Instruction Manual

P6038 PROBE

070-400

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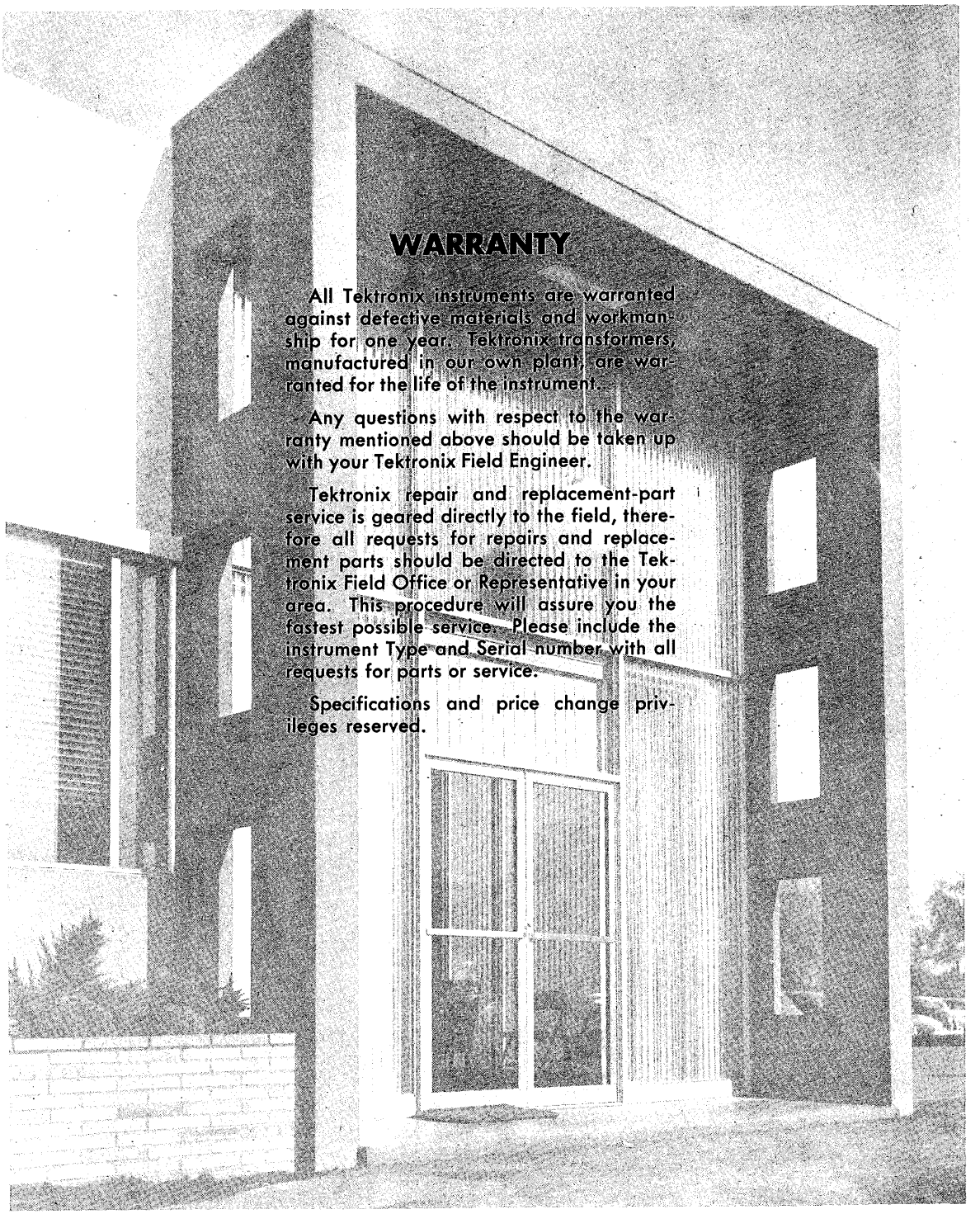


