

Instruction Manual

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P6012 PROBE

010-0203-00

Type P6012

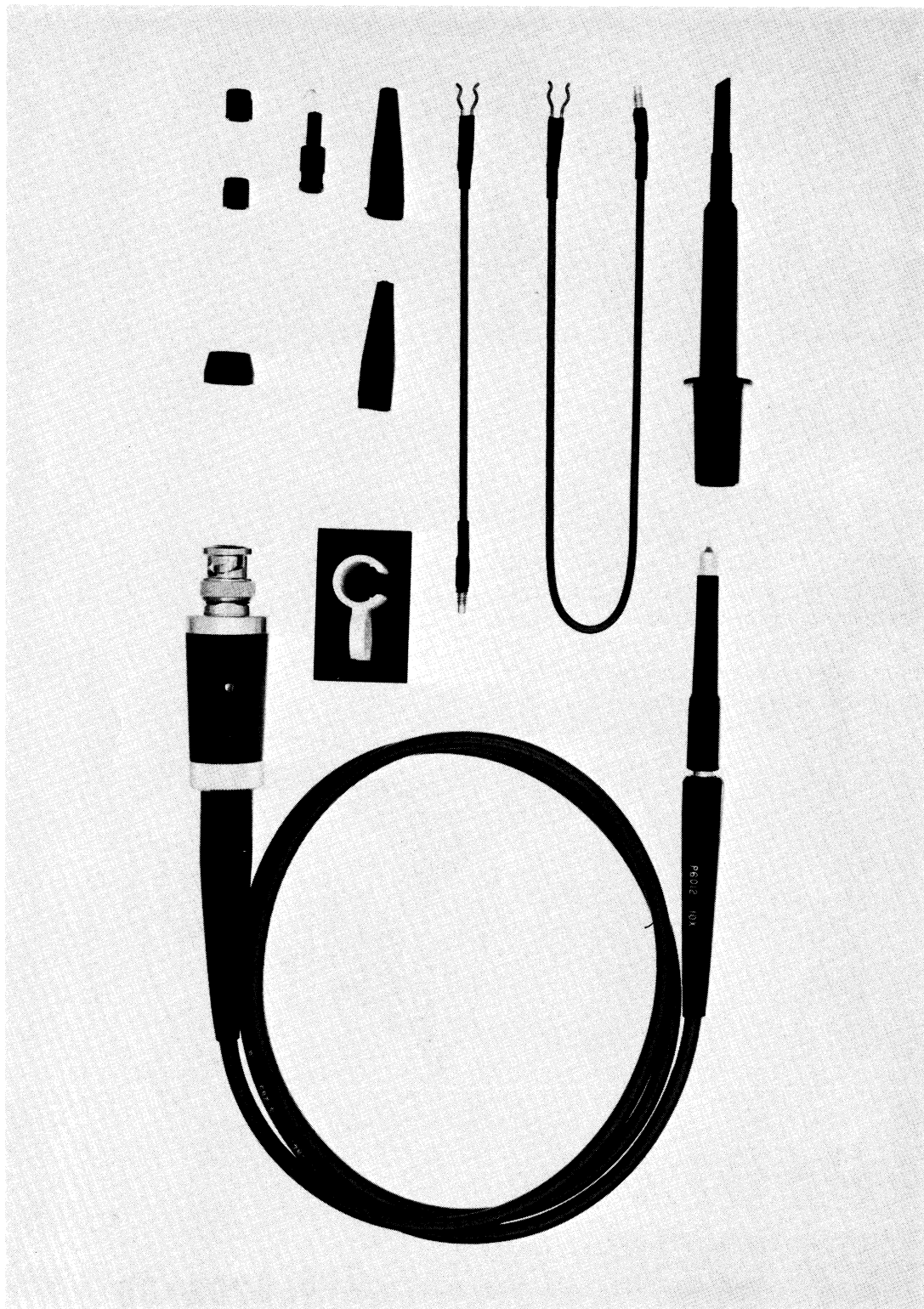


Fig. 1-1. P6012 Probe with standard accessories.

SECTION 1

CHARACTERISTICS

General Information

The P6012 is a passive probe with $10\times$ attenuation of signals, and consists of a probe body assembly, a 3.5-foot, 6-foot or 9-foot cable, and a compensating box with a BNC connector. The small diameter probe body can be used comfortably in compact circuitry.

The probe is designed for use with oscilloscopes or plug-in units having a 1-megohm input paralleled by 15 to 47 picofarads, and is compensated to match the instrument being used by adjusting the variable capacitor through the hole in the compensating box cover.

CHARACTERISTICS

Input Impedance

The input impedance of the probe is 10 megohms paralleled by ≤ 11.5 picofarads with the 3.5-foot cable, ≤ 14.5 picofarads with the 6-foot cable, and ≤ 17.5 picofarads with the 9-foot cable (measured at 140 kHz). See Figs. 1-2, 1-3 and 1-4 for input impedance vs. frequency curves.

Attenuation

Attenuation is $10\times$, $\pm 3\%$ with plug-in or oscilloscope.

Voltage Rating

The maximum DC or AC peak input voltage is 500 volts. See Figs. 1-5, 1-6 and 1-7 for derating curves.

Bandwidth

The probe is designed for use with systems having a bandwidth of DC to 33 MHz.

Transient Response

The risetime of the probe is ≤ 5 nanoseconds with the 3.5-foot cable, ≤ 6 nanoseconds with the 6-foot cable, and ≤ 6.5 nanoseconds with the 9-foot cable. (This does not include the risetime of the test oscilloscope.)

Maximum ringing, rounding and overshoot is within $+1.5\%$ and -1.5% ; total of $\leq 2\%$ peak to peak. (Using a test oscilloscope with a bandwidth greater than 33 MHz may cause aberrations in excess of 2% peak to peak.)

Environmental Capability

The probe operates normally at temperatures from 0 to 50 degrees C, and at altitudes to 15,000 feet.

Connecting Cable

The cable is made with a special resistive center conductor which provides critical damping of reflections.

Weight

The total weight of the probe is 3.7 ounces with the 3.5-foot cable, 4.3 ounces with the 6-foot cable, and 5 ounces with the 9-foot cable.

