

# **Instruction Manual**



**P6202A**

**10X, 500MHz FET Probe**

**070-3642-02**

## **Warning**

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to the Safety Summary prior to performing service.

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## **WARNING**

*THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.*

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# OPERATORS SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

## Terms In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

## Power Source

This product is intended to operate from a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

## Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

## Danger Arising From Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

## Use the Proper Power Cord

Use only the power cord and connector specified for your product.

Use only a power cord that is in good condition.

For detailed information on power cords and connectors, see maintenance section.

Refer cord and connector changes to qualified service personnel.

### **Do Not Operate in Explosive Atmospheres**

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

### **Do Not Remove Covers or Panels**

To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

### **Do Not Operate Without Covers (for TM 500 plug-ins only)**

To avoid personal injury, do not operate this product without covers or panels installed. Do not apply power to the plug-in via a plug-in extender.

# **SERVICE SAFETY SUMMARY**

## ***FOR QUALIFIED SERVICE PERSONNEL ONLY***

*Refer also to the preceding Operators Safety Summary.*

### **Do Not Service Alone**

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

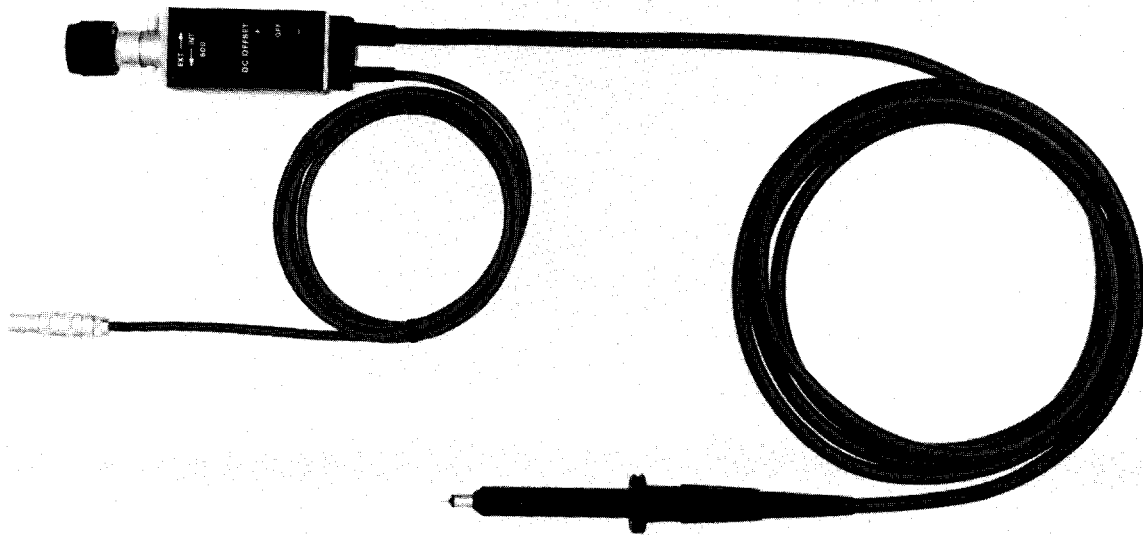
### **Use Care When Servicing With Power On**

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

### **Power Source**

This product is intended to operate from a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.



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The P6202A Probe.

P6202A

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# GENERAL INFORMATION

## INTRODUCTION

The P6202A is a DC to 500 MHz Field-Effect Transistor probe with 10X attenuation. It provides active probe measurement capabilities for oscilloscopes and other test instrumentation.

Use of standard miniature probe-tip accessories is facilitated by the miniature tip on the probe body. A coding pin on the bnc output connector actuates the 10X readout scale factor on oscilloscopes equipped with this feature. Switched offset capabilities are provided by the probe's COARSE and FINE controls. A load switch located in the output bnc connector allows the probe to be used with instruments having either high-impedance or 50- $\Omega$  inputs.

Standard and optional accessories for the P6202A Probe are listed in the "Replaceable Mechanical Parts" section of the manual and are described in the "Operating Instructions" section.

## SPECIFICATION

The electrical characteristics listed in Tables 1-1 through 1-3 are applicable to a calibrated P6202A Probe operating within the environmental conditions stated in Table 1-4 and being used with a calibrated oscilloscope system. Physical characteristics are listed in Table 1-5.

Items listed in the "Performance Requirements" column are qualitative or quantitative limits that may be checked by completing the procedures contained in the "Performance Check" part of this manual (see Section 4). Verification procedures for items listed in the "Supplemental Information" column are not provided in the "Performance Check" part; these items are either explanatory notes, performance characteristics for which no absolute limits are specified, or characteristics that are impractical to check.

**Table 1-1**  
**Electrical Characteristics**  
**(Probe Only)**

Characteristics	Performance Requirements	Supplemental Information
Bandwidth	Dc to $\geq 500$ MHz ( $-3$ dB).	Calculated from rise time.
Transient Response		
Rise Time	0.7 ns or less.	
Aberrations		$\pm 5\%$ , 6% p-p total within first 4 ns. $\pm 3\%$ , 4% p-p total after 4 ns.
Attenuation	10X $\pm 4\%$ .	With $\pm 1.0$ V signal input and with load switch set to INT; or with external load of $50\ \Omega \pm 1\%$ , load switch set to EXT.
High Frequency Gain	$\pm 3\%$ (rolloff or overshoot).	
Input Impedance		
Resistance	10 M $\Omega$ $\pm 2\%$ .	
Capacitance	Approximately 2.0 pF, dc to 500 MHz.	
Input Dynamic Range	0 to $\pm 6.0$ V.	Signal compression or expansion 3% or less of a $\pm 6.0$ V input signal.



**Table 1-1 (cont.)**

<b>Characteristics</b>	<b>Performance Requirements</b>	<b>Supplemental Information</b>
Output Zero	$\pm 10$ mV.	
Dc Offset Range	0 to $\pm 55$ V maximum.	0 to 50 V with COARSE offset control. 0 to 5 V with FINE offset control.
Tangential Noise	150 $\mu$ V or less at the probe output (equivalent to 1.5 mV or less at probe tip).	Rms noise value is approximately 1/2 of tangentially measured value.
Dc Thermal Drift	150 $\mu$ V/ $^{\circ}$ C or less at the probe output (equivalent to 1.5 mV/ $^{\circ}$ C at probe tip).	
Output Load Required		50 $\Omega$ $\pm 1\%$ with load switch at EXT. 500 k $\Omega$ or higher with load switch at INT.
Maximum Nondestructive Input Voltage	$\pm 200$ V (dc + peak ac).	
Signal Delay (Probe Tip to Output Connector)	Approximately 12 ns.	
Power Requirements		+15V dc $\pm 4\%$ (60 mA maximum). -15V dc $\pm 4\%$ (60 mA maximum).

**Table 1-2**  
**Electrical Characteristics**  
**(Optional 10X Attenuation Head)**

Characteristics	Performance Requirements	Supplemental Information
Attenuation	10X $\pm 2\%$ .	Total attenuation with 10X Attenuator head attached to probe is 100X $\pm 6\%$ .
Input Resistance	10 M $\Omega$ $\pm 2\%$ .	With probe.
Input Capacitance	Approximately 2.0 pF, dc to 500 MHz.	
Input Dynamic Range	0 to $\pm 60$ V.	With probe.
Dc Offset Range	0 to $\pm 200$ V.	With probe.
Maximum Nondestructive Input Voltage	$\pm 200$ V (dc + peak ac).	
Bandwidth	Dc to $\geq 500$ MHz.	With probe. Calculated from rise time.
Transient Response		
Rise Time	0.7 ns or less.	With probe.
Aberrations		$\pm 5\%$ in addition to probe aberrations.

**Table 1-3**  
**Electrical Characteristics**  
**(Optional AC Coupler)**

<b>Characteristics</b>	<b>Performance Requirements</b>	<b>Supplemental Information</b>
Bandwidth	$\leq 16$ Hz (–3 dB) to $\geq 500$ MHz (–3 dB).	With probe. Calculated from rise time.
Transient Response		
Rise Time	0.7 ns or less.	With probe.
Aberrations		$\pm 5\%$ in addition to probe aberrations.
Input Capacitance	Approximately 4.0 pF.	
Maximum Nondestructive Input Voltage	$\pm 200$ V (dc + peak ac).	

**Table 1-4**  
**Environmental Characteristics**

<b>Characteristics</b>	<b>Description</b>
Temperature	
Nonoperating	−40° C to +65° C (−40° F to +149° F).
Operating	0° C to +50° C (+32° F to +122° F).
Altitude	
Nonoperating	To 50,000 ft (15,000 m).
Operating	To 15,000 ft (5000 m).
Humidity	
Nonoperating and Operating	Five cycles (120 hours) to 95% relative humidity. Reference to MIL-E-16400F paragraph 4.5.9 through 4.5.9.5.1 Class 4.
Shock	
Nonoperating	To 400 g's, 1/2 sine, 1/2 ms, 1 ms, and 2 ms duration.
Transportation	Qualifies under National Safe Transit Association Preshipment Test Procedure 1A.

**Table 1-5**  
**Physical Characteristics**

<b>Characteristics</b>	<b>Description</b>
Dimensions	
Cable Length	
Signal	2 m
Input Power	1.3 m
Connector to Probe	
Net Weight (includes Standard Accessories)	1.9 lb (0.9 kg)



# OPERATING INSTRUCTIONS

## INTRODUCTION

This section of the manual is intended to familiarize the operator with the use of the P6202A Probe. Included is a description of controls and connectors, probe handling precautions, measurement considerations, instructions for use with accessories, and additional operator's familiarization information.

The P6202A Probe is shipped in a carton along with its standard accessories. At installation time, save the shipping carton and packaging materials for reuse should reshipment become necessary. Refer to the end of the "Maintenance" section for repacking instructions.

## PROBE HANDLING

The P6202A is designed to be as rugged as possible consistent with its extended high-frequency response and

miniature size. As precision devices, the probe, attached cable, and accessories should be handled carefully at all times to avoid damage. The following precautions are recommended.

1. Exercise care not to crush the cables or to place excessive strain on them by pulling.
2. Treat the probe tip with care. Before inserting the probe tip into the AC Coupler, 10X Attenuator, or other accessory jacks, first carefully align the tip with the jack.
3. Avoid dropping the probe body; it contains some of the most sensitive circuitry in the probe.
4. When not in use, protect the probe tip by covering it with the IC Test Tip Adapter.

## DESCRIPTION OF CONTROLS AND CONNECTORS

The following information will familiarize the operator with the location and function of the P6202A external controls and connectors that are accessible from outside the probe. Refer to Figure 2-1 for the following descriptions.

- ① **Input Power Connector**—Connects the probe to the probe power receptacle on either the oscilloscope mainframe or an accessory power supply such as the TEKTRONIX 1101 Probe Power Supply.
- ② **DC OFFSET Switch**—Three-position slide switch used to set either + or - offset to the signal being measured. When set to OFF, no dc offset is applied.
- ③ **FINE Control**—Continuously variable control used to set the amount of dc offset. This control has about  $\pm 5.5$  V offset over its full range.
- ④ **COARSE Control**—Continuously variable control used to set the amount of dc offset. This control has about  $\pm 55$  V offset over its full range.

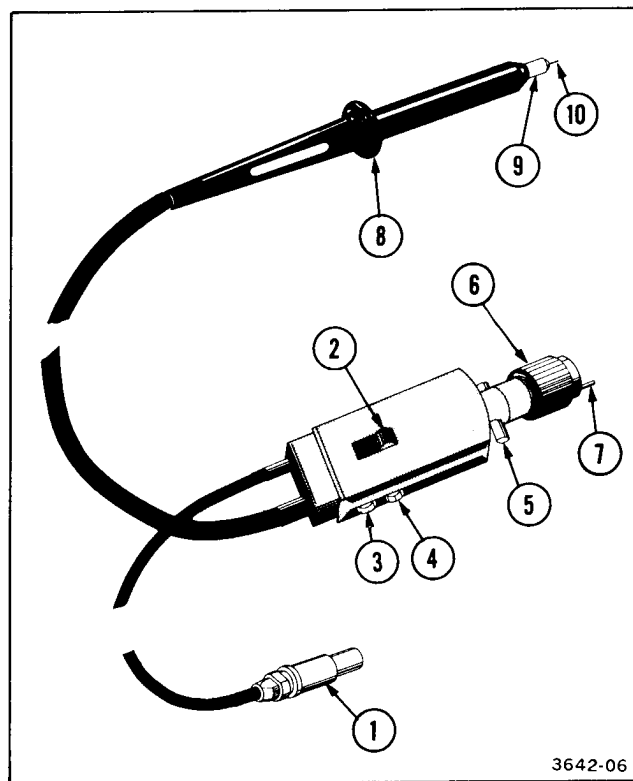


Figure 2-1. Controls and connectors.



⑤ **INT-EXT Switch**—Selects the source of the 50- $\Omega$  load required by the output of the P6202A.

**INT**—A precision 50- $\Omega$  resistor is internally connected across the output of the P6202A. This position is used when the probe is connected to an instrument having an input impedance of 500 k $\Omega$  or greater.

**EXT**—The internal load is removed from the output of the P6202A. This position is used when the probe is connected to an instrument having an input impedance of 50  $\Omega \pm 1$  percent.

⑥ **Output Bnc Connector**—Used for connecting the probe output to the input of an oscilloscope or other test instrument.

⑦ **Probe Coding Pin**—When the P6202A is connected to an instrument having a probe-coding input connector, this pin activates the circuitry in the instrument to automatically include the attenuation factor of the probe in the scale factor indication. For instruments not having this feature, the scale factor should be multiplied by 10 to include the attenuation factor of the probe.

⑧ **Ground**—Standard accessory ground leads are connected here.

⑨ **Ground Ring**—This metal ring is used for connecting the earth ground terminal of the power cord to the probe. To avoid possible short circuits, use the standard accessory insulating sleeve when probing in crowded circuitry.

⑩ **Probe Tip**—Used to apply the source of the signal you wish to measure to the oscilloscope.

## MEASUREMENT CONSIDERATIONS

To obtain the most accurate signal measurements you should become familiar with the following considerations.

### Dynamic Range

The dynamic (signal) range for the P6202A Probe and the probe with optional 10X Attenuator is shown in Figure 2-2. Maximum signal capability for the probe alone is 12 V peak-to-peak. The signal can be offset  $\pm 55$  V to provide a maximum dynamic window of  $\pm 61$  V (dc + peak ac). If the signal you wish to measure exceeds these limits, use the

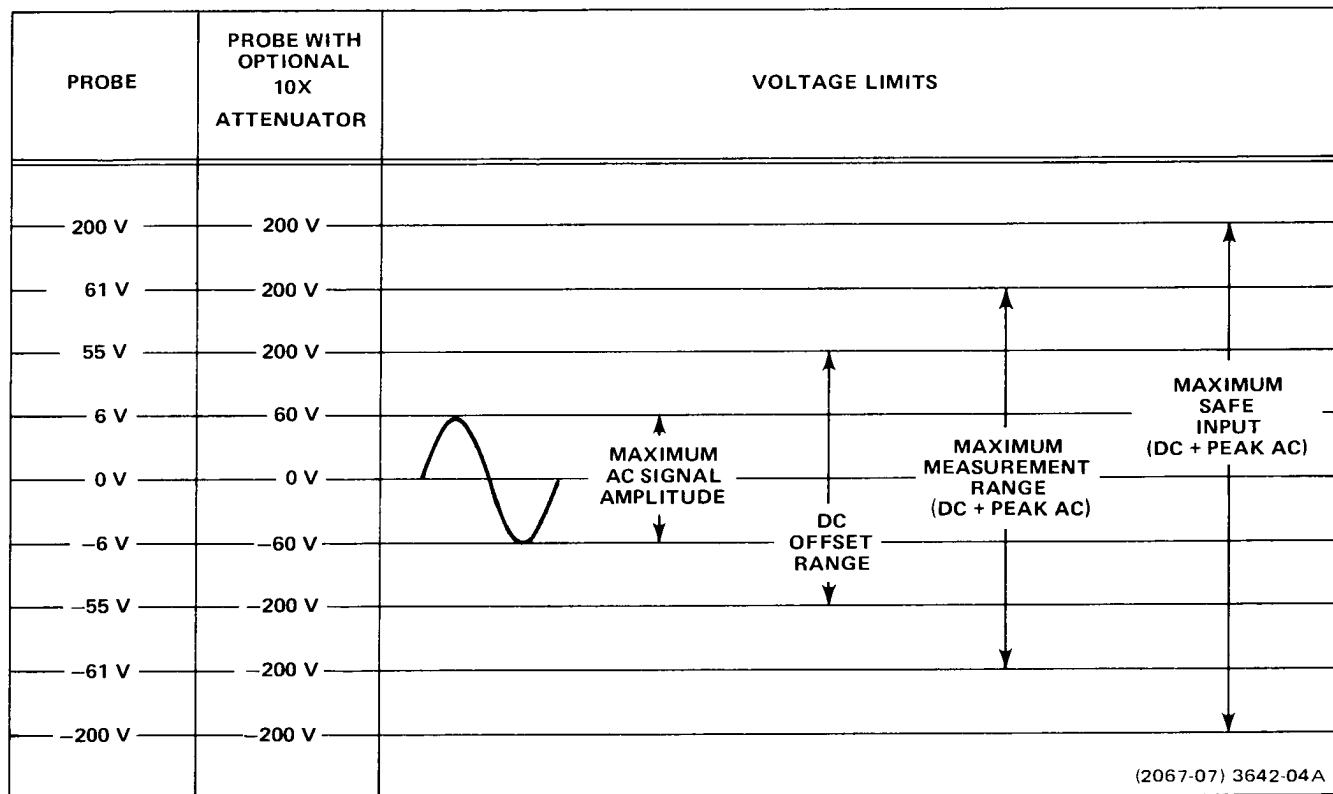


Figure 2-2. Dynamic and offset limitations (with or without optional 10X Attenuator).

optional 10X Attenuator. This will extend the maximum dynamic window to  $\pm 200$  V (dc + peak ac). If the full dynamic range of the probe is used, a signal compression of up to 3 percent may occur.

## Maximum Voltage and Power Limitations

### NOTE

*The maximum nondestructive voltage limit of 200 V may exceed the limits of the dynamic window. For accurate measurements observe the dynamic range limits given in the preceding paragraph (see Figure 2-2).*

The P6202A can withstand up to 200 V (dc + peak ac) at low frequencies. Frequency and duty factor of the measured signal affect the maximum voltage limitations of the probe. The maximum voltage derating curve (Figure 2-3) shows the decrease in maximum nondestructive voltage as frequency increases.

You may connect the probe to peak voltages exceeding the maximum voltage derating curve, but do not exceed

200 V (dc + peak ac) if the average power dissipation is not greater than the maximum power dissipation of the probe. Use the following formula to calculate the maximum peak voltage you can measure.

$$E_{\text{peak}} = \frac{\text{Voltage from Derating Curve}}{\sqrt{\text{Duty Factor}}}$$

where Duty Factor = Pulse Duration x Repetition Rate

## Signal Connection

The input impedance of the probe is 10 M $\Omega$  shunted by about 2 pF. When possible, a low-impedance measurement point in the circuit under test should be selected to minimize probe loading. Figure 2-4 shows the shunt-input resistance and capacitive loading of the probe (with or without the optional 10X Attenuator attached) as a function of frequency. Refer to this graph when loading is a concern.

To measure a signal, touch the probe tip to the signal source. The Retractable Hook Tip, an included accessory, can also be used to allow hands-free connection to the signal source.

