PRELIMINARY INSTRUCTION MANUAL

P6032 CATHODE-FOLLOWER PROBE

This is a preliminary instruction manual. It is not complete, and it may contain minor errors. We will send you the permanent instruction manual just as soon as it is ready. Be sure to complete and send in the attached card so that we can send the manual directly to the user of the instrument.

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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.

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SECTION 1

CHARACTERISTICS

General

The Tektronix Type P6032 Cathode-Follower Probe is a high-frequency probe designed for use with Tektronix vertical sampling plug-in units, such as Types 3S76 or 4S1. The probe provides a high-impedance input for the sampling system. Seven plug-on attenuator heads provide a selection of attenuation ratios between 10 and 1000.

Probe and Attenuator Heads

Attenuation -- 10X, 20X, 50X, 100X, 200X, 500X, 1000X (including probe attenuation of 3X). Selected by changing attenuator heads.

Risetime --
Frequency Response --
Maximum Input Voltage -- — See Table 1-1.
Input Resistance --
Input Capacitance --

Dc Offset -- Approximately +0.5 volt.

Maximum Output -- ±150 mv into 50 Ω load.

Signal Delay -- Approximately 10 nsec.

Coupling Capacitor (Tektronix Part No. 010-330)

Capacitive Element -- .001 μf.

Voltage Rating -- 600 v dc.

Low-Frequency 3-db Point -- 16 cps.

Power Requirements

Heater -- 12.6 volts at 180 ma.

Plate Supply -- +100 volts dc at 12 ma.

Mechanical

Cable Length -- 54 inches.

Power Plug -- 4-pin miniature.

Signal Out Connector -- GR Type 874 (50 Ω).

Accessories

2 -- Ground Clips.

1 -- Bayonet Ground Clip.

2 -- Instruction Manuals.

TABLE 1-1

Attenuator Head	Typical Risetime	Frequency Response(3db)	Max. Input Voltage*	Input Capacitance at DC (±10%)	Input Resistance at DC (±2%)
10X (010-350)	0.4 nsec	850 mc	±1.5 v	3.6 pf	10 meg
20X (010-351)	0.4 nsec	850 mc	±3.0 v	2.6 pf	10 meg
50X (010-352)	0.4 nsec	850 mc	±7.5 v	1.8 pf	10 meg
100X (010-353)	0.4 nsec	850 mc	±15 v	1.5 pf	10 meg
200X (010-354)	0.4 nsec	850 mc	±30 v	1.4 pf	10 meg
500X (010-355)	0.4 nsec	850 mc	±75 v**	1.3 pf	10 meg
1000X (010-356)	0.4 nsec	850 mc	±150 v**	1.3 pf	10 meg

* Limited by linearity of cathode follower. This value may be exceeded by 50% for pulses without damage to probe components.

** Must be derated for continuous wave use (see Table 1-2.)

TABLE 1-2

Attenuator Head	Max. Input Voltage (peak-to-peak)			
	500 mc	750 mc	1000 mc	1250 mc
500X	150 v	150 v	150 v	125 v
1000X	300 v	200 v	150 v	125 v

SECTION 2

OPERATING INSTRUCTIONS

General

When used with Tektronix vertical sampling plug-in units, such as Types 4S1 or 3S76, the Type P6032 Cathode-Follower Probe can be used to display frequencies up to 850 mc. The following section will help you obtain good waveform displays using the Type P6032 Probe. Measurement considerations and typical test systems are included.

Handling Precautions

The P6032 Probe has been constructed as ruggedly as possible, consistent with extremely good high-frequency response. However, as with all devices handling signals in the nanosecond range, small changes in capacitance or inductance will produce pronounced changes in response. For this reason, observing a few precautions in the handling of the probe and cable will insure continued performance and reliability. Avoid the following practices: dropping or rolling equipment on the probe body or cable, kinking the cable, closing doors or drawers on the cable, dropping the probe or attenuator heads, and pulling on the probe or cable.

