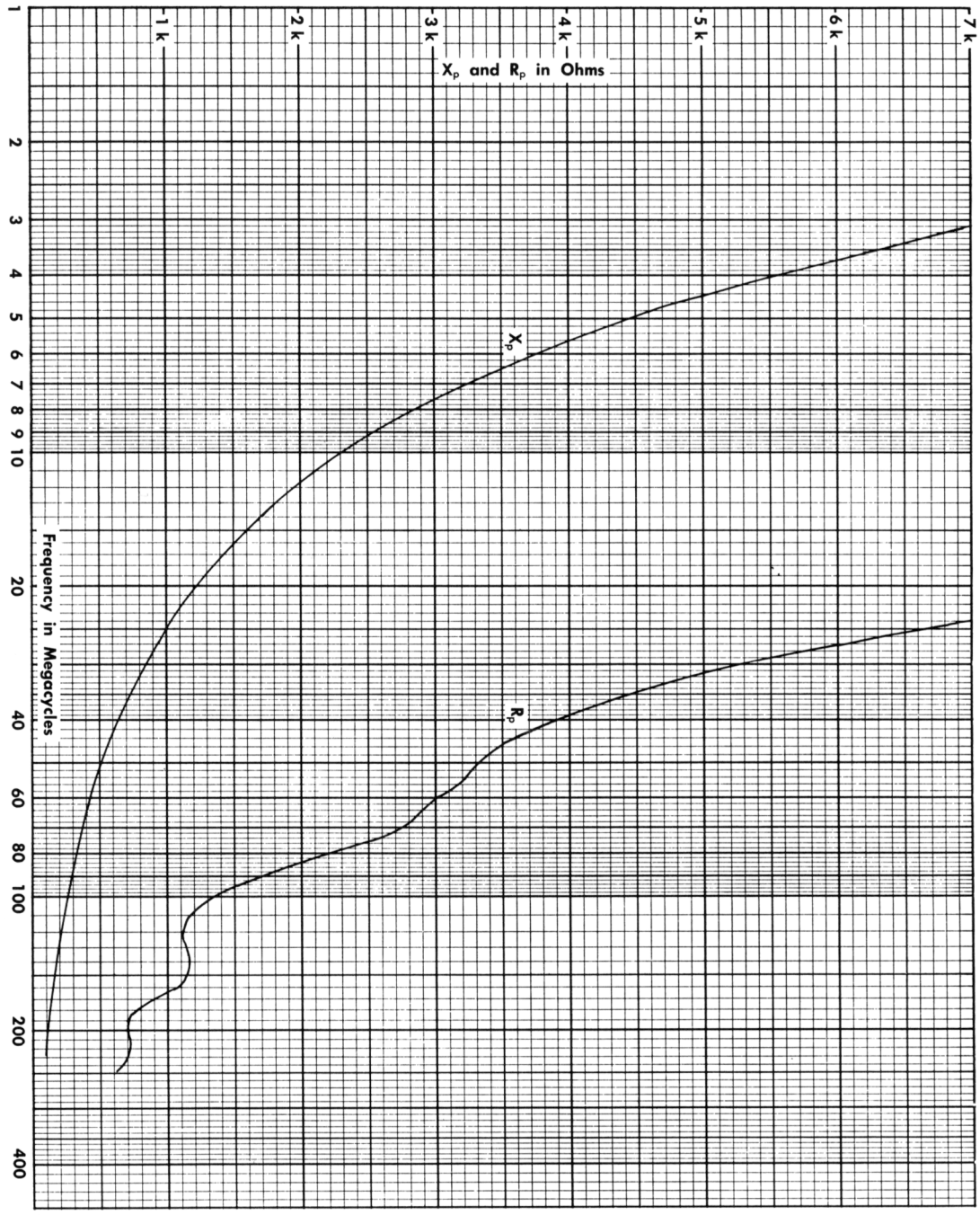


Fig. 2-3. P6008 Input Resistance and Reactance Versus Frequency.

