Instruction Manual

P6015 PROBE

IMPORTANT NOTICE

The desiccant cannister provides a dry atmosphere for the P6015 Probe during shipment. If the P6015 Probe is to be stored in a humid area for a period of several weeks, it should be stored in a moisture-proof package. Reactivate the desiccant cannister by baking for three hours at 180° F. (or until the desiccant turns blue) and seal the cannister inside the moisture-proof package along with the P6015 Probe.

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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 number with all requests for parts or service.

Specifications and price change privileges reserved.

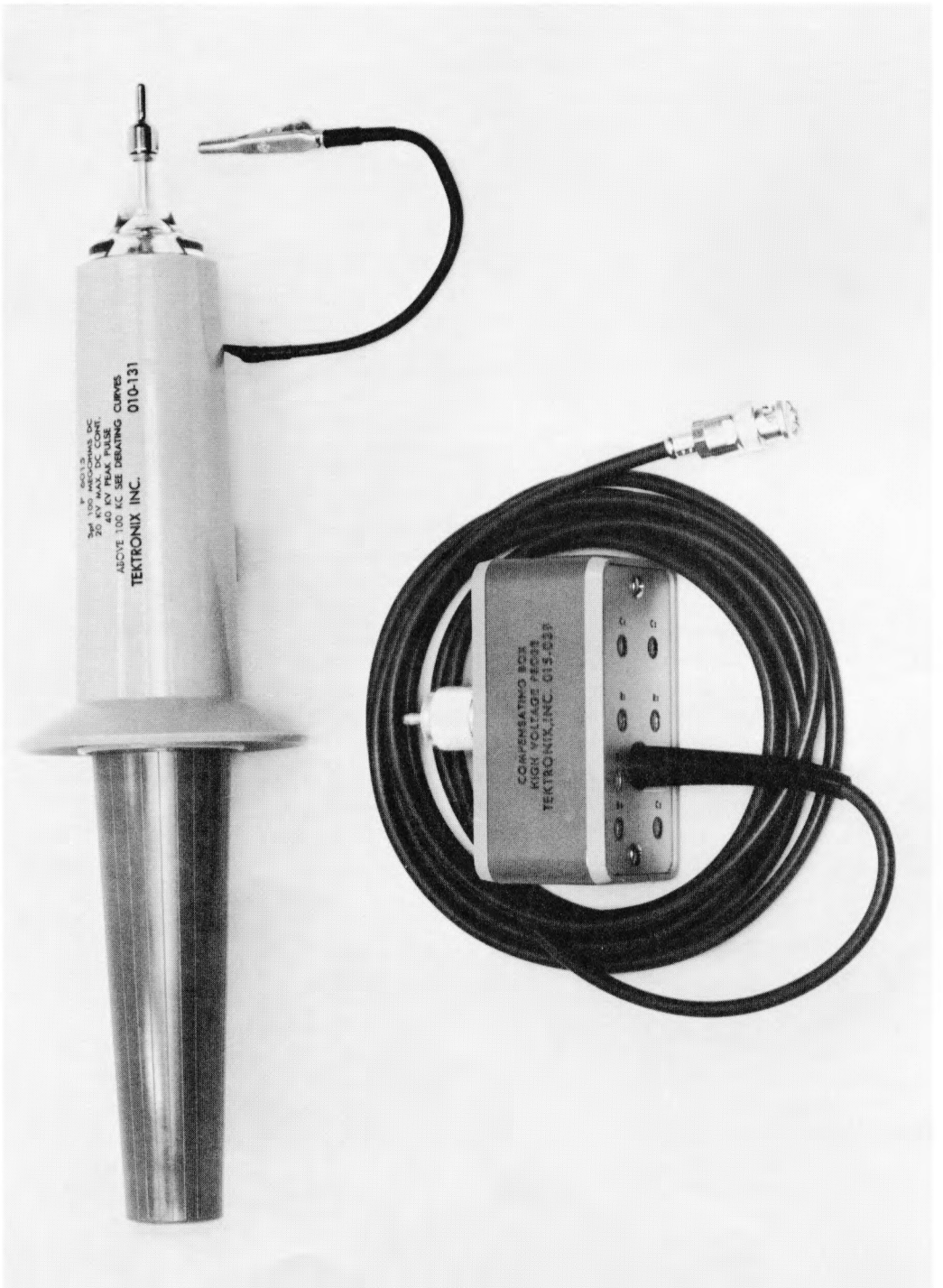


Fig. 1-1. P6015 Probe.