Connecting the Probe

Fig. 2-1 shows the parts that make up the P6032 Probe. The function of each part is as follows.

Power Plug -- Mates with the probe power jack on Tektronix vertical sampling plug-in units. It connects power from the oscilloscope to the probe.

Power Regulator -- Connects the power from the Power Plug to the interconnecting cable. The circuit contains voltage-dropping components to adapt source voltages to the

operating levels of the Probe. Also, the signal cable passes through the Regulator housing to the Signal Out connector.

Signal Out Connector -- Connects the signal from the probe to the vertical input connector of the sampling system.

Probe Body -- Contains the cathode follower circuit and the GAIN adjustment.

Attenuator Heads -- Provide selectable attenuation ratios between 10 and 1000.

Coupling Capacitor -- Contains a capacitor for ac coupling of signals to the probe tip.

Bayonet Ground Clip -- Spring-loaded ground clip to provide convenient ground.

Ground Clip -- Interchangeable with bayonet ground clip. Permits addition of ground connector of your choice.

To set up the Type P6032 Probe for proper operation, connect the Power Plug to the probe power jack on the vertical unit. Connect the probe Signal Out connector to the vertical unit signal-input connector. Allow the probe a short warm up period before making any adjustments.

The P6032 Probe has a positive dc offset of about 0.5 volt at the Signal Out Connector. Since this voltage is sufficient to shift the trace off screen, the vertical sampling unit must be adjusted to center the trace. To make this adjustment, trigger the sampling system for a free-running sweep. Then, adjust the vertical sampling unit DC Offset or Position control to center the trace.

Select an appropriate attenuator for the probe. The attenuation ratio is indicated on each head. This ratio is the total attenuation of the probe and head (the probe itself has an attenuation of 3).

CAUTION

No protection is provided for the probe input grid circuit when the probe is used without an attenuator head. Do not apply more than ±500 mv directly to the probe tip. Also, without an attenuator, the probe input impedance at dc is only 3 megohms paralleled by 7 pf.

Use the bayonet ground or the ground clips to establish a ground between probe and the signal source. A long ground lead on the probe or a common ground between instruments should not be used, as this will introduce inductance into the source loop and produce ringing.

Generally, the Type P6032 Probe can be used in any test system where a Tektronix sampling system is used and a high-impedance input is desired. Fig. 2-2 shows a general test system. More specific test systems will be found in the instruction manuals for sampling-system instruments.