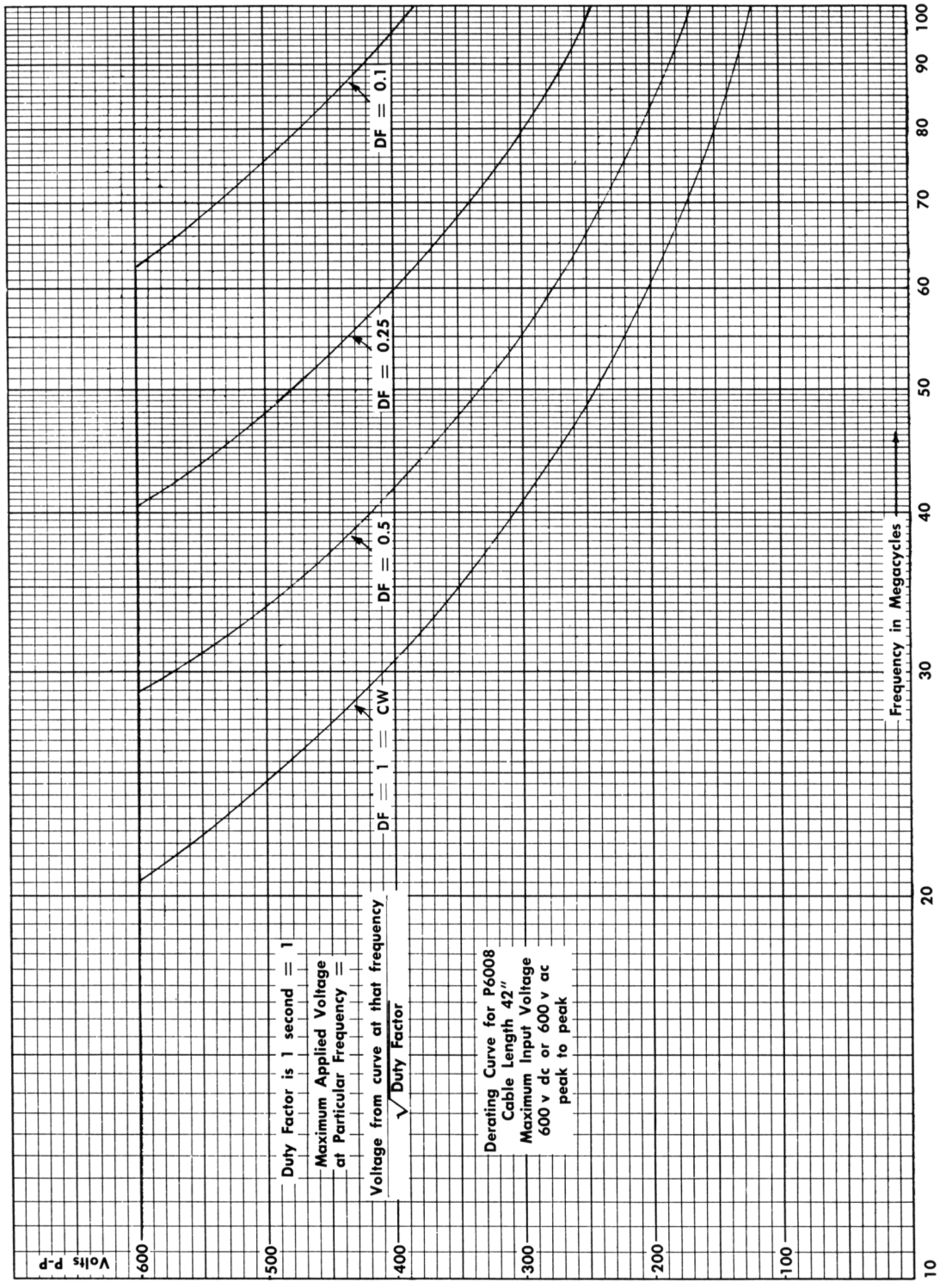


Fig. 2-4. Maximum Applied Voltage At Specific Duty Factors.