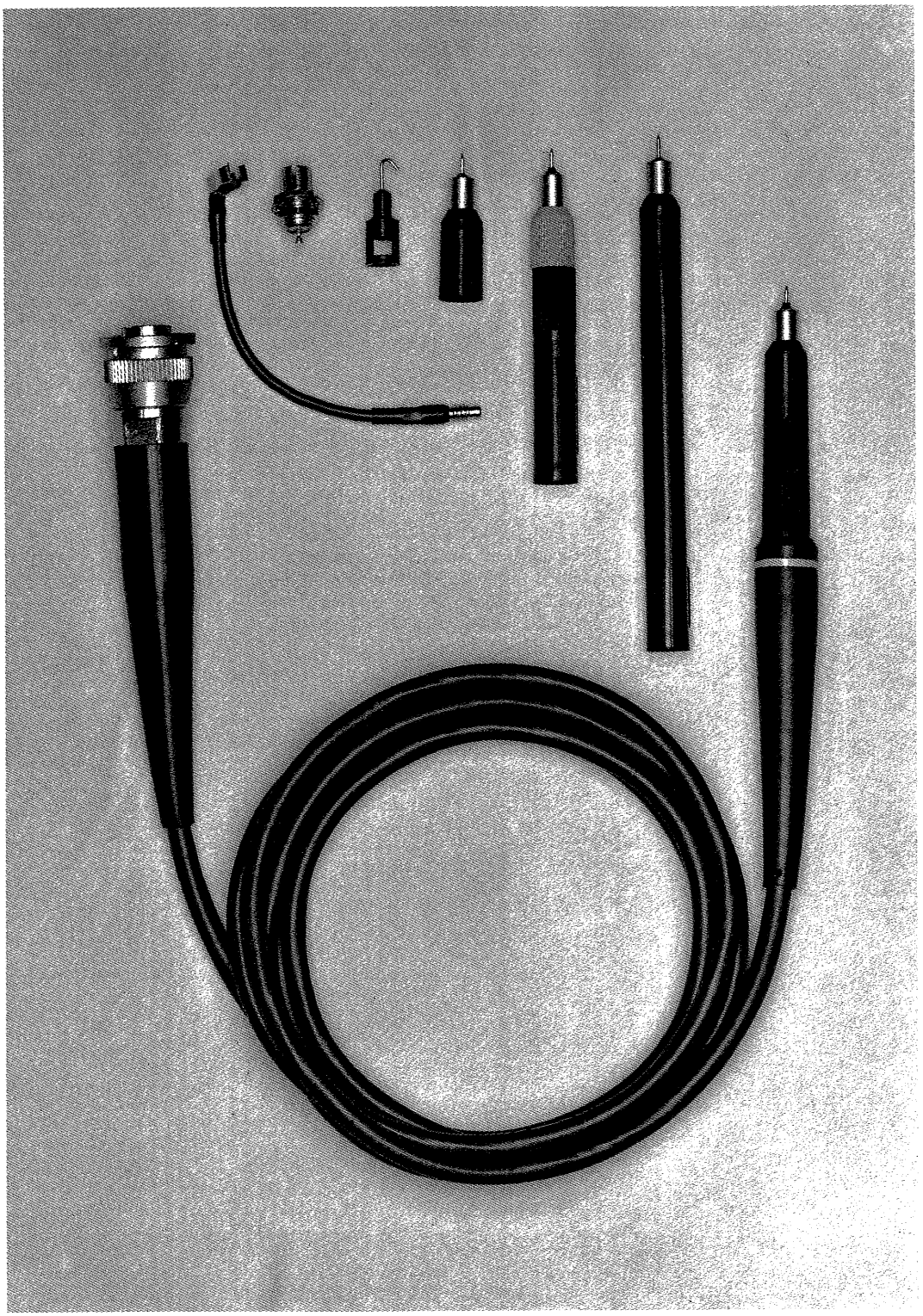
WARRANTY

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.



The P6038 Probe.

P6038 DIRECT SAMPLING PROBE

CHARACTERISTICS

The P6038 Probe is an integral part of certain Tektronix sampling plug-in units. Input resistance is 100 k, paralleled by approximately 2 picofarads. Typical impedance vs frequency curves are shown in Figs. 1 through 4. Small physical size, high input impedance, and wide-band capabilities of the P6038 Probe make it extremely useful for circuit investigation in the dc to 1,000 mc range.

Electrical

The following characteristics are for the four normal forms of operation of the P6038 Probe. Risetime is mainly controlled by the plug-in unit with which the probe is used (see the plug-in unit instruction manual).

TABLE I

P6038 Probe and Adapter Input Characteristics

	Input C	Input R	Max. input, dc + ac peak
P6038 Probe Only	2 pf ±10%	100 k ±1%	SEE
Probe and Coupling Capacitor	3.5 pf ±10%		PLUG-IN UNIT
Probe and 10× Attenuator	1.8 pf ±10%	1 meg ±1%	INSTRUCTION
Probe and Response Normalizer	3.5 pf ±10%	100.3 k ±1%	MANUAL

Mechanical

Probe Body Diameter — 3/8 inch.

Probe Length — 4 inches.

Cable Length — about 4½ feet.

Output Connector — special four pin.

Weight — 3 oz.

Accessories Included

	Tektronix Part No.
P6038 Probe	010-157
1 — Coupling Capacitor	011-072
1 — 10× Attenuator	011-071
1 — Response Normalizer	011-070
2 — Test-Point Jacks	131-258
1 — Hook Tip Assembly	206-114
1 — Ground Clip Assembly	175-249
1 — Plastic Probe Holder	352-024
1 — Carrying Box	202-123
1 — Instruction Manual	070-400

Accessory Characteristics

The Ac Coupling Capacitor (1000 pf min., 100 volts max.) allows the P6038 Probe to be ac coupled to the signal source.

The 10× Attenuator allows the signal to be attenuated to the P6038 Probe input a factor of 10 times. The attenuator is frequency compensated for a uniform frequency response through 1000 mc when driven by a 50-ohm signal source.

The Response Normalizer is a short section of 300-ohm transmission line that can be attached to the probe tip to reduce sensitivity to signal source impedance.

The low-frequency 3-db point, when using the Coupling Capacitor, is approximately:

Probe Only	1.5 kc
Probe and 10× Attenuator	150 cycles
Probe and Response Normalizer	1.5 kc

The test-point jacks included with each P6038 Probe package allow a solid electrical connection that adds little extra capacitance and insures a good high-frequency ground.

Optional Accessories (described in the plug-in unit instruction manuals):

	Tektronix Part No.
GR-To-P6038 Adapter	017-076
BNC-To-P6038 Adapter	103-038
Voltage-Pickoff Adapter, VP-2	017-077

OPERATING INSTRUCTIONS

Introduction

The P6038 Probe operates with Tektronix sampling-probe plug-in units including the Type 4S3 and 3S3. The probe connects to the plug-in unit with a special four-pin locking connector. Two are used with each plug-in unit, each color coded to match the channel on which it was factory calibrated.

The P6038 can be used to signal trace directly within a test circuit, or can be inserted into a special chassis or coaxial fitting. (The test-point jack provided with the probe adds about 0.6 pf to the probe input capacitance.) Use the ground clip assembly for signal tracing; a coax-to-probe adapter, a test-point jack, or the VP-2 for pulse risetime measurements. The signal source impedance must be low when measuring pulses with risetimes near the system limit.

The P6038 can be compared with any standard oscilloscope probe. The bandwidth (risetime) is limited by internal circuitry, source resistance, and input-capacitance time constant. However, the P6038 input capacitance is quite low, nominally 2 pf, allowing a very fast response to low-impedance signals.

Source-Impedance Sensitivity

The probe input is sensitive to both source resistance and capacitance, and the sampling system dot-transient response varies as the input-circuit impedance is varied. The no-signal trace level will shift vertically as the signal source impedance is changed. This is caused by a small amount of kickout from the probe tip due to unavoidable differences in diode and strobe pulse characteristics. (The kickout pulse is a bit larger during the time the sampling bridge is responding to a change in signal level.)

