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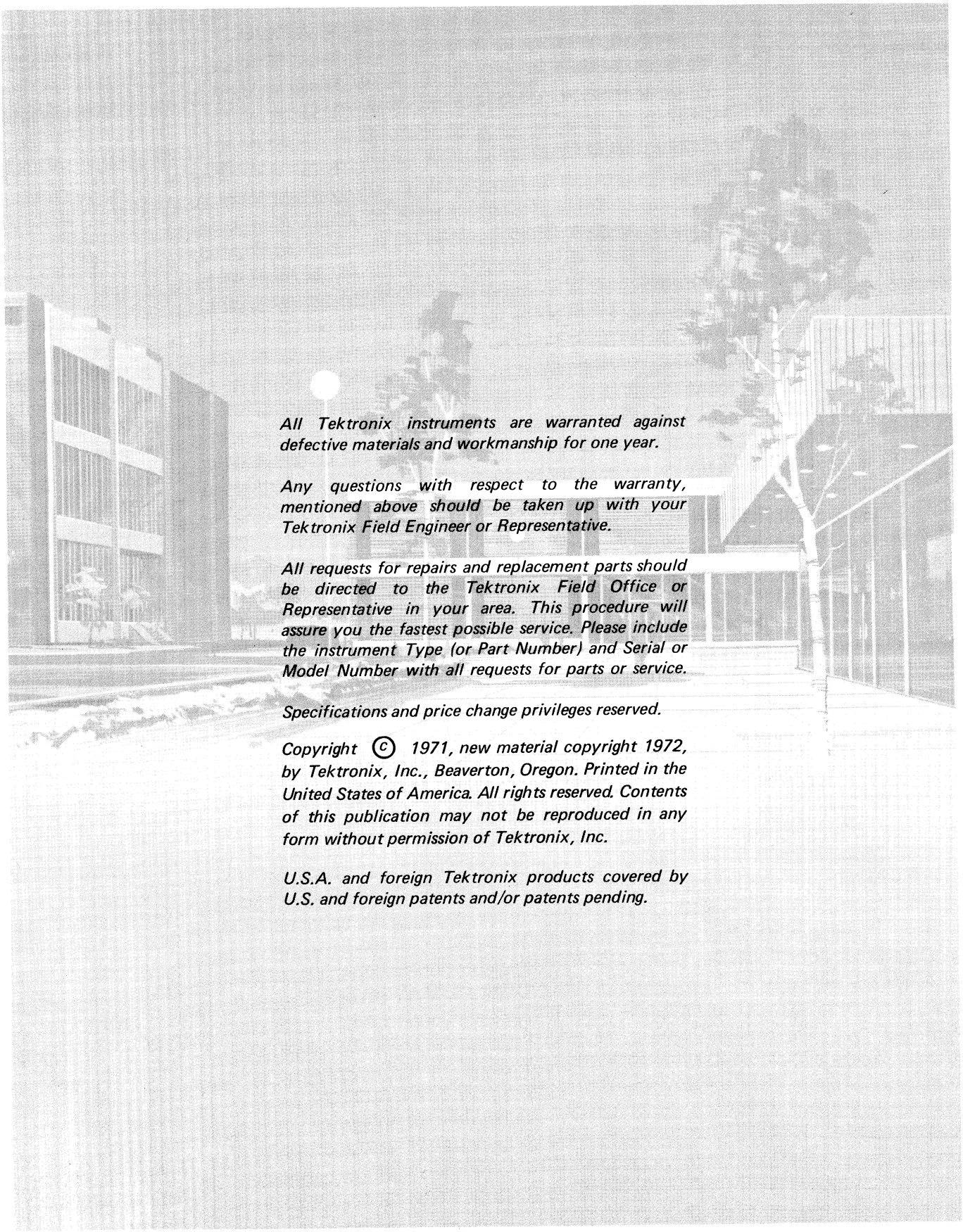
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TEKTRONIX®

P6053A PROBE

010-6053-01

INSTRUCTION MANUAL



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 or Representative.

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 (or Part Number) and Serial or Model Number with all requests for parts or service.

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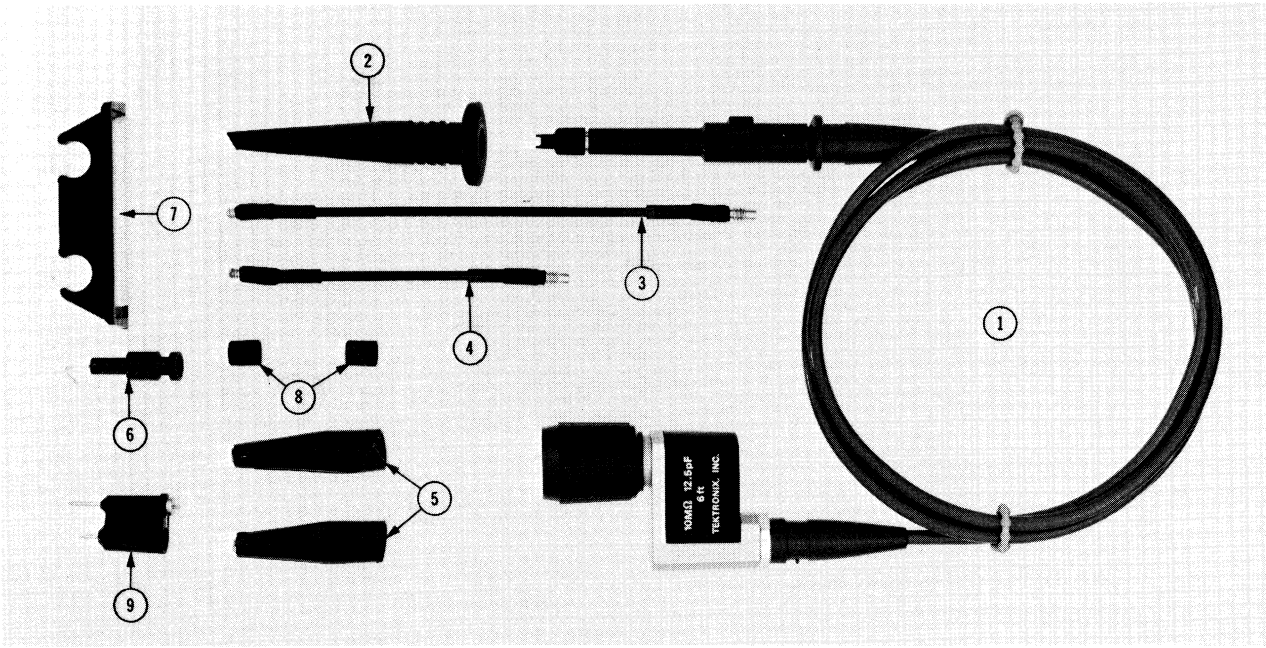


Fig. 1. P6053A Probe and Standard Accessories.