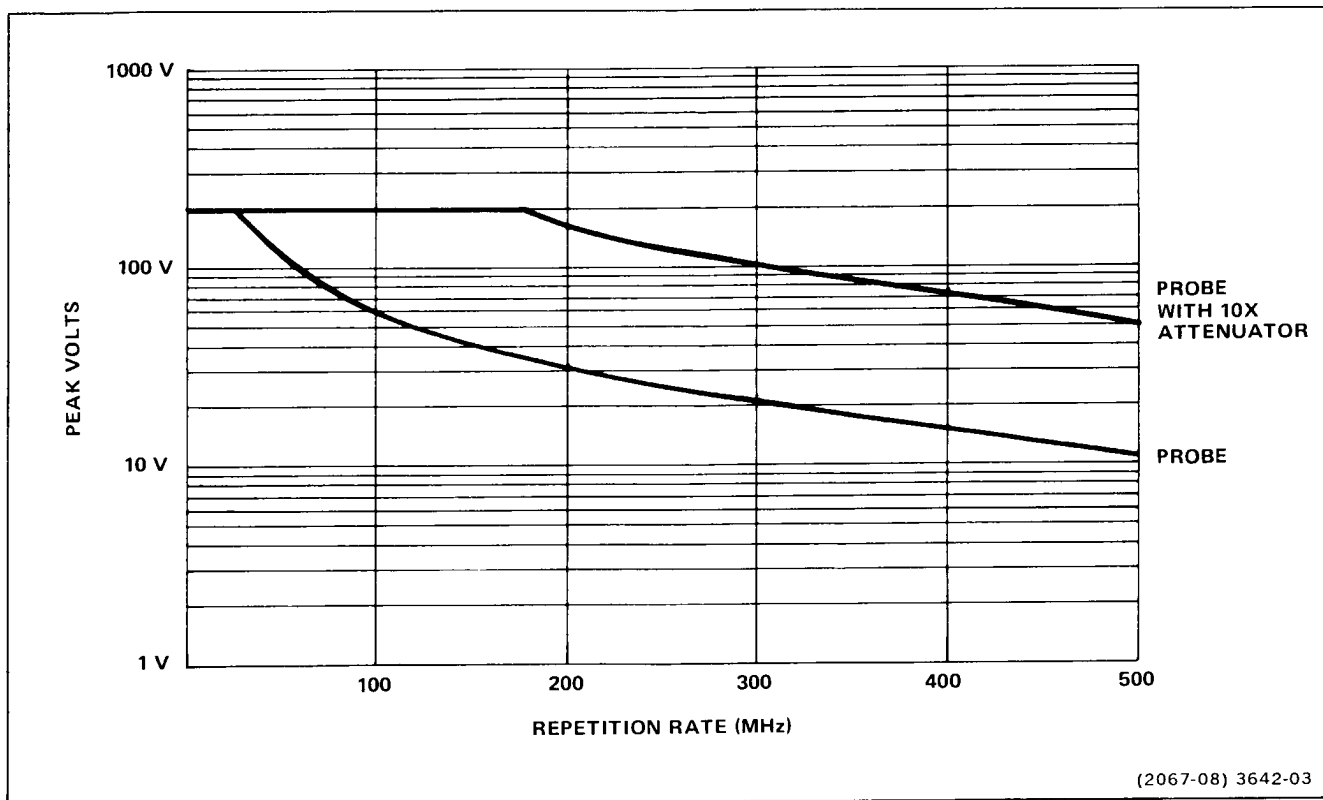


Figure 2-3. Maximum input voltage (with or without optional 10X Attenuator).

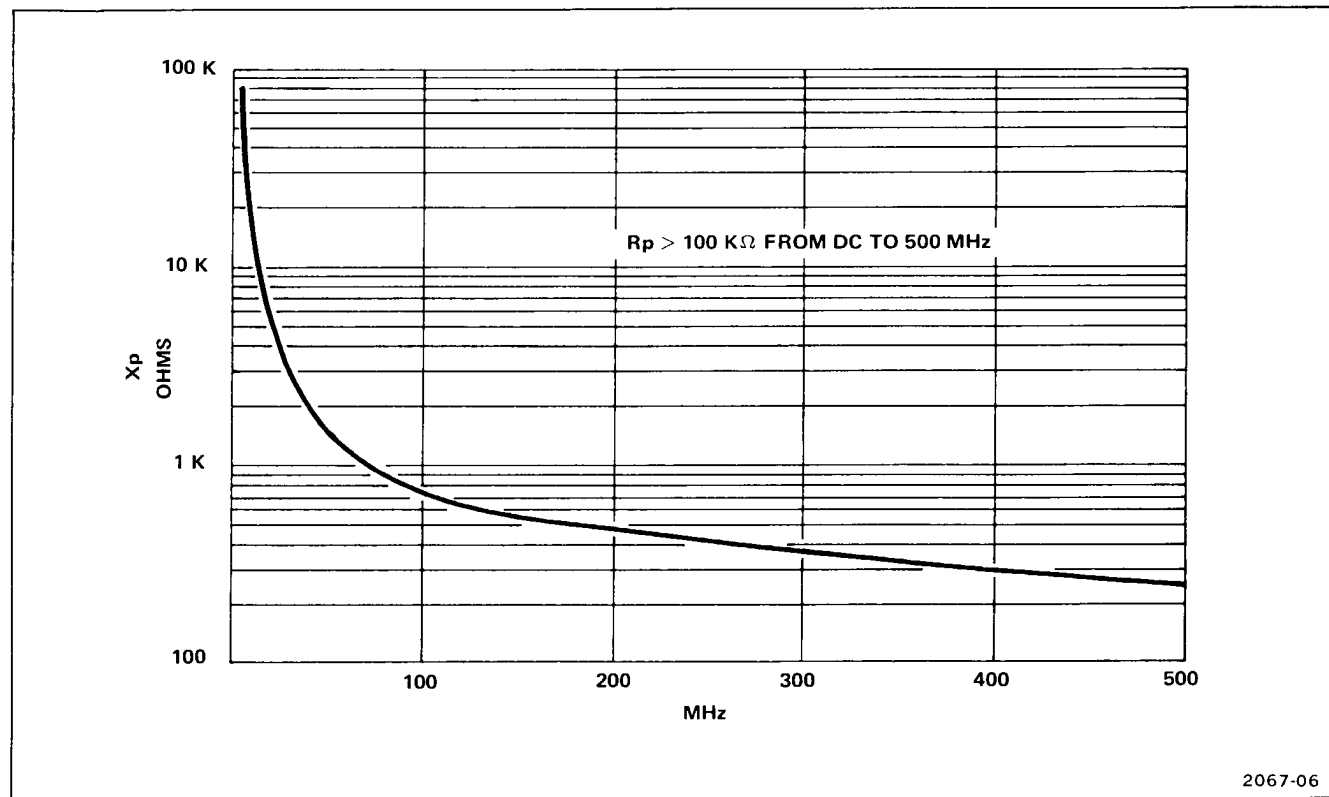


Figure 2-4. Typical input  $R_p$  and  $X_p$  (with or without optional 10X Attenuator).

A good ground connection reduces noise, especially when measuring low-amplitude signals. Use the shortest ground lead possible to avoid ground loops.

If the source of the signal you wish to measure has a coaxial connector, use an optional probe tip-to-coaxial-connector adapter for signal connection. Refer to the "Use of Optional Accessories" part of the manual (in this section) for additional information on this adapter.

## Deflection Factor

When used with test instruments having readout or automatic scale-factor switching, the 10X attenuation factor of the P6202A is automatically compensated and visually indicated by the instrument. If the test instrument does not have readout or automatic scale-factor switching, multiply the indicated scale factor by 10 to obtain the actual scale factor.

Use of the optional 10X Attenuator provides an overall system attenuation factor of 100, which is not automatically computed in the scale-factor indication circuit of the instrument. If you use the optional attenuator, multiply the

indicated scale factor by 10 (or by 100 if the instrument does not have readout or scale-factor switching) to obtain the actual scale factor.

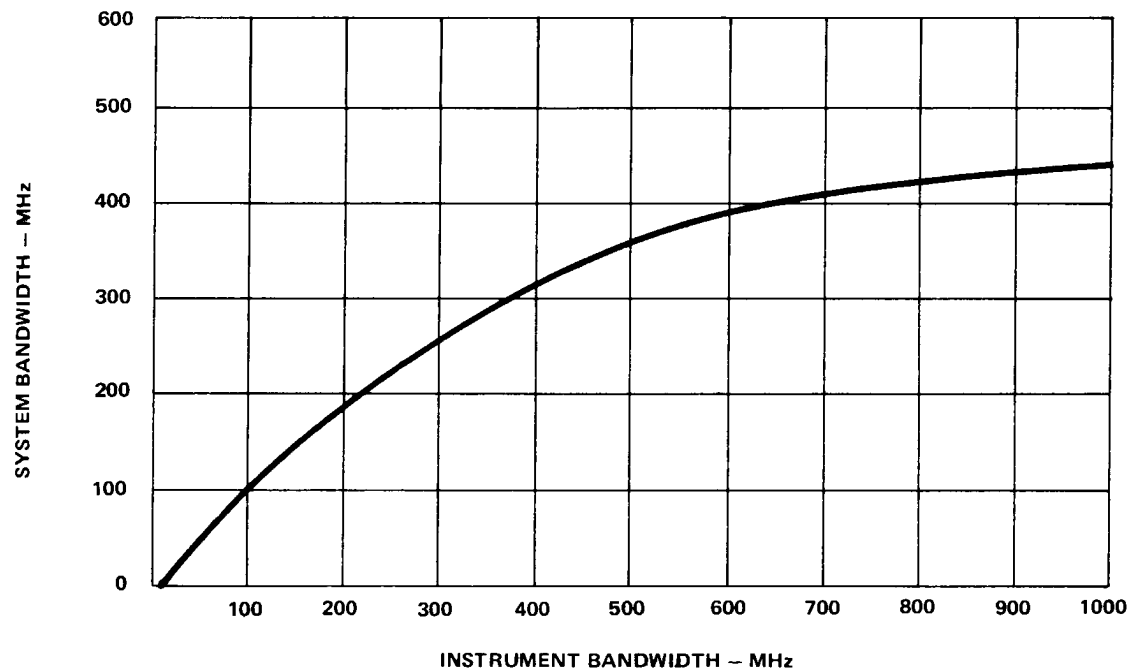
## System Bandwidth

When the probe output is connected to a test instrument, the bandwidth of both the probe and the instrument affect the bandwidth of the measurement system. For example, if both the probe and the instrument each have a bandwidth of 500 MHz ( $-3$  dB at 500 MHz), then the system bandwidth will be  $-6$  dB at 500 MHz. The system's  $-3$  dB point will be about 350 MHz. Figure 2-5 illustrates system bandwidth as a function of instrument bandwidth.

## FIRST TIME OPERATION

Use the following procedure to become familiar with the basic operation of the P6202A Probe.

1. Connect the probe power connector to either the power receptacle on the back panel of the oscilloscope or to the accessory power supply.



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Figure 2-5. System bandwidth.

2. Set the DC OFFSET switch to OFF.
3. Set oscilloscope deflection factor to 1 V and center the display vertically.
4. Connect the P6202A output bnc connector to the input of the oscilloscope.
5. Set the INT-EXT switch on the probe in accordance with the input impedance of the oscilloscope (INT for 500-k $\Omega$  input and EXT for 50- $\Omega$  input).
6. Connect the probe tip to the signal source. If necessary, center the oscilloscope display using the DC OFFSET switch and the COARSE and FINE controls (see "DC Offset Operation").
7. Set the oscilloscope vertical and horizontal deflection factors to obtain the desired display.

## DC OFFSET OPERATION

The dc offset capability allows the input signal to be positioned to the center of the probe amplifier's dynamic range. This ensures optimum probe transient response.

To use the DC OFFSET function, perform the following procedure.



*Use of the optional 10X Attenuator increases the range of the COARSE and FINE controls by a factor of 10. Instrument damage may occur if you exceed the maximum input voltage of 200 V (dc + peak ac).*

1. Set the oscilloscope input coupling switch to GND (or disconnect the probe from the oscilloscope input).
2. Position the trace to the center of the crt using oscilloscope controls. After centering the trace, do not readjust the oscilloscope vertical position controls.
3. Set the oscilloscope input coupling switch to DC and set the probe DC OFFSET switch to OFF.
4. Reconnect the probe output to the oscilloscope input (if previously removed).
5. Connect the probe to the desired signal source and set the DC OFFSET switch to either + or - as required.



6. Center the display using the COARSE and FINE controls.

7. Adjust the oscilloscope vertical and horizontal deflection factors to obtain the desired display.

#### NOTE

*When using the optional AC Coupler, set the DC OFFSET switch to OFF.*

## USE OF STANDARD ACCESSORIES

### Retractable Hook Tip

The Retractable Hook Tip is used to allow hands-free connection to the signal source. It can be installed over the probe tip, the optional 10X Attenuator, or the AC Coupler (see Figure 2-6A).

### 3- and 6-Inch Ground Leads

Figure 2-6A also illustrates how the Ground Lead is connected to the probe. The miniature Alligator Clip screws onto the free end of the lead.

### Insulating Sleeve

Use of the Insulating Sleeve (Figure 2-6B) prevents accidental shorting of the ground surface on the probe to the circuitry under test. To install the Insulating Sleeve, slide it over the probe tip, the optional 10X Attenuator, or the optional AC Coupler, as required.

### IC Test Tip

The slotted IC Test Tip (Figure 2-7) is used for connecting the probe to any pin on an IC package. It prevents accidental shorting between IC pins during testing. To install the IC Test Tip, slide it over either the probe tip, the optional 10X Attenuator, or the optional AC Coupler, as required (see Figure 2-6C).

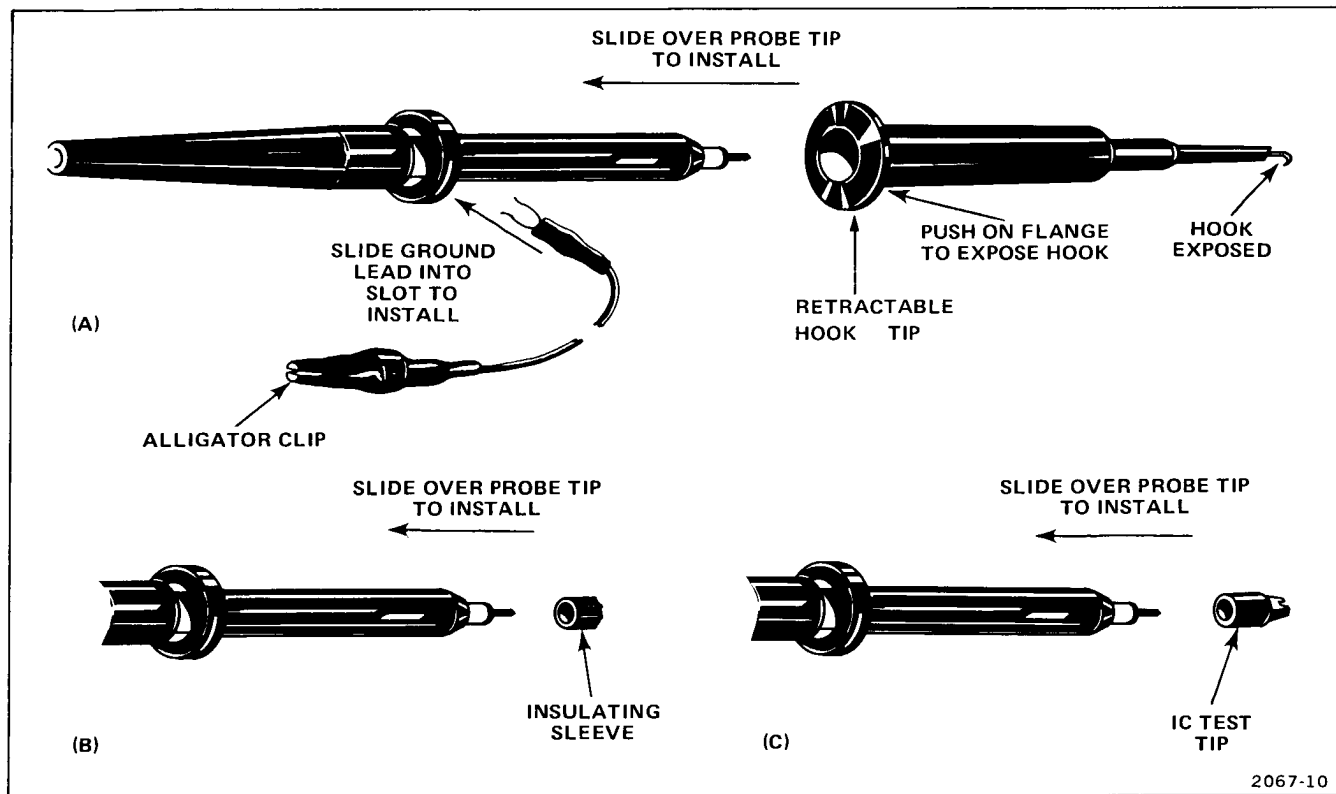
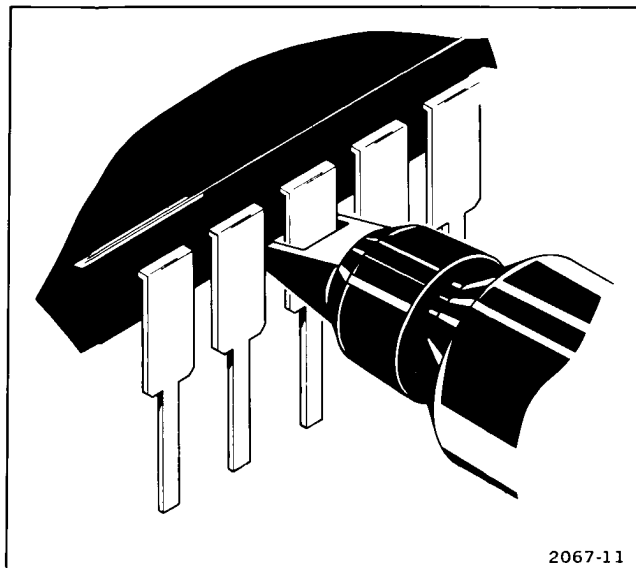


Figure 2-6. Use of standard (included) accessories.



**Figure 2-7. IC test tip.**

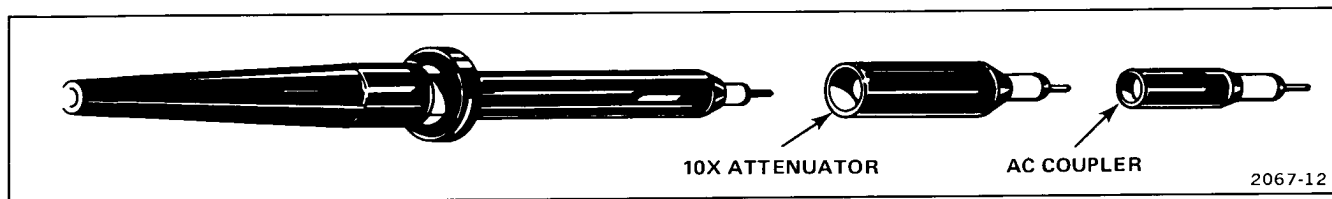
## **USE OF OPTIONAL ACCESSORIES**

### **10X Attenuator**

The 10X Attenuator increases the dynamic range and dc offset capabilities of the probe by a factor of 10. However, due to the maximum input voltage limits, the maximum dc offset range is limited to  $\pm 200$  V (dc + peak ac).