Characteristics—P6012

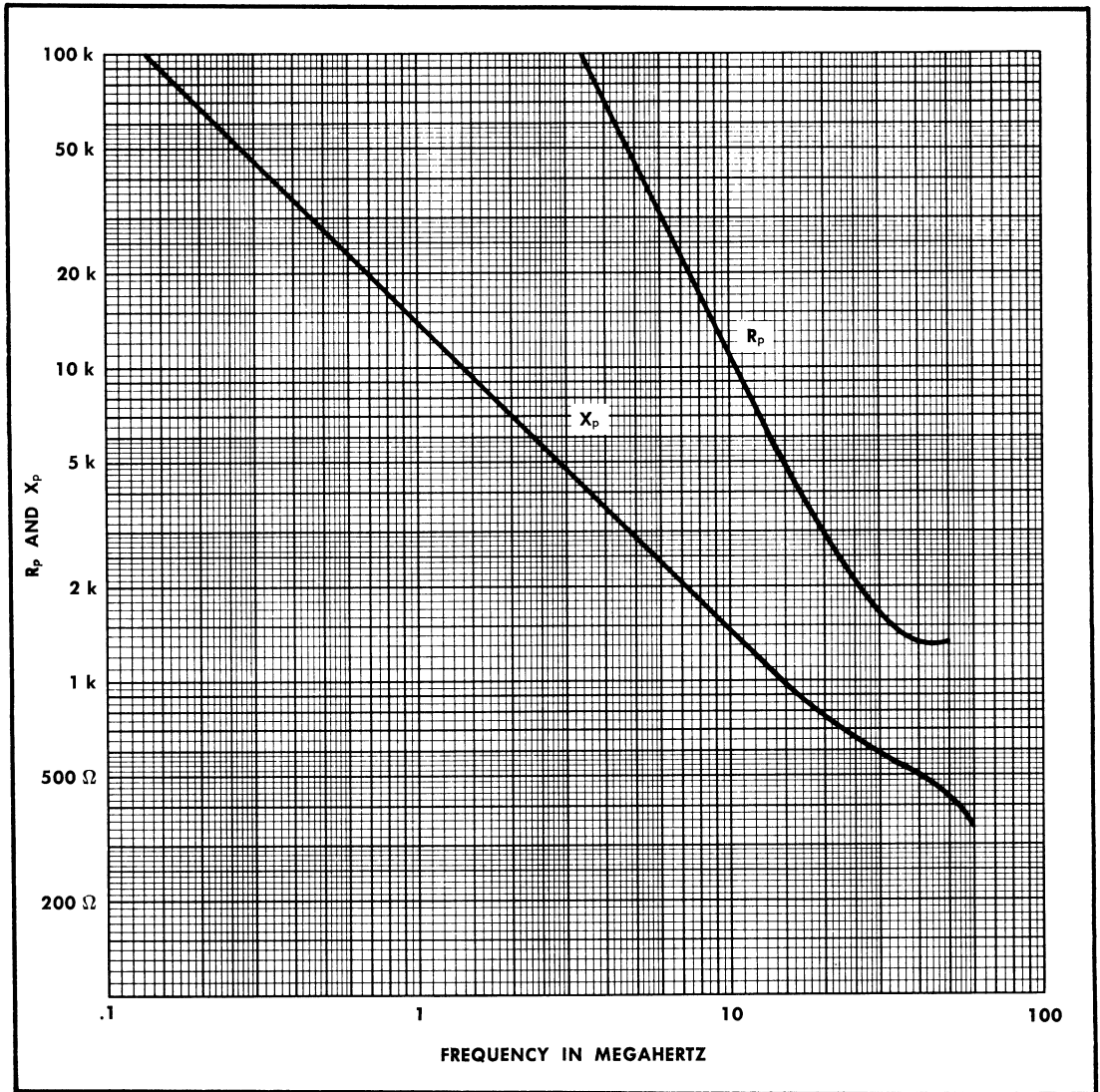


Fig. 1-2. P6012 Input Resistance and Reactance versus Frequency curves (3.5-ft. cable).

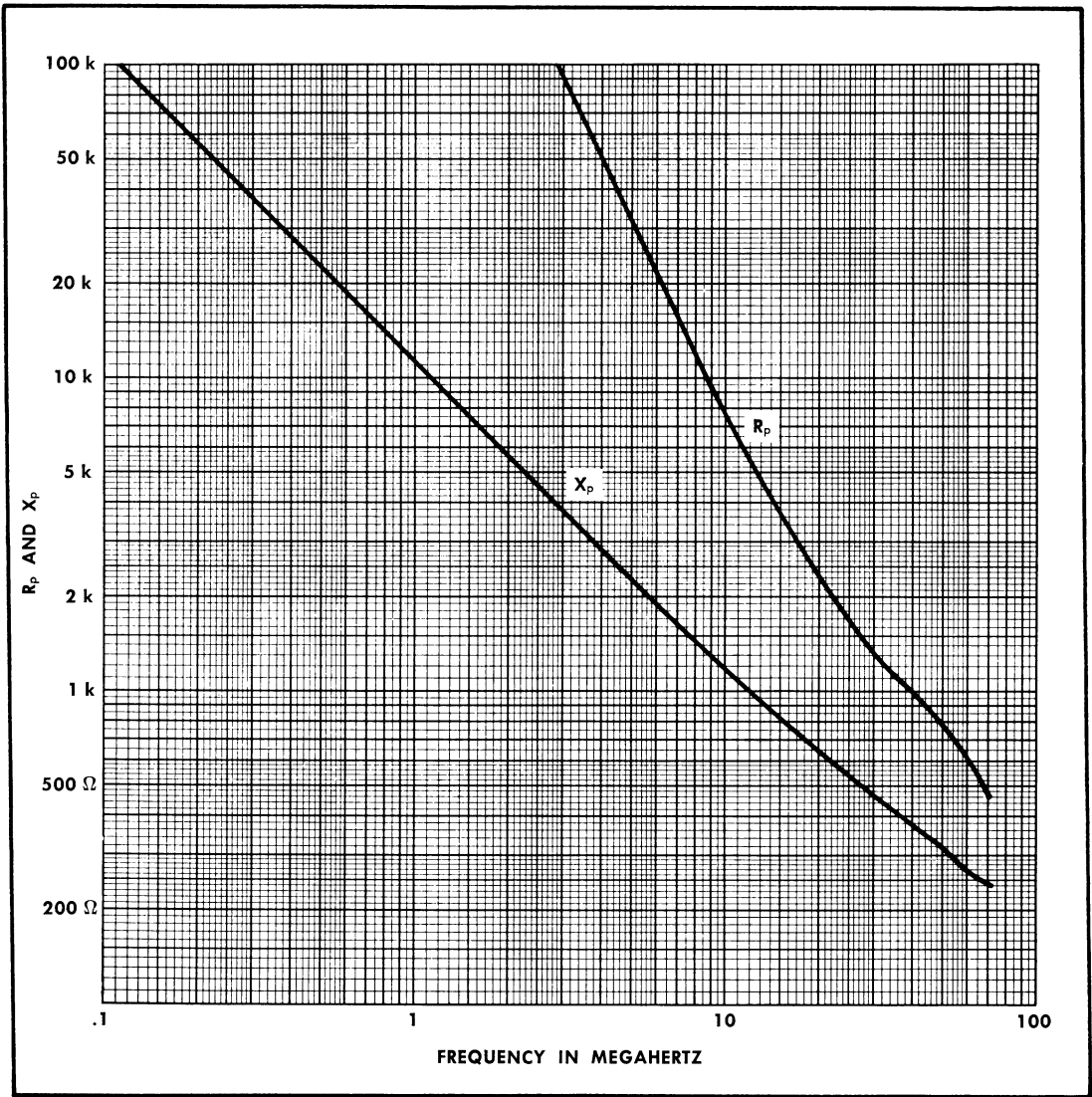


Fig. 1-3. P6012 Input Resistance and Reactance versus Frequency curves (6-ft. cable).

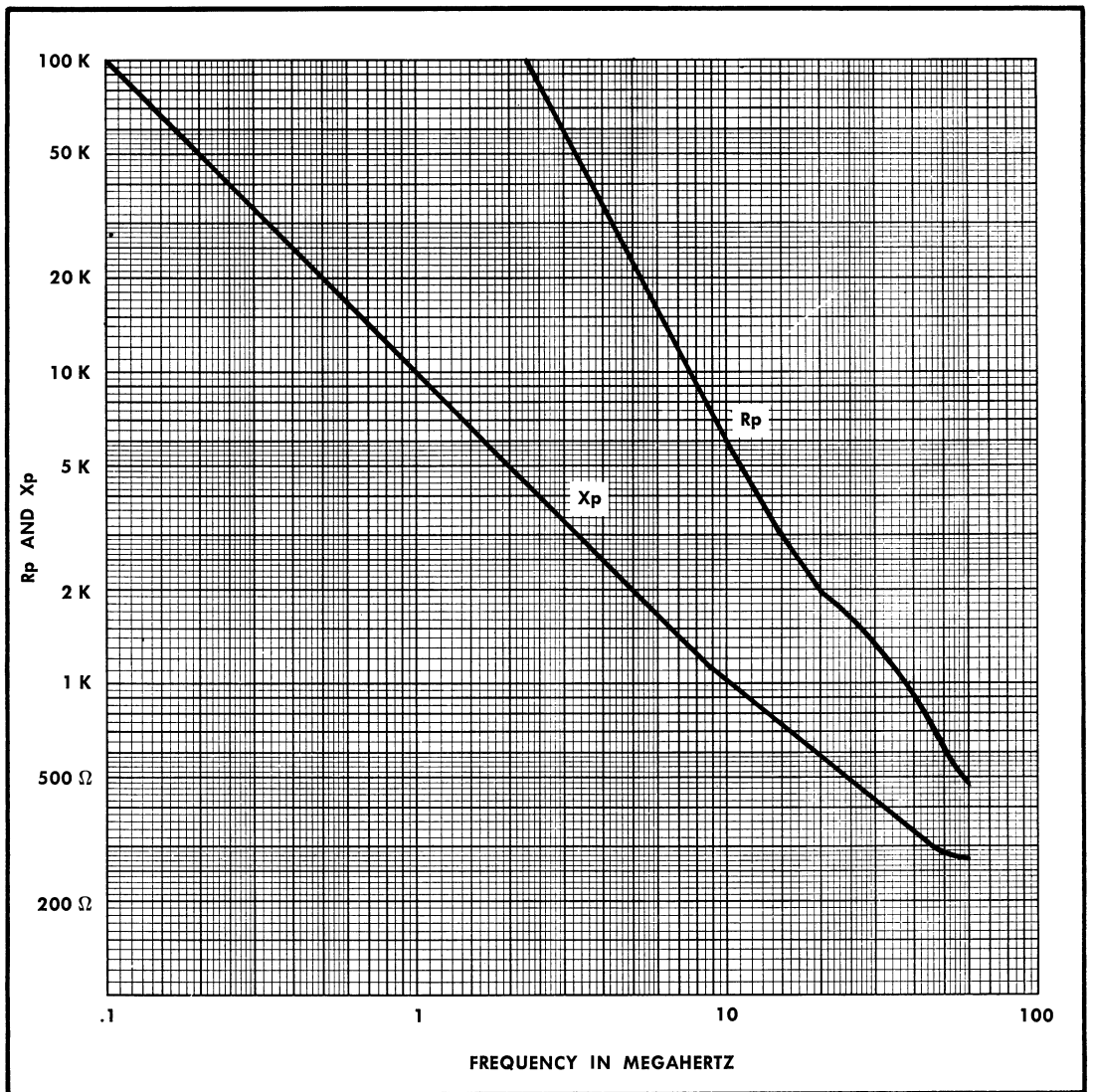


Fig. 1-4. P6012 Input Resistance and Reactance versus Frequency curves (9-ft. cable).