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5	Description
1	010-6053-01			1		PROBE PACKAGE, P6053A, 3.50 foot
thru	010-6053-03			1		PROBE PACKAGE, P6053A, 6 foot
9	010-6053-05			1		PROBE PACKAGE, P6053A, 9 foot
	- - - - - - - - - -			-		probe package includes:
						PROBE ONLY
1	010-6053-00			1		PROBE, P6053A, 3.50 foot
	010-6053-02			1		PROBE, P6053A, 6 foot
	010-6053-04			1		PROBE, P6053A, 9 foot
						ACCESSORIES
2	013-0107-03			1		TIP, probe, retractable hook
3	175-0848-01			1		LEAD, electrical, 5.25 inches long
4	175-0848-00			1		LEAD, electrical, 3.25 inches
5	344-0046-00			2		CLIP, probe, alligator type
6	206-0114-00			1		TIP, probe, hooked
	352-0234-00		3972	1		HOLDER, probe, plastic
7	352-0351-00	4072		1		HOLDER, probe, plastic
8	166-0404-01			2		TUBE, insulating, plastic
9	013-0085-00			1		TIP, probe grounding

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P6053A PROBE

CHARACTERISTICS

General Information

The P6053A is a miniature, passive, fast-rise, 10X attenuation probe designed for use with Tektronix 7A-series vertical amplifier plug-in units. The probe can be compensated for use with other oscilloscopes or plug-in units having an input capacitance of 15 to 24 pF (paralleled by 1 MΩ).

A trace identification pushbutton on the body of the probe permits the user to determine which trace of a multitrace display includes the signal from the P6053A Probe. A coding ring on the BNC output connector actuates the Volts/Div readout of the oscilloscope mainframe to include the 10X attenuation of the probe. The connector is compatible with all BNC input connectors.

The probe consists of a small-diameter probe body assembly, a 3.5-foot, 6-foot, or 9-foot cable, and a compensation box with a BNC connector.

SPECIFICATIONS

Electrical

Probes Dated Before 4072 (wk-yr) Attenuation: 10X within 3%, including 1 MΩ. ±2% amplifier input.

Input Resistance: 10 MΩ within 2%, including input R of amplifier. See X_p, R_p vs. Frequency Curves.

Probes Dated After 4072 (wk-yr) Attenuation: 10X, ±3% (oscilloscope input, 1 MΩ ±2%); 10X, ±0.4% (oscilloscope input, 1 MΩ ±0.15%).

Input Resistance: 10 MΩ, within 0.4% (oscilloscope input 1 MΩ ±2%); 10 MΩ, within 0.25% (oscilloscope input 1 MΩ ±0.15%).

Input Capacitance: 3.5-foot cable; 9.5 pF, ±0.5 pF. 6-foot cable; 12.5 pF, ±0.5 pF. 9-foot cable, 13.5 pF, ±0.5 pF.

Compensation Range: 15 pF or less to at least 24 pF.

Bandwidth (−3 dB):
(With an oscilloscope having a bandwidth of ⩾150 MHz) 3.5-foot and 6-foot cables, ≈150 MHz. 9-foot cable, ≈115 MHz.

Maximum Input Voltage: 500 V (DC + peak AC), derated with frequency. See derating curves.

General

Weight: With 3.5-foot cable; ≈5 ounces (141.8 grams) net. Shipping, ≈12 ounces.
With 6-foot cable; ≈5.25 ounces (148.8 grams) net. Shipping, ≈12.5 ounces.
With 9-foot cable; ≈5.5 ounces (155.9 grams) net. Shipping, ≈13 ounces.

Dimensions:

PROBE BODY: ≈3.7 inches (9.4 cm), length. ≈0.45 inch (1.1 cm), maximum outside diameter.

CABLE: Length; ≈3.5 feet (1.1 meters), ≈6 feet (1.8 meters), or ≈9 feet (2.7 meters) between strain relief bases.

COMPENSATION BOX: Length; ≈1.7 inches (4.3cm). Width; ≈0.6 inch (1.5cm). Height; ≈1.2 inches (3.0cm).

Environmental:

The probe will operate within specifications over the following ranges; Temperature, −15°C to +75°C. Altitude, to 15,000 feet.

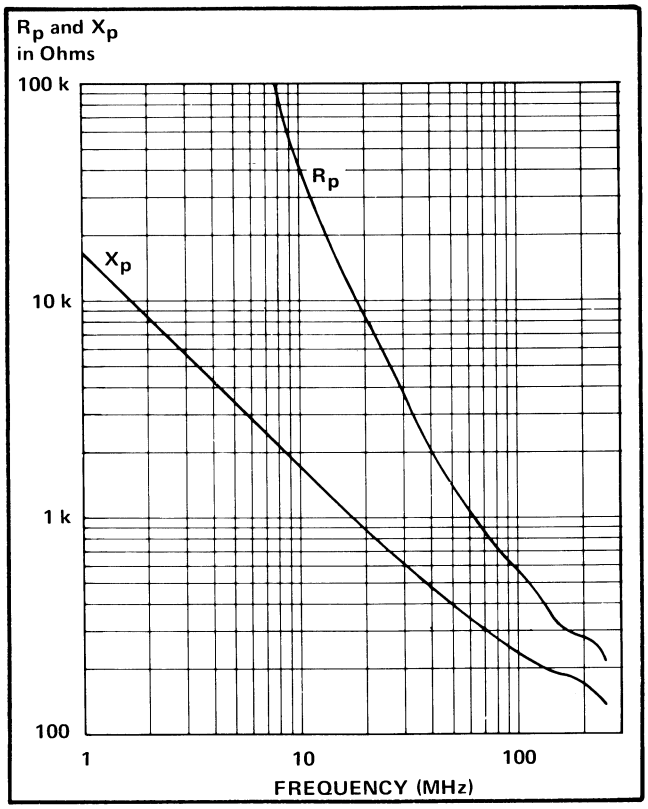


Fig. 2. P6053A Probe (3.5-foot cable), typical X_p, R_p versus frequency curves.