The probe tip is not critically damped when measuring very low-impedance signal sources. The probe tip is a short length of wire between the very tip and the sampling bridge. The tip has about 2 nh of inductance. Combined with the input capacitance of about 2 pf, the input tip will ring when driven from an impedance less than about 33 ohms. The ringing is obvious when the plug-in unit Noise-Risetime switch is at Fast Risetime and the probe sees an impedance less than 50 ohms. Ringing is less when the switch is at Low Noise. For this reason, the Characteristics section of the plug-in unit manuals show risetime figures for signal sources of no less than 50 ohms.

Response Normalizer

To make the probe input insensitive to source impedance, a special non-attenuating Response Normalizer is provided. Placing it on the tip of a probe lets the probe sampling gate look into a constant 300-ohm source impedance during the time each sample is taken. Thus, there will be almost no base-line trace shift due to different source impedances.

The Response Normalizer, however, adds about 1.5 pf to the probe input capacitance. The system risetime is now limited because the sampling gate is fed through 300 ohms in series with the signal source impedance. Without the normalizer, the probe input is 100 k, paralleled by 2 pf with a 0.35-nsec risetime. With the normalizer, the probe is 100 k, paralleled by 4 pf with a risetime of 1.5 nsec. The advantage of the Response Normalizer is that it reduces the display base-line shift as the signal source impedance is changed.

10X Attenuator

A second method for making the probe input insensitive to source impedance is to use the 10× Attenuator which is also effective in isolating the diode gate from the source impedance.

See the plug-in unit instruction manuals for additional operating information.

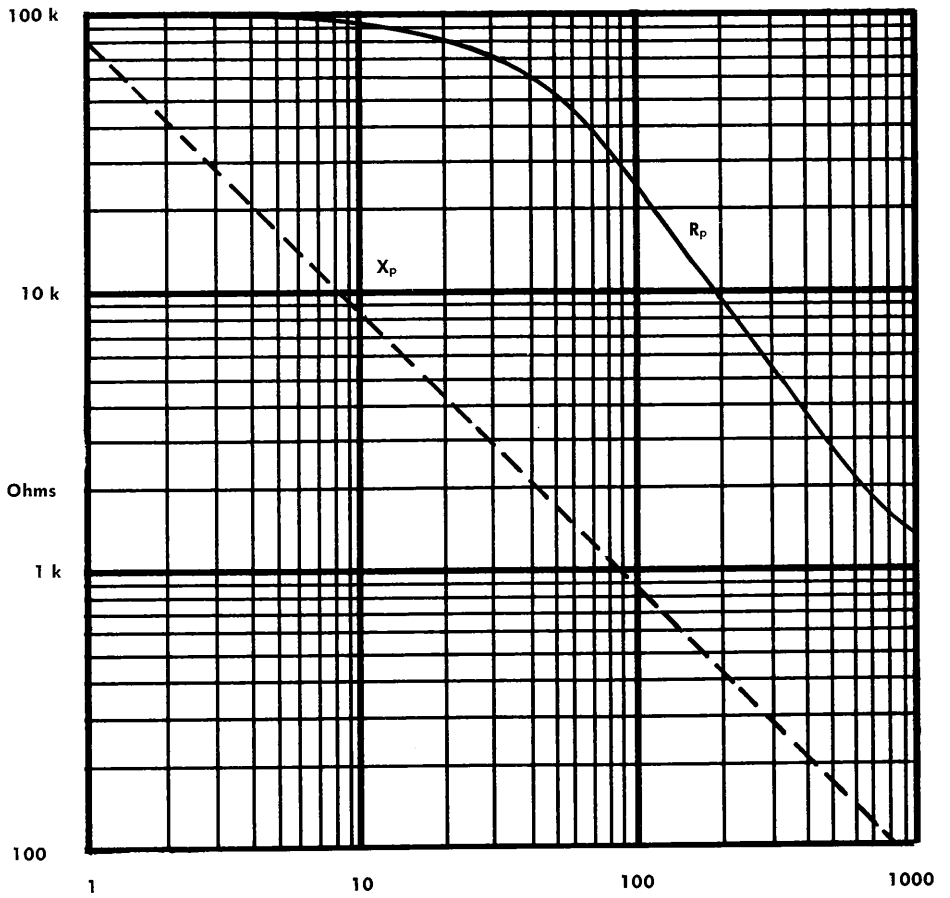


Fig. 1. P6038 Probe only, input resistance and reactance vs frequency.