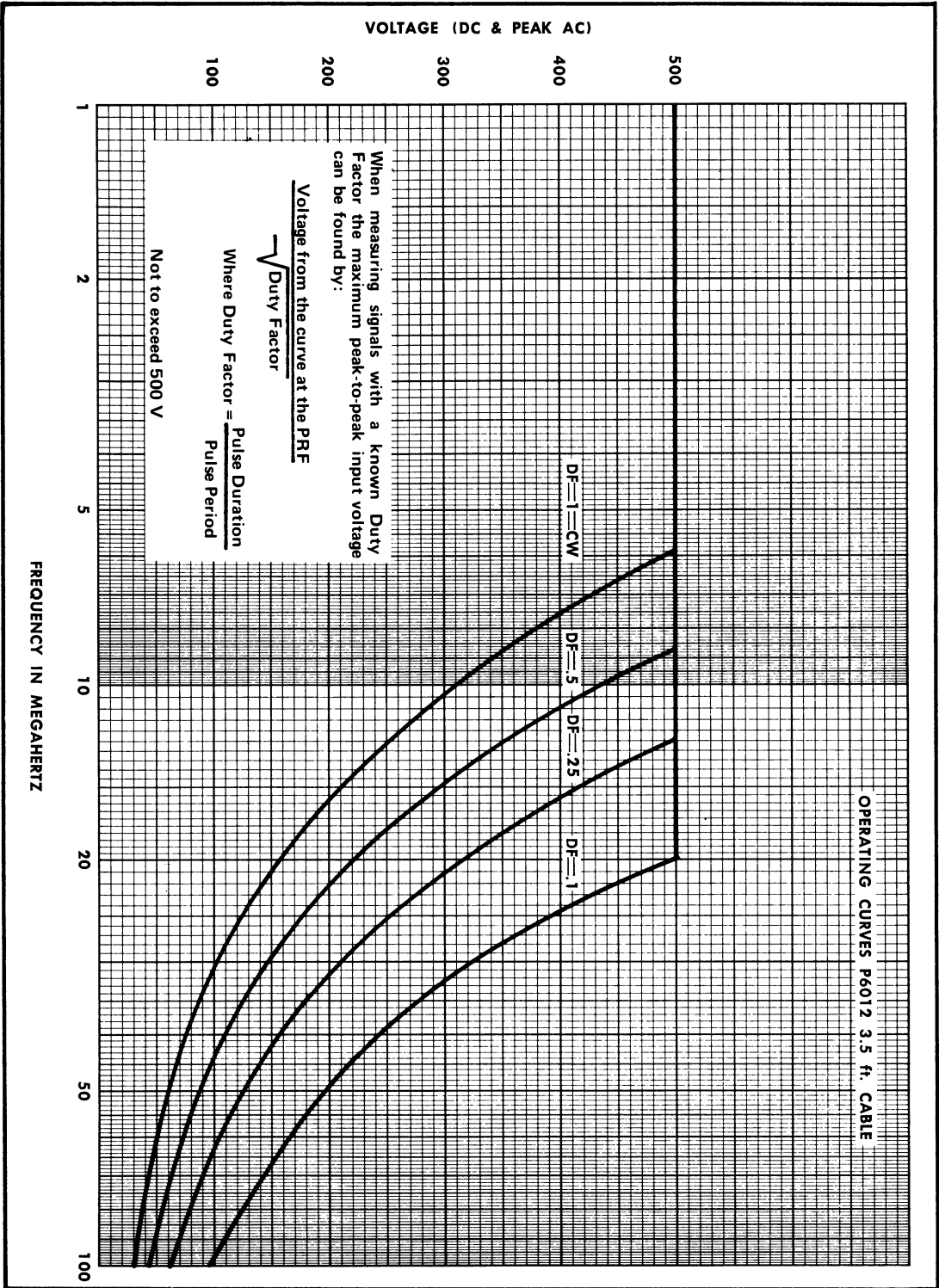


Fig. 1-5. Maximum Applied Voltage at Specific Duty Factors (3.5-ft. cable).

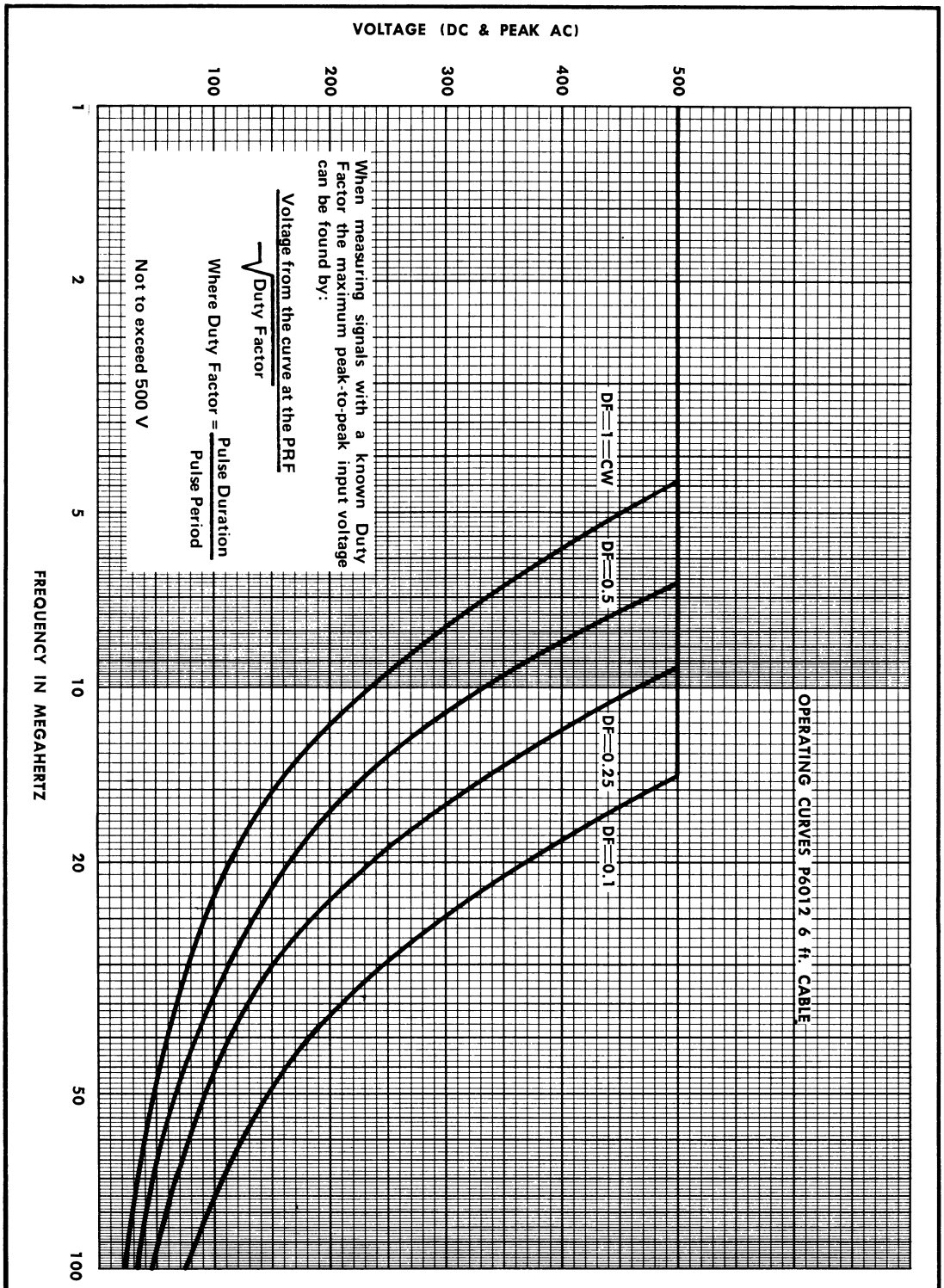


Fig. 1-6. Maximum Applied Voltage at Specific Duty Factors (6-ft. cable).