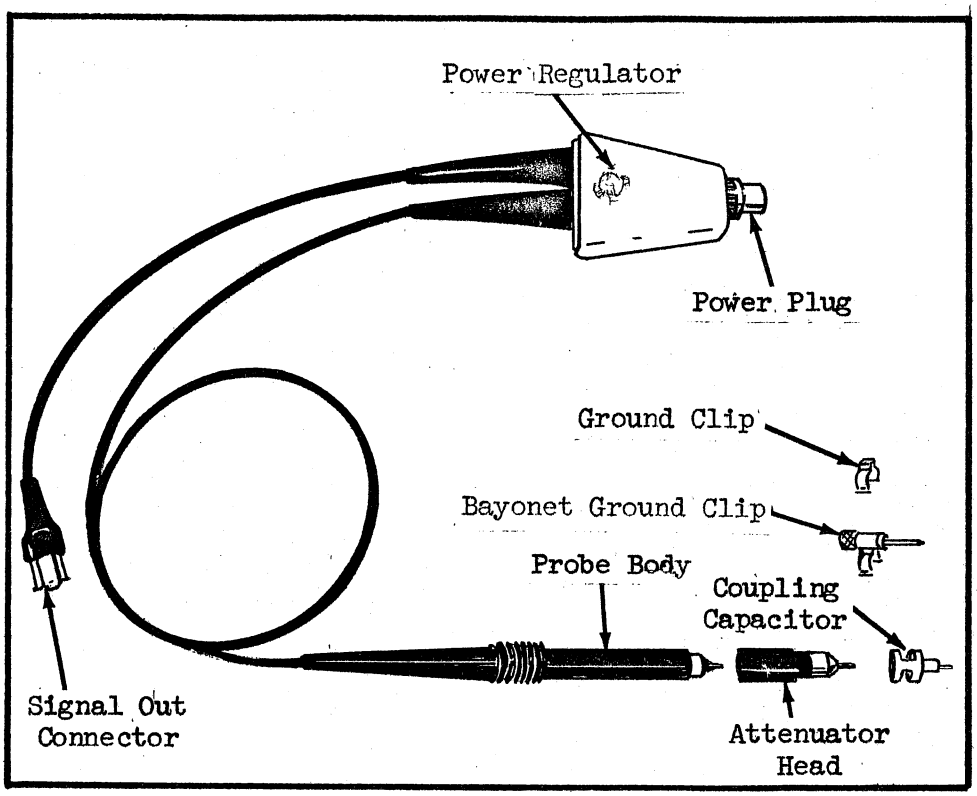


Fig. 2-1. Type P6032 Probe with attenuator head, coupling capacitor, and ground clips.

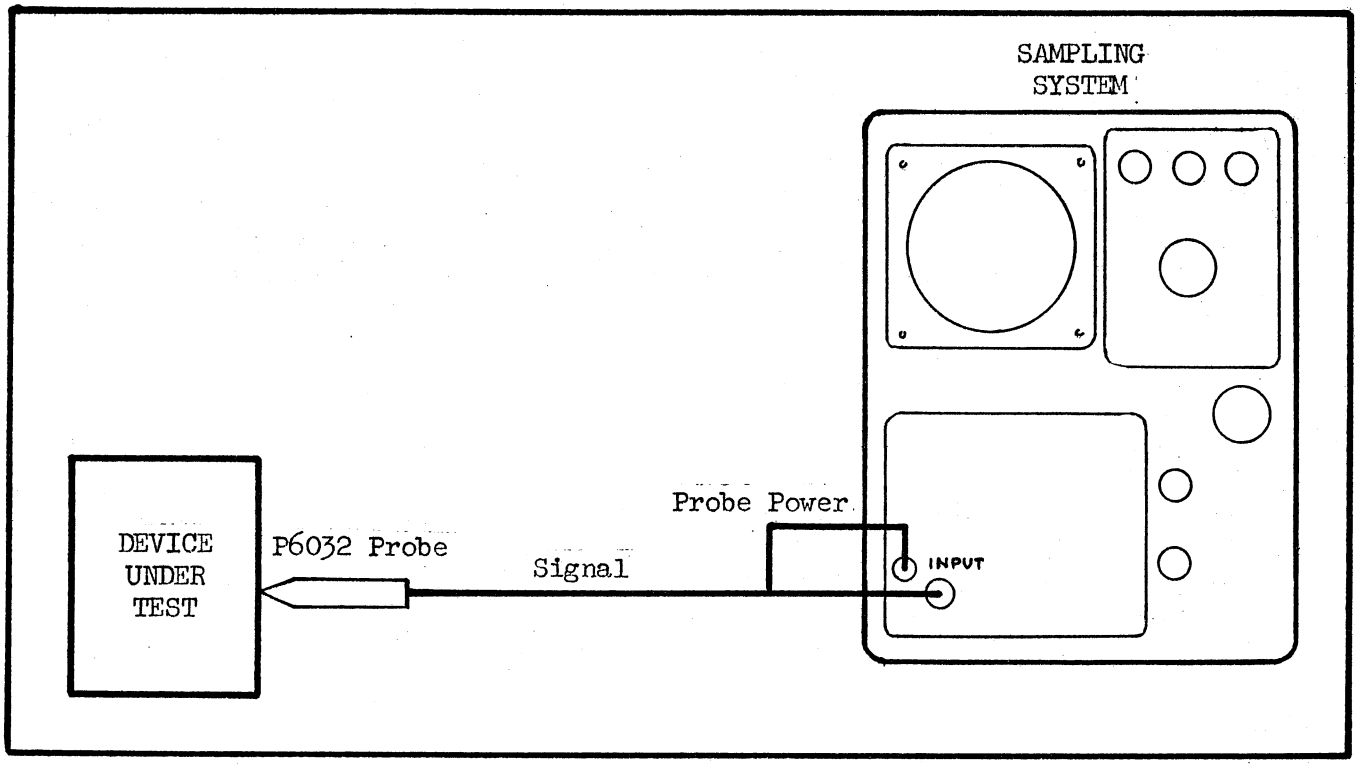


Fig. 2-2. Test setup for the Type P6032 Probe.