SECTION 3
CIRCUIT DESCRIPTION

The P6008 Probe is a simple voltage divider operating in conjunction with the input impedance of the plug-in unit to provide 10:1 signal division. The divider resistor is mounted in the probe body and tip assembly. A spring contact connects the resistor to the sleeve. Capacitance between the probe tip and the sleeve is varied for frequency compensation by turning the probe body and tip assembly with respect to the base bushing to move it along the base bushing assembly. Resistor location in the probe body and tip assembly is carefully controlled during manufacture; therefore, the resistor should not be replaced in the field.

The 3½-ft cable is critically damped by a resistive center conductor which allows the probe to drive the oscilloscope plug-in input without ringing.

A compensating box at the plug-in connection maintains response at high frequencies. The circuit parameters in the compensating box are adjusted at the factory for correct response with plug-in units that have a 1-megohm input paralleled by 12 or 15 pf. When interchanging the P6008 Probe with other Type 82 or Type 86 plug-in units no retuning of the components in the compensating box is necessary, other than to ascertain that the probe is still compensated for the input capacitance of the particular plug-in.

Two ferrite cores around the cable at the compensating-box end sense ground currents in the shield braid and magnetically couple them to the center conductor, establishing common-mode signals which will not be seen by the oscilloscope.

NOTES

SECTION 4
MAINTENANCE AND CALIBRATION

MAINTENANCE

The Type P6008 Probe is designed to withstand normal operation and handling and should give many hours of continuous use without failure. However, if the probe fails or breaks, replacement parts are available. See mechanical and electrical parts lists in Section 5.

Replacing Cable Assembly

If the coaxial cable between the probe and the compensating box should fail, the cable assembly is available complete with fittings and cable reliefs.

Replace the cable assembly as follows:

1. Remove the Compensating Box Cover by unscrewing the Locking Nut that holds it in place (see Fig. 4-2).

2. Unsolder the bare wire from the center terminal of the Cable Assembly (next to L104).

3. Use thin $^{7}/_{16}$- and $^{9}/_{16}$-inch end wrenches to remove the Cable Assembly from the Compensating Box.

4. Turn the Locking Sleeve to unlock the Probe Body and Tip Assembly and remove both by unscrewing from the end of the Base Bushing Assembly (see Fig. 4-1).

5. Unscrew the Sleeve from the plastic Inner Base Bushing.

6. Use thin $^{11}/_{32}$- and $^{3}/_{8}$-inch end wrenches to remove the Base Bushing Assembly from the end of the Cable Assembly.

7. Use a scribe to lift the wire from the thread groove of the Inner Base Bushing and remove the bushing.

8. Unsolder the bare wire from the center terminal of the Cable Assembly.

Install the new Cable Assembly by reversing the above procedure. After assembling the

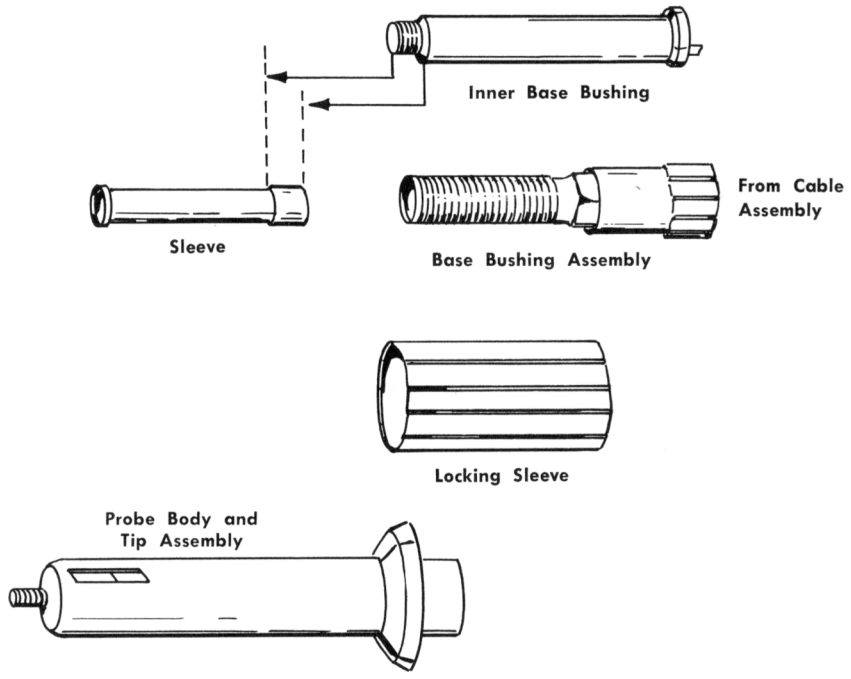


Fig. 4-1. P6008 Probe Body Assembly.