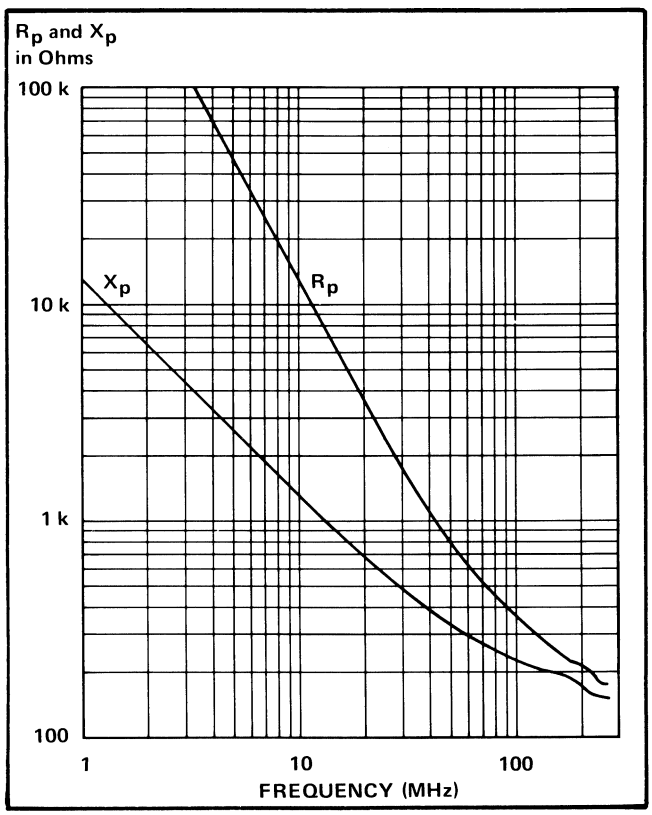


Fig. 3. P6053A Probe (6-foot cable), typical X_p, R_p versus frequency curves.

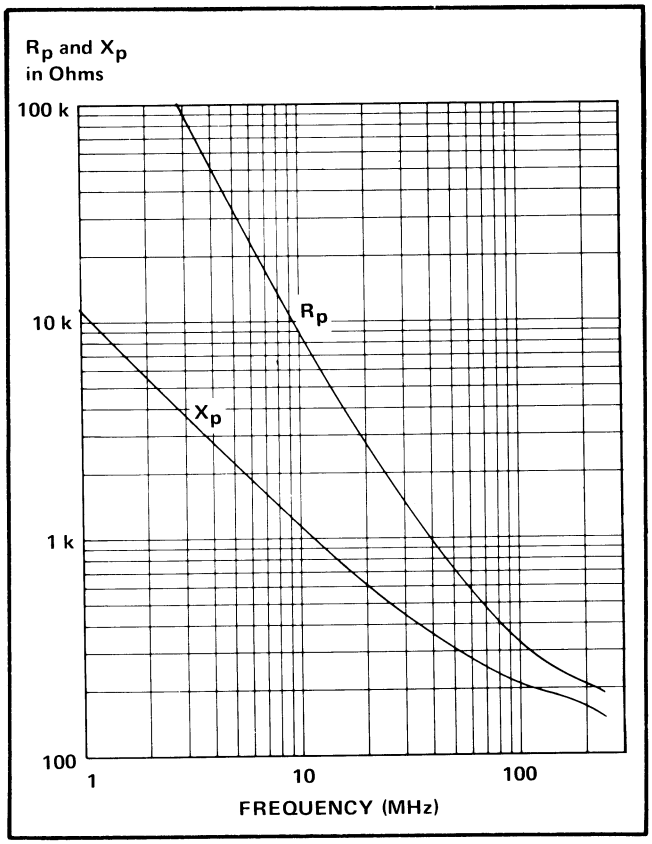


Fig. 4. P6053A Probe (9-foot cable), typical X_p, R_p versus frequency curves.

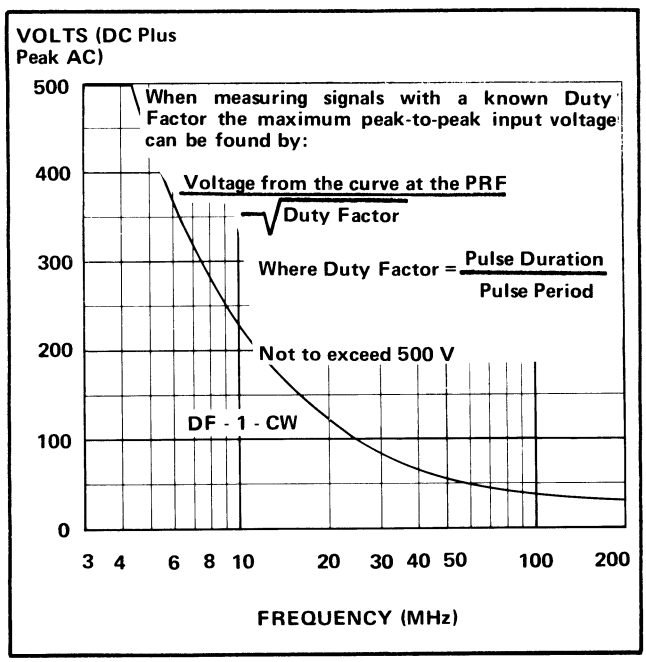


Fig. 5. P6053A Probe, typical voltage derating with frequency curve.