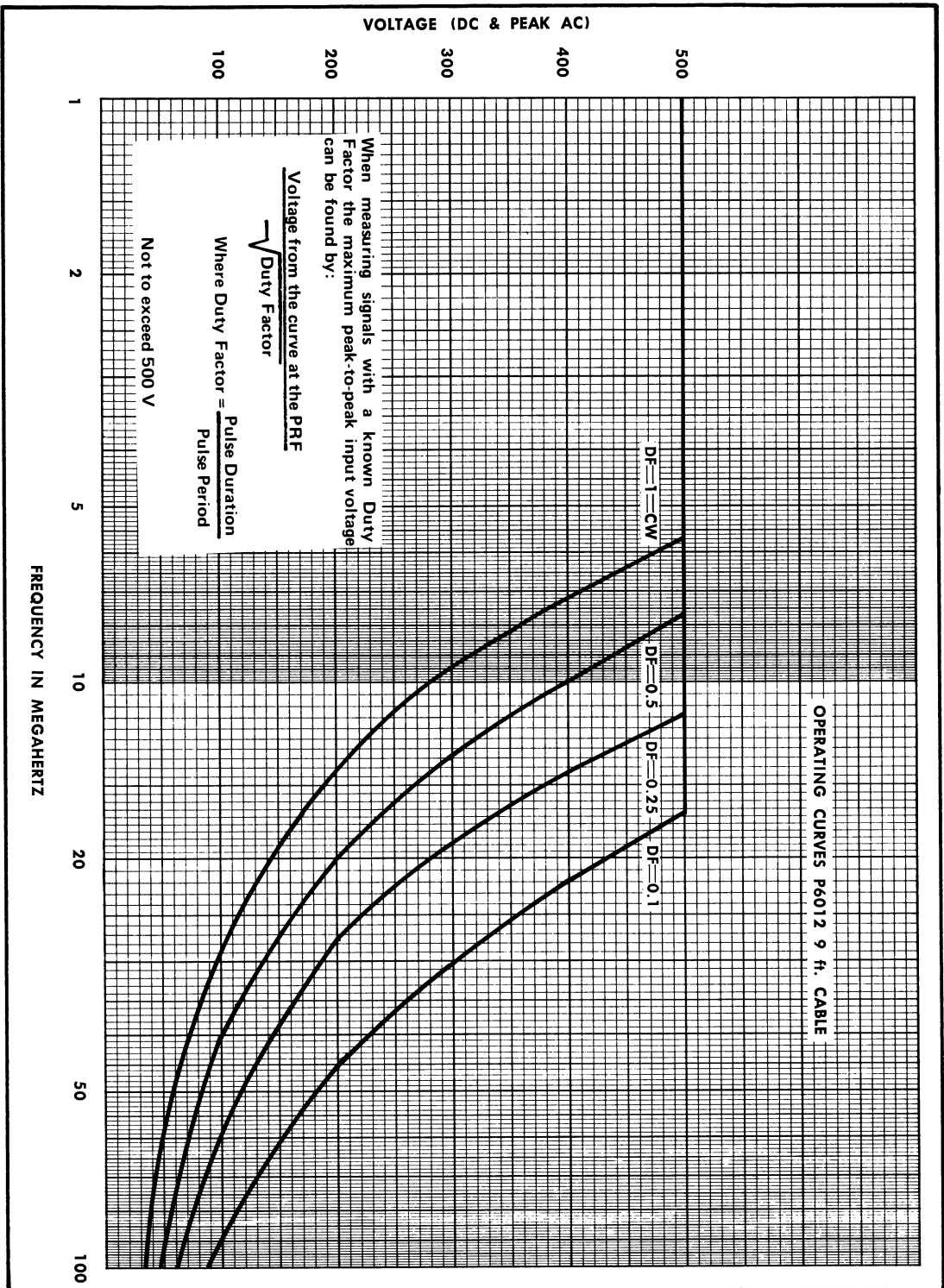


Fig. 1-7. Maximum Applied Voltage at Specific Duty Factors (9-ft. cable).

SECTION 2

OPERATING INSTRUCTIONS

General Information

The P6012 Probe enables you to connect an oscilloscope into a circuit with minimum loading and without impedance matching. Due to slight variations in input capacitance between instruments, even of the same type, it is necessary to compensate the probe whenever changing from one instrument to another. Re-check compensation before making critical measurements. Lack of compensation can cause measurement error since both wave-shape and magnitude of the display are affected. The probe is provided with an adjustment to match the probe time constant to the time constant of the

instrument. The following procedure should be used to compensate the probe.

Compensation

1. Set the oscilloscope calibrator for an output of suitable amplitude.
2. Touch the probe tip to the calibrator output connector.
3. Set the sweep rate to display several cycles of the output signal.
4. Through the hole in the compensating box, rotate the capacitor (C3) with a small non-conducting screwdriver to obtain a flat-top presentation of the calibrator output signal. See Fig. 2-1.

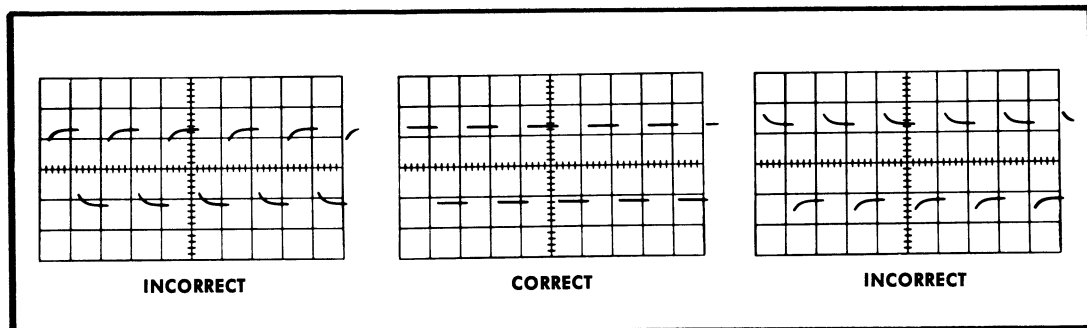


Fig. 2-1. Probe Compensation

ACCESSORIES

Ground Lead

The ground lead clips to the probe between the probe body and the cable assembly.

Insulating Sleeve

When the ground lead is connected to the probe, place the insulating sleeve over the exposed connection to avoid short circuits.

Miniature Alligator Clip

The insulated alligator clip screws onto the ground lead.

Hook Tip

The hook tip provides a stable means of holding on to a test point.

Retractable Hook Tip

The retractable hook tip provides a positive connection to a test point.

Insulating Tubes

When using the probe without one of the above tips, place an insulating tube over the tip of the probe to avoid short circuits.

Probe Holder

The probe holder provides a convenient means of holding the probe when not in use.

After connecting the probe to the instrument being used, place the wide half of the probe holder around the cable and slide onto the tapered portion of the cable assembly near the compensating box. When the probe is not in use, place the tapered portion near the probe body into the holder. See Fig. 2-2.