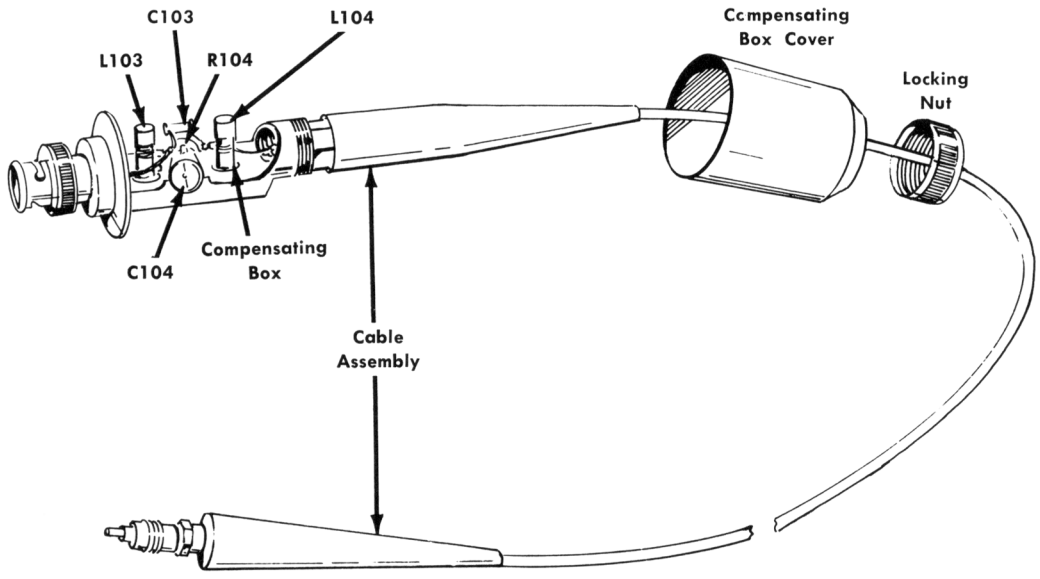


Fig. 4-2. P6008 Probe Compensating Box Assembly.

probe parts, be sure to compensate the probe for low frequencies as described in Section 2. Then compensate the probe for high frequencies according to the procedure given in this section.

Replacing Parts In the Compensating Box

To replace parts in the Compensating Box, you need only a pair of long-nose pliers and a soldering iron. Use a heat sink (tip of long-nose pliers) to protect the new components from excessive heat. If replacing a variable inductor, be careful not to strip the plastic threads. If you have a torque wrench, the proper nut pressure is from 2 to 5 inch-pounds.

Replacing the Probe Body and Tip Assembly (with 9-megohm resistor factory installed)

If the 9-megohm resistor (R100) fails, do not try to replace the resistor. Instead, replace the whole Probe Body and Tip Assembly shown in Fig. 4-1. Order from your local Tektronix Field Office.

CALIBRATION

The Compensating Box of the P6008 does not have to be recalibrated if used with other than a Type 82 or 86 plug-in. However it does not give the optimum response with plug-in units of different input capacitance. When used consistently with Type 82 or 86 plug-in units, only an occasional check of the high-frequency compensation is required.

Equipment Required

1. Type 581 or Type 585 Oscilloscope.

2. Type 82 or 86 plug-in unit.

3. 50-ohm fast-rise square-wave generator, such as the Tektronix Type 109 or Type 110. Risetime must be less than 1 nsec, 10% to 90%.

4. 50-ohm BNC-to-BNC Termination, Tektronix Part No. 011-049.

5. Probe-to-BNC Adapter, Tektronix Part No. 013-054.

6. GR Type 874-to-BNC Jack Adapter (GR Type 874-QBJ), Tektronix Part No. 017-024.

7. 20-nsec 50-ohm cable, with GR 874 fitting. Tektronix Part No. 017-504.