P6015 PROBE
Section 1
Characteristics

The P6015 High-Voltage Probe (Fig. 1-1) is a 1000X attenuator probe that adds high voltage capabilities to oscilloscopes or plug-in units with input resistances of 1 megohm and input capacitances of up to 50 picofarads (pf). The body of the P6015 Probe is made of high impact strength thermoplastic material that provides mechanical protection for the internal components of the probe and electrical protection for the user. Dielectric properties of the probe are improved by filling the probe with fluorocarbon gas. The complete probe assembly consists of the probe body, a 10-foot interconnecting cable with resistive center conductor, and the compensating box.

Electrical Characteristics

Attenuation Ratio—1000:1 (variable by about 9%).

Input Resistance—100 megohms (±3%).

Input Capacitance—Approximately 3 pf.

Maximum Input Voltage (dc or rms) 20 kv (see derating chart, Fig. 1-2, for frequencies above 100 kc).

Maximum Input Voltage (pulse)—40 kv peak (maximum duty factor 10%; maximum pulse duration 0.1 sec).

Bandpass (complete assembly)—Dc to 50 megacycles (flat within 2%).

Risetime (complete assembly)—Approximately 4 nanoseconds.

Temperature Range—10° C to 55° C.

Cable Center Conductor Resistance—50 Ω per foot.

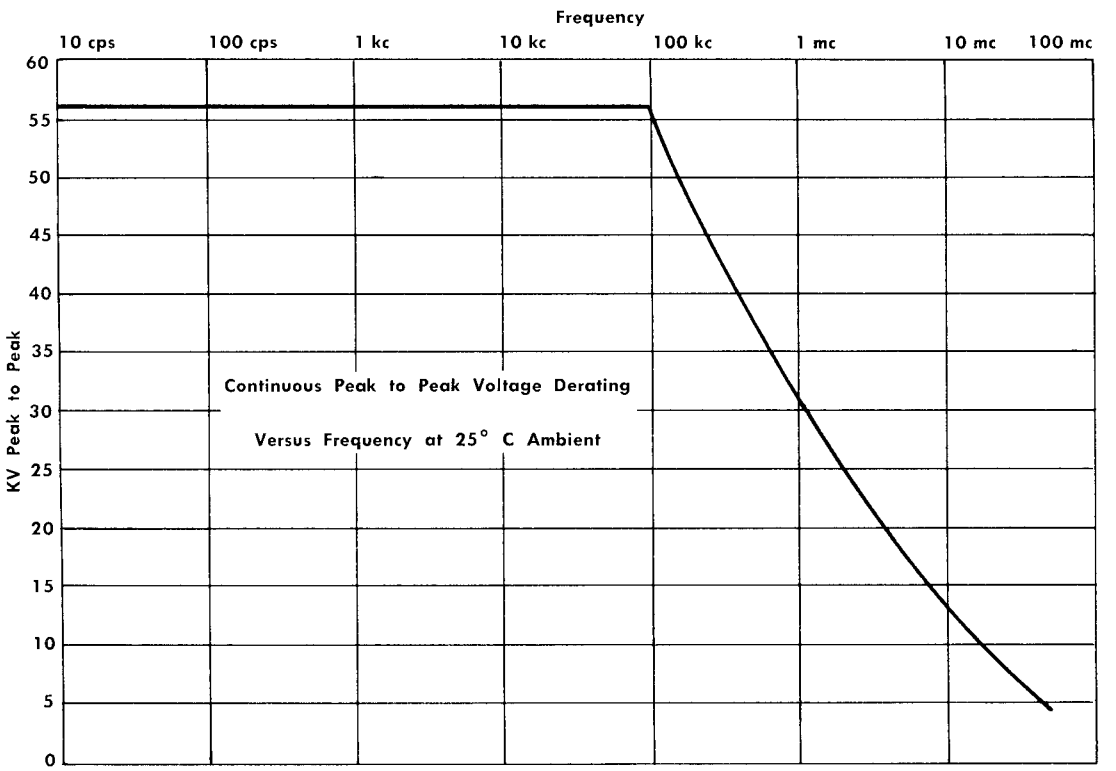


Fig. 1-2. Derating Chart for P6015 Probe.