OPERATING INSTRUCTIONS[1]

Probe Compensation

Due to slight variations in the input capacitance between oscilloscope input amplifiers (even of the same type), it is usually necessary to compensate the probe whenever it is transferred from one instrument to another, or from one channel to another of dual (multi-trace) units. Improper compensation will produce waveshape distortion and/or amplitude measurement error of the display. See Compensation Procedure for method of adjustment.

Maximum Input Voltage

The maximum allowable input voltage of the P6053A Probe is 500 V (DC + peak AC) at the low-frequency end of its range. As signal frequency increases, input capacitive reactance decreases and the maximum safe input voltage decreases. Fig. 5 shows the typical voltage derating vs. frequency curve.

Circuit Loading

Although the DC input resistance of the P6053A is 10 MΩ, it can load any high-impedance circuit it is connected into, and distort the true waveform present. To minimize this loading effect, select the lowest impedance points to check waveforms. As signal frequency increases, the equivalent probe input impedance decreases because of the input capacitance of the probe. Therefore, the probe loading increases with frequency. Figs. 2, 3, and 4 show R_p and X_p as a function of frequency. These curves should be referred to when making measurements of AC signals, especially in high-impedance circuits.

Probe Grounding

A passive probe such as the P6053A is a capacitive divider for high-frequency components. An inductance introduced by a long ground lead will form a series resonant circuit which will "ring" if driven by a signal containing significant frequency components at or above circuit resonance. These oscillations can appear on the oscilloscope display and distort the true waveform.

Ground leads and probe tip connections should be kept as short as possible to minimize chances of "ringing."

[1] **Measurement Concept Booklet; Probe Measurements, Tektronix Part Number 062-1120-00 is a recommended treatise on probe use and measurement evaluation.**

MAINTENANCE

General

The P6053A Probe is built to withstand normal usage, but may be damaged if treated carelessly. Avoid kinking or straining the cable or subjecting the probe to extreme environmental conditions. When not in use, the probe should be stored in a drawer, or supported by the plastic holder supplied with the probe.

If the probe is damaged, replacement parts are available through your local Tektronix Field Office or representative. The mechanical and electrical parts lists at the rear of this manual provide the Tektronix part numbers and descriptions for the components.

Substitution of non-standard parts is not advisable if the original performance is to be restored. Even shortening the cable by more than a few percent will have a noticeable effect on the transient response of the probe. The resistive center conductor has been specifically selected for critical damping of reflections that would otherwise exist.

Connector Replacement

1. Remove the snap-fit cover on the compensation box. See Fig. 6 for instructions.

2. Unsolder the center conductor and the insulated lead from the connector to the circuit board.

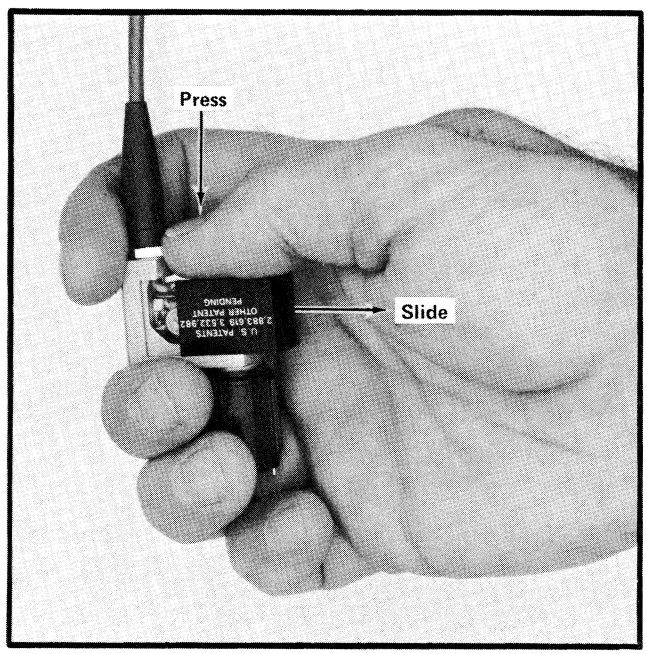


Fig. 6. Removal of compensation box cover.

3. Loosen the 1/4-inch nut with a wrench and remove the nut.

4. Pull off the connector and install the new connector. Then perform steps 1 through 3 above in reverse order. Take care not to damage the insulated lead when tightening the nut.

Cable Replacement

1. Remove the snap-fit cover on the compensation box.

2. Unsolder the cable center conductor and the small copper lead from the circuit board.

3. Remove the 7/16-inch cable bushing from the compensation box.

4. Unscrew the probe body from the cable.

5. Unsolder the cable center conductor from the resistor/capacitor lead (located in the probe head).

6. Pull the resistor/capacitor assembly from the holder.

7. Insert the resistor/capacitor assembly into the holder of the new probe cable and re-assemble the probe, reversing the procedure given in steps 1 through 6 above.

COMPENSATION PROCEDURE

Introduction

The P6053A Probe is a stable device and does not require frequent re-calibration. However, if the probe is transferred from one instrument or input channel to another, the low-frequency compensation will usually require readjustment. If the probe is to be used in observing or measuring sine-waves or pulses with frequency components above 3 or 4 MHz, high-frequency compensation should be checked and adjusted as necessary.

Equipment and Test Fixtures Required

The following list of equipment, or its equivalent, is required to perform the complete compensation procedure. Some of the recommended equipment specifications may exceed requirements; however, substitute equipment must meet or exceed these minimum specifications.

1. Test oscilloscope system with 150 MHz or greater bandwidth. A Tektronix 7704A with a 7A16A Amplifier and a 7B70 Time Base unit are used in this procedure.

2. Pulse or Square Wave Generator; pulse risetime $\leq$ 1 ns, amplitude 0.5 V into 50 Ω; Tektronix Type 106 Square Wave Generator is recommended.

3. Cable, 5 ns, 50 Ω coaxial Type RG58C/U with GR connectors; Tektronix Part No. 017-0502-00.

4. Attenuator, 10X, 50 Ω with GR connectors; Tektronix Part No. 017-0078-00.

5. Termination, 50 Ω thru-line, GR-to-BNC male; Tektronix Part No. 017-0083-00.

6. Termination Adapter, 50 Ω Probe tip-to-GR; Tektronix Part No. 017-0088-00.

Preliminary Procedure

a. Install the P6053A Probe on the 7A16A Amplifier Input connector.

b. Turn the test oscilloscope and associated test equipment power on and allow enough warmup time for the equipment to stabilize.

c. Set the test oscilloscope Volts/Div to 10 mV, the Time/Div to 1 ms, and the Calibrator for a 0.4 V 1 kHz signal.