SECTION 3

CIRCUIT DESCRIPTION

General

The Type P6032 Probe circuitry consists of three parts; the cathode-follower input circuit, the power regulator, and the attenuator heads. A five-conductor cable connects the input circuit to the power connector. One element of the cable is a 50 Ω coaxial line for signal transfer.

The circuit diagram at the rear of this manual may be used throughout the following discussion.

Cathode-Follower Input Circuit

V103 is connected in a cathode-follower configuration to provide high-impedance input with low-impedance output. Plate and heater power for the stage is obtained from the Power Regulator. R106, L106, R107, and C107 in the plate circuit provide a constant damping impedance of about 82 ohms for all frequencies up to about 900 mc.

L108 and L109 prevent high-frequency signals at the cathode of V103 from being coupled into the vertical sampling unit through the heater-circuit power supply.

The output signal is obtained from the cathode of V103. The diode D103 is a dc-setting device which offers very little signal attenuation. The Clipping Line reduces signal aberration to a minimum. The GAIN adjustment R103, in parallel with R104, permits a 5% change in probe gain. The signal is obtained from the junction of R105 and the GAIN adjustment and applied to the Signal Out connector through the interconnecting cable.

The signal path of the P6032 Probe is completely dc-coupled. Therefore, any dc voltage change at the probe tip

will be displayed on the crt as a vertical shift in the trace. Since a cathode follower provides no polarity inversion, the displayed waveform will be of the same polarity as the signal waveform.

Power Regulator

The Power Regulator obtains power from the oscilloscope and applies it to the probe. The 50 Ω signal cable passes through the Power Regulator housing to the Signal Out connector.

The Power Plug is a four pin connector which mates with the probe power jack on the sampling oscilloscope. The voltage requirements are as follows:

Pin A Ground.

Pin B, Pin C } 12.6 volts.

Pin D +100 volts dc.

A common ground between the vertical sampling unit, Power Regulator and probe body is established by pin A. R129, in series with the heater of V103, drops the voltage from pins B and C to 6.3 volts for the tube.

Zener diode D127 drops the supply voltage at pin D to +70 volts at the plate of V103. C127 is a filter to keep high-frequencies out of the +100-volt supply.

Attenuator Heads and Coupling Capacitor

The attenuator heads contain series and shunt capacitors and resistors designed to give the desired attenuation ratio. The 10-megohm input resistance and low input capacitance remain constant, regardless of the attenuator head used. Each head contains a variable capacitor to set the ac attenuation ratio correctly.

The coupling capacitor plugs onto the attenuator heads to provide ac coupling. The low-frequency 3-db point, when the coupling capacitor is used, is 16 cps for all heads.

SECTION 4

MAINTENANCE

Cleaning

A soft, lint-free cloth may be used to wipe the P6032 Probe clean of any accumulated dust or dirt. If dirt remains, it can be removed by using a cloth dampened with water and a liquid detergent. Allow the probe to dry thoroughly before operating.

CAUTION

Do not use organic solvents to clean the plastic parts of the probe.

Removing the Probe Cover

To remove the probe body cover, loosen the small allen set-screw at the rear of the cover. Then, grasp the probe cover firmly in one hand and the ventilation section in the other and pull the cover off the tip end of the probe. The probe cover is tightly fitted to the probe body and may require a firm pull to remove.

When replacing the probe cover, the allen set-screw should be located to go through the hole in the rear of the component channel and seat firmly on the black metal heat radiator.

