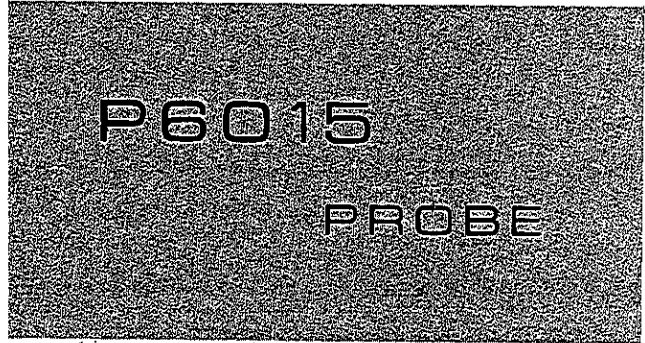


TEKTRONIX®



Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97005

070-0373-02

INSTRUCTION MANUAL

Serial Number _____ 474

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty 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 will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

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U.S.A. and foreign TEKTRONIX products covered by U.S. and foreign patents and/or patents pending.

TEKTRONIX is a registered trademark of Tektronix, Inc.

NOTICE

Use only FLUOROCARBON 114 ($C_2 Cl_2 F_4$) as dielectric fluid. Use of other FLUOROCARBON fluids may develop dangerous pressures. Exceeding Voltage and Temperature specifications may result in dangerous internal pressures developed in the Probe body.

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P6015

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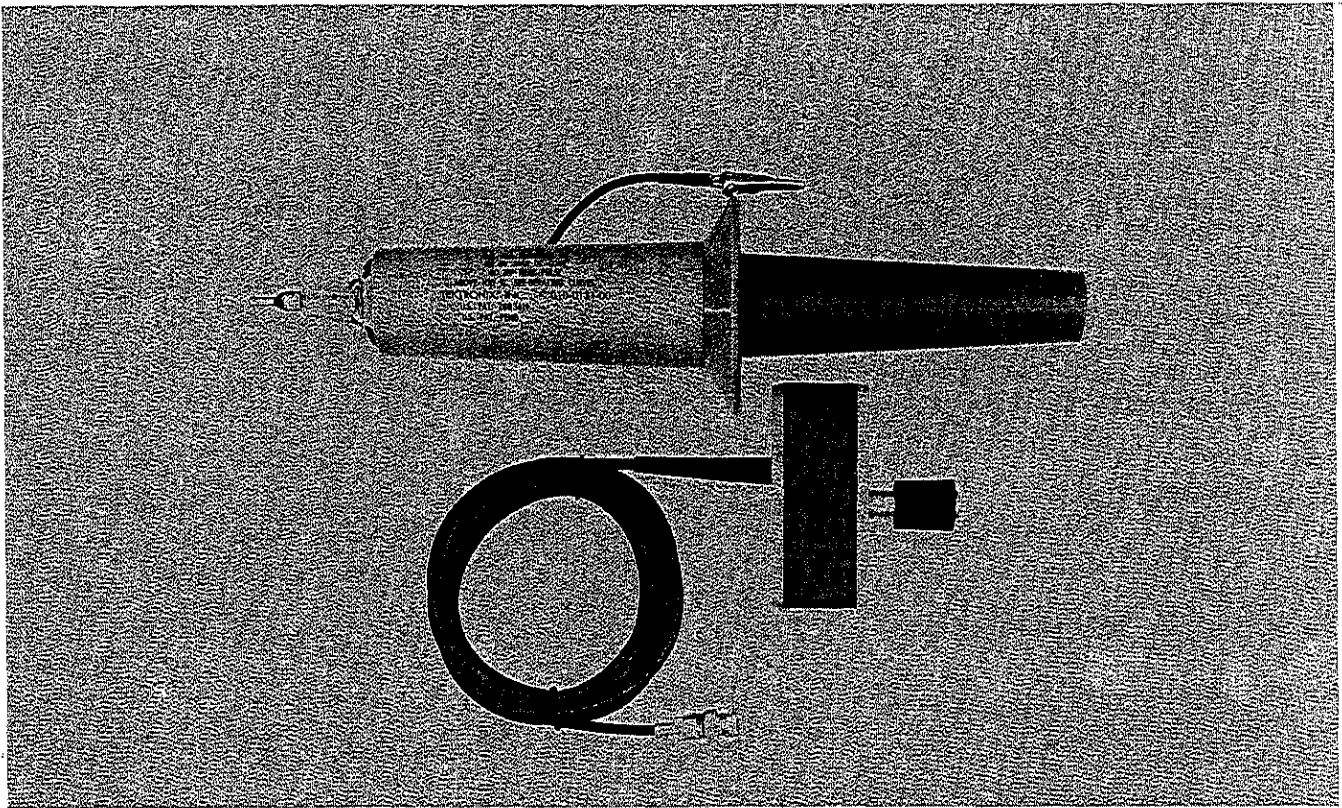


Fig. 1-1. P6015 Probe.