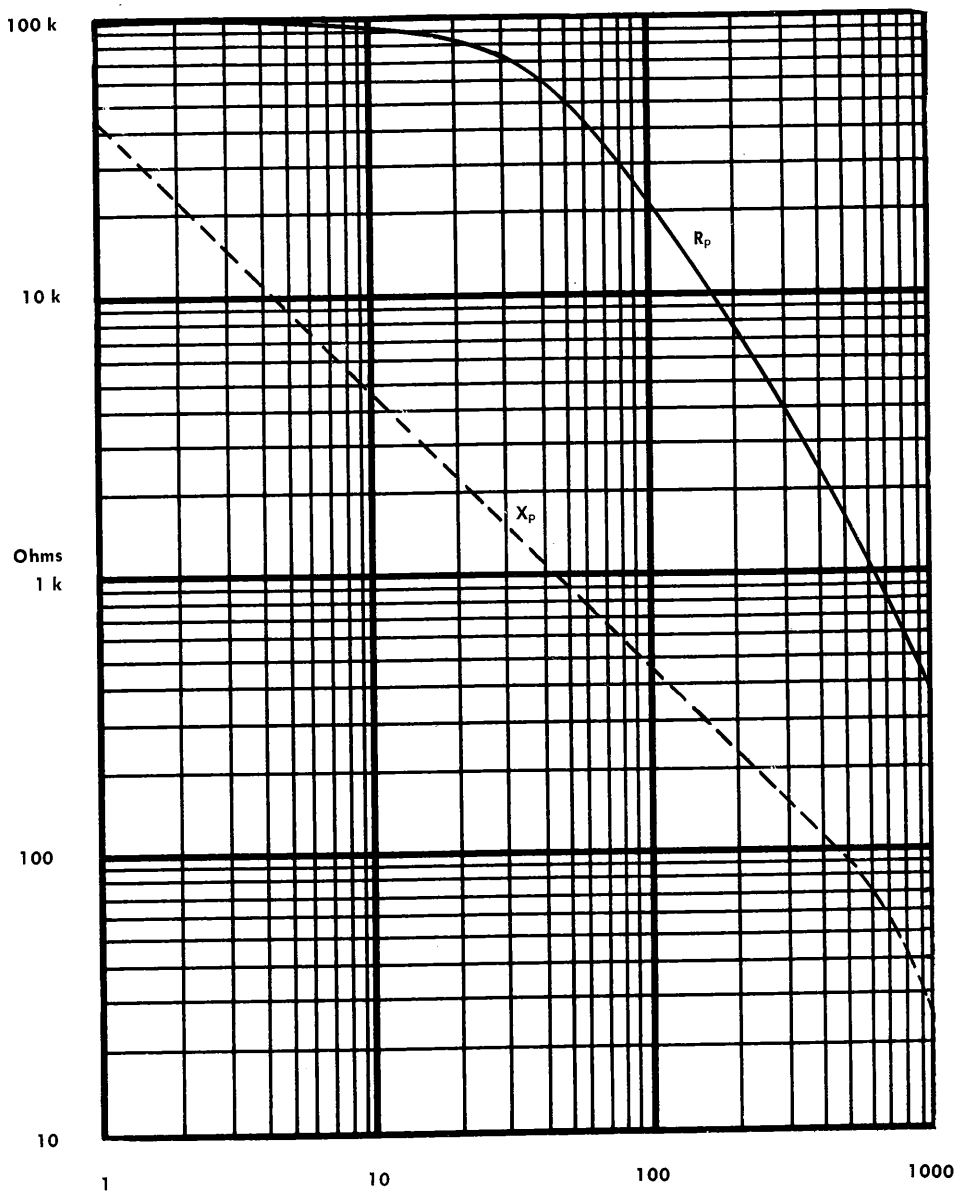


Fig. 2. P6038 Probe and Ac Coupling Capacitor input resistance and reactance vs frequency.

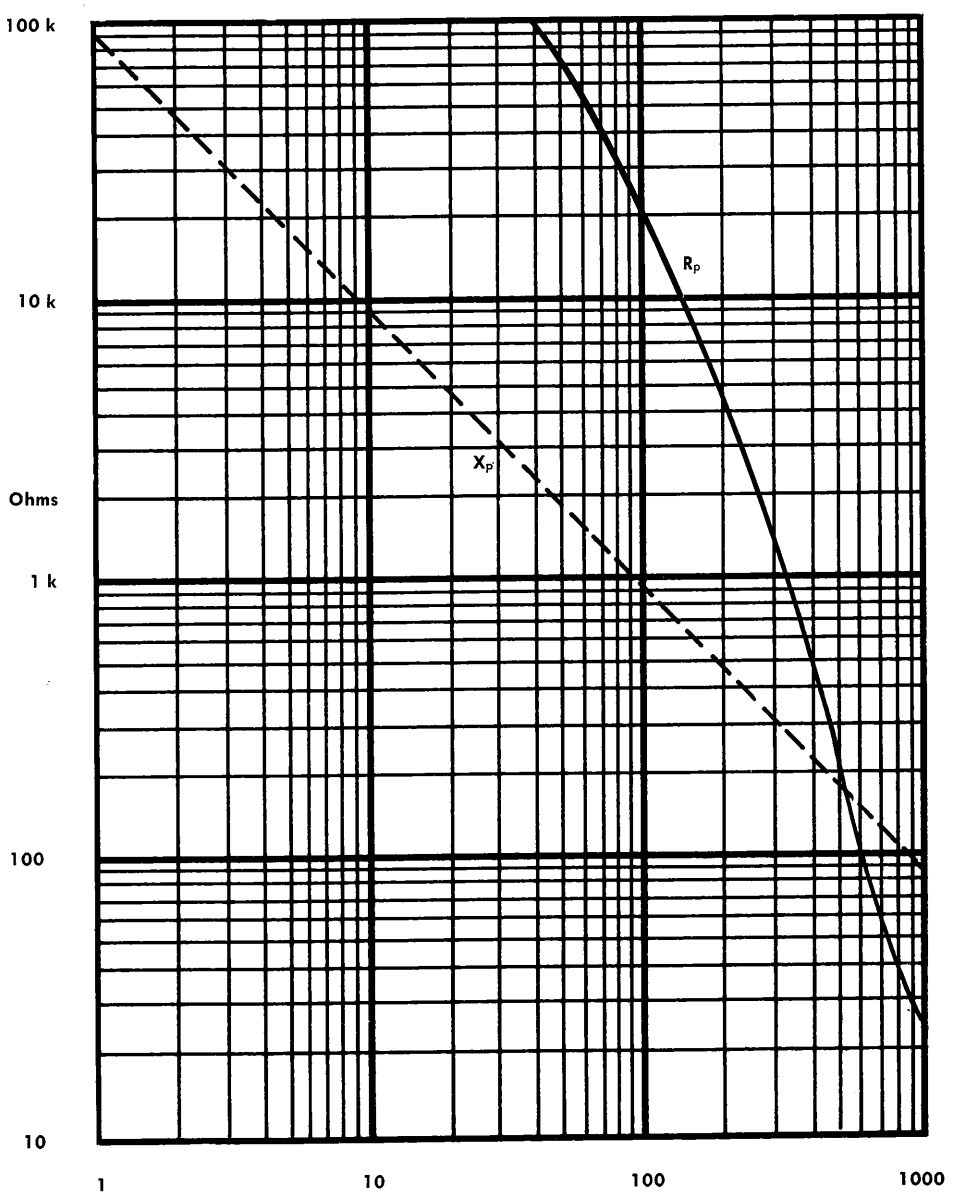


Fig. 3. P6038 Probe and 10× Attenuator input resistance and reactance vs frequency.