8. Special plastic ferrite core alignment tool.

Tektronix Part Nos. { Tool Tip—003-310. / Handle—003-307.

9. Small nonconducting screwdriver, such as Jaco No. 125 with 1½-inch shank, Tektronix Part No. 003-000.

Preliminary Procedure

Check the transient response of the plug-in and 580-Series Oscilloscope before attempting to calibrate the P6008 Probe. Use the procedures in the instruction manuals for the plug-in and oscilloscope.

Set the plug-in controls as follows:

AC - DC	DC
VOLTS/CM	.1
VARIABLE VOLTS/CM	CAL.
GAIN	X1
* MODE	A ONLY
* POLARITY	NORMAL

*** Type 82 only**

Loosen the Locking Nut on the Compensating Box and move the cover back onto the cable. Connect the P6008 Probe to the INPUT (INPUT A on Type 82) connector of the plug-in unit.

High-Frequency Compensation Procedure (Early models)

Early models of the P6008 require a different calibration procedure from later models. To ascertain which model you have, check for the presence or absence of C103, a 1-pf tubular capacitor mounted between the two coils. Early models do not have this capacitor.

1. Set the oscilloscope sweep rate for 2 msec/cm and the triggering controls for a + internal trigger. Set the amplitude calibrator for a 2-volt output.

2. Connect the probe tip to the center conductor of the oscilloscope calibrator output connector. Adjust the triggering controls for a stable display.

3. Set C104 (see probe schematic and Fig. 4-2) to maximum capacitance. Maximum capacitance of C104 is determined when the display shows a minimum spike, or some roll-off.

4. Adjust the compensating capacitor by turning the Probe Body and Tip Assembly until the square-wave display has a good flat top. Tighten the Locking Sleeve and check the flat top display.

5. Use items 3, 4, 5, 6, and 7 of Equipment Required, and connect the probe to the 50-ohm fastrise square-wave generator. Use the 20-nsec cable with the generator as the chargeline to obtain a 40-nsec pulse.

6. Adjust the oscilloscope sweep rate for 0.05 μsec/cm. Turn up the intensity and focus display. It is possible to raise the intensity past the point of being able to obtain a sharp focus. Proper adjustment of the P6008 Probe is easiest when the display is sharply focused.

7. Adjust R104 (near maximum resistance) for a level display.

8. Adjust L103 for the correct front-corner level.

9. Adjust L104 for proper level about 3 or 4 nsec after the display front corner.

10. Adjust the oscilloscope sweep rate for 0.2 μsec/cm. Both square-wave corners should be at the same level. If not, repeat steps 6, 7 and 8, and recheck.

11. Set the oscilloscope sweep rate for 0.05 μsec/cm and magnified 5X. The risetime (10% to 90%) should be 5 nsec or less.

12. Replace the Compensating Box Cover.

High-Frequency Compensation Procedure (Later models)

1. Set the oscilloscope sweep rate for 2 msec/cm and the triggering controls for + external trigger. Set the amplitude calibrator for a 2-volt output.

2. Connect the probe tip to the center conductor of the oscilloscope calibrator output connector. Adjust the triggering controls for a stable display.

3. Set the 9-35 pf capacitor (C104) in the minimum capacitance position so that the dis-

play shows maximum spike.

4. Adjust the compensating capacitor in the probe body by rotating the probe body with respect to the probe base until a square leading corner is obtained.

5. Now set C104 so that the leading edge of the calibrator output pulse has an amplitude of 1.9 cm.

6. Adjust the compensating capacitor in the probe body as in step 4.

7. Connect the charge line to the pulser. Terminate the charge line with the 50-ohm BNC-to-BNC Termination. Connect the probe to the termination with the Probe-to-BNC Adapter.

8. Set the sweep rate of the oscilloscope to 0.05 μsec/cm. Set the pulser amplitude for 2 cm deflection, using the center two centimeters of the graticule.