Removing the Power Regulator Cover

Remove the two screws near the Power Plug, and the bolt near the rear of the cover. The two halves of the cover can then be separated. When replacing the cover, it may be necessary to reposition the Power Plug. Loosen the set screw near the front of the cover and move the Power Plug to the proper position. Then, retighten the set screw.

Soldering

Most of the components in the Type P6032 Probe cannot dissipate large amounts of heat. It is important, therefore, to use care when soldering these components. Use a low wattage soldering iron (60 watts or less.) An iron with a small, chisen tip is best to transfer heat to the junction. Apply heat only for as short a time as necessary to make a good connection.

When soldering to a ceramic wafer in the probe body, use solder containing about 3% silver. This type of solder is used for printed-circuit work and is generally available locally.

Ordinary 60/40 solder may be used on the etched circuit board in the Power Regulator. Since excessive heat can break the bond between the etched wiring and the board, use a low wattage iron with a small tip.

Always use a heat sink when soldering on any part of the P6032 Probe. In most cases, a pair of long-nose pliers serves as an adequate heat sink. Hold the lead between the point where the heat is applied and the body of the component.

Parts Replacement

The high-frequency response of the Type P6032 Probe depends to a large degree upon the type and placement of parts within the probe. It is important to maintain the original lead length and part position when replacing components. Since this temporary manual does not contain a Parts List, contact your local Tektronix Field Engineer for the specified replacement parts.

The replacement procedure for some of the critical parts and assemblies is contained in the following information.

Some of the parts require no special replacement procedure, and only normal soldering and replacement procedures must be observed.

Tube Replacement

To replace the tube in the P6032 Probe, remove the probe cover and the tube shield. Unsolder the two resistors connected to the tube tip. Slide the tube forward out of its socket, and lift it out of the probe. When the new tube is placed in the socket, replace the resistors in their original position.

Ceramic Wafer Replacement

Ceramic wafer replacement requires extensive dismantling of the probe; it is not a simple repair operation. Therefore, we recommend that damaged ceramic wafers be replaced only when they affect the probe operation.

Solder at the base of the ceramic wafers holds them in place. Before removing a wafer, note the exact placement of the components and unsolder them from the wafer. Then unsolder the base of the wafer from the probe body. Remove the wafer and clean the excess solder from the probe body. Position the new wafer in the body and solder it in place using 3% silver-bearing solder. Then replace the components on the wafer.

Circuit Board Replacement

To remove the Power Regulator etched-circuit board, unsolder all connections leading to the Power Plug and the interconnecting cable (note the color of the wires and their location). Remove the two screws holding the circuit board to the housing and remove the board. Solder the components

in place on the new board before installing in the housing. Replace the leads.

Cable Replacement

To replace the P6032 Probe cable, remove the probe and regulator covers. Unsolder all cable connections to the probe body and regulator, noting the color and location of the wires. Remove the small screw from the base of the probe body and remove the probe body from the heat radiator. Unscrew the cable-relief boot from the heat radiator. (The boot is attached to the heat radiator with a locking compound; it may require a firm twist.) Pull the cable out of the heat radiator and remove the toroids, cable clamp, and boot from the damaged cable.

Place the boot, cable clamp, and toroids on the new cable in that order. Feed the new cable through the heat radiator far enough to allow connection to the probe body. Tighten the cable-relief boot firmly onto the heat radiator. Replace the probe body on the heat radiator. Be careful not to strip the threads when the screw is replaced. Solder the leads in their original place and position in both the regulator and probe. Replace the probe and regulator covers.

Attenuator Head and Coupling Capacitor

Repair of attenuator heads or the coupling capacitor should not be attempted. If damaged, they should be replaced with new parts.

TROUBLESHOOTING

Inspection

If trouble develops in the Type P6032 Probe, a thorough visual inspection may reveal the cause. Check for foreign

material, inadequate parts clearances (due to improper handling or parts replacement), loose or broken connections, cracked ceramic wafers, and scorched or burned parts. The corrective procedure for most of these conditions is apparent. In the case of heat-damaged parts however, the cause of overheating should be determined before replacing parts to prevent damage to the new parts.