P6015

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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 ($\pm 3\%$).

Input Capacitance—Approximately 3 pF.

Maximum Input Voltage (DC or RMS) 20 kV (see derating chart, Fig. 1-2, for frequencies above 100 kHz).

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

Bandpass (with 7704A Oscilloscope and 7A13 Plug-In)—DC to 75 megahertz (flat within 2%).

Risetime (with 7704A Oscilloscope and 7A13 Plug-In)—Approximately 4.67 nanoseconds.

Temperature Range— 10°C to 55°C .

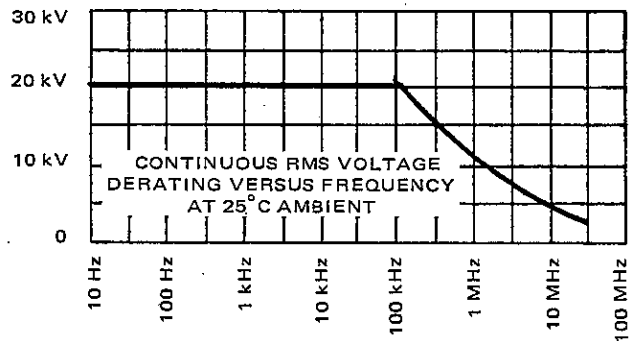


Fig. 1-2. Derating Chart for P6015 Probe.

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Mechanical Characteristics

Maximum Diameter of Probe Body—3 1/2 inches (diameter of guard flange).

Length of Probe Body—13-1/2 inches.

Length of Interconnecting Cable—Nominally 10 feet.

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

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

Output Connector Type—BNC and UHF type.

Weight of Assembly—1 pound 13 ounces.

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 kHz 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%.

Compensation can be checked by displaying the oscilloscope calibrator 40-volt output through the P6015 Probe. Adjust the oscilloscope controls (0.02 volts/div, sweep rate 0.5 ms/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.

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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 $50 \mu\text{s}/\text{div}$ 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 $0.2 \text{ ms}/\text{div}$ and adjust R2 and C2 to level the trailing 2 divisions of the top of the square wave.

5. Set sweep for $0.2 \text{ ms}/\text{div}$. 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.

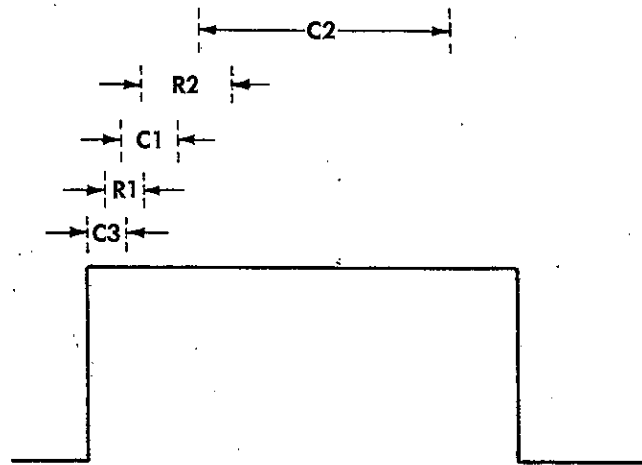


Fig. 2-1. Pulse area affected by each compensation adjustment.

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 fast enough for this adjustment. The most desirable signal source is a fast-rise pulse generator with enough charge line to generate at least a 100 ns pulse. However the 1 MHz output of a Tektronix 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 7A13. R3 should be

adjusted while observing the generator output signal at a sweep rate of $0.1 \mu\text{s}/\text{div}$. 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 kHz, 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.