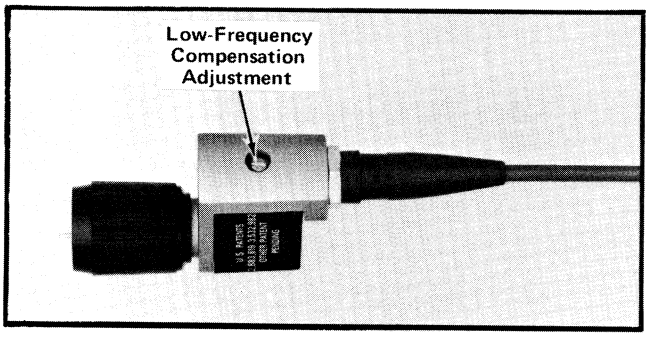


Fig. 7. Location of probe low-frequency compensation adjustment.

1. Adjust Low-Frequency Compensation

a. Connect the probe tip to the test oscilloscope 0.4 V calibrator output.

b. Set the test oscilloscope triggering controls for a stable triggered display. The display should be approximately ten cycles of square wave with an amplitude of 4 divisions.

c. Adjust the probe compensation (C8, see Fig. 7) for optimum flat top on the square wave. Fig. 8 illustrates the correct and incorrect settings of the adjustment.

2. Check/Adjust High-Frequency Compensation

Typical Response—Pulse waveform distortion (aberrations) should not exceed +3%, −3%, or 3% P-P.

a. Disconnect the P6053A Probe from the test oscilloscope.

b. Connect the +Output of the Type 106 Square Wave Generator through a 5 ns, 50 Ω cable, a GR 10X attenuator, and a 50 Ω thru-line termination with GR-to-BNC connectors to the 7A16A Amplifier Input connector.

c. On the Type 106, set the Repetition Rate Range switch to 100 kHz, the Multiplier control to 1, and the Hi Amplitude/Fast Rise switch to Fast Rise.

d. Set the test oscilloscope Time/Div to 0.02 μs. Volts/Div remains at 10 mV.

e. Adjust the +Transition Amplitude control on the Type 106 for a pulse amplitude of 5 divisions.

f. Note the pulse shape and aberrations.

g. Remove the 50 Ω cable, 10X attenuator, and termination from the Type 106 and the test oscilloscope. Install the P6053A Probe on the 7A16A Amplifier Input connector.

h. Connect the probe tip to the +Output of the Type 106, using a Probe tip-to-GR Termination Adapter.

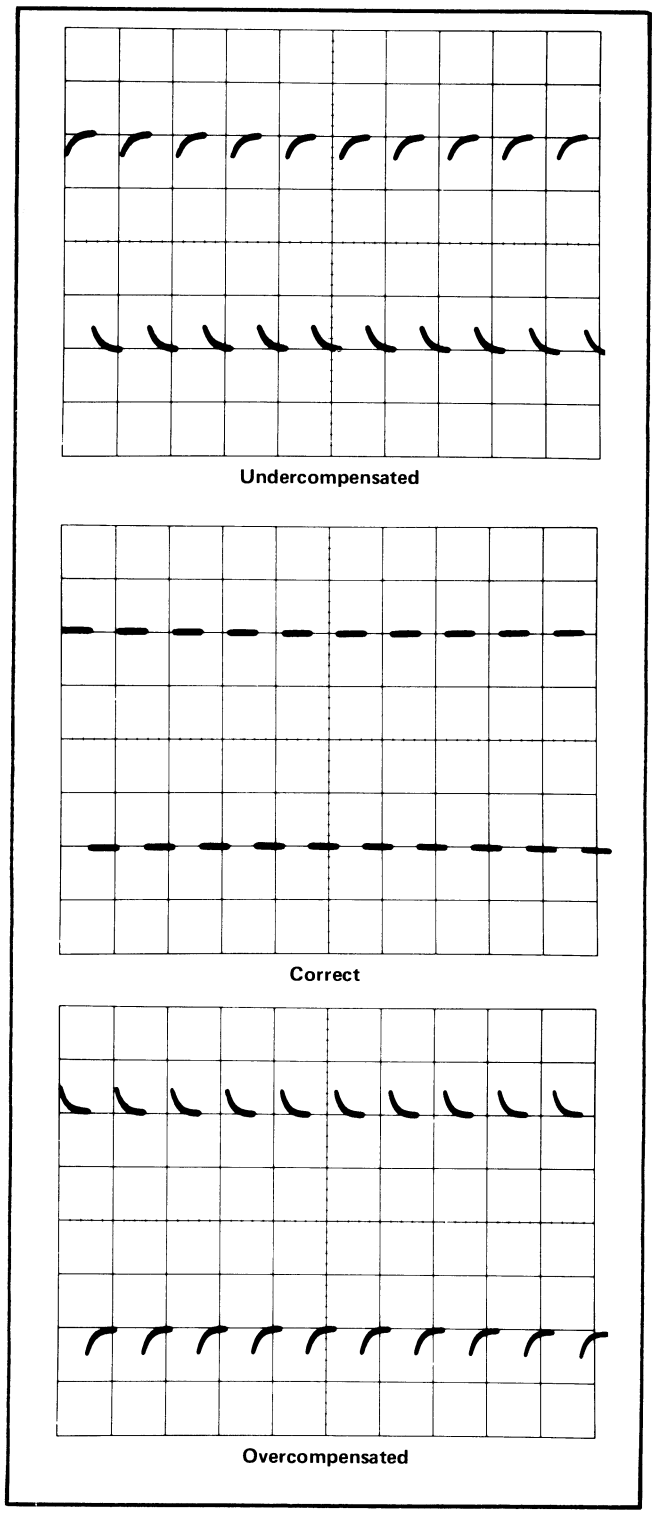


Fig. 8. Probe low-frequency compensation.

i. Check the high-frequency response by comparing the probe/oscilloscope pulse response against the display noted in step f. Aberrations from the reference response should not exceed +3%, −3%, or 3% P-P of the pulse amplitude (or 0.15 div).

j. If aberrations are excessive, proceed as follows:

1) Remove the compensation box cover. (See Fig. 6 for directions).