The following procedure covers basic types of trouble that may occur in the P6032 Probe.

CAUTION

Be careful not to short wires or components when servicing the probe. An incorrect potential on the Signal Out conductor could damage the input diodes of a sampling-type oscilloscope.

No Signal At SIGNAL OUT Connector

First, check for proper voltages at pin D and between pins B and C of the plug-in Probe Power jack. Then visually check V103 for heater glow. If heater glow is not observed, check between pins 3 and 6 for 6.3 volts. If this voltage is about 12 volts, the heater of V103 is open and the tube should be changed.

If there is no voltage between these points, check L108, L109, and R129. If the components check good, check for cable continuity between pins B and C of the Power Plug and pin 3 or 6 of V103.

If the heater circuit is satisfactory, check for about an 0.8-volt drop across R106. If there is no drop across R106, check D127, C127, and L106. If these components check good, check D103, R103, and R104. Then check for continuity

through the Signal Out cable. If all components check good, replace V103.

Incorrect Gain

If the probe gain cannot be correctly set with the GAIN control, check for the following voltages at V103;

Pin 4 or 8 to ground: About +70 volts

Pins 3 to 6: About 6.3 volts

Pin 1 or 5 to ground: About +1 volt

If the heater voltage is not about 6.3 volts, check R129 and the voltage between pins B and C in the plug-in Probe Power jack. The voltages at pin 4 or 8 and pin 1 or 5 will probably both be incorrect if one is wrong. Disconnect the probe from the vertical sampling unit and connect an ohmmeter across R103 and R104. Vary R103 throughout its range; the resistance should vary from 0 to about 30 ohms maximum. Then measure R106 for correct value.

To check D103, use an ohmmeter having an internal battery of not more than 1.5 volts on the X1k range. Connect the positive lead of the ohmmeter to pin 1 or 5 of V103, and the negative lead to the opposite side of D103. The ohmmeter should read less than about 5000 ohms. An infinite reading should be obtained when the leads are reversed. If the reading is the same in both directions, replace the diode. If the readings are correct, replace V103.

Incorrect High-Frequency Attenuation

If the high-frequency attenuation of the probe and attenuator appears different than the low-frequency attenuation, check the attenuator compensation (described in the Calibration section of this manual). If the attenuator cannot be compensated properly, change attenuators. If the high-frequency

attenuation of this attenuator is correct, replace the former attenuator.

If the high-frequency attenuation is incorrect for all attenuators, the trouble is in the probe. Visually check the probe for a damaged or misplaced part. Some of the more important components to check are L108, L109, and R100. Also check for proper component values with an ohmmeter.

SECTION 5

CALIBRATION

General

The Type P6032 Probe has two calibration adjustments; GAIN, and the high-frequency compensation of each attenuator. The probe gain is stable and should not require frequent adjustment. But always check the attenuator compensation before making a critical measurement.

Equipment

The following equipment is required for a complete calibration of the Type P6032 Probe.

1. Sampling oscilloscope, Tektronix Type 561 or Type 567 with Type 3S76 and Type 3T77 plug-in units, or the Type 661 with Type 4S1 and Type 5T1 plug-in units, or equivalent. Specifications required: vertical sensitivity, 20 to 100 millivolts/division; sweep rate, 10 μseconds/division; must have probe power jack that mates with the Type P6032 Power Plug.
2. Square-wave generator, Tektronix Type 105 or equivalent. Specifications: output frequency, 1 kc and 10 kc; output amplitude, variable from 1 to 100 volts across 600-ohm internal load and .25 to 4 volts across 25-ohm external load.
3. Two 50-ohm terminations, Tektronix Part No. 011-045 (or B 52R).
4. 10X "T" attenuator, Tektronix Part No. 011-031 (UHF) or 017-045 (GR).
5. Nominal 50-ohm UHF cable, Tektronix Part No. 012-001.
6. GR Type 874 to UHF Jack adapter, Tektronix Part No. 017-022.