9. Adjust R104 until the ringing disappears and a bump appears right after the leading edge of the waveform.

10. Adjust L103 for best leading edge.

11. Adjust L104 for best waveform.

12. Set the sweep rate of the oscilloscope for 0.2 μsec/cm and adjust R104 for a level top of the pulse.

13. Set the oscilloscope sweep rate to 0.05 μsec/cm and check to see if the top of the pulse appears as a straight line with no steps in the first 10 nsec. If not, repeat steps 10 to 13.

14. Replace the cover on the compensating box and tighten the nut.

15. With a sweep of 2 msec/cm and the 5X Magnifier in the OFF position, touch the probe tip to the calibrator output and adjust the capacitor on the probe body for best square-wave response.

SECTION 5
PARTS LIST AND SCHEMATIC

HOW TO ORDER PARTS

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

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

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

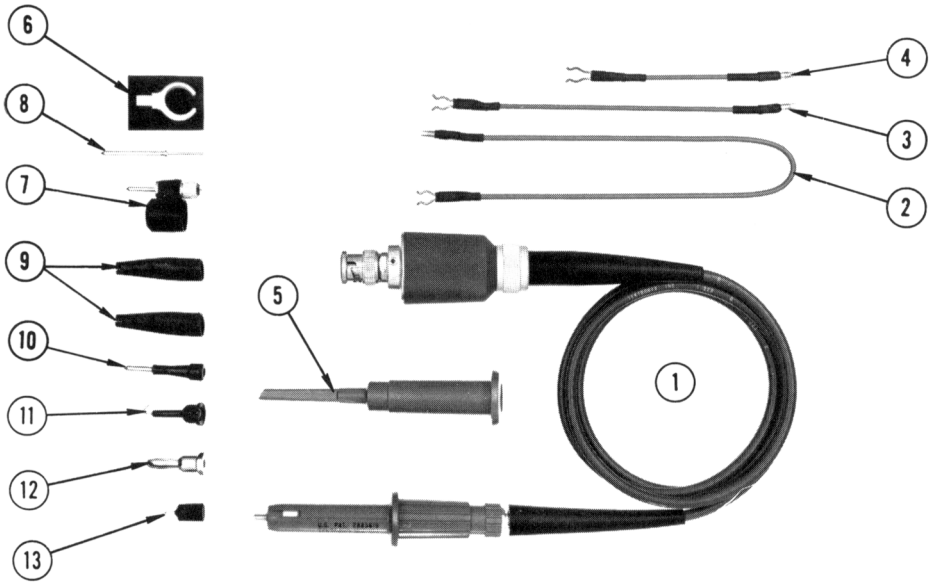
ABBREVIATIONS

BHS	Binding Head Steel	p	Pico, or 10^{-12}
f	Farad	PHS	Pan Head Steel
K or k	Kilohms, or kilo (10^3)	Var.	Variable
M or meg	Megohms, or mega (10^6)	w	Watt
Ω	Ohm	w/	With

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number.
000X	Part removed after this serial number.
*000-000	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, also reworked or checked components.
Use 000-000	Part number indicated is direct replacement.
	Internal screwdriver adjustment.