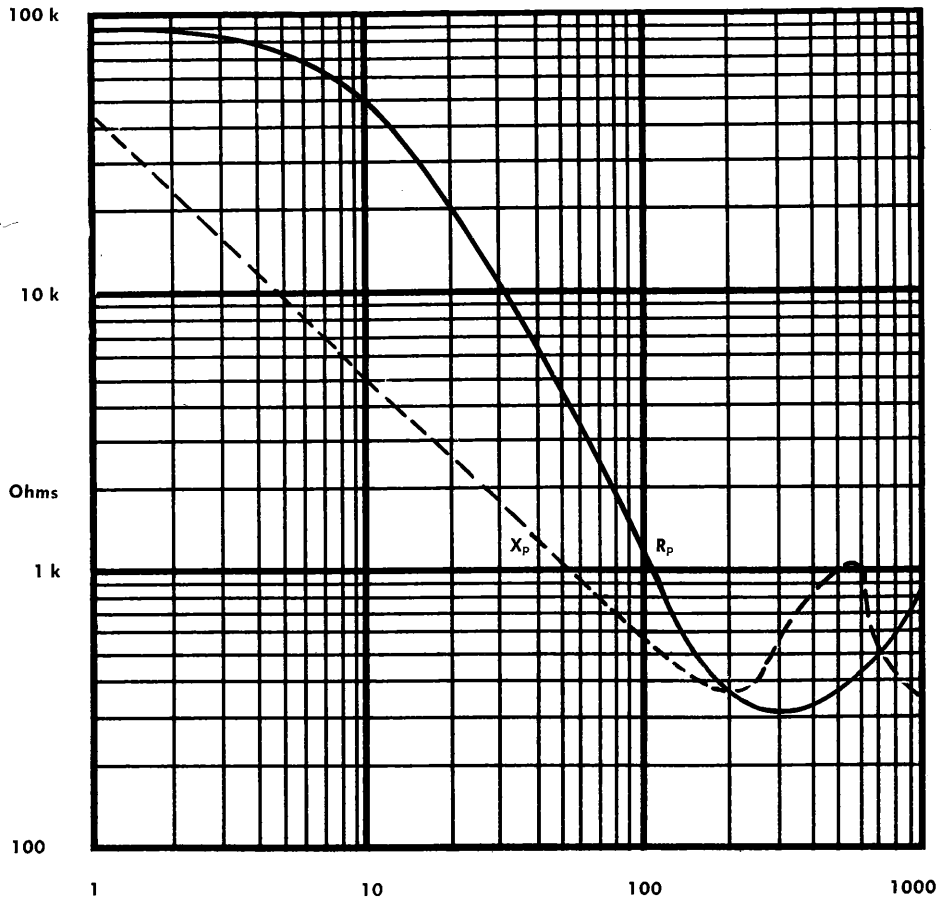


Fig. 4. P6038 Probe and Response Normalizer input resistance and reactance vs frequency.

MAINTENANCE

General Information

The P6038 Probe should be inspected if it is dropped or if damage is obvious. If inoperative, inspect the inside of the probe by grasping the cable-strain relief boot about 3/4 inch from the probe body; then turn the probe body counterclockwise about six complete turns to free the securing threads and allow the body to be removed from the tip end.

The cable strain-relief boot should not be forced back from its normal position, as a special tool is required to reinstall it.

The sampling-gate diodes are snapped in place. If the probe has been dropped, one or more of the diodes may have slipped out of one of its clips. Fig. 5 shows the proper location of the diodes and their polarity. Return a diode to its clips by applying pressure on the lead, not on the ceramic body. (Diodes can be broken by finger pressure on the body.)

If any diodes fail, a selected set of four is available by ordering Tektronix Part No. 152-144. The diodes come in two pairs. Each pair is to be placed side-by-side, either at the tip end, or at the cable end. Do not mix diode

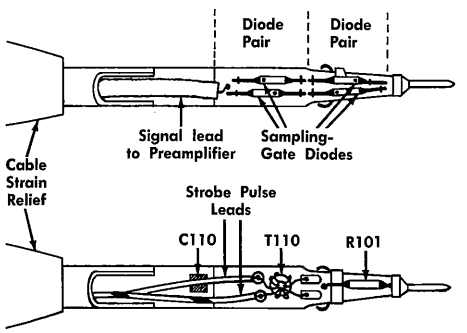


Fig. 5. Inside view of the P6038 Probe.

locations or diode sets. Diode set replacement requires complete recalibration.

If any other parts require replacement, send your probe to your nearest Tektronix Field Repair Center. Do not attempt any soldering, as a special positioning jig is required to set proper tolerances.

To replace the probe body, take care that the threads do not rub against any components or the cable dielectric foam, and reverse the removal procedure. Gentle handling is important; the P6038 Probe is not intended for rugged use.

CALIBRATION

General Information

The P6038 Probe transient and balance calibration procedure is part of the calibration procedure of the associated plug-in unit. However, proper frequency compensation of the 10× Attenuator is accomplished in the same manner regardless of plug-in unit in use.

The 10× Attenuator should not require frequent calibration through normal use.

Equipment Required

The following equipment is required to compensate the 10× Attenuator.

1. A 25-kc square-wave generator capable of delivering about 8 or 10 volts peak-to-peak into 50 ohms, risetime no greater than 13 nsec, 10% to 90%. Tektronix Type 105 Square-Wave Generator recommended.

2. A GR-To-UHF Adapter (GR Type 874-QUP). Tektronix Part No. 017-023.

3. A UHF-To-BNC Adapter. Tektronix Part No. 103-015.

4. A 50 Ω Inline Termination, with BNC connectors. Tektronix Part No. 011-049.

5. A BNC-To-P6038 Adapter. Tektronix Part No. 103-038.

6. A UHF Clip Lead Adapter (clip leads to UHF jack). Tektronix Part No. 013-003.

7. A 10× Attenuator with GR connectors. Tektronix 10×T Attenuator, Part No. 017-044, recommended.

8. A 5× Attenuator with GR connectors. Tektronix 5×T Attenuator, Part No. 017-045, recommended.

9. A short length of RG-8A/U coaxial cable with GR connectors, such as the Tektronix 5-nsec cable, Part No. 017-502.

10. A calibrated Type 661 Oscilloscope, with calibrated Types 4S3 and 5T1A plug-in units. Or, a calibrated Type 560-Series Oscilloscope with calibrated Types 3S3 and 3T77 plug-in units.