Mechanical Characteristics

Maximum Diameter of Probe Body—3½ inches (diameter of guard flange).

Length of Probe Body—13½ inches.

Length of Interconnecting Cable—Nominally 10 feet.

Dimensions of Compensating Box—1 13/16 × 1 5/8 × 3 9/16 inches.

Saturation Pressure of Inert Gas—Approximately 2 atmospheres at room temperature.

Output Connector Type—UHF type.

Weight of Assembly—1 pound 13 ounces.

P6015 PROBE
Section 2
Operating Instructions

Compensation

Check the compensation of the P6015 Probe each time it is used with a different plug-in unit or oscilloscope. Compensation should be checked occasionally during normal use since changes in ambient temperature can also affect compensation. Proper compensation matches the capacitive attenuation ratio to the resistive attenuation ratio.

The P6015 Compensating Box contains seven adjustable components. All except R5 (see schematic) vary the time constant of RC networks. The adjustable components and their affect on a 1-kc square wave (see Fig. 2-1) are as follows:

C3—Part of an RC network that affects the leading corner of the square wave.

R1, C1—Comprise an RC network that affects the area immediately following the leading corner of the square wave.

R2, C2—Comprise an RC network that affects the middle section of the square wave.

R3—A high-frequency peaking adjustment that affects the leading 10 to 100 nanoseconds of a fast-rise pulse. The action of R3 will not be apparent with signals having risetimes greater than 0.1 microsecond.

R5—An attenuation adjustment that varies output amplitude by about 9%.

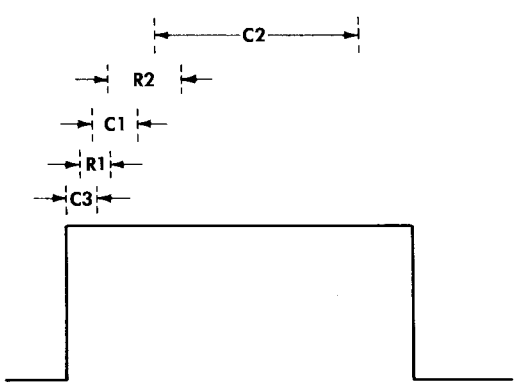


Fig. 2-1. Pulse area affected by each compensation adjustment.

Compensation can be checked by displaying the oscilloscope calibrator 100-volt output through the P6015 Probe. Adjust the oscilloscope controls (0.05 volts/div, sweep rate 0.5 msec/div) to display a waveform similar to Fig. 2-1. If the waveform has aberrations, compensation is necessary. If the aberrations cannot be corrected by making minor adjustments, proceed as follows:

1. Preset the following controls as indicated:

   C3—Set fully clockwise and back off 90 degrees.

   C1—Set fully clockwise and back off 90 degrees.

   R1—Set fully clockwise and back off 90 degrees.

   C2—Set fully clockwise and back off 2 turns.

   R2—Set fully clockwise and back off 90 degrees.

2. Adjust R5 for exactly 2 major divisions of vertical deflection on the crt. Use the level portions of the square wave if the waveform is over- or under-peaked.

3. Set the sweep rates for 50 μsec/div and display the leading corner of the square wave. Adjust R1, C3, and C1 for the sharpest leading corner without overshoot (see Fig. 2-1). Each may have to be adjusted several times for the sharpest corner. Maintain 2 divisions of deflection at the leading edge. The R1-C3 combination affects the very corner and C1 affects the area immediately following with some overlap.

4. Set the sweep rate of the oscilloscope for 0.2 msec/div and adjust R2 and C2 to level the trailing 2 divisions of the top of the square wave.

5. Set sweep for 0.2 msec/div. Adjust C3 and C1 for a flat top on the square wave.

6. Any remaining aberrations may be corrected by slight readjustment of C1, R2, C2, R1, and C3.

The preceding steps do not include high-frequency peaking adjustment R3. The affect of R3 is apparent only with risetimes faster than about 0.1 microsecond. Consequently, the calibrator signal is not fasi enough for this adjust-

ment. The most desirable signal source is a Tektronix Type 109 or 110 Pulse Generator with enough charge line to generate at least a 100-nsec pulse. However, the 1-mc output of a Tektronix Type 105 Square Wave Generator terminated in 50 ohms is also adequate. With any of these generators, it is advantageous to have a plug-in unit with a sensitivity greater than 0.05 volt/div, such as the Tektronix Type L (5 mv/div) or Type 82 (10 mv/div). R3 should be adjusted while observing the generator output signal at a sweep rate of 0.1 μsec/div. R3 should be turned as far as possible in the counter-clockwise direction without causing overshoot on the leading corner of the waveform.