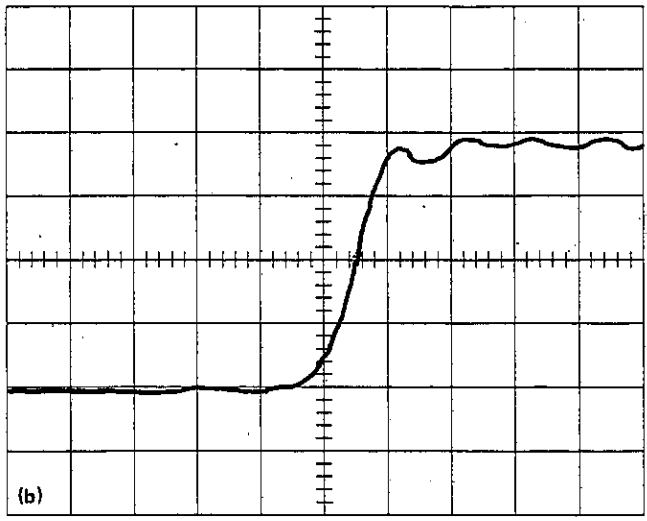
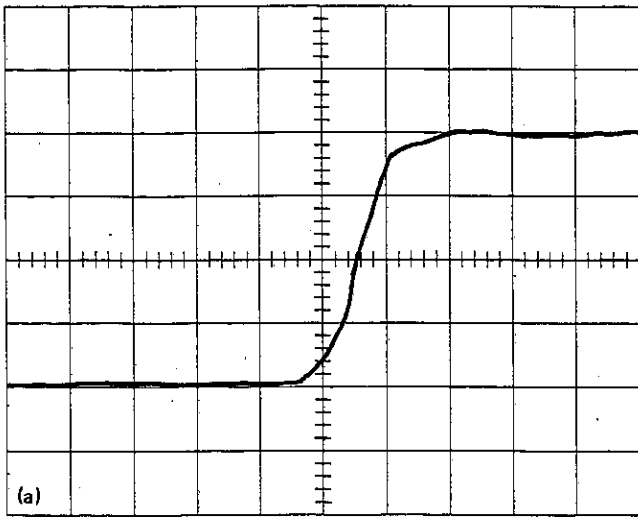


Fig. 2-2. Waveforms showing (a) Typical example of risetime within the probe capability (b) example of risetime exceeding the probes capability.

MAINTENANCE

Introduction

Normally, the 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.

WARNING

Use only Fluorocarbon 114 (C₂CL₂ F₄) dielectric fluid. Use of other Fluorocarbon fluids may develop excessive internal pressure.

Recharging the Probe

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 be approximately even with or .062 inch above the bottom of the small end of the resistor end cap (see Fig. 3-1).

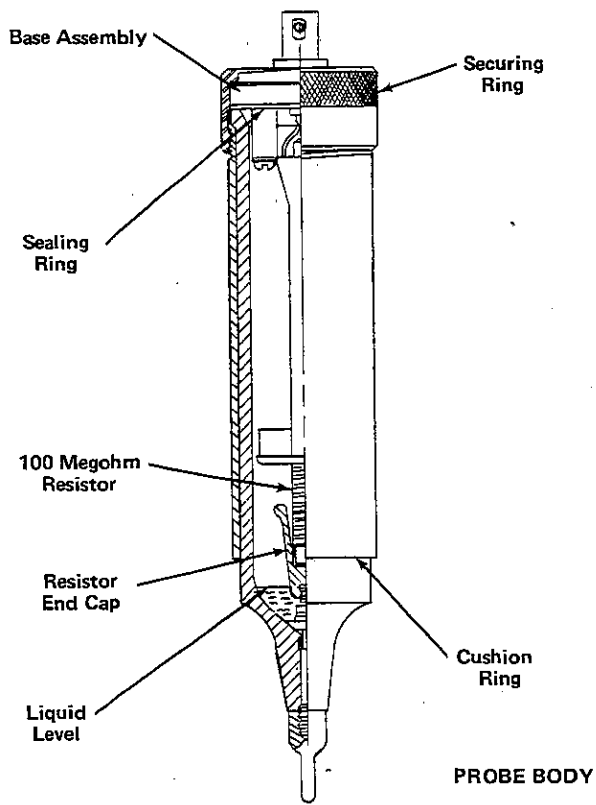


Fig. 3-1. Cutaway drawing of P6015 Probe.

Recharging the probe with fluorocarbon 114 requires no special tools or equipment besides the 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 level is approximately .125 inch above the small end of the gold-plated resistor end cap (see Fig. 3-1).
5. Replace the base assembly. Be sure the 100-megaohm resistor is properly mated. Screw on the securing ring (hand tight) (50-60 inch lbs).
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 approximately even with or .062 inch above 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.