2) Adjust R5 and R6 (also R9 with the 6-ft and 9-ft probes) for the best overall flat response. See Fig. 9 for adjustment locations.

3) Adjust C6 for the best corner response (without ringing).

4) Repeat parts 2 and 3 as necessary for best waveform.

5) Recheck the waveform with the compensation box cover installed. Perform adjustments as necessary to obtain the correct waveform after the cover is installed.

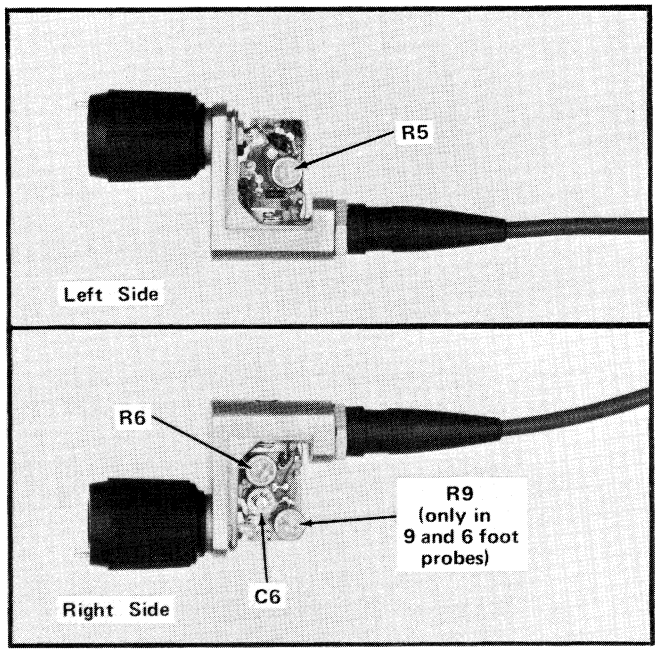
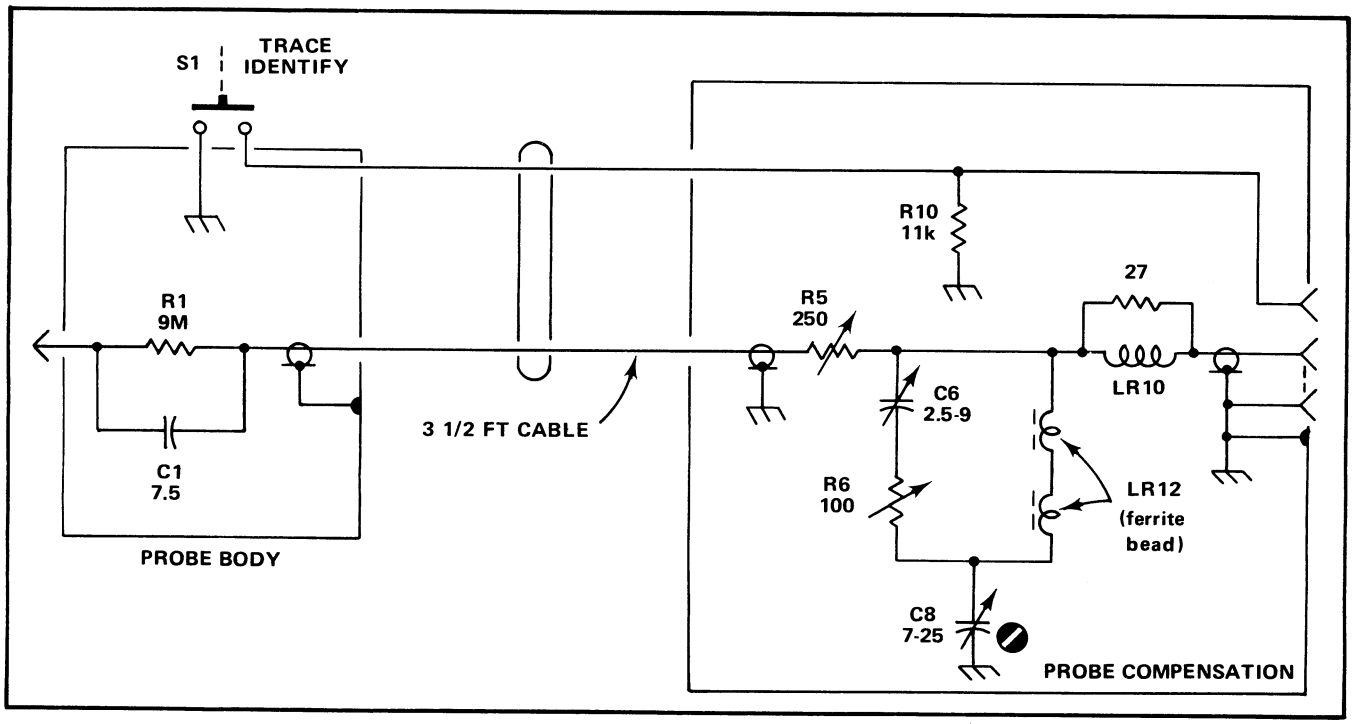


Fig. 9. Location of high-frequency compensation adjustments.

This completes the compensation procedure for the P6053A Probe.