Only minor (if any) readjustment of the controls is necessary when the P6015 Probe is operated with plug-in units with nominal input capacitance. When switching between plug-in units with different input capacitance, compensate the probe by adjusting C3. If the gain of the plug-in units differ, match the gain of the plug-in to the probe rather than adjusting R5. Adjusting R5 will require readjusting the remaining controls.

Using the P6015 Probe

When making amplitude measurements with the P6015 Probe, multiply the amplitude of the display by the attenuation factor of the probe (1000). If the observed voltage is a pulse or a signal over 100 kc, see Fig. 1-2 and the maximum input voltage limitations listed under "Electrical Characteristics" in Section 1. Remember that component heating caused by changes in ambient temperature or high voltage will cause a slight change in calibration accuracy. If the displayed waveform contains fast transients, the inductive effect of the ground lead may make it desirable to remove the probe from its plastic body and build the probe into the circuit under test.

P6015 PROBE
Section 3
Maintenance

Introduction

Normally, the Type P6015 Probe requires very little maintenance except for a visual and operational check. This section is provided as a maintenance guide, and contains procedures for visual inspection, recharging the probe with dielectric fluid, and troubleshooting.

Visual Inspection

A thorough visual inspection of the probe should be performed periodically. Look for such things as loose or broken connections, damaged plastic insulators, and proper dielectric fluid level. Except for low fluid level, the remedy for most of these troubles is apparent.

Check the dielectric fluid level by holding the probe with the tip down. There should be liquid visible through the transparent nose. If not, it is essential for you to determine the cause of the fluid loss before adding more. Temperature as well as a leak could affect the liquid level. See "Recharging the Probe" for details and procedures for adding fluid.

Recharging the Probe

The dielectric fluid in the probe is fluorocarbon 114. Fluorocarbon 114 has a saturation pressure of about 2 atmospheres at room temperature. At room temperature, a small amount of liquid should be visible through the transparent nose of the probe when the probe tip is pointed down. Any liquid visible in the nose is an indication of proper pressure inside the probe. The saturation pressure increases with an increase in temperature, and at higher temperatures it is normal for all of the fluorocarbon 114 to be in a gaseous stage. The liquid, at room temperature, should just touch the bottom of the gold-plated part visible through the transparent nose.

Recharging the probe with fluorocabon 114 requires no special tools or equipment besides the gas dispenser supplied with each probe. If the liquid level in the probe is low, it can be recharged as follows:

1. Uncouple the two halves of the probe body cover and remove the probe body. (See Fig. 3-1)

2. Unscrew and remove the securing ring.

3. Remove the base assembly from the probe body.

4. Hold the probe tip down and release fluorocarbon 114 into the probe body until the liquid

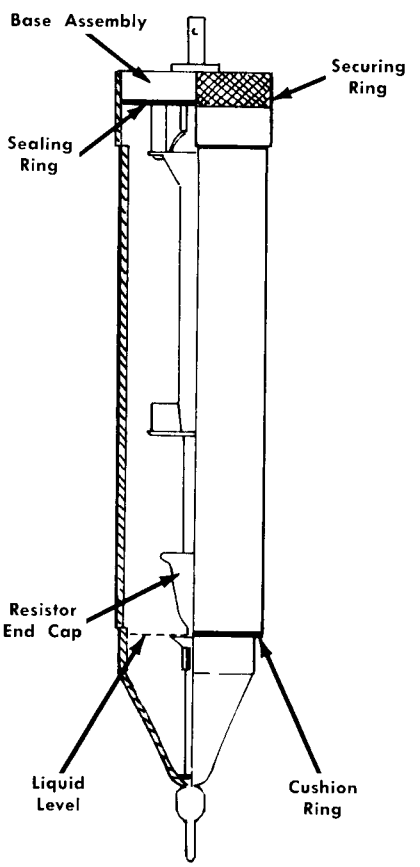


Fig. 3-1. Cutaway drawing of P6015 Probe.

level is 1/16" to 1/8" above the small end of the gold-plated resistor end cap.

5. Replace the base assembly. Be sure the 100-megohm resistor is properly mated. Screw on the securing ring (hand tight).