Troubleshooting

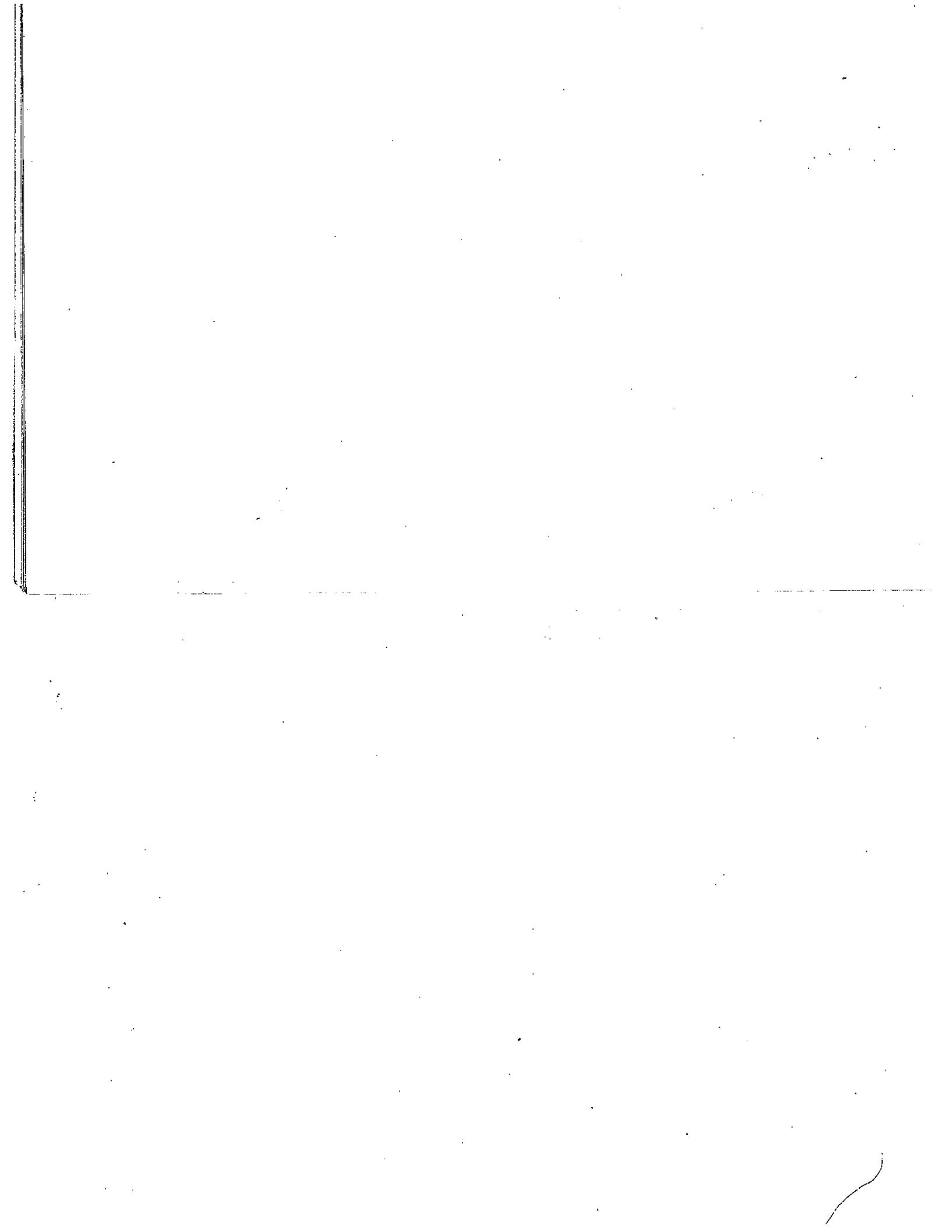
Following are some possible trouble symptoms and causes.

No Output or Differentiated Output. Connect 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.



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 Tektronix 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

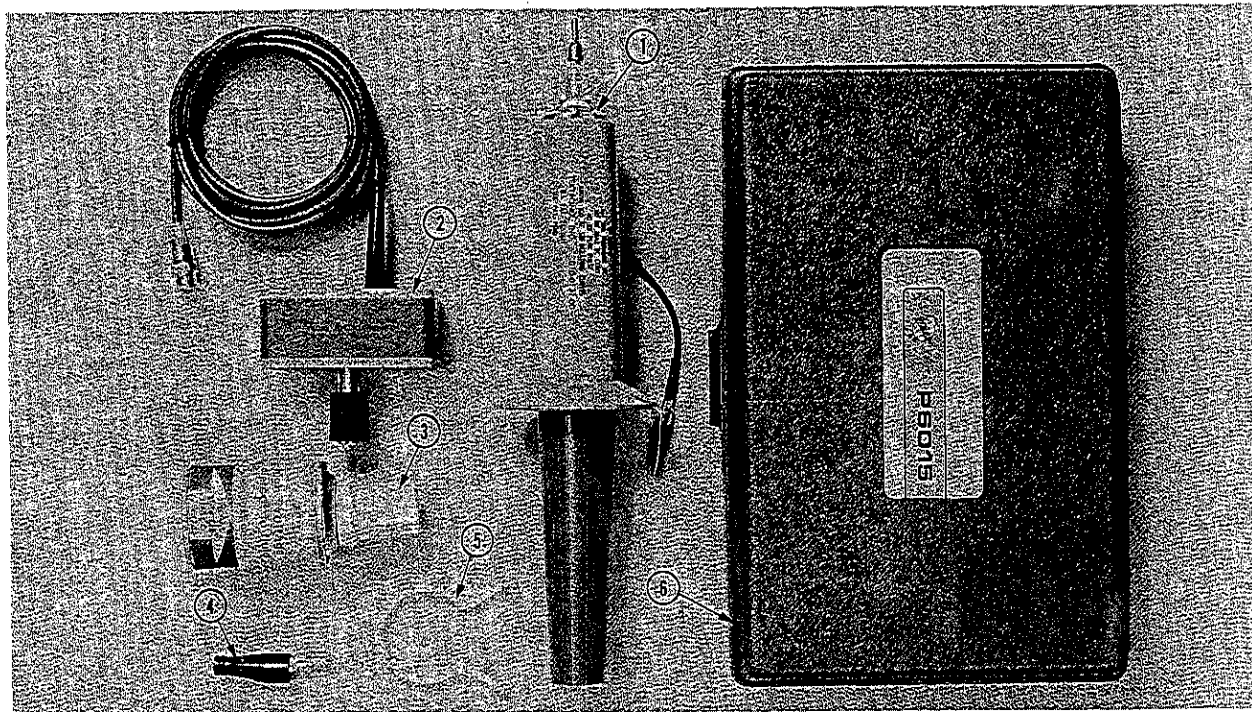
X000	Part first added at this serial number.
X000	Part first added at this serial number.
000X	Part removed after this serial number.
*000-000	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, also reworked or checked components.
Use 000-000	Part number indicated is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