To obtain the correct deflection factor when using the 10X Attenuator, multiply the indicated deflection factor by 10 (or by 100 if the test instrument used does not have readout or automatic scale-factor switching).

To install the 10X Attenuator, slide it over the probe tip (see Figure 2-8). The Retractable Hook Tip, IC Test Tip, Insulating Sleeve, or optional AC Coupler can be installed over the 10X Attenuator in the same manner as over the probe tip.



**Figure 2-8. Use of optional 10X Attenuator and optional AC Coupler.**

### **AC Coupler**

The AC Coupler blocks the dc component of the signal being measured. When using the AC Coupler, probe bandwidth is within the range of 16 Hz to 500 MHz. Maximum input voltage is  $\pm 200$  V (dc + peak ac).

To install the AC Coupler, slide it over either the probe tip or the optional 10X Attenuator tip as required (see Figure 2-8). The Retractable Hook Tip, IC Test Tip, or Insulating Sleeve can be installed over the AC Coupler in the same manner as over the probe tip.

### **Probe Tip-to-Coaxial-Connector Adapters**

These adapters are used to enable convenient connection of the probe tip to coaxial-connector outputs from the signal source. One end of each adapter has a coaxial connector (either GR or bnc). The probe tip, Attenuator, or AC Coupler can be inserted into the other end of the adapter (see Figure 2-9).

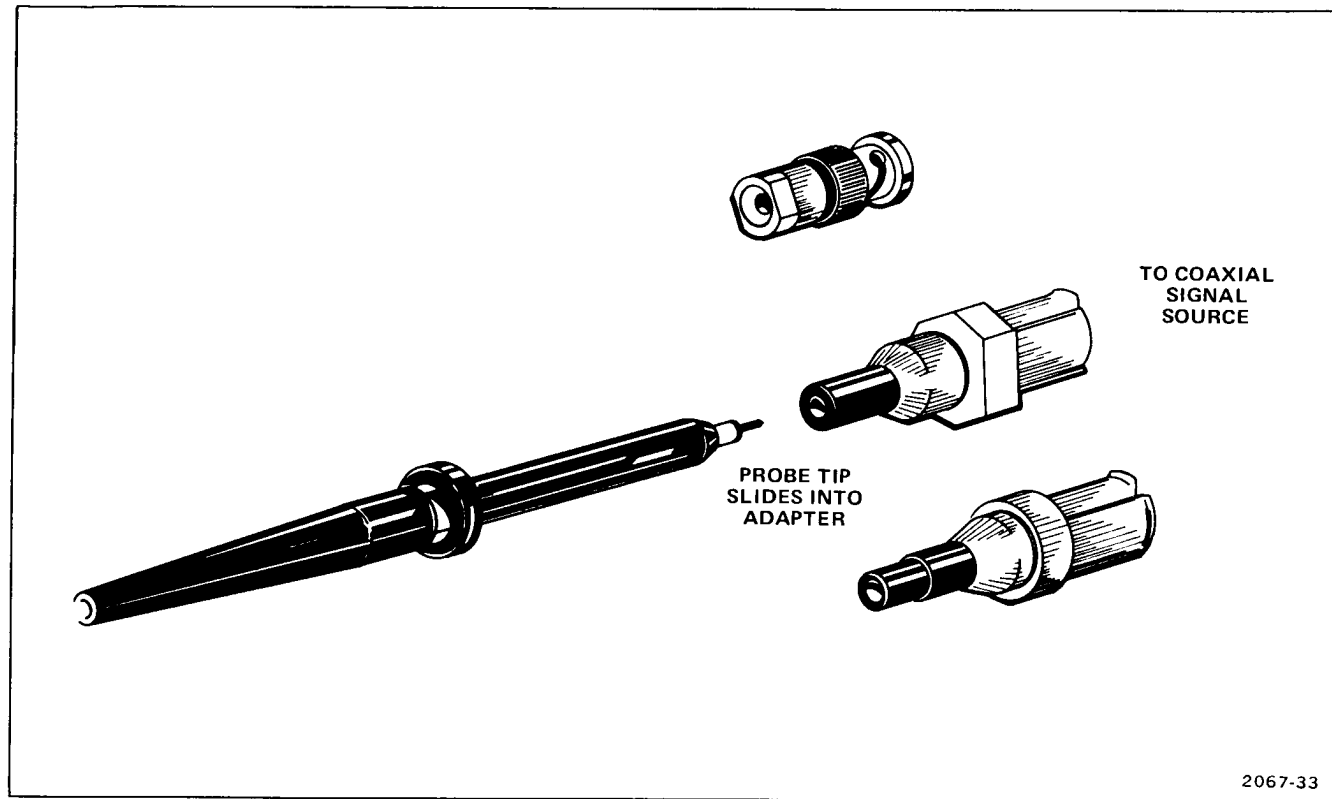


Figure 2-9. Use of optional Probe Tip-to-Coaxial Adapters.



# THEORY OF OPERATION

This section contains a functional description of the circuitry used in the P6202A Probe. The schematic diagram in the "Diagram" section at the back of this manual may be referenced while reading the circuit descriptions. In addition a functional block diagram (Figure 3-1) is provided and can be used together with the schematic diagram to gain optimum understanding of probe circuitry.

## GENERAL CIRCUIT DESCRIPTION

Figure 3-1 is a functional block diagram of the P6202A. The input signal is attenuated by resistors R12 and R14 and applied to the Input Source Follower circuit which provides a high-input impedance. The output of the Input Source Follower is used by the First Emitter Follower circuit to generate signal current gain. From the First Emitter Follower, the signal goes to the Output Emitter

Follower which produces the final current gain needed to drive the low-impedance output. Negative feedback from the Output Emitter Follower to the constant-current source for the Input Source Follower is supplied through C29 and R29. To measure ac signals riding on dc levels, the COARSE and FINE controls null the gate of the Input Source Follower to 0 V through R14. Power for the P6202A is provided by either the test instrument or a separate probe power supply via the probe's input power connector.

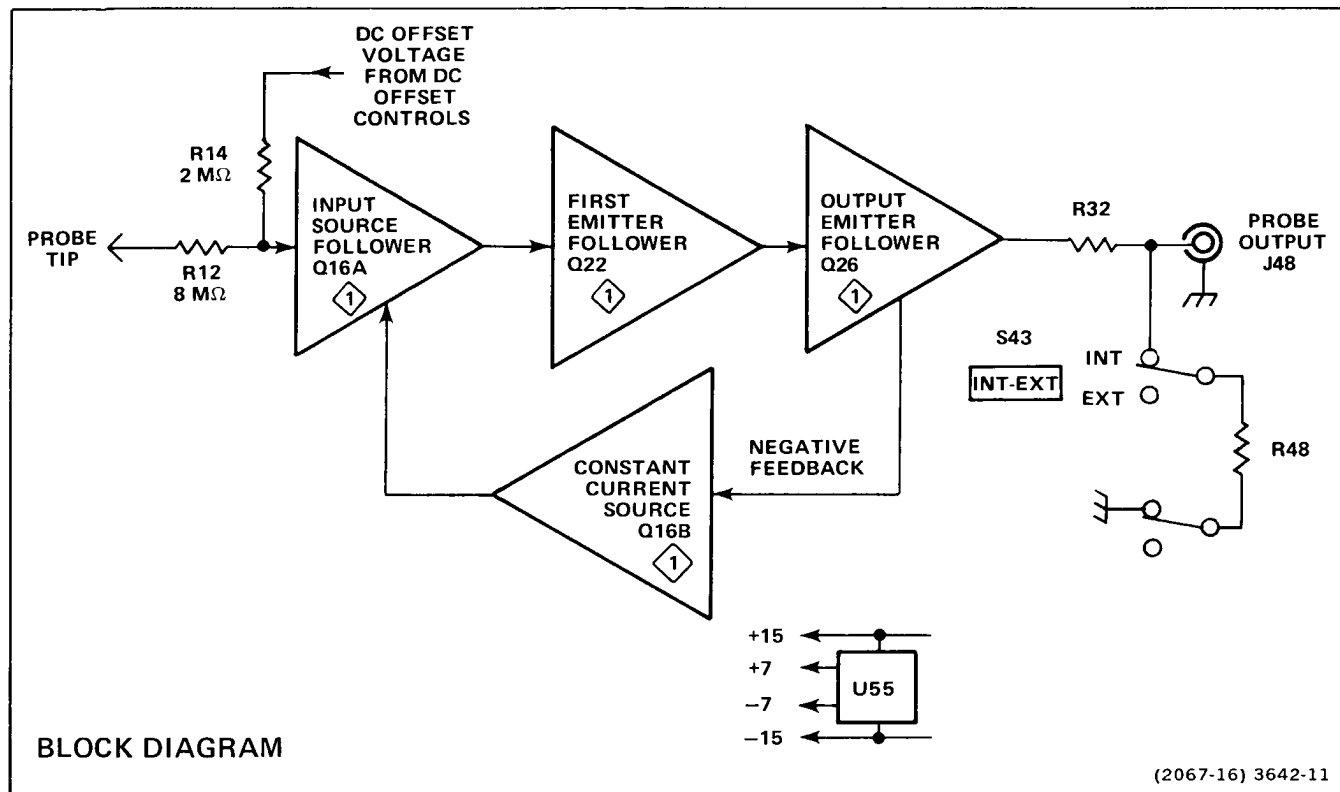


Figure 3-1. Block diagram of probe circuitry.



## DETAILED CIRCUIT DESCRIPTION

### Input Source Follower

Field-Effect Transistor Q16B provides a constant-current source to Q16A which is connected as a source follower. The input signal passes through a voltage divider comprised of R12 and R14. Resistors R10, R41, R42, R44, and R45 are also part of the voltage divider, but have little effect on the signal because they are so small in comparison to R12 and R14. The resulting signal at the gate of Q16A is 20 percent of the input signal at the probe tip (an attenuation factor of 5). Capacitor C12 adjusts to compensate the voltage divider for high-frequency losses caused by stray capacitance and the input capacitance of Q16A.

Variable resistor R50 provides a slight adjustment of the bias on Q16B to set the output dc level to 0 V, both when the DC OFFSET switch is set to OFF and when no signal is connected to the probe tip.

### First Emitter Follower

The First Emitter Follower, comprised of Q22, provides the current gain needed to drive Output Emitter Follower Q26.

### Output Emitter Follower

The signal at the emitter of Output Emitter Follower Q26 passes through a voltage divider comprised of R32 and the 50- $\Omega$  output load. About 53 percent of the signal available at the emitter of Q26 passes to the probe output bnc connector (an attenuation factor of 1.9). This attenuation, when combined with both the attenuation factor of 5 to the gate of the Input Source Follower and the losses in the three follower stages, provides an overall probe attenuation factor of 10.

Transistor Q26 is long-tailed to  $-15$  V through R28 for stability. This eliminates problems caused by current starving Q26 on large negative-going transitions of the input signal.

Negative feedback to the gate of Q16B is provided through R29 and C29. This compensates for minor nonlinearities in the input attenuator (R12-R14).

Compensation for losses in the coaxial cable is provided by C31, R31, C33.

## Dc Offset

If the signal at the probe tip rides on a dc level, the instantaneous voltage (dc + peak ac) can overdrive the Input Source Follower. The COARSE and FINE controls can be used to remove the dc component of the signal at the gate of Q16A.

## Example of Circuit Operation

Assume that a 1-V ac signal at the probe tip rides on  $-25$  V dc. This signal is attenuated by a factor of 5 by the Input Source Follower and applied to the gate of Q16A. The resulting signal at the gate of Q16A is 0.2 V ac riding on  $-5$  V dc.

With the DC OFFSET switch set to  $-$ , a positive voltage is supplied to the junction of R14 and C14. The COARSE and FINE controls are adjusted to supply  $+6.25$  V dc to the junction. This voltage is divided by R14 and R12. With  $-25$  V dc at one end of R12 and  $+6.25$  V at one end of R14, the junction of R12 and R14 is nulled to 0 V.

## Voltage Regulator

Integrated circuit U55 is a dual-voltage regulator used to drop the  $+15$  V and  $-15$  V supplies to  $+7$  V and  $-7$  V. Diode VR59 limits the maximum possible power dissipation of U55 to within its allowable limits.

# CALIBRATION

This section contains a separate Performance Check and Adjustment Procedure for the P6202A Probe. The Performance Check is used to verify the electrical Performance Requirements stated in the "Specification" part of this manual and to determine the need for recalibration (adjustment) of the probe. The Adjustment Procedure is used to restore the probe to its original electrical specification. The recommended calibration interval is one year.

## LIMITS AND TOLERANCES

The limits and tolerances given in this procedure are for the P6202A under test only. Test equipment error is not included except as noted. These limits and tolerances are performance guides and should not be interpreted as performance specifications unless they are also found in Table 1-1.

## TEST EQUIPMENT REQUIRED

You will need the test equipment listed in Table 4-1 to accomplish a complete Performance Check and Adjustment Procedure. Test equipment specifications given in the table are the minimum necessary for accurate results. Detailed operating instructions for test equipment are not contained in these procedures. Should more information be needed, refer to the test equipment instruction manual.

**Table 4-1**  
**Test Equipment Required**

Description	Minimum Specification	Purpose	Examples of Suitable Test Equipment
1. Real time oscilloscope	Bandwidth, dc to about 15 MrHz. Vertical deflection factor, 5 mV to 1 V (doesn't include probe attenuation factor). Vertical accuracy, $\pm 3\%$ .	Output zero, attenuation factor, high frequency gain, and dc offset range checks.	a. TEKTRONIX T921.  b. TEKTRONIX 7704A with 7A16A vertical plug-in.
2. Sampling oscilloscope	Bandwidth, dc to 1 GHz. Input impedance, 50 $\Omega$ . Vertical deflection factor, 50 mV. Horizontal deflection factor, 20 ps.	Probe rise time check.	TEKTRONIX 7704A with a 7S12 sampling plug-in using an S-1 sampling head.
3. Calibration generator	Output, square wave. Repetition rate, 1 kHz. Amplitude, 5 V p-p and 50 V p-p $\pm 0.25\%$ .	Attenuation factor and high frequency gain checks.	TEKTRONIX PG 506.
4. Fast-rise pulse generator	Output amplitude, 200 mV or greater, Rise time, 100 ps or less. Output impedance, 50 $\Omega$ .	Probe rise time check.	TEKTRONIX 284 Pulse Generator.

**Table 4-1 (cont)**

<b>Description</b>	<b>Minimum Specification</b>	<b>Purpose</b>	<b>Examples of Suitable Test Equipment</b>
5. Dc voltage source	Output, + and -55 V dc $\pm 1$ V.	Dc offset range check.	TEKTRONIX PG 505.
6. Adapter	Connectors, bnc female-to-GR.	Signal interconnection.	Tektronix Part Number 017-0063-00.
7. Adapter	Connectors, miniature probe tip-to-GR, 50- $\Omega$ termination.	Signal interconnection.	Tektronix Part Number 017-0088-00.
8. Adapter	Connectors, miniature probe tip-to-bnc.	Signal interconnection.	Tektronix Part Number 013-0084-01.
9. Feedthrough termination	Connectors, bnc. Impedance, 50 $\Omega$ .	Signal termination.	Tektronix Part Number 011-0049-01.
10. Coaxial cable	Length, 42 in. Connectors, bnc. Impedance, 50 $\Omega$ .	Signal interconnection.	Tektronix Part Number 012-0057-01.
11. Screwdriver	Length, 3-inch shaft. Bit size, 3/32 in.	Adjust variable resistors.	Xcelite R-3323.
12. Low-capacitance adjustment tool		Adjust variable capacitors.	Tektronix Part Number 003-0675-00.

# PERFORMANCE CHECK

The Performance Check permits verification of the probe's applicable electrical specifications without making internal adjustments. Each of the following check procedures can be separately performed.

## 1. Output Zero Check

### Equipment Required (see Table 4-1)

Real time oscilloscope (Item 1)

a. Connect the probe to a power source and connect the probe output bnc connector to the input of the real time oscilloscope.

b. Set probe controls as follows:

INT-EXT	INT
DC OFFSET	OFF

c. Set oscilloscope controls as follows:

### Vertical

Volts/Division	50 mV
Input Coupling	GND

### NOTE

*Set vertical deflection factor to 5 mV/division if the oscilloscope you are using does not automatically include the attenuation factor of the probe in its scale factor indication.*

### Trigger

Source  
Mode

Internal  
AUTO

d. Vertically position the trace to the center horizontal graticule line.

e. Set oscilloscope input coupling to DC.

f. CHECK—Trace is within 2 divisions of the center horizontal graticule line. If it is not, refer to the "Output Zero" Adjustment Procedure.

## 2. Attenuation Factor and High Frequency Gain Checks

### Equipment Required (see Table 4-1)

Real time oscilloscope (Item 1)  
Calibration generator (Item 3)  
Adapter (Item 8)  
Cable (Item 10)

a. Connect the calibration generator output to the oscilloscope vertical input using an unterminated 50  $\Omega$  bnc cable.

b. Set the calibration generator for a 0.1-V standard amplitude output.

c. Set the oscilloscope vertical deflection factor to 0.01 V/division. Adjust the oscilloscope Variable Volts/Division control for exactly 5 major divisions of vertical deflection. This eliminates any oscilloscope vertical deflection error from the measurement. Do not readjust the Variable control during the remainder of this step.

d. Disconnect the bnc cable from both the calibration generator and the oscilloscope.

e. Set probe controls as follows:

INT-EXT	INT
DC OFFSET	OFF

f. Connect the probe to a power source.

g. Connect a probe tip-to-bnc adapter to the output of the calibration generator. Connect the probe tip to the adapter and connect the probe output bnc connector to the vertical input of the oscilloscope.

h. Set the calibration generator for a 1.0-V standard amplitude signal.

i. CHECK—Amplitude of displayed signal is between 4.8 and 5.2 divisions. If it is not, refer to the "Troubleshooting" part in the "Maintenance" section of this manual.

j. CHECK—Front corner rolloff or overshoot of the displayed signal is 0.15 division or less (see Figure 4-1). If it is not, refer to the "High Frequency Gain" Adjustment Procedure.

### 3. Dc Offset Range Check

#### Equipment Required (see Table 4-1)

Real time oscilloscope (Item 1)  
Dc voltage source (Item 5)  
Probe tip-to-bnc adapter (Item 8)

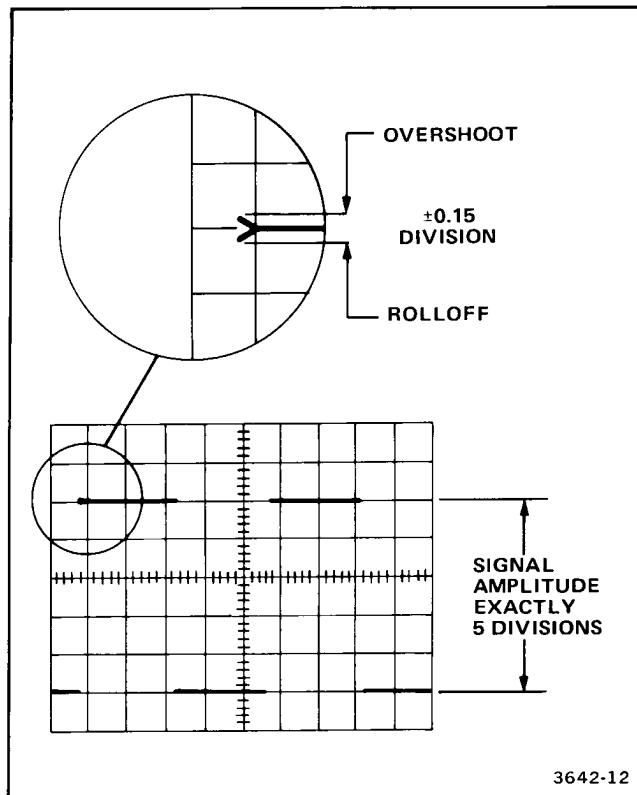


Figure 4-1. High frequency gain limits.