11. A dc resistance bridge, accurate to 0.2% at 900 k.

Preliminary Procedure

Assemble the sampling system for operation and allow at least a ten-minute warmup before making any adjustments. Assemble the square-wave generator and connectors as shown in Fig. 6.

Adjustment Procedure

Set the sampling system controls for an externally triggered display at 5 nsec/cm at 100 samples/cm. The external triggering signal from the Tektronix Type 105 Square-Wave Generator is positive, about 5 volts peak-to-peak. (If using a generator other than the Type 105, use enough attenuation in the external trigger cable to limit the trigger signal to that required by the timing unit.)

Set the square-wave generator to operate at 25 kc at an initial amplitude of about 3 volts peak-to-peak.

Set the sampling unit controls as follows:

Type 3S3

MV/DIV	100
VARIABLE	CALIB
NORM-INV	NORM
POSITION	Midrange
DC OFFSET	Display centered
Noise-Risetime	FAST RT
SMOOTHING	Adjust for unity loop gain

Type 4S3

MILLIVOLTS/CM	200
VARIABLE	CALIBRATED
DISPLAY	NORMAL
VERT POSITION	Midrange
DC OFFSET	Display centered
Noise-Risetime	FAST RISETIME
SMOOTHING	Adjust for unity loop gain

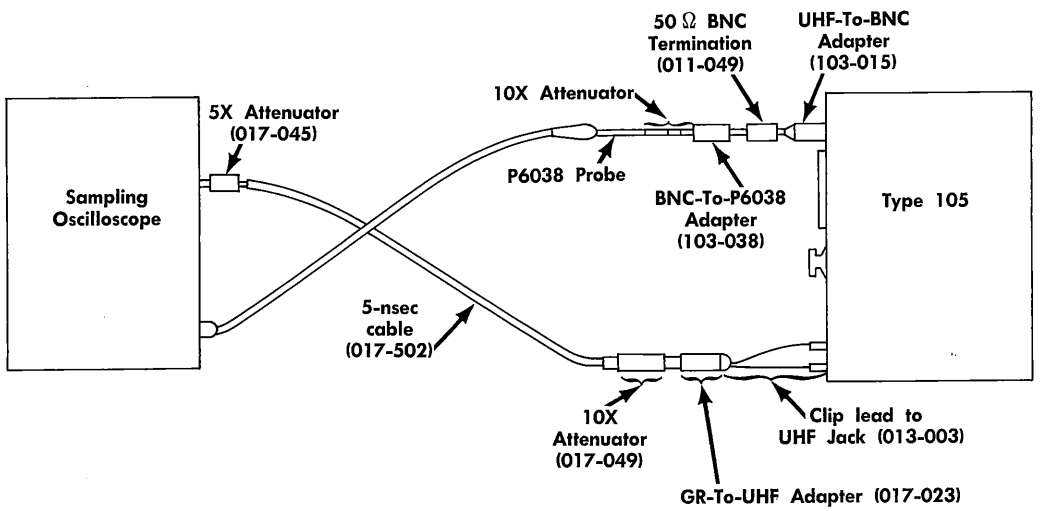
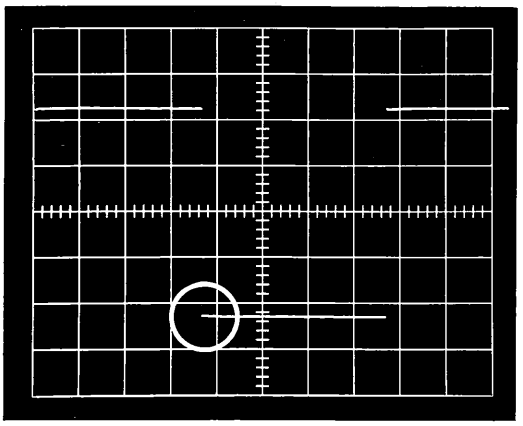
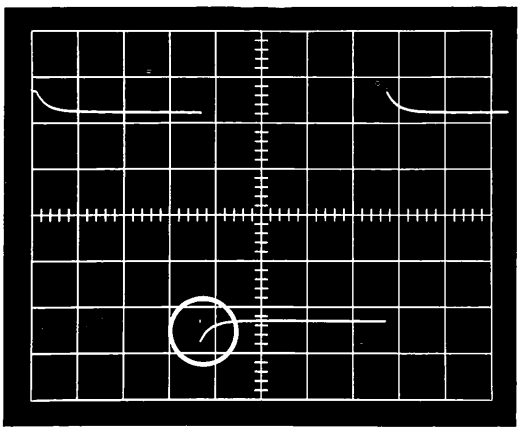


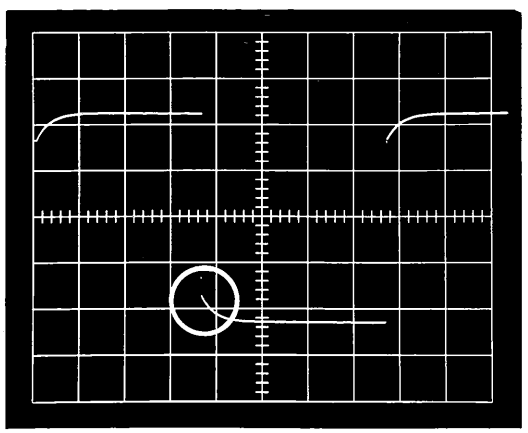
Fig. 6. Equipment setup for 10X Attenuator compensation.



a. Correctly compensated.



b. Over compensated.



c. Under compensated.

Fig. 7. 10X Attenuator compensation waveforms.