Gain Adjustment

Set the square-wave generator for 10-kc output. Connect the generator output to the sampling system vertical input with the 50 Ω cable. Set the sensitivity of the vertical sampling unit to 50 millivolts/division and the sweep rate to 10 μseconds/division. Adjust the generator output amplitude for 6 centimeters of vertical display on the crt.

Disconnect the cable from the generator output and the sampling system. Place a 50 Ω termination on the output of the generator (so that the generator sees the same impedance). Connect the P6032 Power Plug to the plug-in unit Probe Power jack, and the Signal Out connector to the plug-in Input connector. Remove any probe head and the probe cover.

Connect the probe tip through a .001-μf capacitor to the square-wave generator (at the outboard end of the 50 Ω termination). Establish a ground between the probe and the generator. Adjust the probe GAIN control for a 2-centimeter display. As the probe gain is changed, the dc offset voltage at the Signal Out connector will also change. Adjust the vertical sampling unit Position or Offset control to keep the trace centered.

The probe gain is now 0.33 (an attenuation of 3X). To check the accuracy of an attenuator when used with the probe, apply a signal of known amplitude to the probe through the attenuator. Do not exceed the voltage stamped on the attenuator. The total attenuation of the probe and the attenuator should be within 3% of the value stated on the attenuator.

Attenuator High-Frequency Compensation

The high-frequency attenuation of each attenuator must be adjusted to equal the low-frequency attenuation. This is

accomplished by adjusting a variable capacitor in each head.

Connect the P6032 Probe to the vertical sampling unit, and set the sensitivity for 50 millivolts/division. Set the sweep rate to 10 μseconds/division. Set the square-wave generator for a symmetrical 1-kc output. (The amplitude calibrator of a Tektronix Type 530- or 540-series oscilloscope may be used for this adjustment.)

Plug the attenuator head to be compensated onto the probe tip. Attach the bayonet ground clip to the attenuator head. Touch the tip of the attenuator to the generator output, establishing a ground between the generator and the probe with the ground clip. Free-run the sweep and adjust the generator amplitude to display 3-cm signal. Then adjust the triggering for a stable display.

A 3-cm display of 50 millivolts/division limits the signal swing at the probe output to ±150 millivolts for a linear signal.