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
01121	Allen-Bradley Co.	1201 2nd St. South	Milwaukee, WI 53204
01295	Texas Instruments, Inc., Components Group	P. O. Box 5012	Dallas, TX 75222
02958	Rudd Paint and Varnish Co.	1608-15th W.	Seattle, WA 98119
12697	Clarostat Mfg. CO., Inc.	Lower Washington St.	Dover, NH 03820
50293	Standard Pressed Steel, Aerospace Products Div.	Highland Ave.	Jenkinstown, PA 19046
63060	VLN Corp., Victoreen Instrument Div.	10101 Woodland Ave.	Cleveland, OH 44104
71590	Centralab Electronics, Div. of Globe-Union, Inc.	5757 N. Green Bay Ave.	Milwaukee, WI 53201
72136	Electro Motive Mfg. Co., Inc., The	South Park and John Streets	Willimantic, CT 06226
73743	Fischer Special Mfg. Co.	446 Morgan St.	Cincinnati, OH 45206
74868	Bunker-Ramo Corp., The Amphenol RF Div.	33 E. Franklin St.	Danbury, CT 06810
78189	Illinois Tool Works, Inc. Shakeproof Division	St. Charles Road	Elgin, IL 60126
78947	Ucinite Co., The, A United-Carr Div. of TRW, Inc.	459 Watertown St.	Newtonville, MA 02160
80009	Tektronix, Inc.	P. O. Box 500	Beaverton, OR 97005
83385	Central Screw Co.	2530 Crescent Dr.	Broadview, IL 60153
95712	Bendix Corp., The Electrical Components Div., Microwave Devices Plant	Hurricane Road	Franklin, IN 46131

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PROBE PACKAGE



PROBE PACKAGE

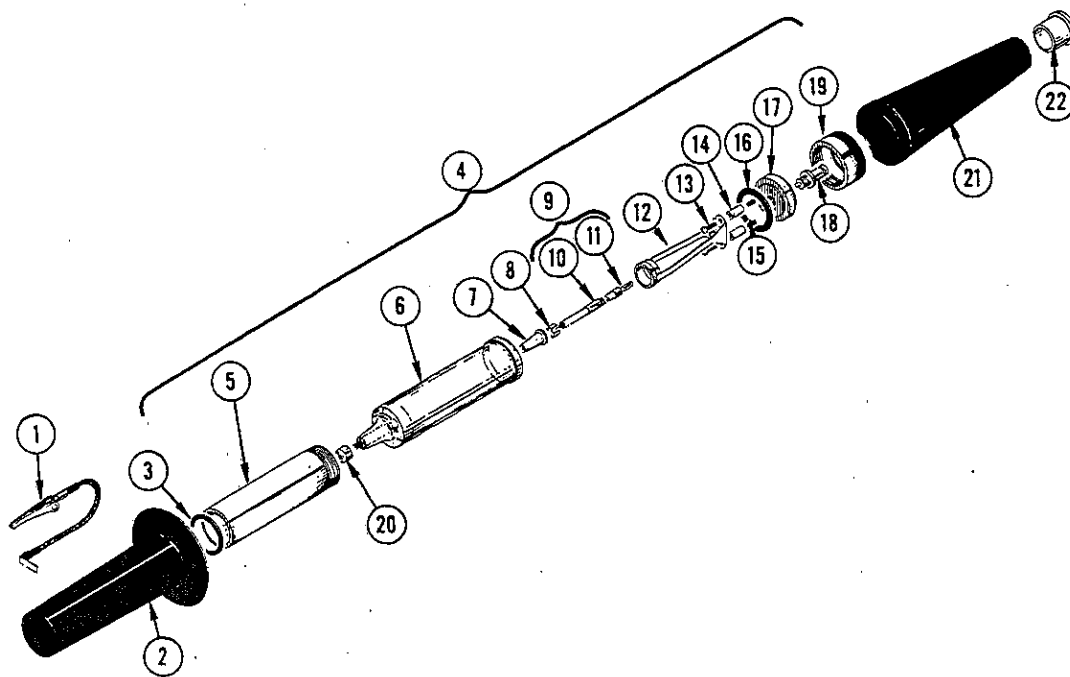
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	010-0132-00			1							80009	010-0132-00
	-----			-								
-1	010-0131-00			1							80009	010-0131-00
-2	015-0049-00			1							80009	015-0049-00
	015-0039-00			-							80009	015-0039-00
-3	252-0120-00			1							02958	202X22124
	256-0570-00		7401X	1								
-4	344-0005-00			1							80009	344-0005-00
-5	352-0056-00			1							80009	352-0056-00
-6	202-0139-00		6834X	1							80009	202-0139-00
	436-0035-00		6834X	1							80009	426-0035-00
	016-0128-00	X6835	7401	1							80009	016-0128-00
	004-0217-00		7401X	1							80009	004-0217-00
	016-0128-01	7402		1							80009	016-0128-01
	070-0373-01		7401	1							80009	070-0373-01
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Parts List and Schematic-P6015