1. Input Resistance Check

a. With the 10× Attenuator separate from the probe, connect the dc resistance bridge between the tip and the center conductor at the other end. The resistance should be 900 k, ±1%. (Do not use an ac signal with the bridge as the attenuator capacitance will cause an erroneous reading.)

b. If the resistance is out of tolerance, do not try to repair the attenuator. Instead, send it to your area Field Repair Center.

2. Compensation Check

a. Assemble the attenuator to its probe and complete the setup shown in Fig. 6.

b. Set the square-wave generator output for a display amplitude of about 5 divisions.

c. Compare the crt display with the waveforms in Fig. 7. If the display shows the attenuator to be correctly compensated, do not make any adjustments.

d. If the attenuator is either over- or under-compensated, proceed to step 3.

3. Adjustment Procedure

a. Loosen the Locking Sleeve, shown in Fig. 8, by turning it about one quarter turn counterclockwise. (Do not remove the locking sleeve.)

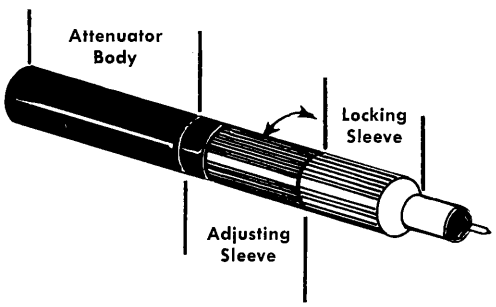


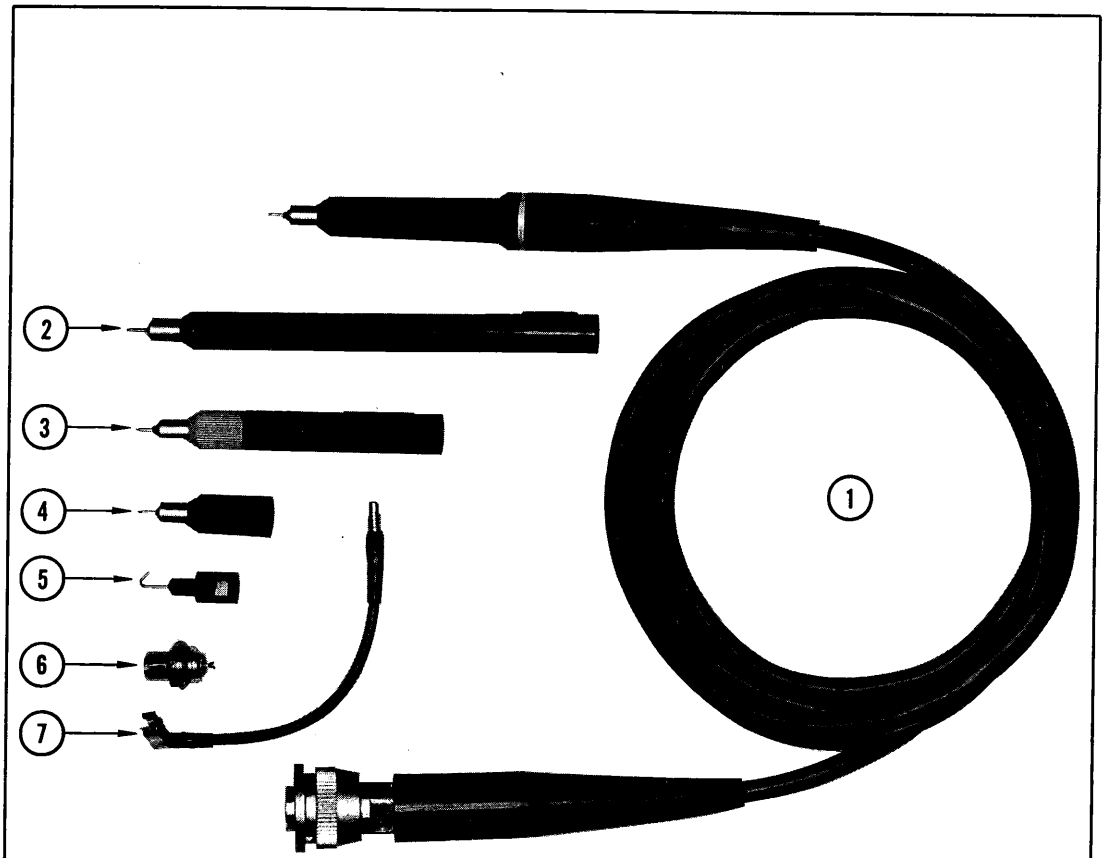
Fig. 8. 10X Attenuator external parts.

b. Hold the Locking Sleeve and the end of the BNC-To-P6038 Adapter with the thumb and forefinger, so the Locking Sleeve cannot turn as the adjustment is made.

c. Slowly turn the Adjusting Sleeve to correct the display. As the display shows correct adjustment, slowly tighten the Locking Sleeve and watch the display. As the Locking Sleeve tightens, the display may shift a small amount, correct it by turning the Adjusting Sleeve while the Locking Sleeve pressure is applied. By this method, the final adjustment will be correct when the Locking Sleeve is finger tight. Snug down the Locking Sleeve by hand pressure only.