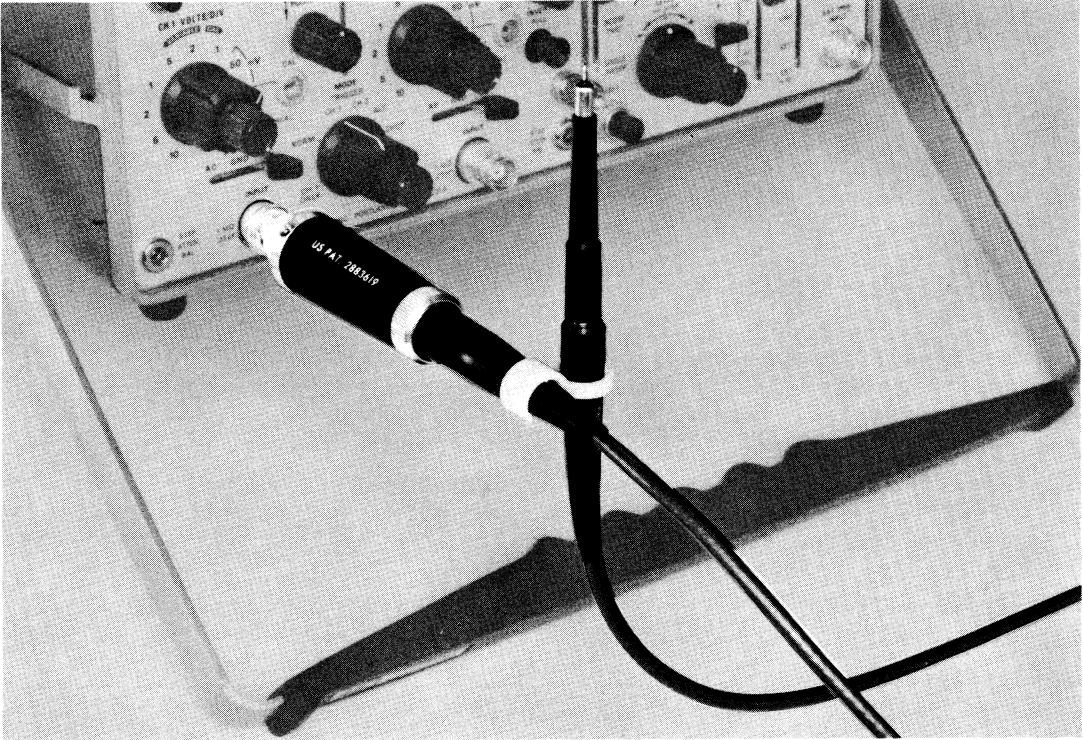


Fig. 2-2. Probe Holder.

SECTION 3

MAINTENANCE

The P6012 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. Fig 3-1 shows location of electrical parts.

Replacing the Cable Assembly

If the coaxial cable between the probe and 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.
2. Remove the snap ring holding the compensating box to the cable assembly.
3. Unsolder the connection to the end of the cable assembly, using a heat sink, and sep-

arate the compensating box from the cable assembly.

4. Unscrew the probe body and sleeve assembly from the other end of the cable assembly.
5. Unsolder the parallel resistor and capacitor from the cable assembly, again using a heat sink.
6. Install the new cable assembly by reversing the above procedure.
7. After the probe is re-assembled, compensate as described in Section 2.

Replacing Components

To replace any electrical parts in either the compensating box or the probe tip, you need only a pair of long-nose pliers and a soldering iron. Use a heat sink to protect the components from excessive heat.

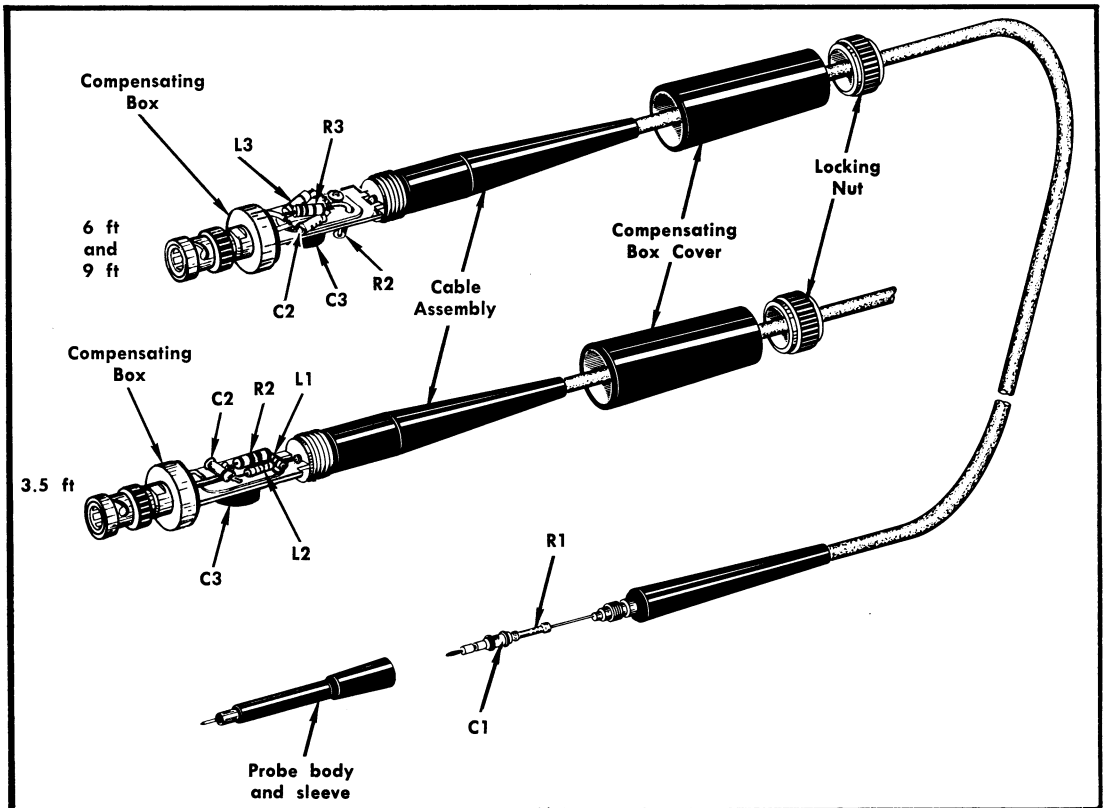


Fig. 3-1. Probe Assembly

SECTION 4

PERFORMANCE CHECK

This section of the manual provides a means of checking the performance of the P6012 Probe. Failure to meet the requirements given in this procedure indicates the need for further checks of individual components.

Equipment Required

1. Test Oscilloscope—33 MHz bandwidth at 50 mV/cm; 0.1 μ s/cm sweep rate with 5X magnification (Tektronix Type 545B Oscilloscope with Type 1A1 Plug-In recommended).

2. Pulse Generator—0.25 ns risetime pulses from 0 to 50 volts into 50 Ω (Tektronix Type 109 recommended).

3. Transmission Line—60 ns delay, 0.1 ns risetime (Tektronix Type 113 Delay Cable recommended).

4. Two 50 Ω Coaxial Cables—5 ns lengths of RG 8A/U (017-0502-00).

5. GR to BNC Adapter—(017-0063-00).

6. 50 Ω BNC Termination—(011-0049-00).

7. BNC to Probe Adapter—(013-0084-00).

1. Risetime Check

a. Using the two RG 8A/U cables, connect the Type 113 Delay Cable to the Type 109 Charge Line connectors. Connect the GR to BNC adapter, the 50 Ω termination, and the BNC to probe adapter to the output of the Type 109. Connect the P6012 Probe to the test oscilloscope input connector and insert the probe tip into the probe adapter. See Fig. 4-1.

b. Set the test oscilloscope controls as follows:

Triggering Mode	Auto
Triggering Slope	+ Int
Time/cm	.1 μ Sec
Variable (Time/cm)	Calibrated
5X Magnifier	On
Volts/cm	.05

c. Set the Type 109 Voltage Range switch to 5.0 and adjust Amplitude for a full screen display.

d. Measure the combined risetime of the test oscilloscope and probe between the 10% and 90% points and calculate the probe risetime. The formula for combined risetimes is as follows:

$$T_r = \left[(T_{r1})^2 + (T_{r2})^2 + \dots + (T_{rn})^2 \right]^{1/2}$$

e. The risetime of the probe only should be less than 5 nanoseconds with the 3.5-foot cable, less than 6 nanoseconds with the 6-foot cable, and less than 6.5 nanoseconds with the 9-foot cable.

2. Ringing, Rounding, and Overshoot Check

Turn the 5X Magnifier off and check ringing, rounding and overshoot for within +1.5% and -1.5%; total of $\leq 2\%$ peak to peak.

3. Compensation Range Check

a. Connect the BNC to probe adapter and the probe to the test oscilloscope Cal Out connector.

b. Set the test oscilloscope controls as follows:

Time/cm	2 mSec
5X Magnifier	Off
Volts/cm	.05
Calibrator	1 Volt

c. Through the hole in the compensating box cover, rotate the variable capacitor (C3) through-out its range. The range of compensation should include a flat top display of the waveform.

4. Attenuation

With the probe connected to the Cal Out connector, check for ten times attenuation of the Calibrator signal.