4-5

PROBE

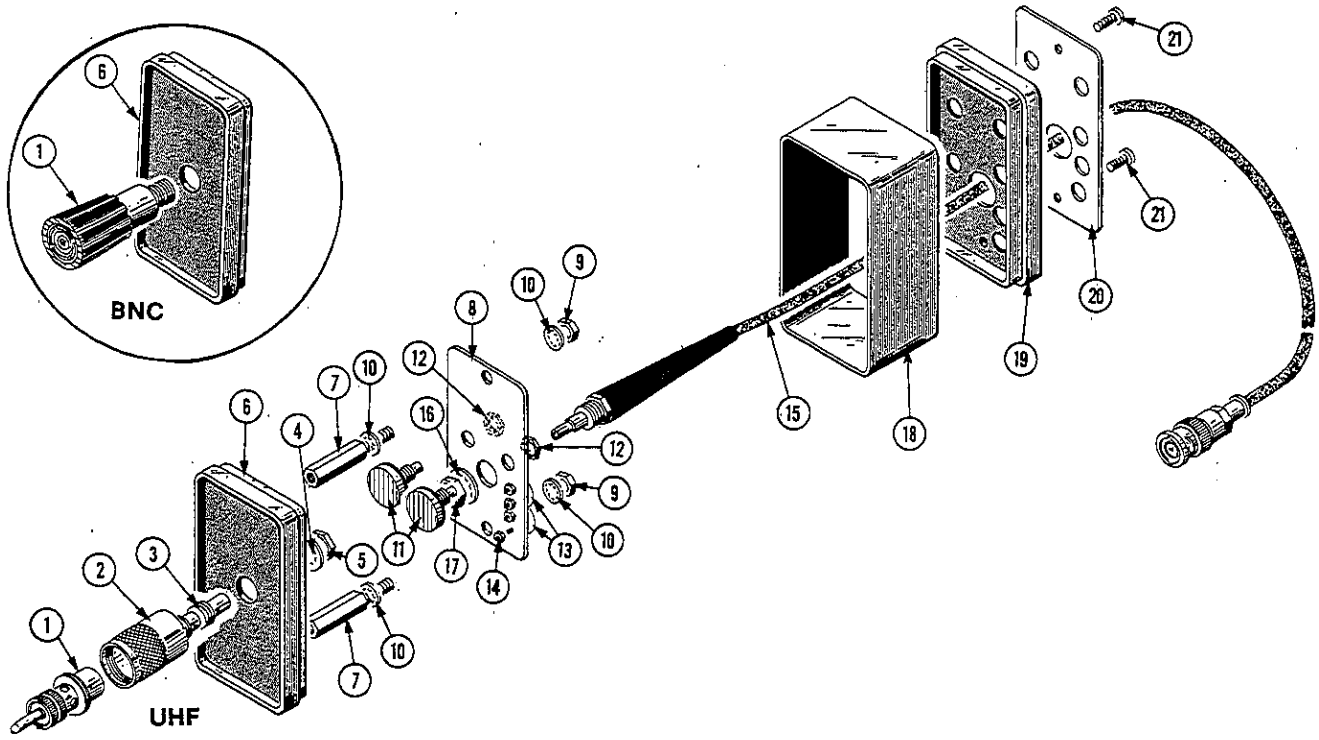


PROBE

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		Eff	Dscont									
-	010-0131-00			1						PROBE:P6015 HV	80009	010-0131-00
	-----			-						. PROBE INCLUDES:		*
-1	175-0592-00			1						. LEAD ELECTRICAL:	80009	175-0592-00
-2	204-0151-00			1						. BODY TEST PROD:	80009	204-0151-00
-3	354-0189-00			1						. RING,CUSHION:1.365ID X 1.50 INCH OD	80009	354-0189-00
-4	204-0158-00			1						. BODY ASSY:	80009	204-0158-00
	-----			-						. . . ASSEMBLY INCLUDES:		
-5	166-0301-00			1						. . . SLEEVE,SHIELD:	80009	166-0301-00
-6	204-0157-00			1						. . . PROBE BODY,INNER:	80009	204-0157-00
-7	337-0559-00			1						. . . SHIELD RESISTOR:	80009	337-0559-00
-8	344-0091-00			1						. . . CLIP,ELECTRICAL:	80009	344-0091-00
-9	214-0318-00			1						. . . RESISTOR,AND PLUG ASSY:	80009	214-0318-00
	-----			-						. . . ASSEMBLY INCLUDES:		
-10	-----			1						. . . RESISTOR:(SEE EPL R100)		
-11	134-0015-00			1						. . . PLUG,TIP:SMALL BANANA,MALE	78947	152004 UF4
-12	214-0310-00			1						. . . LEAF,CAP,ASSY:	80009	214-0310-00
										(ATTACHING PARTS)		
-13	211-0008-00			2						. . . SCREW,MACHINE :4-40 X 0.25 INCH, PNH STL	83385	OBD
-14	361-0046-00			2						. . . SPACER,NONMETAL:0.125D X 0.500 INCHES LG	80009	361-0046-00
-15	213-0115-00			2						. . . SETSCREW:4-40 X 0.312 INCH,HEX SOC STL	50293	OBD
-16	354-0191-00			1						. . . GASKET:1.170ID X 1.445 INCHES OD	80009	354-0191-00
										- - - * - - -		
-17	358-0205-00			1						. . . BUSHING CASE:	80009	358-0205-00
-18	131-0264-00			1						. . . CONNECTOR,RCPT:MALE BNC	74868	31-102
-19	354-0190-00			1						. . . RING,SECURING:	80009	354-0190-00
-20	206-0116-00			1						. . . TIP,TEST PROD:	80009	206-0116-00