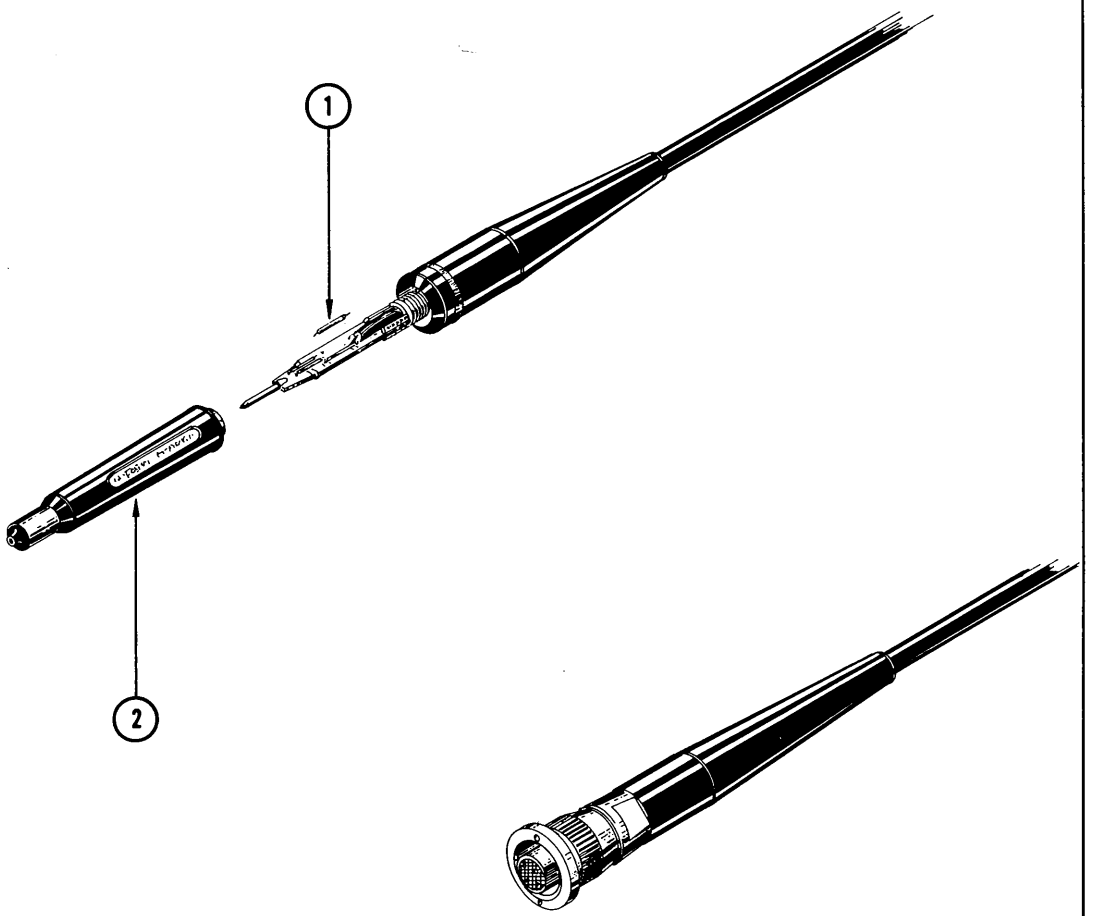
d. Repeat the procedure for the attenuator, on the other channel probe.

P6038 PROBE WITH STANDARD ACCESSORIES



REF. NO.	PART NO	SERIAL NO. EFF.	SERIAL NO. DISC.	QTY.	DESCRIPTION
PROBE PACKAGE					
1-7	010-156				PROBE AND STANDARD ACCESSORIES
PROBE ONLY					
1	010-157				PROBE, P6038
STANDARD ACCESSORIES					
2	011-071			1	10X ATTENUATOR
3	011-070			1	RESPONSE NORMALIZER
4	011-072			1	COUPLING CAPACITOR
5	206-114			1	TIP, probe, hooked
6	131-258			1	CONNECTOR, bulkhead receptacle
7	175-249			1	CABLE, ground assembly

REPLACEMENT PARTS



REF. NO.	PART NO	SERIAL NO. EFF.	SERIAL NO. DISC.	QTY.	DESCRIPTION
	010-157				PROBE, P6038
	- - - - -			-	Includes:
1	152-144			2	DIODE, matched quad
2	204-207			1	BODY, probe, assembly
					FOR REPLACEMENT OF PARTS NOT LISTED, CONTACT YOUR TEKTRONIX FIELD OFFICE.

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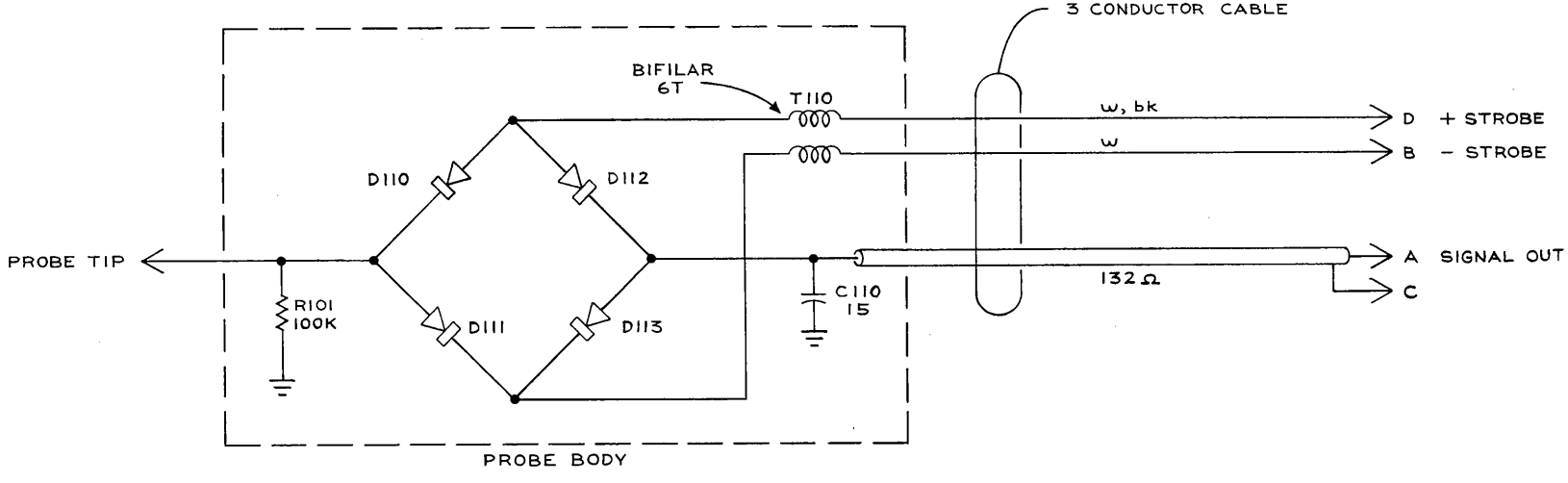

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P6038 SAMPLING PROBE