Performance Check—P6012

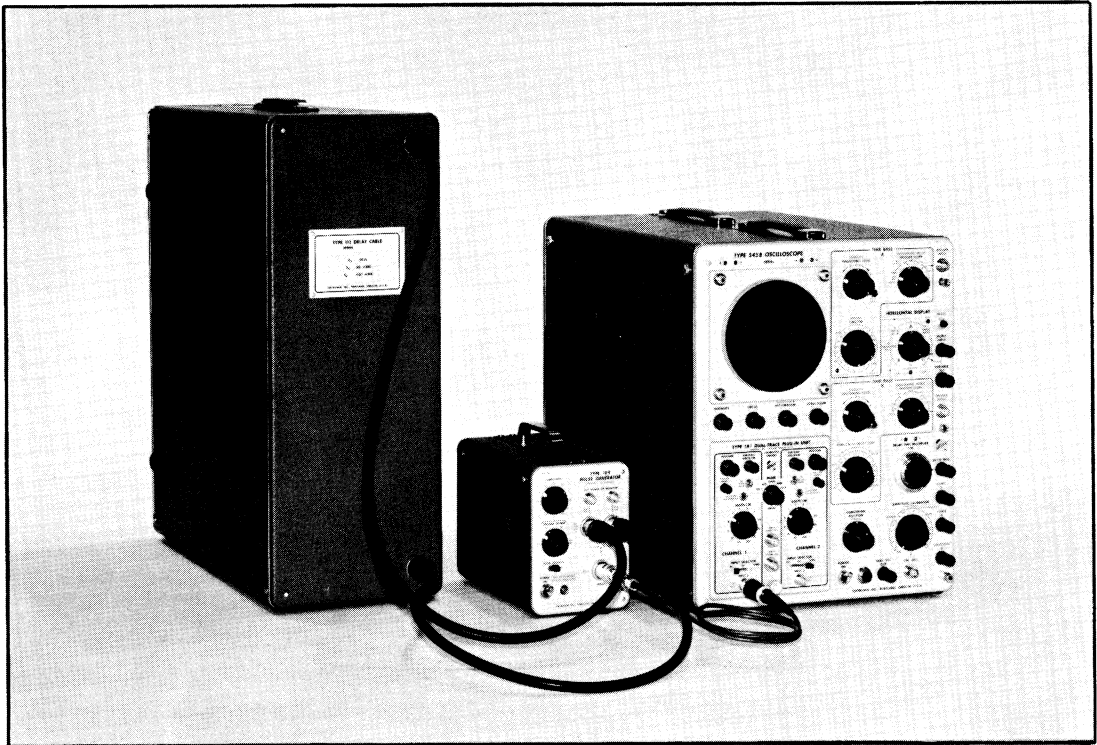


Fig. 4-1. Test setup for Transient Response check.

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, your local Field Office will contact you concerning any change in part number.

ABBREVIATIONS

F	Farad
k	Kilohms, or kilo (10^3)
M	Megohms, or mega (10^6)

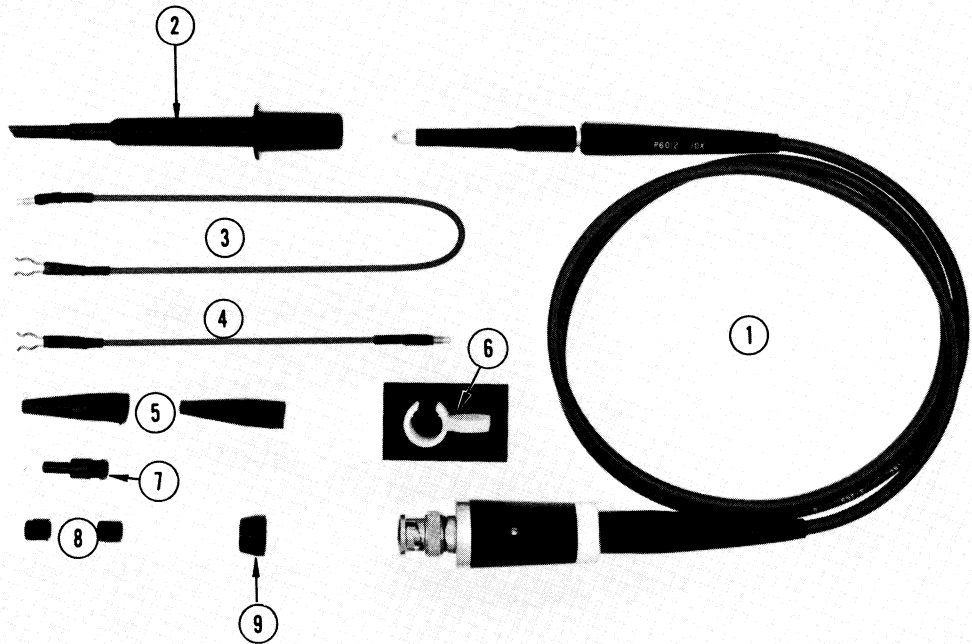
Ω	Ohm
P	Pico, or 10^{-12}
Var.	Variable
W	Watt
w/	With

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number.
000X	Part removed after this serial number.
*000-0000-00	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, also reworked or checked components.
Use 000-0000-00	Part number indicated is direct replacement.
ⓘ	Internal screwdriver adjustment.