6. Shake the probe body to agitate the liquid; this accelerates vaporization and quickly builds up pressure inside the probe body.

7. Check to see that the liquid level is just even with the bottom of the gold-plated resistor end cap. If too much liquid boiled away, add more. If the liquid level is too high, bleed off excess by loosening the securing ring and letting the liquid boil. When the proper level has been reached, retighten the securing ring.

8. Replace the cushion ring on the probe body, if removed, prior to reassembling the probe body and probe body cover.

NOTE

The 100-megohm resistor element should not be handled because it does not have a protective coating.

Troubleshooting

Following are some possible trouble symptoms and causes.

No Output or Differentiated Output. Connect the UHF connector on the compensating box to the INPUT connector of the oscilloscope or plug-in unit and touch the probe tip to the calibrator output connector on the oscilloscope. Set the oscilloscope calibrator for a 100-volt output. If the crt display shows no signal or a differentiated signal, check R6, the center conductor of the interconnecting cable, and R100 in the probe body. Replace the defective component. If R100 is defective, gain access to it as outlined in steps 1 through 3 under "Recharging the Probe."

Erroneous Attenuation Ratio. If there is an obvious error in attenuation ratio, check resistors R3, R4, and R5. To gain access to the resistors, remove the compensating box cover by unscrewing the two screws on the top of the compensating box. Replace or reconnect components as indicated by the type of trouble.

Probe Cannot be Compensated. Check capacitors C1, C2, and C3. Check resistors R1 and R2. If any of the capacitors are shorted, the attenuation ratio of the probe will be greatly changed. If connections to the capacitors are faulty, or if the resistors are faulty, the defective component will not adjust properly when compensating the probe. Open the compensating box by unscrewing the two screws on the top and removing the cover. Reconnect or replace components as necessary.

P6015 PROBE
Section 4
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.

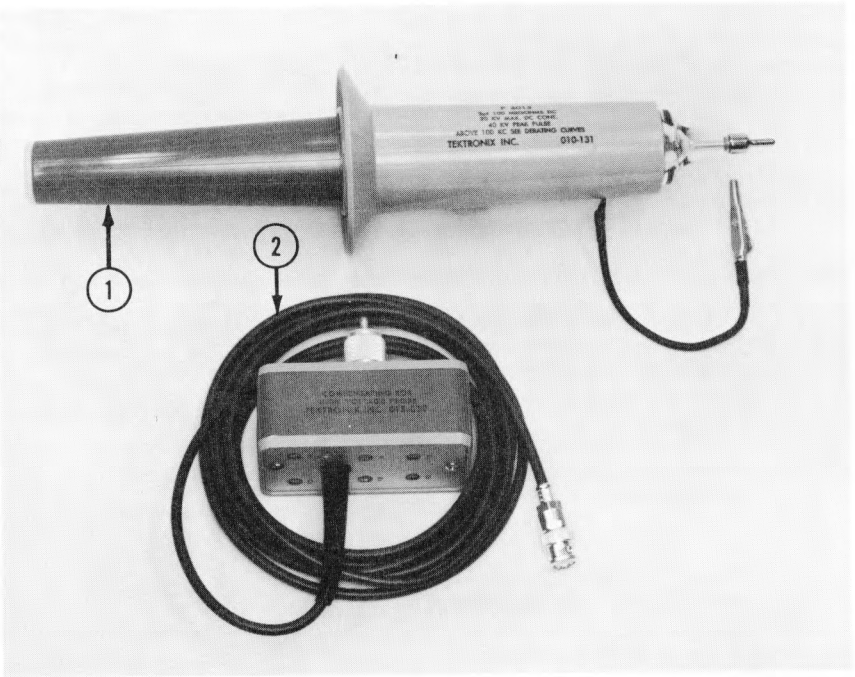


Fig. 4-1. P6015 Probe Package less accessories.