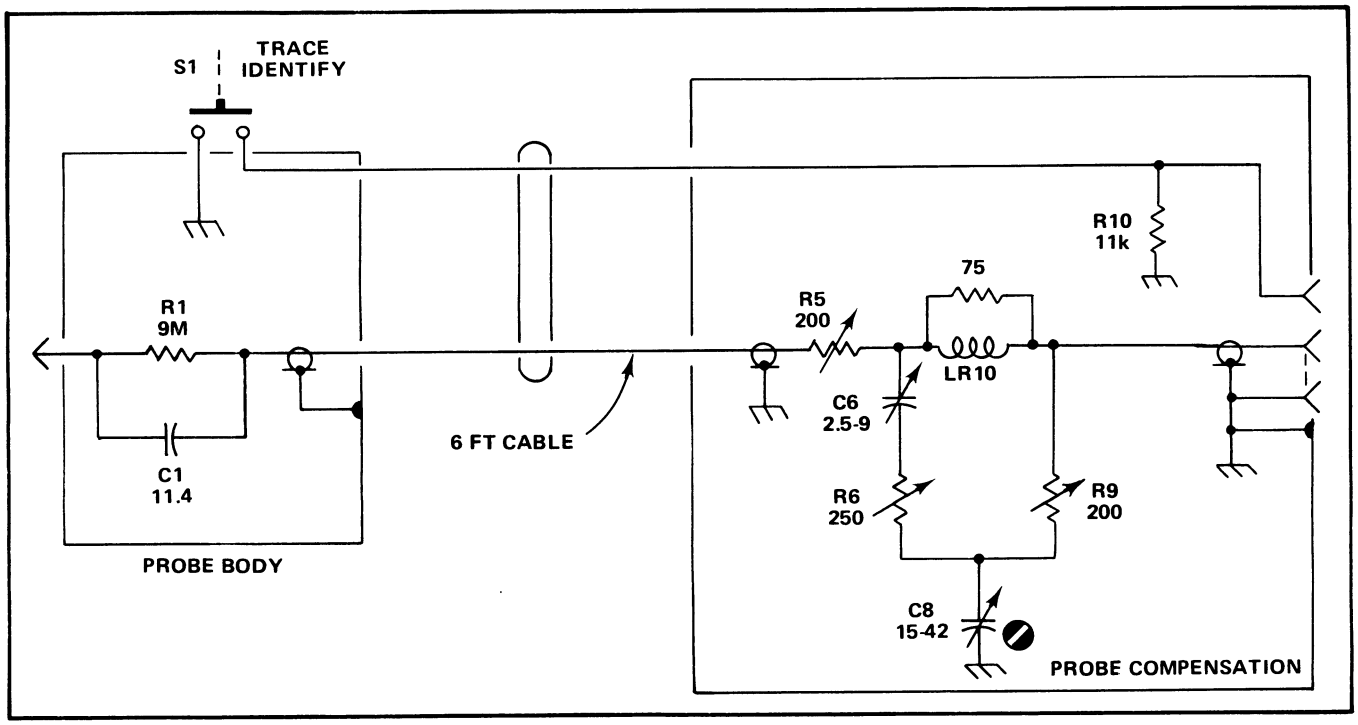
ELECTRICAL PARTS LIST
3.5 Foot Probe



Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
				3.5 FOOT PROBE		
				Capacitors		
C1[1]				7.5 pF	Cer	500 V ±0.1 pF
C6	281-0122-00			2.5–9 pF, Var	Cer	100 V
C8	281-0160-00			7–25 pF, Var	Cer	350 V
				Inductors		
LR10	108-0601-00			60 nH (wound on a 27 Ω, 1/8 W, 5% resistor)		
LR12 (2)	276-0507-00			Core, ferramic suppressor		
				Resistors		
R1[1]				9 MΩ	1/4 W	0.1%
R5	311-0978-01			250 Ω, Var		
R6	311-0622-01			100 Ω, Var		
R10	317-0113-00			11 kΩ	1/8 W	5%

[1] Available as assembly 206-0206-00 only.