- a. Set the oscilloscope vertical deflection factor to 10 V/division.

**NOTE**

*Set vertical deflection factor to 1 V/division if the oscilloscope you are using does not automatically include the attenuation factor of the probe in its scale factor indication.*

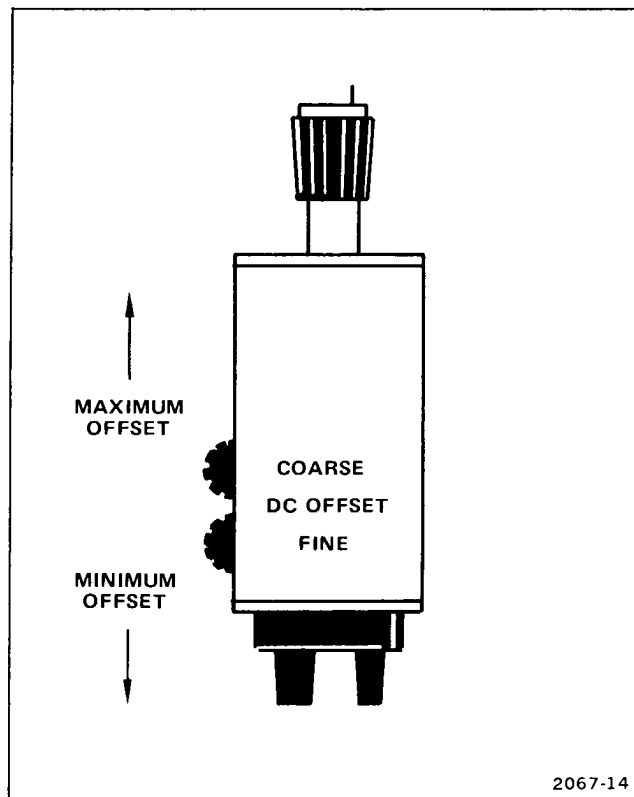
- b. Using the oscilloscope vertical position control, position the trace to the center horizontal graticule line.

- c. Set the probe's COARSE and FINE controls for minimum offset (see Figure 4-2). Set the DC OFFSET switch to +.

- d. Set the dc voltage source for an output of +55 V.

- e. Connect the probe to a power source.

- f. Connect the probe output bnc connector to the vertical input of the oscilloscope.



**Figure 4-2. COARSE and FINE controls.**

g. Connect a probe tip-to-bnc adapter to the output of the dc voltage source and connect the probe tip to the dc voltage source.

h. Set the COARSE and FINE controls for maximum offset (see Figure 4-2).

i. CHECK—Trace moved downward to the center horizontal graticule line or below. If it has not, refer to the "Troubleshooting" part in the "Maintenance" section of this manual.

j. Set DC OFFSET switch to —.

k. Set the dc voltage source for an output of —55 V.

l. CHECK—Trace moved upward to the center horizontal graticule line or above. If it has not, refer to the "Troubleshooting" part in the "Maintenance" section of this manual.

m. Set the DC OFFSET switch to OFF and disconnect the test setup.

#### 4. Probe Rise Time and Bandwidth Checks

##### Equipment Required (see Table 4-1)

Sampling oscilloscope (Item 2)  
Pulse generator (Item 4)  
Adapters (Items 6 and 7)  
Termination (Item 9)  
Cable (Item 10)

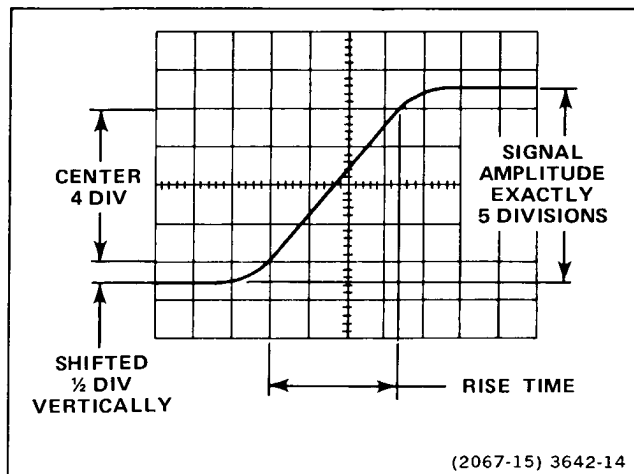
a. Set sampling oscilloscope controls as follows:

Vertical Deflection	50 mV/division
Factor	
Sweep Speed	20 ps/division

b. Connect the pulse output of the pulse generator to the vertical input of the sampling oscilloscope using a bnc-to-GR adapter and a 50-Ω bnc cable.

c. Adjust the oscilloscope variable control for a display amplitude of exactly 5 divisions.

d. Using the oscilloscope vertical position control, shift the display one-half division (see Figure 4-3).



**Figure 4-3. Rise time.**

e. Measure the rise time of the displayed waveform and record it for later use in part m of this check (see Figure 4-3).

f. Disconnect the bnc-to-GR adapter and the 50-Ω cable from the oscilloscope and the pulse generator.

g. Connect the test setup in accordance with Figure 4-4.

h. Set the probe INT-EXT switch to EXT.

i. Set oscilloscope horizontal deflection factor to 200 ps/division.

j. Adjust oscilloscope vertical deflection factor and variable controls for a display amplitude of exactly 5 divisions.

k. Using the oscilloscope vertical position control, shift the display one-half division (see Figure 4-3).

l. Measure the rise time of the displayed waveform and record it for use in the next part of this check (see Figure 4-3).

m. Use the following formula to calculate probe rise time:

$$\text{Probe Rise Time} = \sqrt{\left( \begin{array}{c} \text{Displayed} \\ \text{Rise Time} \\ \text{from part l} \end{array} \right)^2 - \left( \begin{array}{c} \text{Displayed} \\ \text{Rise Time} \\ \text{from part e} \end{array} \right)^2}$$

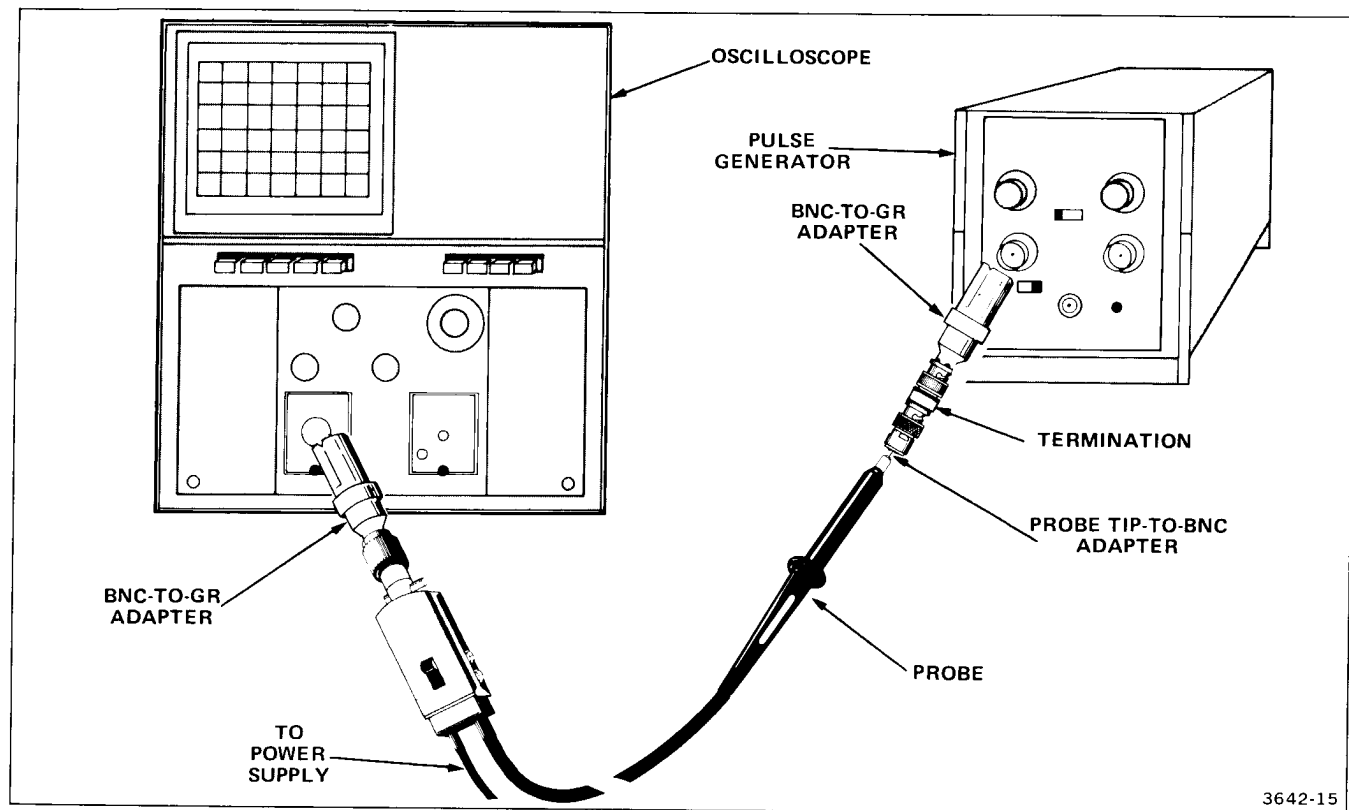


Figure 4-4. Test setup for measuring rise time.

n. CHECK—Calculated probe rise time is 0.7 ns or less. This indicates a bandwidth of 500 MHz or greater as calculated from the formula:

$$\text{Bandwidth} = \frac{0.35}{\text{Rise Time}}$$

o. If calculated rise time is not as expected, refer to the "Troubleshooting" part in the "Maintenance" section of this manual.

# ADJUSTMENT PROCEDURE

Adjustment is generally required after a repair has been made to the probe or whenever completion of a Performance Check procedure reveals a deficiency. A complete Adjustment Procedure is recommended after every 2000 hours of operation or once a year if used infrequently. When accomplishing the following procedures, do not make any adjustments unless it is essential to satisfy a performance parameter. Any fault detected during a procedure should be corrected before continuing.

## 1. Adjust Output Zero

### Equipment Required (see Table 4-1)

Real time oscilloscope (Item 1)  
Screwdriver (Item 11)

- a. Remove the probe control body cover (see Figure 4-5).
- b. Connect the probe input power connector to a power source.
- c. Connect the probe input bnc connector to the vertical input of the oscilloscope.

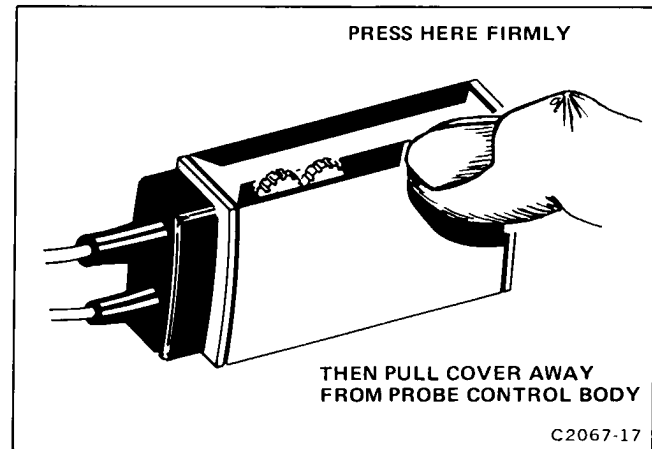


Figure 4-5. Probe control body cover removal.

d. Set probe controls as follows:

INT-EXT	INT
DC OFFSET	OFF

e. Set oscilloscope controls as follows:

**Vertical**

Volts/Division	50 mV
Input Coupling	GND

**NOTE**

*Set vertical deflection factor to 5 mV if the oscilloscope you are using does not automatically include the attenuation factor of the probe in its scale factor indication.*

**Trigger**

Source	Internal
Mode	AUTO

f. Vertically position the trace to the center horizontal graticule line.

g. Set oscilloscope input coupling to DC.

h. ADJUST—R50 (see Figure 4-6) to move the trace back to the center horizontal graticule line.

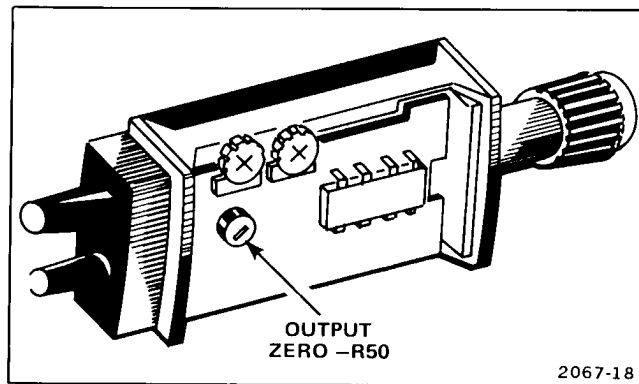


Figure 4-6. Output zero adjustment location.

## 2. Adjust High-Frequency Gain

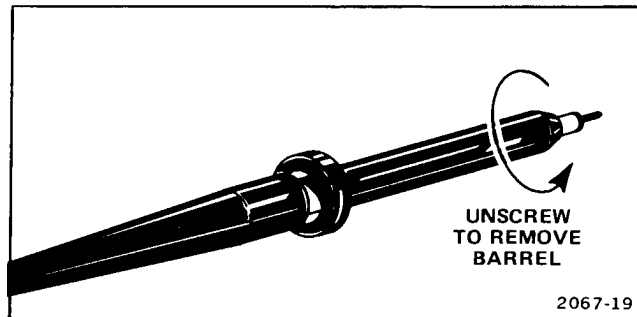
### Equipment Required (see Table 4-1)

Real time oscilloscope (Item 1)  
Calibration generator (Item 3)  
Adapter (Item 8)  
Adjustment tool (Item 12)

### CAUTION

*To avoid shorting components, disconnect the probe from its power source before removing the probe barrel.*

- a. Remove the probe barrel from the probe (see Figure 4-7).
- b. Connect the probe input power connector to a power source.
- c. Connect the probe output bnc connector to the vertical input of the oscilloscope.



**Figure 4-7. Probe barrel removal.**

- d. Connect the probe tip to a 1-kHz square-wave source (see Figure 4-8). Use the probe adjust or calibrator output on the oscilloscope if so equipped.
- e. Set the oscilloscope horizontal sweep speed for 0.2 ms/division.
- f. Adjust the oscilloscope vertical sensitivity for a display amplitude of about 5 divisions.



g. ADJUST—C12 (see Figure 4-8) for a slightly spiked waveform. If you adjust for a perfectly flat top, the front corner will roll off slightly when the probe barrel is reinstalled.

h. Reinstall the probe barrel and check the display for a flat-top waveform.

i. Disconnect test equipment.

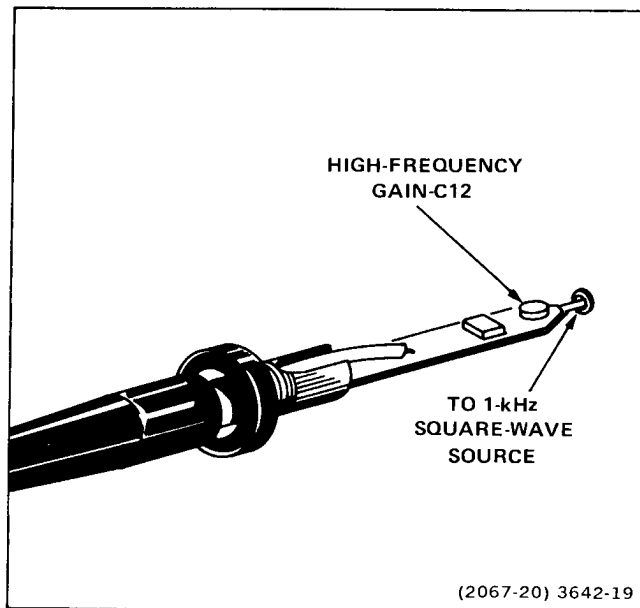


Figure 4-8. High-frequency gain adjustment.



# MAINTENANCE

This section contains information for performing preventive maintenance, troubleshooting, and corrective maintenance on the P6202A Probe.

## STATIC-SENSITIVE COMPONENTS



*Static discharge can damage any semiconductor component in this probe.*

This probe contains electrical components that are susceptible to damage from static discharge. See Table 5-1 for relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.

2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive assemblies or components.

3. Discharge the static voltage from your body by wearing a wrist strap while handling these components. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified service personnel.

4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.

5. Keep the component leads shorted together, whenever possible, with shorting wire or conductive plastic foam.

**Table 5-1**  
**Relative Susceptibility to**  
**Static Discharge Damage**

<b>Semiconductor Classes</b>	<b>Relative Susceptibility Levels<sup>a</sup></b>
MOS or CMOS microcircuits or discretes, or linear microcircuits with MOS inputs (most sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFET	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (least sensitive)	9

6. Pick up components by the body, never by the leads.
7. Do not slide the components over any surface.
8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.
9. Use a soldering iron that is connected to earth ground.
10. Use only special antistatic suction-type or antistatic wick-type desoldering tools.

<sup>a</sup> **Voltage equivalent for levels:**

1 = 100 to 500 V    4 = 500 V    7 = 400 to 1000 V (est)  
 2 = 200 to 500 V    5 = 400 to 600 V    8 = 900 V  
 3 = 250 V    6 = 600 to 800 V    9 = 1200 V

**Voltage discharged from a 100 pF capacitor through a resistance of 100 ohms.**

# PREVENTIVE MAINTENANCE

Preventive maintenance consists primarily of cleaning and visual inspection. When performed on a regular basis, preventive maintenance can prevent instrument breakdown and may improve instrument reliability. The frequency of maintenance depends on the severity of the environment to which the probe is subjected. A convenient time to perform preventive maintenance is just before performing an Adjustment Procedure.

## CLEANING



### CAUTION

*Avoid the use of chemical cleaning agents which might damage the plastics and circuit boards used in this instrument. In particular, avoid chemicals which contain benzene, toluene, xylene, acetone, or similar solvents. For additional information on recommended cleaning agents, consult your Tektronix Service Center or representative.*

## Exterior

Loose dust accumulated on the outside of the instrument can be removed with a soft cloth or small brush. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners.

## Interior

Cleaning the interior of the probe should only be occasionally necessary. Normally the probe body and

probe control body circuit boards will not require cleaning unless a cover has been removed for an extended period of time. The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air (about 9 lb/in<sup>2</sup>). Remove any dirt which remains with a soft brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning more delicate circuit components.

## **VISUAL INSPECTION**

Occasionally inspect the P6202A for such defects as broken connections, damaged parts, bent leads, and heat-

damaged components. Overheating usually indicates other trouble in the instrument; therefore, the cause of overheating must be corrected to prevent recurrence of the damage.

## **SEMICONDUCTOR CHECKS**

Periodic checking of semiconductors is not recommended. The best check of semiconductor performance is proper operation of the instrument.

# TROUBLESHOOTING

The following information is provided to facilitate troubleshooting the probe. An understanding of circuit operation is often helpful in locating troubles. Refer to the "Theory of Operation" section for this information.

Table 5-2 lists the equipment useful for troubleshooting the P6202A Probe.

Table 5-3 is a listing of possible fault indications and their probable causes.