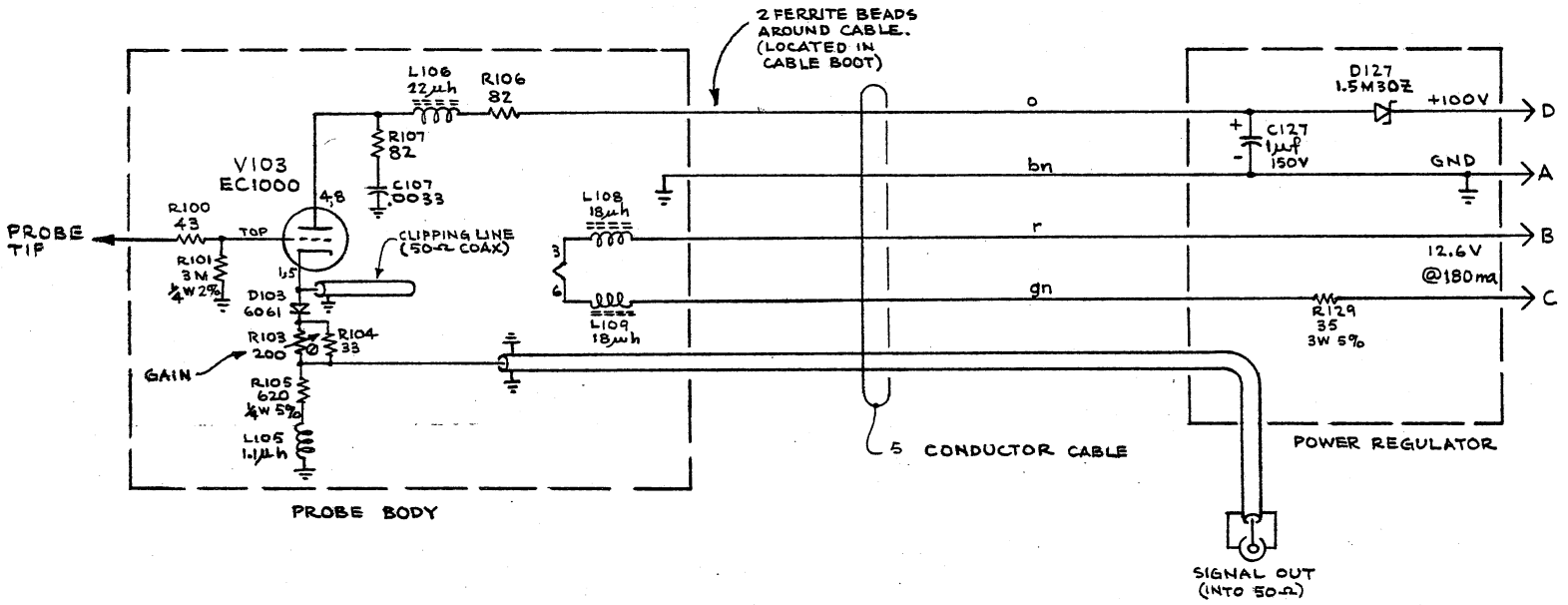
NOTE

Do not use a square-wave repetition rate higher than 5 kc to compensate the attenuators. At repetition rates higher than 5 kc the gain appears to change as the attenuator is compensated.

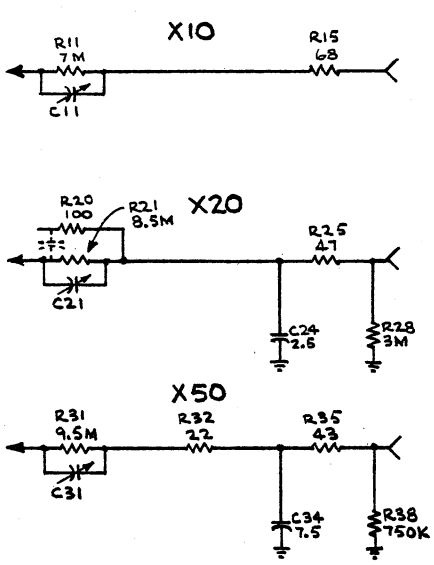
Adjust the set screw near the tip of the attenuator for a flat-top display. Then, set the vertical sensitivity for 10 millivolts/division. Adjust the Offset and Position controls to center the trace. Then, readjust the attenuator compensation for the best flat-top display.

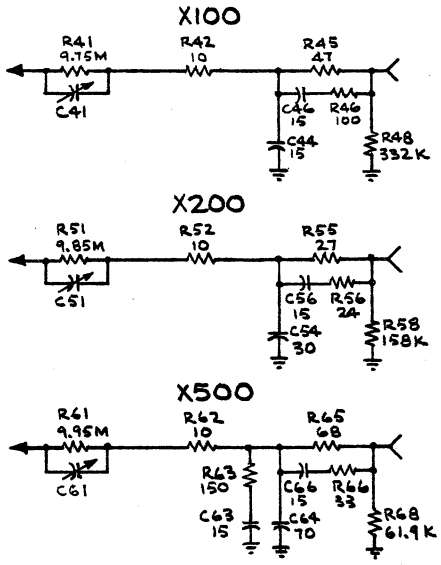
CAUTION

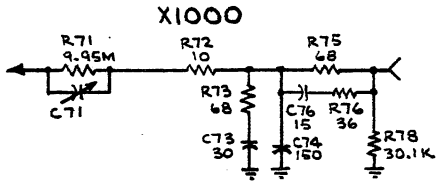
Do not overtighten the nylon set screw. The set screw or internal components may be damaged, making further adjustment impossible.



TYPE 6032 CF PROBE







TYPE 6032

ATTENUATOR HEADS