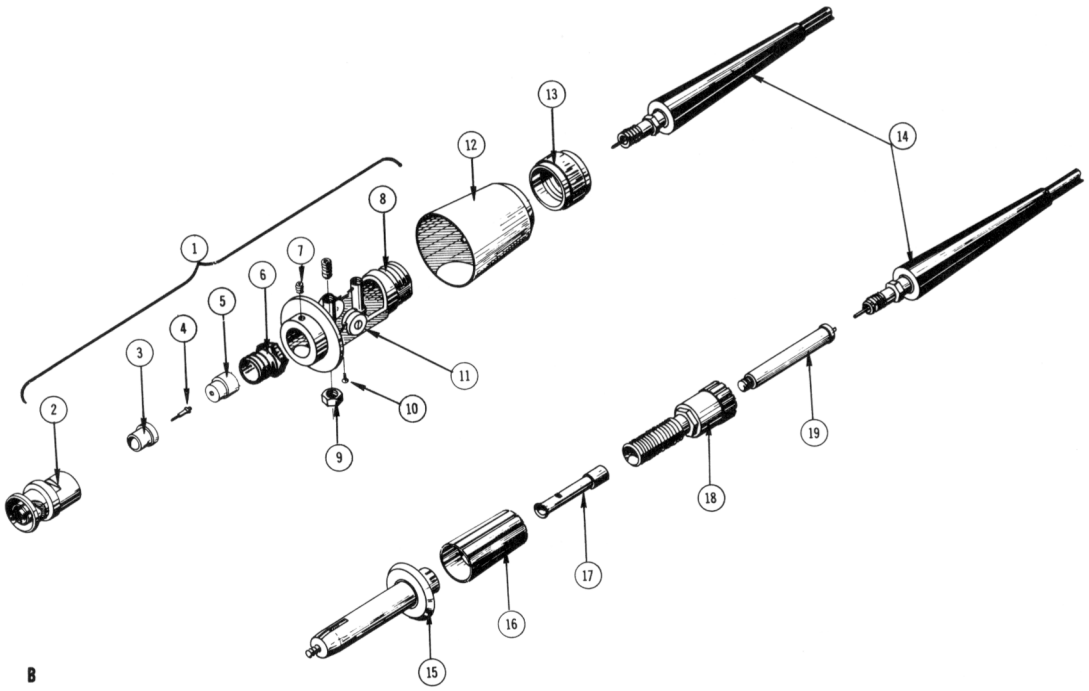
PROBE WITH ACCESSORIES



B

REF. NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
	PROBE PACKAGE				
1—13	010-0129-00			1	PROBE PACKAGE, P6008
	- - - - - -			-	probe package includes:
	PROBE ONLY				
1	010-0130-00			1	PROBE, P6008
	STANDARD ACCESSORIES				
2	175-0125-00			1	CABLE, ground lead, 12 inches
3	175-0124-00			1	CABLE, ground lead, 5 inches
4	175-0263-00			1	CABLE, ground lead, 3 inches
5	013-0071-00			1	PINCHER TIP
6	352-0068-00			1	HOLDER, probe
7	013-0052-00			1	ADAPTER, bayonet
	- - - - - -			-	adapter includes:
8	214-0325-00			1	PIN, center
9	344-0046-00			2	CLIP, probe
10	206-0060-00			1	TIP, probe, male
11	206-0105-00			1	TIP, probe
12	134-0013-00			1	PLUG, banana, female
13	206-0015-00			1	TIP, w/straight shank
	070-0362-01			1	MANUAL, instruction (not shown)

REPLACEABLE PARTS



REF. NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
	010-0130-00			1	PROBE, P6008
	- - - - - -			-	probe includes:
1	202-0116-00			1	BOX, Compensating, assembly (wired)
	- - - - - -			-	box includes:
2	134-0044-00			1	PLUG, probe, BNC
3	358-0072-00			1	BUSHING, insulator
4	214-0109-00			1	PIN, probe contact, male
5	166-0217-00			1	TUBE, spacer insulator
6	132-0081-00			1	NUT, BNC
7	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
8	204-0147-00			1	BODY, Compensating
9	210-0577-00			2	NUT, hex., 9/32-32 x 3/8 inch
10	213-0121-00			1	SCREW, 0-80 x 3/32 inch, RHS
11	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
	210-0504-00			2	NUT, hex., 0-80 x 5/32 inch
12	205-0046-00			1	SHELL, Compensating
13	210-0576-00			1	NUT, locking
14	175-0262-00			1	CABLE, assembly, 3.5 ft
15	204-0144-00			1	ASSEMBLY, body (with resistor)
16	166-0285-00			1	SLEEVE, locking
17	166-0282-00			1	SLEEVE
18	358-0194-00			1	BUSHING, base
19	358-0192-00			1	BUSHING, inner base