-21	367-0034-00			1						. . . HANDLE,TEST PRO:	80009	367-0034-00
-22	134-0068-00			1						. . . GROMMET,PLSTC:1.25OD X .691ID X .700 LG	80009	134-0068-00

A

COMPENSATING BOX



4-8

Parts List and Schematic—P6015

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COMPENSATING BOX

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont									
	015-0039-00			1						COMP, TEST LEAD: (UHF)	80009	015-0039-00
	015-0049-00			1						COMP, TEST LEAD: (BNC)	80009	015-0049-00
	-----			-						. COMPENSATING BOX INCLUDES:		
-1	131-0168-00 ¹			1						. CONNECTOR, PLUG, :MALE, BNC	80009	131-0168-00
	131-0319-00 ²			1						. CONNECTOR, RCPT, :MALE, BNC	80009	131-0319-00
-2	200-0026-00 ¹			1						. SHELL, ELEC CONN:MALE CONNECTOR	95712	1227-18
-3	102-0006-00			1						. BSHG, ELEC CNDCT:REDUCER	80009	102-0006-00
-4	210-0012-00			1						. WASHER, LOCK:INTL, 0.375 ID X 0.50" OD STL	78189	1220-02-00-0541C
-5	210-0413-00			1						. NUT, PLAIN, HEX.:0.375-32 X 0.50 INCH, STL	73743	3145-402
-6	200-0439-00			1						. COV, BOX, REAR:	80009	200-0439-00
-7	361-0047-00			2						. POST, ELEC-MECH:0.125 DIA X 0.420 INCH LONG	80009	361-0047-00
-8	441-0467-00			1						. CHAS, ELEC EQUIP: (ATTACHING PARTS)	80009	441-0467-00
-9	210-0410-00			2						. NUT, PLAIN, HEX.:10-32 X 0.312 INCH, BRS	73743	2X20003-402
-10	210-0010-00			4						. WASHER, LOCK:INT, 0.20 ID X 0.376" OD, STL	78189	1210-00-00-0541C
										- - - * - - -		
-11	-----			2						. RES., VAR: SEE EPL R1 AND R2 (ATTACHING PARTS FOR EACH)		
-12	210-0583-00			1						. NUT, PLAIN, HEX:0.25-32 X 0.312 INCH, BRS	73743	2X20319-402
										- - - * - - -		
-13	-----			2						. RES., VAR: SEE EPL R3 AND R5 (ATTACHING PARTS FOR EACH)		
-14	210-0504-00			2						. NUT, PLAIN, HEX.:0-8 X 0.156 INCH, BRS	73743	3004-402
										- - - * - - -		