**Table 5-2**  
**Troubleshooting Equipment**

<b>Description</b>	<b>Minimum Specification</b>	<b>Example</b>
1. Digital Multimeter	Voltmeter; 10-M $\Omega$ input impedance, 0 to 150 V dc range, 0.15% dc voltage accuracy, 4 1/2 digit display. Ohmmeter; 0 to 20-M $\Omega$ range.	TEKTRONIX DC 501
2. Test Oscilloscope	Dc to at least 15 MHz bandwidth, 5 mV to 5 V/division deflection factor.	TEKTRONIX T921

**Table 5-3**  
**Fault Indication and Probable Causes**

<b>Fault Indication</b>	<b>Probable Causes</b>	<b>Corrective Action</b>
Wrong Gain	1. INT-EXT switch in wrong position.	Set INT-EXT switch to INT for load $>500\text{ k}\Omega$ or EXT for load of $50\text{ }\Omega \pm 1\%$ .
	2. Faulty INT-EXT switch.	Replace INT-EXT switch.
	3. C12 misadjusted (for wrong high-frequency gains only).	Readjust C12. See Adjustment Procedure.
	4. Input signal exceeds probe dynamic range limits.	Reduce signal amplitude or use optional 10X attenuator.
	5. Defective probe assembly.	Replace probe assembly.
Unable to adjust output zero (R50) with no signal input	1. OFFSET switch in + or - position.	Set switch to OFF.
	2. R50 or R51 defective.	Replace R50 or R51.
	3. Defective power supply ( $\pm 15\text{ V}$ ).	Check $\pm 15$ volt supply. Replace if defective.
	4. Defective $\pm 7$ volt supplies.	Check R55, R57 and U55. Replace if necessary.
	5. Defective probe assembly.	Replace probe assembly.
Rise time out of specification	Defective probe body circuit board.	Replace probe body circuit board.



**Table 5-3 (cont)**

<b>Fault Indication</b>	<b>Probable Causes</b>	<b>Corrective Action</b>
Attenuation factor out of specification	1. INT-EXT switch in wrong position.	Set INT-EXT switch to INT for load $>500\text{ k}\Omega$ or EXT for load of $50\text{ }\Omega \pm 1\%$ .
	2. Output load incorrect.	Check output load is $50\text{ }\Omega \pm 1\%$ for EXT switch setting or $>500\text{ k}\Omega$ for INT switch setting.
	3. R48 defective.	Replace R48.
	4. Defective probe body circuit board.	Replace probe body circuit board.
Trace will not move when adjusting COARSE and FINE controls	1. DC OFFSET switch set to OFF.	Set DC OFFSET switch to + or -.
	2. Defective OFFSET switch.	Replace OFFSET switch.
	3. Defective COARSE or FINE control.	Replace control.
Intermittent probe operation	1. Broken or unsoldered wire, connection, or component.	Visually check for damage and repair any damage found.
	2. Broken probe cable or faulty probe assembly.	Replace probe assembly.
	3. Broken power supply cable or defective power supply.	Replace power cable. See power supply manual.
	4. Faulty INT-EXT switch assembly.	Replace INT-EXT switch.

## SCHEMATIC DIAGRAM AND CIRCUIT BOARD ILLUSTRATIONS

A schematic diagram is located on the foldout page in the "Diagrams" section at the end of this manual. The component number and electrical value of each component are shown on the diagram, as well as voltages and waveform-measurement points. Illustrations of probe circuit boards, showing the location of each mounted component, are contained on the page facing the schematic diagram.

## COLOR CODES AND MARKINGS

Resistors used in the probe are either composition or precision metal-film types. They are color coded with the EIA color code, but some metal-film resistors may have the value printed on the body. Refer to Figure 5-2 for color-coding definition.

The capacitance value of common disc and some small electrolytic capacitors is marked on the side of the component body.

The cathode end of each diode is indicated by either a stripe, a series of stripes, or a dot.

## SEMICONDUCTOR LEAD CONFIGURATION

Figure 5-1 shows the lead configuration of the voltage regulator IC used in the probe control body.

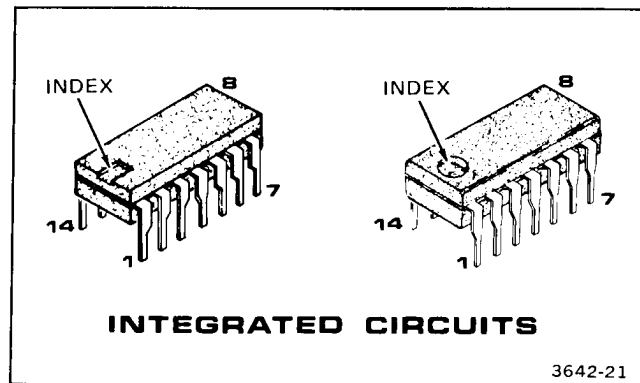


Figure 5-1. Lead configuration of voltage regulator IC.

## TROUBLESHOOTING TECHNIQUES

The following techniques are arranged in an order that checks the simple possibilities before proceeding with extensive troubleshooting. The first few checks ensure proper connection, operation, and calibration. If the trouble is not located by these checks, the remaining steps

should aid in isolating the defective component. Replace defective components using the "Corrective Maintenance" procedures in this section.

### **1. Check Control Settings**

Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, refer to Section 2, "Operating Instructions".

### **2. Check Associated Equipment**

Associated equipment at either the input or output of the probe may be defective. A signal you expect to see might not exist or might be distorted at the point you are testing. If you are using the probe with an oscilloscope the vertical amplifier may be defective or the vertical controls may be misadjusted.

### **3. Check Calibration**

An out-of-calibration condition of either the probe or the test oscilloscope can cause an apparent error in a measurement.

### **4. Visual Check**

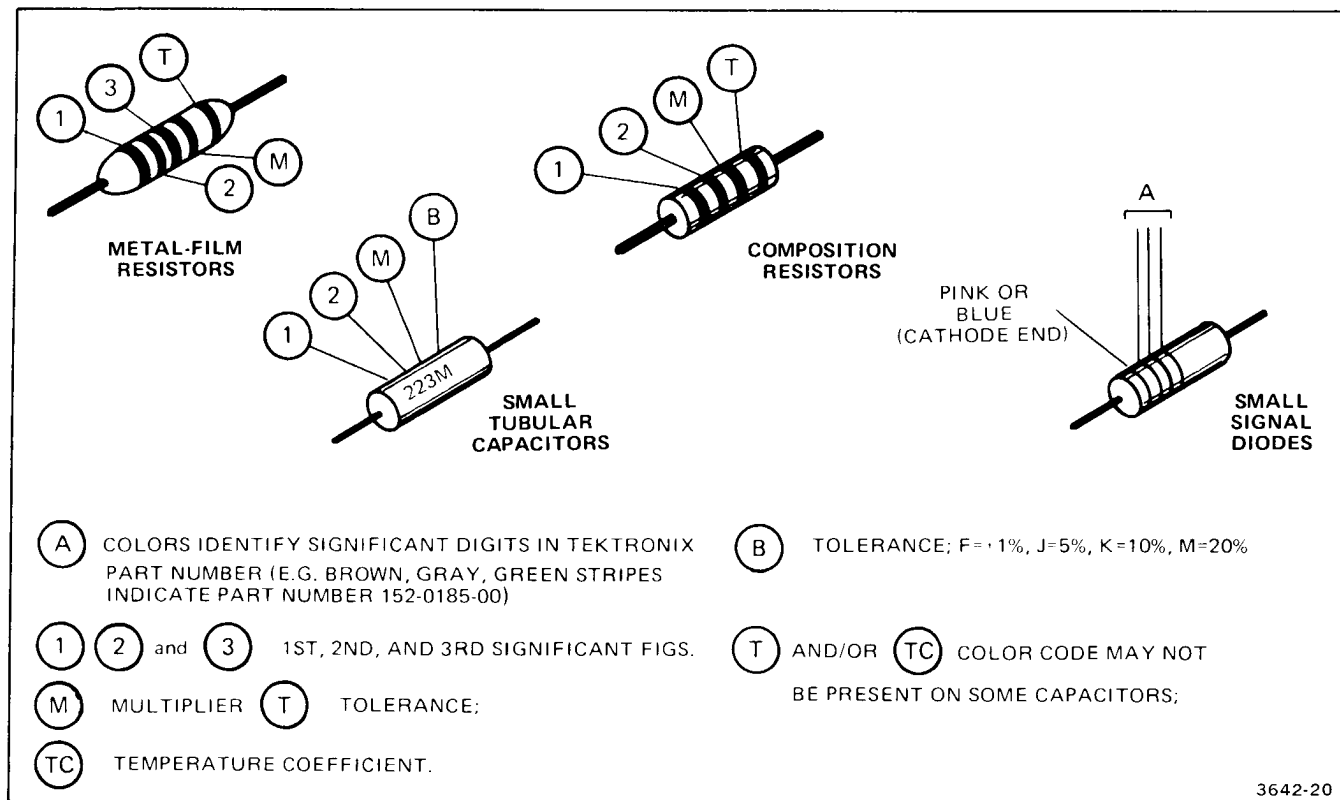
Many problems can be located visually. Check for broken wires, damaged connections, and damaged circuit boards. If you discover a heat-damaged component, find the cause of overheating to prevent recurrence of the problem.

### **5. Refer to Table 5-3.**

Table 5-3 lists some possible malfunctions and probable causes.

### **6. Check Waveforms and Voltages**

Typical voltages are shown on the schematic diagram in Section 8. Waveforms are shown on the page facing the diagram and each is numbered. The point where a waveform was obtained is indicated by a corresponding number on both the schematic diagram and the circuit board illustration.



3642-20

Figure 5-2. Color code for resistors and capacitors.

COLOR	SIGNIFICANT FIGURES	RESISTORS ( $\Omega$ )		CAPACITORS (pF)		
		MULTIPLIER	TOLERANCE	MULTIPLIER	TOLERANCE	
					Over 10 pF	Under 10 pF
BLACK	0	1	— —	1	+20%	$\pm 2$ pF
BROWN	1	10	+1%	10	+1%	$\pm 0.1$ pF
RED	2	$10^2$ or 100	+2%	$10^2$ or 100	+2%	— — —
ORANGE	3	$10^3$ or 1 K	+3%	$10^3$ or 1000	+3%	— — —
YELLOW	4	$10^4$ or 10 K	+4%	$10^4$ or 10,000	+100% -9%	— — —
GREEN	5	$10^5$ or 100 K	$\pm \frac{1}{2}\%$	$10^5$ or 100,000	+5%	$\pm 0.5$ pF
BLUE	6	$10^6$ or 1 M	$\pm \frac{1}{4}\%$	$10^6$ or 1,000,000	— — —	— — —
VIOLET	7	— — —	$\pm 1/10\%$	— —	— — —	— — —
GRAY	8	— — —	— — —	$10^{-2}$ or 0.01	+80% -20%	$\pm 0.25$ pF
WHITE	9	— — —	— — —	$10^{-1}$ or 0.1	+10%	$\pm 1$ pF
GOLD	—	$10^{-1}$ or 0.1	+5%	— — —	— — —	— — —
SILVER	—	$10^{-2}$ or 0.01	+10%	— — —	— — —	— — —
NONE	—	— — —	+20%	— — —	+10%	$\pm 1$ pF

3642-28

Figure 5-2. Color code for resistors and capacitors (cont).

# CORRECTIVE MAINTENANCE

Corrective maintenance consists of replacing a defective component or subassembly. Special techniques required to replace components are given here.

## MAINTENANCE PRECAUTIONS

To reduce the possibility of personal injury or probe damage, observe the following precautions:

### **WARNING**

*To prevent electric shock and shorting of components, disconnect the power connector from the power source before disassembling the probe and before removing or installing any component.*

### **CAUTION**

*Do not use excessive heat when soldering or unsoldering, since circuit and component damage can result.*

Due to the unique design of the P6202A, the circuitry in the probe body is very sensitive. Therefore, none of the components on the Probe Body circuit board should be replaced. Do not try to unsolder any of the components on this circuit board, since heat required to remove the component may cause damage to nearby parts. Should a malfunction occur on the Probe Body circuit board, a new replacement board should be used to effect repair.

## OBTAINING REPLACEMENT PARTS

### Standard Parts

Most electrical and mechanical parts can be obtained through your local Tektronix Field Office or representative. However, you should be able to obtain many of the standard electronic components from a local commercial source in your area. Before you purchase or order a part from a source other than Tektronix, Inc., please check the

Replaceable Electrical Parts List for the proper value, rating, tolerance, and description.

#### NOTE

*Physical size and shape of a component may affect instrument performance, particularly at high frequencies. Always use direct-replacement components, unless you know that a substitute will not degrade instrument performance.*

### Special Parts

In addition to standard electronic components, some special components are used in this instrument which are manufactured or selected by Tektronix, Inc. to meet specific performance requirements. Others are manufactured for Tektronix, Inc. in accordance with our specifications (see Cross Index-Manufacturers Code Number to Manufacturer in the "Replaceable Parts List" sections). Most of the mechanical parts used in the probe have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

### Ordering Parts

When ordering replacement parts from Tektronix, Inc., include all of the following information to insure receiving the proper parts.

1. Instrument type (include modification or option numbers).
2. A description of the part (if electrical, include the circuit number).
3. Tektronix part number.

## SOLDERING TECHNIQUES

### WARNING

*To prevent electric shock and shorting of components, always disconnect the power connector from the power source before soldering.*

**CAUTION**

*Do not perform any soldering or unsoldering on the Probe Body circuit board, since heat can damage sensitive circuitry on the board.*

Use ordinary 60/40 solder and a 15 W pencil-type soldering iron for most soldering. If a soldering iron with higher wattage rating is used on etched circuit boards, excessive heat can cause the etched circuit wiring to separate from the board base material.

The following technique should be used when soldering on a circuit board.

1. Grip component lead with long-nose pliers. Touch soldering iron to lead at solder connection. Do not lay iron directly on board.

2. When solder begins to melt, pull lead out gently. This should leave a clean hole in the board. If not, the hole can be cleaned by reheating solder and placing a sharp

object—such as a toothpick into the hole to clean it out. A vacuum-type desoldering tool also can be used for this purpose.

3. Bend leads of new component to fit holes in board. If component is replaced while board is mounted in the probe, cut leads so they just protrude through board. Insert leads into holes in board with component firmly seated against board (or as positioned originally). If it does not seat properly, heat solder and gently press component into place.

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint. To protect heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clip excess lead that protrudes through board (if not clipped in step 3).

6. Clean the area around the solder connection, being careful not to remove information printed on the board.



## COVER REMOVAL

### **WARNING**

*To prevent electric shock or shorting of components, disconnect the power connector from the power source before removing the covers and before removing any component or assembly.*

### Probe Body Cover

Rotate the Probe Body cover counterclockwise to remove it (see Figure 5-3).

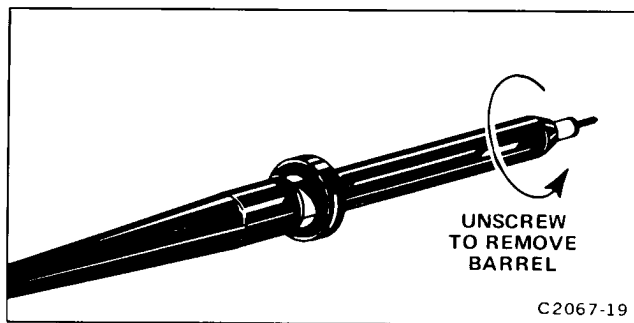


Figure 5-3. Probe body cover removal.

### Probe Control Body Covers

There are two covers on the Probe Control Body. To remove them, press firmly on each edge and pry covers off (see Figure 5-4).

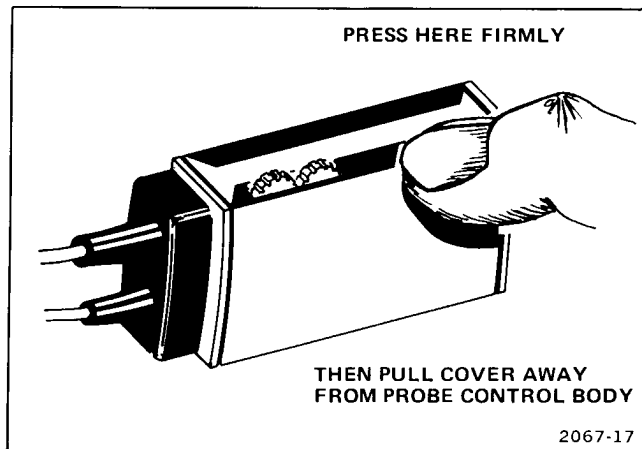


Figure 5-4. Probe control body cover removal.

## COMPONENT AND SUBASSEMBLY REPLACEMENT

Use the following procedures for replacing circuit boards, components, and other subassemblies in the probe.

## Probe Body Circuit Board Removal

Because of the unique nature of the circuitry, you should replace a defective Probe Body circuit board as an assembly. This assembly includes the Probe Body circuit board, probe cable, and plastic fitting.

1. Remove covers from the Probe Control Body (see "Cover Removal").

2. Loosen slightly the two screws holding the Probe Control Body circuit board. Grasp the blue signal coaxial cable near the output bnc connector with a pair of long-nose pliers (see Figure 5-5). Pull the cable out of the connector.

3. Unsolder and identify for later installation the six probe cable wires from the Probe Body circuit board (see Figure 5-5).

4. Remove the Phillips screw from the plastic holder on the cable end of the Probe Control Body (see Figure 5-5). Slide the plastic holder away from the Probe Control Body.