ELECTRICAL PARTS LIST (cont)
6 Foot Probe

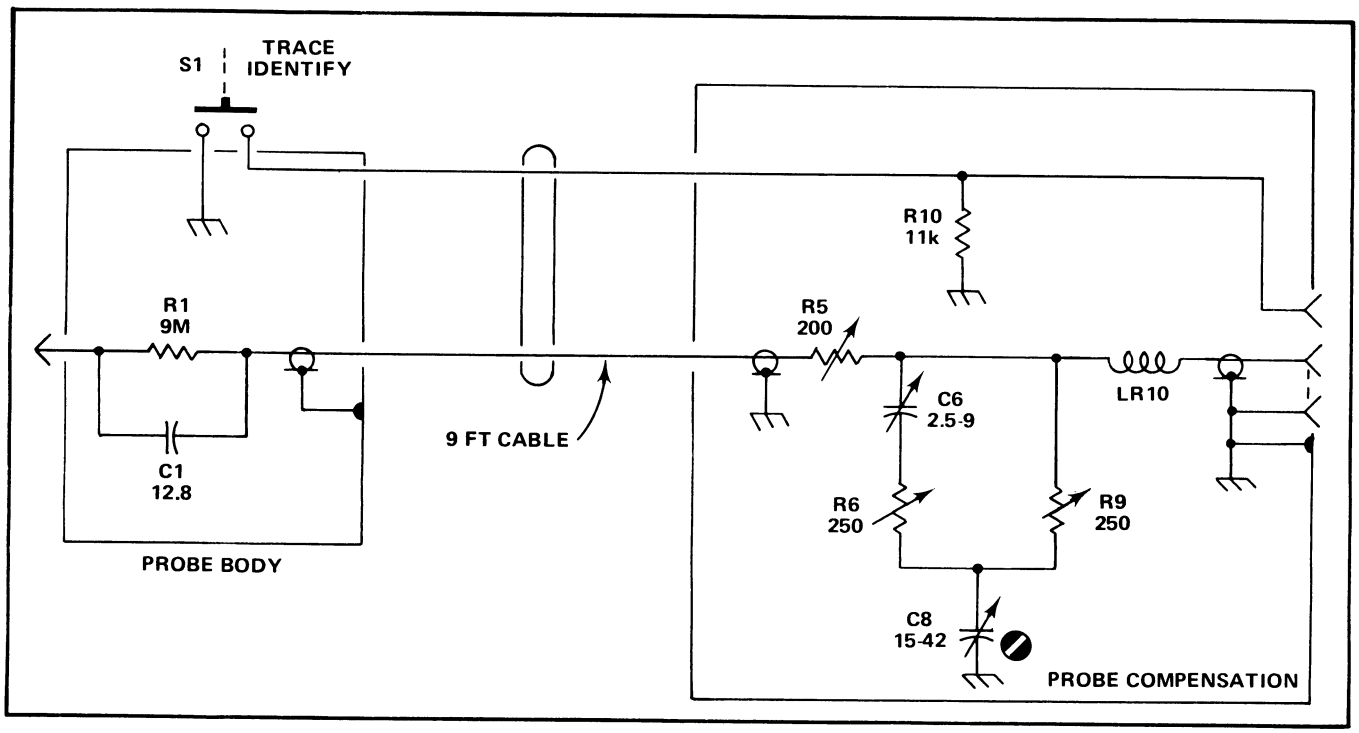


Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
				6 FOOT PROBE		
				Capacitors		
C1[1]				11.4 pF	Cer	500 V 1%
C6	281-0122-00			2.5–9 pF, Var	Cer	100 V
C8	281-0167-00			15–42 pF, Var	Cer	200 V
				Inductor		
LR10	108-0602-00			60 nH (wound on a 75 Ω, 1/8 W, 5% resistor)		
				Resistors		
R1[1]				9 MΩ	1/4 W	0.1%
R5	311-0605-01			200 Ω, Var		
R6	311-0978-01			250 Ω, Var		
R9	311-0605-01			200 Ω, Var		
R10	317-0113-00			11 kΩ	1/8 W	5%

[1] Available as assembly 206-0204-00 only.

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ELECTRICAL PARTS LIST (cont)
9 Foot Probe



Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				9 FOOT PROBE			
				Capacitors			
C1[1]				12.8 pF	Cer	500 V	1%
C6	281-0122-00			2.5–9 pF, Var	Cer	100 V	
C8	281-0167-00			15–42 pF, Var	Cer	200 V	
				Inductor			
LR10	108-0682-00			66 nH (wound on a 15 MΩ, 1/8 W, 5% resistor)			
				Resistors			
R1[1]				9 MΩ	1/8 W		0.1%
R5	311-0605-01			200 Ω, Var			
R6	311-0978-01			250 Ω, Var			
R9	311-0978-01			250 Ω, Var			
R10	317-0113-00			11 kΩ	1/8 W		5%

[1] Available as assembly 206-0205-00 only.

MECHANICAL PARTS LIST

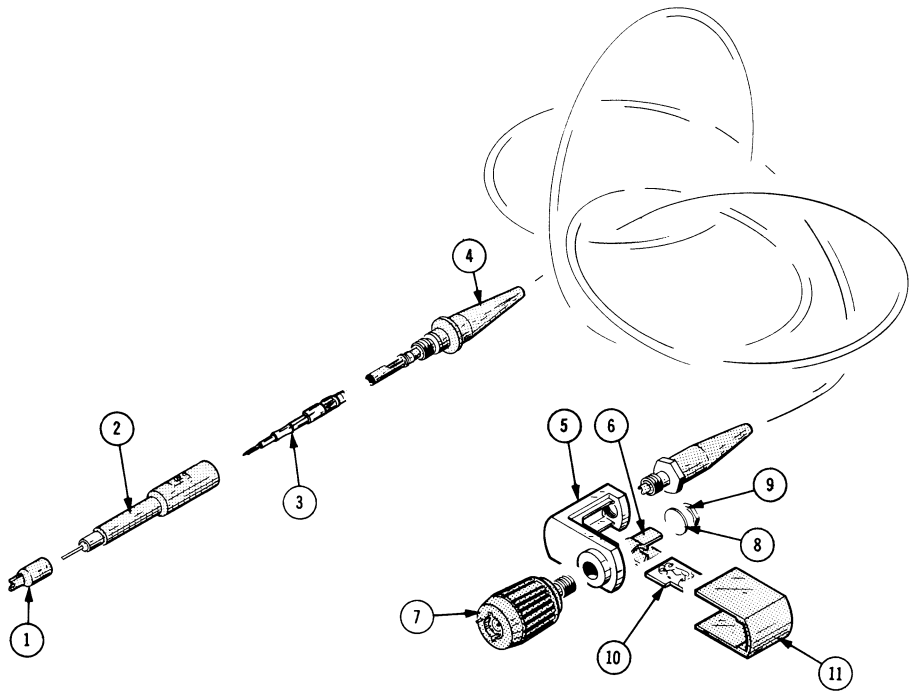


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5	Description
	010-6053-00			1		PROBE, P6053A, 3.50 foot
	010-6053-02			1		PROBE, P6053A, 6 foot
	010-6053-04			1		PROBE, P6053A, 9 foot
	- - - - - - - - - -			-		probe includes:
1	015-0201-00			1		PROBE TIP, IC test
2	204-0429-01			1		BODY ASSEMBLY, probe
3	206-0206-00			1		ATTENUATOR ASSEMBLY (for 3.50 foot only)
	206-0204-00			1		ATTENUATOR ASSEMBLY (for 6 foot only)
	206-0205-00			1		ATTENUATOR ASSEMBLY (for 9 foot only)
4	175-1101-01			1		CABLE ASSEMBLY, electrical, w/eyelet (for 3.50 foot only)
	175-1139-01			1		CABLE ASSEMBLY, electrical, w/eyelet (for 6 foot only)
	175-1311-00			1		CABLE ASSEMBLY, electrical, w/eyelet (for 9 foot only)
5	426-0690-04			1		FRAME, compensation box
6	354-0396-00			1		RING, capacitor mounting
7	131-1070-00			1		CONNECTOR, electrical, w/readout
	- - - - - - - - - -			-		mounting hardware: (not included w/connector)
8	210-0056-00			1		WASHER, lock, split, # 10
9	220-0572-00			1		NUT, hex., 10-32
10	670-1655-00			1		CIRCUIT BOARD ASSEMBLY (for 3.50 foot only)
	670-1656-00			1		CIRCUIT BOARD ASSEMBLY (for 6 foot only)
	670-1657-00			1		CIRCUIT BOARD ASSEMBLY (for 9 foot only)
11	200-1158-13			1		COVER, compensation box (for 3.50 foot only)
	200-1158-11			1		COVER, compensation box (for 6 foot only)
	200-1158-12			1		COVER, compensation box (for 9 foot only)
	070-1233-00			1		MANUAL, instruction (not shown)

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