¹015-0039-00 (UHF)
²015-0049-00 (BNC)

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COMPENSATING BOX

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1	2	3	4	5	Name & Description	Mfr	
		Eff	Dscont								Code	Mfr Part Number
-15	175-0264-00			1						. CABLE ASSY, RF: (ATTACHING PARTS)	80009	175-0264-00
-16	210-0012-00			1						. WASHER, LOCK: INTL, 0.375 ID X 0.50" OD STL	78189	1220-02-00-0541C
-17	210-0590-00			1						. NUT, PLAIN, HEX.: 0.375 X 0.438 INCH, STL	73743	2X28269-402
-18	380-0045-00 ¹			1						. HOUSING, COMPENS: WRAPAROUND	80009	380-0045-00
	380-0069-00 ²			1						. HOUSING, COMPENS: WRAPAROUND	80009	380-0069-00
-19	200-0438-00			1						. COV, BOX, FRONT:	80009	200-0438-00
-20	200-0440-00			1						. PLATE, IDENT:	80009	200-0440-00
-21	211-0071-00			2						. SCREW, MACHINE: 4-40 X 0.375 INCH, PHS STL	83385	0BD

¹015-0039-00 (UHF)
²015-0049-00 (BNC)

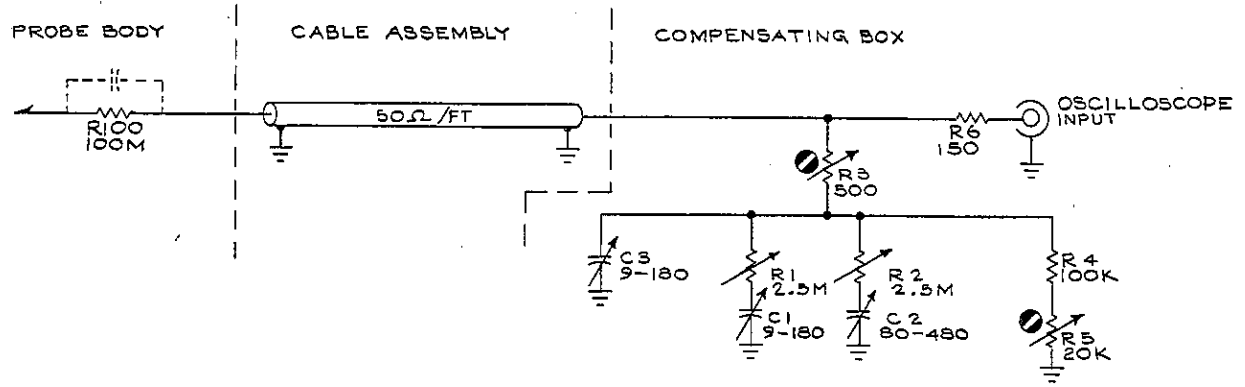
ELECTRICAL PARTS LIST

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr	
		Eff	Dscont		Code	Mfr Part Number
C1	281-0023-00			CAP., VAR, MICA D:9-180PF	72136	T52310
C2	281-0044-00			CAP., VAR, MICA D:80-480PF	72136	T52610
C3	281-0023-00			CAP., VAR, MICA D:9-180PF	72136	T52310
R1	311-0325-00			RES., VAR, NONWIR: 2.5M OHM, 20%	12697	CM33090
R2	311-0325-00			RES., VAR, NONWIR: 2.5M OHM, 20%	12697	CM33090
R3	311-0150-00			RES., VAR, NONWIR: 500 OHM, 20%	71590	BA305-016
R4	309-0045-00		-7345	RES., FXD, FILM: 100K OHM, 1%, 0.50W	01295	CD1-2MR1003F
R4	323-0385-00	7346		RES., FXD, FILM: 100K OHM, 1%, 0.50W	75042	CECT0-1003F
R5	311-0337-00			RES., VAR, NONWIR: 20K OHM, 20%	71590	BA305-036
R6	304-0151-00		-6423	RES., FXD, COMP: 150 OHM, 10%, 1W	01121	GB1511
R6	302-0151-00	6424		RES., FXD, COMP: 150 OHM, 10%, 0.50W	01121	EB1511
RL00	310-0597-00			RES., FXD, FILM: 100M OHM, +/-1%, 50,000V	63060	MOX-4SP

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