5. Unsolder the probe cable shield braid from the DC OFFSET switch frame.

6. Unsolder the three power supply wires from the input power connector (see Figure 5-6).

7. Slide the power supply cable through the plastic holder (see Figure 5-5).

8. Slide the probe cable out of the Probe Control Body. The plastic holder is part of the assembly.

## Probe Control Body Circuit Board Removal

1. Remove the Probe Control Body covers (see "Cover Removal").

2. Disconnect the blue signal coaxial cable from near the output bnc connector (see Figure 5-5).

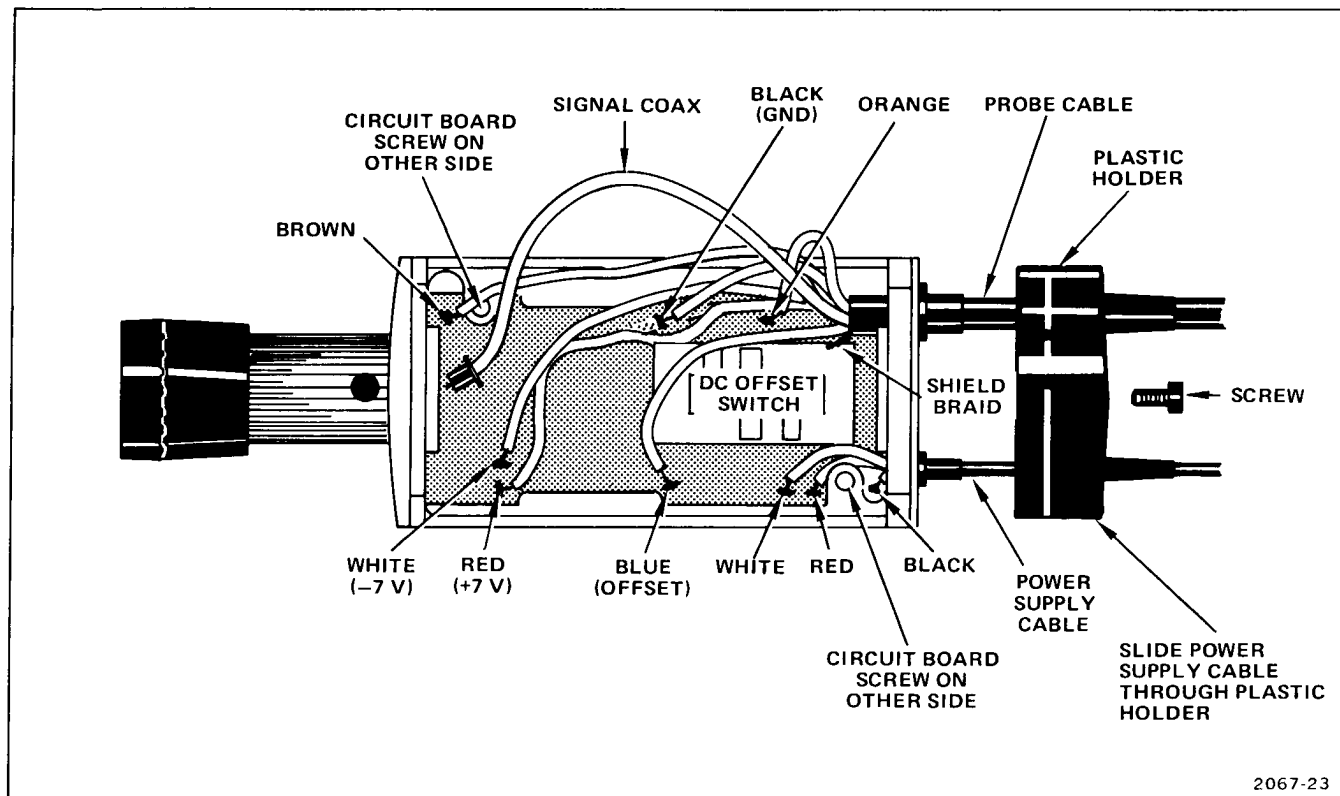
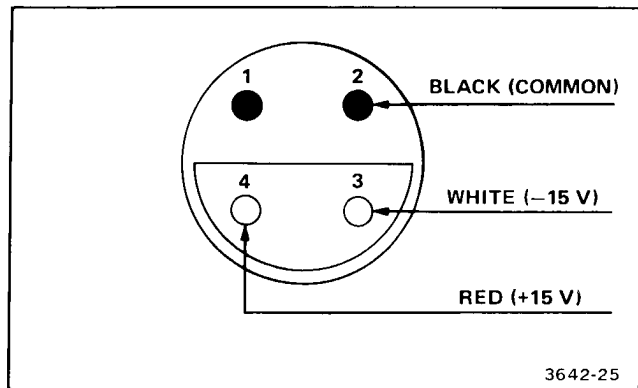


Figure 5-5. Probe control body.



**Figure 5-6. Input power connector pins.**

3. Unsolder all wires from Probe Control Body circuit board and identify them for later installation (see Figure 5-5).

4. Unsolder the shield braid from the DC OFFSET switch frame.

5. Remove the two screws holding the Probe Control Body circuit board and remove the board. Save the two small metal spacers under the circuit board.

## **INT-EXT Switch Removal**

1. Remove the Probe Control Body covers (see "Cover Removal").

2. Unplug the blue signal coaxial cable from near the output bnc connector (see Figure 5-5).

3. Using a 7/16-inch open-end wrench, loosen the bnc connector shell and carefully remove it (see Figure 5-7).

4. Grasp the white plastic piece just exposed and pull to remove (see Figure 5-7).

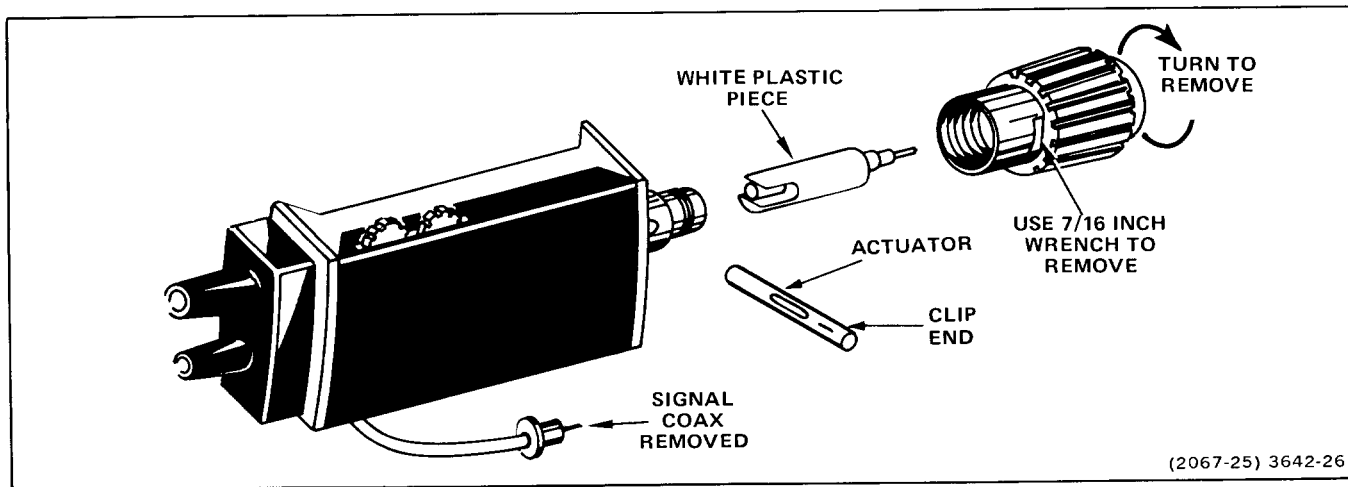
5. Grasp the INT-EXT switch actuator and pull to remove (see Figure 5-7). Note orientation of the clip end.

### **NOTE**

*When reinstalling the switch actuator, be sure the clip end is correctly oriented (see Figure 5-7).*

## **DC OFFSET Switch Removal**

The DC OFFSET switch is very difficult to remove without damaging the Probe Control Body circuit board. If



**Figure 5-7. INT-EXT switch removal.**

possible, have the switch replaced at a Tektronix Service Center.

If the switch must be replaced, use the following procedure.

1. Remove the Probe Control Body covers (see "Cover Removal").

2. Unsolder the shield braid and the ground strap from the switch frame.

3. Using a vacuum desoldering tool, remove as much solder as possible from the five switch leads.

4. Carefully pull the switch away from the board, heating the terminals as necessary. Use as little heat as possible to avoid damage to the circuit board.

### **Probe Tip Replacement**

Using the probe without an accessory slip-on tip subjects the unprotected tip to breaking or bending. Attempting to straighten a bent tip will weaken it and may cause it to break. Use the following procedure to replace the probe tip (see Figure 5-8).

1. Grip probe tip between plastic and grounding sleeve with needle-nose pliers. Don't squeeze or cut the grounding sleeve (see Figure 5-8A).

2. Pull the tip free from the grounding sleeve with a sideways rocking motion.

3. Align the replacement tip as shown in Figure 5-8B and push it into position by tapping sharply with a 3/16-inch hollow shaft nut driver (or similar tool).

## **READJUSTMENT AFTER REPAIR**

After any electrical component has been replaced, complete the "Performance Check" procedure (Section 4) to verify that the probe is within specification limits. If adjustment is necessary, perform the appropriate Adjustment Procedure.

## **INSTRUMENT REPACKING**

Should reshipment become necessary, reuse the original carton in which your probe was shipped. If original packing is unfit for use or is not available, repackage the probe as follows.

1. Obtain a corrugated cardboard carton having inside dimensions of no less than 2 inches more than probe dimensions to allow cushioning. Use a carton having a test strength of at least 175 pounds.

2. Surround the probe with protective polyethylene sheeting.

3. Cushion the probe on all sides by tightly packing dunnage or urethane foam between carton and probe, allowing 2 inches on all sides.

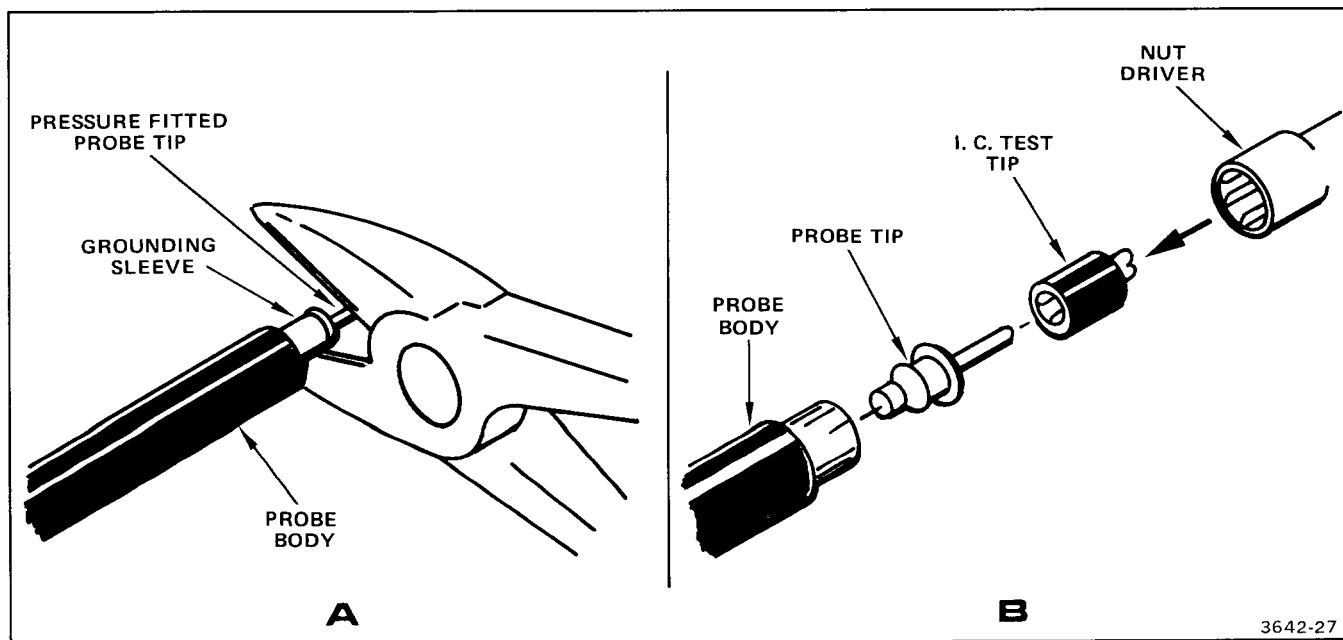


Figure 5-8. Probe tip replacement.

4. Seal carton with shipping tape or industrial stapler.

1. Owner's name and address, with the name of an individual at your firm that can be contacted.

### **Required Reshipment Information**

If the probe is to be shipped to a Tektronix Service Center for service or repair, attach a tag (before packaging) that contains the following information.

2. Description of the services required.



# OPTIONS

At the time of this printing, there are no options available for the P6202A Probe.



# **REPLACEABLE ELECTRICAL PARTS**

## **PARTS ORDERING INFORMATION**

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

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, to include the following information in your order: Part number, instrument type or number, 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, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

## **SPECIAL NOTES AND SYMBOLS**

X000	Part first added at this serial number
00X	Part removed after this serial number

## ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

## ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICON	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

## CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
03888	KDI ELECTRONICS	60 S JEFFERSON RD	WHIPPANY NJ 07981-1001
04222	AVX CERAMICS	19TH AVE SOUTH	MYRTLE BEACH SC 29577
	DIV OF AVX CORP	P O BOX 867	
04713	MOTOROLA INC	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
	SEMICONDUCTOR PRODUCTS SECTOR		
05397	UNION CARBIDE CORP	11901 MADISON AVE	CLEVELAND OH 44101
	MATERIALS SYSTEMS DIV		
07716	TRW INC	2850 MT PLEASANT AVE	BURLINGTON IA 52601
	TRW IRC FIXED RESISTORS/BURLINGTON		
13606	SPRAGUE ELECTRIC CO	70 PEMBROKE RD	CONCORD NH 03301-5755
18796	MURATA ERIE NORTH AMERICAN INC	1900 W COLLEGE AVE	STATE COLLEGE PA 16801-2723
	STATE COLLEGE OPERATIONS		
29454	JOHANSON DIELECTRICS INC	2210 SCREENLAND DR	BURBANK CA 91505-1137
		PO BOX 6465	
32997	BOURNS INC	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
	TRIMPOT DIV		
49956	RAYTHEON CO	141 SPRING ST	LEXINGTON MA 02173-7801
	EXECUTIVE OFFICES		
51406	MURATA ERIE NORTH AMERICA INC	2200 LAKE PARK DR	SMYRNA GA 30080
	HEADQUARTERS AND GEORGIA OPERATIONS		
51959	KYOCERA INTERNATIONAL INC		SAN DIEGO CA
	ELECTRONIC COMPONENTS DIV		
52262	MICROPLEX INC	2126 S LYON ST	SANTA ANA CA 92705-5304
56289	SPRAGUE ELECTRIC CO	92 HAYDEN AVE	LEXINGTON MA 02173-7929
	WORLD HEADQUARTERS		
56845	DALE ELECTRONICS INC	2300 RIVERSIDE BLVD	NORFOLK NE 68701-2242
		PO BOX 74	
65238	NOVACAP	25111 ANZA DRIVE	VALENCIA CA 91335
79727	C-W INDUSTRIES	130 JAMES WAY	SOUTHAMPTON PA 18966-3818

# CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
91293	JOHANSON MFG CO	400 ROCKWAY VALLEY RD	BOONTON NJ 07005
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601-3632
TK0510	PANASONIC COMPANY DIV OF MATSUSHITA ELECTRIC CORP	ONE PANASONIC WAY	SECAUCUS NJ 07094

Component No.	Tektronix Part No.	Serial/Assembly No. Effective    Discont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-4384-00	8341	CIRCUIT BD ASSY:PROBE	80009	670-4384-00
A1	670-4384-01		CIRCUIT BD ASSY:PROBE	80009	670-4384-01
A2	670-4383-04		CIRCUIT BD ASSY:PROBE TIP	80009	670-4383-04
A1	670-4384-00	8341	CIRCUIT BD ASSY:PROBE	80009	670-4384-00
A1	670-4384-01		CIRCUIT BD ASSY:PROBE	80009	670-4384-01
A1C54	283-0156-00		CAP,FXD,CER DI:1000PF,+80-20%,200V	04222	SR152E102ZAA
A1C58	283-0156-00		CAP,FXD,CER DI:1000PF,+80-20%,200V	04222	SR152E102ZAA
A1C60	290-0534-00		CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A1C61	290-0534-00		CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A1C67	290-0534-00	8340	CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A1C68	290-0534-00		CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A1R41	321-0226-00		RES,FXD,FILM:2.21K OHM,1%,0.125W,TC=T0	07716	CEAD22100F
A1R42	311-1863-00		RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3352T-CP8-502
A1R42	311-1863-01		RES,VAR,NONWW:TRMR,5K OHM,20%,0.5W,	80009	311-1863-01
A1R44	321-0322-00		RES,FXD,FILM:22.1K OHM,0.1%,0.125W,TC=T0	80009	321-0322-00
A1R45	311-1863-00	8341	RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3352T-CP8-502
A1R45	311-1863-01		RES,VAR,NONWW:TRMR,5K OHM,20%,0.5W,	80009	311-1863-01
A1R48	325-0212-00		RES,FXD,FILM:50 OHM,1%,0.1W,TC=100PPM/DEG C	03888	A3FT55-20R120
A1R49	321-0293-00		RES,FXD,FILM:11.0K OHM,1%,0.125W,TC=T0 (PART NUMBER NEEDS TO BE VERIFIED FOR 11K)	07716	CEAD11001F
A1R50	311-1862-00	8341	RES,VAR,NONWW:TRMR,5K OHM,0.5W	80009	311-1862-00
A1R51	317-0104-00		RES,FXD,CMPSN:100K OHM,5%,0.125W	80009	317-0104-00
A1R55	321-0312-00	8341	RES,FXD,FILM:17.4K OHM,1%,0.125W,TC=T0	80009	321-0312-00
A1R57	321-0371-00		RES,FXD,FILM:71.5K OHM,1%,0.125W,TC=T0	07716	CEAD71501F
A1S45	260-0984-00		SWITCH,SLIDE:DPTT,0.5A,125V	79727	G-128-S-0012

# Replaceable Electrical Parts - P6202A

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discont	Name & Description	Mfr. Code	Mfr. Part No.
A1U55	156-0496-00			MICROCKT, LINEAR: VOLTAGE REGULATOR	49956	RC4194DC
A1VR59	152-0278-00			DIODE, ZENER: ; 3V, 5%, 0.4W; 1N4372A, DO-35 OR 7	80009	152-0278-00
A2	670-4383-04			, TR		
A2C12	281-0224-00			CIRCUIT BD ASSY: PROBE TIP	80009	670-4383-04
A2C13	283-0373-00		8847	CAP, VAR, CER DI: 0.5-2.0PF, 250VDC	80009	281-0224-00
A2C13	283-0321-00	8848		CAP, FXD, CER DI: 1.8PF, 0.25%, 100V	51406	GRH38C061R8C100V
				CAP, FXD, CER DI: 1.8PF, 0.25PF, 50V	80009	283-0321-00
A2C14	283-0372-00		8847	CAP, FXD, CER DI: 470PF, 10%, 50V	65238	0504N471K500
A2C14	283-5216-00	8848		CAP, FXD, CER DI: 470PF, 5%, 50V, NPO	80009	283-5216-00
A2C16	283-0372-00		8847	CAP, FXD, CER DI: 470PF, 10%, 50V	65238	0504N471K500
A2C18	283-0372-00		8847	CAP, FXD, CER DI: 470PF, 10%, 50V	65238	0504N471K500
A2C18	283-5216-00	8848		CAP, FXD, CER DI: 470PF, 5%, 50V, NPO	80009	283-5216-00
A2C23	283-0324-00		8847	CAP, FXD, CER DI: 0.01UF, +80-20%, 50V	04222	08055C103ZA2055
A2C23	283-5058-00	8848		CAP, FXD, CER DI: 0.01UF, 20%, 50V	80009	283-5058-00
A2C24	283-0324-00		8847	CAP, FXD, CER DI: 0.01UF, +80-20%, 50V	04222	08055C103ZA2055
A2C26	283-0252-00		8847	CAP, FXD, CER DI: 0.001UF, 10%, 50V	56289	
A2C26	283-5053-00	8848	9517	CAP, FXD, CER DI: 1000PF, 10%, 50V	18796	GR40X7R102J50V
A2C26	283-5058-00	9518		CAP, FXD, CERAMIC: MLC; 0.01UF, 20%, 50V	18796	GR40X7R103M50VPT
A2C28	283-0324-00		8847	CAP, FXD, CER DI: 0.01UF, +80-20%, 50V	04222	08055C103ZA2055
A2C28	283-5058-00	8848		CAP, FXD, CER DI: 0.01UF, 20%, 50V	80009	283-5058-00
A2C29	283-0374-00		8847	CAP, FXD, CER DI: 7.5PF, 0.25%, 100V	91293	101R11N7R5CB
A2C29	283-5215-00	8848		CAP, FXD, CER DI: 7PF +/-0.5PF, 50V, NPO 805 PKG	80009	283-5215-00
				, SMD		
A2C31	-----		8847	(C31 IS A SELECTED COMPONENT)		
A2C31	283-0403-00		8847	CAP, FXD, CER DI: 5.75PF, +/-0.25PF, 100V	91293	101R15N5R75CB
A2C31	283-0374-00		8847	CAP, FXD, CER DI: 7.5PF, 0.25%, 100V	91293	101R11N7R5CB
A2C31	283-0465-00		8847	CAP, FXD, CER DI: 10PF, 10%, 50VDC	18796	ADVISE
A2C31	283-0322-00		8847	CAP, FXD, CER DI: 12PF, 5%, 50V	29454	500R11N127J04



Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discont	Name & Description	Mfr. Code	Mfr. Part No.
A2C31	283-5219-00	8848	9016	CAP,FXD,CER DI:15PF,2%,50V,0805 PKG,SMD	80009	283-5219-00
A2C31	283-5214-00	9017	9103	CAP,FXD,CER DI:12PF,5%,50V,NPO	80009	283-5214-00
A2C31	283-5276-00	9104		CAP,FXD,CER,DI:11PF,5%,50V,SMD	80009	283-5276-00
A2C33	-----		8847	(C33 IS A SELECTED COMPONENT)		
A2C33	283-0311-00		8847	CAP,FXD,CER DI:4.7PF,+/-0.25PF,100V	51959	1005C4R7C3T
A2C33	283-0374-00		8847	CAP,FXD,CER DI:7.5PF,0.25%,100V	91293	101R11N7R5CB
A2C33	283-5292-00			CAP,FXD,CERAMIC:MLC,2.7PF,+/-0.25PF,200V,NPO	04222	08052A2R7CAT2A
A2C37	290-0699-00		8847	CAP,FXD,ELCTLT:1UF,20%,20V	05397	T421A105M020AU
A2C37	290-5033-00	8848		CAP,FXD,ELCTLT:1UF,10%,10V SMD TANTALUM	13606	194D105X9010A2T
A2C38	290-0699-00		8847	CAP,FXD,ELCTLT:1UF,20%,20V	05397	T421A105M020AU
A2C38	290-5033-00	8848		CAP,FXD,ELCTLT:1UF,10%,10V SMD TANTALUM	13606	194D105X9010A2T
A2Q16	151-1100-01			TRANSISTOR:W/LEAD FRAME & COVER	80009	151-1100-01
A2Q22	151-0293-00		8847	TRANSISTOR:NPN,SI,U-43	04713	SMT1050
A2Q22	151-5012-00	8848		TRANSISTOR,SIG:BIPOLAR,PNP;15V,30MA,2.0GHZ, AMPLIFIER;MMBTH69L,TO-236/SOT-23,8MM T/R	80009	151-5012-00
A2Q26	151-0294-00		8847	TRANSISTOR:PNP,SI,U-43	04713	SMT1014
A2Q26	151-5003-00	8848	9103	TRANSISTOR,SIG:BIPOLAR,NPN;8V,50MA,1.6GHZ,A MPLIFIER;MMBT3960AL,TO-236/SOT-23,8MM T/R	80009	151-5003-00
A2Q26	151-5069-00	9104		TRANSISTOR,SIG:BIPOLAR,NPN,15V,800MHZ,AMPLI FIER,MMBTH17,TO-2361,SOT-23,8MM	80009	151-5069-00
A2R10	307-0512-00		8847	RES,FXD,FILM:50 OHM,1%,0.075W	52262	MCRA500FY
A2R10	325-5076-00	8848		RES,FXD,FILM:82.5 OHM,1%,0.0625 W	80009	325-5076-00
A2R12	307-0520-00		8847	RES,FXD,FILM:8M OHM,1%,0.25W	03888	PCWT50X150 8M 1%
A2R12	321-5234-00	8848		RES,FXD,FILM:8 MEG OHM,2%,0.125W,TC=300 PPM /C,SMD	56845	RCW575805G
A2R13	307-0515-00		8847	RES,FXD,FILM:510 OHM,1%,0.075W	52262	MCREC511FYZ
A2R13	325-5079-00	8848		RES,FXD,FILM:475 OHM,1%,0.062W	80009	325-5079-00

# Replaceable Electrical Parts - P6202A

Component No.	Tektronix Part No.	Serial/Assembly No. Effective      Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2R14	321-5235-00		RES,FXD,FILM:2 MEG OHM,1%,0.0625W	56845	CRCW0805205FRT1
A2R17	307-0514-00		RES,FXD,FILM:27 OHM,1%,0.075W	52262	MCRA270FYZ
A2R19	307-0518-00	8847	RES,FXD,FILM:1K OHM,1%,0.125W	52262	MCRA102FYZ
A2R19	307-1159-00	8848	RES,FXD,FILM:1K OHM,5%,0.062W,0805,8MM	TK0510	ERJ-6GCSJ102V
A2R20	307-0514-00		RES,FXD,FILM:27 OHM,1%,0.075W	52262	MCRA270FYZ
A2R20	321-5081-00	8848	RES,FXD,FILM:27 OHM,1%,62.5MW,0805,TC=100PPM	80009	321-5081-00
A2R22	307-0516-00	8847	RES,FXD,FILM:800 OHM,1%,0.125W	52262	MCRA801FYZ
A2R22	325-5048-00	8848	RES,FXD,FILM:825 OHM,1%,0.062W	56845	CRCW0805-8200FT
A2R26	307-0513-00	8847	RES,FXD,FILM:120 OHM,1%,0.125W	52262	MCRA121FY
A2R26	321-5236-00	8848	RES,FXD,FILM:120 OHM,5%,62.5MW,TC=200	56845	CRCW08051200JT
A2R28	307-0517-00	8847	RES,FXD,FILM:900 OHM,1%,0.7W	52262	MCRD901FYZ
A2R28	325-5060-00	8848	RES,FXD,FILM:910 OHM,5%,0.125W	91637	CRCW1206-9100JT
A2R29	317-0122-00	8847	RES,FXD,CMPSN:1.2K OHM,5%,0.125W	80009	317-0122-00
A2R29	325-5075-00	8848	RES,FXD,FILM:1.3K OHM,1%,62.5MW	56845	CRCW0805132FT
A2R31	307-0511-00	8847	RES,FXD,FILM:43 OHM,1%,0.075W	52262	MCRA430FY
A2R31	325-5041-00	8848	RES,FXD,FILM:10 OHMS,1%,0.062W	56845	CRCW0805-10R0FT
A2R31	321-5081-00	9104	RES,FXD,FILM:27 OHM,1%,62.5MW,0805,TC=100PPM	80009	321-5081-00
A2R31	-----		M (R31 IS ADDED AS NEEDED)		
A2R32	307-0511-00	8847	RES,FXD,FILM:43 OHM,1%,0.075W	52262	MCRA430FY
A2R32	321-5233-00	8848	RES,FXD,FILM:43.2 OHM,1%,TC=100PPM	56845	CRCW080543R2FT

# REPLACEABLE MECHANICAL PARTS

## PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

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, to include the following information in your order: Part number, instrument type or number, 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, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

## FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

## INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5                      *Name & Description*

*Assembly and/or Component*

*Attaching parts for Assembly and/or Component*

---\*---

*Detail Part of Assembly and/or Component*

*Attaching parts for Detail Part*

---\*---

*Parts of Detail Part*

*Attaching parts for Parts of Detail Part*

---\*---

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol ---\*--- indicates the end of attaching parts.

**Attaching parts must be purchased separately, unless otherwise specified.**

## ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

## SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number  
00X Part removed after this serial number

## ABBREVIATIONS

#	INCH	ELECTRN	ELECTRON	IN	INCH	SE	SINGLE END
ACTR	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ADPTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICON	SEMICONDUCTOR
ALIGN	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
AL	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
ASSEM	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSY	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ATTEN	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
AWG	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVEING
BD	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BRKT	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SO	SQUARE
BRS	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRZ	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BSHG	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
CAB	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAP	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CER	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CHAS	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CKT	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
COMP	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCP	RECEPTACLE	TPG	TAPPING
CONN	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
COV	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
CPLG	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CRT	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W	WITH
DEG	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DWR	DEGREE	IDNT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

## Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
24931	BERG ELECTRONICS INC	BERG ELECTRONICS RF/COAXIAL DIV 2100 EARLYWOOD DR PO BOX 547	FRANKLIN, IN 46131
79727	C-W INDUSTRIES	130 JAMES WAY	SOUTHAMPTON, PA 18966
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077-0001
91836	KINGS ELECTRONICS COMPANY INC	40 MARBLEDAL ROAD	TUCKAHOE, NY 10707-3420
TK0435	LEWIS SCREW CO.	4300 SOUTH RACINE AVENUE	CHICAGO, IL 60609
TK2222	PLANO MOLDING CO	HENNING & S CENTER AVE	PLANO, IL 605450189
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK HWY SUITE 2	VANCOUVER, WA 98661
TK2548	XEROX CORPORATION	DIV OF XEROX CORPORATION 14181 SW MILLIKAN WAY	BEAVERTON, OR 97005
TK2565	VISION PLASTICS INC	26000 SW PARKWAY CENTER DRIVE	WILSONVILLE, OR 97070

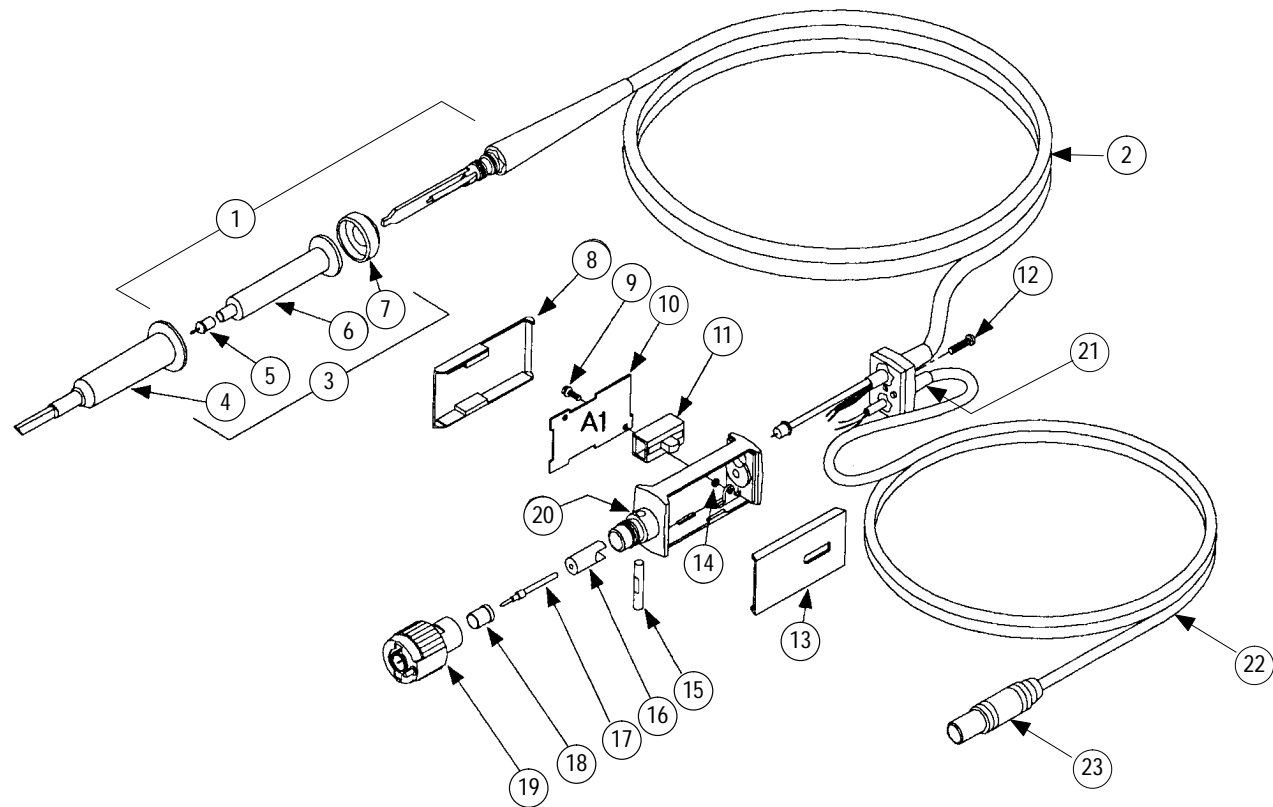


Figure 8-1: Exploded view

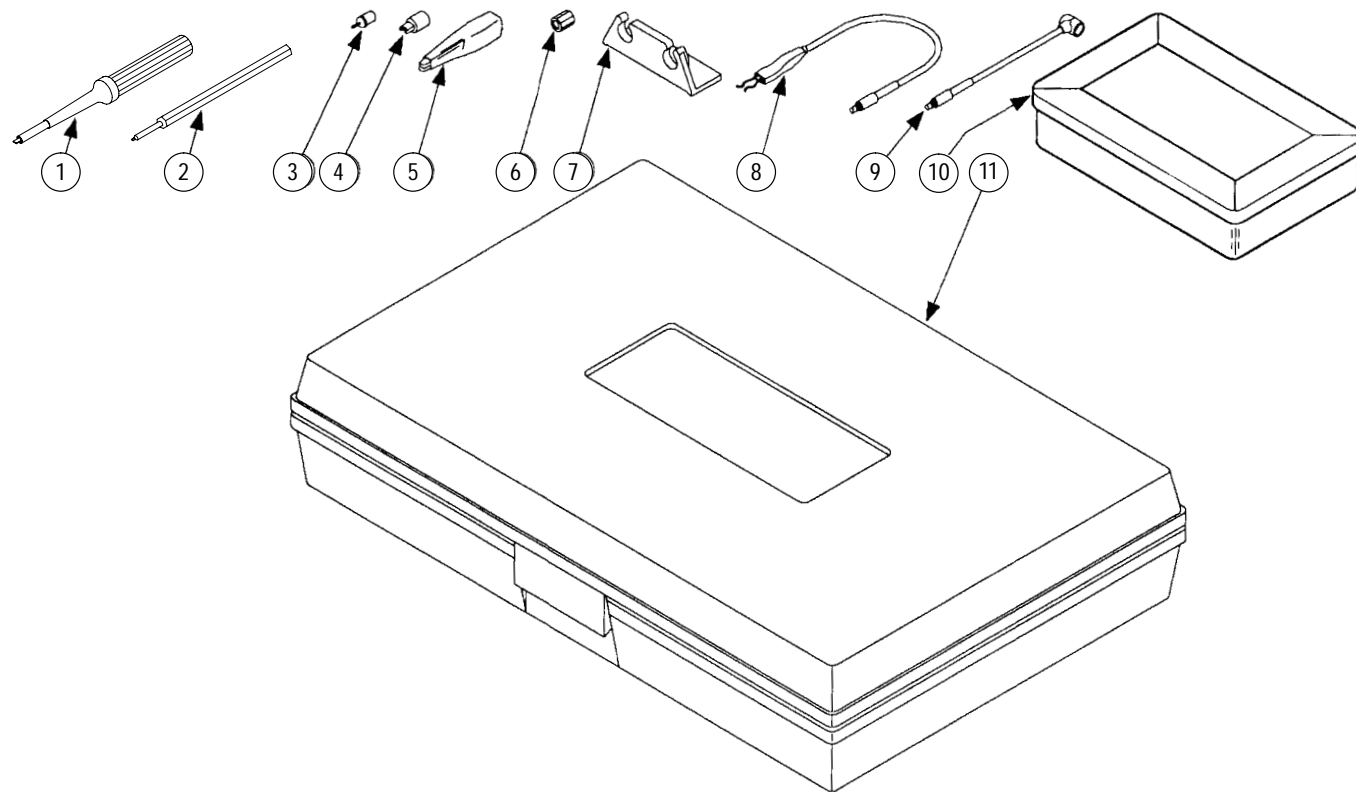


Figure 8-2: Standard accessories

## Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
1-					P6202A		
-1	206-0232-04			1	PROBE ASSY:P6202A	80009	206-0232-04
-2	175-1822-08			1	CA ASSY,SP,ELEC:6,30 AWG,84.0 L	TK2469	175-1822-08
-3	206-0233-01			1	TIP ASSY,PROBE:P6202	80009	206-0233-01
-4	013-0097-01			1	TIP,PROBE:RETRACTABLE HOOK	TK2565	013-0097-01
-5	(See Opt. Acc)			1	TIP,PROBE		
-6	204-0895-00			1	BODY ASSY,PROBE:INNER P6202A	TK2565	204-0895-00
-7	343-0619-00			1	COLLAR,GND CLIP:0.78 DIA,POLYPROPYLENE BLK	TK2565	343-0619-00
-8	200-2129-02			1	COVER,COMP BOX:PLASTIC,WHITE	TK2565	200-2129-02
-9	211-0180-00			2	SCR,ASSEM WSHR:2-56 X 0.25,PNH,BRS,NP,POZ	TK0435	ORDER BY DESCRIPTION
-10	-----			1	CKT BD ASSY:PROBE (SEE A1 REPL)		
-11	260-0984-00			1	SWITCH,SLIDE:DPTT,0.5A,125V	79727	G-128-S-0012
-12	211-0173-00			1	SCREW,MACHINE:4-40 X 0.375,FILH,STL CD PL,POZ	TK0435	ORDER BY DESCRIPTION
-13	200-0851-35			1	COVER,COMP BOX:W/SLOT P6202	80009	200-0851-35



## Replaceable Parts List (Cont.)

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
-14	210-1257-00			2	WASHER,FLAT:0.94 ID X 0.075 THK,BRS 0.156 OD	80009	210-1257-00
-15	262-0998-01			1	SWITCH ASSEMBLY:PROBE	80009	262-0998-01
-16	342-0337-00			1	INSULATOR,BSHG:0.084 ID X 0.281 OD X 0.66 L TEFLON	80009	342-0337-00
-17	131-1893-03			1	CONTACT,ELEC:CENTER COND,BRS GOLD PLATE	80009	131-1893-03
-18	358-0072-00			1	INSULATOR,BSHG:0.192 ID X 0.192 OD X 0.323 PP	80009	358-0072-00
-19	131-1799-01			1	CONN,RF PLUG:BNC,MALE,STR,THD,10X READOUT,BLACK W/11K OHM RES,W/CODE PIN,0.937 L,0.5 DIA REA	24931	28P266-1
-20	426-0423-13			1	FRAME,COMP BOX:W/SWITCH BODY	80009	426-0423-13
-21	200-1063-00			1	CABLE NIP,ELEC:0.143-0.17 ID X 0.718 L,GY	TK2565	200-1063-00
-22	175-1276-00			1	CA ASSY,SP,ELEC:3,26 AWG,54.0 L	80009	175-1276-00
-23	131-0778-00			1	CONN,CIRC PLUG:SLDR CUP,LEMO,2 MALE,2 FEMALE,PLUG	91836	1905-1

## Replaceable Parts List (Cont.)

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
2-					<b>STANDARD ACCESSORIES</b>		
-1	003-1433-00			1	SCREWDRIVER:ADJUSTMENT TOOL,METAL TIP PLASTIC,BLACK	TK2565	003-1433-00
-2	003-1627-00			1	TOOL,ADJUSTMENT:TOOL TIP,PROBE ADJUSTMENT TOOL,0.024 +/- 0.003 SQUARE	80009	003-1627-00
-3	-----			1	TIP,PROBE		
-4	-----			1	TIP,PROBE:IC TEST		
-5	344-0046-01			2	CLIP,ELECTRICAL:MINIGATOR,STEEL	80009	344-0046-01
-6	166-0404-01			1	COVER,GROUND:010-0188-00	TK2565	166-0404-01
-7	352-0351-00			1	HOLDER,PROBE:BLACK ABS P6000 SERIES	80009	352-0351-00
-8	175-1017-01			1	LEAD,ELECTRICAL:DISCRETE,GROUNDING STRAP,SDI,26 AWG,5.0 L,GRD STUD,355-0063-00 X GRD CLIP 344-01	80009	175-1017-01
-9	175-0849-00			1	LEAD,ELECTRICAL:STRD,18 AWG,3.25 L	TK2565	175-0849-00
-10	006-7164-00			1	BOX,PLASTIC:4.625 X 2.875 X 1.0	TK2222	3448-1
-11	016-0673-00			1	CASE,CARRYING:010-6202-02	80009	016-0673-00
	062-1803-00			1	PROBE CARD:	TK2548	062-1803-00
	070-3642-02			1	MANUAL,TECH:INSTRUCTION,PROBE,P6202A,DP	80009	070-3642-02

## Replaceable Parts List (Cont.)

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
OPTIONAL ACCESSORIES							
	010-0384-00			1	ATTEN HD, PROBE: P6202, 10X	80009	010-0384-00
	015-0201-04			1	TIP, PROBE: IC TEST, PKG OF 10	80009	015-0201-04
	015-0201-05			1	TIP, PROBE: IC TEST, PKG OF 100	80009	015-0201-05
	206-0230-03			1	TIP, PROBE: SET OF 10, W/EXTRACTOR	80009	206-0230-03
	206-0230-04			1	TIP, PROBE: SET OF 100, W/EXTRACTOR	80009	206-0230-04



# DIAGRAMS

## Symbols

Graphics symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI/IEEE 91-1984. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

A slash before a signal name indicates that the signal performs its intended function when it is in the low state.