Parts List—P6012

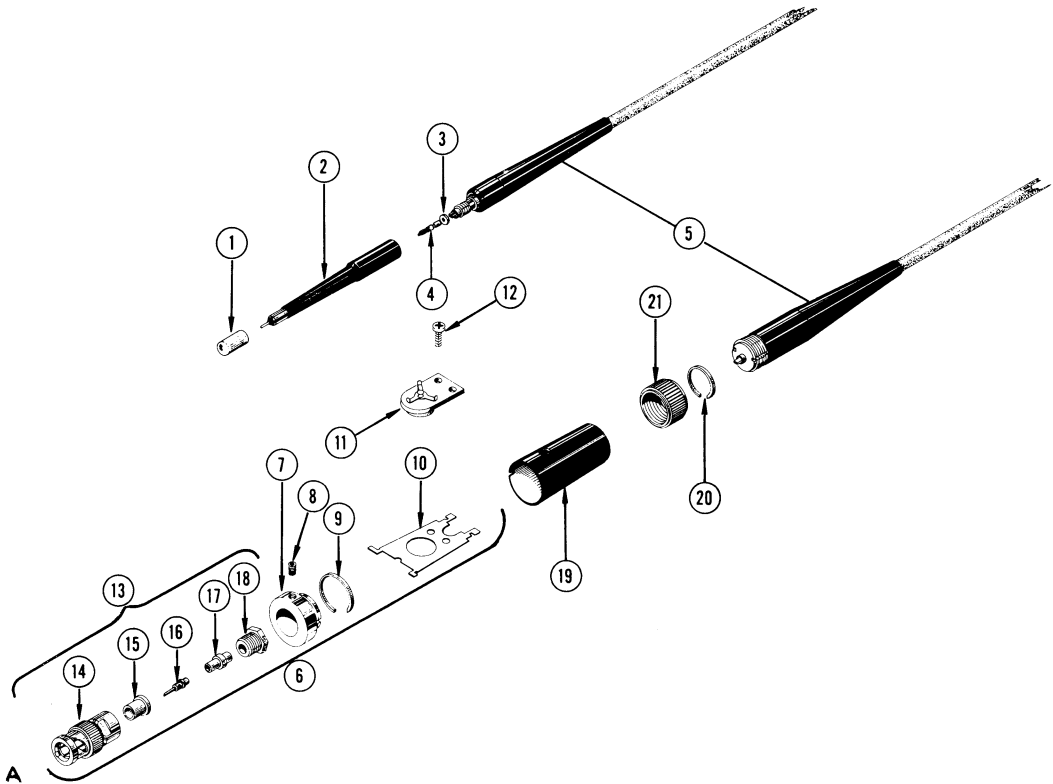
PROBE and STANDARD ACCESSORIES



B

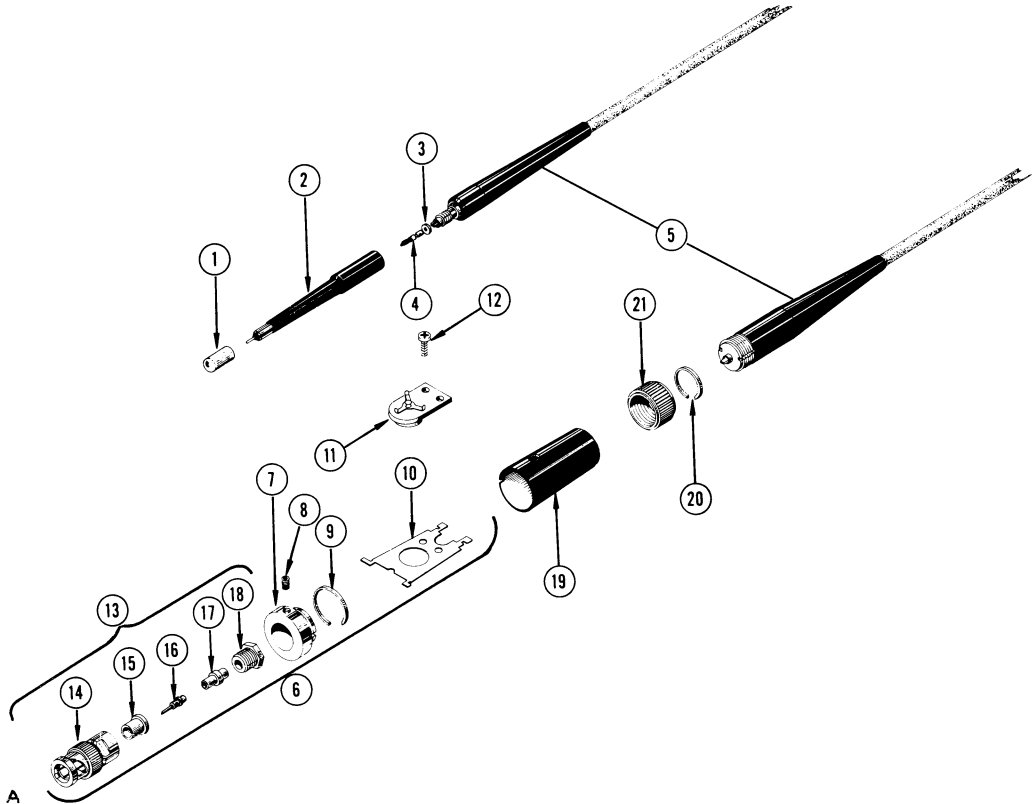
REF. NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO.		Q	T	Y.	DESCRIPTION
		EFF.	DISC.				
PROBE PACKAGE							
1—9	010-0203-00			1			PROBE PACKAGE, P6012, 3.5 foot
	010-0209-00			1			PROBE PACKAGE, P6012, 6 foot
	010-0231-00			1			PROBE PACKAGE, P6012, 9 foot
	- - - - -			-			package includes:
PROBE ONLY							
1	010-0202-00			1			PROBE, P6012, 3.5 foot
	010-0208-00			1			PROBE, P6012, 6 foot
	010-0230-00			1			PROBE, P6012, 9 foot
STANDARD ACCESSORIES							
2	013-0090-00			1			HOOK TIP, retractable
3	175-0125-00			1			CABLE, ground lead, 12 inch
4	175-0124-00			1			CABLE, ground lead, 5 inch
5	344-0046-00			2			CLIP, probe
6	352-0090-00			1			HOLDER, probe
7	206-0114-00			1			TIP, probe
8	166-0404-00			2			TUBE, insulating, molded
9	166-0433-00			1			SLEEVE, insulating, gnd strap
	070-0601-02			1			MANUAL, instruction (not shown)
	367-0105-00	X6926		1			HANDLE, hook tip (not shown)

REPLACEABLE PARTS (3.5 foot)



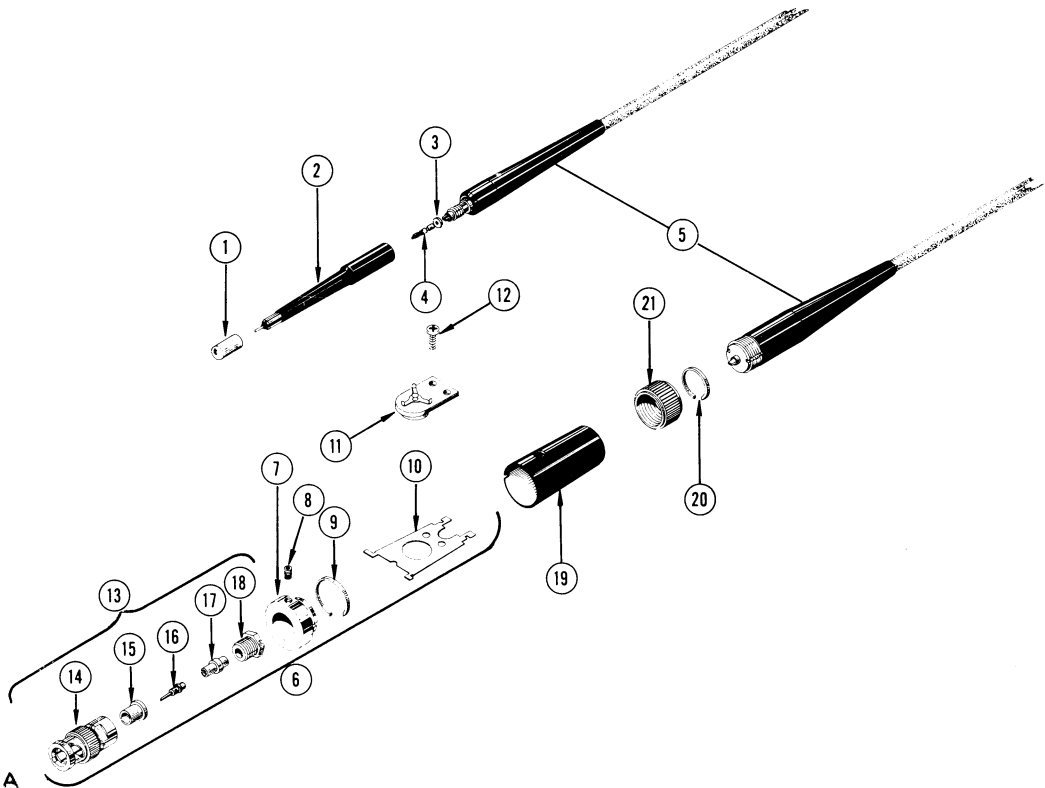
REF. NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO.		Q					DESCRIPTION	
		EFF.	DISC.	Y.	1	2	3	4		5
	010-0202-00			1						PROBE, P6012, 3.5 foot
	- - - - -			-						probe includes:
1	015-0201-00			1						ADAPTER, probe tip (IC test)
2	204-0252-00			1						ASSEMBLY, body and sleeve
	206-0145-00			1						ASSEMBLY, attenuator
	- - - - -			-						assembly includes:
3	210-1004-00			1						WASHER, guide
4	214-0592-00			1						CONTACT, wire form
	- - - - -			-						CAPACITOR, C1
	- - - - -			-						RESISTOR, R1
5	175-0392-00			1						CABLE ASSEMBLY, 3.5 foot
6	015-0076-00			1						ASSEMBLY, compensating box
	- - - - -			-						assembly includes:
7	354-0270-01			1						RING, front, compensating box
8	213-0020-00			1						SCREW, set, 6-32 x 1/8 inch, HSS
9	354-0273-00			1						RING, external, 0.625 inch ID
10	441-0687-00			1						CHASSIS, electrical, compensating box
11	- - - - -			1						CAPACITOR, C3
12	213-0138-00			1						SCREW, sheet metal, #4 x 3/16 inch, PHS
13	131-0428-00			1						ASSEMBLY, connector, BNC
	- - - - -			-						assembly includes:
14	134-0044-00			1						PLUG, probe, BNC
15	358-0072-00			1						BUSHING, insulator, BNC, 0.323 inch long
16	214-0109-01			1						PIN, probe contact, male
17	166-0217-00			1						TUBE, spacer, insulator
18	132-0081-00			1						NUT, BNC
19	200-0698-00			1						COVER, compensating box
20	354-0272-00			1						RING, external, 0.467 inch ID
21	354-0271-00			1						RING, locking, compensating box

REPLACEABLE PARTS (6 foot)