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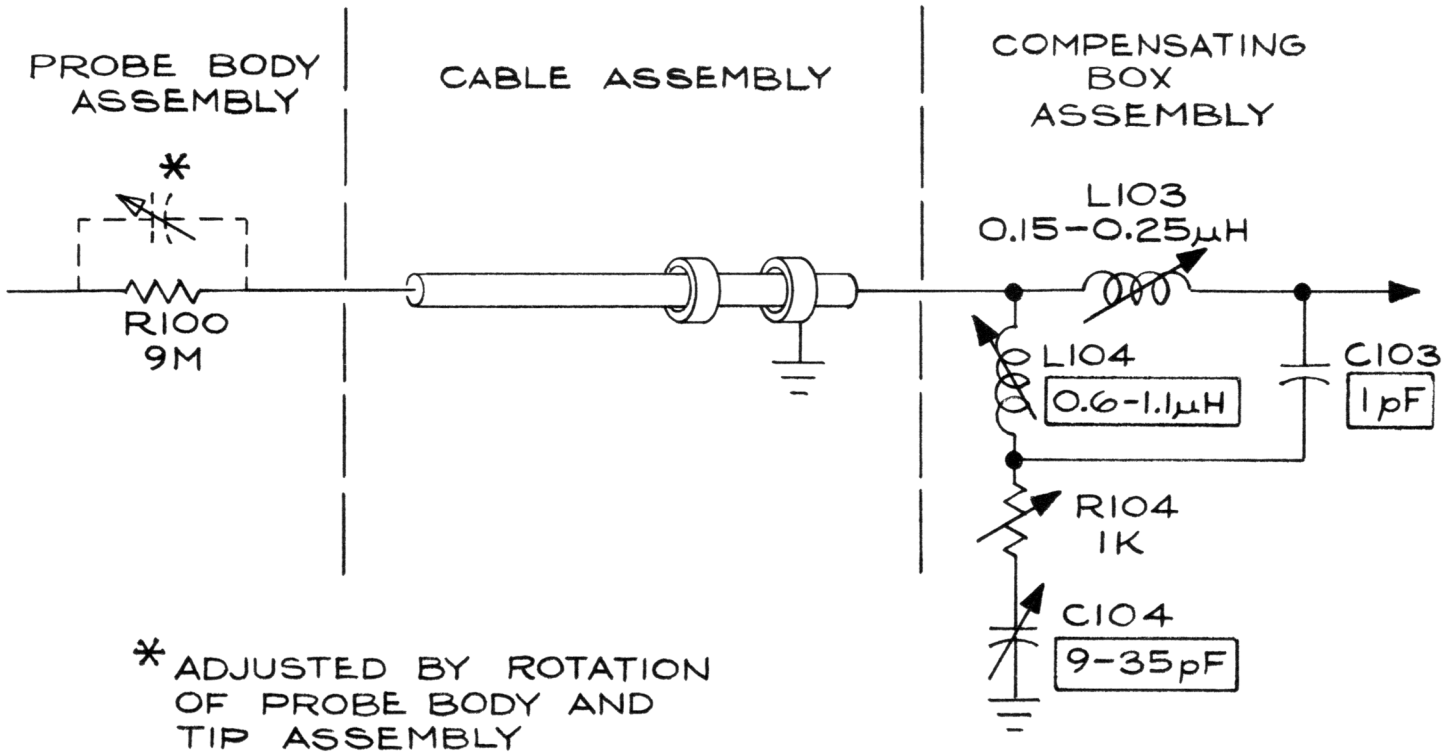
ELECTRICAL PARTS

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Description			Code	Date
		Capacitors				
C103	281-0599-00	1 pF	Cer	200 V ±0.25 pF		X6237-up
C104	281-0060-00	2-8 pF	Cer	Var		-6236
C104	281-0063-00	9-35 pF	Cer	Var		6237-up
		Inductors				
L103	*114-0153-00	0.15-0.25 μH		Var	Core 276-0506-00	
L104	*114-0154-00	0.8-1.5 μH		Var	Core 276-0506-00	-6236
L104	*114-0156-00	0.6-1.1 μH		Var	Core 276-0506-00	6237-up
		Resistors				
R100[1]		9 MΩ				
R104	311-0249-00	1 kΩ		Var		

[1]Furnished as a unit with *204-0144-00 (Probe Body and Tip Assembly).

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* ADJUSTED BY ROTATION OF PROBE BODY AND TIP ASSEMBLY

▭ PARTS CHANGED FROM EARLY MODEL

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P6008 PROBE

NOTES

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