Abbreviations are based on ANSI Y1.1-1972.

## Component Values

Electrical Components shown on the diagrams are in the following units unless noted otherwise:

Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc., are:

Y14.15-1966	Drafting Practices
Y14.2M-1979	Line Conventions and Lettering
ANSI/IEEE 280-1985	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.
	American National Standards Institute
	1430 Broadway New York, New York 10018

Capacitors	Values one or greater are in picofarads (pF). Values less than one are in microfarads (mF).
Resistors	Ohms ( $\Omega$ ).

**The following information and special symbols may appear in this manual.**

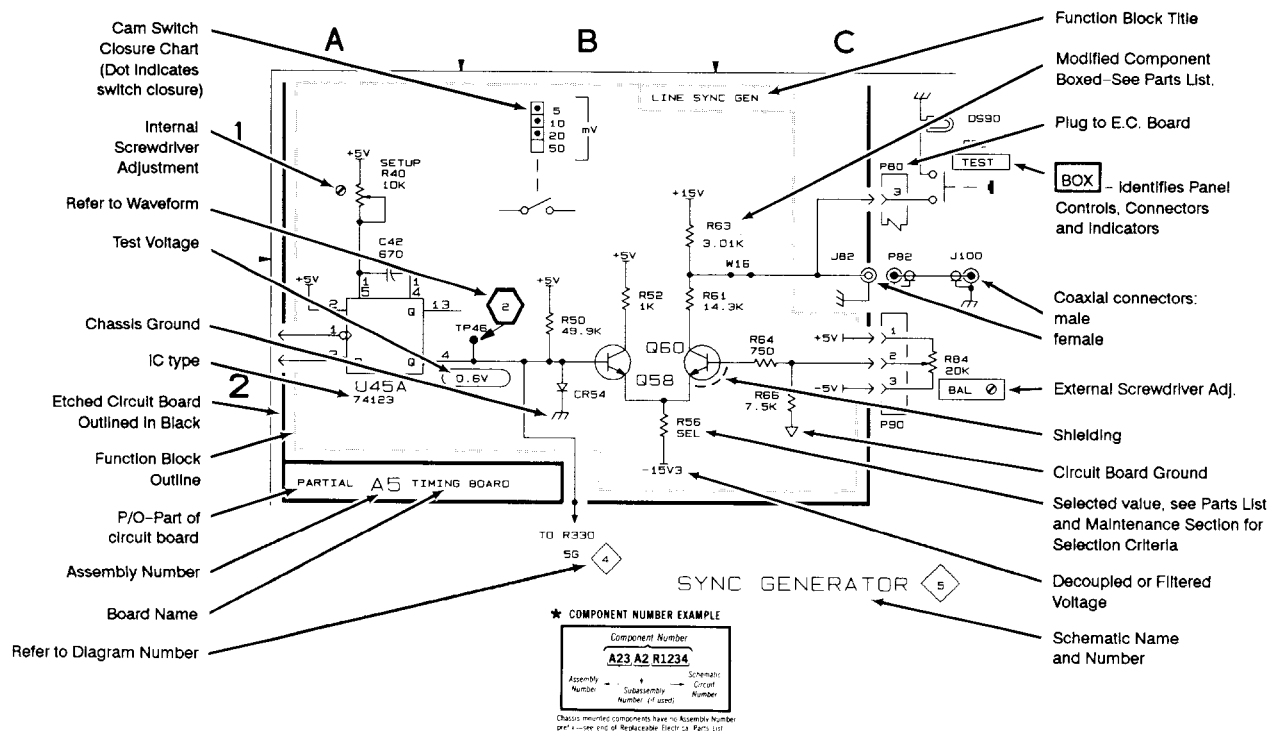
## Assembly Numbers and Grid Coordinates

Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator illustration.

The Replaceable Electrical Parts list is arranged by assemblies in numerical sequence; the components are listed by component number \*(see following illustration for constructing a component number).

The schematic diagram and circuit board component location illustrations have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear near the first diagram on which it was illustrated; the lookup table will list the diagram number of other diagrams that the circuitry of the circuit board appears on.

The following special symbols are used on the diagrams:



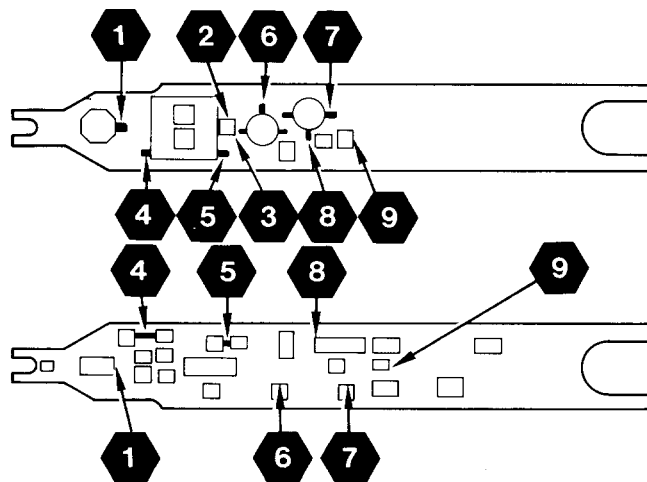


Figure 9-1. Probe body circuit board for instrument numbers to 8847.

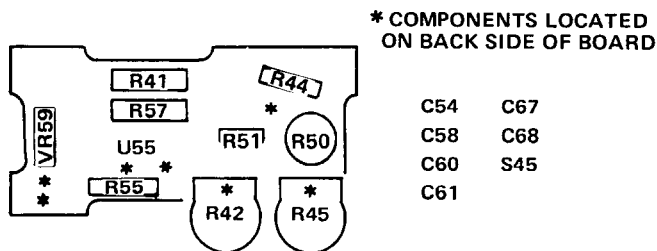


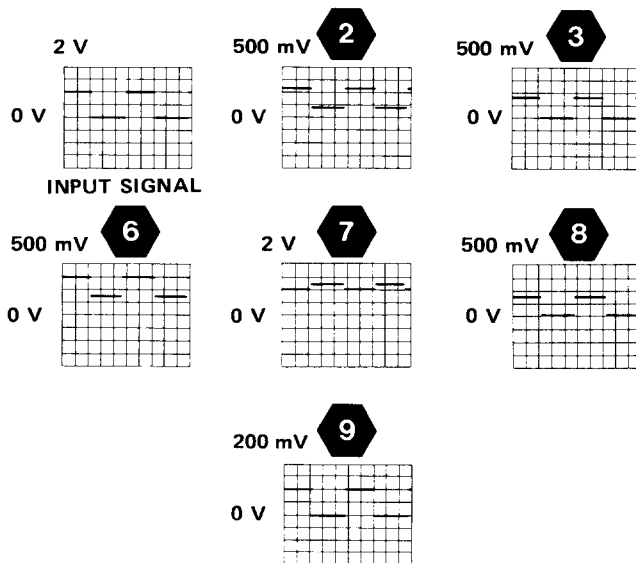
Figure 9-2. Probe control body circuit board.

## VOLTAGE CONDITIONS

DC OFFSET. . . . . OFF.  
 OUTPUT ZERO (R50). . . . .Set according to adjustment procedure.  
 No input signal.

## WAVEFORM CONDITIONS

As above except connect probe tip to a 4 volt 1 kHz squarewave.



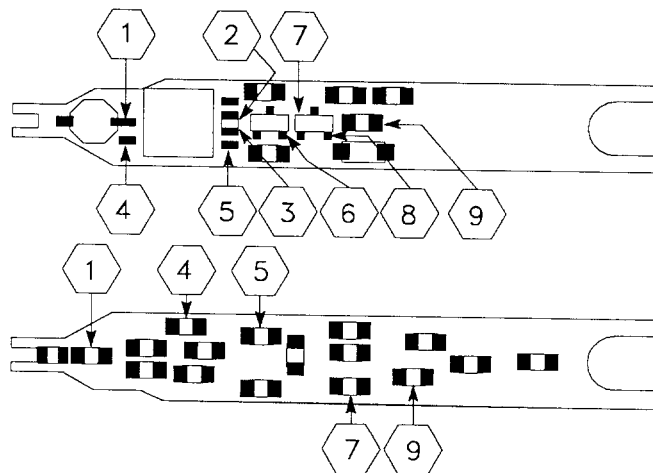


Figure 9-1. Probe body circuit board for instrument numbers 8848 and up.

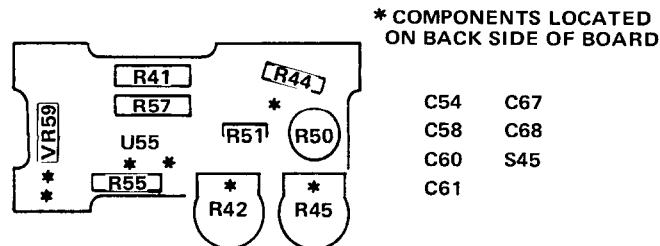


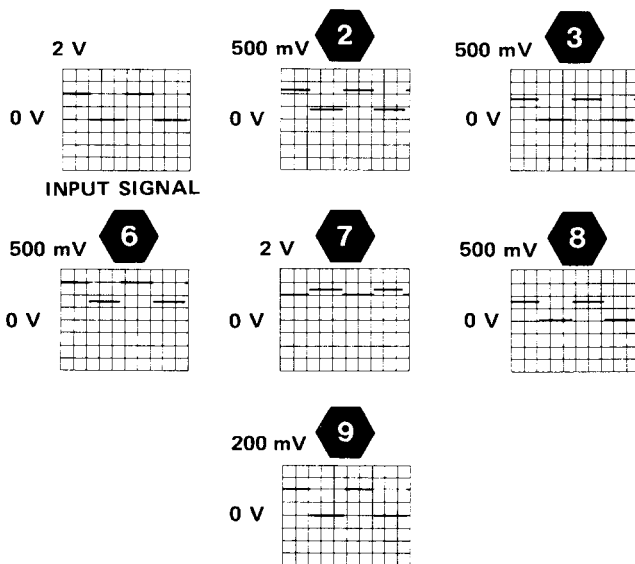
Figure 9-2. Probe control body circuit board.

## VOLTAGE CONDITIONS

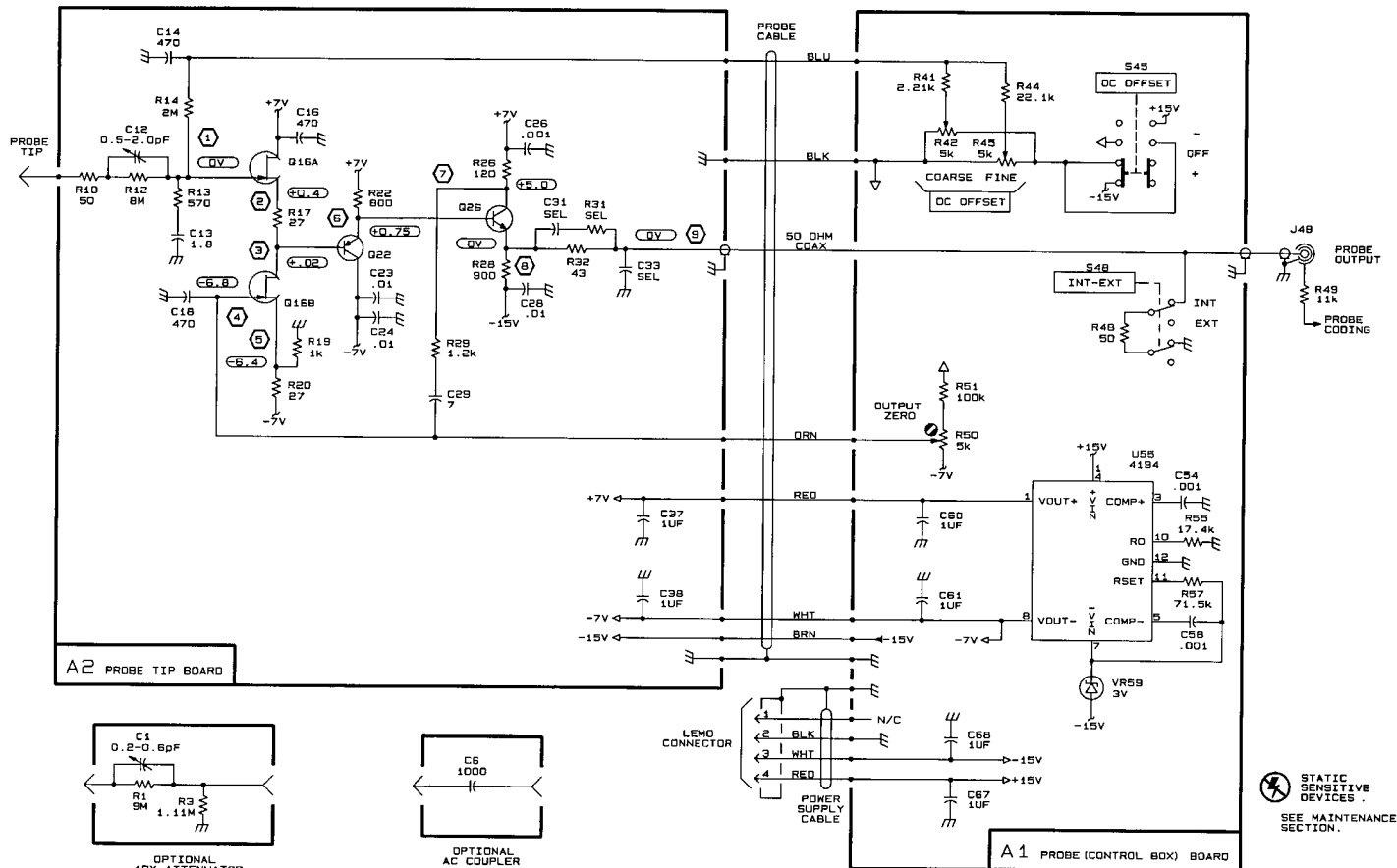
DC OFFSET. . . . . OFF.  
 OUTPUT ZERO (R50). . . . . Set according to adjustment procedure.  
 No input signal.

## WAVEFORM CONDITIONS

As above except connect probe tip to a 4 volt 1 kHz squarewave.



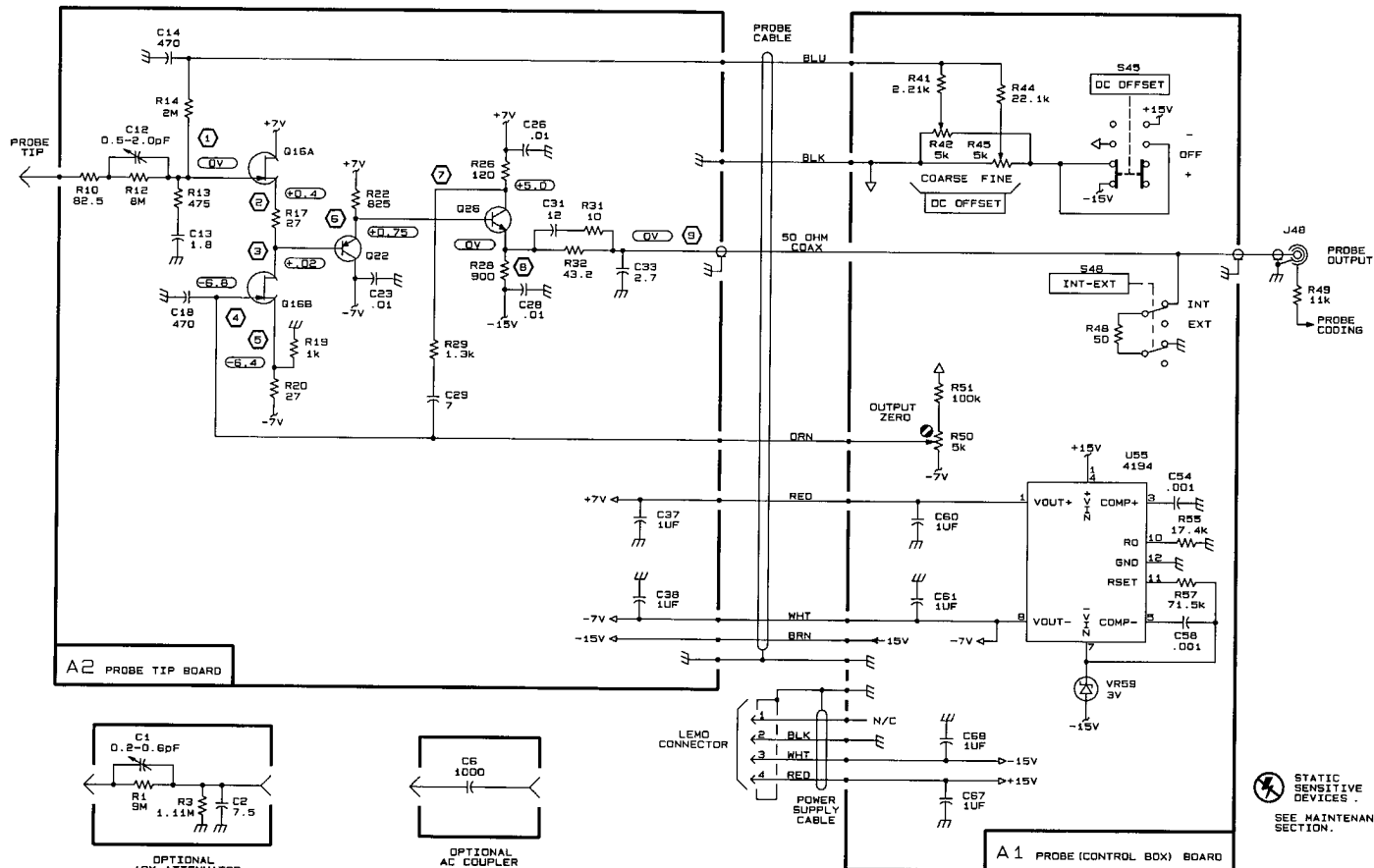




P6202A

3642-30

10X FET PROBE  
INSTRUMENT NUMBERS THRU 8847



P6202A

3642-31

10X FET PROBE  
INSTRUMENT NUMBERS 8846 & UP