REF. NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO.		Q	DESCRIPTION
		EFF.	DISC.		
	010-0208-00			1	PROBE, P6012, 6 foot
	- - - - -			-	probe includes:
1	015-0201-00			1	ADAPTER, probe tip (IC test)
2	204-0252-00			1	ASSEMBLY, body and sleeve
	206-0146-00			1	ASSEMBLY, attenuator
	- - - - -			-	assembly includes:
3	210-1004-00			1	WASHER, guide
4	214-0592-00			1	CONTACT, wire form
	- - - - -			-	CAPACITOR, C1
	- - - - -			-	RESISTOR, R1
5	175-0398-00			1	CABLE ASSEMBLY, 6 foot
6	015-0076-00			1	ASSEMBLY, compensating box
	- - - - -			-	assembly includes:
7	354-0270-01			1	RING, front, compensating box
8	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
9	354-0273-00			1	RING, external, 0.625 inch ID
10	441-0687-00			1	CHASSIS, electrical, compensating box
11	- - - - -			1	CAPACITOR, C3
12	213-0138-00			1	SCREW, sheet metal, #4 x 3/16 inch, PHS
13	131-0428-00			1	ASSEMBLY, connector, BNC
	- - - - -			-	assembly includes:
14	134-0044-00			1	PLUG, probe, BNC
15	358-0072-00			1	BUSHING, insulator, BNC, 0.323 inch long
16	214-0109-01			1	PIN, probe contact, male
17	166-0217-00			1	TUBE, spacer, insulator
18	132-0081-00			1	NUT, BNC
19	200-0698-00			1	COVER, compensating box
20	354-0272-00			1	RING, external, 0.467 inch ID
21	354-0271-00			1	RING, locking, compensating box

REPLACEABLE PARTS (9 foot)



REF. NO.	TEKTRONIX PART NO.	SERIAL/MODEL NO.		Q	T	DESCRIPTION
		EFF.	DISC.			
	010-0230-00			1		PROBE, P6012, 9 foot
	- - - - -			-		probe includes:
1	015-0201-00			1		ADAPTER, probe tip (IC test)
2	204-0252-00			1		ASSEMBLY, body and sleeve
	206-0159-00			1		ASSEMBLY, attenuator
	- - - - -			-		assembly includes:
3	210-1004-00			1		WASHER, guide
4	214-0592-00			1		CONTACT, wire form
	- - - - -			-		CAPACITOR, C1
	- - - - -			-		RESISTOR, R1
5	175-0475-00			1		CABLE ASSEMBLY, 9 foot
6	015-0076-00			1		ASSEMBLY, compensating box
	- - - - -			-		assembly includes:
7	354-0270-01			1		RING, front, compensating box
8	213-0020-00			1		SCREW, set, 6-32 x 1/8 inch, HSS
9	354-0273-00			1		RING, external, 0.625 inch ID
10	441-0687-00			1		CHASSIS, electrical, compensating box
	- - - - -			1		CAPACITOR, C3
12	213-0138-00			1		SCREW, sheet metal, #4 x 3/16 inch, PHS
13	131-0428-00			1		ASSEMBLY, connector, BNC
	- - - - -			-		assembly includes:
14	134-0044-00			1		PLUG, probe, BNS
15	358-0072-00			1		BUSHING, insulator, BNC, 0.323 inch long
16	214-0109-01			1		PIN, probe contact, male
17	166-0217-00			1		TUBE, spacer, insulator
18	132-0081-00			1		NUT, BNC
19	200-0698-00			1		COVER, compensating box
20	354-0272-00			1		RING, external, 0.467 inch ID
21	354-0271-00			1		RING, locking, compensating box

ELECTRICAL PARTS LIST

P6012 PROBE 3.5'

Ckt No.	Tektronix Part No.	Description			S/N Range
Capacitors					
C1 ¹	281-0655-00	9.7 pF	Cer	500 V	±0.1 pF
C2	281-0656-00	22 pF	Cer	200 V	±5%
C3	281-0013-00	8-50 pF	Cer	Var	
Inductors					
L1	*108-0413-00	0.4 μH			
L2	*108-0182-00	0.3 μH			
Resistors					
R1 ¹	319-0037-00	9 MΩ	1/4 W	Prec	2% 6739
R1 ¹	325-0021-00	9 MΩ	1/4 W		1% 6740-up
R2	301-0910-00	91 Ω	1/2 W	Prec	5%

¹Also available in attenuator assembly part no. 206-0145-00.

P6012 PROBE 6'

Capacitors					
C1 ²	281-0657-00	13 pF	Cer	500 V	2%
C2	281-0634-00	10 pF	Cer	500 V	±0.25 pF
C3	281-0013-00	8-50 pF	Cer	Var	
Inductor					
L3	*108-0345-00	1.9 μH			
Resistors					
R1 ²	319-0037-00	9 MΩ	1/4 W	Prec	2% 6739
R1 ²	325-0021-00	9 MΩ	1/4 W	Prec	1% 6740-up
R2	301-0121-00	120 Ω	1/2 W		5%
R3	315-0561-00	560 Ω	1/4 W		5%

³Also available in attenuator assembly part no. 206-0159-00.

P6012 PROBE 9'

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

C1 ³	281-0718-00	15.8 pF	Cer	500 V	1%
C2	281-0634-00	10 pF	Cer	500 V	±0.25 pF
C3	281-0013-00	8-50 pF	Cer	Var	

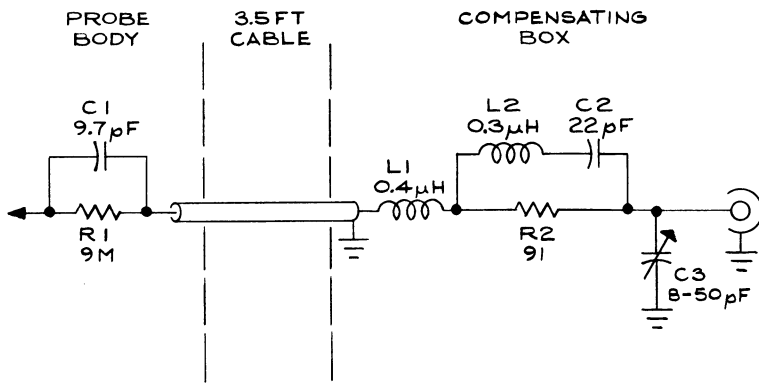
Inductor

L3	*108-0146-00	5 μ H			
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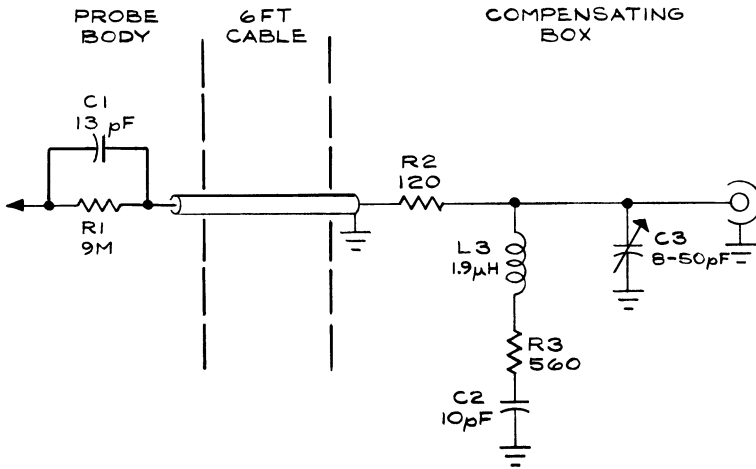
Resistors

R1 ³	325-0021-00	9 M Ω	1/4 W	Prec	1%
R2	301-0680-00	68 Ω	1/2 W		5%
R3	315-0681-00	680 Ω	1/4 W		5%

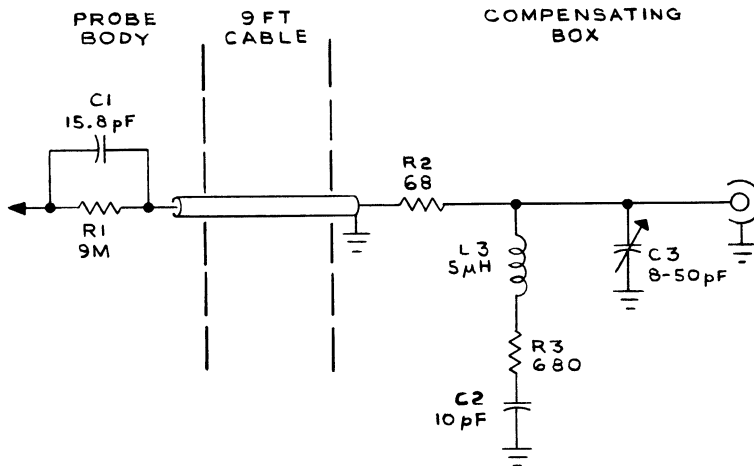
³Also available in attenuator assembly part no. 206-0159-00.



3.5 FT CABLE



6 FT CABLE



9 FT CABLE

P6012 PROBE