REF NO.	CKT NO.	QTY	TEKTRONIX PART NUMBER	DESCRIPTION
			*010-132	P6015 PROBE PACKAGE (Consisting of the following)
1		1	*010-131	P6015 Probe (See Fig. 4-2)
2		1	*015-039	Compensating Box (See Fig. 4-3)
		1	*070-373	†Manual, Instruction
		1	202-103	†Case, Storage
		1	*252-120	†Fluorocabon No. 114
		1	256-570	†Silica-Gel (Desiccant)
		1	*344-005	†Alligator Clip Assembly
		1	*352-056	†Holder, Probe
		1	*436-035	†Insert, Storage Case

† Not Shown

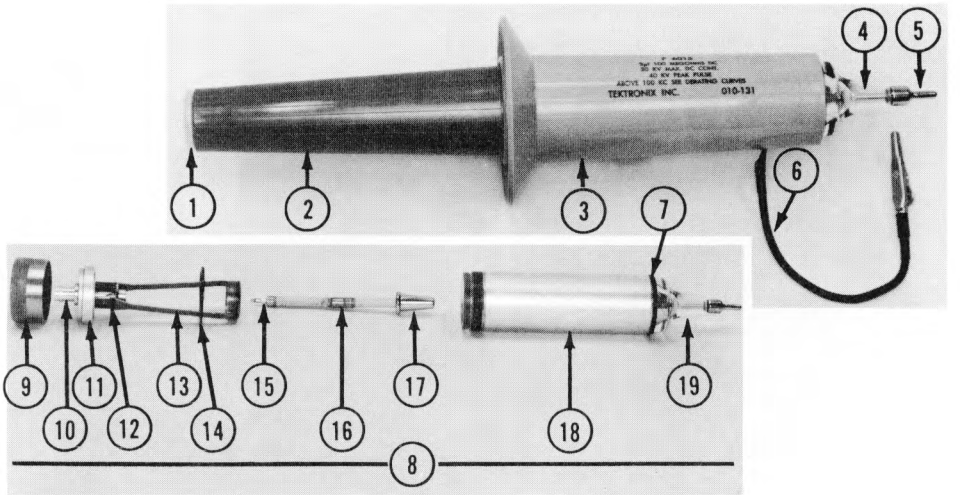


Fig. 4-2. P6015 Probe

REF NO.	CKT NO.	QTY	TEKTRONIX PART NUMBER	DESCRIPTION
			*010-131	P6015 PROBE (Consisting of the following)
1		1	*134-068	Plug
2		1	*367-034	Handle, Probe
3		1	*204-151	Body, Probe
4			*204-158	Inner Body Ass'y (See Ref. No. 8)
5		1	*206-116	Tip
6		1	*175-192	Strap, Ground
7		1	*354-189	Ring, Cushion
8		1	*204-158	Inner Body Assembly (Consisting of the following)
9		1	*354-190	Ring, Securing
10		1	131-264	Connector, BNC
11		1	*358-205	Bushing
12		2	*361-046	Spacer
		2	211-008	†Screw 4-40 × 1/4 BHS
		2	213-115	†Screw, Set 4-40 × 5/16
13		1	*214-310	Spring, Leaf Capacitor
14		1	*354-191	Ring, Sealing
		1	*214-318	†Resistor Assembly
15		1	134-015	Plug, Banana
16	R100	1	*310-597	Resistor, 100 meg, 2%, 2 w
17		1	*337-559	Cap, End
		1	*344-091	†Clip
18		1	*166-301	Sleeve
19		1	*204-157	Body (plastic shell w/nose insert)

† Not Shown

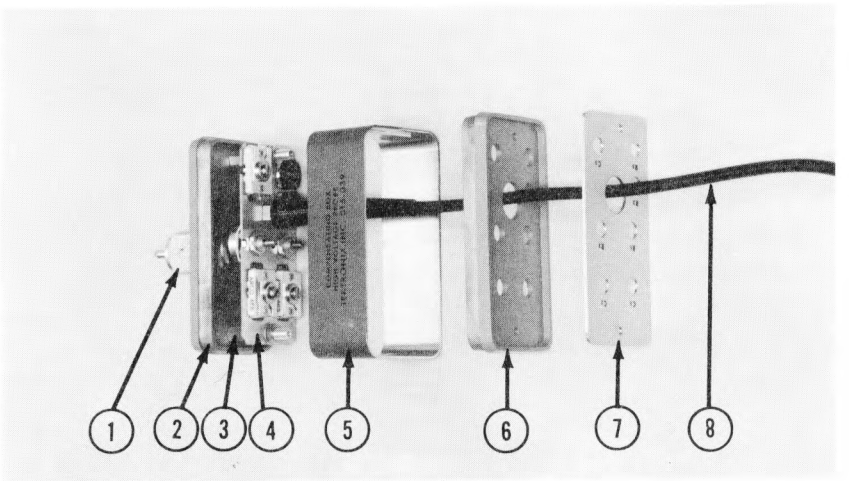
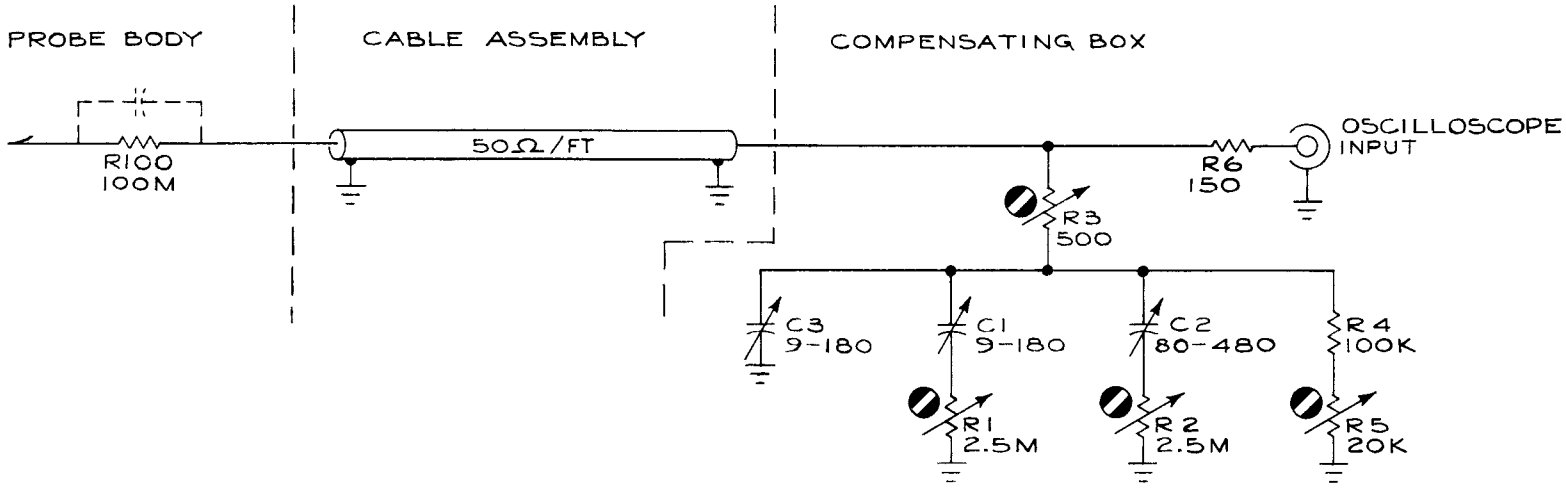


Fig. 4-3. Compensating Box

REF NO.	CKT NO.	QTY	TEKTRONIX PART NUMBER	DESCRIPTION
			*015-039	P6015 COMPENSATING BOX (Consisting of the following)
1		1	131-168	Connector, UHF
		1	*102-006	†Reducer
		1	200-026	†Cover, Connector
		1	210-012	†Washer, Lock int. $\frac{3}{8} \times \frac{1}{2}$ in.
		1	210-413	†Nut, Hex., brass, $\frac{3}{8}$-32 $\times \frac{1}{2}$ in.
2		1	*200-439	Cover
3		2	*361-047	Spacer
		2	210-010	†Washer, Lock int. No. 10
		2	210-410	†Nut, Hex., brass, 10-32 $\times \frac{5}{16}$
4		1	*441-467	Chassis
	C1, C3	2	281-023	†Capacitor, Var. 9-180 pf.
	C2	1	281-044	†Capacitor, Var. 80-480 pf.
	R1, R2	2	311-325	†Resistor, Var. 2.5 meg. 20%
	R3	1	311-150	†Resistor, Var. 500 Ω, 20%
	R4	1	309-045	†Resistor, 100 k, 1%, $\frac{1}{2}$ w
	R5	1	311-337	†Resistor, Var. 20 k, 20%
	R6	1	304-151	†Resistor, 150 Ω, 10%, 1 w
5		1	*380-045	Housing
6		1	*200-438	Cover
7		1	*200-440	Cover, End
		2	211-071	†Screw, 4-40 $\times \frac{3}{8}$ PHS
8		1	*175-264	Cable Assembly

† Not Shown



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